GEO INSTRUMENTS

Track Monitoring Systems

Track Monitoring

Track monitoring systems can provide timely warning of developing geotechnical issues that could affect track geometry and safety.

Automated Track Monitoring

Automated systems offer continuous operation and automated processing, alerts, data visualization, and reports.

Implementation

AMTS systems are the most common solution, but shape arrays, dynamic deflection sensors and tiltmeters are also used.

AMTS Track Monitoring

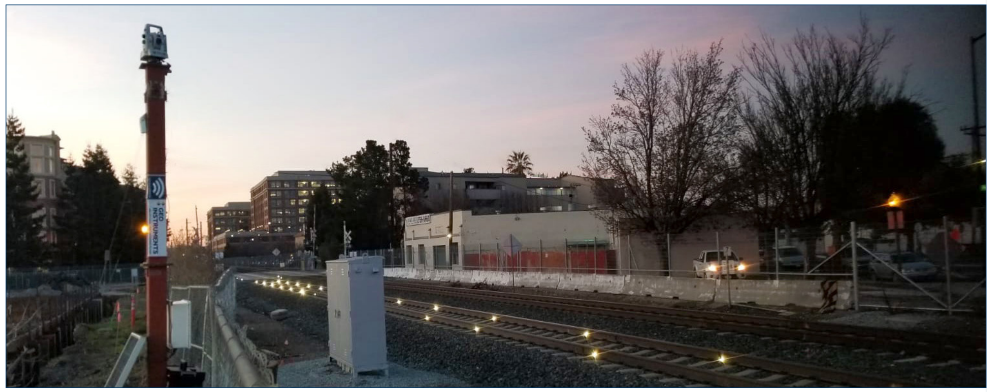
AMTS monitoring components include rail-clip prisms, an AMTS system, and GeoCloud data processing and presentation.

Rail clip prisms are installed in arrays on both rails, typically at the same interval to form prism pairs. Other prisms may be installed to monitor the sub-ballast or engineered soil beneath the tracks. The AMTS monitors the spatial displacement of the prisms and reports changes from the baseline measurements that were recorded when the system was installed.

The AMTS must be positioned for the best line of sight to the prisms. Location flexibility is provided by solar power and GEO's AMTS towers. Multiple AMTS systems can be optically networked to monitor very long spans of track.

AMTS measurements are relayed to GeoCloud web servers by cellular modem. The servers apply least-squares adjustments to the AMTS measurements, process the data as required, send alerts of any alarm conditions, and then present the data on a secure website.

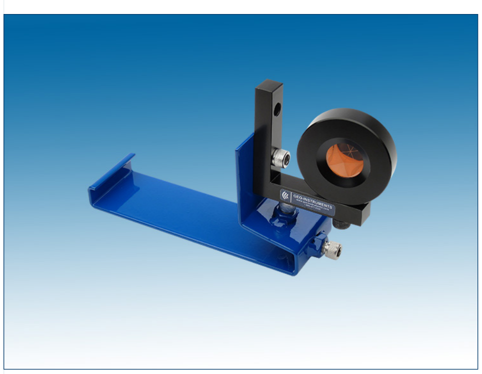
The GeoCloud website typically shows vertical displacements (settlement or heave). Advanced processing may include presentation of profiles, alinements, cross levels, and warp.



AMTS systems monitor arrays of prisms installed on rails.

This AMTS system is monitoring rail clip prisms on the tracks and road prisms on a road crossing.

AMTS systems mounted on towers can be positioned nearly anywhere for best lines of sight. Solar panels provide power.



Rail clip prisms are clamped to the rail and then aligned to the AMTS.

Prisms are typically installed on both rails.

Rail-clip prism in-situ.

Shape Array Track Monitoring

Shape arrays are tilt-sensor instruments that provide measurements for profiles of settlement or heave along the axis of the track.

System components include the shape array, protective conduit, a wireless logger, and an internet gateway. The shape array is inserted into the protective conduit and installed parallel to the rails.

When one end of the array is established as the point of fixity, measurements can show track profiles and displacement profiles.

Shape arrays are connected to a wireless logger which transmits data to a GeoCloud server via a cellular internet gateway. The secure GeoCloud website displays plots and can send out alerts if deviations exceed preset limits.

Tiltmeter Track Monitoring

Tiltmeters are instruments used to monitor rotation of track ties.

System components include wireless tiltmeters and an internet gateway. The tiltmeters are installed on ties, with one axis parallel to the ties and the other axis parallel to the rails.

Tiltmeter measurements can confirm stability or warn of movements and indicate relative changes in crosslevel. Rigid elements between tiltmeters and a point of fixity are required for other calculations.

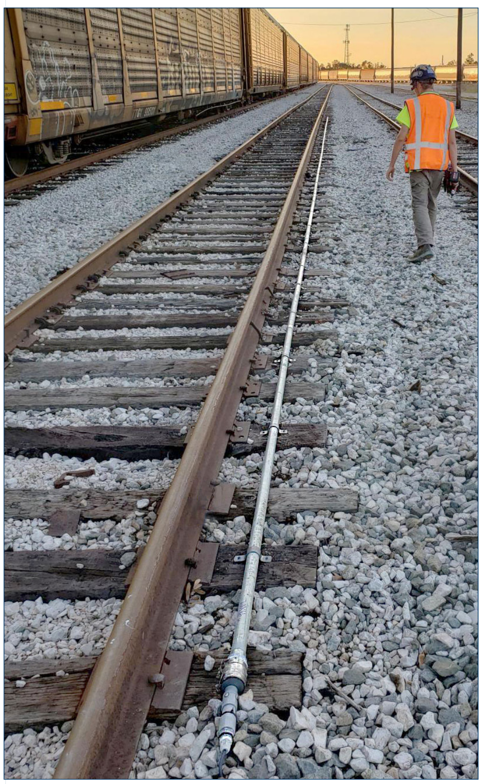
Wireless tiltmeters send measurements to a GeoCloud server via a cellular gateway. A secure GeoCloud website displays plots and can send out alerts if movement thresholds are exceeded.

Dynamic Deflection Sensor

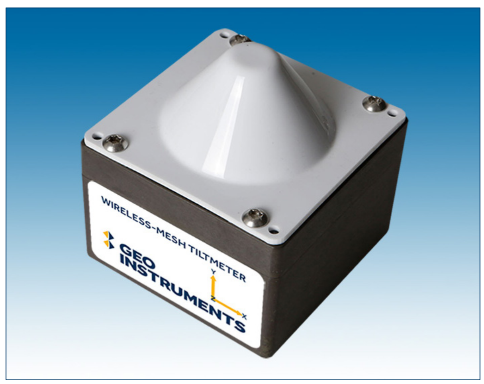
The FLX-Rail Dynamic Deflection Sensor records the maximum vertical deflection of a rail under the load of a passing train.

The FLX-Rail sensor uses an internal optical sensor to monitor the distance between a rail plate, which is magnetically clamped to the foot of the rail, and a reference plate, which contacts the ballast.

The sensor stays in a low-power standby mode until it detects vibrations from an approaching train. It then becomes active, continuously sampling the optical sensor at 350Hz. After the train has passed by, the sensor stores the maximum measured deflection, transmits the measurement to a GeoCloud website via a wireless gateway, and then re-enters standby mode.



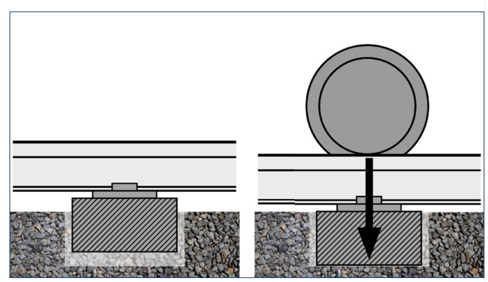
Shape Array Installed on Ties



Wireless Tiltmeter

Array of Tiltmeters

FLX-Rail Sensor



Dynamic Deflection under Load