

LESSON 1: UNDERSTANDING CONSTRUCTION DRAWINGS

INTRODUCTION

In this lesson, you'll learn about the different types of drawings used in the construction industry, and how to read floor plans, section drawings, elevation drawings, and detail drawings. You'll see how symbols, abbreviations, and specifications are used to clarify the information in drawings. Additionally, you'll learn about the different types of lines used to draw shapes and outlines in these drawings. You'll also learn about the importance of scale, and how reading an architect's scale is very important to a proper understanding of blueprints.

SECTION 1.1: READING CONSTRUCTION PLANS AND ELEVATIONS

Read the following section. Then read Section 2.3 in your textbook.

Objective

When you complete this section, you'll be able to explain the importance of construction drawings used on a job site.

READING ARCHITECTURAL PLANS

In this section, you'll learn how drawings are used in the construction industry. It's important for a carpenter to be able to read, understand, and interpret the many symbols, abbreviations, and dimensions used on a set of building plans. The information on blueprints will describe how the finished building is meant to be. However, it's important to understand that general contractors are responsible for means and methods. A straightforward way to think of this is that blueprints tell you where and what you need to accomplish, but not how to get the job done. This course will help you learn some of what's required to get the job done.

A set of plans must contain several different drawings in order to provide a clear and complete picture of an architect's design. Floor plans, foundation plans, plot plans, and framing plans must all show consistent dimensions and details that verify each other.

Floor plans get the most use on a job site. Think of floor plans like road maps that you use when driving a car. When you're laying out a job, the floor plan for each area will give you the dimensions and locations of all the important features. Section drawings, elevations, and detail drawings also help to explain the layout of the project so the contractors working on the job can finish the project as the designer intended. One of the challenges that you'll encounter on every job site is mistakes in the blueprints. As a carpenter, you need to train yourself to look for inconsistencies and then bring these up to your supervisor. Written specifications, window schedules, and door schedules are used to provide further clarity and accuracy to building plans. Before you start on an area of a project, it's always a good idea to check that you have all your materials by going over the blueprints, specifications, and schedules. This way you can plan ahead to get any missing materials.

A successful building project requires good communication among all of the people involved in the project—the architect or designer, the contractors and subcontractors, the material suppliers, and the building owners. The better each of these people understand the jobs and problems of the others involved in the building process, the better the communication will be. As a carpenter, you'll have specific duties and responsibilities on a job site. However, the better you understand the building process from all perspectives, the better you'll be able to contribute to a successful project.

This section contains some basic information about print reading that you'll need to master to successfully read construction drawings. One of the most important parts of this assignment is the discussion on reading an architect's scale. Because buildings can't be drawn full-size on a set of plans, the scale system was devised to allow drawings to be drawn to a consistent scale. Included in this course is an actual architect's scale and a supplemental text: *How to Use Your Architect Scale*. This booklet will help you to master the skill of reading a scale. There are also some practice measurement exercises that you can complete. While this is an important skill for helping to understand your project, remember that noted dimensions on a blueprint should always be followed and that if you don't have enough information, you should consult with your supervisor before building a wall or other feature. Common errors in printing and other issues can cause mistakes in the scale of a drawing.

Another important part of the reading assignment is the discussion of different line types. You must be able to determine what a line on a drawing actually represents. Equally important are the symbols and abbreviations used on construction drawings. Your textbook contains a list of many of these common abbreviations. You may want to make a copy of this page and keep it visible in your work area.

Be sure to pay close attention to the sample drawings included as illustrations in the textbook. Make a list of things that you have trouble understanding or about which you have questions.

In this section, you'll learn about site, foundation, framing, reflected ceiling, mechanical, and electrical plans. *Site plans* are actual maps of the land where a building will be located. They must contain property boundary lines, including the locations of corners. Site plans will usually contain information about the ownership of adjacent lots, the locations of roads and utilities, and any easements that affect the deed to the property. They

may also show land contours or topography and the placement of trees, ponds, and other site details. On smaller job sites, plans will include details about controlling storm water, but on larger jobs these details can take up several of their own pages. There are usually directions for how to handle excavated soil on a site plan.

As a carpenter, if you have the responsibility of laying out the foundation for the excavation contractor, it's very important for you to carefully check the lot boundary lines and setback requirements on the site plans. It would be very costly, if not impossible, to correct any mistakes that were made at this early step of the building process.

Like a floor plan, *the foundation plan* is a horizontal cross section of the foundation of a building. The foundation plan is usually drawn in the same scale as the floor plans; if these plans are placed over each other, their perimeters should line up. If you look at the foundation plan in Section 2.3 of your textbook and compare the dimensions with the floor plan, you'll quickly confirm that these drawings do line up. You can also confirm that the floor plan exterior walls line up with the foundation. Structural details like this will often follow a basic concept called *load transfer*. Basically, you always want to have the weight of a building carried in a straight line to the ground. This design allows for a bit of real world inaccuracy though. Notice that the flooring joists are shown stopping about an inch and half back from the exterior edge. If the framer gets a little out of square this will help when it comes time to install exterior sheathing. You'll need to be able to read and understand these drawings in order to lay out the building's foundation squarely and to the proper size. The squareness and size of the foundation will affect the framing process, so you'll need to check the excavation and foundation layout carefully. This process is another example of the importance of communication among the various professionals who work on a building. In a commercial project, checking the foundation layout will be the responsibility of the construction superintendent and architect. In smaller residential jobs, however, it will usually be the job of the general contractor, the foreman, or the lead carpenter.

Framing plans are another type of drawing that are like floor plans. The difference is that they contain information about how to frame the building. In many cases, these drawings aren't included and the framing will simply be specified by 16" or 24" on center (O.C.). However, when a framing plan is specified it usually means that the building has been engineered to meet certain kinds of requirements or building codes. This means it's crucial to understand and follow the framing plans.

Reflected ceiling plans (RCP) are your final type of plan that follow the same pattern as a floor plan and as the name suggests, they show ceiling details. Reflected ceilings plans are where you'll find placement of lights, openings for ductwork in the ceiling, details about bulkheads and other ceiling features, and basic information like ceiling height and often finish. These are key details to carpenters because you might need to coordinate the placement of your studs with the other related trades. Keep in mind that if the electricians need to move your framing to do their job, it isn't going to look very nice when they're done.

Depending on the job you may or may not have mechanical and electrical plans. Often on single family residential the electrical plan will be as simple as one sheet showing the placement of the plugs, switches, lights, and a panel. A good reason for this is that electrical wiring by its nature is an easily adaptable process. Similarly, there might only be a mechanical plan showing the locations of the mechanical equipment and plumbing fixtures. In cases where there isn't a specified plan for where pipes and ducting will be run, it's important to make sure you're in communication with these trades about what kind of requirements they'll have. On the other hand, large commercial jobs will commonly have 3D models from the architect, structural engineers, and mechanical engineers that have all been coordinated with each other. For carpenters, the main advantage of working on a job that has been coordinated using 3D models is that we're less likely to need to change the work.

ELEVATIONS

As you've learned, floor plans show horizontal cross sections through a building. In contrast, *section drawings* show vertical cross sections through a building. While the floor plan provides information about room dimensions, the section drawings, along with the wall schedules, tell you how the walls in that room are to be constructed. Section drawings provide more specific information about the sizes of individual components in the foundation, floors, walls, or roof. Sections are also an important way that a carpenter can start to understand how the structure will support itself. Look at the section drawing in Section 2.3 of your textbook and you can see how the foundation walls sit on the strip footings. Then, 2×8 joists sit on the foundation walls at 16" O.C. This means that studs will be placed parallel to each other every 16". Both 16" and 24" are common dimensions used for framing because drywall and other sheathing is often manufactured in multiples of 16 or 24", such as 8', 10', and 12'. Above the floor joist, the 2×4 studs go up to the pre-engineered roof joists. Finally, the roof sheathing, felt, and shingles finish the structure.

Elevations are orthographic drawings that show how a building will look when viewed from the front, sides, or back. *Orthographic* means that the entire image is projected onto a flat surface and, compared to a perspective drawing, makes measuring between points straightforward.

Elevations are also used to show the layout of rooms such as kitchens, so that you can see how cabinets, built-ins, fireplaces, and other architectural details will look. On a lot of jobs, the architect will include details like these in the design, but a separate set of blueprints called *shop drawings* will be produced by the subcontractor responsible for actually installing the cabinets, fireplace, or other features. Shop drawings are really important because they're usually a bit different than the architect's drawings and they always take precedence. So, make sure you find out if shop drawings are being used on your job. Architectural elevations don't usually contain a lot of dimensions, but they'll show important details such as the type and style of siding, door and window styles, and roof pitch and cornice styles. The roof pitch is one of the most important bits of information on a

job. Look at the section drawing in Section 2.3 of your textbook. The roof pitch is shown as the number 12 over an upside-down triangle with a 6 on the left. This means the roof pitch is 12 units of run and 6 units of rise. Roof pitch is often notated simply as a fraction with an arrow direction and will always be rise over run. The 12 in this case is a reference to 12" and will also sometimes be noted in the drawing.

When you're talking with a building owner, it will often be easier to explain the construction process if you relate the discussion to the elevation drawing. In some cases, you'll also be supplied with perspective drawings or even renderings that will show images closer to a normal photograph. With advancements to computer assisted drawing (CAD) and building information modeling (BIM), renderings are becoming easier to produce and are being used more often.



Self-Check 1.1

At the end of each section of *Construction Drawings and Building Materials* you'll be asked to pause and check your understanding of what you've just read by completing a Self-Check exercise. Answering these questions will help you review what you've studied so far. Please complete "Self-Check 1.1" now.

Fill in the blank.

1. Blueprints and _____ contain all the information about the characteristic of a finished building.
2. Blueprints will always have _____.
3. _____ and _____ will tell you how the walls are constructed.
4. Orthographic drawings are useful because they're easier to _____ than a perspective drawing.
5. The _____ drawings will help you understand how the weight of the structure gets from the roof down to the foundation of the building.

(Continued)



Self-Check 1.1

Respond to the following based on your reading:

6. What are means and methods?
7. What view on a set drawing is the most commonly used and what's an easy way of describing that view?
8. What should you do when you start work on a new area of the job?
9. Who are the main parties involved in a project?
10. Why should you never use a scale to find dimensions on a blueprint?
11. What's the main reason carpenters should carefully follow the blueprints if they're directing the exaction of foundations for a residential job?
12. What drawing or drawings will you look at to find the information required for job sites?

Check your answers with those at the end of the study guide.

SECTION 1.2: ARCHITECTURAL DRAWING

Objective

When you complete this section, you'll be able to distinguish the elements of a floor plan.

Read the following section. Then read Section 2.2 in your textbook.

Floor plans are the basic drawings that show the interior layout of a building, such as the layout of the walls and floors, and the placement of the doors and windows. A floor plan

shows a horizontal cross section or “cut” through a building. That is, if you could lift the roof off and look down into the house, the view you would see would be a floor plan.

Floor plans contain the most information of any drawings in a set of blueprints. All of the other drawings are used to provide clarity and details to the floor plans. Window and door symbols on the floor plans provide details about the type, size, and exact location of these key elements of a building. Kitchens and bathrooms also use many symbols to show details about the layout of these rooms. Stairways, fireplaces, and chimneys are also located and sized on the floor plans. Keep in mind that not all drawings are the same. Some architects will give measurements to the outside of the framing, others will use center lines, and some will use the finished faces of walls. These are the kinds of details that you need to figure out to correctly layout a job. Always take some time before you start laying out a job to look over the blueprints and try to understand the overall picture before getting started.

The exterior and interior dimensions written on the floor plans are an important point of reference for the carpenter. These dimensions are provided to allow the accurate layout and construction of the building. Note that the carpenter will be responsible for the layout and framing of all floors, walls, and roof systems, including the rough openings for windows, doors, chimneys, fireplaces, and other features. For this reason, it’s very important for the carpenter to verify and cross reference the dimensions shown on the floor plans with the building specifications, window and door schedules, section drawings, and detail drawings. The dimensions should be checked against each other for accuracy and consistency. Mistakes made during the framing of a building can be very expensive to correct during the later stages of construction. Good communication with the trades that are following you is always important. For example, confirming the required rough opening size for a tub with the plumbing subcontractor can be an easy way to avoid fixing your work later. If the blueprints provide the wrong dimensions, your boss will appreciate you catching the mistake in advance. Remember, a rough opening is called a rough opening because drawings show the exact dimensions and don’t allow any extra room. By talking to the other subcontractors and confirming the rough openings, you’ll earn their goodwill by not making their job difficult.

As you start to read this assignment, remember that the textbook contains a glossary at the back. The glossary is a useful reference to look up the meanings of unfamiliar terms.

The textbook contains illustrations of floor plan symbols, as well as drawings of what the actual items look like. These illustrations are useful to help you learn about floor plans, so be sure to study them carefully. As mentioned, communication is important on the job site. Knowing the terms and symbols explained in this course is necessary to understand the other trades and the other carpenters you work with.

To read floor plans correctly, you must be able to locate the dimension lines for a particular feature and then read the dimensions written above that dimension line. In the main floor plan shown in Section 2.3 in your textbook, find the overall dimensions of the house. These dimensions are 80’ 0” across the front and rear of the house, and 22’ 0”, and 38’ 0” at the sides. Note that the drawing shown in your textbook is a floor plan that’s dimensioned to the studs. You can tell this by looking at the placement of the hash marks

at the exterior corners. Notice that the brick veneers and siding are shown to the outside of the framing. The brick is shown with the extra thick lines and diagonal pattern and the siding is just an extra thick line. Another clue is that the brick and siding are only shown on the outside of the house. The windows on this blueprint show a common notation style, where the width then height is specified. For example, 3046 refers to the width being 3' 0" and the height 4' 6". These are exact dimensions of the window frame, not the rough openings. In most cases you'll frame this window $\frac{1}{4}$ " to $\frac{1}{2}$ " larger in each direction. A carpenter or a separate subcontractor will install the windows.

As you study the floor plans, you'll see notes concerning the building materials that make up the finished house. Not all of these materials will be familiar to you at this time, so it may be helpful to start a list of materials that you don't know. Keep the list in your textbook, and see how many of the materials you learn about later on in the program.



Self-Check 1.2

Fill in the blank.

1. A rough opening is a reference to the fact that drawings show the _____ dimensions.

Respond to the following based on your reading:

2. What are the four main elements that a carpenter is responsible for when laying out a building?
3. What are three common reference points that architects use when dimensioning blueprints?
4. What are two important elements of communicating with other subcontractors about blueprints?
5. How wide and tall is a 5060 window or door?

Check your answers with those at the end of the study guide.

SECTION 1.3: ARCHITECT SCALE

Objective

When you complete this section, you'll be able to explain how to use an architect's scale.

Read the following section. Then read the supplemental text *How to Use Your Architect Scale*, and complete the "Testing Your Skill" exercises.

After you've completed all of the exercises, check your answers with those found at the end of the booklet. When you're sure that you completely understand the material from this assignment, complete the examination for Lesson 1.