

Effective Time And Motion Study on Construction Project: “A Case Study of Surat City”

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Abstract— Time and motion study is a work measurement technique for recording the times of performing a certain specific job or its elements carried out under specified conditions. Time study is a direct and continuous observation of a task, using a timekeeping device (e.g., decimal minute stopwatch, computer-assisted electronic stopwatch, and videotape camera) to record the time taken to accomplish a task. Motion studies are performed to eliminate waste. Under this project two sites are selected for time and motion study considering ten selected activities on field for time and motion study. Data will be collected for all activities under time study on field using stop watch and average time will be estimated and then further analysis under motion study to determine the optimum time required for performing selected operations and identify the extra time consumed on site. The analysis result will show that almost all the activities consumed more time more than what is required for actual work. The further future investigation and observations on field explore some reasons for extra time consumption which included inadequate material handling, ineffective method of work, poor planning of inventory poor layout and utilization of space. If these factors are taken into consideration the activities time can be brought nearer to ideal time requires.

Key words: Time And Motion Study, Machinery Coordination, Site Layout Planning, Construction Machinery Planning, Work Process

I. INTRODUCTION

Time and motion study (also referred to as motion and time study, the terms are used interchangeably) is the scientific study of the conservation of human resources in the search for the most efficient method of doing a task. A fascination with the word “efficiency” began in the late 19th and early 20th centuries when it was considered one of the most important concepts. Time study began in the 1880s as a means of wage-rate setting by Frederick W. Taylor, who is regarded as the “father of scientific management.” It consists of a wide variety of procedures for determining the amount of time required, under certain standard conditions of measurement, for tasks involving some human activity. Motion study was developed by Frank B. Gilbreth and Lillian M. Gilbreth and consists of a wide variety of procedures for the description, systematic analysis, and means of improving work methods.

It is difficult to separate these two aspects completely. Therefore, the combined term usually refers to all three phases of the activity: method determination, time appraisal, and development of material for the application of these data. Frank and Lillian also broadened scientific management by including the human element, therefore using psychology to gain the cooperation of employees. Motion and time analysis could be used to help find a preferential way of

doing the work and could assist in effectively managing or controlling the activity. This approach has been successfully applied to factories, hospitals, department stores, housework, banks, cafeteria work, libraries, music, and to many other human activities. For instance, factories have used it to reduce wasted time and improve the time to complete a task, while banks use it to help team members reach their sales goals. However, the goal of a time and motion study is not simply efficiency. These studies are done to create a baseline that can be used in the future when evaluating procedural, equipment, or personnel changes.

II. LITERATURE REVIEW

Miss. Rajshri Shrishirmal, Prof. R.R. Salgude[1] The objective of this paper is to measure the productivity of the various construction activities and The focus is to apply time and motion study and statistical analysis to various construction processes the focus is to apply time and motion study and statistical analysis to various construction processes.

ER. NEELMANI [2] have carried out Motion and time study reduce and control costs, improve working conditions and environment, and motivate people. The basic purpose is to improve the work and to reduce waste.

Abdul Talib Bon, Aliza Ariffin [3] carried out the motion study motion study has the greatest potential for savings. We can by eliminating the task or combining the task with some task. We can rearrange the elements of work to reduce the work content and we can simplify the operation by moving part. Thus among the techniques for motion study are: Process charts, Flow diagrams, Operation charts, Flow process charts, multiple activity charts.

Puniavathi Puranam, Pramila. R. Adavi, [4] in this paper, this paper helpful for the higher productivity in organizations leads to national prosperity and better standard of living for the whole community. Improving productivity through time and motion study is used in the manufacturing sector and allied industries.

Jacob Je-Chian Lin, Wei-Han Hung, Shih-Chung Kang [5] described A motion planning and coordination method for mobile construction machinery is described in this paper. The method includes four-steps that are as follow model development, configuration space construction, path finding and machine coordination.

Yvan J. Beliveau, Shrikant S. Dixit, Taylan Dal and Ayman A. Morad [6] this paper describes the fundamental philosophy of the system, specifically, the strategy of the required path-planning and dynamic behaviour modeler. Current work in these areas is presented. MTMP (Multi Task Motion Planning) help to provide a robust tool for multitask motion planning with several applications, typically in the construction industry.

Ian McLean and Rebecca J. Sargisson [7] this paper helpful for the make time and motion study successful through step by step procedures. Most T&M studies involve a comparison, such as between two teams or between two operational scenarios. However, even the simplest study in which just one operational concept is explored can provide valuable information, for example, in relation to productivity.

III. PROBLEM STATEMENT

The time spent on performing action has direct impact on resources i.e. more time to complete activity is equal to wastage of more money and more energy. In this way time and motion influence determine the overall being entire organization as well as individual.

Hence, Time and Motion study is used to determine the best method for completing action within the required time.

In order to achieve high quality level in construction industry and improve the performance, feasibility and suitability of different new philosophies in construction projects have been studied in recent years, but due to the various processes associated with construction projects, their complexity, and lack of specific metrics, this issue is still questionable and demands further studies.

IV. OBJECTIVE

- Determining the time required by a qualified and properly trained person working at a normal pace to do a specific task and operation.
- To improve the work process in terms of time
- Analysing the existing system under study and identifying the scope of improving the existing operation.
- Identifying the probable measures for field practice to reduce/improve the present activity.

V. RESEARCH METHODOLOGY

A. Preparing for a Time Study

- The steps in the process studied must already be standardized; e.g. sequences have been determined.
- All the information about staff members should be available.
- Operator must be fully qualified, trained, and acquainted with standardized process being studied.
- Must inform supervisor and department head.
- Make sure all materials are available for the process.
- Equipment required for time study are Stopwatch, Study Board and Time study form.

VI. DATA COLLECTION AND ANALYSIS

A. Data collection

Collection of data has been done by personal site visits at the time of activity perform by direct visit. Data has been collected in the form of Time study table form in that particular activity time has to be taken while activities are performing and its actual time has to be noted in time collection sheet.

B. Data Analysis

The collected data has been analyzed using the Excel tool and data analysis by Brain Stroming Method for improve existing Methodology. By the time data operational time is made out.

Total time of operation under existing conditions	Basic work content	Basic work content of product and operation
	Total ineffective time	Work content added by poor product design or material utilization
		Work content added by inefficient method of manufacture or operation
		Ineffective time resulting from human resources contribution

Fig. 1: How Operational Time Is Made Up

Total time of operation under existing conditions	Total ineffective time	Basic work content	Basic work content of product and operation
		A.1 Poor design and frequent design changes	Work content added by poor product design or material utilization
		A.2 Waste of materials	
		A.3 Incorrect quality standards	
		B.1 Poor layout and utilization of space	Work content added by inefficient method of manufacture or operation
		B.2 Inadequate materials handling	
		B.3 Frequent stoppages	
		B.4 Ineffective method of work	
		B.5 Poor planning of inventory	
		B.6 Frequent breakdown of machines and equipment	
		C.1 Absenteeism and lateness	Ineffective time resulting from human resources contribution
		C.2 Poor workmanship	
		C.3 Accidents and occupational hazards	

Fig. 2: Basic and Added Work Content

VII. EVALUATING TIME FOR PERFORM DIFFERENT ACTIVITY

First of all, the permission was taken to carry out the research work by collecting the data from the residential site and commercial site located at various area in Surat city Residential Sites are. 1) Pratham Ganesa which is located at pal, 2) Prayosha Exotica located at Dabholi, 3) Celebration Home located at varacha.

Commercial Sites are 1) International Fashion Market located at Puna 2) Boulevard located at Pal. In all Site Some Activities are ongoing like Concreting, Masonry, Plastering, Flooring and Painting.

A. Concreting

Concreting activity divide in to two parts first is material collection part in that measuring time of collection of different material from storage to mixer machine and second is concreting part in which mixing of ingredients, travel time to destination, spreading ,vibrating, finishing is included.

Sr.No.	Main Event	Sub Activity	Site-1 Pratham Ganesa	Site-2 Prayosha Exotica	Site-3 Celebration Home	Site-4 IFM	Site-5 Boulevard	Overall Average
1	Average Material Collection	Time to Fill/Tagara	10.258	9.32	5.76	8.71	10.75	8.96
		Transfer Material	6.456	22.92	18.89	19.15	19.80	17.44
		Through Material intoBucket	2.27	2.39	2.49	0.00	0.00	1.43
		Return Time	6.062	18.19	14.83	18.95	20.95	15.80
		One Cycle Complete Time	97.44	76.87	103.24	63.10	68.65	81.86
		Unnecessary Time	72.394	24.05	61.27	16.29	17.15	38.23
2	Average of Concrete Work	Mixing Material	45.1	69.8	104.7	90	90	79.92
		Through Material intoTrolley	57	53	10.3	14.6	14.6	29.9
		Transfer Concrete from GF to Floor	61.4	48.2	51.4	25.6	28.5	43.02
		Apply Concreteat Location	11.2	39	42.5	39.6	43.5	35.16
		Spread Concrete	16.7	20.6	36.2	20.6	20.8	22.98
		Vibrator	20.5	24.5	25	20.75	27	23.55
		Finishing Surface	35.1	64.3	66.6	31.1	29	45.22
		Total	234.7	304.7	321.7	229.8	237.2	265.62

Table 1: Concreting Work

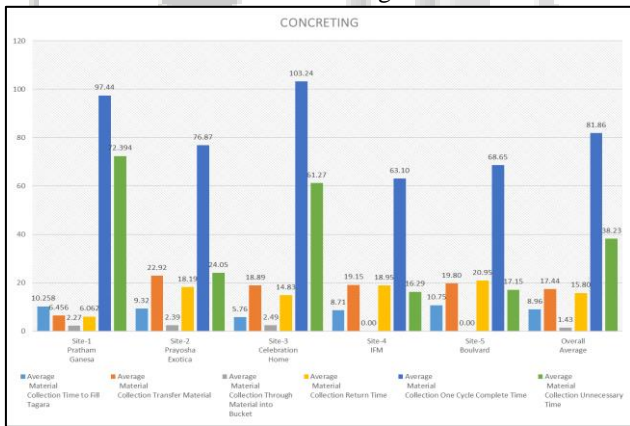


Fig. 3: Graph Concreting Work

B. Masonry

Masonry activity divide in to three parts first is material collection part in that measuring time of collection of different material from storage to lifting machine and second is lead times part and third part is utilization part which mixing of ingredients, travel time to destination, spreading ,vibrating, finishing is included.

Sr.No	Main Event	Sub Event	Site A Pratham	Site B Prayosha	Site C Celebration	Site D IFM	Average
1	Material Collection	Time to Collect Material	216.35	374.3	414.55	685.05	422.56
2		Transfer Time To Lift Trolley	39.5	47.4	48.55	18.4	38.46
4		Return Time	33.8	35.4	41.95	15.6	31.69
5		Total Time	289.65	457.1	505.05	719.05	492.71
6		One Complete Cycle Time	467.15	570.45	570.45	921.25	632.33
7		Unnecessary Time	177.5	113.35	65.4	202.2	139.61
8		Lead Time	Lifting Time	35.35	34.25	38.7	17.9
9	Unloading Time		97.45	500.95	525.45	785.95	477.45
10	Return Time		35.2	35.1	31.25	22.7	31.06
11	Total Time		168	570.3	595.4	826.55	540.06
12	One Complete Cycle Time		465.65	868.3	904.05	948.85	796.71
13	Unnecessary Time		297.65	298	308.65	122.3	256.65
14	Construction Time	Mixing Time	44.2	73.7	97.5	72.3	71.99
15		Transfer to application location	37.3	30.7	36	12.9	29.23
16		Return Time	20.3	29.3	35.3	12.2	24.28
17		Total Time	101.8	133.7	168.8	97.4	125.43
18		One Complete Cycle Time	431.3	491.3	659.3	158	434.98
19		Unnecessary Time	329.5	357.6	490.5	142.6	330.05

Table 2: Masonry Work

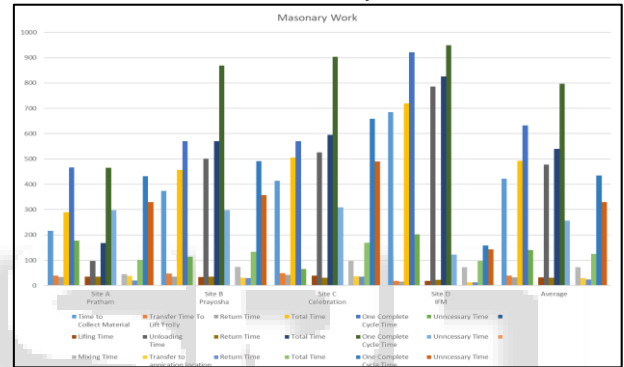


Fig. 4: Graph Masonry Work

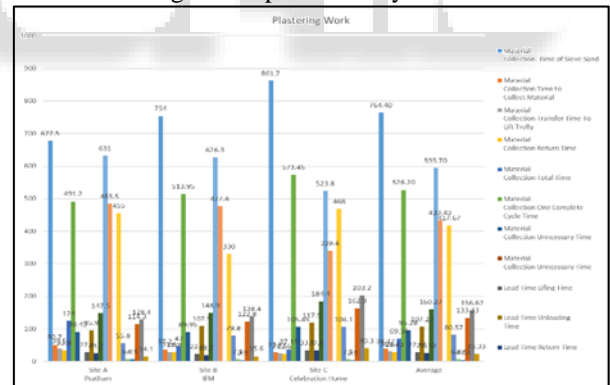


Fig. 5: Graph Plastering Work

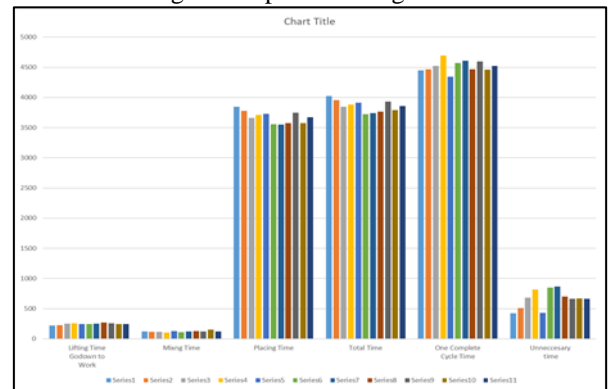


Fig. 6: Graph Painting Work

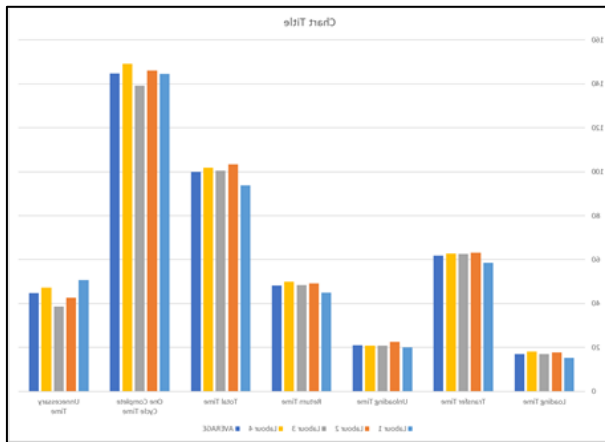


Fig. 7: Graph Flooring Work

VIII. CONCLUSION

From the discussion of the parameters, it can be concluded that this process can be improved based on the parameters that cause the problems. With combination of work process and time measurement and the changes of production layout, it will improve the current work process. These modifications are made by eliminating the wasted time and reduction of the work contents. From the comparison between current and new work process. These improvements was successful to achieve the project goals and objectives, which the improvements was included the processes, production layout, economy in human effort and the reduction of unnecessary fatigue.

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