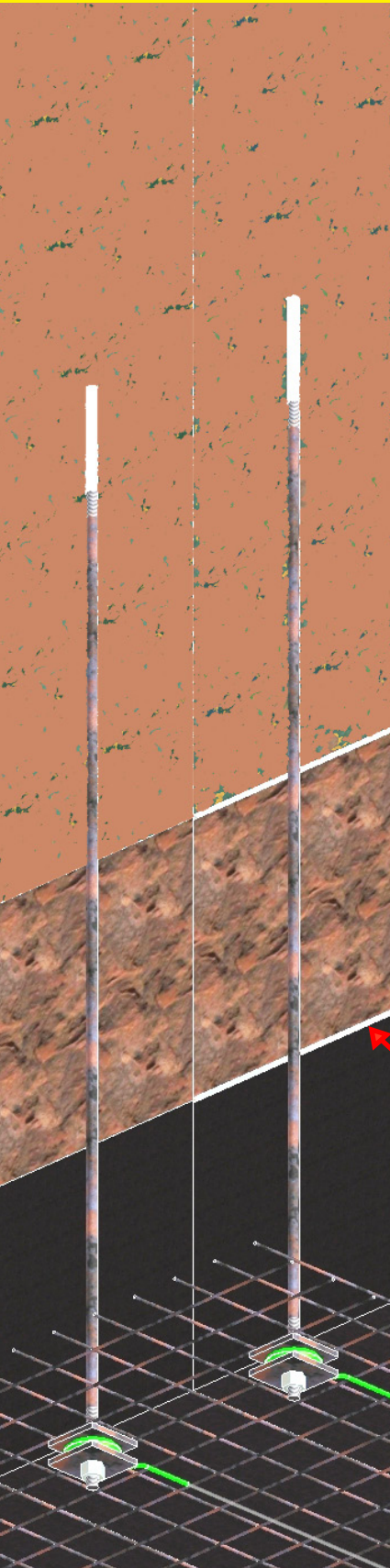


# DOUGHNUT EXTENSIOMETER



The doughnut extensiometer is an extremely simple, economical rock bolt based device that measures the dilation of a rock mass. It is simple to fit as part of a standard bolting operation and is very easy to read.

The doughnut extensiometer can be used in coal, hard rock or civil applications. It is ideally suited for use in coal mine roof installations where it can detect delamination of the strata.

The extensiometer consists of a hollow plastic ring with a port on the side which is connected to a clear plastic tube. The ring contains a fluorescent grease which is squeezed out into the clear plastic tube when the ring is compressed. The extent of grease movement within the plastic tube is easily visible with the aid of a small amount of light, due its fluorescence.

To use the doughnut extensiometer, a hole is drilled to the desired measuring depth then a rock bolt is inserted into the hole and locked in place using a point anchor. The anchor can be mechanical or made by trimming off a resin cartridge to a short length. If the resin cartridge is used, the bolt must be spun for a set time instead of waiting for the normal bolter torque to be reached. The bolt drive nut is removed and a sandwich of an inner washer, doughnut extensiometer and outer washer are slipped on to the bolt and loosely retained by a nut. The clear plastic tube is then aligned with one of the roof mesh wires and tied to it with cable ties. The nut is advanced to squeeze some fluorescent grease out into the tube, usually to the location of the first mesh grid crossing. The lock nut is then screwed on and tightened against the nut to secure the setting.

Roof dilation can then be monitored by simply noting the extent to which the fluorescent grease has extended down the clear tubing. The ratio of movement is approximately 1:100. That is 1 mm of dilation yields 100 mm of visible change in the clear tube. The doughnut permits fine measurement of dilation to a maximum of 20 mm of movement within the rock.

The installation of doughnut extensiometers significantly improves mine safety. Its use can reveal problems before support remediation becomes difficult to install. Several extensiometers used in a coal mine at each intersection and at the mid span of a bolt pattern will enhance safety and reduce the likelihood of disruption to production by failing to detect a potential rock fall. The doughnut extensiometer is a low cost monitoring device that requires scarcely more effort to install than a rock bolt.

fracture/  
delamination

fluorescent  
indicator