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THE IMPACT OF MICRO-CLIMATE ON ARCHITECTURAL DESIGN

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ABSTRACT

Natural systems like weather are now seen as a problem to be conquered and controlled with artificial technologies. Humans create built environment and modify this environment in the search for comfort and control over their own destiny. Built environment epitomizes human made total control of the environment, to the point where it even incorporates new technologies to create an appropriate internal climate independent of that outside.

Traditional principles of integrating environmental influences into buildings are no longer used in contemporary architecture. Furthermore, appropriate features of environmental comfort do not exist to be reinforced by the intended building design. Thus, features can sometimes be created by using latent features. These may include the creation of elements of the building itself to integrate with the site; wing walls, verandahs and so on.

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This paper suggests that the long known principles of microclimate and their application to building design can be incorporated with new technologies in building design in order to achieve more occupant comfort with minimum energy expenditure.

Keywords

Microclimate, Occupant Comfort, Deconstruction Style, Technology.

1 INTRODUCTION:

Arising from both the evolution of building design to style principles, and the development of new technology to achieve comfort in buildings, weather has become to be seen as a problem to be solved by technologies.

The emphasis on microclimate recognizes that not only do the actions of sunshine, wind and humidity affect comfort; but the modification also of these by the landform, vegetation, built form, external envelope and internal features result in creating comfort conditions. Prelgauskas [5]

This paper describes the creation of local weather conditions as a result of harnessing the orientation of built form, the heat imbalance sun side to shade side around built form, and the airflow pressure imbalances on the building envelope from both wind and thermal interactions each create opportunities to create comfort. Prelgauskas [5]

2 DILEMMA OF STUDY:

Architects have always pursued contradictory aims and it is this exactly tension that creates the final enjoyable, it would be too trivial to follow simply and logically just one goal, for example the clarity of construction, as did the structural school of architecture. On the contrary, many famous architects have wanted to show their skill by hinting that all the rules are there to be broken. Although, their innovative solutions and shapes cannot ignore the vital climatic factors, which must be guaranteed first.

The skin of a building is the connection between the natural environment and the built environment. Climate adaptive building skins use materials and design elements to improve interior comfort, provide visual and thermal access to the natural environment, and reduce energy use. Prelgauskas [6]

3 RESEARCH OBJECTIVE:

Energy resource efficiency in new constructions can be affected by adopting an integrated approach to building design specifically its shape.

From this point of view, this paper will introduce a new approach to a controversial style of architecture which get let attention in the last years. It is the **Deconstruction Style**. Showing how Deconstructivist Buildings, with there visually illogical forms, may enhance the microclimate in a way improving their unique abstract forms giving them a functional dimension.

4 NATURALLY OCCURING MICRO-CLIMATE:

The micro climate is the variations in localized climate around a building; it has a very essential impact on both the energy and environmental performance of a building. Cullen [2]. Buildings designed to use micro-climate are achieving substantially lower energy consumption to achieve the same comfort as conventional buildings. Prelgauskas [5]

Existing features contribute to modify the climate from the general area weather. Existing design forms and structures can create shade and moisture variations.

5 USING MICRO-CLIMATE FORCES FOR COMFORT:

Micro-Climate design begins with the attitude that weather is not a problem to be conquered by mechanical technology; rather that it is a force to be incorporated in building design to achieve comfort. Prelgauskas [5]

The first considerations in planning are:

- **Surrounding landscape:** which existing features on the land affect the micro-climate, and determine where the building is to be situated on the land for comfort,
- **Orientation of building:** which way the building, its wall faces and openings are to be oriented to maximize comfort,
- **Location of neighboring objects:** and the heat, cooling and air flows which are created by the above for comfort,
- **The shape of the building:** and how it sits on the site and the locations of rooms with in the building. Cullen [2]

Despite superficial appearances, there is no basic conflict between these approaches. Rather, each is applied in the most appropriate method to suit each individual project. The first three considerations are out of our concern; the current study is devoted for the last one.

Building design has to respond to the existing site features, their micro-climate modification as dictated for each individual solution. As a result, every design problem is unique, has to be thought through from first principles. Not only do individual solutions vary from each other; but also each elevation of a building, by responding to its climate situation, is quite different. Prelgauskas [5]

6 WHY SHAPE IS IMPORTANT IN LOW ENERGY BUILDING DESIGN?

Humans create built form and modify the environment in the search for comfort and control over their own destiny. The built form or the shape can have a strong influence on energy consumption performances: Cullen [2]

- Solar gain
- Savings on energy consumption
- Integration of technology
- Pressure Distribution
- Wind patterns

For instance, it can determine the amount of solar radiation falling onto the external surface area; this in return can increase savings on energy.

In vernacular architecture, builders were aware of this issue so that their built forms are sensitively responding to the systems of microclimate. With the evolution of technology, traditional principles of integrating environmental influences into buildings have fallen into disuse. Thus, the close connection between energy use in buildings and environmental damage arises.

In recent years there are number of architectural styles; every one has some different features of its related building forms which significantly affect the microclimate.

The following part of research navigates through modern architectural history extracting four main styles and concentrates on the deconstruction style as a promising style in dealing with the microclimate issue.

7 KEY STYLES OF ARCHITECTURE:

Through ages, architecture has responded to different cultural, political, economical transforms all over the world, thus results in many different styles spread worldwide. Even though we can determine four main styles:

7.1 Classical Style:

The buildings in the classical age of architecture were more artistic and hence were very decorative, adorned with well-worked column heads and decorative wall motifs. This style had fixed form and proportion and hence did not address individual needs.

7.2 Modern Architecture:

Modern architecture is free of the fixed forms and decorative elements that characterise classical architecture. Buildings were designed to address the individual needs and did not have the character of the region or aspects of religion taking precedence.

7.3 Post Modernist Style:

Just as the other styles, the modernist style was further enhanced and named the post modernist style. The harmony and simplicity of modern style is amalgamated with more decoration and detailing.

7.4 Deconstruction Style:

When post-modernism has become increasingly commercialised, a new style called deconstruction has made its way. This movement breaks all the classical rules of composition, the balance, hierarchy and rigid geometry.

Free flowing organic forms and modern lines are the ways of deconstructivism. The Hindu [8]

8 DECONSTRUCTION IN ARCHITECTURE:

Deconstruction in architecture, also called **Deconstructivism**, is a development of Postmodern architecture that began in the late 1980s. It is characterized by ideas of fragmentation, non-linear processes of design, an interest in manipulating ideas of a structure's surface or skin, which serve to distort and dislocate some of the elements of architecture, such as structure and envelope. The finished visual appearance of buildings that exhibit the many deconstructivist "styles" is characterized by a stimulating unpredictability and a controlled chaos. Wikipedia, D. [9]

The approach of deconstruction in architecture is to get architects to think of things in a new way, to view architecture in bits and pieces. Also to develop buildings which show how differently from traditional architectural conventions buildings can be built without losing their utility and still complying with the fundamental laws of physics. Wikipedia, D. [9]

Deconstructivist Buildings may seem to have no visual logic: They may appear to be made up of unrelated, disharmonious abstract forms.

9 DECONSTRUCTION IN PRACTICE:

In this part a set of projects of contemporary architects will be shown as example of deconstructivism style in order to show how this style can help for achieving substantially lower energy consumption using the mass with its parts, self-shading, solids and voids to create a special microclimate achieving the same comfort as conventional buildings.

9.1 Weisman Art Museum

Architect: Frank Gehry.

Location: Minneapolis, Minnesota.

Date: 1993.

The irregularly placed windows offer snapshot views from the inside of the river and the city, Fig.1. The main entrance is on the north side with two large windows

piercing that wall. A so-called "sun scoop" shades these windows while a dramatic canopy is over the entrance, Fig.2. Mary [3]

9.2 UFA Cinema Center, Coop Himmelblau

Client: UFA Theater AG, Düsseldorf. Carter, B. [1]

Design Architect: Tom Wiscombe.

Schedule: (1993 - 1998)

This multi-screen complex is made up of two units: Fig.3

1. **The cinema block** - opens onto the street to create a large pedestrian area.
2. **The crystal** - like a glass shell rising several storeys up. This deconstructivist corner structure has become the symbol of the building. It serves not only as a foyer and centre for people going to the cinemas, but also as a public plaza where multimedia events may be held. Shira [7]
3. The "Skybar", a double floating cone, is a café and restaurant accessible from the foyer. Circulation through the building is very well structured, permitting visitors to cross it in any direction: at the top, at the bottom, inside the crystal and along the opaque outer façade, Fig.4. Thus the structure becomes an element of active participation in the urban fabric, not just an aesthetic object. Shira [7]

9.3 Walt Disney Concert Hall

Client: Walt Disney Concert Hall Committee.

Schedule: (1999- 2003)

The Walt Disney Concert Hall at 111 South Grand Avenue in Downtown Los Angeles, California is the fourth hall of the Los Angeles Music Center, Fig. 5.

The organ's facade designed by architect Frank Gehry and organ builder Manuel Rosales sparked a great deal of controversy, as it includes a large number of curved wooden pipes set at various angles, Fig.6. Wikipedia,W. [11]

9.4 The Ray And Maria Stata Center

Architect: Frank Gehry, Gehry Partners, LLP.

The building opened on March 16, 2004.

The Stata Center for Computer, Information and Intelligence Sciences is built on the site of MIT's legendary Building 20, a "temporary" timber-framed building constructed during World War II that served as a breeding ground for many of the great ideas that were born at MIT, Fig.7. Designed by renowned architect Frank O. Gehry, Stata

is meant to carry on Building 20's innovative and serendipitous spirit, and to foster interaction and collaboration across many disciplines.

Its striking design - featuring tilting towers, many-angled walls and whimsical shapes - challenges much of the conventional wisdom of laboratory and campus building. MIT [4]. The use of glass for walls on the inside means that those who work in the building have to give up a sense of privacy, Fig.8. Wikipedia, S. [10]

Weisman Art Museum



Fig.1. Weisman Art Museum, Frank Gehry



Fig. 2. The building itself is an extraordinary combination of interconnecting shapes.

UFA Cinema Center, Coop Himmelblau



Fig. 3. UFA Cinema Center, Dresden, Germany



Fig.4. This deconstructivist corner structure has become the symbol of the building.

Walt Disney Concert Hall



Fig.5. Profile view from Grand Avenue



Fig.6. The organ's facade designed by architect Frank Gehry

The Ray And Maria Stata Center



Fig.7. The Ray and Maria Stata Center

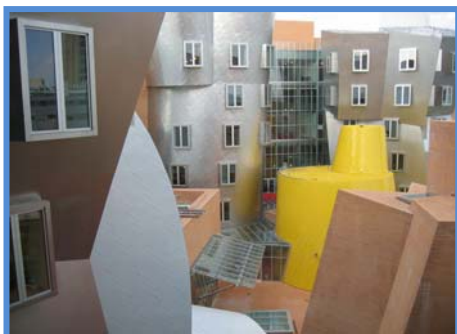
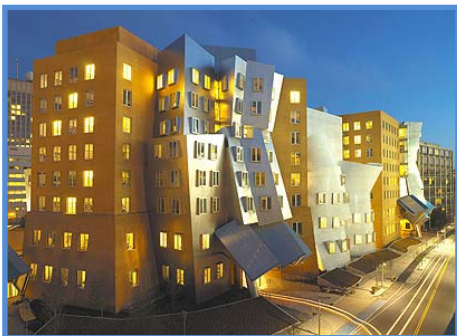


Fig.8. View from a patio & a window

10 CONCLUSION:

In recent years, designing according to deconstruction ideologies is to some extent-limited. The main principle of **Deconstruction** states that it is all right if the architect lets the eventual contradictions in the builder's goals shine through the finished design. Thus, designing deconstructivism becomes an art which can be fully appreciated only by other artists and educated critics.

The deconstruction buildings are uniquely products of the period's technology, computer simulations of the building's structure made it feasible to build shapes that architects of earlier eras would have found nearly impossible to construct. But, the technological aspects of the architectural forms must not ignore the effective utilization of environmental factors.

Using microclimate standards, Deconstruction designs could enhance the tenants comfort. Deconstructivists have to create their shapes with climatic considerations in mind thus, it may consider as adding value to their thoughts.

REFERENCES:

- [1] Carter, B. A Weighty and Mighty Tome, the Phaidon Atlas of Contemporary Architecture, by the editors of Phaidon Press, (2004).
<http://www.thecityreview.com/phaid.html>
- [2] Cullen, J.P., Low Energy Building Design, Homes for the Future, the University of STRATCHLYDE, (2003).
http://www.esru.strath.ac.uk/EnvEng/Web_sites/00-1/lebd_group_2/index.html
- [3] Mary, A.S. Frederick R., Weisman Museum, University of Minneso, Frank Gehry, (2005).
<http://www.bluffton.edu/~sullivanm/minnesota/minneapolis/gehry/museum.html>
- [4] MIT, Massachusetts Institute of Technology, Department of Facilities, (2005).
<http://web.mit.edu/facilities/construction/completed/stata.html>
- [5] Prelgauskas, E., Micro-Climature In Building Design, Urban Ecology Australia, EcoCity 2 Conference - Proceedings 26 August, (2003).
www.urbanecology.org.au/ecocity2/microclimate.html
- [6] Prelgauskas, E., Climate Responsive Building Design In The South Australian Context, (2006).
http://www.emilis.sa.on.net/e10_fram.htm

- [7] Shira Brand, Floor Nature ,Coop Himmelblaw, UFA Film Centre, Dresden, Germany, December, (2002).
<http://www.floornature.com/articoli/articolo.php?id=101&sez=3&lang=en>
- [8] The Hindu, Online edition of India's National Newspaper, Jan 08, (2005).
<http://www.hindu.com/thehindu/mag/index.htm>
- [9] Wikipedia, D., Deconstructivism, the free encyclopedia, (2007).
http://en.wikipedia.org/wiki/Deconstructivism#History.2C_context_.26_influences
- [10] Wikipedia, S., Stata Center, the free encyclopedia, (2007).
http://en.wikipedia.org/wiki/Stata_Center
- [11] Wikipedia, W., Walt Disney Concert Hall, the free encyclopedia, (2007).
http://en.wikipedia.org/wiki/Walt_Disney_Concert_Hall