

## Acoustic modelling of the Veche Square in Veliky Novgorod, Russia

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### ABSTRACT

Every year the awareness of the importance of architectural acoustics grows, its significance and popularity grows. So among the many interests of architectural acoustics, in recent years, "acoustic reconstruction" is gaining considerable popularity. This way we can study the evolution, culture and art, theater and architecture of ancient society by architectural acoustics. Thus, some papers have already been carried out on the acoustic reconstruction of the theaters of Ancient Rome and Ancient Greece. However, the "acoustic culture" of the Slavic countries is not still enough reconstructed and studied. Ancient Russian cities had their public spaces, which also used to be as local forums for gathering "veche". Veche is a popular assembly in ancient and medieval Slavic states. The veche was represented by various city classes. From an acoustical point of view, it was necessary to provide sufficient volume for the speakers and good intelligibility for the audience. Obviously, buildings around the square, fortress walls and other structures influenced the acoustic environment. The particular interest is that the squares are surrounded by a large number of churches and bell towers. Acoustic models were performed for squares to calculate the main acoustics parameters of the space. Full-scale acoustic measurements were carried out.

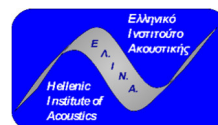
Architectural acoustics takes an extremely important place in architecture [1], it is impossible to imagine either theater design [2, 3], or city planning [4, 5], or a residential areas [6] without architectural acoustics. The result of acoustic design can lead to positive [7], negative health effects [8], and can also be subjected to serious architectural criticism [9].

Every year the awareness of the importance of architectural acoustics grows, its significance and popularity grows. So among the many interests of architectural acoustics, in recent years, "acoustic reconstruction" is gaining considerable popularity. This way we can study the evolution, culture and art, theater and architecture of ancient society by architectural acoustics. Thus, some papers have already been carried out on the acoustic reconstruction of the theaters of Ancient Rome and Ancient Greece [10 - 14].

However, the "acoustic culture" of the Slavic countries is not still enough reconstructed and studied [15]. First mobile theaters (Skomorokhs) appeared by the middle of the XI century in Russia, it is possible to say by the frescoes of the St. Sophia Cathedral in Kiev (1037) and by the leather masks of the actors of the XII-XIV centuries known from archaeological finds in Novgorod and Vladimir. The heyday of buffoonery fell on the XV-XVII centuries. Mobile theatres performed in the central squares of Ancient Russian cities, which also

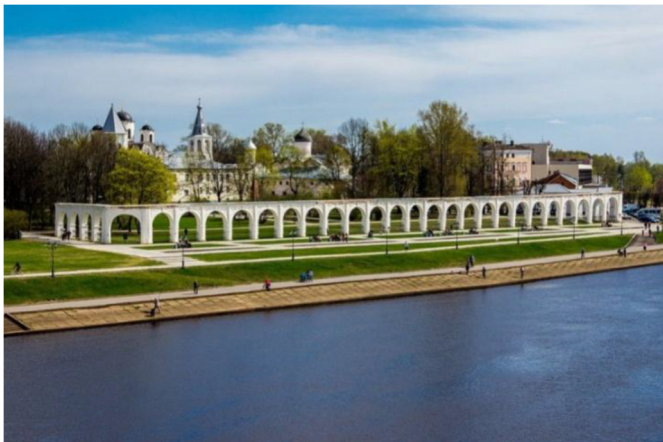
used to be as local forums for gathering "veche". Veche is a popular assembly in ancient and medieval Slavic states. In fact, it is a legislature with signs of democratic governance. In the Novgorod Republic, an independent proto-state that existed from 1136 to 1478 on the territory of the server-west of modern Russia, the veche was the highest legislature and judicial authority [16]. The veche was represented by various classes of society, but primarily citizens. Usually the meetings were quite numerous, so they were held in the city squares in the open air: on the square near the St. Sophia Cathedral, and in case of serious disagreements, some of the townspeople, dissatisfied with the decision, gathered in another place - at Yaroslav's Court [17]. From an acoustical point of view, it was necessary to provide sufficient volume for the speakers and good intelligibility for the audience. Obviously, buildings around the square, fortress walls and other structures influenced the acoustic environment. But the acoustic characteristics of such places have not been studied at all, like the entire acoustic culture in Russia. That is why this research of acoustic characteristics and acoustic reconstruction of the Veliky Novgorod veche square is so extremely relevant, important and necessary.

10.58874/SAAT.2022.109



The spatial architecture of the two squares has been restored according to historical maps and archival documents: 1 - the square near the St. Sophia Cathedral, 2 - the Yaroslav's Court.

The particular interest is that the squares are surrounded by a large number of churches and bell towers. Acoustic models were performed for squares. The models were used to calculate the main parameters characterizing the acoustics of space. Full-scale measurements of acoustic characteristics were carried out. A description of the acoustic conditions in the area is given and the quality of acoustics and the level of acoustic comfort for the participants of the meeting are analyzed.



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