NORTH - SOUTH EASTERN RAILWAY (NSER)
Pre-feasibility study
Prepared for The Government of Adamawa State

Technical Report 14 June 2010
Prepared by

First Class Partnerships
Rail Consultants

with
AMZ Consultants, Wragge & Co, Udo Udoma & Belo-Osagie
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Cover photo: Intermodal train on Alice Springs – Darwin Railway, Australia
Map 1 North - South Eastern Railway (Reference Route)
1. Summary

On 23rd March 2009, the Governors of the five Nigerian states of Cross River, Benue, Taraba, Adamawa and Borno (the Five States) took the first steps to develop a railway linking northeast Nigeria to the port of Calabar. They mandated the Governor of Adamawa State, His Excellency Admiral Murtala Nyako, to commission a Pre-Feasibility Study, to provide initial estimates of costs and benefits and to prepare a “road map” towards funding and implementation. First Class Partnerships Limited, an international rail consultancy based in Britain, was appointed jointly with AMZ Consultants (Nigerian based business development consultancy), Udo Udoma & Belo-Osagie and Wragge & Co. (Nigerian and British law firms).

This Pre-Feasibility Study confirms that a railway from Calabar to Maiduguri (we call it the North - South Eastern Railway or NSER) can be constructed for about $3 billion, and that the economic benefits are likely to exceed this cost by a factor of 9:1 or more. Existing traffic along the route, estimated at less than 2 million tonnes per year, would not support the cost of building a railway. The NSER has the potential to greatly reduce transport costs and transform prospects for development of trade and industry across the five states. It would link the rich farmlands of eastern Nigeria with Calabar Port, facilitating export of agricultural products and importation of fuel, fertiliser, and other inputs. It will also support development of mines and industry, creating employment and raising living standards. It will complement development of Calabar as a major port. Based on experience of middle-income countries with similar geography, traffic could grow ten-fold, exceeding 20 million tonnes per year. Without development of the railway, the prospects of the region are limited.

There is also the potential to extend the NSER north from Maiduguri to connect with a railway now being built south 1,000 km across Libya to Sabha. The 2,000 km “missing link” could be built for a further $3 billion. A Trans-Sahara Railway could transform the prospects of eastern Nigeria as well as Niger and Chad, which are currently isolated from world markets. It would provide direct access to markets in Europe, with the potential even to export perishable farm produce from tropical West Africa to Europe. Free trade zones could be developed at the ports and along the railway.

Various implementation structures are possible. One promising approach would be for the Five States to form a project company or procuring authority/commission to develop the railway under a long-term concession.

The Five States may commission a Full Feasibility Study, which will cost approximately $1.5 million and take 6 months to complete. It would then award a concession to a company that would secure capital funding and proceed with implementation. Consent of the Nigerian Railways Corporation (NRC) will be required for development of the Project.

An international treaty will be required to implement the full Trans-Sahara Railway scheme.

With cooperation of all parties, construction might commence in 2012 with completion in 2015.
2. Project Description

2.1. Proposed Route

The objective is to build a mixed traffic railway linking the Port of Calabar with the population and resources in the Five States (hereafter referred to as the North - South Eastern Railway).

The Port of Calabar forms a definite location for the southern terminal. However there are many possible routes for the railway between Calabar and the northern cities of Maiduguri and Yola. This Pre-Feasibility study is limited to consideration of one possible “Reference Route”, which was selected on the basis of:

- Providing a reasonably direct route from Calabar to Maiduguri
- Passing reasonably close to major passenger traffic generators
- Avoiding terrain that would require expensive cuttings or steep grades

The team travelled by road from Yola to Calabar, mostly on highways A345 and A4, to examine the general terrain. The route is generally suitable for railway construction.

The Reference Route has been identified to minimize expense earthworks, such as this cutting through rock on the Alice Springs-Darwin Railway

The identified “Reference Route” generally follows National Highway A4, with some deviations.¹

- From Calabar the line runs north close to Ugep and Ogoja in Cross River State. The terrain is rugged although the land is all below 200m elevation. Extensive

¹ To see the Reference Route on Google Earth see www.grandavenue.plus.com/NSER
cutting and filling, and many short bridges, will likely be required through this section.

- North of Ogoja, the line climbs high running close to Katsina Ala in Benue State and Wukari in Taraba State. Although the land is higher, it is generally flat or gently rolling, probably requiring less extensive grading. There are three significant river valleys to be crossed, each of which will require a major bridge.
- North of Wukari the line runs through the Benue River valley, which forms a natural route.
- The line passes near Konna and Jalingo in Taraba State and Numan and Yola in Adamawa State.
- At Yola, the line crosses the Benue River and then turns north west to skirt the foothills of the Mandara Mountains, continuing to Maiduguri in Borno State.

Map 1 shows the “Reference Route”. For detailed plans see Appendix 8.

A possible alignment was also developed extending north from Maiduguri, across Niger to connect with the railway being constructed south from the Mediterranean to Sabha in southern Libya. Further work is required to determine the feasibility of building a railway across or close to the “sand seas” in eastern Niger and southern Libya. The alignment for this railway passes closely to the west of Gidimbari before crossing into eastern Niger. The majority of the route will be across desert. Local staging posts will need to be developed to support locomotive fuelling and crew changing needs. The route from Maiduguri to Sabha is about 2,000 km long.

Many alternative routes and variations are possible, which may be studied during the Full Feasibility Study, before implementation. For example:

- From Calabar to Ikom, the route could run further east, closer to the border with Cameroon. This might open access to granite quarries and forestry products. However it would probably have steeper gradients and require expensive bridges and tunnels. There would also be exceptional environmental sensitivity as the line would pass through Cross River National Park, where we understand there are endangered primates.

- From Numan to Maiduguri, the line runs east to Yola before crossing the Benue River, then returning west to pass around the Mandara Mountains. A route directly north from Numan could be shorter but would not directly serve Yola. A route from Yola directly north across the mountains might be constructed but construction costs would likely be very high, requiring expensive tunnels and bridges.

- The route from Maiduguri to Sabha could run west of Lake Chad, through Niger. It might instead run further east, through Chad, but this would probably require the line to cross the north end of the lake.

2.2. **Design Parameters**

Important technical decisions need to be made that will affect the potential uses and performance of the railway. For the purposes of the Pre-Feasibility Study, FCP has
made assumptions as to the traffic mix and capacity, gauge, gradient, axle load, train length and design speed. Generally, we have assumed standards that are used on new railways of similar length and traffic in other countries. These assumptions are discussed in this section. They should all be reviewed during the Full Feasibility Study.

2.2.1. Traffic Type, Speed and Capacity

FCP suggests that the NSER should be built primarily to haul bulk freight and intermodal freight (containers), with a normal running speed of 100 km/h, train lengths of up to 1,800 metres (90 cars) and trailing load of 4,000 tonnes. This would allow operation of trains of a maximum 9,000 tonnes gross with a cargo capacity of approximately 7,200 tonnes. These type and size of trains are normal for heavy haul railways around the world and the technology to support them is well known and understood. The train length and type required requires further work to determine the optimum mix and number of wagons and locomotives required.

Based upon our initial assessment of potential demand, we recommend an initial design capacity of approximately 12 million net tonnes per year, or 5 freight trains per day, in each direction. Design provision can be made to increase capacity in future, probably through the addition of further passing loops and, in time, double tracking.

Heavy haul and intermodal freight are likely to be the most profitable, but intercity passenger trains can also share the infrastructure and contribute to the economic and financial viability of the railway.

For the purposes of the Pre-Feasibility study, we assume a single-track railway, with passing loops typically 2 km in length every 40 km. This will allow operation of approximately 10 freight trains and 5 passenger trains in each direction, per day, with freight capacity of 14 million tonnes per direction per year. We have allowed for these loops in our cost estimate. Also included in the cost estimate is provision for a siding at every loop. This will allow local freight and produce to be loaded and unloaded. Optimally the loops will be located at equal spacing; however, every effort should be made to locate these as close as possible to local settlements to stimulate economic growth and provide communities with access to efficient rail transport.

The estimate also includes for the provision of three train marshalling yards, one at Calabar, one at Maiduguri, and one at Yola. Wagon and locomotive maintenance facilities will also be provided at these three locations, creating local jobs and skills development.

2.2.2. Gauge and Clearances

The existing Nigerian Railways system is built with rail 1067 mm apart, the so-called “Cape” gauge. This gauge is widely used, being the main gauge for freight and passenger lines across southern Africa, in Japan, Malaysia, Queensland and Western Australia. Togo, Congo, and East Africa mostly use the slightly narrower 1000mm “Colonial” gauge. European and North African Railways, including Libyan Railways, are built with rails 1435 mm apart, so called “standard” gauge. This gauge is used in North America, China, and Australia for Heavy Haul, and for high-speed passenger lines in Japan and Taiwan. Different “broad” gauges are used in Russia, India, and South America.
Different railways are built to different vehicle and load clearances.

FCP believes the new railway should be built to the standard 1435 mm gauge. There are several reasons:

- The 1435mm gauge allows passenger and intermodal trains to run at higher speeds, with intermodal freight trains at 120 km/h and passenger trains at 200km/h or even 250 km/h. Speeds on the 1067mm gauge are usually limited to 100 km/h, although passenger train in Japan and Queensland operate at speeds of up to 160 km/h.
- The 1435mm gauge allows operation of “double stack” container trains, offering both capacity and operating cost benefits.
- This will facilitate eventual interconnection into the Libyan and North African railways, which are all built to 1435 mm gauge
- NRC has indicated that it plans to convert its existing lines to the 1435mm gauge. ECOWAS is committed to connecting up all member railway systems and eventually converting to standard gauge.²

There are two disadvantages. Firstly, initial construction costs may be 20% to 30% higher. Secondly, it will not be possible to connect directly into the existing NRC system. The study team believes these disadvantages will be certainly offset by the benefits. There seems limited potential to connect into the existing NRC system, which currently barely functions. Even when it has been rehabilitated, the NRC system will be capacity constrained, with indirect and very slow transit times to Lagos and Port Harcourt. In any case, NRC is planning to convert its system to 1435 gauge.

2.2.3. Traction

FCP has assumed that the NSER is built initially for operation with diesel locomotives, but with provision for eventual electrification using the 25 kV AC overhead system. Diesel locomotives of the required type and power are readily available at relatively low cost and have an excellent residual value should they need to be replaced before the end of their economic lives.

Vertical clearances, for example under road bridges, should provide for double stack container trains and for possible future electrification.

2.2.4. Ruling Gradient

Railways are normally built with a “ruling gradient”. This sets the maximum weight of train that can be hauled with particular locomotive types. Ruling gradients for long distance mixed traffic railways are typically in the range of 0.5% to 2%, although passenger-only high-speed railways are now often built with 3% gradients. Selecting a higher ruling gradient will reduce the amount of grading work, reducing capital costs. However, operating costs will be higher as more locomotives are required per net tonne carried in order to climb the more difficult grades. Environmental

² See ECOWAS West African Railway Master Plan.
considerations also need to be taken into account. The “ruling grade” in more humid areas or those with heavy rainfall needs to be less to avoid locomotives slipping.

For the purposes of this Pre-Feasibility Study, we have assumed the railway is built with a ruling gradient of about 1.3%, which was used on Alice Springs-Darwin. The actual ruling grade for the railway will be determined in final design, probably by the concession company which builds it and based on its view of projected traffic and after further alignment engineering.

FCP recommends that the railway be built with clearances for double-stack intermodal, as operating here on the Alice Springs - Darwin railway

2.2.5. Track and Axle Load

We assume the line is built to carry 25 tonne axle loads, with 60 kg/m continuous welded rail on concrete sleepers. This is commonly the standard on new railways of this type.

2.2.6. Grade Separation and Fencing

Level crossings are a major cause of accidents. For the purposes of the Pre-Feasibility Study, we assume the line is fenced where practical, with grade separation of most public road crossings. For estimating capital costs, we allow for a 2-lane road crossing every 10 km along the line. The actual location and spacing of road crossings will be determined in final design.

2.2.7. Signalling

FCP recommend that the line is equipped with a modern wireless “Positive Train Control” system, such as the “Incremental Train Control System” recently installed on the Qinghai – Tibet railway in China. The more sophisticated “European Rail Traffic Management System” could be used, however the additional cost is probably not justified by the expected traffic requirements.
2.3. Capital Costs

Capital costs include Construction Costs, Equipment Costs, Property Costs, Commissioning Costs and Project Development Costs. Total Capital Costs are estimated at about $3 billion for Calabar – Maiduguri, including all equipment required to carry 20 million tonnes per year but excluding passenger stations or equipment.

It should be noted that this cost includes all building, earthworks and track infrastructure, including signalling, telecommunications, the Control centre and maintenance depots.

Passenger rail equipment costs could range from $50 million to $500 million or more, depending upon the service that is operated and the facilities that are provided. Most likely, these would be financed separately, with costs recovered from a mix of passenger revenues and Government operating support.

All estimates are high-level, based on broad assumptions, and will need to be reviewed in the Full Feasibility Study.

2.3.1. Construction Costs

A top level estimate of Construction Costs is provided in Appendix 7. Construction costs are estimated at about $2.3 billion

2.3.2. Equipment Costs

Equipment requirements for freight traffic of 12 million tonnes, per direction, per year are set out in Table 1. These total about $400 million. Detailed specifications for the equipment will be determined by the railway operator, as traffic develops.

Table 1 Equipment Costs

<table>
<thead>
<tr>
<th></th>
<th>Unit price $</th>
<th>Quantity</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>High power diesel locomotives</td>
<td>$2 million</td>
<td>50</td>
<td>$100 million</td>
</tr>
<tr>
<td>Wagons of various types</td>
<td>$75,000</td>
<td>3,000</td>
<td>$225 million</td>
</tr>
<tr>
<td>Cranes, loading facilities etc</td>
<td>$2m</td>
<td>32</td>
<td>$64m</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>$389m</td>
</tr>
</tbody>
</table>

2.3.3. Property Costs

The railway will require a corridor approximately 1,350km x 10m or 1350 hectares. Additional land will be required at stations and terminals. We assume an average cost of $10,000 per hectare for corridor land, or $13.5 million, plus $2 million for each of 3 terminals for a total of approximately $20 million.

2.3.4. Commissioning Costs

We allow $20 million for testing and commissioning costs, before the railway carries revenue traffic.
2.3.5. Project Development Costs.

Project development costs include promoter costs, costs of feasibility studies, preliminary engineering, concession negotiation and award costs, and financing costs. These costs will be estimated in the Full Feasibility Study, but are likely to be about 5% of construction, equipment, property and commissioning costs or about $125m.

3. Traffic and Revenues

The success of the railway will depend upon the amount of traffic it is able to attract, and the rates that can be charged to carry it. This section presents our initial estimates of the traffic and revenues that the railway could attract.

3.1. Market Area

When estimating the traffic that might be attracted to the NSER, we need to consider the Market Area and make fundamental assumptions about the economic and political development of the region, and about complementary transport infrastructure that will be constructed.

Most critically, we assume that Calabar Port is dredged with clearance for Panamax container ships\(^3\). Unless the port is dredged, there is little point in building the North - South Eastern Railway. Once the port is dredged, it should be competitive with Port Harcourt as the preferred port for access to markets from eastern Nigeria. ECM Terminals, the concession operator of the Calabar Port, have advised that they expect a dredging contract to be awarded before the end of 2010, with completion in 6 months. This will provide a draft of 10 metres. This is deep enough for bulk cargo ships but further dredging to 12m or 14m may be required for use by Panamax container ships.

Promotion of the NSER is critically dependent upon the dredging of Calabar Port. Unless the port is dredged, there is little point in developing the railway.

We also need to understand improvements to competing transport modes. Roads in Nigeria are currently very badly maintained. However, this is a legacy of past bad government. In the time it will take to build the NSER, it is reasonable to expect that the main national roads, at least, will also be restored to reasonable condition. In time, Nigeria is likely to develop a system of long distance toll expressways, as existing in all developed and most developing countries. These will allow more efficient transport of single truckloads of freight. The NSER will need to attract traffic in competition with the improved roads. Rail costs per traffic unit are generally lower, provided the volumes are sufficiently concentrated, so the NSER should be able to compete with road for most traffic to and from Calabar Port. Rail can be competitive with road for bulk commodities over distances as short as 100 km, and for containers over distances of 200 km or more.

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\(^3\) Panamax is the de-facto standard size for deep-sea container ships. It is the maximum size of ship capable of passing through the locks in the Panama Canal. The Canal is currently being enlarged, and even larger ships are being built to fit the “New Panamax” size.
Improved local roads will benefit NSER, as they will be used for transport between the railway and surrounding farms, factories and consumers.

The Market Area for the NSER includes the western part of Benue State, all of Taraba and Adamawa States, all of Borno and potentially also Gombe state. The NSER should be very competitive for most freight traffic between these areas and Calabar Port. The existing NRC line through Makurdi may provide competition for traffic from the western part of Benue, to Port Harcourt. If it is successfully refurbished, NRC may offer some competition from Borno and Gombe State for traffic to Port Harcourt. NRC is proposing to rebuild its existing network with standard gauge tracks, but it will probably also need to change the alignments and reduce gradients if it is to be competitive with NSER.

The NSER may also be competitive to haul some short distance traffic within Cross Rivers, for example cement or granite to Calabar.

There is an existing pipeline from Port Harcourt to Yola, although it is apparently not functioning effectively. Experience in other countries is that pipelines are very competitive for transport of fuels. We must expect that the pipeline will be restored to service and carry the bulk of refined products in the corridor.

There are plans to dredge the Niger River, and it may also be possible to dredge the Benue River to provide a channel for barge traffic. Although the route would be longer and transport slower than the railway this might become competitive with rail for bulk cargoes including fertiliser and grain exports. The potential of barge traffic to compete with the NSER needs to be considered in the Full Feasibility Study.

**Table 2 Competition Matrix**

<table>
<thead>
<tr>
<th></th>
<th>NSER core market</th>
<th>Competition from NRC</th>
<th>Competition from Road</th>
<th>Competition from Pipeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borno</td>
<td>Bulk cargo, containers to/from Calabar</td>
<td>Containers to/from Lagos</td>
<td>Local traffic</td>
<td>Petroleum products to/from Port Harcourt</td>
</tr>
<tr>
<td>Gombe</td>
<td>Bulk cargo, containers to/from Calabar</td>
<td>Containers to/from Lagos</td>
<td>Local traffic</td>
<td>Petroleum products to/from Port Harcourt</td>
</tr>
<tr>
<td>Adamawa</td>
<td>Bulk cargo, containers to/from Calabar</td>
<td></td>
<td>Local traffic</td>
<td>Petroleum products to/from Port Harcourt</td>
</tr>
<tr>
<td>Taraba</td>
<td>Bulk cargo, containers to/from Calabar</td>
<td></td>
<td></td>
<td>Petroleum products to/from Port Harcourt</td>
</tr>
<tr>
<td>Benue – east</td>
<td>Bulk cargo, containers to/from Calabar</td>
<td></td>
<td></td>
<td>Petroleum products to/from Port Harcourt</td>
</tr>
<tr>
<td>Benue - west</td>
<td>Bulk cargo, containers to Port Harcourt</td>
<td></td>
<td></td>
<td>Petroleum products to/from Port Harcourt</td>
</tr>
<tr>
<td>Cross River</td>
<td>NSER core market</td>
<td>Competition from NRC</td>
<td>Competition from Road</td>
<td>Competition from Pipeline</td>
</tr>
<tr>
<td>-------------</td>
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<td>--------------------------</td>
</tr>
<tr>
<td></td>
<td>Bulk cargoes to/from Calabar</td>
<td>Local traffic, containers &lt;300km</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If a connecting railway is built across the Niger Delta, there may also be the potential to carry perishable foodstuffs to the large cities in the Delta and to Lagos. However, experience in Europe and America is that it is difficult for rail to compete with road for this traffic.

Rail can also be competitive with road and air for passenger transport between major towns and cities, depending upon journey times and station locations.

If the railway extends across the Sahara to a port on the Mediterranean, it could attract “land bridge” traffic, carrying higher value and time-sensitive cargoes from west and southern Africa to Europe. A Trans Sahara Railway, linked with ferries across the Mediterranean, could offer journey times of 5 days, possibly less, from Calabar to mainland Europe. This compares with overall journey times of 2 weeks, and often much longer, from Lagos around west Africa to Europe.

### 3.2. Existing Traffic

There is very little traffic data available on the existing traffic that might be attracted onto the railway. However it is clear that there is very little traffic at present between northeast Nigeria and Calabar. Roads are very badly maintained and the existing railway between Maiduguri and Port Harcourt barely functions. Expensive, unreliable transport prevents access to markets.

We travelled the main National Highway A4 on a weekday. Traffic was very light, typically 5 to 10 heavy trucks per hour, per direction. This probably reflects the limited capacity of Calabar Port, which has been allowed to silt up, and the terrible state of the road especially between Gakem and Ugep. This suggests traffic of less than one million tonnes per year on the A4 highway. About half of this traffic was petroleum tankers.

We understand that more traffic moves west, to Lagos and Apapa Port, however the route is also much longer.

Based on the available data, from discussions with shippers, and on the basis of some fairly high-level assumptions, we believe long distance freight traffic in the railway

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4 An analogous situation is the shipment of containerised freight from Asia to the eastern USA. Most travels by rail from the Port of Los Angeles, because journey times are faster than via the Panama Canal or Suez route. This traffic is very profitable for the US railways.

5 See Appendix 5 for excerpts from the WORLD DEVELOPMENT REPORT 2010 for discussion of the transport difficulties faced by agricultural producers in northern Nigeria.

6 COMPETITIVE COMMERCIAL AGRICULTURE IN AFRICA STUDY (CCAA) NIGERIA CASE STUDY Professor Aderibigbe S. Olomola, Director, Agriculture and Rural Development Department Nigerian Institute of Social and Economic Research (NISER), Ibadan.
corridor, excluding purely local moves, is in the order of approximately 2 million tonnes per year.

Passenger traffic on the A4 highway was similarly light, with 3 or 4 buses per hour, suggesting traffic of 10,000 passengers per day, per direction, or less.

Level of confidence of these estimates can be increased in the Full Feasibility Study, using detailed surveys and traffic counts.

3.3. Induced Traffic

The new railway has the potential to dramatically reduce transport costs, and improve travel times and quality. The railway will make it possible to import fertiliser and machinery, and to export crops and manufactured goods. We have estimated the traffic that might be “induced” if the railway is built, by comparing the population, GDP and geography of the market area with analogous regions in other countries, but which have good transport. Specifically, we consider the USA and China, countries at different stages of development which each have well developed freight railways. We also separately consider each of the main potential traffic types. We also consider the example of Australia’s newly constructed Alice Springs – Darwin line.

Current traffic broken down by commodity type for the USA and China railways, and potential traffic for the North - South Eastern Railway, is presented in Table 4. Calculation of the potential traffic on the Eastern Nigerian is described in detail in the following sections, with reference to the market size parameters shown in Table 3.

**Table 3 Comparative Railway Market Size Parameters**

<table>
<thead>
<tr>
<th></th>
<th>China</th>
<th>US</th>
<th>North - South Eastern Railway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>Square km</td>
<td>9,640,821</td>
<td>9,826,675</td>
</tr>
<tr>
<td>Arable land</td>
<td>Square km</td>
<td>1,446,123</td>
<td>1,474,001</td>
</tr>
<tr>
<td>Per Capita GNI (PPP)</td>
<td>6,020</td>
<td>46,970</td>
<td>1,940</td>
</tr>
<tr>
<td>Population</td>
<td>Millions</td>
<td>1,326</td>
<td>304</td>
</tr>
</tbody>
</table>

In summary, FCP believes the potential traffic of the North - South Eastern Railway is in the range of 22 to 34 million tonnes per year. Assuming average hauls of 600 km, total task would be 13.2 to 20.4 billion tonne-km per year.

Traffic is likely to be reasonably balanced, with southbound flows of farm products, and minerals, and northbound flows of fertiliser, construction materials, beverages, and other manufactured products. The profitability of the railway depends both on the total amount of traffic, but also the balance of flows and the utilisation of equipment.

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7 Area and Arable Land are from Central Intelligence Agency, WORLD FACTBOOK [www.cia.gov](http://www.cia.gov)

8 Assuming 33% arable, which is the proportion for Nigeria as a whole.

9 Gross National Income and Population are from WORLD DEVELOPMENT REPORT 2010
For the purposes of this Pre-Feasibility Study, we assume one-way capacity of 14 million tonnes is required to carry 20 million tonnes per year in total.

Using this approach, we are implicitly assuming that other conditions of development are met. Agricultural exports will only increase if farmers have access to finance for equipment, seed and fertiliser, and have the know-how to identify and cultivate profitable crops and livestock. Industry will require reliable electricity, which is currently lacking. Mineral investment requires stable government and a favourable tax regime. Thus our estimate is for a “mature” scenario. An important consideration when funding the railway will be the expected rate of traffic build up.

**Table 4 Potential Traffic**

<table>
<thead>
<tr>
<th>Millions of tonnes</th>
<th>China Railways 2005 actual</th>
<th>US Railways 2007 actual</th>
<th>Nigeria Eastern Railway POTENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL RAIL</td>
<td>2,693</td>
<td>2,141</td>
<td>22 to 34</td>
</tr>
<tr>
<td>- Foodstuffs and farm products</td>
<td>128</td>
<td>272</td>
<td>6 to 14</td>
</tr>
<tr>
<td>- Fertiliser</td>
<td>78</td>
<td>40</td>
<td>2 to 4</td>
</tr>
<tr>
<td>- Ores, minerals</td>
<td>345</td>
<td>124</td>
<td>2</td>
</tr>
<tr>
<td>- Construction materials</td>
<td>119</td>
<td>141</td>
<td>5</td>
</tr>
<tr>
<td>- Metals</td>
<td>181</td>
<td>75</td>
<td>2 to 4</td>
</tr>
<tr>
<td>- Coal, coke, smelt material</td>
<td>1,939</td>
<td>1,134</td>
<td>0</td>
</tr>
<tr>
<td>- Petroleum products</td>
<td>153</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>- OTHER TRAFFIC - TOTAL</td>
<td>304</td>
<td>313</td>
<td>5</td>
</tr>
<tr>
<td>▪ Chemicals, Plastics, Rubber, Salt</td>
<td>66</td>
<td>174</td>
<td></td>
</tr>
<tr>
<td>▪ Beverages</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Wood</td>
<td>36</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>▪ Pulp and paper</td>
<td></td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>▪ Cars, Machinery</td>
<td>5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>▪ Waste and Scrap</td>
<td></td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>▪ Cotton</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>▪ Other products, containers</td>
<td>194</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1 shows the traffic load of major national railway systems. Typical systems have average loads of 5 million to 27 million tonnes per tonne-km. China’s loadings are exceptionally high because it does not have an extensive network of lightly used

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10 Ministry of Railways 2006 as reported in Asian Development Bank TA 4701-PRC RAILWAY PASSENGER AND FREIGHT POLICY REFORM STUDY November 2007. Note that China and the USA do not report the breakdown of rail traffic on the same way. FCP has attempted to aggregate the totals in a meaningful way, for deriving estimates of the potential for the NER

branch lines, while Russia, the USA and Kazakhstan have very long mainline hauls. Canada and Australia have long hauls but Canada also has an extensive branch line network. FCP’s projected traffic of 22 to 34 million tonnes would put it at the higher end of average loadings for national systems. Note that the national averages mask variation between lines. China, for example, has lines with loadings of up to 300 million tonnes, and there are several lines in the USA with more than 50 million tonnes. Our projection of 22 to 34 million tonnes is not exceptional for a trunk railway line.

Figure 1 Loadings of Major Rail Systems

3.3.1. Agricultural Traffic

Agricultural traffic includes imports of fertiliser and pesticides, and bulk export of foodstuffs, livestock and farm products. In principle, the potential agricultural traffic depends mostly upon the arable area of the Market Area, and its productivity. The NSER market area is naturally well endowed. It has fertile soils, heavy annual rainfall although with a dry season, and a year-round frost-free growing season. Much of the land is used for grazing, although with irrigation it is possible to produce at least two crops.\(^\text{12}\)

Farming is currently not intensive, at least in part due to the high cost to import fertiliser and to export products to market. It is understood that current volumes of fertiliser use is quite low, at only 200,000 tonnes with Nigeria as a whole only amounting to 600,000 tonnes per year. As a comparison, Pakistan uses 10 million

\(^{12}\) See Appendix 3 for additional information on local agriculture.
tonnes per year. There is a large potential for bulk fertiliser traffic to key locations for bagging and distribution as well as containerised bagged product for retail.

Overall, 33% of Nigeria is arable and the arable proportion of the NSER Market Area should be similar or higher. Only about 15% of China is arable, and about 18% of the US, as both countries have large areas of deserts and mountains. Thus although the NSER Market Area is only about 2% of the USA or China, it probably has the potential to generate about 5% of the agricultural tonnages. China Railways carries about 120m tonnes per year of foodstuffs and 80m tonnes of fertiliser. In addition, some food products are probably carried in containers or reported as “other products”. US railways carry about 272 million tonnes of foodstuffs and farm products, and a further 40 million tonnes of fertiliser. China and the US also have extensive inland waterway systems. In the US, a further 93 million tonnes or about 25% of foodstuffs move by water. The Benue River may have the same potential, in time, to carry traffic in Nigeria.

Currently, Nigerian cattle are shipped live by road to markets in the south. This is slow, expensive, and does not deliver a very good product. In the USA, livestock is now slaughtered close to where it is raised, packed and shipped in refrigerated containers by road or rail. Beef consumption is typically 25 kg per person per year in middle income countries. Assuming NSER carries half the beef for the 80 million people in southern Nigeria, this is a potential traffic of a 1 million tonnes per year. The railway could also carry hides and other animal products.

On this basis the NSER Market Area has the potential to generate about 5% as much traffic as China or the USA, or about 6 to 14 million tonnes per year of foodstuffs and perhaps 2 to 4 million tonnes of fertiliser traffic.

3.3.2. Ores and Minerals

Haulage of minerals will depend on discovery and exploitation of ore deposits along the route. Currently, no large-scale mining is underway, but several mineral deposits have been identified along the NSER route.

It is likely that more deposits would be discovered and exploited if reliable transport is available. On the Mineral Resources map of Nigeria, eastern Taraba and south-eastern Adamawa are shown in white with very few symbols. The reason is that it is mostly unexplored. The underlying geology is similar to much of central Nigeria where viable deposits are found.

The Alice Springs – Darwin line may be a useful precedent. This 824 km railway opened in 2004. In the following 4 years, three new mineral flows commenced totalling 2.35 million tonnes per year:

- Iron Ore, 1.5 million tonnes, 210 km
- Manganese ore, 0.6 million tonnes, 800 km

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13 As advised by Trevor Bullen, Adamawa Agricultural Development and Investment Limited.
14 US Department of Agriculture, as reported in www.allcountries.org
15 See Appendix 3.
- Copper and Gold Concentrate, 0.25 million tonnes, 2,000 km (from an existing connecting railway).

### Table 5 Mineral Resources

<table>
<thead>
<tr>
<th>Cross Rivers</th>
<th>Benue</th>
<th>Taraba</th>
<th>Adamawa</th>
<th>Gombe</th>
<th>Borno</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baryte</td>
<td>Limestone Salt/brine</td>
<td>Baryte Galena</td>
<td>Gypsum Magnesite</td>
<td>Limestone Trona</td>
<td>Trona</td>
</tr>
<tr>
<td>Limestone</td>
<td>Salt</td>
<td>Beryl Iron ore</td>
<td>Gypsum Kaolin</td>
<td>Limestone Feldspar</td>
<td>Feldspar</td>
</tr>
<tr>
<td>Salt</td>
<td>Coal</td>
<td>Baryte Limestone</td>
<td>Magnesite Kaolin</td>
<td>Gypsum Feldspar</td>
<td>Bentonite</td>
</tr>
<tr>
<td>Silica sand</td>
<td>Baryte</td>
<td>Galena Limestone Fluorite</td>
<td>Cassiterite Bentonite</td>
<td>Limestone Lignite</td>
<td>Coal</td>
</tr>
<tr>
<td>Uranium</td>
<td>Kaolin</td>
<td>Quartz</td>
<td>Gypsum Bentonite</td>
<td>Coal</td>
<td>Lignite</td>
</tr>
<tr>
<td>Manganese</td>
<td>Gypsum</td>
<td>Granite</td>
<td>Fluorite</td>
<td>Coal</td>
<td>Diatomite</td>
</tr>
<tr>
<td>Lead/zinc</td>
<td>Lead/zinc</td>
<td>Kaolin</td>
<td>Quartz</td>
<td>Bentonite</td>
<td>Gypsum</td>
</tr>
<tr>
<td></td>
<td>Clay</td>
<td></td>
<td>Graphite</td>
<td>Feldspar</td>
<td>Kaolin</td>
</tr>
</tbody>
</table>

While there can be no certainty, it would seem likely along the 1,320km NSER there will be mineral deposits that will generate flows of 2 million tonnes, potentially more.

#### 3.3.3. Construction Materials

China and US railways carry roughly similar amounts of building materials, including cement, stone, sand, and timber. Total consumption is driven by population and economic activity, but whether it is carried by rail, road or water depends upon the location of supply and the size and location of cities which are the major attractors.

There are a number of cement factories along the route and limestone deposits with potential for both bulk and containerised loads. Benue state alone has two cement factories with a capacity of over 1.6m tonnes. There are outcrops of granite and clays.

About 30 million people live in the Niger delta, an area with no local building stone or cement. The NSER has the potential to carry cement, granite, and other building materials from the hills north of Calabar. While the distances are short, rail can still be very competitive for this type of traffic. In addition, the NSER can haul building materials to cities in the Market Area. With combined population in the region of 50 million, traffic potential should be at least 4% of China Railways, or 5 million tonnes.

#### 3.3.4. Metals

China Railways carries 181 million tonnes of metal. Metal haulage in the USA is about 365 million tonnes, but most of this travels by road over fairly short distances, averaging 288 km. Only about 75 million tonnes travels by rail, with an average haul of about 900 km. Steel is mostly consumed in manufacturing and construction. There is iron ore, limestone and coal in Benue and Taraba, and it is possible that a local steel industry could be developed. This could generate large tonnages.

At least in the medium term, it seems likely that metals traffic would be limited to importation of steel for local consumption, mostly for construction purposes. On the
basis that the NSER Market Area has about 2% of the population of China or 6% of the USA, but half of USA and China consumption is for manufacturing, metals consumption might be in the range of 2 to 4 million tonnes.

3.3.5. Coal, Coke, and Smelt Material

About one third of tonnages on USA and China Railways is coal, mostly used for electricity generation and also for steel production. While some coal deposits have been identified on the route, they are not large. Nigeria has a large surplus of natural gas, and FCP does not think it likely that coal will be a significant traffic for the NER.

Smelt is an intermediate product in steel production.

3.3.6. Petroleum Products

China Railways carries about 153 million tonnes of petroleum products, but US railways carry a much smaller 22 million tonnes. The trend is for pipelines to carry petroleum products, especially as technology now allows different refined products to be shipped through a single pipeline. FCP does not expect that Petroleum Products will be significant traffic on the NER.

3.3.7. Other Traffic

Traffic of most other commodities is dependent mostly on population and economic activity as measured by GDP. Thus China, with 5 times the USA population but per capita incomes 1/7 as high, generates a similar “other traffic” of about 300 million tonnes. Assuming per capita incomes in the NSER rise to 25% of the USA level, the Market Area should generate “other traffic” of approximately 5 million tonnes.

Included within this total are several sub-categories. We have looked briefly at the traffic in equipment, including automobiles, and containers.

Equipment, including automobiles, are a significant traffic both on China and US railways. In the USA, semi finished and finished cars are shipped to local dealers by rail, as they are in Europe and, increasingly, in Russia. In the US this traffic comprises about 15 million tonnes (400,000 carloads). With a population about 6% of the USA, car imports into the corridor may, in time, generate 24,000 carloads per year (0.6m tonnes), or about one train each day.

Containers (including trailers on flatcar) are used to carry both export products and imports. The amount of export traffic will depend mostly upon the growth of manufacturing and industry (although containers will also be used for some farm products, including refrigerated containers for meat and some types of produce). The amount of import traffic is mostly a function of the population and its income level. US railways carry about 10 million containers per year. With a population about 7% of the USA, the NSER market area might eventually attract 700,000 containers per year, or about 1,000 per day per direction. This would comprise about 10 trains each 100 “boxes”.

3.4. Passenger Traffic

Passenger rail services are rarely profitable, and are unlikely to make a substantial contribution to the financial case for the railway. Often they are subsidised, but this
may be the result of a policy decision rather than economic necessity. They can usually operate on a break-even basis, provided population densities are sufficient and stations are located near to major cities. The Calabar – Maiduguri corridor is currently mostly rural, with only small cities along the route. The potential viability of passenger rail services should be addressed in the Full Feasibility Study.

### 3.5. Revenues and Margins

FCP has estimated the prices that might be charged, and the potential operating margins, based on experience of railways of similar characteristics in other countries. This is, admittedly, a very simplistic approach. The actual rates charged by the railway are likely to vary by commodity, and will depend upon the competitive and regulatory environment.

We were told that truckers currently charge 300,000 to 500,000 Naira ($2,000 to $3,300) to take a load from Yola to Lagos. This corresponds to about $200 to $300 per tonne, assuming truck payload of 10 tonnes.

Table 6 shows railfreight tasks, revenues, operating costs and margins for some major railway operators. Average charges are in the range of $0.0079 to $0.017 per tonne-km. Rail rates are thus typically about one-tenth of the rates currently being charged by Nigerian truckers. This reflects the efficiency of rail transport, compared with the high costs of operating on Nigeria’s poorly maintained roads.

Operating costs are in the range of $0.0057 to $0.013 per tonne-km. Operating margins per tonne-km vary from $0.0012 (Transnet) to $0.0053 (Canadian National) per tonne km. The wide variation reflects differences in the mix of traffic, local conditions, operating efficiency, and price regulation. Operating margin (EBITDA\(^{16}\)) is the money that is available to service debt on capital investment, including infrastructure and equipment, and pay dividends to shareholders.

Typically, operating margin as a percentage of total revenues declines as a railway matures, even as total revenues and margins grow. This is because, in an industry with high fixed costs, it makes sense to set prices to carry new traffic even where the rate is only slightly above incremental cost.

The NSER is expected to cost about $3 billion. Annual EBITDA of about $300 million will be required to pay a nominal 10% return on the capital investment.

The amount of traffic the railway attracts will, of course, depend on the rates that are charged. Rates are normally set to maximize profitability, attracting traffic while generating margins to pay for the high fixed costs.

- If the NSER were to charge $0.10 per tonne-km, just less than the cheapest truckers, it might attract only 3 million tonnes. Assuming operating costs are $0.010 per tonne-km (and thus a margin of $0.09 per tonne-km), and average hauls of 600km, the railway would generate an EBITDA of $162 million.

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\(^{16}\) Earnings Before Interest, Taxes, Depreciation and Amortisation.
With rates of $0.015 per tonne-km, similar to China Railways, NSER might in time attract 30 million tonnes. Traffic might be ten times higher, but the margin of $0.005 per tonne-km only generate an EBIT of $90 million.

With rates of $0.04 per tonne-km, traffic of 20 million tonnes might be attracted, generating an EBITDA of $360 million per year. The implied charge of $40 per tonne from Yola to Calabar is about one-fifth of the current cost to transport to Lagos by road.

In practice, NSER will charge different rates to different customers, depending upon the value of the commodity, the length and cost of haul, and many other factors. The calculations here simply show that, under certain assumptions, the NSER could pay a return slightly over 10% on the capital investment.

The new railway will be able to carry bulk cargos, some of which can be very profitable because they cannot be carried economically in any other way. This train is carrying sulphur on the Canadian Pacific Railway.
Table 6 Railfreight Tasks, Revenues and Margins

<table>
<thead>
<tr>
<th></th>
<th>BNSF Railway USA(^{17})</th>
<th>China Railways(^{18})</th>
<th>Russian Railways(^{19})</th>
<th>Canadian National(^{20})</th>
<th>Transnet Freight Rail South Africa(^{21})</th>
<th>Indian Railways</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight Revenue</td>
<td>$18</td>
<td>RMB156(^{22}) = $22.8</td>
<td>Rbls 847 = $28</td>
<td>$8.5</td>
<td>Rand 14.4 = $1.9</td>
<td>$10.1</td>
</tr>
<tr>
<td>billions</td>
<td></td>
<td></td>
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<tr>
<td>Operating Cost</td>
<td>$14.1</td>
<td>$13.5</td>
<td>$23.9</td>
<td>$5.6</td>
<td>$1.68</td>
<td>$4.81</td>
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<tr>
<td>Operating margin(^{23}) billions</td>
<td>$3.9</td>
<td>$9.4(^{24})</td>
<td>$4.1(^{25})</td>
<td>$2.9</td>
<td>$0.22</td>
<td>$5.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Traffic billion</td>
<td>1,063</td>
<td>2,366</td>
<td>2,423</td>
<td>544</td>
<td>182(^{26})</td>
<td>481(^{27})</td>
</tr>
<tr>
<td>tonne-km</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Revenue per</td>
<td>$0.017</td>
<td>$0.0096</td>
<td>$0.012</td>
<td>$0.015</td>
<td>$0.008</td>
<td>$0.021</td>
</tr>
<tr>
<td>tonne - km</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Cost per tonne-</td>
<td>$0.013</td>
<td>$0.0057</td>
<td>$0.0099</td>
<td>$0.010</td>
<td>$0.009</td>
<td>$0.010</td>
</tr>
<tr>
<td>km</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Margin per tonne</td>
<td>$0.0037</td>
<td>$0.0040</td>
<td>$0.0017</td>
<td>$0.0053</td>
<td>$0.001</td>
<td>$0.011</td>
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<tr>
<td>-km</td>
<td></td>
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</tbody>
</table>

3.6. Conceptual Business Plan

The analysis of revenues and margins indicates that the NSER could, in time, attract 20 million tonnes per year, at average rates of $0.04 per tonne-km. Assuming an average

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\(^{18}\) TRACKS FROM THE PAST, TRANSPORT FOR THE FUTURE, World Bank Beijing Office unpublished paper 2009


\(^{21}\) SPOORNET OPERATIONAL REPORT 2006, [http://www.transnet.co.za/AR_2006/ops_spoornet.html](http://www.transnet.co.za/AR_2006/ops_spoornet.html)

\(^{22}\) Includes “railway construction fund “ surcharge

\(^{23}\) Earnings before Interest, Tax

\(^{24}\) Includes operating margins from passenger services

\(^{25}\) Declared profit on freight traffic; excludes declared loss on passenger traffic

\(^{26}\) Transnet Freight Rail, assuming 1,000km average haul

haul of 600km, gross revenues would be $480m per year. Assuming operating costs of 0.03 per tonne-km, operating income (EBITDA) would be $360 million. This is, in principle, sufficient to service the full capital cost of the Project, at a 12% rate of return. However, it is unlikely that purely private sector investment could be attracted on the basis of these returns. There are large risks in implementing a project of this type, and it is likely some sort of financial support will be required from government. This is discussed in section 5 below.

As shown in the Illustrative financial projection below, private sector investors are unlikely to see a return on their equity, even assuming substantial government financial support.

**Illustrative Financial Projection**

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>CASH FLOW</td>
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<tr>
<td>Government Contributions</td>
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<td>Loans - Government guaranteed</td>
<td>25</td>
<td>300</td>
<td>1000</td>
<td>250</td>
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<td>Equity - Private Sector</td>
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<td>Loans - Private Sector</td>
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<td>1000</td>
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<td>Development Costs</td>
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<td>Capital costs</td>
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</tr>
<tr>
<td>Railway operating costs</td>
<td>-20</td>
<td>-30</td>
<td>-60</td>
<td>-70</td>
<td>-75</td>
<td>-110</td>
<td>-125</td>
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<td></td>
</tr>
<tr>
<td>Rail revenues</td>
<td>25</td>
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<td>100</td>
<td>200</td>
<td>300</td>
<td>400</td>
<td>500</td>
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</tr>
<tr>
<td>Net cash flow</td>
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<td>-34</td>
<td>-279</td>
<td>-334</td>
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**3.7. Economic Evaluation**

The analysis of revenues and margins shows that, under certain reasonable assumptions, railway revenues will pay the total cost, with a 10% return on capital. Clearly the railway is a necessary pre-condition of economic development. Provided other pre-conditions are satisfied, the railway will be a financial success. Other conditions include political and economic stability, a favourable tax regime, and access by farmers, mining companies, and industry, to capital and technical resources.

As it will offer reliable transport to a seaport at one-fifth the current cost, the railway will also almost certainly be an economic success, not only generating revenues that pay the direct costs, but also raising employment and living standards across the region.

The excess of benefits over costs could be very high. One very simple way to estimate the cost is to assume the benefit is half the savings in transport costs, for the generated traffic. Assuming the railway generates traffic of 20 million tonnes per year, with savings of $160 per tonne, the annual benefit would be $1.6 billion. Assuming a capitalisation factor of 15, the benefits will be in the order of $24 billion, for a benefit/cost ratio of about 9:1, or about $1,000 for every resident in the five states.
This is almost certainly a gross under-estimate, as the railway is essential infrastructure that will unlock all kinds of other investment.

A more detailed economic evaluation should be completed as part of the Full Feasibility Study.

4. Trans Sahara Railway

Unlike Asia, America, and Australia, Africa does not have a “transcontinental” railway. There have been many proposals, but none have been realised. There are several reasons:

- Proposals have been conceived for political rather than economic reasons
- Proposed routes have crossed difficult terrain
- They have not served any obvious or large economic need
- They have crossed multiple international borders, requiring a degree of cooperation which has not existed.

Successful transcontinental railways, in Canada, USA, Russia and Australia, are all within a single country. Although originally promoted with a degree of political ambition, they serve clear economic needs, opening new territories and often also serving as a land-bridge (because the sea routes are much longer or blocked with ice).

The French proposal for a Trans-Sahara railway took an expensive route across the Atlas Mountains, linking mostly coastal cities that were already accessible by sea. The British proposal, for a line from the Cape to Cairo, had no obvious economic function whatsoever.

Nigeria is the heart of west Africa, with by far the largest population and economic potential. A railway across Nigeria, extending to a port on the Mediterranean, would give access to the vast markets in Europe. It would also provide better access to the main global shipping routes, which run via the Mediterranean.

Libya is currently building a railway network in the form of a “T”. A coastal line will provide the missing link between the Maghreb railways in Morocco, Algeria and Tunisia, with the Egyptian Railways. A line from a new seaport is being built south 992 km to the city of Sabha. All the Libyan lines are being built standard gauge, with technical standards similar to those proposed for the NSER.

The distance from Sabha to Maiduguri is about 2400km. The most likely route is across Niger, although the line could also run via Chad. The route is almost entirely across uninhabited desert, much of it through or alongside “sand seas”. Construction feasibility is unknown. Based on railways through broadly similar terrain in Australia and China, it might be possible to build the line for $4 billion.

Traffic potential is also unknown. Besides the potential traffic from West Africa to Europe, there may be viable mineral reserves in Niger.

Any Trans-Sahara Railway would require an international treaty. This could include establishing free trade along the railways to ports and intermediate terminals, which could be established as free trade zones.
The States supporting the NSER may wish to consider commissioning a Full Feasibility Study for a Trans-Sahara Railway, perhaps jointly with Libya Railways and the Governments of Niger and Chad.

The Trans Saharan Railway would link the existing lines in Morocco, Algeria, Tunisia and Egypt, the lines being built in Libya, and the proposed line in Nigeria.

5. Implementation Road Map

Under Nigerian law, construction and operation of railways is a monopoly of the Nigerian Railways Corporation (NRC). However NRC is currently pre-occupied with refurbishing and modernising its existing network. This suggests that the NSER will be delayed at least a few years, unless the Five States promote it themselves. We understand that the Five States sponsoring the NSER wish to develop the railway themselves, probably as a concession.

New legislation is pending before the National Assembly to allow NRC to grant concessions. Under the proposed legislation, NRC has the ability to delegate its powers to a state or corporate body, to develop and operate a railway as a concession. Indeed NRC has agreed to this approach for the Lagos Blue Line Mass Transit Rail System. Federal Government support or direction to NRC is required to allow the Five States to develop the NSER as a concession.

While NRC has taken a fairly “hands off” approach to the Lagos Blue Line, which will only carry local passengers, NRC may seek more involvement in the NSER project, for example in the setting of technical standards to ensure the system can ultimately be operated as part of the NRC system.

A concession is a form of Public Private Partnership, where government contributes specific resources to a private sector company, to achieve a specific outcome. This approach has two main benefits. First, government may reduce its financial obligation. Second, private sector skills will be mobilised to deliver the railway more cheaply and operate it more efficiently. Many if not most existing railways in other countries were developed as concessions. These include the Canadian and American transcontinental lines, most lines in Britain, France, and South America, and many lines in China.29

However, relatively few railways of this scale have been built in the last half-century, anywhere in the world, and even fewer have been developed with concessions. New long distance mixed traffic railways have been built in China, India and Russia, funded and developed wholly by government and operated as part of their existing networks. High-speed passenger-only railways have been built in several countries, sometimes within concession companies, but in all cases mostly or entirely with public funds or with debt guaranteed by government. Private-sector companies have built railways have been built for specific traffic, usually iron ore or coal, in China, Australia, Canada and Brazil. The only modern mixed traffic railway, built by a private concession company, is the Alice Springs – Darwin line in Australia. The only other comparable railway concession of this size was for the Channel Tunnel, which carries mixed traffic between England and France.

In principle, the NSER is a larger version of Alice Springs – Darwin. The traffic potential is much larger, but the investment is equally speculative. A concession could be awarded to build and operate the railway, for a period of perhaps 50 years.

It is not known what appetite private investors would have to finance the entire Calabar – Maiduguri Railway, or if they would require public support of some kind.

The initial estimates of traffic and revenues suggest that the line might, conceivably, generate sufficient operating margins to finance the expected $2.23 billion capital cost at a 15% average rate of return. Whether this is in fact possible depends upon growth in traffic, which in turn depends upon economic development of the Market Area. Experience with other concessions in West Africa is that investors will expect a return of 20% or more, because of perceived market-specific risks.

Most likely, Government will need to provide support in some way to the initial capital investment. This could include one or more of the following:

- Guarantee of minimum traffic levels at some minimum tariff;
- Contribution of a share of the initial capital, either as one-off subsidy, or as debt with interest deferred until the railway is generating adequate returns;

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29 See Appendix 2 for information on the Canadian Pacific Railway and Alice Springs-Darwin Railway Concessions.
Some level of annual availability payments (which might become payments to the Government, when the railway is sufficiently profitable);

- Government underwriting of a certain amount of debt, probably in the form of bonds to be issued by the concession company;
- Contribution of assets such as land along the route, development rights, or existing facilities such as ports;
- Protection against competition, for example a guarantee that Government will not allow construction of a competing line for a certain period;
- Grant of other complementary rights for example a concession for a parallel motorway.

Each has advantages and disadvantages, in the financial burdens and risks to Government, in the outcomes they will generate, and how they may distort the behaviour of the concessionaire.

Funding may be available from multilateral agencies such as the World Bank, African Development Bank, International Finance Corporation, and the European Investment Bank. Each of these has specific criteria that must be met before funding is available. The choice of funding sources will be considered further in the Full Feasibility Study.

Setting the amount of public support is always difficult. Ideally, a competitive process is used to select the concession operator that requires the lowest subsidy. In some states, this is required by law. In practice, there is often only a single credible bidder willing to take on the challenge. An alternative approach is for Government to decide what it is willing or able to contribute, and to wait for a company with the necessary resources to step forward. Although built more than a century apart, this was how concessions for both the Canadian Pacific and Alice Springs-Darwin railways were awarded.

Normally, where more than one government is involved in jointly promoting a railway, a project promotion company or procuring authority/commision is formed. All parties enter into a binding contract to work together under defined terms to develop the project. The Alice Springs – Darwin Railway was promoted jointly by the governments of South Australia and Northern Territory, through a company AustralAsian Railway Corporation. This mobilised support for the railway (including support from the Federal Government), managed the competition and selected a concessionaire, and continues to oversee the project through the concession term.

A draft Memorandum of Understanding (MOU) regarding the procurement of a Full Feasibility Study is provided in Appendix 1. This provides for initial collaboration of the Five States that are sponsoring the Pre-Feasibility Study to procure a full feasibility study. The Full Feasibility Study will include evaluation of fundability and develop recommendations as to the preferred method of funding and structuring the Project. This will include analysis of the legal obligations of the individual states, and any

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amendments to state or federal law that may be required to implement the Project in the preferred way.

A legal paper has also been provided at Appendix 9. The purpose of this paper is to consider the relevant legal and regulatory framework surrounding the Project. This will be explored and analysed in further detail in the Full Feasibility Study.

### 6. Next Steps

FCP recommends that the Five States enter into the MOU prepared by Wragge & Co and UUBO, and provided in Appendix 1. The Five States can then move forward with the Full Feasibility Study and the procurement of the Project. A draft specification and schedule for the Full Feasibility Study is provided in Appendix 6.

In parallel, initial work can proceed in promoting the Project to potential investors, with a view to awarding a concession for the railway within 16 months, or before the end of 2011 (see Figure 2). Implementation would take a further three or four years, with railway services beginning in 2015.

#### Figure 2 Possible Schedule to Financial Close

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Appendix 1 Draft MOU for Railway Development Company

This MEMORANDUM OF UNDERSTANDING is entered into on [●] 2010

BETWEEN

THE ADAMAWA STATE GOVERNMENT, a governmental authority established and existing under the laws of the Federal Republic of Nigeria with its seat of government at Government House, Jimeta, Yola represented by [●] (hereinafter called “Adamawa State”) of the first part;

THE CROSS RIVER STATE GOVERNMENT, a governmental authority established and existing under the laws of the Federal Republic of Nigeria with its seat of government at Government House, Calabar represented by [●] (hereinafter called “Cross River State”) of the second part;

THE BENUE STATE GOVERNMENT, a governmental authority established and existing under the laws of the Federal Republic of Nigeria with its seat of government at Government House, Makurdi represented by [●] (hereinafter called “Benue State”) of the third part;

THE TARABA STATE GOVERNMENT, a governmental authority established and existing under the laws of the Federal Republic of Nigeria with its seat of government at Government House, Jalingo represented by [●] (hereinafter called “Taraba State”) of the fourth part; and

THE BORNO STATE GOVERNMENT, a governmental authority established and existing under the laws of the Federal Republic of Nigeria with its seat of government at Government House, Maiduguri represented by [●] (hereinafter called “Borno State”) of the fifth part;

each referred to individually as a “State” or together as the “States”.

WHEREAS:

A. Adamawa State has, on behalf of the States, procured the production of the Pre-Feasibility Report.

B. Following their review of the Pre-Feasibility Report, each State now wishes to procure the production of a full Feasibility Report to be carried out by the Advisers, and if the Feasibility Report confirms that the Project is feasible, to continue to procure the Project.

C. Each State agrees to work together with each other and the Advisers to procure the production of the Feasibility Report on the basis set out in this Memorandum of Understanding and the Engagement Letters.
D. Adamawa State has been nominated by each State to act on their behalf during the preparation and finalisation of the Feasibility Report and to be the States’ interface with the Advisers.

**NOW IT IS HEREBY AGREED AS FOLLOWS:**

**Definitions:**

In this Memorandum of Understanding:

(a) “Advisers” means First Class Partnerships, AMZ Consultants, Wragge & Co LLP and Udo Udoma & Belo-Osagie, and each being an “Adviser”;

(b) “Engagement Letters” means the engagement letters entered into by Adamawa State (on behalf of all of the States) and each Adviser in relation to the Project, and each such letter being an “Engagement Letter”;

(c) “Feasibility Report” means the full feasibility report to be prepared by the Advisers in relation to the Project;

(d) “Pre-Feasibility Report” means the pre-feasibility report dated [●] 2010 prepared by the Advisers; and

(e) “Project” means the project to construct the [Nigeria Great Eastern Railway] as described in the Pre-Feasibility Report.

1 **Collaboration**

The States agree to collaborate in good faith and work exclusively together:

(i) to provide all necessary information and assistance to each other and to the Advisers in preparation of the Feasibility Report;

(ii) to share equally, on a pro-rata basis, the cost of producing the Feasibility Report (including, without limitation, the fees, costs and expenses of the Advisers in accordance with the Engagement Letters); and

(iii) in the event that the Feasibility Report confirms that the Project is feasible, towards the procurement and undertaking of the Project.

2 **Liability**

2.1 No State shall be liable to another for any indirect or economic or consequential loss or damage resulting from the performance or non-performance of any of the obligations under this Memorandum of Understanding.
2.2 Other than Adamawa State acting in its capacity as agent on behalf and on instructions of the States pursuant to Article 4 (Agency), no State shall bind the other States in any way, describe itself as agent or representative of any other State nor enter into any contract in the name of any other State without the prior written consent of the relevant State.

3 Agency

Each State irrevocably authorises Adamawa State to act on its behalf as agent in relation to the Engagement Letters, the Pre-Feasibility Report and the Feasibility Report (and anything ancillary thereto).

4 Engagement of Advisers

4.1 Each State hereby confirms that following its review of the Pre-Feasibility report, it authorises the Advisers to prepare the Feasibility Report.

4.2 Each State hereby authorises Adamawa State to enter, on its behalf, into the Engagement Letters with each of the Advisers and to pay any fees, costs or expenses due and payable pursuant to such Engagement Letters to the relevant Adviser (as they fall due).

4.3 Each State indemnifies Adamawa State for 20% of any amounts paid to the Advisers by Adamawa State pursuant to Article 5.2 above and each Engagement Letter. Such indemnified amounts shall be paid promptly by each State to Adamawa State upon written confirmation from Adamawa State that either such amounts have been paid by Adamawa State to the Advisers, or that such amounts will become payable by Adamawa State to the Advisers within 30 days of any such written confirmation from Adamawa State.

4.4 Adamawa State may (on behalf of the States) engage financial advisers (recommended and approved by the Advisers) to work with the Advisers in preparation of the Feasibility Report. Following such engagement, the financial advisers shall become an “Adviser” for the purposes of this Memorandum of Understanding.

5 Internal State Costs

Each State will bear its respective internal costs which it may incur pursuant to this Memorandum of Understanding, the Feasibility Report or the Project.

6 Non-compete

During the term of this Memorandum of Understanding, no State may individually or jointly with another State, or with any third party, enter into any agreement, joint venture or undertaking which may compete with, or have an adverse effect on, the objectives of this Memorandum of Understanding, the Feasibility Report or the Project.

7 Representatives

Each State appoints the following representatives to act on its behalf for the purposes of this Memorandum of Understanding, the Feasibility Report and the Project:
Adamawa State:
Representative name:
Address:
Fax number:
Email address:

Cross River State:
Representative name:
Address:
Fax number:
Email address:

Benue State:
Representative name:
Address:
Fax number:
Email address:

Taraba State:
Representative name:
Address:
Fax number:
Email address:

Borno State:
Representative name:
Address:
Fax number:
Email address:

8 Meetings
Any representative listed in Article 8 above may upon giving reasonable notice to the other representatives, call a meeting of the representatives to discuss and decide any matters relating to this Memorandum of Understanding, the Feasibility Report or the Project. Any such meeting may be held in person and/or by conference call.

9 Notices
All notices or other communications pursuant to this Memorandum of Understanding shall be sent to the relevant State representative by fax, email or courier to the address or contact details given above in Article 8 or to such other address as each State may from time to time specify by notice in writing to the other States.
10 Confidentiality

10.1 Each State undertakes to treat as confidential any information that it obtains from another State or an Adviser relating to the business of another State, the Feasibility Report or the Project or any other information marked or indicated as being confidential by a State or Adviser (“Confidential Information”) and to use the Confidential Information solely for the purpose of this Memorandum of Understanding, the Feasibility Report and the Project.

10.2 The above undertaking shall not apply in respect of any Confidential Information which:

- at the time of disclosure under this Memorandum of Understanding is in the public domain other than by reason of a breach of duty or of this Memorandum of Understanding; or
- after disclosure under this Memorandum of Understanding becomes generally available to third parties by publication or otherwise, other than by reason of a breach of duty or of this Memorandum of Understanding;
- is disclosed as and to the extent required by an applicable law, court order or by the regulations of a recognised stock exchange; or
- is disclosed to a State’s or Adviser’s affiliates, directors, officers or employees who require the Confidential Information for the purposes of the Feasibility Report or the Project and whom have been advised of, and agreed to be bound by, the confidentiality restrictions.

10.3 The above undertakings in this Article shall continue until the date falling 6 months after the termination of this Memorandum of Understanding.

11 Validity of this Memorandum of Understanding

11.1 This Memorandum of Understanding is effective from the date hereof and will automatically terminate upon the first to occur of the following events:

- the Feasibility Report has been delivered by the Advisers and the Advisers conclude that the Project is not feasible;
- the States, acting in good faith, fail to agree the next steps to be taken on the procurement of the Project within 12 months of the date on which the Feasibility Report is delivered by the Advisers;
- the date of the [fourth] anniversary of this Memorandum of Understanding;
- the States unanimously agree in writing to terminate this Memorandum of Understanding; or
- this Memorandum of Understanding has been superseded by a further co-operation, joint venture agreement or other similar arrangement relating to the procurement of the Project.

11.2 Expiry or termination of this Memorandum shall be without prejudice to the rights and obligations of the States and the Advisers existing as at the date of termination.
11.3 Notwithstanding expiry or termination of this Memorandum, each State shall remain bound by the provisions of Article 2 (Liability), Article 10 (Confidentiality), Article 14 (Settlement of Disputes) and Article 15 (Governing Law).

12 Amendments
This Memorandum of Understanding can only be amended in writing with the prior approval of all of the States.

13 Assignment
No State shall assign or transfer, or purport to assign or transfer, any of its rights or obligations under this Memorandum of Understanding without the prior written consent of each of the other States.

14. Settlement of Disputes
14.1 Any dispute arising out of in connection with this Memorandum of Understanding or its performance, including but not limited to its validity, construction, interpretation, termination or enforcement, shall to the extent possible be settled amicably by negotiation between the representatives of each State within fourteen (14) days of notice having been given by one State to the other States that a dispute has arisen, failing which the matter shall be referred to the governors of each State to resolve such dispute within a further fourteen (14) days.

14.2 If the governors (or a representative thereof) of the relevant States fail to resolve the dispute it shall be referred to and be determined by arbitration in accordance with the provisions of the Arbitration and Conciliation Act, 2004.
For and on behalf of the
GOVERNMENT OF ADAMAWA STATE OF NIGERIA

In the presence of:

Name:
Address:
Occupation:
Signature:

SIGNED, SEALED AND DELIVERED by
[*] ____________________

For and on behalf of the
GOVERNMENT OF CROSS RIVER STATE OF NIGERIA

In the presence of:

Name:
Address:
Occupation:
Signature:

SIGNED, SEALED AND DELIVERED by
[*] ____________________

For and on behalf of the
GOVERNMENT OF BENUE STATE OF NIGERIA

In the presence of:

Name:
Address:
Occupation:
Signature:

SIGNED, SEALED AND DELIVERED by
[*]

For and on behalf of the
GOVERNMENT OF TARABA STATE OF NIGERIA

In the presence of:
Name:
Address:
Occupation:
Signature:

SIGNED, SEALED AND DELIVERED by
[*]

For and on behalf of the
GOVERNMENT OF BORNO STATE OF NIGERIA

In the presence of:
Name:
Address:
Occupation:
Signature:
Appendix 2 Railway Concession Experience

Canadian Pacific Railway and Canadian National Railway

Canada has experience both with privately concessioned and government-owned railways.

From 1840, various railways were built in eastern Canada, usually as Government projects.

When the British colonies in eastern North America obtained self-government in 1867, the colony of British Columbia on the Pacific Ocean expressed interest in joining the confederation, on condition that a railway would be built linking the settlements. Agreement was reached by the governments and British Columbia joined Canada in 1871. At that time the only practical transport link was by steamship around Cape Horn, a journey that took several weeks.

The Federal Government first awarded a concession for construction of the line, but this was terminated in 1872 when it emerged that senior ministers (including the Prime Minister) had been bribed. Subsequent construction was funded and managed directly by the Government of Canada, and continued sporadically through the 1870s. By 1880 about one third of the route was completed.

A new concession was awarded in 1881. The Government agreed to guarantee credit of $25 million and to grant the Canadian Pacific Railway (CPR) 100,000 square km of land along the route. In addition, it was given title to the existing, partly completed line as well as extensive mineral rights. Funding was raised mostly on the London market and the line was completed in late 1885.

The new railway passed through sparsely inhabited territory, much of which was considered at the time to be desert. However new farming methods and crop varieties were developed and the area became the “breadbasket” of Canada. The Canadian Government established experimental farms and funded research and training programmes for farmers. It also encouraged the development of ports.

The railway initially prospered in part by carrying “landbridge” cargo, including tea from China to Europe. The CPR acquired a fleet of steamships, operating from Hong Kong to Vancouver, and from Montreal to Liverpool, to connect with train services.

The CPR concession is perpetual and the Canadian Pacific Railway continues to operate the railway as a private enterprise to this day. Revenues are approximately $5 billion per year with net income of about $1 billion. Average traffic density is 18.6 million tonnes, similar to what is projected for the NSER.

By 1900, the CPR was so profitable that two rival transcontinental railways were granted concessions by the Government. The Canadian Northern Railway (CNR) and the Grand Trunk Pacific (GTP) were mostly completed before the First World War, but there was not sufficient traffic to support all three lines. CPR survived despite competition, but the CNR and GTP both went bankrupt and were acquired by the Federal Government which combined them into Canadian National Railways (CNR). The CNR
was operated, usually making losses until it was privatised in 1995. CNR is now one of the most profitable railways in the world, with a 30,000km network and a market capitalisation of about $20 billion.

The Canadian Government operates long distance passenger trains over sections of the CPR and the CNR, through VIA Rail Canada. Provincial and local governments also operate commuter services in the vicinity of Vancouver, Toronto and Montreal, over CPR and CNR tracks.

The CPR eventually developed two lines across most of its route, although there is only a single line through the Rocky Mountains to the port of Vancouver. It has also acquired lines, which cross over into the United States.

Alice Springs – Darwin Railway

Alice Springs - Darwin is a 1,420 km extension to an existing 830 km line, running north from Tarcoola on the existing East-West transcontinental railway. It was conceived as offering a faster route from the farms and industries of South Australia to the markets of east Asia, via the Port of Darwin.

The Governments of South Australia and the Northern Territories signed a Memorandum of Understanding in 1995, agreeing to promote the railway jointly. After completing detailed feasibility studies and holding an international competition, in 1999 the two Governments together with the Federal Government awarded a 50 year concession to a private sector consortium Asia Pacific Transport (APT). The Governments of Australia and the state of South Australia and the Northern Territory contributed $559 million, and also leased the existing Tarcoola – Alice Springs Line for a nominal charge. The Government also funded the new container port in Darwin.

Construction actually started in 2001 and freight operations commenced in 2004. Total cost is quoted as $1.2 billion, implying private sector debt and equity of about $640 million. As of 2008, the railway was operating 34 trains per week, carrying 4 million tonnes per year. The line is used by heavy haul trains from 4 mines, fast intermodal trains carrying containers, and a weekly luxury passenger train carrying mostly tourists.
Alice Springs - Darwin completes the missing link in Australia's north-south transcontinental railway

The railway is operating profitably, however traffic has taken longer to develop and revenues have not met expectations. The railway faces competition from road hauliers along the route. Operating margins are not sufficient to pay interest on all debt and the railway finances are being restructured. However from a public perspective the project is entirely successful, with farmers and industry benefiting from efficient, low cost transport while the government contribution has been effectively capped.

For more information visit

www.freightlink.com
Appendix 3 Local Environment and Market Information

Ecology and Climate

The route runs through the tropical rain forest belt, lowland, savannah woodlands and savannah in the north. The soils are very fertile (particularly along the Benue River) with abundant agriculture. Most of the land in Benue, Taraba, Adamawa and Borno is settled intensively and farmed. In Cross River the route passes through rain forest, some of which is understood to include endangered species' habitats.

The climate is tropical with two marked seasons, wet/rainy and dry/summer. The wet season is generally from April to October but shorter in the drier northern savannah areas.

Temperatures generally range from 23-30 degrees Celsius.

<table>
<thead>
<tr>
<th></th>
<th>Cross Rivers</th>
<th>Benue</th>
<th>Taraba</th>
<th>Adamawa</th>
<th>Borno</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall annual</td>
<td>1300-3000mm</td>
<td>1200-1500mm</td>
<td>1350mm</td>
<td>1051mm(south)</td>
<td>500 - 800mm</td>
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<tr>
<td>millimetres</td>
<td></td>
<td></td>
<td></td>
<td>759mm (north)</td>
<td></td>
</tr>
<tr>
<td>Rainy Season</td>
<td>May to October</td>
<td>April to October</td>
<td>April to October</td>
<td>April to October</td>
<td>May to October (South)</td>
</tr>
</tbody>
</table>

Geology

Geology was considered briefly in the Pre-Feasibility Study.

Generally, the railway route passes mostly over sedimentary rock, which should not pose any great difficulty for railway construction. It is understood that there is harder granite in the Obudu Plateau. Construction would be more difficult through this rock, however it might also become a valuable traffic for the railway.

The geology of eastern Nigeria is relatively poorly explored, although it is similar to that found in central Nigeria. There is reason to expect that, with construction of a railway, and the potential therefore to transport ores at reasonable costs, prospecting will increase and valuable mineral deposits will be discovered.

---

31 Source: www.fadama.org and various other websites
Key

- Mica
- Feldspar
- Clay/Pottery clay
- Bentonite
- Limestone
- Manganese
### Minerals

<table>
<thead>
<tr>
<th>Mineral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trona</td>
</tr>
<tr>
<td>Graphite</td>
</tr>
<tr>
<td>Baryte</td>
</tr>
<tr>
<td>Brine</td>
</tr>
<tr>
<td>Kaolin</td>
</tr>
<tr>
<td>Galena</td>
</tr>
<tr>
<td>Bauxitic clay</td>
</tr>
<tr>
<td>Beryl, Aquamarine, Emerald</td>
</tr>
<tr>
<td>Tantalite</td>
</tr>
<tr>
<td>Pyrite/Pyroclore</td>
</tr>
<tr>
<td>Granite</td>
</tr>
<tr>
<td>Coal</td>
</tr>
<tr>
<td>Monzanite</td>
</tr>
<tr>
<td>Magnesite</td>
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</table>

### Agriculture

**AGRICULTURAL PRODUCE MILLION METRIC TONNES**

#### 2009/10

<table>
<thead>
<tr>
<th>STATE</th>
<th>MILLET</th>
<th>GUINEA CORN</th>
<th>GROUND NUTS</th>
<th>BEANS</th>
<th>YAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>BORNO</td>
<td>1,926.4</td>
<td>1,107.5</td>
<td>403.5</td>
<td>329.9</td>
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<tr>
<td>TARABA</td>
<td>279.1</td>
<td>376.0</td>
<td>208.1</td>
<td>16.9</td>
<td>12,239.9</td>
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<tr>
<td>GOMBE</td>
<td>506.6</td>
<td>306.8</td>
<td>52.5</td>
<td>104.4</td>
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<tr>
<td>BENUE</td>
<td>169.7</td>
<td>397.7</td>
<td>433.2</td>
<td>29.4</td>
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<tr>
<td>TOTAL</td>
<td>2,881.8</td>
<td>2,188.0</td>
<td>1,097.3</td>
<td>480.6</td>
<td>25,262.2</td>
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<table>
<thead>
<tr>
<th>STATE</th>
<th>COCOYAM</th>
<th>RICE</th>
<th>COTTON</th>
<th>MAIZE</th>
<th>CASSAVA</th>
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</thead>
<tbody>
<tr>
<td>BORNO</td>
<td>0.0</td>
<td>182.6</td>
<td>1,209.3</td>
<td>676.8</td>
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<td>TARABA</td>
<td>0.0</td>
<td>338.2</td>
<td>0.0</td>
<td>582.2</td>
<td>6,640.1</td>
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<tr>
<td>GOMBE</td>
<td>19.1</td>
<td>105.7</td>
<td>6.2</td>
<td>232.7</td>
<td>20.4</td>
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<tr>
<td>BENUE</td>
<td>0.0</td>
<td>333.8</td>
<td>0.0</td>
<td>177.2</td>
<td>8,659.9</td>
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<tr>
<td>TOTAL</td>
<td>19.1</td>
<td>960.3</td>
<td>1,215.5</td>
<td>1,668.9</td>
<td>15,320.4</td>
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*Source: National Bureau of Statistics (Projected figures)*
### Agricultural Products for each State

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<thead>
<tr>
<th>Cross River</th>
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<th>Taraba</th>
<th>Adamawa</th>
<th>Gombe</th>
<th>Borno</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber and forest products</td>
<td>Cashew</td>
<td>Coffee</td>
<td>Groundnuts</td>
<td>Cotton</td>
<td>Beans</td>
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<tr>
<td>Palm oil</td>
<td>Soya beans</td>
<td>Tea</td>
<td>Cotton</td>
<td>Maize</td>
<td>Millet</td>
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<tr>
<td>Maize</td>
<td>Cassava</td>
<td>Cassava</td>
<td>Maize</td>
<td>Rice</td>
<td>Pepper</td>
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<tr>
<td>Cassava</td>
<td>Groundnuts</td>
<td>Guinean Corn</td>
<td>Guinean Sorghum</td>
<td>Groundnuts</td>
<td>Maize</td>
</tr>
<tr>
<td>Groundnut</td>
<td>Cotton</td>
<td>Guinea Corn</td>
<td>Groundnuts</td>
<td>Rice</td>
<td>Rice</td>
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<tr>
<td>Yam</td>
<td>Maize</td>
<td>Millet</td>
<td>Livestock</td>
<td>Sugar cane</td>
<td>Maize</td>
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<tr>
<td>Rice</td>
<td>Rice</td>
<td>Sorghum</td>
<td>Onion</td>
<td>Kola nut</td>
<td>Rice</td>
</tr>
<tr>
<td>Livestock</td>
<td>Dairy products</td>
<td>Fishing</td>
<td>Fruit &amp; vegetables</td>
<td>Groundnuts</td>
<td>Sorghum</td>
</tr>
<tr>
<td>Fruit and vegetables</td>
<td>Livestock</td>
<td>Livestock</td>
<td>Hides &amp; skins</td>
<td>Livestock</td>
<td>Groundnuts</td>
</tr>
<tr>
<td>Millet</td>
<td>Garri</td>
<td>Timmer</td>
<td>Chillies</td>
<td>Onion</td>
<td>Livestock</td>
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<tr>
<td>Sugar</td>
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<td></td>
<td>Gum Arabic</td>
<td>Onion</td>
<td>Gum Arabic</td>
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<tr>
<td>Cocoa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Honey</td>
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<td>Fishery products</td>
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<td></td>
<td></td>
<td></td>
<td>Vegetable oil</td>
</tr>
<tr>
<td>Poultry</td>
<td></td>
<td></td>
<td></td>
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</table>
Appendix 4 Route Tour

Members of the FCP Study Team toured the route from Yola to Calabar May 11 2010. The trips was documented with over 200 photographs and using GPS.

![Route Profile](image-url)
Appendix 5 World Development Report Excerpts

The World Development Report, published annual by the World Bank, had an article in 2010 specifically addressing transport problems of northern Nigeria and surrounding regions.

It also included a map showing the potential of the “Cotton Belt” which includes much of Borno state as well as areas.
Map 9.6  West Africa has potential for cotton-led industrial development

Limit of cotton-producing basin:
- Yellow: Cotton-producing basin
- Orange: Heart of the cotton basin
- Green: Ginning factory

Means of cotton exports:
- Rail
- Road

Cotton exports through the ports:
- National cotton
- Sahelian cotton

Appendix 6 Full Feasibility Study Specification

The Full Feasibility Study will further evaluate the technical and economic viability of the NSER, and provide the basis for awarding a concession for the detailed design, construction and operation.

Key tasks will include:

- Development of technical requirements
- Development of alignment plans and construction cost estimates
- Detailed traffic and revenue analysis
- Full financial evaluation (FIRR)
- Comprehensive Economic and Social evaluation (EIRR)
- Preliminary Environmental Impact Assessment
- Testing of financing options, including meetings with potential funders
- Stakeholder meetings & workshop(s)
- Review of legal requirements, and drafting of any required state or federal legislation

The Full Feasibility Study will cost approximately $1.5 million and take 6 months to complete.

Timescale (6 months)

<table>
<thead>
<tr>
<th>MONTH</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tr>
<td>ROUTE ALIGNMENT STUDY</td>
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<td></td>
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<td></td>
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<tr>
<td>TRAFFIC STUDY</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>OPERATIONAL STUDY (FLEET ETC)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECONOMIC &amp; SOCIAL ANALYSIS</td>
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<td></td>
<td></td>
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<td>PPP OPTIONS</td>
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<tr>
<td>ENVIRONMENTAL IMPACT ANALYSIS</td>
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<tr>
<td>DRAFT REPORT</td>
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## Appendix 7  Indicative Construction Cost Estimate

<table>
<thead>
<tr>
<th>Estimate Description</th>
<th>Units</th>
<th>Quantity</th>
<th>Rate (US$)</th>
<th>Cost (US$)</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td><strong>Land Preparation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>USD 3,060,740</td>
</tr>
<tr>
<td>Land Clearances and grub</td>
<td>Ha</td>
<td>840</td>
<td>3.500</td>
<td>2,940,000.00</td>
<td>1400m x 9m (322km main line, 88km loops)</td>
</tr>
<tr>
<td>Sheet Piling (tile only)</td>
<td>Ha</td>
<td>387</td>
<td>10.00</td>
<td>3,870,000.00</td>
<td>662km fill</td>
</tr>
<tr>
<td><strong>Subgrade Preparation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>USD 3,756,522.52</td>
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<tr>
<td>Cut to Fill 0m to 5m</td>
<td>m³</td>
<td>11,403,269</td>
<td>15.00</td>
<td>171,049,026.00</td>
<td>6m under track, 5m Berm</td>
</tr>
<tr>
<td>Cut to Fill 5m to 12m</td>
<td>m³</td>
<td>3,671,768</td>
<td>18.00</td>
<td>66,111,640.00</td>
<td>6m under track, 5m Berm</td>
</tr>
<tr>
<td>Cut to Fill 12m and above</td>
<td>m³</td>
<td>760,960</td>
<td>20.00</td>
<td>15,279,920.00</td>
<td>6m under track, 5m Berm</td>
</tr>
<tr>
<td>Win haul from Stockpile/Borrow Pit</td>
<td>m³</td>
<td>22,471</td>
<td>22.00</td>
<td>494,500.00</td>
<td>Additional material required</td>
</tr>
<tr>
<td><strong>Reinforcement Construction and Capping</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>USD 2,464,009</td>
</tr>
<tr>
<td>Piles, compact and cap from Cut</td>
<td>m³</td>
<td>4,400,000</td>
<td>22.00</td>
<td>97,800,000.00</td>
<td>6m wide trackbed, 2m base, 1400km long</td>
</tr>
<tr>
<td>Piles and compact from borrow</td>
<td>m³</td>
<td>4,400,000</td>
<td>12.00</td>
<td>52,800,000.00</td>
<td>6m wide trackbed, 0.6m cap, 1400km long</td>
</tr>
<tr>
<td><strong>Drainage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>USD 935,713.00</td>
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<td>Steel drainage layer</td>
<td>m³</td>
<td>4,200,000</td>
<td>10.00</td>
<td>42,000,000.00</td>
<td>300mm deep, 6m wide</td>
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<tr>
<td>PVC Cross drains</td>
<td>km</td>
<td>1,400</td>
<td>120,000.00</td>
<td>168,000,000.00</td>
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<tr>
<td>Embankment run-off</td>
<td>km</td>
<td>406</td>
<td>80,000.00</td>
<td>32,480,000.00</td>
<td>65km of embankment</td>
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<tr>
<td>Allowance for embankment protection (grassing)</td>
<td>m³</td>
<td>656</td>
<td>50,000.00</td>
<td>32,800,000.00</td>
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<tr>
<td>Culverts and cross drainage pipes @ embankment</td>
<td>m³</td>
<td>2,132</td>
<td>5,400.00</td>
<td>11,513,000.00</td>
<td>Sample of 3km suggests 1.25 per km</td>
</tr>
<tr>
<td><strong>Bridge works</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>USD 445,953.00</td>
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<tr>
<td>Longitudinal overbridge 20m span</td>
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<td>225</td>
<td>3,750,000.00</td>
<td>841,250,000.00</td>
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<tr>
<td>Longitudinal overbridge 40m span</td>
<td>ea.</td>
<td>53</td>
<td>3,750,000.00</td>
<td>196,250,000.00</td>
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<td>Longitudinal overbridge 60m span</td>
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<td>2,900,000.00</td>
<td>69,000,000.00</td>
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<tr>
<td>Underbridge 20m span, single width</td>
<td>ea.</td>
<td>45</td>
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<td>Underbridge 30m span, double width</td>
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<td>22</td>
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<td>22,450,000.00</td>
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<tr>
<td>Major wastercourse crossing</td>
<td>ea.</td>
<td>8</td>
<td>12,500,000.00</td>
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<td>Vista Main Bridge</td>
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<td>25,000,000.00</td>
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<tr>
<td>Track Work</td>
<td>Unit</td>
<td>Quantity</td>
<td>Unit Price</td>
<td>Total Price</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------</td>
<td>----------</td>
<td>------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>Ballast (500mm deep) Main line</td>
<td>m³</td>
<td>2,940</td>
<td>15.00</td>
<td>44,100.00</td>
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<td>Rail</td>
<td>tonnes</td>
<td>166,000</td>
<td>1,200.00</td>
<td>199,200.00</td>
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<tr>
<td>Sleepers at 600mm centres inc. Fastenings</td>
<td>ea.</td>
<td>2,203,223</td>
<td>60.00</td>
<td>132,193,380</td>
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<td>Switches and crossings (installed)</td>
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<td>105,000.00</td>
<td>62,095.00</td>
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<tr>
<td>Rail lamping and alignment</td>
<td>km</td>
<td>1,400</td>
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**Provisional Signalling Cost**

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<tr>
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<th>Unit</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Total Price</th>
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<td>Interlocking at loops</td>
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<td>Central control equipment</td>
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<td>Central control building</td>
<td>ea.</td>
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<td>Communications equipment (fixed)</td>
<td>ea.</td>
<td>32</td>
<td>50,000.00</td>
<td>1,600,000.00</td>
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<td>Communications equipment (ropes)</td>
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<td>200,000.00</td>
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<tr>
<td>Central Communications Equipment</td>
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<td>10,000,000.00</td>
<td>10,000,000.00</td>
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<tr>
<td>fibre optic backbone and repeaters</td>
<td>km</td>
<td>1,029</td>
<td>1,200.00</td>
<td>1,234,800.00</td>
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</table>

**Ancillary Buildings and Works**

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<thead>
<tr>
<th>Ancillary Buildings and Works</th>
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<th>Unit Price</th>
<th>Total Price</th>
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<td>10,000,000.00</td>
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<td>ea.</td>
<td>4</td>
<td>5,000,000.00</td>
<td>20,000,000.00</td>
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<tr>
<td>Staff accommodation, mess, stores and offices</td>
<td>sum</td>
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<td>12,000.00</td>
<td>12,000.00</td>
</tr>
<tr>
<td>Yard, sidings and ancillary permanent way</td>
<td>km</td>
<td>40</td>
<td>500,000.00</td>
<td>20,000,000.00</td>
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</tbody>
</table>

**Construction sub total**

| Construction sub total                  | USD | 2,932,672.375 |

**BPIC Costs**

<table>
<thead>
<tr>
<th>BPIC Costs</th>
<th>Unit</th>
<th>USD</th>
<th>1,904,182.39</th>
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<tr>
<td>Project Management</td>
<td>sum</td>
<td>945,025,413.11</td>
<td>7.5% of construction cost</td>
</tr>
<tr>
<td>Mobilisation</td>
<td>sum</td>
<td>134,913,773.38</td>
<td>5% of construction cost</td>
</tr>
<tr>
<td>Site Reclamation and remediation</td>
<td>km</td>
<td>1,519</td>
<td>5,000.00</td>
</tr>
</tbody>
</table>

**Base Capital Estimate for Construction Works**

| Base Capital Estimate for Construction Works | USD | 2,239,986.362 |
Appendix 8 Conceptual Alignment Plans

Available in separate PDF, due to file size.
Appendix 9 Legal and Regulatory Regime

There are various Federal and State laws that will be applicable, albeit at different stages, to the Project. For the purpose of this Pre-Feasibility Report, we have considered those laws that must be complied with before the Project can be implemented, or at the very early stages of the Project.


Nigeria is a Federation comprising of a Federal Government, thirty six States and a Federal Capital Territory in Abuja. States are creations of the Constitution of the Federal Republic of Nigeria 1999 (the “Constitution”). Legislative and Executive powers are shared between the Federal and State governments pursuant to the provisions of the Second Schedule (the “Schedule”) to the Constitution, which specifies the matters over which each tier of government has powers to make laws. Part 1 of the Schedule, called the Exclusive Legislative List, contains matters on which only the Federal Government has power to make laws, whilst part 2 of the Schedule referred to as the Concurrent Legislative List contains matters on which both the Federal Government and the States have concurrent power to make laws, implement projects and exercise executive functions on. Item 55 on the Exclusive Legislative List mentions “Railways” as an item in respect of which the Federal Government has the exclusive power to make laws and to regulate. The implication of this is that no State Government or a combination of them can effectively and lawfully engage in railway operations and management without complying with rules, guidelines and legislation made by the Federal Government to regulate rail.

Nigerian Railway Corporation Act

In compliance with the provisions of the Constitution, the Federal Government enacted the Nigerian Railway Corporation Act, Chapter N129, Laws of the Federation of Nigeria, 2004 (“NRC Act”) to provide for the establishment of the Nigerian Railway Corporation (“NRC”) as the regulator of railways. The NRC also presently operates as a monopoly, combining the role of both an operator and a regulator. The general duties of the NRC are specified in section 15(1) of the NRC Act and include the responsibility to “manage and operate, the railway undertaking...and any expansions or extensions thereof and any new railway...” and to “direct and control any expansions or extensions of the railway and the construction of any new railway”. The NRC Act also grants the Federal Ministry of Transportation supervisory responsibility over the NRC.

Section 29 of the NRC Act makes it unlawful for any person, without the consent of the NRC, to construct and operate a railway for the public carriage of passengers or goods within Nigeria. The NRC Act also confers power on the NRC to fix rates and fares as well as make bye-laws and rules for regulating the working and management of railways.
The prior consent of the NRC would therefore be required in order to implement the Project.

**Environmental Impact Assessment Act**

Under the Environmental Impact Assessment Act (“EIA Act”), public and private sector companies in Nigeria are not permitted to undertake or to authorise projects or activities without prior consideration, at an early state, of their “environmental effects”. An Environmental Impact Assessment (“EIA”) is required to be undertaken where the extent, nature or location of a proposed project or activity is likely to have a significant effect on the environment. The term “environmental effects” is defined in the EIA Act as any change that “a project” may cause to the environment, regardless of whether such changes occur within or outside Nigeria as well as any changes in health or socio-economic conditions.

The EIA Act also provides that all institutions (public or private) must apply to the regulator in writing before embarking on a proposed project so that its activities can be identified and environmental assessments applied.

The requirement to conduct an EIA is both in satisfaction of federal and state laws, and as such, there would be a need to liaise with the Federal Ministry of Environment, the National Environmental Standards and Regulations Enforcement Agency (the federal regulator) and the state regulators for each of the States in order to satisfy the requirements of federal and state environmental laws.

**Land Use Act**

The Land Use Act (“LUA”) vests all ownership rights in the land located within a State in the governor of that State. By implication, this means that the approval of the Federal Government is not required for the clearing of the land, or all other land related matters (unless they relate to land which has been designated Federal Government land within the state), as the only consent required is that of the governor of the relevant State.

As part of its powers under the LUA the Governor may compulsorily acquire any land which is required for purposes of overriding public interest (the Project meets this requirement), subject, of course, to payment of compensation in accordance with the LUA. It would be necessary for the Governor of each of the States to grant land rights/right of access in respect of land located in his jurisdiction.

**Pending Legislation**

Below, we have considered two draft bills currently before the National Assembly, which if passed in their current state, may have an impact on the Project.
The Nigerian Railway Corporation Bill 2008:

The Nigerian Railway Corporation Bill ("Railway Bill") is presently pending before the National Assembly. If passed, the Railway Bill will repeal the NRC Act; provide for effective transportation and infrastructure development; provide a platform for railway concessioning and implementation of the National Rail Policy; and determine public service obligations. The Railway Bill provides for modalities for effective and efficient passenger services and the establishment of a regulatory framework for private sector participation in the provision of railway services.

The Railway Bill seeks to empower the NRC to ensure the smooth operation of the rail transport system by undertaking any expansion or extension of any existing railway and any new railway by providing all reasonable facilities for carriage of passengers and goods within and outside Nigeria. The Railway Bill, like the NRC Act, confers on the NRC the power “to fix rates and fares or regulate the fixing of fares by other carriers of passengers or goods in the Corporation” from time to time. This means that if the Railway Bill is passed into law, the consent of the NRC would still be required in order to implement the Project.

National Transport Commission (Establishment) Bill:

The National Transport Commission (Establishment) Bill ("NTC Bill") is also pending before the National Assembly. The NTC Bill seeks to establish the National Transport Commission ("NTC") to provide for an economic regulatory framework for services and supply of goods in the transport sector or regulated industries; and to provide for efficient operations and regulations of the transport sector through consolidation, streamlining and removing the multiplicity and duplicity of regulatory functions by Government and its agencies. The NTC Bill also seeks to prohibit anti-competition practices in the transport sector.

The NTC Bill will apply to the provision of or use of all regulated services and related transport services and facilities in Nigeria. Under the NTC Bill the rail sector is classified as a regulated sector and, if the Bill is passed into law in its current state, will mean that the Project will be subject to NTC regulation.