

### **CEL 774 CONSTRUCTION PRACTISES**

### Mix design of Concrete: IS method

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### **General Outline**

- The IS 10262 method
- Example



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Step 3: Estimate water content & sand contents for concrete grades <u>up to M35</u>/ above M35

m.s.a (mm)	W kg/m <sup>3</sup>	p=F <sub>agg</sub> Vol (%of Total)
10	208	40
20	186	35
40	165	30



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Step 3: Estimate water content & sand contents for concrete grades up to M35/ <u>above M35</u>

m.s.a (mm)	W kg/m <sup>3</sup>	p=F <sub>agg</sub> vol (%of Total)
10	200	28
20	180	25



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Step 3: Estimate water content & sand contents for concrete grades up to M35/ above M35 \* The Tables are for: Crushed CA Fine aggregate Zone II w/c =0.6(up to M35) & 0.35 (>M35) Compaction factor =0.8



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Step 3: Estimate water content & sand contents for concrete grades up to M35/ above M35 (Adjustments)

Condition	Adjusments	
	$\Delta \mathbf{W}$	∆ <b>p (%)</b>
Sand Zonel,III,IV	0	-1.5% /zone (+ for I)
CF(±) 0.1	3%(±)	0
w/c (±) 0.05	0	±1%
Rounded agg	-15	-7



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Step 4: Calculate cement content, Aggregate contents, \* w/c\*= Min (w/c<sub>curve</sub>, w/c<sub>durability</sub>) . C=Max(W/ w/c\*, C<sub>durability</sub>).  $V = \left| W + \frac{C}{S_C} + \frac{1}{p} \times \frac{F_{agg}}{S_{Fagg}} \right| \times \frac{1}{1000}$  $V = \left| W + \frac{C}{S_C} + \frac{1}{(1-p)} \times \frac{C_{agg}}{S_{Cagg}} \right| \times \frac{1}{1000}$ 



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#### V=1-air content

m.s.a (mm)	Air content (%)
10	3.0
20	2.0
40	1.0



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### **IS METHOD (Example)**

M25 concrete

★ Cement 43 grade
Moderate exposure
Zone III sand
Compaction factor 0.9
20 mm m.s.a rounded aggregate



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### **IS METHOD (Example)**

**Step 1:** 
$$f_m = f_{ck} + 1.65\sigma$$
  
 $\sigma = 4$ 

Grade	SD	TMS
25	4	31.6

*f*<sub>*m*</sub> = 32 *MPa* 



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Exposure	Min C	Max w/c	Min Grade
Mild	300	0.55	M 20
Moderate	300	0.50	<b>M 25</b>
Severe	320	0.45	M 30
Very severe	340	0.45	M 35
Extreme	360	0.40	M40

#### Step 2: w/c\*=0.43,



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Step 3: Estimate water content & sand contents for concrete grades <u>up to M35</u>/ above M35

m.s.a (mm)	W kg/m <sup>3</sup>	p=F <sub>agg</sub> (%of Total)
10	208	40
20	186	35
40	165	30



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#### Step 3: Adjustments

∑∆W=(0.9-0.8)/0.1×0.03\*186-15=-9.2 kg/m<sup>3</sup>

∑ ∆ p (%)=-1.5+(0.43-0.6)×0.01/0.05-7=-11.9

Condition	Adjusments	
	$\Delta \mathbf{W}$	∆ <b>p (%)</b>
Sand Zonel,III,IV	0	-1.5% /zone(+ for I)
CF(±) 0.1	3%(±)	0
w/c (±) 0.05	0	±1%
Rounded agg	-15	-7



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- � w/c\*= Min (0.43, 0.50)=0.43 . W=186-9.2≈177kg/m³

$$(1-0.02) = \left[ 177 + \frac{412}{3.15} + \frac{1}{0.231} \times \frac{F_{agg}}{2.7} \right] \times \frac{1}{1000}$$
$$\mathbf{C_{agg}} = \mathbf{1344.0kg/m^3}$$
$$0.98 = \left[ 177 + \frac{412}{3.15} + \frac{1}{(1-0.231)} \times \frac{C_{agg}}{2.6} \right] \times \frac{1}{1000}$$



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- **☆** W=186-9.2≈177kg/m<sup>3</sup>
- C=Max(177/ 0.43, 300). =411.6≈412 kg/m<sup>3</sup>
- $F_{agg}$ =419.25 kg/m<sup>3</sup>  $C_{agg}$ = 1344.0kg/m<sup>3</sup>
- **Total= 2352 kg/m<sup>3</sup>**



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✤ Actual water to be added =177-water (present – absorption) in aggregate in kg/m<sup>3</sup>

Actual quantity of aggregate in the mix shall be Aggregate content + extra due to (moisture content- absorption)

Trial mix and final adjustment



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# Summary

#### IS method

#### Example





# THANK YOU FOR HEARING

