

Control of concrete shrinkage

Business



Introduction Concrete is the irreplaceable material in civil engineering. The strength and liability of concrete construction is a significant part of life safety. Thus the concrete properties research is necessary.

Concrete shrinkage is the decrease in concrete volume caused by evaporation of moisture to the atmosphere from cement paste. Drying shrinkage is influenced by the concrete material, namely volume of aggregate and water-to-cement ratio of the cement paste, and drying conditions (temperature and humidity). The drying shrinkage continues for the lifetime of the concrete, but the intense shrinkage rates occur within the first 90 days. For the convenience of experimental design, we study the shrinkage for 28 days only. As the cement dries or gets wetted, it changes its volume.

However, the expansion does not occur at the same rate as shrinkage. While concrete loses volume, the tensile stress appears. As it exceeds the tensile capacity, the concrete cracks. The small surface cracks that appeared in early stages of cement drying can result in propagation of full depth cracks. Cracking has been widely studied as it is the issue of practical importance. For example, cracking reduces the concrete service life, increases the maintenance cost due to substantial repairs.

In most cases, drying shrinkage cracking can not be eliminated but minimized. Materials and methods Concrete mixtures were prepared in the laboratory and tested for drying and chemical shrinkage to evaluate the shrinkage characteristics of different concrete mixtures and the shrinkage characteristics of different water-to-cement ratio. Three types of No. 57

coarse aggregates were used for the research: limestone, gravel, diabase. Practice for Sampling Aggregates methodology (ASTM D 75-98) was used to sample aggregates.

The portland cement used in this study was Type I cement according to ASTM C 150-98, specification for portland cement. Table 1 presents the mixture proportions used for the shrinkage tests. Table 1 Cement concrete mixtures Chemical Shrinkage Test Chemical shrinkage was tested using buoyancy method that is based on the Archimedes principles. The sample of fresh cement paste was placed in a 200 ml glass jar. The sample mass used was 200 g.

The sample thickness was approximately 20 mm which allows water infiltration to the sample at representative water-to-cement ratios. The thickness of the sample in the chemical shrinkage test prevents testing of the concrete mixture where the maximum aggregate size is greater than three times the thickness. The sample should be vibrated. The jar should be filled with distilled water and tightly sealed with a rubber lid. The jar was suspended in a mesh basket in a distilled water bath at a constant temperature of 20°C. The bath included a double bucket system with oil covering the water surface as well as lids to prevent evaporation of water.

The weight was logged continuously on a balance with precision of 0.01g. The chemical shrinkage was measured for the first three days after mixing and placing the different mixtures.