# Determination of Productivity Output of Masons in Block Work and Plastering Work in Enugu Urban

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**Abstract: -** The aim of the study is to determine the actual productivity level of masons in blockwork and plastering work in building construction sites in Enugu Urban. The study employed work measurement as a method to determine the output of masons in blockwork and plaster within the stipulated hour of 8hrs working duration per day. The Time it takes to carry out the activity was recorded. The Summary of Field Observation in 225mm blockwork with standard time 0.3842 and standard output 2.6023(ground floor). 225mm block work has standard time 0.4265 and standard output 2.3451(first floor).12mm wall plastering (1:3) has standard time 0.01664 and standard output 60.797(inside).12mm wall plastering (1:3) has standard time 0.0139 and standard output 71.739(outside). The study concluded that adequate and appropriate work measurement techniques should be employed to determine the output of masons in the construction sites. The study therefore recommended that the Government should collaborate with professional bodies to enforce every craftsman to be registered with the professional body and trained. There is an urgent need for speedy passage of the National Building Code Enforcement Bill so that such a regulatory document, which defines roles, will engender mutual understanding and guide every construction work on site.

**Key Words: —** ***Mason, blockwork, plastering, standard output, standard time.***

## I. INTRODUCTION

The term "productivity" itself has various connotations. In one context it may mean the substantive analysis of the technology and operating system of a factory. In another, it might mean the subtle motivational aspects of the management of the efforts of a white-collar workforce. Yet another emphasis might be on long-range improvement in financial results through inventory control. Eze (1981) defined productivity as a measure of how well resources are brought together in organizations and utilized for accomplishing a set of results. Olomolaiye (1990) used the widely known efficiency equation as a measure of productivity:

$$Input = \frac{Output}{Efficiency} \qquad (1)$$

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Output in this study on mason motivation refers to the number of blocks laid and input is the time spent by the masons to lay the blocks. Nwachukwu (2010) defined productivity as a combination of effectiveness and efficiency. That is:

$$\text{Productivity} = \frac{\text{Performance Achieved}}{\text{Resources Consumed}} = \frac{\text{Effectiveness}}{Efficiency} \qquad (2)$$

It is clear from the foregoing definitions and observations that there is an increasing demand for efficiency in the construction industry in order to underpin infrastructural development in Nigeria's growing economy. More than ever, there is an urgent need to confront headlong the problems militating against productivity in the nation's construction industry.

Productivity management has been an issue in Enugu urban because majority of the developers prefer cheap labour, some of the building projects under construction do not have the requisite professional (Builder) in charge of the projects. To cap it all, majority of the developers in Enugu urban do not engage mason trained for the specific work but rather employ cheap labour who are not technically experienced, targeting a stipulated time of completion, neglecting quality output of the

building project. This results in poor quality of work output, cost overrun, projects not completed according to specification and schedule, and outright abandonment of the project. These anomalies have affected the construction industry through reducing profitability and negatively impacting on the industries' reputation thereby resulting in low productivity (Kazunga, 2012). Since construction projects are based on repetitive processes, for example bricklaying, plastering, plumbing etc, successful planning of these processes can result in quality, time and cost savings over the duration of the projects (Graham and Smith, 2004). To achieve this, companies have to undertake productivity assessments and improvements through implementation of various work study techniques.

## II. LITERATURE REVIEW

### *2.1 Work Study*

Work study is a means of enhancing the productivity (production efficiency) of the firm by elimination of waste and unnecessary operations. It is a technique to identify non-value adding operations through investigation of all the factors affecting the job. It is the only accurate and systematic procedure-oriented technique to establish time standards and it contributes to the profit as the savings will start immediately and continue throughout the life of the product.

It forms the basis for work system design. The purpose of work design is to identify the most effective means of achieving necessary functions. This work-study aims at improving the existing and proposed ways of doing work and establishing standard times for work performance. Work-study is encompassed by two techniques, i.e., method study and work measurement.

Work study is a generic term for those techniques, method study and work measurement which are used in the examination of human work in all its contexts. And which lead systematically to the investigation of all the factors which affect the efficiency and economy of the situation being reviewed, in order to effect improvement.

### *2.2 Work Measurement (Time Study)*

Work measurement is concerned with measuring time required for a specific task that is time required to perform a task so that an output standard of production for a worker or group of workers may be established (Calvert, Bailey and Coles, 1995). According to Khanna (2007) work measurement involves observing the worker at work.

The methods used by the worker are observed and recorded in a work measurement study; the time taken by the worker to carry out an operation is recorded. It is the application of techniques designed to establish the time for a qualified worker to carry out a specified job at a defined level of performance (International Labour Organization, ILO, 1979). Such information is required for estimating, planning, setting financial incentives, as part of the data in the method study, determination of optimal labour force in the execution of building projects, and also in monitoring actual production performance against the established standard (ILO, 1979; British Standard Institute, 1992). Interestingly, Harris and McCaffer (2005) observe that this method is increasingly finding its way in the building industry thereby bringing improvements to the badly organized environment often found on construction projects.

To this end, Oxley and Poskitt (2007) avow that the purpose of work study is the provision of factual data to assist management in making decisions and to enable them to utilize with the maximum efficiency all available resources (that is labour, plant, materials, and management) by applying systematic approach to problems instead of using intuitive guess work to ensure effective project delivery.

### *2.3 Time study technique*

Time study is a technique that uses stopwatch and video cameras to determine productivity outputs (Wild, 1995). However, there are numerous challenges encountered when using this technique. Lack of work-study experiences affected the use of this technique in developing countries (Lema, 1995). The difficulties of using time study were summarized as follows (Olomolaiye, Jayawardane, and Harris; 1998):

a) The number of workers studied by one observer is limited which requires employment of several observers making manual study prohibitively expensive;
b) Time study generated information is limited
c) Facts interpreted from the observers' notes may not cover sufficient details such as

Inter-dependencies among components, exact reasons for taking longer or shorter elemental times.

These will increase the variability and reduce accuracy. Time study should not be used to set standards for jobs in which the nature of the task is different each time and inexperienced personnel should not conduct time studies because errors in recording information or in selecting the work elements to

include can result in unreasonable standards (Krajewski, and Ritzman, 1999).

Managers disagree over the use of engineered work standards such as time study and activity sampling to increase productivity (Krajewski and Ritzman, 1999). They argue that time studies dehumanize workers and that the costs of large staffs and the hidden costs of labour management conflicts outweigh the benefits of elaborate standards.

### *2.4 Work sample technique (Activity sampling)*

Work sampling is a technique that is purported to provide valuable information to a construction manager regarding areas of low productivity that need corrective action (Thomas and Napolitan, 1999). Work sampling was shown to provide important information about the characteristics of delays (Thomas, and Daily; 2008). Liou and Borcherding (2008) statistically verified the effectiveness of work sampling in demonstrating true labour performance and also reported that it provides timely information to management in order to determine whether corrective action or detailed study is needed to achieve a higher degree of efficiency.

The study of Joshua and Varghese (2012) stated that work sampling had been accepted as a valuable method for **assessing the productivity** of workforce in construction sites. In Palestine, Enshassi, AL-Halaq and Mustafa; (2011), utilized activity sampling to undertake productivity measurement benchmarking for block work in improving construction productivity. In Canada, Tsehaye and Fayek; (2012) report on a framework to develop crew level productivity analysis using work sampling as they allude to it being less costly, easy to adopt and able to provide quick information. Work sampling has received increased emphasis as managers struggle to control construction costs as its simplicity and low cost makes it a powerful technique for productivity improvement (Bandyopadhyay and Smith; 2004). In Nigeria, Udegbe, (2007), used activity sampling to determine the labour output of painting activity with a view to establish a standard for the financial value of a painter's daily output.

### *2.5 Method Study*

Method study is the systematic recording and critical examination of existing and proposed ways of doing work, as a means of developing and applying easier and more effective methods and reducing cost

Method study enables the industrial engineer to subject each operation to systematic analysis. The main purpose of method study is to eliminate the unnecessary operations and to achieve the best method of performing the operation. Method study is also called methods engineering or work design. Method engineering is used to describe a collection of analysis techniques which focus on improving the effectiveness of men and machines. According to British Standards Institution (BS 3138): "Method study is the systematic recording and critical examination of existing and proposed ways of doing work as a means of developing and applying easier and more effective methods and reducing cost." Fundamentally, method study involves the breakdown of an operation or procedure into its component elements and their systematic analysis. In carrying out the method study, the right attitude of mind is important. The method study man should have:

1). The desire and determination to produce results.
2). Ability to achieve results.
3). An understanding of the human factors involved.

Method study scope lies in improving work methods through process and operation analysis. It is essentially concerned with finding better ways of doing things. It adds value and increases efficiency by eliminating unnecessary operations, avoidable delays and other forms of waste. The improvement in efficiency is achieved through:

a) Improved layout and design of the workplace.
b) Improved and efficient work procedures.
c) Effective utilization of men, machines and materials.
d) Improved design or specification of the final product.

### *2.6 Work gang in Construction project*

Workforce is grouped according to work breakdown or activities. Each work breakdown is assigned a team leader who may be a builder, an engineer, a foreman or supervisor, leading technical and tradesmen to work in a job section. With the work grouping, every craftsman is traceable to a task force or gang. A task force will operate without much interference from the other groups.

In project implementation, according to Okoye, Ngwu, and Ugochukwu, (2015), be it the erection of a building construction, a road or water scheme project, the site engineer or supervisor not only needs to have a sound knowledge of the necessary skills involved but in addition should be able to determine the optimum composition of each skill in order to accomplish a task at shorter duration and reduced cost. This is possible through the use of technological standards for labour as work study. Such standards are usually given as constants in

the form of time necessary for the manual or mechanical completion of defined quantity of work. The constant are

a) Standard time (St),
b) Standard output (Sop).

According to Okereke (2002), standard time is the quantum of time which takes a workman or a group of workmen to produce a good quality product under an ideally organized labour force and working condition. It is measured in hr/m, hr/m2 or hr/m3. Standard output is the quantum of good quality work accomplished by a workman or group of workmen in one working shift or working per day under an ideally organized labour and working condition. It is measured in m2/hr or m2/day, m3/hr or m3/day.

Standardization in construction is primarily aimed at establishing standards in the use of labour, materials and machines. Thus these three elements in standardization are sometimes referred to as technological standards or constants (Okereke, 2002). In view of the peculiarities of each construction site in terms of climatic conditions, social and cultural differences in the level of technological development, organizational structure of contracting firms and the quality of available machines and materials, it is recommended that every construction organization should establish its own standards. The benefits to be derived among others:

i. Increase in individual and collective productivity of labour;
ii. Objective tendering;
iii. Rational use of available resources;
iv. Adaptation of more progressive management techniques

The cumulative effect of the above benefits in having technological standards is that the contract time is correctly predetermined on the basis of available human and materials resources. Ayeni (1997) observes that most practicing firms of quantity surveyors maintain a cost library within their organization. Such a pool of information consists of labour wages and price of various materials and plants. They make references to them whenever they are computing the cost of a given project. Such information is of great importance to a quantity surveyor when preparing cost advice for a client on a new project. It also forms the basis of preparing a final estimate for checking tenders received. Nevertheless, the productivity rate of a construction worker is measured by the quantum of good quality work he is able to perform within a unit time (hour, day, month, and year).

## III. METHODOLOGY

The study adopted **field Survey Design**. The study area is Enugu state. The population of the study comprises ten construction sites in Enugu state. Why? Because, this will help the researcher elicit information for the study and also serve as a precursor for more in-depth research. Which involves observational studies of masons while laying block and plastering in the field as a means of extracting information for the study and using work measurement in analysis? The quantitative method was employed for data collection. Data for the study was collected from the population through the application of Physical Observation with the aid of the following: Stop Watch, Linen tape, Pen, Pencil, Paper and Calculator.

Work measurement was used to determine the output of masons in blockwork and plastering within the stipulated hour of around 8hrs working duration per day. Work measurement is the method of measuring productivity. Because;

i) It provides a method of evaluating human effectiveness.
ii) It provides the output data resulting in improved estimation and production planning etc.

*Procedure:*

The work process particularly at the superstructure stage of a building construction project is where the researcher actually took the measurement of the mason's output at work. The process where field count was carried out in the study includes Block laying and wall plastering with a given number of operatives as gang members. Field counts at random intervals of number operatives working and not working at a given time were observed and recorded.

$$Activity\ Rating = \frac{Total\ Output\ per\ day}{Area\ of\ one\ unit\ output} \quad (3)$$

Time study was carried out for each operation that makes up the activity for each process by observing and recording the start and finish duration of each operation per circle. The quantity of work carried by each gang per eight hour working day was subsequently measured and recorded.

## IV. RESULTS AND DISCUSSIONS

Table 4.1: 225mm sandcrete block bedded and joined in cement mortar (1.3) (ground floor)

| S/N | Location of building sites | No. of Masons/day | No. of Labourers/ day | Standard Time (hrs) | Average Qty/day (m2) |
|---|---|---|---|---|---|
| 1 | Construction of Faculty of Basic Medical Science Building at Enugu State University and Technology | 2 | 1 | 7.87 | 20.55 |
| 2 | Construction of classroom and Office Complex of School of Nursing, Parklane Enugu | 2 | 1 | 7.77 | 20.05 |
| 3 | Construction of Basic laboratory and Research Centre at ESUTH College of Medicine | 2 | 1 | 7.83 | 20.35 |
| 4 | Construction of Science Education at Enugu State College of Education Technical | 2 | 1 | 7.87 | 20,55 |
| 5 | Construction of E-Library at college of Education Technical | 2 | 1 | 7.79 | 20.15 |
| 6 | Construction of School of Technical Education at Enugu State College of Education Technical | 2 | 1 | 7.81 | 20.25 |
| 7 | Construction of Excellence Building at University of Nigeria Enugu Campus | 2 | 1 | 7.85 | 20.45 |
| 8 | Construction of Utility Building at ESUTH Teaching Hospital | 2 | 1 | 7.91 | 20.75 |
| 9 | Construction of Accident and Emergency Building at ESUTH Teaching Hospital | 2 | 1 | 7.83 | 20.35 |
| 10 | Constructions of Stores Permanent site for Kenyette market, Port Harcourt Expressway Enugu | 2 | 1 | 7.89 | 20.65 |

Research's Field Survey, 2020.

Table 4.1 shows Construction of the Faculty of Basic Medical Science Building, has 2 masonry, 1 labour, and standard time 7.87 with average Qty/day 20.55. Construction of the classroom and Office Complex of the School of Nursing has 2 masonry, 1 labour, and std time 7.77 with average Qty/day 20.05. Construction of the Basic laboratory and Research Centre has 2 masonry, 1 labour, and std time 7.83 with average Qty/day 20.35.

Construction of Science Education, have 2 mason, 1 labour, and std time 7.87 with average Qty/day 20.55. Construction of the E-Library has 2 labour, 1 mason, and std time 7.79 with average Qty/day 20.15. Construction of the School of Technical Education has 2 masonry, 1 labour, and std time 7.81 with average Qty/day 20.25. Construction of the Excellence Building has 2 masonry, 1 labour, and std time 7.85 with average Qty/day 20.45. Construction of Utility Building has 2 masonry, 1 labour, and std time 7.91 with average Qty/day 20.75. Construction of the Accident and Emergency Building has 2 masonry, 1 labour, and std time 7.83 with average Qty/day 20.35. Construction of Stores' Permanent site has 2 mason, 1 labour, and std time 7.89 with average Qty/day 20.65.

Table 4.2: 225mm sandcrete block bedded and jointed in cement mortar (1.3) (first floor)

| S/No. | Location of building sites | No. of Masons /day | No. of Labourers/ day | Standard Time hrs) | Average Qty/day (m2) |
|---|---|---|---|---|---|
| 1 | Construction of Faculty of Basic Medical Science Building at Enugu State University and Technology | 2 | 1 | 7.84 | 18.23 |
| 2 | Construction of classroom and Office Complex of School of Nursing, Parklane Enugu | 2 | 1 | 7.82 | 18.12 |
| 3 | Construction of Basic laboratory and Research Centre at ESUTH Teaching Hospital | 2 | 1 | 7.90 | 18.53 |
| 4 | Construction of Science Education at Enugu State College of Education Technical | 2 | 1 | 7.94 | 18.73 |
| 5 | Construction of E-Library at college of Education Technical | 2 | 1 | 7.88 | 18.43 |
| 6 | Construction of School of Technical Education at Enugu State College of Education Technical | 2 | 1 | 7.80 | 18.02 |
| 7 | Construction of Excellence Building at University of Nigeria Enugu Campus | 2 | 1 | 7.92 | 18.63 |
| 8 | Construction of Utility Building at ESUTH Teaching Hospital | 2 | 1 | 7.98 | 18.93 |
| 9 | Construction of Accident and Emergency Building at ESUTH Teaching Hospital | 2 | 1 | 7.88 | 18.43 |
| 10 | Construction of Stores Permanent site for Kenyette market, Port Harcourt Expressway Enugu | 2 | 1 | 8.00 | 19.13 |

Research's Field Survey, 2020

Table 4.2 shows Construction of the Faculty of Basic Medical Science Building, has 2 masonry, 1 labour, and standard time 7.84 with average Qty/day 18.23. Construction of the classroom and Office Complex of the School of Nursing has 2 masonry, 1 labour, and std time 7.82 with average Qty/day 18.12. Construction of the Basic laboratory and Research Center, has 2 masonry, 1 labour, and std time 7.90 with average Qty/day 18.53. Construction of Science Education, have 2 labour, 1 mason, and std time 7.94 with average Qty/day 18.73. Construction of the E-Library has 2 masonry, 1 labour, and std time 7.88 with average Qty/day 18.43.

Construction of the School of Technical Education has 2 masonry, 1 labour, and std time 7.80 with average Qty/day 18.02. Construction of the Excellence Building has 2 masonry, 1 labour, and std time 7.92 with average Qty/day 18.63. Construction of Utility Building has 2 masonry, 1 labour, and std time 7.81 with average Qty/day 18.93. Construction of Accident and Emergency Building, have 2 masonry, 1 labour, and std time 7.88 with average Qty/day18.43. Construction of the Permanent site has 2 mason, 1 labour, and std time 8.00 with average Qty/day 19.13.

Table 4.3: 12mm Cement Mortar Ratio for wall plastering (1:3) (wall plaster inside)

| S/No. | Location of building sites | No. of Masons/day | No. of Laborer's/day | Standard Time (hrs) | Average Qty/day (m2) |
|---|---|---|---|---|---|
| 1 | Construction of Faculty of Basic Medical Science Building at Enugu State University and Technology | 1 | 1 | 8.00 | 0.1296 |
| 2 | Construction of classroom and Office Complex of School of Nursing, Parklane Enugu | 1 | 1 | 7.90 | 0.108 |
| 3 | Construction of Basic laboratory and Research Centre at ESUTH Teaching Hospital | 1 | 1 | 7.98 | 0.1224 |
| 4 | Construction of Science Education at Enugu State College of Education Technical | 1 | 1 | 8.00 | 0.126 |
| 5 | Construction of E-Library at college of Education Technical | 1 | 1 | 8.00 | 0.1332 |
| 6 | Construction of School of Technical Education at Enugu State College of Education Technical | 1 | 1 | 7.95 | 0.1188 |
| 7 | Construction of Excellence Building at University of Nigeria Enugu Campus | 1 | 1 | 8.00 | 0.1368 |
| 8 | Construction of Utility Building at ESUTH Teaching Hospital | 1 | 1 | 8.00 | 0.144 |
| 9 | Construction of Accident and Emergency Building at ESUTH Teaching Hospital | 1 | 1 | 8.00 | 0.1584 |
| 10 | Construction of Stores Permanent site for Kenyette market, Port Harcourt Expressway Enugu | 1 | 1 | 8.00 | 0.1512 |

Research's Field Survey, 2020.

Table 4.3 shows Construction of the Faculty of Basic Medical Science Building has 1 mason, 1 labour, and std time 8.00 with average Qty/day 0.1296. Construction of the classroom and Office Complex of the School of Nursing has 1 mason, 1 labour, and std time 7.90 with average Qty/day 0.108. Construction of the Basic laboratory and Research Centre has 1 mason, 1 labour and std time 7.98 with average Qty/day 0.1224. Construction of Science Education has 1 mason, 1 labour and std time 8.00 with average Qty/day 0.126. Construction of the E-Library has 1 mason, 1labour and std time 8.00 with average Qty/day 0.1332. Construction of the School of Technical Education has 1 mason, 1 labour, and std time 7.95 with average Qty/day 0.1188. Construction of the Excellence Building had 1 mason, 1 labour and a std time of 8.00 with average Qty/day 0.1368. Construction of Utility Buildings has 1 mason, 1 labour, and std time 8.00 with average Qty/day 0.144. Construction of Accident and Emergency Building, have, 1 mason, 1 labour and std time 8.00 with average Qty/day 0.1584. Construction of stores' the Permanent site has 1 mason, 1 labour, and std time 8.00 with average Qty/day 0.1512.

Table 4.4: 12mm Cement Mortar Ratio for wall plastering (1:3) (wall plaster outside)

| S/No. | Location of building sites | No. of Masons/day | No. of Laboure's / day | Standard Time (hrs) | Average Qty/day (m2) |
|---|---|---|---|---|---|
| 1 | Construction of Faculty of Basic Medical Science Building at Enugu State University and Technology | 1 | 1 | 8.00 | 0.108 |
| 2 | Construction of classroom and Office Complex of School of Nursing, Parklane Enugu | 1 | 1 | 8.00 | 0.1116 |
| 3 | Construction of Basic laboratory and Research Centre at ESUTH Teaching Hospital | 1 | 1 | 7.90 | 0.1044 |
| 4 | Construction of Science Education at Enugu State College of Education Technical | 1 | 1 | 8.00 | 0.1092 |
| 5 | Construction of E-Library at college of Education Technical | 1 | 1 | 8.00 | 0.1128 |
| 6 | Construction of School of Technical Education at Enugu State College of Education Technical | 1 | 1 | 8.00 | 0.1152 |
| 7 | Construction of Excellence Building at University of Nigeria Enugu Campus | 1 | 1 | 8'00 | 0.114 |
| 8 | Construction of Utility Building at ESUTH Teaching Hospital | 1 | 1 | 8.00 | 0.1174 |
| 9 | Construction of Accident and Emergency Building at ESUTH Teaching Hospital | 1 | 1 | 7.95 | 0.1056 |
| 10 | Construction of Stores Permanent site for Kenyette market, Port Harcourt Expressway Enugu | 1 | 1 | 8.00 | 0.1164 |

Research's Field Survey, 2020.

Table 4.4 shows Construction of the Faculty of Basic Medical Science Building has 1 mason, 1 labour, and std time 8.00 with average Qty/day 0.108. Construction of the classroom and Office Complex of the School of Nursing has 1 mason, 1 labour, and std time 8.00 with average Qty/day 0.1116. Construction of the Basic Laboratory and Research Centre had 1 mason, 1 labour and standard time 7.90 with average Qty/day 0.1044. Construction of Science Education has 1 mason, 1 labour and std time 8.00 with average Qty/day 0.1092. Construction of the E-Library has 1 mason, 1labour and standard time 8.00 with average Qty/day 0.1128. Construction of the School of Technical Education has 1 mason, 1 labour, and std time 8.00 with average Qty/day 0.1152. Construction of the Excellence Building, have 1 mason, 1 labour, and std time 8.00 with average Qty/day 0.114Construction of Utility Building, have 1 mason, 1 labour, and std time 8.00 with average Qty/day 0.1174. Construction of the Accident and Emergency Building had 1 mason, 1 labour, and a std time of 7.95 with average Qty/day 0.1056. Constructions of Stores Permanent site have, 1 mason, 1 labour and std time 8.00 with average Qty/day 0.1164

Analysis of Table 4.1 to 4.4 to find out the Present Level of Productivity of Masons in the Study Area:

Table 4.5 to 4.8 show the computation of average standard time (St) and average standard output (Sop).

Table 4.5: 225mm sandcrete block bedded and jointed in cement mortar (1.3) (ground floor)

| S/No. | Location of building sites | Unit (m2) | Standard Time (h/unit) | Standard Output (unit/m-h) |
|---|---|---|---|---|
| 1 | Construction of Faculty of Basic Medical Science Building at Enugu State University and Technology | m2 | 0.3829 | 2.6112 |
| 2 | Construction of classroom and Office Complex of School of Nursing, Parklane Enugu | m2 | 0.3875 | 2.5804 |
| 3 | Construction of Basic laboratory and Research Centre at ESUTH Teaching Hospital | m2 | 0.3847 | 2.5985 |
| 4 | Construction of Science Education at Enugu State College of Education Technical | m2 | 0.3829 | 2.6112 |
| 5 | Construction of E-Library at college of Education Technical | m2 | 0.3866 | 2.5866 |
| 6 | Construction of School of Technical Education at Enugu State College of Education Technical | m2 | 0.3856 | 2.5928 |
| 7 | Construction of Excellence Building at University of Nigeria Enugu Campus | m2 | 0.3839 | 2.6051 |
| 8 | Construction of Utility Building at ESUTH Teaching Hospital | m2 | 0.3812 | 2.6233 |
| 9 | Construction of Accident and Emergency Building at ESUTH Teaching Hospital | m2 | 0.3848 | 2.5969 |
| 10 | Construction of Stores Permanent site for Kenyette market, Port Harcourt Expressway Enugu | m2 | 0.3821 | 2.6172 |
| | **Average** | | **0.3842** | **2.6023** |

Research's Field Survey, 2020.

Table 4.5 shows Construction of the Faculty of Basic Medical Science Building has std time 0.3829 and standard output 2.6112. Construction of the classroom and Office Complex of the School of Nursing has std time 0.3875 and std output 2.

5804.. Construction of the Basic laboratory and Research Center has std time 0.3847 and std output 2. 5985.. Construction of Science Education has a std time of 0.3829 and std output 2. 6112.. Construction of the E-Library has a std time of 0.3866 and std output of 2.5866. Construction of the School of Technical Education has a std time of 0.3856 and std output 2. 5928.. Construction of Excellence Building std time 0.3839 and standard output 2.6051. Construction of Utility Building std time 0.3812 and std output 2. 6233.. Construction of Accident and Emergency Building, std time 0.3848 and std output 2. 5969.. Construction of Stores' Permanent site sd time 0.3821 and std output 2.6172. Average std time 0.3842 and std output 2.6023

Table 4.6: 225mm sandcrete block bedded and jointed in cement mortar (1.3) (first floor)

| S/N | Location of building sites | Unit (m2) | Standard Time (h/unit) | Standard Output (unit/m-h) |
|---|---|---|---|---|
| 1 | Construction of Faculty of Basic Medical Science Building at Enugu State University and Technology | m2 | 0.4301 | 2.3253 |
| 2 | Construction of classroom and Office Complex of School of Nursing, Parklane Enugu | m2 | 0.4316 | 2.3171 |
| 3 | Construction of Basic laboratory and Research Centre at ESUTH Teaching Hospital | m2 | 0.4263 | 2.3171 |
| 4 | Construction of Science Education at Enugu State College of Education Technical | m2 | 0.4239 | 2.3589 |
| 5 | Construction of E-Library at college of Education Technical | m2 | 0.4276 | 2.3589 |
| 6 | Construction of School of Technical Education at Enugu State College of Education Technical | m2 | 0.4329 | 2.3103 |
| 7 | Construction of Excellence Building at University of Nigeria Enugu Campus | m2 | 0.4251 | 2.3523 |
| 8 | Construction of Utility Building at ESUTH Teaching Hospital | m2 | 0.4216 | 2.3722 |
| 9 | Construction of Accident and Emergency Building at ESUTH Teaching Hospital | m2 | 0.4276 | 2.3388 |
| 10 | Construction of Stores Permanent site for Kenyette market, Port Harcourt Expressway Enugu | m2 | 0.4182 | 2.3913 |
| | **Average** | | **0.4265** | **2.3451** |

Research's Field Survey, 2020.

Table 4.6 shows Construction of the Faculty of Basic Medical Science Building has std time 0.4301 and std output 2.3253. Construction of the classroom and Office Complex of the School of Nursing has std time 0.4316 and std output 2.3171. Construction of the Basic laboratory and Research Center has a std time of 0.4263 and std output 2.3171. Construction of Science Education has a std time of 0.4239 and std output 2.3589. Construction of the E-Library has a std time of 0.4276 and std output of 2.3589. Construction of the School of Technical Education has a std time of 0.4329 and std output 2.3103. Construction of Excellence Building std time 0.4251 and std output 2.3523. Construction of Utility Building std time 0.4216 and std output 2.3722. Construction of Accident and Emergency Building, std time 0.4276 and std output 2.3388. Construction of Stores' Permanent site std time 0.4182 and std output 2.3913. Average std time 0.4265 and std output 2.3451

Table 4.7: 12mm Cement Mortar Ratio for wall plastering (1:3) (wall plaster inside)

| S/N | Location of building Sites | Unit (m2) | Standard Time (h/unit) | Standard Output (unit/m-h) |
|---|---|---|---|---|
| 1 | Construction of Faculty of Basic Medical Science Building at Enugu State University and Technology | m2 | 0.0162 | 61.728 |
| 2 | Construction of classroom and Office Complex of School of Nursing, Parklane Enugu | m2 | 0.0137 | 73.148 |
| 3 | Construction of Basic laboratory and Research Centre at ESUTH Teaching Hospital | m2 | 0.0153 | 65.196 |
| 4 | Construction of Science Education at Enugu State College of Education Technical | m2 | 0.0158 | 63.472 |
| 5 | Construction of E-Library at college of Education Technical | m2 | 0.0167 | 60.060 |
| 6 | Construction of School of Technical Education at Enugu State College of Education Technical | m2 | 0.0149 | 66.919 |
| 7 | Construction of Excellence Building at University of Nigeria Enugu Campus | m2 | 0.0171 | 58.479 |
| 8 | Construction of Utility Building at ESUTH Teaching Hospital | m2 | 0.0180 | 55.555 |
| 9 | Construction of Accident and Emergency Building at ESUTH Teaching Hospital | m2 | 0.0198 | 50.505 |
| 10 | Construction of Stores Permanent site for Kenyette market, Port Harcourt Express way Enugu | m2 | 0.0189 | 52.910 |
| | **Average** | | **0.01664** | **60.797** |

Research's Field Survey, 2020.

Table 4.7 shows Construction of the Faculty of Basic Medical Science Building has std time 0.0162 and std output 61.728. Construction of the classroom and Office Complex of the School of Nursing has std time 0.0137 and std output 73.148. Construction of the Basic laboratory and Research Center has a std time of 0.0153 and std output 65.196. Construction of Science Education has s

td time of 0.015 and std output of 63.472. Construction of the E-Library has std time 0.0167 and std output 60.060. Construction of School of Technical Education has std time 0.0149 and std output 66.919 Construction of Excellence Building std time 0.0171 and std output 58.479. Construction of Utility Building std time 0.0180 and std output 55.555. Construction of Accident and Emergency Building, std time 0.0198 and std output 50.505. Construction of Stores' Permanent site std time 0.0189 and std output 52.910. Average std time 0.01664 and std output 60.797

Table 4.8: 12mm Cement Mortar Ratio for wall plastering (1:3) (wall plaster outside)

| S/N | Location of building sites | Unit (m2) | Standard Time (h/unit) | Standard Output (unit/m-h) |
|---|---|---|---|---|
| 1 | Construction of Faculty of Basic Medical Science Building at Enugu State University and Technology | m2 | 0.0135 | 74.074 |
| 2 | Construction of classroom and Office Complex of School of Nursing, Parklane Enugu | m2 | 0.0138 | 71.685 |
| 3 | Construction of Basic laboratory and Research Centre at ESUTH Teaching Hospital | m2 | 0.0132 | 75.670 |
| 4 | Construction of Science Education at Enugu State College of Education Technical | m2 | 0.0137 | 73.260 |
| 5 | Construction of E-Library at college of Education Technical | m2 | 0.0141 | 70.922 |
| 6 | Construction of School of Technical Education at Enugu State College of Education Technical | m2 | 0.0144 | 69.444 |
| 7 | Construction of Excellence Building at University of Nigeria Enugu Campus | m2 | 0.0142 | 70.175 |
| 8 | Construction of Utility Building at ESUTH Teaching Hospital | m2 | 0.0147 | 68.143 |
| 9 | Construction of Accident and Emergency Building at ESUTH Teaching Hospital | m2 | 0.0132 | 75.284 |
| 10 | Construction of Stores Permanent site for Kenyette market, Port Harcourt Expressway Enugu | m2 | 0.0146 | 68.729 |
| | **Average** | | **0.0139** | **71.739** |

Research's Field Survey, 2020.

Table 4.8 shows Construction of the Faculty of Basic Medical Science Building has std time 0.0135 and std output 74.074. Construction of the classroom and Office Complex of the School of Nursing, have std time 0.0138 and std output 71.685. Construction of the Basic laboratory and Research Centre has a std time of 0.0132 and std output of 75.670. Construction of Science Education has a std time of 0.0137 and std output of 73.260. Construction of the E-Library has std time 0.0141 and std output 70.922. Construction of the School of Technical Education has a std time of 0.0144 and std output of 69.444. Construction of Excellence Building std time 0.0142 and std output 70.175. Construction of Utility Building std time 0.0147 and std output 68.143. Construction of Accident and Emergency Building, std time 0.0132 and std output 75.284. Construction of Stores' Permanent site std time 0.0146 and std output 68.729. Average std time 0.0139 and std output 71.739

Table: 4.9 Summary of Field Observation Generated Through Work Measurement

| S/No. | Building Process | Unit(m 2) | St(h/unit) | Sop (unit/m-h) |
|---|---|---|---|---|
| 1 | 225mm thick hollow sandcrete block work bedded and jointed in cement mortar (1.3) (ground floor) | m2 | 0.3842 | 2.6023 |
| 2 | 225mm thick hollow sandcrete block work bedded and jointed in cement mortar (1.3) (first floor) | m2 | 0.4265 | 2.3451 |
| 3 | 12mm Plaster thickness Cement Mortar Ratio for wall plastering (1:3) (wall plaster inside) | m2 | 0.01664 | 60.797 |
| 4 | 12mm Plaster thickness Cement Mortar Ratio for wall plastering (1:3) (wall plaster outside) | m2 | 0.0139 | 71.739 |

Table 4.9 shows 225mm thick hollow sandcrete block work bedded and jointed in cement mortar (1.3) (ground floor) has standard time 0.3842 and standard output 2.6023.

225mm thick hollow sandcrete block work bedded and jointed in cement mortar (1.3) (first floor) has standard time 0.4265 and standard output 2.3451

12mm Plaster thickness Cement Mortar Ratio for wall plastering (1:3) (wall plaster inside) has standard time 0.01664 and standard output 60.797

12mm Plaster thickness Cement Mortar Ratio for wall plastering (1:3) (wall plaster outside) has standard time 0.0139 and standard output 71.739.

## V. Conclusion And Recommendations

The researchers conclude that at a standard time of 0.38, a standard output of 2.60 volume of 225mm thick hollow sandcrete block will be laid bedded at 1:3 cement mortar ratio at the ground floor of a project. It was also discovered that the first floor of block work 225mm thick hollow sandcrete, the standard time of 0.43 achieves a given output of 2.35 sop

The researchers admit that output measurement of craftsman work with reference to time cannot be over emphasized because the outcome will show a clear level of projection of the project under construction because their values significantly affect the cost of a project. Nevertheless, the common assessment of the success of construction projects is that they are delivered on time, to budget, to technical specification, and meet client satisfaction.

However, performance measurement on the other hand is a systematic way of evaluating the inputs and outputs of \construction activity. The process acts as a tool for continuous improvements and eliminates time overrun and cost overrun and contributes to the profit as the saving starts immediately and continues throughout the life of the product.

It provides a method of evaluating human effectiveness.

It provides the output data resulting in giving improved estimation and production planning etc

The study concluded that adequate and appropriate work measurement techniques should be employed to determine the output of masons in the construction sites.

The study therefore recommends that the Government should collaborate with professional bodies to encourage every craftsman to get trained in order to upgrade their skills and they should also register with the relevant professional bodies. There is an urgent need for speedy passage of the National Building Code Enforcement Bill so that such a regulatory document, which defines roles, will engender mutual understanding and guide every construction work on site.

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