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RESEARCH, INNOVATION, RESULTS



**TOSHKENT DAVLAT  
TRANSPORT UNIVERSITETI**

Tashkent state  
transport university



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# TASHKENT STATE TRANSPORT UNIVERSITY

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Articles are published in Uzbek, Russian, and English, ensuring a wide-reaching audience and fostering cross-cultural academic exchange. As a beacon of academic excellence, the "Journal of Transport" continues to serve as a vital conduit for knowledge dissemination, collaboration, and innovation in the transport sector and related fields.

## Evaluation of the energy efficiency of passive cooling methods for attic spaces in hot climate regions

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**Abstract:** This article examines the problem of controlling the temperature regime of attic spaces in order to ensure a comfortable indoor microclimate in the upper floors of buildings located in hot climate conditions. Under the sharply continental climate of Uzbekistan, significant fluctuations in outdoor air temperature during the summer period create unfavorable thermal conditions in upper-floor rooms. Therefore, studying and effectively managing the heat transfer processes occurring in the attic space is an important task. In the research, the heat transfer processes occurring in the attic space were theoretically analyzed, and a calculation algorithm was developed based on heat balance equations. The effectiveness of increasing the reflectivity of roof coverings and the use of passive cooling methods was evaluated through comparative calculations. The results show that the combined application of these methods reduces the air temperature in the attic space during the summer period and brings the microclimate parameters in upper-floor rooms closer to comfortable levels. The research findings can serve as a scientific basis for developing energy-efficient building solutions in hot climate regions.

**Keywords:** attic space, heat transfer, passive cooling, microclimate, upper-floor rooms, reflective coating, hot climate, energy efficiency

## Issiq iqlimli hududlarda chordoq makonini passiv sovitish usullarining energiya samaradorligini baholash

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**Annotatsiya:** Mazkur maqolada issiq iqlim sharoitida joylashgan binolarning yuqori qavat xonalarida qulay mikroiklimni shakllantirishda chordoq makonining harorat rejimini boshqarish masalasi o'rganilgan. O'zbekistonning keskin kontinental iqlimi sharoitida yoz davrida tashqi havo haroratining katta tebranishlari yuqori qavat xonalarida noqulay issiqlik sharoitlarini yuzaga keltiradi. Tadqiqotda chordoq makonida yuz beradigan issiqlik almashinuvi jarayonlari nazariy jihatdan tahlil qilinib, issiqlik balansi tenglamalari asosida hisoblash algoritmi ishlab chiqildi. Tom qoplamasining aks ettirish qobiliyatini oshirish hamda passiv sovitish usullaridan foydalanishning samaradorligi solishtirma hisoblashlar orqali baholandi. Natijalar ushbu usullarni kompleks qo'llash yozgi davrda chordoq makonidagi havo haroratini pasaytirib, yuqori qavat xonalarida mikroiklim ko'rsatkichlarini qulay darajaga yaqinlashtirishini ko'rsatdi. Tadqiqot natijalari issiq iqlimli hududlarda energiya samarador qurilish yechimlarini ishlab chiqishda ilmiy asos bo'lib xizmat qilishi mumkin.

**Kalit so'zlar:** chordoq makoni, issiqlik almashinuvi, passiv sovitish, mikroiklim, yuqori qavat xonalar, aks ettiruvchi qoplama, issiq iqlim, energiya samaradorligi

### 1. Kirish

O'zbekiston hududi keskin kontinental iqlim bilan tavsiflanadi. Bunday sharoitda yoz mavsumida tashqi havo harorati juda katta tebranishlarga ega bo'lib, ayrim hollarda kunlik harorat farqi 40–50 °C gacha yetishi mumkin. Tashqi muhit haroratining bunday o'zgaruvchanligi binolarning ichki mikroiklimiga ham sezilarli ta'sir ko'rsatadi. Ayniqsa, chordoq qismi bilan tutashgan yuqori qavat xonalarida havo harorati ko'pincha me'yoriy qulaylik chegaralaridan yuqori bo'lib ketadi. Bunga asosiy sabab sifatida “kvartira–chordoq” tizimida yuz beradigan intensiv issiqlik almashinuvi jarayoni ko'rsatiladi [1].

Mavzu bo'yicha mavjud ilmiy manbalar tahlili hamda o'tkazilgan tadqiqotlar shuni ko'rsatadiki, issiq iqlimli hududlarda yuqori qavat xonalarida qulay sharoit yaratish uchun katta energiya sarfini talab qilmaydigan texnik yechimlardan foydalanish mumkin. Bunday yechimlardan biri chordoq makonidagi harorat rejimini boshqarish orqali bino ichidagi mikroiklimni yaxshilashdir.

Chordoq makonini passiv sovitish usullaridan foydalanish orqali haroratni kamaytirish mumkin. Ushbu usul suvning bug'lanishi natijasida yuzaga keladigan yashirin issiqlikni olib chiqish jarayoniga asoslanadi. Suv maxsus idishlarda joylashtiriladi va bug'lanish jarayonida hosil bo'lgan issiqlik shamol oqimlari yordamida chiqarib yuboriladi. Shamol oqimi binoning shamolga qarshi

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#### 4. Xulosa

O'tkazilgan tadqiqotlar chordoq makonining harorat rejimini boshqarish yuqori qavat xonalarida qulay mikroiklimni ta'minlashda muhim ahamiyatga ega ekanligini ko'rsatdi.

Hisoblash natijalari shuni ko'rsatdiki, tom qoplamasining aks ettirish qobiliyatini oshirish chordoq haroratini pasaytirishga yordam beradi. Biroq yuqori tashqi harorat sharoitida faqat ushbu usul yetarli samara bermaydi.

Passiv sovitish tizimlaridan foydalanish chordoq makonidagi haroratni yanada samarali ravishda kamaytiradi. Tom qoplamasining optik xossalari yaxshilash va passiv sovitish usullarini birgalikda qo'llash yuqori qavat xonalarida havo haroratini qulay darajaga yaqinlashtirish imkonini beradi.

Mazkur tadqiqot natijalari issiq iqlimli hududlarda energiya samarador qurilish texnologiyalarini ishlab chiqish va qo'llash uchun ilmiy asos bo'lib xizmat qilishi mumkin.

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