

of the Government of India, as well as that of the Board of Directors in London. On the 1st February, 1869, he was promoted to deputy chief engineer, and afterwards to chief engineer, and had the satisfaction before long of seeing the completion of the entire system. During his tenure of office as chief engineer, a second bridge was carried across the Ganges, at Cawnpore, and many important bridges were completed on the Oudh line, viz., the Tonse, near Akberpore, in Fyzabad, the Gumti and Saie in Jounpore, and the Burna at Benares.

In the spring of 1875 Mr. Lovell obtained a year's leave of absence. On his way to England he made a tour round the world. From Calcutta he went to China, thence to Japan, San Francisco, and New York, visiting in succession Pekin, Hong Kong, Nagasaki, Yokohama, the far-famed Yosemite Valley, Salt Lake city, Philadelphia, Boston, Washington, and other important cities, finally passing through some parts of Canada. During this tour he inspected most of the important engineering works in each country, especially in the United States, where he received the greatest kindness and courtesy from his brother professionals.

In the autumn of 1876 Mr. Lovell returned to India, and was latterly engaged in drawing up a project for a steam ferry at Rajghat, Benares, to enable goods wagons to cross from the Oudh and Rohilkund railway terminus to the East Indian railway station on the opposite bank of the Ganges. In April of 1878 he lost his wife, to whom he was much attached. This had a most depressing effect; and though he battled manfully against its effects, his health began to give way, and he died of carbuncle at Mussoorie, on the 23rd of August, 1878.

Mr. Lovell was universally esteemed, respected, and liked. Besides a complete mastery of work, he had great powers of organisation, as well as discrimination in selecting his staff. It was owing to these characteristics, and his unflinching determination to overcome all difficulties, that the works on which he was engaged were always executed with promptitude. He was elected a Member of the Institution on the 2nd of December, 1862.

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MR. EDWARD BRAINERD WEBB, son of the Rev. Edward Webb, was born at Leicester in 1820. When about sixteen years of age he was articled to the late Mr. John Hague, M. Inst. C.E., who had just established a new factory at Rotherhithe, and while there he passed through the usual course of instruction, both in the workshops and in the drawing office. Subsequently he served a short

apprenticeship at the locomotive works of Messrs. Potts and Jones, at Chester. A good knowledge of mechanical engineering was thus acquired, and Mr. Webb's first employment was to assist in the erection of the machinery used in the construction of the Thames Tunnel. In 1846 he became Acting Engineer for the contractors on the Londonderry and Coleraine railway, where he successfully carried out many works of magnitude, and of an unusually varied character. These comprised a long sea embankment, a land reclamation embankment, a great blast in basalt and other trappean rock, and several tunnels. One of the latter, 280 yards in length, was laid out on a curve with neither shaft nor side-heading. The accuracy with which this was ranged was such that the boring-bars of the miners working on the opposite faces of the heading literally met in the rock. The capacity of which he gave proof on this railway earned Mr. Webb much credit. In 1851 he prepared plans and sections, and collected data, for the report of Mr. James Abernethy, Vice-President Inst. C.E., on the improvement of the Bann Navigation.

Towards the close of the year 1852 Mr. Webb went to Brazil, having accepted an engagement under the present Viscount Mauá (then Senhor Ireneô E. de Souza) to take part in the construction of a railway near Rio, of which Viscount Mauá was the concessionary, and which is now known as the Mauá railway. This line—the pioneer of railway enterprise in Brazil—was in its inception intended for a trunk line from the head of the Bay of Rio, thence to scale the Serra do Mar and to traverse the province beyond it. On his arrival at Rio Mr. Webb was occupied in an examination of the country northward from the town of Petropolis, and in selecting a route for the continuation of the Mauá railway, leaving, however, the Serra ascent intervening. Several months were spent in the selection of a suitable route; but this part of the enterprise was eventually abandoned, owing to the Government having decided in favour of a competing scheme—that of the Dom Pedro Segundo railway. Mr. Webb then took charge of the construction of the first section of the Mauá railway across the plain, which he completed, and assisted in the solemn inauguration of the line by His Majesty the Emperor. Soon afterwards his services were sought by a company which had undertaken the construction of a macadamised carriage-road in the province of Rio de Janeiro, for the purpose of bringing down the coffee and other products of the interior to the port of Mangaratiba. The work was commenced in May 1855. The first section from the coast was difficult, as the road had to surmount the Serra, involving a rise of about 1,600 feet, and the sides of the

mountain were very precipitous and covered with virgin forest. The road terminates at the town of S. Joaõ do Principe, and was executed with all the perfection of a European road of the first class, some of the works being of considerable importance. The whole of the undertaking was in Mr. Webb's hands; he divided the work into a number of small contracts, and upwards of two thousand men were employed. On its completion, in 1858, he returned to England, and established himself in general practice in Westminster, where he retained an office during the remainder of his life. These Brazilian works are described in a Paper contributed to the Institution, "On the Means of Communication in the Empire of Brazil,"<sup>1</sup> which contained much useful information on a country at that time little known to English engineers, and for which a Council Premium was awarded.

In 1859, when the Suez Canal project was much discussed, and encountered great opposition in this country, Mr. Webb, in conjunction with Mr. Brunlees, Vice-President Inst. C.E., designed a ship railway for transporting vessels overland across the Isthmus. This suggestion was described in a pamphlet, a copy of which is preserved in the library of the Institution (Tracts 8vo., vol. cxii.). In 1860 Mr. Webb took out a patent for "Improvements in Breakwaters and Piers." These improvements comprised a new kind of wave-screen, to be formed of cast-iron pipes and iron standards. Two years later he published a pamphlet on 'Iron Breakwaters and Piers' (Inst. C.E. Library Tracts, 4to., vol. xlviii.). In this essay he points out the most advantageous form for the application of iron structures of that class, and carefully compares their cost and durability with that of solid stone structures, much to the advantage of the former. Mr. Webb never had an opportunity of carrying out these views, but he was fully convinced of their soundness; and it had been his wish quite recently to add the results of experience subsequently obtained on the durability of iron exposed to sea water.

In 1861, in conjunction with Mr. George Higgin, M. Inst. C.E., a proposition was presented to the Spanish Government for the Ordnance Survey of Spain, and a small tract of country was surveyed, at the request of the Government, to show the mode in which the work was intended to be done; but no decision has yet been arrived at on the subject.

Perhaps the busiest period of Mr. Webb's life was that commencing with the year 1867, when his attention was turned to

<sup>1</sup> *Vide* Minutes of Proceedings Inst. C.E., vol. xix., p. 240.

enterprises in foreign lands emanating from this country; and in succeeding years his energies were mainly devoted to these objects. In the Spanish colonial island of Porto Rico two lines of railway and an irrigation scheme were laid out, and waterworks for San Juan, the capital, were designed. These projects, all of recognised utility, were carefully studied and prepared; but, as the necessary capital was not forthcoming, nothing was done in regard to their execution beyond the commencement of the irrigation works. A more successful field was found on the River Plate, where two railways, the Buenos Ayres and Campana (about 50 miles in length), and the North Western railway of Monte Video, between the city and port of Salto and the port of Santa Rosa (a distance of 110 miles), were carried out under his superintendence as engineer in this country. Mr. Webb took an active part in the negotiations for the concession of the Brazilian submarine telegraph, and the friendships formed during his earlier connection with that country enabled him to exercise considerable influence with the Imperial Government. Mr. Webb was also Engineer-in-chief for the Paraguassu (Brazilian) Steam Tramway Company, formed for the purpose of opening up communication between the port of Bahia and the diamond fields in the province of Minas (about 150 miles distant), and eventually with the valley of the San Francisco river. The works were commenced under good auspices, and the first section of the line was completed; but further progress was arrested by the financial depression which supervened. He was likewise concerned in the execution of the Baranquilla railway in the United States of Colombia, an enterprise carried out with capital obtained from Germany. The line was finished in 1870, and was subsequently purchased by the Government. About this period he interested himself in a project for canal communication across the Isthmus of Panama, and was in correspondence with the Government officials of Bogotá. On several occasions Mr. Webb devoted attention to schemes for colonisation, giving to them both time and money. Among these may be mentioned particularly a project for colonising the district of the Knysna, at the Cape of Good Hope, with a view chiefly to working the extensive forests of timber which exist in that region; also the formation of a company for colonising and trading to the island of New Guinea. The closing professional labour of his life was to study the question of a new bridge over the Thames below London bridge. In 1877 he published a pamphlet on this subject, in conjunction with Mr. James Bolland, M. Inst. C.E., in which the adoption of a low level continuous bridge was advocated.

In 1876 Mr. Webb retired from the active pursuit of the profession in consequence of failing health. His previous career had been one of unwearied activity. Endowed with remarkable energy of character, and vigour both of mind and body, he entered earnestly upon whatever work he took in hand, bringing to it much method and good judgment. In Brazil he delighted in going through hardships, in order to show of what an Englishman was capable. He never spared himself, and had a great contempt for any man who was of luxurious or effeminate habits. Although very fond of professional pursuits, his tastes were varied, and a genial disposition and an aptitude for social intercourse earned for him a large circle of friends. He was somewhat brusque in manner, but was most kind-hearted, thoroughly straightforward and of the strictest integrity, and a warm friend.

Mr. Webb was elected a Member of the Institution on the 7th of December, 1858, and he died, after a protracted illness from fatty degeneration of the heart, at the Kaiserbad, Aix-la-Chapelle, on the 26th of May, 1879.

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MR. EDWARD LEADER WILLIAMS was born at Reading in the year 1802. After being educated at Dr. Valpy's school, he settled at Worcester, where the neglected state of the river Severn occupied his attention, and plans were prepared for its improvement, which were produced, with models, in 1835, at a large public meeting. The result was the formation of a Severn Navigation Company, Mr. Thomas Rhodes, M. Inst. C.E., being appointed the consulting engineer, and Mr. E. L. Williams the resident engineer. Detailed surveys and plans were then made, and a Bill was deposited for the session of 1837; but it was thrown out on the second reading by a majority of 149 to 124. Under the advice of Mr. (afterwards Sir William) Cubitt, Past-President Inst. C.E., the plans were modified, to lessen the opposition to the measure, which was again introduced into Parliament in 1838, but had to be withdrawn. It was now determined to abandon the idea of a Severn Navigation Company, and instead, in 1842, after great opposition, an Act was passed giving power to Commissioners to improve the river and to levy tolls. Locks and weirs were constructed between Stourport and Worcester, which, with the