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Reframing Different Layers of Morphological Dimension - A Context of Urban Spaces w.r.t Net Zero Energy to Achieve Zero Carbon Emissions

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Abstract: ***The contemporary city presents itself as an urban organism of great complexity, consisting of an increasingly number of elements, systems, dynamics and extracts, which makes their reading an equally complex task. the method of morphological analysis, it is assumed in this context, as an important reading tool of the city, giving order to what is naturally disordered through a classification process of the different elements that structure it –streets,squares, urban blocks,building , plots among others .Specifically, the paper discusses the morphological component of urban design, concentrating on the forms along with configurations of urban centers, as well as current preferences for urban blocks and interconnecting street patterns. Overall, it is concerned with the network of public spaces as well as actual public realm, which is the physical setting or stage for public activity. An important factor in this is one of the key tensions at the core of modern urban design: complexity, conflicts, andsynergies between the requirement for space and movement necessary for economic and social interaction and everyday living. Urban design goals, according to Jan Gehl, should be prioritized in the following order: first it islife, second it isspace, and third it isbuilding.***

Keywords: Urban morphology,public space network,regular and deformed gridpod development shared spaces

I. INTRODUCTION

The paper focuses on the morphological component of urban design, which includes the arrangement of urban spaceandform, as well as infrastructure'sspatial pattern, which supports it. Fundamentally there are two sorts of urban space systems: one in which buildingdefine space along with another in which buildings are objects in space. As a general rule, the former comprises of buildings that serve as constituent urban blocks'elements, with those blocks defining as well as enclosing exterior urban space—a term that we refer to as "traditional urban space". We call this type as modernist urban space because it generally comprises of freestanding structures in landscape settings.

II. URBAN MORPHOLOGY

Aspects of urban morphology that are studied include physical changes in the shape and form of settlements over time, as well as growth processes and patterns and changes in urban areas. Moudon (1994) distinguishes 3 different thought schools in typo-morphology, yet he comes to the following conclusion:

1) In order to establish a built landscape form, each evaluates the volumetric features of built structures in conjunction with the open spaces that surround them.
2) Each comprises land as well as its sub-divisions as a constituent type element, constructing land the connection between city scale andbuilding scale.
3) Each views the constructed landscape form as a morphogenetic unit since this is described by time – itsproduction, usage, along with mutation time.

III. MORPHOLOGICAL ELEMENTS

Returning to Conzen's four basic morphological components, it is easy to understand how morphological structures are built of interconnected layers by considering the following:

A. Land uses

Land uses are very transitional as compared to other types of structures such as buildings, plot divisions, and street patterns. Land use changes involve both the introduction of new uses as well as the relocation of current uses to other regions.

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Incoming uses frequently result in new structures, plot amalgamations or subdivisions, and in certain cases, modifications to the street plan as a result of subsequent redevelopment efforts. For their part, displaced land usagetend to gravitate toward older structures, which they adapt as well as convert rather than redeveloping.

B. Buiding Structures

There are certain types of structures that will survive longer than others. These include churches, public buildingsandcathedrals. They may have a special value to inhabitants or serve as a symbol for the community. A building's robustness is a quality that, with the exception of major structures and in the absence of conservation regulations, will only tend to survive if it can adapt to new uses or the modern needs of existing uses, which is known as robustness. Buildings that stand the test of time will frequently be able to support a variety of land uses as well as varying levels of use throughout their lifespan.

C. Plot Pattern

Plots and lots are generally subdivided into cadastral units, which are sometimes known as "platted" subdivisions. If the plots are adjacent, the frontage may face the same street or circulation path, while the rear border may be a shared or common plot boundary. Plots may also face onto main street at the front with service alleys at rear.

D. Cadastral (street) a Pattern

Urban blocks and public space/movement channels are laid out according to a cadastral pattern. Space among blocks might be considered public space

Cadastral patterns comprised of a high number of small-sized street blocks are regarded to have great urban grain, whereas patterns composed of a limited number of larger street blocks are regarded to have a coarse urban grain

Aside from increasing visual permeability, smaller blocks also improve people's knowledge of the options accessible to them - because of their small size, smaller blocks make it simpler to see from one junction to other in every direction.

Regular and deformed grids

Deformed grids are frequently referred to as "organic," with their layouts appearing to have been produced naturally—or, at the very least, to have the impression of having been formed naturally—rather than having been intentionally created by humans. Regular grids were criticized for their perceived monotony, but deformed grids have a scenic aspect as a result of the varying spatial confinement.

Ideal and Regular grids are usually planned – or were intended at one point –have few geometric disciplinedegree.

IV. THE PUBLIC SPACE NETWORK

Cadastral pattern creates the major components of network of public space but is also a critical component of the wider capital webconcept. In order to serve as a conduit for access and presentation of private property's "public face," the network of public space serves for facilitating and accommodating the overlapping realms of social spaceand movement space (such as space for people for engaging in numeroustypesof exchange-social, economic as well as cultural)

A. Shared spaces

A typical example of shred spaces is the replacement of conventional road priority management systems as well as devices (signals,signs,lines,kerbs,) along with the vehicles' segregation and other road users with an integrated people-oriented understanding of public space like cycling, walking, and driving automobiles become integrated events.

B. Pod developments

A further transformation in urban areas'morphological structure from facing outward urban blocks to inward building complexes served by only single road connection, which isdenoted as "pods". Shopping malls are only constructed in pod. Convention facilities,hotels,apartment complexes, medical centres,office parks,strip malls,Fast-food outlets are constructed as major components surrounded by their related parking as well as typically with their own exclusive and individual access onto a collector or main distributor road.

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C. Residential pods

Residential cul-de-sacs are a specific type of pod, particularly in its usual suburban incarnation. This is a rather short, dead-end street with a turning hammerhead or circle that serves approximately 20 or 30 dwellings.As its name suggests this is place "…..where one does not enter by chance because it does not lead anywhere other than to private houses." (panerai et al 2004:43)

D. Connected Street Patterns

Connected street pattern do not necessarily mean a regid grid-iron. Marshall (2005) for example, distinguished qualities of connectivity and complexity in street patterns. Dendritic patterns have low connectivity while grids have high connectivity. Marshall recognized four main forms of connection on the spectrum:

1) Tributary
2) Semi-tributary
3) Semi-gridded
4) Gridedded

E. Urban blocks

It is commonly accepted that connected block structures and street patterns go together, while several modern development projects are conceptualizedutilizing connected urban blocksandstreet patterns.As Kropf (2006:12) observes :"the block is the result of connecting streets . the block only comes into being when streets are connected . the perimeter block only rises when streets are connected and well defined by buildings."

F. The cells

In existing urban areaswhere comprehensive redevelopment was not possible or did not happen, quasi-cellular pattern was achieved by cutting downside streets and intersections and combining blocks for creating larger super blocks with new super blocks/enlarged street's perimeters becoming large-scale gyratory systems.

G. Arteries

To attain the design speed , urban roads were designed or modified to provide long forward vision and wide visibility splays at corners , building frontages onto the road were controlled to avoid distractions to drivers, while railing and other barriers sought to prevent intrusion of 'traffic interruptions'(i.e. people) .

H. Road hierarchy

A statement of the principles of hierarchy came in the 1963 Buchanan Report , Traffic in Towns:

'The distributor network has the purpose of channelizing the lengthier movements from one location to another. As a result, the network's connections should be structured to allow for quick and efficient mobility. Because of this, they cannot be utilized to provide direct access to buildings, nor even to secondary roads servicing those structures, because the resulting high frequency of junctions would create traffic hazards and degrade the overall efficiency of the road system. As a result, it is required to establish the concept of a hierarchical distribution system, in which significant distributors feed down through distributors of smaller category to the secondary roadways that provide access to the buildings. In a tree, this system may be connected to many parts of the tree including the trunk, branches, and twigs (which correlate to the tree's access roads). However, there are only two types of roads in general - distributors for transportation and access roads for the structures' services. Buchanan (1963:43-4)

V. NET ZERO ENERGY BUILDING

Net zero energy buildings will play a big role in curbing global warming in the decades to come.

1) What Is a Net Zero Energy Building?

Net zero energy buildings are buildings that make, or supply, their energy through renewable resources, which results in zero carbon emissions.These types of buildings can take energy from electrical grids, and send unused energy back to offset their energy consumption.Net zero energy building also might be referred to as "green buildings."

There is a difference between "net zero" and "zero." For example, New York state law says 85% of reductions must come from the state's own industrial and energy emissions. The remaining 15% may come from carbon offsets, including in forestry and agriculture.
In the sections that follow, some approaches to achieving net zero energy use will be discussed.

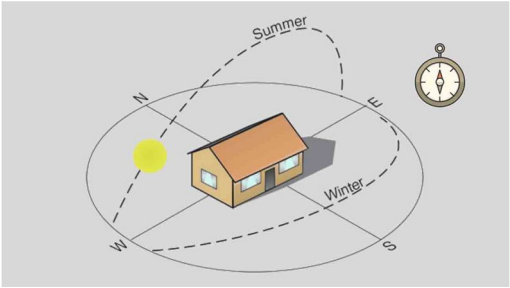
2) How Does a Building Achieve Net Zero Energy?
Several factors go into designing an energy-efficient building that achieves net zero energy goals.

3) Location
To construct a net zero energy building, you must take several conditions into consideration. The building site, where you are building, the climate and the building's exposure all have an effect.
Among other things, take into account:

- Climate
- Sun
- Wind patterns
- Temperature
- Rain patterns

➢ *Orientation*
The orientation of the building depends on the success of achieving net zero energy. Certain renewable energy generation mechanisms, like solar panels, work best when the building is facing south.
Besides harnessing the sun's energy, you can conserve by orienting your building to take maximum advantage of the shade. In warm climates, this means you'll need to use the air conditioning less to keep your building cool.
Lighting is another important factor. Lighting systems can account for almost 25% of a building's total energy consumption.

➢ *Design*



Next is building design. To ensure that the building saves as much energy as possible, choose the finest insulating materials you can. Windows that are double- or triple-paned and effectively sealed can play a significant role in energy conservation.
They actually consume no energy, which is how they support buildings in achieving net zero energy use:

❖ High-efficiency appliances require less energy and lighten the overall energy load.
❖ Low-energy HVAC systems do the same.
❖ Air sealing prevents cooled or heated air from escaping through cracks.
❖ Insulation performs the same function by providing an extra.

VI. RENEWABLES

The final step in designing high-performance buildings is determining the most relevant renewable energy sources based on the building. Solar panels might be the way to go for new homes or even ones that can be converted.
Active strategies reduce energy consumption during the building process through the use of renewable energy strategies, such as:

1) Photovoltaics — Photovoltaics is the direct conversion of light into electric power using semiconducting materials such as silicon. Each solar panel contains numerous photovoltaic cells, which work together to produce electricity.



2) *Wind power* — Wind is a kind of solar energy produced by three factors. It's affected by the sun unevenly heating the atmosphere, irregularities in the Earth's surface, and the planet's rotation. The resulting wind turns propeller blades around a rotor, which spins a generator, creating electricity.



3) *Hydroelectric power* — Hydroelectric plants capture the energy of falling water and convert it into electricity. Water flows downhill and is captured by a reservoir behind a dam. This reservoir acts like a battery, releasing water during periods of peak demand to produce power.



4) *Biomass* — Biomass stores chemical energy from the sun, produced by plants through photosynthesis. It can be burned directly to produce heat or can be converted into renewable liquid and gas fuels.
5) *Geothermal power* — Geothermal power involves water pressure in the form of steam. Geothermal wells drilled a mile or two underground pump hot water to the surface
6) *Solar power* — Sunlight shining on a panel is absorbed by photovoltaic cells in the panel. This creates an electrical charge in response to an electrical field in the cell, producing electricity.
7) *Solar thermal* — Solar thermal power systems use mirrors to collect sunlight and concentrate it. This raises the temperature until it is high enough to produce electricity.

Net Zero Energy Buildings and the Grid

Buildings must be connected to the gridin order to attain net zero energy. Any extra energy that buildings generate is sent back to the power system.

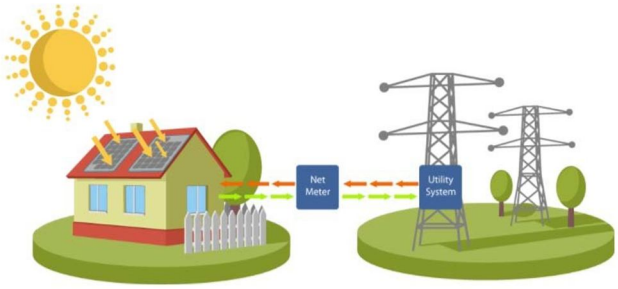
Load flexibility involves full connectedness to the grid, which works like this:

- Integrating a building with the grid to produce your own energy lets you rely on that energy when climate conditions allow.

- Any excess electricity you produce during these periods is fed back into the grid. Most states and utilities employ net metering, which "turns back" your electricity meter as you send power to the grid.

There are two different net zero building typologies: renewable-oriented and efficiency-oriented.

➢ Renewable-oriented buildings:



❖ Use more energy but also generate more energy.
❖ Rely on active strategies such as mechanical HVAC systems, thermal storage, demand response, and night ventilation.

➢ Efficiency-oriented buildings:
❖ Use and generate less energy.
❖ Rely on passive strategies like effective insulation, built-in shading, daylighting, and building orientation.

VII. CONCLUSION

The difficulties are great, but there are strategies for dealing with and getting through them. To increase energy efficiency, we just need to speed the procedures and get them to operate together. We can achieve the objectives if we apply this to both new and current structures.

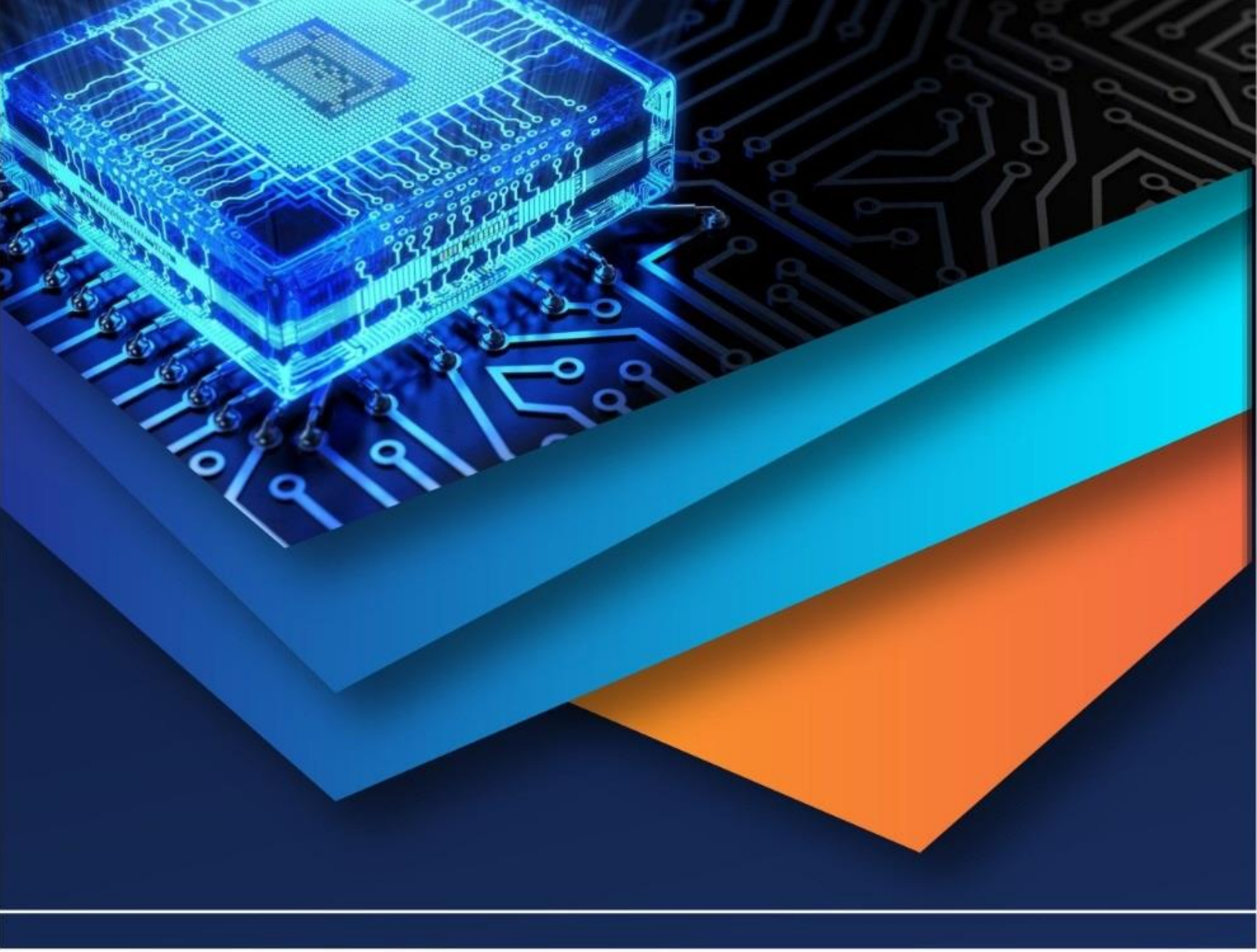
The paper examines the morphological aspect of urban design, concentrating on urban form as well as layout and emphasizing component for urban blocks and connected street patterns. Overall, it is concerned with the network of public spaces as well as the physical public realm, which is the physical setting or stage for public activity.

(Barn (Loyer, 1988) (Marshall, 2005) (Martin, 1972) (Moudon, 1986)

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