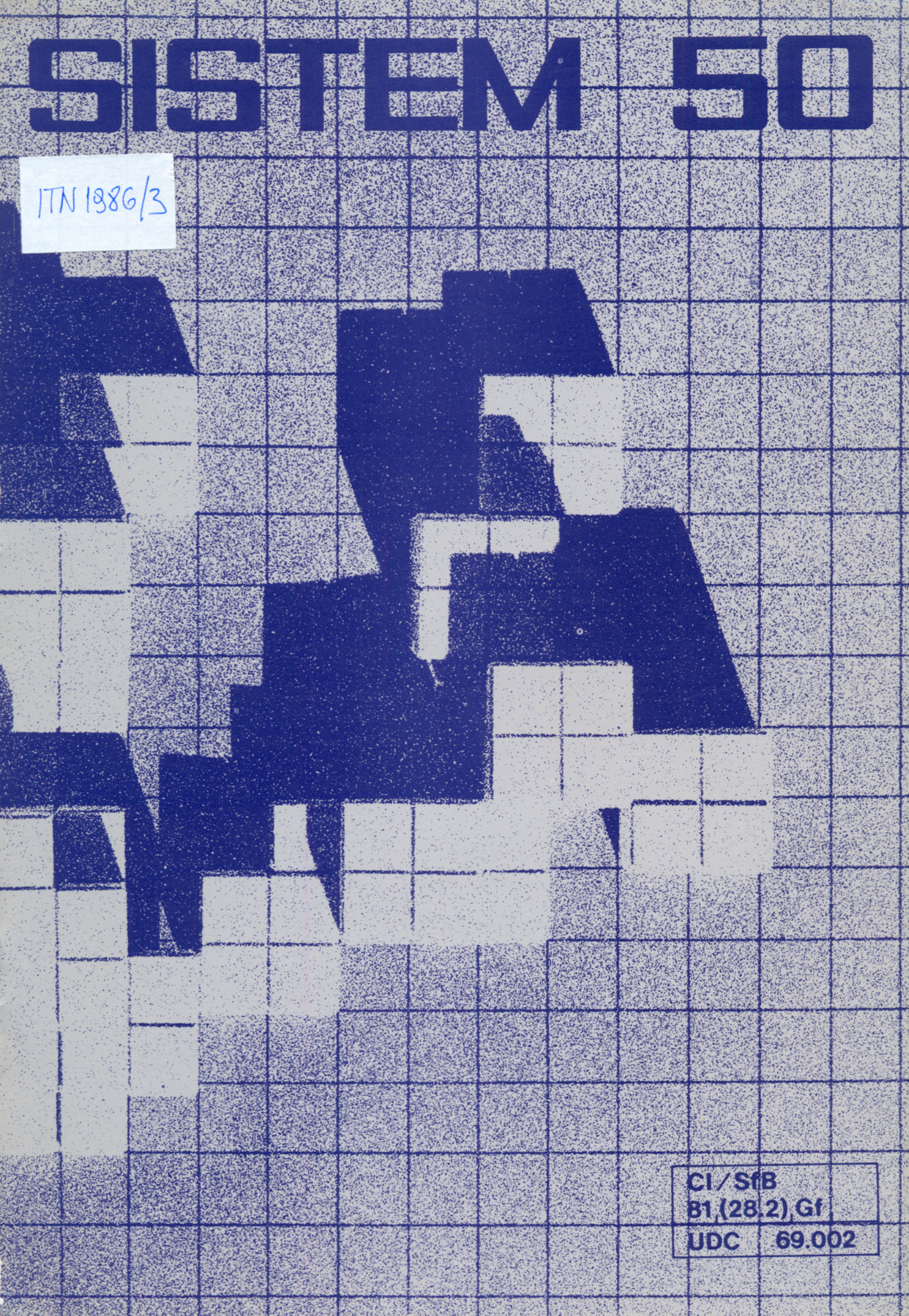
SISTEM 50



CI/SfB
B1,(28.2),Gf
UDC 69.002

SUMMARY INFORMATION

SYSTEM APPLICABILITY

Site situation:
Urban; rural; suburban

Housing types:
Single family detached and attached, multi-family lowrise (up to three stories above grade plus cellar and possible mansarde)

Topography:
Adaptable to all normal topography and soil.

Climate:
Adaptable to all climates.

Nonresidential functions:
Education; commercial; social and service facilities.

CHARACTERISTICS OF THE SYSTEM

- Large clear span (7.20 x 7.20 m.) achieved with small number of basic structural elements
- basic functional unit of 50 sq. m. area
- possible enlargement with units of 12.5 sq. m. area
- the growth of the structure in all directions
- variability and flexibility of space
- opennes of structure in relation to other subsystems
- possible combining of concrete with various other building materials
- high degree of planning and architectural flexibility
- freedom of esthetic creation
- separation of services and partitions from the structure
- simple prefabrication and erection technologies
- relatively small weight (max. 3 tons) of structural components allowing the use of lighter mechanization

PARTICIPATION OF THE DIRECT USER

SISTEM 50 is particularly suited for phased construction including different degrees of finishing, such as:

- erected structure,
- structure with service core,
- structure with service core and envelope,
- completely finished building.

The direct user can take an active part not only in financing but in the planning and construction phases as well, through:

- construction of the envelope, in conformance with town-planning and architectural requirements, and/or
- construction of interior partitions and carrying-out of finishing works in accordance with his budget and needs.

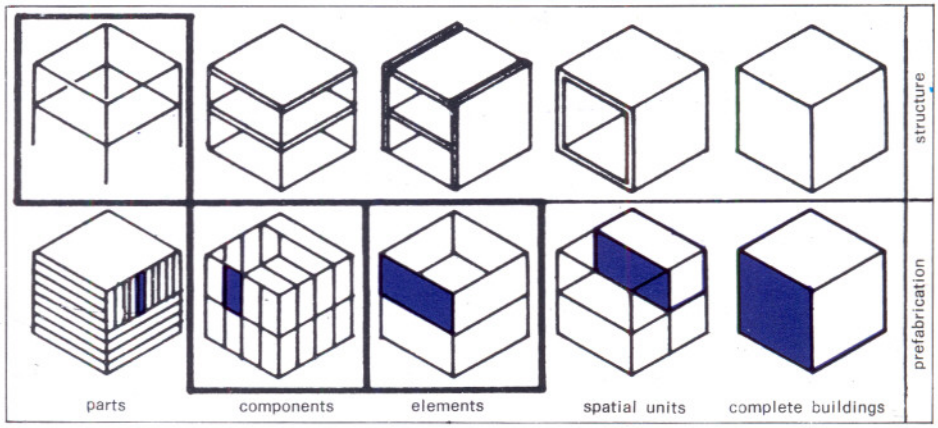


Fig. 1 Classification according to CI/SfB

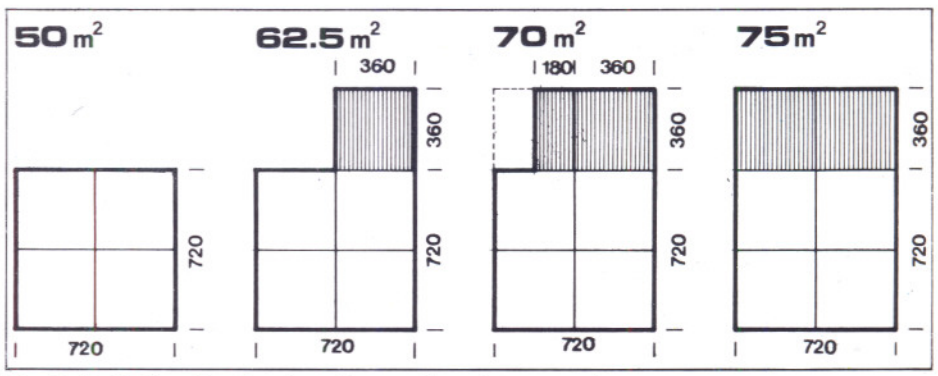


Fig. 2 Basic functional unit and examples of its growth

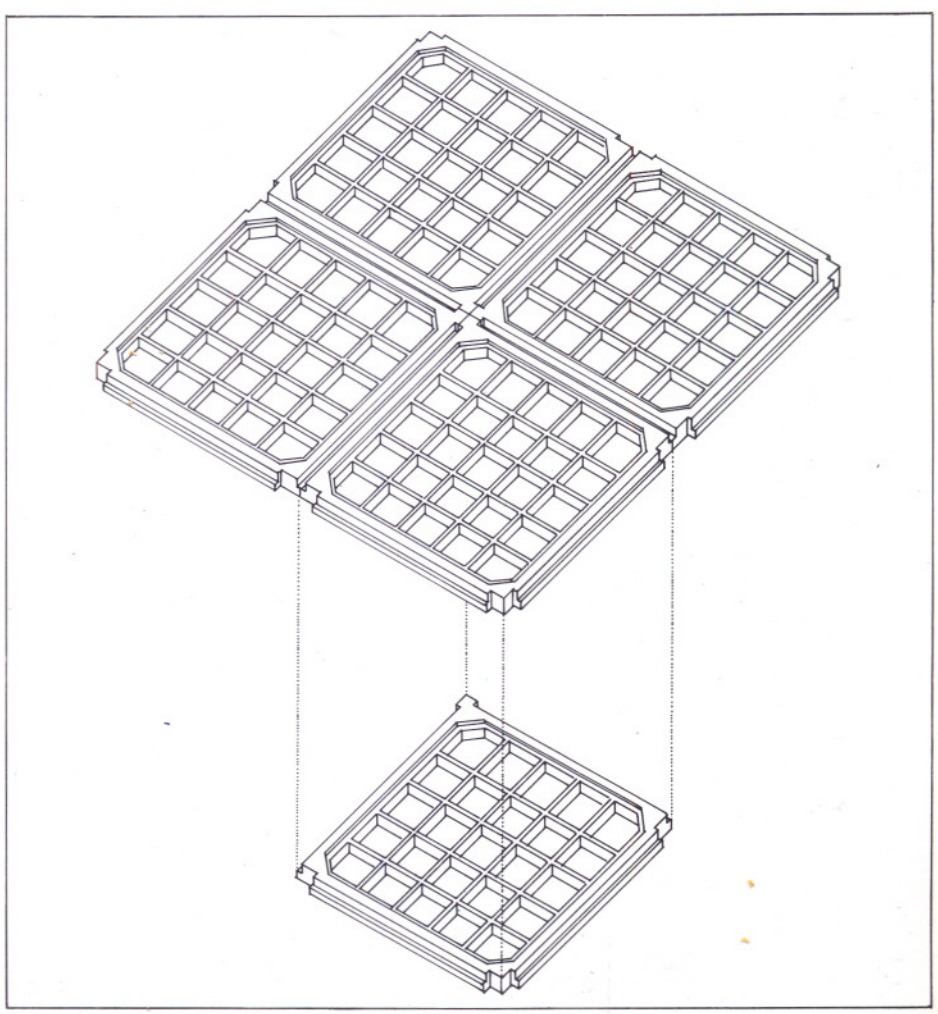


Fig. 3 Isometrics of a floor slab assembly

BASIC CONCEPT

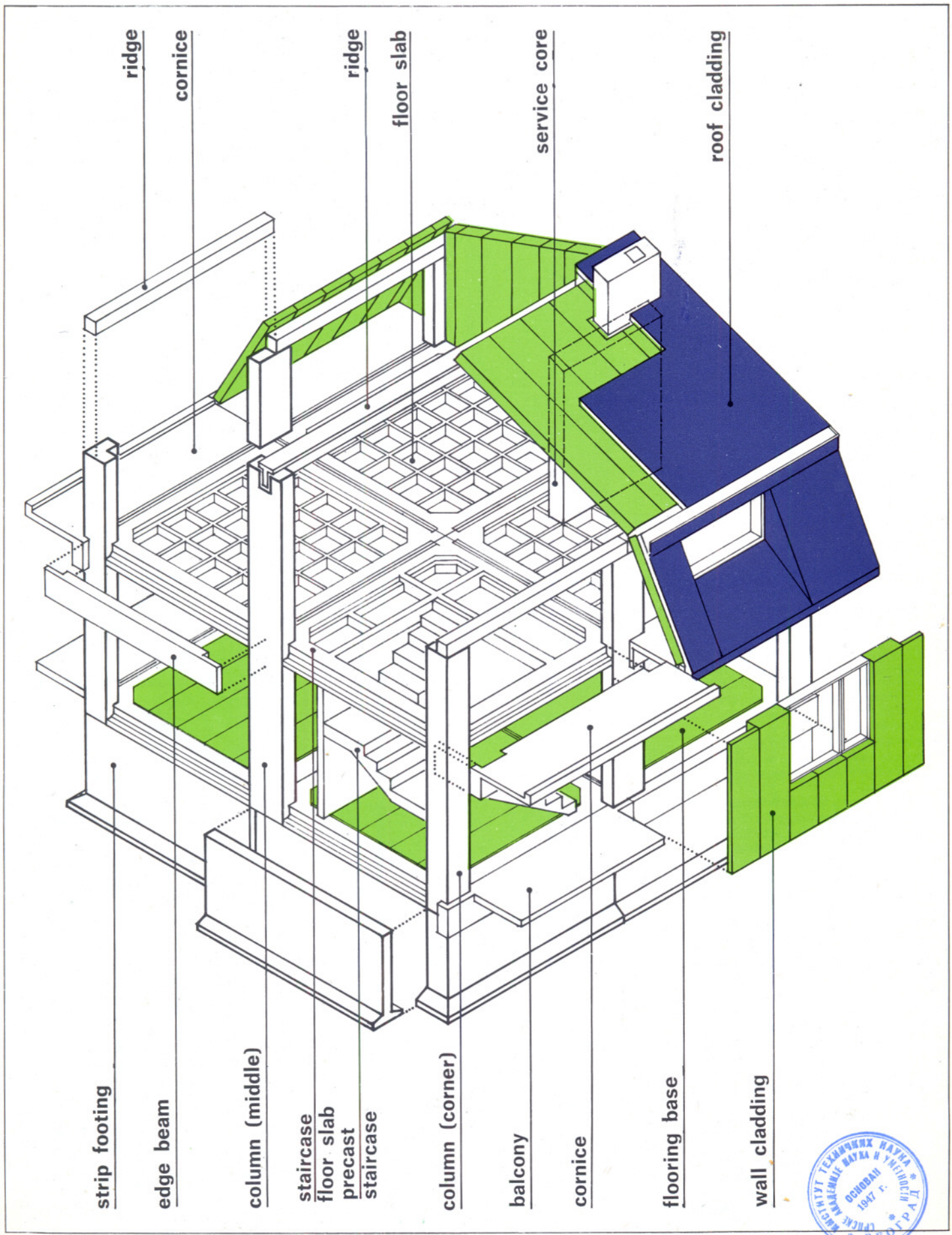


Fig. 4 Isometric view of the system

STRUCTURAL ASPECTS

STRUCTURAL CONCEPT

Precast and in-situ prestressed skeleton structure is formed from 7.20 x 7.20 m and 3.60 x 3.60 modules.

The basic, 7.20 x 7.20 m unit with an area of 50 sq. m. is by using of a simple technique formed from four 3.60 x 3.60 floor elements. Eight columns support the basic unit arround the perimeter.

Additional unit of 3.60 x 3.60 m with an area of 12.5 sq. m. is formed from one floor element supported by four columns at its corners and can be attached to the basic unit in any direction. Expansion of dwelling space can also be achieved through attached loggia with an area of 5.8 sq. m.

The combination of large clear spans, built of lightweight and economic structural elements, forms functional entities with varying surfaces.

STRUCTURAL ELEMENTS

Footing strip elements are prefabricated with various heights from 74 to 264 cm and include provision for column supports and tying.

The columns are precast in one piece from the foundation to the last floor slab or, in the case of low-rise buildings, to the roof. Ceiling height is 280 cm.

Floor slabs differ only on the external side of peripheral beams depending on their positioning. The middle, including waffles for reduced weight, remains unchanged.

The dimensions of floor slabs are 358 x 358 x 24 cm. (Modular 36 M x 36 M).

Gas-concrete slabs are laid as flooring base on rubber pads over the ribs of the waffle slab. Flooring base extends 4 cm. over the floor slab structure allowing easy horizontal distribution of services.

Loggia elements 3.60 x 1.60 m. can be attached to any of 3.60 m bays. The waffle-structured element is tied with columns by prestressing.

Staircases can be with single, double or triple flights depending on functional requirements. In multi-family buildings the staircase is formed as an additional unit (floor slabs 3.60 x 3.60 m).

Edge beams are L-shaped and vary in height to suit required functional requirements.

Balcony elements 3.60 x 1.50 m. correspond to edge elements with extended console slab and can be tied to any of 3.60 m. bays.

Cornice elements 3.60 x 1.20 m. also correspond to edge elements with extended console slab.

Roof elements — for pitched roofs in the case of attics the load-bearing elements are reinforced concrete ridges of 7.20 m. and 3.60 m length supported by columns extensions.

External cladding panels can under normal conditions be considered as one of the alternative solutions for the envelope. Their use is obligatory only in the highest risk earthquake zones where it accepts, together with columns, lateral earthquake forces in order to prevent significant horizontal deflections. Cladding panels are floor high, 3.60 m, wide. Maximum weight of structural elements is 3.20 tons (cladding panels). The weight of other elements does not exceed 3 tons.

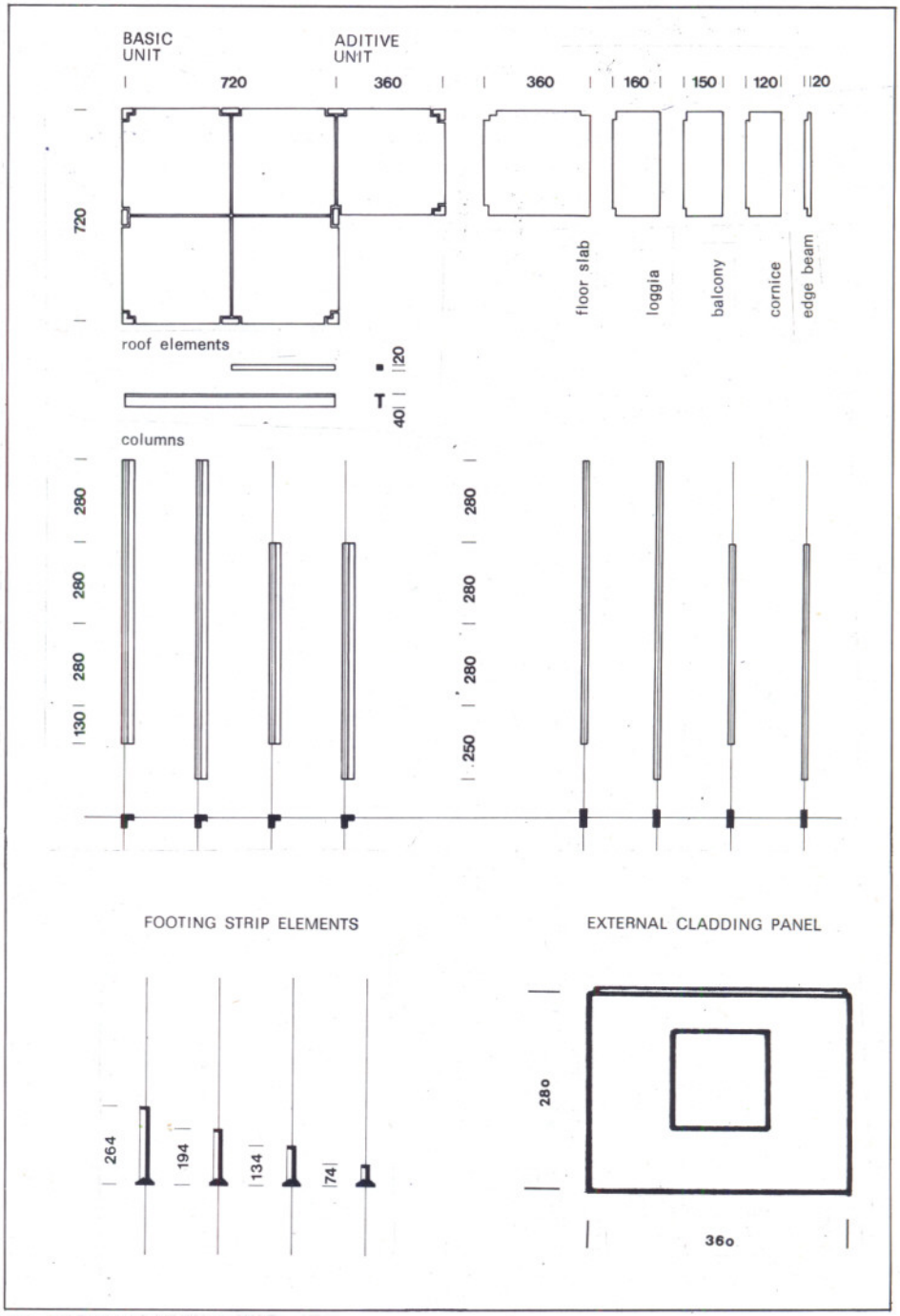


Fig. 5 Structural elements

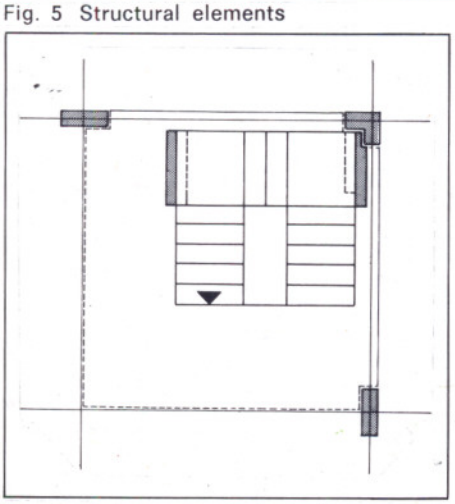


Fig. 6 Staircase for single-family housing

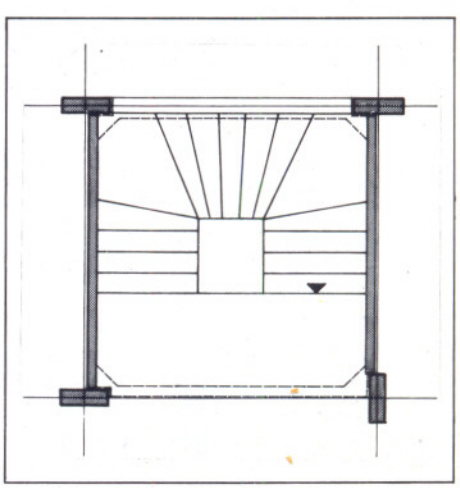


Fig. 7 Staircase for multi-family housing

TECHNOLOGICAL ASPECT

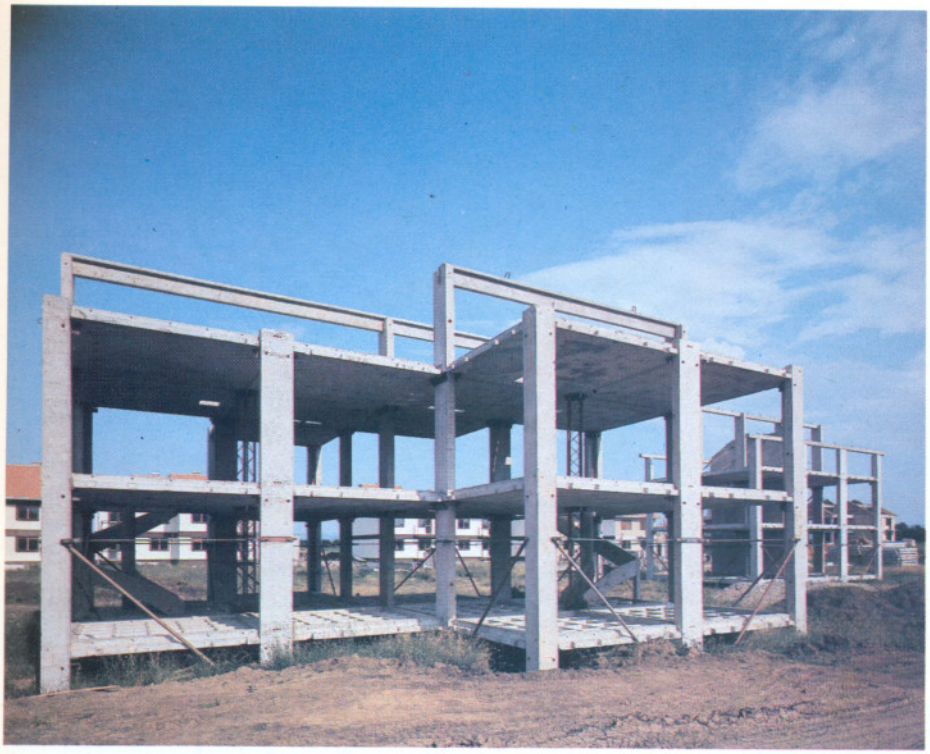


Fig. 8 Erected structure

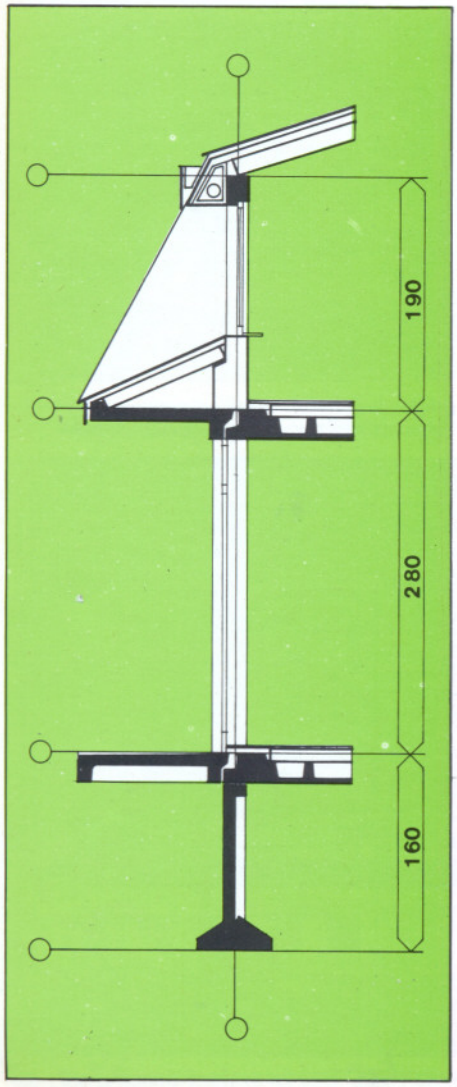


Fig. 9 Vertical section — external wall

Fig. 10 Erection of staircase floor slab

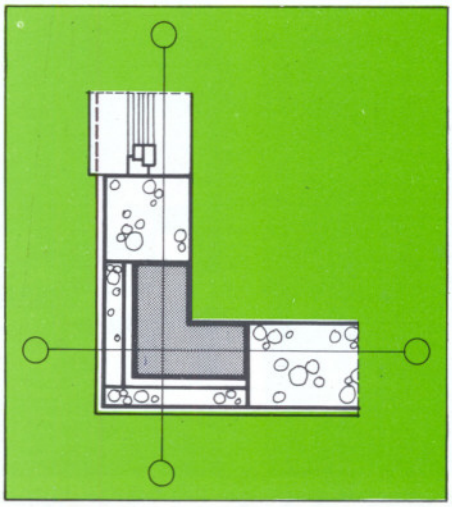


Fig. 11 Corner column with insulation

PREFABRICATION AND ERECTION

The manufacturing of structural elements, manufactured in conformance with up-to-date technological processes, can be organized in succesive stages and in accordance with local conditions, available investment funds and demand, greately reducing in this way possible investment risks.

Structural elements are produced on the basis of local materials — cement, aggregate, reinforcing iron and prestressing cables. The consumption of basic materials is reduced to the minimum with significant savings in cement and reinforcement.

In the case of a building-floor plan shown in Fig. 13., the consumption per sq. m. brutto area calculated per one floor level amounted to 0.138 cu. m. of concrete, 9.57 kg. of reinforcing iron, and 1.72 kg. of prestressing steel cable.

Erection of elements begins with the laying of gravel base and concrete foundation strips as support for prefabricated strip components, followed by the erection of R.C. columns and waffle floor slabs. Once the structure is erected, floor slabs are prestressed in a row from top to bottom.

Following the prestressing of one floor level, temporary supports on the columns and in the middle of the 7.20 x 7.20 m. module, are removed, and prestressing continues at the lower level.

The weight of heaviest structural elements allows the use of lighter mobile lifting and erection equipment. Erection can be carried out directly from the transporting vehicle.

Experience shows that erection and completion can be carried out very fast. The three-storey structure of the experimental building in Novi Sad (Fig. 17) was erected in five days, and it took three months for completion and habitation.

SUBSYSTEMS

The development and use of System 50 is in conformance with the principles of open industrialization based on a balanced, large-scale prefabrication of all components constituting the building, grouped into subsystems of structure, envelope, services, partitions, finishing works and equipment. The compatibility of structure components with the components of other subsystems is ensured through "rules of the game", i.e. dimensional coordination, techno-physical and functional criteria, allowing for a higher flexibility in the processes of planning, design and construction. The realization of the first group of subsystems-structure, envelope and instalation core components, produced in regionally located plants based on use of local materials, ensures the fulfilment of vital requirements of the user as well as public needs. Subsystems of the second group include lighter, catalogued components which allow through changing use of space, equipment and furnishings satisfying of individual needs.

Catalogued products based on unified criteria on dimensional coordination and performance specifications secure high quality of planning, design and construction.

Planning grid — 1 M, structural grid — 36 M and 72 M.

PLANNING ASPECTS

SISTEM 50 allows flexible planning of dwellings and buildings:

— within the same dwelling, through the varying number of rooms included in the basic space unit and combinations of basic and additional spaces;
— within the building, through adding or partitioning of dwellings at the same level and vertical combining of dwellings;
— in the form of exterior flexibility in respect to town-planning, architectural and user's requirements, through subsequent adding of functional units and staircases in cases of timely planned phased construction;
— through reconstruction and adaptation work carried out during the exploitation period in order to meet evolutionary requirements of the direct user due to changes in family, life-style and financial ability.

Large number of town-planning solutions can be obtained through rearranging of functional units, from individual buildings, to more complex combinations of buildings in rows, belts or clusters.

Typology and possible repetition of different succesful solutions raises the quality level of housing, reduces preparatory work, simplifies contracting procedures, reduces the construction time, increases productivity and marketing effect.

Precast edge beams, balconies, loggias and roof elements are used by designers to create harmonious and varied forms.

The only limitation within the basic space unit is a service wall or a wet core grouping all pipe installations needed for the bath and kitchen, while all the remaining space can be freely planned in accordance with users' requirements.

The designer can forsee phased modifications of the dwelling space during the exploitation period, as well as a system of demountable partitions corresponding to offered alternative solutions.

SISTEM 50 can also be used to fulfil non-residential functions either within the residential building or in the form of separate facilities constructed in paralel with residential buildings.

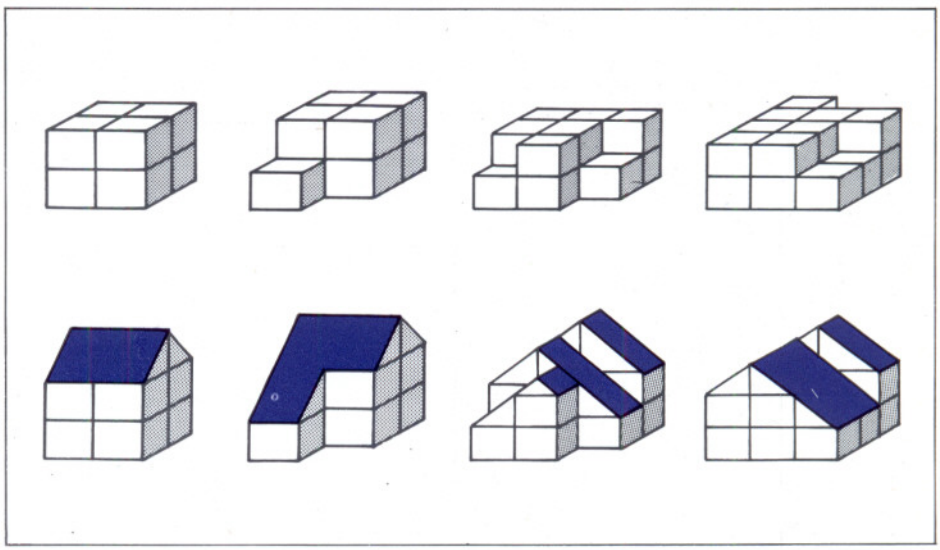


Fig. 12 Functional wholes and their growth

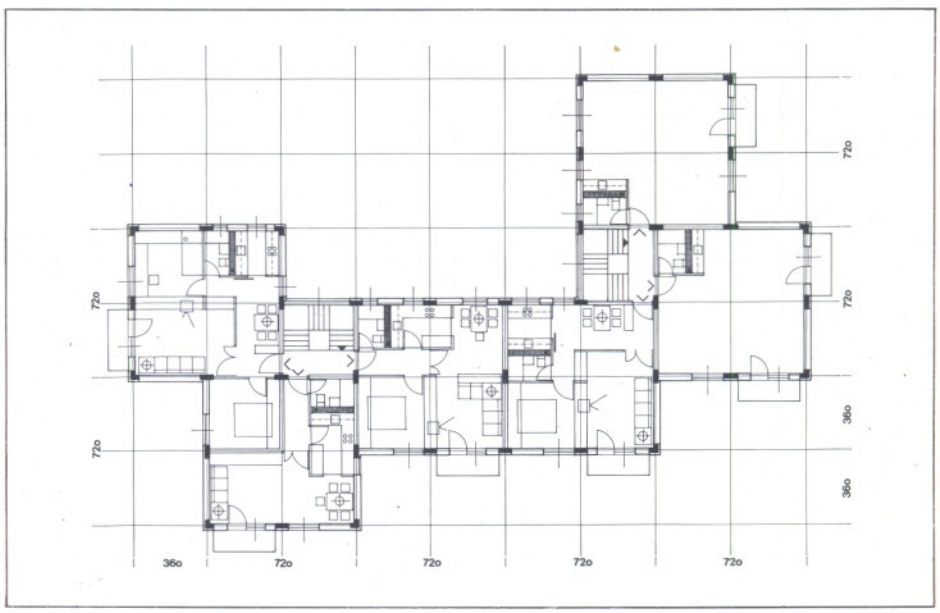


Fig. 13 Floor plan. Three stories high multi-family dwelling in Rača Kragujevačka

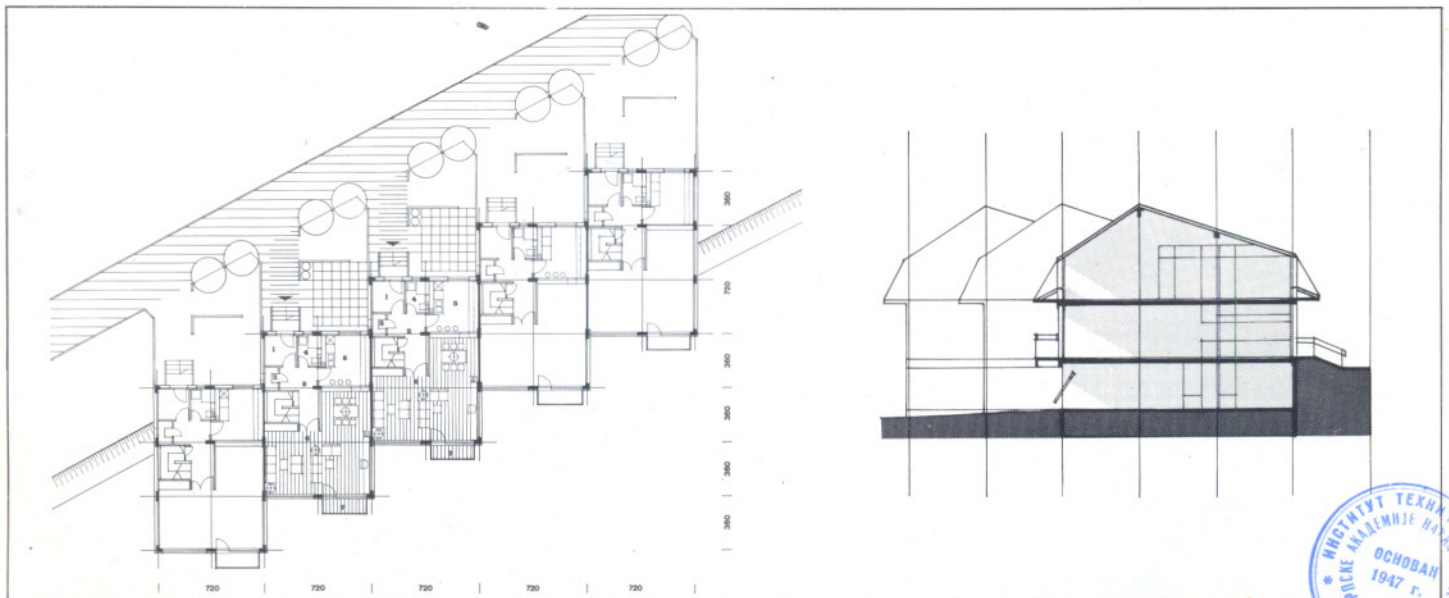


Fig. 14 Floor plan and section of single family attached dwellings, two stories high with cellar in Smederevska Palanka

COMPLETED BUILDINGS

Fig. 15 Experimental (multi-family) dwelling in Batočina

Fig. 16 Multi-family dwelling in Beočin

Fig. 17 Experimental (multi-family) dwelling in Novi Sad with commercial facility at ground floor

Fig. 18 Multi-family dwelling in Rača Kragujevačka

Fig. 19 Housing project of the "NAPREDAK" co-operative in Kragujevac

Fig. 20 Housing project of the "GOŠA" factory co-operative in Smederevska Palanka

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