

Investigation, assessment and realtime readjustment of the rheological fresh concrete properties of SCC

Untersuchung, Beurteilung und zeitnahe Aussteuerung der rheologischen Frischbetoneigenschaften von SVB

Selfcompacting concrete with realtime readjustment of the mix-design in the concrete mixer

Selbstverdichtender Beton mit zeitnaher Aussteuerung der Mischungszusammensetzung im Betonmischer

Project is founded by the Bavarian Research Foundation

Industrial partners :

- Schleibinger Geräte Teubert und Greim GmbH
- Südbayerisches Portlandzementwerk Gebr. Wiesböck & Co. GmbH
(ROHRDORFER ZEMENT, SPZ)
- BETOSERV GmbH
- GODELMANN GmbH & Co. KG
- Hemmerlein Ingenieurbau GmbH

Content

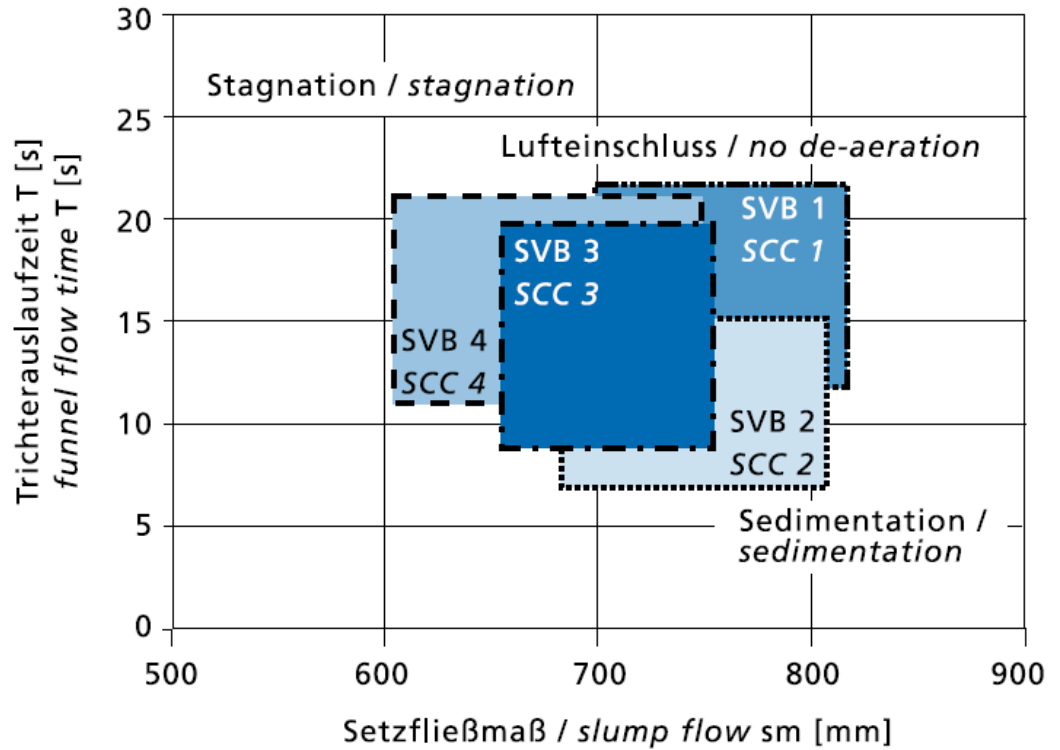
- Ballrheometer
- Experimental results
- Conclusions

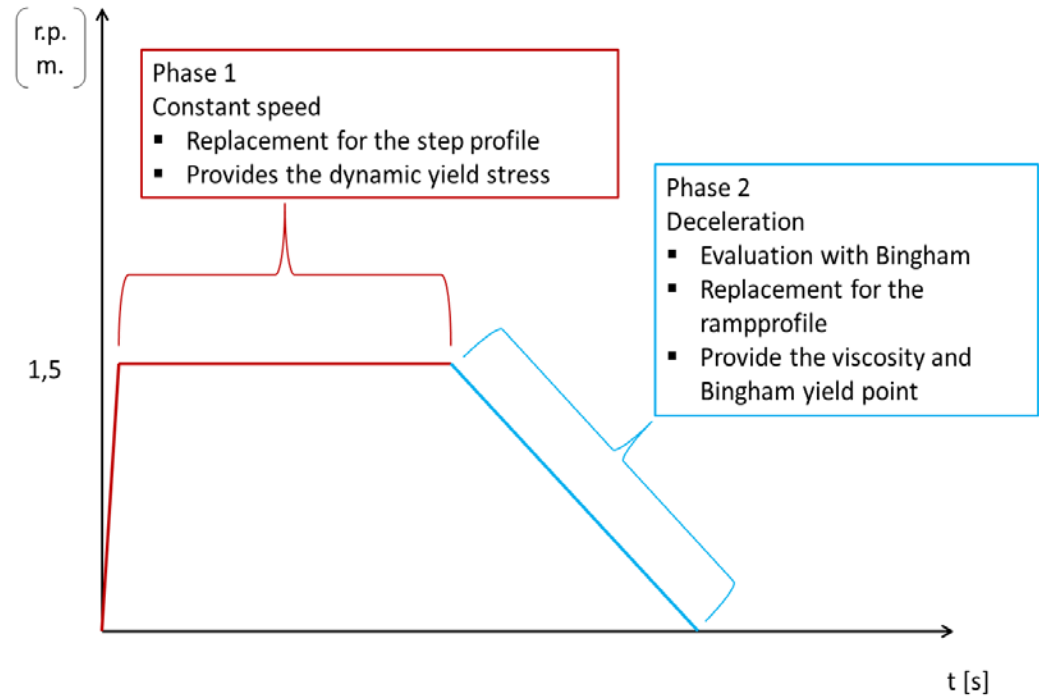
State of technology / science



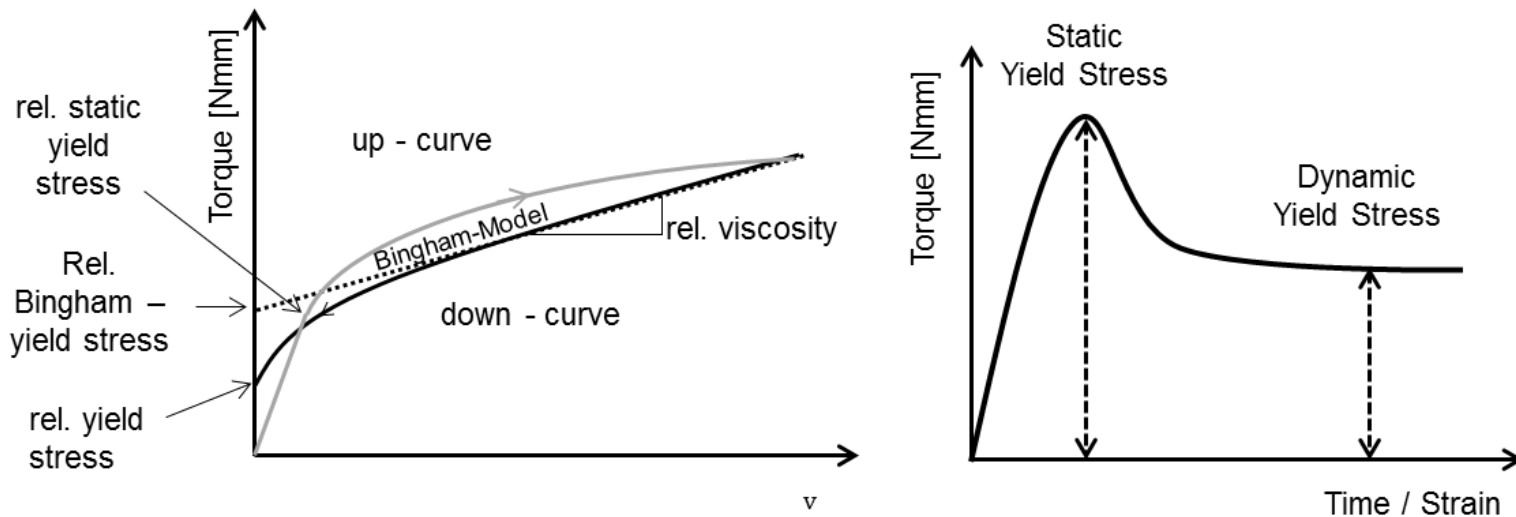
Left the combined flow cone
on the right the rheometer RheoCT installed in a mixer

State of technology





A new condensed measuring profile

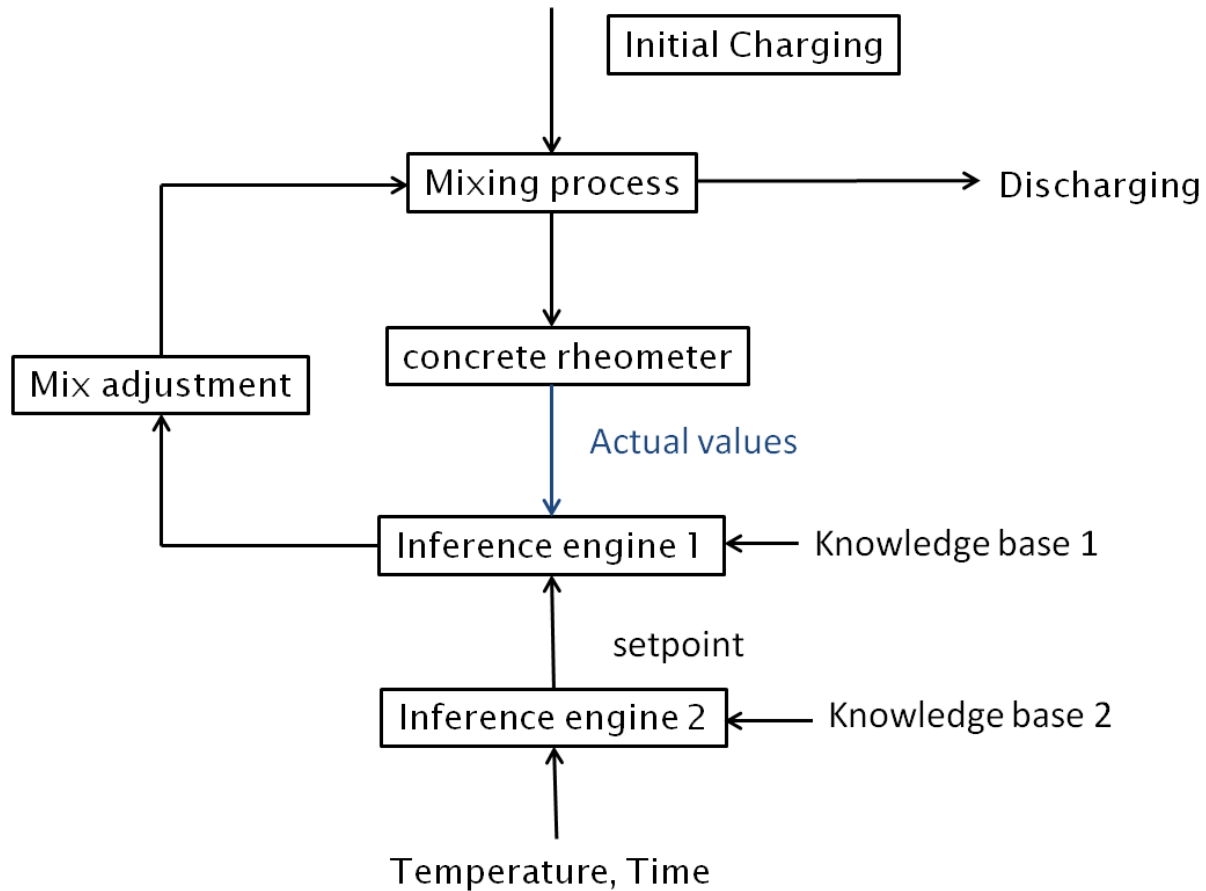


Test results and assessment according to the Bingham model. Flow curve with Bingham yield stress and viscosity (left) and results with constant shear rate for determination of static and dynamic yield stress (right).

Aims achieved

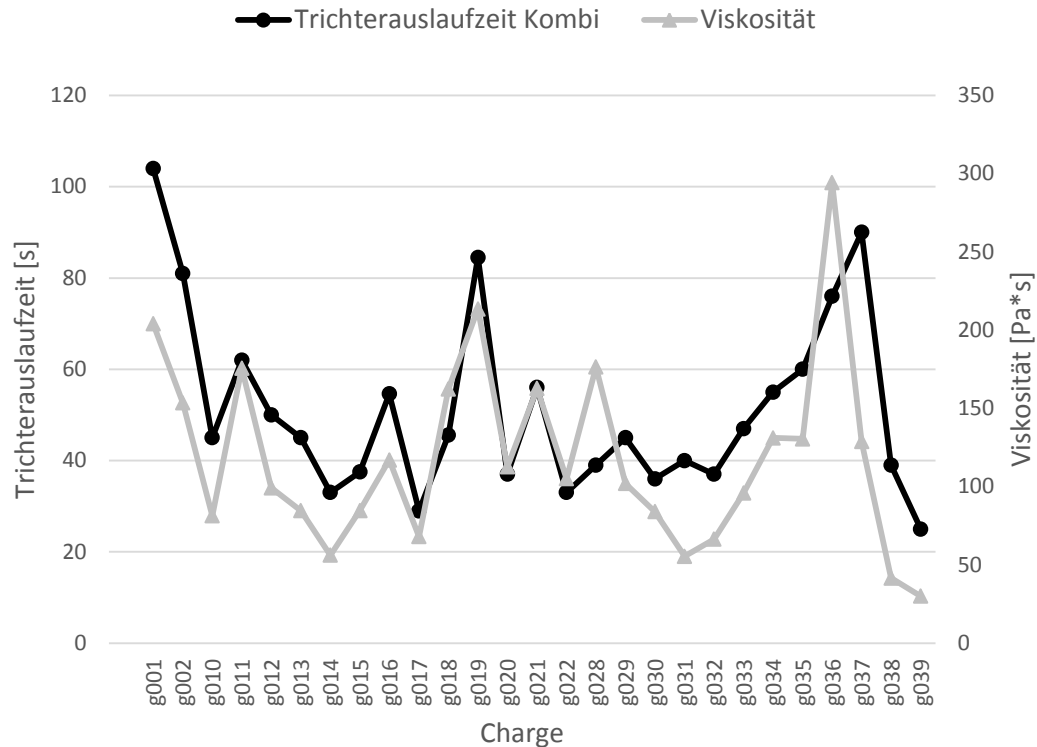
- At the end of the mixing process a rheometer immerses into the concrete and starts the measurement
- Evaluation of the rheological properties of SCC
- Correction of the mixture is possible, before it is discharged

Who decides the correction within some seconds?



Principle of an expert system

Tests in precast factory



Comparison of the V-funnel flow time with the viscosity of different batches of the same composition

For the determination of the correlation between a given parameter and the total water content, the following experimental design was prepared.

Production of the SCC with different w/c values

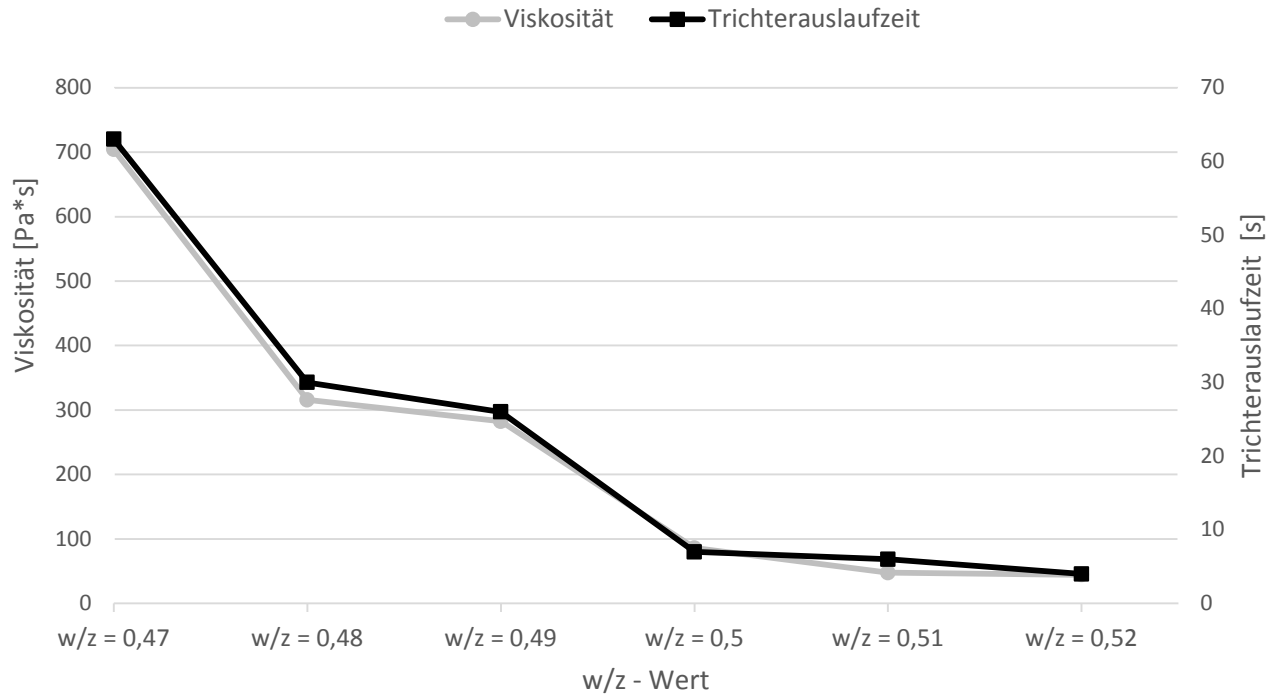
Definition of meaningful processing areas

Influence of water addition in the post-control in 0.01 w/c value increments

- 0,01 [-] = 3,5 l Water per m³ = 140 ml Water per 40l
- 30 s additional mixing time

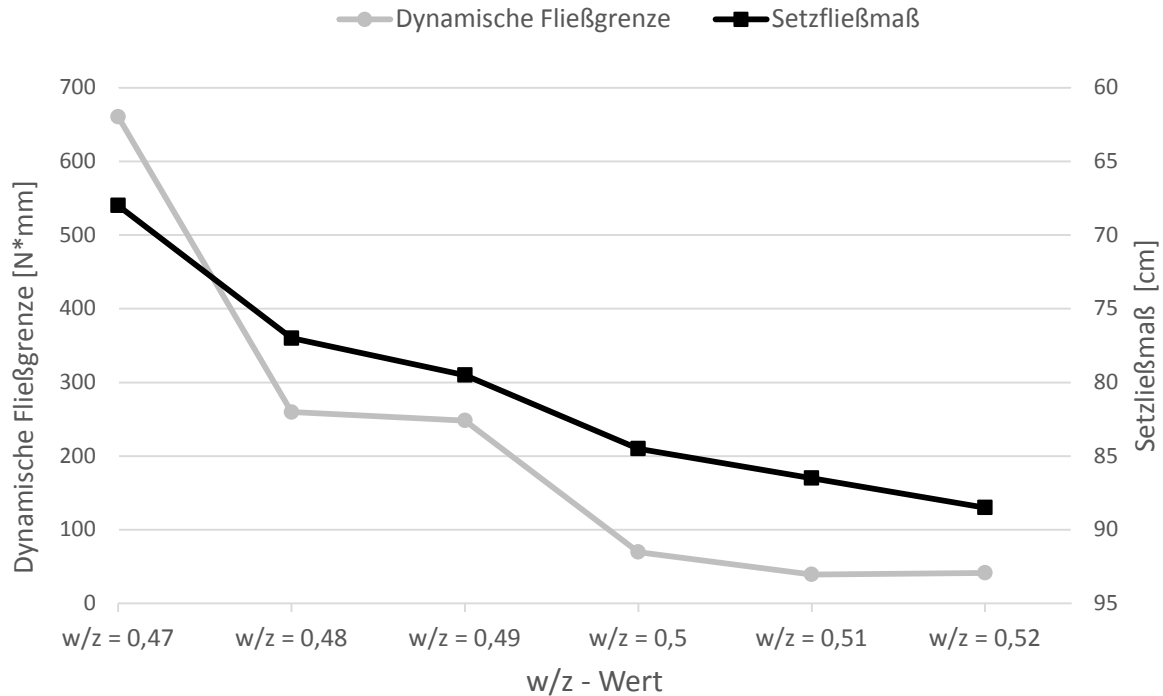
One-point experiments and the combined flow cone were used in parallel

Tests in the Lab. Mixture 1



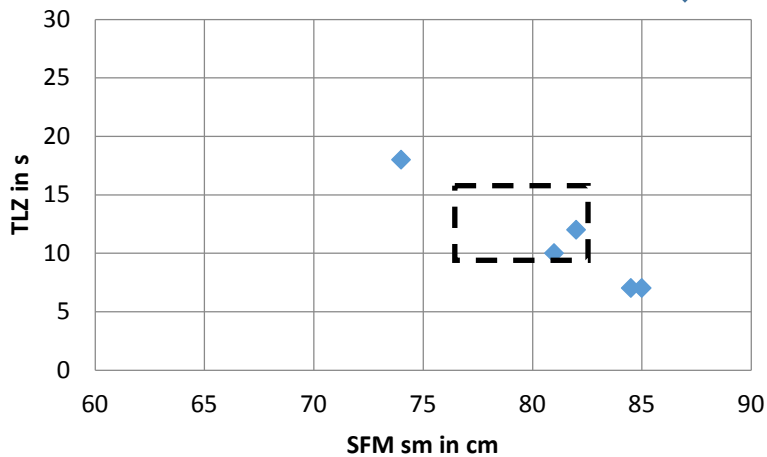
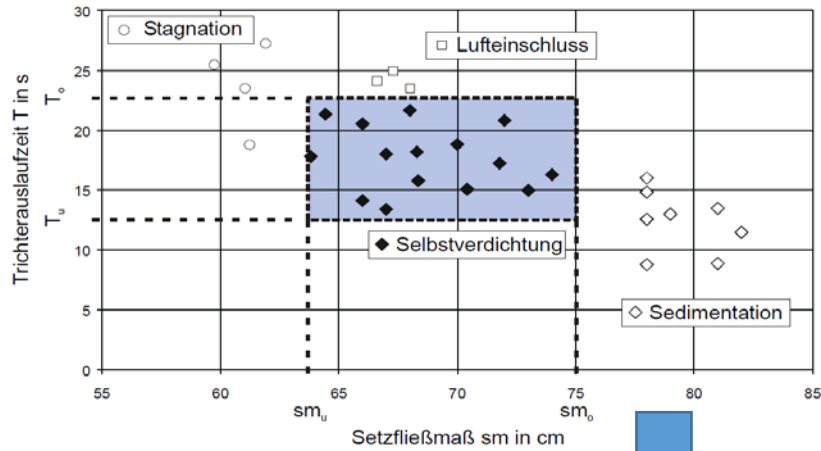
Comparison of V-funnel flow time and viscosity as a function of the w/c ratio

Tests in the Lab. Mixture 1

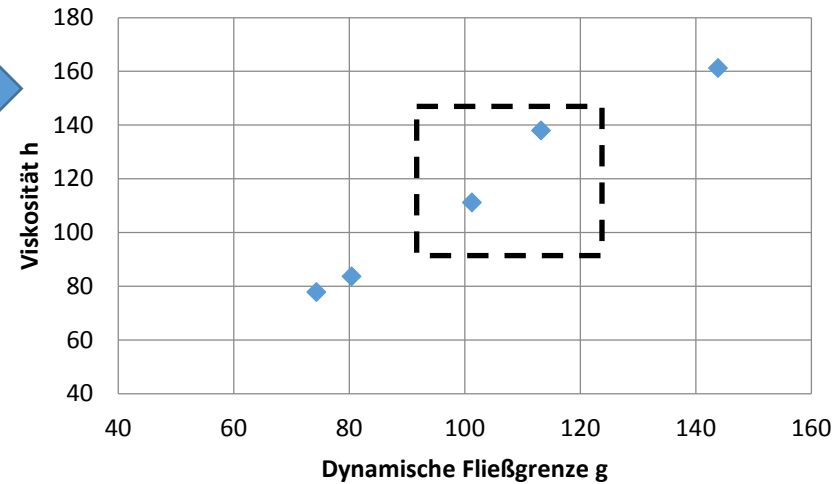


Comparison of slump flow and dynamic yield stress as a function of the w/c ratio

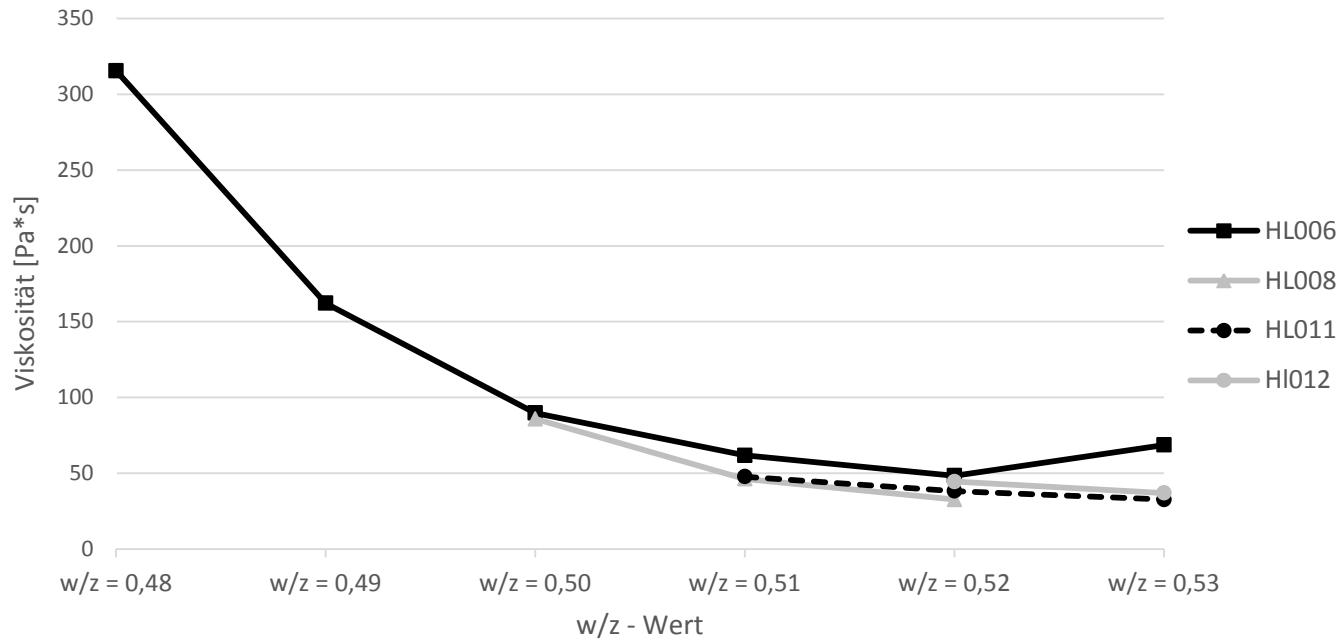
Tests in the Lab. Mixture 1



Definition of processing areas with different systems

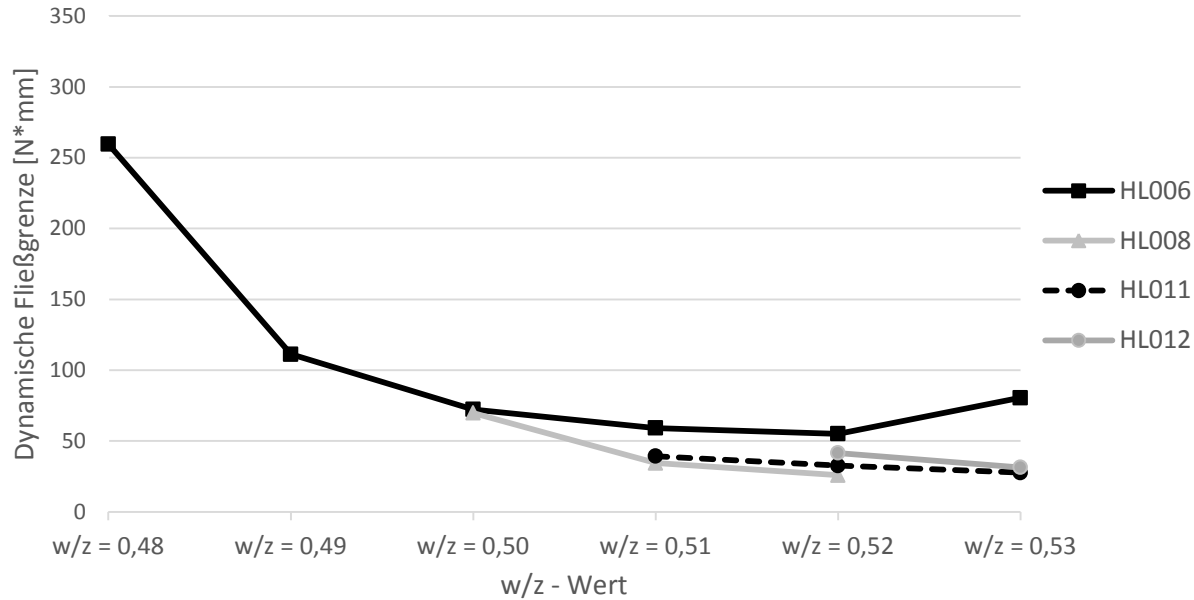


Tests in the Lab. Mixture 1



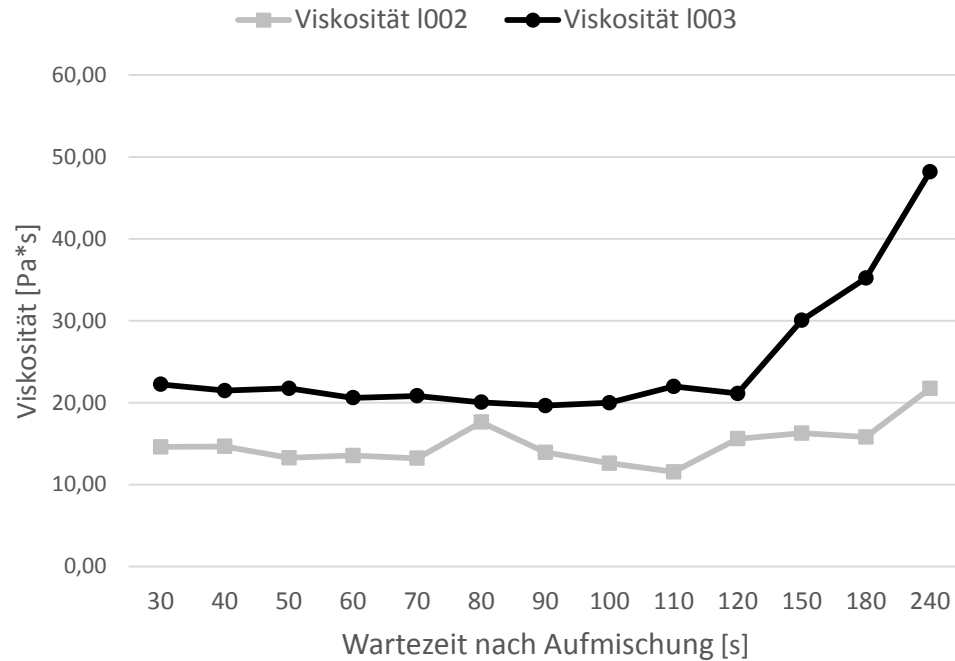
Viscosity as a function of the readjusted w/c ratio of the individual batches

Tests in the Lab. Mixture 1



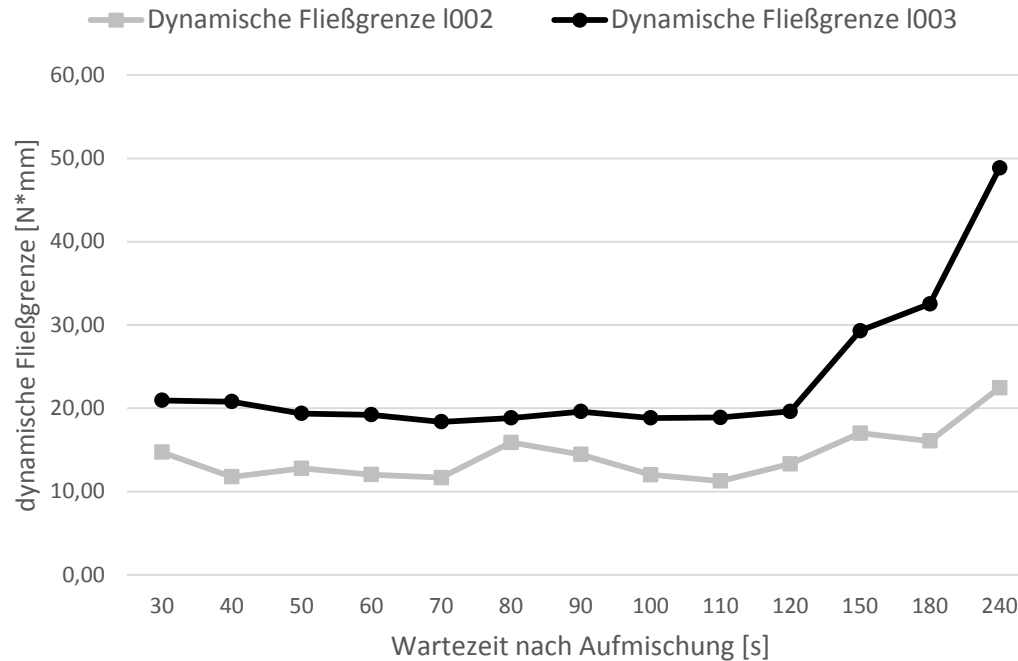
Dynamic yield stress as a function of the adjusted w/c ratio of the individual batches

Tests in the Lab. Mixture 2



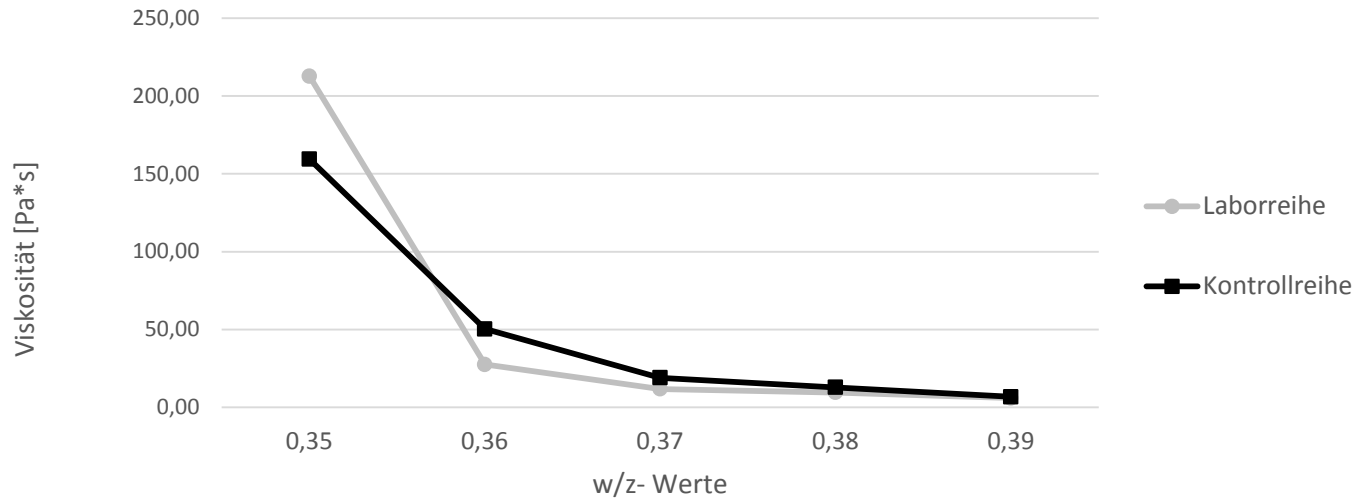
Comparison of the series I002, I003: Viscosity after increasing waiting time after a respective mixing time of 3 s

Tests in the Lab. Mixture 2



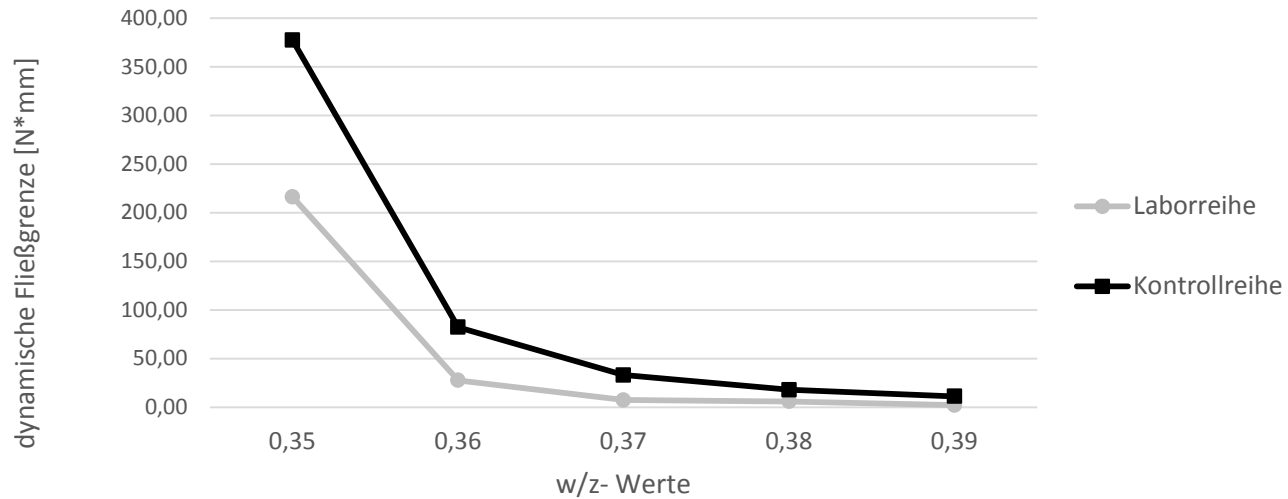
Comparison of the series I002, I003: Dynamic yield stress after increasing waiting time after a respective mixing time of 3 s

Tests in the Lab. Mixture 2



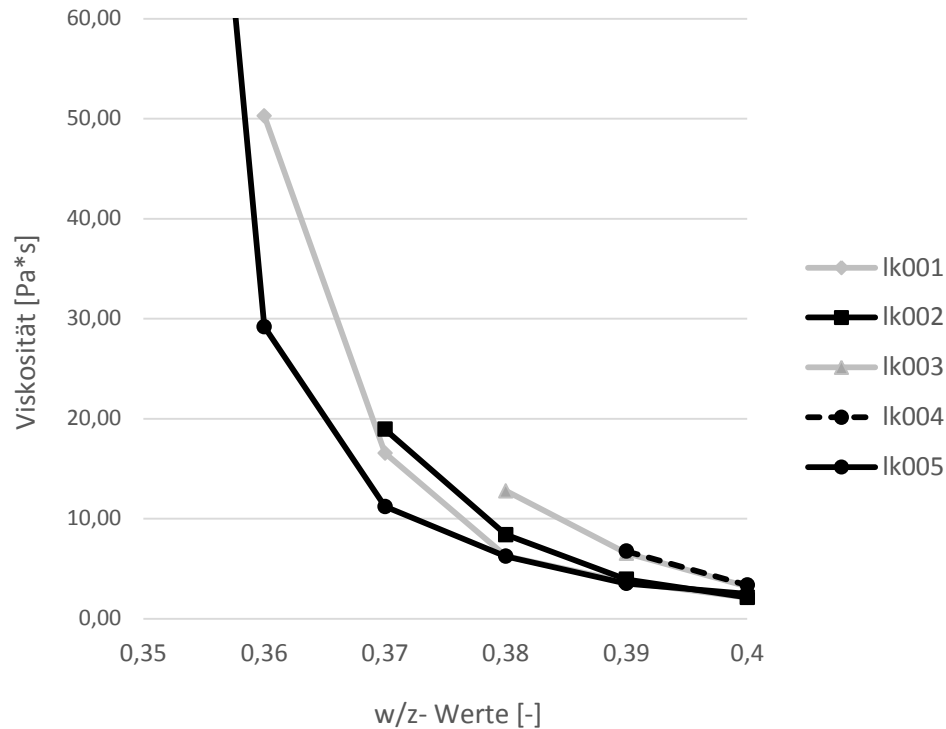
Viscosity results of the second laboratory series. Variation of the starting w/c ratio

Tests in the Lab. Mixture 2



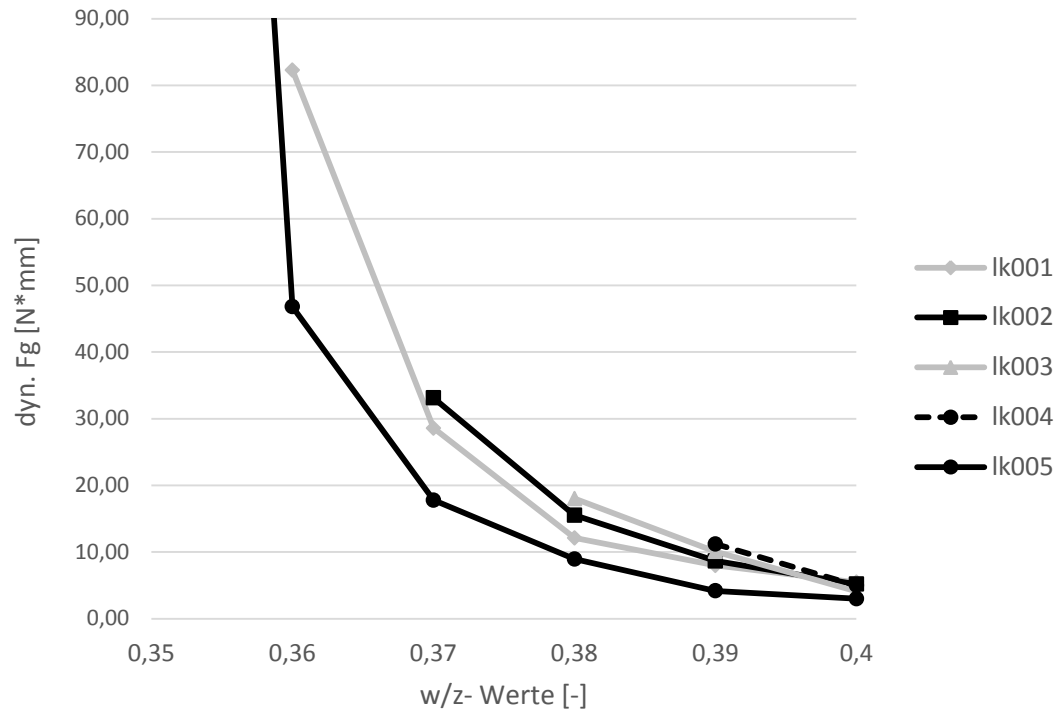
Dynamic yield stress results of the second laboratory series. Variation of the starting w/c ratio

Tests in the Lab. Mixture 2



Viscosity results of the second laboratory series. Mixes with different start w/c ratios with subsequent addition of water

Tests in the Lab. Mixture 2



Dynamic yield stress of the second laboratory series. Mixes with different start w/c ratios with subsequent addition of water

Ongoing research

- Expert system for readjustment of SCC with the required input parameters
- Instant automated readjustment
- Accurate production with minimal waste

SCC can be produced economically with low error potential, used as a permanent building material and replace vibrated concrete.

Thank you for your attention