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MODERN TEMPLE WORKS  
OF ORDINARY CONCRETE,  
A MATERIAL WITH DIVERSE APPLICATIONS

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WSPÓŁCZESNE ŚWIĄTYNIE  
DZIEŁA Z POSPOLITEGO BETONU,  
MATERIAŁU O WIELU PRZEZNACZENIACH

Abstract

Concrete is a material that was perceived, especially in the 1980s and 1990s, to be ordinary and one of the most readily available, also called the cheapest. Many designers of sacral architecture used concrete as one of the necessary construction materials. Properly chosen and prepared, well used in the construction and interior creation, it became a material with diverse applications for architects. The use of this common material turns out to be much broader, which is proven by churches made almost exclusively of concrete, becoming a material of unusual properties and possibilities of work creation.

*Keywords: modern churches, concrete temples*

Streszczenie

Beton to materiał uznawany szczególnie w latach osiemdziesiątych i dziewięćdziesiątych XX w. za pospolity i jeden z łatwiej dostępnych, określany jako najtańszy. Wielu twórców architektury sakralnej używało betonu jako jednego z niezbędnych materiałów do budowy. Właściwie dobrany i przygotowany, odpowiednio zastosowany w budowie i kreacji wnętrza stał się dla architektów materiałem o wielu przeznaczeniach. W obiekcie sakralnym widoczny jest jako element konstrukcji, kasetonów, detalu wnętrza, niejednokrotnie pozostawiony w swej naturalnej barwie, lub jedynie wybialkowany. Zastosowanie tego pospolitego materiału okazuje się jednak dużo szersze, czego przykładem mogą być świątynie wykonane niemalże w całości z betonu, który tu staje się materiałem o niezwykłej właściwości i możliwości kreacji dzieła.

*Słowa kluczowe: współczesne kościoły, betonowe świątynie*

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## 1. Introduction

It is commonly accepted that it was concrete that became the material, which revolutionized 19<sup>th</sup>-century construction and architecture. The first traces of the use of this material date back to 7000 BC. The oldest remains proving the use of concrete were found in southern Galilee in Israel, where floors and fragments of the walls of a structure were made with the use of concrete, with lime cement and crushed limestone used as aggregate<sup>1</sup>. Lime cement was also used during the creation of the Mesopotamian city-states, including Ur, some 2500–2000 years BC<sup>2</sup>. Written records of concrete only appeared in 1<sup>st</sup> century BC, thanks to Vitruvius, a Roman architect, designer and engineer. It is worth noting that the majority of objects built in the Roman Empire and preserved to date are made of concrete based on pozzolanocement<sup>3</sup>. The material that was once forgotten for ages was again brought to light thanks to Bernard de Belidor, a Frenchman who in 1748 published his work *Architecture hydraulique*, where he used the notion of *concrete to denote the mixture of sand, water and hydraulic lime*<sup>4</sup>. Today, concrete is one of the most commonly used construction materials. Typical concrete is made by setting and bonding of concrete mix. The concretes can be divided due to their specific gravity, method for compaction, properties and directions for development. That is why today we can speak about the transmutation of concrete, if we see its initial applications and current use.

## 2. Use of concrete in sacral architecture

The use of concrete as a construction material in contemporary sacral architecture, as well as its different possible applications, transformations and the visual transformations connected therewith, will be discussed in further part with reference to sacral structures fully constructed of it or utilizing it in some particular manner. This analysis pertains to selected contemporary sacral objects built after the Second World War. Churches were always a reflection of the spirit and idea of each age; sacral architecture was treated as an object with unique aesthetics and new materials and structures were used to construct it. But before the transmutation of the long used construction material that we know today as concrete occurred, for centuries, sacral construction was dominated by bricks, stone and wood. In the 19<sup>th</sup> century, the already known material, used widely in civil engineering, was also used in sacral architecture. At this point, we should note the work of Frenchman Francois Coignet<sup>5</sup>, who in 1893, was the first to use concrete for structural purposes in sacral architecture<sup>6</sup>.

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<sup>1</sup> W. Raczkiwicz, *Beton-materiał budowlany znany od wieków*, Przegląd Budowlany 10/2012, Wyd. Zarząd Główny Polskiego Związku Inżynierów i Techników Budownictwa, Warszawa 2012, p. 13.

<sup>2</sup> L. Westfal, *Dzieje betonu*, Czasopismo BTA 3(51) 2010, Wyd. Stowarzyszenie Producentów Cementu, Kraków 2010, p. 34.

<sup>3</sup> W. Raczkiwicz, *Beton-materiał...op.cit.*, p. 13–14.

<sup>4</sup> L. Westfal, *Dzieje betonu...op.cit.*, p. 37.

<sup>5</sup> Coignet, together with Luis Charles designed the Le Vesinet church in Seine-et-Oise. The church has shell made of concrete that was clad with facing material.

<sup>6</sup> W. Niebrzydowski, *Beton i jego faktura w architekturze sakralnej*, Budownictwo Sakralne i Monumentalne 2000, Wyd. Politechnika Białostocka, Białystok 2000, p. 152.

The new materials and technologies created in the 20<sup>th</sup> century caused the growing tendency towards their use in creating sacral architecture and thus contributed to the search and creation of new aesthetic. Cast iron, steel, concrete, reinforced concrete and glass became the decisive factor in the appearance of new architecture, and their use brought about a technological breakthrough. These materials enabled the possibilities of creating a spatially new architecture with an image that had forms and shapes that were previously unknown. Concrete, reinforced concrete and glass freed the architecture from traditional structural schemes<sup>7</sup>. There was not a single material to that date, which would give so many possibilities for creation; its technical advantages stopped to limit the shape; additionally, the economic benefits encouraged its use. Concrete was defined as artificial stone in architecture. The term reflects the durability, indestructibility that are similar to stone, it also has a wide range of applications as a structural material, binder, facing and outer texture. It gives the possibility of its multi-purpose application in a single object. In the beginning, the use of concrete and reinforced concrete was limited to technical aspects only, frequently hidden under different stone, plaster or sheet metal facings. The texture and structure of raw material was not instantly accepted in Poland. In 1980s, the notion of the aesthetic side of concrete appeared. H. Naradowski in his *Sacrum przestrzeni* [Sacrum of space] asked *Does, and if yes how far, the concrete enable the aestheticization and sacralization of churches?*<sup>8</sup> and this question clearly shows how far the use of concrete changed the reception of sacral architecture. The effects brought about by its use and exposition give contrast, light-shadow play, the feeling of movement, they stress the boldness of structural solutions. *We even speak about sacralization of concrete with propagators and eulogists in person of Le Corbusier, and later Tadao Ando*<sup>9</sup>. The sculptural quality and fluid shapes in Le Corbusier's Notre Dame du Haut chapel in Ronchamp (1950–1954), the concrete solids were the foreshadows of a new look and shape of sacral architecture. In the La Tourette cloister in Eveux-sur-Arbresle near Lion (1957–1960) was designed by the author as a simple, ascetic solid, devoid of soft lines, manifesting the aesthetic of raw concrete. Tadao Ando, who among other structures designed the Church of Light in Osaka (1989) created his own style, inspired by geometrical solids composed of simple systems, where concrete and its smooth texture resulting from the use of metal formwork manifest his distinct style – minimalism. Oscar Niemeyer is also among world architects who designed works made of concrete, based on ovoid lines and shapes, a designer of numerous churches and cathedrals, including the world famous cathedral in Brasilia (1958). Completed roughly at the same time were works by Félix Candela, *an architect who used parabolic hyperboloids (...), Candela, in every way possible, tested the potential of thin wall shell structures*<sup>10</sup>.

The Church of the Most Holy Trinity in Vienna (1974–76, ill. 1) designed by Fritz Wotruba, an Austrian sculptor, is an enormously interesting example of sculptural, brutalist architecture. This church is a huge concrete structure fully demonstrating the spirit of brutalism in architecture. The object is made of 152 reinforced concrete blocks of different size,

<sup>7</sup> J. Sz. Wroński, *Kościóły Krakowa*, Wyd. Akademia Wychowania Fizycznego, Kraków 2010, p. 297.

<sup>8</sup> H. Nadrowski, *Sacrum czasoprzestrzeni*, Wyd. Adam Marszałek, Toruń 2012, p. 281.

<sup>9</sup> *Ibidem*.

<sup>10</sup> I. Cichońska, K. Popera, K. Snopce, *Architektura VII dnia*, Wyd. Fundacja Nowej Kultury Bęc Zmiana, Wrocław 2016, p. 94–95.



- III. 1. The Church of the Most Holy Trinity in Vienna. Source: Wąs C., *Antynomia współczesnej architektury sakralnej*, Wyd. Muzeum Architektury we Wrocławiu, Wrocław 2008, p. 249
- III. 2. Chapel in the German Eifel region. Source: Jodidio P., *Architecture now! 6*, Wyd. Taschen, Germany 2009, p. 562
- III. 3. The Church of Divine Mercy in Kalisz. Source: photo credit: Igor Snopek

connected as if they were building blocks. The clearances between the blocks were glazed, thus enriching the interior with light and shadow effects<sup>11</sup>.

The monumental character of the church was achieved by cuboid blocks made of reinforced concrete that were inseparably connected.

Among contemporary sacral architecture designers, who create with the use of the still experimental material with wide applications, we should point the Swiss, Peter Zumthor. In 2003, he designed a unique chapel in Germany, in the Eifel region. It was constructed in the middle of a field, modern, simple, clean both outside and inside, made completely of concrete. The designer composed the solid as a cube without window openings, with triangular metal doors. The façade of the chapel is the result of the concrete used, which, poured layer after layer, created multi-colourstripes resembling windswept grain crops. From the viewers' perspective, the chapel forms unity with its surroundings, forms part of the natural world, also through its material, that independently created the figure of façade. What is surprising is the chapel interior. *Inside there is a pentagonal, windowless space, almost 12 m high. The sole opening located in the roof collects water. (...) The raw, dark texture of walls was achieved by burning 112 fir branches used as formwork and chosen by the architect himself. Every day a new layer of concrete was poured, 24 in total. Then fire was set to branches and beams inside*<sup>12</sup>, (ill. 2).

### 3. Concrete sacral architecture in Poland

The political situation that Poland was in after the Second World War largely inhibited and limited the construction of new cult objects of the Roman Catholic religion. There were several periods of intensification of creative and design works. During the political thaw, it met the period in time, when atypical sacral objects were already created around the world, with the use of new materials and structural solutions. In this spirit, the proposal of new objects in Poland was investigated, trying to follow the world aesthetic trends and fashions even when there was the Iron Curtain in place. Contemporary architects tried to use the advantages of concrete and reinforced concrete using solutions that were already known and well tested in the west. In many cases, concrete became a material treated in a multidisciplinary fashion. It was used as a structural material and a material for filling whole walls. It created textures with different effects, from the clean, wooden or metal framework moulded texture to the porous textures of spray-on concrete. The multitude of applications of a single construction material is also demonstrated by the fact that it was used to make details, decorations, frame divisions that were filled with glass or stained glass, which replaced the use of windows. The structural elements and panel ceilings visible in the interiors were left with natural concrete textures. One material with a multitude of uses and possibilities, used in the times of renewed development of sacral construction in Poland became the indispensable construction material for new

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<sup>11</sup> C. Waś, *Antynomia współczesnej architektury sakralnej*, Wyd. Muzeum Architektury we Wrocławiu, Wrocław 2008, p. 249.

<sup>12</sup> P. Jodidio, *Architecture now! 6*, Wyd. Taschen, Germany 2009, p. 562.



- III. 4. The Holy Cross Church in Szczecin. Source: photo credit: Author
- III. 5. The Church of Mother of God, Queen of Poland in Elbląg. Source: KAWTiMP Archives
- III. 6. The Church of Mother of God, Queen of Poland in Elbląg. Source: KAWTiMP Archives

churches. It was most widely used until the late 1980s, influencing the construction of hundreds of churches that we today call concrete temples.

Many architecturally interesting churches were built in the period that was most difficult for the Roman Catholic Church. The scale of some of the investments caused their never-ending construction, and some bold projects waited years for construction. An example of architecture that was bold for its time is the church built for the competition announced in 1958<sup>13</sup> by SARP for a sacral object in Kalisz. The church selected in the competition was a courageous vision of young architects, following the spirit of modernity, and referring to the thin shell structures similar to the solutions by Candela<sup>14</sup>. The Church of Divine Mercy in Kalisz (ill. 3) was designed by Jerzy Kuźmienka and Andrzej Fajans and as a competition design, it was very novel, with a unique thin shell structure that was difficult and costly to construct. It was only constructed twenty years later. The object was designed with vast boldness and thoroughly thought of, the designers also cared for the plastic quality of the interior and its equipment. The church solid is made of waving surfaces, fully made of concrete and there are no structural support elements inside. The concrete, waving wall-ceiling reaches a height of 45 meters in its highest location. The surfaces are self-supporting, slightly profiled, white-painted shells falling down, which makes them additionally stick out of the prefabricated concrete residential district surrounding it. The concrete structure seems light, climbing high and dominating the district.

The construction of the church took years and the technical difficulties during the construction were also the result of economic aspects, concrete as the relatively best accessible material was not easy to process, required engineering skills and also frequently the use of specialist construction equipment. This little-known church still meets with admiration and awe today. The object did undergo small repairs, renovations and also a thorough cleaning of white surfaces; in the current age of concrete development, these surfaces would be constructed with the use of self-cleaning concrete, as it was the case in the Jubilee Church in Rome<sup>15</sup>.

The Holy Cross Church in Szczecin, constructed between 1972 and 1989 and designed by Zbigniew Abrahamowicz (ill. 4), is also an example of bold and novel solutions. This temple was built as an expansion of an existing, pre-war church, and in reality, a new object was created that covered and included the pre-existing church under its roof. The new object is a contemporary temple on a central plan designed on a section of a circle. The enclosing wall is made of equally spaced (every 1.5 m) arch reinforced concrete, 6m high supports. The north-eastern wall is also made of a row of irregularly spaced, reinforced concrete pillars with varying height. The space between them was filled with glass, half of which is made in a colourful, geometrical pattern. The irregularly spaced pillars climb up. Each subsequent pillar has a different height. A reinforced concrete, curved line ceiling stretches above and is supported by the two arches of walls. The dominant curvature plane of the ceiling covers the main nave and is supported on arches of walls with a different height. The interior is devoid of structural elements that support

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<sup>13</sup> This date fits in the period of the short-term political thawing that started in 1956 when Władysław Gomułka came to power, this period witnessed the temporary warming of the state-church relations and resulted in over one hundred church construction permits issued, only few of those permits were actually executed.

<sup>14</sup> I. Cichońska, K. Popera, K. Snopek, *Architektura VII ...op.cit.*, p. 95–98.

<sup>15</sup> Object built in 1998–2003 and designed by Richard Meier. The white sculptural solid is made of three ovoid shells covered with panels of self-cleaning concrete.

the roof; we only see the main ribs of the ceiling curvature structure. The whole object, including the roof, was made of reinforced concrete. The elements of the ribs of the suspended ceiling have a panel structure. The walls and the ceiling were left in their raw form of concrete structure with visible traces of formwork structures and only some elements painted white. The raw texture of concrete and the visible transitions left by the formwork elements are still visible, even when covered with white paint. The concrete texture in roof space was clad with copper sheet, the exterior walls plastered white. The exposed reinforced concrete elements stress the boldness of structural solution. This church is a dynamic, single-space solid on a plan of a fragment of a circle, where the interior is shaped in an amphitheatre form.

When it comes to the use of concrete, the Church of Mother of God, Queen of Poland in Elbląg (1983–1995) by Adam Szymiski (Ill. 5), is an interesting example. This object, which is vast and technically complicated, was made of cast reinforced concrete in a spherical shield structure, and was an extremely difficult structure to construct. It was built on the site of a pre-war church. The assumption was the uninterrupted liturgical activity, which was only possible when the whole would be completed in stages. At the same time, the investment required efficient construction and, in the second stage, demolition of the old church, and also connecting the newly constructed part with the already used part of the temple. The object was to be an accent in urban space, visible in its panorama from the Gdańsk side. The designer proposed a solution that referred to the traditions of Gothic canon, based on a plan with nave, transept and choir. The solid was based on simple geometry. The whole temple was built of interconnected triangular and trapezoid elements. This allowed the ease in dividing the work in stages, thus enabling smooth transitions between them, without making the old church inoperable. The solid elements of the temple are roof-walls that were solved as reinforced concrete spatial clad. The interrupted rows of skylights that rise above the roof-walls introduce daylight in the temple's interior<sup>16</sup>. The whole object is covered by sheet metal from the outside. The tower is unfinished with its sides demonstrating layers of poured concrete and impressive formwork elements that leave the tower with a raw finish. What is visible in the interior of the church is the system of planes of the roof-walls that form the church geometry, structure of reinforced concrete planes and the subsequent elements that all together form a white painted solid. White surfaces were cut with skylights that connect the triangular geometry. This gives the reinforced concrete structure a degree of lightness. This church is an example of a total coverage of material that the object was made of; the façade is a completely covered roof-wall. The interior is in contrast to the façade, with bright walls surrounded with ramps that follow the system of wall planes and stress the dynamic of the interior.

### 3. Conclusions

Concrete temples, churches of reinforced concrete, ascetic temples and many similar notions describe the churches constructed in the 1980s. The common material concrete has become at that time, mainly because of economic considerations and relative availability,

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<sup>16</sup> A. M. Szymiski, *Kanon formy architektonicznej w Kościele katolickim*, Wydawnictwo Politechniki Szczecińskiej, Szczecin 2000, p. 515–523.

influenced the mass construction around the world. The churches built with its use developed the will of construction of ever more modern objects with more complex forms and structures in designers. Experiments with the possibilities offered by concrete and reinforced concrete influenced the creation of spectacular objects. The possibilities of concrete as a material and its potential applications changed the attitude towards its perception as a purely structural material. The broad, ever changing and broadening uses that the concrete gathered from its reinvention until present date may be called its transmutation. The possibilities of concrete and its diverse and multidimensional applications in structures and construction were traced on the example of just a fragment of global and Polish sacral architecture. The presented extreme examples of sacral architecture demonstrate different approaches to the use of the discussed material. The presented objects utilize concrete both as a structural material – reinforced concrete for the whole object – from walls to roof – e.g. in the church in Kalisz, Elbląg; through treating concrete as texture for façade – e.g. in the field chapel in Germany; and up to treating it as a ready element, block that is used to construct the whole – e.g. in the Viennese church. Concrete was used to construct objects ranging from small scale ones – as the aforesaid chapel – up to those of a size of cathedrals built by Oscar Nemeier. Every time, the architects using concrete together with steel and glass created concrete architecture, which is new, modern and includes subsequent applications of the common concrete. Concrete has become an indicator for modernity, and sometimes referred to as the artificial stone, it is extremely frequently used, and the textures and aesthetics it enables grant uniqueness and non-repeatability of outcomes. The aestheticization and sacralization of sacral objects with the use and broad application of concrete do not give rise to doubt. The nobleness and beauty of temples built with its use prove its uncommon character in the dimension of quality and architecture, also demonstrating the ever changing applications of concrete.

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