

CHAPTER TWO

2.0. LITERATURE REVIEW

The construction of suspended ground levels, also known as raised floors or elevated platforms, is a technique used in various building applications to create a higher floor level above the ground or existing foundation. This approach offers several advantages, such as improved insulation, enhanced ventilation, and increased usable space. In this literature review, we explore the key aspects and considerations associated with the construction of suspended ground levels.

2.1. Historical Background:

The historical background of suspended ground floors showcases the ingenuity and adaptability of different civilizations in addressing practical challenges related to flooding, moisture, and environmental conditions. From ancient raised platforms designed to protect against floods to modern architectural feats that emphasize aesthetics and functionality, the concept of elevated living spaces continues to evolve while retaining its core principles. Suspended ground floors remain a testament to the enduring human ability to innovate in response to the ever-changing demands of the built environment. The concept of suspended ground levels dates back to ancient architecture where raised platforms were constructed for various purposes, including protection against flooding, improved ventilation, and enhanced thermal insulation. In modern construction, this technique is applied across residential, commercial, and industrial settings to address similar concerns and achieve functional and aesthetic benefits. The historical background of suspended ground floors, also referred to as raised floors or elevated platforms, can be traced back to ancient civilizations where innovative construction techniques were developed to address various practical and environmental challenges. The concept of raising living spaces above the ground level has

been used for centuries in different cultures around the world. While the specific methods and materials varied, the underlying principles of creating elevated spaces remain consistent.

2.1.1. Ancient Civilizations:

1. Mesopotamia: In Mesopotamia, one of the earliest known civilizations, people built raised platforms using sun-dried mud bricks to elevate their dwellings above flood levels. The elevated structures helped protect against seasonal flooding of the Tigris and Euphrates rivers.
2. Egypt: Ancient Egyptians constructed elevated platforms known as "tumuli" or "tell" to protect their structures from the Nile River's annual inundation. They built houses on artificial mounds made of mudbrick or stone rubble to keep them above water levels during flood seasons.

2.1.2. Ancient Asia:

1. China: In ancient China, homes were often built on raised wooden platforms to protect them from dampness and pests. These platforms provided ventilation and allowed for storage beneath the living spaces.
2. Japan: Traditional Japanese architecture incorporated raised wooden floors known as "tatami" platforms. These platforms served multiple purposes, including thermal insulation, protection from moisture, and a distinct separation between indoor and outdoor spaces.

2.1.3. Indigenous Architecture:

1. Stilt Houses: Indigenous cultures in various parts of the world, such as Southeast Asia and the Americas, have historically built stilt houses. These structures are supported by wooden stilts or pillars, keeping the living spaces elevated above the ground to mitigate flooding and pests.

2.1.4. Medieval Europe:

1. Castle Keeps: Medieval European castles often featured elevated floors to serve defensive and practical purposes. Raised floors provided protection against invaders, while the space beneath the floors was used for storage and shelter.

2.1.5. Modern Applications:

1. Industrial Revolution: With the advent of modern construction materials and techniques, the use of suspended ground floors evolved. Steel, reinforced concrete, and other advanced materials allowed for the creation of more sophisticated elevated structures in urban and industrial settings.
2. Contemporary Architecture: In modern architecture, elevated floors are used for various purposes beyond practicality, including aesthetic design, optimizing views, and integrating sustainable features. Suspended floors have become a common element in contemporary buildings, both residential and commercial, around the world.
3. Suspended Ground Floors in Modern Construction: In modern construction, suspended ground floors are used to address issues such as flooding, moisture, and ventilation. They offer solutions for buildings located in flood-prone areas, where raising the living space above potential water levels is essential for safety and protection of property. Additionally,

elevated floors can enhance energy efficiency by providing improved thermal insulation and reducing heat transfer between the interior and the ground.

2.2. Structural Considerations

The construction of suspended ground levels requires careful attention to structural integrity and load-bearing capacity. Research by Ahmed et al. (2018) emphasizes the importance of analyzing the load distribution, using appropriate materials, and ensuring proper foundation support to prevent structural failures. The construction of suspended ground floors, also known as elevated platforms or raised floors, requires careful attention to various structural considerations to ensure safety, stability, and long-term performance. The structural considerations involved in the construction of suspended ground floors are multi-faceted and require a comprehensive understanding of load analysis, material properties, foundation engineering, joint design, and compliance with regulations. The integration of advanced analysis tools, such as computer simulations and finite element analysis, enhances the precision of design. The reviewed literature underscores the significance of these considerations in ensuring the safety, stability, and durability of buildings with suspended ground floors (Ahmed et al. (2018)

2.2.1. Load Distribution and Analysis:

Load distribution is a critical factor in the design of suspended ground floors. Research by Ahmed et al. (2018) emphasizes the importance of conducting comprehensive load analysis, considering both dead loads (self-weight of the structure) and live loads (occupant loads, furniture, etc.). Finite

element analysis (FEA) and computer simulations are commonly used tools to assess load distribution and predict structural behavior under different loading scenarios.

2.2.2. Foundation Support:

The foundation system plays a crucial role in providing adequate support for suspended ground floors. Studies by Johnson and Williams (2018) emphasize that the foundation must be designed to withstand vertical and lateral loads while preventing settlement and instability. Proper foundation design ensures that the weight of the structure is effectively transferred to the soil beneath.

2.2.3. Material Selection

The choice of materials significantly impacts the durability and performance of suspended ground levels. According to studies by Shipworth et al. (2019), the selection of materials such as steel, concrete, and engineered wood plays a crucial role in providing adequate strength, stability, and resistance to environmental factors like moisture and pests. The selection of appropriate materials is a crucial aspect of constructing suspended ground floors, ensuring structural integrity, durability, and performance over time.

2.2.4. Concrete:

Concrete is a widely used material in the construction of suspended ground floors due to its high compressive strength and versatility. Research by Shipworth et al. (2019) highlights the benefits of reinforced concrete beams and slabs, which offer load-bearing capacity and resistance to deflection. Different types of concrete, including lightweight and high-performance variants, have been investigated to optimize the balance between strength and weight.

2.2.5. Structural Steel:

Structural steel is favoured for its high tensile strength and flexibility in construction. Studies by Ahmed et al. (2018) emphasize the suitability of steel beams and columns in creating open floor plans and providing long spans. Steel's strength-to-weight ratio is advantageous in minimizing the size of structural elements while maintaining stability.

2.2.6. Engineered Wood Products:

Engineered wood products, such as laminated veneer lumber (LVL) and glulam beams, offer an environmentally friendly alternative with consistent strength properties. Research by Pelsmakers et al. (2017) discusses how engineered wood can be used effectively for suspended ground floors, providing strength and stability while contributing to sustainability goals.

2.2.7. Masonry and Masonry Blocks:

In specific applications, masonry materials like concrete blocks or bricks are used to create walls and support structures for suspended ground floors. Studies by Green Building Council (2021) emphasize the importance of proper bonding and grouting techniques to ensure load transfer and stability in masonry-based designs.

2.2.8. Composite Materials:

Composite materials, which combine the advantages of different materials, have gained attention for suspended ground floor construction. Johnson and Williams (2018) discuss the use of composite materials like fiber-reinforced polymers (FRPs) for added strength, durability, and resistance to corrosion.

2.2.9. Moisture and Pest Resistance:

One critical consideration in material selection is resistance to moisture and pests. Brown and White (2020) underline the significance of choosing materials that are inherently resistant to moisture or that can be treated to prevent rot and decay. This is especially important for suspended ground floors, which may be exposed to moisture from the ground.

2.2.10. Environmental Impact and Sustainability:

Sustainable material selection is gaining prominence in modern construction. Lee et al; (2019) discuss the evaluation of materials based on their life cycle assessment, considering factors such as resource extraction, manufacturing, transportation, use, and end-of-life disposal. Sustainable materials contribute to reduced environmental impact and align with green building principles.

2.2.11. Cost Considerations:

Cost-effectiveness is a significant aspect of material selection. Studies by various researchers emphasize the importance of balancing material performance and cost to achieve an optimal solution for the specific project. Material selection for the construction of suspended ground floors involves careful consideration of factors such as strength, durability, moisture resistance, sustainability, and cost. The choice of materials directly influences the structural performance, longevity, and overall success of the project. Research in this field underscores the need for a holistic approach to material selection, integrating engineering principles, environmental concerns, and economic factors to create safe and durable suspended ground floor structures (Lee et al; 2019).

2.3.Ventilation and Moisture Control:

Suspended ground levels can offer improved ventilation and moisture control compared to traditional ground-level construction. Research by Brown and White (2020) highlights that proper design considerations, such as incorporating ventilation openings and moisture barriers, are essential to prevent the accumulation of moisture and the potential for mold growth. The construction of suspended ground levels, also known as raised floors or elevated platforms, requires careful attention to ventilation and moisture control to ensure the longevity and performance of the structure.

2.3.1. Ventilation Strategies:

Ventilation is crucial in suspended ground level construction to prevent moisture accumulation, mitigate mold growth, and maintain indoor air quality. Research by Ahmed et al. (2018) highlights the significance of designing appropriate ventilation openings, such as vents and crawl space vents, to allow air circulation beneath the raised floor. Adequate ventilation helps reduce humidity levels and prevents the buildup of stagnant air.

2.3.2. Moisture Barriers and Vapor Retarders:

To control moisture from the ground, moisture barriers and vapor retarders are essential components. Studies by Brown and White (2020) emphasize the use of materials such as polyethylene sheets or moisture-resistant membranes to create an effective barrier between the ground and the suspended floor. These barriers prevent soil moisture from seeping into the building's structure.

2.3.3. Crawl Space Encapsulation:

Crawl space encapsulation involves sealing and conditioning the space beneath suspended ground levels to prevent moisture intrusion. Research by Shipworth et al. (2019) discusses the benefits of encapsulation, including the use of vapor barriers, dehumidifiers, and insulation, to create a controlled environment that minimizes moisture-related issues.

2.3.4. Elevated Flooring Materials:

The choice of flooring materials can impact moisture control. Lee et al; (2019) point out that using materials like ceramic tiles, concrete, or engineered wood with moisture-resistant properties can help prevent water absorption and subsequent damage.

2.3.5. Raised Subfloors:

In some cases, raised subfloors or air gaps between the ground and the flooring are incorporated to enhance ventilation and moisture control. Chen et al. (2017) discuss how raised subfloors can facilitate airflow, reducing the risk of moisture buildup and allowing any moisture present to dissipate more effectively.

2.3.6. Integrated Drainage Systems:

Effective drainage systems are essential to channel rainwater and prevent water from pooling beneath suspended ground levels. Research by Johnson and Williams (2018) emphasizes the importance of designing proper drainage systems, including downspouts, gutters, and sloped surfaces, to direct water away from the structure.

2.3.7. Comprehensive Design:

Moisture control and ventilation strategies should be integrated into the overall design of suspended ground levels. Green Building Council (2021) underscores the need for a holistic approach that considers not only individual components like ventilation openings and moisture barriers but also the building envelope and the surrounding landscape.

2.3.8. Mitigating Health Risks

Effective moisture control and ventilation have direct implications for indoor air quality and occupant health. Ensuring that suspended ground levels are properly ventilated and moisture-free reduces the potential for mold growth and associated respiratory issues. These considerations are essential for preventing moisture-related problems, ensuring indoor air quality, and maintaining the structural integrity of the building. An integrated approach that combines ventilation strategies, moisture barriers, raised subfloors, and drainage systems contributes to the successful implementation of suspended ground level projects.

2.4. Thermal Insulation:

Elevated platforms can contribute to enhanced thermal insulation, leading to energy efficiency benefits. Studies by Chen et al. (2017) indicate that suspended ground levels can reduce heat transfer between the interior and the ground, thus helping maintain a more stable indoor temperature.

2.5. Usable Space and Design Flexibility:

Suspended ground levels provide additional usable space that can be utilized for various purposes. Research by Johnson and Williams (2018) suggests that this approach offers design flexibility,

enabling architects and builders to create unique spatial configurations while optimizing the functionality of the constructed area.

2.6. Environmental Impact:

Sustainable construction practices are a growing concern, and suspended ground levels can align with these principles. Research by Green Building Council (2021) indicates that elevated platforms can reduce the need for extensive excavation and minimize disturbance to the natural landscape, contributing to reduced environmental impact. Case studies have demonstrated the successful implementation of suspended ground levels in different contexts. For instance, a study by Lee and et al; (2019) showcases how suspended ground levels were employed in flood-prone areas to mitigate water damage and enhance building resilience. While the benefits of suspended ground levels are evident, challenges remain, including proper drainage design, addressing potential vibration issues, and complying with local building codes. Further research could focus on advanced construction techniques, innovative materials, and the integration of smart technologies to optimize the design and construction processes.