External Advisory Committee Teleconference Meeting

June 30, 2011

10:30 am – 11:45 am

1) Introduction
   a) External Advisee Committee
      i) Dr. Kornel Kerenyi
         J. Sterling Jones Hydraulics Research Laboratory, Turner-Fairbank Highway Research Center, Federal Highway Administration
      ii) Keith Ferrell
         Missouri Department of Transportation (MoDOT)
      iii) Dr. Huimin Mu
         City of San Jose
      iv) Larry Olson
         Olson Engineering
      v) William Porter
         WFS Defense
      vi) Ross Johnson (not present due to schedule conflict)
         Geometrics

2) Overview of Project
   a) Project Duration
      Two years
   b) Funding Level
      i) $500,000 from US DOT RITA (cash)
      ii) $350,000 from Mo DOT (in-kind)
      iii) $166,041 from Missouri S&T (cash + in-kind)
   c) Goal
      i) Develop new scour monitoring devices: passive and active smart rocks
      ii) Integrate scour monitoring and mitigation into a rugged system
   d) Application Scenarios
      i) Real-time max scour depth monitoring with smart rocks
      ii) Real-time riprap countermeasure effectiveness monitoring with smart rocks
   e) Technical Approach
      The proposed remote sensing technology involves passive and/or active sensors embedded in rocks or reinforced concrete blocks, both referred to as smart rocks, and magneto-inductive or acoustic communications for a real-time engineering evaluation

and prediction of bridge scour on a Geographic Information System platform. For application scenario #1, smart rocks are deployed around the perimeter of a pier foundation. They will sink into the scour hole as developed. With deposit refilling or not, the smart rocks can give the maximum scour depth, a critical data for engineering design and assessment of bridge scour. For application scenario #2, together with natural rocks, smart rocks are not only distributed around a bridge foundation for scour mitigation but also represent the process of bridge scour as they are washed away.

3) Application parameter ranges for bridge scour monitoring
   a) Horizontal and vertical movement accurate to within 0.5 meters
   b) Transmission distance: 5-30 meters
4) Electronics parameter for smart rock design
   a) Data speed
      i) Gates transmit data every 15 minutes
      ii) Small flashy streams need hourly data transfers during flood conditions
      iii) In flood conditions transmit data as needed, more frequently than in calm river conditions
5) Potential implementation challenges and solutions with smart rocks
   a) Determine best shape to prevent wash away
      i) Sphere/octagonal shape to monitor max scour
      ii) Natural rock shape for scour mitigation
   b) Determine how to place smart rocks
      i) Divers
      ii) Drop rocks from boat
      iii) Drops rock from boat and guide with string/chain
6) Others
   a) Battery life
      i) Battery life estimated to last 15 years
      ii) Life expectancy changes based on the number of data transmissions
      iii) Make more frequent measurements during flood conditions and less out of flood conditions to preserve battery life
   b) Lab vs. field smart rock
      i) No problem to make lab and field scale magnetic passive smart rock
      ii) More expense and time involved in making both lab and field scale acoustical smart rock
   c) Lab test accuracy
      i) Function of many variables
      ii) Need to do many lab tests to determine the minimum movement measured in the lab