task 3.1. (progettazione e valutazione a ciclo di vita per edifici)
task 3.1. (design and life cycle assesment of the existing buildings)

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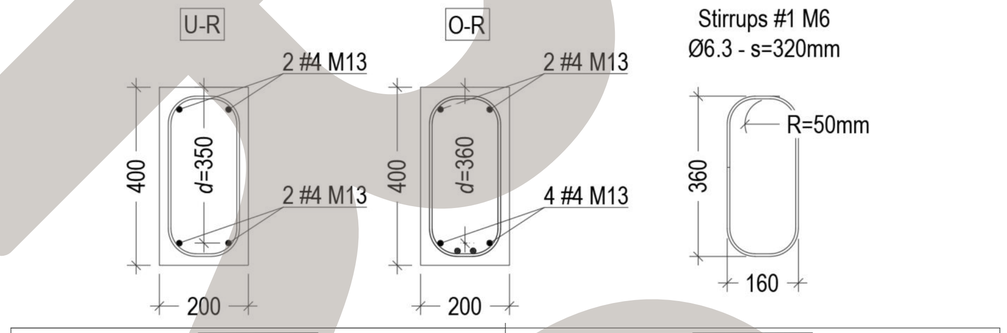
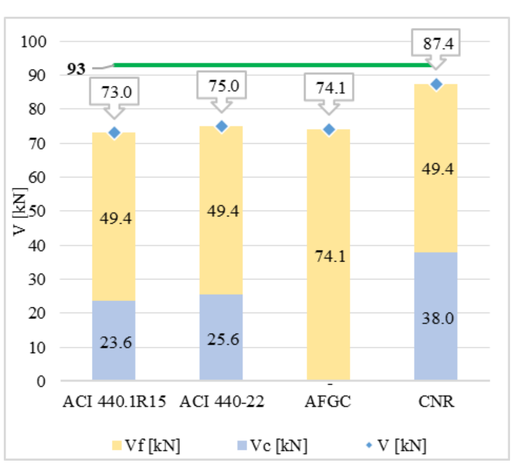
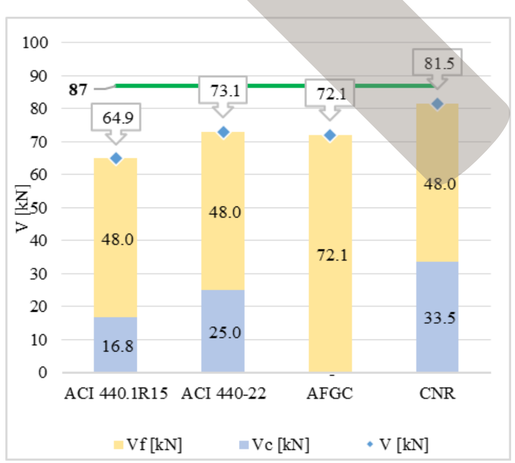




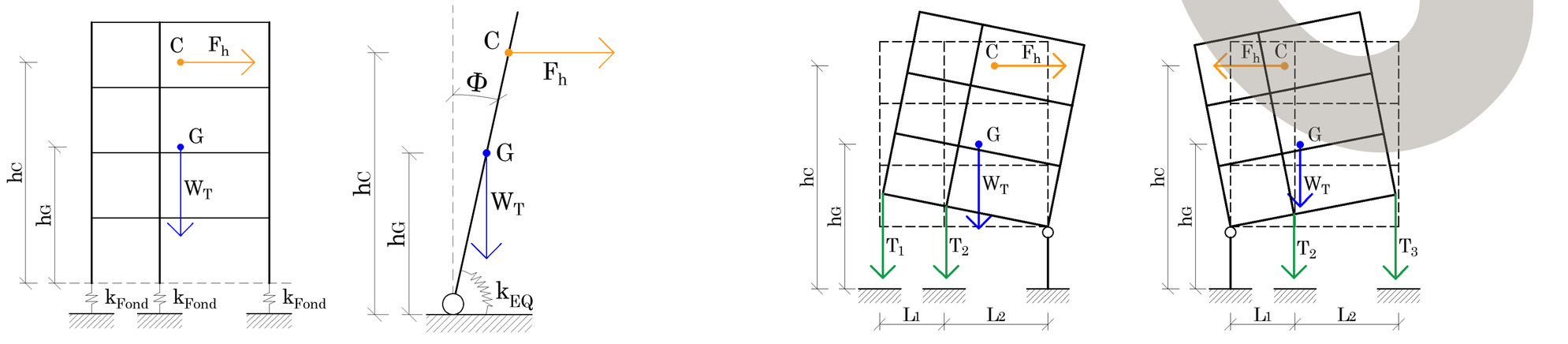


The present study draws on an experimental campaign carried out at the Building Materials Testing Laboratory of the University of Cagliari. In this one, the flexural and shear behavior of concrete beams with non-metallic bar reinforcement is investigated. The reinforcements used here are glass fiber bars of the Glasspree© type produced by Sireg Geotech. The specimens examined are provided with two different longitudinal reinforcement ratios to have a prototype with metal reinforcement side rupture and a prototype with concrete side rupture. In this context, shear reinforcement was designed to obtain shear failure for both prototypes. This was also done through normative comparison as from the histograms below. The test campaign highlights that although there are significant limitations in technological development today that limit the performance of these products, there is technical scope for their application for both new construction and retrofitting of existing buildings.)

The results of the experimental campaign carried out on GFRP-reinforced concrete beams, with a reduced amount of shear reinforcement, were compared with the shear capacity formulations of the American ACI (version of 2022 and previous), the French AFGC, and the Italian CNR. The comparison between the three analyzed standards has shown that:

- The bending capacity expression *M* of the analyzed standards produced consistent results, with a reduced deviation, under the 4% in the case that the expected values are considered (and up to 23 % in case of design value).
- Despite the limited quantity of stirrups used in the current case studies, following standard guidelines, they should be analyzed as beams without explicit shear reinforcement. However, the experimental tests reveal a failure mechanism and a corresponding failure load that is characteristic of shear-reinforced beams.
- ACI, AFGC, and CNR standards expressions are applied to the illustrated case of study, and it is shown that the current standard formulae always underestimate the shear capacity of the prototypes (min 25%, max 6%);
- The shear capacity expression of the analyzed standards produced a deviation from 9% (in case of expected value) to 30% (in case of design values). The design values of shear capacity *V* are between 9% and 30% for U-R and between 9% and 23% for O-R. The CNR code produces a major estimation of shear capacity both for the design and for expected values.
- The calculation of V_c is carried out with different formulas leading to scattered results (up to 27%). This indicates that further investigations should be pursued, particularly for beams without or with reduced shear reinforcement.

The case studies shown below are buildings with weak floors also named “Pilotis” buildings. These found widespread use particularly in the 1950s-70s, hand in hand with the boom in reinforced concrete buildings, and there are therefore numerous cases in the existing building stock. A seismic vulnerability study of these buildings is first carried out, also performed by rocking analysis in which the building is likened to a simple oscillator with one degree of freedom in each of the two main directions. The next phases of the study involve the study and design of sustainable reinforcement systems that can extend the life cycle of these buildings.



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