Experimental investigation of the bond between Glass Textile Reinforced Mortar (GTRM) and masonry substrate: the effect of textile impregnation

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ABSTRACT

Textile Reinforced Mortar (TRM) is a composite material comprising fiber grids embedded in an inorganic (cement- or lime-based) matrix. The used textiles consist of dry or coated (partially impregnated) or fully impregnated fiber yarns. TRM systems have been gaining the technical world's acceptance as externally bonded strengthening means of existing masonry structures. However, the efficient use of TRMs significantly depends on both the bond between the composite material and the existing substrate and the bond between the grid and the matrix. In the current study, the TRM-to-masonry bond was experimentally investigated foccusing on the parameter of the yarns' treatment, that is none or impregnation with Styrene-Butadiene Rubber – SBR latex. For this purpose, both double-lap/double-prism (DL) and single-lap/single-prism (SL) shear bond test configurations have been employed. The used specimens comprised strips of glass fiber textiles (either uncoated or fully impregnated) applied on wallettes of stack-bonded smooth clay units through a cement-based mortar.

TRM strips of DL specimens (with uncoated textile – UT or impregnated textile – IT) had a bond length (BL) equal to 150 mm. This BL was larger than the effective one, i.e. the minimum length needed for the attainment of the maximum TRM bond capacity [1]. Due to the inadequacy of the DL set-up in capturing specimens' post-peak response, the SL set-up was also opted for. TRM strips of SL specimens (with UT or IT) had various BLs (100 mm, 150 mm, 200 mm) in order to study the combined effect of BL and textile impregnation.

In the case of UT, the failure mode was due to load-aligned yarns' slippage from the matrix simultaneously with their sleeve fibers' rupture regardless of the used set-up. Partial yarns' impregnation with the matrix led to the well-documented telescopic failure mechanism. In the case of IT, the failure mode differentiated between the used set-ups. DL specimens failed due to textile slippage from the matrix while SL ones failed due to yarns' rupture close to the load introduction point of the projecting textile. Full impregnation of the textile with SBR prevented matrix penetration within individual peripheral filaments transforming each yarn to a macro-fiber.

According to the results of both set-ups, the maximum bond load (F_{max}) of specimens with IT was increased by 40% in comparison with specimens with UT. Additionally, F_{max} of specimens with IT was increased with increasing BL (also observed by [2] where carbon textile was applied on masonry prisms through lime-based mortar).

REFERENCES

[1] P.D. Askouni and C.G. Papanicolaou, "Experimental investigation of bond between glass textile reinforced mortar overlays and masonry: the effect of bond length", Materials and Structures, Vol. **50**, pp. 164, (2017), doi:10.1617/s11527-017-1033-7.

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