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TIME ANALYSIS OF PRE-ENGINEERED BUILDING WITH CONVENTIONAL STEEL BUILDING

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Abstract— Pre-Engineered Buildings are the new trending, customisable buildings made as per the requirements yet providing plenty of space than the Conventional Steel Buildings. According to the literature available the construction of PEB is economical in terms of cost as well as time with respect to conventional steel building. This paper focuses on the time required for the erection process of the industrial sheds with the help of time study technique and the time analysis undertaken proves that the time required for the erection of PEB is less than that of CSB.

Keywords— Pre-Engineered Building, Conventional Steel Building, Customisable, Time analysis, economical

I. INTRODUCTION

Time study is the study based on direct observation method that can easily help us know what quantum of work a worker can carry out in a specific time, with standard working specifications, work environment. Thus after knowing the standard time required for the work, the work done by the worker can be thus compared to the standard working time and the effectiveness of the work carried out can be easily calculated. Time study can also be termed as work measurement and can be used for planning and controlling the operations.

II. METHODOLOGY

The stop watch time technique is the most basic method used to determine the accurate timings with laps in it. The entire work was broken into smaller components. General steps that are usually carried out are as follows:

a) Selection: The work that has to be timed is selected first.
b) Define: Defining the smaller components of the work selected.
c) Observe and Record: The work once started needs to be recorded at the appropriate moments to gather the data.
d) Convert: The observed time is then converted into the Normal Time.
e) Measure: The timings once obtained lets us know the rating.
f) Calculate: the Standard time is then calculated by adding various allowances

The work that was undertaken was erection of a bay of area 102sq.m. and the entire job was classified as follows:

a) Bringing the assembled rafter
b) Base fixing using torque machine
c) Erection with help of crane
d) Hydraulic scaffolding supports
e) Bringing the end rafter
f) Base fixing using torque machine
g) Erection with crane
h) Scaffolding and hydraulic supports
i) Fixing the V-cleats for bracings
j) Fixings of girts and purlins
k) Alignment

III. OBSERVATION TABLE

TABLE I
Standard Timings Calculated for PEB and CSB

Elemental Description	Standard time for PEB	Standard time for CSB
Bringing the assembled rafter	8.33	7.10
Base fixing using torque machine	15.56	36.35
Erection with help of crane	26.08	34.34

Hydraulic scaffolding supports	15.48	21.22
Bringing the end rafter	9.34	9.45
Base fixing using torque machine	12.40	27.40
Erection with crane	35.31	27.40
Scaffolding and hydraulic supports	20.04	30.26
Fixing the V-cleats for bracings	50.50	23.14
Fixings of girts and purlins	52.05	1:12.20
Alignment	25.17	41.32
Bringing rafter 3		8.03
Erection		7.15
Fixing girts of earlier bay		8.18
Fixing Purlins		35.49
Final Standard Time(mins)	269.86	444.75

The calculations for determination of Standard time are as follows:

$$\text{Normal Time} = \frac{\text{Observed Time} * \text{Rating}}{100} \quad \ldots\ldots (1)$$

When the number of cycles considered for the work undertaken is more than 1 then the rating may vary as 90 or 110 depending upon the time requirement for the particular task undertaken compared with the first recorded time. If the time recorded first is more than the time required for the next operation then the rating is 90 as the pace of the work is low and vice versa if the time required for the work is less than the first recorded time then the rate is 110 showing that the work is being performed with efficiency more than standard one.

Example : The observed time for Step 1 is 7.28 mins and number of cycles to be considered is 1 thus the rating to be considered is 100. The Normal time will be calculated as

$$\text{Normal time} = 7.28 * (100/100) = 7.28$$

The number of cycle that is considered in the study is 1 so the rating automatically turns out to be 100. So by using the equation 1 the normal time can be calculated and further used to find the standard time for the entire job work undertaken.

$$\text{Standard Time} = \text{Normal Time} * (1 + \%\text{allowance}/100) \quad \ldots (2)$$

The allowances are considered as per ILO Recommended Allowances and are as follows:

TABLE III
Allowance summary

Personal Needs	5
Basic Fatigue	4
Variable Fatigue	0
Special	0
Total Allowance %	9

Example: The Normal time for Step 1 is 7.28 and the % allowances is 9 then the standard time can be calculated as

$$\text{Standard time} = 7.28*(1+ 9/100) = 7.9352$$

The obtained time further converted into standard time saying 60 sec makes a minute and 60 minutes makes an hour. Thus the time calculated becomes 8.33 mins. Table I shows the standard times calculated for each and every individual step and the total standard time of the entire process. The difference in time requirement can be summarised in fig.1 given below

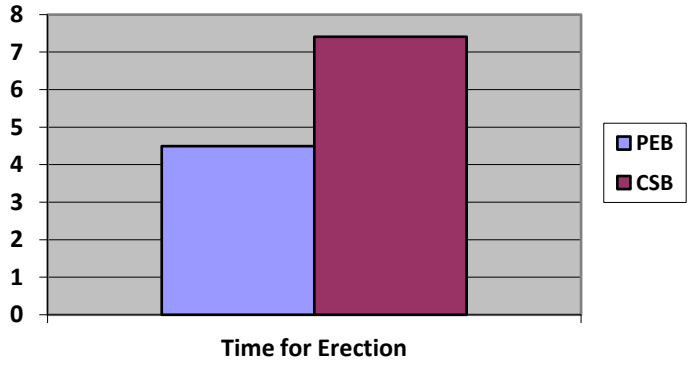

Fig. 1 Time Requirement for Erection Process

Fig. 1 shows the number of hours required for the erection process by using PEB as well as CSB. It can be clearly see that the required time for erection of 102sq.m. shed requires approx. 7.41hrs and that of PEB requires approx. 4.5hrs. Thus as said the PEB are economical in terms of time can been clearly justified from the data analysed.

Conclusions

The time required to erect a shed for102 sq.m are calculated by direct observation method of time study and can be proved economical in terms of time. The time required for the erection of shed using CSB is 7.41hrs and by PEB is 4.5hrs and the percentage saving in overall time can be calculated as

$$(7.41-4.5)/7.41 *100 = 39.27\%$$

Thus using PEB than CSB can save 39.27% of time requirement making the construction of the industrial shed speedy.

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