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PREFABRICATED ARCHITECTURE, PAST AND FUTURE: FROM PAST INDUSTRIALIZED RESIDENTIAL BUILDINGS TO CONTEMPORARY REQUIREMENTS

TRADYCYJNA ARCHITEKTURA PREFABRYKOWANA A WYZWANIA PRZYSZŁOŚCI – DOŚWIADCZENIA PŁYNĄCE Z HISTORII UPRZEMYSŁOWIONYCH BUDYNKÓW MIESZKALNYCH W KONTEKŚCIE WSPÓŁCZESNYCH WYMAGAŃ

Abstract

From the 1920s housing estates in Frankfurt and Berlin designed by Ernest May and Martin Wagner, the history of factory-produced apartments is reaching its 100 year mark. Can we therefore talk about traditional prefabricated architecture? What this term can mean in Poland and how past experiences can be transposed into contemporary challenges facing residential architecture, especially in the context of housing affordability and sustainable urban development? The article analyses the part of Polish history of prefabricated residential architecture on the basis of a chosen implementations of housing estates erected in the 20th century in Warsaw, attempting to answer the above questions.

Keywords: prefabrication, prefabricated architecture, prefab, residential architecture, housing estate, Warsaw

Streszczenie

Rozważania na temat technologii prefabrykowanej w architekturze mieszkaniowej Europy należy rozpocząć od lat dwudziestych XX wieku, od osiedli we Frankfurcie i Berlinie projektu Ernesta Maya i Martina Wagnera oraz działalności Bauhausu. Zatem historia fabrycznie produkowanych mieszkań ma 100 lat. Czy przy okazji tej rocznicy możemy mówić już o tradycyjnej architekturze prefabrykowanej? Co ten termin oznaczać może w Polsce i jak przeszłe doświadczenia mogą przekładać się na współczesne wyzwania stojące przed architekturą mieszkaniową, zwłaszcza w kontekście dostępności mieszkań i zrównoważonego rozwoju? Artykuł analizuje wycinek polskiej historii prefabrykowanej architektury mieszkaniowej, na podstawie wybranych realizacji osiedli wzniesionych po II wojnie światowej w Warszawie, i podejmuje próbę odpowiedzi na powyższe pytania.

Słowa kluczowe: prefabrykacja, architektura prefabrykowana, zabudowa mieszkaniowa, osiedle, Warszawa

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1. INTRODUCTION

Prefabrication has always been a technology discussed and considered in the context of affordable housing. In 20th century Europe, including in Poland, whenever a shortage of housing seemed particularly acute, decision-makers and engineers, including architects, most often chose prefabrication as a way to solve the problem.

Prefabricated solutions in residential construction began in Europe in the interwar period, the first significant projects in Poland appeared after 1945.

The need to build quickly and relatively cheaply a large number of flats in a war-damaged country was huge in Poland (it is estimated that the destruction of urban real estate reached 50% of the pre-war resources)[2]. Apart from the obvious reconstruction and ensuring a "roof over one's head", the new projects were to be of a higher than pre-war standard, especially those designed for workers. The pre-war city had to offer them flats, which were mostly dark, damp, cramped, with no access to green open spaces. The improvement of housing conditions was postulated in the Athens Charter (1933), and the implementation of its ideas in Poland began already in the interwar period. After the war, though in different interpretations, these concepts were also implemented.

The war damage has made the housing situation more difficult than ever before. The demand for quickly built and affordable flats did not decrease in the following post-war decades, either, due to the development of industry and the influx of rural residents into cities and high natural growth (in the years 1946–1988 the population of Poland grew from almost 24 to 38 million, and the percentage share of urban residents in the total number of citizens from 39 to 61[3]).

The interest in prefabrication of building elements among designers was a natural consequence of the search for optimal technologies that could solve the housing problem.

From the early post-war years, over the next decades, multi-family buildings, housing estates and even significant parts of cities with a residential function were designed using various methods of prefabrication.

This paper focuses on two examples of prefabricated housing in Warsaw – the housing estate of the Warsaw Housing Cooperative in the area of Koło (erected in the years 1947–50) and the Prototype Housing Estate in Służewiec (erected in the 1960s). The pre-war investment of the Association of Workers' Housing Estates (also in Koło), built in traditional technology in 1935, was described as an introduction to and a point of reference for the discussion on prefabrication. Both these estates were established in the neighborhood of industrial plants with the idea of ensuring a proper place of residence for the employees working in them.

Such a selection of analyzed examples allows to trace changes in the technology of building objects, the transition from the traditional way to the widespread industrialization of residential architecture, which occurred in the early seventies of the twentieth century and was used in the following two decades.

The discussed examples show the stage of creative search for technology that was to make residential architecture more accessible and egalitarian. At the same time, these were projects in which a compromise was sought between architectural and technological solutions, trying not to give construction methods and related economics a leading role.

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[2] *Promemoria 1939–1945*, Główny Urząd Statystyczny, Warszawa 2015.

[3] *Historia Polski w liczbach*, GUS, Warszawa 1994.

The housing estates presented below have been analyzed in terms of construction technology and its impact on urban solutions, architectural expression and plans of buildings.

Conclusions from the analysis of those significant developments in the history of 20th century Warsaw residential architecture may also be relevant today. Nowadays, once again, we are looking for methods that will help to solve the problem of the shortage of affordable flats. Over the last few years in our country we have observed a new interest in industrial construction in the context of solving housing problems. The return to the prefabricated way of building houses (which was abandoned after 1989 along with political changes) is gradually being popularized.

Prefabrication return to Polish residential architecture is promoted by public institutions, producers of building materials/elements and, more and more often, architects themselves. Apart from its obvious features (reduction of costs and time of construction), they also see the advantages of this technology in the context of sustainable construction. A controlled production environment may result in the saving of energy and environmental resources, facilitate predictions about the life cycle of a building. At the same time, the organization of production and assembly may change seasonal nature of workers' employment and forces the control of working conditions and safety.

In the context of these new discussions and searches, it seems reasonable and noteworthy to use the tradition of prefabricated building of the past years. It may give us arguments for re-introducing certain solutions or for rejecting them. As architects, we do not want to blindly repeat the mistakes of the past and obviously new technological developments can help arrive at new solutions. Contemporary prefabrication, as shown by the experience of European solutions, is different from the one used in the Modern Architecture of the 20th century, but it is still based on the experience of past years. Therefore, it is worth analyzing and learning from the domestic tradition.

2. RESIDENTIAL COMPLEX OF TOR (TOWARZYSTWO OSIEDLI ROBOTNICZNYCH – THE ASSOCIATION OF WORKERS' HOUSING ESTATES) – KOŁO I

The development of the Wola district in Warsaw, of which the area of Koło is a part, began in the second half of the 19th century with a new railway line and the construction of many factories. Their number increased in the following years, also after the Second World War.

The beginnings of Wola, as a part of Warsaw (since 1916), are characterized by not only the industrial function but also housing of a very low standard.

The history of residential architecture designed with affordability in mind begins with the housing estate – an exhibition of single-family houses – organized in 1935 by BGK (Bank Gospodarstwa Krajowego – Domestic Investment Bank). But the size of the buildings and the costs of their construction and maintenance meant that the houses were not affordable enought.

The BGK exhibition contributed to hardening of streets and equipping the plots with media. As a consequence the neighboring location was selected for residential complex financed by TOR (Towarzystwo Osiedli Robotnicznych – The Association of Workers' Housing Estates).

TOR was established by the state authorities in 1934 with the aim of building houses for the lowest paid workers. It was considered that the buildings erected earlier for them were too expensive and in practice unaffordable. As a result, the housing conditions of the lowest earners were unacceptably low.

It was assumed that the cost of new flats had to be adjusted to the financial possibilities of the worker, so the apartment had to be small and rationally designed.

In September 1935, the construction of a housing estate designed by R. Piotrowski (in cooperation with K. Lichtenstein, A. Brzozowski and Z. Szulc) began. Together with the Syrkus couple (designers of another of the discussed housing estates), he had taken part in a congress proclaiming the Athens Charter.

The first phase covered the area between the streets of Dahlberga, Bolecha, Długomiła and Obozowa; the second – Deotymy, Obozowa, Magistracka and Ożarowska.

The estate was to include about 1,000 small flats, not exceeding 30 m². In order to adapt the rent level to the possibilities of future residents, *very far-reaching savings were applied both in the planning and in the equipment of flats*[4].

In the first phase (north of Obozowa Street), 10 identical three-storey buildings containing 54 flats each were erected. The form of the individual buildings consists of two displaced cuboidal blocks connected by a part which originally contained bathrooms, laundries and drying rooms. Flats are accessible from the corridor naturally lit at the edges.

Due to sunshine and ventilation, the buildings are located perpendicularly to Obozowa Street. The windows overlook the inter-block zones. The courtyards are the same size, but serve different purposes – utility yards with garbage cans and carpet beating stand, green areas and playgrounds for children.

The type of connector for this part of the complex is an internal pedestrian street, it goes through all courtyards and is kind of passage under the building.

There are two types of flats in the first part of the housing estate. Slightly larger ones have a hallway, toilet, main room, sleeping space and a separate, naturally lit kitchen. The smaller ones were single-room flats with a kitchenette (without window), hall and toilet (Ill. 1). On each floor there was one bathroom for 9 apartments.

Although the flats were small (there were more than 4 people living in each on average), the small area was compensated for by common rooms, services and green open spaces.

There were no shortages of people willing to dwell in these flats, 6 families applied for one apartment (which forced TOR to develop careful selection conditions). Today, flats may seem very poor, but for the most impoverished workers of pre-war Warsaw they were very attractive.

The architecture of the buildings was simple and inexpensive. The walls were plastered, only some of the surfaces were decorated with façade bricks. The architectural expression of the façade is formed by large windows with multiple divisions (Ill. 2).

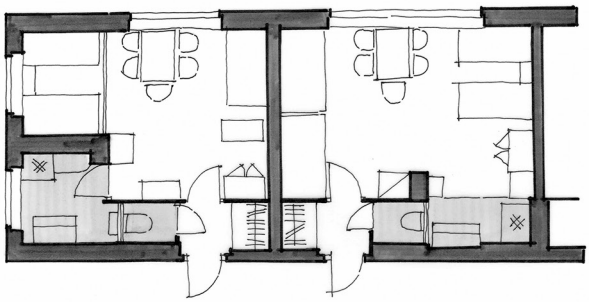
The buildings were erected using traditional technology, the construction is made of brick walls and Ackerman's beam and block floors.

The construction of the second phase, slightly different in form, but analogical in design assumptions, was completed in 1938.

The Koło I housing estate shows how the affordable flats were designed and built in the period preceding the development of prefabrication. Although it was built in traditional

[4] *Osiedle TOR na Kole*, Dom, Osiedle, Mieszkanie, 1935, no. 11, p. 33–35.

Ill. 1. The Koło I housing estate, the first phase, the plans of flats
Ill. 2. The Koło I housing estate, present state
Ill. 3. The Koło II housing estate, present state



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technology, it shows the features that characterized prefabricated architecture after World War II – identical buildings of simple form, whose architectural expression is shaped by the repetition of elements (in this case, windows). The flats are the same within two types and they are very economical. Construction technology has also been reduced to simple, repeatable solutions.

Koło I is a good example that proves that the architectural features often associated with prefabricated buildings were present in residential architecture before industrial technology emerged. It can even be said that if prefabrication similar to that used in the interwar period by, for example, E. May and M. Wagner in Frankfurt and Berlin housing estates ("Praunheim Siedlung", "Splanemann Siedlung") had been known and used in Poland, Koło I could have been built in a similar way without significant changes in architectural design.

3. RESIDENTIAL COMPLEX OF WSM (WARSZAWSKA SPÓŁDZIELNIA MIESZKANIOWA – WARSAW HOUSING COOPERATIVE) – KOŁO II

Warsaw Housing Cooperative was established in 1922. Its aim was to *provide and lease to members cheap and healthy flats built by collective self-help with the support of state and municipal institutions* and to *satisfy the cultural needs of members*[5].

Before World War II WSM built in Warsaw housing estates in Żoliborz and Rakowiec, the first investment after the war was the housing estate Koło II. It was designed by Helena and Szymon Syrkus in 1947 and erected until 1950. The urban plan was based on Michał Przerwa Tetmajer's diploma project.

The buildings were no higher than four floors. They were designed as multi-staircase or arranged along a single-loaded open corridor (access deck).

In proportions, blocks are relatively low and elongated in one direction. They were usually situated in pairs, parallel to each other with longer elevations. Between them the open spaces were formed providing access to space, sunshine and air. Some of the ground floors had openings supported by columns to vary the façade and shorten communication routes.

Despite the repetition of building types the architecture is not monotonous. The longer elevations have a different character in each building. The parallel arrangement of a pair of the same building types makes the facades seen from green spaces different. Elements such as bays, balconies, loggias and retracted walls also vary the form of the building.

The blocks have individual entrance zones – e.g. characteristic roofs with side walls perforated like a Swiss cheese. Some buildings are entered through openings in the ground floors (Ill. 3).

Apartments have two rooms and a separate hallway, bathroom and naturally lit kitchen. Larger flats are double aspect apartments, windows of smaller ones face one side. Many of the apartments have balconies or loggias. The flats are bigger and more comfortable (bathroom, separate kitchen, loggias) than in the Koło I housing estate (Ill. 4).

The buildings were erected in the technology of the so-called small prefabrication (on-site prefabrication). Building elements (blocks, tiles, beams, etc.) were made next to the construction site. The place was organized like an industrial production line. It was decided to use repeatable solutions to optimize fabrication process.

[5] *Statut i Regulaminy*, Warszawska Spółdzielnia Mieszkaniowa, Warszawa 1930.

The external walls were built of concrete blocks (50 x 50 x 20 cm) produced from the debris left after the destruction of the capital. They were insulated with foam concrete blocks (50 x 50 x 13 cm) and faced with cement-lime tiles (50 x 50 x 2 cm). The joints of each layer of the wall were offset in relation to each other to avoid thermal bridges.

The partition walls were also made of debris (100 x 25 x 50 cm). DMS ceilings were used – reinforced concrete beams with a span of 6m and height of 27cm filled with concrete hollow blocks (Ill. 5).

The "small prefabrication" used in the Koło II housing estate was the first step towards the nowadays understood full prefabrication (although today we consider multi-layered walls and beam and block floors to be rather traditional technology).

The project tried to reduce the amount of elements needed to be produced (which was particularly important in the post-war reality) without sacrificing the interesting form of the building and ergonomic apartments.

The Syrkus couple considered prefabrication to be the future of residential architecture[6].

In the paper *Technical progress in housing construction*, prepared in 1956, the authors – H. Syrkus, Z. Kleyff, J. Nowicki – admited that the future of multi-family construction are typical plans, which should be developed by multidisciplinary teams (architect, constructor, technologist, economist, sociologist). Typical plans should *contain a maximum of standardized elements and a maximum of flexibility in the exchangeability of both structures and forms of housing systems*. The authors pointed out that the goal to be achieved was *a typical plan with the benefits of individual plan and the standardization required by the full prefabrication and dry assembly*[7]. The authors believed that a typical plan was only a transitional solution preceding the development and production of prefabricated building systems, which would be so diverse that it would let design individual plans.

4. THE PROTOTYPE HOUSING ESTATE IN THE WARSAW SŁUŻEWIEC AREA

The year 1967 was crucial for the development of residential architecture in Poland. It was then decided to build the so-called house factories – industrial plants producing ready-made prefabricated elements to assemble even several-storey blocks of flats. In 1968, a competition for a construction and assembly system was announced, which in the following years was to become the basis for housing construction.

The winner was the W-70 large-plate system by architects Maria and Kazimierz Piechotka (in cooperation with D. Szafnicka, Z. Paszkowska, S. Goetz), which was sent to mass production. In the following years the system was modified and new large-plate systems were developed. The residential architecture of the 1970s and 1980s was dominated by structures of this type. Architects designing large plate systems made every effort to ensure that architectural values would be not sacrificed on the altar of the rapid implementation of the investment and its economy. Despite this, buildings and entire housing estates were erected which did not

[6] Lachert B., *Szymon Syrkus i jego dzieło 1893–1964*, Architektura, 1964, no. 10, pp. 417–424; Roguska J., *Helena i Szymon Syrkusowie: koncepcja typizacji i uprzemysłowienia architektury mieszkaniowej*, Kwartalnik Architektura i Urbanistyka, 2000, no. 2, pp. 105–119; Syrkus H, *Ku idei osiedla społecznego 1925–1975*, PWN, Warszawa 1976.

[7] *Ibidem*, p. 373.

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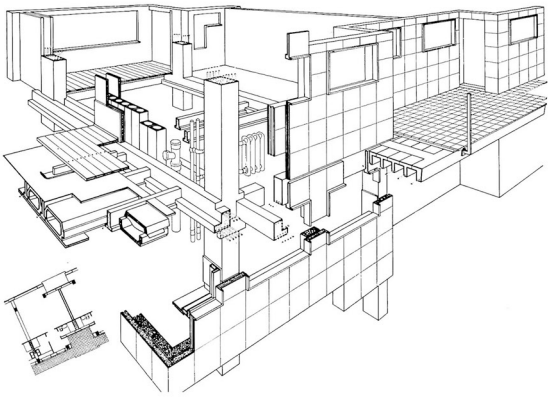

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differ significantly from each other. Monotony, overwhelming and extreme repetition of forms became the features of a large part of these projects.

However, before this happened at the turn of the 1950s and 1960s, the intensive search for solutions that would allow to shape the best and most affordable residential architecture took place. One of the elements of this search was technological and construction solutions.

The Prototype Housing Estate in Warsaw's Służewiec district – in the area between Bełdan, Bokserska, Obrzeżna and Lotników streets – was a special project among others. In this area, in 1960, the construction of buildings differing in terms of structure and technology, architectural expression and apartment plans began. It was a kind of a testing ground for new design ideas.

The whole estate was designed by a team (U. Ciborowska, Z. Łuszczyński, A. Łyczewski) headed by Jan Skrzypczak from Biuro Projektów Typowych i Studiów Budownictwa Miejskiego (Typical Projects and Urban Studies Company). Individual blocks of flats were also designed by other architects.

The construction of the housing estate was connected with the industrial and storage district, established in 1951 in the immediate vicinity, where a number of factories were built.

The housing estate was designed for about 20,000 inhabitants. Residential buildings, commercial pavilions, schools and health care facilities were built.

The housing estate consisted of prototype blocks of flats built with the use of various experimental technologies. It was a place for testing new systems, and the best and proven ones were to be produced on a wider scale and used in other projects.

Przedsiębiorstwo Budownictwa Doświadczalnego (Company for Experimental Construction) was established, which conducted research on each solution.

The urban planning of the estate was designed with the assumption that most of the buildings would be made in prefabricated technology. Therefore, heavy machinery would have to be operated between the buildings. The layout of the estate was also subordinated to the general concept based on the separation of pedestrian and road traffic. The whole area were divided into two parts by Rzymowskiego Street.

Groups of buildings form units linked by clear pedestrian routes, which also lead to the former workplaces. In the first phase of the estate's construction, the buildings were erected (west of Rzymowskiego Street) in two construction systems – WPP and WUF.

4.1. BUILDINGS IN THE WPP SYSTEM (WARSZAWSKI POLIGON PRZENOŚNY – WARSAW MOBILE SYSTEM)

The designers of the WPP architecture were W. Minich and J. Stolarska.

In this system, four – and eleven-storey towers (single centralized communication core) and eight-storey blocks were erected.

Ill. 4. The Koło II housing estate, central part of a multi-staircase building and central part of a building with an open corridor (access deck)
Ill. 5. The Koło II housing estate, isometric view of the building structure, source: H. Syrkus, *op. cit.*
Ill. 6. Prototype Housing Estate, buildings in the WPP system, current state; the lowest building hasn't undergone thermal modernization – the current appearance is similar to the original one
Ill. 7. Prototype Housing Estate, ground floor plan of a 4-storey building in the WWP system

The architectural expression of the building façades was created by various types of windows, loggias and surfaces of glass blocks. The facades had the axis of symmetry. Horizontal divisions dominated (Ill. 6).

The flats in this system were of different sizes. In higher buildings, there were one – and two-room flats (single aspect), in four-storey three – and four-room ones (corner aspect). All apartments had bathrooms and a separate naturally lit kitchen. In the larger flats in the four-storey buildings, the bathroom and toilet weren't combined. All flats had loggias (Ill. 7).

The basic element of the structure were cross-reinforced ceiling slabs of standardized dimensions (420 x 420/270/210/210/120 cm) corresponding to particular functional elements such as living room or hallway with bathroom.

The floor slab was 8 cm thick with ribs on the edges, which were based on "pillars" – vertical reinforced concrete blocks (120 or 150 cm wide). These blocks provided support for the slabs in the corners – the interiors could be shaped relatively freely. The exterior walls – prefabricated slabs – were designed as curtain ones.

Nowadays, most of the buildings have been thermomodernized, which, according to interviews with the inhabitants, was particularly necessary. In winter even ice appeared on the internal surfaces of external walls (especially in the place where "pillars" and curtain walls are joined together). In addition, thin ceilings did not provide proper sound insulation.

Probably for these reasons, among others, despite the rather interesting architectural expression and ergonomically designed apartments, the production of WPP technology was not continued.

4.2. BUILDINGS IN THE WUF SYSTEM (WARSZAWSKA UNIWERSALNA FORMA – WARSAW UNIVERSAL FORM)

Another project in the Prototype Housing Estate were the buildings in the WUF-60 system, designed by Bielobradek, J. Drużyński, T. Stefański and W. Wojczyński.

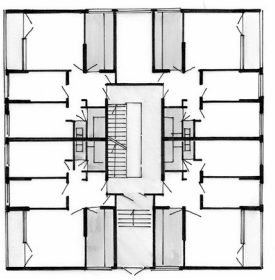
The universal form was based on the construction of various types of buildings and flats using prefabricated large plate elements. The designed prototype series included 5 different types of buildings (semi-detached, row houses, towers, blocks of flats with different number of floors).

The buildings were located next to those constructed in the WPP technology. Various forms of buildings and their heights created a complex which, although subordinated to the general principle of communication, seems a bit random. This is a consequence of the assumed idea of prototyping.

Although it is now difficult to evaluate the architectural expression of WUF buildings because of thermal upgrades, rebuilding and superstructure, it seems that it was characterized by greater monotony and repetition of elements than the WPP system (Ill. 8).

Ill. 8. Osiedle Prototypów, budynki w systemie WUF, stan obecny. Prototype Housing Estate, buildings in the WUF system, current state

Ill. 9. Prototype Housing Estate, ten-storey building in the WUF system, current state and typical floor plan



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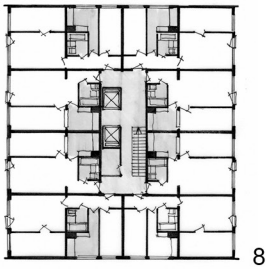

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The WUF system was designed for different types of buildings, with flats of different sizes, which contained from one to four rooms. As in the WPP system, the principle was that, the larger the flats, the lower the building.

In general, most apartments have two rooms (single aspect) with kitchens without windows. The exception is a five-storey building where kitchens are naturally lit. In small apartments, access to the kitchen is through the living room (Ill. 9).

The WUF system was a large plate system. The load-bearing structure consisted of prefabricated concrete walls. The external walls were three-layered, made of an external layer (4 cm), foamed polystyrene insulation (4 cm) and a load-bearing layer (16 cm). The floor slabs were three-layer (with acoustic insulation) with a span of 4.80 x 5.40 m.

Buildings in the WUF system turned out to be better than those erected in the WWP system to meet the expectations of the time and were implemented for further production in the house factory launched in the neighboring industrial area.

5. CONCLUSION

The examples described above illustrate only a small part of the history of building technology in post-war Polish residential architecture, how it evolved from traditional methods, through the beginnings of mass production of various elements, to prefabrication of large panels. Nevertheless, they show a certain way of searching for solutions. Together with many other projects, they build a Polish tradition of prefabricated architecture, which, although abandoned after 1989, may be worth recalling in present-day reality.

The use of prefabrication in residential buildings was related to the need and intention to build apartments affordable for as many users as possible. The focus of the search on various prefabrication forms was a natural way resulting from the development of industry, but also from the specific features of affordable residential architecture.

Modernist urban planning also turned out to be suitable for the production and assembly of relatively large building elements (such as large slabs). Locating residential buildings with repetitive plans at significant intervals (access to sun, space and air) was as if “created” for prefabrication.

As the examples show, prefabrication allows to shape different types of urban layouts, formally diversified buildings and floor plans. And although undoubtedly prefabricated technologies have their limitations – like all other technologies – the analysis proves that they also leave designers a room for creative design.

Although there is no denying that prefabrication is one of the important reasons why the form of 20th century buildings and housing estates is often simple, repetitive and monotonous, a glance at many contemporary housing estates (mostly built in reinforced concrete frame technology) is enough to state that these features are not attributed only to prefabricated technology.

Contemporary prefabrication used in Western Europe (especially in Scandinavian countries) are based on 20th century experience analogical to that of Poland. Therefore, the knowledge and analysis of Polish experience in the context of the growing interest in these technologies seems reasonable.

20th century Polish prefabricated architecture, although after 1970 in many cases it developed into peculiar and controversial forms and contents, is inseparably connected with the tradition of building to improve housing conditions.

References

[1] Bielobradek A., Stefański T., *System WUF*, Architektura, 1965, no. 8–9, pp. 319–328.
[2] Chomątowska B. Betonia. Dom dla każdego, Wydawnictwo Czarne, Wołowiec 2018.
[3] Chyliński B., *Osiedle Prototypów*, Architektura, 1965, no. 8–9, pp. 315–318.
[4] Cymer A., *Architektura w Polsce 1945–1989*, Centrum Architektury Narodowy Instytut Architektury i Urbanistyki, Warszawa 2018.
[5] Geppert W., *Prefabrykacja wielkowymiarowa w budownictwie*, Architektura, 1961, no. 6, pp. 217–232.
[6] *Historia Polski w liczbach*, GUS, Warszawa 1994.
[7] Lachert B., *Szymon Syrkus i jego dzieło 1893–1964*, Architektura 10/1964, str. 417–424
[8] Mika G., *Od wielkich idei do wielkiej płyty. Burzliwe dzieje warszawskiej architektury,* Skarpa Warszawska, 2017.
[9] *Osiedle TOR na Kole*, Dom, Osiedle, Mieszkanie, 1935, no. 11, pp. 33–35.
[10] *Promemoria 1939–1945*, Główny Urząd Statystyczny, Warszawa 2015.
[11] Roguska J., *Helena i Szymon Syrkusowie: koncepcja typizacji i uprzemysłowienia architektury mieszkaniowej*, Kwartalnik Architektura i Urbanistyka, 2000, no. 2, pp. 105–119.
[12] Springer F., *13 Pięter*, Wydawnictwo Czarne, Wołowiec 2015.
[13] *Statut i Regulaminy*, Warszawska Spółdzielnia Mieszkaniowa, Warszawa 1930.
[14] Strzelecki J., *Organizacja i działalność Towarzystwa Osiedli Robotniczych*, Dom, Osiedle, Mieszkanie, 1935, no. 2, pp. 2–16.
[15] Syrkus H, *Ku idei osiedla społecznego 1925–1975*, PWN, Warszawa 1976.

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