

The International Conference on the 120th Anniversary of the Bulnay earthquake: Advances in Astronomy and Geophysics

Resonant coincidence of the dominant frequencies

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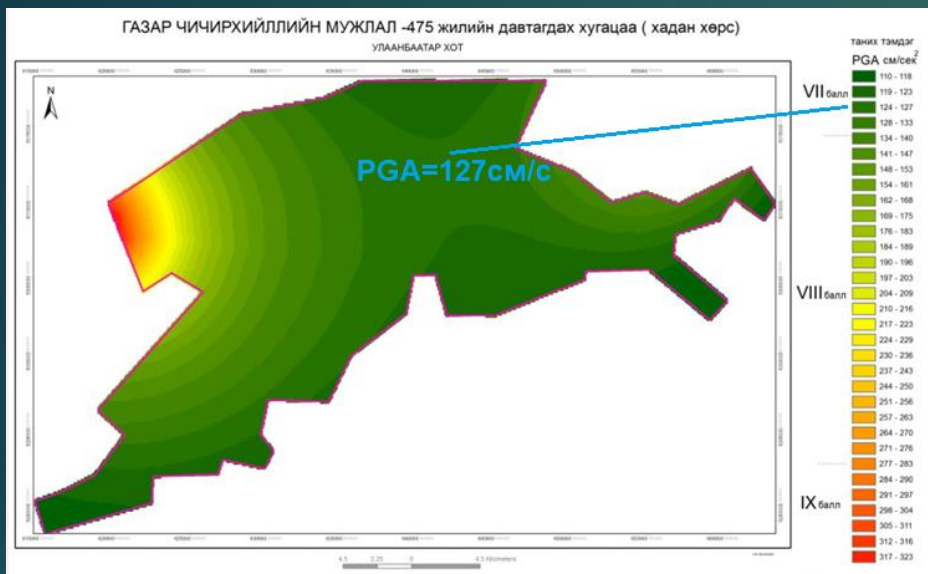
SEISMIC RISK ASSESSMENT FOR HIGH-RISE BUILDINGS

EARTHQUAKES OF 2021

DETERMINATION OF THE BUILDING'S NATURAL FREQUENCY

CONCLUSION

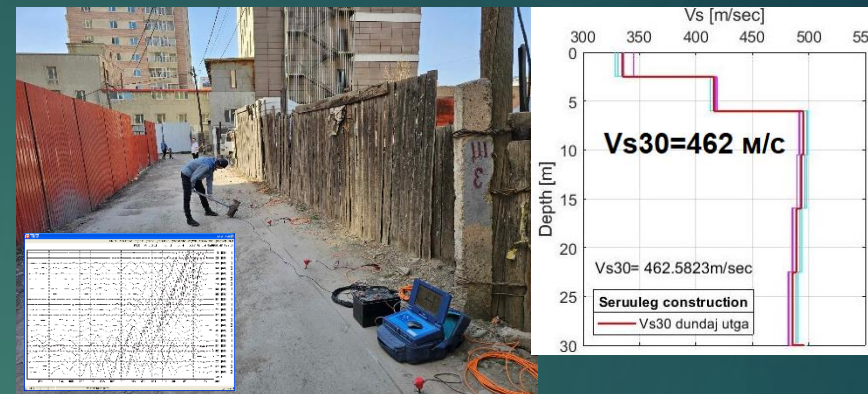
SEISMIC RISK ASSESSMENT FOR HIGH-RISE BUILDINGS



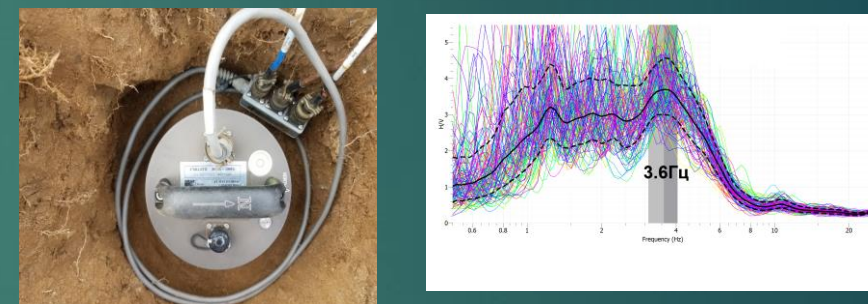
The map of peak ground acceleration for the rock soils of Ulaanbaatar with a return period of 475 years.

The increases value calculated for each frequency range

	The Tuul river valley 1-4 Hz	Neogene zone 1-4 Hz	Zone 4-7 Hz	Zone 7-10 Hz
International Building Code	1.4-1.6	1.2	1.2	1
Theoretical calculations	1.4-1.9	1.4-1.6	1.4-1.7	1.1
Final result of the calculation	1.6	1.4	1.5	1.1



Result of OYO McSeis SX24 seismic device measurements



Result of Guralp seismic station measurements

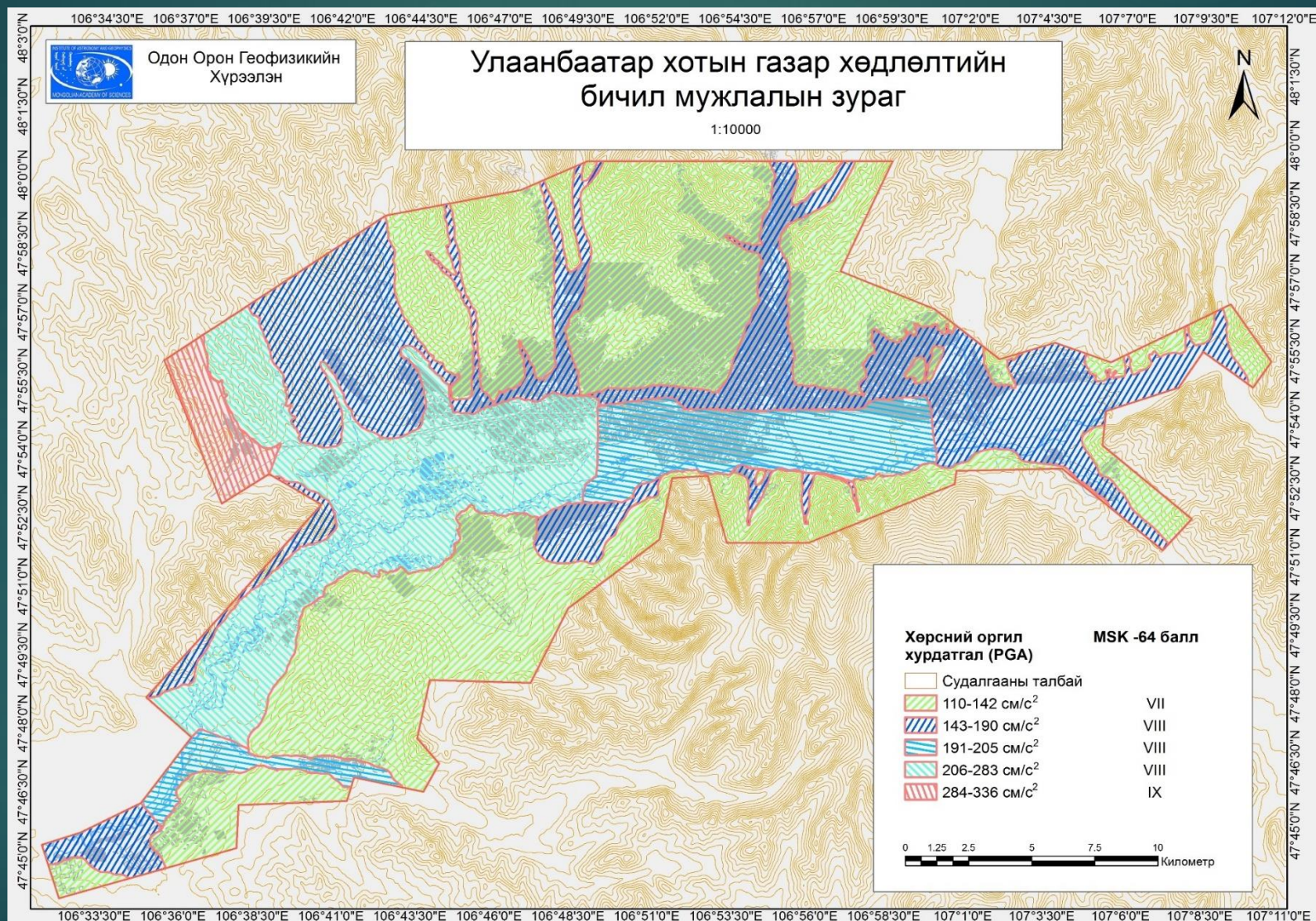
At the construction site of the company 'Seruuleg Construction', located in the Sukhbaatar district of Ulaanbaatar, during a possible strong earthquake, a peak acceleration of 177.8 cm/s² will be observed. The intensity of the ground shaking will be assessed at 8 points.

SEISMIC RISK ASSESSMENT FOR HIGH-RISE BUILDINGS

д/ д	Buildings	Vs30, м/с	Natural frequency, Hz	PA, см/с ²	Encrease value	PGA, см/с ²
1	ХУД 10 хороо, “Мандах Тауэр” ХХК	>745	8.7-9.3	124-127	1.1	139.7
2	БЗД 1 хороо, “Эс Энд Ви Юу” ХХК	>667	13.6	124-127	1.1	139.7
3	БЗД 1 хороо, “Тайм Консалтинг” ХХК	>553	10.7	119-123	1.2	147.6
4	СБД 8 хороо “Этүгэн” их сургууль	>400	6.6	119-123	1.2	147.6
5	СБД 8 хороо "СН трэйд" ХХК	>400	8.0	119-123	1.2	147.6
6	ХУД 4 хороо, “Хүчит Шонхор” ХХК	>450	1-4	119-123	1.4	172.2
7	ЧД 1 хороо, “Од театр” ХХК	>581	3.6	124-127	1.4	177.8
8	БЗД 1 хороо, “Вишн Девелопмент” ХХК	>456	1.0	124-127	1.4	177.8
9	ЧД 9 хороо "Грин финанс" ХХК	>450	1.0	119-123	1.5	184.5
10	ХУД 15 хороо, “Таймскүэр Девелопмент” ХХК	>470	3.3	119-123	1.5	184.5
11	ХУД 15 хороо, “Эм-Си-Эс” ХХК	>485	3.6	119-123	1.5	184.5
12	СБД 1 хороо, “Алтернатив клин энерги” ХХК	>398	5.6	119-123	1.5	184.5
13	ХУД 15 хороо, “Фор сийз гарден” ХХК	>414	4.4	119-123	1.5	184.5
14	ЧД 1 хороо, “Их Монгол товер” ХХК	>630	5.1	124-127	1.5	186.0

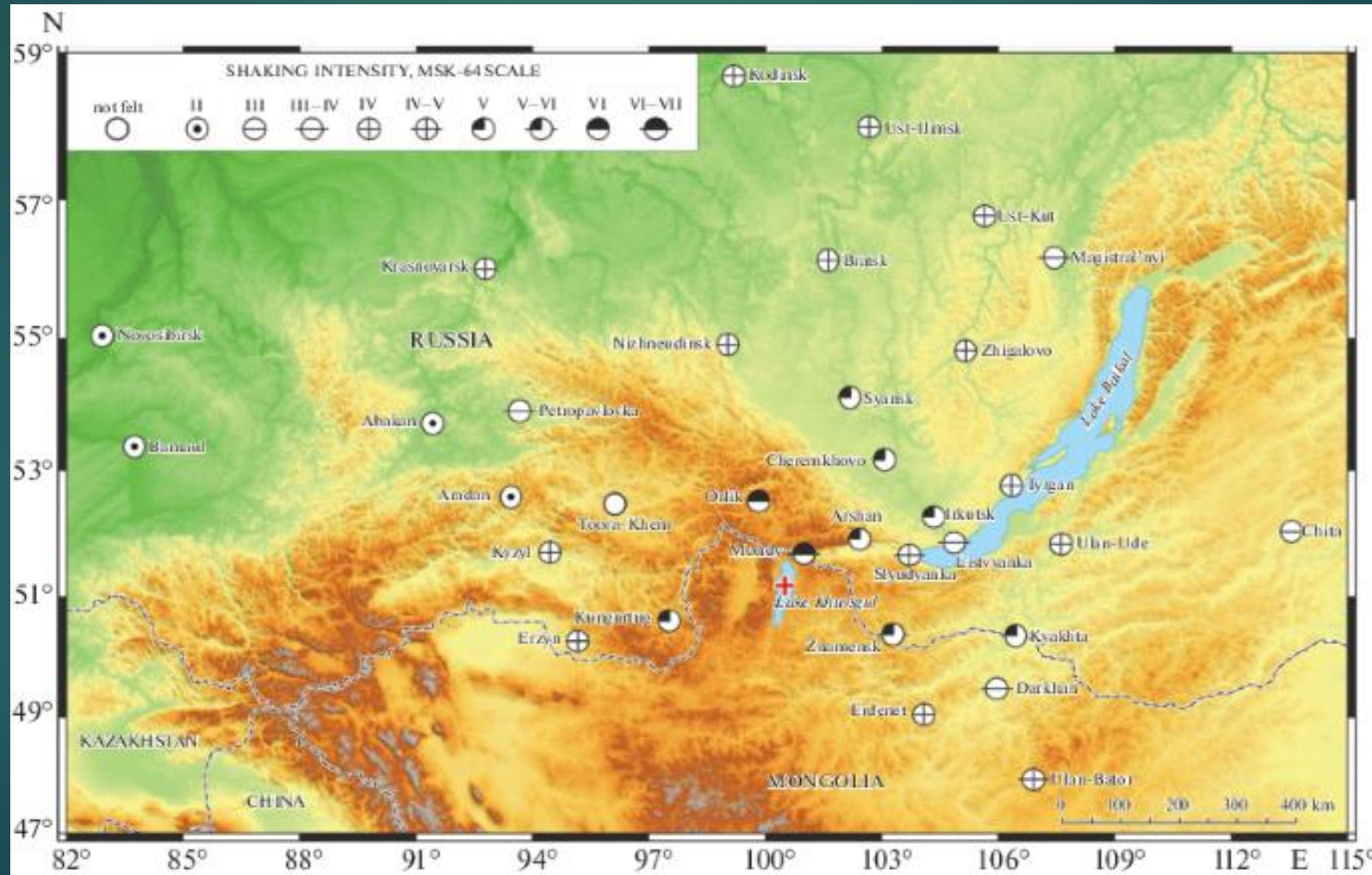
15	ХУД 17 хороо, “Нью капитал” ХХК	>390	1.4	110-118	1.6	188.8
16	ХУД 15 хороо, “Тайм Констракшн” ХХК	>531	3.2	110-118	1.6	188.8
17	ХУД 17 хороо, “Биг тауер констракшн” ХХК	>390	1.4	110-118	1.6	188.8
18	СБД 1 хороо Баттрейд Си ХХК	>543	4.7	124-127	1.5	190.5
19	ХУД 15 хороо, “Монх-Сан” ХХК	>417	4.7	124-127	1.5	190.5
20	СБД 1 хороо "Эжо тауэр" барилга	>474	5.4	124-127	1.5	190.5
21	СБД 1 хороо "Марко Поло" ХХК	>520	4-6	124-127	1.5	190.5
22	СБД 1 хороо "П.Гэндэнгийн сан"	>518	4.8	124-127	1.5	190.5
23	ХУД 15 хороо, “Суруга Трейдинг” ХХК	>456	4.2	124-127	1.5	190.5
24	СБД 3 хороо, “Нарны зам Энканто” төсөл	>346	5.1	124-127	1.5	190.5
25	ЧД 2 хороо, “Даяр өндөр” ХХК	>360	4-8	124-127	1.5	191
26	ХУД 15 хороо, “Өөжин” ХХК	>487	3.7	119-123	1.6	196.8
27	ХУД 15 хороо, “Таван Богд пропери” ХХК	>400	3.5	119-123	1.6	196.8
28	ХУД 3 хороо, “ЭГЭ” ХХК	>488	1.15	124-127	1.6	203.2

The seismic microzoning map of Ulaanbaatar (Odonbaatar 2016)



EARTHQUAKES OF 2021

The $M_W = 6.7$, $M_L = 6.9$ Khuvsgul (Khubsugul, Khövsgöl) earthquake occurred on January 12, 2021 in the Northern Mongolia close to the border of Russia. The earthquake caused ground shaking which reached intensity IX at the epicenter and was perceptible in the cities and villages of the Eastern and Western Siberia, Ulaanbaatar.

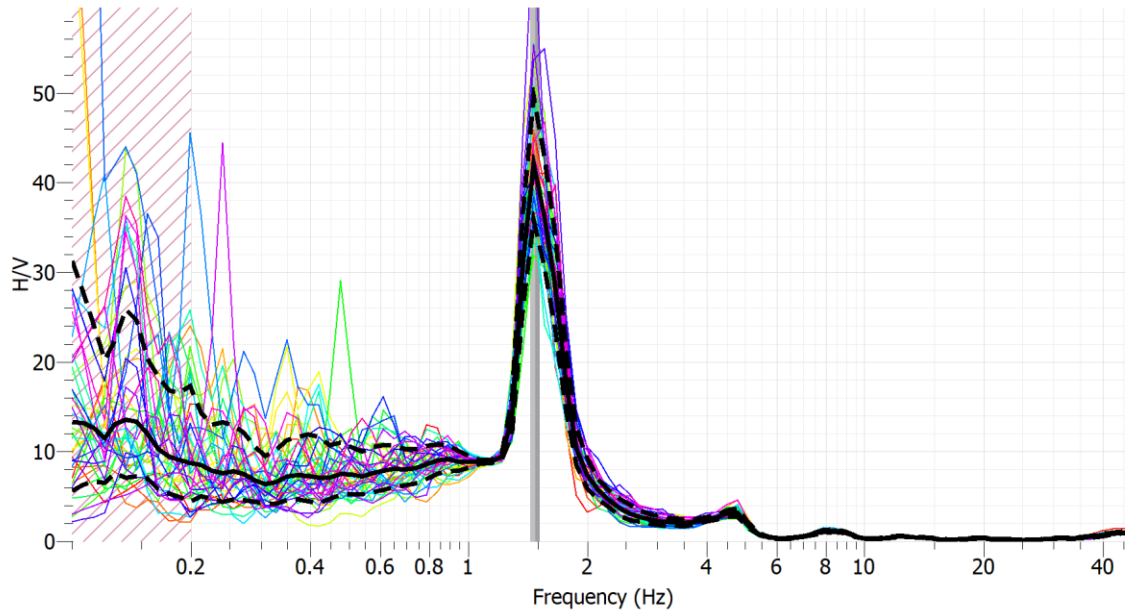
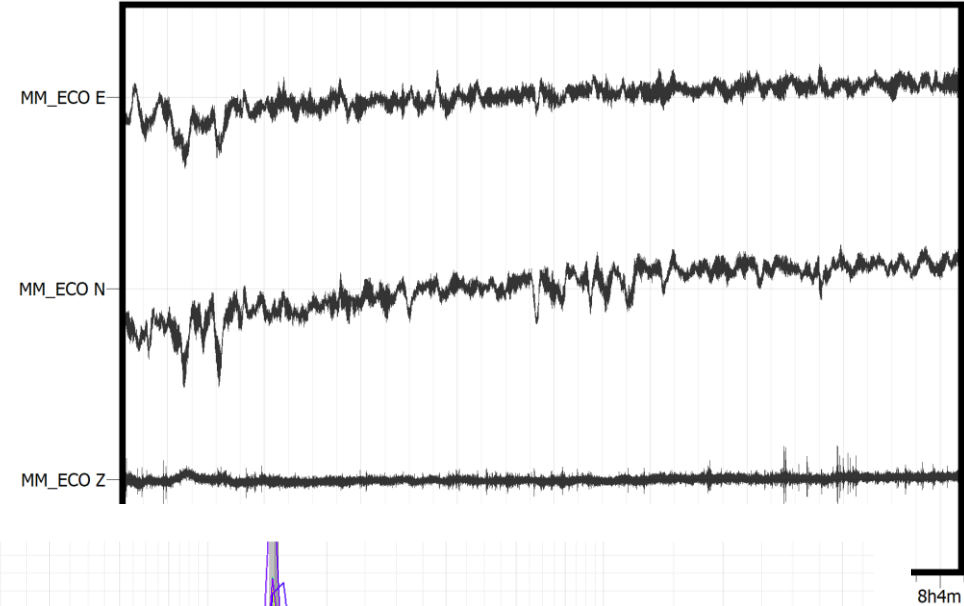


DETERMINATION OF THE BUILDING'S NATURAL FREQUENCY



A resident of this building felt not only the strong earthquake in Hubsugol 12JAN2021, but also the weaker aftershocks.

DETERMINATION OF THE BUILDING'S NATURAL FREQUENCY

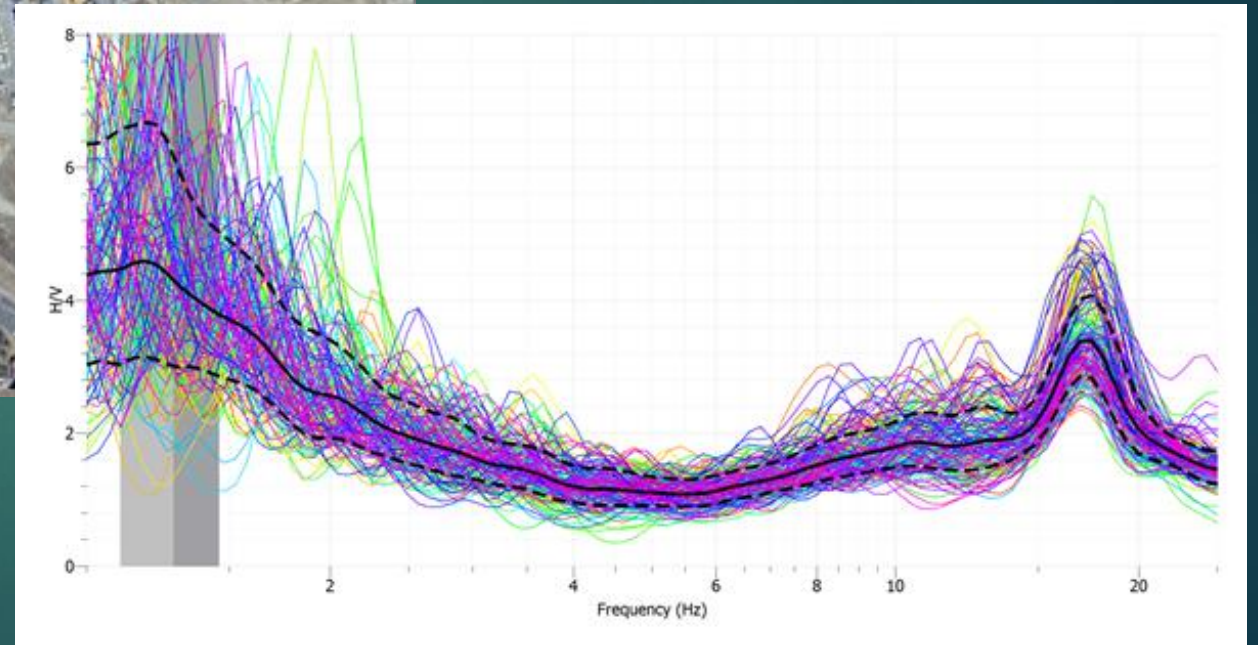


THE BUILDING'S NATURAL FREQUENCY IS 1.47Hz.

DETERMINATION OF SOIL DOMINANT FREQUENCY



THE SOIL'S DOMINANT FREQUENCY IS 1.47Hz.



CONCLUSION

Resonance in the context of ground vibrations, buildings, and seismic waves occurs when the frequency of the external seismic wave coincides with the natural frequency of the ground or building vibrations. This leads to an amplification of the vibration amplitude, which can be dangerous and cause destruction.

It is necessary not only to calculate peak accelerations and determine the natural vibrations of the soil for high-rise buildings, but also to determine the natural vibrations of the soil for 7-15 story buildings.

