Construction

Self Consolidating Concrete

Ketan Sompura, Ph.D
Product Engineer
Sika Corporation

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Agenda

- SCC – Definition
- SCC Applications
- Materials
- Mix Design
- SCC Properties
- Benefits of SCC

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Self Consolidating Concrete

▲Basic Definition:

Self-consolidating concrete (SCC) can be defined as a highly fluid concrete that is able to flow in the interior of the formwork, passing through the reinforcement and filling the volume, under its own weight without internal or external methods of consolidation.

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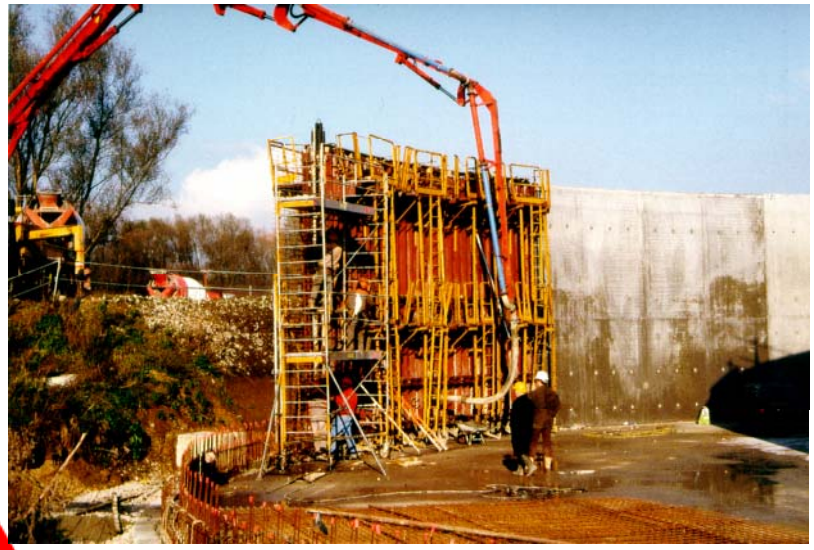
Vertical Applications

- Can be poured from the top or pumped from bottom to top
- Can be poured from a single point



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Horizontal Applications

- Faster placing time
- No Vibration required
- Less labor

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Need for SCC today...

- Slender sections
- Congested reinforcement
- High productivity
- Better surface finish

Producers:

- Ready Mix Industry
- Precast Industry
- Contractors

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Case Study – Precast Double T's

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Cost Analysis – Double T's

Using SCC:

- Higher material cost
- Low labor cost
- Lesser pouring time
- Less equipment cost (vibration)
- Less/No patch repair cost
- Higher Productivity

Lower Overall Cost per cubic yard

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High flow concrete v/s SCC

High Flow Concrete	SCC
▲Slump 8” to 10”	▲Slump flow 24” to 30”
▲Vibration needed	▲No Vibration needed
▲Not self Leveling	▲Self Leveling

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SCC - Key Properties

Fresh SCC must possess:

- ***Filling ability*** :

  Ability to flow into all spaces within the form-work under self weight

- ***Passing ability*** :

  Ability to flow through tight openings such as spaces between steel reinforcing bars, under self weight

- ***Resistance to segregation*** :

  Its composition at any stage must be uniform through the process of transportation and placement

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Concrete Technology for SCC

SCC is so designed that:

- It is **Self Levelling**
- **Defoam** itself by its self weight
- **No air entrapment**
- **Fair faced** exposed surface
- **Self compaction** and no external vibration
- Flowable **without bleeding / segregation**
- **Non-sedimentation** of bigger aggregates

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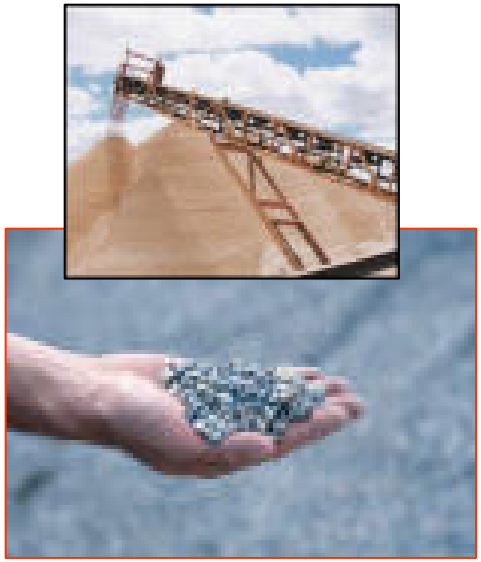
SCC Materials

Aggregates:

- Normal concreting aggregates for structural concrete can be used.
- Maximum size of aggregate to be used depends on reinforcement layout in the same way as in traditional concrete.



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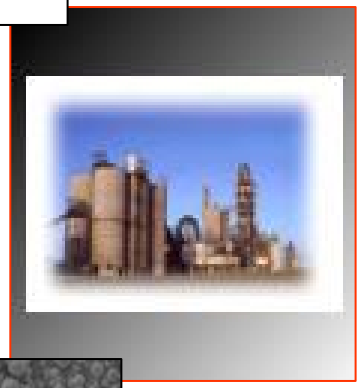
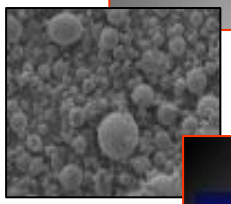
SCC Materials

Cement and fines:

- Cement and fillers are required for cohesion and stability in larger proportions.
- Fillers like lime stone powder derived from crushed rock,or active materials like slag, Fly ash, silica fume may be used.
- Fillers must be assessed for their effect on water demand.





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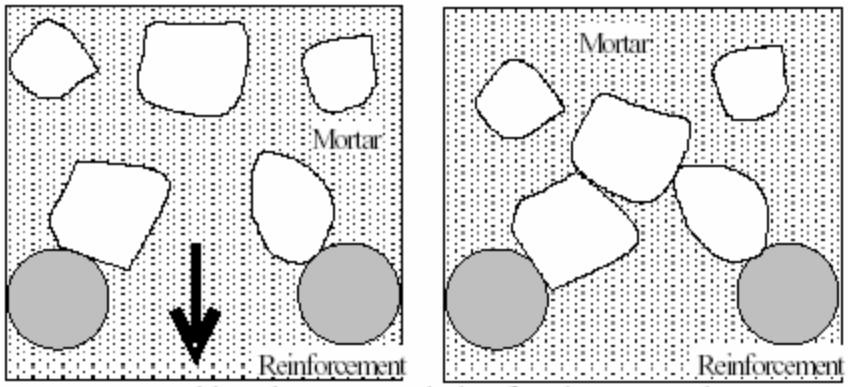
SCC Materials

Chemical admixtures:

- High Range Water Reducers
  - Polycarboxylate based
  - Conventional admixtures can also be used

- Viscosity Modifying Admixtures (VMA's)
  - Enhances Viscocity, provides stability
  - Resists bleeding and segregation



Arching phenomenon during flow in congested area

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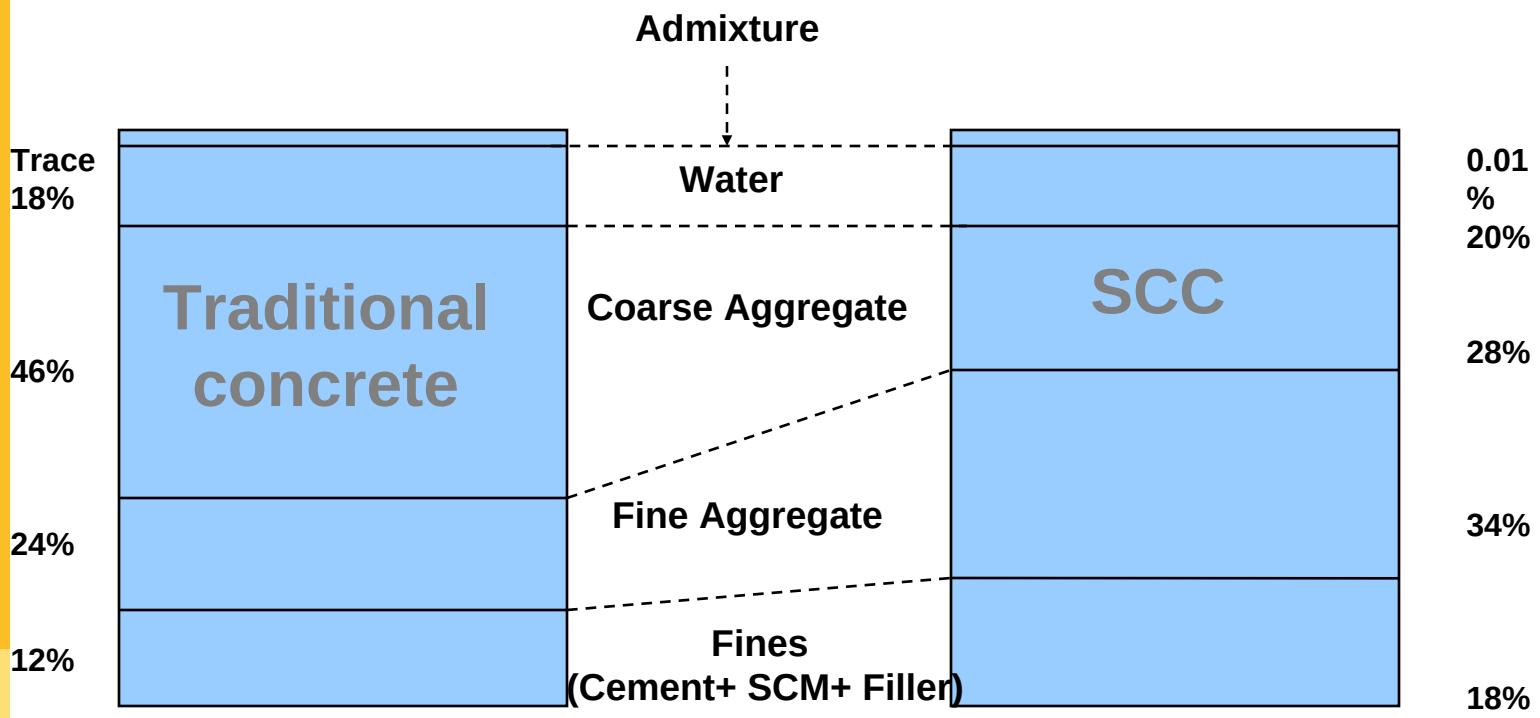
Typical Mix Design Volume Percentage



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SCC – Focus area in the Mix Design

- Reduction in coarse aggregate content
- Increase in paste content to increase fluidity
- Manage the Rheology

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SCC – Fluid Properties

Tests to evaluate typical fluid properties:

Characteristic	Test Method
Flowability	Slump Flow test
Viscosity (Rate of flow)	T500 of Slump Flow test V-funnel test Rheometer
Passing ability	L-Box test J-Ring test U-box
Segregation	Column segregation test Segregation resistance (Sieve test) Visual Stability Index

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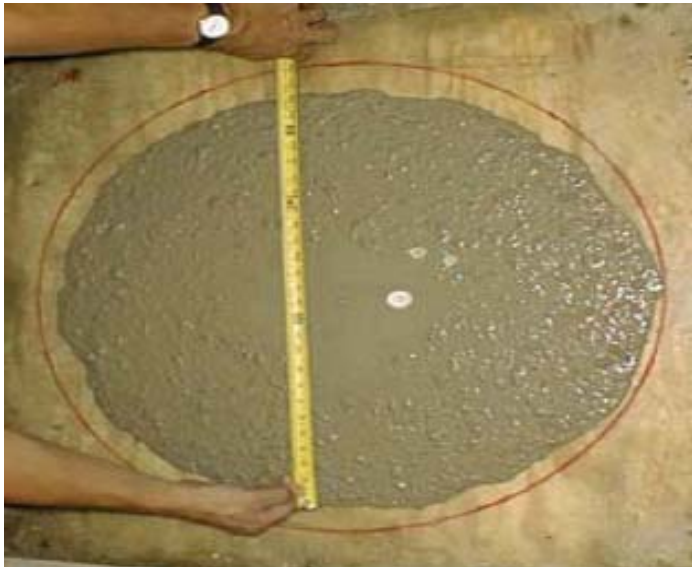
Flowability and Viscosity (Slump flow test)- ASTM C 1611



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Visual Stability Index (VSI)-ASTM C 1611

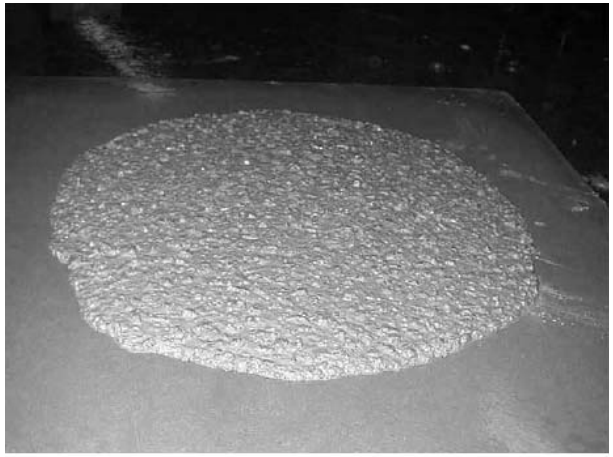

FIG. X1.1 VSI = 0 – Concrete Mass is Homogeneous and No Evidence of Bleeding.

FIG. X1.2 VSI = 1 – Concrete Shows Slight Bleeding Observed as a Sheen on the Surface.

FIG. X1.3 VSI = 2 – Evidence of a Mortar Halo and Water Sheen.

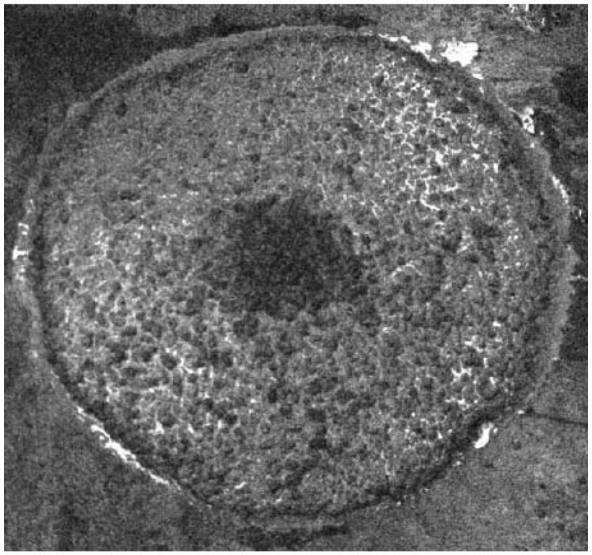

FIG. X1.4 VSI = 3 – Concentration of Coarse Aggregate at Center of Concrete Mass and Presence of a Mortar Halo.

Ref: ASTM

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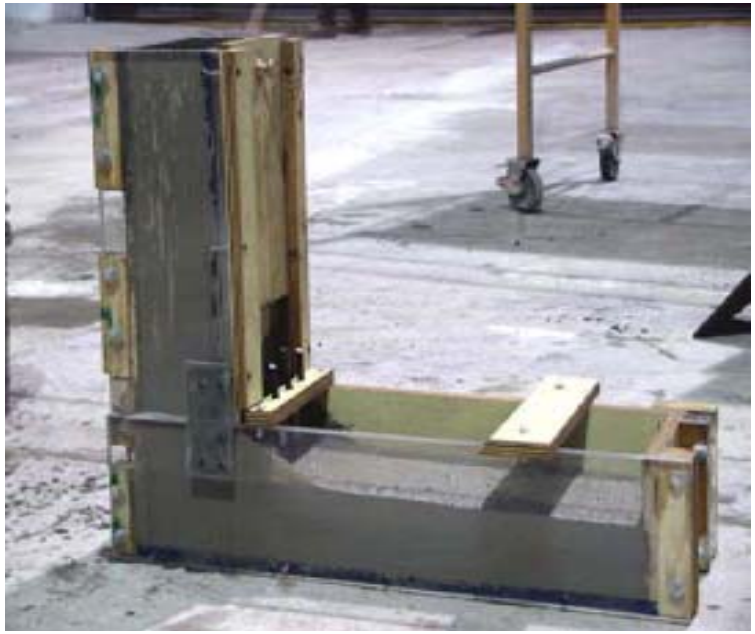
Passing ability (L-box test)



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J-Ring Test –ASTM C 1621

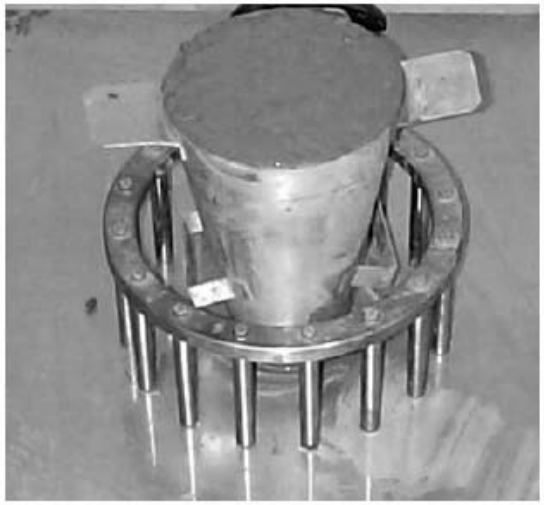

FIG. 2 J-Ring Setup with Inverted Mold Filled with Concrete

FIG. 3 J-Ring Flow

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Ref: ASTM

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Stability – Column segregation test

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SCC -Hardened properties

- Compressive strengths greater than 10000 psi can be easily achieved
- Tensile strength comparable to traditional concrete
- Drying shrinkage similar to traditional concrete
- Stronger bond to the reinforcement
- Improves durability
- Very low surface absorptions

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Quality Control

- Higher degree of quality control needed as compared to Conventional Concrete
- Aggregate gradation should be optimized
- Consistent quality of aggregates
- Moisture content and W/Cm ratio
- Formwork - Increased form pressure

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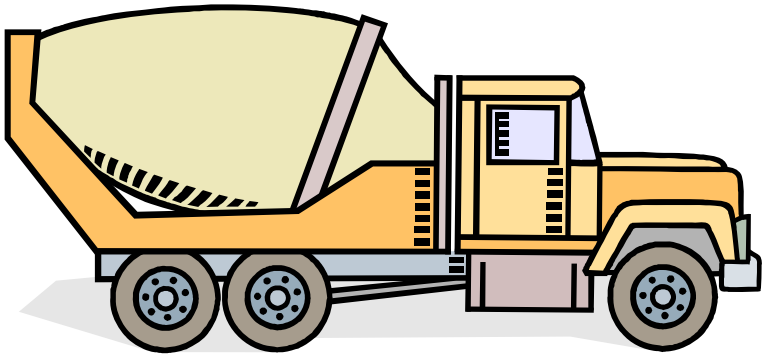
Benefits

- Ease in placement
- Cost saving, through reduced equipment and labour requirements
- High productivity
- Reduced casting time in the production cycle
- Reduction of on-site repairs
- Reduced noise pollution
- Use of SCM's which are "by-products" which helps environmental considerations



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Summarizing...

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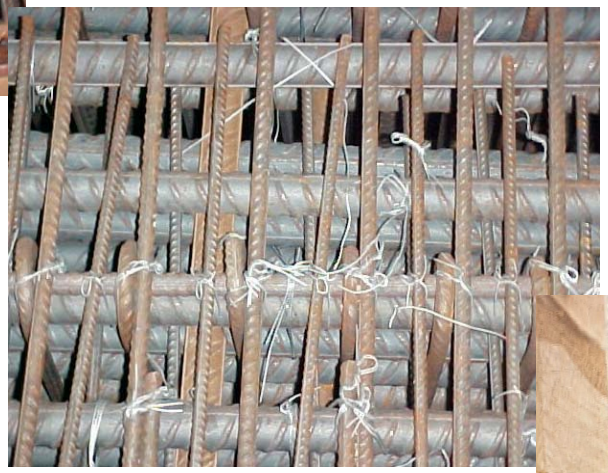
SCC will flow through this…..

This….



And that……

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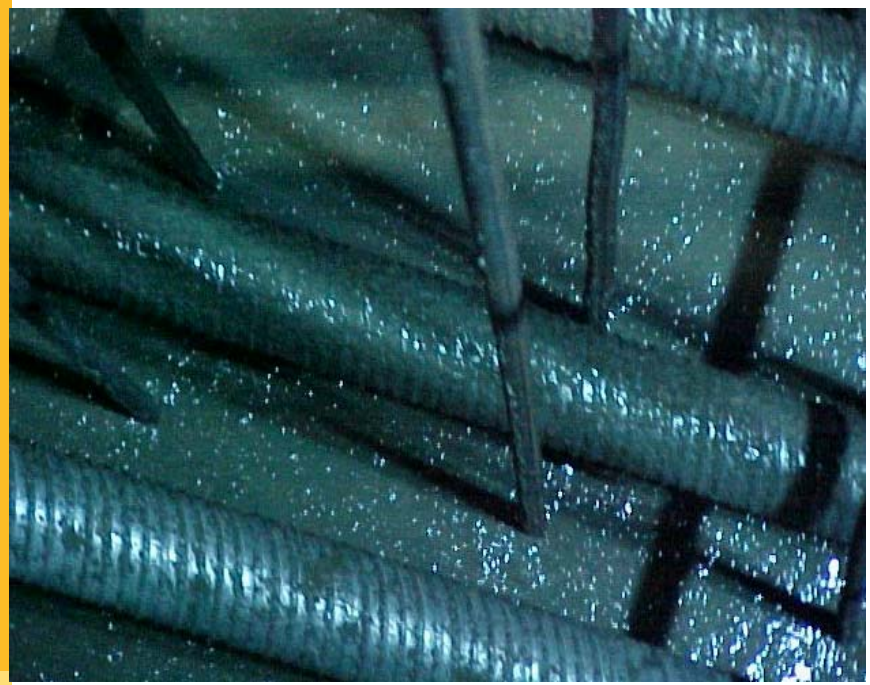
….and it will flow “quietly”



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A finish which is truly fair-faced

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SCC – A boon for Environment, Health & Safety

- Improved environment for both concrete workers and the people in the neighborhoods due to less noise pollution
- The work (ie execution) will be less physically strenuous.

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Thank you !!

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