House lifting: Economic and Environment Friendly Method for Foundation Repair

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***Abstract*— Demolition of a house needs a strict attention and supervision to carry out the demolition and hen new construction is done. The project study includes the process of house lifting and new construction of building. Estimation, drawings are prepared for both house lifting and new construction of building. Drawings are prepared in accordance with the site visited for the house lifting. From the drawings estimation of house lifting method and new construction are done, which gives the total cost of both methods.The project study will give us the idea to adopt a particular method on the basis of feasibility, economy in cost & time and practicability.**

***Keywords*— Demolition, House Lifting, Economy, Foundation Repair**

I. INTRODUCTION

In the field of civil engineering there are different techniques used conventionally for the repair and restoration of foundations. Conventional methods used for the repair of foundation are underpinning, soil replacement etc. are costly, time consuming and also may result in damage to the superstructure.

Nowadays repair of foundation is done with new techniques known as lifting and shifting. In this technique the building is lifted with number of jacks and new foundation are constructed.

This technique is based on the relocation of structures by lifting it with hydraulic jacks. By raising the structure with jacks, we can also provide new foundation to the building or also strengthen the building foundation. It will result in increase of stability of the superstructure and life span of the building. This technique is economical as compared to the techniques used conventionally in the repair and restoration of the foundation. But this method damage the superstructure may also be minimized.

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.

This project is to compare the economy in the house lifting method and the construction of the new building. This project study titled "Comparison of House lifting and new construction" is including the Design of House lifting and estimation of total cost for the lifting of the house require. It also includes the Estimation of the construction of the new building

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II. METHODOLOGY

The methodology adopted to achieve above objectives Comprise of following steps.

1. Surveying of the residential building is to be done before starting the process of house lifting. It's important to study the weak members and the members of the building which requires the support before lift.
2. Load calculation of the building is done to get the numbers of jacks to apply for lifting the weight of the building and the numbers of jacks are applied according to the area of the building. Total load of the building is divided with the capacity of jacks which gives the number of jacks required to lift the building.

Load calculation for the building is as below:

Dead load of slab = 0.10*1*25 = 2.5 KN/m2
Floor finished = 10.0 KN/m^2
Live load = 3.0 KN/ m^2
Total load = 6.5 KN/ m^2
Factored load = 1.5*6.5 = 9.75KN/m2
Load transfer from slab to beam = 9.75 KN/m2
Load calculation for beam
Self weight of beam = 0.23*0.45*25 = 2.58 KN/m2
Parapet wall load on beam = 2 KN/m2
Total load transfer = 14.33 KN/m3
Wall load of super structure = 0.23*22.55*20 = 11.73 KN/m2
Total load coming to the foundation = 11.73+11.73+14.33+14.33+2.58 = 54.7 KN/m^2
Load in ton= 5.49/m2
Jacks requirement per m^2 = $\frac{\text{Total load}}{\text{Capacity of one jack}}$

= 5.49/2
= 2.75 jack/ m^2 required

Therefore, 3 jacks required per m^2

3. Before starting the lifting of the building it's important and necessary to disconnect the supplies of the building like electricity, gas connection, drainage connection etc. to avoid the interruption in the work and for the safety of the people working.
4. The support to weak members is provided to avoid the falling of members down during the process of lifting as the safety precautions to ensure the safety of the building and workers. Generally the supports of I-beams are provided as the supports.
5. At first the excavation is done near the walls for the application of the jacks, the jacks are applied below the ground beam or supports of steel beams.
6. The jacks are applied in the space of the excavation and the jacks are applied and the house is lifted by jacking the jacks simultaneously. The jacks are removed and the parallel brick masonry is done to support the lifting of the building.

7. The brick masonry is to be done to act as the foundation of the building, it supports the whole building and this ultimately increases the height of the building.

8. The jacks are removed after the brick masonry is completed and can sustain or bear the load of the building.
9. The pebbles and murrum are filled in the plinth area of the building. The backfilling of the sand should be well compacted to support the floor load of the building.
10. The flooring is done after the compacted soil filling. After the completion of the flooring the supply connections are connected.
11. After the lifting of the house is done the filling of cracks is done with the cement grouting is done

III. ESTIMATION

The demolition cost of the building is excluded for the estimation of new construction because the scrap value is assumed equal to demolition charge and therefore the cost of demolition is excluded.

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.

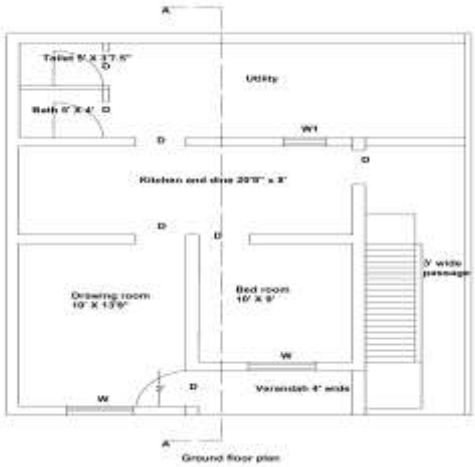

Figure 1: Ground floor plan of residential building

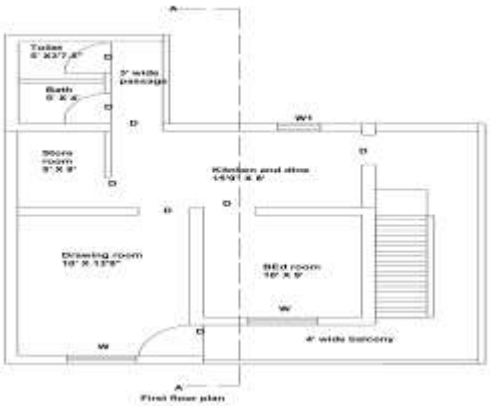

Figure 2: First floor plan of residential building

1. Estimate for New Construction

Total quantity of different items for Ground floor and first floor for new construction is combined and presented in table 1.

Table 1: Quantities of different work items for new construction

Item No.	Particulars of items and details of work	Quantity
1	Earthwork includes excavation in foundation	71.64m^3
2	B.B.C.C of proportion (1:4:8) with brick bats including compaction curing etc.	16.53 m^3
3	First class brick masonry in foundation CM (1:6)Up to plinth including curing etc.	32.28m^3
4	Back filling with ordinary soil in foundation trenches	26.66m^3
5	Back filling with yellow soil in plinth including watering, compaction and levelling etc.	43.7m^3
6	R.C.C work in ground beams including formwork, compaction curing etc.but excluding reinforcement.	2.98m^3
7	First class brick masonry in super structure including scaffolding, curing etc. in Cement mortar (1:6) 0.23 m thick. up to bottom level of beam. After deduction for door and window	47.10m^3
8	First class brick masonry in compound wall and Bath and toilet 0.23 thickness in Cement mortar (1:6)	06.84 m^3
9	First class Brick masonry in cement mortar (1:6) including curing in compound wall, bath room, toilet, and stair way railing	36.93m^2
10	RCC work including formwork, scaffolding, compaction, curing etc.Excluding reinforcement in lintel, weather shed, beam and slab	21.45m^3
11	Plastering and pointing 12 mm thick plastering with 1:6 cement local sand mortar in walls.Including scaffolding	534.95m^2
12	Flooring 2.5 cm Cement concrete (1:2:4) floor	42.56m^2
13	Flooring With ceramic tiles Inside the house	86.24 m^2
14	Dado with wall tiles	28.76m^2
15	Walls tile - Cream Royale/ Riviera in kitchen	09.22 m^2
16	Wood work in Door and windowSal wood work in chaukhats in door and window	00.26m^3
17	Sal wood work in chaukhats in doorand window, 3 cm thick paneled shutters of Deodar, wood in door and window	24.40 m^2
18	Doors and windows fittings of oxidized iron	24.40 m^2
19	Steel and Iron work Steel reinforcement TMT bars including bending in RCC work@ 1% of RCC work Excluding steps	19.28 MT
20	Iron work in hold fast and window bars	396.24 kg
21	Painting two coats over one coat of Priming for door and window	48.72m^2
22	Distempering one coat after one Priming coat	396.5 m^2
23	Parapet wall -0.10 m thick First class brick masonry in cement mortar (1:6) Including curing, on terrace.	30.18 m^2
24	Plastering and Pointing - 12 mm thick CM 1:6 Both side of parapet.	33.50m^2
25	Water proofing- Using china mosaic and 50 mm thick Cement mortar 1:6 including finish-ing, levelling and curing etc.	55.65 m^2

2. Estimate for House lifting

Total quantity of different items for house lifting is presented in table 2.

Table 2: Quantities of different work items for House Lifting

Item No.	Particulars of items and details of work	Quantity
1	Excavation for placing of jacks from plinth to the depth of footing	9.40 m^3
2	First class brick masonry above foundation up to 1.5 m	12.97 m^3
3	Backfilling of rubble and sand murrum including compaction with watering and levelling	64.91 m3
4	Flooring with ceramic tiles on ground floor above compacted soil backfilling.	43.27 m^2
5	Filling of cracks by cement grouting including finishing	1 job
6	Jack application	1 job

IV. RESULT

If foundation repair is carried out using conventional method i.e. by demolishing and new construction from foundation than Cost of new construction is Rs.1072636. and simultaneously more construction materials utilized. If foundation repair is carried out using house lifting method than Cost of house lifting is Rs.422916 and also leads to save in construction material.

Construction time for new construction is around 120 days while Construction time for house lifting is around 30 days. This also leads to time saving and economic for owner.

V. CONCLUSION

Construction by method of House lifting is cheaper around Rs. 649720 than usual construction method & saving around 90 days. Hence, it is preferred to use house lifting method for repairing of foundation and increasing plinth height for residential building. This method also helps to save construction materials which indirectly help in saving the natural resources of environment.

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