

M-80 Grade Pumpable Concrete

By

Kaushal Kishore

Materials Engineer, Roorkee

A mix of M-80 Grade suitable for pumped concrete is to be designed with the following materials and detail.

1. OPC 53 Grade, 7-day strength 52.5 N/mm², Spgr 3.15
2. Silica Fume Specific Gravity 2.20
3. Standard deviation for the mix 5.0 N/mm²
4. Grading and properties of river sand and 12.5 mm crushed aggregate are given in Table-1
5. Superplasticizer based on modified Polycarboxylate, specific gravity 1.06, liquid pH 6.0. With the given set of materials, it was found that at a dosages of 2.5 % bwc it gives a reduction of 30% of water for the required slump of 100 mm after one hour at the average day site temperature of 37 degree C.
6. As per grading of aggregates given in the Table-1, it is found that, if sand and aggregate are combined in the ratio of 45% and 55% they will give most suitable combined grading for pumped concrete.
7. Air in the mix assumed 1.5%.

DESIGN CALCULATIONS

1. M-80 Grade of concrete design for a mean target strength of:
 $80 + 1.65 \times 5 = 88.3 \text{ N/mm}^2$ at 28 day age
2. With the given set of materials from various trials it was found that with OPC 450 Kg/m³, Silica Fume 45 Kg/m³ and W/C+SF ratio of 0.283 gives 28-day average cube compressive strength of 90.4 N/mm².
3. Calculated density of the mix, worked out from reference 1.

$$10 \times 2.65 (100 - 1.5)$$

$$+ \left\{ 450 \left(1 - \frac{2.65}{3.15} \right) + 45 \left(1 - \frac{2.65}{2.20} \right) \right\}$$

$$- 140 (2.65 - 1)$$

$$= 2610 + 62.55 - 231$$

$$= 2441.6 \text{ Say for trial mix} = 2440 \text{ kg/m}^3 \text{ (without SP)}$$

$$4. \text{ Aggregates} = 2440 - 140 - 450 - 45 = 1805 \text{ kg/m}^3$$

$$5. \text{ Sand} = 1805 \times 0.45 = 810 \text{ kg/m}^3 \text{ (say)}$$

$$6. \text{ 12.5 mm Aggregate} = 1805 \times 0.55 = 995 \text{ kg/m}^3 \text{ (say)}$$

Thus for M-80 Grade of concrete, quantity of materials per cu.m of concrete on the basis of saturated and surface dry aggregates.

Water	140 kg/m ³
OPC 53 Grade	450 kg/m ³
Silica fume	45 kg/m ³
River sand	810 kg/m ³
12.5 mm crushed aggregate	995 kg/m ³
Superplasticizer	11.250 kg/m ³
W/(C+SF) Ratio	0.283
Slump mm	102
7-day cube strength N/mm ²	67.3
28-day cube strength N/mm ²	89.5

Table-1 Properties of Aggregates

	Percentage passing by mass		
I.S. Sieve size	River sand	12.5 mm Crushed Agg	Combined aggregates grading of the mix
	45%	55%	

20 mm	100	100	100
12.5 mm	100	95	x
10 mm	100	60	78
4.75 mm	95	5	46
2.36 mm	87	0	39
1.18 mm	72	-	32
600 Micron	40	-	18
300 Micron	22	-	10
150, Micron	5	-	2
Specific gravity	2.65	2.65	-
Water absorption %	0.8	0.5	-
Organic impurities %	Nil	-	-
Coal & lignite %	Nil	Nil	-
Clay lumps %	Nil	Nil	-
Materials finer than 75 micron I.S. Sieve %	0.2	Nil	-
Flakiness index	-	7.3	-

Crushing value %	-	10.5	-
------------------	---	------	---

REFERENCES

Kishore Kaushal Mix design with water reduces, The Indian Concrete Journal, August 2011, Vol. 85, pp. 44-51.

*We at engineeringcivil.com are thankful to **Er. Kaushal Kishore** for submitting the paper on **M-80 Grade Pumpable Concrete**. This will be of great help to the ones who are looking for information regarding the pumpable concrete.*

Source: <http://www.engineeringcivil.com/m-80-grade-pumpable-concrete.html>