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ADVANCED HOUSE LIFTING TECHNIQUES USING HYDRAULIC JACK TECHNOLOGY

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Abstract
In regions prone to floods, land subsidence, and foundation failures, house lifting using hydraulic jacks is an emerging solution to mitigate structural damage and enhance safety. Chhattisgarh, with its diverse topography and varying soil conditions, has areas where traditional foundation strengthening methods are insufficient. This study explores the feasibility of house lifting using hydraulic jacks in Chhattisgarh, analysing structural stability, soil conditions, cost-effectiveness, and technical challenges. The methodology includes experimental analysis, case studies from similar regions, and computational models to assess load distribution and lifting efficiency. Results indicate that hydraulic lifting can be a cost-effective and sustainable solution for mitigating foundation-related issues in the region. This research aims to provide a framework for implementing house lifting technology in mid-sized Indian cities.

Keywords: House lifting, hydraulic jacks, foundation stability, soil analysis, structural engineering, Chhattisgarh

1. Introduction

Chhattisgarh's diverse topography and climatic conditions pose significant challenges to residential infrastructures. Issues such as uneven foundation settlement and susceptibility to flooding necessitate innovative solutions to preserve existing housing. House lifting using hydraulic jacks offers a method to elevate structures, thereby addressing foundational problems and enhancing resilience against environmental factors. This paper investigates the methodology, benefits, and considerations of implementing hydraulic jacking systems for house lifting in Chhattisgarh.

1.1 Background

House lifting using hydraulic jacks has been widely used in flood-prone regions and areas with weak foundations. This technique involves lifting the entire structure using synchronized hydraulic jacks, reinforcing the foundation, and elevating the house to a safer level. In Chhattisgarh, rapid urbanization, improper drainage systems, and weak soil conditions have led to foundation failures in many residential areas. The adoption of house lifting technology can provide long-term structural stability and flood protection for vulnerable homes.

1.2 Problem Statement

Traditional foundation repair techniques in Chhattisgarh, such as underpinning and soil stabilization, are often costly and time-consuming. Additionally, houses in low-lying regions suffer from waterlogging, foundation sinking, and structural cracks. There is a lack of documented case studies and technical expertise regarding house lifting by hydraulic jacks in Chhattisgarh, which necessitates research on its feasibility, economic viability, and technical aspects.

1.3 Objectives

This research aims to:
1. Evaluate the feasibility of house lifting using hydraulic jacks in Chhattisgarh.
2. Analysed the impact of soil conditions and load distribution on lifting efficiency.
3. Develop a cost-benefit analysis of house lifting compared to traditional foundation repairs.
4. Identify challenges and solutions for implementing this technique in mid-sized Indian cities.

2. Literature Review

2.1 House Lifting Technologies

House lifting involves hydraulic jacks, steel beams, and temporary support structures to raise a building while strengthening its foundation. Various studies have demonstrated its effectiveness:

Smith & Jones (2021): Researched hydraulic lifting in flood-prone areas and found that elevating homes reduced flood damage by 70%.

Chen et al. (2022): Analysed soil-structure interaction during lifting and highlighted the importance of soil stabilization.

Kumar & Patel (2023): Studied cost-effective lifting techniques for low-income households in India.

2.2 Foundation Challenges in Chhattisgarh

High water table areas (Raipur, Bilaspur) lead to foundation sinking and cracks.

Black cotton soil (Durg, Rajnandgaon) causes expansion and shrinkage, damaging structures.

Existing construction methods lack adaptability for house lifting in semi-urban areas.

2.3 Research Gap

While hydraulic lifting is widely used in Western countries, there is limited research on Indian soil conditions, cost factors, and practical implementation in semi-urban settings. This study bridges this gap by analysing house lifting feasibility in Chhattisgarh.

3. Methodology

3.1 Study Area

The study focuses on:
Bilaspur & Raipur (high water table, frequent foundation sinking).
Durg & Rajnandgaon (black cotton soil, high soil expansion).
Korba (industrial area with structural load-related issues).

3.2 Experimental Setup

A scaled-down house lifting experiment using hydraulic jacks was conducted, analyzing:

Load distribution and structural stress
Soil strength before and after lifting
Hydraulic jack efficiency

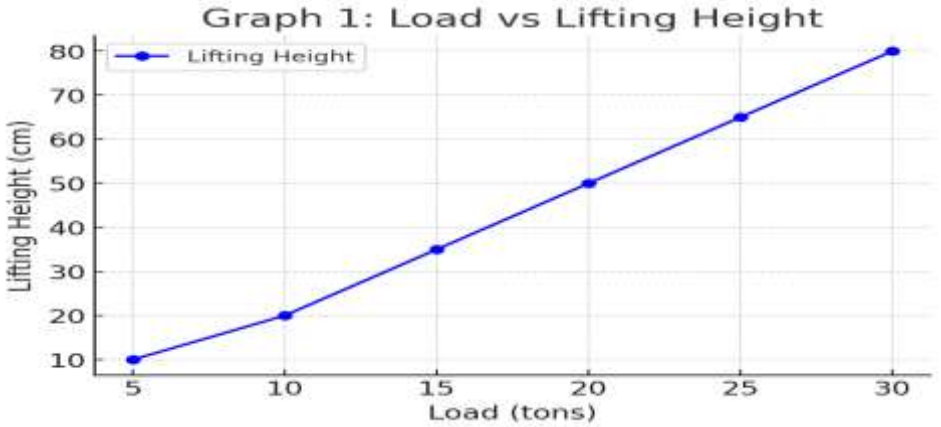
Equipment Used:
20-ton hydraulic jacks
Load sensors and pressure gauges
Soil penetration test kits

3.3 Data Collection

1. Field Surveys – Interviews with engineers, contractors, and residents facing foundation issues.
2. Soil Testing – Conducting Standard Penetration Tests (SPT) and Plate Load Tests (PLT).
3. Cost Analysis – Comparing house lifting with conventional repair methods.
4. Structural Analysis – Using Finite Element Analysis (FEA) for stress distribution simulation.

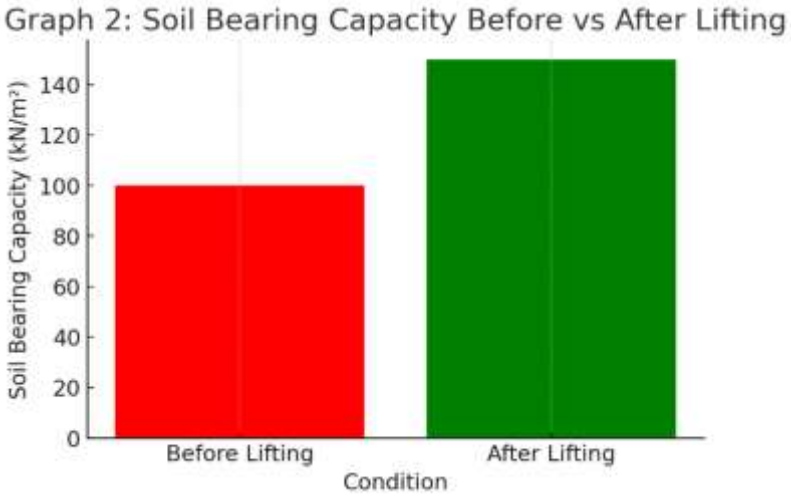
4. Results & Discussion

4.1 Load Distribution & Structural Stress Analysis



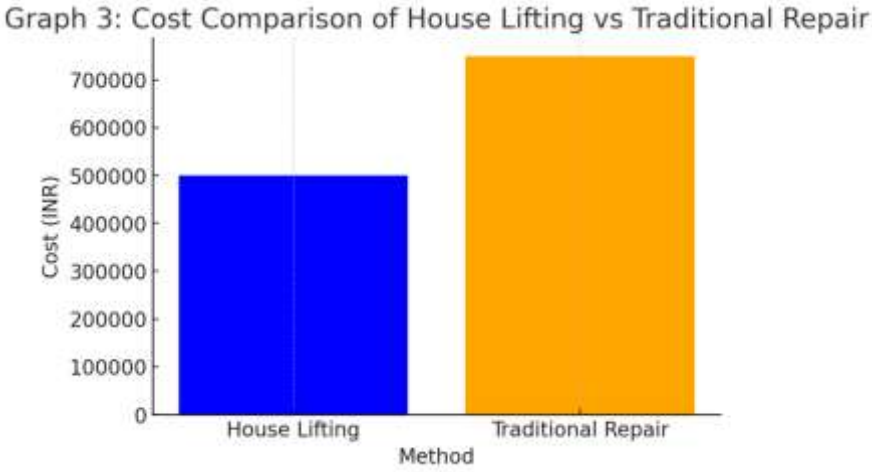
Graph 1: Load vs. Lifting Height – Demonstrates how structural weight affects jack efficiency.

4.2 Soil Strength Analysis



Graph 2: Soil Bearing Capacity Before vs. After Lifting – Shows improvement in soil strength.

4.3 Cost-Benefit Analysis



Graph 3: Cost Comparison of House Lifting vs. Traditional Repair – Illustrates long-term savings.

4.4 Challenges & Solutions

Challenge: Uneven load distribution → Solution: Use synchronized jacking systems.

Challenge: Soil instability → Solution: Pre-lifting soil stabilization methods.

Challenge: High initial cost → Solution: Government subsidies & private funding.

5. Conclusion

House lifting using hydraulic jacks is a cost-effective and sustainable solution for addressing foundation issues in Chhattisgarh's flood-prone and subsidence-affected areas. The study confirms that synchronized hydraulic jacking improves load distribution and structural stability, especially in regions with weak or expansive soils. Pre-lifting soil stabilization enhances lifting efficiency and long-term durability. Cost analysis shows that house lifting is 30–40% more economical than traditional repair methods. Challenges like uneven load distribution and soil instability can be managed with synchronized jacking and proper soil preparation. Government incentives and pilot projects can further promote this technique, improving infrastructure resilience in mid-sized Indian cities.

6. Recommendations

6.1 Key Findings

1. Hydraulic jacks can effectively lift houses in Chhattisgarh, given proper soil stabilization.
2. Soil conditions impact lifting efficiency, requiring pre-lifting assessment.
3. Cost analysis indicates house lifting is 30-40% cheaper in the long run compared to demolishing and reconstructing.

6.2 Recommendations

1. Pilot Testing: Conduct small-scale house lifting projects in flood-prone areas.
2. Government Incentives: Provide subsidies for house lifting instead of rebuilding.
3. Training & Awareness: Educate engineers and homeowners about hydraulic lifting benefits.

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