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# A CREATIVE IDEA OF AN UNDERGROUND TOWER CEMETERY

*Abstract: One of the biggest problems of nowadays society regarding burial sites is the lack of space and, at the same time, the huge areas that cemeteries occupy. This problem was approached during the course of "An introduction to technical creativity" and a possible solution was reached with the help of students, using brainstorming and the 3d criteria method. The proposed concept consists in building an underground cemetery, as a buried tower of minimum 20 floors down, which can accommodate hundreds of coffins. The building will appear, at the ground-floor level, like a funeral monument, but in depth, the access to the burial chambers will be made with an elevator placed at the middle of the structure. Therefore, in a world where cemeteries occupy huge areas, this concept provides an alternative to traditional customs and approaches a topic that concerns all humanity.*

*Key words: cemetery, underground tower, creativity, brainstorming, 3d criteria method.*

## 1. INTRODUCTION

Creativity is the main side of human nature that separated people from animals. The growth and development of our society was ensured by the ability of man throughout prehistory and history to solve problems, to produce tools, shelters, weapons and others. During the facultative course of "An Introduction to Technical Creativity", which aims at stimulating creativity in the first year of bachelor at the Faculty of Civil Engineering and Building Services of Iasi, the teachers applied different methods and techniques to challenge students to think outside the box. This lecture provided the students the theoretical information mixed with various practical exercises meant to stimulate their imagination and creativity. Even though creativity is the capability of people to produce new solutions for solving problems, creative ideas do not always appear by chance. There are three types of creative ideas:

- Spontaneous ideas, that come from inspiration, imagination, from the subconscious mind, without previous analysis
- Stimulated or semi-spontaneous ideas, coming from inspiration after a certain period of "incubation" as an answer to a problem that was previously expressed
- Logically determined ideas, which come from certain methods and techniques that, when correctly applied, almost always help in finding a new solution [1, 2, 3, 5, 6].

The morphological matrix of ideas is a logical determined method that was used to come up with the concept of underground tower cemetery.

This method was taught during the lecture "An Introduction to Technical Creativity" and some of the results from applying it with the students during the classes are presented hereinafter.

## 2. THE MORPHOLOGICAL MATRIX OF IDEAS

"The morphological matrix of ideas" is based on ideas diagrams, which are tree-type graphical representation that contain structured information regarding the current state of a certain topic, [1, 2, 4, 7].

The steps that ought to (should) be applied for this method are the following:

Step 1. Choose three different assembles using: selection criteria A, B and C.

Step 2. Draw the morphological matrix of ideas.

Step 3. Delete the known and divergent-incompatible solutions.

Step 4. Introduce new selection criteria to rank the new solutions.

Step 5. Choose the optimum solution based on the new selection criteria.

Step 6. Develop and apply the chosen solution.

During the classes of "An Introduction to Technical Creativity", for the application of "the morphological matrix of ideas", the topic *"Multi-story buildings"* was chosen. The presented steps were followed.

### 2.1. Step 1. Choose three different assembles

The selection criteria that were chosen by the teacher and students are inserted in Table 1, together with their ideas diagrams.

*Table 1*

**The three chosen selection criteria for *Multi-story buildings***

| Selection criterion code | Selection criterion name and ideas diagram |
|---|---|
| A. | Number of stories |
| *A1.* | *One story* |
| *A2.* | *10 stories* |
| *A3.* | *Up to 100 stories* |
| *A4.* | *-50 stories* |
| *A5.* | *1000 stories* |
| *A6.* | *Ground floor (0 stories)* |
| B. | Construction material |
| *B1.* | *Stone* |
| *B2.* | *Wood* |
| *B3.* | *Steel* |
| *B4.* | *Reinforced concrete* |
| *B5.* | *Masonry* |
| *B6.* | *Composite materials* |
| *B7.* | *Clay* |
| C. | Purpose of the building |

| C1. | Office spaces |
|-----|----------------|
| C2. | Hospital |
| C3. | Dwellings |
| C4. | Laboratories spaces |
| C5. | Hotel |
| C6. | Commercial spaces |
| C7. | School |
| C8. | Cemetery |

Considering that for selection criterion A, the number of stories that can be chosen is theoretically infinite, only certain key number of levels were selected for the ideas diagram.

## 2.2. Step 2. Draw the morphological matrix of ideas

For a better understanding of the 3D matrix, the information synthesis is graphically represented on three sides of a parallelepiped, drawn in Cartesian coordinates, [2, 4, 6, 7].

The resulted morphological matrix of ideas is a 6 by 7 by 8 rows parallelepiped, as shown in Figure 1, having on the three orthogonal planes the diagrams of idea previously developed. Thus, the parallelepiped presents on:
- XOY plane: symbols for the first diagram of ideas, A;
- XOZ place: symbols for the second diagram of ideas, C;
- YOZ plane: symbols for the third diagram of ideas, B.

Each small cube that is part of the morphological matrix of ideas provides a combination of data, gathering on its sides ideas from the three selection criteria. Thus, the morphological matrix of ideas provides solutions written in the following manner:
- A1B1C1, A1B1C2 … A1B1C8;
- A1B2C1, A1B2C2 … A1B2C8;
- …;
- A6B6C1, A6B6C2 … A6B6C8;
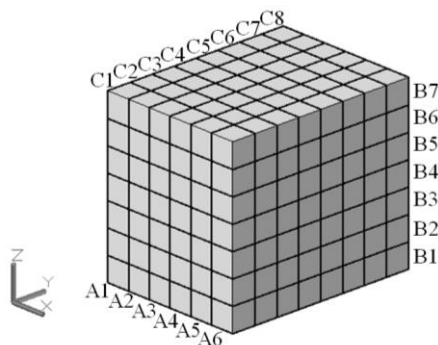- A6B7C1, A6B7C2 … A6B7C8.



**Fig. 1** The morphological matrix of ideas

These solutions must be analyzed in the following step of "the morphological matrix of ideas" method, in order to find the new possible solutions that can be further developed.

## 2.3. Step 3. Delete the known and divergent-incompatible solutions

According to the morphological matrix of ideas, there are 6 x 7 x 8 = 336 possible solutions for multi-story buildings.

This step involves analyzing each small cube from the morphological matrix of ideas, and deciding what type of solution it offers. Figure 2 shows a picture of the board with the analysis of all these possible solutions, done by the teachers and students, underlining the known ideas, new ideas and divergent-incompatible ideas.



**Fig. 2** Blackboard with the analysis on the possible solutions done during the class

## 2.4. Step 4. Introduce new selection criteria to rank the new solutions

After selecting the new solutions, there were a number of 10 ideas that were considered viable and also reasonable for multi-story buildings, namely:
a) A2B2C2: 10 stories wood hospital;
b) A3B2C1: 100 stories wood office building;
c) A3B2C2: 100 stories wood hospital;
d) A3B2C5: 100 stories wood hotel;
e) A3B4C7: 100 stories concrete school;
f) A3B3C7: 100 stories steel school;
g) A3B4C8: 100 stories concrete cemetery;
h) A4B4C1: -50 stories concrete office building;
i) A4B4C3: -50 stories concrete dwelling;
j) A4B4C8: -50 stories concrete cemetery.

In order to select only one or two solutions for further development and application, new criteria for ranking these solutions were added:

1) How common is the purpose of the building?

To fit this criterion, the buildings with the uses of office space, hotel and dwelling were eliminated, thus solutions b), d), h) and i) were considered unfit.

2) How cost-efficient is the building?

This criterion considers the use and cost of the building, utilized materials versus the potential profit that the building can produce for the owners. Applying this criterion, from the students and teachers points of view, solutions a), c) and g) can be excluded.

Due to the fact that only 3 new solutions were left, there were introduced no further additional selection criteria.

## 2.5. Step 5. Choose the optimum solution based on the new selection criteria

After applying the two additional criteria, only three solutions were left to develop, namely e), f) and j).

It was observed that solutions e) and f) both refer to the purpose of school, for a 100 stories building, made of

concrete or steel, therefore they were considered the same solution, both aiming to the same idea: a school that will need up to 100 levels. Solution j) referred to an underground tower cemetery made of concrete and another team of students was appointed to continue developing this idea.

### 2.6. Step 6. Develop and apply the chosen solution

Both solutions were considered viable for further analysis therefore the student groups, guided by the teachers, analysed and developed them. The results on the underground tower cemetery are presented hereinafter.

## 3. THE UNDERGROUND TOWER CEMETERY CONCEPT

Death is and has always been one of the most important human existential moments, so since the beginning of man, people wanted to somehow mark the passage to the other world.

Studying the history of cemeteries and burial customs, it can be observed that the first burial sites that were found exist since the Paleolithic era and were in the form of "grave fields" [8]. From about the 7th century, the burial was under the control of the Church and could only take place on consecrated church ground. Burial practices varied, but in continental Europe, the dead bodies were usually buried in a mass grave and after a few years, taken the decomposition time, they were exhumed and stored in ossuaries or buried under the walls, floor slabs or behind the walls of the church [8]. Starting with the 19th century, the burial of the dead in the village or city graveyards began to be discontinued, due to rapid population growth that came with the Industrial Revolution. New places of burial were found, outside the populated areas, in order to save space and protect the people from diseases and pollution of the underground water, these being the main problems that came with having the cemeteries in the cities.

There are a number of different styles of cemetery in use [8]:

- Urban – is a burial ground located in the interior of a village, town, or city;
- Monumental – is a traditional style of cemetery, where headstones or other monuments made of marble, granite or similar materials rise vertically above the ground;
- Rural – is a style of burial ground that uses landscaping in a park-like setting;
- Natural – also called eco-cemetery or green cemetery is a new style of cemetery as an area set aside for natural burials, with or without coffins.

In the present paper, the proposed concept comes as an improvement to the already existing custom, the burial of the inanimate bodies. One of the biggest problems of today's society regarding this subject is the lack of space and, at the same time, the huge areas that the cemeteries occupy.

The best way to solve this issue is deep exposure by building a 20-floors cylindrical overlaid cemetery, with the aim of protecting the environment and respecting funerary traditions, at the same time. Above ground, the building will look like a simple funeral monument, but in depth, where access will be made with an elevator placed at the middle of the structure, the stories constituting a layered cemetery, Fig. 3. For a burial building, it is recommended to use materials that allow the isolation and protection of the environment and of the buried bodies, because their decomposition has always been a real biological hazard (pollution of soil or of water sources). Hence, the principle of grave vaults is applied.

The cylindrical structure is made of reinforced concrete, with a rigid core as an elevator shaft, and radial solid walls which, besides creating the burial chambers, also have a stiffness, strength and stability purpose, to support the pressure coming from the surrounding soil, Fig. 4.



**Fig. 3** The underground tower cemetery above ground computer-generated view
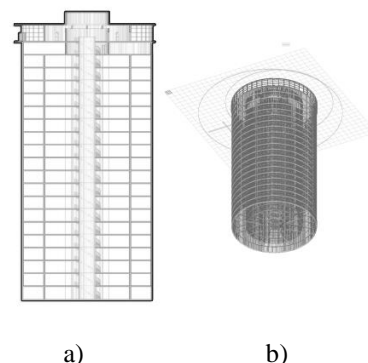


a)        b)
**Fig. 4** The underground tower cemetery:
a) cross-section, b) three-dimensional layout

The coffins will be introduced in the burial chambers using the elevator, which has opening doors towards all structural slices. This implies manual labor, which is cheaper and easier than mechanized insertion of the coffins.

Therefore, in a world where cemeteries occupy huge areas, this concept provides an alternative to traditional custom or at least opens a topic that concerns all humanity.

### 4. CONCLUSION

New ideas can be obtained by combining information in the diagrams of ideas. These diagrams represent a plane information analysis, from several independent points of view that provide us with oversight to discover

new solutions for technologies, products, materials, concepts and so on.

According to the theory of combinations, results obtained from ideas combinations can be known solutions, new solutions or divergent-incompatible solutions. "The morphological matrix of ideas" method searches for new solutions, on a certain topic of interest.

Applying this logical-determined method is a sure way to find new ideas, as it has been demonstrated by the practical application done during the classes of "An Introduction to Technical Creativity". The concepts reached by using this method are new, innovative and present a starting point for developing inventions.

As a general conclusion of the presented experience, it can be stated that, even though spontaneous ideas and stimulated ideas are desired and considered a luck, new solutions provided by logical determined methods, like "the morphological matrix of ideas", always reach new potential inventions.

## ACKNOWLEDGEMENT

## REFERENCES

[1] Belousov, V. *Creatia tehnica*, Ed. Junimea, Iasi, 1986.
[2] Belousov, V., Plahteanu B., *Fundamentele creatiei tehnice,* Ed. Performantica, ISBN 978-603-685-218-0, 2014.
[3] Gardner, H. *Les formes de la creativite*, Ed. Odile Jacob, ISBN-13: 978-2738106353, Paris, 2011.
[4] Seghedin, N., *Aplicatii in creatia* tehnica, Ed. Performantica, ISBN 978-973-730-454-4, 2008.
[5] Stanila, Al. *Constructii si inventica*, Ed. CERMI Iasi, 1998.
[6] Stanila, Al. *Initiere in creatia tehnica*, Ed. CERMI, ISBN 978-973-667-430-3 Iasi, 2012.
[7] Stanila, A., Stanila, O., Buduleci, A.I., *Multi-purpose compact – expandable – easily transportable buildings*, C60 International Conference „Tradition and Innovation – 60 Years of Constructions in Transilvania", Cluj-Napoca, 7-9 noiembrie 2013, pag. 161-162.
[8] *https://en.wikipedia.org/wiki/Cemetery*

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