

# Analysis Of Labour Productivity for Building Construction Industry

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*Abstract- Construction project contractors are seeking for ways to reduce waste and boost profitability because profit margins are always narrowing and competition is growing. The use of statistical techniques holds the potential of minimising, if not completely eliminating, non-value-added activity, despite the fact that numerous strategies have been created to increase the efficacy and efficiency of the construction process. One of the most important businesses in every economy is construction. It makes a sizable contribution to the national economy and employs a sizable number of people. The scientific study of the conservation of human resources in the quest for the most effective way to complete a task is known as time and motion study (sometimes known as motion and time studies; the phrases are interchangeable). Time and motion studies are conducted to assess human efficiency through improved planning and reliable employee incentive schemes.*

*Index Terms- Labour Productivity, Time Motion, Work Study, Regression Analysis*

## I. INTRODUCTION

Work study might be characterized as the investigation of a vocation to locate the favoured strategy for doing it and furthermore deciding the standard time to perform it by the liked (or given) technique. Work study, hence, contains two territories of study: technique study (movement study) and time study (work estimation). So as to comprehend the job of work study, we have to comprehend the job of technique study and that of time study. Technique study (likewise some of the time called Work Method Design) is generally used to improve the strategy for doing work. It is similarly relevant to new openings. At the point when applied to existing employments and existing occupations, technique study intends to discover better strategies for carrying out the responsibilities that are

affordable and safe, require less human exertion, and need shorter prepare/set away time. The better strategy includes the ideal utilization of best materials and proper labour with the goal that work is acted in efficient way prompting expanded asset usage, better quality and lower costs. It can along these lines be expressed that through technique study we have an orderly method for creating human asset adequacy, giving high machine and gear use, and utilizing materials. Time study, then again, gives the standard time, that is the time required by specialist to finish a vocation by the standard strategy. Standard occasions for various employments are fundamental for legitimate estimation of

- Manpower, apparatus and hardware necessities
- Daily, week by week or month to month pre-requisite of materials
- Production cost per unit as a contribution to all the more likely settle on or purchase choice
- Labour spending plans
- Worker's effectiveness and make motivating force wageinstallments.

By the utilization of strategy study and time study in any association, we would thus be able to accomplish more prominent yield at less expense and of better quality, and henceforth accomplish higherprofitability

Movement and time study can decrease and control costs, improve working conditions and condition, and rouse individuals. The essential object is to improve the work and to decrease squander.

1. Movement examination methods
2. Time study methods
3. Employments of time guidelines.

Assembling the board and building understudies are being set up to structure work stations, create productive and compelling work techniques, set up time guidelines, balance sequential construction systems, gauge work costs, create viable tooling, select appropriate gear, and design fabricating offices. In any case, the most significant thing is to figure out how to prepare creation laborers in these abilities and procedures so they can become movement and time cognizant. Movement study offers an incredible potential for reserve funds in any region of human exertion. We can decrease the expense by consolidating components of one assignment with components of another. Movement study utilizes the standards of movement economy to create work stations that are amicable to the human body and effective in their activity. Movement study must consider the administrator's security Time study can lessen cost fundamentally well. Time benchmarks are objectives to take a stab at. On the off chance that extra generation yield is required, don't purchase more hardware, don't include a subsequent move, and don't assemble another plant. Simply set up a movement and time study program. Movement and time study is viewed as the foundation of mechanical building, modern innovation, and modern administration programs in light of the fact that the data that time thinks about create influences such a large number of different zones, including the accompanying:

1. Costevaluating
2. Generation and stockcontrol
3. Plantformat
4. Materials andprocedures
5. Quality
6. Wellbeing

Movement study starts things out before the setting of time models. Movement study is a nitty gritty examination of the work strategy with an end goal to improve it.

## II. METHODOLOGY WORK STUDY

To understand the work of work studies, we need to understand the work of technology studies and time

studies. Study technique (also called Work Method Design here) is mostly used to improve the strategy for doing work. It is similarly suitable for new openings. As the study of technology is applied to existing occupations and jobs, it intends to discover better strategies for performing duties that are conservative and safe, require less human effort, and require less preparation/dedication time. Better engineering involves the ideal use of the best materials and the right work to get the job done efficiently, resulting in increased asset utilization, better quality, and lower costs. It can therefore be stated that by studying technology we have a precise method of creating the adequacy of human assets, high utilization of machinery and hardware, and utilization of materials. The time study then again gives the standard time, which is the time required by the worker to complete the occupation according to the standard strategy. Standard opportunities for different occupations are important for a legitimate estimate

- Manpower, machinery and equipment requirements
- Daily, weekly or monthly material needs
- Production cost per unit as an input for better decision making or purchasing
- Work budgets
- Efficiency of workers and payment of incentive wages.

### A. Method Study Procedure

The following general steps describe the procedure for conducting a method study.

1. Select the job - to which method the study should be applied.
2. Get information and record it.
3. Examine the information critically.
4. Create the most functional, prudent and successful strategy by thinking about the real obstacles of the circumstances.
5. Install the new method as standard procedure.
6. Maintain standard procedure by regular monitoring.

## III. PROBLEM STATEMENT

Improve productivity using correlation and regression method and reveal the cause of low productivity.

Higher productivity in an organization leads to national prosperity and a better standard of living for the entire community. Productivity improvement using time and motion studies is used in construction and related industries. Work study consists of 2 aspects, method study and measurement, which when effectively applied lead to higher productivity. The main problem of construction productivity depends on the way labor is used. Work productivity may be higher or lower depending on factors such as availability of workload, material, work tools, energy availability, work efficiency, motivation level, training level of working conditions (comfortable or bad) etc. For the above target 5 days of observation are recorded from Sinhgad Guardian, Paranjape Broadway Wakad & Pristine Equilife.

- 1) Study Area 1 - Sinhgad Guardian
- 2) Study Area 2 - Paranjape Broadway Wakad
- 3) Study Area 3 - Pristine Equilife

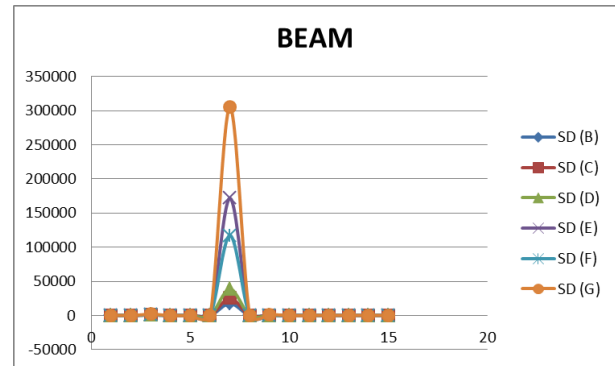
IV. RESULT AND DISCUSSION

A. Study Area 1 - Sinhgad Guardian

Table 1 Data Analysis - Beam

DATA ANALYSIS						
SD (A)	SD (B)	SD (C)	SD (D)	SD (E)	SD (F)	SD (G)
163.7442288	132.710777	159.715267	196.871139	414.2902978	342.431025	552.4501879
MA X(A)	MA X(B)	MA X(C)	MA X(D)	MA X(E)	MA X(F)	MA X(G)
900	1300	633	870	1200	990	1895
MIN (A)	MIN (B)	MIN (C)	MIN (D)	MIN (E)	MIN (F)	MIN (G)
240	68	0	-58	0	0	0
VAR (A)	VAR (B)	VAR (C)	VAR (D)	VAR (E)	VAR (F)	VAR (G)
2681246	176104	255064	387555	1716508	117207	3052101
ME DIA N(A)	ME DIA N(B)	ME DIA N(C)	ME DIA N(D)	ME DIA N(E)	ME DIA N(F)	ME DIA N(G)
564	250	350.634669	181	534.8404847	450.248367	1476.965075

COR REL C12	COR REL C13	COR REL C14	COR REL C15	COR REL C16	COR REL C17	COR REL C23
0.460133563	-0.061716	0.0482352	0.1994474	0.19779076	0.19235934	0.270617238
COR REL C24	COR REL C25	COR REL C26	COR REL C27	COR REL C34	COR REL C35	COR REL C36
-0.22997646	0.3192295	0.3192294	0.1294783	0.394306435	0.52660145	0.523347574
COR REL C37	COR REL C45	COR REL C46	COR REL C47	COR REL C56	COR REL C57	COR REL C67
0.254633193	0.74029292	0.74099685	0.41864456	0.999899351	0.56890321	0.57004491



Graph 1 Data Analysis – Beam

• Productivity Table

Activity	No. Of Workers	No. Of Observations	No. Of Samples	Expected Productivity	Productive Work %	Non Productive Work %
1	6	9	54	89%	80	17.7
2	6	9	54	89%	79	21
3	6	8	48	89%	80	20
4	6	9	54	89%	74.5	25.5
5	6	8	48	89%	78.5	21.5

After tracking all the activities at Sinhgad Guardian and from the productivity table above we conclude

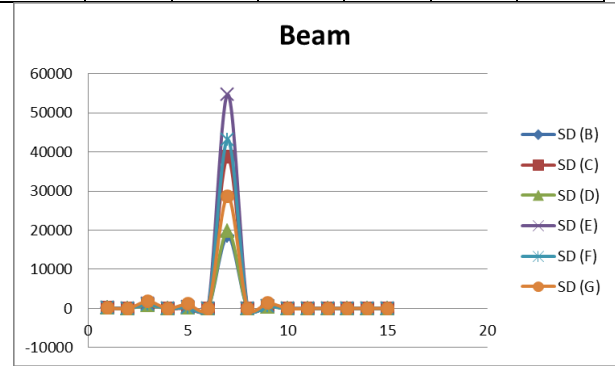
that there is 21.14% unproductive work on site and 78.86% productive work on site.

B. Study Area 2 - Paranjape Broadway Wakad

Table 2 Data analysis –Beam

DATA ANALYSIS						
SD (A)	SD (B)	SD (C)	SD (D)	SD (E)	SD (F)	SD (G)
1757.3607	136.0252	196.6806	140.7079	233.8822	207.7793	169.2474
72	2	0	5	43	1	96
MAX(A)	MAX(B)	MAX(C)	MAX(D)	MAX(E)	MAX(F)	MAX(G)
7372	990	1025	775	1120	995	1825
MIN(A)	MIN(B)	MIN(C)	MIN(D)	MIN(E)	MIN(F)	MIN(G)
400	381.80427	105.18530	265.63403	320.062442	284.34118	1131.35708
VAR(A)	VAR(B)	VAR(C)	VAR(D)	VAR(E)	VAR(F)	VAR(G)
3088316.62	18502.861	38683.260	19798.729	54700.9040	43172.243	28644.7149
MEAN(A)	MEAN(B)	MEAN(C)	MEAN(D)	MEAN(E)	MEAN(F)	MEAN(G)
2194.37302	534.95648	544.38148	458.33146	598.723589	531.90176	1412.90469
CORREL C12	CORREL C13	CORREL C14	CORREL C15	CORREL C16	CORREL C17	CORREL C23
0.22652001	0.5491647	0.812050	0.7058192	0.70581920	0.3041601	0.54582946
CORREL C24	CORREL C25	CORREL C26	CORREL C27	CORREL C34	CORREL C35	CORREL C36
0.25772636	0.6515340	0.6515340	0.6690494	0.59934483	0.83091761	0.830917606
CORREL C37	CORREL C45	CORREL C46	CORREL C47	CORREL C56	CORREL C57	CORREL C67
0.49	0.73	0.73	0.34	0.43	0.65	0.65

8517794	693404	693404	55069	2211	605199	6051992
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Graph 2 Data analysis –Beam

• Productivity Table

Activity	No. Of Workers	No. Of Observations	No. Of Samples	Expected Productivity	Productive Work %	Non Productive Work %
1	6	9	54	89%	80	17.7
2	6	9	54	89%	79	19
3	6	8	48	89%	80	20
4	6	9	54	89%	74.5	25
5	6	8	48	89%	78.5	21

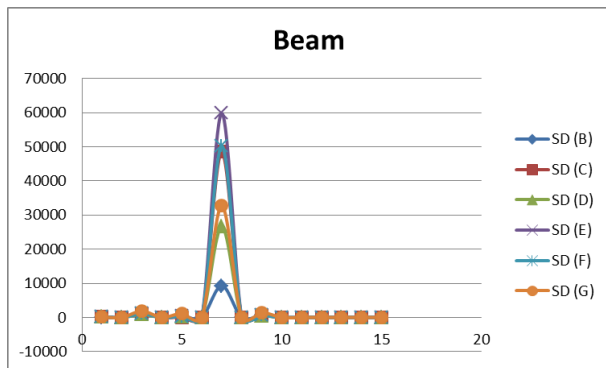
After observing all the activities at Paranjape Broadway Wakad and from the productivity table above we conclude that there is 20.54% unproductive work and 79.46% productive work at the site.

C. Study Area 3 - Pristine Equilife

Table 3 Data analysis –Beam

DATA ANALYSIS						
SD (A)	SD (B)	SD (C)	SD (D)	SD (E)	SD (F)	SD (G)
1729.87815	96.462329	220.27369	163.23448	244.537293	224.29873	180.839790
MAX(A)	MAX(B)	MAX(C)	MAX(D)	MAX(E)	MAX(F)	MAX(G)
7372	1100	1125	900	1200	1100	1950
MIN(A)	MIN(B)	MIN(C)	MIN(D)	MIN(E)	MIN(F)	MIN(G)
503.277592	560	105.18530	338.1	380	335	1208.84729

VAR (A)	VAR (B)	VAR (C)	VAR (D)	VAR (E)	VAR (F)	VAR (G)
2992 478. 41	9304 .980 9	4852 0.49 8	2664 5.49 6	5979 8.48 79	5030 9.92 1	3270 3.02 98
ME DIA N(A)	ME DIA N(B)	ME DIA N(C)	ME DIA N(D)	ME DIA N(E)	ME DIA N(F)	ME DIA N(G)
2574 .890 93	671. 7397 7	591	517. 6556	708. 6855 97	591. 1491 2	1509 .678 98
COR REL C12	COR REL C13	COR REL C14	COR REL C15	COR REL C16	COR REL C17	COR REL C23
0.27 4758 41	0.58 8898 1	0.78 4236 0	0.75 6509 3	0.71 3582 84	0.31 1647 2	0.61 5842 85
COR REL C24	COR REL C25	COR REL C26	COR REL C27	COR REL C34	COR REL C35	COR REL C36
0.27 3846 30	0.66 4511 9	0.69 8006 3	0.68 3198 1	0.51 5448 29	0.85 5295 0	0.86 6109 74
COR REL C37	COR REL C45	COR REL C46	COR REL C47	COR REL C56	COR REL C57	COR REL C67
0.51 9933 76	0.63 0810 06	0.58 4103 72	0.22 5485 71	0.99 5729 927	0.64 0344 98	0.66 0266 425



Graph 3 Data analysis –Beam

• Productivity Table

A	No.	No.Of	No.	Expect	Produ	Non
ct	Of	Obser	Of	ed	ctive	Prod
iv	Wor	vation	Sam	Produc	Work	uctiv
it	kers	s	ples	tivity		E

y					%	Work %
1	8	7	56	88%	79	18
2	8	7	56	88%	80	20
3	8	7	56	88%	79	21
4	8	7	56	88%	75	25
5	8	7	56	88%	78	22

After observing all activities at Pristine Equilife and from the productivity table above, we conclude that there is 21.2% non-productive work on site and 78.8% productive work on site.

Table 4 Labour Productivity

S/ N	Trades	Unit of Measurement	Average Trade Productivity
1	Formwork	m <sup>2</sup> /man/ hour	2.3
	<i>(Tableform for slab/beam)</i>		
2	Mesh placing and fixing	kg/man/ hour	142
	<i>(Slab)</i>		
3	Concrete placement	m <sup>3</sup> /man/ hour	1.85
	<i>(Slab, using stationary concrete pump)</i>		
4	Drywall	m <sup>2</sup> /man/ hour	2.25
	<i>(12 mm thick board)</i>		
5	Painting	m <sup>2</sup> /man/ hour	5.5
	<i>(Emulsion 3 coats, using roller)</i>		
6	Timber door installation	num/ma n/hour	0.34
	<i>(Dimensions 2100 mm x 950 mm)</i>		
7	Wall tiling	m <sup>2</sup> / man/hou r	1.02
	<i>(Using adhesive to lay ceramic tiles)</i>		
8	Floor tiling	m <sup>2</sup> /man/ hour	2.03
	<i>(Using adhesive to lay ceramic tiles)</i>		
9	Suspended ceiling	m <sup>2</sup> / man/hou	5.04
	<i>(Exposed grid)</i>		

	<i>system</i> )	r	
10	Air-con ducting ( <i>Metal</i> )		
a)	Formed and insulated on-site	m <sup>2</sup> /man/hour	2.9
b)	Pre-formed and pre-insulated	m <sup>2</sup> /man/hour	4.2
11	Electrical conduit installation (20 mm diameter uPVC electrical conduit fixed to ceiling)	m/man/hour	2.71
12	Water pipe installation (20 mm diameter copper pipe concealed in wall)	m/man/hour	1.65

CONCLUSION

- A comprehensive study can be carried out for various activities such as flooring, excavation and painting etc.
- It is also possible to use the work study concept for various construction activities to sample work and improve productivity on site.
- A study on motivation, improvement of work techniques, use of good machines and labor conflict can be done through questionnaires and sample surveys to improve productivity.
- according to the analysis in all case studies for the beam, the creation of the bottom cap takes more time than other activities (SD B)
- After monitoring all the activities at Sinhgad Guardian and from the productivity table given, we conclude that there is 21.14% unproductive work on site and 78.86% productive work on site.
- After observing all the activities at Paranjape Broadway Wakad and from the given productivity table, we conclude that there is 20.54% unproductive work on site and 79.46% productive work on site.
- After observing all activities at Pristine Equilife and from the given productivity table, we conclude that there is 21.2% unproductive work on site and 78.8% productive work on site.

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