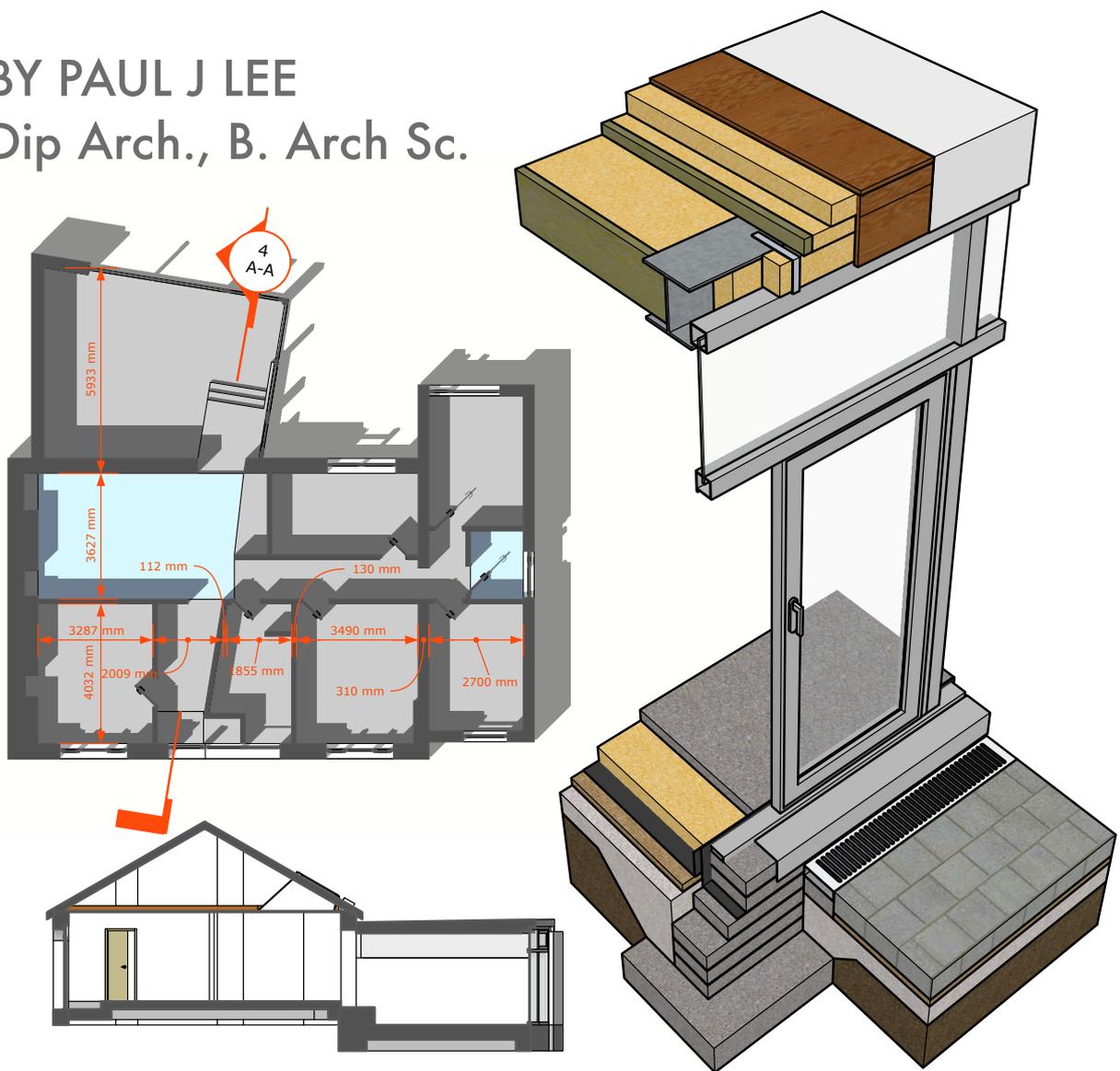# CONSTRUCTION DOCUMENTS USING SKETCHUP PRO 2020

BY PAUL J LEE
Dip Arch., B. Arch Sc.

A short project-based course to increase your effectiveness at using SketchUp and give you a truly professional approach to modelling.

THIS BOOK IS AIMED AT INTERMEDIATE TO ADVANCED USERS. IT IS BEST TO FAMILIARISE YOURSELF WITH BASIC MODELLING AND NAVIGATION BEFORE PROCEEDING WITH THE EXERCISES CONTAINED INSIDE.

WHO SHOULD USE THIS BOOK?

This book is for anyone involved in creating documentation for Construction whether **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**
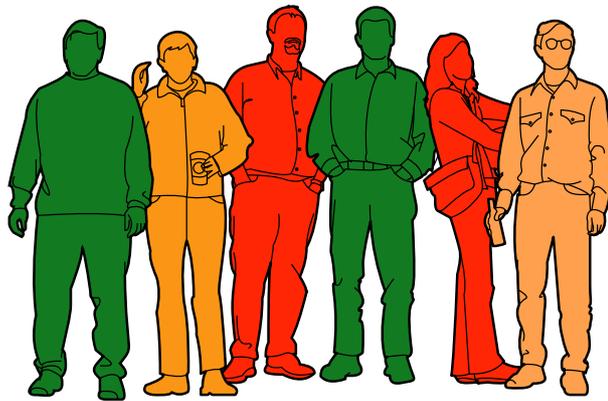
WHAT DO I NEED TO COMPLETE THIS COURSE?

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 required to run the software. There are also hardware requirements that you should be aware of.

Hardware and software requirements are available 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.)
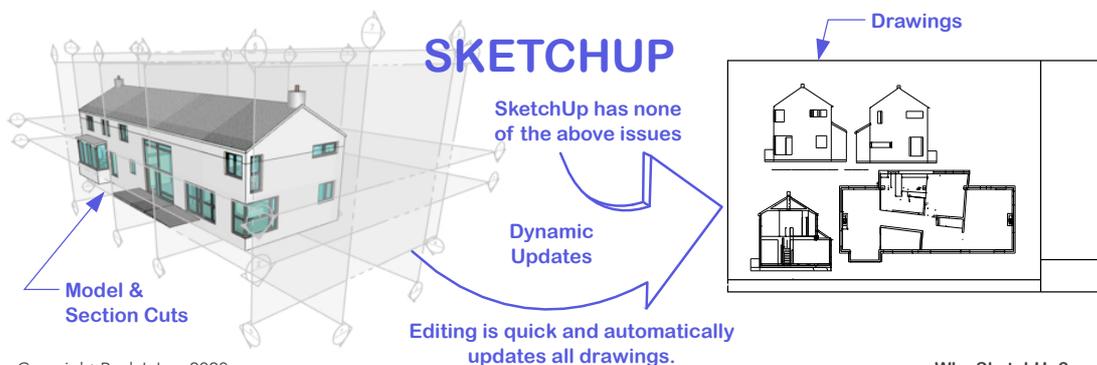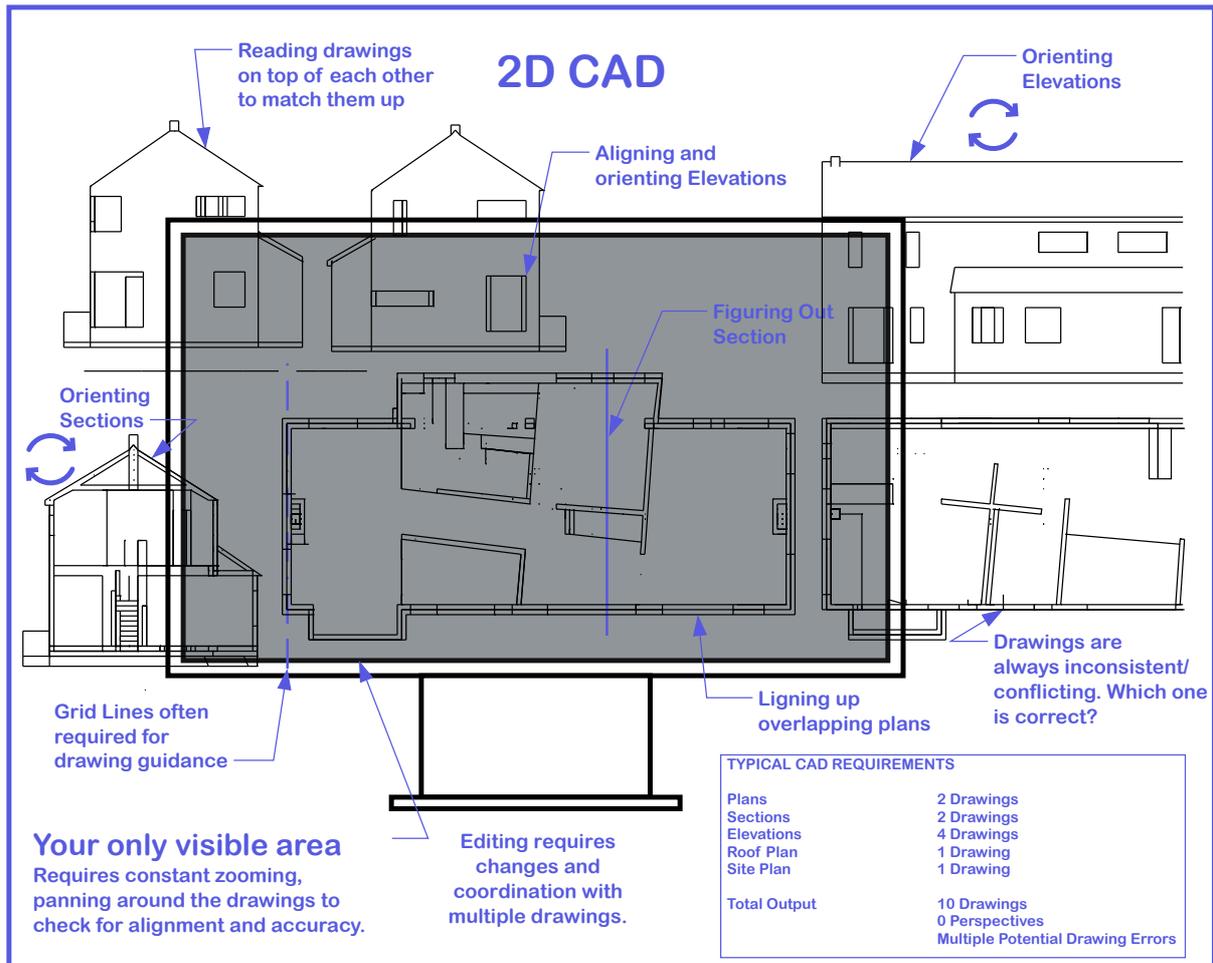
Who should use this book?

CONTENTS

WHY IS SKETCHUP BETTER THAN 2D CAD?

SketchUp delivers an efficient 3D model that provides updatable drawings directly from the model. 2D CAD

2D CAD

Reading drawings on top of each other to match them up

Orienting Elevations

Aligning and orienting Elevations

Figuring Out Section

Orienting Sections

Drawings are always inconsistent/ conflicting. Which one is correct?

Grid Lines often required for drawing guidance

Ligning up overlapping plans

Your only visible area
Requires constant zooming, panning around the drawings to check for alignment and accuracy.

Editing requires changes and coordination with multiple drawings.

TYPICAL CAD REQUIREMENTS

Plans	2 Drawings
Sections	2 Drawings
Elevations	4 Drawings
Roof Plan	1 Drawing
Site Plan	1 Drawing
Total Output	10 Drawings
	0 Perspectives
	Multiple Potential Drawing Errors

SKETCHUP

Drawings

SketchUp has none of the above issues

Dynamic Updates

Model & Section Cuts

Editing is quick and automatically updates all drawings.

Why SketchUp?

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.
Facility modelled in SketchUp using BIM functionality (Attribution: sketchupitalia.it)

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:

- **3D virtual tours**
- **Construction sequencing**
- **Cost reports and analysis**
- **Energy analysis/ strategy appraisal**
- **Photographic Renders (with extensions)**
- **Clash Detection**
- **Online Collaboration**
- **Component Cataloguing**
- **Parametric Modelling**
- **IFC Classification**
- **Construction Documentation (CAD)**
- **Open Program Interface (Extendability)**
- **Shadow studies**
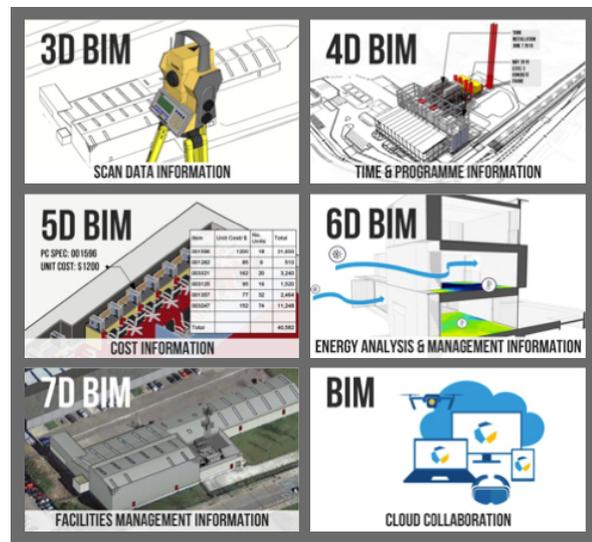
This list is by no means exhaustive.

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 multinationals either as a complete business solution or part of a set of tools.

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 the **BIM** section on **www.SketchUp.Expert**

SketchUp and BIM

INTRODUCTION

This is the second version of the book entitled "Construction Documents Using SketchUp Pro & LayOut." which was released in October 2012 as a digital download from **Sketchucation.com**. It was the first book ever released on the topic of producing Construction Documents from SketchUp Pro. Since that time a number of great titles have been published by other authors around the same topic. Following the digital rollout, this book was published in paper format in 2013 on Createspace (Now Kindle Direct.) A lot has happened with SketchUp since the book's release. There have been some excellent improvements in the software, tools and plugins. This update is well overdue.

This course is a practical step by step course showing you how a building model is created and organised. **First I'll show you what we're going to build, then we'll go back to start to building it from scratch.**

Visual connection between front and garden Garden Perspective (East)

The project I've selected for these training exercises is a small home refit/ extension that I designed and project managed in 2011. The location is a suburb of Cork City, Ireland. I selected this project because it's small in size but reasonably complex- presenting us with a worthwhile learning opportunity.

This view from the South West shows the existing vs new elements.

TECHNICAL DESCRIPTION

All interior walls were demolished except for the central structural wall which supports the roof. Existing floors and walls were upgraded and timberframe extensions were added to the East and South. The new plan exploits the split level of the site, creating a generously-sized sun room to the East facing garden.

I've been teaching SketchUp since 2008 and having tried out different approaches I've found the "dive-in-first" to be the best- Building starts immediately and then after a while we review what we've been doing- We're ready for a little bit of theory. After looking at some tools and settings we continue building some more and then review again etc. At the end we finish with tangible assets: A set of 3D models and drawings that look great in your portfolio.

I hope you'll enjoy this course and hope that SketchUp brings benefits to you as it's done for me.

Paul Lee.

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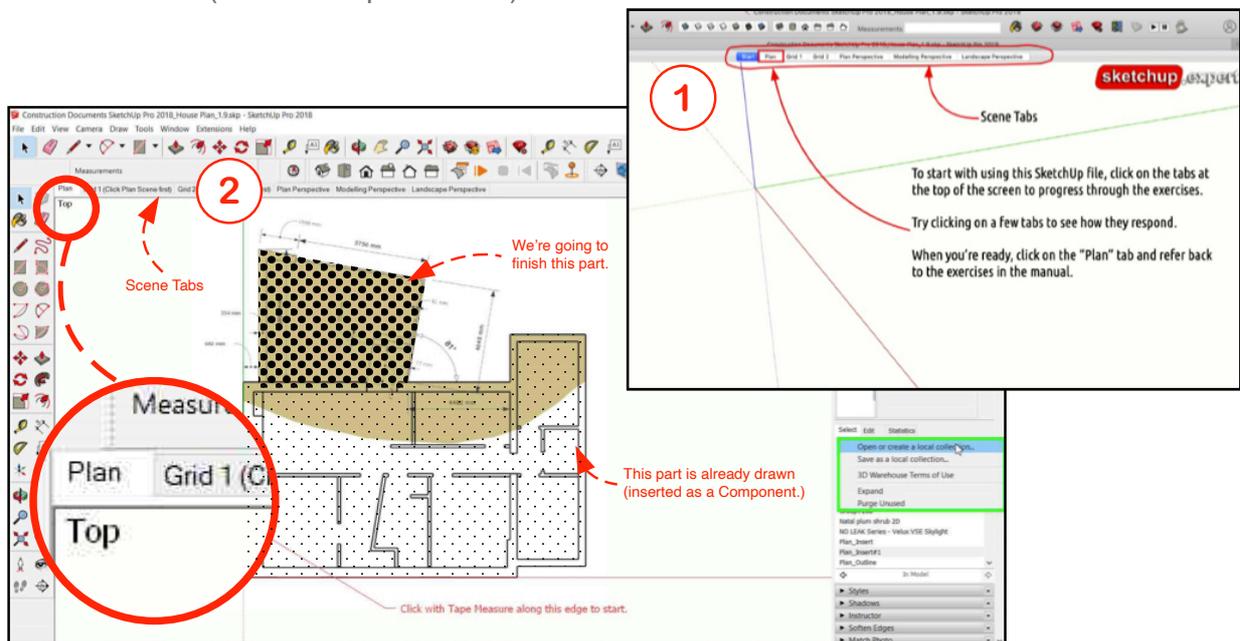
Check out the Scene Tabs to see what each of them contains. When you've finished exploring, click on the "Plan" tab to begin the exercises. The units used in this book are **millimetres**- Our SketchUp files have a millimetre default setting.

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

The Line Tool

Line

Construction Line

Drawing Line

End Point of Line

Construction Point

1. Draw a random line using the **Line Tool**.
2. Select the **Tape Measure Tool**, click on a <u>**random**</u> 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.)

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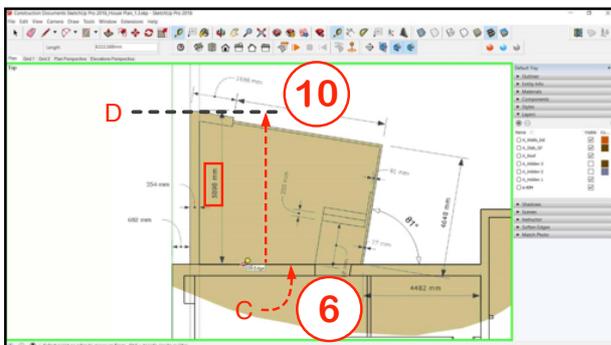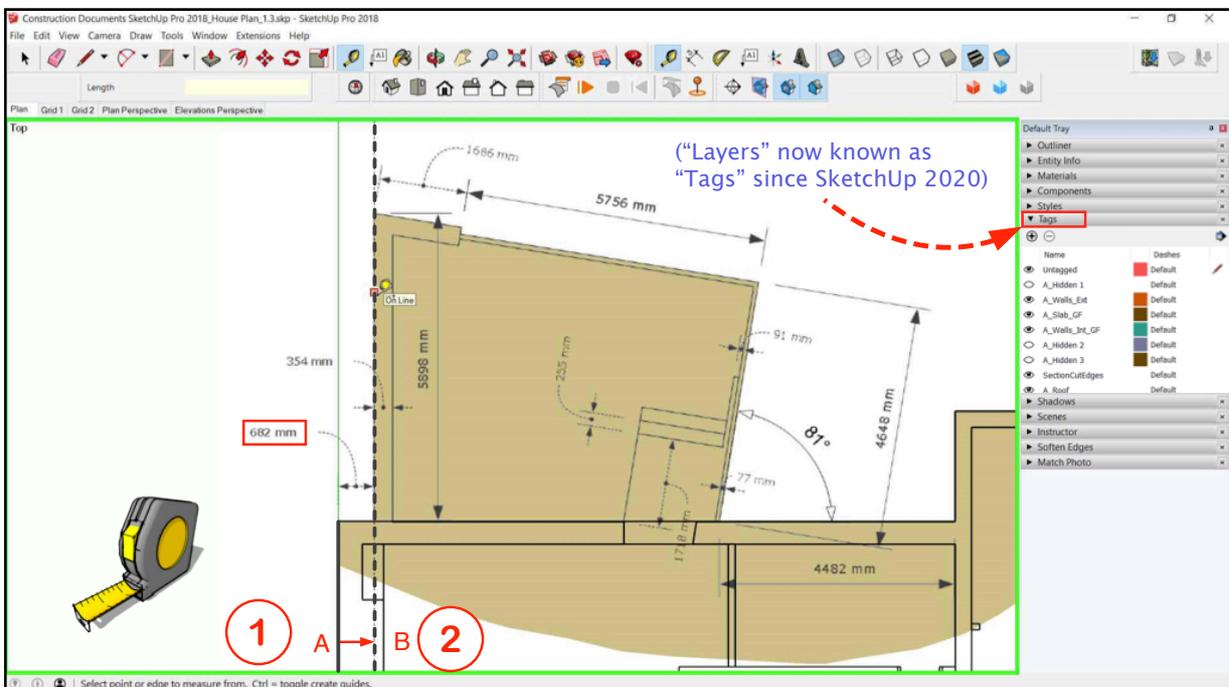
6. Click on the edge "C" as indicated.
7. Move the cursor upwards and click at a random distance.
8. Type the number "5898"
9. Hit Enter.
10. The construction line "D" is formed.

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

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"
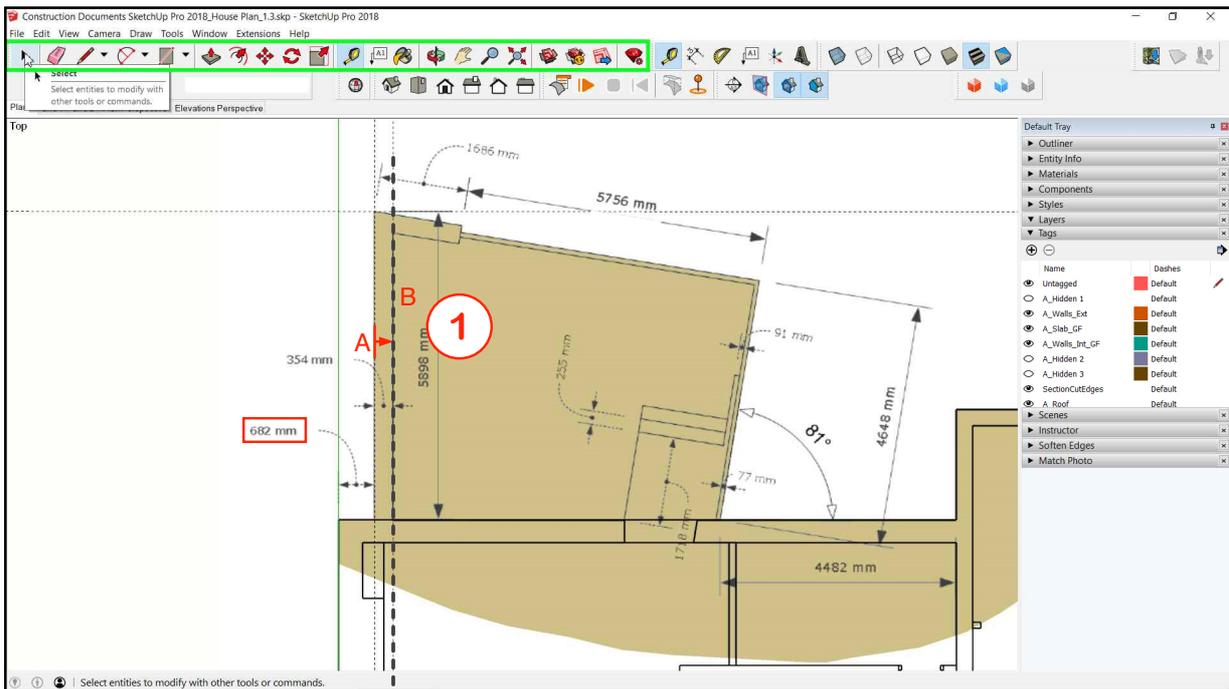
INFERENCING

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.

INFERENCING ALONG A LINE- COLOUR INDICATORS

INTERSECTION

MID   EDGE - RANDOM

EXTENDED

PARALLEL

END

HOLD SHIFT KEY TO LOCK A DIRECTION.

ALSO USE THE ARROW KEYS- UP = VERTICAL AXIS, LEFT = GREEN, RIGHT = RED, DOWN = PARALLEL.

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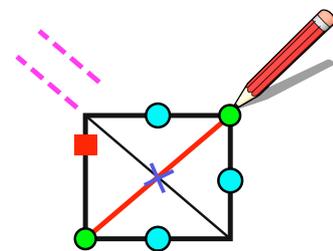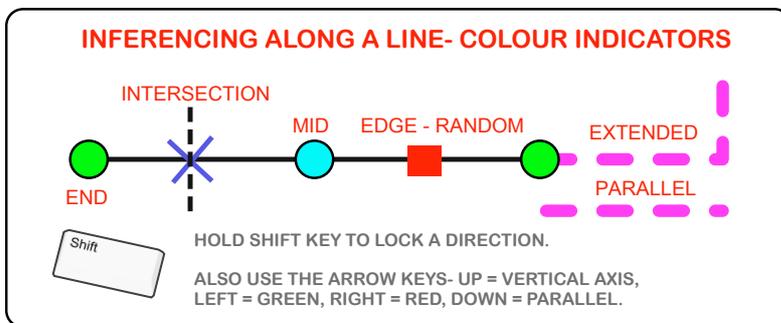
Drawing a line from one corner of an existing box to another corner is using inferencing to find the points of reference.

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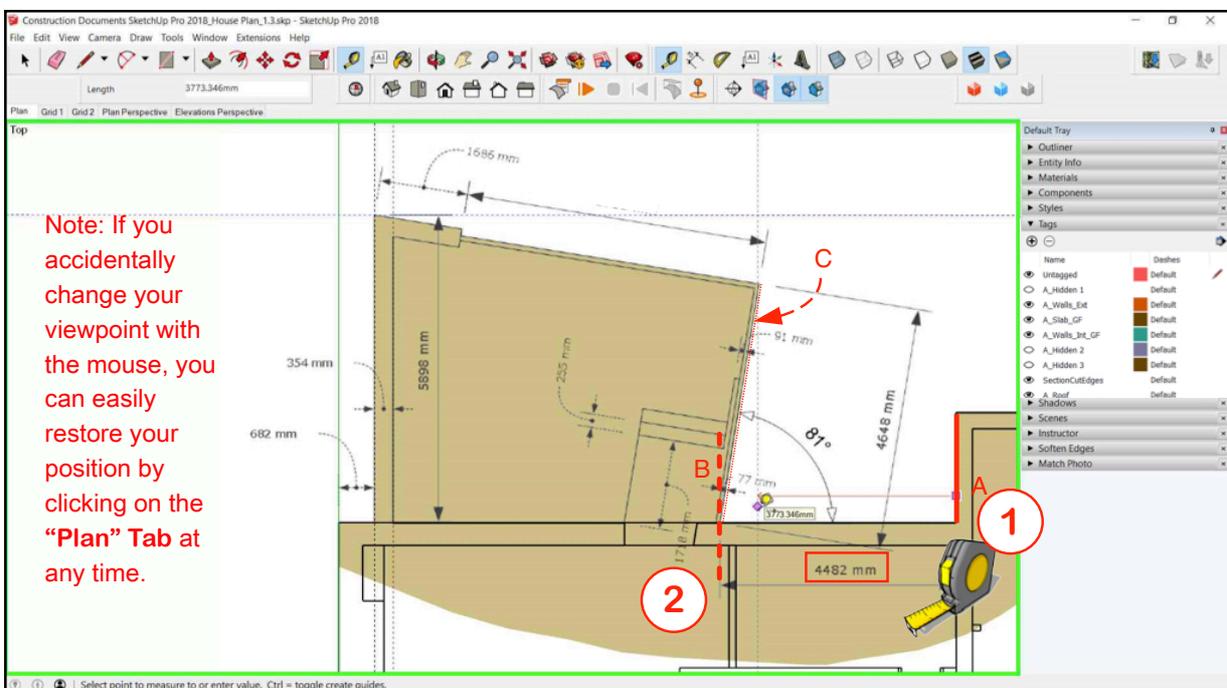
The next tool we're going to use is the Protractor which also produces a construction line. It requires picking:

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

Sequence of Clicks using the protractor

D. Type angle of rotation
C. Rotation Direction
0 degrees
B. Starting angle
A. Turning point ("Fulcrum")
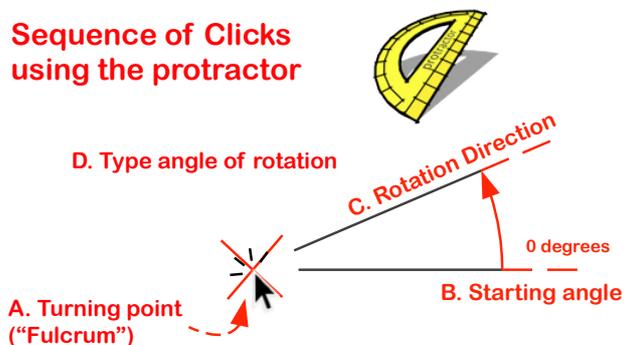
DRAWING THE PLAN

Using the protractor tool:

We're now going to form a Construction Line using the **Protractor Tool**. The origin and the angle of rotation have to be established following the sequence below:

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 to 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.
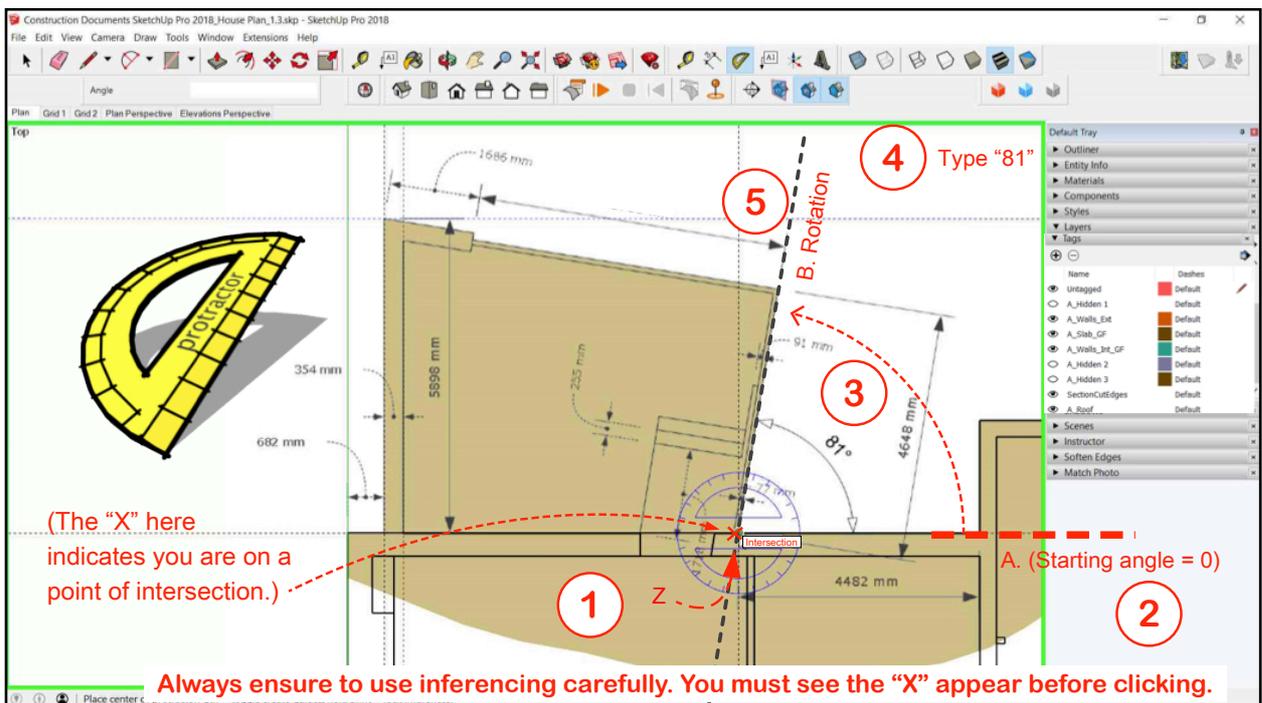
DRAWING THE PLAN

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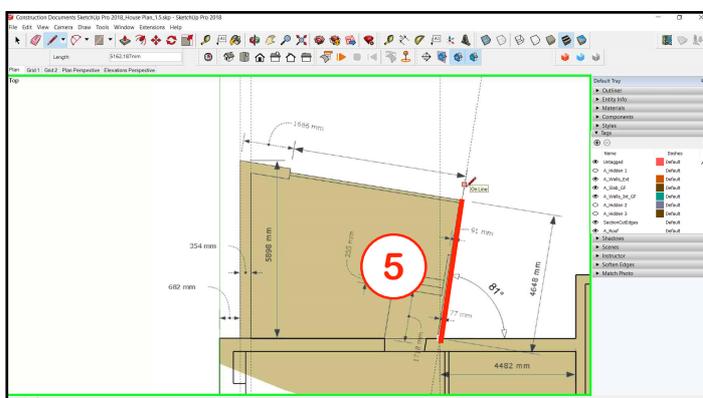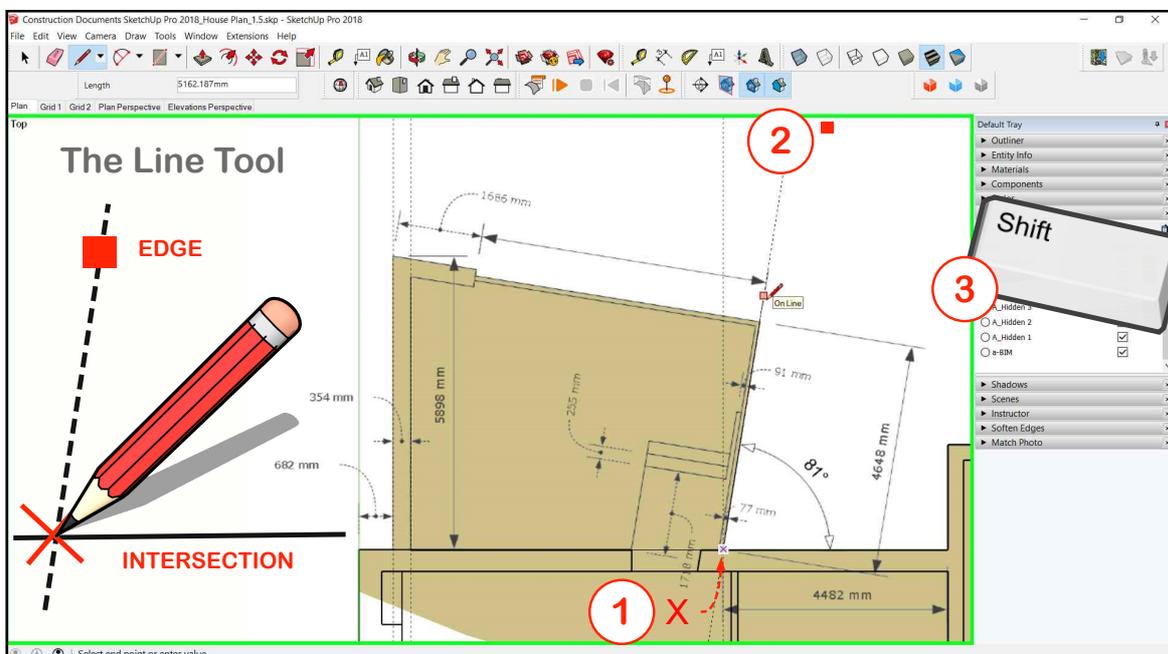
4. While holding down the Shift Button, type "**4648**" and hit enter. (Note: In doing this, don't click into the measurements dialogue- Just type the number.)
5. The line should appear as indicated.

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.
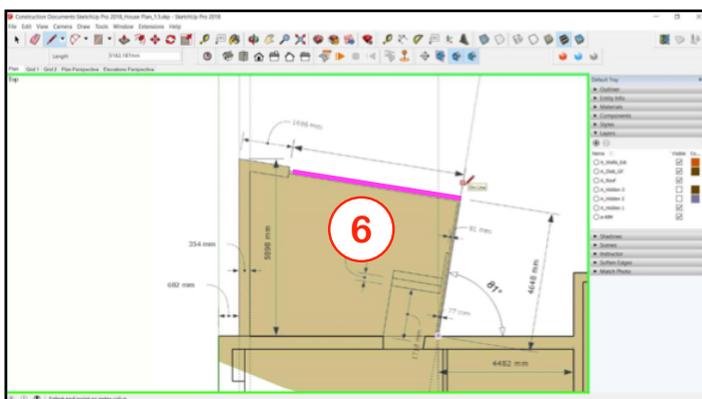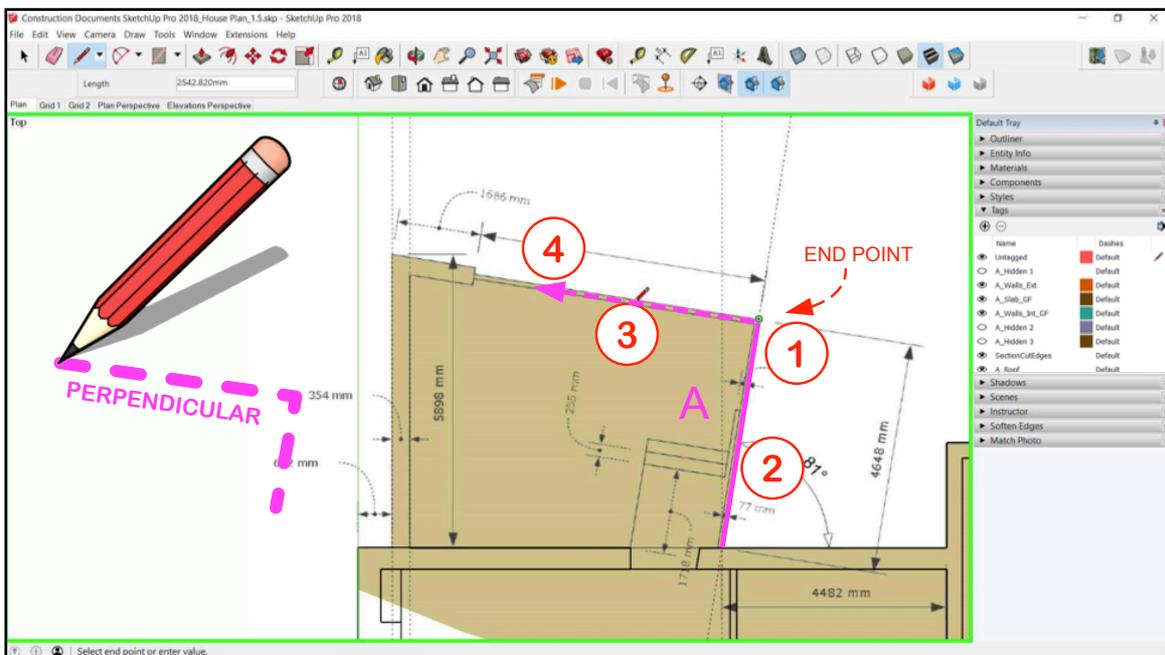
4 Move the cursor in the direction of the magenta line as illustrated. (Don't drag or click the mouse while doing this.)

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.

DRAWING THE PLAN

Draw a line from the endpoint of the previous line at a perpendicular direction:

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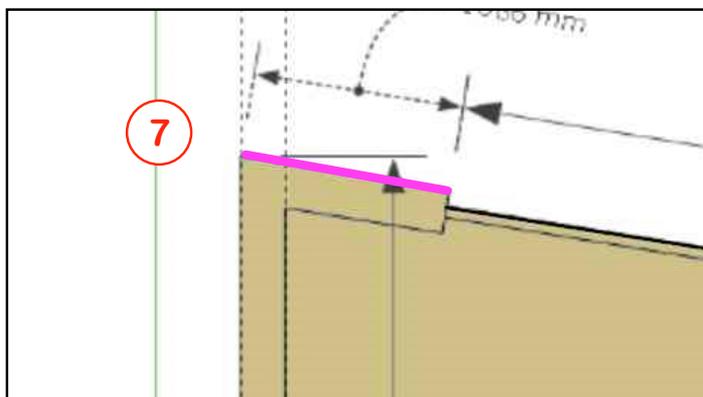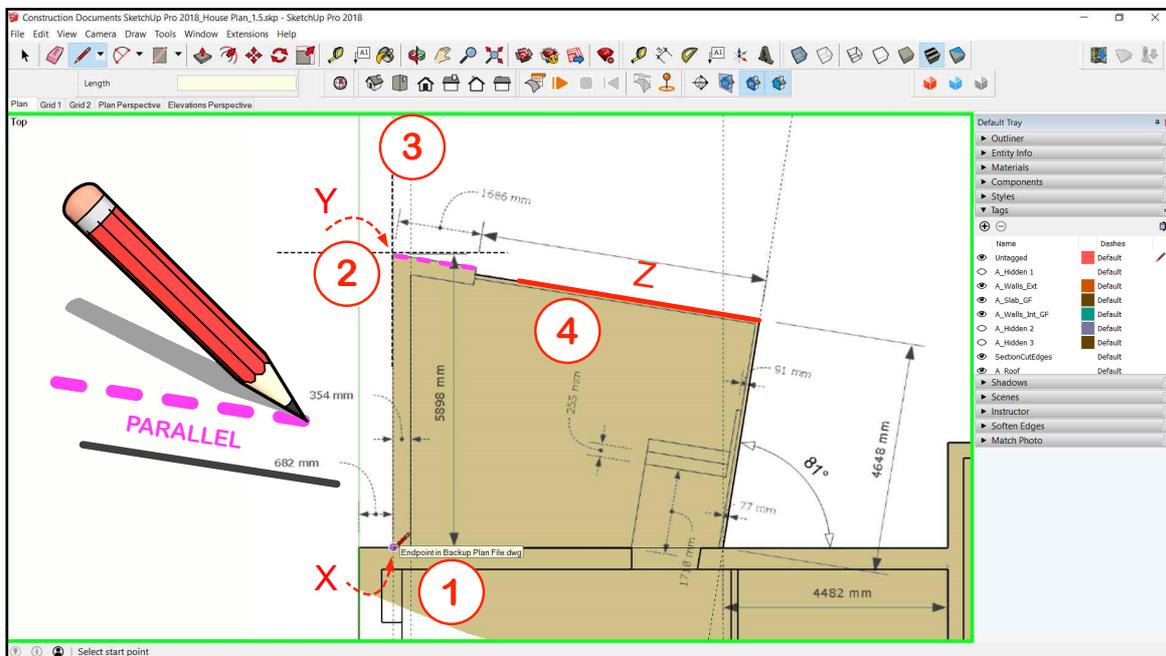
6. Whilst the magenta colour is showing, type "**1686**" and hit **Enter**.
7. The line should be as indicated.

Note: If you make a mistake, go back using CTRL + Z   (UNDO)

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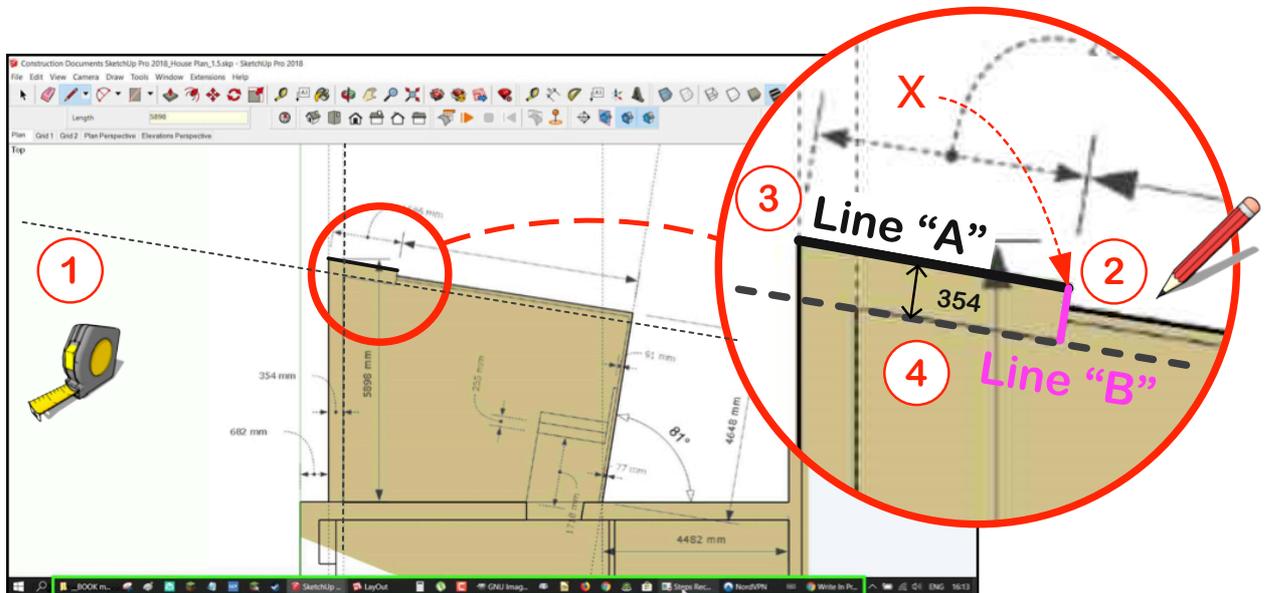
Finish drawing the shape as outlined below using the construction points you created.

Using Endpoints and intersection points, build the shape as indicated.

Shift

Use Shift to lock in the green direction and infer point "Z"

X = Intersection points.

You should see a grey-blue colour appear within the area illustrated here.

Finished shape
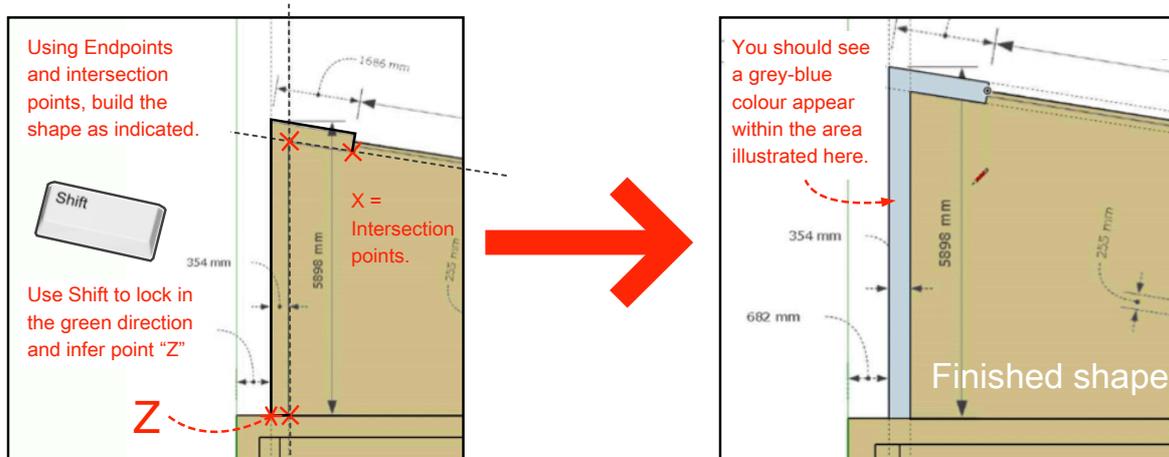
DRAWING THE PLAN
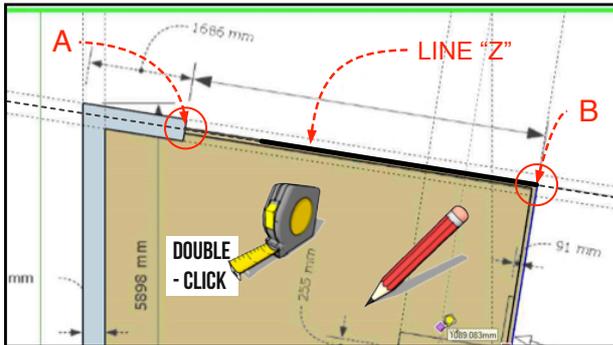
Finish the boundary shape.

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)
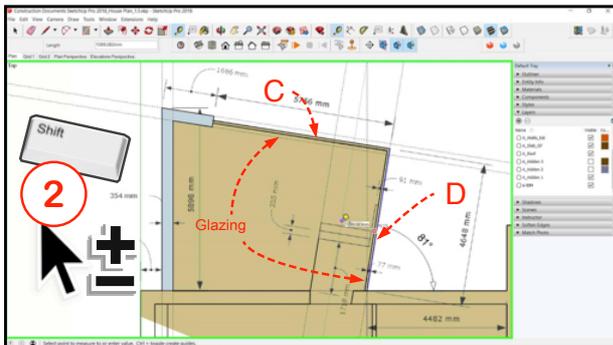
The next tools we're going to use are Select and Offset.
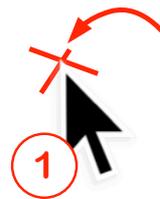
Use the top tip of the arrow when selecting objects.

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.
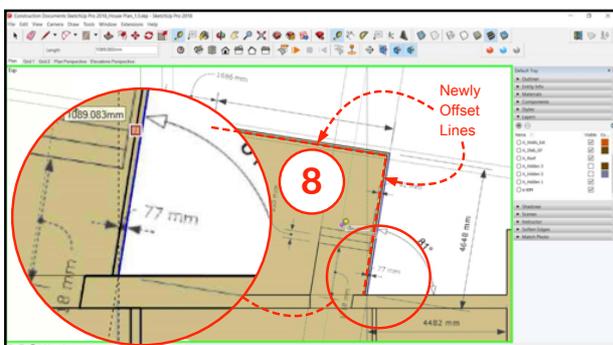
DRAWING THE PLAN

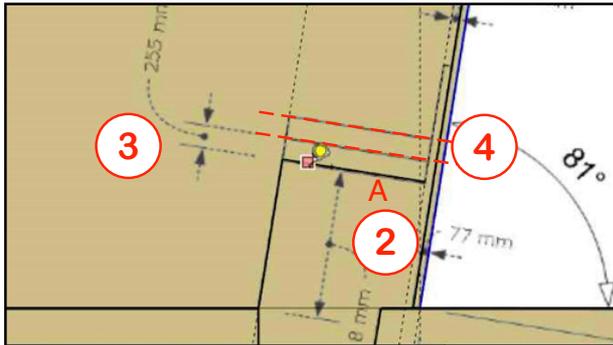## DRAWING THE STEPS

We're setting up construction lines to create a drawing of the steps. We'll first use the existing geometry of Line "A" to set up a parallel construction line at point "B".

1. Click on the **Tape Measure**.
2. Click on Line "A"
3. Click to the left (anywhere) of Line A and type a distance of "91" to create construction line "B"
4. To create the next construction line, click on Line "A" again.
5. Click on Intersection point "C". (This creates construction line "D".)
6. Select the **Line tool**.
7. Click on point "C" and float the cursor on construction line "D"
8. Type "1718" and hit Enter.
9. The resulting line should be as indicated.
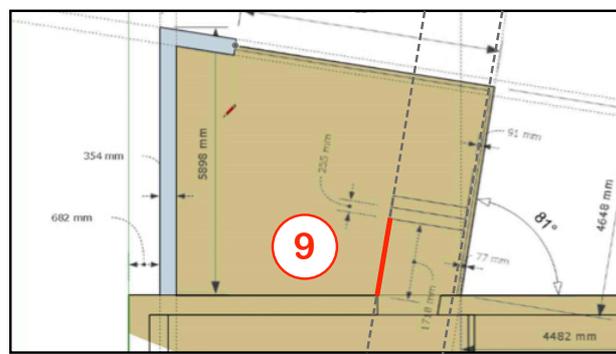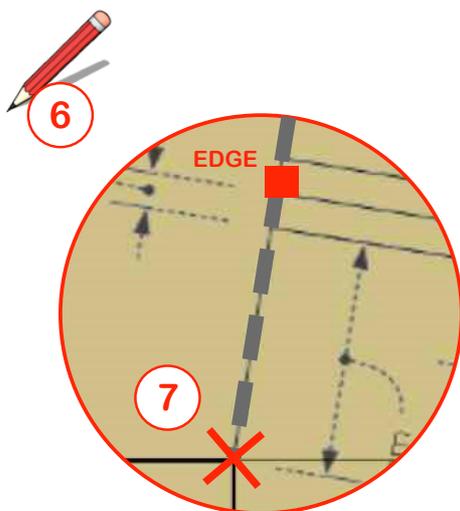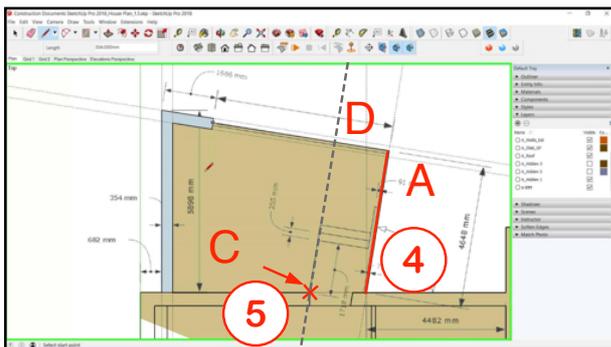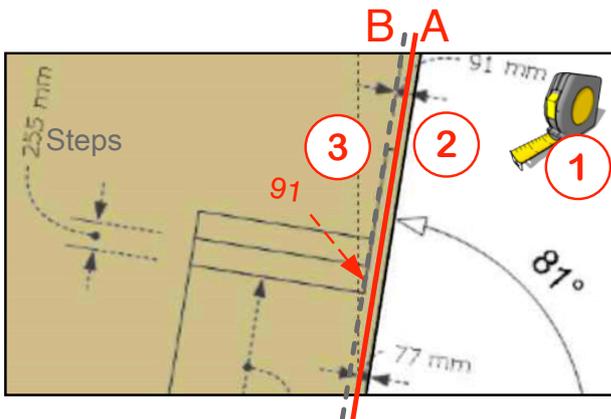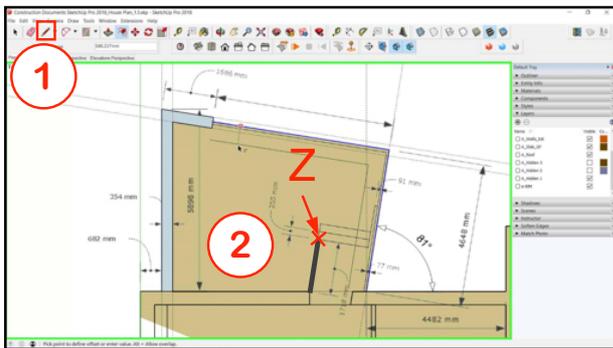
DRAWING THE PLAN

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.
5. Move the cursor onto the construction line "B" and click.
6. The line formed should be as indicated.
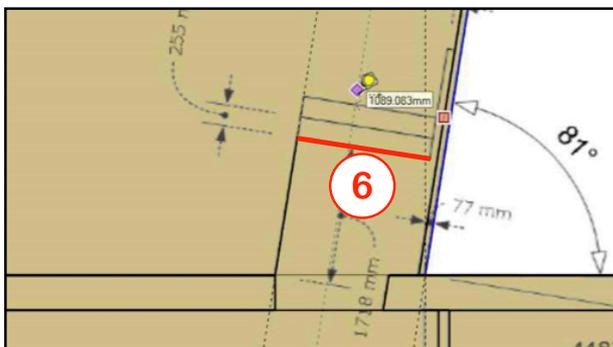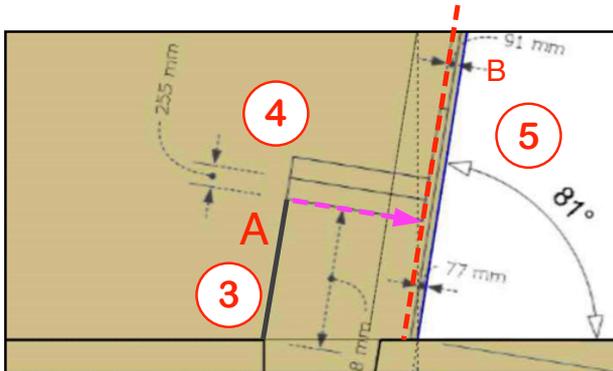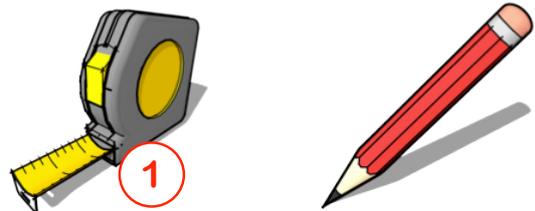
DRAWING THE PLAN

DRAWING THE STEPS

1. Select the **Tape Measure**.
2. Click on the line "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.
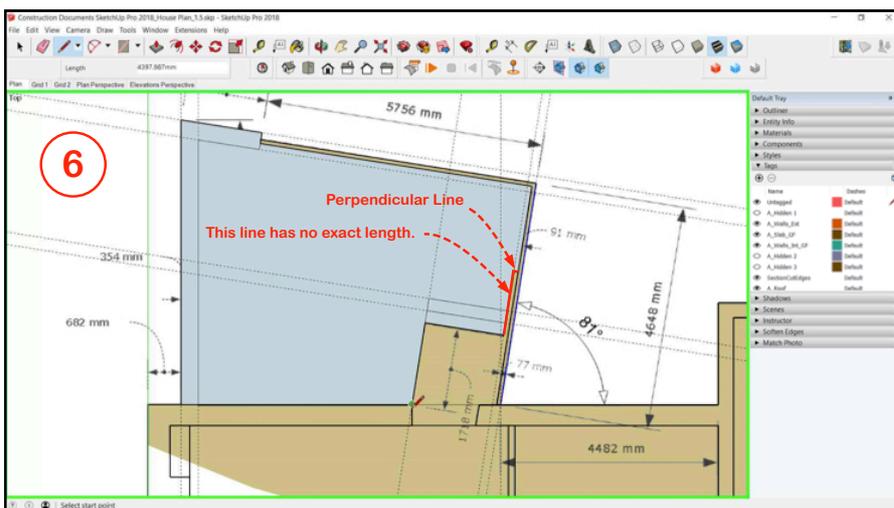
Faces are only formed when lines are properly joined end-to-end.

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 overcome the axis snap function, **zoom very close** into the area that you need to place the endpoint of your line. Zooming increases relative distance between elements to make positioning easier.
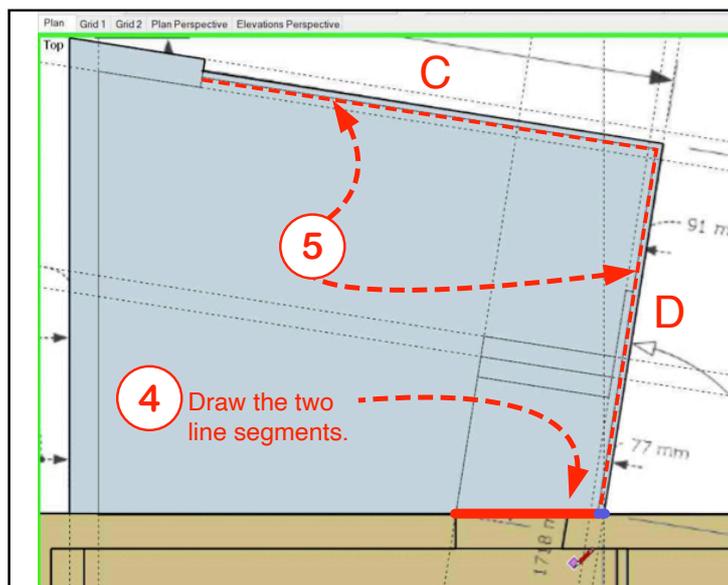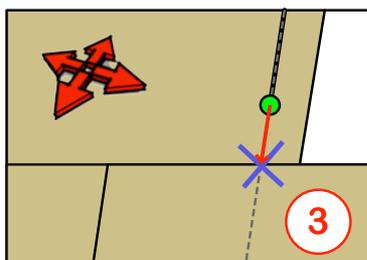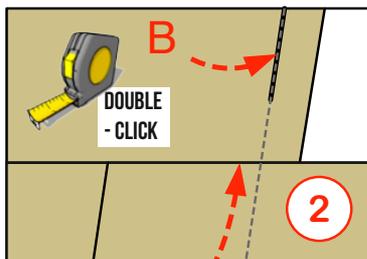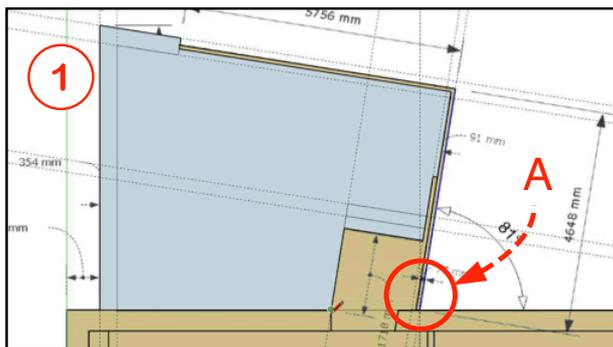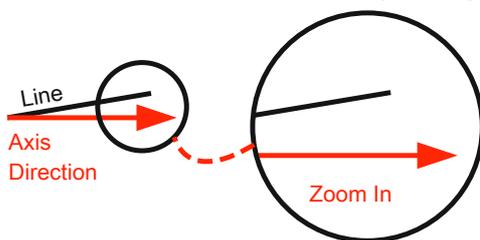

Finish the drawing.

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.)

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.
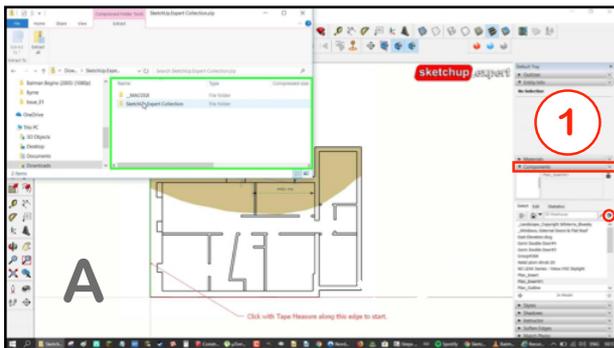
1. Click on the **Components Dialogue** on the right hand side of your screen.
2. Click on the right-hand arrow button
3. Select "Open or Create A New Collection"
4. Navigate to the SketchUp.Expert folder (which we downloaded from the website.)
5. Double-click on the folder.
6. Now the Collection is 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.
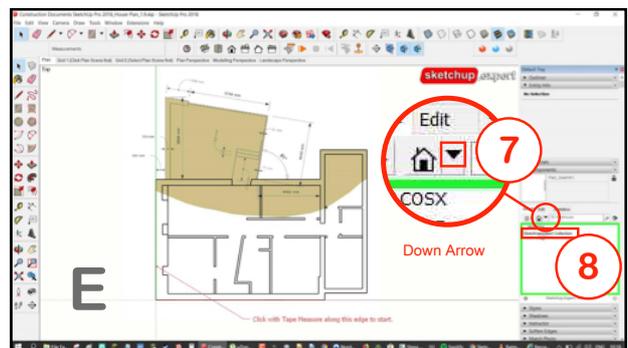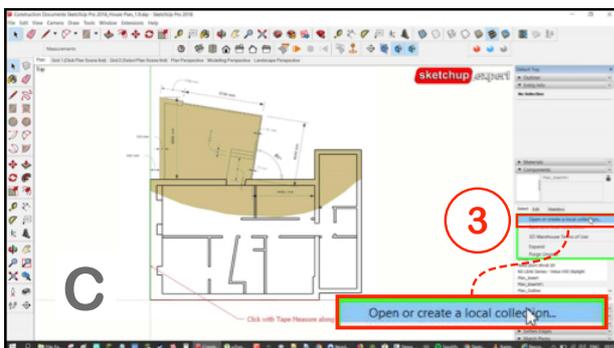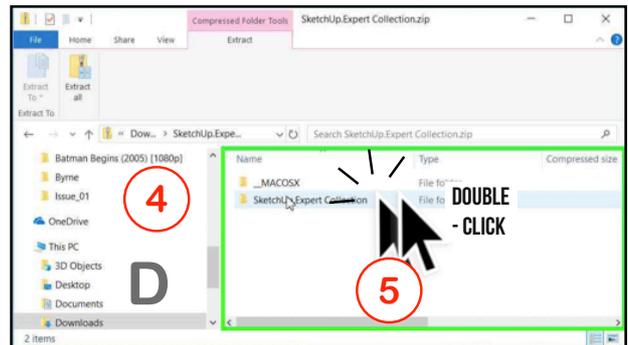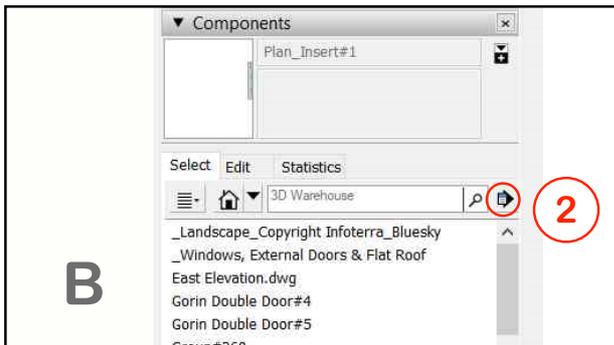
When you select the down arrow in the Components browser, you'll see the "**SketchUp.Expert Collection**" folder listed. Click on the folder to see the contents.