Gibson Consulting Newsletter

No 10: Spring 2012

In this Newsletter.

Over the past few months I have being doing a lot of research for my second book, '**Acceleration and Productivity Disputes in Construction & Engineering'**. As a consequence, the two articles in this newsletter concern productivity and the substantiation and quantification of this contentious subject.

The first article discusses productivity and efficiency loss in general; whilst the second article focuses on two methods of productivity measurement, namely the 'Measured Mile Analysis' and the 'Earned Value Approach'.

Roger Gibson

April 2012

Books, Books, Books !!!

Following on from the success of his first book, '**Construction Delays: Extension of Time Submissions and Prolongation Claims**', Roger Gibson has now been commissioned by publishers to write a further three books.

These are:

'**Acceleration and Productivity Disputes in Construction & Engineering'**.

This book is being co-authored with a Barrister, Mr Anthony Edwards. Current status is that compilation of the final manuscript is proceeding for a book publication date of September 2012.

The Third book is titled '**Construction Delays: Managing Extensions of Time and Prolongation Claims'.**

This recently commissioned book is effectively an update of my first book***, 'Construction Delays: Extensions of Time and Prolongation Claims'***, published in 2008, with a slightly amended title.

The new book will contain updated case law and the consequences, together with new chapters, worked examples and graphics. The completed manuscript is due to be delivered to the publishers by the end of August, with publication planned for late-2012,

The fourth book is titled, ***'Managing 'Time' Under the NEC3 Contract'***, and will focus on the 'time' aspects of this increasingly popular form of Contract.

Publication of the book is planned for mid-2013. More details will be given in our future newsletters.

PRODUCTIVITY AND EFFICIENCY

Productivity, whether it is in manufacturing, white-collar work, professional sports, or construction, is one of the major components distinguishing success from failure. In construction, productivity has become even more important as budgets and time frames are tightened to the point of strangulation. As a result, the ability to measure productivity and to articulate deviations in productivity has become essential for the success of businesses involved in the construction and engineering industries.

Simply stated, productivity is a measurement of rate of output per unit of time or effort usually measured in labour hours. For example, cubic meters of concrete placed, linear meters of conduit or pipe installed, etc. per hour.

Productivity loss, therefore, 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.

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 cause(s) of poor labour productivity, i.e. efficiency.

Productivity and efficiency are critically important in the context of construction and engineering contracts, both large and small. Construction contractors are typically paid for work completed in place that conforms to the terms of the contract. This is sometimes referred to as pay item work and is generally true whether the contract is lump sum/firm fixed price, cost reimbursable, target cost, unit cost or pay item work or as a percentage of previously defined categories of work, often referred to as a bill of quantities.

Therefore, unlike companies such as car manufacturers, construction contractors are rarely paid on the basis of the entire completed product. Furthermore, for contractors, productivity is related to project cash flow and profitability.

All too often in construction, the terms “productivity” and “production” are used interchangeably. This is, however, incorrect. Production is the measure of output (i.e., things produced) whereas productivity is the measurement of the production.

Given this set of operating terms, it is therefore possible for a contractor to achieve 100% of its planned production but not achieve its planned productivity. That is, a contractor could well be accomplishing the planned rate of production of 300 linear metres of pipe per day in the ground but be expending twice the amount of labour planned to accomplish this daily production rate, for example. In this case, the contractor would be accomplishing 100% of planned production but operating at 50% productivity.

PRODUCTIVITY AND EFFICIENCY (Cont')

Thus, production and productivity are not reciprocal numbers. It does not necessarily follow that if a contractor is 75% productive then they are 25% inefficient.

Measurement and allocation of responsibility for loss of efficiency can be difficult. There are a number of reasons for this difficulty. Amongst them, are the following.

i. Loss of efficiency resulting from some action which is the responsibility of the owner, may not be easily detected or observed at the outset. Unless a contractor has a good productivity monitoring plan, all that may be known at the outset of a problem is that the on-site crews are not completing work activities as planned, and project schedule, costs and cash flow are suffering as a result. As a result, appropriate written notice to the project owner is often not promptly issued.

ii. Efficiency is frequently not discretely tracked on construction projects in a contemporaneous manner. Unless a contractor uses some sort of structured earned value system for tracking output units and input units, there is no way to measure efficiency and productivity contemporaneously. Thus, loss of efficiency can be difficult to prove with the degree of certainty demanded by many owners.

iii. There are myriad ways to calculate loss of efficiency and productivity. There is no common agreement amongst cost professionals as to how such lost hours should be calculated. Notwithstanding this statement, there is general agreement among cost professionals that a comparison to unimpacted work on the project is generally preferred when there is sufficient data available

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Finally, after efficiency loss is calculated, it is still difficult to establish causation. Contractors tend to blame such losses on owners and ask to be compensated. Owners, on the other hand, often blame under-estimation by the contractor or poor management and site organisation and thus deny additional compensation for lost efficiency.

PRODUCTIVITY AND EFFICIENCY (Cont')

A typical employer's criticism of loss of efficiency claims is that the calculation of the loss lacks certainty or precision. The irony of this criticism is that, more often than not, the very factors that cause a contractor to suffer efficiency losses are the precise reasons why detailed direct cause and effect records cannot be accurately maintained to calculate damages on a discreet impact by impact basis.

For example, generally, a contractor's project records and accounting system do not separately isolate costs for efficiency and productivity losses from other costs of the project because the work impacted by the loss is integral with base contract work.

METHODS OF PRODUCTIVITY MEASUREMENT

The 'Measured Mile' Approach

The measured mile analysis employs the above productivity techniques to compare different periods of productivity within a project. This comparison is often used to explain and quantify the effect different conditions have on a labour force's ability to perform. The measured mile represents the labour force's ability to perform on the particular project at hand, versus a theoretical calculation.

For example, if ABC Electrical contractor obtains a project away from its normal area, a measured mile analysis will identify the base efficiency at which ABC is able to employ a different labour force. Further, the measured mile can be used to determine the labour inefficiencies caused by a delay, disruption, or interference

on a project. If it can be determined that there is a period of unhindered or least hindered time on a project in which the labour expended reflects an efficient use of the labour force, then a ratio can be established between physical work accomplished and actual manhours expended. This time and associated percentage of work accomplished and related actual manhours provides a ratio of manhours to percent (manhours/percent) that becomes the measured mile.

The measured mile period is then compared to the impacted period, which in turn allows for a calculation of lost time associated with the impact. Further, if the employer is responsible for the delay or disruption, the contractor may be entitled to a claim for the added labour hours associated with the inefficiency. In some projects, the impact is very clear, such as in the case of acceleration. If the first 60% of the project were proceeding at a normal 40-hour workweek for 8 months and for 8 months a reasonably consistent level of productivity was achieved, then if for whatever reason the employer directed the contractor to accelerate the completion of the project by working 7-tens starting on the first day of the ninth month, the resultant loss of productivity becomes apparent.

METHODS OF PRODUCTIVITY MEASUREMENT (Cont')

Figure 27.5 illustrates the measured mile comparison. Labour productivity would be measured subsequent to the authorization of this acceleration and compared to the previous period. The contractor, however, has the burden of establishing a causal link between the impact caused by the employer and the contractor's increased time and cost. The measured mile approach has been found to be a reasonable approximation of those actual costs incurred.

The key advantage of a measured mile approach is that it relies on data agreed to by the architect/engineer on a contemporaneous basis during the actual contract performance. The labour productivity levels for both the measured mile and the impact periods are derived from project records, payroll records, and interim payment applications.

By employing the above crosschecks and adjustments, and having the parties work together on progress monitoring, the criticisms of using percent of labour as a measured mile are minimized. The labour percent complete is preferred over attempting to isolate a single commodity such as the installation of 1" conduit because there are many more construction activities associated with the success of the installation than just installing the conduit. It is important to note that it is widely recognized that the measured mile approach avoids the shortcomings of industrial studies or estimating guidelines because it is tied to the actual performance at the job site.

Support for the 'Measured Mile Analysis'

One of the more common criticisms of a measured mile analysis is that some practitioners allege that a measured mile can only be performed on same or identical work activities. An example of one such position is that one can only measure productivity of exactly the same type of work, such as installing one-inch branch conduit on the third floor of the building, and this cannot be compared to the labour productivity of two-inch feeder conduit on the fourth floor of the building. However, in 2001, the US Department of Veterans Affairs Board of Contract Appeals ruled that a contractor could use the measured mile method of calculating labour productivity, even though it was impossible to compare identical impacted and less impacted work activities.

The contractor in this case was P.J. Dick Inc. (PJD), who was awarded a contract by the VA to construct a clinical addition to a medical centre in Ann Arbor, MI. PJD subcontracted the electrical work to Kent Electrical Services (KES), on a time and material basis. PJD alleged that the VA's electrical design was incomplete and in error, and these problems resulted in delays and inefficiencies.

The VA refused to grant a time extension and ordered Dick to accelerate. Dick's subcontractor, Kent, was forced to add crews and perform the work in an accelerated, disruptive manner.

METHODS OF PRODUCTIVITY MEASUREMENT (Cont')

Dick paid Kent for all the increased labour required and then pursued a claim against the VA. Dick's expert, Mr. Apprill, used a measured mile analysis. Mr. Apprill determined that all installation of branch circuits had been affected by design problems or acceleration. He examined other electrical work performed and determined that the installation of feeder circuits was sufficiently similar to branch circuit installation. Both branch and feeder circuits use the same basic materials of conduit and wire and were installed by union electricians. However, feeder circuits were long continuous vertical runs of large size conduit and did not involve any device installation. Mr. Apprill compared the branch circuit work against productivity achieved on the installation of feeder circuits prior to the acceleration.

The VA's expert expressed a general objection to the measured mile methodology on the basis that feeder circuit work is not the same as branch work. The expert argued that the measured mile methodology requires good and bad period productivity performance of one crew performing the same work and that since the feeder and circuit work involved different crews, Dick's measured mile analysis was fatally flawed. The VA Board of Contract Appeals disagreed. "We find no basis to conclude that either the productivity of the same crew or exactly the same work is a prerequisite for a valid measured mile analysis to establish the amount loss of productivity. We agree with the GSA Board of Contract Appeals when it held in Clark Concrete Contractors, Inc., 99-1 BCA 30,280 [1]:

> *"(The government) is correct in asserting that the work performed during the periods compared by (the contractor) was not identical in each period. We would be surprised to learn that work performed in periods being compared is ever identical on a construction project, however. And it need not be; the ascertainment of damages for labour inefficiency is not susceptible to absolute exactness (citation omitted). We will accept a comparison if it is between kinds of work which are reasonably alike, such that the approximations it involves will be meaningful.*
>
> *VA-caused productivity loss is reasonable and valid. We recognize that feeder circuit work generally involves installation of larger sized electrical conduit and wire in longer, straighter conduit runs. However, KES' labour for feeder circuit installation was drawn from the same labour pools used for branch circuit work, and work are reasonably similar enough to branch circuit work to permit a valid comparison. The work was performed in the working conditions planned and budgeted by KES.*
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> *Consequently, we find PJD's measured mile analysis to be a reasonable approximation of the effect of the VA-caused inefficiencies under the Clark Concrete Contractors standard."*

METHODS OF PRODUCTIVITY MEASUREMENT (Cont')

In addition to providing the above clarification that the work need not be identical, the board goes on in a quantum discussion to describe the merits of the measured mile analysis.

> *"We, as most other courts and boards, recognize that quantifying the loss of labour productivity is difficult and that the determination of the dollar amount of damages for labour inefficiency with exactitude is essentially impossible. In recognizing this fact, we expect that measurement of the amount of inefficiency would usually be supported by expert testimony. The use of a "measured mile" analysis developed by a qualified expert is recognized as the most reliable, though not exact, methodology to quantify labour inefficiency. Clark Concrete Contractors, Inc. GSBCA No. 14340, 99-1 BCA 30,280; W.G. Yates & Sons Construction Company, ASBCA No. 48,398, 01-2 BCA 31,428; U.S. Industries, Inc. v. Blake Construction Co., 671 F.2d. 539 (D.C. Cir. 1982); Luria Bothers & Co. v. United States, 369 F2d. 701 (Ct. Cl. 1966)."*

In the Clark Concrete Contractors case the General Service Board of Contract Appeals upheld Clark's use of a measured mile analysis to quantify labour productivity decreases as a result of the government's design changes. Clark Concrete Contractors, Inc., was contracted to build an FBI field office in Washington DC. As a result of the Oklahoma City bombing, federal building designs were changed in order to make the structures more blast proof. As a result of the late design changes, Clark's labour costs were impacted. Clark used a measured mile analysis comparing the unaffected work prior to the design changes and the affected work after. Clark made adjustments to the measured mile due to the floor elevation and type of construction. The government characterized the Clark measured mile as a total cost method of pricing a claim. The board ruled that the measured mile analysis was the preferred method and a reasonable method to calculate lost labour and efficiencies. The board did selectively agree or disagree with some of Clark's measured mile adjustments.

Conclusion

The courts generally recognize the validity of loss of efficiency claims based on the measured mile analysis. While there are many methods of computing such damages, the use of a measured mile analysis, properly developed by a qualified expert, is the most reliable. The success or failure of a construction project often rides on the shoulders of labour productivity. Therefore it is incumbent upon the industry to educate and understand the basis for measurement and monitoring of labour productivity. If a project's planning and budget allow for the assignment of cost engineers and quantity surveys, the project has an extremely high probability of success. Also, should occurrences, problems, and/or events be introduced into a project, it is critical for management to recognize the importance and return on investment of employing onsite monitoring of the labour productivity. The measured mile technique provides the avenue for loss of productivity mitigation and labour impact analysis.

METHODS OF PRODUCTIVITY MEASUREMENT (Cont')

The 'Earned Value' Approach

Current performance is the best indicator of future performance and therefore using trend data it is possible to forecast programme and/or cost overruns at quite an early stage in a project. The most comprehensive trend analysis technique is the 'Earned Value' method.

Earned Value is an approach where you monitor the project programme, actual work and work-completed progress and value to see if a project is on track. Earned Value indicates how much of the time and budget should have been spent, with regards to the amount of work done to date.

Earned Value differs from the usual budget verses actual costs incurred model, in that it requires the progress and/or cost of work in progress to be quantified. This allows the project team to compare how much work has been completed against how much was expected to be completed at a given point.

The project manager needs to agree the project scope, create a Work Breakdown Structure [1] (WBS) and assign budget to each work package [2], the lowest level of the WBS. Next he/she will create a schedule showing the calendar time it will take to complete the work. This overall plan is baselined (this is the planned value) and used to measure performance throughout the project. As each work package is completed (earned) it is compared with planned value, showing the work achieved against plan. A variance to the plan is recorded as a time or schedule deviation.

It is necessary to obtain the actual costs incurred for the project from the organisations' accounting system. This cost is compared with the earned value to show an overrun or under run situation.

Earned Value provides the project manager with an objective way of measuring performance and predicting future outcomes. This can enable him/her to report progress with greater confidence and highlight any overrun earlier. This in turn enables the management team to make cost and time allocation decisions earlier than would otherwise be the case.

It is generally true that past performance is a good indicator of future performance and as such Earned Value is a very useful tool for predicting the outcome of projects in terms of time to completion, cost to completion and expected final costs.

Earned Value is also known as Performance Measurement, Management by Objectives, Budgeted Cost of Work Performed and Cost Schedule Control Systems.

METHODS OF PRODUCTIVITY MEASUREMENT (Cont')

In addition to assessing any slippages or cost overruns in a project in general terms, Earned Value Analysis (EVA) can be used to help determine if a project is providing value for money or not. EVA concentrates on three basic parameters:

i. How much work SHOULD have been done so far;
ii. How much money has ACTUALLY been spent to progress the project so far, and
iii. What is the VALUE of work that has been accomplished so far.

By comparing these values, assessments can be made about how efficient a project is and where problems may lie.

Contact Us
Details of our services can be found on our website, ***http://www.gibsonconsulting.co.uk/***, but if you would like to discuss how we can help you, Please don't hesitate to contact Roger Gibson on 024 7624 3607 or 07970 119 465, or send an email to ***roger.gibson@gibsonconsulting.co.uk***