Experimentation has a fundamental role for scientific research: validation of models and theories, structural identification and performance definition of systems and components are just few applications. Within the structural and seismic engineering framework, the importance of experimental activities keeps increasing, progressively assuming a key role exploiting the development of new technologies, both for test execution and data acquisition and processing. The equipment of Eucentre Laboratories allows executing static and dynamic tests on large or real scale specimens, strongly reducing the uncertainties related to scale effects and improving the correlation to real cases. This, in turn, facilitates the process of data analysis and results interpretation.
The constant willingness to improve the organisation of its own resources, the effectiveness of the adopted internal procedures and their daily application allowed Eucentre to get a certified management system according to ISO 9001:2015. Furthermore, Accredia recognized to Eucentre the ability to perform tests in accordance to the international standard UNI CEI EN ISO/IEC 17025:2018 “General requirements for the competence of testing and calibration laboratories”.

The laboratories of the Eucentre Foundation includes the following experimental facilities:
· High performance uniaxial shaking table;
· Multi-axial shaking table (6 DoFs)
· Strong floor-reaction wall system;
· Dynamic testing system for bearings and isolators;
· Damper testing system;
· Contactless motion capture system;
· Mobile laboratory;
· Mobile unit for structural assessment.

The Founders

PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

ISTITUTO NAZIONALE
DI GEOFISICA E VULCANOLOGIA

IUSS

Università degli Studi
di Pavia

1. High performance uniaxial shaking table

The main shaking table is an earthquake simulator able to replay every recorded natural earthquake testing large specimens. Its main characteristics are reported in the following.

Structure of the table: Cellular steel structure with high stiffness and low mass. It was designed to withstand high stress levels typical of large dynamic tests.

Guides: Hydrostatic bearings to minimize friction.

Technical Details:

Platen dimensions	5.6 m x 7.0 m
Maximum displacement	± 500 mm
Maximum velocity	2200 mm/s
Maximum acceleration (bare table)	6.0 g
Maximum acceleration (with 60 t payload)	1.8 g
Maximum flow rate	11000 l/min
Maximum dynamic force	1720 kN
Maximum static force	2150 kN
Maximum payload	140 t
Maximum overturning moment	4000 kNm
Reaction mass	2350 t
Guide friction	350 N
First natural frequency	84 Hz

2. Multi-axial shaking table (6 DoFs)

This shaking table has been design to perform test on non-structural elements of structural system having low mass.

Structure of the table: Cellular steel with characteristics of high rigidity and low mass compatible with the efforts generated by structural tests.

Technical Details (6DoFs configuration):

Maximum X and Y displacement	± 500 mm
Maximum Z displacement	140 mm
Maximum X and Y velocity	2.0 m/s
Maximum Z velocity	0.5 m/s
Maximum X and Y force	1400 kN
Maximum Z force	5000 kN
Maximum payload	30 t
Frequency range	0.3 - 60 Hz

3. Strong floor-reaction wall system

Two mutually orthogonal walls and a strong floor constitute the main lab reaction structure. The control system allows the execution of pseudo-static, pseudo-dynamic and hybrid bi-directional tests. Oleo-dynamic actuators impose forces and displacement on large or real scale buildings and structural elements.

Technical Details:

Strong floor dimensions	14.4 m x 9.6 m
Height of the reaction walls	12 m
Maximum reaction force at 1 m height	46120 kN
Maximum reaction force at 12 m height	3840 KN
Available 250 kN actuators	5
Available 500 kN actuators	3
Available 1000 kN actuators	2
Available 2000 kN actuators	1

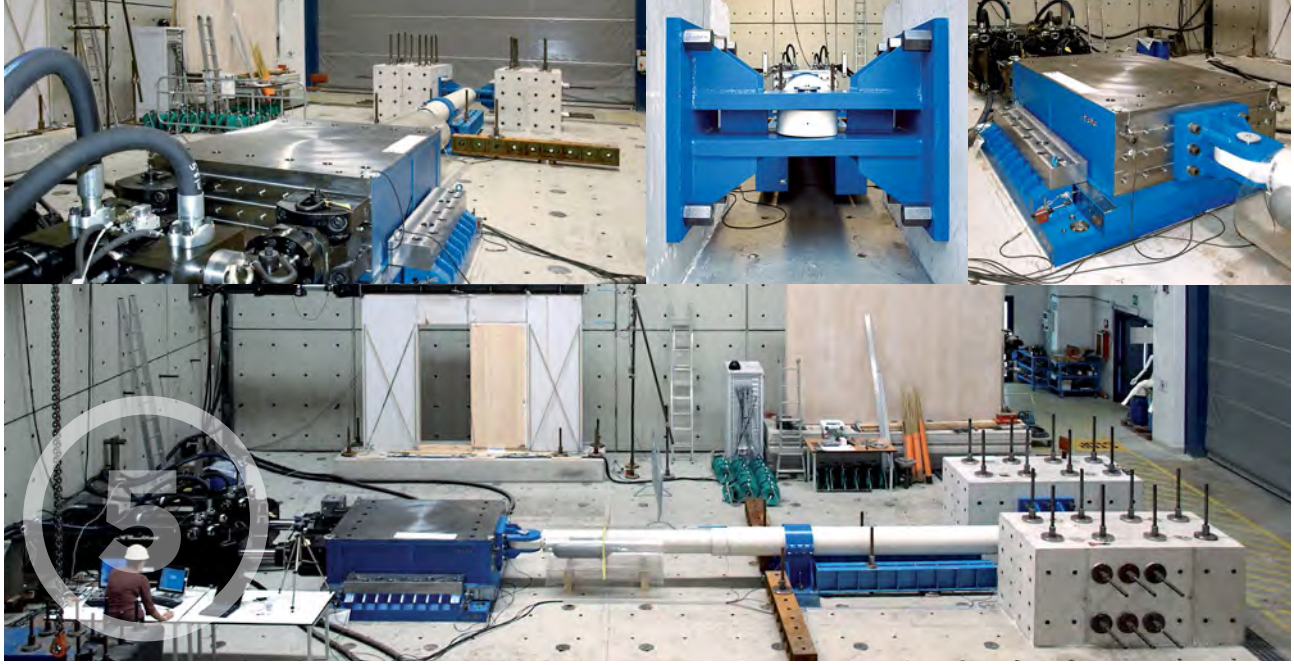
4. Dynamic testing system for bearings and isolators

The testing equipment for of real scale bearings and isolator devices has 5 dynamically controlled degrees of freedom and allows the application of vertical (up to 50 MN) and horizontal (up to 2 MN) forces or maximum horizontal displacement equal to ± 495 mm. This experimental facility is unique in Europe.

An additional component, limiting some of the other performances, increases to 6 the controlled DoF's: this module, mainly used for research objectives, allows performing 3D test protocols. On the other hand, a different actuators configuration increases the maximum horizontal force to 2.8 MN.

Technical Details:

Platen dimensions	1.6 m x 4.4 m
Maximum displacement	Long. ± 495 mm, Transv. ± 265 mm, Vert. ± 75 mm
Maximum velocity	Long. 2200 mm/s, Transv. 600 mm/s, Vert. 250 mm/s
Maximum acceleration	± 1.8 g
Maximum flow rate	11000 + 16000 l/min
Maximum static force	Long. 1900 kN, Transv. 1000 kN, Vert. 40000 ± 10000 kN
Maximum dynamic force	Long. 1700 kN, Transv. 750 kN, Vert. 40000 ± 10000 kN
Inertia mass	~ 22.1 t
Maximum overturning moment	20000 kNm
Operative frequency range	0-20 Hz



5. Damper testing system

Recently moved to the new 6D Lab, the testing system for dampers and shock transmitter units is composed by two high-power oleodynamic actuators moving a steel sledge that impose force and displacement on the specimens. Two reinforced concrete masses are used to transfer the reaction force to the strong-floor of the laboratory; their position can be adapted allowing the installation of large devices.

Technical Details:

Maximum length of the specimen	8000 mm
Maximum diameter of the specimen	1200 mm
Maximum displacement	± 250 mm
Maximum velocity	1100 mm/s
Maximum flow rate	3000 l/min
Maximum dynamic force	4400 kN

6. Contactless motion capture system

A video motion capture system records the displacement of the specimens undergoing dynamic tests, aiding the monitoring of their behaviour normally operated using wired transducers. A system of up to 16 infrared cameras tracks the motion of spherical retroreflective markers applied on the specimen. Elaboration of such data allows estimating the local deformations induced by the external action, which can in turn be correlate to damage states.

7. Mobile laboratory

The mobile laboratory is a fully autonomous system designed for the execution of on-site dynamic tests. A truck trailer hosts pumps, oil reservoir, accumulators and distribution lines; a 0.5 MW power generator, actuators and a digital control system completes this unique system. The performances of the equipment allows executing static and dynamic test on structures, including building and bridges, or soil. As an alternative, once connected to existing testing laboratories, the mobile laboratory can significantly increment their testing capacity.

Technical Details:

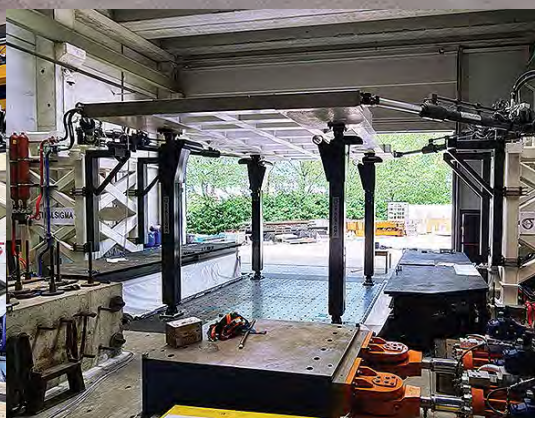
Maximum displacement	± 250 mm
Maximum velocity	700 mm/s
Maximum acceleration (with 400 t specimen)	1.0 g
Maximum flow rate	6000 l/min
Maximum static force	4000 kN
Maximum dynamic force	3600 kN
Maximum specimen mass	1000 t
Electric power	500 kW
Working pressure	280 bar
Volume of the accumulators	700 l
Preload pressure in the accumulators	210 bar
Available 1000 kN actuators	4

8. Mobile unit for structural assessment

The Mobile Unit of the Eucentre was developed as part of a pilot project funded by the European Community with the objective of extending to site applications those experimental procedures and numerical methods traditionally used in laboratories. The mobile unit has been conceived for several operations, between these:

1. To support the Civil Protection Department in post-earthquake emergencies management, particularly when working within a network of mobile units, operating in synergy while managed by the Coordination and Control Centre developed at Eucentre.
2. To carry out accurate assessment surveys, useful for seismic risk mitigation studies, in single applications such as the monitoring of buildings;
3. To act as control system of the mobile laboratory.

The Mobile Unit is equipped with a system of transducers (potentiometers, strain gauges, accelerometers, geophones etc.) and data acquisition often used for the monitoring of structures. Beside this, the mobile unit includes equipment for carrying out numerous non-destructive tests (thermographic, sonic tests, flat jacks etc.) The mobile unit is also equipped with a communication structure based on Wi-Fi, 4G and satellites connections that enable direct contact to be maintained, even in emergency situations, with both the on-site assessors, the Coordination Centre and with the laboratory partner network of the Eucentre.



EUCENTRE
FOR YOUR SAFETY.

Eucentre Foundation - Via Adolfo Ferrata, 1 - 27100 Pavia (Italy)
Phone: (+39) 0382.5169811 - Fax: (+39) 0382.52913
E-mail: info@eucentre.it - Website: www.eucentre.it