2018

Q-Module® technology in investments.

Local governments and administration; business; housing construction.

Budownictwo Modułowe Sp. z o.o.

Modular Building Cluster [Prv.Ltd.]

Contents

THE Q-MODULE® (SUMMARY)

The Q-Module® TECHNOLOGY was developed by passionate people and with the involvement of construction engineers who specialize in the latest construction solutions. The unique, patented structure of hybrid reinforcement allows for the construction of residential or public utility modules, up to 4 stories in height. The technology provides unrivaled durability and use comfort, while maintaining high standards in terms of construction parameters and resistance to extraordinary loads, such as earthquakes; the load-bearing capacity of the ceilings at operational loads in the range from 4kN/m2 to 10kNm2 is ensured by the technology.

Owing to the use of innovative prefabrication technology, the dimensions of the modules (both width, length, and height) can be determined freely.

The individual Q-Modules® are created under the construction supervision of staff representatives of the University of Technology.

The Q-Module® SYSTEM solution enables multiple uses of a single module. Through the appropriate distribution of installation inside the module's walls, as well as by the patented system of interconnections, the module may be transported to a new place and adapted to new utility functions after years of initial use.

The Q-Module® PRODUCT offers a unique solution, both in terms of technology, as well as organization and execution time of the construction. By combining the modules, it is possible to arrange large areas of facilities, e.g., multi-family buildings for large families, as well as studios, i.e., mini-apartments. The technology ensures high construction parameters, durability guaranteed for up to 20 years, a high level of resistance to vandalism, fire safety, excellent soundproofing properties, and, generally high comfort and safety of use. The facilities are designed in such a way as to make it possible for them to be relocated. Moreover, their functionality can be changed, e.g., from an immigrant accommodation facility/amenity building to a dormitory, hotel, municipal facility, or multi-family residential building.

The Q-Module® – construct with vision!

BUDOWNICTWO MODUŁOWE SP. Z O.O. [priv.Ltd.] was established in 2001 in Mazovia as a general construction company. During the first 3 years of its operation, the company implemented several works in terms of installation and infrastructure; in subsequent years the company's focus shifted to housing construction. In June 2013, Budownictwo Modowe Sp. z o.o. [priv.Ltd.] launched the strategy of focusing on the modular construction industry, which eventually led to the creation of Klaster Budownictwa Modułowego [Modular Construction Cluster] based on a supply chain structure. For this purpose, architectural offices and construction engineers, as well as construction companies and complementary technology representatives were invited to cooperate in the project. Employing a skillful combination of tradition and modern technology, Klaster Budownictwa Modułowego [Modular Construction Cluster] provides services within 2 major business lines:

- sales of Q-Module® modules of various variants and dimensions,
- "design and build" for shell and core condition, development condition, or turnkey condition.

In September 2015, in cooperation with the University of Technology, the initial research and development processes were completed with the development of a new construction technology/system/product named the "Q-Module®". The module ensures durability, mobility, and functionality of various purpose modular facilities and a good quality/durability-to-price ratio.
The Q-Module® corresponds to "Quality", which guarantees the solution's high quality and durability. At the same time, the name reflects the actual direction of work towards developing the product, which concerned reaching subsequent levels of "3xQ"

(Quality - the product's quality; Quick – production speed and efficiency; Quest - constant search for new solutions both in terms of technology and its application).

TO ARCHITECTS AND CONSTRUCTION ENGINEERS

The Q-Module®, a monolithic reinforced concrete building module should not be treated as the final product, but rather as a brick; it is merely a building material. The actual final product consists of a complete documentation of a facility, where its specific structure, architectural solutions, and function are determined. The individual object's form results from its function. This statement depicts the basic assumption of modernism. Cubic architecture offers a wide range of possibilities determined by technology and the investor's readiness to bear the costs. By using the Q-Module® technology, it is possible to construct objects with a modern shape/building body, as well as facilities in a more traditional arrangement. Therefore, the design of a manor-style villa or other building forms poses no problem.

Although it may seem otherwise, the size of the rooms is not limited to an individual module's size. Rooms whose size exceeds 7440x3700mm are successfully obtained through:

- combining 2 or more modules with full openings of walls, or
- spacing of 2 or more modules at a width that corresponds to the size of the room between them and the subsequent implementation of a ceiling to cover the open space formed in this way.

Combining 2 or more modules:

The Q-Module® design enables the full opening of both the shorter and the longer walls of individual modules, including the opening of opposing walls, with a full facing of wall sides and the ceiling. By combining 2 modules whose dimensions equal 7440x3700 mm, given the full opening of the longer wall, it is possible to create a room with dimensions of 7440x7440 mm (about 50m2). It is also possible to use a full opening in the case of opposing walls. Thus, by arranging 3 modules with dimensions of 7440x3700 mm, a room with dimensions of 7440x11100 mm (an area of about 82m2) may be created. Unlimited possibilities of this type of connection may be applied, i.e., it is possible to implement such connections along any length, thereby creating a tunnel-shaped object with a width of 7440 mm and any chosen length.

Spacing 2 or more modules to the width corresponding to the demand:

A method for combining the Q-Module® technology with the disassembled ceiling technology has also been developed. Hence, it is possible to obtain open rooms, whose dimensions are determined by the span of ceilings (up to 780 0mm) and their construction parameters.

The use of the above solutions offers a chance to obtain open spaces of up to several hundred square meters, such as conference rooms, restaurants, and suchlike while maintaining the possibility of multiple relocation of the facilities.

All facility's construction parameters with the use of the Q-Module® are specified by the module manufacturer based on the presented concept or architectural design.

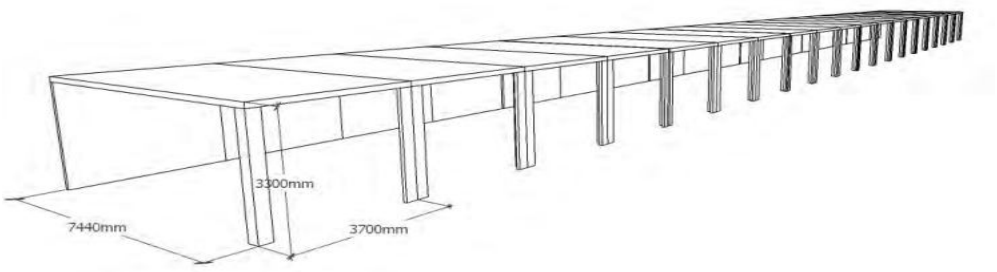
THE Q-MODULE® (TECHNOLOGY, SYSTEM, CONSTRUCTION MATERIAL)

We raise the bar in the modular construction industry!

The Q-Module® technology has been developed with passion and with the involvement of constructors who specialize in the latest construction solutions. Its unique structure makes it possible to combine residential or public utility modules, currently up to 4 storeys, to ensure unrivaled durability and comfort of use.

Figure 1. /

- The Q-Module® constitutes both a building material, technology, and a system; it is a new, previously unknown solution on the global market. The concrete monolithic spatial module is entirely manufactured at a concrete prefabrication plant. Reinforced using hybrid reinforcement (using the steel-composite technology developed by the scientific staff of the University of Technology), the module uses high-quality concrete, which guarantees its solid and durable structure and mobility. The Q-Module® modules are made as a monolithic structure wherein walls and roofs constitute a combined element during the first technological process of concrete solidification. The technology is extremely safe and durable
- it provides high construction parameters and gives the possibility of assembling objects of a height up to 4 storeys and loaded with a green roof, also in seismically endangered areas (and in the presence of other extraordinary loads).



The connection of the lower storey floor to the entire module is conducted in the second stage of the prefabrication process, it is also possible to integrate the lower storey modules with the foundation plate. In the case of higher-storey modules, the ceiling of the lower module serves as the floor of the upper module. The module includes openings for doors and windows; these are prepared to fit the dimensions of the joinery to be installed (depending on the project and the client's order). It is also possible to fully eliminate any wall or any opposite walls without retaining visible corners or downstand beams. Inside the walls and ceilings, all required installations (electricity, water, utility water and heating, low-current) are installed.

Owing to the use of innovative prefabrication technology, it is possible to freely determine the dimensions of the modules (in terms of such parameters as width, length, and height).

• The internal height of the room remains between 2550mm and 3150mm. The manufacturer suggests indoor height for residential use to be 2600mm, and 3050mm for public use.
• Wall thicknesses range from 100mm. The wall thickness recommended by the manufacturer for residential and public utility purposes equals 100mm. For objects embedded in the ground, it is possible to create walls with a thickness of 120mm or greater (160mm, 200mm, etc.), depending on the object’s purpose.
• Thickness of ceilings ranges from 120mm. The thickness of the ceilings recommended by

the manufacturer for residential and public utility purposes equals 150mm. In the case of objects embedded in the ground, it is possible to create ceilings with a thickness of 200mm or greater.

The most popular external dimensions of the Q-Module®, as recommended by the manufacturer, include:

1. 7440x3700mm (the most convenient dimension, meets the space requirements for "*****" standard hotels, requires over gauge transport with 2 pilots;
2. 6700x3350mm (the most convenient to be assembled for residential, service, and public utility facilities, requires over gauge transport with 1 pilot;
3. 6800x2990mm (the most convenient for warehouse and industrial use and to be assembled as garages, adapted to road transport as regular transport, does not require a pilot).

Regardless of the suggested dimensions, it is possible to manufacture modules with different various dimensions, in accordance with the Investor's expectations and fitting the shape of the investment site.

The limit dimensions, above which the prefabrication of a module would require additional structural strength calculations include 3700mm in width, 7440mm in length, and 3150mm in height. It is possible to manufacture prefabricated elements whose dimensions exceed the ones defined as "limit dimensions", for example, modules with a length of 11000 mm, intended for one or two-storey buildings. However, their use would require a separate calculation of construction parameters.

THE BASIC FEATURES OF THE MODULE®:

1. The concept reflects the idea of building "brick houses". However, the technology is not only aimed at cubic architecture. The use of modules and their mutual arrangement is limited only by imagination.
2. Monolithic, reinforced concrete structure (walls and ceiling constitute one element created in the process of concrete solidification;

1. Hybrid (steel-composite) reinforcement which ensures high construction parameters and resistance to extraordinary loads (e.g., earthquakes, tornadoes, tsunamis, etc.);
2. The load-bearing capacity of the ceilings within the range between 4 and 10 kN/m2 ensures a high level of functionality and safety of use.
3. The ceiling of the ground floor storey may serve as a ready floor of the upper storey (e.g., polished concrete) using sound and thermal insulation in the lower part of the ceiling.
4. The internal height of the room is to be determined within the range of 2550mm to 3150mm. The manufacturer suggests indoor height for residential use to be 2600mm, and 3050mm for public utility use.
5. Wall thicknesses, from 100mm, are to be determined. The wall thickness recommended by the manufacturer for residential and public utility purposes equals 100mm. For facilities embedded in the ground, it is possible to create walls with a thickness of 120mm or greater (160mm, 200mm, etc.), depending on the object's purpose.
6. The thickness of ceilings, from 120mm, is to be determined. The thickness of the ceilings recommended by the manufacturer for residential and public use in multi-storey buildings equals 150mm. In the case of objects embedded in the ground (basements, shelters), it is possible to create ceilings with a thickness of 200mm or thicker.
7. It is possible to fully eliminate any wall or any opposing walls, without leaving any corners and downstand beams, which makes it possible to combine several modules into larger spaces.
8. All installations embedded in the walls and ceiling provide a high degree of resistance to vandalism
9. High fire resistance and noise suppression parameters;
10. Possibility of compiling modules up to 4 storeys with an additional load created by usable and biologically active surfaces on the roof;
11. The special formula of the concrete ensures high durability and resistance against water columns reaching up to 100m (it can also function as floats and caissons);
12. The construction's warranty is 20 years, but the declared durability of the solutions exceeds at least 100 years.
13. The use of commonly available construction technologies in the field of foundation technology, insulation, and finishing materials for facilities;
14. High efficiency and low production costs (a team of 6 people can produce 1 module per day, or 1 module per 2 days in the case it is required to install more complex structures and installations);
15. The possibility of production in field prefabrication conditions, with the use of mobile factories. A mobile factory with one mold is placed in 2 shipping containers; up to three low-loader semi-trailers need to be involved in the case of road transport. High availability of construction materials used to create molds for the production of Q-Module® on the European market;
16. The speed of building objects ("brick houses"). The possibility to erect a 4th-story house in one day;
17. The possibility of efficient disassembly of objects after many years of use to transfer them to a new place; multiple migrations of objects;
18. The possibility to create intelligent, energy-saving facilities
19. **Tax benefits** - in the case of entrepreneurs, in the light of applicable tax regulations, the Q-Module® does not have to be permanently connected to the ground, which results in the possibility of 10 years of depreciation (as opposed to the 40 years provided for building structures), as well as the possibility of leasing.
20. In some cases, the structure does **not require a building permit** (construction notification is enough).
21. Especially beneficial **pro-ecological properties** resulting from the module's production cycle, no need to implement complex construction processes at the investment site, high durability during operation, and easy recycling (favorable LCA).
22. The application of the technology **in housing construction**- summer lodges, residential houses, multi-family housing construction, apartments, mini-apartments, etc.;
23. The application of the technology **in business**, e.g., to erect offices, warehouses, industrial facilities, warehouse and production halls, residential buildings for rent, shops, motels, hotels, holiday resorts, banks, floating houses, specialist modules as extensions to the existing

facilities, e.g., an amenity module for social purposes, toilet at the existing industrial facilities, etc.;

24. The application of the technology for the needs of **government administration and local governments**- social and communal housing, administration facilities, schools, dormitories, night shelters, immigrant accommodation, facilities related to maintaining public order and defense (mobile barracks systems, watchtowers, prisons, armories, secret offices, etc.).

The Q-Module® modules are created under design supervision from scientific staff representatives of the University of Technology

The database of ready-made architectural designs for facilities erected with the Q-Module® technology is constantly being expanded to include new offers. To browse through ready-made designs and architectural concepts for residential, service, warehouse, industrial, and public utility buildings please visit the online store on our website: www.sklep.budownictwomodulowe.com

The Q-Module®: **Q**uality, **Q**uick, **Q**uest

THE Q-MODULE®- CONSTRUCTION PARAMETERS

The Q-Module® modules are manufactured with the use of industrial methods (in the processes of concrete prefabrication), in a portable mold that allows for precise compliance with an individual element's dimensions, including wall and ceiling thickness. The design of the mold makes it possible to introduce openings doors and windows, or to create an object completely devoid of a wall/opposing walls. The Q-Module® reinforcement is prefabricated; it incorporates a mesh welded from reinforcement bars of appropriate quality BSt500B steel and composite bars. The design of the mold, the prefabrication of the reinforcement, and the element's production technology make it possible to create high-quality components with repeatable strength properties. The designer selects the type of reinforcing meshes (bar diameters and bar spacing), based on the materials prepared by the Q-Module® manufacturer. For this purpose, it is sufficient to determine those loads of the Q-Module® which exceed its weight. The materials include loads from ceilings and wall finishing, as well as functional loads evenly distributed on the Q-Module®'s ceilings. This load can include substitution loads from partitions according to EN 1991-1-1. If the imposed load is not uniformly distributed, the designer should determine the design static values and compare them with the design capacities of the relevant cross-sections, as provided in the manufacturer's materials.

The Q-Module® modules are individually selected, which enables the selection of the optimal solution for each architectural and construction project. The spatiality of the entire structure was taken into account in the static calculations; 3D models for individual modules and their combinations were used for this purpose.

Simple load cases (finishing layers, uniformly distributed load, wind, and snow) need no special approach; ready-made diagrams and manufacturer's solutions can be used to determine those. Stairs usually require an individual approach. This is due to their location in the structure, the way, and place where load transfer to the Q-Module® structure occurs, as well as the material used for flights and staircase landings.

The load-bearing capacities of Q-Module® structural elements (walls and ceilings) allow them to be used in structures whose height does not exceed four storeys, with the imposed loads of the ceiling within the range from 4kN/m2 to 10kN/m2. The wind does not pose a significant load for structures erected with the Q-Module®, due to the high degree of spatial stiffness of the wall-plate system provided by the Q-Module®.

Supplementary materials for designers have been developed in accordance with the European standard recommendations. The requirements of EN standards are also met by the connections between individual Q-Module®. The connection method is simple and consists of bolted connections. These connections are reversible, i.e., the Q-Module® can be disassembled and reused in other facilities or locations. The Q-Module® also meets the design requirements for components of this weight during the transport and assembly phase, with a dynamic factor of 1.5. The assumed value of the dynamic factor does not limit the choice of means of transport and assembly.

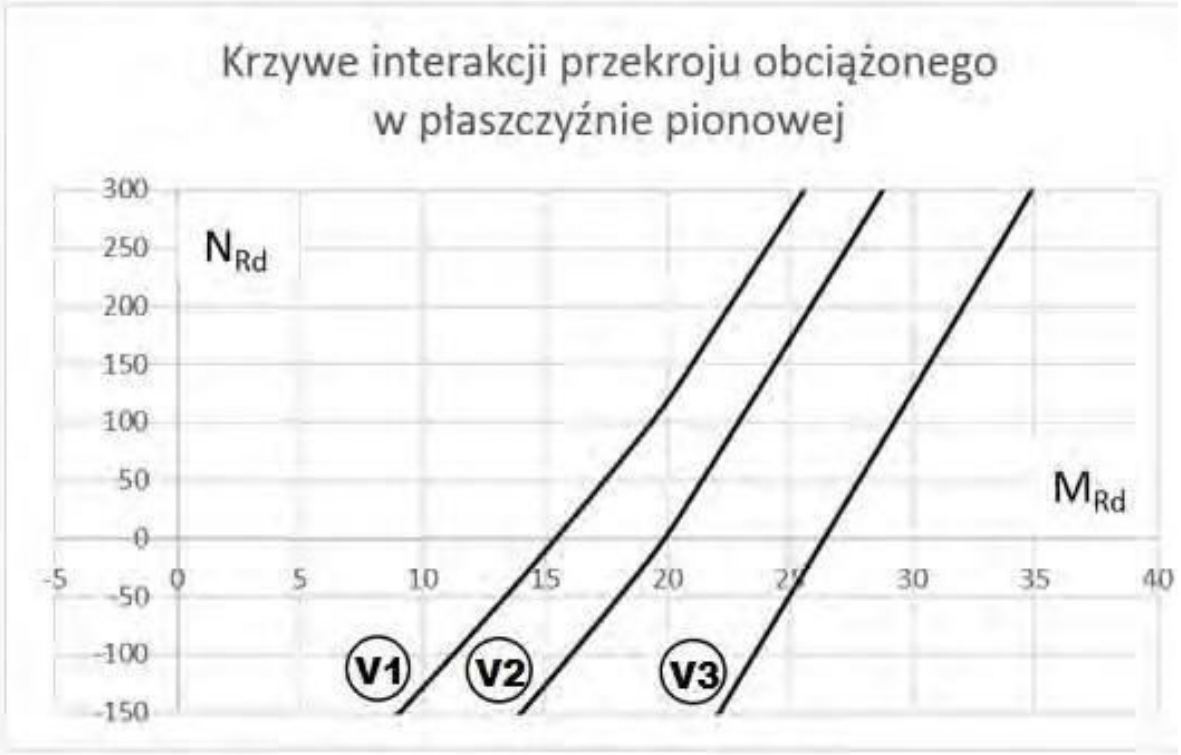
Characteristics of the element

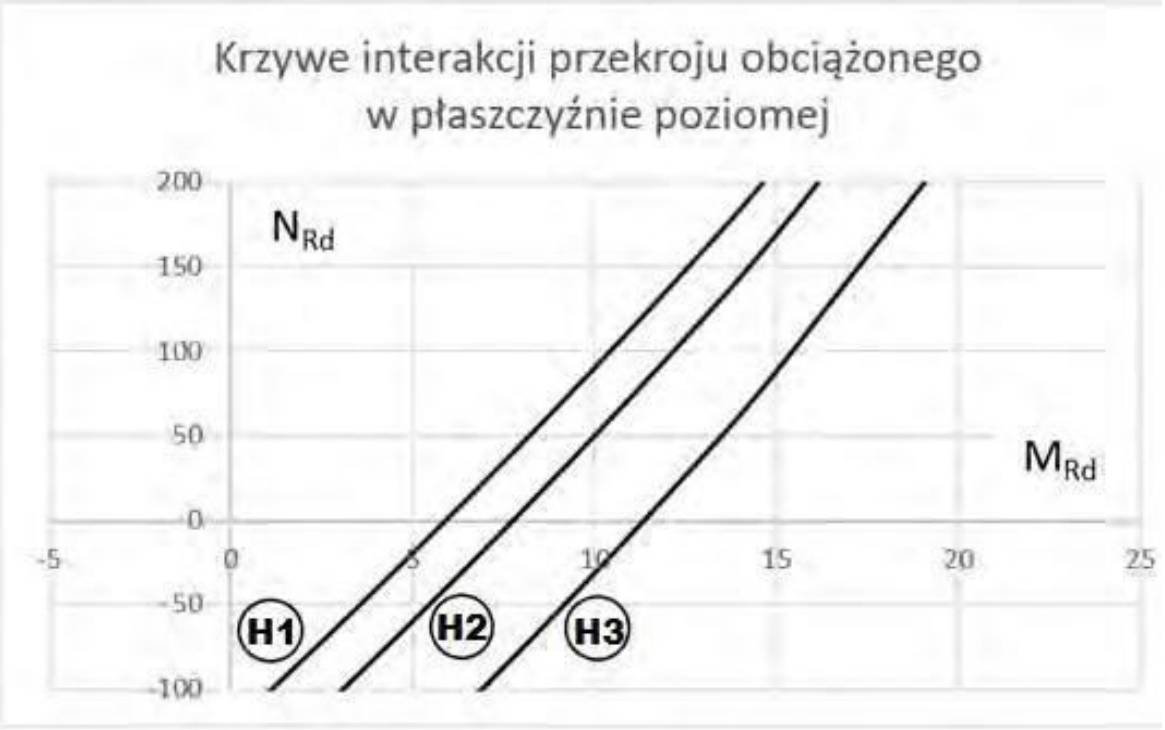
- Monolithic element with integrated walls with the ceiling
- Wide range of Q-module® dimensions
  -Maximum length of 7440 mm
  - The applied widths equal 2990 mm, 3390 mm, and a maximum of 3700 mm
  - Height within the range from 2550 to 3150 mm
- Possibility to erect buildings of up to 4 storeys
- A high degree of spatial stiffness of the element
- Specially developed system of inter-story connectors
- Transport connectors adapted to common types of loops
- Concrete class of C30/37 to C50/60
- Reinforcing steel of BSt500B class
- All design calculations are based on applicable European standards

The Q-module®'s walls

- The suggested wall thickness equals 100 mm, with the possibility of thickening it up to 120 mm, 160 mm, or 200 mm
- Nearly unlimited possibilities in terms of openings, including the entire longitudinal wall
- The minimum fire resistance standard of a 100mm wall equals REI30, in accordance with PN-EN 1992-1-2; it is possible to increase it to REI60 by applying a 1 cm-thick layer of plaster
- Minimum parameters of sound proofing insulation: Rw (C; Ctr) = 47 (-1; -5), in taccordance with PN-EN 12354-1

Calculations of the load-bearing capacity and deformability of the Q-modules' cross-sections were performed in accordance with the recommendations of the PN-EN 1992-1-1 standard. Wall cross-sections are loaded with a bending moment and a normal force, whereas the load-bearing capacity of the section depends on both these values. Therefore, the load-bearing capacity of the wall cross-sections is presented in the form of nomograms, in the coordinate system, with the bending moment (horizontal axis) and the normal force (vertical axis). The analysis was presented for three different vertical layout solutions (V1, V2, V3) and three solutions for the horizontal layout (H1, H2, H3).


Krzywe interakcji przekroju obciążonego
w płaszczyźnie pionowej
N_Rd
M_Rd
300
250
200
150
100
50
0
-50
-100
-150
-5
0
5
10
15
20
30
35
40
V1
V2
V3


Krzywe interakcji przekroju obciążonego
w płaszczyźnie poziomej
N_Rd
M_Rd
200
150
100
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0
-50
-100
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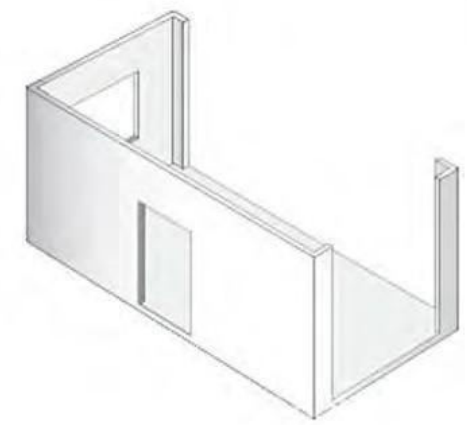
0
5
10
15
20
25
H1
H2
H3

The Q-module®'s ceiling



- The suggested ceiling thickness equals 150 mm, with the possibility of thinning it up to 120 mm or thickening it up to 200 mm
- The possibility of opening the ceiling for vertical communication of buildings
- The range of the load-bearing capacity for the ceiling of 150 mm for the characteristic external load equals from 4 to 10 kN/m2
- The possibility to apply hybrid reinforcement
- The minimum standard fire resistance of the ceiling of 150mm equals REI90, in accordance with the PN-EN 1992-1-2 standard
- The minimum parameters of soundproofing insulation for a ceiling with a thickness of 150 mm are as follows:
  R_w (C; C_{tr}) = 54 (-2; -7) [dB] in accordance with the PN-EN 12354-1 standard
  $L'_{n,w}$ = 45 [dB] in accordance with the PN-EN 12354-2 standard

Calculations of the load-bearing capacity and deformability of the Q-module cross-sections were performed in accordance with the recommendations provided by the PN-EN 1992-1-1 standard. Numbering from 1 to 4 refers to successive reinforcement variants, both steel reinforcements, and hybrid reinforcements, for a ceiling of 15cm thickness. The "a" symbol indicates the load-bearing capacity towards the ceiling's shorter direction, whereas the "b" symbol - towards the ceiling's longitudinal direction. M_{Rd} is understood as the maximum load-bearing capacity of the floor at bending. In the calculations, the weight of the ceiling itself should be taken into account.

MANUFACTURER'S DECLARATION

Budownictwo Modułowe Sp. z o.o.	**OŚWIADCZENIE PRODUCENTA** **KRAJOWA DEKLARACJA ZGODNOŚCI** **nr 1/2016** Q-Moduł 1/335/670/2016	Sporządzono dnia: **09.02.2016r.** Miejscowość: **Raszyn**

1. **NAZWA I ADRES WYDAJĄCEGO OŚWIADCZENIE:**

   Budownictwo Modułowe Sp. z o.o.
   05-090 Raszyn ul. Cypriana Godebskiego 32

2. **NAZWA WYROBU BUDOWLANEGO:**

   2.1. Nazwa wyrobu: Q-Moduł
   2.2. Wzór: Moduł budowlany W.123186
   2.3. Klasa: C50/60
   2.4. Kolor: wg katalogu producenta
   2.5. Kształt i wymiary: wg katalogu producenta

3. **MIEJSCE WYTWORZENIA:**

   Warszawa Ursus

4. **PRZEZNACZENIE:**

   Q-Moduł parterowy w budynku 4-kondygnacyjnym. Dopuszczalne obliczeniowe obciążenie stropu zgodnie z Normami Europejskimi 6kN/m^2.

5. **KLASYFIKACJA WYROBU:**

   SYMBOL PKWiU 23.61.20.0 „Budynki prefabrykowane z betonu"

6. **IDENTYFIKACJA DOKUMENTACJI TECHNICZNEJ:**

- **autorstwa dokumentacji:**

  PROJEKT ARCH. BUDOWLANY WYKONANY PRZEZ .....
  DLA .....
  OBLICZENIA STATYCZNE ORAZ PROJEKT KONSTRUKCYJNY WYKONANY PRZEZ .....
  .....
  W OPARCIU O TECHNOLOGIĘ ORAZ DOKUMENTACJĘ SPORZĄDZONĄ PRZEZ KATEDRĘ BUDOWNICTWA BETONOWEGO POLITECHNIKI ŁÓDZKIEJ.

7. **STWIERDZENIE ZGODNOŚCI:**

   OŚWIADCZAM Z PEŁNĄ ODPOWIEDZIALNOŚCIĄ, ŻE WYROBY SĄ ZGODNE Z DOKUMENTACJĄ TECHNICZNĄ.

8. **ADRES OBIEKTU BUDOWLANEGO I ZAKRES STOSOWANIA WYROBU:**

   ADRES OBIEKTU BUDOWLANEGO .....
   BETONOWE MODUŁY PRZESTRZENNE WYKONANE W SYSTEMIE Q-MODUŁ STOSOWANE JAKO: BUDYNKI MIESZKALNE, OBIEKTY UŻYTECZNOSCI PUBLICZNEJ, HANDLOWE, MAGAZYNY, TECHNICZNE, GARAŻE.

9. **MIEJSCE WYDANIA OŚWIADCZENIA:**

   Budownictwo Modułowe Sp. z o.o., 05-090 Raszyn ul. Cypriana Godebskiego 32.

OSOBA UPOWAŻNIONA

Kierownik Działu Kontroli Jakości
i Laboratorium

THE Q-MODULE® TECHNOLOGY LIMITATIONS

The basic limitation of the Q-Module® technology is the same as the typical limitation experienced by the entire prefabrication and modular construction industry, i.e., no or limited possibilities to modify the existing installations' layout. In the case of buildings erected with the use of the traditional method (brick, breeze-block, etc.), the modification of such elements as the electrical installation by introducing an additional electric socket or a switch poses no special problems. In prefabricated technologies, however, driving a pin into the wall in order to hang a picture may prove problematic. This is due to both the hardness of the materials used for prefabrication and the potential risk of damaging the entire installation. This is the reason why careful preparation and development of an architectural and construction design with the determination of possible interior design variants and installation optimization is of utmost importance. The manufacturer attempts to place the installations in such a way as to provide the user with a wall mounting zone where it is possible to freely hang certain elements and other installations.

FOUNDATIONS AND RECESSES (CELLARS)

In the basic technological process, the Q-Module® modules are manufactured as a monolithic structure, where the walls and ceiling constitute one prefabricated element emerging in the same concrete solidification process. The connection with the ground is created during the object's installation on the investment site. This solution allows for the following:

- The use of any foundation-laying techniques available on the market (e.g., foundation plates, continuous footings made on the investment site or prefabricated, prefabricated footings, foundation piles, etc.)
- The use of the lower storey's ceiling as the floor for the upper storey.

In order to estimate the investment cost and select the most appropriate foundation technology, it is necessary to conduct geological soil surveying and answer the question of whether the facility is expected to be relocated in the future. In the event of an intended relocation, the manufacturer prefabricated footings, dismantled footings, or screwed piles as the most beneficial solutions, since these technologies enable the disassembly and relocation of the object, together with its foundations. The use of screwed piles is especially worth attention, as its purchase and installation seem to incur costs similar to the ones of traditional technologies but its assembly is much faster and can be performed regardless of the weather (also in winter). The piles are not only used on sites where soil parameters do not allow for traditional foundation techniques. In the case of one-story buildings on the ground with averaged geological parameters, the use of 12 piles up to 2m in length should solve the issue of providing a foundation to one module. Additionally, in this case, the foundation can be completed within one day. The Q-Module®, irrespective of the foundation structure, is placed on 12 supporting points universally designed as connections with the ground or with the lower module.

When planning the implementation of an object with a recess on the lower floor (e.g., basements), the pressure of soil and water on the modules' walls should be accounted for while developing the construction design. This may determine the use of thicker module walls, over 10cm, which poses no significant problems from a technological point of view.

INSULATION AND FACADES

The use of reinforced concrete makes it possible to achieve high construction parameters (durability and strength of solutions). However, reinforced concrete fails to offer the desired

insulation parameters. The choice of insulation and facade solutions is the investor's decision; the technologies and technologies available on the market may be used materials, with no restrictions. Therefore, light wet and light dry methods, facade cladding panels, thermo-protective paints, and other available solutions may be selected. High insulation parameters of ceilings, concrete floors, or the roof are possible by using Alutermo®.

When planning the facility to be relocated, it is worth considering the use of removable facade cladding panels, thermal protection paints, or combinations of these two solutions. The use of ventilated facades with the grillage structure attached to the walls of the modules is also possible, provided that the additional load is taken into account in the construction calculations for the building.

ROOF

The Q-Module® technology ensures high strength, stiffness, and durability parameters of the ceilings; the ceiling thickness suggested by the manufacturer equals 150mm. No restrictions on roof structures commonly used in construction occur in this case. When designing the facility, the most advantageous solution (if permitted from the architectural point of view) seems to be to enclose the facility with a flat roof, which could serve a technical or recreational function (including the so-called green roof). In this case, the Investor gains additional space, e.g., for the installation of antennas, photovoltaic systems, and suchlike, or simply as a place for recreation. In the case of some Plan Zagospodarowania Przestrzennego [Spatial Development Plans-PZP] plans, a green roof gives the possibility of a more favorable ratio of biologically-active areas to the plot's built-up area. Due to the ceiling's high construction parameters, it is not necessary to remove snow in winter, even in the case of intense snowfall.

Before deciding to design a flat roof, it is necessary to verify the provisions of the PZP, as they sometimes impose the necessity to use roofs of a specific structure or a given architectural layout.

Izolacyjność akustyczna Q-moduł

Elementy Q-moduł mogą być stosowane w obiektach mieszkalnych, socjalnych, administracyjnych, magazynowych, przemysłowych, hotelowych, letniskowych itp. Zgodnie z normami *PN-EN 12354-1 „Akustyka budowlana – Określenie właściwości akustycznych budynków na podstawie właściwości elementów – Część 1: Izolacyjność od dźwięków powietrznych między pomieszczeniami"* oraz *PN-EN 12354-2 „Akustyka budowlana – Określenie właściwości akustycznych budynków na podstawie właściwości elementów – Część 2: Izolacyjność od dźwięków uderzeniowych między pomieszczeniami"* parametry akustyczne przegród konstrukcji Q-moduł są następujące:

Element	Grubość [mm]	Masa powierzchniowa [kg/m²]	R_w [1] (C; C_{tr} [2]) [dB]	$L'_{n,w}$ [3] [dB]
Strop	150	360	54 (-2; -7)	45
Ściana zew. nośna	100	240	47 (-1; -5)	-
Ściana wew. nośna	2x100 [4]	480	59 (-2; -7)	-
Ściana wew. nośna	100	240	47 (-1; -5)	-

UWAGI:

1) Wartość ważonego wskaźnika izolacyjności właściwej R_w określono zgodnie ze wzorem B.5 normy PN-EN 12354-1.
2) Wartość wskaźnika adaptacyjnego C_{tr} określono zgodnie ze wzorem B.6 normy PN-EN 12354-1.
3) Wartość ważonego wskaźnika adaptacyjnego $L'_{n,w}$ określono zgodnie ze wzorem 21 normy PN-EN 12354-2, przyjmując:
   - $L_{n,w,eq}$ zgodnie ze wzorem B.5 normy PN-EN-12354-2,
   - ΔL_w zgodnie z rysunkiem C.1 normy PN-EN-12354-2, przy założeniu 2cm styropianu oraz 5cm wylewki cementowej,
   - K zgodnie z Tablica 1 normy PN-EN-12354-2.
4) Ściana wewnętrzna nośna powstała przez zestawienie dwóch Q-modułów. Przy obliczeniu pominięto wpływ 1cm warstwy styropianu pomiędzy Q-modułami.

The structure of Q-Module® is compliant with the PN-EN 1992-1-2 standards: Designing concrete structures. Part 1-2: General rules. With regards to fire conditions, the load-bearing elements of the Q-Module®'s structure can be classified as:

1. The ceiling of 150mm, the concrete cover 15, REI 90 (according to table 5.8)
2. The load-bearing external wall of 100mm, the concrete cover 15mm, REI 30 (according to table 5.4)
3. The internal load-bearing wall 2x100mm, the concrete cover 15mm, REI 30 (according to table 5.4)
4. The internal load-bearing wall of 100mm, the concrete cover 15mm, REI 30 (according to table 5.4)

Łódź, dn. 19.01.2016r.

Oświadczenie

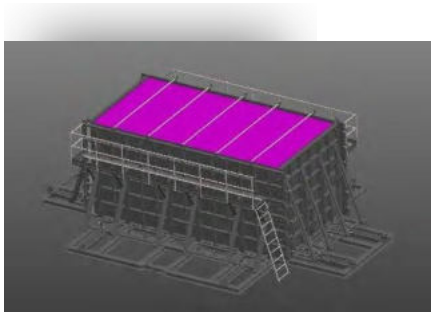
Elementy Q-moduł mogą być stosowane w obiektach mieszkalnych, socjalnych, administracyjnych, magazynowych, przemysłowych, hotelowych, letniskowych itp. Zgodnie z normami PN-EN 1992-1-2 „Projektowanie konstrukcji z betonu. Część 1-2: Reguły ogólne. Projektowanie z uwagi na warunki pożarowe" elementy nośne konstrukcji Q-moduł można zaklasyfikować odpowiednio:

Element	Grubość [mm]	Otulina [mm]	Standardowa odporność ogniowa
Strop	150	15	REI 90 (zgodnie z Tablica 5.8)
Ściana zew. nośna	100	15	REI 30[1)] (zgodnie z Tablica 5.4)
Ściana wew. nośna	2x100[2)]	15	REI 30[3)] (zgodnie z Tablica 5.4)
Ściana wew. nośna	100	15	REI 30[4)] (zgodnie z Tablica 5.4)

UWAGI:
1) Standardową odporność ogniową można podnieść do REI 60 poprzez zastosowanie 10 mm warstwy tynku (lub gipsu) wewnętrznego, spełniając wymagania dla ściany nagrzewanej z jednej strony.
2) Ściana wewnętrzna nośna powstała przez zestawienie dwóch Q-modułów.
3) Standardową odporność ogniową można podnieść do REI 60 poprzez zastosowanie 10 mm warstwy tynku (lub gipsu) po wewnętrznej stronie dla ściany 100 mm zestawionej ze ścianą drugiego Q-modułu, spełniając wymagania dla ściany nagrzewanej z jednej strony.
4) Standardową odporność ogniową można podnieść do REI 60 poprzez zastosowanie 10 mm warstwy tynku (lub gipsu) po obu stronach dla ściany 100 mm oddzielającej dwa pomieszczenia, spełniając wymagania dla ściany nagrzewanej z obu stron.

The internal load-bearing wall is created by combining 2 modules. Standard fire resistance can be increased to REI 60 by using a 10mm-thick internal layer of plaster (or gypsum), or by applying this layer on both sides while meeting the requirements for a wall heated from one side. Further improvement to fire resistance parameters is possible by applying appropriate insulation materials between the individual modules' walls or by using insulators as finishing layers.

PRODUCTION TECHNOLOGY



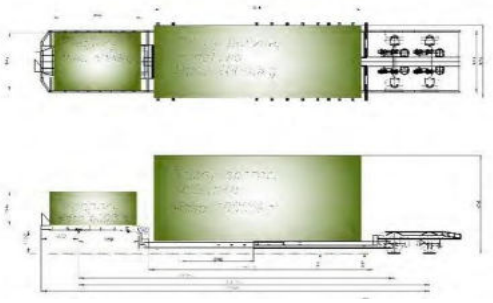
The production of the Q-Module® takes place in molds specially designed for prefabrication. The walls and the ceiling constitute one element created in the process of concrete solidification. Both the design of the mold, the parameters of the reinforcement, and the concrete used for prefabrication appertain the manufacturer's know-how and are protected by a patent.

Figure 2 Exemplary production mold

Compared to other technologies, the production technology of the Q-Module® is simple and fast. Preparation for pouring concrete involves spreading the walls of the mold, laying reinforcement, arranging electrical, water and sewage, and heating installations, as well as introducing protective elements to prevent places intended for openings (e.g. doors and windows) from being poured with concrete. Prior to prefabrication, tests are conducted regarding the entire installation’s tightness and efficiency. Once the mold walls are tied, concrete is poured over the molds; it is later subject to potential vibration and heating during the solidification process. After the concrete solidifies, the formwork is removed and the module is transported to the maintenance station. The Q-Module® leaves the production line equipped with electrical, water, sewage, ventilation, and heating installations. With 100% work organization efficiency, the production cycle makes it possible to produce up to 1 module daily (using one form).

It is possible to modify the dimensions of the width, length, and height of the prefabricated elements. However, each modification to dimensions requires a certain amount of time for the mold to be adapted for production. The mold can be disassembled relatively easily and transported on two low-floor semi-trailers; thus, the production line constitutes a mobile factory. The production of modules on site reduces transport costs to a minimum but incurs higher costs resulting from preparation for production to be launched.

Production can be launched both at concrete prefabrication plants, as well as by using mobile factories at the investment site or the nearest concrete batching plant. The manufacturing of modules on the prefabrication plant premises offers an advantage, as it allows easier supervision, control over product quality, and production processes efficiency. Yet, it entails additional transportation costs.



INSTALLATIONS

When designing the installations, the suggested wall thickness of 10cm and the installation space inside the walls of about 5cm should be taken into account. The manufacturer suggests installing electrical, water, heating, and utility water installations, as well as other low-voltage installations within (inside) the module's walls and ceilings.

WATER AND AIR CONDITIONING INSTALLATIONS

No restrictions arise for the Q-Module® technology in relation to commonly applied solutions for heating systems. The solution suggested by the manufacturer is the use of innovative heating and cooling systems based on a water installation with heat sinks embedded in the walls, floor, or ceiling of the rooms. This solution takes advantage of the properties of reinforced concrete as an energy storage battery, with a boiler in the form of an air-to-water heat pump or an induction boiler. The distribution of water installations inside the walls and floors of the module is performed using the highest quality polybutylene pipes, which ensures a high level of durability and good insulation parameters. In the case of passive buildings, it is also possible to apply more expensive solutions in the form of pipes with aero gel casing, thereby providing exceptional thermal insulation parameters.

Before concrete is poured, each water system is subjected to strict controls and pressure testing. The use of the latest heating and cooling panel solutions generates significant savings in terms of heating costs. The amount of water required in the heating system to heat the module whose area equals about 22 m2 is only 3.2 liters.

AIR CONDITIONING

No restrictions arise for the Q-Module® technology with regards to common solutions for cooling systems, including the need to distribute and cover ducts in the case of installing centralized solutions. The manufacturer suggests the use of innovative heating-cooling systems based on a water installation with heat sinks, which act as absorbers embedded in the room's walls or the ceiling. This solution makes it possible to use the properties of reinforced concrete as an energy storage, with the boiler in the form of an air-water heat pump.

RECUPERATION

No restrictions arise for the Q-Module® technology with regards to common solutions for recuperation systems, including the need to distribute and cover ducts in the case of installing centralized solutions. The solutions suggested by the manufacturer include a dispersed recuperation system that eliminates the need for ducts and their maintenance.

ELECTRICAL AND LOW-CURRENT INSTALLATIONS

No restrictions arise for the Q-Module® technology in relation to the commonly applied solutions for the distribution of high and low-current electrical installations. All electrical installations are installed in electrical conduits; there is a possibility of multiple replacements thereof.

WHEN WILL THE BUILDINGS BE CHEAPER? (WHERE WE ARE HEADING)

In the context of cheaper buildings and apartments, we refer to the current market prices, both in the context of the purchase barrier and the maintenance cost. From the analyzes conducted by Budownictwo Modowe Sp. z o.o. (Ltd. prv.], it stems that the following factors come into play when trying to reduce the facility's building cost (the order of the below factors is irrelevant):

1. Low cost of land acquisition (including long-term lease)
2. Creating as many structural and finishing elements as possible in the prefabrication process.
3. Striving to apply technologies that ensure the homogeneity of walls and ceilings (regarding their layers), which eliminates workload, as well as the potential risk of condensation inside the partitions.
4. The speed with which the investment can be implemented.
5. In prefabrication, aiming at the lowest possible transport/delivery costs.
6. Implementation of construction tasks in a modular layout or repetitive projects, implementation of the so-called "Economies of scale" phenomenon.
7. The use of durable materials that ensure the expected construction parameters, thermal insulation, fire resistance, sound insulation, and resistance to vandalism.
8. The use of materials that ensure the minimum possible thickness of the partitions, which translates into effective use of space and the minimization of tax costs, which are calculated based on the facility's gross area.
9. Designing simple solutions, sometimes ones that expose the structure of the applied matter.
10. Aiming at designing buildings in a 4-storey layout, especially in terms of residential and multi-family housing. Currently, a commonly used practice assumes eliminating basement storeys. The manufacturer considers this solution to be controversial in the context of the maintenance cost.
11. In the layout without a basement, the use of an insulated foundation plate was determined as the recommended solution.
12. High attention to the effective arrangement of the surface and room layout.
13. The use of such facility heating and cooling systems as to ensure a relatively cheap, independent, and pro-ecological source of energy and heat accumulation.
14. The use of simple but proven gravity and mechanical ventilation solutions in combination with recuperation; the so-called "hybrid ventilation".
15. Whenever possible, the use of flat roofs that can serve as a technical or recreational area.
16. Organization of work.
    16.1. The concentration of organizational and industrial processes on the reduction of the production cost per unit, as well reducing direct costs, the use of the flow manufacturing, and specialized construction brigades.
    16.2. Concentrating the necessary resources and raw materials on the implementation of repeatable processes and products, with intensive use of external products and services for incidental tasks.
17. Allowing the investors to obtain an inexpensive source of financing/capital for the investment implementation.
18. Providing a relatively simple and economical possibility to disassemble/remove the object from a given location ("exit cost").

THE Q-MODULE® - AN ALMOST PERFECT SOLUTION (HOW ARE WE GOING TO GET THERE?)

Regarding the individual issues discussed in the part above:

Re. 1. LOW COST OF LAND ACQUISITION

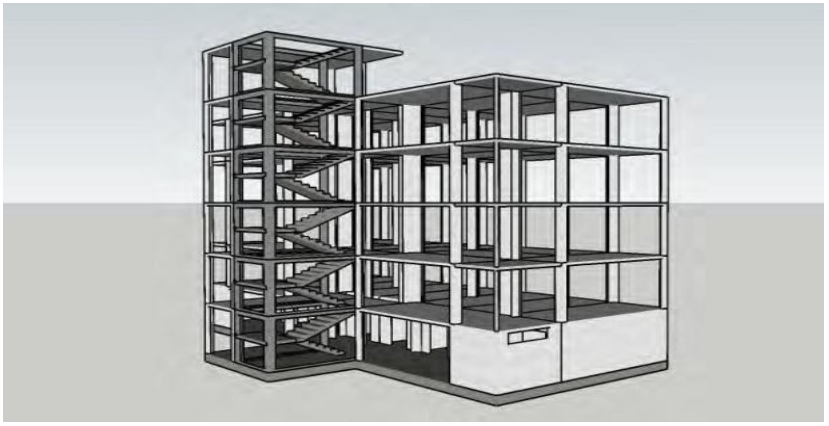
The low cost of land acquisition in the context of the cheap construction concept seems not to be a key issue, especially in the case of the 4-storey layout. In the case of the governmental Mieszkanie + program, currently launched on the market, this problem has been eliminated. However, also in the case of purely commercial activities, it seems possible to apply solutions similar to the ones typical of real estate development activities, e.g., inviting the land owner to participate in a special purpose vehicle (SCV), or long-term lease of the land (the technology makes it possible to relocate the building once the lease period has expired).

Re. 2. IMPLEMENTATION AS MANY STRUCTURAL AND FINISHING ELEMENTS AS POSSIBLE IN THE PREFABRICATION PROCESS

The Q-Module© technology ensures, most importantly, a safe and durable reinforced concrete structure, as well as relative design ease. At the facility's design stage, the following techniques can be applied:

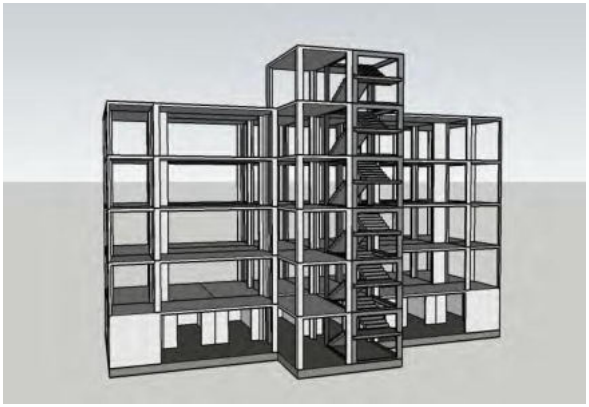
top-down (developing the building's body in a skeleton layout, leaving the modules' ceilings and corners that resemble the currently used techniques of reinforced concrete skeletons; then filling the solid with vertical partitions in the appropriate layout to denote individual apartments). The final designed partitions can be created in the prefabrication process as a monolithic part within the module;

botton-up (developing the layout of individual rooms and partitions and subsequently compiling them in the mutual connection between the first and subsequent floors).



Regardless of the design approach, each building developed with the use of the Q-Module® technology requires an individual structural analysis.

In the prefabrication process, it is possible not only to create modules but also to perform finishing works, in particular, such as plastering, planting windows, painting, laying floors, laying ceramic tiles, and installing fittings.



Not unimportant is the fact that the monolithic, three-dimensional (cubic) modules' layout facilitates and speeds up connecting individual installations within the building's body, as compared to the possible combination of individual flat wall elements and connecting installations in the corners. Paired with the stiffness of the structure, the above advantages outweigh any possible arguments against the solution, such as the one related to "transport without loads" when comparing the transport of the modules to transporting flat prefabricated wall elements.

Re. 3. UNIFORMITY OF WALLS AND FLOORS

It has so far been impossible to achieve this feature with the Q-module® technology. This fact results from too few available materials which could simultaneously provide sufficiently high thermal insulation and design parameters. It is possible to use other concrete forms, such as foamed concrete, perlite concrete, organic concrete, etc. in the future. However, at the present stage, this technology has not been sufficiently recognized and developed by Budownictwo Modowe Sp. z o.o. [Ltd. Prv.]; it remains within the scope of the planned research and development works. Applications for funding research work submitted so far to Narodowe Centrum Badań i Rozwoju [the National Center for Research and Development] have been rejected.

With regard to vertical partitions, at this stage, it is recommended to use the cheapest solutions commonly used in reinforced concrete technologies, such as the use of Styrofoam, wool, or demountable system solutions such as coffer-cladded facades, ventilated facades, etc., as an insulator for the reinforced concrete wall structures used.

Moreover, the homogeneity of the ceilings and the walls poses a difficult task. In cooperation with the research and development communities as part of the Modular Building Cluster, a ceiling insulation technique was successfully developed that enables the investor to receive modules with a pre-insulated thermally, fire-insulated, and soundproofed ceiling, **where the top layer of the prefabricated module can provide a ready-to-use floor.**

Re. 4. THE SPEED OF INVESTMENT IMPLEMENTATION

The speed of the investment implementation results directly from the production technological cycle, which, at a relatively small commitment of personnel and assuming 100% work cycle efficiency, allows to obtain 1 Q-Module® residential unit per day. It is also possible to produce the modules "to stock", which, given the possibility of standardization, offers new possibilities related to time and cost management.

Re. 5. THE USE OF POSSIBLE LOWEST TRANSPORT/DELIVERY COSTS

The innovativeness of technologies and applied solutions extends also to organizational innovation. In the Q-Module® technology, especially when implementing larger projects, it is possible to prefabricate modules directly on the investment site (so-called field prefabrication). Upon their disassembly, the mold and tools for the production of modules are placed onto two low-loader semi-trailers. For a team of 6 people, it may take up to 2 weeks to prepare for prefabrication in a new location. This solution allows almost complete elimination of transportation costs; the solution is favorable with regard to environmental protection, despite the fact that it required cyclical deliveries of concrete to the investment site (it is also possible to use mobile concrete plants, which in turn requires the supply of raw material for the production of concrete).

The innovativeness of technologies and applied solutions also extend to organizational innovation. In the Q-Module® technology, especially when implementing larger projects, it is possible to prefabricate on the investment site (so-called field prefabrication). The mold and tools for the production of modules after disassembly are placed on two low-loaders. Preparation for prefabrication in a new location for a team of 6 people may take up to 2 weeks. This solution allows almost complete elimination of transport costs, the solution is favorable for environmental protection, despite the fact that it refers to the need for cyclical deliveries of concrete to the investment site (it is also possible to use mobile concrete plants, which in turn means the need to supply raw material for the production of concrete).

Re. 6. ECONOMIES OF SCALE

This phenomenon, known in the economy, exerts a positive and significant impact on reducing production costs. For effective implementation, it is necessary to strive at the maximum repeatability of the type and amount (proportion) of raw materials, as well as the similarity within the product. This directly translates into cheap construction if it is made of elements with the same structure, the same parameters, and dimensions, under almost continuous operation conditions. Undoubtedly, the Q-module® technology makes it possible for these parameters to be achieved. Completed projects are currently being developed, which are usually based on 1 or 2 module dimensions. The differences between the modules only occur in terms of installations and openings system; introducing such elements in this respect poses no significant difficulties.

Re. 7. PERMANENT, SAFE, HEAT-INSULATING AND FIREPROOF TECHNOLOGY, RESISTANT TO VANDALISM, WITH APPROPRIATE LEVEL OF SOUND INSULATION

Durability, resistance to vandalism, and construction safety. These are the reasons why reinforced concrete technologies are considered the most durable solutions used in construction. The proposed modular solution can successfully be used in residential construction, as well as in the ones erected for the country's defense purposes.

Insulation - the possibility of erecting energy-saving and passive objects through the use of appropriate insulator layer parameters.

Fire resistance and soundproofing – as typical of a reinforced concrete structure. To improve these parameters, a double arrangement of module walls is used, together with a 2cm thick soundproofing and insulating layer in the partition between the walls. The research works confirm obtaining high parameters that guarantee comfort and safety in residential construction, including multi-family housing, tourism industry, etc.

Re. 8. MINIMUM THICKNESS OF PARTITIONS - EFFECTIVE USE OF SURFACE

The combination of modules with 100 mm-thick walls with a 20 mm-thick insulator layer inside gives a total wall thickness of 220mm. Insulations available on the market allow, depending on the expenditure, to obtain an external wall with high thermal insulation parameters, with a thickness between 300 and 440 mm gross. This results in significant benefits related to the efficient use of space. The ceiling height together with an internal insulator will amount to between 250 and 300mm.

Re. 9. DESIGNING WITH EXPOSURE TO MATERIAL STRUCTURE/BRUTALISM, MODERNISM

The technology enables:

- eliminating the need to plaster and paint all or a part of the building's walls, thereby obtaining the effect of the so-called architectural concrete, which, in this case, results from the modules' prefabrication process. It is possible to take into account the possibility of additional brightening of the concrete to give it an interesting design.

- eliminating the need to insulate ceilings and lay screed or other floor layers. Modules with a pre-prepared floor on which the final surface layer of flooring can be created and delivered directly to the investment site; the use of polished concrete floors is also possible, the execution of which is technologically facilitated.

- it is possible to use other solutions with which to reduce the object's construction costs by eliminating the need to lay top layers and mask the construction materials used, especially in cases where the visibility of construction materials provides an interior design element.

Re. 10. ATTEMPTING AT THE DESIGN OF 4-STOREY FACILITIES

This solution accounts for the most effective use of space; it leads to a proportional reduction in the costs incurred by such factors as ground surface, foundation plate, and roof per 1m2 of the obtained area. At the same time, this system does not require the use of elevators.

Re. 11. ELIMINATION/APPLICATION OF BASEMENTS, FOUNDATION PLATE

The erection of both basements and foundations requires in each case a geological examination of the soil, as it is necessary to adjust the foundation structure to the parameters of the soil on which the building will be placed. Although it may seem otherwise, buildings made in Q-module® technology are lighter than those constructed with the use of the majority of traditional construction technologies.

The erection of basements always generates significant investment costs. The Q-module® technology enables the use of basement modules of improved structural parameters. In particular, the Q-Modules are equipped with thicker walls that can carry the weight of the upper floors, but also to withstand the pressure exerted on the walls of the recessed building by the soil and water (it gives the possibility to eliminate the need to use retaining walls in some cases).

For objects with no basement, an insulated foundation plate has been adopted as the recommended (the cheapest and fastest) solution. However, this does not refer to the particular conditions, usually specific to a given location. All foundation technologies used on the market, such as continuous footings, prefabricated foundational footings, piles, etc., are applicable.

Re. 12. CARE FOR EFFECTIVE SURFACE ARRANGEMENT AND ROOM LAYOUT

This factor depends mainly on the architect and results from the architecture and planned function of the facility. The technology sometimes allows significant design freedom, with account to zoning and distribution of functional spaces, energy efficiency in the context of the freedom to arrange windows and doors. It is possible to arrange balconies and loggias, as well as to implement a variety of arrangements and adapt to changing needs

To conclude, while using cheap construction, it is worth sparing extra costs on a proper architectural design, which should be well-conceived in many aspects and is only apparently simple.

Re. 13. APPLICATION OF HEATING AND COOLING SYSTEMS THAT PROVIDE CHEAP AND INDEPENDENT AND PRO-ECOLOGICAL ENERGY SOURCE; HEAT ACCUMULATION

As part of the Modular Construction Cluster, the recommended solution was developed, based on:

- An air-to-water heat pump. It should be installed, if possible, on the facility's roof, which ensures the ability to effectively produce both heat in the winter and the so-called ice water in the summer.

- A photovoltaic panel system to power the heat pump. It should be installed, if possible, on the facility's roof. Its use significantly contributes to the reduction of hot water production costs and to eliminating electricity costs in relation to the production of cooled-down water in the summer.

- The system of the so-called "dry" heating and cooling panels embedded in the modules' walls during the prefabrication process. This solution distributes heat through the surface of the walls in the winter to heat the room, whereas in the summer it cools the room by absorbing heat from the air (walls as a radiator or cooler). The thermal stabilization of the building inside is significantly increased by the accumulative property of structural concrete.

Attention! As confirmed by tests and practice, the amount of water in the heating and cooling system is only 3.2 liters per module whose usable area equals 22m2!

Re. 14. HYBRID VENTILATION (GRAVITY AND MECHANICAL VENTILATION COMBINED WITH RECUPERATION

As part of the Modular Construction Cluster, a solution was developed that uses gravity vent ducts in kitchens and possibly in toilets, with the simultaneous use of Prana 150 and Prana 200 recuperators in a distributed system (without ducts) (www.ecoventeam.com).

Assuming the tightness of ventilated apartments, the amount of air discharged through gravity vent ducts is regulated by the operation intensity of the wall recuperator which simultaneously introduces fresh air into the room and removes used air, creating a slight (7%) overpressure, regardless of the operation intensity (mode). This solution is economically effective in terms of acquisition costs as well as operating costs; it eliminates the costs of maintaining recuperative ducts (no ducts in this solution) and enables maintenance of the exchanger by users themselves.

Re. 15. FLAT ROOFS AS A TECHNICAL AND/OR RECREATIONAL AREA

It has been proven that flat roofs significantly reduce construction costs. Unfortunately, not everywhere in Poland does Plan Zagospodarowania Przestrzennego [the Spatial Development Plan] allow for the implementation of such a roof. A flat roof is a perfect location for photovoltaic, heating, air conditioning, and ventilation devices to be installed; alternatively, it can simply function as a recreational area, a place of integration, or a green (biologically active) roof. In some situations, the use of a biologically active surface on the roof may exert a positive effect on the development intensity index. Flat roofs implemented based on the Q-Moduł® structure do not require snow removal even during heavy snowfall (except for zone V).

Re. 16. WORK ORGANIZATION

Work organization is a cost-generating element with a very significant impact on the final price of the facilities; it almost entirely depends on the management and organization of production. In the developed production model, a brigade system with flow production processes was used.

Re. 17. COST-EFFICIENT FINANCING OF INVESTMENTS

In the Q-module® technology, facilities can be financed both based on leasing and bank mortgage loans. In such situations, the following factors may be decisive: the technical method of the object's erection (as a portable or stationary structure) and the descriptions contained in the documentation. Obtaining financing by the Investor requires coordination of activities also on the part of the producer. Thus, it is advisable not to delay the proper planning of activities and inform the producer about the adopted strategy.

Regardless of the financing form, the manufacturer assumes advance payment and staging of the investment.

Re. 18. DISASSEMBLY/EXIT COSTS

Spectacular demolition of reinforced concrete buildings with dynamite is oftentimes shown on TV. This only proves reinforced concrete is a durable material and showcases difficulties in its disassembly. Some objects have been present for so long that they no longer fulfill their functions, perhaps they disfigure the landscape, which makes it necessary to demolish them. Equally often, relocations of light-frame construction buildings which have been simply sold to another owner and are being transferred in their entirety are shown on TV.

Despite the fact that the Q-module® technology is made of reinforced concrete, it is possible to disassemble and move the building to another location in the future. Most likely, this task will be technically easier than relocating a wooden building. In this situation, it is easy to imagine the possibility of selling and dismantling a building that we simply do not need in a given location. Therefore, in the future, it will be easy to sell the structure after it has been used or simply give it away, even free of charge, in return for cleaning the site

THE Q-MODULE® FOR ADMINISTRATION AND LOCAL GOVERNMENTS

The Q-Module® modules differ in terms of features from other modular technologies available on the market; this technology stands between traditional construction and usually light, mobile modular construction.

Exceptional durability resulting from the use of reinforced concrete technology,

comparable to that in the case of traditional construction technologies;

Relatively easy mobility and possibility to relocate buildings despite relatively high masses;

The comfort of use (including soundproofing and rigidity) is similar to that of traditional construction. It results from the use of reinforced concrete and solutions with relatively high deadweight loads;

High parameters of fire resistance, resistance to extraordinary loads, and acts of

vandalism.

In construction and construction environments, it is assumed that the durability of reinforced concrete is no less than 100 years. In the course of research and development works, a hybrid structure with a special connection system was developed. It provides solutions with high design parameters that enable investments in the Q-Moduł® technology to be implemented also in areas with a high degree of seismic risk.

The mobility of solutions and the possibility of buildings' relocation results from the objects' cubic layout, which enables easy and quick disassembly and transport using conventional means of transport. Disassembly and reassembly of a multi-family building in a new location may only take days. This solution makes it possible, for example, to build a city marketplace in order to later sell or migrate the facility to a new place once it has been used for many years, as well as to devote it to a different purpose at a new location.

The comfort of use is largely ensured by the weight of prefabricated elements, although it is sometimes wrongly perceived as a disadvantage of the solution. The deadweight load results in both the durability and rigidity of the structure. The appropriate thickness of reinforced concrete ceilings and walls allows for a high degree of soundproofing parameters.

Fire resistance is typical, as for all reinforced concrete solutions. For the same reason, the modules are largely resistant to acts of vandalism and extraordinary loads (hurricanes, explosions, etc.).

SPECIFICITY OF SOCIAL AND MUNICIPAL BUILDINGS, POSSIBILITIES OF APPLICATION OF THE Q-MODULE TECHNOLOGY ®

Social amenities and municipal housing, regardless of the country where it is implemented, have

common features in the form of expectations:

1. low price of the implemented construction investment;

2. high degree of the objects' durability;

3. the speed at which it is erected;

4. resistance of applied solutions to vandalism;

5. the speed at which the investment is implemented and reaction speed in the event of sudden and unexpected events, such as natural disasters, warfare, etc.

6. possibilities of public engagement in the construction processes (interested parties for whom the construction is implemented);

7. appropriate comfort of living, as close as possible to the one offered by traditional construction technologies (striving to build social amenity buildings that do not differ from facilities inhabited by other social groups).

8. slight losses in case it is needed to demolish social amenity buildings with regards to the development of a metropolis (social amenity buildings, once erected on the city outskirts, may with time hinder urban development if they become facilities located in centers of districts).

9. freedom to design objects with interesting architecture, adapted to local conditions.

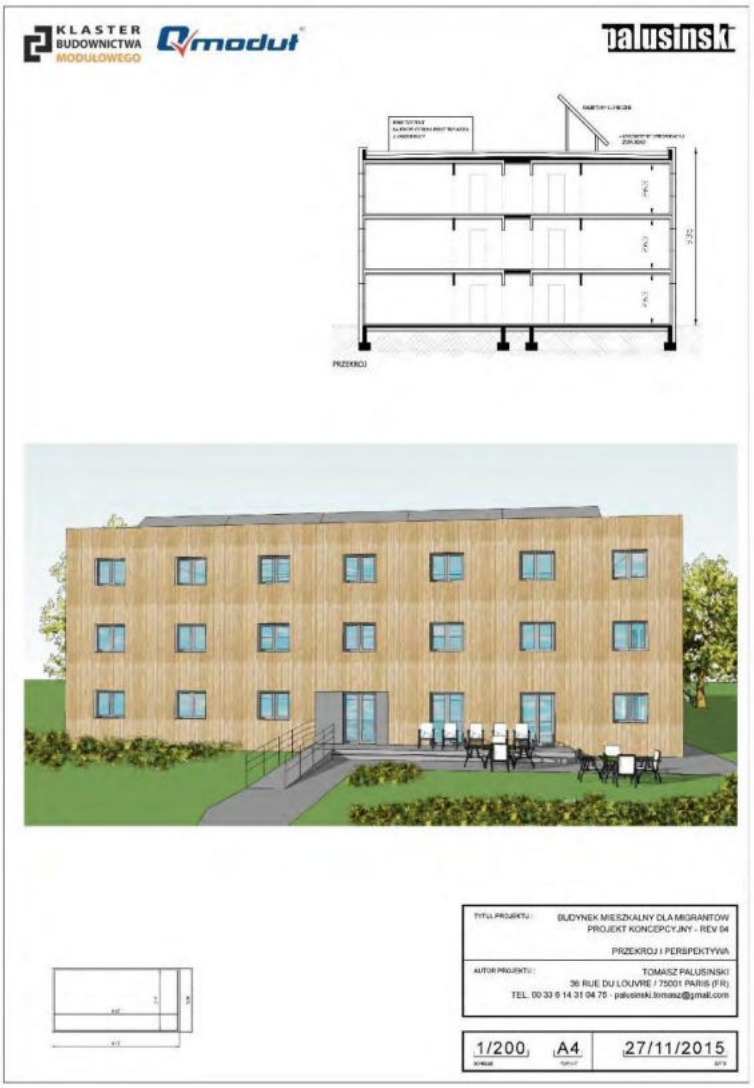
The Q-Moduł® technology is a solution that perfectly meets the above parameters.

- The possibility of social engagement in construction processes is limited to the possibility of social factor participation in finishing works (implementation of finishing works from the building shell and core condition or raw development to "turnkey" condition).
- The comfort of living in Q-Moduł® buildings practically does not differ from the comfort typical for prefabricated buildings and does not differ much from buildings erected in the traditional technology.
- The speed of the investment implementation results directly from the technological production cycle, which makes it possible to obtain, on average, 1 Q-Module® module of residential unit per day with relatively little personnel involvement. It is also possible to produce to stock.
- Particularly low loss resulting from the need to demolish buildings related to metropolis development. This is due to the possibility of implementing the investment, with the account to their long-term, but temporary nature. Objects built in the Q-Module® technology can be successfully relocated, after many years of use, together with their foundation. Losses resulting from relocation result only from the costs of disassembly, transport, and reassembly at a new location.
- The Q-Module® technology enables significant design freedom and obtaining a modern or traditional, attractive design. It depends on the mutual arrangement of the modules within the building's body and the materials used. The Q-Module® technology also enables an easy arrangement of the so-called green inverted roofs, which create biologically active surfaces in place of classic and expensive roofing. This solution is seen as modern and practical, giving the buildings additional functionality, and also ecological (a significant reduction occurs with regards to draining rainwater, as it largely evaporates, similarly to the natural cycle).

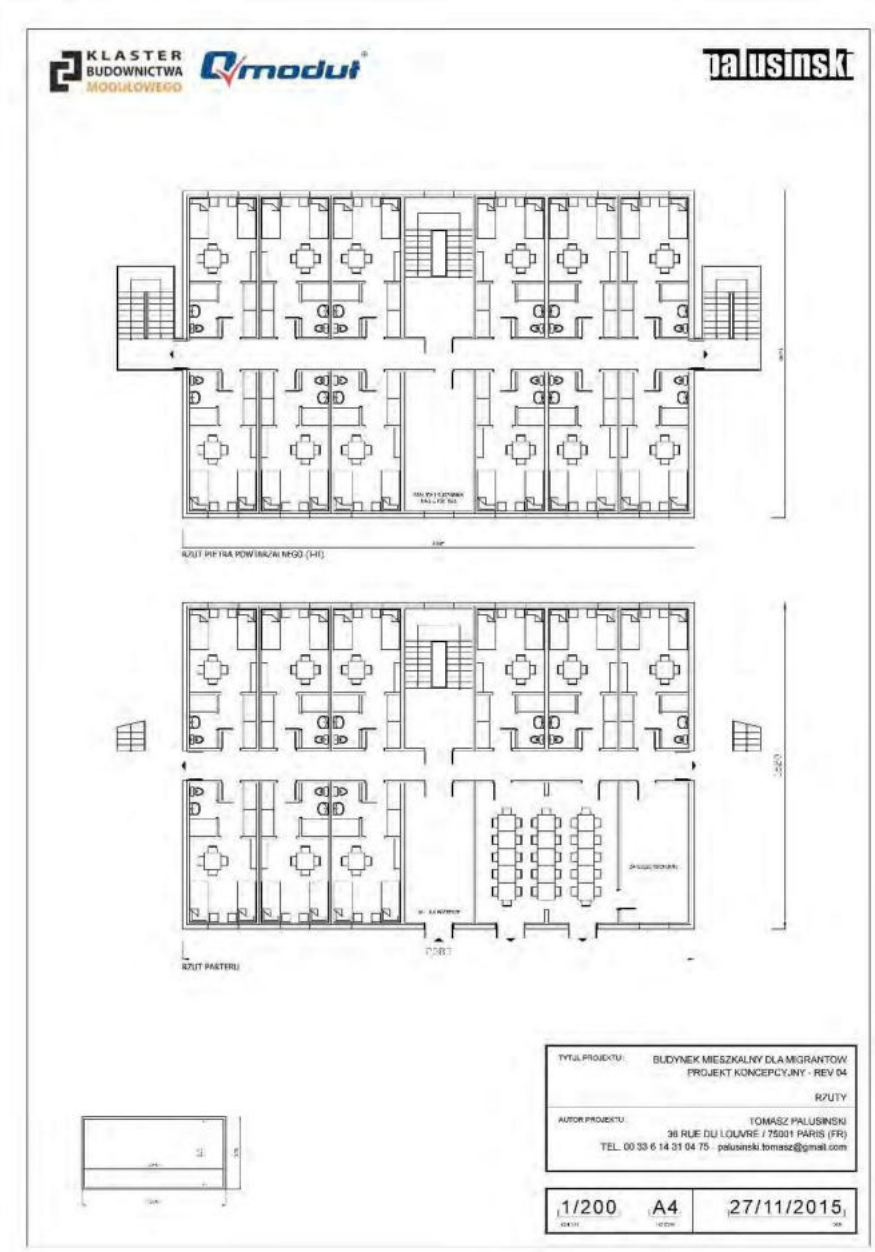
A FACILITY FOR IMMIGRANTS, A DORMITORY, A SOCIAL AMENITY BUILDING

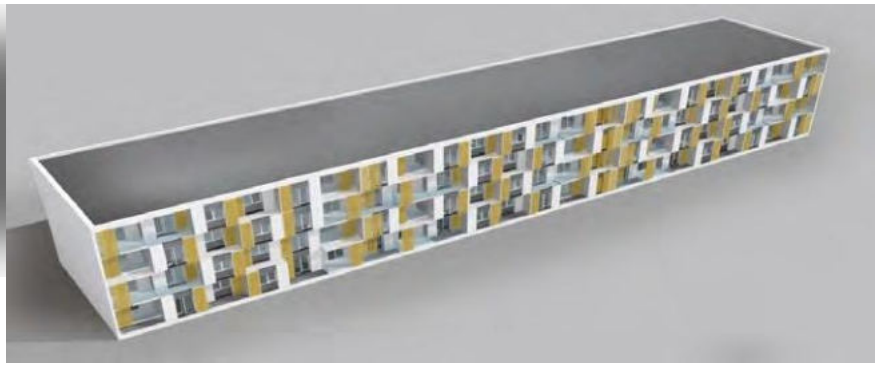
An example of a facility for immigrants/dormitory/social amenity building in a three-story layout. A production capacity of 100 modules per month can be achieved within 2 months. In practice, this means the possibility of producing at least 1 building per month (after proper preparation).

Figure 3 Three storeys, projection and visualization



In practice, a four-storey building layout seems to be the optimal solution, due to the better use of space and the lowest cost per square meter of the building's surface.





A simple and functional solid assumes a modular repeatable structure, where modules of the same dimensions perform the following functions:

1. 3 or 4-person mini apartments equipped with a bathroom and a room with a kitchenette,
2. 5 or 6-person two-module or larger apartments (for larger families) that are obtained by the arrangement of combined modules
3. Staircase modules equipped with prefabricated concrete or steel stairs,
4. Technological modules and common-use modules as laundry/drying room, boiler room, room for prams, administration rooms, etc.

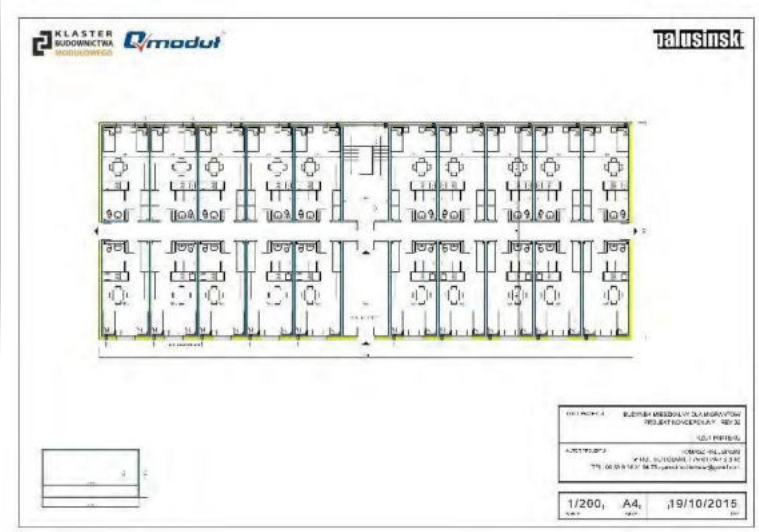


Figure 4 Immigrant House/dormitory/ social amenity building - ground floor

The need to introduce fast, mass-produced, and cost-efficient technology determines the 4-storey layout of the building with a staircase in the central part, with two rows of modules separated by a corridor in each direction.

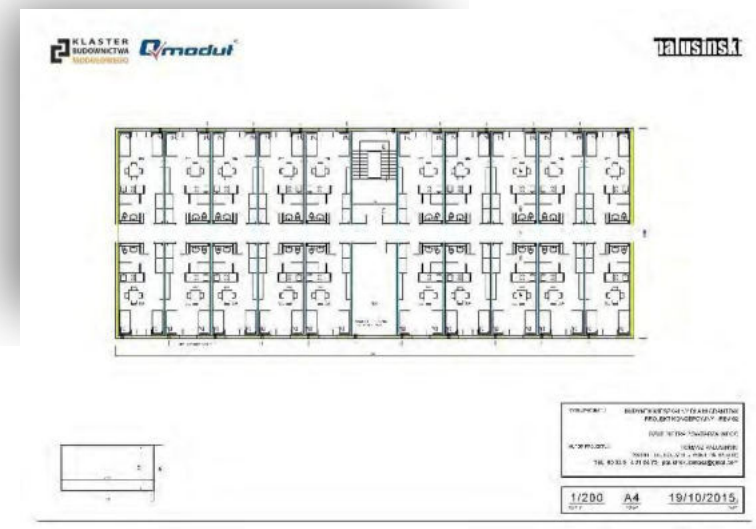


Figure 5 Immigrant House/dormitory/social building - 2nd-4th floor.

Storeys II-IV structured in a repeatable layout.

The Q-Module® as an apartment (accommodation) for 3 or 4 people: Each module is provided with a fully equipped bathroom; a kitchenette room enables the preparation of meals (electric induction cooker). A gravity-mechanical extractor hood is installed above the cooktop. A fridge is provided under the kitchen countertop. By the kitchenette, a table for 4 people is provided, together with a modest wall unit where a TV can be installed and 2 bunk beds. Wardrobes are placed in the corridor. Near the window, there is a recuperator to ensure air recuperation. Tilt-and-turn, double-glazed, five-chamber plastic window, without the possibility of full opening, is installed. The usable area of one module is about 25m2.

All installations are embedded in reinforced concrete walls. The heating system used in winter serves also as a cooling system in summer, it is integrated with the central air-to-water heat pump installed on the technical roof surface. On the roof, photovoltaic cells are installed to support the operation of the pump.

On the first floor, opposite the stairs, there is a common laundry room of 25m2 area (several washing machines/dryers). On each floor, the residents of a given floor are provided with a drying room for laundry. One of these rooms can also be used as an administrative facility, or for other purposes.

20 residential modules on each floor and 2 technical modules (staircase and drying room), 22 modules in total are implemented on each storey. The layout offers the possibility of accommodating up to 80 residents on one floor and 320 residents in the building in total. Heating-cooling and recuperation systems will ensure adequate comfort. The reinforced concrete construction of the Q-Module® ensures both a high level of fire safety, resistance to vandalism, and safety of storing personal belongings. Moreover, adequate soundproofing of the partitions is ensured, whose degree in this respect exceeds the standards offered in modular frame structures.

The number of modules used: 88 pcs. The living area (excluding staircases and corridors) is about 2000m2.

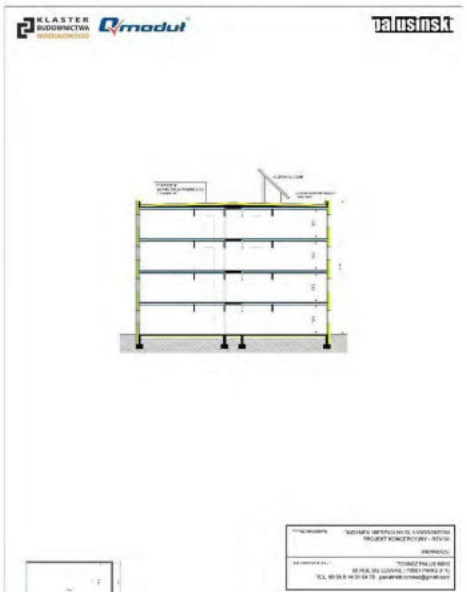
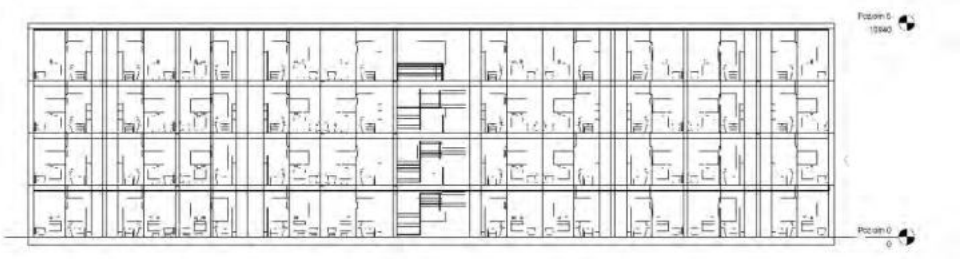


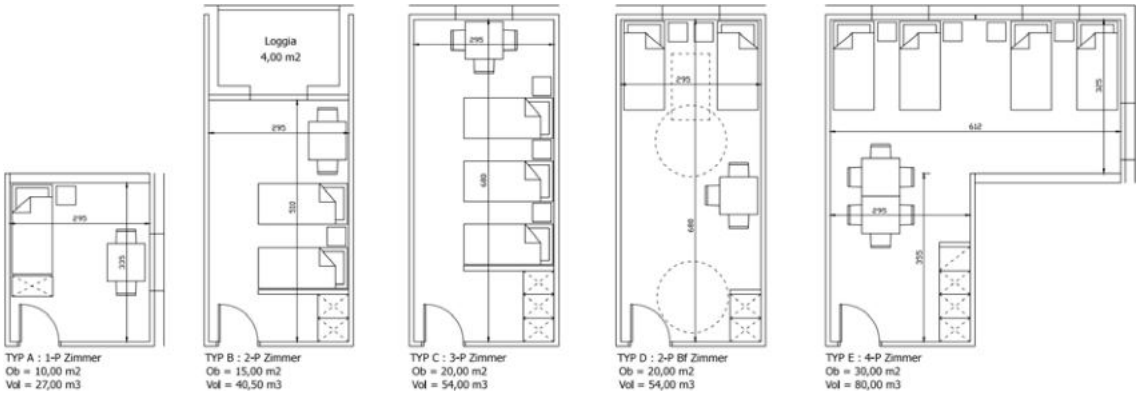
Figure 6 5 Immigrant House/dormitory/social building -cross- section.

The height of the storey inside is 2750mm, with the possibility of adapting it to the Investor's needs. A multi-layer insulated flat roof is implemented. No need arises to remove snow in winter, even during heavy snowfall. On the roof, it is possible to install a central air-water pump together with the infrastructure thereof.

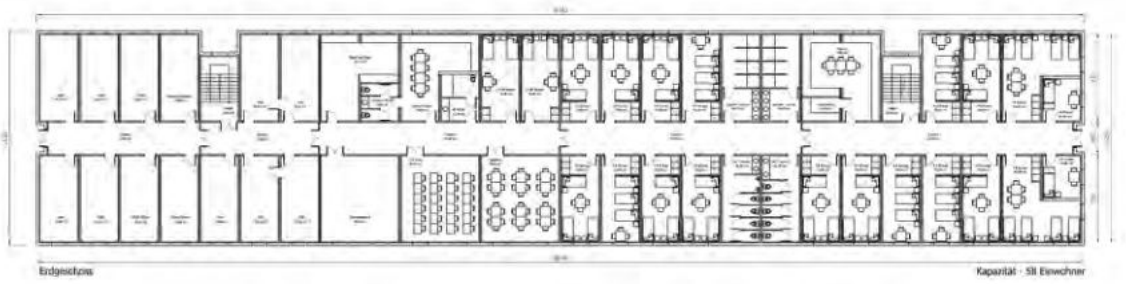


FACILITY FOR HOMELESS/NIGHT SHELTER

The facility is designed for a maximum of 250 people, in a three-story layout. The design assumption adopts an extended common infrastructure, e.g., with. toilets/water closets, with separate zones for men and women, a common kitchenette area for collective catering, a common room, a staff room, and technical rooms. One of the project assumptions was also the use of electric heating, with the highest possible thermal insulation and energy recovery/ acquisition.



In addition to common areas and administration rooms, the facility consists of 5 residential units of various sizes, some of which are also adapted to the needs of the motor-impaired.



The amount of modules used for each floor: 52 pcs. Modules with a width of 315 cm were used in the concept due to the intended transport of the prefabricated elements by rail.

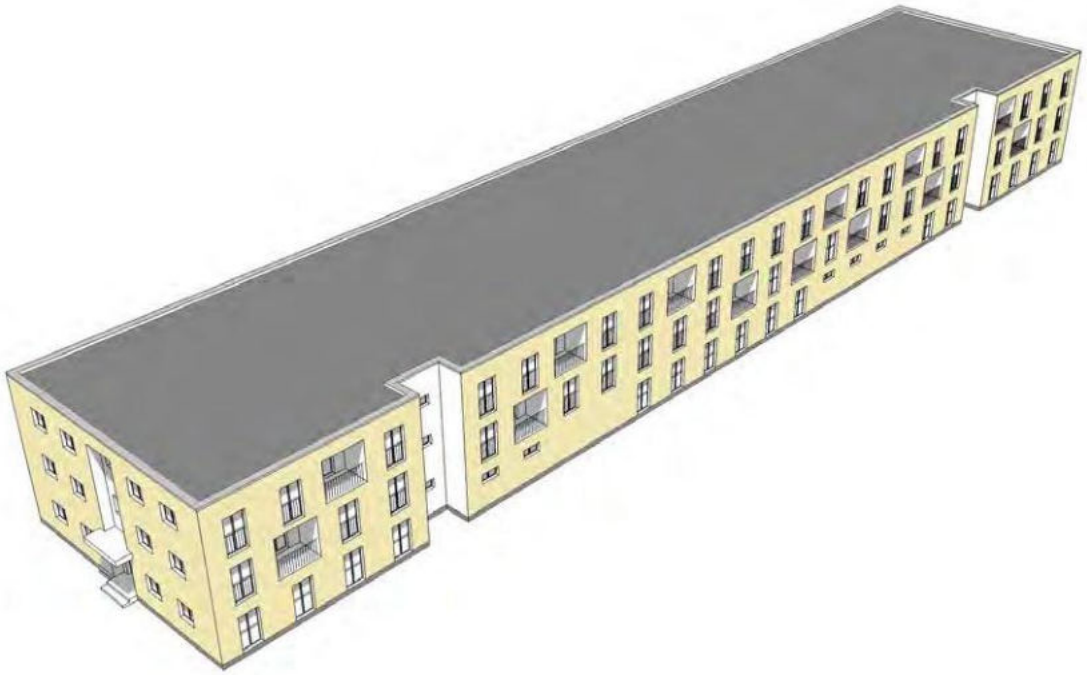
MUNICIPAL BUILDING/RESIDENTIAL BLOCK OF FLATS

An initial design concept of a municipal building.

In the design concept, the use of heating panels embedded in the walls with a power supply through a water system (the possibility of using gas, oil, and other sources of energy) is assumed, together with electric induction furnaces arranged in a cascade layout. Moreover, hybrid–gravity vent ducts and the Prana distributed recuperators were also used for ventilation.

A flat, load-bearing roof enables the implementation of photovoltaic installations in the future, which significantly contributes to the reduction of the facility’s operating costs

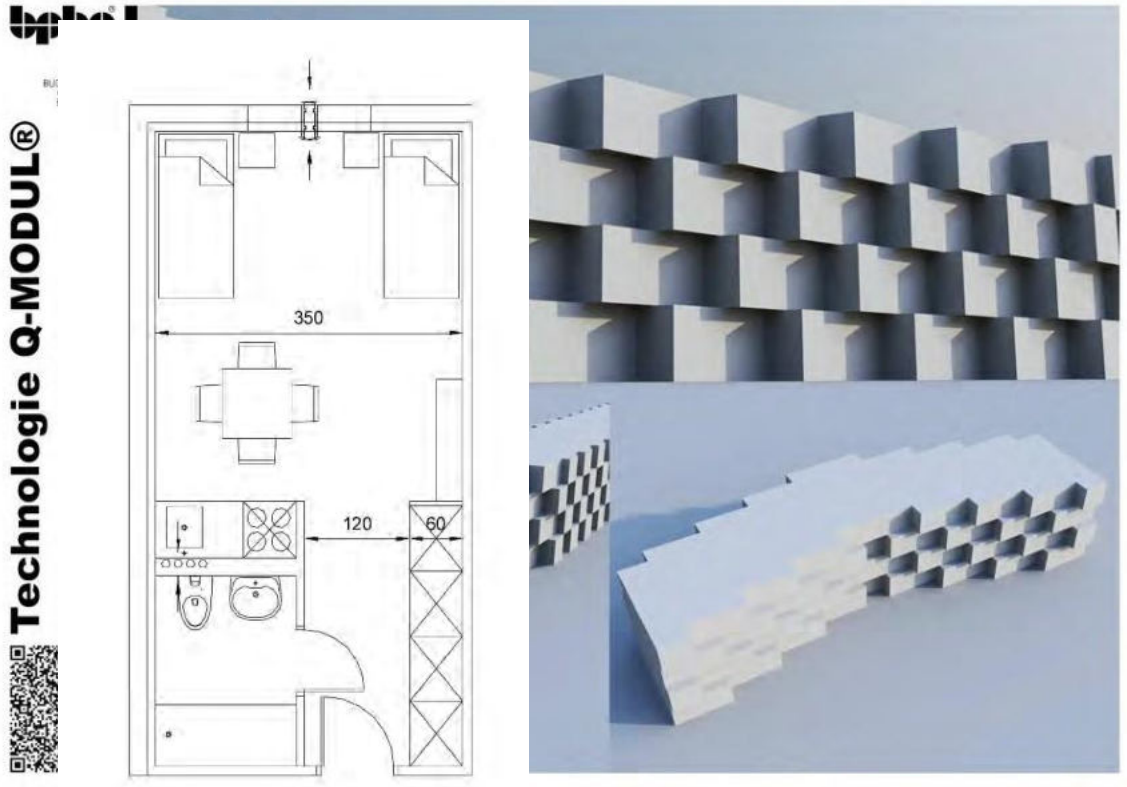
An initial concept developed in response to an inquiry from the ARLD administration.

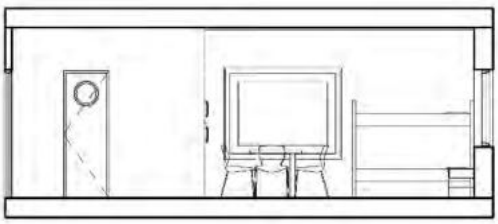


Technologie Q-MODUL®
Construction de modules habitables préfabriqués en béton

Technologie Q-MODUL®
Construction de modules habitables préfabriqués en béton

ROOM LAYOUT DEPENDING ON THE OBJECT’S PURPOSE

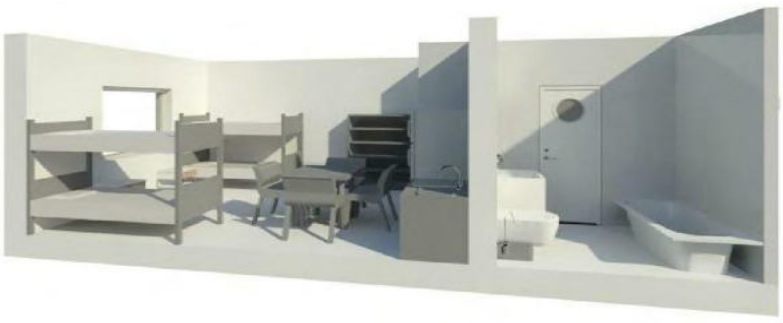




The least demanding arrangement of the module layout is one with no toilet or a kitchenette. The Q-Module® designed for immigrants or as a dormitory/social amenity building can consist of a room equipped with an air recuperation system, 2 double beds, a table with chairs, a kitchenette (sink, 4-ring kitchen, a fridge under the kitchen countertop, basic cupboards and kitchen equipment), a corridor with wardrobes, a bathroom with a shower or a bathtub, a washbasin, and a toilet. By combining three modules (two along and one across), a common kitchen for two residential modules equipped with separate toilets can be arranged.

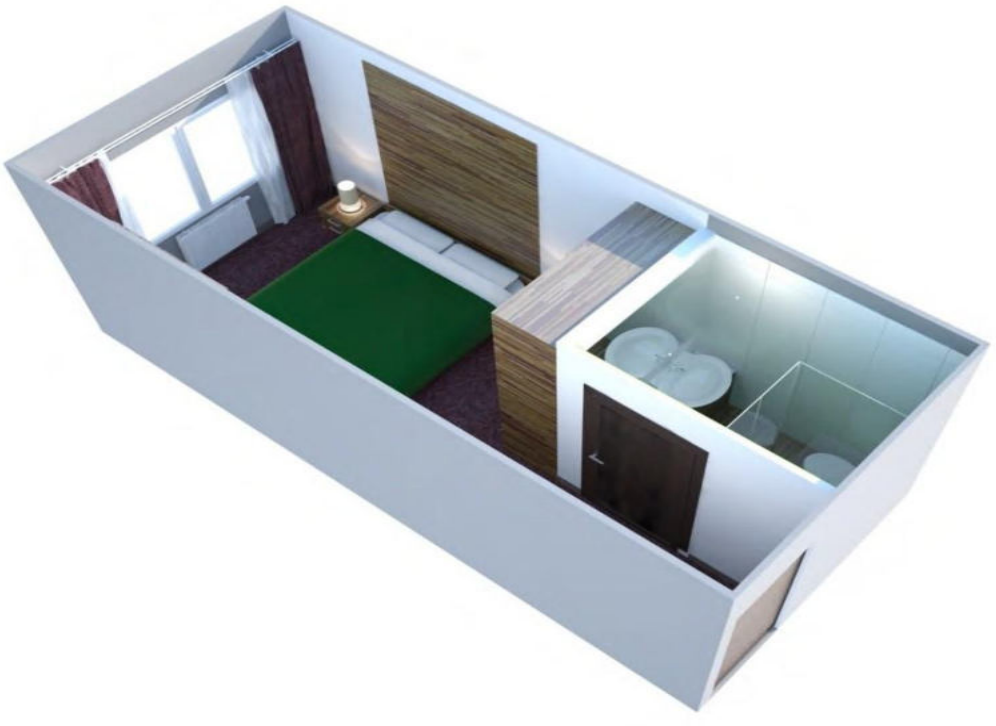
If additional requirements with regards to surface per inhabitant occur, the planned layout of rooms can be redesigned.

An exemplary arrangement of an Immigrant House/dormitory/social amenity building may assume specific standards to be achieved with minimized expenditures while maintaining the durability and functionality of the solutions.



Regardless, after many years of use, it is possible to change the facility's use and its layout, e.g., from a facility for immigrants to hotel room.

The rooms in this layout were arranged in order to confirm the practical applicability of the technology in business. Facilities built in this technology were built in Raszyn as Studio 1, and Studio 2 and are rented in the popular Airbnb apartment rental system. The feedback they obtain is highly positive.



CARE FACILITY FOR THE ELDERLY

The presented materials concerning an exemplary care home for the elderly are available on the Internet at:
http://www.arcspace.com/features/aires-mateus-e-associados/houses-for-elderly-people-in-alcacer-do-sal/

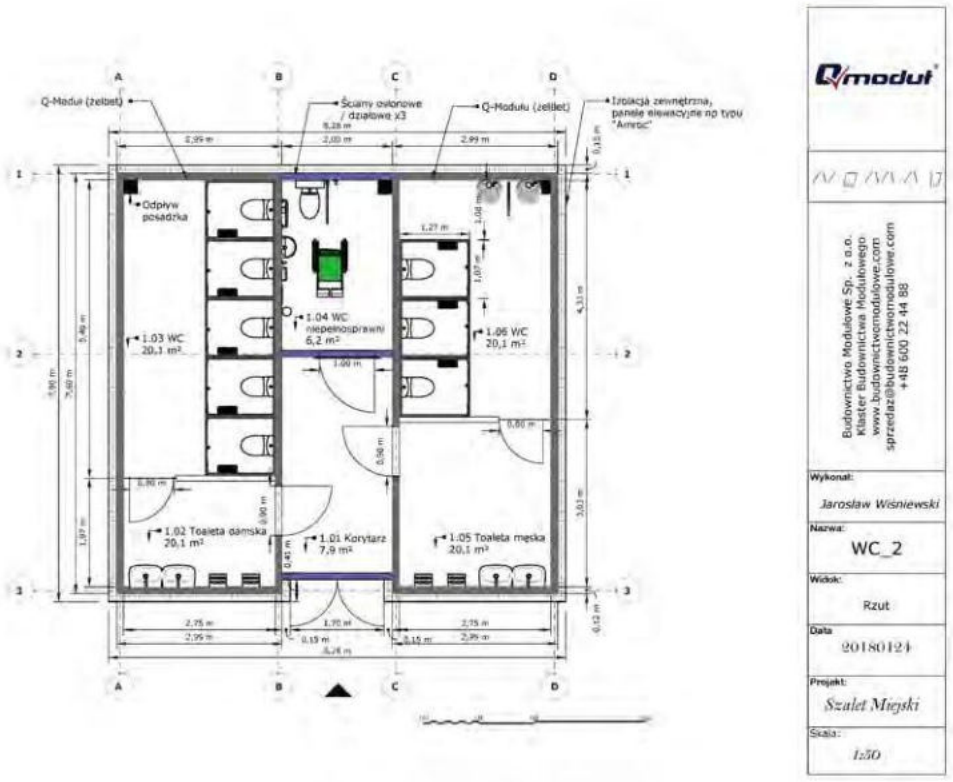
The Q-Module® modules enable the construction of both classic and modern, cubic architecture objects.

The way the modules are created together with their integrated floor which can act as a ceiling for the lower storey, enables effective management of the facility's space and surface.

The application of the Q-Module® prefabrication technology enables the construction of this type of object much faster and cheaper, as compared to traditional technologies.

Jarosław Wiśniewski©, +48 600 22 44 88, sprzedaz@budownictwomodulowe.com

PUBLIC RESTROOM



It is a simple facility consisting of 2 modules, whose central part is arranged as a corridor with a toilet for the disabled.

Inside, it is possible to plan any given layout, including the exposure of architectural concrete.

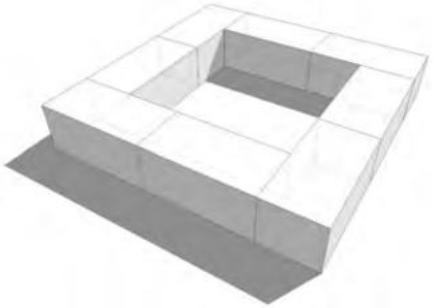
GROUND-FLOOR FACILITIES AND OTHER APPLICATIONS the Q-MODULE® FOR ADMINISTRATION AND LOCAL GOVERNMENTS

The Q-Module® technology offers nearly unlimited investment possibilities, determined only by the imagination of architects and investors. It can be successfully used to erect objects such as:

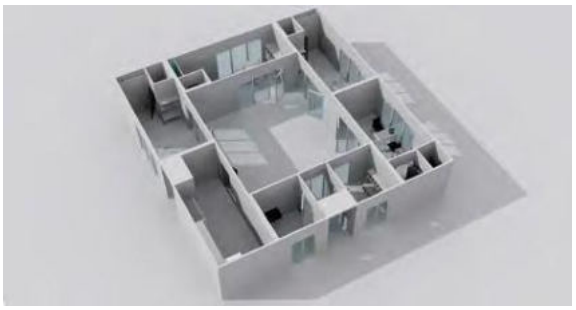
- care homes and, in general, facilities for the elderly;
- public administration office buildings;
- common rooms, community centers;
- schools, kindergartens, nurseries;
- fire stations, storage, technical rooms;
- municipal/city guard and police station facilities, courts, prisons;
- national defense-related facilities.

Particularly in relation to single-story buildings, the use of the Q-Module® technology offers a wide range of design possibilities and advantageous room layouts.

The use of modules in a square or rectangular perimeter layout allows for:



- the use of a lightweight skeletal roof structure with roof windows and sidelights;
- any arrangement of rooms inside the facility with the use of prefabricated panels, stud walls (e.g., G-K), brick walls in traditional technologies, or other solutions - with the possibility of use as a kindergarten, office, fire station, community center, clinic, etc.;
- a high degree of acoustic insulation, both outside and inside the building;
- fast implementation and low costs per 1 m2 of final space.



THE Q-MODULE® IN BUSINESS

The mobility and durability of solutions provide business with the possibility to adopt a novel approach to investments in properties they do not own themselves. So far, erecting a facility on leased land was associated with the need to purchase the property in the future or eventually lose the facility.

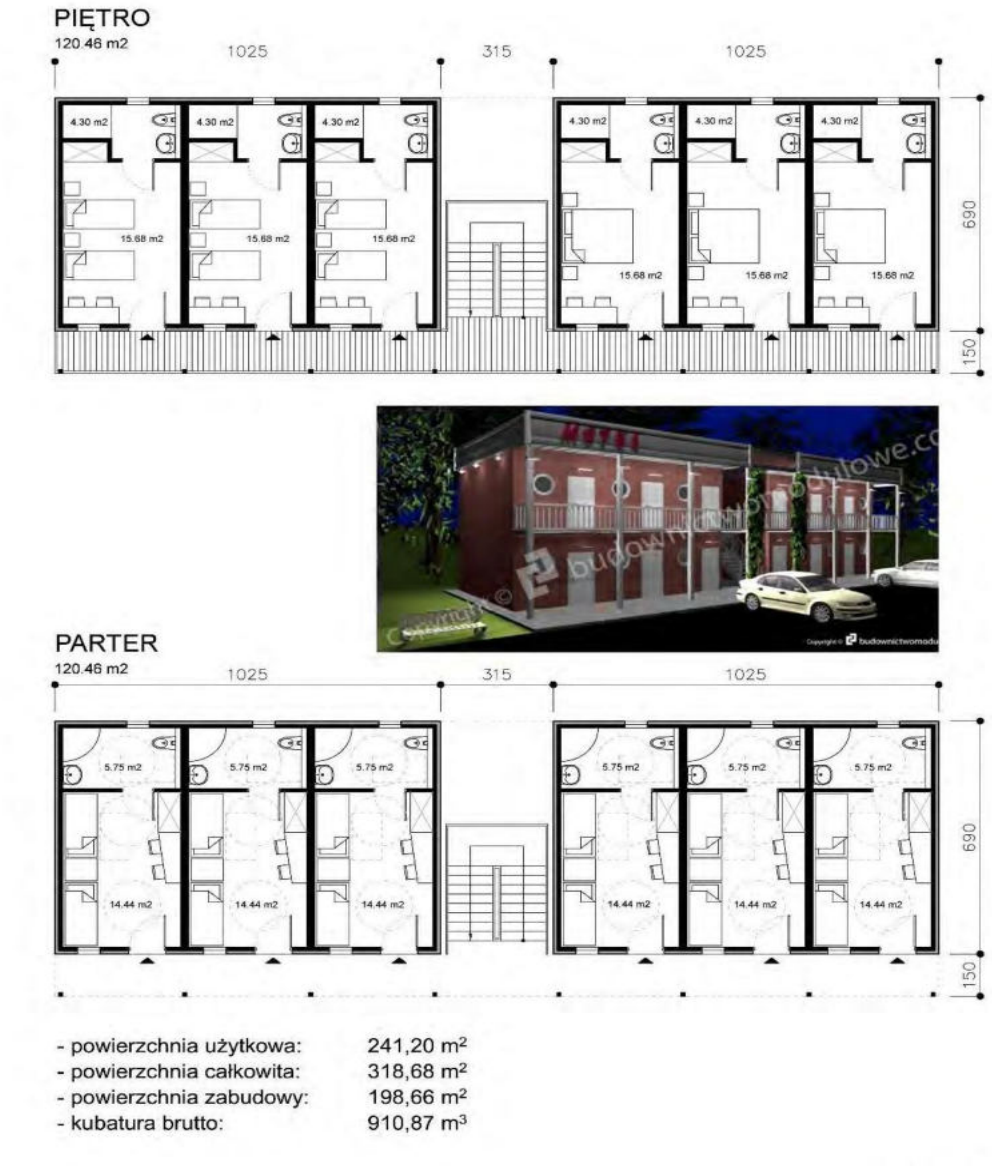
Using the Q-Moduł® technology, we offer the solution to build on someone else's land, which may eliminate the cost-related barrier to entering a new business. High costs usually result from the need to purchase land, which is usually expensive as it should be well located, especially for business purposes.

This approach is best reflected in the concept of erecting a chain of motels for motorists in the vicinity of petrol stations. By means of a notarial lease of a small plot of land nearby a petrol station for a certain period, for instance, for 10 years, makes it possible to build a motel and achieve business goals during this period. The solution will trigger the need to incur additional costs in the form of rent, but it does eliminate the initial barrier, i.e., the need to invest a significant amount of money to purchase land or manage the costs of external financing.

The features of Q-Moduł® such as durability, resistance to vandalism, soundproofing, fire resistance, and resistance to extraordinary loads are also vital in terms of business purposes.

MOTEL 12

A ready-made architectural and construction project is available on the www.budownictwomodulowe.com website. The project is provided with a set of documents sufficient to submit an application for a building permit/construction notification. However, the documents are not adapted to the individual conditions of the construction law on a given investment site, the foundation of the building in relation to the plot dimensions, or to an investor's individual expectations. Adjusting the documentation requires an additional order for the execution of an architectural concept with an estimate.



- powierzchnia użytkowa: 241,20 m²
- powierzchnia całkowita: 318,68 m²
- powierzchnia zabudowy: 198,66 m²
- kubatura brutto: 910,87 m³

MOTEL 12

Above, we present the finished architectural design of a motel. The project assumes the use of Q-Moduł® in a two-story layout. Common areas such as the lobby or reception were excluded, assuming the facility to be of self-service functionality, as well as owing to the proximity of a petrol station. The possibility to arrange technical or recreational space was assumed on the roof.

The facility can be built on rented land, potentially dismantled, and transported to a new location.

At the investor's request, it is of course possible to develop a similar structure with a larger or smaller number of modules and areas, with the possibility of other applications.

HOTEL 16

Below, we present the ready-made architectural design of a hotel. More information can be found at www.budownictwomodulowe.com.

The ready-made architectural and construction design is provided with a set of documents sufficient to submit an application for a building permit/construction notification.

However, it is not adapted to the individual area' conditions of the construction law, the foundation of the building in relation to the dimension of a given plot, and the investor's individual expectations. Adjusting the documentation requires an additional order for the execution of an architectural concept with an estimate.

At the investor's request, it is of course possible to develop similar structures, using a larger or smaller number of modules and adopting their areas to make other applications possible.

Usable area 1264,56m2
Total area 1435,03m2
Development area 660,60m2
Gross building
cubature4352,98m2

ROB VI CAR WORKSHOP

The ready-made architectural and construction design is provided with a set of documents sufficient to apply for a building permit. However, the design is not adapted to the individual construction law conditions on a given investment site, the foundation of the building in relation to a given plot, or to the investor's individual expectations. Adjusting the documentation requires an additional order for the execution of an architectural concept with an estimate.

ROB VI is an excellent idea for business implementation; it eliminates a significant initial cost in the form of the need to purchase an investment site. The solution can be fully portable. The facility consists of 6 Q-Module® modules adapted to the function performed within the facility, and a repair hall erected with the use of light-frame construction technology, which can be modified to a tent form or other technology.

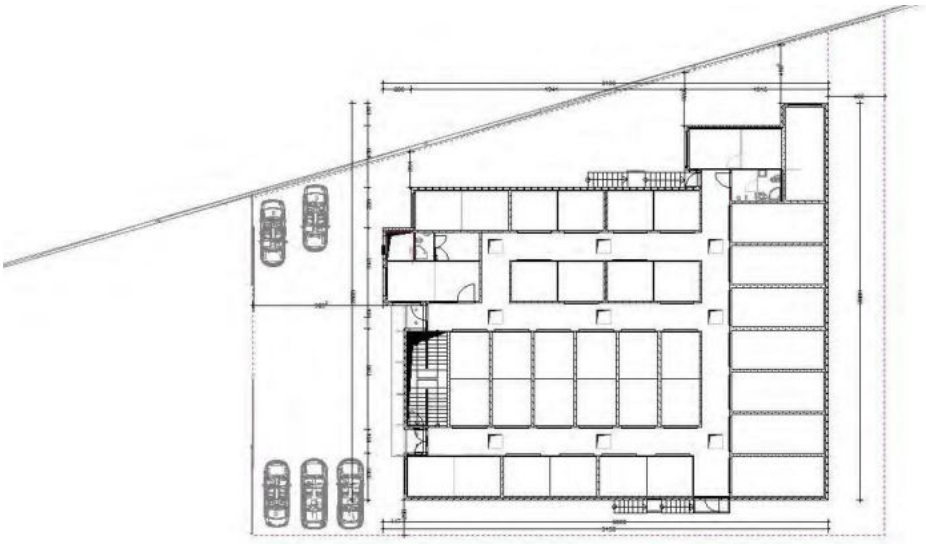
At the investor's request, we can design similar structures with a larger and smaller number of modules and workspace areas, potentially with other applications than the car repair workshop.

Building width: 16,12m
Building length: 21,96m
Building height (from the ground level in front of the entrance)
5,25m Development area: 347,90m2
Total area: 347,90m2
Usable area: 284,97m2
Gross building cubature:
1543,64m3

SELF-STORAGE WAREHOUSES

For storage purposes, the load-bearing capacity of the ceilings reaches 10kN per a m2.

The warehouse service module with an area of 18.5 m2 to 25 m2 may be combined with other modules in order to create an open space or to arrange storage and office spaces. For the arrangement of a fully functional self-storage building, the space must be equipped with toilet modules, as well as elevators and stairs.



OFFICE/SHOP

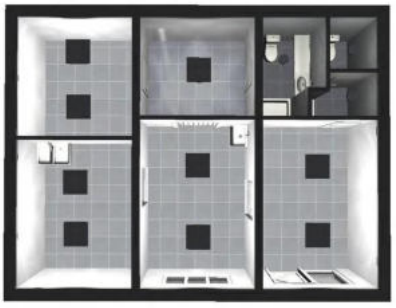
Here is an exemplary layout using the Q-Module® for the purpose of an office building/possibly a shop (following minor modifications). The visualization shows three connected modules, which can of course be expanded by adding additional modules to create a larger usable area. Thus, it is possible to create unique solutions tailored to individual needs. This facility can expand together with the company.

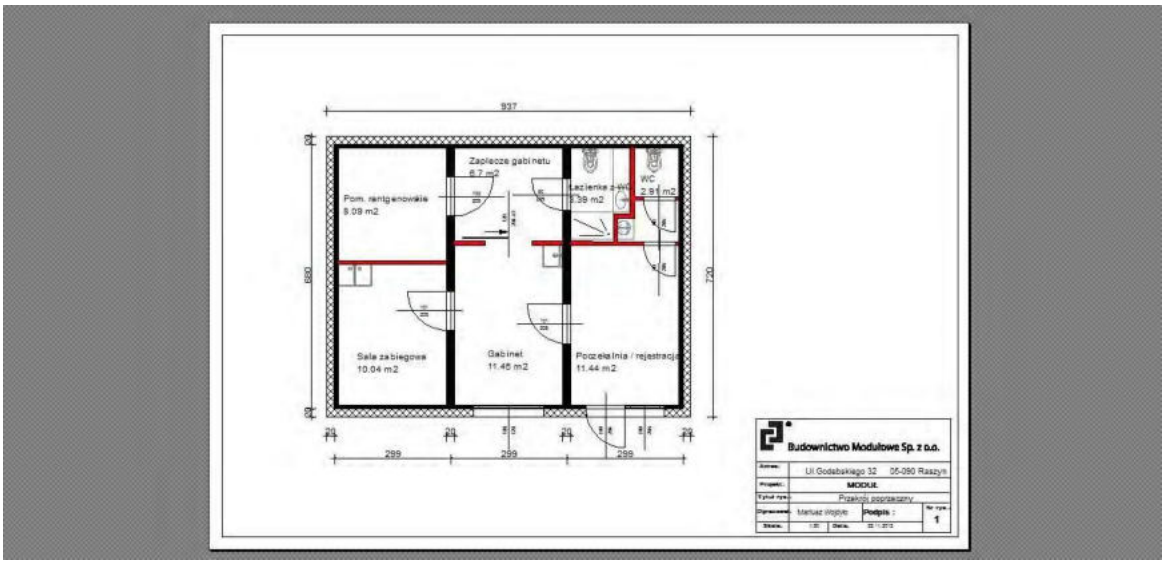
The ready-made architectural and construction design is provided with a set of documents sufficient to apply for a building permit. However, it is not adapted to the individual construction law conditions on a given investment site, the foundation of the building in relation to the plot dimensions, or the investor’s individual expectations of the investor. Adjusting the documentation requires an additional order for the execution of an architectural concept with an estimate.

Building width: 7,84m
Building length: 11,50m
Building height (from the ground level in front of the entrance): 4,40m
Development area: 90,16m2
Usable area: 75,38m2
Total area: 90,16m2
Building cubature: 396,70m
Flat green roof.

MEDICAL CLINIC

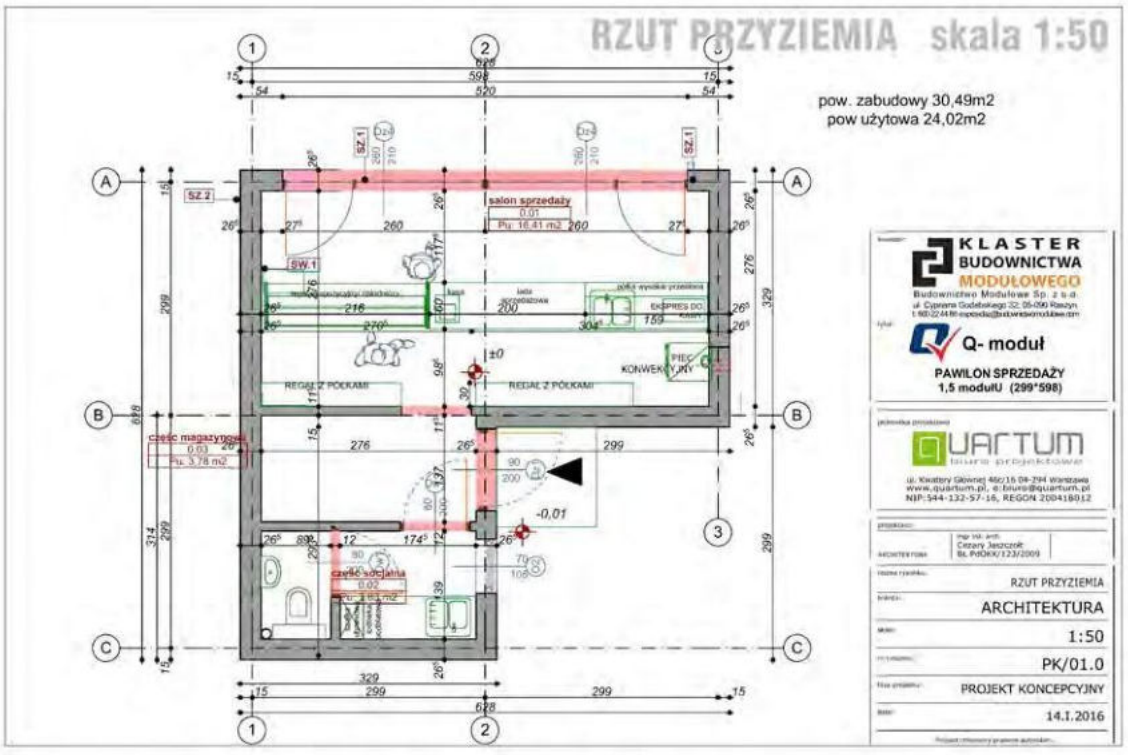
Any layout and arrangement of the rooms is possible, with account to the facility's planned function. The manufacturer installs a hybrid ventilation system with copper-based recuperation and antiseptic heat exchangers, which will certainly contribute to the improvement of bacteriological safety in the facility.





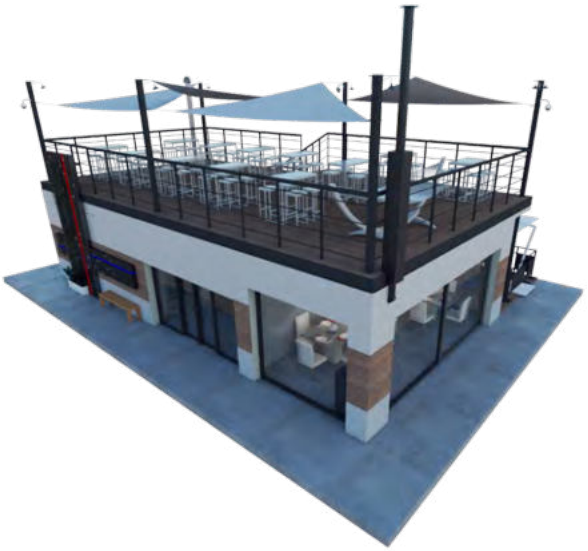
SHOP/SALES PAVILLION

Sample layout using 1 and ½ modules.



PORT CAFE (2 MODULES)

CAFE/ RESTAURANT (3 MODULES)



SECRET REGISTRAR'S OFFICE, MEETING ROOM, SERVER ROOM

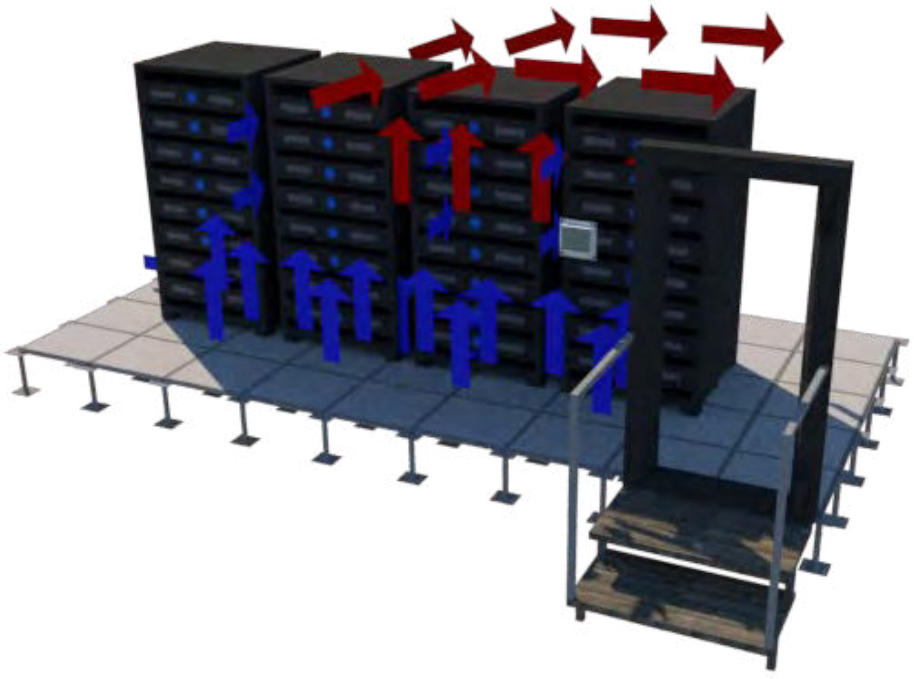
The specific design of the Q-Module® makes the structure of an entire module likely to be treated as a huge safe, a place for storing secret documents and sensitive data on servers, or as a place to hold confidential meetings at.

In the case of rooms such as secret registrar’s offices or a meeting room, please contact us directly to select the equipment.

In the case of server rooms, the manufacturer recommends the use of the following systems:

.

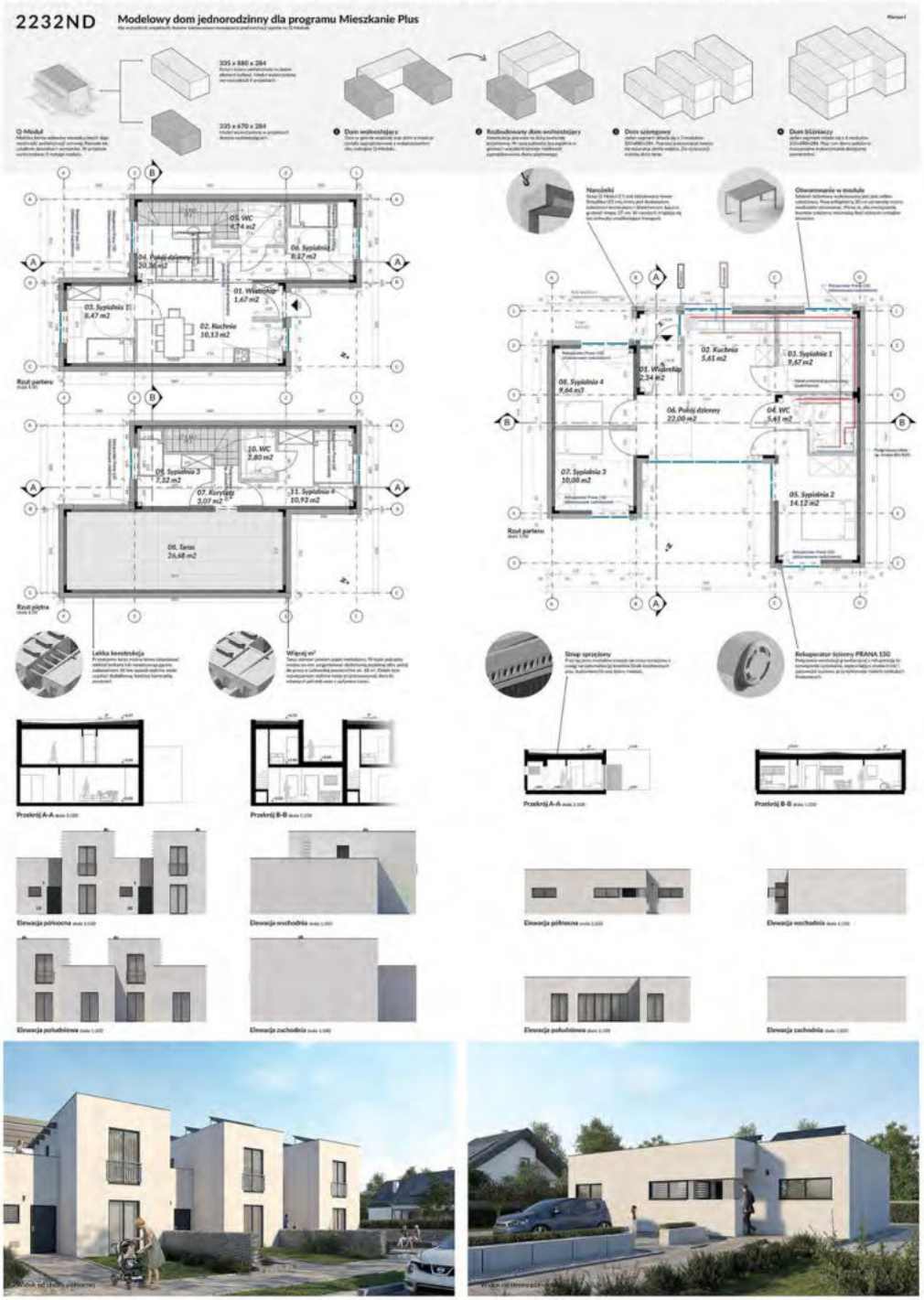
• Selection of room dimensions (height, length, width) to match the needs.
• Double floor as installation surface (power, connectivity).
• Eliminating the range of electromagnetic waves with specific frequencies, including GSM telephone calls, from inside the facility.
• Basic cooling system as heat absorption through the ceiling and walls with the discharge of the heating system through the water system. In this case, the server room can be treated as a heating furnace with a connection to the building's heating system (e.g., the energy obtained from cooling servers is used to heat office rooms).
• Back-up cooling system in the form of air conditioners with power adjusted to the needs.
• Recuperation system with adjustable humidity and carbon dioxide levels in the room.
• Fire protection system (gas extinguishing) with sensors and notification.
• Video-monitoring system with registration and notification.
• Access control system with notification
• Other systems, to be individually agreed on.



PROPERTY DEVELOPMENT USE OF THE MODULES

In the case of property development projects, the repeatability of module dimensions is crucial. Below, charts are provided to present a detached house, a detached house in a rural commune, a terraced house, and a semi-detached house. In each case, the designed property can be expanded. The properties are designed for a 2+3 family members; they are arranged in terraced and semi-detached buildings about 70 m2 each, or as detached buildings, about 80 m2 each.

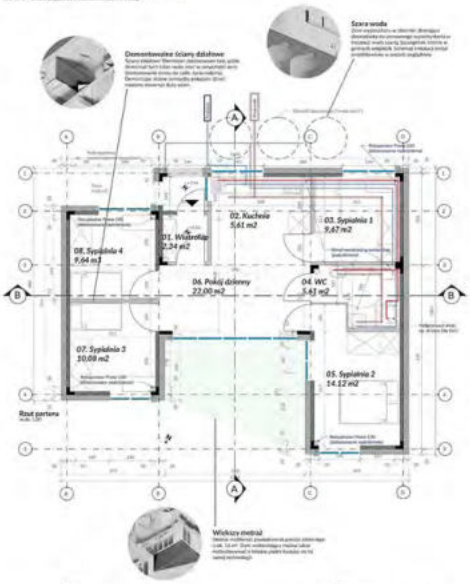
Plansza I

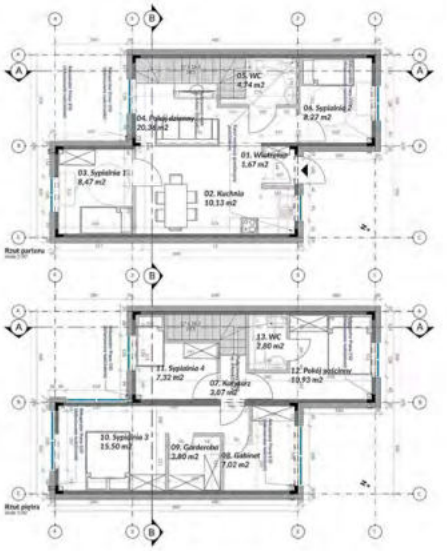


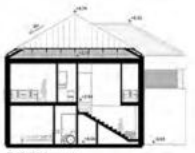
Plansza II

2232ND Modelowy dom jednorodzinny dla programu Mieszkanie Plus

Detal połączenia płyty fundamentowej i ściany żelbetowej






Przekrój A-A


Przekrój B-B


Przekrój A-A


Przekrój B-B


Elewacja północna


Elewacja wschodnia


Elewacja północna


Elewacja wschodnia


Elewacja południowa


Elewacja zachodnia


Elewacja południowa


Elewacja zachodnia

OTHER POSSIBILITIES TO USE THE Q-MODULE® TECHNOLOGY IN BUSINESS

The Q-Moduł® technology offers nearly unlimited investment opportunities, restricted only by the architects' and investors' imagination. The technology can be successfully used to build objects such as:

- housing for the elderly;
- office and meeting facilities;
- cafes, restaurants, food outlets;
- schools, kindergartens, nurseries;
- warehouses, storage and production halls, cold storage chambers, facilities with controlled temperature and humidity, technical facilities;
- gatehouses, temporary facilities, and other objects.

THE Q-MODULE® IN PRIVATE AND HOUSING CONSTRUCTION

Private construction in Poland is most often conducted using the so-called economic method, according to which the price constitutes the most important factor to determine whether or not to use a particular technology. Individual investors are no strangers to problems resulting from sickness-related absences of individual contractors, the need for constant supervision, or spoiling the effects of the previously implemented construction works. Usually, when deciding to commence investment in accordance with the economic method, the costs of supervision and possible repairs are overlooked. However, in a situation when the blame for a loss cannot be put on anyone, the cost is borne by the Investors themselves.

The manufacturer has provided for the possibility to use the Q-Module® technology in investment implementation processes according to the economic method. On offer are both, "the design and build" mode services, as well as the possibility of purchasing individually prepared Q-Module® modules in the raw or shell and core condition for the investor to set and adapt (to enable the continuation of works using the economic method).

An example of modern architecture of a three-story building, with a basement and a recreational area on the roof; the possible implementation using the Q-Module® technology:

Figure 7. source: http://www.archdaily.com/566207/muhlestrasse-residential-and-studio-building-amreinherzig

The use of Q-Module® in private construction makes the investor able to undergo an efficient transition directly to the finishing works phase. The features of Q-Module®, such as durability, resistance to vandalism, sound insulation, fire resistance, and resistance to extraordinary loads are also significant for private construction purposes.

DOMINO I, II, III – HOUSE THAT GROWS ALONG WITH FAMILY

Here is an example layout of the Q-Module® used for the purpose of the Domino I, II III year-round residential house. The concept assumes the possibility to expand the residential building along with the growing family and the investor's needs. The house can be enlarged from a ground-floor-only version to a two-story facility, using a flat roof as a recreational space. The project assumes the use of 3 connected modules on each floor, arranging an additional living room area on the ground floor by means of the appropriate separation of three modules, and adding another 3 modules on the first floor. Domino III features a living room part of the height of both storeys. It is possible to arrange technical or recreational space was assumed on the roof.

The ready-made architectural and construction design of the next versions of the Domino I, II, III residential house is provided with a set of documents sufficient to submit an application for a building permit/construction notification. However, the project is not adapted to the individual construction law conditions on a given investment site, the foundation of the building in relation to the plot, and the individual investor's expectations. Adjusting the documentation requires an additional order for the execution of an architectural design with an estimate.

Usable area 194,25m2

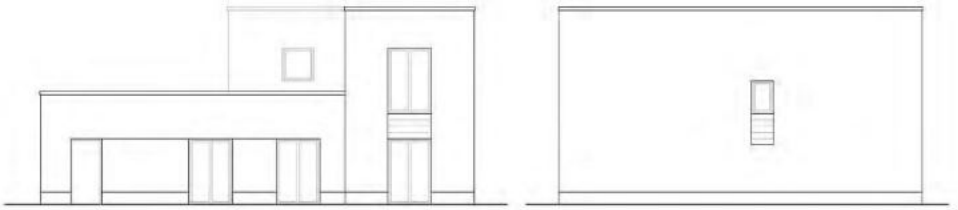
Total area 273,02m2

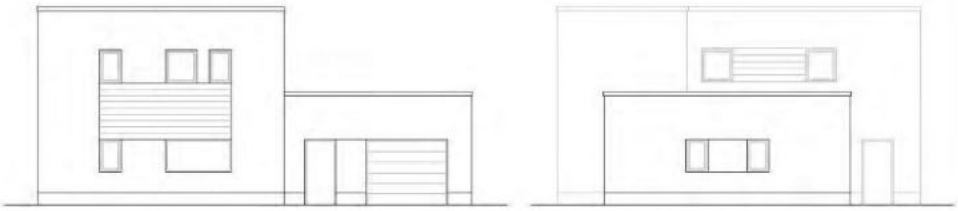
Building area 128,64m2

Gross building cubature 892,22m3

- powierzchnia użytkowa: 111,19 m^2
- powierzchnia całkowita: 128,64 m^2
- powierzchnia zabudowy: 128,64 m^2
- kubatura brutto: 501.696 m^3

PARTEROWY BUDYNEK MIESZKALNY DOMINO I





- powierzchnia użytkowa:	156,69 m^2
- powierzchnia całkowita:	191,29 m^2
- powierzchnia zabudowy:	128,64 m^2
- kubatura brutto:	672,10 m^3

DWUKONDYGNACYJNY BUDYNEK MIESZKALNY DOMINO II

PIĘTRO
45.26 m2

- powierzchnia użytkowa: 156,69 m²
- powierzchnia całkowita: 191,29 m²
- powierzchnia zabudowy: 128,64 m²
- kubatura brutto: 672,10 m³

PARTER
111.43 m2

DWUKONDYGNACYJNY BUDYNEK MIESZKALNY DOMINO II

KLASTER BUDOWNICTWA MODUŁOWEGO

Qmoduł

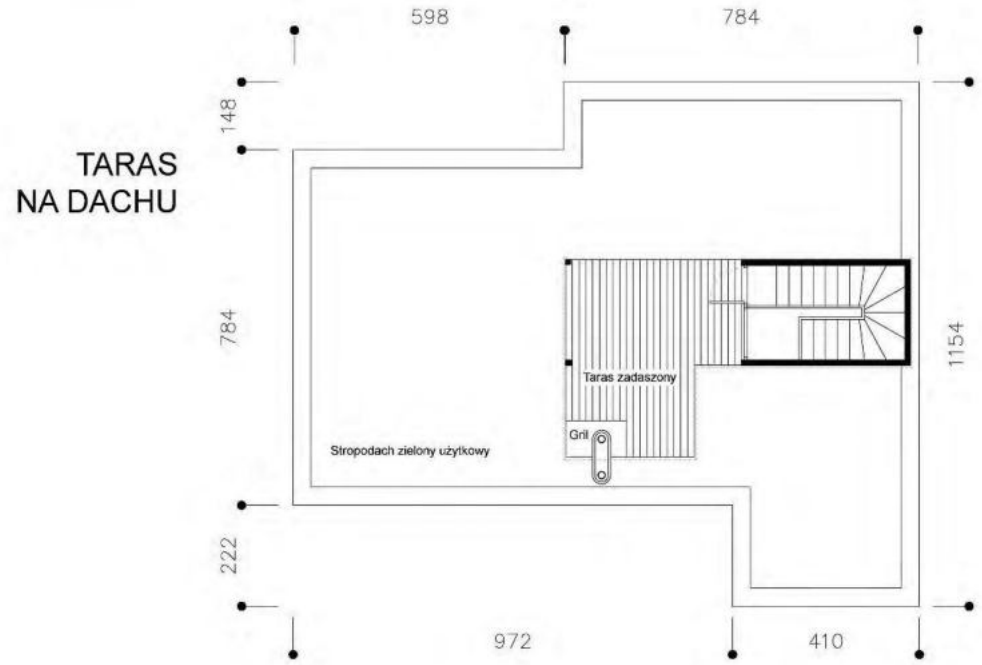
pałusiński

PIĘTRO
83.22 m2

PARTER
111.43 m2

DWUKONDYGNACYJNY BUDYNEK MIESZKALNY DOMINO III

Qmoduł



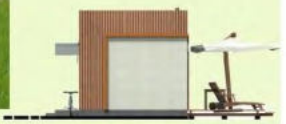
- powierzchnia użytkowa: 194,65 m²
- powierzchnia całkowita: 273,02 m²
- powierzchnia zabudowy: 128,64 m²
- kubatura brutto: 892,22 m³

DWUKONDYGNACYJNY BUDYNEK MIESZKALNY DOMINO III

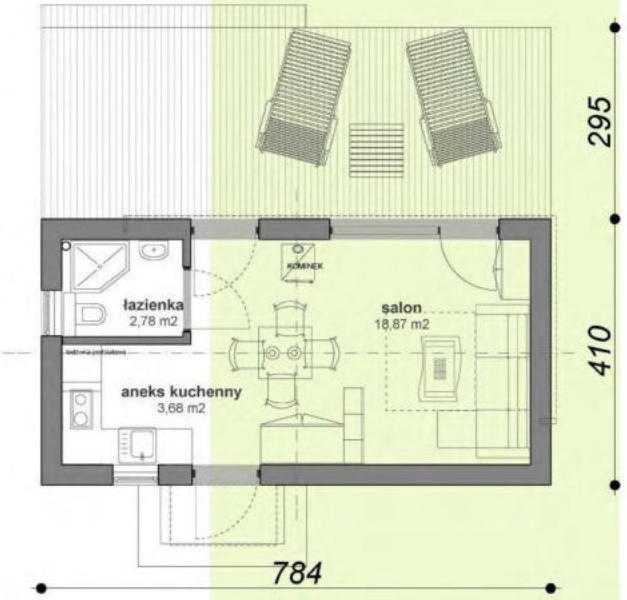
SUMMER HOUSE I, II

quartum.pl

DOMEK LETNISKOWY 1 MODUŁ



POW ZABUDOWY	32,14 m2
POW UZYTKOWA	25,33 m2
POW CAŁKOWITA	32,14 m2
KUBATURA NAZIEMNA	128,12m2



KLASTER BUDOWNICTWA MODUŁOWEGO

Qmoduł

This is an exemplary layout of the Q-Module® intended for a year-round summer house. After minor changes, it can even serve as an apartment for young people. The concept offers the possibility of expanding the facility from a single-module DL1 to a two-module DL2. While the first module contains a kitchen, a toilet, and a living room, the second module features a free layout of one or two bedrooms. Of course, two connected modules can be expanded by adding another one to create a larger usable area, thereby composing unique solutions tailored to your individual needs.

This house can also easily expand together with the growing family that lives in it!

The ready-made architectural and construction design is provided with a set of documents sufficient to apply for a building permit. However, it is not adapted to the individual construction law conditions on the investment site, the foundation of the building in relation to the plot, and the investor's individual expectations. Adjusting the documentation requires an additional order for the execution of an architectural concept with an estimate.

The summer house modules are delivered to the indicated address in Poland, both in the shell and core condition or as fully finished and equipped units, ready for use. Durable concrete solutions can be equipped with structured cabling, ventilation, and air-conditioning, and fire and burglary prevention installations embedded in the wall, depending on individual needs.

At the Investor's request, similar structures with a larger or smaller number of modules and various areas, can be designed to give the possibility of other applications.

Building width: 4,10m
Building length: 7,84m
Building height (from the ground level in front of the entrance): 4.0m
Building area: 62,96m2
Usable area:49,99m2
Total area: 62,95m2
Building cubature: 250,56m3
Flat, green roof.

WHEN A BUILDING PERMIT IS NT REQUIRED?

In 2015, changes were intraduced in the BUILDING LAW regulations in force in Poland. Two ways to start construction works are now available:

• commencement of construction works according to the previous procedure (with a building permit), or

• commencement of construction works without not permit, but only with a prior notification.

The investor is under no obligation to submit an application for a building permit if they plan to erect a single-family residential building (except for terraced houses, including semi-detached houses). This solution is very convenient to investors in terms of the waiting time required in order to for an administrative decision to be made. The following investments can also be implemented based on a building notification:

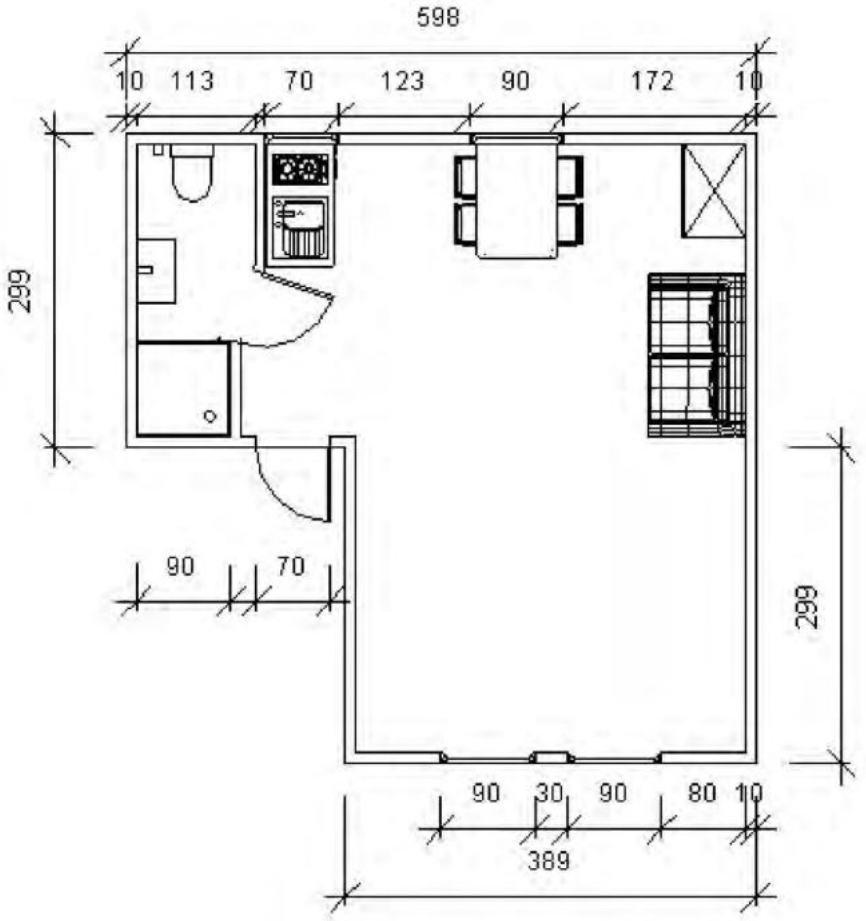
- a free-standing, one-story outbuilding;
- a garage;
- a bower;
- a backyard porch and conservatory;
- a free-standing, one-story building for individual recreation, e.g., small-sized summer cottages (seasonal);
- a swimming pool or pond.

This applies to facilities whose total area does not exceed 35 m2 (except for the swimming pool and pond – in this case, the area cannot exceed 50 m2).

It should be remembered that the implementation procedure of investment upon construction notification does not mean the lack of necessity to develop design documentation or to comply with Plan Zagospodarowania Przestrzennego [Spatial Development Regulations] in a given area. Still, if the PZP is not in force in the area, it is necessary to obtain a decision concerning development conditions.

Pursuant to Art. 29 sec. 1 point 2a of the Construction Law Act of 7 July 1994 (consolidated text: Journal of Laws of 2013, item 1409, as amended) – hereinafter referred to as const. law [pr. bud.], building permits are not required for the construction of free-standing one-story individual recreation buildings, understood as buildings intended for periodic recreation, whose built-up area does not exceed 35 m2, whereas the number of these facilities on a plot may not exceed one for every 500 m2 of the plot area. This provision clearly states that the notification obligation applies only if there is 500 m2 of a building plot per individual recreation building. This provision can only be understood in such a way as to determine that one building can be built on a plot whose minimum area is no less than 500 m2; on a plot whose minimum area is no less than 1000 m2, 2 buildings can be erected; on the plot whose minimum area is no less than 1500 m2, 3 buildings can be erected.

Below, an exemplary layout of an individual recreation building is presented. It is made based on the DL2 summer house project. The basic module with dimensions of 2990x5980 is equipped with a toilet, as well as a kitchenette combined with a living room. An additional module whose dimensions equal 2990x3990mm provides an area to be developed, using drywall technology, as a sleeping area.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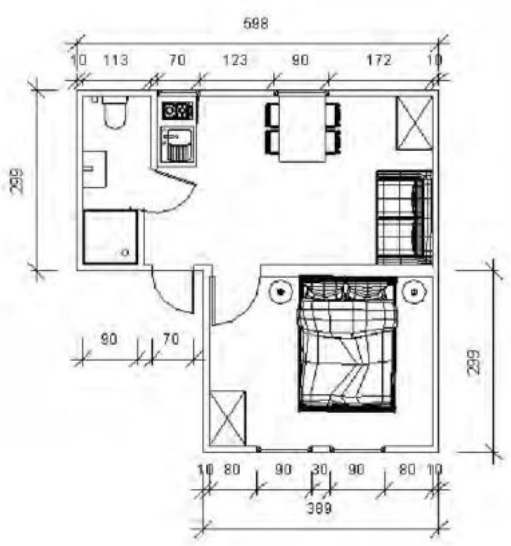
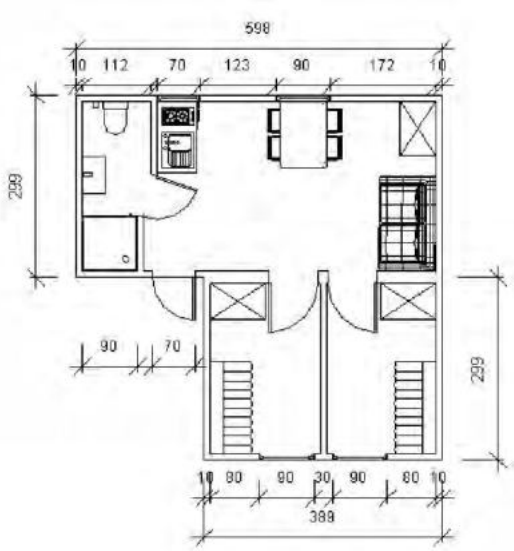
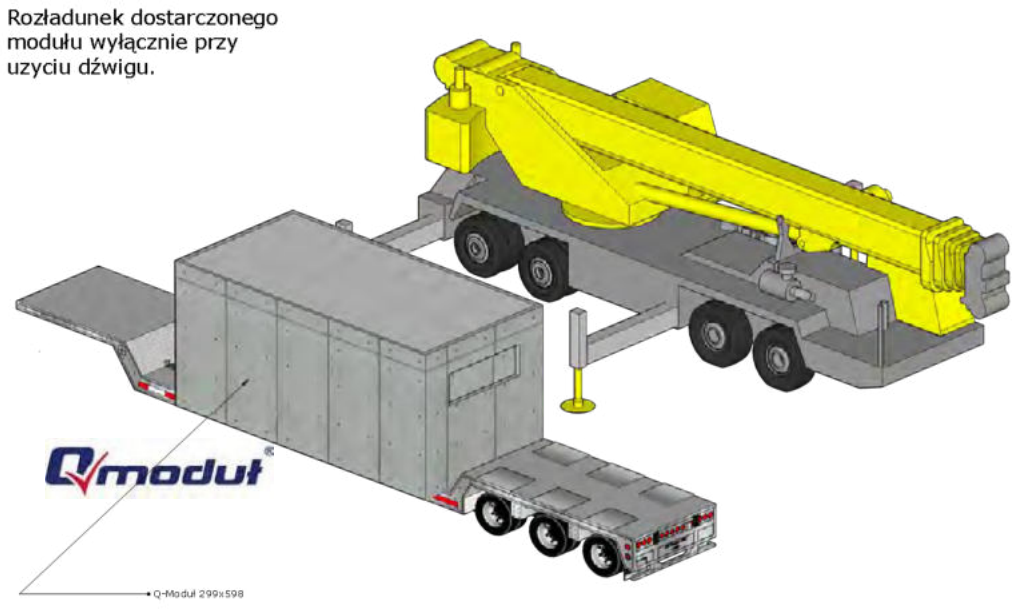


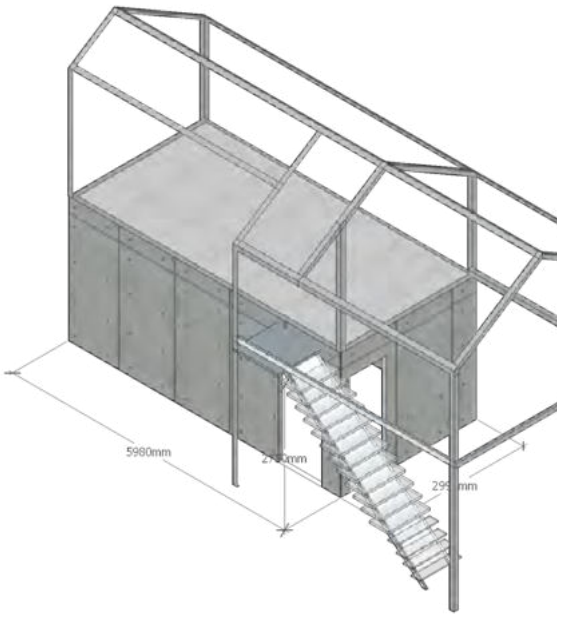


NOMAD_299 ALL-YEAR SUMMER HOUSE "OUT OF A BOX"

The concept assumes the construction of a two-story, year-round recreational house (ground floor with an entresol), with a construction notification only. The facility's core with installations is provided by a module in which installations have been made, whereas the facade with insulation serves only as a casing. The concept offers the possibility to arrange the façade on one's own or choose from several available architectural styles developed for the catalog. More information concerning the project can be found at:

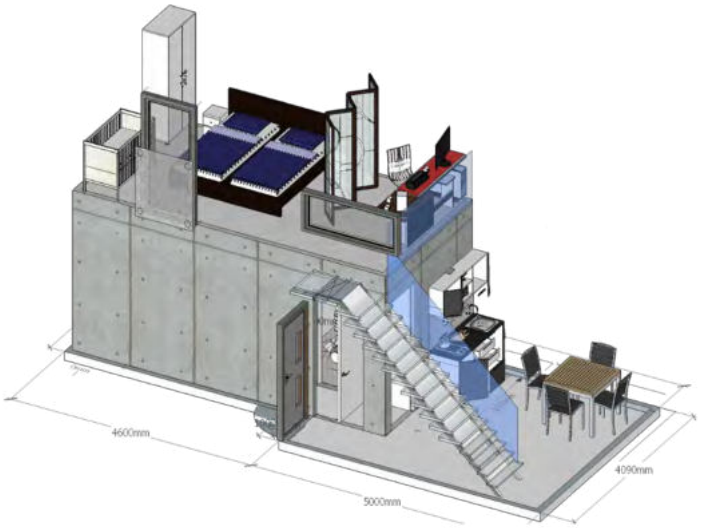
http://www.budownictwomodulowe.com/wp-content/uploads/Nomad-299.pdf

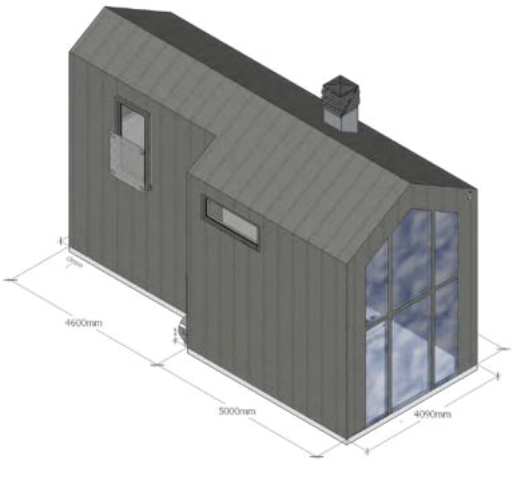




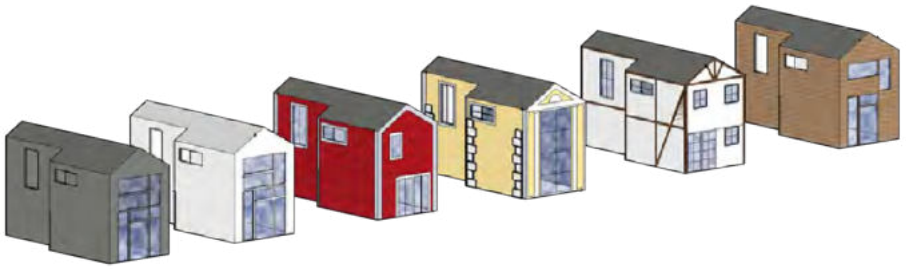
The structure of the facility is attached to the previously prepared mounting slots of the module's walls and reinforced concrete ceiling. The module's mass and its rigidity guarantee the entire structure's rigidity, thereby enabling the saving of the frame profiles.

Inside the module, there is a corridor, a bedroom, and a toilet. The outlets for kitchen installations are provided on one of the outer walls of the module which will also serve as a connecting dayroom, with the possibility of going to the upper floor. The reinforced concrete ceiling of the module guarantees the use of another bedroom with an area of at least 18m2 as an entresol.





The façade performs architectural and insulating functions. It may be exchanged. The construction of the object makes it possible to disassemble the facility and relocate it multiple times.



Interchangeable facades for the same construction offer the possibility to adapt the facility's architecture to that of the region.

VARIOUS POSSIBILITIES OF USING THE Q-MODULE® TECHNOLOGY IN PRIVATE BUILDINGS

The Q-Module® technology offers nearly unlimited investment opportunities, constrained only by the architects' and investors' imagination. It can be successfully used to erect objects such as:

- summer and year-round houses, for the elderly and apartments for the young;
- buildings of up to four storeys and terraced houses;
- shelters and dugouts;
- facilities used in agriculture (warehouses, garages, fruit, and vegetable storage rooms, cold storage rooms, animal and technical facilities;
- energy-efficient and passive buildings.

SINGLE-FAMILY HOUSE DESIGN BY AN ARCHITECT NOT ASSOCIATED WITH MODULAR BUILDING CLUSTER

Anyone can design in the Q-Module® technology, permanent cooperation with an architect is not expected. The manufacturer will gladly provide the necessary information in the field of architectural and construction issues, to enable the design of individual facilities. Below, an example of a project created by an architect not associated with the Modular Construction Cluster is presented. It may serve as an example to prove that designing individual buildings entirely in the Q-module technology is possible.


Elewacja zachodnia
Elewacja wschodnia
Elewacja południowa
Elewacja północna
Ściany żelbetowe (moduły)
Ściany działowe murowane (bloczki silikatowe lub inne)
Termoizolacja (Styrodur XPS lub wełna mineralna)
Obróbka blacharska malowana proszkowo
Okładziny elewacyjne, drewniane
tynk strukturalny
pergola z elementów drewnianych
cokół, tynk strukturalny
Rzut parteru
Studio Rafał Szanser


Studio Rafał Szanser
Qmodul

On Facebook, the architect whose user profile is named Studio Rafał Szanser commented:

“The investor commissioned me to design a small service facility with a residential part. Everything has to be done quickly and efficiently. The investor recommended the Q-Module company (https://www.facebook.com/Q-module-1401725650044975/) whose objective is to develop modular constructions. At first, I was skeptical to the idea, as I was under the misconception that my creativity would be limited by the fixed dimensions of the individual modules. Despite the unfavorable Plan Zagospodarowania Pzestrzenego [Local Spatial Development Plan], as well as the plot’s shape and size, I succeeded in designing a one-story building that met the investor’s initial requirements. The initial concept is likely to undergo further changes. Finally, I can comment that, as long as plot dimensions do not impose restrictions, designing in a modular system has its justification, i.e., the execution time, and the effect is no different from the traditional one.”

We care about cooperation with architects not associated with Modular Construction Cluster. Therefore, we recommend contacting Rafał Szanser's Architectural Studio.

https://www.facebook.com/Studio-Rafa%C5%82-Szanser-151519428249552/

IMPLEMENTATION TIME

The delivery time depends on a number of factors.

The production of Q-Module® should be preceded by careful preparation of documentation and obtaining appropriate permits/submitting construction notifications, which usually takes longer than the production of the modules themselves.

Preparation for production of the arranged size of modules requires from 1 to up to 20 days.

Prefabrication of the module in one form, depending on the complexity of its structure, takes from 24 to 48 hours.

The manufactured modules are subject to proper care for a minimum of 7 days. Only after this period is over can they be transported.

Placing the modules on the investment site and the facility's assembly, depending on its size, takes up to several days. At this stage, the weather conditions also significantly affect the implementation time.

BASIC STANDARD (PRECAST SPECIFICATION)

The modules are offered in the basic standard in the form of prefabricated elements with installations. The prefabricated unit consists of:

• Walls and ceiling as a monolithic building prefabricated element of reinforced concrete, whose dimensions and openings (window and door openings, shafts, installations) are adapted to their function based on the architectural and construction design. They are subject to the following maximum external dimensions: length 740cm, width 370cm, and height 330cm.

1. Hybrid reinforcement (steel-composite).
2. Concrete, based on the manufacturer's recipe, with parameters corresponding to C50/60, waterproof up to 100m of the water column.
3. The load-bearing capacity of the ceiling from 4kN/m2 to 10kN/m2 (with a 15 cm ceiling thickness and 10 cm walls thickness).
4. All high-current and low-current electrical installations embedded in the walls and ceiling in conduits, in accordance with the project's installation documentation. Installed junction boxes and sockets.
5. All domestic water and central heating installations are embedded in the walls and ceiling, in accordance with the project installation documentation.
6. Heating and cooling panels embedded in the walls or ceiling.
7. Transport sockets permanently integrated with the module's structure. Mounting slots to connect individual modules with each other as part of the facility's structure (solution covered by legal protection), permanently integrated with the module's structure.
8. The deadweight load of the prefabricated element is about 20 tons.
9. Installation warranty: 10 years. Guarantee for prefabrication: 20 years.

A reliable investment estimate relates to the prior development of the architectural design. The manufacturer offers the possibility to develop an architectural design, which service will be included in the final price of m2 of the building's area. It will then be settled together with the last tranche of the transaction settlement.

It is possible to provide a module in the turnkey condition, with internal equipment according to the Investor's expectations.

FORMAL AND LEGAL ASPECTS

Budownictwo Modowe Sp. z o. o. and the Modular Construction Cluster prefer the following model of cooperation with the Investor:

1. commissioning by the Investor to develop an architectural concept with an estimate - in the mode of an individual design or purchase of a ready-made architectural design;
2. conducting geological surveys of the ground in the place of the planned facility's foundation;
3. development by architects/approval by the Investor of the facility's architectural concept;
4. development of the investment cost estimate by the cost estimator;
5. signing the contract for the investment implementation. The contract comes with appendices, i.e., the approved architectural concept of the facility and the cost estimate. Advance payment is required which equals 50% of the costs of the agreed prefabricated elements' value;
6. development of architectural and construction documentation (in the individual project mode);
7. obtaining a building permit/submitting a construction notification;
8. preparation of the foundations and the building's foundation site (cost borne by the investor or depending on the arrangements);
9. execution and maintenance of prefabricated elements (at the Investor's risk, it is possible to create prefabricated elements before the building permit becomes valid);
10. inspection by the Investor of prefabricated elements at the prefabrication plant/at the place of their execution. Advance payment of 25% (up to 75%) of the agreed prefabricated elements' value;
11. transport of prefabricated elements to the investment site/foundation within the designed facility's layout (at the Investor's cost). The cost of transport and crane depends on the distance, the choice of means of transport, and crane service prices depend on the local market);
12. combination of prefabricated elements and installations. Control by the Investor. Final settlement of the agreed prefabricated elements' value;
13. performing other works agreed in the contract.

The content of the final contract will include detailed arrangements to confirm the complexity level with regards to the scope of commissioned works.

TRANSPORT IN PRACTICE, POSSIBILITIES, AND COSTS

In terms of the Q-Module® mobility and transport costs, the following issues should be analyzed:

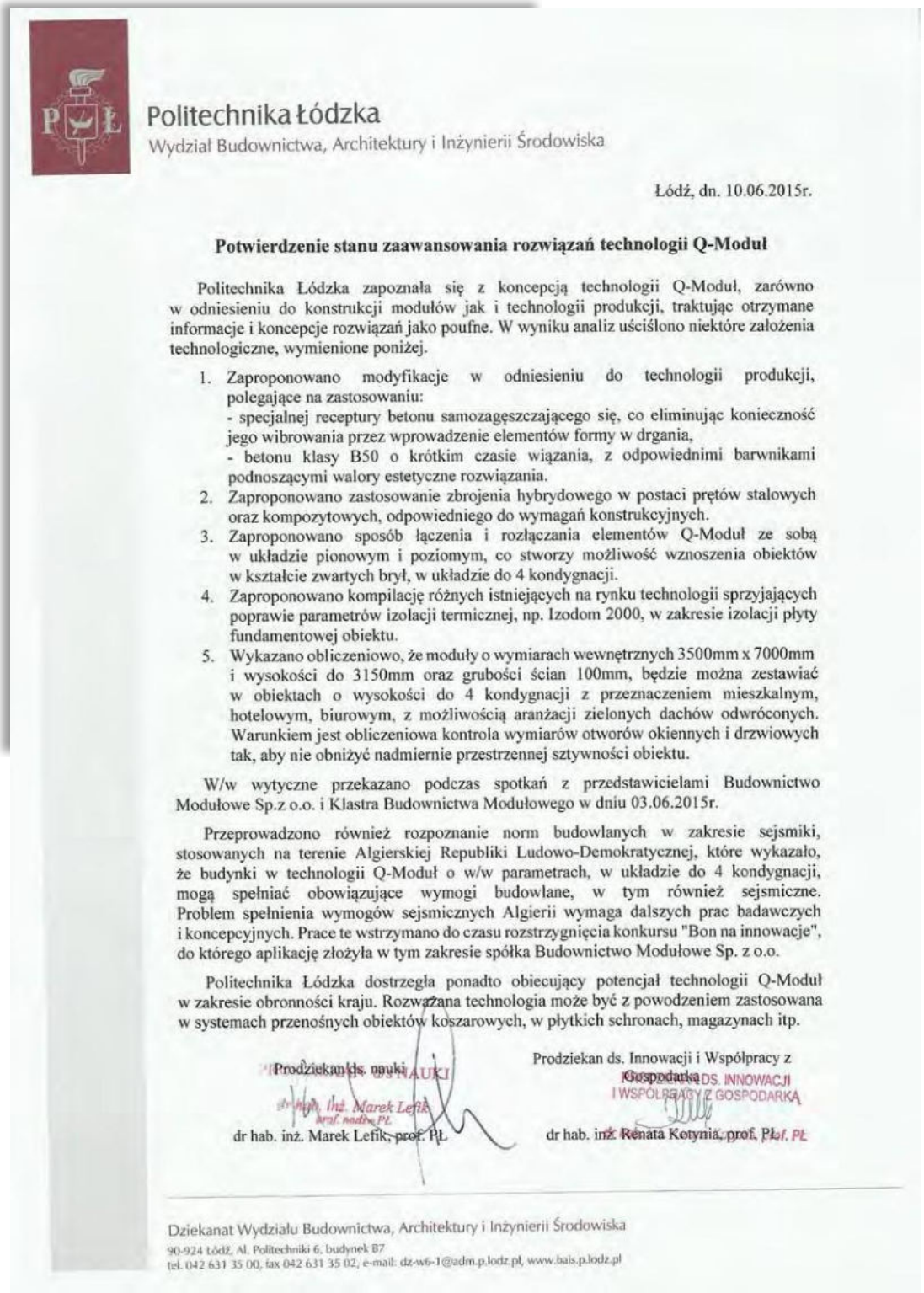
1. Type and cost-efficiency of transport/delivery of the prefabricated element to the investment site, i.e.:
   1.1. Possibilities to access the investment site by paved roads, taking into account the weight of the vehicles involved.
   One module is loaded per semi-trailer. The dead weight of the semi-trailer with the module will amount to about 30 tons (the average weight of the module is about 20 tons). The load borne by the axles depends on the semi-trailer's construction (number of axles). Therefore, it should be ensured that heavy equipment with load will be able to access the place of investment implementation.
   1.2. Quality of subgrade stiffening at the investment site.
   Adequate stiffness of the surface at the investment implementation site should be ensured. Investment implementation in the Q-Moduł® technology is impossible in wetlands and areas with an insufficient load-bearing capacity of the soil. In some cases, it is possible to substructure the access road and set the crane on the site by temporarily placing prefabricated concrete slabs on the ground.
   1.3. Sufficient space to unload cargo while using a 70-ton crane. The location, size, and shape of the plot on which the investment is to be implemented are always individual. Sometimes, despite the plot's small dimensions, it is possible to temporarily unload prefabricated elements on a local road or on a neighbor's plot, sometimes on a large plot. The investment implementation is prevented by its intensive tree cover.
2. Preparation of a mobile form for the production of prefabricated elements takes a team of 5 people a minimum of 7 working days. In the production phase, the distance between the investment site and the nearest concrete plant capable of producing concrete with the desired parameters is rather significant.
3. Road transport and intermodal transport (rail and road).
   The production plant in Ursus, Warsaw is capable of loading prefabricated elements onto rolling stock. One team is able to load up to 50 modules, while the maximum external width of each module cannot exceed 315cm.
4. The cost of transport in Polish conditions.
   4.1. Road transport of one module, up to 2990mm wide.
   4.2. Specialist transport of a module that does not exceed the width of 3390mm, with one pilot.
   4.3. Specialist transport of a module that does exceeds the width of 3400mm, requires two pilots.
   4.4. Using rail transport makes it possible to load up to 50 modules on one train stock. This applies to modules whose width does not exceed 3150mm.
   4.5. The use of a 70t crane with an operator, depending on work organization, allows the foundation of about 8 - 14 modules.
5. The analysis of risks and costs of possible loss resulting from damage related to the delivery and installation/production of prefabricated elements on-site using a mobile factory.
   Entering heavy equipment onto the investment site may result in damage and the need to clear the infrastructure after the investment is completed (devastation of greenery, ruts, etc.). In practice, with proper investment planning, these losses are usually lower compared to multi-stage construction investments conducted with the use of the traditional method.

SELECTED ASPECTS OF MOBILE PRODUCTION

Due to the potential use of the Q-Moduł® technology in mobile production, an exemplary calculation of production costs was conducted, based on the assumption of the following aspects:

1. the implementation of social amenity facilities should be based only on repeatable solutions, whereas the introduction of individual facilities features should be limited only to finishing materials and the object's urban layout;
2. up to 14 staff members work on one mold alternately in a two-shift system adapted to the production cycle (this solution ensures the continuity of the mold's operation). This workflow solution guarantees of production of 0.5 to 1 module per day, depending on the scale of construction difficulty and the number of installations;
3. not less than 500 m2 of the area of the hall/production pavilion should be allocated for one mold;
4. the concrete batching plant should meet the demand for concrete, its amount being about 8 m3 (depending on the module's structure and dimensions);
5. the crane construction should ensure that efficient transport of raw materials and finished products are available, in such a way as to ensure the safety of processes conducted on other workstations/forms. This parameter can be ensured, for example, by locating the crane transport line (without personnel access) between two rows of molds. In case of lower production demand, it is possible to use cranes or elevators;
6. as an alternative to production at the Investor's site, mobile production can also be performed at the concrete plant or nearby.

Mobile production is profitable only in case of orders for larger-scale investments (large buildings or housing estates). The application of the mobile factory solution makes it possible to reduce production costs by eliminating or reducing transportation costs. However, in this case, costs are incurred by technological breaks in production related to relocating the factory and the need to organize work with account to external factors. Using a mobile factory will, therefore, be profitable when significant distances need to be covered between the investment sire and the existing prefabrication plants. Such expenses will depend on the transport costs in a given region. The use of a mobile factory enables the implementation of modules with dimensions that are difficult to transport (the so-called oversized modules), e.g., 3500x7200mm.



Politechnika Łódzka
Wydział Budownictwa, Architektury i Inżynierii Środowiska

Łódź, dn. 10.06.2015r.

Potwierdzenie stanu zaawansowania rozwiązań technologii Q-Moduł

Politechnika Łódzka zapoznała się z koncepcją technologii Q-Moduł, zarówno w odniesieniu do konstrukcji modułów jak i technologii produkcji, traktując otrzymane informacje i koncepcje rozwiązań jako poufne. W wyniku analiz uściślono niektóre założenia technologiczne, wymienione poniżej.

1. Zaproponowano modyfikacje w odniesieniu do technologii produkcji, polegające na zastosowaniu:
   - specjalnej receptury betonu samozagęszczającego się, co eliminując konieczność jego wibrowania przez wprowadzenie elementów formy w drgania,
   - betonu klasy B50 o krótkim czasie wiązania, z odpowiednimi barwnikami podnoszącymi walory estetyczne rozwiązania.
2. Zaproponowano zastosowanie zbrojenia hybrydowego w postaci prętów stalowych oraz kompozytowych, odpowiedniego do wymagań konstrukcyjnych.
3. Zaproponowano sposób łączenia i rozłączania elementów Q-Moduł ze sobą w układzie pionowym i poziomym, co stworzy możliwość wznoszenia obiektów w kształcie zwartych brył, w układzie do 4 kondygnacji.
4. Zaproponowano kompilację różnych istniejących na rynku technologii sprzyjających poprawie parametrów izolacji termicznej, np. Izodom 2000, w zakresie izolacji płyty fundamentowej obiektu.
5. Wykazano obliczeniowo, że moduły o wymiarach wewnętrznych 3500mm x 7000mm i wysokości do 3150mm oraz grubości ścian 100mm, będzie można zestawiać w obiektach o wysokości do 4 kondygnacji z przeznaczeniem mieszkalnym, hotelowym, biurowym, z możliwością aranżacji zielonych dachów odwróconych. Warunkiem jest obliczeniowa kontrola wymiarów otworów okiennych i drzwiowych tak, aby nie obniżyć nadmiernie przestrzennej sztywności obiektu.

W/w wytyczne przekazano podczas spotkań z przedstawicielami Budownictwo Modułowe Sp.z o.o. i Klastra Budownictwa Modułowego w dniu 03.06.2015r.

Przeprowadzono również rozpoznanie norm budowlanych w zakresie sejsmiki, stosowanych na terenie Algierskiej Republiki Ludowo-Demokratycznej, które wykazało, że budynki w technologii Q-Moduł o w/w parametrach, w układzie do 4 kondygnacji, mogą spełniać obowiązujące wymogi budowlane, w tym również sejsmiczne. Problem spełnienia wymogów sejsmicznych Algierii wymaga dalszych prac badawczych i koncepcyjnych. Prace te wstrzymano do czasu rozstrzygnięcia konkursu "Bon na innowacje", do którego aplikację złożyła w tym zakresie spółka Budownictwo Modułowe Sp. z o.o.

Politechnika Łódzka dostrzegła ponadto obiecujący potencjał technologii Q-Moduł w zakresie obronności kraju. Rozważana technologia może być z powodzeniem zastosowana w systemach przenośnych obiektów koszarowych, w płytkich schronach, magazynach itp.

Prodziekan ds. nauki
dr hab. inż. Marek Lefik, prof. PŁ

Prodziekan ds. Innowacji i Współpracy z Gospodarką
dr hab. inż. Renata Kotynia, prof. PŁ

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WYDZIAŁ
PROMOCJI HANDLU I INWESTYCJI
AMBASADY
RZECZYPOSPOLITEJ POLSKIEJ
W ALGIERZE

Polska

WPHI/ALG/ 987 /JP/15

Algier, 10 maja 2015 r.

Zaświadczenie

Wydział Promocji Handlu i Inwestycji Ambasady RP w Algierze niniejszym potwierdza, że Pan Jarosław Wiśniewski reprezentujący firmę Budownictwo Modułowe Sp. z o.o. i Klaster Budownictwa Modułowego z siedzibą w Raszynie prowadzi rozmowy z przedstawicielami Ministerstwa ds. Mieszkalnictwa, Urbanistyki i Miast – MHUV (www.mhuv.dz) Algierskiej Republiki Ludowo – Demokratycznej., celem realizacji na terenie Algierii wieloletniego kontraktu budownictwa socjalnego opartego na technologii Q-Moduł.

W dniu 5 maja 2015 w Algierze odbyło się spotkanie przedstawicieli Klastra Budownictwa Modułowego z Panem Mohamed Yassine HAFIANE, Prezesem (President Du Directoire) SGP INDJAB, w którym uczestniczyli również przedstawiciele Ambasady RP w Algierze. INDJAB jest algierską instytucją rządową realizującą w imieniu Ministerstwa Mieszkalnictwa ARLD (MHUV) jako inwestor zastępczy, wieloletnie programy budownictwa socjalnego, na realizację których państwo przeznacza wielomiliardowe nakłady (w ramach rządowego planu pięcioletniego na okres 2015-2019 zrealizowanych ma zostać 1,6 mln mieszkań). Podczas spotkania strony potwierdziły zainteresowanie współpracą i ustaliły postępowanie zmierzające do podpisania kontraktu pomiędzy SGP INDJAB i Klastrem Budownictwa Modułowego.

RADCA
Kierownik Wydziału Promocji
Handlu i Inwestycji
Ambasada RP w Algierze

Janusz PISZ

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Politechnika Łódzka
Wydział Budownictwa, Architektury i Inżynierii Środowiska

Łódź, dn. 25.09.2015r.

Oświadczenie o innowacyjności technologii Q-Moduł

Po zapoznaniu się z koncepcją technologii Q-Moduł, zarówno w odniesieniu do konstrukcji modułów jak i technologii produkcji, traktując otrzymane informacje i koncepcje rozwiązań jako poufne, oświadcza się, że omawiany produkt spełnia warunki innowacyjności.

W szczególności:

- produkt pozwala na wytwarzanie obiektów o różnorodnym przeznaczeniu, przy minimalizacji dodatkowych robót budowlanych,

- proces osiągania stanu surowego obiektu ogranicza się do ustawienia gotowych elementów Q-moduł i ich połączenia śrubowymi węzłami montażowymi,

- technologia produkcji jest przyjazna dla środowiska; nie wymaga zagęszczenia betonu ani przyśpieszania procesu dojrzewania betonu przez jego nagrzewanie, co sprzyja oszczędności energii,

- w elementach Q-moduł może być stosowane nowoczesne zbrojenie hybrydowe, składające się z prętów kompozytowych, zawierających włókna szklane (GFRP – Glass Fiber Reinforced Polymer) oraz stalowych prętów zbrojeniowych.

Wymienione cechy uzasadniają uznanie elementów Q-moduł za rozwiązanie innowacyjne w zakresie konstrukcji i technologii w skali światowej.

Prodziekan ds. Innowacji
i Współpracy z Gospodarką

dr hab. inż. Renata Kotynia, prof. PŁ

ŻAGIEL ROZWOJU

expo ARENA 2016

Polska Izba Handlowo-Przemysłowa we Francji

Chambre de Commerce et d'Industrie Polonaise en France

LIST REFERENCYJNY

Polska Izba Handlowo-Przemysłowa we Francji gratuluje przedstawicielom Klastra Budownictwa Modułowego opracowania i wdrożenia na rynek technologii Q-Moduł, której założenia przedstawił Pan Tomasz Palusiński, architekt, członek PIHPF. Podczas wizytacji w Warszawie umożliwiono zapoznanie się z technologią włącznie z zakwaterowaniem w obiektach wykonanych w tej technologii.
W ślad za Wydziałem Budownictwa Betonowego Politechniki Łódzkiej stwierdzamy ze technologia Q-Moduł ma charakter wysoko innowacyjny zarówno w odniesieniu do konstrukcji modułów, jak i technologii ich produkcji z możliwością realizacji w oparciu o fabryki mobilne. Jesteśmy pod wrażeniem możliwości wykorzystania tej technologii w obiektach o przeznaczeniu dla mieszkalnictwa, obiektów użyteczności publicznej czy w biznesie, a także konstrukcji, której parametry umożliwiają realizacje inwestycji również na obszarach zagrożonych sejsmicznie.
Mamy nadzieję, że zapewni pełną satysfakcję przyszłym użytkownikom.

Urszula Majorkiewicz
Sekretarz Generalny

Warszawa, 29 stycznia 2018 roku

BGK NIERUCHOMOŚCI

LIST REFERENCYJNY

BGK Nieruchomości S.A. realizując rządowy program „Mieszkanie Plus" poszukuje innowacyjnych idei, które mogą istotnie przyczynić się do poprawy efektywności na polskim rynku budowlanym. Wspólną inicjatywą naszej spółki i Wydziału Architektury Politechniki Warszawskiej był konkurs „Dom jutra. Model budownictwa dostępnego", którego celem było pozyskanie nowatorskich rozwiązań.

Główną nagrodę w kategorii „Technologie przyszłości" otrzymała praca autorstwa pana Jarosława Wiśniewskiego. W opinii Sądu Konkursowego „projekt przedstawia kompleksowe i bliskie realnemu spojrzenie na zagadnienia prefabrykacji betonowej ze zintegrowanymi inteligentnymi systemami obsługi budynku".

Technologia Q-Moduł była również prezentowana 27 kwietnia 2017 roku podczas konferencji „Mieszkanie Plus. Od innowacji do inwestycji". W siedzibie Giełdy Papierów Wartościowych spotkali się architekci i producenci nowoczesnych technologii budowlanych. Spółka „Budownictwo modułowe" znalazła się także w katalogu prezentującym rozwiązania proponowane przez uczestników konferencji.

Jan Jujeczka

DYREKTOR BIURA
KOMUNIKACJI I MARKETINGU

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XII Wydział Gospodarczy Krajowego Rejestru Sadowego, KRS 0000494251, NIP: 7010412096

Qmoduł

PATENT COOPERATION TREATY

From the RECEIVING OFFICE

To:

PCT

NOTIFICATION OF THE INTERNATIONAL APPLICATION NUMBER AND OF THE INTERNATIONAL FILING DATE

(PCT Rule 20.2(c))

Date of mailing *(day/month/year)*: 24 March 2021 (24.03.2021)

Applicant's or agent's file reference

IMPORTANT NOTIFICATION

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/PL2021/000015	22 March 2021 (22.03.2021)	09 February 2021 (09.02.2021)

Applicant: WIŚNIEWSKI Jarosław

Title of the invention: Building structure

1. The applicant is hereby notified that the international application has been accorded the international application number and the international filing date indicated above.

2. The applicant is further notified that the record copy of the international application:

☒ was transmitted to the International Bureau on 24 March 2021 (24.03.2021)

☐ has not yet been transmitted to the International Bureau for the reason indicated below and a copy of this notification has been sent to the International Bureau*:

☐ because the necessary national security clearance has not yet been obtained.

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Name and mailing address of the receiving Office	Authorized officer
URZĄD PATENTOWY RZECZYPOSPOLITEJ POLSKIEJ Al. Niepodległości 188, 00-950 Warszawa	Paulina Gortat
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Form PCT/RO/105 (July 2008)

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Reproduction of the mark in color under Rule 9.4(a)(vii)	
Registration number	**1 713 180**
Registration date	**October 31, 2022**
Date next payment due	**October 31, 2032**
Name and address of holder	BUDOWNICTWO MODUŁOWE sp. z o. o. ul. C. Godebskiego 32, PL-05-090 Raszyn (Poland)
Legal nature of the holder (legal entity) and place of organization	limited liability company, Poland
Name and address of the representative	Kancelaria Patentowa Wyszyńskiego 58 m. 25, PL-94-047 Łódź (Poland)
Classification of figurative elements	24.17; 27.5; 29.1
Colors claimed	Red and navy blue.
List of goods and services NCL(11-2022)	37 Building services; industrial construction. 42 Design of buildings.
Basic registration	Poland, 03.11.2016, R.293548
Designations under the Madrid Protocol	Canada, European Union
Designations under the Madrid Protocol by virtue of Article 9sexies	Ukraine
Date of notification	16.02.2023
Language of the international application	English

Hongbing Chen
Director, Madrid Operations Division
Madrid Registry
Brands and Designs Sector

Geneva, February 16, 2023

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