CIV102F Quiz # 1: Friday AM September 18, 2020
Engineering Computation and Judgement

Shown on the opposite page is a schematic of the Golden Gate Bridge, located in San Francisco and built in 1937. Each of the two cables which support the deck consists of 27,572 high-strength steel wires wound together into a bundle. The diameter of the individual wires is 4.93 mm. Estimate the volume of the steel used in the bridge in m^3. Assume the portion of the cables between the two takes the shape of the parabola, and the portions outside of the main span are straight lines.

The volume calculated in the first part of the question is valid at a temperature of 20°C. Suppose that the ambient temperature ranges from 20°C at the lowest point of the cable to only 5°C at the high point. If it is assumed that the temperature varies linearly between the high and low points of the cable, **estimate** the actual volume of steel in these cables, considering temperature effects. How different are these two volumes? Express your estimate in m^3.

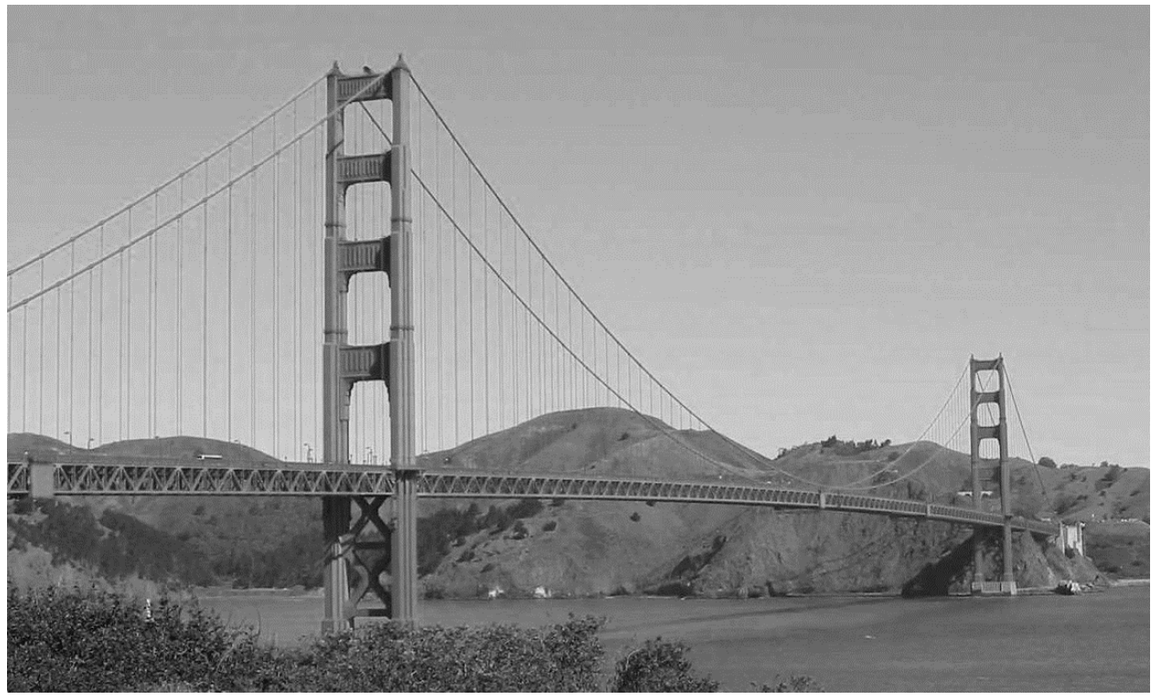
Note the volume of the steel at a temperature T, **V(T),** is related to the volume at 20°C, $\mathbf{V_{20C}}$, and the ambient temperature **T** by the following relationship:

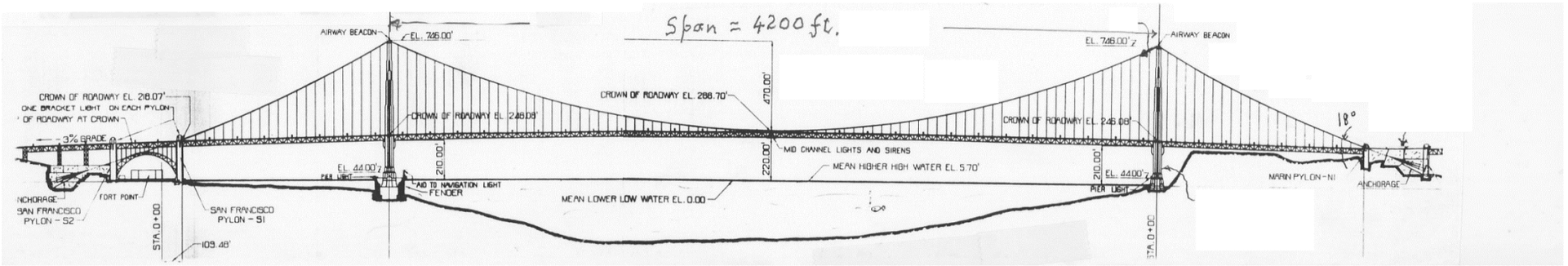
$$V(T) = V_{20C} \times \left(1 + \alpha(T - 20°C)\right)$$

α is a thermal expansion coefficient equal to $35\times10^{-6}K^{-1}$. When you use this equation, keep your temperatures in °C to avoid problems with units.

State all of your assumptions and simplifications used to obtain your answer.

Reminder: Please report all final answers using slide-rule precision
(ie, four significant figures if the first digit is a "1", three otherwise)





Note: All dimensions on the drawings are given in units of ft (i.e. US Customary units). Note 1 ft = 305 mm.

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