STANDARD GAUGE RAILWAY (SGR) PROJECT

THE REPUBLIC OF UGANDA

SGR Reliable Connectivity

INFORMATION ABOUT STANDARD GAUGE RAILWAY (SGR)

The Government of Uganda has put emphasis on infrastructure development in order to achieve the aspirations of Ugandans as enshrined in the Uganda Vision 2040.

Infrastructure development is primarily meant to provide a conducive investment climate thus attracting large foreign direct investment especially in heavy industries and services so as to reverse the large trade imbalance due to limited exports. It is important to know that there is worldwide competition of attracting investors by different countries, it is imperative that our investment climate is competitive at global stage. These investors must be assured of reliable, cheap and adequate transport services to the high end markets.

Standard Gauge Railway as a back bone of transport infrastructure must provide a transport service for export and import that is comparable to other services in other countries in terms of quality, cost and reliability.

Regional countries of Kenya, Uganda, Rwanda South Sudan, Tanzania and Ethiopia are at different stages of developing their respective railway systems in order to fully participate in international global trade and production.

Uganda's strategic geographical positioning, puts it at the heart of the East and Central Africa logistics chain and can evacuate its products through the ports of Djibouti, Mombasa and Dar Es Salaam among others. However, due to many factors, the port of Mombasa in Kenya and the port of Dar As Salaam in Tanzania are anchor points for two transport routes—the Northern Corridor and the Central Corridor—both crucial for the domestic, regional, and international trade of five Eastern African countries.

Northern Corridor is the busiest and most important transport route in East and Central Africa, providing a gateway through Kenya to the landlocked economies of Uganda, Rwanda, Burundi and Eastern DR Congo. It also serves Southern Sudan.

Uganda in Particular has planned to develop 1724Km of SGR network in a phased manner starting with the Malaba-Kampala SGR route (273km)

The purpose of this write up is therefore to provide factual information about key aspects of the SGR project.

1. The Ministry of Works and Transport procured an independent world leading international German consultant **Gauff Ingenieure** who carried out an Engineering and feasibility study for the Malaba-Kampala SGR that provided the basis for negotiations. The contract price negotiated and signed with the contractor is below the engineers estimate derived from the study. The contractors' proposal was therefore based on the engineering design that was provided by the consultant.
2. Before procurement, the Uganda team benchmarked from Ethiopia, Kenya, India, and China to share knowledge and experience in development of SGR systems including technical designs, contracting modes, development and operational costs, traction among others.
3. It is important to note that a gauge is not a standard and hence the railway systems can all be Standard Gauge but designed to different standards e.g. AREMA (American Railway Engineering and Maintenance of Way Association) or Chinese or any other standards. There is no universally agreed classification of railways. The classification in America is different from Europe, India, Japan and China. The NCIP countries of Kenya Uganda, Rwanda and South Sudan, agreed to build **China** Class 1 railway system.
4. The Northern Corridor Integration Projects (NCIP) countries agreed on **China** Class 1 Railway standard to ensure a seamless transport network while Tanzania which is not a member of the NCIP has designed its railway system to AREMA. Kenya has built **China** Class 1 railway system which Uganda must also build for purposes of seamless connectivity and other embedded advantages. Ethiopia which is also not a member of the NCIP has developed its railway to **China** Class 2 Standard. It is misleading to claim that Kenya has constructed China Class 2 railway whereas this can be easily verified from the Kenyan Authorities. Also, changing from Class I to class 2 will affect the seamlessness thus introducing non-tariff barriers that will hinder trade and increase the cost of doing business. The SGR Protocol specifies the need for seamlessness across the region. In Railways, it is important to note the difference between the route length and the track length, for example in Uganda for Malaba-Kampala, the route length is 273 and track length is 338km while in Kenya for the Mombasa- Nairobi the route length is 472KM and the track length is 609KM. It is proper to compare based on route length and not track length since the cost of developing many tracks at the station is different from developing equivalent cost of route kilometers elsewhere.
5. Over the last 30 years, China has built the largest railway network in the world and has invested massively in railway research and development. Today, Chinese contractors are in several parts of the world either constructing and/ or funding railways. Given the unique position of China in terms of demand for transport capacity, China has developed its Chinese railway standards which are much safer, robust, and durable. Some of the key varying features include: The formation width of the Chinese standards is 7.7 Metres compared to 6.6 Metres of AREMA, the minimum height of embankment is 2.5 Metres high for Chinese standards while AREMA is 0.64 Metres. The requirements for protection of the embankments in Chinese standards is strictly by concrete hellingbone structure and stone masonry. Construction of the embankments, backfill material specifications and requirements, use of geo-synthetics, soft ground treatment mechanisms are more stringent with the Chinese standard than AREMA. This is simply because the Chinese standard targets low operation and maintenance costs than AREMA over the life of the project. Overall, the life ***cycle-costs*** of the Chinese standard is lower than railways built to AREMA.
6. The railways in the four countries are dominantly freight (cargo) but will have passenger services. All the major design parameters are based on freight railway system. Passenger trains can move on these railways at a faster speed compared to freight trains because they are shorter and lighter while the freight trains are longer and heavier. It is important to differentiate the attainable speeds of passenger and freight trains when analyzing the capabilities of the railway systems. Therefore the speed of passenger trains is largely inconsequential to the design parameters and therefore the change in the speed of the passenger trains will not affect the cost of development of the railway.
7. It is important to note that in railway development, the highest cost is in bridges, followed by the earthworks (embankment), track, stations, electrification, signaling etc. For example, on Malaba- Kampala, 35% of the route is in bridges, 25% is in earth works and 10% in track, 10% stations, 5% electrification, 5 % signaling and 10% others. The bridges and earth works are a result of hydrology (Rivers, swamps, and amount of rainfall), terrain and geology of the respective routes. These parameters vary significantly among the various project sites in the different countries. Even on road projects in Uganda, variances in project costs can be seen in wet and hilly areas like Kanungu, Kisoro, Kabaale, Kapchorwa and Mbale, compared to the flat areas in Teso and Karomoja region. It is important to note that a large part of the Uganda Malaba-Kampala route lies in the lake Victoria basin which is mashy and swampy, unlike her neighbors of Kenya, Ethiopia and Tanzania whose routes where comparisons are being made do not lie in such hydrologically and geotechnically complex sections.
8. Strictly from professional Engineering perspective, the cost of a civil engineering structure is built up using the engineers build up cost estimate method whereby the cost of various inputs, (material, labour, technology, equipment) and the quantities are computed to come up with engineer's estimates. The cost comparison should be made on this basis. However, the cost per kilometre comparisons which are being used to compare different infrastructure are generic and meant to give an indicative perspective not exact comparison. The FIDIC EPC turnkey contracting mode (under which SGR contracting was done) is a lumpsum cost approach and not based on detailed unit rate (ad-measurement) approach. In Engineering, the common contracting modes include, Force Account, Design Bid and Build, Design and Build and EPC/ Turnkey. The choice of the mode of contracting depends on the magnitude and complexity of the structure to be built. A good detailed analysis can only be done using detailed designs and understanding the environmental and macroeconomic parameters of each country. The costs are mainly driven by the depth of the piers, length of bridges/viaducts, the width and height of embankments (60% of costs are in bridges and embankments). It is important to take into account the technical difference in the respective countries' SGR projects before making conclusions on costs.
9. It is the practice of the financier to conduct independent review of the whole process including, procurement, contracting, engineering design, cost, economic and financial viability of the project. This review will be done before the financing is agreed. The EXIM Bank has noted that it is hiring an independent consultant to review the whole process and the project including the costs.
10. The SGR regional protocol that denotes the seamlessness between Uganda and Kenya was submitted to the Financier. There is no way the Financier can allow Uganda and Kenya to build different classes.
11. The NCIP partner states agreed to develop a common railway policy across the region. This will help in developing the legal, regulatory and institutional frameworks across the countries. This is crucial of seamless connectivity.
12. The issue of power/electricity extension to the substations and the reliability thereof has been fully discussed with the Ministry of Energy and Mineral Development and the Ministry of Finance, Planning and Economic Development. They have provided written commitment to this effect.
13. To date approximately 100km (60m width) has been acquired and paid for in Tororo (except Municipality), Butaleja, Namutumba and parts of Iganga. Compensation is still ongoing. Approximately 2500 PAPs have been paid. A bull dozer is on the ground demarcating the acquired land.
14. The Ministry/ Project has developed a local content strategy and is working in line with the Buy Uganda Build Uganda (BUBU) policy with an intention of ensuring that local content reaches 40% of the contract value. The Ministry continues to engage private sector players.

Sn	Item	Uganda (Malaba-Kampala)	Kenya (Mombasa-Nairobi)	Ethiopia (Addis Ababa-Djibouti)	Tanzania (Dar Es Salaam-Morogoro)
1	Contracting Mode	EPC/Turnkey (Based on FIDIC)	EPC/Turnkey (Based on FIDIC)	EPC/Turnkey (Based on FIDIC)	Design and Build (Based on FIDIC)
2	Route Length	273KM	472KM	656KM	205KM
3	Track length	338KM	609KM	765KM	300KM
4	Class	China Class 1 Railway	China Class 1 Railway	China Class 2 Railway	AREMA
5	Gauge	SGR (1.435m)	SGR(1.435m)	SGR (1.435m)	SGR (1.435m)
6	Traction	Electric	Diesel	Electric	Electric
7	Welding	Continuously Welded	Jointed	Long welded	Continuously Welded
8	Curvatures	1200/800	1200/800	800/600 m radius	1000 mR
9	Gradient	1.2%	1.2%	1.85%-2.65%	1.8%/ 2%
10	Trailing Load	4000/5000 metric tonne	4000/5000 metric tonne	3500/4000 tonnes	
11	Structure Gauge	Double Stack	Double Stack	Single Stack	Single Stack
12	Signaling	Fully Automatic	Fully Automatic	Semi-Automated	Fully Automatic
13	**Percentage of Bridges along the route**	**8.8 % of the route**	**5.9% of the route**	**3% of the route**	**1.8% of the route**
14	**Super Bridge**	**938M Bridge over river Nile**	**No Major River**	**River Awash (155m Bridge)**	**River Ruvu (32m bridge)**
15	Cost per route USD/ KM (excluding locomotives)	6.9m/km (Diesel) USD7.32m/Km (Electric)	USD7.288m/ KM (Diesel)	USD 5.213M/ KM	USD5m/KM
16	Tonnage per year	Designed for 20-35m tonnes per year	Designed for 20-35m tonnes per year	Designed for 10-20m tonnes per year	Designed for 18 tonnes per year (Max)
17	**Swamp/ Marshy**	**53KM (20%)**	**No major swamp**	**No major swamp**	**No major swamp**
18	Formation width	7.7 metres	7.7 metres	7.7 metres	6.6 metres
19	Minimum embankment height	2.5 metres	2.5 metres	2.5 metres	0.64 metres
20	**Cost of cement (Normal grade)**	**USD180/tonne**	**USD 120/ tonne**	**USD125/ tonne**	**USD100/tonne**
21	Cost of steel	USD680/tonne	USD 562 per Ton	USD480/ tonne	USD680/tonne
22	Cost of Diesel	USD 0.897/Litre	USD 0.862/ Litre	USD 0.71/ Litre	USD 0.82/Litre
23	Transportation capacity	20-35 million tonnes per annum	20-35 million tonnes per annum	10-20 million tonnes per annum	18 million tonnes per annum
24	Average distance from the coast	1,170KM	236KM	350KM	100KM

From the table, one can note the following:

a) An electric system requires an additional cost of about USD 0.54m/ km. Uganda deliberately took a decision to invest in an electric system due to the lower operation and maintenance requirements (at least 40%) compared to the diesel system. This will significantly reduce the operation and maintain costs and also contribute to the country's carbon credit. Kenya has committed to upgrade her railway system to electric by 2020.

b) The Uganda Malaba-Kampala route lies in a more undulating terrain compared to the projects in the neighbouring countries. This calls for more cuts and fills, bridges/viaducts given the flatter gradient of 1.2%. This coupled with the fact that Uganda's project is comprised of 24km of bridges means that the project is more complex than its counterparts. To demonstrate the impact of terrain on the cost, it is important to look at the Naivasha-Kisumu section in Kenya that passes through the rift valley where for 262KM, the cost is estimated at USD 3.6bn roughly translating into USD13.7M per route- KM. This is nearly twice as much as the cost for Mombasa-Nairobi route that lies in a more construction friendly section. This is also the case for Uganda especially where a large super bridge over the river Nile and other bridges over river Mpologoma and Naigombwa among others have to be constructed.

c) There are major differences as illustrated above in the terrain, topography and hydrology of the respective countries' project sites thus resulting in varying amounts of rock fill, soil cut, embankments, bridges, geo-synthetics that are major cost centres of railway development. Given that 53km (20%) of Uganda's alignment lies in swamps and the more gentle gradient, more cuts, fills and treatment is required.

d) Developing lower class railways may appear cheaper at investment stage but will be more expensive in operation and maintenance. Because of the construction standard requirement, it is important for railways designed for 100 years and more to look at life cycle costs rather than investment costs.

e) The major differences between the Chinese standard and the AREMA standard are:

1. The formation width (top width of embankment) is 7.7 meters for Chinese standards while AREMA is 6.6 meters. See illustration below:
2. The height, design and construction of the embankment which is limited to a minimum of 2.5 meters high for Chinese standard and 0.64 meters for AREMA. These high embankments in the Chinese standards require slope protection.
3. The Chinese classification requires the herringbone concrete structure for protection of embankments and concrete masonry for higher embankments of 6 meters while this is not a requirement for the AREMA standards require only benching and grassing.
4. The safety factor in the concrete structures is higher in Chinese standards than the AREMA standards.

It is important to clarify that Kenya has undertaken to develop her SGR from Mombasa to Nairobi to Naivasha to Kisumu –Malaba. Contracts have already been signed and bilateral agreements have been signed between Uganda and Kenya to this effect. The Kisumu port is designed for 0.6m tonnes capacity whereas imports through Malaba for 2015 were about 10 million tonnes.

Hon. Bagiire Aggrey
Minister of State for Transport