Fiber Optics Bolts

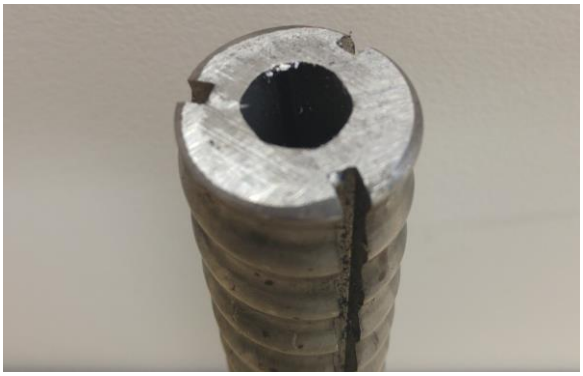
High Resolution Optical Strain/Shear Monitoring

Rock bolts are subjected to a combination of axial and shear loading. Over the life cycle of the excavation, rock movements may transition from distributed to discrete as cracks and shear zones localize. Accurately monitoring the strain profile of fully grouted rock bolts reveals much about rock mass behavior around an excavation and about the rock bolts. Optical Strain Sensing represent the perfect solution for strain monitoring for most bolt types.

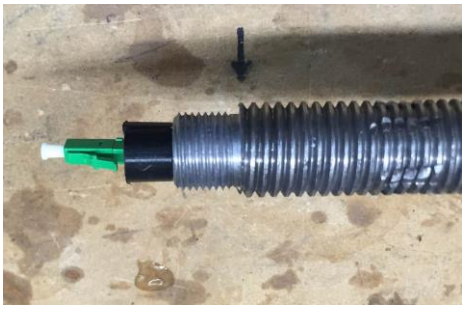
An optical fiber is wrapped along 3 grooves machined along the length of the rock bolt. The 120° arrangement allows excellent resolution on axial strain and shear vector.

The optical bolt is installed with standard methods. The cap is removed for connection to the optical cable coming from the optical analyzer. A new cap is mounted to permanently protect the optical connector and cable if shotcrete is not used.

Pull tests can be made with the instrumented bolt.



An optical connector is mounted at the end of the bolt. This connector is protected by a metal cap during both shipping and installation.



The optical analyzer can be located several hundreds of meters away from the bolts.

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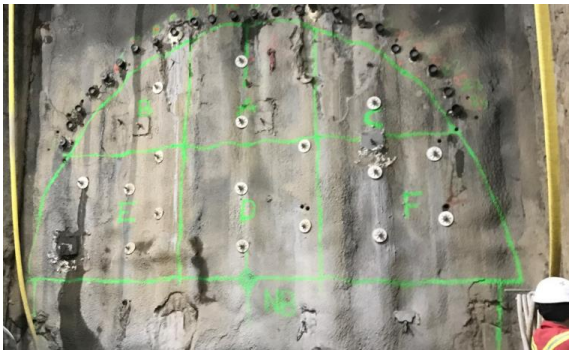
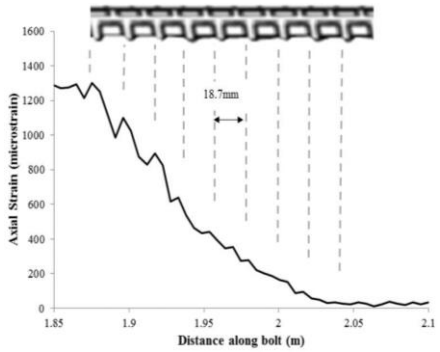
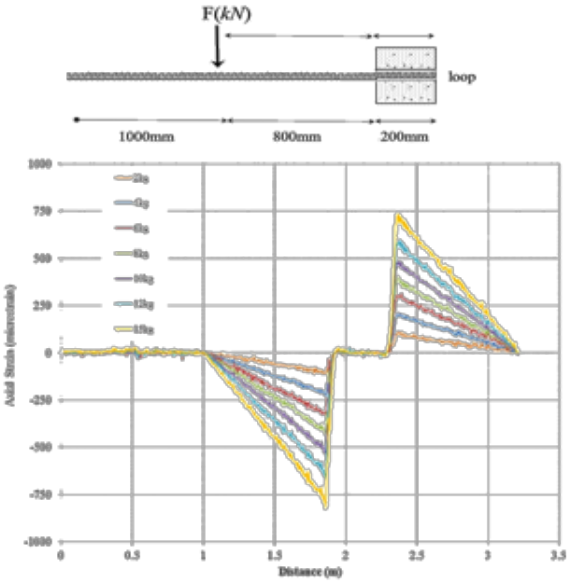
Suitable for both rock mines and coal mines - Inherently safe and IS certifiable optical rock bolts - Measurement of strain profile rather than localized strains - Spatial resolution from 5cm down to 1mm - Operational accuracy better than +/- 10 microstrains - Instrumented optical bolt cost minimized - Suitable to a variety of rock bolts : rebar, threadbar, NMX, CT, AT & AX grade bolts - Clusters of bolts can be monitored simultaneously - Autonomous monitoring - Networking ready - Data plentiful and accessed remotely in real-time.



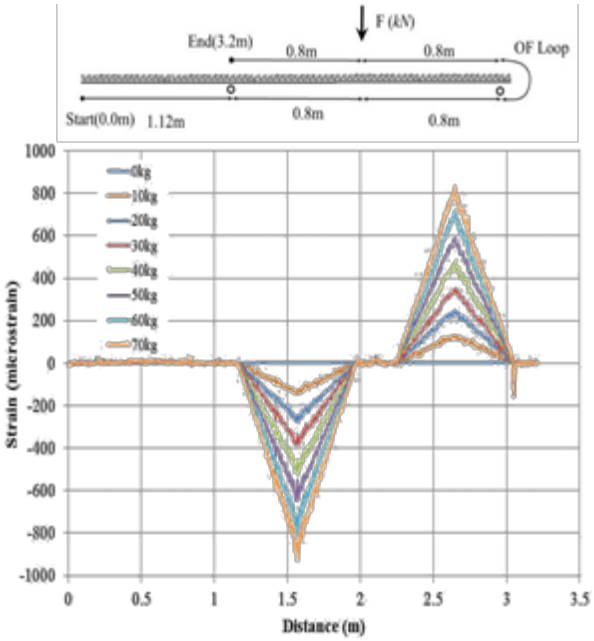
Optical forepoles in a tunnel



Axial strain profile periodic modulation of rib geometry with rebar



Simple axial strain test



Bending test