# Shrinkage and creep

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## 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

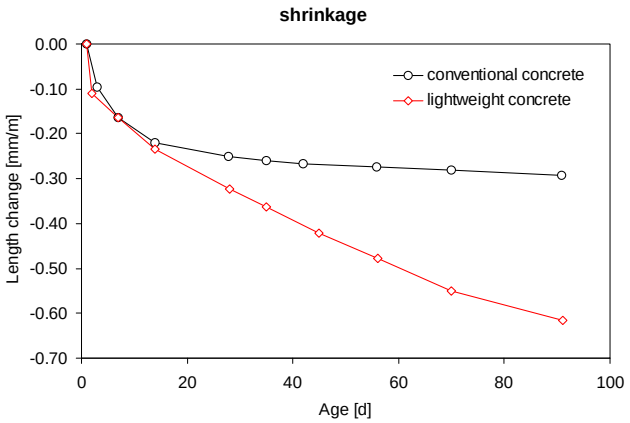


Figure 3: Length change due to shrinkage in function of time for a conventional concrete and a lightweight concrete

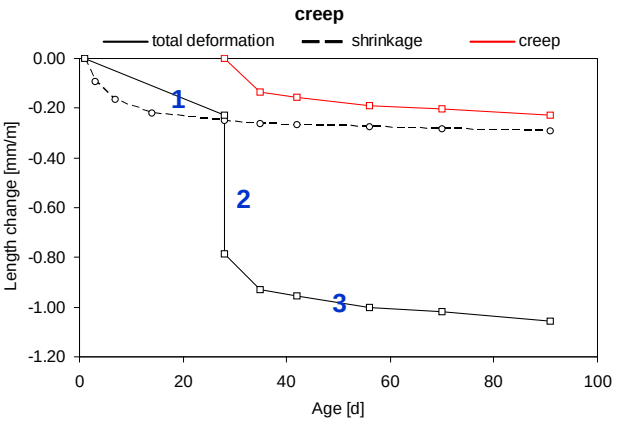


Figure 3: Length change in function of time during creep test for a conventional concrete:
1 = shrinkage before applying the load at the age of 28 days
2 = elastic deformation when load is applied
3 = combined creep and shrinkage under constant load
red line: creep = total def. – elastic def. – shrinkage

## 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