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" The New Howrah Bridge, Calcutta: Design of the Structure, Foundations, and Approaches." †

By ARTHUR MAURICE WARD and ERNEST BATESON, MM.I.C.E.

Paper No. 5612

" The New Howrah Bridge, Calcutta, Construction." ‡

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Mr. G. W. M. Boycott observed that in his experience of compressed-air working, in caisson and cylinder sinking and for tunnelling, including pressures of up to 48 lb. per square inch above atmospheric, he had never known a single case of bends to occur immediately after leaving the air-lock, even in those days when stage decompression had never been heard of and when contractors who adopted a rate of decompression of 1 minute for every 5 lb. of pressure were regarded as unusually progressive. Therefore he considered that the methods of decompression adopted by the contractors on the Howrah bridge construction were quite safe and no risk had been run of bends coming on in the period between leaving the working air-lock and entering the re-compression chamber.

It was important that the first drop of pressure to half the absolute should be rapid, in order to obtain the greatest benefit from the shorter periodi n the working air-lock. At the same time, it should be remembered that an excessively high rate of decompression, measured in seconds, perhaps, rather than minutes, was highly dangerous, as had been pointed out by the late Dr. J. S. Haldane, in the latest edition of his book " Respira-

† J. Instn Civ. Engrs, vol. 28 (1946–47), p. 167 (May 1947).
‡ *Ibid.*, p. 211 (May 1947).

tion." That risk had also been observed by American investigators and, as a consequence, in the late war, American pilots and crews of cabin planes had been instructed to reduce the pressure in the cabin and, as an alternative, to breathe oxygen, when in the presence of the enemy, so as to reduce to the minimum the sudden drop in pressure which would occur if the cabin of the plane were to become punctured by a hit.

Dr. W. D. Jones observed that the protection of large steel structures from corrosion was a subject of increasing interest. Rather more knowledge was now available to engineers on that matter than before the late war. In the case of the Howrah bridge very extensive corrosion tests were made by Messrs. Woodcock and Mellersh, consulting chemists, in conjunction with Messrs. Rendel, Palmer and Tritton, for the purpose of deciding upon the best method of reducing the maintenance cost of the bridge to the minimum over an extended period of years. Those tests included examination of steel panels coated with a variety of paints and also sprayed with either zinc or aluminium by various methods. From that work there was little doubt that treatment by sand blasting, followed by spraying with zinc, was preferable to all other methods, if full protection from corrosion was to be secured. Although the war had prevented those plans being put into execution, Dr. Jones's firm had subsequently had an opportunity of establishing the value of zinc spraying. In 1940 the links of the Menai Straits bridge were replaced and the whole of the high steel work was sprayed with zinc prior to painting. A recent examination of that bridge by a panel of engineers and chemists interested in the subject, had revealed that the paint work on the zinc surface was in perfect condition and needed no repainting after seven years' exposure. On the other hand, portions of the bridge which had not been zinc sprayed exhibited a fair number of rust postules and were generally in bad condition. In future plans for the erection of large steel structures, it would appear worthwhile to give full consideration to that work on the Menai bridge.

Mr. G. M. Pickard observed that it was a great tribute to the designer and to British constructional engineering that the original floating bridge, built for an estimated useful life of twenty-five years, had actually functioned for sixty-nine years.

With regard to the adequacy of the new bridge for present traffic needs across the Hooghly, Messrs. Ward and Bateson had stated (p. 201) that " owing to the war, the intended provisions of lighting and traffic control could not be completed, but temporary signs were erected and *in a very short time the various streams of traffic operated freely* along the various routes with very little control from the Traffic Police." In May 1947, Mr. Pickard had received from an engineer in Calcutta a photograph clipping from *The Statesman* which showed a traffic jam extending from Strand road across the bridge ; and that engineer had written that he had on one occasion taken three hours to cross the $\frac{1}{4}$-mile bridge. That statement and the photograph raised the query whether scientifically-designed traffic

arrangements which would almost certainly work perfectly in a European country, were adequate in an Eastern country.

The New Howrah bridge was doubtless another monument to British designing and constructional ability; but unless means could be devised for better regulation of the traffic over it, its usefulness would appear to be diminished.

Messrs. Ward and Bateson, in reply, agreed with Dr. Jones that the protection tests showed that sand-blasting followed by a coat of sprayed zinc gave superior protection to paint. Incidentally the tests mentioned did not include sprayed aluminium.

It appeared that the traffic jam reported in May 1947, to which Mr. Pickard had referred, had occurred at a time when communal disturbances were taking place, as the hold-up was stated to have extended from Strand Road across the bridge. In the present times it was not unreasonable to expect such happenings and the narrow streets in Howrah and Grierson Road very quickly became totally closed.

It was believed that when all the roads leading to and from the bridge on the Calcutta and Howrah sides had been fully developed, the bridge and traffic arrangements on the approaches would be adequate even in abnormal circumstances. The traffic arrangements were not designed to deal with communal disturbances of the magnitude of those which had taken place during the past year in Calcutta and other large cities in India.

Fig. 25, Plate 4, indicated future western and northern approaches to the bridge which would provide alternative routes for traffic.

Messrs. Howorth and Shirley Smith, in reply, observed that they appreciated Mr. Boycott's contribution and his further confirmation of the safety of the system of decompression adopted.

It had been suggested to them that their reference (p. 226) to the result of trials of Franki piles constituted unduly severe criticism of that system of piling. The reference was not intended, and should not be taken, to mean anything more than that, as a result of the trials, Mr. Howorth, in his capacity as agent for the Cleveland Bridge and Engineering Company, Ltd., had not felt justified in relying on either Franki piles or any other type of piling for the construction of the temporary foundation in question.