Introduction

Shrinkage is a time dependent deformation (decrease of volume) of a cement based material which is subject to drying. Every concrete shrinks which is exposed to the environment. If shrinkage deformations are restrained, tensile stresses are developing and cracks occur.

Creep is a time dependent viscoelastic deformation of a cement based material under permanent load. Creep can cause additional, time dependent deformations in building components.

Shrinkage and creep are taken into account in the design of concrete structures.

Measurement Principle

Figure 1: Measuring length change (shrinkage)

Figure 2: Testing device to apply a constant load over time (creep)

Shrinkage: Measuring the length change of prisms due to drying at 20°C and 70% r.h. as a function of time

Creep: Measuring the length change of prisms under a constant load as a function of time at 20°C and 70% r.h. and subtracting shrinkage deformations measured at unloaded prisms made from the same concrete.

Example

Figure 3: Length change due to shrinkage in function of time for a conventional concrete and a lightweight concrete

Figure 3: Length change in function of time during creep test for a conventional concrete:
1 = shrinkage before applying the load at the age of 28 days
2 = elastic deformation when load is applied
3 = combined creep and shrinkage under constant load
red line: creep = total def. – elastic def. – shrinkage

Relevance for Our Field

• Prediction of deformation behaviour of concrete building components
• Assessment of stress development and cracking risk in case of restrained deformations

Applications & Potentials

• new binder types
• new concrete types such as:
  • SCC
  • concrete with recycled aggregates
  • lightweight concrete
  • insulation concrete

Limitations

• one climate only
• creep in compression only
• limitations concerning load and dimensions of specimens for creep measurements