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THE FORTH BRIDGE.

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SO much has already been written upon the Forth Bridge and the difficulties experienced in its construction, that it is almost impossible at the present day to describe the structure with any pretensions to originality.

It is also particularly difficult for anyone who during the construction of the bridge has, day after day, watched its gradual growth, to realise what effect the structure has upon those who see it for the first time.

Probably the ordinary visitor to Queensferry is chiefly impressed with the magnitude of the work as a whole, its great height especially causing astonishment, but to engineers and others conversant with the problems connected in bridging a river like the Forth, the two large openings of 1700 feet each are the features of greatest interest, for in no instance had it hitherto been attempted to bridge over a distance of well nigh one-third of a mile without any intermediate supports.

No better illustration to express the comparative size of the bridge in this respect, and that of the next largest railway bridge in the country, can be found than that given by Sir B. Baker in the lecture he read before the British Association in 1882, when he pointed out that the following simple rule-of-three sum:—"As a Grenadier Guardsman is to a new born infant, so is the Forth Bridge to the largest railway bridge yet built in these islands"—is sufficient to convey a very clear idea of the magnitude of the undertaking. Then, again, the question of cost is one of much interest, and requires more than a mere expression in figures to be easily realised. In walking over the bridge, therefore, it should be remembered that the portion included in each successive step cost about £2000 before it was completely finished.

That a large amount of labour was involved in carrying out a work of this nature will be readily understood. During the busiest times as many as 5000 men were employed every week, and although the work of each varied very considerably, it was only by the combined efforts of all engaged that the structure was ultimately completed. From the highest to the lowest, each had their duties to perform, and there never was a want of willing hands to undertake any task, however

hazardous. As a matter of fact, one of the chief difficulties of those in control was to endeavour to make the men appreciate that they should exercise more caution in working 300 feet above the ground than when they were standing on *terra firma*.

To provide for the variations of temperature, or, in other words, for the expansion and contraction of a structure like the Forth Bridge, necessitates much consideration, since owing to the large spans, very considerable movements occur. The average range of temperature in this country between summer and winter may be taken to be about 60 deg. Fahr., and the expansion and contraction due to this variation, although insignificant in many cases, cannot be neglected in bridges and similar structures of any size. For instance, the rails that are laid along the lines between Edinburgh and London are nearly a quarter of a mile longer in warm weather than they are in cold weather. Consequently, the total length of the Forth Bridge being rather more than 8000 feet, a movement of $3\frac{1}{2}$ feet has to be provided for.

The dimensions and particulars given below are those which, we think, will be found to be of most general interest:—

Total length—Upwards of $1\frac{1}{2}$ miles.

Largest spans—1700 feet each.

Height of structure above high water—360 feet.

Amount of steel in bridge—About 52,000 tons.

Wind pressure allowed for—56 lbs. per square foot.

Greatest depth of water in channels—218 feet.

Greatest depth of foundation—88 feet below high water.

Forty miles of steel plates are used in the construction of the tubes alone.

