

LAGOS GOVERNMENT RAILWAY.

As we pointed out in an article which appeared in our issue of February 25th, 1898, at the commencement of the Lagos Railway—the formal opening of which by the Governor, Sir William MacGregor, took place in March last—one of the first difficulties was the choice of a suitable site for the terminus. On referring to Fig. 1 it will be seen that Lagos town is situated on an island in the Lagoon about one mile from the mainland, and in order to bring the railway into Lagos itself, a considerable sum of money would have been expended in constructing a railroad bridge of this length, besides purchasing land in the town of Lagos to provide a sufficiently commodious site for a railway depôt. Nature, however, has provided a small island called Iddo, between Lagos and the mainland, and on this island Messrs. Shelford and Son, the consulting engineers for the West African Railways, finally decided to place the terminus. In order to connect Lagos with the terminus on Iddo Island it was decided to construct a bridge for light carts and foot passengers only, and this was continued on the other side of the island, thus forming communication for foot-passengers between Lagos and the mainland, apart from the bridge carrying the railway. It will thus be seen that there are three distinct bridges at Lagos, the first the Carter-road Bridge, named after the late governor, Sir Gilbert Carter, which connects Lagos with Iddo Island; the second and third are road and railway bridges which run alongside each other and connect Iddo Island with the mainland. These latter are generally known as the Denton Bridges, and are named after Sir George Denton, the late Colonial Secretary of Lagos, and now administrator of the Gambia. Owing to the great depth of mud and the treacherous bottom of the Lagoon, considerable difficulty was experienced in constructing the Carter Bridge, which is over 2200ft. in length. It was commenced in February, 1898, and the last girder was placed in position in October, 1899. The bad foundations, the swift current—about four knots—and the unhealthiness of the work formed the chief difficulties to be contended with.

The following are a few particulars of the Carter



Fig. 1—LAGOS TERMINUS

Bridge:—The piers consist of piles screwed well down into the soft bottom of the Lagoon. The lower ends of the piles are solid steel, 8in. diameter, with a cast iron screw, 4ft. in diameter, and the upper ends are built up from sections of rolled steel—four sections going to make up the pile—which were rivetted together by hydraulic pressure at the railway workshops. The main girders are in 70ft. and 50ft. spans, the former run from the Lagos end of the bridge to the swing span and rest on piers having four piles, the pitch of the piles being 18ft. 6in. square; the latter are on the other side of the swing span and rest on piers with two piles, every third pier, however, having four piles. The swing span has a total length of 124ft. 6in. giving an opening for small ships of about 50ft. The cantilever arms are of the lattice type, in ten panels about 57ft. long with an overall depth of 8ft. tapering to 3ft. at the ends. The roller path for the swing span is 19ft. in diameter and rests on a pier built up of seven piles, six being in the form of a hexagon and the seventh situated in the centre.

The distance between the main girders for the entire length of the bridge is 13ft., and the width of the roadway between the handrails is 20ft. 6in. The whole of the ironwork of the Carter and Denton bridges was contracted for and delivered by the Patent Shaft and Axletree Company. The Carter Bridge is approached on the Lagos side by a number of brick arches, of which we give a photograph in Fig. 6. It has now been decided to construct a light steam tramway over the Carter Bridge to connect Lagos with the railway terminus; but as this bridge was originally designed to carry light traffic only, the gauge of the tramway will be 2ft. 6in., which will thus prevent any of the heavy rolling stock of the 3ft. 6in. gauge from traversing the bridge at any future time.

The railway, after leaving Iddo Island, traverses the Denton railway bridge, and after passing through Ebute Metta, a small town on the mainland, where the chief depôt is situated with the locomotive and carriage sheds, runs dead straight for no less than 12 miles with level portions and easy gradients for the greater part of the way, there is another five miles straight between 36 and 41 miles, and here again the line is nearly level. The maximum grade allowed is 1 in 50, and is invariably compensated for curvature, the sharpest curve permitted is five chains radius in difficult country, and ten chains in easy country.

The line was first sanctioned to be constructed to Olta, a small town situated about 21 miles up country from Lagos; it was next decided to continue the railway to Abeokuta, a town of 150,000 inhabitants, lying on the

east bank of the river Ogun, about 60 miles from Lagos, and finally to its present terminus at Ibadan with its population of nearly 200,000. A flying survey, however, is now being made from Ibadan to the Niger River—see Fig. 2—as it is considered desirable to produce the railway to that point and so tap the fertile districts which lie in the valley of the Niger, and also make use of that great waterway.

Between the two termini there are twelve stations, making an average distance apart of about ten miles. At each terminus and at Aro, which is the station for Abeokuta, there are, besides the ordinary station buildings, engine and carriage sheds, turntables, and weigh-bridges. The station buildings are simple in form, and in nearly all cases consist of a timber structure, with corrugated iron roof supported on concrete piers, which raises the whole building clear of the ground. All the woodwork for these buildings has been sent out from England after having been erected at home, and has been re-erected *in situ* by native carpenters, of whom there is a fair supply at Lagos. The permanent way is laid with Vignoles rails weighing 50 lb. per yard, resting on a special form of steel sleeper weighing 82 lb., made by the Moss Bay Company, and placed every 2ft. 9in. apart. These sleepers are pressed out of one solid plate, and have lips to receive the rail according to the necessary requirements of gauge, which is 3ft. 6in. on the straight. Creosoted sleepers are, however, used at all points and crossings and over bridges, in which case the rails are simply spiked down to the sleeper. It is fair to say that creosoted sleepers have so far stood fairly well, but whether they will undergo the test for long it is at present difficult to say.

All the banks and cuttings are tipped and excavated entirely by hand; and except where the bank or cutting is long when small tip-wagons are sometimes used, the

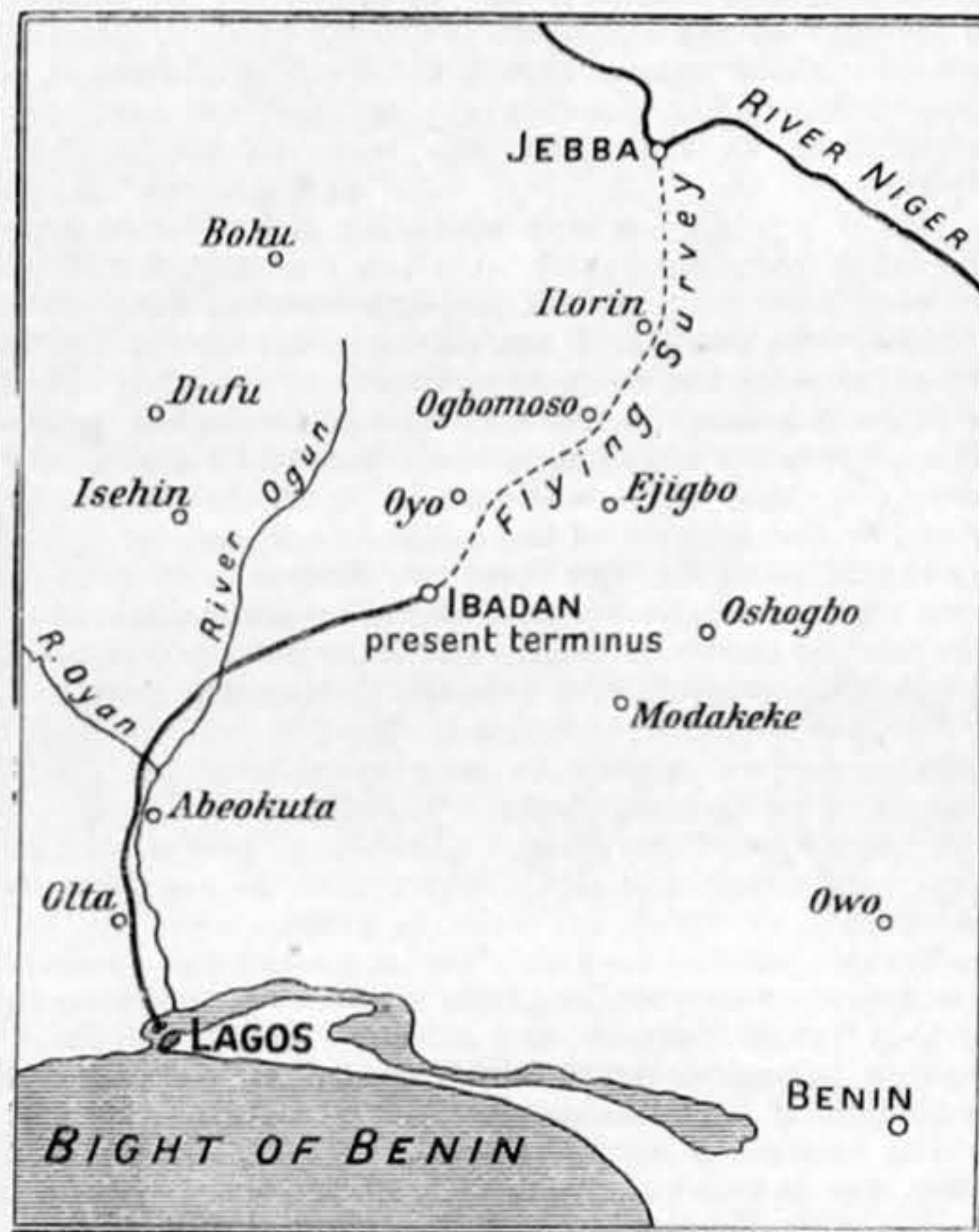


Fig. 2—FLYING SURVEY TO THE NIGER

whole of the earthwork is carried by the natives on their heads from one point to the other. The average pay for this class of work is 9d. per day, and the average amount of work done in this time is almost exactly one cubic yard per man. The formation width is 13ft., with a slope of 1½ to 1 on embankments; but in cuttings it has been found in general more suitable to leave the sides vertical, with the result that the heavy rains do not come down the sides of the cuttings and wash away portions of the earthwork.

Among the obstructions to rapid progress have been lack of sufficiently good ballast, and the heavy bush-clearing operations. No ballast was obtainable until sixty miles of line had been constructed, and then only at one or two points on the line, and therefore had to be transported for considerable distances.

Besides the Carter-road bridge and the Denton-road and railway bridge, several other bridges of importance have been constructed, and of these two are on the main line. The first, over the river Oyan, consists of three 60ft. spans, and the other, over the river Ogun, of three 100ft. spans, and is shown in Fig. 5. A type of half-through girder has been adopted in the 100ft. spans shown on Fig. 5, the total depth of girder being 9ft. The rail level is 2ft. below the top of girder, and the body of the carriages passes over the bridge quite clear, although the distance from centre to centre of girders is only 10ft. 6in. By this means some of the advantages of both deck and through bridges are obtained.

As the town of Abeokuta—see Fig. 2—lies on the east side of the river Ogun and the railway runs along the western side for some miles before crossing the river, it was decided to construct a short branch to carry the railway into the town itself. The river Ogun here, however, is wide, and necessitated the construction of a bridge which is larger than the other two bridges just mentioned put together, and consists of three 100ft. spans, three 60ft. spans, and one 30ft. span. The same design was used as for the other bridges, and as an example of rapid delivery it may be mentioned that the whole of the steel work for this bridge, with the exception of the small 30ft. span which was ordered later, was delivered f.o.b. Liverpool ten weeks after date of order by the Widnes Foundry Company—a result which we believe will compare favourably with the Atbara and Tugela records.

The locomotives used for hauling the traffic consist chiefly of six-coupled engines with six-wheeled tenders and leading pony-wheels, and are shown on Fig. 4. They have been constructed by Hawthorn, Leslie and Co., and all are fitted with the Waelscheart valve gear, which has given every satisfaction. The leading dimensions are as follows:—Cylinders, 14in. diameter by 18in. stroke; grate area, 12 square feet; heating surface, 703 square feet; diameter of driving wheels, 3ft. 3½in.; fuel capacity, 80 cubic feet; width over footplate, 7ft. 6in.; and between frames 2ft. 11½in. Weight in working order on coupled wheels 22 tons 18 cwt., and on pony wheel three tons, making a total of 25 tons 18 cwt. A spark arrester is fitted inside the smoke-box, which does away with the necessity of providing one on the top of the funnel as is common with most engines for foreign parts. The locomotives are sent to the Colony in parts and are put together by native fitters working under the supervision of one or two Europeans. The carriages and wagons are all of the bogie type without exception. The standard length of the carriage underframes is 45ft. and over body 40ft., and the length of wagon underframes 26ft. The carriages have been built partly by the Bristol Carriage and Wagon Company, and partly by Brown, Marshall, and Co., from designs furnished by Shelford and Son.

There are three classes of carriages—first, second, and third. It may seem unnecessary to provide three classes, but it must be remembered that the result of British rule in West Africa has been to produce three classes which are more pronounced than they are at home, viz., Europeans, educated natives, and uneducated natives. The first-class compartments are fitted with comfortable cane seats with cane backs sloping backward at a considerable angle. All windows are fitted with louvres, which can be used in the place of the glass when required. The roof is double, the top one being made of corrugated iron and the bottom one of wood, with a gap between the two in which air is allowed to circulate freely. All along either side of the carriage is a sheet iron sunshade kept well away from the body of the carriage. Fig. 3 shows a mixed train and station building.

The railway is the property of the Lagos Government, the cost being defrayed by the issue of a loan. The work was carried out departmentally by Shelford and Son, of Westminster, who are responsible for the design and construction of both bridges and railway and the appointment of both construction and working staffs. The number of Europeans employed during the construction of the bridges and railway since the commencement has averaged sixty, and includes engineers, assistant engineers, accountants, storekeepers, fitters, drivers, platelayers, &c. The average number of natives employed has been about 8500, with a maximum of about 10,000 employed at one time.

THE INSTITUTION OF NAVAL ARCHITECTS AT GLASGOW.

On Tuesday, the 25th inst., the summer meeting of the Institution of Naval Architects, which is being held again in Glasgow this year, and which lasts until to-day, opened in the Corporation Galleries, in Sauchiehall-street. The Earl of Glasgow, President of the Institution, was introduced by Lord Provost Chisholm, and soon afterwards took up his position as chairman of the meeting. There was a large and representative gathering of delegates from practically all countries, making a total of about 250. Again we regretted to miss the always welcomed face of Sir W. H. White, Director-in-Chief of Naval Construction, but the naval element was in strong force as usual, and many well known experts in shipbuilding and its kindred sciences had found time to make their way north.

The Lord Provost, in the course of his introductory remarks, said he desired in the name of the municipality and the citizens of Glasgow to offer to the members of the Institution the heartiest welcome to the city. Nothing that was in any way connected with the building of ships could possibly be a matter of indifference to the citizens of Glasgow, who had been so long and so closely identified with that industry.

The Earl of Glasgow said that his first duty was very agreeable, as he took the chair primarily to return thanks on behalf of the Institution for the welcome which had been extended to the members, and which was assured to them wherever they went during the present visit. He noted with pleasure the presence of so many friends from other countries, especially Germany, which, he said, they recognised as having given a great impetus to shipbuilding. The chairman pointed out the vast improvement which had been effected on the Clyde since the last visit of the Institution to this city in 1899. Last year was the record year of shipbuilding on the Clyde. Of 541,031 tons launched during the year in Scotland, no less than 444,609 tons were built on the Clyde, leaving 49,429 tons for the rest of Scotland. But that was not all. In England last year the total tonnage launched was 961,426 tons, a very little more than double that built on the Clyde, so that the Clyde shipbuilding for 1900 was half that of all England. Since 1889, too, the length of Glasgow's quays had been increased by two and a-half miles, viz., from six miles to eight and a-half; the revenue of the Clyde Trust had risen in the same time from £287,953 to £441,419; the Customs revenue practically from one million to two millions sterling; the total tonnage of exports and imports from three million tons to 7.4 millions; whilst the total registered tonnage had developed to four and a-third million tons. The Earl pointed out that Glasgow was now in possession of a dock—No. 3—which he believed to be second to none in existence. It was 130ft. longer than the well-known Prince of Wales' Dock at Southampton. The water area had been extended 52 acres, whilst the river had been deepened so as to take vessels of 26ft. draught. A new departure in the Clyde passenger steamship service was