International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 01 | January - 2023 Impact Factor: 7.185 ISSN: 2582-3930

# CASE SELECTION AND DATA DESCRIPTION FOR THE WORKING LABOURS IN A RESIDENTIAL BUILDING

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## ABSTRACT

Nowadays, many construction companies are facing with ever stricter environmental impacts and changing, innovative material markets in which customers are being increasingly aware of environmental impacts. In today's societies the built environment accounts for 10% of global economic, activity, consumes 40% of the world's material and energy production, accounts for 70% of the fresh water consumption and uses 25% of the annual global wood harvest. As we know, the construction of a building consisting of many activities that begins with Earthwork and ends with handover of the building to the customer by the contractor. Hence it includes many different construction materials which cause great impacts to the environment. Not only the building materials, but also the pollution producing during the period of construction and demolition of a building creates largest impact to the surrounding environment.

## 1. GENERAL

Of the many environmental impacts of development, the one with the highest profile currently is global warming, which demands changes from government, industry and public. Concerns about the local and global environment situation are rising all over the world. Global warming is the consequence of long term build up of greenhouse gases (CO2, CH4, N2O, etc.) in the higher layer of atmosphere. The emission of these gases is the result of intensive environmentally harmful human activities such as the burning of fossil fuels, deforestation and land use changes. This is generally accepted to be the reason that average global temperatures have increased by 0.74 °C in the last 100 years. Global temperatures are set to rise by a further 1.1 °C in a low emissions scenario, and by 2.4 °C in a high emissions scenario, by the end of the century. It is necessary to

reduce Green House Gases (GHG) emissions by 50% or more in order to stabilize global concentration by 2100. The Tyndall Centre has suggested that a 70% reduction in CO2 emissions will be required by 2030 to prevent temperature rising by more than 1 °C. UK emissions of greenhouse gases fell by nearly 14.6% between the 1990 base year and 2004, but have risen by about 1 % since 2002, most recently because of increased oil and gas consumption. The UK has a legally binding target under the Kyoto 1 protocol to reduce its emissions of the basket 2 of six major greenhouse gases, and has announced its intention to put itself on a path towards a reduction in CO2 emissions of 80% by about 2050.

Perhaps because GHG emissions can be more readily quantified than other impacts, they have attracted most attention from researchers and policy makers but GHG emissions are just one of a range of parameters that should be considered in assessing environmental impacts. Others are ozone depletion, water consumption, toxicity, eutrophication of lakes and rivers, and resource depletion, and the aim of this paper is to review Life Cycle Assessment (LCA) as a means of evaluating the environmental impact of buildings.

## 2. CASE SELECTION AND DATA DESCRIPTION

### 2.1 CASE STUDY - INTRODUCTION

The following case study deals with the activities carried out for a small Residential building of about 596 sq.ft and the details of labour involved for each activities which starts with the Excavation process and ends with the Finishing process.

## 2.2 PLAN OF THE RESIDENTIAL BUILDING


**Fig.1** Plan of the Building

## 2.3 QUANTITY TO BE WORK BY LABOURS FOR EACH ACTIVITY

- Earthwork = 52.02 $m^3$
- Sand Filling = 9.54 $m^3$
- PCC 1:5:10 = 3.36 $m^3$
- Cement Concrete 1:2:4 = 21.14 $m^3$
- Flooring Concrete = 3.82 $m^3$
- Brickwork (F & B) = 11.29 $m^3$

- Brickwork 1:6 = 29.12 $m^3$
- Brick Partition = 16.25 $m^2$
- Plastering CM 1:5 = 336.60 $m^2$
- Ceiling plastering = 38.71 $m^2$
- White wash = 38.71 $m^2$
- OBD = 158.17 $m^2$
- Emulsion = 171.64 $m^2$
- Iron Work = 5.00 $m^2$
- Wood Work = 13.09 $m^2$
- Floor Tiles = 39.10 $m^2$
- Wall Tiles = 21.85 $m^2$
- Antiskid = 4.20 $m^2$
- Cupboard Slab = 7.40 $m^2$
- Formwork = 128.74 $m^2$

## 2.4 ACTIVITY AND LABOUR REQUIRED DETAILS

**Table 1** Number of Labours Working Per Day

| ACTIVITIES | M | MH | WH | BB | C | P | E |
|---|---|---|---|---|---|---|---|
| Earthwork by JCB | - | - | - | - | - | - | - |
| P.C.C and Bar bending for footing | 1 | 1 | 2 | 3 | - | - | - |
| Column marking & Bar bending for footing | 1 | 1 | 1 | 3 | - | - | - |
| Erection of Column & Matt & Formwork | 1 | - | - | 4 | - | - | - |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Formwork for footing & Erection | 1 | - | - | 3 | 3 | - | - |
| Footing concrete 1:2:4 | 2 | 4 | 6 | 1 | 1 | - | - |
| Shoe Marking & Column Concrete | 1 | - | 1 | - | - | - | - |
| Column Box Fixing for 4 nos & Column Concrete | 1 | 2 | 3 | - | 2 | - | - |
| Column Box Fixing for 5 nos upto Grade Beam | 1 | 2 | 4 | - | 2 | - | - |
| Column Box Fixing for 4 nos & Column Concrete | 1 | 1 | 2 | - | 2 | - | - |
| Refilling of Earthwork by JCB | - | - | - | - | - | - | - |
| Consolidation Process | - | 1 | 1 | - | - | - | - |
| Consolidation Process Bar bending for grade Beam | - | 1 | 1 | - | - | - | - |
| Grade Beam Earthwork, Barbending for grade beam | - | 2 | - | 2 | - | - | - |
| P.C.C 1:5:10 for Grade Beam & Formwork for same | 1 | 2 | 3 | 3 | - | - | - |
| Erection of Grade Beam around Column rod cutting | - | - | - | 4 | 4 | - | - |
| Grade Beam Concrete Column laping upto roof | 1 | 2 | 4 | 3 | - | - | - |
| Shoe Marking for all column | 1 | - | 1 | 3 | - | - | - |
| Column Concrete & Box fixing (Day 1) | 1 | 2 | 4 | - | 2 | - | - |
| Column Concrete & Box fixing (Day 2) | 1 | 3 | 6 | - | 2 | - | - |
| Brickwork for Basement (Day 1) | 2 | 1 | 2 | - | - | - | - |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Brickwork for Basement (Day 2) | 3 | 1 | 3 | - | - | - | - |
| Septic Tank R.R Masonry | 1 | 2 | 2 | - | - | - | - |
| Septic Tank Brick Work | 2 | 1 | 2 | - | - | - | - |
| Septic Tank curable Wall Brickwork | 1 | 1 | 1 | - | - | - | - |
| Filling excavated earth for basement &<br>Septic Tank Inner Plastering | 3 | 1 | 3 | - | - | - | - |
| Consolidation for Basement | - | 2 | 1 | - | - | - | - |
| Consolidation for Basement | - | 1 | 1 | - | - | - | - |
| Flooring P.C.C 1:5:10 | 2 | 5 | 7 | - | - | - | - |
| Staircase 1st flight formwork | - | - | - | - | - | 3 | - |
| Staircase 1st flight Bar bending | - | - | - | 3 | - | - | - |
| Staircase 1st flight & Step Concrete | 1 | 1 | 2 | 1 | 1 | - | - |
| Roof slab formwork<br>Septic Tank Formwork | - | - | - | - | 4 | - | - |
| Roof slab formwork Erection | - | - | - | - | 4 | - | - |
| Roof slab Bar bending & Septic Tank Bar Erection | - | - | - | 4 | - | - | - |
| Roof slab Bar Erection &<br>Septic tank cover slab concrete | - | - | - | 4 | - | - | - |
| Roof Slab Concrete 1:2:4 | 2 | 5 | 9 | 1 | 1 | - | - |
| Curing (Day 1) | - | - | 1 | - | - | - | - |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Curing (Day 2) | - | - | 1 | - | - | - | - |
| Curing (Day 3) | - | - | 1 | - | - | - | - |
| Curing (Day 4) | - | - | 1 | - | - | - | - |
| Curing (Day 5) | - | - | 1 | - | - | - | - |
| Curing (Day 6) | - | - | 1 | - | - | - | - |
| Curing & Resulting (Day 7) | - | - | 1 | - | - | - | 3 |
| Brick upto sill level (Day 1) | 3 | 1 | 3 | - | - | - | - |
| Brick upto sill level (Day 2) | 3 | 1 | 3 | - | - | - | - |
| Brick upto lintel level<br>Lintel & Subshsde formwork (Day 1) | 2 | 1 | 2 | - | - | - | - |
| Lintel & Subshsde formwork (Day 2) | 3 | 1 | 2 | - | 2 | - | - |
| Lintel & Subshade Fabrication<br>Lintel concrete | 1 | 2 | 3 | 2 | 1 | - | - |
| Curing & Lintel Concrete | 1 | 2 | 4 | 1 | 1 | - | - |
| B.W upto Roof level (Day 1) | 3 | 1 | 3 | - | - | - | - |
| B.W upto Roof level (Day 2) | 3 | 1 | 3 | - | - | - | - |
| Inner Ceiling Plastering & Pipeline<br>B.W for parapet<br>Electrical work | 4 | 2 | 5 | - | - | - | 2 |
| Inner Ceiling Plastering<br>Inner wall Plastering (Day 1) | 5 | 2 | 6 | - | - | - | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Inner wall Plastering (Day 2) | 3 | 1 | 3 | - | - | - | - |
| Inner wall Plastering (Day 3) | 3 | 1 | 3 | - | - | - | - |
| Door & Windows fixing | 1 | 1 | - | - | 2 | - | - |
| Outer Plastering & Inner W.C fixing (Day 1) | 3 | 1 | 4 | - | - | - | 2 |
| Outer Plastering & Inner W.C fixing (Day 2) | 4 | 1 | 4 | - | - | - | 1 |
| Outer plastering balance portion & bath | 2 | 1 | 2 | - | - | - | - |
| Floor tiles & wall tile laying | 2 | 1 | - | - | - | - | - |
| Floor tiles for Inner rooms (Day 1) | 3 | 2 | - | - | - | - | - |
| Floor tiles for Inner rooms (Day 2) | 2 | 1 | - | - | - | - | - |
| Kitchen hearth slab Concrete | 1 | 1 | 1 | - | - | - | - |
| Inner Painting Primer Coat | - | - | - | - | - | 2 | - |
| Outer Painting Primer Coat (Day 1) | - | - | - | - | - | 3 | - |
| Outer Painting Primer Coat (Day 2) | - | - | - | - | - | 1 | - |
| Inner painting OBD & Outer Emulsion (Day 1) | - | - | - | - | - | 5 | - |
| Inner painting OBD & Outer Emulsion (Day 1) | - | - | - | - | - | 4 | - |
| Outer painting Emulsion & Door Window | - | - | - | - | - | 6 | - |
| Wiring & Electrical works | - | - | - | - | - | - | 2 |
| Pipeline for outer | - | - | - | - | - | - | 2 |
| Cleaning & Glass fixing | - | - | - | - | 2 | - | - |

Where,

M - MASON

MH - MEN HELPER

WH - WOMEN HELPER

BB - BAR BENDER

C - CARPENTER

P - PLUMBER

E - ELECTRICIAN

## 2.5 LABOUR (MAZDOOR) REQUIRED FOR DIFFERENT WORKS

Extracts from the report on Productivity Projects in Building Industries issued by "**NATIONAL BUILDING ORGANISATION**" are given below:

(A) Earthwork per 28.30 cu m (1000 cu ft) -

- Excavation in foundations, trenches, etc. in ordinary soil including disposal upto 30m (100') and lift of 1.5m (5 ft) - 5 Beldars and 4 Mazdoors can do 28.30 cu m(1000 cu ft) per day.
- Refilling excavated earth in foundations, plinth, etc., including consolidation in 15 cm (6") layers - 3 Beldars, 2 Mazdoors and 1/2 Bhisthi can do 28.30 $m^3$
  (1000 cu ft) per day.
- Disposal of surplus earth within a lead of 30 m (100') - 1 Mazdoor can do 2.83 cu m (100 cu ft) per day.

(B) Cement Concrete work per 2.83 cu m (100 cu ft) -

- Laying cement concrete - 2 Beldars, 3 Mazdoors, 3/4 Bhisthi and 1/4 Mason can do 2.83 cu m (100 cu ft) per day.

(C) R.C.C Work -

- Laying reinforced concrete - 3 Beldars, 3 Mazdoors, 1 1/3 Bhisthi and 1/2 Mason can do 2.83 cu m (100 cu ft) per day.

- Centering and shuttering for flat surfaces - 4 Beldars and 4 Carpenters (II class) can do 9.6 sq m (96 sq ft) per day.
- Reinforcement work for R.C.C - 1 Blacksmith or fitter and 1 Beldar can bend and place in position 1 quintal (2 cwt) of steel per day.

(D) Stone work per 2.83 cu m (100 cu ft) -

- Random rubble masonry with blue stone in foundations - 3 Masons, 3 Beldars, 2 Mazdoors, and 1/4 Bhisthi can do 2.83 cu m (cu ft) per day.

(E) Brick work per 2.83 cu m (100 cu ft) -

- First class brick work in 1:4cement mortar in superstructure partition walls, junctions of roof, parapet walls and string course - 2 1/4 Masons, 4 1/2 Mazdoors and 1/2 Bhisthi can do 2.83 cu m (cu ft) per day.

(F) Wood Work -

- For the frames of doors and windows - 2 Carpenters and 1 Beldar can work 0.18 cu m (6.40 cu ft) of wood equipment to 4 door frames 7.5 cm x 10 cm of 1.2 m x2.1 m size per day.
- For pannalled, glazed, etc., shutters - 15 carpenters and 4 beldars can make and fix 4 shutters 40 mm thick of size 2.00 m x 1.15 m per day. quantity of wood per shutter - 0.075 cu m, i.e., 2.66 cu ft.

(G) Iron work -

- Fixing 40 mm x 3 mm x 38 cm flat iron holdfasts - 1 Blacksmith (II class), 1 Mason and 1 Beldar can fix 36 holdfasts per day.
- Fixing 16 mm dia M.S rods - 1 Blacksmith (II class), 2 Carpenters (II class) and 3 Beldar can fix 16.5 m per day.

(H) Flooring -

- 4 cm thick cement concrete flooring of 40 sq m require - 5 Masons, 4 Beldars, 3 Mazdoors and 1 Bhisthi per day for mixing, laying and finishing.

(I) Finishing -

- Plastering with any mortar 12 mm thick - 3 Masons, 3 Mazdoors and 1 Bhisthi can plaster 40 sq m (400 sq ft) per day.
- White washing or Colour washing (3 coats) - 1 White washer and 1 Mazdoor can do 60 sq m (600 sq ft) per day.
- Painting two coats such as chocolate; red, grey, etc., on wood or steel - 3 6.6Painters and 2 Mazdoors can paint 10 sq m (sq ft) per day.

## 2.6 CALCULATION OF LABOURS GETTING AFFECTED

**Table 2** Labour Details Per Day for Some Activities

| **ACTIVITIES** | **NUMBER OF LABOURS INVOVLED/ DAY** | **NUMBER OF LABOURS AFFECTED/ DAY** |
|---|---|---|
| Earthwork | 0 | 0 |
| Refilling | 0 | 0 |
| Cement Concrete work | 6 | 2 |
| Brickwork | 7 | 3 |
| Plastering | 7 | 1 |
| White wash | 2 | 1 |
| Painting | 6 | 5 |
| Iron work | 5 | 1 |
| Wood work | 19 | 19 |
| Tiles work | 11 | 5 |
| **TOTAL** | **63** | **35** |

**FORMULA USED:**

$$\% \text{ of Labours affected / day} = \frac{\text{No. of Labours affected / day}}{\text{No. of Labours involved / day}} \times 100$$

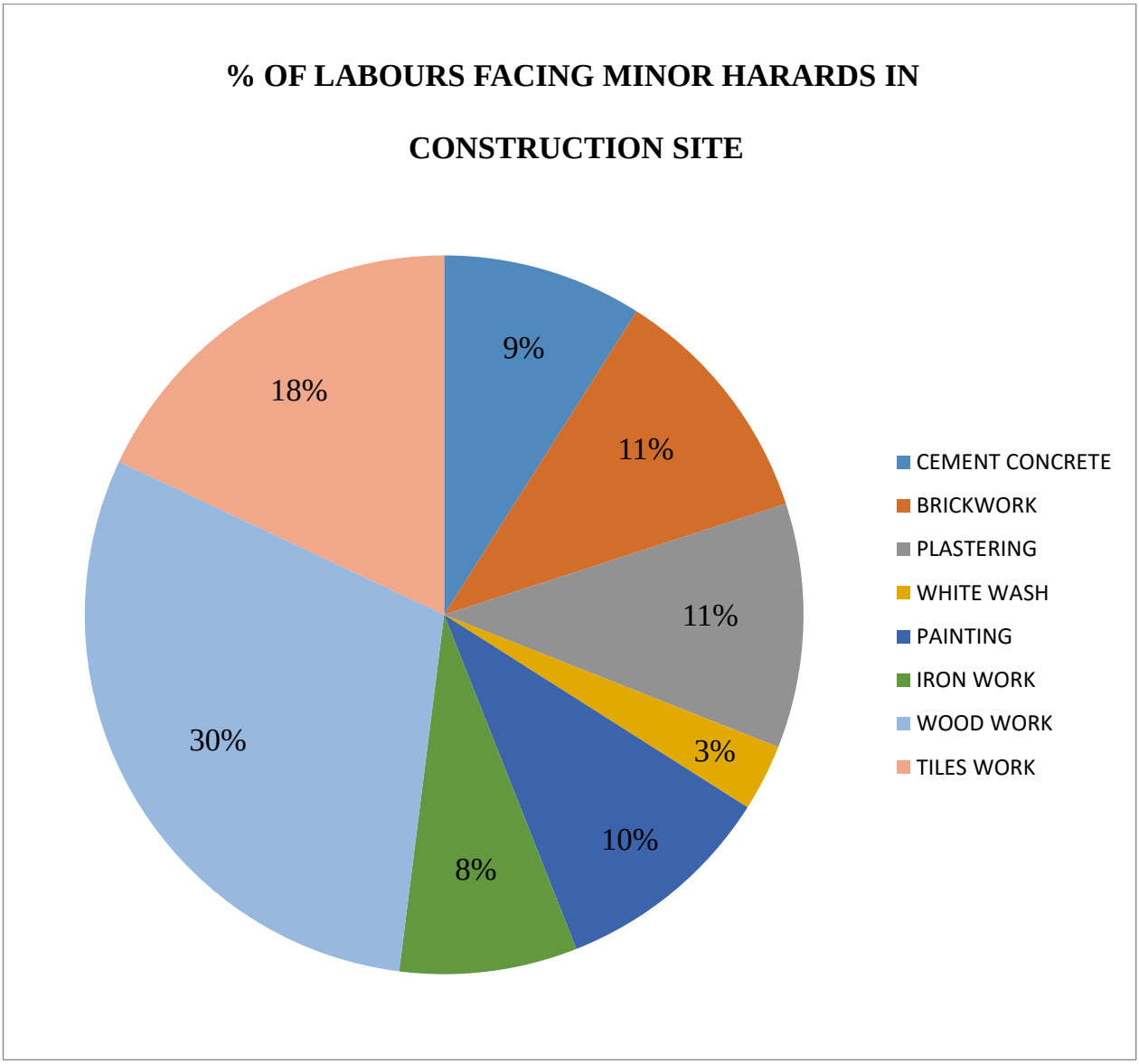


**Fig.2** Pie Chart Shows the % of Workers Facing Hazards During Work

## CONCLUSION

## REPORT AND DISCUSSION

- This project deals with the Life Cycle Assessment of labours involved in the construction work of a small residential building of about 596 sq.ft. For this study, initially the details of the construction activities in step by step , the construction equipment and activities involved in construction which produces air, noise, water pollution are collected. A survey is made and the percentage of labours getting affected per day for all activities is calculated and a pie chart is drawn from the collected details. This Pie Chart clearly says that :
    1. the labours invovled in building works are getting minor hazards in their day to day life and the workers engaged in wood work are affected more i.e., 30% than the labours involved in other activities.
    2. if a certain percentage of labours getting affected from the above calculation for a small sq.ft as per the above plan , then let us assume the strategy of the labours will get affect if the area of the building doubles.

- The safety procedures and the controlling measures are studies from different sources and they are explained briefly in this project in order to prevent the labours from the hazards.

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