

PRODUCTIVITY LOSS CLAIMS

PRESENTED AT THE SECOND ANNUAL
NORTHEAST SURETY & FIDELITY CLAIMS CONFERENCE

Rocky Hill, Connecticut

November 7, 1991

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Introduction

Delay and disruption. The words roll off the tongue with practised ease. We often think of delay and disruption as two manifestations of the same problem, when in fact they are quite different. The delayed contractor usually suffers additional indirect costs such as extended overheads, whereas the disrupted contractor experiences increased direct costs due to lost labor and equipment productivity. The accelerated contractor will also lose productivity due to the special working conditions which must be imposed to accelerate the schedule.

Productivity loss claims are sometimes ignored because of the tendency to focus on delay claims and because of the inherent difficulties involved in proving productivity loss entitlement and damages. The consequences of emphasizing delay damages at the expense of productivity losses can be seen by comparing a \$2000/day overhead with the \$25,000/day labor rate for a 100 man work force. The labor cost can easily double on a disrupted project, so the potential productivity loss could be on the order of \$25,000/day whereas the delay damage might be only \$2,000/day. There are admittedly many assumptions in the foregoing analysis, however the overall comparison is valid. Productivity losses can greatly exceed delay damages when delay and disruption are both present.

Definitions

Productivity in the construction industry is simply the manhours required to accomplish a given unit of work. The productivity of a painter brushing two coats of stain on exterior siding might be expressed as .01 man hours (MH) per square foot (SF) or a concrete team may place concrete in an elevated slab at the rate of .5 MH per cubic yard (CY). Productivity is therefore expressed as MH/Unit

Productivity is really the same as efficiency, and we are accustomed to measuring efficiency as Output/Input. Since the unit of work is the output and the labor hour (MH) is the input, one would expect productivity to be expressed as Units/MH. More Units/MR would mean better productivity and fewer Units/MR would mean less productivity. Unfortunately, Units/MH does not readily combine with materials and quantities when estimating cost, so we use the inverse function, MR/Unit. Fewer MH/Unit means greater productivity.

The cost of labor is expressed as \$/MH, which multiplied with productivity as MH/Unit yields \$/Unit. The cost of materials may also be expressed as \$/Unit. Combining labor and materials as \$/Unit, times the number of units, produces the direct cost of the activity. This is why productivity is expressed as MH/Unit rather than as Units/MH.

Productivity is always expressed as a rate, so the terms productivity and productivity rate are the same.

Production is not the same as productivity, and in some cases, may be quite the opposite. Production is the number of units installed and a production rate is the number of units installed in a given time period. Returning to the example of the team placing concrete in an elevated slab, a production rate of 130 CY/Day might be expected. It is sometimes necessary to increase production beyond the most efficient rate, such as when attempting to recover lost schedule time. In those cases productivity will decrease as production increases.

Problems and Presumptions

Productivity losses occupy a unique place in the spectrum of claims. These losses are usually associated with Disruption, Acceleration and Changed Conditions claims, and will also arise under Extra Work claims when the frequency, number or nature of changes create a disruptive working environment.

Unlike other claims, such as delay, non payment, wrongful termination, etc., the events which give rise to productivity losses are often denied by the responsible party. The contractor suffering the loss must therefore prove that there was, in fact, a disruption or acceleration before establishing the linkage between the event and the lost productivity.

The productivity loss claimant is faced with a strong presumption against entitlement. Since the contractor theoretically controls the means and methods of construction, the productivity of the work force is presumed to be the contractor's responsibility.

Having proven that the disruption, or whatever, occurred and that the loss was not the contractor's fault, the claimant must also show that its losses went well beyond what might be considered usual under the circumstances. It is well understood by all save recent management school graduates that construction is a rather uncertain and imprecise endeavor, and that some losses in productivity should be anticipated.

Productivity rates are not calculated by most contractors and the usual accounting and contractual records will not readily support an effort to reconstruct productivity rates after the fact. Those contractors which do calculate productivity face quantification problems because of cost coding and timing errors. Other obstacles to the proof of productivity loss damages will be discussed later. At this point it should be obvious that productivity losses can be quite substantial and yet difficult to prove.

Compensable Causes

In order to be compensable, productivity losses must be beyond both the control and the reasonable anticipation of the claimant. The following paragraphs discuss situations which commonly create productivity losses. The listing does not cover all such events, nor does it imply that such events always give rise to compensable losses.

Disruption

We use the term disruption to describe a break in the orderly progress of the work. The dictionary definition is "...to throw into disorder" and this better characterizes the effects of disruption on construction activities.

Foremen and journeymen who know what they are doing, what they will be doing next, and how their activities relate to the successful completion of the project, develop a job rhythm. Labor productivity is at its optimum when there is good job rhythm. When that job rhythm is interrupted, the productivity of those engaged in the interrupted work is definitely impacted and the effect can spread to other concurrent activities as well.

Disruption occurs when workers are prematurely moved from one assigned task to another. Regardless of the competency of the workers involved, some loss of productivity is inevitable while they shift materials, tools and equipment to a new location and become oriented to the new assignment. This loss is repeated when the workers are returned to their original task.

That loss which is related to reorientation is called a learning curve loss. The basic principle is that efficiency increases as an individual or team repeats an operation over and over. Although construction work involves the repetition of similar tasks, these tasks are rarely identical. Skilled construction workers are trained to perform a wide variety of tasks related to their trade, so that the newly assigned work may vary materially from the work that was interrupted. Even if the mechanics of the new assignment are the same, the interrupted worker may be faced with new supervisors, new partners, new inspectors etc.

Many of the common causes of lost productivity can be viewed as disruptive events, and hence disruption tends to be a rather general term. This can be illustrated by considering the various reasons why workers might be prematurely reassigned, for instance:

- Design changes
- Delayed clarifications
- Interference from other contractors
- Weather
- Defective material, etc.

Suspension

When an interruption is of such magnitude as to cause the work involved to be essentially abandoned, we have loss of continuity impacts in addition to the impacts described in the section on disruption.

When an entire section of the work is unable to begin or must be discontinued, the impact is comparable to a suspension of performance even if the Owner has not expressly directed the contractor to stop work.

A loss of continuity involves demobilizing and remobilizing major equipments, laying off and rehiring personnel and reprogramming material procurement and storage. All of these factors cause the contractor's productivity to worsen and his costs to increase. If weather conditions are less favorable when the suspended work resumes, the contractor will suffer additional productivity losses.

Restricted Access

Access may be restricted to the work area and/or the work itself.

A contractor may be restricted from a work area by the failure of the Owner to provide access to the site or restricted access may be another consequence of the loss of construction continuity. Returning to a work area at a later stage in the project will often create a severe access problem for the contractor.

Tradesmen may experience restricted access to their work due to crowding or the presence of other trades.

When access limitations restrict the flow of men, materials and equipment, productivity will suffer. When men must work in close quarters and in the same area with different trades, productivity losses will result.

Extended Working Hours

One of the most common causes of lost productivity is fatigue and pacing as a consequence of working longer shifts, second and third shifts and holidays.

Resequencing

The logic of a construction schedule is apparent in the sequence of activities. The contractor orchestrates the involvement of many parties in a way which provides for optimum efficiency and minimum interference. By carefully sequencing activities, the contractor insures that when subcontractors or his own forces arrive to begin an activity, all of the required preceding activities have been completed, all necessary material, tools, equipment and support services are available, the related designs are approved for construction and the work area is clean and accessible.

When a contractor is forced, due to events beyond his control, to alter the sequence of his activities, major losses in productivity are inevitable.

Interference

The impacts from interference will vary greatly depending on the nature of the interference. The interference may result from the actions of the Owner, Architect, Engineer, or other contractors. Anything which deprives the contractor of control over the means and methods of its work is a form of interference.

The Owner has an implied obligation to not interfere with the performance of its contractors, and an implied obligation to schedule and coordinate the work so that prime contractors will not interfere with each other.

Repairs and reworks which are made necessary the the actions of others are also examples of interference.

Morale

The effects of disruptions, suspensions, access restrictions, resequencing and interference will change a contractor's work plan from an operation organized to maximize productivity, into a confused start-stop, hurry and wait process. Such disorder increases the contractor's direct costs and has a detrimental effect on the labor force.

Few outsiders recognize the pride that construction tradesmen take in their work, and so the effect of forcing them into poor work practices is seldom identified as a productivity loss factor. Nevertheless, when the workers sense that they will not be able to perform efficiently, their desire to do a good job is diminished and the efforts of their foremen are undermined. The informal time study standards which govern their work are lowered and the contractor's costs are increased.

Non-Compensable Causes

Lost or reduced productivity is often the fault of the contractor. The following are common examples of non compensable causes of lost productivity:

Contractor Management Shortcomings

Whenever the contractor fails to properly plan, staff and supervise the work, or when it does not properly support its forces with material, equipment and tools, productivity will suffer.

Labor Problems

Unskilled or uncooperative tradesmen can also cause labor costs to increase with no opportunity to recover the loss.

There is an important aspect of this situation which is not at all obvious to many observers. Normally compensable events can cause large, essentially non compensable losses when dealing with uncooperative labor.

As mentioned earlier under the discussion of morale, most building tradesmen take pride in the quality and efficiency of their work. However, when the trades think that they are working themselves out of a job, they often reduce the pace of the work to extend their employment. This tendency is even more pronounced when trade unions are involved. Union leaders will sometimes strive to put more members on the payroll, even when there is relatively good job security for those already working.

Contractors can counteract slowdowns and other contrived reductions in productivity by threatening layoffs, open shops, appeals to the union headquarters, etc. These efforts are only effective when the contractor can demonstrate that productivity levels are below published rates AND the lower productivity is not due to management failings.

When obvious disruptions, suspensions, accelerations, etc. are taking place, the contractor cannot force a decent days work out of a labor force that wants to extend the job and/or the payroll. This is why a relatively modest interruption or inconvenience can lead to a major loss in productivity, and this is why the monies recovered in claims may be considerably less than the loss actually suffered.

Anticipated or Excluded Conditions

A certain level of inefficiency is common to most construction activities and should be provided for in the contractor's bid. Sometimes the request for proposal will identify specific factors which the experienced contractor will recognize as causes of lower efficiency, and sometimes the contract will expressly exclude claims for lost productivity associated with certain, anticipated conditions. These situations give rise to non compensable productivity losses.

Proof of Loss Difficulties

Some of the unique aspects of proving causation and damages were mentioned earlier. In addition to the presumption of fault which the contractor must overcome, the causes of productivity loss are frequently concurrent. In this respect disruption claims are similar to delay claims and apportioning responsibility can be just as difficult as it is with concurrent delays.

Another complication arises when one recognizes that many different activities can be impacted by a single cause, and the impacts are likely to be different for each activity.

Proving damages accurately and conclusively requires the collection of man hours and quantities associated with each impacted activity. Time sheets must be properly cost coded to relate man hours to activities, and quantities must be documented for specific activities and time periods. This level of cost reporting is approached by only the most modern and best managed contractors. Most of the others know approximately what productivity is being achieved on major activities, but they cannot prove or quantify productivity losses.

Fortunately the courts are aware of the practical limitations faced by most contractors attempting to precisely quantify a loss of this nature, and they will accept standards of proof and damage calculations which are, at least, reasonable.

One last obstacle need only be mentioned to be understood. At some point it may be necessary to explain all of the above and some of what follows - to a jury.

Proving a Loss

A productivity claim must prove three things:

The claimant suffered a loss.

The defendant caused the loss.

The value of the loss.

The fact that the claimant suffered a loss may be proven by quantifying the loss. The first and third proofs may therefore be the same. Another way of demonstrating that a loss occurred is to show that production slipped during the impact period, and that it was not possible to reduce the work force. Doing less work with the same number of people strongly implies a loss of productivity.

Proving Causation

The second proof requires that the contractor overcome the presumption that all productivity losses are the contractor's fault. Those impacts which were indeed the responsibility of the claimant must be segregated and the remaining impacts must be placed at the doorstep of the defendant. The following approaches may be used to establish the causal relationship:

- Affirmation
- Published Studies
- Time Dependency
- Place Dependency

Affirmation

The most common and least successful approach is to simply affirm that the defendant caused the loss. The reasoning goes ... "Somebody caused a loss and it wasn't me so it must have been you". This is the causation equivalent of the total cost approach to damages. Needless to say this is a less than compelling argument.

Published Studies

A number of published studies which go to the quantification issue also address causation. Although the purpose of a study may be to quantify the losses which are historically associated with certain causes, one may use the study to show that the party responsible for the cause must also be responsible for the effect, ie: productivity loss. These studies are discussed later with the Empirical Analysis Method.

Time_Dependency

A graph of productivity over time would be expected to show poor productivity at the beginning of the work as the learning curve takes effect, followed by good productivity during the bulk installation phase and finally reduced productivity during the punch list phase. If an actual productivity curve shows an unanticipated loss concurrent with an alleged causation, one can suggest a causal link between the two. This might be called a time dependent link.

Labor hours are usually kept on a daily basis, however quantities may only be recorded monthly (if at all). In such cases, productivity rates must be averaged over each month and it may not be possible to show that the impact and the lower productivity occurred during the same time period. This is not a serious shortcoming if causation can be demonstrated by other methods.

A labor histogram may also be used to show time dependency if it can be demonstrated that productivity impacts occurred at the same time as wide fluctuations in the work force.

Place_Dependency

Similarly, it may be possible to show that the productivity of a certain activity at an impacted location was lower than the productivity of the same activity at an unimpacted location, indicating that the impact caused the lower productivity. This might be called a place dependent link.

Proving_Damages

There are currently three basic approaches to the quantification of productivity losses. These are:

The Total Cost Method

The Empirical Analysis Method

The Comparison Method

Total_Cost_Method

The total cost claimant says essentially, "I bid \$X for labor and I spent \$Y and you owe me the difference". This method is used quite often despite its obvious weakness because of the difficulties of properly demonstrating damages. Because the claimant has usually contributed to the loss, the defendant can easily show that it was not responsible for many of the claimed losses.

Modified Total Cost Method

The total cost method can be strengthened by attempting to segregate and deduct the contractor caused productivity losses from the claimed amounts. When the contractor caused losses cannot be established by any other method, the court may assign a percentage of the loss to the contractor. This is called the jury verdict method of apportioning damages and is only used when the evidence in the case provides some basis for doing so and there is no more reliable method available.

Empirical Analysis Method

A number of organizations and individuals have published studies which relate common causes of labor inefficiencies to the loss in productivity which usually results. The U.S. Army Corps of Engineers published the Modification Impact Evaluation Guide in 1979 which includes curves describing the productivity losses associated with reorientation, crowding, crew overloading, and extended overtime. The Mechanical Contractor's Association Labor Estimating Manual and a similar manual published for electrical contractors also contain information on productivity losses.

One of the most significant and least understood causes of lost productivity are excessive change orders. In 1988, a Canadian Engineer, Charles A. Leonard, published the results of a regression analysis performed on data from a large number of projects. Mr. Leonard developed statistical models relating the labor component of change orders to productivity losses on different types of projects.

Comparison Method

The preferred method for quantifying productivity losses is to compare the actual productivity for each impacted activity with the productivity which would have been achieved "but for" the alleged impact.

Actual Productivity

The proof of actual productivity depends on the contractor's documentation to establish the output (quantity installed during a given time period) and the input (labor or equipment hours used on that same quantity). In all cases the hours and the quantities must relate to the same activity and the same time period.

When the contractor has established a comprehensive system of cost codes and has kept track of the costs associated with specific work activities, the productivity rates may be readily calculated. Such cost reporting systems are often computerized and the program will usually calculate productivity or some other measure of efficiency.

When such systems have not been established, or when the accuracy of the system is in question, other records must be evaluated to quantify the loss.

The installed quantities may be recorded in various site logs, journals, reports and requisitions. Labor hours are usually found on time sheets and other payroll records. These records sometimes suffer from cost code and timing errors, and one must take care to insure that the data makes sense. Nevertheless, the fact remains that calculating actual productivity is a relatively simple matter. The same cannot be said for establishing the productivity rate which the claimant says could have been achieved.

"But For" Productivity

Demonstrating the productivity rates which could have been achieved is a matter of trying to prove something which never happened.

The Measured Mile

The most credible approach involves a "measured mile" which is a representative sample of productivity actually achieved in an unimpacted environment by the same contractor using, to the degree possible, the same supervisors and tradesmen on the same project and on comparable activities.

The measured mile is useful because it proves that the contractor is capable of achieving "but for" productivity rates.

Unfortunately, projects that are impacted early in the schedule often have no unimpacted periods or areas, and no measured mile or benchmark can be identified.

The Bid Estimate

The productivity used by the contractor for the bid estimate may serve as an indication of the "but for" rates provided that they are reasonable and supported by productivity records from other jobs.

Estimating Manuals

Estimating Manuals published by various sources such as Means, McGraw Hill, Richardsen, Walker and some contractor's associations are based on productivity rates. Those rates are industry averages and must be carefully adjusted for local conditions, however they do provide a source of "but for" productivity when no other source is available.

Time Studies

Specific time studies have been used to prove the productivity levels which can be achieved. Needless to say the conditions under which such studies are conducted tend to be idealistic, however the ideal rates can be discounted to produce more practical levels.

Productivity Index

The productivity index approach is an overall comparison method which can be used when man hours and quantity data are not able to support specific productivity calculations.

The index is a measure of the labor cost required to achieve a certain progress. By dividing payroll into progress payments during an unimpacted period, one may establish a "normal" productivity index. Applying the normal productivity index to the impacted progress payments produces the "but for" impacted payroll. The productivity loss damages are then calculated by subtracting the "But for" impacted payroll from the actual impacted payroll.

This method assumes, among other things, that the relationship between progress payments and payroll would be constant throughout an unimpacted job.

Expert Opinions

Productivity experts are often used to establish the "but for" rates, however they must present evidence showing that the productivity levels which they propose are reasonable. In fact, it is usually necessary to present expert opinions together with one or more of the other methods described herein to establish the productivity which could have been otherwise achieved.

Equipment Productivity

This paper has focused on labor productivity, however lost productivity claims may also be asserted for the inefficient use of construction equipment. Equipment that has been idled or demobilized due to compensable delay situations will usually be included in the delay claim. Other equipment inefficiencies caused by disruptions, restricted access, acceleration, etc. should be included in a productivity loss claim.

Unlike labor input which is recorded for payroll purposes, equipment hours are not usually tracked, and when they are, many contractors assign the costs to site overhead accounts. Equipment hours may therefore be difficult to relate to specific activities. Equipment quantities may be recorded if the activity is a pay item, or a major operation such as excavation. Total quantities may also be taken off as-built drawings and related to total hours to produce an overall productivity figure.

Summary

Productivity losses can generate sizable damages which should be pursued despite the many problems and presumptions which must be overcome.

Disruptions, suspensions, restrictions, interferences, shifts, overtime, management deficiencies and labor problems will all cause productivity to be lost, but only those causes which are beyond the control and reasonable anticipation of the contractor can be claimed.

Productivity losses may be quantified by the total cost, modified total cost, empirical analysis or comparison methods. The preferred approach is the comparison method by which the claimant compares the impacted productivity with the productivity which could have been achieved "but for" the impacts.

Proving the "but for" productivity is particularly difficult. The "measured mile" or "benchmark" approach uses productivity actually achieved under similar but unimpacted conditions. When this is not available, claimants may use various estimating, time study or rule of thumb techniques, supported by expert testimony.

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1991