

# Long-term Tensile Strength of Concrete



RESEARCH SCHOOL  
INTEGRAL DESIGN OF STRUCTURES

Speerpunt  
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## SUBJECT

It is well known that the long-term strength of the concrete is lower than its short-term strength. To take in to account the effect of long-term loading, current standards maintain a strength reduction factor. Related to tensile strength, the VBC standard (Dutch Design Code for Concrete Structures) prescribes a strength reduction factor of 0.70. Long-term tensile strength takes an important role in design processes. However, it is not yet clearly defined. This research, therefore, focuses on studying the long-term tensile strength of concrete.

## GOALS

The main objective of the research is to determine long-term tensile strength of normal concrete and more comprehensively understand the fracture processes of concrete under long-term tensile loading.



Test Equipments



Fracture of the specimens

## EXPECTED RESULTS

A proper definition of the long-term tensile strength of normal strength concrete which can be used to assess the residual bearing capacity of various new and existing concrete structures. The results will be used as input for a parallel research program on the shear capacity of beam under sustained loading.



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Program/Subprogram

Structural Engineering/Concrete Structures

Host University

Delft University of Technology/Faculty of Civil Engineering and Geosciences

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# Long-term Tensile Strength of Concrete

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## Subject

It is well known that the long-term strength of the concrete is lower than its short-term strength. To take in to account the effect of long-term loading, current standards maintain a strength reduction factor. Related to tensile strength, the VBC standard (Dutch Design Code for Concrete Structures) prescribes a strength reduction factor of 0.70. Long-term tensile strength takes an important role in design processes. However, it is not yet clearly defined. This research, therefore, focuses on studying the long-term tensile strength of concrete.

## Goals

The main objective of the research is to determine long-term tensile strength of normal concrete and more comprehensively understand the fracture processes of concrete under long-term tensile loading.

## Research Question

1. The literature review reveals that the long-term tensile strength of concrete strongly depends on the rate of loading at which the short-term tensile strength is obtained. The question here is what is the influence of loading rate on the behavior of the concrete? What is the most appropriate loading rate for defining the short-time tensile strength?
2. Which model can be used to explain time-dependent fracture processes of concrete?

## Strategy

The research comprises an experimental and a theoretical part. A range of loading rates, which refers to long-term loading, is applied in a test program. In addition to this, high-sustained tensile load tests are also carried out. A constitutive relationship will be derived. By combining this constitutive relationship with the fracture mechanic theories, the fracture processes of concrete will be clarified and a definition of long-term strength of concrete will be drawn.

## Expected Results

A proper definition of the long-term tensile strength of normal strength concrete, which can be used to assess the residual bearing capacity of various new and existing concrete structures.

The results will be used as input for a parallel research program on the shear capacity of beam under sustained loading.

## Preferred Partners Applications / Sponsors

Rijkswaterstaat (Ministry of public works, The Netherlands)

## Research Period

September 2008 - September 2012