# Projects of Incredibly High Skyscrapers and Their Implementation Possibilities

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**Annotation** People have been obsessed with the idea of building skyscrapers since time immemorial. Everyone is well-known for the mythical story of the Tower of Babel, which is the best example of the existence of such a desire of people and their striving for its implementation. If at that time people were interested in building a building as high as heaven only in order to get closer to the gods, then this was replaced by other considerations. First of all, this is the accommodation of as many people as possible in a small area. Despite the centuries-old experience of construction, the possibility of constructing such buildings structurally arose only at the end of the 19th century in the form of arranging metal frames. After the construction of many skyscrapers in different parts of the world, construction technology has improved and the use of reinforced concrete along with steel has made it possible to build super-tall buildings. Although many such projects have been implemented, there are still incredibly tall skyscraper projects that belong to the realm of fantasy and need to be evaluated for their feasibility.

**Key words:** Skyscraper, Project, Building. Foundation, Structure, Concrete, Steel

## Introduction

The number of cities and the population in the world are growing rapidly. Compared to past centuries, this process is currently more accelerated and requires the most optimal use of existing urban areas. The main solution is still the construction of skyscrapers, but due to the ever-increasing needs. The number of projects for buildings 1 kilometer high and higher is increasing. Their development is associated with high costs and, if not implemented, seriously harms the customer. Despite this, there are many unrealized projects for incredibly high skyscrapers (height 2.0 - 4.0 km), which can be used in the future. This is not surprising, because many projects, thanks to their authors, are geniuses and are far ahead of their time. A vivid example of this is the project of Antonio Gaudi's 360-meter-high hotel "Attraction" in New York in 1908, when a 200-meter building had not yet been built anywhere in the world. The project was presented in the form of drawings, but it is one of the most important examples of architectural Azov. The central part of the complex is a building in the shape of a pointed parabolic arch, surrounded by several similar elongated domed buildings. On the lower floor there is a large hall with six-level spaces erected above it, since the use of the word floor does not accurately reflect the grandeur of the project. The second, highest level, has a wide arched roof similar to a temple. It was intended for a theater, lecture and exhibition halls. The third and fourth levels were devoted to galleries, above which it was planned to arrange a passage into a large spherical storage room with a viewing platform for 30 people. The hotel project turned out to be very difficult from a technological point of view, the arrangement of very large arched structures on the upper levels was of particular difficulty. Because of this, the project was forgotten for a long time. It was first proposed almost 65 years later, but the twin towers of the World Trade Center had already been built on that site in 1972. A second version was considered as a replacement for the towers destroyed on September 11, 2001. A new

version was proposed on January 23, 2003, but was later abandoned (Fig. 1).

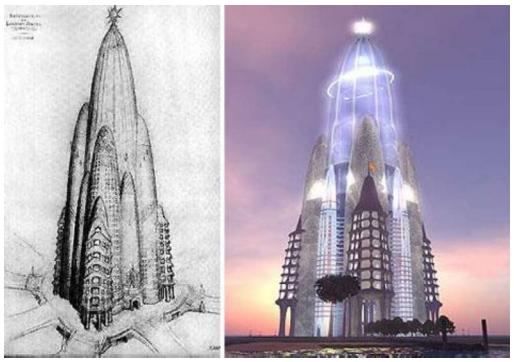

Fig. 1. Gaudi's project

## 1. Main part

Japan has always tried and is trying to solve the problem of overpopulation practically and profitably. Despite the country's location in a very seismically active zone, the main emphasis has always been on building buildings that are as capacious and comfortable for people as possible. Based on this approach, in 1966-1969, by order of one of the Japanese companies, the first project of the world's tallest skyscraper, 4000 meters high, was developed by Nikitin and Travush, the chief designer of one of the world's unique projects at that time, the Ostankino television tower in Moscow. The name of the skyscraper is known as "The Nikitin-Travush Tower". It was a four-tiered conical metal lattice structure. The height of each tier was 1000 meters. The foundation of the skyscraper with a diameter of 800 m was a 100 m high prestressed reinforced concrete cylinder, which was part of the first tier. The structure was calculated taking into account the most extreme effects of hurricanes and earthquakes in Japan. It was supposed to be a residential building for 500,000 people, with all the engineering communications projects worked out perfectly (Fig. 2). The world-famous Japanese architect Kenzo Tange was also ready to start developing the architectural project, but the first difficulties arose when Soviet specialists were sent to Tokyo, since they were supposed to work mainly there. Then the Japanese side, interested in the implementation of the project, could not resolve other organizational issues and first demanded a reduction in the height of the tower to 2 km, and then to 550 meters. This led to a complete cessation of cooperation, and no one was interested in the project for a long time. owever, in the 1990s, its elements were used in the development of the X-Seed 4000 project.

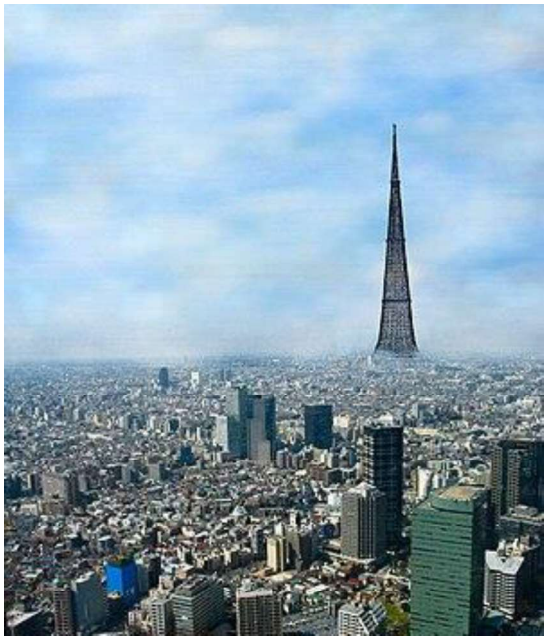

Fig. 2. „The Nikitin-Travush Tower"

X-Seed 4000 is one of the hypothetical projects of the tallest and largest building in the world. Its height is 4000 meters above the ground and 800 floors. Thanks to the base with an area of 6 km$^2$, the structure can be built on the sea. In its configuration, it resembles, but is higher than the highest mountain in Japan, Mount Fuji, whose height above sea level is 3776.24 meters (the highest point in Japan). The skyscraper-city is designed for 700,000 to 1 million inhabitants. The project was developed by the Japanese company Tasai Corporation in 1995 as a building of the future in Tokyo. Where an ultra-modern lifestyle should be combined with nature. Unlike conventional skyscrapers, the X-Seed 4000 will protect its residents from pressure differences and changes in natural conditions. Throughout the

entire height of the building. Its design provides for the use of solar energy to provide the building with energy and maintain a microclimate. The main problem for the implementation of the project was its location in the "Pacific Ring of Fire" region - the world's most powerful volcanic activity zone, which makes the occurrence of earthquakes and tsunamis very dangerous. The elevators are designed for 200 people and take 30 minutes to the highest point. In addition to apartments and offices, the building will include entertainment and shopping centers, parks, and forests. Its construction, according to current calculations, should be completed in 8 years from the start. No one has been working on the project for a long time, but its estimated cost is growing every year and, according to recent estimates, has exceeded 1.5 trillion dollars (Fig. 3).

Fig. 3. **X-Seed 4000**

In Japan, against the backdrop of such interest in the tallest housing, the Chinese-American architect Eugene Tsui designed one of the tallest buildings of the future in 1991, the 500-story "Ultima Tower", with a height of 3218 meters. It is designed to accommodate 1 million people and is aimed at relieving overly dense settlements. The concept of Ultima arose as a result of studying the development of San Francisco. It turned out that there are very few green areas in this large city, and in the conditions of the unstoppable growth of the megalopolis, one of the best solutions is to build vertical structures. The idea is based on the construction of nests by African termites, or an order of insects. The height of the "towers" created by these microscopic creatures sometimes reaches 15 meters. They have great strength, easily resist strong winds. .The structure has passages and tunnels cut inside, which provide natural ventilation and keep cool even on hot days. The architect's goal was to turn San Francisco into a benchmark for "natural living", which should become a role model for humanity. Eco-architecture was an important direction for this author, and he has also implemented several interesting small-scale projects. The implementation of the "Ultima Tower" project has been widely discussed for a long time, but the final decision has not yet been made, because it is too grandiose and ambitious. Nevertheless, the project is unusually unique, because it is designed as a closed ecosystem where the entire city should be located. The structure of the tower consists of many floors, each of which has its own ecosystem, reservoirs and landscape. The diameter of its base is almost two kilometers, or more precisely 1828.8 meters. The internal area of the building is incredibly large - 140 km2, which far exceeds the entire territory of some countries. Lakes and waterfalls are provided at the base. According to the laws of physics, they should cool the upper levels of the building. Natural air conditioning ensures the preservation of oxygen and its increase in the building. To ensure sunlight, giant mirrors are placed in the central part, which reflect the rays coming from the aerodynamic windows. The architect was a great propagandist of the use of renewable materials, and this is evident in the use of recycled raw materials as building materials. In addition, the secondary use system involves the purification of all wastewater and its use for watering the gardens inside the building. The use of solar panels and wind generators. Also, due to the shape of the skyscraper, the electrical energy generated at the expense of the difference in atmospheric pressure at its base and top

should be completely allocated to the building's power supply. The building will have its own internal "mini-ecosystem". To reach the top, new types of elevators need only 10 minutes, which is already realistic. A new protection system for conical reinforced concrete walls with double spiral reinforcement has also been designed to protect against ground shaking. As the population on Earth grows and climate change continues, such a building becomes more and more necessary to ensure a normal life for people, and this well-thought-out project can be implemented in just a few decades (Fig. 4).

Fig. 4. "Ultima Tower"

After the completion of the Burj Khalifa in Dubai in 2010, there was talk of a new fantastic project, "The Dubai City Tower", which would be 2.4 km high with a slightly smaller diameter base. This idea, like many others, seemed at first to be impractical and unrealistic, although experts immediately said that there were no technical obstacles to this project. The only problem was economic efficiency. Many believed that building a 600-meter tower would be more profitable than building one of these skyscrapers. Some also noted that it would be more difficult to operate than to build. In addition to the residential part, the building is planned to house a hotel, offices, shopping, sports and tourist centers, and green spaces.

Fig.5. „ The Dubai City Tower"

In fact, this project involves the construction of a vertical city, consisting of six interconnected, inclined towers made of steel and reinforced concrete, which, with different colored glazing, were to become the most distinctive and largest building in the world. Three such towers are built clockwise, and three in the opposite direction, which leaves an extraordinary impression and should become a symbol for Dubai similar to the Eiffel Tower. The towers are connected after every 100 floors, that is, a total of 400 such connections are formed. People are

not supposed to be transported to the floors by elevators, but by special trains moving at a speed of 200 km/h. Inside the building, all conditions for people to stay and relax are created. According to the report, the skyscraper itself should generate the colossal amount of electricity that the skyscraper should consume using wind turbines and solar panels. Despite all the difficulties, financiers appeared, whose main goal was to build the most grandiose building in the world, but considerable time passed in refining the structural part of the project, then the pandemic period followed, and the project, which was already ready for implementation, unfortunately stalled and is no longer being discussed (Fig. 5).

„The Shimizu Mega-City Pyramid" is an idea proposed by the Shimizu Corporation to create a pyramid-shaped artificial city in Tokyo Bay, Japan. The building will house shopping and business centers, parks, squares and everything else that a person needs for a full life. The project aims to solve one of Tokyo's major problems related to the lack of living space. The building is designed for 1 million residents. The pyramid, which is 2,004 meters high and has a base of approximately 2.0 X 2.0 km, is so massive that today's existing building materials cannot withstand its weight and its implementation is impossible in the near future. The idea and design are based on the use of future super-strong carbon nanotubes and graphene-based lightweight materials that have already been discovered and research is underway. The construction was scheduled to begin in 2030, and completion is expected by 2110, but all this is still at the level of an idea. It will become the tallest building in the history of mankind, if no higher project has been implemented before. For the 15th year in a row, the Burj Khalifa in Dubai, with its 828 meters high, has not lost the title. The huge pyramid structure consists of five rows of trusses. Among them, the first row houses pyramid-like dwellings, each of which is the size of the Great Pyramid of Giza. The foundation of the entire building will be formed by 36 piers made of special concrete. Because the seismically active Pacific Ring of Fire runs through Japan, the pyramid's outer structure will be an open network of megastructures that will help the carbon nanotube supports withstand the effects of strong winds, earthquakes, and tsunamis that affect the pyramid. The trusses will be covered with photovoltaic film to convert sunlight into electricity and power the city. Robotic systems are planned to play a significant role in both construction and building maintenance. Transportation within the city will be provided by accelerated walkways, inclined elevators, and a personal rapid transit system, where automated poles will move between the trusses. Residential and office space will be provided by twenty-four or more 30-story skyscrapers, which will be suspended from above by nanotube cables and, together with the pyramids below, will create a system of development (Fig. 6).

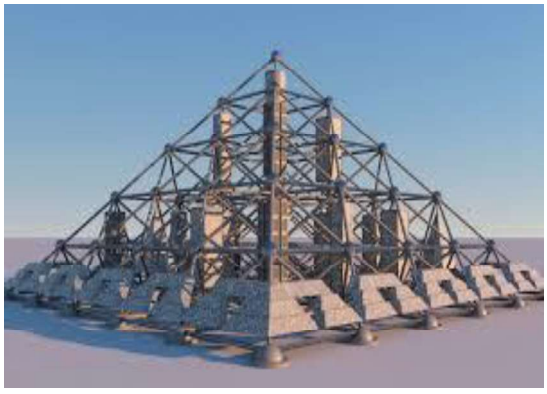

Fig. 6. "The Shimizu Mega-City Pyramid"

"Rise Tower" is a skyscraper project planned for Riyadh, the capital of Saudi Arabia, which will become the world's tallest building upon completion. It is 2,000 meters tall, 1,180 meters taller than the Burj Khalifa. The building has 678 floors. The project, developed by the famous design company Foster & Company, was first announced in December 2022, when the Public Investment Fund of Saudi Arabia announced its decision to build the world's tallest skyscraper on an area of 18 square kilometers in Riyadh. The construction process will use the latest engineering and construction

technologies, ultra-strong concrete and high-strength steel reinforcement. The main structural element is a central reinforced concrete core. Its outer steel frame is a high-strength structure that reduces mass and increases flexibility during wind and earthquakes. The shape of the building is also such that the impact of wind is minimized. A giant damper will be placed at the top of the building, which will reduce the vibration during strong winds or earthquakes. Flexible joints will be built into the structure, which will also reduce the impact of earthquakes. The foundation should be one of the deepest and strongest in the world, with 80-100 meter long bored piles, which rest on the rock layer and eliminate soil movement. The "concrete slab" will be built with high-strength concrete several meters thick. (Fig. 7).

Fig. 7. "Rise Tower"

**Conclusion**

1. The implementation of the currently existing projects for the construction of incredibly high skyscrapers is still impossible due to the mass of the buildings and the technological difficulties of construction. Nevertheless, in the very near future, with the practical application of new ultra-light and ultra-strong building materials that have already been almost completely researched, there is a great opportunity to realize each such project;

2. Despite the existence of numerous unfulfilled skyscraper projects, the development of which is associated with high costs, all of them play a major role in creating a more interesting and even more incredible project. One of the best examples of this is the X-Seed 4000, a grandiose project created in Japan using elements of a previously developed project, which will probably be implemented in the future.

3. The Shimizu Mega-City Pyramid project, which is currently under development, is particularly interesting, but its idea and constructional solution depend entirely on the use of lightweight materials based on future super-strong carbon nanotubes and graphene. These materials have already been discovered and their research has been actively underway for several years. Hopefully, with the start of mass production of these materials, the project will also begin to be implemented, and another wonder of the world will be added.

**References**

1. Amelia Khatri. Skyscrapers World Wide. 2024. 102 p.;

2. I.Kvaraia., S.Gelashvili. The Use of Concrete in The Construction of Skyscrapers. BUILDING. Sientific-Technical Journal N1(69), 2024. P.14-18;

3. I.Kvaraia., S.Gelashvili. The Tallest Buildings in The Word, Bult in Different Times. BUILDING. Sientific-Technical Journal N1(69), 2024. P.91-95;

4. 1.Kvaraia. Seismic systems in construction and their arrangement. Technical University. Tbilisi. 2023. 125 p.;

5. I.Kvaraia. Longevity of skyscrapers and some cases of their dismantling. BUILDING. Scientific-technical Magazine "Construction" 4(60). 2021. P.112-116;

6. I.Kvaraia. Innovative technologies in construction. Technical University. Tbilisi. 2020. 184 p.;

7. John Hill. How a Skyscraper is Built. Firefly Books. 2017. 192 p.