Change of Temperature in the Room with the Living Wall

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Abstract. With the advent of the modern industrial city, more than half of the world’s population, planners, designers and urban advocates are once again turning to plants. Green infrastructure is a key strategy to provide cleaner air and water, while improving living environments, human health and mental well being. This paper is a part of doctoral study focusing on interior green walls and their qualities in terms of air temperature, humidity and level of CO2. The paper describes living wall built in vestibule in laboratory of Technical University of Kosice, its construction, irrigation and vegetation. The paper deals with effect of green wall on only one parameter – air temperature in the room.

1. Introduction
The mix of the living, natural frameworks portrayed by green dividers with the inorganic and inert structures that have come to rule cutting edge building design, holds the guarantee of "living" construction modeling. Living structural engineering is multi-disciplinary, blending the abilities of designers, scene draftsmen, specialists and horticulturalists.

Individuals need greenery, it influences them to feel more casual furthermore, tranquil, and this paves the way to remaining longer close to the green wall. They provide fascinating unsupported basic components. Not exclusively can green dividers be executed in officially standing structures, yet they can go about as self-supporting structures, impersonating a divider with no extra materials required [1].

Living dividers can be likewise utilized as commotion boundaries, as the substrate where plants develop has a sound-retaining impact and gives acoustic benefits got from commotion disconnection.

On a terrific scale, vegetation enhances the general state of nature. Plants catch the tainting particles on their leaves, directing the temperatures and fighting air contamination. Green dividers can go about as air cleaning frameworks lessening poisons noticeable all around and, in this way enhancing the general strength of individuals [2,3].

The benefit of living green dividers is a surefire approach to upgrade a building's visuals, enhance air quality and also representative sharpness and vitality levels. Over the past 50 years, a remarkable increment of urban-living searchers has prompted an extensive uptick in air contamination and loss of green spaces. Living green dividers (additionally usually alluded to as vertical gardens or living dividers) are a superb answer for any property keen on enhancing their space with characteristic advantages of nature. They offer a moving and tastefully captivating characteristic lift to worker resolve. Regardless of whether they are introduced on the outside or inside of a building, the structures of absolutely real vegetation make the significant number of inside architects look for while championing manageability. Living green dividers put forth an amazing expression by making
appealing and welcoming conditions. They are as similarly great in appearance as they are purveyors of good wellbeing; the plants in the dividers fill in as a characteristic air-filtration framework that building inhabitants can appreciate. Representatives are welcomed by a green lavish condition while relishing the mitigating impacts of being around a wealth of foliage.

Afore mentioned qualities of green walls can be sorted in three categories. The effect of green wall on aesthetic, construction and ecology. The paper describes green wall in term of its effect on ecology – temperature in the vestibule, where the wall is situated. Only this factor is an object of research in this paper in detail, an ongoing doctoral study focuses on more, before mentioned factors.

2. Living wall
Living green dividers put an amazing expression by making appealing and welcoming conditions. They are as similarly great in appearance as they are purveyors of good wellbeing; the plants in the dividers fill in many positive qualities that building inhabitants can appreciate.

The experimental model exists in the laboratory at Technical University of Kosice, Slovakia. People entering the vestibule of laboratory in Kosice are welcomed by a green lavish condition while relishing the mitigating impacts of being around a wealth of foliage (Fig. 1, Fig. 2).

Figure 1. Floor plan of the living wall in the vestibule of laboratory in Kosice (on the left)
2.1. Living wall construction

The construction of this living wall is made of plastic segments. There are two types of these plastic units (Fig. 3). The direct, size 600x200 mm, height 180 mm, 3 plants can be planted in it. The corner segment, size 200x200 mm height 180 mm, 1 plant can be planted in it. Total size of the wall is 1600x2850 mm.
2.2. Layers of living wall
At the bottom of each plastic segment is a filtration layer, securing that the holes for irrigation do not clog. Soil, where the plants are planted is covered with ceramsite granules. The irrigation is secured automatically from the room next to the vestibule. The wall used to be irrigated on Monday, Wednesday and Friday at 6 a.m. for 2 minutes. After observations, the time schedule of irrigation was changed to Monday, Wednesday, Friday and Sunday at 6 a.m. for 3 minutes.

2.3. Vegetation
6 types of plants are used for the green wall: Dryopteris [4] (24 pieces), Chlorophytum [5] (12 pieces), Aglaonema [6] (23 pieces), Scindapsus [7] (24 pieces), Philodendron [8] (21 pieces), Anthurium [9] (16 pieces), totally 120 plants.

3. Experimental study
For the measurement of this research, the sensors were used. The list of sensors is in Tab. 1 and the location of each sensor is pictured in Fig. 3.

   As it can be seen in Fig. 4, 3 sensors were placed on the living wall, between the vegetation; TI1 in the upper part of the wall, TI2 in the middle part of the wall and TI6 in the bottom part of the living wall.

   After one measurement from October 2017 focusing on a temperature differences between these sensors located in different parts of the wall, the change of temperature in 101st minutes is pictured in Fig. 5.
### Table 1. List of sensors used for the measurement.

| TEO   | Temperature | Exterior | Outside |
|-------|-------------|----------|---------|
| RHO   | Relative    | Humidity | Outside |
| DTO   | Dewpoint    | Temperature | Outside |
| PO    | Pressure    | Outside  |         |
| TI1   | Temperature | Inside   | 1       |
| TI2   | Temperature | Inside   | 2       |
| TI3   | Temperature | Inside   | 3       |
| TI4   | Temperature | Inside   | 4       |
| TI5   | Temperature | Inside   | 5       |
| TI6   | Temperature | Inside   | 6       |
| SMH   | Soil        | Moisture | HPA     |

#### Figure 5. Temperature differences between sensors TI1, TI2 and TI6, October 2017

### 4. Conclusions

The main goal of this paper is to present partial measurement of ongoing doctoral research focusing on living wall and its effect on temperature. Following data from October 2017, the change in temperature observed on living wall in three different locations is noticeable. The idea of the research is to focus on differences of different temperatures – air temperature in the room, air temperature closer to the living wall (specified in PhD work), surface temperature on the leaf of vegetation, surface temperature on the ceramsite, surface temperature on the wall, air temperature closer to the wall (specified in PhD work) etc.
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