Regression Analysis of Construction Site For Labour Productivity

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Abstract- *With the continuous decline in profit margins and increased competition in construction projects, construction contractors are finding ways of eliminating waste and increasing profits. Although numerous approaches have been developed to improve efficiency and effectiveness of construction process, implementing statistical techniques offer the promise to minimize. The construction industry is one of the largest industries in any economy. It makes a significant contribution to the national economy and provides employment to large number of people. Labour cost accounts for a major share in the total project cost along with the cost of materials and machineries. Labourers are the most dynamic element in the construction industry and accounts for 30 to 50% of the total construction cost. Therefore, it is imperative to identify the important factors influencing labour productivity and its effects on labour productivity. The purpose of this work is to compare the time required by the labourers for material handling of different structural components with the time calculated by regression equation for different structural components. Data is collected for time required for material handling of different structural components by the labourers of the site selected in the case study. Data is analyzed for the time required by labourers for material handling of different structural components by regression analysis model. The study shows there is more variation in time for material handling of bricks and sand when compared with regression analysis and less variation in time for material handling of plastering, slab, and column when compared with regression analysis.*

Keywords- Labour productivity, time motion, work study, data collection, regression analysis

I. INTRODUCTION

Labour productivity is an important economic indicator that is closely linked to economic growth, competitiveness, and living standards within an economy. Labour productivity represents the total volume of output (measured in terms of Gross Domestic Product, GDP) produced per unit of labour (measured in terms of the number of employed persons) during a given time reference period.Labour is the most important asset to a construction industry. In spite of many technological advances, construction continues to be a labour intensive industry. 30% to 50% of total cost of project is spent on labours. Quality of the construction largely depends upon the quality of work done by labour. Labour productivity directly affects construction productivity; it is important to know the factors affecting labour productivity. Construction performance and productivity improvement are key focus areas in construction industry for any nation. Indian construction industry forms an integral part of economy. Construction constitutes 40% to 50% of India's capital expenditure on projects in various sectors such as highways, roads, railways, energy, airports, irrigation, etc. and is the second largest industry in India after agriculture. It accounts for about 11% of India's GDP. Improving productivity is major concern for any profit oriented organization. In general terms productivity is termed as ratio between input and output. Proper management of available asset can help in improving productivity.

II. LITERATURE REVIEW

Productivity is a very important element in the process of construction project management especially with regard to the estimation of the duration of the construction activities. Various authors have different contribution in their own respective method or technique. It becomes intense need to learn and understand the view of various authors from various parts to give our own contribution on this topic. Purpose of this chapter is to highlight the work done on labour productivity and give some terms which will be useful in further project. Aparna B., studied the labour cost accounts for a major share in the total project cost along with the cost of materials and machineries. Labour cost accounts for 30 to 50% of the total construction cost. From the viewpoint of control theory author found that the important factors influencing labour productivity and its effects on labour productivity. Author analyzes the different factors affecting the labour productivity by using Multivariable Linear Regression analysis. Author with some example found that the labour productivity decreases with female workers, higher floor number, native speaker, communication problem and afternoon work hours.[1] R.Chitra, studied that the productivity is dominantly aspect in the construction industry, it is important both in developed and under developing countries. From the viewpoint of study author conducted questionnaire survey to collect the data. From the

questionnaire survey author found that the accidents, project size and improper work planning among site management people is the prominent reason for the reduction in productivity. Author concludes that these factors should be kept in mind while executing the construction project to achieve the optimal.[2] In the above literatures by various authors, concluded that the productivity is the most dominating factor in the construction industry. They found out the labourers are the most dynamic element in the construction industry and accounts for 30 to 50% of the total construction cost. From the above literatures studies by various authors found out the factors affecting the labour productivity by using various methods such as work study, time study, reliability tests, questionnaire surveys etc. In this study, we will compare between the actual time required by labour for material handling of particular activity at site and time required for material handling of the same activity by using regression analysis.

III. AIM OF THE PRESENT WORK

To analyze time required by labourers for material handling of different structural components and compare it with regression equation.

IV. OBJECTIVES: LABOUR PRODUCTIVITY AND USES:-

- To study the concept of regression analysis for productivity of labourers.
- To collect the data using live case study of building for regression analysis.
- To analyze the data collected using the regression analysis equation.
- To give the finding of the outcome from the regression equation.

Problem statement:

- Higher productivity in organization leads to national prosperity and better standard of living for the whole community. Improving productivity through time and motion studies is used in construction sector and allied industries. Work study consists of 2 aspects, method study and measurement which when applied effectively results to higher productivity. The main problem of constructions productivity depends upon how labors are utilized. Labour productivity can be higher or lower depending on factors like availability of work load, material, working tools, availability of power, work efficiency, level of motivation, level of training of working condition (comfortable or poor) etc.

- For above objective 5 days observation are recorded from site Stargaze, Kolte Patil,Pune.

I. SITE DETAILS

- Name of site : Stargaze, B- Type (Phase-1)
- Location of site : Bavdhan, West Pune zone, Pune, Maharashtra 411021
- Second Floor of a P+14 proposed building is taken for case study
- Design Team :Jw consultancy
- Owner and Developer :Kolte patil
- Architect : Manoj Tatooskar and Vikas Achalkar
- Cost of 1 flat: 64.4 Lakhs Onwards
- Cost of project:52 cr.
- Structural Engineer : Jw consultant
- Builder : kolte patil
- Area : 1.91 acre
- Present condition of the project : under construction
- Starting date:14/03/2018

V. DATA COLLECTION

Sample data collection of bricks

NO OF OBSERVATION	LOADING OF BRICKS (TIME IN SECONDS) -X1	LIFTING THE BRICKS TO THE 2ND FLOOR(TIME IN SECONDS)-X2	UNLOADING OF THE BRICKS(TIME IN SECONDS)-y
	A	B	C
1	45.33	100.34	99.56
2	51.46	98.43	94.24
3	50.78	101.07	124.778
4	41.78	90.23	100.32
5	39.02	98.14	98.52
6	65.23	121.54	134.45

NO OF OBSERVATION	LOADING OF BRICKS (TIME IN SECONDS) -X1	LIFTING THE BRICKS TO THE 2^{ND} FLOOR(TIME IN SECONDS)-X2	UNLOADING OF THE BRICKS(TIME IN SECONDS)-y
7	45.55	87.46	125.42
8	59.45	85.23	118.62
9	43.45	105.34	130.53
10	33.34	120.12	104.78
11	44.56	96.27	90.99
12	53.53	84.75	118.39
13	44.56	103.53	134.45
14	50.32	105.28	90.34
15	38.53	89.05	132.94
16	42.76	90.56	150.64
17	43.45	120.43	124.86
18	44.38	87.07	99.34
19	39.58	111.34	90.99
20	67.34	84.34	140.23
21	53.23	96.54	134.22
22	45.56	94.52	120.25
23	39.56	87.03	116.44
24	44.78	99.34	98.45
25	67.34	104.77	100.56

Similarly data for other structural components are collected

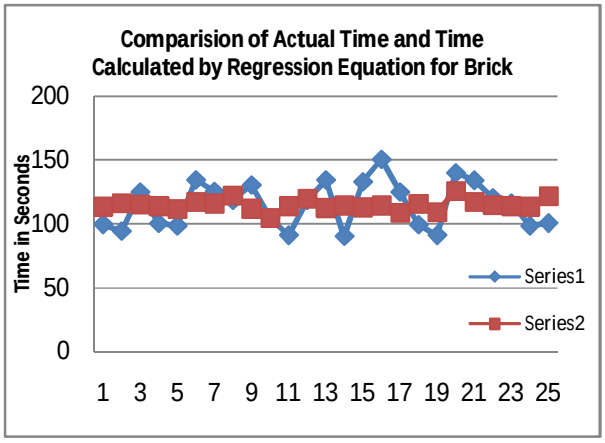
DATA ANALYSIS

Sample data analysis of bricks is as follows

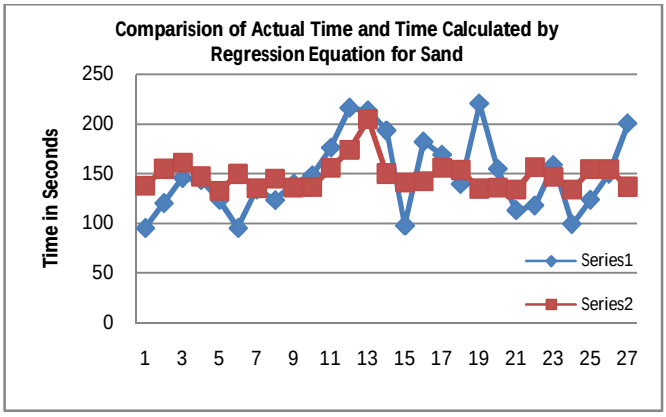
NO OF OBSERVATION	UNLOADING OF THE BRICKS(TIME IN SECONDS)-y	RESULT OF UNLOADING TIME OF BRICKS FROM REGRESSION EQ.(TIME IN SECONDS)-Y	REMARK.
	C	D	E
1	99.56	113.602	Advance
2	94.24	116.488	Advance
3	124.778	115.688	Delay
4	100.32	114.145	Advance
5	98.52	111.454	Advance
6	134.45	117.56	Delay
7	125.42	116.235	Delay
8	118.62	122.364	Advance
9	130.53	111.845	Delay
10	104.78	104.79	Advance
11	90.99	114.091	Advance
12	118.39	120.036	Advance
13	134.45	112.657	Delay
14	90.34	114.669	Advance
15	132.94	113.048	Delay
16	150.64	114.481	Delay
17	124.86	108.866	Delay
18	99.34	115.833	Advance
19	90.99	109.077	Advance
20	140.23	125.769	Delay
21	134.22	117.585	Delay
22	120.25	114.845	Delay
23	116.44	113.869	Delay
24	98.45	113.574	Advance
25	100.56	121.735	Advance

Similarly data analysis for other structural components is carried out with the help of regression equation.

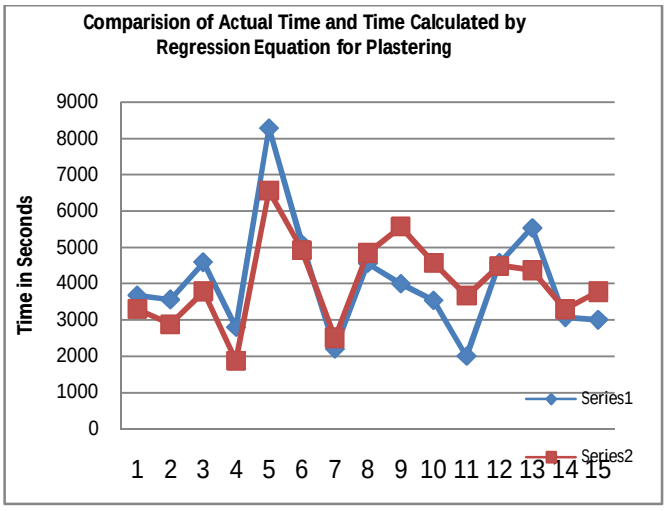
VI. RESULT



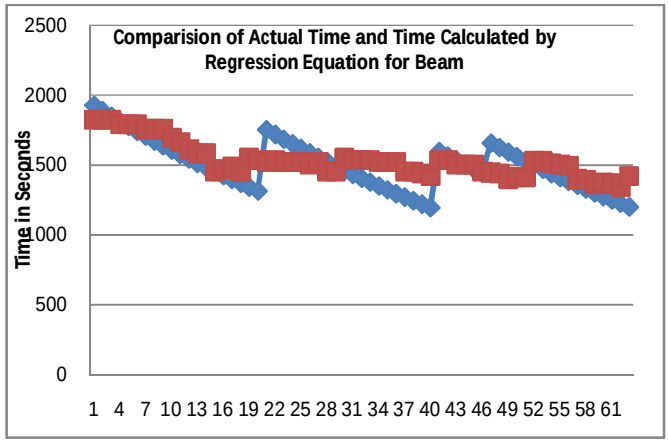
Graph: Outcome of Data analysis of Bricks



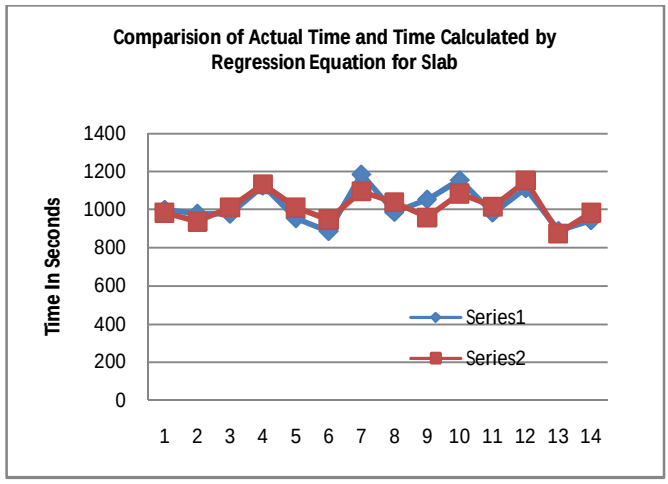
Graph: Outcome of Data analysis of Sand



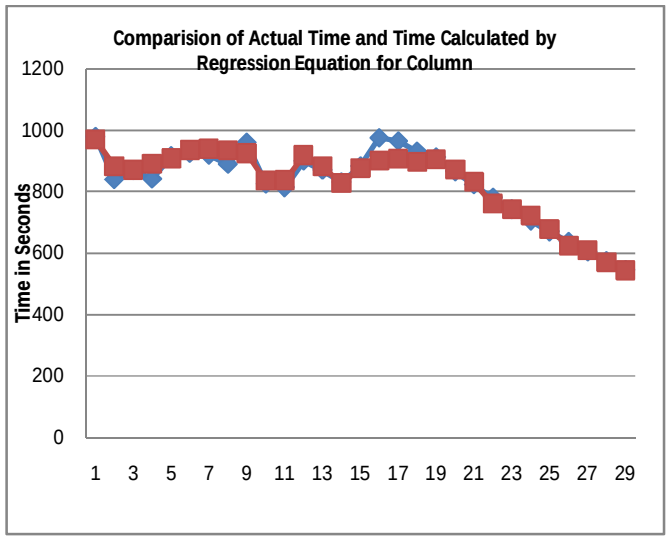
Graph: Outcome of Data analysis of Plastering



Graph: Outcome of Data analysis of Beam



Graph: Outcome of Data analysis Slab



Graph: Outcome of Data analysis Column

VII. CONCLUSION

- Regression analysis provides a powerful statistical method for examining the interest between two or more variables of interest.
- Data is collected for time required by labourers for material handling of different structural components from the live case study of under construction site located at Pune. This under construction site is selected for case study because analysis of data collected with respect to time taken by labourers for material handling of different structural components is compared with time calculated by regression equation of different structural components and this will certainly give better understanding with respect to time taken by labourers for material handling which will helps in improving the efficiency of future projects.
- Data analysis of material handling of different structural components is carried out with the help of regression analysis in order to compare the time taken by labourer to complete particular activity on site with time calculated by regression equation.
- Outcome of data analysis of bricks and sand shows that there is variation in time taken by labourers and time calculated by regression equation. It is observed that lifting of the brick and sand to the second floor is the main cause of delay because lack of communication between the labours and operators on the site.
- Outcome of data analysis of plastering shows that there is less variation in time taken by labourers and time calculated by regression equation of some observations whereas in some observations it is found that time taken by labourer on site and time calculated by regression equation is almost same. It is observed that the main reason for the delay of some observation is due to delay in applying mortar to the wall due to laziness of labourers on site.
- Outcome of data analysis of beam shows that there is less variation in time taken by labourers and time calculated by regression equation of some observations whereas in some observations it is found that time taken by labourer on site and time calculated by regression equation is almost same. It is observed that the main reason for the delay of some observation is delay in cutting of the bars and tying of the bars.
- Outcome of data analysis of slab and column shows that time taken by labourers and time calculated by regression equation for material handling is almost similar with each other.

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