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Executive summary

Introduction
As part of its vision to improve the transportation system in the country, the Government has drawn up a long-term development plan that proposes to expand the existing railway network from the Southern to the Northern parts of the country. In order to attract private investment into the rail transport sector, the Government of Ghana has since 1997 accepted rail concessionary as the preferred Public Private Partnership (PPP) model. It is in this direction that African Rail Ghana Limited has been mandated by the Government of Ghana to modernise the Eastern railway corridor linking Tema, Accra, Nsawam, Koforidua and Kumasi.

Project Description
The project involves the rehabilitation and construction of the railway lines between Tema, Accra, Nsawam, Koforidua and Kumasi. New double track railway lines will be laid from Tema – Accra – Nsawam - Koforidua – Kumasi through Boankra. This will involve the removal of old installations and the fitting of new railway tracks.

Project Scope Cost Summary
As set out in SCHEDULE FOUR of the Concession Agreement

<table>
<thead>
<tr>
<th>USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detailed Planning, Engineering and Architectural design</td>
</tr>
<tr>
<td>Foundation – Civil Works</td>
</tr>
<tr>
<td>Clearing of Vegetation and Removing Existing Railway Lines</td>
</tr>
<tr>
<td>Levelling and Compacting – Flat Terrain</td>
</tr>
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<td>Levelling and Compacting – Sloped Terrain</td>
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<tr>
<td>Drainage and Fencing Along Tracks</td>
</tr>
<tr>
<td>Construction of Railway Bridges</td>
</tr>
<tr>
<td>Construction of Railway Stations</td>
</tr>
<tr>
<td>Construction of Level Crossing Roads</td>
</tr>
<tr>
<td>Tracks, Coaches and Engines</td>
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<tr>
<td>Tracks</td>
</tr>
<tr>
<td>Passenger Trains With Coaches</td>
</tr>
<tr>
<td>Goods Trains with Coaches</td>
</tr>
<tr>
<td>Installation of Communication Systems</td>
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<tr>
<td>GSMR</td>
</tr>
<tr>
<td>Signal System</td>
</tr>
<tr>
<td>I.T. Systems</td>
</tr>
<tr>
<td>Project Management</td>
</tr>
<tr>
<td>Machines and Equipment (including shipment)</td>
</tr>
<tr>
<td>Training of Local Personnel</td>
</tr>
<tr>
<td>Offices and Living Quarters</td>
</tr>
<tr>
<td>Local Travel and Transport</td>
</tr>
<tr>
<td>Travelling Expenses of Expatriates</td>
</tr>
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<td>Security</td>
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<tr>
<td>Management and Administration</td>
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Modernization of Eastern Railway corridor

<table>
<thead>
<tr>
<th>Sub-Total</th>
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<td>Contingency Against Cost Over-runs</td>
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Project Financing & Repayment Schedule
<table>
<thead>
<tr>
<th>Month</th>
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<tr>
<td>12</td>
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<tr>
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<td>42</td>
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</table>

Retention

- 82.67%

Initial Drawdown - Project Mobilisation

- 12.03%

Contract Payments
Revenue Expectations
Operation of the eastern rail transport system will generate resources from two major sources namely: Passenger transportation and freight transport (bulk cargo haulage).

Profitability
The figure below shows the profitability distributions expected during the operational years of the project.
Project profitability distribution

Cash flow Analysis

The Cash Flow Analysis is available upon request subject to confidentiality.

Project Viability

The cash flow streams proposed are adequate to meet all financial obligations under the financing arrangement proposed. This will result in the socioeconomic viability of the project. By way of an economic indicator the multiplier for every US$ 1 spent on a railway infrastructure project in a developing country such as Ghana is 30 times.

This means that the economic benefit to every man, woman and child in Ghana’s population of 24 million people is US$ 2,500
Introduction

Background

Ghana Railways came into existence in 1903 when the Colonialists built the first lines in the then Gold Coast to convey heavy equipment from the Takoradi Harbour to the mines in Tarkwa in the Western Region, which was then attracting considerable attention. Data available indicates that the volume of traffic in 1906 was then 47,388 tons\(^1\). This went up to 298,593 tons in 1916 and peaked at 805,227 tons in 1926. Passenger traffic showed similar growth from a total of 689,292 in 1906 and rising gradually to 1.5 million passengers in 1925/26.

At the peak of its performance in the early 1960s, the rail transport lifted an average of over two million (2,000,000) tons of freight and eight million (8,000,000) passengers in a year. However, the performance of Rail transport started sliding downwards to a low of three hundred and fifty thousand (350,000) tons of freight in 1983. This trend was however salvaged by rehabilitating existing infrastructure, acquiring new rolling stocks and spare parts from 1983 onwards. This move could not be sustained in order to achieve the desired impact.

From 1999 onwards, the Ghana Railway Company (GRC) has experienced significant improvement in patronage. A total freight of 973,000 tons and 1.5 million passengers was transported by rail in 1999 and this increased to 1.8 million tons and 2.3 million respectively in 2003. However, lack of capital to maintain and upgrade its tracks, engines and coaches has stalled the sustainability of these gains. The fact that rail transport is believed to be the cheapest and safest means of transport, its poor development and sustainability is a major source of worry to both the formal and informal economic sector. Operating a rail transport system in Ghana and elsewhere is characterized by high capital injection and slow cost recovery. Therefore investments in rail transportation will require long operational periods to ensure that investments are recovered at affordable and realistic rates.

\(^1\) Ghana News Agency
To usher rail transport into a new phase of its development, the Government of Ghana has drawn up a long-term development plan that proposes to expand the existing railway network from the Southern to Northern parts of the country. This would pave the way for linking the country to its Sahel neighbours of Burkina Faso, Mali and Niger as well as Cote d’Ivoire and Togo to west and east, respectively.

In line with the government transport policy against the backdrop of the NEPAD initiative, government intends to redevelop and expand the current railway networks to other parts of the country. In order to attract private investment into the rail transport sector, the Government of Ghana has since 1997 accepted rail concessionary as the preferred Public Private Partnership (PPP). Towards this end, the Ghana Railway Development Authority (GRDA), established in 2008 under the Ghana Railway Act 779 has been tasked to give the rail industry a robust transformation. A number of international companies have expressed interest to operate specific sections of the railway network/lines.

African Rail Ghana Ltd has proposed to the Government of Ghana to modernize the eastern railway corridor that stretches from Tema-Accra-Nsawam-Koforidua-Kumasi. African Rail Ghana Limited appointed AREF a Cayman Islands domiciled Fund to co-ordinate the financing for the Project and TTE a Turkish domiciled engineering company to co-ordinate the construction and operations and maintenance. There is a co-operation agreement with a Norwegian domiciled construction consortium Viking SPV AS and the interaction with the Government of Ghana is through Lambfield Investments Limited of the UK and African Rail Ghana Limited of the UK. The abovementioned ARGL consortium has the delivery capability with its partners to bring the Project to financial close and implementation.

**Mandate and scope**

Deloitte was mandated by African Rail Ghana Ltd to undertake a financial feasibility assessment of the project and to determine how long it will take to achieve viability based on unit rates of passenger and goods traffic expected to patronize this modern rail transport system when it becomes operational.

Therefore the scope of that assignment involved:

- A review of the mass transportation industry in Ghana over the years and the potential opportunities and threats in view of the economic and political environment.
A market study to assess the potential demand for rail transport services along the eastern corridor and the rates at which services can be charged.

♦ Development of financial projections to assess the economic viability of the project.

♦ A determination of how the project financing will be absorbed and how long loans associated with the total investment can be repaid.

Promoter(s)

African Rail Ghana Ltd Consortium (“African Rail”, “the Consortium”) comprises a group of construction contractors and investors who will implement the requirements of the Concession Agreement and in particular provide:

♦ Technical advisory services in constructing foundation works, design and fitting of rail tracks, signals, road barriers as well as telecommunication;

♦ Construction, maintenance and installation of substructure; rail tracks; signals and telecommunication systems; barrier installations

♦ Technology transfer and training for railway operators.

African Rail Ghana Ltd through AREF is facilitating the fundraising for the project. The capital requirements will be sourced from lending banks, two of which met with then Vice-President HE John Dramani Mahama in Accra on 28 March 2012 to provide their support to the Project and to hear the Vice-President’s statement that the Project had the highest national priority and would receive his office’s full support.; Capital will also be sourced from Export Credit Agencies and, where appropriate from multi-lateral agencies. Consortium equity will make up the balance of the financing package.

Project concept

African Rail Ghana Ltd proposes to modernize the eastern railway corridor between Tema and Accra; and Accra to Kumasi through Boankra. The company is providing technical expertise to undertake the construction and the laying of a double railway track system that meets international standards. The aim is to provide both passenger and cargo transport services along this route to facilitate potential economic activities in view of the ongoing development of the inland port at Boankra and the mining of huge
bauxite deposits at Kyebi several years from now. The geographical coverage of the corridor is shown in Figure 1:

**Figure 1: Geographical perspective of Ghana’s railway network**

![Geographical perspective of Ghana’s railway network](image)

Source: UN Dept of peace keeping operation, cartographic section 2006, map no. 4186 rev.3

From figure 1, the eastern railway corridor passes from Tema - Accra (14.75 miles), Accra - Nsawam (25.25 miles), Nsawam - Koforidua (24.5 miles), Koforidua - Nkawkaw (58 miles), Nkawkaw - Konongo (43.75 miles), and Konongo - Kumasi (37.25 miles).

Modernizing the railway means that, old installations will be removed and the current track width will be expanded to meet international standards. Instead of a single track, a double track with modern communication and signalling system will be installed.

The terminals will be upgraded with warehouses and shops to attract commercialization and increase the momentum of economic activity in the area.

This project will be operated under a concessionary agreement with the Government of Ghana through the GRDA. The concession gives African Rail the mandate to Build Operate and Transfer (BOT) the assets of the project to the GRDA after the concessionary period. This will be 40 years post construction. During the concessionary period, African Rail will setup and run a training school to build local capacity to take over the operations of the eastern railway corridor when ownership is fully transferred to GRDA.
Project scope

The scope of activities under the project includes:

♦ Removal and replacement of existing railway lines along the routes;
♦ Civil works involving ground levelling and bridge constructions along the routes;
♦ Provision of new engines and coaches for passengers, consumer goods and Bulk haulage & containers
♦ Installation of modern communication systems for Railway traffic monitoring and communication
♦ Establishment of inland container terminals to be located at Nsawam, Koforidua, Nkawkaw and Kumasi.

The PPP arrangement

Ownership structure

With respect to the Modernization of the Eastern Railway Corridor, the Project will utilise a Public-Private Partnership (PPP) Model which will entail financing, designing, building, operating and transfer (BOOT).

This is outlined as follows:

African Rail has agreed a concessionary period of 44 years out of which 4 years will be used for construction, installations and test runs and 40 years will be used for operation and repayment of debt facility taken for the project.

African Rail Ghana Ltd Consortium partners will oversee the construction and operations of the Eastern Railway Corridor. African Rail Construction Ltd, a Project Management Company will oversee the construction management of the Eastern Railway Corridor.

On completion, a Special Purposed Vehicle (SPV) will be formed to operate and manage rail transport on the Eastern Railway Corridor. The proposed Special Purposed vehicle (SPV) will provide its operations and maintenance support services strictly in compliance with the terms of the Concession Agreement. The SPV will be owned by investors introduced by AREF.

African Rail will fulfil and abide by all legal and regulatory requirement and obligations as prescribed by GRDA in accordance with the Railway Act 2008 (Act 779).
Africa Rail will also acknowledge the regulatory role of GRDA and allow its operations and management practices to be monitored by GRDA in accordance with the Railway Act 2008 (Act 779).

**Financing structure**

The financing Consortium, led by AREF will source a Credit Facility to be granted pursuant to the terms of the Concession Agreement. The Credit Facility and the Export Credit Loan Facilities will be guaranteed by the provisions of the Construction and the Operations and Maintenance Contracts, and any revenue shortfall below the amount required to service debt will be guaranteed by the Ministry of Finance and Economic Planning ("MOFEP") representing the Government of Ghana.

**Expected benefits**

The economic importance of an efficient railway transport system lies in the fact that it complements other modes of transport, especially road transport, in the haulage of bulk cargo between the ports and up-country to promote export and import trade. It also facilitates the movement of passengers to pursue various economic and social activities.

In the urban areas, particularly within the Accra-Tema Metropolitan area, high population density and high vehicle population causes severe traffic congestion on the main arterial roads. This has negative impact on the economic life of the two cities serving as the economic nerve centres of the country. That an efficient sub-urban rail network has the potential of helping to solve the road traffic congestion cannot be over-emphasized.

This project is expected to provide the following benefits:

- Save travel time and offer reduced fares for city dwellers particularly the urban poor. (Presently, it takes about one and a half hours to travel by bus from Accra to Tema during the peak hours instead of less than thirty minutes by train.)

- Reduce traffic congestion and pollution (i.e. the number of small vehicles) on city roads and thereby reduce pollution by exhaust fumes from vehicles, as well as reducing noise from vehicles and accidents on our roads.

- Assist in decongestion of the Tema port; since some of the bulky goods arriving in the country could be transported by rail to a central
terminal point for custom clearance and onward transportation to final destination.

The inland container terminals are needed to decongest the Tema port. A terminal is expected to be located at Nsawam and Koforidua respectively. The Nsawam terminal is expected to serve Kumasi and the rest of Northern Ghana, whiles the Koforidua one serves the Eastern and Volta Regions of Ghana. Some of the commodities expected to be transhipped through these terminals include cement, iron rods, plastic products and foodstuff. Also cargo destined for Accra, Nsawam, Koforidua and their surrounding towns as well as neighbouring West African countries without ports could also be hauled to the main terminal at Nsawam for clearing and onward transporting to their final destinations. The Koforidua container terminal is expected to be useful to the Eastern region and surrounding towns, from where cocoa, foodstuffs and other raw materials meant for the Accra and Tema markets and factories would be transported.

Transportation of foodstuffs currently dominates cargo transportation along this route. There is however no data on volumes of foodstuff transported along this line, as they are not presently categorized as goods but rather as passenger luggage.

Tema is an industrial city and has a number of factories located there. Products from these factories are currently transported by road to cities and towns all around the country. Big cargo trucks, which transport these products, normally break down on the roads, causing accidents and posing other hazards on the roads. Several of them fall off the roads and cause significant loss of lives and properties. A survey was conducted to assess the possibility of various companies utilizing the railway system if it was regular and reliable.
Socioeconomic analysis

The Political Environment

The Republic of Ghana is located in West-Africa region; alongside the Gulf of Guinea (coastline: 539 km). It expands over a total area of: 238,540 sq. km (land: 230,020 sq. km; water: 8,520 sq. km). The bordering countries to Ghana are: Burkina Faso over 548 km to the North; Cote d'Ivoire over 668 km to the West; Togo over 877 km to the East.

Ghana operates a three arm governance system composed of the Executive, headed by the President, a unicameral Parliamentary system with 275 members, headed by the Speaker of Parliament and the Judiciary, headed by the Chief Justice. The members of parliament are elected by direct, popular vote to serve four-year terms just as the Executive while the Chief Justice is appointed by the president to serve a work-life term.

Ghana enjoys one of the most robust democracies in Sub-Saharan Africa. From 1972, Ghana did experience a mix of military and democratic rules until 1992 when a constitution was put in place to establish the fourth republic and returned the country to democratic governance. Since then there have been six successful democratic elections which have all been judged free and fair by international standards. The last election was held on 7 December 2012 in which the current government’s party –the National Democratic Congress (NDC) won a majority of seats and President John Dramani Mahami became President Elect with 50.7% of the presidential vote.

A major challenge facing the administration will be speeding up the recovery of the Ghanaian economy from the effects of the global recession. This is gradually being achieved through prudent management of resources, the elimination of wasteful expenditure and meticulous planning of strategies towards the achievement of realistic economic targets.
The political environment is expected to remain stable and under control with the help of the security forces who have been tasked to remain impartial and to dispense their duties professionally.

**Administrative Regions and Legal Systems**

Administratively the country is divided into 10 regions namely Ashanti, Brong-Ahafo, Central, Eastern, Greater Accra, Northern, Upper East, Upper West, Volta, and Western. The Greater Accra region is host to the central administration of the Government. In addition, it is the industrial hub of the country and the most densely populated.

Ghana's legal system is based on English common law and customary law. It has the Lower Courts, High Courts, Appeal Courts and a Supreme Court at the apex of the judiciary. In an attempt to speed up commercial arbitration, a Commercial court and a Fast-track High court have been established to provide settlement services to the investors in the private sector of the economy. Every region is equipped with basic court infrastructure but the Greater Accra region is again the host to the Appeal Court, Fast-track High Court and the Supreme Court.

**International Relations**

A number of International Organizations operate and participate in the economy of Ghana. They include ACP, AFDB, AU, C, ECOWAS, FAO, G-24, G-77, IAEA, IBRD, ICAO, ICC, ICCT, ICRM, IDA, IFAD, IFC, IFRCs, ILO, IMF, IMO, IMSO, Interpol, IOC, IOM, IPU, ISO, ITSO, ITU, ITUC, MIGA, MINURCAT, MINURSO, MONUC, NAM, OAS (observer), OIF (associate member), OPCW, UN, UNAMID, UNCTAD, UNESCO, UNHCR, UNIDO, UNIFIL, UNITAR, UNMIL, UNOCI, UNOMIG, UNWTO, UPU, WCL, WCO, WFTU, WHO, WIPO, WMO and WTO.

The government continues to maintain good relations with Ghana’s major trading partners and donors throughout, especially the US and the UK, both of which have a large Ghanaian Diaspora. However, the recent development of links with China, backed by concessional Chinese funding for infrastructure projects, has led to a shift in emphasis in Ghana’s international relations. The traditionally strong relations with Nigeria will also continue, with Nigerian companies having a growing presence in Ghana, although frictions over the large and increasing number of Nigerians working in Ghana may intensify. One potential threat to international relations is concern over a maritime border dispute with Côte d’Ivoire, especially as there are
significant oil reserves in the region. An amicable solution is expected, but tensions could flare up as a resolution is negotiated.

**Demographic data**

Ghana is one of the most populous countries in Western Africa ranking next to Nigeria. Total population 24,658,823 (2012 census) with average population growth per year estimated at 2.1%. Accra is the most populous town in Ghana followed by Kumasi, Sekondi-Takoradi and Tamale as shown in Table 2.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Name of Town</th>
<th>Region</th>
<th>Population ('000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Accra (capital)</td>
<td>Greater Accra</td>
<td>2,280</td>
</tr>
<tr>
<td>2</td>
<td>Kumasi</td>
<td>Ashanti</td>
<td>1,766</td>
</tr>
<tr>
<td>3</td>
<td>Sekondi – Takoradi</td>
<td>Western</td>
<td>454</td>
</tr>
<tr>
<td>4</td>
<td>Tamale</td>
<td>Northern</td>
<td>428</td>
</tr>
<tr>
<td>5</td>
<td>Ashiaman</td>
<td>Greater Accra</td>
<td>255</td>
</tr>
<tr>
<td>6</td>
<td>Tema</td>
<td>Greater Accra</td>
<td>172</td>
</tr>
<tr>
<td>7</td>
<td>Cape Coast</td>
<td>Central</td>
<td>169</td>
</tr>
<tr>
<td>8</td>
<td>Teshie</td>
<td>Greater Accra</td>
<td>168</td>
</tr>
<tr>
<td>9</td>
<td>Obuasi</td>
<td>Ashanti</td>
<td>161</td>
</tr>
<tr>
<td>10</td>
<td>Koforidua</td>
<td>Eastern</td>
<td>107</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>5,960</strong></td>
</tr>
</tbody>
</table>

Table 1: Population distribution of major towns

**Investment Climate**

The need for increased private sector investment has been the driver of the economic policies of the Government of Ghana for over a decade. In this direction, government is committed to ensuring that the private sector plays a prominent role in the country’s accelerated growth. To achieve this, significant levels of opportunities and incentives have been made available to the private sector by the government. Also of significance to the boost in investment is the increased attention being given to the concept and operation of the Free Trade Zone Enclave under the Free Zones Act of 1995.

Areas demarcated for its operation include:

- 680 acres of land earmarked for development of the Tema Export Processing;
- 2,200 acres of land at Sekondi;
- the sea ports of Tema and Takoradi and the Kotoka International Airport;
• Fumesua—a location near Kumasi earmarked for the development of an inland port (to be the first in West Africa).

The Ghana Investment Promotion Centre (GIPC) is empowered by Act, 1994 (Act 478) to regulate all business in Ghana excluding those in the Mining, petroleum, free zones and portfolio investments. The minerals commission oversees business operations in the mining industry while the Ghana National Petroleum Authority (GNPA) oversees business operations in the petroleum industry.

To enable the government to meet its social obligations against the concept of cost recovery, the concept of Private Public Partnership (PPP) has been accepted as a major tool for private investment in areas such as real estate, road safety, safe water, transportation, health, education, energy and oil production among others.
Economic outlook

Ghana's existing infrastructural base is moderately developed particularly in the transport and telecommunications sectors. There are two major teaching hospitals, each located in Accra and Kumasi and about 36 significant regional and urban hospitals largely owned by the government. There are also in existence, five (5) state owned universities and none of them currently offers any distinct discipline in Petrochemical engineering.

For the years (2005-2007), Ghana achieved an average real GDP growth of 6.1% (refer to Table 1) compared to a twenty year average real GDP growth of 4.4% (refer to Table 1). This progress was achieved under the first phase of the Ghana Poverty Reduction Strategy (GPRSI, 2004-2007). The second phase of the Ghana Poverty Reduction Strategy (GPRSII) with the objective of building on the gains of the first, ended with a GDP growth of 7.3% in 2008 and 4.1% in 2009. Figure 4 shows the performance and forecast of real GDP from 2005 – 2010. Average inflation has increased continuously from 10.5% in 2006 to 19.3% in 2009. It is expected to fall to 14.7% in 2010.

Figure 2: Performance and forecast of GDP growth

Ghana’s economic policy for the two years (2011 – 2012) focused on improving the management of public expenditure, increasing revenue collection, developing the business environment and extending credit and support for the private sector.

Politicians will continue to focus on investment in infrastructure and poverty-reduction schemes, and will also revisit the mining tax regime. Amid high global prices for Ghana’s main export, gold, there are growing calls for increased mining taxes and royalties. This may cause friction with
investors, although given the trend for tax increases elsewhere in the world a similar move in Ghana would not be overly controversial. The passage into law of the petroleum revenue management bill is taking a long time, and it is becoming increasingly likely that the oil will start to pump before the bill has been passed, causing potential confusion.

Economic Sector Analysis

The Services sector has dominated contribution to GDP since overtaking the industry sector in 2007 growing from 8.2% in 2007 to 9.3% in 2009 and fell to 6.6% in 2009. It is closely followed by the industry sector increasing from 7.4% in 2007 to 8.15 in 2008 and decreasing to 5.9% in 2009. The agriculture sector falls behind but increasing steadily from 2007 by 4.3% to 5.7 in 2009.

In 2010, the industry sector recovered its lead to grow at 5% and by 36% in 2011, decreasing to 11.5% in 2012 due to the commercial production of oil in the upstream market. The services sector fell behind to grow at 4.6% in 2010, increasing to 8.0% in 2011 and 2012. The Agriculture sector continued in its third position in GDP at 4.5% in 2010 and 2011 increasing slightly to 4.8% by 2012 as shown in figure 5.

Figure 3: GDP Growth rates by economic sectors (2005 – 2012f)

<table>
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<th>Year</th>
<th>Agriculture</th>
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<tr>
<td>2012f</td>
<td>4.8</td>
<td>11.5</td>
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</tr>
</tbody>
</table>

Source: Budget Statements 2009

Agricultural Sector

Agriculture is a dominant economic activity in Ghana and employs about 75% of the country’s workforce. From 2005 onwards, this sector contributed over 4% to the national GDP as shown in Table 3. By the end of 2008, the agriculture sector grew by 5.1% against a target of 5.0% improving marginally over the 2007 rate of 4.3 percent. This fell to 4.5% in 2010. Key contributor to
the agriculture sector was crop and livestock through value addition. This sub-sector increased its growth from 3.3% in 2005 to 6.5% in 2009. It decreased to 4.5% in 2010.

Cocoa production and marketing recorded a growth of 5.0% in 2008 decreasing to 3.5% in 2009 and increased slightly to 4.0% by 2010. Forestry and logging maintained a growth rate of 3.5% in 2008 and 2009. It decreased to 3.0% in 2010. The Fishing subsector recovered from a 3.0% growth in 2008 to 5.0% in 2009 and is maintaining the rate.

Industrial Sector
Growth in the Industry sector has experienced some challenges over the past years. The mining and quarrying subsector showed impressive growth from 2005 recording a growth of 6.3% to 30.0% in 2007 and falling sharply to 2.0% in 2009 and recovering slightly to 5.5% in 2009 but reducing to 5.0% in 2010.

The manufacturing subsector fell sharply from a growth of 5.0% in 2005 to -2.3% in 2007 and recovering to 4.5% in 2008. It maintained a growth rate -2.3% in 2007 and recovering to 4.5% in 2008. It also maintained a growth rate of 4.0% recorded in 2009 in 2010. Electricity and water have experienced an undulating growth trend from 2005 to 2008. It has experienced double growth from 5.0% in 2009 to 10.0% in 2010. Similarly the construction subsector decreased growth from 12% in 2008 to 8.0% in 2009 and has maintained this growth in 2010.

<table>
<thead>
<tr>
<th>GDP - YEAR AVERAGE</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
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<td>AGRICULTURE</td>
<td>4.1</td>
<td>4.5</td>
<td>4.3</td>
<td>5.1</td>
<td>5.7</td>
<td>4.5</td>
</tr>
<tr>
<td>Agriculture &amp; Livestock</td>
<td>3.3</td>
<td>3.5</td>
<td>4.0</td>
<td>5.8</td>
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<tr>
<td>Cocoa</td>
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<td>5.0</td>
<td>3.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Forestry &amp; Logging</td>
<td>5.6</td>
<td>2.6</td>
<td>2.5</td>
<td>3.5</td>
<td>3.5</td>
<td>3.0</td>
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<tr>
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<td>5.0</td>
<td>3.0</td>
<td>5.0</td>
<td>5.0</td>
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<td>7.4</td>
<td>8.1</td>
<td>5.9</td>
<td>5.0</td>
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<td>13.3</td>
<td>30.0</td>
<td>2.1</td>
<td>5.5</td>
<td>6.0</td>
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<tr>
<td>Manufacturing</td>
<td>5.0</td>
<td>4.2</td>
<td>(2.3)</td>
<td>4.5</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Electricity &amp; Water</td>
<td>12.4</td>
<td>24.2</td>
<td>(15)</td>
<td>19.4</td>
<td>5.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Construction</td>
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<td>11.0</td>
<td>12.0</td>
<td>8.0</td>
<td>8.0</td>
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<tr>
<td>SERVICES</td>
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<td>8.2</td>
<td>9.3</td>
<td>6.6</td>
<td>4.6</td>
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<td>Transport, Stor &amp; Com</td>
<td>7.9</td>
<td>7.2</td>
<td>6.0</td>
<td>8.9</td>
<td>7.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Trade, Rests &amp; Hotels</td>
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<td>7.5</td>
<td>10.0</td>
<td>7.2</td>
<td>7.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Fin, Insur, Real est, biz</td>
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<td>7.6</td>
<td>15.0</td>
<td>9.6</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Government Services</td>
<td>5.0</td>
<td>5.7</td>
<td>6.0</td>
<td>9.7</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Social &amp; Pers Services</td>
<td>4.3</td>
<td>4.2</td>
<td>5.0</td>
<td>4.5</td>
<td>4.5</td>
<td>6.0</td>
</tr>
<tr>
<td>Private non-profit services</td>
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<td>6.6</td>
<td>6.5</td>
<td>7.4</td>
<td>6.1</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Table 2: Breakdown of GDP growth analysis by economic sectors

Modernization of Eastern Railway corridor

African Rail Ghana Ltd | APPENDICES 22
Services Sector

The finance, insurance and business subsector continue to dominate the Services sector increasing a sustained growth of 7.6% in 2005 and 2006 and increasing to 15% in 2007. However, its growth fell to 9.65% in 2008 recovering slightly to a growth rate of 10.0% in 2009 which was maintained in 2010.

Trade and hospitality continue to show significant performance growing from 10.0% in 2005 to 7.5% in 2006 increasing to 10.2% in 2008. It fell to 7.0% in 2009 and recovered to 8.0% in 2010.

The transport subsector fell gradually from 7.9% in 2005 to 6.0% in 2007. It recovered growth to record a rate of 8.9% in 2008 only to fall back to 7.0% in 2009. It reduced further to 6.0% in 2010.

Summary of economic indicators

Average depreciation of the Ghana cedi (GH₵) to the United States dollar (US$) indicates an average depreciation of 5% from the last quarter of 2008 to the first quarter of 2010.

Average Treasury bill rate increased from 13.2% in the second quarter of 2008 to 23% in the first quarter of 2010.

<table>
<thead>
<tr>
<th>Description</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 Qtr</td>
<td>3 Qtr</td>
<td>4 Qtr</td>
</tr>
<tr>
<td>Prices:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer prices (2000=100)</td>
<td>142.8</td>
<td>147.7</td>
<td>149.2</td>
</tr>
<tr>
<td>Consumer prices (% change, year on year)</td>
<td>16.9</td>
<td>18.1</td>
<td>17.6</td>
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<tr>
<td>Financial indicators:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exchange rate GH :US$ (avg.)</td>
<td>1.03</td>
<td>1.14</td>
<td>1.21</td>
</tr>
<tr>
<td>Deposit rate (avg.; %)</td>
<td>8.1</td>
<td>11.7</td>
<td>16.4</td>
</tr>
<tr>
<td>M1 (end-period; GH bn)</td>
<td>4,418</td>
<td>3,865</td>
<td>3,572</td>
</tr>
<tr>
<td>M1 (% change, year on year)</td>
<td>52.5</td>
<td>49.5</td>
<td>48</td>
</tr>
<tr>
<td>GSE all-share index (end-period; 1990-93=100)</td>
<td>10,164</td>
<td>10,891</td>
<td>8,771</td>
</tr>
<tr>
<td>Sector trends:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gold price, London (US$/troy oz)</td>
<td>896</td>
<td>869.6</td>
<td>794.7</td>
</tr>
<tr>
<td>Cocoa beans price, New York &amp; London (US$/tonne)</td>
<td>2,782</td>
<td>12,807</td>
<td>52,239</td>
</tr>
<tr>
<td>Foreign reserves (US$m)</td>
<td>2,079</td>
<td>2,023</td>
<td>1,783</td>
</tr>
</tbody>
</table>
Modernization of Eastern Railway corridor

Transportation industry

Ghana’s transportation overview

Ghana’s transportation and communications systems are centred in the southern regions, especially the areas in which gold, cocoa, and timber are produced. The northern and central regions are connected through a major road system; some areas, however, remain relatively isolated. Road transport is the predominant mode of transport in Ghana, accounting for the vast majority of freight and passenger travel. Ghana’s road construction boom followed the country’s independence in 1957. The transportation network at that time, though significant, was not well maintained. It began to deteriorate in the 1970s until the commencement of the structural adjustment programme in 1983. The deterioration of the country’s transportation and communications systems has been blamed for impeding the distribution of economic inputs and food as well as the transport of crucial exports.

Consequently, the first priority of the ERP was to repair physical infrastructure. Under the program’s first phase (1983-86), the government allocated US$1.5 billion, or 36 percent of total investment, for that purpose and an additional US$222 million in 1987 for road and rail rehabilitation. By the 1990’s, Ghana had experienced marked improvement in its roads network that has led to its emergence as a hub linking the entire West African trading zone. The privatization of many of Ghana’s transport and logistics enterprises has also led to greater efficiency in these areas. In 1991 the Ghanaian government allocated 27 percent of its budget for various road projects.

Developments in the road transport sector

Road transport continues to be predominantly the most popular mode of transport in Ghana, contributing 9 percent to GDP and accounting for 97 percent of freight and 94 percent of passenger travel. The road construction boom in Ghana followed the country’s independence in 1957. The road network at that time, though significant, was not well maintained and therefore deteriorated by the 1970s until the commencement of the Structural Adjustment Programme (SAP) in 1983. By the 1990’s Ghana had
experienced marked improvement in road network and emerged as the linking hub to the entire West African trade zone.

The cost of roads construction and maintenance has been borne by the government while private contractors assume the task of implementation in the form of contracts between the MoT and local and international engineering firms via competitive bidding. These have been underwritten by development partners (DP) such as the World Bank, African Development Bank, EU, JICA, BADEA, DANIDA, AFD and KfW. These DP will continue to support road development programmes.

With the population of the major cities growing at an average rate of nearly 2% per annum as most cities now record population sizes double those of 1984. In the same vein, the transport industry has grown correspondingly over the period, with scores of small and medium-sized service providers emerging to satisfy the growing demand. In addition, GDP has averaged over 6% since 2004 with growing industries like timber, agriculture, mining, and tourism all compounding the need for a diversified transport system.

The Ministry of Transport has been embarking on a medium term strategic plan for the road and railway subsectors. The aim of the government is to provide the enabling environment for private sector participation in the development of the transport sector in Ghana. In this direction the government has developed some policy framework aimed at providing all stakeholders through private public partnership arrangements.

The objective of the government for the rail subsector is to acquire sustainable funding to revamp Ghana’s rails network to all strategic economic destinations. This is intended to considerably reduce the traffic, pressure and health hazards on our roads, and thus minimize the cost of repairing and maintaining the road networks in the country. Ghana’s railway network is 950km of mostly single track rail of 1.067w. Though not a major system of transportation, mining companies rely heavily on the system. This subsector, however, has the potential of influencing economic growth.

Developments in rail transport

The Ghana railway transport system commenced under the Gold Coast Civil Service with headquarters in Sekondi in 1898. By 1901, the first rail track of 66km was laid from Sekondi to Tarkwa, and by 1902, the second extension of rail track of length 133km was laid from Tarkwa to Obuasi. In 1903, the third extension of length 68km was laid from Obuasi to Kumasi.
By 1912, the first section of the eastern line, from Accra to Mangoase was completed and at the same time, a branch line from Tarkwa to Prestea of 29km was also completed. By 1923, the rail line from Accra reached Kumasi and by 1944, the Dunkwa to Awaso branch line of 73km was also completed. In 1954, the Achimota Junction to Tema line of length 16.5km was completed and by 1956, Achiasie to Kotoku of 81km was also completed.\(^3\)

The headquarters was transferred to Takoradi following the construction of the Takoradi Harbour, and railways and ports were jointly administered as the Ghana Railway & Ports Authority. In 1976, SMCD 95 separated the Railway from Ports and became known as the Ghana Railway Corporation. It enjoyed the status of a public corporation until March 19, 2001 when it was transformed into a limited liability company known as the Ghana Railway Company Limited (GRCL).

### Ghana’s Railway Network

Ghana Railway Company Limited (GRCL) currently owns and operates the total rail network of Ghana of length of 947 route kilometers of tracks (1,200km) all located in the southern part of Ghana. This is made up of the Western, Central and Eastern lines. With the exception of the 30-kilometre Takoradi to Manso double track section, the rest of the network is a single track system of 1067 mm (3’ 6”) gauge.

The country’s railway operates through various cities, major towns and small towns and mainly centred on the southern part of the country. Among some of the major cities and towns are; Kumasi, Nkawkaw, Koforidua, Obuasi, Awaso, Tarkwa, Huni Valley and Dunkwa. The rest are Kade, Achiasi, Nsawam, Kotoku, Accra, Takoradi and Sekondi. Figure 6 highlights the various cities and town which over the years have benefited from the operations of the railway transport.
Figure 4: Ghana’s railway network

The Western line links Takoradi and Kumasi, while the Eastern Line links Accra and Kumasi. The Central Line connects the Eastern and Western Lines running parallel to the coast. The network has five branch lines: the Sekondi, Prestea and Awaso branches originating from the Western Line; the Tema Branch originating from the Eastern Line; and the Kade Branch originating from the Central Line.

Figure 5: A Railway section showing a crossroad in Koforidua

Current developments

Over the years, Ghana’s railway infrastructure has deteriorated due to lack of funds for maintenance and modernization. The rail transport system is currently characterized by:

- Dilapidated railway tracks, terminals, platforms
- Insufficient rail linkages to key mineral deposits and key agricultural “breadbasket” centres of the country
- Insufficient rail linkages to land-locked West African trading partners, i.e. Burkina Faso, Niger, Mali
The above problems have resulted in over-utilized road system that is also deteriorating quickly. Over 90% of the railway freight traffic is bulk minerals hauling bauxite and manganese transported from the mines at Awaso & Nsuta to Takoradi port for export. Most passenger service has been suspended due to lack of rolling stock, station disrepair, and fuel costs and most of the other traditional freight commodities such as timber, cocoa, petroleum products and cement, as well as intercity passenger traffic, has been lost to road transport.

Figure 6: A section of rail track over grown with weeds

In 2003, the government established Ministry of Harbours and Railways to show its commitment to the development of infrastructure and service delivery for the Maritime and Rail Transport sub-sectors. This was to enable the government focus on the re-vitalization of the rail and maritime transport system to complement other modes of transport, enhance the development of domestic and International trade and contribute to the socio-economic development of the country.

The Ministry though chalked some achievements some of which includes:

- Establishment of rail and maritime regulatory bodies to oversee safe and effective rail and maritime transport.
- Submission of draft on regulations in rail sector to Parliament
- Promotion of the private sector participation in development of rail infrastructure
- Integration of modes of transport, including feasibility studies to improve accessibility and rail linkage with Burkina Faso.
• Introduction of rail commuter Service to ease traffic in major cities
• Port development to improve infrastructural development and provision of increased opportunities to the private sector to provide stevedoring and terminal services.
• Protection of interest of shippers and building of capacity and competitiveness in a sustainable manner.

The Ghana Railway Development Authority (GRDA)

In 2008, the Railways Act, Act 779 was laid and assented on the 6th January 2009 establishing the Ghana Railway Development Authority ("the Authority", GRDA) to oversee the operations of the railway transport sector and all related matters.

The objectives and functions of the Authority are as follows:

1. To promote the development of railways and railway services;
2. Hold administer and improve the railway assets; and
3. Promote the development and management of suburban railway.

To achieve the above objectives, the Authority is empowered to:

a. Implement and ensure compliance with guidelines outlined under Part two of this Act – Operations of Railways;
b. Grant licenses, concessions, and leases which are necessary for the operation of railways and railway services and perform other related functions including the keeping of a register of railway operations; licenses; and sub-licenses;
c. Exercise ownership rights over asset that are transferred to the Authority from Railway assets;
d. set and enforce safety and security standards for the construction and operation of railways in accordance with this Act;
e. Regulate and monitor the activities of licensees, concessionaires and operators of railway;
f. Initiate, conduct, promote and encourage studies necessary for growth and developments of railways including the development of master plans in accordance with the schedule to this Act and set standards.
g. Oversee the administration of Railway Development Fund and ensure that Fund is used for the purpose set out for it in this Act.
h. Ensure collaboration with other public, private or international agencies necessary for the performance of its functions,
i. advise the government on railway matters generally
j. subject to section 98,
(i) Carry out any transactional function that is necessary for the growth and sustainability of railways,

(ii) Carry out other activities incidental to its functions, and

k. Subject to ministerial directives, perform the functions of a railway regulator.

Historical Performance of Rail Transport

The railway sub-sector since its inception has played a significant role in the economic development of Ghana. Figures available to the Ghana News Agency had indicated that the volume of traffic increased from 47,388 tons in 1906 to 298,593 tons in 1916, representing a growth of 530%. By 1926, the figure has increased by 169% to 805,227 tons. Passenger traffic showed similar growth from a total of 689,292 in 1906 to 1.5 million passengers in 1925/26.

At the peak of its performance in the early 1960s, the railway transport lifted 2.3 million tonnes of freight in 1965 and 8.0 million passengers in 1971. By 1983, freight haulage slumped to an all-time low of about 357,000 tonnes with passengers carried hitting the lowest level of 546,000. A number of factors including ineffective management of the rail system, the changing world economy, sharp drops in commodity prices, and physical deterioration of the network, inadequate coaching stock and competition from the road transport sector largely contributed to this feat. By the end of 1983, a rehabilitation of infrastructure and acquisition of rolling stock started in an attempt to arrest the downfall in rail traffic.

Following the completion of rehabilitation on parts of the western line and procurement of new locomotives, freight traffic improved significantly from the 816,000 tonnes in 1998 to 1.87 million tonnes in 2003. (See Table 4)

<table>
<thead>
<tr>
<th>Years</th>
<th>Cocoa ('000 tonnes)</th>
<th>Timber ('000 tonnes)</th>
<th>Bauxite ('000 tonnes)</th>
<th>Manganese ('000 tonnes)</th>
<th>Others ('000 tonnes)</th>
<th>Total ('000 tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>31.05</td>
<td>60.13</td>
<td>362.18</td>
<td>300.53</td>
<td>62.11</td>
<td>816</td>
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<tr>
<td>1999</td>
<td>26.73</td>
<td>60.35</td>
<td>365.95</td>
<td>444.4</td>
<td>75.59</td>
<td>973.02</td>
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<tr>
<td>2000</td>
<td>19.08</td>
<td>55.04</td>
<td>398.17</td>
<td>652.36</td>
<td>32.81</td>
<td>1,157.46</td>
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<td>2001</td>
<td>14.4</td>
<td>40.86</td>
<td>582.14</td>
<td>864.78</td>
<td>52.06</td>
<td>1,554.24</td>
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<td>2002</td>
<td>11.61</td>
<td>40.3</td>
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<td>917.01</td>
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<td>11.26</td>
<td>46.32</td>
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<td>2004</td>
<td>18.78</td>
<td>33.08</td>
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<td>2006</td>
<td>21.42</td>
<td>19.36</td>
<td>368.12</td>
<td>1,222.72</td>
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<td>1,654.40</td>
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<tr>
<td>2007</td>
<td>9.12</td>
<td>8.19</td>
<td>249.49</td>
<td>854.59</td>
<td>15.08</td>
<td>1,136.47</td>
</tr>
</tbody>
</table>

Source: Ghana Railway Company Limited 2008
This intervention was short lived due to lack of funding and therefore failed to make the desired impact. So in 2004, freight traffic decreased again to 1.76 million tonnes.

In 2005 some of the existing wagons were rehabilitated and put to use in addition to the purchase of new high-density coaches. As a result freight traffic increased to 1.76 million tonnes of freight as against the targeted 1.40 million tonnes but started a gradual decline thereafter. By 2007, total freight traffic had reduced to 1.14 million tonnes.

Manganese dominated the volume of freight traffic peaking at 1.22 million in 2006 and declining sharply to 854,000 tonnes in 2007. This is followed by bauxite enjoying its peak at 655,000 in 2002. Other commodities such as foodstuffs and consumables enjoyed more traffic than cocoa and timber.

**Figure 7: Distribution of freight traffic of major commodities**

All freight commodities declined seriously from 2006 down to 2007.

Apart from a thrice daily service to INSERT there no other services.
Following the same pattern for freight traffic, passenger traffic also dropped from 1998 to 2003, and then sharply increased to 2.5 million passengers in 2005 with the intervention of the rehabilitation and then started a continuous decline due to the sustenance of rehabilitation efforts. Figure 11 shows that passenger traffic declined to as low as 988,000 in 2007.

The Accra – Nsawam passenger traffic largely contributed to the national traffic as indicated from 2002 – 2007. It increased from 71% in 2002 to 95% by 2007. In 2008, the railway shuttle from Tema to Accra commenced with the introduction of new engines and coaches and the rehabilitation of the rail tracks. Figure 12 shows how this was patronised.
In March, 2008, there was no service as a result of industrial action by the workers of GRCL. Service however resumed in April.

By July 2008, lack of maintenance had diminished passenger patronage once again. This compelled GRCL to suspend operations on this line until the needed funds was acquired to rehabilitee the system.

From the above analysis, the following assumptions can be made:

1. That rail transport is still popular and much favoured by customers. Therefore with rehabilitation and modernization of rail transport, the demand from both freight and passenger is likely to be very high.

2. That manganese and bauxite can provide about 80% of expected revenue. However, there are no manganese deposits along the eastern line but the western. There is a substantial amount of bauxite deposit in Kibi which has been planned to be mined to promote an integrated aluminium industry in Ghana. The mining of these deposits will boost revenue for the project and African Rail will complete freight offtake negotiations with these industry members in the beginning of 2013.

3. The introduction of freight transport by rail will receive high patronage as a result of the various benefits outlined above, traders, businesses, importers, passengers and government stand to achieve.
Figure 11: Abandoned coaches and goods wagons
Future Outlook

Realizing the important roles that the sector can play to the realization of the economic growth of the country, government is determined to resuscitate the rail transport sector by allowing private investors bid for concessions, invest in the rehabilitation and modernization and operate to recover cost and expected returns.

The government’s ultimate aim is to make the system the cheapest, most efficient and safest transport mode with improved capacity. After the existing lines have been revived, the government hopes to extend the system to its neighbouring countries in the sub region.

As part of the Ghana Government long term development plan it is proposed to expand and modernize the existing rail network from southern Ghana to northern Ghana, This will pave the way for linking the country to our neighboring countries like Burkina Faso, Mali and Niger in the North.

Trans ECOWAS railway line

- Engagement of Consultants by Ecowas to undertake feasibility studies for a Trans-Ecowas Line from Aflao to Omape (Western Region) funding by Africa Development Bank (AfDB)
- Route: Aflao-Tema-Kotoku-Tarkwa-Prestea-Omape
- Rapid Economic Integration and Facilitation of free movement of goods and services
- Expansion of Eastern and Western Line would also facilitate regional integration and economic development

Most investments made by the Government in the railway infrastructure from 1983 - 1997 with World Bank assistance have not been sustained due to the high cost involved with infrastructure renewal and maintenance. There is the need to re-engineer and re-orient Ghana's railway system to operate as much as possible without Government subvention. It is, therefore, important that the Government's decision to liberalize the rail sector is implemented to the latter through private public partnership arrangements in which the private partner is capable of injecting capital to improve productivity and quality of service at competitive price and lower total costs to the economy. This will enable the Government to transform Ghana Railways from its current fragmented, unprofitable state into a viable transport system.

There is evidence of success of this nature from Brazil; Cote d'Ivoire; Zambia, Cameroon and Burkina Faso, Tanzania, Kenya and Uganda. With the passing of the Railway Act 779, 2008 setting up the Ghana Railway...
Development Authority (GRDA) to regulate the concessionary construction and operation of railways in Ghana, the country is now set to revamp its railway system into a vibrant transport sector.
Market assessment

Commercial activities along rail lines

Currently, the railway network serves only southern Ghana. The areas served happen to be the most productive, and populated in the country. The Tema and Takoradi Port, through which Ghana’s import and export trade are carried out, are also located in this region. The bulk of the country’s export commodities, such as cocoa, bauxite, manganese and timber are produced and transported through this section. Most of the manufacturing industries in the country are also located in the south. The railway network thus carries a significant volume of export and import traffic to and from the ports.

The population along the corridors served by the railway network also depends on the railway to transport their farm produce to markets, procure essential needs and access healthcare and educational facilities.

Minerals, such as bauxite and manganese, cocoa and timber traffic, constitute the main commodities of goods (freight) traffic. As already noted manganese and bauxite bring in the bulk of rail revenue. Other commodities transported by rail also include cement and flour. It is the hope of government that, an improvement in rail transport will reduce the carting cost of petroleum products to the northern parts of the country.

The creation of an inland port is rail transport based. That is, the railway system will be the means by which all containerised cargo meant for the northern part of Ghana and bordering countries will be transported to an inland port to be established at Boankra in the Ashanti region and close to Kumasi. Once deposited at this inland port, they are taken over by road transport vehicles to their final destinations. This is expected to decongest the Tema port and also reduce the amount of haulage vehicles plying the roads and causing fatal accidents to other motorists.

The GRCL have been a loss-making venture with passenger revenue averaging 25% of service cost. It is important to note that since 1998, portions of the Eastern Lines and the entire Central Lines have not been operational. The Accra to Nsawam stretch was the only active section of the eastern and mainly used for passenger transit. The bulk of volumes of freight
traffic 1998 to 2007 indicated above have been undertaken mainly along the western lines with just a small fraction being hauled along the eastern line on the Accra Nsawam section.

Assessment of traffic demand

In this section, Deloitte identified active sections of rail transport on the eastern lines to assess current demand. These sections were used as basis for justifying the projection of passenger and freight traffic along the corridor. The active sections were identified as follows:

1. Accra – Achimota – Dome – Nsawam
2. Accra – Achimota – Batsona – Tema
3. Accra – James Town
4. Nsawam – Koforidua

Its study revealed a two way traffic on these lines through which both freight (bulk cargo, container, other goods such as cement, iron rods, etc) and passenger traffic were high. Interviews were held with manufacturing firms located in Accra, Tema and Kumasi, whose transport significant volume of their products along this corridor.

Bulk traffic bound for north included cement, iron rods, plastic products, rice, among others. Ghacem for instance, indicated monthly haulage of at least 30,000 tonnes of cement to Nsawam, Koforidua and its environs. With facilities such as forklifts, security and vehicles positioned at train terminals, others such as Tema Steel and Ferro Fabric would haul a minimum of about 400,000 tonnes of iron rods to the eastern region. Another organization CCTC, one of the major importers of rice and fishing gears also indicated a northbound traffic of about 300,000 tonnes to the eastern corridor on regular basis.

Appendix 1 shows some of the firms interviewed and their indications for rail transport patronage.

Decongesting the Tema habour

The need to decongest the Tema harbour was another major source of assessing demand along the eastern corridor. Trends of containers and other bulky goods meant for the eastern and northern parts of the country were also analysed to be used as a basis to project freight demand. Figure 18 shows the volumes of imports arriving at the Tema port from 2003 to 2008:
Normally, Cargo arriving through the Tema port are meant for the Greater Accra, Volta, Eastern, Ashanti and the rest of the northern parts of the country. Landlocked countries such as Burkina Faso, Mali and Niger imports their goods through the Tema port and are likely to cart them along the eastern corridor.

Based on the above, Deloittes assumed about 10% - 15% of all port cargo destined for Accra, Koforidua and their environs and 40% - 50% to Nkawkaw, Konongo and Kumasi to be hauled by rail transport. It is expected that the project will include the establishment of a container terminal at Nsawam or Koforidua to handle goods bound for the Volta and eastern regions.
South Bound Traffic and Haulage

Items such as foodstuffs, cocoa and other non-traditional exports can mainly be obtained from the eastern and Ashanti regions and bound for Accra or Tema. Also, Produce Buying Companies who purchase cocoa and other cash crops for export are also potential users of the eastern rail transport system when completed.

Passenger haulage is another key activity that will generate the rest of the income on routes such as Nsawam, Teshie, Tema and its environs. People who live in these areas but also work in Accra will want to avoid being trapped in their vehicles as a result of huge traffic.

If the government decides to implement the implementation of extending the eastern line to Paga, then it is expected to increase traffic demand for agricultural products including shea nuts, cotton, millet, rice and cola. About 40% of food prices in the country are attributed to the cost of transportation. Most of them are destroyed due to non-availability of transport. This situation could be reversed with an efficient and reliable rail system.

Mineral deposits like bauxite, limestone, diamond and gold have been located along the routes and construction of this line will serve as catalyst for their exploration.
Operational requirements

Legal obligations and procedure

Operations of railways

Under the Railway Act 779, 2008, guidelines have been provided for licensing and regulations of railways as follows:

1. A person shall not construct, manage or operate a railway, or carry a passenger or freight by railway except in accordance with a railway license issued by the Authority.

2. An application for a license to construct, operate or manage a railway shall be to the Authority.

3. The application for the railway license shall be in the form and be accompanied with the documents and fees determined by the Authority.

4. The Authority may be Regulations prescribe the requirements for a railway license.

5. Despite Regulations made by the Authority, an application for a railway license shall indicate
   a. The terminal and route of each line of railway proposed to be operated, and
   b. The nature of the services to be provided by a railway company.

Common or private carrier

1. A railway license shall specify whether the company is to operate the railway as a common carrier.

2. A company which operates as a private carrier is exempt from compliance with sections 64 to 72 and 75 to 84.

3. A company which intends to operate wholly or in part on the railway of another or on a railway in which ownership is vested in the Authority must include in its application for a railway license,
Grant of license

1 The Authority shall:

(a) Acknowledge receipt of the application, and

(b) Within a period of not more than one hundred and twenty days of receipt of the application, inform the applicant in writing of the decision of the Authority.

2 The Authority shall grant a license to the applicant where it is satisfied that the railway operation in respect of which the application is made is technically suitable for the service intended to be rendered.

3 The Authority may refuse to grant an application, where there are compelling reasons founded on technical or economic grounds, national security, public safety or other reasonable justification for doing so.

4 Where the Authority refuses to grant an application, the reason shall be communicated to the applicant within fourteen days after the decision.

5 A person whose application for a license is refused may apply to the Railway Complaints, Appeals and Review Panel established under section 100 for a review of the decision.

Conditions of License

1 A license granted by the Authority under this Act shall be subject to the conditions specified in the license.

2 Without limiting the effect of subsection (1) a railway license may require the railway operator to

   (a) Interconnect to another railway company or to permit the connection to its operations or facilities including stations by another railway company,

   (b) Determine the tariffs, charges, terms, or conditions that apply to the provision of the service as specified in the license,
(c) Publish a notice indicating the methods that are to be adopted to determine the charges, the terms and the conditions that apply to the service provided,

(d) Pay the fees determined by the Authority to the Authority during the existence of the license,

(e) Provide documents, accounts, estimates, returns or other information that the Authority requires to the Authority,

(f) Operate the railway in accordance with the standards of performance prescribed by the Authority, and

(g) Abide by the terms specified in the license unless written approval is given by the Authority to do otherwise.

**Condition of transfer of license**

A license granted is not transferable except with the written approval of the Authority

**Renewal of license**

1 A license granted is for a period of five years in each instance and may be renewed under terms specified by the Authority.

2 A person who desires to renew the license shall submit an application for the renewal to the Authority not later than six months before the license expires.

3 The procedure for the renewal of the license is the same as that for the grant of the original license except that the fees for renewal shall be lower than that payable for an original license.

4 An operator who fails to renew the license or whose application for renewal is rejected by the Authority shall cease to operate the railway service.

**Power to suspend, cancel or modify license**

1 The Authority may suspend, cancel or modify a license with prior notice to the Minister if it has good reason for the cancellation or modification.

2 The Authority shall not suspend, cancel or modify a license under subsection (1) unless the Authority has given to the holder of the license,
a. At least a thirty working days written notice, in the case of suspension or

b. At least a ninety days written notice, in the case of cancellation or modification.

3 The notice shall state

a. That the Authority proposes to suspend, cancel or modify the license, and

b. The reason for the suspension, cancellation or modification of the license.

4 The notice shall be given

a. By publication in a manner that the Authority considers appropriate to bring the suspension, cancellation or modification to the attention of a person likely to be affected by the notice, and

b. By sending a copy of the notice to the railway company.

5 On receipt of a notice, the operator may make a representation to the Authority.

6 The Authority shall consider a representation or objection made to it before the suspension, cancellation or modification is made.

7 A person dissatisfied with a decision of the Authority in respect of section 43 or this section may apply for review to the Railway Complaints, Appeals and Review Panel in accordance with section 99 to 104.

Construction without approval by the Authority

1. Despite the grant of a licence, a railway company shall not construct a railway line without the written approval of the Authority for the construction of the railway line.

Grant of approval for construction of railway line

1 The Authority may, grant approval to construct a railway line if it considers that the location of the railway line is reasonable, taking into consideration the requirements for railway operations and services, the interests of the localities and persons that may be affected by the line or its constriction.
2 An approval for the construction of the railway across the railway line of another railway line company shall be subject to the provisions on railways, roads and utility crossing on sections 52 to 54.

Powers in relation to natural or man-made obstacles

1 A railway company may exercise the following powers to construct or operate its railway:
2 Make or construct tunnels, embankments, aqueducts, bridges, roads, conduits, drains, piers, arches, cuttings and fences across or along a railway, watercourse, canal or a road that adjoins or intersects the railway;
3 divert or alter a watercourse or the course of a road, raise or lower the course in order to move the course more conveniently across or along the railway;
4 make drains or conduits into, through or under land adjoining the railway for the purpose of conveying water from or to the railway; or
5 divert or alter the position of a water or gas pipe, sewer or drain, telegraph, telephone or electric line, wire or pole across or along the railway.
6 A railway company shall limit the amount of damage and make good any damage caused either directly or indirectly in the construction of a railway line.
7 A railway company shall pay compensation for any damage caused to property in the construction of a railway line.
8 A railway company shall not exercise its powers without:
   a. consulting with the relevant agency responsible for or connected with the construction,
   b. the approval of other relevant authorities responsible for giving specific approval for the construction, including:
      (i) the Environmental Protection Agency in respect of an environment permit,
      (ii) the Water Resource Commission in respect of construction related to water course, and
      (iii) the appropriate district assembly in respect of a development permit, required under the Local Government Act, 1993 (Act 462).

Acquisition of land for railway purposes

1 Where the Authority is satisfied that:
   a. it is necessary for a railway company to acquire a particular piece of land for the construction or operation of its railway,
b. the owner of land has failed to consent to the acquisition of a particular parcel of land by agreement, despite diligent efforts made by the railway company, or

c. there is no reasonable prospect of the land being acquired by agreement,

The Authority may take steps to acquire the land for the use of the railway company under the State Lands Act, 1962 (ACT 125) and the land shall vest in the Authority but the railway company shall bear part or all of the cost of the land acquisition including the compensation payable to the owner as determined by the Authority.

2 The minimum width of right of way, which a railway company may acquire shall unless the Authority otherwise prescribes be thirty metres.

Power to enter and inspect land

1 The Authority may, enter land which is earmarked or required for the construction or operation of a railway for inspection in order

   a. to establish the location of the railway,

   b. mark and delimit the areas of land required for the construction or operation of the railway, and

   c. determine the extent of the work necessary to be carried out before the acquisition of a parcel of land by agreement or by Authority.

2 The Authority shall exercise the power to enter and inspect land after forty-eight hours notice in writing has been given to the owner or occupier of the land.

Accommodation works on new lines of railways

1 A railway company shall, during the construction of railway or as soon as practicable after the construction of a railway, construct and maintain accommodation works for the benefit of the owners or lawful occupiers of adjoining lands.

2 The accommodation works include

   a. road crossings, bridges, culverts, drains or works that are necessary for the purpose of making good any interruption caused by the construction of the railway, and

   b. works which are necessary to restore the owner or lawful occupier to quiet enjoyment of related facilities including water, electricity, telephone or other utilities from or to adjoining lands.
c. This section does not authorize a railway company to construct or maintain accommodation works

(i) in a manner that prevents or obstructs the proper operation of the railway,

(ii) where the owners or lawful occupiers or their predecessors in title have received compensation instead of the construction or maintenance of the accommodation works, or

(iii) after a period of five years from the date on which the railway passing through the land was first opened for the public carriage of passengers or goods.

Additional accommodation works
1 If at any time, the owner or lawful occupier of land on which a railway is constructed desires accommodation works beyond what has been planned or constructed by the railway company under sections 50, the owner or lawful occupier may request the railway company in writing to construct the accommodation works
   a. agreed on between the railway company and the owner or lawful occupier, or
   b. if no agreement is reached, as determined by the Authority.

2 The cost of constructing or maintaining the additional accommodation works shall
   a. except for road crossing or utility crossing be borne by the owner or lawful occupier who requires them, or
   b. with respect to road crossing or utility crossing be borne
      i. by the appropriate utility or road agency that requires them
      ii. by the railway company, or
      iii. in a manner determined by the Authority

3 Where the additional works required by the owner or lawful occupier of land of an appropriate authority are as a result of the insufficiency of the works undertaken by the railway company, the cost shall, be borne by the railway company as determined by the Authority.

Constructions across a railway line
1 A person shall not
   a. construct a railway line across the railway line of another railway company, or
   b. construct a road or utility line across a railway line, or
   c. a railway line to make that railway line cross the railway line of another company, or
d. a road or utility line to make that road or that utility line cross a railway line

Without the prior approval in writing of the railway company whose railway line is to be crossed and without an express approval issued by the Authority which permits the construction or alteration

2 Where the railway company whose line is to be crossed fails to give its consent, the Authority may grant approval if it is of the opinion that the construction or alteration of the line is in the public interest.

Agreement on construction or maintenance

3 if a person is not successful in negotiating a written agreement with a railway company for the construction, alteration or maintenance of a railway, road or utility crossing, then the Authority may, authorize the construction, maintenance or alteration of the railway, road or utility crossing on application.

Failure to agree on appointment of costs

1 If a person is not successful in negotiating a written agreement with a railway company in relation to
   a. the apportionment of the costs of construction,
   b. alteration or maintenance of a railway, or
   c. road or utility crossing,

2 the person or the railway company may refer the apportionment of liability for the construction or maintenance cost of the railway, road or utility crossing to the Authority for determination.

3 The referral may be made either before or after the construction, alteration or maintenance of the crossing begins.

4 Where the Authority is to adjudicate a referral, the Authority shall take into consideration,
   a. the relative benefits that the person requesting the crossing and the railway company stand to gain from the crossing, and
   b. any other factor that it considers relevant in the circumstances to determine the proportion of construction, alteration or maintenance costs to be borne by each party.

5 A person dissatisfied with a decision of the Authority under section 53 and this section may apply to the Railway Complaints, Appeals and Review Panel for a review of the decision.
Regulations for construction, alternation, maintenance and others

The minister may by legislative instrument make Regulations for the construction, alteration, maintenance, safety or operation of railway works, road crossings, and the maintenance, safety or operation of railway works, road crossings, utility crossings, and the maintenance and operation of railway equipment.

Appointment of Railway Safety and Security Inspectors

1. Subject to section 15, the Authority shall appoint Railway Safety and security Inspectors from among its staff.
2. The Authority shall prescribe the qualification of a Railway Safety and Security Inspector.
3. Notice of the appointment of each Railway Safety and Security Inspector shall be published in the Gazette.
4. A Railway Safety and Security Inspector shall
   a. enforce this Act and Regulations made under this Act and
   b. perform any other function that the Authority directs in relation to the safety and protection of passengers or goods carried by railway.

Rates to be charged

Subject to section 69, a railway company shall charge the rate for the carriage of passengers of freight that is set out in a tariff approved by the Board and issued and published by that railway company.

Minimum information on tariff

The following information shall be included in a tariff:

1. a statement of the rates, in local currency for each
   I. designated unit of weight or volume, for each type of freight
   II. service rendered, or
   III. passenger;
2. a brief description of the category of traffic that is transported;
3. the point of origin and point of destination of any traffic;
4. a description of the route over which a rate applies, or a reference to a routing guide to describe that route
5. the date of issuance, commencement and expiration of the tariff;
6. terms and conditions of the tariff or an explanation with reference to where the terms and conditions can be found; and
7. an explanation of the symbols or abbreviations used in the tariff.
Request for tariff by shipper

1. A railway company shall issue a tariff in respect to the movement of traffic on its railway line at the request of a shipper, not later than thirty days after the request.

2. If traffic is to move over a continuous route and portions of the route operated by two or more railway companies, the companies shall, agree on a joint tariff for the continuous route and on the appointment of the rate in the joint tariff.

Technical design

The technical regulations governing this project will ensure safe and harmonized solutions for the planning, construction, and maintenance of the railway network. These regulations will be aligned to the strategic future expectations of the Ghana Railway company and the vision of the Government.

It is expected that the Ghana Railway Company will be able to develop a new set of technical regulations through their cooperation with African Rail which could form the basis for a common standard in Africa, quite possibly via an African railway union.

The set of regulations should at least, highlight the following:

A. Substructure
The railway's substructure should have a high standard of levelling and adequate drainage, which is dependent on the terrain—whether it involves filling in and/or cutting, under a bridge or in a tunnel. In addition, construction profiles must be of a high standard taking into consideration their environment.

B. Superstructure
The railway's superstructure consists of the tracks, sleepers, point rail, switches, spikes, joints, tie plates, ballast, and junctions.

C. Signal
The signal system consists of remote-controlled installations, security, and speed control systems.

D. Tele
Tele consists of the part of the telecommunication system that has to do with transmission of messages such as telephones, radio, and information.
systems related to the rail networks. This should be incorporated in the design.

**E. Electronics**

Electronics consists of all the areas where power units are required (tele signal) for the successful running of an electronic magnetic coordination (EMC).

**Planning**

African Rail through its Consortium partners will carry out the entire planning segment of the construction work. Projections for projects of this type vary greatly within its different areas of specialization. This will demand various types of competence and resources.

Projections will be based on international standards. Engineers specializing in Civil Works, track systems, signal systems, telecommunications and training will carry out the projections using advanced computer technology, and all data will be stored in secured data banks. African Rail will also give personnel at Ghana Railway the necessary training in the new standards and regulations.

**Foundation/Civil Work**

**Task Description**

The foundation/civil work will consist mainly of the following:

**A: Removal of vegetation:** The vegetation along the existing track will be removed with a maximum width of 3m on either side. The vegetation will be collected and deposited continually along the track, without further transport out of the area.

**B: Removal of old tracks:** The existing tracks and sleepers will be dismantled and removed from the area. The materials will be transported to a given location with an average transportation distance of 5km (10km back and forth).

**C: Levelling of existing terrain:** Flat terrain will be levelled at a width of 15m. A width of 25m will be affected where the railway exists on an inclined terrain.

**D: Ditches and gutters:** Surface ditches and gutters will be dug where necessary for adequate drainage. It is estimated that every kilometre requires 5 gutters. It is also expected that there would be adequate material on site for the coverage of the gutter pipes and drains.
E: Compacting: The ground will be compacted after the drainage system has been covered.

F: Transport of crushed stone: Trucks will be used to transport the crushed stone from the quarry. The average transport distance is estimated at 20km (40km back and forth). The plan is to use with trailers with an average capacity of 4 trips per shift.

G: Levelling of crushed stone: The transported stone will be levelled to set or prepare the foundation. There is a minimum foundation thickness of 0.5m.

Assumptions:

It is assumed that the existing ground is stable and that a new foundation can be laid on it. Consequently, there have been no projections made for replacing the existing ground mass. The existing ground will be levelled and compacted before the new foundation is prepared.

Where the ground is inclined, the soil will be used to flatten the foundation. Building of transport roads have not been taken into consideration. It is assumed that the existing roads can be used for the transport of ground masses. The ground along the railway needs to be firm enough for the movement of vehicles.

Double Tracks

The project plan assumes that 70% of the route will be constructed on a flat terrain and the remaining 30% with a moderately sloping terrain with a maximum vertical incline of 1:5.

The project plan assumes that 70% of the route will be constructed on flat terrain and the remaining 30% with moderately sloping terrain with a maximum vertical incline of 1:5.

Figure 14: Principal diagram for the preparation of the Foundation
Table 4: Foundation Dimension for Double Tracks

<table>
<thead>
<tr>
<th>Description</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top width of foundation</td>
<td>10m</td>
</tr>
<tr>
<td>Minimum thickness of foundation</td>
<td>0.5m</td>
</tr>
</tbody>
</table>

Ditches, Drains and Fences

Ditches:

Table 5: Dimensions for Ditches for Surface Water

<table>
<thead>
<tr>
<th>Description</th>
<th>Dimension (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>2-2.5</td>
</tr>
<tr>
<td>Depth</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Drains:

Table 6: Dimensions for Drain pipes under single and double tracks

<table>
<thead>
<tr>
<th>Description</th>
<th>Dimension (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of drainpipe double track</td>
<td>15-20</td>
</tr>
<tr>
<td>Length of drainpipe single track</td>
<td>10-15</td>
</tr>
<tr>
<td>Dimension of pipe</td>
<td>Ø 0.5</td>
</tr>
<tr>
<td>Number of drains per km of foundation</td>
<td>5 per km</td>
</tr>
</tbody>
</table>

Fences:

Pedestrian traffic along and over the track must be restricted in order to reduce accidents and damage to people, animals and equipment. In the pilot project, we have taken into account that fences will be built along both sides of the track. Nevertheless, it may be more suitable, due to local conditions, build fences in some areas. The final decision would be made at a more detailed phase of the project plan. The pilot project estimates a fence height of 1.5 – 2m in netting and a distance between fence posts of about 5m.

Densely populated areas will need gangways over the railway line. This is not included in the project, but can be handled by establishing a footbridge over the railroad. Automated barriers can also be an option, but will be a more expensive solution.

In areas with small populations, stairs can be built on both sides of the track making it possible to walk over the fence. The installation of stairs will make it
easier to limit the pedestrian traffic over the track at certain areas, while reducing the wear and tear and the incidence of vandalism to the fence.

**Railway Bridges:**

30 small railway bridges, at a maximum of 450m are planned. The bridge height varies up to 5m. The maximum length of a projected bridge is 30m. The bridge pillars will be built in concrete and placed on the foundation. Pre-fabricated steel constructions will be assembled as part of the bridge construction. Sleepers and rails will be assembled afterwards on the steel constructions. The table below indicates bridge dimensions:

**Table 7: Dimensions for Railway Bridges**

<table>
<thead>
<tr>
<th>Height (m)</th>
<th>Length (m)</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>90</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

A 3m high bridge will be constructed with a concrete foundation of 10x2x1.5m (LxBxH). Armoured pillars of 10x0.75x3m (LxBxH) will be established on the foundation.

The table below shows a diagram representing an alternative bridge construction.

**Figure 15: Sketch Diagram for alternative Bridge Construction**

Pre-fabricated steel constructions will be assembled on the pillars. The length of the steel constructions and the distance between the pillars will be determined in due course.

**Railway Tracks**

The railway’s superstructure consists of the line’s tracks, sleepers, junctions, fortification, joints, ballast and level crossings. The line will be divided into
superstructure classes and quality classes. The track gauge will be the same as the international standard of 1435mm.

There will be a division between main lines and branch lines.

Main lines refer to:

- Open lines
- Train tracks at stations
- Other heavily trafficked lines
- Other lines not mentioned

The railway’s class of superstructure refers to its construction, particularly to track profiles and sleeper distances. Particular line superstructures have different specifications for their construction.

The rail line’s class of superstructure is one of the factors that determine which traffic can be allowed along the track. Each class of superstructure has a fixed maximum allowed speeds on the main line with matching upper limits for the permitted axle loads for passenger trains, motor-coach trains and freight trains.

Classification is based on superstructure classes which are decisive for permitted speed and axle load. A recommended top speed of 150km and a maximum axle load of 22.5 tonnes are recommended for this project. This will be a class A superstructure. Lines with class A classification will be built with a top track and sleeper quality.

**Types of Sleepers**

The sleepers will be of top-quality cement, with fast clips fortification joining the tracks to the sleepers. The standard distance between the sleepers will be 600mm.

*Figure 16: illustration for Sleeper type for Normal Ground*
a. Fortification

Fortification connects the rails to the sleepers. The fortification must be springy with a huge amount of lasting resistance capability against horizontal moving forces. A fast clip form of fortification will be used.

b. Track profile

Top quality tracks that have the steel quality required for a Class “A” superstructure will be used.
c. Junctions

Junctions will be built directly into the track with the same general regulations for gauge, fortification, and sleepers in the junction. Junction components are more exposed to excessive wear and tear than other tracks along the line. This means that special attention is required of the steel track’s mechanical capabilities in these components.
Communication solutions

**ETCS + GSMR = ERTMS**

ETCS is the new control command system. GSMR is a modern radio system for voice and data communication. Together, they form ERTMS, the new signalling management system for Europe, which enables interoperability throughout the rail network in Europe.

ERTMS, the European Railway Traffic Management System, has been designed by the European railways and the supply industry supported by the European Commission to meet the future needs of the European Railway System.

**Features and Advantages of ERTMS**

Some of the features and advantages of this solution are as follows;

Features of ERTMS:

- Interoperability
- Highest speeds up to 200km/hr
- Automatic Train Protection (ATP)
- Smaller Headways
- Moving Block Operation (Level 3)

Advantages of ERTMS:

- Long term cost reduction
  - Major Equipment Reduction
  - Better Assets Utilization
  - Increase Capacity
  - Less Trackside Equipment
Higher Operational Throughput
- Highest Level of Safety
- Possibility of More Trains per Line
- Interoperability or Railway Networks
  - Standardization
  - Reduction of Some Technical Barriers
  - Ease in Cross-Border Operations
- Open Market for Signalling Systems
  - Increase Competition

**Recommended solution**

African Rail will use the ERTMS and GSM-R for the establishment of a new signal and communication system for the project. The implementation of ERMTS takes place through a wireless system where base stations communicate with the trains.

Balises will be placed along the line at regular intervals. The equipment registers and reports the train’s position at any given time. The train communicates continually with the base station. Thus, if one base station drops out, another base station automatically takes over.

The list below summarizes the system’s concept:

- Eurobalise + Euroradio (GSM-R) + Radio Block Centre
- Movement authorities through GSM-R
- Train position via Eurobalise
- Train integrity onboard
- Moving block

*Figure 16: Key Diagram of ERMTS*
GSMR = The Railway System for Mobile Communication

The GSM-R technology is based on a standard GSM system, but uses various frequencies specific to rail as well as certain advanced functions. It is the radio system used for exchanging voice and data information between the track and the train.

Train drivers need to be able to contact controllers and other staff at the push of a single button. As the train moves through different areas, the required points of contact are liable to change. Consequently, it is necessary to provide a means of handling calls from a train to certain functional areas based on the location of the train. With GSM-R, the basic means of determining the location of a train for the purpose of location dependent addressing is based on cell dependent routing.

Stations

Station buildings
A total of 23 stations have been planned along the railway. These stations vary in size and structure and can be classified as:

- Type 1 - Complete stations
- Type 2 - Simplified stations
- Type 3 - Platform-only stations (halt)

Type 1: Accra – Complete Station
A new station/terminal with three floors and a surface area of approximately 6 000m² is planned. By using a three centre-based platforms (between two tracks) there could be up to 6 tracks to facilitate routes to different destinations. The width of each centre’s platform is scheduled to be about 6m. Transitions between the platforms have also been planned. However, tunnels can also be considered as an alternative solution.

Tema, Nsawam, Kotoku and Koforidua – Complete Stations
Four new stations/terminals with one floor each and a surface area of 2000 m² is planned for the cities.

It is assumed that two platforms, handling traffic of four different tracks will be sufficient. A centre platform with a width of 6m is also planned. Transition solutions between the platforms are also included.

Type 2: Simplified stations in smaller towns
Simplified stations are planned for smaller towns or densely-populated areas. The existing terminals would be renovated. This will apply to stations in
Odaw, Achimota, Achimota Depot, Baatsonaa, Asoprochona, Dome, Amasaman, Papase, Pakro, Mangoase and Asuoya. Two side platforms and walkways between the platforms would also be developed.

Type 3: Other stations – Platforms only (halts)

The remaining stations for densely populated areas would not have newly built terminals. The plan is either to renovate the existing ones, or if necessary, build new platforms. This covers stations in Ml Camp, Ml 17.7, Sakumono, Ofankor, Bawkrom, Aboagyena and Kentenkiren. Two side platforms for each station will also be developed.

Restrictions

The next phase of the detailed projections will deal with the details surrounding the interior design of the new stations. The need for structures and areas to handle bulk goods would be clarified by the detailed projection. This will also include areas for station car parks. Estimates of cost for projections are however not included in this plan.

Station track layout

The layouts shown in the diagrams below indicate the track layouts and switches at the stations and designated stops. Stops with more than two tracks are referred to as stations, whereas designated stops with only two tracks are referred to as halts.

The diagram depicts a track with a straight line and a switch, which is indicated by a black triangle. When a train runs along a double track, the right-handed track is used in the train’s direction. Simple switches, both along the main line and at the stations, have been chosen for the project. The switches have the same profile as the rest of the tracks and use the standard track gauge of 1435. The tracks at the stations will be constructed with cement sleepers using fastclips to join them. The standard components of international standard are the switches at points where the frogs, point blades and middle sections.

The switch components are exposed to a great deal of wear and tear than the other sections of the tracks. Consequently, it puts special demands on the steel’s mechanical characteristics. Single-casted frogs in manganese steel without recurrent bolts will be used. Switches with a basic radius of 2500m will have swing-nose crossings or check rails.
“Spring-tongued” switches have been chosen. The allowed speed over the switch which is dependent on the tongue's construction is controlled by a defined set of regulations. The switches will have check rails of 20mm over the track top. Check rails, UIC33, will be used.

Stations will have more than two tracks and a lot of switches. Tracks and switches will be constructed such that carriages and trains can be parked at the stations. To increase flexibility, the track layout will allow trains to drive over to neighbouring tracks.

At Odaw, Pakro, Asuoya Achimota depot, Baatsonaa and Sakumono, switches have been planned at both ends of the halts, such that trains can pass each other or drive into the correct track.

A: Track layout for Accra station

B: Track layout for Tema station

C: Track layout for Achimota station
D: Track layout for Amasaman station

E: Track layout for Nsawam station

F: Track plan for halts: Odawa – Ofankor – Pakor - Asuoya – Achimota depot – Baatsonaa -Sakumono

The table below shows numbers of switches, track and platform lengths for each station and halt.

Table 8: Technical Requirements for Accra - Koforidua Lines

<table>
<thead>
<tr>
<th>Station</th>
<th>Type</th>
<th>Number of switches</th>
<th>Track Length (m)</th>
<th>Platform Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accra</td>
<td>1</td>
<td>28</td>
<td>4 000</td>
<td>450</td>
</tr>
<tr>
<td>Odaw</td>
<td>2</td>
<td>8</td>
<td></td>
<td>300</td>
</tr>
<tr>
<td>Achimota</td>
<td>2</td>
<td>19</td>
<td>3 000</td>
<td>300</td>
</tr>
<tr>
<td>Dome</td>
<td>2</td>
<td></td>
<td></td>
<td>300</td>
</tr>
<tr>
<td>Ofankor</td>
<td>3</td>
<td>10</td>
<td></td>
<td>300</td>
</tr>
<tr>
<td>Station</td>
<td>Type</td>
<td>Number of switches</td>
<td>Track Length</td>
<td>Platform Length</td>
</tr>
<tr>
<td>--------------</td>
<td>------</td>
<td>--------------------</td>
<td>--------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Achimota Depot</td>
<td>2</td>
<td>8</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>ML camp</td>
<td>2</td>
<td></td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Baatsonaa</td>
<td>2</td>
<td>8</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>ML 17-7</td>
<td>2</td>
<td></td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Asaporchona</td>
<td>2</td>
<td></td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Sakumo</td>
<td>3</td>
<td>8</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Tema</td>
<td>1</td>
<td>27</td>
<td>5 600</td>
<td>450</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>51</td>
<td>5 600</td>
<td>2250</td>
</tr>
</tbody>
</table>

### Table 9: Technical Requirements for Accra – Asaporchona Lines

**Maintenance**

African Rail will offer operative solutions for maintenance. The technical regulations indicated earlier puts specific demands on maintenance, with regards to quality and safety, whenever necessary and/or normal. The regulations state how quickly the revealed faults must be repaired. In special situations, demands for operative actions will be made. The new rail lines will require their own process standards. These will be established by African Rail.

A computer-based Control system will be built for the control of all railway plants. A detailed track maintenance signal systems has been discussed below. Related maintenance routines will also be implemented in other specialised areas.

**Tracks**

Track maintenance will be controlled by a rigorous track maintenance system. The maintenance will comprise a weekly visual survey. Tracks and sleepers will be packed and adjusted by tamping machines once or twice a year. After each tamping, the track position will be controlled by a measuring...
carriage which measures gauge, height-above-ground, curves and wear and tear. Tracks around switches will be packed and adjusted once or twice a month.

Railway lines are worn out mostly at, and around, the switches. These will be monitored by a system that can identify movements and send a signal to traffic controls when errors occur. All the maintenance manuals along the railway are computer-based. Ghanaian personnel will be trained in the maintenance procedures.

**Signals**

The technical solutions used in signalling are specialized in order to meet security demands posed by transport on railways. These tasks are governed by rules and internal regulations, including the internal control systems. The signal system requires a systematic maintenance procedure and schedule. A procedure manual will be designed for guidelines and the control of all installations. The signal system will be checked at regular intervals of 6, 12 and 24 months. Maintenance must be carried out by signal personnel with special expertise in the selected signal system.

Signal installers are key personnel with a comprehensive competence in their specialised field. The field is complicated, containing elements of electronics, computer technology and mechanics. Technical solutions, equipment and documentation used in the field, have been developed in cooperation with equipment suppliers and various organizations within railway management. This has resulted in a special system of solutions that are only used in this field. Technological development seems to be going in the direction of increasing specialization. The required expertise is normally acquired internally within the rail industry.

**Training**

African Rail considers personnel training and the transfer of competence within the fields of regulation/certification, as well as quality control, as an essential condition for the successful accomplishment of the project.

**Objectives**

The training component of the project has the following objectives and frameworks:

- A collective resource centre for training of skilled workers and other project personnel will be established in connection with the
development and maintenance of the infrastructure/railway network in Ghana.

- A multimedia based training concept which will focus on practical, occupational education and work will be established. This will be done by developing an internal school which will focus on on-the-job training and apprenticeships. Training will be given in the technical solutions for communication and participants will receive certificates of competence (qualifications).
- The concept will focus on the needs of the project. It will offer the highest quality of competence-based training, with the best concepts for on-the-job training within the fields of project management, control, development and maintenance.

Development Model – School and Education

Using the above framework as a foundation, the outlined sketch of elements which will be utilized is shown below:

- Development of technical infrastructure and communication and training/schooling
- Training programmes in modules and elements
- On-the-job training for project and specialist workers/counselling
- Recruitment and manning
- Running and development of competence

Platform for Technical Infrastructure and Communication

African Rail will develop a “state of the art” based education system for coordination of the various training sequences. African Rail will base this on:

- Development of a multimedia learning gateway/platform
  - This will involve the so-called ‘course hotels’, course administration, communication with participants/students and reporting
  - This system will be able to offer both tailor-made training solutions and shelf training models, with video production, texts and graphics, where suitable.
  - It will lay the groundwork for a maintenance/support system which, when possible, shall be run by ASP, taking care of safety installations, data storage, user support and technical support.
Curriculum design

a. Principles
The training program includes certifying of skilled workers and other project personnel, based on the On-the-job Training Model. The starting point for this is the workplace and the local environmental experience entailed in teaching and training. A multimedia based learning model, with a combination of theory and practical training will be developed.

- Practical training and theoretical explanations will be taught by controlled supervision
- PC-based modules shall be offered for parts of the education, where appropriate.
- Students will be able to contact counsellors and search for information, wherever this is made technically possible.
- On-the-job training will run parallel with assignments, studies and exercises.
- All knowledge modules will be tested using Multiple Choice evaluations, computers/CD whenever suitable
- Completion of the school's programmes will be merited/certified and should be cohesive with the standards and requirements that are developed in the Union.

b. School structure, level and extent
African Rail will build a school structure with a level, extent and quality that is of international standards.

The main objective of this educational system is to ensure an effective maintenance system for the Ghanaian railway network via a technical set of regulations.

Another objective is to secure future competence in local hands, in accordance with demands and regulations. The set of regulations would be adapted to suit the strategic needs of the Ghana Railway network and for future guidelines.

i. Module 1: Basic module

The main target for this module is to impart basic knowledge and skills in the construction and projecting of signals and tracks. The module covers elements such as substructure, superstructure, signals, telecommunications and electronics at an introductory level. In addition basic knowledge of
mathematics, physics and electronics will be incorporated. Content detail will follow a defined curriculum.

The module will have duration of 6 months full time study plus parallel on-site training. The module will comprise theory, practice, problem-solving, as well as a written examination and additional supervision. Pass level at module 1 will form the basis of qualifying for level 2 (In-depth modules).

ii. Module 2: In-depth modules

A set of in-depth modules that satisfy the demands of the main project will be developed. A specified curriculum will be drafted based on the following areas:

- **Track systems**
  Students will be provided with thorough knowledge and skills connected to the projecting and laying of new tracks.

- **Signal systems**
  Students will be provided with thorough knowledge and skills connected to controlling signal systems, including remote-controlled systems, safety systems and speed surveillance systems.

- **Telecommunications**
  Students will be provided thorough knowledge and hands on skills needed in telecommunications, including transmission systems, telephones, radio and information systems related to railway networks.

- **Electronics**
  Students will be provided with thorough knowledge and skills connected to the area of electronics, particularly the installations necessary for electromagnetic coexistence (EMC)

- **Operations and maintenance**
  The model will provide students with thorough knowledge and skills in the running, operating and maintenance of all structure elements, including tracks, signal, telecommunications and electronics.

The Modules will have duration of a 3 months tuition excluding parallel on-site practice. This will comprise of theory, practice, problem solving, as well as a written examination and additional supervision. Pass level at module 2 will form the basis for/qualifying for skilled worker level within the given skill areas.
iii. Model for accomplishment

The programme will comprise different skilled and practical approaches and will use different suitable methodologies which will facilitate learning. It will also comprise a specialist model which will be covered over a period of 12 to 18 months. This will include:

- Theory
- Skill training/ experience
- ‘On-the-job” Training
- eLearning
- Individual coaching/follow up

The programme will consist of a basic module and specialist modules or programme elements that will cover a period of 12 to 18 months and will consist of:

- Common sessions
- Theme sessions in both groups and everyone
- Training on site
- Individual coaching
- Candidates will work with practical assignments during the sessions, receiving individual coaching as a part of the programme’s service.
- eLearning
- Some teaching will be net-based. African Rail will develop an eLearning platform.
Financial analysis

Project start – up cost

Key Assumptions

i. All cost estimates are in the United States Dollar and converted to local currency at the current rate of GH₵1.91 to US$1.

ii. All equipment and machinery needed for the project such as tracks, engines, coaches, machinery, equipment and communication systems will be acquired from overseas destinations.

iii. Cost of machinery, equipment, engines, tracks, coaches and communication systems includes shipment, installation and testing.

iv. All estimates have a contingency provision of 5% to make up for facilitating cost and the effect of cost overruns on major components.

Breakdown of Project Cost

A. Foundation and Track Works

Foundation works will include the planning and implementation of civil works and tracks. Project design will be done through the use of computer tools and systems to be adopted from Europe. The civil works will include the levelling of terrains and the construction of bridges, crossroads and train stations. Existing railway tracks will be dismantled and replaced with double tracks. The existing foundation will be levelled and compressed before a new foundation is established. New ballast will be filled and compacted to a thickness of 0.5m up to the lower edge of the sleeper.

B. Coaches and Engines

Four (4) train engines and ten (10) coaches each will be acquired and assembled for both passenger transports whilst another four (4) train engines with twenty (20) wagons each will be acquired for freight transport at the cost of US$xxxxxxxx. They will come with spare parts and are expected to meet standard specifications.

C. Communication Systems

This will involve the acquisition and installation of GSMR, Signals and IT systems at the cost US$xxxxxxxx.
D. Machines and Equipment
This component involves the acquisition and shipment of all machines and equipment needed for the project is estimated to cost USxxxxxxxx.

E. Accommodation
The estimate covers the rental of offices and apartments for the European expatriates who will be resident in Ghana during the implementation phase of the project. It is expected an amount of US xxxxxx will be adequate for a ten year accommodation.

F. Intangibles
This category covers project management cost, travelling expense of expatriates, local travel and transport, security and training of local personnel. This has been estimated to cost USxxxxxxxxxxxx

Project financing

Key Assumptions
i. The total cost of the project is expected to be financed through term loans to African Rail and backed by Freight Offtake and GoG “revenue shortfall” MOFEP guarantees.
ii. The loan will be provided and repaid in United States Dollars.
iii. The ECA Loan Portion is expected to account for approximately 50% of the debt portion and to carry terms consistent with OECD guidelines.
iv. The Commercial Loan Portion is expected to account for the other 50% of the debt portion and to carry interest at prevailing market rates. A 10-12 year tenor will be sought from commercial lenders with a 6 year grace period.
v. Interest and principal payment schedules will begin after the moratorium and be paid down within 10 years of operations.
vi. An arrangement fee of each principal drawn down is paid to the arranger on the date of execution of the facility.
vii. An agency fee per annum is payable to the facility agent throughout the period.

Loan Draw down and payment schedule
The first draw down of principal is expected to commence in construction Year 1.
The second draw down is expected to occur in construction Year 2 and thereafter in accordance with the drawdown schedule summarised herein

Operational revenue

Key Assumptions

i. Operation of the eastern rail transport system will generate resources from two major sources namely: Passenger transportation and freight transport (bulk cargo haulage).

ii. Revenue from passenger transportation will be generated along three main routes namely: Accra – Tema; Accra – Nsawam and Nsawam - Koforidua

iii. Tracks to and from all the above destinations will be laid in double lines to enable a concurrent inbound and outbound rail transportation system.

iv. Four (4) engines will be used for the passenger rail transport and each is expected to carry 10 coaches in conformity with the manufacturer’s specifications.

v. Travelling at a speed of 60km/hr -65km/hr, each train is expected to cover the total distance of 96.8km in a time of 1 ½ hrs – 2hrs including all temporal stops.

vi. Each passenger coach has a maximum capacity up to 80 passengers.

vii. The trains will travel for a maximum of six days a week and each is expected to travel for 18 hours a day. A total of eight (8) trips a day with a trip lasting between 1 ½ - 2 hrs is expected.

Passenger traffic assumptions

Below is a summary of the assumptions that forms basis for expected revenue.

1. Four (4) engines will be allocated to passenger transport;

2. One (1) train will be devoted to short distance from Accra to Koforidua;
   a. Temporal stops: Tema - Accra; Asopochona; Nsawam; Suhum, Koforidua;
   b. Average travelling speed = 80km/hr; Total dist. From Tema - Koforidua = 96.8km; Coverage = 1.5hrs including all temporal stops;
   c. Starting at 4.30 - 6.00am; 6.15 - 7.45am; 8.00 - 9.30pm; 9.45 - 11.15pm; 11.30 - 1.00pm; 1.15 - 2.45pm; 3.00 - 4.30pm; 4.45 - 6.15pm; 6.30 - 8.00pm: 8.15 - 9.45pm. Train makes 10 one-way trips per day
d. Starting at 4.30 - 6.00am; 6.15 - 7.45am; 8.00 - 9.30pm; 9.45 - 11.15pm; 11.30 - 1.00pm; 1.15 - 2.45pm; 3.00 - 4.30pm; 4.45 - 6.15pm; 6.30 - 8.00pm; 8.15 - 9.45pm. Train makes 10 one-way trips per day;

3. Two (2) trains will be committed to long distance from Accra to Kumasi. One (1) will start from each end of the journey;

   1. One (1) train will be devoted to city stops at: Anyinam, Nkawkaw, Konongo, Boankra
   2. Average travelling speed = 120km/hr; Total dist. From Accra - Kumasi = 303.23km; Coverage = 3 hrs including temporal stops;
   3. Starting at 4.30 - 7.30am; 7.45 - 10.45am; 11.00 - 2.00pm; 2.15 - 5.15pm; 5.30 - 8.30pm; 8.45 - 11.45pm train travels makes 6 one-way trips per day for 6 days per week;

4. One (1) train will be devoted to express with only one temporal stop at Nkawkaw;

   a. Average travelling speed = 160km/hr; Total dist. From Accra - Kumasi = 303.23km; Coverage = 2 hrs including a single temporal stop
   b. Starting at 4.30 - 6.30am; 6.45 - 8.45am; 9.00 - 11.00am; 11.15 - 1.15pm; 1.30 - 3.30pm; 3.45 - 5.45pm: 6.00 - 8.00pm; 8.15 - 10.15pm. Train makes 8 one-way trips per day;

5. Each passenger engine will carry at a start 10 coaches. Each coach has a maximum capacity of 80 passengers;

6. Passenger fares have been estimated at 70% of road transport fares and increase by 30% after every five years.
Freight traffic assumptions

1. Four (4) engines will be allocated to Freight transport.
2. Capacity of each engine is 20 coaches at 60 tons each.
3. All four (4) engines will be used to move goods from Tema to Kumasi.
4. Temporal stops: Asopochona; Koforidua; Kumasi.
5. One freight train will be allocated to foodstuffs and light cargo starting from Kumasi at an average speed of 120km/hr. Assuming 1 hr for loading/discharging at final destination, it takes 3hrs for each one-way trip;
6. Starting at 5.00 - 8.00am; 9.00 - 11.00pm; 12.00 - 3.00pm; 4.00 - 7.00am, train travels makes 4 one-way trips per day for 6 days per week;
7. Three (3) freight train will be allocated to heavy cargo, containerized from Tema - Boankra/Kumasi at an average speed of 150km/hr. Assuming 1 hr for loading/discharging at final destination, it takes 2hrs for each one-way trip,
8. Starting at 5 - 7.00am; 8.00 - 10.00pm; 9.00 - 11.00pm; 12.00 - 2.00pm, 3.00 - 5.00pm travels makes 5 one-way trips per day for 6 days per week.

<table>
<thead>
<tr>
<th>Passenger Capacity</th>
<th>No. of Engines</th>
<th>No. of coaches</th>
<th>Cap/ coach</th>
<th>No. of trips/day</th>
<th>Traffic/ day</th>
<th>Traffic/ week</th>
<th>Traffic/ year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tema-Accra-Koforidua</td>
<td>1</td>
<td>10</td>
<td>80</td>
<td>10</td>
<td>8,000</td>
<td>52,000</td>
<td>2,704,000</td>
</tr>
<tr>
<td>Tema-Accra-Kumasi</td>
<td>1</td>
<td>10</td>
<td>80</td>
<td>6</td>
<td>4,800</td>
<td>31,000</td>
<td>1,602,400</td>
</tr>
<tr>
<td>Tema-Accra-Kumasi (Express)</td>
<td>1</td>
<td>10</td>
<td>80</td>
<td>8</td>
<td>6,000</td>
<td>45,000</td>
<td>2,165,200</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Freight capacity:</th>
<th>No. of Engines</th>
<th>No. of coaches</th>
<th>Capacity (tons)</th>
<th>No. of trips/day</th>
<th>Traffic/ day</th>
<th>Traffic/ week</th>
<th>Traffic/ year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foodstuffs &amp; Light cargo (Accra - Kumasi)</td>
<td>1</td>
<td>20</td>
<td>60</td>
<td>4</td>
<td>4,800</td>
<td>31,000</td>
<td>1,602,400</td>
</tr>
<tr>
<td>Heavy cargo, Containers (Accra - Kumasi Express)</td>
<td>2</td>
<td>20</td>
<td>60</td>
<td>6</td>
<td>14,400</td>
<td>95,000</td>
<td>4,867,200</td>
</tr>
</tbody>
</table>

Note: Tema-Accra-Kumasi (Express) is 2 engines Passenger and two engines for Foodstuffs and Light Cargo.
Fare assumptions

**Passenger revenue**

1. Except for Accra – Tema – Nsawam for which passenger train fares existed, passenger fares were estimated at 70% of road transport fares.
2. Accra – Tema: GH¢1.20
3. Accra – Nsawam: GH¢1.40
4. Nsawam – Koforidua; GH¢1.20
5. Accra – Nkawkaw; GH¢9.00
6. Nkawkaw – Konongo; GH¢1.50
7. Konongo – Kumasi; GH¢1.13

**Freight revenue**

**Freight revenue (Light cargo):**

1. Freight fares were estimated at 70% of road transport fares.
2. Tema - Accra: GH¢12.92
3. Tema–Accra–Nsawam: GH¢18.28
4. Tema-Accra-Koforidua; GH¢30.05
5. Tema-Accra-Nkawkaw; GH¢34.83
6. Tema–Accra-Kumasi; GH¢51.68

**Freight revenue (Heavy cargo):**

1. Tema - Accra: GH¢10.00
2. Tema–Accra–Nsawam: GH¢13.75
3. Tema-Accra-Koforidua; GH¢19.38
4. Tema-Accra-Nkawkaw; GH¢21.88
5. Tema–Accra-Konongo; GH¢25.00
6. Tema-Accra-Kumasi; GH¢30.00

**Expected Revenue**

The highest stream of revenue is expected from freight traffic and the lowest from other services such as advertising and rentals. In operational Year 1, total revenue is expected at US$xxxxxx million and this is expected to increase to US$xxxxxx million in operational Year 5, US$xxxxxxx million in operational Year 10 and then to US$ xxyyxy billion in operational Year 15.
Figure 22: Revenue projections
Operational cost

Key Assumptions

i. Direct material cost is expected at 10% of net revenue.

ii. Routine Maintenance on rail tracks, bridges, stations, buildings etc. is expected to be carried out at the cost of 1.5% of yearly revenue. In operational Year 1 and 2, maintenance cost will amount to 25% of expectation. This will increase to 50% in operational Years 3 and 4, 75% in operational Years 5 – 7 and 100% from operational Year 8 onwards.

iii. Management cost is estimated at USxxxxxx in operational Year 1 and is expected to increase by 2% annually.

iv. Insurance is estimated at 0.07% of net book value of vehicles and equipments.

v. Depreciation and amortization charges are as follows: track works including roads and bridges are depreciated at 2%; coaches and engines at 5%; communication systems at 5%; machines and equipments at 5%; accommodation at 5% and intangible amortization at 5%.

vi. The project is expected to be exempted from corporate tax until the loan is fully paid and therefore no taxation has been estimated.
Financial viability analysis

Profitability

*Income statement analysis*

In the first ten operational years debt service will be met from net revenues. The Financial Model is available for inspection under conditions of confidentiality.

Cash flow analysis

Cash Flow Analysis is available for inspection under conditions of confidentiality.
### Appendix 1:

<table>
<thead>
<tr>
<th>Name of Company</th>
<th>Products</th>
<th>Quantity transported per month (Southbound)</th>
<th>Quantity transported per month (Northbound)</th>
<th>Preferred Stations / Terminals</th>
<th>Expectations for using railway transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>GHACEM</td>
<td>Cement</td>
<td>30,000 tonnes</td>
<td></td>
<td>Achimota, Adenta and Nsawam</td>
<td>Fork lift, vehicles, security, competitive rates and professionalism</td>
</tr>
<tr>
<td></td>
<td>Limestone</td>
<td>25,000 tonnes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEMA STEEL</td>
<td>Iron Rods</td>
<td>500 tonnes</td>
<td></td>
<td>Accra, Tema and Nsawam</td>
<td>Competitive rates, security and reliable &amp; timely service</td>
</tr>
<tr>
<td></td>
<td>Scrap Metal</td>
<td>350 tonnes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JELLY PLASTICS</td>
<td>Plastic products</td>
<td>450 tonnes</td>
<td></td>
<td>Accra, Tema</td>
<td>Security, rates, efficiency, reliability and timely service</td>
</tr>
<tr>
<td>WAHOME</td>
<td>Iron Rods</td>
<td>1500 tonnes</td>
<td></td>
<td>Nsawam, Koforidua</td>
<td>Timely service, quality service</td>
</tr>
<tr>
<td></td>
<td>Scrap Metal</td>
<td>1300 tonnes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRODUCE BUYING COMPANY</td>
<td>Cocoa</td>
<td>5000 tonnes</td>
<td></td>
<td>Tema, Accra, Nsawam, Koforidua</td>
<td>Regular and reliable service</td>
</tr>
<tr>
<td>PRODUCE BUYING COMPANY</td>
<td>Container Cargo</td>
<td>220 tonnes</td>
<td></td>
<td>Accra, Tema, Nsawam, Koforidua</td>
<td>Timely service, reliability and competitive rates</td>
</tr>
</tbody>
</table>