d-CABLE

YieldPoint's **d-CABLE** technology allows engineers, technicians, consultants and contractors to monitor how the load develops along 7-wire stand cable bolts over time, and hence to assess the Factor of Safety against cable rupture. The instrument is applicable to cable bolts, ground anchors, tendons, and tie-backs used in all types of mining and civil projects. It has the potential to predict the risk of catastrophic structural failure: in fact **d-CABLE** data can enhance many aspects of *engineering design*, *installation quality control*, *long-termoperation assessment,* and *rehabilitation*.

The **d-CABLE** is indistinguishable from a regular cable and deployment simply involves replacing a regular cable with its instrumented equivalent. During cementing/grouting no special procedures need to be followed. The readout head of the **d-CABLE** has the same diameter as the 7-wire strand itself, and therefore grips and a jack can be applied over the readout head if the cable is to be plated. If no face-plate is required the readout head can simply be recessed into the collar of the hole.

Features:

▲ *Digital (d-Tech) instrumented cable with RS485 signal out.*

▲ *Instrumented 7-wire strand cable applicable to plain strand, Bulb cables.*

▲ *Applicable to cables spun in resin*

▲ *Available with 1(d^1CABLE) to 5 (d^5CABLE)loadmeters*

▲ *Readout head is same diameter as cable to facilitate installation of grips. No special procedure for plated cables.*

▲ *Microcontroller provides output directly in load (tons).*

▲ *Individually calibrated.*

▲ *Immunity to hostile environment*

▲ *High survivability to shock and vibration.*

▲ *Easy to install and maintain.*

▲ *Low cost peripheral devices for data-logging (d-LOGGGER) and data Ethernet and WiFi running TCP/IP upload (DESTINY).*

▲ *Competitively priced.*

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Technology

How Does it work?

The **d-CABLE** is based on a miniature inductive strain-gauge small enough to be recessed into a surrogate tubular king-wire. The gauges are configured with base-lengths of 200mm to 2000mm. When the ends of the strain-gauge are secured (usually swaged) it will measure how a certain length of the cable bolt is stretching in response to load.

Either a single strain-gauge (for end anchored cables spun in resin) or an array of strain gauges may be specified. These can be concentrated at locations where it is predicted that the cable may intersect a known geotechnical feature. The base-length between the ends of the strain-gauges is specified by the customer. During manufacturing the entire strain-gauge array is independently manufactured and calibrated and then recessed into the king-wire and swaged in place.

Since the technology involves strain gaugesdistributed within the cable rather than displacement sensors housed in an instrumentation head, the "signal processing head" of the **d-CABLE** is reduced to a diameter equal to that of the cable. This has significant advantages in applications that require plating or pre-tensioning.

Postensioning/Plating Procedures

In many applications cables require post-tensioning using a plate and grips. Since the readout head of the **d-CABLE** in the same as that of the cable itself, the grips and tensioning jack can simply be placed over the end of the instrumented cable.

Telemetry

The RS485 output signal can be transmitted over 500m without amplification. Readings (one for each strain gauge) are directly in tons allowing immediate interpretation of cable load without having to enter the raw voltage data in a spreadsheet.

Manual Readout

YieldPoint's low cost **d-READER** readout unit provides the temperature and load data directly in ^{o}C and tons.
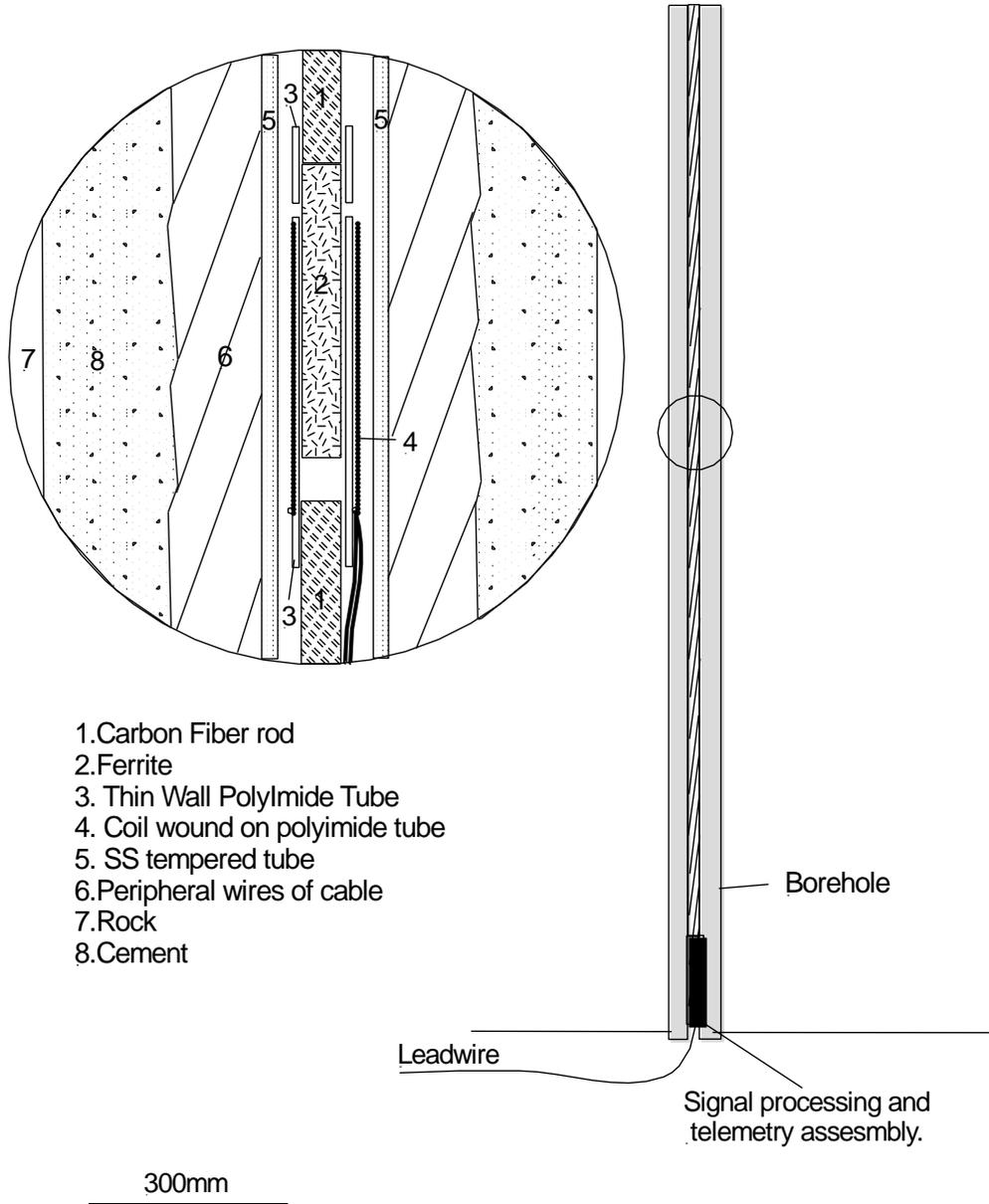
Datalogging

Data from the **d-CABLE** can be collected using YieldPoint's **d-LOGGER** dataloggers (**d^{1}LOGGER** and **d^{4}LOGGER**). The data-loggers require no configuration and are fully interchangeable with any other type of YieldPoint instrument (**d-MPBX** borehole extensometers, **d-GMM**, **d-TILT**, **d-PLUCKER** etc). Therefore arrays of instruments to monitor cable load and ground movement can easily be combined.

Automated Data Retrieval

Clusters of sensors (4 per Slave) can be polled using YieldPoint's **DESTINY** (digitally Enabled Sensor Transducer and Instrumentation Network from YieldPoint) technology. Each low-cost **DESTINY** node interfaces 4 instruments directly to a TCP/IP network.

DISPLACEMENT SENSOR DETAIL

1.Carbon Fiber rod
2.Ferrite
3. Thin Wall PolyImide Tube
4. Coil wound on polyimide tube
5. SS tempered tube
6.Peripheral wires of cable
7.Rock
8.Cement

Borehole

Leadwire

Signal processing and
telemetry assesmbly.

300mm

The figure above shows detail of the miniature inductive strain gauge that can be recessed into the tubular king-wire. The strain can be determined accurately *in situ* rather than translated to an instrumentation head at the end of the cable.

NOTE: The YieldPoint manual readout unit (*d-READER*) outputs load directly in tons (resolution 0.01ton).

d-CABLE

Applications

- ▲ Slope monitoring.

- ▲ Monitoring cable reinforcement in tunnels and drifts

- ▲ Monitoring cable reinforcement in stopes and other large openings

- ▲ Monitoring cables in fill mats

- ▲ Monitoring ground anchors

- ▲ Monitoring strand reinforced concrete

- ▲ Monitoring tie-backs
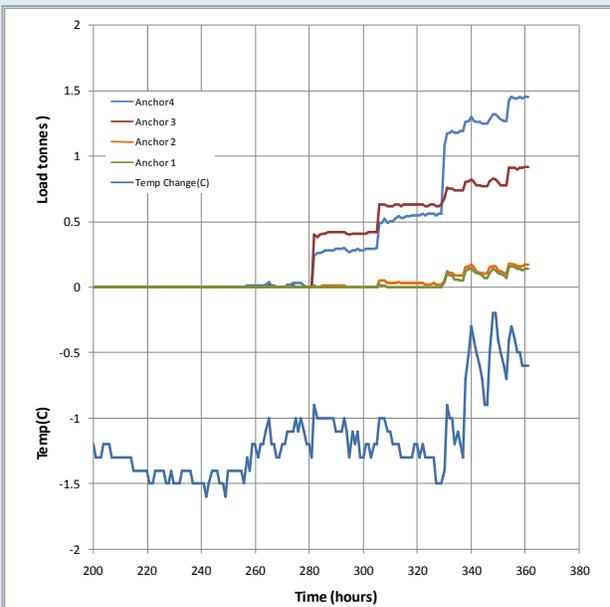
Detailed d-CABLE data recorded using a d-LOGGER.

Specification

- ▲ **Core Technology:** Temperature compensated inductive strain gauge. User specified baselength.

- ▲ Digital Temperature sensor

- ▲ **Output Signal** –RS485 with transmission up to 500m over 2xtp.

- ▲ **Load Range (F.S.)** – 0-24tons (linear relation for load v strain) 24-26tonnes (yielding relation for load v strain).

- ▲ **Load Resolution** - 0.01ton.

- ▲ **Load.Linearity** - typically 1.5% F.S(0-24.0ton)

- ▲ **Total Load Accuracy** – typically better than +/- 1.0ton.

- ▲ **Temp. range**: Temp: -40 to 125°C

- ▲ **Temp Resolution**: 0.1^{o}C

- ▲ **Temp Accuracy**: +/- 2°C Temp

- ▲ **Temp. coeff for loadmeter:**<+/- 0.01%

To Order Specify:

- ▲ Number of strain gauges(1-5).

- ▲ End Locations of gauges.

- ▲ Leadwire length.

- ▲ Poly leadwire cover.

YieldPoint