

# Concrete

Lecture - 2

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# Segregation and Bleeding



# Freedom from Segregation



Segregation can be defined as the **separation of the constituent materials of concrete**. If a sample of concrete exhibits a tendency for **separation of say, coarse aggregate from the rest of the ingredients, then, that sample is said to be showing the tendency for segregation**. Such concrete is not only going to be weak; lack of homogeneity is also going to induce all undesirable properties in the hardened concrete.

# Freedom from Segregation



There are considerable differences in the sizes and specific gravities of the constituent ingredients of concrete. Therefore, it is natural that the materials show a tendency to fall apart. Segregation may be of three types firstly, the coarse aggregate separating out or settling down from the rest of the matrix, secondly, the paste or matrix separating away from coarse aggregate

# Freedom from Segregation



and **thirdly**, water separating out from the rest of the material being a material of lowest specific gravity. **A well made concrete, taking into consideration various parameters such as *grading, size, shape and surface texture of aggregate with optimum quantity of waters* makes a cohesive mix.** Such concrete will not exhibit any tendency for segregation.



# Freedom from Segregation



The cohesive and fatty characteristics of matrix do not allow the aggregate to fall apart, at the same time, the matrix itself is sufficiently contained by the aggregate. Similarly, water also does not find it easy to move out freely from the rest of the ingredients.

## ***Cause of segregation***

- 1. There is a too much water in the mix*
- 2. There are badly graded aggregate.*
- 3. There are too much shocks to a concrete mix due to transport over longer distances, discharge of concrete from a considerable height (more than 1 m), pumping of concrete*

# Freedom from Segregation



- 4. leakage of mortar from formwork
- 5. Concreting is done under water

## *Prevention of Segregation*

- I. Mix should be designed correctly and minimum amount of water should be used for mixing.*
- II. Height of free fall of concrete should not be more than 1 m.*
- III. The concreting operations should be supervised strictly.*



# Freedom from Bleeding



A good concrete should be free from bleeding. The appearance of water along with some particles of cement and very fine sand on the surface of freshly placed concrete after compaction is called **bleeding**. *Due to bleeding watery scum (water + particles of fine sand and cement) is formed on the concrete surface. This scum layer is known as laitance. This layer should be removed if new concrete layer is to be placed over old layer.*

# Freedom from Bleeding



Bleeding is predominantly observed in a highly wet mix, badly proportioned and insufficiently mixed concrete. In thin members like roof slab or road slabs and when concrete is placed in sunny weather show excessive bleeding. When the surface is worked up with the trowel and floats, the aggregate goes down and the cement and water come up to the top surface. This formation of cement paste at the surface is known as “Laitance”.

# Freedom from Bleeding



The bleeding water is likely to accumulate below the aggregate. This accumulation of water creates water voids and reduces the bond between the aggregates and the paste. The above aspect is more pronounced in the case of flaky aggregate. Similarly, the water that accumulates below the reinforcing bars, particularly below the cranked bars, reduces the bond between the reinforcement and the concrete.

# Freedom from Bleeding



The poor bond between the aggregate and the paste or the reinforcement and the paste due to bleeding can be remedied by revibration of concrete. The formation of laitance and the consequent bad effect can be reduced by delayed finishing operations. Bleeding rate increases with time up to about one hour or so and thereafter, the rate decreases but continues more or less till the final setting time of cement. Bleeding is an inherent phenomenon in concrete.

# Freedom from Bleeding



All the same, it can be reduced by proper proportioning and uniform and complete mixing. Use of finely divided pozzolanic materials reduces bleeding by creating a longer path for the water to traverse. The use of air-entraining agent is very effective in reducing the bleeding. It is also reported that the bleeding can be reduced by the use of finer cement or cement with low alkali content. Rich mixes are less susceptible to bleeding than lean mixes.

# Freedom from Bleeding



Early bleeding when the concrete mass is fully plastic, **may not cause much harm, because concrete being in a fully plastic condition at that stage, will get subsided and compacted.** It is the delayed bleeding, when the concrete has lost its plasticity, that causes undue harm to the concrete. Controlled revibration may be adopted to overcome the bad effect of bleeding.



# Cause of bleeding



- I. Presence of excess water
- II. Deficiency of fine aggregate
- III. Too much finishing

## Prevention of bleeding

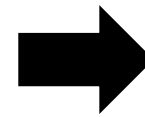
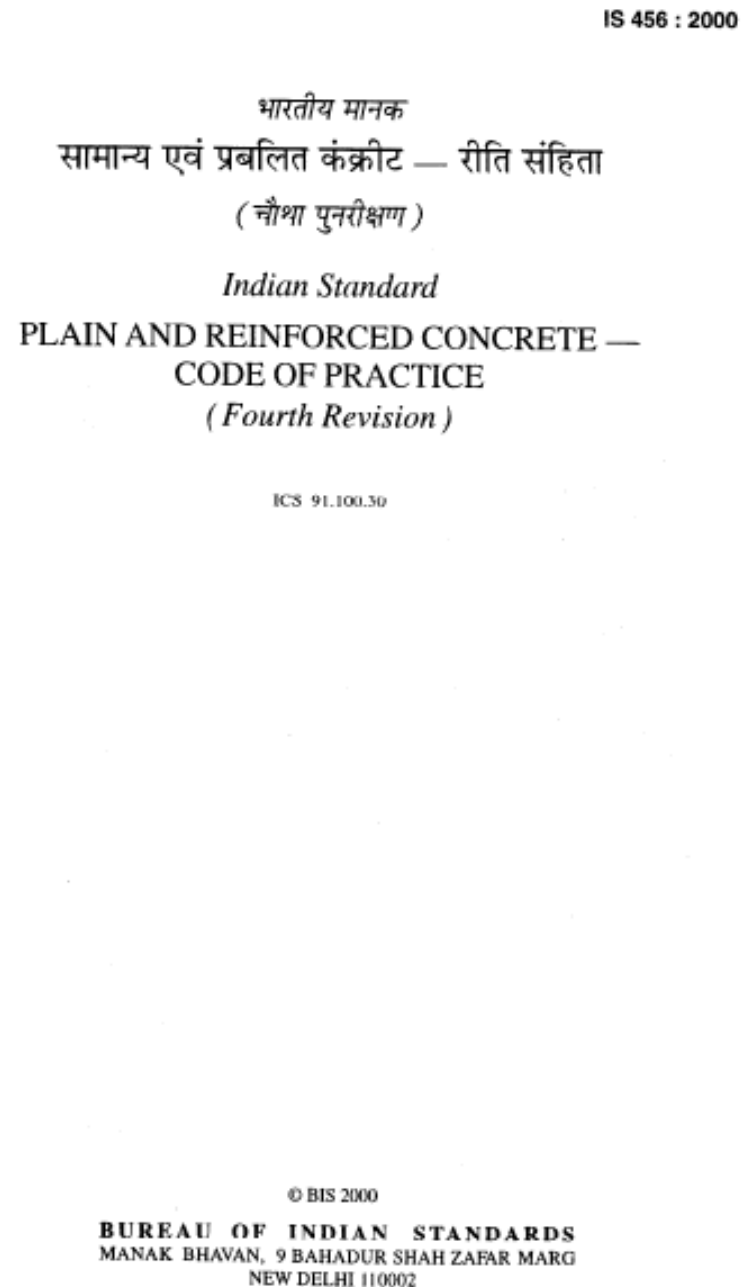
- 1. Controlling the water content
- 2. Providing fine grading of fine aggregate
- 3. Using finely ground cement
- 4. Controlling compaction
- 5. The air entraining agent should be used to prevent bleeding

# Range of Slump for Different Applications



Degree of Workability	Slump (mm)	Compacting Factor		Use for which concrete is suitable
		Small Apparatus	Large Apparatus	
Very low Compacting Factor is suitable	-	0.78	0.80	Roads vibrated by power operated machines. At the more workable end of this group, concrete may be compacted in certain cases with hand opened machines
Low	25-75	0.85	0.87	Roads vibrated by hand operated machines. At the more workable end of this group, concrete may be manually compacted in roads using aggregate of rounded or irregular shape. Mass concrete foundation without vibration or lightly reinforce section with vibration
Medium	50-100	0.92	0.935	At the less workable end of this group. Manually compacted flat slab using crushed aggregates. Normal reinforced concrete manually compacted and heavily reinforced section with vibration
High	100-150	0.95	0.96	For section with congested reinforcement. Not normally suitable for vibration. For pumping and tremie placing
Very High	-	-	-	Flow table test is more suitable

# Range of Slump for Different Applications



## 7 WORKABILITY OF CONCRETE

7.1 The concrete mix proportions chosen should be such that the concrete is of adequate workability for the placing conditions of the concrete and can properly be compacted with the means available. Suggested ranges of workability of concrete measured in accordance with IS 1199 are given below:

Placing Conditions	Degree of Workability	Slump (mm)
(1)	(2)	(3)
Blinding concrete; Shallow sections; Pavements using pavers	Very low	See 7.1.1
Mass concrete; Lightly reinforced sections in slabs, beams, walls, columns; Floors; Hand placed pavements; Canal lining; Strip footings	Low	25-75
Heavily reinforced sections in slabs, beams, walls, columns; Slipform work; Pumped concrete	Medium	50-100 75-100
Trench fill; In-situ piling	High	100-150
Tremie concrete	Very high	See 7.1.2

NOTE—For most of the placing conditions, internal vibrators (needle vibrators) are suitable. The diameter of the needle shall be determined based on the density and spacing of reinforcement bars and thickness of sections. For tremie concrete, vibrators are not required to be used (see also 13.3).

7.1.1 In the 'very low' category of workability where strict control is necessary, for example pavement quality concrete, measurement of workability by determination of compacting factor will be more appropriate than slump (see IS 1199) and a value of compacting factor of 0.75 to 0.80 is suggested.

7.1.2 In the 'very high' category of workability, measurement of workability by determination of flow will be appropriate (see IS 9103).

# Summary



- ✓ Segregation
- ✓ Bleeding
- ✓ Range of Slump for Different Applications

**THANK YOU**