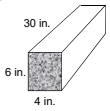
Proportioning Concrete

- Determine the amount of cement, fine aggregate, coarse aggregate and water required to mix and construct ***three*** beams, each having the dimensions shown in the figure below.



- Include a "make-sure-you-have-enough" factor of 1.5 in your mix calculations.
- Assume a *w/c* ratio of 0.4 and a mix design of 1 : 1.5 : 2. Assume that concrete weight 145 lb./ft.^{3}. All weights should be reported in 0.05 lb. increments (just like in lab).

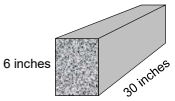
Proportioning Concrete

- The volume of a beam is:

$$Volume_{Beam} = WHL$$

where ***W*** is the width, ***H*** is the height, and ***L*** is the length of the beam

- The beams are 6 inches in height and 30 inches in length



Proportioning Concrete

- How much concrete do we need to make to 3 beams?

$$Volume_{Beam} = 3(4\,in)(6\,in)(30\,in) = 2{,}160\,in^3$$

Since we need 3 beams

$$Volume_{Beam} = 2{,}160\,in^3\left(\frac{1ft^3}{(12in)^3}\right) = \frac{2{,}160\,in^3ft^3}{1{,}728\,in^3}$$

$$= \boxed{1.25\ ft^3}$$

Proportioning Concrete

- Next, apply the "make sure you have enough" factor

Make sure you have enough factor

$$Volume_{Total} = \left(1.25\,ft^3\right) \times MSYHEF$$

$$Volume_{Total} = \left(1.25\,ft^3\right) \times 1.5 = \boxed{1.88\,ft^3}$$

Proportioning Concrete

- Next, we need to convert this volume to an equivalent weight of concrete

$$Weight_{concrete} = 1.88\,ft^3\left(\frac{145\,lb.}{ft^3}\right) = 271.88\,lb.$$

- To compute the amount of each component required for this mix, use the ratio of the each component to the sum of all components
- For a 1 : 1.5 : 2 mix, the weight of cement required is 1/4.5 of the total weight

$$Weight_{cement} = \left(\frac{1}{4.5}\right) \times 271.88\,lb. = \boxed{60.40\,lb.}$$

Proportioning Concrete

- Next, we need to convert this volume to an equivalent weight of concrete

$$Weight_{concrete} = 1.88\,ft^3\left(\frac{145\,lb.}{ft^3}\right) = 271.88\,lb.$$

- To compute the amount of each component required for this mix, use the ratio of the each component to the sum of all components
- For a 1 : 1.5 : 2 mix, the weight of fine aggregate required is 1.5/4.5 of the total weight

$$Weight_{fine\ agg.} = \left(\frac{1.5}{4.5}\right) \times 271.88\,lb. = \boxed{90.65\,lb.}$$

Proportioning Concrete

- Next, we need to convert this volume to an equivalent weight of concrete

$$Weight_{concrete} = 1.88\,ft^3\left(\frac{145\,lb.}{ft^3}\right) = 271.88\,lb.$$

- To compute the amount of each component required for this mix, use the ratio of the each component to the sum of all components
- For a 1 : 1.5 : 2 mix, the weight of coarse aggregate required is 2/4.5 of the total weight

$$Weight_{coarse\,agg.} = \left(\frac{2}{4.5}\right) \times 271.88\,lb. = \boxed{120.85\,lb.}$$

Proportioning Concrete

- Next, we need determine the amount of water required
- The weight of water is specified by the ***w/c*** ratio
- In this example, the ***w/c*** = 0.40
- For this mix, the weight of cement is 60.4 lb. Therefore, the weight of water required is:

$$Weight_{water} = 60.4\,lb.(0.40) = \boxed{24.15\,lb.}$$

Proportioning Concrete

- In summary, the weight of each component in 1 : 1.5 : 2 mix with ***w/c*** = 0.40 is:

Cement	60.40 lb.
Fine aggregate	90.65 lb.
Coarse aggregate	120.85 lb.
Water	24.15 lb.

- In the lab, we will round each weight to the nearest 0.05 lb. increment.