Behavior of EAF concrete under cyclic axial loading

Flora Faleschini[1], Daniel Trento[2*], Vanesa Ortega Lopez[3]

[1]University of Padova, Padova, Italy, flora.faleschini@unipd.it
[2]University of Padova, Padova, Italy, daniel.trento@studenti.unipd.it corresponding author
[3]University of Burgos, Burgos, Spain, vortega@ubu.es

Abstract

Among the different recycled aggregates that can be used to improve the sustainability of structural concretes, Electric Arc Furnce (EAF) slag were demonstrated to provide at the same time increased mechanical properties, reduced environmental impacts but also high unit mass in the final conglomerate. Despite several studies analyzed the above-mentioned EAF concrete properties, no one has dealt with the assessment of both elastic and plastic strains under cyclic axial loading of non-reinforced concrete members. Thus, in this study, two concrete mixes were realized, one reference and one with EAF slag as coarse aggregates at 100% replacement ratio, and they were subject to both monotonic and cyclic axial loading, continuously monitoring the applied stress and strains in the axial and transverse direction. The following properties were analyzed: compressive and indirect tensile strength, secant elastic modulus, Poisson coefficient, axial and transverse strains development and, lastly, the volumetric dilation. Results indicate that EAF concrete mix has higher compressive and tensile strength than the reference concrete, as well as higher elastic properties. The aggregates type influences the deformability of the concrete also beyond the elastic regime, both in the longitudinal and transverse direction, and the co-causes can be associated to the different intrinsic mineralogy of the aggregates and the micro-cracking of the cementitious paste under loading.

Keywords: *cyclic load, EAF concrete, load/reload paths, plastic strain, recycling, stress-strain.*

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