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TO ANALYZE WHICH LOCATION THE BARRIER APPLIED TO REDUCE THE VIBRATION WAVES GENERATED FROM RAILWAY TRAINS WILL BE MORE EFFECTIVE IF THEY ARE DESIGNED

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ANNOTATION
The article examined the distribution of vibration waves during the movement of railway trains on the ground and in building structures. In order to reduce the level of vibration waves, a barrier is placed. The effectiveness of the set was analyzed. Come to the flat issue of the theory of elasticity, the issue is solved by the method of finite elements.
KEYWORDS: *vibration waves, harmonic load, semi-plane, relief, grunt, construction, theory of elasticity, amplitude, building, model, boundary conditions, barrier, rail.*

DISCUSSION

As of now, the number of the population is growing year-over-year. As a result of this, there is a reduction in the land allocated for construction. This, in turn, requires consideration of the issue of reducing the boundaries established in the normative documents around the railways. The construction of buildings near railways at a distance of at least 50 m is listed in the normative documents. The vibration and noise absorption generated by the movement of trains is 50-100 m. If the distance to the transport facilities is reduced, then the possibility of productive use of these places is formed. If the distance is reduced, it is observed that the vibrations generated from the train movement have a very large negative impact on the health and labor productivity of people living near the transport facilities, as well as on technological processes [4].

The purpose of the vibration assessment is to determine the measures to reduce the impact in the proposed project, in the areas where the resulting vibration may have a negative impact. To do this, we determine the displacement values that are formed as a result of vibration on the surface of the Earth and under the ground, building structures.

This research work is an expression from determining its effectiveness by creating a barrier at a certain distance from the building so that the vibrations in the buildings located near the railway station do not exceed the norm level.

The results of the research work carried out in this area indicate that, as an obstacle, it was determined that when using reinforced concrete contracts, various materials, they did not have a high ability to absorb vibrations [5;6;7;8]. In the study, computational work was also performed on materials such as local materials (construction waste, sand, penoplast) as a barrier but the vibration level did not decrease significantly. The open trenches used to absorb the vibrations gave positive results. It is for this reason that the effectiveness of open tranche barrier has been studied in this research work.

At a distance of 20 meters from the railway station, the building was placed. The foundation of the building is located 2 m below the road level line, the building is designed as two-storey and full-fledged. A tranche was dug between the railway station and the building. We will analyze the effectiveness of locating at different distances from the railway station of tranche. Tranche width was taken as 1 m, depth 5 m, the area under investigation was divided into 854 elements. (Picture 1)

To do this, we bring the issue to the flat matter of the theory of elasticity. According to the results of the experiment, the vibration of the grunt is subject to harmonic law, and since the vibration amplitude is very small, we see the issue as linear[9;10].

Taking into account the physico-mechanical characteristics of the material under the influence of a pair of harmonic particle, which is placed on the free boundary of the semi-plane, we determine the displacements in the floors and columns of the buildings. In this matter, we replace the infinite half-plane with the finite sphere [1]. In this AC, CD and DM at the borders (Figure 1) the following conditions have been established that ensure waves seek infinity at the AC and CD [2].

$$\text{in } AC \quad \left.\begin{aligned} \sigma &= \alpha\ \rho\, V_p\, \dot{v} \\ \tau &= \beta\ \rho\, V_S\ \dot{u} \end{aligned}\right\}, \qquad \text{in } CD \quad \left.\begin{aligned} \sigma &= \alpha\ \rho\, V_P\, \dot{u} \\ \tau &= \beta\ \rho\, V_S\ \dot{v} \end{aligned}\right\}$$

In there σ and τ – normal and surge voltages; $\dot{u}$ and $\dot{v}$ – projection of the speed of the boundary points on the arrows; V_P and V_S – P and S speeds of waves ; α and β– parameters without dimensions; ρ–is the density of the material.

To solve the issue, we use the method of finite elements.

We write the equation of motion as follows [3]:

$$[M]\left\{\ddot{u}(t)\right\}+[C]\left\{\ddot{u}(t)\right\}+[K]\left\{\ddot{u}(t)\right\}=\{P(t)\}-[\Gamma]\left\{\ddot{u}\right\} . \qquad (1)$$

In this: $[M]$, $[C]$ and $[K]$ – system mass, dempfir and bikr matrices, respectively; $\{u\ (t)\},\{p(t)\}$ – node migration and vectors of impacting forces; $[\Gamma]$ – diagonal matrix, taking into account the conditions of the boundary [3].

The finite dynamic model of the problem-solving sphere can be seen in the picture below.

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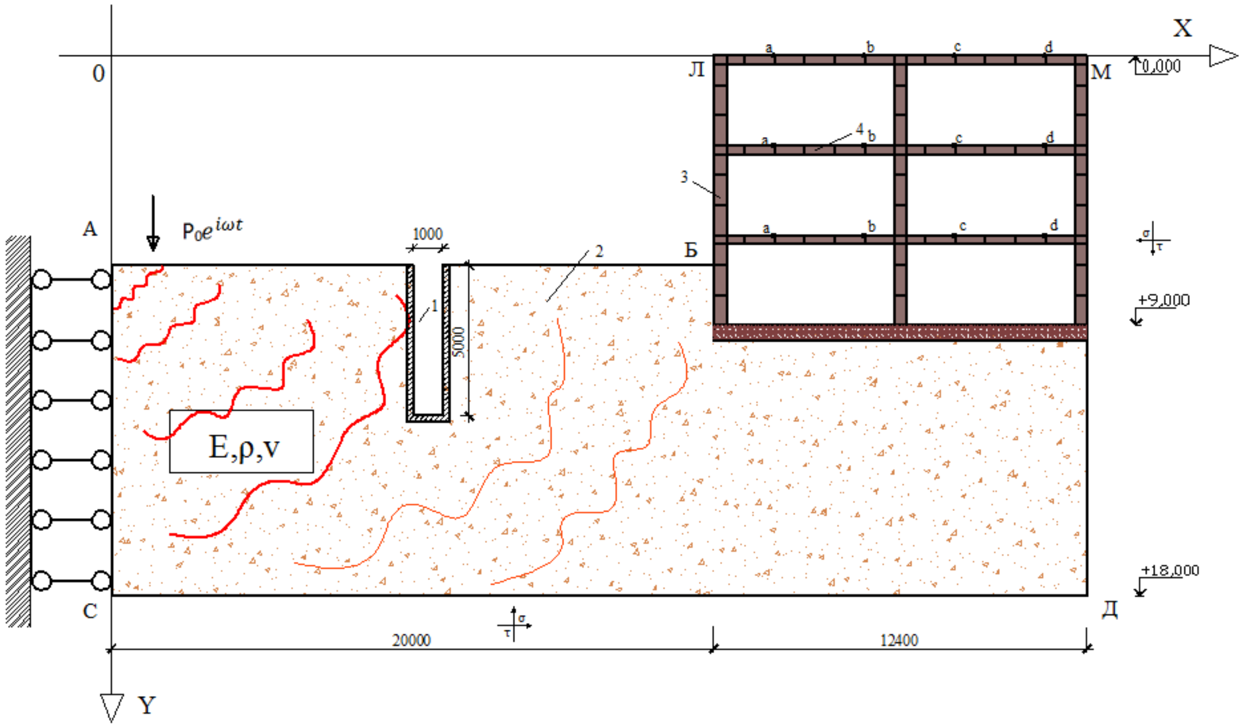

1-picture. Accounting scheme for solving the issue

Here are the types of material with the numbers 1, 2, 3 shown (listed in Table 1), the nodes investigated with the letters a, b, c, d are marked. The checked nodes are located at a distance of a=22 m, b=2 m, c=28 m and d=31 m from the railway station.

The results of the calculations are shown in Table 2 and graphs when designing the railway station at distances of 4m, 7m, 10m and 13m. In this matter, the type of grunt is taken as the same for both cases.

The elasticity module and Puasson coefficients in solving the issue were obtained in the table below.

1-жадвал

№	type of material	Elastic modules - E, H/sм^2	Specific weight -ρ, kg/m^3	The Poisson coefficient - ν
1	vacuity	0	0	0
2	sandy-gravel grunt	2850	1800	0,35
3	Iron-concrete	200000	2500	0,15

Suppose that the external acting power frequency is given in the form of a harmonic function ω

$$\{P(t)\} = \{P_o\}e^{i\omega t}. \quad (2)$$

The reaction of the system for a stagnant process will be as follows

$$\left.\begin{aligned} \{u(t)\} &= \{\overline{u}\}\cdot e^{i\omega t} \\ \left\{\dot{u}(t)\right\} &= i\omega\{\overline{u}\}\ e^{i\omega t} \\ \left\{\ddot{u}(t)\right\} &= -\omega^2\{\overline{u}\}\ e^{i\omega t} \end{aligned}\right\} \quad (3)$$

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Now, if we put (2) and (3) into the equation of motion (1), we will have a system of time-dependent complex algebraic equations

$$[K]\{\bar{u}\} = \{P_o\}. \quad (4)$$

Here $\{\bar{u}\}$ –vector of the amplitude of vibration; $\{P\}$– vector of the amplitude of the acting force.

By the Gaussian method (4) solve the equation, the constant complex amplitude vector of the system is determined.

$$\{\bar{u}\} = \{\bar{u}_1, \ \bar{u}_2, \bar{u}_3, ..., \bar{u}_N\} . \quad (5)$$

Here N- is the degree of freedom of the sphere. Real migrations are determined by the following formula.

$$\{u(t)\} = \mathrm{Re}\{\vec{u}\}\cos\varpi t + \mathrm{Im}\{\vec{u}\}\sin\varpi t \quad (6)$$

The die of the amplitudes of the vibrations on the surface of the grunt has quenching and nomotonic character, away from the polotno axis.

Taking the nodes shown in Figure 1 from each floor of the checked buildings were considered for cases where the load frequency ω= 10÷50 Gts.

2-Table

№	Checked nodes	Tranche 4m distance	Tranche 7m distance	Tranche 10m distance	Tranche 13m distance
1-floor ω= 20 Gts	a	0,09558	0,10072	0,15388	0,09503
	b	0,02386	0,01901	0,02237	0,04001
	c	0,04548	0,02627	0,02865	0,00547
	d	0,00509	0,0039	0,00475	0,00154
2-floor ω= 20 Gts	a	0,10309	0,10232	0,15071	0,08707
	b	0,01093	0,00889	0,01799	0,01553
	c	0,0341	0,03266	0,0531	0,03476
	d	0,00295	0,0102	0,01106	0,00844
wall coating floor ω= 20 Gts	a	0,11009	0,10421	0,14842	0,08047
	b	0,02941	0,04119	0,04031	0,05275
	c	0,0156	0,04796	0,07309	0,07033
	d	0,0031	0,01413	0,01705	0,01805
1-floor ω= 30 Gts	a	0,02926	0,02391	0,01234	0,00816
	b	0,01098	0,00212	0,00606	0,00938
	c	0,01616	0,01702	0,00291	0,00729

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	d	0,00374	0,00458	0,00163	0,00081
2-floor ω= 30 Gts	a	0,03346	0,02321	0,01362	0,00855
	b	0,00739	0,00602	0,00503	0,00917
	c	0,01661	0,00769	0,0125	0,01091
	d	0,00738	0,00497	0,00263	0,00268
Wall coating floor ω= 30 Gts	a	0,03814	0,02296	0,0172	0,01035
	b	0,01762	0,01046	0,00891	0,00868
	c	0,01253	0,01011	0,00417	0,00455
	d	0,00605	0,00439	0,00291	0,00197

1-form

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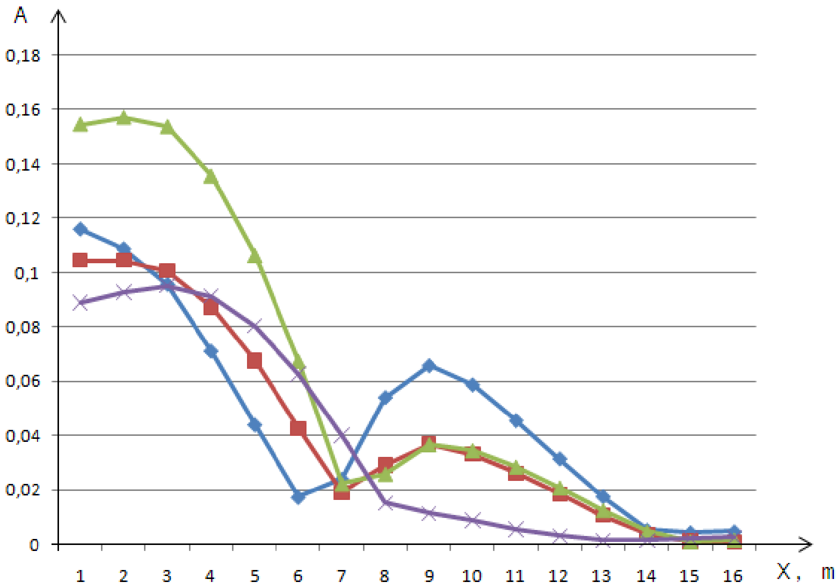
Бинонинг биринчи қаватидаги
тугунларнинг кўчишлари

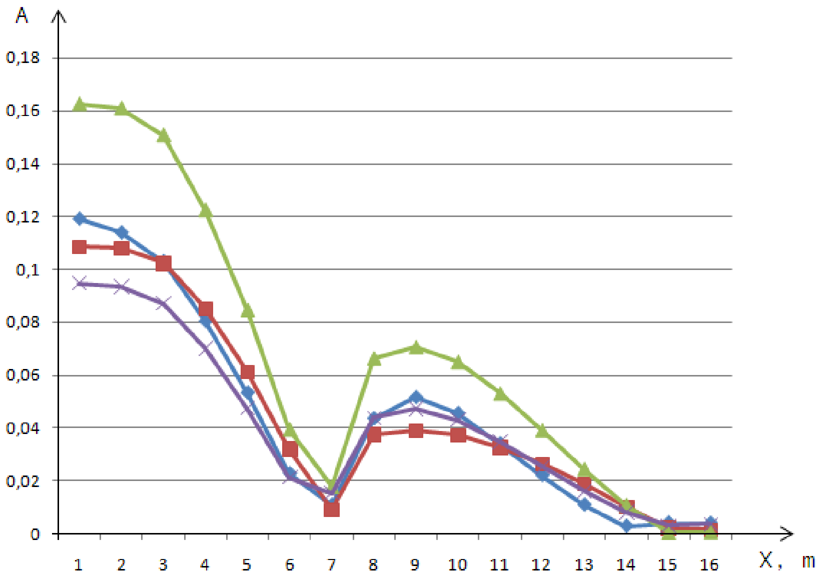
частота 20 гц



2-form

Бинонинг иккинчи қаватидаги
тугунларнинг кўчишлари

частота 20 гц



3-form

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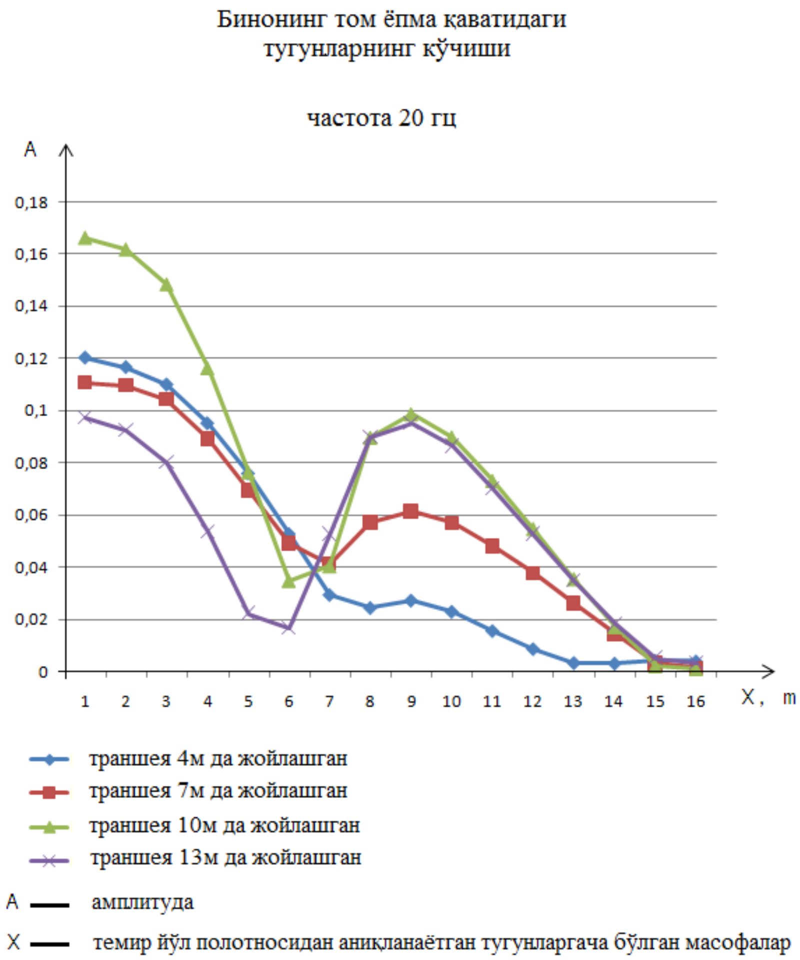

4-form

We check the migrations when the frequency is at 20 Gts, when the tranche is at 4, 7, 10, 13 m distances.For the first floor, in node a, we compare it to the values of the displacement in the tranche at a distance of 4m. At a distance of 7m from polotno, the vibration rate increased by 5,3%, at a distance of 10m the vibration rate increased by 60%, while at a distance of 13m the vibration rate decreased by 1%. When we finished b, it decreased by 7m at a distance of 20%, decreased by 10m at a distance of 6,3%, increased by 13m at a distance of 40,4 %. In stock, there was a decrease of 7m at 42%, 10m at 37%, and 13m at 87%. We check the changes in the d node. At a distance of 7m decreased by 13,4%, at a distance of 10 m to 6,7% and at a distance of 13m to 70%.

When analyzing the results of the study, the moving load frequency was found to be effective at ω=10 ÷ 20 GHz, compared to the trains at 4m in 7m, 10m and 13m which means that the number of migrations was determined to be small.

The above condition change was observed when the load frequency was greater than 30 Gts. The numerical value of the migrations became smaller, and the efficiency of the tranche, located at a distance of 10 m, was better than others.

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