F. L. O' Callaghan, 'Uganda Railway', 26:8 (1900),
***Professional Papers of the Corps of Royal Engineers. (Occasional Paper Series)*, pp. 1–20.**

PROFESSIONAL PAPERS
OF THE
CORPS OF ROYAL ENGINEERS.
(OCCASIONAL PAPER SERIES).
1900.
VOL. XXVI. Paper VIII.

UGANDA RAILWAY.

BY

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[...] The general configuration of the country shows a steady rise from the coast inland for about 350 miles to the highlands of Kikuyu, them a sudden dip into a valley, varying from 15 to 20 miles in width, and running generally in a north and south direction, an equally sudden rise to a second ridge, the Man, and a gradual descent to the lake.

The valley, called the Great Rift Valley, is one of the remarkable features in this part of Africa, and extends for several hundred miles. Apparently it is due to an immense subsidence or 'down-throw.' It has several extinct volcanoes along its floor, and many lakes, most of which are salt. The crest of the eastern escarpment varies from 7,000 to 11,000 feet in height above sea level, and that of the western one is somewhat higher.

The descent into and ascent out of this valley were the two difficult problems in the construction of the railway, so far as the physical features of the country are concerned.

In August, 1895, Her Majesty's Government having decided to construct the railway, a small grant for preliminary expenses was obtained from Parliament, a supervising Committee, with Sir Alexander Rendel[1] as Consulting Engineer, was appointed in London, while a Chief Engineer, with a proportion of staff sufficient for the work to be at first undertaken, was despatched to Mombasa, where the party arrived towards the close of December in the same year.

The matters requiring the Chief Engineer's immediate attention were the preparation of a base on the coast and the survey of the best route to the summit of the coast hills, these hills rising rapidly for the first 15 or 20 miles inland from the sea.

It was at once obvious that the best site for a base was to be found on the island of Mombasa, because excellent harbours existed on both sides of this island, and on it was the only large piece of / open and tolerably level ground available, as had already been noted in Capt. Macdonald's report.

The preparation of the base included the following:–

1. Housing of staff and shelter for imported labour.

2. Preparation of a station site, and sites for store yard, stacking ground for permanent way materials, girders, and such like.

3. Construction of a landing stage for stores, and its connection by rail with the stores yard, and stacking grounds.

4. Construction of workshops for the erection and repairs of locomotive engines and rolling stock, and for other work connected with the railway.

5. Organization of offices for accounts and stores.

6. Connection of the island with the mainland by a temporary bridge.

7. Water supply, including erection of condensing plant.

8. Organization of an agency in India for the supply of labourers and of food for them, besides sundry stores procurable in that country.

The survey parties arranged were eventually three in number. The first, a strong party, examined the country in detail, staked out the railway, for construction, ahead of the working parties, and prepared the usual large scale plans (400 feet to 1 inch) and working sections.

The second party was despatched to Kibwezi (mile 190) to work backwards until met by number one party. This was desirable, as the country is somewhat intricate between the 150th and 190th miles, and it was important that the plans and sections should be ready in time to prevent any delay to construction works.

The third survey party was sent on to Kikuyu to investigate the different routes that might be possible from the Athi plains across the escarpment and into the great Rift Valley, and, when the best route was ascertained, to mark it

out and complete the working plans and sections; then to go forward and similarly examine the Mau range on the west side of the valley, fix on the best point for crossing this, the last and highest of the two great ridges to be surmounted, settle on the best route to the lake, and finally to prepare working plans and sections.

The first and second parties joined up in November, 1897, and these continued the location work from mile 190 onwards to mile 325, where the third had started, completing this work by October, 1898; but the third party did not finish its task until April, 1900. /

The difficulties which had to be overcome by these parties varied somewhat in different localities, but on the whole their work was of an arduous nature.

On the first 200 miles from the coast the country, for the most part, is covered by dense thorn bush, which has to be cleared for every survey line run.

This bush is infested with tsetse fly,[2] fatal to all beasts of burden, thus limiting the means of carriage to that by native porters; the 'fly' district extends for some 30 miles or so beyond the thick bush, or up to the 220th mile.

The Kikuyu and Mau ranges are clothed by heavy forests with thick undergrowth, making survey work tedious and difficult.

Up to mile 320 the country is sparsely inhabited and produces no surplus food stuffs, while water is scarce and bad, being in most cases impregnated with salts injurious to health.

Moreover, in addition to these difficulties inherent to the country, the first party, during the early months of 1896, was impeded by disturbances due to a local rebellion, which made it dangerous to establish isolated camps without strong escorts, and escorts were not readily available, all troops being employed in suppressing the rising.

The positive hardships endured by the first survey party were severe; frequently, by the desertion of porters, they were in danger of starvation and of the horrors of thirst, while all, both Indians and Europeans, suffered severely from malaria fever, and the former from ulcers and sores due to the thorns of the aloes,[3] cactus, and other bushes through which they had to cut their way.

The third survey party found that, as surmised by Sir Guilford Molesworth[4] in 1891, the lowest point on the Mau range was between the Guaso Masai Valley on the east and Nyando Valley on the west, the summit being 8,321 feet over sea level, the ground falling away very quickly on both sides. The highest point is in the 489th mile, and for some little distance on either side works will be easy.

The ruling gradient adopted for the coast section was 2 per cent., with 10°* curves as a maximum, and the same ruling gradient has been used over the Kikuyu and Mau ranges, but in combination with 7°† curves.

Wherever the permanent working section showed heavy earthwork, which could not be completed in time to allow of the rails / being laid over them, temporary lines, commonly called 'diversions,' were marked out, with gradients as steep as 3 per cent. and curves of 14° in order to keep these diversions as near the natural surface of the ground as possible, and thus keep down both their coast and the time necessary to construct them.

On the first portion of the railway up to Nairobi (326th mile) the aggregate length of diversions was about 40 miles. On the second portion the total length of these temporary lines will not fall far short of 44 miles.

The selection of temporary lines, as a rule, preceded that of the final permanent location, and required quite as much care and study of the ground.

Notwithstanding the care taken, some of the temporary works were of considerable magnitude; the first, of course, was the temporary bridge connecting the island of Mombasa with the mainland; next, a trestle structure across a ravine in the 12th mile; while every river met had to be temporarily crossed by bridges made with sleeper stacks and girders. Many other temporary structures were required, such, for instance, as stages for water tanks at temporary stations, for which timber is used.

While the first party of Engineers was on its way to East Africa, permission was obtained from the Government of India to recruit labourers in that country, this permission being necessary under the Indian Emigration Laws; arrangements were also made with that Government for the loan of an experienced engineer from their Public Works Department, as well as of a medical officer, with sufficient hospital staff. These in the first instance were engaged in selecting labourers, and about one thousand Indian navvies, with a proportion of carpenters, blacksmiths, rivetters, masons, etc., were shipped for Mombasa; several surveyors and draughtsmen, and also European and Eurasian overseers, were procured and despatched. An accounts officer was borrowed from the same source, who selected and engaged a staff of Indian accountants and clerks, and arrived in Africa with them during February, 1896.

In England a supply of tools, plant, workshop machinery, tents, iron houses, permanent way materials, small bridge girders, timber beams and scantlings,[5] locomotives and rolling stock were contracted for, and the first shipment reached Mombasa in April, 1896, followed by others at frequent intervals.

* 573 feet radius.

† 816 feet radius.

The temporary bridge to connect the island with the mainland – / over a channel about one-third of a mile wide, with a depth of water up to 17 feet at high water – was then put in hand and completed by the 4th August, 1896, on which date the rails were laid over it, and plate laying may be said to have commenced. This bridge had to carry the whole of the traffic passing up the railway for a period of nearly three years. Before two years had elapsed the supporting piles were nearly destroyed by that marine pest the *teredo navalis,*[6] and heavy renewals were necessary. [...]

It is usual to guard timber used in marine works either by sheathing it with zinc or by covering all exposed surfaces up to highwater mark with 'scupper nails,' *i.e.*, a nail with a large flat head and a very short shank. These nails very quickly rust and cover the timber with a hard layer of red oxide of iron, thus preserving the timber from attack.

The conditions under which construction had to be carried on precluded heavy works of any kind being executed far from the rails, because the carriage of food and water in large quantities, except by rail, was practically impossible. The 'telescopic' method, therefore, was imperative, and no pains were spared to obtain, even at the cost of very steep gradients and sharp curves, as nearly a surface line as possible. Once the rails were laid, the heavier permanent cuttings, embankments, bridge, and culverts could be attacked with large gangs of workpeople to the full extent that economy of construction rendered advisable, and completed without further difficulty.

In the first instance the utmost that could be done was to keep a gang of about 300 Indian earthwork coolies at from one to two miles in advance of railhead, clearing away the bush and preparing the temporary surface line.

The supplying of these coolies, as well as the plate laying gangs, with food and water was a constant source of anxiety. The accumulation of spare food sufficient for some few days was not a matter of very great difficulty, but water, which had to be carried daily by train, and of which the supply in Mombasa was limited, was a serious matter, and any breakdown in its supply might have been followed by terrible consequences. At the railway base it was necessary to erect heavy plant for the supply of fresh water by distilling sea water, because the wells in the island gave little more than sufficient for the requirements of the fixed population.

[...] On the 10th November the railhead was at mile 460 on the eastern slope of the Mau range. The number of labourers had attained its maximum during August last, and the full supplies of locomotives and rolling stock were completed in December, 1899, and in April, 1900, respectively.

The number of workpeople to be employed depended on the amount of work opened up by the advance of the rails, and thus their increase, as shown in the diagram, is proportionate up to a certain point to the advance of the line.

The principal permanent structure on the first 360 miles of the railway, *i.e.*, up to the Kikuyu Escarpment, is the long steel bridge on screw piles connecting the island of Mombasa with the mainland, completed on the 28th June, 1899, and now called the Salisbury Bridge [...]. The spans are 60 feet in the clear each, and the roadway, with a footway for men engaged on the railway, is on the top of the girders.

The next largest bridge is one of four spans of 60 feet over the Tsavo River, mile 132 [...].

Twenty-six other girder bridges of 40-foot span and upwards have been built, or are building, on this length, as well as a very large number of drains, culverts, and minor girder openings.

The bridges are of three types as regards piers and abutments – first, masonry piers and abutments; second, piers and abutments of concrete; and, lastly, trestle piers, composed of 3-foot diameter steel cylinders, braced together with cross girders and angle iron,[7] the cylinders being filled with concrete.

Small drains are provided for by stoneware pipes, 12 inches and 18 inches diameter, laid on a concrete bed; larger drains are of oval steel cylinders on concrete, while arched culverts from 3-foot to 15-foot spans are usually of concrete. The whole of the masonry and concrete work is made with Portland cement, because no limestone, except coral, on the coast, is to be found; concrete and masonry, therefore, are very costly, and when possible they have been avoided.

The largest single-span girder bridge on the railway is 100 feet clear span, and there are two such spans (both with 'through' roads). The girders are triangulated open web, weighing with cross / girders, etc., 65.6 tons each span; all other girders are of the plate web type, with road on top of girders, and are classed as follows:–

60-foot spans, weighing22.3 tons each span.
40-foot spans, weighing 10.15 tons each span.
20-foot spans, weighing 3.16 tons each span.
12-foot spans, weighing 1.16 tons each span.
10-foot spans, weighing 0.19 cwt. span.
6-foot spans, weighing 0.11 cwt span.

On the 13 miles required for the descent from the Kikuyu summit to the floor of the Great Rift Valley eight ravines are met with, which are being crossed by steel trestle viaducts varying from 120 feet to 780 feet in length, and from 32 feet to 85 feet in height at the deepest points. Embankments over these would have necessitated very long and costly culverts owing to the steep side slope of the escarpment, and in many instances it is doubtful if the earthworks would have stood, while they would in any case have been a constant source of trouble and anxiety.[...]

The viaducts are of the ordinary trestle type, the tower spans being 20 feet, the intermediate spans 40 feet, and the batter of the legs 1 in 6.

[...] As regards the method of erection. A traveller, with jib[8] long enough to reach to the forward tower, stands on the last completed span, and the pieces being brought up on a lorry which passes underneath the traveller, [...] are then laid hold of by a tackle and traversed forwards into place, or raised and lowered by winding on one winch and paying out on the other.

A third tackle at the mast takes the tail of the 40-foot girders, which are the heaviest pieces, when putting them into position. Besides these main tackles there are light ones worked by hand for raising and holding in position the smaller parts. By these means the viaducts can be erected very rapidly, and when one is finished the traveller is conveyed on its own wheels to the next.

The erection of these is now in progress. That the spans adopted are the most economical is proved by the fact that the total weight of the girder work is almost exactly equal to the total of the bents or piers.

Along the floor of the Rift Valley itself, which is crossed / very obliquely, the works are of a simple character, only two streams of any magnitude being met with. The first 15 miles up the slope of the Mau range is also easy, but from mile 465 onwards to 539 is the most difficult and costly part of the whole of the railway. On these 74 miles there will be twenty-eight steel viaducts, similar to those on the descent from Kikuyu, varying in length from 160 feet to 880 feet, and in height from 30 feet to 110 feet, the severe side-slopes here also rendering embankments with consequent culverts inadvisable. In the 526th mile a narrow high spur necessitates a short tunnel about 200 yards long, the only one, strange to say, on the whole length of this railway. Between mile 539 and Port Florence (mile 582) eleven rivers have to be crossed by bridges varying in size from one span of 40 feet to three spans of 60 feet.

At Port Florence there will be a small engine-repairing shop, and a jetty at which steamers can load and discharge cargo.

Station buildings are of the simplest character, made of timber framework covered with galvanized corrugated iron, easily removable to other sites when advisable.

The headquarters station has been fixed at Nairobi (326th mile), 5,600 feet above sea level, the last point at which an open level plain is found before entering the broken country of the Kikuyu range. Here are being constructed the central workshops and offices, the elevation insuring a tolerably cool climate. Other engine-changing stations, besides the two termini, are at Voi (mile 100), Makindu (mile 207), and Nakuro (mile 450).

On the portion of the railway between Kikuyu and the Lake the first temporary structure is in the 363rd mile [...]. Here the heavy works on the descent into the valley commence, and as they would evidently take considerably over a year

to complete, it was decided to construct a rope lift to lower materials into the valley. This lift or incline overcomes a difference of level of 1,523 feet, and consists of four portions. Two of them – one at the top and one at the bottom having inclinations of 16 per cent. and 9 1/2 per cent. – are laid as double lines, with drums at the top of each, round which a steel wire rope is passed. The railway wagons are run down and up these inclines, the full wagons going down, hauling the empty ones up, speed being regulated by brakes on the drums. The two middle portions are on inclines of nearly 50 per cent., similarly worked by steel wire ropes, 1 1/4 inches in diameter, passing round 'Howard' Clip drums attached to winding engine. On these inclines / the wagons are taken on a carrier built with its top horizontal, having a pair of rails to take the wagon, and suitable clips and fastenings to keep the wagons in place while being lowered.

The gauge of the carrier inclines is 5 feet 6 inches, in order that lateral stability may be insured.

At the top the carrier comes up against a platform (beneath which is fixed the clip drum), so that the rails on the carrier form a continuation of a road ending on the stage front, thus allowing a wagon to be pushed on to the carrier by hand. At the bottom the carrier goes into a pit until the rails similarly coincide with a road, on to which the wagon is pushed off.

The line is a double one, but on the lower side of the middle point the rails overlap so as to save width in the cuttings and to economize sleepers.

From the foot of this lift a temporary line is laid until the permanent alignment is reached at mile 375.

Besides ordinary temporary bridges over the Morendat and Gilgil Rivers no diversions are needed until the 460th mile is reached, but between that point and Mau summit there will be 15 miles of temporary railway with 3 per cent. grades and 14" curves, and with several reverses or zigzags. Between the summit and mile 539 22 miles of diversions are laid out, the steepest grades in this case being as much as 4 per cent., as they will be with the load.

The permanent way used consists of 50 lbs. per yard 'Vignoles' pattern steel rails,[9] laid for the most part on steel transverse sleepers of the 'pea pod' pattern, with clips punched up out of the solid, and the rails fastened in with a taper steel key. Where much salt is found in the soil creosoted pine sleepers are substituted for the steel.

For details of the permanent way material reference may be made to *Instruction in Military Engineering,* Part VI., *Plate* XX., and *Notes on Permanent Way Material, etc.,* by W. H. Cole.

In the first instance the road has been laid without ballast, as it seems to have been a leading idea with every engineer who advised on the project that ballast would be a luxury. On the first section, across the desert portion, the natural soil, being of a sandy nature, has up to the present answered fairly well, but the black

soil between mile 275 and Nairobi turned into a quagmire during the first rainy season after laying, and blocked the traffic for over a / month. This was foreseen by all who had had experience of similar country and of tropical rains, and the Chief Engineer had made arrangements to collect ballast for this section in any case. The result of this experience was that the Supervising Committee at home decided to ballast the whole length of the line.

The locomotives built specially for the railway are 6-wheeled coupled, with a load of 10 tons on each axle. Just over one-half of the total number were procured from the Baldwin Company in America, and these have a pony truck (two-wheeled bogie) in front which on the sharper curves is of much advantage, and enables the coupled axles to be kept closer together.

The total number of locomotives on the line is 92, made up as follows:–

Six second-hand shunting engines from India.

Sixteen second-hand 6-wheeled coupled engines with pony trucks, also from India, but of low power.

Thirty-four standard type engines from England.

Thirty-six standard type engines from America.

The particulars of these standard engines are:–

Diameter of cylinder	14 1/2 inches.
Length of stroke of piston	20 inches.
Diameter of coupled wheels	42 1/2 inches.
Firegrate area	13.4 square feet.
Heating surface	766 square feet.
Working pressure in boiler	160 lbs. per square inch.
Wheel base (rigid)	11 feet.

Tender.

Number of wheels	6.
Diameter of wheels	25 3/8 inches.
Wheel base	7 feet 10 1/2 inches.
Capacity of tank	2,000 gallons.
Capacity for fuel	180 cubic feet.

The rolling stock has steel underframes in all cases, and the goods stock built for the line is wholly of that metal. The 120 old ballast wagons purchased in India have wooden frames, but these are nearly worn out.

The whole of the stock is fitted with central buffers and the / Norwegian pattern coupling hook, which seems to be stereotyped by English makers, but which is a fruitful source of breakaways during the time the road is rough and unballasted.

Rolling stock consists of

149 passenger vehicles,
3 horse boxes,
25 cattle trucks,
3 powder vans,
60 special water tank wagons,
50 brake vans,
850 goods wagons.

The peculiarities appertaining to this part of Africa have thrown upon the Chief Engineer many duties beyond those which ordinarily fall upon the railway builder. Although it was known that skilled labour did not exist, it was hoped and supposed that the natives would readily take up earthworks, and for over two years every possible effort was made to induce them to labour. On several occasions it seemed as if these efforts would be successful, and at one time as many as 1,700 local men were on the works, but their stay was always fitful, and after a week or two the numbers quickly melted away. Even the pressure of famine, which in 1899 was heavy in the land, failed to make them work – they preferred to die.

Indian labour, therefore, had to be relied on altogether, and although costly, owing to the expenses of importation and repatriation, the Indian navvy has been the only sure workman. The outbreak of plague in India during 1897 was the cause of much delay and great additional trouble and expense, adding considerably to the work of the agent in India.

Transport was another serious undertaking. Many efforts were made to work animal transport in the 'tsetse fly' region, as porters were very difficult to obtain in sufficient numbers, but after a loss of nearly 1,500 animals their use had to be abandoned. Towards the end of 1897 the Consulting Engineer recommended the trial of traction engines of an improved pattern, manufactured by Fowler & Co., of Leeds; two were ordered and delivered in March, 1898. After a few months' trial they proved so satisfactory that two more were asked for and sent out, and all of these have done excellent service ever since. /

The particulars of these traction engines are as follows:–

The engines are compound.	
Cylinder, H.P.	6 3/4 inches diameter.
Cylinder, L.P.	11 1/2 inches diameter.
Piston stroke	12 inches diameter.
Boiler pressure	180 lbs. per square inch.
Revolutions	150 per minute.
Brake, H.P.	70.
Speeds, fast	5 miles per hour.
Speeds, slow	2 1/2 miles per hour.
Weight of engine	18 tons 18 cwt.
Fuel, oil tank capacity	50 gallons.

Coal bunker capacity	9 cwt.
Water tank capacity	400 gallons.
Water in tender	900 gallons.

Beyond mile 250 mules and oxen have been employed with success.

The provision of food for the small army of labourers now nearly 20,000 strong is no light undertaking. Flour in large quantities has to be imported from India, but as a check on the suppliers corn mills had to be set up in Kilindini, and wheat is occasionally imported from England.

The amount of bridging to be provided for the passage of maximum floods called for early decision on the part of the Chief Engineer. This question is one of the most difficult matters to determine in any country which has not a long series of rainfall records, and particularly so within the tropics. To the railway engineer the average annual or monthly rainfall is not a matter of so much moment as the maximum fall that may take place in 24 hours, or 6 hours, or 1 hour, depending on the areas affected in each case. Mere inspection of the watercourses is, as a rule, misleading, more especially as the railway works tend to concentrate the flow that would otherwise pass by many small and, in the dry season, unnoticeable channels into the main depressions. Already on this railway there have been several instances of pipe drains being superseded by large culverts, and one in which a drain has been replaced by a girder bridge of 40 feet span. It is very possible, / indeed probable, that longer experience of the country will show other weak points necessitating revision of the provision for waterways. Within my own experience I have come across several instances where maximum floods occurred at intervals of from 30 to 50 years. In the case of one of these, where I was fortunate enough to obtain a very precise record of an old flood, the reliability of the information was doubted by those in high authority, and the waterway provided in the design for a bridge was curtailed. Many years after I witnessed a flood in this river which rose 2 feet higher than the level shown by the old record, resulting in considerable damage to a large military station, aggravated by the still further rise caused by the throttling of the river by the bridge so built. The river above the bridge drains an area of over 3,000 square miles, and at several places within that area a rainfall of upwards of 20 inches within 24 hours was registered on this occasion. Over smaller areas the intensity of rainfall is frequently much greater. I have known of a fall equivalent to 4 inches in 50 minutes registered in a basin of 5 square miles.

In another case of a bridge of three spans of 150-foot girders the under side of the girders was at a level of 15 feet above the roadway of an adjacent public road bridge which had been in existence for over 20 years. Both were swept away by a flood, which must have been 20 feet at least above the level of any previously recorded.

During the present year the Rajputana railway in India (a line 25 years old) has been breached in many places by floods, although hitherto it has been considered that the waterways allowed on this line had been excessive.

These instances, out of a very large number on record, show the amount of care and of study of all data and records available, which is necessary in deciding on the openings to be allowed for the passage of flood waters through a railway. It is desirable, however, that over-caution in this respect should not lead to extravagance; neither, on the other hand, should too great a regard for present economy lead to ultimate waste of time and money.

In order to provide for the traffic that may be gathered from the shores of Lake Victoria, and for the distribution of imported goods, steamers will be placed on this inland sea to be worked in communication with the railway. The whole of the material and engines will be prepared in this country ready for erection, and will be forwarded directly the rails reach Port Florence. /

The leading dimensions of these vessels will be as follows:–

Length	175 feet.
Breadth	29 feet.
Depth (moulded)	9 feet 6 inches.
Draught (loaded)	6 feet.
Speed	10 knots when loaded.
Cargo capacity	150 tons.
Engines, triple expansion with twin screws.	

Supplementary Note on Traffic.

A few remarks on this subject may not be out of place. The railway is opened for public traffic up to the last complete station interval as soon as possible after the rails are laid, generally within a month or two, to the great convenience of travellers and of the Protectorate Authorities. The public traffic, *i.e.,* all traffic not on account of the railway itself, has averaged about £4 per mile per week since the first length of 100 miles was opened in February, 1898.

Stores, troops, and other passengers connected with the Protectorates have been conveyed to the extent of 5,000 tons of stores and 47,000 passengers, including troops. The difference in cost of conveying these by rail as against road transport has up to June, 1900, amounted to about £300,000; while during the Soudanese Mutiny in Uganda in 1898 the saving in time in transport of reinforcements just saved the situation. /

APPENDIX I

Summary of Captain Pringle's Description of the Method of Surveying for the Reconnaissance Survey of 1891.

The daily route was traversed with compass, aneroid barometer, and pedometer, and the plan plotted on the field. The general slopes of the country at right angles to the traverse were observed with Abney's levels.[10] By a combination of these cross sections with the barometer observations the plans were approximately contoured at vertical intervals of 100 feet. A section was at the same time prepared from the barometer readings, corrected as far as possible for the daily wave and for atmospheric changes. These field plans were re-plotted in camp, linked together by triangulation where feasible, and otherwise by astronomical observations, and were amplified by sketching in surrounding country by means of plane tables set up on commanding points.

The dense nature of the bush and want of time preventing regular triangulation, astronomical observations were made to check the positions occupied at the end of each day's march, one or other of the following methods being used as was found suitable:–

(a). Latitude and azimuth observations to any well-defined point previously fixed to the north or south of the camp.

(b). Latitude and distance observations where the only previously determined points lay east or west of the camp, the distance being determined by measuring a short base, and taking theodolite or sextant observations from either end.

(c). When the above two methods failed, the position of the camp was determined by latitude and longitude observations, the latter depending for their accuracy on the ratings of watch chronometers.

(d). Observations for absolute longitude were taken whenever opportunity occurred of occulations, either of a star by the moon or Jupiter's first satellite, and thereby the ratings of chronometers were checked. /

During halts of 24 hours or over diurnal wave curves were made for each aneroid barometer, and instruments were frequently checked and adjusted. Notes were made during each day's march on the following points:–

Number and position of all small waterways crossed; breadth height of banks, high flood marks, nature of soil in bed and banks, slope of bed and depth of water, if any, of all streams of 20 feet in width and upwards; and of the general, physical, and geological features of the country.' /

APPENDIX II.

Method Employed for Final Survey.

The method adopted for the final survey was the usual one of a theodolite and chain traverse following a route determined by preliminary trial lines. This

traverse is levelled over with sights taken at every chain; and, where necessary, frequent cross-sections with the spirit level extending according to circumstances for so much as 400 yards on either side of the traverse are made. By means of the longitudinal section combined with the cross-sections a contoured plan is plotted, with contours at 10 foot vertical intervals.

On this plan in the office a centre line is laid out, and a rough section prepared from the contours; when found satisfactory it is transferred to the ground, and then a final set of levels is taken over it, from which the working section is prepared.

It may be explained that for railway work a transit theodolite is the instrument usually employed, and for measuring a 100-foot chain is used, pickets being driven at every chain length nearly flush with the ground on which levels are taken, as well as intermediate points where necessary.

F. W. Emett, 'Some Curiosities of the Uganda Railway', *Wide World Magazine* (April 1901), pp. 26–35.

Some Curiosities of the Uganda Railway.

By Frederick W. Emett.[1]

[...]

To construct a railroad of over 500 miles in length, under the most favourable conditions and in the most highly-civilized country, is not a task to be lightly undertaken; but when a work of such magnitude has to be carried out in the heart of the Dark Continent of Africa the difficulties are well-nigh appalling – and, judging by what has been done or attempted by foreign Governments in their African dependencies, only surmountable by British engineers and under British administration. Such a work has not only been planned and commenced, but will at no distant date become an accomplished fact, and the silence of the shores of the Victoria Nyanza, that great inland sea in the very heart of Africa, will be broken by the whistle of the locomotive and the bustle inseparable from a great railway terminus.

Every reader of The Wide World has heard of the Uganda Railway, but it is a matter for speculation as to how many realize what these two words mean.

Well, then, they mean that a wide track has been cut for a distance of 500 miles, or about the same distance as from Euston to Aberdeen, across swamps, through primeval forest, through malarial and tsetse-fly ridden belts, where horses cannot live and man becomes fever-stricken, across high, wind-swept plateaus and round mountains in places almost as steep as the sides of houses, until the beautiful Nyanza with its wave-lapped shores is reached. The wonders of this line cannot be better summarized than in the words of Sir Harry Johnstone, His Majesty's Commissioner in Uganda, one of our ablest administrators and certainly our most interesting despatch-writer.

'I wonder,' he says, 'if in England the importance of one aspect of this railway construction has been realized! It means the driving of a wedge of India, two miles broad, right across East Africa, from Mombasa to the Victoria Nyanza. Fifteen thousand coolies, some hundreds of Indian clerks, draughtsmen, mechanics, surveyors, and policemen are implanting the use of the Hindustani language, are carrying the Indian Penal Code, Indian postal system, Indian coinage, Indian clothing, right across these wastes, deserts, forests, and swamps, tenanted hitherto by wild, naked savages or wild beasts. It is one of those strong gouges which civilization employs to / rough-hew her ends – a gouge which leaves a great, clean track of good, sprinkled at its edges with items of suffering, little deeds of harm and unintentional injuries of atoms. As you roll by so smoothly in a well-appointed carriage you see occasionally from the windows, perhaps twice in three hundred miles, a headless corpse flung on to the grass below the embankment. It is a native who has not yet realized the truth, so frequently told at British railway stations by placard, that "it is dangerous to walk along the line." ' Contrasting the lesser ills, Sir Harry Johnstone says that 'the railway has taught the negro the value of honest work and has saved thousands from death by famine. To the hungry people of East Africa dying from the result of three years' drought the railway has brought food and shelter, and the Masai who, a year ago, were chiefly engaged in raiding and slaughtering are now working as navvies on the line, decently clad for the first time in their lives.'

Before proceeding with my more immediate task – the recital of some of the difficulties encountered from wild beasts – it will not be inappropriate to give a few 'dry' but useful particulars concerning this line.

It has now been five years under construction, having been commenced in January, 1896, and at the time of writing rail-head is somewhere about the Salt Lake Nakuro, some 460 miles from the coast terminus of Kilindini, at Mombasa, thus leaving a distance of 120 miles to be constructed before the terminus at Port Florence, on the Victoria Nyanza, is reached – probably in another year.

The photograph on the preceding page (not included) shows a portion of the line near Mackinnon Road Station, in the Taru Desert. A curious contrast is here shown – a group of naked Wateita natives standing complacently at the side of the track watching the inspection trolley, which has just returned from a trip along a section of the line. This vehicle is worked by the Indian coolies, a number of whom are shown in the photograph (not included).

For the first 200 miles the line has had to be constructed through dense forest; and the second picture, taken near Masongoleni Station, 180 miles from Mombasa, shows the method of working, after a path has been cut through the trees and thorns for the railroad track. Here a gang of coolies are seen engaged in making a cutting, the baskets of earth as removed being used to form the embankment. On some parts of the line the earth-work has been insignificant

compared with the dense, thorny jungle and the difficult work of grubbing up and removing stumps from the track.

But, as I said earlier, this great railway line is an accomplished fact for a considerable distance, and in order to show what travelling is like on a Central African railway I will give a few extracts from a letter recently received from a friend who has by this time safely reached his destination in Uganda.

'Last Thursday,' he says, 'we got a special train to take us up as far as Kikuyu, 340 miles from the coast, where we spent some time encamped beside the railway siding at Kikuyu Road. There was, of course, much to interest / and instruct along the railway route. We have journeyed the 340 miles from Mombasa in about a day and a half. Starting at noon on Thursday we arrived at Kikuyu about midnight on Friday – not a bad speed considering that we have ascended over 6,500ft. on African soil on a single line. The first stage of the journey, to Voi, ninety-five miles, took till midnight to traverse – just twelve hours. But this included, besides various short stoppages on the line, a halt of four hours at a place called Samburu, occasioned by an accident to a train ahead. The country between Mombasa and Voi was fairly interesting. The scenery was pretty ordinary, and reminded one very much of Surrey at times – low thorn bush and scrub in the foreground, with hills behind. A few villages and occasional signs of cultivation appeared at intervals. At Samburu, which is in the waterless Taru Desert, our enforced detention enabled me to go off for a good long walk, mostly along the rails, for fear of missing the train when she should start. I walked on so far, in fact, that I did not hear the warning whistle of the engine, and had to stop the train when it overtook me. I must have wandered ten miles or so, but it was in the late afternoon and was very pleasant. I took my place in the train, and at midnight was awakened with the news that we had reached Voi, a hundred miles up the line, and that a dinner awaited us hard by the station. And, sure enough, a bare 100 yds. from this Central African station we found a well-kept, spacious restaurant, where a hot six-course dinner was immediately served at 2 1/2 rupees a head! We had soup, fish, game, mutton, plum-pudding, and fruit. Voi is a large and important station, just like any country station in England. After dinner, contrary to custom, we again entrained, and, travelling all through the night, reached Makindu, another large station, at 9.30 the next morning, just in time to do justice to breakfast, which was ready immediately on the arrival of the train, as at Voi. Makindu, 200 miles from Mombasa, was not even known two years ago, but is now a large Indian settlement – all railway hands, of course. The luxury of dining-cars being at present unknown on the Uganda Railway, we bought at this place cold meat, vegetables, and fruit, and took them on board to eat for the midday meal on the way.

'After leaving Makindu we saw a good deal of monotonous desert scenery. Taken as a whole the country through which the line passes is very thinly inhabited. As

we sped along we passed a few swamps with long grass, which, we were told, would be the sort of thing we should have to march through later on. The mountains we saw varied in range from 3,000ft. to over 7,500ft., and included the grand Kilimanjaro range. Numerous Indian encampments, consisting chiefly of breakdown gangs, were scattered along the line. Some of the temporary bridges over which we passed were decidedly shaky, and occasionally have given way under the weight of heavy trains. We were told that we were very fortunate to have escaped accident or breakdown. During the journey I espied two rhinos, some ostriches, two elands, and several wildebeestes and antelope. Thirty miles beyond Makindu we stopped at the station of Simba, which, being interpreted, means 'Lion.' It is in the heart of the lion country, and we saw several very ingenious lion-traps near the station. Two of our party went off for a long tramp while the train was at rest here, forgetting about the lions, and as they did not return till after sunset fears were entertained for their safety. But on their return they assured us that they had not met a specimen of King Leo's tribe or even heard aught of his voice. Another fifteen miles brought us to Kibwezi, situated amid beautiful hills, and I longed for a camera to snap-shot a few of the glorious, verdure-clad ranges. At 9.30 at night we steamed into Nairobi, the railway head-quarters, 330 miles from Mombasa. After an hour's halt for dinner in the vicinity of the station we started off on the last short nine miles to Kikuyu, which was reached at about midnight.

[...]

The third photo. is a curious one and shows how in the tsetse-fly belt which extends for some 250 miles from the coast attempts are being made to prevent the enormous mortality among transport animals. As will be seen, the animals are attired in a complete suit, which I understand is only partially successful in keeping off the fatal fly. In the tsetse zone it is quite impossible for horses to live, but by the help of the railway animals are gradually being got up to the healthier districts of the interior.

The old 'safari' or caravan road runs parallel with the railway, and the next photograph (not included) shows a caravan on its way. The long line of native porters in Indian file is clearly depicted in this snap-shot. The natives are particularly fond of flags and drums, and with the latter keep up a continuous 'tum-tumming' as with their loads on their heads they march to and from the coast. Not infrequently the tired natives fall out *en route*, and when camp is pitched for the night the drummers do good service in scouring the vicinity for their missing comrades.

Some of the engineering difficulties connected with the construction of the Uganda Railway have been very great, and in many places tremendous gradients have to be negotiated. The highest of these summits is that at Mau, with an altitude of 8,300ft., whence there is a sheer drop of nearly 5,000ft. to the level of Lake Victoria. /

The next photograph (not included) is a view of the second highest point on the railway – the Kikuyu escarpment (7,500ft.) – and it also shows a rope incline which has been constructed temporarily so that the completion of the permanent line round the gradient may not be delayed. This temporary line is a most interesting piece of engineering work. In the photograph the 'carrier,' which is hauled by steel ropes, is just about to ascend to the summit with a loaded truck, which it will deposit on the more level line at the top, the whole being pulled up by a weighted truck coming from the summit, and which is easily discernible in the picture.

A peculiar interest attaches to the next photograph (not included). Equator Camp is some distance off the railway line, being in reality on the old caravan route, and situated some little way beyond the Eldoma Ravine Station. Although no positive observations have been taken, this is supposed to be the spot where the Equator crosses that part of the country, and the sign announcing the fact was erected by one of the officials. It is in the midst of a vast stretch of desolate and uninhabited country; and with the exception of an occasional passing caravan there is no sign of human life. Close by this notice-board is a clearing, which has been made on the site / of a camp which has been used probably for hundreds of years by the old ivory traders.

In the letter I have quoted my friend speaks of the quantity of big game he saw from the track; and some of the photographs I have been permitted to reproduce will sufficiently indicate that the Uganda Railway passes through a country that is indeed a paradise for sportsmen. The great stretches of grass land are often literally covered by herds of game, and numbers of the animals approach fearlessly quite close to the trains. Instead of the cows and horses to be seen grazing close to the English railway the traveller on this great Central African line will see zebras, gnus, gazelle, hartebeest, jackals, ostriches, giraffe, and lion within easy distance of the rails. In the earlier days of the railway it was no uncommon thing for the train to be pulled up while the passengers alighted to have a shot at some lion or zebra that had strayed on the track.

[...] Rhinos, too, occasionally cause trouble on the railway. One day while running between Makindu and Tsavo stations the train crashed into one of these animals which was walking unconcernedly along the metals. As in the encounter between Stephenson's engine and the 'coo,' the locomotive came off best, and the unfortunate rhino after getting pushed along the rails was caught, becoming entangled in the cow-catcher, whereupon the engine-driver got down and shot him. On another occasion the train ran into a herd of zebra on the Athi Plains, where these animals congregate in hundreds.

Sir Harry Johnstone, in a recent report, gives a graphic account of the big game to be met with on the Uganda Railway, and I cannot do better than give an extract from his despatch.

'From Makindu,' he says, 'I travelled on through the night towards Nairobi. As the dawn diffused itself over the Athi Plains we saw from the windows of the train a rare and beautiful sight. These immense level stretches of grass land, reduced in the present drought to uniform grey-yellow stubble, were literally covered by herds of game, individuals of which would approach quite close to the line, as though they had already lost all fear of the rushing, jointed monster with the smoking head. We saw zebras as close as one might see horses grazing in the meadows along an English railway, and gnus were to us as cattle lazily flicking the flies off their haunches. Grant's gazelle and Thomson's gazelle would graze and merely lift their lovely heads as we rattled by. Hartebeestes faced us and shook their horns with mock indignation. Three or four giraffes, even, could be discerned on the sky-line, while pallah and oribi, wart-hog and jackals were things of no account. Ostriches were constantly seen, and I noticed a group of three very handsome males – black, with white plumes – in a dry stream-bed just as we were entering the precincts of Nairobi Station. The whole hour's panorama of this wonderful zoological garden was like a sportsman's dream, but the fact was we had been crossing the Athi Game Reserve, where some two years of strenuously enforced respect for the game regulations has brought about this wonderful collection of animals, so rapidly growing in confidence of the protection accorded them, that herds of zebra frequently gallop like runaway horses through the stretched-out township of Nairobi.'

In the early days of the railway construction the English guards and travellers are said to have done a good deal of indiscriminate shooting. The sum total of their shooting, however, was as nothing compared with the disastrous / organized raids of military officers travelling backwards and forwards to Uganda (and tales are even told of their good-natured desire that the passengers should share in these delights). The train was sometimes brought to a standstill, and the eager-faced guard would look in at a first-class carriage to say: 'There is a fine rhino over there, sir, and I will give you a quarter of an hour's stop if you like to go after him.' In the interests of game preservation this is now, however, prohibited.

With so enormous a staff as that employed on the railway the medical needs are necessarily great, and in the picture given on the previous page we see the hospital which was established at Kibwezi, about 180 miles from the coast, for sick coolies.

Wherever rail-head happens to be there is now always a flying hospital, chiefly consisting of tents, where both medical and surgical cases are treated.

The last photo. of this series shows how one of the steel boats which have been taken out from England in sections is being bolted together, preparatory to being placed on the Lake, a portion of which is also shown in the picture.

[...]

***Memorandum for the Private Enterprise Committee by the Hon. Gideon Murray, Master of Elibank* [n.d.]; held at the National Archives CO 766/1.**

MEMORANDUM

– for –

THE PRIVATE ENTERPRISE COMMITTEE

by

THE HONOURABLE GIDEON MURRAY, MASTER OF ELIBANK.[1]

During the past three years I have been studying the question of railway development in East and Control Africa and in 1920 was in this connection in close consultation with my Parliamentary colleague and friend, the late Mr. Henry Wilson Fox,[2] M.P., who at that time submitted comprehensive development proposals to the Imperial Development Committee (now defunct). I have officially resided in and have a knowledge in a business capacity of many parts of the British Empire, including South Africa, also of America. I venture, therefore, to lay before the Committee the following virus and suggestions with regard to the questions raised in their Terms of Reference.

I understand that the Committee is interested particularly in the transportation problems in Africa and that to interpret the terms of reference the two main issues which the Committee are primarily considering are (a) whether the Railways, existing and future, should be under private or departmental control and (b) whether any future Railways should be constructed privately or departmentally.

The first issue is already very such complicated by the fact that the Railways in East, Control and West Africa are already under departmental control, and that around these Railways there has been built up a system founded upon the

Colonial Office Regulations which will be difficult to break through. To begin with, therefore, even if the Committee were to report in favour of the / transfer of these Railways to private control the Colonial Office would, I expect, find themselves met by many cogent arguments in opposition on the part of the Governments concerned. I wish to emphasise this point, because it may have to be taken into consideration by the Committee. On the other hand, I hope that the Committee will not allow a point of this nature to influence their judgment in their final recommendations should they come to the conclusion on reasoned facts that the preponderance of argument is in favour of private, or partially private, control. The transition period of any transference of control in a large undertaking must necessarily be difficult and sometimes complicated, but should not be allowed to stand in the way of a practical solution.

In my view, Railways are always better and more efficiently administered when under private control. The Railway Staff and Officials under private control regard themselves as servants of the public. Under Government control they are apt to regard the public as their servants. This is principally due to the fact that under departmental control there is always considerable difficulty and usually a long delay in discharging an inefficient Official. Secondly, the Railway Staff and Officials have not the same inducement to make the Railway pay, not being dependent to the same definite degree upon the revenue of the Railway as they are when under private control. With government Railways any deficit on working is invariably made good by the taxpayer. With private Railways they must out their cost according to their cloth or otherwise go into liquidation. This leads to greater keenness on the part of all to increase the Railway's earnings and efficiency. /

In a new Country development of local resources should go hand in hand with railway development, When a Railway is under private control the Company owning and administering it takes every possible opportunity of promoting the development of the local resources by assisting to find new markets, possibly in some cases by assisting to find Capital, in other cases by opening up lands and by promoting through-freights; and this they do by methods of enquiry and business connections which are open to no Government Department. The Canadian Pacific Railway is one of the best examples of the development of a country's resources by private railway enterprise.

The reason why in the past in our Crown Colonies we have not seen the same degree of, and swiftness of, development as in the Dominions is due largely to the fact that the policy of development has been so cautious and so slow. In the Dominions and in South America if a Railway is required the Government concerned calls for Tenders, accepts a Tender, and the thing is put through at once, or else if the Government has not the necessary funds wherewith to pay for the railway construction themselves they offer to an individual or group a

concession under which the individual or group finds the money to build the Railway, and in return for this is given substantial reward in the shape of guaranteed interest on a substantial scale and grants of lands or minerals or both. In South America the guaranteed interest is never less than 6%.

On the other hand, what is the policy in our Crown Colonies? Usually the Colony is unable to find the funds for railway development. They then cast about for a concessionaire. Individuals or groups come to them or to the Colonial Office or to the Crown Agents and long and lengthy intricate negotiations ensue. The Colonial Government, the Colonial Office and the Crown Agents / together in consultation will perhaps decide that they will grant a concession to build the Railway, but that the interest to be guaranteed for a term of years by the Colonial Government shall be 5% at the outside and that there shall be no guarantee of Principal and no concession of lands or any return for the risk which the Capitalist undertakes when he launches his money often into the midst of a virgin jungle. British Financiers, therefore, prefer to go to those Countries like South America where they can expect some ultimate return commensurate with the speculative risk of the outlay.

I would suggest, therefore, that in future where Colonial Governments desire railway development they should grant more generous terms both in the way of guarantee of principal and sinking fund and where the Principal is not guaranteed, of grants of land, together with their mineral deposits, upon freehold or long leasehold basis.

I am of the opinion that the construction of Railways where Government funds are available should be thrown open to competitive Private Tender. In my judgment a Government Department should not be allowed to tender for big railway contracts because, as I have already pointed out, speed is requisite and no Department as a rule has the means of carrying through a large contract quickly. Furthermore, how can a private firm tender upon equal terms with a Government Department. The Department is obviously in a superior position because if it breaks any conditions of the Tender it is only breaking its own conditions and there is no enforcement of penalty against it. Speed and efficiency in railway construction is especially desirable in the Tropics and this the private contractor can give. The Government Department cannot do so. There were some very interesting figures given in a leading article in the Morning Post of 18th, August, 1923, showing the cost of railway construction in West and East Africa and / comparing the estimates of construction under a private or department system, and the times taken to construct by Government machinery.

Let me give two instances of this:

In the case of Uganda Railway, the cost of the railway was at first estimated at £5,600 per mile as compared with the estimate of £4,300 a mile supplied by

a private firm. The cost was actually £9,900 per mile and the time taken in construction, instead of three to four years, was seven to eight years.

Take another case. The cost of the Gold Coast railway was double the official estimate and amounted to nearly £11,000 per mile and three years were occupied in completing 40 miles.

From what I have stated above the Committee will appreciate that I am in favour of private construction and private control so far as possible. I admit that Government control may be necessary in regard to supervision of freight rates. Also if War took place power must be reserved for any or all Railways to revert to Government control during that period.

I appreciate, however, that for various reasons complete private control may not be realisable or practicable in Africa and that therefore endeavours should be made to find a via media. I have in mind the example of the Anglo-Persian Oil Co.[3] which whilst administered entirely as a private Company has on its Board Government Representatives and also Government Share Capital. I see a way in which this principle might be applied to certain of the African Railways.

UGANDA AND BRITISH EAST AFRICAN RAILWAY SYSTEM.

My suggestion in short is that a strong private Company should be formed, consisting of a combination of several important Contracting and Shipping groups; that the Uganda Railway, with its branch lines and including the Busoga and Kampala railways and the railway / now being constructed at Uasin-Gishu, should be valued as they stand to-day; that these Railways should be handed over to that Company at a Valuation agreed upon between the Government and the Company; that the Valuation so arranged together with a certain addition for Working Capital be the declared Capital of the Company; that 40% of the Capital be allocated free to the Imperial and Colonial Governments and that the Company then should go to the public for the remaining 60% in the form of Debentures, the Imperial Government guaranteeing a low rate of interest thereon and repayment of principal. The Debentures so raised should be secured upon the whole agreed value of the Railways. The Government share of 40% would be paid to them in free ordinary shares. Of the capital thus raised sufficient should be retained for Working Capital, the remainder to be paid to the Imperial and Colonial Governments as purchase money for the Railways required.

With regard to this purchase money, however, there should be this understanding, that it should be there should be this understanding, that it should be utilised again as soon as possible and after careful investigation by the Government and the Uganda Railway Company upon further railway development

in British East Africa and Uganda – any Railway constructed out of such purchase money to be placed under the managing direction of the Uganda Railway Company upon financial terms to be agreed between the Government and the Company. The new Railway would in other words become a subsidiary of the principal Uganda Railway Company and would provide security for the additional raising of Capital for further construction.

I should, moreover, as in the case of the Anglo-Persian Oil Co., add two Government Representatives to the Board so that the Government may keep in close touch with the policy of the Company. The parent Company should have its headquarters in London with a Local Committee in British East Africa. /

It would also be advisable to arrange that a Port Authority be established at the Port of Mombass, upon which should sit a Representative of the Government and a Representative of the Railway Company. This would enable the Government, Railway Company and the Port to work in close co-operation, although I should prefer to see the Port directly administered by the railway authority.

TANGANYIKA RAILWAY SYSTEM.

Whilst in the case of the Uganda Railways a net annual profit is now shown which therefore makes my foregoing proposals immediately financially possible, the same does not apply to the railway system of Tanganyika, and therefore, in that territory, at any rate in the meantime, different action would be necessary.

The mainline railway running from Dar-es-Salaam to Kigoma shows at present a heavy annual loss and so far a I can judge this loss will continue until this line, which is the main artery of Tanganyika and East Central Africa, is supplied with feeders opening up the rich territories near and around the adjacent Lakes. It would therefore seem desirable for the Government to press on new railway schemes with that object.

Those most important in my opinion would be a railway connecting –

(a) Lake Nyasa with Lake Tanganykia, 200 miles in length (Mwaya to Kasanga) with a small extension from Kasanga to Aberoorn, about 30 miles. This would open up a most fertile part of Central Africa and add to the world's food supplies in both beef and cereals. It is a country that has hitherto been untapped, and also a part of the country in which I understand Europeans could live in comfort.

(b) Lake Tanganyika with Lake Kivu, about 60 miles in length, along the Rusisi River Valley, opening / up another very fertile area and incidentally bringing nearer the territory of Ruanda, alleged to contain some two to three million head of cattle, sheep and goats, and thickly populated with an industrious people.

(c) Mwanza, on the southern end of Lake Victoria-Nyanza with Tabora (on the main Dar-es-Salaam line about 200 miles east of Lake Tanganyika) about 190 miles in length.

(d) Kelossa (situated on the main Dar-es-Salaam railway about 150 miles from Dar-es-Salaam) south-west through rich territory with the north end of Lake Nyasa, a distance of about 250 miles.

Another projected railway is that of Tabora in a north-eastern direction to Kasseke on the edge of the Ruanda country between Lakes Kivu and Lake Victoria-Nyanza. There has, however, been considerable controversy regarding this railway both as to route and point of terminus, and I do not bring this into the scheme for the moment although ultimately I think it is clear that a railway will have to be built somewhere in that direction.

There are two possible methods under which these railways might be financed and constructed;– Either the Imperial Government could provide the necessary funds for their construction in the same manner as they did for the Uganda Railway and that they be constructed by private contract; or else a private company might be formed for this purpose, which would go to the London money market for the necessary funds with an Imperial guarantee as to interest and principal for a period of say 30 years or instead of guarantee of principal the company might be granted concessions of lands and minerals upon a freehold or long leasehold basis alongside the railway lines.

In any event, I would suggest that a private company, with government representation, similar to that which I have proposed for the Uganda Railway, / should be formed in connection with Tanganyika to administer all the railways of that territory. In the case of the main Dar-es-Salaam Railway this Company should act as managing directors, receiving agreed payment for this service, for obviously the present financial circumstances would not admit of this line being taken over entirely by any private company unless guaranteed by the Government both as to principal and interest, until such time as it showed sufficient profit to pay its own way.

CO-ORDINATION OF RAILWAY SYSTEMS OF EAST AND CENTRAL AFRICA.

Some form of co-ordination for the purposes of policy between the two railway systems of British East Africa and Tanganyika is obviously desirable, but I am not at present prepared to make any recommendation on this point.

IMPERIAL DEVELOPMENT OF RAILWAY SYSTEMS.

Finally, I would like to submit this recommendation. I believe that the time has come when the Imperial Government should consider, very seriously indeed, the more speedy development of their large central and East African tropical possession. Such development, however fast, must necessarily take considerable time and a generation passes very quickly when development on this large-scale nature is proceeding. During the late Great War Central Africa was useful, even with its present small degree of development, in assisting the food supplies of the world, especially by export to India. If there is ever another war the food supply position is likely to be more complicated and difficult even than in the last. Central Africa contains enormous / food resources only awaiting development. I venture to go so far as to say that it is the duty of the Imperial Government to take every reasonable measure to develop those resources.

It should, moreover, not be overlooked that where railway construction is concerned, much employment can be given in Great Britain, and so the Government could with domestic advantage also initiate a bold policy in connection with the development of African transportation and of transportation in her other Crown Colonies. Legislation might be introduced to enable the Government to borrow on the London market up to fifty million pounds for that purpose, as and when it is required. When we remember that in the past three years we have spent £400,000,000 in hard cash in unemployment benefits to the workless in this country and that our national debt is some £8,000,000,000 to-day, 50 or even 100 millions for the Imperial purposes outlined in this memorandum seems a mere bagatelle, especially as a very great percentage of it would come back to the unemployed in this country and create good profitable employment of a reproductive nature.

I venture to hope that this memorandum may be of some service to the Committee and I shall be very glad to elaborate any of the points in it should it be possible for me to arrange a meeting with them.

[...]

O' Callaghan, 'Uganda Railway'

1. *Sir Alexander Rendel*: Sir Alexander Meadows Rendel (1828–1918), consulting engineer to the India Office, the East India Railway and other Indian railroads.
2. *Tsetse fly*: two-winged blood sucking African fly of the genus Glossina, which often carries and spreads pathogenic trypanosomes to humans and livestock.
3. *aloes*: Aloe bushes have rosettes of succulent, often spiny-margined leaves and long stalks that bear yellow, orange, or red tubular flowers.
4. *Sir Guilford Molesworth*: Sir Guilford Lindsey Molesworth (1828–1925), civil engineer. Chief engineer of the government railways in Ceylon and consulting engineer to the Indian government (1871–99).
5. *scantlings*: small timbers used in construction.
6. teredo navalis: wormlike marine mollusks of the genera Teredo and Bankia. They bore into wood, especially submerged timbers, and can do extensive damage.
7. *angle iron*: a length of steel or iron bent at a right angle and used as a support or structural framework.
8. *jib*: the arm of a mechanical crane.
9. *'Vignoles' pattern steel rails*: named after their inventor, Charles Vignoles, an early railway engineer.
10. *Abney's levels*: An abney level is a surveying instrument comprising a spirit level and a sighting tube and is used to measure the angle of an inclination.

Emett, 'Some Curiosities of the Uganda Railway'

1. *Frederick W. Emett*: Frederick William Emett (1881–1946).

Memorandum for the Private Enterprise Committee

1. *GIDEON MURRAY, MASTER OF ELIBANK*: Gideon Oliphant-Murray, second Viscount Elibank (1877–1951), Scottish politician. Private Secretary to Commissioner for Native Affairs, Transvaal (1901); Assistant Native Commissioner, Zoutpansberg (1902–6); and Assistant Private Secretary to the Permanent Under-Secretary of State for the Colonies (1907–9).
2. *Mr. Henry Wilson Fox*: Henry Wilson Fox was the MP for Tamworth. Entered Parliament on 23 February 1917 as a coalition Conservative and served until his death in 1921. Married to Hon. Eleanor Birch Sclater-Booth, daughter of George Sclater-Booth, first Baron Basing of Basin Byflete and of Hoddington.
3. *the Anglo-Persian Oil Co*: founded in 1908 on the discovery of large oil deposits at Masjed Soleiman, Persia. In 1935, it was renamed the Anglo-Iranian Oil Company, and, in 1954, became the British Petroleum Company (BP).

Smith Wright, *Railways in Rhodesia*

1. *Sir Arthur Lawley*: Arthur Lawley, sixth Baron Wenlock (1860–1932), politician, soldier and administrator. He served as the administrator of Matabeleland (1898–1901), Governor of Western Australia, Lieutenant-Governor of Transvaal and Governor of Madras.