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**Summary:** In earlier studies, the properties of concrete made from substitution of 30% of coarse aggregates by limestone have been already pointed out [1]. In addition, the mechanical properties of concrete made from substitution of 50% and 100% of coarse aggregates by limestone were studied [2]. In this work, concrete made from substitution of 70% of coarse aggregates by limestone dust was studied by experiment. The elastic properties of concrete made from substitution of 70% of coarse aggregates by limestone are investigated.

**Context – Objectives:** This paper presents a parametric experimental study which investigates the potential use of abandoned limestone powder wastes (LPW) combination for producing a low-cost and lightweight composite as a building material. The results of investigations on the suitability of using limestone dust as aggregate in lightweight aggregate concrete (LWAC) production are reported.

**Method:** The materials used are: Algerian Grade 42.5 ordinary silicate cement, natural sand in middle fineness, fine limestone. normal weight aggregate used was grading of 3-8 mm and superplasticizer used is SP40. The mixture was prepared by replacing 70% weight of normal aggregate by limestone. Concrete test samples were standard cylindrical samples with 160 mm diameter and 320 mm length and were cast to examine the elastic properties. Three samples were prepared and cured for 28 days, 90 and 180 days at ambient temperature until the time of testing.

**Results:** The elastic modulus of concrete can be determined by static modulus of elasticity tests or by the secant modulus of the stress strain curves resulting from compressive tests. In this study, the second method was used and the measured E value was compared with static modulus of elasticity estimated by empirical formulae. The E of concrete is a function of compressive strength. Various building codes have provided empirical equations relating E and compressive strength. The E value of concrete also depends on the stiffness of coarse aggregate, interfacial zone between the aggregates and paste and the elastic properties of constituent materials [3]. The statistical analysis carried out to obtain the power relationship between the modulus of elasticity and compressive strength yielded the following equations for the lightweight concretes [4]:

Static modulus:  $E_s = 8,8 f_c^{0,24}$  (1)

Dynamic modulus:  $E_d = 12,0 f_c^{0,21}$  (2)

Where: E: Modulus of elasticity [kN/mm<sup>2</sup>],  $f_c$ : Compressive strength [N/mm<sup>2</sup>].

Table 1: Compressive strength, static and dynamic modulus of elasticity results

	Modulus of elasticity (GPa) [5]	Static modulus of elasticity (GPa)	Dynamic modulus of elasticity (GPa)
28 days	21.87	17.81	22.24
90 days	19.95	17.49	21.89
180 days	17.08	16.24	20.51

The values of  $E_s$  and  $E_d$  are listed in Table 1. The calculated 28-day value of E using expression (1) is 17.81 GPa. In expression (1),  $f_c$  is the cube compressive strength. The above value of 17.81 GPa was obtained using cylinder strength value of 18.87 MPA. If the cylinder strength were converted into equivalent cube strength, the estimated value of E would be even greater than 17.81 GPa. More often than not, the empirical formulae are reported to overestimate the E value of lightweight concretes. However, for the concrete reported here the calculated E values are less than the observed value.

In a situation where the static modulus of elasticity of a particular mix of concrete may not be readily available for design purposes, it will be quicker and convenient to determine the dynamic modulus, and the static modulus of lightweight concrete can then be determined from the following recommended equation:  $E_s = 0.87 E_d - 0.78 \pm 3 \text{ kN/mm}^2$

This equation should give satisfactory results for most of the structural lightweight aggregate concretes.

**CONCLUSIONS:** This experimental work showed that limestone can be used for the production of concrete with acceptable mechanical properties. However, the complete investigation of limestone concrete, should include further tests concerning mainly with their durability.

## REFERENCES

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