Development of cold-forming technologies for the construction of concrete reef structures

Master Universitario en Ingenieria de Caminos,Canales y Puertos

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Summary

In this Master Thesis, the objective is to advance the mix design and technologies to produce thin shell concrete elements by cold forming criteria, based on Ultra High Performance Fiber Reinforced Concrete (UHPFRC). Therefore, a research is done containing three phases. In the first phase, a new type of setting test is used to define the influence of an accelerating admixture on the concrete hardening. In the second phase, specimens were compacted at different times relative to the start of the setting as defined in phase one. The influence of this delay on the strength of the concrete was tested. In the last phase the possibility to create thin shells by vibrating concrete externally was tested. This included trying different mixes and delays of vibration with the objective that the concrete kept its form in a negative, convex mold.

Keywords: UHPFRC, setting, shells, curved, accelerator, external vibration

State of the art

1.Ultra High Performance Fiber Reinforced Concrete (UHPFRC)
2.UHPFRC composition
3.Production methods to create thin shell concrete elements

Research:

First phase

Objective: test the influence of different amounts of superplasticizer and accelerator on the hardening of the concrete.

Second phase

Objective: to see if it the accelerated concrete is still workable at different times except from the first minutes after mixing, even past start setting time. Workability in this case, can be defined as the possibility of giving the concrete its final shape and compacting it.

Third phase

Objective: to see the practical possibilities of the accelerated concrete in the creation of thin shells. The goal is to simulate a sequence of actions of how real size thin shell elements could be produced with an accelerated UHPFRC.

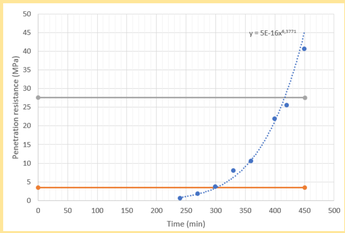
First phase

Define start- and end setting time

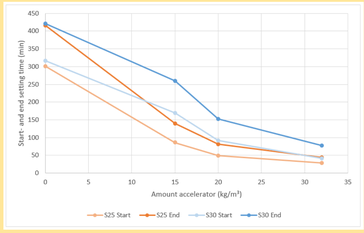
- Measure penetretion resistance during setting
- Mold 160x160mm²

- Comparing two types of accelerator

Result of one test



Compare test results



Second phase

- Try compaction during hardening of the concrete

Mold 3 specimens 40x40x160mm³

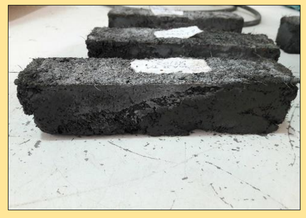
Compactor

- Compact at times T1, T2 and T3

T1	T2	T3
Tss/2	Tss-5	Tss*1,5

Tss = start setting time (min)

- Specimens in bad shape



Test specimens

- Compression strength
- Flexural strength

Intermediate conclusion

Decide which mixes can be applied in our case

Third phase

Vibration technologies and concrete workability

Create flat surface elements (200x200mm)




Optimizing time interval to create thin shell form

- Create positive and negative mold
- Use perpendicular and more energetic vibrator