Structural Concrete Laboratory

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Evaluation of damage progress caused by ASR in concrete using image analysis

Alkali-Silica Reaction (ASR) is a phenomena which occurs over time in concrete between the cement paste and the silica causing cracking in concrete. Image analysis technique is very useful to understand the tensile strain developed at crack tip due to ASR.
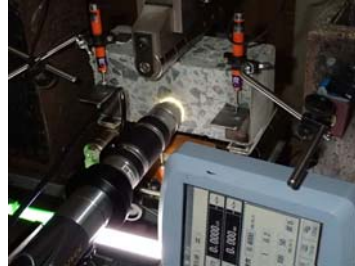

Cracking caused by ASR
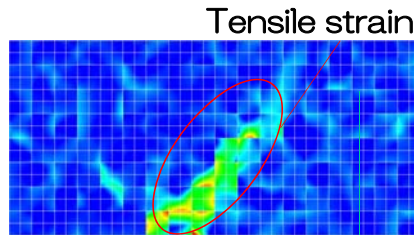
Tensile strain


Image analysis

Loading test setup
Observations are made using high-quality digital camera and microscope.

Shrinkage properties and shear strength analysis in UFC beams

Ultra High Strength Fiber Reinforced Concrete (UFC), corresponds to pre-mixed concrete powder enriched with steel fibers. Using steel fiber, high-performance AE water reducing agent, makes an excellent material in durability with high strength.


Pre-mixed powder
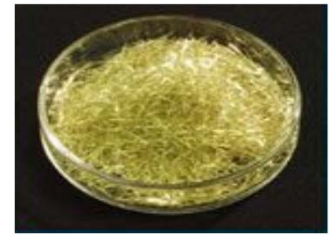
Steel fibers (Length = 15mm, Diameter = 0.2 mm, Tensile strength = $2700 N/mm^2$)

To understand the characteristics of the shear failure of UFC beam, we examine the effect of steel fiber mixing rate and the amount of shrinkage on the shear strength of the beam. The progress of cracking is observed using a high-speed camera (4000fps, 130 million pixels).

Loading test of UFC beam

Seismic performance evaluation of RC structures


P1 P2 P3 P4 P5 P6 P7 P8
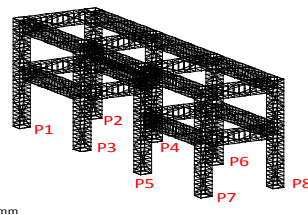
Unit: mm

Seismic performance is verified under cyclic loading using the 3D Lattice Model. The damage evaluation in RC piers is studied from the energy dissipation approach.

Analysis of pre-stressed concrete

In the degraded PC structure it is possible to introduce more of pre-stress. However, if not properly grasped the remaining pre-stressing force, and excessive pre-stress is introduced, the result may be the buckling of the structure. Thus, to accurately estimate the pre-stressing force, we propose an estimation method using the newly developed force applicator device (jack) and the circular hole near the stress concentration.

We can measure the strain in a specific point in the strain gauges, in addition to measuring the planar strain distribution around a circular hole and perform image analysis.
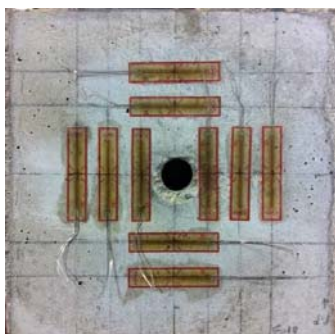
Specimens

Loading test

Developed jack

Stress measurement based on image analysis