



ROOF SET UP AS A RELAXING GREEN SPACE

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Abstract: Starting from a quite old (100 years) idea, the paper presents a project proposal for setting up a relaxing area on top of a building. The targeted building is part of the Research and Development Institute of Transylvania University of Brasov. This building presents some particularity which is the presence of technical equipment on this roof. Consequently, the set up should avoid these areas and provide a relaxing area for the researchers in this laboratory. The set-up design consists of furniture objects design, while the vegetation choosing and watering system to be presented in a subsequent paper.

Keywords: architecture, ecodesign, eco-materials, energy saving, green roof

1. INTRODUCTION

One of the main problems people are confronting with today is the human – environment relationship. Since many years this is no longer a fair relationship as long as we, humans, continue the aggression against the environment by all possible means.

Any human activity is considered to be harmful to the environment. Building houses, factories, roads, making and using the products we use every day, transporting people, merchandise or fuels, all these activities have a negative impact on the environment.

Ecodesign come with a challenge in what concerns reducing the products' environmental impact during the entire lifecycle, i.e. including production, fabrication, transportation, use, and products disposal. This relatively new approach in design came with some change of paradigm, meaning that the main objective of the activity is to obtain products with a minimum environmental impact, by reducing the materials and energy involved and also reducing the environmental impact that includes solid waste, air and water pollution, global warming, acidification, and so on [1].

In what concerns the architecture and construction domain, the challenge is connected to the fact that every square meter of building or road, represent a surface which is taken away from the environment for good. This means that beyond the fact that raising a building represents an impact due to the materials and energy involved in producing, fabrication, transportation (the components) and use (the building), it "steals" an area from the nature. When "belonging" to the natural environment, this surface would be friendly to the nature, hosting vegetation and animal species, but with buildings on it, will turn to „unfriendly”, therefore producing a negative impact.

Unfortunately, we need more and more constructions; hence, the surface taken away from the natural environment is increasing every day. If we add to this loss the large areas destroyed by deforestation, desertification, or other consequences of the climate change, every year we have less surface meant to counterbalance the negative environmental impacts we produce.

One solution which permits partly recovering the loss of vegetation caused by constructions is to create a green area on top of the buildings. This will have at least two functionalities: as green area and as recreation space.

2. GREEN ROOFS

The solution of creating a green space on top of the building is not a new idea, but lately it is adopted by an increased number of developers and architects (Fig.1). This early choice is important, because it is essential that the project to include this possibility, the building design being different in this case.

It is much more difficult to develop such a project for a building which roof has not been designed for this destination, as a roof covered with vegetation. This is because the roof structure is different, fulfilling constrictions related to functional or aesthetic elements. It is the case of this project.

A green roof set-up represents a good example of passive technologies involvement. The so called "roof gardens", besides the aesthetic function, might provide a relaxing space, extremely useful for the people living or

working into the building, especially for the busy city downtowns. People can spend some time, short breaks or so, in plain air, have a drink, a chat with colleagues or friends, enjoying a friendlier, natural environment. Also, such a set-up contributes to reducing the environmental negative impact of the building, and city as well, by controlling and preserving the rain water, improving/refreshing the air, and reducing the solar radiation which overheats the roof [2].

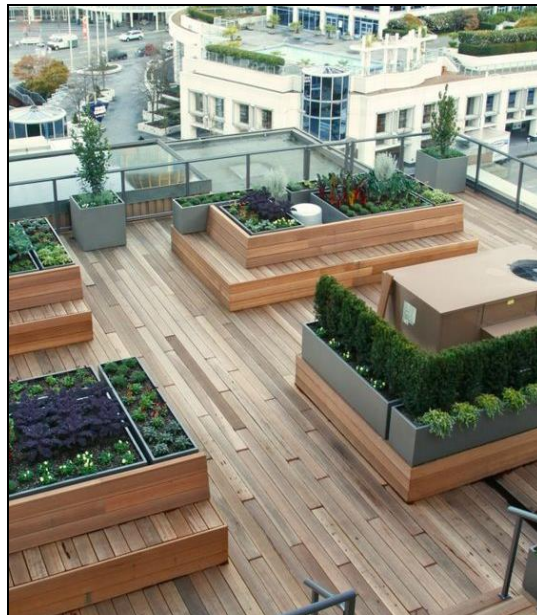


Figure 1: Existing green roofs in Vancouver, Canada [4]

These roof gardens are the best choice in the case of buildings with a flat roof, having various destinations like homes, commercial, industrial or for institutions [10].

In this paper, we propose creating a green zone for relaxation on top of a building belonging to the University Transylvania Research and Development Institute (ICDT), Laboratory 7 (Fig.2). This is the case of a building which was not designed to be covered with vegetation. Moreover, the roof of this building is hosting significant amount of technical equipment for which total access should be ensured. Consequently, the result of our design will not be a genuine „green roof” [2], but a space suitable for relaxation, and containing some green areas. This solution reflects a concept meant to combine the “green roof” environmental benefits, with a relaxing space for the people involved in research activities and who have an indoor, preponderant static activity, either in sitting or standing posture.



Figure 2: The Research and Development Institute – ICDT – University ”Transylvania” of Braşov.

In conclusion, for setting up this roof as a relaxing green space, some important sub-objectives should be considered:

- Creating a relaxing space for the laboratory researches;
- Ensuring a comfortable and healthy position, ensured by some ergonomic furniture;
- Providing a covered area for bad weather, extending the roof using periods;
- Rain water management and easy maintenance for the green areas;
- Avoiding the roof over-heating during hot season by maximizing the green areas;
- Improving the air quality due to the photosynthesis process;
- Improving the building energetic efficiency.

3. RESEARCH ON DESIGN REQUIREMENTS

The design process will start with a research activity which involves doing some measurements in order to identify the available areas, a critically evaluation of existing solutions both for the set-up and furniture, and assessing the target group, i.e. a study on the potential beneficiary of the green space. It is necessary to make precise measurements for the existing objects on the roof, in order to develop a design that, whilst avoiding them, will be compositionally coherent, aesthetic, comfortable and useful.

The research on the user, involves observation on the target group for identifying the activities that will be developed in this space, finally establishing the people's needs (Fig.4). This can be fulfilled performing a classic research [3], or by observation. This research leads, besides others, to some conclusions related to the furniture type, shape and set-up, and also to the most adequate materials to be used.

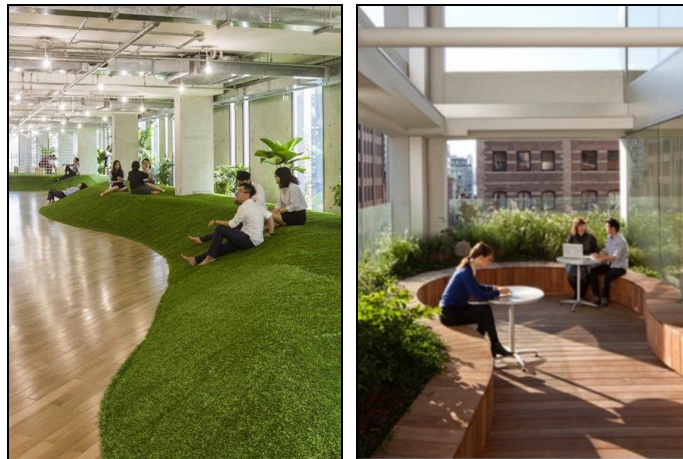


Figure 3: Research on users. [4] [5]

The research stage continues with the evaluation of the most adequate materials that should be used for the furniture and the other objects [8].

The present situation that can be seen in pictures (Fig.2), shows the cover of the building, which material is concrete. In order to permit human traffic, some paths were designed and covered with rubber carpets. When turning this roof into a relaxing area, probably the traffic will increase. Therefore, the area not covered with equipment should be covered with a boarded floor. The objects that will be part of the set-up should be benches, low tables, chairs and vegetation containers. Because the roof of the building was not designed to support a garden, its structure is not suitable for placing the plants directly on the roof floor. Changing the structure involves costs and insurmountable difficulties, thus the best solution is to place the vegetation in pots, suspended on legs to prevent keeping the floor wet.

The material research lead to some options in what concerns every part of the final design. The environmental impact of materials was taken into consideration. For the floor, the WPC – Wood Polymer Composite – is considered a good option. It is a composite material which combines wood and plastic waste in equal proportions [6], a mixture stable and safe to UV radiation, differences in temperature, fungi and insects. The technology used for shaping the composite is extrusion. This material can be impregnated in order to get a fire retarding quality. The estimated life span of such a floor is minimum 15 years, turning it into a sustainable, eco-friendly solution.

Furniture and the supports for vegetation included into the bench design should be made from impregnated wood. This will ensure long lasting objects, combined with a good aesthetics in accordance with the idea of natural environment, which this set-up is promoting.

Metallic parts will be built from stainless steel. The barrier that will be built along the building perimeter, the floor supports, and some of the furniture joints are designed from steel.

The sun rays, wind, rain and snow protection will be designed as a dome shaped construction, and will require a metallic (aluminium) frame and a textile waterproof cover (hemp based). As the strongest natural fabric, hemp guarantees durability and longevity; it has a high resistance to UV rays, allowing the fabric to retain its dyes more than any other natural fibre. Hemp fabric can be treated and processed to be antibacterial, biodegradable and completely organic [7].

An extended research should focus on the “green” side of the project. This should include choosing and combining diverse species of vegetation, according to the expected weather conditions and ensuring the necessary aesthetics and comfort. This aspect will make the subject of a future paper.

4. THE OBJECTS DESIGN

Before establishing a set-up, it is necessary to start designing the objects to be part of the final composition. The research previously performed showed the necessity for sitting comfortable, with possibilities of socializing one with each other. This led to the idea of designing modular furniture, giving the possibility to arrange the modules according to the necessities and available space.

Because the set-up is situated on top of the building, a cover for at least a part of the sitting area would be necessary. This can protect the users both from the direct sun radiation, and from the rain/snow in bad weather. In time, the idea of cover turned to a closed area that can provide an extended protection, due to the wind exposure of the relaxation place.

The final shape of the protected area is a hemisphere designed as a dome. The structure is built from aluminium alloyed bars, assembled by threaded joints (Fig.4). CatiaV5 software was used for modelling the dome components and ensemble.

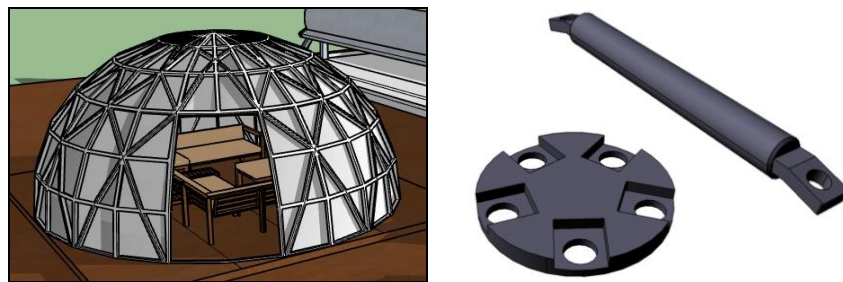


Figure 4: The dome layout and main components

The dome metallic structure is covered with a textile sun blind. The previous research led to conclusion that hemp is suitable for the cover material. Thus, the dome hemispheric structure will be covered with hemp, which involves the material tailoring using methods specific to the descriptive geometry. The unfolded view has been designed and then the parts will be joined by sewing. The dome construction is based on a 2.5m diameter sphere. The metallic bars are inter-connected into a round connector using screw-and-nut joints (Fig.4). This assembly solution provides the opportunity of rapid assembly and disassembly when the structure is moved. Moreover, the access on the top of the building is difficult, so a rapid and easy transportation and mounting structure is in fact a design constriction.

Next, the other objects are designed, the bench and the pots, more precisely the small pots. The larger “green areas” will be designed later.

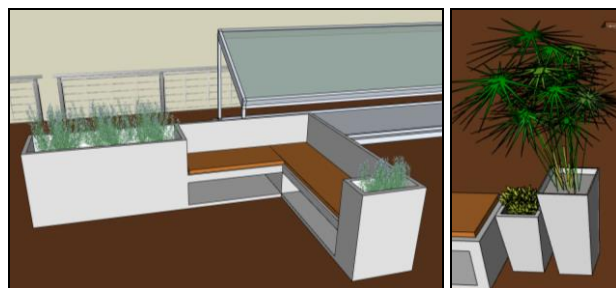


Figure 5: The bench and small pots layout

The bench is designed as an “L” shaped module. It contains also small green areas, suitable for reduced height plants. The benches can be arranged in line, to face the view, or facing, to help people join together and facilitate socialization. The materials chosen for the bench are concrete and impregnated wood.

Concrete is a composite material, largely used in construction, and for this building as well. It is time resistant even for tough conditions like rain, snow, and differences in temperature like day-night and winter-summer extents; it can be coloured and easily maintained. The same concrete is used for the small pots, containing vegetation and for the larger areas where higher vegetation species will be planted.

Wood is a warm, friendly material, optimal for the bench sitting and backrest areas. It can be easily shaped even then the proposed design is minimalistic. Under the benches some spaces were created, being multifunctional. They can be used for storing useful objects, protected from sun, wind, rain, dust or other, and being necessary as an ergonomic solution improving the sitting position of the users. Wood bench is a good solution considering that the floor is also built from a composite-based wood. The reduced number of materials used reflects the design objective fulfilling.

As the components were designed, they were checked for compatibility – shape, material etc. – in order to proceed the design with the last stage of it, a solution for the set-up (Fig.6). The objects were placed according to the restrictions established at the beginning of the design process.

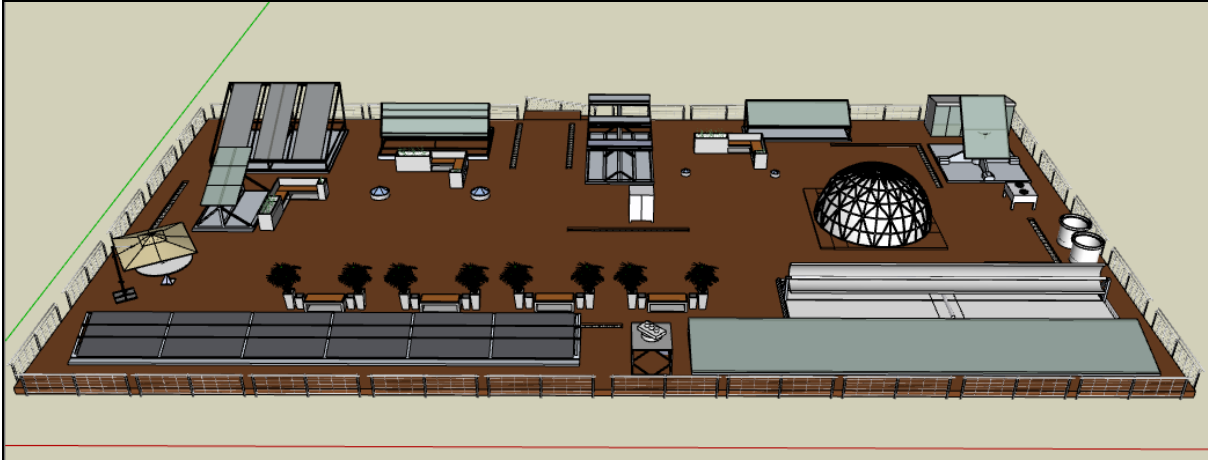


Figure 6: Objects placing on the green roof – initial layout

4. GREEN ROOF LAYOUT

The set-up design started with the floor. This should cover the entire roof area, not yet covered with equipment. The height of the floor is designed to cover some functional or non-functional subsidence of the roof. An example of functional elements of the roof is the light wells, designed to provide natural light at lower levels. The floor must avoid covering them, and also the final set-up should consider keeping out from shadowing them by furniture, vegetation or other objects.

The floor will be built from WPC, as previously assumed, and set on a stainless steel structure, designed to protect the existing water proof insulation of the building roof. The roof perimeter will be protected against human accidental falling down, an ergonomic barrier being designed. This fence is built from stainless steel and fixed on the existing structure.

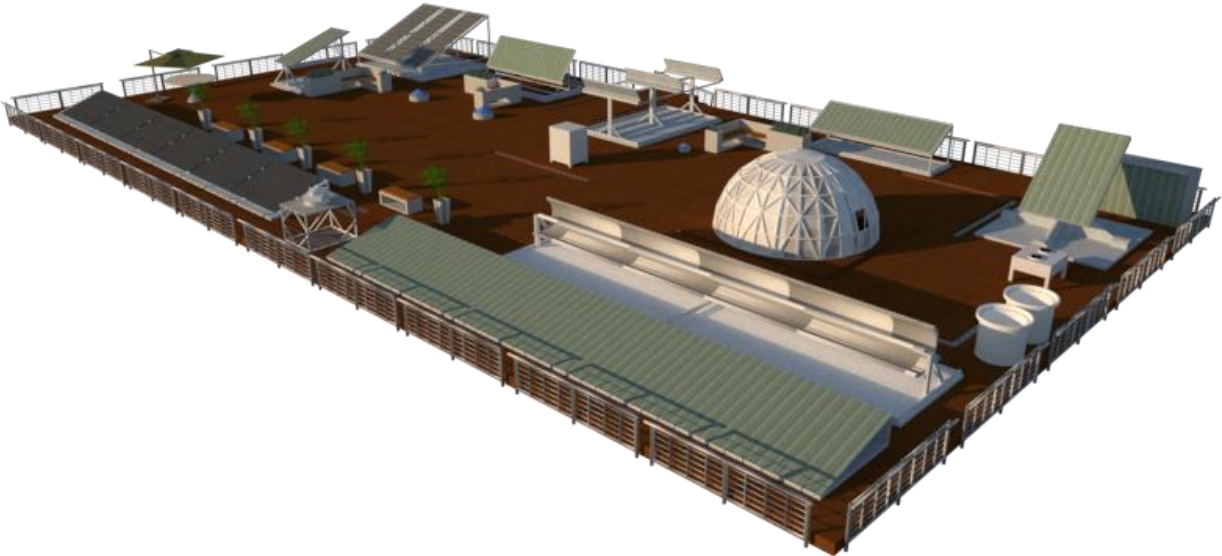


Figure 7: Set-up rendering for the main pieces of furniture

The first layout was designed in Sketch Up software (Fig.7) and contained the surrounding barrier, the dome, several benches arranged in line with alternating small pots, and some L-shape benches placed in the corners of the available area. The access into the dome is from the north, permitting the door to be left open in sunny days.

The access on the roof is from the north (opposed side in the picture). The next step in visualising the design is a rendered representation of the solution (Fig.8) to which completions are to be made after the vegetation areas, the watering system and reservoir will be designed.

5. CONCLUSION

This paper is partly presenting a complex project having as main objective the design of a relaxing space on top of a research laboratory of the Transylvania University of Brasov. The project consists in designing the furniture, the access paths, and the places where the researches should spent some time between the working hours. The objects were designed using solid modelling software and Sketch Up software for the set-up.

For the design process, a number of restrictions were considered. The most important one that became the main design objective; it is the environmental impact of the final solution, which is supposed to be minimised. Other constrictions are related to the ergonomics and aesthetic quality of the objects, and to the compositional quality of the set-up. For the quality of the set-up, the objects were carefully designed, starting with a rational choice of materials and a simple and effective processing of these. The combination of materials was an important issue to ensure the intended harmony in shape, texture and finishing. Natural materials were preferred, like wood and hemp, with focus on their durability and eventual recycling.

In this paper, the focus was on designing the objects necessary for the final roof set-up. A future development will complete the project, focusing on the “garden” design, which will include the other part of the project. This part will consist in choosing and combining the plants, i.e. some species that will cope with the climatic conditions, respect a limited height and require a minimum maintenance. Also, the watering system will be designed consisting of a water collecting reservoir and a distribution network. The present layout was designed based on estimations related to the above mentioned systems.

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