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CONCRETE IN SPORTS ARCHITECTURE

BETON W ARCHITEKTURZE SPORTOWEJ

Abstract

Sports architecture seems to be made for concrete. We automatically associate it with monumental buildings that stand out and create strong dominants, due to their scale. Designers are aware of this, so they look for unusual, often innovative formal and technological solutions. Thanks to its characteristics (carrying heavy weights and the flexibility of form), concrete seems to be the perfect material to fulfil these needs. However, contemporary buildings are hardly ever based on it as a material that describes them. The main factors influencing this phenomenon are mainly economic and time associated, and also changing trends when it comes to architecture. Although the focus on durability is weakening, it remains one of three principles of a good building. Some examples, where concrete gives the building its character, receive very good social feedback and stand out from other objects of this kind, which should provoke reflection when forecasting development paths for this type of buildings.

Keywords: Concrete, Olympic Games, sports facility, stadium

Streszczenie

Architektura sportowa wydaje się być stworzona dla betonu. Myśląc o niej przywołujemy w pamięci odruchowo prawie zawsze monumentalne budowle, które samą swoją skalą wyróżniają się w przestrzeni tworząc silne dominanty. Świadomi tego projektanci szukają niestandardowych, często prekursorskich rozwiązań formalnych i technicznych. Beton dzięki swoim właściwościom (możliwość przeniesienia bardzo dużych obciążeń i swoboda kształtowania formy) wydaje się być idealnym materiałem do zaspokajania tego typu potrzeb, jednak we współczesnych obiektach sportowych rzadko występuje, jako materiał kluczowy dla ich rozpoznawalności. Na to, dlaczego tak się dzieje mają głównie wpływ czynniki związane z ekonomią i czasem realizacji, ale również zmieniające się trendy w myśleniu o architekturze, gdzie wyraźnie osłabia się nastawienie na jej trwałość. Nieliczne przykłady, w których zastosowany beton w decydujący sposób nadaje charakter budynkowi, mają jednak bardzo dobry odbiór społeczny i korzystnie wyróżniają się wśród innych o podobnym przeznaczeniu, co powinno dawać do myślenia w prognozowaniu dróg rozwoju tego typu budowli.

Słowa kluczowe: beton, igrzyska olimpijskie, obiekt sportowy, stadion

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1. Concrete in sports architecture

Sports architecture has a potential to achieve recognition in history that would be comparable to sacred architecture or other buildings significant for culture, science and art. Evidence for this can be found in ancient times. Mass sport used to play a significant part in Greek culture, and sporting competition aroused excitement and gathered audiences of thousands. Buildings dedicated to various games e.g. the Olympic, Delphic or Panathenaic Games, created in those times, have survived to the present day and cause amazement equal to iconic temples. These were fantastic projects that surprised with formal solutions and thoroughly designed location. The Panathenaic Stadium in Athens has a horseshoe shape, which opening on a long axis, frames the view over the Acropolis perfectly. When exploring Delphi we climb up the slope of Parnas Mountain, passing further temples, amphitheatres, gymnasiums or treasuries, and as soon as we believe there is nothing left, we encounter a surprisingly huge stadium, with terraces on one side, from where an incredible multi-kilometre view of the Pleisteos River valley stretches out. When the Romans conquered the Greeks, they closed the Olympics, but they did not abandon their games. Although their character was different, commercial, we would say today, they constructed magnificent buildings, in both their scale and functional complexity, such as the most famous one – the Colosseum. Nowadays, we would not be experiencing these emotions associated with admiration for those ancient sports arenas if they had not survived. It was especially difficult as they lost their initial function due to the fact that sport after the ancient times had been dead for ages and reappeared scarcely towards the end of the 19th century. The possibility to readapt them was especially difficult due to their uniqueness, and they happened to be mainly used as providers of building material.

When in 1894 the idea of olympism was revived by Pierre de Coubertin, they decided to organise the first modern Olympic Games using the ancient Panatheanic Stadium in Athens. It was built in the heart of the city by Lycurgus around 330 BC, and then rebuilt in 143 BC by Herodes Atticus¹. The stadium is also known under the name Kallimarmaro, which in the Greek language means that it is built from “beautiful marble”. It was reconstructed in 1896 in its original form with large private financial support, using, as it was initially, only white marble. This object, preserved in perfect condition, holds over 80 000 people, and continues to enrapture despite the fact that its arena, with its unusual proportions, has not met the requirements of contemporary sport for over 100 years and this makes it impossible for any official tournaments² to be organised there². During the 2004 Olympics, a symbolic archery competition and the marathon finish line were symbolically located in the arena.

The development of the sports construction industry in the 20th century seems to be mainly dictated by the investments associated with the greatest sports events such as not only the Olympic Games, but also the World Football Championships and European Football Championships. The growing popularity, recognition and, above all, the increasing prestige of these events has encouraged their hosts (cities, countries) to invest in new architectural, constructional and urbanistic projects that represent the level of economic development and

¹ R. Wierszyłło, (red.) *Urządzenia Sportowe*, Arkady, Warszawa 1966, p. 23.

² Running competition in Ancient Greece had different rules than nowadays. They would run to the end of the track with a 180-degree direction change, why the stadiums were so narrow (the widest one in Athens was 33.4m wide) and made it impossible to place a contemporary track inside of it, as it requires more than 100 metres.

technological and cultural proficiency and therefore their international position. These motivations used to generate the need to look for pioneer solutions or provoked experimenting, that not so rarely resulted in inventing new construction technologies and new formal solutions in architecture. The huge financial support that was usually very generously given by the organizers served these processes very well.

At the beginning of the 20th century, the listed ambitions of countries were satisfied thanks to the World Exhibitions. The Olympics were only an addition to them. So it was for example in Paris in 1900 or in Saint Louis in 1904. In time, the importance of games kept on growing and they started to outgrow the exhibitions. The very first modern stadium that has survived till this day, not only physically, but also in the consciousness of the people, is the Olympic Stadium in Amsterdam that was built in 1928. It is a simple stadium built in the spirit of modern architecture that was being shaped back then. What determines its character is the minimalistic, even for today's standards, brick-covered elevation with panels of horizontal windows. In 1978, the city authorities were planning to demolish the stadium. What saved it was putting it on the list of monuments which was a decision that served as a precedent especially when it came to a modernistic sports building. In 1996 the general renovation of the stadium begun and it ended in the year 2000. In the ancient times in Greece, the stadium architecture was determined by the form of the stands, which were built using natural basins and mountain slopes. Romans used to build on flat ground, which resulted in impressive elevations surrounding the stands from the outside (the best examples of that are the amphitheatres preserved to this day). The stadiums built in the 20th century, like the one in Amsterdam, had been following these rules for a very long time. The roofing of the stands, very characteristic for contemporary arenas and currently one of their symbols, did not use to be adapted almost at all, so difficulties in both constructing big stands capable of holding dozens of thousands of spectators and designing the elevation representing the quality of the perception, were crucial. What was found very helpful in finding the solution was parallel dynamic technological development, based on reinforcement of concrete and its further pre-fabrication possibilities. The availability of the material, resistance aspects and the possibility to provide high standards of fire protection³ have resulted in concrete becoming the leading material used in these kinds of solutions. Currently, all stands in permanent buildings are being created using ferroconcrete technology.

A great example illustrating the scale and consequences of using concrete is the Olympic Stadium in Berlin. It was initially designed by Otto March in 1915 with the idea of organising the Olympics in 1916, which did not take place due to World War I. The decision to organise the games in Berlin in 1936 was a pretext to rebuild it so that it could fit over 100 000 people (before it was 64 000). Otto's son, Werner March, took this on and the works were supervised by Adolf Hitler himself. The stadium was to be the symbol of the 1000-year Reich's power. After two years of construction involving thousands of workers, a monumental concrete building was created. The material was formed so that it resembled stone blocks, it gave the impression of being huge and solid (crucial characteristics of concrete). To this day its construction is surprising in its simplicity, monumentality above all, momentum. Designed on an elliptical plan (just like Roman amphitheatres) in the spirit of classic modernism, it

³ In 1985 wooden stalls of the English football club Bradford City burnt down, which resulted in 56 casualties and 265 injured. This event tightened the anti-fire regulations during spectacular sports events.

derives from the best ancient solutions. Its location and composition are determined by the city situation and one of the stands on the long axis had a wide cut (a reference to the horse-shoe Panatheanic Stadium) which in the long perspective is closed with a monumental clock tower, with the additional 40 out of 71 rows located in a basin, which enabled to achieve great elevation proportions. The stadium survived till this day and it has been functioning as a modern object that suits strict contemporary requirements in almost the same form, thanks to the exceptional modernisation process carried out by the Architekten von Gerkan, Marg und Partner studio, before the World Football Championship in 2006. The outside had retained its original character. Inside however, the stands panel located in the basin was rebuilt, improving the visibility and the layout of rooms under the stands and it was completely modernised, adjusting to current needs. The only highly visible change is the addition of the roof over the entire stands. This was done in an incredibly subtle way, so not to change the former character of the building. The roof is very sight, flat and delicately isolated from the elevation crown. It can be assumed that it duplicates the hypothetical solution of the roofing of the stands of the ancient Colosseum in Rome, through using the sailing canvas. The most important and interesting part of this solution is the cut in the roof that aims to retain the opening of the stands to the tower. This resulted in serious construction difficulties, as the roof couldn't work as a light, hanging dome (the cut of the outside and inside circle) and the support of poles was necessary. However, they had to be located in the auditorium and such solutions are claimed to be a basic mistake, as they obstruct the view from the stands. It rarely takes place that historical composition requirements have to be prioritised over functional aspects in architectural modernisation.

There are very few examples of modernisations equally as successful as that of the Berlin stadium. Especially when we think of monumental concrete buildings. The requirements of contemporary sports events have changed so drastically that according to the common opinion, determined by economic issues, it makes more sense to demolish an old building and create a new one. The most drastic example of such actions, which is the complete opposite of what happened in Berlin, is the construction of the new Wembley stadium. Built in 1923, it is the most famous football stadium in the world, its Mecca, with characteristic architectural elements (two towers on the long side, enhancing the entrance), it was fully demolished. A new, ultramodern stadium was designed by a world-famous architect Norman Foster to replace it. However, with no reference to its predecessor. Tradition is not continued at all, as an attempt to do so seems very difficult or even impossible. The new stadium, despite its unusual, wannabe outstanding solutions (a huge arch), seems quite anonymous and is not the highlight of Foster's designs, unlike the fantastic (concrete!) Millau Viaduct.

The 1960s can easily be called the peak season of concrete's influence on the creation of sports architecture, as it was the most fertile era. It was associated with the Olympics in Rome in 1960 and in Tokyo in 1964. Back then, the Olympic movement was already highly developed, but not yet commercialised, with original ideas still being alive. It is hard to say whether such conditions have influenced the quality of architecture, but the buildings created back then, which, together with innovation, were known for their quality, durability and perfect proportions, comparable to the ancient buildings. Both in Rome and Tokyo, the objects created are not stadiums but halls, whose construction was associated with the increasing need to make the games independent from atmospheric conditions.

An outstanding engineer and constructor Pier Luigi Nervi, with the cooperation of Annibale Vitellozzi (Pallazetto) and Marcello Piacentini, built two fully ferroconcrete

buildings in the capital of Italy, using prefabricated elements, that have become historical architectural pieces, not only in the sports industry. The Pallazetto dello Sport (capacity of 4000 people) deserves special attention. Designed on a perfect circle plan, surrounded by a symmetric ring of tilting Y-shaped columns, supporting a roof made of rhomb-shaped modules, astonishes with its regularity and purity of form, resembling concentric, ancient temples. Many solutions, such as the wavy roof edge, can be considered formal and used for aesthetic purposes. However, each time they are determined by the construction requirements resulting from the static work of the building. Another, much bigger hall, Pallazzo dello Sport (15,300 people), is very similar to the Pallazetto in its structure, with the same composition and construction rules. The high glass flat elevation however, has in my opinion deprived it of individual characteristics and has weakened the architectural expression generated by the elegant building structure.

The next Olympic Games in 1964 in Tokyo were the ones to take place in Asia and they were the first attempt to take on sports architecture by Japanese architects. It resulted in outstanding designs, which have redefined this industry and showed new development directions. Kenzo Tange was the one who designed the whole Olympic complex. The main material he used was concrete, but he played with it in a very carefree way, in order to give the buildings an organic form. The composition of the plans was also innovative and far from the European tradition. Two halls in Yoyogi (a park in Tokyo) are the most outstanding pieces, which created a coherent unit (picture 2). The first one holds a swimming pool with stands for 14,246 people and was designed on a plan of two arches along a long axis, which enabled the location of two opposite entrances/exits leading to the stands. The roof is also based on an arch situated between monumental concrete pylons. The smaller hall for 5,000 people is a natural addition to the big one, it has the shape of an open circle and its roof falls naturally from one of the central pylons. These partly forgotten buildings are in my subjective opinion the best sports buildings ever created and we cannot underestimate their influence on contemporary architecture.

In the following years sport gradually became commercialised and bound to politics. This has had a visible influence on sports architecture, which has to not only meet all the commercial events requirements, but also the political-image ambitions of organisers. The well-known concrete-based technologies did not really correspond with the above, therefore new solutions were looked for. The very first and at the same time a spectacular example of these is the building complex created for the Olympics in Munich in 1972. German architects Frej Otto and Günter Behnisch suggested historically precedent-free solutions. The whole concept was created with soft lines on an open park-like surface. In order to create arenas and stands, they carved basins, which then were covered with transparent roofs of an organic, or even biomorphic form, hanging on ropes (in his constructive calculations Otto used some studies on surface forces in water drops). The idea was completely new and even ahead of technical capabilities. The transparent roof, resting on nets creating a soft, two-curve surface, was made of hard polyurethane tiles. To avoid breakage, they were connected to neoprene battens, which ended up not being successful, as the tiles keep breaking to this day and have generated huge maintenance costs. Back then, contemporary materials such as soft, permeable to light membranes made of glass fibre covered in Teflon were unknown. It is worth pointing out that the genesis of this extraordinary idea is a very prosaic reason – the quality of television broadcast. Old cameras would have such difficulties adapting to the dynamic lighting changes which

appeared when cameras moved from the sports pitch's shadow to direct sunlight. The transparent roof was to be the solution.

The following Olympic Games in Montreal in 1976 had the architectural bar set very high. The Canadians decided to partly take on the challenge to design a new stadium. French architect Roger Tallibert decided to tackle an opening roof concept as the first man in history. The concrete building with a monumental 175-metre tower above it was created. Its function was meant to be holding a Kevlar roof, thanks to the ropes attached to its peak. This experiment, bizarre from the contemporary architectural perspective, failed. The investment was not completed before the Olympics and the roof was opened for the first time in 1988 and due to false assumptions, it was immediately torn apart. Thus, after several modification attempts, it was demounted for good. This was associated with huge costs that were paid for by the Canadians only two years ago.

This experience influenced the approach of future investors. They started to take expenses into account and look for new, cost-effective ideas and technologies, using already-existing objects more often. At the end of 20th century the idea of balanced development, that the Olympic Movement had been very engaged in, gained significance. The difficulty of the usage and maintenance of objects after games started to become more obvious, as a perspective for them to be the hosts again was small and surely remote. Projects based on light constructions, that could easily be put up and then taken down or rebuilt according to new needs, were to become a solution. Paris, which wanted to become the 2012 Olympics host, suggested foldable objects, which were supposed to be fully transported to Africa after the games. More attention started to be paid to saving energy during the whole investment process as well as the usage of recyclable materials. Concrete did not meet those requirements though. A heavy, energy-consuming material in both production and construction process, time-consuming in the building process and difficult to take down. It is being avoided or more likely hidden in the contemporary architecture. Concrete stands and arenas are packaged with representative light structures built using the newest materials such as EFTE foil (Allianz Arena in Munich, WaterCube in Beijing), which very often twinkle and flash thanks to LED systems.

Stepping back from long term problems has in my opinion not solved them, but taken away some of their quality. Despite a few exceptions, with the usage of plenty of spectacular solutions, it is difficult to find contemporary sports designs that are widely recognisable and have a timeless character, so that they can compete against other public utility buildings. This exception is a football stadium, built for the European Championship in 2004 in Portugal, close to the city of Braga. The object is located on a mountain slope, where some rocks were blown up and made into concrete, which was the only material used in the construction. Stands are located on the sides of the pitch only. Behind one of the gates, there is a rock, whereas the other one has a wide view of the horizon in the background. The scenery for the sports events is unique and resembles the ancient stadium in Delphi. This heavy monumental piece that suits the surroundings so perfectly continues the tradition started by the best concrete sports objects such as the Berlin stadium, Pierre Luigi Nervi's halls in Rome or those of Kenzo Tange in Yoygi. Eduardo Souto de Moura, its Portuguese designer, received Pritzker's prize in 2011, and according to the jury, what differentiated Estadio Municipal de Braga was its uniqueness.

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