Self compacting concrete (SCC)

INTRODUCTION

- By the early 1990's, Japan has developed and used SCC.
- Self compacted concrete is highly engineered concrete with much higher fluidity without segregation and is capable of filling every corner of formwork under its self weight .
- Thus SCC eliminates the vibration for the compaction of concrete without affecting its engineering properties.
- As of the year 2000, SCC used for prefabricated products (precast members) and ready mixed concrete (cast-in-situ) in JAPAN, USA and later on INDIA etc.

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Self compacting concrete (SCC), also known as self consolidating concrete,

is: – a highly flowable,

– non-segregating concrete

that: – can spread into place,

– fill the formwork and

– encapsulate the reinforcement without any mechanical compacting

Self compacting concrete (SCC)

Problems with Conventional Concrete ´Requirement of skilled worker for compaction in conventional concrete ´Difficult to use mechanical compaction for ´Underwater concreting ´Cast in-situ foundation ´Structures with heavy reinforcement.

Properties of fresh SCC

SCC must have the following characteristics in fresh state:

1. **Filling ability (excellent deformability)** - flows easily at suitable speed into formwork
2. **Passing ability (ability to pass reinforcement without blocking)** - passes through reinforcements without blocking
3. **High resistance to segregation**- the distribution of aggregate particles remains homogeneous in both vertical* and horizontal** directions

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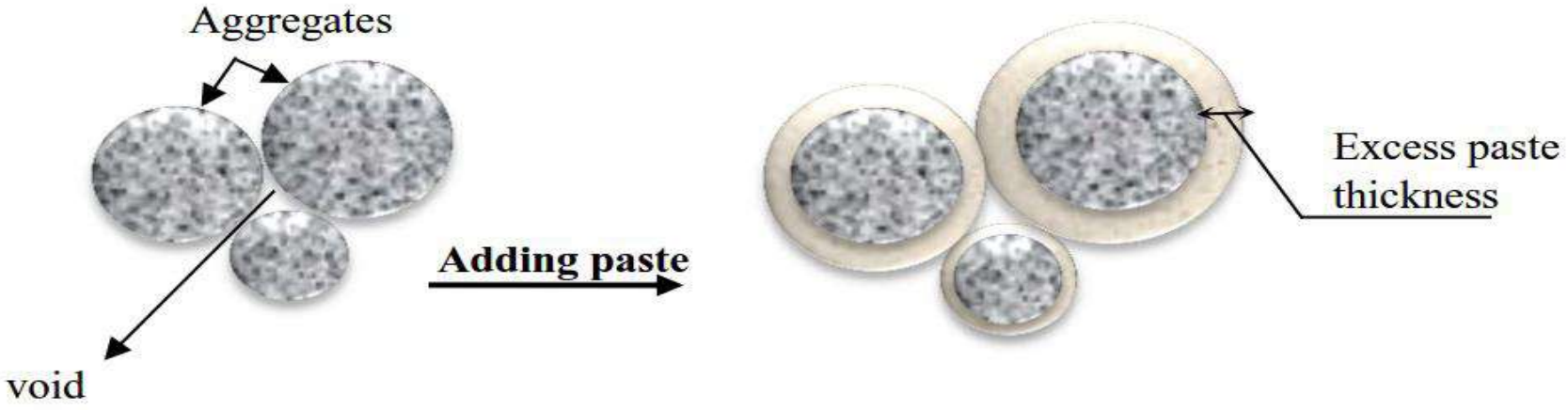
Deformability (flow and filling ability)

"Excess Paste Theory" explains the mechanism governing the workability of concrete.

Enough paste to cover the surface area of the aggregates, and that the excess paste serves to minimize the **friction among the** aggregates and give better flow-ability. Without the paste layer, too much friction would be generated between the aggregates resulting in extremely limited workability.



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Passing ability

The probability of blocking increases when the volume fraction of large aggregates increases.

- The size of aggregates, their shapes and their volume
- fraction influence the passing ability of SCC
- The potential of collision and contacts between particles increases as the distance between particles decreases; which therefore results in an increase in the internal stresses when concrete is deformed particularly near obstacles causing blockage.

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Segregation resistance

- Segregation resistance is largely controlled by viscosity ensuring a high viscosity can prevent a concrete mix from segregation and/or bleeding.
- Bleeding is a special case of segregation in which water moves upwards by capillary action and separates from the mix. Some bleeding is normal for concrete, but excessive bleeding can lead to a decrease in strength, high porosity, and poor durability particularly at the surface
- Two basic methods can ensure adequate stability:
- The frist approach uses a super-plasticiser (SP), low water/cement ratio, high powder content, mineral admixtures, and low aggregate content.
- The second approach is based on incorporating a viscosity-modifying admixture (VMA), low or moderate powder content and super-plasticiser

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SCC mix design principles

SCC should have

- Low coarse aggregate content
- Increased paste content
- Low water powder ratio
- Increased super plasticizer dosage
- Viscosity modifying agents

Testing self-compacting concrete

Test Method	Property Measured
Slump-flow	Filling ability
T_{50}Slump-flow	Filling ability
J-Ring	Passing ability
V-funnel	Filling ability
V-funnel at $T_{5\ minutes}$	Segregation resistance
L-box	Passing ability
U-Box	Passing ability
Fill-box	Passing ability
GTM screen stability test	Segregation resistance
Orimet	Filling ability

Testing self-compacting concrete

Flow tests of self compacted concrete

U box test

Slum test

L box test

V funnel test