Anidolic Day-Light Concentrator of Innovative Structural Building Envelopes

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MOTIVATION

In a building, all the openings placed on its envelope (i.e., façades and/or roofs) usually have non-structural and non-insulation properties. In fact, the energy saved in a building is usually lost through these openings. Therefore, it is necessary to develop a structural element capable of being used in the building envelope and leads to light permeability from the outside to the interior of the building.

MAIN OBJECTIVES

Basic research is conducted on a single panel element designed considering four simultaneous requirements which are usually set apart:

- **A. Permeability of light through the building**
- **B. Avoiding losses and gains of energy inside the building**
- **C. Structural stiffness and strength**
- **D. Conforming the building envelope to construction practice**

THE PROBLEM / PROJECT BACKGROUND

A. **Permeability** of light is usually in conflict with the structural requirements, unless the elements are permeable to the light without significant losses.

B. **Losses or gains** of energy are through the openings of the building envelope.

C. **Structural stiffness and strength** are reached through proper design of the panel, e.g., thickness and use of reinforced concrete with fibers, e.g., carbon or glass.

D. **Conforming the building envelope** to practice, from a pragmatic standpoint, means that:

- Cost should be as low as possible.
- No other elements are needed for finishing the envelope.
- The envelope should collaborate as a part of the structural system.
- The construction procedure should be simple and scalable.
- Movable and mechanized parts are avoided.

DISCUSSION

The solution presented herein does not obviate the need of channeling the energy, e.g., light, heat, and noise, crossing the envelope. It simply reaches the twofold goal:

- **Permeability of light**
- **Structural stiffness and strength**

From the test results (TEST 1 and TEST 2)

- The panel with WC's offers a constant amount of light during the day, with less variation than the one without WCs. Based on test findings, the horizontal positioning of the panel with WCs is not the most efficient configuration for using the WCs.

- When the panel is inclined close to the sunlight incident angle of the test location, i.e., 30° in TEST 2, use of WCs was very beneficial for light capturing.

From the test results (TEST 3)

- For the tested TC panels, it is important to optimize the orientation of the panel if one seeks to maximize the light transmission from such panels.

- The optical fibers conduct the sunlight and the indirect light from outside to the interior of the building but the highest efficiency is achieved when the sunlight is impinging the optical fiber cross-section using WCs.