Settlement degrades the performance of foundations, leading to cracks, tilting, and possible failure of the supported structure. Monitoring provides early detection of settlements, documents changes, and helps control corrective actions.

Instrumentation includes rod extensometers, inclinometers, and shape arrays to monitor subsurface movements, and automated total stations (AMTS), beam sensors, liquid level gauges, tiltmeters, and crackmeters to monitor movements above grade.

**Hernando de Soto Bridge**
The Hernando de Soto bridge carries I-40 traffic across the Mississippi river. During a seismic retrofit project, sudden settlement of a pier forced temporary closure of the bridge. After evaluating the failure, engineers revised construction methods and resumed work, this time with a monitoring & alarm system implemented by GEO-Instruments. Four automated total stations (AMTS) gave hourly updates on the position of the piers, providing safety for workers and confidence that the new methods were working. The automated system was more practical and less expensive than manual monitoring.

**Lower North Outfall Sewer**
The City of Los Angeles had to replace nearly six miles of the Lower North Outfall Sewer. The project involved tunneling beneath residential and commercial properties, with extensive use of compensation grouting. Tasked with monitoring numerous structures for heave from grouting and settlement from tunnelling, GEO-Instruments deployed a cost-effective geomatic system. The system included three automated total stations (AMTS) that monitored low-profile prisms on seventy potentially affected structures. A wireless network provided efficient collection of the measurements.

**East Side Access Tunnels**
Continuous monitoring for settlements was required while the ESA tunnels were driven under some of New York’s highest value real estate. The busy streets and sidewalks chosen for monitoring locations presented significant challenges for installation, power, protection, and data retrieval. GEO expedited installation by deploying preassembled fiberglass-rod extensometers, solved power and protection issues by sealing loggers, radios, and battery packs in stainless steel canisters installed below grade, and enabled wireless data communications with traffic-rated, flush-mount Lid Link® antennas.

**Tank Foundations**
Plant engineers at an oil storage facility requested a monitoring system that could provide early detection of differential settlements while retired storage tanks were returned to service. GEO installed four high-resolution tiltmeters in sparkproof enclosures on the foundation rings of each tank. Readings were collected by data loggers located outside the hazard zone. GEO’s server retrieved the data, checked for alarms, and then posted updates on a dedicated website. The system provided confidence in the performance of the tank foundations and helped the facility increase capacity at low cost.

**Storm Sewer Microtunnel**
A microtunneling machine had to pass under an 8-lane highway for completion of a storm sewer. Monitoring was required, since ground loss from tunneling could result in settlements. To avoid lane closures and safety hazards, the monitoring system had to be flush with the pavement, automated, and wireless. GEO installed MPBXs, each fitted with a data logger, battery pack, cellular modem, and GEO’s Lid-Link®, flush-mount, traffic-rated antenna. The wireless systems successfully provided hourly readings for the two month duration of the project, and was safer and much less expensive than manual monitoring.
About GEO-Instruments
GEO-Instruments provides automated solutions for monitoring the safety and stability of buildings, excavations, bridges, railways, roads, tunnels, dams, embankments, and slopes. We help clients manage risk by installing advanced monitoring systems and automating the collection, processing, and delivery of alarms, data, and reports.

We work as part of the design and construction team or as independent consultants. Our highest priorities are delivering practical, cost-effective solutions and maintaining good communications with our clients. Established in 2003, we have acquired a reputation for getting results and providing excellent customer service. We now operate from offices in Rhode Island, New York, District of Columbia, California, and Washington.

Advanced Technologies
The GEO-Instruments team has extensive experience in instrumentation, civil engineering, information technology, and construction. We can integrate and deploy a wide range of technologies to meet project requirements.

Wireless Communications
GEO-Instruments can implement wireless systems in nearly any environment. Our systems provide reliable data collection, eliminate the costs of installing and protecting cables, and reduce the need for site visits.

Efficient Field Services
GEO-Instruments can mobilize field services quickly. Our technicians are trained and cross-trained to ensure that field services are performed efficiently and that systems are installed and commissioned correctly.

Web Access to Data & Reports
GEO-Instruments creates a website for each project. The website automatically updates data, graphs, and reports, freeing engineers for other work. Reports can be emailed to all stakeholders, and site status can be reviewed in real time at meetings.

Green Line Metro
Construction of a 2.5 mile test track next to the busy Green Line posed safety issues. To monitor for possible deformation of the Green Line track bed, GEO deployed an array of fifteen automated total stations (AMTS) and 900 target prisms. Although the total stations were 800 feet apart, GEO was able to create a strong geometric network through the use of shared target prisms and 60 control prisms. Measurements were transmitted off site hourly, processed with least-squares software, converted to site coordinates, and posted on a dedicated website. See Monitoring Deformation

FDR Drive
Significant deterioration of the pilings supporting this busy six-lane parkway threatened its stability. To help manage risk during reconstruction, GEO-Instruments installed 3D crackmeters and biaxial tiltmeters at expansion joints located over the deteriorated piles. A solar-powered data logger transmitted readings wirelessly to GEO’s servers for processing and alarm checking. Authorized users viewed data and graphs on a project website. The system enabled continued use of the highway during reconstructions and ensured safe passage for thousands of vehicles. See Monitoring Structures

Chinatown Excavation
To monitor the support system for this 35-foot deep excavation in Washington DC’s historic Chinatown, GEO-Instruments deployed 50 target prisms on the walls and bracing of the support system and a solar-powered, automated total station (AMTS) on the roof of an adjacent building. Powering the system with a solar panel eliminates the need for an electrician and makes it easier to obtain permission from the building owner. Measurements were retrieved every two hours, corrected and validated with least-squares software, and then posted to a website. See Monitoring Support of Excavation