Carleton Laboratory
COLUMBIA | ENGINEERING

Applied Materials Testing

MISSION STATEMENT

The Carleton Laboratory is dedicated to the testing of materials and structures for education and for basic and applied research. The Laboratory has a threefold aim in its principal operations covering materials and structural testing. First and foremost, it will provide a rich teaching facility for educational support of students at the undergraduate and graduate levels including MS courses and Ph.D. and Eng.Sc.D. research support. A second objective is the conduct of research which contributes to fundamental knowledge but at the same time can have practical application to the infrastructure and to the built environment in general. A third part of the mission is in support of the City of New York and the country by conducting specialized laboratory and field testing as needed, especially for non-routine applications.

FACILITY OVERVIEW

The Robert A.W. Carleton Strength of Materials Laboratory is the central experimental research facility of the Department of Civil Engineering and Engineering Mechanics at Columbia University. It occupies an area of 24,000 square feet (2200 m^2) and is equipped for testing of all types of engineering materials, structural elements, structural models, damage detection, fatigue, vibrations, distributed wireless sensor networks, etc. Five full-time staff members, who specialize in applied industrial materials testing, enable the Laboratory to collaborate with industry partners on specialty projects. The facility is outfitted with a 30'×100' (9×30 m^2) strong floor to allow the testing of full-scale structural elements, a cementitious materials laboratory, a geotechnical centrifuge, a hydrology laboratory, as well as a structural dynamics laboratory with multiple shake tables.

DIRECTOR
Adrian Brügger, Ph.D.
MANAGER
William Hunnicutt, Ph.D.

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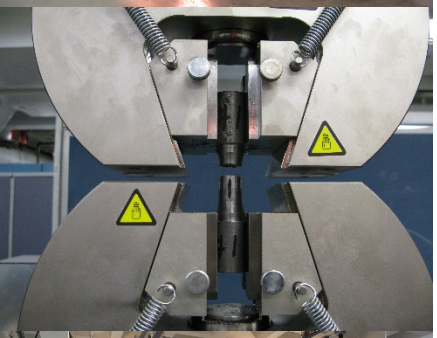


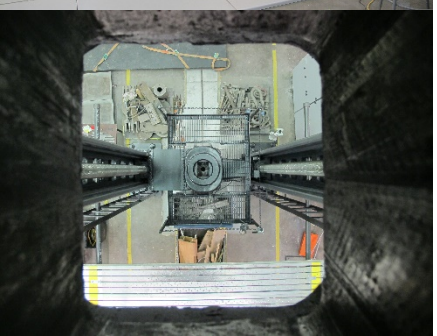

STRENGTH OF MATERIALS & STRUCTURES TESTING

The Carleton Laboratory is accredited to ISO/IEC 17025:2017 by A2LA under Certificate #5617.01. Please contact laboratory management for a complete scope of testing accreditation.

The Laboratory maintains a full fleet of structures and materials universal testing machines [UTM]:

- Instron 5984 150 kN (34 kip) UTM
- Instron 600DX 600 kN (135 kip) UTM
- Instron 1500HDX 1500 kN (337 kip) UTM
- MTS 15 kN (3 kip) Dynamic UTM
- MTS 30 kN (7 kip) UTM
- MTS 100 kN (22 kip) Dynamic UTM with Furnace
- MTS 220 kN & 2880 Nm Dynamic Axial-Torsion UTM
- MTS 1 MN (220 kip) Dynamic UTM
- MTS 250 kN (55 kip) Dynamic Structural Actuator
- MTS 500 kN (110 kip) Dynamic Structural Actuator
- Southwark-Emery 3 MN (600 kip) UTM
- MTS/ANCO Hydraulic Shake Table

National Instruments PXI data acquisition systems with approximately 1000 A/D acquisition channels ranging from voltage, strain, current, temperature, to ICP coupled acceleration are available as well. The abovementioned systems are calibrated and serviced for ASTM compliance and NIST traceability.

ENVIRONMENTAL TESTING & AGING

- Full-Scale Bridge Cable for Corrosion and Fire Testing
- CCT 1100 Q-FOG Cyclic Corrosion Tester
- Q-UV Ultraviolet Wear Chamber
- Schleibinger Freeze-Thaw Tester

MATERIALS CHARACTERIZATION

- LECO Hydrogen Analyzer (Diffusible and Total H)
- SPECTRO Spark Optical Emissions Spectrometer (OES)
- HAAKE Mars Rheometer
- TA Instruments 18 N Dynamic Mechanical Analyzer
- TA Instruments Vertical Dilatometer
- TA Instruments TAM Air Isothermal Calorimeter
- TA Instruments Q50 Thermogravimetric Analyzer
- Wilson/Rockwell Hardness Tester
- Keyence VHX-5000 Digital Microscope
- FLIR SC8300 HD Infrared Camera

MACHINE SHOP

The Carleton Laboratory Machine Shop is designed for precision heavy-duty ferrous and non-ferrous machining to support the organization's testing mission. The machine shop is outfitted with a full assembly of heavy machine tools:

- Haas CNC Mill & Clausing CNC Mill
- Bridgeport Vertical Mill with Acu-Rite DRO
- Clausing Colchester 15" Lathe with Acu-Rite DRO
- Browne & Sharpe Reciprocating Precision Grinder

The Carleton Laboratory continues to expand its capabilities and is investing in new testing systems to meet evolving research and industry demands.

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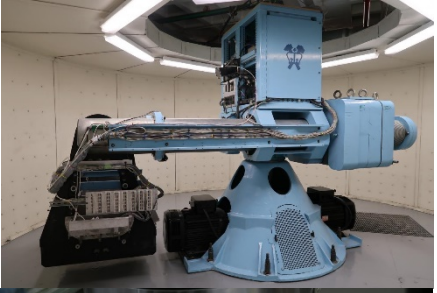





TESTING STANDARDS

The Carleton Laboratory is accredited to ISO/IEC 17025:2017 by A2LA under Certificate #5617.01 and an Organizational Member of ASTM International. The Laboratory has a rich history of supporting the New York engineering community with specialty testing services.

Previously performed standards include but are not limited to:

- AASHTO: M306, T240, T324, TP63
- ACI: 355.4, 440.3R
- ANSI: MH16.1, 77, SC100-5/05, Z359
- ASTM:
  - A48, A90, A239, A262, A370, A416, A536, A586, A615, A751, A931, A956, A1034, A1061
  - B117
  - C39, C67, C140, C301, C469, C473, C666, C881, C882, C884, C900, C1028, C1314, C1354, C1512, C1551, C1587, C1609
  - D570, D638, D648, D695, D2084, D2556, D2584, D3039, D3171, D4501, D5117, D7205, D7264, D7617, D7705
  - E4, E8*, E23, E83, E112, E165, E228, E322, E350, E415, E488, E1058, E1085, E1251, E1512, E1820, E1922
  - F606, F1055, F2192
  - G77, G176
- AREMA: CH-30
- CI: 1500, 2100
- ISO: 2417, 3690
- ITM: 1019, 1059
- MIL-STD: 2159
- NCHRP: Report 534
- NASM: 1312
- NYCBC: 615, 1713, 1714
- NYS: 709

MTA, NYCDOT, NYCBC, CDOT, ConEdison Prequalified Testing Laboratory

The lab management is happy to discuss your testing needs with you, especially if the test in question must adhere to a specific industry standard. Only test methods marked with * are A2LA accredited services, please contact lab management to discuss adding services to our accreditation scope.

FIELD INSTRUMENTATION CAPABILITIES

The Carleton Laboratory boasts extensive field instrumentation and analysis capabilities, both for static and dynamic applications. The Laboratory's areas of expertise encompass the following instrumentation types, for both a short and extended periods of time:

- Static and dynamic strain instrumentation of large civil structures
- Multi-point autonomous GPS-synchronized triaxial acceleration instrumentation
- Multi-point differential GPS displacement instrumentation
- Modal analysis of large civil structures, including natural frequencies, mode shapes, and damping estimations
- Low and high-amplitude vibration sensing, from DC to high frequency
- Live threshold detection and alarm systems for sensitive areas

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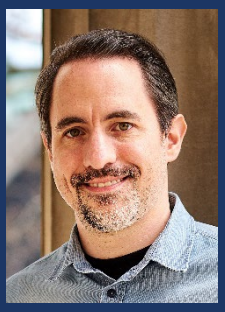
People



Adrian Brügger, Ph.D. – Director
Experimental mechanics of materials, structural health monitoring and damage detection, bridge cable corrosion, engineering materials neutron diffraction
B.S., 2004, Civil Engineering, Columbia University
M.S., 2005, Civil Engineering, Columbia University
Ph.D., 2017, Civil Engineering, Columbia University

William Hunnicutt, Ph.D. – Manager
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B.S., 2011, Civil Engineering, Iowa State University
M.S., 2013, Civil Engineering, University of Illinois at Urbana-Champaign
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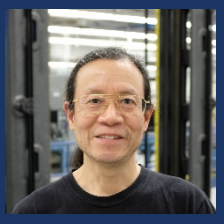

Liming Li, Ph.D. – Associate Research Scientist
Geotechnical, geo-environmental, and earthquake engineering
B.S., Civil Engineering, Southwest Jiaotong University, China
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Freddie Wheeler, Jr. – Senior Laboratory Engineer
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B.S., 2015, Mechanical Engineering, Polytechnic Institute of NYU
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Jamie Basirico – Senior Laboratory Technician
CAD/CAM, CNC & Manual Fabrication

Management curriculum vitæ available upon request

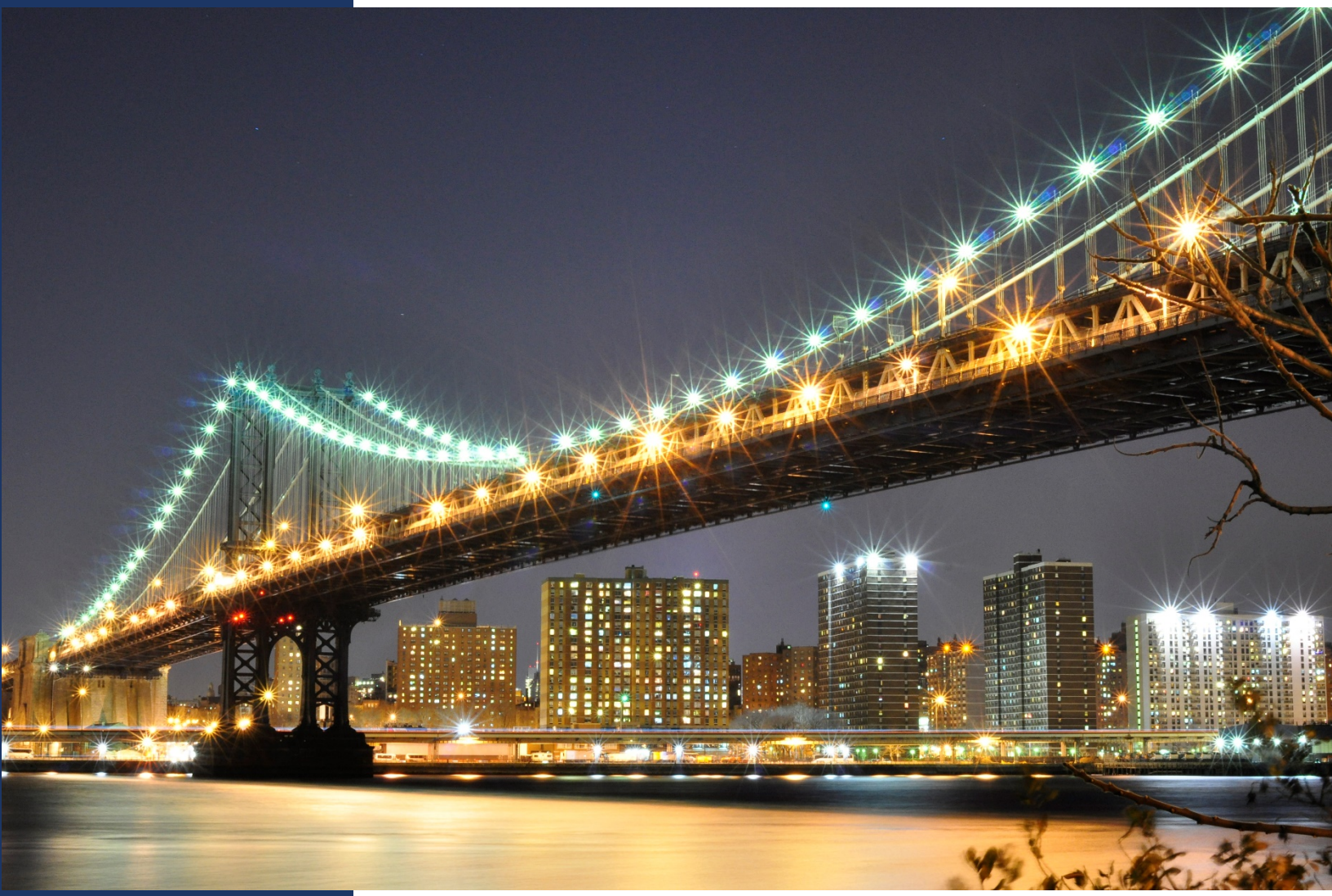

Photo Credit: Leo Nemirovsky

ROBERT A. W. CARLETON STRENGTH OF MATERIALS LABORATORY

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