

Modulus of elasticity for mortars containing discarded waste foundry sand (WFS)

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Abstract

There are several studies on the application of waste foundry sand (WFS) in mortars, however, it is necessary to study the behavior of this material in relation to its ability to absorb deformation according to movements of the substrate to which it is applied. The aim of this research was to determine the modulus of elasticity (E) for laying and coating mortar with partial replacement of small aggregate with WFS. The results indicated that the increase in WFS content reduces E because of smaller values for compression strength.

Keywords: Solid Waste , cementitious matrix , elastic constants.

Introduction

The mortars used at the civil construction field are manufactured with natural aggregates , however, due to the need to reduce the consumption of non- renewable natural resources and to create alternatives of use for waste generated by the various industrial sectors, several studies are being made in this regard. WFS is a mineral residue classified as II-A, which can replace the sand in mortars. The objective of this study was to determine the elastic modulus of laying coating mortar with WFS. Cylindrical test specimens (NBR 7215: 1996) ruptured at the ages of 7, 28 and 120 days; three types of recipe and contents of 0% , 50 % and 80 % WFS were used (Table 1) . For the modulus of elasticity (E) was considered NBR 8522 : 2008 .

Table 1. Recipes considered in the research.

Recipe	WFS content		
	0%	50%	80%
A	1:3.2: (CP:sand:lime:0.5)		
B	1:2:7: (CP:sand:cal:0.5)		
C	1:3.2: (CP:sand:0.5)		

Results and Discussion

With the results for Rc and E, it was calculated the average of each recipe, WFS content and rupture age (Figures 1 and 2). The line A showed increased strength due to the proportion of materials, i.e. higher consumption of cement. Results for E have indicated the direct interference of WFS content and recipe. But the 80% content showed values closer to the literature, with less variation for age and type of rupture and type of recipe, for both parameters (Rc and E). These results can be explained because of the presence of bentonite in WFS herein, which affect the cement hydration in cementitious matrices (ARMANGE, 2009; SIDDIQUE et al., 2005) .

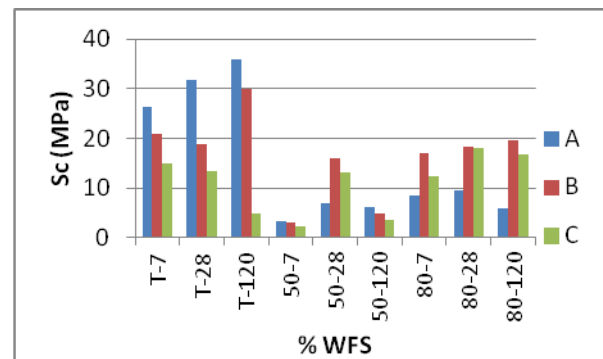


Figure 1. Average Compression Strength for mortars.

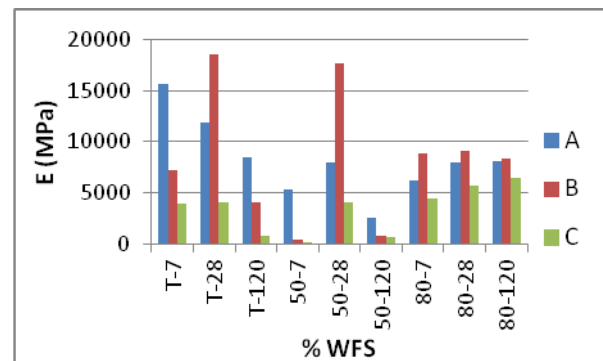


Figure 2. Average Modulus of Elasticity for mortars.

Conclusions

The research has shown the viability of the use of WFS in mortars up to the 80% content, considering E for the recipe 1:3 (CP:sand).

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¹ ABNT (2008) NBR 8522: Concreto –Determinação do módulo estático à compressão. Associação Brasileira de Normas Técnicas. Rio de Janeiro.

²ARMANGE, L. C. Utilização de areia de fundição em argamassas. In: 54 Congresso Brasileiro do Concreto, Maceió, AL, 2012.

³ SIDDIQUE, R. Effect of used-foundry sand on the mechanical properties of concrete. Construction and Building Materials, v. 23, p. 976-980, 2009.