Modeling on Top of Photo Textures

After you place a photo texture on the right face and in the right place on that face (yeah, we've been reading a lot of Dr. Seuss), you can use the information in your photograph to help with adding geometry to your model. It's a great way to be roughly accurate without having to measure much, and the combination of photo textures and a few simple push/pull operations can be very convincing.

Making a texture projected

Modeling with photo-textured faces isn't hard, but you *have* to take one critical step before you can do it: You have to make sure that your texture is *projected*.

Figure 8-17 shows what happens when you try to push/pull an opening in a photo-textured face: On the left, when the texture *isn't* projected, the inside faces are painted with random parts of the texture, making your model look like a sticker-laden eye puzzle. On the right, when it *is* projected, note how the "inside" faces that the push/pull operation creates are a plain, easy-to-discern gray. The result is typically more appropriate for what you're doing.

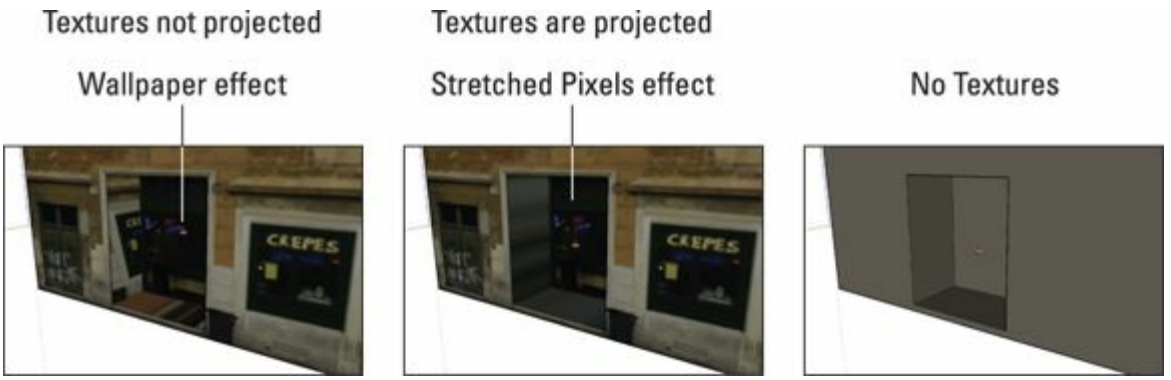


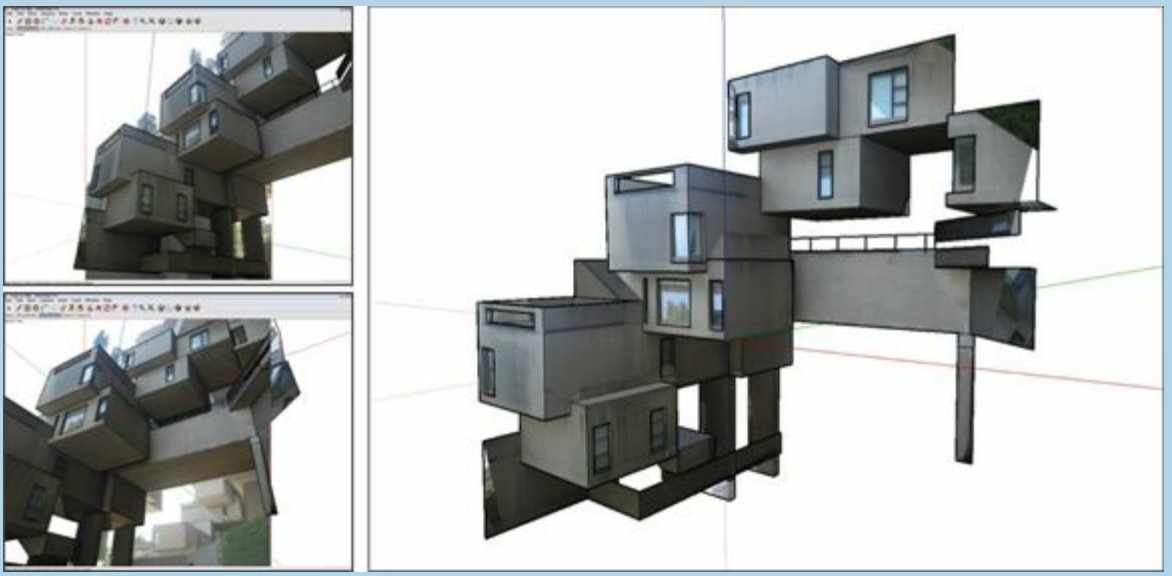
FIGURE 8-17: Pushing/pulling an opening in a textured face when the texture *isn't* projected (left) and when it *is* projected.

REMEMBER Make sure that your face's texture is projected *before* you start drawing on top of it. Happily, telling SketchUp to make a photo texture projected is just a matter of flipping a switch. Context-click the face with the photo texture and choose Texture ⇒ Projected from the context menu. If you see a check mark next to Projected, your texture is already projected; don't choose anything.

MAKING MULTIPLE MATCHES

If you have more than one photo of your modeling subject, you can have multiple matched photos in the same SketchUp file. Just get as far as you can with the first photo and then start again with the next by using the geometry you created as an "existing building." See the section "Matching a photo to an existing model," earlier in this chapter, and follow the steps to line up an existing model with a new photograph.

The following shows a model Aidan started to build of Habitat 67, in Montreal. He used two pictures to create two matches in the same SketchUp file. Making more than one photo match is a great way to build more of a model than you could see in a single picture.



Modeling with projected textures: A basic workflow

Follow these steps to get the hang of working with projected textures (and see the steps in action in Figure 8-18):

1. **Make a basic rectangular box and then apply a photo texture to one of the side faces.**
   Check out the section, "Adding photos to flat faces," earlier in this chapter.
2. **Context-click the textured face and choose Texture ⇒ Projected from the context menu.**
   Make sure that Projected has a check mark next to it.
3. **Draw a rectangle on the textured face and push/pull it inward.**
   Notice the stretched pixels effect?
4. **(Optional) Add other angles or features to your model.**
   Notice the angled face we created in Figure 8-19.

5. **Switch to the Paint Bucket tool, hold down the Alt key (Command on a Mac), and click somewhere on the textured face to sample the texture. (Your cursor looks like an eyedropper when you do this.)**

   This step loads your Paint Bucket with the projected texture.

6. **Release the Alt (Command) key to switch back to the Paint Bucket cursor and then click the angled face once to paint it with the projected texture.**

   You see the stretched pixels effect here, too.

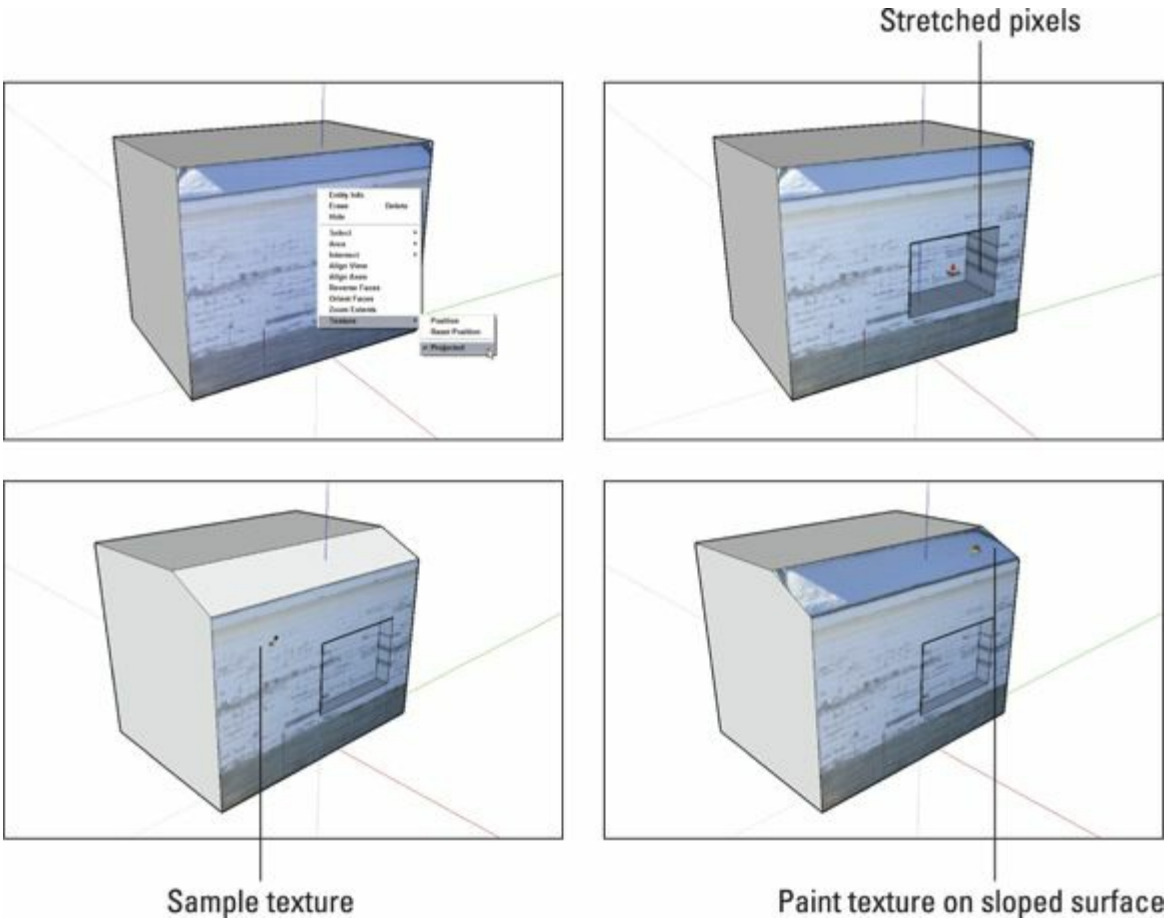


FIGURE 8-18: Working with projected textures.

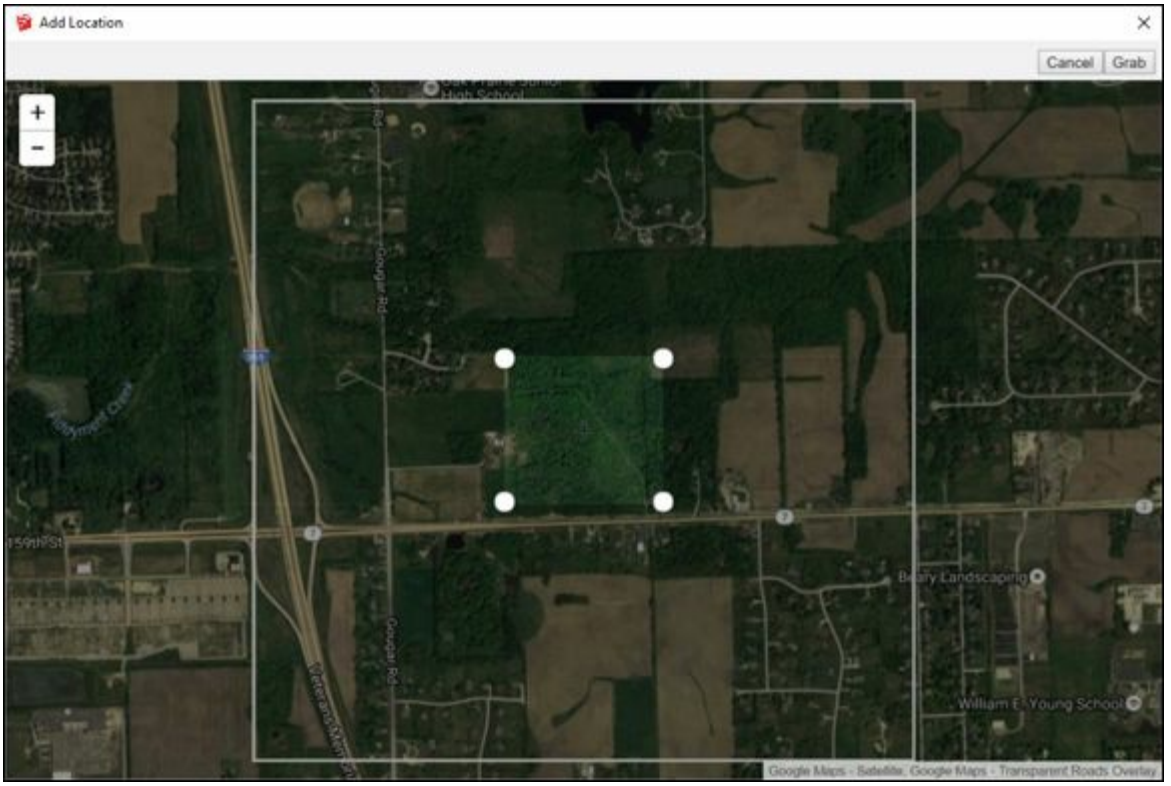


FIGURE 8-19: The area you frame with the pins is imported into your model as a geo-location snapshot.

Adding Geographic Data

When you add geographic data to your model (also called *geo-locating* your model), you give it a specific latitude, longitude, and cardinal orientation based on an address, cross streets, or other information. That doesn't sound like much at first, but here are three things geo-location enables you to do:

- **Perform accurate shadow studies.** For most designer-types, this is probably the biggest benefit of geo-locating a model. With a latitude, a longitude, and a cardinal orientation, SketchUp's shadow engine can display crazy-accurate shadows for any time of day, any day of the year. You can find all the juicy details in the second half of Chapter 10.
- **Build photo-textured context models.** If you're designing a building, it's probably surrounded by other buildings, and those other buildings are probably major influences on the design of *your* building, no? Wouldn't it be nice to have them in your model? You can combine high-res, color, aerial (taken by airplanes or satellites) imagery with street-level photography to build the quickest, most useful context models you've ever had. Heck — you might not even need to visit the site in person. Try a web search for *"Site Modeling in SketchUp video"* (or just point your browser to this web address: `https://youtu.be/nVhM3IYMF8o`) to find an in-depth YouTube tutorial that Aidan put together on just this subject.
- **View your model in Google Earth.** After your model understands where on the planet it belongs, you can easily export the model file and send it to your copy of Google Earth. Flying from the Eiffel Tower to the Taj Mahal and then to your proposed new tool shed gives your design a level of seriousness that proclaiming, "Look what I've spent the last 37 hours working on!" to your spouse simply can't match. It's also impressive to clients.

The sections that follow outline the nitty-gritty steps for telling SketchUp where on Earth your model is (literally), looking at it in Google Earth, and saving it as a Google Earth file that you can share with other humans.

Geo-locating your model

Follow these steps to add a geo-location snapshot to your SketchUp file:

1. **Make sure you're online.**

   All geo-data is stored on far-flung servers; if you don't have an Internet connection, you can't use the geo-data.

2. **Open the SketchUp file you want to geo-locate.**

   You can add a geo-location snapshot to your model anytime as you work on it. If you haven't started modeling yet, it's perfectly okay to add a geo-location to an empty file.

3. **Choose File ⇒ Geo-Location ⇒ Add Location from the menu bar.**

   A new window that you may recognize opens: It's a simplified version of Google Maps.

4. **Find the area where you want your model to be located.**

You can type an address into the search bar in the upper-left corner if you like. You can also just use your mouse or the controls on the left side of the window to navigate around. Scroll your mouse wheel to zoom; click and drag to pan.

When you're zoomed in close enough, you see a white, 1 km x 1 km square: This is the largest snapshot you can import all at once. That's still a very big area, so you probably want to keep zooming.

5. **Click the Select Region button to display a cropping rectangle.**
6. **Drag the pins to specify the precise corners of your geo-location snapshot, as shown in Figure 8-19.**

   Try to frame an area that's just big enough to provide a base for your model. Importing too much terrain data can bog down your computer. You can always bring in more terrain data later.

7. **Click the Grab button to add a geo-location to your SketchUp file.**

   The separate window closes, and a big, colorful rectangle appears in the middle of your model. That's your new geo-location snapshot.

8. **If you're geo-locating a model you've built already, move it into position on the snapshot.**

   Use the Move tool (and maybe the Rotate tool) to pick up your model and place it where it belongs. You're not done yet, though — you still need to make sure your model is *vertically* situated on the terrain. Follow these steps to do just that:

   a. *Choose File ⇒ Geo-location ⇒ Show Terrain to switch to the 3D version of your geo-location snapshot.*

   b. *Select everything you want to move and use the Move tool to start moving; tap the up- or down-arrow key to constrain your move to the blue axis.*

   c. *Sink your model into the terrain until it sits properly — avoid the dreaded floating model syndrome at all costs.*

REMEMBER If you want to import another snapshot into SketchUp, you can. SketchUp automatically tiles all the snapshots you take to form a patchwork in your model. This feature is super-handy if you find that you didn't get everything you needed the first time.

ALL ABOUT GEO-LOCATION SNAPSHOTS

When you import a geo-location snapshot, you access Google's huge repository of geographic data. The snapshots are a lot more than pretty pictures. In addition to geo-locating the model's position, a snapshot has the following features:

- **Everything is already the right size.** Perhaps you take a snapshot of a football field; when you measure that football field in SketchUp, it is exactly 100 yards long. That's because SketchUp scales your snapshot to the correct size as part of the import process.
- **Snapshots look flat but contain terrain data, too.** The snapshot that SketchUp imports is more than just a color aerial photo. The snapshot also includes a chunk of topography — terrain. The *terrain* is flat when you first import it because it's easier to build on that way, but you can toggle between flat and 3D (not flat) views by choosing File ⇒ Geo-Location ⇒ Show Terrain. Don't fret if you don't see any difference when you flip between the views — you probably just chose a flat site.

Viewing your model in Google Earth

After you make (or simply position) a model on top of a geo-location snapshot, exporting the model so you can view it in your copy of Google Earth is a simple operation. You can also e-mail the KMZ file to all your friends. If you model for clients instead of friends, you can send the file to them, too.

When someone opens the KMZ file, Google Earth opens on his computer (if he has Google Earth), and he's "flown in" to look at the model you made. Try sending directions to your next party this way; your friends will think you're a genius.

Follow these steps to export a SketchUp model to a KMZ file:

1. **In SketchUp, select File ⇒ Export ⇒ 3D Model.**
2. **In the Export Model dialog box that appears, choose where on your hard drive you want to save the KMZ file.**
3. **Give the file a name and select the KMZ file type.**
4. **Click the Export button to save your model as a KMZ file.**

Working with Imported CAD files

On the SketchUp Spectrum of Fun, importing and preparing CAD files is located right between latrine digging and cat milking — it's not something many folks look forward to doing. This section is a collection of tips and tricks Aidan has learned in his many years of dealing with other people's CAD files.

Importing a CAD file into SketchUp Pro

This would probably be a great time to let you know (just in case you missed the heading right above this paragraph) that only SketchUp Pro can import 2D CAD files in DWG and DXF format; SketchUp Make doesn't include this functionality.

Your CAD file may be one you made yourself, but more likely you've received one from someone else. In that case, the absolute best thing to do is to open it in the same software that created it. If you have an AutoCAD file, open it in AutoCAD and take a look at its layer structure. Make a copy of the file, delete everything you don't need to bring into SketchUp Pro, and proceed from there.

Simple, right? But what if (like Aidan) you don't have AutoCAD? That's okay — most folks don't. You'll have a fair amount of cleanup work to do in SketchUp after you've imported the CAD data, but it's manageable. The section after this one describes a series of things you can do to wrangle the drawing into shape before you can start modeling.

Actually importing CAD data into SketchUp Pro isn't very complicated. Follow these steps, and you'll do just fine:

1. **Open a fresh, new SketchUp file.**

   You can't just open a DWG or DXF file in SketchUp Pro; you have to import the data into an existing model. We strongly recommend starting with a new SketchUp file because most CAD files are super complex. Bringing all that complexity — thousands of edges and tons of layers — into an already-complex SketchUp model is just asking for trouble. Keep things separate and stay sane.

2. **Choose File ⇒ Import.**

   The File Import dialog box opens.

3. **Select AutoCAD files (*.dwg, *.dxf) from the Formats drop-down list.**

   For some reason, you have to tell SketchUp what kinds of files you want to import before it will let you select them on your file system.

4. **Locate the CAD file (DWG or DXF) that you want to import and select it.**

   Don't click Import just yet.

5. **Click Options.**

   The DWG Import Options dialog box opens.

6. **Set the Units to match the default measurement units of the CAD file you're about to**

import.

If the CAD file is from someone in the U.S., there's a good chance the units are Inches or Feet. Other countries (wisely) use the metric system. If you have no idea what units to choose here, so start with Inches and see whether that works.

7. **Decide what to do about the other three options in the dialog box:**

   - *Merge Coplanar Faces* tells SketchUp to automatically combine adjacent faces that are coplanar into a single face. This can save you cleanup time if the CAD file you're importing actually has faces in it, but CAD files rarely do. If you select this check box and your import fails (it happens), try deselecting it the next time.
   - *Orient Faces Consistently* instructs SketchUp to do its best to make sure that the faces in your imported data (if there are any) are all facing the same way. Again, this might save you some cleanup time, but it also might throw a wrench into your import process.
   - *Preserve Drawing Origin* is useful if you'll be importing more than one CAD file into the same SketchUp model. You might do this if you're importing multiple floor plans of the same building and you want them to line up.

8. **Click OK to close the DWG Import Options dialog box.**

9. **Click Import … .**

   … and cross your fingers. With a few tries, you're usually able to import the CAD data. If you get a failure message, try again with a different Units setting in the Import Options dialog box (Step 6). If that doesn't work, the file might have been saved in a CAD format that's newer than the ones that your copy of SketchUp Pro can import. Contact the person who sent you the file and ask her to save another copy for you in an older CAD format.

10. **Take a look at the Import Results dialog box to see where you stand.**

    If, after the import progress bar goes all the way to the right and the import itself is successful, SketchUp Pro will present you with a dialog box with statistics about what it imported and what it ignored. The simple version is that CAD layers, blocks (which translate to components in SketchUp), and edges of all sorts are importable. Text objects, dimensions, and hatches (of the sort that denote different materials) aren't. When you're satisfied, click OK and breathe a sigh of relief.

TIP After you've gone through the CAD import process and SketchUp has plunked the resulting geometry into your model, make sure everything went according to plan: Measure a couple of things with the Tape Measure tool to see whether they're the sizes you expect them to be. Doorways are a good place to start; if you measure one and it's many times smaller or bigger than it should be, your Units (in Step 6 of the preceding steps) were set wrong. Close the file, open a new one, and try again.

Cleaning up imported CAD data

Most of the time, your imported CAD file looks something like the mess shown in the top image of Figure 8-20. Walls, annotations, grid lines, and other stuff are all jumbled up, and it seems like you're going to have to spend the rest of the week deleting edges. Probably not, actually — the following sections explain improvements you can make.

Switch to a style that's easier to read

If you're using a display style that includes lots of edge embellishments (such as Profiles, Extensions, and Endpoints), dense geometry of the sort in most CAD drawings looks like your model received an unwelcome visit from the Mascara Fairy. Yuck. Use the Styles panel to apply a style that's plain and simple. We recommend either Shaded or Shaded with Textures, both of which you can find in the Default Styles collection. You can read all about styles in Chapter 10. Figure 8-20 shows what a difference a style can make.

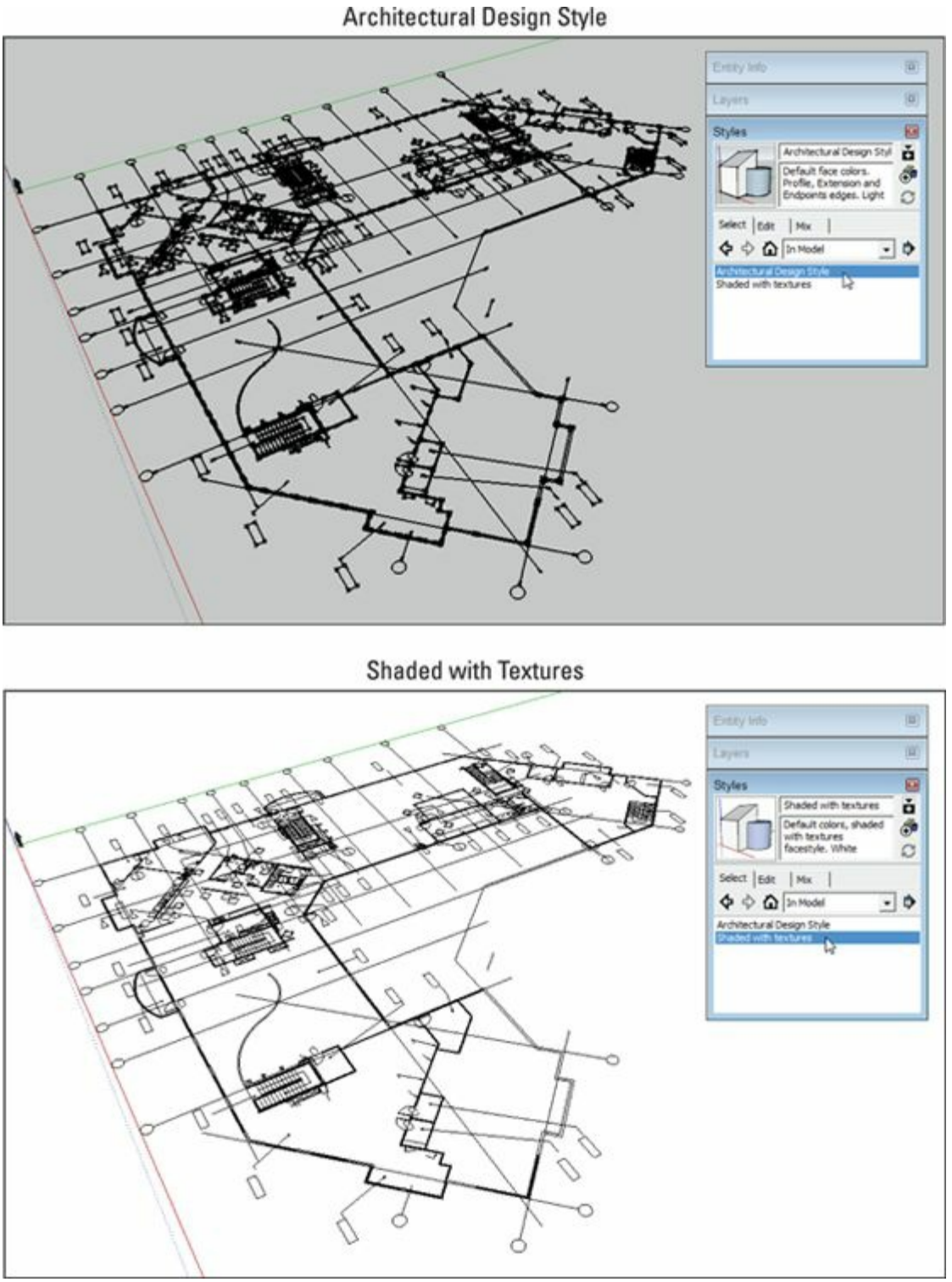


FIGURE 8-20: Applying a simple display style to a model with imported CAD data makes it a lot easier to work with.

Turn off layers you don't need

Most of the drawing symbols and other annotations you brought into SketchUp aren't things you need,

at least right away. The simplest and safest way to get rid of them is to turn off their layers. Remember that SketchUp Pro also imports all of the layer information associated with the CAD data you brought in; now's the time to use all of that complexity to your advantage.

Follow these steps to identify and hide the stuff you don't need:

1. **Open the Layers panel.**

   CAD files usually come with dozens of layers. Make the Layers panel nice and big so you can see more of them.

2. **Open the Entity Info panel.**

   The Entity Info panel tells you which layer a selected entity is on.

3. **Context-click any part of the imported CAD drawing and choose Edit Component.**

   As long as your model contains at least one entity when you do a CAD data import, SketchUp Pro automatically puts all the imported geometry into a single component. Whatever you do, try not to explode this component — you find out why later on in this chapter.

4. **Select an entity that you don't want to see right now.**

   In Figure 8-21, a grid line that we don't think we'll need for awhile (or at all) is selected.

5. **Look at Entity Info to see what layer contains your selected entity.**

   In this case, the selected grid line is on layer A-GRID. Okay, maybe we didn't need Entity Info to tell us that.

6. **Find the offending layer in the Layers panel and turn it off.**

   In the second part of Figure 8-21, switching off the A-GRID layer temporarily hides all the entities on that layer. Better already! If you're positive you won't need the contents of a particular layer, you can delete it altogether. Rebecca loves throwing out unneeded stuff, digital or otherwise, but Aidan's the kind of person who holds onto things (and has the basement to prove it).

7. **Repeat Steps 4–6 for all of the entity types you want to hide.**

   This part of the cleanup process is pure SketchUp catharsis. It takes time, but the results are immediately visible. The last part of Figure 8-21 shows the result of hiding a bunch of layers.

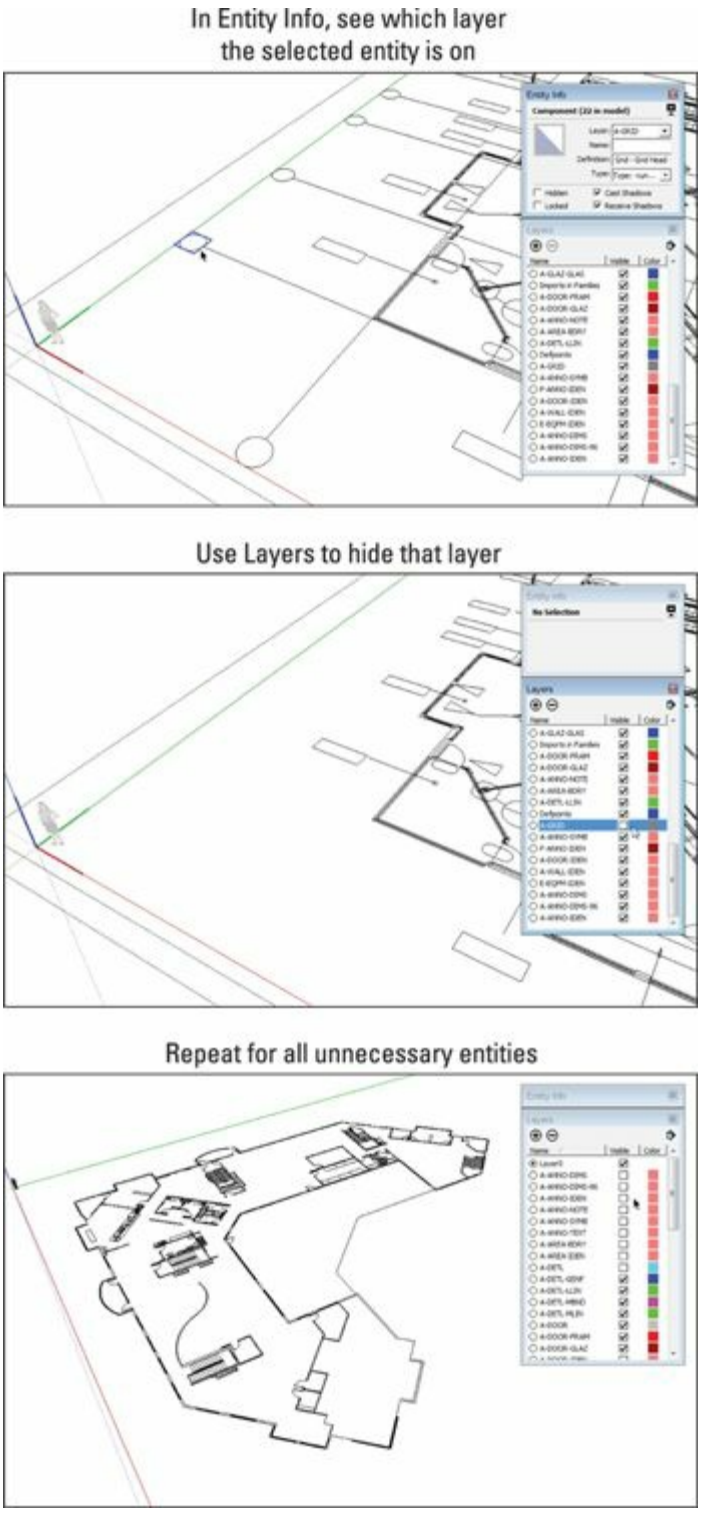


FIGURE 8-21: Select things you don't need and hide the layers they're on.

TIP Of course, you can also dive right into the Layers panel and start turning off individual layers, especially if you know what entities they contain. The preceding steps are useful for situations where layers aren't named descriptively or for when you're overwhelmed and don't know where to begin.

Modeling on top of imported CAD data

So you've successfully imported a CAD drawing and stripped down its style and visible layers to make it more manageable. Kudos — it's time to start having some fun. Building a 3D model based on underlying (literally) CAD linework can be a surprisingly Zen experience *if* you follow one simple rule:

REMEMBER **Keep the imported CAD data isolated inside of its own component and build your model on top of it.** *Don't* be tempted to use the imported edges to create faces directly.

Here are three reasons why:

- **CAD data is almost always full of gaps.** Lines that should extend all the way to their neighbors are sometimes short by tiny, invisible amounts, meaning you'll spend hours drawing edges and trying to figure out why faces won't appear where you want them to.
- **CAD lines that should be parallel to one of the colored axes often aren't.** Think that edge is parallel to the red axis just because it looks like it might be? Not necessarily. Blithely turning imported edges into faces and then pushing/pulling them into 3D geometry is like building a house on quicksand; things get wonky quick.
- **Imported CAD drawings aren't always flat.** Sometimes different parts of your imported linework are located at slightly, maddeningly different heights. We're talking thousandths of an inch — not enough to notice initially but certainly enough to mess up your work.

Instead of trying to use the imported edges as part of your 3D model, use them as references for new geometry that you draw on top of them. Tracing the imported geometry doesn't take as much time as you'd think, and the result is a model whose geometry is far more accurate and predictable. The following two sections talk about strategies for "tracing" imported CAD content.

Modeling straight, vertical walls based on imported CAD edges

There's a technique for modeling simple walls and other straight elements on top of imported CAD linework that's so simple and *enjoyable*, that audiences regularly applaud when Aidan demonstrates it. The credit for this method goes to our friend (and colleague) Mike Tadros.

REMEMBER Before you get started, make sure you're not editing the component that contains your imported CAD linework. Remember that you're using the CAD drawing as a reference underlay for your own 3D modeling activities. You'll be working "on top" (outside) of the component.

The Push/Pull tool is the hero of this method. Follow these steps (and see Figure 8-22) to model a straight wall based on edges in an imported CAD drawing:

1. **Use the Axes tool to line up the colored modeling axes with the wall you're about to model.**

   If the axes are already parallel to the wall, you can skip this step. If not, just choose Tools ⇒ Axes and line up the modeling axes with an edge in the CAD drawing that represents the wall you're working on. If you're not familiar with the Axes tool, "Matching a photo to an existing model" earlier in this chapter walks you through an example of aligning the axes with a model.

2. **Draw a rectangle next to the wall.**

   It doesn't matter how big it is; you'll see why in a moment.

3. **Use the Push/Pull tool to extrude the rectangle up to the height of the wall you're modeling.**

   If you don't know it just yet, just guess. It's easy to change this later.

4. **Use the Push/Pull tool to extrude the box you just made so that it's flush with one side of the wall.**

   If you drew the rectangle in Step 3 to the *outside* of the wall, push/pull the face so it's flush with the *inside* of the wall. (See Figure 8-22.)

   The key to this step is pure SketchUp Inferencing 101: Click to start pushing/pulling, hover your pointer over the edge (or its endpoint) that you're aiming for, and then click again to stop pushing/pulling. You're using the imported CAD edge as an inferencing reference for your tool. It's cake after you've done it once or twice.

5. **Use the Push/Pull tool to make the opposite face of the box flush with the other side of the wall.**

   See what's happening? You're using the Push/Pull tool and carefully chosen inferences to turn the box *into* the wall.

6. **Push/pull the ends of the 3D wall so they match the underlying drawing.**

   We told you this was fun.

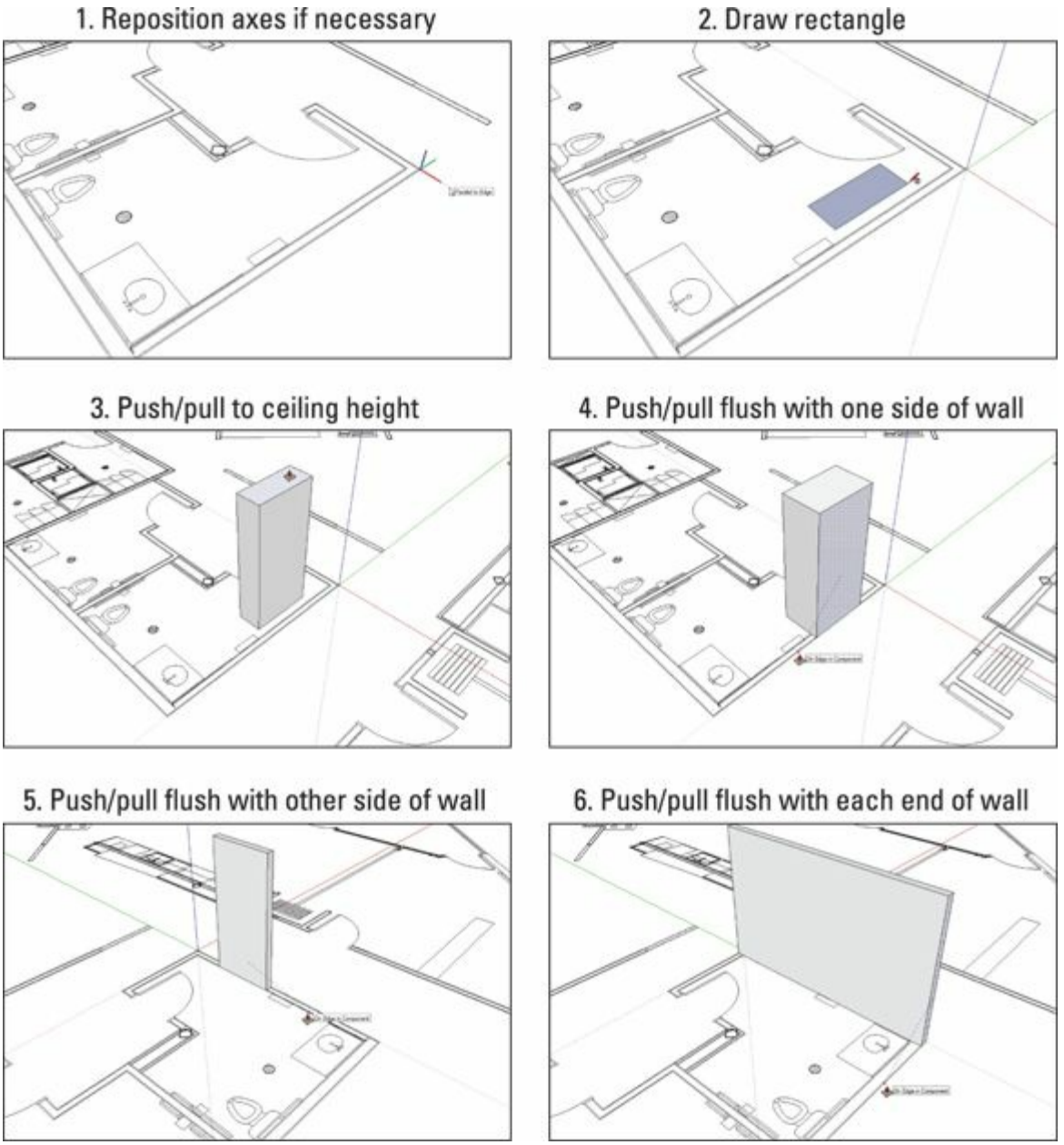


FIGURE 8-22: Modeling a simple wall based on a couple of edges in an imported CAD drawing.

What happens when walls meet up at corners? Well, that can happen at right angles (which is common) or at other angles (which isn't uncommon).

MODELING RIGHT-ANGLED WALLS

For 90-degree corners, all you have to do is draw a rectangle on the inside face of your wall and use the Push/Pull tool to extrude it out. After that, use the same tool to make it flush with the edges in the CAD drawing. Figure 8-23 provides a visual.

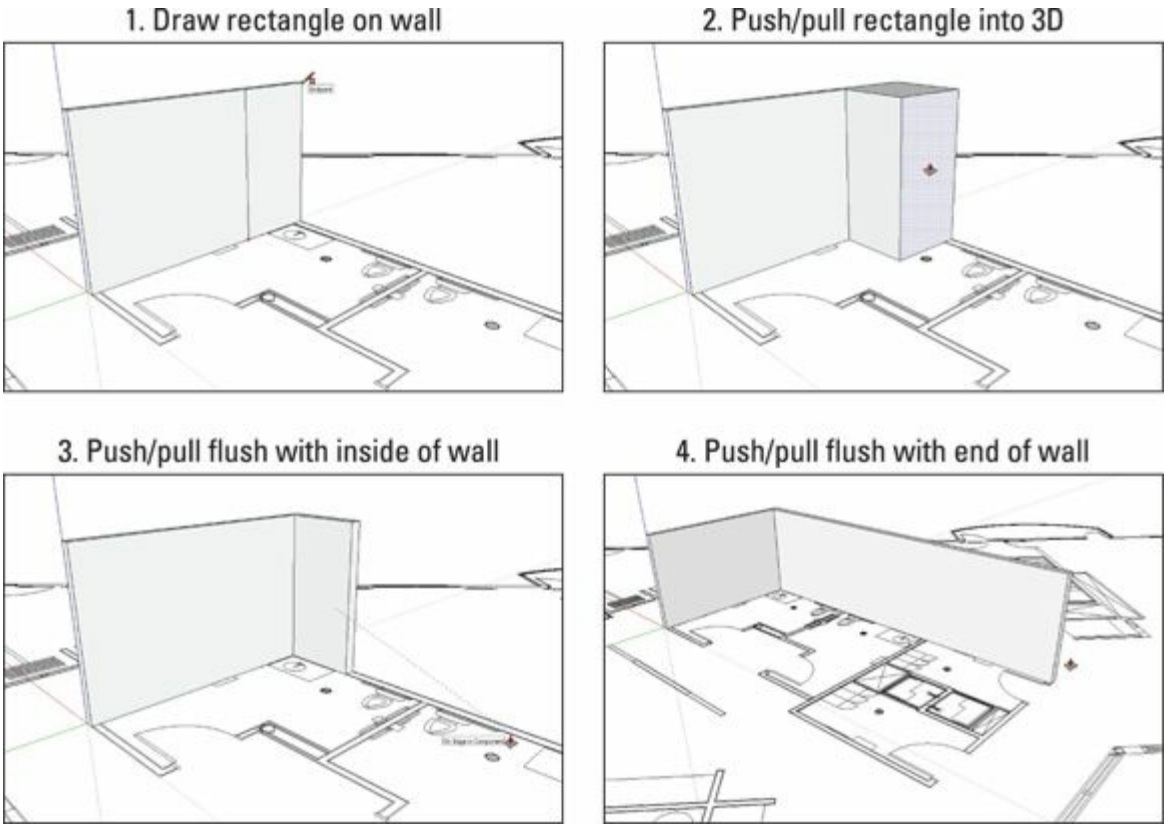


FIGURE 8-23: Use the Rectangle and Push/Pull tools to model walls that meet at right angles.

MODELING WALLS THAT MEET AT NON-RIGHT ANGLES

If you're dealing with a corner that isn't 90 degrees, you can proceed in a few different ways; using the Intersect Faces tool is a great place to start. The following steps (and Figure 8-24) elaborate on the technique:

1. **Model each straight wall segment independently but don't overlap their ends just yet.**

   Follow the steps in the section "Modeling straight, vertical walls based on imported CAD edges," a few pages earlier, to build each wall so it's parallel with the CAD edges to which it corresponds. Don't worry about the two wall ends that will eventually meet; keep them apart for now.

2. **Use the Push/Pull tool to extend each wall well past the point at which it should meet the other.**

   You're modeling something that looks like an *X* from above.

3. **Select the inside and outside faces of each wall.**

   You should have a total of four faces selected.

4. **Choose Edit ⇒ Intersect Faces ⇒ With Selection.**

   This action tells SketchUp to draw an edge wherever two faces intersect. If you had four faces selected, you should now have two new edges.

5. **Use Push/Pull to push away the wall segments you don't need.**
   Pushing their top faces all the way down to their bottom faces makes them disappear.
6. **Use the Eraser tool to get rid of any extra edges.**

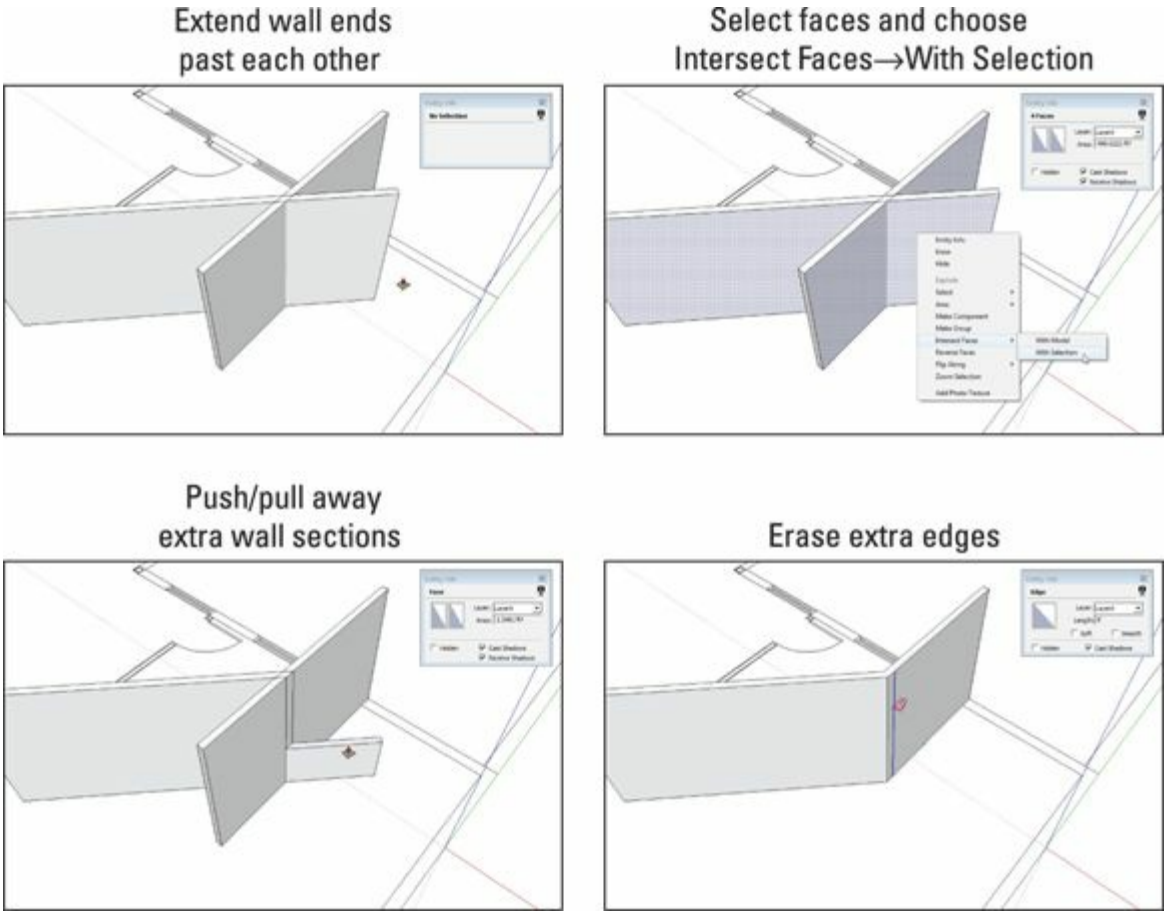


FIGURE 8-24: Use Intersect Faces to model walls that form non-90-degree corners.

Modeling curved and irregular forms from CAD data

For rectilinear walls, stairs, and other shapes, SketchUp's Rectangle and Push/Pull tools are rock stars. Rounded forms (such as concrete patios and castle turrets) and irregular lines (such as riverbeds and Frank Gehry buildings) call for other, more drastic measures.

The following steps give a general example dealing with features in your CAD file that aren't worth painstakingly tracing with the Line tool but which need to appear in your SketchUp model. In these situations, you can rely on the handy Paste in Place command:

1. **Dive into the component that contains the imported CAD linework.**
   By "dive into," we mean edit it, which you can do by double-clicking it with the Select tool.
2. **Select the edges you want to reuse.**
3. **Make a group out of the edges.**

Choose Edit ⇒ Make Group to do this. Grouping your selection accomplishes two things: Grouping makes reselecting it easier (in case things go awry), and it keeps things nice and separate for the next couple of steps.

4. **Choose Edit ⇒ Copy.**
5. **Stop editing the CAD linework component.**

   You can exit a component (or a group) by double-clicking with the Select tool somewhere outside its bounding box.
6. **Choose Edit ⇒ Paste in Place.**

   Voilà! The edges in question are now a part of your model, and (thanks to Step 3) are quarantined from the rest of your geometry by means of a group.

For shapes that are made up of simple arcs (segments of circles), your best bet is to try to re-create them by using SketchUp's own Arc tools. Why not just use the Paste in Place method (described in the preceding steps) to copy them? For arcs, it's nice to have control over their number of sides, and drawing them from scratch is the only way to do that.

Follow these steps to accurately trace an arc from underlying CAD linework (see Figure 8-25):

1. **Draw an edge that's perpendicular to one of the arc's line segments, heading in the direction of the arc's center point.**

   You can use SketchUp's Perpendicular linear inference to help you draw a perpendicular edge. This is the first step in figuring out the precise location of the arc's center point.
2. **Repeat Step 1 for another of the arc's line segments, crossing your new edge over the one you just drew.**

   The point at which these two edges intersect is the center point.
3. **Erase two of the edges that you just drew, leaving a small V that points to the arc's center point.**

   Look at the third image in Figure 8-25 to see which two edges I'm referring to.
4. **Choose Draw ⇒ Arcs ⇒ Arc to activate the Arc tool.**

   What is now called *2 Point Arc* used to be SketchUp's *only* Arc tool; it works by first setting endpoints and then setting a bulge. The new(ish) Arc tool, which is called simply *Arc*, lets you start by defining a center point; this is much more useful for situations like the one you're in now. If you have SketchUp 2014 or later, you have this new Arc tool.
5. **Click once to set the center point of your new arc.**

   This is, of course, at the tip of the V you drew in Step 3.
6. **Complete the arc by clicking to set each of its endpoints.**
7. **(Optional) Change the number of edge segments in your new arc.**

   Before you move onto anything else, type the number of segments you want, followed by the letter **s**, and then press Enter. Most likely, you want more than the default 12 segments on arcs

that represent major features in your design.

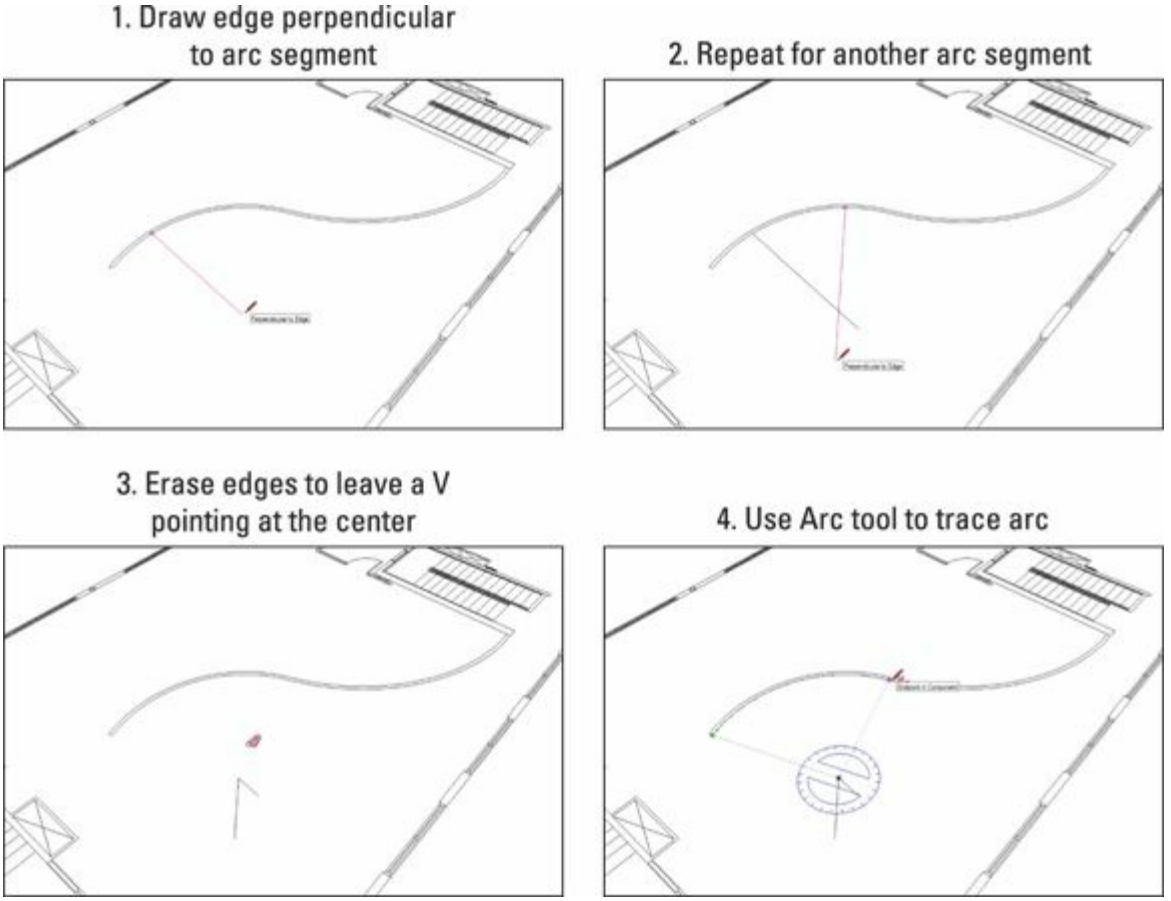


FIGURE 8-25: The Arc tool lets you easily draw arcs with a given radius.