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The Effects of Surrounding Factors on Building Health in Urban Neighbourhood

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Abstract: ***Urbanization has become an increasingly important factor in the lifespan of buildings. As the population in urban areas continues to grow, many buildings fail to reach their expected life expectancy of 50-60 years due to multiple factors. In addition to poor construction, climate, architecture plan and design, material quality, human errors, health monitoring, geological conditions, and natural disasters can all adversely affect the building health. This paper examines the connection of urbanization and the deterioration of buildings and explores the various components contributing in the construction and post-construction stages. It also discusses the various factors that impact building health and whether it measures the impact on buildings. Lastly, it examines the climate impact on buildings and the measures that can be taken while designing and post-construction. The paper concludes that city development directly impacts the speed of building deterioration. To keep buildings healthy and sustainable, it is important to contemplate all the factors that can influence the building health and to measure the impact of these factors, incorporate project management and quality control practices into architectural design and implementation, and to take steps to mitigate the effects of climate change. By doing so, urban infrastructure-building life spans can be extended, and buildings can be kept in good condition for longer periods of time.***
Keywords: Urbanization, Architecture, Climatic factors, building health, urban habitat.

I. INTRODUCTION

Relation between urbanization and span of building deterioration. Urbanization can have an impression over the speed of building deterioration. Urbanization brings population expansion density and often an increased level of pollution, both of which can speed up the breakdown of building materials. Urbanization can also increase the number of people using and occupying buildings, which can contribute to the wear and tear of a building. Increased traffic, both pedestrian and vehicular, can also cause vibrations that can take the lead to building deterioration. In addition, city sprawl can be in the lead to a absence of green spaces, which can reduce the degree of shade and ventilation a building receives, leading to an increased rate of deterioration.

The steps of the maintenance of the building are divided into 3 types.

1) Architect's planning and designing. (Initial Stage)
2) Constructions at the period of the construction and at the moment of the work. (Execution Stage)
3) Structural health. (Completion, repair, and maintenance)

The agencies, which are integrated into the above 3 types, do a lot of quality control and work viz. architects and planners, contractors and structural designers – auditors. They are critical caretakers to maintain the structural health of any building throughout the process. The resolution of the structure and the solution thereto is not only a part of the completed work, but it starts immediately after the selection of the place is done in the planning phase. If we follow the rules and regulations and standards of materials and technology for the ongoing work, then definitely health will improve, and construction time and expenses will be reduced. It is difficult to find a single composition without a list of glitches, cracks, footing collapses, fractures in the concrete, and structural changes for interior design. Identification of such problems and the solution is another way for us. The best adaptation of the practices by related agencies will make the structure more sustainable and durable in the long term.

II. NEED OF PROJECT MANAGEMENT AND QUALITY CONTROL RELATED PROFESSION IN ARCHITECTURAL DESIGN AND IMPLEMENTATION

Project management and quality control are essential components of any architectural design and implementation project. To ensure the successful completion of a project, all stakeholders must be actively involved in the planning, execution, and monitoring of the project. Project managers and quality control professionals help to ensure that the project is completed on time, within budget, and according to the desired specifications. They also help to identify any potential risks or issues that could arise during the project and provide solutions to mitigate those risks.

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List of factors that impact building health. Whether here is a demand to measure the impact on buildings?

1) *Air Quality:* Poor air quality can convert in to a variety of health issues, including respiratory and cardiovascular ailments. The presence of pollutants, dust, mold, and other allergens in the air can cause headaches, fatigue, and other symptoms. It is important to measure air quality in buildings to ensure that it is safe for occupants.
2) *Temperature and Humidity:* Temperature and humidity levels can have a significant impact on the health of building occupants. Too much humidity can create ideal conditions for mold growth, while too little humidity can cause dry skin, nosebleeds, and other health issues. Temperature extremes can cause problems such as heat exhaustion or hypothermia.
3) *Lighting:* Poor lighting can cause eyestrain, headaches, and fatigue. Natural light is the most beneficial, but even artificial lighting can be improved with the right placement, design, and type of bulb.
4) *Ventilation:* Poor ventilation can cause air quality to decline quickly. It is important to ensure that there is adequate ventilation to keep the air fresh and clean.
5) *Water Quality:* Poor water quality can convert in to a variety of illnesses, including gastrointestinal issues. It is important to test the water regularly to ensure that it is safe for drinking and bathing.
6) *Structural Integrity:* Poor structural integrity can convert in to a variety of health issues. Cracks and other structural issues can cause mold growth, lead to water damage, and create conditions for other harmful pollutants.

Here is a need to measure the impact on buildings. Buildings are complex systems, and it is important to understand how the various components and factors interact with each other to ensure the best possible health and safety of occupants. Regular inspections and measurements can help to identify problems and ensure that buildings remain healthy and safe. In the above-listed factors, all are natural things except one that is “Structural Integrity”. The experts can hold and manage things by maintaining the quality of the components involved in the construction and post-construction stages.

III. LITERATURE REVIEW

This paper examines the correlation of city development and the span of building deterioration, exploring the various components involved in the construction and post-construction stages, and discussing the various factors that impact building health, as well as whether there is an essential to measure the impact on buildings. The literature review will cover research conducted on the topics of urbanization, building deterioration, and climate change, as clearly as the various components and measures that can be taken to improve the building health.

Urbanization and Building Deterioration: Sukumar et al. (2017) conducted a study to determine the correlation of city development and building deterioration. The study found that increased urbanization, in terms of population density, pollution levels, and traffic, can convert in to an increased rate of building deterioration due to factors such as the wear and tear of building materials, vibration from traffic, and a absence of green spaces that can reduce the level of shade and ventilation a building receives. The study concluded that it is essential to consider all of the factors that can influence the building health in a sequence keep buildings healthy and sustainable.

Climate Change and Building Health: Jana et al. (2018) conducted a study to examine the impact of climate change on building health. The study found that extreme weather events, such as floods, hurricanes, and extreme temperatures, can have a significant effect on the integrity of a building. The study discovered that more subtle changes, such as prolonged periods of drought or periods of higher temperatures, can also have an effect on the building health. The study concluded that it is crucial to take measures to alleviate the effects of climate variation in both the planning and post-construction stages.

Components and Measures to Improve Building Health: Kumar et al. (2016) conducted a study to examine the various components involved in the construction and post-construction stages and the measures that can be taken to improve the health of buildings. The study found that it is important to believe all of the factors that can influence the building health, such as air quality, temperature and humidity levels, lighting, ventilation, water quality, and structural integrity. The study also discovered that it is important to measure the impact of these factors on buildings and to incorporate project management and quality control practices into architectural design and implementation. The study concluded that by taking these measures, it is possible to improve the building’s health and increase their life expectancy.

IV. RESEARCH METHODOLOGY

The research methodology used in this paper is a combination of qualitative and quantitative methods. Qualitative methods include literature reviews and surveys, while quantitative methods include statistical analysis. For the literature review, research was conducted on the topics of urbanization, building deterioration, and climate change, as well as the various components and measures that can be taken to improve the building’s health.

Relevant articles, reports, and books were reviewed to gain an awareness of the topics and the current state of the research. For the survey, a survey was designed to collect data on the impact of city development on building deterioration and the measures that can be taken to improve the building's health. The survey was distributed to a sample of architects and structural engineers and the responses were analyzed to gain insights into the topics. For the statistical analysis, data were collected from public sources such as the World Bank and analyzed to gain insights into the correlation of city development and building deterioration. Overall, this research methodology combines qualitative and quantitative methods to gain a comprehensive understanding of the topics and to provide a well-rounded analysis of the research.

V. VARIOUS COMPONENTS INVOLVED IN THE CONSTRUCTION AND POST-CONSTRUCTION STAGES

1) *Excavation:* The bearing capacity of the soil is an important thing to realize. For this, it is important to send the safe bearing capacity of the land to the structural engineer for RCC design. It has to be kept in mind that the level of excavation must be as much as the depth of the soil sample taken for testing. Due to ignorance of the depth of the soil sample and the level of footing construction may be different. Also, the soil may expand or shrink which causes settlement or puncture of soil due to footing.
2) *Architectural Planning Criteria and Rules:* Architectural construction can be done by following the rules directed by the local municipal authorities very frequently. More FSI, additional construction, and change in use can be avoided. While constructing the building, the architect can study the pattern of the site, the needs of the customers, the weather conditions, and the area. Planning the habitable space following the Sun path and the Wind flow can be the main study for the best health of the building. A façade may play an important role as it may be impactful due to these natural conditions so it can be designed according to the main guidelines.
3) *Human Error During the Stages of Construction:* Unskilled workers cannot read sketches and maps of areas related to architecture. The wrong meaning of the things on the map can convert in to permanent mistakes in the building. Pre-term incomplete processes e.g. Early removal of shuttering, inadequate watering, improper mixing of ingredients, and quantity can reduce the health of the building. Changes in the permissible use and additional loads over already granted floor space can cause permanent structural damage.




Fig 1: Slab Leakage. Source: www.connectedrestoration.com
Fig 2: Open Steel Bar

4) *Geological Conditions and Natural Disasters:* Flood, lightning, earthquakes, storms, man-made attacks, fires, landslides and groundwater rise can cause damage or partial damage to the building; which cannot be repaired. While constructing the building, different soil levels and the load-bearing capacity of any region can be studied. Various disasters can make the region unsafe, and it can have a direct influence on the health of the building if the agency's administration made is failing.




Fig 3: Structurally Cursing, Source: www.downtoearth.org.in
Fig 4: Neglected Building Service. Source: sourceable.net

5) *Construction Material Quality:* Various construction materials can be purchased from the same vendor as possible, which may maintain the same quality and harmony. Proper stacking space may be provided on the site to maintain the quality of the content. According to the Indian Standard Code, construction material can be purchased. Due to this, development and construction quality can be maintained for the building health.
6) *Weather Conditions and Environment:* The weather conditions are different for each region. The climate is divided into six ways across the world. Considering the air pressure, wind, heat, cold, and soil the ways are decided. These factors are having a strong impact on health. In all types of buildings, e.g. Residential, commercial, institutional, industrial, etc. The impact of the weather is very important in places, especially residential buildings. These buildings are used 24 x 7 by humans. Green Techniques will help ie economic development to move forward in a sustainable way that has the most impact on the environment and to adapt the circumstances naturally to climate changes. The increasing demand for energy creates a challenge for promotion, creation and distribution, architectural skills, and a need to discover new knowledge.
7) *Repair and Maintenance after Construction:* Post-construction repair and care is a technical process that has been activated or treated at the post-construction level by skilful structural auditors. The post-construction structural health system has been greatly emphasized, but the 'pre-construction' and 'ongoing construction phase of a structure is equally important to provide the minimum requirement of processes and guarantee the best quality so that the project will be economically sustainable for the long term. When considering the new approach to health reforms mentioned above, mainly three initial stages should be considered: architectural construction and planning, structural and RCC design and construction zones where the major role of the architect, structural engineer and contractor has been defined.

VI. LIVE CASE STUDY OF A BUNGALOW

1) Building: Residential Bungalow
2) Established: 1980 (42years)
3) Construction Type: Load Bearing ground floor structure
4) B/U area: 835 Sq.Ft.
5) Soil: Murum at 1.5m
6) Surrounding: East- G+5Residential Apartment

South- Road, West- Access Road, North- Building

1) Access Roads: South and West
2) Climate: Hot and Dry
3) Building Materials: Stone, Brick, Cement Mortar, Cement Concrete, Wooden frame openings, steel.

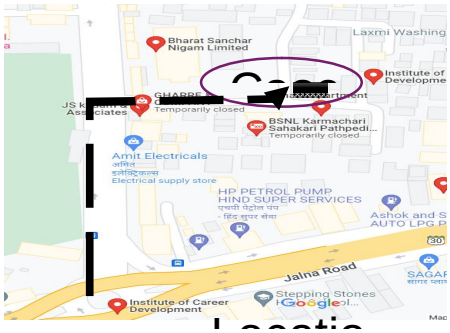


Fig 5: location map, Source: author

A. *Sun, Wind Directions*

In the Marathwada region, the sun path is moving from east to west through a south tilt, the maximum time of the year. Also, the wind direction is from South West to North East.
The orientation of the building is East-West.
There is no direct sunlight from the East due to the tall apartment.

B. *Information On Habitable Room*

Sr. no.	Habitable Room	Length (m)	Width (m)
1	Verandah	4.5	2.0
2	Living hall	4.5	3.3
3	Dining room	3.65	3.0
4	Kitchen	4.2	2.4
5	Bedroom	3.9	3.0
6	Bathroom	2.4	1.2
7	W.C.	1.2	0.9

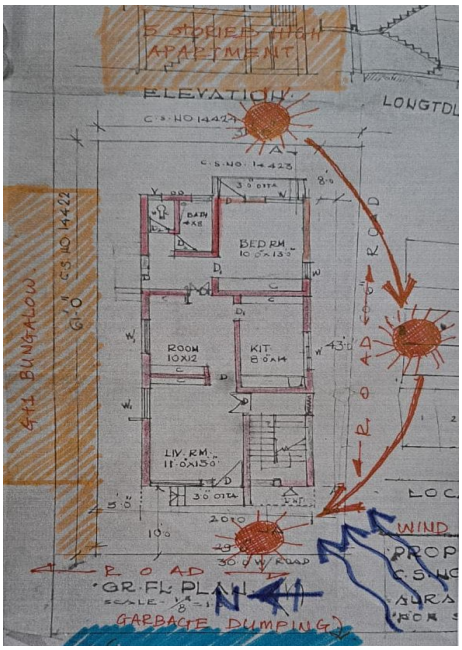


Fig 6: Sun and Wind flow, Source: author

Air, And Noise Quality Values

To assess the quality check, Mobile apps have been used namely

1) Compass- to fix the North and orientation of the building
2) Sound Meter- to notice the surrounding Noise in dB.
3) AQI – to measure AQI and other parameters
4) Sun's path- to study the sun path in summer and winter for the Aurangabad region



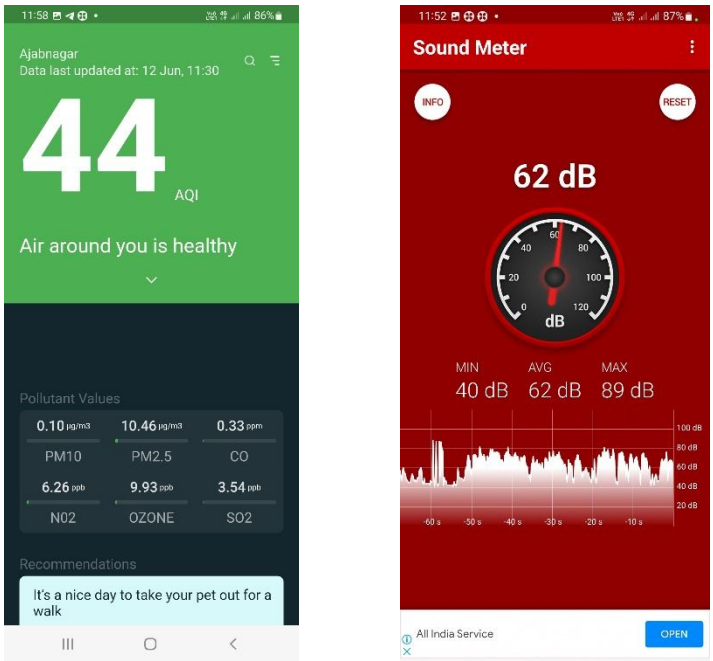


Fig 7: Façade image with AOI and Sound meter, Source: Author

a) Rain Water retention till its evaporation
b) Fungus growth and its Polans due to huge quantity of garbage dump yard in front of the entrance
c) Decay at the wall and flooring joint.

C. Fungus And Algae


Fig 8: Fungus and Algae, Source: author

D. Construction Techniques
1) Load-Bearing Structure.
2) Stones are used in Plinth
3) 0.23 thick Brick walls
4) RCC slabs and roof beams



Fig 9: Affecting factors on health of the building, Source: Author

E. Building Elements

The sill level is taken at 3'6" (1.05 m), All windows' height is 3'6" (1.05 m) above sill level.

F. Deterioration Of The Building

The dampness, Cracks at lintel level, cracks in brackets at roof level, fade of colours.

VII. FINDINGS AND OBSERVATION

1) The south side, where the highest heat generates, is treated with vegetation, high compound wall and elevational treatment of vertical fins. Thus direct sunlight breaks and the interior remains comfortable.
2) Moisture, Dampness, Seepage, Fungus and Capillary action in the lower wall area and in the building elements are commonly seen.
3) Air Quality Index, Noise level, Temperature, CO2 emission, and Humidity values are moderated after random checking.
4) The wind blows in the Living room and verandah, no natural wind in the remaining part of the house.
5) There is no direct sunlight from any direction in the house. Only ambient light is experienced.
6) Stinky smell throughout the year due to garbage dump yard, the result is, the owner keeps west side windows closed always.
7) Colour Fading of external elements, a few cracks at bracket beam, chajja (steel corrosion), and joints are seen.
8) Shrubs are grown on the terrace parapet wall, causing seepage.

VIII. CLIMATE IMPACT ON THE BUILDING. MEASURES TO BE TAKEN WHILE DESIGNING, POST CONSTRUCTION.

Climate impact on the building can range from extreme weather events such as hurricanes, flooding, and extreme temperatures to more subtle changes such as prolonged periods of drought or periods of higher temperatures. All these climate-related events can influence the integrity of the building and its ability to function as intended.

IX. POST-CONSTRUCTION MEASURES THAT CAN BE TAKEN TO HELP ALLEVIATE THE EFFECTS OF CLIMATE CHANGE

1) Regularly maintain and inspect the building to ensure it is functioning as intended.
2) Utilizing energy-efficient lighting and appliances.
3) Installing and maintaining weatherstripping, insulation, and other weather-proofing materials.
4) Utilizing natural ventilation systems to decrease the need for air conditioning.
5) Utilizing water-efficient fixtures such as low-flow faucets and showerheads.
6) Utilizing solar and wind power as renewable energy sources.
7) Installing green roofs and other vegetation to help reduce the extent of heat absorbed by the building.

X. CONCLUSION

The health of buildings is an important factor that affects their longevity, integrity, and sustainability. Climate change has a significant impact on buildings and must be taken into consideration when planning and building structures. To mitigate the effects of climate change and ensure healthy and green buildings, it is vital to respect all of the factors that can influence the building's health. This includes air quality, temperature and humidity levels, lighting, ventilation, water quality, structural integrity, and climate. In supplement, it is crucial to incorporate project management and quality control practices into architectural design and implementation, and also, to utilize sustainable building materials, energy-efficient design features, and renewable energy sources. Post-construction measures such as regular maintenance and inspections, utilizing energy-efficient lighting and appliances, and utilizing water-efficient fixtures can also help to ensure that buildings remain healthy and safe. The influence of urbanization must also be taken into account, as it can increase population density, pollution levels, and traffic. By taking these measures, it may be possible to improve the building's health and increase its life expectancy.

XI. ACKNOWLEDGMENT

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REFERENCES

References from journals:

[1] Jayakumar Jivraj Shah, Oct. -November-December 2017. "Good Construction Structures of The Way of Building Sustainable Buildings Part 2," I. s. E. s. E. Quarterly Journal, vol. 2019-4, p. 13

[2] Jayakumar Jivraj Shah, Jul-August-September 2017."The Best Construction Practices for Building Sustainable Buildings, Structures Part 1," I. s. E. s. E. Quarterly Journal, vol. 19-3, p. 8-15

[3] Teresa, M., Larriva, B., Sofía, A., and Forcada, N. (2022). "The effect of climatic conditions on occupants' thermal comfort in naturally ventilated nursing homes." *Building and Environment*, Elsevier Ltd, 214, 108930.

References from books:

[4] Arun Kelkar, F. E. 2015, Building- (structural audit, repairs and restoration) guidebook, Majestic Publishing house. 129 pp

Er. R. B. Chaphalkar, F.E. 2007, My Construction Practices, Vikram Printers, Pune, 251pp

References from the internet:

[5] www.connectedrestoration.com (visited: 25.2.22)

[6] https://www.nbmcw.com/product-technology/construction-chemicals-waterproofing/waterproofing-repair-chemicals/necessity-of-health-monitoring-of-structures-constructed-before-2000-across-india.html(visited: 25.2.22)

[7] https://www.linkedin.com/pulse/building-orientation-hot-dry-climate-majdi-ayeb/ (visited: 26.2.22)

[8] https://www.prodyogi.com/2017/06/quality-control-of-concrete.html (visited on 26.2.22)

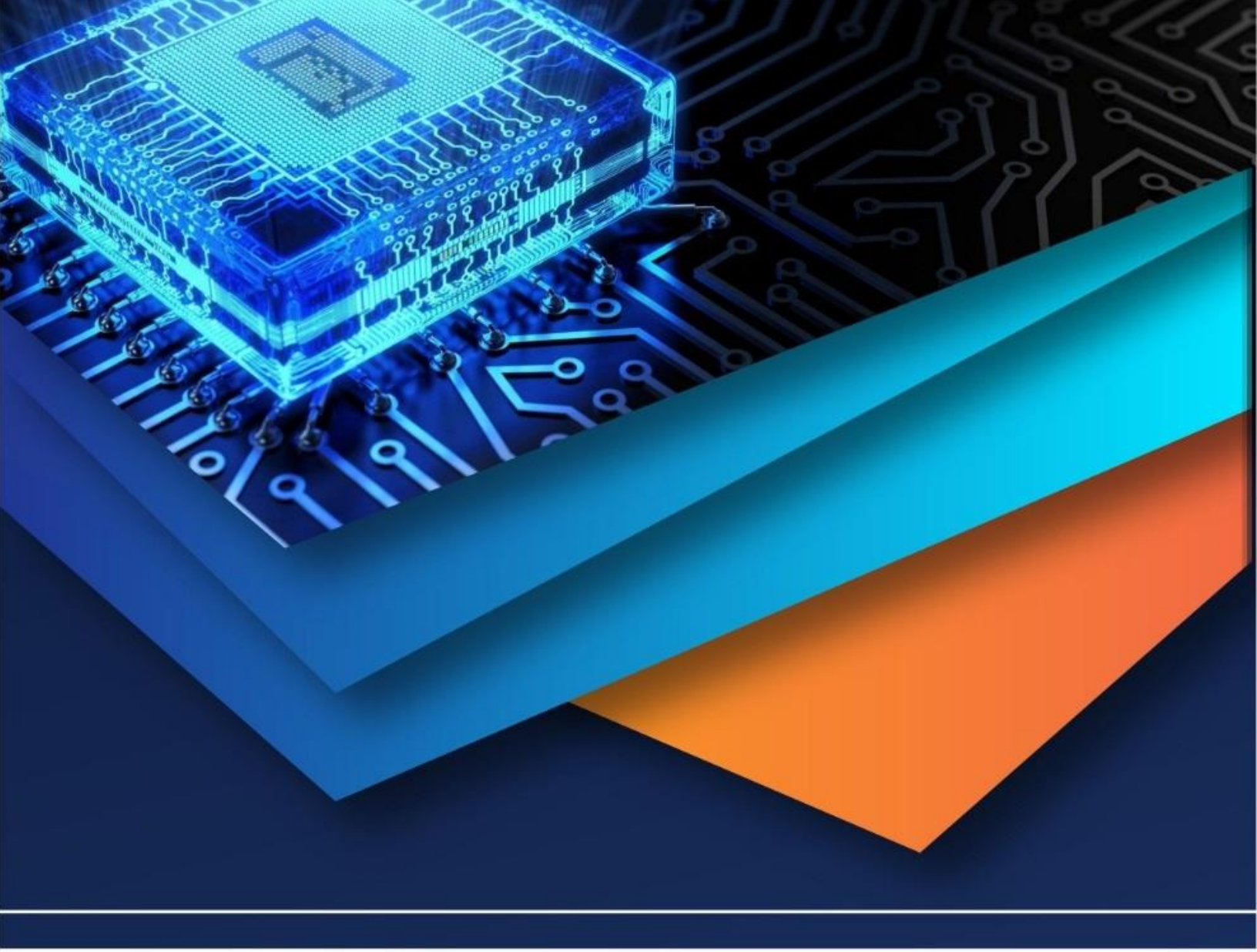
[9] https://www.nbmcw.com/product-technology/construction-chemicals-waterproofing/waterproofing-repair-chemicals/waterproofing-importance-of-filling-cracks-joints-voids.html (visited: 26.2.22)

[10] https://www.downtoearth.org.in/news/urbanisation-making-us-more-susceptible-to-natural-disasters-says-global-report-42561 (visited: 26.2.22)

[11] https://www.bigrentz.com/blog/healthy-buildings https://www.scirp.org/journal/paperinformation.aspx?paperid=120135

[12] https://tigertmt.com/blog/why-buildings-deteriorate.php

[13] https://www.mapfreglobalrisks.com/en/risks-insurance-management/article/fatigue-in-materials-a-key-factor-in-the-lifespan-of-structures/



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