

Active Mass Dampers are active and smart systems for the control of the seismic response of buildings. The technology is completely non-invasive: it can be installed on the top of the building or on the last floor, without troubles for the inhabitants and the architecture of the building. The aim of the systems is to "counteract", thanks to the forces generated by each one of the installed machines, the movements of the building by **reducing the oscillation amplitudes**, the stress applied on structural and non-structural elements, and therefore the **damages**. The entity of the delivered force is calculated in real-time by **control algorithms** based on the accelerations measured by sensors, installed in significant points of the building.

#### OUR PRODUCT

Electro-Pro is a new generation active electric system for the control of seismic response, that protects the structure and avoids the damages generated by medium intensity earthquakes. In fact, these represent the main cause of damages to non-structural elements and of temporary unavailabilities of the building.

Electro-Pro is made up of fully electric machines, equipped with linear synchronous motors with permanent magnets. The single unit delivers a maximum force of 20kN in horizontal direction. The units can be arranged in a modular configuration to set the ideal solution for the protection of the building from earthquakes. It is also suitable for **vibration control of the building, to increase housing comfort and ease mental anxiety**. Electro-Pro is **modular in size and weight**, depending on the structure and its dynamic. If the structure requires a higher vibrations dampening, it is possible to assemble more units to reach the desired performance.

COMMISSIONING	Comune di Buti
ARCHITECTURAL DESIGNER	Arch. Katuscia Meini
STRUCTURAL DESIGNER	Eng. Maurizio Lenzi
CONSTRUCTION DIRECTOR	Eng. Maurizio Lenzi
TESTER	Eng. Filippo Dacarro
COMPLETION DATE (INCLUDING TESTING)	05/2024
TARGET	Obtain a risk index of $\xi=0.60$ starting from $\xi=0.40$ With ISAAC's intervention we obtained $\xi=0.85$
SEISMIC PROTECTION METHOD USED	Electro-Pro 20x produced by ISAAC srl (8 inertial axes)



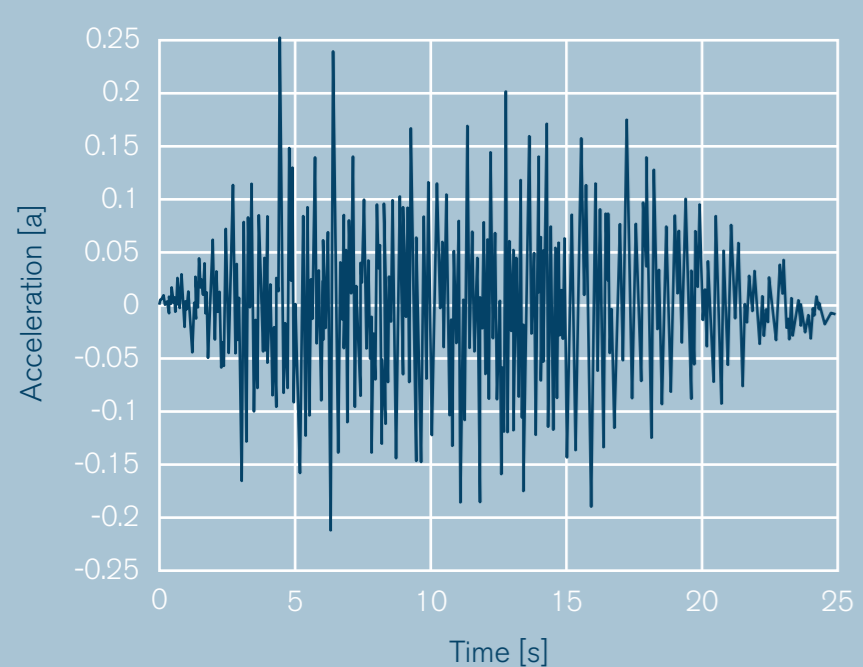
#### THE PROJECT

Structural design related to the seismic improvement of the elementary school complex named "Scuola secondaria di Primo grado F. Di Bartolo" located in Buti (PI), via Icilio Felici 10.

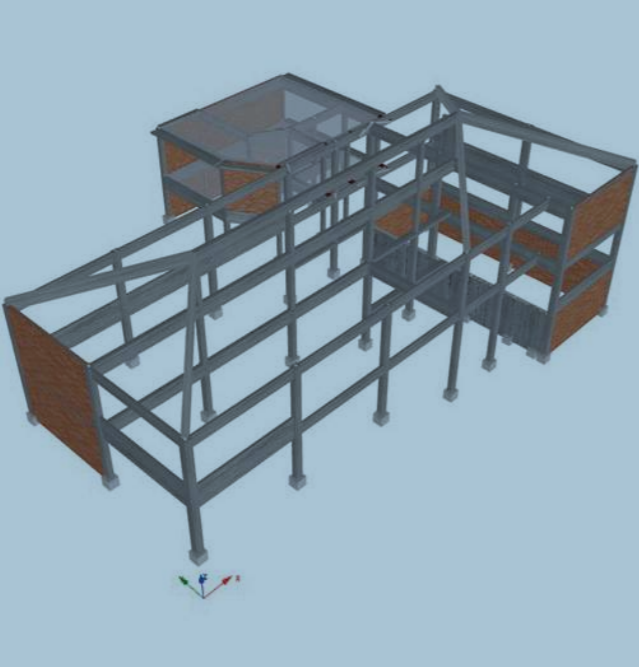
In order to achieve this improvement, it was decided to adopt the innovative technology proposed by ISAAC srl, which involves the insertion of an active seismic protection control system on the building. The active system introduces energy dissipation through additional damping that allows the reduction of the incoming seismic demand on the structural elements which, as a result, are protected.

BUILDING	School F. Di Bartolo, Buti (PI)
POSITION	43.728272 N; 10.591506 E
TYPE OF BUILDING	Reinforced concrete frame 2 buildings
YEAR OF CONSTRUCTION	Building A (main) 1965 Building B (enlargement) 1979
NUMBER OF FLOORS	Building A: 3 Building B: 2
m <sup>2</sup> /FLOOR	560 m <sup>2</sup>

#### ACCELEROGRAM USED FOR THE ANALYSIS



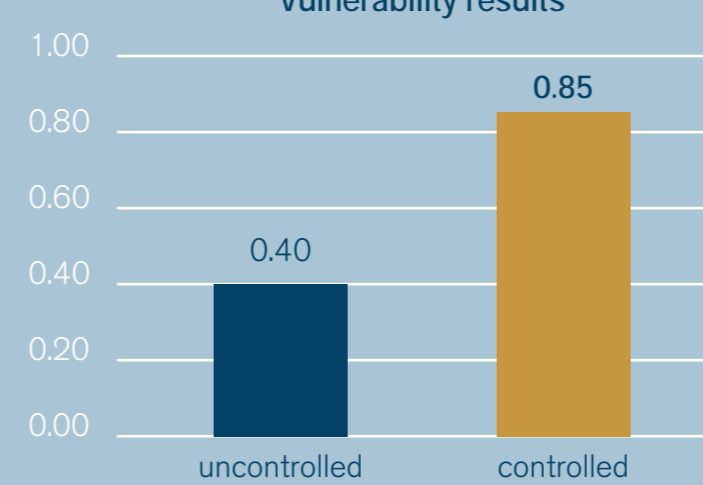
#### NUMERICAL MODEL OF THE BUILDING



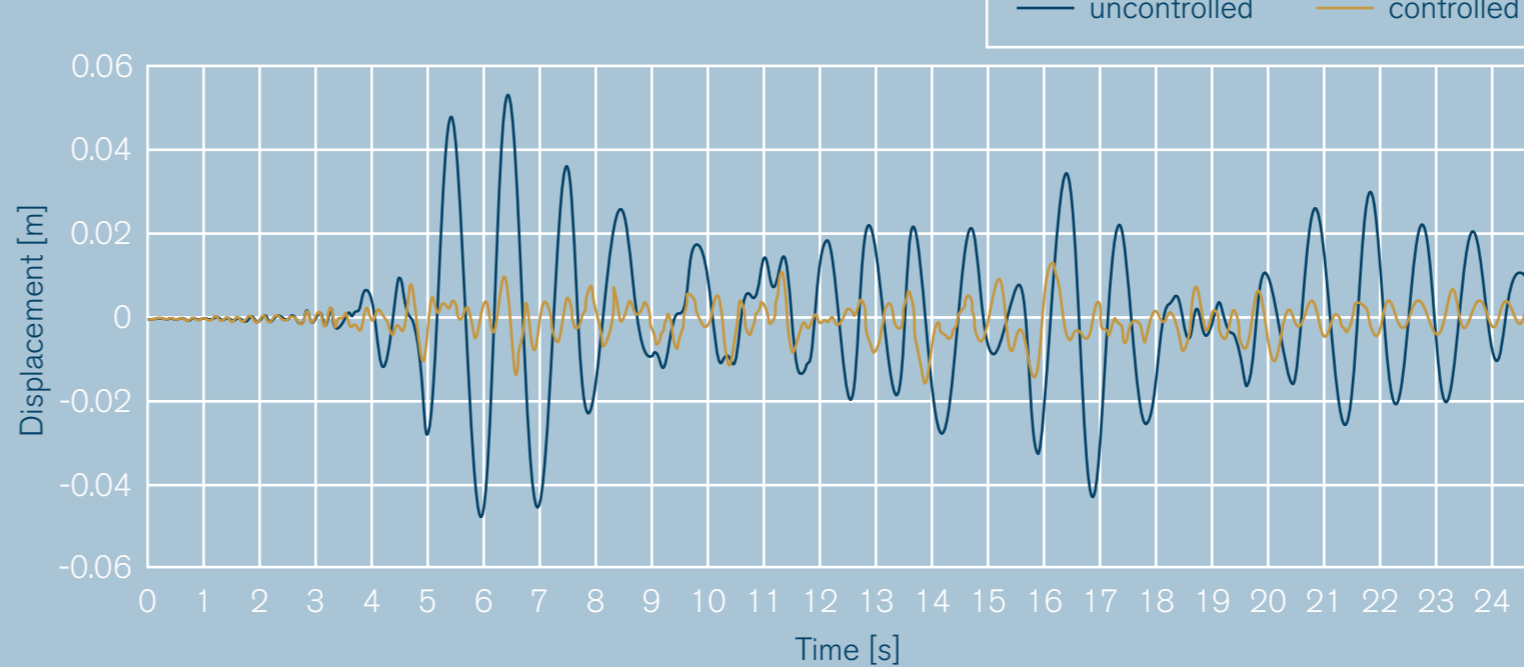
#### THE RESULTS

The active technology proposed by ISAAC srl made it possible to **exceed the safety objectives requested by the client**, ensuring a minimum degree of invasiveness. The intervention has, in fact, guaranteed **short installation times without ever interrupting operations**, a fundamental aspect given the intended use of the work in question. In addition, the accelerometer sensors installed - which are essential for the operation of the active seismic protection system, allow for **continuous dynamic monitoring** of the building, which is very useful for keeping track of the building's health status during its useful life.

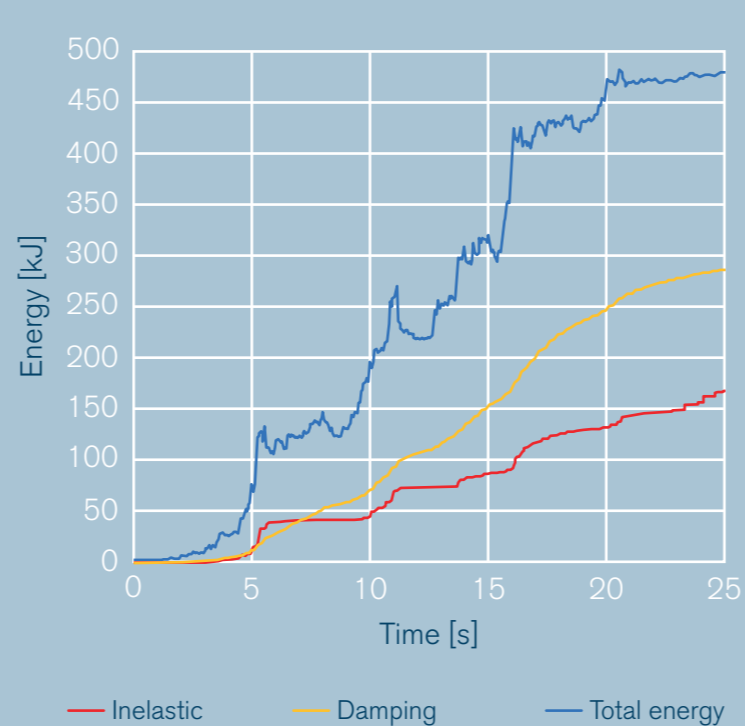
#### Vulnerability results



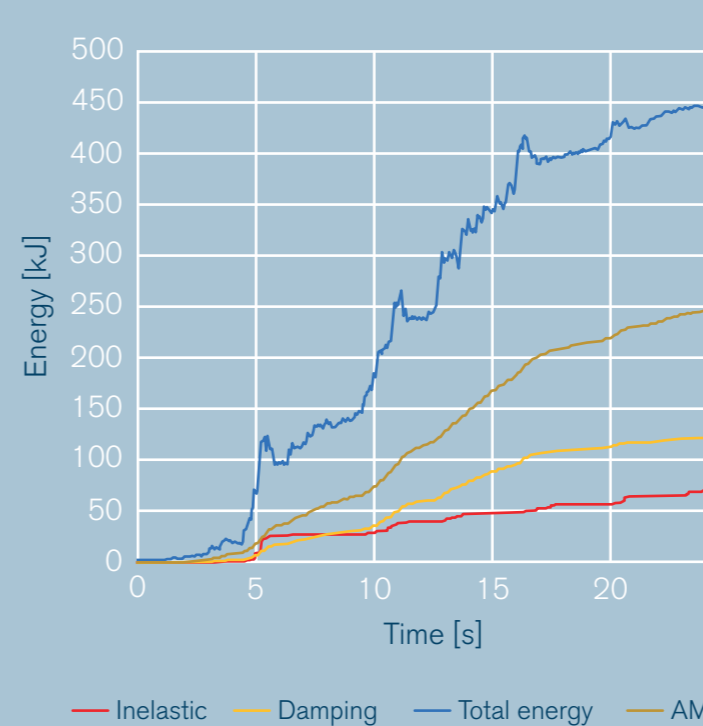
#### DISPLACEMENT COMPARISON



#### ENERGY BALANCE - UNCONTROLLED



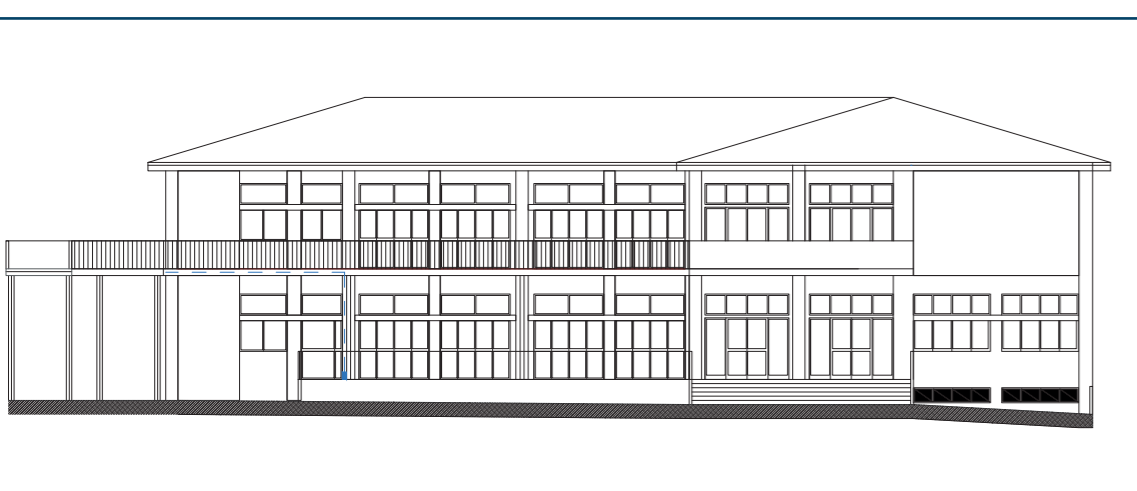
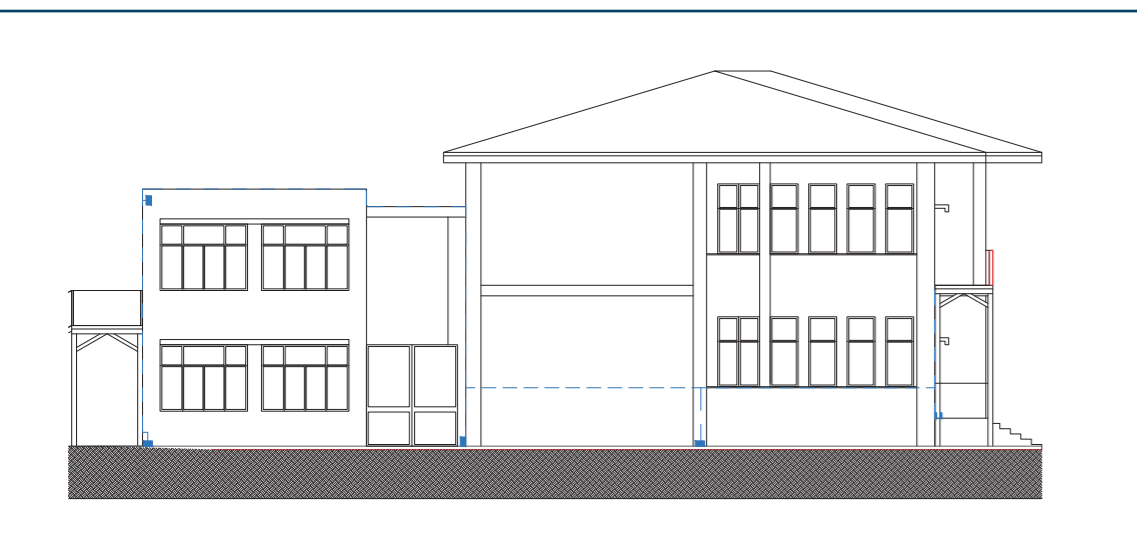
#### ENERGY BALANCE - CONTROLLED



#### COMPARISON BETWEEN TRADITIONAL INTERVENTIONS AND ACTIVE MASS DAMPERS

METHOD OF INTERVENTION	DIRECT COSTS	INDIRECT COSTS	TOTAL COST
Reduction of displacement demand	338.400,00€	1.170.000,00€	1.508.400,00€
Isolation systems	300.800,00€	1.170.000,00€	1.470.800,00€
Strengthening elements	288.768,00€	1.170.000,00€	1.458.768,00€
Inserting additional elements	188.000,00€	1.170.000,00€	1.358.000,00€
Active Mass Dampers (ISAAC)	588.800€	0,00€	588.800,00€

The technology allows to minimize the indirect costs, thanks to the non-invasiveness of the intervention. When installing an Active Mass Damper system, there's no need to interrupt the activities that take place in the building or to move people out of the structure, making it the perfect solution for strategic buildings such as schools and hospitals.



**AMD (Active Mass Damper)**  
Vertical weight: max 1000 kg  
Horizontal force: 35 kN  
Machine height: 0.4 m  
Caster height: 0.5 m

**QERMT (Remote control panels)**  
Vertical weight: max 130 kg  
Height: 0.7 m

**OECNT (Central control panel)**  
Vertical weight: max 280 kg  
Height: 1.30 m

