



DID YOU KNOW?

The Caravan Bridge in Izmir, Turkey is the oldest known bridge still in use today. The bridge dates back to 850 BCE and runs over the Meles River.

Safe and Accurate Measurement with the Static Load Testing System by Jorge Beim

Static Load Testing (SLT) is used to evaluate the behavior of deep foundations prior to structure construction, and tests the foundation's axial compression or tension behavior or its deflected shape under a lateral load. In North America, static axial compression tests are standardized based on ASTM D1143 (originally approved in 1950). There are numerous codes from around the world, however that specify the different allowable static load test procedures (Quick, Maintained, or Constant Rate of Penetration). Other pertinent ASTM codes are D3689 for static axial tensile loads and D3966 for lateral loads.



SLT Acquisition Boxes daisy-chained (yellow cables) with smart analog sensors connected (blue cables). The Master Box is connected to a PDI Tablet using the longer yellow Main Cable.

Traditionally, SLT readings were done manually—personnel would get close to the load application device at each loading increment to visually observe and record the jack pressure, load cell, and displacement readings. Those readings were later manually transferred to graph paper (or more recently to a computer spreadsheet) to generate the report. This approach posed safety risks for personnel and potential transcription errors. The advent of the digital era made the use of data loggers a natural choice.

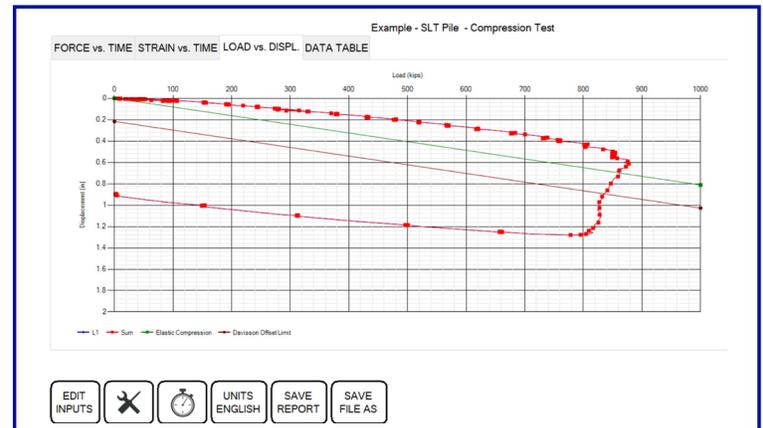
Although several such systems were available on the market, the vast majority were general purpose data loggers adapted for SLT use. GRL Engineers has been performing static load tests for years. Overtime it felt the need for a customized system, to be designed and built according to its exacting specifications. Pile Dynamics accepted the challenge. In 2017, the first SLT units were produced. The system's performance and user-friendliness continues to receive high praises. GRL Engineers and other PDI clients have noted that the system incorporates new useful features and extensions.

The SLT System consists of a Data Acquisition Box placed close to the pile being tested. The box has twelve analog and four digital inputs. Frequently, additional boxes are "daisy chained" together if more channels are needed, such as for a multitude of embedded strain gages. Each Data Acquisition Box is powered by an Ni-MH battery that lasts more than 24 hours, or by any available 110/220 V AC source. The system uses PDI's proven Smart Gage plug and play technology to automatically detect the sensor's type and calibration factor, which makes it much easier and quicker to set up the system in the field saving many hours of setup time.

Load, Strain, Displacement, Pressure, Tilt and other measurements can be made with supported sensor types such as digital transmission,

analog voltage, resistance and vibrating wire gages. New sensor types can be added as needed. The data is read at user-adjustable intervals (minimum of five seconds) and can either be immediately sent to a processing device or saved in local memory until it is requested by the processing device. Signal transmission to the processing unit can be accomplished by either cable or wireless communication, having a range of at least 100m (330 ft). Also, the data can be sent to a cloud server in real time.

The processing device can be a PDI Tablet, or any PC running Windows® 10. There are two versions of the data processing program available including the full-featured SLT-Professional, with real-time graph and table capability, and SLT-Standard, used for setting up acquisition box(es), collecting data, and saving it in a text or Microsoft® Excel format.



Load vs Displacement report on a recent Static Load Test

SLT-Standard and SLT-Professional Features

- Data is automatically saved in text format for reprocessing using a spreadsheet program or directly in a Microsoft® Excel format if available on the data processing device
- Sensors automatically zero at beginning of test, or can be individually zeroed at any time by the operator
- Conversion of strain to load using user-adjustable Elastic Modulus and Area
- Conversion of pressure to load using user-adjustable jack calibration
- User-adjustable collection rate and number of intermediate points
- Can be operated remotely using Site-Link® technology
- Provides three general-use timers and calculates the Load and Displacement rate of change per second, minute or hour

SLT-Professional Additional Features

- Real-time graphs with autoscaling: Force vs. Time, Strain vs. Time, Load vs Displacement (with Elastic Deformation and several built-in and/or user adjustable criteria offset lines)
- Complete raw data saved for reprocessing
- Sensors save strain gage locations along the length of the pile
- Easy reading of data saved in the Acquisition Box(es) and merging of SLT data files for the same test
- Field-generated report saved in jpg and pdf format
- Will send data to a Cloud Server in real time when an Internet connection is available in the field, or after completion of test from an internal database



GRL performed a SLT with GRL's 500 ton frame on a 30-inch (76.2cm) open-ended pipe pile for the Calcasieu Pass Liquefied Natural Gas (CPLNG) project.

SLT Test on Calcasieu Pass LNG, Cameron, LA

On August 15, 2019, seven days after the test pile was driven, GRL Engineers completed a Static Load Test with their 500 Ton SLT frame on a 30-inch (76.2cm) open-ended pipe pile for the Calcasieu Pass Liquefied Natural Gas (CPLNG) project in Cameron, Louisiana. The SLT System was used to capture the readings for one Vibrating Wire (VW) pressure gage, one resistive strain load cell and four digital dial indicators for displacement measurement. Data was collected at a rate of one scan every five seconds and graphed every 30 seconds for a total of approximately three hours. The live graph feature with the plotted Davisson Failure Criteria was utilized throughout the test, especially when the pile started to creep and eventually plunge. Within 30 minutes of completion of the load test, the load versus displacement graph was transmitted to the client for review. To learn more, visit www.pile.com/products/slt.



7Seventy7 Apartments project in Milwaukee, WI.

GRL Engineers Nominated for Top Projects Award

Up for the Top Project Award, GRL Engineers, Inc., has been recognized for the contributions made during construction of the 7Seventy7 apartments in Milwaukee, WI. In 2016, engineers Van Komurka and Travis Coleman performed static load testing, pile driving analysis and APPLE testing with GEI Consultants. GRL was brought on to monitor hammer performance and driving system, calculate the pile driving stresses, assess the integrity, and evaluate the bearing capacity.

Five production piles were dynamically tested during initial driving, between April 18 - April 21, 2016. These piles consisted of 60.1 to 60.3 foot (18.32 to 18.38m) long pile sections, which were spliced either once or twice to form piles with final driven lengths of approximately 120.3 to 180.3 feet (36.67 to 54.96m). The close-ended-piles had a 16 inch (406mm) outer diameter with a 0.5 inch (12.7mm) wall thickness. Soil conditions on-site ranged from loose to very dense sand and gravel fill extending from ground surface to depths of approximately 102 to 152 feet (31.1 to 46.3m). Based on the analyses performed, the average maximum compression measured near the top of the pile ranged from 33.3 to 37.2 ksi (230 to 257 MPa) at the end of initial driving. No pile damage was detected below the gage location by the dynamic test records. CAPWAP® capacities for three of the piles were 628, 661 and 779 kips (2800, 2950 and 3475 kN). The engineers were able to provide quantifiable data for the high-rise from the APPLE, SLT and PDA testing and analyses performed.

GRL Engineers Welcome Christy Bugher

GRL Engineers, Inc. welcomes the newest addition to its team, Christy Bugher. A recent graduate from the University of Delaware, Christy focused on geotechnical engineering in her studies. She received her Bachelor of Civil Engineering in 2016, and her Masters in 2019. During her studies,



Bugher worked for the Delaware DOT in a bridge management co-op. There she conducted and reviewed in-field inspections on bridges, dams, and culverts, identified bridge elements and recorded defects. Additionally, Christy has experience with inspections and testing services for concrete, masonry, reinforcing, and backfill compaction using a nuclear density gage, as well as geotechnical field exploration and analysis on ground penetrating radar and seismic resistivity tests.

Upcoming Events

Complete list of events available at www.pile.com/pile-events/

September

- 11: **Seminar:** Deep Foundation Integrity Testing and Wave Equation Analysis in Cleveland, OH ([Link to register](#))
- 12-13: **Workshop:** High Strain Dynamic Foundation Testing Workshop and Proficiency Test in Cleveland, OH ([Link to register](#))
- 29: **GEO St. John's** Newfoundland and Labrador, Canada

October

- 15-18: **44th Annual Conference on Deep Foundations** Chicago, IL
- 17: **Workshop:** Rammen-Schlagzahlen-Tragfähigkeit und GRLWEAP; Hamburg, Germany ([Link to register](#))
- 20: **Webinar:** Quality Control of Drilled Shafts with Dr. Brent Robinson (*Details Forthcoming*)

November

- 04-07: **STGEC Conference:** Chattanooga, TN
- 05-06: **DICEP:** Cleveland, OH
- 10-14: **GeoMEast 2019:** Cairo, Egypt
- 11: **Seminar:** State of Practice- Quality Control of Deep Foundations in Miami, FL ([Link to register](#))
- 13: **Seminar:** State of Practice- Quality Control of Deep Foundations in Tallahassee, FL ([Link to register](#))
- 14-16: **DFI India 2019:** Telangana, India
- 15: **Seminar:** State of Practice- Quality Control of Deep Foundations and Proficiency Test in New Orleans, LA ([Link to register](#))
- 17-20: **XVI Panamerican Conference:** Cancun, Mexico

December

- 03-05: **Webinar:** Integrity Testing of Concrete Foundations by Low Strain Dynamic Testing, Cross-Hole Sonic Logging and Basic Principals of Thermal Integrity Profiling with Ryan Allin ([Link to register](#))
- 10: **Webinar:** Pile Driving Hammer Performance with Dr. Frank Rausche ([Link to register](#))
- 17: **Webinar:** Load Testing and Quality Control with Ryan Allin ([Link to register](#))
- 19-21: **Indian Geotechnical Conference:** Surat, India



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