Novel Materials and Technologies in Seismic Retrofit of Existing Reinforced Concrete Structures

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The presentation will review the background of the introduction of new technologies and materials in the seismic retrofit of structures. Emphasis is placed in the transition towards the new generation of tension-hardening ultra high-performance cementitious materials, (UHPFRC) and the prospects and opportunities that these materials provide for seismic design and seismic retrofitting solutions. These materials are used already in bridge construction and bridge rehabilitation, as well as in 3D printing technologies. Apart from very high compressive and tensile strengths (>120MPa and >6 MPa respectively), their particular, very useful characteristic is the extended tensile deformation capacity, the tension hardening characteristic property after cracking and their exceptional durability. These qualities bypass some of the weaknesses of the existing methods and render the tension hardening materials ideal solutions for application in structures subjected to significant seismic demands. After reviewing the state of the art and experimental evidence regarding the performance of retrofitted components using novel tension hardening materials under reversed cyclic loading, the presentation is focused in the formulation of performance criteria and their integration in the framework of seismic design of structural retrofits using these technologies. The same principles are extended to cover recently developed strategies for seismic retrofitting of corrosion damaged components. A review of the experimental evidence is relied upon for the development of performance-based criteria and their implementation in the context of seismic design and assessment procedures for seismically deficient, corrosion-affected structures.