# Comparative Study on the Monetary Value of R. C. Structure with CLC Blocks & Burnt Clay Bricks

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*Abstract*— A building could be defined as an enclosed structure designed for human occupancy. Constructions work have been seen in almost all over the countries. In the construction industry, as there is an increase in material cost, there is a need to find more cost saving alternative materials, so as to maintain the cost of construction which can be afforded by people. In the inventing of burnt clay bricks, smoke exhibited at an extent and also some toxic gases evolve which will be harmful to an environment. So as to overcome with all the issues, Cellular lightweight concrete blocks have been used which is more economical and eco-friendly. This project present an analysis and comparison of G+3 residential building by using Cellular lightweight concrete blocks at the replacement of burnt clay bricks. Analysis is made by using burnt clay bricks and Cellular lightweight concrete blocks for different densities. Overall modelling and analysis was done by using STAAD-Provi8 software. By using cellular lightweight blocks the overall cost of construction will be reduced and it will ensure the safety and economical condition in earthquake forces also.

***Key words:*** Enclosed Structure; Constructions Work; Developing Countries: Burnt Clay Bricks; Cellular Lightweight Concrete; Earthquake Forces

## I. INTRODUCTION

Bricks can be of different types such as cellular light weight concrete blocks, burnt clay bricks, aerated concrete blocks etc. The bricks which is used in this project is of cellular light weight concrete blocks (CLC blocks). Cellular lightweight concrete blocks are classified as Grade A, Grade B, Grade C. The densities of cellular light weight concrete blocks are less as compared to burnt clay bricks. So those cellular lightweights concrete blocks are used in the high rise residential building at the replacement of the burnt clay bricks. Due to lightweight of these blocks there will be less dead load will act on the structure, therefore the structure became lighter. If the structure will be lighter then there will be reduction in the size of the member, reduction in the concrete and also by using these blocks there will be no use of sand for the plastering purpose.

The main ingredients of the CLC blocks are ordinary Portland cement based foaming agent and industrial by products includes fly ash and ground granulated blast furnace slag.

The aims of the project are:

- To design the building in economic way.
- To compare the cost analysis between CLC Blocks and Burnt clay bricks.
- To analyze the reduction of dead loads of CLC Blocks with burnt clay bricks.
- To reduce the cost of the building by using CLC blocks

This study is focused on to reduce the material cost in construction work. To implement in low cost residential building to benefits the middle class people.

## II. METHODOLOGY

We have selected the proposed plan of G+3 building for the comparison of monetary value of the structure using CLC blocks and burnt clay bricks. We have done the load calculation and load analysis for the structure using Burnt clay bricks and CLC blocks separately with the help staad pro v8i.We have designed the structural member of the structure using CLC blocks and Burnt clay bricks separately and taken the quantities for both structures separately. We have obtained the differences of quantities of steel and concrete. The cost estimate of the structure using CLC blocks reduced by 25% from the Structure using Burnt clay bricks.

### *A. Selection of Plan*

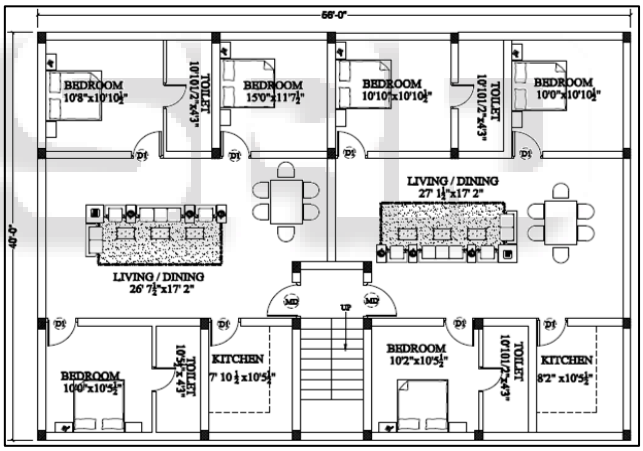



Fig. 1: Selection of Plan

### *B. Cellular Light Weight Concrete Blocks*

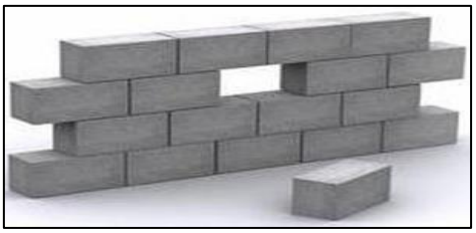


Fig. 2: Cellular Light Weight Concrete Blocks

CLC Blocks is slurry of cement, sand, water, fly ash and preformed stable foam. Due to light weight of these blocks there will be less dead load will act on the structure, therefore the structure became lighter. CLC Blocks are used in high in high rise residential building at replacement of the conventional burnt clay bricks. The density of CLC blocks are less as compared to burnt clay bricks and it is porous, nontoxic, reusable, renewable and recycled. If the structure will be lighter than there will be reduction in the

reinforcement, , reduction in the concrete and also by using blocks there will be no use of coarse sand for the plastering purpose. And the building should be constructed in a most economical way.

*C. Burnt Clay Bricks*

Fig. 3: Burnt Clay Bricks

Burnt Clay bricks are made up of with clay and water. Common burnt clay bricks are formed by pressing in molds. Then these bricks are dried and fired in a kiln. Common burnt clay bricks are used in general work with no special attractive appearances. When these bricks are used in walls, they require plastering or rendering. Typical characteristics of burnt clay brick are as follows: Dimensions – Length-250mm; width -125mm; Height: 75mm, Color – Red, Weight – 3.6 Kg, Bulk density – 1700 – 1800 Kg/m³, cold crushing strength – 70 – 90 kg/m³, Water Absorption – 20%.

## III. LOAD CALCULATIONS

*A. Load Calculations for Burnt Clay Bricks Dead Load*

Self-weight of RCC Members (Beam and column) are taken by STADD pro software itself

*1) Slab Load*
- Slab thickness at terrace= 0.150 m
- Density of concrete= 25.00 kN/m³
- Slab Load= 3.75 kN/m²
- Roof Finish= 1.50 kN/m²
- Total Load= 5.25 kN/m²

*2) Brick Wall Load (230mm)*
- Unit weight of brick= 20.00 kN/m²
- Thickness of wall= 0.23 m
- Height of wall= 3.00 m
- Load= 13.8 kN/m

*3) Brick Wall Load (115 mm)*
- Unit weight of bricks= 20.00 kN/m²
- Thickness of wall= 0.115 m
- Height of wall= 3.00 m
- Load= 6.9 kN/m

*4) Parapet Wall Load*
- Unit weight of bricks= 20.00 kN/m²
- Thickness of wall= 0.115 m
- Height of wall= 1.20 m
- Load= 2.8 kN/m

*5) Staircase Load*
- Slab thickness= 0.175 m
- Unit weight of concrete= 25.00 kN/m²
- Width= 1.00 m
- Length= 3.50 m
- Weight of slab= 15.313 kN

*6) Brick Steps Load*
- Unit weight of brick= 20.00 kN/m²
- Treads= 0.30 m
- Riser= 0.15 m
- No. of steps= 20.00 Nos.
- Weight of Brick steps= 9.00 kN
- Total staircase load= 24.13 kN

*7) Live Load*
- Live load on Roof Terrace= 1.5 kN/m²
- Live load on the Head Room Roof= 0.75 kN/m²
- Live load on Rooms= 2.00 kN/m²

*B. Load Calculation – CLC Blocks*

*1) Slab thickness at terrace= 0.15 m*
- Density of concrete= 25.00 kN/m³
- Slab Load= 3.75 kN/m²
- Roof Finish= 1.50 kN/m²
- Total Load= 5.25 kN/m²

*2) CLC Wall Load (230mm)*
- Unit weight of brick= 12.00 kN/m²
- Thickness of wall= 0.23 m
- Height of wall= 3.00 m
- Load= 8.3 kN/m

*3) CLC wall Load (115 mm)*
- Unit weight of bricks= 12.00 kN/m²
- Thickness of wall= 0.115 m
- Height of wall= 3.00 m
- Load= 4.1 kN/m

*4) CLC Parapet wall Load*
- Unit weight of bricks= 12.00 kN/m²
- Thickness of wall= 0.115 m
- Height of wall= 1.20 m
- Load= 1.7 kN/m

*5) Staircase load*
- Slab thickness= 0.175 m
- Unit weight of concrete= 25.00 kN/m²
- Width= 1.00 m
- Length= 3.50 m
- Weight of slab= 15.313 kN

*6) Brick Steps Load*
- Unit weight of brick= 12.00 kN/m²
- Treads= 0.30 m
- Riser= 0.15 m
- No. of steps= 20.00 Nos.
- Weight of Brick steps= 9.00 kN
- Total staircase load= 15.313 kN

*7) Live Load*
- Live load on Roof Terrace= 1.5 kN/m²
- Live load on the Head Room Roof= 0.75 kN/m²
- Live load on Rooms= 2 kN/m²

*C. Wind Load Calculations*

Wind load on building

Wind load shall be calculated based on the code IS875-1987(part-3)
- Design wind pressure (Pz)= $0.6*Vz^2$
- Design wind speed (Vz) = $vb*k_1 *k_2 *k_3$
- Life of the structure= 50 Years
- Basin wind speed (Vb) = 50 m/sec
- $K_1$ = Risk coefficient= 1 (IS 875 –Table 1)

- $K_2$ = (Terrain category) 4 (height= 20m) = 1 (IS 875 – Table 1)
- $K_3$ = Topography factor= 1 (IS 875 –Table 1)
- Design wind speed (vz) height up to 20 m = 50 m/ sec
- Design wind pressure (Pz) height up to 20m= 1162 N/m²
- Design wind pressure (Pz) up to 20m= 1.162 kN/m² (STAAD INPUT)

*D. Seismic Load Calculations As Per IS 1893(1) – 2002*

- Seismic zone= III STAAD INPUT
- Seismic zone factor Z= 0.16 STAAD INPUT
- Importance factor I= 1.00STAAD INPUT
- Response Reduction factor= 5.00STAAD INPUT
- Seismic weight are applied as joint weights

*E. Load Combinations*

LOAD COMB 101 1.5DL+1.5LL
3 1.5 4 1.5
LOAD COMB 102 1.5DL+1.5SL +X
3 1.5 5 1.5
LOAD COMB 103 1.5DL+1.5SL -X
3 1.5 5 -1.5
LOAD COMB 104 1.5DL+1.5SL +Z
3 1.5 6 1.5
LOAD COMB 105 1.5DL+1.5SL -Z
3 1.5 6 -1.5
LOAD COMB 106 1.5DL+1.5WL +X
3 1.5 7 1.5
LOAD COMB 107 1.5DL+1.5WL -X
3 1.5 8 1.5
LOAD COMB 108 1.5DL+1.5WL +Z
3 1.5 9 1.5
LOAD COMB 109 1.5DL+1.5WL -Z
3 1.5 10 1.5
LOAD COMB 110 1.2DL+1.2LL+1.2SL+X
3 1.2 4 1.2 5 1.2
LOAD COMB 111 1.2DL+1.2LL+1.2SL-X
3 1.2 4 1.2 5 -1.2
LOAD COMB 112 1.2DL+1.2LL+1.2SL+Z
3 1.2 4 1.2 6 1.2
LOAD COMB 113 1.2DL+1.2LL+1.2SL-Z
3 1.2 4 1.2 6 -1.2
LOAD COMB 114 1.2DL+1.2LL+1.2WL+X
3 1.2 4 1.2 7 1.2
LOAD COMB 115 1.2DL+1.2LL+1.2WL-X
3 1.2 4 1.2 8 1.2
LOAD COMB 116 1.2DL+1.2LL+1.2WL+Z
3 1.2 4 1.2 9 1.2
LOAD COMB 117 1.2DL+1.2LL+1.2WL-Z
3 1.2 4 1.2 10 1.2
LOAD COMB 118 0.9DL+1.5SL +X
3 0.9 5 1.5
LOAD COMB 119 0.9DL+1.5SL -X
3 0.9 5 -1.5
LOAD COMB 120 0.9DL+1.5SL +Z
3 0.9 6 1.5
LOAD COMB 121 0.9DL+1.5SL -Z
3 0.9 6 -1.5
LOAD COMB 122 0.9DL+1.5WL +X
3 0.9 7 1.5
LOAD COMB 123 0.9 DL+1.5WL -X
3 0.9 8 1.5
LOAD COMB 124 0.9DL+1.5WL +Z
3 0.9 9 1.5
LOAD COMB 125 0.9DL+1.5WL -Z
3 0.9 10 1.5

*F. 3D Views*

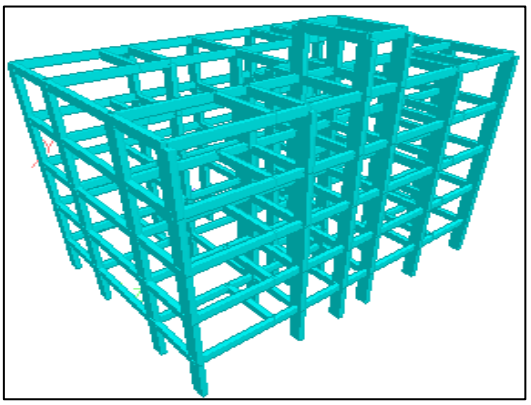
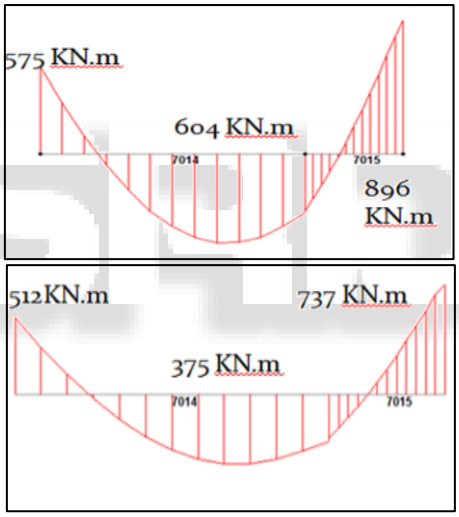


Fig. 4: 3d View

*G. Bending Moment Diagram for Critical Sections*




*1) CLC Block*

Length of the beam =3.65 m, Cross section of the beam =0.23*0.60m

*2) Shear Force Diagram for Critical Sections*

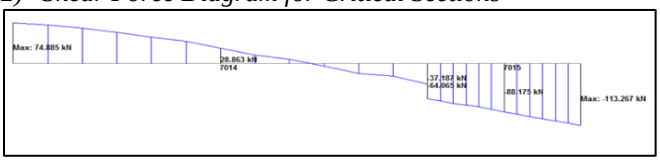


Fig. 5: Bending Moment Diagram for CLC Blocks & Burnt Clay Bricks

*3) Burntclay Bricks*

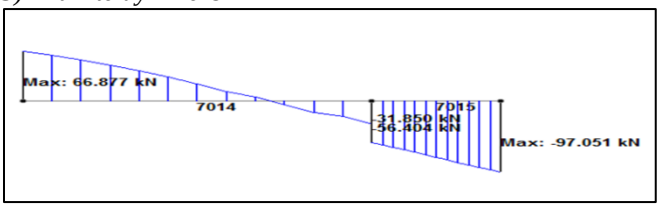



Fig. 6: Shear Force Diagram for CLC Blocks & Burnt Clay Bricks

*4) CLC Blocks*

## IV. RATE ANALYSIS

*A. Rate Analysis for Concrete Work 1:1.5:3, Mix Rate 1m³*

| Quantity | Description | Rate (Rs.) | Unit | Amount (Rs.) |
|---|---|---|---|---|
| 8.61 Bags | Cost of cement | 380.00 | Bags | 3274.08 |
| 0.45 m³ | Cost Sand | 2293.00 | M³ | 1031.85 |
| 0.90 m³ | Cost of 20mm Blue metal | 1165.00 | M³ | 1048.50 |
| 1 m³ | Labour charges | 180.00 | M³ | 180.00 |
| Total Amount (Rs.) | | | | 5534.43 |

Table 1:

*B. Rate Analysis for Brick Masonry 230mm Thick, CM 1:6, Rate for 1m³*

| Quantity | Description | Rate (Rs) | Unit | Amount (Rs.) |
|---|---|---|---|---|
| 500 nos. | Clay Bricks | 6.50 | Each | 3250.00 |
| 0.30 m³ | River Sand | 1600.00 | M³ | 480.00 |
| 1.40 Bag | Cement | 400.00 | Bag | 560.00 |
| 1.00 m³ | Labour Charges | 600.00 | M³ | 600.00 |
| 1.00 m³ | Curing | 50.00 | M³ | 50.00 |
| 1.00 m³ | Scaffolding | 110.00 | M³ | 110.00 |
| 1.00 m³ | Tools & Plants 1% | 50.00 | M³ | 50.00 |
| Total | | | | 5100.00 |

Table 2:

*C. Rate Analysis for CLC Blocks 230mm Thick, CM 1:6, Rate for 1m³*

| Quantity | Description | Rate (Rs.) | Unit | Amount (Rs) |
|---|---|---|---|---|
| 36.00 nos. | CLC Blocks | 80.00 | Each | 2880.00 |
| 0.75 Bag | Cement | 400.00 | Bag | 300.00 |
| 0.10 m³ | River Sand | 1600.00 | M³ | 160.00 |
| 1.00 m³ | Labour Charges | 450.00 | M³ | 450.00 |
| 1.00 m³ | Curing | 50.00 | M³ | 50.00 |
| 1.00 m³ | Scaffolding | 130.00 | M³ | 130.00 |
| 1.00 m³ | Tools & Plants 1% | 50.00 | M³ | 50.00 |
| Total Amount (Rs.) | | | | 4020.00 |

Table 3:

*D. Rate Analysis for Reinforcement Steels TMT Fe415 Bars, Rate for 1 MT*

| Quantity | Description | Rate (Rs.) | Units | Amount |
|---|---|---|---|---|
| 1.03 MT | $Fe_{415}$ Steel | 36000.00 | MT | 37080.00 |
| 9.00 Kg | Binding wire | 70.00 | Kg | 630.00 |
| 1.00 MT | Labour Charges | 10000.00 | MT | 10000.00 |
| 1.00 MT | Cover Block | 80.00 | MT | 80.00 |
| 1.00 MT | Scaffolding | 100.00 | MT | 100.00 |
| 1.00 MT | Plant & Machineries | 210.00 | MT | 210.00 |
| Total Amount (Rs) | | | | 48100.00 |

Table 4:

## V. COST VARIATION ANALYSIS

*A. Cost Variations CLC Blocks vs Burnt Clay Bricks*

| S.No | Item of Works | Unit | Rate in Rs. | Quantities | | Cost(Rs.) | |
|---|---|---|---|---|---|---|---|
| | | | | CLC Blocks | Burnt Clay Bricks | CLC Blocks | Burnt Clay Bricks |
| 1 | Concrete works | Cum | 5534.00 | 274.084 | 332.395 | 1517456.00 | 1839473.00 |
| 2 | Brick Work | Cum | 5100.00 | | 274.206 | | 1398450.00 |
| 3 | CLC Blocks | Cum | 4020.00 | 282.699 | | 1136450.00 | |
| 4 | Reinforcement | MT | 48100.00 | 16.13 | 26.09 | 775853.00 | 1254929.00 |
| TOTAL AMOUNT(Rs.) | | | | | | 3429759.00 | 4492852.00 |

Table 5:

*B. Quantities of Concrete*

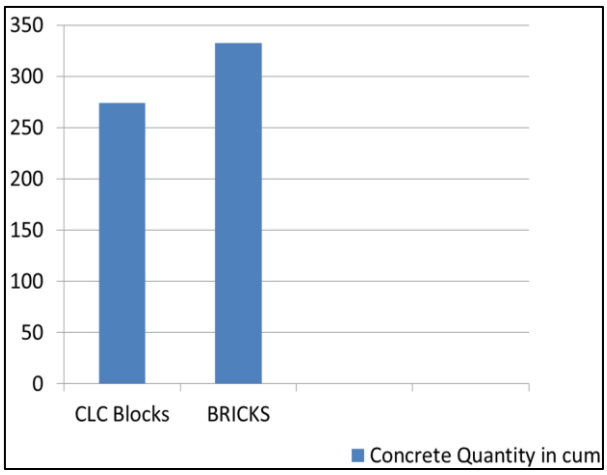



Fig. 7: Quantities of Concrete

*C. Total Weight of Steel in KGS*

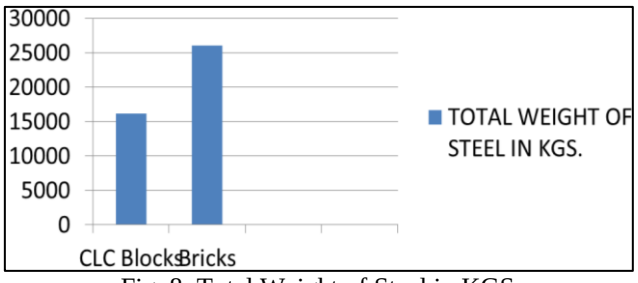



Fig. 8: Total Weight of Steel in KGS

*D. Monetary Value of R. C. Structure with CLC Blocks & Burnt Clay Bricks*

| Item of Works | Cost(Rs.) | | Difference in Amount (Rs.) | Difference in % | Difference in Rate/Sft. |
|---|---|---|---|---|---|
| | CLC Blocks | Burnt Clay Bricks | | | |
| Concrete works | 1517456.00 | 1839743.00 | 322287.00 | 17.52 % | |
| Brick Work | | 1398450.00 | 262000.00 | 18.74 % | |
| CLC Blocks | 1136450.00 | | | | |
| Reinforcement | 775853.00 | 1254929.00 | 479076.00 | 38.17% | |
| TOTAL AMOUNT (Rs.) | 3429759.00 | 4493122.00 | 1063363.00 | 23.67% | 120/Sft. |

Table 6:

## VI. CONCLUSION

- By using the cellular light weight concrete blocks, the cost of buildings has been reduced drastically as we can save an amount of Rs.120/sft approximately.
- The cost difference is coming nearly about 23.67% when we made the comparison analysis between CLC Blocks & Burnt Clay Bricks. This gives the great impact on cost of the construction of building.
- Due to the low density of the CLC Blocks, the dead load of this masonry is considerably reduced, when comparing with the Burnt Clay Bricks. This may get reflected in the design of structure.
- As we are using the Fly Ash & Slag as the raw material of the CLC Blocks, the waste materials can be reused and it will be Eco friendly structure as well.

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