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Technical code for architectural acoustics of stadium

体育场建筑声学技术规范

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1 General provisions

1.0.1 The code was drawn up so that the spectator stands, the competition area and the related rooms of a stadium have good listening conditions.

1.0.2 The code applies to the architectural acoustic design, the noise control, the building acoustic measurement, the acoustic construction work and the quality acceptance of newly built, extended and rebuilt stadiums.

1.0.3 Architectural acoustic design shall begin at the architectural scheme design stage and shall be carried out in step with, and coordinated with, the design of the sound

reinforcement system.

1.0.4 When the site is being chosen, the effect of the stadium on the surrounding sound environment shall be assessed.

1.0.5 The architectural acoustic design documents shall include the acoustic calculation sheet and the acoustic design description.

1.0.6 Besides this code, the architectural acoustic design, noise control, acoustic measurement, acoustic construction work and quality acceptance of stadiums shall also meet the relevant current national standards.

2 Terms

2.0.1 Stadium: a building with a wide open outdoor area usable for sports competition and other performances, which at the same time provides seats for a large number of spectators.

2.0.2 Sound decay time: within a stadium, the time in seconds needed for the sound pressure level of a given frequency band to fall by 60 decibels after the source has stopped.

2.0.3 Echo: a reflected sound, or a sound returned to the listener for some other reason, whose strength and time difference are both large enough for the human ear to tell it apart from the direct sound.

2.0.4 Background noise: the sound pressure level of the underlying noise at a measuring point inside the stadium while the sound reinforcement system is not working, assessed with NR curves.

2.0.5 Speech intelligibility: the proportion of the speech units uttered by a speaker, that is sentences, words and syllables, that are correctly identified by the listener after passing through the speech transmission chain.

2.0.6 Speech transmission index (STI): the objective parameter for assessing speech intelligibility, derived from the modulation transfer function (MTF).

2.0.7 Speech transmission index for public address system (STIPA): a simplified form of the speech transmission index (STI) under certain conditions, suitable for assessing the speech transmission quality of room acoustics including the sound reinforcement system.

2.0.8 Stands: the structure in a stadium that carries the spectator seats and gives the spectators good viewing conditions together with safe and convenient means of escape.

3 Architectural acoustic design

3.1.1 The building acoustic conditions of a stadium shall be aimed above all at clear speech when the sound reinforcement system is in use.

3.1.2 The architectural acoustic design shall set its targets according to the size or the grade of the stadium, and the design shall adopt the measures that achieve the targets set.

3.1.3 The design solution shall be settled together with the form of the building structure and the position of the loudspeaker system.

3.1.4 Acoustic defects such as echo, flutter echo and sound focusing should not occur in the spectator areas of a stadium.

3.1.5 The press conference hall, the announcer room, the commentator rooms and the sound control room of the stadium building shall be given an architectural acoustic design.

3.2.1 Measures shall be taken during the design to control the sound decay time of the stadium.

3.2.2 The sound decay time of an empty stadium should meet the following requirements: with the retractable roof fully closed, the sound decay time should not be greater than 6 s; for a stadium where the awning over the stands covers more than one third of the area of the stands, the sound decay time should not be greater than 5 s; for a stadium with no awning over the stands, or with an awning covering less than one third of the area of the stands, no sound decay time index is required.

3.3.1 The spectator stands and the competition area of a stadium shall have good speech intelligibility.

3.3.2 During the design the following shall be observed: the sound decay time of the stadium should meet 3.2.2; measures shall be taken to control interference from background noise; interference from echoes caused by building surfaces shall be avoided and long delayed sound interference from several sources shall be reduced; the choice and the arrangement of the loudspeaker system shall, beyond the relevant standards for sound reinforcement design, also work together with the architectural acoustic design.

3.3.3 The speech transmission index for the public address system (STIPA) of a stadium shall not be less than 0.5.

3.4.1 The awning design shall meet the following requirements: it shall suit the layout of the loudspeaker system; the inner surface of the awning structure should be treated for sound absorption; the shape and the structural form of the awning should not give rise to acoustic defects; the load bearing design of the awning structure shall include the weight of the sound absorbing material and of equipment such as the loudspeaker system.

3.4.2 The retractable roof design shall meet the following requirements: the retractable roof should be given a matching acoustic treatment; its shape and structural form should not give rise to acoustic defects.

3.5.1 The inner face of the enclosing walls of a stadium should be given an acoustic treatment.

3.5.2 The wall behind the rostrum shall be treated for sound absorption.

3.5.3 In rooms such as boxes, commentator rooms, sports presentation rooms, announcer rooms, sound control rooms and lighting control rooms, the building face towards the field should be set at an angle, or treated for diffusion or absorption.

3.5.4 The enclosing walls around the competition area should be set at an angle or treated for sound absorption.

3.5.5 The two side walls of the entrance passage to the competition area should be made non parallel or treated for sound absorption.

3.5.6 Semi enclosed foyers connected to the outside through the entrance and exit openings of the spectator stands shall be treated for sound absorption.

4 Noise control

4.0.1 Besides meeting the relevant provisions of the current professional standard JGJ 31 Code for design of sports buildings, the choice of the stadium site shall also meet the following requirements: noise measurements shall be made on the proposed site, and besides the average noise of the site, the standard deviation, the maximum and minimum noise levels and the time and frequency of occurrence of the maximum noise level shall also be measured; the site shall not be subject to noise interference of high intensity that occurs with high probability and in a regular pattern.

4.0.2 The noise control design inside the stadium shall begin at the overall design stage of the stadium, shall guard against noise from the following sources and shall adopt matching noise control measures: interference inside the stadium from the various kinds of noise coming from outside shall be prevented; high noise installations should not be placed near the spectator stands, and where this cannot be avoided, effective noise and vibration control measures shall be taken; the retractable roof and the awning structure should be treated so as to reduce rain induced noise; the background noise inside the stadium should not exceed 50 dB(A).

5 Installations and construction

5.0.1 The construction unit shall prepare a construction organisation design scheme, and the scheme shall be confirmed by acoustic specialist technical staff.

5.0.2 A technical briefing shall be given before construction starts, and it shall cover the features of the works, the construction scheme, the process requirements, the construction quality and the acceptance standards.

5.0.3 Building acoustic materials arriving on site shall be inspected as follows: the kind, specification, quantity and place of origin of the acoustic materials shall meet the design requirements; the certificates of conformity, the instructions and the relevant technical