Tecnostrutture ACADEMY

How to build safely in a seismic area?

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To answer this question, it is necessary to define the meaning of the word 'safe'.

For decades, the objective of design has been identified with preventing collapse of the structure, which must have adequate strength, but also deformation capacity. Avoiding fragile collapses by applying principles of hierarchy of strengths and providing ductility have been the key aspects to be considered. In this context, 'safe' essentially means protecting life.

Over the past two decades, it has become progressively clear that this is not enough: it is necessary to limit the direct costs of repair work, but above all to estimate and contain the induced social costs, which include the costs of homeless people, but also of hospitals that cannot be used, bridges that cannot be crossed, universities that are closed, industries that are at a standstill, and so on.

The meaning of 'safe' is therefore not limited to the protection of life, but extends to the limitation of global losses.

This vision entails a revision of design logic, with two fundamental aspects to be taken into account:

- The limitation of damage to non-structural elements especially for relatively frequent seismic actions, but also in the case of rare actions when it comes to buildings whose functioning is essential in the event of a disaster.
- The design of structures that favour damage limitation for frequent actions

and that allow rapid and concentrated repairs in areas of easy access and intervention for strong actions.

Composite steel-concrete structures lend themselves very well to the limitation of structural damage and its concentration in pre-defined areas by means of simple and fast interventions, which can also be pre-defined.

> ***Steel-concrete composite frame structures contribute to the limitation of structural damage***

The superiority of composite structures over similar concrete frames has been demonstrated beyond doubt by the recent experimental campaign conducted at the Eucentre Foundation.

Their high deformability, however, is not conducive to limiting damage to non-structural elements in the event of events inducing relatively modest actions.

I believe that the solution to be pursued is to combine composite frames with bracing structures, in walls that are also composite or braced frames. Efficiency and reparability could be further increased by adopting coupled bracing structures, with damage concentrated in the coupling elements and controlled rocking at the base.

Frames could become pendulous, but with dissipative capacities that contribute to the reduction of displacements.

Perhaps this theme could accompany Tecnostrutture's research in the fifth decade of its life.