

# Labour Productivity of Precast Construction in Housing Projects

Pratik Vaid, Prof. Dr. Sunil Pimplikar

<sup>1</sup>M.E.- Construction & Management, MIT College of Engineering, Pune

<sup>2</sup>GUIDE, HOD- Dept. of Civil Engineering, MIT College of Engineering, Pune

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**Abstract**—Productivity is particularly important especially in developing countries, where most of the building construction work is still on manual basis. Poor productivity of construction workers is one of the causes of cost and time overruns in construction projects. Pre-cast housing is becoming popular in the construction industry. Time saving and quality aspects attract people for adopting this method. So this study is an equitable approach to the study of repetitive activities of the precast construction. The approach is to study labour productivity and determine the factors to improve labour productivity in order to a faster time cycle.

**Keywords**—Labour Productivity, Precast, Time Cycle, Erection, Casting Yard

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## I. INTRODUCTION

The total housing shortage in the country was 18.78 million. Further, an additional requirement of 1.82 million dwelling units has been projected for the 11th Plan, bringing the total housing requirement during the 11th Plan Period to 26.53 Million dwelling units.<sup>1</sup>

Since the construction industry in India is primarily labour intensive, key factors like project duration, project cost and quality of any project are inevitably depend on the quality and efficiency of the labour. The conventional construction with onsite solutions has been criticized for a long time, because of their low productivity, poor safety records and large waste production. Time saving and quality aspects of precast construction attract people for adopting this method.

Precast concrete by definition is cast in a different location with respect to the structure that it will be incorporated into.<sup>2</sup> Precast concrete is a construction product produced by casting concrete in a reusable mold or "form" which is then cured in a controlled environment, transported to the construction site and lifted into place.

## II. NEED & OBJECTIVE

A number of projects are facing the problem of time overruns because of several unknown factors. Schedule performance of any construction project depends on project planning, continuous monitoring and evaluation of short term schedules. So the repetitive activities of the precast construction shall be targeted for productivity study and determine the factors to improve labour productivity in order to a faster time cycle.

The objective is to find out the factors affecting labour productivity for repetitive precast construction activities at low rise precast residential projects in Gujarat and Maharashtra.

## III. LITERATURE

Only factory manufacturing cannot assure in-time work completion. And just by keeping resources busy both on site & plant, one cannot improve productivity or reduce the time cycle. For that, we have to divide activity in simple actions and try to do them with minimum efforts and within minimum time with proper planning & management.

#### IV. PRODUCTIVITY MEASUREMENT

The measure of the rate at which work is performed is called “productivity”. It is a ratio of production output to what is required to produce it<sup>3</sup>. The measure of productivity is defined as a total output per one unit of a total input.

Construction labour productivity can be measured with many different methods. Choosing a measure that is appropriate and result oriented for the purpose is important. The study was performed through time study technique, which is based on the measurement of time consumed in each activity on a site base observation. It is most preferable technique to calculate the labour productivity for repetitive activities.

**Time study:** It records the time needed to do a certain amount of work in a certain way. It is tied in directly with the specific method of doing the work and is good only for that method. The use of time study provides a fixed base so the worker will know what is expected of him during a certain period of time.

#### V. DETAILS OF CASESTUDY

The study includes major precast construction activities of all structural elements both at casting yard and at erection site in terms of labour productivity.

Specification	Case Study 1	Case Study - 2	Case Study - 3
Location	Anand	Navi Mumbai	Dahod
Blocks	15	16	20
Floors	G+3	G+4	G+1
Units	464	454	480
Slab	Waffle	Simple Precast	Hollow core
Wall	Waffle	Block Masonry	Waffle
Column	-----	Hollow core	-----
Beam	-----	Simple Precast	-----

Table 5-1: Selection Criteria for Case Studies

This study measures the productivity by understanding the activity sequence and time study. The survey separates the time consumed by labours at site and at casting yard.

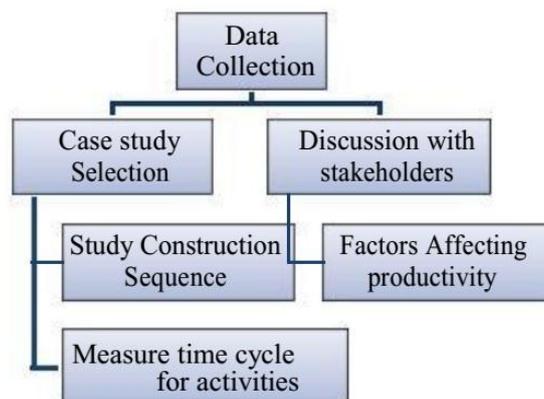


Figure 1: Data Collection Method

## VI. OUTCOMES

The productivity was carried out in  $M^3 / \text{Day}$  and  $M^2 / \text{Day}$ , to understand the variation in productivity values. Time consumed in different activities was studied in order to understand the problem associated with project planning, resource management & labour motivation.

<b>Casting Yard</b>		<b>Case Study - 1</b>	<b>Case Study - 2</b>	<b>Case Study - 3</b>
<b>Time Required for a Unit</b>		652Min (11 Hrs.)	1560 Min (23 Hrs.)	669Min (11 Hrs.)
<b>Total Qty. of Precasting Done</b>		13 $M^3$	13.79 $M^3$	11.8 $M^3$
<b>Labour</b>	Skilled	22	12	21
	Unskilled	38	16	33
<b>Time Required for 1 <math>M^3</math> Work</b>		51 Min / $M^3$	113 Min / $M^3$	57 Min / $M^3$
<b>Qty. of Concrete per Day</b>		9.45 $M^3$ / Day	5.50 $M^3$ / Day	8.58 $M^3$ / Day

*Table 6-1: Precast work done at casting yard*

<b>Site</b>		<b>Case Study - 1</b>	<b>Case Study - 2</b>	<b>Case Study - 3</b>
<b>Time Required For A Unit</b>		444 Min (7.5 Hrs.)	988 Min (16.5 Hrs.)	358 Min (6 Hrs.)
<b>Qty. Of Concrete Per Unit</b>		8.2 $M^3$	13.79 $M^3$	8.2 $M^3$
<b>Labour</b>	Skilled	7	7	7
	Unskilled	8	6	8
<b>Time For 1 <math>M^3</math> Precast Work</b>		55 Min / $M^3$	71 Min / $M^3$	44 Min / $M^3$
<b>Qty. Of Concrete per Day</b>		8.2 $M^3$ / Day	6.68 $M^3$ / Day	10.93 $M^3$ / Day
<b>Erection Done per Day</b>		20.5 Ton / Day	16.70 Ton / Day	27.32 Ton / Day

*Table 6-2: Precast work done at site*

## VII. ANALYSIS & RESULTS

Primary analysis is done for the data collected from the time cycle study, while the secondary analysis is done for the information gathered from the physical survey at both site and casting yard.

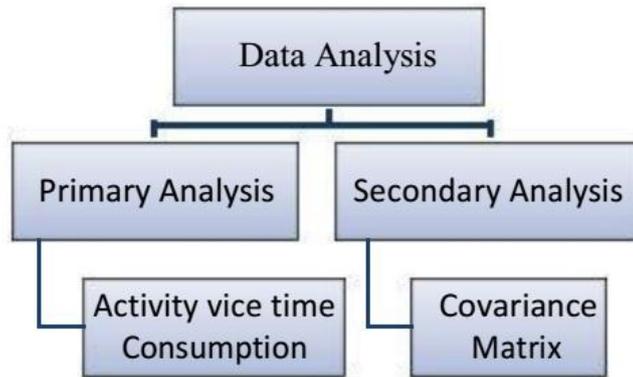


Figure 2 Analysis Procedure

• Activity vice Time Consumption

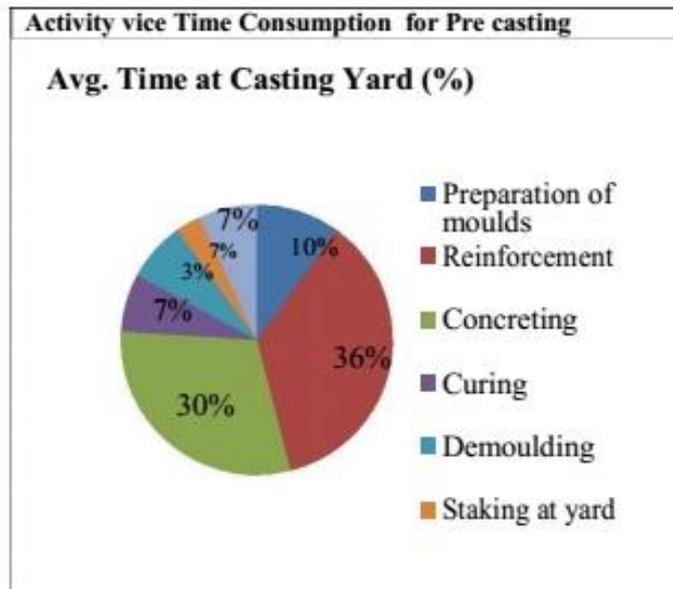


Figure 3: Avg. Time Consumption at Casting Yard

Avg. Time at Site (%)

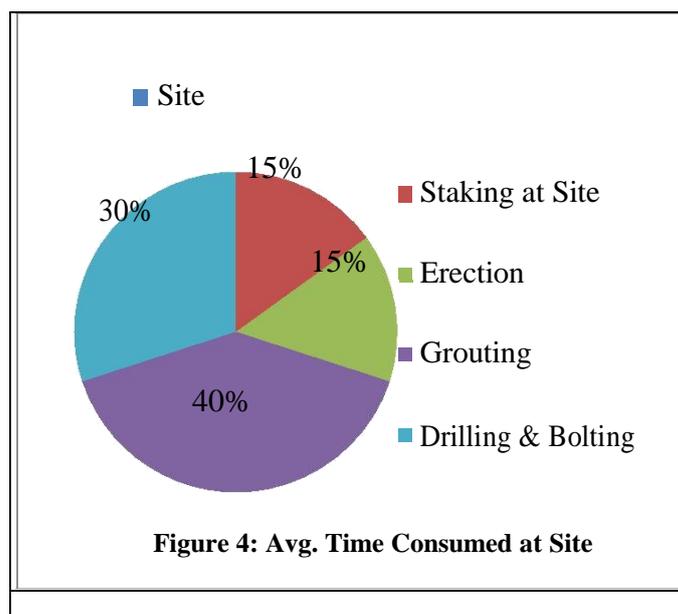
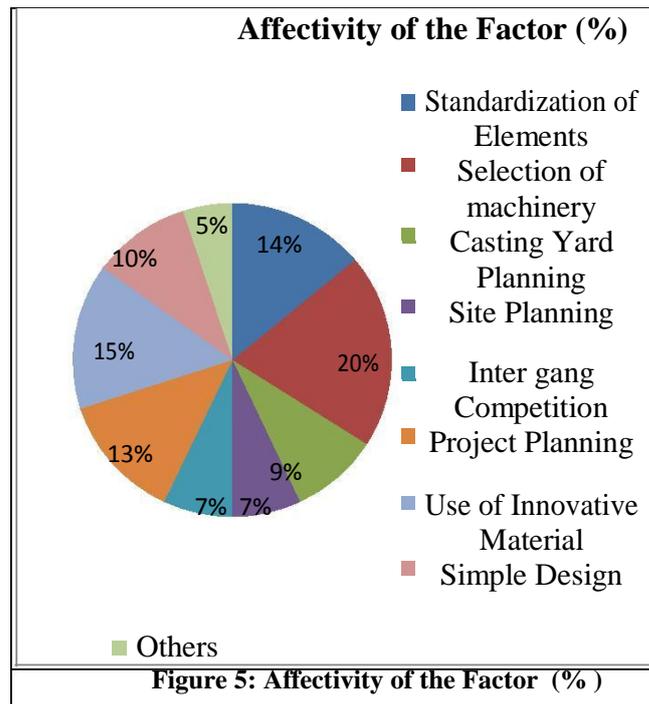


Figure 4: Avg. Time Consumed at Site

- **Factors Affecting the Pre -casting Activity**



## VIII. CONCLUSION

- The conclusion derived is based on the observations for both casting yard and the site activities for precast work.
- Covariance matrix analysis establishes the correlation between Labour Requirement and Time Cycle: **10%**  
**Labour increment reduces the Time cycle by 8% for low rise precast construction for housing project.**
- Major factors affecting the labour productivity are:  
**Selection of machinery (20%), Use of innovative material (15%), Standardization of elements (14%), Project planning (13%), and Simple design (10%).**
- Ineffective resource management has been cited as a primary cause of low productivity rather than other factors.
- Practically it is difficult task to improve labour productivity up to 100%. But if you have a proper control on above factors, productivity can be improved up to large extent.

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