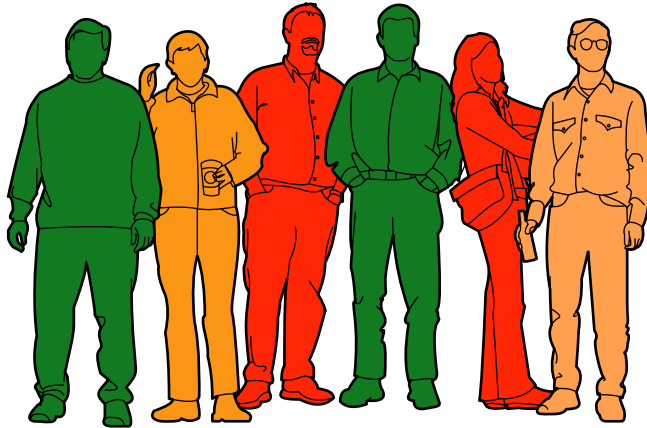


WHO SHOULD USE THIS BOOK?

This book is for anyone involved in creating documentation for Construction whether you're an **architect, builder, engineer, interior designer or DIY enthusiast**.

It is recommended that the user should become familiar with SketchUp's tools and concepts before attempting the exercises in this book. While the lessons are quite self-contained, **familiarity with modelling, navigating the model space, and model management is strongly advised**. For excellent advice and links to further resources to help you regarding this, please visit the Resources Section on www.SketchUp.Expert



WHAT DO I NEED TO COMPLETE THIS COURSE?

To make use of this book, you'll need access to **SketchUp Pro 2019** or later. A modern laptop or desktop computer running Windows 7+ or later MacOS X.12 or newer is a minimum requirement. In addition there are hardware requirements that you should be aware of which can be found on the SketchUp website.

<https://help.sketchup.com/en/sketchup/sketchup-hardware-and-software-requirements>

You'll need an internet connection to download the files that go with this book- (See Link on Page 4.)

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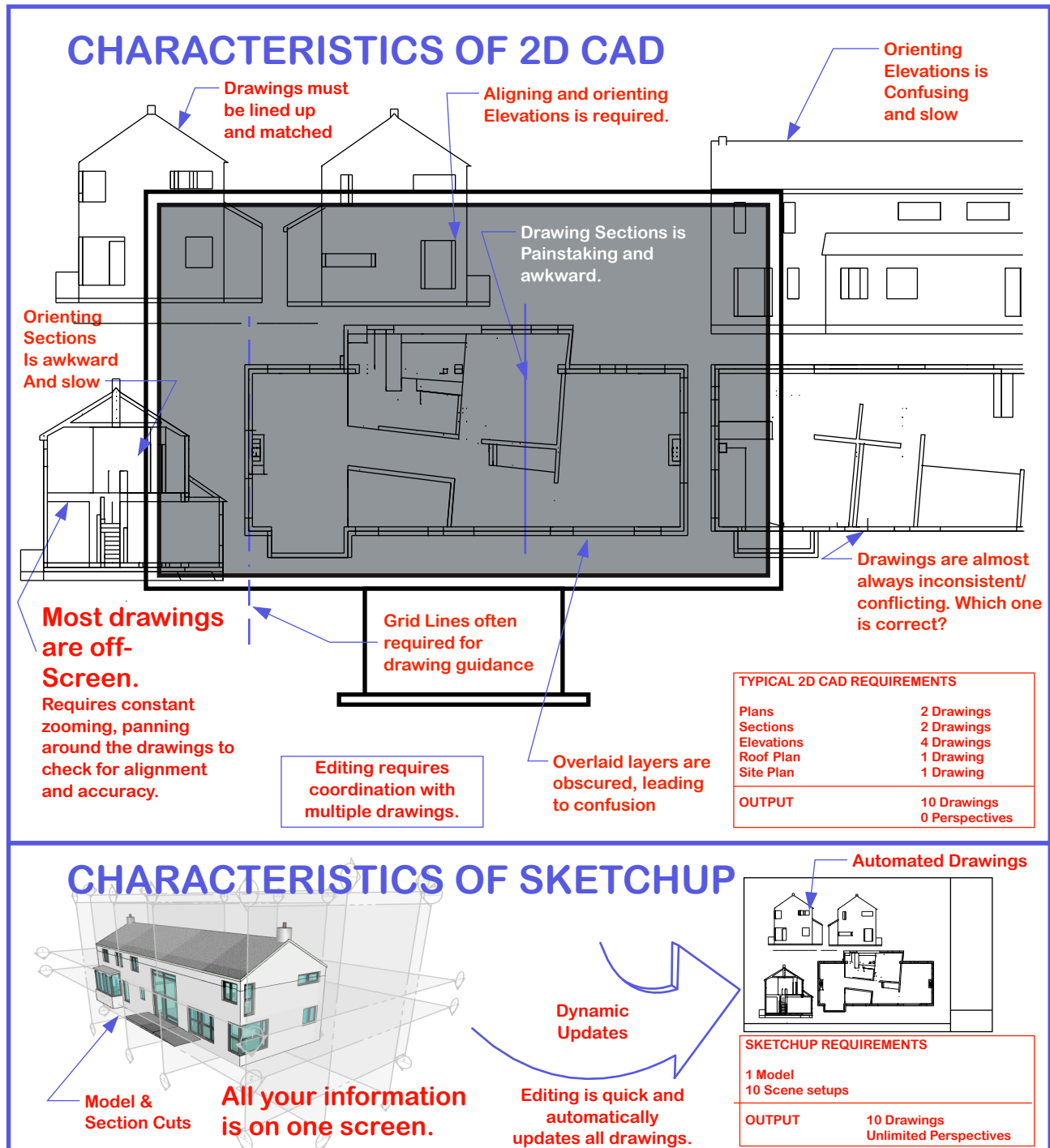
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WHY IS SKETCHUP SUPERIOR TO 2D CAD?

SketchUp creates an efficient 3D model that automatically pushes updates to drawings.
2D CAD requires creation of “one use only” drawings that contain potential errors.



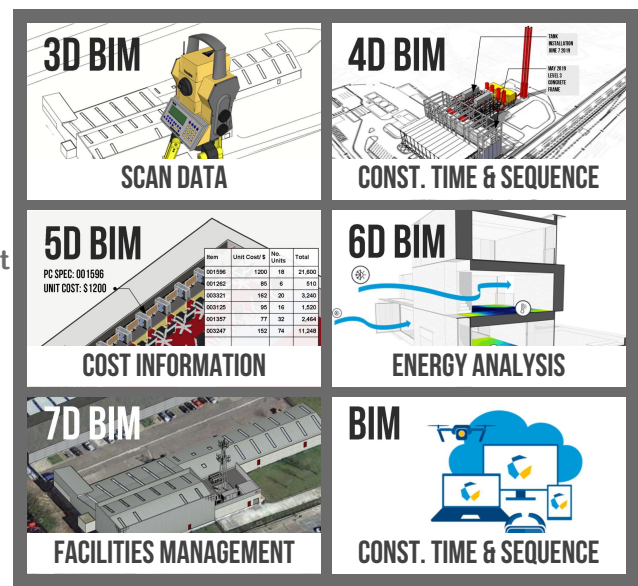
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SKETCHUP AND BIM

SketchUp's unique blend of user friendliness, flexibility and extendability means that it has quite an unlimited potential as a BIM tool.

While certain tasks are handled better by other platforms, they are limited to a particular speciality. Not so with SketchUp, which can be used for a myriad of purposes. For example, SketchUp provides the following capabilities:

- 3D virtual tours
- Virtual space immersion.
- Construction sequencing
- Cost reports and analysis
- Energy analysis/ strategy appraisal
- Photographic Renders (with extensions)
- Clash Detection
- Online Collaboration via Trimble Connect
- Component Cataloguing
- Parametric Modelling
- IFC Classification
- Construction Documentation (CAD)
- Open Program Interface (Extendability)
- Shadow studies



The above list is by no means exhaustive.

SketchUp is not hampered by large file sizes or complex automated ("Parametric") components. Modelling an object doesn't require programming an object or looking at a dialogue box. Sharing files is instantaneous. SketchUp Pro is used as a BIM tool by both small and large organisations ranging from one-man operations to multi-discipline teams either as a complete business solution or integrated into a delivery process.

See SketchUp.Expert Resources for Examples of SketchUp for BIM in action:

- **Mortenson Construction:** SketchUp Pro in construction - video case study
- **Barton Malow 3D for Construction:** delivering quality & efficiency
- **McCarthy Building Company:** Case Study

Find out more at <https://SketchUp.Expert>

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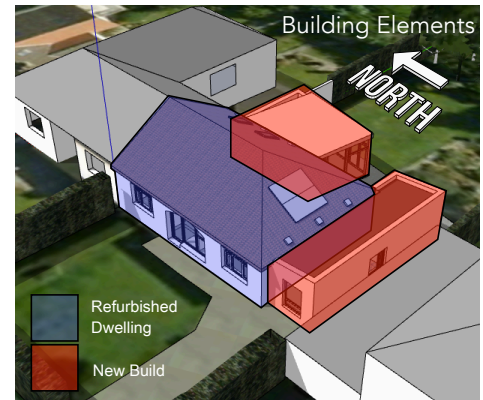
INTRODUCTION

SketchUp always had the potential to challenge traditional 2D CAD as a construction documentation tool; however it was only when LayOut was introduced in 2008 that SketchUp Pro threw down the gauntlet. Still, SketchUp had a long way to go before it could become a reliable solution for drawing offices. With the introduction of **section cut fill** in version 2019 SketchUp started to look like it was truly ready to take on the behemoths such as AutoDesk and Dassault.

This book is a follow up to the 2020 version. While it contains much of the same content (the exercises use standard tools and settings that are still current) I have made edits to improve legibility and added a section that deals with improvements in the software since 2020.

THE PROJECT

The project selected for these training exercises is a small home refit/ extension that I designed and project managed in 2011. I selected it because of it's small size vs relative complexity. The location is a suburb of Cork City in Ireland. The project was a refurbishment and extension to the existing. All interior walls were demolished except for the central structural wall which supports the mid-point of the roof trusses. Existing floors and walls were upgraded and timberframe extensions were added to the East and South.



View from the South West illustrates existing vs new elements.

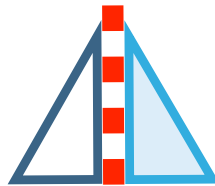


What's new in SketchUp?




The improvements to SketchUp since 2020 have been many, but a majority of them are behind-the-scenes, or small improvements to existing functionality. **The entire list can be found at <https://help.sketchup.com/en/release-notes> or on the <https://sketchup.expert> home page** as a pull-out document. (This provides more flexibility to add in extra features over time. With that said, here I'll highlight just a couple of improvements before I encourage you to view the remainder online.) **The most notable change (improvement? debatable.) is the new set of icons which are more “flat” in their design.** Without a doubt (for me at least) the most fundamental and notable improvement is the addition of the **Flip Tool**. (For which I've personally been campaigning for years on the SketchUp Forums- You're welcome.) It is now finally possible to flip and mirror an object as easily as moving or copying. The interface is smooth and intuitive. Good job SketchUp team.

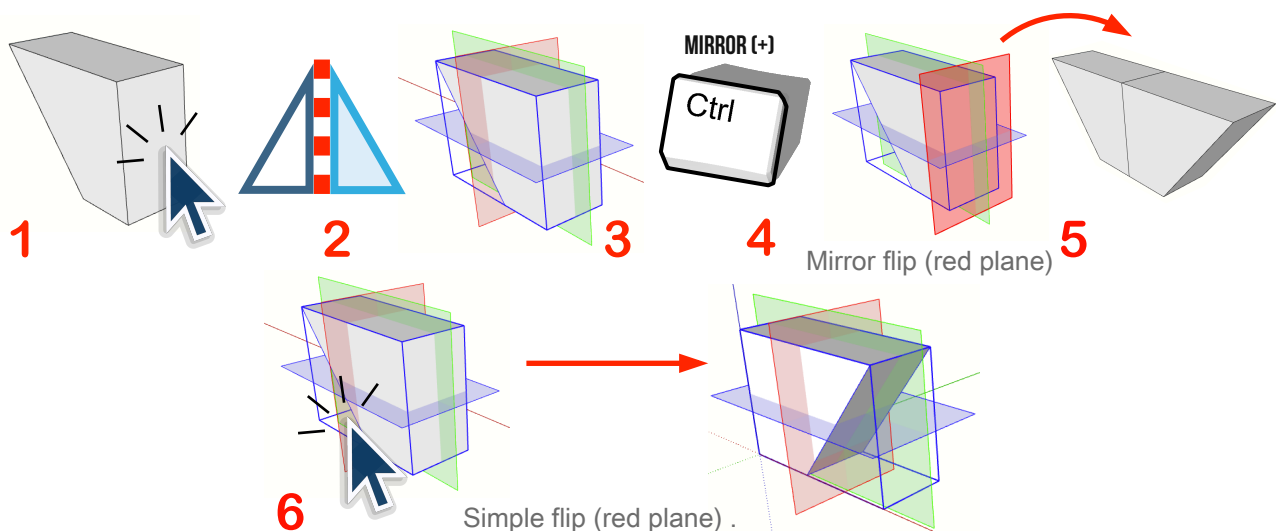
1. The Flip Tool

To initiate the tool, you can use the button which is available on standard toolbars - Or create a shortcut which I recommend doing. Just go to Window>Preferences>Shortcuts (or SketchUp>Preferences>Shortcuts on Mac) to create a new bespoke shortcut. **See the shortcuts section in this book (The first one is on page 27) to find the full guidelines for doing this.** The shortcut I'm using for flip is alt + F (on Mac)



To use the tool, follow the sequence as follows:





1. Select the object you want to flip. 
2. Click on the Flip Tool button (or shortcut.) 
3. Decide in which plane you wish to perform the flip: Red/ Green/ Blue.
4. If you want to mirror (i.e. copy the original) then hit CTRL (Win) or alt (Mac) to reveal the plus sign on the icon (+) 
5. Drag the selected plane into position and release.
6. - To perform a simple flip without copying just click once on the chosen plane.

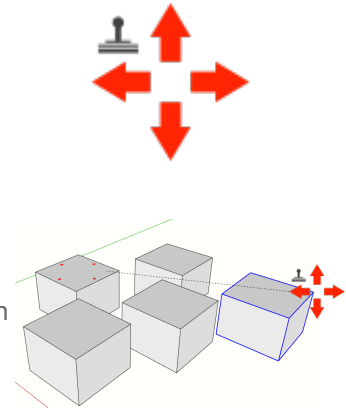


What's new in SketchUp?

2. Move/ Copy/ Stamp




Improvements to the Move/ Copy tool include the ability to create multiple copies of a group or component at random by pointing and clicking. To initiate this functionality, follow this procedure:

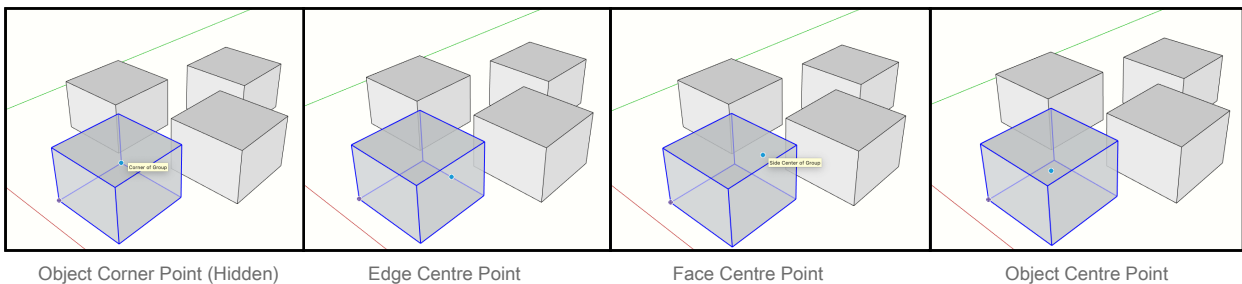
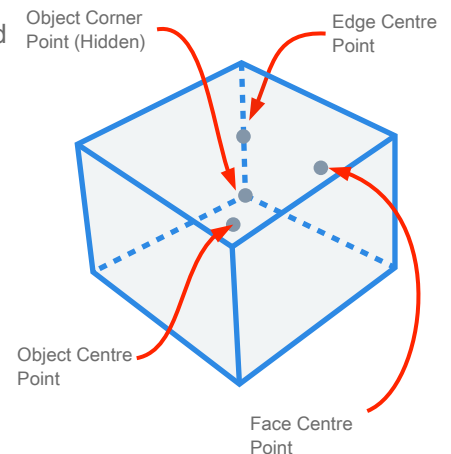
1. Select the object you want to copy. (Select Tool) 
2. Click on the **Move Tool button (or shortcut "M").** 
3. Hit the hit the CTRL key  (or alt key on Mac) **TWICE** so that you see a  icon show up beside the move icon.
4. Click a starting point to begin your move operation (usually a well-chosen position on the object you are copying that corresponds precisely with the destination position.)
5. Click to create copies of your object.
6. Hit the esc button when finished.



3. Object Grips

When moving an object you can now select multiple grips that are located on the hidden (far) side of the object, at centre points of the sides or at its centre point. To see this working for yourself follow the steps below.

1. Select a group/ component. 
2. Click on the Move Tool. 
3. Float the cursor over the object and notice how grips appear.
4. Click on one of the "hidden side" grips and notice how the object becomes translucent and the grip sticks to the cursor.
5. Wiggle the cursor around to see how the object reacts
6. Hit the esc key to let the object spring back into position. 
7. With the object still selected and the move tool still in operation, hit the alt key (windows) or Cmd key (Mac).
8. Notice how the grips change position: Corners > Edge Midpoints > Side Centre Points > Object Centre Point > Corners.



What about LayOut?

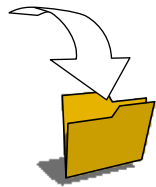
There are many developments in LayOut too- But you'll find all the details about all the developments in SketchUp and LayOut at **SketchUp.Expert**

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GETTING STARTED

sketchup.expert

-> **RESOURCES PAGE**

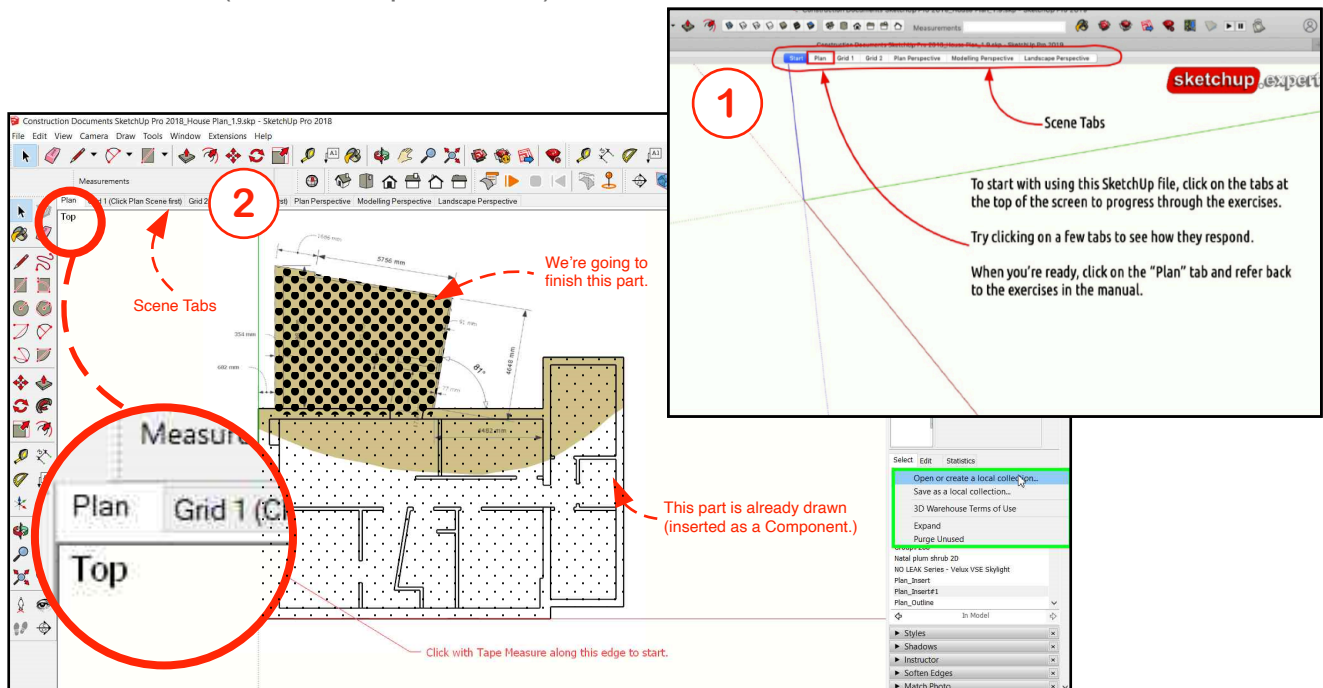


First let's check that we have the companion course models for this manual:

- A. Construction+Documents+Using+SU+Pro+2020_House+Plan+X.X.skp
- B. Details_X.X+Construction+Documents+SketchUp+Pro+2020_(For+All+Users).skp

If you don't have the above SketchUp files, you'll need to download them from the **Resources Section** at www.SketchUp.Expert

To begin, open the SketchUp file "Construction Documents SketchUp Pro House Plan_X.X". You'll see the "Scene" as illustrated in (1). This provides instructions regarding the use of the file. Clicking on the "Plan" Scene as directed (2), you'll notice that it consists of an outline drawing and an image. First we're going to finish the highlighted part of the plan shown below. (The rest is pre-drawn.)



Check out the Scene Tabs to see what each contains. When you've finished exploring, click on the "Plan" tab to begin the exercises. The units used in this book are **millimetres**. Our SketchUp files have a millimetre default setting.

DRAWING CONSTRUCTION LINES

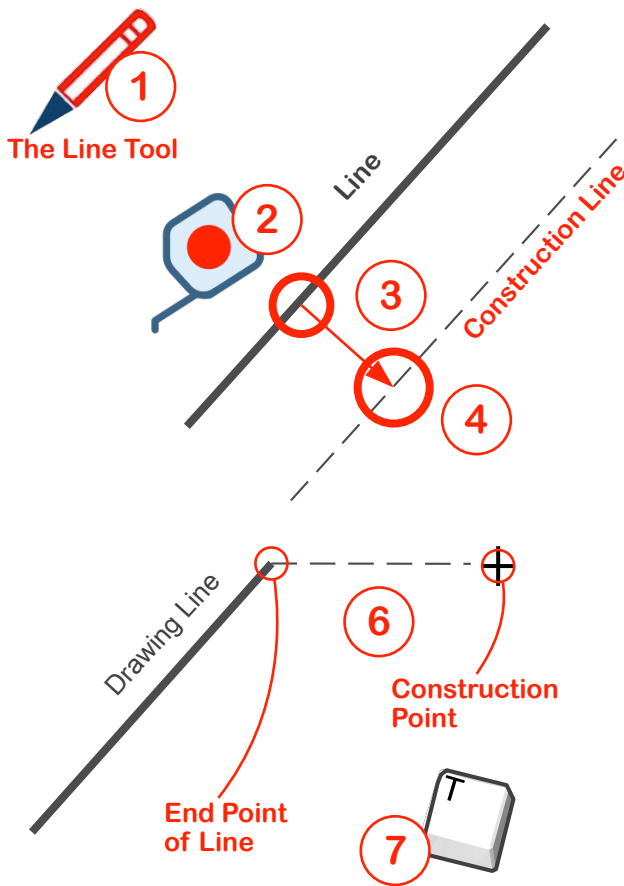


The **Tape Measure** is a multifunctional tool. Besides providing measurements it also **builds construction lines and points** (“guides”). Guides are used to help create geometry.

We’re going to use the Tape Measure Tool to set up our first construction framework. We’ll then use that framework to “hang” our drawing. Below is a primer on how the Tape Measure creates construction guides.

DRAWING GUIDES (LINES & POINTS) AT A SET DISTANCE

Try this exercise yourself

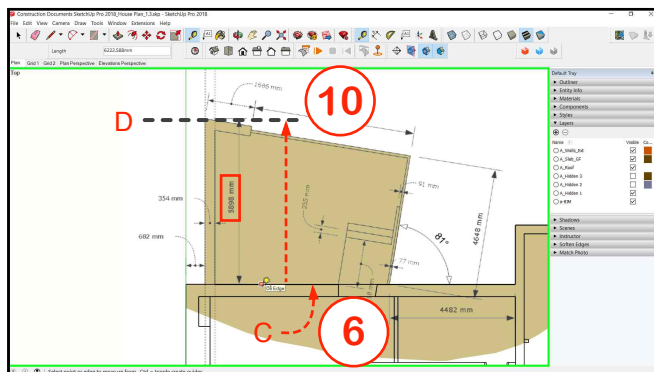
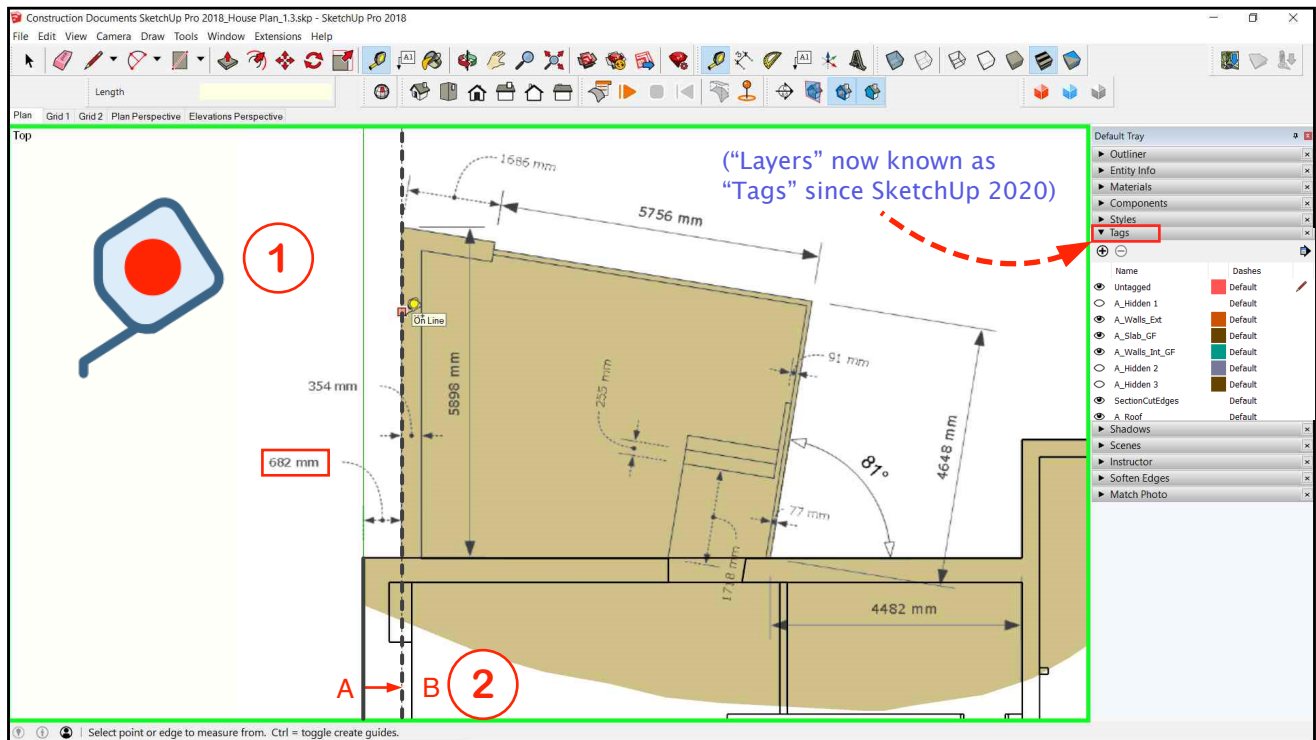


- 1 Draw a random line using the **Line Tool**.
- 2 Select the **Tape Measure Tool**, click on a **random** point on the line.
- 3 Move the mouse in the direction you want to place the (parallel) construction line.
- 4 Click to place the construction line at a random distance.
- 5 **Type a number** which represents the distance you want to give it and hit “enter”. **The line is now at the distance from the line that you specified.**
- 6 Note that if you click on the **endpoint of a line**, you will get a **Construction Point**, not a parallel line. Again, move your mouse in the desired direction and type a distance from the point and hit “enter”
- 7 Useful Tip: Typing “T” will activate the Tape Measure (Default Shortcut.)

CONSTRUCTION DOCUMENTS USING SKETCHUP PRO - UPDATED 2024

DRAWING THE PLAN

1. Using the Tape Measure Tool, click on the edge “A” as indicated.
2. Move the cursor to the right and click a random distance away.
3. Type the number “682” (Don’t click into any dialogue box to do this.)
4. Hit Enter.
5. The first construction line “B” is formed.



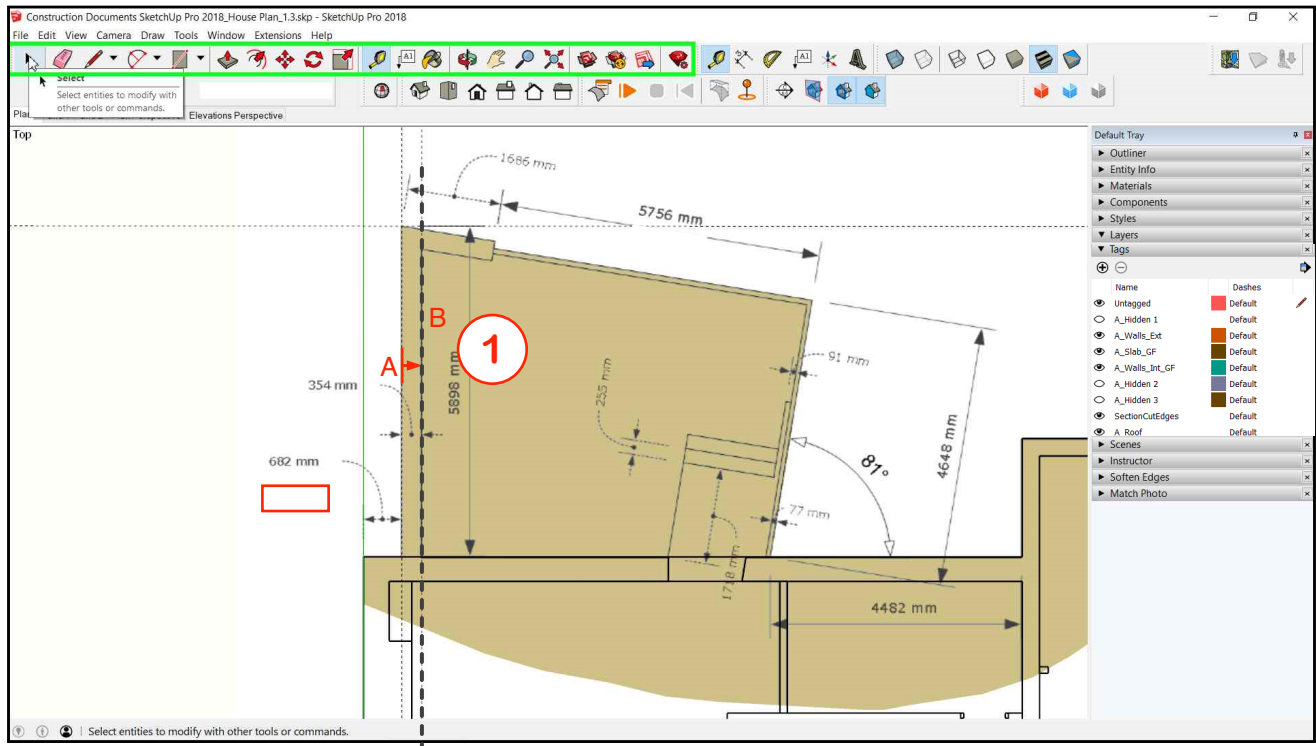
6. Click on the edge “C” as indicated.
7. Move the cursor upwards and click at a random distance.
8. Type the number “5898”
9. Hit Enter.
10. The construction line “D” is formed.

(Note that “Layers” (SketchUp 2019 and earlier) will here be referred to in this Manual as “Tags” (SketchUp 2020+))

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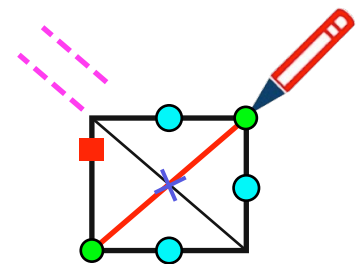
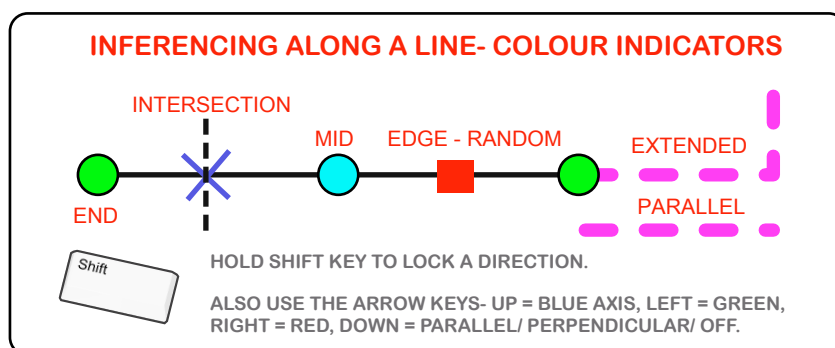
DRAWING THE PLAN

Follow the procedure as outlined on the previous page to create the construction line “B” at a distance of “354” from “A”



INFERENCING

As we draw lines or use other tools to move or rotate things, we need to be able to refer to lines, points, angles or planes that are already in place. This is what's known as **inferencing**. The diagrams below illustrate the various inferencing options.

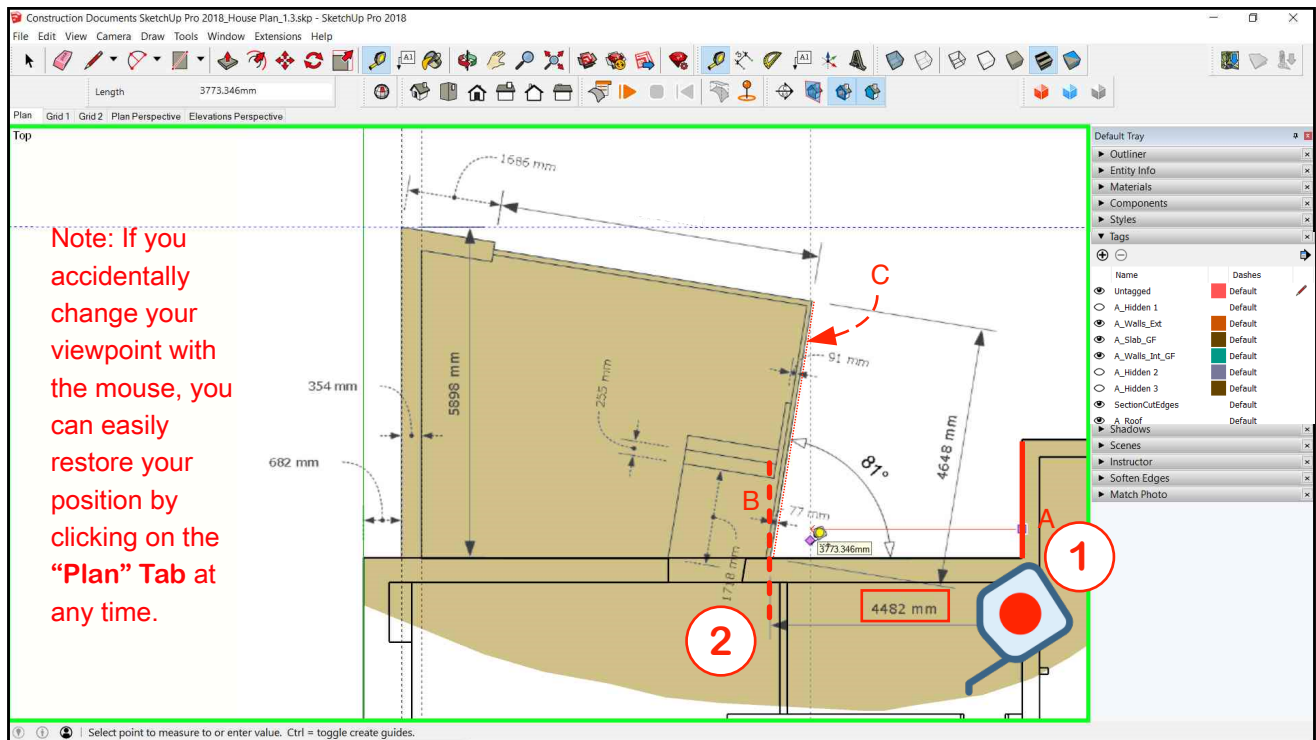


Drawing a line from one corner of an existing box to another corner is using inferencing to find the points of reference.

DRAWING THE PLAN

Now we'll draw lines to start forming the angled corner. To form the edge "C" takes a few steps. First we'll form a construction point using a line.

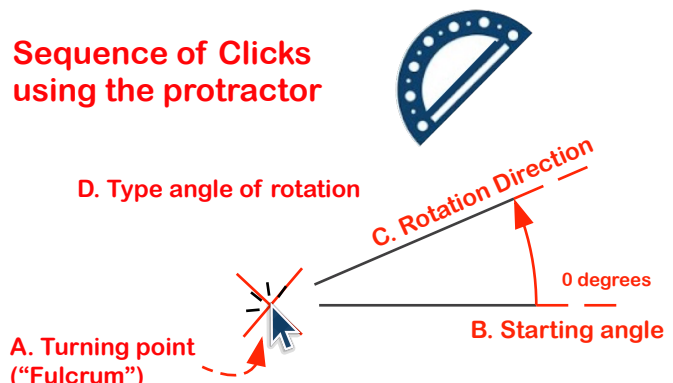
1. Using the **Tape Measure Tool** click on the line "A" as indicated.
2. Using the procedure outlined previously, create a construction line "B" at a distance 4482 to the left of "A".



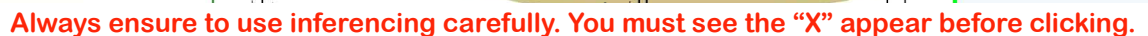
The next tool we're going to use is the Protractor which also produces a construction line. It requires picking:

- A A turning point (or "Fulcrum")
- B Starting angle (0)
- C A direction
- D An angle of rotation

Sequence of Clicks using the protractor



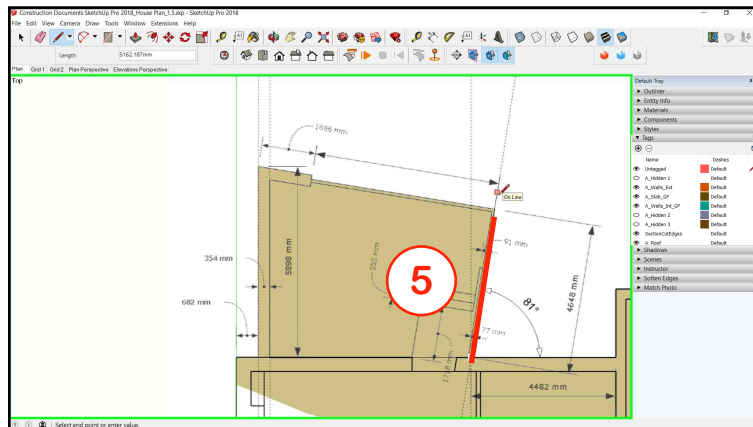
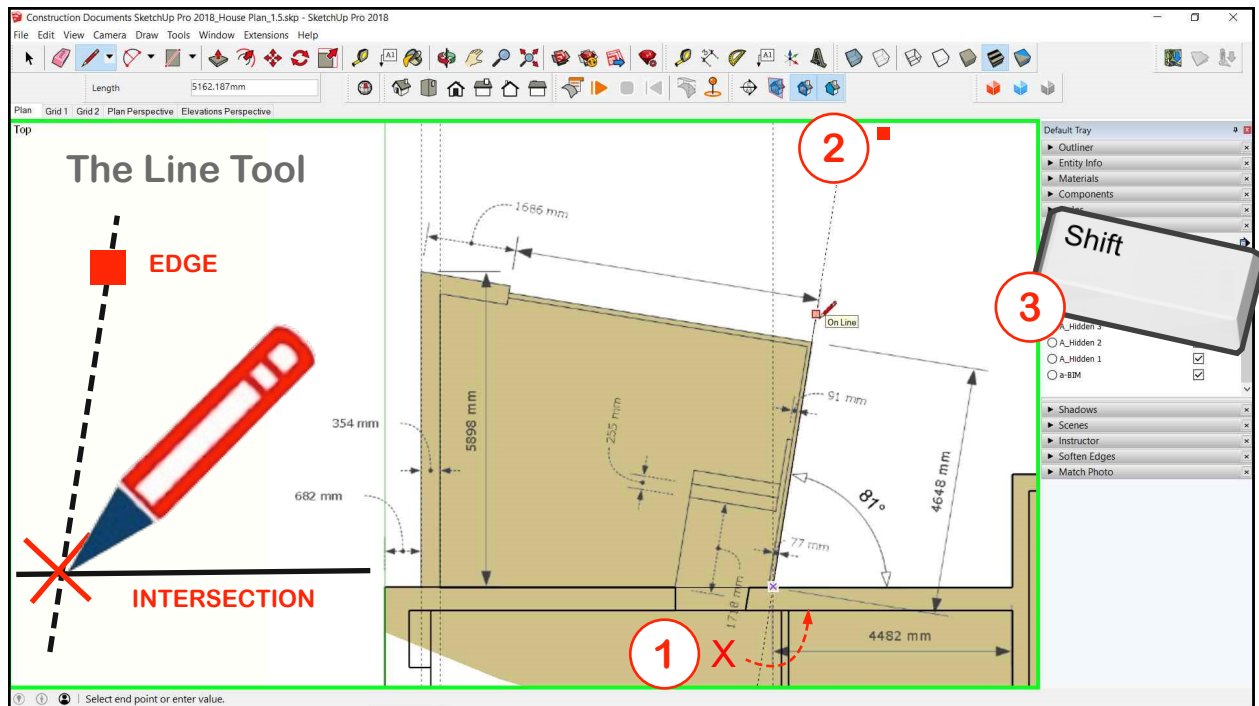
1. Click on the intersection point “Z” (between the construction line and the horizontal line.)
2. Pick a **zero** starting angle “A”: Move the cursor to the right (We want the cursor to “stick” to the red axis.) Click.
3. Move the mouse upwards (Anticlockwise direction) and click a random angle.
4. Type “81” and hit Enter.
5. The construction line at “B” is formed.



CONSTRUCTION DOCUMENTS USING SKETCHUP PRO - UPDATED 2024

DRAWING THE PLAN

1. Next: Using the **Line Tool**, draw a line starting from the point of intersection “X”.
2. Move the cursor onto the construction line. Notice the red dot appearing- This indicates that your next point will be placed on that line.
3. Hold down the shift button- Notice that with the Shift button held down, wherever you place the cursor it is stuck on the construction line.

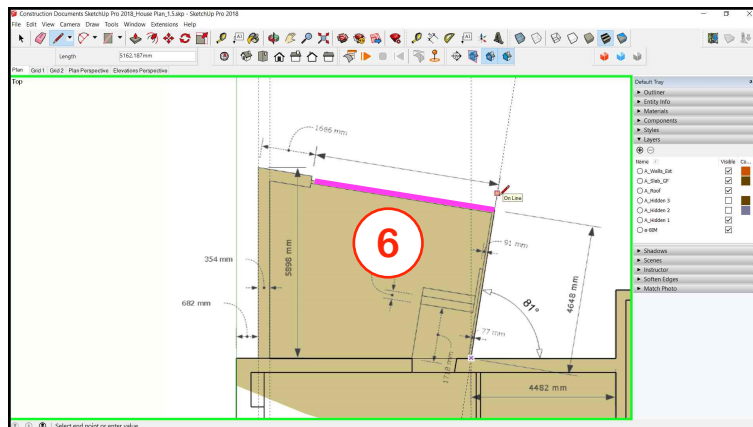
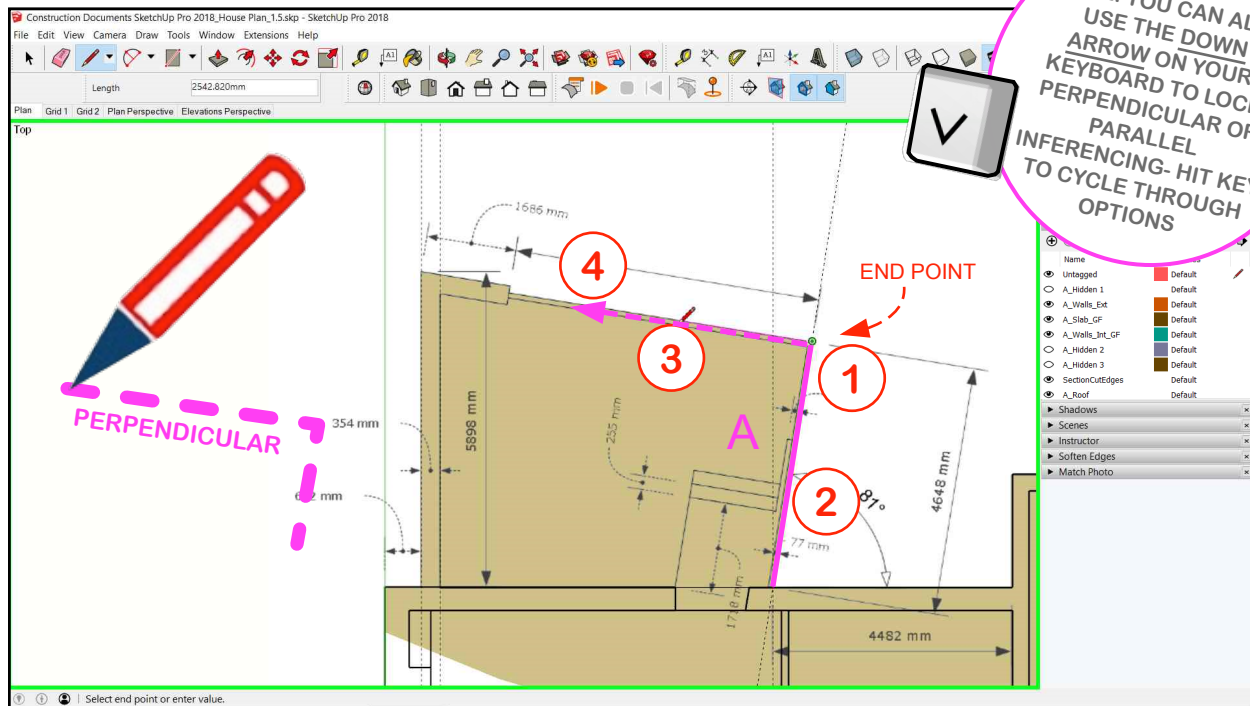


4. While holding down the Shift Button, type “4648” and hit enter. (Note: In doing this, don’t click into the measurements dialogue- Just type the number.)
5. The line should appear as indicated.

DRAWING THE PLAN

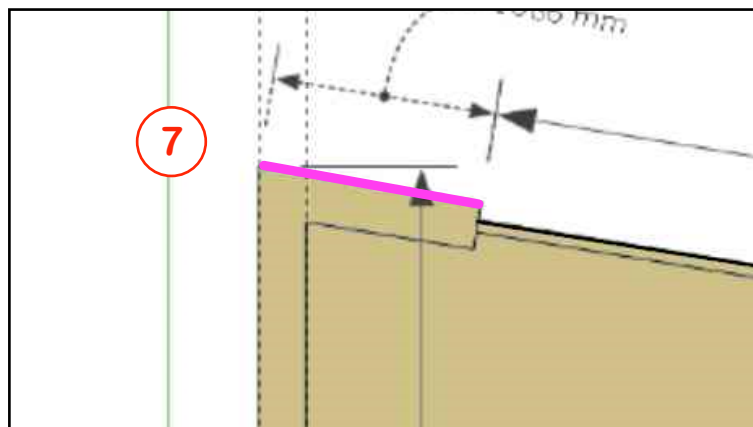
To draw a line from the endpoint of the previous line at a perpendicular direction:

1. Start drawing a line from the end of the previous line- Let's call this "A". (Make sure to start from exactly the end point. See the green dot occurring below.)
2. Without clicking on your mouse button, **run the cursor along A**.
3. Notice when you move the cursor around that a magenta line appears perpendicular to A. (See **note opposite** for more options.)



- 4 Move the cursor in the direction of the magenta line as illustrated. (Don't drag or click the mouse while doing this.)
- 5 With the line showing as magenta, type "5000" and hit Enter. (We'll complete it later.)
- 6 The resulting line should be as indicated.

1. Start drawing a line from point X
2. Click on the intersection Y.
3. Start drawing a line from Point Y.
4. Float the cursor along line Z (without clicking) to pick up on it's direction.
5. Notice when you wiggle the cursor around that a **magenta line** appears parallel to Z.

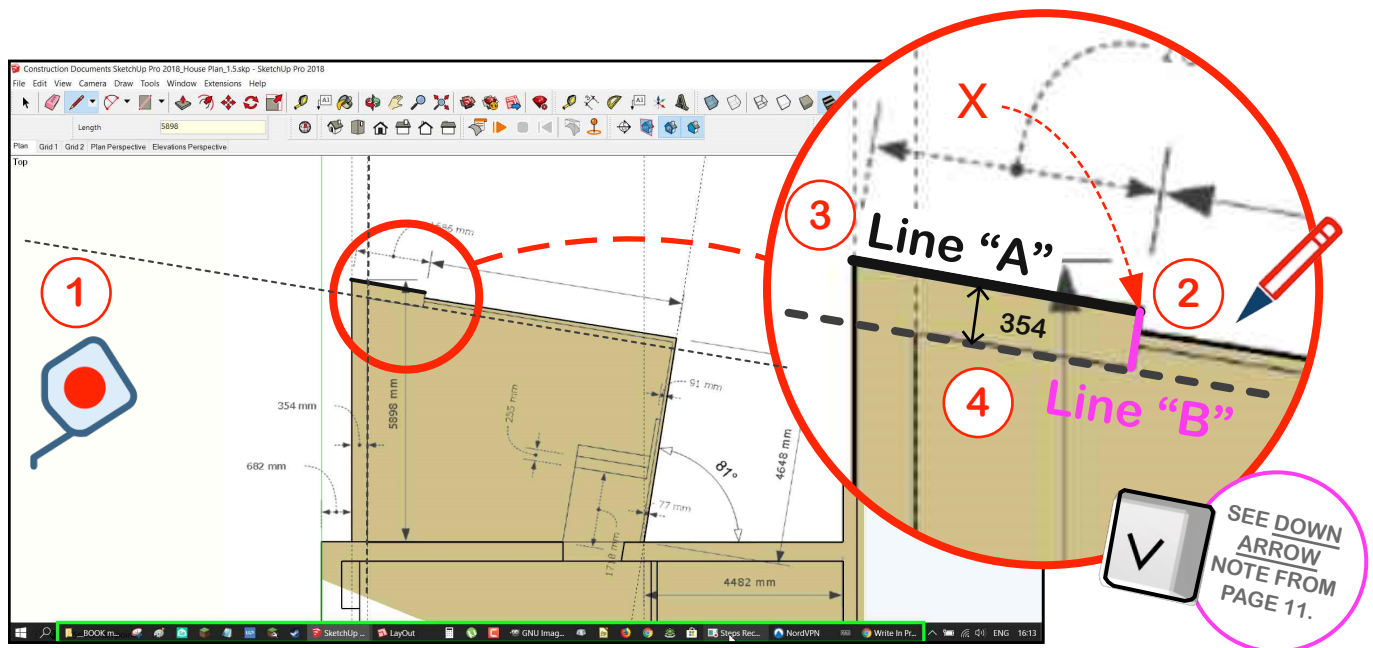


6. Whilst the magenta colour is showing, type “**1686**” and hit **Enter**.
7. The line should be as indicated.

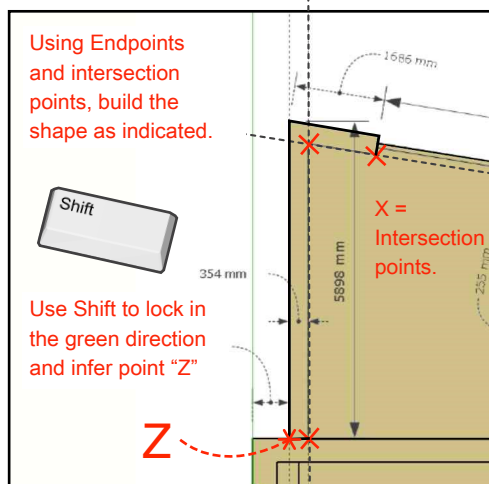
Drawing The Plan Page 12

DRAWING THE PLAN

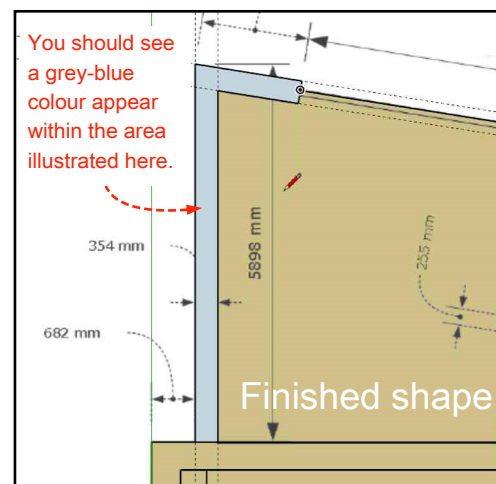
1. Using the Tape Measure Tool, click on a **random** point (not an end point) along **Line A** to create a **parallel construction line** at a distance of "354" from Line A.
2. Using the **Line Tool**, click on the point "X" to start a line from there.
3. Float the cursor along Line A to pick up it's direction.
4. Move the cursor around so that it turns magenta (perpendicular direction to Line A.) Draw a line B perpendicular to Line A which meets the construction line as illustrated.



Finish drawing the shape as outlined below using the construction points you created.



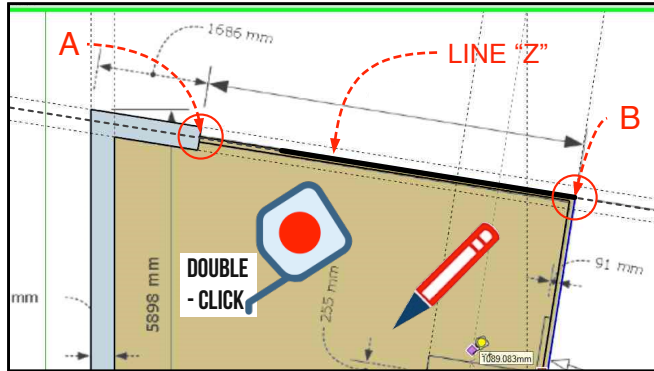
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Drawing The Plan

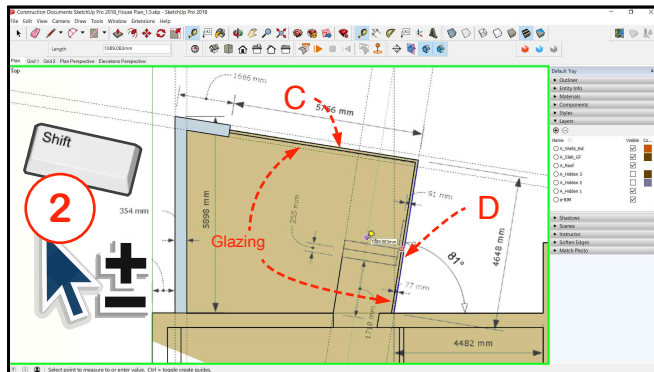
Page 13

DRAWING THE PLAN

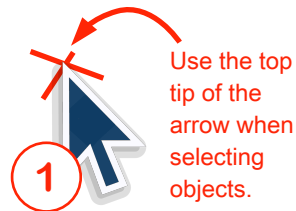


Finish the boundary shape.

- 1 Using the **Tape Measure Tool** double-click on Line "Z"
- 2 Using **Select Tool**, right-click on Line "Z" to delete it
- 3 Redraw Line "Z" from Point A (Endpoint) to Point B (Intersection)



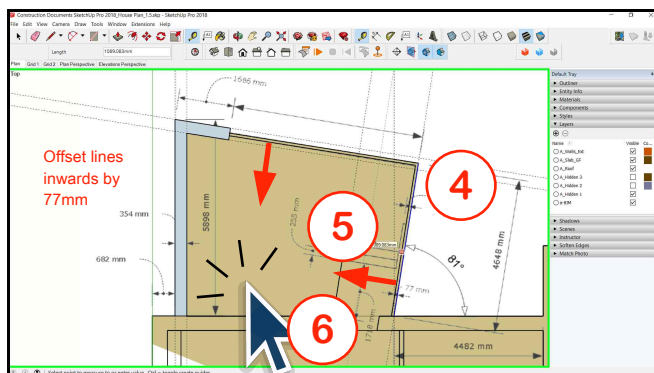
The next tools we're going to use are **Select** and **Offset**.



SELECT TOOL



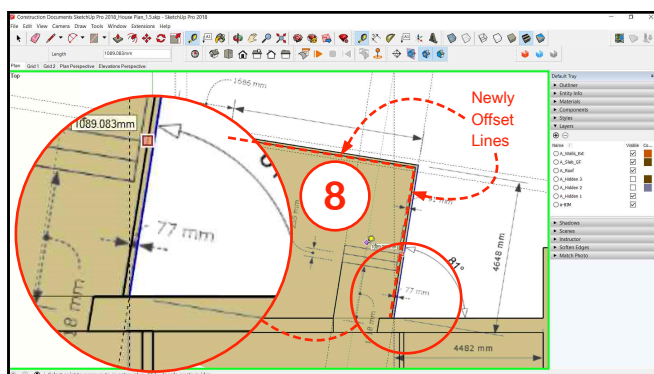
OFFSET TOOL



OFFSETTING LINES

Form inner lines to finish drawing the glazing around the perimeter.

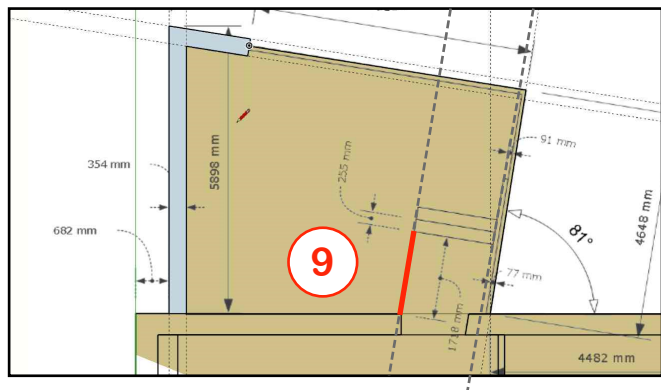
1. Click on the **Select Tool**.
2. Holding down the Shift button, select lines C and D as indicated.
3. Click on the **Offset tool**.
4. Click on one or other of the selected lines.
5. Move the mouse inwards.
6. Click the mouse to select a random distance,
7. Type "77" and hit Enter.
8. The resulting lines should be as indicated.



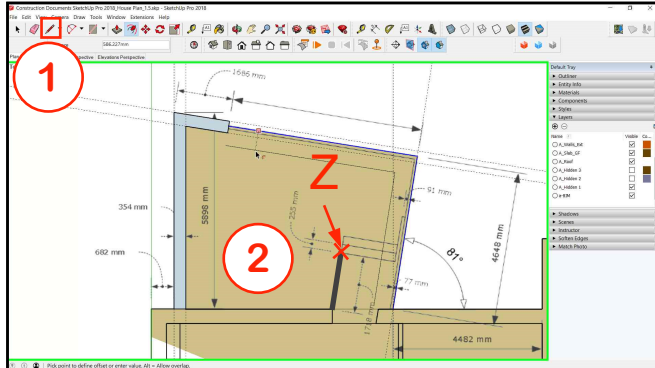
Technical drawing of a mechanical part. The drawing shows a cross-section of a part with a central hole. Key dimensions and features include:

- Dimensions:** 255 mm (overall width), 91 mm (width of the central section), 77 mm (width of the base), and 87° (angle of the base).
- Callouts:** A red circle with the number 1 points to the central hole. A red circle with the number 2 points to the top surface of the central section. A red circle with the number 3 points to the side surface of the central section.
- Labels:** "Steps" is written near the 255 mm dimension. "A" and "B" are labels at the top right corner.

-
- Diagram 6: A circular inset showing a close-up of a handwriting sample. A red square marks the 'EDGE' of a letter. A red 'X' marks a point below it. A red circle with the number '7' is also present.

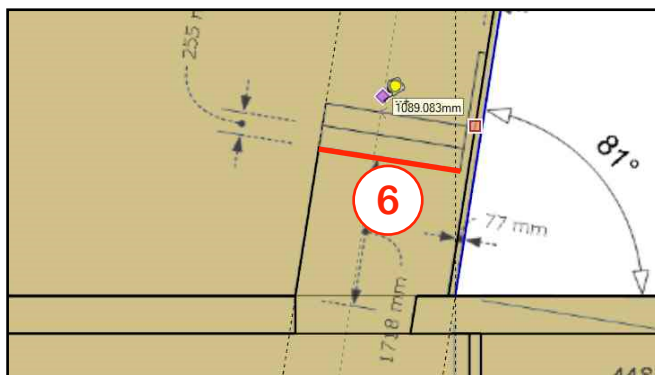
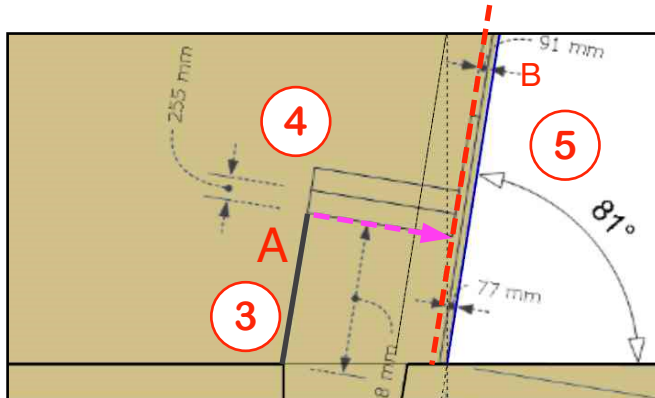


DRAWING THE PLAN

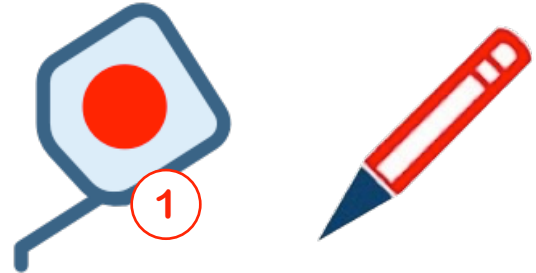
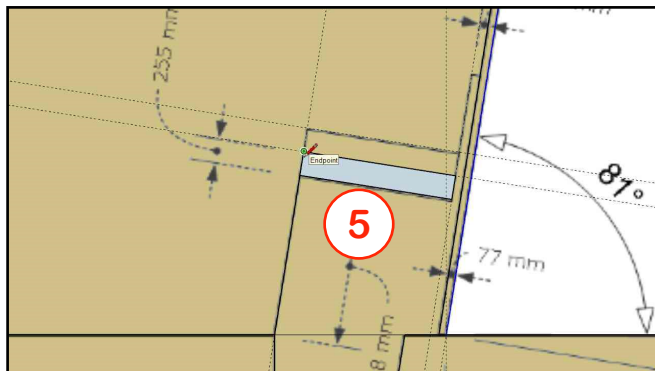
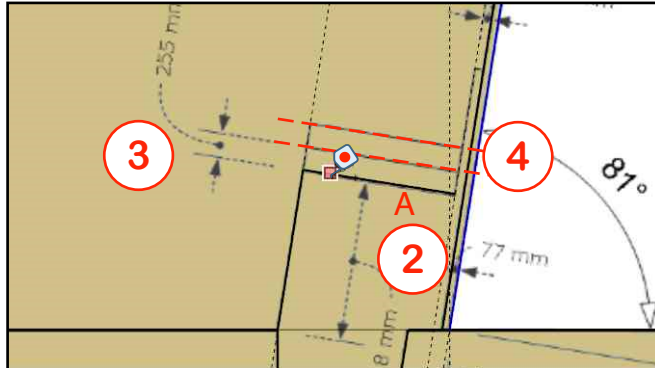


DRAWING THE STEPS

1. Select the **Line Tool**.
2. Click on the endpoint “Z”.
3. Run the cursor along Line “A”
4. Move the cursor to the right until you see the perpendicular **magenta** inference line appear- Hit the **down arrow** for better control (see note on Page 11).
5. Move the cursor onto the construction line “B” and click.
6. The line formed should be as indicated.

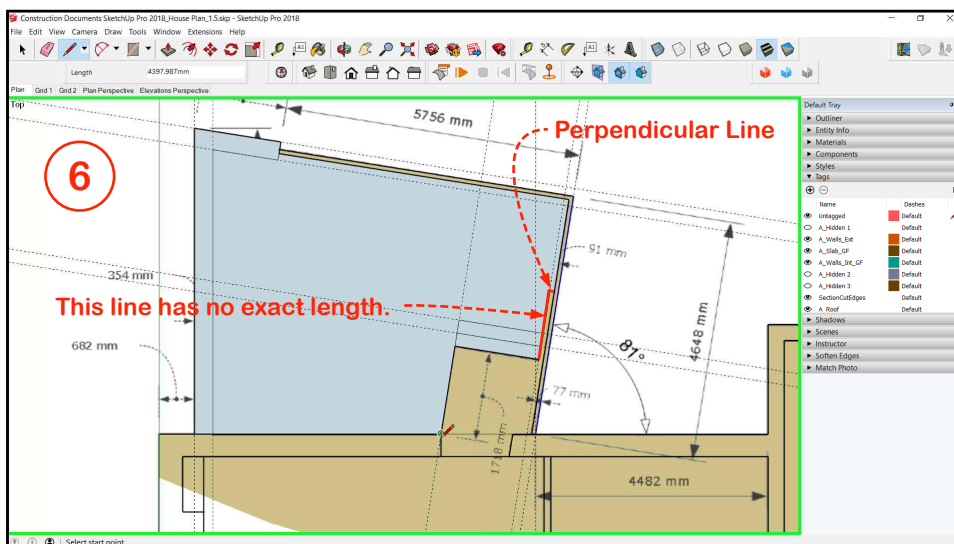


DRAWING THE PLAN



DRAWING THE STEPS

1. Select the **Tape Measure Tool**.
2. Click on the edge "A".
3. Click on any point above the line, type "255" and hit Enter.
4. Repeat to create a second construction line.
5. Start constructing the outlines of the steps using the methods previously outlined.
6. Draw the lines indicated in red. You should be able to complete the blue-grey region as indicated.



Note: Faces are only formed when lines are properly joined end-to-end.

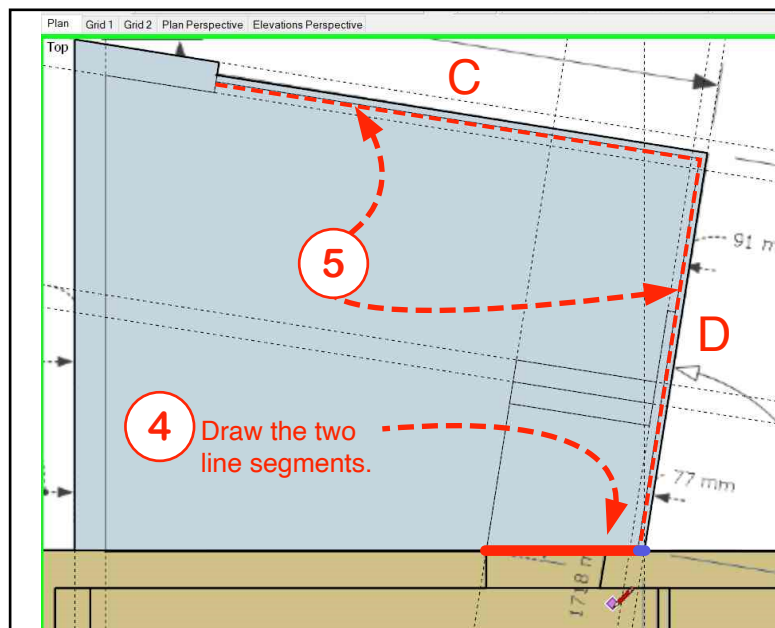
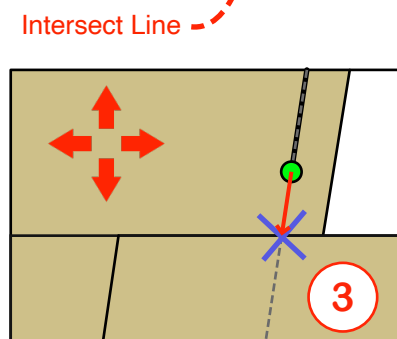
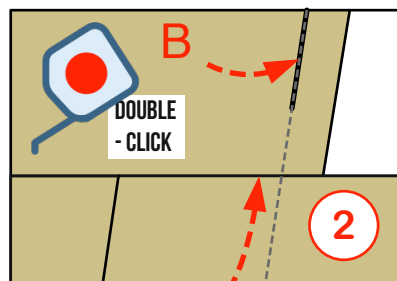
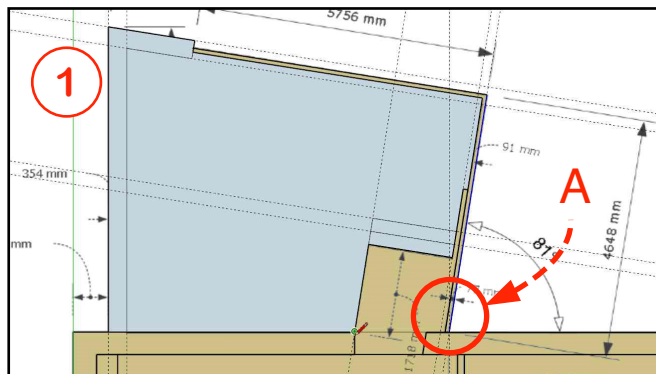
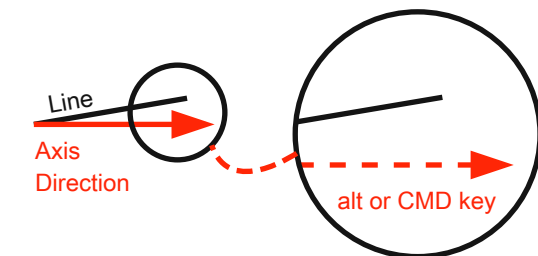
If there are any minute gaps- even so small you can't see them, then surfaces won't form.

DRAWING THE PLAN

Handy Tip:

Drawing or editing a line that is “nearly” parallel to an axis:

To override the axis snap function (when drawing a line only) hit alt key (Windows) or CMD key (Mac). Hit the same key again to toggle the function back on.



Finish the drawing.

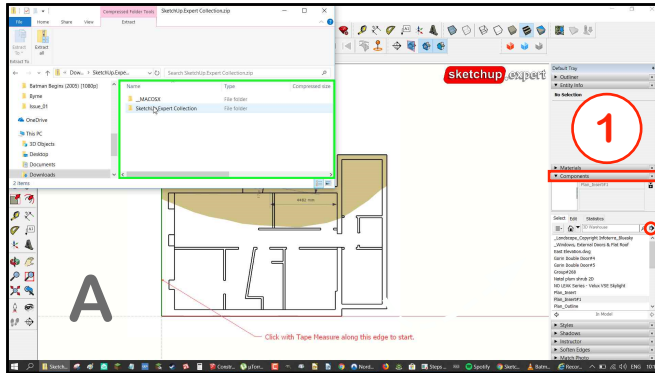
To complete the grey-blue block as illustrated in below we first need to tidy up one section of the drawing.

- 1 Zooming closely into Corner “A” we see that Line “B” doesn’t connect with the Intersect Line.
- 2 To extend Line “B” as required, we first need to create a construction line. Use the Tape Measure Tool to **double-click** on Line “B”.
- 3 Using the Move Tool, click on the endpoint of “B” and then click on the intersection point.
- 4 Finish by drawing in the two line segments illustrated here.
- 5 Delete Lines C and D (These represent the line of the glazing but for the purposes of building our slab they must be eliminated.)

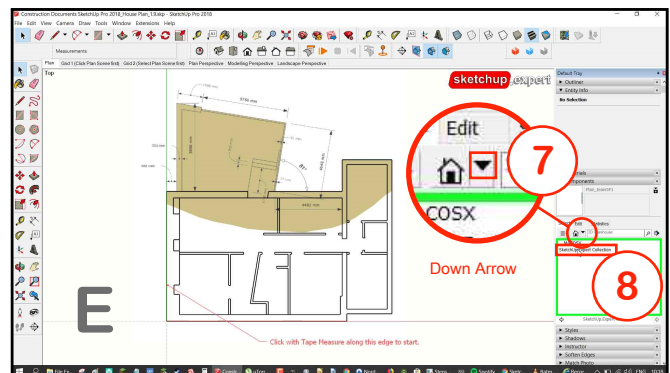
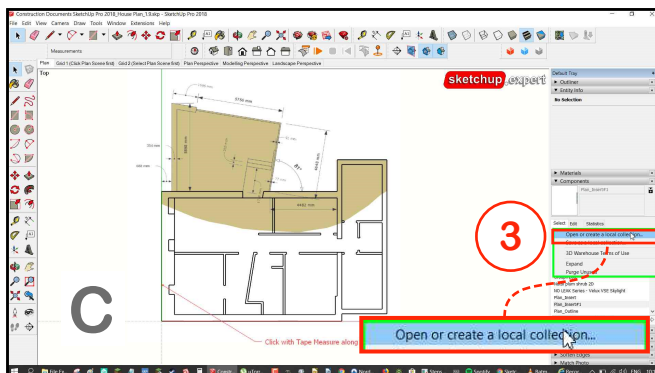
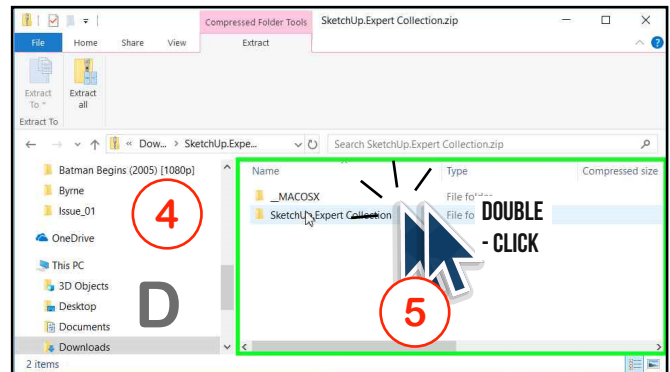
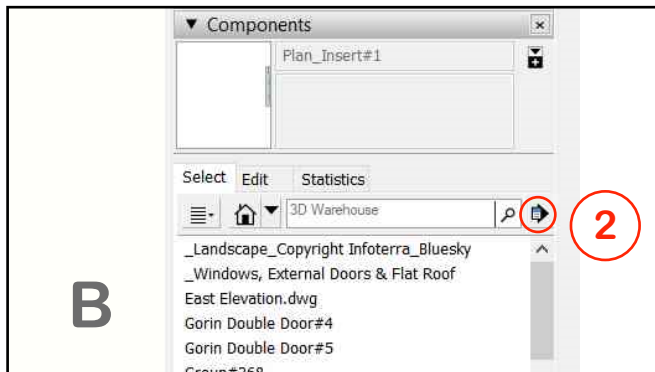
CONSTRUCTION DOCUMENTS USING SKETCHUP PRO - **UPDATED** 2024

DRAWING THE PLAN

Now we'll create a Local Component Collection for use in our model. This means we'll make the **SketchUp.Expert Collection** available so that we can insert SketchUp components from it.



- 1 Click on the **Components** Dialogue on the right hand side of your screen.
- 2 Click on the right-hand arrow button
- 3 Select "Open or Create A New Collection"
- 4 Navigate to the SketchUp.Expert folder (which we downloaded from the website.)
- 5 Double-click on the folder.
- 6 Now the Collection is available for you to select Components from it.
- 7 Click on the down arrow to see the full list of available collections.
- 8 Click into the SketchUp.Expert Collection to explore the components inside.



When you select the down arrow in the Components browser, you'll see the **"SketchUp.Expert Collection"** folder listed. Click on the folder to see the contents.