

SUCCESS STORY

THE MODERN WIRELESS MONITORING IN NORTH AMERICA

REGION:

North America

PROJECT TYPE:

Tunnel Monitoring for Metros

SECTOR:

Construction - Tunnels

MAIN PRODUCT:

Loadsensing | The Wireless Monitoring System

Challenge

The Purple Line Rail Link in Washington D.C. is a light rail line under construction to link the Maryland suburbs to the Washington metropolitan area. The lines will allow riders to move between the other lines of the Washington Metro transportation system without needing to ride into central Washington, D.C. Meanwhile, the Purple Line Extension in Los is a new heavy rail subway corridor in Los Angeles County, extending the Metro Purple Line to the Westside region.

The two projects had similar pain points. While installing cables, some of the sensors were placed in boreholes drilled from the road surface or sidewalk. Installing cables to power and read the sensors were too expensive due to the necessity of trenches. The instrumentation monitoring in a tunnel is crucial not only during the initial phase of tunnel boring but also for some time after project completion. During the initial tunnel construction stages, it is very costly and inefficient to conduct monitoring using cabling because of the rapidly changing environment as the tunneling progresses. The sensors could be read manually but it required traffic interruptions and resulted in sporadic data acquisition. Also, the nodes are usually installed underneath manholes covered with a metal lid which is a very limiting condition for the radio transmission.

Solution

Loadsensing wireless data nodes are successfully collecting and transmitting data from different types of sensors installed deep in the tunnels, on the ground surface and in surrounding buildings.

Loadsensing has been proven to work excellently in spite of harsh conditions during tunnel monitoring. The wireless nodes are collecting and transmitting pore water pressure, subsidence above tunnels, ground movements in depth, horizontal displacements in depth, induced movements in buildings (settlements and tilt), stresses in structural elements, stresses in tunnel linings and other required parameters.

Loadsensing uses LoRaWAN: a long-range, low-power wireless technology used by IoT networks worldwide. The wireless nodes are IP67 certified and tested from -40C to +80C making them highly robust and protected.

The Loadsensing monitoring system was deployed in some of the biggest metro extension projects in North America such as the Purple Line Rail Link in Washington D.C. and the Purple Line Extension in Los Angeles in order to monitor the stability of the surrounding ground structures during the metro extension. Worldsensing was not only able to discover the root cause of a problem that other wireless monitoring service providers in the region were unable to resolve but also provide solutions to the pain points.

ADVANTAGES

- Real-time, wireless monitoring of sensors in harsh environments
- Compatibility with multiple types of sensors from different manufacturers
- Minimal maintenance required for the low-power wireless data nodes

Benefits

Loadsensing easily provides real-time data from the sensors installed in-ground and helps in measuring the impact of the construction project. A monitoring program based on geodetic survey monitoring can only work when the movements reach the surface but the irregularity of the data acquisition makes accidents difficult to anticipate. With Loadsensing, any deviation from the predicted performance can be detected earlier and makes it possible to implement remedial or preventive actions.

A wireless monitoring system that is able to monitor the preliminary phases of a project can bring a wealth of data and overall project visibility that was not previously available or feasible. With the easy to install, battery powered and long range Loadsensing wireless nodes, it is possible to collect automatic readings in near-real time from the beginning to the completion of the project.

Through Loadsensing, the metro expansion projects are able to gather data on the stability of the tunnels in an unintrusive way through the data units that are connected to their sensors even inside the metal-covered manholes. This helps to ensure the safety not only of the construction site but also the surrounding areas.

“A lot of tunnel projects have a mishmash of systems. They could use 3 or 4 systems because operators feel like they have to use a specific system for a certain type of sensor. On our project, for the first time, we are using an integrated, automated data acquisition system. We are using the Loadsensing system for pretty much everything. In fact, Loadsensing is being used for every single monitoring sensor we're deploying.”

Dots Oyenuga

Ph.D., P.E., ASC

Geotechnical Expert for

tunneling projects in the US



Figure 1:

Loadsensing wireless tiltmeter, a 2-in-1 sensor + data node, is among the various wireless data units deployed for tunnel monitoring projects.



Find out more:

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