## How drawings are used

Every design discipline in theater uses drawings to one extent or another. In this section, we will focus most heavily on the drawings used for scenic communication, many of which are used in lighting, audio, and projections as well, but drawings are also a major component of costume design and props coordination and construction.

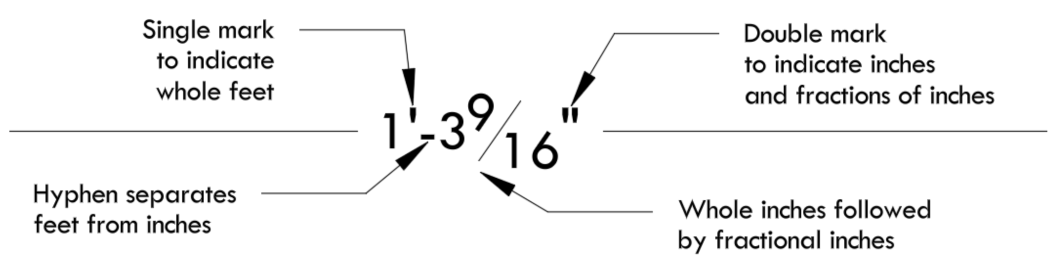
When we deal specifically with the larger elements of the physical installation—again scenic, lighting, audio, and projections—these drawings are important not just for the communication of design ideas and engineering techniques, but also for coordination across those departments.

## Drafting and drawing to scale

A typical drawing package for a scenic design will almost always include several different drawings. Most of these drawings will be **drawn to scale**, also known as **drafting**. Drafting to scale allows us to represent very large objects, such as the theater building, on smaller, handleable sheets of paper while retaining the proportions of the larger objects. This is important because it allows us to accurately visualize how things will look when they're constructed and gives us the capability to determine accurate measurements for both construction and placement from the drawings.

This is achieved by setting a unit of measurement that we use on our paper equal to a real-life or full-scale unit of measurement. Theater (and most, but not all, other entertainment disciplines) use what are known as **architectural units** for these measurements. Architectural units are based on feet, inches, and the fractions thereof. Operationally, this means that we'll set a paper unit, let's say half of an inch (1/2") equal to the full-scale unit of one foot (12"). In this case, we would call this half-inch scale and it would be represented on our drawing as 1/2"=1'-0".

**<u>A note on how to read dimensions:</u>** Architectural measurements use single and double marks that resemble apostrophes and quotation marks to indicate feet and inches. A typical dimension will look like this:



So, if we were using half-inch scale to draw a rectangular stage platform that is will be 20'-0" wide by 12'-0" deep, each line would be drawn 1/2" on the paper for every 1'-0" in reality. The rectangle that we would draw on our paper would measure 10" wide x 6" deep.

When we are hand drafting or measuring physical drawings, the tool that makes this conversion easiest is a **scale rule** or **scale ruler**. The version of this tool that you will see most frequently is shown in Figure 1.4-1 below. This triangular ruler can be used to measure scales from 3/32"=1'-0" to 3"=1'-0" and full-scale. On each edge of the ruler (except for the full-scale edge which functions just like a standard ruler) there are two scales, a larger one and a smaller one. The larger scale in this pair is always twice the size of the smaller: 1/8" is paired with 1/4", 1/2" is paired with 1", 3/8" is paired with 3/4", etc. and the Zero points (from which we start our measurements) of each scale are on opposite ends of the ruler. This construction allows every hash mark on the edge of the ruler to work for both scales, with the longer marks primarily corresponding to the larger of the scales and the shorter marks to the smaller.

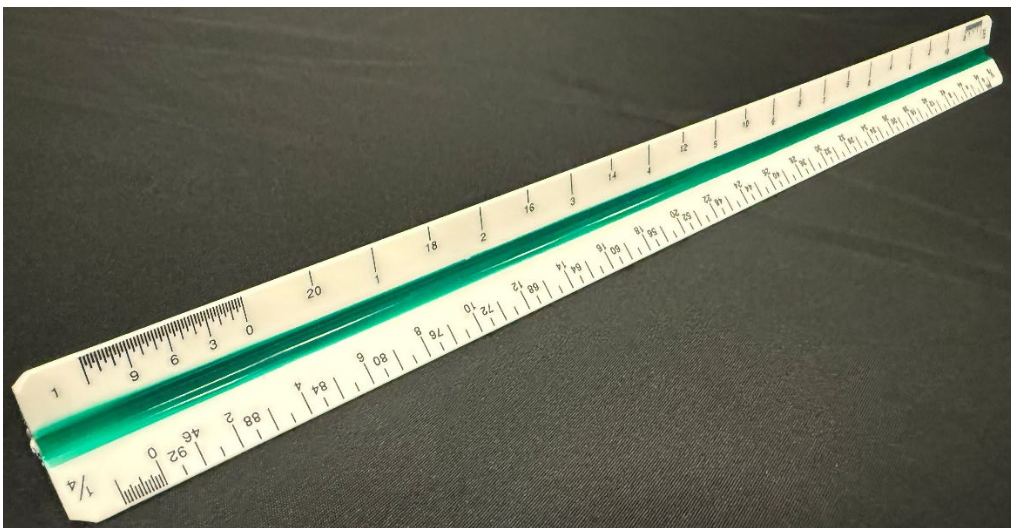


*Figure 1.4-1-Scale ruler*

For example, in Figure 1.4-2 below, showing 1/2"=1'-0" scale, if we start from the 1/2" zero mark and move along the ruler to our left, we see a long mark labeled "10" followed by a shorter mark labeled "2". The longer mark is labeled for the larger scale, in this case 1", and indicates the 10' mark in 1" scale. Because the scales are paired the way they are, that longer hash also corresponds to the 1' mark on 1/2" scale and the "2" is the 2' mark for the 1/2" scale.

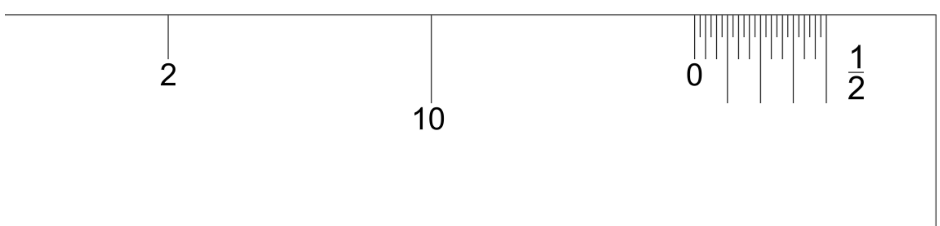
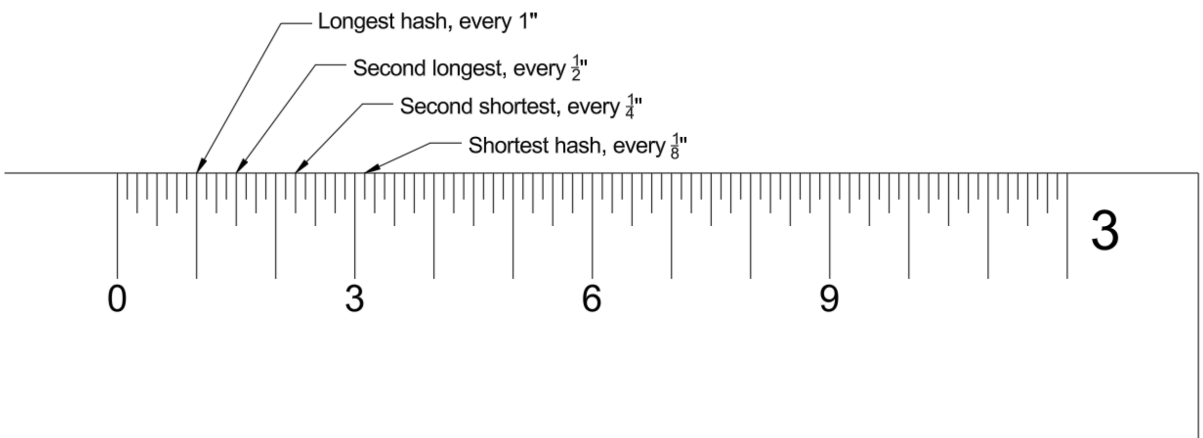



*Figure 1.4-2: Detail of 1/2" scale ruler*

The other major feature of the scale ruler is that each edge breaks down the scale foot into smaller increments. Staying with our 1/2" scale, to the right of the zero mark (Figure 1.4-2, again), we see the foot broken down into a series of long and short marks. The convention with many measuring tools is that the longer an indication mark, the larger the increment. In this case, the long lines represent every 3" in the foot, the next longest every 1", and the shortest represent 1/2". The larger the scale, the more accurate the measurement. In Figure 1.4-3 you can see the breakdown of 3" scale, accurate to 1/8" vs. 3/8" scale, which is only accurate to 1".




VS.

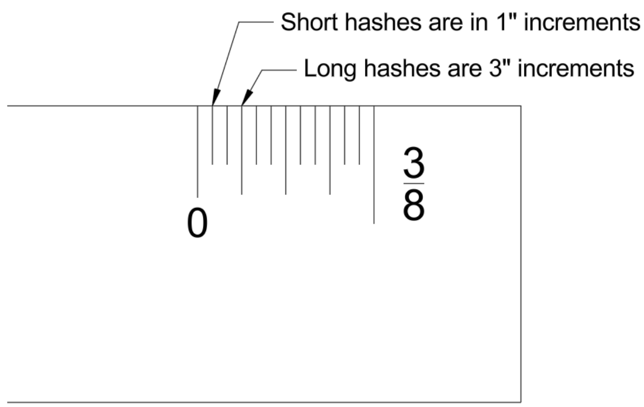



*Figure 1.4-3: 3" scale VS. 3/8" scale*

## Using the scale ruler

To learn how to use the scale ruler, let's figure out the missing dimension of the piano in Figure 1.4-4. When we’re taking a measurement from a scaled drawing we start by locating the zero mark on the corresponding scale. In this case, we'll use 3/4"=1'-0".

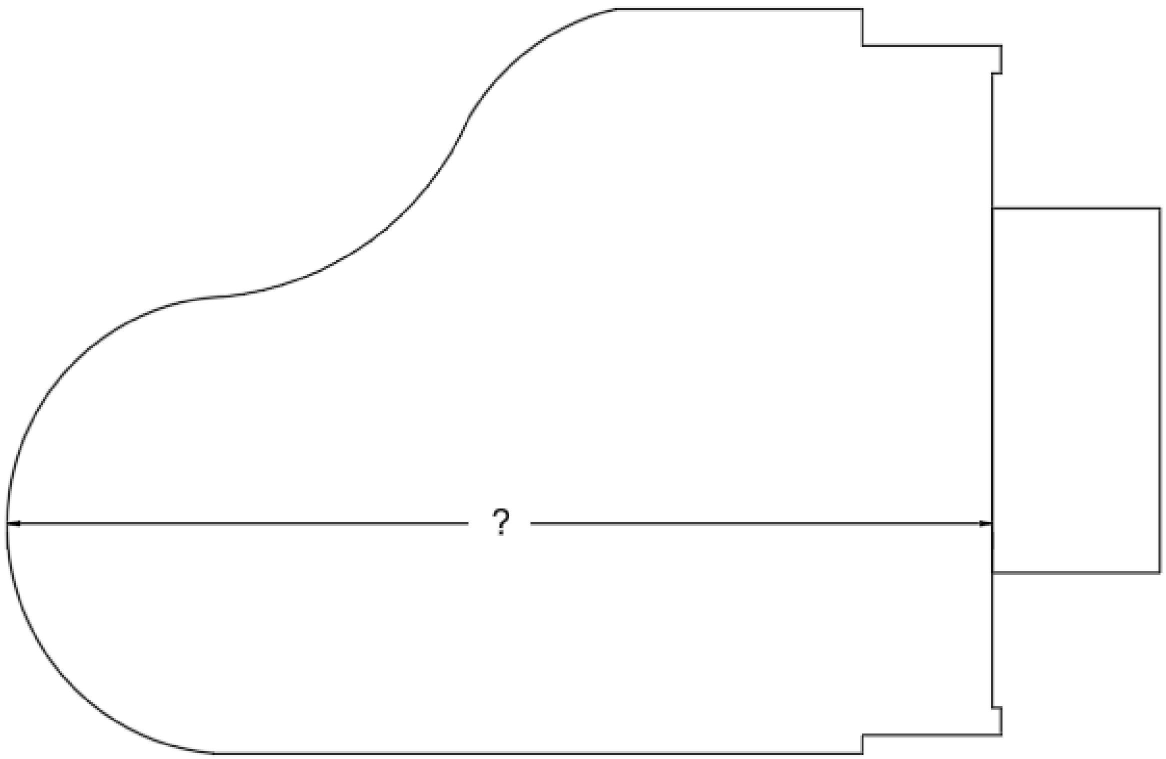



Figure 1.4-4: Piano in plan view, Scale: 3/4"=1'-0"

We align the zero mark with the starting point of the measurement (Figure 1.4-5). Then we go to the endpoint of the measurement, and identify the last whole foot indicator that we've passed (Figure 1.4-6).

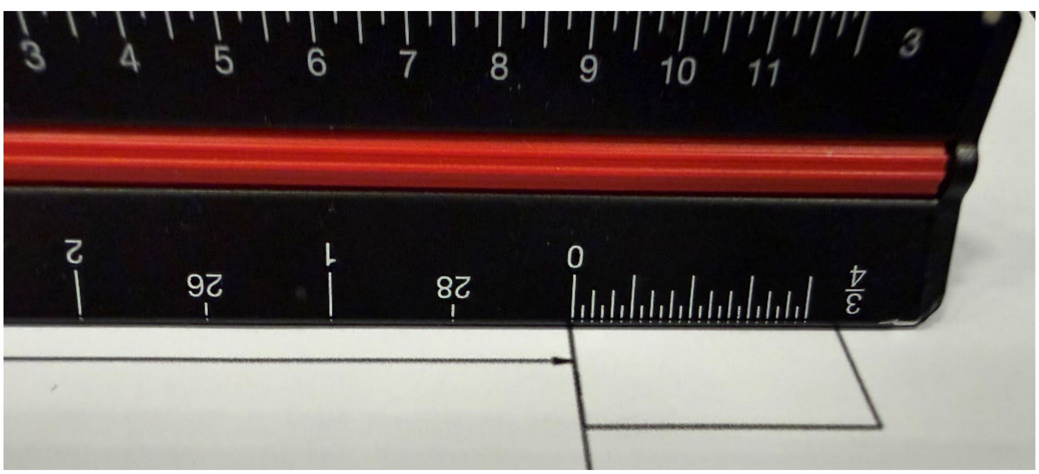



Figure 1.4-5: Set the zero mark at the point we're measuring from

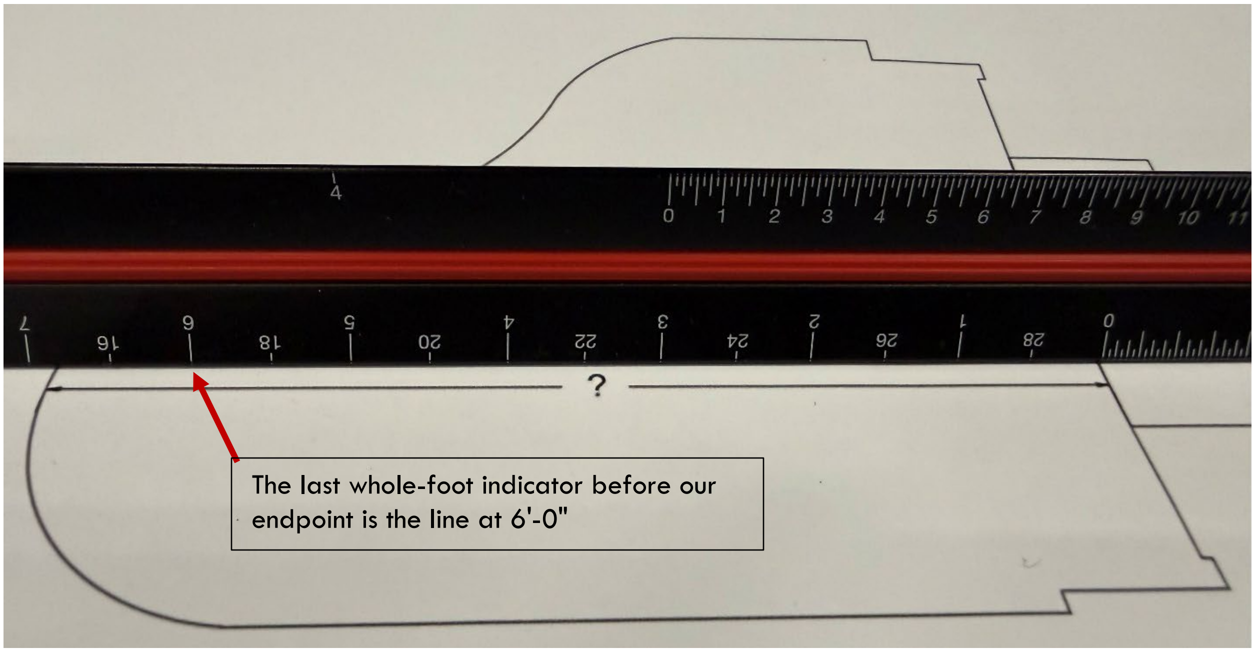



*Figure 1.4-6: Identify the last whole-foot measurement before the endpoint for our measurement*

So, we've established that the piano is somewhere between 6'-0" and 7'-0" long. Now, we need to figure out how many inches (and fractions of inches, if we can) there are in this measurement. To do that, we slide our scale ruler until the whole-foot measurement (6'-0" in this case) is on our endpoint (Figure 1.4-7). Now, we look at the other end to see where our starting point intersects the breakdown of the scaled foot to the right of our zero mark. In this case, we see that it is about 10 1/2" (figure 1.4-8). This tells us that our piano is 6'-10 1/2" long.

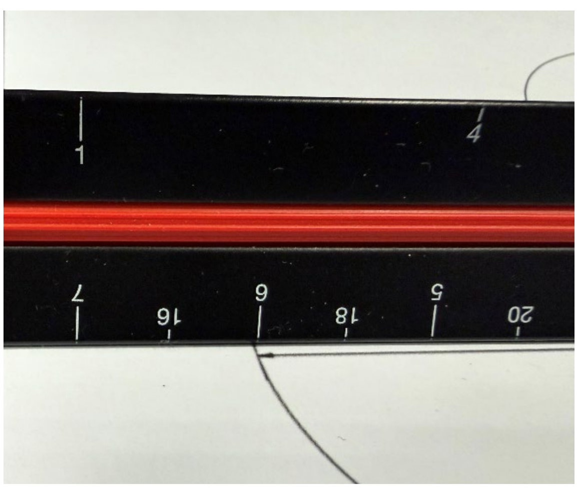


*Figure 1.4-7: Set the 6'-0" mark at the endpoint*

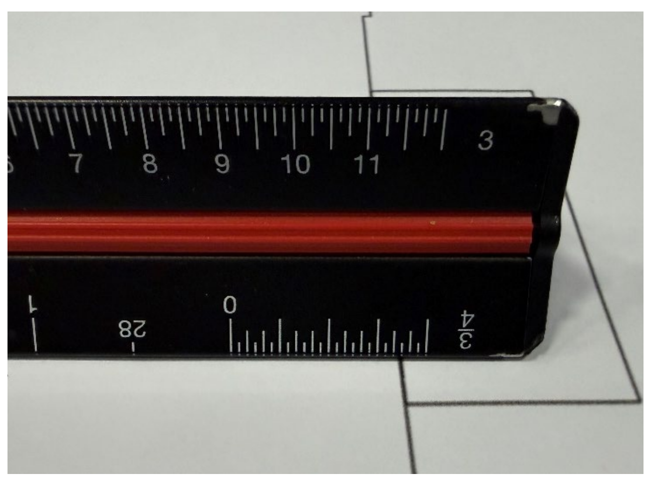


*Figure 1.4-8: Note where the starting point crosses the foot, in this case 10 1/2"*

**Why do we still use the 12" system?**

The 12 unit system for measuring length that is used commonly in the United States (known as US Customary, imperial, or sometimes just the standard system) is frequently criticized for being harder to work with than the metric system that is used throughout most of the rest of the world. Personally, I find feet and inches far more flexible as a craftsperson and designer. The biggest benefit, in my opinion, is that a foot can be broken down evenly into halves, thirds, and quarters, resulting in full-inch measurements that are easy to remember and practical to layout. Additionally, inches are infinitely divisible in halves by just doubling the denominator in your dimension. Very often, the kind of shop math that we are doing in our heads involves finding centers of objects or dividing lengths evenly, and for that I find the foot and inch model very easy to use.

**The case for using 3/4" scale in the shop.**

Half-inch scale (1/2"=1'-0") and its derivatives (quarter-inch and one-inch scales), tend to be the most commonly used scales that you'll find on design drawings. As someone who came up building in scene shops, I am a fan of using three-quarter-inch (3/4"=1'-0") for shop drawings (the drawings we have in-hand when building) when possible. Here's why: Our most commonly used tool in the shop will be our tape measure. On most tape measures, the smallest unit available to us is 1/16". If we do a little math, we know that there are twelve sixteenths of an inch in three-quarters of an inch, which meshes nicely with the twelve inches in a foot. Therefore, if we have a shop drawing in 3/4"=1'-0" scale, we can use our tape measure to pull dimensions accurate to 1" (realistically, probably even 1/2") right off the drawing without having to trudge back to a computer, find a scale rule, or call the person who generated the drawing. Clearly, if you need a more accurate dimension, you'll still need to go down one of those routes, but I have found this useful for rough material allocation, double-checks, etc.

## Common drawing types

One of the earliest design drawings that will be generated for discussion of design concept and direction is known as a **rendering** (Figure 1.4-9). This is typically a sketch or series of sketches that show the stage picture as an audience would experience it and is not drawn to scale. These tend to be a little more digestible for folks who don't regularly look at some of the more technical draftings that we'll be covering and are therefore very useful for early design development and discussion.

*Figure 1.4-9: Concept rendering for* Sonnets for an Old Century *at Bryn Mawr College, Dahlia Al-Habieli, scenic designer, 2026*

Often, the first **sheet** or **plate** in the drafting package for a production will be the **groundplan** (Figure 1.4-10). This drawing shows a bird's-eye or top-down view of our performance space. This is often the most crucial drawing to reference when discussing the placement of objects in the space.

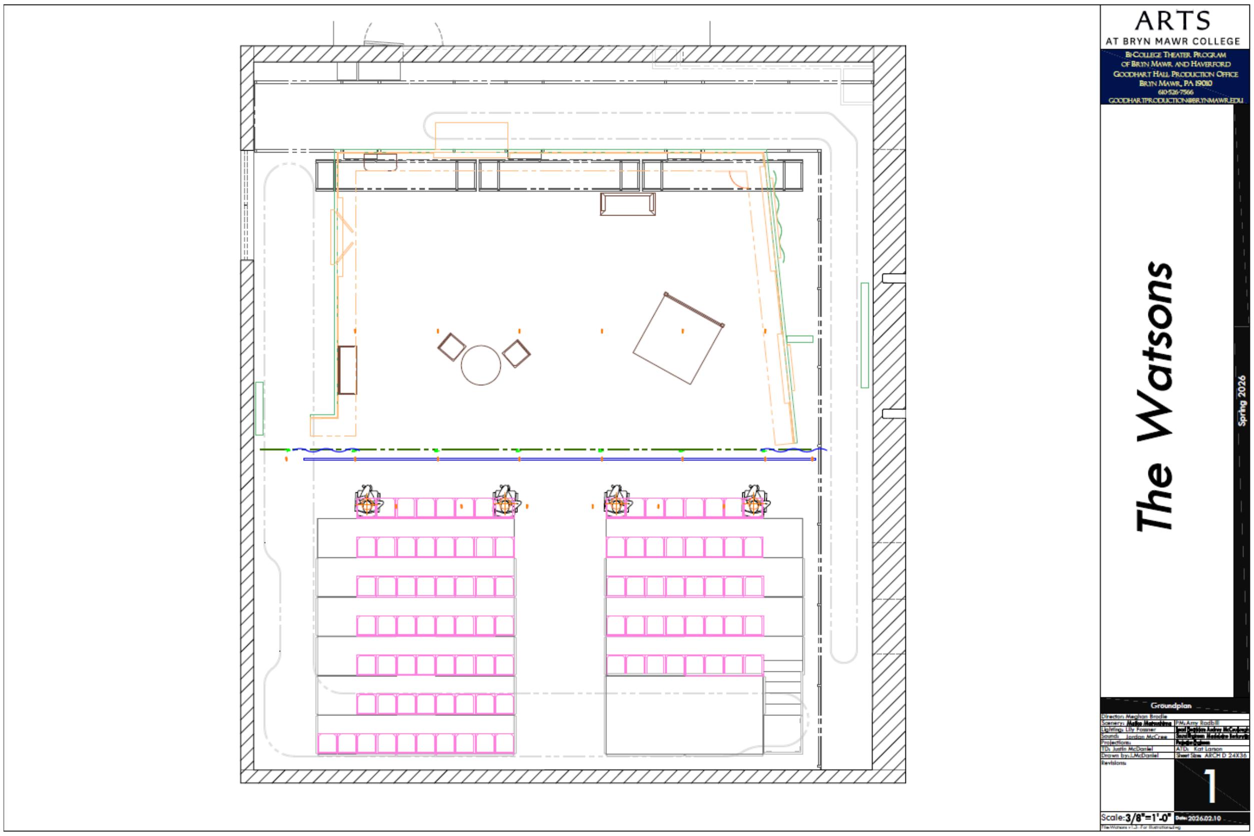



*Figure 1.4-10: Groundplan for* The Watsons *at Bryn Mawr College, Maiko Matsushima, scenic designer, 2026*

When we use the groundplan in conjunction with the **centerline section** drawing, and a little drafting know-how, we should be able to determine the location of most of the physical objects used scenically as well as objects for lighting, sound, projections, etc. The centerline section is generated by imagining that we've sliced the performance space in half vertically along the centerline and are now viewing that slice from the side (from SL looking to SR in our example, figure 1.4-11). By comparing the horizontal placement of objects (from the groundplan) with their vertical placement (from the CL section) we are able to map out locations and check interferences in three dimensions.

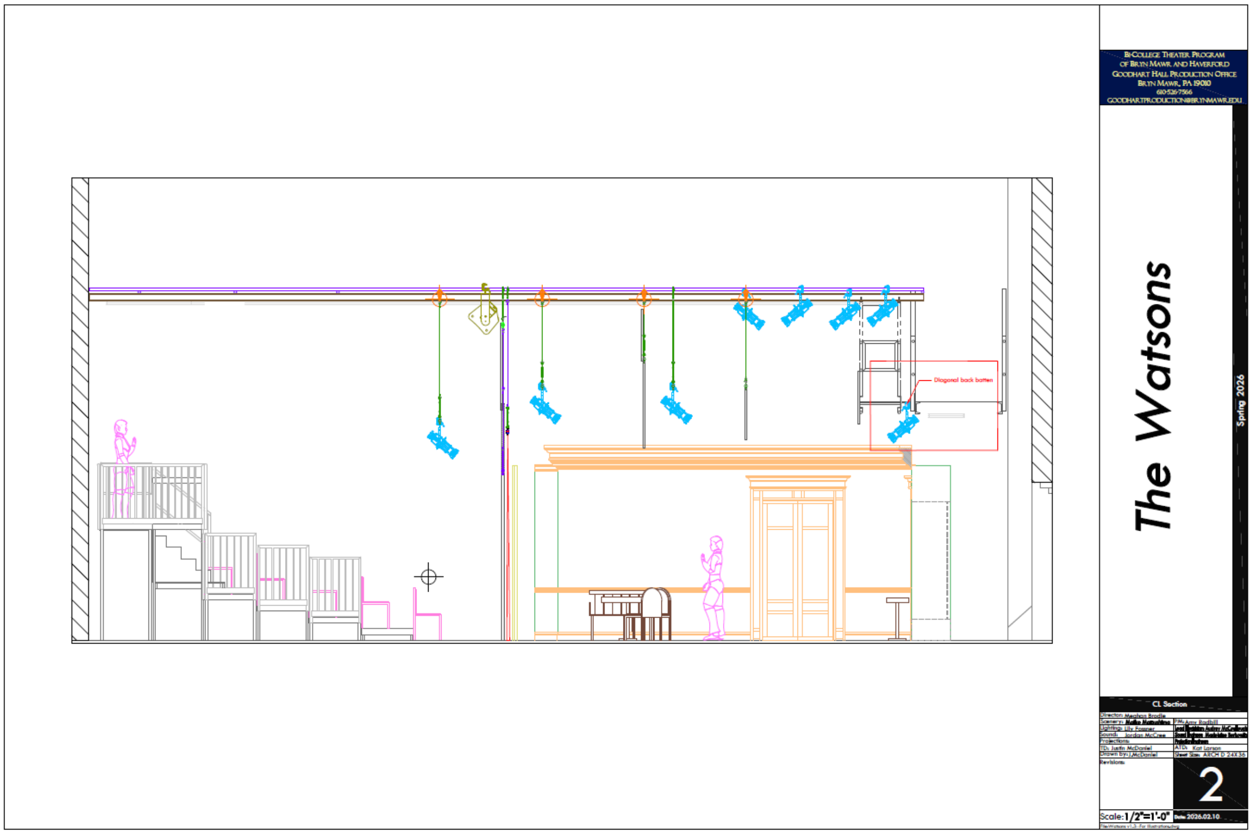



*Figure 1.4-11: Centerline section for* The Watsons *at Bryn Mawr College, Maiko Matsushima, scenic designer, 2026*

But sections aren't just for centerlines, we use this drafting technique anytime that we need to look at an object laterally to show elevation, thickness, or profile details. To show the point and direction that we view the section from we use a **section plane**, indicated by a line (typically long-short-short-long broken line, more on linetypes soon) with arrows or extensions showing the direction to view the drawing (figure 1.4-12).

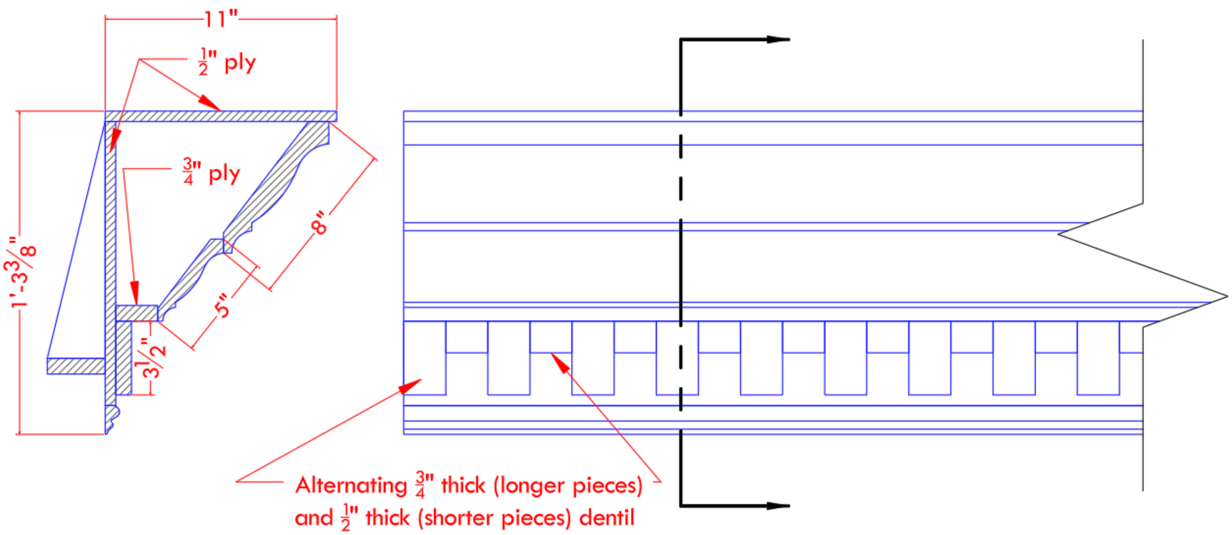



*Figure 1.4-12: Crown moulding drawing, Front (right) and Section (left)*

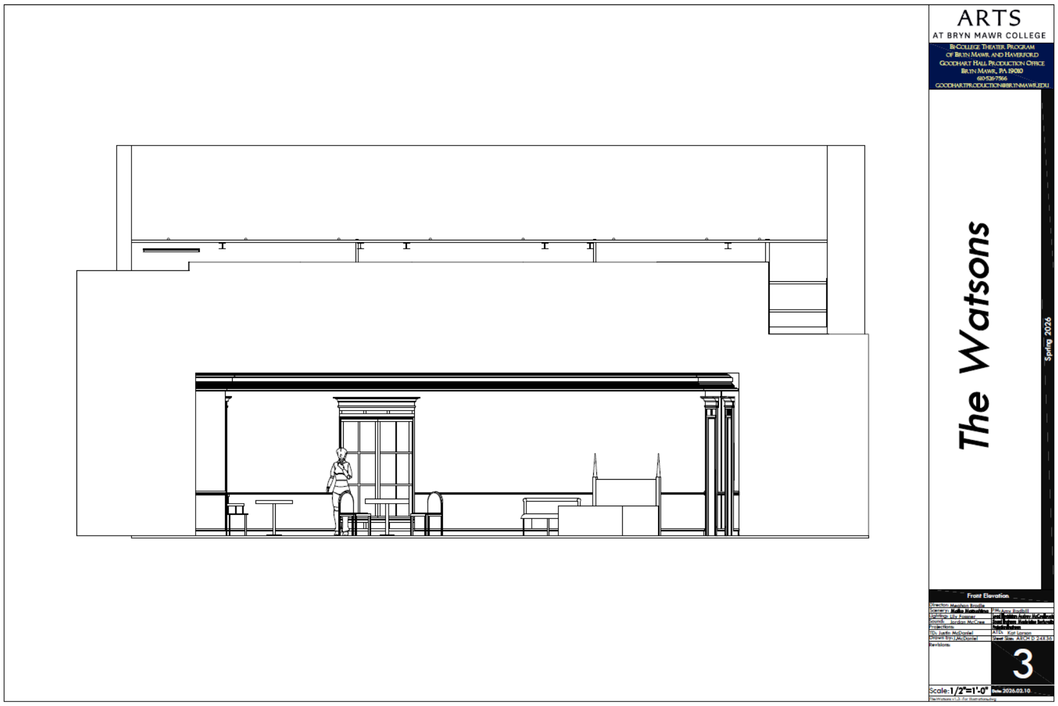



*Figure 1.4-12: Front elevation for* The Watsons *at Bryn Mawr College, Maiko Matsushima, scenic designer, 2026*

The next category of drawings that we'll cover are **elevations**. The term elevation is one that gets used a bit liberally when discussing this topic, but we're usually talking about looking at a face of something. A front, side, or rear elevation will show the object head-on from the front, side, or back. We'll sometimes see a front elevation of the whole show (though this is not always included, figure 1.4-12), but we'll often see front elevations of the individual elements of the set. In a **box set**, we're also likely to see flattened elevations (figure 1.4-13), which take all of the individual sections of wall and flatten them into front elevations that are laid out side-by-side so that we can see the relationship of features such as door and window heights and moulding layouts.

**Box sets vs. Unit sets**

A **box set** is a set that has a static location and is usually (but not always) an interior. The audience is very often in a proscenium orientation looking through the downstage wall of the set (often known as the fourth wall).

A **unit set** is a set with multiple locations represented by different units of scenery that may move on and off of the stage via the use of wagons, lifts, flies, and other scenic movement technologies.

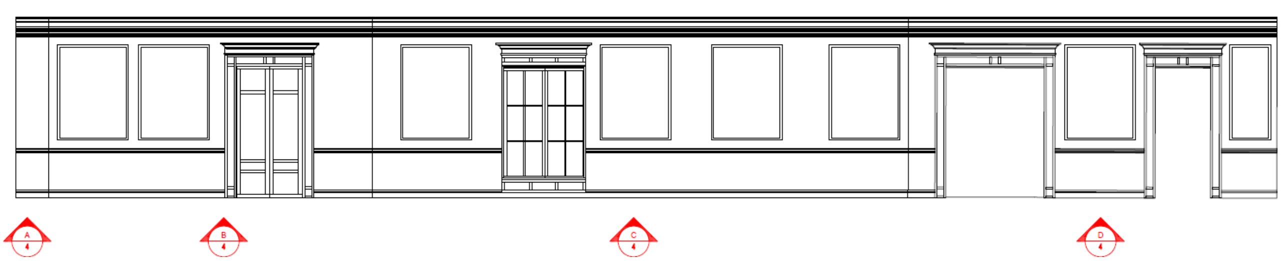


*Figure 1.4-13: Flattened elevations for* The Watsons *at Bryn Mawr College, Maiko Matsushima, scenic designer, 2026*

Within any of these drawings you may see **detail views**. Detail views allow us to blow up portions of a drawing into a bigger scale to show, you guessed it, more detail. Popular candidates for detail treatment are mouldings, ornament, and connections (figure 1.4-14). In a heavy moulding/trim show you may also see **revolved sections**, that show the profile of a trim piece without a separate detail drawing (figure 1.4-15).

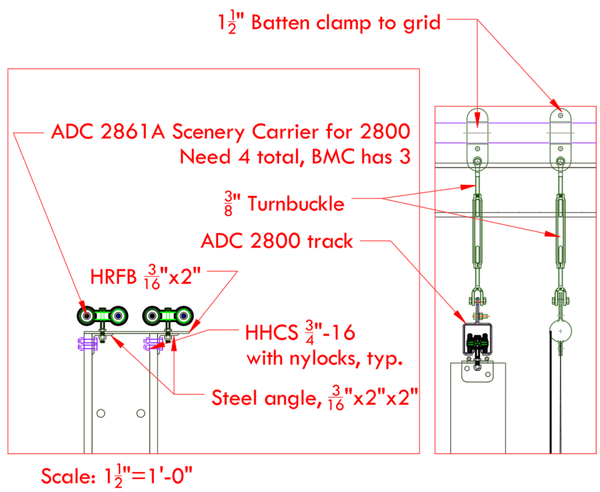



Figure 1.4-14: Rigging connection details for a scenic unit

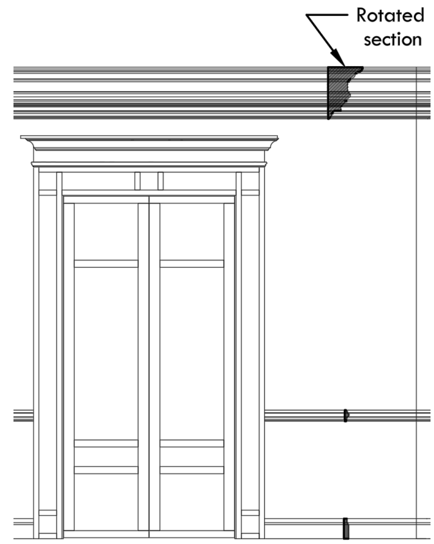



Figure 1.4-15: Rotated sections for moulding profiles

Proper layout of drawings is crucial for accurate communication, but before we discuss the proper layout of two-dimensional views, we should introduce the concept of the **isometric view** which can be thought of as a three-dimensional view of an object, typically from one corner (figure 1.4-16). We're going to use this example to explain **orthographic layouts**.

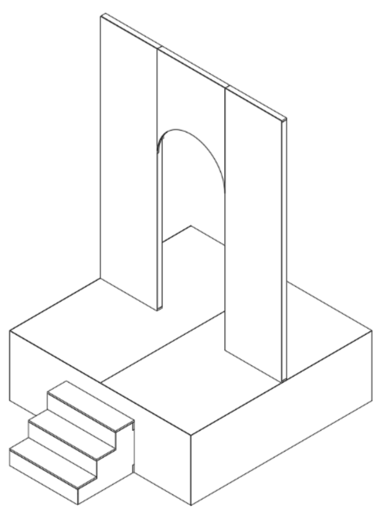


Figure 1.4-16: Isometric view

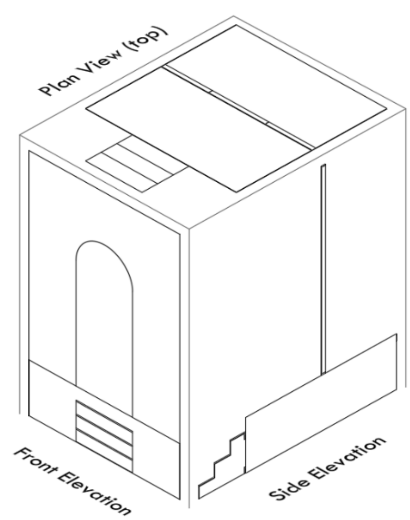



Figure 1.4-17: Two-dimensional views from the isometric

When looking at the two-dimensional views we've been discussing, it's crucial that, unless otherwise noted, drawings are laid out using **orthographic projection** rules. To lay views out orthographically, it is easiest to imagine our object represented on a box (figure 1.4-17) with each face being one of the views. If we imagine that each face of our box has an elevation on it, and then we unfold the sides of our box with our top view (groundplan) at the center, we can see how each of the views should relate to each other (Figure 1.4-18).

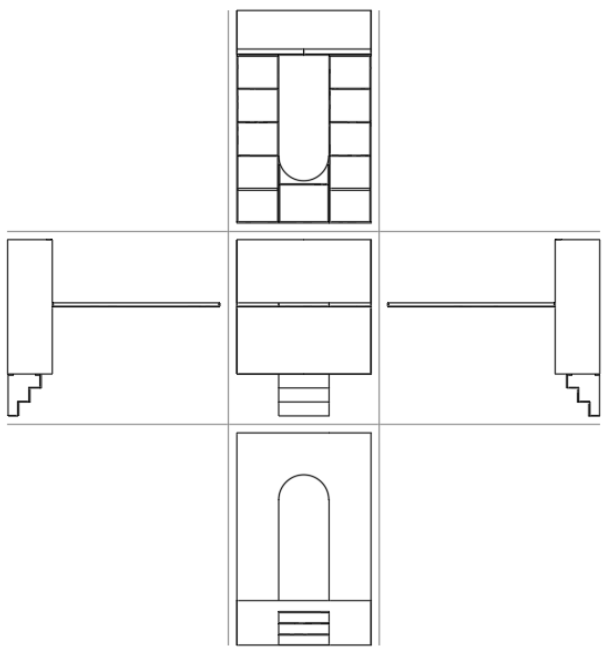


*Figure 1.4-18: Orthographic views*

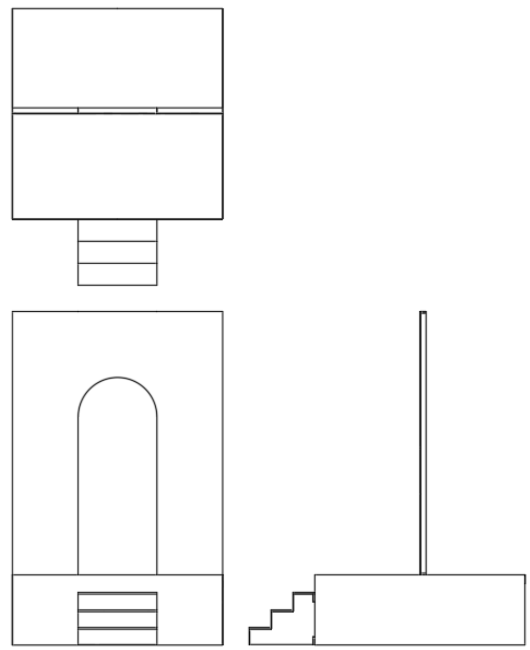


*Figure 1.4-19: Working drawing layout for this object*

The groundplan doesn't always need to be centered and in a practical application, the piece shown figure 1.4-18 would likely be laid out on a working drawing as shown in figure 1.4-19, omitting one side elevation and the rear elevation. For a piece that is symmetrical like this one, the view orientation is less critical (although it is still good practice to follow it) but proper layout becomes crucial for asymmetrical objects that could be built incorrectly if the views are not properly reconciled.

All of the views that we've covered can be created by hand with a pencil and some drafting tools and techniques. These days, particularly in technical drawings, using **computer aided design (CAD) programs** like AutoCAD and Vectorworks are very popular. Both of these programs give the user the tools to develop both two-dimensional and three-dimensional views of objects. Three-dimensional modeling has become very accessible and widely used in both design and technical drawings and is a popular and fast way to create all of these views from a single model, saving the drafter from needing to generate multiple versions of a drawing to create different views.

A more in-depth discussion of CAD programs is outside the scope of this text, just know that these programs have greatly improved the efficiency of design and technical drawing, though as many folks who have honed their hand-drafting skills would argue, this efficiency comes at the cost of losing some of the character of hand-drawn designs.

## Drafting conventions: Linetypes, lineweights, and other symbols

Now that we know how to *look* at drawings and their orientations, let's talk about how to *read* the drawings. This requires some understanding of the conventions used to develop the drawings and indicate important physical features in the space and designs. One of the first things to notice is the type of line being used. We use a variety of **linetypes** and some indicate very specific things, and others indicate more general concepts.

This will not be an exhaustive list of linetypes, but some of the ones you will see most commonly are:

> **Drafting Rules vs. Styles**
>
> In my opinion (and I'm sure there are folks who would vehemently disagree with me), there aren't many hard-and-fast, non-negotiable rules for technical drafting, though there are some widely accepted conventions. The United States Institute for Theatre Technology (USITT) has a document of recommended graphic practices, but ultimately a successful drafting style is clear, consistent, and understandable by the people who use it most frequently. Some of what follows are practices and conventions that I have picked up and/or adapted into my drafting style. I'll try to clearly distinguish between widely accepted conventions and those that come from my style.

### Continuous ————————————

**Continuous** lines are just regular old unbroken lines. Probably unsurprisingly, these will be most of the lines used in this work and designate a variety of things. In addition to being used frequently in notations (titleblocks, labels, dimensions, etc. more on all of those soon), continuous lines will be used for the most prominent elements of a particular view.

### Hidden – – – – – – – – – – – – – – – – – –

**Hidden** lines are a broken line type with all of the dashes being the same length, typically short. This linetype is used for often to represent physical objects that are below the main viewing plane of a drawing. In the example below (figure 1.4-20), hidden lines are used to indicate internal framing members behind the perimeter framing of a platform. Hidden lines may also be used to represent temporary or storage positions of scenic units.

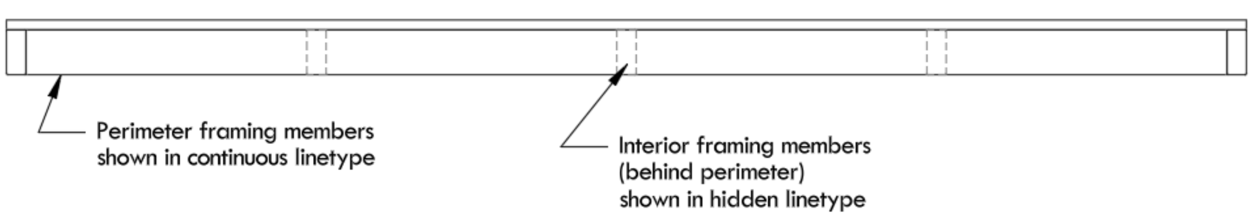



*Figure 1.4-20: Example of continuous and hidden linetypes*

Phantom

**Phantom** lines are a broken line type in a long-short-short-long format. I most often use these to show objects that are above our main viewing plane. For example, in the groundplan shown above (figure 1.4-10), I draw the tracks that are above the space as phantom lines. Elsewhere in the industry they are often used to show alternate positions of moving units or assemblies.

Centerline CL PL

The **centerline** is a broken line type in a long-short-long format and will frequently be labeled with and overlapping CL notation. This can be used both to represent show center and the center of individual objects when necessary. I also use the centerline linetype for my plaster lines, but the USITT practices recommend a long-long dashed line for plaster. Again, we frequently will label these with an overlapping PL notation.

Section

The **section line** or **cutting plane line** is basically a phantom line in a larger scale. It again uses a long-short-short-long format but the lengths of each of the elements is typically longer than in a standard phantom line. Additionally, the section line will have extensions on it indicating the direction of the view shown in the corresponding section drawing (see figure 1.4-12 for an example).

The next crucial element when looking at what the lines mean is **lineweight**. You can think of this as line thickness. The lineweights most often used according to the USITT standard are:

CAD Lineweights according to USITT

Thin (.15mm)

Medium (.30)

Thick (.60)

Extra thick (.70mm)

The basic idea with lineweight is that the more permanent an element, or the more important the element is to the drawing, the thicker the line will be. Thick and extra-thick lines are used for things like drawing borders and notations, and building walls and other permanent structures. Medium lines are used for the main objects in the drawing—framing members, for example—while thin lines are used for things like hidden framing members, cover seams, and center marks and other notations.

**Break lines** are used when we want to show specific areas of an object but don't need or want to show the entire object in the drawing. The break lines indicate that a section of the object has been removed for clarity or page layout spacing. Figure 1.4-21 shows break lines in use to detail the ends of a scale ruler.

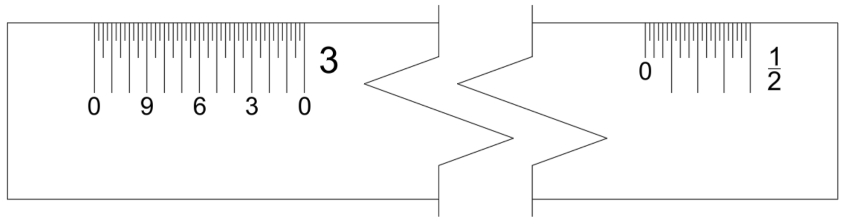



*Figure 1.4-21: Breakline examples - Scale ruler*

Another common use is in detailing rigging drawings where the most important information to convey are the end details and overall length as shown in Figure 1.4-22.

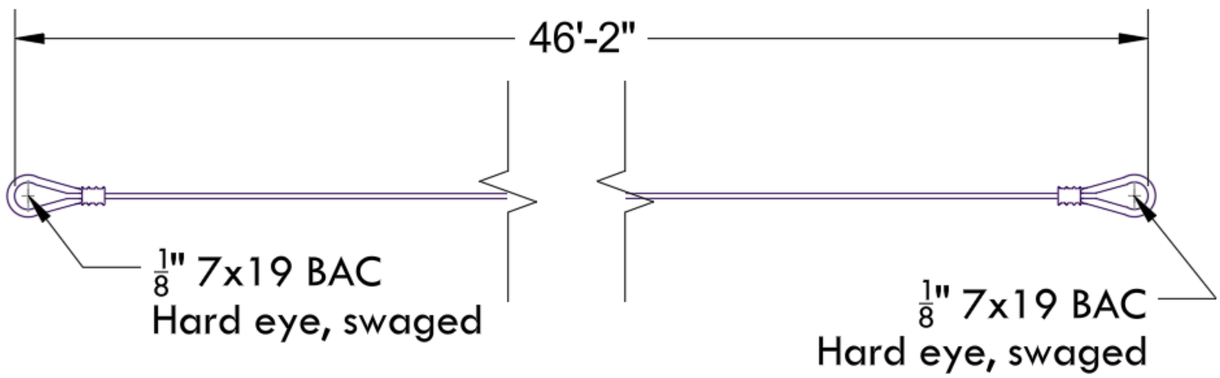



*Figure 1.4-22: Breakline examples - Rigging point dimension*

Often, especially in groundplans and sections (see figures 1.4-10 & 11), we will see **points** indicating the most extreme viewing positions for the audience. These are known as **sightline markers**. We can use these markers in conjunction with the drafting of the space to determine what the audience can and cannot see from these positions. This is useful when figuring out trim heights and positions for masking, so that we can hide behind the scenes stuff from the audience, but the same principle can be used to make sure that important visual elements of the production are visible to the entire audience.

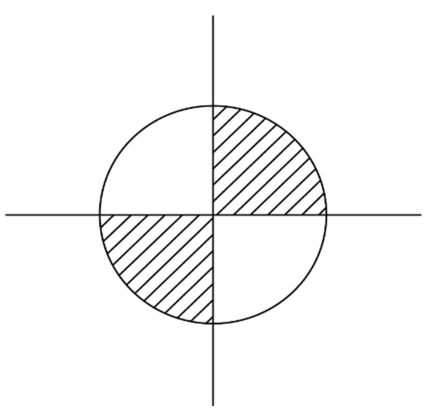


*Figure 1.4-23: Example of a point marker used for sightlines and rigging locations*

We will occasionally see these point markers (or similar markers) used to indicate rigging point placement for rigged or flown objects.

**Hatching** is a series of lines or patterns that are included inside a shape and indicate that the view plane in the drawing cuts through solid portions of the object. In the groundplan shown in figure 1.4-10, the building walls are hatched to show that they are solid objects. Hatching can also be used to show differences in materials in a cross-section view (figure 1.4-24).

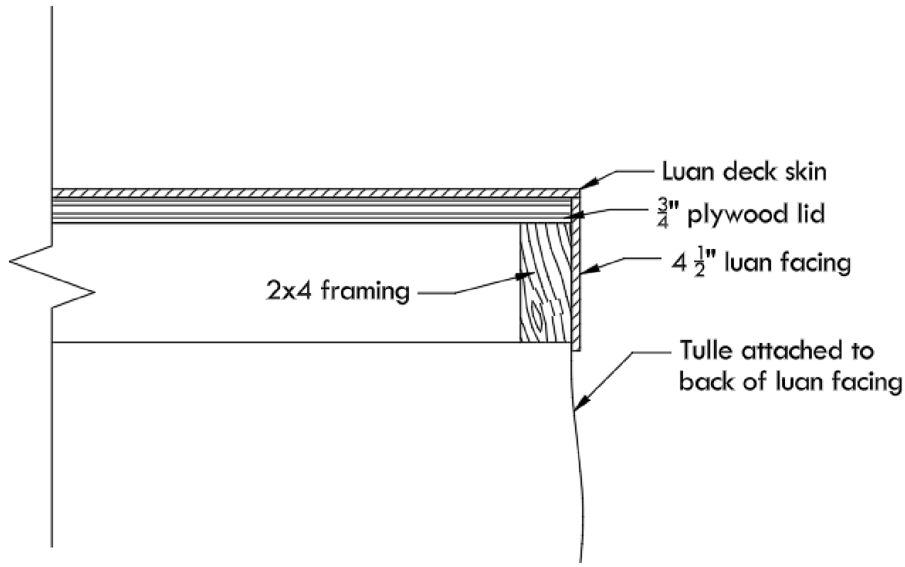



*Figure 1.4-24: Hatching to differentiate between materials*

## Dimensions and notations

Dimensions and measurements are some of the most important, if not *the* most important, information that we expect to get from drawings of all sorts. The most common dimensions that you'll see are **linear** and **aligned dimensions**. Both of these measure a straight-line distance, the beginning and end points of which are indicated by **extension lines** which relate to physical elements of whatever is being dimensioned. The only difference between linear and aligned dimensions is that linear dimensions run horizontally and vertically, and aligned dimensions are typically at angles aligned with physical elements of the drawing. **Angular dimensions** indicate the angular relationship between two lines.

Figure 1.4-25 shows examples of various kinds of dimensions and notations.

**Leader lines** are the lines that point to an element or dimension and are used for both dimensioning and information like material callouts and other notes.

Dimensions of circles and arcs are typically called out via leader line and a notation of an "**R**" for **radius dimension** or a **Ø** for a **diameter dimension**. Other common notations include "**OC**" for "**on center**," that is center-to-center dimensions, or "**TC**" for "**to center**," which are measured edge to center of an object. OC and TC will often be used to indicate framing and toggle spacing. In this case, they may also be accompanied by "**typ**" which means "**typical**" indicating that the spacing listed once can be assumed to be the spacing for all similar cases unless otherwise noted.

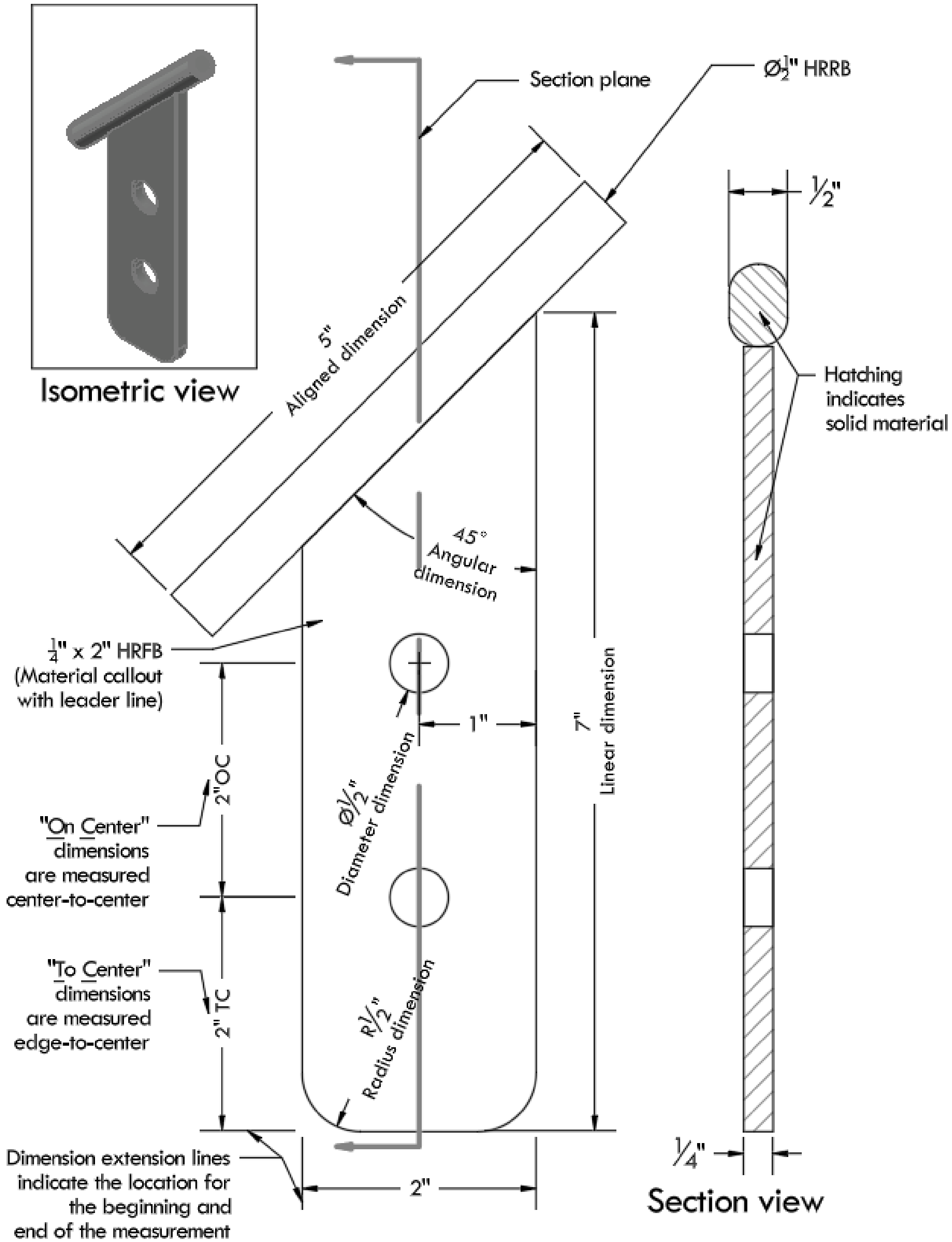



*Figure 1.4-25: Examples of various dimensions and notation*

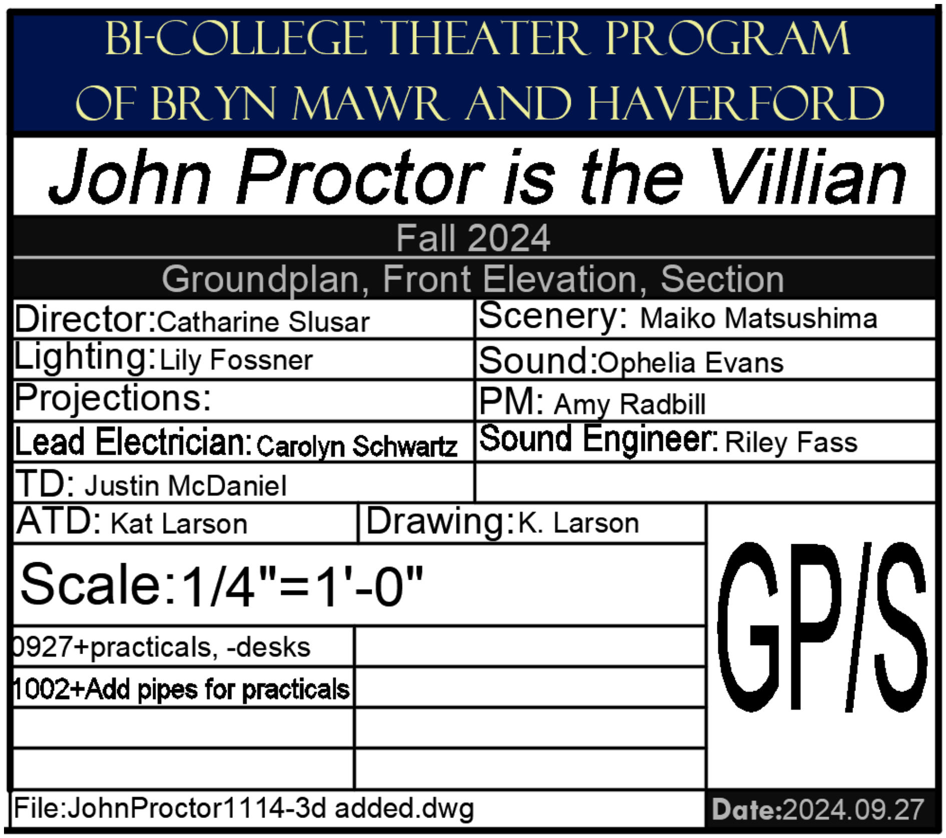



*Figure 1.4-26: Titleblock example*

The final major pieces of notation that we'll cover are the titleblock, drawing labels, and note blocks. **Titleblocks** (figure 1.4-26) are found in the corner or along an edge of the drawing and contain information including but not limited to:

- Producing organization
- Production title
- View title(s)
- Plate or sheet number
- Production personnel, including directors, designers, and/or production leads
- Drawing scale (I also like to include paper size, particularly if sharing drawings electronically with PDFs)
- Date that the drawing was generated
- Revisions fields, indicating date of the revision and a brief description
- File name and location, if applicable

**Drawing labels** are commonly found on sheets where multiple views or objects are detailed. These are like mini titleblocks and usually contain information like:

- Drawing or view title
- Scale
- Build details like, "Build 3" or "Make from ¾" plywood"

Drawing labels will usually have both a drawing number or letter and make reference to the larger sheet/plate on which they are published. See the labels under each individual drawing in figure 1.4-27.

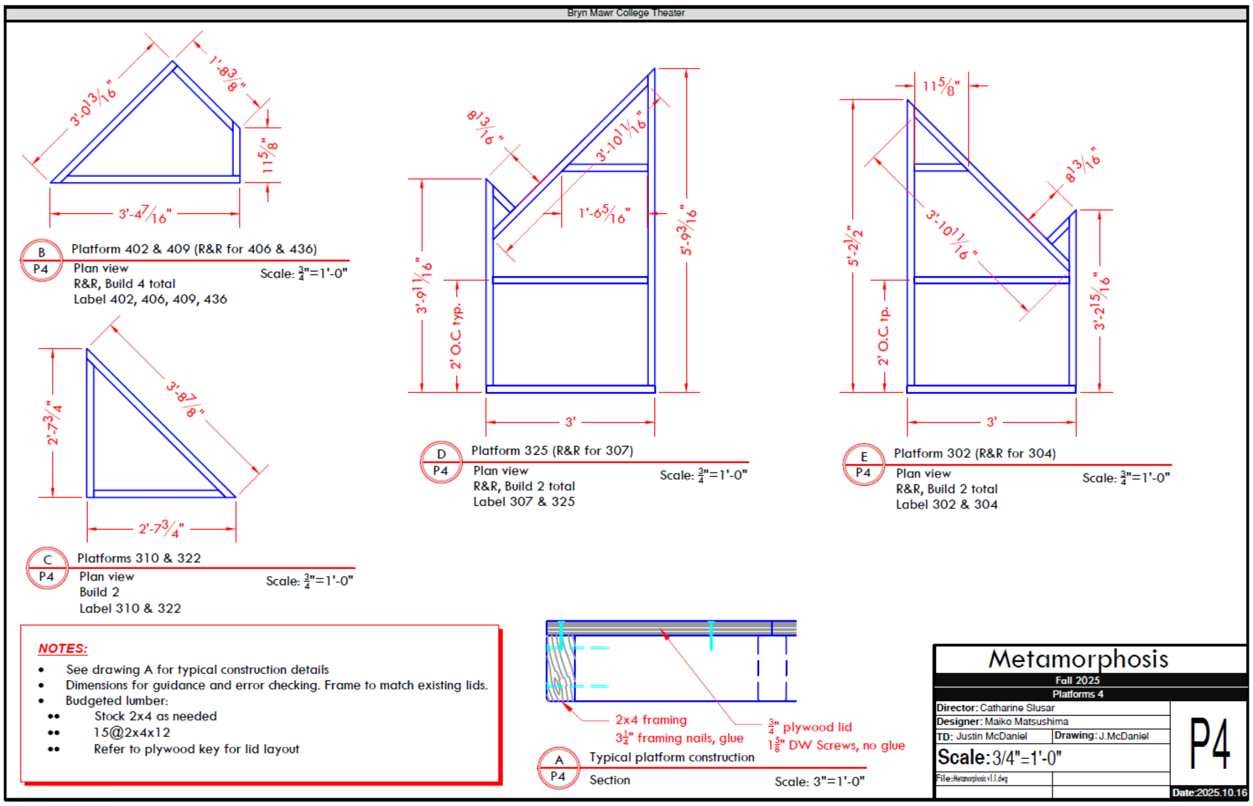



*Figure 21.4-27: Working drawing example. Includeds notes box and drawing label examples.*

**Notes blocks** provide information that is applicable to the whole drawing. In our example, the notes include general carpentry guidance and estimated material to be used.