Experiment 3: DETERMINATION OF COEFFICIENT OF ELASTIC UNIFORM COMPRESSION (C_Z)

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ABSTRACT

The coefficient of elastic uniform compression of soil is the most important parameter while dealing the design of structures subjected to dynamic loading. The study was conducted to experimentally determine the coefficient of elastic uniform compression of soil by direct method. A soft rubber pad was used to simulate the soil. The shaker system was made to vibrate under constant frequencies and the vibrations caused by the shaker system were measured using an accelerometer for various frequencies ranging from 5 to 15 Hz. The resonant or natural frequency of the experimental system was found to be 9Hz and the coefficient of elastic uniform compression was computed as 2267.36 kN/m^3.

OBJECTIVES

The objective was to experimentally measure the coefficient of elastic uniform compression of soil

EXPERIMENTAL DETAILS

The experimental setup comprised of a machine (shaker system) resisting on a concrete block which was placed on a soft rubber pad to simulate the soil. A function generator was used to generate the signal at specified frequencies and was transmitted to the amplifier. The amplifier amplified the signals and sent to the shaker system. The accelerometer kept on the concrete block measured the vibrations caused by the shaker system and sent the signals to sensor signal conditioner, which further conditioned the signal and transmitted it to oscilloscope. Oscilloscope generated the plot of acceleration with respect to time. The procedure was repeated for various frequencies ranging from 9 to 15 Hz.

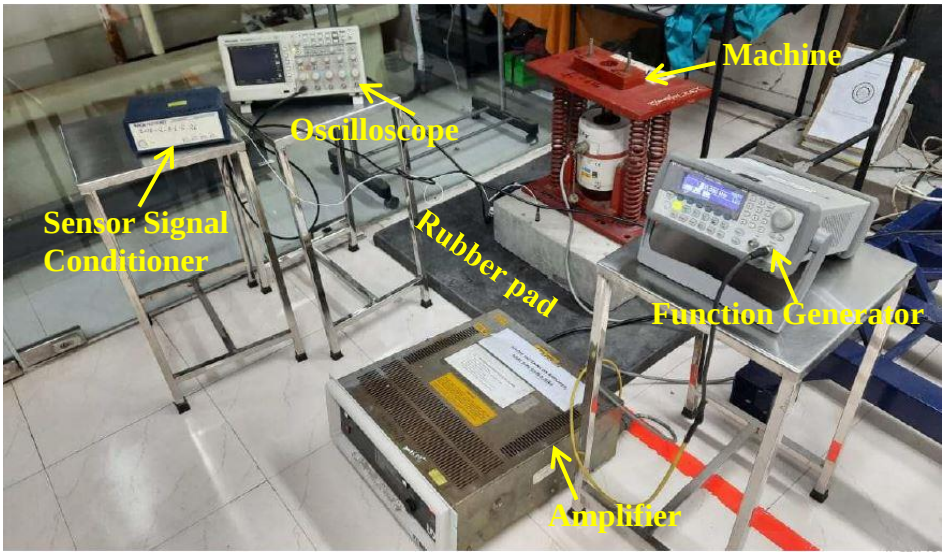

Fig. 1. Experimental set up

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RESULTS

Data

Total mass of the system (Block + Shaker), M : 177.262 kg
Area of the block, A_b : 0.25 m^2
Sensitivity of accelerometer : 100 mV/g
Time interval considered : 21 – 22.5 sec

Equations

Stiffness, $K_z = M\omega_N^2$ (1)

Coefficient of Elastic Uniform Compression, $C_z = \frac{K_z}{A_b}$ (2)

Corrected Coefficient of Elastic Uniform Compression, $C_{z(corrected)} = C_{z(measured)}\sqrt{(\frac{A_b}{A_f})}$ (3)

where ω_N is the natural frequency in rad/s, A_b is the area of the block and A_f is the actual area of the foundation

Calculations

Natural/ Resonant frequency (ω_n) = 9 Hz = 56.55 rad/s
Stiffness, K_z = 566.84 kN/m
Coefficient of Elastic Uniform Compression (C_z) = 2267.36 kN/m^3

Figures

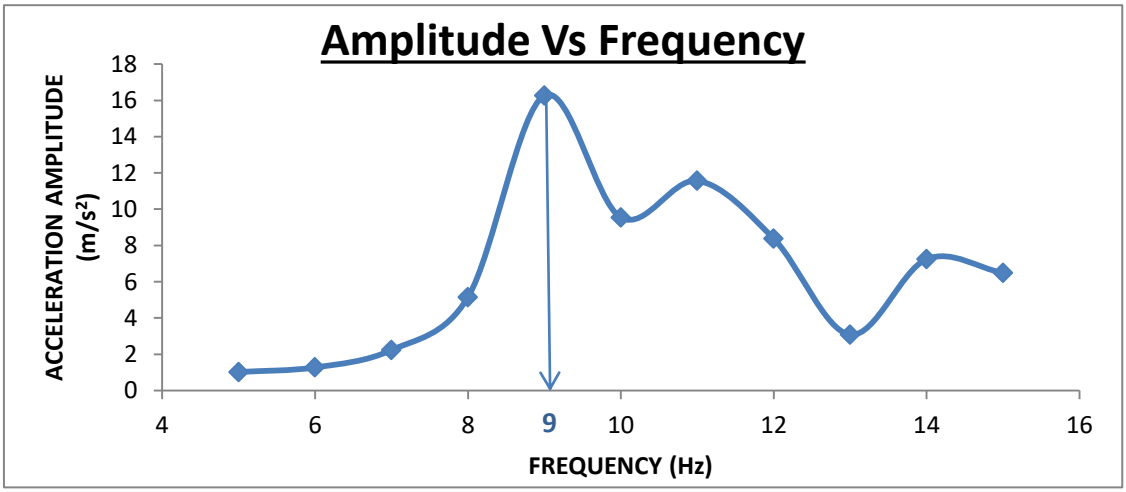

Fig. 2. Amplitude Vs Frequency graph

CONCLUSIONS

The coefficient of uniform elastic compression C_z was obtained as 2267.36 kN/m^3 and the natural frequency of the system was found to be 9 Hz. The Cz value of the actual foundation can be found using the equation (3), provided the maximum area of the foundation is limited to 10m^2.

REFERENCES

1. IS 5249:1992 – Determination of Dynamic Properties of Soil – Method of Test.

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