

“Time Standardization For Building Maintenance Tasks”

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Abstract

It's natural that the construction facility starts deteriorating from the time it has constructed. Maintaining the constructed facilities is the call of the how and should be given first preference than constructing new. In order to maintain a building the owner should know the expenses which might occur for maintenance task, Labour cost demanded for maintenance has large impact on the budget of owner, So in order to have guidelines for budgeting provision this work has been undertaken to studying the standard time required, based on cost also can be calculated. The result shows the variation in labour cost.

Keywords- — Labour Cost, Maintenance task, Standard Time, Work Measurement,

1. Introduction

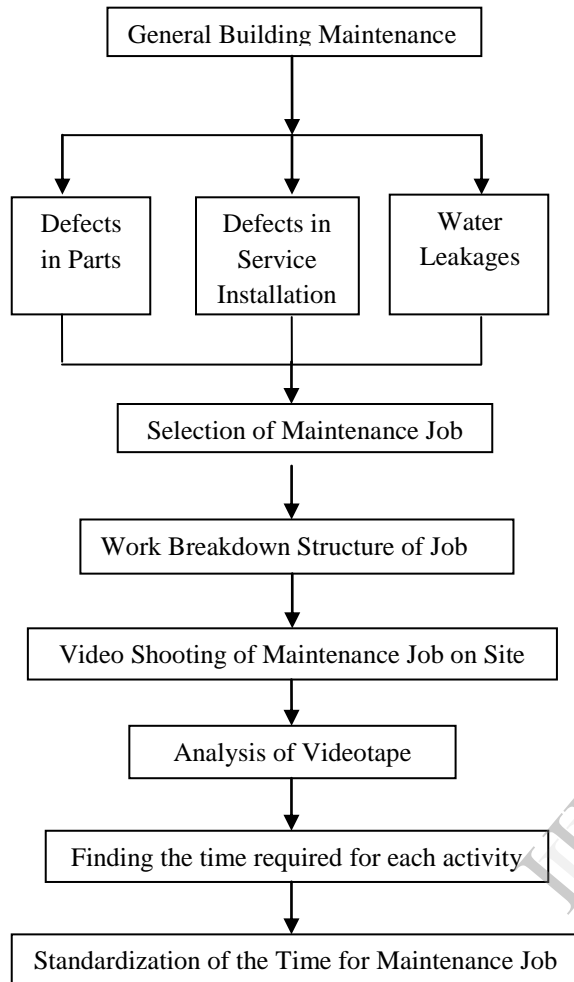
Time is very important resource in any of construction work and how long a job should take must be known to plan that job. Here we are using the work measurement techniques to know prior the standard time of the maintenance jobs. Maintenance jobs are different from the regular construction jobs. They require skilled workforce to indentify the problem and take correct action to repair it. Basically the cost problems are more in maintenance works as it differs from the original works. Here we have found out the standard times for some of the frequently occurring maintenance tasks. From those standard times we have found out labour cost required to do the work. In the maintenance industry there is lack of standards about time requirement of the particular maintenance job. So work is undertaken to find out the standard time require for maintenance jobs. This can be helpful while planning and managing the maintenance works. If we

know the work breakdown structure of the maintenance job we can plan and execute the jobs in well manner. So we decided to apply the work measurement technique to find out the standard time requirement of maintenance jobs.

Work measurement is the application of techniques designed to establish the time for a qualified worker to carry out a task at defined rate of working. Work measurement as name suggests provides management with a means of measuring the time taken in performance of an operator or series of operations in such a way that the ineffective time is shown up and can be separated from effective time.

Building and services are under the maintenance phase for 95% of its life from concept to demolition. So maintenance can be defined as “maintenance is synonymous with controlling the condition of a building including its services so that the serviceability remains within specified region of acceptability.” Building maintenance is actually a process by which a building is kept usable at a pre-determined standard for the use and benefit of its occupants or users.

2. Methodology



1. Selecting the Task-In this process the Building is divided into three parts as stated above, like defects in building parts, defects in building services installations and problems of water leakages. According to this we contacted the concerned professionals who are working in the field of building maintenance and repairs. The maintenance sites were found out and Data collection work was done.

2. Taking the labour and site supervisor into confidence and explaining them about objectives of study.

3. Collect the required data on site with the video camera. From the start to end video recording of the tasks is done.

4. Work break down structure of the each task is done. Time required to complete it is found from analysis of video.

5. Work measurement analysis of task is done to find out standard time of each task.

3. Work measurement Analysis

3.1. Standard Time-The standard time for the particular task is the sum of the standard times for all the elements of which it is made up. It is the total time in which a job should be completed at standard performance. Standard Time is unit value for the accomplishment of work task as determined by proper application of appropriate work measurement technique.

$$\text{Standard Time} = \text{Basic Time} + \text{Allowance}$$

3.2 Allowances-Allowance is the amount of time added to the normal time to provide for personal delays, fatigue of the worker. Allowances when added to the normal time, it results in standard time. The fundamental purpose of allowances is to add enough time to the normal time to enable the average worker to meet the standard when performing at a normal pace.

Total Allowance allocated as follows

1. Personal allowance -5%
2. Fatigue allowance -15%
3. Safety Protective dress – 10%
4. Tediousness + Mental strain -10%

3.3 Rating System- When collecting the data we observe carefully the performance of the worker during the entire course of time. Performance rating or Rating is a technique for equitably calculating the time required to perform a task by the normal operator after the observed value of the operation under study have been recorded. The rating factor is used to convert observed time into basic time.

For this work measurement analysis work we used the 0-100 standard rating scale has been adopted as the British Standard. In the 0-100 scale, 0 represents zero activity and 100 the normal rate of working of the motivated qualified worker that is standard rate.

TABLE 1
0-100 STANDARD RATING SCALE

Scale 0-100 Standard	Description
0	No Activity
50	Very slow –no interest in job
75	Steady, deliberate unhurried performance of the worker.
100 (Standard Rating)	Brisk, businesslike performance with quality and accuracy.
125	Very fast with a degree of assurance dexterity and coordination of movement.
150	Exceptionally fast, requires intense effort and concentration, cannot be kept long periods.

Referring to the 0-100 Standard Rating Scale, '100' represents standard performance

$$Basic\ Time = Observed\ Time \times \frac{Rating\ in\ percent}{100}$$

Sample Calculation of standard Time for activity in task Repair of Malfunction of waterproofing, Leakage for sample A

WBS activities	Start time	End time	Observed time	For 1m ²
Breaking of waterproofing coat	0:01:00	1:29:53	1:28:53	0:53:18

Time given in (HH:MM:SS) format

Rating given for this activity is 75 on rating scale

So basic Time = 0:53:18*75/100

=0:39:58

After taking the average three samples namely Sample A, Sample B, Sample C Average Basic Time is calculated and it is given in table for this task

So Average of Basic Time for Breaking of waterproofing coat =0:43:44

After Addition of Allowances to Basic Time we get the Standard time for the particular activity of the task. The Standard Time for the particular task is the sum of the standard times for all the activities of which it is made up.

4. DATABASE OF STANDARD TIME FOR TASKS UNDER STUDY

4.1 Task- External Plaster Pebble Type

Unit of Measurement=Square Meters

TABLE 2
STANDARD TIME FOR EXTERNAL PEBBLE TYPE PLASTER

WBS Activities	Basic Time (HH:MM:SS)	Standard Time (HH:MM:SS)
Breaking	0:03:51	0:05:23
Bond Coat	0:00:28	0:00:39
Dash Coat	0:01:40	0:02:20
First Coat	0:01:13	0:01:42
Leveling & filling spots	0:02:01	0:02:49
Second Coat	0:02:44	0:03:50
	Total Time	0:16:43
		16 Minutes 43 Seconds

Labour Cost required for External Plaster Pebble Type of 1m²

Assuming the transportation for each labour is 5 Km distance. Time required for this distance is 12minutes. So that time is also added for the cost calculations with their respective rate.

TABLE 3

LABOUR COST FOR EXTERNAL PEBBLE TYPE

Type of labour	On Site Rate (8Hours)	Rate according to DSR (8 Hours)	Cost for 1m ² onsite rates	Cost for 1m ² DSR rate
Skilled Labour				
Plasterer	500	311	24.15	15.08
Breaker	350	270	12.57	2.92
Semiskilled	300	270	17.76	15.99
Unskilled	200	270	11.84	15.99
			66.34	49.99
			66 Rs.	50Rs.

Actual Labour Rate on site for External Plaster Pebble Type of 1m²=70Rs.

4.2 Task- Micro-concrete for repairs of beam for problems of bulging, falling off of concrete from beam with reinforcement exposed

Unit of Measurement= Running meter

Size of beam 230mm X 400mm

TABLE 4
STANDARD TIME FOR MICRO CONCRETE FOR REPAIRS OF BEAM

WBS Activities	Basic Time (HH:MM:SS)	Standard Time (HH:MM:SS)
Rust Kill Coat & Bond Coat	0:01:57	0:02:44
Fixing necessary reinforcement	0:21:58	0:30:45
Fixing the shuttering	0:13:13	0:18:30
Filling the POP	0:05:04	0:07:06
Micro concrete filling	0:16:28	0:23:03
Removing shuttering	0:03:29	0:04:53
	Total Time	1:27:01
		1Hour 27Minutes 1Second

Labour Cost required for Micro-concrete for repairs of beam 1m

TABLE 5
LABOUR COST FOR MICRO-CONCRETE FOR REPAIRS OF BEAM

Type of labour	On Site Rate (8 Hours)	Rate according to DSR (8 Hours)	Cost for 1m onsite rates	Cost for 1m DSR rate
Skilled Labour				
Bar bender	450	270	42.45	25.47
Carpenter	450	311	35.02	24.20
Semiskilled	300	270	21.89	19.70
Unskilled	200	266	37.08	49.20
			136.46	118.59
			136 Rs.	119 Rs.

Actual Labour Rate on site for Micro-concrete for repairs of Beam 1m = 170 Rs.

4.3 Task- Repair of Malfunction of waterproofing, Leakage

Unit of Measurement=Square Meters

TABLE 6
STANDARD TIME FOR REPAIR OF MALFUNCTION OF WATERPROOFING, LEAKAGE

WBS Activities	Basic Time (HH:MM:SS)	Standard Time (HH:MM:SS)
Breaking of waterproofing coat	0:43:44	1:01:13
Breaking of slab cover	0:58:11	1:21:28
Cleaning of area	0:21:25	0:29:59
Aggregate spreading	0:08:52	0:12:25
Fixing sockets	0:18:41	0:26:09
Grouting	0:08:06	0:11:20
Cleaning of area	0:16:29	0:23:05
Waterproofing coating	0:06:40	0:09:20
Dash coat	0:02:20	0:03:16
Filling with concrete	0:06:07	0:08:34
Finishing work	0:11:41	0:16:21
	Total Time	4:43:12
		4 Hours 43 Minutes 12 Seconds

Labour Cost required for Repair of Malfunction of waterproofing, Leakage 1m²

TABLE 7
LABOUR COST FOR REPAIR OF MALFUNCTION OF WATERPROOFING, LEAKAGE

Type of labour	On Site Rate (8 Hours)	Rate according to DSR (8 Hours)	Cost for 1m ² onsite rates	Cost for 1 m ² DSR rate
Skilled Labour				
Leakage worker/ Mason	320	311	196.93	191.19
Semiskilled	200	270	110.67	166.00
			307.60	357.19
			307Rs.	357Rs.

Actual Labour Rate on site for Repair of Malfunction of waterproofing, Leakage 1m² = 320 Rs.

4.4 Task- Polymer modified mortar for repairs & patching of spalling surfaces of slab

Unit of Measurement=Square Meters

TABLE 8

STANDARD TIME FOR POLYMER MODIFIED MORTAR FOR REPAIRS

WBS Activities	Basic Time (HH:MM:SS)	Standard Time (HH:MM:SS)
Fixing the necessary steel	0:14:20	0:20:04
Bond coat	0:01:25	0:01:59
Dash coat	0:06:55	0:09:40
Hand placing of PMM	0:17:24	0:24:22
	Total Time	0:56:05
		56 Minutes 5Seconds

Labour Cost required for Polymer modified mortar for repairs & patching of spalling surfaces of slab 1m²

TABLE 9

LABOUR COST FOR POLYMER MODIFIED MORTAR FOR REPAIRS

Type of labour	On Site Rate (8 Hours)	Rate according to DSR (8 Hours)	Cost for 1 m ² onsite rates	Cost for 1m ² DSR rate
Skilled Labour				
PMM labour	550	311	55.00	31.10
Bar Bender	450	270	30.03	18.02
Semi skilled	300	270	42.66	38.39
			127.70	87.52
			128 Rs.	88 Rs.

Actual Labour Rate on site for Repair of Polymer modified mortar for repairs & patching of spalling surfaces of slab 1m² =130 Rs.

4.5 Task- External wall paint work
Unit of Measurement=Square Meters

TABLE 10

STANDARD TIME FOR EXTERNAL WALL PAINT WORK

WBS Activities	Basic Time (HH:MM:SS)	Standard Time (HH:MM:SS)
Surface cleaning	0:00:14	0:00:20
Crack finding, splitting	0:00:34	0:00:48
Crack filling	0:01:43	0:02:24
Applying Primer	0:03:11	0:04:27
Applying paint coat 1	0:02:50	0:03:58
Paint Coating to windows	0:00:48	0:01:07
Applying paint coat 2	0:02:44	0:03:50
	Total Time	0:16:54
		16 Minutes 54 Seconds

Labour Cost required for External wall paint work 1m²

TABLE 11

Labour Cost for External wall paint work

Type of labour	On Site Rate (8 Hours)	Rate according to DSR (8 Hours)	Cost for 1m ² onsite rates	Cost for 1m ² DSR rate
Skilled labour				
Painter	450	277	26.75	16.46
Unskilled	200	266	11.89	15.69
			38.64	32.16
			40 Rs.	32 Rs.

Actual Labour Rate on site for Repair of External wall paint work 1m² =45 Rs

4.6 Task- External Sand faced Plaster
Unit of Measurement=Square Meters

TABLE 12
STANDARD TIME FOR EXTERNAL SAND FACED PLASTER

WBS Activities	Basic Time (HH:MM:SS)	Standard Time (HH:MM:SS)
Breaking	0:03:51	0:05:46
Bond Coat	0:00:13	0:00:20
Dash Coat	0:02:00	0:03:00
First Coat	0:04:49	0:07:13
Leveling & Filling spots for first coat	0:04:09	0:06:14
Second coat	0:01:25	0:02:08
Leveling & Filling spots for Second coat	0:04:19	0:06:28
Application of sprung	0:03:18	0:04:57
	Total Time	0:36:06
		36 Minutes 06 Seconds

Labour Cost required for External Sand faced Plaster $1m^2$

TABLE 13
LABOUR COST FOR EXTERNAL SAND FACED PLASTER

Type of labour	On Site Rate (8 Hours)	Rate according to DSR (8 Hours)	Cost for 1 m^2 onsite rates	Cost for 1 m^2 DSR rate
Skilled Labour				
Plasterer	500	311	43.94	27.33
Breaker	350	270	12.73	9.821
Semiskilled	300	270	26.36	23.73
Unskilled	200	270	20.03	27.03
			103.08	87.92
			103 Rs.	88 Rs.

Actual Labour Rate on site for External Sand faced Plaster $1m^2 = 110$ Rs

5. RESULTS

The results show the Standard time for six maintenance tasks. Basic times for tasks are calculated from the observed time. Addition of allowances to the basic time gives the Standard time for the tasks. Standard Times are calculated for the unit of $1m^2$ or 1m

TABLE 14

RESULTS OF STANDARD TIME

Sr. No.	Task	Basic Time	Allowance Added				Standard Time
			P.A.	F.A.	S.P.D.A.	T.M.S.	
1.	External Plaster Pebble Type (1m ²)	11 Minutes 27 Seconds	5%	15%	10%	10%	16 Minutes 43 Seconds
2.	Micro-concrete for repairs of Beam (1m)	1 Hour 02 Minutes 10 Seconds	5%	15%	10%	10%	1 Hour 27 Minutes 1 Seconds
3.	Repair of Malfunction of waterproofing, Leakage (1m ²)	3 Hour 22 Minutes 17 Seconds	5%	15%	10%	10%	4 Hours 43 Minutes 12 Seconds
4.	Polymer modified mortar for repairs of slab (1m ²)	40 Minutes 07 Seconds	5%	15%	10%	10%	56 Minutes 5Seconds
5.	External wall paint work (1m ²)	12 Minutes 04 Seconds	5%	15%	10%	10%	16 Minutes 54 Seconds
6.	External Sand faced Plaster (1m ²)	24 Minutes 04 Seconds	5%	15%	10%	10%	33 Minutes 42 Seconds

6. CONCLUSION

From the above study important conclusions are as follows.

1. Building owners can beforehand understand the maintenance cost and can plan for the budgetary requirements.
2. Building owners will be able to negotiate the task labour rates.
3. There is wide difference between actual cost required and cost quoted for maintenance tasks. This study will help engineers and owner to decide on maintenance task prioritization based on available budget.
4. From the data collected, Actual labour rates are 2.36% to 25% higher than the computed rates based on the time requirement.
5. Maintenance engineers can supervise the work on basis of work break down structure given for the tasks.

7. REFERANCES

- [1] Abdul Talib Bon, Aliza Ariffin “An Impact Time Motion Study on Small Medium Enterprise Organization”, *International Conference on Business and Economic Research*, pp1-11,2010.
- [2] Ammar Olabi, Ammar Olabi, Jean Hunter, Peter Jackson, Michele Segal, Rupert Spies, Carolyn Wang, Christina Lau, Christopher Ong, Conor Alexander, Evan Raskob, Jennifer Plichta, Ohad Zeira, Randy Rivera, Susan Wang, Bill Pottle, Calvin Leung, Carrie Vicens, Christine Tao, Craig Beers, Grace Fung, Jacob Levine, Jaeshin Yoo, Joanna Jackson, Kelly Saikkonen, Matthew Zimmerman, Megan Cunningham, Michele Crum, Naquan Ishman, Norman Voo, Raul Cadena, Robert Relinger, Saori Wada “Work Measurement for Estimating Food Preparation Time of a Bioregenerative Diet”, *Habitation* , Vol.9, pp1-44,2003.
- [3] *CPWD maintenance manual* ,pp 1-277 ,2000
- [4] Liju Joshua,Koshy Varghese “Classification of bricklaying activities in work sampling categories using accelerometers”, *Construction Research Congress ASCE*, pp 919-928,2012.
- [5] Productivity Networks, Inc “How to use Work Measurement for High Productivity Maintenance Operations”, pp 1-8,2002.
- [6] “Repairs and maintenance needs of RCC structure” *Rebuild*, vol.4, pp 1-20, 2010.
- [7] Shabbir Syed Abdul, Luai A. Ahmed, Rachapalle Reddi Sudhir, Jeremiah Scholl , Yu-Chuan Li , Der-Ming Liou “Comparison of Documentation Time Between an Electronic and a Paper Based Record System by Optometrists at an Eye Hospital in South India: A Time–Motion Study” *Elsevier Computer Methods and Programs in Biomedicine*, Vol.100, pp283–288,2010.
- [8] Sitaramraju Mantena, Lisa K. Spainhour, Yaw A. Owusu “Time and Motion Study for Affordable traffic Data collection system for the State of florida” vol.15, pp 122-131,2008.
- [9] Tom Best “Work Measurement in Skilled Labour Environment” *Society for Health System*, pp 1-26,2009
- [10] O.P.Khanna “Work Study Motion and Time Study” Revised Edition, 1992, Dhanpat Rai and Sons, New Delhi