Long-term concrete strain measurements of large-scale experiments exposed to environmental effects

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Abstract

Standard creep and shrinkage strain measurements of concrete are usually carried out in a laboratory on small cylinder specimens with constant temperature and humidity with a low variation. Monitoring a real construction allows the depiction of the actual developments of concrete strains. Unfortunately, the evaluation, separation of the single strain effects and interpretation of the measured values is not unproblematic, because of the different influences affecting the measured results. The idea of the Creep & Shrinkage Project was to combine the two described approaches for strain measurement creating an experimental setup which would benefit from the advantages of both procedures. The following paper presents the experimental results of almost five years and compares them to the creep and shrinkage models contained in the Eurocode and the fib Model Code 2010.

Keywords: creep; shrinkage; vibrating wire strain gauges; monitoring; large scale experiments

1 Introduction

Creep and shrinkage are an important part of the material properties of concrete. Standard creep and shrinkage measurements of concrete are usually conducted in a laboratory on cylinders with a diameter of 150 mm and a height of 300 mm. Based on this laboratory measurements the rheological effects of large concrete structures should be described for their whole operating life.

Monitoring of a real structure shows the actual development of the deflections and concrete strains, but the evaluation and interpretation of the measured values is not trivial since the real impact to the structure, e. g. loading, temperature and humidity is unknown.

The combination of the described approaches was the idea for the Creep & Shrinkage project. Therefore, large concrete specimens with cross sections up to 1 m² were produced which have similar dimensions as concrete elements at a construction site. The monitoring of the concrete strains is ensured by means of vibrating wire strain gauges. The temperature and ambient humidity at the storage area of the experiment is also monitored to measure the environmental effects to which the specimens are exposed.