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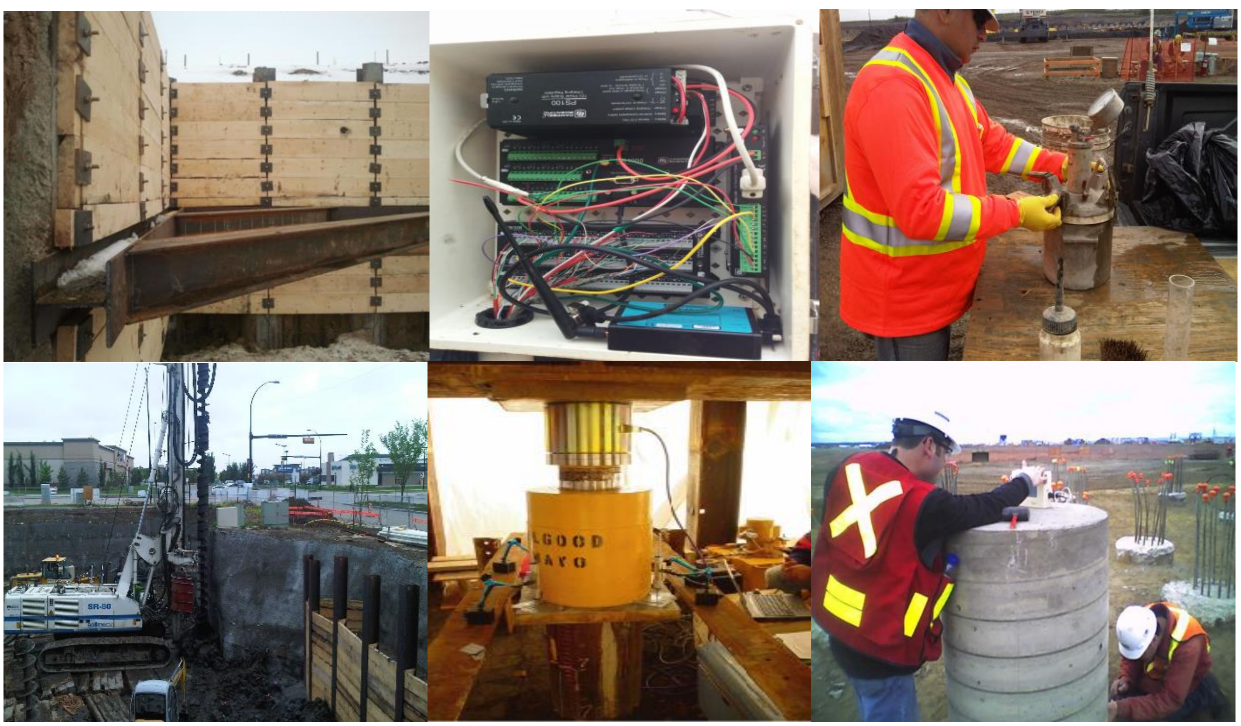
COMPANY STATEMENT OF QUALIFICATIONS FOR GEOTECHNICAL ENGINEERING & FOUNDATION TESTING SERVICES



COMMITTED TO QUALITY SERVICES SINCE 1997

Leaders *in Geotechnical & Foundation Engineering*

Celebrating 20 years of quality service!

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Corporate Profile

AATech Scientific Inc. (ASI) is a Geotechnical engineering company, owned and operated by Professional Engineers. Our highly qualified engineers have acquired extensive experience in all aspects of geotechnical, and foundation engineering, including site investigation, stability assessment and remediation, design of foundations and retaining structures, consulting, instrumentation and monitoring, foundation testing and analysis, ground improvement, construction supervision, inspection, quality assurance, quality control, equipment calibration services and other engineering disciplines.

Based in Ottawa, Ontario, Canada, ASI has offices in Calgary Alberta, and Evans Mills, New York. AATech was established in 1997 by experienced Professional Engineers, with a long list of successful contributions to the geotechnical engineering industry. AATech is now a recognized and respected company with experience spanning over thousands of successful projects across North America and overseas. Our objective is to continue to provide high quality professional services worldwide and we are committed to maintain our stellar reputation as a leading-edge company.

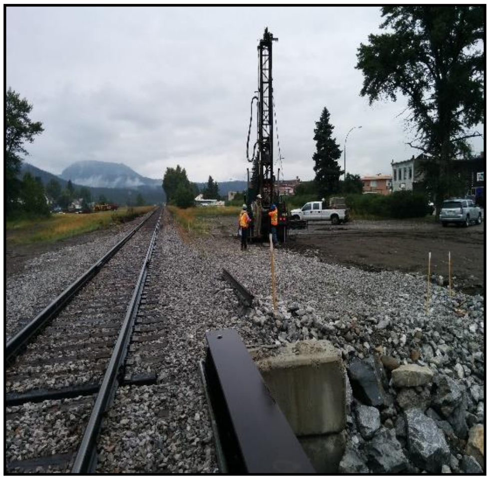
In addition to the conventional geotechnical engineering work, AATech has established itself as a leader in many fields of specialized engineering services involving modern state of the art data acquisition and testing capabilities:

- Fully automated geotechnical instrumentation with remote sensing and wireless data transfer
- Static testing of foundation piles, including traditional head-down and bidirectional testing, with a full range of instrumentation for detailed resistance distribution.
- High-strain dynamic testing of foundation piles (PDA)
- Pile integrity testing using low-strain sonic echo (PIT), cross-hole sonic logging (CSL), and thermal integrity profiling (TIP) with infrared probe or embedded sensors.
- Calibration of loading systems up to 1,000 tons at our testing facility in Ottawa, Ontario.
- Ground-penetrating radar (GPR) for soil characterization, and other services.

ASI is also active in research and development, resulting in many technical publications. Our engineers stay on top of the evolving industry by adapting new technologies, software and electronics to advance geotechnical engineering services. We also encourage continuing education and innovation within the company to provide our clients with the best possible service.

AATech Scientific Inc. is focused on working with its clients to provide complete geotechnical solutions that are both adequate and economical. We are committed to client satisfaction and our ever-growing list of returning clients is a proof of our commitment.

Site Investigation Services



Our engineers have acquired extensive experience in North America and overseas, performing site work related to the design and construction of major facilities. We have provided services in remote areas and harsh site conditions, where our crews had to adapt to the work environments, using portable equipment and wireless devices, along with ingenuity and innovation. We have been retained for investigation and consulting on challenging cases, including slope stabilization and remediation of failed slopes, construction on extremely sensitive soils and soft organic deposits, etc.

Our site services include but are not limited to:

- Subsurface investigation and consulting
- Site characterization and improvement
- Vibration monitoring
- Construction supervision, materials testing, and quality assurance

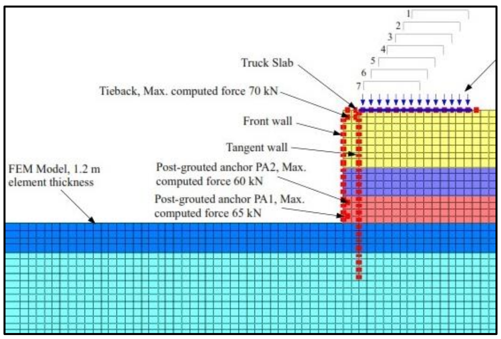
Geotechnical and Foundation Consulting Services

Our engineers have been involved in design, consulting, inspection, and problem solving for hundreds of projects across the North American continent and overseas, including embankments, unstable slopes, ports, bridges, oil exploration structures, high-occupancy residential, factories, parking structures, etc., often in challenging condition where bedrock and competent soils are nonexistent or deep below the ground surface. The diversity of hydro-geological conditions, foundation types, loading conditions, and geotechnical problems we have encountered across the distant geographical boundaries of our involvement, makes for a unique knowledge database. This gives us an edge in recognizing potential difficulties at project sites and in applying advanced solutions for more economical and safer designs.

Along with designing and implementing geotechnical structures and foundations from the basic type, all the way to the most complex design projects, AATech can provide a complete package of testing, instrumentation and inspection of the built product, using the latest technologies available in the industry. In addition, AATech provides experienced and certified engineers and technicians for quality assurance, quality control, site inspections and materials sampling and testing.

Geotechnical Stability and Settlement Analyses

Stability and settlement are at the core of geotechnical engineering, and can be a challenging problem to many practicing engineers. Whether the situation involves natural slopes and erosion, artificial landscapes, earth pressure on retaining structures, effects of excavations and fills, or a multitude of other situations, each problem has unique circumstances and nature and must be addressed on its own merit. Diversified experience, proper tools, and innovative thinking are key to adequate and economical solutions to such geotechnical problems.



AATech has a team of experienced engineers and a set of powerful tools to address, identify, remediate and solve stability and settlement problems. Our engineers have extensive experience in analysis and design of geotechnical structures, including foundations, slopes, excavations, fills, embankments, retaining walls, shoring, marine and other geotechnical structures using state of the art analysis and design software spanning from simple limit equilibrium and bearing equations to multi-dimensional Finite Element analysis using stress-deformation-consolidation models. With such powerful tools and diversified experience over hundreds of projects, our engineers can accurately predict soil behavior and can offer complete solutions including cost saving design alternatives.

Geotechnical Instrumentation and Monitoring

Automated instrumentation is a fast-growing industry that is quickly becoming an essential part of the geotechnical engineering practice. With relatively low cost, reliability, and versatility, automated instrumentation is becoming the key to economical, safe, and predictable solutions for most geotechnical problems. The versatility of automated instrumentation lies in the following advantages:

- Programmable instrumentation can collect data far more frequently, and with less potential for errors, than a surveying crew or an instrumentation technician. It therefore provides more reliable and more representative data.

- For long term monitoring, programmable datalogging is far more cost effective than manual readings, especially during frequent collection requirements

- Programmable instrumentation continues data collection during extreme weather events when the monitored conditions are critical and manual readings are impossible.

- Modern instrumentation allows for remote data retrieval through various modes of telecommunication, which eliminates the need for traveling to remote sites. This also allows project engineers to retrieve the data directly which results in quick analysis and interpretation.

AATech's engineers have installed state of the art instrumentation on many sites for monitoring parameters such as pore water pressure, settlement, slope movement, stresses in structural support members, strain profile in tested piles, and other engineering parameters. Some of these installations are routinely monitored from our main offices, thousands of kilometers away from the site. We also provide consulting on major instrumentation projects such as bridges, dams and tunnels.

AATech also designs and manufactures instrumentation systems for specialized monitoring situations and modifies other systems to adapt to specific problems as needed by clients.

Deep Foundations

Deep foundations belong to a highly specialized industry. AATech is a leading company in design, testing, and inspection of driven piles, drilled shafts, caissons, rock anchors, driven screw piles, micropiles, and other foundations.

In addition to its group of highly qualified engineers and the latest design software and tools, AATech has state of the art electronic equipment for testing driven piles for capacity and stress, monitoring the performance of driving equipment, testing the integrity of driven and cast in place piles and shafts, and semi-automated static load testing. AATech's engineers have built up a wealth of experience in acquiring and interpreting test data on projects worldwide, with over 10,000 tests performed. The strength in foundation testing and interpretation, along with versatile and economical foundation design, positioned AATech Scientific Inc. as one of the leaders in deep foundation engineering.

High-strain PDA testing of driven piles and caissons

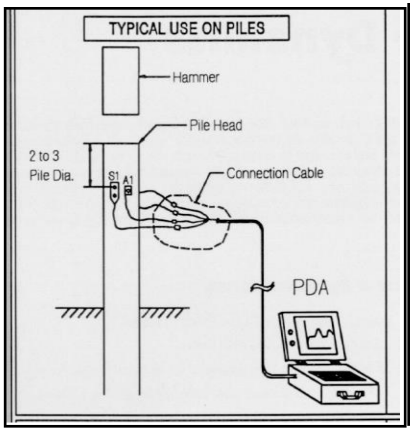
Dynamic testing is not expensive but problem foundations are. All construction depends upon a firm foundation. With the use of deep foundations more thorough and reliable inspection methods are essential. Traditional pile testing methods have serious drawbacks; energy formulae are dangerously unreliable, while static load tests can be expensive, time consuming and in many cases physically impossible to conduct. The need for cost effective quality assurance has been widely acknowledged. Dynamic testing has satisfied this need as evidenced by a rapidly growing number of specifications and test standards, resulting in worldwide routine and comprehensive dynamic testing programs.

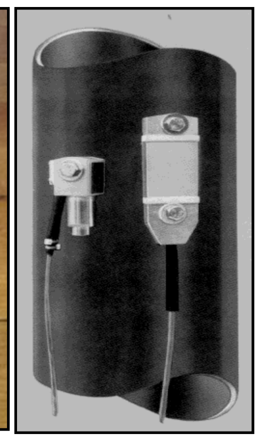
The Pile Driving Analyzer (PDA) uses signals from reusable strain and acceleration transducers which are quickly bolted or anchored to steel, concrete or timber piles, or to drilled shafts.

PDA utilizes closed form solutions to wave propagation theory to solve the following:

- hammer performance to qualify pile driving equipment
- activated bearing capacity during driving, or later at restrike to include time dependent soil strength changes
- driving stresses to investigate potentially damaging situations, and assess effects of changes to the driving system
- structural integrity of pile shaft

The following illustrations show the dynamic testing system and apparel:





Schematic of PDA testing system PDA unit Reusable gauges

Static loading test of piles and caissons

Traditionally, static loading was the most common way of testing pile foundations. There are several accepted procedures to set-up and perform static loading tests, which are explained in detail in corresponding ASTM standards for compression, tension, and lateral testing, in addition to anchor and tie-back testing, which are described in documentations by the Post-Tensioning Institute. ASI's engineers have developed automated testing systems and data acquisition software to eliminate human errors and to increase the reliability and accuracy of measurements in load testing. With our specialized in-house expertise and advanced technology, we can perform tests of high complexity while capturing applied loads and displacements at high frequency (complete reading of load and displacement gauges every second) and exceptional accuracy. ASI's Engineers have performed over hundred tests in North America and overseas, including the design of high-load reaction frames and specific testing adapted to special site conditions.

Bidirectional loading test

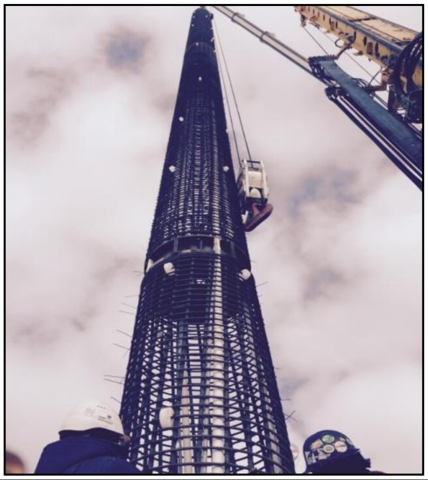
By using bidirectional (BD) loading test, we can simultaneously and independently capture both the pile's end-bearing and shaft resistance. This is achieved by installing a sacrificial hydraulic bidirectional cell into the test pile prior to its installation. Digital gauges, or mechanical telltales are used to measure the bidirectional cell expansion and pile toe displacement. Vibrating-wire strain gauges can be embedded into the concrete or attached to a steel shaft to measure the forces in the pile. These can be read simultaneously with the load and other displacements using advanced specialized datalogging technology

Benefits of Bidirectional loading test

- High capacity tests
- Savings in cost and time
- Simultaneously capture both end bearing and shaft resistance

- Elimination of a reaction beam / reaction pile system
- Safer as the loads are being applied underground instead of at the pile head
- Measures the actual resistance at the cell level overcoming the residual load uncertainty encountered in traditional head-down tests.

ASI engineers have developed efficient loading and control systems. ASI builds complete BD Cells with upper and lower plates customized for the test pile and we ship to the site ready for installation, thus reducing the fabrication work by the contractor. ASI also developed specialized state-of-the-art datalogging and control systems for robust simultaneous measurement of all instruments. In addition to our superior products and systems, ASI's main strength is in its background as a foundation engineering specialist for many years with a stellar track record in designing, inspecting, and consulting for major deep foundation projects across North America and overseas. As a result, we tailor our analyses and reports for the use of design engineers with clear and detailed graphics and provide full support before and after testing to ensure seamless implementation of the test results.






Structural integrity testing of piles and caissons

Where deep foundations are required, loads must be carried safely by the pile or caisson shaft. During installation piles may be damaged due to high stresses. Bored or augured shafts may suffer from separation of concrete, necking, inclusions, voids, etc. driven concrete piles may also be damaged during installation. AATech Scientific provides three state-of-the art non-destructive methods for testing the structural integrity of concrete piles, drilled shafts, and caissons. Two of the methods use the sonic wave propagation theory to detect changes in concrete quality, voids, soil intrusions, and other defects. The third method uses thermal profiling of the pile during concrete hydration to investigate the integrity of the pile.

Low-strain pile integrity testing (PIT)

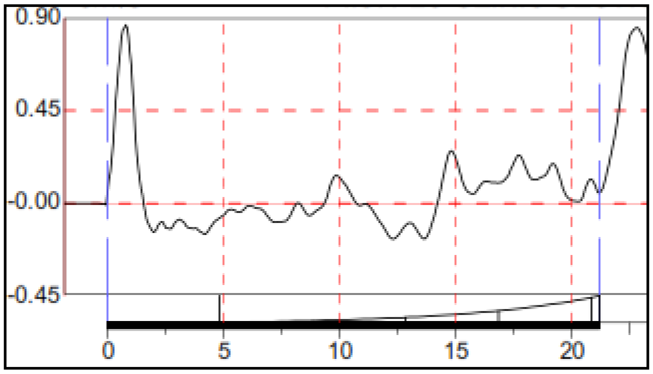
For today's deep foundation industry, this inexpensive and reliable non-destructive test for pile integrity offers a practical and cost-effective solution.

Low strain testing is used for rapid testing of a large number of concrete piles or drilled shafts, and in some cases steel and timber piles, at minimal cost. Low-strain tests are performed with a small impact device (hand-held hammer), a sensitive accelerometer, and a Pile Integrity Tester (PIT). The accelerometer is easily attached to the pile top using a viscous material. Low-strain compressive impact waves are generated by tapping the pile top with the hammer. When the downward traveling compression wave encounters a change in cross section or in concrete quality, it generates an upward traveling tension wave, which is observed later at the pile top. The time of arrival of the reflected wave is used to estimate the location of the damage.

The PIT technology was also used successfully in other applications. One application was to determine the length of existing piles and sheet piles using the toe reflection and the material-specific wave speed.

The following figures show the PIT system and sample data:

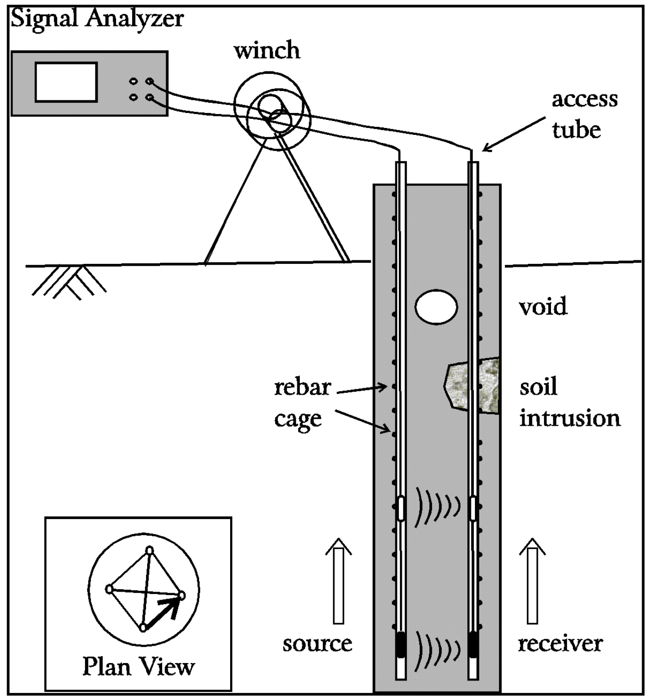
PIT – X system



Sample PIT data

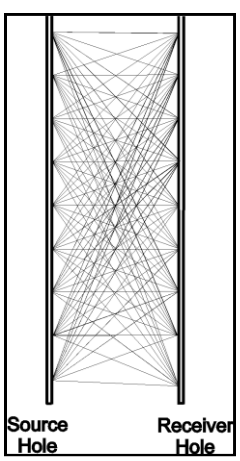
Cross-hole sonic logging and tomographic imaging

AATech Scientific Inc. provides a complete arsenal of hi-tech tools to locate and map problem areas within drilled shafts or caissons. This line of inspection and testing uses the PILELOGs - Full Waveform Crosshole Sonic Logging (CSL) System and Pile Dynamics CHAMP-X Crosshole Sonic Logging (CSL) system.



The Crosshole Sonic Logging (CSL) method is designed for logging of drilled shaft foundations and slurry walls between water-filled plastic or steel tube pairs. This test is developed to provide a comprehensive in-situ evaluation of the newly placed concrete.

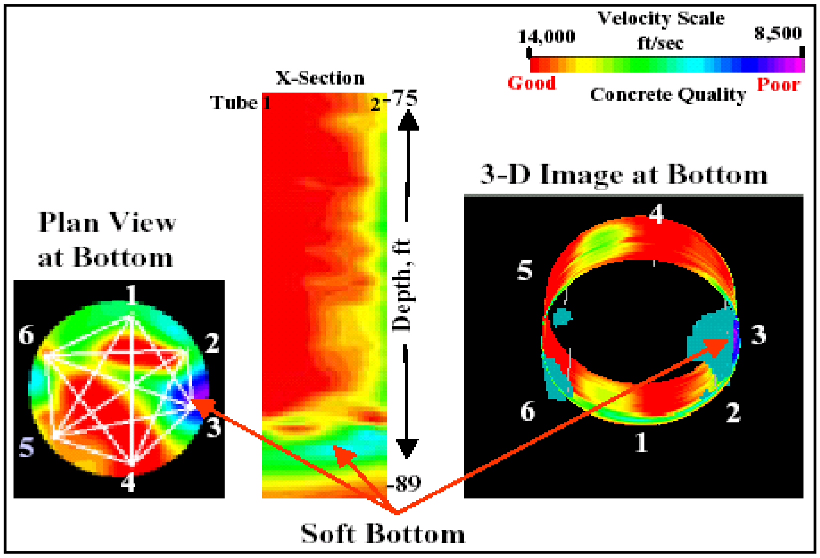
In the CSL test, ultrasonic transmitter/ receiver probes are initially lowered to the bottom of a pair of access tubes. The two probes are then pulled simultaneously as to maintain near horizontal paths between them. Our system is calibrated to measure the sonic wave field at every 5 cm (2.4 in) depth intervals throughout the length of the shaft. Thus, a near continuous "sonogram" display is obtained between any tube pairs. This test is repeated for all test paths along the outer perimeter as well as across the inner diagonal of the shaft. The data collected between a given pair of tubes is plotted for a full waveform sonic display of the data. Good concrete condition will result in a near continuous vertical alignment of the data. Longer travel times and lower signal levels characterize anomalous zones, due to soil intrusions or voids.



One of the CSL applications is Crosshole Sonic Logging Tomography (CSLT). This technique is an inversion procedure that provides for two-dimensional and three-dimensional velocity (or attenuation) images between drilled holes from the observation of transmitted first arrival energy. This method can be used for imaging underground structures as well as delineating internal flaws in man- made structures such as buildings, bridges, slurry diaphragm walls, and dams.

Tomography data collection involves scanning the region of interest with many combinations of source and receiver depth locations (see illustration on the right). Typically, the receiver is held at the bottom of one hole and the source is moved in the opposite hole from the bottom to the top.

The receiver is then moved to the next depth location and the test procedure is repeated until all source-receiver combinations are incorporated. A typical 3-D tomographic image is shown in the illustration below



Thermal Integrity Profiling (TIP)

Thermal Integrity Profiler (TIP) testing is performed by means of an infrared probe that is lowered in access tubes around the perimeter to measure the temperature of the concrete at regular depth intervals. Alternatively, Thermal Wire® cables embedded in the concrete and Thermal Acquisition Ports (TAPs) can be used. The Thermal Wire cables consist of temperature sensors spaced every foot along the delivered length of a wire. For drilled shaft, Thermal Wires are attached symmetrically along the full length of the shaft's reinforcement cage prior to cage placement. Once the cage is set and concrete placed, a TAP box is attached to each wire, and data acquisition begins.

During the curing of the concrete, the hydrating cement generates heat, increasing the temperature in the shaft. Every 15 minutes the TAP units automatically record the measured temperature at each sensor location along the length of the wire, generating a profile of temperature versus depth at each increment of time. After the concrete peak temperature has been achieved, the TAP is connected to a TIP processing unit and the data is downloaded for further interpretation. The infrared probe performs a similar task by reading the temperature profile around the concrete peak temperature.

The TIP results may be evaluated for shaft shape and integrity, concrete quality and for location of the reinforcing cage. The overall average temperature for all readings over the embedded depths can be directly related to the overall volume of concrete installed. Shaft integrity may be assessed based on the average temperature measurements from each Thermal Wire or access tube at each depth increment. If the measured average temperature versus depth is consistent, the shaft is considered to be of uniform shape and quality. Bulges can be identified as localized increases in average temperature, while insufficient concrete quality or section reductions can be identified as localized decreases in average temperature. Anomalies present over more than ten percent of the effective cross-sectional area are normally seen in multiple Thermal Wires or access tubes at the same depth. Because soil and/or slurry pockets produce no heat, areas of soil intrusion or inclusion are indicated by lower local temperatures. Reinforcement cage location can be estimated based on the relative difference between an individual Thermal Wire or access tube and the average of all wires/tubes.

Higher individual temperatures indicate the wire/tube is closer to the center of the pile, or near a local bulge, while lower individual temperatures indicate the wire/tube is closer to the soil-shaft interface, or a local defect. By viewing diametrically opposite measurements, instances where a lateral shift of the reinforcing cage has occurred can be determined if one temperature is higher than average and the diametrically opposite temperature is lower than average.

Equipment Rental and Calibration Services

AATech Scientific Inc. (ASI) has a workshop with a testing frame that is capable of testing jacks and load cells up to 1000 tonnes, with hydraulic pumps and pressure gauges to 10,000 psi. We calibrate load cells and hydraulic jacks in accordance to ASTM D5720-95. ASI also provides rental of load cells (ranging capacity from 50 tons to 1000 tons) and hydraulic jacks (ranging capacity from 100 tons to 1000 tons). Please contact the Head Office in Ottawa for more details regarding our rental and calibration services.

Details of Selected Projects

Suncor MSE Wall, Fort McMurray, AB, Canada (2013-2017)

AATech Scientific Inc. (ASI)was retained to design and supervise the construction of retaining Wing Walls for the MSE “C” wall. ASI proposed a tangent wall design using rock socket concrete piles with a 1220 mm pipe casing and a concrete wall tie back. Our inspectors supervised the pile installation and preformed concrete testing and cylinder casting to ensure the concrete met the design specifications.

MSE Front Wall and Wing Wall

AATech Scientific Inc., was retained again later to design the replacement of MSE Main Walls A, B, and C, and supervise their construction. ASI proposed 762 mm concrete socket soldier piles with concrete panels and ground anchors tiebacks. ASI was also retained to investigate the stability of MSE Walls. Slope stability analysis was conducted using GSLOPE software and the best stabilization measure to implement was determined. Piezometers were installed into the face of previous MSE Walls to monitor drainage and give advance notice of water head rise in the fill. A programmable datalogger was installed at the top of each wall to allow piezometer data to be collected in real time.

Walterdale Bridge Replacement, Edmonton, AB, Canada (2013-2015)

The Walterdale Bridge Replacement Project consists of the construction of a new bridge across the North Saskatchewan River in downtown Edmonton, to replace the existing 100+ year old steel truss bridge. The new bridge is a landmark structure consisting of an arch steel superstructure that is supported by four massive concrete thrust blocks that are anchored into the bedrock with post grouted micropiles. AATech Scientific Inc. provided professional expertise in the design, inspection, and instrumentation of four cofferdams to allow the construction of the thrust blocks.

The project required the cofferdams to be 14x15m, 16-18m deep, and have clear working spans of the excavation footprint. Due to the space restrictions, ASI's proposed design consisted of driven sheet pile walls embedded into the bedrock with steel wale braces installed as ring structures around the excavation perimeter to provide support. A geotechnical finite element model (FEM) was established to determine the lateral earth pressures, porewater pressure, and lateral defections. This provided structural loads to be applied to the wale bracing system that was analyzed in SAP2000. As excavation of the cofferdams progressed, a monitoring system consisting of vibrating-wire strain gauges, inclinometers and piezometers were installed at points of interest (that was provided in the SAP2000 analysis). The monitoring system collected continuous data until the backfilling of the cofferdams were completed. The data was remotely collected, analyzed and compared to the expected design values in order to determine the stability of the shoring structure. The monitoring showed that the shoring system performed with the design matching the expected. The monitoring finished with the final cofferdam being backfilled to original grade after completion of the thrust block foundations.

As the project progressed, ASI was retained to provide additional services. Other services provided on this project included additional designs and monitoring, PIT and PDA testing, vibration monitoring, and analysis.

ASI was involved in the design/testing/monitoring of foundation piles for the primary temporary support towers hoisting the bridge arches, shoring for one of the abutments, the temporary winch anchor points for the navigation of the primary barges carrying the main bridge arches down the North Saskatchewan River, and several formwork systems for the construction of the approach abutments, thrust block, and other concrete structures.

Our Engineers were on site to preform Pile Integrity Tests on several piles and a thrust block to check for any anomalies or defects. We also preformed PDA testing on several piles for the temporary towers, and Vibration monitoring to determine the safe distance where newly cast piles would not be affected from a vibrating hammer.

ASI provided slope stability analysis and remediation/ground improvements for high risk areas where the primary lifting cranes approach the river banks.

CNRL Hydrotreaters and TR Project, Fort McMurray, AB, Canada (2012-2013)

AATech Scientific Inc. was retained for CIP inspection, conducting static load tests, and preforming PIT for both projects. The TR Project also required a shoring design from ASI before later stages of piling could continue. AATech Inspectors supervised the installation of hundreds of piles on the project sites and conducted daily concrete tests and cylinder castings to ensure that the concrete was meeting project standards. AATech Engineers later performed one of the largest static load tests in the oil sands area (~17,000 kN) and PIT on previously selected production piles. Our engineers preformed numerous compression, lateral, and tension tests throughout the duration of the project.