# TETE IRON ORE PROJECT

## TRAFFIC AND TRANSPORT ASSESSMENT

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EXECUTIVE SUMMARY

The mine will produce 1 Mtpa (million tonnes per annum) of pig iron, with a mine life in excess of 35 years. The pig iron product will be in the form of 20kg ingots or pellets with a mass not greater than 8kg (URB Mining Logistics, 2011). Two packaging options exist: the palletised option (for ingots) or the bulk option (for pellets).

- The palletised option will involve the stacking of ingots on pallets, with each pallet weighing 1 440 kg. The pallets will be shrink wrapped, and loaded and unloaded using forklifts. The advantage of the palletised option is that the ingots can be easily stored and handled, and will not require tipping bulk wagons or semi-trailers.
- The bulk option involves the use of front end loaders to load pellets into end-tipping semitrailers or side tipping bulk rail wagons. This option is quicker and requires less manpower (URB Logistics, 2011).

From site, the mine product will be transported via truck along a dedicated haul road to a transfer station on the Sena–Moatize railway line. The current preferred site for the transfer station is near the town of Moatize. The product will be transported via rail to the port of Beira for export.

In the Pre-feasibility study (SNC Lavalin 2012a), working on the 1Mtpa production scenario, product transport taking place 365 16-hour working days a year, it has been calculated that transport of the product to the Sena-Moatize railway siding will require 82 loaded truck trips per day from mine to siding, which assumes an average payload of around 35 tonnes in a seven-axle vehicle with GVM 56 tonnes. 82 empty trucks a day will return from the siding to the mine site. This means that a truck will be passing a given point on the haul road in each direction every 12 minutes. Importantly, a heavy goods vehicle will cross the EN103 every 6 minutes.

The haul road will be within a defined access corridor, which will also contain a power line, and possibly in the future a rail line. This corridor will consist of a 20m wide raised embankment accommodating the haul road, and future railway line, with a 15m wide servitude alongside the road to facilitate access to the power line. The embankment will be raised a minimum of 1m above natural ground level according to good engineering practice to ensure that the road and rail foundations are protected from the surrounding overland water flows during rain storms and any standing water that results.

The haul road will need to cross the following major obstacles: the Ncondezi River, the Modizo River, the EN103 road linking Mozambique and Malawi, the Sena railway line, and the Vale line under construction.

With regards to the construction period, if it is assumed that:
- The construction period is 18 months;
- The total mass of materials and equipment required for construction is 45 000 tonnes;
- Two-thirds of the total (30 000 tonnes) is delivered in a six-month period during the peak of construction activity;
- The average payload is 25 tonnes (five E80 axle-vehicle: GVM approximately 45 tonnes);
- Deliveries are evenly distributed over an eight-hour day, six days a week;
  - then the average number of heavy vehicles per day, loaded and unloaded, travelling to and from the site, will be approximately 16, or two vehicles an hour.

At this stage it is unknown which route will be used to access the mine site. It seems most sensible to construct the haul road first, before commencing construction on the mine site. The route to site via the north will not be accessible to construction vehicles without significant upgrades.
1 INTRODUCTION

1.1 Project background

Baobab Resources Limited has contracted Coastal and Environmental Services (Pty) Ltd (CES), independent environmental and social consultants of Grahamstown, South Africa, who are licensed to operate in Mozambique, to undertake an Environmental, Social and Health Impact Assessment (ESHIA) for a proposed iron ore mine in Tete Province, Mozambique. This Traffic and Transport Assessment is one of a suite of studies that have been conducted as part of the assessment.

The project will be an open pit mine. Assuming that both the Tenge and Ruoni North deposits are mined, the mine will produce 1 Mtpa (million tonnes per annum) of pig iron, and the mine life will be in excess of 35 years. Titanomagnetite ore will be extracted from the pit by drilling and blasting, and will be transferred using haul trucks to a nearby processing area. The end product of the processing will be pig iron and Ferro-Vanadium. The simplified processing steps are as follows:

1. Concentrate is separated from the ore by crushing, screening, and dry magnetic drum separation.
2. The concentrate is reduced using a series of furnace and kiln combinations.
3. The hot metal product is cooled in a pig casting machine.
4. Vanadium slag, a by-product of one of the preceding steps, is processed in a dedicated roast/leaching plant to produce Ferro-Vanadium, a hardener, strengthener and anti-corrosive additive used in the steel-making process.

The pig iron product will be in the form of 20kg ingots or pellets with a mass not greater than 8kg (URB Mining Logistics, 2011), see Plate 1.1.

Two packaging options exist: the palletised option (for ingots) or the bulk option (for pellets).

- The palletised option will involve the stacking of ingots on pallets, with each pallet weighing 1 440 kg. The pallets will be shrink wrapped, and loaded and unloaded using forklifts. The advantage of the palletised option is that the ingots can be easily stored and handled, and will not require tipping bulk wagons or semi-trailers.
- The bulk option involves the use of front end loaders to load pellets into end-tipping semitrailers or side tipping bulk rail wagons. This option is quicker and requires less manpower (URB Logistics, 2011).

From site, the mine product will be transported via truck along a dedicated haul road to a transfer...
station on the Sena–Moatize railway line. The current preferred site for the transfer station is near the town of Moatize (see Figure 2.1). The product will be transported via rail to the port of Beira for export.

The haul road will be within a defined access corridor, which will also contain a power line, and possibly in the future a rail line. This corridor will consist of a 20m wide raised embankment accommodating the haul road, and future railway line, with a 15m wide servitude alongside the road to facilitate access to the power line. The embankment will be raised a minimum of 1m above natural ground level according to good engineering practice to ensure that the road and rail foundations are protected from the surrounding overland water flows during rain storms and any standing water that results.

1.2 Terms of Reference

Objectives

- Characterise the existing traffic, road network and conditions, and existing infrastructure of the study area;
- Identify and assess key potential issues/impacts on traffic, roads and other infrastructure associated with the construction and operation and de-commissioning of the project.

Assessment Methods

To assess the impact that the project will have on road (and possibly) rail infrastructure and other users of such infrastructure, the traffic study will include the following:

- A description of existing road infrastructure and traffic volumes.
- Estimates of project traffic by vehicle type and time of day.
- An assessment of the potential impacts of the project on traffic and roads in terms of:
  - The risk of road traffic accidents associated with increased traffic generated by the project, during the construction and operation phases of the project.
  - Anticipated changes in traffic volumes during construction and operation.
  - Changes in road condition resulting from project traffic.
  - Closure of public roads within the project area.

The study also takes account of the Mozambican Government’s strategic plans for roads and the prospect of similar new industrial or infrastructure developments, whose nature and purposes may have a bearing on how project roads are located and designed.

1.3 Approach to the study

At this stage in the planning and design of the project it is not possible to quantify the volumes of traffic that will be generated by the project with any precision. However, estimates of traffic volumes have been made based on a thorough review of available project planning documents. These are considered to be sufficient to assess the potential environmental and social impacts of project-related traffic on the roads in the project area, between the project site and the port of entry for equipment and materials, and for product export. The study was informed by a site visit, during which detailed observations were made of conditions on site and candidate transport routes all of which may influence project planning.

During the construction phase it will be necessary to import certain materials and equipment into Mozambique and transport them to the project site. The contractor appointed for the construction of the mine will be responsible for sourcing and obtaining all materials and equipment required for completion of the construction work. Detailed construction plans are not yet available, and it is not possible at this stage to accurately quantify traffic volumes expected to be generated by the delivery of construction-related materials and equipment. It has therefore been necessary to focus on transport routes and potential traffic related impacts. However, in order to make an estimate of
the possible maximum construction traffic volumes some broad estimates have been made about the tonnage of materials and equipment that will typically be required for a project of this kind, the time period(s) in which it will be delivered to site, the types of delivery vehicles, and the routes they will take to reach the site.

Similarly it is not possible to make precise estimates of the volumes of traffic generated during the operation of the mine. However, in this case the most significant generator of heavy goods traffic will be the delivery of product from the mine to the port at Beira, for which the number of loaded and unloaded vehicle trips is generally much higher than for the delivery of materials such as fuels, lubricants and other miscellaneous goods,

Since many of the measures required to mitigate the impacts of increased volumes of traffic on public roads, including impacts related to public safety issues, relate to adherence to prevailing traffic and transport regulations, a summary is provided of the relevant requirements of the Mozambican Road Traffic Code: Decree-Law 1/2011 of 23 March 2011.

1.4 Assumptions and limitations

The source of equipment and materials, the means and routes of transport of construction materials are details that will be decided by the contractor when the construction phase begins. No accurate quantification of traffic expected to be generated during the construction phase can be made until a detailed bill of quantities is available, suppliers of goods and equipment are known, and a timetable of construction activities has been agreed on. Accordingly estimates of vehicle trips must be regarded as preliminary and indicative.

Many aspects of the operation phase are still in the planning stages, and as a result assumptions have had to be made with regard to the likely numbers of vehicles entering and leaving the site, and the quantity of ore processed per annum and the scheduling of transport of product off the mine site. In the quantification of vehicle trips the annual production rate of 1 million tonnes of pig iron and Ferro-Vanadium has been assumed.

1.5 Structure of this report

Chapter 2: Road and rail infrastructure. This chapter provides a description of existing infrastructure surrounding the site.

Chapter 3: Construction phase traffic and transport description. This is a relatively brief chapter presenting currently available information on how the transport aspects of the construction phase of the project will be handled.

Chapter 4: Operation phase traffic and transport description. This chapter presents currently available information on the operation phase of the project, with a focus on traffic and transport issues.

Chapter 5: The Road Code. This chapter presents a thorough review of the Mozambican Road Traffic Code: Decree-Law 1/2011 of 23 March.

Chapter 6: Assessment of impacts. This chapter presents details of the impacts expected to be generated and suggests mitigation measures to avoid the impacts or lessen their severity.

Chapter 7: Summary and recommendations.
2 ROAD AND RAIL INFRASTRUCTURE

2.1 Existing Roads

The routes of existing roads in and around the project area are described in detail in SNC Lavalin’s Technical Report: Civil Infrastructure (SNC Lavalin 2013a), which also assesses the condition of the road surfaces, bridges, culverts and drainage systems. The existing road system in the area is shown on Figure 2.1. The sections following are a summary of SNC Lavalin’s findings.

2.1.1 National Road EN221

- The road is approximately 33.6km long from its junction with National Road EN103 to the Y-junction with gravel road EN222 leading towards the mine site.
- A two-lane asphalt surfaced road, approximately 6.5 metres wide.
- The road surface is in generally poor condition, and has no line markings or reflective cat’s eyes.
- Road shoulder is compacted gravel.
- Speed limit of 40 km/h through villages but no speed limit indicated on open road. Most vehicles observed to travel approximately 100 km/h or more.
- Road used by cyclists, motorcyclists, slow-moving rigid trucks and pedestrians, but limited numbers of heavy goods vehicles.
- Road passes through at least three formal settlements with street lights, and crosses numerous bridges and culverts.

Plate 2.1: Typical road damage on the EN221
Source: SNC Laval 2013a
Figure 2.1: Existing roads and railways in the project area
2.1.2 EN222

- An engineered gravel road which branches off from EN221 just before the village of Matema, 36.4km to the village of Machenga at a junction with an off-road track leading to Baobab’s exploration camp.
- Approximately 5 metres wide, from shoulder to shoulder.
- The surfacing includes large loose and exposed aggregate.
- Crosses more than 100 streams and rivers via small concrete bridges, concrete overflow culverts, concrete drifts, and standard corrugated mild steel pipe culverts.
- Some stretches of the road, especially on approaches to some of the drifts, will not be passable by large articulated vehicles.

Plate 2.2: Typical stretch of EN222
Source: SNC Laval 2013a

2.1.3 EN459

- An unpaved track leading from Machenga on the EN222 leading to the village of Muchena near the Revuboe River.
- Suitable only for off-road vehicles
2.1.4 National Road EN103

- Main road from Harare, Zimbabwe (where it is designated A2) through Mozambique to Zobue on the Mozambique / Malawi border, via Tete.
- The road crosses the Zambezi River in Tete via the recently-refurbished Samora Machel catenary (suspension) bridge, which carries approximately 800 trucks every day.
- A new bridge across the Zambezi is under construction (nearing completion) about 5km downstream from the Samora Machel Bridge, which will bypass Tete and re-join the EN103 a short distance west of the existing Revuboe River crossing. The new bridge will take all heavy traffic.
- A two-lane asphalt-surfaced road, approximately 6 metres wide, without any line markings or reflective cat eyes.
- Potholes as large as 2m diameter and 400mm deep were observed along the road, which is locally considered unsafe to travel at night since trucks avoid the potholes and encroach on the oncoming lane.
- Road shoulder is of compacted gravel.
- Speed is limited to 30km/hr through the centre of the town of Moatize, 40 km/hr when travelling through villages and not indicated when on the open road, where most vehicles were observed to travel approximately 100 km/h or more.
- Road used by a large number of long-haul articulated heavy goods vehicles, cyclists, motorcyclists, slow-moving rigid trucks and pedestrians.
- Road passes though Moatize and a number of formal villages, and crosses numerous bridges and culverts. The Samora Machel Bridge is restricted to maximum 8 tonne (E80) axle loads and 48 tonne GVM, but this restriction will not apply to the new road bridge.
2.2 Proposed Haul Road

A number of routes have been investigated for the construction of a dedicated haul road between the mine site and the existing Sena-Moatize railway line.

Factors considered in identifying the route of the access corridor were as follows:

- The position of villages and farms;
- A suitable point for crossing the Ncondezi river;
- The tenements of other miners and positioning of their infrastructure;
- Engineering requirements such as slopes and soils.

All the routes cross the Ncondezi River and the EN103, and join the railway at a point between Moatize and Caldas Xavier, some 50km west of Moatize, where the railway turns south towards Beira. Route Option 7 is currently the preferred route, which crosses the EN103 and joins the railway a short distance east of Moatize.

A number of village clusters were identified along the route of the haul road, using Bing imagery dated August 2011. In addition, a number of tracks and roads were noted, crossing the route of the haul road, which are used by local communities to access cultivated areas and other villages (see Figure 2.2).

2.2.1 Ncondezi River Crossing

The Ncondezi River runs from east to west, about 10km south of the project area, and separates the project area from the Sena-Moatize Railway. It will be necessary for the access corridor to cross this river, the proposed crossing point being at 15°52'0.68"S 33°52'7.54"E.

The bridge will be designed to span the river and its floodplain, with a total length of around 170m. The bridge will be standard concrete beam and slab-type causeway, with spans of between 20 and 30m. The deck width will be about 14m to accommodate the haul road and to make provision for a possible railway line in the future. The gradient of the approaches to the bridge will need to be of the order of 1% maximum to accommodate the railway line, and this will mean a cutting on the
north bank and a filled embankment on the south bank.

The river at the crossing point is illustrated in Plate 2.5.

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<th>Downstream of crossing point</th>
<th>At the crossing point</th>
<th>Upstream of crossing point</th>
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Plate 2.5: Ncondezi River: proposed haul road crossing point

### 2.2.2 Modizo River Crossing

The haul road will cross the Modizo river at the following co-ordinates: 16°7’25.88”S; 33°48’29.76”E. The Modizo river is shown in Plate 2.6 (not the crossing point).

Plate 2.6: The Modizo river
2.2.3  Sena railway line crossing

The haul road will need to cross the existing Sena-Moatize railway line, and the Vale railway line currently being constructed next to it, to reach the transfer station.

Plate 2.7: The Sena-Moatize railway line.

Plate 2.8: A train on the Sena-Moatize railway line.
Figure 2.2: Villages and road crossings identified* within the haul road buffer

* Identified using Bing Aerial Imagery dated August 2011. Arrows indicate tracks and minor roads running within or perpendicularly across the proposed haul route. The area shown as “No Data” could not be analysed due to lack of imagery.
2.3 Rail Transport

A logistics study conducted in 2011 (URB 2011: reported in SNC Lavalin 2012a) investigated various options for transporting product from the Baobab mine by rail to a port for export. A range of options, including using existing rail routes and constructing new ones, were investigated, which are briefly described below. Currently the preferred option is to transport product via the new haul road to a siding on the Sena-Moatize railway line, at a point known as the “Reinaldos Patch” (see Figure 2.1), and then onwards via the railway to Beira (Option 1). Mining companies Vale and Rio Tinto have already established rail sidings in the Moatize area to handle their operations.

1. Option 1: Moatize to Beira Port via Sena
   • The line from Moatize to Sena has been partially upgraded to a capacity of 5Mtpa. Beira Port is currently being upgraded to a capacity of 20Mtpa.
   • Sections of the route have a speed restriction of 10–15 km/h, and 200 km of the track is still 40 kg/m rail, instead of 45 kg/m as required.

2. Option 2: Tete to Nacala Port #1
   • Road transport from Tete to Blantyre in Malawi.
   • Product offloaded at Blantyre and deposited onto rail bound for Nacala.
   • Nacala line, which is a narrow Cape gauge (1.067m), will need to be upgraded from 0.25Mtpa capacity to between 40 and 60 Mtpa by 2016.
   • Nacala Port will need to be upgraded from capacity of 1.5Mtpa to 16Mtpa within 20 years.

3. Option 3: Tete to Nacala Port #2
   • New 218km railway line from Moatize to Liwonde in Malawi. Is being promoted by Vale.
   • At Liwonde will link to Nacala railway.
   • Will require upgrading of Nacala line and the Port.

4. Option 4: Tete to Nacala Port #3
   • New 1 010 km railway line from Moatize to Nacala Port.
   • Will run through Mozambique and along the southern border of Malawi.
   • Will require upgrading of the Nacala Port.

5. Option 5: Moatize to a new port established north of the Zambezi River mouth
   • New railway line, approximately 500km long, to run from Moatize to a new deep water port to be established near Quelimane.

2.4 Alternative transport arrangements:

2.4.1 New railway from Moatize to new port

Option 5 above is part of the Integrated Transport Development (IDT) project being promoted by the Mozambique Coal Industry Export Initiative (MCIEI). IDT is a joint venture involving Rio Tinto, Minas de Revuboe, and the Ncondezi Coal Company amongst others. They are seeking support to build a new high speed rail link from Moatize to a new port to be constructed somewhere between the Zambezi river mouth and the town of Quelimane. The ITD is planned to have a capacity of 25-100Mtpa. The proposed port would be capable of accommodating Cape-sized vessels (150,000 long tons deadweight). Should this development become a reality Baobab may consider using it.

2.4.2 River barging down Zambezi

In 2011/12 Rio Tinto investigated the option of barging product down the Zambezi River to ships waiting at Chinde. Rio Tinto undertook an EIA, which was submitted to the Mozambican authorities in late 2011 / early 2012. The authorities refused authorisation, citing the potential negative impacts as a reason. The government has indicated its preference for the use of rail, deeming it less environmentally destructive.
3 CONSTRUCTION PHASE TRANSPORT DESCRIPTION

Project implementation will be undertaken by an Engineering, Procurement, Construction and Management (EPCM) Contractor, who will be appointed by Baobab to manage and supervise the engineering, equipment and material supply, and complete the construction of the plant. At this stage, without a detailed construction plan formulated by the EPCM Contractor, it is not possible to quantify the volumes of traffic which will be generated by the mine construction.

Some estimates are, however, made of the quantities of materials required for construction, the time periods over which they will be delivered, and the types of vehicles in which they will be delivered, to derive an indicative estimate of heavy traffic volumes to and from the site.

3.1 Traffic generation

A range of vehicle types are likely to be used during the construction of the mine. Heavy vehicles which will be required to transport goods, materials and equipment to site will include three, five and seven axle trucks; flatbed semi-trailers and, possibly, road trains pulling a number of trailers. Tracked vehicles such as excavators and bulldozers will be transported to site on lowloaders. It is probable there will be some abnormal loads for large items such as transformers that cannot be assembled on site. Tete is experiencing an economic boom due to mineral resources discovered in the area, and various medium- to large-scale construction projects are already underway (including the construction of the new bridge spanning the Zambezi River, approximately 5km downstream of the existing Samora Machel catenary bridge). As a result there are, in all likelihood, numerous contractors familiar with the area, and with teams and equipment already in the Tete area, thereby reducing the impact of long-haul transport of construction equipment to site.

An accommodation camp will need to be constructed to house construction workers, but since the accommodation camp and the mine infrastructure will all be within a defined, access-controlled mine area, no impact is expected on external, public roads once vehicles enter this defined area.

The major structural elements at the mine site, for which building and other materials will be required, are:

- The tailings storage facility (TSF);
- The beneficiation plant, which will include: crusher and screening units, dry magnetic cobber, hydrocyclone, process water dam;
- A production plant, which will include: multi-hearth furnace, rotary kiln, transfer flask, waste heat boiler, melting furnace;
- Ancillary offices and infrastructure, including: staff accommodation, workshops, kitchens, recreation areas, laundry rooms, fuel storage depots, concrete mixing area, water treatment facility and a sewage treatment plant.

The detailed design of the mine and the ancillary structures on site is not yet at a stage where accurate estimates of quantities and weights of materials and equipment are available. The main items of equipment and materials transported will be:

- Structural steelwork;
- Ready-mixed concrete, or aggregate, sand and cement for on-site batching;
- General civils and building materials (falsework, bricks, cement);
- Pre-assembled items of equipment for the processing plant (crushing; milling, regrind, product handling), electricity distribution system, and wastewater treatment plant;
- Pumps and pipes for the water supply system;
- Construction plant and machinery.

In addition, construction staff and personnel will have to be transported to the site during construction, as well as consumable materials such as fuel and lubricants.

If it is assumed that:
• The construction period is 18 months;
• The total mass of materials and equipment required for construction is 45 000 tonnes;
• Two-thirds of the total (30 000 tonnes) is delivered in a six-month period during the peak of construction activity;
• The average payload is 25 tonnes (five E80 axle-vehicle: GVM approximately 45 tonnes);
• Deliveries are evenly distributed over an eight-hour day, six days a week;

- then the average number of heavy vehicles per day, loaded and unloaded, travelling to and from the site, will be approximately 16, or two vehicles an hour.

If the peak delivery period is reduced to four months the average number of heavy vehicles per day increases to 24, and the hourly rate increases to three.

These numbers of vehicles represent a very small percentage of the estimated 800 heavy vehicles per day crossing the Samora Machel Bridge in Tete (SNC Lavalin 2012a) and travelling along the EN103.

3.2 Trip distribution

During construction all materials will be sourced locally where economically feasible. The following routes have been identified for long-distance haulage of equipment and materials that are not available locally (Coffey Mining, 2013):

1. South African ports (Richards Bay, Durban, Port Elizabeth, East London) to Johannesburg by rail or road, N1 South African national road or rail from Johannesburg to Zimbabwe border at Beitbridge, along A4 Zimbabwean national road or rail to Harare, along A2 Zimbabwean national road to the Zimbabwe / Moazambique border at Nyampanda, along EN103 Mozambican national road to Tete.
2. Beira port in Mozambique by Sena rail to Cambulatsitsi siding near Caldas Xavier (depending on infrastructure capability) or Moatize siding.
3. Beira port along the EN6 Mozambican national road towards Zimbabwe, north at Gimo onto the EN102 Mozambican national road, onto the EN103 Mozambican national road at Changara towards Tete.
4. Nacala port in Mozambique along the Nacala rail to Blantyre in Malawi, S137 Malawian national road from Blantyre to junction with S103, along S103 Malawian national road to the Malawi / Mozambique border at Zobue, EN103 Mozambican national road to Tete.
5. Nacala port along the EN8 Mozambican national road to Malawian border at Mandimba, M3 Malawian national road to junction with S131, S131 Malawian national road to junction at Liwonde, undesignated Malawian national road to junction with S103 at Tseka, along S103 Malawian national road to the Malawi / Mozambique border at Zobue, EN103 Mozambican national road towards Tete.
6. Tete International Airport can accommodate cargo planes to carry small equipment and materials. There is a possibility of the mining company that owns the tenement mining the airport site. This will require relocating the airport to a new site, and logically rebuilding it to accommodate cargo planes with larger load capacity. However, at present air transport is not a viable option for large equipment or large tonnages of materials.

Irrespective of the route by which construction traffic travels towards the site (and it is possible that materials and equipment will use all the routes described above), all vehicles will eventually travel along the stretch of the EN103 between Tete and Cana-Cana, some 50km north-east from Tete.

There are two possible routes by which construction traffic can travel to the mine site from the EN103:

1. Via the new haul road in the access corridor. During construction a temporary structure may be built across the Ncondezi River. The haul road will be gravel surfaced, and will only be upgraded to asphalt during the operations phase, since there is a risk that an asphalt surface
will be damaged by construction traffic. Traffic arriving from the south, via Tete, will travel through the centre of Moatize, a distance of about 9km. The junction of the EN103 and the haul road must be carefully designed to minimise the hazard presented to through traffic caused by heavy vehicles turning from or onto the EN103, and will almost certainly require the construction of auxiliary accelerating and decelerating lanes. All alterations to the national road must be approved by the Mozambican traffic authorities.

2. Via the EN221, EN222, EN459, or a new section of road going south, to the Revuboe River, thence across the river to the mine site. This will require repairs to portions of the EN222, including vertical realignment at some of the watercourse crossings, upgrading of the EN459, or the construction of a new road, or both, and a substantial, probably temporary, bridge across the Revuboe River. Traffic arriving from the north will travel through the town of Moatize, a distance of about 9km.
4.1 Product transport

The output of the mine (the product) will be pig iron ingots and Ferro-Vanadium. In the base case scenario that has been considered in the Pre-feasibility Study (Coffey Mining 2013), 1 million metric tons per annum (Mtpa) of pig iron will be produced from the mining of the Tenge and Ruoni North Pits. Under this production scenario, the mine will have a life of 37 years.

Mining will be undertaken by conventional open pit mining, involving drilling, blasting, loading and hauling ore to the processing area, which will be located nearby. 120-250 tonne hydraulic excavators will load ore onto off-highway dump trucks with capacities of 60 to 150 tonnes. Haul roads within the mine area will be 30 metres wide, including drainage, giving the roads a running width of 25 metres. Mining operations are scheduled for 365 days a year, but abnormal (but not unexpected) events such as heavy downpours may suspend mining activities temporarily. The crushing plant will operate continuously except for planned maintenance periods. Pig iron production is planned for 80% of production capacity in year 1, ramping up to 100% in year 2.

From the mine, the product will be transported along a dedicated haul road to the “Reinaldos Patch”, the site for the road-to-rail transfer station that will be located on the Sena-Moatize rail line and east of Moatize. This haul road will need to cross various obstacles including: the Ncondezi River, the EN103, the Modizo river, the Vale railway line that is under construction, and the existing Sena-Moatize line itself. Project engineers and management are in the process of determining how best to safely cross the railway lines, which are relatively close together (10 to 20 metres at the haul road crossing point.

The two candidate options for crossing the railway lines are a bridge spanning both lines, or a conveyor constructed either over or under the lines. The conveyor option will require the construction of infrastructure to transfer product from road trucks onto the conveyor. A further sub-option is to extend the route of the conveyor to a road-to-conveyor transfer station on the north side of the EN103 highway, which is some 4.5km north of the rail lines. The long conveyor option has the advantage of obviating the need for special arrangements to manage traffic safety at the haul road / EN103 crossing.

The haul road will be 20 metres wide (and may in future include a railway), and will run within the access corridor. Also within the access corridor will be a 220 kV power line. During the construction phase, it has been recommended (Coffey Mining, 2013) that this road remain as gravel surfaced, but in the operations phase it will be upgraded to asphalt. This is to prevent the asphalt road being damaged during the construction phase.

An asphalt road could have advantages in terms of:

1. Safety. Better road conditions, reduced skid risk, road markings, reflective cat’s eyes and crash barriers will reduce the risk of accidents;
2. Dust suppression;
3. Maintenance costs and lifespan of haul trucks.

The Sena-Moatize railway line has been partially upgraded and now has a capacity of 5Mtpa, indicating that it could serve to transport product to Beira, from where it will be exported. Other potential routes to a port have been considered and are described in Chapter 2. However, this study and assessment will only focus on the transport plan described thus far.

Transport arrangements may change in the future, since establishment of a new rail link from Moatize under the proposed Integrated Transport Development (ITD) project will enable Baobab to construct a railway from the mine, in the access corridor, linking directly into the new line and avoiding double handling of product at the railhead.
Baobab will establish a siding on the Sena-Moatize line in an area known as the Reinaldos patch, about 5 km east of Moatize. This is currently an undeveloped area.

The access corridor will need to cross the Ncondezi river, the EN103, the Modizo river, a rail line currently being built by Vale, and the existing Sena-Moatize line. The Ncondezi river crossing is discussed in more detail in Chapter 2. The EN103 is a two lane surfaced road which, in many places, is without any line markings or reflective cat eyes (SNC Lavalin, 2012a). The road is approximately 6 metres wide with a shoulder of compacted gravel. The road is surfaced with a medium, continuously graded concrete asphalt (Plate 5.1; and see also Plate 2.4 for typical road surface damage). A variety of different road users travel the route (SNC Lavalin 2012a):

- Regular private passenger vehicles;
- Buses and taxis;
- Pedestrians and cyclists;
- Motorbikes;
- Medium sized rigid trucks;
- Large numbers of large articulated trucks.

Arrangements will need to be put in place to ensure that the hazard presented by large product haul trucks crossing the national road is minimised.

Plate 4.1: The EN103 at the haul road crossing point, looking west towards Moatize
4.2 Workforce transport

Although the biggest source of operations phase traffic is expected to be due to heavy truck traffic related to the transport of product, there will also be increased light and medium-heavy passenger vehicle traffic due to the transport of mine employees and contractors. At this stage it is not known how large the operations phase workforce will be, or how the workforce will be divided between locals (those living within the surrounding villages, or Tete or Moatize) and outsiders (including people from other parts of Mozambique and foreign workers and contractors).

It should be possible to source most of the unskilled labour from the numerous villages surrounding the mine area, which includes Nhambia, Nhamidima, Matacale, Muchena, Nkakame, Tchissi, Massamba, Caundo, Kapenda, and other smaller settlements the names of which are not known.

Access in the area is difficult in the rainy season, therefore the mine will probably need to upgrade existing access routes to a standard that allows them to be used by a 2-wheel drive passenger vehicle all year round, such as the buses which will probably be used to ferry workers from collection points to the mine, and return them at the end of their shift.

There will also be a number of skilled workers coming to site from further afield than Tete for their
shifts. These individuals will typically stay on site for 3 to 6 weeks, with 1 to 2 week rest periods thereafter. To arrive on site, this section of the workforce will need to fly in and out via Tete Airport, and be transported to site via road, more than likely along the haul road.

The magnitude of personnel-related traffic on the haul road will probably be relatively insignificant in comparison to product transport in the operations phase. Personnel transport will increase morning and evening traffic on the EN103, but the number of vehicles will be a relatively small proportion of existing traffic, and will not prejudice the free-flow capacity of the road.

4.3 Equipment and supply transport

4.3.1 Production supplies

The day to day functioning of the mine will require the delivery of certain consumables. These are expected to be:

- The delivery of production supplies to the mine, including:
  - Diesel,
    - Estimated consumption of 2.5 million litres per annum until year 18, and 7.7 million litres per annum from year 19 to 31. Up until year 18, the mine will require one delivery of fuel approximately every 3 days, assuming 22,000 litre delivery tankers. From year 19 to 31, this will increase to one delivery per day (or 2 trips: one loaded to site, one empty away).
  - Explosives,
  - Oils,
  - Chemicals,
  - Spare parts.

Depending on how power for the mine will be sourced, the delivery of fuel to site could become more significant. A few options have been considered in previous studies:

1. Self-generation with Heavy Fuel Oil (HFO) or Diesel
   a. It is estimated that the total power requirement for the mine will be 100MW (SNC Lavalin, 2012b). To generate this power using HFO and Diesel has been determined to be prohibitively expensive, and would require great volumes of fuel to be delivered to site. This is an unlikely option for the operations phase, although generators will be used in the construction phase until power infrastructure is established.

2. Self-generation using coal from a nearby supplier (such as the Ncondezi Coal Company located immediately south of the mine area).
   a. It has been roughly estimated that to produce 100MW of power will require 860 metric tons of coal per day (50 trips a day (loaded and empty) assuming a payload of 35 tonnes). This depends on the quality of the fuel (an average of 29 MJ/kg assumed) and plant efficiency - 35% assumed (SNC Lavalin, 2012c).
   b. Considering this quantity of coal, it would make more sense to establish the power generation plant close to the source of coal, and transfer power generated to the mine using overhead power lines.

3. National grid
   a. This option will require construction of an overhead power line to site.

Both options 1 and 2 could potentially lead to an increase in operations phase traffic. It is understood that currently the preference is for option 2, with the power generation plant to be established close to the coal source.

4.3.2 Domestic supplies

In the absence of information on the size of the operations phase workforce it is difficult to accurately quantify the volume of traffic which will be generated due to delivery of domestic
supplies to site during the operations phase.

The supplies will come from Tete / Moatize, deliveries vehicles will travel along the EN103 and then north on the haul road to site, and will be by light delivery vehicles. The volume of traffic will be small compared to existing traffic volumes.
5 THE MOZAMBIAN ROAD CODE

This chapter presents a summary of the Mozambican Road Code, Decree-Law 1/2011 of 23 March. Only those sections deemed pertinent to Baobab and its mine operations have been presented. The Mozambican Road Code is an over-arching document, presenting the framework for the laws on Mozambican roads. Some specific details have been left to be defined in the regulations. The regulations necessary for effective enforcement of this code, are approved by the Minister responsible for overseeing the transport sector.

Article 9 (Traffic control), paragraph 1:

“Traffic control is the responsibility of:
 a) The National Vehicle Institute (INAV), on all roads;
b) Administrative bodies or Municipalities, within towns.”

Article 10 (Traffic oversight), paragraph 1:

“The overseeing of compliance with the provisions of this code, and other transport legislation, shall, without prejudice to other entities with specific responsibility, be the responsibility of:
 a) The traffic police (PT);
b) The National Vehicle Institute (INAV);
c) The National Roads Administration (ANE), in the case of national roads; and municipalities in the case of municipal roads, streets and rural roadways.

Article 14 (Hierarchy of rules), paragraph 2:

“The hierarchy of rules derived from signposting, is the following:
 a) Rules of temporary signposting, which modify the normal road use regime;
b) Rules resulting from illuminating signs;
c) Rules resulting from vertical signs;
d) Rules resulting from road markings.

Practical interpretation: All drivers associated with the mine should be aware that this is the order in which to obey road rules.

Article 22 (Traffic at intersections, junctions and traffic circles), paragraph 4:

“At intersections and junctions, drivers may not overtake.”

Article 23 (Signalling of manoeuvres), paragraph 1:

“When a vehicle commences travelling, slows down, stops, changes direction of travel or lane, starts to overtake or changes it’s direction of travel, and in all in which it is necessary to indicate it’s approach, the driver shall be obliged to use a mechanical light or sound device, or, in the absence thereof, his arm, to make the corresponding signal, as per regulations, with due warning.”

Paragraph 2:

“The measure shall continue to be effected, and shall cease as soon as it has been concluded.”

Article 24 (Sound signals), paragraph 1:

“Sound signals shall be brief, used moderately, and shall in no case be used to protest against traffic interruptions, or as ways of calling others”

Paragraph 3 states:
“It shall only be permissible to use sound signals in the following cases:
   a) Imminent danger;
   b) Outside of towns, to warn a driver of the intention to overtake him, and also on bends, intersections, junctions and slopes with reduced visibility”

**Practical interpretation:** Drivers will need to use their hooters appropriately, in accordance with this paragraph.

**Article 31** (Slow travel), paragraph 1:

“Without prejudice to the maximum limits set down, vehicles shall not travel so slowly as to cause an unjustified hindrance to the remaining road users.”

**Practical interpretation:** This has important implications for mine vehicles carrying heavy loads, which as a consequence are travelling very slowly.

**Article 33** (Speed limits), paragraph 1:

“Without prejudice to the provisions of articles 29 and 32, and the lower limits which may be imposed in terms thereof, drivers may not exceed the following instantaneous speeds (in kilometers per hour):

<table>
<thead>
<tr>
<th>Classes and types of vehicles</th>
<th>Speed in km/h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inside of towns</td>
</tr>
<tr>
<td>Mopeds and quadricycles</td>
<td>40</td>
</tr>
<tr>
<td>Motorcycles</td>
<td></td>
</tr>
<tr>
<td>Simple:</td>
<td>50</td>
</tr>
<tr>
<td>With side car</td>
<td>50</td>
</tr>
<tr>
<td>Light vehicles</td>
<td></td>
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<tr>
<td>Passenger and mixed use:</td>
<td></td>
</tr>
<tr>
<td>Without trailer</td>
<td>60</td>
</tr>
<tr>
<td>With trailer</td>
<td>60</td>
</tr>
<tr>
<td>Goods:</td>
<td></td>
</tr>
<tr>
<td>Without trailer</td>
<td>60</td>
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<tr>
<td>With trailer</td>
<td>60</td>
</tr>
<tr>
<td>Heavy automobiles:</td>
<td></td>
</tr>
<tr>
<td>Passenger</td>
<td>60</td>
</tr>
<tr>
<td>Goods and mixed use</td>
<td>60</td>
</tr>
<tr>
<td>Agricultural tractor with or without trailer</td>
<td>30</td>
</tr>
</tbody>
</table>

**Practical interpretation:** Vehicles associated with the mine are likely to be: Passenger and mixed use, Goods with trailers, Heavy automobiles (passengers and goods/mixed use). Drivers of these vehicles will need to be instructed to obey the speed limits described in this article.

Paragraph 3:

“Without prejudice to the provisions of Article 31, on freeways, drivers may not drive their vehicles at a speed of less than 40 km/h.”

**Article 43** (Overtaking), paragraph 6:

“All drivers of vehicles or animals are obliged, whenever there is no impeding obstacle, to immediately facilitate overtaking by moving as far left as possible, and not increasing their speed while being overtaken.”
Practical interpretation: Slow moving transport vehicles are likely to be overtaken frequently by other road users. They will need to be aware of this requirement.

Paragraph 8:

“Except during the time necessary to perform overtaking, heavy vehicles, when travelling outside of towns, shall keep a distance of not less than 50 metres between them.”

Practical interpretation: An important consideration for mine vehicles driving in convoy.

Article 50 (Places at which stopping or parking is prohibited), paragraph 1:

“It is forbidden to stop or park:

a) On bridges, in tunnels, at level crossings, at underpasses and overpasses, and in all places of insufficient visibility;

b) Less than 5 metres from either side of an intersection or junction, without prejudice to the provisions of line (a) of paragraph 2;

c) Less than 3 metres in front, or less than 15 metres on either side, of signs indicating the stopping of vehicles employed for the collective transport of passengers, depending on whether this runs on rails, or not;

d) Less than 5 metres from areas marked for the crossing of pedestrians and velocipedes;

e) Less than 20 metres before traffic lights placed at the entrance to intersections and junctions, and next to signs or traffic lights, if the height of the vehicles, including their cargo, conceals these signs;

f) In bicycle lanes, on directional islands, on the central plazas of traffic circles with circular vehicle movement, on sidewalks and at other places designated for the travel of pedestrians;

g) On the carriageway, whenever this is marked with a continuous longitudinal line, and the distance between this and the vehicle is less than 3 metres;

h) 10 metres from level crossings in the case of those vehicles which transport explosive substances.”

Practical interpretation: Important regulations for drivers of vehicles used for the transporting of passengers and goods, these rules specify the places where it is illegal to stop or park.

Article 54 (General rules), paragraph 1:

“It is forbidden to enter or exit, load, unload, or open the doors of vehicles which have not stopped completely.”

Article 55 (Transport of passengers), paragraph 3:

“The transport of passengers of a number exceeding the seating of the vehicle, or in a manner which compromises their safety, or the safety of driving, is prohibited.”

Paragraph 4:

“The transport of unseated passengers is equally prohibited, except in exceptional situations, to be defined in regulations.”

Article 56 (Transport of cargo), paragraph 1:

“Loading and unloading shall be done at the back of the vehicle, or on the side of the edge of the carriageway against which the vehicles is stopped or parked.”
Paragraph 3:

“When placing cargo, it shall be verified that:
   a) The vehicles equilibrium is duly assured, whether stopped or on route;
   b) The cargo cannot fall on the road, or oscillate in a manner which makes it’s transport
dangerous or difficult, or result in the projection of debris onto the public roadway;
   c) It does not reduce the driver’s visibility;
   d) It does not drag on the ground;
   e) It’s capacity for transporting animals is not exceeded;
   f) A height of 4.3 metres from the ground is not exceeded;
   g) In the case of vehicles intended for the transport of passengers, or mixed cargo, that these
do not exceed beyond the contours of the vehicle, and that the correct signalling,
illumination and registration devices are maintained;
   h) In the case of vehicles intended for the transport of goods, such goods fit within the limits of
the cabin, in length and width, except in exceptional situations set out in regulations;
   i) In the case of bulk goods, that these do not exceed the height of the top of the dropsides or
similar devices.”

### Practical interpretation:
This article provides specifications for the size of cargo that may be carried.

Paragraph 4:

“At stopping places, during loading and unloading operations, and when parked, a vehicle shall be
positioned in the direction of traffic, parallel to the edge of the carriageway, and against the curb,
duly signposted exceptions being permissible.”

Article 58 (Special authorisation), paragraph 1:

“On the conditions set out in regulations, the National Vehicle Institute (INAV) may permit the travel
of vehicles of a weight or dimensions which exceed those set out in law, or which transport
indivisible objects which exceed the limits of their respective cabins.”

Paragraph 2:

“The authorisations referred to in the previous number [paragraph 1] require the issuing of a
favourable opinion by the National Roads Administration (ANE) and the municipal authorities, in
accordance with the cases in question, regarding the nature of the surface, the resistance of
artworks on the authorised routes, or the technical characteristics of public roads, making it a
condition that these vehicles only be used on public roads which have the necessary technical
characteristics therefor.”

Paragraph 5:

“The owners of these vehicles may be required to provide a guarantee, or insurance, aimed at
guaranteeing the payment of civil liabilities flowing from damage imputable to them, as well as
other guarantees necessary or convenient for traffic safety.”

### Practical interpretation:
In the event of having to transport an abnormal load to site, these three paragraphs from article 58 will provide the reader with information regarding the legal procedure to be followed.

Article 59 (General rules [Section VIII - Lighting]), paragraph 1:

“Those illumination and light signalling devices, and reflectors, with which a vehicle shall be
equipped, as well as their respective characteristics, shall be defined in regulations.”
Article 61 (Situations in which lights must be used), paragraph 2:

“The use of floodlights is prohibited whenever meteorological or environmental conditions do not justify it.”

Article 64 (Travel of vehicles which perform special transport), paragraph 2:

“Vehicles which transport powdery and inert materials, shall travel in a manner so as to avoid the dispersion of these materials into the air or soil, by being covered by tarpaulins or canvasses of suitable dimensions.”

Practical interpretation: This paragraph states that the mine product must be suitably secured during transport.

Article 72 (Freeways), paragraph 1:

“Pedestrians, animals, animal-drawn vehicles, velocipedes, mopeds, motorcycles with cylinders exceeding 50 cm³, agricultural tractors, as well as vehicles or convoys of vehicles which cannot reach speeds of 40 km/hr when travelling on the level, may not travel on freeways and their respective accesses, when duly signposted.”

Practical interpretation: As there are no freeways along the transport route at the time of writing, this article is not currently relevant.

Article 74 (Transport of heavy goods vehicles or of vehicle convoys), paragraph 1:

“On freeways, or stretches of freeways with three or more lanes of traffic travelling in the same direction, the drivers of heavy goods vehicles, or of vehicle convoys, the length of which exceeds 7 meters, may only use the two traffic lanes on the furthest left hand side.”

Article 79 (Sound pollution), paragraph 1:

“The driving of vehicles, and loading and unloading operations, shall be done in such a way as to avoid creating a disturbing noise.”

Paragraph 2:

“The transport of vehicles which emit noise of a level exceeding the maximum limits set out in regulations, prohibited.”

Article 81 (Driving under the influence of alcohol, narcotics or psychotropic substances), paragraph 3:

“A driver shall be deemed to be under the influence of alcohol if his blood alcohol level is equal or superior to 0.3 mg/l when tested using a breathalyser, or by way of a blood test.”

Practical interpretation: The legal blood alcohol limit under which a driver can operate a vehicle is defined in this paragraph.

Article 88 (Professional driving of transport vehicles), paragraph 1:

“The performance of paid services is only permissible in the case of holders of professional driver’s licenses.”
Paragraph 2:

“For reasons of safety, times of driving and of rest may be defined for professional drivers of transport vehicles, and the presence of more than one person qualified to drive the same vehicles, may be required.”

**Practical interpretation:** These paragraphs state that drivers used in the transport of goods must hold a “professional” drivers licence. It may also be required that a relief driver is present, if a schedule of driving and rest is not defined.

**Article 91** (Signs for indicating danger), paragraph 1:

“All motor vehicles in circulation, except those having only two or three wheels, motor cultivators and tractor cars, shall be equipped with two reflective signs for indicating danger, and one reflective jacket.”

**Practical interpretation:** This paragraph states that all mine vehicles will need to be equipped with 2 triangles and a reflective jacket, for breakdown or other dangerous situations in which their use would seem applicable.

Paragraph 2:

“The use of a sign for indicating danger shall be obligatory:

a) During the day, whenever the vehicle is immobilised, totally or partially, on the carriageway, or whenever goods which have fallen onto the road surface are not visible for a distance of at least 100 metres;

b) At dusk, or at dawn, in any circumstances or vehicle immobilisation, or of goods having fallen onto the carriageway or onto the shoulder, except in places where lighting conditions allow this to be easily seen from a distance of 100 metres, without prejudice to the provisions of this code, as regards vehicle lighting;

c) In towns, in situations in which the placing of warning triangles is not viable, the broken down vehicle must be signposted by way of the simultaneous use of all indicator lights.

**Practical interpretation:** Guidelines for the use of warning triangles and hazard lights during breakdown situations.

Paragraph 4:

“Heavy vehicles and trailers with a gross weight exceeding 10,000 kg, or which are longer than 6 meters, shall be equipped with yellow reflective marks, so as to enable their easy identification on the public roadway.”

Paragraph 5:

“In the circumstances referred to in number 2, the person who attends to the placing of the sign for the indicating of danger, or to the repair of the vehicle or the removal of goods, shall use a reflective jacket.”

**Article 92** (Identification in case of accident), paragraph 1:

“A driver involved in an accident shall provide, to all other parties involved, his identification, as well as that of the owner of the vehicle and of it’s insurer, as well as the number of the insurance policy, and shall, whenever requested, produce documentation in proof thereof.”

**Practical interpretation:** All transport drivers must be knowledgeable of their company’s insurance policies, so that these can be provided in the case of an accident.
Article 109 (Classes and types of automobiles), paragraph 1:

"Automobiles are classified as:
   a) Light: vehicles with a gross weight up to 3,500 kg, and with seating not exceeding nine places, including that of the driver;
   b) Heavy: vehicles with a gross weight exceeding 3,500 kg, or with seating of more than nine places, including that of the driver, and tractor units."

Paragraph 2:

"Light or heavy automobiles include, according to their use, the following types:
   a) Passenger vehicles: those intended for the transport of persons;
   b) Goods vehicles: those intended for the transport of cargo;
   c) Mixed: those intended for the transport, alternatively or simultaneously, of persons and cargo;
   d) Tractors: vehicles constructed so as to provide traction force, without carrying goods;
   e) Special: vehicles intended for employment for a specific function, different from the normal transport of passengers or goods."

Article 113 (Trailers) paragraph 6:

"No more than one trailer may be linked to each motorised vehicle, except in the case of vehicles called "interlinks", which may tow two semi-trailers."

Article 117 (Characteristics of vehicles) paragraph 6:

"The import of left hand drive vehicles for commercial purposes is prohibited."

Article 118 (Vehicle transformation) paragraph 1:

"Transformation of a vehicle shall mean any alteration of it’s characteristics of construction, or functioning."

Paragraph 2:

"The transformation of motor vehicles and trailers shall be authorised on the terms set out in the regulations."

Article 119 (Inspections) paragraph 1:

"Motor vehicles and their trailers may be subject, on terms set out in regulations, to inspection for:
   a) The approval of their respective design or trademark;
   b) Registration;
   c) Approval of the alteration of their characteristics of construction, or functioning;
   d) Periodic verification of their characteristics, and safety."

Article 120 (Registration requirement) paragraph 1:

"Motor vehicles, and their trailers, may only be driven if they have a registration document which contains details of their identifying characteristics."

Paragraph 4:

"The registration of the vehicle shall be requested from the competent authority by the person, singular or collective, who attends to its admittance, import, or introduction onto the consumer market, in the national territory."
**Practical interpretation:** A copy of all vehicle registration documents should be kept in vehicles.

**Article 127 (Driver’s license) paragraph 1:**

“A driver’s license authorises the driving of one or more of the following categories of vehicles:

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Motorcycles, with or without sidecar, or motorcycles with four wheels, and cylinder capacity of less than 125 cm³.</td>
</tr>
<tr>
<td>A</td>
<td>Motorcycles, with or without sidecar, or motorcycles with four wheels, and cylinder capacity greater than 125 cm³.</td>
</tr>
<tr>
<td>B</td>
<td>Light automobiles, including those with a trailer, provided that the gross weight of this trailer does not exceed 750 kg, or if it does exceed 750 kg that it does not exceed the tare weight of the vehicle, and the sum of the gross weight of the automobile and trailer together does not exceed 3,500 kg.</td>
</tr>
<tr>
<td>C1</td>
<td>Heavy goods or passenger vehicles with a gross weight of less than 16,000 kg including those with a trailer provided that the gross weight of these trailers does not exceed 750 kg, that it is not heavier than the tare weight of the automobile and the gross weight of the tractor unit.</td>
</tr>
<tr>
<td>C</td>
<td>Heavy goods or passenger vehicles with a gross weight exceeding 16,000 kg including those with a trailer provided that the gross weight of these trailers does not exceed 750 kg, or if it does exceed this weight, is not greater than the tare weight of the vehicle and the gross weight of the vehicle tractor.</td>
</tr>
<tr>
<td>BE, CIE and CE</td>
<td>Articulated vehicles or vehicle convoys.</td>
</tr>
<tr>
<td>P</td>
<td>Public passenger services.</td>
</tr>
<tr>
<td>D</td>
<td>Transport of dangerous goods.</td>
</tr>
<tr>
<td>G</td>
<td>Merchandise.</td>
</tr>
</tbody>
</table>

Paragraph 3:

“The holders of driver’s licenses valid for vehicles in category B, shall also be deemed qualified to drive:

a) Agricultural or forestry tractors, by themselves, or with mounted equipment provided that their maximum weight does not exceed 6,000 kg.

b) Light agricultural or forestry machines, motor cultivators, tractor cars and light industrial machines.”

Paragraph 4:

“The holders of driver’s licenses valid for vehicles in category C1, shall also be qualified to drive:

a) Vehicles in category B;

b) Vehicles referred to in the previous number [paragraph 3];

c) Other agricultural or forestry tractors, with or without trailer, agricultural or forestry machines, and industrial machines.

Paragraph 5:

“The holders of driver’s licenses valid for vehicles in category C, shall also be deemed to be qualified to drive:

a) Vehicles in category C1;

b) Vehicles referred to in [paragraphs] 3 and 4 of this article;

c) Other agricultural or forestry vehicles, with or without trailer, agricultural or forestry machines, and industrial machines.”

**Practical interpretation:** Drivers should have driver’s licences for the correct class of vehicle they will be driving.
Article 129 (Other licenses) paragraph 1:

“The following also authorize the driving of motor vehicles, in addition to the licenses referred to in articles 127 and 128:

a) Special driver’s licenses issued by the diplomatic corps and consular posts accredited in the country;
b) Driver’s licenses issued by other SADC member states;
c) Driver’s licenses issued by a foreign state, which the state of Mozambique has been obligated to recognise, by international convention or treaty;
d) Driver’s licenses issued by a foreign state, provided that this state gives identical validity to national [Mozambican] licenses;
e) International driver’s licenses;
f) Military driving authorisations.

Practical interpretation: This paragraph explains the validity of foreign driver’s licences in Mozambique.

Article 130 (Requirements for the obtaining of driver’s licenses) paragraph 1:

“Any person who satisfies the following requirements, cumulatively, may obtain a driver’s license:

a) Possession of a document identifying him, in legal terms;
b) Be of the minimum age, according to the category for which he intends to obtain a qualification;
c) Have the necessary physical, mental and psychological aptitude;
d) Be resident in the national territory, in the case of a foreigner;
e) Be able to read and write;
f) Have passed the respective driving test.

Practical interpretation: This paragraph describes the attributes necessary of a person wishing to obtain a driver’s licence.

Article 140 (Liability for offences) paragraph 3:

“Liability for the offenses set out in the Road Traffic Code and in complementary legislation, falls to:

a) The driver of the vehicle, as regards offenses which relate to driving;
b) The titleholder of the vehicle identification document, as regards offenses relating to the conditions for the driving of the vehicle on public roadways, as well as offenses referred to in the previous line when it is not possible to identify the driver;
c) Pedestrians, as regards offenses relating to pedestrian traffic;
d) The passenger, as regards that which is applicable to him or her.”

Paragraph 4:

“If the titleholder of a vehicle identification document proves that the driver used the vehicle abusively; or infringed the orders, instructions or terms of authorisation issued, his liability shall cease and the driver shall in this case be liable.”

Practical interpretation: This paragraph states that drivers of mine vehicles are responsible in the case of an accident when the accident was clearly due to their negligence, or when it can be proved by the owner of the vehicle (Baobab) that the driver disobeyed instructions with regards to safe driving. Baobab will be responsible for accidents caused due to the poor condition of the vehicle.

Paragraph 7:

“The following persons are also liable for offenses set out in the Road Traffic Code and complementary legislation:
a) Employers who require from drivers a degree of effort which makes driving unsafe, or who subject drivers to a work schedule incompatible with their need for rest, when offenses are a consequence of the fatigue of the driver;
b) Parents or guardians who are aware of the inability or imprudence of their minor children or those under their guardianship, and who do not prevent them from driving, while being able to do so;
c) The drivers of vehicles which transport minor passengers or those who may not be held criminally liable and who permit these passengers not to use obligatory safety accessories;
d) Those who facilitate the use of vehicles by persons who are not duly qualified to drive, who are under the influence of alcohol or psychotropic substances, or in whom the physical or psychological faculties necessary for driving have been reduced in any other way.”

**Practical interpretation:** Baobab could be held liable for accidents and offences when they require of their drivers a “degree of effort which makes driving unsafe” or “subject drivers to a work schedule incompatible with their need for rest”.

Paragraph 8:

“The titleholder of a vehicle identification document shall be … liable for the payment of fines and costs which may be due by the offender, without prejudice to his right of recourse against this offender, except when the vehicle had been utilised abusively."

**Article 146** (Medium offenses) paragraph 1:

“The following are considered to be medium driving offenses:

a) Throwing objects or substances out of the vehicle, or leaving them on the road;
b) Failing to indicate, in advance, by way of a regulated arm gesture or by use of a light indicating the direction of the vehicle, the commencement of travel, the performance of a vehicle stopping manoeuvre, or a change of direction of travel, or a lane;
c) Travelling with a vehicle speed less than half of the maximum vehicle speed set down for that road, thereby delaying or obstructing traffic, unless traffic or meteorological conditions do not permit otherwise;
d) Driving with a vehicle displaying identification plates which do not comply with the specifications and designs established by the National Vehicle Institute (INAV);
e) Failure to keep parking lights on, at night, when the vehicle is stopped for the purpose of loading or unloading passengers and goods, or unloading merchandise;
f) Driving with a part of the body outside of the vehicle;
g) Crossing or driving without regard for, one or two continuous longitudinal lines delimiting traffic directions, or one mixed line with the same meaning;
h) Driving a motorcycle or a moped without the use of a protective helmet;
i) Travelling with a vehicle which may damage a road, or it’s installations or equipment;
j) Excessive speed, in accordance with the classification contained in [paragraph] 2 of article 33;
k) Not using, or allowing a passenger not to use, a safety belt or protective helmet;
l) Transporting children in an automobile, without complying with the special safety rules set out in this code.”

**Article 147** (Serious offenses) paragraph 1, sub-section D:

“The following shall be considered to be serious driving offences:

d) Failure by a driver involved in an accident, in which there is a victim:
   i. To give or provide first aid to the victim, when he is able to do so;
   ii. To take measures, when he is able to do so, to avoid danger to traffic at the location;
   iii. To preserve the accident scene, so as to facilitate the work of the police and experts;
   iv. To take measures to remove the vehicle from the accident scene, when required by
police or a traffic officer;
v. To identify himself to police, and to provide information necessary for the drafting of an incident report, when requested by the authority and it's agents."

**Article 157** (Insurance obligation):

“Motor vehicles and their trailers, on terms to be set out in regulations, may only travel on a public roadway if they have obtained, in terms of special legislation, third party liability insurance.”

**Practical interpretation:** Vehicles require third party liability insurance.

**Article 162** (Seizure of vehicles) Paragraph 1:

“Vehicles shall be seized by the authorities when:
   b) They are driven without number plates, or have not been registered, except in cases where this is legally permitted;
   f) An accident has been caused, without third party liability insurance, as required by law.”

Paragraph 5:

“In the case of accident, the seizure referred to in line (f) of [paragraph] 1 shall remain in place until it is proven that due compensation has been paid, or if the respective amount has not been determined, until a security deposit is paid in an amount equal to the minimum amount of obligatory insurance.”

Paragraph 6:

“The title holder of the vehicles identification document shall be liable for the payment of expenses flowing from it’s seizure.”

**Article 163** (Undue or abusive parking) paragraph 1:

“Parking is deemed to be undue or abusive, if:
   d) The vehicle remains in a limited parking zone for more than 2 hours after the permitted time period has expired.”

**Practical interpretation:** An important consideration for transport vehicles having to perform loading and unloading jobs in urban areas.
6 ASSESSMENT OF IMPACTS

6.1 Construction phase impacts

6.1.1 Increased construction traffic on the EN103

Cause and comment

The Samora Machel bridge in Tete has approximately 800 trucks a day crossing it (SNC Laval 2013a). Based on the calculations presented in Section 3.1, the construction phase of the Baobab mine will add approximately 16 truck trips per day to the EN103. This is not a significant increase, and will occur only during the construction phase, but will have an impact nonetheless as heavily loaded vehicles will be slowing down on the EN103, in order to turn onto the haul road, and unloaded vehicles will be turning onto the haul road. With their slow acceleration, these could impact the free flow of traffic along the EN103. If the impact was more permanent, it would be suggested that acceleration and turning lanes be added to the EN103, but due to the short term of the impact, these are not deemed to be necessary.

Mitigation and management

The following mitigation measures are suggested:

- The temporary erection of signage and flashing lights in the area close to the intersection of the haul road and EN103, warning road users of activity ahead;
- Temporary speed limits;
- These measures will need to be decided upon in consultation with Mozambican traffic authorities;
- Trucks should avoid forming convoys.

Significance statement

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6.1.2 Dust generated on the haul road

Cause and comment

Two options exist for access to the project site during the construction phase: access from the north via the EN221 and EN222, or access from the south along the haul road which will be used during the operations phase. It is likely that the haul road will be constructed first, but left as a gravel road until the operations phase. This is to prevent damage to the road by construction phase traffic. Therefore, during construction the haul road is likely to be quite busy and generate fugitive dust, which could be a significant nuisance to residents alongside the road, and could also be deposited on crops of villagers living within close proximity of the road. It will also decrease visibility, which could lead to accidents.

Mitigation and management

Methods that could be employed to reduce dust levels generated within the villages include:
- Watering the road periodically;
- Speed reduction – all vehicles on the haul road should be required to obey reasonable speed limits;
- The gravel surface of the road needs to be maintained;
- The road could be treated with chemical binders.

Significance statement

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6.1.3 Pedestrian safety on the haul road

Cause and comment

It is possible that during the construction phase, communities living alongside the haul road could become involved in accidents with construction vehicles, especially if adequate safety measures are slow in being implemented.

Mitigation and management

Designated crossing points should be established along the haul road, and these should be decided upon in consultation with local communities. The mine’s Health and Safety Department should monitor these crossing points, deciding upon an appropriate system once requirements and conditions are clearer.

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6.1.4 Transport of abnormal loads

Cause and comment

This is not considered to be serious impact as it may well be possible to assemble abnormally sized items in Tete and transport them only a short distance along national roads where they could cause delay or be a hazard to other road users.

Mitigation and management

Trucks with abnormal loads should be escorted by at least two vehicles (before and behind). The truck should consider pulling off the road periodically to allow trailing vehicles to overtake.
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6.2 Operation phase impacts

6.2.1 Loss of access by communities to agricultural land / hunting areas on either side of the haul road

Cause and comment

It will be necessary to fence the boundaries of the access corridor, to reduce the risk of non-mine personnel using the road or walking across it, and potentially being involved in accidents with the frequent operations phase mine traffic. This will cause communities to lose access to areas on the opposite side of the haul road where they used to cultivate crops, practise some other form of agriculture or harvest natural resources (Figure 7.1).

Mitigation and management

Designated crossing points should be established along the haul road, and these should be decided upon in consultation with local communities. The mine’s Health and Safety Department should monitor these crossing points, deciding upon an appropriate system once requirements and conditions are clearer.

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6.2.2 Road accidents and safety risks

Cause and comment

This impact captures a few potential sources of risk:

1. Risks associated with travel along the haul road: speeding, collisions, accidents involving pedestrians, use of the haul road by non-mine vehicles and pedestrians.
2. Risks associated with the haul road crossing of the EN103.

Access to the haul road needs to be controlled to prevent its use by non-mine personnel who may cause accidents. A boom gate could potentially be considered. It will be necessary to install appropriate warning signs along the length of the route, advising drivers of speed limits, hazards ahead, and especially the approaching intersection with the EN103. Placement of warning signs will need to take consideration of the longer stopping distances required for the heavy vehicles transporting product.

Trucks will need to cross the EN103, from the mine to the rail siding. There could be accidents if
existing traffic on this road is not warned of the crossing point ahead.

**Mitigation and management**

Consider the implementation of some or all of the following:

- A boom gate at the entrance to the haul road;
- Erection of traffic signs including speed limits, stopping points, community crossing points, hazards ahead (including bridges and culverts);
- Regular monitoring of the haul road by the Health and Safety department for adherence to road rules;
- To prevent speeding by drivers, ensure that delivery schedules are reasonable and achievable;
- Have an action plan in place, which all drivers should be familiar with, on what should be done in case of an accident;
- On the EN103 illuminated and flashing signs warning traffic of the approaching crossing point should be erected.

**Level crossing (railway crossings):**

- We suggest active warning mechanisms at the railway crossings;
- This will involve boom gates, flashing lights and warning tones, that are activated automatically by an approaching train.

These impacts, and the need for measures to mitigate them, will be eliminated if product is transferred from road trucks at a point north of the EN103 to a conveyor that crosses over or under the EN103, and then continues across the existing and new rail lines to the transfer station to be constructed on Reinaldos Patch.

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### 6.2.3 Dust generation at the rail siding

**Cause and comment**

At the rail siding there will be a lot of activity, potentially leading to large amounts of fugitive dust emissions. Trucks will be arriving with fresh deliveries of product, product will be stored and arranged or be loaded into rail wagons.

**Mitigation and management**

Surface the delivery area or spray – dust suppression measures - the area regularly.
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6.2.4  Dust generation on the haul road

Cause and comment

The generation of fugitive dust from vehicle wheels depends, among other things, on the speed of the vehicle and the nature of the road surface. The extent to which dust is distributed beyond the road corridor depends on wind speed.

Operational traffic will generate considerable volumes of dust, particularly from multi-axle heavy vehicles, which will reduce visibility and increase the risk of vehicle collisions, and will also create a nuisance for the several residences that are situated close to the road.

However, current plans are that the haul road will be surfaced during the operations phase, which will make dust generation negligible.

Mitigation and management

Surfacing of the haul road.

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7 SUMMARY AND RECOMMENDATIONS

The mine will produce 1 Million tonnes per annum (Mtpa) of pig iron and Ferro-Vanadium, requiring 82 truck trips per day between the project site and a siding on the Sena-Moatize Railway line. Delivery will be along a dedicated haul road, with product being delivered 16 hours a day and 7 days a week.

The haul road will be approximately 45 kilometres long, and will need to cross 3 major obstacles: the Ncondezi River, the EN103 national road (a 2 lane road connecting Tete to Malawi) and a railway line currently under construction by Vale. It will also need to cross the Modizo river, but this is a less significant obstacle than the Ncondezi due to its smaller size. It is anticipated the haul road will be compacted gravel during the construction phase, and be upgraded to a sealed asphalt road during the operations phase. This is to ensure that construction phase traffic does not ruin and shorten the lifespan of the asphalt road. The bridge across the Ncondezi will be approximately 180 metres long, spanning the main river channel and its floodplain. The banks of the river will need to be modified to allow construction of a bridge with a gentle enough slope so that potentially a railway line can be constructed along the haul road. Product delivery trucks will need to cross the EN103 safely, and without being a hazard or obstruction to traffic along that road. It is anticipated that a delivery truck will need to cross this road every 11 minutes. There is a blind rise for traffic travelling on the EN103, from Malawi westwards towards Moatize. Warning signs will need to be erected advising traffic of the haul road crossing ahead.

Without a Bill of Quantities for the construction phase, it has not been possible to quantify traffic to be generated during the construction phase. It is also unknown where the construction team will choose to source their material from. Various potential sources and their delivery routes have been discussed in the main body of the report. Nevertheless it has been possible to anticipate certain generalised impacts that may occur during the construction phase. It should be noted that Tete is experiencing an economic boom associated with the mining industry, and therefore there are already many construction firms operating in the area, with equipment and personnel in place, and supply chains for acquiring material. This situation lessens the significance of construction phase impacts than would be the case in a remote area. Impacts related to dust along the compacted gravel haul road, and the transport of abnormal loads have been identified and assessed for this phase. With mitigation measures implemented, these will not be significant.

During the operation phase, an important impact identified is the potential loss of access by communities to farming and hunting areas on the opposite side of the haul road to their home and village. For safety reasons, it will be likely that Baobab will choose to fence the boundaries of the access corridor and have entrance to the road controlled by boom gates. It has been suggested that dedicated crossing points on the haul road be established, and appropriately controlled, to allow safe and adequate crossing opportunities for people living on the fringes of the haul road. It will be necessary to erect adequate signage at appropriate locations, advising delivery trucks of upcoming community crossing points, the bridge, speed limits, and the EN103 stopping point. This road is not heavily trafficked so it should be possible for trucks to cross safely, if they give way to traffic on the EN103. There will be impacts related to dust in the delivery yard at the siding, for which mitigation measures have been suggested.
8 REFERENCES

Coffey Mining 2013: Tete Pig Iron and Ferro-Vanadium Project Pre-Feasibility Study, Coffey Mining Pty Ltd, 2013.

