Low-Cycle Fatigue of Fiber-Reinforced Concrete

When subjected to strong earthquake ground motions, the beams and columns of reinforced concrete buildings are experiencing a number of load cycles well into the inelastic range. The behavior of concrete material under repeated loads of such severity can be considered as a low-cycle fatigue phenomenon, i.e., the material can fail after several such load applications at a stress level well below that at which it would fail in a single monotonically applied load test. To improve our understanding of this kind of behavior, and how it can be improved by reinforcing the concrete with different types and amounts of randomly distributed fiber, a comprehensive experimental test program had been undertaken.

*Cyclic load-deformation curves for biaxially loaded steel fiber-reinforced concrete cubes*
Four-inch concrete cubes were loaded repeatedly either uniaxially or biaxially up to failure, and their energy absorption capacities (taken as the total area under the load-displacement curve) served as a measure of the material's capacity to resist cyclic load. The graphs on display here illustrate typical load-deformation curves and the improvement of low-cycle fatigue resistance of concrete made possible with the addition of hooked-end steel fibers.

The research project had also a theoretical component, using continuum damage mechanics to develop mathematical models to simulate the experimentally observed behavior.

![S-N curves for steel fiber-reinforced concrete](image)

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