Principles of reconstruction of multifunctional stadiums on the example of the Kiev stadium of CSC Armed Forces of Ukraine

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Abstract. The most common to date are multifunctional sports complexes. Their multifunctionality, in addition to competing in various sports, provides the opportunity for a variety of grand events, including corporate brand companies, concerts of the most popular music groups and performers, as well as meetings and conferences of religious denominations. When designing and reconstruction stadiums, it is important to anticipate activities and lay out ideas that may be implemented in the future. Although multifunctionality is ensured by the ability to organize and conduct various public events, the stadium must retain a number of features that will help it to fulfill its essential function of generating appropriate revenue. For modern sports facilities it is necessary to perform two main functions - the city-forming and the function of the development of the multifunctional urban environment. Today, work is underway on the reconstruction of the Kiev stadium of the CSC AF of Ukraine, located on Povitroflotsky Prospekt. The reconstructed site is located in the city's central planning zone, in the northern part of Solomenskiy administrative district on Povitroflotsky prospect, 6. The capacity of the facility is 20,000 seats. The updated CSK AFU Stadium will be a football and athletic arena. The project meets modern European and world standards. This stadium, located in the center of the capital, together with a spare (warm-up) and separate thrower stadium, as well as a special athletics arena, can become the main base for the preparation of the national athletics team of Ukraine, the athletes of Kiev, and the place of qualitative holding championships in athletics of Ukraine.

1. Introduction
The topic of new construction and reconstruction of existing multifunctional stadiums is still relevant. Trends in the development of the morphology of modern stadiums, the innovativeness of architectural and design solutions for sports facilities are being studied all over the world, the requirements for spectators’ safety are being improved all the time, and the infrastructure of stadium visitors’ service is being improved. Conducting world-class, continental or regional competitions puts forward their respective requirements for the organizers of these events and should, of course, be taken into account in the concepts of new stadium or reconstruction projects.
2. Review of current research
A large number of publications by both Ukrainian and foreign scientists are devoted to the problems of studying and researching the reconstruction of existing stadiums. The most relevant are the researches of scientists from Germany, such as: S. Klos, K. Güppert, T. Schober, M. King and others [1]-[4].

Much attention in the research of Ukrainian scientists is paid to the state of the national regulatory framework. Compared to foreign reference guidelines for the design of modern stadiums [5]-[7], Ukrainian building standards are far behind [8]-[9]. The research of reconstruction of existing Ukrainian stadiums was carried out by: V V Kutsevich, D F Goncharenko, G G Zubko, O V Starkov and others [10]-[13]. It should be noted that the latest modernization of the national regulatory framework was in the form of annex №1 from October 1, 2010 to the State Building Regulations “Sports and Physical Culture and Health Facilities”. This made it possible to partially harmonize Ukrainian design requirements with the European stadiums, two of which were built and two were reconstructed to participate in the EURO 2012 Football Championship.

It should be noted that the aforementioned annex to the State Sports and Sports Center "Sports and fitness facilities" only partially satisfies the need to modernize the national regulatory framework for the design of sports facilities and only for football stadiums. Stadiums that specialize in other sports, such as athletics, require further changes to the state building codes mentioned.

3. Statement of the problem
Today there is a constant monitoring of the world experience of competitions. Accordingly, the regulatory framework of UEFA, FIFA, IAAF is changing. Ukrainian architects involved in the modernization of existing multifunctional stadiums need to address the issue of compliance of design solutions with new changes. It is necessary to take into account the condition of these stadiums; to predict their future existence; take into account the possibilities of holding international competitions in the future; as well as their existence after these competitions.

4. Principles of work
Based on the experience gained from participating in the preparation for EURO 2012, namely, the design and reconstruction of Metallist Stadium in Kharkiv (figure 1), one of the authors of the article developed and implemented the principles of reconstruction of multifunctional stadiums [14].

Figure 1. Reconstruction project for Metallist Stadium in Kharkiv.
In the process of working on the project for the reconstruction of Metallist Stadium, four principles were formulated:

1. The principle of developing a new quality of interaction of the existing stadium, which is reconstructed with the urban structure of the city.
2. The principle of preserving the historical and cultural value of the stadium or its place in the city structure.
3. The principle of compliance of the morphology and planning structure of an existing multifunctional stadium with the applicable standards and standards by which the stadium is to be certified.
4. The principle of forecasting the continuous sustainable development of the stadium in the future.

The developed principles were formulated on the basis of the methodology of decision making regarding the reconstruction of the existing stadium (Figure 2).

**Figure 2.** Methodology of the formation of a solution for the reconstruction of an existing stadium
5. Discussion of results

The gained experience and developed principles are implemented in the following works on reconstruction of multifunctional stadiums, namely, in the framework of cooperation between the Federation of Athletics of Ukraine and the Ministry of Defense of Ukraine on the construction of a new object of athletics infrastructure in the framework of work on the reconstruction of the Kiev stadium of CSC AFU prospectus. The reconstruction of the stadium of the Central sports club of the Armed Forces of Ukraine, Kyiv is relevant and urgent [15]. This object has a history of existence. The stadium, formerly called CSCA, was built in 1964-1965 (architects: MM Shmorgun, YK Belous, II Ponomaryov). The facility had a capacity of 12,000 seats. The arena hosted matches of the USSR Army Second League Championship football team. In the years of independence, the stadium began to accept members of the major league championships of Ukraine, in addition, the youth national teams of Ukraine played here. In 2004, the stadium was declared an emergency, and in 2009, CSCA football club stopped performing at the stadium.

The reconstructed site is located in the central planning zone of the city of Kyiv, in the northern part of the Solomenskiy administrative district on Povitroflotsky avenue (Figure 3). The site includes a number of existing sports facilities, namely: a stadium with a football field, treadmills, four triples and lighting masts (all in unsatisfactory condition), swimming pool, tennis courts, training football fields, a complex of sports halls for playing sports, outdoor fields for athletics, auxiliary technical buildings, administrative and sports unit.

![Figure 3. Layout scheme of a site in the city of Kiev.](image)

According to the Planning Restrictions Scheme of the Master Plan of Kyiv until 2020, the site is located in an area where there are no enterprises with harmful emissions. The site does not fall within the restricted area. Landslides and groundwater flooding are not possible in this area. According to the scheme of greening and recreational areas of the Master Plan of Kyiv by 2020, part of the site (stadium) is assigned to sports parks. After reconstruction the complex will be provided for the possibility of holding competitions at continental, national and regional levels.

The project provides the following facilities and services:
- central sports arena with stands for 20,000 spectator seats with a complex of all necessary premises, namely: spectator service premises, locker rooms, VIP spectators complex, restaurants, conference
rooms, competition service infrastructure, fitness center, media center, administrative sports club complex, two-level parking under the western and eastern stands, technical facilities required; which includes:

- space intended specifically for athletics competitions consists of the following flat structures;
- a standard 400-meter 8-meter track and field track meet the IAAF requirements for running straight (100m and 110m hurdles) and in a circle equipped with an obstacle course inside the oval.

A football field of 105.0 × 68.0 m inscribed in the running oval, which meets UEFA requirements: The 100 m and 110 m barrier lanes are located on two longitudinal sides.

Sectors inside the oval for track and field athletics for javelin throwing competitions (both ways), discus throwing, hammering, kernel bouncing and pole vaulting. Along the straight 100-meter paths from the north and south are platforms with divergent paths and sand pits for long jumps (each in two directions). The architectural solution received positive results from aerodynamic studies on the construction of the roof above the stands and relatively wind conditions in the field of athletics competitions, which are particularly sensitive to the direction and strength of the wind. The project takes into account the conditions for athletes with disabilities.

From the south, the sports arena is covered by the construction of a 130-meter special athletics arena.

The updated CSC AFU Stadium will be a football and athletic arena, and athletics will be its main sport. The project meets modern European and world standards. Only with such stadiums can we be optimistic about the future and become strong players in the European and World Athletics market in relation to competitions of the highest international level. This stadium, located in the center of the capital, together with a training jogging complex, a training complex for throwing a spear, a disk, a shot put and others, can become the main base of preparation of the national athletics team of Ukraine, athletes of Kiev, and a place of qualitative holding of championships of continental and national levels.

Separately, it is important to note that the location of the stadium with regard to the connection with the two airports of the city is very important for the international level competitions - with the Zhuliany Airport, and the airport of Boryspil - by the railway shuttle.

It is very important to increase the level of general funding for the training of high-class army athletes. It is necessary to update and reconstruct the unique bases of Olympic training, which are subordinated to the Defense Ministry. In addition to general and special training of servicemen of the Armed Forces of Ukraine in the program of purely military training, it is also necessary to rehabilitate employees and members of their families.

The stadium must be of the IAAF category, which will allow them to host level competitions for the European Championship and the European Cup inclusive. Also, let's not forget about the ambitious plans of the army to hold Invites Games in Ukraine - Igor Neskorynykh (Figure 4-5).

Figure 4. Concept of reconstruction of the stadium of the Central sports club of the Armed Forces of Ukraine.
Figure 5. Concept of reconstruction of the stadium of the Central sports club of the Armed Forces of Ukraine

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