SmartPM™

Best Practices in Building a High Quality Baseline Schedule

Course Topics

How to Build a Solid Plan and Schedule

Reminder: Simple Explanation of How it works

All tasks necessary to complete a construction project are listed

- Durations are assigned to each task
  - Relationships are assigned amongst the tasks to create order
    - Tasks, Durations, Relationships are superimposed on a calendar to create a readable plan
      - Priority is assigned to each task based on its sensitivity of delaying the project end date

THIS IS THE MOST IMPORTANT PART!!!

Reminder: Simple Explanation of How it works

The scheduling process is not rocket science and does not require a specialist. Most companies feel as though they need to hire a specific scheduler who knows how to use the software. But it's not really necessary for that type of person to be involved. It's more important to have the people who are building the project, the Project Manager, the Supers, even the subs, heavily involved in the schedule management process. Since the information or the tools out there aren't that difficult to use, it's it should be done by these people. They're the ones building, they're the ones who know how to build, they're the ones who have the knowledge of how to build in their head. This knowledge is what needs to be what's placed into these scheduling programs to create the plan which is usable for managing the project. The schedule is a listing of all tasks necessary to complete a project.

Steps

1. Create a list of all of the things necessary that need to be done.
2. Assign durations to those tasks.
3. Assign relationships. For example, I can't start activity B until I start activity A or I can't start activity C until I finish activity B.

Once all of that information is included, the schedule is created. Programs like MS Project or P6 can take that from there and just print it out, create a Gantt chart, and overlay the Gantt charts on top of a calendar. The scheduling program takes your activities, it takes your logic, and it puts it on top of the calendar in a manner that allows you to understand when you should be starting each activity. It is dynamic and prioritization is necessary. The scheduling program determines for each activity that's in there, how much room for delay there is, called float or slack. The amount of float or slack is a meter of the sensitivity towards delaying the project end date. The program will show the critical path sensitivity, which shows at any given point in time, the areas that require being done on time and which activities have some room for delay. This enables the PMs and the Supers to better manage the resources because we all know, resources can be hard to come by. Sometimes resources are in short supply and you have to know where to prioritize your resources to finish on time.

The Most Important Rule of CPM

It is so important that the critical path is accurate, or else the project will not be properly managed. ***This means that all logic needs to be accurate, all durations need to be estimated right and that best practices are deployed when creating and updating a schedule.***

This, unfortunately, requires strict attention to detail, brutal honesty, or the entire scheduling process falls apart!

But you are in luck! You are about to learn best practices in Schedule Development on how to develop a high Quality Schedule!

The Most Important Rule of CPM

The most important rule of CPM scheduling is that it requires near perfection to be effective. You can't put together a half-assed schedule and hope and use it. You have to make sure that the schedule takes into account everything including every single bit of order, every bit of logic, every relationship that's necessary. You can't tell the program that once the roof is done, nothing else needs to happen on the roof. You need to tie in the next piece of logic of what work is done after the roof is complete. You need to specify that windows have a requirement towards doing drywall. You need to specify that once I get done with level two drywall, my guys are moving to level three drywall. Most people forget to put in those logic ties, because the order was already set when setting up a structure. If you're willing to put in a little bit of extra time, think through a little bit more detail, and be a little bit more honest with durations, you, you will create a plan that is actually useful. You will know what to do and when with your resources. There are processes for analyzing that you will learn today.

You will learn:

- The best way to set up a schedule
- The best way to determine all the things that are necessary
- How to come up with the best flow of this information
- How to organize it
- What logic is necessary

Once you use these best practices, you will have very tight plan which produces a useful critical path.

What is Schedule “Quality” and Why is it important?

- Schedule Quality is how well a schedule is built, not just if the durations are right.
- Schedule Best Practices: 1) sufficient detail, 2) all necessary logic and 3) accurate durations
- Schedule Quality needs to be nearly “perfect” for schedules to be effective
- Without Quality, the Critical Path is potentially off and the schedule becomes misleading

What is Schedule “Quality” and Why is it important?

What is schedule quality? Why is it important? The schedule quality is based on how well the schedule built. It's not just the durations are right in the order looks good.

To have a high quality schedule you need to ask:

1. Does the schedule follow best practices?
2. Are there things in the schedule which cause risk to the accuracy of the critical path?
3. Is there's sufficient detail and is all the necessary logic included?
4. Are durations accurate?
5. Are all of the dependencies and logic included?

This is a process that requires near perfection. But it doesn't take that much time. Spend an extra two hours thinking through it, and then you've got yourself a perfect schedule. Know the rules for best practices and make sure that they're all incorporated into the program and you've got yourself a perfect schedule.

The most important fact is that if you don't have quality, there's a high risk of your critical path being inaccurate, which defeats the whole purpose of building a schedule.

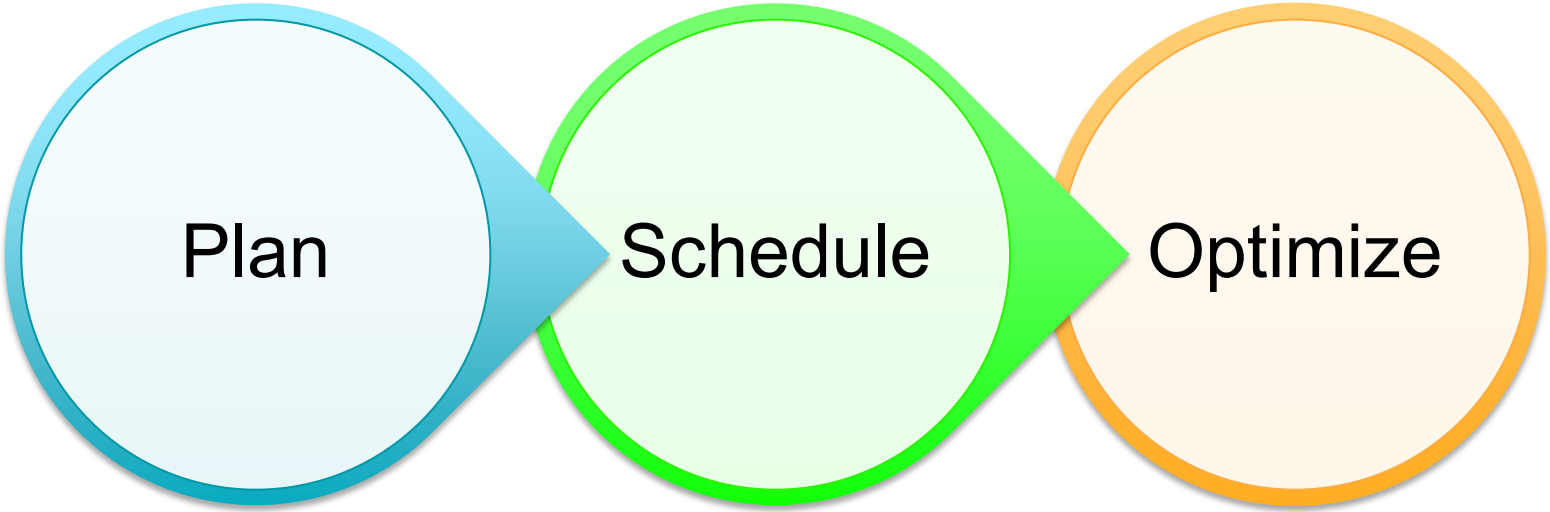
Remember, this program is designed to do one thing, well, take your brain, your ideas, your thoughts, put it down on paper and produce one thing, that's a metric that tells you what's critical at any point in time:

- What's important, what's not
- Which activities require resources
- Which durations need to be met or end date of the job will be impacted

The critical path concept is that anytime you see a critical path item, you absolutely must hit that duration, or else you're going to be delayed.

Planning vs. Scheduling

There is a three-step process. There is a difference between planning and scheduling.



Planning is actually thinking through how you are going to do the job and what process to use for building the project.

Scheduling is placing the information from the plan into the scheduling program.

Optimizing is making necessary changes to the schedule to reflect proper durations and making sure that it feels right in your gut.

Plan, Schedule, Optimize. This is the order in which you do it. You can't sit there and punch a bunch of things in the schedule and then think through how to plan it. You must conceptually plan it out and then you put the information into the schedule program. After that, the scheduling program is probably not going to look the way you thought it should look. Then you need to optimize it, especially if the durations are too long or too short and doesn't feel good in the gut.

Step 1: Choose a CPM Scheduling Tool

Choose a tool. Don't use Excel, Excel is not a scheduling tool. Excel is a databasing spreadsheet program. Don’t use Microsoft Visio. It’s not a CPM scheduling tool. it is a drawing tool which will not lead to effective or efficient schedule management. Use tools like Microsoft Project, and Primavera and other scheduling software. These are the main tools in the industry designed to make sure that we get that float calculation so we can understand critical path sensitivity. The main point of this scheduling program is to highlight areas of priority at any point in time, so you don’t have to spend hours calculating how to draw it out.

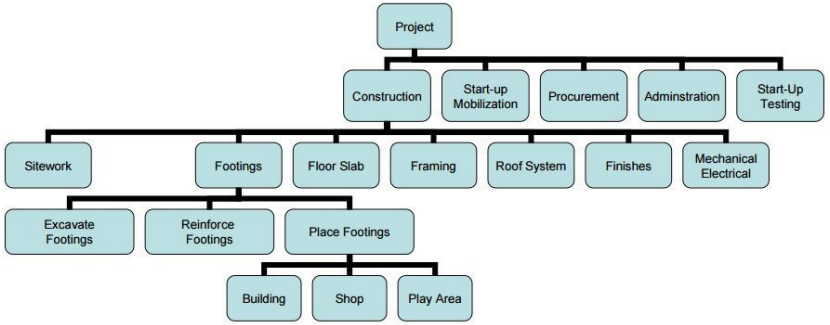
Step 2: Conduct Working Sessions to map out Project Plan

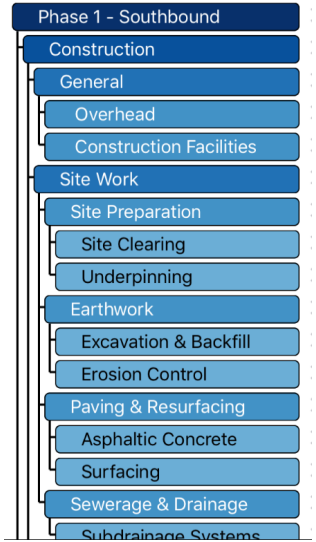
Conduct working sessions to map out the project plan. Sit down with a group of people because you've got to get buy-in from different people. If you're the PM or the Super, you should be collaborating with assistant PMs, assistant supers, the other PMs, the other supers, and even subcontractors. This is when you all sit together, you look at the plan, you start thinking through, the process.

- What order are we going to go in which building?
- What are we going to start with?
- How are we going to clear this site?
- How long are these things going to take?
- And what order do we think we should go in?

This is not always a one-person job. For simpler projects where there's very straightforward work, you can have a single PM. You can have a single PM on projects that you have built over and over and over again. As a single PM on a job, you still need to think about the project and conceptualize the plan. And the drawing should be present in front of you as you think through the plan. There are access areas. There are going to be constraints built into the process that you need to understand. Think about it, get people involved and sit in a room for a few hours and talk about it, conduct those working sessions and understand the general flow of the job

Step 3: Map Organizational Structure (Activity Codes or WBS)





Step 3: Map Organizational Structure (Activity Codes or WBS)

We need to come up with an organizational structure. The organizational structural component of the schedule enables the presentation of the data within the schedule to look nice and be intuitive. You want the owner, subs, supers and everyone involved to be able to understand it. If you just had a whole listing of activities, it would not be intuitive, and information could be lost in translation.

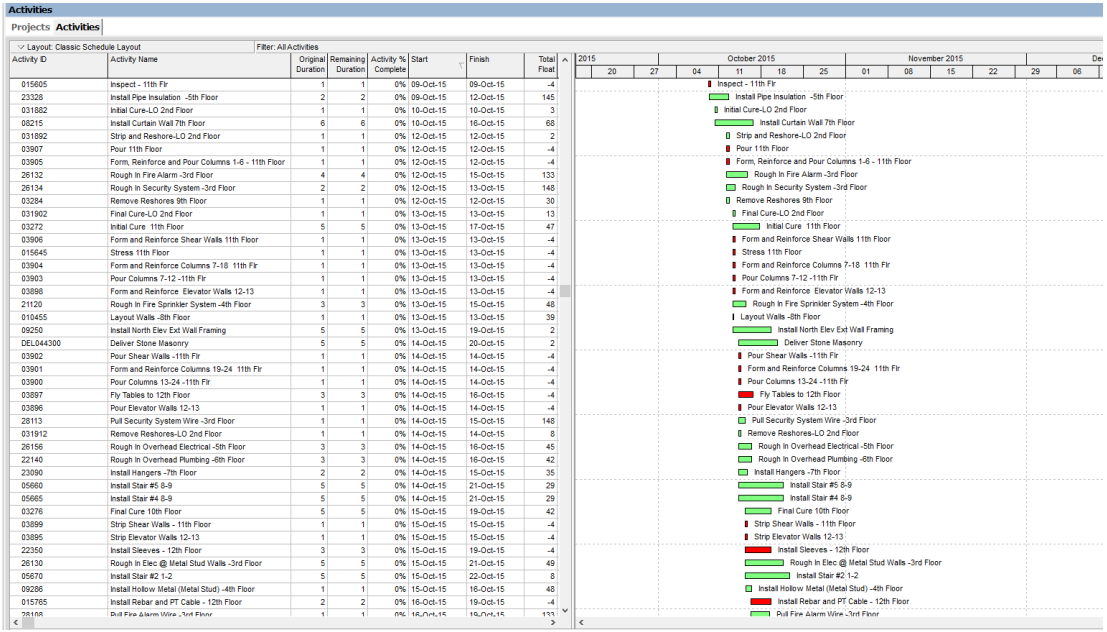
The way to do that is to break it up into components. Start by breaking it up into general phases. Break it up into design, construction, procurement, testing, Final punch list, administration, etc. Identify which category each activity falls into.

The next level is to understand where the trades fit in. Where should structural, concrete, exteriors interiors, etc. fit in.

Then continue to break it up by area or location.

Grouping activities into discrete components, like phase, area, trade, enables you to roll things up and understand the schedule intuitively. You must think through it. After you do this a few times over and over, it'll become self-explanatory and the phases, the organizational structure will be very clear in your brain.

Without Organizational Structure



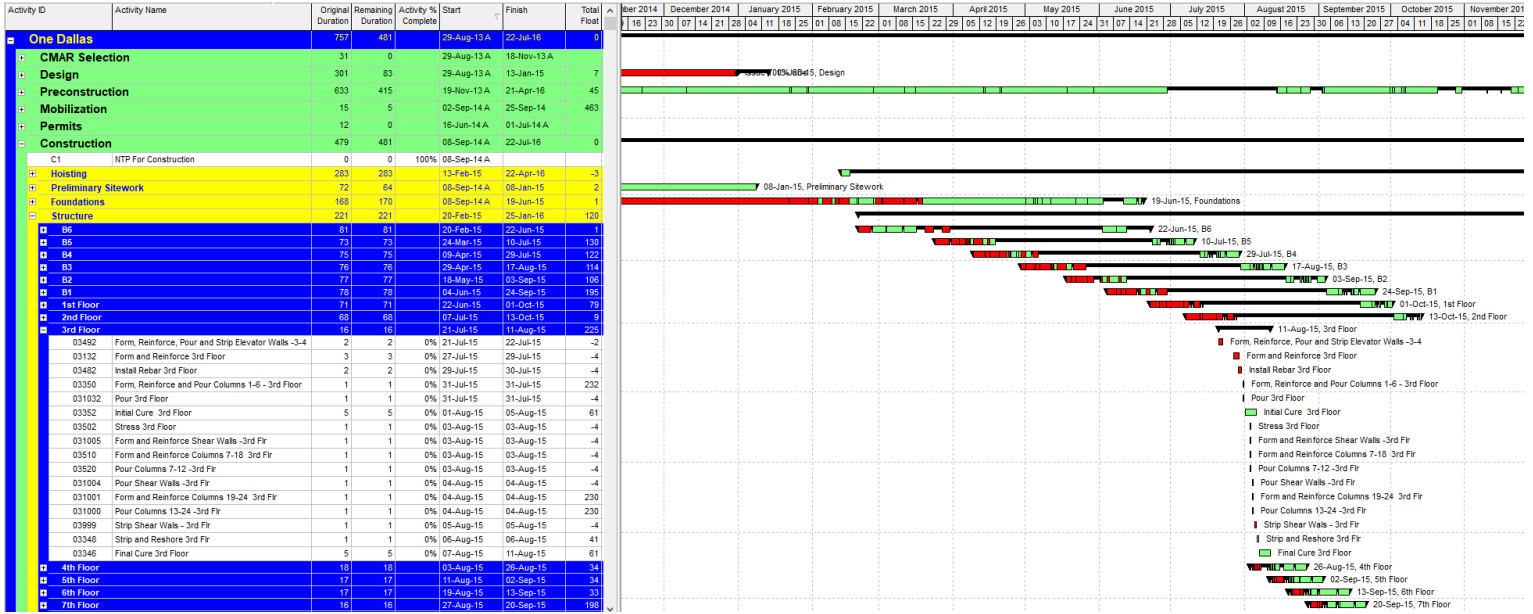
Without an organizational structure, all the activities get laid out in a specific order, and they're not categorized. All you have is this really long waterfall of activities. Locations and the trades are all over the place. In this work breakdown chart you see:

- curtain wall on the seventh floor
- fire alarm going on the third floor
- curing on the 11th floor

This gives you that prioritization through the float values but it is not easy to understand.

Organization Structures (Work Breakdown Structure (WBS) and Activity Codes)

With Organizational Structure



Activity ID	Activity Name	Original Duration	Remaining Duration	Activity % Complete	Start	Finish	Total Float
One Dallas		757	481		29-Aug-13 A	22-Jul-16	0
CMAR Selection		31	0		29-Aug-13 A	18-Nov-13 A	
Design		301	83		29-Aug-13 A	13-Jan-15	7
Preconstruction		633	415		19-Nov-13 A	21-Apr-16	45
Mobilization		15	5		02-Sep-14 A	25-Sep-14	463
Permits		12	0		16-Jun-14 A	01-Jul-14 A	
Construction		479	481		08-Sep-14 A	22-Jul-16	0
C1	NTP For Construction	0	0	100%	08-Sep-14 A		
Hoisting		283	283		13-Feb-15	22-Apr-16	-3
Preliminary Sitework		72	64		08-Sep-14 A	08-Jan-15	2
Foundations		168	170		08-Sep-14 A	19-Jun-15	1
Structure		221	221		20-Feb-15	25-Jan-16	120
B6		81	81		20-Feb-15	22-Jun-15	1
B5		73	73		24-Mar-15	10-Jul-15	130
B4		75	75		09-Apr-15	29-Jul-15	122
B3		76	76		29-Apr-15	17-Aug-15	114
B2		77	77		18-May-15	03-Sep-15	106
B1		78	78		04-Jun-15	24-Sep-15	195
1st Floor		71	71		22-Jun-15	01-Oct-15	79
2nd Floor		68	68		07-Jul-15	13-Oct-15	9
3rd Floor		16	16		21-Jul-15	11-Aug-15	225
03492	Form, Reinforce, Pour and Strip Elevator Walls -3-4	2	2	0%	21-Jul-15	22-Jul-15	-2
03132	Form and Reinforce 3rd Floor	3	3	0%	27-Jul-15	29-Jul-15	-4
03482	Install Rebar 3rd Floor	2	2	0%	29-Jul-15	30-Jul-15	-4
03350	Form, Reinforce and Pour Columns 1-6 - 3rd Floor	1	1	0%	31-Jul-15	31-Jul-15	232
031032	Pour 3rd Floor	1	1	0%	31-Jul-15	31-Jul-15	-4
03352	Initial Cure 3rd Floor	5	5	0%	01-Aug-15	05-Aug-15	61
03502	Stress 3rd Floor	1	1	0%	03-Aug-15	03-Aug-15	-4
031005	Form and Reinforce Shear Walls -3rd Flr	1	1	0%	03-Aug-15	03-Aug-15	-4
03510	Form and Reinforce Columns 7-18 3rd Flr	1	1	0%	03-Aug-15	03-Aug-15	-4
03520	Pour Columns 7-12 -3rd Flr	1	1	0%	03-Aug-15	03-Aug-15	-4
031004	Pour Shear Walls -3rd Flr	1	1	0%	04-Aug-15	04-Aug-15	-4
031001	Form and Reinforce Columns 19-24 3rd Flr	1	1	0%	04-Aug-15	04-Aug-15	230
031000	Pour Columns 13-24 -3rd Flr	1	1	0%	04-Aug-15	04-Aug-15	230
03999	Strip Shear Wals - 3rd Flr	1	1	0%	05-Aug-15	05-Aug-15	-4
03348	Strip and Reshore 3rd Flr	1	1	0%	06-Aug-15	06-Aug-15	41
03346	Final Cure 3rd Floor	5	5	0%	07-Aug-15	11-Aug-15	61
4th Floor		18	18		03-Aug-15	26-Aug-15	34
5th Floor		17	17		11-Aug-15	02-Sep-15	34
6th Floor		17	17		19-Aug-15	13-Sep-15	33
7th Floor		16	16		27-Aug-15	20-Sep-15	198

This is the schedule with an organizational structure, this is the same exact schedule we were just looking at in the previous slide. When you add that organizational structure, it creates this order. This viewable order can be rolled up and can be expanded. It has these titles on the left-hand side. It shows you all the activities that roll up into each category. It enables you to look at it at a different level.

Step 4: List Activities and Set Durations for Each Activity in CPM Tool

Activity	Description	Duration
A	Lower 8" Water Main	5
B	Demolition and Site Prep	4
C	Remove Unsuitable Material	18
D	Order and Deliver Pilings	15
E	Place Select Backfill	6
F	Order and Deliver Sewer Pipe	20
G	Drive Pilings	10
H	Build Embankment	14
I	Lay Sewer Under Embankment	6
J	Construct Saddles	10
K	Place Crushed Rock Base	4
L	Place Asphalt Surface	8
M	Lay Sewer Not Under Embankment	6

Step 4: List Activities and Set Durations for Each Activity in CPM Tool

The next step is to think through the activities and set durations. So far, you selected your scheduling program. You've talked to the people involved. You've thought about flow. You've thought about order. You've come up with an organizational structure.

Now the schedule is going to store this information in a smart way. You need to create a list of all the activities and the durations that you need to do for each category that you created through your WBS structure. Adding categories makes it easy to understand the things that need to be done in this location for that trade. Interiors are a different story. Sometimes you have a whole listing of trades and an order on a location. With the organizational structures enabled, you can start categorizing, even in your own brain, all the little things that need to happen for that item or area. Sometimes that information can be copied and pasted. But you still need to think about each area, each location, phase, the activities that fall into that, and set the durations.

Setting durations factors in some risk. Our brains are wired towards a best-case scenario, known as, planning fallacy. Planning fallacy causes us to estimate time assuming everything will go right. When somebody asks, “What time can you get meet me at the park?”; we usually estimate the shortest possible time in our head. We don’t take into consideration how long it will take us to get out of the house, how many traffic lights we will hit and how long it will take to park. We're not thinking about expected value, we're thinking about best case value, because that's just how we're wired to think. There are a ton of little things that can happen that will extend the time that it takes to get from point A to point B that you're not thinking about.

That's risk. Those are the things that you need to be thinking about in construction. Think about things like the contractor not showing up, the materials being deficient, rain, RFIs, change orders, etc. You need to plan for things to not be ideal with this particular activity or series of activities. If you don't plan for these things, you create a schedule that is not going to happen. If you base your durations on best-case scenarios in every activity across your entire job, your project is going to be much later because of all the little things. There is going to be a critical path and on that critical path, things will get impacted.

You must start thinking about these risk factors here. Most of the time, people don't do that, which is a huge contributor to projects being late and over budget.

Step 5: Apply Necessary Relationships amongst Activities in CPM Tool

The next step is the logic. Assigning logic is the most important part of construction scheduling. The logic is the reason these programs can run calculations. Without the logic, you have static start dates and finish dates, and there's no reaction when there are updates. Logic explains the order to the program. That order is how the program calculates the float value, the start dates and finish dates. Float value helps you prioritize activities to effectively manage to an end date two years from now. There are five different types of logic that are in these programs:

- Finish-to-Start
- Start-to-Start
- Finish-to-Finish
- Start-to-Finish
- Lag

THIS IS THE MOST IMPORTANT PART, MAKE SURE ITS THOROUGH AND ACCURATE

Step 5: Apply Necessary Relationships amongst Activities in CPM Tool

Finish-to-Start – A tie denoting that a Successor can start after its Predecessor is Complete

"Finish" is the predecessor and "Start" is the successor ties. Once I finished my predecessor, I can start my successor. That's a Finish-to-Start tie. This tells the program that I need to finish activity one, then activity two can start. The Finish-to-Start tie is considered a best practice because once this activity is done, that trade is going to clear out and another trade is going to come in and start working on the next activity.

Start-to-Start – A tie denoting that a Successor can start after its Predecessor has started

Start-to-Start ties allow you to start a second activity shortly after the first one. Once I start activity A, I can start activity B. For example, once the mechanical guy progresses enough in the area, then the electrician can follow but you don't necessarily need to wait until the mechanical trade is completely finished. The same thing goes for drywall, mud, tape and painting. You're not going to wait until a giant room is done with all the drywall hanging to get the guys to come behind with the mud and the tape. And you're not going to wait until it's all done to start painting.

Finish-to-Finish – A tie denoting that a Successor can finish after its Predecessor is finished

Finish-to-Finish ties say you can't finish activity B until activity A is finished. For example, I can't finish painting until I put my drywall up. I don't have to wait until drywall has been hung to start painting but I can't finish painting until drywall is done. You can't paint the drywall if it's not hanging up.

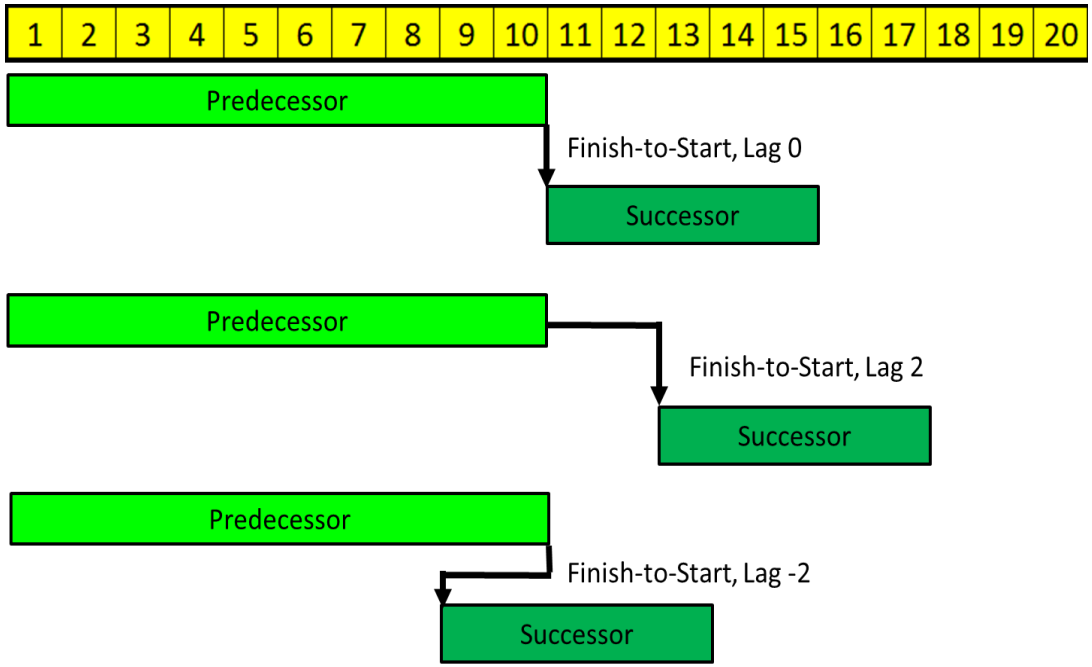
Start-to-Finish – A tie denoting that a Successor can finish after its Predecessor has started (?)

Start-to-Finish ties should never be used. The Start-to-Finish tie says, you can't finish activity B until activity A starts. It doesn't make sense because it is the opposite of a successor predecessor relationship. It doesn't have any place in construction schedule. All the standard quality gauging metrics say that you shouldn't do this, or your schedule gets an F.

Lag – an additional time component that can be assigned to a relationship

Lag is an additional time component that can be assigned to a relationship. It says you can't start activity B until three days after you start activity A. Lag allows you to perfectly align the schedule plan in the program with what you're anticipating in your brain.

Finish-to-Start



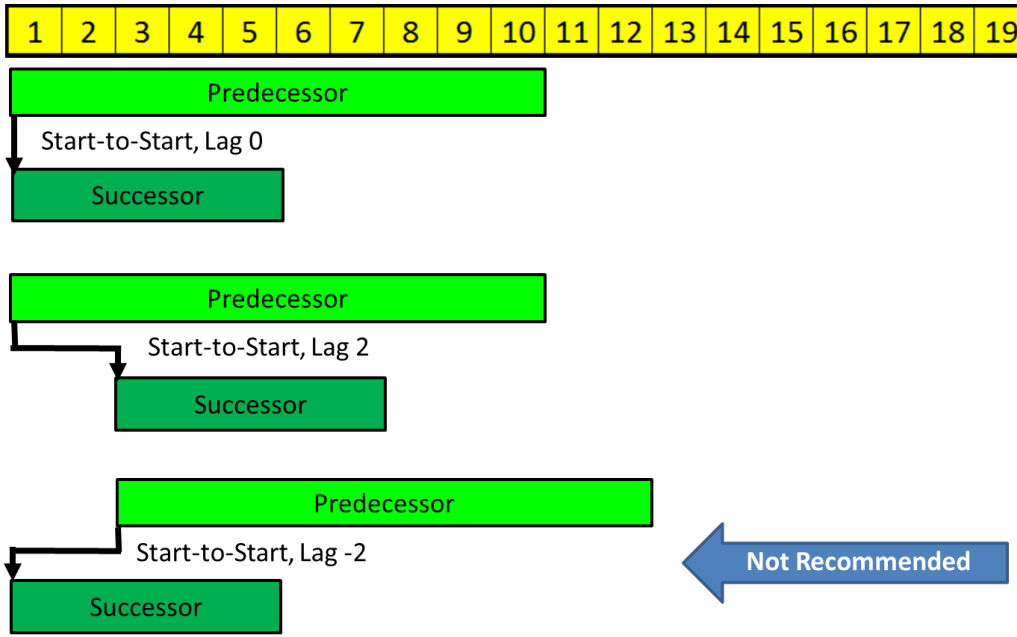
Finish-to-Start Example:

- I can't start activity B until I finish activity A.
- Lag zero would be: I'm starting immediately
- Lag two would be: I'm going to start two days later.

Finish-to-Start should be done sparingly. Curing of concrete is a common place where lag is used. You're going to set your forms, rebar, then you're going to pour it, and then you have to wait for it to dry. You know how long it's going to take to dry. It is going to take two days. You are going tell the program not to start this successor until two days after its finished.

Another way to show Finish-to-Start is negative lag. Negative lag is frowned upon, but it is okay as long as you don't have giant lag numbers. The risk is that the predecessor is not going to be completely done before you start the next activity.

Start-to-Start



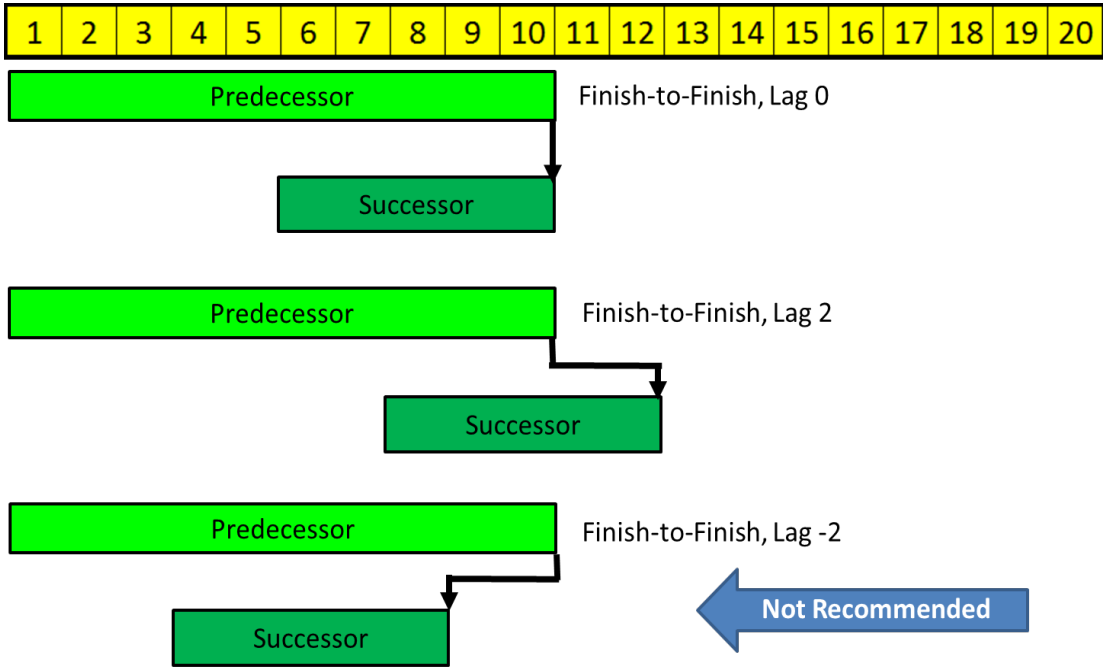
Start-to-Start Example:

- **Start-to-Start lag zero:** I'm going to start on the same day. If you just say Start-to-Start, it means the program is going to default to starting on the same day.

- **Lag 2**: The lag component is how you can stagger it a little bit. For example, have the mechanical guy start his work and then have the electrical guy start his work two days later. You can put in that lag of two days, and it will stagger the start dates consistently with what you're anticipating. And this is generally the most common way to do it.

- **Lag -2:** The other way in which people might do this is a negative-two lag. I'm going to start my successor two days before I start my predecessor. If that were the case, then you generally should just switch the two. This is not recommended.

Finish-to-Finish



Finish-to-Finish Example:

- **Lag zero** – It says that the predecessor is going to get started and the successor is going to get started half-way through and then they're going to finish up on the same day. This is a way for which you to perfectly time completions of things. For instance, if the predecessor is the guy putting up the drywall and the successor is the guy putting up the mud and tape, by that last day, drywall and mud and taping will finish on the same day.

- **Lag 2** - I'm going to finish drywalling and then I will finish the mud and taping two days later

- **Lag -2** I'm finishing my successor before I finished my predecessor. If this is the case, you might as well make it same activity because it's sort of embedded in the process. It's not recommended that you do this.

Step 6: Apply Necessary Constraints (Date, Crew, Calendars, etc.)

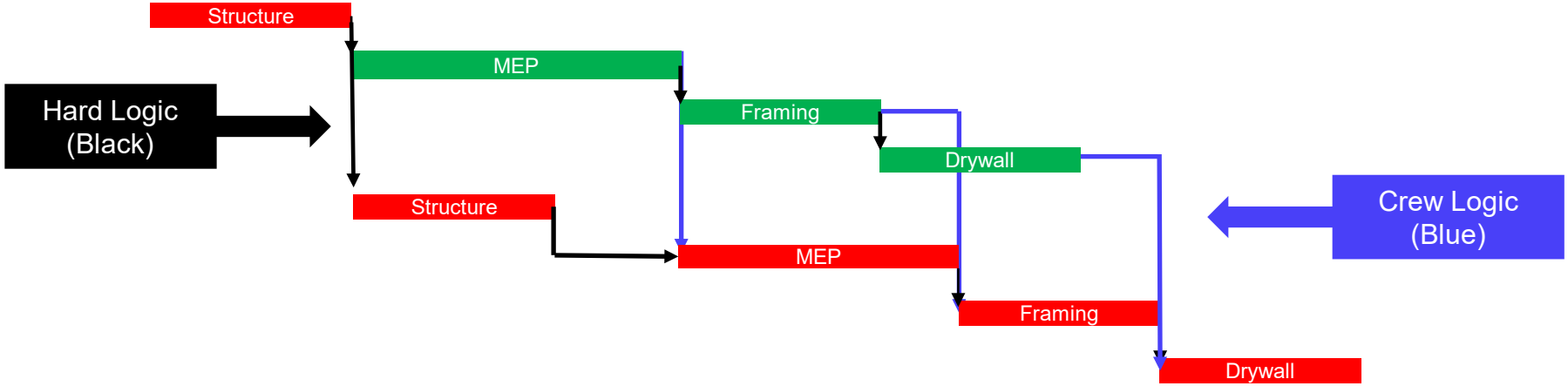
Up until this point you've created the list of activities, organizational structure, and refined your logic. However, the first pass of logic is usually incomplete. You need to sort through what's possible versus what's ideal.

For instance, you can't put a roof on before you've put up a structure. You can't put in a foundation until you've dug a hole, and you've cleared out the earthwork. You can't put in drywall, until you've hung up the framing. You can't put in a window until the walls are there.

You need to consider other things that come into play like holidays, crew logic, and number of crews. Plan how you are going to shift crews from area A to area B. Consider start date issues like if there's some sort of mandate that you can't get access to an area until a certain date and time. Make sure, that you plan for times certain trades can't work.

To account for these items, you can put in constraints, set up calendars, and put crew logic into the schedule.

What is Hard Logic and What is Crew Logic??



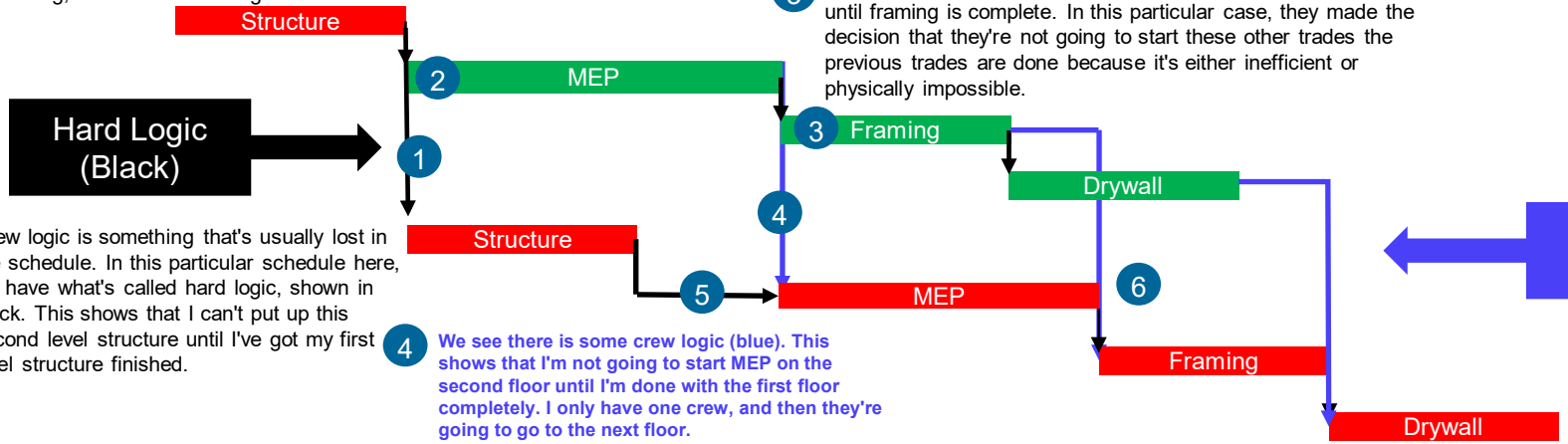
Hard Logic represents logic that can't be done any other way (ie *MEP can't happen until the Structure is Complete)*

Crew Logic represents logic that is 100% based on crew restraints (*ie Site teams choose not to start MEP on Level 2 until Level 1 is complete*)

BOTH ARE REQUIRED FOR SCHEDULES TO BE USEFUL

What is Hard Logic and What is Crew Logic??

2 Once I get this structure in on the first level shown in red, I can actually get into the MEPs, I can start working on my mechanical, electrical plumbing, which is shown in green.



3 But framing can't start until MEP is done. Drywall can't start until framing is complete. In this particular case, they made the decision that they're not going to start these other trades the previous trades are done because it's either inefficient or physically impossible.

1 Crew logic is something that's usually lost in the schedule. In this particular schedule here, we have what's called hard logic, shown in black. This shows that I can't put up this second level structure until I've got my first level structure finished.

4 **We see there is some crew logic (blue). This shows that I'm not going to start MEP on the second floor until I'm done with the first floor completely. I only have one crew, and then they're going to go to the next floor.**

5 Ideally once the structure is done here, we're going to start a crew here, just like we did on the previous floor. But if you did that, you would need two crews. If this is only a one crew job, you need to put in this crew logic tie.

6 The situation is the same with framing. If I only have one crew, I'm not going to split them up. They're never going to be able to overlap. And we have the same situation with drywall.

If you don't put this logic tie in here, this MEP and these framing and drywall activities would have all moved left.

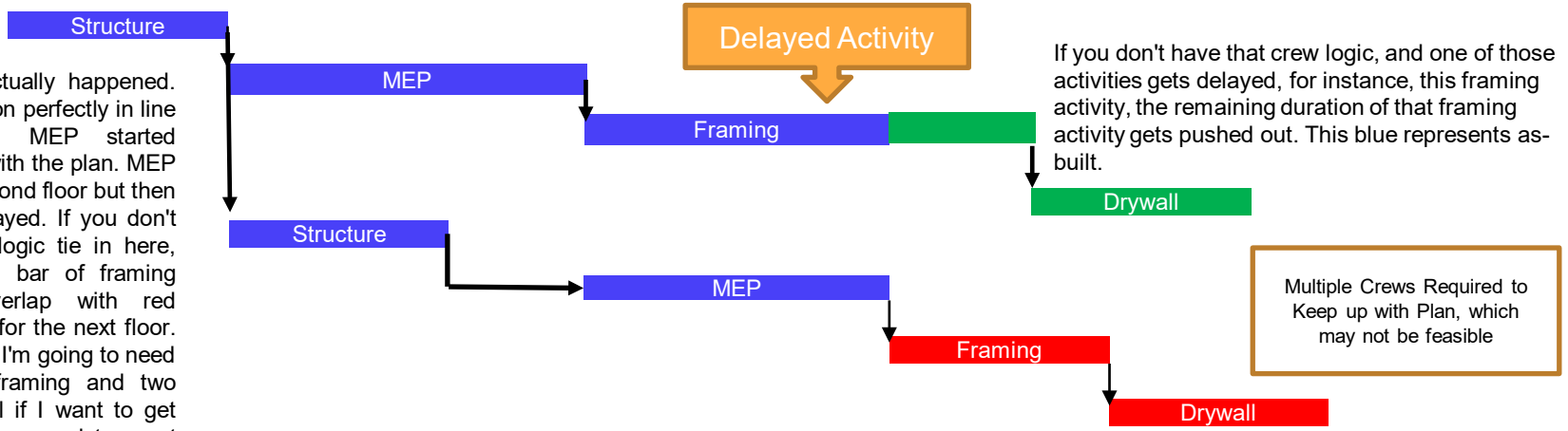
The program would have said, I can start them up right after structure is done. But did you have the two crews? That is why you put in crew logic. In this case, I've only got one crew. When they're done, they're going to go here, which is why we see no break between the first structure and MEP and we see a break between the second structure and MEP.

Why is Crew Logic so Important?

Without it, trades can stack upon delays in a manner that doesn't reflect reality, when it comes to resource/crew restraints.

Here is what actually happened. Structures went on perfectly in line with the plan. MEP started perfectly in line with the plan. MEP moved to the second floor but then framing was delayed. If you don't have that crew logic tie in here, this extra green bar of framing activity will overlap with red framing planned for the next floor. This is telling me I'm going to need two crews for framing and two crews for drywall if I want to get done on time. You need to react quickly and realize that that since you just lost time on framing, you will need to go get a second crew for framing and a second crew for drywall.

Most people do not react quickly because they're not paying that close attention and they don't even realize their project will be delayed.

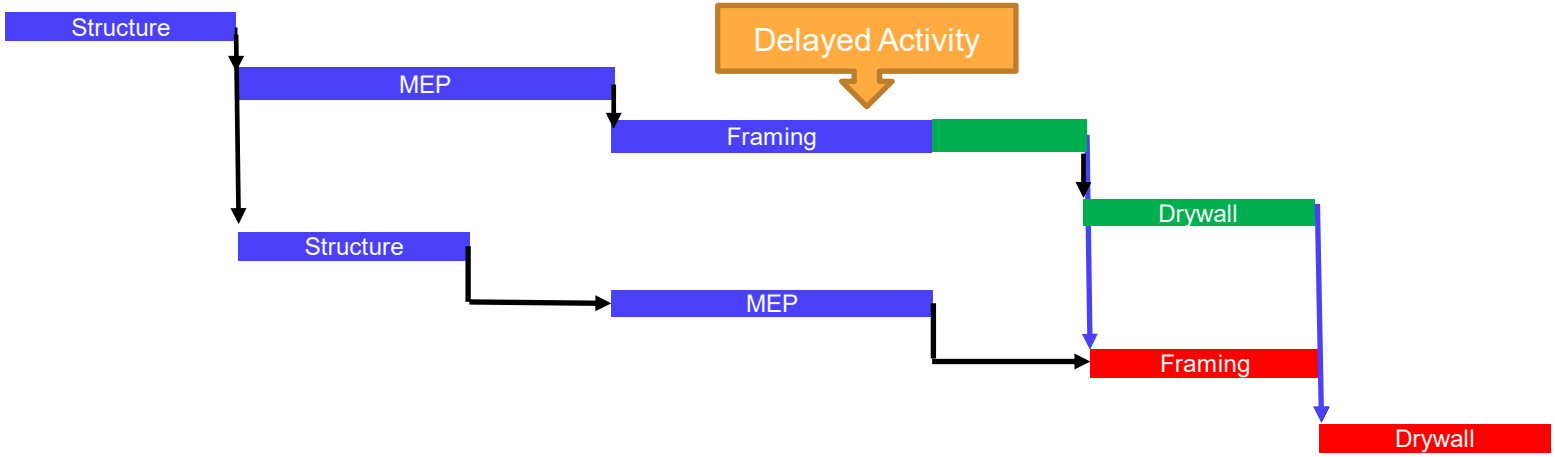


That crew logic is what pushes the framing date out shown by the green bar. Crew logic shows you that you can't do framing on the second floor. We are only going to need one crew for framing and drywall.

But there is a delay. Crew logic lets us see that delay. A lot of people in construction have been wired to put blinders on when there are delays because they don't want to hear it. They don't want to feel it. They don't want to talk about it. But look at it a different way. I want to know that there are delays because I don't want to be scrambling at the end of the job. I don't want to suddenly find out I need two crews.

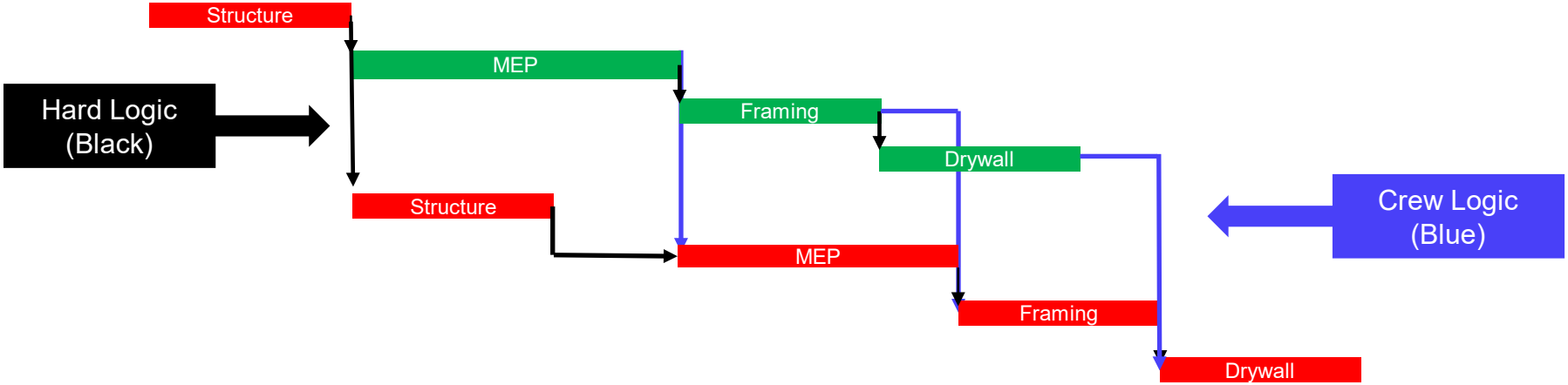
If you get in the habit of ignoring delay, and are constantly course correcting the schedule, you're your schedule will be overly compressed, and the critical path will be inaccurate. You've essentially defeated the purpose of the plan. You are sending out information to people that says you're going to get done before you're really going to get done. And that really ends up causing more problems down the road. Crew logic is what makes schedules more reactive.

Why is Crew Logic so Important?



Crew Logic makes sure crew restraints are reflected in the plan, this is important because it ensures the schedule reacts, so the site team can see the true potential impact of delay. Crew logic also takes away artificial float value.

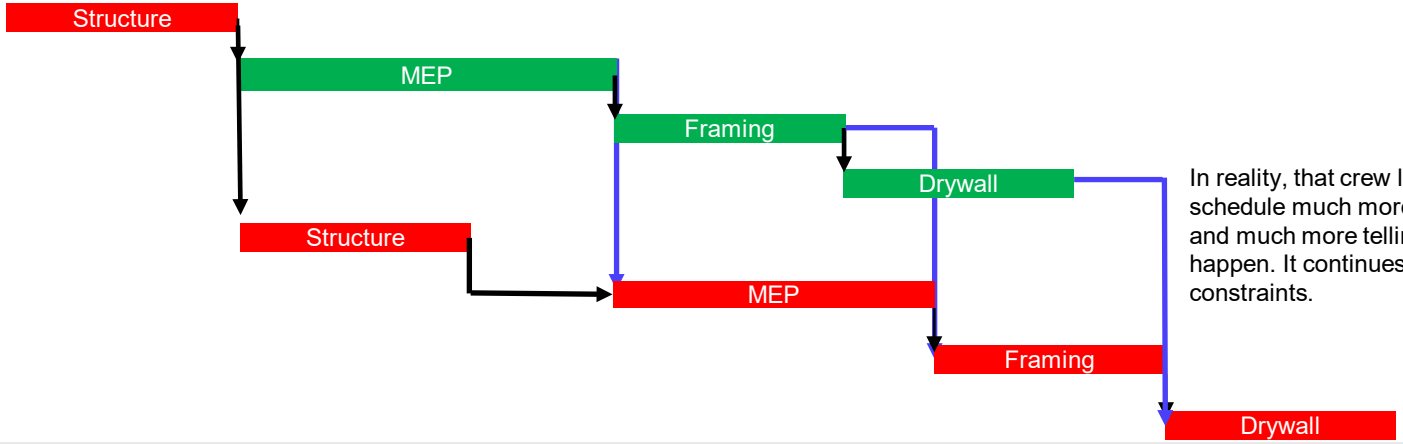
Why is Crew Logic so Important?



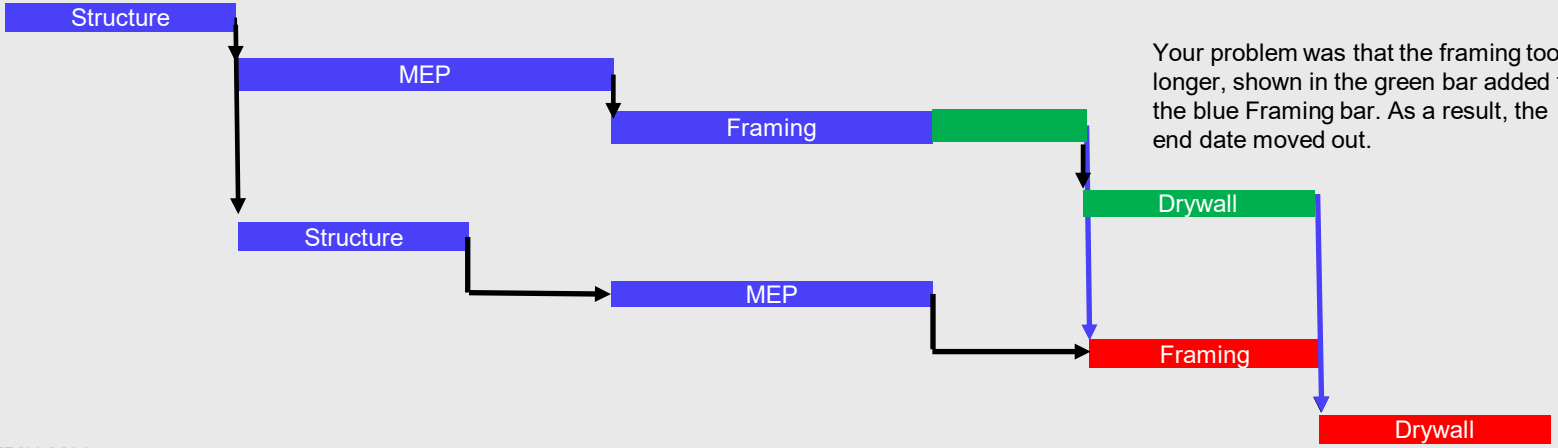
Crew logic will allow the schedule to adjust and show you the impact of changes. If the Drywall crew is unable to work, the float values will adjust with impacts. It will become critical sooner.

It is important to know when the critical path truly shifts so that you know exactly where to place your resources at any given time to manage to an end date two years down the road.

With Crew Logic, Impacts are clear…



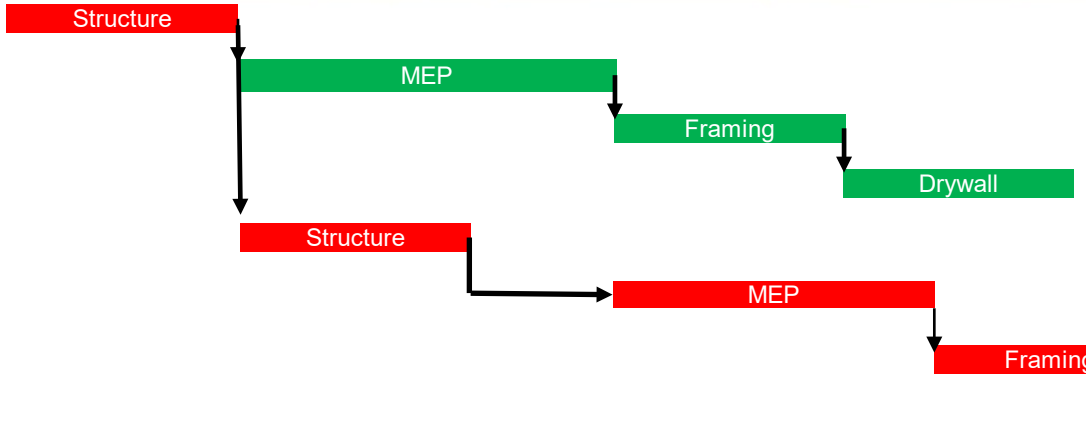
In reality, that crew logic is what makes the schedule much more functional and accurate and much more telling when certain impacts happen. It continues to align with your crew constraints.



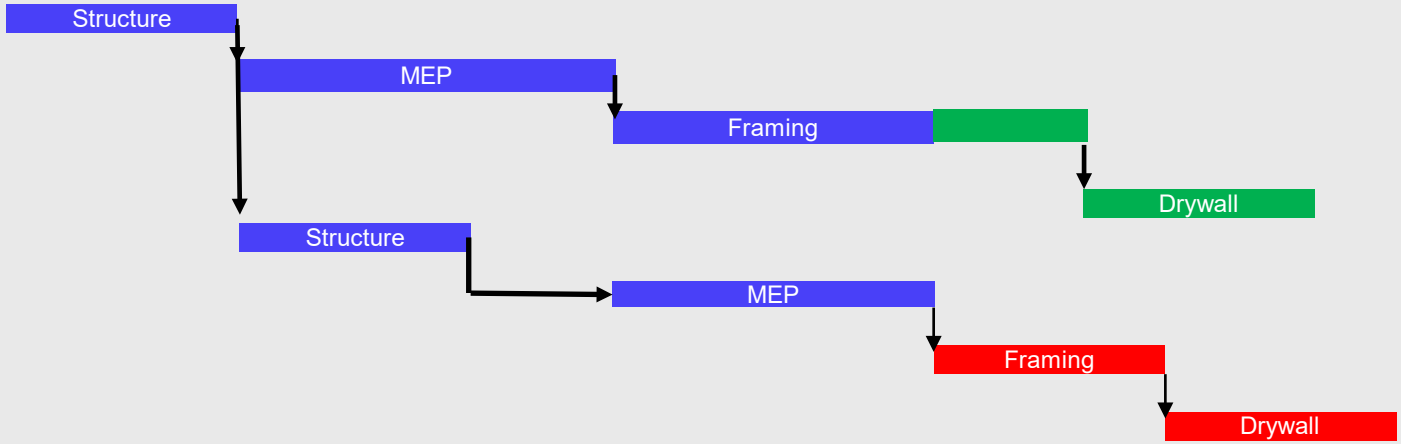
Your problem was that the framing took longer, shown in the green bar added to the blue Framing bar. As a result, the end date moved out.

SmartPM

Without Crew Logic, Impacts are not clear…



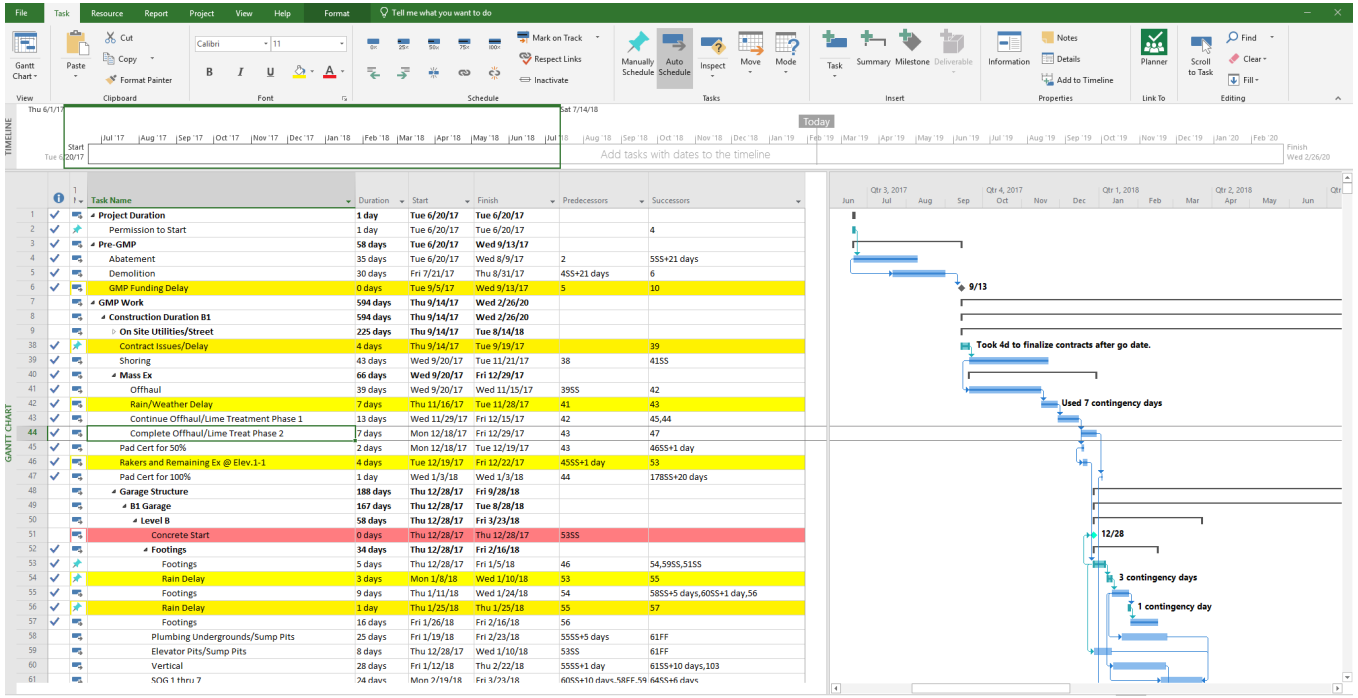
Without it, you see trade stacking, by design, built into your schedule in a manner that goes undetected. It is a recipe for delays, inefficiencies and future disputes. Make sure you have added crew logic to your plans.



SmartPM

How to Build a Solid Plan and Schedule

Step 7: Optimize Schedule



SmartPM

Step 7: Optimize Schedule

To build a solid plan and schedule, you have:

1. Thought of the activities
2. Added organizational structure
3. Come up with the logic
4. Added the logic
5. Tweaked the logic
6. Thought about crew logic
7. Added crew logic to your calendar
8. Broken up those calendars to include holidays and weekends, etc.
9. Placed in constraint data that basically says I can't do X or Y until this date, or we can’t do any work in this period of time.

Once you have completed all these steps, your schedule is almost done. You are at about 95%. Now it's time to just look at it again and analyze it for quality. You can import your schedule to SmartPM to get a schedule quality grade. It's time to take a second pass and optimize it. Optimization is taking your rough draft stage to final draft stage.

In any report, or any letter you write, you are going to have spelling, grammar and other mistakes. Your schedule is going to have mistakes and you must find them. Make sure your schedule aligns with what you were expecting.

What is the best way to optimize a schedule? You can roll it up to the WB s to summary levels to closely examine the higher-level flow. That makes it easier for you to understand if there are logical mistakes because some area will not look right.

Key Indicators to Assess Schedule Quality

Total Activities	110	
Milestones	4	
Activities	106	
Total Relationships	228	2.1:1
Finish to Start	222	97.4%
Start to Start	5	2.2%
Finish to Finish	1	0.4%
Start to Finish	0	0.0%
Missing Logic	5	4.5%
Negative Lag	26	11.4%
Positive Lag	0	0.0%
Constraints	0	0.0%

High Float Activities	49	44.5%
High Duration Activities	0	0.0%
Resource Loaded Activities	0	0.0%
Critical Path %	31	28.2%
Avg. Activity Total Float		51

The Driving Indicators

Driving Indicators are typically at the root of all other Schedule quality issues. For more info. on this subject matter, Google “DCMA” & “Schedule” together.

Key Indicators to Assess Schedule Quality

Once you have optimized your schedule, it's time to analyze it for quality. Quality is about the structural integrity of the schedule and the use of best practices. Is person who built this schedule knowledgeable enough to incorporate the best practices to build a good plan?

There are about 14 indicators. There's an organization called the DCMA, which has come up with a certain set of these indicators that look at structural integrity of a schedule.

One of the indicators is the frequency of various logic ties. How many ties are:

- Finish-to Start,
- Start-to-Start
- Finish-to-Finish

If there are an excessive amount of Start-to-Start and Finish-to-Finish ties, your schedule is at risk. It is at risk because it either represents not enough detail or missing logic. Not enough detail is an issue because the more work each activity represents, the harder it is to say: wait for one activity to be done, before moving onto the next. As a result, activities end up getting staggered through Start-to-Start and Finish-to-Finish ties, which can be misleading.

Missing logic is another one. If an activity does not have a successor, there is missing logic. Nothing needs to happen after the activity is completed. If that activity is delayed, nothing else will be delayed. Similarly, an activity without a predecessor is an activity with missing logic. The activity requires nothing to get started. There should only be two activities in the entire schedule that have either a missing predecessor or a missing successor: The first activity of the schedule or the TP milestone, and the last activity. Every activity should have a predecessor and a successor.

Key Indicators to Assess Schedule Quality

Another indicator of quality is the frequency of negative lag and positive lag. Lag is the component of time that you add to your ties. Some people believe that you should never have lags, but there is a place for lags and SmartPM has a grading structure to help you understand it.

Too many constraints is another quality indicator. Often these constraints are reflective of a schedule that's lacking logic. The logic should be dictating start dates and finish dates, not the not the user.

Consider a constrained start date. A constrained start date is saying that you can't start this activity until a specific date and time. A constraint enables me to say, I'm not going to start structure until next October. If you put a constraint in and you just say, here's the date, and there's no logic tied to it, there's nothing that could push it out. If it's delayed ahead of time, then there's a problem. Structure could be depending on getting the earthwork done or getting the design done or getting the actual materials in place and having them to be delivered. If you select an arbitrary date without any logic for this to start, you're become the person who decides how the schedule should go. This is risky because you are saying it is going to happen, no matter what.

Finish constraints are another issue. You can come up with a point in time that an activity has to be finished. What will end up happening is the scheduling software will create a critical path to that activity. If things are late, the scheduling software will show negative float, which means you're two days late. What happens with negative float is it starts makes the whole schedule look critical. Every activity that has zero days of float or less becomes a critical path activity. If the project becomes delayed, it starts to say all your near critical activities are now critical, which is a problem because it becomes confusing. We want that critical path sensitivity to understand what's driving the end date of this job. It is confusing if the schedule shows multiple paths are driving the end date of the job, where only one path should be driving the end date of the job. It gets especially confusing if you start putting finish constraints on several interim milestones and not just on that last activity. Then the whole schedule turns red showing that everything is on the critical path, and that's a problem. That's why constraints are an issue.

Key Indicators to Assess Schedule Quality

Another indicator is High Float Activities. High float is indicative of missing logic. If you have a lot of high float values, your schedule is not reactive enough, which means that maybe you forgot crew logic, or the schedule is not structured.

Another indicator is High Duration Activities. High duration activities are activities that exceed two months of duration. Any activity that has over two months of duration generally does not have enough detail. Something that takes two months is a lot of work. If you don't break it up into smaller components, the logic is harder to assign properly. It is also a lot harder to assign a percent complete to a two-month activity than it is for a five-day activity. The room for error is much more drastic because it's poised to overtake the critical path if you're inaccurate. If the critical path is off, you're being misled by your own plans. That's why high duration activities are a problem.

These three are the leading indicators which drive all these other metrics. If you want to create high-quality schedules, get good these three things.

1. Missing Logic - Make sure that every activity has a start as a predecessor or a successor.

2. Constraints - Make sure that you minimize the number of constraints, so your schedule is not based on start and finish dates that someone arbitrarily selected. It is very risky because you can't see the true critical path.

3. High Duration Activities – Make sure to break down activities into shorter durations. Otherwise you increase the risk of the critical path not being right.

These three issues are drivers of the other issues. And if you see these issues, then you'll see a lot of high float and low number of activities on the critical path.

SmartPM Schedule Quality Cheat Sheet

Here's the grading structure that's generally accepted in the SmartPM program. Just like spell-checking in Microsoft Word, SmartPM checks your schedule for best practices. It makes sure that you see what your mistakes, like forgetting to add logic, entering wrong durations, stagger, and constraints. This is about cleaning up mistakes, so that you can get your schedule to a level that's acceptable.

Metric	Good	Okay	Bad
Total Relationship Ratio	>= 1.5	1.5 - 1.25	< 1.25
Finish to Start	> 80%	70% - 80%	<= 70%
Start to Start	<= 10%	10% - 15%	>= 15%
Finish to Finish	<= 10%	10% - 15%	>= 15%
Start to Finish	<= 0%	0% - .2%	>= .2%
Missing Logic	<= 1%	1% - 2.5%	> 2.5%
Negative Lag	<= 2.5%	2.5% - 5%	> 5%
Positive Lag	<= 2.5%	2.5% - 5%	> 5%
Constraints	<= 2.5%	2.5% - 5%	> 5%
High Float Activities (> 44 days)	<= 20%	20% - 33%	> 33%
High Duration Activities (> 44 days)	<= 5%	5% - 10%	> 10%
Critical Path %	10% - 20%	5% - 10% or 20% - 30%	< 5% or > 30%
Average Total Float	15 - 44	7.5 - 15	< 7.5 or >=44
Resource Loaded	>= 80%	65% - 80%	< 65%

- Indicates a schedule that lacks crew logic
- Indicates a schedule that lacks detail or is highly compressed from the get go
- Results in an unreactive schedule, with an inaccurate critical path
- Indicator of schedule that is compressed or lacks detail, resulting in inaccurate critical path
- Results in an unreactive schedule, with an inaccurate critical path
- Indicates a amount of risk associated with missing logic
- Indicates a schedule that lacks detail increasing the risk of an erroneous critical path

SmartPM Schedule Quality Cheat Sheet

Metric	Good	Okay	Bad
Total Relationship Ratio	>= 1.5	1.5 - 1.25	< 1.25
Finish to Start	> 80%	70% - 80%	<= 70%
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Total Relationship Ratio: We can see here, it's better to have greater than one-and-a-half successors for every activity on average. You can't have one-and-a-half successors, or one-and-a-half predecessors, for every activity. You can only have one or two. But on average, you can have one-and-a-half. And the reason that's important is that when an activity is finished, two things need to happen. One, the people who just did the work need to go somewhere. Second, the next activity needs to start.

For example, once dry wall is done, that crew needs to go somewhere. You need to tell the program that they're going to go somewhere. You can't let the program just assume that they're going to go somewhere, because it looks like they should. The program needs to know where the crew is going to go. Once that drywall is done, the second thing you need to tell the program what's going to happen next. If you're just telling the program one thing, then you're missing something. That's why we want to have that average at about one and a half, or greater than one and a half, that's reflected that you've actually thought through for a lot of the activities, the multiple things that are going to happen at time every activity is done. If you don't have that crew logic, your schedule will have a lot of high float, and can be compressed without even knowing it.

SmartPM Schedule Quality Cheat Sheet

Metric	Good	Okay	Bad
Total Relationship Ratio	>= 1.5	1.5 - 1.25	< 1.25
Finish to Start	> 80%	70% - 80%	<= 70%
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Resource Loaded	>= 80%	65% - 80%	< 65%

Finish-to-Start, Start-to-Start and Finish-to-Finish ties: The rule of thumb from the DCMA says that you need them for 90% of your activities, but you can tweak that. For a multi-family unit general contractor, you can have more Start-to-Start and Finish-to-Finish ties because there's some general flow built into the floor plan. To make the entire schedule Finish-to-Start would require finishing drywall in Room #1 before doing drywall in Room #2. Realistically what is really going to happen is that a few days after I start drywall, the mudders, tapers and painters are going to start. Once I get started on mechanical, I'm going to follow up with electricians and they're going to know how to operate with each other because of the inherent model of the floor. Room #1 Room #2 Room #3 and Room #4. If that order is very clear, it's less of a risk to have these Start-to-Start and Finish-to-Finish ties. A lot of people ask, how the hell am I supposed to put Finish-to-Start? Everything is a Finish-to-Start tie. There is a sweet spot here. But at the same time it depends on the business, the projects, and the project type.

Start-to-Finish ties should be zero, anything more than that's a problem. Sometimes people say, if you have a single Start-to-Finish tie, your schedule fails. That's what DCMA says.

SmartPM Schedule Quality Cheat Sheet

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Average Total Float	15 - 44	7.5 - 15	< 7.5 or >=44
Resource Loaded	>= 80%	65% - 80%	< 65%

Missing Logic:

DCMA says if you have one missing logic tie on anything other than the start activity and the end activity, then your schedule fails. In SmartPM, we give a little bit more leeway. If 1% of your activities have missing logic, that's one out of every 100 activities has a missing logic tie, you're not going to get dinged. If you have over 2.5% of your activities that are missing logic, your schedule is broken. There's a high risk of your schedule not being useful because you will have a critical path that's off either today or will become off in the future. Make sure that there's no missing logic.

SmartPM Schedule Quality Cheat Sheet

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Finish to Start	> 80%	70% - 80%	<= 70%
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Average Total Float	15 - 44	7.5 - 15	< 7.5 or >=44
Resource Loaded	>= 80%	65% - 80%	< 65%

Negative and positive lag:
Negative and positive lag need to be less than 2.5%. The reason for this is because it's showing you that you're going to stack your schedule from the beginning, or it doesn't have enough detail. If the durations of activities are too high, it's impossible to do everything Finish-to-Start, which would mean you're going to stagger it Start-to-Start.

A lot of times there are long duration for activities on a large structure. Mechanical activities are 70 days, electrical activities are 70 days, and then drywall activities are 70 days, and then carpeting activities 70 days. They are just bucketing these large bits of work activities into one giant activity and it's very difficult to update percent complete. They're going to have leads and lags.

SmartPM Schedule Quality Cheat Sheet

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Total Relationship Ratio	>= 1.5	1.5 - 1.25	< 1.25
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Average Total Float	15 - 44	7.5 - 15	< 7.5 or >=44
Resource Loaded	>= 80%	65% - 80%	< 65%

High Float: You have high float if you have over two months of float for an activity or float is greater than 20%. It's pretty clear that there's a problem if 20% of your schedule has room for delay of over two months. You probably have missing logic. We gauge high duration by number of days, and 44 days is two months. If greater than 5 % of activities are greater than two months duration, there is risk.

SmartPM Schedule Quality Cheat Sheet

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Total Relationship Ratio	>= 1.5	1.5 - 1.25	< 1.25
Finish to Start	> 80%	70% - 80%	<= 70%
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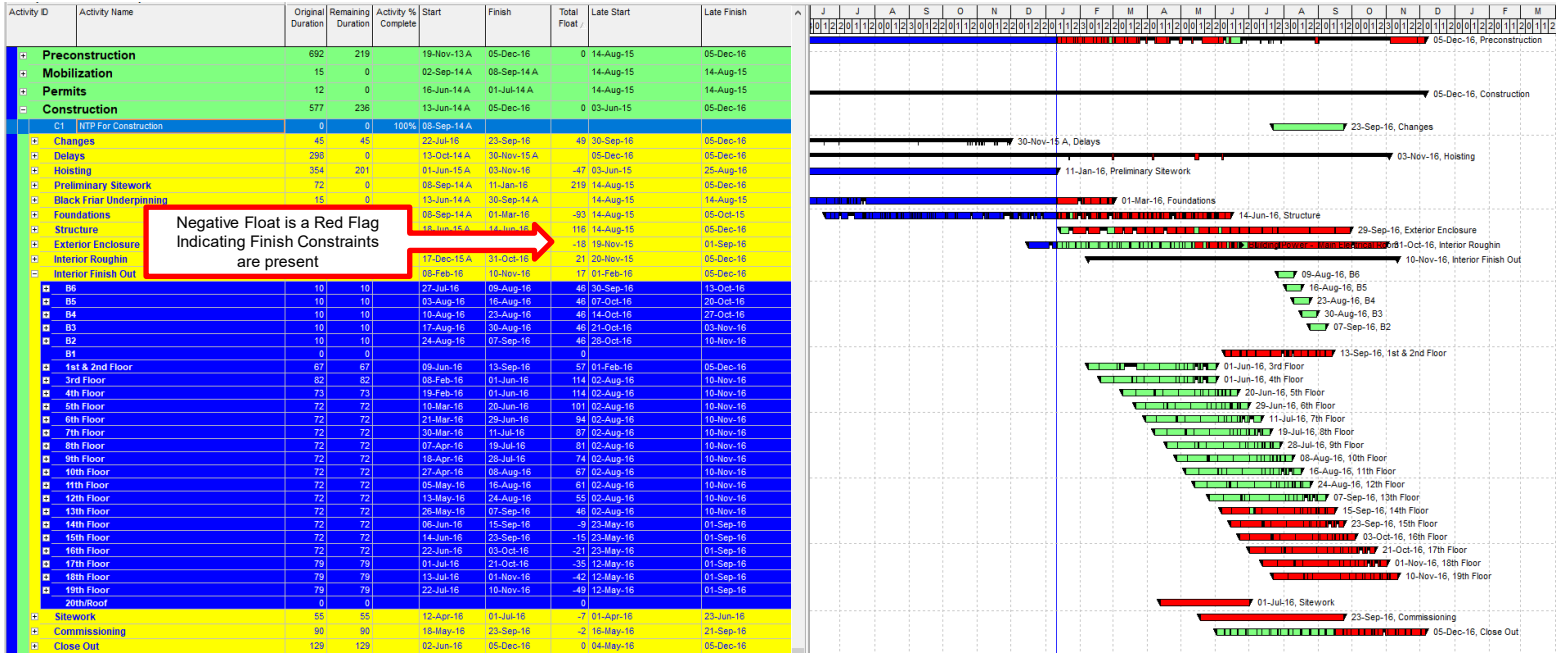
Resource Loaded	>= 80%	65% - 80%	< 65%

High Duration: There are activities that should have long durations, like procurement activities. These activities are nearly impossible to update accurately with a percent complete because you don't really know where they are in fabrication. If you're wrong, it could take over the critical path and tell you something is critical when it really is not critical. In the meantime, the real critical path has no progress because now it's calculating that it has float. The higher the amount of activities with both high duration and high float, the more likely there is a problem.

Example Schedule (unaltered with Missing Logic and has Finish Constraints)

Here's the schedule that has missing logic and has finish constraints. Here you can see some negative float and that means that there is a finish constraint. You can also see that this whole schedule looks critical. That negative float, anything that has zero-time left or less, is going to turn red. This schedule has Finish constraints and some missing logic, and because of this, everything on the schedule is on the critical path. The foundations, structures, enclosures rough-ins, and all the work on the floors is all critical. The entire pre-construction is critical. With everything on the critical path, how can you prioritize your resources, your people? The entire job is critical, according to this plan. This schedule does not tell me the most important place to put people today to manage to an end date down the road. What is basically telling me to scatter the hell out of my people, which is going to be inefficient. It's all because there's missing logic and a finish constraint. Let's see what happens to the schedule when the finish constraint is removed.

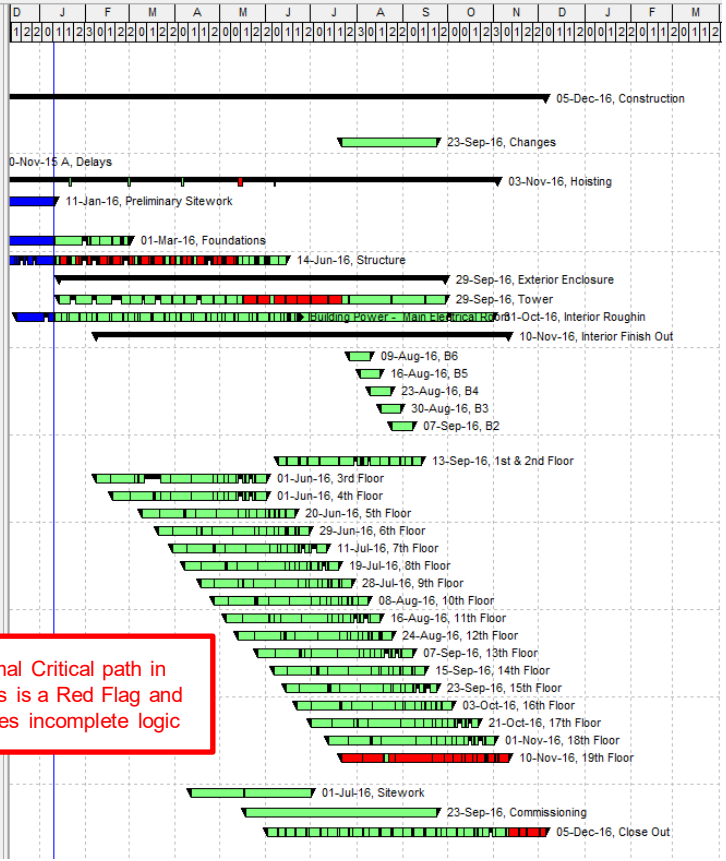


Example Schedule (with Missing Logic, Finish Constraints Removed)

Activity ID	Activity Name	Original Duration	Remaining Duration	Activity % Complete	Start	Finish	Total Float	Late Start	Late Finish
	Mobilization	15	0		02-Sep-14 A	08-Sep-14 A		12-Jan-16	12-Jan-16
	Permits	12	0		16-Jun-14 A	01-Jul-14 A		12-Jan-16	12-Jan-16
	Construction	577	236		13-Jun-14 A	05-Dec-16	0	03-Jun-15	05-Dec-16
C1	NTP For Construction	0	0	100%	08-Sep-14 A			12-Jan-16	
	Changes	45	45		22-Jul-16	23-Sep-16	49	30-Sep-16	05-Dec-16
	Delays	298	0		13-Oct-14 A	30-Nov-15 A		05-Dec-16	05-Dec-16
	Hoisting	354	201		01-Jun-15 A	03-Nov-16	0	03-Jun-15	03-Nov-16
	Preliminary Sitework	72	0		08-Sep-14 A	11-Jan-16	219	12-Jan-16	05-Dec-16
	Black Friar Underpinning	15	0		13-Jun-14 A	30-Sep-14 A		12-Jan-16	12-Jan-16
	Foundations	298	34		08-Sep-14 A	01-Mar-16	41	12-Jan-16	03-May-16
	Structure	227	103		18-Jun-15 A	14-Jun-16	116	12-Jan-16	05-Dec-16
	Exterior Enclosure	174	174		14-Jan-16	29-Sep-16	29	05-Feb-16	10-Nov-16
	Tower	174	174		14-Jan-16	29-Sep-16	29	05-Feb-16	10-Nov-16
	Interior Roughin	198	198		17-Dec-15 A	31-Oct-16	21	25-May-16	05-Dec-16
	Interior Finish Out	199	199		08-Fe				05-Dec-16
	B6	10	10		27-Ju				13-Oct-16
	B5	10	10		03-Au				20-Oct-16
	B4	10	10		10-Au				27-Oct-16
	B3	10	10		17-Au				03-Nov-16
	B2	10	10		24-Au				10-Nov-16
	B1	0	0						
	1st & 2nd Floor	67	67		09-Jun-16	13-Sep-16	57	09-Aug-16	05-Dec-16
	3rd Floor	82	82		08-Feb-16	01-Jun-16	114	02-Aug-16	10-Nov-16
	4th Floor	73	73		19-Feb-16	01-Jun-16	114	02-Aug-16	10-Nov-16
	5th Floor	72	72		10-Mar-16	20-Jun-16	101	02-Aug-16	10-Nov-16
	6th Floor	72	72		21-Mar-16	29-Jun-16	94	02-Aug-16	10-Nov-16
	7th Floor	72	72		30-Mar-16	11-Jul-16	87	02-Aug-16	10-Nov-16
	8th Floor	72	72		07-Apr-16	19-Jul-16	81	02-Aug-16	10-Nov-16
	9th Floor	72	72		18-Apr-16	28-Jul-16	74	02-Aug-16	10-Nov-16
	10th Floor	72	72		27-Apr-16	08-Aug-16	67	02-Aug-16	10-Nov-16
	11th Floor	72	72		05-May-16	16-Aug-16	61	02-Aug-16	10-Nov-16
	12th Floor	72	72		13-May-16	24-Aug-16	55	02-Aug-16	10-Nov-16
	13th Floor	72	72		26-May-16	07-Sep-16	46	02-Aug-16	10-Nov-16
	14th Floor	72	72		06-Jun-16	15-Sep-16	40	02-Aug-16	10-Nov-16
	15th Floor	72	72		14-Jun-16	23-Sep-16	34	02-Aug-16	10-Nov-16
	16th Floor	72	72		22-Jun-16	03-Oct-16	28	02-Aug-16	10-Nov-16
	17th Floor	79	79		01-Jul-16	21-Oct-16	14	22-Jul-16	10-Nov-16
	18th Floor	79	79		13-Jul-16	01-Nov-16	7	22-Jul-16	10-Nov-16
	19th Floor	79	79		22-Jul-16	10-Nov-16	0	22-Jul-16	10-Nov-16
	20th/Roof	0	0				0		
	Sitework	55	55		12-Apr-16	01-Jul-16	90	17-Jun-16	10-Nov-16
	Commissioning	90	90		18-May-16	23-Sep-16	47	26-Jul-16	01-Dec-16
	Close Out	129	129		02-Jun-16	05-Dec-16	0	11-Nov-16	05-Dec-16

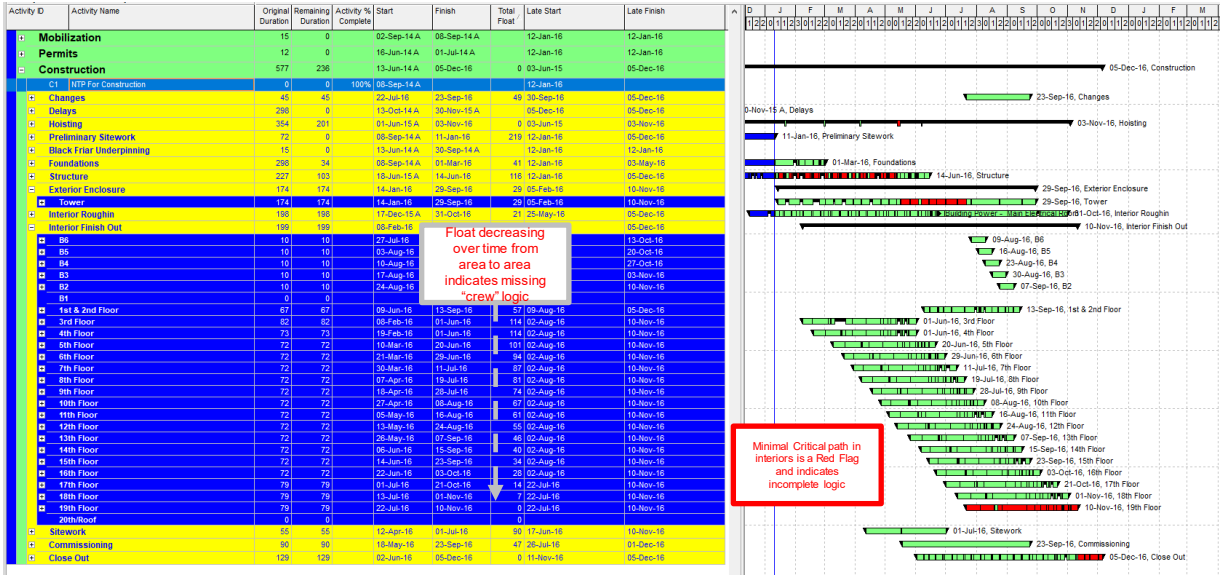
Float decreasing over time from area to area indicates missing "crew" logic

Minimal Critical path in interiors is a Red Flag and indicates incomplete logic



Example Schedule (with Missing Logic, Finish Constraints Removed)

Once I removed that finish constraint, look what happened. The whole schedule is no longer red. Now I see another issue. If you look at this critical path, you can see that it's through the structure, then into the enclosure, and then it's the top floor. This schedule is telling me is, as long as I get the structure up on time, and as long as I do some of these windows on time, to the point where I can get my 19th floor on time, then I'm good to go. But that doesn't really hold water here. If you think about your job, there's so much more work activity that's going to be going on up the building, than there is just to get the structure, the enclosure and the top floor done. All of these things are likely going to be critical. Because there's no crew logic or there's missing logic, there is a problem. We see that there's a critical path, that's not going up my building and not following most of the activity through the crews up the building.

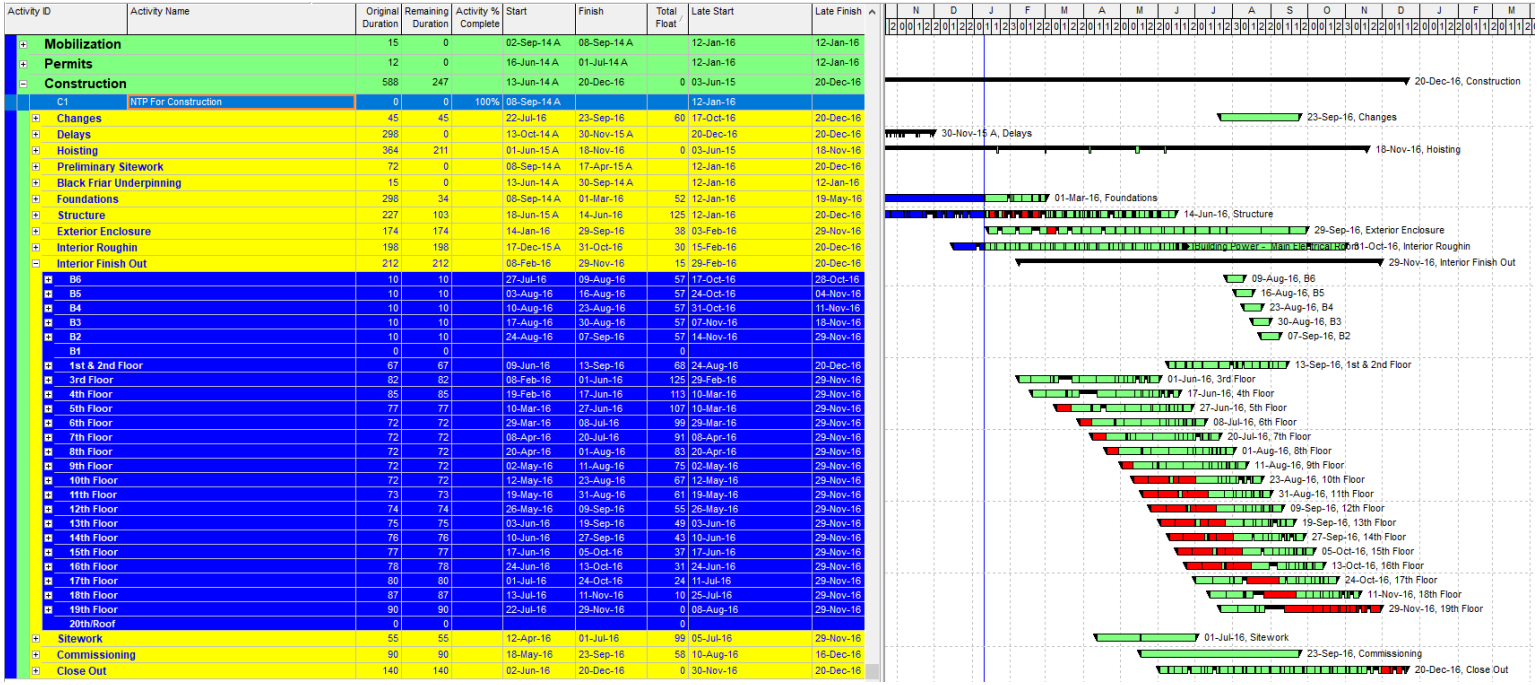


This schedule shows that each floor has float. It is telling me that I can be 114 days late on this third floor, without impacting the end date. It shows the same thing for the next floor, and a little less time for delay on the fifth floor. This schedule is telling us is every activity has up until this point in time, the beginning of the lowest red bar showing critical path, to get done - even if they all happen simultaneously, which we know is impossible. The schedule doesn't know it's impossible, because this isn't what you told it. When you forgot to put in that crew logic, you got all this unnecessary, inaccurate amount of float and inaccurate critical path.

At this point I would go to the trades for each floor and start to tie logic. Drywall can't start on floor four until it's done with floor three. Drywall can start on floor or five till it's done with floor, four. I only have one crew and that crew logic needs to be there. I would do it for several of the major trades, like mechanical, electrical and plumbing.

Example Schedule (with Repaired Logic, Finish Constraints Removed)

Look what happens when I add crew logic. My critical path looks more reasonable. And my float values are different as well. Now the critical path says that it's going to be going up this building and into the trades in the beginning. In the middle of the building there is sensitivity towards critical path delays, and the trades amongst themselves. Towards the top of the building, we need to make sure that these finish trades get done on time. This means you have to keep up with those finish trades throughout. You might want to consider having a contingency plan with crews to be able to keep to this schedule. Think about how to get resources there, how to stagger those resources, and what sort of contingency plan you need to have. Ask yourself, “What are the trades that are going to require?” Have those discussions and give that thought.



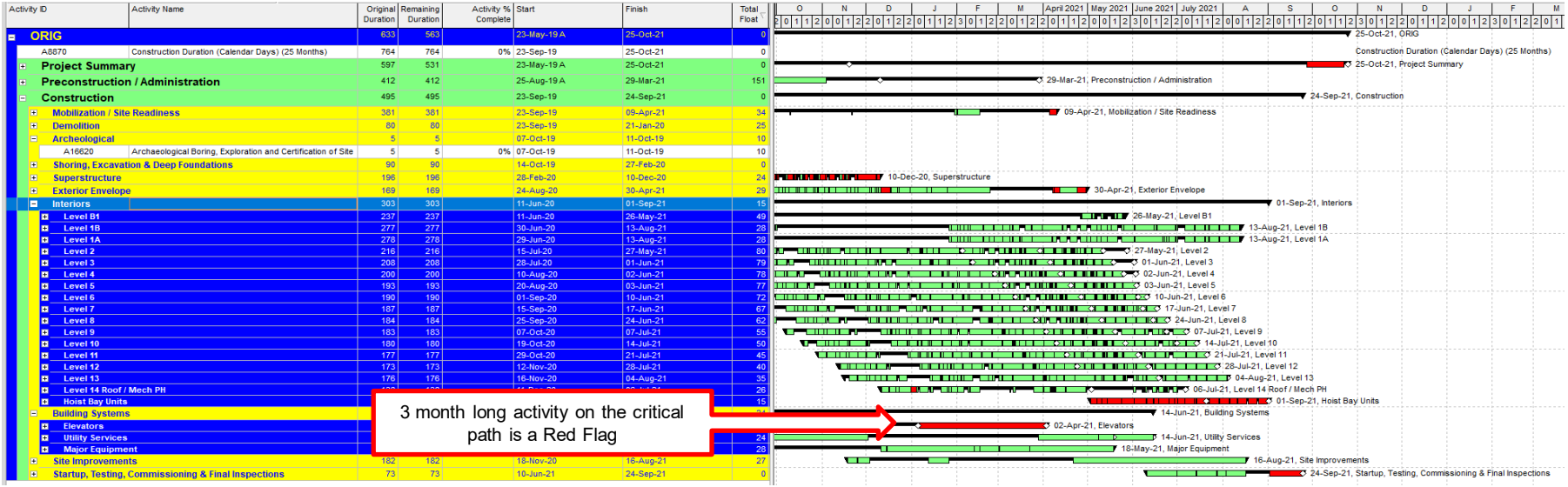
Activity ID	Activity Name	Original Duration	Remaining Duration	Activity % Complete	Start	Finish	Total Float	Late Start	Late Finish
Mobilization		15	0		02-Sep-14 A	08-Sep-14 A		12-Jan-16	12-Jan-16
Permits		12	0		16-Jun-14 A	01-Jul-14 A		12-Jan-16	12-Jan-16
Construction		588	247		13-Jun-14 A	20-Dec-16	0	03-Jun-15	20-Dec-16
C1	NTP For Construction	0	0	100%	08-Sep-14 A			12-Jan-16	
Changes		45	45		22-Jul-16	23-Sep-16	60	17-Oct-16	20-Dec-16
Delays		298	0		13-Oct-14 A	30-Nov-15 A		20-Dec-16	20-Dec-16
Hoisting		364	211		01-Jun-15 A	18-Nov-16	0	03-Jun-15	18-Nov-16
Preliminary Sitework		72	0		08-Sep-14 A	17-Apr-15 A		12-Jan-16	20-Dec-16
Black Friar Underpinning		15	0		13-Jun-14 A	30-Sep-14 A		12-Jan-16	12-Jan-16
Foundations		298	34		08-Sep-14 A	01-Mar-16	52	12-Jan-16	19-May-16
Structure		227	103		18-Jun-15 A	14-Jun-16	125	12-Jan-16	20-Dec-16
Exterior Enclosure		174	174		14-Jan-16	29-Sep-16	38	03-Feb-16	29-Nov-16
Interior Roughin		198	198		17-Dec-15 A	31-Oct-16	30	15-Feb-16	20-Dec-16
Interior Finish Out		212	212		08-Feb-16	29-Nov-16	15	29-Feb-16	20-Dec-16
B6		10	10		27-Jul-16	09-Aug-16	57	17-Oct-16	28-Oct-16
B5		10	10		03-Aug-16	16-Aug-16	57	24-Oct-16	04-Nov-16
B4		10	10		10-Aug-16	23-Aug-16	57	31-Oct-16	11-Nov-16
B3		10	10		17-Aug-16	30-Aug-16	57	07-Nov-16	18-Nov-16
B2		10	10		24-Aug-16	07-Sep-16	57	14-Nov-16	29-Nov-16
B1		0	0				0		
1st & 2nd Floor		67	67		09-Jun-16	13-Sep-16	68	24-Aug-16	20-Dec-16
3rd Floor		82	82		08-Feb-16	01-Jun-16	125	29-Feb-16	29-Nov-16
4th Floor		85	85		19-Feb-16	17-Jun-16	113	10-Mar-16	29-Nov-16
5th Floor		77	77		10-Mar-16	27-Jun-16	107	10-Mar-16	29-Nov-16
6th Floor		72	72		29-Mar-16	08-Jul-16	99	29-Mar-16	29-Nov-16
7th Floor		72	72		08-Apr-16	20-Jul-16	91	08-Apr-16	29-Nov-16
8th Floor		72	72		20-Apr-16	01-Aug-16	83	20-Apr-16	29-Nov-16
9th Floor		72	72		02-May-16	11-Aug-16	75	02-May-16	29-Nov-16
10th Floor		72	72		12-May-16	23-Aug-16	67	12-May-16	29-Nov-16
11th Floor		73	73		19-May-16	31-Aug-16	61	19-May-16	29-Nov-16
12th Floor		74	74		26-May-16	09-Sep-16	55	26-May-16	29-Nov-16
13th Floor		75	75		03-Jun-16	19-Sep-16	49	03-Jun-16	29-Nov-16
14th Floor		76	76		10-Jun-16	27-Sep-16	43	10-Jun-16	29-Nov-16
15th Floor		77	77		17-Jun-16	05-Oct-16	37	17-Jun-16	29-Nov-16
16th Floor		78	78		24-Jun-16	13-Oct-16	31	24-Jun-16	29-Nov-16
17th Floor		80	80		01-Jul-16	24-Oct-16	24	11-Jul-16	29-Nov-16
18th Floor		87	87		13-Jul-16	11-Nov-16	10	25-Jul-16	29-Nov-16
19th Floor		90	90		22-Jul-16	29-Nov-16	0	08-Aug-16	29-Nov-16
20th/Roof		0	0				0		
Sitework		55	55		12-Apr-16	01-Jul-16	99	05-Jul-16	29-Nov-16
Commissioning		90	90		16-May-16	23-Sep-16	58	10-Aug-16	16-Dec-16
Close Out		140	140		02-Jun-16	20-Dec-16	0	30-Nov-16	20-Dec-16

Software: P6- Primavera

Example of Project with Long Duration of Elevators

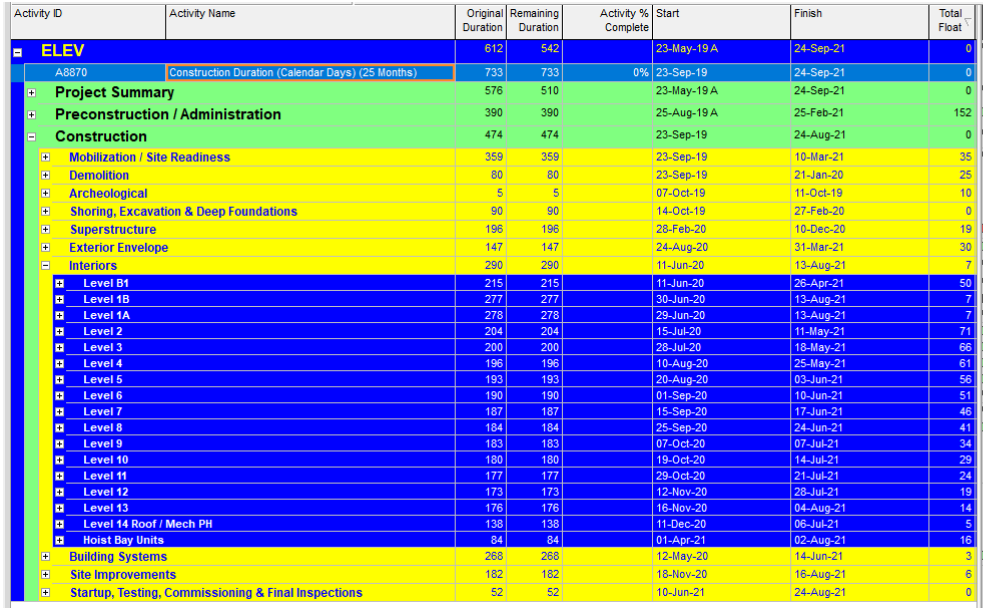
Here is an example of a project with long duration for elevators. This schedule shows a three-month activity for elevators. You can see the critical path is going through superstructure, into elevators, to the exterior envelope, and then the hoist bay units. It indicates interiors will finish wherever the hoist Bay units are done. When there's this really long activity, it will hijack the real critical path. When you have a long duration activity, it doesn't tie very well into the rest of the schedule because you're going to have to do Start-to-Start or Finish-to-Finish ties. Because of one long activity, our critical path looks funky. This project is all about completing the structure on time, the elevators in on time, then doing the exterior envelope, we remove that man hoist, then fill out the interiors on those outside units, and then we're done.

This schedule tells us that all the other things that are going on in the building are okay because they've got lots of float. We can be up to three months delayed in this entire building, as long as we get that elevator in on time, as long as we get these hoist bay units done on time. We know this is not true. Most of the activity that's going on in your schedule is up the building through the trades. The elevator crew could be near critical, but it is not the most critical. The building is what is truly critical. Once you break up the elevator activity into smaller components and tie it more properly into the plan, you will see what happens.



Example of Project with Long Duration of Elevators

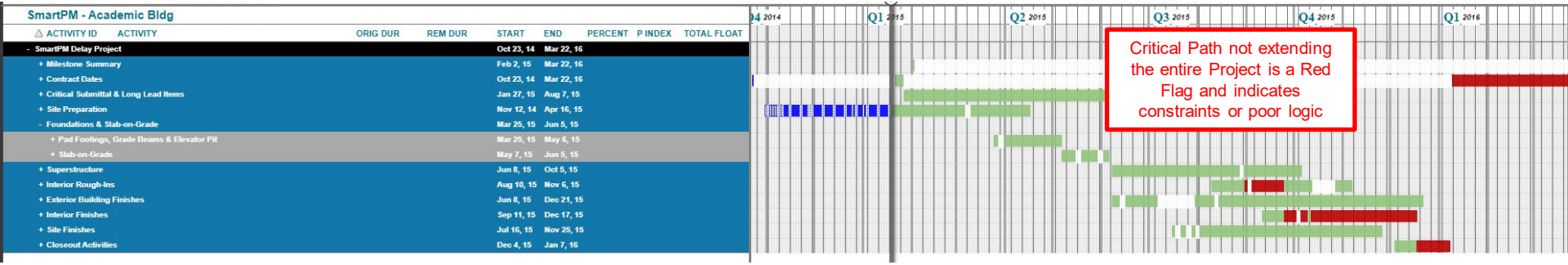
Once you break up the long duration, the critical path will go into the building through the major trades up to the top floors, and then then you get to startup testing and commissioning. That is a more realistic critical path. The hoist bay units have some float but keep on it and get it done. Everything should be getting done as soon as possible except for the things with massive amounts of float. This is a much more logical critical path. When you're making these schedules, it's important for you to follow all these issues and follow all these rules. Make sure to do a gut check. Make sure that the critical path makes sense to you. The critical path is most important part of the schedule.

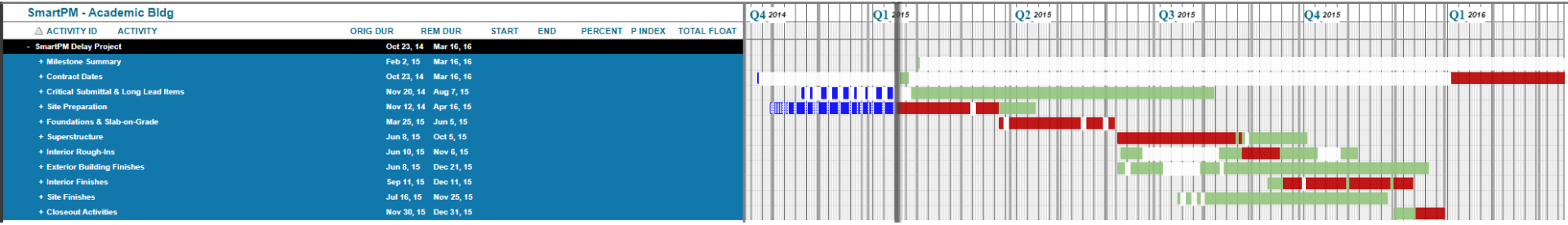


Activity ID	Activity Name	Original Duration	Remaining Duration	Activity % Complete	Start	Finish	Total Float
ELEV		612	542		23-May-19 A	24-Sep-21	0
A8870	Construction Duration (Calendar Days) (25 Months)	733	733	0%	23-Sep-19	24-Sep-21	0
Project Summary		576	510		23-May-19 A	24-Sep-21	0
Preconstruction / Administration		390	390		25-Aug-19 A	25-Feb-21	152
Construction		474	474		23-Sep-19	24-Aug-21	0
Mobilization / Site Readiness		359	359		23-Sep-19	10-Mar-21	35
Demolition		80	80		23-Sep-19	21-Jan-20	25
Archeological		5	5		07-Oct-19	11-Oct-19	10
Shoring, Excavation & Deep Foundations		90	90		14-Oct-19	27-Feb-20	0
Superstructure		196	196		28-Feb-20	10-Dec-20	19
Exterior Envelope		147	147		24-Aug-20	31-Mar-21	30
Interiors		290	290		11-Jun-20	13-Aug-21	7
Level B1		215	215		11-Jun-20	26-Apr-21	50
Level 1B		277	277		30-Jun-20	13-Aug-21	7
Level 1A		278	278		29-Jun-20	13-Aug-21	7
Level 2		204	204		15-Jul-20	11-May-21	71
Level 3		200	200		28-Jul-20	18-May-21	66
Level 4		196	196		10-Aug-20	25-May-21	61
Level 5		193	193		20-Aug-20	03-Jun-21	56
Level 6		190	190		01-Sep-20	10-Jun-21	51
Level 7		187	187		15-Sep-20	17-Jun-21	46
Level 8		184	184		25-Sep-20	24-Jun-21	41
Level 9		183	183		07-Oct-20	07-Jul-21	34
Level 10		180	180		19-Oct-20	14-Jul-21	29
Level 11		177	177		29-Oct-20	21-Jul-21	24
Level 12		173	173		12-Nov-20	28-Jul-21	19
Level 13		176	176		16-Nov-20	04-Aug-21	14
Level 14 Roof / Mech PH		138	138		11-Dec-20	06-Jul-21	5
Hoist Bay Units		84	84		01-Apr-21	02-Aug-21	16
Building Systems		268	268		12-May-20	14-Jun-21	3
Site Improvements		182	182		18-Nov-20	16-Aug-21	6
Startup, Testing, Commissioning & Final Inspections		52	52		10-Jun-21	24-Aug-21	0

Example of Project with Start Constraints altering Critical Path

Here's a situation where somebody put a constraint start date for something down the road. This shows that there is no critical path until next October. Is that true? Probably not. You want to be able to see a critical path that extends from today all the way to the end of the job. If your critical path is not extending from today until the end of the job, you have a problem. If you roll it up in the summary view, and there is not a red critical path, going from the all the way from the today's date to the end of the job, then you've got a broken critical path. Your critical path is telling you that nothing today is going to impact the end of the job, which never happens in construction.





Guidelines for Minimizing Schedule Quality Risks:

Learn these concepts and go through this check list for every job.

1. Every Activity shall have at least 1 Predecessor and 1 Successor (except for Project Start and Completion Milestones)

   If you follow that rule, you're doing better than 95% of the world.

2. There Shall not be any Finish Constraints at all and the # of Start Constraints Shall be Minimal

   Finish constraints are problematic, so don't use them. They were placed into this program because people asked for them to be placed into this program. Finish constrains do not show you the longest path towards the end date. They create an alternate critical path within the actual series of activities that causes confusion. Finish constraints make things more critical. The negative float value makes all the near critical activities into critical activities. The more delayed you get, the more activities become critical red activities. Then you don't have visibility on the true longest path which requires the most sensitivity towards managing resources, and to managing to an end date two years from now.

3. No Construction Activity Shall have greater than a 20-day duration

   All construction activities should be 20 days or less, or one month. Don't schedule any activities that last more than a month because trying to estimate progress on a month-long activity is difficult to do with certainty. Even if you're a few days off, it can alter the critical path.

4. "Crew Logic" shall be Present in Most Major Trades (from Area to Area)

   For all your major trades, you need to put in crew logic. You need to let the scheduling program know that there is a crew, and then they're going to go from this place to that place. It is especially important to add crew logic for the major trades from area to area. The major trades are trades that represent the most amount of work and the highest amount of dollars. Also take into consideration the trades that you're most nervous about impacting your job. Think about the trades that didn't show up with people, who never really listened, who always seem to be the problem. You definitely want to have your crew logic for them.

5. Most Importantly, if something seems "off" with the schedule, it probably is.

   Make sure you do a gut check. Always look at the schedule after you've done all these things and make sure that it looks right. You're the one building it. You're the one who put together the schedule. You're the one who's building the building. You're the one who knows construction. This scheduling program has no damn clue about construction. It's just doing what you told it, and it's telling you something cool to help you. It's not telling you how to build. If you're looking at that schedule and something seems off, it probably is. Make sure that you think through that and make sure that you go figure out what the issue is.

If you follow these five rules, you will have good quality schedules and be doing better than most schedulers.

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PLATFORM FOR CONSTRUCTION