Support of excavation refers to the temporary shoring system used to stabilize the excavation. The performance of the system affects not only the safety of workers within the excavation, but also the safety and stability of adjacent structures.

Instrumentation may include strain gauges and load cells to monitor struts and braces, automated total stations (AMTS), inclinometers, and shape arrays to monitor deformation of the support walls. Settlement monitoring may be required for adjacent buildings.

Salesforce Tower
Salesforce tower will be the tallest building in San Francisco and the centerpiece of the Transbay Redevelopment project. To monitor the support system, GEO-Instruments has deployed 138 prisms and four automated total stations (AMTS), two mounted on walers and two mounted on buildings. This configuration not only provides complete coverage of the support system, but also allows the four AMTS to share some common points of measure, creating a strong geometric network for least-squares processing and delivery of accurate measurements. The system provides updates every two hours.

的支持系统，GEO-Instruments部署了138个棱镜和四个自动化总站（AMTS），两个安装在walers上，两个安装在建筑物上。这种配置不仅提供了完整的支持系统覆盖，也允许四个AMTS共用一些共同的测量点，创建一个强大的几何网络用于最少平方处理和交付精确的测量。系统每两小时更新一次。

Transbay Transit Center
Construction of the Transbay Transit Center required a massive support of excavation system. GEO-Instruments provided continuous monitoring of the support system, deploying six automated total stations (AMTS) and a strong geometric network of 250 target prisms and 30 control prisms. GEO’s Monstar software output measurements in project coordinates for easy use with other project documents. Every two hours for four years, the system delivered spatial measurements with an accuracy better than one mm, providing critical observational data for evaluating operations and managing risks.

Transbay Transit Center的建设需要一个巨大的支护系统。GEO-Instruments提供了持续的监测支持系统，部署了六个自动化总站（AMTS）和一个强大的几何网络，包括250个目标棱镜和30个控制棱镜。GEO的Monstar软件以项目坐标输出测量结果，便于与其他项目文件一起使用。每两小时连续四年的运营中，该系统提供了空间测量，其精度优于1毫米，提供了关键的观测数据，用于评估操作并管理风险。

Elliott Bay Seawall
Seattle’s waterfront is being renewed by construction of a new seawall designed to meet current seismic standards, protect critical infrastructure and utilities from the bay, and enhance both marine and human habitats in the area. GEO-Instruments initially monitored the utility vaults as the old wall was excavated. As work proceeded, GEO was able to provide rebar strain gauges, load cells, and shape arrays to monitor the support of excavation systems. Hourly readings were transmitted to GEO’s server, processed and checked for alarms, and then posted to a dedicated website.

Elliott Bay Seawall
西雅图的海滨正通过建造新的 seawall来更新，该 seawall设计用于满足当前的抗震标准，保护关键基础设施和公用事业免受海湾的影响，并增强海洋和人类栖息地。GEO-Instruments最初通过挖掘旧墙来监测公用事业井，随着工作的进行，GEO能够提供钢筋应变计、载荷细胞和形状阵列来监控支护系统的支撑。每小时的读数会被传输到GEO的服务器，处理并检查警报，然后发布到一个专用网站。
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, Illinois, 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.

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.

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.

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.

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 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. See Monitoring Settlement

Sound Transit I-5 Undercrossing

Sound Transit’s U-Link project extends the light-rail system from downtown Seattle to the University District. GEO-Instruments monitored a high risk section of the project, where twin tunnels would cross under I-5 and through the foundations of the 40-foot high, 400-foot long retaining walls on either side of the highway. To monitor for deformation of the walls, GEO deployed multiple technologies, including automated total stations (AMTS), a laser scanner, tiltmeters, crackmeters, inclinometers, six data loggers, and mixed mode data communications. See Monitoring Deformation

Old South Church

Jet grouting at a nearby construction site opened a 70-foot vertical crack in the east wall of Old South Church, a national historic landmark. Construction was halted while engineers and specialists in stained glass, masonry, and historical restoration developed an action plan. Responding to the emergency, GEO-Instruments installed a fully automated monitoring system within 36 hours. Crackmeters, some specially configured for the stained glass windows, monitored the crack, while an AMTS monitored the stability of the entire wall. Readings were updated every 15 minutes. See Monitoring Structures