Commentary: Why Monitor Performance: The Abridged Version

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Many geotechnical engineers have experienced the benefits of using instrumentation to monitor structural and geotechnical performance, but we often struggle to justify the expense of instrumentation to our clients. We struggle, I believe, because we don't communicate the benefits of instrumentation in terms our clients understand—risk, probability, and money. Based on my paper from the recent Seventh International Symposium on Field Measurements in Geomechanics (FMGM 2007) conference in Boston, I've developed an approach to help define and quantify the benefits of instrumentation programs. This commentary is an abridged version of the approach described.

The many potential uses and benefits of geotechnical monitoring for civil works construction are much broader than the traditional use of keeping geos out of trouble. Effective performance monitoring can save money by helping to reduce risk. One example is the $15 billion Central Artery/Tunnel project in Boston, where performance monitoring during construction decreased the risk exposure from damaged property and construction delays by more than $500 million. I believe that performance monitoring must be a part of every risk management strategy for constructed facilities and I urge the instrumentation community to more clearly define and document the purposes and benefits of instrumentation in terms that non-technical people can understand.

The principal messages I took from FMGM 2007 are:

- There are lots of gadgets to provide measurements and technologies to log the data and transmit it anywhere. Some of these technologies, such as fiber optic sensors, global positioning surveying, and wireless data communications, are evolving rapidly;
- being challenged to find ways to interpret and act on it in a timely manner.

As an example of the last item, our firm is currently on a tunneling project where the client wants to see data from the geotechnical instrumentation and from the tunnel boring machine (TBM) visually displayed on computer monitors in near real-time and they want all data from the start of the project available for viewing. This sounds very reasonable—have the system show how the surrounding ground is responding to the behavior of the TBM. We discovered only a few days before startup that the TBM data consist of 500 sensors being read every 3 seconds. The instrumentation database is growing at the rate of 1 gigabyte per day! Our IT manager can't sleep for fear of being drowned in data. The challenges in geotechnical monitoring are changing from the details of the gadgets to making the entire monitoring system works seamlessly, reliably, and simply.

Of special interest to me is the important role that performance monitoring can take in the future of geotechnical engineering practice. I'm a strong advocate for our profession becoming more focused on helping clients identify and manage their risks during facilities construction. Many risks to project costs and schedules have geotechnical origins. Best management practices teach us that to effectively manage anything, key performance indicators must be identified and then measurements made of that performance to monitor changes.

Logically, good risk management requires key risk indicators and performance measurements to indicate changes in risk as the project progresses. Effective performance monitoring can give early warnings so that we can take steps to decrease the likelihood of undesirable events and reduce their consequences. In this way, effective performance monitoring becomes an integral