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Executive Summary

The Resource Corridors Concept

The Afghan economy must find new sources of growth if continued development and long-term stability are to be achieved. Afghanistan’s resources sector offers many opportunities for economic development not found in other areas of the economy. Leveraging resource investments and developments to expand their utility can help broaden and transform the Afghan economy.

The Government of the Islamic Republic of Afghanistan (GIRoA) recognized that a corridor approach to development anchored to planned, large mining investments will be essential and launched the National and Regional Resource Corridor Program (NRRCP). The World Bank established an advisory team to help the GIRoA prepare this Resource Growth Corridor strategy.

The development of regional resource corridors is made pressing by the planned exit of most ISAF\(^1\) forces by the close of 2014. Stability and security demand a broad-based economy that creates benefits and opportunities for many segments of the Afghan nation.

This Report is about the roles the rail sector can, and cannot, play in helping to leverage the mineral resources of Afghanistan, and how railways can help broaden and transform the economy. An important consideration in thinking about railways in Afghanistan is that the country had no railways until last year. The railway spur that was extended from Uzbekistan towards Mazar-i-Sharif was designed and built and is still operated by Uzbekistan’s national railway. Afghanistan has no institutional or technical experience with railway technology or regulation. Given

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\(^1\) International Security Assistance Force, a NATO led security mission in Afghanistan established by the United Nations
Afghanistan’s other pressing economic and development needs, it has limited, if any, resources available to subsidize rail investment and continuing operations.

**Key Findings**

The most pressing rail need for Afghanistan’s development of resource corridors is the (a) commercialization of any railway and (b) the provision of terminals and other facilities for local distribution of wagonloads to industries and for transshipment between roads and rail. Transshipment includes a small modern container dry port. Commercialization includes the brokers, logistics companies, railway sales and pricing staff, and a market-driven operations staff.

Another pressing need is for the development of rail expertise and a regulatory authority that can oversee safety and interoperability and ensure access to infrastructure for shippers of all commodities.

Many schemes for railway lines in Afghanistan have been conceived and proposed. It is unlikely that most of them should, or even could, be constructed. Many, even if constructible, may not be financially viable; instead, their construction would create a drain on the Afghan national economy. The lines would not generate sufficient economic development to cover the cost to the debt necessary to build, operate and maintain them.

A few railway lines are feasible and could foster economic development along the northern border. These lines extend from Kunduz in the east to the Iranian border between Herat and Khaf. These railway lines are extensions of other regional rail networks. Most extensions would be 1520 mm gauge line built to Commonwealth of Independent States (CIS) standards. The CIS lines would connect with the Iranian 1435 mm network at Herat extending to Khaf. The CIS lines would also extend the Uzbek railway connection at Hairatan and the Turkmen connection at Torghundi. Some of these lines have been built or are underway.

Connections to Tajikistan through Sherkhan Bandar should be deferred pending completion of a route to Kashgar in China. This rail link is simply not a priority; the likely deficit from its operation and maintenance would be a drain on the economy and
government. Distribution of material west of Kunduz would logically be by truck from terminals located near Kunduz.

A review of the proposal for the copper mines at Aynak strongly suggests that constructing a new major railway is not necessary for the operation of the mine. Copper products could be moved by road transport. But, it is highly uncertain that the oft-delayed Feasibility Study by Metallurgical Construction Company (MCC), that is now due in 2014, will show that a North-South railway from Hairatan to Kabul through to Torkham, thence connecting with the 1676 mm Pakistani network, will be economically justified. In any event, the feasibility report is not expected before 2014, and construction of this difficult line would extend at least through 2020.

There are alternative near-term investments in transportation that MCC could make that would foster economic growth sooner than the North-South line. Indeed, it is likely that the deficits incurred on operating and maintaining a North-South line would be an economic drain on the Afghan economy. Therefore, this report recommends against actively pursing this route.

Analysis of the proposals for the iron ore mines and possible metallurgical works near Hajigak shows that the maximum projected output of the mines would exceed the current capacity of connecting Iranian or Pakistani networks without a major upgrading of those network’s assets to support low-cost cargo operations. This upgrading is not currently contemplated. Exploiting the mines and any steelworks at the scales described for full production requires the eventual construction of an entirely new medium-to-heavy duty railway through Afghanistan plus substantial upgrading of existing lines or, more likely, a new rail line to ports in Iran or Pakistan. This entirely new mining railway would likely extend from Hajigak southwesterly, passing the Ring Road highway, thence by a new line to an ore port at Chabahar, Iran or Gwadar, Pakistan. Consideration of this future railway must await geo-political developments not within the time or scope of this report. At the present time, the Indian sponsors of the Hajigak mines have publicly stated that they intend to use trucks to move mine products to Gwadar for export. On the other hand, other sponsors have expressed plans to build a railway to one of the ports.

It is possible that not all of Hajigak’s output would need to move across a single route (to either of the Iranian or Pakistani ports). It
is more likely that output would start low and rise over time.\footnote{It may be possible for the IRIR to gradually upgrade its capacity as volume builds.} Some output could be distributed and used inside Iran; some could exit via the CIS rail connections if a line were extended through Dar-i-Suf, and some, especially pig iron and steel mill products, might be trucked to various outlets, including within Afghanistan and Pakistan.

Construction of short-haul railways – less than 100 km – from coal mines or ore pits to generating stations or smelters may not add to the general transportation network. The firms intending to construct the iron ore mines, metallurgical works, coal mines, and associated electric power plants may choose to make these substantial investments as a part of their overall resource development investment. However, unless these lines contribute rail transport capacity beyond the limited short-haul, they are considered as part of the production mining/production facilities and not considered in this report. In the future, such lines may become a part of a larger national rail network.

The Asian Development Bank’s study of the railway gauge issue persuasively argues that both traffic flows and the problems of interoperability show that the concept of a single gauge ring-railway around Afghanistan is flawed. Our technical analysis shows that the use of UIC-oriented standards, which was the policy choice in the past, to be the wrong choice should a ring-railway even be built: a result also supported by the ADB’s gauge study.

Because no subsidy mechanism has been identified to fund the inevitable major losses that light-density passenger services create, no investment or provision for service should be contemplated at this time.

We believe instead that investments in basic highways and roads make more sense for local and regional corridor development at this time. Indeed, transport investment should focus first on all-weather, high axle-load highways instead.
1: Background

Objectives

The overarching objective of the Resource Growth Corridor effort is to achieve inclusive, integrated economic growth along geographic corridors by leveraging very large private sector anchor investments in Afghanistan’s mining sector. This objective has two components:

1. Determine how to accelerate the proposed and planned very large private sector anchor investments to ensure that surrounding communities benefit from these investments and that the revenue streams they generate trigger inclusive growth. This determination may include a possibility that the construction of some mining railways may not, in the short- and mid-term, contribute to the development of inclusive growth.

2. Leverage these investments to generate additional growth. The overall World Bank strategy is to orient incremental catalytic investment so as to increase the public benefits from private investment. Railways may contribute by improving the cost structure of physical distribution, of manufacturing, and of large-scale agriculture. Alternatively, railways may become a drain on resources if volumes or revenue are insufficient to cover operating and asset renewal costs.³

Bank investment may be in “hard” infrastructure, such as roads, railways, water, and electric power; investment in supporting

³ Finally, railways, if badly managed, can become a threat to the safety and environment of communities because railways are a preferred way of moving hazardous and explosive materials. Alternatively, well-managed railways can improve matters by diverting shipments from hazardous highways.
enterprises that supply mines, distribution terminals and dry ports, and other private sector enterprises; or for “soft” projects in technical assistance, training, developing commercial skills, rationalizing regulatory entities, and providing entrepreneurship opportunities.

The Bank seeks to develop the capabilities of communities and the private sector to supply goods and services to generate additional jobs and income. Given Afghanistan’s other pressing economic and development needs, it has limited, if any, resources to use to subsidize rail investment and continuing operations. The Bank and the Government have premised railway developments on a limited role for long-term government support. New rail systems in Afghanistan should not require long-term subsidies from the national budget, either for debt service or for continuing operations and maintenance. This implies that new rail lines must be operated commercially – transportation revenue should be sufficient to cover debt service and operating and maintenance costs. This is not to say that railways should not be built with grant funds, rather that, once built, it should be possible for railways to be commercially self-sustaining.

The Bank wants to identify what institutions and fiscal and regulatory mechanisms are required to implement development and management of these new assets over the long term. Until last year, Afghanistan had no railways. The railway spur that was extended from Uzbekistan towards Mazar-i-Sharif last year was designed and built and is still operated by Uzbekistan’s national railway. Afghanistan has no institutional or technical experience with railway technology or regulation. This is a significant issue for the future development of railways in Afghanistan.
Issues

Although there are two natural resource growth corridors, there are many competing, complementary and even contradictory proposals and plans for railways that might be built, and hence, contribute to the development of the corridors.

The first rail-oriented corridor is the mineral rich alignment centering on Kabul itself: to the South are the Aynak copper deposits; to the West are deposits of iron ore and steam and metallurgical coal. The iron and the copper ores have been concessioned for development. The concessions include opportunities to exploit the coal deposits.

The second rail-oriented corridor stems from the oil and gas fields in northern Afghanistan. These await further development, and lie along a natural railway route that extends out of Iran towards Tajikistan, linking up intermediate extensions of the Uzbekistan and Turkmenistan national railways, themselves linked through the CIS common rail network.

The purpose of this report is to examine the myriad of proposals for and actual efforts to construct railways into and inside Afghanistan. Different parties have advanced different ideas; yet other parties have adopted some of these ideas, even though the initiating party may have abandoned the idea. Most of the ideas
have not been accompanied by careful engineering estimates. Only a few include any economic analysis, and even these analyses use global averages as if Afghanistan is an average nation with average terrain and typical problems.

Any current plan for a railway must consider its surrounding quite different politico-technical regions. Afghanistan is landlocked so railways to places outside Afghanistan must connect to railways built to different country technical standards.

The analysis of what, if any, railways could contribute to the development of resource growth corridors and to growth in the Afghan economy is made more difficult by significant constraints:

- Afghanistan’s security issues, which are well known and are not discussed here.
- Afghanistan has almost no institutional knowledge of railways, of how to design, operate, and maintain them.
- Afghanistan has almost no commercial knowledge to assist consignees and consignors, and logistics firms.
- The Government has few resources to subsidize railway investment, maintenance, and continuing operations.

Our analysis will frame its recommendations in light of these constraints.

**How This Report is Organized**

This report develops its findings and recommendations by initially establishing a technical basis for choosing one alternative over another, then by examining the alternatives that have been advanced or sponsored in light of that technical basis. The technical basis includes infrastructure costs when these are given or can be estimated.

The methodology that one would prefer to use in this report is not technical but financial. However, almost all alternatives lack good financial data about costs for construction, rolling stock, start-up, and continuing operating and asset renewals. Traffic forecasts are limited to estimated production volumes from major mining and industrial developments and rarely include the type of freight traffic related to economic development – cement, building supplies, food products, oil and petroleum products, container
shipments and other commodities relied on by most other railways contributing to economic development. Finally, the question of rail revenue is almost entirely ignored. No prior analysis was found that compared likely railway costs with actual trucking rates in the relevant corridors.

Some studies do offer indicative analysis of potential volumes by looking at the volume of current truck movements or by cataloging inter-regional trade flows. We have decided not to attempt to justify investment in railways insofar as resource growth corridors are concerned by looking at trade that is simply flowing through Afghanistan because such trade is deminimus under current and foreseeable conditions and does not foster local development. Nor do we analyze investment by looking at goods movements that could be diverted from highway trucks to railway wagons because until the specifics of the new railway and the connecting design family are specified, the relative competitiveness of rail vs. truck is uncertain.\footnote{Using global averages for costs, assets, and revenues in a nation so far removed from global averages may prove highly misleading.}

After establishing technical criteria, we then review what may be the two most pressing development prerequisites for railways in Afghanistan: removing the constraints of a national lack of technical knowledge about rail transport and the lack of parties and assets to carry forward the commercialization of railways assets.

The report then moves to examine the myriad of proposals to construct railways into and around Afghanistan. The proposals are grouped by sponsor. The sponsors include development banks, the Afghan Government’s ministries, mining enterprises, and other nations. The proposals are examined one-by-one. Conclusions about each line’s functionality and even basic plausibility are reviewed. A key part of the narrative is objectively evaluating the functionality of other railways linked to the proposed railway. There is no reason to add a link to a broken chain.

The report then discusses a regulatory framework appropriate to foster the development of railways in Afghanistan. An adequate, but not stifling, regulatory environment can foster development by removing uncertainty and risk on the part of investors and
operators. It may also provide greater public safety. Indeed, a streamlined, predictable regulatory process may take priority over construction of rail infrastructure surrounded by financial and technical risks.

The report addresses commercial development requirements and needs and outlines the types of commercial environment, facilities and investments required for commercial operation of railways.

Finally, the report discusses findings, recommendations and priorities related to railway infrastructure investment.

An appendix is included as a separate document. This appendix contains the large tables describing railway technical standards associated with surrounding railways and for the major proposed rail investments.
The objective of this chapter is to describe a technical basis for evaluating the many competing proposals to construct or extend rail lines into, around, and out of Afghanistan. This chapter provides a broad comparative analysis of the characteristics of the connecting regional railways of Central Asia, South Asia, and Iran. Finally, the report provides a technical basis for making recommendations on the best regional routes to reach Chinese, Indian, and world export markets\(^5\) from Afghan mines, and to facilitate the goal of developing resource growth corridors.

**Railway Design Families**

There are several broad approaches to designing railway networks, each incorporating one typical track gauge. While within the broad approaches there are endless variations, it is very useful to discuss matters in terms of these broad approaches. Each broad approach uses specific design norms for interfaces between rolling stock and infrastructure, as well as building the infrastructure and manufacturing rolling stock to even more quite specific norms.\(^6\) It may be said that these design norms form technical “families” of norms, and “design families” will be the term used within this chapter.

Each of these design families emphasizes specific needs of the railway users’ regions or user industries. These needs may be moving vast quantities of lower value material, such as ore or coal,

\(^5\) We focus on China and India because companies from these countries have won initial bids for the development of natural resources. China has won a copper mining and development concession; India has won an iron ore mining concession.

\(^6\) There are other design norms than physical track and rolling stock. There are also norms for commercial matters, such as how cargo is secured, how wagons and containers are marked, and invoices and tariffs are developed. Analysis of these norms is outside the scope of this report.
from point to point; or moving almost all kinds of cargo over a complex, long network; or transporting people in densely populated regions; or fulfilling societal and historical mandates. Finally, different design families often have different access to capital for new construction or modernization. Track gauge is typically viewed as the major question to be decided among competing rail networks that seek to connect Afghanistan to the economic activities of neighboring regional economies. It is well understood that different neighboring economies have different track gauges. Crossing between different gauges creates operating costs and delays because wagons must have their bogies swapped or commodities shifted from one freight wagon to another and trains must have their locomotives changed. The question of the different track gauges – 1435mm, 1520 mm, and 1676 mm – has been explored in other studies. However, there are infrastructure gauge measures other than the track gauge, and these other gauges are as crucial as the track gauge in making decisions about what rail lines inside Afghanistan should – or even could – connect with rail networks outside Afghanistan. Even where infrastructure is compatible between rail networks, the interfaces between wagons, locomotives and the traffic control systems may be incompatible.

Afghanistan faces choices not only of track gauges but also of very different ways of constructing and operating railways. Each of the possible track gauges and technical standards is associated with a different design family that neighboring nations have chosen. Hence, the choice of a track gauge through a specific route can also be a choice to link Afghanistan to the technical standards and geopolitics of a neighboring nation. Track gauges, geopolitics and transport efficiency are often interlinked choices.

**A Brief Introduction to Railway Design Families**

There are four major families of design competing to enter and circulate inside Afghanistan. Each design is associated with a national interest. These designs are usually associated with a region, a specific nation or an investor class. Admittedly this grouping into just four design families is a simplification but it is a useful simplification.

The four design families that compete in Afghanistan are:

1. Commonwealth of Independent States (CIS)
2. Heavy Haul (for mineral railways)
3. Legacy
4. Union Internationale des Chemins de Fer (UIC)

There are two other major design families among global railways but neither is competing per se in Afghanistan:

1. Association of American Railroads (AAR) and the American Railway Engineering and Management Association (AREMA) standards.
2. High-speed trains, those operating over 240 km/hour.

The AAR standards share many characteristics with the CIS family, as will be discussed below. High-speed trains present so many financial and physical obstacles that no serious party is contemplating building true high-speed rail into or around Afghanistan. The competing design families and their national or regional affiliations are shown in the next table.

A complete comparison of the technical standards can be found in Table One in the Appendix. The tables in the Appendix also give footnote sources for data and allow comparison between the six shown above and their variations, such as China’s Ministry of Railway design norms. Many statistics cited in this chapter are taken from Table One or its footnoted sources.

It may be asked why technically obscure matters such as net-to-tare ratios and loading gauges matter? The answer is that different design families are markedly better at doing one thing, e.g. moving people, than doing something else, e.g. moving iron ore. 

Colonial administrations built railways according to the needs of 19th century administration and the military, and created infrastructure and management organizations that persist to this day in many nations, despite the colonizing power’s long-distant departure. An example will illustrate. Consider an iron ore Pakistan railway train connecting with the Pakistan railway line that reaches up to Afghanistan’s border at Chaman. That particular Pakistan line has a maximum loading gauge of only 17.8 tonnes per axle. A standard 4-axle ore wagon can only weigh 4 x 17.8 = 71.2 tonnes. Of this 71.2 tonnes, 23.5 tonnes is the weight of the wagon and 47.7 tonnes is the weight of the ore. The wagon must be moved back to the mine empty. So, moving 47.5 tonnes of ore one kilometer generates 47.5 net-tonne-kilometers of ore and an additional 71.2 tonne-kilometers of wagon movement. The net-to-tare ratio for these movements is 1:1. Using CIS technical standards, where axle loads are currently increasing from 23.5 to 25 tonnes/axle and empty wagons weigh about 23.5 tonnes, we find that loaded (continued, next page)
What follows in this chapter is necessarily a simplification of a complex subject. The discussion is not intended to be exhaustive. It is intended to show that to choose to build a line to one nation is to connect Afghanistan with a technology that may be inadequate at transporting Afghanistan’s resources or at developing resource growth corridors.

### CIS Technical Standards

<table>
<thead>
<tr>
<th>Design family</th>
<th>Uzbekistan &amp; Beyond</th>
<th>Mining – Aynak and Hajigak</th>
<th>Pakistan</th>
<th>Iran</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track gauge</td>
<td>1520 mm</td>
<td>connecting line</td>
<td>1676</td>
<td>1435 (&quot;standard&quot;)</td>
</tr>
<tr>
<td>Loading gauge of wagons – cross section in square meters, est.</td>
<td>15 connecting line</td>
<td>14.6</td>
<td>10.6</td>
<td></td>
</tr>
<tr>
<td>Distance from AFN border to nearest modern seaport</td>
<td>1,800 km Hairatan to Novorsyssik connecting line</td>
<td>1,300 km Torkham to Gwadar 960 km Herat to Bandar-e – Abbas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical cost per ton-km, bulk material, 1000 km movement</td>
<td>0.7 cents$^9$</td>
<td>0.5 cents$^{10}$</td>
<td>1.6 cents$^{11}$</td>
<td>Not available</td>
</tr>
<tr>
<td>Typical maximum payload of train, tonnes</td>
<td>4,800 Connecting line’s max</td>
<td>2,000</td>
<td>1,400</td>
<td></td>
</tr>
<tr>
<td>Typical net to tare, bulk wagon</td>
<td>2.8</td>
<td>3.7</td>
<td>2.0</td>
<td>2.4</td>
</tr>
<tr>
<td>Typical maximum gradient</td>
<td>2.5%</td>
<td>2.5%</td>
<td>n/a</td>
<td>2.8%</td>
</tr>
<tr>
<td>Axle Gauge</td>
<td>23.5 to 25</td>
<td>Depends on connecting line</td>
<td>17.8 to 22.5</td>
<td>14 to 22.5</td>
</tr>
</tbody>
</table>

Wagons carry 76.5 tonnes, giving a gross- to- net ratio of 76.5/47.5 or 1.6:1. Using heavy haul technical standards, that ratio can be as high as 2.7. This is significant because energy usage is directly related to total gross-tonne-kilometers generated to move freight.

$^9$ Obtained through HWTSK research into RZD tariff structure

$^{10}$ Typical rate for EVRD, the Brazilian heavy-haul and general cargo iron-ore line

$^{11}$ Rate taken from PR’s own rate data base website for iron ore moved 880 km between Dalbandin and Karachi Port, after recent 30% surcharge and at the exchange rate of 0.01106 Rs to US$1.00
CIS technical standards form one design family. The CIS railways formerly comprised the Soviet Union’s vast railway system. It is one of the largest rail networks today. The main-line network uses 1520 mm track gauge\textsuperscript{12} and includes almost all the central Asian states including Uzbekistan, Turkmenistan, Tajikistan, Kazakhstan and Mongolia. The CIS network permits wagons and locomotives to travel as far as the Baltic ports of St. Petersburg, Russia, and Helsinki, Finland; to Uzbekistan, Kazakhstan, and Mongolia; and to Russia’s Pacific ports.

The new ADB Phase I rail line from Hairatan to Mazar-e-Sharif is built to CIS technical standards. This 1520 mm track gauge line connects Balkh Province and the Solang highway with the entire CIS network through Termez, Uzbekistan.

CIS design norms emphasize the need to move a variety of cargoes over a range of distances. Designs are robust, generally economical and can withstand extremes of climate. Repairs to rolling stock are easily accomplished. Costs per tonne-kilometer are low because the type and dispatching of wagons favors finding backhauls for emptied wagons. The axle gauge and the loading gauge are both large but not as large as AAR or typical heavy-haul axle gauges.

The loading gauge, track gauge, and axle gauge is uniform throughout the network. Axle gauge is being upgraded to from 23.5 to 25 tonnes in much of the network. Couplers, air brakes and other running gear are standardized and robust. Wagons can be assembled into mixed trains, with mixed loadings bound for many destinations.

Little hardware and accounting software is used that is sole-source. There is an emphasis on exploiting a robust, competitive supply market. The largest CIS railways encourage private-sector supply of wagons and there is an active wagon leasing market. Minimum shipment is usually one wagonload but shippers and

\textsuperscript{12} There are a number of industrial and special purpose railways within CIS countries that are built to different technical standards, including track gauge. This is true of many countries where specialized railways may not be built to the predominant technical standard.
carriers are accustomed to moving small loads that are consolidated by global logistics firms into a single complete wagonload. Block and unit trains move efficiently, though they are not of the size and the low cost of AAR or heavy-haul railways.

Most CIS railways focus on serving a wide variety of customers spread over a wide area. There is a growing commercial culture. This culture is still evolving but it recognizes the need for both the carrier and the shipper to use railways without the need for external subsidies or central planning.

CIS railways are accustomed to expediting movements across national borders, including outside the CIS, without transloading the cargo or having burdensome customs paperwork and delays. CIS railways are typically international in outlook.

CIS railways are poorly evolved to move containers or highway trailers. This is changing but will remain a fact for the immediate future. CIS railways usually downplay intercity and commuter passenger trains, partly for historical reasons and partly because of the focus on financial sustainability.

The CIS family of railways relies heavily on the Russian central rail institutes for engineering, managerial and technical capital. Consequently, non-Russian CIS railways often possess limited abilities to adopt new technologies and carry out major design and construction work successfully. Procurement has been known to be cumbersome and exposed to corruption.

The CIS family of designs resembles the AAR family. Both are successful at interoperability and the involvement of very large public and private sector parties. Both are focused on economic development that favors the use of rail. Both will accommodate passenger trains but do not design for passenger trains as a primary mission.

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13 For an example of the evolving abilities in CIS railway movement of containers, see http://www.fesco.ru/en/clients/container/intermodal/. This is also an example of the commercialization of a state railway, in this case RZD’s transformation of its massive cargo wagon fleets into leasing companies.
Heavy Haul

Heavy haul railways are purpose-built to move large quantities of minerals, often in excess of 70 million tonnes per year. They may be of any gauge, from Brazil’s highly effective 1067 mm narrow gauge EFVM railway (owned and operated by Vale) through any broad gauge. Typically, the lines are standard track gauge or narrower because many minerals are in mountainous areas. As a generalization, the MCC copper mine, the Hajigak iron ore mine or even lines extending from coalmines would be expected to follow a heavy haul design patterns.

Heavy haul designs emphasize uphill grades of less than 1% but will accommodate curves less than 300 meters radius and grades of up to 2.5%. Wagon designs emphasize aggressive net-to-tare ratios. Axle gauge is usually 32+ tonnes and higher, compared to the CIS 25 tonnes, the Iranian 14-to-22.5 tonnes or the Pakistani 17.8-to-22.5 tonnes. Locomotives are heavy and develop extraordinary tractive efforts. Locomotives are equipped to operate in multiple-unit combinations (MU), typical of AAR practice, and additional locomotives are often added to trains in the middle and ends to assist in moving truly stupendous weights and numbers of wagons. Trains usually begin at 100 wagons carrying 100 tonnes in each wagon and may exceed 200 wagons and five kilometers in overall length.

The great need for “tractive effort” has favored the use of the heavier diesel-electric locomotives over the lighter weight UIC and even CIS use pure electric locomotives or diesel-hydraulic

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14 20 one-way trains per day of 10,000 net tonnes load, or 40 round trip trains, which is often the capacity of a CTC-traffic controlled single-track railway with 2 km passing loops every 20 km
15 Multiple-unit capabilities allow railways to couple 2, 3, 4, 5, or more locomotives and operate them from a single control locomotive location with a single crew. Locomotives operating in the middle and/or end of heavy haul trains are usually electronically MU’d and require no independent crew
16 A measure of pulling-power, tractive effort is a function of weight-on-axles, traction control schemes that prevent wheel-slip or the use of heavy-duty traction motors that do not over heat at low speeds or with high power application
locomotives. However, electrification is often applied, for example, in South Africa and even on some Chinese lines.

Running gear is typically high-strength versions of AAR couplers, brakes, and bogies. Most individual heavy-haul wagons can be coupled into AAR-style trains. But while heavy-haul lines can and sometimes do move passengers or general cargo, their focus is on the low-cost movement of the minerals belonging to the lines’ sponsors. For that reason, generous loading gauges that permit the use of double-stack containers, multi-level automobile carriers, or multi-level commuter passenger cars are not typical of heavy-haul construction. The cross section of a typical heavy-haul wagon is only about 16 m². This can be compared with the AAR designs that permit 20 square meters, and even higher for double stack. Despite the narrow clearances and tighter curves admitted by heavy-haul railways, construction costs can be quite high because of heavy axle gauges, minimizing uphill grades and the need to reduce track component replacement.

Heavy haul railways are designed & operated to keep long-term costs low

Heavy-haul railways do not focus on commercial issues, sales, or marketing matters, or on general economic development. They are designed and operated to keep the costs of moving mined minerals from one point to another down to a long-run minimum. Heavy-haul railways typically have only a few, similar customers, sometimes only one. These railways may even be owned by the customer.

Heavy-haul railways require a strong in-house operations staff and engineering ability. Heavy-haul wagons and locomotives need not be interoperable with other railways, although they often are. They do not rely on governmental agencies or regulators for technical knowledge or design standards.

Legacy Railway Technical Standards

Legacy railways is a term used here to describe those railways largely built during colonial eras, which have not yet been rebuilt and expanded into one of the other design families. Pakistan’s rail network is a legacy railway. Legacy railways retain many of their 19th century design norms.

The movement of passengers is usually important in a legacy railway. Passenger services are designed to be cross-subsidized by
freight services. Legacy railways are generally government owned and operated. Labor is often inexpensive and it may appear that the railway’s purpose is to provide employment rather than move cargo and passengers efficiently. Legacy railways’ market share of cargo movements often becomes an insignificant part of the national or regional transportation sector.

Axle and loading gauges are usually restrictive, often because of obsolete rolling stock, bridges, stations and tunnels, stemming from a lack of investment. Grades are steep and curves are tight. Trains tend to be short and light: typically 40 wagons and 2,000 net tonnes of cargo. One Pakistani line to the Afghan border is restricted to 17.8 tonne axle loads, compared with the Iranian 22.5 and the CIS 23.5 tonnes. By way of comparison, network AAR axle gauges are typically 32 tonnes or higher, maximum train length is 110 wagons, and maximum payload of a train is 11,000 tonnes or more.

Legacy railway wagon designs are often lightweight but with low capacity. Net-to-tare ratios are poor. Locomotives have low tractive effort and low horsepower and do not easily MU into powerful sets.

Keeping in mind that these are all generalizations, one may still say these railways have weak technical and procurement staffs. Procurements tend to be opportunistic and based on government trading partners. They are often beset by technical failures and delays. Design norms are often obsolete or reflect what grants and development loan financing the vendor nation provides rather than what design norm is required to provide modern assets matching future needs.

Legacy railways often have general cargo terminals, but many are only suitable for small shipments requiring less-than-wagonload volumes. Traffic control is often manual. Signaling systems, accounting and invoicing are often manual, slow, labor intensive and cumbersome.

Legacy railways often operate at considerable deficits and require government subsidy. For example, in 2007-08, a recent year of “normal” operations for Pakistan’s railways, operating expenses were 110% of operating revenue and the deficit was US$140 million, according to Pakistani Railways accounting statements. By 2010-11, after a near collapse of the locomotive fleet, operating expenses were 169% of operating revenues, reaching US$200
million in of losses on operating revenues of less than US$120 million.\textsuperscript{17}

Pakistan Railways is not the only neighboring railway displaying a Legacy management approach. While Uzbekistan’s railway, Uzbekistan Temir Yullari (UTY), ostensibly uses CIS technical standards, a report by the ADB in 2010 notes many characteristics that one associates with a Legacy operation: high cross-subsidization of passenger services by profitable freight operations; reluctance to rationalize UTY’s human resources and employment levels; cumbersome and expensive procurement practices; and political interference in international tariffs and service disruptions.\textsuperscript{18}

Legacy railways do not emphasize commercial development of industries or logistics terminals. Transloading is not infrequent, and Legacy railways typically have complex and redundant paperwork and reporting requirements. An internal World Bank study in late 2009 provides an excellent example of the crippling customs handling and paperwork requirements of rail shipments to the Afghani border on the Pakistani Railways.\textsuperscript{19}

**UIC Technical Standards**

The Islamic Republic of Iran Railways (IRIR) may be said to aspire to the Union Internationale des Chemins de Fer (UIC) design family. While it is important to note that the Iranian railways focus heavily on interchange with railways of different gauges and design families, the railways’ technical aspirations displayed in recent years are typical of those associated with the UIC.

The UIC railways originated in, and look to the historical European experience and European designs and the movement of passengers. While the CIS’s Soviet-based “GOST” specifications

\textsuperscript{17} Pages 116 and 120 of the Pakistan Railways Yearbook for 2010-2011. Newspaper reports give confusing accounts that have generally higher losses than those reported by the railway’s management. [http://pakrail.com/yearbook.php](http://pakrail.com/yearbook.php)

\textsuperscript{18} ADB Performance Evaluation Report: Reference Number: PPE: UZB 2010-63 Uzbekistan: Railway Rehabilitation Project and Railway Modernization Project, December 2010

are used when required in Iran, a review of actual purchases and specifications shows that wagon running gear, capacities, net-to-tare ratios and locomotive design philosophy are oriented towards UIC specifications.\(^{20}\)

In the past, the IRIR utilized AAR-style locomotives: six axle, high tractive effort, low-RPM diesel-electric designs from EMD or GE that are suitable for heavy cargo trains. Current procurements are Siemens’ lighter designs with shorter-duty cycle, higher RPM diesel engines by MTU. These new four axle Siemens locomotives show a commitment to a 22.5 tonne axle gauge. This is consistent with HWTSK’s team reviews of actual European UIC cargo wagons: There is much discussion of upgrading to 25 tonne axle gauge but newly built bulk transport wagons are all for 22.5 tonne axle gauge.\(^{21}\) The UIC’s specifications for new tank wagons limit wagons to an axle gauge of 22.5 tonnes and do not allow the construction of heavier wagons.\(^{22}\)

UIC designs attempt to foster interchange of national assets across international borders and emphasize interchanges across the many different technical standards that were used in Europe before the advent of the EU. Although the IRIR moves a considerable and growing amount of cargo (31 million tonnes in recent years), it has a robust passenger business of 13 billion passenger-kilometers a year, which is typical of a UIC focus.

The IRIR follows UIC design practices in another crucial area, that of the maximum weight of a train.\(^{23}\) It is possible to assemble a bulk oil or mineral train with a weight of 4,500 gross tonnes on many routes, with a net payload of 2,900 tonnes. However, other routes are limited to 14 tonne axle loads, reducing net payloads to

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Refer also to IRIR “General specifications for IIRR required freight cars.”

\(^{21}\) This may be contrasted to CIS and AAR axle gauge upgrades. Little of the CIS and AAR networks have had their infrastructure upgraded but almost all new wagons and many rebuilt wagons are rated for the higher axle gauge.

China is also upgrading its rolling stock to a 25 tonne axle load standard.

\(^{22}\) § 1.1.2 of UIC 573 *Technische Bedingungen für en Bau Kesselwagen*, Revision of 2008.

\(^{23}\) Passing loop length is not always a limit on train length for single-track railways. It is possible to run a limited number of trains that are longer than a passing loop within a larger number of trains. The short trains are held on either the loop track or the main line track parallel to the loop track and the longer trains simply go past or around the short train.
perhaps 1,400 tonnes. Just to move ore over a main line with the higher axle gauges would take four IRIR trains to move what one AAR-style train moves. It would take seven IRIR trains to move the iron ore currently moved on just one heavy-haul iron ore train.

The limit on train weight is controlled by several factors. The most important is the strength of the UIC standard drawgear, both the buffers and the actual coupler. The drawgear couples a train of wagons together. The weakest coupler or drawgear component in the chain of linked wagons determines the maximum weight of the train.\textsuperscript{24} Standard UIC hook and link screw coupler components for interchange in the European network are required by UIC Standard 526-1 and 827-1 to withstand only 100,000 pounds-force. New designs go up to 191,000 pounds of tensile force. This may be compared to new AAR requirements for 650,000 pounds-force.

The result of this, and other factors, is that UIC design families, such as those used in Iran, require much more rail infrastructure to move a given amount of cargo. The infrastructure usually takes the form of double-tracking and more traffic control signals. A UIC style railway requires more investment in infrastructure than a CIS, Chinese or AAR railway to move large amounts of cargo, especially bulk cargo, and far more than a heavy-haul railway. If one connects a new heavy-haul railway to a UIC railway, one only gets the cost structure and capacity of a UIC railway.\textsuperscript{25}

Typically, UIC designs emphasize fast passenger train operations. The emphasis on passenger operations results in:

\textsuperscript{24} Theoretically, a weak link could be placed at the rear of the train, and strict orders given to all crews at all locations not to move or shunt the train in the opposite direction from its original dispatch. This is not a conventional practice and presents a safety problem for tank wagons of oil, gas, or chemicals.

\textsuperscript{25} Of course, special purpose mineral trains, composed of wagons and locomotives designed to operate from an origin to a destination and back as a single train, are not necessarily limited by UIC drawgear strength or even axle gauge. Trains with higher axle gauges can be operated over many UIC railways with minor upgrades to bridges and overpasses. While the existing infrastructure may require replacement earlier than normal, the added volume and revenue from mineral movements can generally finance infrastructure upgrades. The Iranians have evinced little interest in this approach. Even though exclusive rolling stock may be used, trains remain limited by other loading gauge factors (physical size of equipment, and train lengths, for example).
• Larger radius curves, which make mountain and urban construction more expensive.
• Lower maximum grades, which makes mountain construction more expensive.
• Lower loading gauges, which makes construction less expensive but inhibits the use of efficient double-stack containers and efficient high-capacity cargo wagons.
• Lower axle gauges and bridge capacities, which makes construction less expensive but eliminates the use of highly-efficient heavy diesel-electric locomotives.

A major advantage of the UIC design family mindset is that UIC members are oriented towards international exchange of wagons. Hence paperwork for customs and commercial carriage documents tend to be standardized and streamlined. Many UIC railways use the General Contract of Use for Freight Wagons, usually referred to as the RIV. This is a major difference from Legacy railways, which are insular in outlook. A Legacy railway may use the same “hardware” and track gauge as a UIC railway but have very different marketing and paperwork “software”.

Highways & Backhauls

The predominant flow of goods in Afghanistan is into Afghanistan and is, of course, by truck. This situation is likely to remain for the foreseeable future. As a result, there is probably substantial empty backhaul capacity in the road transport network leading to points of entry and exit all around Afghanistan. This extra capacity might be used to transport cheaply produced Afghan concentrates and products from the mining ventures to export markets. This low-cost transport capacity may make it difficult for rail-based outbound transport to compete unless there is a substantial shift to inbound rail movements.

26 The IRIR displays the UIC outlook. The IRIR interchanges with a number of nations: Pakistan and the CIS network through Turkmenistan. It has connections to the UIC-RIV network through a ferry service to Turkey. Also under construction are the Khorramshahr–Basra line and the Kermanshah–Baghdad line as a link with southern and northern Iraq.
3: Role of Railways in Development

Efficient transportation is a critical component of economic development. Transport investments can link factors of production and consumption together in a web of relationships between producers and consumers to create a more efficient division of production and provide a means to expand the economies of scale and scope. Railways can play a significant role in economic development. At their best, they are energy and space efficient but rely on economies of scale to contribute to economic development. Railways are ideal for transporting high volumes of commodities or passengers that can be concentrated to provide scale efficiencies. Where scale efficiencies are absent, investments in rail infrastructure can invite poor financial returns and burden their builders with excess debt and the need for continuing outside support to fund operating costs.

The need for scale means that railways are an efficient transport mode for bulk products and materials that generally move from a single point of production to one or a few points of consumption. Examples include oil, coal and iron ore production and transport. For products whose points of production and consumption are distributed over large geographic areas, railways can be an efficient mode, if there is a network of railway lines and facilities that support concentration so that scale economies can be achieved. Examples of such railways include transport from ports (a point of concentration), border connections or agricultural areas to population centers. Extensive networks permit long distance transport of many commodities between multiple centers of production and consumption. Generally, the value and utility of network businesses increases with the size of the network.

Some of the most successful railways combine bulk and general cargo transport. In these railways, bulk transport along a few corridors provides a base of financing for general cargo infrastructure.
While many governments build general-purpose road networks for road transport at public expense, such roads are generally also available for public use: even toll roads are open to anyone who can pay the toll (and is licensed to operate a vehicle).²⁷

Railway technology generally limits public use of rail infrastructure – freight cars, locomotives, and passenger equipment is generally too expensive for every farmer, small producer or passenger to have their own and to become qualified operators. Some form of concentration is needed. Because access to and use of rail infrastructure is much more limited, many governments organize railways differently from road transport. In developing countries, most railways are either organized as private enterprises (mineral railways are a prime example) or as a state-owned enterprise with the objective of operating commercially, requiring no government subsidy or support.

Unlike road transport infrastructure, many governments seek to limit the use of public funding for rail infrastructure and any subsidies required to provide and operate railway services. In the case of mineral production projects, rail infrastructure is often considered part of the cost of the mineral development and the ability to use rail infrastructure for non-bulk transport purposes is a side benefit. Many governments explicitly require that revenue from rail transport of bulk goods cross-subsidize general cargo and passenger services.

Some railways successfully provide commercial general cargo services (requiring no public subsidies) even if there is not a bulk transport base to cross-subsidize infrastructure costs. Commerially sound general cargo railways have several characteristics:

- Typically, they have acquired the use of rail infrastructure at less than it cost to build (either through transfer from prior owners or in the form of a transfer of use rights from government entities who originally built the railway). In any event, few new general cargo railways support the debt that must be incurred to build them.

²⁷ Vehicles usually have to meet safety standards which may include maximum gross weight, physical size, and minimum speed capabilities.
They connect to a larger rail network and typically have relatively low interchange costs.

They provide services between areas of commercial concentrations.

Rail tariffs are not regulated – commercial general cargo railways usually compete directly with road transport and must be flexible in pricing and service commitments.

For commercial railways with both bulk and general cargo services, there is a greater ability to support new construction but general cargo services usually rely on past investments; new investments are commercially justified on a return on investment basis. Sometimes governments seeking to provide commercial services will enter into a PPP structure with even state-owned railways wherein the government makes a contribution to the construction of new facilities. The contribution usually shows up on railway enterprise balance sheets as an increase in asset value and an increase in government equity participation.

Railway enterprises providing commercial general-purpose services have other characteristics:

They are managed to minimize costs and generally have lean staffing levels.

They buy second hand rolling stock – freight wagons, locomotives, and passenger equipment - or they lease it.

Commercial and marketing staff hold important high-level positions and they pay close attention to competition and market conditions and set prices based on the market, not on costs.

The viability of the railway enterprise depends on attracting traffic and good commercial arrangements with customers so railways pay close attention to customers and make it easy to ship by rail.

They team with and support freight forwarders, shipping agents, distribution and logistics companies, trucking companies, and other commercial intermediaries normally involved in distribution and local shipping services.

The most successful general cargo railways typically do not face direct rail competition on the basis of access rights. They may share infrastructure with bulk operators but do not compete with other rail enterprises operating under access rights unless...
network density is high or the government subsidizes the infrastructure.

**Regulation and Customer Relationships**

Trucking and road transport companies are usually seen as easy for customers to interact with; customer relationships with railways are almost universally seen as difficult. This need not be true.

Often, railways are treated as monopolies and are heavily regulated. Government bodies sometimes set railway transport prices independent of cost and many governments see their railways as employers of last resort. When prices are set without regard to cost, investment required or risk, it is not feasible for railways to operate without subsidy, except where there is a bulk customer that can be forced to cross-subsidize loss making services and absorb the risks. Even state-owned railways are pressured to minimize their requirements for subsidy so it is not surprising that they become difficult to deal with and do not focus on trying to attract general cargo customers.

**Network of Commercial Relationships**

Where railways are lightly regulated and are free to design economical services, it is usually easier for customers and railways to make mutually beneficial arrangements for transport services. Such railways have close relationships with their customers.

Where regulations are more intrusive, railways focus on bulk transport and most state-owned railways typically work through shipper agents, freight forwarders, and other agents. These entities have employees who understand how the railway is organized and how general cargo is sorted and marshaled into trains. They are also familiar with the documents that the railway needs for transport services (usually a waybill), billing purposes (notice of charges, proof of commodity, commodity handling requirements, etc.), for interchange with other rail systems (transfer consists), and border documentation (customs forms, shipper releases, customer acceptance letters, etc.). They are also familiar with the breadth of railway charges including shunting, loading assistance, loading and unloading charges, demurrage and
placement charges and know how to manage these services and costs.

In some cases, these third party intermediaries can provide rolling stock for freight shipments. This is now the standard practice in CIS countries where private rail operators are essentially freight forwarders that own or control a fleet of freight cars. Shipper agents, forwarders and rail operators tend to re-distribute some of the risk associated with investments in railway assets, most of which have a very long life (e.g. 25 to 30 years).

In addition to agents, other parties to successful general cargo railways include operators of distribution terminals. Often, the terminals are built on land provided by the railway but built by distributors, logistics operators, freight forwarders and operators to enhance their own distribution services. The pictures at left show a large logistics center on BNSF railway in the US. Here the railway provided the land, rail facilities, container handling yard and land for distributors to develop special purpose bulk and general cargo distribution facilities.

In developing countries, the railway or a third party operator may provide public warehousing and other distribution facilities for multiple logistics providers. The pictures at left show a Chinese distribution facility serving rail-to-truck customers as well as container services, a liquids distribution facility in Germany with tankage, storage, and rapid loading and unloading facilities. Other bulk distribution facilities include grain and fertilizer facilities, built by grain distributors and a multi-product warehouse distribution facility in Japan.

These types of facilities are typically provided at commercial centers but can also be built where significant physical barriers make the construction of rail infrastructure too expensive for commercial services. The railway provides low-cost transport of large volumes (say several freight car loads) of commodities which are taken into a general or specialized distribution and logistics terminal and then distributed by road transport from the terminal to many locations.

The construction of such facilities requires a number of commercial arrangements – between the logistics center developer and suppliers, road transport enterprises and the railway (or railways in case goods are transported over multiple railways). Railways often enter into contractual arrangements with local or
national government agencies, which provide the land and access to road networks as well as distribution companies.

Modern logistics terminals are an essential part of general cargo railways. In some cases, railway customers build factories and assembly plants along the railway. They also build receiving facilities with rail sidings and the unloading equipment needed to service the materials they are receiving and shipping. This might include forklifts, storage facilities, conveyers and other types of materials handling equipment.

These arrangements provide access to low cost rail transport while also providing the distribution facilities needed in both developing and developed countries. They provide an opportunity for local investment in transport infrastructure while also maximizing the utility of the railway – using it for what it does best.
Afgan national policy appears to have evolved the idea of a ring railway that mimics the national highway that circles the nation. The ring highway touches most major cites, and has spokes outward and inward to major developments lying off the ring. The outward spokes also connect to border crossings with other nations.

The national ring railway is thought of in the same way: a circular railway that unites the nation. Furthermore, its spokes inward and outward permit the railway to connect everywhere important with everywhere else. These spokes may reach inward to mines and outward to connect with the railways of other countries.

Circulating railways are neither unknown nor unusual. The smallest versions include the Chicago Loop and London’s Circle Line. Larger examples include Chicago’s Belt Line Railway and the Oktyabrskaia Railway’s belt line around Moscow.

We have been unable to find the exact origin of the concept of a ring railway for Afghanistan but the concept is firmly embedded in Afghanistan’s ministries. The concept of a ring railway is an integral part of the Asian Development Bank’s discussion of the gauge issue in the ADB’s Rail Gage Study Report Project Number: ADB TA 7259-AFG published one year ago.

The concept of a ring railway remains sufficiently strong in Afghan government thinking that a discussion of its origins, its

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28 Thus was confirmed in meetings with the Ministries of Public Works Railway Department on March 13, 2012 and with Mines on March 17, 2012.
29 Rail Gage Study Report Project Number: ADB TA 7259-AFG, April 2011, HB Consult, consultant.
problems and its fallacies is necessary. The concept of ring railway is sufficiently embedded in Afghanistan’s own transportation thinking to warrant some discussion. The most recent ADB study, which concerns the gauge issue, still accepts the idea of the Afghan great ring railway.

**Standard Gauge**

Afghanistan has expressed a strong preference for the use of standard 1435 mm track gauge for the entire ring railway, except for some spurs. This preference is made clear in earlier ADB Reports, which go so far as to project standard gauge track being laid along the recently laid 1520 mm railway from Mazar-i-Sharif to Hairatan. The Pre-Feasibility study envisages a line connecting Herat to Sherkhan Bandar (and the projected Tajik 1520 mm line) to form the northern section of the ring railway. This would be for a 1435 mm line with a 1435 mm spur line paralleling the new 1520 mm line,\(^{30}\) which was the result of the ADB’s Phase I construction. However, for Phase II, the ADB’s consultants recommended a 1435 mm line oriented towards Iran rather than 1520 mm lines oriented towards the Central Asian republics. Phase II also recommended building dual gauge track for 1435 mm and also 1520 mm between Kusskh and Herat.

Initial thinking that fostered the idea of Afghanistan building a ring railway appears to have been motivated by the idea that Afghanistan could serve as a “hub” for trans-Asian trade. This idea is related to the CAREC initiatives.\(^{31}\) In this thinking, Afghanistan becomes a “hub” for trans-Asian trade connecting the Middle East, Central Asia and South Asia with China:

“Afghanistan, by virtue of its location, would become the rail ‘hub’ of neighboring countries and seaport connectivity.”\(^{32}\)

It will be seen that many problems beset this concept of a ring railway acting as a transportation hub.

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\(^{31}\) See page 96 of the ADB *Gauge Study, Op Cit* for a strong expression of the importance of the CAREC in Afghanistan railway development.

\(^{32}\) p. 24, *Op Cit.*
Flaws with the Concept of a Ring Railway

Track Gauge

The obvious problem with the ring railway is that Afghanistan’s connections with other regional and trans-Asian networks have different gauges. Earlier studies assumed away this problem by positing that, because technologies and practices exist that permit railway stock to move from one gauge to another, change of gauge would not be a problem.

The ADB’s Rail Gage Study Report argues that there are manifest and serious problems with changes of gauge in a concept of a ring railway. Based on our analysis in Table One and our experience, we agree with the ADB’s Rail Gauge Study Report’s conclusions about these flaws and the need to resolve the problem by abandoning the concept of a 1435 mm true ring railway.

Interoperability

We would go further than the ADB’s report. The report brings up the important fact that the ability to operate trains from one region in another region around a ring railway becomes very difficult – and in some instances impossible – because the technologies and physical dimensions of the different regions are very different or totally incompatible.

The ADB report notes that different systems have different clearance outlines. That is: the tunnels, station platforms, curves and other features are narrower or lower on different systems: a railcar from China may not fit into a tunnel in Pakistan; an ore train from Afghanistan may be too heavy for a bridge in Iran.

Even when changing bogies and other compromises can accommodate a train, a basic problem remains. Trains – other than container trains and block trains of minerals or oil – are assembled from wagons from everywhere in one large region and then travel to everywhere in another region. This permits, for example, assembly of trains with wagons of Finnish paper, Ukrainian steel, Kazakh diesel fuel and Russian building lumber.

Interopera

Interoperable cargo trains require that wagons have a common technical standard

33 pages 8 thru 23, Op Cit.
to arrive in Termez, Uzbekistan, for distribution to Uzbekistan and to the new Afghan line from Hairatan to Mazar-i-Sharif.

This assembly of wagons into cargo and even passenger trains requires the wagons all to be built to uniform technical requirements. The “running gear” of brakes, bogies, couplers must all couple with each other then interact uniformly. Air brakes must operate at the same pressures. The strength of couplers must be the same as the couplers act as the links of the chain of wagons that make up a train. Coupling these cars into the same train reduces the maximum permitted weight of the train to the strength of its weakest link. Requiring inter-regions to “hub” their cargo trains around the ring railway requires that all rail commerce be moved in either special block trains or be reduced to the technology of the weakest link of the railway chain, in this case the 19th Legacy infrastructure of Pakistan.

Financial Problems with the Ring Road

Table Five in the Appendix summarizes the various proposals contemplated by the Ministry of Public Works to complete a ring railway and its branches. The entire construction budget – based on what may be highly problematic studies by third parties\textsuperscript{34} – amounts to $12 billion dollars for 3,160 kilometers of new construction. This sum does not include initial working capital or most of the rolling stock and maintenance depot spares, much less start-up losses. It is clear that the sheer cost of the ring railway and its branches is well beyond the financing ability of Afghanistan. The financial difficulties include construction and the subsidies to operate and maintain the railway.

The core financial problem inherent in the Pre-feasibility studies concerns the projected economic benefits. The typical projected benefits arise from transport expenses reduced by diverting from highway to railway and from broader benefits, such as reduced pollution and increased safety. However, there is yet no method of capturing those savings by either the railway operators or by

\textit{A core financial problem is that even if the projected economic benefits projected in the studies happen, there is no method of capturing those savings by the railway operators or by the Government.}

\textsuperscript{34} For example, Table 3 of the Pre-feasibility Study for Phase II shows contingencies of 34\% for a non-mountainous line but Phase III uses less that 11\% for mountainous lines in security issues areas. See also the World Bank’s informal note on Phase III suggesting that $2.7 million per km may be more appropriate than the $2.2 million km employed in Phase III.
the Government. Shippers would privatize the supposed cost reductions benefits while the railways’ operating losses would remain public.
Resource Corridor Development

In any event, a ring railway that acts as a routing hub for other regions to use Afghanistan as a rail conduit does not automatically generate resource growth corridors.\textsuperscript{35} Once construction is finished, development would be limited to transit fees and some train crew and maintenance crews. Our review of the various studies for CAREC, TRACEC, and EurAsEc groups’ routes transiting Afghanistan shows just that: ways of connecting distant economic regions, rather than developing regional economies inside the county being transited.\textsuperscript{36}

\textsuperscript{35} The entire question of whether or not an Afghan-routed hub would compete with $800 TEU sea routes is not addressed. However, HWTSK’s work in other studies argues that such a route – even if there were not technical problems – would not compete with the current sea routes at $800 per TEU.

\textsuperscript{36} See, for example, Appendix II of the Final Report for the Mazar-i- Sharif I-A Corridor.
The Afghan Ministries’ Views on New Lines

Current Afghan government views vary with the perspectives of the different ministries. The Ministry of Public Work’s Railway Department retains a ring railway focus. It has informally expressed the views that mining railways from the Bamyan (Hajigak) iron ore district either west to Herat or southwest towards Zarang is “impossible”. These lines would be physically daunting, to be sure. The Ministry remains committed to at least studying the feasibility of a ring-railway but with the use of two gauges instead of just one standard gauge. The 1435 mm standard gauge would extend along the southern rim from Kabul through Kandahar to Herat while the 1520 mm gauge would be used in the North.

The Ministry of Public Works believes that Pakistan has committed itself to fund the first 11.5 km of the 100-kilometer line connecting Pakistan’s 1676 mm system to the ring railway at Kandahar. This is despite Pakistan Railway’s financial and operating collapse in 2011. The remainder of the 100-kilometer line is justified according to the earlier Phase III pre-feasibility study performed for the ADB, a study the ADB now expresses some qualifications about.

Another belief was expressed that the MCC copper mining enterprise will perform the feasibility study of a north-to-south portion of the ring railway from Mazar-i-Sharif area to Jalalabad, with a branch to the copper mine near Kabul. Pakistan has already performed an ADB sponsored study of reconnecting the Pakistan line up from Landi Kotal to Torkham, which not surprisingly concludes that the 1676 mm line is justified. The

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37 We were unable to meet with the Ministries of Finance, of Economics, and of Transportation and Aviation.
38 Meeting with M of PW on March 13, 2012
39 The M of PW advises us that it has a feasibility study being carried out by a Czech firm for this portion of the ring-railway
Torkham connection north to Jalalabad was also justified by the Phase III pre-feasibility study.⁴⁰

Table Three, below, summarizes the various proposals contemplated by the Ministry of Public Works. The entire construction budget – based on what may be problematic studies by third parties – amounts to $12 billion dollars for 3,160 kilometers. It is clear that the sheer cost of the ring road and its branches are well beyond the financing ability of Afghanistan. The financial difficulties include the costs of construction and the subsidies to operate and maintain the railway.

The core financial problem with the Pre-feasibility studies is that even if the economic benefits, which usually consist of the savings by diverting from highway to railway, that are projected in the studies, do actually happen, there is no mechanism to capture the savings by either the railway operators or by the Government.

Finally, the Ministry of Public Works Railway Department made it clear that it was well aware that a US$700 million shortfall exists to upgrade, complete or repair the existing highways, and that its plans and hopes for new railways did not exist in a funding vacuum.

The Ministry of Mines, instead, focuses on whether or not the miners will build railways and which these will be. This includes the MCC-sponsored commitment to build a north-south route through Kabul if feasible. The focus also encompasses routes north from Bamyan through the coal field at Dar-i-Suf towards the CIS or Iranian connections around the area of Mazar-i-Sharif, as well as the AFISCO-sponsored lines either west or south-west.

The Ministries’ Views on Passenger Operations

Meetings with various ministries, an examination of the Iranian designs for the line from Khaf east to Herat and the Phase II and III pre-feasibility studies all point towards the conclusion that many Afghan government staff believe that passenger operations

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should be provided immediately, or at least provided for in the very near future.

The Ministry of Urban Planning focuses on the MCC-sponsored north-south route. It advised us that it has worked with representatives from five major cities along the route to locate the passenger stations and the goods depots when this new railway is built.

**Asian Development Bank & the CAREC Routes**

The ADB took much of the initiative in the initial planning and funding of Afghanistan’s railways. This initiative includes sponsoring the construction of the first railway in Afghanistan to extend beyond a simple border crossing. This work was carried out in cooperation with the GoIRA’s Ministries, usually the Ministry of Public Works.

Our report requires us to comment on the previous and current ADB efforts. This is highly appropriate because much of the thinking in the various ministries has been, and remains,
informed by the initial, innovative ADB work. Furthermore, the ADB remains active and actively provides planning and construction funding.

The Report’s discussion of the ADB background is arranged as follows:

- Afghanistan’s Initial Commitment to CAREC
- The Phase I, II, and III Pre-Feasibility Studies and Afghanistan’s First Railway
- The Gauge Study
- Present Efforts

Where possible, text from prior reports and studies, often documents provided to us by the ADB, are quoted or cited directly.

Afghanistan’s CAREC Background and Initial Commitment to CAREC

The GoIRA publicly had committed itself to the Central Asia Regional Economic Cooperation (CAREC) approach by 2007. CAREC members are the Central Asian Republics, China, and Mongolia. According to a report prepared for the Bank by Richard Bullock in 2010:

“In November 2007, the Central Asia Regional Economic Cooperation (CAREC) Transport and Trade Facilitation Strategy was endorsed by a Ministerial Conference. The Strategy aims to improve the efficiency of passenger and freight transport in the CAREC region by upgrading key transport corridors and harmonizing the regulations governing regional cross-border trade.

Six corridors are defined in the strategy:

- Corridor 1: Europe – East Asia
- Corridor 2: Mediterranean – East Asia
- Corridor 3: Russian Federation – Middle East and South Asia
- Corridor 4: Russian Federation – East Asia
- Corridor 5: East Asia – Middle East and South Asia
- Corridor 6: Europe – Middle East and South Asia
Of these, two (3b and 6b) cross north-western Afghanistan from Hairatan to Herat and Islam Qila and two (5 and 6c) cross north-eastern Afghanistan from Shirkhan Bandar on the Tajikistan border to Torkham. Both corridors include projects to improve the relevant roads in Afghanistan but omit any mention of rail.

The target is to implement all the schemes identified in the strategy by 2017 and thus help to increase regional trade by 50%. Some reports quote the potential for north-south transit trade at 20-30 million tonnes. This seems relatively large considering the relatively low import/export volumes at present from Central Asia and the historic trade links.”

In 2009, the ADB issued its Railway Development Study. This study affirmed the CAREC concept. The 2010 ADB’s Phase I Report’s Executive Summary’s very first paragraph restates the GoIRA’s commitment to CAREC:

“In order to meet the demand for the fast growing intra-regional trade and improve connectivity, Afghanistan is in need to develop its transport infrastructure. The present road system of the country in terms of its capacity and network is inadequate and the Railway infrastructure almost non-existent. So the movement of passengers and goods within the country and across the borders remains seriously constrained. In addition to that the Government of Islamic Republic of Afghanistan (GOA) has agreed with the strategy adopted by the Central Asia Regional Economic Cooperation (CAREC) program, which is aimed to develop six corridors across the region and all through Afghanistan. Once these Rail corridors are commissioned, the country can efficiently handle the growing transportation demand.”

This theme continues throughout the ADB’s reports. The initial ADB reports frequently refer to CAREC when framing their analyses and justifications. Therefore, to move Afghan policy towards resource corridor development requires knowing where

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41 “CAREC Corridor Section, unnumbered page, Preliminary Policy Note on Development of Railways in Afghanistan: Focus On the Jalalabad to Peshawar Corridor. July, 2010
42 ADB Project Number: 42533: Islamic Republic of Afghanistan: Railway Development Study; Policy and Advisory Technical Assistance (PATA), March 2009
43 page X of the Final Report, Op Cit.
44 pages X, 1,3,4,6,9,10,12,15,18,20,21 and following appendices in the Phase I Final Report, Feb 2010; pages VI, 1,3-5,7,9,12,13,30,45,49 of the Phase II Final Report, May 2010; pages 1,3 in Vol, pages 14-15, and following in Vol II of Phase III Prefeasibility Report, December 2010. All reports cited previously.
A ‘resource corridor’ is a sequence of investments and actions to leverage a large extractive industry investment, in infrastructure, goods and services, into viable economic development and diversification in a defined geographic area.

World Bank Concept Note

The starting point of the movement is, and that point was a CAREC stance of trans-Asian trade corridors. The ring railway would place Afghanistan as a key hub in trans-Asian trade, even though the CAREC analysis emphasized highways instead of railways through Afghanistan.

The ADB has been migrating away from viewing Afghanistan’s railways as a means of implementing the goals of CAREC with its goals of trans-Asian commerce flows. The ADB’s Rail Gauge Study Report points out the technical problems created by the differences in track gauge and loading gauge between the regional rail networks that would intersect in Afghanistan, and adopts a less ambitious stance towards viewing Afghanistan as a rail transit conduit.

The ADB remains committed to developing Afghanistan’s transport capacity, both physical and institutional. The ADB has proposed year-by-year tranches to a total of a $575 million for the ADB’s “Transport Network Development Program.” This is in addition to the more than US$754 million previously committed to this program. The first tranche of this effort is to improve the capacity of the Ministry of Public Works, as well as augmenting the road and rail network. Significantly, the US$189 million tranche provides funds for the operation and maintenance of the new 75 km line from Hairatan to Mazar-i-Sharif: that is, an operating subsidy.

**Mining Railways**

The idea of resource growth corridors originates in the opportunities presented by mining developments. Mines require major assets to be developed in a region. The assets are heavy machinery, transportation infrastructure, electric power infrastructure and human capital. The construction phase and the operation phase of the mines require employees and these employees require residential communities.

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45 ADB Grant 0261-AFN, Tranches 1 through 4.  
http://www2.adb.org/projects/project.asp?id=44482
The World Bank’s own concept briefing defines the hoped-for relationship between wide-based economic development and the exploitation of Afghanistan’s mineral resources:

“To realize the mining sector’s full potential, hard and soft infrastructure must be combined over time along a ‘resource growth corridor’. A resource growth corridor aims to exploit resources’ potential while escaping resource dependency. It represents a combination of efforts to leverage a large extractive industry investment, and its requirements for infrastructure and goods and services, into viable economic development and diversification. For a number of reasons, especially in a low-income country, economic linkages between mining and the rest of the economy will not naturally occur through market forces. When the barriers to wider benefits are not addressed, the local economy is unlikely to take advantage of the opportunities to supply goods and services to the mine or other resource-based investment or take advantage of any potential to use its products and its associated infrastructure. In particular, there is a need to rapidly prepare the fledgling Afghan private sector to reap the downstream benefits generated by the large mining projects and generate jobs.”

There are three very large mineral deposits that have attracted the attention of mining corporations or “miners”. The first of these is Aynak copper, the second is iron ore in Bamiyan Province, specifically at Hajigak and the third is the coal deposits to the north of Hajigak, notably those at Dar-i-Suf. The coal is typically treated as an extension of the copper and iron ore mines because the coal can be used to generate electricity and some of the coal can be used to make coke to smelt the iron ore into raw iron (“pig iron”). The raw iron can then use even more coal to make the pig iron into steel. The electricity generated by burning coal to make steam is also used to smelt the copper ore into raw copper.

There are many other mineral deposits in Afghanistan. These have been treated in other studies. Some of these valuable deposits lie along the possible paths of railways from the mines westward towards export facilities. These are not discussed in this report because their development is thought unlikely to happen until growth corridors emerge from Hajigak and Aynak.

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46 Page 2, Concept note: AFGHANISTAN: SUPPORT FOR PROGRAMMATIC RESOURCE GROWTH CORRIDOR DEVELOPMENT, early 2012.

Basic Transport Economics

Some simplified technical facts will facilitate understanding the transport economics of iron ore and copper. What mining railways will be built, and how and where they will happen, is initially influenced by basic transport economics.

Afghan iron ore contains about 60% to 65% pig iron; the rest is rock and dirt. An efficient rail ore wagon load carries not less than 65 tonnes of ore. Although the price can vary, pig iron sells for about US$500 a tonne. Therefore, a wagon-load of iron ore has about $20,000 of iron inside it. A wagon load of pig iron has about US$32,000 sitting inside it.

Copper ore is 1.5% to 2.5% elemental copper, plus some traces of other valuable metal that is released in small amounts during smelting. Raw copper sells approximately for about $4,600 a tonne. A 65 tonne wagon load of copper ore has only $7,500 of copper and and other metals in it. If it costs 2.0 cents per gross tonne-kilometer to move the ore and the wagon - including returning the empty wagon back to the mine - then a one-way movement of 3,300 kilometers reduces the value of the ore to absolutely zero. A movement of only 900 km will reduce the value of the wagon load copper ore by $2,000. For this reason, copper ore tends to be moved very short distances before it is smelted.

The fact that bulk minerals – even iron ores – are sensitive to transport costs drives railways to become remarkably efficient when moving bulk minerals. For example, switching from a typically European UIC Type F bulk wagon to a North American AAR Type HT, and from typical UIC axle gauge of 22.5 tonnes to 48

50 The World Bank advised us by e-mail on April 26, 2012 that MCC may refine copper to pure Grade A anodes, which would increase the value to over $8,000 a tonne. However, although the transport distance would be much longer to reduce the price to zero just because of rail transport, it would also make trucking more attractive because of the reduction in transit time and hence the reduction in “pipeline inventory” costs.
51 This is borne out by an author’s own experience immediately out of the university. The author was the cost estimator for the Southern Pacific’s copper ore trains in Arizona for Kennecott Copper. Copper ore trains never moved more than 60 kilometers to the central Hayden copper smelter.
an AAR-AREMA axle gauge of 32.5 tonnes, can lower the cost per tonne-kilometer of ore by 83%. For this reason, the efficiencies embedded in the design family of any railway network a mining railroad connects to, becomes crucial to the transportation equation. No matter how efficient a mining railway is, its realized efficiency will depend, in very large part, on the railway it connects with.

Finally, there are other minerals not generally treated in many studies concerning rail and resource growth corridors. These are cement, oil and natural gas. We believe that both resources provide highly illuminating instances of the importance of commercializing a railway to foster resource growth corridors. Cement is dense, a by-product of steel-making processes, and rail is typically the preferred mode for transporting cement over long distances. Natural gas is often transported by rail tank cars, especially in the CIS. Usually, natural gas is concentrated into LNG or PNG. Some railways in the region have fleets of LNG tank containers for distribution to smaller centers. A great deal of oil is transported by oil tank wagons in CIS countries. Russia alone has more than 200,000 privately owned tank wagons for oil transport. Rail transport is an efficient alternative to pipeline construction because various grades of crude can be moved in different wagons, maximizing the potential returns from oil field developments.

Aynak Copper & MCC

The Aynak copper deposit of 240 million tonnes, less than forty kilometers east of Kabul, is believed to be one of the richest remaining large copper ore deposits available for exploitation. By 2004, the Ministry of Mines sought offers to develop the deposits and, by 2008, it had awarded a concession.

The winning consortium was China’s Metallurgical Construction Company (“MMC”) and Jiangxi Copper Company Limited bid an up front premium of US$808 million (payable in tranches against

52 The IBD’s internal discussion “concept note” is an exception. It specifically mentions development of oil in Amu Darya and gas in Sheberghan.
53 /www.mcclatchydc.com/2009/03/08/63452/chinas-thirst-for-copper-could.html
development benchmarks), together with ancillary infrastructure that includes a shared-use 400 MW power plant, water supply system and a regional road/rail system. The mine, with its claimed direct employment of 5,000 and possible annual revenue stream of USS300 million to the government, was to build ancillary infrastructure linkages that include power transmission through Kabul to a power plant in the north, together with rail options to the north, east or south connecting to regional rail systems. Most discussion of the winning consortium refers to the consortium by the name MCC.

**North-South Route and Aynak**

We have been repeatedly advised that MCC offered to construct a North-South railway that would connect the mine to the Pakistani 1676 mm gauge railway to the south and the CAREC and CIS 1520 mm gauge lines to the north, or even to a distant-future 1435 mm gauge line extending all the way into China.

The North-South route would be both daunting to construct and expensive to operate. Before MCC would construct the line, it would conduct a feasibility study to estimate the alignment, construction costs, operating expenses and operating revenues. This study was to be completed by 2011.\(^\text{54}\) The date was extended to 2012, and then again to 2014. We have been advised that MCC has just engaged an entity from China’s Ministry of Railways to conduct the feasibility study. We also understand, albeit informally, that, whatever the cost of this line, MCC is only obligated to fund up to the first USS3 billion to construct the line. The line’s exact length remains uncertain, as does its alignment. However, it would need to extend from Naibabad in the North to Torkham on the Pakistan border in the South, a distance of perhaps 600 kilometers over several mountain ranges, possibly paralleling Afghan highway routes A1 and A76. Construction would require at least four years. Assuming that the feasibility study concludes the line is constructible and operable and construction would begin immediately after the conclusion of the

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\(^{54}\) Much of the discussion that follows is based upon interviews with a number of Ministries during the week of March 12, 2012. We do not have access to the Agreement that governs MCC’s obligations to the GoIRA. MCC was also unable to meet with HWTSK representatives. Therefore, HWTSK’s analysis is based in part, upon what may be viewed as a consensus view of the many parties we met with and the many reports we read.
feasibility study, the earliest opening date would be 2018, if no problems were encountered.

It may be possible to construct such a line for less than US$3 billion. The new 1,142 kilometer-long Quinhai to Lhasa Railway built by China in daunting mountain terrain is publicly reported to have cost US$3.22 million per kilometer. This figure appears to exclude rolling stock, terminals and working capital. Construction costs were mitigated by building through secure territory and by starting from a Chinese railhead. Afghanistan’s costs could be much higher. But, assuming the best of all possible parameters and no security issues whatsoever, a 600 kilometer-long modern North to South could cost “as little as” US$2 billion using the figures China published for its Tibetan efforts.

Many plans we reviewed assume the line will be built; that is, they plan on the North-South line’s construction. In the Ministry of Public Works planning - the idea of a ring road – the North-South route is a very large piece of the ring. The World Bank and Asian Development Banks’ reports and studies, and even the Urban Development Ministries’ plans for passenger trains often assume the construction of this showpiece railway.55

**Reasons not to Construct North-South Route**

There are very good reasons not to construct the line, however. We strongly recommend that thinking take into account that MCC North-South route could be a mistake in planning.

1. It was shown above that operation of a copper mine rarely relies on the use of a railway to move ore long distances. There is no necessary requirement for the Aynak mine to use a long-distance railway. MCC does not need to build this or any railway to construct or operate its mine.

2. The plausible thought has been advanced that Hajigak’s iron mines could share the MCC line. Inasmuch as the copper mine does not need the new railway to begin with, this thought then becomes hoping that MCC builds a railway not for itself, but for the benefit of the AFISCO. While AFISCO could repay the cost of the North-South route from Kabul to Torkham through tariffs, the expensive Kabul-northward

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55 It may be said to be a “Keystone” of transportation and development, a term not unknown in railways.
section would remain unused by AFISCO, or *visa-versa*. Furthermore, the discussion below on Hajigak shows that AFISCO *always* has a better alternative than paying for a North-South route via Kabul.

3. We have been advised that MCC intends to construct its electric power station at the coalmine mouth, and then transport the power over transmission lines. This means that coal will not move to Aynak. Coal movements are typically by railway.

4. The railway connection to the south is the shortest route to seaports, such as Karachi. At this time, the Pakistan Railway cargo operations are severely constrained by a lack of resources (rolling stock and locomotives) and the physical plant is said to be in poor condition. It needs to be rebuilt, a huge project in itself. Furthermore, the Pakistan Railway network is largely obsolete and cannot accommodate modern, high capacity wagons.

5. There is, as of now, no business case for a northern link from Kabul/Aynak to the CIS region. The line will not have a base of bulk commodity movements (neither coal nor copper ore) and the extent of general cargo traffic is largely unknown. It is as likely as not that any new line will not be able to cover both its operating costs—which are likely to be high in the mountainous and snowy terrain—and maintenance of infrastructure costs. The result may be annual deficits with no identified source of funding.

6. Our review suggests there is considerable expectation that a North-South line will be expected to provide conventional passenger services. There is almost no evidence that conventional passenger trains cover even their above-the-rail costs, resulting in another drain on the national government’s finances.

7. There is a classic change-of-gauge problem. The current plan is to change at Kabul from northern 1520 mm gauge to southern 1435 mm “standard” gauge. Pakistan is 1676 mm gauge. The line could reduce the problem by changing the gauge plan so that the mine is either 1676 mm or 1520 mm. But, then, this destroys the concept of a unified North-to-South through route!

8. Finally, and perhaps most significantly, there are better opportunities to invest US$2 to $3 billion in transportation infrastructure than a North-South railway.

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*There are better opportunities to invest US$2-$3 billion in transportation infrastructure than a North-South railway.*
infrastructure. Indeed, such opportunities may provide MCC and the national government with much greater political as well as economic benefits.

Therefore, we recommend that (a) alternatives to an MCC sponsored North-South railway be investigated and (b) that planning not assume or include this route.

**Hajigak Iron Ore & Investors**

Development of the Hajigak iron-ore deposit west of Kabul is hoped to reinforce Aynak’s infrastructure contributions. Hajigak will demand large-scale power, rail, roads and water systems. Like Aynak, Hajigak is thought to be an important node within overall emerging resource corridor development.

> “Connecting these two mines could have an economic spillover effect – in which other mineral resources are economically translated into more viable commercial assets; while alternative land uses and commercial activities are stimulated.”

We understand there are two concessionaires for mining and development of the iron ore deposits. One is an Indian consortium named AFISCO and a smaller deposit is held by a Canadian-based firm named KILO. The tenor of our interviews and documents at hand is that AFISCO is the leading entity and that KILO will base its actions to dovetail into AFISCO’s plans, although we cannot be certain.

As of the time of writing, it remains completely unclear what AFISCO’s exact transportation plans are. What we have is speculation among many alternatives. The Ministry of Mines advised us that AFISCO plans should become firm by May 2012 and that a formal contract signing is planned for June 2012. Our work shows that there are a great many ideas being floated. Some are more likely than others. Table Two in the Appendix attempts to capture most of the ideas and their salient features and the map below illustrates them.

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56 Page 1, World Bank Concept Note, _Op Cit._
57 Ibid.
Regardless of current geopolitics, one may be prudently skeptical of the alternatives that rely on connections with the IRIR, the Iranian national rail system, to transport the entire output of the iron ore district. Even under the optimistic assumptions, the final amount of mine product that needs to be moved would simply overwhelm the IRIR and its proposed connections into Herat. It is a matter of arithmetic. The line east to Herat has a capacity of 35 trains a day if the line is upgraded. It is built to a 22.5 tonne axle load, a relatively lighter axle gauge. The iron ore mines would require, under the most optimistic assumptions, 36 trains per day to move steel mill products and pig iron. The high number results from the small payload of individual IRIR trains. To move steel and pig iron when both AFISCO and KILO are operating at full plan, would require 60 trains per day, and 30 trains per day even if
the net payload if the IRIR per ore train was somehow doubled.\textsuperscript{58} The Hajigak output could begin to crowd out all the IRIR’s other traffic.

On the other hand, it is possible that not all of the output would need to move across one route of the Iranian system and move at full output instantaneously with the initial opening of the iron ore mines.\textsuperscript{59} Some output could be distributed and used inside Iran; some could exit via the CIS rail connections if a line is extended down to Mazar-i-Sharif through Dar-i-Suf, and some, especially pig iron and steel mill products, might be trucked to various outlets, including within Afghanistan. All this points to the benefit of connecting the mines to heavy-duty regional networks of general cargo railways. It also gives more economic and pricing resiliency to the mines’ outputs.

The alternative of building eastward to connect with the North-South line at Kabul has two major problems. The first is that the North-South line may not be built, as we have seen above. The second is that it connects with the problematic Pakistan railways, a railway with technical standards even lighter than those of IRIR. The Pakistan railway lines, built to a very light Legacy technical standard, would have to be almost entirely rebuilt in very difficult terrain. Therefore, this spur line could be a railway to nowhere.

This leaves the alternatives of building a dedicated, heavy duty railway from mine to port, alternative #3, or, perhaps sending the output into the CIS nations, alternative #4. A heavy-duty line could be built down to Gwadar (or Chabahar under a variation of this alternative.) This is feasible and constructing heavy-duty lines is often rational. Alternatively, a short, CIS style line could be built northward to the steam coal and metallurgical coal fields nearby, and continued the short distance downhill to Mazar-i-Sharif. This would bring coking coal to the mine and would connect the mines to the heavier duty CIS gateways in Uzbekistan and Turkmenistan, as well as the IRIR at Herat.

\textsuperscript{58} Upgrading would add CTC traffic control using fiber optic lines. At 15 million tonnes per annum from only the AFISCO mine, and with 100% empty backhaul on ore jenny wagons, and operating 350 days p. a, 36 trains are needed. For 4,800 tonne net payload and 25 million tonnes p. a. for both operations, 30 trains are needed.

\textsuperscript{59} It is also possible for the IRIR to gradually upgrade its axle loads as volume gradually builds up. At the present time, the IRIR appears to take a UIC approach instead.
Table Three: Potential Hajigak Mine Railways

<table>
<thead>
<tr>
<th>From</th>
<th>Via</th>
<th>Connecting With</th>
<th>Distance to port in Km</th>
<th>Gauge (mm)</th>
<th>Construct-ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 Hajigak</td>
<td>New line through Kandahar to Zarang</td>
<td>Iran at Zarang, then IRIR to Chabahar port</td>
<td>2,200</td>
<td>1435</td>
<td>easier</td>
</tr>
<tr>
<td>#2 Hajigak</td>
<td>West through mountains to heart</td>
<td>IRIR at Herat, then IRIR to Chabahar</td>
<td>1,800</td>
<td>1435</td>
<td>“impossible”⁶⁰, ⁶¹</td>
</tr>
<tr>
<td>#3 Hajigak</td>
<td>East to Kabul</td>
<td>MCC North-South Route</td>
<td>1,800</td>
<td>Probably 1676</td>
<td>difficult</td>
</tr>
<tr>
<td>#4 Hajigak</td>
<td>New line through Kandahar to port</td>
<td>Pakistan at Gwadar port</td>
<td>1,700</td>
<td>1676 or 1435</td>
<td>moderate</td>
</tr>
<tr>
<td>#5 Hajigak</td>
<td>North Mazar-i-Sharif &amp; Hairatan</td>
<td>Coal mines &amp; C. I. S network thru Uzbekistan</td>
<td>390 km new construction</td>
<td>1520</td>
<td>difficult</td>
</tr>
<tr>
<td>#6 Dar-i-Suf</td>
<td>North to Hajigak mine</td>
<td>mine with other routes at Hajigak</td>
<td>&gt;200</td>
<td>t/b/d</td>
<td>moderate</td>
</tr>
<tr>
<td>#7 Hajigak</td>
<td>New haulage road for trucks</td>
<td>Pakistan at Gwadar port</td>
<td>Shorter by at least 100 km than by rail</td>
<td>highway</td>
<td>easiest</td>
</tr>
</tbody>
</table>

Possibility to Move Output by Truck

It appears, however, from some information available to us, that AFISCO might also build a heavy-duty road from the mines to the Pakistan border, thru Pakistan, and then into Indian smelters.⁶² This would initially move only 6 million tonnes a year of ore, an amount that could also be moved by UIC style railways such as the IRIR. Observers have questioned the feasibility of such a trucking

The railways from Hajigak and Aynak are not likely to contribute to resource growth corridor development.

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⁶⁰ Several meetings characterized this alignment as “impossible” or in similar terms because of mountainous terrain.
⁶¹ The World Bank advises there is a dam in rthw way of the natural alignment, among other problems.
effort. Certainly it is possible but clearly daunting in the mountains with the violence that attends such a route.\textsuperscript{63}

What AFISCO will do remains a matter of conjecture until no sooner than June, and perhaps well after that. However, it may be concluded that railway route from Hajigak to the ports, like Aynak, will not likely contribute to the resource growth corridor development in the near term because of the problems discussed above. However, a much shorter, less expensive new route from the mines to their coal supplies to the north, and thence to the CIS and CAREC routes built or under construction, may have significant benefit to both the mine economics and resource growth corridor development.

**Miners & National Tariff Pressures**

A consideration for a miner – or any private investor in a railway – is that a national government or provincial leadership may impose economic rents in the form of tariffs and tolls on the mines lines. Of particular concern in Afghanistan is any mineral line that connects to a national system so that the mineral line can gain access to a port. This argues for a strategy of connecting to more than one national railways, relying on trucks to a significant extent, or constructing one’s one railway that does not interchange with a national system.

**Connecting National Railways**

**Iran:**

**Background**
The Islamic Republic of Iran Railways (IRIR) is involved with Afghanistan’s resource growth corridors. The IRIR is often discussed as an outlet for the mines’ outputs, such as Hajigak. The IRIR is also building an extension of its network into northern Afghanistan, at least as far as Herat.

\textsuperscript{63} The practice of trucking minerals distances is not unknown. South Africa trucks coal and Mongolia’s ERR does the same to China. Issues of topography and security are much less however.
The IRIR displays aspects of several types of railways. It employed AAR-style higher-capacity cargo locomotives in the past. It is standard gauge. Running gear is UIC-style, but with adapters to handle short trains of CIS-wagons. Finally, its concepts of logistics and passenger operations appears to display what could be associated with ‘legacy’ or colonial era railways.

The IRIR is a natural connection to Afghanistan for a number of reasons. The IRIR network connects to the substantial Iranian economy and to major ocean ports. Unlike Pakistan’s railways, the IRIR still operates cargo trains; much of this is bulk cargo, especially oil and gas. The natural connection to Herat and thence westward follows easy terrain for railway construction. The IRIR is accustomed to interchanging wagons with the CIS railways. There is a history of trade and common culture between Iran and northern Afghanistan.

**Drawbacks to Iranian Connections**

There are, however, two serious drawbacks to coupling economic development of resource growth corridors to the IRIR. The first is geopolitical considerations. The second concerns railway technologies.

Geopolitical considerations are not the province of this report. Therefore, we will confine our observation to noting that, in our experience, strident political agendas and rational railway economic development appear inversely correlated.

![Graph of Freight Charges](image)

As to the technologies: The IRIR appears committed to the UIC design family, regardless of its claims. The IRIR embarked on double-tracking to gain capacity rather than increasing axle gauge beyond 22.5 tonnes. It has purchased Siemens/MTU lightweight, 4-axle diesel-electric locomotives that are not suitable for heavy cargo trains, especially mineral trains, and its specifications for wagons explicitly call for short, fast trains that operate frequently, that is, for passenger trains. Increasing train length and wagon payload is the typical way to gain capacity for cargo trains.

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64 Double-tracking is perfectly rational way to gain capacity if the capacity that is needed is for short, fast trains that operate frequently, that is, for passenger trains. Increasing train length and wagon payload is the typical way to gain capacity for cargo trains.
out UIC running gear designs that limit the over-all weight of cargo trains. The result is a railway that displays some of the highest cargo tariffs among railways.\(^{65}\) Doubtless some of the high tariffs are to provide a cross subsidy from the oil and gas movements to the passenger operations. But this does not change anything: movements into and out of Afghanistan through the IRIR face very high tariffs and a railway that has a high cost structure.

**Railway to Herat**\(^{66}\)

It appears the government of Iran has made commitments to extend its railway from Mashad to Herat via Khaf. A line from the city of Torbat-Hayderriayyah to Khaf was recently completed, a distance of 250 km.\(^{67}\) The line from Khaf to Herat is to be built in four packages. Each package is about 62 kilometers of railway although we are also informed the line is only 200 km from Khaf. The first two packages are within Iran. The second two packages take the line from the border eastward to Herat.

Iran will fund and manage the first three packages, to be finished by the end of 2012. The Ministry of Public Works hopes to secure funding for the final 62 kilometers to Herat. The estimated figure provided to us is that another $60+ million is required for package #4, to which must be added an unspecified sum to construction a large bridge, rolling stock and working capital.\(^{68}\) This figure uses $1 million a mile as a typical figure for construction. We and other sources believe that $2+ million is more appropriate.

We are advised that, at the present time, Iran has graded the alignment and built civil works. We are also advised that Iran has not, however, installed the rail and ballast or the traffic control system on any of its first three packages to Herat. There are conflicting reports about the percent complete of the line, including reports that the grading is almost complete for Package #4 has not been funded nor tendered. Until actual progress can be verified, the date that IRIR can participate in resource growth corridor development will remain uncertain.

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\(^{65}\) The figures for Iran are from 2001, the latest figures available. The source is the World Bank’s data for other nations.

\(^{66}\) The section on the railway to Herat is based, in large part, on a meeting with the Ministry of Public Works railway department on 13 March 2012. HWTSK was not able to meet with GoIRI’s officials, and so relies on the M of PW meeting and public domain material.

\(^{67}\) en.wikipedia.org/wiki/Islamic_Republic_of_Iran_Railways#Links_to_Iraq.2C_Syria_and_Afghanistan

\(^{68}\) Apparently Iran has not installed rail, ballast, or traffic control systems on any of its lines to Herat.
#4, which is not funded nor tendered.\(^69\) Until we can inspect the actual progress on site, uncertainty will remain about the date at which the IRIR can ever participate in resource growth corridors.

**Problems with IRIR Design of Heart Line**

During our meeting with the Ministry of Public Works, some problems with the IRIR’s design of Package 3 emerged. Package 3 appears to be designed as a legacy railway; that is, it is already obsolete. The axle gauge is only 22.5 tonnes instead of a forward-looking 25 or 30 tonnes. This clearly limits its ability to participate in developing mines and metallurgical complexes within Afghanistan.\(^70\)

The IRIR railway in Package 3 fails to include modern cargo provisions. There is almost no opportunity to use the railway to advance agriculture, manufacturing or the distribution of energy such as coal, distillate fuels, and natural gas. An inspection of the terminus station shows a layout emphasizing passenger trains; obsolete wagon unloading platforms; no provision for sidings connecting to industries or logistics warehouses; no container yard, no major highway connection, and no tracks to unload fuel on any kind, much less to unload bulk commodity wagons of fertilizer, cement, and the like. There is no provision for a grain elevator track. Although there are several kilometers of yard tracks, and a provision to maintain and fuel a shunter locomotive, the tracks do not lend themselves to switching or marshaling cargo wagons; that is, there is no tail track or ladder track. In summary, the IRIR design is for the railway’s economic world of the 1920’s. There is no provision for modern economic development that makes use of a cargo railway.

A priority action, therefore, is amending the design of Package #4 to include modern provisions for bulk and manufactured goods, and for containers arriving from Iranian ports and from inland.

\(^69\) http://www.andrewgrantham.co.uk/afghanistan/railways/iran-to-herat/

\(^70\) While Iran may view matters differently and may claim it has a major iron ore mining effort and steel industry, one source states: “Mining in Iran is under-developed. Yet the country is one of the most important mineral producers in the world, ranked among 15 major mineral rich countries, holding some 68 types of minerals, 37 billion tonnes of proven reserves and more than 57 billion tonnes of potential reservoirs. Mineral production contributes only 0.6 per cent to the country’s GDP. …. Many factors have contributed to this, namely lack of suitable infrastructure, legal barriers, exploration difficulties, and government control over all resources.” http://en.wikipedia.org/wiki/Mining_in_Iran
Furthermore, the axle gauge should be at least 25 tonnes with bridges rated at 30 tonnes. Passing loops and loading gauge should equal or exceed the latest CIS standards to permit change of gauge at heart with a 1520 mm lien arriving from the east. Bridge clearances should permit double-stack container moves.

Lastly, the provision for passenger trains should be challenged. Providing passenger service – even the token service projected in the media – will saddle the railway with losses that will over-burden cargo shipments or drain public funds.\(^\text{71}\)

**Pakistan**

This report has discussed the concepts that propose connecting the Pakistan Railways or Pakistan ports to Afghanistan. The concepts either rely on building from existing railheads near the Pakistan border or on constructing all-new railways from the mines down to Pakistan ports.

Three major concepts – the variations appear endless – are described in Table Four. The two extensions of railheads are at border crossings at either Chaman or Torkham, where colonial legacy lines extend almost to the border. The completely new line would extend down from the Hajigak mines through Kandahar through Baluchistan to an ore port at Gwadar. All these concepts were discussed in previous sections on mines and ADB’s CAREC-related studies.

As with Iran’s IRIR, there are several almost insurmountable problems with using the existing Pakistan Railway connections at Torkham and Chaman. These problems include:

- The contentious geo-politics of transportation and investment in Pakistan.
- The Pakistan legacy-design railway with limited ability to move cargo economically

\(^{71}\) We read internet reports of 320,000 projected passengers per year. This is 876 average passengers per day. Assuming a 60% average load factor, modest five-coach long trains with 400 seats, and an equal movement of passengers in both directions, this is 1.82 trains per day per direction, or two round trips a day, only.
• The virtual collapse of the Pakistan Railways’ cargo operations.\textsuperscript{72}

• The significant distances from the Afghan border to the ports.

• What will the connectors connect to?\textsuperscript{2}

Discussion of geo-politics is beyond the scope or competency of this report. It must suffice to state that the problem is real and introduces an element of risk and uncertainty into any resource growth corridor investment that relies on a timely-built, then operationally reliable railway that furthermore relies on fairly arrived-at tariffs and predictable border customs. The Pakistan Railways recently announced a 30\% increase in tariffs for its remaining, vestigial cargo business.

The other problems require substantial investment and substantial time to remedy. In short, any Pakistan Railways route from a border crossing to a port must be rehabilitated and upgraded for almost its entire length. Table Four shows that this line would require investment of $1.7 billion or more to upgrade the 1,000+ kilometer lines from a seaport to a border connection, as well as acquiring reliable locomotives and building the actual new tracks at the border connection.

The need for upgrading track and new AAR-style reliable cargo locomotives is now beyond dispute. While the Pakistan Railways claims an axle gauge of 22.8 tonnes, this is a maximum. The line to Chaman is rated at only 17.8 tonnes. The Annual Report for 2010-211 discusses the fact that only 2,500 million Rs was budgeted to cover a maintenance need of 8,935 million, an allocation of only 27% of estimated need. Although the Pakistan Railways is rebuilding its legacy fleet of locomotives in-house, and is able to restore some cargo services, it remains critically short of motive power with its newest locomotives displaying major problems.

A review of Pakistan Railway’s investment program shows an emphasis on UIC paradigms. As in Iran, track capacity is increased by double-tracking rather than by improving axle gauge and train length. New rolling stock recently ordered is almost entirely passenger stock from China. The existing cargo wagon fleet is largely obsolete. In 2011, some 13,100 wagons of the fleet of 18,400 wagons were still 2-axle wagons with a payload of perhaps 25 tonnes. This may be compared with an AAR payload of 90 tonnes; 70 tonnes for a modern CIS wagon; or 60 tonnes for a recent UIC wagon. Even the 4-axle wagon, such as the one at the left for steel mill products, carries only 46 tons.

This is not to say that bulk commodities cannot move on the Pakistan Railways: oil moves on new links with India or Iran. Commercial sources indicate that 10,000 tonnes a month of sugar moves by rail towards the railheads to be trucked; sugar alone is 5 to 7 modern wagonloads a day. However, the almost spasmodic and certainly archaic cargo service does not augur well for a resource growth corridor’s success.

Therefore, this report can not recommend that the resource growth corridor support initiative any investment in rail at the existing Pakistan border crossings until and unless the Pakistan Railways are rebuilt and reformed into a modern cargo operation.

New Mining Railways to the Sea through Pakistan

One concept is simply to build an altogether new railway by and for the miners at Hajigak. The investment, while possibly greater...
than rebuilding the existing Pakistan routes, would yield a superior cargo railway that would not require the structural reform the Pakistan Railways appears to need. The gauge could even be different from the 1676 mm broad gauge as the new line would not connect to the old Pakistan Railways network. The new line could profitably carry several trainloads of general cargo for the rest of the Afghan economy. The likely general cargo terminals would be where the new railway would intersect the ring highway near Kandahar.

Advancing this project is a matter for the miners. Certainly it is expensive and AFISCO has recently expressed a preference for trucking its outputs. While initial capital costs may be higher than other alternatives, the railway could be optimized for iron ore transport, resulting in much lower operating costs. Furthermore, the miners would have an improved likelihood of being able to control tariffs and thereby avoid national demands for ore traffic to cross-subsidize other services. But should AFISCO and its neighbors decide to build a new railway to a port, there is much to recommend this concept.
6: Railway Regulation

Institutional Arrangements for Rail Regulation

Objectives
Satisfactory institutional arrangements are needed to facilitate the development and use of railways for exporting mining products and for transporting general cargo. They should include a simple regulatory system to ensure railways are efficient, safe and meet environmental standards.

An important determinant of efficiency will be the integration of railways with each other (where connected), with the railways in other countries and with road transport. These arrangements need to cover not just regulation but also the making of policy to provide the framework for regulation.

GoIRA objectives include that of requiring mining companies to operate railways to serve the wider economy. These requirements should reflect GoIRA’s transport policies and be set out in the concession agreements for mining. *Regulation is required here to ensure that the commitments made by the concessionaire are met.*

Current and Institutional Arrangements
The current institutional arrangements for rail policy making and regulation are almost non-existent. This is to be expected given that Afghanistan had no operating railway until 2011. The 1520 mm spur from Hairatan on the Uzbekistan border to Mazar-e-Sharif (funded by ADB) was opened recently and will be run by Uzbekistan railways under a three year agreement. It is being operated under the railway rules of Uzbekistan. Similarly, the 1435 mm gauge line reported to be under construction from the Iranian border to Herat (funded by Iran) will be operated by the

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Railways of the Islamic Republic of Iran. Both these railways will be owned by the Ministry of Commerce and Industry (MoCI). GoIRA recognizes the accreditation and standards of these foreign operators in their own countries.

Policy on railways appears to be largely driven by the Ministry of Mines, one of the strongest Ministries in the Government. The Ministry of Mines has a particular interest in rail development at present since it is government policy that mines should if possible export their products by railway and it often makes commercial sense to do so. However, at present, the Ministry of Mines appears to have no control over the railway standards being developed by the mining companies.

The Ministry of Public Works is responsible for construction of infrastructure and contains a railway directorate. It also produced the Railway Plan for ADB. However it has no involvement in transport operations or regulation. Its Railway Department has only a few employees and should have its staff capacity strengthened.

The Ministry of Transport and Civil Aviation (MoTCA) is mainly focused on civil aviation at present. It has only one person working on railways to the best of our knowledge. As with the Ministry of Public Works, capacity building is important for MoTCA.

It is envisaged that the Rail Regulatory Authority, the RRA, whose establishment is waiting for approval from the Afghanistan presidential cabinet at the time of our meetings, will monitor and regulate the railway industry in the country.

**Required Institutional Arrangements**

As noted by Bullock, the government should ensure that there are no legal restrictions preventing the various mechanisms that are commonly used to construct and operate railways. For example, laws or policies need to be established to ensure access to land during survey and construction, to enable land acquisition and to

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75 Bullock op.cit.
76 Source: ISAF press release December 7 2011.
modify legal structures to permit public-private partnerships and leasing.

MoTCA should eventually be responsible for overall rail sector planning and development since it should cover all modes so as to be in a position to make optimal decisions for the transport sector as a whole. MoTCA needs to establish procedures for initiating, developing and evaluating railway projects. However, MoTCA appears to require institutional capacity building, is under-funded and may not be in a position to take on this role now. Developing its capabilities to do so should be a priority. These capabilities should include expertise in policy formulation. This could easily happen within less than two annual budget cycles, in our experience.

Suitable institutional arrangements also need to be developed for regulation in the same time frame of less than two annual budget cycles. These need to be considered together with the structure, method of financing, ownership, and management arrangement for the railways. To consider the needs for regulation, we classify the railways into three types:

1. Railways owned, financed and managed by mining companies designed to transport their products all or part of the way to borders (with possible transshipment to other railways or even road);

2. Railway spurs from adjacent countries designed to serve exports and imports – a second railway of this kind is being built by Iran towards Herat;

3. Eventually, railways designed to connect other railways – for example, linking railways built by mining companies to the spurs from adjacent countries or to other mining company railways. Because there is no experience of operating railways in Afghanistan, their operations should be concessioned out, ideally to private operators capable of introducing best practice.

As more lines are built across borders, and railways eventually cross Afghanistan to provide transit services, the management of international rail corridors will become important. Co-ordination across borders on technical standards, infrastructure capacity, wagon-sharing arrangements, and sharing of information on tariffs will be required. The concerned railway companies, the regulator and MoTCA will all need to be involved in these issues.
The Rail Regulatory Authority’s role should be mainly limited to technical standards, at least initially.

**Technical, Safety and Environmental Regulation**

It is important not to impose unnecessary restrictions. However, mining railways should not be simply allowed to determine the standards they use. If they were, if and when the railways are eventually joined up, significant costs might be involved in conversion. On the other hand, railways built as spurs from adjacent countries should normally be allowed to adopt the standards of those countries – if different gauges were adopted, for example, there would be an immediate cost of transshipment at the border.

For each railway, technical and safety standards need to be approved and their implementation supervised. They should be based on international standards such as those of the UIC, AAR or CIS, but should reflect Afghan conditions. Environmental standards would be subject to existing Afghan legislation and the regulator should co-operate with the National Environmental Protection Agency.

However, the powers of the regulator need to be constrained. For example, the regulator should not impose standards without justification, especially on such key policies as gauge, which have major economic and commercial implications. A national policy on standards therefore needs to be established and possibly defined in law – in this report we have set out some possible elements of that policy. The regulator would need to enforce the policy, mainly through the licensing process.

The regulator would also be responsible for ensuring accident investigations are carried out to the required standard although these might be carried out by separate bodies. Significant training is required to establish the capability to analyze the immediate and underlying causes of accidents, and to recommend practical remedies and implementation timetables. The safety regulator must be independent of and insulated from local political and commercial pressures and may be affiliated with an outside organization, such as the United States’ Federal Railway Administration or the United Kingdom’s Office of the Rail Regulator. These organizations have few if any conflicting interests with the three broad classes of railways above.
The regulator’s enforcement powers on safety would derive from its power to impose fines and to issue/revoke licenses to operate.

**Economic Regulation**

In principle, there should be no independent economic regulation. Railway companies would be allowed to charge “what the market will bear” and, if one railway company wishes to gain access to the infrastructure of another railway, this should be matter for commercial negotiation between them. This would ensure that investors make good returns on their investment and so have an incentive to invest in Afghanistan’s future.

Such market solutions work particularly well with freight railways in North America where there is strong competition from road, plus sometimes more than one railway serving a particular market and also source competition. However, in Afghanistan, the competition from road is weak, and there will be almost no other railways for some time. There is therefore potential for railways to abuse their monopoly power, either by refusing to provide access to other operators, by charging them too much for access or by charging customers too much for transport services. Competition law, under which monopoly abuse is sometimes handled in other countries, is still in draft form and the proposed Competition and Consumer Authority, once established, is unlikely to be able to handle railway matters.

This a problem for GoIRA, since GoIRA wants to general cargo to be carried economically on miner owned lines whilst miners rarely have much interest in this and prefer to concentrate on exporting mining products. Another example where regulatory interventions may be desirable is where a small Afghan owned mine wants to use railway infrastructure owned by big foreign mine.

It is therefore desirable to require that third party access is permitted on all railways in principle, and that access charges are

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77 Source competition occurs when two railway companies serve the same location, so that they may compete for traffic to or from that location even if they do not serve additional common locations. For example, farmers may ship their crops on one railway to Pacific Coast ports for export and on another railway to the Gulf of Mexico ports for export, and those two railways compete for the traffic at its mid-west origins, even though neither serves both ports.
fair and do not discriminate between operators, there may be exceptions where Afghanistan wants to encourage development of general cargo movements by investors. This exception does not apply to mining movements. Where there is no competition between operators, customer tariffs may also need to be regulated.

Economic regulation may however be carried out through concession agreements, where they exist. In the case of mining railways, the mining concession agreement, as well as stipulating that a railway line will be built, may also state the principles of third party access to infrastructure and the principles for setting access charges. A national policy is needed to set the framework for access. Also, for any other lines that are concessioned on their own (without a mine), the same principles may be stipulated in the concession agreement. There is then an issue about whether to involve the regulator in these matters, other than as an appeal body in case of disputes.

**Location of Regulator**

The GoIRA is expected to decide that a Rail Regulatory Authority, the RRA will be established. The usual location for the rail regulator would be under the Ministry of Transport and Civil Aviation which, as noted earlier, should also make transport policy. However, this Ministry requires institutional capacity building and it lacks funding. As some new railways will be built by mining companies, they will be talking to the Ministry of Mines. This is an issue for the GoIRA to decide.

Ideally the regulator should be independent in its decision making of any Ministry. This independence is important for attracting private investment since potential investors may be concerned about political interference in decision-making. The head of RRA should therefore be appointed by Parliament on the recommendation of the responsible Minister. The regulator should have a Board on which other ministries might be represented to ensure that their policies are fully represented.

**Funding the Regulator**

The regulator could either be funded by the Government’s general appropriations or by the railway industry through concession or license fees. Funding by the industry has the advantages that funding is not placed in jeopardy by Government financial problems and it may make it easier to pay higher salaries
to attract better quality staff. The EU has provided a grant for training the staff in the regulator.

**Conclusions on Railway Regulation**

The Ministry of Transport and Civil Aviation is under-funded and requires institutional capacity-building for railways. The MofTCA may not be in a position to take on a policy-making role in the transport sector now. Developing its capabilities to do so, as well as its safety management and accident investigation abilities, should be a priority.

A safety regulator is needed now because international experience shows that it is difficult to retrofit processes into an existing operation as methods of operations tend to become entrenched.

The need for the regulator to also undertake independent economic regulation is less urgent and may be avoided altogether, depending on how the railways develop and the practicality of handling economic regulation through concession agreements and experience in other sectors with the proposed law on competition.
7: Recommendations & Priorities

Summary

It is unlikely that many of the schemes conceived for railways in Afghanistan should, or even could, be constructed.

Some, even if constructible, may not be financially viable; instead, constructing these rail lines will create a drain on the Afghan national economy. The lines will not generate economic development and its resulting revenue. Instead, the lines will require subsidies for operation of trains and maintenance of assets.

Therefore, basic highways and roads may assume a higher priority for local and regional corridor development. Basic highways and roads make more sense for local and regional corridor development. Indeed, the answer to what additional rail lines should be built may turn out to be a focus on all-weather, high axle load highways instead.

Our major recommendations are described below. While we have prepared a tentative map of a few new lines that might form a northern network of new rail spurs, it appears premature to advance such a concept until the recommendations below are accepted. The first and foremost of these recommendations concerns commercialization.

#1 Commercialization & Development

The most pressing rail need for Afghanistan’s development of resource growth corridors is the (a) commercialization of any railway and (b) the provision of terminals and other facilities for local distribution of wagon-loads to industries and for transshipment between roads and rail. Transshipment includes a

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78 For example, our discussion in this Chapter of the CIS lines
small modern container dry port, possibly at Mazar-i-Sharif’s airport. Commercialization includes the brokers, logistics companies, railway sales and pricing staff, and market-driven railway operations staff.

Because mineral-only railways will not provide a broad-based platform for economic development, it is important to sponsor general-purpose cargo railways that build in the physical capacity to move both general cargo and the output of mines and metallurgical works. To be successful at providing general cargo services on a commercial basis, railway enterprises should have these characteristics:

- Railways are managed to minimize costs and generally have lean staffing levels
- Railways buy or lease second hand rolling stock – freight wagons, locomotives, and passenger equipment -or have customers lease their own wagons
- Commercial and marketing staff hold important high-level positions and have adequate sales staff and international representation. *The viability of the railway enterprise depends on attracting traffic and commercial arrangements with customers.*
- Railways team with and support freight forwarders, shipping agents, distribution and logistics companies, trucking companies and other commercial intermediaries normally involved in distribution and local shipping services

Successful general cargo railways are not forced to endure direct rail competition on the basis of access rights. They may share infrastructure with bulk operators, but they do not compete with other rail enterprises operating under access rights unless network density is high or the government subsidizes the infrastructure. This has implications for “open access” thinking: Giving competitors “open access” to an asset may discourage the potential developer of that asset from building it, thereby requiring more grant funds to construct the assets. Conventional wisdom is to permit “open access” but conventional wisdom fails in this case. Only an irrational or highly subsidized operator of a general cargo rail will finance and then develop a broad base of general cargo shippers and terminals if the operator must then face open competition from newcomers that did not share the expense and risk of creating the market.
Integration with Other Modes
The design of any future rail investment should include design provisions for integrating the rail mode with other modes, particularly trucking. These provisions include:

- Public delivery tracks with loading docks, unloading tracks for bulk wagons, loading ramps to flatcars, well-drained & graded parking for trucks, and well-drained, paved road access.
- Land that is available for private-sector business to set-up food service, truck repairs, and fueling stations.
- Track switches leading to land that is available for private-sector development of warehousing and logistics, bulk terminals for fuel, scrap and recycling material yards and even manufacturing plants.

These intermodal nodes should be located where rail lines cross the ring roads, particularly for new mining lines.

Operating Plan & Customs Clearance

The construction of any future rail investment should include an operating plan for trains. The plan should show at what classification or marshaling yard trains will be assembled; where customs will be cleared,\(^79\) and at what points passing loops should be placed. The operating plan should precede the design of the infrastructure.

#2 Regulatory Matters:

Technical, Safety and Environmental Regulation

A safety regulator is needed now because international experience shows that it is difficult to retrofit processes into an existing operation as methods of operations tend to become entrenched.

\(^79\) This question was raised to one of the authors for wagons coming through Hairatan. Experience shows that customs should be cleared prior to departure from Hairatan or, when tendered for return from Afghanistan through, upon arrival back to Termez.
It is important not to impose unnecessary restrictions. However, mining railways should not be simply allowed to determine the standards they use. If they were, once the railways are eventually joined up, significant costs might be involved in conversion. On the other hand, railways built as spurs from adjacent countries should normally be allowed to adopt the standards of those countries.

For each railway, technical and safety standards need to be approved and their implementation supervised. They should be based on international standards such as those of the UIC, AAR or CIS, but should reflect Afghan conditions. Environmental standards would be subject to existing Afghan legislation and the rail regulator should co-operate with the National Environmental Protection Agency.

However, the powers of the regulator need to be constrained. For example, the regulator should not impose standards without justification, especially on such key policies as gauge, which have major economic and commercial implications. A national policy on standards therefore needs to be established and possibly defined in law. The regulator would need to enforce the policy, mainly through the licensing process.

The regulator would also be responsible for ensuring accident investigations are carried out to the required standard although these might be carried out by separate bodies. Significant training is required to establish the capability to analyze the immediate and underlying causes of accidents, and to recommend practical remedies and implementation timetables. The safety regulator must be independent of and insulated from all political and commercial pressures, and may be affiliated with an outside organization, such as the United States’ Federal Railway Administration or the United Kingdom’s Office of the Rail Regulator. These organizations have few if any conflicting interests with the regional railway networks that would connect with Afghanistan.

The regulator’s enforcement powers on safety would derive from its power to impose fines and to issue/revoke licenses to operate.

**Economic Regulation**

In principle, there should be no independent economic regulation. Railway companies would be allowed to charge “what
the market will bear” and, if one railway company wishes to gain access to (and use of) the infrastructure of another railway, this should be matter for commercial negotiation between them. This would ensure that investors make good returns on their investment and so have an incentive to invest in Afghanistan’s future.

However, the GoIRA may insist that for reasons of political acceptability or economic development, general cargo should be carried on miner owned lines. This is despite some miners not having much interest in this business, preferring, instead, to concentrate on exporting mining products. Another example where regulatory interventions may be desirable is where a small Afghan owned mine wants to use railway infrastructure owned by big foreign mine.

While it is generally desirable to require that third party access is permitted on high-volume railways, and that access charges are fair and do not discriminate between operators, there are exceptions if Afghanistan wants to encourage development of general cargo for resource growth corridors. (This exception does not apply to mining movements.) Where there is no competition between operators, customer tariffs may also need to be regulated. Therefore, a national policy is needed to set the framework for access to reduce uncertainty to PPP and other investors.

The need for the regulator to also undertake independent economic regulation is not as urgent as it is for safety. It may be avoided altogether, depending on how the railways develop and the practicality of handling economic regulation through concession agreements and experience in other sectors with the proposed law on competition.

**Location of Regulator**

The initial ideal location for the rail regulator would be under the Ministry of Transport and Civil Aviation, which should also make transport policy. However, this Ministry needs institutional capacity building and lacks funding.

*Ideally the regulator should be independent in its decision making of any Ministry.* This is important for attracting private investment since potential investors may be concerned about political interference in decision-making. The head of RRA should therefore be
appointed by Parliament on the recommendation of the responsible Minister. The regulator should have a Board on which other ministries might be represented to ensure that their policies are fully represented.

**Funding the Regulator**

The regulator could either be funded by the Government’s general appropriations or by the railway industry through concession or license fees. Funding by the industry has the advantages that funding is not placed in jeopardy by Government financial problems and it may make it easier to pay higher salaries to attract better quality staff. The EU has provided a grant for training the staff in the regulator.

**#3 Passengers Trains Inhibit Development**

If the goal of constructing and operating railways in Afghanistan is to foster broad-based economic growth, especially in mineral resource corridors, *the operation of passenger trains will be a mistake.* Passenger trains require additional infrastructure investment, create chronic operating expense deficits, and give rise to special safety needs. Governments face strong political pressures to force mineral and general cargo traffic to cross-subsidize passenger operations. All of these problems will dissuade potential investors and operators of railway service for coming forward. At the population densities and distance now facing Afghanistan, other modes of passenger travel are clearly more rational. These other modes include roads and airports.

**#4 Development of Specific Rail Corridors**

**The Ring Railway & CAREC**

The Asian Development Banks study of the railway gauge issue persuasively argues that both traffic flows and the problems of interoperability make the concept of a ring-railway around Afghanistan to be untenable. Our technical analysis shows that the use of a UIC-oriented 1435 mm gauge, which was the policy choice in the past, to be the wrong choice should a ring-railway even be built, a result also supported by the ADB’s gauge study.
Our analysis based upon Table One of the Appendix shows that the 1435 mm Iranian network and the 1676 Pakistani network have serious limitations in the amount of cargo these railways can reliably move, and in the tonne-kilometer cost of moving cargo. These facts call into question the entire idea of a ring railway serving as a hub for CAREC routes or as a catalyst for resource growth corridor development.

Lines to the CIS

There are a few railway lines that might be feasible and might foster economic development along the northern border. These lines extend from Kunduz in the East to the Iranian border between Herat and Khaf. These railway lines are connections of other regional rail networks to Afghanistan’s economy. Most connections would be 1520 mm gauge line built to Commonwealth of Independent States, or “CIS”, standards, or better. The CIS lines would also extend the Uzbek railway connection at Hairatan and the Turkmen connection at Torghundi. Some of this has been built or has been studied. The ADB is facilitating these lines’ development at present.

However, highway development, repairs, and improvement should not be deferred to fund rail expansion.

Lines to Iran

The CIS lines described above would connect with the Iranian 1435 mm network at Herat extending to Khaf. Package 4 of the Iranian line needs to be designed differently than the previous Iranian designs. This final 60+ kilometer line to Herat should have the commercial and intermodal facilities described above and should be built with a greater axle load and longer passing loop length.

Lines to China

Connections to Tajikistan through Sherkhan Bandar should be deferred pending completion of a route to Kashgar in China. This rail link is simply not a priority. As with other rail lines, the likely deficit from its operation and maintenance would be a drain on
the economy and government. Distribution of material west of Kunduz would logically be by truck from terminals located near Kunduz should a 1520 mm line from Herat to Mazar to Naiababad be constructed.

Lines to Pakistan

The severe reduction in the Pakistan Railways’ cargo capability closes off any short-term efforts to build connections at Torkham through the Khyber Pass and at Chaman through the Bolan Pass.

The cost of modernizing the Pakistan Railway infrastructure, and replacing its fleet of cargo locomotives is sufficiently large to terminate short-term efforts to build connectors to these outlets.

Miners: Aynak

A review of the proposal for the copper mines at Aynak strongly suggests that constructing a new, major railway is not necessary or even desirable for the operation of the mine. It is highly uncertain that the oft-delayed Feasibility Study by MCC that is due in 2014 will show that a North-South railway will be justified from Hairatan to Kabul through to Torkham, thence connecting with the 1676 mm Pakistani network. In any event, the feasibility report is not expected before 2014, and completion of this difficult line would extend at least through 2020. It appears that there are alternative near-term investments in transportation that MCC could make that would foster economic growth sooner than the North-South line. Indeed, it is likely that the deficits incurred on operating and maintaining a North-South line would become an economic drain on the Afghan people and government. Therefore, this Report recommends against actively pursuing this route.

As attractive as a North-South Route extending through Kabul province may sound, it will have deep operating problems that will reduce potential revenue while increasing operating costs. To recap just some of these problems:

(1) The high value copper from Aynak will probably exploit be transported using empty backhaul truck capacity instead of slower backhaul railway wagons, causing a loss of high-revenue cargo.
(2) The South connection is to a dilapidated Pakistan system that has very limited capacity and troubled geo-politics.

(3) Banyan iron always has a shorter route down through the Dar-if-Suf coal fields to reach northern markets.

(4) Operating costs in the snow and steep grades are high.

Miners: Hajigak

Analysis of the proposals for the iron ore mines and possible metallurgical works shows that the maximum projected output of the mines would eventually overwhelm the capacity of connecting Iranian or Pakistani networks unless both networks commit to major upgrading programs, possibly coupled with new operating procedures in the interim. At the present, there is little to indicate this will come about for either Iran or Pakistan.

Instead, there are two alternatives for exploiting the mines and any steelworks. One alternative requires construction of an entirely new medium-to-heavy duty railway through not only Afghanistan, but also to ports in Iran or Pakistan. This entirely new mining railway would likely extend from Hajigak southwest, passing the Ring Road highway, thence by a new line to an ore port at Chabahar, Iran or at Gwadar, Pakistan. Because of political considerations, consideration of this future railway must await developments not within the time or scope of this report. At the present time, the Indian sponsors of the Hajigak mines have publicly stated that they intend to use trucks to move the mine products to Gwadar and then to India; on the other hand, others have expressed plans to build a railway.

The alternative is constructing a CIS-style 1520 mm line down past the coalfields to the new railhead at Mazar-i-Sharif and thence westward to connect with the CIS outlet at Torghundi and the Iranian outlet that is supposed to reach Herat. This railway would facilitate economic growth by providing links to the CIS nations and Iran. The links would be for general cargo and mine outputs. Not all the products of the mines would need to be instantaneously funneled into one UIC-style Iranian rail corridor, and rail lines’ axle gauges could be gradually upgraded as tonnage volumes increased.

Miners: Physical Characteristics of New Construction
In return for the ability to obtain an alignment and the provision of security forces, the GoIRA should require any mining railway to be built with basic physical characteristics. These characteristics should result in building a national transportation asset.

The railway should have a loading gauge that permits general purpose cargo wagons and that facilitates the construction – perhaps by third parties – of cargo distribution terminals where there is the likelihood of demand for general rail cargo shipments.

The railway should minimize reliance on sole-source technologies and products.

The railway should not gamble on untried or cutting edge technologies. Afghanistan should not be a “test bed” for railway designs development.

*The choice of track and axle gauges, however, should be left up to the mining enterprise or its financial sponsors* unless it is clear that the gauges will effectively prohibit the use of mining railway by any user other than the miner.

**Short-haul railways**

Construction of short-haul railways – less than 100 km – from coal mines or ore pits to generating stations or smelters will not add to the general transportation network unless connected to a network. Only coal, ore and concentrate will move on these railways until the longer general cargo railways are constructed. In the future, such lines may be parts of longer routes. However, unless these lines add to the near-term construction budgets inside resource growth corridors, any short mining stub line is unlikely to produce significant local benefits.

The firms intending to construct the iron ore mines and associated electric power plants, coalmines, and metallurgical works may choose to make these substantial investments in short-haul railways. However, the opening of these works and any railway will be after the immediate horizon of Afghanistan’s pressing and immediate needs of its resource growth corridors.