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Dynamic Analysis Of A Beam Based On A Ground

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Abstract: This article presents the results of a dynamic experiment conducted on an elastic beam with a length of 1 meter, based on a sheben soil. In the study, the effect of the soil base on vibrations, changes in the acceleration and displacement values in the beam were experimentally studied. Dynamic loads were applied through a vibration device, and vibrations were measured using an AV-1600-3 vibration tester. Based on the results obtained, the vibration energy absorption properties of the soil and the effect on the stiffness of the beam were analyzed.

Keywords: Dynamic analysis, vibration, sheben grunt, beam stiffness, acceleration, displacement, vibration experiment.

INTRODUCTION:

In recent years, the issues of soil foundations in relation to dynamic loads in building structures have become one of the important scientific directions. Various sources of vibration - machines, vehicles, earthquakes - have a significant impact on the stability of foundations. Therefore, experimental study of the vibration behavior of beams located on the soil foundation under such conditions is of great practical importance.

In this work, the dynamic response of an elastic beam installed on a sheben soil to vibrations generated at different frequencies was studied. The experimental results help to verify theoretical models and determine the dynamic properties of the soil-beam system(1-fig).

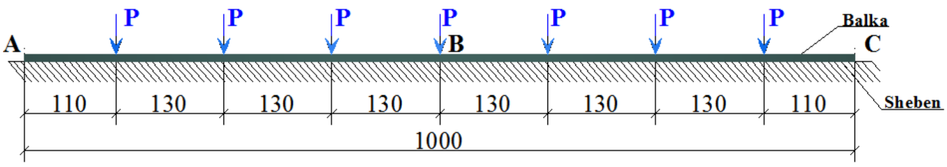

FIGURE 1. Calculation scheme of a beam with a foundation of soil

FORMULATION OF THE PROBLEM

The experiment was conducted in the laboratory of Samarkand State "GeoFundamentProekt" LLC. A 10–12 cm thick layer of soil was placed on the bottom of the stand, the surface was leveled, and a 1 meter long metal beam was installed on it. Three control points (A, B, and C) were selected on the beam, and the displacement and acceleration values were measured at each of them. Dynamic loads were applied using a vibration device. The device allowed changing the vibration amplitude in dynamic scale levels from 5 to 12. Measurements were carried out using an AV-1600-3 vibration tester. The results of the displacement (mm) and acceleration (m/s²) obtained from three points at each scale value were entered into a table and the average values were calculated (fig. 2).

FIGURE 2. Dynamic analysis results for a 1-meter long beam with a base of Sheben soil

During the experiment, it was found that the amplitude of the vibration and acceleration of the beam increased proportionally as the dynamic scale increased. For example, at the 5th scale value, the displacement at point A was 0.3–0.5 mm, and the acceleration was in the range of 3.2–6.3 m/s², while at the 12th scale value these indicators increased to 3.5 mm and 17.9 m/s², respectively.

This indicates that with increasing force, the inertia forces in the beam also increase and the soil partially absorbs the vibration energy. Since the soil has a low modulus of elasticity, the vibration does not pass completely, but partially dies out. This indicates the presence of a damping property.

In the experiment, the deformations were smaller in the experiment on a beam 0.8 meters long. This showed that with decreasing length, stiffness increases and dynamic response decreases.

SOLUTION METHOD

Based on the results obtained, an almost linear relationship was observed between acceleration and displacement. This confirms the direct proportionality between force and acceleration, in accordance with Newton's second law.

The experiment showed that the higher the density of the soil and the bonding between the particles, the faster the vibration damping occurs. Therefore, the sheben soil used as a base acted as an effective layer absorbing vibration energy.

Based on the results, the necessary experimental data were obtained to determine the dynamic stiffness coefficient of the beam. These data will serve as the basis for further modeling and theoretical analysis (table).

TABLE 1

T/R	Dynamic scale	Displacement (mm)			Acceleration (m/s²)		
		A(point)	B (point)	C point)	A(x)	B(z)	C(y)
1	4	4.85	10.45	4.67	0.4	0.5	0
2	5	4.94	10.8	4.75	1.1	3.1	0
3	6	5	11.15	4.85	1.6	4.9	0.7
4	7	5.2	12.1	5	1.7	6.9	0.8
5	10	6	14	6	2.3	16.5	3.6
6	12				5.9	23.1	7.2

CONCLUSION

1. Under the influence of dynamic loads, the deflection and acceleration values in the beam increase linearly with increasing load force.

2. The presence of a sheben soil foundation partially dampens vibrations and increases the stability of the structure.

3. Reducing the length of the beam increases its stiffness and reduces the amplitude of vibrations.

4. The obtained experimental results can serve as a

reliable basis for modeling the dynamic response of the soil-beam system.

REFERENCES

1. Жемочкин Б.Н., Синицын А.П.Практические методы расчета фундаментов балок и плит на упругом основании (без гипотез Винклера). Стройиздат, М.,1947.
2. Глушков .Г.И.Расчет сооружений заглубленных в грунт. М.Стройиздат. 1977. 295.с.
3. Рашидов Т.Р.Б Кузнецов С.В. Мардонов Б.М, Мирзаев И. Прикладные задачи сейсомдинамики сооружений.Ташкент. 2019. 268 с.
4. Власов В.З., Леонтьев Н.Н.Балки, плиты и оболочки на упругом основании.М. Изд. Физмат.лит. 1960. 490 с.
5. Будак Б.М.,Самарский А.А,,Тихонов А.Н. Сборник задач по математической физике. М.Физмат. лит 1956. 682 с.
6. Dilshod Kholiqov, Jamshid Abdurazzoqov, Rustambek Usmonov, Kamola Xaydarova // Free torsional vibration of an elastic thin-walled cylindrical shell with variable cross sectio// AIP 2024/11/27 060029-1. https://doi.org/10.1063/5.0241748
7. B Mardonov, KX Xaydarova, DM Ismatova // горизонтально- вращательные колебания сооружений с фундаментом, взаимодействующим с основанием по билинейному закону при сейсмических воздействиях// problems of architecture and construction 2 (3), 824-827
8. XK Xakimovna, ID Maxmudovna// prospects for the application of brick walls in modern housing construction under construction in uzbekistan.// indonesian journal of law and economics review 19 (1), 10.21070/ijler. v19i1
9. Kamola Xaydarova// Bir qatlamli elastik asosda joylashgan to‘sinning seysmik kuchlar ta’siridagi tebranishining V.Z. Vlasov usuli asosida analitik tadqiqi // Yashil iqtisodiyot va taraqqiyot 2025-yil, may. № 5-son, 148-152 b.
10. Batirjan Mardonov Kamola Xaydarova Ilhom Turayev E.Yadigarov// Dynamics of a rigid beam on an elastic single-layer foundation with mechanical characteristics varying with depth// Innovative: International Multi-disciplinary Journal ofApplied Technology (ISSN 2995-486X) VOLUME ISSUE 4 2025.