VIBRATION EFFECTS IN THE PROCESS OF DYNAMIC COMPACTION OF FRESH CONCRETE AND STABILIZED EARTH

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Abstract

Vibration effects are presented in the compaction of fresh concrete and stabilized earth. Thus, stabilized by compacting earth under a forced vibration dynamic relations were established for calculating the modulus of elasticity, load capacity, Poisson's ratio and modulus volume. They also played in the yard and experimental results based on samples in situ.

For the fresh concrete in the compacting process has been established and the relationships for calculating the rheological model of dissipative energy in accordance with the effect of compaction. There are shows experimental results where it is found that the optimal duration of vibration can be determined by experimental and analytical assessments based on whether the vibration and the concrete grade.

Keywords: Rheological model, Fresh concrete, Coefficient of Poisson, Performance

1. Introduction

Internal energy dissipation in fresh concrete under the action of the harmonic vibration compaction process is proportional to the overall effect of reducing voids and porosity default.

To do this, the search for the optimal duration of the vibration can be achieved so that the concrete strength in the cured state maximum of 28 days. [1]

Essentially paper presents parametric evaluation of the internal dissipated energy according to the vibrations regime defined by the pair of values: amplitude A and circular frequency ω of the formwork in which the fresh concrete is vibrated.

For road structures using existing soils are necessary additive materials, as well as appropriate technologies, in order to obtain the resistance and stability performances at the levels required by normative regulations.

In this context, this paper highlights the effect of ground mixed with natural enzymes, mineral aggregates and additive materials. For certain categories of ground with large content of clay mixed with sand and mineral aggregates with an adequate treatment of enzyme stabilizers were obtained remarkable experimental results. Thus, the characteristics of the stabilized enzyme structures can be defined based on the mechanical strength σ_z of the vertically longitudinal elasticity modulus E_z, of the volumetric elasticity modulus E_v and rigidity coefficient k vertical direction. [2]

The presence of enzymes in the mixture of material is remarked, under conditions of corresponding dosing, mixing and homogenization, by modifying the coefficient Poisson, noted with υ. In this case, by increasing values of u towards the maxim limit υ_{max} 0,5 it is found the increase of the volumetric elasticity modulus, the increase of resistance as well as the increase of the completed structure rigidity.

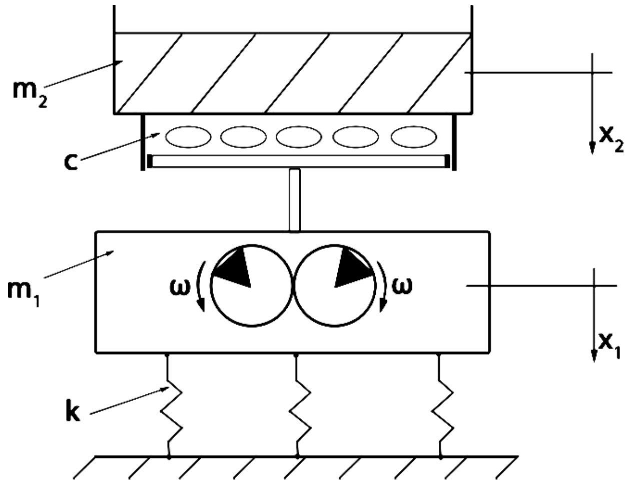

Fig. 1. The scheme of the calculation model

2. The Parametric Assessment of the Dissipated Energy

For the Kelvin-Voigt model presented in Fig. 1, it is considered that the stiffness, k, of the fresh concrete is much smaller than the rigidity, $c\omega$, as the effect of the viscosity under dynamic regime. For this reason, the amplitude of the vibrating formwork, having the mass m_1 is considered as A_1 and the amplitude of the concrete mass m_2 from the vibrating formwork, is considered as A_2.

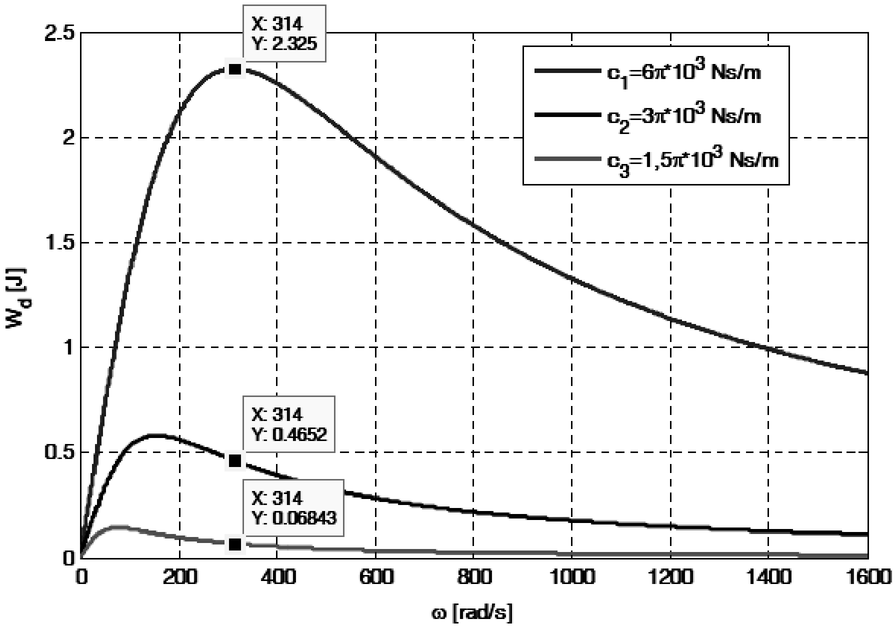

Fig. 2. The variation curves of the dissipated energy, W_d, depending on the pulsation ω

a. The assessment of the dissipated energy, based on the pulsation

Taking into account that the transmissibility T^{V-K} for k=0 is specific only for the viscous element, with the constant c, it is considered [3]:

$$T_0 = \frac{A_2}{A_1} = \lim_{k \to 0} T^{V-K} = \sqrt{\frac{c^2}{c^2 + m_2^2 \omega^2}} \tag{1}$$

and following, is resulting:

$$A_2 = A_1 \frac{c}{\sqrt{c^2 + m_2^2 \omega^2}} \tag{2}$$

From the relationship (1), it was used the expression of T^{V-K} given by the relationship:

$$T^{V-K} = \sqrt{\frac{k^2 + c^2\omega^2}{(k - m_2\omega^2) + c^2\omega^2}} \tag{3}$$

The dissipated energy, in the freshly compacted concrete, is expressed, as:

$$W_d = \pi c \omega A_2^2 \quad \text{or} \qquad W_d = \pi A_1^2 \frac{\omega c^3}{c^2 + m_2^2 \omega^2} \tag{4}$$

Based on the relationship (4) and the following experimental data: A= 5x10^{-4} m; m_2=60 kg;
c=1,5π 10^3 Ns/m and ωg0 ... 1600 Rad/s, the curves presented in Fig. 2 are obtained [3].

b. The assessment of the dissipated energy, based on the hysteresis loops

The force transmitted to the concrete mass during the vibrating is:

$$Q(x) = \pm\left(-\frac{m_2^2\omega^2 c}{c^2 + m_2^2\omega^2}\sqrt{A^2 - x^2}\right) + \frac{c^2 m_2^2\omega^2}{c^2 + m_2^2\omega^2}x,$$

where x, where $x \equiv x_1(t)$, and $A \equiv A_1$ (5)

The ellipse area is equal to the maximum dissipative energy ω_d^{max}. In Figs. 3, 4 and 5 are presented the family of ellipses, for three different frequencies: ω_1 = 314 Rad/s, ω_2 = 158 Rad/s and ω_3 = 79 Rad/s.

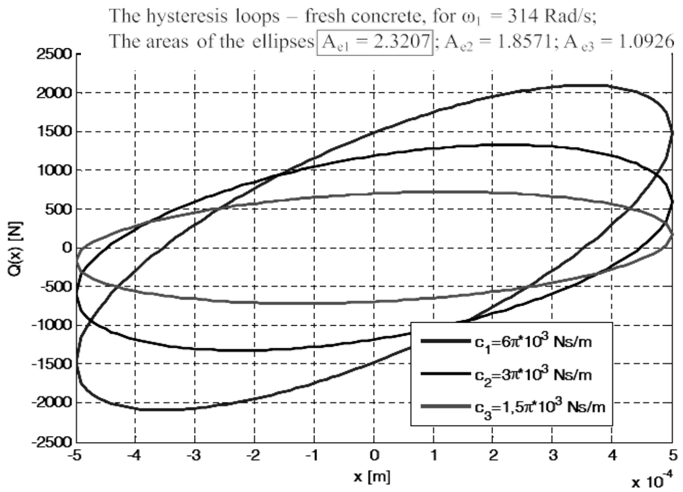

Fig. 3. The dissipation loops (ellipses) for ω_1 = 314 Rad/s

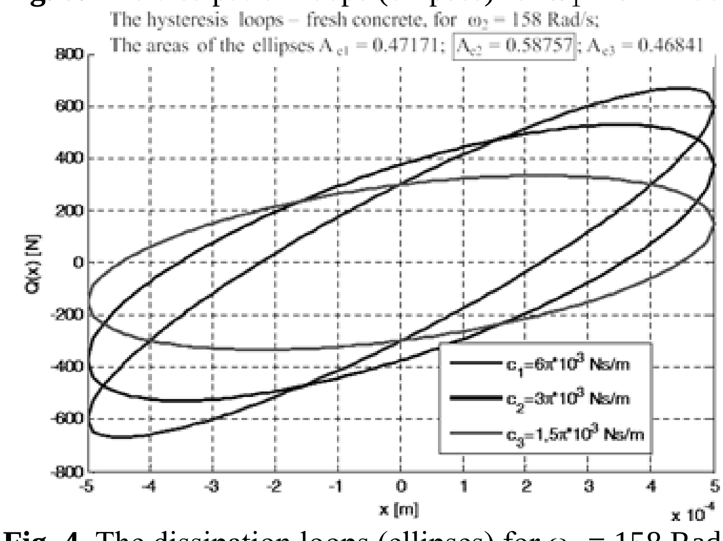

Fig. 4. The dissipation loops (ellipses) for ω_2 = 158 Rad/s

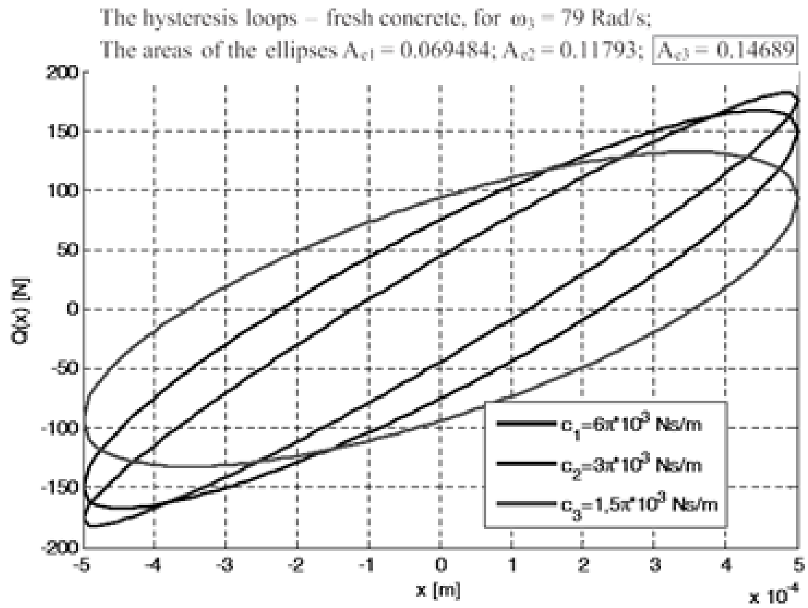

Fig. 5. The dissipation loops (ellipses) for $\omega 3$ = 79 Rad/s

c. Conclusions

The rheological model that was adopted has a significant viscous component, in such a manner, that $c\omega \cong k_r$ is equivalent with a dynamic rigidity. Based on the graphic representations, the following conclusions are highlighted:
a) the maximum values of the dissipated energy, in the families of curves, W_d (ω, c), are found to be numerically equal to the areas of the ellipses, presented in Figs. 3, 4 and 5;
b) the inclination angle of the ellipse is increasing, as the pulsation is significantly increasing, which shows that an equivalent dynamic rigidity, $c\omega$, is produced, being able to influence the inclination of the loop.

3. References

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