The Bi-Axial Testing System in Tainan Laboratory of Taiwan NCREE

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New Tainan laboratory

- High-speed and long-stroke seismic simulation shaking table -- reproducing near-fault ground motions
- Strong floor and reaction wall system -- large-scale structural experiments
- High-performance bi-axial testing system (BATS). Simultaneous applying horizontal forces, with high horizontal velocities, large displacements, and large vertical forces on the test specimen.
Mechanical configuration

- Length: 22.5 m, width: 6.1 m, height: 3.8 m above the strong floor.
- The BATS consists of a reinforced concrete base, a reinforced concrete side wall, a steel reaction frame, a steel platen, and various types of servo-hydraulic actuators.

![Diagram of mechanical configuration with dimensions 1.5m, 1.9m, 1.4m]
Platen and Steel reaction frame

- **Platen**—8.3 m x 2.54 m x 1.0 m. 42-mm diameter and 85-mm deep threaded holes with a 250 mm spacing in both directions.

- **Steel reaction frame**—8.7-meter tall, 4.0-meter wide, and 4.7-meter long. 48 holes with an inner diameter of 93.6 mm were made through the cross beam. The spacing is 500mm in both directions.
Capacity of the BATS

- A bi-axial testing facility: large vertical loads and longitudinal displacements. Cannot impose forces and moments in the transverse direction.
- Maximum allowable specimen height is 2 meters.
- 15 pressure-bearing (PB) or hydro-static (HS) type of servo-hydraulic actuators
- 4 high speed horizontal actuators

<table>
<thead>
<tr>
<th>Dir.</th>
<th>Force (MN)</th>
<th>Disp. (mm)</th>
<th>Velocity (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ver.</td>
<td>Static</td>
<td>60.0</td>
<td>+125</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(comp.)</td>
<td>±150</td>
</tr>
<tr>
<td></td>
<td>Dynamic</td>
<td>30.0</td>
<td>±4.0 (tension)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(comp.)</td>
<td>±1200</td>
</tr>
<tr>
<td>Hori.</td>
<td>±4.0</td>
<td>±1200</td>
<td>±1000</td>
</tr>
</tbody>
</table>

30000kN Static Actuator
6X 5000kN Vertical Actuators
4X 2000kN Hold Down Actuators
4X Lateral Actuators
4X Horizontal Actuators
Constructions and acceptance tests

- The steel frame was first divided into four parts in the fabrication shop.
- Base, side walls, and steel frame were constructed simultaneously.
- Hydraulic equipment and platen.
- High damping rubber bearing and friction pendulum bearing
16th, 17th and 18th of September, 2019, Taipei, Taiwan

- Engineering seismology
- Near fault ground motion
- Geotechnical earthquake engineering
- Seismic design, evaluation and retrofit
- Seismic loss and risk assessment
- Monitoring and early warning
- Advanced method for simulation
- Photogrammetry and visualization
- Lessons learned from post-disaster response and recovery
- Policy and implementation for reducing seismic risk
- Public-private-partnership for seismic risk management

Abstract Deadline: 31, October, 2018

Website: chichi20.ncree.org.tw
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Today Poster Session:

- **Time:** 5:15 – 7:00 pm
- **Room:** Pasadena (Exhibit Hall) - One Level Below Lobby
- **Poster location:** Number 066