

Subarea POB3: Modern materials for use in construction**Title of the presentation: Impact of technical textile on the facility acoustics with membrane roof****Author: dr hab. inż. arch. Krzysztof Gerlic****Abstract:**

Membrane roofs are an attractive type of structure due to their visual lightness and interesting irregular form. They are most often used in open facilities for protection against environmental factors. They protect against solar radiation and rainfall. They should be tensed and properly shaped so that they can bear external loads from wind or snow. The flexible material of which they are made requires a double negative curvature, hence the saddle form of the tense membrane. The architect, who defines the spatial form of the object and its surroundings, needs cooperation with a structural engineer. He needs the engineer who uses the membrane modeling program. The shape of such a stressed coating results from the assumed pretension and is determined in a process called formfinding.

Most of the roofs are designed to protect places where people stay longer: stadiums stands, amphitheater audiences, railway platforms or consumption places. Such roofs are formed to fulfill a protective function and to be visually attractive. The acoustic aspects of the membrane are often overlooked because it is made of technical textile and the objects are in an open space. It seems that the membrane does not constitute an acoustic barrier because it is light and not stiff. As a result, the sound waves can be transmitted through such a barrier that there is minimal attenuation or reflection. These issues may be ignored for venues where the crowd is cheering for the players, but cannot be ignored for venues intended for cultural events. In amphitheaters, it is primarily about the correct reception of performing artists. Modern technical solutions, including amplifiers, help to amplify and transmit sounds over a greater distance.

The sources of sounds are not only the artists and their instruments. A shout, voice or even a whisper of the audience may make it difficult to receive. The form of the roof, its size and the tension may influence the sounds reflected on the inside of the membrane. An example is the amphitheater roof in Świnoujście. Already at the gala concert opening the rebuilt facility, the audience had problems understanding the performers. The noise of the audience was so bothersome that it was necessary to introduce additional noise dampening elements. It is even worse when trying to organize concerts in a stadium with a closed membrane roof.

It confirms the need for research on the acoustic properties of technical textile. It is necessary to check if the tension and curvature affect the acoustic properties. Can these quantities be compatible with a specific sound frequency or can the reflection of the sound wave be regulated by the tension and curvature? These are interdisciplinary issues that require specialized research, and their results are needed when designing new facilities.