

In 1839 he was appointed on a similar commission for determining the best route to Scotland and Wales, and the most convenient port for steam communication with Ireland.

On the 5th of March, 1839, a Paper of his was read at the Institution of Civil Engineers, intitled 'An Investigation into the Power of Locomotive Engines, and the effect produced by that power at different Velocities.'¹

In 1842 he was similarly employed upon an inquiry into the general merits of the atmospheric system, and in 1845 he was appointed one of the Gauge Commissioners, in which he was associated with Sir Frederick Smith and Professor Airy.

In 1847, being then seventy-one years of age, he retired from his duties at the Royal Military Academy, and in consideration of his eminent public services, the Government awarded him his full pay on his retirement.

From this time, although he ceased to engage in active professional duties, he continued to take a lively interest in all the leading scientific questions of the day.

So late as the year 1857, although he was eighty-one years of age, he wrote a postscript to a Paper communicated to the Royal Society by his son, Mr. W. H. Barlow, M. Inst. C. E., on the 'Resistance of Flexure,' which postscript contained a mathematical investigation of considerable difficulty.

Mr. Barlow was elected a Fellow of the Royal Society in May, 1823, and he was a member of most of the other scientific societies of this and other countries. He joined the Institution of Civil Engineers as an Honorary Member in 1820, and always took much interest in the proceedings. Of a kindly and cheerful disposition, he retained his full powers of mind until his death, which took place on the 1st of March, 1862, deeply regretted by his numerous friends, and especially by those Officers, his former pupils, who, whilst under his guidance at the Royal Military Academy, had ever found him as valued a friend as a conscientious and talented tutor.

MR. JAMES JOHN BERKLEY was born at Holloway, on the 21st of October, 1819, and completed his education at King's College, London, under Dr. Major. He was articled to Mr. Wicksteed (M. Inst. C. E.), then Engineer of the East London Water Works, in the year 1836; but very soon left him, and entered the office of Mr. G. P. Bidder (M. Inst. C. E.), and in 1839 he may be said to have commenced his real pupilage under Mr. Robert Stephenson (M. Inst. C. E.), by whom he was very actively

¹ *Vide Minutes of Proceedings, Inst. C. E., vol. i. (1839) p. 46, and Trans. Inst. C. E., vol. iii. p. 183.*

employed, travelling with his chief, writing reports for him upon his numerous works, arbitrations, and other engagements.

Among these may be mentioned the Bute Docks at Cardiff; the examination of a system of railways projected to connect London, Brussels, and the various towns of the north of France, with Paris, which was reported on by the late Robert Stephenson in 1842; the Hesse Cassel and the Leopold Railways; the construction of the Northampton and Peterborough, the Trent Valley, the Churnet Valley, and the North Staffordshire Railways, on which latter Mr. J. J. Berkley held the position of Resident Engineer.

At the latter end of the year 1849, an Engineer of ability, experience, and judgment being required to go to Bombay to lay out an extensive system of railways in that presidency, Mr. J. J. Berkley was so strongly recommended for the important work by the late Mr. Robert Stephenson, Mr. Brunel, Sir W. Cubitt, Sir John Rennie, Mr. Bidder, and other eminent Engineers who knew and appreciated his talents, that he was unhesitatingly appointed to the position of Chief Resident Engineer of the Great Indian Peninsula Railway, and he left England for India in January, 1850.

The Company's undertaking was at that time confined to the construction of 33 miles of "experimental line" from Bombay to Callian, and having early decided the most important points connected with the course of that line, through the town of Bombay, and the mode of crossing the creek which divided the island of Bombay from the mainland, Mr. Berkley turned his attention to the extensions which he perceived would inevitably be called for, and to the means of surmounting the great barrier of the Western Ghâts, which any extension into the interior immediately involved. The original projectors of the Great Indian Peninsula Railway proposed to make one ascent of the Ghâts, bifurcating at the top to the north-east and the south-east; but an examination of the line of Ghâts led Mr. Berkley to report unfavourably of that scheme, on account of the almost impracticable nature of the works, and to recommend the adoption of lines branching off from Callian to the south-east and north-east, ascending the Ghâts at the Bhore Ghât and the Thul Ghât on the line of a large existing traffic.

In 1852 the surveys for both the lines were commenced. Four years were spent in the surveys of the Bhore Ghât, and during that period Mr. Berkley laboriously worked out the details of the plans and designs.

On the 16th of April, 1853, the first 20 miles of the line, from Bombay to Tanna, were opened for public traffic, thus initiating the Indian railway system. This is alluded to in a very interesting letter from Sir Bartle Frere, who, doing full justice to the intelligence, skill, and energy of Mr. Berkley, alludes to

the previous unexecuted scheme of Mr. George Clark, in 1844, which, he says, preceded the plans of Mr. Chapman, and of Sir Macdonald Stephenson, to whom, however, he gives credit for their energy and perseverance, and in pressing forward their plans to fruition.

Considerable delay occurred in obtaining official sanction to the Thul Ghât portion of the scheme, owing to the Government of India having entertained a project for turning the Ghâts, by a line from Surat along the course of the Taptee River. This resulted in further surveys and elaborate reports on the Ghât ascent, by which the superiority of the line, as proposed by Mr. Berkley, was fully established.

In 1856 the North Eastern Line, viâ the Thul Ghât, was sanctioned by the Government of India, thus completing the Great Indian Peninsula system of lines, as projected by Mr. Berkley, comprising a total length of 1,237 miles, forming a grand trunk communication, by the North Eastern line, between Bombay, Calcutta, and the North-West, and by the South Eastern line, between Bombay and Madras; including also an important line to Nagpore, passing through some of the most extensive cotton districts of Western India.

The control which the Government exercises, under the guarantee system, has unquestionably been a source of special difficulty to the Engineers of the respective companies, and it was mainly due to Mr. Berkley's firmness and tact that a minute and harassing supervision was avoided, and that efficient co-operation established between the company and the Government authorities, which has generally subsisted on the Great Indian Peninsula Railway, to the manifest advantage of both parties.

Mr. Berkley was a firm and zealous advocate of the contract system, under which the whole of his works were constructed. The system on a large scale was new in India and was regarded at first, by the Government, with some suspicion; it has now, however, been adopted almost entirely in the public works, with the best effect in the rapidity and extent of their operations.

The details of the great works, comprising the inclines of the Ghâts, are so well known, from the description given by Mr. Berkley in his address to the Mechanics' Institution at Bombay, and from other publications, that it is only necessary here to allude to the satisfactory solution of the question of practicability, by the successful working of them with enormous traffic, although these inclines exceed in difficulty and importance those of the Sömmering, and the Giovi. In connection with this undertaking mention should be made of the courage of the widow of Mr. Solomon Tredwell, the Contractor, who, after his too early decease, determined, for the honour of her husband's name, to continue the

works, and with the efficient aid of Mr. Clowser and Mr. Adamson, did complete them most satisfactorily.

The labour entailed upon Mr. Berkley by the works he had undertaken, affected his health, and he visited England in the year 1856. Advantage was taken of the opportunity, by a number of the principal Civil Engineers, to invite him to dine with them ; when Mr. Robert Stephenson, who occupied the chair, spoke thus of his former pupil :—

“Gentlemen,—I have very sincere pleasure in presiding at this entertainment, which is offered to my friend Mr. James Berkley. I feel that on the present occasion it is not necessary to enlarge upon the professional acquirements, or talents, or the social virtues of my friend, for he has already prominently brought himself to your notice by his professional abilities under exceedingly trying and adverse circumstances, and by the esteem in which he is held by all who know him. Very early in his life, and when I was tolerably advanced in my career, he was introduced to my notice as a young and professionally inexperienced man, but a very short acquaintance and association with him, convinced me that he was possessed of a good heart and a good head, and in a short time he became not only confidentially associated with me in professional life, but my intimate friend in my domestic circle. I freely imparted to him my own views and opinions, and employed him in the construction of several of the principal lines intrusted to me. When the opportunity for his going to India presented itself, I felt that he had embarked in an exceedingly difficult task. Having myself been thrown in early life upon my own resources, in a foreign country, where engineering operations were of a very difficult character, I well knew the variety and nature of the obstacles he would have to encounter, and you will readily comprehend how operations, even such as are easy in this country, would become extremely arduous when undertaken abroad. The Directors of the Railway Company were influenced by my recommendation, strengthened as it was by the highest testimonials, and my friend went to India, where he has amply justified the opinion I had formed of his capabilities, and has successfully overcome numerous difficulties and impediments of no ordinary character. A favourite expression of my father's, in his early career, was—‘I can engineer matter very well, but my great difficulty is in engineering men.’ Mr. Berkley has, I am happy to say, succeeded not only in engineering matter in a foreign country, with few available resources for railway operations, but he has also been eminently successful in that more difficult task of engineering men. No small tribute to his talents and temper.

“It is scarcely necessary for me to do more than allude briefly to the works executed by our guest, during his comparatively short stay in India. He has already executed 90 miles of railway which are on the point of being opened, as far as the Ghâts, the great physical feature of the West of India. The question of the ascent of the Ghâts, is one of considerable difficulty, and demanding much knowledge, skill, and consideration. Excellent designs of them have, however, been prepared by Mr. Berkley, and the explanations he has afforded me are so minute and interesting, that I assure you I should feel proud of being the author of the plans he has proposed. Throughout these operations he has encountered all the formidable obstacles which the Ghâts present, and has overcome them with remarkable success. And this redounds all the more to his credit, when we consider, that the Ghâts present greater engineering difficulties than either the passage of the Sömmerring to Trieste, or the Giovi Incline between Turin and Genoa ; and that the ascent of those mountains was

long considered barely practicable. Although those mountain inclines are serious undertakings, it is compulsory for the good of the country to make and to maintain them, and, in spite of all difficulties, Mr. Berkley has, after six years of laborious research, succeeded in designing a series of lines, which I have no doubt will be amongst the most successful in the world. I trust, however, that greater wisdom will be displayed by the Indian Government than by our home legislature in that respect. That they will be watched over with something more like parental care, for here they have been deserted like prodigal sons. India demands accommodation for an enormous traffic and population, and if the railways are permitted to be extended with discretion and wisdom, there cannot be a question that they will be both beneficial to those who have invested capital in the enterprise, and of incalculable advantage to that important country. My friend at my side has also the honour, whether accidental or not, of being the engineer who constructed and opened the first railway in India. This is no small credit to him, and in all that he has done I feel proud of him, and that he has reflected honour upon my recommendation."

Notwithstanding the extent and the laborious nature of his professional duties, Mr. Berkley took an active part in many of the useful and scientific institutions of Bombay. In the Mechanics' Institution especially he took a lively interest, and by his personal exertions and active measures, as President, he greatly increased its sphere of public utility, and gave an interest to its proceedings which had before been wanting.

The Council of the Mechanics' Institution has accorded a "Berkley Gold Medal" as an annual prize for competition among its members in commemoration of his valuable services, and the first gold medal was sent to his widow with a resolution expressing sympathy and condolence.

Constant demands were made upon his services, but he was obliged to decline everything except the nomination to such position as indirectly bore upon the chief events of his life. In 1855 he became a magistrate. In 1857 he was appointed one of the commissioners of the Municipal Board, and in 1858 he was elected a member of the Senate of the Bombay University.

Mr. Berkley's energy of mind far exceeded his physical strength, which was suffering severely from the effects of the Indian climate, so that in April, 1861, the state of his health compelled him to return to England. At that time he had the satisfaction of seeing his plans and designs of the Bhoze Ghât, his most cherished work, fully developed, and the works being carried on with extraordinary activity under a very efficient management. He eagerly desired to return to India to witness the accomplishment of the great work he had designed and almost carried out to completion, but it was otherwise ordered; and after a lingering illness he closed his short but useful career, at Sydenham, on the 25th August, 1862.

From early boyhood, James John Berkley showed signs of great

activity of mind and love of knowledge. He was a great reader, and was ever ready with his pen as a contributor to general literature, or as a clear and able writer on professional subjects. In after years, when his position in India called forth the particular talent, he proved himself both as President of the Bombay Mechanics' Institution, at the meetings, and on public occasions, a fluent and indeed an eloquent speaker.

By his devoted attention to the important duties of his office as Chief Engineer, in Bombay, of the Great Indian Peninsula Railway, by his high sense of honour, by his gentlemanly bearing and liberal sentiments, as well as by the kindness and consideration which he ever displayed towards all those who were connected with him in business, he deservedly obtained the esteem and affectionate regard of all who knew him.

The high estimation in which he was held is proved by the following extracts, which have been selected from numerous voluntary testimonials.

The Directors of the Great Indian Peninsula Railway in reporting his death to the shareholders stated :—

"The Directors have the melancholy duty of announcing to the Proprietors the death, on the 25th August last, of Mr. James J. Berkley, M. Inst. C. E., the Company's Chief Resident Engineer in India. Mr. Berkley from the commencement of operations in January, 1850, down to the beginning of last year, when his failing health compelled his return to England, conducted the whole of the engineering operations with remarkable devotion, energy, and engineering skill, to the entire satisfaction of the Directors. In order to record more permanently their sense of the valuable services which Mr. Berkley rendered to the Company, the Board have directed a tablet to be erected to his memory in some favourably conspicuous position at the Bhoze Ghât Incline."

Sir James Outram, whose large experience of Englishmen in India, rendered him no mean judge of his fellow-countrymen, and who has established a world-wide character for truthfulness and talent, wrote to him on his leaving Bombay in 1857 :—

"MY DEAR BERKLEY,

Porell, 9th July, 1857.

"I am loth to leave Bombay without seeing and bidding you good-bye, for which purpose I called at your old house in Mazagon, which I found shut up, and there was no one at the premises to tell me where you are. I am informed, however, that you are travelling in Candeish, I hope out of harm's way in these troublesome times.

"When your line meets our line (from Calcutta) I trust we may have personal communication, if not before ; but in the meantime I hope you will not scruple to command me, wherever I may be, for there is no one for whom I have a greater esteem, or to whom this Presidency is more indebted, than yourself.

"Believe me to be, my dear Berkley,

"Very sincerely yours,

(Signed) "J. OUTRAM."

In addition to the above, the Engineers on the staff of the

Great Indian Peninsula Railway, and a few other gentlemen in Bombay, united soon after the death of Mr. Berkley to prove their high appreciation of his talent, as well as their great esteem and affection for their late friend and companion, by a substantial testimonial.

In a few days a sum of nearly £3,000 was raised, and it was determined to erect a monument over the grave of their late friend, at a considerable cost, and to expend the remainder of the fund, amounting to about £2,000, in the establishment of a fellowship, to be called the "Berkley" fellowship, at the Bombay University. They well knew that the high value he attributed to education and the proper development of the powers of the mind, and the great interest he always evinced in this excellent university, would, were he living, render this, in his eyes, one of the most valuable testimonials of their regard which could be offered to him.

Mr. Berkley was elected a member of the Institution of Civil Engineers in the year 1855, and his Paper on "Indian Railways," in 1860, obtained for him a Telford Medal and a Council Premium of Books.

He was one of the men who, if his mission had not been to become one of the engineering pioneers in the East, would have risen to a very eminent position in the profession, for which he possessed the highest qualifications.

MR. JAMES COOPER was born at Highgate, in the year 1817. Soon after leaving school he entered the factory of Messrs. Cooper, of Old Street, where he only remained a short time, but where he acquired useful practical knowledge, which was of service to him in his future career.

After studying for some time under Mr. Hale, land surveyor at Colchester, he entered the office of Messrs. Walker and Burges, as a pupil, in the year 1835, and he rendered himself so useful that he subsequently continued with them as an Assistant, and finally was admitted into partnership with the firm in 1851.

Under the direction of, and in connection with, Messrs. Walker and Burges, he enjoyed rare opportunities of observing, and of being actively engaged in, many of the great engineering works of the period, such as the Caledonian Canal, the Middle Level Drainage, the Admiralty Works at Dover, Jersey, Alderney, Plymouth, &c., the Birmingham Canal, and the Lighthouses for the Corporation of the Trinity House, with many other important undertakings.

Whilst he was in charge of the works at the Edystone Lighthouse, in 1839, when it was decided to carry out Smeaton's inten-