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Experimental investigation of the behaviour of Unreinforced Masonry strengthened with UHPFRC

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1 Abstract

The majority of existing Unreinforced Masonry (URM) structures are prone to weathering and catastrophic events such as earthquakes. The repair and strengthening of unreinforced masonry is a challenging task mainly due to the poor connection between the new materials and the existing substrate. The applications of Fibre Reinforced Polymers (FRP) for the strengthening of URM show that premature de-bonding and failure of the strengthened elements may occur.
In the current study, the application of Ultra High Performance Fibre Reinforcement Concrete (UHPFRC) layers for the improvement of the structural performance of URM specimens made of engineering bricks has been examined. Different percentages of steel fibres have been used and layers have been cast in connection with the URM specimens. Additional provisions for the improvement of the connection between the UHPFRC and the bricks have also been examined. The effect of the thickness of the layers and the effect of the fibre percentage of the UHPFRC have been investigated via flexural out of plane tests. The load mid-span deflection results have been recorded alongside with the slip at the UHPFRC-to-bricks interface and the results show that the structural performance of the URM specimens can be significantly improved with the proposed technique.

Keywords: Masonry; walls; strengthening; UHPFRC.

2 Introduction

Unreinforced Masonry (URM) is one of the most commonly used construction types in many areas worldwide including earthquake prone regions. However, the majority of the existing URM structures are prone to seismic loads due to the low tensile strength characteristics of the material and URM elements suffer of significant damages and collapses after earthquakes. Even in cases where URM is not used as the main load bearing elements (e.g. infill walls) the contribution of URM elements to the structural performance of the structures is of high importance and failures or even collapses of these elements may significantly affect the performance of the structures while they can also lead to injuries and fatalities of the occupants. In case of damaged URM elements, it is common practice to demolish and rebuild these elements to avoid brittle type of failures and collapses. In other cases where additional strength is required, various strengthening techniques have been using conventional materials such as Reinforced Concrete (RC) layers or novel materials such as Fibre Reinforced Polymers (FRPs) [1-4]. However, a

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