CHAPTER FIVE

THE PROJECT SCHEDULE
HERE’S WHAT YOU’LL LEARN

• Primary reasons for scheduling the project
• Ten characteristics of a good schedule
• Common scheduling techniques used by design firms
• When to use milestone charts
• How and when to use bar charts
• The Critical Path Method (CPM) of planning and scheduling
• Definition of CPM terms
• CPM equations
• The full-wall scheduling technique
• Which scheduling technique is best?
• Using the schedule to stay out of trouble
• Five pitfalls to avoid in preparing project schedules
BACKGROUND
The task outline section of the project management plan has been completed, and the team is convinced that it covers the scope of services in the contract. In addition, the various tasks have been or need to be planned—sequenced in the most efficient order for completion by the team members, and also reflecting the priorities of the client and the firm.

As the team continues the development of the plan, schedule, and budget, it is important to remember the three basic levels of project control. In many ways, these levels will define the detail presented in the project schedule. To review:

Level 1 (usually called the milestone level) is the least detailed and consists of measurable milestones that are scheduled for completion by certain dates throughout the project. The purpose of a Level 1 schedule is to establish a framework upon which to base a more detailed breakdown of due dates. Level 1 schedules are usually submitted in the proposal and are always monitored by the principal-in-charge and client in order to ensure that the project is on track.

Level 2 is a more detailed breakdown of the tasks and activities that must be completed to achieve the various milestones. It is often in the form of a bar chart, although on more complex projects it may be developed using computer-scheduling programs. It is put together by the project team and is used routinely by the project manager in order to schedule and track the activities of each project team member.

Level 3 is usually focused on completing the individual deliverables within a specific task. These schedules are in the form of either detailed bar charts or network diagrams. Each project team member creates Level 3 schedules to monitor the detailed activities and meet his or her commitments to the project.
The following provides a graphical representation of these three levels:

### LEVELS OF PROJECT CONTROL

<table>
<thead>
<tr>
<th>LEVEL 1 MILESTONES</th>
<th>LEVEL 2 PROJECT CONTROL</th>
<th>LEVEL 3 DELIVERABLE CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept Design</td>
<td>Architectural</td>
<td>S-101 Fndn Plan 1</td>
</tr>
<tr>
<td>Preliminary Design</td>
<td>Structural</td>
<td>S-102 Fndn Plan 2</td>
</tr>
<tr>
<td>Detail Design</td>
<td>Civil</td>
<td>S-103 Fndn Plan 3</td>
</tr>
<tr>
<td>Bidding</td>
<td>Mechanical</td>
<td>S-104 Fndn Plan 4</td>
</tr>
<tr>
<td>Construction</td>
<td>Electrical</td>
<td>S-105 Fndn Plan 5</td>
</tr>
<tr>
<td>Commissioning</td>
<td>Plumbing</td>
<td>S-106 Fndn Plan 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S-107 Fndn Plan 7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S-108 Fndn Plan 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S-109 Fndn Plan 9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S-110 Fndn Plan 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Specifications</td>
</tr>
</tbody>
</table>

### PRIMARY REASONS FOR SCHEDULING THE PROJECT

Is it really critical that the project have a schedule? Most clients and design firms will probably answer the question with “You must be kidding! Of course you need a schedule. It’s usually part of the proposal.” Here are some of the more important reasons that schedules are developed:

1. **First and foremost—to get the project done on time**
   Without a schedule, it gets done when it gets done. Not at all acceptable at any time—certainly not in today’s business environment.

2. **To serve as the foundation for cash flow plans for the firm**
   The project schedule defines when the firm is using cash and when payments should be received. If possible, the firm should relate the cash flow plan to the start and completion of schedule milestones in order to accelerate payments and facilitate client financing of the project.

3. **To indicate specific time periods for resource requirements**
   The completion of specific tasks by people with defined skills over a certain time period is a natural outcome of the project schedule. Without this information, the project manager cannot make the most efficient use of the staff assigned to complete the work.
4. To establish individual time schedules
It is important to know that a particular project needs a civil engineer during the first week in March. It is more important for the project manager and the specific individual to know the name of the civil engineer.

5. To enhance communication among all project participants
A well-formulated schedule paints an excellent picture of how the project will be completed over time. It enhances communication among the project manager, the client, and the management of the design firm.

TEN CHARACTERISTICS OF A GOOD SCHEDULE
Regardless of the scheduling system or the project, a number of specific attributes are found in many a good schedule.

1. It’s easily communicated
Those who are doing the work must understand what the schedule is all about. If none of your team has ever seen a Critical Path Method Diagram (CPM), the last thing you want to do is use a CPM as your scheduling method. In general, schedules that are in a graphic format are most easily communicated.

2. It’s flexible
Schedules change. It’s a fact of project life. No matter what you say or do, a high percentage of your schedules are going to change. Hopefully, these schedules will not change as a result of mistakes that you make, but they will change, nonetheless.

3. It has the commitment of the project team
If you tell a team member that he or she must have a task finished by Wednesday, that team member must agree to get it done and believe that the task can be done under that time constraint. Otherwise, the team member won’t feel committed to the schedule and may not feel compelled to meet it.

4. It shows interrelationships among tasks very clearly
Tasks are never done in isolation, and most rely on information or results from a previous or concurrent task or group of tasks. Your schedule must show how these tasks interrelate.
5. It’s prepared in calendar time, not in number of work days
To illustrate this point, try to determine the date, within a day or two, that is 60 work days from today. Now, see how much easier it is to determine the date that is 60 calendar days from today. Everyone thinks in terms of calendar time, so use it when preparing your schedules.

6. It forces early deadlines
Tasks will generally expand to fill the available time. If your deadline is July 31, you can count on your office to be humming at 11:59 p.m. on July 30, as everyone scrambles to finalize last-minute changes. The same thing would happen if the deadline were July 20 or August 10. Set the clock ahead, and give yourself some extra time to clean up loose ends.

7. It allows for revision time following each review
Revisions follow reviews like night follows day; however, most project managers schedule time only for the reviews, not the revisions.

8. It builds in time for slippage
Plan for time, or even several periods of time, within the schedule when absolutely nothing is scheduled. Use that time to catch up on those tasks that have fallen behind. If your schedule is so tight that you cannot find any slippage time, use the weekends. Do not schedule any activities for Saturdays and Sundays, and use them instead to catch up when you fall behind.

9. It has correlation with other projects assigned to the team
The single biggest influence on the schedule of your project is the workload from other projects that are currently in your unit/team. If you prepare your schedule in isolation from other projects of the unit/team, it is, most likely, going to fail.

10. It extends beyond the due date of the contract
There will always be activities that extend or arise beyond the contractual due date. Your client will want to ask you questions, contractors will call you, and summary meetings will be held. Anticipate these activities and build them into your schedule.
COMMON SCHEDULING TECHNIQUES USED BY DESIGN FIRMS

Most design firms have adopted some type of standard scheduling program for use on their projects. Many firms are using computer software to assist the project team during the initial stages of the project to plan, schedule, and budget the work. Most computer programs (e.g., Microsoft Project®, Primavera, etc) are easily adaptable to even the smallest projects but have capability for handling the more complex ones, too. Whether created by a computer program, typed, or drafted manually, most projects can be effectively scheduled using one or a combination of the following four methods:

- Milestone charts
- Bar charts
- Critical Path Method (CPM) techniques
- Full-wall scheduling techniques

WHEN TO USE MILESTONE CHARTS

This is the very simplest form of schedule technique used by design firms. It commonly lists the task, the responsible person, the deadline date, and the actual completion date. Using the task outline you have prepared, simply select the completion of the major tasks, assign individual responsibility and a deadline for completion, and you have a milestone chart. Better still, call a meeting of the team and have team members develop a milestone list with you.

Milestone charts are simple, quick, and easy to do. They keep your team focused on major deadlines, and they are best suited for short projects with only a few participants.

Milestone charts fall short because they do not create a graphical “picture” of the milestones against calendar dates. In addition, they give no indication as to when a task should begin in order to make sure it is completed by the deadline date. Milestone charts do not indicate the various interdependencies that might exist among the individual tasks.

There is always a need for this type of scheduling technique, even on more complex projects. Milestone charts can be used to summarize the tasks in more detailed scheduling techniques such as CPM programs. The milestone chart—or summary level schedule—provides the client and senior management with the “big picture” of a project in progress. Here is a sample milestone chart showing actual completion of some tasks:
HOW AND WHEN TO USE BAR CHARTS

Some of the shortcomings of the milestone chart can be overcome by using a technique that is slightly more complex. Bar charts, also known as Gantt charts, are easy to prepare and have the added appeal of being graphic; they present the completion of activities against calendar time frames. In addition, a bar chart indicates the expected start dates for each task, which was lacking in the milestone chart.

Bar charts are perhaps the most widely used scheduling techniques. The chart is created on a sheet divided into a horizontal and vertical grid. Tasks are listed down the left-hand column, and the horizontal axis is a time scale. A series of horizontal bars indicate the start, duration, and finish of each task.

The single most obvious shortcomings of bar charts is that they do not reflect any interrelationships and dependencies among the various tasks, nor do they give any indication of which tasks might be the most important for completing the project on schedule.

<table>
<thead>
<tr>
<th>TASK</th>
<th>STAFF</th>
<th>DEADLINE</th>
<th>ACTUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gather field data</td>
<td>STL</td>
<td>2/28</td>
<td>3/4</td>
</tr>
<tr>
<td>2. Programming</td>
<td>BGM</td>
<td>2/28</td>
<td>3/1</td>
</tr>
<tr>
<td>3. Preliminary design</td>
<td>BGM</td>
<td>4/15</td>
<td></td>
</tr>
<tr>
<td>4. Preliminary cost estimate</td>
<td>STL</td>
<td>4/30</td>
<td></td>
</tr>
<tr>
<td>5. QA/QC review</td>
<td>QAS</td>
<td>5/2</td>
<td></td>
</tr>
<tr>
<td>6. Client review</td>
<td>STL</td>
<td>5/7</td>
<td></td>
</tr>
<tr>
<td>7. Design development</td>
<td>BGM</td>
<td>6/28</td>
<td></td>
</tr>
<tr>
<td>8. Production drawing</td>
<td>DKR</td>
<td>8/6</td>
<td></td>
</tr>
<tr>
<td>9. Final cost estimate</td>
<td>STL</td>
<td>8/15</td>
<td></td>
</tr>
<tr>
<td>10. Final specifications</td>
<td>WJS</td>
<td>8/15</td>
<td></td>
</tr>
<tr>
<td>11. QA review</td>
<td>QAS</td>
<td>8/16</td>
<td></td>
</tr>
<tr>
<td>12. Client review</td>
<td>STL</td>
<td>9/7</td>
<td></td>
</tr>
<tr>
<td>13. Bidding</td>
<td>STL</td>
<td>9/15</td>
<td></td>
</tr>
<tr>
<td>14. Project management</td>
<td>STL</td>
<td>10/15</td>
<td></td>
</tr>
</tbody>
</table>
Nonetheless, bar charts are justifiably popular because they are simple to understand and fast to prepare using manual or automated techniques. As with milestone charts, bar charts are commonly generated from computer programs. Even more complex projects that use CPM scheduling techniques produce bar charts as a typical output report for use by the project manager and the members of the project team. The project manager can select the task level (i.e., Level 2 or 3) and produce the appropriate bar charts.

Finally, just as with milestone charts, bar charts can be updated with progress information during the completion of a project. Comparison charts can be developed to indicate both the initial and current schedule of task completion dates. Bar charts remain an extremely useful and powerful scheduling tool for most project teams.
THE CRITICAL PATH METHOD (CPM) OF PLANNING AND SCHEDULING

Despite its past reputation as an extremely complex and time-consuming method of scheduling, the Critical Path Method (CPM) is actually a simple concept and is being used by more and more design firms. Most computerized project management programs are designed to include CPM as the primary scheduling technique.

In contrast to the more simple scheduling techniques (milestone lists and simple bar charts), CPM focuses on two extremely important areas. It:

- Highlights the interrelationships and dependencies among individual tasks
- Identifies those tasks or activities that are critical to completing the project on time

In many respects, the primary function of the PM is to manage the interfaces among the members of the project team. If each member of the team could accomplish his or her work without input from anyone else, the PM’s job would be rather simple. It’s the interfaces that cause the problems, and the CPM focuses on these relationships immediately.

Just as important, the PM must know which tasks are most critical to completing the project on time. A change in the completion date of any of these tasks (either earlier or later) impacts the final completion date by the same amount. Again, the CPM highlights these “special” tasks so that more management attention can be directed at their completion.

But keep in mind that you may not need to use all the details of the CPM technique to monitor your project on a daily basis. Instead, perform the initial planning and scheduling of your project at the start using the CPM technique. Then immediately convert the plan to a bar chart format (or have the computer program generate bar charts that will be useful for the team), and use the bar charts for routine monitoring. Go back to the CPM format only if there is a major change in your project scope or schedule. In addition, it is prudent to review the CPM baseline tasks and assumptions on a periodic basis to make sure the bar charts reflect the latest information.

**There are six basic steps involved in the CPM technique:**
1. Develop the work breakdown structure (task outline)
2. Establish the relationships between tasks
3. Complete the network diagram
4. Add task durations
5. Create the CPM schedule
6. Determine the critical path
1. Develop The Work Breakdown Structure (Task Outline)

The task outline forms the foundation of the CPM technique. Just as with milestone and bar charts, the various tasks that will be accomplished to complete the project must reflect the scope of work in the contract. The project team must ensure that all tasks are identified clearly, with well-defined work assignments and project deliverables. If the CPM technique is to provide the correct results, the foundation (task outline) must be solid.

2. Establish The Relationships Between Tasks

The preparation of a network precedence diagram, sometimes also known as a “task interface diagram,” graphically identifies what kind of relationship exists between one or more tasks. The CPM technique uses only three different types of relationships. Each has a very specific graphic representation, or meaning, that is used in the preparation of precedence diagrams. Examine the following three relationships:

- **Type 1 indicates that**: Task A must be completed before Task B can begin.

  An example: The design of structural members cannot be sized until all loads from different parts of the building have been determined.

- **Type 2 says that**: Task A must have certain portions complete before Task B can begin.

  An example: It is not necessary to have the design completely established in order to begin laying out the sheets for production drawings.

- **Type 3 says that**: Task A must be completed before Task B can be completed.

  An example: You can begin writing the specifications as soon as the design has been sketched out, but you cannot complete the specifications until the drawings have been finished.
3. Complete The Network Diagram
After determining the relationships that exist—either type 1, 2, or 3 for each individual task in the outline—put the tasks into a single interface diagram. This network precedence diagram, sometimes also known as a “task interface diagram,” will now display graphically the sequence of tasks and their dependency on all other tasks. The following is a sample of a relatively simple task interface/network diagram.
4. Add Task Durations

Once the precedence diagram is prepared, the next step is to estimate the number of calendar days it should take to perform each task. This duration should be estimated following a review of the scope contained in each task and the estimated number of resources that will be applied. The durations can be recorded by simply putting the estimated duration beside each task on your task list.

One thing to keep in mind is that the length of the overall project will determine the task of project management. Do not assign a specific duration to the project management task directly; instead, simply indicate that it will be completed 60 days after the completion of all other activities.

<table>
<thead>
<tr>
<th>Task</th>
<th>Duration (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Zoning review</td>
<td>20</td>
</tr>
<tr>
<td>B. Programming</td>
<td>28</td>
</tr>
<tr>
<td>C. Preliminary design</td>
<td>40</td>
</tr>
<tr>
<td>D. Code review</td>
<td>15</td>
</tr>
<tr>
<td>E. Preliminary cost estimate</td>
<td>15</td>
</tr>
<tr>
<td>F. Design development</td>
<td>32</td>
</tr>
<tr>
<td>G. Production drawing</td>
<td>55</td>
</tr>
<tr>
<td>H. Final cost estimate</td>
<td>15</td>
</tr>
<tr>
<td>I. Final specifications</td>
<td>40</td>
</tr>
<tr>
<td>J. Bidding</td>
<td>15</td>
</tr>
<tr>
<td>K. Project management</td>
<td>To be completed 60 days following all other activities</td>
</tr>
</tbody>
</table>

5. Create The CPM Schedule

The duration of each task can be combined with the precedence diagram that you prepared previously by joining them in a bar-chart-like diagram that indicates both duration and the interdependency of the tasks. The following example shows how the graphics of the precedence diagram can be translated to those of the time scale.

Most computer CPM scheduling programs will create the schedule showing the calendar time frame and the task interdependencies after the durations and project start dates are entered into the program. The following is a sample CPM schedule from a typical program:
6. Determine The Critical Path
The final step is to determine which tasks are considered “critical.” By definition, critical tasks are those in which any slippage will affect the completion date of the overall project, day for day.

The “critical path” is the sequence or path through the critical tasks that allows the project to be completed in the shortest possible time. Another important CPM concept concerns “float time,” which is defined as the amount of time that a non-critical task can slip before it becomes a critical task and subsequently affects the overall schedule completion.

On smaller projects, critical tasks and the critical path can usually be determined by a visual inspection of the CPM diagram. Follow the arrows through the network of tasks to find the path or paths that have no float time. This will locate the sequence of tasks that determine the critical path.

The larger number of tasks on more complex projects makes it more difficult to visually determine the critical path. Most computer programs will provide various types of critical path reports to assist the team. You can use tabulated results that allow you to identify start date, duration, finish date, and calculated float time. In addition, most programs display the critical path tasks using different colors or shading on CPM network or schedule diagrams.
DEFINITION OF CPM TERMS

Duration
The length of time required to complete an activity assuming all prerequisites have been completed and estimated manpower is available.

Early Start
The earliest date that the necessary prerequisites can be completed for a task to begin.

Early Finish
The earliest date that a task can be completed.

Late Start
The latest date that an activity can begin and still not affect the overall project completion date.

Late Finish
The latest date that an activity can be completed and still not affect the overall project completion date.

Free Float
The length of time (in days) that a task can be delayed and still not affect the start or finish of other tasks.

Total Float
The length of time (in days) that a task can be delayed and still not affect the overall project completion date.

CPM EQUATIONS

Early Finish = Early Start Date + Duration

Late Start = Early Start Date + Total Float

Late Finish = Late Start + Duration = Early Finish + Total Float
THE FULL-WALL SCHEDULING TECHNIQUE

Wall scheduling or, as it is also known, full-wall scheduling, is a somewhat simple technique, but it has definite advantages since it involves the entire project team. For larger projects, it brings together the client, subconsultants, and even review agencies with the single purpose of finalizing the project schedule. If the schedule is developed using this technique, everyone understands it better and is usually fully committed to its success. For construction phase projects or private design-build projects, the project team also should include the contractor.

STEP 1: Identify and Educate

As with the other scheduling techniques, the first step is to finalize the task outline. Using this as a source of the scope of work to be completed, identify who will be key project supervisors responsible for completing the various tasks.

Give a copy of the scope of work, task outline, and any other pertinent information to these team members. Establish the date, time, and location for a scheduling meeting and require that each member prepare for this effort by reading the background information prior to the meeting.

STEP 2: Set Up a Wall

Hang sheets of easel paper on a wall. Then draw vertical lines five inches apart; the space between each pair of vertical lines represents one workweek. Draw horizontal lines spaced three inches apart; these separate the key individuals on the project team.

Write the name of each key individual on a 3 inch by 5 inch card, and pin the cards down the left most column of the divided wall. The following is a sample layout:

<table>
<thead>
<tr>
<th>Team Member</th>
<th>Jan 7</th>
<th>Jan 14</th>
<th>Jan 21</th>
<th>Jan 28</th>
<th>Feb 4</th>
<th>Feb 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jim C. Civil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angie S. Mech</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walt R. Elec</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jill G. Arch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Art D. Landscap</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Art C. Struct</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dave D. PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bart S. Client</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
STEP 3: Create Task Cards
Using two 3 inch by 5 inch cards per task, write the name of each task on both cards; label the first card “start” and the other “finish.” Then divide the cards into piles—one for each person responsible for performing the various tasks.

STEP 4: Establish Milestones and Dates
Identify a few critical milestones and the dates by which they should be completed. These might include the submittals of interim reports, dates that certain drawing sets must be sent to the client, or internally established targets for the project team.

Hang the milestone cards on the wall in the appropriate location, in the row that indicates who is responsible and during which week the milestone will occur.

STEP 5: Conduct the Scheduling Meeting
Everyone responsible for carrying out a task should attend (consider including the client, any third-party agency representatives and, if possible, the contractor). Hand everyone their designated stack of 3 inch by 5 inch cards, and ask them to begin hanging each card along their row showing the workweeks during which the various tasks will be started and finished.

If necessary, tasks may be divided into subtasks or better defined as required by the person responsible for the task. Additional tasks that were not included in the task outline (but should be anticipated) may also be added. Others may be modified.

During the meeting itself, all conflicts should be discussed openly and solutions considered while everyone is in the room. Trace through all the tasks with all team members to ensure everyone understands their interrelationships and dependencies. Obtain verbal commitment from all parties that their tasks will be accomplished on schedule.

STEP 6: Convert the Schedule to a Reproducible Format
Unless the wall schedule can be left on the wall for the duration of the project—like a project conference room—it will be necessary to convert this information into a form that can be readily reproduced.

Reduce the schedule to 8 inch by 11 inch format and distribute it to each team member. Now everyone has a comprehensive yet simple schedule, which they have already agreed to.
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STEP 7: Keep Updating the Schedule During the Project
Revisions can be made quickly by telephone or e-mail, or, if necessary, by reassembling the team. Use the schedule to indicate progress. When changes are necessary, incorporate them into the schedule and distribute a copy to all team members.

Advantages And Disadvantages
A major advantage to the wall scheduling technique is the high degree of interaction that takes place during the scheduling meeting. In other situations, the PM may develop the schedule in isolation and then present it to the rest of the project team. Wall scheduling will require a certain amount of advance planning by the project manager, but when everyone is brought together, conflicts are identified early, discussed, and resolved.

Another advantage is that it’s easier to get commitment from team members. When the structural engineer takes a “complete by” card that says “prepare foundation drawings” and pins it on the wall at Week 17, indicating he’ll complete the task by Week 17, that’s true commitment. It’s certainly more concrete than if the PM tries to coerce the engineer to agree to complete the task by that time.

Wall scheduling also increases communication among members of the project team. The process of preparing the schedule as a member of the group encourages team members to fully understand the project’s details—not only their own tasks, but those of the rest of the team as well.

A realistic assessment of the workload is another consideration that’s addressed by wall scheduling. When the team meeting occurs, members know their workloads and other commitments. They aren’t likely to make commitments that conflict with other projects.

The biggest disadvantage of wall scheduling is that it requires all parties to attend a scheduling meeting. This can be very challenging if your team is scattered, especially if people must participate from multiple offices throughout the country.

Another disadvantage is that when the wall schedule is complete, it’s somewhat similar to a bar chart. It doesn’t necessarily contain all the interdependencies and other detailed, management-related information you’d get from a CPM diagram. What’s more, a highly skilled project manager is required in order to keep the scheduling session from rapidly descending into individual arguments and chaos. The PM must be strong enough to get his or her people to work together constructively.
As with any scheduling method, full-wall scheduling is most appropriate for certain types of projects. This method works best for projects with fewer than 100 tasks and with three to ten people involved in the scheduling session. Many firms report that clients and third-party agency representatives are among the strongest supporters of this method of scheduling.

**WHICH SCHEDULING TECHNIQUE IS BEST?**

Hundreds of scheduling techniques are used within the design industry, everything from “we’ll-start-today-and-finish-when-we’re-done” to the most sophisticated, computer-based methods available.

Each technique presents its own advantages and disadvantages, depending upon the firm, the project, and the client’s requirements. No single technique is suitable in every situation. The scheduling technique you choose should be influenced by the:

- Abilities of the project leaders
- Scope of work—its size and complexity
- Number of disciplines involved
- Duration of the project
- Amount of fee involved
- Number of people working on the project
- Specific requirements or expectations of the client

Therefore, the best scheduling technique is the one that is most suited to the project, the project manager, the team, and the client. No one system will work in every situation. The following chart reviews the most important criteria for selecting a scheduling system.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Milestone Chart</th>
<th>Bar Chart</th>
<th>CPM Diagram</th>
<th>Wall Scheduling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ease of communication</td>
<td>Good</td>
<td>Good</td>
<td>Poor</td>
<td>Excellent</td>
</tr>
<tr>
<td>Cost to prepare</td>
<td>Minimal</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>Cost to update</td>
<td>Minimal</td>
<td>Minimal</td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>Degree of control</td>
<td>Fair</td>
<td>Good</td>
<td>Excellent</td>
<td>Good</td>
</tr>
<tr>
<td>Applicable to large projects</td>
<td>Poor</td>
<td>Fair</td>
<td>Excellent</td>
<td>Good</td>
</tr>
<tr>
<td>Applicable to small projects</td>
<td>Excellent</td>
<td>Good</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>Commitment of project team</td>
<td>Fair</td>
<td>Fair</td>
<td>Fair</td>
<td>Excellent</td>
</tr>
<tr>
<td>Client appeal</td>
<td>Fair</td>
<td>Fair</td>
<td>Good</td>
<td>Excellent</td>
</tr>
</tbody>
</table>
Once the project is complete, take the time to analyze the successes and failures of the schedule. Incorporate the Schedule Analysis Checklist in the Project Closeout chapter into your project closeout activities.

**USING THE SCHEDULE TO STAY OUT OF TROUBLE**

Regardless of which scheduling technique you use, you can avoid problems on the project by anticipating these common schedule mistakes:

- Project managers consistently forget to schedule time for the reviews or for the corrections and changes that invariably follow any review. Use your experience and judgment to estimate the volume of the changes, and schedule an appropriate amount of time to make corrections accordingly.

- Many project managers forget the critical role that the client plays in achieving the schedule. This is particularly important when reviews, approvals, and sign-offs are involved. Make sure the client understands his or her role in keeping the project on track. Be sure that the schedule includes time required for client activities.

- Don’t assume that all the preliminary groundwork has been done that allows the next task to begin. Build contingency plans for worst-case scenarios. Use the CPM diagram to locate float time to make up for tasks that are delayed in starting or are not completed on time.

- Often, the biggest mistake project managers make is assuming that the needed technical staff is available. Work with the principal-in-charge and other project managers in your unit/practice group to coordinate staffing and resources.

- The PM should schedule adequate time for agency and private utility company reviews, as well as time to make any changes associated with these reviews.

- Do not plan merely for completing all the technical tasks, without interruption. Make sure your plan allows enough time for the not-so-obvious tasks like phone calls, meetings, and general client “hand-holding.”

- Unfortunately, it is safe to assume that many of your deadlines will be missed. What are your contingency plans for the day this assumption becomes a reality?
• No project effort actually ends on the contract completion date. Make sure your schedule allows for the inevitable meetings, phone calls, questions, and little changes that always come after the project is finished.

• Just because you are the project manager, don’t expect that everyone will accept the schedule, especially if you planned it yourself. Make sure the entire project team has seen, understood, and agreed to your schedule. Make them participate in the development to get the best commitment from each of them.

• Finally, never make the dangerous assumption that all activities in the schedule are under your control. You must depend on your leadership skills to accomplish the project—through people. It’s impossible to have your finger on every last detail of the project—and it’s no fun if you try.

FIVE PITFALLS TO AVOID IN PREPARING PROJECT SCHEDULES

1. Scheduling time for “final review” without scheduling time to make the changes that always result.
For instance, when you schedule review by a building code plan examiner one week before your bid date, you risk a major code violation that could cause significant changes and a delay in bidding.

2. Failure to anticipate the non-technical activities that must be performed after all the contractual requirements have been met.
This includes phone calls from contractors to clarify drawings and meetings with review agencies to obtain the necessary permits.

3. Scheduling a project without properly considering the impact of other projects on the workload of the project team.
Many principals are guilty of this omission, which causes teams to lose motivation and overall quality of work to suffer. Promises to clients should be qualified with statements that allow you to check your manpower “loading” before committing yourself.

4. Failure to obtain firm commitments from key project team members.
This includes outside consultants.

5. Failure to provide time for slippage in the schedule. All schedules slip.
For instance, if no time is allowed for an architectural designer to miss a deadline, you will create an impossible chain of unmet future deadlines, causing frustration for your project team and client. Slippage time is a necessary ingredient of good scheduling, to allow for reviews or changes that will occur in every project.
TAKE AWAY POINTS

• **The best scheduling technique is the one that fits the project.**
  Don’t attempt to force a single technique on every single project. Simple projects need simple techniques—milestone charts or bar charts. Complex projects will fail if they don’t use Critical Path Methods for their schedules. Make the decision based on the project needs.

• **The most effective schedules use a graphic format.**
  People relate schedules to calendar time frames. They want to see the date that a task will start and finish. Lists and lists of start and completion dates are less effective tools than bar charts and CPM network diagrams.

• **The task outline is the foundation of any schedule technique.**
  The task outline represents the scope of work that must be competed to finish the project. Fundamentally this is the work that must be scheduled—not some, but all. All the tasks must be represented on the schedule, either as single elements, broken into multiple sub-tasks, or combined into a larger task.

• **Before scheduling can occur, all interdependencies must be known.**
  It is impossible to schedule accurately if all the task interfaces are not known and integrated into the plan. The logical sequence of task completion must be developed prior to calculating calendar dates to start and complete each task. Remember to plan the work—then schedule it.

• **Simple computer programs can reduce the scheduling efforts.**
  Very powerful, but user-friendly project management software is available at relatively low cost to simplify how schedules are created. Most of these programs can be installed on personal computers, including laptops, and some are available on mobile devices. With some fundamental knowledge of scheduling, each team member can develop the level of detail required to follow his or her own work.

• **The full-wall scheduling technique promotes team building and commitment.**
  Even though it takes lots of effort to pull together most of the project team to perform a full-wall scheduling exercise, it is well worth it. The team works out the schedule details together, learns how what they do impacts others, and develops more commitment to each other and the final schedule. Even if the final schedule is entered into to a computer program, the technique is well worth the effort it takes.
• Plan the completion of every project task to “beat the schedule.”
  Every person (including clients) is overjoyed when something is delivered before it is expected. If you want to create a very visible differentiator for your project or firm—beat every schedule date. Most of the pack gets things done late. A few get finished on time. The real winners “beat the schedule”!