GENERAL DESCRIPTION.

On further investigation it will be discovered that the proportions here assumed are the most efficient and the most economical. The more weight is thrown upon the cables, the cheaper the structure will be. But at the same time a certain amount must be reserved for the arches, else they will be too light, and the balance between the centre span and the side spans may be endangered under the action of heavy transitory loads. This will be rendered more clear hereafter. Each cable is composed of 19 smaller cables or wire-ropes. The maximum tension of each rope is, therefore,

\[ 764 + 38 = 20.10 \text{ Tons.} \]

Allowing 6 times the strength, we have the ultimate strength of each rope,

\[ 20.10 \times 6 = 120.60 \text{ Tons.} \]

Each arch is composed of 12 channel-bars, 9 inches deep; we therefore find the maximum compression of each of the channel-bars,

\[ 764 + 24 = 31.83 \text{ Tons.} \]

Allowing a maximum compressive force of 4 tons per square inch of wrought-iron, we get the section of each bar,

\[ 31.83 \div 4 = 7.96 \text{ inches.} \]

In the estimate of weight this section was assumed at 7\frac{1}{2} \text{ in. average, at the same time allowing 25 \text{ c in. section for the two top plates in the centre. The compression at the crown being less, the estimate is sufficiently correct for the present.}\\

For much larger spans than 500 feet, it may be found more economical, and at the same time safer, to employ a mild Bessemer Steel for the arches, and also to manufacture the cables out of cast-steel wire. But it would be a mistake to do so in this plan, because the weight of the structure would thereby be too much reduced for safety, and its cost would be enlarged. To insure a proper degree of stability between the spans under the action of heavy transitory loads, the weight of the structure should not be less than one ton per foot lineal, for a single-track railway, on the supposition that the maximum transitory weights do not exceed 1\frac{1}{2} \text{ T per foot. In Great Britain, where 2 tons per foot are required by law, a greater weight of structure will be needed in proportion. But for the railway traffic of this country, an allowance of 5000lbs maximum load for single-track is amply sufficient. Heavy coal roads like the Reading may, perhaps, claim a larger allowance.}\\

The cables of the side spans form portions of the same curve as those of the middle span. The only difference is, that they are cut off 62 feet beyond the centre. An exact half-span would measure 265 feet from centre to tower to end of truss. But the actual length of the truss is 62 feet more, which makes 327 feet, the object being to make the side spans about 300 feet in the clear at low-watermark. Whether the cable is anchored at that point or is continued, its tension will not vary, provided its weight or load per unit of length remains the same. In proportioning the arches of the side spans, two conditions have to be fulfilled. Their horizontal thrust at the foot of the towers must balance the horizontal pressure caused by the arches of the central span. Secondly, their horizontal pressure against the anchor-plates must balance the horizontal tension of the cables at those points. These two conditions will determine the proportions of the arches as well as the length of the spans. If, on the other hand, the length of span is fixed, we can also proportion the arches and cables so as to fulfill the above conditions. An easy and practical method for a preliminary investigation, is to lay down the curve of the cable, then construct a full arch, similar to the central arch, on thick drawing-paper, cut out its curved outline and lay it down upon the plan; then try its various positions, to find out approximately what length of span and what proportions will about suit. This examination made, we can then calculate the proportions of the arch, its supporting power, and its pressure at the foot and at the anchor-plate. This process, repeated a few times, will bring us near enough to the exact quantities which are required. A practical method like this will be found much more satisfactory, and at the same time easier and more certain than the use of complicated equations.

By lowering the anchor-plate, we shorten the cable until we have reached its centre, which forms an exact half-span. By raising the anchor-plate we lengthen the span, and the greatest length will be obtained when the plate is at the level of the upper chord. In that case the arch would have to rise above the upper chord. On the other hand, we can also reduce this span to less than a true half-span by moving the anchor-plate back until we meet the upper chord. This point of intersection will then have a strong tendency to rise, which must be met by anchoring to the masonry, in such a manner that contraction and expansion from changes of temperature will not be interfered with.