CERIS : Civil Engineering Research and Innovation for Sustainability

# DISSIPABLE – Fully Dissipative and Easily Repairable Devices for Resilient Buildings with Composite Steel-Concrete Structures

**Summary**

Civil structures subjected to strong earthquakes need to dissipate large amounts of energy. This energy dissipation is achieved through development of inelastic deformation in the so called "dissipative zones" of structural members. This means that conventional systems suffer significant inelastic deformations in main structural elements and residual storey drifts after a strong seismic event. Repair work in these cases is most of the time not feasible, or too expensive.

Other consequent effect is the long interruption of functionality of the building, leading to additional costs and discomforts for building owners and occupants. Reduction of damage of structural and non-structural elements after a disaster becomes a fundamental aspect for improving the long-term sustainability and resource conservation. The resources spent in the reconstruction after a disaster can be significantly reduced through innovative structural systems for new buildings and retrofit measures for existing buildings, dropping environmental and economic costs in a life cycle perspective.

The interest on the development of dissipative devices in earthquake risk mitigation of civil structures has greatly increased. The introduction of devices aims to dissipate the seismic energy through their plastic deformation, leaving main structural elements undamaged. They must provide adequate characteristics of ductility and energy dissipation in order to absorb large strains due to concentration of plasticity. Although the "dissipative" character of such innovative devices has been studied intensively in many research projects all over the world, their reparability performance still remains uncertain. Since it is crucial to restore buildings and its functions as quickly as possible after an earthquake, it is strongly advisable to develop structural systems that are simple to repair.

Anti-seismic devices previously designed and characterized within RFCS Projects by the partners involved in DISSIPABLE will be further developed taking into account the experience collected so far. Optimized structural systems will be proposed, with improved dissipation, reliability and reparability features. Single storey buildings with seismic resistance provided by the improved devices will be built and subjected to strong earthquakes. Systematic post-earthquake repair and reassembly procedures for these buildings applied and provided as "instructions for use". Ability of repaired systems to resist strong earthquakes will be examined. Economic and environmental benefits and improved resiliency properties of the proposed systems will be quantified.

**Work packages**

The project will be implemented in 36 months, by accomplishing 7 work packages:

- WP1. Optimization of previously developed devices;
- WP2. Numerical analysis of DRDs;
- WP3. Numerical investigations on 3D frames with DRDs;
- WP4. Demonstration of the seismic safety and resilience of pilot buildings;
- WP5. Development of instructions for use;
- WP6. Assessment of economic, sustainability and resilience aspects, and worked examples;
- WP7. Project management and dissemination.

**Benefits for the European steel sector**

DISSIPABLE project aims to reach an increased material efficiency, an improved performance of construction, and a generation of new markets, that are key driver for innovation. However, Europe is not good enough at turning its excellence in ideas into marketable goods and products. This project is in line with the new industrial innovation policy, which encourages the much faster development and introduction of products in market and aims to ensure that EU firms are first onto the market of Constructions in Seismic Areas. The project will introduce 3 pure European new dissipative systems into the market, which will be extremely competitive with all systems that, until now, were mostly developed outside Europe.

DISSIPABLE

**Project Reference**

800699

**Leading Institution**

PoliMI – Polytechnic University of Milan (Italy)

**Partners**

IST – Instituto Superior Técnico (Portugal), NTUA – National Technical University of Athens (Greece), SOFMAN (Greece), University of Trento (Italy), RWTH Aachen – Rheinisch-Westfaelische Technische Hochschule Aachen (Germany), RINA Consulting – Centro Sviluppo Materiali S.p.A. (Italy), UNIPI – Università di Pisa (Italy)

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**Period**

2018-2021

**Total**

907 406.00€

**CERIS**

187 383.80€

**Project Website**

http://dissipable.ntua.gr/

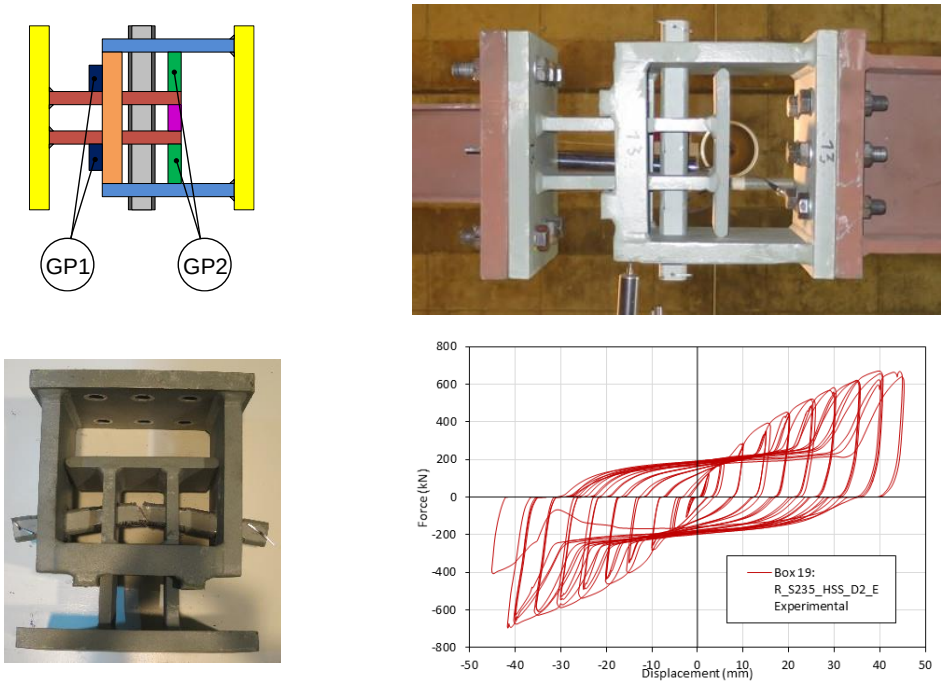


*Figure 1. DRBRC – Device developed and tested in Instituto Superior Técnico.*