Bendable Concrete

Innovation Description

Bendable Concrete (technical name Engineered Cementitious Composites, or ECC) is a ductile concrete material that overcomes the brittleness of normal concrete. In direct tension, bendable concrete with tensile strain capacity of 3%, is 300 times more deformable than typical concrete. Its tensile stress-strain curve resembles that of a ductile metal, with a yield point and subsequent strain-hardening behavior. Yet it uses only 2% by volume of short fiber reinforcement in order to achieve cost effectiveness and easy execution in casting plant or field construction. This material has been designed for use with common construction equipment, such as readi-mix plant and trucks.

Bendable Concrete enhances concrete structure and product performance while reducing both initial and long-term costs. While concrete brittleness to a large extent can be compensated with steel reinforcements on a structural scale, intrinsic material tensile ductility in bendable concrete eliminates cracking and fracture problems resulting in improved structural durability, safety as well as improved performance in infrastructure sustainability.

Bendable Concrete has been under development at the University of Michigan since 1991. It was used in the construction of the jointless Mihara bridge deck in 2004, the bridge deck link slab on Grove Street Bridge in Michigan in 2005, and the 27-story Glorio Roppongi High Rise in 2006. The 41 story Nabeaure Tower under construction in Yohohoma also uses bendable concrete in coupling beams in the building core.

Innovation Illustration

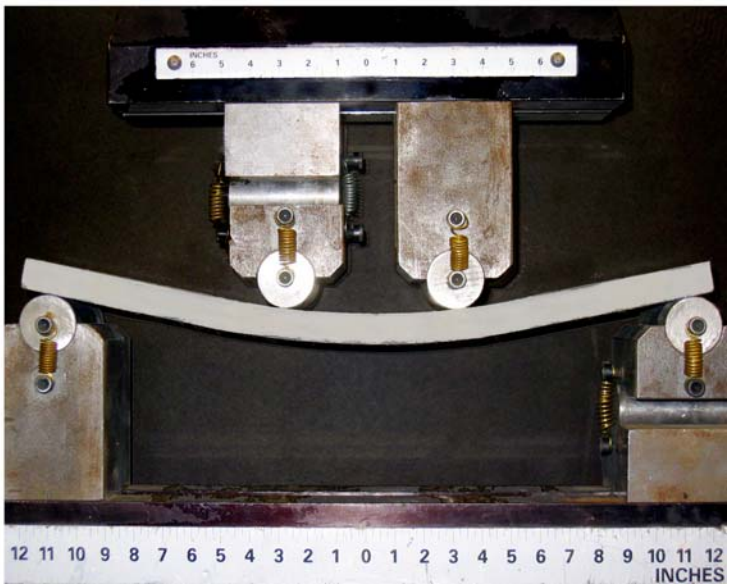

Figure 1: Bendable Concrete subjected to flexural loading

Figure 2: Glorio Roppongi high-rise residential building, located in Central Tokyo, uses ECC coupling beams in core for seismic resistance (Building height: 27-stories, 95m high; built by Kajima Corporation, construction completed in 2006).