CONSTRUCTION PRODUCTIVITY
A Practical Guide for Building and Electrical Contractors

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NEGOTIATING LOSS OF LABOR EFFICIENCY

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INTRODUCTION

One of the economic consequences of construction is the loss of construction labor efficiency resulting from various events that occur during the course of construction. Occurrences such as scheduled overtime, schedule acceleration, numerous changes, and congestion can seriously erode contractor profits.

Although the construction contract may grant the contractor economic relief for labor inefficiencies, recovery of these monies is not guaranteed for several reasons. The economic consequences of losses of labor efficiency can be quite severe. It is not unusual for a contractor to experience labor productivity losses in the range of 25% to 40%. Unlike material and some equipment resources, using additional labor resources cannot be easily related to some cause or event for which there is entitlement, and there are no invoices to establish a link. A common argument by owners and general contractors for avoiding payment is that the cause of the labor overrun is incompetent management on the part of the specialty contractor. When combined with the magnitude of the losses, it is little wonder that the owner or general contractor is reluctant to acknowledge that it has an obligation to pay.
The purpose of this chapter is to provide guidance for the contractor and subcontractor on presenting loss of labor efficiency claims. Following these guidelines will enhance the likelihood of recovering the additional labor costs. The emphasis in this chapter is on educating the owner or general contractor as to the causes and consequences of labor inefficiencies. Another essential emphasis is on establishing cause-effect relationships so as to substantiate the labor overrun. The purpose of this chapter is not to explain how to calculate damages.

Schedule delay damages and losses of labor efficiency go hand in hand. However, it is important to observe that a schedule delay analysis and a loss of labor efficiency analysis are not the same. Different analysis methodologies are applied, and the cause-effect relationships are very different. With a loss of labor efficiency, it means that it takes longer to perform a certain task. There need not be a work stoppage or time delay that is necessary to perform a schedule analysis.

Although loss of labor efficiency may result in delayed completion, loss of efficiency is not included as an element of delay damages. When permitted by the contract, both delay damages and losses of labor efficiency can be recovered. It is not considered double recovery to receive both types of damages.

MAKING THE CASE FOR LABOR INEFFICIENCIES

There are numerous events that can cause a loss of labor efficiency. Research at Penn State has led to the development of the Factor Model, which is graphically shown in Figure 7.1. This model is explained in this section as well as other issues that can make educating the owner about the causes and magnitude of work hour losses much easier.

The Factor Model

There are two broad categories related to the work that affect labor productivity. These are the work to be done and the environment in which the work is done. Both are shown in Figure 7.1. The figure shows that the inputs in terms of labor hours are converted to outputs or quantities of work through the application of some work method. The work to be done and the work environment categories can be viewed as either contributing to or inhibiting this conversion process. The work to be done is defined in the contract documents, and there is little that the contractor can do about this category.

Direct Factors Affecting Labor Efficiency

Of importance to the discussion on labor efficiency is the work environment. There are numerous factors that can affect labor efficiency. Fortunately, some of
these factors are relatively minor and others generally occur infrequently. Research on more than 100 projects covering more than 4,000 workdays and 250,000 work hours of labor-intensive work has shown that there are only a few factors that consistently occur on large numbers of projects that negatively affect labor efficiency. These factors, which are also shown in Figure 7.1, are as follows:

- Congestion
- Out-of-sequence work
- Adverse weather
- Inadequate supervision
- Work performed while the facility is in operation
- Lack of information
- Lack of equipment
- Lack of tools
- Lack of materials
- Rework

These factors repeatedly occurred on the 100-project database mentioned above. By concentrating on these factors, arguments are more convincing because
there is reliable scientific research to support their effect on productivity. Research has documented that these factors have a significant effect on labor productivity (Thomas et al. 1990). Table 7.1 summarizes the relative daily output when some of these factors are present.

The results of Table 7.1 are applicable to the daily crew output. For example, on days when rework is performed, the average output is reduced to 0.40 to 0.50 of the normal output experienced when no disruption factor is present. Factors that occur most often relate to the lack of materials and weather. The most severe disruption factor is having to perform out-of-sequence work.

To illustrate the impact of the factors in Table 7.1 on labor productivity, suppose an electrical contractor is performing work in an area of limited space in a new commercial structure. The work took five days to complete. However, after the second day, the prime contractor changed the schedule and assigned two other specialty contractors to work in the same area. Thus, three days of the five were affected by congestion. The electrical contractor spent 225 work hours in this area during the five days. Pertinent data are shown on Table 7.2.

### Table 7.1 Impact of Disruptions on Daily Output

<table>
<thead>
<tr>
<th>Factor (Disruptions)</th>
<th>Relative Daily Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Disruption</td>
<td>1.00</td>
</tr>
<tr>
<td>Congestion</td>
<td>0.30–0.35</td>
</tr>
<tr>
<td>Out-of-Sequence Work</td>
<td>0.20–0.30</td>
</tr>
<tr>
<td>Adverse Weather</td>
<td>0.35–0.50</td>
</tr>
<tr>
<td>Lack of Equipment</td>
<td>0.45–0.55</td>
</tr>
<tr>
<td>Lack of Tools</td>
<td>0.35–0.45</td>
</tr>
<tr>
<td>Lack of Materials</td>
<td>0.45–0.65</td>
</tr>
<tr>
<td>Rework</td>
<td>0.40–0.50</td>
</tr>
</tbody>
</table>

### Table 7.2 Relative Output per Day

<table>
<thead>
<tr>
<th>Day</th>
<th>Relative Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>1.00</td>
</tr>
<tr>
<td>Tuesday</td>
<td>1.00</td>
</tr>
<tr>
<td>Wednesday</td>
<td>0.30–0.35</td>
</tr>
<tr>
<td>Thursday</td>
<td>0.30–0.35</td>
</tr>
<tr>
<td>Friday</td>
<td>0.30–0.35</td>
</tr>
</tbody>
</table>

**Average Weekly Output**

| Average Weekly Output | 0.58–0.61 |
The output of the crew was reduced to approximately 60% of normal. The change in schedule caused an estimated loss of labor efficiency of $(225)(1.0 - 0.6) = 90$ work hours.

**Indirect Factors Affecting Labor Efficiency**

As shown in Figure 7.1, there are also indirect factors that affect labor efficiency. The common indirect factors are:

- Changes and change orders
- Scheduled overtime
- Increased manning levels or overmanning
- Shift work

These factors are considered indirect because the factors do not automatically lead to inefficiencies. For instance, there are certain times when scheduled overtime or changes work can be performed without a loss of productivity. How then do indirect factors lead to labor inefficiencies? To illustrate, consider scheduled overtime. Overtime creates an environment where the pace of the work is accelerated. Everything accelerates. Materials will be installed faster, and unfortunately, the material supply network may not be able to cope satisfactorily with the accelerated pace (Thomas et al. 1995). Without materials, the efficiency of the workforce is impaired. Thus, scheduled overtime is inefficient when it triggers the direct factors to occur, in this case, lack of materials. The same analogy can be applied to the other indirect factors shown in Figure 7.1.

**EDUCATING THE OWNER**

The first aspect of educating the owner is to keep the discussion simple. Convince the owner that there are relatively few factors that adversely affect labor performance. Concentrate on the fundamental or direct factors listed in Figure 7.1.

If surveyed, a list of 50 factors affecting productivity could be easily developed. Unfortunately, such a list leaves the owner with the feeling that the contractor is helpless in managing the work. This is not the impression that one wants to create. One approach is to use Figure 7.1 to illustrate that there are relatively few factors affecting productivity, and under ordinary circumstances, these factors are manageable. These are the direct factors shown. Other factors that were caused by or are the responsibility of the owner, called indirect factors, actually caused the inefficiency by triggering the direct factors to occur. The following examples illustrate how this may occur.
Example 7.1: Consider the indirect factor of design changes, and suppose the owner has put certain work on hold pending a possible change. Some three months later, the owner informs the contractor that there will be no change and that the work should proceed as shown on the drawings. The environment at the work location is now entirely different than it would have been had the work proceeded three months sooner as planned. Now the contractor must work around other contractors performing other activities. The area is congested (stacking of trades) and different, less efficient methods need to be used. Some rework was also required because of damage from the other contractors. So, a relatively minor issue over a change that never materialized created congestion and the need for less efficient methods and rework that, in turn, caused a deterioration of labor productivity. The flow diagram in Figure 7.2 illustrates this simple concept. The contractor could argue schedule acceleration as a cause, but a more direct approach is to argue congestion and rework. The alternate method was caused by the congestion, so that argument may only confuse the simplicity of the situation.

Example 7.2: A contractor was contracted to install an underground fiber-optics innerduct across 60 miles of a northeastern state. Approximately 25 permits were required from numerous townships, the State Department of Transportation, and a major railroad. Unfortunately, the contract was awarded without any permits being secured. The contractor had areas of work made available to him in a piece-meal fashion. While it could be argued that the lack of permits was the main cause
of the labor productivity overrun, the owner could counter that there was no work stoppage and there was always some work available for the contractor to do. A better position for the contractor is that out-of-sequence work was the main cause of lost efficiency. Out-of-sequence work resulted in the need to frequently change locations, find busy work to do when limited work was available, and return to work areas to complete tie-ins.

The focus of educating owners and general contractors should be on changes in the environment. These factors are the direct causes of lost productivity and have the greatest impact on how efficiently the work is performed. Because there are relatively few environmental factors, the discussion can be kept simple.

**Common Indirect Factors**

There can be a number of indirect factors; however, there are some that occur more frequently than others. These are explained below. Understanding why there is loss of efficiency is important because a clear understanding makes it easier to explain and convince the owner that his or her actions were the root cause of the labor overrun and it establishes the facts that are important to document, which creates the element of proof.

**Design Deficiencies**

The contract drawings show the intent prescribed by the designer. Specialty contractors use their knowledge and skill to efficiently construct the work within the bounds of this intent. When the design is deficient, the specialty contractor has difficulty in understanding what the designer wants. The specialty contractor must stop and wait for further instruction and interpret the drawings to his or her best ability, and sometimes the intent is innocently misunderstood. Each of these situations leads to a similar conclusion; that is, the specialty contractor must stop and wait for clarification, go elsewhere while the designer makes a determination, wait for new materials to be procured, perform rework, or a host of other scenarios. Each situation can lead to loss of labor efficiency.

Why are there design deficiencies? Two reasons seem to occur frequently. First, some designers have a tendency to overspecify what is required rather than letting the contractor use his or her ingenuity to get the job done efficiently. By overspecifying, discrepancies are often created, particularly with dimensions. The contract documents may then be uncoordinated leading to rework and out-of-sequence work. When the designer is behind schedule or has not been given adequate time to develop the contract documents, errors and omissions inevitably occur. The origin of these deficiencies can often be traced to indecision or procrastination by the owner.
Changes and Change Orders

Changes are often related to design deficiencies, but there can be other causes. These include changes in regulations, contractor errors, contractor requested changes, and owner preferences. Regardless, labor inefficiencies will result unless the change is identified early. The key determinant in labor inefficiencies resulting from changes is the timing of the change. If the need for a change is identified early, the impact is minimal or nonexistent. The absolute worst scenario is for the crew performing the work to identify that something is wrong and that a clarification or change is needed. As in the example described earlier, even a nonchange can lead to inefficiencies because the environment in which the work is done has changed.

Shop Drawings and Submittals

The review and approval of shop drawings and other submittals is a very important process that occurs early in the construction process. Contractors should expeditiously and carefully initiate this function. The contractor must take care in preparing a schedule of submittals to ensure that long lead items are done first and that all items are submitted in a timely manner. All too often, the approval process is delayed, and these delays ultimately lead to delays in the construction. The causes of delay are relatively few. Submittals may not be submitted on time or the submittals are incomplete. Both are the responsibility of the contractor. On other occasions, the delay may be caused by the owner or designer because the submittal is not returned in a timely manner. Both are the responsibility of the contractor. On other occasions, the delay may be caused by the owner or designer because the submittal is not returned in a timely manner. A rule of thumb is that the designer should be able to return the submittals to the contractor within two or three weeks. Obviously, owners and designers should avoid a cumbersome and lengthy review process. All parties need to be especially diligent where the design schedule is tight or has been delayed. Sometimes, designers will use the review process to buy time by disapproving the submittal as incomplete, not prioritized, or other reasons. Pay special attention to the submittal process. Do not give the owner reason to blame you for delays in the submittal process.

Late submittals need not involve your line of work. Frequently, other items such as structural steel may be the culprit. These delays are likely to lead to schedule acceleration impacts to the specialty contractor long after the steel erector has left the site. Thus, maintaining submittal logs is important. Other subcontractor’s logs can also be relevant. This information may be readily available from minutes of the weekly progress meetings.

Late submittals lead to obvious delays in procuring materials and installed equipment. Less obvious is the implication when submittals are approved in a random sequence. This situation may mean that the work must be done out of sequence. The material procurement, storage, and distribution process may also be more difficult to manage.
Scope Increases

When there are increases (or decreases) in the scope of work, several situations can occur. If the scope changes are late, then the work will need to be done in a less favorable environment. If the facility is operational or occupied, then the work will be impacted further. It may be more difficult to obtain materials, and there may be premium charges added by the vendor for quick deliveries. Another problem that can occur is that the scope change can involve smaller segments of work than would have been ordinarily required. Here the contractor must distribute additional setup time and costs (fixed cost) over a much smaller quantity of work. The work environment may also be more difficult. Obviously, it is important to identify scope changes early in the construction process to avoid significant disruptions to the work.

Schedule Acceleration

Schedule acceleration has been studied extensively in Chapter 4. It is fair to say that schedule acceleration is very inefficient and expensive. Labor inefficiencies over the total work have been calculated as high as 50%. Inefficiencies in the range of 25% to 40% can routinely be expected. Schedule acceleration leads to labor inefficiencies in a number of ways. One of the greatest impacts is in material management. The problem with schedule acceleration is that resources are consumed at an accelerated pace. Materials must be installed faster, equipment will be needed more frequently, and design issues and RFIs will occur more regularly. There may be limited space in which to store materials, and the distribution of materials into the facility may be more difficult. The management of waste materials and trash is another potential issue.

In acute acceleration situations, the ability to plan ahead is impaired because there are so many schedule changes that it is hard to say where a crew will be working the next day or week. The orderly sequence of the work is disrupted, leading to out-of-sequence work. The planning horizon becomes very short. Where scheduled overtime is used extensively, fatigue may become a problem. Where overmanning occurs, there will be dilution of supervision and stacking of trades.

Cause–Effect Diagram

Obviously, educating the owner is not a quick and easy task. It takes some thought because the owner does not want to pay for the labor inefficiency cost, which can be substantial. Your best chance for success is to keep it simple. However, recovery is predicated on how well you show the cause-effect relationships. There must be a showing that what the owner or general contractor did, caused you to take
certain actions, and those actions resulted in labor inefficiencies. You had no other alternatives and the contract entitles you to recover the added cost. A cause-effect diagram like the one illustrated is Figure 7.3 may be helpful. In this case, the owner is late in obtaining a needed permit, which delays the start of the work. The owner accelerates the schedule by refusing to grant a time extension.

The indirect factors like changes or design deficiencies are the events that happen on the job. Make the connection between the indirect causes or events and the factors that actually cause labor inefficiencies, like lack of materials, out-of-sequence work, or rework.

Returning to Example 7.2, a cause-effect diagram is illustrated in Figure 7.4. Notice the simplicity of the presentation and how the causes of inefficiency are traced back to the failure of the owner to procure the necessary permits. In this situation, the owner reacted to the difficulties on the project in such a manner as to make the inefficiencies worse. These reactions are also shown in Figure 7.4. Figure 7.5 shows the work hour inefficiencies that occurred. Notice that in the first half of the project, the inefficiencies occur in groupings associated with the issuing of permits. This graphic clearly shows the link between inefficiencies and the lack of permits. The inefficiencies occur because of insufficient work to perform and moving to new locations. In the latter half of the project, the inefficiency patterns are different. These inefficiencies occur because of cleanup and tie-in issues and because removing work from the contract made it more difficult to maintain any orderly sequence to the work even on a daily basis.
WHAT TO DOCUMENT AND WHEN

The chronology about losses of efficiency and how monies were lost is not an easy story to reconstruct, especially after the fact. Therefore, it is imperative that the documentation of events and conditions is done as the project is in progress, not later.

Contractors should organize a project file containing correspondence and other documentation. Documents are needed to show adherence to the contract requirements and to establish the factual basis of the claim.

Organizing a Project File

The documents and records needed to support a claim for a loss of labor efficiency form part of the overall documentation that collectively is called the project file. McDonald (1989) cites the checklist of 10 essentials to include in the project file:

1. Estimating and bidding files. These files should include the original estimates and related backup sheets. There may be other information that is helpful to substantiate the validity of the estimate.
2. *Complete file of contract documents.* This file should contain the entire contract including addenda, change orders, and any correspondence related to contract negotiations.

3. *Cost records.* The week-by-week cost records should be maintained. Additionally, all documents related to requisitions, deliveries, and payments need to be filed.

4. *Schedules.* This portion of the file should include preliminary, original, updated, and revised schedules.

5. *Correspondence and similar documentation.* All correspondence, internal memoranda, notes of phone conversations, minutes of meetings, and other documents are crucial in establishing the proof of key events and the timing thereof. Many claims fail because of the inability to establish when certain events happened or that they happened at all.

6. *As-built data.* Files should be maintained of all daily reports, inspection reports, daily timesheets, job diaries, inspector’s and engineer’s reports, and so on. These records may be the only documentation of the conditions under which the work is done. The job diaries are par-
particularly important, and each foreman should maintain his or her own personal diary. It should be completed daily and include the nature and location of the work, quantities installed, visits and inspections, and relevant factors or events affecting the crew's performance.

7. **Standard form correspondence.** Files should be kept of phone conversations, RFIs, field clarifications, transmittals, and submittals. Maintaining transmittal, submittal, and changes logs should be a routing part of every contractor's operation.

8. **Subcontractor files.** While records of other contractor activities may seem irrelevant, there are times when it is important to be able to document their progress. Manning levels and the location of their workforce are important elements of information to substantiate out-of-sequence work or that the slow progress or interference of others affected your work.

9. **Photographic documentation.** Photographic records can be an important element of proving entitlement to a claim or to show that the conditions under which you worked were much different than you could have anticipated when you submitted your bid. However, the value of the photos is dependent on the care with which details are recorded. Photos should be used to substantiate disorderly material storage, random adherence to sequence by others, poor housekeeping, and other factors affecting the work. Panoramic “vacation-type” photographs are of limited value because of the absence of detail.

10. **Job completion documents.** This part of the job file should contain punchlists, certificates of substantial completion, certificates of occupancy or certificates of final acceptance. These documents and any protest you may file are important to show how others adhered to the contract documents in closing out the project. It should be noted that problems often occur with project closeout. From a contractual viewpoint, the warranty period begins when substantial completion is achieved, so establishing this date is important.

**Documentation**

There are two forms of documentation with each serving a specific purpose. The first involves correspondence and communication which are used to preserve contractual rights. This correspondence involves notice requirements, reserving rights to impact costs, responses to orally directed changes, and other forms of communication. Responses to orally directed changes and extra work are particularly important. Always make your position clear using language that is concise
and straight to the point. Avoid the use of “weasel words.” Specific language such as the following should be routinely incorporated:

*It is my understanding that on [date], you directed me to perform certain work that is not called for in the contract documents. [Describe the work.] Since this is beyond the scope of our work and is extra, I am expecting that a written change to the contract is forthcoming. If my understanding is incorrect, please advise me by [date]. Otherwise, I will proceed with this work under the assumption stated above.*

Other elements of the communication involve making positions clear through correspondence and minutes of meetings.

The second form of documentation establishes the factual basis of a claim. This task involves maintaining logs of changes, RFI s, submittals, and other relevant items. Photographs and videos can be very effective in substantiating a variety of conditions and circumstances.

**Correspondence and Communication**

The contract defines various obligations of the subcontractor. Therefore, it is imperative that you read the contract before a problem arises. If a dispute arises later, there will be no sympathy from a general contractor, owner, arbitrator, or judge if you have not read, understood, and complied with the contract.

**Notification of Possible Claim**

All contract requirements must be followed. First and foremost, contractors must comply with the notice requirements of the contract. The time limit for compliance varies, so a careful reading of the contract is necessary. The form of compliance should be a letter to the contract administrator or to the person designated in the contract. The letter should not be accusatory or hostile. Rather, it should state the facts as you know them and indicate that it may become necessary for you to submit a claim at a later date. Always cite the relevant contract language that you feel entitles you to an equitable adjustment. Whenever there is doubt, write a notice letter. This is the only way to preserve your rights. Sadly, there are many instances where failure to file notice has precluded an otherwise valid claim.

**Impact Costs**

One problem that arises relative to asserting a loss of labor efficiency is that there may be impact costs. Impact costs are often associated with changes, but they can occur in many other ways. These costs are very difficult to estimate. For instance, work may have been bid in the contract at 1.0 work hour per unit. A change may be priced and negotiated by the owner or prime contractor at 1.2 work hours per
unit. However, when the work is actually performed, it may take 1.7 work hours per unit. This additional 0.5 work hours per unit are impact costs and are often the result of rapidly deteriorating conditions at the site resulting in congestion, out-of-sequence work, and so on. These conditions may be difficult to foresee at the time the change proposal is made. On change proposals, reserve your rights to impact costs. Unless this is done, at a later date, you may not be able to assert entitlement to impact costs. How then do you reserve your right to impact costs when the change proposal says that 1.2 work hours per unit is the limit of entitlement? It is important that you not sign the change proposal unless you have added a statement that you reserve the right to file a claim at a later date for impact costs. Keep the owner and general contractor abreast of impact costs as you observe them. Understand that these costs may not become apparent until later in the project.

**Meeting Minutes**

The minutes of weekly progress meetings are an important project document. It is your responsibility to make sure it contains a fair and accurate record of difficulties affecting your work. Therefore, you must first go to these meetings prepared to discuss problems and with the willingness to support these with notes, dates, correspondence, logs, and so on. Minutes may also serve as a form of notice. Insist that minutes be published in a timely manner. Once minutes are published, read them carefully and offer corrections in writing of any misstatements of a factual nature. Unless this is done, the minutes may be accepted at a later time by an arbitration board as being accurate. Keep copies of all such correspondence in the project file related to the minutes.

**Documenting the Facts**

Contractors need to be judicious in how a claim is substantiated by the facts. It is imperative that one be able to establish who did what to whom and when it happened. Being able to do so can require many forms of documentation that are too numerous to list. However, a few suggestions may be helpful. Maintain up-to-date logs of submittals, change proposals, diaries, and other relevant data. These logs are an important source of information to establish a timeline of important events. Logs are an important source of factual information. These are simple records of when project documents are transmitted and received. The most common logs are of submittals and change proposals. Logs should include a unique numbering system for each record and should contain the dates of transmittal and receipt. Also, there should be a comment column to note conditions of acceptance or reasons for rejection. There should also be a cross-reference to any correspondence related to the log entry. The types of logs can be numerous and specific to a par-
Particular job. Other types of logs include telephone conversations, contractor directives, and a record of visitors.

PRICING AND TRACKING CHANGES

Changes are an integral part of any construction work. How these are priced and tracked can make the difference between being paid or not. Much has been written about pricing and tracking changes. The following briefly reviews some of the more important points as they relate to loss of labor efficiency.

Pricing Changes

Changes can vary widely in scope and timing. Changes can be additive, deductive, or have no impact on the construction work. Some may even be for the convenience of the contractor. It is important for the contractor to take the first change as seriously as the last change. Usually changes evolve as a number of small changes, and it is the cumulative effect that eventually leads to significant losses of labor efficiency. If the change is a large one, the impact can be anticipated. However, with small ones, the impacts will be gradual and may not be noticeable until near the end of the project.

Pricing the Conditions

There are three levels of estimating the labor hours needed for a change. These levels relate to differences in the environment in which the change is to be performed. For convenience, these levels are described as green, yellow, and red. These levels are analogous to normal, abnormal, and severe conditions.

Green (Conditions Normal)

When conditions are normal, conventional estimating techniques, manuals, and databases can be used. These resources can provide a reasonable estimate of the hours needed to perform the work.

Yellow (Conditions Abnormal)

Many factors can cause conditions to become abnormal or difficult. Among these are severe weather, congested conditions, rework, having to work in an operating environment, and others. Whenever one or more factors cause the conditions to change, conventional estimating methods will not be satisfactory because conventional methods are based on normal conditions. The most common way contractors handle abnormal conditions is to identify a number of impact factors. An
example of impact factors for one contractor performing electrical and mechanical work is included in Table 7.3. The estimated work hours determined from conventional estimating methods are multiplied times the appropriate impact factors. Generally, only one or two factors are applied to a single change. If multiple factors are present, then this method may lead to faulty estimates. Using these factors, contractors can usually arrive at a reasonable estimate. The problem, however, is that the owner does not want to pay for a change with what appears (to the owner) to be an “inflated” labor rate.

In Table 7.3, the conditions are rated and the total percentages are summed. The “normal” estimate is multiplied times the percentage to reach the final estimate. For example, suppose a change will be done where there will be congestion and stacking of trades. The percentage increase from Table 7.3 is 5%. Therefore, if under normal conditions, the change is estimated to require 375 work hours, then for the conditions described, the change should be estimated to take 375 (1.05) = 394. If materials can be located no closer than 250 ft, then the work hour estimate will increase to 375 (1.08) = 405.

**Red (Conditions Severe)**

Condition red is the most difficult situation for pricing changes because there are no methods for producing reliable estimates other than experience. In the red condition, the sequencing of the work and the project schedule is no longer followed. The schedule is usually accelerated and congestion, overtime, and overmanning are common.

The impacts on labor productivity are acute when conditions are severe, and it is unlikely that an owner or prime contractor would agree to such a change, even if a reliable estimate could be produced. Therefore, it is essential that in every change proposal, contractors reserve their rights to claim impact costs at a later date when actual costs are known. Two other aspects are important in the red or severe condition: (1) Keep the owner or general contractor fully informed of the factors affecting your work. Concentrate on the principal factors of sequencing, scheduling, congestion, overmanning, and so on. Keep a positive attitude in conveying these concerns. Try to be cooperative in getting the job finished without compromising your rights. Legal counsel may also be helpful. (2) Document additional cost as much as possible. Sadly, many claims fail because there is little to substantiate that the additional labor costs occurred because of factors beyond the contractor’s control. Photographs are invaluable for collaborating losses of labor efficiency. The photographs should be made for the specific purpose of documenting the conditions in which the work is done. In this regard, panoramic photographs are of limited value. Some forethought should be given to the content of photographs.
### Table 7.3 Impact Factors for Changed Work

<table>
<thead>
<tr>
<th>Impact Factor</th>
<th>Normal</th>
<th>Max Degree 2 (%)</th>
<th>Max Degree 3 (%)</th>
<th>Max Degree 4 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Temperatures</td>
<td>None 0</td>
<td>None 0</td>
<td>Above 90°F 2</td>
<td>Above 110°F 3</td>
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<tr>
<td>Design</td>
<td>Complete -2</td>
<td>Normal 0</td>
<td>Field Direct 10</td>
<td></td>
</tr>
<tr>
<td>Material Handling</td>
<td>100'–200' 1</td>
<td>200'–300' 3</td>
<td>300'–500' 5</td>
<td>500'–750' 8</td>
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<tr>
<td>Congestion</td>
<td>Clear and Open 0</td>
<td>&lt; 20 ft/person 5</td>
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<td></td>
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<tr>
<td>Height</td>
<td>0'–12' 0</td>
<td>12'–20' 1</td>
<td>20'–40' 3</td>
<td>40'–60' 5</td>
</tr>
<tr>
<td>Operating Environment</td>
<td>None 0</td>
<td>In Operation 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scenarios and Adjustments

- Max Degree Normal (%): None 0
- Max Degree 2 (%): Above 90°F 2
- Max Degree 3 (%): Above 110°F 3
- Max Degree 4 (%): Field Direct 10
Tracking Changes

Tracking changes begins before the first change is issued. It is important that all changes are tracked, even those you are not sure are changes and others for which the owner or prime contractor denies a change order.

Logs and files of correspondence, RFIs, and submittals should also be maintained. These should be kept in a file such that all correspondence and paperwork associated with a particular change should be kept in a single folder. The filing system should anticipate that certain changes will not be made or will be denied. Others may be combined into a single larger one so the filing system must be flexible.

Changes File

A changes file should be maintained for every known or contemplated change. This file consists of a folder for each potential change. The folder should be labeled according to a unique numbering system. The folder should contain all worksheets, diaries, notes, quotations, invoices, observations, estimates, photographs, correspondence, schedules, sketches, drawings, and anything else that relates to the change.

Changes Log

A log should be maintained that tracks the dates of transmission of change proposals, responses, change orders, and other related correspondence. At a later time, these dates may be important in establishing the project timeline. Similar logs should be maintained for RFIs and submittals.

OWNER AND DESIGNER EDUCATION

The owner, designer, and general contractor must be informed early in the process that labor productivity is being affected. It is important that these communications not be threatening or accusatory, but rather, state the facts as you know them.

Preconstruction Actions

Effective preconditioning of the owner, designer, and general contractor requires that the specialty contractor present a positive and constructive attitude. Professionalism is important to maintain open lines of communication, and open communication begins at the outset. Before construction work begins, contractors should do the following:
Establish contractual lines of communication. For each of the primary parties, identify the person who has the authority to make things happen. Always follow the command chain. If you cannot get satisfactory resolution from the next person up the chain, request a meeting where all relevant persons are in attendance.

Determine the time schedule for submittals. Many jobs start on the wrong foot because the submittals are not submitted or reviewed in a timely manner. An overall time schedule should be established for various submittals, and all relevant parties, including the owner, should agree upon this schedule. Make sure submittals are submitted promptly and as thoroughly as practical. Do not let yourself be blamed for delays in the submittal process.

Involve the owner in the submittal process. It is in everybody’s interest to have submittals reviewed thoroughly and returned promptly. The owner should be keenly aware of and monitor this process, and it should be discussed at all weekly progress meetings until the reviews are complete.

Communicate a summary of logs to the owner. The owner should routinely be advised of the status of submittals, changes, and RFIs. Periodic meetings should be held as needed with all affected parties just to discuss these issues.

Construction Execution

During the construction phase, contractors should do the following:

Keep lines of communication open. Communication with the general contractor and owner is very important. Make sure that the owner becomes a participant in all important meetings. Make sure the minutes of meetings are accurate, and keep correspondence professional and factually correct at all times.

Use linear scheduling. CPM schedules are very detailed and can be difficult to follow. A problem that occurs frequently, especially on commercial and institutional projects is that the sequencing of the work becomes inefficient. That is, instead of the work progressing from one floor to the next, work progresses on all floors simultaneously and the completion of the project is not orderly. This situation is not easy to show visually using CPM, but it can be readily seen using linear scheduling methods. Use this graphical scheduling method to show owners how the work is out of sequence and explain how this impairs labor efficiency. Figure 7.6 is an example of a planned sequence for a
five-story building. Four activities are shown. As can be seen, work is planned to progress from one floor to the next in an orderly progression, and completion of the work occurs in a sequential manner.

- Consider using outside consultants. When jobs become chaotic, short-range planning suffers. The conditions gradually deteriorate, and the symptoms of planning deficiencies begin to appear. While these symptoms can easily escape the contractor’s notice, they are readily obvious to the trained eye. Outside consultants can identify conditions related to the work that, if removed, can make the work more efficient and minimize the potential economic losses. If a report is prepared, it can be used to convince the owner that labor inefficiencies actually occurred. Such reports are much more effective if done during the course of the work rather than later when a claim has been filed. If receptive, engage the owner as a participant.

Post-Construction

Once the project is finished, there is little that can be done to educate the owner aside from an effective claim presentation, which is discussed in the next section. However, throughout the post-construction period, contractors should be responsive to inquiries by the owner and should always be courteous and professional.

CLAIM PRESENTATION PRINCIPLES

An effective negotiation session and claim presentation should follow certain principles. The principles cited below are general and each claim will be unique.
The next section is a case study that illustrates how this uniqueness can be expressed.

**General Principles**

A positive attitude is important to convey to the owner that it is economically advantageous to the owner to settle the claim because you, the specialty contractor, are going to prevail if the dispute goes further. Obviously, this is no time to try to bluff your way to settlement. How you present the facts will convey the strength of your position. Therefore, you must go to the core issues that are the strength of your claim. These issues should be relatively few and logical. Also, be sure to remove emotion from the negotiations. In preparing for the claim presentation and negotiating session, it may be helpful to identify the person on the other side that seems to understand the facts and is understanding of your position. If you can convince that person, he or she may be able to convince the others.

Lastly, where possible make use of previous court cases that support your entitlement to damages. The circumstances should be similar to your situation. The cases need not be from your own trade, since the contract language and surrounding circumstances are what is important, not what is being built.

**Presentation Principles**

In making the actual claim presentation and in subsequent negotiations, it is essential to establish cause-effect relationships. There must be a showing of what the owner or general contractor did, how that changed your work, how you responded, and how and why the situation resulted in the less efficient use of labor resources. If you cannot establish cause-effect relationships, you have little or no chance to recover monetary damages. Instead, it will appear as if you are merely complaining.

The presentation must be factually correct and logical. It should be free from superfluous facts and issues. The entire purpose of the presentation is to tell a story. The presentation needs to be a “Dick and Jane” story. It should focus only on relevant facts and circumstances and should concentrate on the core issues. Above all, it must be presented logically and it must be straightforward and simple.

The person with the authority to agree to a settlement probably was not intricately involved with the project. This person will not be able to easily follow a detailed presentation, especially if the facts are not central to the claim. The claim presentation should follow these principles:

- The presentation should be supported with documents such as letters, logs, minutes of meetings, and photographs. Highlight the relevant parts of documents so others can readily find them. Be conscious of
information overload. Too much information will only make the timeline difficult to follow.

- Supplement the presentation with simple charts, graphs, and summaries. These should be your own, since project documents are often too detailed to follow. Graphs and charts should summarize important facts and leave out unnecessary details.

- Give careful consideration in selecting the person to make the presentation. Quite often, a person closely involved with the project is not a good choice because their emotions may come across too strongly. Further, the tendency to elaborate and provide irrelevant details may be too great for the presentation to be effective.

- When conducting the meeting, follow a prepared agenda. This is your meeting and you should be in charge. Avoid discussing items that will be discussed later in the meeting.

**Negotiating Principles**

Negotiations need not be intimidating provided several principles are followed to avoid a confrontational environment. Anderson (1992) outlines four points dealing with elements of negotiation:

1. *Separate people from the problem.* It is necessary to separate the substantive elements of the claim from personalities and the relationship between the parties. Personal attacks will make it difficult to reach any kind of equitable settlement.

2. *Focus on interests, not positions.* It is easy for egos to replace the interests of the parties. The result is that the positions of the parties can mask what the participants really want or need. It is often more effective to focus on the underlying need to be made whole, which is the real cause for the company taking a certain position.

3. *Maintain flexibility.* It is difficult to arrive at satisfactory settlements under pressure and in the presence of an adversary. Keep an open mind as to settlement options, and know your flexibility prior to the negotiating session.

4. *Insist on objective criteria.* Discuss the conditions of the negotiation in terms of the language of the contract. By doing so, neither party needs to give in to the other, and both parties defer to the fair and equitable solution established in the contract.

Preparation for negotiation is also important. Following are several rules to follow that can increase the likelihood of a successful negotiation:
Do your homework. This involves hard work and discipline to understand all the facts and focus on the core issues.

Go to the top. You must hold discussions with persons who are authorized to make an equitable adjustment. Do not rely on someone else’s ability to communicate the story on your behalf. In addition, dealing with others who cannot make contract adjustments lessens accountability and may hinder the proceedings.

Avoid quick concessions. Make concessions only after considering all the issues and risks.

Accentuate the positive. By framing negative points in a positive way, you will be more likely to elicit a positive response. Couching controversial issues between positive points increases your chances of getting others to listen and agree with you.

Maintain your composure. Keep the discussion on the facts without getting personal. Make sure all statements made contribute positively to a desirable outcome.

CASE STUDY

In this section, a case study of an actual arbitration is presented where an electrical contractor brought the arbitration action against the general contractor. The purpose of this case study is to illustrate how you may create documents to tell the story of lost labor efficiency and how to establish cause-effect relationships. In the case study, labor inefficiencies were calculated following the methodology explained in Chapter 4. Therefore, how the calculations were made is not explained herein.

Project Description

This project involved the renovation and construction of a federal courthouse in the northeastern United States. The existing facility was a five-story building constructed in a U-shaped configuration. In the open area called the infill area, the height of the existing building was two stories. Storage areas for construction materials were very limited.

The construction work involved the demolition of all floors, leaving intact the structural frame, which was reinforced concrete. Some asbestos was present but played no role in the ensuing electrical claim. The infill area received a new five-story structural steel frame. This work consisted of erecting approximately 200 to 250 pieces of steel, an activity that should have taken two to three weeks. When completed, there was no longer a vacant infill area. New concrete floors were con-
structed, and all remaining work was consistent with the construction of a new facility.

The electrical contractor’s rough-in work was integrated with that of the framing and drywall contractor. The millwork contractor followed the drywall work. The millwork was most detailed on the top three floors where the larger courtrooms were located. The paneling was rather expensive, and some of the finish work, including finish electrical, could not proceed until the millwork was finished. The electrical fixtures in the courtrooms were also very expensive. These could not be installed until all other work was completed. Other elements of the work, like the sound system, could not be tested until all work was completed. Therefore, the electrical contractor’s work depended on other contractors performing their work in an orderly and timely manner.

**Basis of Claim (Core Issues)**

The work of the electrical contractor was impacted because various specialty contractors were late in performing their work, and when performed, it was done out of sequence and not prosecuted aggressively. Work was not completed on a particular floor before proceeding to the next. Thus, the electrical contractor was forced to complete all its work in the last few months of the project. Thus, the core issues in this dispute are as follows:

- The general contractor did not manage the subcontracts by allowing the steel erection, framing and drywall, and millwork contractors to work at a leisurely pace.
- The general contractor did not manage the project schedule by allowing the framing/drywall and millwork contractors to work in random locations rather than follow the floor-by-floor sequence established by the CPM schedule.

**Compartmentalize the Analysis**

A careful examination of the progress of the work indicated that the work evolved through four phases. Dividing a project into phases is an effective way to compartmentalize the discussion and, thus, simplify the telling of the story. This makes it easier for owners and arbitrators to understand. The various phases should be logically selected based on the conditions in which the work was performed and how the work was made available to the electrical contractor. In this case study, four phases were identified. These are summarized in Table 7.4 and shown graphically in Figure 7.7. Figure 7.7 shows the four phases in a diagram developed following the methodology explained in Chapter 4 where the actual and normal weekly
By partitioning the project into these four phases, specific events can be limited to a particular phase, thus keeping the discussion focused on the core issues. The factors affecting labor efficiency were different in each phase. Table 7.5 summarizes the factors that affected labor efficiency during each phase. In this case study, the lengthy details are reduced to a few causes that can be readily understood.

**Presentation and Arbitration Exhibits**

The presentation during the arbitration proceedings was done by the phases listed in Table 7.4. The actual exhibits consisted on a collection of slides that explained the major issues. These exhibits were organized by phase and cover key events, nature of the work, causes of labor inefficiency, and the numerical estimate of inefficiencies. In this chapter, we have summarized those exhibits into Tables 7.6 to 7.12 and Figures 7.7 to 7.9.

In these exhibits the facts are condensed to only the essential matters that relate to the core issue, which is that the general contractor did not effectively manage the subcontracts or the project schedule. Contractually, this is the basis for the claim. Compartmentalizing and condensing facts is consistent with telling a "Dick and Jane" story. Notice also that the graphics are simple. Simplicity means

### Table 7.4 Definition of Case Study Project Phases

<table>
<thead>
<tr>
<th>Phase</th>
<th>Dates</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sept. 4, Year 1–Dec. 31, Year 1</td>
<td>Steel Erection Delay: The infill steel erection was delayed by five months.</td>
</tr>
<tr>
<td>2</td>
<td>Jan. 1, Year 2–Apr. 29, Year 2</td>
<td>Framing-Rough-in-Drywall Sequencing: Infill steel was completed opening up significant areas of work. Rough-in electrical was sandwiched between framing and drywall.</td>
</tr>
<tr>
<td>3</td>
<td>Apr. 30, Year 2–Sept. 9, Year 2</td>
<td>Millwork Delay: The millwork contractor worked at a slow pace and out of sequence. He worked on all floors simultaneously and did not finish any single floor until the latter part of August, Year 2. The electrical contractor could do nothing but wait.</td>
</tr>
<tr>
<td>4</td>
<td>Sept. 10, Year 2–Nov. 4, Year 2</td>
<td>Rush to Completion: All other contractors completed their work and left the area to the electrical contractor. The fixtures, much of the finish electrical, and testing of various systems were completed in about five to six weeks.</td>
</tr>
</tbody>
</table>
that there is no need for elaborate verbal explanations that would make compre-
hension more difficult.

In this case there are two core issues as shown in Figure 7.8. This figure also
illustrates why the contractor is entitled to additional expenses associated with
inefficient management by the general contractor.

Phase 1

The discussion of Phase 1 is covered in Table 7.6. There are only five key events,
but these are sufficient to explain the effect that late steel erection had on the
framing and rough-in electrical. The nature of work performed is explained con-
sidering that the infill area was off limits. Finally, the causes of labor inefficiencies

Table 7.5 Factors Affecting Labor Efficiency by Phase

<table>
<thead>
<tr>
<th>Phase</th>
<th>Factors Affecting Labor Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Piecemeal and out-of-sequence work</td>
</tr>
<tr>
<td>2</td>
<td>Interference with framing and drywall contractors requiring inefficient methods</td>
</tr>
<tr>
<td>3</td>
<td>Little work available to perform; piecemeal work</td>
</tr>
<tr>
<td>4</td>
<td>Intense acceleration, overmanning, overcrowding, and out-of-sequence work</td>
</tr>
</tbody>
</table>

Figure 7.7 Case study project phases.

Table 7.5 Factors Affecting Labor Efficiency by Phase
are mainly piecemeal and out-of-sequence work. Notice how Table 7.6 reduces the facts to an essential few. It details the causes that are beyond the contractor's control, summarizes the contractor's response, and indicates the effects in descriptive terms. The story is simple and logical, and it has the essential elements of cause-effect. It is easy for an owner or arbitrator to understand.

Phase 2

The information for this phase follows the same pattern as for Phase 1. The primary difference is that Phase 2 is more easily divided into three subphases, even though all the work is included in Phase 2 because the factors affecting efficiency, as shown on Table 7.5, are the same. Subphases are defined because it is easier to convey how the conditions on the top two floors affected the work more severely than the conditions on the lower floors. The most complicated courtroom work occurred on the top two floors.

- **Phase 2a.** Table 7.7 describes Phase 2a, which encompassed from January 14, Year 2 to February 11, Year 2. Little is made of the fact that the framing contractor worked for four or five months without a signed contract and appeared to have been given preferential treatment. This fact could not be substantiated, and such allegations would
potentially become personal and would deflect attention away from
the core issues. During Phase 2a, the work performed was primarily
on the top two floors. Table 7.7 explains how being “short tethered” to
the framing operation caused the electrical contractor to use ineffi-
cient methods.

- **Phase 2b.** The key events, nature of the work, and causes of ineffi-
ciency are summarized in Table 7.8. This subphase went from
February 12, Year 2 to March 25, Year 2. The work was largely on the
second and third floors where the work was more efficient than on the
fourth and fifth floors.

- **Phase 2c.** In this phase that ran from March 26, Year 2 to April 29, Year
2, the electrical contractor began to run out of work. Workers were
sent back to the less-efficient fifth floor to complete more work, but
overall, the finish electric work could not be performed because the
millwork subcontractor had not completed work on any single floor.
Table 7.9 summarizes this phase.

Figure 7.9 summarizes the relationship between labor inefficiencies and the
floor on which the work was performed.

---

Table 7.6 Relevant Facts for Phase 1

<table>
<thead>
<tr>
<th>Key Events</th>
<th>Nature of Work</th>
<th>Causes of Labor Inefficiency (Electrical Sub)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel erection subcontractor does not complete steel until December, Year 2.</td>
<td>All the work by framing and electrical subcontractors done in the existing structure.</td>
<td>The work is piecemeal. There is limited production work. Systems that integrate or occupy the existing building and infield cannot be done.</td>
</tr>
<tr>
<td>Framing/drywall subcontractor does not sign contract with the general contractor.</td>
<td>Electrical sub increases manpower faster than would normally be expected in order to meet the original schedule.</td>
<td>Limited work in individual rooms is done.</td>
</tr>
<tr>
<td>Framing/drywall subcontractor mans job, but with few workers.</td>
<td>Much of the work by framing sub involves layout of wall track. Little or no framing is done.</td>
<td>The work is done out of sequence.</td>
</tr>
<tr>
<td>Project schedule slips weekly.</td>
<td>Electrical work in existing building is limited.</td>
<td></td>
</tr>
<tr>
<td>Pressure mounts to make substantial progress.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Samples Chapter
Phase 3

This phase is presented in Table 7.10. Most of this phase was spent in performing finish electric work when available. The work was severely strained because the millwork subcontractor did not prosecute the work aggressively or in the manner laid out in the CPM schedule. Figure 7.10 shows the worker days per week for the millwork contractor by floor. The figure shows that work progressed on all floors simultaneously, and that the work on all floors was completed at essentially the same time. This simple graphic effectively drove home the point that the general contractor allowed the work to be randomly performed to the detriment of the electrical contractor. Project photographs show clearly how completed areas were used by other specialty contractors to store materials, thus denying the electrical contractor access. These photographs are not shown in this chapter.

Table 7.7 Relevant Facts for Phase 2a

<table>
<thead>
<tr>
<th>Key Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recovery schedule implemented.</td>
</tr>
<tr>
<td>The order of completing the floors is reversed.</td>
</tr>
<tr>
<td>Infield area available in early January.</td>
</tr>
<tr>
<td>Framing subcontractor signs contract with general contractor in February.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nature of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Framing subcontractor begins both framing and drywall on the 5th and 4th floors.</td>
</tr>
<tr>
<td>Drywall closely follows framing forcing electrical contractor to be &quot;short tethered&quot; to framing contractor.</td>
</tr>
<tr>
<td>Framing contractor sequence is walls, then ceilings, instead of room to room.</td>
</tr>
<tr>
<td>Electrical contractor uses inefficient sequence because walls and ceilings not done together. Revisits to a room are required.</td>
</tr>
<tr>
<td>Work on 4th and 5th floors is very disruptive.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Causes of Labor Inefficiency (Electrical Sub)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical contractor must accelerate its work and perform rough-in between framing and drywall.</td>
</tr>
<tr>
<td>Work must be done in the order and pace established by framing contractor.</td>
</tr>
<tr>
<td>Work is done in a very inefficient sequence because of the lack of framing and ceiling coordination and drywall leaves no room to maneuver.</td>
</tr>
</tbody>
</table>
### Table 7.8 Relevant Facts for Phase 2b

<table>
<thead>
<tr>
<th>Key Events</th>
<th>Nature of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Framing effort by framing contractor shifts from the 4th and 5th floors to the 2nd and 3rd floors.</td>
<td>Drywall lags sufficiently behind framing to allow electrical contractor to work more efficiently.</td>
</tr>
<tr>
<td>When rough-in work is complete on the 4th and 5th floors, electrical contractor sends electricians to 2nd and 3rd floors.</td>
<td>Wall and ceiling coordination less of a problem.</td>
</tr>
<tr>
<td>Drywall work shifts to 2nd and 3rd floors when work on 4th and 5th floors is complete.</td>
<td>Overall, 2nd and 3rd floors less disruptive than 4th and 5th floors because electrical contractor has a short tether to framing contractor.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Causes of Labor Inefficiency (Electrical Sub)</th>
<th>Lack of wall and ceiling coordination means that electrical contractor must make multiple visits to many of the rooms.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The sequence of work is inefficient.</td>
</tr>
<tr>
<td></td>
<td>Efficiency improves when not working on the 4th and 5th floors.</td>
</tr>
</tbody>
</table>

### Table 7.9 Relevant Facts for Phase 2c

<table>
<thead>
<tr>
<th>Key Events</th>
<th>Nature of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed signals regarding the schedule.</td>
<td>Having completed work on 3rd floor, electrical contractor sends electricians back to the 5th floor.</td>
</tr>
<tr>
<td>Substantial completion expected by the end of July.</td>
<td>By the end of March, electrical contractor begins to run out of work because the rough-in is being completed, but millwork contractor has not completed millwork on any floor.</td>
</tr>
<tr>
<td>Drywall/plaster to finish on time.</td>
<td>By April 29, rough-in is substantially complete on all but the 1st floor.</td>
</tr>
<tr>
<td>Concerns over coordination of some trades.</td>
<td></td>
</tr>
<tr>
<td>Concerns over submittals and material delays.</td>
<td></td>
</tr>
<tr>
<td>Concerns over letting things slip.</td>
<td></td>
</tr>
<tr>
<td>Start of terrazzo delayed.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Causes of Labor Inefficiency (Electrical Sub)</th>
<th>Electricians return to the inefficient environment on the 5th floor.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On the other floors, there is less and less work available.</td>
</tr>
</tbody>
</table>
Phase 4

During Phase 4, intense acceleration occurred. This phase is outlined in Table 7.11. Most of the inefficient work hours on the project were incurred during this phase.

Table 7.10 Relevant Facts for Phase 3

<table>
<thead>
<tr>
<th>Key Events</th>
<th>Nature of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early July, general contractor warns all specialty contractors of not meeting schedule.</td>
<td>Finish work stretches on and on.</td>
</tr>
<tr>
<td>Terrazzo falls behind schedule.</td>
<td>Millwork contractor’s work never seems to end and is in progress on all floors.</td>
</tr>
<tr>
<td>CPM schedule updated infrequently.</td>
<td>Electrical contractor must wait for millwork contractor to finish.</td>
</tr>
<tr>
<td>Schedule continues to slip.</td>
<td>Electrical contractor reduces work hours and responds when work becomes available.</td>
</tr>
</tbody>
</table>

Figure 7.9 Relationship between inefficiency and location during Phase 2.
Figure 7.10 Worker days per week for millwork contractors.

Table 7.11 Relevant Facts for Phase 4

<table>
<thead>
<tr>
<th>Key Events</th>
<th>Pressure to achieve Oct. 10 substantial completion date.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Completion schedule slips.</td>
</tr>
<tr>
<td></td>
<td>Substantial completion achieved in November.</td>
</tr>
<tr>
<td>Nature of Work</td>
<td>Electrical contractor installs fixtures and devices, completes systems such as fire alarm and courtroom sound, and works on punchlist items.</td>
</tr>
<tr>
<td></td>
<td>Most of electrical contractor's work requires all other work to have been completed.</td>
</tr>
<tr>
<td></td>
<td>To achieve substantial completion, electrical contractor increases his/her workforce to a high of 23.</td>
</tr>
<tr>
<td>Causes of Labor Inefficiency (Electrical Sub)</td>
<td>Intense acceleration.</td>
</tr>
<tr>
<td></td>
<td>Overcrowding and stacking of trades.</td>
</tr>
<tr>
<td></td>
<td>Disorderly process with little time to plan the work.</td>
</tr>
</tbody>
</table>
Finally, Table 7.12 summarizes the labor inefficiencies on the total project. It is estimated that the electrical contractor incurred a loss of 6,581 work hours, or a loss of efficiency of 43%.

**Synopsis of Presentation Exhibits**

The exhibits summarized in this chapter were used in an actual arbitration against the general contractor. The exhibits and presentation followed a number of important principles. These are briefly explained in the following.

The presentation tells a simple “Dick and Jane” story. The facts are condensed only to those that are relevant. Simplicity is also shown in how the events are related to a very few causes of lost efficiency, primarily piecemeal and out-of-sequence work, inefficient methods, and acceleration that resulted in congestion and stacking of trades. The presentation exhibits contain no complaining or personal assertions about the general contractor. It is both professional and factual. An important source of the factual information was the minutes of the progress meetings. Therefore, the facts were not in dispute.

If there is no showing of a cause-effect relationship, then the likelihood of recovery is minimal. The exhibits show this relationship by detailing key factual events and showing how these events affected the contractor’s work. The electrical contractor’s work was forced to be out of sequence and piecemeal. Inefficient methods were used, and in the last phase, stacking of trades and overmanning were significant factors. Notice how numerous detailed facts have now been related to a few causes of inefficiency. Owners and arbitrators can readily understand how these conditions affect efficiency. If not, experts can explain the effects and support their conclusions with data from literature and actual projects.

Lastly, the exhibits are simple and straightforward. They do not contain excessive information and are easy to comprehend. A copy of the exhibits can be provided to the owner or arbitrator, allowing notes to be taken thereon. They can be reviewed at a later time.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Total Work Hours</th>
<th>Inefficient Work Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3,517</td>
<td>1,664</td>
</tr>
<tr>
<td>2</td>
<td>7,617</td>
<td>2,153</td>
</tr>
<tr>
<td>3</td>
<td>6,710</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>4,090</td>
<td>2,764</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>21,934</strong></td>
<td><strong>6,581</strong></td>
</tr>
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CONCLUSIONS

When negotiating compensation for loss of labor efficiency, the recommendations provided in this chapter should enhance the likelihood of recovering the additional labor costs. When presenting a claim, the emphasis should be on educating the owner or general contractor as to the causes and consequences of labor inefficiencies and on establishing cause-effect relationships to substantiate the labor overrun.

The presentation should tell a simple story limited to the relevant facts. The facts should be properly documented. No complaints or personal assertions about the general contractor or the owner should be included, as the objective should always be to generate a professional and factual case.