Appendix B: Mechanical Press Apparatus Weight Calculations

1. Finding the necessary mass values 1500 mm from the top end of the column, considering total height of the column as 300 mm:

- Total height of concrete above the 305 mm (12 in.) tall sample at the middle of the column (Figure B1) equals:

$$300cm - 150.00 = 150.00\ cm$$

- Area of the 6" diameter cylinder:

$$6" \times 2.54 = 152\ mm$$

$$Area = \frac{(\pi\ d^{\ 2})}{4} = \frac{(3.1415\ (152)^{\ 2})}{4} = 18145\ mm^2$$

- Volume of the concrete on top of the section:

$$V = 18145\ mm^2 \times 1500\ mm = 27217500\ mm^3 = 0.0272\ m^3$$

- Mass of the concrete:

If $\rho_c = \frac{Mass\ of\ Concrete}{Volume\ of\ Concrete}$

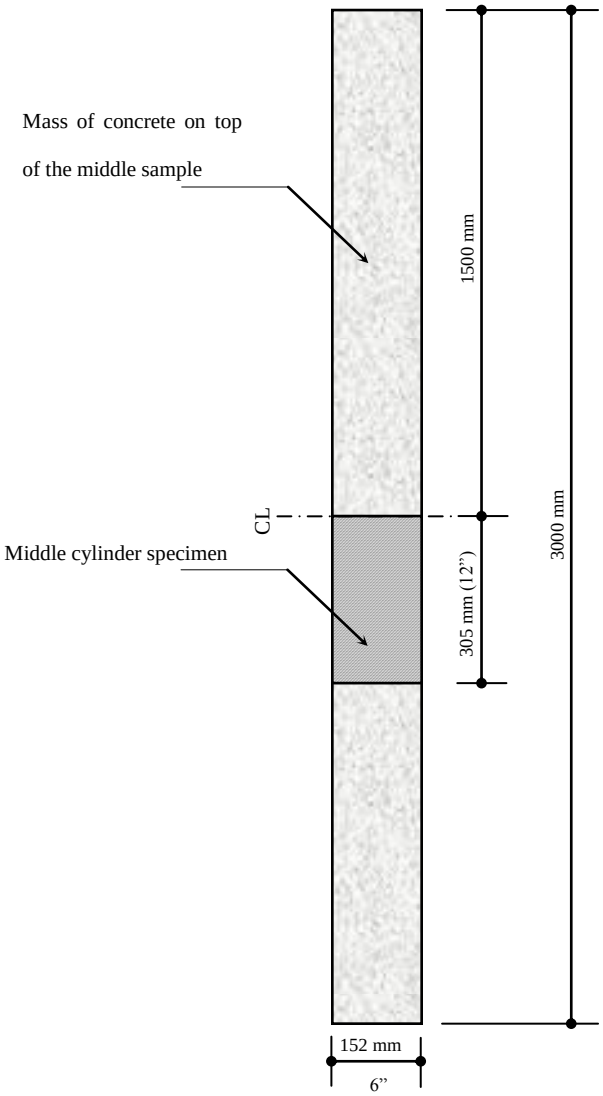

Figure B1: Position of the 6 by 12 inch middle concrete sample along the length of a 3 meter high concrete column

Considering ρ for concrete as 2300 kg/m^3 then:

$$M = \rho_c \times V = 2300\,kg/m^3 \times 0.0272\ m^3 = 62.56\,kg$$

Therefore, 63.02 kg of load needed to be applied on top of the middle cylinder to simulate the load of the concrete column at that point.

- Self weight of the lever handle including wooden piston and the hook (Figure B2):

$$4.67\ kg\ +\ 0.95\ kg\ =\ 5.62\ kg$$

- Reaction at point B, due to the self wight of the handle, wooden piston and hook only:

$$\circlearrowleft + \sum MA = 0$$

$$-R_B \times O.25 + 5.62\ \times 1.00\ \times \frac{1.00}{2} = 0 \quad \Rightarrow \quad R_B = 11.24\ kg$$

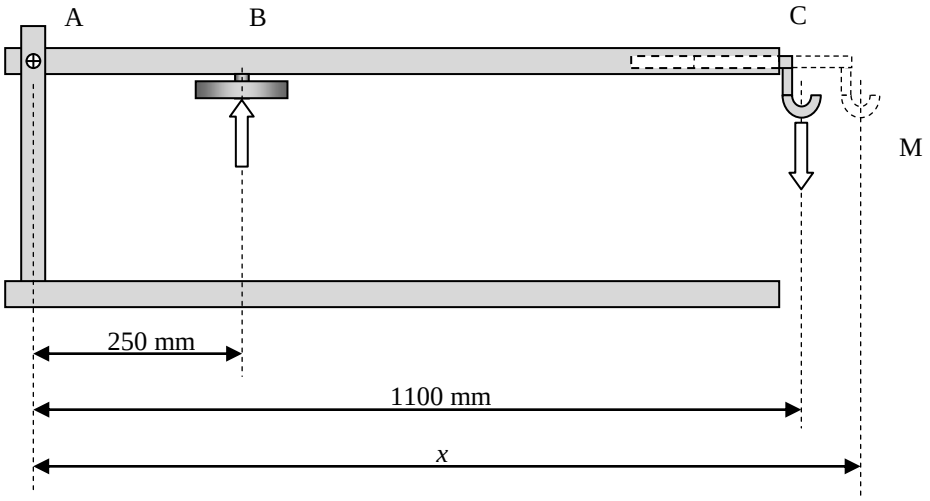

Figure B2: Press apparatus configurations and details

R_B equals the reaction at point *B* or at the wooden piston due to the weight of the piston and the steel lever handle alone. Therefore, necessary mass (M) hung on the one meter long lever handles equals:

$$1000\ mm \times M = 250\ mm\ (62.56 - 11.24) \quad \Rightarrow \quad M = 12.83\ kg$$

Using a bucket of water as M= 12.83 kg hung on the hook, the lever would apply 62.56 kg of load on the fresh cast fabric formed concrete sample. This weight was applied on mid height samples to find the bleeding ratio of the middle point of a three meter high concrete column.

2. To find the necessary mass value on the bottom sample (Figure B3), following calculations were made. Considering the total height of the column as 300 mm:

- Total height of concrete above the 12" tall sample:

$$12" = 305\ mm$$

$$3000\ mm - 305\ mm = 2695\ mm$$

- Area of the 6" diameter cylinder = $18241\ mm^2$

- Volume of the concrete:

$$V = 18241\ mm^2 \times 2695\ mm = 49159495\ cm^3 = 0.0492\ m^3$$

- Mass of the concrete equals:

$$M = \rho_c \times V = 2300\ kg/m^3 \times 0.0492\ m^3 = 113.16\ kg$$

- Total weight of the lever handle, wooden piston and the hook:

$$4.67\ kg\ +\ 0.95\ kg\ =\ 5.62\ kg$$

- Reaction at point B (R_B), due to the wight of the handle, including wooden piston and the hook only:

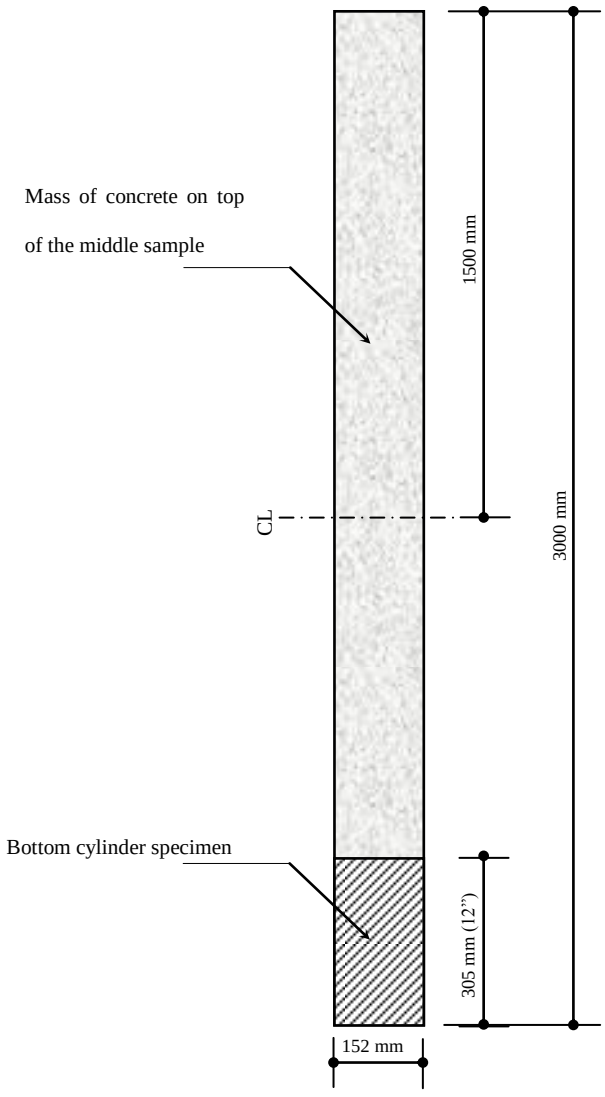

Figure B3: Position of the 6 (diameter) by 12 (height) inch bottom concrete samples along the length of a 3 meter high concrete column

$$\circlearrowleft + \sum MA = 0$$

$$-R_B \times O.25 + 5.62 \times 1.00 \times \frac{1.00}{2} = 0 \quad \Rightarrow \quad R_B = 11.24\ kg$$

R_B equals the reaction at point *B* or at the wooden piston due to the weight of the piston and the steel lever handle alone. To find *"x"* (Figure B2) we have:

$$x \times 24\ kg = 250\ mm\ (113.16 - 11.24) \quad \Rightarrow \quad x = 1061\ mm$$

Using available fixed weights of 24 kg hung on to the hook, *"x"* is the total length needed on the lever's handle to create and apply 113.16 kg of load on our fresh cast fabric formed concrete sample.