



Integrated monitoring delivers

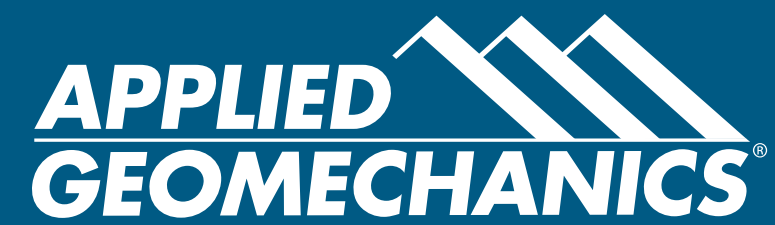
clarity





Founded in 1983, Applied Geomechanics Incorporated (AGI) began as a small tiltmeter manufacturing company in Santa Cruz, California. By the end of the decade, however, AGI had begun to build a reputation for excellence within the fields of geomonitoring and tilt sensor development. Since then, AGI has expanded its expertise to include performance-monitoring equipment and solutions from offices in San Francisco, Denver, Chicago and Boston. Spanning from man made structures to natural features, our company has developed performance-monitoring solutions for bridges, dams, roadways, tunnels, and mining operations worldwide. Applied Geomechanics draws upon a vast resource of GPS, fiber-optic and software development experts to customize monitoring solutions to your needs, to achieve the informational clarity your project demands. By integrating cutting-edge technology with experience and innovation, AGI provides turnkey risk monitoring solutions for clients across the globe.

Integrated Monitoring Solutions



*AGI performance monitoring and risk assessment solutions provide for transportation infrastructure projects with valuable site information, and give clients the flexibility to adjust and revise project proceedings as conditions change.*

*During construction of the Central Artery Tunnel in Boston, AGI personnel were responsible for system development, installation and long-term data collection, assuring the structural integrity of high-rises immediately adjacent to open cut excavation operations.*



## Geotechnical Monitoring

AGI's geotechnical monitoring services give clients real-time monitoring capabilities through web based data management systems. By utilizing wireless communication, dataloggers can be synced automatically to integrate surface and subsurface sensors on the structure or natural feature of interest. Data collected in the field are then uploaded onto a secure web server maintained by AGI. Measurements of tilt, strain, stress, displacement, deformation, vibration and noise allow us to create a geotechnical profile of the site of interest, which can then be interpreted visually with plots or field reports. This profile also highlights potentially dangerous geologic trends as they are developing in real-time.

**Tunneling and Excavations.** Applied Geomechanics personnel have developed geotechnical monitoring programs for a variety of tunneling and excavation projects, including the Central Artery Tunnel (CAT) in Boston and the South Ferry Terminal in New York. Excavation procedures like open-cut excavation, common to these projects, can endanger the structural integrity of the surrounding cityscape. By implementing fiber-optic, GPS and tilt sensor technology with our advanced software, AGI places real-time monitoring at your fingertips. Our automated software and equipment replaces the need for conventional surveying procedures, which can be expensive and time consuming. Additionally, our easy-to-use web interface allows you complete access to your data remotely, for comprehensive site observation globally, 24 hours a day.



*Monitoring solutions for mining operations, such as those at Trapper Mine in Colorado, integrate in-place inclinometers, piezometers, and our web-based monitoring systems for comprehensive data coverage.*

**Mining Operations.** Mining operations often involve the displacement of large amount of earth, making them susceptible to landslides or subsidence advanced by weather conditions. As of such, detailed surface and sub-surface site monitoring is crucial, and can help anticipate potentially dangerous geologic trends. Such was the case at the Trapper Mine site in Colorado, where a 105-hectare landslide developed after heavy rainstorms in the area. AGI monitoring services integrate subsurface inclinometers and piezometers, with GPS to monitor deformation at and below ground level. Our dynamic system interfaces indentify slide precursors automatically, notifying you when potentially concerning geological trends arise. Software can even be programmed to alert personnel via the internet, phone, or text message, so that corrective action can be implemented before a hazardous situation develops.

**Subsidence.** Subsidence in urban areas occurs as the result of advanced subsurface void development, and poses a major threat to property and commercial real estate. AGI monitoring services protect these assets by developing clear and detailed deformation profiles in the area of interest. Subsurface borehole tiltmeters and robotic, surface level, total stations cooperate through our data management software to pinpoint movements caused by rotational deformation and vertical displacement. Our software also allows for programmable alert thresholds, which notify key personnel automatically when a dangerous situation develops.

## Structural Health Monitoring

AGI staff have over 30 years of structural health monitoring experience, allowing us to customize monitoring solutions to your exact needs from the ground up. Monitoring service applications include building foundations, steel-truss-, segmental box-girder-, cable-stay-, and composite-type- bridges, and even unique structures such as wind towers, retractable roofs, or historical landmarks. With a culmination of fiber-optic, GPS, tiltmeter and software technology, AGI's dynamic condition-assessment solutions provide clear and immediate performance feedback for your structure of interest. Our structural-performance profiles not only help determine component integrity and frequency response over time, but can also detect component damages as they occur, allowing for precision structure-response verification. As an added bonus, AGI's structural health monitoring services manage and mitigate these features automatically, giving you clear and turnkey monitoring resources regardless of your project's complexity.

*Applied Geomechanics's GPS monitoring services monitor surface displacement in three-dimensions for absolute position accuracy, and can be coupled with subsurface tiltmeters to identify slide precursors.*



*Fiberglass turbine blades can be instrumented with fiber Bragg grating sensors, which are not susceptible to electrical noise or transient electrical currents caused by lightning interference.*

## GPS Monitoring

GPS is a reliable, precise, and cost effective monitoring solution for computing three-dimensional position in near real-time. Applied Geomechanics has further improved this powerful technology by coupling it to our 3D Tracker™ software. 3D Tracker™ is specifically designed to monitor movement and deformation of fixed structures including bridges, dams, oil platforms, and buildings. This innovative software has also proved invaluable for the geologic monitoring of natural features such as volcanoes and landslides.

3D Tracker™ implements a custom-tuned, triple differencing Kalman filter to compute 3-D positions simultaneously, in real-time, to millimeter accuracy. These data are then graphically interfaced via AGI's web-based reporting services. Through these services, 3D Tracker™ provides you with clear and current models of 3-D displacement vectors, real-time rates of movement, 3-D displacement history, and much more. AGI's dynamic web-based interfaces can even combine GPS technology with other geotechnical equipment for comprehensive site monitoring. Appended with our installation, data management and web-based reporting services, AGI's 3D Tracker™ monitoring systems give you the highest levels of precision the industry has to offer. Our experienced field engineers and sales staff welcome the new challenges of your project; contact us today about your unique monitoring needs.



*Distributed fiber-optic technology can replace conventional sensor arrays for cost effective monitoring solutions with maximum signal channel efficiency.*

## Fiber-Optic Technology

Fiber-optic technology is useful for monitoring applications where conventional electrical instruments are not an option. AGI's fiber-optic sensors can consolidate the number of instruments needed for projects normally requiring high sensor counts; applications include bridges, dams, mines, levees, tunnels and pipelines. Fiber-optic sensors are intrinsically safe, and can be used where electrical shorts or fire hazards are cause for concern. These sensors also minimize electrical interference by operating independently of electrical current. AGI's fiber-optic monitoring services provide precise, economical solutions for even the most extensive monitoring requirements.

**Bragg Grating Fiber-Optics.** Fiber Bragg grating (FBG) sensors are among our most typical single-point optical sensors, and allow for multiplexed measurements over a single fiber line. Short gage length and microstrain accuracy make FBG sensors ideal replacements for conventional strain gages. Applied Geomechanics's FBG sensors provide high levels of accuracy, and are multifaceted enough to be used as spot weldable, spot glue-able, or even as concrete-cast strain gages.

**Distributed Strain and Temperature Fiber-Optics.** Distributed fiber-optic sensors offer economical monitoring solutions for large projects where conventional instruments may not be fiscally accessible. AGI's distributed strain and temperature fiber-optics utilize the Brillouin effect to measure strain or temperature along any point of a given cable. This replaces the need for multiple point-sensor arrays, while maintaining high resolution comprehensive site monitoring. A single distributed optical fiber is capable of taking continual measurements of over tens of thousands of points, and can carry a signal up to 30 kilometers without decay. Coupled with our automated data management services, AGI's distributed strain and temperature fiber-optics offer virtually limitless monitoring capabilities.

## System Integration & Database Management

Large projects tend to generate extensive amounts of data over short time intervals, and often require multiple monitoring techniques. Applied Geomechanics offers complete instrumentation and system integration services to meet these demands.

AGI monitoring services appropriate sensor arrays, database systems, and programmable thresholds to suit your exact needs, and give you easy access to dynamic visualization models via the internet. Our Atlas data management software allows you to view and process deformation profiles through your web browser anywhere on the globe, and can even be programmed to send plots or PDF field reports to your email account.



AGI's data management and system integration services use a combination of Instrument Service (IS) and Atlas software to display comprehensive data within a clear and intuitive graphical user interface. With Atlas software, users can superposition site photos and drawings for point-and-click web browser navigation, making sensor data easily accessible. Additionally, Atlas is capable of both automatic and manual operation, giving users the control to upload additional data onto our secure web-based server. Atlas also allows for programmable alarm thresholds, which can trigger audible and visual alert relays in the field, or notify personnel and staff technicians via email, text message, and telephone automatically.

AGI Instrument Service (IS) speeds up monitoring system integration using advanced resource-allocating software. IS resides in the field as a network appliance, and allows field deployments to maintain a redundant copy of their collected data while simultaneously synchronizing with our secure data server. Using scalable programming and deployment techniques, IS coordinates up to hundreds of instruments in the field to cooperate with our Atlas user interface on the web, giving you detailed and easy-to-use site monitoring solutions. All these features are maintained by AGI's experienced staff for continuous and worry-free system operation.

# Tilt Mapping

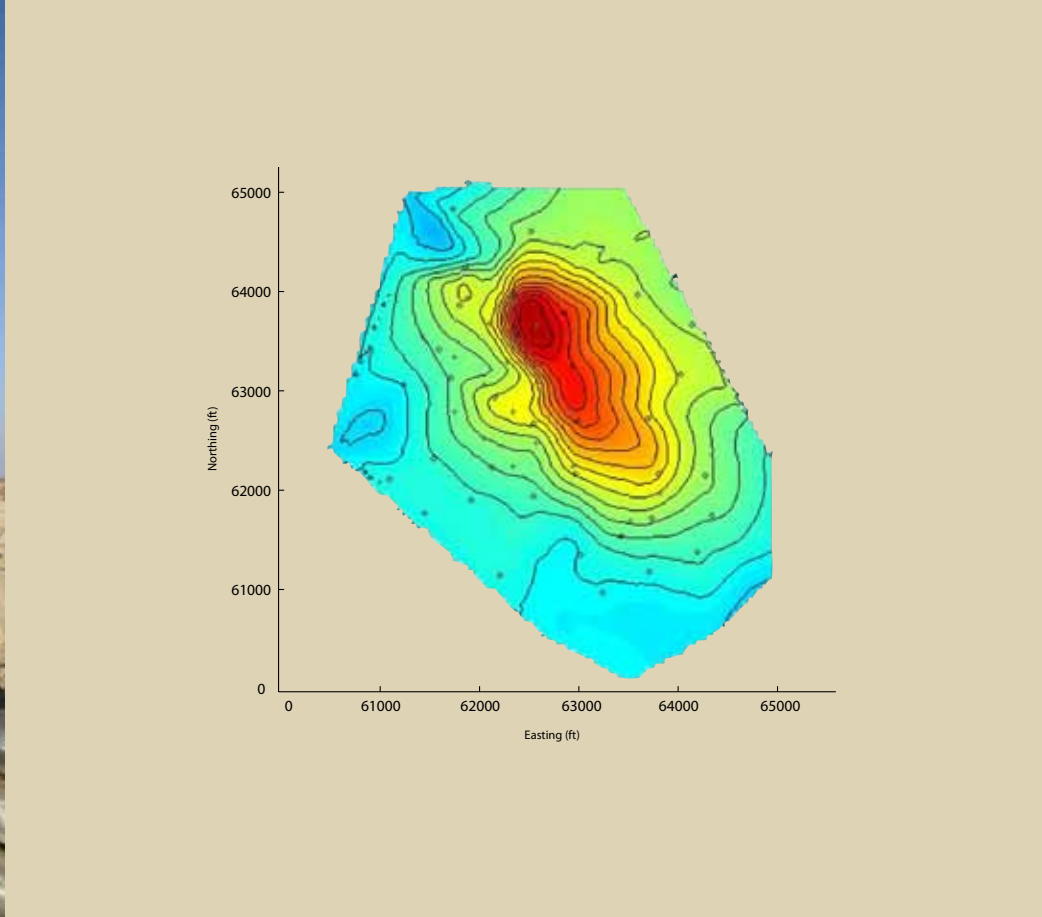
AGI now offers powerful tilt mapping services for clients in civil, mining, and environmental engineering. Tilt mapping, as developed in the oil and gas industry, refers to the derivation of displacement profiles and contours from tilt measurements made by tiltmeter arrays on the site of interest.

Since tilt measurements are continuously recorded, tilt maps can be compiled to form animated site profiles which reveal feature deformation over time. Tilt mapping provides valuable information about displacement fields and the nature of forces acting on a monitored structure.

Other advantages of tilt mapping include the following:

- Tiltmeters are affordable, quick, and easy to install.
- Tilt measurements are easily recorded using conventional dataloggers.
- High-precision Applied Geomechanics tiltmeters produce finer resolution displacement profiles than other surveying methods.
- Tilt mapping can be combined with GPS technology to achieve absolute position accuracy.
- Tilt data can be easily integrated into our Atlas online database for world-wide access.
- Displacement profiles, map creation, and animations are completely supported by Atlas.

Tilt mapping is widely used today in groundwater remediation projects involving hydraulic fracturing and measuring ground subsidence.



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