

Abstract

Restoration of Deteriorated Concrete Columns by Wrapping with an Ecological UHPC †

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Ultra high performance concrete (UHPC) is self-compacting, reaching compressive strength over 200 MPa and flexural strength exceeding 30 MPa material. The used very low W/C ratio and high amount of Portland cement often exceeding 900 kg/m³, addition of up to 30% of silica fume produces a very dense and nearly impermeable binder matrix. In this research, cement was substituted with limestone filler to lower the effective CO₂ footprint. Prepared concrete mixes had high slump flow of 850 mm and reached the compressive strength of 150 MPa after 28 days. Full-scale columns having dimension of 30 × 30 × 250 cm were produced using self-compacting concrete (Figure 1a,b), having the 28 days compressive strength of 40 MPa. External surfaces of the 3 months old columns were water jetted to simulated real case scenario (Figure 1c). For the test, the columns were surrounded by a plywood formwork leaving less than 3 cm of spacing between the concrete surface and the formwork (Figure 1d). The concrete was poured from top of the column and with no segregation reached the bottom and perfectly filled the mold. Test included determination of basic mechanical properties, bond strength between UHPC and “old” concrete, crack formation and frost durability. All results exceeded expectations.

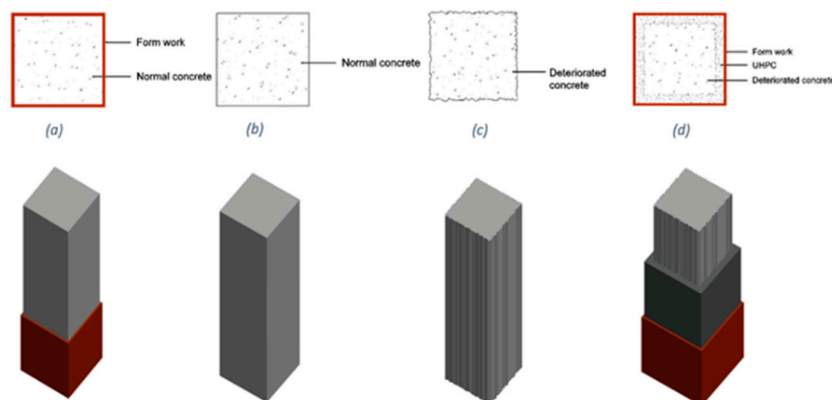


Figure 1. (a) Normal concrete casting, (b) Hardened NC after curing, (c) Deteriorated NC, (d) UHPC covered over deteriorated NC.



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