APPENDIX 1

Model Calculation for Volume Fraction of Reinforcement (V_r)

For meshes the formula recommended in FMC is

\[ V_r = \frac{(N \cdot W_r)}{(h \cdot \gamma_r)} \]

N = number of layers of mesh

W_r = unit weight of reinforcing mesh

h = thickness of the ferrocement element

\( \gamma_r \) = density of reinforcement material

(A) Chicken Mesh

N = One layer

W_r = 0.40 kg/m²

h = 0.030 m

\( \gamma_r = 7850 \text{ kg/m}^3 \)

\[ V_r = \left( \frac{1 \times 0.4}{0.03 \times 7850} \right) \times 100 \]

\[ = 0.17\% \]

\( V_r \), for one layer = 0.17 %

Similarly, V_r is calculated for ferrocement panels with 2 and 3 layers of mesh reinforcement.

\( V_r \), for two layers = 0.34%

\( V_r \), for three layers = 0.51%

Model Calculation for Specific Surface of Reinforcement (S_r)

Eqn. (4.4) is used to calculate S_r for ferrocement pannels with two type of mesh reinforcement.

(A) Chicken Mesh

Diameter of the wire = 0.15 cm

Density of wire = 7.85 gm/cm³
Weight of the mesh used for casting 760 x 150 x 30 mm ferrocement panel excluding cover all around is = 72.76 gm

Length of wire = \((\frac{\pi}{4}) \times 0.15^2\) \(\times 7.85 = 72.76\)cm

\[L = \frac{(72.76 \times 4)}{(0.15^2)} \times 7.85 = 72.76\text{cm}\]

Perimeter of Wire = \(1653 \times \pi \times 0.071\)

\[= 3666\text{cm}\]

\[Sr = \frac{3666}{(76 \times 15 \times 30)}\]

\[= 0.10\text{cm}^2/\text{cm}^3\]

Sr for One layer = 0.10 cm\(^2\)/cm\(^3\)

Two layer = 0.20 cm\(^2\)/cm\(^3\)

Three layer = 0.30 cm\(^2\)/cm\(^3\)
APPENDIX 2

Material Requirements for Mix ratio: 1: 2.5 [Fly ash: sand]

Mould size: 50mm*50mm*50mm
Volume of cube = 0.00125m$^3$
Unit weight of fly ash = 2300 Kg/m$^3$
Amount of fly ash = $2300 \times 125 \times 10^{-6} \times 1/3.5 = 0.085$ Kg
Amount of sand = $2.5 \times 0.085 = 0.205$ kg
Amount of NaOH = 9.6% of fly ash
Amount of Na$_2$SiO$_3$ = 24% of fly ash
Molarity used in the concrete is 16 molar in which 444 grams of NaOH solids dissolved in 556 grams of water. D. Hardjito and B. V. Rangan(2005)
Amount of NaOH solution = $9.6\% \times 0.085 = 0.00816$ kg

Mix ratio: 1: 2.5 [Fly ash: sand] –cylinder

Mould size: height=100mm, dia=50mm
Volume of cylinder = $3.14 \times 25 \times 25 \times 100 = 0.196 \times 10^{-3}$ m$^3$
Unit weight of fly ash/ fly ash to sand ratio = $2370/ (1+2.5) = 677.14$ kg/m$^3$
For one cylinder:
Amount of fly ash = $677.14 \times 0.196 \times 10^{-3}$ m$^3 = 0.132$ kg
Amount of sand = $2.5 \times 0.132 = 0.3317$ kg
Amount of NaOH = 9.6% of fly ash
Amount of Na$_2$SiO$_3$ = 24% of fly ash
Molarity used in the concrete is 16 molar in which 444 grams of NaOH solids dissolved in 556 grams of water. Amount of NaOH solution = $9.6\% \times 0.132 = 0.0126$ kg
So, Solid (NaOH) = $0.444 \times 0.0126 = 5.62 \times 10^{-3}$ kg
Water (H$_2$O) = $0.556 \times 0.0126 = 7.00 \times 10^{-3}$ L
Amount of Na$_2$SiO$_3$ = 24% $\times 0.132 = 0.03168$ kg
W/B ratio = $(H_2O + NaOH + Na_2SiO_3)/ FA$
Amount of water for $0.416 = (0.416 \times 0.132) - 0.0126 - 0.03168 = 0.010632 \text{ L}$

**Mix ratio: 1 : 3 [Fly ash : sand]-cube**

Mould size: 50x 50 x 50mm

Volume of cube = $0.125 \times 10^{-3} \text{ m}^3$

**For one cube:**

Amount of fly ash = $592.5 \times 0.125 \times 10^{-3} = 0.0740 \text{ kg}$

Amount of sand = $3 \times 0.0740 = 0.222 \text{ kg}$

Amount of NaOH = 9.6% of fly ash

Amount of $\text{Na}_2\text{SiO}_3$ = 24% of fly ash

Molarity used in the mortar is 16 molar in which 444 grams of NaOH solids dissolved in 556 grams of water. From the reference of D. Hardjito and B. V. Rangan (2005)

Amount of NaOH solution = $9.6\% \times 0.0740 = 7.104 \times 10^{-3} \text{ kg}$

So, Solid (NaOH) = $0.444 \times 7.104 \times 10^{-3} = 3.15 \times 10^{-3} \text{ kg}$

Water ($\text{H}_2\text{O}$) = $0.556 \times 7.104 \times 10^{-3} = 3.94 \times 10^{-3} \text{ L}$

Amount of $\text{Na}_2\text{SiO}_3$ = $24\% \times 0.0740 = 0.01776 \text{ kg}$

$W/B$ ratio = ($\text{H}_2\text{O} + \text{NaOH} + \text{Na}_2\text{SiO}_3$)/ FA

Amount of water for $0.416 = (0.416 \times 0.0740) - 7.104 \times 10^{-3} - 0.01776 = 5.92 \times 10^{-3} \text{ L}$

**Mix ratio : 1 : 3 [Fly ash : sand] -cylinder**

Mould size: height=100mm, dia=50mm

Volume of cylinder = $3.14 \times 25 \times 25 \times 100 = 0.196 \times 10^{-3} \text{ m}^3$

Unit weight of fly ash/ fly ash to sand ratio = $2370/(1+3) = 592.5 \text{ kg/m}^3$

**For one cylinder:**

Amount of fly ash = $592.5 \times 0.196 \times 10^{-3} \text{ m}^3 = 0.11613 \text{ kg}$

Amount of sand = $3 \times 0.11613 = 0.34839 \text{ kg}$

Amount of NaOH = 9.6% of fly ash, Amount of $\text{Na}_2\text{SiO}_3$ = 24% of fly ash

Molarity used in the concrete is 16 molar in which 444 grams of NaOH solids dissolved in 556 grams of water. From the reference of D. Hardjito and B. V. Rangan (2005)
Amount of NaOH solution = 9.6% x 0.11613 = 0.011148kg
So, Solid (NaOH) = 0.444 x 0.011148 = 4.94 x10^{-3}kg
Water (H\textsubscript{2}O) = 0.556 x 0.011148= 6.198x10^{-3}L, Amount of Na\textsubscript{2}SiO\textsubscript{3} = 24%
x 0.11613= 0.0278kg
W/B ratio = (H\textsubscript{2}O + NaOH + Na\textsubscript{2}SiO\textsubscript{3})/ FA