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INNOVATIVE ARCHITECTURAL DESIGN TO COUNTER AND LIMIT DAMAGES CAUSED BY NATURAL DISASTERS – EARTHQUAKE & FLOOD

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BACKGROUND

In recent years, the world has experienced an increase in the frequency and severity of natural disasters, such as earthquakes and floods. These disasters have devastating effects on both human lives and property, especially in vulnerable regions with inadequate infrastructure and building design. To address this challenge, innovative architectural design has been proposed as a solution to mitigate the impact of natural disasters.

Innovative architectural design to counter and limit the damagse caused by natural disasters has become a key factor for all design been rolled out into the making. The recent earthquake disaster in Syria caught the attention of construction industry and by that the design industry as well.

This factor has once again gained immense importance for the design sector as such disasters cannot be averted by man kind. Hence our design ideas need to be changed with individual attention to these kind of occurences prone to the city, zone or country where the design is to be created and built.

Natural disasters are the result of a hazard overwhelming highly vulnerable community, often resulting in mortality and morbidity. Over the past decade, over 300 natural disasters occur yearly around the world affecting millions and cost billions.

SUBJECT MATTER –

Resilient and adaptable housing designs that can withstand strong earthquakes and flooding without compromising the comfort of the occupants.
Elevated homes or buildings that are constructed above flood-prone areas, allowing occupants to escape the floodwaters and minimize damage to the structure.
Eco-friendly and sustainable architectural designs that incorporate materials that are both durable and environmentally friendly, reducing the impact of the structure on the surrounding environment.
Earthquake-resistant building designs that utilize innovative engineering techniques and materials, such as base isolation and flexible frames, to reduce the impact of seismic forces.
Building designs that incorporate natural flood control methods, such as rain gardens and bioswales, to help reduce the likelihood of flooding and minimize damage in the event of a flood.
Designs that utilize modular construction techniques, allowing for rapid deployment and easy relocation in the event of a natural disaster.

NEED –

Innovative architectural design has become increasingly important in the face of the growing frequency and severity of natural disasters, such as earthquakes and floods. These disasters can cause significant damage to homes, buildings, and communities, resulting in loss of life, property damage, and economic instability. As such, it is essential to develop innovative architectural designs that can withstand the impact of natural disasters, minimize damage, and ensure the safety and well-being of occupants. Such designs can incorporate resilient materials, advanced engineering techniques, and smart technologies to help prevent or mitigate the effects of natural disasters, ultimately helping to create more sustainable and resilient communities.

ISSUE-

Natural disasters can have significant and far-reaching impacts on individuals, communities, and entire regions. From earthquakes and floods these events can cause widespread destruction and displacement, resulting in loss of life, damage to property and infrastructure, and economic disruption. Natural disasters can also exacerbate existing social and economic inequalities, particularly affecting vulnerable populations such as low-income individuals, minorities, and marginalized communities. Climate change is contributing to the increasing frequency and severity of natural disasters, highlighting the urgent need for effective mitigation and adaptation strategies. Addressing the issues related to natural disasters requires a multi-faceted approach that involves proactive disaster preparedness, innovative architectural design, and equitable distribution of resources and support services.

SCOPE OF STUDY –

The scope of study for innovative architectural design that can counter and limit damage caused by natural disasters such as earthquakes and floods is extensive and multifaceted. It involves understanding the scientific and engineering principles behind these events, identifying the potential risks and vulnerabilities of existing structures, and developing innovative design solutions that can enhance resilience and reduce the impact of natural disasters. This requires a comprehensive understanding of materials, technologies, and design strategies that can be utilized to create durable, adaptive, and sustainable structures that can withstand the forces of natural disasters. Additionally, a deep understanding of the social, economic, and environmental factors that influence the impact of natural disasters is crucial to ensure that the resulting designs are equitable and sustainable for all communities.

ABSTRACT

This paper aims to study, apply and successfully design a model for innovative architectural design of settlements to counter and limit the damage caused during such disasters.

A completely self sustainable & resilient township averting huge damage by such natural disasters and helping in maintaining a balance with regards to the necessity of humans in such troubled time. Finally, the paper will conclude with recommendations for future research and practical applications of innovative architectural design to enhance resilience against natural disasters.

Overall, this research paper aims to contribute to the development of innovative architectural design strategies that can mitigate the impact of natural disasters, protect human lives and property, and foster sustainable development

Study will seek limited relative case studies and other part will be sought from literature and available sources.

KEYWORDS –

Counter, Limit, Natural Disaster, Innovative design and technology.

INTRODUCTION –

Natural disasters, such as earthquakes, floods, and wildfires, pose a significant threat to human lives and property. In recent years, the frequency and intensity of these events have increased, due in part to climate change and human activity. Traditional building designs and construction practices are often inadequate to withstand the forces of natural disasters, resulting in devastating consequences. Innovative architectural design has emerged as a solution to mitigate the impact of natural disasters on buildings and infrastructure.

The objective of this research paper is to explore innovative architectural design solutions that can counter and limit damages caused by natural disasters. It will provide an overview of innovative architectural design principles and techniques that have been proposed to mitigate the effects of natural disasters.

The paper will also review case studies of innovative architectural design solutions that have been implemented in various regions around the world. These case studies will provide insight into the effectiveness of different design strategies and materials in reducing damages caused by natural disasters.

Additionally, the paper will discuss the role of smart technology in innovative architectural design, including the use of sensors and monitoring systems to detect potential hazards and alert occupants to evacuate in case of an emergency.

Yearly 60,000 people die to due to earthquake. In 2020, 6000 people died due to floods.

Earthquake are usually caused when underground rock suddenly breaks and there is rapid motion along a fault. This sudden release of energy causes the seismic waves that make the ground shake.

Earthquakes can result in ground shaking, soil liquefaction, landslides, fissures, avalanches, fires and tsunamis. The extent of destruction and harm caused by an earthquake depends on its magnitude, intensity and duration.

CASE STUDY –

The Torre Mayor ("Major Tower") is a skyscraper in Mexico City, Mexico. With a height of 225 meters (738 feet) to the top floor and 55 stories, it is the third tallest building in Mexico. The building was designed by the architectural firms of Zeidler Partnership Architects and Executive Architects Adamson Associates Architects. The structural engineers and designers were The Cantor Seinuk Group from New York City. Located at Paseo de la Reforma.

Construction work began in 1999 and was finished in late 2003. Due to Mexico City's high propensity to earthquakes, the tower incorporates several anti-earthquake measures. Torre Mayor is one of the strongest buildings on Earth in terms of earthquake resistance, being designed to withstand earthquakes measuring 8.5 on the Richter Scale.

The Torre Mayor stands in the lakebed area where most of the 1985 earthquake damage occurred, It was built with 96 dampers, which work like car shock absorbers to block the resonating effect of the lakebed and its own height. These diamond-shaped dampers are seen architecturally on its perimeter. With this extra bracing, this tower can withstand earthquake forces nearly four times as efficiently as a conventionally damped building. The dampening system proved its worth in January 2003, as a 7.6 earthquake shook the city. Not only did the building survive undamaged, occupants inside at the time did not know a tremor had occurred.

Torre Mayor's elevators have a seismic detector that detects any movement of earth and therefore automatically stops the elevator nearest to allow passengers to get off. The Torre Mayor is administered by the Building Management System (BMS), an intelligent system that controls all facilities and equipment harmoniously and efficiently to protect human life from danger.

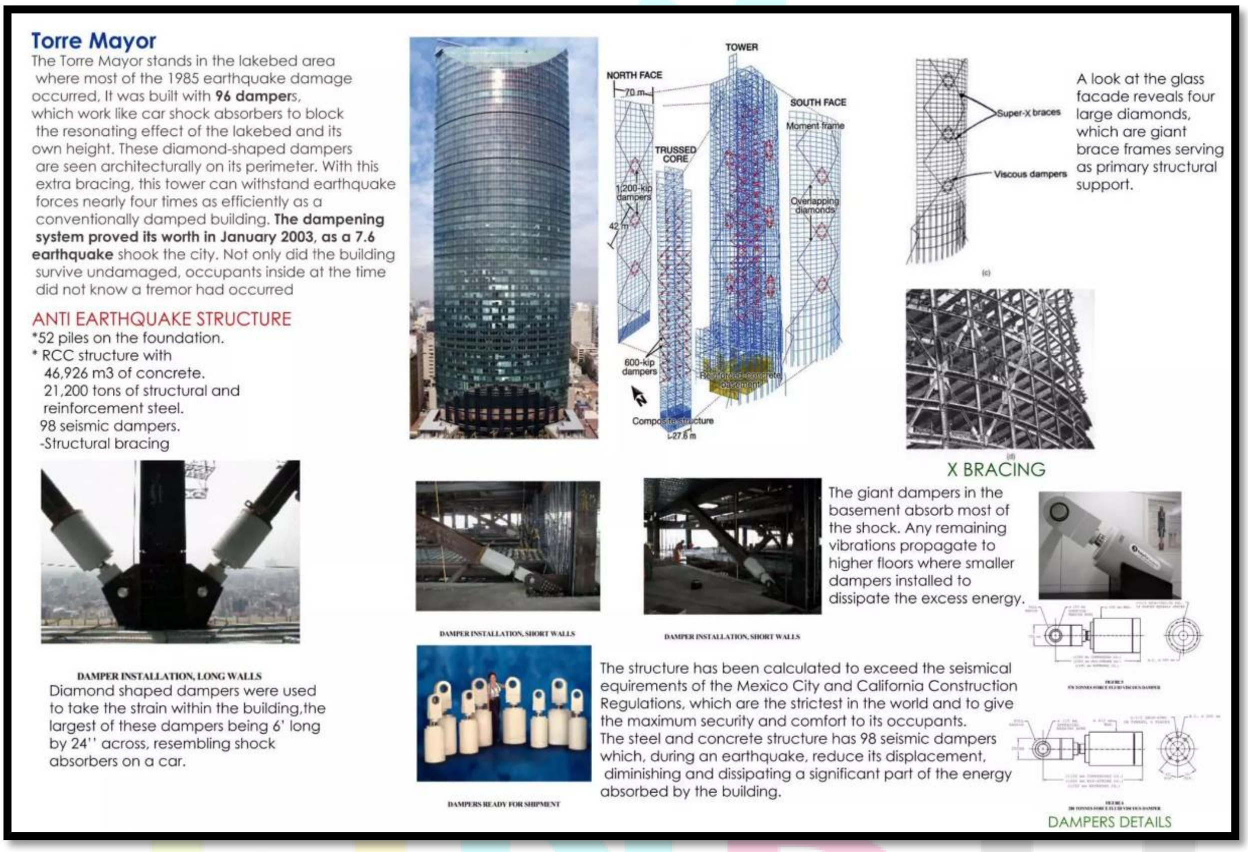
The integrated system has the ability to control elevators, fire protection and lighting in the building and it is considered an intelligent building like that of many other buildings in Mexico City. The floors' underground injection machines have fans and fresh air exchange to prevent excessive concentration of pollutants entering the building, which is also linked to the intelligent building system.

The design of the Torre Mayor incorporates several features that make it earthquake-resistant. One of the key design elements is a unique structural system called the "mega-brace." This system consists of four large steel braces that run diagonally through the building's core, connecting the floors and providing additional support. The mega-brace system is designed to distribute the energy generated by seismic activity evenly throughout the building, reducing the risk of structural damage.

Another critical design feature of the Torre Mayor is the use of damping systems to absorb seismic energy. The building is equipped with 96 viscous dampers, which are hydraulic cylinders that absorb the energy generated by seismic waves. The dampers act like shock absorbers, reducing the building's movement during an earthquake and protecting against structural damage.

In addition to its structural features, the Torre Mayor is also designed with safety measures to protect its occupants during an earthquake. The building has emergency generators that can provide power in the event of a power outage, as well as emergency lighting and water supply systems. The building also has a sophisticated seismic monitoring system that can detect seismic activity and automatically shut down elevators and other critical systems in the event of an earthquake.

The construction of the Torre Mayor required a high level of engineering expertise and attention to detail. The building's foundation was designed to withstand the powerful forces generated by earthquakes, with 492 piles driven into the ground to support the weight of the building. The building's walls are constructed of reinforced concrete, and the floors are made of steel and concrete.



CONCLUSION –

An innovative architectural design approach can greatly contribute to mitigating damages caused by natural disasters. By incorporating features such as flood-resistant structures, earthquake-resistant buildings, architects and designers can create structures that are more resilient to natural disasters. Additionally, the use of sustainable materials and energy-efficient technologies can make buildings more environmentally friendly and reduce their carbon footprint.

It is essential to recognize that natural disasters are unpredictable and can occur at any time, causing significant damage to both life and property. By implementing innovative architectural design approaches, we can not only reduce the damage caused by these disasters but also increase the safety and well-being of those affected. It is also important to note that the cost of rebuilding after a natural disaster is significantly higher than implementing preventive measures, making it a wise investment for individuals, communities, and governments.

Overall, an innovative architectural design approach to counter and limit damages caused by natural disasters is a crucial step towards creating sustainable and resilient communities. By prioritizing disaster-resistant design in our building practices, we can create a safer, more sustainable, and more resilient future for all.

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