Use of fibre reinforced concrete in support of sustainable infrastructure systems

Barzin Mobasher

ABSTRACT

Sustainability is the main driver for development of new materials and design methods and some of its tools such as life cycle cost modeling are routinely used to evaluate the merits of new construction system. As the cost of raw materials, labor, and energy change, many new alternatives become cost effective. It is therefore imperative that new guidelines and alternatives for concrete materials be developed such that materials with higher strength, ductility, and stiffness are considered fairly during the preliminary design of a project. By addressing a combination of alternative ingredients, production technology, and life cycle costs of structural systems, we must focus on improving on the traditional approaches in the design and construction of concrete structures. Our traditional design methodologies ignore tensile capacity of concrete altogether, treat the cracking and associated durability problems as an afterthought, and are inherently inefficient, wasteful, and therefore expensive. By using innovative fiber reinforced concrete materials designed using fundamental aspects of mechanics of composites, and materials science of durability; we hope to design efficient structural systems.

The presentation addresses areas of research geared toward developing sustainable construction systems using fiber reinforced concrete materials which include the following tracks:

1) New materials, testing procedures, and applications for fiber reinforced concrete to address improved ductility-durability measures. Examples include early age properties, shrinkage cracking, and correlation of ductility with durability.
2) Testing, analysis, and design guidelines to obtain material models that can be directly integrated within structural analysis software. Both material and structural design can then concurrently accomplished. Analytical closed form solutions are instrumental in design and analysis of composite systems such as beams, slabs, retaining walls, and buried structures.
3) Solutions for sustainable development of infrastructure systems using blended cements, thermal-energy considerations of concrete buildings, blast, impact, and high ductility required designs, use of natural fibers, and statistical process control.
4) Guidelines for the systems analysis based design space to incorporate the cost effectiveness of using new materials in the context of reduction in labor, materials, and equipment.