**MAPEI FRP SYSTEM: INNOVATIVE EXTERNAL APPLICATION**

**TO COUNTERACT SEISMIC RISK IN REINFORCED CONCRETE BUILDINGS**

To meet the demand for **cutting-edge technological solutions** to **strengthen** structures and **upgrade their seismic capability**, **Mapei**, in collaboration with **DiSt** – Department of Structural Engineering and Architecture of the **Federico II University of Naples**, has developed an **innovative, low-impact, rapid FRP system** for strengthening **non-confined beam-pillar joints in reinforced concrete** which only needs to be applied **externally**.

This innovative application technique **reduces the amount of disruption** typical of more invasive, traditional systems, **avoids having to remove portions of external cladding, reduces the overall cost of the work** and minimises the amount of disturbance to occupants of the building.

From a functional point of view, the external FRP strengthening system, which consists of **quadriaxial carbon fibre fabric applied around a non-confined joint**, is similar to horizontal clamps positioned inside a joint and **prevents brittle-type failure** in the joint panel **in favour of more yield in the longitudinal rebar** in the adjoining beam.

The validity of the system was verified by carring out an **experimental test campaign** in the **DiSt test lab** on two beam-pillar joints; the first one in its original, as-built configuration and the second one in a strengthened configuration, representative of reinforced concrete buildings typically found in medium-risk seismic zones designed according to construction norms and standards which are now obsolete. They were characterised by their lack of clamps in the hinge panel and poor transversal reinforcement in the beams and pillars.

The failure mode of the *as-built* joint was typical of the type of failure found in existing buildings with diagonal shear cracks in the joint panel, while the **joint strengthened with FRP** on the external side only confirmed the **effectiveness of the strengthening system**. The tests demonstrated that initial stiffness was more or less similar to that of the as-built joint, which means this application may be considered to be a **“localised” type**. The effectiveness of the system was confirmed by it achieving the main objective: **to modify the failure mode from brittle-type** (shear failure in the joint panel) **to ductile-type** (flexural yield of the beam).

To summarise, **the experimental test campaign demonstrated the validity of this new strengthening system** which increases the shear strength of the joint panel and favours the development of ductile yield failure in the beam. This results in a significant **increase in the amount of energy dissipated**, leading to an **increase in the performance characteristics and seismic capability of a building**.

Founded in 1937 in Milan, Mapei now has 90 subsidiaries, including the parent company, in 57 countries and 83 production facilities in 36 countries spread across 5 continents, a consolidated turnover in 2019 of €2.8 billion and more than 10,500 employees worldwide.

The foundations for the success of the Company are Specialisation in the world of building by offering certified products and systems to meet the requirements of clients and market demand; Internationalisation to be more in tune with local needs and to reduce transport costs to a minimum; Research & Development, which receives the most support from the Company in terms of both investments and human resources. Mapei has always been fully aware of the impact the Company has on the environment and on society in general and, over the years, the three cornerstones of the Mapei philosophy have been joined by Sustainability as an essential driver behind the continuous development of the Company.

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