Smart Scheduling
Helps Projects to Finish on Time

Whether you're a pro or a homeowner contracting your own project, meticulous planning will help you to stay on time and on budget

BY MICHAEL PATTERSON

"When will you be done?"
"About two weeks."
"But you said that two weeks ago!"

It's been said that stereotypes are stereotypes because they contain a grain of truth. While "two weeks" may be funny, it hits close enough to home that whatever smile we contractors may have is a bit pinched, and whatever smiles our clients may have are knowing ones. I'm all for smiles, but I'd rather they be the satisfied grins of contractors and homeowners whose jobs went according to plan. Scheduling a project well ensures that satisfied grins are the rule.

Schedules allow me to plan my work so that I have an answer when a potential client asks, "When can you start?" They allow me to give subs plenty of notice for when I'll need them, increasing the chances they'll show up on time. Subs appreciate knowing what work they've got coming, and they respect contractors who run their jobs well. Mostly, though, a good schedule saves time, which—whether you're a contractor or a homeowner—is money.

Job scheduling entails three major components: determining the scope of the work, including who will do each task and how long each task will take; building a schedule chart so that you can track progress; and tracking progress and responding to scheduling glitches.

All of this follows what's called the "critical path," a chain of tasks that have to happen to complete a project. Delaying any critical task will delay finishing the project as a whole unless corrective steps

Center photo, this page: ZEPHYR/Photodisc/Getty Images

are taken. Critical tasks include getting a foundation in or receiving a framing inspection. Until these jobs are completed, nothing else can happen on the critical path, and everything after that is delayed.

To keep a schedule, you have to be able to see the critical path during both planning and construction. This knowledge lets you accurately estimate project time; give subcontractors, inspectors, and suppliers plenty of notice; plan things such as your own time off; and make adjustments to stay on track when things go wrong.

Know the scope of work

The first aspect of scheduling is to know the scope, or extent, of the work. Where does the work begin and end? If you're building an addition, does your work end where it ties to the existing house? For instance, are you painting the new siding to match the house, or will you repaint the existing house for a good color match? On projects originating from an architect, the scope of work is usually laid out fully in the construction drawings and specifications. Other times, you as the general contractor or as the homeowner define the scope of work with your plans or your detailed proposal.

The next step is to break that scope of work into a list of tasks and to determine whether they're on the critical path or parallel to it. This list generally follows the order of construction, from excavation to finish painting. The more detailed the list, the more accurate the schedule can be. If it doesn't appear in the schedule, it's not going to happen on time.

Once the list of tasks is set, it's time to determine who is going to accomplish those tasks. This has a lot to do with how your company is structured. As a sole proprietor with a couple of employees, I maintain a business goal of keeping us all working productively. One key to staying productive is to minimize switching between job sites. Having to do one set of things, pull off for a week or two, then come back and set up for another bit of work is not efficient, so I try to schedule as many successive tasks at one site as possible.

To this end, as well as to control the schedule, I try to make myself or my guys responsible for most tasks on the critical path, while leaving subcontractors such as roofers, painters, and tile and flooring contractors as much leeway as possible to complete their work. I have control over my end of things, but they are at the mercy not just of my job, but of their other clients as well—clients whose scheduling efficiency the subs have no control over. Some trades have work on the critical path, such as the foundation contractor, the plumber, and the

electrician. For the others, though, that leeway is appreciated, particularly when they know that the job will be ready as promised when they arrive.

On the other hand, if your company model is one in which a project manager runs one or two jobs and the labor is provided by specialized subs, such as framers, siding crews, and so on, then keeping your crew on one job might not be so important. Also, more subs end up being responsible for critical tasks, so keeping them informed and motivated to maintain your schedule becomes more important.

How long does each task take?

Now that you've laid out what's to be done and who will do it, the hard part comes: figuring out how much time each segment will take. In my experience, errors in time estimation are responsible for most schedule slippage. Take a realistic and slightly pessimistic look at what will affect the way the works gets done. Tempting as it might be just to add a month to a schedule to account for Murphy's Law, that is ineffective planning. The goal is to build your project as quickly as possible and to use your resources as efficiently as you can. If you're a pro, that makes you more money. If you're a homeowner running your own project, it saves you money. In either case, it makes for happier subs and a less stressful job site.

The time taken by individual tasks such as framing, mechanical rough-ins, roofing, and so on varies with the size and complexity of the job. Because I've been contracting for a couple of decades, I have a pretty good sense of how long any particular task will take on a given job, so I often rely on my own time estimates. It's a good idea to log how long work actually takes, though, so that you can verify your estimates and make adjustments to current and future schedules.

When I'm unsure of the necessary time, I ask the subcontractor for his or her opinion. It's a good idea afterward to track how accurate your subs are with their

Who's doing the work? Some tasks, such as framing, might be handled by in-house crews, but that's not always the best approach. Specialist crews can be faster, helping to maintain a schedule and freeing you up for other jobs.

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GANTT CHARTS SHOW THE JOB AT A GLANCE

As a graphic representation of the schedule (in this case for a kitchen addition), a Gantt chart lets you know what needs to be done, when it needs to be done, who is supposed to do it, and eventually, whether it's been done. Gantt charts also differentiate the critical path—that is, the sequence of events that must stairstep in a particular order to complete a project—from the less critical tasks whose timing doesn't affect the finish date.
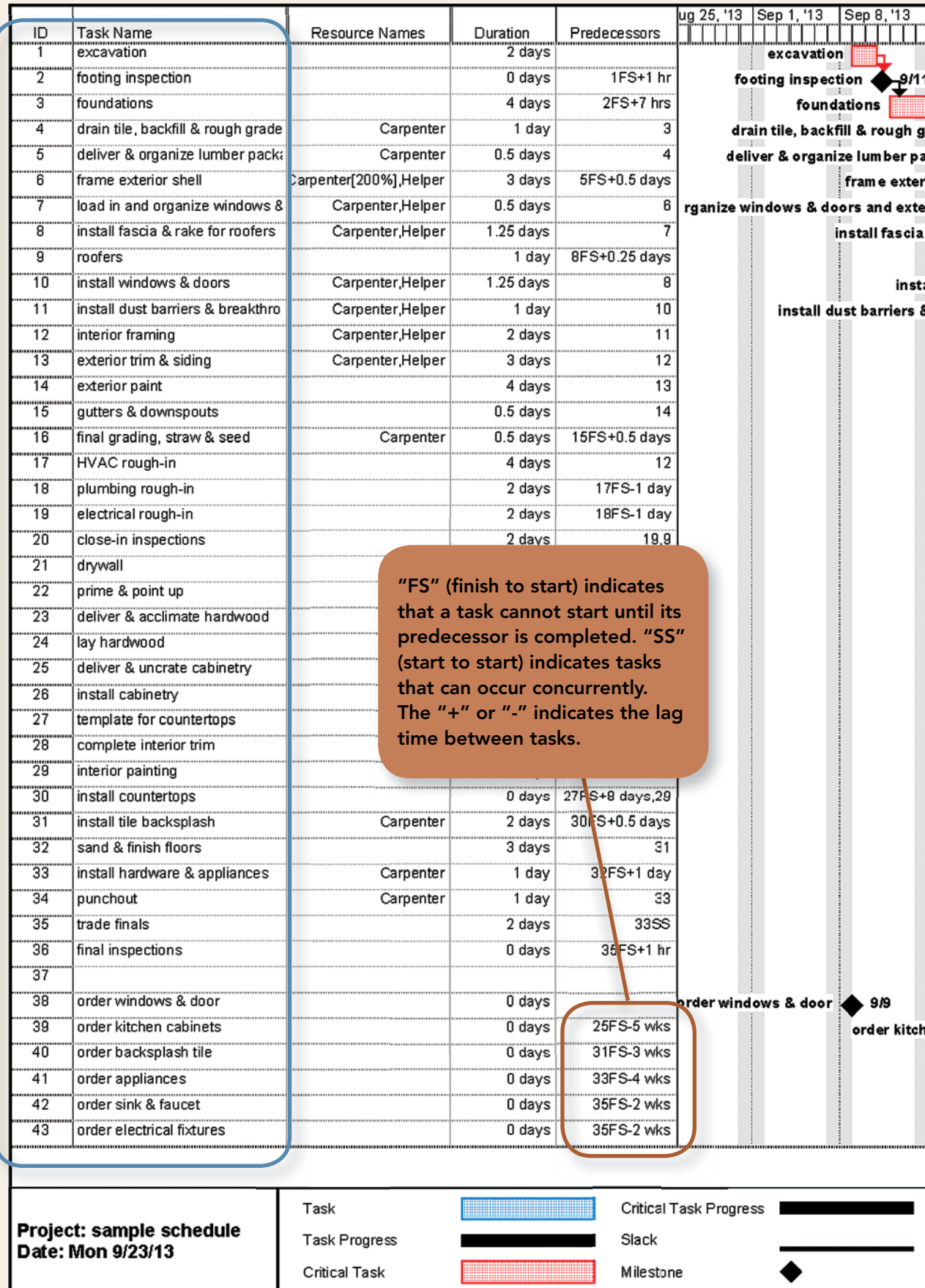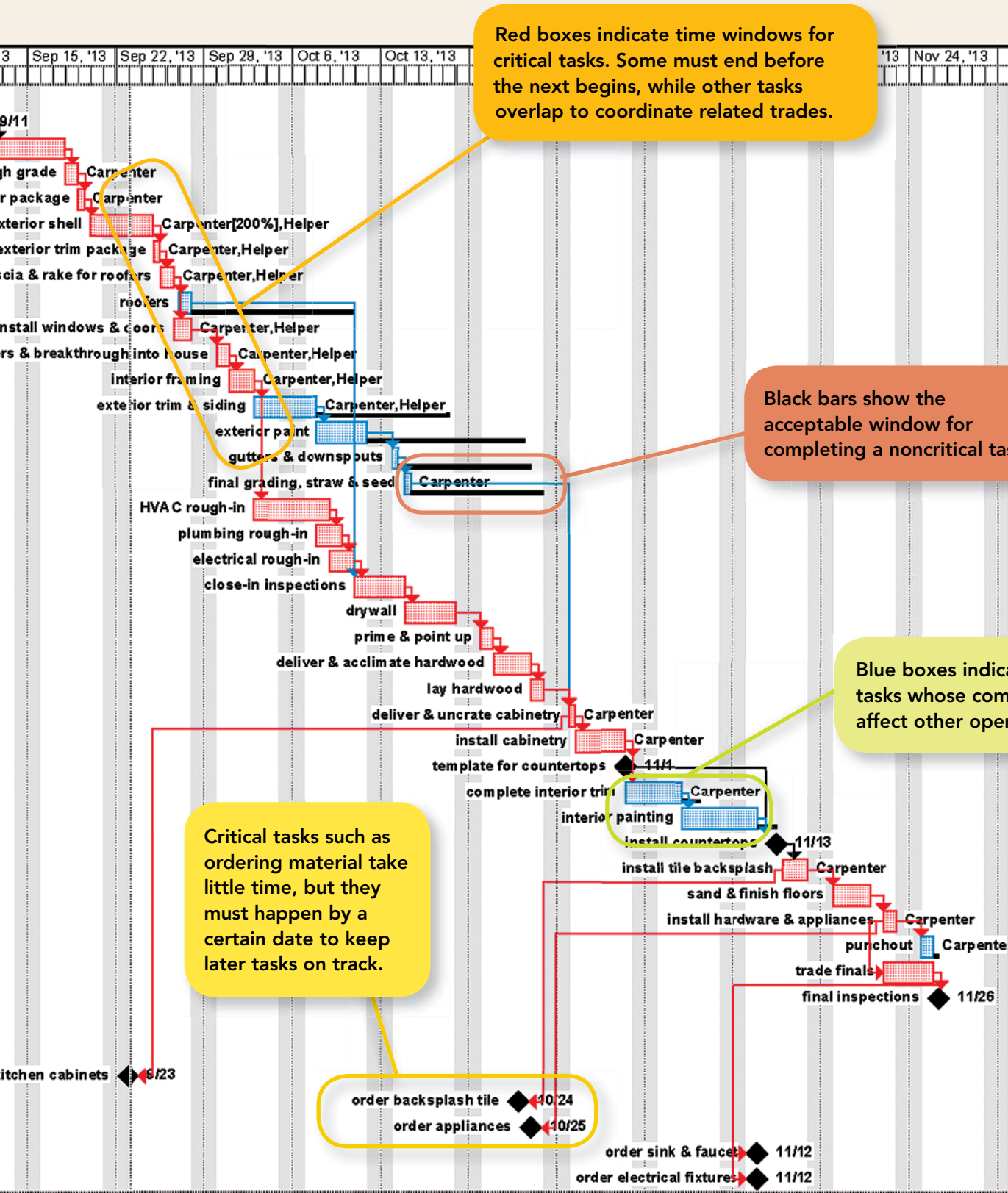
SOURCES

Microsoft Project
microsoft.com

Gantt Project
ganttproject.biz

TeamGantt
teamgantt.com

The list view spells out the detail shown graphically in the chart.

"FS" (finish to start) indicates that a task cannot start until its predecessor is completed. "SS" (start to start) indicates tasks that can occur concurrently. The "+" or "-" indicates the lag time between tasks.

ID	Task Name	Resource Names	Duration	Predecessors
1	excavation		2 days	
2	footing inspection		0 days	1FS+1 hr
3	foundations		4 days	2FS+7 hrs
4	drain tile, backfill & rough grade	Carpenter	1 day	3
5	deliver & organize lumber packa	Carpenter	0.5 days	4
6	frame exterior shell	Carpenter[200%],Helper	3 days	5FS+0.5 days
7	load in and organize windows &	Carpenter,Helper	0.5 days	6
8	install fascia & rake for roofers	Carpenter,Helper	1.25 days	7
9	roofers		1 day	8FS+0.25 days
10	install windows & doors	Carpenter,Helper	1.25 days	8
11	install dust barriers & breakthro	Carpenter,Helper	1 day	10
12	interior framing	Carpenter,Helper	2 days	11
13	exterior trim & siding	Carpenter,Helper	3 days	12
14	exterior paint		4 days	13
15	gutters & downspouts		0.5 days	14
16	final grading, straw & seed	Carpenter	0.5 days	15FS+0.5 days
17	HVAC rough-in		4 days	12
18	plumbing rough-in		2 days	17FS-1 day
19	electrical rough-in		2 days	18FS-1 day
20	close-in inspections		2 days	19,9
21	drywall			
22	prime & point up			
23	deliver & acclimate hardwood			
24	lay hardwood			
25	deliver & uncrate cabinetry			
26	install cabinetry			
27	template for countertops			
28	complete interior trim			
29	interior painting			
30	install countertops		0 days	27FS+8 days,29
31	install tile backsplash	Carpenter	2 days	30FS+0.5 days
32	sand & finish floors		3 days	31
33	install hardware & appliances	Carpenter	1 day	32FS+1 day
34	punchout	Carpenter	1 day	33
35	trade finals		2 days	33SS
36	final inspections		0 days	35FS+1 hr
37				
38	order windows & door		0 days	
39	order kitchen cabinets		0 days	25FS-5 wks
40	order backsplash tile		0 days	31FS-3 wks
41	order appliances		0 days	33FS-4 wks
42	order sink & faucet		0 days	35FS-2 wks
43	order electrical fixtures		0 days	35FS-2 wks

Project: sample schedule
Date: Mon 9/23/13

Task		Critical Task Progress
Task Progress		Slack
Critical Task		Milestone

Red boxes indicate time windows for critical tasks. Some must end before the next begins, while other tasks overlap to coordinate related trades.

Black bars show the acceptable window for completing a noncritical task.

Blue boxes indicate noncritical tasks whose completion doesn't affect other operations.

Critical tasks such as ordering material take little time, but they must happen by a certain date to keep later tasks on track.

9/11

gh grade — Carpenter
r package — Carpenter
exterior shell — Carpenter[200%],Helper
exterior trim package — Carpenter,Helper
scia & rake for roofers — Carpenter,Helper
roofers
nstall windows & doors — Carpenter,Helper
rs & breakthrough into house — Carpenter,Helper
interior framing — Carpenter,Helper
exterior trim & siding — Carpenter,Helper
exterior paint
gutters & downspouts
final grading, straw & seed — Carpenter
HVAC rough-in
plumbing rough-in
electrical rough-in
close-in inspections
drywall
prime & point up
deliver & acclimate hardwood
lay hardwood
deliver & uncrate cabinetry — Carpenter
install cabinetry — Carpenter
template for countertops — 11/4
complete interior trim — Carpenter
interior painting
install countertops — 11/13
install tile backsplash — Carpenter
sand & finish floors
install hardware & appliances — Carpenter
punchout — Carpenter
trade finals
final inspections — 11/26

kitchen cabinets — 9/23

order backsplash tile — 10/24
order appliances — 10/25
order sink & faucet — 11/12
order electrical fixtures — 11/12

Symbol	Legend	Symbol	Legend	Symbol	Legend
■	Summary	▬	Rolled Up Milestone ◇		External Tasks
	Rolled Up Task		Rolled Up Progress ▬		Project Summary
	Rolled Up Critical Task		Split		

"The key is to **overlap the trades enough,**
but not so much that they step on each other's toes."

time estimates. You might learn that a particular sub tends to estimate time optimistically, and you can keep that in mind as you schedule future jobs.

As a last resource, I occasionally refer to an estimating book, such as *R.S. Means Residential Cost Data*. For example, I've installed cedar sidewall shingles only a couple of times in my career. When faced with installing them recently, that wasn't enough history to base my time estimate on, so I turned to the estimating book. Estimating manuals aren't inexpensive, but they might be well worth the price if they save a major mistake in estimation.

Think about what can go wrong

In addition to the amount of time it takes to do tasks normally, there is also the calendar to contend with. Getting a foundation in and an addition shell up and dried in happens faster in the summer than in the winter, for example. Holidays and vacations slow progress. In some places, construction grinds to a halt during deer season or when striped bass are running. You might have other projects underway that compete for your resources. Proper scheduling lets you anticipate such issues and plan solutions.

You can compensate for anticipated slowdowns by adding time when building the schedule or by assigning different people or numbers of people to the job. Maybe you have one foundation contractor who is fast but a little sloppy, while another is dead on, but slow. The schedule might drive your choice.

The calendar may dictate the order of work, as well as its duration. With an addition, for instance, the question arises of when to start on the siding. For me, that is usually when the shell is up and all the interior framing is done. The mechanical trades can begin their rough-ins inside, and I can hang siding. I'm out of their way, but I'm still productive. Ideally, by the time the mechanical trades are finished and the inspections and drywall are done, my crew and I are just finishing outside and can

move inside seamlessly to begin the trimwork, while the exterior is turned over to the painters.

Depending on the time of year, though, that sequence might not be the best choice. My painters usually stop exterior work in November and don't start again until April. If I don't finish the exterior trim until November, painting won't be done until the spring, long after I'm otherwise finished. Knowing this, I could postpone interior framing and go right from framing the shell to siding. That gets the mechanical trades roughing in a little later, but allows painters to finish before winter. While that might add time to the project overall, it ensures that the entire scope of work will be completed sooner.

In other cases, a supplier's schedule might drive yours. It usually takes my kitchen-countertop fabricator two weeks from when the measurements are taken to the day the countertops are installed. With that in mind, I install the kitchen cabinets as soon as I start inside so that he can measure right away. Having done that, I move to other trimwork while waiting for the tops.

I schedule the mechanical trades efficiently as well, getting the least flexible work done before the work with more leeway. That means the big stuff—the ductwork—goes in first. I have the plumber in a day or two before the HVAC people are done so that they can go over any conflicts. Because wires can fit just about anywhere, the electrician is the last to come in, a day or two before the plumber is done, so that they can resolve any conflicts between their work. The key is to overlap the trades enough so that they can go over things together, but not so much that they step on each other's toes.

See it to believe it

You've put a lot of thought into it at this point, but without some sort of document to help see the schedule, it's hard to comprehend. Schedule documents have different looks; the two most common are a calendar and a Gantt chart (see pp. 68-69). Both are good, but I prefer Gantt charts because they allow me to see the project as a whole, from beginning to end. Seeing the entire job makes it much easier to gauge the impact of items that throw schedules off course. Unique to Gantt charts is their ability to display the critical path.

I have been creating Gantt charts in Microsoft Project for 15 years, so that is the basis of my example here. You can use a number of other programs to create Gantt charts. Most of them are less costly than Project, and some are free. There's also information online about how to create Gantt charts in Excel. Given that Gantt charts were invented about 100 years ago, it's even pos-

Bring in mechanical trades in a specific order. Ducts are the least flexible mechanicals, so they go in first, followed by the plumbing. Wires take up little space and can go almost anywhere, so schedule the electrician last.

sible to create them with pen and paper, although it's much easier to manage and update charts on a computer than on paper.

Working with a Gantt chart

Knowing the sequence, the time frame for each task (its "duration"), and the crew allows you to start putting that work in order on a Gantt chart. The links between tasks are called "dependencies," as one depends on another. There are several different types of dependencies used in Gantt charts, but only two are generally useful in residential building.

The most common dependency is called "finish to start," or "FS"; that is, a certain task cannot start until its predecessor has finished. You can't start framing before the foundation is done, for example. Other tasks, however, don't have to wait for their predecessor to finish, but cannot start until the predecessor starts. These are "start to start," or "SS," dependencies. An example of this would be installing bathroom tile in an addition, which can happen concurrently with interior trim but cannot begin until the carpenters set the bathroom doors.

Another consideration is whether there should be any lag time between dependencies. Not all tasks should immediately follow their predecessors. A case in point would be the link between hardwood flooring arriving on the job and being installed. Because wood flooring should acclimate to the site for several days before installation, it makes sense to link the two with an FS dependency and a +4-day lag time. In other words, the flooring cannot go in until it has been delivered, but it also should acclimate for at least four days.

Another example might be linking "Order cabinets" with "Install cabinets." Installing clearly follows ordering, but not immediately. In that case, you might assign an SS dependency with a lag time of, say, –4 weeks. That is, the cabinets must be ordered prior to their installation, and ordering also must be done early enough to account for the four-week lag time from order to delivery. I generally build the construction schedule first. Then, knowing when I'll need materials at the site, I list and assign deadlines to the orders and selections, tying them via dependencies to the task.

Once the work has been defined, durations assigned, and dependencies applied, what emerges is a graphic representation of how the project is meant to proceed. In the illustration, tasks in red represent the critical path. Tasks in blue are not critical, and as long as they finish or start by the constraints assigned them, they can happen at any time. Tile installation, which I mentioned earlier, could be one. Exterior trim and siding is another.

As long as I complete that work before it's time for me to head inside and begin trimming, I'm in good shape.

Injecting reality into the schedule

After construction starts, begin comparing actual progress to the progress demanded by the schedule. Identifying a problem early lets you take action. If, for example, the foundation takes longer than scheduled, ask yourself what can be done to make up the lost time. Can you sub out the subsequent framing to a faster specialist crew, add a carpenter to your own crew, or put in some overtime to get things back on track?

The answer is up to you, but a Gantt chart lets you know where you should be at any time and allows you to avoid major delays.

One bit of truth remains. However finely crafted and thought out, no schedule is useful unless it is actively shared with all the stakeholders. Consult the schedule to remind yourself to contact subs, inspectors, and suppliers. More important, monitor and adjust the schedule as the job proceeds. If something comes up that will delay the start of a task or allow it to begin earlier, contact the people who are affected so that they can adjust their schedules.

Adjusting a schedule does not mean continually pushing back the end date, nor does it mean trying to finish early. A schedule's goal should be to forecast the life cycle of a project realistically and to help build it as quickly and as efficiently as possible. Finishing consistently early or late means the same thing: You've been sloppy.

The data you gather by tracking past projects makes subsequent schedules more accurate. That improves your bottom line, and coupled with all the other promises you keep as a contractor, it also ensures that you're perceived as an expert not just by your team and your peers, but also by your clients as well. □
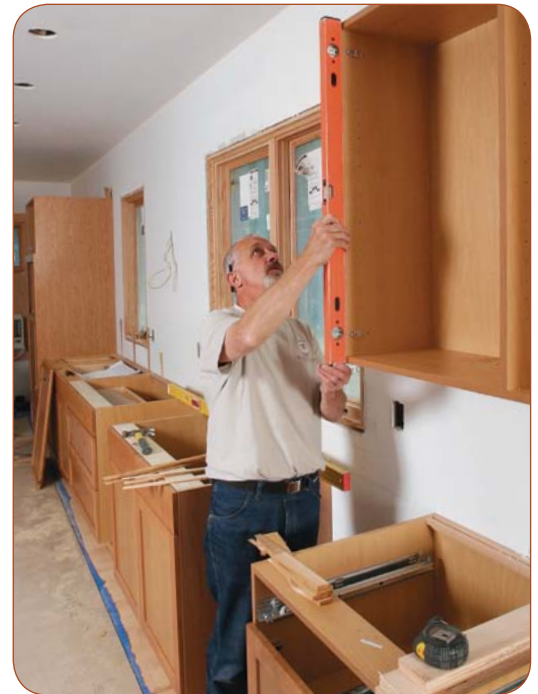
Do your own work in order. Countertops take a couple of weeks from measurement to installation. Start interior trim by installing the cabinets so that the countertop measurements can be taken, then continue on to the doors and trim.

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