July 27, 2020

Fiber Optic Sensing Association Comment on Guidance to Establish Policies for the Agency Levee Safety Program Entitled Engineer Circular 1165-2-218

The Fiber Optic Sensing Association (FOSA) thanks the U.S. Army Corps of Engineers (USACE) for their continued support of levee safety and commend them on creation of the Water Resource Policies and Authorities US ARMY CORPS OF ENGINEERS LEVEE SAFETY PROGRAM, Levee Safety Circular (EC 1165-2-218).

Toward the stated goals of performance monitoring to assess groundwater pressure, deformation, total stress, temperature, seismic events, leakage, and water levels, FOSA desires to raise awareness within USACE of technology generically referred to as Distributed Fiber Optic Sensing (DFOS). DFOS is a technology that can be configured to effectively and efficiently detect temperature, strain and/or vibration when coupled through fiber optic cables to assets such as levees, dams, perimeters, pipelines and other structures. Where DFOS is concerned, the emphasis is placed on the concept of “distributed” as the technology allows connection of a centrally located and powered interrogator (black box) to a fiber optic cable or cables, coupling laser light pulses into a single fiber and gathering backscattered signals (triggered by interactions with environmental effects) from that same fiber. This method takes advantage of “time-of-flight” of the laser pulses as their velocity within optical fibers are very well understood and stable. As such, using the velocity of laser pulses to and from an event, the location of the event can be pinpointed with an asset monitoring range of up to 50 km (~ 31 miles) in each direction – for a span of 100 km (~62 miles). Furthermore, the entire length of the optical fiber within the cable becomes a fully distributed sensor with spatial resolution as small as 1 meter (~3 feet) – a 100 km span effectively becomes 100,000 sensing points that can be continuously monitored.

As sensors, the fiber optic cables may be affixed to linear assets or buried/embedded in those same structures, depending on the aspects they are intended to monitor (groundwater pressure, deformation, total stress, temperature, seismic events, leakage, water levels). Additionally, many of these systems can also detect foot traffic, vehicular movement, hand-digging and excavation to add additional security functionality to the installed monitoring system.

It is also important to note that electricity is only required to power the interrogator equipment while the fiber optical cable is completely passive, requiring no electricity and, depending on cable design, may also be completely dielectric, immune to the effects of radio frequency and electromagnetic interference.

As a non-profit trade association tasked with promoting DFOS technologies, FOSA stands ready to support the USACE as an information resource with many publicly available technology resources at https://www.fiberopticsensing.org.