POLYTECHNIC OF TORINO
FACULTY OF ARCHITECTURE 2
Degree in Architecture
Honors theses

Self-compacting concrete: mechanical properties and structural applications
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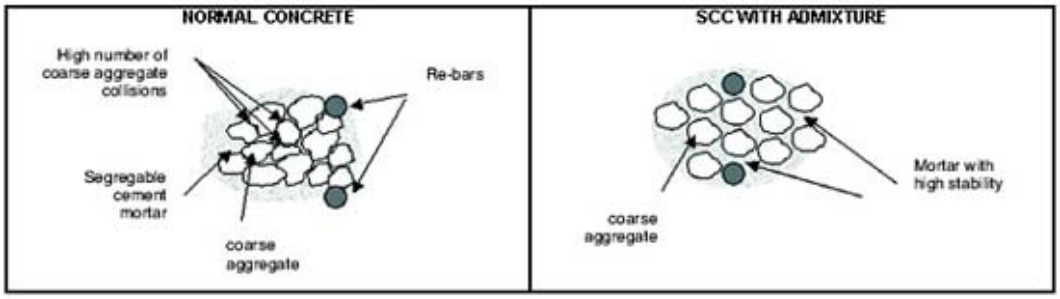
This thesis is based on a study in depth of self-compacting concrete (SCC).
This type of concrete is a rather new material, still little known and not widely used, but due to its remarkable properties it could represent a turning point in the field of construction and infrastructures.
The main property of this material is the self-compactingbility, which means that it can be cast into a framework and fill every corner exclusively thanks to its own weight, without the need of any type of compacting or external vibration.

Filling of structure heavely congested with SCC.

As far as the composition is concerned, the self-compacting concrete has different features compared to the traditional cement concrete. The main differences are:

- a greater volume of material with fineness lower than 80 µm (concrete, mineral additions, very fine fractions of stone aggregates)
- a lower amount of corse aggregates whose maximum size usually does not exceed 20 mm
- the use of superplasticizer because of a reduced ratio water/cement.

It is a concrete with particular rheological, physical and elastic-mechanical properties, featuring high stability and reduced tendency to segregation also when the laying operation is carried out incorrectly.

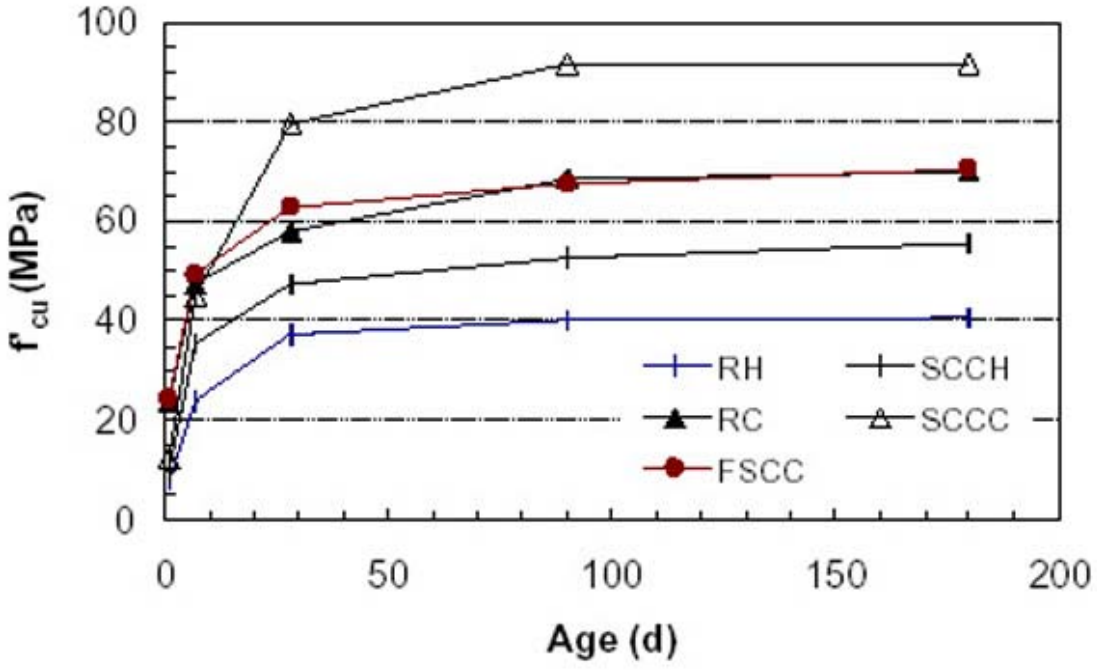


A) Segregation and blocking; B) Passing ability in narrow spacing and absence of segregation.

The main goal of the thesis is to analyse the properties of the hardened material, with regard to traditional concrete, most important of which are:

- a better ability to resist compressive strength
- greater durability in the case of atmospheric, chemical and physical aggression.

For similar mixtures, in fact, it has been observed that the resistance of self-compacting concrete to compressive strength is higher than that of traditional concrete. This can be attributed to the greater uniformity of the structure and to a reduced porosity in the interfacial zone between the concrete paste and the aggregate in the SCC.



Compressive strength development.

The new concrete, completely filling up the mold and eliminating macro-voids and excess air independently from how efficiently it is compacted, leads to the elimination of macro-defects and air-bubbles responsible for penalizing mechanical performance and structure durability.
After describing the main technological and mechanical features of the material, the final part of the thesis is dedicated to the presentation of the structural applications that have been used so far.
The use of self-compacting concrete in the study cases presented shows numerous and interesting advantages, among which the rationalization of construction processes, technical innovation, a better distribution of labour, improvement in working conditions and more durable structures.
In general, it is calculated that the use of self-compacting concrete can reduce construction time of massive structures by about 20-25%.
The use of SCC allows an increase in site productivity that widely compensates the initial costs of the new concrete with regard to the traditional concrete.
This is only the beginning of the use of this excellent material but the first impressions are very encouraging.
In order to obtain a structure of durable concrete, it is necessary to render the quality of the conglomeration as independent as possible from the workmanship and the compacting systems available on-site.
This is possible using a conglomeration such as the self-compacting concrete that, once unloaded from the truck mixer, is able to make up for possible deficiencies and errors that may occur during laying and compacting.
Studies and applications show that an innovative product can be put on the market that is able to offer a new way of construction with definitely lower realization costs.

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