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Sustainable Urban Rehabilitation in Europe

GENERAL BUILDING ENGINEERING

PREFABRICATED BULDINGS

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PREFABRICATED BUILDING

A large slab is a prefabricated structural element used for modular construction of buildings, mainly multi-family buildings.

Blocks from the big slab were supposed to be characterized by simplicity, functionality and usability. The form of large-panel buildings was based on the assumptions of modernism: facades of raw concrete without plasters or with prefabricated claddings, eg mosaic tiles. Structures based on prefabricated concrete elements with reinforcements and fastenings made of steel rods, welded anchors, and fasteners and hangers were made of stainless steel. Large-panel systems contained structured ceiling elements as well as supporting, stiffening, partition and elevation walls, as well as finished stairs, elevator and installation shafts, and sometimes full sanitary blocks.

The great album was used for the first time after the First World War in the Netherlands. In 1923, a two-storey housing estate was built in Germany, larger structures were built in 1934 in France. The flourishing of large-panel construction took place after the Second World War. Then blocks from the big slab were a chance for a ruined Europe a chance to quickly make up for housing shortages.

A building on the Splanemanna housing estate in Berlin-Lichtenberg from 1923 [16]

PREFABRICATED BUILDING IN POLAND

The first large-panel building in Poland was put into use in 1960. in Warsaw. From the 1960s to the 1980s, the large slab was very widespread in Polish housing, and the largest development in the 1970s was the period of planning and construction of new, large housing estates. The capacity of building new apartments reached almost 300,000. flats per year.

The first block from the big album in Poland, located in Warsaw at Wolska Street. [14]

Construction of a housing estate using large-panel technology. [15]

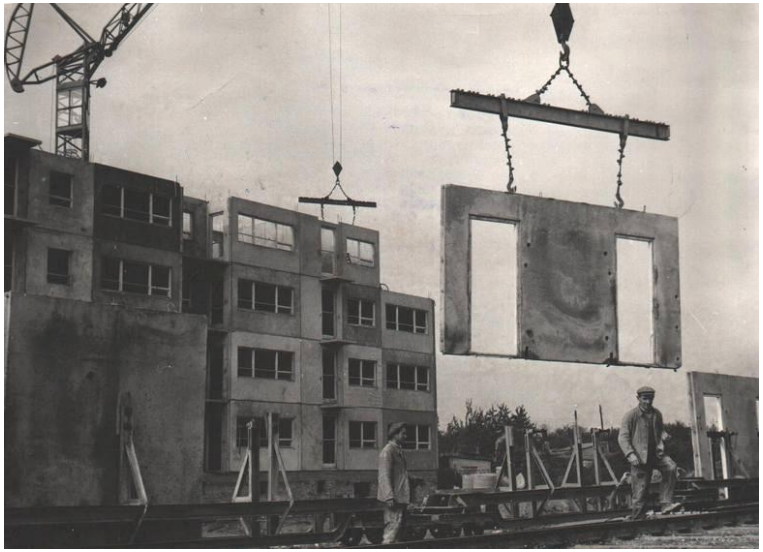
PREFABRICATED BUILDING IN POLAND

Prefabricated system

- In Poland, several large-panel systems have been used, which can be divided into closed and open systems.
- Closed systems consist in the fact that the large-panel elements were assembled in one way, the typification was limited to a repeatable solution of the building type or its segment. These systems were usually used in a specific area.
- Open systems allow the ability to create different configurations in a limited number of building types that make up any urban complex.
- Each system contained a limited number of different elements produced in the so-called type series.

PBU

- A large-panel housing system used by Przedsiębiorstwo Budownictwa Uprzemysłowionego in the following varieties: Warsaw, Krakow and Toruń.
- It was first used in the late 1950s for the construction of the Jelonki housing estate.
- Elements of the system made it possible to build blocks of flats with a height not exceeding eleven storeys.
- One of the first versions, PBU-59, was based on boards for making inner walls of the Gr. 14 cm and ceiling slabs 9 cm External walls were made as layered with styrofoam insulation. The solution uses a cross-section of load-bearing walls.
- The PBU-63 variant included design solutions for buildings with transverse load-bearing walls. The thickness of ceiling slabs was changed to 14 cm and external curtain walls were used. 24 cm made of aerated concrete.
- The system became the basis for the design of housing estates in other regions of the country. In Poznań, the construction project of the Świerczew housing estate was based on it.



Construction of the Świerczewskie housing estate (currently housing estate Jerzy Popiełuszko), 1961. [2]

„Domino”

- It was made in Krakow and Silesia. Like PBU, it belongs to the oldest large-panel construction systems used in Poland. In the following years, several variants were developed.
- In the "Domino 63" version, residential buildings have been designed in a three-tier arrangement with a mixed construction system. The first one uses floor slabs supported on four edges (longitudinal and transversal walls are load-bearing). During the middle ceiling, it is based only on longitudinal walls, and in the third stage only on transverse walls.
- The panels of internal walls and ceilings were manufactured by the gr. 10 cm
- External walls were made as light horizontal stripes made of hard plaster, felt boards and expanded polystyrene with façade texture.

Building in the "Domino" system. [6]

„Dąbrowa”

- The system has been developed and applied in Łódź.
- It provides for the construction of 5 and 11-story blocks in a transverse layout, using a spacing of 240, 300, 360 and 400 cm. Tract depth - 510 cm. For the construction of houses, reinforced concrete slabs were used. 14 cm (ceilings and internal walls) and gr. 24 cm of cellular concrete - external walls.
- The prefabricated elements needed for the construction of houses were produced in polygonal factories.
- In this technology, both large housing estates and small residential complexes were built to supplement existing buildings.

Osiedle in Łódź built in the "Dąbrowa" system. [8]

„Fadom”

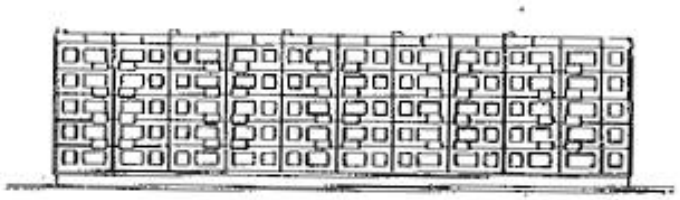
- The system is mainly used in Upper Silesia. Prefabricated elements were produced in the so-called "Home factories" Fadom in Bziu Zamecki and Zory.
- The solutions included in the system included 5 and 11-storey buildings in a cross-section. The wall spacing 240, 360 and 600 cm for apartments and 480 cm for staircases was used. Tract depth - 480 cm. The system uses one-way reinforced floor slabs with a thickness of 14 cm (plates with a span of 600 cm were additionally compressed). Internal wall panels gr. 15 cm and exterior walls 29 cm as layered with mineral wool insulation.

Construction of blocks in the "Fadom" system in the early 70s [13]

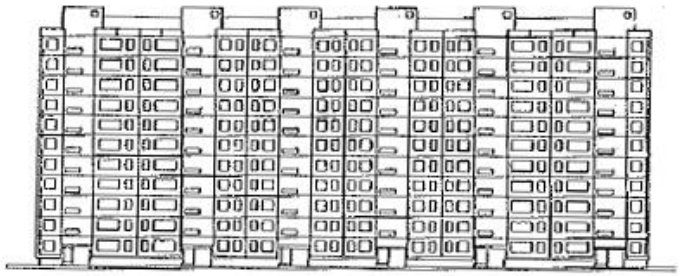
Block in Jastrzębie-Zdrój, in the construction of which the "Fadom" system was used. [4]

WUF-T

- Warsaw Universal Form - Typical; system developed by the Typical Design Office and Urban Construction Studies in Warsaw in 1967. In Warsaw, used in the Służewiec, Wrzeciono and Wawrzyszew housing estates, it was also adapted to the needs of other voivodships.
- The system was intended for the construction of 5 and 11-story blocks, allowing the construction of segments with two apartments accessible from the staircase, both sides lit up. The system is based on a modular grid (nx150 cm) × 480 cm. Tracks with a depth of 480 cm were designed, and the assumed spacing of transverse walls was: 300, 450, 600, 750 and exceptionally 900 cm. The boards used in the system had gr. 14 cm (for internal walls and ceilings) and 25 cm - for external walls. The latter had a layered structure: reinforced concrete - 14 cm, insulation - styrofoam - 5 cm and the outer layer of concrete - 6 cm. Height of residential floors - 270 cm. The floor slabs were cross-braced with the possibility of supporting them on two, three or four edges. The boards were manufactured in polygonal (open field) factories or in stationary prefabrication plants.

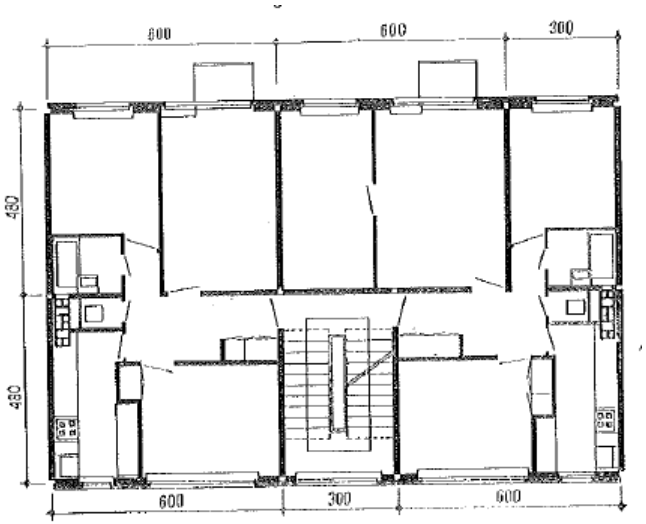


Elevation of the 5-story building. [1]

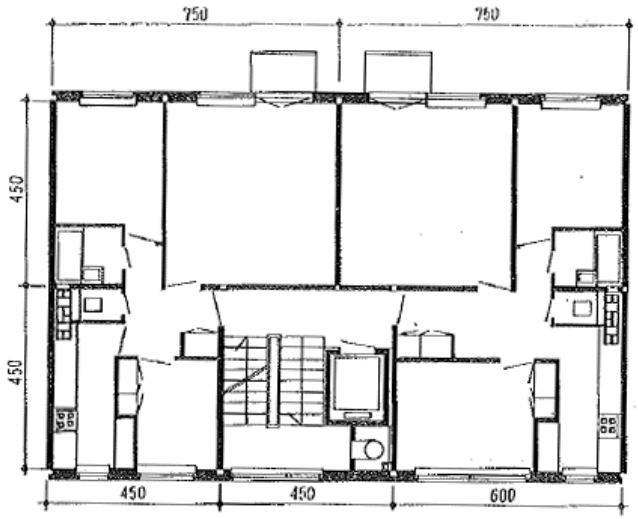


Elevation of the 11-story building. [1]

WUF-T



An example of a building segment
5-storey in the WUF-T system. [1]



An example of a building segment
11-storey in the WUF-T system. [1]

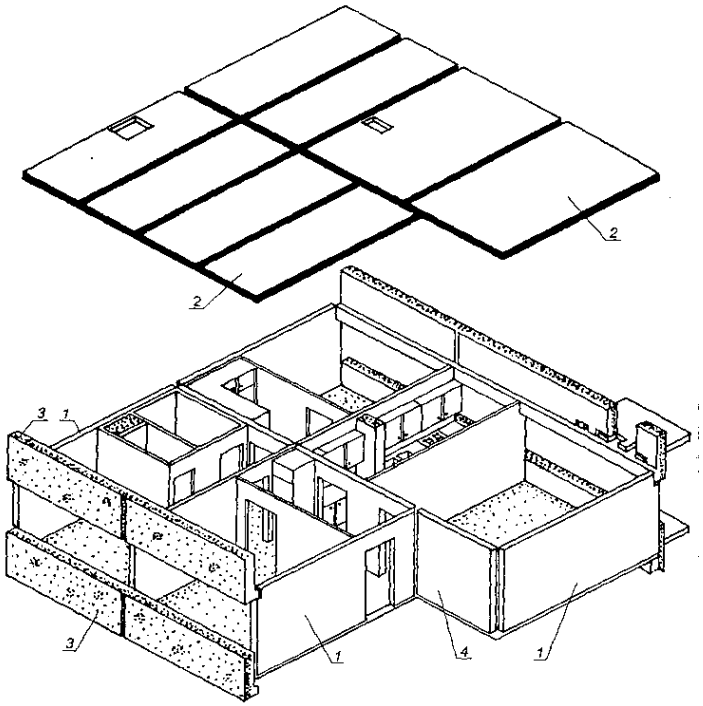
OW-T

- Economical Large-panel - Typical; the system was developed in 1962 by the Typical Design Office and Urban Construction Studies in Warsaw.
- The system enabled the construction of 5 and 11-floor residential buildings in cage and 11-storey systems in corridor systems. In 1975, the solution marked OWT-75 was developed, increasing not only the size of typical apartments, but the height of the storey was raised from 270 cm to 280 cm. The OW-T system is based on a mesh of 540 × 480 cm (as a basic unit) with a supplement of 540 × 540 cm for residential areas and 270 × 480 and 480 × 540 cm for communication routes. After the system modification was introduced in 1975, a modular grid of 120 × 120 cm was adopted using the depth of the housing line - 480 cm, width in the series of types: 240, 360, 480, 600 cm.

Building assembly
in the OW-T system. [5]

OW-T

- Material solution of the system: internal walls and ceilings - reinforced concrete slabs 14 cm, external three-layer walls, thickness: 16 cm (longitudinal walls) or 24 cm (gable walls) with an insulating layer made of expanded polystyrene 5 cm (the difference in thickness resulted from a different thickness of the reinforcing layer of the reinforced concrete - 6 or 14 cm respectively). For OWT-75, the gr. ceilings up to 16 cm, internal walls up to 15 cm and external longitudinal walls up to 19 cm. Alloy plates were cross-reinforced, supported on three edges.



Construction scheme OW-T system;
1 - internal wall,
2 - floor slab,
3 - beam-wall,
4 - internal wall. [7]

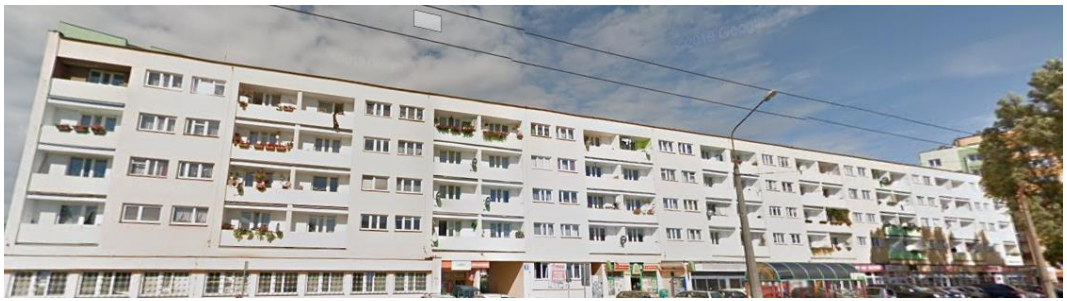
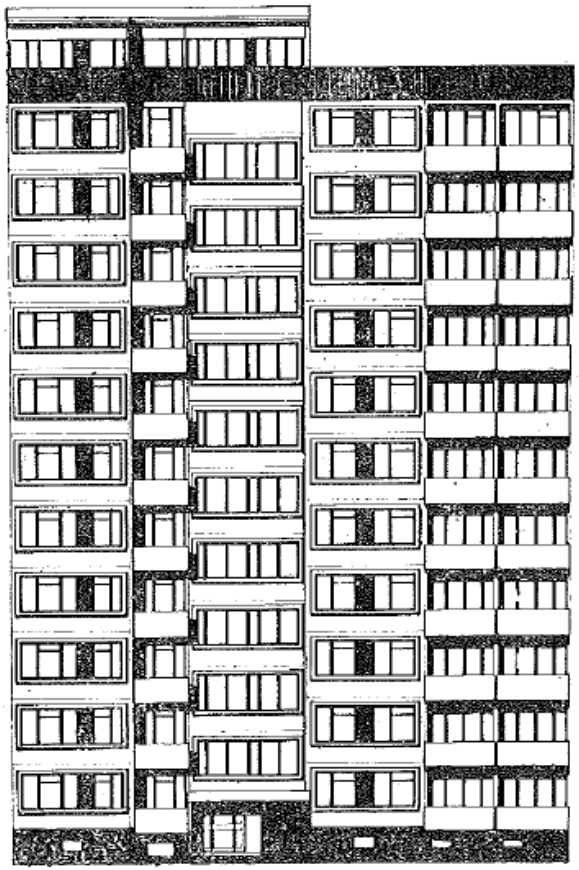


Fig. 11 Block of flats built in the OW-T system, located in Lublin in the Tatary district. (source: Google Street View)

WWP

- this system was developed for the needs of housing estates in Wrocław and Lower Silesia.
- As part of the system, buildings were constructed in a transversal construction system with various number of storeys from 2 to 12 storeys. Typology provided for two or three apartments for one staircase. Buildings were built exclusively in a cage system. A characteristic feature of this system was the rather large scale and the possibility of constructing buildings of varied shape and height.
- Plates for the construction of load-bearing walls and ceilings were manufactured by the gr. 14 cm. The external walls were oblong in a layered system with insulation made of expanded polystyrene or glass wool.



An example of a building elevation in the WWP system. [1]

„Rataje”

- The system used in Poznań for the construction of the Rataje housing estate (in the Nowe Miasto district). The system was developed in 1962 by Biuro Projektowo-Badawcze Budownictwa Ogólnego "Miastoprojekt". The first blocks of flats based on this solution were built in 1966.
- As part of the system, concrete slabs were used. 14.0 cm as floor slabs and internal walls as well as curtain panels made of expanded clay, thickness: 30 cm for the construction of external walls. Height of residential floors - 280 cm. A typical solution was limited to 5, 11 and 16-storey buildings.

Block of flats on the estate Piastowski on Ratajach, 1974. [12]

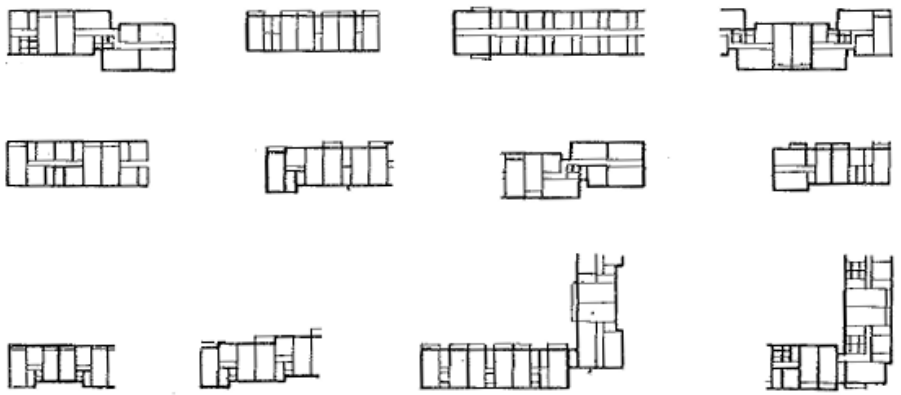
„Winogrady”

- system used in Poznań for the construction of the Winograd housing estate located in the Stare Miasto district. The construction of a housing estate began in 1968. The system was also used to build hotel facilities.
- The system includes the construction of 5 and 13-story buildings. 5-story buildings have been solved in a cage system. Segments composed of 3 or 4 staircases were designed, which could be freely combined with each other. High buildings were solved in the corridor system. The basic grid of the system was 540 × 540 cm.
- The system provides for the height of a residential storey of 270 cm. The buildings have a mixed system of structural walls with cross-reinforced plates supported on three edges. The panels of internal walls and ceilings were produced in the 14 cm. Outer walls of the gr. 35 cm was produced from expanded clay.

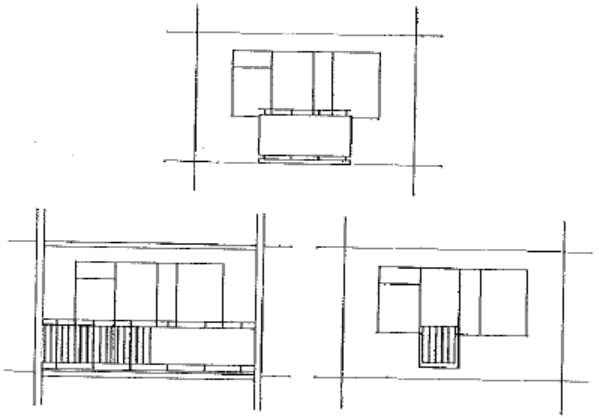
The Polonez Hotel in Poznań was built
in the technology of a large grape plate. [3]

„Szczeciński”

- It was based on technological lines imported from the USSR. The solutions used in it were adapted to Polish conditions by design offices in Szczecin and Warsaw. In the first period a catalog was developed, in which 140 typical elements were placed. From them, exemplary solutions of individual sections of 5- and 11-story buildings were designed in cage, corridor and point systems. Based on them, solutions for housing estates and entire urban layouts were prepared in design offices. The first buildings in this system were built in 1971-1972 in Szczecin.



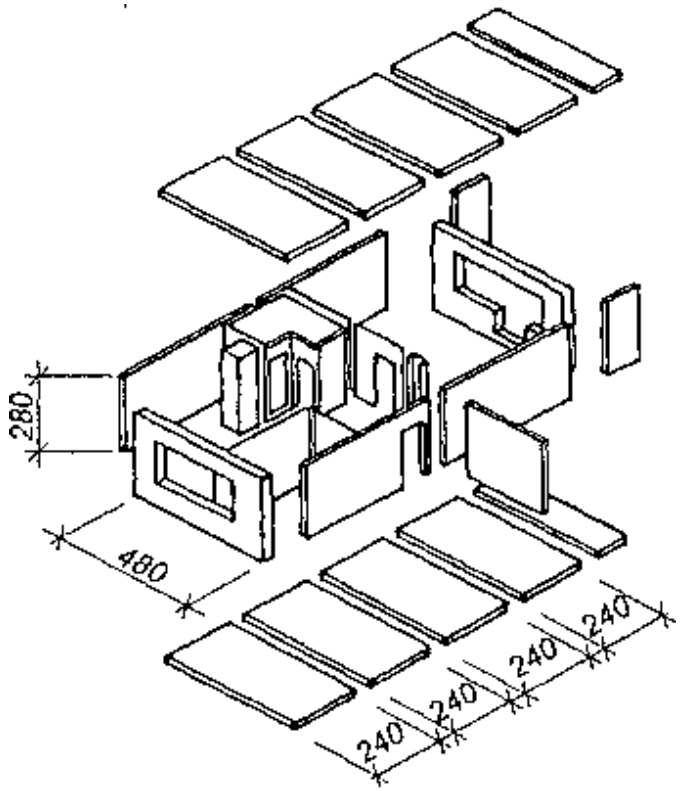
Example projections of buildings built in the system. [1]



Examples of exterior walls. [1]

„Szczeciński”

- The basic units were based on a grid of 480 × 480 cm and 480 × 240 cm, later also elements with dimensions of 480 x 155 cm and 240 x 155 cm were added. The basic spacing of load-bearing walls was 480 cm, the basis for shaping solutions was the transverse wall arrangement. Floor slabs, one-way reinforced had gr. 14 cm, and interior wall panels bearing - 15 cm, departmental - 5 cm. The external walls made of expanded clay were two thicknesses: 40 cm - for load-bearing walls and 36 cm for curtain walls. The prefabrication, in addition to sanitary facilities, staircases, elevator shafts, etc., also included cellar walls. It is a system with the highest rate of concrete consumption among systems existing in Poland.



The construction system of the Szczecin system. [7]

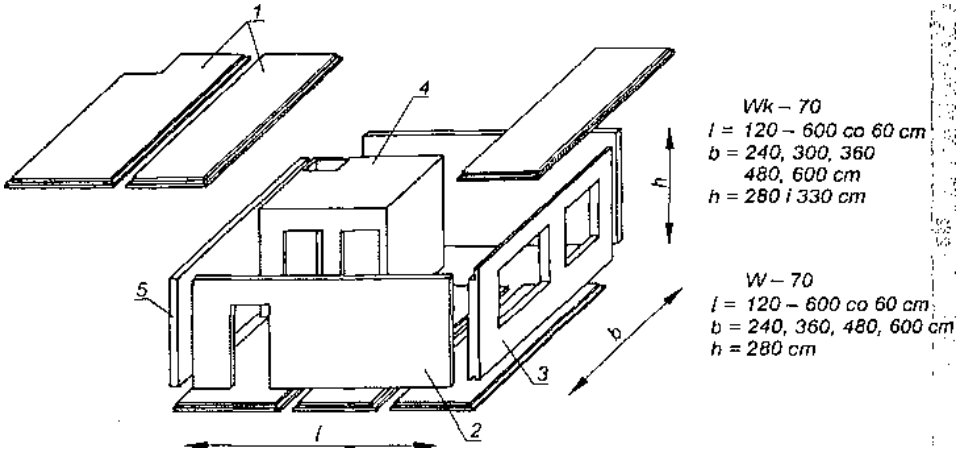
Leningrad

- The specific type of large-panel buildings erected in Poland in the 1980s is the "Leningrad" type buildings assembled from elements imported by rail from the USSR in closed areas of units of the Northern Group of the Soviet Army. As part of the system, 5-story buildings were erected with three or five staircases.
- Buildings of this type were created, among others in Świnoujście, Legnica (about 20), Zgierz, Police, Strzegom, Jaworze, Trzebień, Brzeg, Świętoszów, Białystok, Wałcz, Bornem Sulinów, Kłomina, Czarna Tarnowska and on the housing estate serving the Airport in Krzywe near Chojnów and Wiechlice / Airport not far from Szprotawa.

Abandoned block of flats
from a large "Leningrad" type plate in Kłomina.
[17]

Systemy otwarte: W-70 i Wk-70

- W 1968 roku zorganizowano konkurs na opracowanie systemu budownictwa mieszkaniowego, który stałby się podstawą rozbudowy w latach 1970-85. Wygrał system W-70, system otwarty, zaprojektowany tak, by pozwalał na dowolne łączenie poszczególnych części budynku w zależności od wizji architektów i urbanistów. Pierwsze budynki mieszkalne w tym systemie powstały w Radomiu.
- System został oparty na siatce modularnej 60 × 60 cm. Podstawowym rozwiązaniem konstrukcyjnym był poprzeczny układ ścian nośnych. W systemie W-70 elementami podstawowymi były: płyty stropowe kanałowe, jednokierunkowo zbrojone o gr. 22 cm, ściany wewnętrzne gr. 15 cm – kondygnacje mieszkalne i 20 cm – ściany piwnic, ściany zewnętrzne wielowarstwowe gr. 27 cm. lub gr. 40 cm z keramzytobetonu. Typowe rozpiętości stropów (rozstawy ścian nośnych) wynosiły: 240, 360, 480 i 600 cm. Wysokość kondygnacji mieszkalnych – 280 cm.

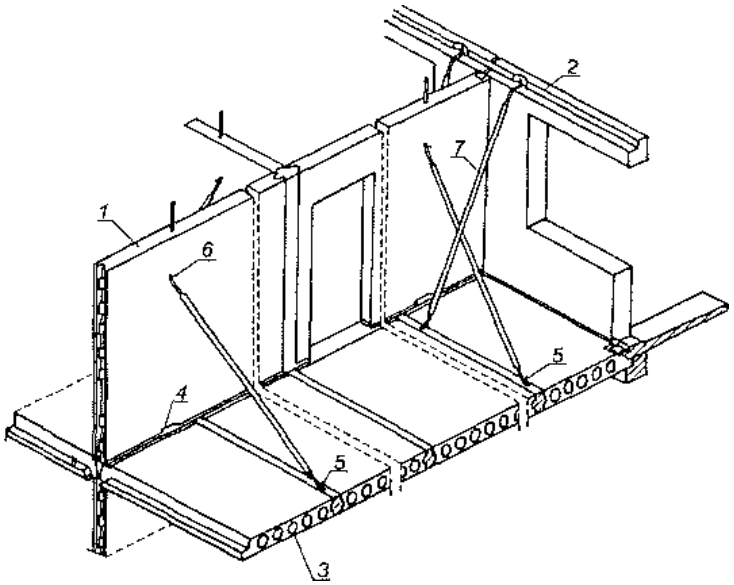


Rys. 10 Układ konstrukcyjny systemu W-70 (Wk-70); 1 — płyty stropowe, 2 — ściana wewnętrzna, 3 — ściana zewnętrzna, 4 — kabina sanitarna (prefabrykat przestrzenny), 5 — ściana wewnętrzna. [7]

Fot. 15 Osiedle Ustronie w Radomiu, pierwsze wybudowane w systemie W-70. [11]

W-70 i Wk-70

- The catalogs included series of elements covered by central typization (identical elements produced in stationary or polygonal factories throughout the country). The system includes the possibility of using additional elements taking into account the needs of the region and produced for the needs of a single housing estate.
- The Wk-70 variant introduced an additional span of the ceilings - 300 cm, an additional storey height - 330 cm, the duct ceiling slabs were replaced with solid slabs by a thickness of approx. 16 cm, the external walls of expanded clay were abandoned. The floor height of 330 cm was introduced for typical solutions of schools, hotels and other public facilities.
- In 1975, another variant of the W-70 system named OWT-75 was developed. It introduces a new solution for fixing external boards. Elements of this system were produced mainly in polygonal factories.



A fragment of the W-70 system structure during assembly;
1 - internal transverse wall, 2 - external wall,
3 - floor slab, 4 - rectification bay,
5, 6 - mounting strut holders, 7 - strut. [7]

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