



THE EFFECT OF BRICKLAYER'S WORK METHOD ON TILE INSTALLATION WORKING TIME

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Abstract:

The implementation of a construction project consists of several works that carried out by labourer or craftsman in accordance to their specifications of expertise. To achieve both time and quality target of work output, each craftsman use different work method that consists of a series of activities. From a series of activities that carried out by each craftsman, the time needed to complete a work can be calculated. This study observed the activities of bricklayers in tile installation.

The method that used in the study of bricklayers in tile installation is a literature study. On the other hand, an on-site study is performed by recording a number of bricklayers in tile installation. The recordings of each bricklayer were studied so that a series of activities and the activity time of tile installation can be obtained.

From the observations of 35 bricklayers regarding work method and activity time of the tile installation, 4 (four) work methods were identified. Of all the samples that have been studied, the fastest is the bricklayer number 9 (nine) whose activity time was 7.69 minutes by using the work method number 2 (two).

Keywords: Work Method; Bricklayers; Activity Time; Tile Installation.

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1. Introduction

1.1. Background

The implementation of a construction project consists of several works. For example, in building construction projects, it consists work of preparation, excavation and piling, foundation, concrete, wall, roof, floor, tile installation, etc. up to finishing.

Each work is carried out by labours or craftsmen in accordance to their specifications of expertise. In carrying out the work, the craftsmen are required to achieve a targeted output, both in terms of time and in terms of the quality of the work. To achieve the target, each of the craftsmen completes their work using different work method in accordance to their nature/style.

The work method that be used by each craftsman consists of a series of activities in different sequences even though the final output will be the same. From a series of activities carried out by each craftsman, the time that they needed to complete a work can be counted.

From the observations of the work method and activity time of bricklayers, by taking the example of a bricklayer in tile installation, it is necessary to study the effect of the bricklayer's work method on the tile installation activity time.

1.2. Problem Formulation

Based on the background description, problems can be formulated as follows:

- What is the work method of bricklayers in tile installation?.
- How much activity time for each bricklayer's work method in tile installation.
- How does the work method affect the activity time of bricklayers in tile instalation.

1.3. Objectives

The objectives of this study are:

- Identify the work methods of bricklayers in tile installation.
- Counting the activity time needed by each of bricklayer's work methods in tile installation.
- Identify the effects of the work method on the activity time of bricklayers in tile installation.

1.4. Boundaries

To limit the the scope of the study of The Effect of Bricklayer's Work Method On Tile Installation Working Time, the following limitations are made:

- Observation is carried out on bricklayers that do tile installation.
- The observed activity is the installation of rectangular-shaped interior tiles which sizes are 30x30cm and 40x40cm
- The bricklayers that be observed are considered to have relatively the same work experience.
- The quality of their work is considered the same, the costis not taken into account.
- Observations were made on the work methods that carried out by bricklayers in tile installation.
- The method that be used is Time and Motion Study.
- Availability of material is not taken into account (considered available).
- Thread setting as a guideline for floor height is not taken into account.
- The conclusions are based on observed samples.

2. Materials and Methods

2.1. Theoretical Basis

According to Ervianto (2005) a series of activities in construction projects can be divided into 2 types, they are routine activities and project activities. Routine activity is a series of long-term continuous activities that are repetitive, while project activity is a series of activities which are

only once carried out and generally take place in a short period of time. Therefore, a project activity has a clear beginning and end of activities and outputs that are unique.

According to Wignjosoebroto (1995) work method is a series of activities needed to process or change a set of inputs into a number of outputs that have added value. Processing or changes that occur can be physical or non-physical, the changes can occur in term of form, dimensions, or characteristics. The added value referred to is the value of the output that increases in terms of functional value and or economic value.

In an effort to find out a work method there are two things that needs attention, namely:

1) Motion study-

Motion study is a study of the worker's movements in completing their work so that they can reduce some movements to be more effective and therefore increasing their productivity.

2) Measurement of activity time-

Measurement of activity time is to find out how much time is needed in each activity to produce a particular product. With the measurement of activity time, the time that is needed to complete a work will be find out.

Based on the explanation above, this study only reviewed the series of activities and the time that is needed to do it. This study is not reviewing the layout arrangement of equipment and material.

2.2. Study Method

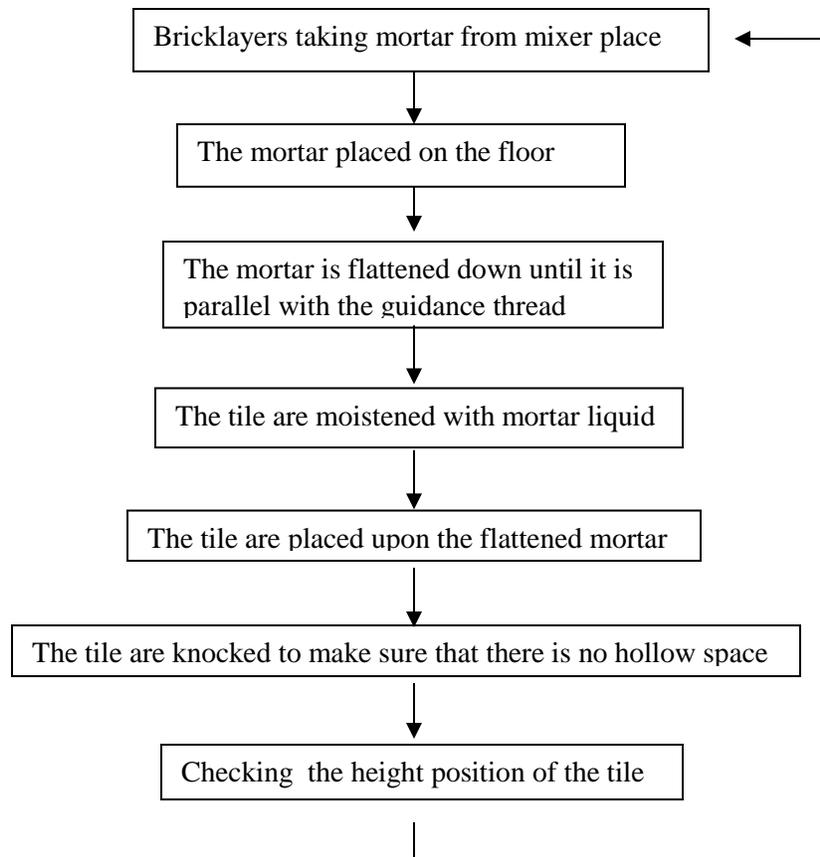
The technique that is used to measure activity is the Time and Motion Study method. Time and Motion Study is a method of measuring productivity that carried out using a video camera. The shooting aims to record all certain activities that will be measured. Information's that is obtained from this method is a series of activities and the time that is needed for each activity to be completed thoroughly (Erviyanto, 2004).

The step taken in the study of bricklayers in tile installation was a literature study. On the other hand on-site study recording was carried out on a number of bricklayers doing tile installation. Each recordings were observed so that a series of tile installation activities and activity time were obtained.

2.3. Stages of Research

The initial stage of the study was formulating the problem that make this study need to be done. Then, a literature study is carried out and determined the theoretical basis of the work method and activity time of bricklayers in tile installation.

This study only observe from mortar placement until the installation of tile. The working methods of tile installation in general can be seen in Figure 1 as follows:



Picture 1: Work method of bricklayers in tile installation

The next step was observing the activity time and work method of the bricklayers in tile installation. From the several work methods that carried out, the work method that required the least activity time can be found out to draw conclusions as the final step.

3. Results and Discussions

3.1. Data Collection

The bricklayers observed were bricklayers who worked in projects in Banyumas area and its surroundings. Sampling is done by using probability sampling which is a random sampling technique. This technique giving an equal opportunity for every bricklayers to be selected as a sample.

Roscoe (1982) in Sugiyono (2011) gives advice that the proper amount of samples for a study are between 30 and 500. This study observed 35 bricklayers. The number of 35 bricklayers was taken with the assumption that the error rate or data accuracy was 10%, based on the table that determining the number of samples that developed by Isaac and Michael in Sugiyono (2011) the number of samples was 31, it means the amount of data was still above the minimum. If the number of eligible samples is less than 30, small samples are used.

Recording activities of bricklayers in tile installation are carried out in the following order:

- Determined the bricklayer that will be studied.
- Prepare a video camera that will be used to carry out the recording activities.
- Measuring the field of work of the bricklayers, which is 1 m²
- Recording the activities of the bricklayer starting from picking up the mortar until the tile was properly installed upon the mortar in a flat position and parallel to the thread. The recording process is unknown by the observed bricklayer.
- Turning off the video camera after the recording activities are completed.
- The steps above are repeated with the other bricklayers.

Based on the activities carried out by bricklayers in tile installation, observations were made using the existing work methods. As a result of the observations, 4 (four) work methods that used by bricklayers in tile installation are identified.

3.2. Data Observation

In general, from the 4 (four) bricklayer's working methods, each has advantages and disadvantages as described in table 1 as follows:

Table 1: Advantages and Disadvantages of Bricklayer's Working Method in doing Tile Installation

No	Work Method	Advantages	Disadvantages
1	The bricklayer taking a pail of mortar and pour it on the floor and then put on the tile.	The direct mortar pouring from the pile is faster than using trowel	Using this method sometimes needs repetitive action that is knocking the tile if the position is not fit or proper enough.
2	The bricklayer taking a pail of mortar and pour it on the floor and then putting on the tile. The tile is cleaned with cloth and a nail is placed on the slit between tiles.	The direct mortar pouring from the pile is faster than using trowel	The activities of cleaning tile and placing nail adds work time.
3	The bricklayer taking a pail of mortar and put it on the floor using trowel until a certain volume that is enough for a single tile and then put on the tile.	The repetitive activity of flattening mortar in small amount is easier than flattening a single large amount of mixture.	The repetitive activity of putting on the mortar is not practical
4	The bricklayer taking a pail of mortar and put it on the floor using trowel until a certain volume that is enough for a single tile and then put on the tile. The tile is cleaned with cloth and a nail is placed on the slit between tiles.	The repetitive activity of flattening mortar in small amount is easier than flattening a single large amount of mixture	The repetitive activity of putting on the mortar is not practical The activities of cleaning tile and placing nail adds work time.

3.3. Measurement of Activity Time

After observing the working methods that be used, the time that is needed by the bricklayers to complete the tile installation can be measured. The required activity time includes:

- Activity time that is needed to complete each activity carried out by bricklayers. This activity time is measured to find out the time that is needed to complete a motion, so that it can reduce the required time if a motion will be eliminated because it is not needed.
- The time that is needed to complete 1 m² of tile installation. The time measurement is based on the required time to complete all activities until the tile installation is as large as 1 m². The results of the measurement of activity time to complete 1 m² of tile installation from each sample can be seen in table 2 as follows:

Table 2: The required time to complete 1m² tile installation.

NO. SAMPLE	Sample Area (m ²)	Required Time		Activity time (menit /m ²)
		(Second)	(Minute)	
1	0.99	873	14.55	14.70
2	0.99	936	15.60	15.76
3	0.90	894	14.90	16.56
4	0.99	765	12.75	12.88
5	0.99	767	12.78	12.91
6	0.99	766	12.77	12.90
7	0.96	718	11.97	12.47
8	1.12	722	12.03	10.74
9	1.12	517	8.62	7.69
10	1.12	756	12.60	11.25
11	0.99	675	11.25	11.36
12	0.99	739	12.32	12.44
13	0.96	565	9.42	9.81
14	0.96	560	9.33	9.72
15	0.96	449	7.48	7.80
16	0.96	740	12.33	12.85
17	0.96	630	10.50	10.94
18	1.28	775	12.92	10.09
19	0.96	562	9.37	9.76
20	0.99	780	13.00	13.13
21	0.99	687	11.45	11.57
22	0.96	623	10.38	10.82
23	0.96	579	9.65	10.05
24	0.96	639	10.65	11.09
25	0.96	821	13.68	14.25
26	0.96	807	13.45	14.01
27	0.99	678	11.30	11.41
28	0.96	653	10.88	11.34
29	0.99	764	12.73	12.86
30	0.99	846	14.10	14.24
31	0.99	810	13.50	13.64
32	0.99	829	13.82	13.96
33	0.99	632	10.53	10.64
34	0.99	679	11.32	11.43
35	0.96	678	11.30	11.77

3.4. Analysis of Work Methods

From the observations of the data it can be seen that there are various work methods of bricklayers in tile installation and each method has advantages and disadvantages. Each work method has different activities and from the implementation observation the following things can be identified:

- Repeated Activities

The same types of activities in the same work method but on different sequences will have different influences. In a work method there are types of activities that are repeated. The sequence of activities with repeated activities becomes inefficient. For example in the knocking activity of the work method number 1 (one), if it is done after checking the position of the tile, the tile knocking activity does not need to be repeated if the checking activity found that the position of the tile is not proper.

- Activities that do not need to be done by bricklayers

The number of activities carried out by bricklayers will affect the activity time. In a series of activities carried out, activities that can be carried out by helpers do not need to be carried out by bricklayers, thus reducing the number of activities carried out by bricklayers. For example, wiping the tile that have been installed in work method number 2 (two) and work methods number 4 (four), in some of the samples it is still carried out by bricklayers

- Activities with the same results

Each work method has a different set of activities, and there are different activities to get the same results. By choosing more practical activities, the number of activities is lesser and the time needed will be shorter. For example, when pouring the mortar before put on the tile, it is more practical if poured directly from the pail then flattened it as in the work method number 1 (one) and work method number 2 (two) compared to using trowel and carried out the same work repeatedly as in the work method number 3 (three) and work method number 4 (four).

3.5. Time Activity Analysis

The time of activity of each sample listed in table 2 has approximately the same value. The fastest bricklayer is sample number 9 (nine) that use work method number 2 (two), the activity time is 7.69 minutes. Whereas the slowest bricklayers is sample number 3 (three) that use work method number 3 (three), the activity time is 16.56 minutes. However, the overall time activities cannot only be determined from the total time of an individual, but by observing the average time of each activity in a series of activities that carried out by several bricklayers that use the same method. From the observations of all samples, the following things can be identified:

- Time for Repeated Activities

Activities that are not carried out at one time or repeated takes longer time to finish. This can be seen in tile knocking activity in work method number 1 (one) where if there is a mismatch after the knocking activity the knocking activity is carried out again. If it is done after checking the position, it will required less time.

- The quantity of the series of activities

The quantity of activities that carried out by bricklayers in a whole series to complete Installing 1 m² of tile does not affect the total time that is needed. The length of time needed depends on each activity time.

- The time to pour mortar

The time needed to put on mortar using trowel is longer than pour it directly from the pail. This is because the bricklayers will need to take time to take a stir and put it on with trowel up to many times compared to poured it directly from the pail, the bricklayer only needs one movement, which is taking a bucket and pouring it into the floor

- Furthermore, an analysis is carried out to find out the effect of the work method on the activity time of bricklayers in tile installation. This analysis is based on a series of activities carried out and the time needed to complete the activities for each work method. The series of activities and the required time of activities based on work methods can be seen in table 3 as follows:

Table 3: Activity and Activity Time based on Work Method

Activity Number	Activity Description	Method 1		Method 2		Method 3		Method 4	
		Carried Out	Time (second)						
K1	The Bricklayer taking a pail of mortar	√	9.06	√	11.71	√	12.0	√	8.00
K2.1	The mortar is directly poured from the pail	√	27.94	√	30.71				
K2.2.1	Pick up a Trowel					√	11.6	√	8.00
K2.2.2	Scoping mortar with trowel					√	73.8	√	54.80
K2.2.3	Putting on the mortar with trowel					√	64.6	√	51.60
K3	Bricklayers put back the pail	√	6.67	√	6.29				
K4	Flattening the mortar	√	271.67	√	233.29	√	235.0	√	239.80
K5	Put back the trowel and pail	√	8.78	√	6.71	√	9.80	√	9.00
K6	Pick up the tile	√	16.39	√	19.71	√	14.0	√	9.20
K7	Put the tile upon the mortar.	√	46.83	√	43.57	√	41.0	√	32.80
K8	Pick up a hammer	√	8.61						
K9	Knocking the tile's surface	√	187.61						
K10	Put back the hammer	√	8.61						
K11.2	Checking the tile's position	√	1.50	√	3.14	√	4.20	√	6.20
K11.2.1	Pull off the tile	√	1.44	√	2.57	√	2.00	√	8.20
K11.2.2	Taking the mortar and trowel	√	1.11	√	1.14	√	3.60	√	3.80
K11.2.3	Adding and flattening the mortar	√	8.44	√	18.29	√	15.40	√	41.20
K11.2.4	Put back the pail and trowel	√	1.83	√	1.14	√	1.60	√	3.40
K6	Pick up the tile	√	1.17	√	1.86	√	1.60	√	3.40
K7	Put the tile upon the mortar	√	3.11	√	4.00	√	3.00	√	16.80

K8	Pick up a hammer	√	1.11	√	7.57	√	9.80	√	8.20
K9	Knocking on the tile's surface	√	18.50	√	176.29	√	184.00	√	167.40
K10	Put back the hammer	√	1.11	√	7.57	√	9.80	√	8.20
K12	Tidying up the installed tile					√	122.00	√	38.20
K14	Wiping he tile with cloth			√	22.86			√	59.40
K15	Placing a nail on the slit between tiles			√	44.71			√	22.80
K12	Tidying up the installed tile	√	30.39	√	57.43				
K13	Taking a pail of mortar								
Total activity time			661.88		700.56		818.80		800.40

From Table 3 it can be seen that each work method has a different set of activities and can be analyzed as follows:

- The series of activities in Work Method number 1 (one) consist of 21 activities and the total time needed to complete 1 m2 of installed tile is 661.88 seconds.
- The series of activities in Work Method number 2 (two) consist of 20 activities and the total time needed to complete 1 m2 of installed tile is 700.56 seconds.
- The series of activities in work method number 3 (three) consist of 19 activities and the total time needed to complete 1 m2 of installed tile is 818.80 seconds.
- The series of activities in work method number 4 (four) consist of 21 activities and the total time needed to complete 1 m2 of installed tile is 800.40 seconds.

4. Conclusions and Recommendations

4.1. Conclusion

From the observation that has been done on the work methods of bricklayers in tile installation, the following things can be concluded:

- Of the 35 (thirty-five) bricklayers, there are 4 (four) work methods that been used in tile installation.
- Of the 4 (four) work methods, work method number 1 (one) required the shortest time to complete 1 m2 of installed tile which is 661.88 seconds or 11.03 minutes. Work method that required the longest time is work method number 3 (three) with 818.80 seconds or 13.65 minutes.
- From the observations and measurement, it can be discovered that the work method influences the activity time in carrying out a work.

4.2. Suggestion

Suggestions that can be given after making observations are as follows:

- The scope of this study is limited in the Banyumas region and its surroundings, for this reason there is a need for research in other areas to obtain more accurate conclusions.
- The method of Time and Motion Study can be used to measure work methods and time of activity on other works, especially construction work.

- Further study is needed to test whether the new work method that bring out the fastest activity time will have the same result if tested on a different worker.
- From the discussion it can be seen that there are still many factors that can affect the activity time, such as material layout, tool layout, material quality, outcome quality, and the number of helpers, for this reason further research is needed.

References

- [1] Asmal, Sapta, 2004, Penerapan Telaah Metode Kerja dan Ergonomis Untuk Meningkatkan Produktifitas Kerja Masyarakat Pengrajin Batu Bata, , Lembaga Penelitian UNHAS
- [2] Dipohusodo, Istimawan, 1996, Manajemen Proyek dan Konstruksi, Kanisius, Yogyakarta
- [3] Dwi Laksono, Taufik, 2001, Metode Kerja dan Produktivitas Tukang Plester Pada Pekerjaan Pemasangan keramik, Tesis Program Studi Magister Teknik Sipil, Universitas Islam Indonesia, Yogyakarta
- [4] Ervianto, Wulfram I., 2004, Teori Aplikasi Manajemen Proyek Konstruksi, Andi Offset, Yogyakarta
- [5] Ervianto, Wulfram I., 2005, Manajemen Proyek Konstruksi, Edisi Revisi, Andi offset, Yogyakarta
- [6] Harijanto, Setiawan, 2006, Efektivitas waktu kerja kelompok tukang, Jurnal Teknik Sipil Volume 7 No 1
- [7] Pamuji, 2008, Pengukuran produktivitas pekerja sebagai dasar perhitungan upah kerja pada anggaran biaya, Tugas Akhir Program Studi Teknik Sipil, Universitas Sumatera Utara
- [8] Purnomo, Sukirno, 1999, Pengantar Manajemen Proyek, Diktat Kuliah Magister Teknik Sipil UII, Yogyakarta
- [9] Silalahi, Bennet, 1994, Perencanaan Pembinaan Tenaga Kerja, PT. Pustaka Binwan Pressindo, Jakarta
- [10] Soeharto Iman, 1999, Manajemen Proyek dari Konseptual Sampai Operasional, Erlangga, Jakarta
- [11] Sritomo Wignjosoebroto, 1995, Ergonomi, Studi Gerak dan Waktu, Edisi Pertama, Guna Widya, Jakarta
- [12] Sugiyono, 2011, Metode Penelitian Kuantitatif Kualitatif dan R & D, Alfabeta, Bandung
- [13] Sugiyono, 2011, Statistika untuk Penelitian, Alfabeta, Bandung
- [14] Suparyono, 2010, Metode Pelaksanaan Bangunan, Pro Estimasi Indonesia. Jakarta
- [15] Tamrin, A.G., 2008, Teknik Konstruksi Bangunan Gedung Jilid I, Direktorat Pembinaan Sekolah Menengah Kejuruan, Jakarta
- [16] Wuryanti, Wahyu, 2010, Standarisasi pedoman pengukuran Produktivitas Tenaga Kerja untuk Pekerjaan Konstruksi Bangunan Gedung, Prosiding PPI Standarisasi, Banjarmasin

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