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# Experimental analysis of short confined columns

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## Abstract

The reinforcement of a concrete structure consists in improving the mechanical characteristics of the elements that compose it, so that it offers a better reliability both in service state and state of ultimate strengths. In this study, we propose to develop new technical solutions to improve the properties and strength of concrete through internal confinement.

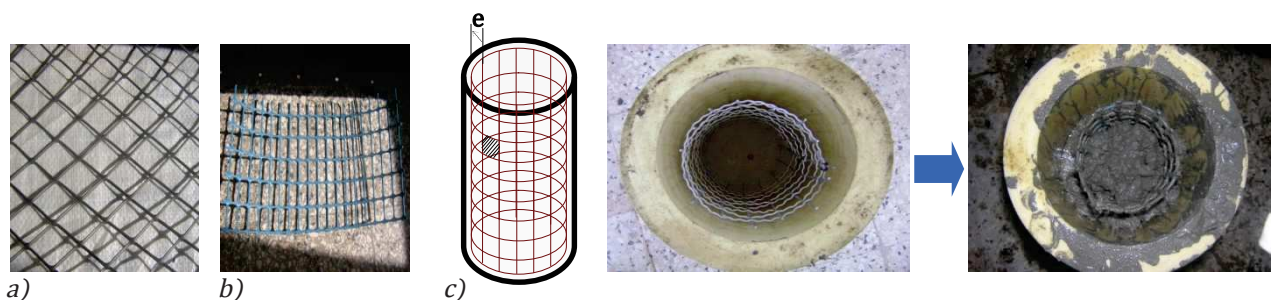
**Keywords:** concrete, confinement, steel grid, polypropylene grid, short columns

## 1. Introduction

Concrete material is a living material that changes throughout its useful life. Due to its weak tension strength, it is classically associated with steel reinforcements (reinforced concrete). Yet, As part of this work, we investigate an alternative reinforcement technique based on internal confinement. This approach allows to avoid corrosion and related durability problems on structures but also improve the global stability of concrete elements under seismic events [1,2]. Contrary to external confinement technique [3], grids reinforcement are introduced inside the material during casting. This paper intends to evaluate the influence of the reinforcement (material, mesh size, position) on the final response of the concrete.

## 2. Experimental protocol

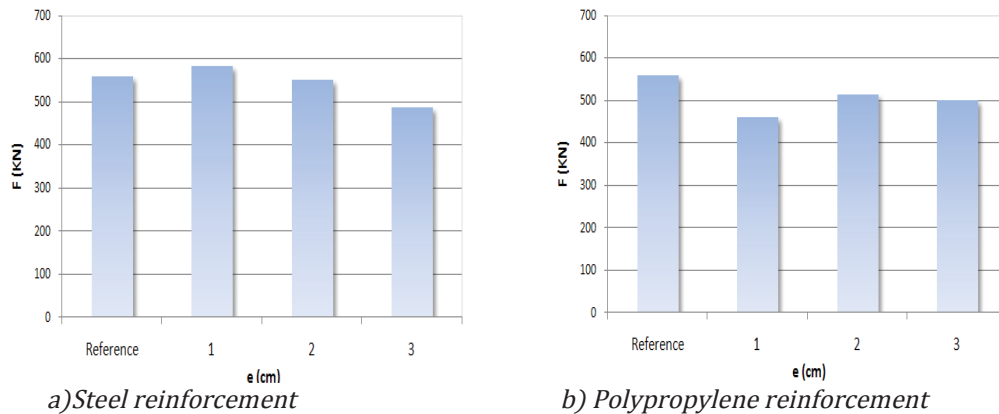
Different kind of grids are used, either made in steel (Fig. 1a) or polypropylene material (Fig. 1b), with various mesh size. Also, several values of concrete coating have been tested to see the influence of the reinforcement position inside the material. These reinforcements are located cylindrically inside the mould and then concrete is poured (Fig. 1c). Once material is hardened, standard axial compression tests on cylindrical concrete specimens have then been performed to establish the limit load in different cases.



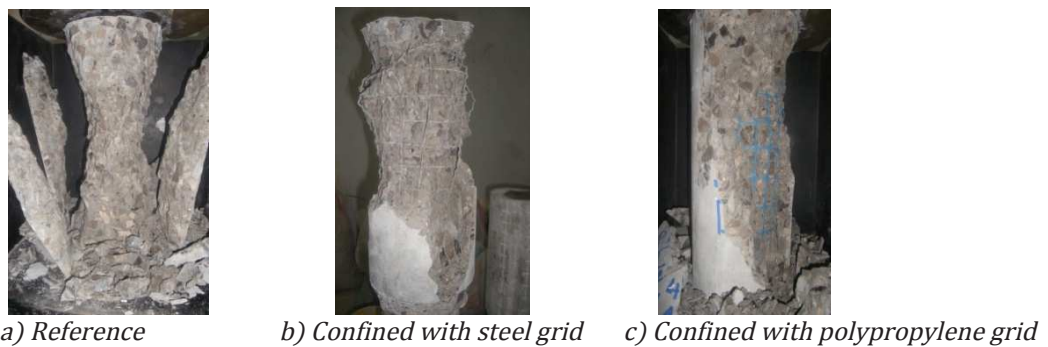
**Figure 1:** Examples of grids (a: steel, b: polypropylene) and manufacturing process (c)

### 3. Results and discussion

Illustrations of failure mode and strength data are provided on Figures 3 and 4. Note that Reference case corresponds to unconfined concrete.



**Figure 2:** Evolution of the limit load for different reinforcement materials and values of the coating  $e$



**Figure 3:** Failure mode of concrete specimens

Through the results obtained, we can conclude that integration of the grid modifies the behavior of concrete specimens. It affects in particular the failure mode by giving a new rigidity to the concrete whereas initially we have a bursting of the specimen. Secondly, integration of the grid in some specific position has made it possible to increase the mechanical strength of the concrete. This increase could reach around 30%. On the contrary, other positions or design may cause a decrease in resistance. Specially, such decrease is obtained for mesh sizes that have an effect on the distribution of grains. In this case, local heterogeneous areas with low resistance appear and promote the beginning of damage.

### References

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