

Successful Home Contracting



How to save thousands of dollars and get a better quality home by acting as your own contractor.

Lesson Nine

Planning the Construction Schedule



Interactive LINKS are [BLUE](#) and [UNDERLINED](#).
Click on them for additional information on the subject you are reading about.

Where You Are In The Course

LOT

- PHYSICAL - Selecting the Lot
- FINANCIAL - PURCHASING THE LOT

PLANNING

- PHYSICAL - PLANS AND SPECIFICATIONS
- PROJECT SCHEDULING
- FINANCIAL - COST ESTIMATE
- CASH FLOW PROJECTIONS

CONSTRUCTION

- FINANCIAL - FUNDING
- COST CONTROL - JOB COST ACCOUNTING
- PHYSICAL - SUPERINTENDING
 - DAILY SCHEDULING
 - PURCHASING
 - SUPERVISING AND COORDINATING THE CONSTRUCTION (QUALITY CONTROL)

SUCCESSFUL HOME CONTRACTING

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Overview

Well, you made it all the way through your new home for the first time! You have considered in detail all of the elements about which you could exercise some control.

Now it's time to take a look at the Construction Process itself. This is the second half of physical planning. We will see what tasks are involved in building your home and how they relate to each other - that is, not only which activity follows which sequentially, but also, which activities may happen simultaneously.

We will examine some formal systems that tie all of this information together in a way that will help you schedule the delivery of materials and the work of subcontractors, and will allow you to proceed through construction with a definite, realistic time schedule in mind. This process is called Schedule Planning.

WHAT YOU WILL LEARN IN THIS LESSON

- The purpose and value of schedule planning.
- What activities are included in the construction process.
- How the Critical Path Method (CPM) of schedule planning was developed and how it works.
- How to develop your own CPM Chart.
- How the Bar Chart works, and how it differs from the CPM Chart.

INTRODUCTION TO SCHEDULE PLANNING

THE PURPOSE OF SCHEDULE PLANNING

Your planning will allow you to know in advance when things are supposed to happen. This will let you schedule subcontractors and materials deliveries so that the proper sub and the necessary materials arrive when they are needed, which in turn will allow you to save time, money, and hassle.

SETTING DEADLINES

Another reason to have a plan is so that there are some specific deadlines for getting things done. Otherwise, your construction project might drag on for years! With good planning and a reasonable amount of effort on your part to keep things moving along, you should be able to complete your home in three to four months. A good reason not to let it drag on forever is the interest you'll be paying on the construction

loan. This can get pretty expensive towards the end of the project when you've borrowed most of the construction loan. Also, once things start to drag, it is often hard to pick the pace up again. Subs have moved on to other jobs, and it's hard to get them back to finish things up. So, as the old saying goes, plan your work and work your plan!

THE DIFFERENCE BETWEEN PROJECT SCHEDULING AND DAILY SCHEDULING

Project Schedule Planning has one goal - to save the builder money by helping him build the home in the shortest time possible. By developing a building schedule, the builder knows in advance when every facet of the job is to begin and when it should be completed. This is a planning function, and is carried out before the job is begun.

Armed with this information, you will be able to carry out the Daily Scheduling - a day-to-day activity that runs throughout the construction process, which involves getting subs and materials to the job site when they are needed.

A WORD OF CAUTION

Do not let this lesson throw you! The sequence of events in building a home is really very simple. It includes:

- Clearing the Lot
- Footings and Foundations
- Framing
- Windows and Exterior Doors
- Plumbing, Mechanical, and Electrical Roughs
- Siding, Roofing, and Exterior Trim
- Insulation and Drywall
- Interior Doors and Trim
- Cabinets, Tile, and Glass
- Painting, Paper, and Floor Coverings
- Hardware, Equipment, and Fixtures
- Finish Plumbing, Mechanical, and Electrical
- Finish Grading and Landscaping

If you are only building one home, the schedule planning presented in this lesson could conceivably be skipped entirely. If you simply took this list as a guide and proceeded to build your home, you wouldn't go too wrong. The only thing you'll lose is some construction time and a

little money. Remember that when you are dealing with borrowed funds - time is money! Some small builders just play it by ear - keeping it all in their heads. So don't get up tight if the material in this lesson seems a little complicated. It's presented to give you a firmer grasp on how your home will go together.

A MORE FORMAL METHOD

We are including in this lesson a summary of some systems that have been developed to help builders have greater control over the building process. Any of these systems could help you, the builder, keep track of what activities are upcoming and when they can be scheduled (when subs and materials need to arrive).

We are going to examine two methods builders have developed for looking at Project Scheduling. First we'll look at a system developed for commercial construction and adapted for residential use - the Critical Path Method (CPM). Then we will explore a little less complicated method which presents the same type of information in a different form - the Bar Chart. In Lesson Thirteen, you will see how a large Southeast builder simplified the CPM system to a set of Scheduling Strips that his superintendents are able to use to schedule the daily work on the houses under construction. You can use any of these systems . . . or none at all! They are presented for your education and optional use.

CRITICAL PATH METHOD

HISTORY

You can imagine how important scheduling must be on the construction of a skyscraper in central Manhattan. Storage space for materials is extremely limited, so steel that must be ordered and fabricated months in advance and reach the job site on the precise day it is to be installed. To solve this kind of scheduling nightmare, a scheduling system called the [Critical Path Method \(CPM\) was developed in the late 1950's](#). We are not going to present an exhaustive discussion of CPM in this course. If you are interested, we have included several references in the bibliography at the end of this lesson.

HOW IT WORKS

Briefly, what is done in the Critical Path Method is to identify all of the activities required to complete a project. These activities are then put together in a kind of flow chart which shows the order in which they

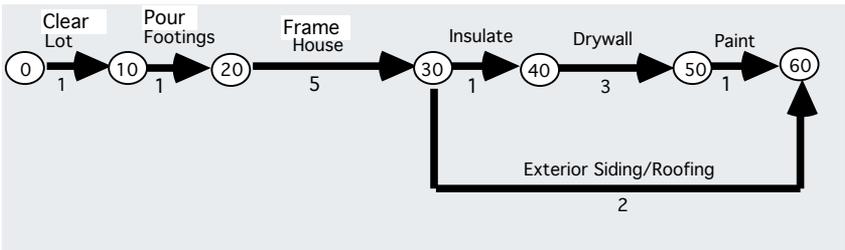
must occur. Some activities must follow others (you have to frame the house before you can put the roofing on), while some activities can be happening at the same time (the landscape sub and the wallpaper hanger will not interfere with each other, and one's work is not dependent on the completion of the other's). You can readily see that a delay in some activities may delay the start of the succeeding activities. If a delay occurs in a critical activity, the completion of the job will be delayed. Understanding which activities are critical will help you to keep the construction moving along.

A CPM EXAMPLE

In a CPM diagram, each activity is represented by an arrow. Each activity must have a beginning (either at the beginning of the project or at the end of some preceding activity) and an end (either just before the beginning of some succeeding activity, or at the end of the project). The following figure illustrates this principal.

The activities shown are:

- Clear Lot
- Pour Footings
- Frame House
- Insulate
- Drywall
- Paint
- Exterior Siding/Roofing



Example Critical Path Diagram

ACTIVITIES AND EVENTS

The activities are represented by the arrows which begin and end with the circles 0, 10, 20, 30, 40, 50, and 60. The circles are called "events", and simply designate the point in time at which one activity has ended and another is about to begin. The numbers in the event circles are arbitrarily

assigned and have no meaning other than their use to name the arrows (activities). For example, the "Clear Lot" activity is called "Activity 0-10." The project starts at the circle labeled "0" and proceeds to the right.

POSITION AND DEPENDENCY

By their position in the diagram, the dependency of the activities is shown. For example, it is obvious that the footings can not be poured until the trees have been cleared from the area of construction. Similarly, the house can not be framed until a footing has been poured. Exterior siding and roofing can take place at the same time as insulating, hanging drywall, and painting, but not until framing is completed. Activities that happen at the same time (roofing and drywall) are shown as parallel arrows. Assuming the project is completed at "60", all activities must be completed by then.

ACTIVITY DURATION

Notice the number under each arrow. This represents the number of days it will take to complete each activity. You will see that insulating, hanging the drywall, and painting will take a total of 5 days, while exterior siding and roofing will only take 2 days. It would be possible to wait three days after the framing is completed before starting on the siding and roofing and still complete the project on time.

FLOAT TIME

There is said to be three days of "Float Time" in activity 30-60. That is because while activity 30-60 will only take two days to complete, it is scheduled to be done sometime during the five day period when insulation, drywall, and painting are being completed. Activity 30-60 doesn't have to be started immediately after the framing is completed. You could wait until after the first day of drywall work before starting 30-60 without holding up the job.

CRITICAL ACTIVITIES

Any activity which has float time is not on the critical path. All other activities in our example are "critical." A delay in completing any of them will delay the completion of the job. Notice that if the float time in activity 30-60 is used up, then that activity also becomes critical. The Critical Path is that path through the Critical Path Diagram which links critical activities sequentially. A delay in any activity on the Critical Path will delay completion of the job.

A TYPICAL CPM

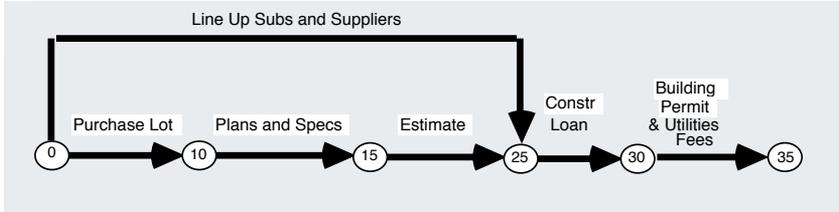
PRE-CONSTRUCTION ACTIVITIES

The following activities take place prior to construction:

- Purchase Lot
- Plans and Specifications
- Estimate
- Secure Construction Loan
- Secure Building Permit(s)
- Line Up Subs and Suppliers

The time required to accomplish these things could vary considerably from situation to situation, so we have shown their relationship to the process in their own diagram below. No time frame has been assigned to these activities. You may take six days or six months to find a lot. It really doesn't matter. But once you start construction, it should proceed in a consistent, well organized manner.

Note that activities 0-10 and 10-15 could be reversed. In other words, you could start with a lot and design a home to fit it, or you could design your home and then find a lot that will accommodate it.



A Pre-Construction Critical Path Diagram

CONSTRUCTION ACTIVITIES

The following is a list of the more important activities you would encounter in building a typical home. We have assumed that this home will be a framed home on a crawl space, with a prefab fireplace, and connections to municipal water and sewer.

For the most part, the tasks are self-explanatory. That is, when we say "pouring the footings" or "framing the house," you may not know everything that is involved in those tasks at this point, but you generally know what is being talked about. That's all that is necessary for now - knowing that pouring the footings and framing are part of the process,

discovering about how long these tasks should take, and finding how they fit into the overall process of construction.

Later in the course, in the lessons on the physical portion of the construction itself, we'll take a closer look at what is actually involved in each task.

ACTIVITIES

Lot Preparation (clearing and rough grading)

Footings

Foundations

Soil Treatment (spraying to prevent termites)

Framing (wood structure of the home plus sheathing)

Roofing

Set Windows and Exterior Doors

Cornice, Veneer, and Exterior Trim

Exterior Painting

Gutters and Downspouts

Set Fireplace

Rough Plumbing (pipes in slab, pipes in walls)

Rough Electrical (wiring in walls, switch and outlet boxes installed)

Rough HVAC (ducts in walls)

Telephone Pre-wire (telephone wire in walls)

Framing Inspection

Insulation

Drywall

Interior Doors and Trim

Appliances

Cabinets

Ceramic Tile

Painting

Hang Wall Paper

Finish Plumbing (water heater, showers, tubs, sinks, faucets)

Finish Electrical (light fixtures, switches, outlets, fans, smoke det.)

Finish HVAC (furnace, a.c., air handler, registers, thermostat)

Glass and Hardware

Floor Coverings

Walks, Drives, and Patios

Deck

Finish Grading (final elevations set, trash removed)

Landscaping
Final Inspection
Punch Out (all remaining uncompleted and defective work finished)
Turn Utilities On

The list itself more or less shows the order in which activities occur. But it falls short of showing which activities are dependent on each other and which activities can occur simultaneously. To discover these relationships, we can put them into a CPM diagram.

THE CPM DIAGRAM

To see the CPM diagram for the construction of the home described by the construction activities listed above, click [here](#).

The following notes will help you see how the diagram was constructed and how it can be used to help you schedule activities, deliveries, etc.

1. In a real CPM, like the one opposite, the arrows are drawn to a length that is proportional to the time involved in the activity. In other words, an arrow representing an activity that takes four days to complete is drawn twice as long as the arrow for an activity lasting two days. The vertical lines on the grid behind the CPM represent days, and are numbered at the top of the page. We'll use these later to keep track of where we are in the construction process, and for planning future activities.

Arrow 10-15 (Foundations) is five units long, since it is scheduled to last five days. Similarly, 20-25 (Framing) is drawn nine units long. Arrow 0-20 (Temporary Electric Service) is drawn thirteen units long even though it only takes one day to do the job. There are twelve Float Days in this activity. In other words, getting the temporary electric service to the job site can take place any time during that thirteen day period preceding framing. Note that one day is the least amount of time shown for any activity. In reality, treating the soil for termites (15-20) will only take an hour or so!

2. Notice that the construction diagram shows the home being built in a total of 59 working days (about twelve weeks). There are no idle days shown - that is, days when the home sits with no work being done on it. You'll probably have some of these days! You may also experience some delays because of materials shipments, inspectors, and bad weather. So don't be surprised if you take longer than 59 working days. This is an "ideal." If you take twice as long, it's OK.
3. The gray arrows (40-45) are called "dummy" arrows. They do not represent any activity or any passage of time. They either show dependence or are used to prevent two activities from having the same number. Arrow 50-55 is a dependency arrow. It shows that the exterior doors and windows should be set before you insulate (so insulation can be stuffed into those narrow spaces between the door and window frames and the 2x4 studs). Therefore it is said that activity 55-60 (insulation) is dependent on activity 25-50 (Exterior Doors and Windows). It would be more accurate to say that the starting of activity 55-60 is dependent on the completion of activity 25-50.

Arrow 40-45 is an example of the other type of dummy. Without 40-45, "Rough Elec" and "Telephone Pre-wire" would have the same number . . . 40-55.
4. The usual schedule for inspections and surveys is indicated. The footing inspection is usually performed after the trench has been excavated and any form materials and steel are in place, but prior to pouring the concrete.

UNDERSTANDING THE CPM DIAGRAM

Careful study of the CPM Diagram will help you develop an understanding of the steps necessary to build your home, and how they all fit together. Most of the "activities" listed above are actually several activities grouped together under one heading. For example, "Footings" is actually comprised of:

1. Lay out the house.
2. Dig the trenches.
3. Place form materials (if required).
4. Place Steel (if required).

5. Footing inspection.
6. Pour concrete.

The components of each activity will be discussed in detail in the sections on construction (Lessons 14-17). As the contractor you will only need to schedule the beginning of the task. The subcontractor who actually does the work will take care of scheduling the sub tasks.

DIAGRAMS FOR DIFFERENT CONSTRUCTION METHODS

The CPM diagram shown above would differ slightly from one involving say masonry construction, or a masonry fireplace, or a well and septic tank, or a slab instead of a crawl space. An example of an alternate diagram to cover a slab floor system is shown on the next page. Notice that only five days are shown here for framing, whereas on the first one there were nine days allotted for framing. That's because with slab construction, there is no first floor to frame. So you will save three or four days.

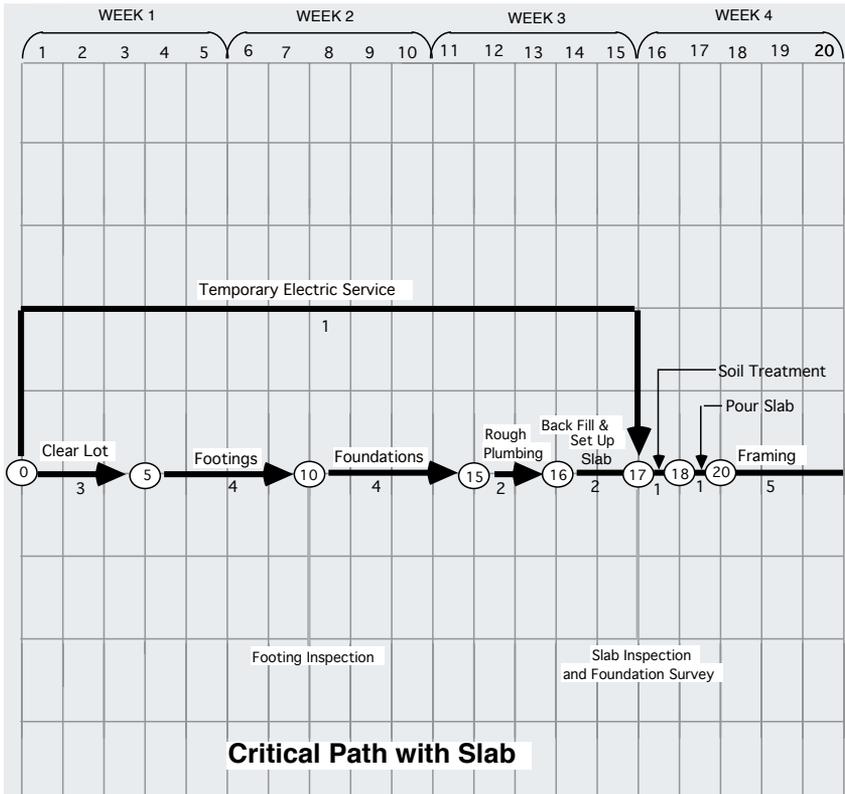
DEVELOPING YOUR OWN CPM DIAGRAM

A blank grid is included [here](#), so that you can develop a schedule to fit your home plans. For example, if you plan to have a masonry fireplace, the chimney should be completed before roofing so that proper flashing can be done between the chimney and the roof. Your subcontractors will be able to help you decide how much time to allow for each of their operations, and in what order they should occur. This varies with the size of the job and from place to place around the country. If you want to try your hand at developing a Critical Path Diagram, just make several photocopies of the blank grid sheet and tape them together.

THE BAR CHART

THE SAME INFORMATION

The bar chart is a different way of presenting or viewing some of the same information. Take a look at the example of a Bar Chart by clicking [here](#). These are the same activities which are shown in the Critical Path Diagram. Look at number 8 (Framing) on the Bar Chart. It shows this activity as being scheduled for days 14-22. This is identical to the information we have on the Critical Path Diagram.



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DIFFERENCES

For some people, the Bar Chart is a little easier to grasp. Notice a couple of differences though.

1. The Bar Chart does not show any dependencies. In the Critical Path Diagram, an activity (arrow) cannot happen until all of the previous activities (arrows) have been completed. These relationships are not depicted in the Bar Chart. For example, line 13 shows the Cornice, Veneer, & Exterior Trim being completed on day 31. Line 25 shows Drywall starting on day 32. You may think there is some relationship.

But a look at the Critical Path Diagram shows that the two are unrelated. The only things that can be said of their rela-

tionship (again looking at the Critical Path Diagram) is that the framing must be completed before either exterior trim or drywall can begin, and that both activities must be completed before the final inspection - for those are the two points in the diagram where their lines diverge and then come back together again.

2. Another shortcoming of the Bar Chart is its inability to show float times very well. On the Critical Path Diagram you will see that setting the prefabricated fireplace and installing the hearth and profile takes four days, and can take place any time between days 23 and 42. The Bar Chart shows activities taking place at their earliest possible time. So the hearth and profile are shown on days 24-26, immediately following setting the fireplace on day 23. Obviously, knowing where your float occurs can give you some flexibility in scheduling the work.
3. Finally, the Bar Chart does not indicate which activities are critical. By looking at the chart, there is no way to tell that a delay in the Interior paint and wallpapering will delay completion of the home - where a delay in the exterior painting will not (as long as the 16 float days between event 25 and event 135 on the Critical Path Diagram have not all been used up).

A blank form is included [here](#), in case you want to create your own Bar Chart. A modified Bar Chart will be used to plan Cash Flow in the next lesson (financial planning).

Summary

Whew! Some of that was kind of complicated, wasn't it? Especially the CPM. Well, the good news is that you don't really have to understand it all or use it to build your home. The Bar Chart and the Planning

Strips are progressively easier and easier concepts to understand and use, although they don't give you as much information as the CPM.

For the first time, you were able to see here all of the tasks involved in building your home, and how they all fit together. By plugging this information into a chart, we were able to develop a workable schedule that let us put some dates to the project.

Looking Forward

Well, now we know where we're going to build, what the home is going to look like, what will be in it, and when it's all going to

happen. Our next step is to get a handle on the finances - the costs. In the next two lessons (Ten and Eleven), we'll look at all of the costs involved in building your new home and develop a system for doing a Cost Estimate and a Cash Flow Projection. If you don't know exactly what these things are, don't worry. We'll explain them in detail in the next two lessons.

That will complete our second major section of the course - Planning. All that will be left is the actual funding and construction of the home.

Q&A's



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