MATERIAL ESTIMATION

Cement, Banana Fibre (BF), Fine Aggregate, Coarse aggregate

Concrete Grade : M15, Mix Ratio = 1 : 2 : 4

BF % : 0%, 1.5%, 2%, 3%

1. Days of Compression Test : 7, 14, 28 days

No of cubes per day of each BF content

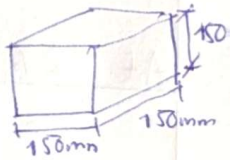
3 Concrete cubes per testing day of each BF%

∴ Total number of cubes required for each BF% content at 7, 14 and 28 days combined is 9 cubes each.

Calculating the amount of material required for 9 cubes of each BF% by mass

Using Unit weight of concrete = 2400 kg/m³

Dimension for concrete cube = 150mm x 150mm x 150mm



Volume of 1 Cube = 0.15m x 0.15m x 0.15m

= 0.003375m³

Mass of 1 Cube = 2400kg/m³ x 0.003375m³

= 8.1kg

Volume of 9 cubes = 0.003375m³ x 9

= 0.030375m³

Mass of 9 Cubes = 8.1kg x 9

= 72.9kg

Using the Mix Ratio of M45

1 : 2 : 4
Cement : Fine Agg : Coarse Agg

1 + 2 + 4 = 7

Cement Mass : $\frac{1}{7} \times 72.9 = 10.41\ kg$

Fine agg : $\frac{2}{7} \times 72.9 = 20.83\ kg$

Coarse agg : $\frac{4}{7} \times 72.9 = 41.66\ kg$

The Banana Fiber (BF) of this study is replacing the cement by % by weight in terms of the mass

At 1.5% Replacement

= 1.5% x 10.41 kg

= 0.156 kg (BF required for 9 cubes)

Cement required at 1.5% replacement

10.41 kg − 0.156 kg

= 10.25 kg

At 2% Replacement

= 2% x 10.41 kg

= 0.208 kg (BF required for 9 cubes)

Cement required at 2% replacement

10.41 kg − 0.208 kg

= 10.20 kg

At 3% Replacement

= 3% x 10.41 kg

= 0.312 kg (BF required for 9 cubes)

Cement required at 3% replacement

10.41 kg − 0.312 kg

= 10.1 kg

Total BF required for the cube tests

0.156 kg + 0.208 + 0.312 kg

= 0.676 kg

ii.

Tensile Strength Test

Total No. of beams: (Tests will be carried out at 7 and 28 days)

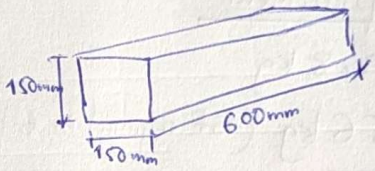
3 concrete beams per testing day of each BF% content

∴ Total number of beams required for each BF% content at 7 and 28 days combined is **6 ~~cubes~~ beams each**

Using unit weight of concrete = 2400 kg/m³

Dimension of concrete beam

150mm x 150mm x 600mm



Volume of 1 beam = 0.15 m x 0.15m x 0.6m

= 0.0135 m³

Mass of 1 beam = 2400 kg/m³ x 0.0135m³

= 32.4kg

Volume of 6 beams = 0.0135m³ x 6

= 0.081 m³

Mass of 6 beams = 32.4kg x 6

= 194.6 kg

Using the mix ratio of M15

1 : 2 : 4

Cement mass : $\frac{1}{7}$ x 194.6kg = 27.8 kg

Fine aggregate : $\frac{2}{7}$ x 194.6 kg = 55.6 kg

Coarse aggregate : $\frac{4}{7}$ x 194.6kg = 111.2kg

BF replacing the cement by % by weight in terms of mass

Cement replacement for Beams with M15 grade

At 1.5% replacement

1.5% x 27.8 kg

= 0.417 kg (BF required in 6 beams)

Cement required at 1.5% replacement

27.8 − 0.417

= 27.4 kg

At 2% replacement

2% x 27.8 kg

= 0.556 kg (BF required in 6 beams)

Cement required at 2% replacement

27.8 kg − 0.556

= 27.2 kg

At 3% replacement

3% x 27.8 kg

= 0.834 kg (BF required in 6 beams)

Cement required at 3% replacement

27.8 kg − 0.834

= 26.9 kg

Total BF required for the beam tests

0.417 + 0.556 + 0.834

= 1.81 kg

iii. Split Tensile Test

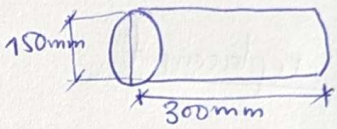
Total number of cylinders : (Test will be carried out at 7 and 28 days)

3 cylinders per testing day of each BF% content at 7 and 28 days combined is 6 cylinders each,

Using the unit weight of concrete = 2400 kg/m³

Dimension of concrete cylinder

150mm , 300mm



Volume of 1 cylinder = $\pi\left(\frac{d}{2}\right)^2 h$

$= \pi\left(\frac{0.15m}{2}\right)^2 \times 0.3m$

$= 0.005301 m^3$

Mass of 1 cylinder = $2400 kg/m^3 \times 0.005301 m^3$

$= 12.72 kg$

Volume of 6 cylinders = 6×0.005301

$= 0.0318 m^3$

Mass of 6 cylinders = $6 \times 12.72 kg$

$= 76.32 kg$

Using the Mix ratio of M15

1 : 2 : 4

Cement mass : $\frac{1}{7} \times 76.32 kg = 10.9 kg$

Fine aggregate : $\frac{2}{7} \times 76.32 kg = 21.81 kg$

Coarse aggregate : $\frac{4}{7} \times 76.32 kg = 43.61 kg$

BF replacing the cement by % by weight in terms of mass

Cement replacement for M15 grade

At 1.5% replacement

= 1.5% x 10.9 kg

= 0.16 kg

Cement required at 1.5% replacement

10.9kg - 0.16kg

= 10.74 kg

At 2% replacement

2% x 10.9 kg

= 0.22kg

Cement required at 2% replacement

10.9 - 0.22 kg

= 10.68 kg

At 3% replacement

3% x 10.9 kg

= 0.33 kg

Cement required at 3% replacement

10.9 - 0.33

= 10.57 kg

Total BF required for the cylinders

0.16 kg + 0.22kg + 0.33 kg

= 0.71 kg