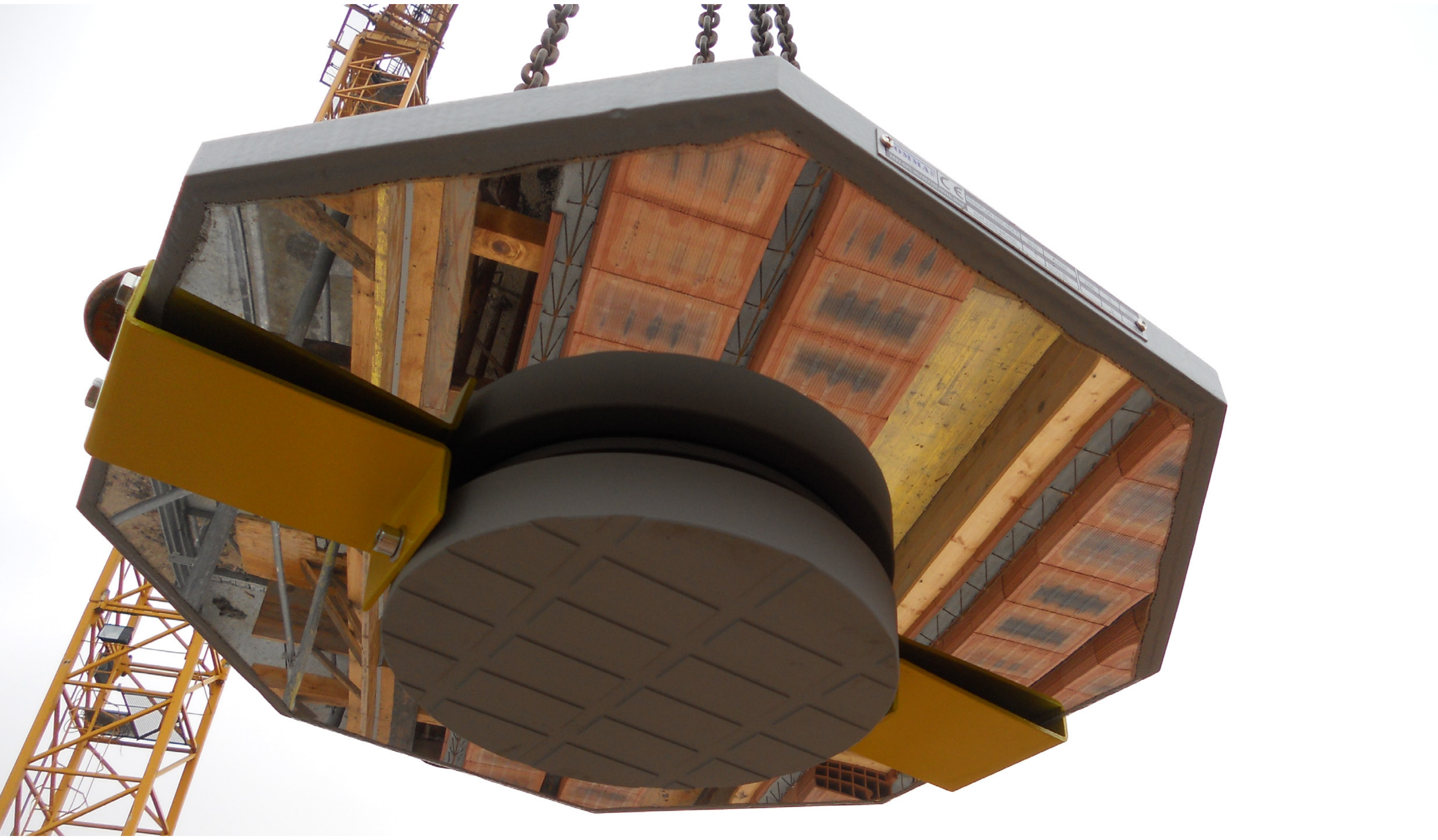
SEISMIC PROTECTION SYSTEMS OF BUILDINGS

SOMMA thanks to its experience in base isolation systems since 1984 , is able with its technical office to provide the best solution of seismic retrofit on different kind of buildings.

Thanks to its group structure, **SOMMA** can provide the turnkey solution if required.



SEISMIC ISOLATION OF NEW BUILDING

One of the modern seismic protection technologies most widely used in new buildings is seismic isolation, which is achieved by making a structural disconnection, generally above the foundation or basement level, interposing devices between the substructure and superstructure with low horizontal rigidity, so as to increase the period of the structure to values around 2-3 seconds, within the low-acceleration design spectrum. The behaviour of the superstructure is that of a rigid body that transfers onto the insulators, stressed by strongly reduced accelerations and subject to very limited interfloor deformations.

As a result, the design approach with seismic isolation has the following advantages over fixed base buildings:

• Reduction of stresses on both superstructure and substructure;
• Elimination or strong reduction of damage, not only to the structure but also to the non-structural elements and to the content of the buildings;
• Drastic reduction of torsional effects also in irregular structures on the surface (since a correct arran–gement of the devices is able to make the centre of mass coincide with the centre of rigidity);
• Greater architectural flexibility

It is easy to see how structural ductility requirements become secondary for buildings designed with seismic isolators at the base.

As a result, an isolated structure does not, in most cases, entail higher costs than traditional structures.

In particular, the following considerations apply:

• Design: the modelling of a building isolated at the base usually fits into the condition where the isolation system can be modelled as a linear equivalent, which does not involve greater design costs.

• We find two different types of benefits as regards the structural elements: reduction of the actions (and therefore of the resistant sections) due to the filtering action operated by the devices; savings in terms of materials and execution times (therefore of manpower) thanks to the simplification of the construction details under the regulations for isolated structures in seismic areas. By virtue of these advantages, the cost difference between a traditional structure and a seismically isolated one can be eliminated or even become beneficial for multi-storey buildings and/or in areas with a particularly severe seismic input.

SEISMIC RETROFIT OF BUILDING IN CONCRETE

The use of seismic isolation as an adaptation or improvement technique allows most of the operations to be concentrated on the isolation level (foundation, basement or ground floor), significantly limiting the reinforcement operations for the structural elements of the superstructure.

Seismic isolation technology has often proved to be the only technology capable of achieving the safety standards required by the regulations, which can otherwise only be pursued through demolition and reconstruction of damaged buildings.

It should be noted that if the operational phases are designed with care, the building can remain in use during the work of inserting the isolation devices.

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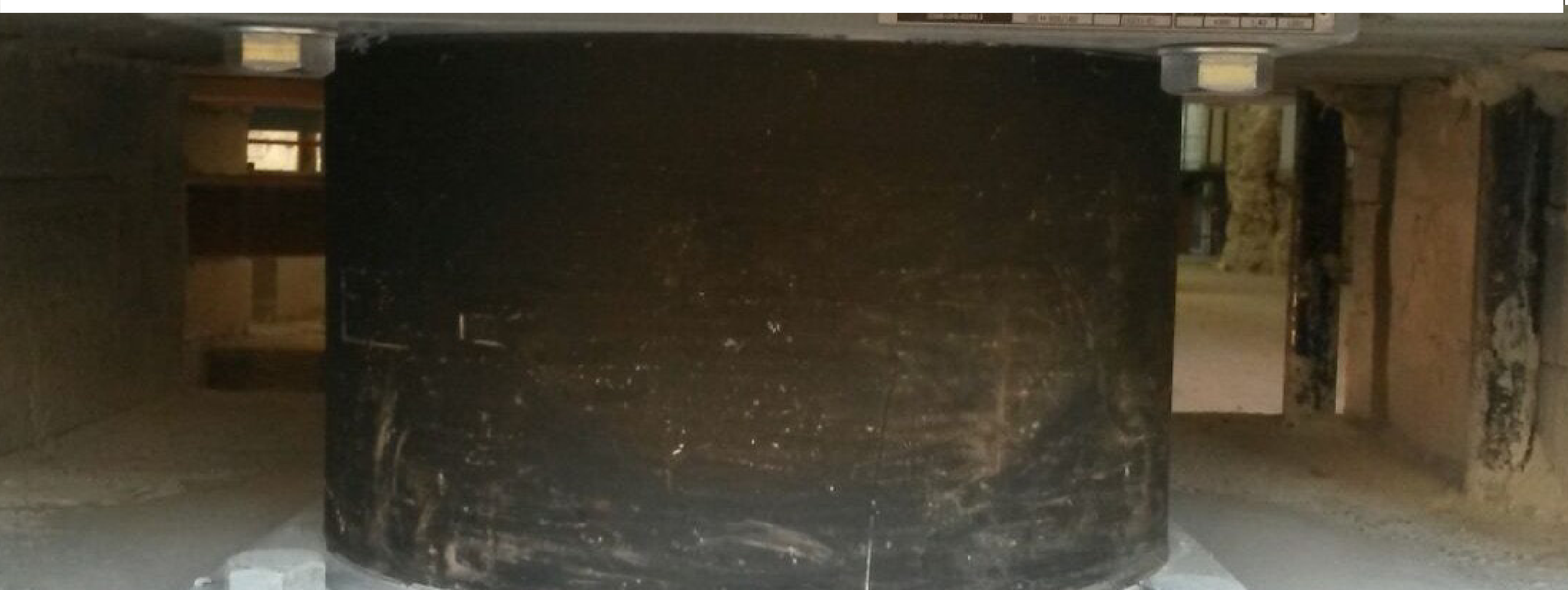

SEISMIC RETROFIT WITH HYSTERETIC BRACING AND VISCOUS DAMPERS

In addition to seismic isolation, seismic improvement/adjustment of existing buildings is often achieved through the use of dissipators, usually inserted into framed structures as components of dissipative bracings, that is, by using inter-storey displacement to dissipate energy.

Energy dissipators are divided into two families:

- Displacement dependent devices, typically based on the hysteretic properties of **SOMMA** HBF type metal elements.

- Speed-dependent devices, that is cylinder/piston devices (either MC type hydraulic or fluid-dynamic) that exploit the viscous dissipation due to the passage of particular fluids through a suitable hydraulic circuit. The resulting constitutive bond depends on the speed, usually with a non-linear dependence that maximises the dissipative capacity.

The insertion of dissipators in a structure greatly reduces the need for ductility in the structural elements, and therefore greatly improves the ability of the structure to withstand an earthquake.

However, it is not always possible to keep the structure completely elastic, and thus wholly avoid damage to it.

However, a high level of safety can always be achieved, with excellent cost-benefit ratios. It should also be noted that, unlike seismic isolation which is not always feasible in an existing building, the insertion of energy dissipators into an existing framed building is almost always feasible, although architectural implications have thus far limited its use mostly to public buildings, especially schools.

TUNED MASS DAMPER

The TMD system is applied to avoid the vibration control on the structures.

It consists of the installation of an auxiliary mass on the top of the building. The mass has to be suitably connected to the building. This mass has the function of damping the vibration of the structure thanks to the dissipation of the energy. With the application of this system it is possible to reach a reduction of the response of the structure against the dynamic excitations

The devices are the damper of the TMD system and the behaviour affects the period of vibration.

SEISMIC RETROFIT OF ADJACENT BUILDINGS

Anti-seismic devices used in the seismic upgrading of existing buildings, also include dynamic restraint devices (or ROD type temporary restraint or shock transmitters), devices that constitute a rigid axial restraint between the structures to which they are connected when subjected to dynamic actions (such as an earthquake), but that allow movement in the event of slow actions (thermal expansion).
Typically, these devices are used where the joints between adjacent buildings are not sufficient to connect the different bodies during seismic activity, after checking the overall behaviour of buildings that during seismic activity form a new single seismic resistant structural body.

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