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Urban Infrastructure and the Psychological Impact of Life and Work in High-Rise Buildings

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ABSTRACT

This research paper looks into the psychological effect of living and working in high-rise buildings, In urban cities, where developers encounter the hurdles of restricted space and population jump, condensed living shift has developed towards high-rise towers as a useful exchange of feasible solutions. These soaring structures may offer potential solutions to this land problem, where the population must adapt to find fewer living and working spaces, but they also bring their own challenges in a modern world. The physiological and psychological effects of the construction of high-rise living and working spaces are the subject of the above research as it also draws on various human psychological processes, such as behavioral and social attachment and its use for a positive self. Those living in the upper floors of high-rises typically fare worse across a spectrum of psychological measures stress, to feelings of isolation to discomfort from the building's height, absence of natural elements, limited social interaction than those on low floors.

These problems got worse when individuals were forced to stay indoors for months as a result of the COVID-19 pandemic. During lockdown, the majority of residents were exposed to the negative effects of staying away from society and nature, particularly in poor living conditions. This article explores various studies, personal experiences, and modern skyscrapers to unveil the immense impact of building design on human health. It explores how these living spaces can be improved for the benefit of mental health. To eliminate these problems, various solutions have been proposed, such as letting more natural light into the spaces, designing green spaces such as indoor gardens or plant-covered balconies, and designing large common spaces that promote social interactions. These suggestions aim to reduce stress and reduce social isolation, thereby improving the quality of life of the residents or employees in tall buildings to the maximum.

Key words -Tall buildings, Research methods, Residential satisfaction, Mental health, Stress, Crime and security, Social relations.

1.1 INTRODUCTION

The concept of building tall is attractive and interesting. In fact, the concept of high-rise building or the vertical city typology provides a meaningful solution for the conservation of land and resources. Skyscrapers, which are commonly thought of as masterpieces of architectural engineering and paragons of modern progress, offer efficient solutions to the space problems that characterize high-density urban spaces. Those skyscrapers offer additional residential, commercial, and mixed-use space within restricted floor areas, thereby saving valuable ground floor space and preventing urban sprawl. The Council on Tall Buildings and Urban Habitat (CTBUH) offers the definition of a high-rise building as one that extends between 35 to 100 meters or more than 12 stories. While the material and economic advantages of building tall structures are unarguable, the psychological and emotional effects such an environment imposes on its inhabitants cannot be overlooked anymore.

Living and working in skyscrapers poses a unique set of problems related to human comfort, health, and psychological well-being. This tower residence too often associated with wealth, status, and wide views can bring at the same time isolation, stress, and social isolation. Residents may have fewer opportunities for nature exposure, contact with others, and separation from the street-level world that affords a sense of identity and affiliation. These vertical worlds may, at times, operate at cross-purposes to fundamental human needs: exposure to natural environments, social contact, physical mobility, and sensory balance. Prolonged exposure to confined, artificial, and highly dense environments can negatively impact cognitive functioning, emotional health, and overall life satisfaction.

This research addresses the psychological aspects associated with high-rise building design, specifically highlighting the influence of spatial organization, environmental conditions, and building interactions on the mental and emotional well-being of residents and employees. The research analyzes the influence of architectural design choices, such as natural light exposure, integration of green spaces, sound control, shared spaces, and visual connection with the outside world on the lived experience in high-rise buildings. Through the analysis of global case studies, recent scholarly literature, and emerging design strategies, this research seeks to emphasize the significance of designing livable high-rise cities that transcend functional requirements to enhance human health, social connection, and psychological resilience. Ultimately, this research encourages a redirection of the philosophy of high-rise design

from purely utilitarian or symbolic paradigms towards more human-centered, sustainable, and wellness-driven strategies that enhance both the aesthetic and emotional qualities of vertical living.

2.AIM OF RESEARCH

The aim of this research is to analysis the existing literature on human discomfort and phycological effect of living in high-rise buildings with a view to identify recent trends and possible gaps in the literature. The key theoretical concepts guiding this review are "enhance human comfort" and "high-rise building". This review assumes a hypothetical position based on the idea that the height of a building may hold potential relationship with human habitable space of its users, that there must be a threshold beyond which it becomes impractical to apply passive design strategies and techniques for tall buildings. The paper identifies existing approaches adopted to investigate the optimal height or height threshold for solution for discomfort in high-rise living and working buildings in the tropics.

2.1 OBJECTIVE OF RESEARCH PAPER

- · To explore the phenomenon that high-rise buildings reduce human comfort levels as measured in both residential and working environments.
- To investigate the impact of vertical living on residents and staff with regards to mental health, social interaction, stress, and well-being.
- The purpose is to investigate the Integration of Green Building Practice providing comfort, health and environmental sustainability within high-rise buildings.
- Propose interventions and strategies that promote human comfort and mental well-being in high-rise urban environments.
- To present key design considerations such as access to natural light, air movement and circulation, sound control, spatial layout, and operator areas.
- To explore the effects of space relationship in architecture (public and private, vertical and horizontal movement) and their impact on users' behaviour in high-rises.

2.2 NEED OF RESEARCH

As more people live in cities, high-rise buildings have become a common solution to the problem of limited land. High-rise buildings address the space issue but raise serious issues about the well-being of people who live and work there. In spite of the popularity of high-rise buildings, we still do not fully understand the effect of these buildings on the mental and social well-being of the people who live and work there. We must act quickly to probe the impact of residing and working at higher elevations on psychological well-being, interpersonal relationships, and overall way of life. This research would like to link city architecture to the way people think and feel by examining the impact of living in high-rise buildings. The findings will provide valuable information to architects, planners, and developers to design spaces that not only concern how well a space functions and how dense it is, but also the mental and emotional well-being of its inhabitants. In this way, this research hopes to contribute to making cities more caring, livable, and mentally healthy for their inhabitants.



4.METHOD AND COLLECTION

4.1 COMPARATIVE ANALYSIS IN LOW RISE & HIGH RISE

This study takes into consideration high-rise and low-rise buildings. It uses real-world situations to see how each one affects the emotions of people in their homes and working lives. It takes into consideration the role of building height in changing the behavior of people, making them feel comfortable, in changing social interaction, and in changing their mental health. By taking note of important design features and how people use these places, the study describes the relationship between human emotions and building design—how different spaces can influence our lives and emotional health. The results are depicted in the chart below.

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FEATURE	HIGH-RISE LIVING	LOW-RISE LIVING	POTENTIAL BEHAVIORAL IMPACTS	EXAMPLES
Sense of Community	Often lower, as residents may have limited shared spaces and interactions.	Potentially higher, with more opportunities for casual encounters and neighbourhood connections.	High-rise dwellers might feel more isolated, while low-rise living could foster a stronger sense of belonging.	The Interlace (Singapore) green spaces provide opportunities for residents to relax, socialize, and connect with nature. And interconnected blocks create a sense of horizontal connectivity, promoting interaction between neighbors.
Connection to Nature	Limited access to green spaces and natural elements. Views might be dominated by concrete and other buildings.	More likely to have yards, gardens, and be closer to parks and green spaces.	High-rise living could lead to feelings of disconnection from nature, while low-rise living might promote a greater sense of well-being and stress reduction.	One Central Park (Sydney) This building is renowned for its extensive vertical gardens, designed by botanist Patrick Blanc. It also features a cantilevered heliostat that reflects sunlight into the building's lower levels.
Privacy	Generally higher, with less direct interaction with neighbours	Can be lower, with more shared walls and closer proximity to neighbours	High-rise living might suit those who value privacy, while low-rise living could appeal to those who prefer a more social environment.	(Shanghai Tower) It could give a person a very undisturbed living space with safty
Physical Activity	Increased use of elevators and stairs could lead to more incidental exercise.	May involve more walking and cycling for errands and leisure activities.	Both have the potential to encourage physical activity, but in different ways.	The Residences at 1428 Brickell (Miami)

				It features expansive terraces with deep overhangs, providing ample shade and creating comfortable outdoor spaces.
Noise Levels	Can be higher due to traffic, building systems, and neighbou rs	Generally quieter, with less exposure to external noise sources.	High-rise living might contribute to stress and sleep disturbances, while low-rise living could offer a more peaceful environment.	Subway Noise in a New York City) Living near busy city streets, in a building like those that line (Park Avenue)in New York city, will result in high noise levels.
Social Interaction	More likely to be limited to planned gatherings and events.	Having more opportunities for spontaneous interactions with neighbours.	High-rise living might require more effort to build social connections, while low-rise living could facilitate more organic social bonds.	Periférico 2008 Mexico City (Mexico) Residents of a high rise apartment building might attend social events held in the buildings community room.

Fig no 1 : As Per Article and Research

4.2 PSYCHOLOGICAL CHALLENGES OF HIGH-RISE LIVING AND WORKING

Sick Building Syndrome

High rise buildings are highly dependent on artificial ventilation and limited natural airflow, which can lead to "sick building syndrome." The medical reactions, including headaches, fatigue and respiratory problems, are damaging to productivity and mental health. These are the effects that can be mitigated through better ventilation systems or the use of natural materials or by biophilic design 2.

Ecological and Environmental Considerations

Skyscrapers negatively alter natural ecosystems and urban microclimates. Less sunlight at street level and the "heat island" effect can make life uncomfortable for walkers and residents nearby. The people involved in the planning and design processes, amongst others, can incorporate energy-efficient designs, green roofs, sustainable building and construction practices which will contribute to minimisation of these impacts.

Social Isolation and Loneliness

Those living above ground in high-rises often feel lonelier. In apartments, it's more difficult to run into neighbours, to chat with them, compared to people in houses or low-rise buildings. The architecture of many high-rises doesn't lend itself to spontaneous, casual social interaction, making it more challenging to create a sense of community.

Psychological Stress

Some people may find living in tall buildings stressful. Someone afraid of heights may feel that way all the time. In emergencies such as fires, people can feel stuck.

Busy cities are noisy, too, and high-rise buildings amplify that noise, so these buildings can interrupt sleep and increase our stress levels. "They can also lead people to feel detached from nature," which is beneficial to mental health, she said; Some people might experience. Some people might experience "Sopite Syndrome," caused by the slight sway of tall buildings in the wind. This can make them feel tired, moody, and unfocused.

Effects on Children

Children in high-rise buildings may have limited outdoor play space. They can also affect on their physical health and social skills. Also, parents may not feel safe allowing their kids to play unsupervised in or around the building, which eliminates the independence of the child.

Indoor Environment Issues

Insufficient air circulation in a high-rise leads to urban indoor air pollution, which influences mood and cognitive ability. Not all high-rise apartments receive enough sunlight, too, which is critical for sleep, mood and overall health.

Urban Density Stress:

Because you know so many people are living around you, living in a high-rise building can sometimes feel overcrowded, even in your private apartment. The noise and activity of urban life, particularly at elevated levels, can soon become daunting and anxiety inducing. But a high-rise living experience can vary widely depending on factors including personal tastes, the design of the building and the surrounding environment. Good design, which includes common spaces and access to green areas close by, can help make high-rise living more comfortable and reduce some of these issues.

4.3CURRENT HIGH-RISE BUILDING DESIGN

The design of high-rise buildings is being transformed including new urban needs, a greater eco-awareness, plus new technologies. As cities are being forced to build up to meet explosive population growth, architects and urban planners are now reimagining the potential of skyscrapers not just as monumental homes but as green, smart, and community-oriented spaces. The study presented shall examine the aspects of formation of contemporary visual semantics, which are the most pressing and reflect the most pressing innovative solutions in the design of high-rise buildings. These innovations signal an even greater movement toward the development of more livable, resilient, and visionary urban environments.



Fig no 2: As Per current high-rise building design development

The future high-rise environment is increasingly driven by the values of sustainability, innovation and responsiveness. Green design principles such as vertical greening and high-tech energy systems are the standard of operation to limit environmental impact and maximize occupant health. The integration of technology gives us smarter building control; prefabrication and the use of responsive materials make construction a lot more efficient. Mixed-use development promotes community integration and versatility in vertical properties, while modernist design forms seek contextual-fit and iconicity. With pressure for urban density increasing, these trends interconnected provide for high-rise buildings that are not only optimized for efficiency and aesthetics but are also responsive to the needs of people and the environment.

4.4 BASIC DESIGN CONSIDERATION

Its significant design concerns regarding a tall structure are these details:

- The city's politics, culture, and social life where the building will be situated.
- Close relation to the city
- The master plan and the right site selection
- Safty and security issues
- Understanding the potential and limitation of technology.

The design team should keep in mind the codes, rules, zoning requirements, and safety concerns while designing a high rise building.

The master plan is an important part of designing high-rise buildings. Good site analysis looks at things like cars, traffic, and how people walk. It also checks for easy access, keeping views clear, and reducing shadows from the building on nearby buildings. Also, choosing a good site means thinking about using or fixing up old buildings and making sure they are safe. Where high-rise buildings are built in a city can change how much daylight they get and may even cause strong winds.

Sustainability is also an important factor in high rise building design. This concept is founded on the following goals: optimization of site potential, reduction of energy use, conservation and protection of water, utilization of environment-friendly materials, improvement of indoor environmental quality, and optimization of operational and maintenance measures. Day lighting, natural shading, energy efficient and photovoltaic facades, wind power systems, and the concept of the sky garden are also the most important parameters for a more sustainable high rise building design.

It has never been a high priority for owners, architects, engineers, and project managers to design a tall building that is secure and safe. There is greater concern about these issues in tall building design, particularly following the unfortunate 9/11 incident. Natural disasters, terrorism, indoor air quality, hazardous materials, and fire are extremely important and pressing issues to consider while designing.

It is very important to know what technology can and cannot do to make the project a success. New technology and new materials come very rapidly, and therefore we have to keep an eye on these developments. The various requirements of our changing business and lifestyle also compel us to keep an eye on the developments in technology.

4.5 PSYCOLOGICAL IMPACT ON SPACES IN ARCHITECTURE

Architecture is not simply about functionality or aesthetics-it profoundly affects our mental and emotional health. The psychological effect of the architectural design penetrates into subtle but influential realms of human experience, influencing the way we feel, think, and interact in a space.



Fig no 3: As Per relation between space and architecture with their psycological impact

The most important determinants of this psychological bond are the strategic application of light, enhancing circadian rhythms and mood; spatial layout, which influences privacy, interaction, and wayfinding and biophilic design that re-establishes our bond with nature to alleviate stress and improve cognitive function; and acoustic design, which controls sound to preserve comfort and focus. By combining these, architects can design spaces that foster body and mind. it is important to research on those topic to help for design development process.

4.6 RECOMMENDATIONS FOR SUSTAINABLE HIGH-RISE DEVELOPMENT

To enhance psychological well-being in high-rise environments, this study suggests the following:



Fig no 4: As Per Article High-rise Construction in 21st Century

(Farid Ghasemi1, Navid Ghasemi2)

4.7 DESIGNING HIGH-RISE BUILDINGS FOR PSYCHOLOGICAL WELL-BEING

4.7.1 Incorporating Natural Light and Ventilation

Natural light is one of the most important factors in architecture because it helps in improving the psychological well-being of users. In high-rise buildings, increasing the exposure to natural light helps, enhancing sleep quality and reducing symptoms of anxiety, stress, and depression. It is important to improve mood and mental health for occupants. Also, in the office area, they improve the productivity of working people while using proper natural light in working spaces. Providing the large-window strategic placement of glass panels while designing the high-rise building helps enhance a sense of space and create a feeling of openness.

Introduction

One Central Park is one of the unique architectural buildings that prominently represents a residential complex in Sydney, Australia, and is a creative example of integrating nature into urban living. It was designed by Jean Nouvel and completed in 2013. The two towers (34 and 14 stories) are well thought out for their lush vertical gardens. One Central Park is transforming the city skyline into an energetic green oasis.



Fig no 5: External & internal view, One Central Park, Sydney, Australia.

Design Program

One Central Park is designed on the concept of vertical greenery on their facade, with consideration of human behaviour with nature. This was achieved because of a collaboration with botanist Patrick Blanc, resulting in 50% of the building's facade being covered in plants.

Key design elements include

Vertical Greenery: In this project, over 200 native Australian plant species, 38,000 native plants, are used throughout the buildings. Also, hydroponic planters are used across every floor. They are selected for their aesthetic appeal and for creating a musical composition of foliage and blooms.

Environmental Features: The green facades act as natural air purifiers, providing shade and improving air quality by absorbing pollutants & CO2 and releasing oxygen with the help of reducing the heat of the building microclimate. They also function as a natural solar control system.

Sustainable Water Usage: A recycled water system is used in which on-site stormwater collection and a blackwater treatment plant. Also, the use of a smart irrigation system, utilizing sensors and weather data, secures an optimal hydration and fertilization system that gives a sustainable approach to the development.

Sunlight Optimization: The use of a cantilevered mirror structure at the higher tower top, combined with heliostat mirrors on the shorter tower, captures and reflects direct sunlight into the shaded areas between the buildings spaces, optimizing the natural sunlight.

4.7.2 Provide Green Spaces and Biophilic Design

While designing the high-rise building users safety and their comfort is most important. Design should Incorporating natural elements which can significantly improve users well-being. Also use Biophilic design in building, which combined nature into the built environment and create a feeling of access to nature. Its helps to reducing stress and improved mood of users and give views of green spaces which create illusion of lower levels. In Biophilic design, use of shared garden space, rooftop parks, or communal green spaces which create a opportunities for users to interact and feel connected and reducing feeling of isolation and promoting social interaction. Natural element like indoor plant, water features, and use of natural materials create calm interior environment.

Introduction

Oasia Hotel Downtown is located In the heart of Singapore's densely packed Central Business District, it stands as an impressive building of innovative urban architecture. This 27-story "living tower," which was completed in 2016, the Oasia Hotel Downtown, is not just a building but a best experiment in integrating nature into the urban fabric, biophilic design, and creating a new standard for sustainability in tropical cities. and give unique buildings throughout urban contexts. and improve living conditions in the building.



Fig no 6: Green facade & big open zones to make livable spaces ,

Oasia Hotel Downtown, Singapore

Design Principles

The design of the Oasia Hotel Downtown is based on several key principles, like harmonious integration of nature and architecture. In this building there is extensive use of landscaping, both internally and externally, that creates a habitable space for biodiversity with a green plot ratio of 1100%. Throughout the building's red aluminum mesh façade are uses that act as a canvas for 21 species of creeping plants and give not only greenery but also vital habitats for users. And use of open-air sky gardens at regular intervals. Hotel designed to promote natural ventilation and reduce dependency on air conditioning. And also give such beautiful sky gardens, shielded by the preceding levels, offer visual transparency while considering and maintaining a comfortable microclimate that helps in indoor living comfort. The building is majorly filled with flowering plants, promotes biophilic design, and contributes to air purification. Overall, the Oasia Hotel Downtown specifies a design philosophy that prioritizes sustainability, biodiversity, and the creation of comfortable, naturally ventilated spaces. And feel like you're connected to nature.

4.7.3 Designing for Social Connection

high rise can bring people together and create them as a community. That used of Common Spaces and Lounges which Sharing good and well-planned common spaces like lounges, gyms, and work areas enables people to socialize and feel part of a community. in high rise building must consider Mixed-Use Developments concept in which Tall buildings with residences, offices, stores, and entertainment centers bring together different parts of society, that making the community lively.

high rise building should used Adapted Spaces that help Offering spaces adaptable for social, cultural, or leisure activities permits residents to enjoy community activities.

Introduction

Spire Edge office tower stands as an iconic landmark on a new IT park located in Manesar, Gurgaon, India. The first mainstream green office complex, it is a radical, unconventional and sustainable complex, which serves as a point of reference for future infrastructure development. The main tower id designed by Dr. Ken Yang with an iconic green ramp and water collecting scallops. The tower is a 21 storey building accommodating offices, auditorium, gallery and other facilities.



Fig no 7: Create social connection zoning that make a livable space, Spire edge office tower, Manesar, Gurgaon

Design Principles

It boasts of a 28 days water backup by collecting rainwater while water treatment is done through STP and ETP installed on site. The tower is designed so as to reduce the Urban Heat Island effect and also includes a green roof. Structural PT slab is employed to reduce consumption of steel.

Limiting the slab depth to 35 meter curtails energy consumption in excessive artificial lighting for optimum lighting of work spaces. Another remarkable feature is that the HVAC system, incorporating the reduced plate size, provides for 280sqftTN as against 200sqft/TN in BAU. Parking scalability results in efficient space utilization and a highly ventilated basement space is achieved through integrated cut outs in landscape which enhance its aesthetic quality, adding further to the iconic nature of the project. The Spire Edge building in Manesar, Gurgaon, stood to showcase sustainable and innovative architectural design. Environmentally friendly aspects directly into its infrastructure. For example, this structure incorporates green ramps that spill unimaginably in ecological terraces and gardens. The vertical landscapes areas creating a connection between the ground and the roof garden, integrating the building with nature. It has a features a self-sufficient water recycling system as well, where rainwater collected from landscaped areas and roof gardens is stored for reuse as per the need, providing an innovative irrigation key. The design features several eco-cells, which provide access to vegetation, daylight, and ventilation even at the parking levels, and serve as rainwater storage and pump facilities. Spire Edge Facade is cleverly designed with sunshade venetian blinds and light shelves, designed using solar path analysis based on the local solar path. It reduces heat gain and creates micro-climates that encourage energy efficiency. The building also features panoramic roof gardens and sky courts to create habitable spaces for occupants to meditate, socialize, and interact in a more nature-centric landscape. Unsplash collectively, these tenets stress social responsibility, climate adaptation, and the seamless integration of contemporary envelopes in the built environment within a more ecological context.

5. CONCLUSION

In short, the psychological effect of working and living in high-rise buildings depends greatly on the quality of urban infrastructure and the intentionality of their design. As cities continue to sprawl upward to accommodate multiplying numbers, it is more critical that these towering verticals do more than merely house or provide workspace—they must work actively to improve the mental and emotional health of their inhabitants. Well-designed architectural space that incorporates greenery, natural light, ventilation, and noise mitigation can turn high-rise living and working space into environments that promote calm, comfort, and community. More than function or beauty, these elements are critical in minimizing stress levels, concentrating the mind, and cultivating a sense of belonging. Ethical human-centered and sustainable design enables architects and developers to reimagine high-rises not as isolating or suffocating space, but as adaptive, supportive, and thriving communities in the sky. By balancing urban development with the wisdom of psychology, environmental science, and social dynamics, we can construct urban infrastructures that raise not just the skyline, but the quality of life for all who live and work in them.

REFERENCE

[1]https://www.maisonvalentina.net/en/news-events/the-interlace-singapore-world-building-of-the-year-winner

[2]https://www.jeannouvel.com/en/projects/one-central-park/

[3]https://www.shutterstock.com/image-photo/new-york-ny-december-9-2016-646635184

[4]https://global.ctbuh.org/resources/papers/download/1836-case-study-one-central-park-sydney.pdf

[5]https://www.mdpi.com/2075-5309/13/9/2362

[6]https://archello.com/story/99190/attachments/photos-videos/1

[7]https://www.peverellicode.com/en/design/biophilic-design-a-guide-for-harmony-between-nature-and-interior/

[8]https://www.archdaily.com/963706/back-to-basics-natural-ventilation-and-its-use-in-different-contexts

[9]https://www.forbes.com/sites/jennifercastenson/2021/04/28/fluid-spaces-are-the-future-of-better-housing-and-community/

[10]https://www.jessupmfg.com/blog/fire-safety-in-high-rise-buildings-unique-challenges-and-solutions.html

[11]https://uni.xyz/journal/transforming-early-education-through-chi

[12]https://parametric-architecture.com/sustainable-technologies-for-high-rise-buildings/

[13]https://medium.com/@sammorrow_21970/model-scale-a-floating-object-toyo-ito-b58686cc7987

[14]https://www.archdaily.com/800878/oasia-hotel-downtown-woha/5845df59e58ece101300004f-oasia-hotel-downtown-woha-image

- [15]https://www.archdaily.com/800878/oasia-hotel-downtown-woha/5845dee3e58eceb519000158-oasia-hotel-downtown-woha-image
- [16]https://www.archdaily.com/800878/oasia-hotel-downtown-woha/5845deffe58eceb519000159-oasia-hotel-downtown-woha-image?next_project=no

[17]https://www.bestinteriordesigners.eu/top-architects-jean-nouvel/

[18]https://www.architecturalrecord.com/articles/10084-shanghai-tower

[19]https://www.sohu.com/a/432864620_661262

[20]https://1428brickell-residences.com/

[21]https://www.proptiger.com/gurgaon/spire-world-edge-sector-17-12403709/2bhk-2t-1080-sqft-apartment

[22]https://shift.org.in/spire-edge.php

[23]https://www.ijss-sn.com/uploads/2/0/1/5/20153321/ijss-isi_jul_oa09_- 2017.pdf(Farid Ghasemi1, Navid Ghasemi2)

[24]https://www.sciencedirect.com/science/article/pii/S1877705817318398 (Tayyab Ahmada,*, Ajibade Aibinua, Muhammad Jamaluddin Thaheemb)

[25]https://www.researchgate.net/publication/323580885_Socioecological_Aspects_of_High-rise_Construction (Michael ,Eichner1* and Zinaida Ivanova2)

[26]https://www.researchgate.net/publication/271891350_Sustainable_development_of_high-rise_building (Pan Fenga, Wu Xingkuanb)

[27]<u>https://www.mdpi.com/2078-1547/10/2/34</u> (Danica-Lea Larcombe 1,2,* , Eddie van Etten 1 , Alan Logan 2, Susan L. Prescott 2,3,4 and Pierre Horwitz 1)