The Third Mission of the University: The Response of GRAFOS' Students to the Consequences of Natural Disasters in Croatia 2020

Lončar-Vicković, Sanja; Krajnović, Marija; Kamenarić, Martina

Source / Izvornik: **Tehnički glasnik, 2020, 16, 139 - 147**

Journal article, Published version
Rad u časopisu, Objavljena verzija rada (izdavačev PDF)

https://doi.org/10.31803/tg-20210907140656

Permanent link / Trajna poveznica: https://urn.nsk.hr/urn:nbn:hr:133:810715

ISSN 1846-6168 (Print), ISSN 1848-5588 (Online)
https://doi.org/10.31803/tg-20210907140656

Professional paper
Received: 2021-09-07, Accepted: 2022-01-13

The Third Mission of the University: The Response of GRAFOS' Students to the Consequences of Natural Disasters in Croatia 2020

Sanja Lončar-Vicković, Marija Krajnović*, Martina Kamenarić

Abstract: The universities of the 21st century are dedicated to three missions - education, science and advancement of the community. The impact of two major earthquakes in Croatia in 2020 as well as the impact of the COVID 19 pandemic, led to the integration of these topics into the educational process at the Faculty of Civil Engineering and Architecture Osijek (GRAFOS), Croatia. In this example, GRAFOS architecture students designed shelters for people left homeless following natural disasters. The paper presents the process of creating innovative and bold shelter proposals, simultaneously developing students' skills like critical thinking, team work, communication and interpersonal skills.

Keywords: GRAFOS; natural disasters; shelter architecture; students' design; third mission of the university

1 INTRODUCTION

Universities in Europe, first emerging nearly a thousand years ago, were focused on two basic objectives - education and scientific research. The importance and significance of those objectives changed through centuries depending on the political, economic and social environment surrounding academia. However, in the last few decades, a deeper involvement and cooperation between academia and the society started to develop.

The term *third mission of universities* describes the orientation of universities towards connecting education (the first mission) and science (the second mission with the needs of their socio-economic surrounding.

The Faculty of Civil Engineering and Architecture Osijek (GRAFOS), a faculty within the University of Josip Juraj Strossmayer of Osijek, Croatia, defined its third mission in official documents as "socially responsible involvement within the community". In recent years this mission has been noticeable in engagement of GRAFOS' teachers and students with respect to eliminating the consequences of 2014 floods in eastern Croatia and the 2020 earthquakes in Croatia's capital Zagreb and around Petrinja in central Croatia.

This paper presents analytical and graphical overview of GRAFOS' students' residential shelter designs for communities affected by natural disasters within the study course *Architectural design.*

2 THE THIRD MISSION OF THE UNIVERSITY

Most definitions of the term university describe the university as a place for teaching and providing scientific and artistic services.

A definition by the Croatian Encyclopedia states: university (Ger. Universität, from Lat. universitas, Genitive case universitatis: association, community) is a community of faculties and other institutions of higher education founded to promote educational, scientific or artistic activities. [1]

According to the Croatian Law on higher education and science (Official Gazette 131/17) "academic freedom, academic self-administration and university autonomy entail responsibility on the part of academic community towards social community it operates in" [2].

The third mission of the university is a concept where universities are "the carriers of positive changes that contribute to social and economic development on local, regional and national level" [3].

Majority of modern universities incorporate all three missions while envisioning their development. The University of Zagreb defines its mission and vision through the engagement "in public activities that generate technological, economic and social development consistent with the strategic needs of the Republic of Croatia". [4]

The University of Josip Juraj Strossmayer in Osijek cites that "higher education is of exceptional importance for the community because it contributes to regional development as well as national societal development". [5]

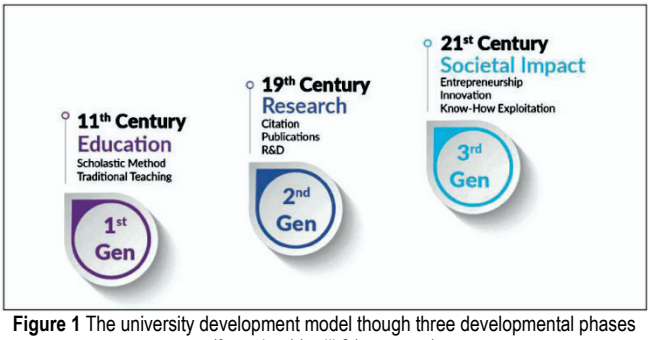

Figure 1 The university development model though three developmental phases (from the 11th till 21st century)

A model of university development, starting in the 11th century and divided in three phases or generations following up to the 21st century, is presented in Fig. 1.

According to this graphic model, first generation of universities arose with the founding of "modern" universities in Europe in the 11th century and the most important aspect of their engagement was education (the first mission) by means of traditional scholastic methods. Previous periods and civilizations are not to be disregarded, but contemporary universities can be viewed as successors of universities

established in the Middle Ages in cities like Bologna, Paris and Krakow.

The second generation of universities, formed in the 19th century, was oriented towards science and development (Research & Development), emphasizing research authenticity, transparency and publishing research results (the second mission).

The universities of the third generation emerged in the 21st century and are orientated towards social impact of university activities, innovations and transforming knowledge into socially useful products (the third mission). Subsequently, the universities of the third generation are currently undergoing a change from the *transfer of knowledge* paradigm to the process of *co-creation*. *Transfer of knowledge* is a model in which the researcher "generates" the knowledge at the university and transfers it by means of patent or some other way into technologically advanced products. Co-creation is a model in which the university researcher and partners from economy collaborate from the beginning of the research. Co-creation model positions the university as a proactive place for connecting people and ideas through education and research - students, teachers, businessmen, public sector and the civil society. [6]

3 THE THIRD MISSION OF THE FACULTY OF CIVIL ENGINEERING AND ARCHITECTURE OSIJEK (GRAFOS)

The Faculty of Civil Engineering and Architecture Osijek (GRAFOS) accentuated the importance of its third mission in several official documents. However, that is more visible in the presence of GRAFOS's students and teachers in co-operation with the economy, local and national authorities, lifelong learning programs, humanitarian actions, volunteering etc. Throughout 2020 and 2021 that mission was in most part directed towards dealing with the consequences of the Zagreb and Petrinja earthquakes.

3.1 Earthquakes in Croatia 2020; Professional and Scientific Engagement of GRAFOS' Teachers and Students in the Aftermath of Disasters

The Faculty of Civil Engineering and Architecture Osijek (GRAFOS) was directly and indirectly active in the process of minimizing the consequences of the 2020 earthquakes in Zagreb and Petrinja.

GRAFOS's students and teachers participated in evaluating the level of the damage and usability of buildings affected by the earthquakes, both on a professional and on a scientific level. They were involved in the creation of reports regarding earthquake consequences, in seismic activity monitoring in eastern Slavonia and the rest of Croatia, in providing expert lectures and consulting, publishing scientific research regarding Zagreb and Petrinja earthquakes, as well as in volunteering on locations damaged by the earthquakes.

GRAFOS employees surveyed damaged buildings in the Petrinja region in January 2021 [7] and February 2021 as volunteers. GRAFOS teachers participated in Croatian Center for Seismic Engineering conference called *Renovation of Zagreb after the earthquake* [8].

GRAFOS teachers participated in the creation of a preliminary report on earthquake consequences in Petrinja. The report was finalized in January 2021, as a part of collaboration between the American Earthquake Engineering Research Institute (EERI) and the Structural Extreme Events Reconnaissance (StEER) Network. The report involved thirty experts from renowned universities like Stanford University, University of California, Texas Tech University, Oregon State University and Swiss Federal Institute of Technology Lausanne. The seismic report, damaged buildings' illustrations, building regulations and building tradition, infrastructural damages, observed geotechnical damages were all included in the report [9]. GRAFOS teachers took part in scientific research of the Zagreb and Petrinja earthquakes with results published in 2021 [10], [11]. GRAFOS students were involved in volunteer activities in disaster areas as well, mostly on an individual basis [12].

3.2 Earthquakes in Croatia 2020; Educational Aspects of GRAFOS' Teachers' and Students' Involvement in the Aftermath of Disasters

Besides direct involvement, GRAFOS teachers included the topic of earthquakes and earthquake consequences in the educational process.

In the 2018 EUA report related to the trends in higher education, conducted by the European University Association (EUA Trends Report), many universities joined in the trend of dealing with practical problems and projects in teaching and learning. Projects arose from local and wider communities' needs and were often initiated by students [13]. Such approach to education is supported to a great extent by Project Based Learning (PBL). Project Based Learning is a teaching method that encourages students' active participation in research aimed at a specific project, problem or task. In Project Based Learning students are given a task based on facts, a problem they need to solve, or a specific goal they need to achieve, while knowledge, skills and attitudes are acquired in the course of solving a specific problem/example. In addition to knowledge and skills related to teaching and learning, students develop communication and interpersonal skills, problem-solving skills, critical thinking, etc. This type of education takes place in phases (from research to presentation), with students being able to see and examine results in real time [14, 15].

Teachers of the Undergraduate University Study of Architecture and Urban Planning at GRAFOS practice PBL within several courses. In 2020 and 2021 PBL [16] was used as a basis to tackling problems related to alleviating earthquake consequences in Croatia, specifically within study courses *Architectural Design*, *Residential Buildings* and *Urban Planning 2*.

Study course *Architectural design* tasked the students with designing shelters for people affected by natural disasters. The results and students' designs are presented in the following text.

4 STUDENTS' RENSPONSE TO RESIDENTIAL CHALLENGES CAUSED BY NATURAL DISASTERS

Natural disasters have recently become more frequent and dangerous, resulting in numerous civilian casualties and inflicting material damage. The consequences of natural disasters are both expensive and protracted as they result in humanitarian crises that last for years and require huge reconstructive investments.

The architects and builders have an important role in the process of both restoring the lost infrastructure and responding to the basic human need for accommodation and safety. Building after a disaster has to deal with short term needs for immediate shelter as well as long term needs for wide ranging reconstruction because relocated population often keeps living in temporary shelters with limited approach to water, sewage and electricity.

4.1 Study Course Architectural Design

Architectural design course is part of the Undergraduate University Study of Architecture and Urban Planning at GRAFOS. It is a first study year course with the goal of introducing the students to different aspects of project and design thinking [17].

4.2 Preliminary Research

The choice of the project task relevant to Croatia after the earthquake and pandemic of 2020 was followed by preliminary research necessary for defining students' assignments. Preliminary research included the topic of natural disasters (definition, typology and damage, natural disasters registry), shelter architecture (definition, prevention, adaptive and modular architecture) as well as referent examples of various shelters used after natural disasters.

4.2.1 Natural Disasters

According to the Croatian Law on Protection against Natural Disasters [18] it is considered that a natural disaster is a sudden occurrence that disrupts usual course of life, causes victims, damage/loss of the property to a great extent, as well as the damage of the infrastructure and/or the environment.

Republic of Croatia possesses a unique digital database of damages caused by natural disasters called the Natural Disaster Damage Registry. The data, based on the damage estimations conducted by the municipal/city/county, is collected and documented in the Damage Registry. The Registry data contain the following: assessed damage content, final damage assessment, cost of repair [19].

Natural disasters typology includes earthquakes, storm and hurricane winds, fires, floods, droughts, frost, snow and snow-drift, pandemics, whirlwinds, environment pollution, causes being natural, technical, technological or biological events.

Table 1 Shelter design recommendations in case of various natural disasters

Type of Disaster	Cause of Disaster	Location of Shelter	Design Guidelines
Earthquake	displacement from the ground	avoiding fault lines, rivers and coastal areas	light materials, firm and stable structures
Flood	water level increase, humidity	avoiding floodplain and high water level areas	waterproof materials, lifting shelters above the ground
Wind/Storms	wind load	avoiding strong wind areas, tall buildings and trees	foundation reinforcement, ideal building shapes

4.2.2 Shelter Architecture

Shelter is a building or a part of a building constructed for protection and rescue of people and material goods in case of disasters caused by war destruction or other activities conducted by man or natural forces [20].

According to a detailed classification, there are seven types of shelters: emergency shelter, temporary shelter, temporary residence, transitional shelter, progressive shelter and permanent housing [21].

When designing shelters, it is important to consider climatic, geographical, constructive and economic aspects of design. A modular approach to shelter design contributes to the increase in flexibility and has a potential to combine the units thus enabling the survival of existent communities.

Prevention or Recovery?

Problems caused by natural disasters could be assessed through discourses of prevention or recovery. Design solutions of buildings resistant to possible future damages caused by natural disasters are defined by prevention or resistance architecture. Design solutions of buildings to be used after natural disasters are defined by immediate recovery. In this case, architects have to take into account the extent of damage caused by natural disaster, required infrastructure, speed of construction, available construction typology including materials, technology, etc. during recovery of the area. Design solutions should consider minimal needs required for functioning of the unit/ community/ more communities over a longer period of time, with adaptability and modularity being an important aspect of the project quality.

Prevention - Adaptive/adjustable Architecture

Building of safe houses as a part of "how to live with danger" concept is a basis for the adaptive/adjustable architecture. Understanding risks, settlement planning, safe construction, as well as improvement and renewal after the catastrophe are all included in this type of architecture.

The adjustable building is usually comprised of the following:

- lightweight structures - structures made of light materials, more resistant to earthquakes
- safe and firm structures - prevention of the wind penetration

- safe ground anchorage - additional anchoring of the building
- raising structures above the ground - prevention of the flood impact
- additional diagonal stiffeners of the wind bonds - prevention of the horizontal wind load
- careful shaping of the building - compact buildings are more resistant to earthquake. [22]

Recovery - Modular Architecture

The use of prefabricated units that can be multiplied sums up the concept of modular architecture. Their rapid and cheap production, storage and transportation as well as swifter assembly in natural disaster circumstances is achieved by the multiplication of the same or alike units.
The advantages of modular constructions include shorter time for construction work, less need for labor, safer work conditions, better product quality, less material waste and smaller environmental impact. Logistic aspects of crisis management (supply, transport, storage) are most challenging and expensive in this case. The factors to be taken into account when designing a modular system include type and extent of disaster, climate and geography of the affected area, among others.

4.2.3 Reference Examples

Temporary shelter for earthquake victims in Nepal, Barberio Colella Arc, 2013

After the 2013 earthquake, hundreds of thousands of people in Nepal lost their houses. A temporary shelter unit was designed by the Barberio Colella Arc office for accommodation of 4 to 10 people by means of modular units 4 by 11,7 meters long. The modules could be quickly built and delivered, they are made of local materials, and once built, they create spaces with respect to users' needs and facilitate life of a community after the earthquake.

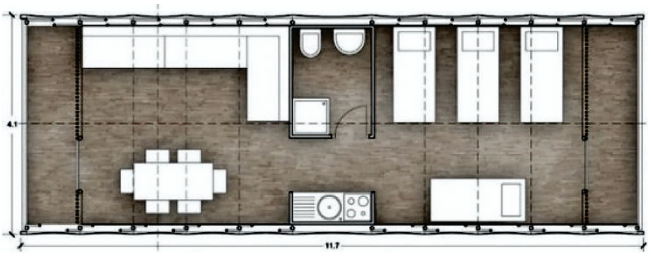

Figure 2 Temporary shelter for earthquake victims in Nepal, Barberio Colella Arc, 2013, visualization and layout

Alternative housing for the earthquake victims in Petrinja, Faculty of Architecture Zagreb, 2021

The teachers of the Faculty of Architecture in Zagreb have designed 20 types/60 subtypes of modular prefabricated houses for the earthquake victims in the Petrinja region.

Those houses, half prefabricated and/or prefabricated, are made of light materials with varying layouts based on modular design. All the proposed house designs take into account traditional architecture features, escaping simplistic shape imitations, and creatively interpreting local life. [23]

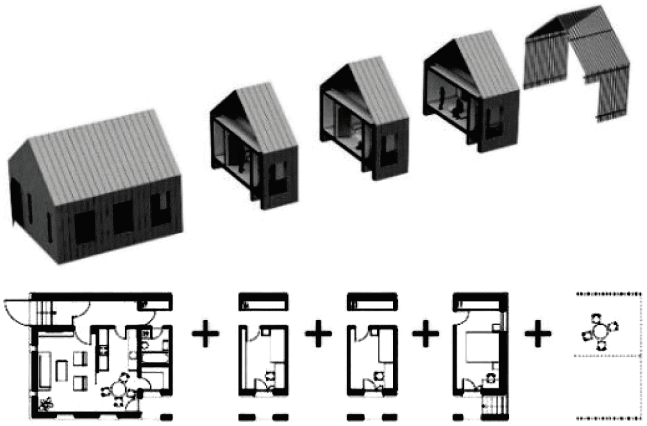

Figure 3 The examples of the modular object solution for the earthquake victims in Petrinja, author: Luka Korlaet

Temporary shelter for all the types of natural disasters, Abeer Seikaly, 2013

In 2013, Abeer Seikaly defined the solution of a shelter to be used for all types of natural disasters. The modular unit represents a structure made of fabric adjustable to different climates, by shape and materials similar to a tent used by nomadic desert people. It is shaped following wave curves and inwrought in flexible fabric membrane. The shelter could be multiplied to create a settlement. Abeer Seikaly primarily considers the placement of a large number of refugees who could find a place for a temporary stay that allows them "to weave" their new lives.

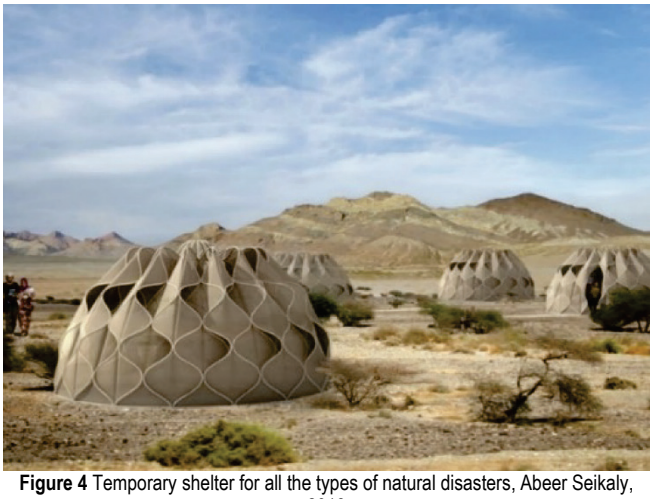

Figure 4 Temporary shelter for all the types of natural disasters, Abeer Seikaly, 2013

Temporary shelter system for the Japanese flood victims, Shigeru Ban, 2018

A temporary modular shelter system for the flood victims in Japan was designed by the architect Shigeru Ban in 2018, and it was shaped from paper tubes and textile blinds with dimensions 2 by 2 meters. The units were built in evacuation centers of the affected area, and a unit could be built in a few hours. Shigeru Ban was inspired by traditional Japanese architecture where fabric (tatami, straw, bull-rush) and paper (barriers made of rice paper) enable flexibility and transparency of the space.

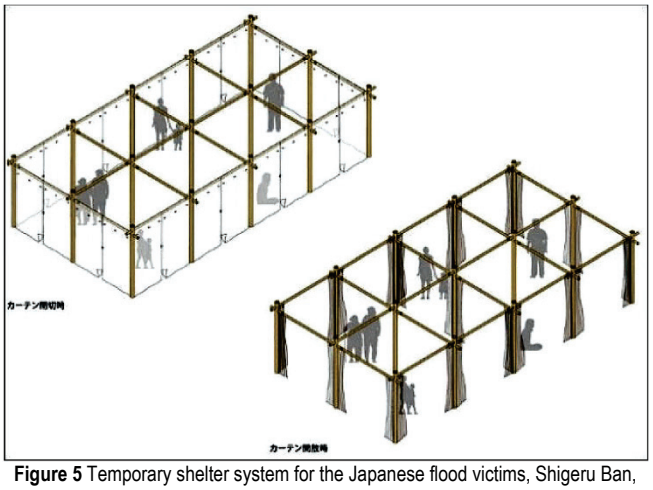

Figure 5 Temporary shelter system for the Japanese flood victims, Shigeru Ban, 2018

Temporary shelter from strong winds and high temperatures, Christian Weber, 2014

Aiming to secure accommodation for a large number of people participating in a music festival in Black Rock desert, architect Christian Weber defined a shelter solution in 2014. The shelter was designed with the primary goal to protect from strong winds, cold nights and heat in desert areas. The basic shelter module is a hexagonal unit with a 195 cm base line and 2 meters high. The unit is resistant to wind, dust and temperature oscillations in desert which range from 40 to 50 °C.

Figure 6 Temporary shelter from strong winds and high temperatures, Christian Weber, 2014

5 STUDENTS' SHELTER DESIGNS

Study course *Architectural design* is a second semester course that usually consists of three design assignments for students. The topic of the second assignment in academic year 2020/2021 was the design of a shelter suitable for people to use after natural disasters. Incentives for such topic were the consequences of both the corona virus pandemic as well as consequences earthquakes that struck Zagreb, Petrinja, Sisak, Glina and the surrounding regions in 2020.

The financial consequences of the March and December 2020 earthquakes are estimated to be worth around 160 billion kuna, amounting to 40% of the Croatian Gross Domestic Product (GDP) per year [24]. At the same time, consequences of the global corona crisis have led to a record drop of the Croatian GDP of 8,4% for the whole of 2020 [25].

A part of the above-mentioned costs refers to accommodating the population affected by the earthquakes by means of mobile homes and residential/office containers in Zagreb (total of 76 units) and Petrinja (262 units). Residential containers were part of an existing economic contingency stock of the Republic of Croatia, though the large number of containers within the contingency (over 170) has already been allocated across hospitals and health centers related to consequences of the pandemic. Public donations of containers and mobile homes were insufficient so 722 containers had to be urgently procured in 2021 [26].

Although the project task was extremely demanding for the students of the first year of undergraduate studies, both students and teachers agreed that such urgent, real problems had to be addressed and that including socially responsible architecture in architectural education is essential.

Students were given two possible options of the assignment. Option A, called PREVENTION / RESISTANCE / RESILIENCE, referred to shelters designed with the aim to achieve resistance to the impacts caused by the consequences of natural disasters. Option B, called RECOVERY / IMPROVEMENT / RENEWAL, referred to solutions designed as shelters to be used after natural disasters.

Students had to investigate different natural disasters (earthquake - whirlwind - fire - flood - drought - snow-drift/avalanche - soil avalanche - pandemic - air pollution - nuclear catastrophe), research reference examples for the disaster they have chosen to work on and propose and present specific design solutions. The project task limited the shelter to a space necessary for living of one or more persons over a longer period of time (place to sleep, eat, reside, store and a sanitary space), as well as additional places per choice. Special attention was dedicated to conceptual response to the topic, adequate dimensioning and functionality of the place, shelter construction, choice of materials and integration into the environment.

5.1 Task Choice and Analysis

At the beginning of the assignment students could independently choose the type of natural disaster which would be a starting point for shelter design. In most cases the students referred to floods (33%), earthquakes (31%) and avalanches (23%), as illustrated in Fig. 7. In those three cases, the connection between the form and function of the shelter is the most evident.

When given a choice between prevention and recovery, most students designed objects with respect to prevention of the possible future damages which is indicative of the high level of reflection regarding sustainable architecture, in line with environmental changes. A smaller number of students defined solutions which respond to the residential needs in the process of recovery from the consequences of natural disasters, and some students provided no response to any of the provided topics but dealt with the topics such as flexible and modular residences (Fig. 8).

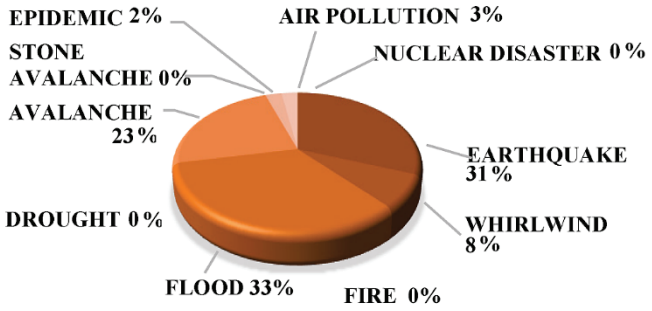

Figure 7 Analysis of chosen topics

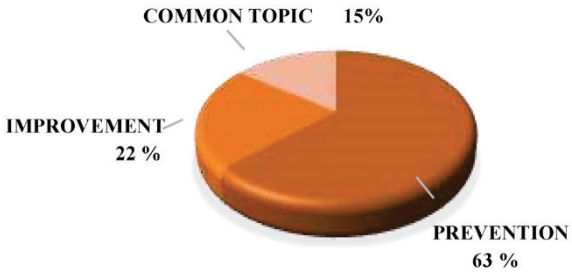

Figure 8 Analysis of chosen responses on the topic

Designed shelters vary widely in terms of size and shape and most shelters range from 50 to 150 square meters in size (Fig. 9). Relatively large square footage of students' shelters is not surprising with respect to reference examples and given the educational aspect of the assignment.

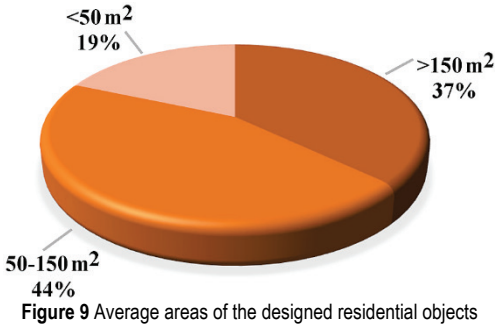

Figure 9 Average areas of the designed residential objects

5.2 Selected Students' Solutions

Students presented their final shelter designs to colleagues and teachers. The assignments were then assessed based on several criteria (concept, quality of technical and functional design, multiplication options, innovation etc). For this paper, best three shelter designs were chosen and are presented in detail, including students' descriptions and illustrations.

5.2.1 Domagoj Gregačević - Avalanche - Maginot Line

Student Domagoj Gregačević provides answers in his design to the questions of prevention in the areas exposed to avalanches and snow-drifts. The proposed solution/house operates as a monolithic rock inside of which the life is not disturbed during and after the natural disaster.

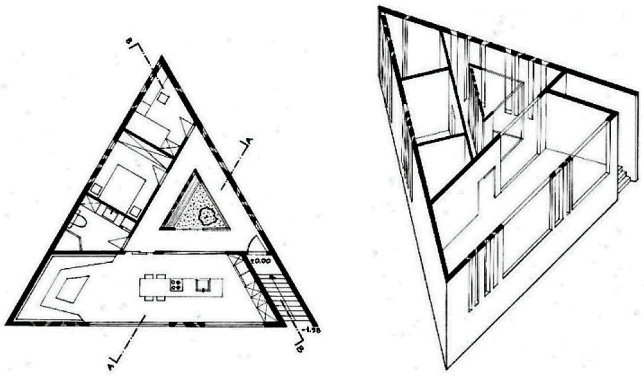

Figure 10 Domagoj Gregačević, Maginot Line, layout and axonometric display

The layout is a form of an equilateral triangle that, with its sharp angles, decreases the blow intensity of snow mass and redirects it away from the house. Two sloped trapezoidal facades exposed to the avalanche impacts are conceptualized as powerful walls, while the third facade is extroverted with the views directed towards the surrounding area. The house looks like a wedge stuck in a rock and reminds of a piece of mountaineering equipment. It is possible to connect the units into an assembly which then additionally diminishes the destructive power of the avalanche, and as such it presents a defense mechanism, i.e. the front line - the Maginot line that the solution got its name after.

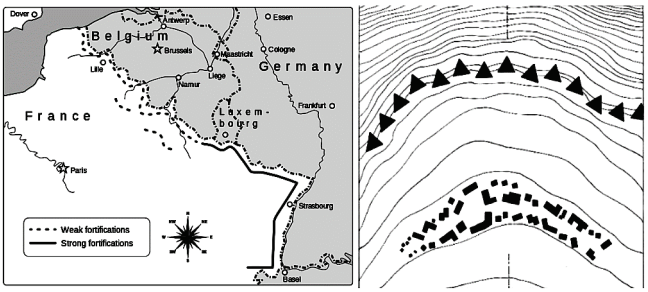

Figure 11 Domagoj Gregačević, Maginot Line
Maginot Line in France, shelter settlement proposal

5.2.2 Ana Domjančić - Pandemic - The Tree of Life

The challenge of preventive building in cases of epidemics and pandemics is tackled by student Ana Domjančić. The relationship between a man and his family / small community and nature is emphasized by the designed solution. There is a central atrium in the middle of a house in which the house pulls in the surrounding greenery. All rooms of the house are connected with the atrium, and they encircle it.

Glass walls that enclose the house can be completely opened so that ventilation of the object is enabled, as well as transformation from a closed in a (half) opened space.

There is a zone for self-isolation in the house that encompasses the bedroom, bathroom and terrace and that can be separated from the rest of the house.

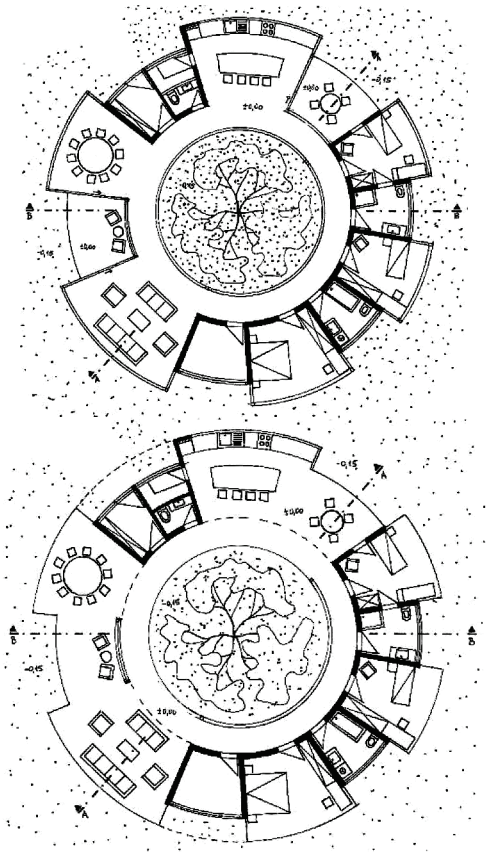

Figure 12 Ana Domjančić, The Tree of Life, layout – closed and opened

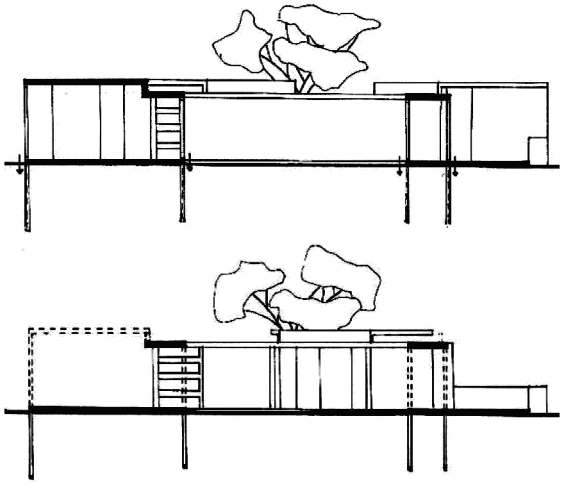

Figure 13 Ana Domjančić, The Tree of Life, section view - closed and open

5.2.3 Leon Lipovac - Environment Pollution – The Approximate Present

The question of permanent "natural disaster", i.e. environment pollution, is dealt with by student Leon Lipovac.

The (approximate) vision of catastrophic future confronts the student's vision of the approximate present. The cycle and behavior of the natural atmosphere is replicated and mapped onto within the architecture as an answer to air pollution by means of bringing external clean air through a system of pipes in the interior. Warmth, moisture, and other aspects of the outer residence are pulled into the house depending on the function of the room as well as the ideal conditions for human use. A man habits the atmospheric voids, and the walls become their room dividers.

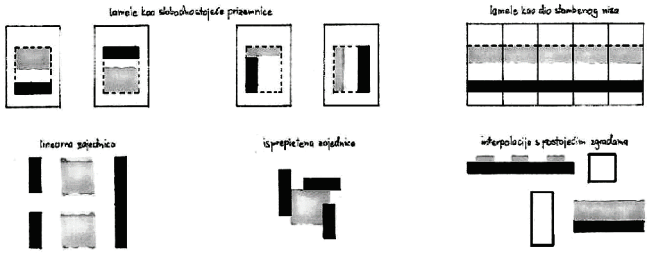

Figure 14 Leon Lipovac, The Approximate Present, unit matching scheme

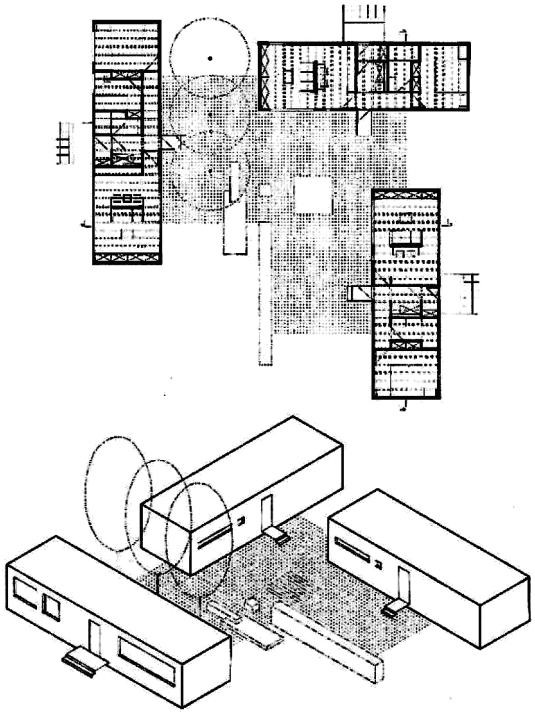

Figure 15 Leon Lipovac, The Approximate Present, layout, axonometric display

On a conceptual level, this design was inspired by the vertical capsules from "The Fifth Element" movie in which the possibilities of partition and function compacting are examined. Shelter functions within different urban and rural situations are researched, taking into account aspects of both disaster prevention and recovery. The earthquake resistant construction is enabled by a light structure anchored on the reinforced concrete pedestal.

6 CONCLUSION

The "third generation" universities are dedicated to three missions - education, science and advancement of the community. They are oriented towards entrepreneurship and innovation, striving to become places of collective knowledge production.

The impact of the 2020 earthquakes in Zagreb and Petrinja, as well as the 2020 pandemic that affected the whole

world, has led to the integration of these actual topics in the educational process at The Faculty of Civil Engineering and Architecture Osijek (GRAFOS), considering that engineers have an important role in the process of restoring the lost infrastructure and responding to basic human need for accommodation and safety.

This paper presents the process of creating, executing and assessing a student assignment within the study course *Architectural design* at GRAFOS in 2021, based on real needs for designing shelters for a large number of people.

Students researched numerous recent examples of buildings and constructions that were used for urgent sheltering of people affected by floods, earthquakes, drought or hurricanes, and their design solutions were both innovative and bold. An aproach to education that includes practical projects and challenges in teaching, is ever more present in Europe and the world as evident from different reports on trends regarding development of higher education. Within that type of learning, students examine, cooperate, acquire new knowledge, develop critical thinking, communication skills as well as interpersonal skills.

By designing shelters and providing individual solutions to the consequences of recent natural disasters in Croatia, students of the Faculty of Civil Engineering and Architecture Osijek enforced the third mission of Osijek's university, already positioning themselves as a part of a community they operate in and whose advancement they contribute to.

7 REFERENCES

[1] Croatian Encyclopaedia ONLINE, The Miroslav Krleža Institute of Lexicography (2021, January 6). Retrieved from http://www.enciklopedija.hr/Natuknica.aspx?ID=59054

[2] Croatian Law on higher education and science (Official Gazette 123/03, 198/03, 105/04, 174/04, 02/07, 46/07, 45/09, 63/11, 94/13, 139/13, 101/14, 60/15, 131/17)

[3] Ćulum, B. & Ledić, J. (2011). *Sveučilišni nastavnici i civilna misija sveučilišta,* Rijeka, Filozofski fakultet u Rijeci.

[4] Misija i vizija Sveučilišta u Zagrebu (2021, March 15) http://www.unizg.hr/o-sveucilistu/sveuciliste-jucer-danas-sutra/misija-i-vizija-sveucilista/

[5] Misija i vizija (2021, March 15) Retrieved from http://www.unios.hr/o-sveucilistu/misija-i-vizija/

[6] Gaebel, M. & Zhang, T. (2018). *Learning and teaching in the European Higher Education Area*, European University Association. Retrieved from https://www.eua.eu/downloads/publications/trends-2018-learning-and-teaching-in-the-european-higher-education-area.pdf

[7] Dokšanović, T. (2021, February 26). Aktualnosti s GRAFOS-a, *Glas Slavonije, Sveučilišni glasnik,* 66(2), 16. Retrieved from https://www.glas-slavonije.hr/sglasnik/sveucilisni-glasnik-66.pdf

[8] Savjetovanje 7: Obnova Zagreba nakon potresa - Zagrebu od Osijeka (2021, February 22). Retrieved from https://www.hcpi.hr/22022021-savjetovanje-7-obnova-zagreba-nakon-potresa-zagrebu-od-osijeka

[9] Hadzima-Nyarko, M. (2021, February 26). Potres pokraj Petrinje – preliminarni izvještaj o posljedicama potresa. *Glas Slavonije, Sveučilišni glasnik*, 66(2), 16. Retrieved from https://www.glas-slavonije.hr/sglasnik/sveucilisni-glasnik-66.pdf

[10] Markušić, S., Stanko, D., Korbar, T., Belić, N., Penava, D., & Kordić, B. (2020). The Zagreb (Croatia) M5.5 Earthquake on 22 March 2020. *Geosciences, 10*(7), 252. https://doi.org/10.3390/geosciences10070252

[11] Markušić, S., Stanko, D., Penava, D., Ivančić, I., Bjelotomić Oršulić, O., Korbar, T., & Sarhosis, V. (2021). Destructive M6.2 Petrinja Earthquake (Croatia) in 2020—Preliminary Multidisciplinary Research. *Remote Sensing, 13*(6), 1095. https://doi.org/10.3390/rs13061095

[12] Dimter, S. (2021, April 27). Pohvala studentima Građevinskog i arhitektonskog fakulteta Osijek. Retrieved from http://www.gfos.unios.hr/pohvala-studentima-gradevinskog-i-arhitektonskog-fakulteta-osijek

[13] Gaebel, M. & Zhang, T. (2018). *Learning and teaching in the European Higher Education Area*, European University Association. Retrieved from https://www.eua.eu/resources/publications/757:trends-2018-learning-and-teaching-in-the-european-higher-education-area.html

[14] Obrazovni trendovi za suvremenu nastavu - Osnove istraživačke nastave (2021, May 25) Retrieved from https://mooc.carnet.hr/mod/book/view.php?id=25646&chapterid=6781

[15] Obrazovni trendovi za suvremenu nastavu – Projektna nastava (2021, May 25) Retrieved from https://mooc.carnet.hr/mod/book/view.php?id=25646&chapterid=6782

[16] Dolaček-Alduk, Z., Lončar-Vicković, S., Stober, D. (2011). *Projektna nastava u obrazovanju građevinskih inženjera,* Sveučilište Josipa Jurja Strossmayera, Građevinski fakultet, Osijek

[17] University Undergraduate Study Programme in Architecture and Urban Planning (2021, May 25). Retrieved from http://www.gfos.unios.hr/app/storage/protected/studijski-program-arhitektura-i-urbanizam-hrv.pdf

[18] Croatian Law on Protection against Natural Disasters (Official Gazette 73/97)

[19] Natural Disaster Damage Registry Rule Book (Official Gazette 65/2019)

[20] Croatian Encyclopaedia ONLINE, The Miroslav Krleža Institute of Lexicography (2021, May 25). Retrieved from http://www.enciklopedija.hr/Natuknica.aspx?ID=56451

[21] Bashawria, A., Garritya, S., & Moodleya, S. (2014). An overview of the design of disaster relief shelters. *Procedia Economics and Finance, 18*(2014), 924-931. https://doi.org/10.1016/S2212-5671(14)01019-3

[22] Francioni, A., Capizzi, P., Chome, J., Rakotoarison, M., Ferreiro, F., Rosario, W., Ramanankolazaina, R. (2014). *Disaster Risk Reduction Architecture: Key Practices for DRR Implementers*. Retrieved from https://www.fao.org/3/i3773e/i3773e.pdf

[23] Sutlic, K. (2021, February 26). Ovo su tipske kuće koje će se graditi na Baniji i zamijeniti one koje su oštećene u potresu. Retrieved from https://www.jutarnji.hr/vijesti/hrvatska/ovo-su-tipske-kuce-koje-ce-se-graditi-na-baniji-i-zamijeniti-one-koje-su-ostecene-u-potresu-15053844

[24] Penic, G. (2021, March 13). Procijenjena je šteta nastala u potresu na Baniji, upola je manja od one u Zagrebu. Retrieved from https://www.jutarnji.hr/vijesti/hrvatska/procijenjena-je-steta-nastala-u-potresu-na-baniji-upola-je-manja-od-one-u-zagrebu-15057450

[25] Jutarnji.hr (2021, February 26). Marić o mjerama za pomoć poduzetnicima, poskupljenjima i BDP-u: 'Očekujem rast od 5 posto'. Retrieved from https://www.jutarnji.hr/vijesti/hrvatska/maric-o-mjerama-za-pomoc-poduzetnicima-poskupljenjima-i-bdp-u-ocekujem-rast-od-5-posto-15053749

[26] potresinfo.gov.hr (2021, February 13). Počelo useljavanje u kontejnersko naselje u Petrinji. Retrieved from https://potresinfo.gov.hr/pocelo-useljavanje-u-kontejnersko-naselje-u-petrinji/299

Authors' contacts:

Sanja Lončar-Vicković, Ph.D. in Arch, Associate Professor
Josip Juraj Strossmayer University of Osijek,
Faculty of Civil Engineering and Architecture Osijek
Vladimira Preloga 3, 31000 Osijek, Croatia
E-mail: sloncar@gfos.hr

Marija Krajnović, M.Sc. in Arch, Research Assistant
(Corresponding author)
Josip Juraj Strossmayer University of Osijek,
Faculty of Civil Engineering and Architecture Osijek
Vladimira Preloga 3, 31000 Osijek, Croatia
E-mail: mkrajnovic@gfos.hr

Martina Kamenarić, univ. bacc. ing. arch.
E-mail: kamenaricm@gmail.com