STRAINS IN ARCHES AND CABLES.

The trusses of the side spans are 327 feet long, measured from the centre of tower. The arches of the side span form part of a curve whose chord is 352 feet in length with a versed sine of 18.8 feet. The ratio of deflection to span is therefore as 1:18.72, and the coefficient of compression 2.4.

The greatest weight upon the arches of the central span is 450 Tons. Or per foot, linear, \(450 \div 500 = 0.9\) "

The weight upon the side arches will be nearly the same per lineal foot, and we will compute their compression by supposing their whole length weighted down at the same rate. This gives a total weight of

\[352 \times 0.9 = 316.8 \text{ Tons.}\]

Hence, their compression at the foot of tower,

\[316.8 \times 2.4 = 760.32 \text{ Tons.}\]

To illustrate:

Let \(d e\), Fig. 5, represent half the chord of the central arch, 258 feet long, \(e f\) twice the height of its rise, equal to 80 feet, then the hypotenuse \(d f\) will form a tangent to the arch, and will measure 270, omitting fractions. Now, the compression of this arch is represented by \(d e\), its horizontal thrust by \(d e\), and its vertical pressure by \(f e\). Consequently, we find the horizontal thrust of the central arches (since the compression is 449.57 \times 1.78)

\[764 : x :: 270 : 258\]

\[x = \frac{764 \times 258}{270}\]

\[x = 730 \text{ Tons.}\]

Also, let \(a b\), Fig. 4, represent half the chord of the side arch, equal to 176 feet, and \(a c\) its double rise, equal to 37.6, then \(b c\) represents the tangent, and will measure 180 feet. The horizontal thrust of the arch is then found

\[760 : x :: 180 : 176\]

\[x = \frac{760 \times 176}{180} = 743 \text{ Tons.}\]

There is a difference of 13 tons on the part of the side arch, which is readily met by the strength of the lower chord and the stability of the foot of the tower.

Again, let Fig. 6 represent a rectangular triangle, where \(a b\) is one-half of the main span or 265 feet, \(b c\) twice the versed sine of the cables or 120 feet, then \(a c\) is the tangent, equal to 291, and represents the tension of the cable, while \(a b\) is its horizontal force, and \(b c\) its vertical pressure. We therefore find the horizontal force or \(x\)

\[291 : x :: 265 : 764\]

\[x = \frac{265 \times 764}{291} = 696 \text{ Tons.}\]