Anisotropic Concrete Compressive Strength

Søren Gustenhoff Hansen, Henrik Brøner Jørgensen

University of Southern Denmark, Department of Technology and Innovation, Odense, Denmark

Linh Cao Hoang

Technical University of Denmark, Department of Civil Engineering, Lyngby, Denmark

Contact: sgh@iti.sdu.dk

Abstract

When the load carrying capacity of existing concrete structures is (re-)assessed it is often based on compressive strength of cores drilled out from the structure. Existing studies show that the core compressive strength is anisotropic; i.e. it depends on whether the cores are drilled parallel or perpendicular to the casting direction. Engineers may therefore misjudge the load carrying capacity. Thus structures may be strengthened or rebuilt unnecessarily or left in service with high failure probability.

This paper presents a literature review and an experimental study on the anisotropy and its correlation to the curing time. The experiments show no correlation between the anisotropy and the curing time and a small strength difference between the two drilling directions. The literature shows variations on which drilling direction that is strongest. Based on a Monto Carlo simulation of the expected variation it is argued that the variation of the anisotropy may be statistically coincidences.

Keywords: Anisotropy, Drilled cores, Concrete compressive strength, Assessment, Compressive test, Existing structures, Monte Carlo simulation

1 Introduction

The calculation models that are used for designing new concrete structures are often validated with laboratory experiments with structural specimens. Here, the concrete compressive strength is usually documented by tests of stand-alone cylinders of standard size, made of the same concrete and cured in the same conditions as the structural specimens. This cylinder strength is used to calibrate the calculation models.

When new structures are designed and build the concrete strength is documented by tests with stand-alone cylinders as well. Therefore, there is good agreement between how the experiments are conducted in the laboratory and how the load carrying capacity of new structures is documented.

When the load carrying capacity of existing structures is (re-)assessed, the calculations performed are often based on the compressive strength of drilled cores and - in absent of more accurate tools - models that are developed for design of new structures. This assessment procedure is correct if the following assumptions are correct.

1) The compressive strength of the drilled cores is representative for the compressive strength that the calculation models are calibrated by the strength of stand-alone cylinders of standard size.

https://doi.org/10.2749/vancouver.2017.3068
Distributed by structurae