Independently of the comparative weights and cost, which I believe have been fairly placed before you, the comparative merit as regards efficiency has yet to be alluded to.

You may be aware that at the present time theorists are quite at variance with each other as to the action of a load in straining a beam in the various points of its depth, and the fact is now known that all the received formulæ for calculating the strength of a beam subjected to a transverse load, require remodelling; therefore, at present it is far beyond the power of the designers of *trellis* or *triangular* bridges to say with precision what the laws are which govern the strains and resistances in the sides of beams, or even of *simple solid beams*. Yet one thing is certain, which is, that the sides of all these trellis or "Warren" bridges are useless, except for the purpose of connecting the top and bottom, and keeping them in their proper position. They depend upon their connection with the top and bottom webs for their own support, and since they could not sustain their shape, but collapsed immediately they were disconnected from these top and bottom members, it is evident that they add to the strain upon them, and consequently to that extent reduce the ultimate strength of the beams.

In the case of the Newark Dyke Bridge, when tested to a strain of $6\frac{3}{4}$ tons to the inch, its deflection was 7 inches in the middle; and when tested with its calculated load of one ton per foot run, the deflection was $11\frac{3}{4}$ inches. The deflection of the Victoria tubes by calculation will not be more with the load of one ton per foot, than 1·6 inch; and we have had sufficient proof of the correctness of this calculation in existing examples. That of the Boyne Bridge, with a uniform load of 540 tons, was 1·9 inch, with the spans shortened in effect as described.

Many other bridges of similar spans to those above named have been constructed upon the "open-side" or "truss" principle, which are, in every sense of the word, *excellent* structures; but since no comparison of economy between them and the Victoria tubes has been offered, it would be improper to class them with those already named, which have actually been put forward as examples of economy to a large extent over the tubular system.

As an argument in favour of the trellis-beams, it has been stated that no formula has been used to value the sides of a plate-beam for horizontal strains; and therefore, since the sides are thrown away, except for the office they perform in connecting the top and bottom webs, it is asked, why should more material be placed in the sides than sufficient for that purpose? Now, I admit that there is no formula for valuing the solid sides for strains, and that we only ascribe to them the value or use of connecting the top and bottom; yet we are aware that, from their continuity and solidity, they *are* of value to resist horizontal and many other strains independently of the top and bottom, by which they add very much to the stiffness of the beam; and the fact of their containing more material than necessary to connect the top and bottom webs is by no means fairly established.

It is also said that the "trellis" or "Warren" beams are usually made deeper in proportion to their span than the tubes; and therefore, the strain being less, a less quantity of material is employed in the top and bottom webs. An important consideration should be named in reply to this, which concerns all the