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A Comparative Study on Labour Productivity in Organized, Semi-organized, Unorganized Residential Buildings Construction

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ABSTRACT— A successful construction project is one that is finished on time, on budget, meets quality standards, and strictly adheres to safety policies and precautions. All of this is only possible if the planned levels of productivity are met. In the present study three sites of similar type (residential buildings), site A (organized), site B (semi-organized), site C (unorganized), where site A is considered as bench mark and site B & C are compared against site A. Comparative study was carried out where in, quantities of shuttering, concrete works, reinforcement works, block work, plastering, flooring and dado works were calculated and daily productivity of each site were tabulated. The reasons for lower productivity rate were identified and discussed at the end of the study. The results showed site A had higher productivity rate compared to site B & C.

Keywords—Labour, Labour productivity formatting, style, styling, insert.

I. INTRODUCTION

Construction is one of the country's largest global ventures, and it has played an important role in both economic development and unemployment reduction. Profitability is an important consideration for organizations in the development industry. Changes in the efficiency of the development business are therefore critical, given its large contribution to GDP (Gross Domestic Product).

Labour productivity is one of the least researched aspects of the construction industry. Productivity enhancements result in significant cost savings with minimal investment. Because profit margins on construction projects are small, cost savings associated with productivity are critical to becoming a successful contractor.

Thus, in the construction industry, productivity can be defined as labour productivity. Because labour costs 30-50 percent of the total project cost, the construction industry is a labour-intensive industry. According to numerous studies, labour productivity is the primary cause of project delays and cost overruns.

Efficient labour productivity in the construction industry can play a significant role in increasing the benefits to stakeholders and contractors. Greater efficiency allows for significant cost savings with minimal investment. Because construction projects have lower profit margins, cost savings associated with productivity are critical to becoming a successful contractor. Total output per worker or total output per labour-hour is used to calculate productivity. Productivity rises when output remains constant while input falls, or when output remains constant while the quantity or quality of output rises. Measuring labour productivity is a major setback in improving labour productivity. As a result, the primary goal of this research is to compare the labour productivity of shuttering, concreting, reinforcement, blockwork, plastering, flooring and dado works at three different sites of similar type (residential buildings). To identify and explain the factors that contribute to a lower productivity rate.

II. LITERATURE REVIEW

Productivity is influenced by several parameters related to construction, which more or less improve or degrade labour productivity. By conducting a questionnaire survey on these issues encountered on construction sites, attempting to identify potential issues that could negatively affect labour productivity in construction industries. Labour productivity is a key factor in the success of any construction project.

Quantifying labour productivity in the activities of block masonry and sand-mix plastering, as well as to start investigating the variability of

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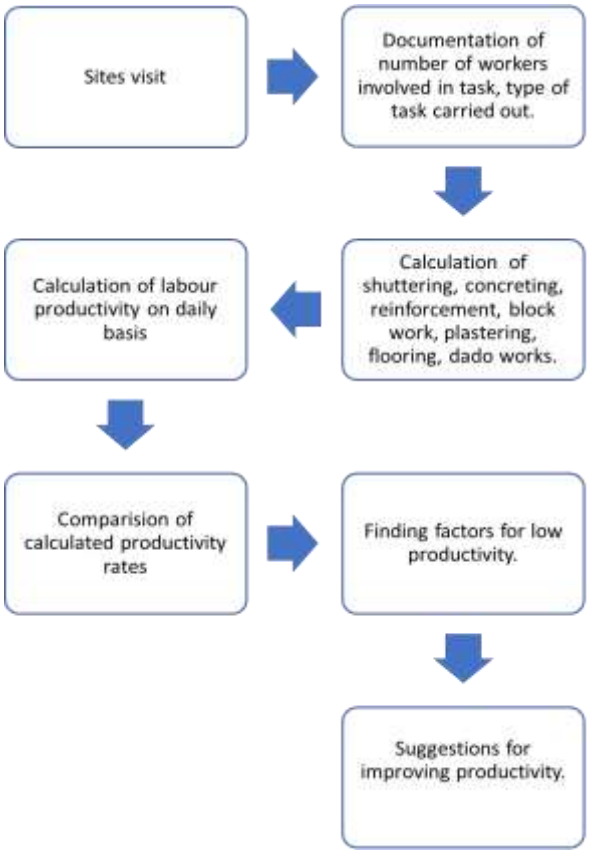
construction labour productivity data in these activities.

Labour performance is influenced by many factors and is usually related to time, cost, work pressure, and safety performance quality and measurements. The questionnaires were distributed to supervisors, project engineers, and labourers, and the top 35 factors were identified, categorised into three different groups, and analyzed and ranked using the SPSS tool, which is analytical software. The outcome shows the factors considered that have the greatest impact on labour productivity loss in residential buildings, as well as the actual productivity versus expected productivity of brick masonry work.

The work study method of data collection identifies skilled labour as a critical factor influencing labour productivity. Labour productivity is closely related to productivity in a construction project. Many previous studies have been conducted by researchers in various countries to identify the factors that affect construction labour productivity (CLP).

III. METHODOLOGY

The study will take place at three different locations. To determine labour productivity, an activity-oriented model is used. The total amount of shuttering, concrete, reinforcement, block work, plastering, flooring and dado works is calculated, and the total output of the day is divided by the total number of labours involved multiplied by the number of hours worked (9hrs). One site is used as a benchmark, and the other two sites are compared to the benchmarked site to determine the cause of the low productivity rate. If this is observed, suggestions for improving productivity are made, which reduces the amount of time required to complete the work, resulting in the work being completed at a lower cost.



IV. SITE DESCRIPTION

SITE A

Site A multi-story residential building with four towers located near Bannerghatta Road in Bengaluru. The project comprises a total of 6 acres. Tower 2 is selected for study which has G + 16 floors, with each floor containing 8 flats classified as Type A, Type B, Type C, and Type D. Type A is a two-bedroom apartment with a total floor area of 1109

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square feet. Type B is a three-bedroom flat with a total floor area of 1342 square feet. Type C is a three-bedroom flat with a total floor area of 1617 square feet. Type D is a three bedroom apartment with a total floor area of 1810 square feet.

The company is well-organized, with a General Manager, a Manager, a Site Engineer, a Quality Surveyor, a Store Supervisor, and a Quality Control Officer.

Equipment's used: Tower crane(for lifting heavier materials), passenger & Material hoist, Concrete pump. Materials used: Aluminium form(0.6mX2.4m), Plywood form 12mm(size- 1.22mX2.4m), Concrete block (size-8" and 6"),Vitrified floor tile(size-2'X2'), Dado(size-0.4mX0.8m,0.3mX0.6m).

In this study, this site is used as a benchmark.

SITE B

Site B is a four-story residential building with a total built-up area of 8400 square feet, located near RT Nagar, with four three-bedroom flats per floor, classified as Type A, Type B, Type C, and Type D, with built-up areas of 1500, 1300, 1385, and 1375 square feet, respectively. Built by a medium-sized builder/developer. On the job site, there were eight workers and one supervisor.

Equipment's used: Concrete pump, Hydraulic lift.

Materials used: Plywood form 12mm(size-1.22mX2.4m), Concrete block (size-8" and 6"),Vitrified floor tile(size-2'X2'), Dado(size-0.4mX0.8m,0.3mX0.6m).

SITE C

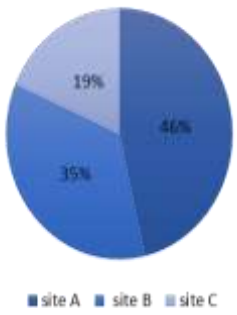
Site C is a small residential building of 2 BHK with a built up area of 784 sq. ft. Located near Sampangiramanagar, Bengaluru. On the job site, there were four workers and one supervisor. Equipment used: Concrete mixer. Materials used: Plywood form 12mm, Concrete block (size- 6"),Vitrified floor tile(size 2'X2'), Dado(size-0.4mX0.8m, 0.3mX0.6m).

V. COMPARITIVE ANALYSIS

1. Shuttering productivity

- 100 sqm of shuttering quantity is considered for the purpose of comparison.

Site	No. of workers	No. of days	Productivity (sq.m/labour/day)
A	10	1	1.031
B	14	3	0.78
C	6	5	0.41



2. Reinforcement productivity

- To cut, bend, shift and to place steel quantity of 1.15 tonnes.

Site	No. of workers	No. of days	Productivity (ton/labour/day)
A	6	1	0.0214
B	6	1	0.0212
C	3	3	0.014

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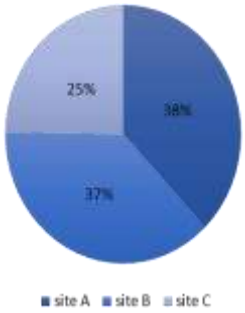

3. Concrete productivity

- At site A, **10 labourers**, place concrete in a quantity of **18.17 cu.m**. Ready-mix concrete with special additives is used to prevent concrete segregation when it is pumped to higher levels. Concrete is pumped into buckets and lifted to the required height of placement using a tower crane; vibrators are used to compact the concrete. Because the concrete must be pumped at a higher level, it requires time to place and compact the placed concrete to ensure that there is no segregation, so the productivity of concreting work in this site is lower, i.e., **0.202 cu.m/labour/day**.

- At site B**, 5 labourers,** place **14.67 cu.m**. of concrete. Because the concrete is being placed on the second floor, it takes less time. The concrete is being placed using a concrete pump, and ready mix concrete is being used in the construction. At this location, the productivity of concreting work is **0.326 cu.m/labour/day.**

- In site C, **3 labours,** place concrete of quantity **10.6 cu.m**. The placement height as well as the concrete quantity to be placed is less compared to other two sites, productivity in this site is on the higher side **0.39 cu.m/labour/day**.

4. Blockwork productivity

Site	No. of. days	Masons	Helpers	Quantity (sq.)	Quantity/day
A	15	15	15	2798.37	186.56
B	15	4	4	1300.39	86.69
C	15	2	2	183.64	12.24

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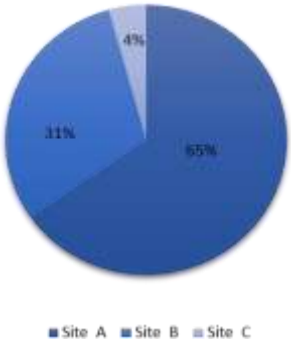
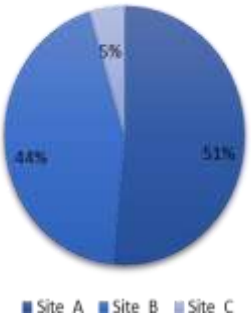


5. Plastering productivity

Site	No. of. days	Masons	Helpers	Quantity (sq.)	Quantity/day
A	36	5	5	3389.4	94.15
B	22	3	3	1757.14	79.87
C	30	2	2	256.2	8.54



6. Flooring productivity

50 sq. m of work is taken for the purpose of comparison.

Site	No .of. days	Masons	Helpers	Productivity (sq.m/labour/day)
A	2.5	4	4	0.69
B	4	3	3	0.92
C	15	2	1	1.72

To complete 50 sq.m of flooring work **site A** takes **2.5 days**, where, as **site B** takes **4 days**, **site C** takes **15 days**. Productivity is site A is on higher side compared to B and C.

7. Dado productivity

Site	No .of.	Masons	Helpers	Productivity (sq.m/labour/day)

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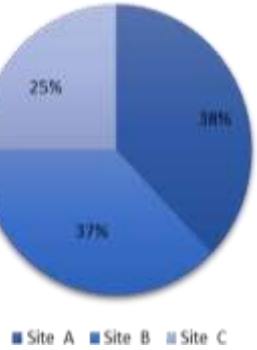
	days			
A	0.3	1	1	1.668
B	0.3	1	1	1.66
C	0.3	1	1	1.108



VI. CONCLUSIONS

The higher the productivity rate, the faster the project will be completed, lowering the project cost. Efforts must be made to increase a company's labour productivity.

At site A, there were 30-40 skilled labourers and 4-5 unskilled labourers.

- The works performed on that particular day were briefed by their respective heads, for example, a bar bender instructs his helpers on the work that must be completed by the end of the day.
- Client company supervision ensured minimal/no errors in the work.
- The site had enough space for storing the materials used for carrying out the work, reducing the time required for material procurement when needed.
- There were more skilled workers, resulting in a higher productivity rate.
- Planning of concrete quantities to be ordered for the day allowed the concrete work to proceed smoothly and without lag, after the shuttering work was completed.
- Aluminum formwork was used for column shuttering.
- The plywood forms for the beam and slab were refabricated after 5-6 cycles to ensure high-quality finishes.
- Tower cranes were erected to lift the reinforcement to higher levels, making it easier for workers to work (reduced transportation time)
- Tower cranes were erected to lift the reinforcement to higher levels, making it easier for the workers to work (time reduction for transportation).
- Having weekly progress meetings helped workers involved in the project stay on schedule.

At site B, there were 8 labourers in total.

- Because there were fewer labourers assigned to the job, completion was delayed.
- There was a shortage of skilled labourers.
- Less space for material storage, more time spent on procurement when needed.
- Less supervision than at site A.
- Laborers were sometimes late to sites, leading to delays in the start of the day's work.
- Due to a lack of managerial skills, the planning for concreting was inadequate, resulting in a 1–2-day delay.
- Poor procurement planning.
- Environmental factors decelerated progress.
- Fatigue.

At site C, there were 5 labours in total.

- The project included skilled labourers with extensive experience.
- The task was made easier by the workers' planning and coordination.
- The client's prompt payment encouraged the workers.
- Plenty of storage space for materials.

The following factors were observed to affect labour productivity in this study

1. Management(organization).
2. Number of workers
3. Skill of the worker.
4. Technology/equipment's involved in the construction.
5. Absenteeism /unpunctuality.
6. Material storage area.
7. In time payment of labour renumeration.
8. Planning and supervision by the site in-charge.

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