Problem Set 3

Problem 3.1

Consider the following ideal arch (only compression forces act on the structure) with fixed supports at both ends.

You have to build a solid masonry bridge to support not only the self-weight of the structure ($\gamma$, weight per unit volume for both the fill and the vault) but also a uniform load ($w$, weight per unit area).

1) Neglect the self-weight (i.e. assume the loading is uniform) and find the corresponding shape $v(x)$.

2) Using the shape determined in (1), discuss how you would include, in an approximate way, the self-weight.

3) Given $\sigma_{\text{max}}$ and $f$ (the maximum height), determine the thickness $t$ as a function of $f$, $\sigma_{\text{max}}$ and $D$. 