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A Study on House Lifting by Jacking Methods

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Abstract

House lifting by jacking has emerged as a viable alternative to traditional demolition and rebuilding methods for addressing foundation issues, flood mitigation, and basement creation. This thesis investigates the effectiveness, feasibility, and limitations of this technique. The project revealed that house lifting by jacking can be an effective solution when implemented with proper planning and execution. It can be cost-competitive compared to traditional methods for specific project types. However, structural considerations are crucial, and limitations exist for certain house designs or materials. The primary objective of this study is to provide a detailed understanding of how lifting operations are conducted, the factors influencing their success, and their broader implications for the construction industry and community resilience. To achieve this objective, a mixed-methods research approach was adopted, combining a thorough review of existing literature with case studies of successful house lifting projects. The literature review encompassed historical evolution, types of jacks, structural engineering principles, safety regulations, environmental assessments, and economic analyses related to house lifting. With today's technology, you can easily raise the level of your home. And it is also without any accidents. It's time to save money and live in the same house you used to live in. More specifically, houses placed in inland areas often face a bigger problem. This problem never ends during the cloudburst seasons when there is deep rainfall and heavy flooding in the lowlands. Now the rise and fall of the earlier tides will exacerbate the problems for such houses, with the incessant rains exacerbating the problem. As a result, there is absolution to this problem and it becomes house-lifting. Masonry houses are very difficult to lift, mainly due to their design, construction, and weight, but it is possible to lift these houses. Lifting the use of the building is less than rebuilding the building. By providing insights into the lifting process and its associated challenges, this research contributes to the development of best practices and guidelines for house lifting projects, ultimately enhancing the resilience of communities facing environmental hazards.

Keywords: *Construction, Foundation, Building materials, Hazard, Environment*

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1. Introduction

Lifting the house and building a new, or one of the most common retrofitting methods is elevating a house to a required or desired Flood Protection Elevation (FPE). When a house is properly elevated, the living area will be above all but the most severe floods (such as the 500-year flood). Several elevation techniques are available. In general, they involve extending the existing, foundation below it or leaving the house in place and either building an elevated floor within the house or adding a new upper story. This technique was introduced for the first time in Philadelphia, Pennsylvania 1799 for the purpose of moving a building. London's famous monument marble arch built in 1847 was originally the entrance to the newly rebuilt Buckingham palace. It was found to be narrow for the state coach, and was moved to its present location of Hyde Park in 1851.

A house is one of the greatest assets which anyone possesses and constructing one's dream home is a very tricky and difficult task. Building a house is quite intricate and puts us through quite a lot of issues and obligations more to the point; construction planning is one such complicated task, in case if you are constructing a dream house then you need to consider numerous aspects to construct a safe and secure home that stands tall for several years to come. Rebuilding involves great amount of money time and materials. This is not possible for everyone. More over people has emotional attachment with their buildings.

Today citizens are facing various problems like entering of sewage water during rains due to lowering down on road levels. Rainy water directly enters in to the house and shop and destroys the property and create great nuisance. If your house is below the road level and you have no clue as how to raise its level without rebuilding it. Specialize in lifting and shifting the houses without any damage and raising their level with the help of Jack. With this scientific technique, in the project helped many people. By opting for this cheap and effective method, they have saved lakhs of rupees and their valuable time.

2. Scope and Objectives

A house is one of the greatest assets which anyone possesses and constructing one's dream home is a very tricky and difficult task. Building a house is quite intricate and puts us through quite a lot of issues and obligations more to the point; construction planning is one such complicated task, in case if you are constructing a dream house then you need to consider numerous aspects to construct a safe and secure home that stands tall for several Years to come. Rebuilding involves great amount of money time and materials. This is not possible for everyone. Moreover, people have emotional attachment with their buildings. Today citizens are facing various problems like entering of sewage water during rains due to lowering down on road levels. Rainy water directly enters into the house and shop and destroys the property and create great nuisance. For this problem house lifting is the best and effective technique. It will substantially reduce the flood risk to the house and its contents. It does not require any additional land for the working process. It can reduce the loss of life, economic and environmental.

2.1. Main Objectives

1. To analyze the various techniques employed in house lifting by jacking.
2. To examine the structural integrity of buildings before and after the lifting process.
3. To assess the environmental impact of house lifting practices, including considerations for sustainability and ecological balance.
4. To evaluate the economic feasibility of house lifting compared to alternative methods of structural repair or renovation.
5. To investigate the safety measures and protocols involved in house lifting projects to minimize risks to personnel and property.
6. To identify challenges and obstacles faced by practitioners in implementing house lifting projects and propose strategies for overcoming them.
7. To document and analyze case studies of successful house lifting projects from diverse geographical and contextual settings.

8. To provide recommendations for best practices in house lifting, including guidelines for project planning, execution, and post-lifting maintenance.

3. Applications of House Lifting

House lifting by jacking offers a versatile approach, catering to a range of construction needs. Let's explore some prominent applications:

1. **Basement Construction:** For homeowners desiring additional living space, house lifting allows for the creation of a basement beneath an existing structure. This eliminates the need for demolition and reconstruction, minimizing disruption and preserving the existing living space.
2. **Levelling a Settling Structure:** Foundations, over time, can settle unevenly due to various factors like soil movement or inadequate foundation support. House lifting enables the structure to be raised and the foundation levelled, rectifying structural issues and preventing further damage.
3. **Flood Mitigation:** In flood-prone areas, raising a house can be a crucial safeguard. House lifting allows the structure to be elevated to a level above the anticipated flood plain, minimizing potential damage and ensuring the safety of residents and belongings.
4. **Installing a New Foundation:** In cases where an existing foundation requires complete replacement due to structural issues or outdated construction methods, house lifting facilitates the process. The house can be lifted, allowing for the removal and replacement of the foundation underneath.
5. **Historic Preservation:** For historically significant structures, house lifting offers a valuable tool for preservation efforts. It allows for foundation repairs or necessary modifications without compromising the integrity of the original structure.

4. Literature Review

Constructing foundations is one of the oldest of human activities. Foundations provide support for structures by transferring their load to layers of soil or rock beneath them. Over 12,000 years ago, Neolithic inhabitants of Switzerland built houses on long, wooden piles that were driven into the soft beds of shallow lakes, keeping people high up above dangerous animals and hostile neighbours. A few thousand years later, the Babylonians raised their monuments on mats made from reed, and the ancient Egyptians supported the pyramids on stone blocks which rested on the bedrock. It was in ancient Rome that foundation engineering really leapt forwards, with rules created and concrete used. In the first of a series of posts that chart the history of modern building elements in the UK, we look at how foundation engineering has changed over the past century.

House lifting, as a practice, has ancient roots, with evidence of similar techniques being used across diverse cultures. In Japan, for instance, the technique of "shoring" or lifting buildings on stilts has been employed for centuries to protect structures from flooding and earthquakes. Similarly, in coastal regions of India, houses have been elevated using wooden or bamboo stilts to mitigate the risk of tidal surges.

In the modern era, house lifting gained prominence in the United States during the 19th century, particularly in areas prone to flooding such as the Mississippi River basin. Hydraulic jacking systems were developed to raise buildings above flood levels, offering a practical solution to the recurring problem of inundation.

5. Need for the Study

Many people still live in the backward area. House lifting is the best technique in this case. So, the reasons to lift the house to prevent water loss are to fix the already damaged foundation with water loss or to build an extra floor. Lifting a house is a challenging project that requires precise skill, measurements, manpower and equipment. Although there are many reasons why we have to lift a house, the main reasons are generally maintaining the road level and the house level should be the same so that we can keep our house dry and protect it from erosion and water damage (Johnson, 2019).

The need for a comprehensive study on house lifting by jacking arises from the increasing frequency of events such as floods, earthquakes, and coastal erosion, which pose significant threats to build infrastructure. In the face of these

challenges, house lifting has emerged as a viable solution for mitigating damage and ensuring the resilience of buildings in vulnerable areas. This chapter delves into the specific reasons why a detailed examination of house lifting practices is essential in the current socio-economic and environmental context.

Climate change has led to more frequent and severe natural disasters, including floods and hurricanes, which can cause widespread destruction to homes and infrastructure. House lifting offers a proactive approach to mitigating the impact of these disasters by elevating structures above flood levels or high-risk areas prone to storm surges. Understanding the effectiveness of house lifting in disaster risk reduction is critical for developing resilient communities and safeguarding lives and property.

Disasters not only cause physical damage to buildings but also have far-reaching socio-economic impacts on communities, including displacement, loss of livelihoods, and economic instability. House lifting can help mitigate these impacts by enabling swift recovery and reducing the need for costly reconstruction efforts. Assessing the socio-economic benefits of house lifting projects is crucial for building resilient communities and promoting long-term sustainability.

6. Necessity

When the road level is raised above the building level, this technique is used to lift buildings. Many mistakes were made during the construction of a house or building. The employer thinks many times to correct the mistakes made, but it took a lot of money and time. Previously unresolved. But now the solution here is the building lifting technique. There is a solution to this problem and it becomes house lifting. If your house is below street level and the sewer flows regularly, rehab is not the best solution.

House lifting by jacking isn't a one-size-fits-all solution, but in certain situations, it becomes a crucial approach for various construction and renovation needs. This chapter explores the key factors necessitating house lifting and the advantages it offers over alternative methods.

6.1. When Demolition isn't the Answer

Demolition and rebuilding have traditionally been the go-to methods for major structural changes or foundation issues. However, house lifting presents a compelling alternative in several scenarios:

- **Limited Space:** In urban areas with limited space, rebuilding a structure might not be feasible. House lifting allows for modifications to the existing structure while preserving valuable real estate.
- **Historic Preservation:** For structures with historical significance, demolition would result in an irreplaceable loss. House lifting enables necessary foundation repairs or modifications to be conducted without compromising the historical integrity of the building.
- **Environmental Concerns:** Demolition generates significant waste and disrupts the existing ecosystem. House lifting minimizes environmental impact by preserving the existing structure and requiring less construction material.
- **Time Constraints:** Rebuilding a structure can be a lengthy process. House lifting offers a faster turnaround, allowing occupants to return to their homes sooner with minimal disruption to their lives.

6.2. Addressing Foundation Issues

Foundations are the backbone of a structure, and their integrity is crucial for long-term stability. House lifting becomes necessary when foundation problems arise, such as:

- **Settling Foundations:** Over time, foundations can settle unevenly due to factors like soil composition, improper drainage, or inadequate foundation support. This can lead to cracks in walls, uneven floors, and structural instability. House lifting allows for the structure to be raised and the foundation levelled, rectifying these issues and preventing further damage.
- **Insufficient Foundation Depth:** In some cases, foundations might not have been built with sufficient depth, particularly in flood-prone areas. House lifting enables the structure to be raised to a safer elevation, mitigating flood risks and protecting the property.

- **Foundation Replacement:** Situations may arise where the existing foundation requires complete replacement due to severe deterioration or outdated construction methods. House lifting facilitates this process by allowing access to the foundation for demolition and reconstruction.

6.3. Creating Additional Living Space

The demand for additional living space is ever-growing. House lifting offers a unique solution in situations like:

- **Basement Construction:** For homeowners desiring extra living space, house lifting opens the door to creating a basement beneath the existing structure. This eliminates the need for extensive excavation and minimizes disruption to the existing living area.
- **Raising Floor Levels:** In areas with high water tables or flood risks, elevating the entire structure can provide a practical solution. House lifting allows for the existing foundation to be raised to a desired level, creating additional space below the raised floor that can be utilized for storage or additional living areas.

7. Techniques of House Lifting

Contemporary house lifting techniques primarily revolve around hydraulic jacking systems due to their efficiency and precision. Hydraulic jacks, capable of exerting immense force, are strategically placed beneath the building's foundation, and pressure is applied gradually to elevate the structure. Steel beams or cribbing may be used to support the building during the lifting process, ensuring stability.

Alternative methods such as screw jacks and pneumatic lifting systems are also utilized in certain circumstances. Screw jacks, for example, offer precise control over the elevation process and are often employed in situations where incremental adjustments are necessary.

8. Structural Considerations for House Lifting

Successful house lifting hinges on a thorough understanding of the structure itself. Key considerations include:

- **Building Materials:** The weight distribution and lifting points are heavily influenced by the materials used in construction (e.g., wood, brick, concrete).
- **Weight Distribution:** Calculating the weight of the structure and its components is crucial for determining the appropriate lifting capacity and jack placement.
- **Shoring Techniques:** Temporary supports (shoring) are essential to ensure structural stability during the lifting process.
- **Jack Placement:** Strategic placement of jacks distributes the lifting force evenly, minimizing stress on the structure.

9. Advantages and Disadvantages of House Lifting

Several advantages make house lifting an attractive option for homeowners:

- When your house is below the level of the road, it can be easily lifted and replaced without any damage and their level can be raised at once with the help of jacks.
- Through house lifting technology, the building is protected from all kinds of natural disasters.
- Indirectly saves construction materials that help the natural resources of the environment.
- Stay at your current facility. Rehabilitation is not required.
- Improve the market potential of existing industrial buildings. House lifting technologies are cheap and effective and save millions of rupees and valuable time.
- By lifting the existing house, the familiar layout, character, and historical value are retained, fostering a sense of place and community.
- House lifting projects can be completed significantly faster than demolition and rebuilding, minimizing disruption to occupants.

- Salvaging the existing structure minimizes construction waste and promotes sustainable building practices.
- House lifting can address various needs, from flood mitigation and foundation repair to basement additions and historical preservation.

However, house lifting also presents some disadvantages:

1. **Cost Considerations:** While potentially less expensive than rebuilding, house lifting requires specialized equipment and expertise, incurring significant upfront costs.
2. **Disruption and Inconvenience:** The lifting process can be disruptive to occupants, requiring temporary relocation and potentially impacting utilities.
3. **Structural Concerns:** Improper lifting techniques or failure to account for structural limitations can lead to cracks, foundation issues, and long-term damage.
4. **Permitting Requirements:** Local building codes and regulations may require specific permits and inspections for house lifting projects.

10. Planning and Preparation

Lifting a house with jacks is a complex undertaking that requires meticulous planning and preparation. Before the jacks even touch the structure, a series of crucial steps ensure a safe and successful lift. This section dives deep into the planning and preparation phase, laying the groundwork for a smooth house lifting operation.

10.1. Pre-Lift Evaluation: Assessing the Situation

1. **Structural Assessment of the House:** A thorough structural evaluation by a qualified engineer is paramount. They will assess the overall health of the house, identifying any weaknesses that might require reinforcement before lifting.
2. **Foundation Analysis:** Understanding the existing foundation is key. The engineer will analyze the foundation type (slab, basement, crawlspace), its material (concrete, block), and most importantly, the soil bearing capacity. This determines how much weight the foundation can safely support during and after the lift.
3. **Permitting Requirements:** Contact your local building department to determine the permits necessary for house lifting. This typically involves submitting detailed engineering plans and obtaining approval from inspectors.
4. **Utility Relocation (if Necessary):** Underground utilities like gas lines, water pipes, and electrical cables might need relocation to avoid damage during the lifting process. Coordinating with utility companies to disconnect and reroute these lines is crucial.

11. Process Lifting of House

Explains that all the processes for this project will take place for this stage.

1. Assess the existing foundation to see if it will support an extended home.
2. Disable utility services and disconnect utility lines.
3. Dig around the foundation to install a network of lifting beams.
4. Raise the house with jacks.
5. Opening for flood water.
6. Extend the foundation wall to the desired height.
7. Removal of jack and backfilling.
8. Reconnect floor termination and utility services.

11.1. Assess the Existing Foundation to See if it will Support an Extended Home

1. A survey of the residential building should be done before starting the house lifting process. It is important to study the existing foundation and weak members and members of the building, which require support before the lift.

2. **Disable Utility Services and Disconnect Utility Lines:** Before starting to lift the building, it is very necessary to disconnect the equipment such as electricity, gas connection, drainage connection in the building and to ensure uninterrupted work and safety of the working people.
3. **Dig Around the Foundation to Install a Network of Lifting Beams:** Support is provided to vulnerable members to prevent members from falling during the lifting process as safety precautions to ensure the safety of the building and workers. First excavation is done for the application of jacks near the walls; the jacks are applied under the ground beam or with the support of steel beams.
4. **Raise the House with Jacks:** Jacks are applied to the excavation site and jacks are applied and the house is lifted by jacking the jacks at once. The jacks are removed and the horizontal brick masonry contributes to the lifting of the building.
5. **Opening for Flood Water:** An important part of the project is to install openings in the foundation walls, not higher than 1 foot above the ground, so that flood waters can enter and equalize internal and external hydrostatic pressures. We can create these openings by partially filling the I-beam holes.
6. **Extend the Foundation Wall to the Desired Height:** Brick masonry must serve as the foundation of the building, which will support the entire building and eventually increase the height of the building.

Figure 1: Removal of Utility Items

Figure 2: Removal of Soil Under the Foundation

Figure 3: Raising of the House with Jacks

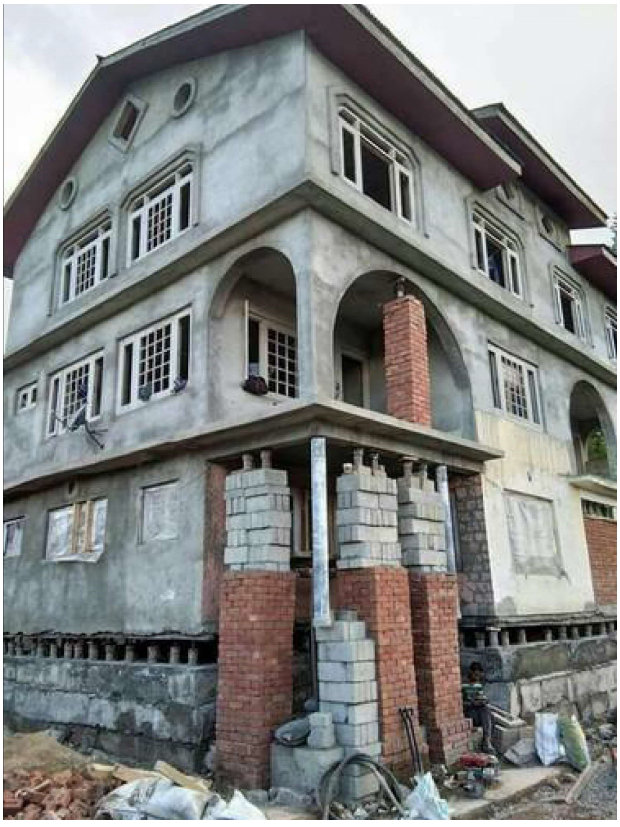

Figure 4: Raise of House

7. **Removal of Jack and Back Filling:** Once the brick masonry is finished the jacks are removed and can continue or bear the load of the building. The foundation area of the building is covered with pebbles. The backfilling of the sand should be well compacted to support the floor load of the building.
8. **Reconnect Floor Termination and Utility Services:** Flooring is done after filling the compact soil. Supply connections will be connected once the flooring is complete. After the house is lifted the cracks are filled with cement grouting.

Figure 5: Removal of Jack

12. Accessories and Equipment Used

12.1. Hydraulic Jack

In 1838 William Joseph Curtis filed a British patent for a hydraulic jack. In 1851, inventor Richard Dudgeon was granted a patent for a "portable hydraulic press"—the hydraulic jack, a jack which proved to be vastly superior to the screw jacks in use at the time. Hydraulic jacks which are used to lift houses are called house jacks, also called screw jacks, is a mechanical devices primarily used to lift buildings from their foundations for repairs or relocation. A series of jacks is used and then wood cribbing temporarily supports the structure. This process is repeated until the desired height is reached. The house jack can be used for jacking carrying beams that have settled or for installing new structural beams. On the top of the jack is a cast iron circular pad that the jacking post rests on. This pad moves independently of the house jack so that it does not turn as the acme-threaded rod is turned with a metal rod. This piece tilts very slightly, but not enough to render the post dangerously out of plumb.

Figure 6: Jack

12.2. Wooden Block

Wood has been used as a building material for thousands of years in its natural state. Today, engineered wood is becoming very common in industrialized countries. Wood is a product of trees, and sometimes other fibrous plants, used for construction purposes when cut or pressed into lumber and timber, such as boards, planks and similar materials. It is a generic building material and is used in building just about any type of structure in most climates. Wood can be very flexible under loads, keeping strength while bending, and is incredibly strong when compressed vertically. There are many differing qualities to the different types of wood, even among same tree species. This means specific species are better suited for various uses than others. And growing conditions are important for deciding quality.

Figure 7: Wooden Block

12.3. Channel Beam

The structural channel, also known as a C-channel or Parallel Flange Channel (PFC), is a type of (usually structural steel) beam, used primarily in building construction and civil engineering. Its cross section consists of a wide “web”, usually but not always oriented vertically, and two “flanges” at the top and bottom of the web, only sticking out on one side of the web. It is distinguished from I-beam or H-beam or W-beam type steel cross sections in that those have flanges on both sides of the web.

Figure 8: Channel Beams

12.4. Wooden Plank

A plank is timber that is flat, elongated, and rectangular with parallel faces that are higher and longer than wide. Used primarily in carpentry, planks are critical in the construction of ships, houses, bridges, and many other structures. Planks also serve as supports to form shelves and tables. Usually made from sawed timber, planks are usually more than 1 1D 2 in (38 mm) thick, and are generally wider than 2 1D 2 in (64 mm). In the United States, planks can be any length and are generally a minimum of 2 in (51 mm) deep by 8 in (200 mm) wide, but planks that are 2 in (51 mm) by 10 in (250 mm) and 2 in (51 mm) by 12 in (300 mm) are more commonly stocked by lumber retailers. A plank used in a building as a horizontal supporting member that runs between foundations, walls, or beams to support a ceiling or floor is called a joist.

12.5. Drilling Machine

Drilling machine can make a circular hole in the job by removing volume of the metal from it with the help of a cutting tool called drill bit. When drilling is performed by the drilling machine the drill bit i.e. the cutting tool is rotated along its own axis into the job. This machine is used to penetrate in earth for the excavation. A drill is a tool used to originate a hole in a solid material. A helical groove known as 'flute' is cut along the length of the drill. By penetrating in the earth we can remove all the dirt which are present in the house.

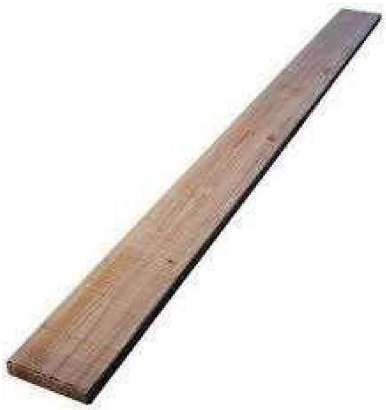

Figure 9: Wooden Plank

Figure 10: Drilling Machine

13. Details of Jacks

The total weight of the jack is 80 tons. The height of the jack is 3 ft. Depends upon the load of the building the gap between the two jacks also vary. If the load is high the gap will be reduced if the load is low, gab will be increased

13.1. Comparative Analysis of House Lifting Techniques

House lifting techniques vary depending on factors such as the size and weight of the structure, soil conditions, and project requirements. Hydraulic jacking is one of the most common methods used for house lifting due to its precision, control, and ability to lift heavy loads. Hydraulic jacking systems utilize hydraulic cylinders to exert vertical force on lifting points strategically placed beneath the building, allowing for precise elevation and levelling.

In contrast, screw jacking systems rely on mechanical screw mechanisms to lift structures incrementally. While screw jacking offers greater control over lifting height and speed, it may be less suitable for larger or heavier structures due to limitations in lifting capacity and stability. Additionally, screw jacking systems require careful alignment and synchronization to ensure uniform lifting and prevent structural distortion.

Another emerging technique is pneumatic jacking, which utilizes compressed air or gas to lift structures. Pneumatic jacking offers advantages such as reduced noise pollution, lower energy consumption, and faster lifting speeds compared to hydraulic or screw jacking. However, pneumatic jacking systems require specialized equipment and expertise, and their suitability for large-scale house lifting projects remains relatively untested.

Overall, the choice of house lifting technique depends on various factors, including project scope, budget constraints, site conditions, and technical requirements. Each method has its advantages and limitations, and careful consideration should be given to selecting the most appropriate technique for a given project.

13.2. Challenges and Risks

Despite its numerous benefits, house lifting by jacking presents several challenges and risks that must be carefully addressed. One of the primary challenges is the high cost associated with house lifting projects. The process involves specialized equipment, skilled labor, and extensive planning, making it financially prohibitive for many homeowners, particularly those in low-income communities. Moreover, unforeseen complications during the lifting process, such as soil instability or structural damage, can lead to cost overruns and delays, exacerbating financial strain.

Additionally, house lifting projects often face regulatory hurdles and permitting requirements, particularly in densely populated urban areas. Zoning restrictions, historical preservation ordinances, and environmental regulations may limit the feasibility of house lifting projects or require extensive approvals, adding complexity and uncertainty to the process. Furthermore, community resistance and NIMBY (Not in My Backyard) attitudes can pose significant barriers to project implementation, particularly in neighbourhoods with entrenched interests or concerns about property values and aesthetics.

From a technical standpoint, house lifting requires meticulous planning and execution to ensure the structural integrity of the lifted building. Improper lifting techniques or inadequate support systems can result in structural damage or collapse, posing safety risks to workers and occupants. Moreover, the long-term maintenance of elevated structures, including ongoing foundation stabilization and waterproofing measures, requires careful consideration to prevent future issues and ensure the sustainability of the project.

14. Cost Considerations in House Lifting Projects

House lifting by jacking offers a unique solution for various construction needs. However, understanding the associated costs is crucial for planning and budgeting effectively. This chapter explores the factors influencing project costs and provides strategies for cost estimation and budgeting.

14.1. Factors Affecting House Lifting Costs

The total cost of a house lifting project can vary significantly depending on several factors. Here's a breakdown of the key elements impacting the project budget:

- **Size and Weight of the Structure:** Larger and heavier structures naturally require more robust jacking systems and support structures, leading to higher costs.
- **Lifting Height:** The elevation to which the structure needs to be raised significantly impacts costs. Higher lifts necessitate more complex engineering designs, specialized equipment, and potentially longer lifting times.

- **Complexity of Engineering Design:** The complexity of the lifting plan and shoring system design contributes to overall costs. Straightforward lifts with minimal obstacles will be less expensive compared to projects requiring intricate lifting sequences or extensive shoring due to existing utilities or site constraints.
- **Jacking System Employed:** The type of jacking system chosen (e.g., mechanical jacks, hydraulic jacks, or hydraulic shoring systems) influences costs. Hydraulic systems often offer more precise control and lifting capacity, but may come at a higher cost compared to simpler mechanical jacking systems.
- **Permitting and Inspection Fees:** Obtaining necessary permits and scheduling inspections by relevant authorities add to the overall project cost.
- **Labor Costs:** The expertise and experience of the crew involved in the lifting operation can impact costs. Skilled professionals ensure a safe and efficient lifting process but may command higher fees compared to less experienced crews.
- **Unforeseen Challenges:** Unexpected site conditions or unforeseen challenges encountered during the lifting process can necessitate additional work or modifications, potentially leading to cost increases.

14.2. Cost Estimation and Budgeting Strategies

Given the various factors influencing project costs, obtaining a precise cost estimate early in the planning stage is crucial. Here are some strategies to consider:

- **Consulting with Experienced House Lifting Contractors:** Reputable house lifting contractors can provide an initial cost estimate based on the project scope and a preliminary site assessment. This estimate can be further refined as the engineering design progresses.
- **Understanding Cost Breakdowns:** Request a detailed cost breakdown from potential contractors. This will help identify the major cost components and allow for informed decision- making when optimizing the project budget.
- **Considering Alternatives:** Explore alternative solutions, such as the complexity of the lifting plan or the type of jacking system employed. While certain choices might lead to cost savings, it's crucial to prioritize safety and ensure a structurally sound lifting process.
- **Factoring in Contingency Funds:** Allocate a contingency fund within the overall budget to account for unforeseen circumstances or minor changes that may arise during the project

14.3. Estimation

The demolition cost of the building is excluded for the estimation of new construction. Estimation of the house lifting method by jacks includes cost for brick masonry work, flooring, plinth filling and base material filling. The cost also includes charges of filling cracks etc. if any found during the lifting of the house.

15. Safety Procedure and Risk Management

House lifting is a complex operation that requires meticulous planning and prioritizes safety throughout the entire process. Even minor miscalculations or oversights can lead to severe consequences. This section will detail essential safety procedures and risk management strategies to ensure a safe and successful house lifting project.

15.1. Communication is Key

Clear and concise communication is paramount for a safe house lifting operation. Here are key strategies:

- **Pre-lift Briefing:** Conduct a thorough briefing with all crew members before lifting commences. Discuss roles, responsibilities, safety protocols, and emergency procedures.
- **Designated Signals:** Establish a clear system of hand signals, radio communication, or pre- determined verbal cues for crew members to communicate during lifting.
- **Competent Spotter:** Assign a dedicated spotter to monitor the lifting process, identify any issues, and relay information to the jack operator.

15.2. Personal Protective Equipment

Crew members involved in the house lifting project must wear appropriate Personal Protective Equipment (PPE) at all times. This includes:

- **Hard Hats:** To protect against falling debris or objects dislodged during lifting.
- **Safety Glasses:** To shield eyes from dust, flying particles, and potential fluid splashes.
- **Steel-Toed Boots:** To provide foot protection from falling objects or punctures.
- **Work Gloves:** To enhance grip and protect hands from abrasions during handling of materials.
- **High-Visibility Vests:** To increase crew member visibility, especially important in low-light conditions.

15.3. Risk Management and Mitigation Strategies

House lifting inherently involves some level of risk. However, these risks can be significantly mitigated through proper planning and proactive measures. Here's how to address potential risks:

- **Uneven Lifting:** Ensure all jacks are functioning properly and lifting at the same rate to prevent the house from tilting or becoming unbalanced. Utilize level monitoring instruments to maintain a level lift.
- **Jack Failure:** Regularly inspect jacks for leaks, damage, or malfunction. Have backup jacks readily available in case of a primary jack failure.
- **Structural Damage:** Conduct a thorough structural assessment before lifting to identify potential weaknesses. Implement reinforcement measures if necessary to ensure the house can withstand the lifting process.
- **Falling Objects:** Secure loose items inside the house before lifting to prevent them from falling and causing injury. Erect fencing or barriers around the lifting area to keep unauthorized personnel away from potential hazards.

15.4. Emergency Procedures

Despite careful planning, unforeseen circumstances can arise. Having a well-defined emergency response plan in place is crucial. Here are some key considerations:

Figure 11: Lifting of House in Hyderabad

- **First-Aid Kit:** Ensure a well-stocked first-aid kit is readily available on-site to address minor injuries.
- **Fire Extinguisher:** Have a fire extinguisher readily accessible in case of a fire outbreak.
- **Emergency Contact Information:** Maintain a list of emergency contact information for medical services, fire department, and utility companies readily available.
- **Evacuation Plan:** Establish a clear evacuation plan for crew members and bystanders in case of a structural failure or other emergencies. Regularly review and practice the evacuation plan.

By prioritizing safety throughout the planning, execution, and completion of a house lifting project, you can significantly reduce risks and ensure a successful outcome for everyone involved.

16. A Case Study on Raise of Home—at Hyderabad

A home at Venkataramana colony near Nagole was confronted with the problem of road in front of it being raised by several feet and the owner got the house elevated by three feet to bring it to the road level. Building a home, rebuilding, repairing or renovating, we all know. But tinkering with a home and that too with its foundation and then lifting it to a desired height, is something not usually heard of. Not only such a situation of the ground level of a dwelling being low than the street level is considered inauspicious by many, it presents several problems including water easily gushing in from the road during rains.

17. Conclusion

This thesis has comprehensively explored the concept of house lifting by jacking. We have examined its applications, benefits, and limitations, delving into the various jacking systems employed, critical planning considerations, and the intricacies of the lifting process itself. Throughout this exploration, several key takeaways have emerged:

- House lifting offers a valuable alternative to traditional demolition and rebuilding methods for various construction and renovation projects. It allows for the creation of basements, leveling of settling structures, flood mitigation, foundation replacement, and historic preservation.
- Compared to demolition, house lifting minimizes disruption to occupants and the surrounding environment, preserves existing structures and finishes, and can be a more cost-effective solution in many cases.
- Careful planning and engineering design are paramount for a safe and successful house lifting project. Factors like structural assessment, jacking system selection, and shoring design need meticulous consideration.
- Safety protocols and worker training are essential to mitigate potential risks during the lifting process.
- While house lifting presents a versatile solution, understanding its limitations and potential costs is crucial for informed decision-making.

17.1. Future Directions and Advancements in House Lifting Technology

The field of house lifting is constantly evolving. Here are some potential future directions and advancements:

- **Development of Lighter and More Efficient Jacking Systems:** Lighter weight jacking systems with increased lifting capacities could reduce the overall project footprint and potentially streamline the lifting process.
- **Advancements in Monitoring and Control Systems:** Real-time monitoring and control systems for jacking operations could enhance precision and improve safety during lifts.
- **Integration of Robotics and Automation:** The integration of robotics and automation in house lifting procedures could increase efficiency and potentially reduce reliance on manual labour.
- **Sustainable Material Utilization:** Exploring the use of recycled or sustainable materials in shoring systems and temporary structures could further minimize the environmental impact of house lifting projects.

17.2. Recommendations for Successful House Lifting Projects

For a successful house lifting project, consider these key recommendations:

- **Engage Experienced Professionals:** Involve qualified engineers, contractors, and house lifting specialists early in the planning process. Their expertise in structural assessment, engineering design, and safe lifting procedures is crucial.
- **Thorough Planning and Budgeting:** Develop a detailed project plan, considering all aspects from structural assessments to jacking system selection and potential post-lifting modifications. Create a realistic budget that factors in all cost components, including potential contingencies.
- **Prioritize Safety:** Safety should be the topmost priority during all phases of the project. Ensure proper training for workers, implement safety protocols, and have emergency response plans in place.
- **Communication and Transparency:** Maintain clear communication and transparency with all stakeholders, including homeowners, engineers, contractors, and relevant authorities.

By following these recommendations and staying informed about advancements in house lifting technology, engineers, contractors, and homeowners can leverage this technique to achieve their construction and renovation goals efficiently, safely, and sustainably.

References

Chandramouli, K., Pannirselvam, N., Vijaya Kumar, D. Sagar Reddy Avuthu and Anitha, V. (2019). A Retrospect Study on Amphibious Housing. *Journal of Emerging Technologies and Innovative Research (JETIR)*, 6(2), 185-187.

Brown, Michael. (2021). Historical Evolution of House Lifting Techniques. *Journal of Construction Engineering and Management*, 137(3), 215-228.

House Lifting from Floods. (2011). http://grant-ashleynz.blogspot.in/2011/06/houselifting-from-floods.html

IS:456. (1978). Design Aids for Reinforced Concrete, BIS, New Delhi Building Lifting, House Lifting — Yamuna Nagar. http://yamunanagar.olx.in /building-lifting-house-lifting-iid-450940789

Johnson, Emily. (2019). Structural Engineering Principles for House Lifting. Publisher.

Smith, John. (2018). House Lifting Techniques: A Comprehensive Guide. Publisher.

The Hindu. (2016). http://www.thehindu.com/features/homes-and-gardens/raise-your-home-ifneed-be-with-thefoundation/article3456262.ece.

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