

# THE RELATION OF SUSTAINABLE ARCHITECTURE WITH DYNAMIC STRUCTURE IN HIGH-RISE BUILDINGS

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**ABSTRACT:** Dynamic Structures are structures that rotate independently of each floor of the building. This move freely creates a unique shape. Dynamic structure introduces the fourth dimension in architecture which is time dimension. According to dangers that have threaten the environment from high buildings is more than air pollution. Because of this, many architects offered sustainable architecture. Therefore, this study is based on concepts of sustainable architecture and its importance in the world of adaptability the pillars of sustainable architecture in dynamic structures is investigated. And the result was that dynamic structures are being based on sustainable architecture and it is following sun dimension and wind power. These towers are Eco-friendly towers that able to providing energy with itself. Also, these buildings able to changing the overall shape of buildings and cities will change faster than we thought.

**Keywords:** Dynamic structure, high-rise building, sustainable architecture, time dimension

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## I. INTRODUCTION

The structure is one of the essential components of architecture which is a conservator of buildings in against Gravity and dangerous loads. Given that the sense of beauty is one of the human innate sense. Therefore, stricter requirements on structure compare to the condition of the strength and economy imposed. The main purpose of the structure enclosing a space for performance is clear [1]. Always, there is a relationship between architecture and structure. Also, architecture and structure in high-rise buildings are linked together from different aspects. Architectural innovation in high-rise buildings in the late 19th century by the use of new materials and methods of construction has taken place [2]. We can say that in high-rise buildings with dynamic structure each floor individually spinning and in during the time changed the overall form and the building will not be a single, fixed form. As a result, these buildings can enter time dimension in the urban landscape. This architecture that is sustainable architecture can use nature as an energy producer. However, the aim of this article is surveying relation and coordination of sustainable architecture and dynamic structure in high-rise buildings.

### 1.1 AIM AND OBJECTIVE:

The aim of this project is introducing dynamic structure in high-rise buildings which are new technology and method in engineering and architecture. One of the most important the features of the dynamic structure is producing energy by nature.

### 1.2 METHODOLOGY:

This requirement was obtained from studying on the case study and I think that it can be a benefit for design to achieve a good environment.

### 1.3 QUESTIONS:

Find the answers to these questions will determine the necessity of this research.

- What is the feature of dynamic architecture?
- How to producing energy in dynamic structure?
- What change in architecture and urban landscape create in during the time?
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## II. SUSTAINABLE ARCHITECTURE:

Verb "sustain" has been common in English in 1290 AD. Oxford dictionary mentioned to "sustainable" in 1400 AD and the New Face of this verb in 1611 it is mentioned. Also, it seems that the verb of "sustain" has been existing before. But the past few decades the definition of "sustain" has a new face which is "what can be continued in future". These days we are using sustain of the word for explaining something in global which can use or continue in future or next generation [3]. The application of sustainability concepts in architecture is

introducing new field which are sustainable architecture, ecologic architecture or green architecture that all of them are the same meaning [4]. One of the most important thing in temporary architecture is sustainable architecture. In fact, sustainable in architecture is pervasive. We can say that sustainable architecture is the maximum use of nature talents and environment for users also minimize the adverse conditions of the construction [5]. Sustainability in architecture is often more focus on the environmental sustainability in relation to architecture. Actually, sustainable building is a building which has a least adverse effect on the natural environment during the life of the building. But it has to be understood that the architecture is based on human thinking and is for consumer comfort and sustainability in architecture is trying for the maximum of human comfort and least damage and create less pollution to the environment [7].

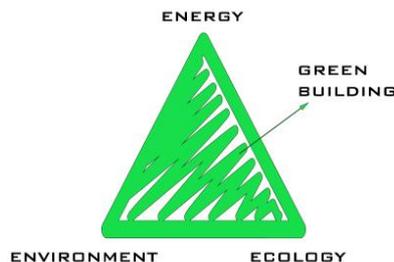


FIG.1. Three main pillars sustainable architecture [8]

Principles of sustainable architecture	
saving energy	The maximum use of renewable energy sources and minimize the use of fossil fuels.
Reducing the use of new resources	Reuse of recycled materials and reduce the use of new materials
Harmony with the climate	Harmony with the climate and energy sources available at the construction site
According to human needs and meet them	Meet mental and physical human needs and improve quality of life
Harmony with the site	Lack of compatibility with surroundings
Holism	According to the urban environmental sustainability in the design of buildings and the construction of a healthy environment.

TABLE.1. Principles of sustainable architecture. [11]

### III. HIGH-RISE BUILDINGS:

Tall building based on height and number of floors is not specified. The important criterion is that the building design aspect of the looming influenced or not. The high-rise building is building which is caused special circumstances that are different with typical buildings. According to this definition, we can see those

high-rise buildings are not only based on high but also the type of building performance is involved [7]. Basic principles of structural design are same in a high-rise building and typical buildings. The meaning of high-rise building has a relative concept that in addition to the height it should be noted that other cases [8]. Build high-rise buildings in the world from the late 19th century and early 20th century began and from 1880 to 1900 the first of high-rise buildings built in Chicago.

Advantage of High-rise building	Disadvantage of High-rise building
Increase the quality of building and using technical principles	Prevent access to sunlight
To improve the quality of urban signs	Increasing destructive power due to wind
Reduce the level of infrastructure	High consumption of energy and materials to build in height
Create a building with different applications	High population density in specific locations
Reducing the cost of construction	Visual abnormalities in the urban context
Prevent the horizontal expansion of cities	Create indoors, isolated in height
Reduce to damage to the environment	

**TABLE.2.** Advantages and disadvantages of High-rise building [14]

#### IV. THE HARMONY OF SUSTAINABLE ARCHITECTURE AND DYNAMIC STRUCTURE:

Dynamic structure is based on sustainable architecture. Not only change the line of the sky but also with the dynamic structure is following sun direction and change direction to the wind direction. This phenomenon can use nature as a natural providing energy. In the buildings with dynamic structure enter time, dimension Buildings will not rigid boundary shape. And cities change much faster than what we think. Dynamic architecture buildings always changing the shape and form. Actually, each floor is individually able to slowly rotate 360 degrees around its center at any moment.as a result, the buildings do not have a fixed façade. Dynamic structure is based on three main concepts:

- Dynamic design: It means that each floor able to rotate individually and in during the time change the form and shape of the building.
- Green architecture: with this method the building able to produce energy (sun and wind) by itself.
- Industrial production: In this method, we are using components and prefabricated with high quality [11].

The features of dynamic structure
Using advanced manufacturing
The ability to produce its own energy
using components and prefabricated
Requires fewer workers than conventional methods
Increase speed of work and reduce the cost of construction

**TABLE.3.**The features of dynamic structure [12]

**V. COMPARING CONSTRUCTION IN TYPICAL BUILDING AND DYNAMIC BUILDING:**

In these pictures we can see the different of dynamic structure and typical structure.



**FIG.2.**The different of how they are using elements. (The picture on the right: components elements [18]. The picture on the left: construction by traditional method [16].



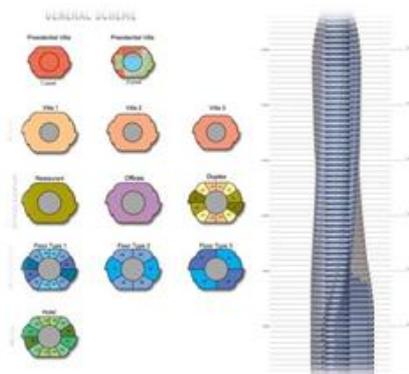
**FIG.3.**The different of between the type of structure and the number of worker. The picture on the left [15]. The picture on the right [17].

**VI. CASE STUDY:**

Since, starting construction, the first dynamic structure designed by David fisher. After this idea started new style in architecture and engineering that they called “DYNAMIC ARCHITECTURE”. These days is “ANIMATED ARCHITECTURE PERIOD”. Buildings that can change the direction and speak to several languages in architecture and produce by itself. “Da Vinci Tower” was fishers suggest in DUBAI. This building with dynamic structure will build in DUBAI in future. Here we are explaining Da Vinci Tower as a case study that shows us everything about dynamic structure.



**FIG.4.** Da Vinci Tower [11]



**FIG.5.** different modules that using [11]

- This skyscraper will have 420 meters height and 80 floors with 12 different design modules. This building are included Hotels, Residential and Offices.



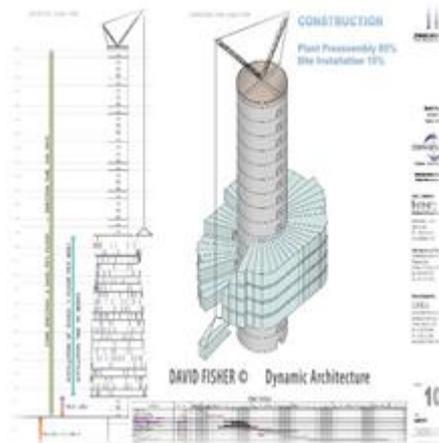
**FIG.6.** The turbines between each floor [11]

- Each floor is individually able to slowly rotate 360 degrees around its center at any moment. The rotation speed can reach 6 meters per minute so the move in without looking out it is not felt. The tower uses wind turbines that are horizontal arrange between floors and are provided own energy and even a few nearby buildings.



**FIG.7.** Central concrete core [11]

- The tower is designed based on a central concrete core and consoles classes. At the core of vertical communication center is a facility that they have taken concrete cylindrical. Each floor has separate parts such as slice of cake completely before which these parts are made.



**FIG.8.** Components elements [11]

- These components are installed such that the placement of a crane at the top Cylinder and two vertical rails at the height of the tower, the individual parts on rails on top and by rotating it opens next piece.

### Conclusion:

From above studying, we reach a conclusion which dynamic structure built by components elements and it is based on according to sustainable architecture. This method of construction able to changing the view of urban. In this building, there is forth direction that the scientific called “TIME DIRECTION”. In this way, in during the time changing the overall form and shape of the building. The dynamic tower is the first high-rise building which producing energy by itself and also there is fewer worker in the workshop. Because all elements are a component. The first dynamic tower will be built in DUBAI in future. After that in others country, we can see this building. In finally we can say that dynamic structure as a first building that designed by Automatic power. This masterpiece by solar panels in the top of tower and wind turbines between each floor there is there.

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