

Underground Tunnel Monitoring



- **Objectives:** Monitor stability of tunnels
- **Solution:** [Jewell Instruments Little Dipper](#)
- **Benefits:** High-precision and ruggedness
- **Results:** Continuous detection of potential instability

Project

There are six different road tunnels in Singapore. The most commonly travelled ones are the Central Expressway (CTE), the Kallang-Paya Lebar Expressway (KPE), and the Marina Coastal Expressway (MCE); and these tunnels have a speed limit of 80km/h, though certain bends on the KPE have a speed limit of 70km/h.

After those are the Fort Canning (FCT) and Woodsville Tunnel (WVT), which have a speed limit of 50km/h. The slowest of the tunnels is the Sentosa Gateway Tunnel, which has a speed limit of 40km/h.

Underground tunnels are constructed throughout Singapore to improve the country's transportation. Geotechnical engineers need to monitor the stability of the tunnel walls during and after construction to prevent costly and dangerous collapses.

A series of [Little Dippers](#) were installed in boreholes near the tunnel walls, at 2 meter intervals. The inclinometer system detects any ground displacement around the tunnel that could cause structural instability to the walls.

[Little Dipper](#) is an in-place inclinometer system for monitoring slopes, embankments, deep excavations, tunnels, tank foundations, retaining walls, and other types of ground movement. Installed as a string of vertical or horizontal sensors inside inclinometer casing, or by direct burial, this instrument provides a continuous record of ground



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displacement. Fiberglass rods connect the sensors inside the casing, and fins or universal pivots couple the sensors to the casing walls. [Little Dipper's](#) on-board electronics accept a wide input voltage range and drive long cables without signal loss. The waterproof and non-corrodible ABS sensor housing also makes the [Little Dipper](#) a popular tool for underwater tilt measurements in shallow marine applications

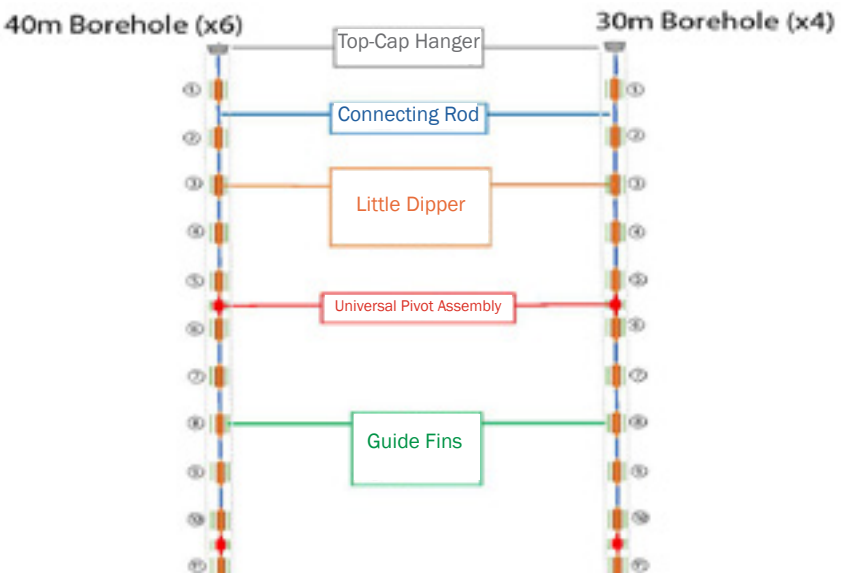


Diagram of Little Dippers strung together in each borehole

About Jewell Instruments

Jewell Instruments is a world leader in the design, manufacture, and distribution of high-precision products. Our expertise includes acceleration and tilt sensors, electronic compasses, avionics components, solenoids, and panel meters. The extensive application knowledge we have obtained through decades of experience allows us to provide custom solutions for a diverse group of industries. In fact, customers from all over the globe contact us for solutions to aerospace, medical, industrial, and telecommunications applications - to name a few.

To find out more, visit our website!



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