www.elsevier.com/locate/jobe

Mechanical Properties Of Lightweight Aggregates Concrete Made With Cameroonian Volcanic Scoria: Destructive And Non-Destructive Characterization

Willy H. Juimo Tchamdjou, Toufik Cherradi, Moulay Larbi Abidi, Luiz A. Pereira-de-Oliveira

PII: S2352-7102(17)30050-5
DOI: https://doi.org/10.1016/j.jobe.2018.01.003
Reference: JOBE391

To appear in: *Journal of Building Engineering*

Received date: 13 February 2017
Revised date: 30 November 2017
Accepted date: 3 January 2018

Cite this article as: Willy H. Juimo Tchamdjou, Toufik Cherradi, Moulay Larbi Abidi and Luiz A. Pereira-de-Oliveira, Mechanical Properties Of Lightweight Aggregates Concrete Made With Cameroonian Volcanic Scoria: Destructive And Non-Destructive Characterization, *Journal of Building Engineering,* https://doi.org/10.1016/j.jobe.2018.01.003

MECHANICAL PROPERTIES OF LIGHTWEIGHT AGGREGATES CONCRETE MADE WITH CAMEROONIAN VOLCANIC SCORIA: DESTRUCTIVE AND NON-DESTRUCTIVE CHARACTERIZATION

Willy H. Juimo Tchamdjou[1,2], Toufik Cherradi[1], Moulay Larbi Abidi[1], Luiz A. Pereira-de-Oliveira[3]
[1]Mohammadia School of Engineers, Mohammed V University of Rabat, Morocco
[2]Higher Institute of the Sahel, University of Maroua, Cameroon
[3]Ceuma University, São Luís, Brazil

ABSTRACT:

This paper analyses the properties of concrete produced with Natural Lightweight Aggregates from Cameroonian volcanic scoria VS. Two groups of concretes with VS were prepared. A first concretes group produced with a natural sand from Covilhã-Portugal was cast in cubic specimens (150x150x150 mm) and a second with a natural sand from Rabat-Morocco was cast in cylindrical specimens (160x320 mm). The concrete mechanical properties were evaluated by non-destructive tests (NDT) and destructive test (DT). Schmidt Rebound Hammer (SRH) and Ultrasonic Pulse Velocity (UPV) were performed to determine the concrete rebound number (RN) and the concrete dynamic modulus of elasticity (E_d) at 28, 56 and 90 days. The concretes compressive strength at 28, 56 and 90 days on cylindrical specimens has been determined using DT method and predict by empiric expressions, normally applied for normal concretes, in function of RN or/and UPV. The results show that, at ages from 28 to 90 days, the concrete compressive strengths increase by 27.42-35.36%, the RN increase by 5.2–22.3%, while the UPV increase only by 4.2–7.4%.
A concrete compressive strength model f_{c28} was proposed considering the effect of water-binder (W/B) and aggregate-binder A/B ratios, matrix volume R_m, VS aggregate V_{VSA} and sand V_s , the densities of the aggregates and the characteristic resistance of the cement R_C. It has been concluded that W/B, A/B, V_{VSA} and R_C showed more influence on the prediction model than V_m and V_s . Finally, it was concluded that concretes with VS from Cameroon can be used as structural or semi-lightweight concrete.

Keywords: Cameroonian volcanic scoria; lightweight aggregates; lightweight concrete; mechanical behavior; Non-destructive and destructive methods.

1 INTRODUCTION

Lightweight aggregate concrete (LWAC) is of utmost importance to the construction industry and is used in the civil engineering field as concrete structure dead weight reducer or as heat and sound insulating elements **(Bomhard, 1980; Bouguerra & al., 1998)**. The structure dead weight reduction could contribute to decrease the structure earthquake damages, because the earthquake forces on engineering structures and buildings are proportional to the mass of those structures and buildings. Thus, by reducing the mass of the structure or building, the risk of damage due to earthquake acceleration can be minimized **(Yasar et al., 2003; Kilic et al., 2003)**.
LWAC has been successfully used and investigated for structural purposes for many years due to a lot of obvious advantages, including higher strength to weight ratio, better tensile strain