Concrete

Lecture - 8

Course Coordinator
Dr. Raju Sharma
Assistant Professor
Department of Civil Engineering
Thapar Institute of Engineering and Technology
Patiala, Punjab

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1. Introduction of Self Compacted Concrete
2. Reason behind the development of SCC
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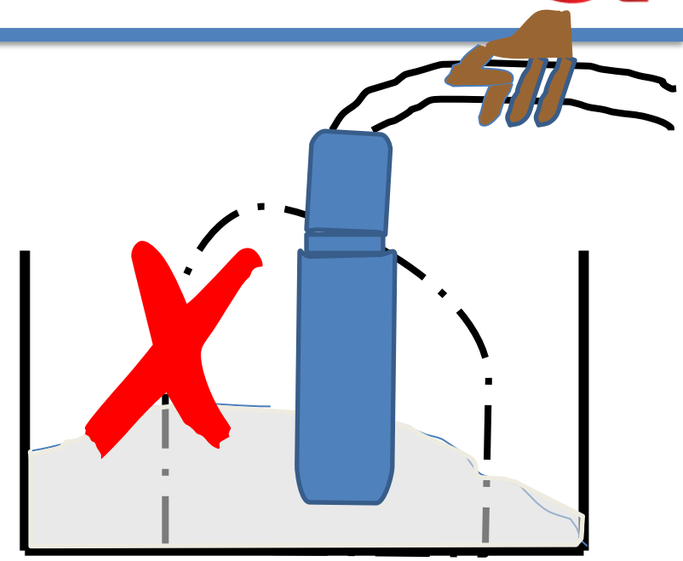
Self Compacted Concrete

Originally developed in Japan with the first significant applications in the early 1990s, it has rapidly been adopted worldwide in construction



Self-compacting concrete (SCC)

Fresh concrete which has an ability to flow under its own weight, fill the required space or formwork completely and produce a dense and adequately homogeneous material without a need for compaction.

Reasons for the development of SCC

One of the key issues for traditional concrete is that external energy has to be provided to compact it. This can be obtained on site from vibrating pokers and in concrete factories from vibrating tables or alternative methods. Concrete practice has shown that for on-site casting, vibration is not always carried out as it should be. This is quite understandable – no one really likes to handle a vibrating tool for a whole day – but it is surely harmful to the quality of the final structure. The quality of non vibrated traditional concrete is far lower than its intrinsic quality when properly compacted.

Reasons for the development of SCC

The loss in strength may be acceptable in some cases, but the decrease in durability can often be much more significant, leading to accelerated degradation processes such as reinforcement corrosion, frost damage, sulfate attack etc.

In simple terms, this concrete fills the formwork like a viscous liquid and does not need any external compaction energy

Schutter et al., Self Compacted Concrete, Whittles Publishing

Reasons for the development of SCC

The vibration-based compaction process aimed to '**liquefy**' the fresh mix and temporarily increase its consistence so that the air trapped in the mix was able to rise to the surface and escape from the mix.

In practice, not all of the trapped air could be expelled and an adequate (sometimes defined as 'full') compaction was assumed to be reached even when 1–2% of air still remained trapped in the mix. There was an additional requirement for that residual air to be uniformly distributed.

It was also important to ensure that the volume of any additional 'entrained' air was not substantially reduced and that such air was not expelled from the mix during compaction.

Reasons for the development of SCC

Inadequate compaction has sometimes been apparent on exposed surfaces but in many other cases it remained hidden within the mass of concrete and reinforcement and only showed up as the principal cause of poor performance (strength, durability) of both plain and especially reinforced concrete.

SCC not only possesses a very high workability, but, unlike the 'flowing' concrete, it does not require compaction of any kind, it completely resists segregation and it maintains its stable composition throughout transport and placing. An SCC mix must therefore be both adequately fluid and cohesive. As the title suggests, SCC does not require any compaction

Properties of fresh self-compacting concrete mixes

Filling Ability

Passing Ability

Segregation Resistance

Filling ability is the ability of the fresh mix to flow under its own weight and completely fill all the spaces in the formwork. It is the characteristic often referred to as 'flow' or 'fluidity'. ***It indicates how far a fresh SCC mix might flow, and how well it would fill formwork and spaces of varying degrees of complexity****. The filling ability also governs the 'self-compaction'. The filling ability must be high enough, the mix must be fluid enough, to permit any air introduced in the mixing process, or trapped during placing, to escape and leave behind an adequately compact concrete.*

Schutter et al., Self Compacted Concrete, Whittles Publishing

Properties of fresh self-compacting concrete mixes

Filling Ability

Passing Ability

Segregation Resistance

The passing ability determines how well the fresh mix will flow through confined and constricted spaces, narrow openings and between reinforcement.

In order for concrete to pass freely through reinforcement, it is necessary for the coarse aggregate particles to rearrange their positions within the mix, maintain a degree of separation and not converge, interlock and block the gaps. It has been observed that in a mix with low filling ability the coarse aggregate particles have difficulty in doing so. Such a mix has poor passing ability, even without an excessive content of coarse aggregate.

Both an adequate filling ability and passing ability are required for a fresh mix to be adequately self compacting, and suitable for a given application.

Schutter et al., Self Compacted Concrete, Whittles Publishing

Properties of fresh self-compacting concrete mixes

Filling Ability

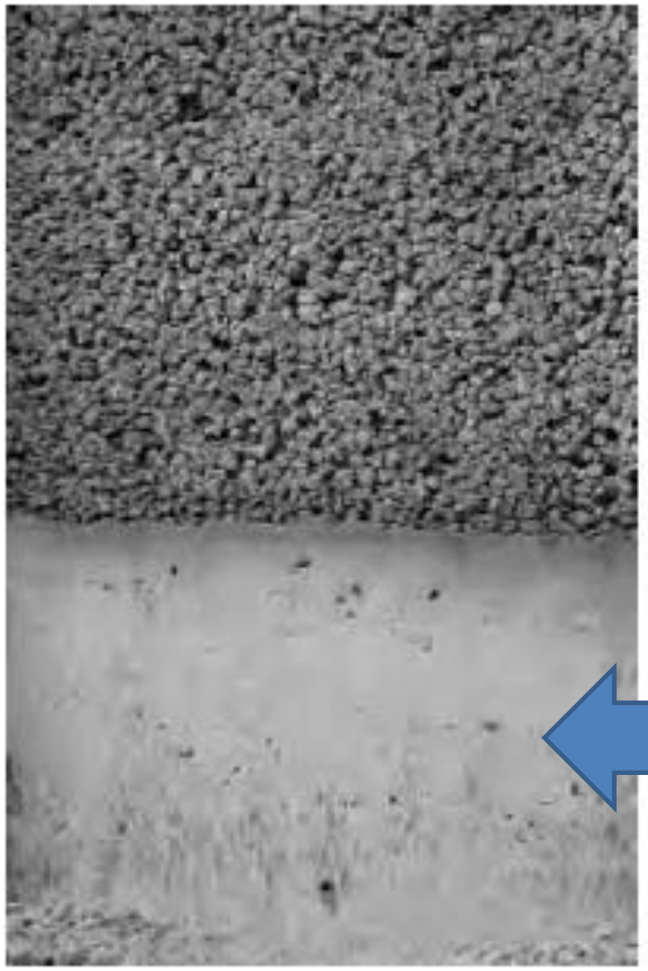
Passing Ability

Segregation Resistance

Segregation resistance is the ability of a fresh mix to maintain its original (adequately uniform) distribution of constituent materials (namely aggregate) during transport, placing and compaction. It has the same meaning as the 'stability' of a fresh mix. An underlying, fundamental difficulty in the assessment of segregation is the absence of a benchmark, an agreed minimum degree of uniformity of distribution of the constituents of a concrete mix. A completely uniform distribution cannot be achieved in practical construction

Schutter et al., Self Compacted Concrete, Whittles Publishing

Variation in Concrete Performance using Traditional Vibrated Concrete

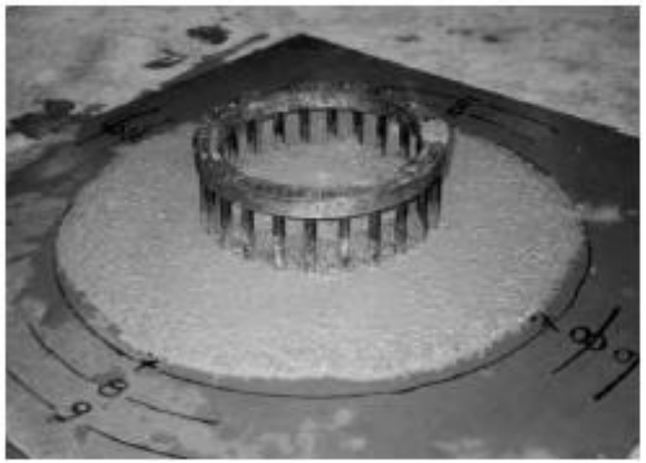


A single batch of a traditional low-medium slump concrete was used to cast the whole of this wall element. The bottom part was compacted by poker vibrators, the top part was placed without any compaction

Honeycombing and many 'cold' joints. Poorly compacted concrete.

Tests for Self Compacted Concrete

- Slump Flow Test
- V Funnel Test
- J Ring
- L Box
- Penetration test for Segregation
- Sieve Segregation Test



Summary

- Self Compacted Concrete

- *Introduction*

- *Reason of the development of SCC*

- *Properties of SCC*

- *Laboratory experiment of SCC*

THANK YOU