# NEWMARK STRUCTURAL ENGINEERING LABORATORY

## Overview

The Newmark Structural Engineering Laboratory (NSEL) of the Department of Civil and Environmental Engineering has a long history of excellence in large-scale, experimental structural research and over the years has contributed greatly to the state-of-the-art in civil engineering. Completed in 1967 and extended in 1971, the structural testing section of the laboratory is a versatile area with a three-story clear height that can be used to carry out a wide range of tests of building materials, components, structural assembles, and models. The testing equipment was upgraded in 1994. New controllers and instrumentation were purchased. This acquisition increased laboratory's performance in terms of quality of test control and experimental data generated during testing. Twenty eight foot tall, L-shaped reaction wall was added in 2004. Also, Loading Boundary Condition Boxes (lbcb) for seismic related experimental research was added to testing facility of NSEL. Both reaction wall and multi-axial loading units were sponsored by Network for Earthquake Engineering Simulation (NEES). This upgrade was followed by new instrumentation, primarily for strain measurements of structures tested.

Newmark Structural Engineering Laboratory has been actively interacting with highly respected faculty members primarily from the Department of Civil and Environmental Engineering as well as some faculty members from other departments from the College of Engineering. Also, the NSEL contributes to the teaching activities of our department. The laboratory sections of classes CEE-300, CEE-400, CEE-401, CEE-410, CEE-575, and CEE-498 are carried out in the NSEL using our universal testing frames. Both undergraduate and graduate students are involved in the experimental research programs carried out in the laboratory.

Servo-hydraulic testing equipment available in the laboratory for testing is listed in Table 1. Testing frames are capable of running tests in position, load, strain, and any external transducer control modes using digital controller. The same applies to the actuators listed in Table 1. Multi-axial systems of testing are available for experiments with structures. Both materials tests and structural tests could be carried out using either manual control mode (front panel of the controller) or computer control mode (PC computer is associated with each controller). Servo-hydraulic actuators are supported by hydraulic power supply, which is capable to deliver 90 gpm of oil at the pressure of 3,000 psi. 120 gpm HPS has been added to the 90 gpm one, primarily to support NEES lbcbs. Also, there is 300 kip RIEHLE testing frame available in the lab to perform monotonic tests of structural materials in compression. This testing frame is equipped with instrumentation, which supports analog outputs from load cell, displacement transducer, and two strain channels.

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Structural testing in our lab can be supported by hydraulic double way and single way ram cylinders with capacity ranging from 2 to 300 kips. Those rams are supported by either manual or electric pumps capable of developing pressure up to 10,000 psi

We have developed LabView based software for running tests using any load history specified by the research project. Computer based data loggers are offered for any test specification for any number of channels and frequency of data logging. Also, classic methods of recording data are offered; e.g. X-Y plotters, strip chart recorders. Our instrumentation group is capable of designing and building instrumentation to measure load, displacement, strain, acceleration, velocity, temperature, pressure, etc. The complete list of equipment and accessories with their technical characteristics is posted on the web (http://cee.uiuc.edu/nsel/).

Well-equipped cee machine shop is available for both students and faculty to have test specimens, fixture, as well as reaction frames for structural testing fabricated. Highly experienced and skillful personnel works for our machine shop. They are capable of manufacturing demanding elements for experimental research. In addition, Student Instrumentation Workshop (SIW) is also available, in which students and faculty can fabricate parts by themselves. Student shop is managed by NSEL coordinator and supported by personnel of cee machine shop for training and advice. SIW is open 24 h a day, 7 days a week.

Table 1 Overview of servo-hydraulic equipment.

| Equipment | Load capacity (kip) | Stroke capacity (in.) | Servovalve capacity (gpm) | Rating, quantity |
|---|---|---|---|---|
| Testing frames | 600 | 10 | 20 | fatigue, 1 |
| | 100 | 6 | 5 | fatigue, 1 |
| | 50 | 6 | 15 | fatigue, 1 |
| | 20 | 6 | 10 | fatigue, 1 |
| | 11 | 6 | 90 | fatigue, 1 |
| | 100, b-x | 4 | 40 | fatigue, 1 |
| Actuators | 220 | 40 | 15 | static, 2 |
| | 100 | 20 | 10 | static, 2 |
| | 100 | 6 | 10 | fatigue, 2 |
| | 25 | 6 | 10 | fatigue, 3 |
| | 2.5 | 6 | 10 | static, 1 |
| | 2.2 | 6 | 10 | static, 1 |
| lbcb | 1,000 | 4 | 90 | static, 3 |