Ministry of Education and Science of Ukraine
SHEI "Prydniprovska State Academy of Civil Engineering and Architecture"

Innovative Sustainable Engineering Practices

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Innovative Sustainable Engineering Practices

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This monograph is the result of studies which were carried out resechers and students of the SHEI "Prydniprovska State Academy of Civil Engineering and Architecture". The project is aimed at addressing environmental friendliness and energy efficiency of the cities and towns and reducing greenhouse gas emissions as the result from their construction and in operation. The monograph presents two projects: "Suggestions for improving the quality of living environment in the Center-Hall Betanium in Malatski" and "Concept of reconstruction of Obchodna Street in Bratislava".

Ця монографія є результатом наукових досліджень вчених і студентів ДВНЗ «Придніпровська державна академія будівництва та архітектури». Проект стосується екологічних питань з точки зору енергоефективності будівель та міських поселень та скорочення викидів парникових газів внаслідок їх будівництва та експлуатації. В монографії представлено два проекти: «Концепція енергоефективної реконструкції вул. Обхідна в Братиславі» і «Проектні пропозицій щодо підвищення якості середовища існування в Центрі-притулку Бетанія в м. Малацки».

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SUGGESTIONS FOR IMPROVING THE QUALITY OF LIVING ENVIRONMENT IN THE CENTER-HALL BETANIUM IN MALATSKI

Introduction

The European Development Strategy until 2020 ensures a reduction of energy efficiency by 20%, a decrease by 20% of greenhouse gases in the atmosphere (from the 1990 level) and the achievement of a 20% coverage of energy consumption in Europe by using renewable energy sources.

According to the European directive of energy efficiency of buildings, all new residential buildings from December 31, 2020 must meet the standard of a building with zero energy consumption or be "positive", all existing buildings must be thermally modernized to meet modern requirements.

The project "Suggestions for improving the quality of living environment at the Bethany Center-Shelter in Malatskiy" aims to solve technical and social problems of staying at the Center by taking measures of improving the energy efficiency of the Center's building, constructing a greenhouse, redesigning it and reassigning its premises to improve the comfort of the indoor environment as well as landscaping and greening its adjacent territories.

Keywords: energy efficiency, thermomodernization of buildings, greenhouse, solar heat gain, heat loss.

1.1. Complex centers of social services

Centers of social help for families and children are social service institutions directed to assist families, children and individuals who find themselves in difficult life situations, namely assistance in realization of legal rights and interests, social support providing social, domestic, medical, psychological, legal and other assistance.

The main task of such centers is to conduct social, health, educational, preventive and other measures aimed at social, domestic, psychological, legal support and services for various groups of the population who need it.

1.1.1. Care centers for single mothers. Ukrainian experience

Ukrainian experience in creating such social assistance centers is solved as follows.

Social Support Centers are created in Ukraine to solve problems of helping citizens who find themselves in a difficult life situation. First of all, such centers are aimed to help single mothers to prevent early failures from newborn babies. This partially helps to solve the problem of orphanhood in Ukraine.

The Mother and Child Social Center in Ukraine is an institution for the temporary residence of women in the seventh-ninth month of pregnancy and mothers with children under the age of 18 months who are in difficult life situation that interfere to perform a maternal responsibilities.

The center is created by local executive authority or local government. The maintenance of the center is carried out at the expense of the local budget, provided for solving the problems of children, women and family.

The main goal of the activity is to introduce the new social support forms for women and to prevent parents abandonment of newborn children.


Fig.1. Center for Mothers with Children in Dnipro, Ukraine

1.1.2. Center-shelter for mothers with children of Bethany in Malacky

Bethany Center was founded in 2006 in the Malacky town (Slovakia).

The center is a shelter designed for mothers with children who are in a difficult life situation for various reasons (unemployment, difficult financial situation, domestic violence, etc.).

Each family in the Bethany Center has a separate space in the form of a separate room, and common areas (bathroom, living room, kitchen).

The Bethany Center works with employment offices, municipalities and courts to help residents deal with issues of a different nature. Also, social workers of the center help residents in matters of children upbringing, education and the organization of their leisure time.

Fig.2. Center-shelter Bethany in Malacky town

The Bethany Center-Shelter also has a number of different problems:

- the building is quite old and does not meet modern requirements in the field of energy efficiency;
- in the center there is no in-patient station for the provision of qualified medical care;
- there is no program for the rehabilitation of the shelter residents;
- there are no playgrounds for children and landscaping around the center.

1.2. Suggestions for improving the quality of the environment in the Bethany Center-Shelter in the Malacky town

To solve technical, social problems, as well as increase the comfort of staying at the Center, it is necessary to work out a set of tasks.

Namely, to carry out a number of activities aimed at improving the energy efficiency of the building, by warming the external enclosing structures and constructing a greenhouse combined with the Center`s building; internal redevelopment or changing the purpose of existing premises for the medical service center organization; improvement of the adjacent territory, by creating recreational areas for children and adults, as well as additional landscaping.

The construction of a greenhouse combined with the building of the Center partially allows to solve the issues of psychological rehabilitation and leisure activities for the residents of the center by growing, taking care and contemplating various plants. Also this decision will have an economic effect, since residents of the center will be able to receive a variety of additional plant products in the form of fresh vegetables and greens.

1.2.1. Plant growing is a psychological therapy

Growing plants is more than a way to make a home more attractive. A recent study by the Department of Public Health at Harvard University, together with Brigham and Women Hospital, has shown that people who live in areas with many trees have better physical and mental health and low levels of depression.

Professor Tim Lang from the Center for Food Policy at the City University of London (City University London) speaks of the widely recognized fact that regular contact with plants, animals and the natural environment can improve a person's physical and mental well-being. When we grow plants and flowers, we interact with the natural world, which provides protection from the modern life stresses [1].

For a large number of people in our society - children and adults who live with physical or mental health problems, gardening and growing plants in the community can help to relieve the symptoms of serious diseases, prevent the development of some painful conditions and improve their well-being in long term.

London therapists even prescribe patients time to grow plants. Therapy is conducted on the territory of the Lambeth Hospital food cooperative, where the researches of farming benefits for person's physical and mental state, while growing food, are held.

This cooperative was established in 2013 at Brockwell Park Surgery Hospital in South London, but today it has branches at other hospitals in different parts of the city, where unused space is turned into garden beds for patients who cultivate fruits and vegetables.

The soil has a beneficial effect on the brain. This effect is similar to the effect of antidepressants that improve mood. Researchers at the University of Bristol and University College London have found out that, under the influence of "friendly" soil bacteria, there is a change in human behavior, just like when an antidepressant is received. Treatment with the bacteria Mycobacterium vaccae activates a group of neurons that produce serotonin in the brain that affects mood. People who grow plants inhale these bacteria and are in constant contact with them [1].

Hilda Burke, a psychotherapist, says that growing plants is a process that helps a large number of people enter a state of “flow.” This means that you don’t notice the time flow, don’t think about different things at the same time, don’t create plans and don’t dig in the past.

It helps people to disconnect from other things and feel themselves in the present moment. Working with the soil, growing plants, patience and taking care of them use a large number of the human brain function and include training, solving problem and sensory activity, keeping our brain active.

Fig.3. Crop production has a positive effect on human health

1.2.2. Technical condition of the building of the Bethany Center

1. Basic data

Name of space object	Shelter Bethany in Malacky, Slovakia				
Addres	MALACKY, SKUTECKE 5246/16, PARC. No. 3631/1				
Building type:	Shelter				
Year of construction	unknown	Year of entry into service	2006		
The date of the last repair / reconstruction	2006				
Climate data					
Facility:	Shelter Bethany in Malacky, Slovakia				
North latitude:	48°26'17"	East longitude:	17°01'25"	Elevation	159
Heating season (HS); the beginning	01.10	The end: [*dd/mm*]	30.04	Heating degree day	3500
Temperature regime of the cold period: (°C)	-24	Temperature mode of the warm period: (°C)	21,3		
Average wind speed	-	Prevailing wind direction			
Internal space, schedule of people's stay and heating					
Current conditions of the internal environment	acceptable				
Internal air temperature	Measured	at ambient temperature	Norms		
Internal air temperature (°C)	-	Average for the heating period	20		
Cool-down – night (°C)	-	-	18-20		
Cool-down – weekend (°C)	-	-	18-20		
Schedule	Working days	Saturday	Sunday		
Stay schedule (hour/day)	constantly	constantly	constantly		
Heating schedule (hour/day)	constantly	constantly	constantly		
Number of present					
Permanent residents / workers	40	Man			
Temporary residents / workers / visitors	3	Man			
The average number of inhabitants	40	Man			

2. Enclosing the structures of buildings

The total space of the building (m^2)	494,4	Total air-conditioned space (m^2)	494,4
Total volume (m^3)	2392,8	Air-conditioned volume (m^2)	1393,22
The square of the 1st floor (m^2)	459,81	Number of floors	1
Perimeter of the 1st floor (m)	109,82	Net room height (m)	3,03
Overall length of the building (m)	42,38	Overall height of the building (m)	4,84
Overall width of the building (m)	12,53	Average floor area (m^2)	-

2.1. External walls

The overall assessment of the current state								acceptable
Total area (m^2)	469,3 m^2		The heat transmission coefficient U W/m^2K					1,78
Wall structure	Profiled sheet + Brick + interior plaster = 330 mm			Thermal insulation	- missing			
Orientation	N	NE	E	SE	S	SW	W	NW
Wall area (m^2)	188,5	-	48,5	-	177,7	-	54,6	-
Wall materials	brick	-	brick	-	brick	-	brick	-
The heat transmission coefficient U (W/m^2K)	1,78	-	1,78	-	1,78	-	1,78	-

Wall heat transfer coefficient $U1 = 1.78$ W / (m2 * K) significantly exceeds the standard value.

Fig.4. The south facade of the Bethany Center

2.2 Windows and doors

The overall assessment of the current state			Partially acceptable
Total area (m^2)	62,08	The heat transmission coefficient U W/m^2K	0,6
Material type	W – wood., P – plastic, A – aluminium, etc		
Type of frame / box	S – single, D – double, T – twin		

Orientation	The size (a x b), m	The area of one, m^2	Quantity, pcs	Total area, m^2	Material type	Type of frame	Type of glazing.	U W/m2K
South	1,42x1,06	1,51	15	22,65	P	D	2	1,96
Doors with glazing	1,39x2,1	2,92	1	2,92	P	D	2	1,96
Entrance doors	0,9x2,0	1,8	1	1,8	W	-	-	2,28
Western	1,42x1,06	1,51	4	6,04	P	D	2	1,96
North	1,42x1,06	1,51	6	9,06	P	D	2	1,96
	0,6x1,06	0,636	4	2,54	P	D	2	1,96
	0,6x1,35	0,81	1	0,81	P	D	2	1,96
Doors with glazing	1,15x2,0	2,3	1	2,3	P	D	2	1,96
Doors with glazing	0,94x2,0	1,88	1	1,88	P	D	2	1,96
East	1,42x1,06	1,51	4	6,04	P	D	2	1,96
	1,42x1,06	1,51	4	6,04	A	D	2	2,5
Total				62,08				

90% of windows are plastic and have a two-chamber profile, but have a high coefficient of thermal conductivity. The rest (10%) are old windows with aluminum profiles. Windows need to be replaced with modern energy efficient ones.

Fig. 5 Windows in the Bethany Center

2.3 Roof

The overall assessment of the current state			Acceptable
Total area (m^2)	494,4	The heat transmission coefficient U W/m^2K	0,6
Type of roof	Roof construction		Thickness, mm
Flat roll roofing	Reinforced concrete roof plank Gritting Cement sand cushion Waterproofing Bituminous paving		200 100 50

2.4 The floors

The overall assessment of the current state			Acceptable
Total area (m^2)	494,4	The heat transmission coefficient U W/m^2K	0,27

1.2.3. Heat loss through the enclosing structures of the Bethany Center building

The main heat fluxes are directed through external enclosing structures. Their value is directly related to the indicator of materials thermal resistance from which the enclosing structures are made.

To develop measures aimed at improving the energy efficiency of the building and improving the quality of the indoor microclimate, heat loss was calculated through the building envelopes every month during the heating period. The calculation of heat losses was carried out according to the methodology of the Ukrainian National Standard [2]. Data on climatic conditions and calculated temperatures were taken according to [3].

The results of the calculation are presented in Table 1 and in Fig.6.

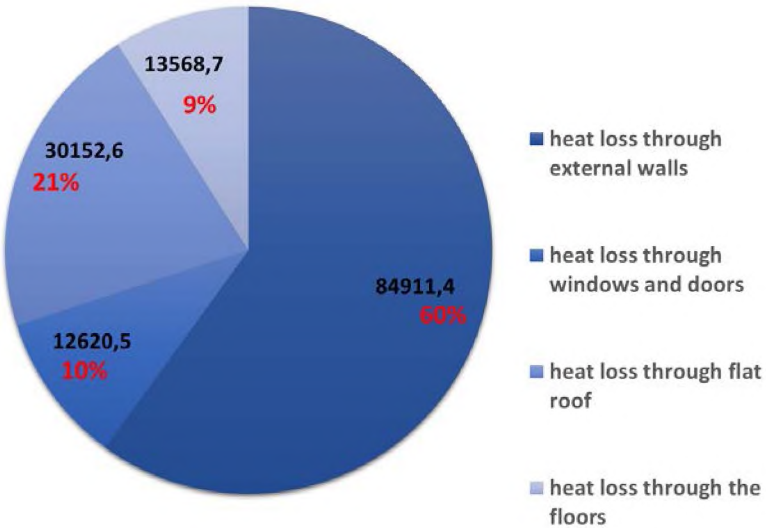


Fig.6. Heat losses through the enclosing structures of the Center's building for the heating period, kWh,%

Heat losses through the enclosing structures of the Bethany Center building

Table 1

Envelope building	Area (m^2)	Heat transmission coefficient U W/m^2K	Internal temperature t_i, °C	**Monthly heat loss, kWh**							
				October	**November**	**December**	**January**	**February**	**March**	**April**	**General for the period, kWh**
Walling	469,3	1,78	21	9260,4	11547	14232	15165	13080	12244	9383	**84911,4**
Windows	62,08	2	21	1376,4	1716	2115	2254	1944	1820	1394	**12620,5**
Roof	494,4	0,6	21	3288,4	4101	5054	5385	4645	4348	3332	**30152,6**
Floors	494,4	0,27	21	1479,8	1845	2274	2423	2090	1956	1499	**13568,7**
Total heat loss for the heating period, kWh				**141253,2**							

The calculation results showed that the greatest heat losses occur through the external walls of the building - 60%, the smallest through windows and floors. This can be explained by the fact that most of the windows of the Center have already been replaced by more modern ones, which, comparing to the old windows with metal frames, have a lower coefficient of thermal conductivity.

But in general, the calculation results showed that heat loss in the building is significant 141253,2 kW•h = 508.5 GJ during the heating period. The specific heat losses of the building are calculated as 285.7 kWh / m². This suggests that the building corresponds to the lowest energy efficiency class F.To increase the building energy efficiency class, reduce heat loss through the building envelope, and at the same time improve the quality of staying inside the building, it is necessary to take measures for the thermal insulation protection of the external building envelope.

1.2.4. Improving the heat-shielding properties of building envelopes

Improving the heat-shielding properties of wall enclosing structures is to increase their resistance to heat transfer and is achieved by insulating them with thermal insulation materials. The heat-insulating layer is protected from external influences by a decorative protective layer that can preserve and improve the architectural and artistic appearance of the structure.Thermal insulation must comply with fire safety and thermal conductivity of supporting enclosing structures.

Exterior walls.

For the external walls heat insulation of the Center, ventilated front systems were selected using basalt wool slabs as a heat insulation layer.

Basalt wool has a number of significant advantages compared with other heat-insulating materials: high heat and sound insulation qualities due to the low thermal conductivity of the material 0.035 - 0.041 W / m • K, durability, water resistance, environmental friendliness and fire resistance.

Windows and doors

Windows are the weakest, in thermal terms, places in the house, through which a lot of heat is lost, and if the windows are not of high quality, the losses will grow even more. To reduce heat loss through translucent openings and doors, it is necessary to provide their replacement with modern energy-efficient structures.

Flat roof

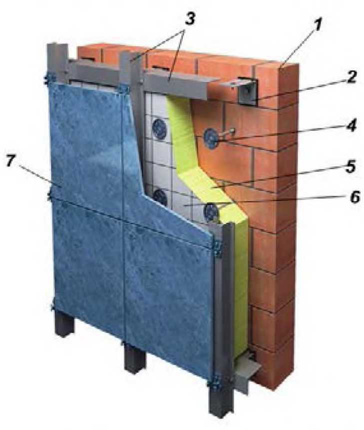
The main feature of the design is strict requirements for all elements, since different loads will act on the heat-insulating layer: wind, snow, maintenance, installation, etc. The heat insulation layer must have satisfactory physical and mechanical characteristics, because it is impossible to exclude the possibility of moisture ingress into the coating completely. Therefore, it must be water-repellent. For warming the roof of the Bethany Center, as a heat insulating layer it is proposed to use mineral wool on a basalt basis of high density 100 - 180 kg / m^3.

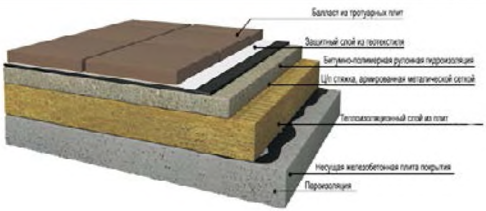
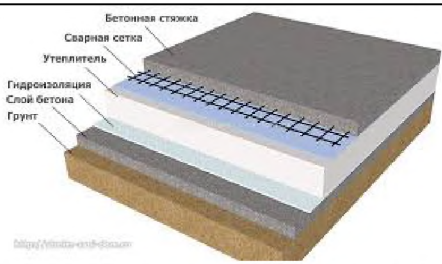
Floors

Materials used for floor insulation are exposed to increased loads. Therefore, among the requirements for them, in addition to thermal conductivity, high compressive strength and a low degree of deformation under compression are emphasized. We use a basalt based mineral wool of high density 160 - 180 kg / m³ as a heat insulating layer for the Center's floor insulation. And to protect from moisture penetration it is necessary to provide waterproofing. Waterproofing in the floor construction should be permanent. In places where the floor is adjacent to the walls and other protruding structures above the floor, waterproofing should be permanently continued to a height of at least 300 mm from the floor covering level.

Elements of enclosing structures of a building with insulating layer

Table 2

<table>
<tr><th colspan="3">Building component</th></tr>
<tr><td colspan="3"><u>External wall</u></td></tr>
<tr><td>
</td><td colspan="2">1 – existing walls – 330 mm
2 – bracket
3 – horizontal and vertical track of attachment
4 – heat insulation material attachment
5 – heat-insulating material – 150 mm
6 – wind-waterproof membrane
7 – wall board – 6 mm</td></tr>
<tr><td colspan="2">Heat transfer resistance, $m^2 \cdot K/W$</td><td>4,9</td></tr>
<tr><td colspan="2">Coefficient of thermal conductivity, $W/ m^2 \cdot K$</td><td>0,21</td></tr>
</table>

Windows and doors	
	Replacing windows for modern energy efficient, e.g. REHAU SYNEGO
Heat transfer resistance, m²·K/W	0,9
Coefficient of thermal conductivity, W/ m²·K	
Flat roof	
	Heat-insulating layer – basalt wool – 250 mm
Heat transfer resistance, m²·K/W	7,44
Coefficient of thermal conductivity, W/ m²·K	0,134
Floors	
	Heat-insulating layer – basalt wool – 250 mm
Heat transfer resistance, m²·K/W	6,4
Coefficient of thermal conductivity, W/ m²·K	0,155

The results of thermal calculation and calculation of heat loss through the building envelope after the measures for their insulation are given in Table 3. Comparing the results of thermal indicators before and after measures for the enclosing structures insulation are presented in Table 4 and Fig.7.

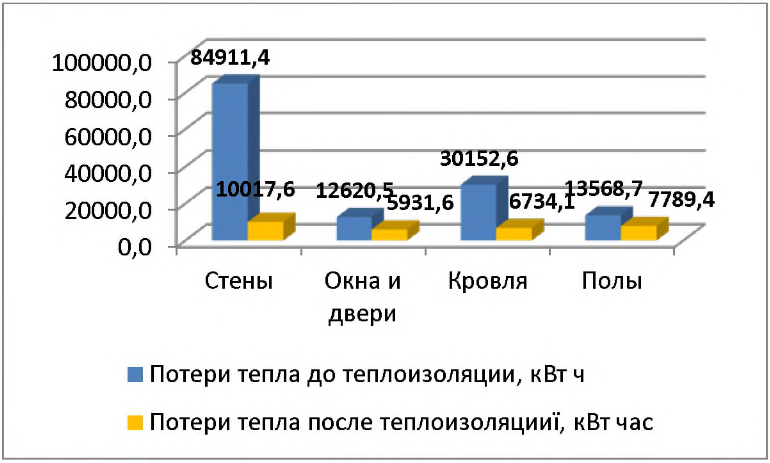


Fig. 7. Heat losses through the building envelope of the Central before and after their thermal insulation

After analyzing the calculation results before and after the thermal insulation of the enclosing structures of the Bethany Center building, it can be concluded that by taking measures to insulate the enclosing structures of the building, heat losses can be reduced by almost 80% during the heating season. Reducing heat loss will reduce the temperature of heating devices, the power of air conditioning systems, which, in turn, will reduce energy costs, as well as increase the sanitary and hygienic conditions in the premises.

Thermal insulation of the fencing structures of the Bethany Center will allow saving 400 GJ of thermal energy per heating season.

Heat loss through enclosing structures with thermal insulation

Table 3

Envelope building	Area (m^2)	Heat transmission coefficient U W/m^2K	Internal temperature t_i, °C	Monthly heat loss, kWh							
				October	November	December	January	February	March	April	General for the period, kWh
Walling	469,3	0,21	21	1092,	1362,	1679,	1789,	1543,	1444,	1106,	**10017,6**
Windo	62,08	0,94	21	646,9	806,7	994,2	1059,	913,7	855,3	655,4	**5931,6**
Roof	494,4	0,134	21	734,4	915,8	1128,	1202,	1037,	971,0	744,1	**6734,1**
Floors	494,4	0,155	21	849,5	1059,	1305,	1391,	1199,	1123,	860,7	**7789,4**
Total heat loss for the heating period, kWh				**30472,8**							

Thermal performance before and after the insulation of the casing of the Bethany Center building

Table 4

Building element	The heat transmission coefficient before insulation, U, W/m^2K	Heat losses before insulation, GJ/year	The heat transmission coefficient after insulation, U, W/m^2K	Heat losses after insulation, GJ/year	Annual saving, GJ/year	Annual saving, %
Walling	1,78	305,7	0,21	36,1	269,6	88%
Windows	2	45,4	0,94	21,3	24,1	45%
Roof	0,6	108,6	0,134	24,2	84,4	78%
Floors	0,27	49,9	0,155	28,0	21,9	44%
Common values	-	509,6	-	109,6	400	78%

1.2.5. Greenhouses, interlocked with buildings

One of the solutions for the technical and socio-psychological problems of the Bethany Center may be the construction of a greenhouse interlocked with the building center. Greenhouses are used for growing vegetables, flowers, as well as for exhibition purposes (gardening shops, oranges, botanical gardens). For these various functions, different types of single or multi-level greenhouses in various sizes and shapes are offered.

The idea of growing plant products in cities, close to consumers, is becoming increasingly popular. Ways to translate this idea into reality are "Vertical Farms", farms on the roofs of houses, underground farms in abandoned underground mines, etc.

The farm on the roof allows you to get crops directly at the place of consumption, the design of the greenhouse increases the energy and environmental characteristics of the main building because the soil and vegetation protects the building construction of the roof from the adverse climatic effects of the environment.

Fig. 8. Montreal farm Lufa Farms on the roof of the building

Brooklyn Grange (fig. 9) is the largest roof farm in the world. This is the base for a local community that produces truly organic vegetables and fruits. City Farm in Tokyo compares favorably with European and American counterparts. Here reigns the same idea about producing local food for a certain community, and also measures are being taken to ensure the big city residents witness the growth of the food they consume.

Fig.9. Brooklyn Grange is the largest roof farm in the world.

Vertical trusses - highly automated agro-industrial complex, located in a special designed high-rise building. Vertical farming is a concept that argues that it is economically and environmentally beneficial to grow plant products within high-rise buildings.The main difference between vertical farms from traditional greenhouses (Fig. 10) and livestock farms is an intensive approach to the use of the territory, a vertical multi-tiered distribution of plantations. In fact, the farm is a multi-storey greenhouse.

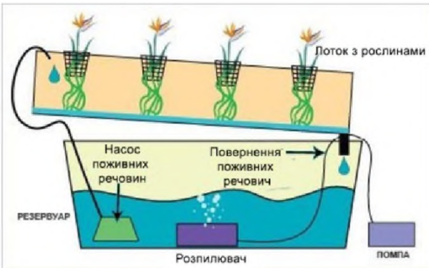
Fig.10. Vertical trusses

By growing plants indoors, it is possible to get precise control over the resources that the crop needs. This allows plants to grow in a predictable and carefully controlled manner.There are several basic models of closed agriculture (Fig. 11):

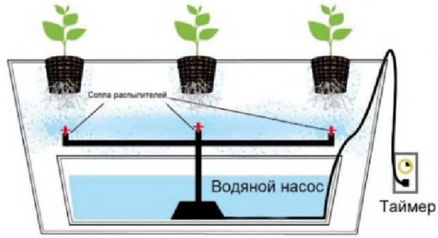
- hydroponics - when plants are grown in a nutrient-rich water pool;
- aeroponics - when the roots of plants are periodically sprayed with mist containing water and substances, while using less water, but there are more technical problems;
- aquaponica - includes the breeding of fish, which helps to cultivate bacteria, which are used to feed the plants then.

Examples of vertical farms projects in various countries of the world, which include all modern achievements of science and technology, adhere to environmental requirements and have a positive effect on society (Fig. 12).

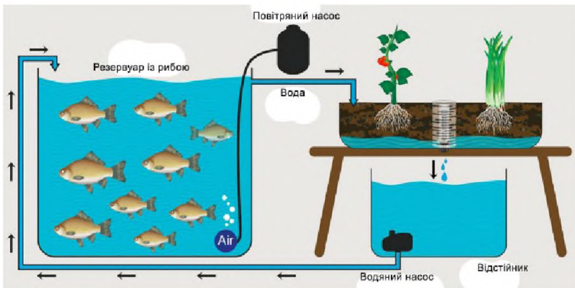
In addition to vertical farms, underground greenhouses are becoming increasingly popular around the world. In most cases, the hydroponic method of growing plants is used in underground greenhouses. For example, the company Zero Carbon Food, using the old bomb shelters, created underground greenhouses, which, using only a quarter of the available space, can produce from 5 to 20 tons of products per year. (Fig. 13).



a)



b)



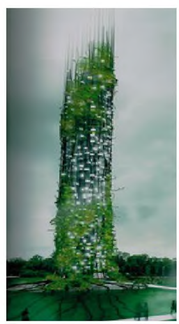
c)

Fig. 11. Models of closed agriculture:
a) hydroponics; b) aeroponics; c) aquaponics

a)

b)

c)



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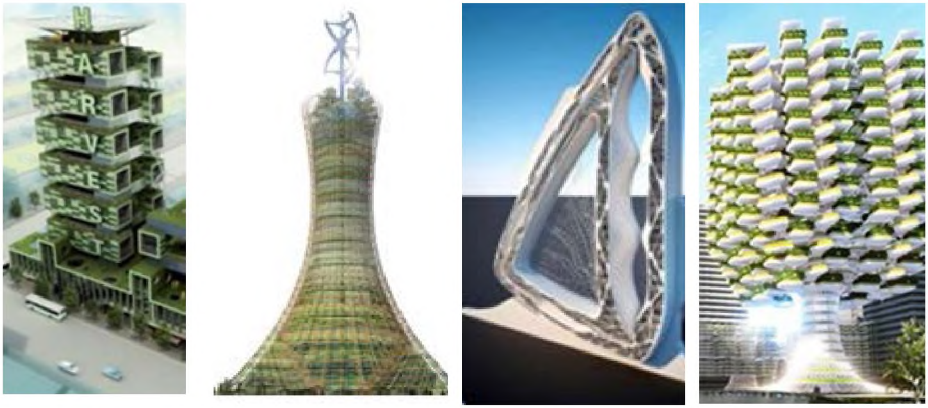


f) g) h) i)

Fig. 12. Examples of vertical truss projects

Fig.13. Underground greenhouse companies Zero Carbon Food

If we talk about small farms or individual building houses, the idea of a house combined with a greenhouse is becoming increasingly popular. The greenhouse directly adjacent to the building is an additional cozy human habitat. Greenhouse can be used for growing plants, useful and decorative, and a veranda for recreation. Due to the presence of a transparent fence in the greenhouse, it is possible to accumulate most of the solar radiation incoming energy, which significantly reduces the overall heat loss in the building.

Fig.14. Greenhouses in individual building houses

Many people believe that greenhouses can be created only in rural areas, and in urban environments this applies only to small buildings. However, it is not. Greenhouses can also be arranged in apartments in multi-storey buildings, where they form an individual or collective outdoor area in which it is possible grow crops or spend free time.

Fig.14. Greenhouses in individual building houses

1.2.6. Architectural design solutions for greenhouses

In addition to functional and physical factors, architectural and construction solutions of greenhouses largely depend on the type of building, for example, on its size, number of floors, etc. The choice of an effective solution is also significantly influenced by the peculiarities and nature of the environment - the shape and terrain of the area, surrounding buildings, and shading. In small one-and two-storey individual buildings there are various options for the layout of greenhouses. Such greenhouses give the building an individual character, but in their design they must be subordinated to the main architectural solution of the building. A greenhouse should become not a random extension, but a harmonious part of the building. Architecturally, a greenhouse is a natural continuation of the building shape, and is built regarding to building materials and the color shades of the building.

Due to the presence of a transparent fence in the greenhouse, it is possible to accumulate most of the incoming energy of solar radiation. Therefore, the greenhouse must be placed on the sunny side of the house, where insolation is provided mainly from February to November. The greenhouse functions as a solar energy storage device and contributes to the heating of the building due to the supply of free solar heat and the reduction of heat losses. On a sunny day, when the building quickly overheats, the greenhouse effectively functions as a building cooler.

In addition to the vents, in the upper part of the greenhouse, vents can be placed to connect with the cool side of the house (northwest - north - northeast), in this case air flows can be created, in which the heated air pulls out the cooler air.

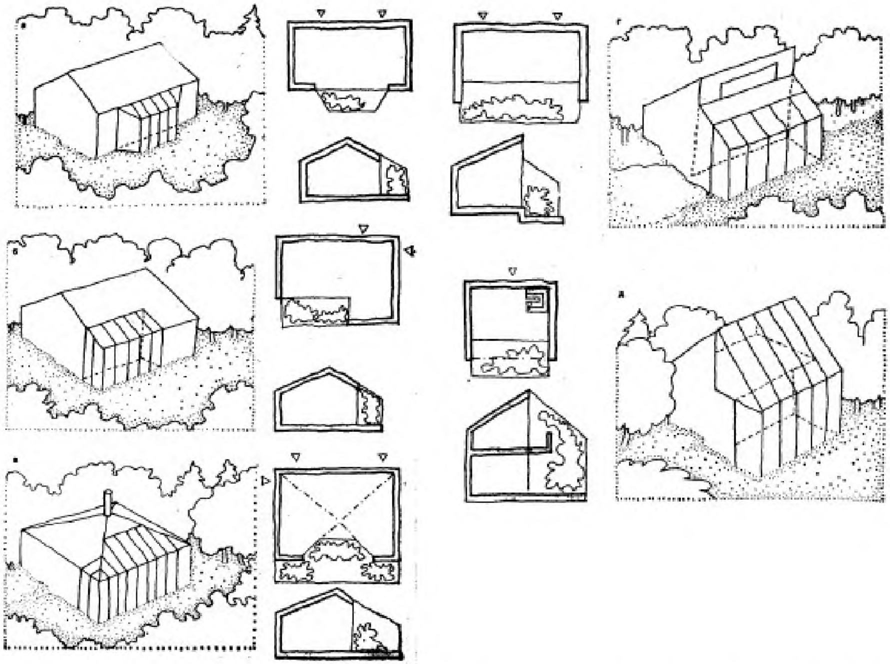


Fig.15. Constructive solutions for greenhouses in a small building

In addition to functional and physical factors, architectural and construction solutions of greenhouses largely depend on the type of building, for example, on its size, number of floors, etc. The choice of an effective solution is also significantly influenced by the peculiarities and nature of the environment - the shape and terrain of the area, surrounding buildings, and shading.

To device greenhouses translucent coatings such translucent materials: plastic film, glass and polycarbonate are used. Today, cellular polycarbonate, that has indisputable advantages over other materials, is becoming increasingly popular for these purposes: high transparency - high transparency for visible radiation (80-86%); small specific weight (1200 kg / m^3); high thermal insulation properties (heat transfer coefficient - 2.05 W / m² * K); resistance to weathering, etc. The plasticity of polycarbonate allows forming honeycomb sheets of various configurations (zigzag and wavy), as well as profiled sheets.

To make a greenhouse frame apply materials such as wood or light-weight thin-walled steel structures (LSTC) are used. The advantages of LSTC are environmental friendliness, ease, speed and ease of installation, wide possibilities for architectural solutions, durability, low cost..

Taking into account the diversity of profiles, installation technologies in conjunction with various materials and construction techniques, light steel structures are used in various fields. This truly revolutionary technology allows you quickly and efficiently to put up buildings for a wide variety of purposes: residential buildings and cottages up to 3 floors high, cultivation and livestock buildings, as well as high-rise buildings using metal frame as the building envelope.

1.2.7. Constructing a greenhouse in Bethany Center.

Architectural planning solution for the greenhouse construction in Bethany Center consists of two options.

The first option is to build a greenhouse (Fig. 16), adjacent to the building center from the southern and eastern sides (as the most favorable for the orientation of the greenhouse). The width of the greenhouse is taken on the basis of the presence of the adjacent area around the center building, and is 5 m. The length of the attached greenhouse is taken according to the length of the building. The height of the greenhouse complex is 4.5 m - for the entire height of the building. Part of the enclosing structures of the Center’s building, which are not in contact with the greenhouse, is proposed to be insulated, according to the design solutions developed earlier.

Fig.16. Greenhouse attached to the Center's building from the south and east side.

The second option provides for the construction of a greenhouse on the roof of the Bethany Center building (Fig. 17). Unlike the first option, this option is possible only with sufficient bearing capacity of the existing building structures, or provided that an additional frame-bearing system is installed on detached foundations.

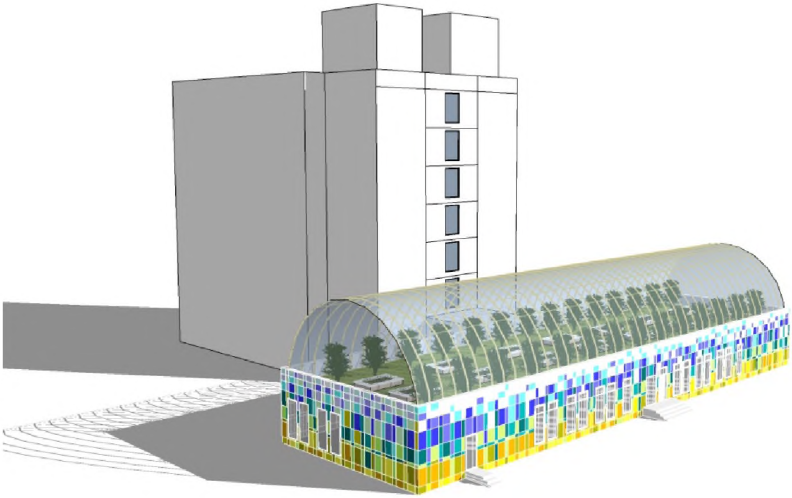


Fig.17. The construction of greenhouses on the roof of the building of the Center

For the construction of a greenhouse in the center of Bethany, we propose to use a frame made of LSTC, the step of transverse frames is recommended 3 m, cover should be made on farms of LSTC, the frame stand is C-shaped, 200x70x2.5 mm.

Due to the relatively small weight of structures, such a building is installed on reinforced concrete foundations of shallow foundation — a monolithic slab or pile foundation.

The greenhouse we use cellular polycarbonate, 16 mm thick as a material of translucent coating.

1.2.8. Heat losses in the building of Bethany Center combined with the greenhouse

For the variants of the Bethany Center building combined with the greenhouse, heat loss was calculated monthly for the heating period, as well as monthly solar heat gains were calculated every month. The results for the variant with an attached greenhouse are presented in tables 5, 6, 7 and in Fig.18.

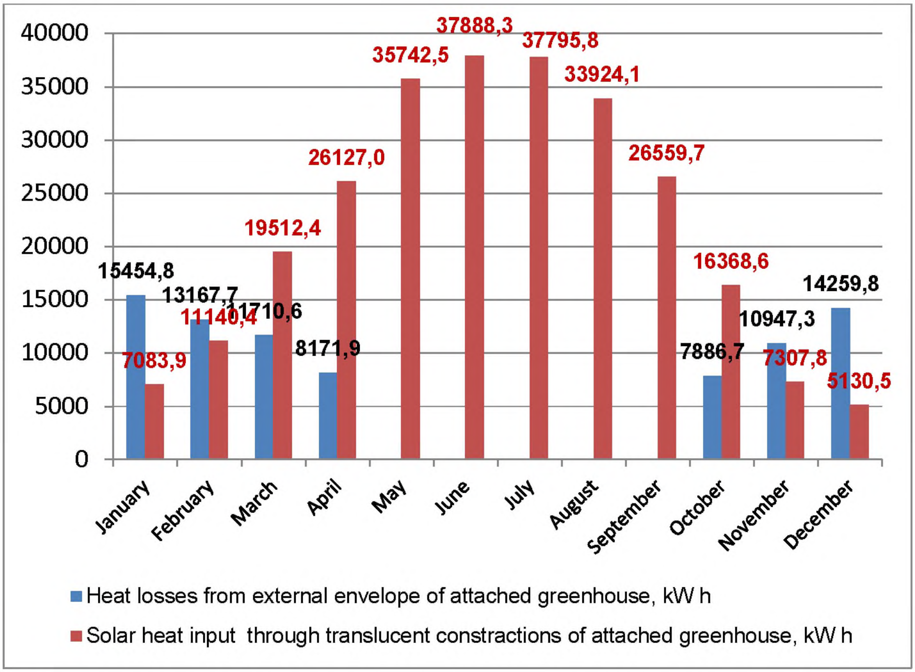


Fig. 18. Annual heat losses and heat gains through the translucent structures of the attached greenhouse

Heat losses through the building envelope with the attached greenhouse of Bethany Center

Table 5

Envelope building	Area (m^2)	Heat transmission coefficient U W/m^2K	Internal temperature t_i, °C	Monthly heat loss, kWh							
				October	November	December	January	February	March	April	General for the period, kWh
Walling	243,1	0,21	21	565,9	705,7	869,8	926,8	799,3	748,2	573,4	5189,2
Windows	15,1	0,94	21	157,3	196,2	241,8	257,7	222,2	208,0	159,4	1442,8
Roof	494,4	0,134	21	734,4	915,8	1128,7	1202,7	1037,3	971,0	744,1	6734,1
Floors	494,4	0,155	21	849,5	1059,4	1305,6	1391,1	1199,9	1123,2	860,7	7789,4
Total heat loss for the heating period, kWh				**21155,5**							
Greenhouse fencing	428,3	2,5	16	7886,7	10947,3	14260	15455	13168	11710,6	8171,9	81598,9
Total heat loss for the heating period in the greenhouse, kWh				**81598,9**							

Solar heat gains through the translucent fences of the attached greenhouse

Table 6

Building element	Orientation	Building element material	Area, m2	Equivalent insolation area, Asol, m2	Solar heat gain through the building structure element, Φsol, W											
					I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
South facade	S	Alveolated Polycarbonates 16 mm	105,95	64,84	3242	4669	5901	6419	6614	6354	6549	7197	7911	6160	3177	2334
East facade	E	Alveolated Polycarbonates 16 mm	31,3	19,16	402	690	1092	1552	2069	2280	2222	2069	1552	881	383	287
Transparent cover	E+S	Alveolated Polycarbonates 16 mm	291,00	178,09	5877	11220	19234	28317	39358	43989	42030	36331	27426	14960	6589	4274
Total solar heat gains, kWh					**7084**	**11140**	**19512**	**26127**	**35742**	**37888**	**37796**	**33924**	**26560**	**16369**	**7308**	**5130**
Total solar heat gains during the heating period, kWh					**92670,7**											
Solar revenues during the summer, kWh					**171910,4**											
The total solar heat gain for the year, kWh					**264581,0**											

Monthly heat losses and heat gains for an attached greenhouse

Table 7

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Heat loss through the building envelope attached greenhouses, kWh	**15454,8**	**13167,7**	**11710,6**	**8171,9**						**7886,7**	**10947,3**	**14259,8**
Solar heat gains in the attached greenhouse, kWh	**7083,9**	**11140,4**	**19512,4**	**26127,0**	**35742,5**	**37888,3**	**37795,8**	**33924,1**	**26559,7**	**16368,6**	**7307,8**	**5130,5**

The results of the calculation of heat losses and heat gains for the variant with a built-in greenhouse are presented in tables 8, 9, 10 and in Fig.19.

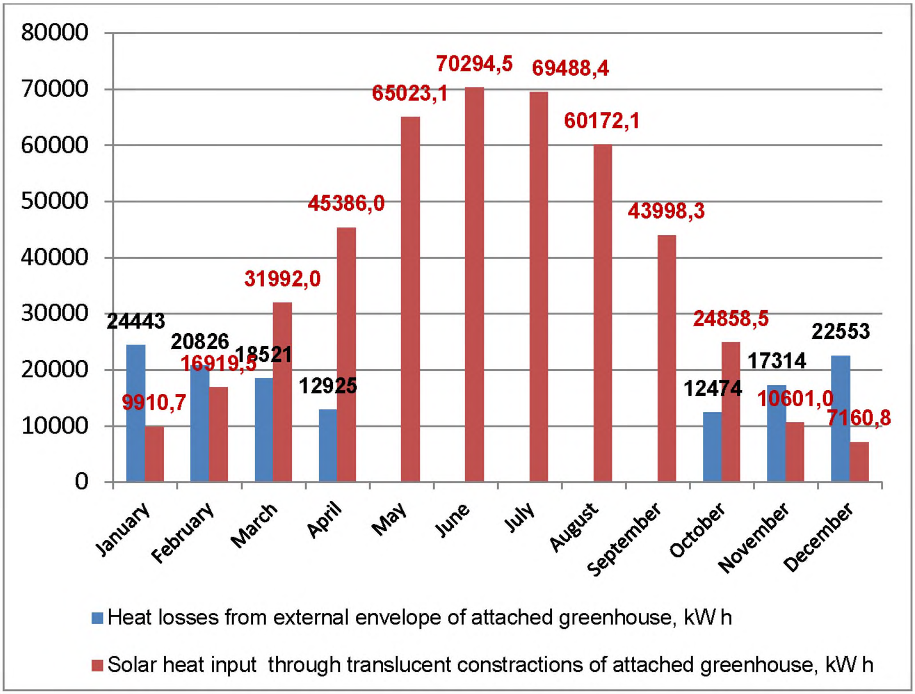


Fig.19. Annual heat losses and heat gains through the translucent structures of the built-in greenhouse

Heat loss through the building envelope with a built-in greenhouse

Table 8

Envelope building	Area (m^2)	Heat transmission coefficient U W/m^2K	Internal temperature t_i, °C	Monthly heat losses, kWh							
				October	November	December	January	February	March	April	Total heat loss during the heating period, kWh
Walls	469,3	0,21	21	1093	1362	1679	1789	1543	1444	1107	10018
Windows and doors	62,08	0,94	21	647	807	994	1059	914	855	655	5932
Floors	494,4	0,155	21	850	1059	1306	1391	1200	1123	861	7789
Total heat losses of the building during the heating period, kWh				**23739**							
Greenhouse fencing	677,4	2,5		12474	17314	22553	24443	20826	18521	12925	129057
Heat losses during the heating period through translucent greenhouse structures, kWh				**129057**							

Solar heat gains through translucent fences of a built-in greenhouse

Table 9

The building's structural components	Orientation	Building element material	Area, m2	Equivalent insolation area, Asol, m2	Solar heat gain through the building structure element, Φsol, W											
					I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
South facade	S	Alveolated Polycarbonates 16 mm	29,9	18,30	457	695	1116	1427	1848	2049	2031	1757	1391	805	366	274
East facade	E	Alveolated Polycarbonates 16 mm	29,9	18,30	384	659	1043	1482	1976	2178	2123	1976	1482	842	366	274
Transparent cover	S+E	Alveolated Polycarbonates 16 mm	617,90	378,15	12479	23824	40841	60127	83572	93404	89245	77144	58236	31765	13992	9076
Total solar heat gains, kWh					**9911**	**16920**	**31992**	**45386**	**65023**	**70295**	**69488**	**60172**	**43998**	**24858**	**10601**	**7161**
Total solar heat gains during the heating period, kWh					**146828,5**											
Solar revenues during the summer, kWh					**308976,4**											
The total solar heat gain for the year, kWh					455804,9											

Monthly heat losses and heat gains for an attached greenhouse

Table 10

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Heat loss through the enclosing structures of the attached greenhouse, kWh	**24443**	**20826**	**18521**	**12925**						**12474**	**17314**	**22553**
Solar heat gains in the attached greenhouse, kWh	**9910,7**	**16919,5**	**31992,0**	**45386,0**	**65023,1**	**70294,5**	**69488,4**	**60172,1**	**43998,3**	**24858,5**	**10601,0**	**7160,8**

According to the results of the calculations, it was found that in both cases the annual heat gains significantly exceed the annual heat loss of the building. But at the same time, due to the climatic conditions, heat gains are unevenly distributed throughout the year. The greatest value of heat gains is observed in the summer period, while in the winter period, in the coldest winter months (November, December, January, Ferval), the amount of heat loss exceeds the amount of heat gains.

It should also be noted that in the autumn-spring transitional period, even though the heat input is higher than the heat loss, the outdoor air temperature can have large fluctuations, especially in the dark.

Therefore, we can conclude that for the operation of the greenhouse all year round, it is necessary to provide additional sources of heating during the coldest period or means of external protection of translucent structures from overcooling (external louvers). Additional sources of heating can be heat accumulators: daily allowances for the autumn-spring transitional periods, and seasonal for the coldest winter months.

1.2.9. Heat accumulators in the greenhouse

As heat accumulators in a greenhouse, there may be both elements of its structure (floor, walls, soil), as well as individual objects installed in it (containers with water, stones) laid close to the wall or free-standing.

<u>Water heat accumulators</u>. As water heataccumulators, you can use various containers, such as vessels from under the paint and barrels of metal or plastic. It is desirable to cover the surface of the

vessels with dark paint so that it absorbs well the thermal energy of the sun. In the greenhouse, they should be placed so that they fall the sun's rays.

A mandatory condition for the water placement heat accumulators is their tightness to prevent evaporation of moisture.The main feature of water heat accumulators is that in large tanks with water, heat is stored longer, but it is transferred more slowly to the lower layers of water. Small tanks react quickly to changes in temperature, thus avoiding overheating, but they too quickly transfer the accumulated heat to the greenhouse’s air, especially on cold nights.

Therefore, the optimal volume of water storage tank capacity of 10-20 liters. Soil as a battery of thermal energy. The use of soil (Fig. 20) is one of the cheapest and most affordable ways to heat a greenhouse, but it is ineffective and in many respects inferior to water heat accumulators. The fact is that the soil has a relatively low heat storage capacity; therefore, it is advisable to use special mechanical devices, such as fans, to heat it.

Stone and brick heat accumulators. Natural stone has the highest heat storage capacity. Getting on the dark stone surface of the floor, the sun's rays heat it. Due to thermal radiation and convection, part of the heat energy from the floor is transferred to the air, and it heats up.

Another part of the heat energy is accumulated by the floor material, and at night, when it becomes cooler, this heat is also radiated into the surrounding air (Fig. 21).

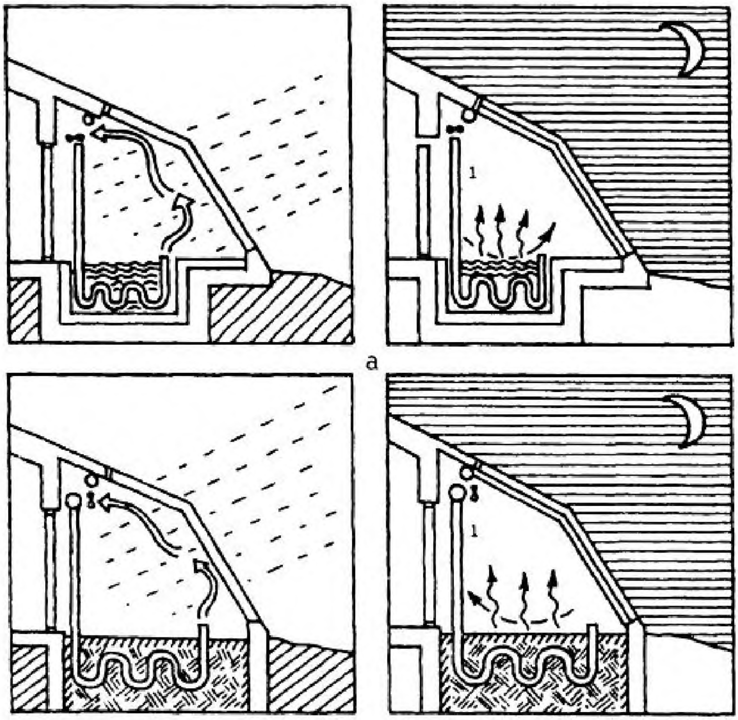


Fig.20. Use of soil as a heat accumulator

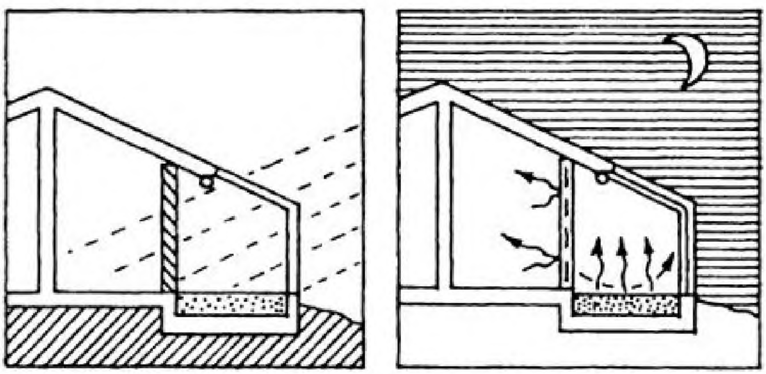


Fig.21. Accumulation of heat stone floor

If the rear wall of the greenhouse is laid out of stone, it will be heated by the sunlight falling on it and also radiate heat to the surrounding air (Fig. 22).

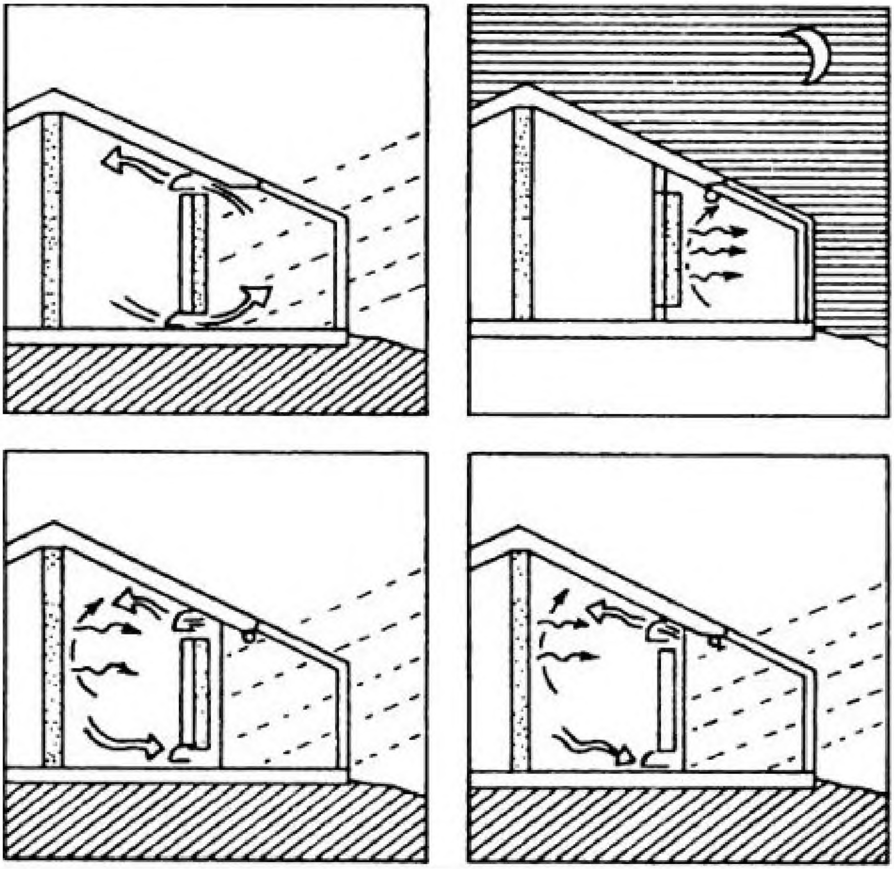


Fig.22. Stone wall as a heat accumulator

Stone heat accumulators without the use of fans have low efficiency. The stone heat accumulator can also be installed under the greenhouse floor with a fan mounted in it. Such a heat accumulator can already perform the functions of a seasonal heat accumulator.

Warm air to the bottom of the stone heat accumulator is injected through an air duct, from which it enters the stones, passes between them, cools, and then returns to the greenhouse. If you arrange a thermal insulation layer on top of the accumulating layer, then the heat will move from the warm zone during the cold season, heating starts in February - March, and cooling in October. In October, convection heat begins to flow into zones without thermal insulation (Fig. 23).

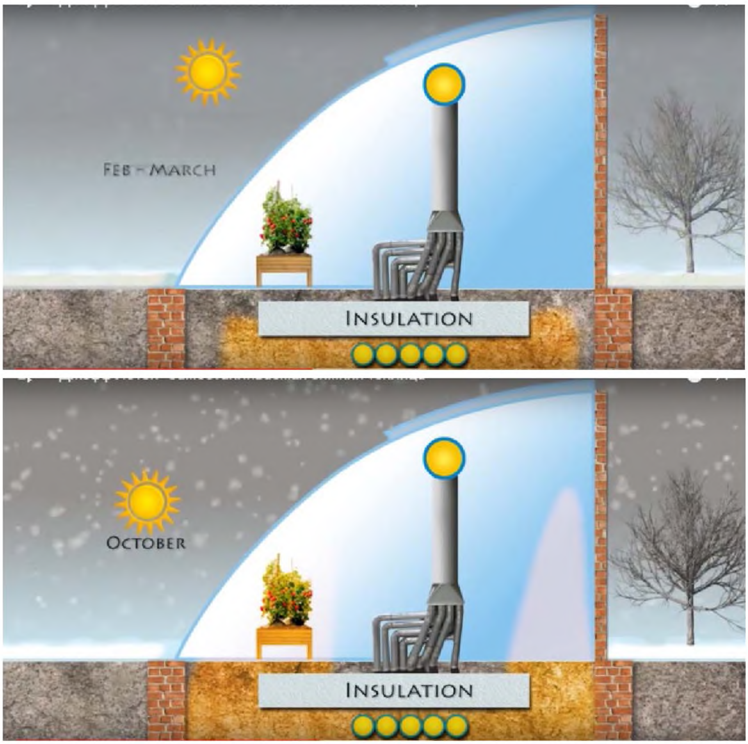


Fig.23. The principle of the seasonal heat storage accumulator operation

1.2.10. Calculation of the daily heat accumulator for the attached and built-up greenhouses of Bethany Center

As part of the project, a calculation of the required volume of accumulating mass for the attached and built-in greenhouse of Bethany Center was made.After analyzing the ratio of heat loss values and heat gains in greenhouse variants, it can be concluded that the use of a daily heat accumulator will suffice for the greenhouse to be used for additional heating of the greenhouse for the autumn and spring months.As a daily heat accumulator, we take 20 liter sealed containers filled with water, because water has the highest specific heat capacity of 4.2 kJ / (kg K). For the calculation we accept the initial temperature of the water in the batteries 15 ° C. Water heating temperature - 35 ° C. We accept to calculate that 3/4 of heat loss will be covered with daily heat gains.

$$m = \frac{Q}{c \cdot \Delta t} \quad (1)$$

where Q - the amount of heat; c- specific heat capacity of water, Δt - the initial and final temperature of water heating.he calculation results are summarized in table 11.

Daily heat accumulator for greenhouses Bethany Center

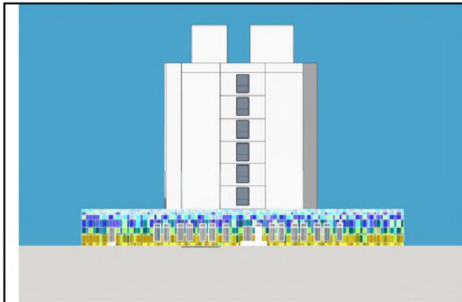
Table 12

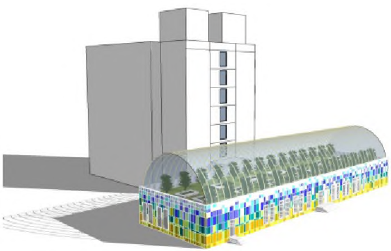
	Attached greenhouse			Built-up greenhouse		
	October	March	April	October	March	April
Number of daily heat losses, kWh	254	378	272	402	597	430
Number of daily heat gains, kWh	528	629	871	802	1032	1512
Number of heat storage mass, l / pc	2160	3222	2331	3429	5108	3668
	108	161	116	171	255	183

Technical and energy characteristics of options.

Table 13

Bethany Center - Shelter in the Malatsky town	Total area, $м^2$	Activities to improve the quality of stay	Heat losses of the Center building during the heating period, kW · h	Heat input to the building of the Center for the heating period, kW · h
The actual state of the Bethany Center building	494,4	-	**141253,2**	**7025,7**
Center building with thermal insulation of external enclosing structures	494,4	Improving the heat-shielding properties of the building envelope by insulating the enclosing structures; Redevelopment and reassignment of premises - device medical cabinet and psychologist; Improvement and gardening of the territory, device of children's game and sports	**30472,8**	**7025,7**

		grounds.		
The building of the Center with thermal insulation of external enclosing structures and a greenhouse attached to the south and east 	Building area – 494,4 м^2; Площадь пристраиваемой теплицы – 298,4 м^2	- Improving the heat-shielding properties of the building envelope by insulating enclosing structures; - the construction of a greenhouse adjacent to the south and east facade of the building; - improvement and gardening of the territory, the device of children's game and sports grounds; - redevelopment and reassignment of premises -	Centre building – **21155,5;** Greenhouse – **81598,9**.	Heating period – **92670,7;** Summer period – **171910,4.**

		device medical cabinet and psychologist.		
Center building with thermal insulation of external enclosing structures with a built-in greenhouse 	Building area – 494,4 м^2; Greenhouse area – 530 м^2	- Improving the heat-shielding properties of the building envelope by insulating enclosing structures; - construction of the built-up greenhouse; - improvement and gardening of the territory, the device of children's game and sports grounds; - redevelopment and reassignment of premises - device medical cabinet and psychologist.	Centre building – **23739;** Greenhouse – **129057**.	Heating period – **146828,5;** Summer period – **308976,4.**

1.3. Conclusions

In the process of implementing the project to improve the quality of the conditions of staying at the Bethany Shelter Center in Malacky, a number of activities were proposed to solve various problems:

- technical, related to improving the comfort of staying at the shelter center;
- social and household - aimed at organizing leisure activities of residents of the center and obtaining additional high-quality food;
- psychological - the possibility of psychological rehabilitation by uniting with nature and the environment;
- medical - the opportunity to receive quality medical care or advice.

Carrying out technical measures to improve the quality of the stay, aimed at improving the energy efficiency of the building, by insulating the outer walling will provide an opportunity to significantly reduce heat loss in the cold period of the year, which in turn will save on utility bills.

The redevelopment and reassignment of the premises will also have a beneficial effect on the quality of life in the shelter center, since the availability of inpatient medical care will improve the health of Bethany residents through early diagnosis and prevention.

The construction of the greenhouse combined with the building of the Center has a multi-faceted value to improve the comfort and quality of stay in the Center. The design of the greenhouse can serve as an additional heating source during the cold period, and solar energy stored in the greenhouse can be used as an additional source of heat for the building. Also, the greenhouse design serves as a transitional thermal zone between the outer and inner space.

On the social and domestic side, building a greenhouse and growing plant products in it will diversify the daily ration of Bethany residents with high-quality and healthy food, save money for buying food, and possibly give additional income from selling surplus products.

Another positive aspect of the construction of the greenhouse can be considered the organization of leisure activities of the residents of Bethany through employment in crop production, which is very important not only for adults, but especially for children from the point of view of upbringing and becoming a personality.

Growing plants and caring for them will have a beneficial effect on the inhabitants of the center and from a medical point of view. Crop production will help those who in need of psychological assistance.

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SECTION 2.
CONCEPT OF RECONSTRUCTION OF OBCHODNA STREET IN BRATISLAVA

2.1. Methodology of Urban Sustainable Renovation

The core aim of urban sustainable renovation is a complex rehabilitation of the buildings and infrastructure with respect to its functional, spatial, aesthetic, energetic and structural aspects along with reducing environmental impact and improving comfort for citizens.

Before development rehabilitation concept it is necessary to gather relevant information about existing state of the object (separate building, street or district) in context of structural behavior and energy performance of the buildings and engineering systems, compliance with current environmental standards; aesthetic and functional functions, possibilities of introduction of renewable energy technologies etc.

As the street may be situated in a historical area of the city, some buildings may be classified as "historical heritage". This feature complicates the use of traditional reconstruction and renovation methods. Within the reconstruction of historical buildings, the requirement of thermal performances meets building aesthetics and its historical features.

Therefore an important task is to preserve architectural features and historical value of buildings and infrastructure of the street while improving structural reliability, thermal and environmental performance.

Considering these peculiarities the survey steps may be:

1. Functional analyses of the territorial and urban context.
2. Structural and technical assessment of existing buildings.
3. Thermal assessment.
4. Bioclimatic analyses

2.1.1. Functional analyses of the territorial and urban context

Functional analyses of the territorial and urban context suggests investigation of the historical background, origins and development of the buildings and other objects under study etc. To conduct functional analyses historical development of urban areas it is necessary to use the historical cartographic material and the current maps of the city. The key features that are considered are an urban structure, social and economic environment, protected valuable areas, transport network and land use.

At the same time it is necessary to follow three key principles of sustainability, consumer orientation and efficiency. It is necessary to rebuild not only the physical space, but also the understanding of the city by its inhabitants, to form a new dynamic, to create an economic interest for staying in the territory.

Sustainable development of urban territory is a rather complex concept. In particular, it includes a functional flexibility of a buildings and engineering ifrastructure, implying a willingness to change over time. Another element of sustainability is ecology which includes the application of energy-saving technologies, waste management and recycling, and much more.

Based on the information received and statistical data, a search for a new function and the development of transformation measures are carried out.

2.1.2. Structural and technical assessment of existing buildings

Reconstruction of the streets often requires changes of the spatial, structural and planning solution. This leads to changes in the load-bearing structures of the existing buildings. Thus structural and technical inspection of buildings and structures becomes an important part in the complex of work on the reconstruction. The purpose of the surveys is to obtain reliable data on the state of building structures and engineering systems. Inspection indicates a condition of the buildings and infrastructure from the user and technical point, their construction and moral value, functionality, integrity of building structures.

The main result of the survey is a conclusion about the possibility planned reconstruction, further exploitation of the building elements, need to repair or reinforcement, and measures to ensure their reliability and durability.

During inspection, the actual bearing capacity and operational suitability of building structures and foundation should be established. Attention should be paid to the study of the experience of design and construction of used constructive solutions, building materials for the historical period, which covers the construction and operation of the surveyed buildings and structures.

For preparation to the inspection of construction objects, attention should be paid to the study of the experience of design and structural solutions used, building materials for the historical period of exploitation of the surveyed buildings and structures from the moment of construction and installation works.

In the process of the inspection of constructions, the following types of work are usually performed:

1. Investigation of project documentation;
2. Study of the peculiarities of a current and planned exploitation mode;
3. Preliminary visual inspection;
4. Detailed inspection.

Investigation of project documentation is performed before visiting the object.

The preliminary assessment includes reviewing all relevant documents and drawings that are available. The original design and construction documents and drawings, previous assessment reports; other available reports should be studied. If the investigated building has a historical value, a review of local, provincial and national heritage registries should be carried out as well.

Records of ongoing maintenance and repairs should be reviewed. When possible, maintenance staff and property owners should be interviewed to identify known areas of distress, corrosion, cracking or water leakage.

The results of this step of the survey allow to:

1. Understand the building's structural systems.
2. Identify the originally specified design loads and assess the existing loading.
3. Identify if there have been any additions or changes.
4. Reveal critical areas for detailed inspection.

In investigation following aspects of transformation of historical urban area were considered:

- structural and functional;
- architectural and planning;
- infrastructural;
- architectural and compositional,
- landscape.

Investigation methods were used: cartographic, photograph of the area, field surveys.

2.1.3. Thermal assessment

Thermal assessment of an existing building is a complex of measurements which results in technical basis data for further energy efficiency improvement.

The complexity of historical buildings requires particular accuracy for energy retrofit that represents a huge challenge. Heritage buildings are not suitable to ensure a modern use of the internal spaces in optimal conditions and the typical retrofit interventions are not useful and too invasive and usually damage the architectural artefact and its intrinsic value. For this reason, it does not exist a unique methodology to be applied in historical buildings, but it is necessary to delve deeper into and to study every case in its own context. The starting point has to be the knowledge of constructive techniques and strategies and their recovery aimed at not only at conservative restoration, but also at energy retrofit.

Furthermore, the severe regulations in this field forbid any modification to the facade exterior appearance, i.e. construction materials and architectural features. For this reason, it is usually quite difficult to identify and apply sustainable and effective solutions for improving energy efficiency in these buildings.

The implementation of internal and external envelope insulation, window retrofit represents the best solution in order to improve the energy efficiency of building envelopes. Additionally, upgraded control systems, lighting, ventilation, thermal storage, and heat recovery are listed as major retrofit technologies to reduce the energy demand of heritage buildings within climate conditions.

Possible energy renovation methods can be defined as follows:

1. Additional thermal insulation of the building envelope
    - External thermal insulation
    - Replacement of the insulation material
    - Additional thermal insulation of roofs
    - Additional thermal insulation of the base floor
2. Window replacement and improvements in air-tightness
3. Increasing the air tightness of the building envelope
4. Renovation of ventilation system
    - Upgrading natural ventilation system to mechanical ventilation (supply-exhaust mechanical ventilation) with modern heat moisture exchangers;
    - Replacement old mechanical ventilation with green energy recovery ventilation system.
5. Heating systems
    - Renovating distributed heating system, or a water-circulated electrical heating system into centralized geothermal heat pump system
    - Complementing room-specific electrical heating with an air heat pump
    - Converting heating system into a wood pellet powered boiler system

• Attaching solar heat into water-circulated oil or electric heating system

• Reducing the energy consumption of a ventilation system by control systems and maintenance

2.1.4. Bioclimatic analyses

An implementation of bioclimatic design principles in public open spaces can lead to more sustainable cities. The main parameters that influence the environmental conditions of the open spaces are variations of the external temperature, the incident solar energy, the relative humidity, the generated noise, as well as the aesthetic quality of the environment and buildings on the streets.

A bioclimatic analysis for the future urban transformation is based on the criteria of the thermal, visual and acoustic comfort, the construction materials, the vegetation and water elements.

Consideration of bioclimatic indices while developing usrban transformation measurements will help to improve average sense of the thermal, visual and acoustic comfort of the old city street spaces.

Outdoor thermal comfort can be achieved through:

• control of insolation aims (definition of shaded or sun exposed areas according to the season, modification of the area insolation using plants and urban equipment, movable shading devices and trees etc.);

• control of air temperature (creation desirable shading patterns, use of vegetation, application of special materials (e.g. cool materials) or equipment (e.g. cooling towers), appropriate utilization of water etc.)

- regulation of relative humidity (creation systems of vegetation, use of water surfaces, systems of outdoor fog cooling and refreshment etc.).

Improvement of visual comfort should be achieved by application of suitable façade materials and glazing that exclude an excessive glare on the buildings surface. For this purpose vertical greening could be using as well.

Acoustic comfort means the elimination of traffic noise, specific sources (road works, loading, sirens) and other annoying sounds. These can be accomplished with the help of noise reducing road surfaces, street furniture diffusing noise and vegetation, improving quality of priority zones and protecting city's sensitive and quiet areas.

2.2. Urban Green Transformation

The modern development of human race goes under the sign of greening the way of life. The processes of greening mean a change not only the way of life and the worldview of people, but also the transformation of the society.

Today, the environment protection and ecological development of society are considered as an alternative to technical progress and exaggerated economic development.

The concept of ecoprogress is formed as an alternative direction which allowing solving modern problems of civilisation.

Fig. 2.1. Model of greening the urban environment

There are many eco-city projects, some are already built or under construction. However, they are all formed as autonomous urban formations, isolated from existing cities. In this regard, the question arises, what to do with the old cities?

A person must move from the consumer's attitude to nature to cooperation with it and build the activities in accordance with the possibilities of nature.

Environmental problems are closely intertwined with architectural issues, many old ideas and knowledge must be rebuilt in accordance with new environmental challenges.

Proposals for the transformation of the city should be based on the conditions ensuring the implementation of the principles of sustainable development as the reduction of anthropogenic pressure on the environment, the maximum preservation of the ecosystem, the introduction of safe and waste-free technologies, the development of the social component, etc.

2.2.1. Impact of eco-technologies on the nature of the transformation of the structural planning frame of the city

Transformation of the urbanized environment on the basis of eco-technologies involves the transformation of five subsystems of the city: engineering infrastructure, transport infrastructure, social infrastructure, housing and landscape.

Eco-technologies predetermine the approaches of the structural-planning organization of the city as a whole and the elements of the urban structure in particular.

2.2.2. Transformations of subsystems of the city

Engineering infrastructure. The existing engineering infrastructure of large cities strictly regulates the planning structure of the city, depriving the flexibility, variability and rapid response to changing technologies in construction.

To optimize issues related to engineering infrastructure, it is necessary to use:

- self-sufficient system of local energy production and use of decentralized energy systems;
- promising technologies integrated into construction;
- efficiency of resource use and recycling of natural resources;
- green design and bioclimatic architecture techniques.

Transport infrastructure. Today, in modern large cities, there is an “occupation” of public space with private cars. The dominance of motor vehicles has created significant health problems for residents: air pollution and increased noise levels, sedentary lifestyle, etc. The existing network of main streets and roads does not cope with the traffic load. Traditional methods of solving the transport problem using reserves of residential streets, public and residential spaces and green areas are not effective.

When solving transport problems, the city should provide:

- eco-mobility with a developed system of public transport;
- polarization of all types of transport in the structure of a multi-level street;
- the transition from the "city car" to "city for the people";
- encouraging and promoting active walking and cycling;
- introduction of environmental modes of transport.

Social infrastructure. At the present stage, the laws of a market economy prevail in the organization of a city's public service system, which affects both the content of the service system and the reduction in the quality of public spaces where these services are implemented (public centers and complexes, etc.).

When forming a service system, it is necessary to strive for:

- reduction the information dependence of society on the laws of the market;
- formation of a socially oriented service system capable of taking into account the whole range of social order;
- rational use of modern information technologies that promote the development of system thinking, expanding the scope of professional and amateur activities;
- creating conditions for providing “movement of services” to the consumer;
- priority development of the “live communication” model.

Dwelling. In a modern consumer society, a strictly economic approach to architecture and urban planning is practiced. This leads to an increase in the number of floors of buildings, a density of settlement, and, naturally, a decrease in the quality of the environment.

High-rise buildings do not belong to environmental facilities. As a rule, they consume a third more energy than low-rise buildings of similar size. However, due to a number of objective and subjective factors, society is not ready to abandon the construction of high-rise buildings. Therefore, if they will be building, they must be economical and environmentally friendly.

Different researches show that with the help of imagination one can normalize the nervous system and directly influence the human immunity. The decisive role in solving this problem can be played by landscaping and putting into practice the principles of architoprofeliography.

In the development of housing in the process of reconstruction of urban development must be oriented on:

- psychophysiological indicators of human health;
- high demands on the ecology of housing and living comfort;
- construction of biopositive buildings;
- phytomelioration technologies (for example, vertical and horizontal greening).

Landscape. Modern cities are characterized by the predominance of the artificial environment, a low level of gardening, the lack of green areas. Landscape objects (parks, squares, boulevards, etc.) are often considered as a territorial reserve for developing the infrastructure of a city.

The city of the future is a garden city, a city of priority to nature.

This idea can be realized by:

- transformation of existing green areas and creation of a city greening system according to the principle of uniformity and continuity;
- creating a system of flowing green spaces (recreational landscapes) with access to large natural complexes, both in the city and outside the city;
- preservation and protection of the existing ecosystem at all levels of urban planning;
- preservation the maximum biodiversity of the urban environment;
- widespread application of "green" technologies that increase the comfort and recreational attractiveness of the urban environment.

2.2.3. Algorithm of transformation of infrastructure subsystems of a large city

Engineering infrastructure. It is proposed: the creation of a self-sufficient system of local energy production (based on renewable energy sources: sun, wind, water, earth); formation of flexible, variable, autonomous energy systems; application of innovative technologies integrated into construction (recycling, biotechnological and bioclimatic systems, etc.).

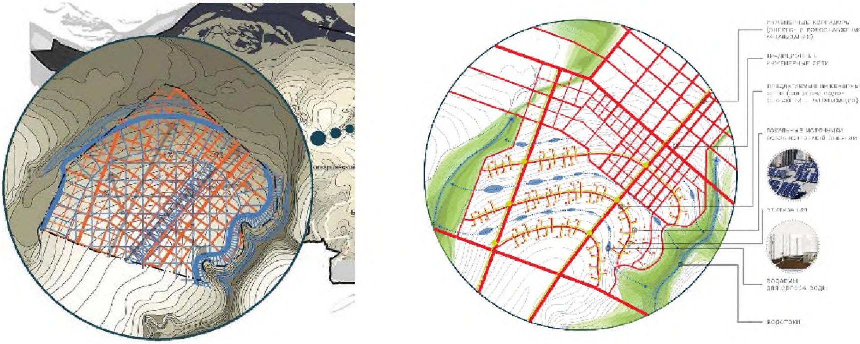


Fig. 2.2. Engineering infrastructure: before and after reconstruction

Transport infrastructure. It is proposed: optimization of the existing transport system and reduction of the transport load in the whole city and in the central part of the city, in particular; increase in the share of public transport; development of monorail and ecotransport; formation of a system of road junctions, terminals and parking lots; development of bicycle transport and cycle paths, creation of pedestrian spaces.

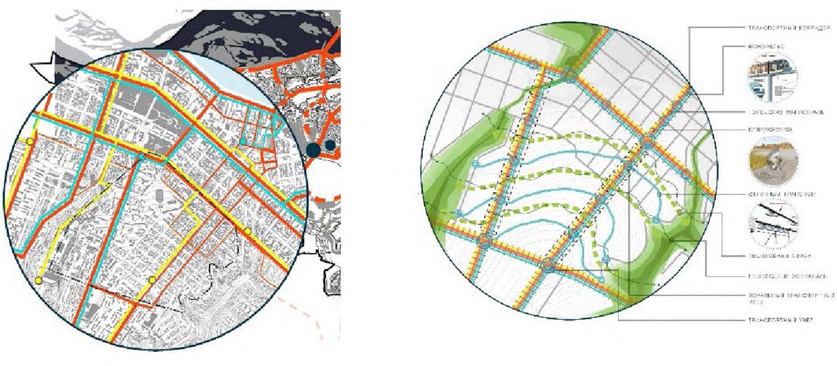


Fig. 2.3. Engineering infrastructure: before and after reconstruction

<u>Social infrastructure</u>. It is proposed: optimization of the system of social infrastructure elements with the priority development of cultural and educational facilities and leisure facilities; creation of a socially-oriented service system. Social infrastructure is solved as a system of polyfunctional centers of episodic and periodic (selective) services and complexes of daily (standard) services integrated into the structure of the planning eco-modules of the city.

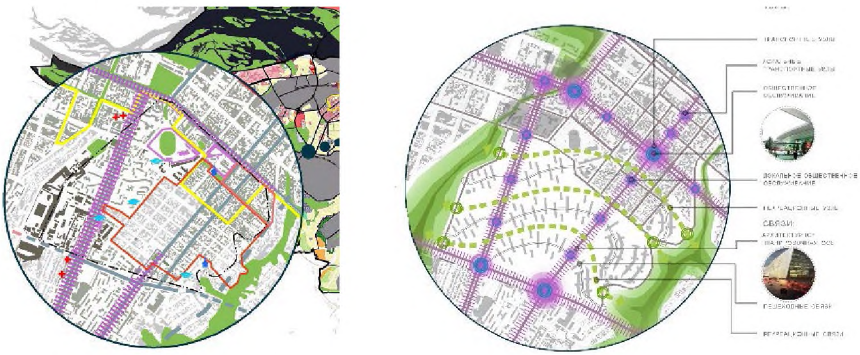


Fig. 2.4. Engineering infrastructure: before and after reconstruction

<u>Dwelling</u>. It is proposed to form a typological series of urban eco-modules in the system of interconnected main transport and green corridors, which are formed taking into account the existing transport and natural frame of the city, but have a qualitatively new content.

The building is flexible, "floating". The main elements of eco-modules are eco-buildings with a high level of biopositivity.

The implementation of the proposed concept is phased, with the maximum preservation of historical buildings and the environment. At the first stages, the reconstruction of territories characterized by a high level of physical and moral deterioration of buildings and structures is necessary.

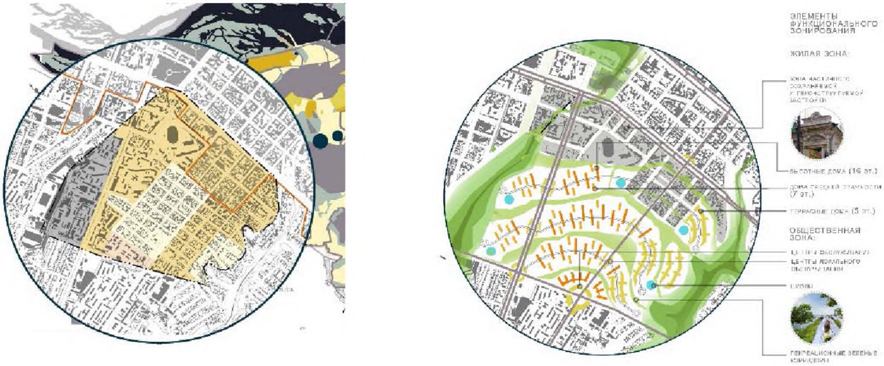


Fig. 2.5. Building techniques: before and after reconstruction

Landscape. It is proposed to: formation of a landscaping system in accordance with the principles of uniformity and continuity; revival and reconstruction of city parks; development of a system of urban gardens and squares; forming a system of pedestrian eco-spaces; introducing "green technologies" (vertical gardens, phyto-walls, winter gardens, green roofs etc.).

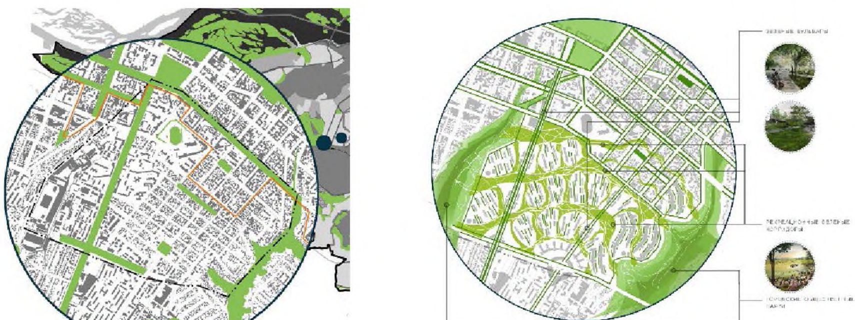


Fig. 2.6. Greening systems: before and after reconstruction

2.3. Case Study: Concept of reconstruction of Obchodna Street in Bratislava

Aspects of transformation of historical urban area:
- structural and functional;
- architectural and planning;
- infrastructural;
- architectural and compositional,
- landscape.

Investigation methods:
- cartographic
- photograph of the area
- field surveys.

2.3.1. History of Obchodna Street

Obchodna Street is the heart of today's city of Ferdinand. It connects two gates - Michalskú and Schöndorfskú.

According to the city reports of 1459, the ditch, stone gates and barriers closed the street. Today Hurbanovo square connects with Kollárovo square.

The oldest name of the street was Hungarian (Uhorská, Ungarngasse) from the oldest citizens – Hungarians, who lived here in 13th century. In 1279 Villa Zeplock is mentioned here. This year, the sons of Yakub were selling a wild vineyard in the hills. Another name Schöndorf (Krásna ves, Széplak) is often mentioned in 1382, and then in the 15th and 16th centuries.

Fig. 2.7. Map of the Bratislava XV – XVI centuaries

King Ladislav bestowed the name Schöndorf on this ancient settlement in 1288. In 1292, King Andrew, at the request of the citizens, confirmed this name. In 1297, he ordered a merger of Schöndorf with the city of Preshpor to compensate the loss of the urban population. In 1297, there were various buildings of stone and other materials (brick, wood) on the street.

In 1311, Schöndorf began to decline, but recovered at the end of the 14th century. In the tax register of 1379, the street is called a Platea Schöndorf. In the city books and testaments of the 15th century, it is also referred to as a Schöndorfergasse street with a German population. Under this name the street is also registered in the city land register of 1439. In the Middle Ages, the street was also called Beautiful Village (Krásna ves, Pulchra villa, Schewndorf).

According to the city land book of 1439, brothel buildings also were on this street. They were called “Frauenhaus", not often “Frauenhof" or “Weissenburg". According to the city land register of 1439, there were 52 houses on the street, one craftsman and one empty land plot. In 1440 - 1470, 9 new houses were added. According to the Land Registry, the price of one house was 20 gold.

At the end of the street in the Middle Ages was a pottery workshop (mentioned since 1451). Clay consumption was very large in the Middle Ages, it was used to reinforce the city fortifications.
There was a Mateja Ebeczkého house on the street where in 1578 an uprising against the city council was born. The uprising was led by Ulrich Hauser. The reason for the uprising was the city council’s ban on fishing, grass mowing and wood production. Subsequently, the rebels were expelled from the city.

At the beginning of the 17th century, the courtyard of Schupfner’s house was for some time a prayer house for evangelicals.
In the 18th century, there was a Protestant elementary school of Martin Betrany on the street. 60 schoolchildren studied there. The first bank was opened on the street in 1772. In 1781 the Black Eagle Hotel (Schwarzadlerwirthshaus) was located here.

There was also a Corona tavern, and on the corner of Drevenej Street was the Deer tavern. On the left side were private vineyards. There were also several public wells on the street.

The Kollar Square is a square in Bratislava in the Old Town. It is named after Ján Kollár (1793 - 1852), a Slovak national revivalist, politician and poet. Located between May 1 Square, Freedom Square, Commercial and Radlin Street. In the past, the town square was home to burgher houses that were largely demolished during the 20th century during the socialist era.

On the northern side of the square is the Faculty of Chemical and Food Technology of the Slovak University of Technology in Bratislava, on the west side of the former parking lot Park One.

At the corner of the Hurbanovo square is a private women's school, founded by Sofia Urbauer in 1857. After her death, the school was run by her daughter, Malvina Urbauer, until 1905. It is also worth mentioning Michael Bruckner - a gardener who grew roses.

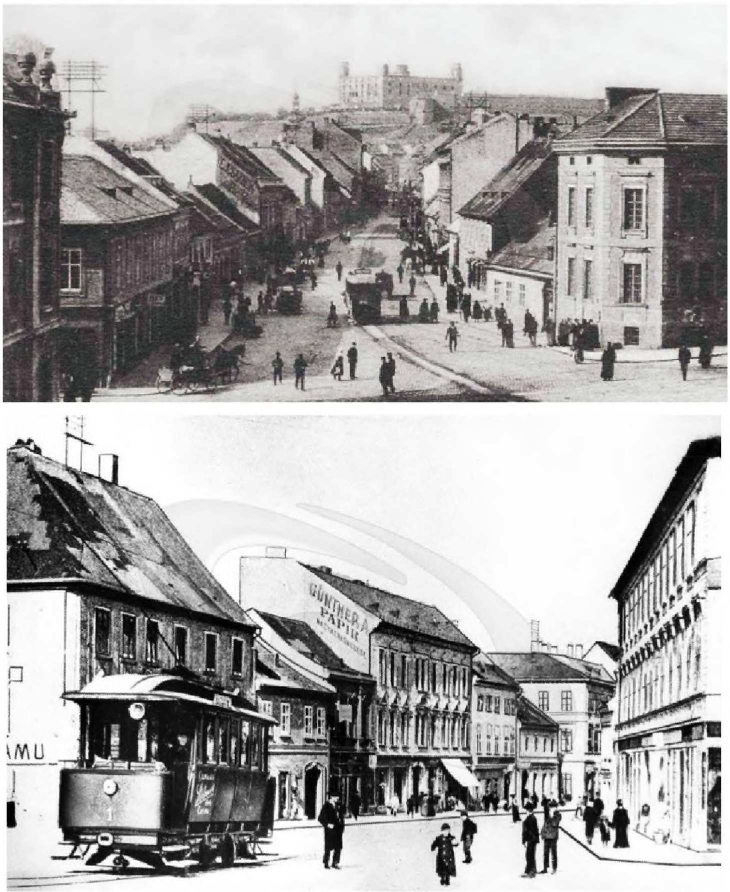


Fig. 2.8. Obhodna Street, 1900

Municipal beer factory. In the time of the First Slovak Republic (1939 – 1945) there was a coffee shop, Azhbeta, with respectful waiters, a newspaper for easy reading, included in the bamboo frame. During Soviet times, the cafe turned into a eatery.

Fig. 2.9. Kollar Square, 1924

The Drevená ulica in Bratislava is located in the Old Town and was named after the wood from the Little Carpathians. It connects the Main Street (Vysoka ulica) with Obchodna Street. It is dated to the 15th century with the name Holzgassl;

After the First World War, the population of the Obchodna Street increased significantly, it became a busy commercial street, merchants and artisans settled here.

2.3.2. Town planning

Obchodna Street with adjacent blocks is located on the border of the old and the new city, between two historical squares in the north-east (Kollar Square and Hurbanovo Square) and bordered by the historical range of Bratislava.

Buildings along Obchodna Street belong to the category of objects with the value of a monument and the category of historically valuable buildings. Monuments of history and architecture of national and local significance are located within a radius of 250 meters from Obchodna Street, which are an integral part of the history of Obchodna Street.

The compositional and planning axis of the Obchodna Street is focused on the Bratislava Castle, which is an important town-planning factor that largely predetermined its spatial planning, structural-functional, architectural-compositional and architectural-landscape organization. It also provided an active visual connection of the street space with the old city.

2.3.3. Transport

Obchodna Street has formed as a "pedestrian-tram" street, which is typical of European historical cities. The street is 500 m long and has an average width of 15 m. The main tram route passes along the street and this is an objective reality that creates certain problems in ensuring safe walking traffic. The movement of cars is limited, except for service vehicles and individual cars which belong to citizens living on the street, which also creates problems for pedestrians.

To create a comfortable and safe environment of the street it is necessary to: make pedestrian zones wider, planning and visually divide pedestrian and tram areas, minimize vehicles traffic, organize an vehicle access through inner-yard passages, create underground parking.

2.3.4. Function

In 2015, the team: Marco and Placemakers (Petra Marco, Milota Sidorova, Igor Marco. Photos: Marko & Placemakers research group, Leontina Berkova, Obchodná ulica a okolie oz) conducted a social-economic study of retail business on Obchodná Street, which was the first of such kind in Slovakia. The purpose of the study was to identify the key problems and opportunities of this historically important place in the field of trade, as well as to develop a long-term vision and a coordinated concept for improving business in this part of the city. The study was initiated by citizens of Obchodná Street and brought together business owners and stakeholders.

The study combines qualitative and quantitative methods based on surveys of more than 120 enterprises, providing an overview of the economic and social aspects of the street to inform and manage future transformation. The graphic range of interpretation of key statistical data is complemented by the ethnographic profiles of individual enterprises, which attract visitors, and the characteristic features of this dynamically changing urban space. An audit of public space, access and traffic helped to create a complete picture of the potential of the area.

Despite the rapidly changing retail trends and new urban developments affecting the city, research shows that Obchodná Street has a good foundation and realistic potential for positive transformation. The fact that almost half of the shops on Obchodná Street is independent is its competitive advantage over the overall experience offered by shopping centers.

The diversity, inclusiveness and good accessibility of public transport are fundamental qualitative parameters for the long-term sustainability of this unique place. The study revealed vast reserves in the mental image and street branding, which will be subject to future psychological transformation.

The results of this study were taken into account when developing a design solution.

A preliminary analysis of social infrastructure facilities that was established on the Obchodna Street showed the predominance of trade and fast-food facilities designed for transit pedestrians. At the same time, the actively developing private trading business negatively affects the quality of the architectural environment. The large-scale development of the apartments of the first floors of the historical building under the trading function has a spontaneous, inconsistent, and, at times, destructive character. The hotel business, cultural, educational and educational facilities, leisure and entertainment facilities are insufficiently developed.

Proposals for the structural and functional transformation of Obchodna Street are based on the idea of returning to the origins and essence of the historical commercial street, searching for a "lost history".

Obchodna Street was one of the busiest commercial streets in Bratislava, with a developed network of pubs, shops, stores, home vineyards, etc. It is necessary to study the history of the street in order to revive the types of activities, functional areas and objects characteristic. Undoubtedly it will help to increase the degree of its representativeness and attractiveness for both tourists and city residents. It is proposed to expand the range of tourist services and create a network of hotels, art galleries, museums in the inner blocks of the street. A comprehensive analysis of the current state and characteristics of existing buildings is required to develop proposals for the reconstruction of Obchodna Street. This includes an assessment of historical value, functional use of buildings, moral and physical deterioration of buildings, technical condition of building structures and engineering networks, etc. It is also important to develop a program for the modernization of buildings, taking into account eco-smart technologies.

2.3.5. Space. Planning

The street space is narrow, mono-functional (commercial) with transverse dimensions that do not vary along its length. The space of the street is dominated by the processes of merging and continuity of development, which on an emotional level reinforces the feeling of "transit" of the street. The quality of the environment is negatively influenced by advertising, which chaotically fills the space of the street and is performed at a rather low artistic and aesthetic level.

The space of the Obchodna Street, as an object of reconstruction, cannot be viewed out of communication with the adjacent territories.

Transformation and further development of social infrastructure of the street, improving the quality and expanding the range of social and cultural services is impossible without a spatial planning reorganization of the street, aimed at expanding the area of public spaces, namely:

- horizontal transformation of street space - extending into the quarter and incorporating into the street structure inner courtyards, arched aisles, passages providing communication with parallel streets, creating galleries at the first floor level;
- vertical development of street space - use of underground premises of buildings for cafes, museums, clubs, cinema halls, quest rooms, etc.;
- square creation at the intersection of Obchodna and Pochtovaya Streets;
- dismantling of temporary buildings - pavilions, trade and promotional tents, other temporary structures.

2.3.6. Architecture. Composition.

In recent decades the space of two-, three-story historic buildings, has been violated by modern multi-storey buildings, which destroy, to a certain extent, the peculiarity of the historical environment of the street. Contrasting and dissimilar buildings create a conflict of architectural styles. It is necessary to trace the evolution of the “conflict” of the new and old buildings in order to develop optimal architectural solutions which minimize the level of the existing conflict.

There is an active transformation of the first floors of historically valuable buildings developed for commercial premises. As a result, there is a loss of historical authenticity, a violation of the rhythmic and metric patterns of architectural composition, stylistic unity and scale, both of the elements of individual buildings and the street as a whole.

Obchodna street at this stage is characterized by the active processes of randomization of architectural styles, coloristic and aesthetic decisions.

The main goals of the architectural, compositional and aesthetic aspects of transformations of Obchodna street are: restoration of the historical identity of buildings, harmonization of architectural styles, volume-compositional and coloristic decisions (especially outdoor advertising), the formation of the environment of the historical street on the principle of "unity in diversity and diversity in unity", inclusion of lighting design elements and small architectural forms into the street space.

2.3.7. Greening

The modern city should be considered as an ecosystem in which the most favorable conditions for human life are created. This is not only comfortable homes, transport, diverse services. It is a favorable habitat for living and health, clean air and a green urban landscape.

The transformation of the existing urban environment should be based on the principles of greening. The city of the future is a garden city, a city of priority to nature. This idea can be realized by:

- transformation of the existing green areas and creation of a greening system according to the principle of uniformity and continuity;
- creating a system of flowing green spaces (recreational landscapes) with access to large natural complexes;
- preservation and protection the existing ecosystem at all levels of urban planning;
- preservation of maximum biodiversity in the urban environment;
- carrying out a complex phyto-reclamation activities in the construction and reconstruction of buildings and structures (vertical gardening of the walls of buildings (gardening of terraces, balconies, creation of ampelous coverings and mounted "green facades"), application of biopositive structures; creation of winter gardens; creating green roofs and roof gardens; greening of all free areas on territories);
- application of "green" technologies that increase the comfort and recreational attractiveness of the urban environment.

Landscape aspect of transformations on the Obchodna Street is the creation of a comfortable, environmentally friendly and aesthetically attractive environment.

The existing landscaping of Obchodna Street and adjacent neighborhoods is insignificant. These are a boulevard on Pochtovaya street, landscape compositions on the square in front of the Bratislava hotel, green spaces in the courtyards.

The project proposes the creation of a system of green spaces, landscape objects, landscape design elements, combined into a unified architectural and landscape complex: boulevards, thematic gardens, green roofs, roof gardens, vertical greening of buildings, phytowalls, eco-graffities, tree planting, grid lawns, ornamental flowerpots, vertical flower beds etc.

3. ALBUMS OF DESIGN SOLUTIONS

PRYDNIPROVSKA STATE ACADEMY
OF CIVIL ENGINEERING AND ARCHITECTURE
UKRAINE

MALACKY – PROJECT PROPOSALS ON IMPROVING THE ENVIRONMENT QUALITY IN BETHANY CENTER

AUTHORS OF PROJECT:

Valeriia POTOTSKA
Anna HLUSHCHENKO

CONSULTANTS:

Oksana ZINKEVYCH
Maryna BORDUN

2019

Master plan

Malacky - the most western town of Slovakia, it is located on the river Moravain the southern part of Zagorskaya lowlands. Malacky town is considered to be the natural center of the Zagorje region. This region has extensive cooperation with the Austrian-Czech border regions. Malacky town is located near the highway connecting the Slovak capital Bratislava with the Czech capital - Prague and the city of Brno in the south of Moravia.

Neighborhood with three European capitals makes the region attractive enough for both living and business development.

The population of Malacky town is 18,000 people, and 62,000 people in the whole region. About 4,000 entrepreneurs plus 680 companies are registered in the District. The unemployment rate is around 18%.

The population of Malacki is predominantly young.

According to the independent analytical agency EAO Empirica Delasasse research supported by the European Union, the Malacky region was rated as the most suitable for investment in Europe.

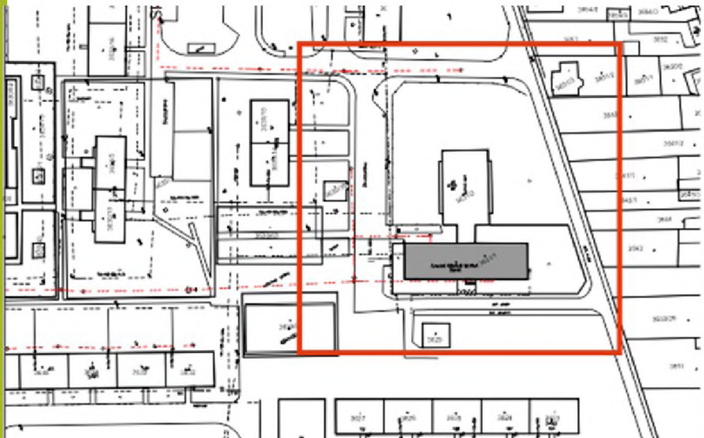
During the research, the development potential of 471 European regions in over 20 years was analyzed. Analysis was based on factors such as infrastructure, skills level and labor costs.

Many international investors such as Pepsi-Cola, IKEA and Volkswagen emphasized Region's benefits and its environs.

Ukrainian experience (mother care centers in Ukraine)

Center for Mothers with Children in Dnipro, Ukraine

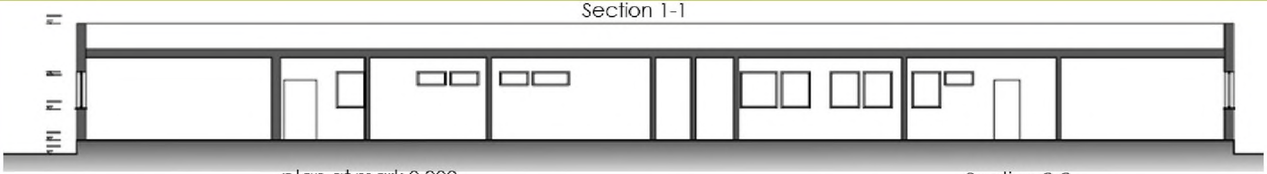
BETANIA CENTER IN MALACKY



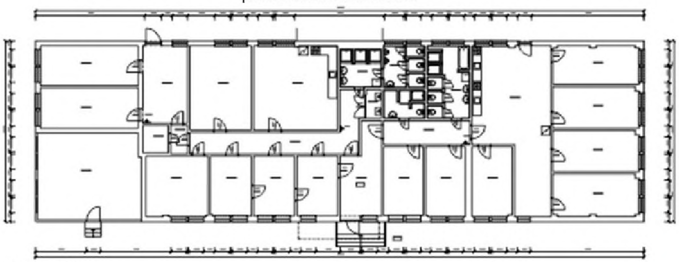
Bethany Center was founded in 2006 in Malacky town (Slovakia). Center - shelter is designed for mothers with children who have nowhere to go or perhaps their lives at home are unbearable. The center opened on October 31, 2006, when the first mothers with children settled here. Each family has own room, separate space, and a shared bathroom, living room and kitchen. The Bethany Center works with labor offices, municipalities and courts, and also helps mothers in courts with such issues as alimony / spousal support etc.

The Bethany Center also has a number of different problems:
- the building is quite old and does not meet modern requirements in the field of energy efficiency;
- there is no medical station to provide qualified medical care in the center ;
- there is no rehabilitation program for the shelter residents;
- there are no children playgrounds and landscaping around the center.

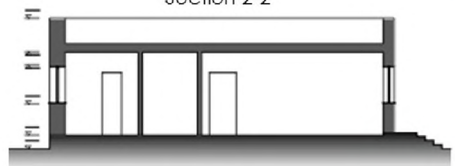
Section 1-1



plan at mark 0.000

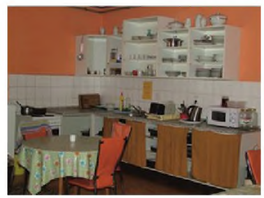


Section 2-2



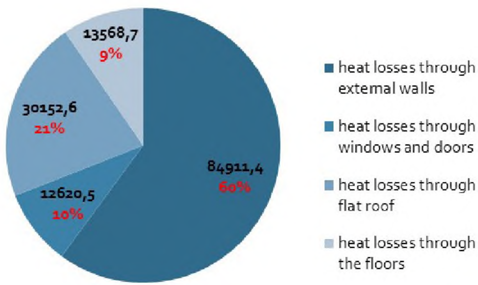
Explication:

101. Entrance hall
102. Office
103. Office
104. Office
105. Corridor
106. Room
107. Room
108. Kitchen
109. Room
110. Room
111. Room
112. Room
113. Room
114. Female bathroom
115. Room for staff
116. Corridor
117. Technical room
118, 119. Male bathroom
120. Corridor
121. Store
122. Corridor + Hall
123. Room
124. Room
125. Room
126. Room
127. Kitchen
128. Boiler + warehouse



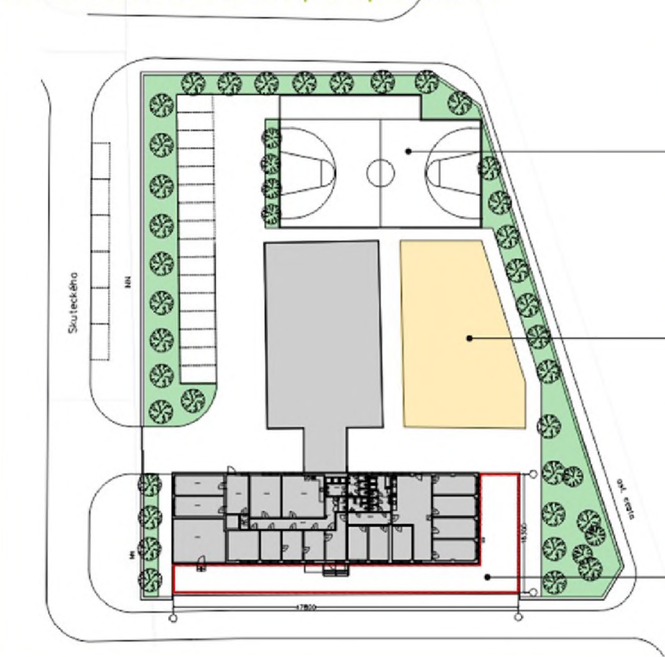
Heat losses through Center's building envelope during the heating period

External envelope	Area, m2	The heat transmission coefficient U, W/m²K	Inside temperature t_{in}, °C	Heat losses during the heating period, kW·h							
				October	November	December	January	February	March	April	Total for the period, kW h
Walls	469,3	1,78	21	9260,4	11547	14232	15165	13080	12244	9383	84911,4
Windows	62,08	2	21	1376,4	1716	2115	2254	1944	1820	1394	12620,5
Flat roof	494,4	0,6	21	3288,4	4101	5054	5385	4645	4348	3332	30152,6
The floors	494,4	0,27	21	1479,8	1845	2274	2423	2090	1956	1499	13568,7
Total heat losses during the heating period, kW·h				141253,2							



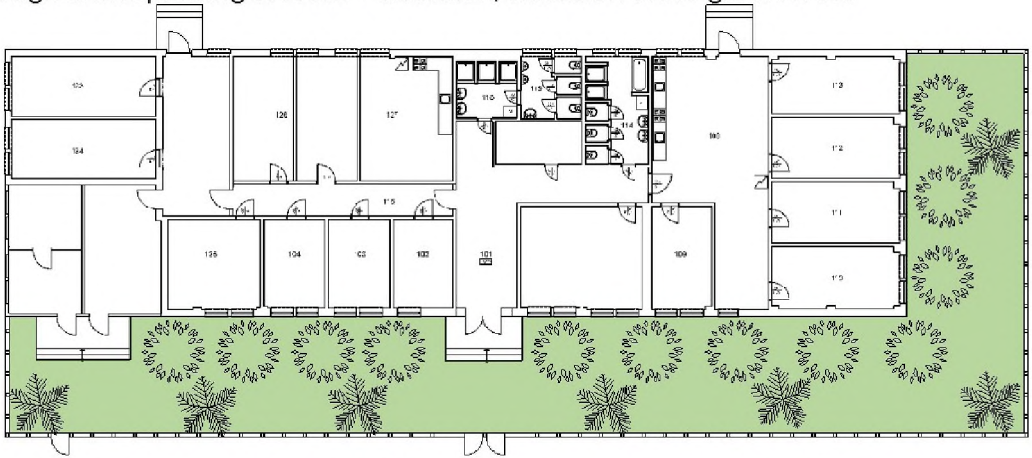
Heat losses through Center's building envelope during the heating period, 141253,2 kW·h, %

Reconstruction proposals:



1. Improvement

2. Redesign and reprofiling of room + extension/extension of the greenhouse



Explication

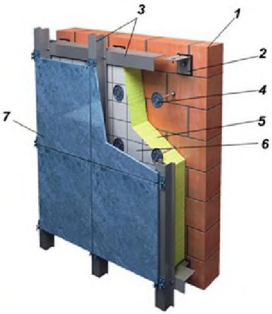
101. Entrance hall
102.Tech Room
103.Shower for men
104. Male bathroom
105. Female bathroom
106. Library
107.Room
108. Kitchen
109.Room
110. Room
111.Room
112. Room
113. Room
114.Room
115.Room
116. Room
117. Psychologist's office
118, 119. Medical service
120.Office
121.Office
122. Room
123. Room
124. Kitchen
125.The entrance hall
126.Corridor

- Insulation of envelope;
- Combined a greenhouse with building;
- Internal redesign and opening medical room;
- Improvement of the surrounding area, creation of recreational zones, playgrounds and landscaping.

3. Insulation

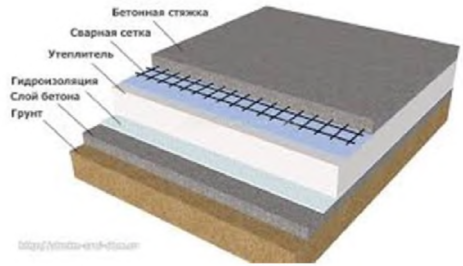
Ways to improve the insulation

Outer wall

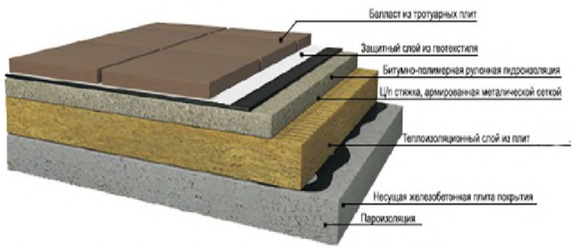


Windows and doors

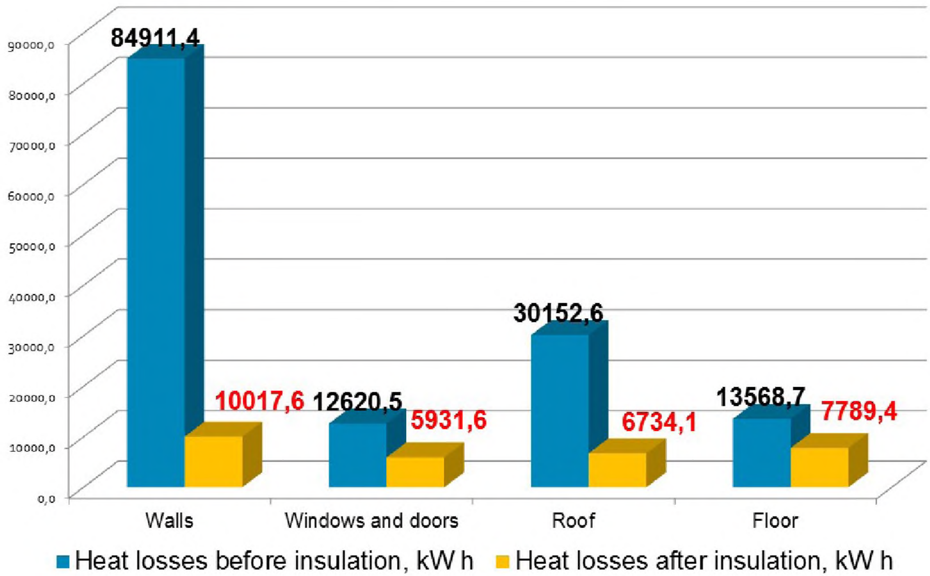
Floors



Roof



3. Heat losses through envelope of the Center **BEFORE** and **AFTER** thermal insulation



Gardening - as an essential tool for improving well-being and life quality.

Worldwide experience. Greenhouses

Montreal farm Lufa Farms on the building roof.

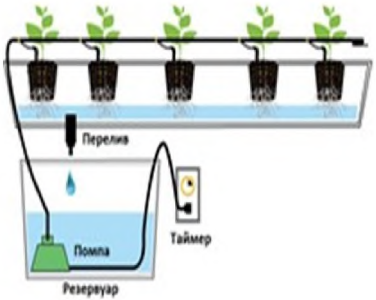
Brooklyn Grange - the biggest roof farm in the world.

Vertical trusses

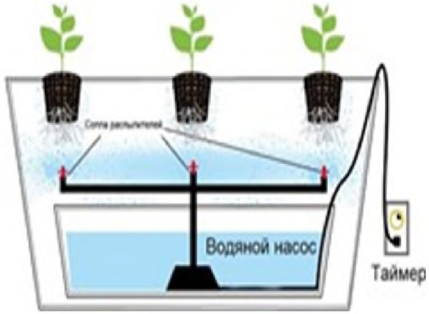
"Zero Carbon Food" Underground greenhouse company

Greenhouses in individual building houses

Ways to grow plants



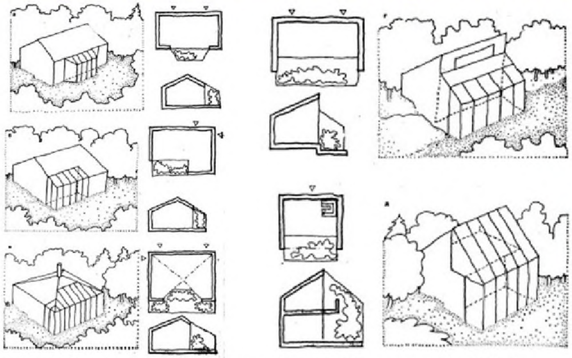
Hydroponics



Airponics

Aquaponics

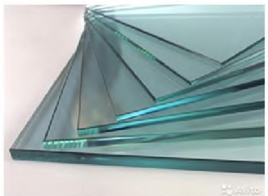
Design features of the greenhouse



Constructive solutions for greenhouses in a small building.

LSTK

Covering:



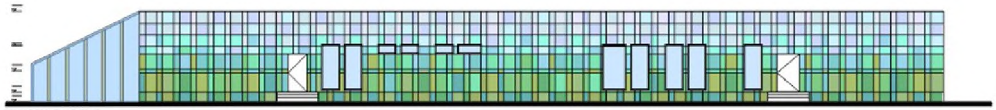
Glass

Slick

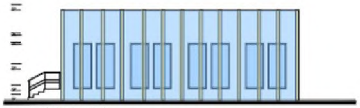
Polycarbonate

Project proposal (Option 1)

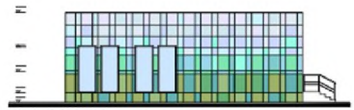
POHĽAD ČELNÝ - JUŽNÝ



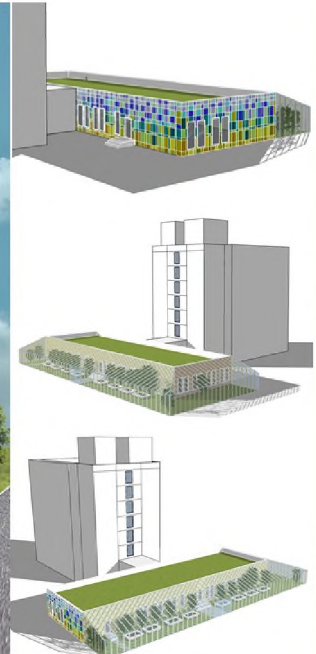
POHĽAD ZADNÝ - SEVERNÝ



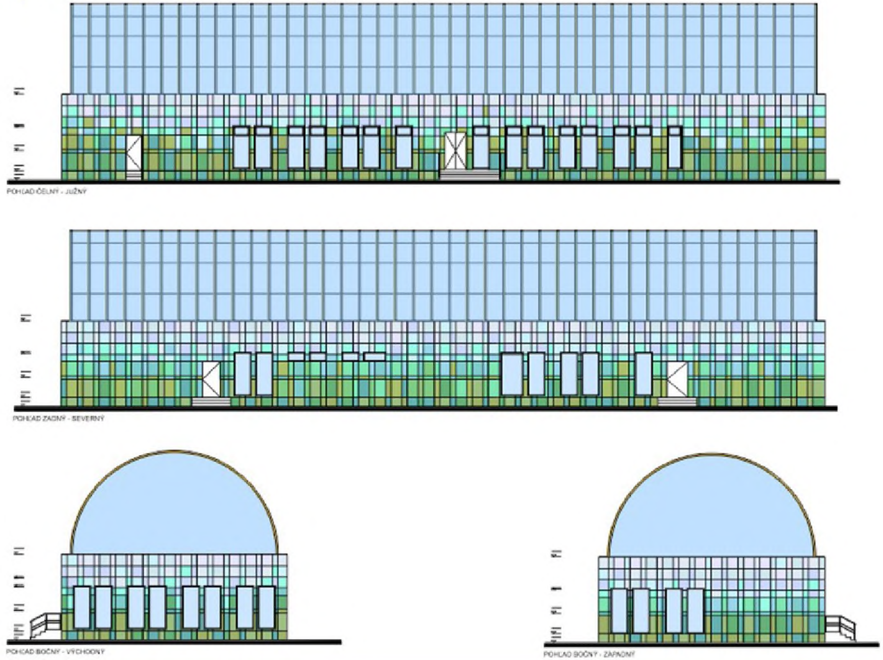
POHĽAD BOČNÝ - VÝCHODNÝ

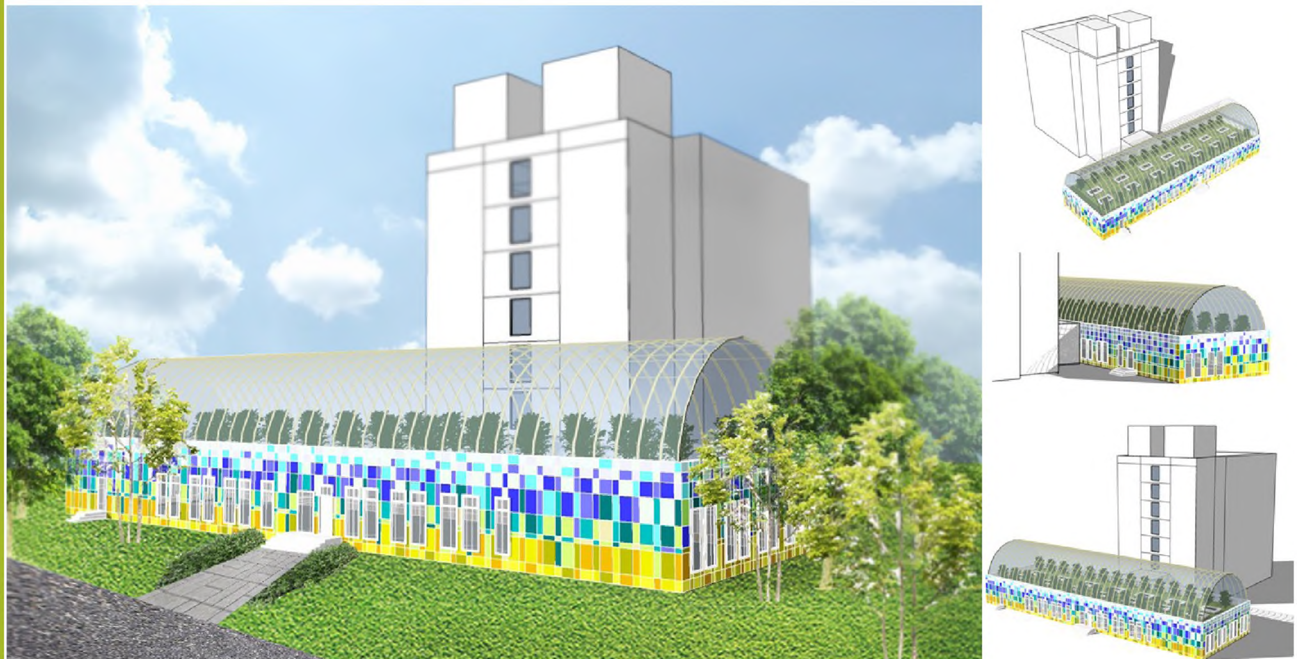


POHĽAD BOČNÝ - ZÁPADNÝ



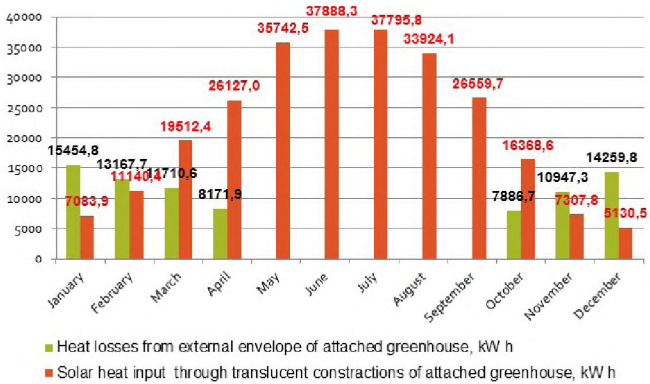
Project proposal (Option 2)



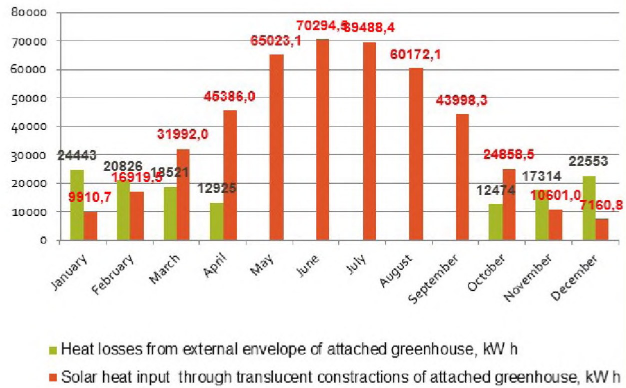


19

Comparison of heat losses and revenues



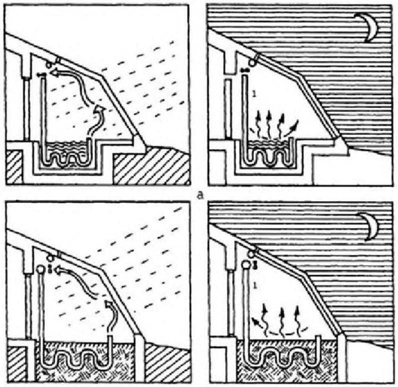
Option 1



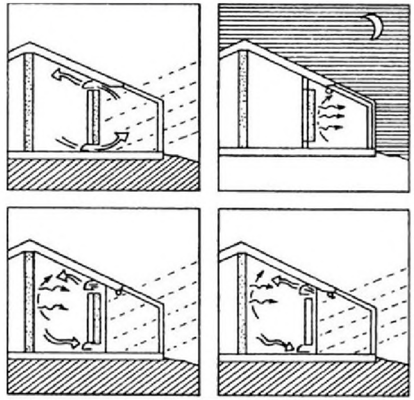
Option 2

20

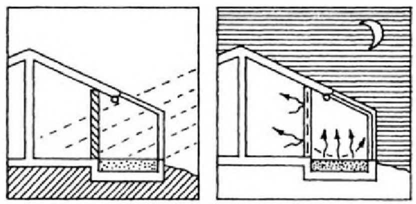
Heat accumulators



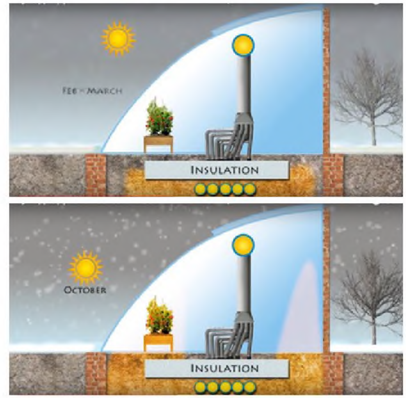
Using soil as
heat accumulator



Stone wall as a heat accumulator



Accumulation of heat stone floor



The principle of the seasonal
heat storage heat

Comparative table

Center - Bethany shelter in the Malatsky town	Activities to improve environment quality	Heat losses of the Center building for the heating period, kW · h	Heat inputs in the building of the Center for the heating period, kW · h
The current state of the building 	-	**141253,2**	**7025,7**
with thermal insulation of external structures 	• Improving the heat-shielding properties of the envelope by insulating the external structures; • Redesign and reprofiling of premises - opening medical room and psychologist's office; • Improvement and landscaping of the territory, creation of playground.	**30472,8**	**7025,7**
with thermal insulation of external structures and greenhouse 	• Improving the heat-shielding properties of the envelope by insulating the external structures; • The construction of a greenhouse adjacent to the south and east facade of the building; • Redesign and reprofiling of premises - opening medical room and psychologist's office; • Improvement and landscaping of the territory, creation of playground.	Center building– **21155,5;** Greenhouse – **81598,9**.	Heating period– **92670,7;** Summertime – **171910,4.**
with thermal insulation of external structures with a built-in greenhouse 	• Improving the heat-shielding properties of the envelope by insulating the external structures; • Construction of the built-up greenhouse; • Redesign and reprofiling of premises - opening medical room and psychologist's office; • Improvement and landscaping of the territory, creation of playground.	Center building – **23739;** Greenhouse – **129057**.	Heating period – **146828,5;** Summertime – **308976,4.**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supported by
Visegrad Fund
Presentation
Concept of reconstruction of
Obchodna Street in Bratislava
Authors: SHEI PSACEA. Students: Ihor Andriienko, Illia Karmalit. Consultants:
Svitlana Shekhorkina (assistant professor), Olha Bondarenko (senior lecturer)
13.05.2019-
19.05.2019
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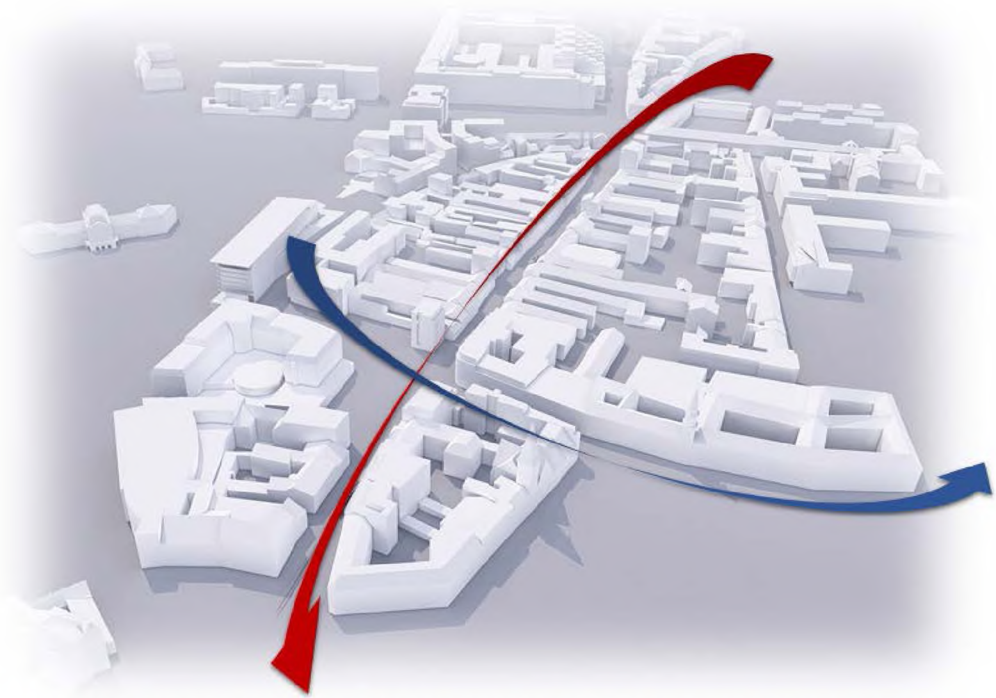

CONCEPT OF RECONSTRUCTION OF OBCHODNA STREET IN BRATISLAVA

FACTS AND PEOPLES IN BRIEF HISTORICAL REVIEW OF ORIGIN, FORMATION AND DEVELOPMENT OF OBCHODNA STREET IN BRATISLAVA

Obchodna Street is the heart of today's city of Ferdinand. It connects two gates - Michalskú and Schöndorfskú.

According to the city reports of 1459, the ditch, stone gates and barriers closed the street. Today Hurbanovo square connects with Kollárovo square. The oldest name of the street was Hungarian (Uhorská, Ungarngasse) from the oldest citizens – Hungarians, who lived here in 13th century. In 1279 Villa Zeplock is mentioned here. This year, the sons of Yakub were selling a wild vineyard in the hills. Another name Schöndorf (Krásna ves, Széplak) is often mentioned in 1382. and then in the 15th and 16th centuries.

XIII King Ladislav bestowed the name Schöndorf on this ancient settlement in 1288. In 1292, King Andrew, at the request of the citizens, confirmed this name. In 1297, he ordered a merger of Schöndorf with the city of Preshpor to compensate the loss of the urban population. In 1297, there were various buildings of stone and other materials (brick, wood) on the street.

Obchodna Street

XIV In 1311, Schöndorf began to decline, but recovered at the end of the 14th century. In the tax register of 1379, the street is called a Platea Schöndorf. In the city books and testaments of the 15th century, it is also referred to as a Schöndorfergasse street with a German population. Under this name the street is also registered in the city land register of 1439. In the Middle Ages, the street was also called Beautiful Village (Krásna ves, Pulchra villa, Schewndorf).

XV According to the city land book of 1439, brothel buildings also were on this street. They were called "Frauenhaus", not often "Frauenhof" or "Weissenburg". According to the city land register of 1439, there were 52 houses on the street, one craftsman and one empty land plot. In 1440 - 1470, 9 new houses were added. According to the Land Registry, the price of one house was 20 gold.

Obchodna Street, 1900

XVI At the end of the street in the Middle Ages was a pottery workshop (mentioned since 1451). Clay consumption was very large in the Middle Ages, it was used to reinforce the city fortifications.

There was a house Mateja Ebeczkého on the street where in 1578 an uprising against the city council was born. The uprising was led by Ulrich Hauser. The reason for the uprising was the city council's ban on fishing, grass mowing and wood production. Subsequently, the rebels were expelled from the city.

XVII At the beginning of the 17th century, the courtyard of Schupfner's house was for some time a prayer house for evangelicals.

Kollar Square, 1924

XVIII In the 18th century, there was a Protestant elementary school of Martin Betrany on the street. 60 schoolchildren studied there. The first bank was opened on the street in 1772. In 1781 the Black Eagle Hotel (Schwarzadlerwirthshaus) was located here.

There was also a Corona tavern, and on the corner of Drevenej Street was the Deer tavern. On the left side were private vineyards. There were also several public wells on the street.

Authors: SHEI PSACEA. Students: Ihor Andriienko, Illia Karmalit. Consultants: Svitlana Shekhorkina (assistant professor), Olha Bondarenko (senior lecturer)

FACTS AND PEOPLES IN BRIEF HISTORICAL REVIEW OF ORIGIN, FORMATION AND DEVELOPMENT OF OBCHODNA STREET IN BRATISLAVA

XVIII

The Kollar Square is a square in Bratislava in the Old Town. It is named after Ján Kollár (1793 - 1852), a Slovak national revivalist, politician and poet. Located between May 1 Square, Freedom Square, Commercial and Radlin Street. In the past, the town square was home to burgher houses that were largely demolished during the 20th century during the socialist era.

On the northern side of the square is the Faculty of Chemical and Food Technology of the Slovak University of Technology in Bratislava, on the west side of the former parking lot Park One.

Kollar Square

XIX

At the corner of the Hurbanovo square is a private women's school, founded by Sofia Urbauer in 1857. After her death, the school was run by her daughter, Malvina Urbauer, until 1905. It is also worth mentioning Michael Bruckner - a gardener who grew roses.

Drevena ulica

XX

Municipal beer factory. In the time of the First Slovak Republic (1939 – 1945) there was a coffee shop, Azhbeta, with respectful waiters, a newspaper for easy reading, included in the bamboo frame. During Soviet times, the cafe turned into a eatery.

The Drevená ulica in Bratislava is located in the Old Town and was named after the wood from the Little Carpathians. It connects the Main Street (Vysoka ulica) with Obchodna Street. It is dated to the 15th century with the name Holzgassl.

Hurban Military barracks

Exit from Obchodna Street to Hurbanovo Square

Municipal beer factory Alzhbeta

Obchodna Street

Obchodna Street

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FACTS AND PEOPLES IN BRIEF HISTORICAL REVIEW OF ORIGIN, FORMATION AND DEVELOPMENT OF OBCHODNA STREET IN BRATISLAVA

Obchodná ulica, pohľad na Hurbanovo námestie – okolo roku 1908.
Schöndorfergasse, Blick auf den Hurbanplatz – um 1908.
A Hurban tér (régi Nagy Lajos tér) a Széplak utca felől 1908 körül.

Улица Обходная (Obchodna ulica)

Площадь Коллара (Kollarovo namestie) 1900 г.
Obchodná ulica od Michalskej brány – okolo roku 1900.
Schöndorfergasse vom Michaelertor – um 1900.
A Széplak utca a Mihály kapu felől – 1900 körüli felvétel.

Улица Обходная (Obchodna ulica) 1900 г.
Obchodná ulica v smere ku Kollárovmu námestiu – okolo roku 1900.
Schöndorfergasse in Richtung zum Kollárplatz (Fruchtplatz) – um 1900.
A Széplak utca Kollár tér (régi Búzapiac) felőli része 1900 körül.

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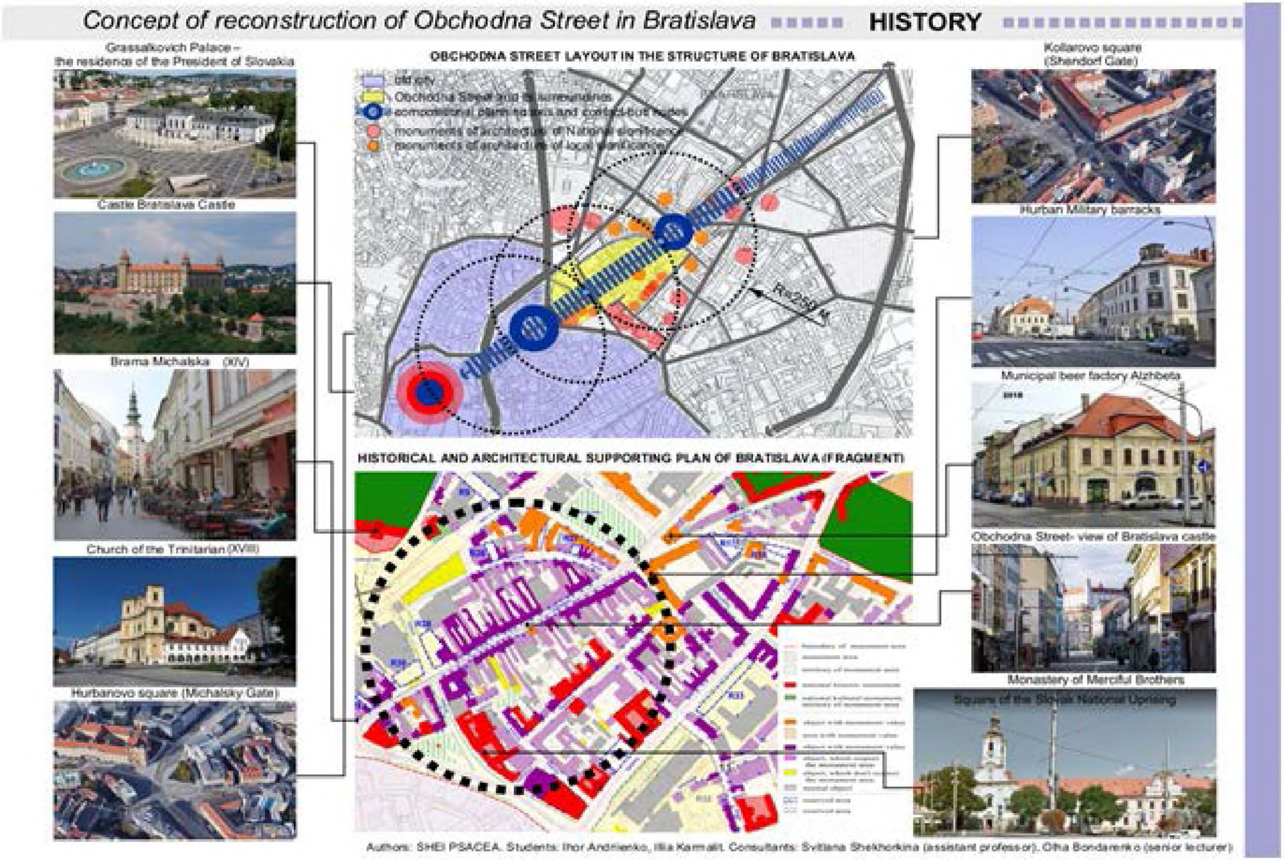

Concept of reconstruction of Obchodna Street in Bratislava
HISTORY
Grassalkovich Palace – the residence of the President of Slovakia
Castle Bratislava Castle
Brama Michalska (XIV)
Church of the Trinitarian (XVIII)
Hurbanovo square (Michalsky Gate)
OBCHODNA STREET LAYOUT IN THE STRUCTURE OF BRATISLAVA
old city
Obchodna Street and its surroundings
monuments of architecture of National significance
monuments of architecture of local significance
HISTORICAL AND ARCHITECTURAL SUPPORTING PLAN OF BRATISLAVA (FRAGMENT)
Kollarovo square (Shendorf Gate)
Hurban Military barracks
Municipal beer factory Alzhbeta
Obchodna Street- view of Bratislava castle
Monastery of Merciful Brothers
Square of the Slovak National Uprising
Authors: SHEI PSACEA. Students: Ihor Andriienko, Illia Karmalit. Consultants: Svitlana Shekhorkina (assistant professor), Olha Bondarenko (senior lecturer)


Concept of reconstruction of Obchodna Street in Bratislava
FUNCTION
Southeast Exposition
FUNCTIONAL AND SPATIAL ORGANIZATION OF SOCIAL INFRASTRUCTURE IN THE OBCHODNA STREET
REFERENCE PLAN
PROJECT PROPOSITION
Social infrastructure (existing)
Clothes, shoes, accessories
Gifts, antiques, home goods
Jewelry
Consumer goods
Catering facilities:
Restaurants
Cafe
Pastry shops, fast foods \
Bars, pubs
Objects of culture, education, leisure
Sacred objects
Residential buildings
Hotels, hostels
Offices, banks
Pharmacies
Social infrastructure in the inner quarter space:
museums, art galleries, exhibitions, recreation and leisure centers, folk art centers, restaurants, cafes, bars, hotels, apartments
Northwest Exposition
Authors: SHEI PSACEA. Students: Ihor Andriienko, Illia Karmalit. Consultants: Svitlana Shekhorkina (assistant professor), Olha Bondarenko (senior lecturer)

Concept of reconstruction of Obchodna Street in Bratislava ▪▪▪▪ TRANSPORT ▪ PEDESTRIANS ▪▪▪

THE SCHEME OF SEPARATION OF THE MOVEMENT OF TRAMS. BICYCLES. PEDESTRIANS

REFERENCE PLAN

The scheme of transport and pedestrian connections on the Obchodna street

PROJECT PROPOSITION

The scheme of transport and pedestrian connections on the Obchodna street

- inside-quarter passage (existing)
- driveways for maintenance of inside-public spaces
- entrances to inside -public spaces
- pedestrian routes
- bicycle routes
- tram routes
- tram stops
- parking (existing)
- bicycle parking

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Concept of reconstruction of Obchodna Street in Bratislava ▪▪▪▪ TRANSPORT ▪ PEDESTRIANS ▪▪▪

Pedestrian tram Obchodna street - the evolution of space

Methods for division of traffic zones and pedestrians on the city street

Dynamics of parameters change of a pedestrian traffic are on the street

Bicycle parking - an element of urban design

Bicycle land-art

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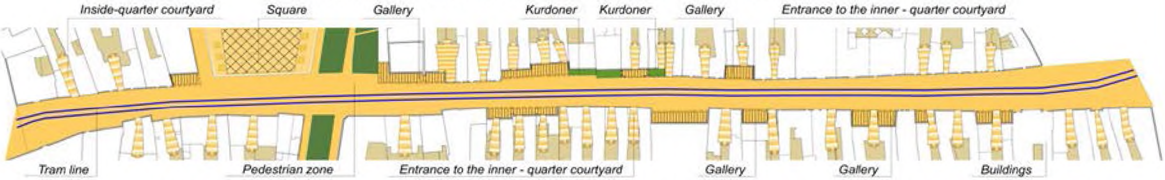
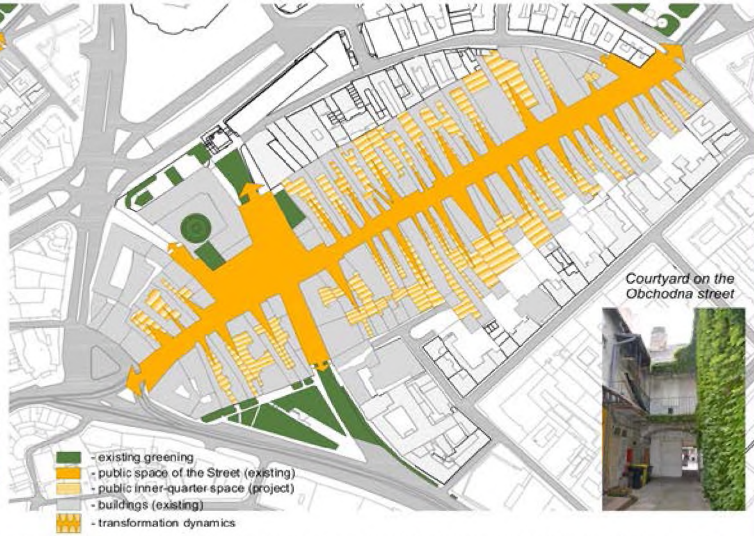
Concept of reconstruction of Obchodna Street in Bratislava **SPACE**

TECHNIQUES OF SPACE TRANSFORMATION FOR OBCHODNA STREET



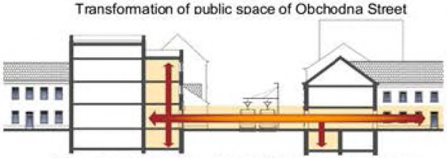
REFERENCE PLAN

PROJECT PROPOSITION. The scheme of transformation of public space of Obchodna Street



Courtyard on the Obchodna street

Transformation of public space of Obchodna Street



Enlargement of public space through the use of kurdoners, galleries in the area of the first floor of buildings, inner courtyards, underground space, roof space

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Concept of reconstruction of Obchodna Street in Bratislava SPACE

OBCHODNA STREET IN BRATISLAVA TODAY

Obchodna Street: from Kollárovo square to Hurbanovo square

Obchodna Street is a structural element of the urban framework, which unites the new and old city. An important urban significance determines the character, content and scenario approach to the formation of public space of the street. In fact, today, this is a transit, not articulated space of a city street. A rich, centuries-old history is hidden behind the facades of buildings, in courtyards, quarterly buildings. Communication with these courtyards is carried out through a system of arched corridors.

Obchodna Street: from Hurbanovo square to Kollárovo square

COURTYARDS OF OBCHODNA STREET

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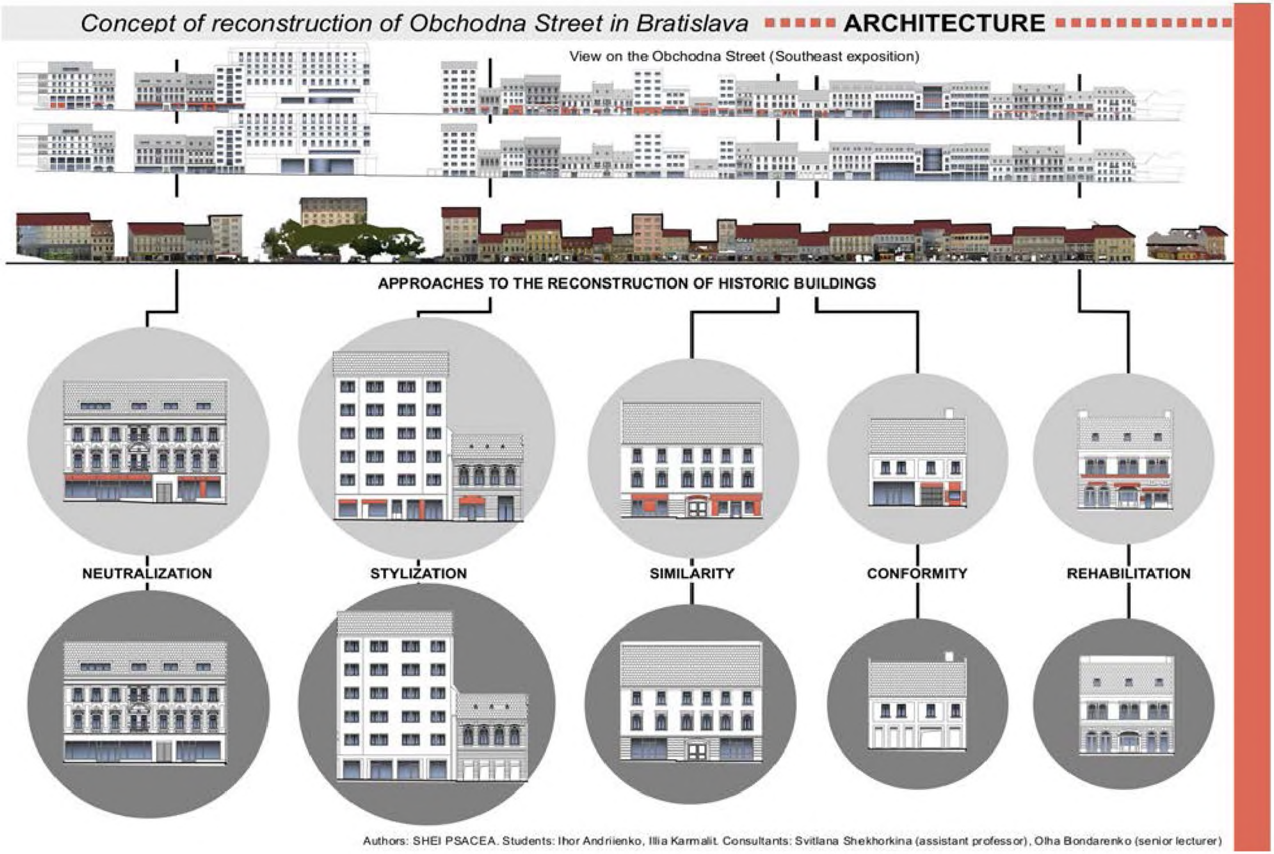
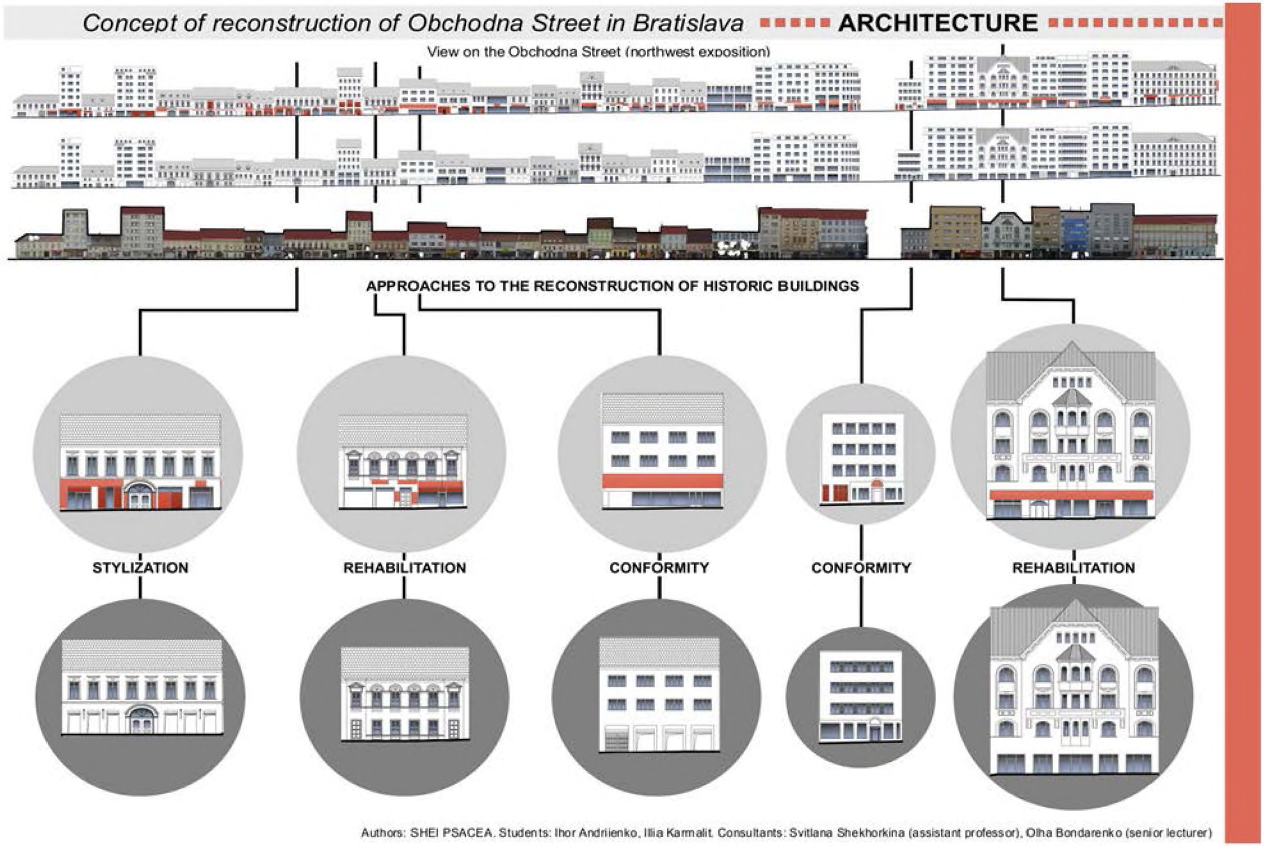

Concept of reconstruction of Obchodna Street in Bratislava
ARCHITECTURE
View on the Obchodna Street (Southeast exposition)
APPROACHES TO THE RECONSTRUCTION OF HISTORIC BUILDINGS
NEUTRALIZATION
STYLIZATION
SIMILARITY
CONFORMITY
REHABILITATION
Authors: SHEI PSACEA. Students: Ihor Andriienko, Illia Karmalit. Consultants: Svitlana Shekhorkina (assistant professor), Olha Bondarenko (senior lecturer)


Concept of reconstruction of Obchodna Street in Bratislava
ARCHITECTURE
View on the Obchodna Street (northwest exposition)
APPROACHES TO THE RECONSTRUCTION OF HISTORIC BUILDINGS
STYLIZATION
REHABILITATION
CONFORMITY
CONFORMITY
REHABILITATION
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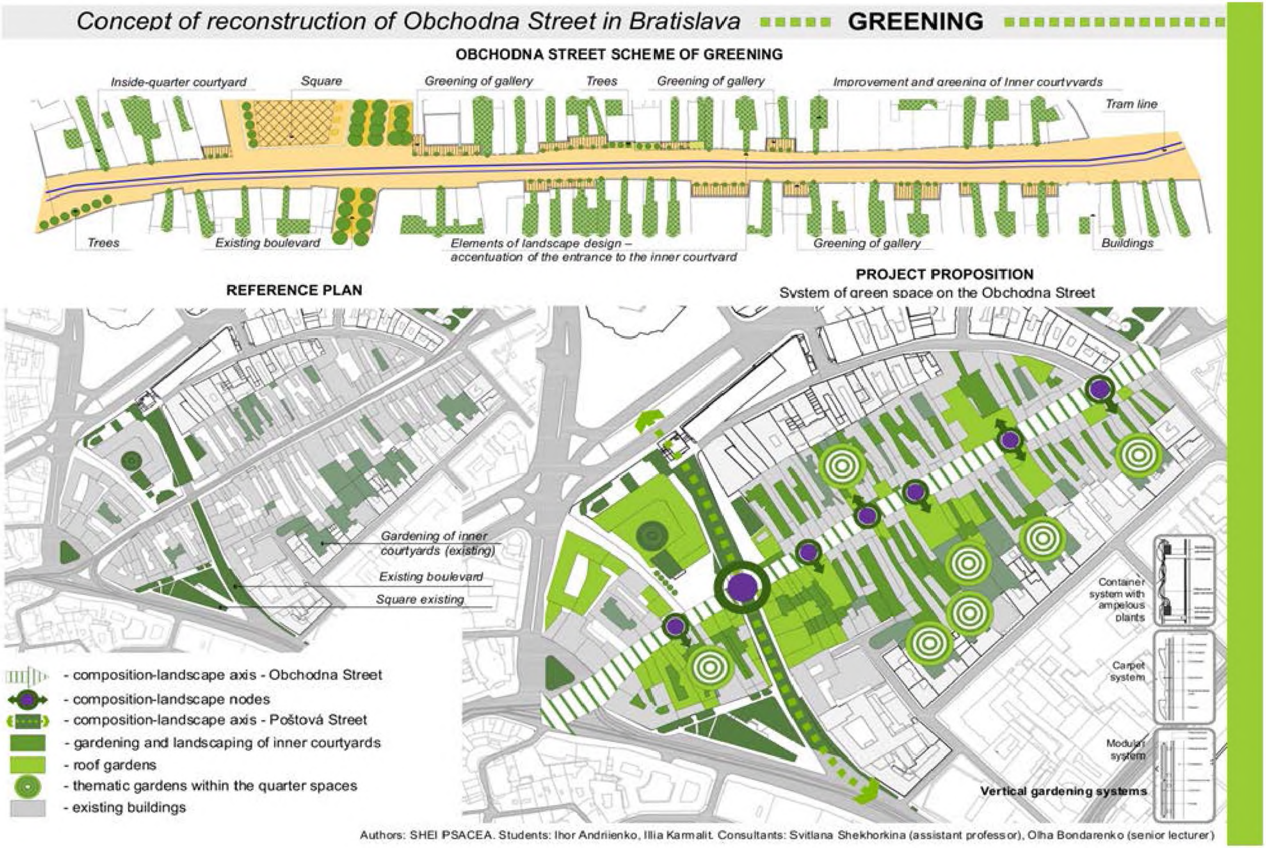
Concept of reconstruction of Obchodna Street in Bratislava
GREENING
OBCHODNA STREET SCHEME OF GREENING
Inside-quarter courtyard
Square
Greening of gallery
Trees
Greening of gallery
Improvement and greening of Inner courtyards
Tram line
Trees
Existing boulevard
Elements of landscape design – accentuation of the entrance to the inner courtyard
Greening of gallery
Buildings
REFERENCE PLAN
PROJECT PROPOSITION
System of green space on the Obchodna Street
Gardening of inner courtyards (existing)
Existing boulevard
Square existing
Container system with ampelous plants
Carpet system
Modular system
Vertical gardening systems
- composition-landscape axis - Obchodna Street
- composition-landscape nodes
- composition-landscape axis - Poštová Street
- gardening and landscaping of inner courtyards
- roof gardens
- thematic gardens within the quarter spaces
- existing buildings
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Concept of reconstruction of Obchodna Street in Bratislava
GREENING
Greening of the Obchodna street (southeast exposition)
Greening of the Obchodna street (northwest exposition)
Cross-section profiles of the Obchodna street. Greening
Green roof
"Green facade" - a background for historical buildings
Textures of phytowalls
METHODS OF ARCHOFITOMELIORATION IN URBAN ENVIRONMENT
Roof gardens: intensive and extensive green roofs
Greening a pedestrian street
Eco-graffiti in an urban environment
Ampels and tubs with flowers - basis of landscape design of pedestrian streets
Vertical greening of buildings
Landscape design of the inside courtyard
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Concept of reconstruction of Obchodna Street in Bratislava **COMPOSITION**

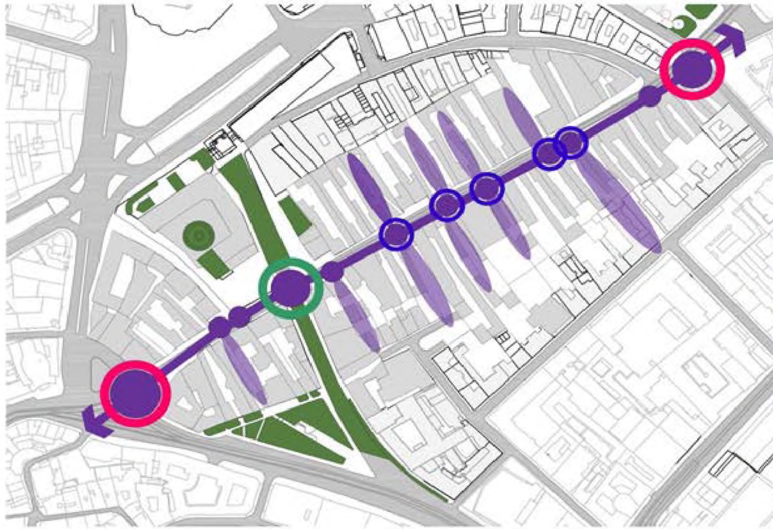
BRONZE SCULPTURE – THE WAY OF ARTICULATING THE SPACE OF THE HISTORIC STREETS OF BRATISLAVA





DESIGN OF ARCHITECTURAL ENVIRONMENT


PROJECT PROPOSAL. COMPOSITION OF THE ARTICULATED SPACE OF THE OBCHODNA STREET



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Concept of reconstruction of Obchodna Street in Bratislava **COMPOSITION**

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