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CONTROL THE LOSS OF LABOR PRODUCTIVITY

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Abstract: **Loss of labor productivity is one of the most prevalent types of damages found in construction claims and also one of the most difficult to compute and prove. Construction projects are heavily labor based along with the materials and equipments. Therefore, the utmost attention has to be given to handle the effective labor productivity. When the expected labor productivity is adversely affected, there is an immediate impact upon the time required to carry out the affected tasks with a consequent impact, which may be substantial, upon the costs of the operations. A contractor's difficulty arises from the need to demonstrate the labor productivity coefficients used for the bid / contract price and the impact upon these productivity coefficients of the external influencing events. Once this is demonstrated, the contractor must also prove that the external influence entitles him to claim the costs of the loss of productivity. Many projects are not completed on scheduled time and within the budget cost. There are some circumstances where the project exceeds the budget and is not delivered on time due to the various factors affecting labor productivity. This thesis exhibits the various types of factors that are affecting labor productivity. The project manager should be aware of various factors which could affect directly or indirectly the labor productivity at construction sites and then identify the ways to control loss of labor productivity or improve the labor efficiency by using the various methods of motivation for the employees. During the execution of the contract, a project may get many changes affecting labor productivity such as additional works to the original contract, modification works and re-works. Hence, the project manager should clearly identify such changes and notify them to the Quantity Surveyors or Cost Engineers, in order to decide whether to claim the costs of the changes done or whether to absorb the cost if it is a re-work. This thesis also exhibits the various methods of calculating the loss of productivity which can be used to support a claim for non-productive labor hours due to an owner caused delay.**

Keywords: **Labor Productivity.**

1. INTRODUCTION

One of the most contentious areas in construction claims is the calculation or estimation of lost labor productivity. There is no uniform agreement within the construction industry as to a preferred methodology of calculating lost productivity. In fact, there are numerous ways to calculate lost productivity, thus making settlement of the issue on a particular project problematic.

Labor productivity refers to quantities of work produced per employee hour of effort and it is measured generally by the output per hour of input. Productivity is a measurement of rate of output per unit of time or effort usually measured in labor hours. For example, cubic meters of concrete placed, linear meters of conduit installed or pipe placed, etc. per crew hour or some other standard measure.

Therefore, the productivity loss is experienced when a contractor is not accomplishing its anticipated achievable or planned rate of production and is best described as a contractor producing less than its planned output per work hour of input. Thus, the contractor is expending more effort per unit of production than originally planned. The result is a loss of money for a contractor. Therefore, a challenging aspect of construction cost control is measuring and tracking work hours and production in sufficient detail to allow analysis of the data in order to determine the root causes of poor labor productivity.

Productivity is critically important in the context of construction contracts, both large and small. Contractors are typically paid for work completed in place that conforms to the terms of the contract. An efficient and effective labor force will achieve these objectives in time thus increasing the contractor's revenue and reducing its costs. [2]

2. DEFINITION

The productivity is defined as the craft hours necessary to produce a unit of finished product, and it can be defined by any of the following equations;

Productivity = Output / Input
= Units / Work Hours
= Total Output / Total Work Hours

3. FACTORS AFFECTING LABOR PRODUCTIVITY

Labor productivity is affected by many factors and these are explained below. The contractor will be required to demonstrate that the causes of the loss of productivity lie outside its own responsibility if it is to be successful in any claim for reimbursement of its losses.

3.1. Variable Location: - Employees working at different height of the building will have different level of productive works. Also availability of access and logistical supports are the other factors affecting the labor productivity.

3.2. Adverse Weather: - Changes in weather like very hot, very cold, very windy, very wet, very humid and snow will affect the labour productivity and due to the bad weather absentees of workers at site may increase. Hence the contractors will be achieving a different level of work productivity. [1]

3.3. Work Load: - Employees working with heavy work load or target work will create loss in quality of work and increase the need for re-working. Tiredness and speed cause inefficiency and the resulting poor quality.

3.4. Transportation: - Employees late arrival to the site and early departure from site will affect the labour productivity, if the same amount of work has to be achieved in the shorter time. Again, quality suffers and re-working increases.

3.5. Shortages of Material, Tools and Equipment: - Delay in procurement of materials and delivery to the site will create idle man hours and eventually affects the labor productivity. If materials, tools or construction equipments are not available at the right location and time then the labour productivity will probably suffer as they may be unable to proceed with the works in an orderly and consistent manner. Similarly, if the wrong tools or improperly sized equipment is provided, this may also affect the labor productivity. [2]

3.6. Field Organization and Management Factors: - A result of poor project management is that the sequence of works is not properly planned / scheduled and the shortage or unavailability of critical construction equipments may lead to loss of labour productivity. For example, mobilizing the labours prior to having access to the site and electrical power supply. [2]

3.7. Work Area Access Restrictions: - If a work site is remote and difficult to get in to or has inefficient or limited access and suffers from delay in issuance of permits, then the loss of productivity may occur due to the idle man hours. [2]

3.8. Stacking of Trades: - To achieve good productivity each crew member must have sufficient working space to perform his works without being interfered with by other members. When too many laborers are assigned to work in a limited work area, it is probable that interference may occur, thus affecting the labour productivity. [2]

3.9. Poor Estimating: - Loss of productivity may be the result of poor initial estimating by the contractors. The contractors may have simply miscalculated and / or failed to consider the various conditions under which the work will be executed. In this case, the contractor will fail in a claim for reimbursement of its losses as they result from its own mistakes.

4. HOW TO CONTROL THE LOSS OF LABOR PRODUCTIVITY

A contractor must control the loss of labor productivity to avoid the risks / costs associated with any loss in this respect. This may be done in a number of ways some of the most important of which are identified below.

4.1. Incentives: - Labor efficiency and output can be improved by the introduction of incentive programs such as Open Book Management, The Green Stamp Program, Suggestion Program, Sharing Savings, Target Bonuses, Honoraria, Service Awards, Merit Raises, Cross Training, Special Training, the Simple "Atta Boy", Management by Walking Around, Certificates of Appreciation and Achievement, Certificates of Completion, Decals, Token Award, Employee or Crew of the Month, Problem Solving Teams and Team Builders to the Employees. All these incentive programs have been shown to increase labor performance and productivity, reduce waste, reduce absenteeism and improve the quality of works. [3]

4.2. Insurance: - Workmen's compensation and employee benefits insurance policies could be made available to all the employees and an insurance claim should include the remedy of an individual injured worker or of the family of one who dies as the result of an industrial accident. [4]

4.3. Motivation:- The motivation of the work force to achieve higher production by introducing incentives such as bonuses, over time and outstation allowances have been proven to encourage the people to work hard and thereby achieve more productivity.

4.4. Skilled Workers: - Choosing properly skilled workers for the job. As people work at different rates of output, a person's experience and speed must be a factor when establishing productivity. For example, a junior member of the team might take two days to deliver a specific product whereas a more senior member who is having a unique complement of skills, knowledge, experience and competencies could do the same work in half the time. [5]

4.5. Man Management: - A structured man management program should be employed within engineering and construction phases and good management practice should be maintained with the employees through frequent visits to the work areas during which the managers should show sincere interest in the work force and the works in order to create better relationships and get improved labor productivity.

4.6. Communication: - A formal and informal structure of effective communication is absolutely essential in the work area, and with effective communication, all project participants can stimulate co-operation and productivity. However as a result of the many people involved in a project, all with different personalities, cultures, nationalities and varying levels of understanding, the communication can be difficult and misunderstandings can arise. Company organizations can try to avoid that by giving guidelines for the effective communication of messages and by allowing people the freedom to organize some of the work and by treating people as important individuals.

4.7. Training: - In-house or external training should be conducted for all labor categories. For example, when a company purchases new equipment demonstration is to be given as how to use and maintain the same equipment as well as in the use and maintenance of any other power tools deployed for construction purposes.

4.8. Material Handling: - Handling of material is a very important role in increasing labor productivity. Manual work should be avoided whenever equipment can be used to transfer the materials from one location to another location within the site. Company has to implement a proper efficient system in order to expedite the handling of materials on site to avoid waste of time, thereby increasing the labour productivity. Materials should be delivered to work forces in manageable packages so as to avoid loss of time in manipulating and re-handling the materials.

4.9. Health and Safety: - Every measure should be taken to make the work place a hygienic one including proper sanitary facilities, proper drinking water facilities, proper dining and recreation room, good house keeping, etc. Company organization should conduct safety induction courses for each employee and arrange regular safety meetings for all the workers and accordingly introduce strict compliance of using the right PPE (Personal Protective Equipment), proper sign boards, barricades and right tools or equipments to reduce the employee's exposure to hazards at work area.

4.10. Quality Control: - Establish strict QA/QC procedures so that all employees understand the need to work accurately and precisely. Eliminating both poor quality workmanship and the consequent re-working to correct errors is a major contributory factor in improving labor productivity.

5. METHODS OF CALCULATING LOSS OF PRODUCTIVITY

The task of calculating and proving damages for loss of productivity represents one of the most difficult problems in construction claims. The contractor bears the burden of proof in presenting a claim. The contractor must demonstrate a cost impact through evidence that is persuasive enough to prove that the claimed costs were incurred as a result of extra work, adverse weather, etc. The most widely used methods by contractors to claim losses of productivity are detailed below; [6]

5.1. Total Cost Method: - In this method, the difference between the actual costs incurred and what had been estimated plus approved change orders are established. This method can be used for any category of direct costs. However, it is most often used to calculate labor related damages. In order to have acceptability of the total cost method the following prerequisites must be met.

1) The nature of the particular loss must allow accurate calculation of the costs. Frequently the type of loss makes it impossible or highly impractical to determine them with a reasonable degree of accuracy.
2) The contractor's bid or estimate was realistic and the total labor cost can be established.
3) Its actual costs were reasonable and can be demonstrated.
4) Contractor was not responsible for the added expenses, i.e., contractor performance was reasonably efficient and the loss was, demonstrably, caused by external factors beyond contractor's control.

This method is often viewed with some skepticism and should be used only as a last resort when no other feasible method is available. [6]

Table 1 – Example for Total Cost Method

Description	Estimated Hrs	Actual Hrs	Variance Hrs	Hourly Rate (US$)
Activity 1	1000	1200	200	20
Approved change order	200	250	50	20
Total	**1200**	**1450**	**250**	**20**

Assume that all the prerequisites are met in Table 1, then the total claim amount shall be 250 Hrs x US$ 20.00 = US$ 5,000.00

5.2. Modified Total Cost Method: - This method is similar to the total cost method. It differs in the fact that a contractor makes certain adjustments to its estimated cost by deducting the cost for inaccuracies or re-works for which the owner is not responsible. Thus adding credibility to the claim. [6]

Table 2 – Example for Modified Total Cost Method

Description	Estimated Hrs	Actual Hrs	Variance Hrs	Hourly Rate (US$)
Activity 1	1000	1200	200	20
Approved change order	200	250	50	20
Re-works	0	-100	-100	20
Total	**1200**	**1350**	**150**	**20**

Assume that all the prerequisites are met in Table 2, then the total claim amount shall be 150 Hrs x US$ 20.00 = US$ 3,000.00

5.3. Comparison of Productivity Levels: - The best way to illustrate this method is through an example. Assume a contractor had planned to perform all concrete work prior to the onset of winter, but due to an owner caused delay, the contractor was forced to perform part of the work during the winter. It is well known and documented that concrete work performed during winter months is less productive than non-winter conditions. Actual job records of performance under winter and non-winter conditions would provide precise and accurate data to prove that a loss in productivity occurred. Labor time sheets and concrete pour records in Table 3 below would provide the necessary information.

Table 3 – Data for Comparison of Productivity Levels

Description	Sept. – Nov.	Dec. – Mar.	April & May	Actual Total	Bid Total
Work Hours (WH)	2948	4674	1104	8726	6300
Quantity Concrete (CM)	1218	1387	511	3116	2800
WH/CM	**2.42**	**3.37**	**2.16**	**2.8**	**2.25**

As shown above, during the non-winter months (Sept – Nov. and April & May) the contractor averaged 2.34 WH/CM for concrete work (2948 + 1104 divided by 1218 + 511). This compares with the 3.37 WH/CM that the contractor experienced during the winter months of Dec. – Mar. This analysis shows the contractor expended an additional 1.03 WH/CM (3.37 – 2.34) for work performed during the winter months. The additional cost resulting from the owner caused delay would be calculated as;

Concrete poured Dec. – Mar. x Loss of Productivity @ 1.03 WH/CM = 1387 CM x 1.03 WH/CM = 1428 WH @ US$ 20.00 Per Hr = US$ 28,560.00

This method is also referred to as the cause and effect method. Obviously, proper documentation and substantiation are vital in accurately determining the amount of damages and also helping in proving that a loss was actually incurred, thus strengthening the contractor's position and increasing the chances of recovery. [6]

5.4. Measured Mile Method: - This method is used on an extrapolation of actual work hours expended. It requires a period of unhindered time in which the labor expended reflects an efficient use for that type of work. Using this efficient time and the percentage of work accomplished and the related actual work hours, a theoretical estimate of the total efficient work hours required for completion of that type work can be derived, on that project.

Comparing this projected work hour estimate to the total actual work hours expended allows for a judgment as to the probable accuracy of total labor estimated and the efficient or inefficient use of those work hours.

A monthly summary of the actual percent complete and the actual labor hours for each type of work to be investigated, as well as the labor budget hour estimate for the project, are the only data needed for the development of this analysis. The percentages are often available from the progress payment procedure and the budget estimate would be the contractor's bid estimate. [6]

5.5. Revenue per Work Hour Approach: - Another method for identifying productivity trends is the revenue per work hour approach. This method compares the revenues earned for each labor work hour consumed during various time periods of the job. This approach is often used with total revenues but is most effective if labor revenues can be isolated. Caution is required, however, if significantly different work activities are performed that would inherently result in fluctuations of revenues per work hour. [6]

5.6. Factor Approach: - Many claims for lost productivity are computed on the so-called "factor approach." The factor approach is based on the application of lost efficiency "percentages" for various conditions (e.g. Stacking of trades, beneficial occupancy, etc) to actual labor costs. Numerous trade organizations have developed these productivity factors to quantify the economic impact on contractors.

The method in which the factors are applied is also very important. The application is different depending on whether the factors are applied prospectively or retrospectively. If one is prospectively pricing a change order where impacts are anticipated, the factors percentages should be added together and multiplied by the base (standard) work hours to determine unproductive work hours. For example;

Base work hours 1000

Factors:

Stacking of Trades	10%
Overtime	10%
Total	20%

Inefficient Hours 200 (0.20 x 1000)
Total Hours 1200 (Base work hours + Inefficient hours)

The use of factors when used retrospectively against actual work hours is somewhat different. In this case, the inefficient work hours are already included in the actual hours; therefore, the factor percentages should not be multiplied by the actual hours. More appropriately, the actual hours should be subtracted from the actual hours divided by one plus the applicable factors to determine the inefficient hours. To illustrate, assume 1000 work hours were actually expended and loss of productivity factors total 20%.

Actual Hours – {Actual Hours / (1 + Factor)}

1000 – {1000 / 1.20} = 167 Work hours loss of productivity

Thus, using the factors, loss of productivity is estimated to be 167 hours and efficient hours would be 833 hours. If the 20% factor was multiplied by 1000 actual hours, the result would be 200 inefficient hours (1000 x 0.20) and productive hours would be 800. Thus, under this scenario, the computed loss would actually be 25% (200 divided by 800), and not the 20% stated. [6]

6. CONCLUSION

The purpose of this thesis is to identify the factors that are affecting the labor productivity in various ways. The contractor is required to demonstrate that the causes of the loss of labor productivity lie outside its own responsibility, if it is to be successful in any claim for reimbursement of its losses.

A contractor should be aware of how to control the loss of labor productivity in order to avoid the risks / costs associated with any loss in this respect. Contractor also should introduce the various programs / schemes in favor of employees and implement them in a proper manner to motivate them and thereby achieve the more effective labor productivity at construction sites.

When making a claim for loss of productivity, a contractor must demonstrate a cost impact through evidence that is persuasive enough to prove that the claimed costs were incurred due to an owner caused delay. By using the described methods of calculating loss of productivity in construction claims, the contractor will be strengthened with reasonable arguments in its favor.

Improving effective labor productivity is entirely dependant on both the employees and the management. Hence, the organization, to maximize its total work force, must target waste in all forms not only in materials or equipment waste but also the waste associated with inefficiencies, interruptions and re-works which effectively control the loss of labor productivity.

REFERENCES

[1] Delay and Disruption in Construction Contracts, Second Edition, Published in 2000 – By Keith Pickavance.

[2] AACE International Recommended Practice No. 25R-03, Estimating Lost Labor Productivity in Construction Claims, TCM Frame Work: 6.4 – Forensic Performance Assessment, Published in 2004.

[3] Skills & Knowledge of Cost Engineering, Performance and Productivity Management, Fifth Edition Revised, Published in 2007 – By Dr. Scott J. Amos, PE.

[4] Standard Hand Book for Civil Engineers, Fifth Edition, Published in 2007 – By J.T.Ricketts, M.K.Loftin, and F.S.Merritt.

[5] Guide to Project Management, Achieving lasting benefit through effective change, Published in 2007 – By Paul Roberts.

[6] 1992 AACE transactions C.1, Use of Productivity Factors in Construction Claims – By Robert Dieterle, CCE and Alfred Destephanis.