

Creating a critical path

As you've just learned, the **critical path** refers to the list of required project milestones you must reach to complete the project schedule, as well as the mandatory tasks that contribute to the completion of each milestone. You can think of the critical path as a framework that tells you, the project manager, where you are, where you are headed, and when you will get there.

Why the critical path is critical

The critical path helps you determine the essential tasks that need to be completed on your project to meet your end goal and how long each task will take. The critical path also provides a quick reference for critical tasks by revealing which tasks will impact your project completion date negatively if their scheduled finish dates are late or missed. A critical path can help you define the resources you need, your project baselines, and any flexibility you have in the schedule.

How to create a critical path

Each project you work on will be different, but there are some general steps for creating a critical path that are applicable to most projects.

Step 1: Capture all tasks

When you first start working on your project schedule, you will capture all of the tasks associated with the completion of the effort. Remember to use the key planning documents you have created to get you to this point, such as your **work breakdown structure (WBS)**. The main goal in this step is to make sure that you aren't missing a key piece of work that is required to complete your project. When creating a critical path, focus on the essential, "need to do" tasks, rather than the "nice to do" tasks that aren't essential for the completion of the project. Here is an example of critical tasks for building the structure of a house:

Task

- A) Excavation
- B) Foundation
- C) Framing
- D) Roof
- E) Plumbing

Task

F) Heating, ventilation, and air conditioning (HVAC)

G) Electrical

H) Insulation

I) Drywall + Paint

J) Flooring

Step 2: Set dependencies

Now that you have captured all of your critical tasks in list form, arrange those tasks in order of completion by identifying dependencies. To determine **dependencies**, figure out which tasks must be completed before other tasks can start. For example, you can't paint the outside of a house before the house is built, so the task of framing the walls must come before the task of painting them. Identifying dependencies is key to a successful project schedule.

To figure out dependencies for each task, ask:

- Which task needs to take place before this task?
- Which task can be finished at the same time as this task?
- Which task needs to happen right after this task?

Once you have answered these questions, you can list these dependencies next to your list of tasks:

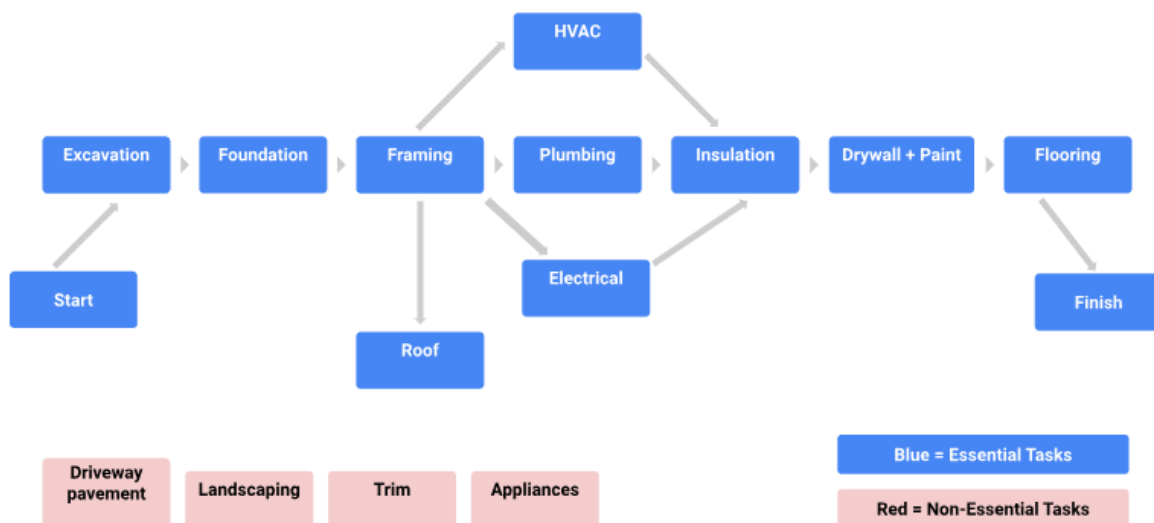
Task	Dependency
A) Excavation	
B) Foundation	A) Excavation
C) Framing	B) Foundation
D) Roof	C) Framing
E) Plumbing	C) Framing
F) HVAC	C) Framing
G) Electrical	C) Framing

Task	Dependency
H) Insulation	E) Plumbing, F) HVAC, G) Electrical
I) Drywall + Paint	H) Insulation
J) Flooring	I) Drywall + Paint

Step 3: Create a network diagram

One common way to visualize the critical path is by creating a **network diagram**. Network diagrams, like the example below, sequence tasks in the order in which they need to be completed, based on their dependencies. These diagrams help visualize:

- The path of the work from the start of the project (excavation) to the end of the project (flooring)
- Which tasks can be performed in parallel (e.g., HVAC and plumbing) and in sequence (e.g., plumbing then insulation)
- Which non-essential tasks are NOT on the critical path

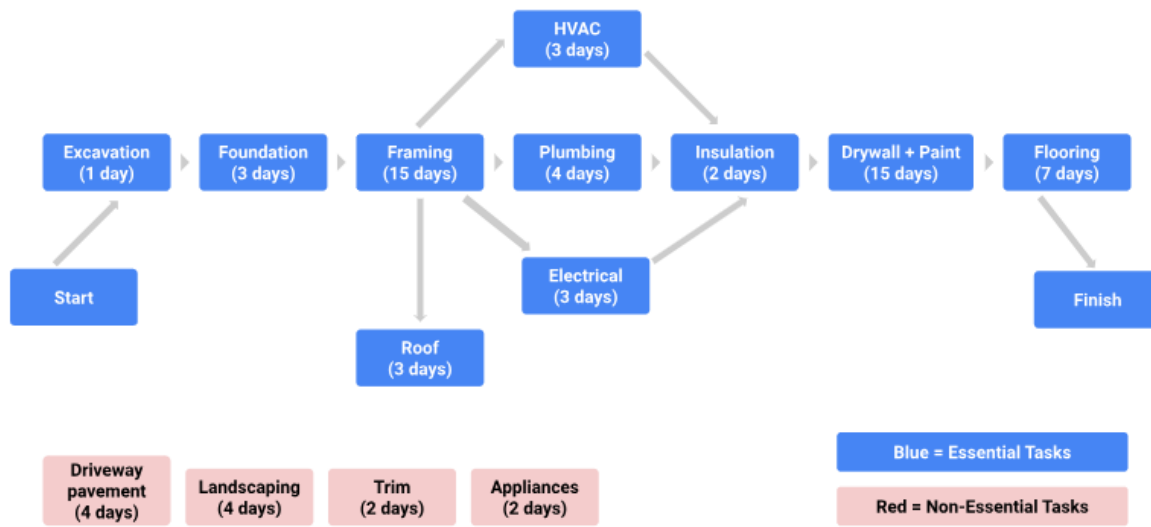


[Long description of graphic above: Essential tasks, including Start, Excavation, Foundation, Framing, Roof, HVAC, Plumbing, Electrical, Insulation, Drywall+Paint, Flooring, and Finish, are laid out in a sequential path and highlighted in blue. Roof, HVAC, and Electrical are shown as tasks able to be done concurrently with Framing and Plumbing. Non-essential tasks are separated from essential tasks and are highlighted in red. Non-essential tasks include Driveway Pavement, Landscaping, Trim, and Appliances.]

Step 4: Make time estimates

After determining tasks and dependencies, consult key stakeholders to get accurate time estimates for each task. This is a crucial step in determining your critical path. If your time estimates are significantly off, it may cause the length of your critical path to change. Time estimates can be reviewed and updated throughout the project, as necessary.

Task	Duration	Dependency
A) Excavation	1 Day	
B) Foundation	3 Days	A) Excavation
C) Framing	15 Days	B) Foundation
D) Roof	3 Days	C) Framing
E) Plumbing	4 Days	C) Framing
F) HVAC	3 Days	C) Framing
G) Electrical	3 Days	C) Framing
H) Insulation	2 Days	E) Plumbing, F) HVAC, G) Electrical
I) Drywall + Paint	15 Days	H) Insulation
J) Flooring	7 Days	I) Drywall + Paint



[Long description of graphic above: Essential tasks, including Start, Excavation, Foundation, Framing, Roof, HVAC, Plumbing, Electrical, Insulation, Drywall+Paint, Flooring, and Finish, are laid out in a sequential path and highlighted in blue. Roof, HVAC, and Electrical are shown as tasks able to be done concurrently with framing and plumbing. Non-essential tasks are separated from the blue items and are instead highlighted in red. The non-essential tasks include Driveway Pavement, Landscaping, Trim, and Appliances. Additionally, each task, (other than Start and Finish) include the task duration measured in days as laid out in the Step 4 table.]

Step 5: Find the critical path

Now that you have your estimated durations for each task, add that information to your network diagram:

If you add up the durations for all of your “essential” tasks and calculate the longest possible path, you can determine your critical path. In your calculation, only include the tasks that, if they go unfinished, will impact the project’s finish date. In this example, if the “non-essential” tasks—like landscaping and driveway pavement—are not completed, the house structure completion date will not be impacted.

You can also calculate the critical path using two common approaches: the **forward pass** and the **backward pass**. These techniques are useful if you are asked to identify the **earliest and latest start dates** (the earliest and latest dates on which you can begin working on a task) or the **slack** (the amount of time that task can be delayed past its earliest start date without delaying the project).

- The **forward pass** refers to when you start at the beginning of your project task list and add up the duration of the tasks on the critical path to the end of your project. When using this approach, start with the first task you have identified that needs to be completed before anything else can start.
- The **backward pass** is the opposite—start with the final task or milestone and move backwards through your schedule to determine the shortest path to completion. When there is a hard deadline, working backwards can help you determine which tasks are actually critical. You may be able to cut some tasks—or complete them later—in order to meet your deadline.