

Structural Testing Laboratory

[Outline](#)

Structural Testing Laboratory is designed to examine the strength, deformation, vibration, and fatigue properties of a building structure and its elements and materials. The outcome of these experiments is used to verify structural design concepts and techniques to meet high level and/or multi-purpose performance requirements to building structures.

●Laboratory Equipment

① Electric shaking table excitation equipment

Shaking table is a testing equipment to investigate dynamic properties and/or earthquake response behaviors of buildings using scaled-model specimens of buildings or building components. Dimension and capacities of the shaking table are as follows, dimension: 4.5m×3.5m, shaking direction is uniaxial, maximum loading weight: 300kN, maximum acceleration: $\pm 2G$ (without weight), maximum velocity: $\pm 120\text{cm/sec}$, maximum displacement: $\pm 250\text{mm}$.



Overall view of the shaking table testing area



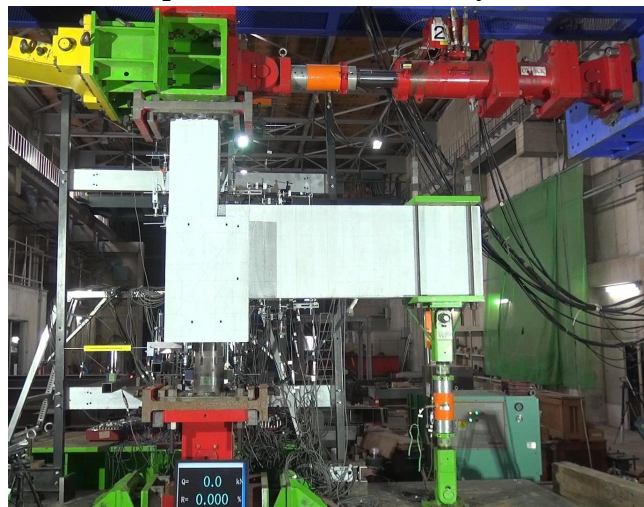
Shaking table excitation control device

② **Test machine for cyclic lateral loading system under axial force (so-called BRI-type horizontal loading machine)**

A testing machine was invented by BRI to investigate the structural performance of columns and beams under earthquake. The feature of this test machine is the ability to easily perform the cyclic loading under anti-symmetric moment condition with keeping the specimen surfaces at top and bottom horizontal all the time by using pantograph. By changing loading setup, it is possible to conduct loading test with subassembly consisting of column, beam and so on. The maximum loading capacities of axial force in compression and tension and shear force are 2000kN, 1000kN and 2000kN, respectively.



Experiment with column specimen under anti-symmetric moment condition



Loading test with foundation subassembly

③ 20MN Vertical and Multi Horizontal Direction Loading Test Machine

This machine can apply forces by at most seven hydraulic jacks which are simultaneously controlled by computer. As for the horizontal force direction, any direction can be chosen. It can test a strength and a deformation condition of multi-story shear wall, frame specimen, large-size column and concrete pile under severe earthquake condition. The maximum loading capacities are 20MN in a vertical direction, 4MN in a horizontal in-plane direction and 0.4MN in an out-of-plane direction.



The front side of the Test Machine

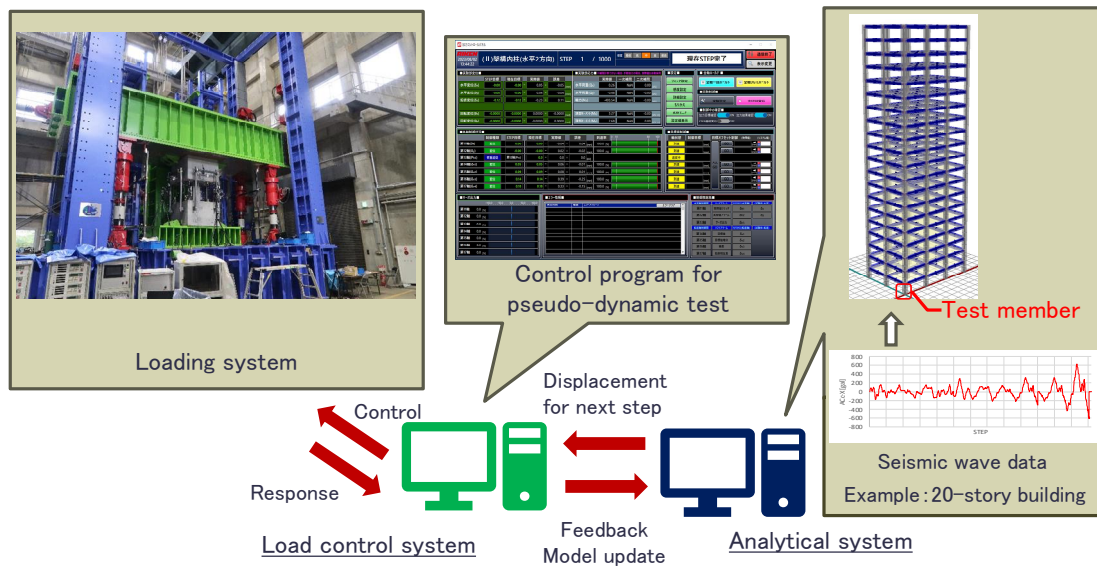
one hydraulic jack in a horizontal in-plane direction, four jacks in a vertical direction



The back side of the Test Machine

two hydraulic jacks in an out-of-plane direction

This machine can conduct pseudo dynamic test for directly simulating the earthquake response behavior of building components. One of components in a numerical building model is replaced with an experimental member. By determining target displacement for loading test through numerical analysis, and by updating analytical model for numerical analysis based on loading test response, it is possible to observe and analyze the failure process to collapse state of building components under severe earthquakes.



Outline of pseudo-dynamic test system