

**1. Design characteristics**

Cereus is a cactus blooming at night, whose beauty was an inspiration to create the modest architecture of presented project. The natural movements of the flower have been directly translated into architecture - the designed shelter opens and closes depending on the needs of the users. In summer, "The Cereus" might be a semi-open space for shelter and sky observation. When the temperature drops elastic walls can be folded to close the unit. Like a cactus, the shelter is also a reservoir of rainwater, that can be used during drought.

"The Cereus" is a result of a reductive approach to design, maximum simplification, awareness of the costs and the complexity of the materials. It follows the current issues such as climate crisis, a developing pandemic, crisis in the world markets: it is cheap, made from recycled materials, it preserves the land, harvests rainwater, enables grow, isolation, observation - it could be structured to establish a city or a private village.

The basic function of the unit is a shelter, but it can also be used as the kitchen, living room, reading room, bathroom or warehouse. Depending on the structure, the functionality of the unit will change, but "The Cereus" can also function independently, even without connection to the media.

The units can be organized in geometric or organic structures. Geometric structures are architectural layouts planned in advance, with a carefully planned function and distribution in the field. Geometrical organisation could be compared to the arrangements of the American cities with orthogonal grid. In contrary, orogenic systems and structures support the bottom-up activities, so the units will be added by the users and the layout is not top-down organized. The organic growth of the structure might be an interesting urban experiment. The experimental form made of semi-permanent shelters could determine the need and features of the village that could be later built on Fly Ranch for permanent use. The growing, organic system could be compared to the development of the European Cities in past centuries - accumulating and growing over decades in response to the basic needs of the users. Thanks to the system of modular decks and paths, small public squares or semi-private external rooms could be easily located between the units. The structure will take on a character that depends on the inhabitants, their culture and lifestyle. In this way, the shelter is designed with respect for different cultures and with sensitivity to the cultural heritage of different groups (through its flexibility). The unit is designed as semi-permanent .

The complicated situation in our opinion requires a modest, simplified approach, as well as it needs a political and cultural reflection. The project is not only an architectural proposal, but also a universal outlook manifesto. It is based on the architectural trends that gain popularity within the North American and European countries:

Circular economy and design for disassembly

Even 70% of materials needed to erect "The Cereus" could be recycled or reused. Except the high insulation aerogel panels gaining the used materials should not be a problem. The building is easy to assembly and disassembly and therefore all materials are easy to reuse. All joints are removable, so the materials keep their value during the whole Lifecyle.

Biomimicry

Both the shape of the plan and the geometric design of the shelter, including the foldable elastic walls, are the solutions borrowed from nature. Triangular walls made of recycled fabric can by opened by the user during the day for ventilation or lighting and during the night - to observe the night sky. The structure made of units (whether it will be an organic or geometric one) will thus change as a blooming meadow, where flowers open and close, creating a living and dynamic structure.

Modularity and multi-use plan

The plan of the shelter is based on a regular hexagon. The simple shape allows easy arrangement, modularity and repeatability of elements, as well as energy and material optimization that supports sustainable development.

Adaptation

The function of the unit is variable. Due to its universal nature it can be rearranged into various functions.

Land preservation

The shelter is embedded on recycled plastic portable foundations that do not require additional embedding in the ground. Due to the floor level elevation the terrain below is completely preserved, and the natural paths of animals migration are preserved. It is due to the care for the area related to ecology, but also due to the respect for the local communities. Additionally, the assembly of the units on a raised structure facilitates location on uneven terrain - the footings have an adjustable elevation degree.

**2. Technology used within the design**

The unit is based on simple, cheap, reused and easily available technologies and materials to minimize carbon dioxide emissions caused by transportation and material production. Structural walls, layered floor and platform system are made of used wooden/OSB board (depending on availability). Following technologies were used:

2.1 Heating and cooling

The heat inside is generated by supplying the unit with electricity from a solar farm or other renewable energy sources located on Fly Ranch. There is an energy saving heating mat located within the layered floor. Heating from the bottom and even distribution of the heat throughout the floor provides natural air circulation (warm air travels up) from the floor towards the roof, which can be opened accordingly to needs of ventilation. The temperature can be regulated via the temperature controller integrated in the floor, which is a standard and low-cost component of electric underfloor heating systems.

2.2 Electricity

The shelter used external energy supplied to the interior through the connection designed in the layered floor that accommodates all needed utilities. There should be 6 standard voltage sockets located inside to meet the needs of min. two people (e.g. mobile phones, PCs, camera batteries, flashlight batteries).

2.3 Water and waste management

Due to its function designed shelter does not require water connection. In order to adapt the unit for different functions water connection could be installed within the floor.

**3. System inputs and outputs**

|  |  |
| --- | --- |
| Floor area | 5 m2 usable area, 6m2 building area |
| Building internal cubic volume | 16,5 m3 open; 11m3 closed |
| Heating requirement | 4,336 BTU or 1,271 Watts |
| Water requirement | -  |
| Waste management | Wooden scraps will be used to make external decks and stairs, wall dimensions designed to match standard dimensions of insulation mats, heating mats to avoid scraps |
| Maintenance required | Seals and wood conservation/once per year, maintenance of foundations accordingly to manufacturer, regular cleaning of external surfaces |

**4. Materials and cost estimation**

|  |  |
| --- | --- |
| **List of primary materials**  | **Estimated cost** |
| **Element/component** | **Material** | **Dimensions** | **Per m2** | **In total for 1 unit** |
| Portable foundations min. 25cm/10’’ | Adjustable prefabricated steel brackets | - | Summary cost according to the manufacturer, no info without formal offer |
| Support top block manufactured from recycled plastic  | 30x30x10cm |
| Incremental base made of recycled plastic e.g. Jackpad | 40x40x5cm |
| Plastic geogrid Ecobase covered with indigenous gravel  | 50x50x5cm |
| Unit base ca. 23cm/9’’ | Hardwood plywood with additional thermal conductivity | 15,9mm/5/8’’ | ~ 30 $ | ~ 150 $ |
| Underfloor silver heating mat | 2mm | ~ 23$ | ~ 115 $ |
| Underfloor silver foil insulation | - | ~ 5$  | ~ 30 $ |
| Damping levelling sheet  | 40mm/2’’ | ~ 25 $  | ~ 150 $  |
| Exterior OSB/3  | 15,9mm/5/8’’ | ~ 24$ per board | ~ 48$ |
| Vapour barrier film | - | ~ 5$  | ~ 30$ |
| Ventilation void  | 15mm/1/2’’ | - | - |
| Thermal insulation | 125mm/5’’ / aerogel 20mm | ~ 21 $ for insulation panels ~ 58 $ for aerogel | ~ 105 $ for insulation panels~ 290 $ for aerogel  |
| Wooden structure | 38x140mm/ 2x6’’ |  |  |
| Windproof membrane | - | ~ 5$  | ~ 30 $ |
| Exterior OSB/3 | 15,9mm/5/8’’ | ~ 24 $ per board | ~ 48 $ |
| Fixed wall 8,2cm  | Waterproof hardwood plywood (15,9mm/5/8’’) | - | ~ 30$ | ~ 405$ |
| windproof membrane  | - | ~ 5$ | ~ 68$ |
| aerogel  | 10mm)  | ~ 58$ | ~ 783$ |
| wooden frame - construction |  |  | ~ 360$ |
| vapour barrier film | - | ~ 5$ | ~ 68$ |
| hardwood plywood  | 15,9mm/5/8’’ |  |  |
| Movable partition wall | Waterproof fabric  | - | ~ 5$ | ~ 75$ |
| Aerogel mat | 10mm)  | ~ 58$ | ~ 783$ |
| Recycled Fabric  | - | ~ 5$ | ~ 75$ |
|  |  | Overall total: |  | ~ 3508$ |

**5. Strategy for on-site prototype development**

The shelter can be erected by unqualified team of at least 4 people from previously prepared materials. Before the prototype is built, materials research and on-site study visits should be carried out. There is no need for a specialized large-scale equipment to erect the unit. Basic carpentry tools will be indispensable.

**7. Environmental impact summary**

Depending on material specification, that should be prepared before building the prototype of shelter, 30-50% of materials used to erect "The Cereus" could be recycled or second hand. Preferable materials are local to avoid carbon dioxide and harmful substances emissions. The unit is designed for disassembly, so all the materials remain valuable through its whole lifecycle (which is one of the most important postulates of the Circular Economy approach in architecture). "The Cereus" is designed to fully preserved the land due to the system of its portable used-plastic foundations. Under the floor of the unit is located elastic rainwater tank.