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### **SPORTS FACILITIES SUSTAINABLE DESIGN**

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*Abstract.* Construction of sport facilities has always been very interesting for architects. Even in Ancient times, this two disciplines have been related and one depended on other. Architecture was always medium to express importance of sport in everyday life of one man. Because of the special technical requirements, these facilities shape is subordinated to function. Through history, because of lack of technology, these buildings were very expensive and their maintenance was not economically efficient. Even so, building of these facilities was very important for every nation and because of that many experts have been developing strategies to make these kinds of facilities more energy efficient and more sustainable. Today, thanks to the technology development, these facilities are more and more rational built and their construction is optimized. Main accent is on sustainable design and energy efficiency. This paper is about sustainable design of sport facilities around the world.

*Key words:* sustainable design, sports facilities, energy efficiency, green design

*Introduction.*

The design of sports facilities is a major challenge for architects because it is necessary to make a multi-purpose facility that will meet the needs of many people. There are a number of rules that should be respected and the most important thing is to design functional communications and to make a compact facility that will meet the needs of all users and to be visually appealing. In designing architect encountered numerous problems because of the need to organize a large number of facilities within a building, appropriate structure should be used in order to enable large spans, care should be taken to maximize the benefits of natural light and ventilation, and of course the complete form of the building should blend in with the environment and connect with it.

This paper is about sustainable design and strategies to make sport facilities more energy efficient. Trend of sustainable design is already in use, and in this paper good praxis will be highlighted. Because of lack of funds for investing and maintaining sport facilities, architects must think forward and offer more efficient solutions in order to enable normal functioning of sport activities. Aim of this paper is to analyze and highlight good strategies for sport facilities design that can be applied anywhere. Analyzing main strategies and showing good examples advantages of sustainable design will be highlighted.

#### *Sport facilities sustainable design main principles*

Nowadays, most of the objects are planning according to green and sustainable design standards. This design is based on use of ecologically materials and using of renewable resources. Buildings that are built according these strategies are planned to achieve less energy consumption and to become financially beneficial. At the same time, using ecologically materials nature pollution is reduced. Designing according this principles, main resources are natural resources and often, recycled materials are used. By just planning building in right direction – depending on wind ways, natural ventilation can be used. Instead of using industrial systems for ventilation, we can use wind direction to make constant aeration. Especially in sport facilities where there is large number of visitors and constant air change is priority. Natural ventilation can be achieved just by using dynamic construction – grids that are having irregular shape, or to make openings on roof or facades that can function as constant air passages. According standards it is necessary to have about 11–12 air changes during one hour during sport events and temperature

should be constant between 13–22 C. When there are only trainings and preparations for sport events it is enough to have about 3 changes [6].

In sport hall in Medellin in Colombia, thanks to the dynamic grid shape, intrusion of natural light and air is enabled (Figure 1.1). Construction is from grids that are placed as tapes and every third is the same. Space between two grids is used for openings which enable constant air-flow.



Figure 1.1. Sport center Medellin Columbia – natural ventilation scheme

Another important impact has use of natural lightning. Using natural lightning is especially important for sportsmen because it has positive effects and creates natural and healthy atmosphere. Beside use of natural lightning, it is recommended to use reflecting materials to enhance lightning and to reduce energy consumption. When there is artificial lighting it is preferable to use energy efficient lighting system that provide different light use depending on event type and in that way energy save will be provided [5]. Universiade Bau in Chenzhen in China, built in 2011 (Figure 1.2). Is completely glazed and that way all the courts are having natural lightning. Also, thanks to the shape – prisms that are placed under different angle make possible light intrusion during all day.



Figure 1.2. Universiade Bau u Chenzhen-u u Kini

Sport facilities are objects with huge span and roof surfaces are often to large. Beside construction type to connect this spans, it is necessary to take into account materials that can support presure from atmospheric

water on roof. To optimize these influences, modern sport facilities often have systems to collect harvest water and to reuse it again in buildings toilets and for building cleaning. Sometimes, sport facilities are covered with greenery – green roofs and there are adequate systems that are collecting and reusing rainwater again. Sport center in Langreo Spain (Figure 1.3) had irregularly shaped green roof and mechanical systems for collecting and reusing water are installed. In Richmond Oval Olympics sport center (Figure 1.4), there are many systems for collecting water, but also from ground water that is drawn with pumps many artificial lakes and this water is also used for outdoor cleaning and watering plants.



Figure 1.3. ACXT sport center, Langreo, Spain



Figure 1.4. Richmon Oval Olympics, London

Except this measures, special attention should be paid on materials for facades, but also for indoor materialization. It is preferable to use polycarbonate materials, as much as possible glass so that natural lighting can be used and also to use more reflecting materials that can provide more light.

Most of these kind facilities have steel or aluminum grids for large spans, but there are many with concrete construction systems. Where ever it is possible, it is recommended to use as much as possible greenery so that summer overheating can be avoided. Problem with overheating and overcooling is very important in locations that have special climate conditions. In interior, it is preferable to use adaptive materials – floors should be from materials that can be used for different sport types, walls should have thermal and acoustic characteristic that are adequate for these kind of objects. Also, very important is position of sport facility on the parcel. With good positioning, many costs can be saved and less infrastructure is needed. As imperative in sport facilities is good motor

and pedestrian communications. Because of that, right positioning can enable normal functioning and can save materials for building and planning large useless communications.

### *Conclusion*

No matter in which country is a sports facility, strategies for the design are the same. The form and plan of the facility are subordinated to technical requirements, and visual concept depends on the architecture. For each sports facility, it is recommended that maximum use natural light, which can be achieved by the sun roof and glass facades should be planned so that during the summer months provide a sufficient quantity of fresh air in the winter to properly warm room. This can be achieved by using a good ventilation system and with the help of natural ventilation. All technical requirements are part of the plan for sustainability of the building and provides the design of all facilities in the future, according to Bioclimatic and ecological architecture. As of today there are less funds to finance the construction and maintenance of sports facilities, an architect in the planning process must take into account the concept of sustainability and to maximize the use of natural resources, save energy and reduce costs. Therefore, it is very important to combine the technical requirements and bioclimatic architecture to lighting, ventilation and heating up to use natural resources.

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