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Redesign of Aluva Market

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Abstract
This project focuses on the redesign of the Aluva Market, aiming to enhance its functionality, aesthetics, and overall user experience. Aluva Market, a traditional market in Kerala, is a central hub for commerce and community engagement. The proposed redesign involves a comprehensive improvement of the market's utility system and an enhancement of its overall appearance while preserving its traditional characteristics. The project emphasizes a user-centric approach, considering the needs of both vendors and customers. The revitalization includes strategic layout adjustments, modern infrastructure integration, and sustainable design principles. By leveraging contemporary design practices, the project seeks to breathe new life into Aluva Market, ensuring its relevance in the rapidly evolving urban landscape. The anticipated outcomes include a more vibrant, efficient, and culturally rich market space that fosters economic growth and community cohesion. This project aligns with the broader goal of urban regeneration, promoting sustainable development and preserving the market's historical and cultural significance.

***Keywords*—Redesign, Utility system, Sustainable development, Economic growth**

I. INTRODUCTION

A. Aluva market

For decades, Aluva's market has stood as a venerable cornerstone of trade and commerce, deeply rooted in tradition and history. As a testament to the rich cultural heritage of Kerala, India, this marketplace has been the beating heart of economic transactions and community interactions. Yet, the passage of time has brought about contemporary challenges that now demand a thoughtful and comprehensive redesign to secure the market's enduring legacy.

The traditional charm and historical significance of Aluva's market have not shielded it from the challenges of the modern era. Persistent issues such as congestion and outdated infrastructure have cast shadows on its once-thriving vibrancy. Aluva Market stands as more than just a marketplace – it is a bustling center of commerce, culture, and community life. This traditional market holds a unique place in the local landscape, embodying the vibrant spirit and diverse offerings that characterize the region. Aluva Market is not merely a collection of stalls and shops; it is a tapestry of history, where generations have engaged in the age-old tradition of trade and shared moments of daily life. From the kaleidoscope of colors in the produce section to the lively exchanges between vendors and customers, Aluva Market encapsulates the essence of community and connectivity.

As we embark on the journey to explore and potentially redesign Aluva Market, we recognize the significance of preserving its rich heritage while addressing the evolving needs of the community and the marketplace itself. This introduction sets the stage for an in-depth exploration of Aluva Market, delving into its current dynamics, historical roots, and the potential for a thoughtful redesign that harmonizes tradition with modernity.

This project goes beyond the mere renovation of physical structures; it aspires to breathe new life into the essence of the market. The vision is not just to address the visible challenges but to rejuvenate the very spirit of Aluva's market. The mission is to create an environment where tradition seamlessly intertwines with modernity, ensuring that the market remains a vital hub for trade and commerce for generations to come. The introduction of this redesign is not merely a response to challenges; it is an acknowledgment of the market's enduring significance and a commitment to preserving its legacy. The project envisions a future where Aluva's market becomes a symbol of adaptive resilience, embracing contemporary solutions while staying true to its roots. In the following sections, we will delve into the multifaceted aspects of this transformative endeavor, exploring how improved working conditions, enhanced support services, and expanded business opportunities will collectively contribute to the revitalization of Aluva's market.

B. Historical background

Aluva (also known by its former name, Alwaye) is a municipality in the Ernakulam district of Kerala, India, Situated 14.5 km from Kochi, along the banks of the Periyar River, and is a part of the Kochi metropolitan area. Aluva is a transportation hub, connecting North Malabar and Central Kerala to Kochi. The Cochin International Airport at Nedumbassery, located 11.7 km from Aluva, is an aviation hub hosting both domestic and international flights. Aluva is also the northern terminus of the Kochi Metro.

Aluva is home to the summer residency of the Travancore royal family (the Alwaye Palace), is also known for the Sivarathri festival, which is celebrated annually on the sandbanks of Periyar. The Advaita Ashram in Aluva, which was founded in 1913 by Sree Narayana Guru, an Indian social reformer, adds to the cultural aspect of the region. Today, despite being a part of the city as well as the Kochi urban agglomeration, Aluva is still an autonomous municipality, with its civic administration conducted by the Aluva Municipal Council, since Kochi Corporation has not expanded its limits for over 53 years.

Aluva also serves as the administrative center of the Aluva taluk. The taluks of villages including Mukundapuram,

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Kanayannur, Kunathunad and North Paravur were combined to form the Aluva taluk in 1956. The headquarters of the District Police Chief of Ernakulam Rural Police District, Superintending Engineer, PWD (Roads) and the District Educational Officer are also located there. It is the northern starting point of Kochi Metro rail's first phase, which began its operations in June 2017, as well as the Kochi city bus network. The Metro station is at Bypass, Aluva.

Historically, Aluva has been a centre of trade and commerce - especially as the gateway to Idukki, famous for its spice production, tea plantation and rubber cultivation. In the 1930s the Maharaja of Travancore promoted the modernisation of the town and introduced a number of heavy industries. However the industrial sector has gradually fell into decline. The recent closure of the Kathai cotton mills, has been one of the key instigators of the change in the economic profile of Aluva. The historic commercial signifinance, The Federal Bank, has retained its headquarters in the Aluva.

C. Importance of redesign of market

The redesign of markets holds paramount importance in the dynamic landscape of urban development, responding to the evolving needs of communities and the contemporary challenges faced by traditional market spaces. Markets serve as pivotal hubs of economic activity, cultural exchange, and community engagement, and their redesign becomes a strategic imperative to foster resilience and relevance. In an era marked by rapid urbanization, technological advancements, and changing consumer behaviors, market redesign offers a transformative opportunity to enhance functionality, optimize spatial utilization, and introduce innovative technologies. Beyond the utilitarian aspect, the redesign addresses aesthetic and cultural considerations, revitalizing these spaces as vibrant centers that reflect the identity and aspirations of the community.

Moreover, a well-thought-out market redesign contributes to improved traffic flow, sustainable practices, and enhanced accessibility, aligning with broader urban development goals. It underscores a commitment to creating inclusive, adaptable, and aesthetically pleasing environments that not only meet the present demands but also anticipate and cater to the future needs of a dynamic and growing urban populace. In essence, the redesign of markets emerges as a strategic investment in the vitality and sustainability of urban spaces, promoting economic growth, fostering community cohesion, and enriching the overall urban experience.

D. Motivation for the study

Motivated by an unwavering commitment to elevate the quality of life for Aluva's residents, preserve the cultural and historical significance embedded in its market, and invigorate local businesses, this comprehensive study is a dedicated effort to stimulate economic growth. At its core, the project recognizes the symbiotic relationship between a thriving marketplace and the well-being of the community it serves. By addressing persistent challenges like congestion and outdated infrastructure, the initiative aims not only to enhance the physical landscape but to seamlessly align with local regulations, ensuring a harmonious integration that fosters community well-being. The endeavor goes beyond the immediate revitalization of structures; it envisions a holistic transformation that uplifts the spirit of the residents, offering improved working conditions, support services, and expanded business opportunities. Through this concerted effort, the project endeavors to create a vibrant and sustainable ecosystem where the market becomes a catalyst for positive change, reflecting a deep respect for the cultural heritage and an earnest commitment to the prosperity of Aluva's residents.

E. Scope of study

The scope of this transformative study extends across a multifaceted evaluation and redesign initiative, envisaging a comprehensive revitalization of Aluva Market. At its core, the study is committed to addressing a spectrum of critical components that collectively contribute to the sustainable development and holistic well-being of the community.

A foundational aspect of the undertaking involves conducting an exhaustive analysis of the existing market landscape, delving into the intricacies of its layout, infrastructure, and socio-economic dynamics. Simultaneously, the study places a premium on preserving the historical, cultural, and architectural significance of the market, ensuring that any proposed changes harmoniously blend modernization with the preservation of its intrinsic character.

Traffic management emerges as a pivotal consideration within the study's ambit, with a dedicated focus on developing innovative solutions to alleviate congestion and streamline both vehicular and pedestrian flow. The potential integration of a multilevel car parking facility stands out as a strategic measure to address parking challenges and enhance overall accessibility, thereby contributing to a more seamless and efficient market experience.

Zoning considerations form an integral part of the study, aiming to strategically organize different sections of the market to optimize spatial layouts. This approach seeks to create an intuitive and user-friendly environment that enhances the overall experience for both vendors and visitors. Public amenities also come under scrutiny, with the study identifying opportunities to improve and expand rest areas, sanitation facilities, and green spaces to enrich the overall ambiance of the market.

A distinctive aspect of the study is its concerted effort to elevate working conditions for vendors, acknowledging their pivotal role in the market's vitality. This involves the design and implementation of well-structured stalls, provision of adequate shelter, and the incorporation of facilities that cater to the day-to-day operational needs of vendors. Importantly, the study seeks active input from vendors, aiming to create a workspace that not only meets their requirements but also fosters productivity and contributes to the economic prosperity of the local business community.

Economic expansion is another key facet of the study's scope, encompassing strategies to stimulate growth within the market. This involves encouraging the establishment of new businesses, supporting the expansion of existing ones, and exploring avenues for entrepreneurship and skill development. By fostering a thriving economic ecosystem, the study envisions the market as a dynamic hub that propels local businesses forward.

Lastly, the study prioritizes improved accessibility as an overarching goal. Through thoughtful design and

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implementation measures, it seeks to create pathways, entrances, and facilities that are inclusive and accommodating to diverse mobility needs. In essence, the study aspires to forge a revitalized Aluva Market that not only aligns with the evolving needs of the community but does so while preserving its rich cultural heritage, ensuring a vibrant and inclusive marketplace for generations to come.

F. Socio economic study

The underdeveloped condition of Aluva Market has significant socio-economic implications for the local community and the broader region. Socio-economically, the market's state reflects a range of challenges that affect both residents and businesses.

From a social perspective, the inadequate infrastructure and facilities in Aluva Market can negatively impact the quality of life for residents. Limited access to basic amenities such as sanitation facilities, proper lighting, and safe pedestrian pathways can contribute to health and safety concerns. Additionally, overcrowding and congestion within the market area can create discomfort and inconvenience for shoppers and vendors alike. These conditions may also deter visitors from other areas, limiting social interaction and community engagement within the market vicinity.

Economically, the underdeveloped condition of Aluva Market can hinder local economic growth and development. The lack of modern infrastructure and amenities may discourage potential investors and businesses from establishing or expanding their operations in the area. This, in turn, can lead to reduced job opportunities and income levels for residents. Furthermore, the market's unattractive appearance and substandard facilities may deter tourists and visitors, limiting potential revenue streams from tourism-related activities. Investments in infrastructure upgrades, such as improved sanitation facilities, better lighting, and enhanced pedestrian infrastructure, can improve the overall quality of life for residents and visitors alike.

Overall, addressing the socio-economic challenges of Aluva Market is essential for fostering inclusive growth, enhancing community well-being, and unlocking the market's full potential as a vibrant economic and social hub.

II. METHODOLOGY

A. Detailed methodology

The comprehensive methodology for the redesign of Aluva Market follows a meticulously planned multi-phased approach aimed at addressing various facets of urban development and community engagement while enhancing functionality. The project initiation phase, spanning one week, involves defining scope, objectives, and assembling a dedicated project team. Key stakeholders are identified, and initial meetings are held to align project goals with community aspirations, culminating in the development of a project initiation document to guide subsequent activities.

Following project initiation, a two-week research and analysis phase commences, focusing on gathering and analyzing relevant data. A literature review examines global trends and successful market redesign models, while local context analysis considers historical significance, demographic trends, and economic dynamics. Infrastructure assessment and urban planning parameters are also analyzed to inform subsequent project phases.

Upon completion of the research phase, findings and proposed plans are presented for approval in the project approval phase. This step involves obtaining necessary approvals from local authorities and stakeholders to ensure compliance with regulatory requirements and community expectations.

Subsequent phases include an extensive literature survey, a site visit and analysis, questionnaire survey, and data collection, each contributing to a comprehensive understanding of the project context and community needs. Innovative planning follows, where the project team synthesizes research insights and community feedback to develop creative solutions addressing identified challenges and opportunities.

Fig 1. Pictures taken while site visit

The subsequent detailed design phase, spanning five weeks, translates innovative plans into actionable designs for the market's physical infrastructure. Architectural, engineering, and aesthetic considerations are integrated to create a well-rounded design reflective of community aspirations.

The final week involves creating a 3D model of the proposed design using specialized software, aiding in visualization and

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communication of proposed changes to stakeholders and relevant authorities.

This phased and systematic approach ensures the redesign of Aluva Market is grounded in thorough research, community engagement, and innovative design principles, ultimately contributing to the creation of a vibrant and functional urban space meeting community needs.

Fig 2. Satellite view of Aluva Market area

TABLE 1. GENERAL DETAILS OF THE PLOT

Latitude	10°06'23"N
Longitude	76°20'56"E
Perimeter	750.21 m
Plot area	32,406.4 m²
Nearby buildings	Aluva metro station,KSRTC Bus station,

B. Softwares used

SIn the redesign of Aluva Market, Autodesk AutoCAD played a pivotal role in streamlining architectural and engineering processes. Leveraging its powerful tools, designers created precise 2D and 3D models of the market layout, facilitating efficient collaboration and communication among stakeholders. AutoCAD's extensive libraries of building components and materials enabled exploration of various design options while ensuring compliance with structural requirements and local regulations. Overall, AutoCAD proved indispensable in the successful redevelopment of Aluva Market, demonstrating its significance in modern architectural endeavors.

The redesign of Aluva Market utilizes ETABS (Extended Three-dimensional Analysis of Building Systems) software for structural analysis and design. Through ETABS, a detailed 3D model of the existing structure is created, incorporating accurate representations of components such as beams, columns, slabs, and walls. The software facilitates comprehensive structural analysis, considering factors like gravity loads, lateral loads, and other specified loads to assess the structure's behavior under different conditions. ETABS ensures compliance with local building codes through automatic code-based checks, optimizes load distribution, and addresses foundation design with consideration for specific loads and soil conditions. Seismic and dynamic analyses further enhance understanding of the structure's response, while visualization tools aid in interpreting analysis results, ensuring safety and performance criteria are met.

SketchUp proved invaluable for visualizing and conceptualizing architectural plans in the Aluva Market redesign. Its user-friendly interface and 3D modeling capabilities enabled creation of detailed renderings, facilitating efficient design iteration. Precise measurement tools and an extensive library of pre-made components streamlined floor plan drafting and spatial arrangement. SketchUp's compatibility with other design software enhanced collaboration among team members, contributing to project efficiency and accuracy. Overall, SketchUp's integration significantly contributed to the success of the Aluva Market redesign, providing a comprehensive platform for design exploration and communication.

C. Building plan

Our project primarily focuses on the redesign of a market building and a multilevel parking structure, with both designs being executed using ETABS software. This comprehensive endeavor involves utilizing ETABS to conduct detailed structural analysis and design optimization for both the market building and the parking facility. Our objective is to enhance the structural integrity, functionality, and safety of these structures through rigorous analysis and innovative design solutions. By leveraging the capabilities of ETABS, we aim to develop structurally efficient and aesthetically pleasing designs that meet the diverse needs of users while adhering to relevant building codes and standards. Through this project, we seek to demonstrate the proficiency of ETABS software in facilitating the design process and achieving optimal outcomes for complex architectural projects.

In the redesign of both the market and multilevel parking buildings, ensuring basic functional requirements has been a top priority. For the market building, careful consideration has been given to spatial layout, circulation, and usability for vendors, customers, and other stakeholders. Functional areas such as stalls, walkways, entrances, and service areas have been meticulously planned to optimize the flow of goods and people while enhancing overall user experience. Similarly, for the multilevel parking building, functional requirements such as ease of access, efficient parking space utilization, and safety measures have been meticulously integrated into the design. Adequate lighting, signage, and wayfinding systems are incorporated to facilitate smooth navigation for drivers and pedestrians alike. By prioritizing basic functional

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requirements, both buildings are designed to meet the diverse needs of users while ensuring compliance with relevant building codes and regulations.

Furthermore, the structural modeling, analysis, and detailing of both the market and multilevel parking buildings have been conducted with precision and thoroughness. Using advanced software tools such as ETABS, detailed 3D models of the structures have been developed, incorporating accurate representations of various structural components including beams, columns, slabs, and walls. Comprehensive structural analyses have been performed to assess the behavior of the buildings under different loading conditions, including gravity loads, lateral loads, and seismic forces. Through rigorous analysis, potential structural vulnerabilities have been identified and addressed, ensuring the safety and stability of the buildings.

In addition to structural modeling and analysis, meticulous structural detailing has been carried out to ensure the integrity and durability of the buildings. Detailed drawings and specifications for reinforcement, connections, and other structural elements have been prepared in accordance with industry standards and best practices. This attention to detail in structural detailing not only enhances the overall strength and resilience of the buildings but also facilitates efficient construction processes. By integrating functional requirements with thorough structural modeling, analysis, and detailing, the redesign of both the market and multilevel parking buildings exemplifies a holistic approach to architectural and engineering excellence.

III. RESULTS AND DISCUSSIONS

A. Structural modeling

The beam-column layout for the typical floor plan of our project was meticulously crafted using Autodesk AutoCAD, ensuring precise alignment and adherence to design specifications. Following this, the centerline of the layout was established, providing a reference for subsequent structural analysis and modeling. This layout was seamlessly imported into CSI ETABS, a powerful structural engineering software, where sectional properties were defined, and columns were strategically positioned according to the layout. Additionally, slabs were meticulously drawn and assigned appropriate properties to accurately represent the structural elements of the building.

To initiate the analysis process, comprehensive load calculations were conducted in accordance with Indian Standard codes IS: 875 (Part I, II, and III) for dead loads, live loads, and wind loads. Seismic loads were determined by referencing IS 1893:2016 (Part I), ensuring compliance with regulatory requirements for seismic design. These various load combinations were systematically applied to the space frame model within ETABS, enabling us to derive critical design loads, moments, and shear forces on each structural member.

Subsequently, the design process was executed in accordance with the relevant Indian Standard codes, ensuring structural integrity and safety under anticipated loading conditions. Concrete mix design specifications adhered to the prescribed grade of M30, while high-yield strength deformed (HYSD) steel rebars of grades 415 and 500 were utilized for reinforcing concrete elements, ensuring robust structural performance. Through meticulous attention to detail and rigorous adherence to industry standards, our project endeavors to achieve a structurally sound and resilient building design that meets the highest standards of safety and durability.The structural model of the multi-storey building in CSI ETABS are shown in figure:

TABLE 2. MEMBER PROPERTIES OF MARKET BUILDING

MEMBER PROPERTIES	Dimensions
Column-C1	600×300 mm
Beam-B1	400×500 mm
Slab-S1	103 mm

TABLE 2. MEMBER PROPERTIES OF MULTILEVEL PARKING BUILDING

MEMBER PROPERTIES	Dimensions
Column-C1	1600×800 mm
Column-C2	1300×800 mm
Beam-B1	500×765 mm
Slab-S1	452 mm

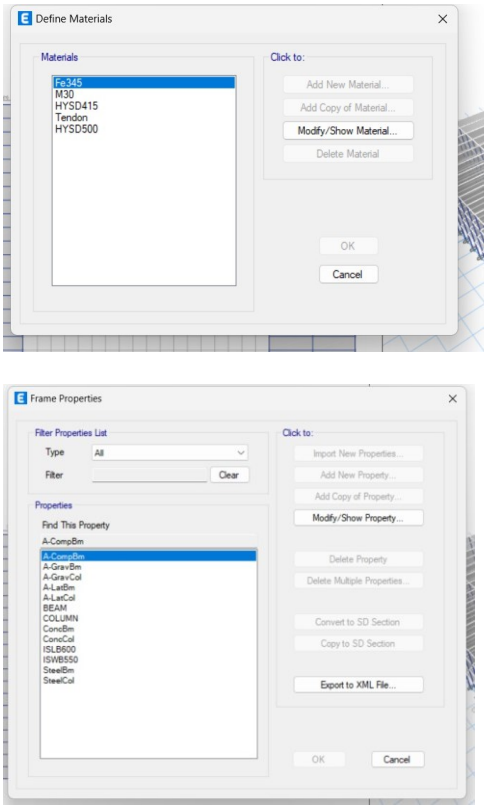

Fig 3.Figure showing the member properties

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B. Analysis

The analysis of both the market building and the multilevel parking structure was conducted using ETABS software, a powerful tool for structural analysis and design. This comprehensive analysis enabled us to assess the behavior of the structures under various loading conditions, including gravity loads, lateral loads, and seismic forces. By creating detailed 3D models of the buildings and inputting accurate representations of structural components such as beams, columns, slabs, and walls, we were able to simulate real-world scenarios and evaluate structural performance with precision. ETABS facilitated the calculation of critical design parameters, including internal forces, moments, and deflections, providing valuable insights into the structural behavior and performance of the buildings. Additionally, the software's advanced analysis capabilities allowed us to optimize structural configurations, ensuring that the redesigned buildings meet safety and performance criteria while maximizing efficiency and minimizing material usage. Overall, the use of ETABS software played a pivotal role in the successful analysis of both the market and parking buildings, contributing to the development of structurally sound and resilient designs.

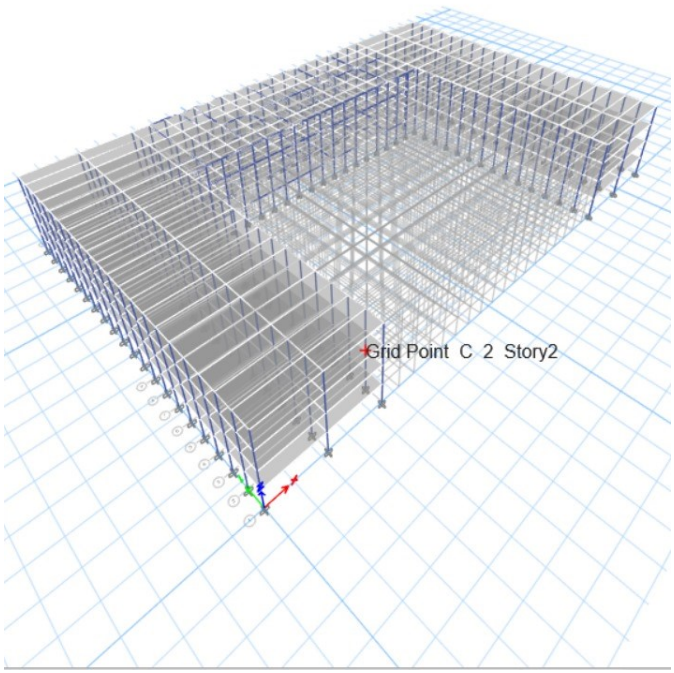

Fig 4. Analysis of market building in etabs software

C. Structural designing

The structural design process for both the market and parking buildings was meticulously executed using ETABS software, a powerful tool for structural analysis and design. Leveraging the software's advanced capabilities, we created detailed 3D models of the buildings, incorporating accurate representations of various structural components such as beams, columns, slabs, and walls. Through rigorous analysis, we assessed the structural integrity and stability of the buildings under various loading conditions, including gravity loads, lateral loads, and seismic forces. ETABS facilitated comprehensive structural design optimization, ensuring efficient distribution of loads while minimizing material usage and construction costs. Additionally, the software's dynamic analysis capabilities provided insights into the dynamic behavior of the buildings, informing design decisions to enhance performance and safety. By utilizing ETABS for structural design, we were able to develop robust and resilient structures that meet safety standards and performance criteria, contributing to the overall success of the project.

D. 3D modelling

The comprehensive 3D modeling of the entire market, encompassing both the analyzed market building and the multilevel parking structure, was efficiently executed using SketchUp software. SketchUp's intuitive interface and powerful 3D modeling capabilities allowed us to create detailed and realistic representations of the buildings, accurately capturing their architectural features and spatial layouts. By leveraging SketchUp's extensive library of pre-made components and precise measurement tools, we were able to intricately design every aspect of the market and parking buildings, from the exterior facades to the interior spaces. The software's compatibility with other design tools facilitated seamless integration with the structural analysis conducted in ETABS, ensuring that the 3D models accurately reflected the structural design considerations. Through SketchUp, we were able to visualize and communicate our design concepts effectively, providing stakeholders with a clear understanding of the proposed redevelopment project. Overall, SketchUp played a pivotal role in bringing our vision for the redesigned market and parking buildings to life, enabling us to create dynamic and immersive 3D models that showcase the project's potential and impact.

CONCLUSION

The redesign project for both the market and multilevel parking buildings exemplifies a comprehensive approach to urban development, architectural innovation, and structural engineering excellence. By prioritizing basic functional requirements and integrating them seamlessly into the design process, the project ensures that the buildings meet the diverse needs of users while adhering to relevant building codes and regulations.

Through meticulous structural modeling, analysis, and detailing, potential structural vulnerabilities have been identified and addressed, ensuring the safety, stability, and durability of the buildings. Advanced software tools such as ETABS have been instrumental in facilitating accurate 3D modeling, comprehensive structural analysis, and efficient load optimization techniques, leading to optimized structural designs that meet safety and performance criteria.

Furthermore, the project showcases the successful integration of various design and engineering disciplines, including architecture, structural engineering, and urban planning. Collaborative efforts among project team members, stakeholders, and community members have been pivotal in

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shaping the project's vision and ensuring its successful implementation.

Overall, the redesign project for the market and multilevel parking buildings represents a significant contribution to the field of urban development and architectural engineering. By revitalizing existing infrastructure and incorporating innovative design solutions, the project aims to create vibrant, functional, and sustainable urban spaces that enhance quality of life for residents and contribute to the socio-economic vitality of the community.

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