JOURNAL OF TRANSPORT

ISSUE 3, 2024 vol. 1
ISSN: 2181-2438

SLIB.UZ
Scientific library of Uzbekistan

RESEARCH, INNOVATION, RESULTS

TOSHKENT DAVLAT TRANSPORT UNIVERSITETI
Tashkent state transport university

JOURNAL OF TRANSPORT
RESEARCH, INNOVATION, RESULTS

ISSN 2181-2438

VOLUME 1, ISSUE 3

SEPTEMBER, 2024

jot.tstu.uz

TASHKENT STATE TRANSPORT UNIVERSITY

JOURNAL OF TRANSPORT

SCIENTIFIC-TECHNICAL AND SCIENTIFIC INNOVATION JOURNAL
VOLUME 1, ISSUE 3 SEPTEMBER, 2024

Founder of the scientific and technical journal “Journal of Transport” – Tashkent State Transport University, 100167, Republic of Uzbekistan, Tashkent, Temiryo‘lchilar str., 1, office: 465, e-mail: publication@tstu.uz.

The “Journal of Transport” publishes the most significant results of scientific and applied research carried out in universities of transport profile, as well as other higher educational institutions, research institutes, and centers of the Republic of Uzbekistan and foreign countries.

The journal is published 4 times a year and contains publications in the following main areas:

- Business and Management;
- Economics of Transport;
- Organization of the Transportation Process and Transport Logistics;
- Rolling Stock and Train Traction;
- Infrastructure;
- Research, Design, and Construction of Railways, Highways, and Airfields: Technology and Organization of Construction, Management Problems;
- Water Supply, Sewerage, Construction Systems for Water Protection;
- Technosphere Safety;
- Power Supply, Electric Rolling Stock, Automation and Telemechanics, Radio Engineering and Communications, Electrical Engineering;
- Materials Science and Technology of New Materials;
- Technological Machines and Equipment;
- Geodesy and Geoinformatics;
- Car Service;
- Information Technology and Information Security;
- Air Traffic Control;
- Aircraft Maintenance;
- Traffic Organization;
- Operation of Railways and Roads;

Tashkent State Transport University had the opportunity to publish the scientific-technical and scientific innovation publication “Journal of Transport” based on the Certificate No. 1150 of the Information and Mass Communications Agency under the Administration of the President of the Republic of Uzbekistan. Articles in the journal are published in Uzbek, Russian and English languages.

CONTEXT / MUNDARIJA

Advantages of circular and rectangular seismic barriers

Sh.S. Yuldashev[1][a], A.Sh. Abdunazarov [1][b]
[1] Namangan Engineering-Construction Institute, Namangan, Uzbekistan

Abstract: In the article, the effect of seismic surface waves on the building is determined using the Plaxis 3D software complex using the Finite Element method. The highest displacement amplitudes at each point are determined. Efficiency was analyzed by comparing rectangular and circular seismic barriers.
Keywords: Building, seismic surface waves, finite element method, theory of elasticity, seismic barrier

Aylana va to‘g‘ri to‘rtburchak shaklidagi seysmik to‘siqlarning afzalligi

Yuldashev Sh.S.[1] [a], Abdunazarov A.Sh.[1][b]
[1]Namangan muhandislik-qurilish instituti, Namangan, O‘zbekiston

Annotatsiya: Maqolada binoga seysmik sirt to‘lqinlarining ta’siri Plaxis 3D dasturiy majmuasi yordamida Chekli elementlar usulini qo‘llagan holda aniqlangan. Har bir nuqtadagi ko‘chishning eng yuqori amplitudalari aniqlangan. To‘g‘ri to‘rtburchak bilan aylana shaklidagi seysmik to‘siqni qiyosiy taqqoslash orqali samaradorligi tahlil qilingan.
Kalit so‘zlar: Bino, seysmik sirt to‘lqinlari, chekli elementlar usuli, elastiklik nazariyasi, seysmik to‘siq

1. Kirish

Bino va inshootlarni tabiiy va sun’iy tebranishlardan himoya qilish muammosi zamonaviy qurilish uchun muhim ahamiyatga ega. Sun’iy tebranish manbalariga yer osti temir yo‘l liniyalari, avtomobil yo‘llari, og‘ir yuk: uskunalar va jihozlar yuklangan mashinalar hisoblanadi. Hozirgi vaqtda zilzilaga chidamli binolarning zamonaviy konstruktiv tizimlari seysmik qarshilikning maqbul darajasini ta‘minlaydi. Bu ko‘p hollarda binolar va inshootlarning loyihaviy intensivlikdagi zilzilalarga xavfsiz dosh berishiga imkon beradi. Biroq, ayrim hollatlarda seysmik himoya tizimlari bilan jihozlangan inshootlar loyihaviy seysmik yuklar ta’sirida vayron qilingan holatlar mavjud. Shuning uchun aylana va to‘g‘ri to‘rtburchak shaklidagi seysmik to‘siq orqali passiv himoya tizimi dolzarb masaladir.

2. Tadqiqot metodikasi

Seysmik xavfsizlikni ta’minlash va inshootlarning seysmik ta’sirlarga chidamliligini oshirish uchun seysmik to‘siqlar keng qo‘llaniladi. Aylana va to‘rtburchak shaklidagi seysmik to‘siqlarni qiyosiy tahlil qilish va ularning samaradorligini o‘rganish masalalari ko‘rib chiqiladi. Har bir shakldagi to‘siqning seysmik to‘lqinlarni yutish, tarqatish va binolarni himoya qilishdagi xususiyatlari tahlil qilinadi.

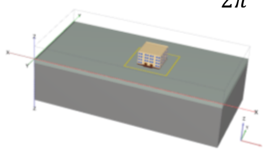
Aylana shaklidagi to‘siqlar seysmik to‘lqinlarni bir xil taqsimlash qobiliyatiga ega. Bu turdagi to‘siqlarni joylashtirish va ularni geometrik jihatdan mustahkamlash osonroq bo‘lib, ular seysmik to‘lqinlarni samarali yutadi va binolarga ta’sirini kamaytiradi.

To‘rtburchak shaklidagi to‘siqlarni joylashtirish va ulardan foydalanish seysmik himoya tizimlarida ko‘proq qo‘llaniladi. Ushbu to‘siqlar seysmik to‘lqinlarni muayyan yo‘nalishlarda yutish va tarqatish qobiliyatiga ega bo‘lib, ular yuqori seysmik xavf hududlarida samarali hisoblanadi.

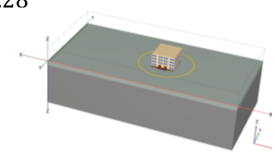
Maqolada aylana va to‘g‘ri to‘rtburchak shaklidagi seysmik to‘siqlarni afzalligini aniqlash bilan bog‘liq bir qator masalalar ko‘rib chiqilgan.

Binoga ta’sir etayotgan seysmik sirt to‘lqinlarni ta’sirini kamaytirish uchun aylana shaklidagi seysmik to‘siq modellashtiriladi va to‘g‘ri to‘rtburchak shaklidagi seysmik to‘siq bilan taqqoslash orqali qaysi shakldagi afzalligini aniqlanadi. Binodan 10 metr uzoqlikda qalinligi 1 metr chuqurligi 3 metr bo‘lgan to‘rtburchak shakldagi seysmik to‘siqni (1-rasm) aylana shakliga keltirib olamiz. To‘rtburchak shaklidagi seysmik to‘siqning uzunligi $l = 178$ metr (2-rasm), aylana radiusini topish uchun:

$$r = \frac{l}{2\pi} = \frac{178}{6.28} = 28$$



1-rasm. To‘rtburchak shaklidagi seysmik to‘siq



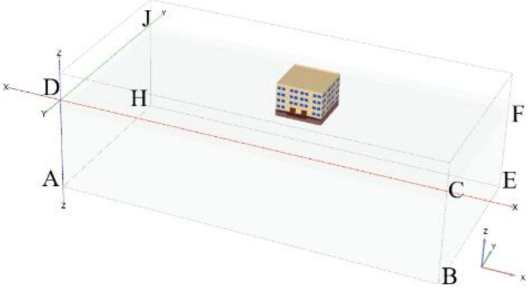
2-rasm. Aylana shaklidagi seysmik to‘siq

Seysmik to‘siqni bino markazidan 28 metr radius uzoqlikda qalinligi 1 metr chuqurligi 3 metr bo‘lgan aylana shaklida modellashtirildi. Modelning uzunligi 200 *m* eni 100 *m* va chuqurligi 50 *m* o`lchamlarga ega. Masalada yer osti suvlari borligi ham hisobga olinadi, yer osti suvlarining sathi 20 *m* chuqurlikda deb olingan. Bino 24 *m* uzunlikda, eni 24

[a] https://orcid.org/0000-0002-3992-9066
[b] https://orcid.org/0009-0003-1614-0913

m va balandligi 14.75 *m*, qavat balandligi 3,3 *m*, binoning yer to'la qismi esa 3 *m* chuqurlikda joylashgan. birinchi qatlami 5 metr qumloq (suglinka), ikkinchi qatlami 45 metr shag'alli (galichniy) grunt modellashtirildi.

Masalada cheksiz yarim fazoni chekli soha bilan almashtiramiz. Bunda chegaralarda to'lqinlarning cheksizlikka intilishini ta'minlovchi quyidagi shartlar qo'yilgan. Ajratilgan parallelepipedning $AHJD$ va $BEFC$ yog'larida (a), $ABCD$ va $HEFJ$ yog'larida (b) hamda $ABEH$ yog'ida (c) shartlar qo'yilgan (3-rasm).



3-rasm. Chegaraviy shartlar qo'yilishi

$$\left.\begin{matrix}\sigma_x = a\rho V_p\dot{u}\\ \tau_{yz} = b\rho V_s\dot{u}\\ \tau_{zy} = b\rho V_s\dot{w}\end{matrix}\right\}a)\quad \left.\begin{matrix}\sigma_y = a\rho V_p\dot{v}\\ \tau_{xz} = b\rho V_s\dot{w}\\ \tau_{zx} = b\rho V_s\dot{u}\end{matrix}\right\}b)\quad \left.\begin{matrix}\sigma_z = a\rho V_p\dot{w}\\ \tau_{xy} = b\rho V_s\dot{u}\\ \tau_{yx} = b\rho V_s\dot{v}\end{matrix}\right\}c) \quad (1)$$

Tadqiqot sohasi 46517 ta chekli elementga va 87829 ta tugunlarga ajratilgan. Cheki elementlarning shakllari noto`g`ri tetraedr shaklida tanlanadi.

Harakat differensial tenglamalar sistemasining tartibi $87829 \times 3 = 260\,487$ ga teng.

Bu yerda x o'qi bo'ylab Reyle to'lqini harakatlanadi deb tasavvur qilamiz. Materialning fizik-mexanik xususiyatlarini hisobga olgan holda gruntdagi tugunlardagi ko'chish, tezlik va tezlanishlarini aniqlaymiz.

Dinamik yuk ta'siridagi diskret mexanik sistema harakatining differensial tenglamalar sistemasi quyidagicha ifodalanadi:

$$\boldsymbol{M\ddot{u}} + \boldsymbol{C\dot{u}} + \boldsymbol{Ku} = \boldsymbol{F} \quad (2)$$

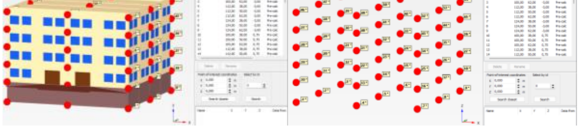
Bu yerda $\boldsymbol{M}$ – massalar matrisasi, $\boldsymbol{C}$ – so'ndirish matrisasi, $\boldsymbol{K}$ – bikrlik matrisasi va $\boldsymbol{F}$ – dinamik yuk vektori. $\boldsymbol{u}$ – ko'chish, $\boldsymbol{\dot{u}}$ – tezlik va $\boldsymbol{\ddot{u}}$ – tezlanishlar vektorlari vaqtning uzluksiz funksiyalari deb olindi.

(2) tenglamalar sistemasini yechish uchun Nyumark usulidan foydalanamiz.

Dinamika masalasini raqamli ifodalashda vaqt iteratsiyasini shakllantirish hisoblash jarayonining barqarorligi va aniqligi uchun muhim omil hisoblanadi.

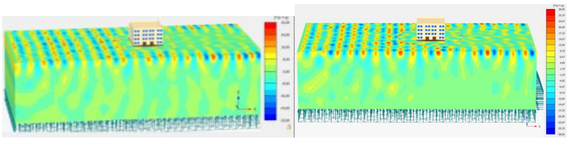
Nyumark usulining vaqt iteratsiyasi koeffitsentlarini $\alpha = 0.25$ va $\beta = 0.5$ deb qabul qilamiz.

Binoga ta'sir etayotgan seysmik sirt to'lqinlarni aniqlash va taqqoslash uchun binoning har qavatidan 9 ta jami esa 54 ta kuzatuv nuqtalari belgilab olindi (4-rasm).



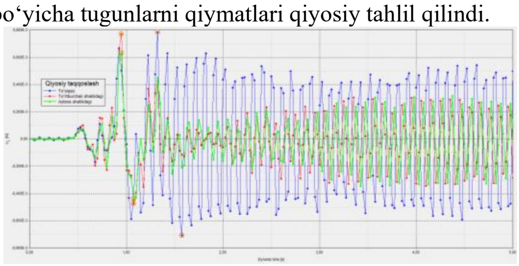
4-rasm. Kuzatuv nuqtalari

Seysmik sirt to'lqinlarni tarqalishini Garmonik kuch orqali hosil qilindi. Garmonik kuchning fazasi 0, amplitudasi 1 va chastotasi 10 Hz davomiyligi 5 sekund deb olindi.



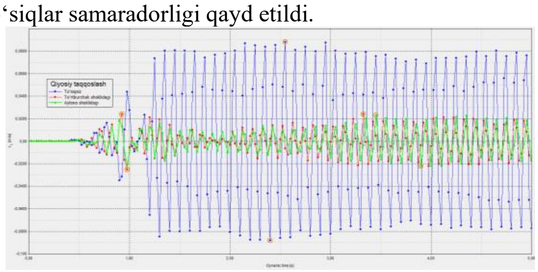
5-rasm. Seysmik sirt to'lqinlarni binoga ta'sir etish jarayoni

Binoning oldindan belgilab kuzatuv nuqtalari yordamida z bo'yicha tugunlarni qiymatlari qiyosiy tahlil qilindi.



6-rasm. 34-kuzatuv nuqtasidagi ko'chishni taqqoslash grafiki

6-rasmda, atrofida xech qanday to'siq joylashmagan modeldagi binoning 34-kuzatuv nuqtasida seysmik sirt to'lqinning u_z o'qi bo'yicha ko'chishning maksimal qiymati u_{zmax} =0,782 *mm*, to'g'ri to'rtburchak shaklidagi seysmik to'siqli modeldagi binoda u_{zmax} =0,770 *mm*, aylana shaklidagi seysmik to'siqli modeldagi binoda u_{zmax} =0,632 *mm* ni tashkil etdi. Qiyosiy taqqoslanganda, atrofida xech qanday to'siq joylashmagan holga nisbatan to'rtburchak shaklidagi seysmik to'siqli modeldagi binoning 34-kuzatuv nuqtasidagi ko'chish 1.53%, aylana shaklidagi seysmik to'siqli modelda binoda 19.18% ga teng bo'lgan seysmik to'siqlar samaradorligi qayd etildi.



7-rasm. 49-kuzatuv nuqtasidagi tezlikni taqqoslash grafiki

7-rasmda, atrofida xech qanday to'siq joylashmagan modeldagi binoning 34-kuzatuv nuqtasida seysmik sirt to'lqinning v_z o'qi bo'yicha tezlikning maksimal qiymati v_{zmax} =8,831 *sm/s*, to'g'ri to'rtburchak shaklidagi seysmik to'siqli modeldagi binoda v_{zmax} =2,502 *sm/s*, aylana shaklidagi seysmik to'siqli modeldagi binoda v_{zmax} =2,308 *sm/s* ni tashkil etdi. Qiyosiy taqqoslanganda, atrofida xech qanday to'siq joylashmagan holga nisbatan to'rtburchak shaklidagi seysmik to'siqli modeldagi binoning 34-kuzatuv nuqtasidagi tezlik 71.67%, aylana shaklidagi seysmik to'siqli modelda binoda 73.86% ga teng bo'lgan seysmik to'siqlar samaradorligi qayd etildi.

8-rasm. 34-kuzatuv nuqtasidagi tezlanishni taqqoslash grafiki

8-rasmda, atrofida xech qanday to‘siq joylashmagan modeldagi binoning 34-kuzatuv nuqtasida seysmik sirt to‘lqinning a_z o‘qi bo‘yicha tezlanishning maksimal qiymati a_{zmax} =83,94 *sm/s²*, to‘g‘ri to‘rtburchak shaklidagi seysmik to‘siqli modeldagi binoda a_{zmax} =35,28 *sm/s²*, aylana shaklidagi seysmik to‘siqli modeldagi binoda a_{zmax} =33,16 *sm/s²* ni tashkil etdi. Qiyosiy taqqoslanganda, atrofida xech qanday to‘siq joylashmagan holga nisbatan to‘g‘ri to‘rtburchak shaklidagi seysmik to‘siqli modeldagi binoda tezlanish 57.97%, aylana shaklidagi seysmik to‘siqli modeldagi binoda tezlanish 60,50% ga teng bo‘lgan seysmik to‘siqlar samaradorligi qayd etildi.

3. Xulosa

Bino atrofiga xech qanday to‘siq joylashtirilmagan binoga nisbatan bir xil koordinatada joylashgan to‘rtburchak shakldagi seysmik to‘siqli modeldagi binoda ko‘chish o‘rtacha 20.05%, tezlik 54.72% va tezlanish 48.84%, aylana shakldagi seysmik to‘siqli modeldagi binoda ko‘chish o‘rtacha 24.11%, tezlik 56.70% va tezlanish 50.13% ga seysmik to‘siqlar samaradorligi qayd etildi.

Bu tahlilga binoan binoga ta’sir etayotgan seysmik sirt to‘lqinlar ta’sirini kamaytirish uchun to‘rtburchak va aylana shaklli seysmik to‘siqlar modellashtirilganda, ikki turdagi seysmik to‘siq ham ijobiy natija berdi. Aylana shaklli seysmik to‘siq to‘rtburchak shaklli seysmik to‘siqqa qaraganda afzalligi aniqlandi.

Foydalangan adabiyotlar / References

[1] Abdunazarov, A., & Sharofitdin, Y. (2023). Binoga ta’sir etayotgan seysmik sirt to‘lqinlarni aniqlash va seysmik to‘siq (penopoliuretan) yordamida kamaytirish.

[2] Abdunazarov, A., & Sharofitdin, Y. (2023). Yer osti suvlari sathining seysmik sirt to‘lqinlari tarqalishiga ta’siri.

[3] Abdunazarov, A., & Sharofitdin, Y. (2023). Binoga ta’sir etayotgan seysmik sirt to‘lqinlarining grunt xususiyatiga bog’liqligi.

Mualliflar to‘g‘risida ma’lumot/ Information about the authors

Yuldashev Sharafitdin Sayfitdinovich	Namangan muhandislik-qurilish instituti, “Materiallar qarshiligi va mexanika” kafedrasi professori, t.f.d. Sh.yuldashev1953@gmail.com Tel.: +998974275438 https://orcid.org/0000-0002-3992-9066
Abdunazarov Akbarjon Shamsuddin o‘g‘li	Namangan muhandislik-qurilish instituti, “Qurilish materiallari va buyumlari” kafedrasi o‘qituvchisi, Abdunazarovakbar16@gmail.com Tel.: +998911860505 https://orcid.org/0009-0003-1614-0913