

### CIVE 6111 Graduate Seminar Series

#### Sarah L Billington

Professor  
Civil and Environmental Engineering  
Stanford University

#### Tension-stiffening & Bond-slip in Reinforced Ductile Cement-based Composites

**Monday, September 15, 2014**

10:30 am - 11:30 am

Room: D3 W205

#### Abstract

Ductile fiber-reinforced cement-based composites are being developed for precast and field applications to provide damage-tolerance and improved durability to structures. The materials exhibit fine, multiple cracking in direct tension and maintain their tensile strength up to strains of 1 to 3 percent. The materials also resist spalling under high compressive loads. However when reinforced with traditional mild reinforcement, hardening and fracture of the reinforcement has been observed to occur significantly sooner than in traditional concrete. In addition, there is limited information on the bond-slip behavior of reinforcement in these composites, which is needed both for design and numerical modeling to predict structural performance. In this talk, recent experiments on tension stiffening and bond-slip behavior of several high performance fiber-reinforced cement-based composite (HPFRCC) materials reinforced with mild steel will be presented. Experimental results are used in combination with numerical modeling to develop a method of predicting the flexural capacity of reinforced HPFRCC materials. Bond-slip data is combined with tension-stiffening results to predict the cyclic response of components tested to fracture of the reinforcement.

#### About the speaker:



**Professor Sarah L Billington** is Professor and Associate Chair in the Department of Civil and Environmental Engineering at Stanford University. She is also the Milligan Family University Fellow in Undergraduate Education. Prof. Billington received her B.S.E. (1990) with high honors in Civil Engineering & Operations Research from Princeton University and her M.S. (1994) and Ph.D. (1997) in structural engineering from the University of Texas at Austin. Prof. Billington's research focuses on sustainable, durable construction materials and their application to structures and construction. Two current areas of focus are damage-tolerant, high-performance fiber-reinforced cementitious composite materials, and bio-based fiber-reinforced polymeric composites that have a closed loop life-cycle. Her group also conducts research on performance-based design and assessment of highway infrastructure vulnerable to corrosion and to scour damage. Prof. Billington has served on the Board of Directors of the Structural Engineers Association of Northern California and will begin an appointment as a Senior Fellow at the Woods Institute for the Environment at Stanford in September.

