2007-2008

1) a) Here,

$f_c = 20\ MPa$

From table 1,

$f_c' = 6000\ PSi = 41\ MPa$,

for a W/C Ratio of 0.41.

Maximum Size of C.A = 25 mm

say, Required slump is 100-150 mm

∴ Mixing water content $= \frac{193+202}{2}$

$= 197.5$ ~~mm~~ KG

& entrapped Air = 1.5%

~~Cement content = W/C~~ $= \frac{197.5}{0.41} = 481.71$ kg

Admixture Reduces 15% of Mixing water

∴ Mixing water $= \left(197.5 - \frac{197.5 \times 15}{100}\right)$ kg

$= 167.875$ kg

Cement content $= \frac{W}{W/C} = \frac{167.875}{0.41} = 409.45$ kg

Let's use 700 ml ~~Megaflow~~ Admixture per 100 kg

∴ Amount of Admixture $= \frac{700}{100} \times 409.45 = 3.44$ kg

∴ Mixing water $= 167.875 - 3.44 = 164.4$ kg

Estimation of C.A :

From table 3,

Dry Rodded bulk vol^{m} of C.A = 0.69 m^3

From, table 4,

Dry Rodded bulk density of C.A = 1530 kg/m^3

∴ Dry mass of C.A = (0.69×1530) kg = 1055.7 kg

∴ SSD mas of C.A = $1055\left(1+\frac{1}{100}\right)$ kg

= 1066.26 kg

calculation of F.A: (Mass Method)

Density of fresh concrete = 2350 kg/m^3

∴ 164.4 + 409.45 + F.A + 1066.26 + 3.44 = 2350
~~167.875~~ (SSD)

∴ F.A (SSD) = 706.45 kg

∴ F.A (OD) = $\frac{706.45}{1+\frac{1.5}{100}}$ = 696 kg

Ans: (a) water = 164.4 kg, cement = 409.45 kg

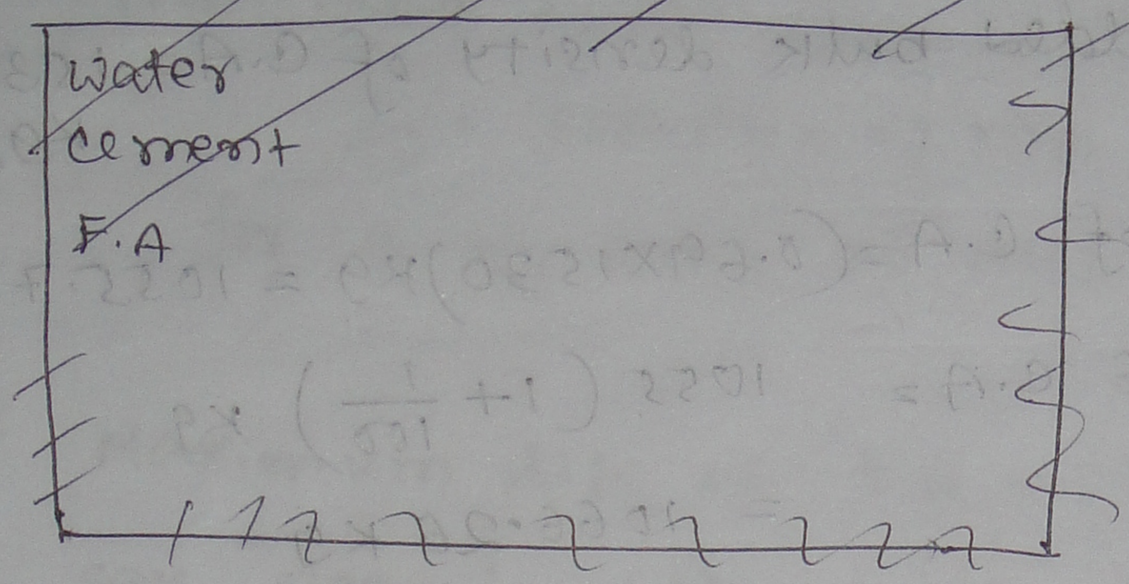
F.A (SSD) = 706.45 kg ; C.A (SSD) = 1066.26 kg

Mix proportion for $1m^3$ fresh concrete

Water	= 164.4 kg
cement	= 409.65 kg
F.A (SSD)	= 706.45 kg
C.A (SSD)	= 1066.26 kg
Adm	= 3.44 kg

b) Vol/m of cylindrical Mold = $0.0027\ m^3$
considering 25% loss during handeling, $V = 0.034\ m^3$
~~Density of fresh concrete in lab = 2430~~

Now, Mix Proportion for $0.0273\ m^3$ Fresh Concrete



Surface Moisture in F.A = $\left(696 \times \frac{3.5-1.5}{100}\right)$ kg
= 13.92 kg

∴ F.A (wet) = (706.45 + 13.92) kg = 720.37 kg

surface moisture in C.A = $1055.7\left(\frac{0.5-1}{100}\right)$ kg
= −5.3 kg

∴ C.A (wet) = (1066.26 − 5.3) kg = 1060.96 kg

∴ Adjusted Mixing Water = (164.4 − 13.92 + 5.3) kg
= 155.78 kg

~~Adjusted F.A~~ =

Mix Proportion for $0.034\ m^3$ fresh concrete

	Adj. wet mass	Adj. wet mass
water	155.78 × 0.034	= 5.3
cement	409.45 × 0.034	= 13.92
F.A	720.37 × 0.034	= 24.5
C.A	1060.96 × 0.034	= 36.07
Adm	3.44 × 0.034	= 0.117

Now, 0.4 kg Additional water is Added to achieve required slump.

∴ Mass of water Added = 5.3 + 0.4 = 5.7 kg

Mass of ingredients mixed = 5.7 + 13.92 + 24.5 + 36.07 + 0.117

= 80.307 kg

Measured density of fresh concrete = 2430 kg/m³

∴ yield of trial Mix = $\frac{80.307}{2430}$ = $\boxed{0.033\ m^3}$

Now, surface Moisture in F.A :

F.A (SSD) = $\frac{24.5}{1 + \frac{2}{100}}$ = 24 kg

∴ surface water in F.A = (24.5 - 24) kg

= 0.5 kg

surface water in C.A :

C.A (SSD) = $\frac{36.07}{1 - \frac{0.5}{100}}$ = 36.25 kg

∴ surface water in C.A = 36.07 - 36.25

= -0.18 kg

∴ Mixing water in 1st lab trial Mix

= 5.7 + 0.5 - 0.18 + 0.117

= 6.136 kg

∴ For 1 m³ concrete, Mixing water = $\frac{6.136}{0.033}$ = $\boxed{185.94\ kg}$

Now, observed slump = 85 mm

Required slump = $\frac{100 + 150}{2}$ = 125 mm

∴ slump to be increased = 40 mm

∴ water to be increased = $\frac{2}{10} \times 40$ kg

= 8 kg

∴ Modified Mixing water = 185.94 + 8 kg

≈ 194 kg

∴ Modified cement = $\frac{194}{0.41}$ = 473.17 kg

∴ ~~Mod~~ C.A (wet) = $\frac{36.07}{0.033}$ = 1093.03 kg

∴ F.A (wet) = $\frac{24.5}{0.033}$ = 742.4 kg

∴ Admixture = $\frac{0.117}{0.033} = 3.54$

Mixing water = 194 − 3.54 = 190.46 kg

Materials	Adjusted wet mass (kg)
water	190.46
cement	473.17
F.A	742.4
C.A	1093.03
Adm	3.54

(b) For 9 cylinders, the diameter and height of mold should be 4" & 8"

∴ Volm of 9 cylinders = $9\left\{\frac{\pi}{4} \times (0.1016)^2 \times 0.2032\right\}$ m

= 0.015 m^3

~~Mix Proper~~ 25% loss during handeling,

∴ Volm fresh concrete for 9 cylinders

= 1.25 × 0.015 m^3

= 0.01875 m^3

∴ Mix proportions of fresh concrete for a cylinder

Material	Adjusted wet mass	Adj. wet mass (kg)
Water	190.46 × 0.01875	= 3.57
Cement	473.17 × 0.01875	= 8.87
F.A	742.4 × 0.01875	= 13.92
C.A	1093.03 × 0.0187	= 20.5
Adm	3.54 × 0.01875	= 0.066

2)

Material	Mass (kg)	Loose bulk dens (kg/m3)	Bulk vol m
water	1000×0.6 = 600		
cement	1000		
F.A	1800	1280	1.40625
C.A	4500	1320	3.41
	Total = 7900		

∴ bulk volume of concrete $= \frac{7900}{2400}$

$= 3.3\ m^3$

∴ cement content $= \frac{1000}{3.3} =$ **303.03 kg**

∴ F.A $= \frac{1.40625}{3.3}\ m^3 = 0.426\ m^3 =$ **15.037 cft**

∴ C.A $= \frac{3.41}{3.3} = 1.033\ m^3 =$ **36.464 cft**

Ans

2006-2007

1) $f_c = 28$ MPa

As the construction is exposed to sea water w/c ratio shouldn't exceed 0.45

From table 1,

For w/c = 0.45

$f_c' = 41$ MPa

from manipulation, we get,

when, w/c = 0.45

$f_c' = 37$ MPa

required slump-value = 25-50 mm

Max^m size of C.A = 25 mm

∴ Mixing water content = 179 kg (From table 2)

Entrapped air = 2 %.

cement content = $\frac{W}{W/C} = \frac{179}{0.45} = 398$ kg

Estimation of C.A:

Dry Rodded bulk vol^m of C.A = 0.67 m^3 (From table 3)

" " unit weight of C.A = 1540 kg/m^3

∴ ~~Dry~~ C.A (OD) = 0.67 × 1540 kg

= 1032.8 kg

∴ CA (SSD) = $1032\left(1+\frac{0.78}{100}\right)$ kg = 1039.84 kg

Estimation of F.A:

Vol^m method:

$$\frac{179}{1000}+\frac{398}{3150}+\frac{1032.8}{2670}+\frac{F.A\,(OD)}{2580}+\frac{1.5}{100}=1$$

$$\Rightarrow F.A\,(OD) = 755.5\ kg$$

$$\therefore F.A\,(SSD) = 755.5\times\left(1+\frac{1.45}{100}\right) = 766.47\ kg$$

	Weight (SSD) (kg
water	179 kg
Cement	398 kg
F.A (SSD)	766.47 (~~SSD~~)
C.A (SSD)	1039.84

Now,

surface Moisture in F.A = $755.5 \times \frac{3.65-1.45}{100}$

$\simeq 16.621$ kg

surface Moisture in C.A = $1032.8 \times \frac{0.3-0.78}{100}$

$\simeq -4.957$ kg

$\therefore$ Adjusted water = $179 - 16.621 + 4.957$

$\simeq \boxed{167.336 \text{ kg}}$

$\therefore$ Adjusted F.A = $766.47 + 16.621$

$= \boxed{783 \text{ kg}}$

Adjusted C.A = $(1039.84 - 4.957)$ kg

$\simeq \boxed{1034.88 \text{ kg}}$

Material	Adjusted Wet mass
water	167.336 kg
Cement	398
F.A	783
C.A	1034.88

(Ans)

2005-2006

5) b) $f_c' = 4000\ psi = 27.6\ MPa$

$\therefore\ w/c = 1.1734\, e^{-0.0259 f_c'} = 0.57$

Required Slump = 80-100 mm

Max^m size of C.A = 20 mm

$\therefore$ From table 19.5,

Mixing water content = ~~215~~ 200 kg/m^3

Entrapped Air = 3%.

cement content = $\frac{w}{w/c} = \frac{200}{0.57} = 350.87$ kg

<u>calculation of C.A:</u>

Dry Rodded bulk vol^m of C.A = 0.64 m^3

(From tab. 19.10)

$\therefore$ Dry Rodded Unit weight = 1550 kg/m3 (say)

$\therefore$ ~~Dry~~ C.A (O.D) = (0.64×1550) kg

= 992 kg

$\therefore$ C.A (SSD) = $992\left(1+\frac{3}{100}\right) = 1021.76$ kg

<u>Calculation of F.A:</u>

$$\frac{200}{1000} + \frac{350.87}{3150} + \frac{992}{2730} + \frac{F.A\,(OD)}{2520} + \frac{3}{100} = 1$$

$\therefore$ F.A (OD) = 744 kg

$\therefore$ F.A (SSD) = $744\,(1+3/100) = 766.32$ kg

Mix proportion for $1m^3$ fresh concrete

Material	~~Adjusted~~ mass
water	200
cement	350.87
F.A(SSD)	766.32
C.A(SSD)	1021.76

Now,

Surface moisture in F.A $= 744 \times \frac{1-3}{100}$

$= -14.88 kg$

" " " C.A $= 992\left(\frac{4-3}{100}\right)$

$= 9.92 kg$

$\therefore$ Adjusted water for site $= 200 - 9.92 + 14.88$

$= 205 kg$

$\therefore$ Adjusted F.A (wet) $= 766.32 - 14.88$

$= 751.44 kg$

$\therefore$ Adjusted C.A (wet) $= 1021.76 + 9.92$

$= 1031.7 kg$

Material	Adjusted wet mass (kg)
water	205
cement	350.87
F.A	751.44
C.A	1031.7

c)

Material	Mass (OD)	Loose dry den	bulk vol/m	vol/m Ratio
water	205.	1000	0.205	0.826
cement	350.87	1410	0.248	1
F.A(OD)	744	1300	0.57	2.3
C.A(OD)	992	1500	0.66	2.66

Vol/m Ratio = 1 : 2.3 : 2.66

2004-2005

$f_c' = 30 MPa$

$\therefore w/c = 1.1734 e^{-0.0259 f'c}$

$= 0.54$

Let, cement content = 400 kg/m3

∴ water content = 216 kg

Engineering Materials (Jahangir Sir)

~~2/9/17~~ 2010-11 (HRIDOY)

1) Moisture content, Absorption capacity = 1.5%

F.A = 3.5%

C.A = 0.5%

Maxm size of coarse aggregate = 20 mm

Here, For Fine Agg.

$$\frac{W_{wet} - W_{OD}}{W_{OD}} = 3.5\%$$

$$\Rightarrow W_{OD} = \frac{W_{wet}}{1 + \frac{3.5}{100}}$$

$$\Rightarrow W_{OD} = \frac{600}{1 + \frac{3.5}{100}} = 580 \text{ kg}$$

$\therefore W_{OD}$ (F.A) = 580 kg

For coarse Agg.

$$\frac{W_{wet} - W_{OD}}{W_{wet}} = 0.5\%$$

$$\Rightarrow W_{OD} = \frac{1100}{1 + \frac{0.5}{100}} = 1094.5$$

~~Free moisture of F.A =~~

Now, $$\frac{W_{SSD}(F.A) - W_{OD}(F.A)}{W_{OD}(F.A)} = 1.5\%$$

$$\Rightarrow W_{SSD}(F.A) = 588.7 \text{ kg}$$

And, $\frac{W_{SSD(C.A)} - W_{OD(C.A)}}{W_{OD(C.A)}} = 1.5\%$

$\Rightarrow W_{SSD(C.A)} = 1110.9\ kg$

Free moisture content:

For F.A = ~~6000~~ $\frac{6000 - 588.7}{588.7}$ kg

∴ For F.A = (1100 − 1110.9) kg

= −10.9 kg

For F.A = (600 − 588.7) kg

= 11.3 kg

∴ Total mixing water = 200 + 11.3 − 10.9

= 200.4 kg

Material	Mass, kg	Specific gr.	Absolute density kg/m³	Absolute volume m3
cement	500	3.15	3150	0.1587
water	200.4	1	1000	0.2004
F.A	~~6000~~ 580	2.60	2600	0.223
C.A	1094.5	2.60	2600	0.421

a): Total Volume = Vconcrete + Vair

$= 1.0231 + 1.0081 \times \frac{2}{100}$

$= 1.023 \, m^3$

c) Dem compacted density = $\frac{m}{V}$

$= \frac{200 + 500 + 600 + 1100}{1.023}$

$= 2345.67 \, kg/m^3$

b) $W/c = \frac{200.4}{500} = 0.4008 \approx 0.4$

Now,

1.023 m^3 concrete contains 200.4 kg water

∴ 1 m^3 " "

$\frac{200.4}{1.023}$ kg =

= 196 kg

d) ∴ expected slump value is 50 mm – 75 mm

(From table 3)

e) From table – 3

target mean strength = 6000 psi

∴ design compressive strength,

6000 = 1.00 fc' + 1200

=) fc' = 4800 psi = 33 MPa (psi)

5)

Material	Volume	Bulk density	mass (kg)
Water	0.6345	1000	634.5
cement	1	1410	1410
F.A	1.2	1350	1620
C.A	2	1450	2900

$\therefore$ Total mass of concrete = 6564.5 kg

2400 kg concrete $\equiv$ 1 m^3

$\Rightarrow$ 6564.5 kg concrete $\equiv \frac{6564.95}{2400}\ m^3$

$\equiv$ 2.735 m^3

Now,

2.735 m^3 concrete contains 1410 kg cement

$\therefore$ 1 m^3 " " $\frac{1410}{2.735}$ " "

= 515.5 kg cement

= $\frac{515.5}{50}$ bags

= 10.31 bags

$\approx$ **11 bags**

$\therefore$ Loose bulk vol^m of F.A = $\frac{1.2}{2.735} \times 0.44\ m^3$

= $0.44 \times (3.28)^3$

= **15.48 cft**

∴ Loose bulk vol^{m} of C.A $= \frac{2}{2.735}\ m^3$

$= 0.73\ m^3$

$= 0.73 \times (3.28)^3$ cft

$= \boxed{26\ \text{cft}}$

Or,

Material	bulk volume (m3)	mass (kg)	absolute vol^{m} (m3)
water	.	634.5	0.6345
cement	1	1410	0.4476
F.A	1.2	1620	0.61
C.A	2	2900	1:137
			= 2.83

∴ $2.83\ m^3$ concrete needs 1410 kg cement

∴ $1\ m^3$ " " $\frac{1410}{2.83}$ kg "

$= 498.23$ kg cement

$= \frac{498.23}{50}$ bags

$= 10$ bags

∴ Loose bulk vol^{m} of F.A $= \frac{1.2}{2.83} = 0.424\ m^3$

$= 0.424 \times (3.28)^3$

$= 14.96$ cft

∴ Loose bulk volm of C.A = $\frac{2}{2.83}$ m3

= 0.7067 m3

= 0.7067 × (3.28)3 cft

= **24.94 cft**

2009-10

(1) f_c' = 4000 psi

required slump-value = 50-75 mm

ordinary portland cement (NO Fly ash)

~~As the~~ Maximum size of C.A = 20 mm

using table: 8 (from book)

for slump 50-75 and max^m size of C.A = 20 mm,

Mixing water = $\frac{190+205}{2}$ = 197.5 kg

Entrapped Air = 2%.

Now, From table 5.3.3.2:

Mean target strength f_c' = (4000 + 1200) psi

= 5200 psi

= $\frac{5200}{145}$ MPa

= 36 MPa

$$\therefore \quad w/c = 1.1734 e^{-0.0259 f_c'}$$

$$\Rightarrow \boxed{w/c = 0.46}$$

$\therefore$ cement content $= \dfrac{W}{w/c} = \dfrac{197.5}{0.46} = 427.6$ kg

$\therefore$ clinker $= 0.97 \times 427.6 = 414.77$ kg

Determination of C.A:

From table 5,

Dry rodded bulk Vol^{n} $= 0.64\ m^3$

From table 2,

Dry Rodded unit weight $= 1600$ kg/m^3

$\therefore$ Dry mass of C.A $= 0.64 \times 1600$ kg

$= 1024$ kg

$\therefore$ SSD mass of C.A $= 1024\left(1 + \dfrac{1}{100}\right)$ kg

$= 1034.24$ kg

Volume Method:

$$\frac{W}{1000} + \frac{C}{3150} + \frac{F.A(OD)}{2500} + \frac{C.A(OD)}{2600} \times \left(1 + \frac{2}{100}\right) = 1$$

$$\Rightarrow \frac{197.5}{1000} + \frac{427.6}{3150} + \frac{F.A(OD)}{2500} + \frac{1024}{2600} = 1$$

~~∴ F.A (OD) = 682.35 kg~~

∴ F.A (OD) = 632.27 kg

∴ F.A (SSD) = $632.27\left(1+\frac{1.5}{100}\right)$ kg

= 641.75 kg

Mix Proportion for $1\,m^3$ Fresh concrete :—

Water	= 197.5 kg
cement	= 427.6 kg
F.A (SSD)	= 641.275 kg
C.A (SSD)	= 1034.24 kg

~~Total = 2023.04~~ ~~2301.29~~

Total = 2301 kg

~~Ab~~ Adjustment and 1st lab Trial Mix :

Surface moisture in F.A = $632.27\left(\frac{3-1.5}{100}\right)$

= 9.5 kg

surface Moisture in C.A = $1024\left(\frac{0.5-1}{100}\right)$

= −5.12 kg

∴ Adjusted Mixing Water = (197.5 − 9.5 + 5.12) kg

= 193.12 kg

Adjusted F.A = 641.75 + 9.5 = 651.25

Adjusted C.A = 1034.24 - 5.12 = 1029.12

Mix proportion for 1 m^3 Fresh concrete:

Water	=	193.12
cement	=	427.6
F.A	=	651.25
C.A	=	1029.12
total	=	2301 kg

Now, For 1st Lab trial mix, 3 cylinders of 6"x12" is made.

$\therefore$ Vol^m of 3 cylinders $= 3 \times \left\{\frac{\pi}{4} \times (0.150)^2 \times .300\right\}$

$= 0.0159\ m^3$

considering 25% loss during handeling,

Vol^m of fresh concrete needed

for 1st Lab trial mix $= 1.25 \times 0.0159$

$= 0.02\ m3$

Mix proportion for $0.02\ m^3$ fresh concrete

Water	= 193.12 x 0.02	= 3.86
cement	= 427.6 x 0.02	= 8.552
F.A	= 651.25 x 0.02	= 13.025
C.A	= 1029.12 x 0.02	= 20.58

It is Assumed that, 0.3 Kg more water is added to achieve required Slump value from visual observation.

After that, From Slump test, we get,

Slump value = 50 mm

We know, For 20 mm nominal Maxm size

average density of fresh concrete = 2400 Kg/m³

∴ Mass of water Added = (3.86 + 0.3) ~~+ 8.55 + 13.025 + 20.58) Kg~~

= 4.16 Kg

∴ Mass of ingredients Mixed = (4.16 + 8.55 + 13.025 + 20.58) Kg

= 46.315 Kg

∴ Volume of trial Mix = $\frac{46.315}{2400}$ m³

= 0.0193 m³

Surface Moisture in F.A

F.A (OD) = $\frac{13.025}{1 + \frac{3}{100}}$ = 12.64 Kg

$\therefore$ surface moisture $= 12.64\left(\frac{3-1.5}{100}\right)$ kg

$= 0.19$ kg

Surface Moisture in C.A:

$$C.A(OD) = \frac{20.58}{1+\frac{0.5}{100}} = 20.48 \text{ kg}$$

$\therefore$ surface moisture in C.A $= 20.48\left(\frac{0.5-1}{100}\right)$ kg

$= -0.102$ kg

$\therefore$ Mixing water for 1st lab trial Mix $=$

$4.16 + 0.19 - 0.102$

$= 4.248$ kg

For $0.0193\ m^3$ concrete, Mixing water $= 4.248$ kg

$\therefore$ " 1 " " " " $= \frac{4.248}{0.0193}$

$= \boxed{220.1 \text{ kg}}$

Now, slump required $= \frac{50+75}{2} = 62.5$ mm

" Found $= 50$ mm

---

slump to be increased $= 12.5$ mm

$\therefore$ According to ACI,

water to be increased $= \frac{2}{10} \times 12.5 = 2.5$ kg

∴ Modified Mixing Water = 220.1 + 2.5 Kg

= 222.6 Kg

Modified cement content = $\frac{222.6}{0.46}$ = 483.9 kg

C.A (wet) for 1 m^3 concrete = $\frac{20.58}{0.0193}$ = 1066.32 kg

C.A (OD) " " " = $\frac{1066.32}{1 + \frac{0.5}{100}}$ = 1061 kg

C.A (SSD) " " " = $1061\left(1 + \frac{1}{100}\right)$

= 1071.6 kg

∴ surface water in wet C.A = (1066.32 - 1071.6) kg

= −5.3 kg

F.A (SSD) = (2400 - 222.6 - 483.9 - 1071.6) kg

= 621.9 kg

∴ F.A (OD) = $\frac{621.9}{1 + \frac{1.5}{100}}$ = 612.71 kg

∴ surface Moisture in F.A = $612.71\left(\frac{3 - 1.5}{100}\right)$

= 9.19 kg

∴ Mixing water in adjusted wet masses = (222.6 − 9.19 + 5.3) kg

= 218.71 kg

Adjusting for casting in site:

F.A (OD) = 612.71 kg

C.A (OD) = 1061 kg

∴ surface Moisture in F.A = $612.71\left(\frac{5-1.5}{100}\right)$

= 21.44 kg

& surface Moisture in C.A = $1061\left(\frac{1.5-1}{100}\right)$

= 5.305 kg

∴ Adjusted mixing water = $(\overset{222.6}{\cancel{218.7}} - 21.44 - 5.305)$

~~= 191.905 kg~~

= 195.855 kg.

Adjusted F.A = (621.9 + 21.44) kg

= 643.34 kg

Adjusted C.A = (1071.6 + 5.305) kg

= 1076.9 kg

Mix Proportion for $1\ m^3$ concrete in site

Water	195.855 kg
Cement	483.9 kg
F.A	643.34
C.A	1076.9

~~water~~	Adjusted wet mass	Loose unit weigh	Bulk vol'm	volumetric ratio
water	195.855	1000	0.196	0.567
cement	483.9	1400 (compacted)	0.3456	1
F.A	643.34	1300	0.495	1.43
C.A	1076.9	1300	0.83	2.4

∴ Volumetric Ratio = 1 : 1.43 : 2.4

(2) Here, $w/c = 0.6$

Material	bulk vol'm (m^3)	unit weight	Mass (kg)
water		~~846~~	846
cement	1	1410	1410
F.A	2	1300	2600
C.A	3	1350	4050
			= 8906 kg

∴ volume of concrete = $\frac{8906}{2400} = 3.71\ m^3$

∴ required cement = $\frac{1410}{3.71} = \boxed{380\ kg}$

∴ loose bulk vol'm of F.A = $\frac{2}{3.71} = 0.54\ m^3$

$= 19\ cft$

loose bulk vol^m of C.A $= \frac{3}{3.71} = 6.8086\ m^3$

$= 28.5\ cft$

2008-2009

5)

	Bulk vol^m	unit weight (loose) m^3	Mass (kg)
Water	0.42	1000	420
cement	1	1400	1400
F.A	1.16	1280	1484.8
C.A	1.84	1300	2392
			Total = ~~5702.8 kg~~ 5696.8 kg

$\therefore$ vol^m of concrete at site $= \frac{\text{~~5702.8~~ } 5696.8}{2420}\ m^3$

$= 2.35\ m^3$

$\therefore$ Water $= \frac{420}{2.35} = 178.72\ kg$

cement $= \frac{1400}{2.35} = 595.74\ kg$

F.A (wet) $= \frac{\text{~~1280~~ } 1484.8}{2.35} = 631.83\ kg$

C.A (wet) $= \frac{2392}{2.35} = 1017.87\ kg$

$$\therefore F.A(OD) = \frac{631.83}{1+1.2}$$

$$F.A(SSD) = \frac{631.83}{1+\frac{4-1.25}{100}} = \boxed{614.92\ kg}$$

$$C.A(SSD) = \frac{1017.87}{1+\frac{1-0.43}{100}} = \boxed{1012.1\ kg}$$

Now,

$$\frac{W}{C} = \frac{178.72}{\sqrt{95574}} = 0.3$$

Ex According to ACI Method :

$$W/C = 1.1734e^{-0.0259fc'}$$

$$\Rightarrow \boxed{fc' \rightarrow 52.66\ MPa}$$

Surface water in F.A = 631.83 − 614.92

= 16.91 kg

" " in C.A = 1017.87 − 1012.1

= 5.77 kg

∴ Mixing water in SSD condition

= 178.72 + 16.91 + 5.77

= 201.4 kg

$$\therefore W/C = \frac{201.4}{595.74} = 0.34$$

According to ACI,

$$W/C = 1.1734 e^{-0.0259 f_c'}$$

$$\therefore \boxed{f_c' = 48 \text{ MPa} = 6966.81 \text{ PSi}}$$

6.

Material	Mass	Loose unit weight [kg/m³]	bulk volume (m³)
water	500	1000	0.5
cement	1000	1400	0.71
F.A	1800	1280	1.4
C.A	4500	1300	3.46
			Total = 6.07 m³

$$\therefore \text{cement content} = \frac{1000}{6.07} = \boxed{164.74 \text{ kg}}$$

$$\therefore \text{F.A} = \frac{1800}{6.07} \cdot 1.4 = 0.23 \text{ m}^3 = \boxed{8.13 \text{ cft}}$$

$$\therefore \text{C.A} = \frac{3.46}{6.07} = 0.57 \text{ m}^3 = \boxed{20.11 \text{ cft}}$$