AUTODESK UNIVERSITY

CI124023-L - Subassembly Composer Beginner Lab

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Class Description

Does Subassembly Composer scare you off? Well, me too. Up until now, anyway. Join us as we take a look at Subassembly Composer. We will create some basic to advanced subassemblies here in the hands-on lab. We will go from creating the PKT files, to importing them into AutoCAD Civil 3D software, to applying them to our corridor. This class is ideal for those in the transportation industry who need just a bit more than the tools that AutoCAD Civil 3D software has to offer. So whether you've tried the software for yourself or never even heard of it before, this class is one you won't want to miss.

Learning Objectives

At the end of this class, you will be able to:

- Learn how to create a subassembly from scratch
- Learn how to add advanced parameters to the assembly
- Learn how to import into AutoCAD Civil 3D software
- Learn how to apply to our corridor in AutoCAD Civil 3D software

About the Speaker

Over the past 8 years with ProSoft, Inc., Shawn Herring has become one of the most sought-after trainers, speakers, and technical writers in the civil infrastructure industry. During his vast career, Shawn has trained thousands of CADD users, and he has helped hundreds of civil infrastructure companies and major Departments of Transportation implement new technologies, standardize workflows, and enhance productivity. In addition to ProSoft's training and implementation services, Shawn has been involved in the engineering design process and the creation of construction drawings for over 500 commercial, residential, and transportation projects.

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What is Subassembly Composer (SAC)??

Autodesk Subassembly Composer has been available for a while. You may have no idea that it was ever even installed! Or maybe you opened it up once closed it as fast as I did the first time.

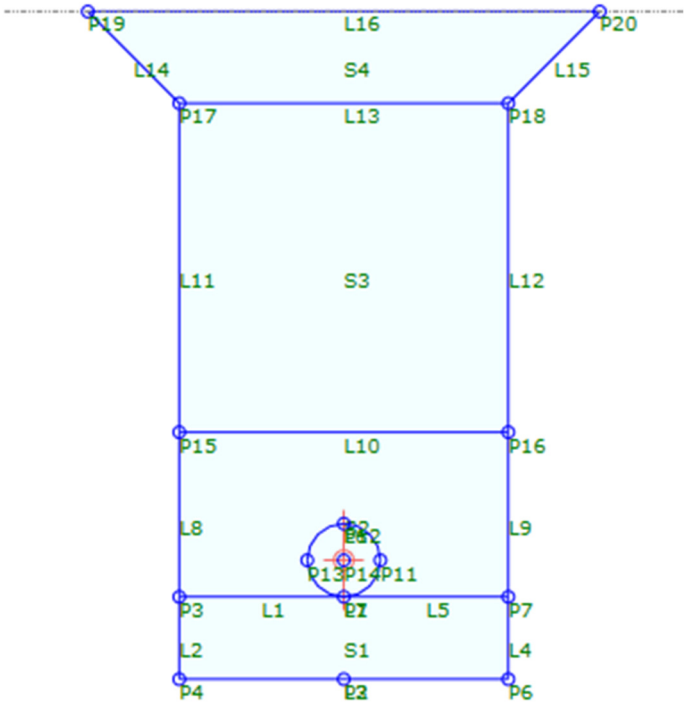
But if you really want to make yourself more productive within Civil 3D, then this is a great start.

SAC is a simple interface used to develop subassemblies for use within AutoCAD Civil 3D without the need to learn programming. The user interface is basically drag and drop from a "Tool Box" into the "Flowchart" in order to define geometry.

You can add the basic building blocks of a subassembly; points, links, and shapes using SAC.

This can be a very simple process, or these can be extremely advanced, all depending on the needs of your project.

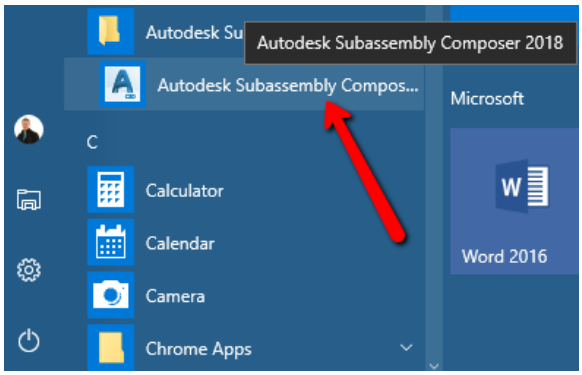
Sure, you can turn a polyline into an assembly pretty quick, but go to the properties to modify a depth or width and you will quickly learn while Autodesk SAC will quickly find it's way into your workflow and hopefully this session and document will help.



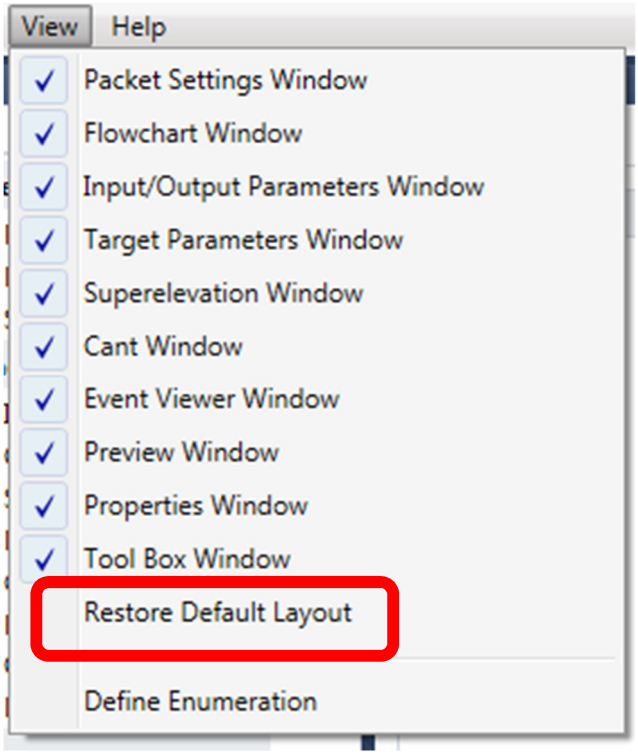
Understanding the User Interface

Let's go ahead and launch Subassembly Composer. Either from your desktop icon or through the programs list on your computer.

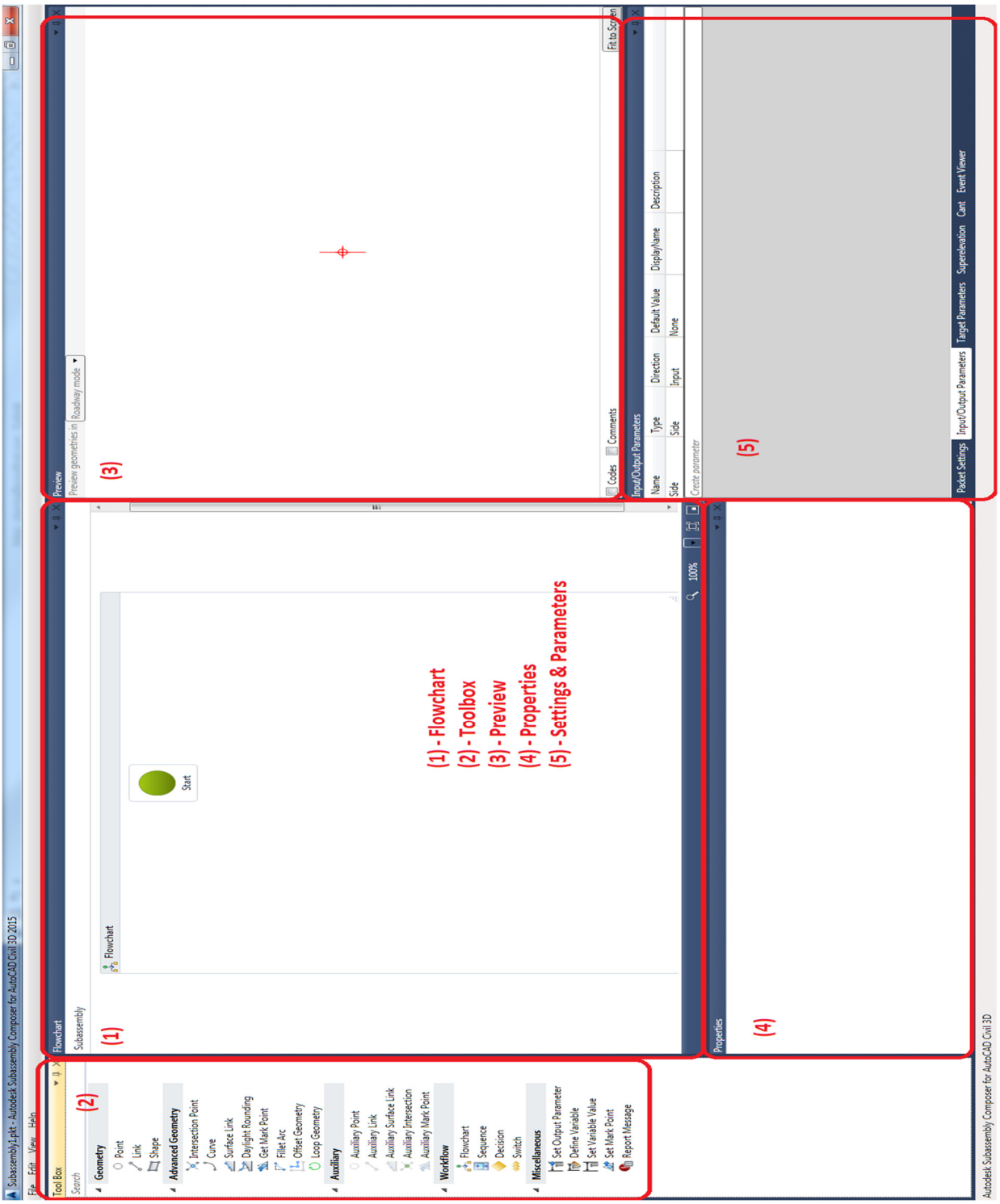
1. Select Start > All Programs > Autodesk > Subassembly Composer 2015



2. From the list of pull downs along the top, choose Restore Default Layout (May or may not see a change)



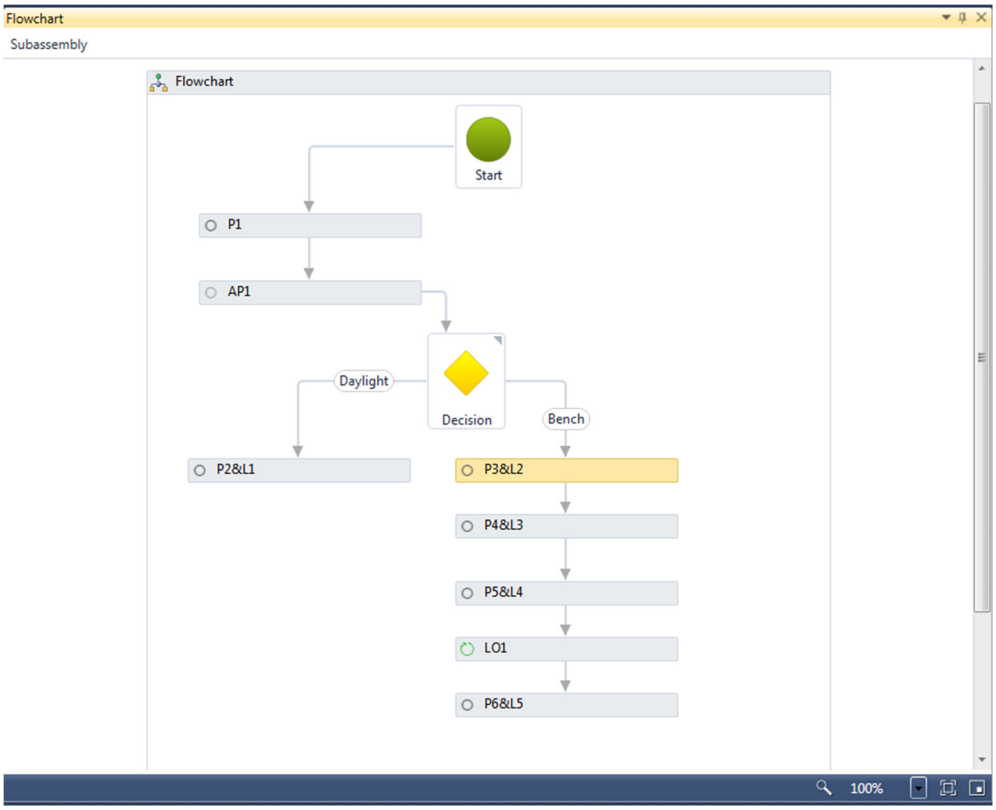
Overall User Interface



The interface is broken down into 5 sections. Each section will be shown and explained below.

The Flowchart (1)

The Flowchart panel is the workspace used to build and organize the subassembly logic and elements. A flowchart can be a simple straight line of logic, or it can be a complex tree of decisions. The subassembly definition tree always begins with the Start element, shown below as a big green circle. If a problem is found within your subassembly, a small red circle with an exclamation point will be displayed in the upper-right corner of the problem point.

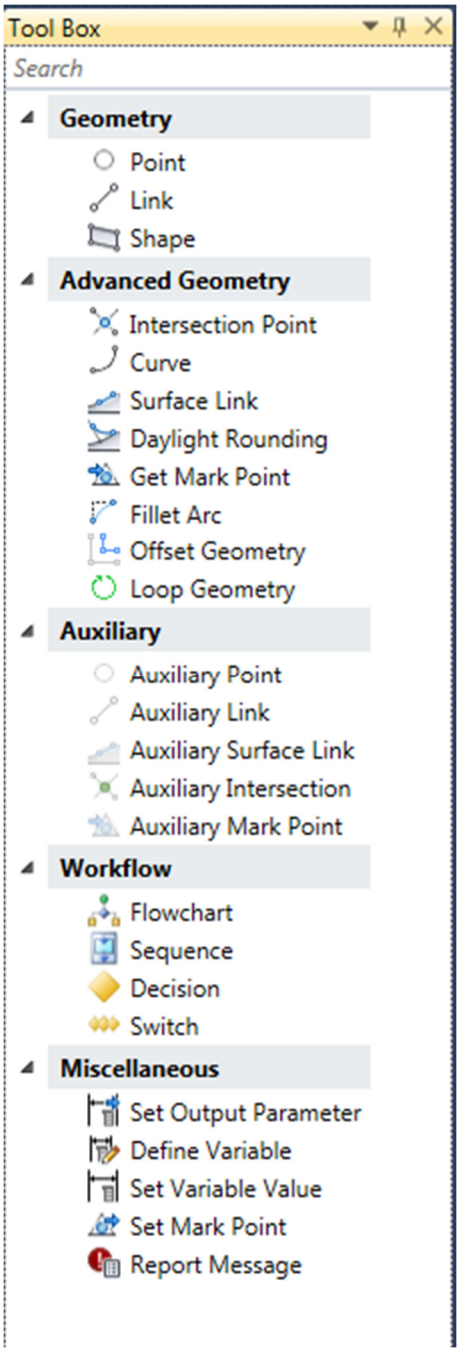


The Toolbox (2)

The Tool Box panel is the storage location for elements available for constructing the subassembly. This panel will provide all the elements you'll use to build your flowchart. At the simplest level, 2 or 3 elements may be used to complete a subassembly. To use any of these elements, click and hold on the desired element and drag and drop it in the Flowchart panel. The five branches of the toolbox are explained below.

Elements Explained

- **Geometry -** Use these tools to create basic subassembly geometry such as:
  - Points
  - Links
  - Shapes
- **Advanced Geometry -** Use these tools to add complex geometry elements such as:
  - Intersection Points
  - Curves
  - Daylight Rounding
  - Offset Geometry and more…
- **Auxiliary -** Use the tools in this collection to generate points and links that are not included in the final subassembly geometry, but can be used to create other geometry elements.
- **Workflow -** Use these tools to organize geometry elements and add branches for conditional behavior.
- **Misc -** Use these tools to define and set variables, report errors in the Autodesk Subassembly Composer Event Viewer, and to broadcast subassembly information for use by other subassemblies.



Preview (3)

The Preview panel allows you to view your subassembly as currently defined by the Flowchart panel. There are two preview modes:

Roadway Mode - Shows the subassembly built using any target elevations, target surfaces, and/or target offsets.

Layout Mode - Shows the subassembly built using only the input parameters.

The Properties (4)

The Properties panel is the main input location of the parameters that define each geometry element. This is where you will spend most of your time defining the subassembly's geometry.

Settings & Parameters (5)

The Settings and Parameters panel consists of five tabs that define the subassembly:

- Packet Settings
- Input/Output Parameters
- Target Parameters
- Superelevation
- CANT
- Event Viewer.

We will take a detailed look at these in the next section, this is really where you can harness the power of SAC.

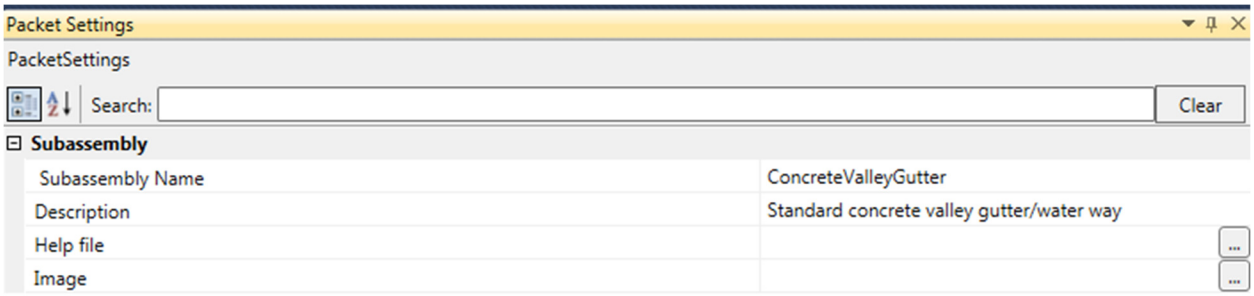
Space Reserved for Notes:

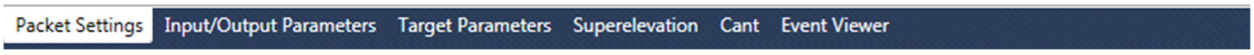
Settings and Parameters

Packet Settings

On the Packet Settings tab, you can define the subassembly name, provide a description, link to a help file, and link to an image. The only required piece of information is the subassembly name. The name shall contain NO spaces, although it can contain dashes and/or underscores. A name like ConcreteWedgeCurbing, is an appropriate name.

The subassembly name will be the name that is displayed on the tool palette once it's imported into Civil 3D. If you include a description, this text will appear on the tool palette as a tool tip text. If you provide an image, it will display in the tool palette next to the subassembly's name. This is not required, but helpful once imported into Civil 3D. This can be as easy an taking a snapshot of the Preview window of SAC.

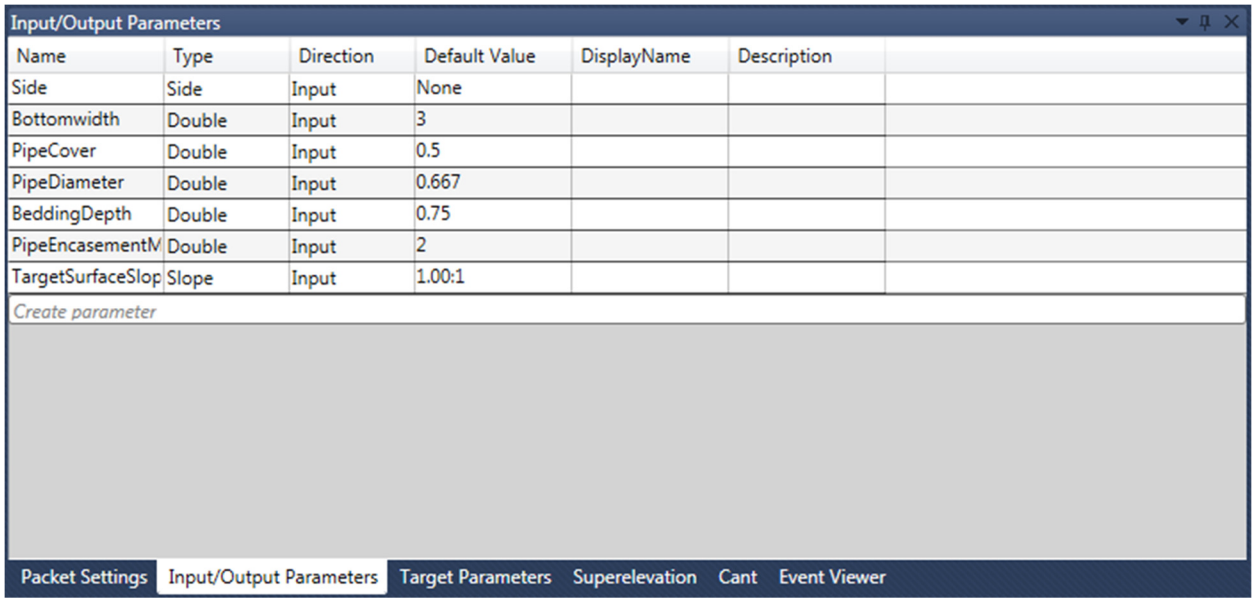




Space Reserved for Notes:

Input/Output Parameters

On the Input/Output Parameters tab you can define numerous parameters along with their default values. The information on this tab is presented in a table. To add a parameter, simply click the Create Parameter text. To remove a parameter, highlight that row in the table and press Delete on your keyboard. As you will see coming up within this document, we reference this information within our properties to create a more dynamic subassembly.



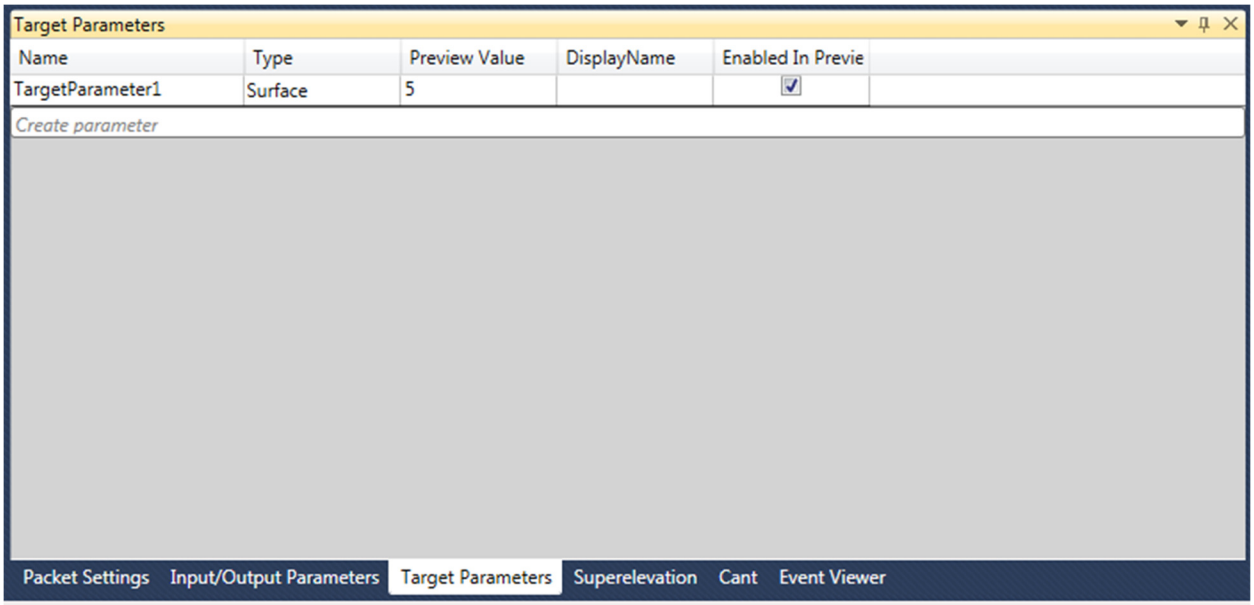
Space Reserved for Notes:

Target Parameters

On the Target Parameters tab you can define the targets to be used by the subassembly. You can use three types of targets:

- **Offset targets –** Option within Civil 3D to target a polyline, alignment, feature line, etc
- **Elevation targets –** Option within Civil 3D to target a feature line or profile, for example.
- **Surface targets -** Option within Civil 3D to target a surface or surfaces.

As with the Input/Output Parameters tab, click on the Create Parameter text to add/remove a parameter.



Superelevation

Here you can input superelevation values if needed for the subassembly. This can be left blank if not used.

CANT

For the first time, SAC 2015 will now allow the use of the CANT calculation when using a RAIL alignment. This can be left blank if not used.

Event Viewer

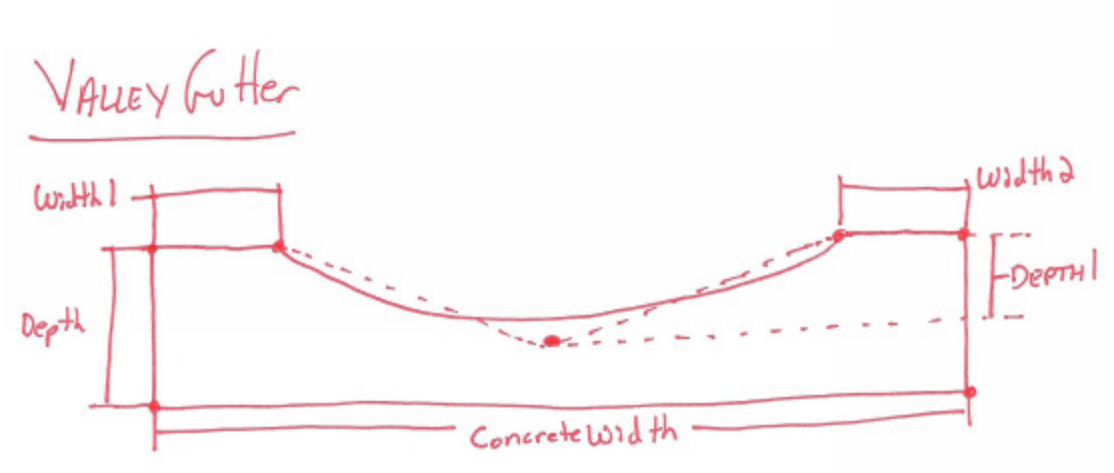
The Event Viewer tab is similar to the AutoCAD Civil 3D Event Viewer. Error, Warning, and Informational messages about the subassembly are posted to the Event Viewer while the subassembly is being built in Autodesk Subassembly Composer. Event Viewer messages are not published to the AutoCAD Civil 3D Event Viewer.

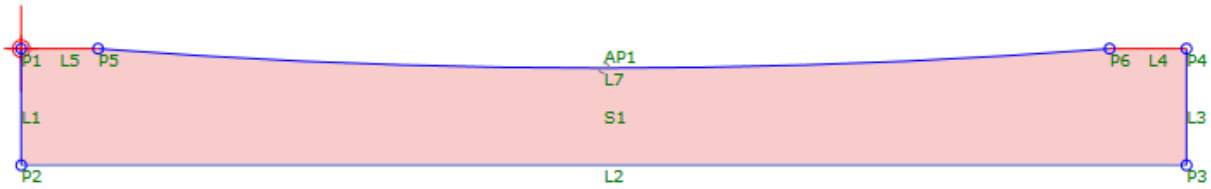
Getting Started Example 'A' - (Concrete Valley Gutter)

Sketch it Out First

I always sketch out my intended subassembly, this will be helpful in making sure you meet the standard detail you are looking for. As you draw it out, you may also think of things that may get lost while attempting to connect the dots.

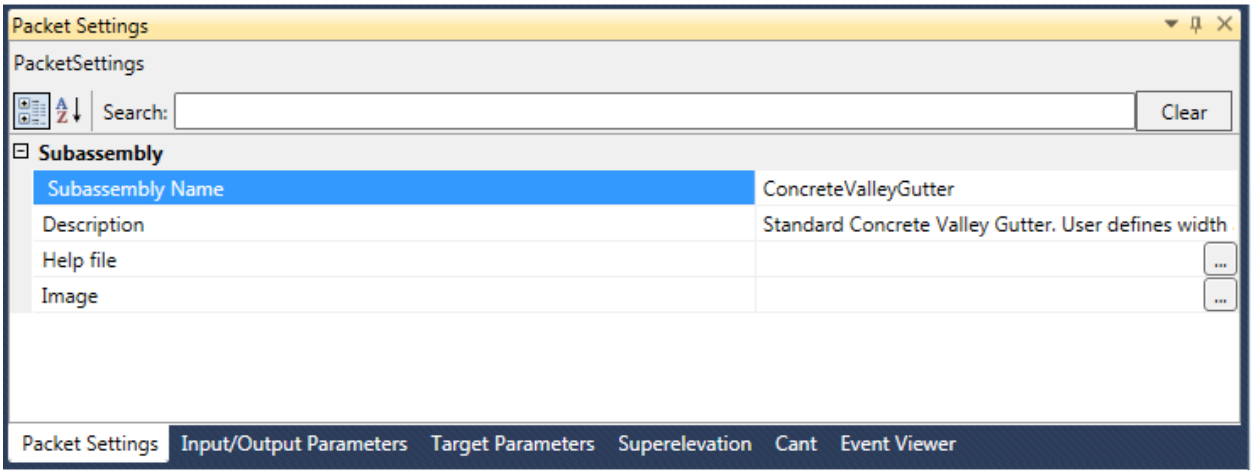
A simple sketch will help. Below is an example of one of the subassemblies we will be using throughout this session.





Getting Started Example 'A' (Concrete Water Way)

1. If you haven't already, launch Subassembly Composer.
2. Save your file to the desktop, called **ConcreteValleyGutter.pkt**
3. We will first start with the **Packet Settings**
    - For the Subassembly Name, type in **ConcreteValleyGutter**. SAC does not like spaces, but you could do underlines.
    - Add a description. **Standard Concrete Valley Gutter. User defines width and flowline depth.**
    - Leave the help file and image file blank for now.

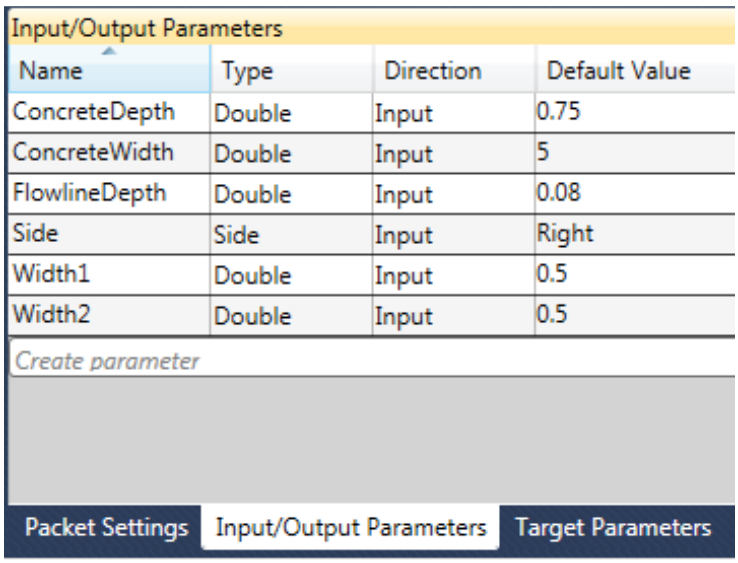


Set Input/Output Parameters

4. Refer to your hand sketch if needed. This is where we can really use some power of basic modeling within Subassembly Composer. Here we will create several parameters that we will reference as we build the valley gutter. It is best to put as many as you can up front in here, but you can always go back and Add/Remove.
    - The SIDE parameter is already there. Change the default value to **LEFT**.
    - To add a parameter, click on **CREATE PARAMETER**.
    - Rename the parameter to **ConcreteWidth**
    - Type = **Double**
    - Direction = **Input**
    - Default Value = **5**

5. Create more parameters based on the image below.

    - If you mess up an input, or add additional parameters, all you do is select the row, and hit the DELETE button on your keyboard.



Set Target Parameters

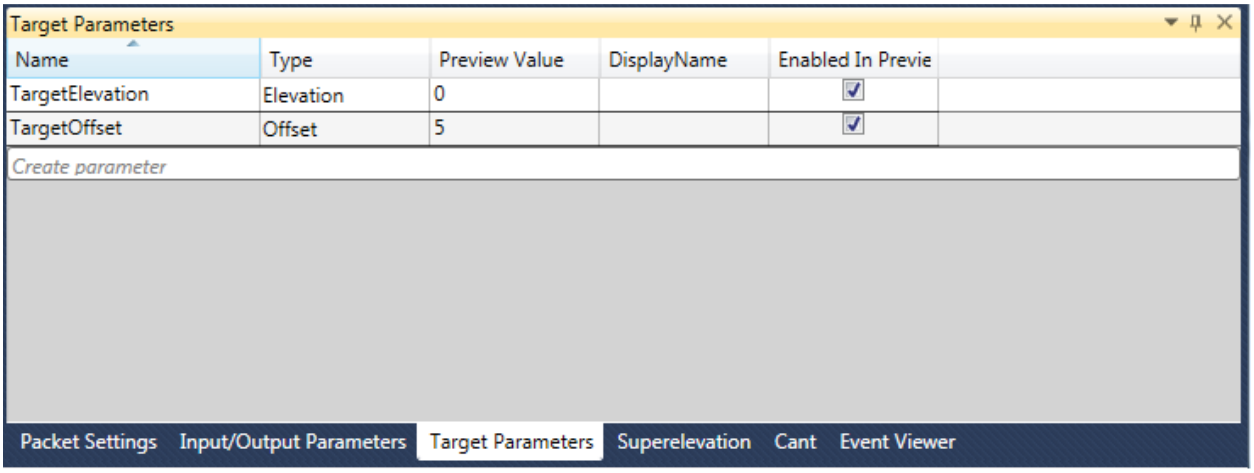
We will want to add in a couple Target Parameters, this could be useful when targeting an existing concrete edge and elevation. These are the same target types you currently use in corridor modeling.

6. To add a parameter, click on **CREATE PARAMETER**.

    - Rename the parameter to **TargetOffset**
    - Type = **Offset**
    - Preview Value = **5**

7. Now let's add one for the Elevation. Click on **CREATE PARAMETER**.

    - Rename the parameter to **TargetElevation**
    - Type = **Elevation**
    - Preview Value = **0**



Save your PKT file.

Space Reserved for Notes:

Building the Subassembly Flowchart

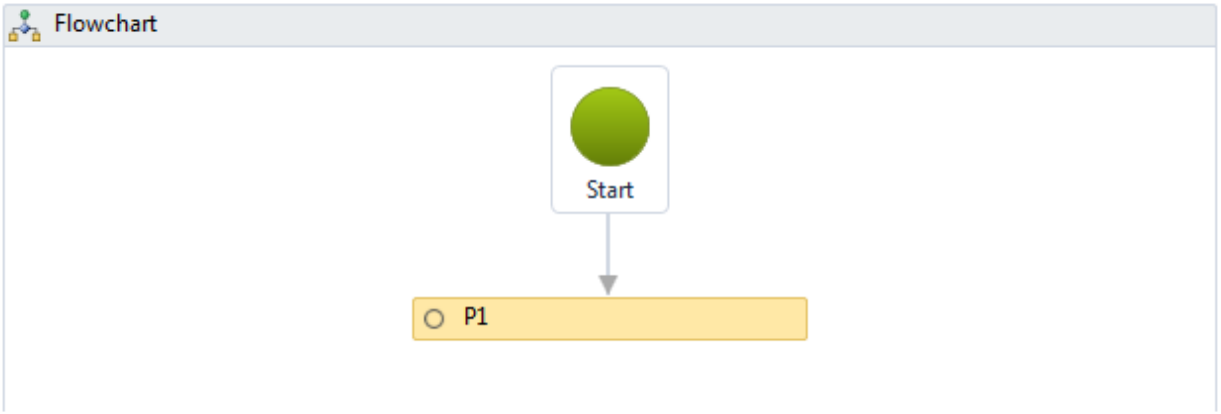
Every flowchart will start from the Start element.

From there, the flowchart is builds out with elements from the Tool Box, which are connected together with arrows. Every element you add from the Tool Box has at least two nodes:

- One node for an incoming connection arrow
- One node for an outgoing connection arrow

Now let's start dragging and dropping to see our shape take form!!

1. From the Tool Box, under the Geometry branch, drag a Point element to just below the Start element. The Start element will connect to the new Point element, which has automatically been numbered P1. See below.



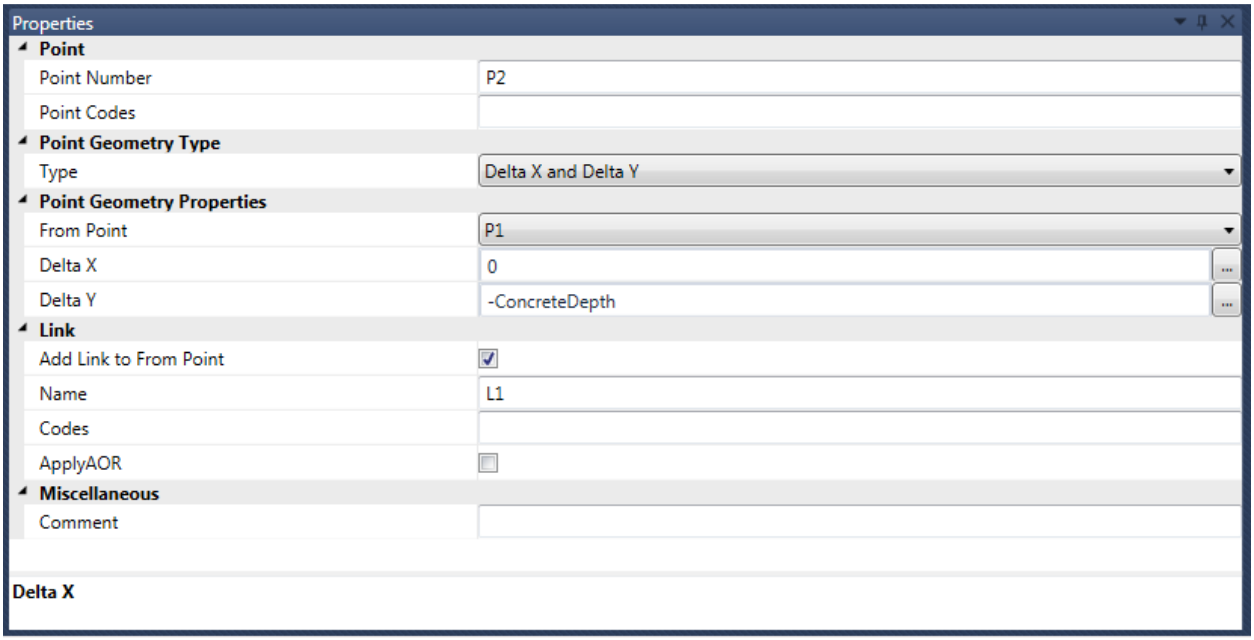
2. Select the P1 point element. Notice below, that the properties box is no longer blank.

    - You will see that it has been placed on the origin. The origin is the geometry point your subassembly will attach to when generating an assembly in Civil 3D.

3. From the Tool Box, drag another Point element to just below the P1 element. This point will be automatically numbered P2 (or P2&L1), and will represent the LEFT edge of concrete, from the top to bottom.

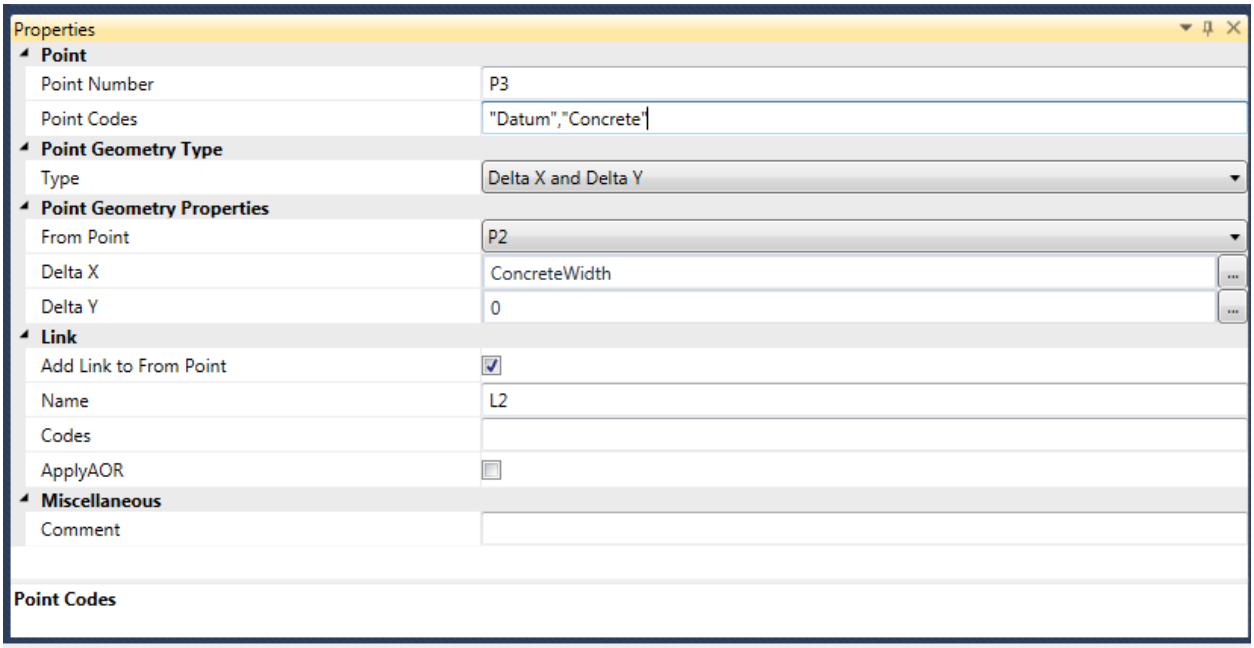
4. Define P2 as shown below:

    - Under the Point Geometry Type, ensure that Delta X and Delta Y is selected
    - Under the Point Geometry Properties, Delta X will remain 0, but Delta Y needs to change. If we were to type in 0.50, we would have a static depth. By using the Input/Output Parameters that we previously set up, this will allow the user to define a depth. So for Delta Y type in **–ConcreteDepth** (we do – so that the elevation goes down, not up).
    - Make sure, under Link, that ADD LINK FROM POINT is checked ON.

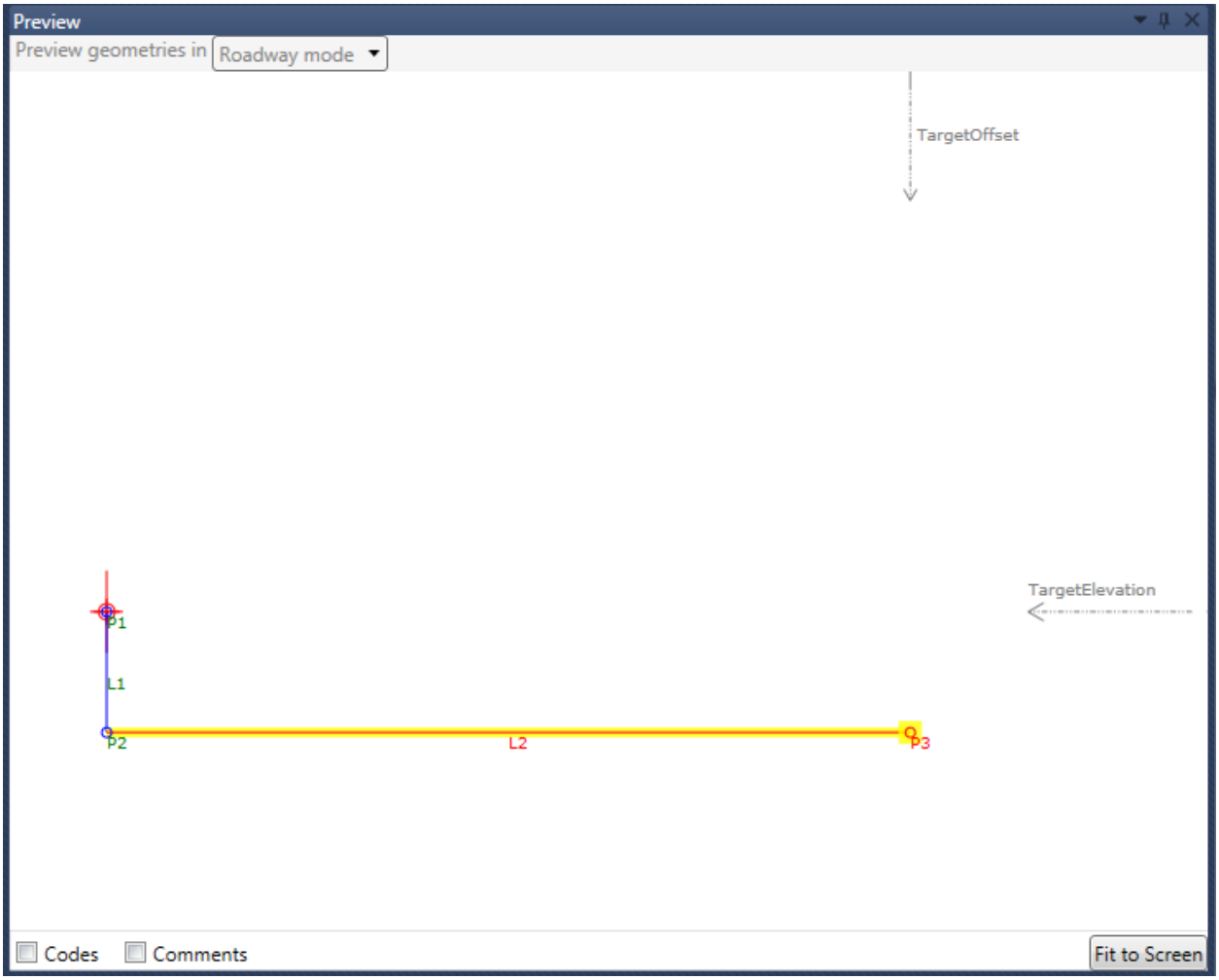


5. From the Tool Box, drag another Point element to just below the P2&L1 element. This point will be automatically numbered P3 (or P3&L2), and will represent the width along the BOTTOM of concrete, from left to right.

6. Define P3 as shown below:

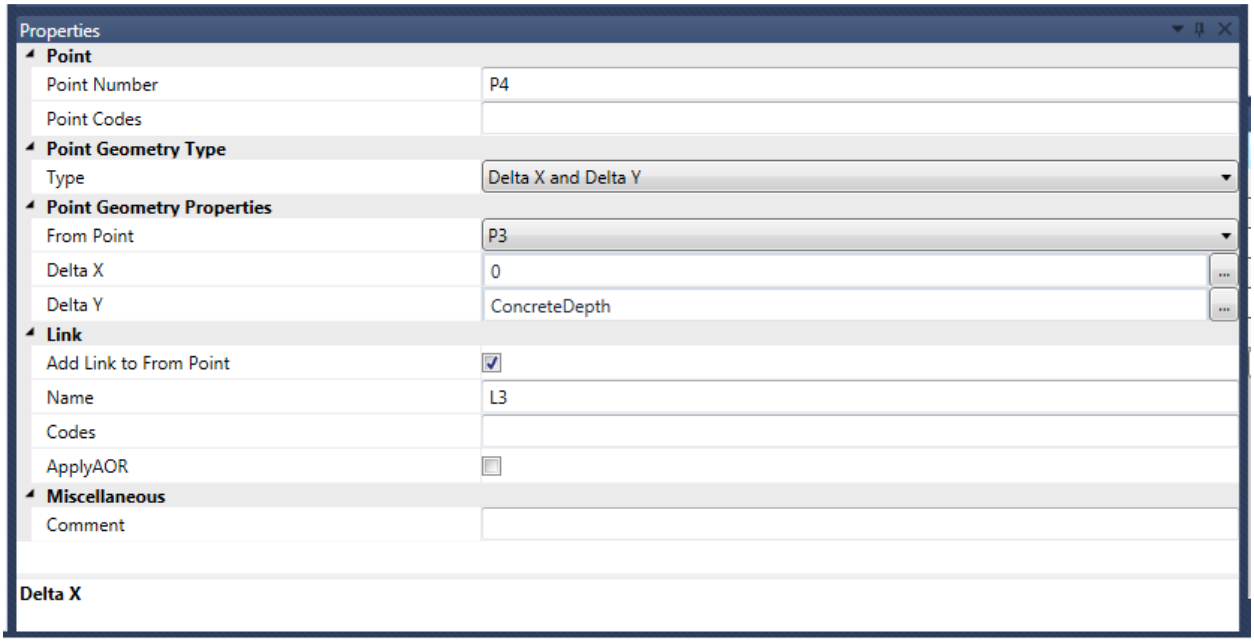


7. Take a look at the Preview window. Yours should look similar to this:



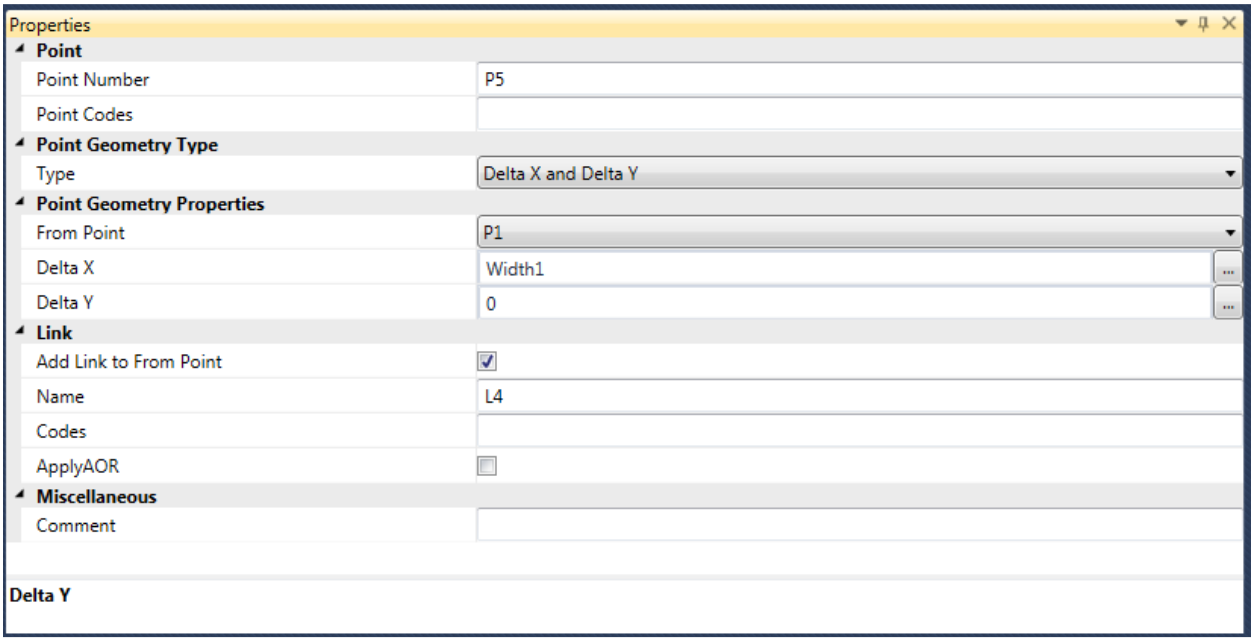
8. From the Tool Box, drag another Point element to just below the P3&L2 element. This point will be automatically numbered P4 (or P4&L3), and will represent the width along the BOTTOM of concrete, from left to right.

9. Define P4 as shown below (Make sure to take the negative (-) out of the ConcreteDepth):



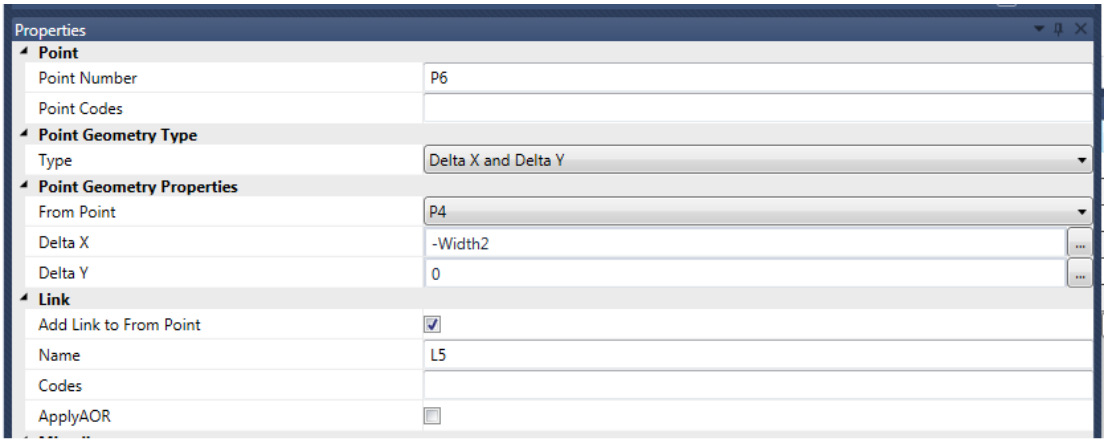
10. From the Tool Box, drag another Point element to just below the P4&L3 element. This point will be automatically numbered P5 (or P5&L4), and will represent the width along the TOP LEFT of concrete, from left to right.

11. Define P5 as shown below (Begin from Point P1):



12. From the Tool Box, drag another Point element to just below the P5&L4 element. This point will be automatically numbered P6 (or P5&L4), and will represent the width along the TOP RIGHT of concrete, right to left.

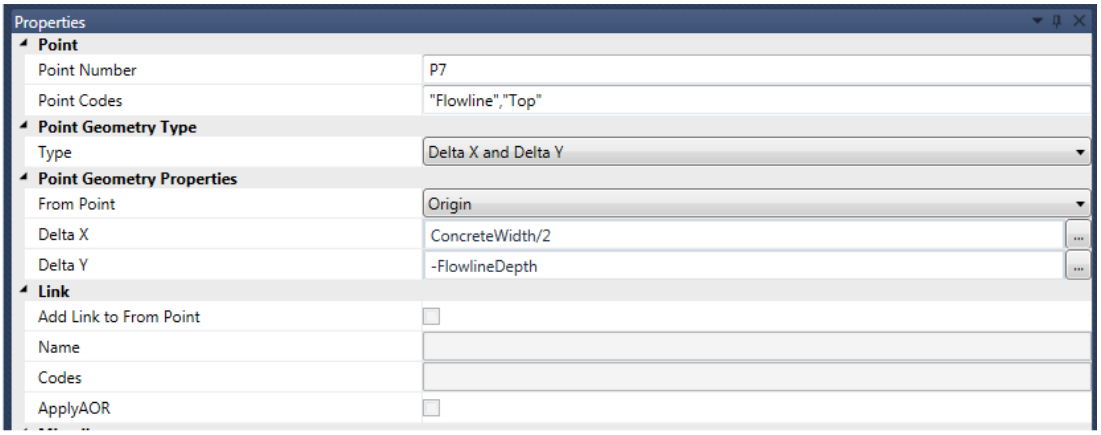
13. Define P6 as shown below (Begin from Point P4):



14. From the Tool Box, drag another Point element to just below the P6&L5 element. This point will be automatically numbered P7, and will represent the FLOWLINE along the TOP of concrete.

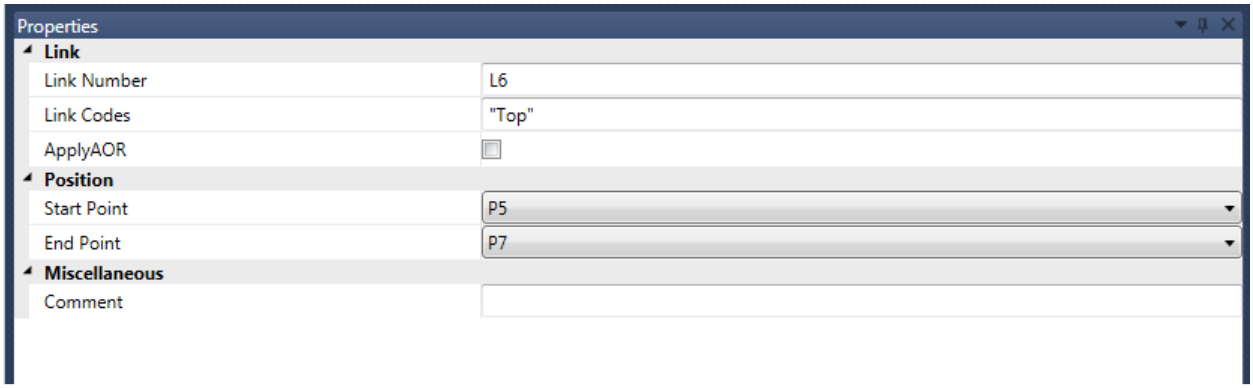
    - We will choose to do a simple equation. So for Delta X, we want this centered in the valley gutter, we will use **ConcreteWidth/2** (For half the total width)

15. Define P7 as shown below (Begin from ORIGIN):



16. This time let's add a LINK instead of POINT. From the Tool Box, drag a LINK element to just below the P7 element. This LINK will be automatically numbered L6, and will connect P5 to P7.

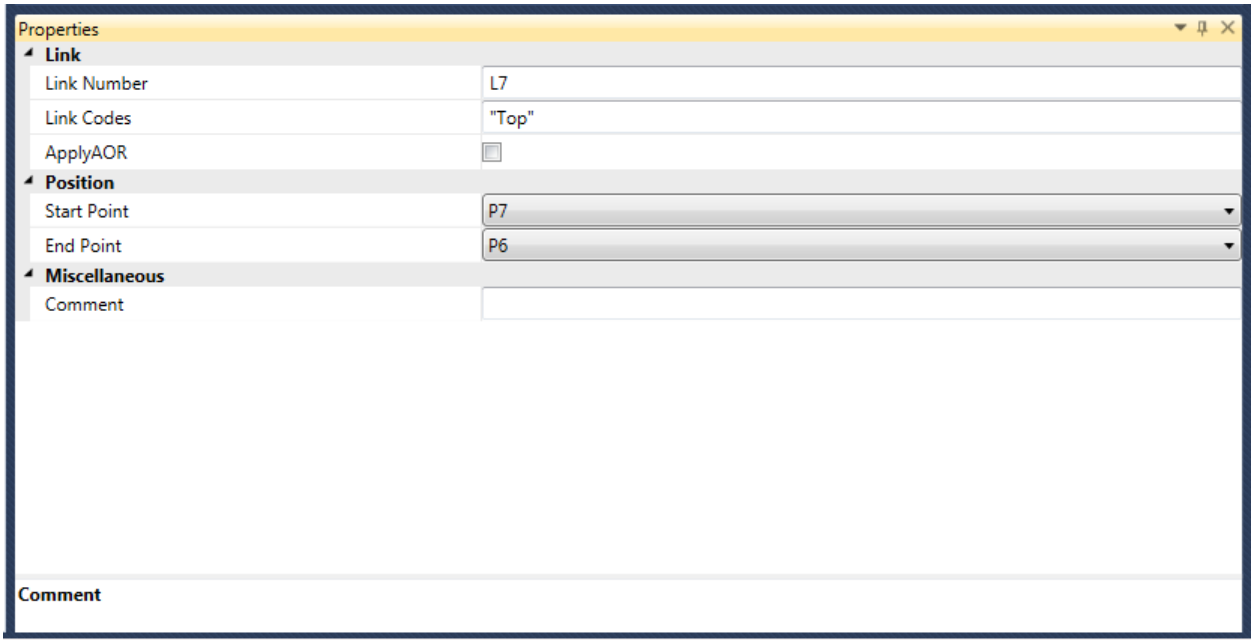
17. Define L6 as shown below:



ALMOST DONE!!!

18. From the Tool Box, drag a LINK element to just below the L6 element. This LINK will be automatically numbered L7, and will connect P6 to P7.

19. Define L7 as shown below:



We will finish our subassembly by creating a SHAPE. This will be used by Civil 3D to compute material volumes.

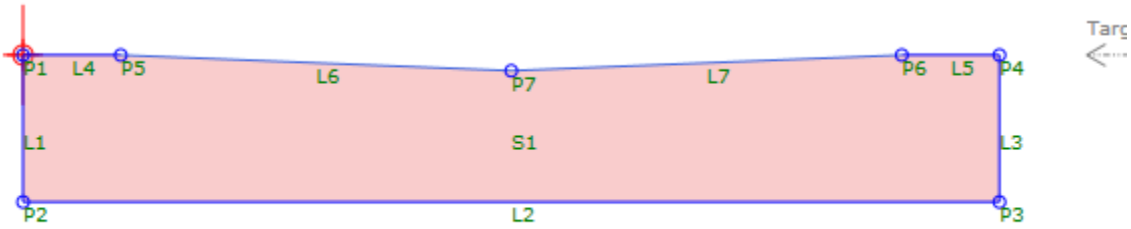
20. From the Tool Box, drag a **SHAPE** element to just below the L7 element. This SHAPE will be automatically numbered S1.

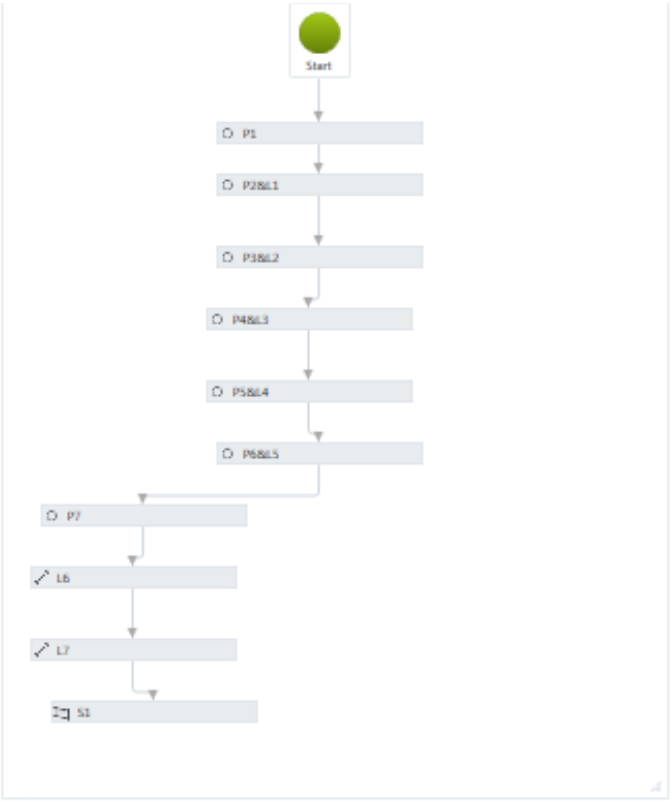
21. Select the **GREEN** box under the Component property.

22. Hover your mouse over the Preview, once inside the shape it will highlight YELLOW. Click to activate the shape.

Congratulations!! You just finished your first subassembly. Save your file.

This should look similar to below:



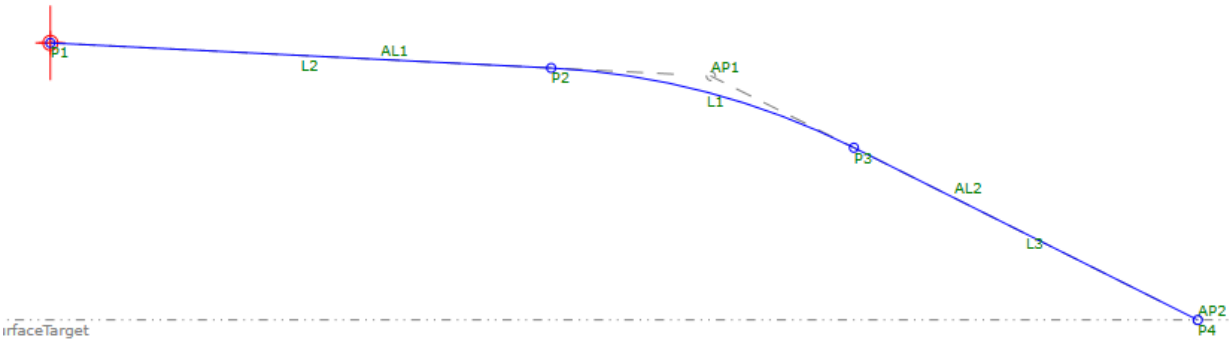


Getting Started Example 'B' - (Rounded Target Daylight)

If you haven't already, launch Subassembly Composer.

Add in your Input/Output Parameters as shown below.

Add your Target Parameters as shown below.

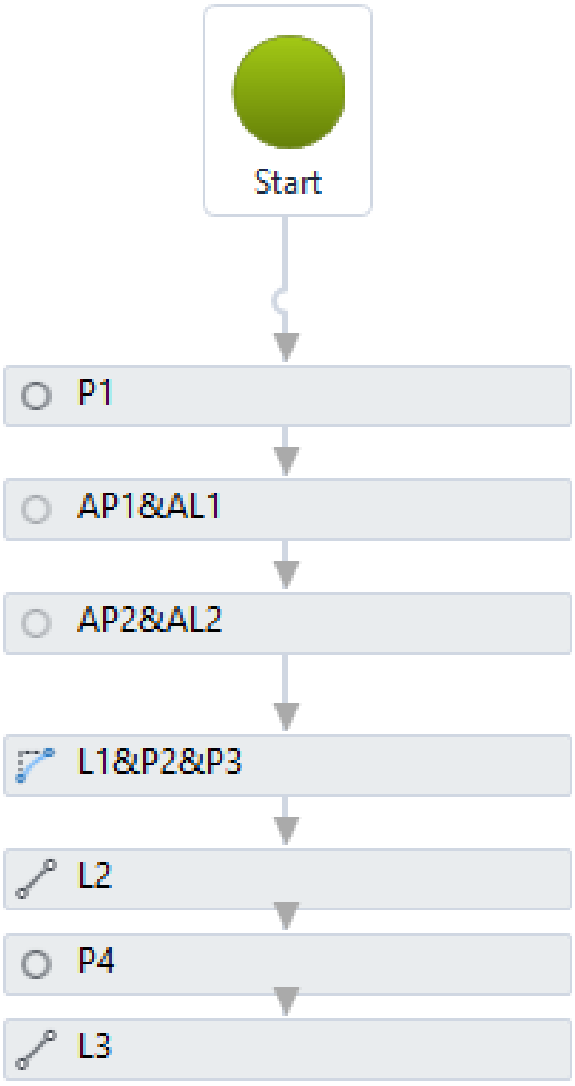


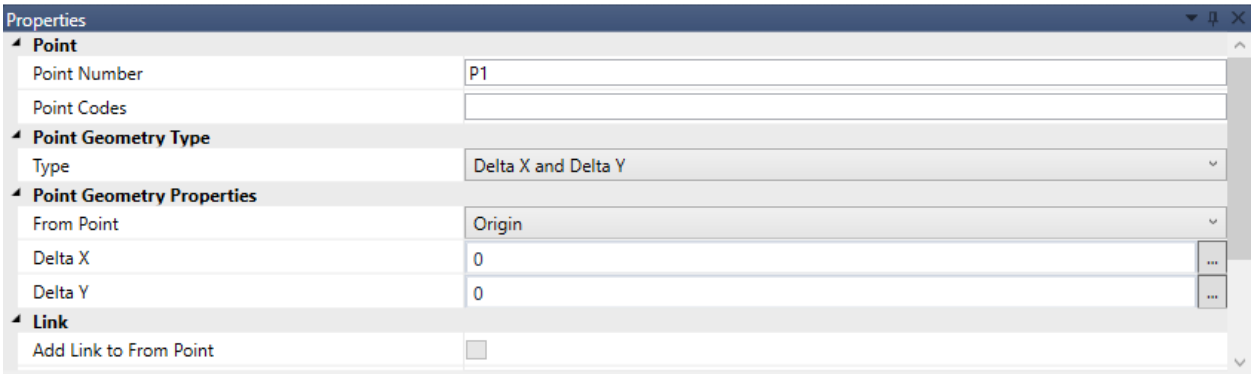
Input/Output Parameters

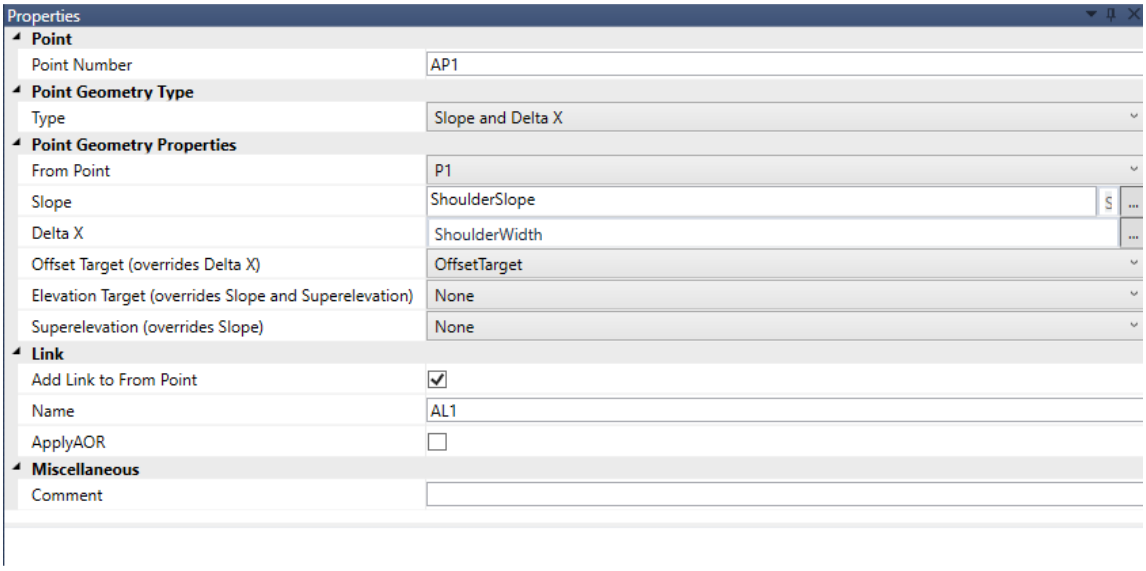
Name	Type	Direction	Default Value	DisplayName	Description
Side	Side	Input	Right		
ShoulderSlope	Grade	Input	-5.00%	Shoulder Slope	
DaylightSlope	Slope	Input	2.00:1	Daylight Slope	
RoundingCurve	Double	Input	2.5	Rounding Curve	
ShoulderWidth	Double	Input	5		
Create parameter					

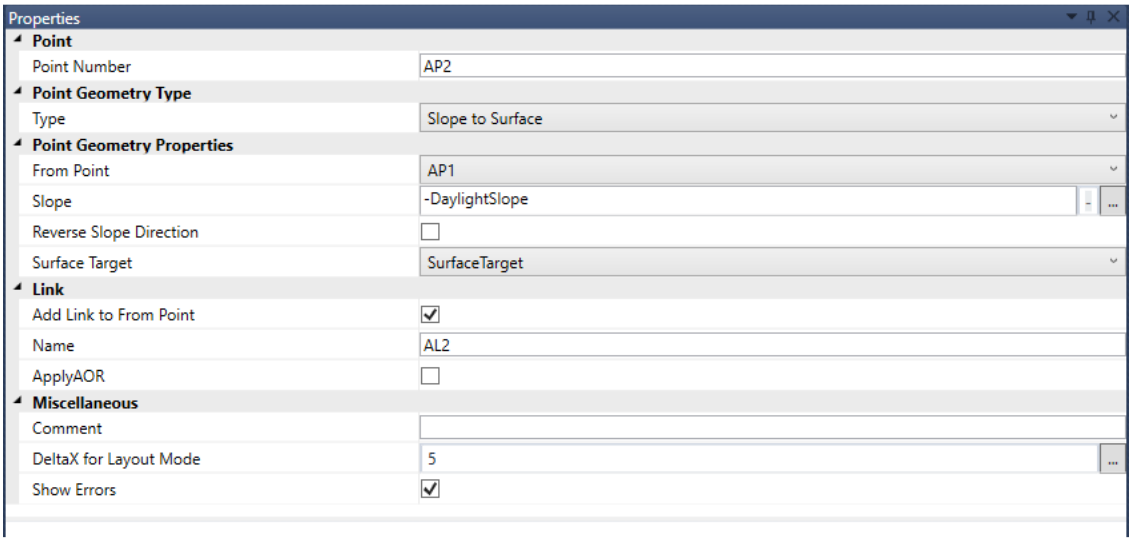
Target Parameters

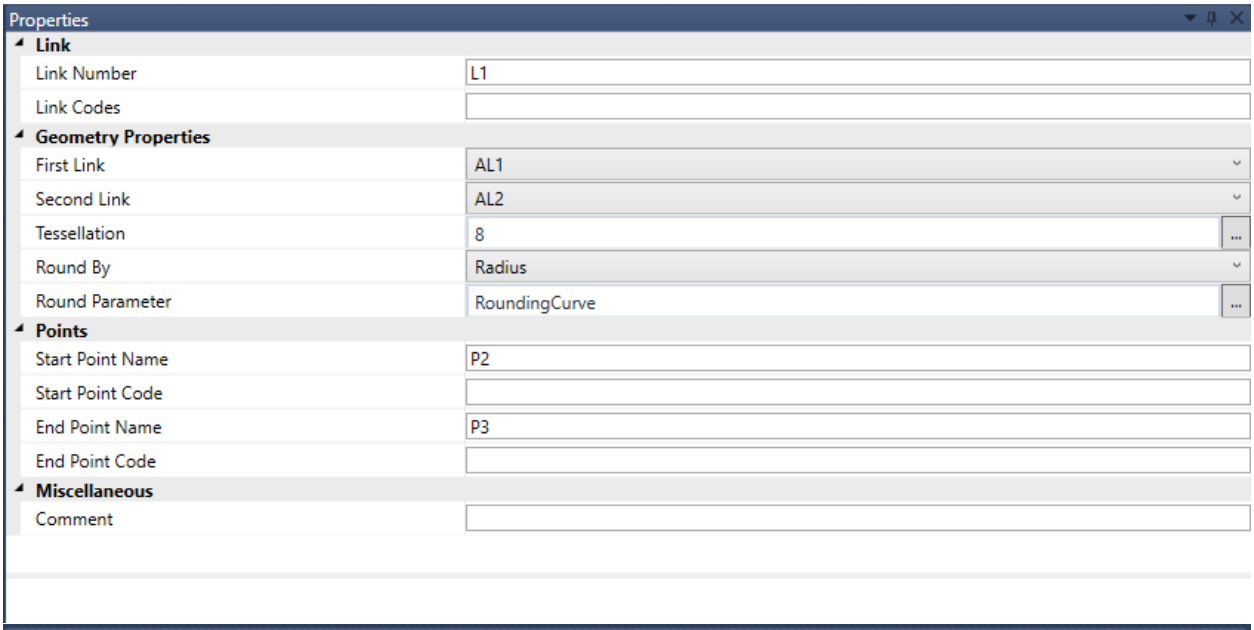
Name	Type	Preview Value	DisplayName	Enabled In Previe
SurfaceTarget	Surface	-0.907	Surafce Target	☑
OffsetTarget	Offset	2.167	Shoulder Offset Ta	☑
Create parameter				

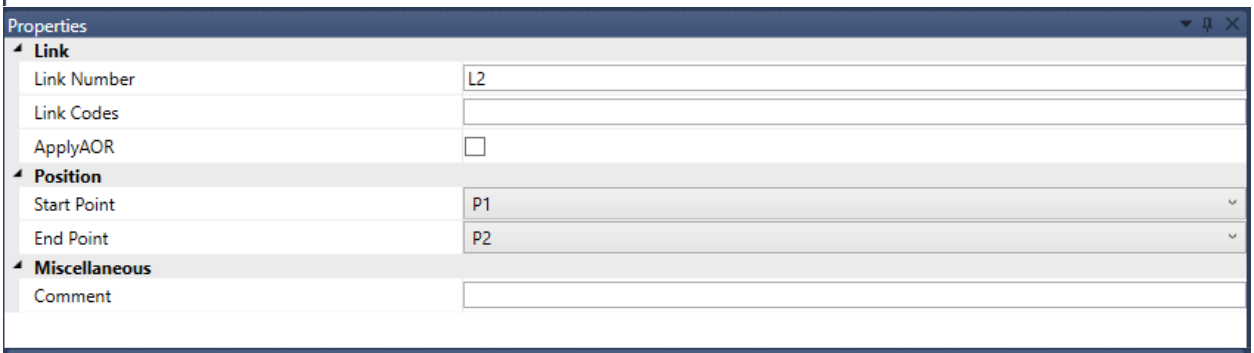

Start
P1
AP1&AL1
AP2&AL2
L1&P2&P3
L2
P4
L3

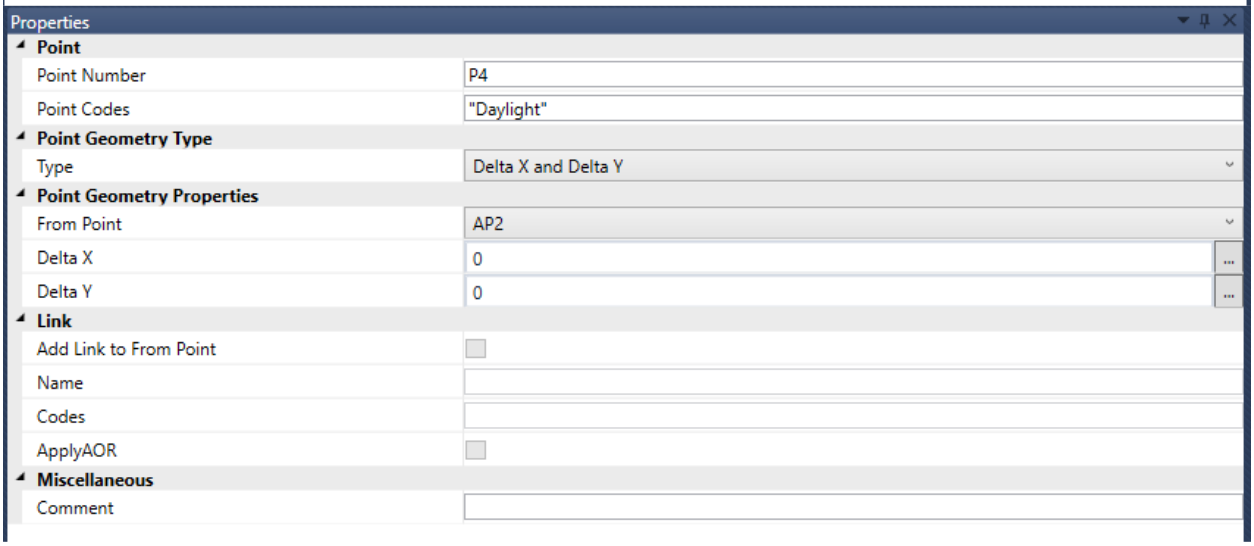

Properties
Point
Point Number
P1
Point Codes
Point Geometry Type
Type
Delta X and Delta Y
Point Geometry Properties
From Point
Origin
Delta X
0
Delta Y
0
Link
Add Link to From Point

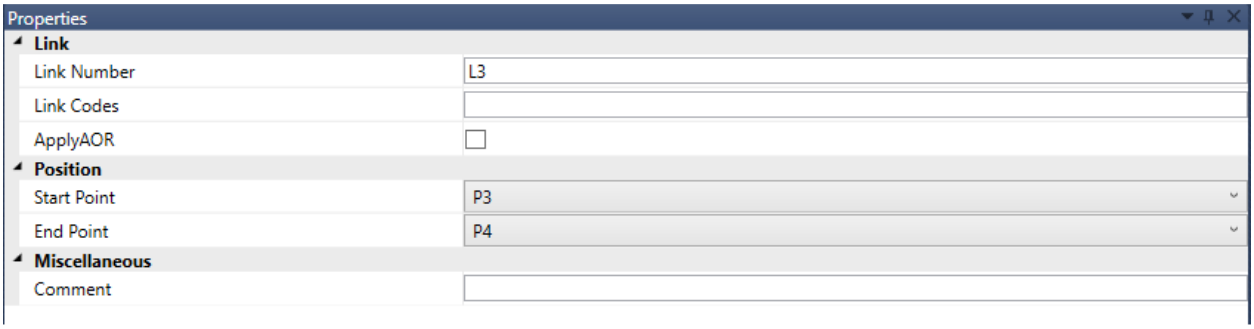

Properties
Point
Point Number
AP1
Point Geometry Type
Type
Slope and Delta X
Point Geometry Properties
From Point
P1
Slope
ShoulderSlope
Delta X
ShoulderWidth
Offset Target (overrides Delta X)
OffsetTarget
Elevation Target (overrides Slope and Superelevation)
None
Superelevation (overrides Slope)
None
Link
Add Link to From Point
Name
AL1
ApplyAOR
Miscellaneous
Comment


Properties
Point
Point Number
AP2
Point Geometry Type
Type
Slope to Surface
Point Geometry Properties
From Point
AP1
Slope
-DaylightSlope
Reverse Slope Direction
Surface Target
SurfaceTarget
Link
Add Link to From Point
Name
AL2
ApplyAOR
Miscellaneous
Comment
DeltaX for Layout Mode
5
Show Errors


Properties
Link
Link Number
L1
Link Codes
Geometry Properties
First Link
AL1
Second Link
AL2
Tessellation
8
Round By
Radius
Round Parameter
RoundingCurve
Points
Start Point Name
P2
Start Point Code
End Point Name
P3
End Point Code
Miscellaneous
Comment


Properties
Link
Link Number
L2
Link Codes
ApplyAOR
Position
Start Point
P1
End Point
P2
Miscellaneous
Comment

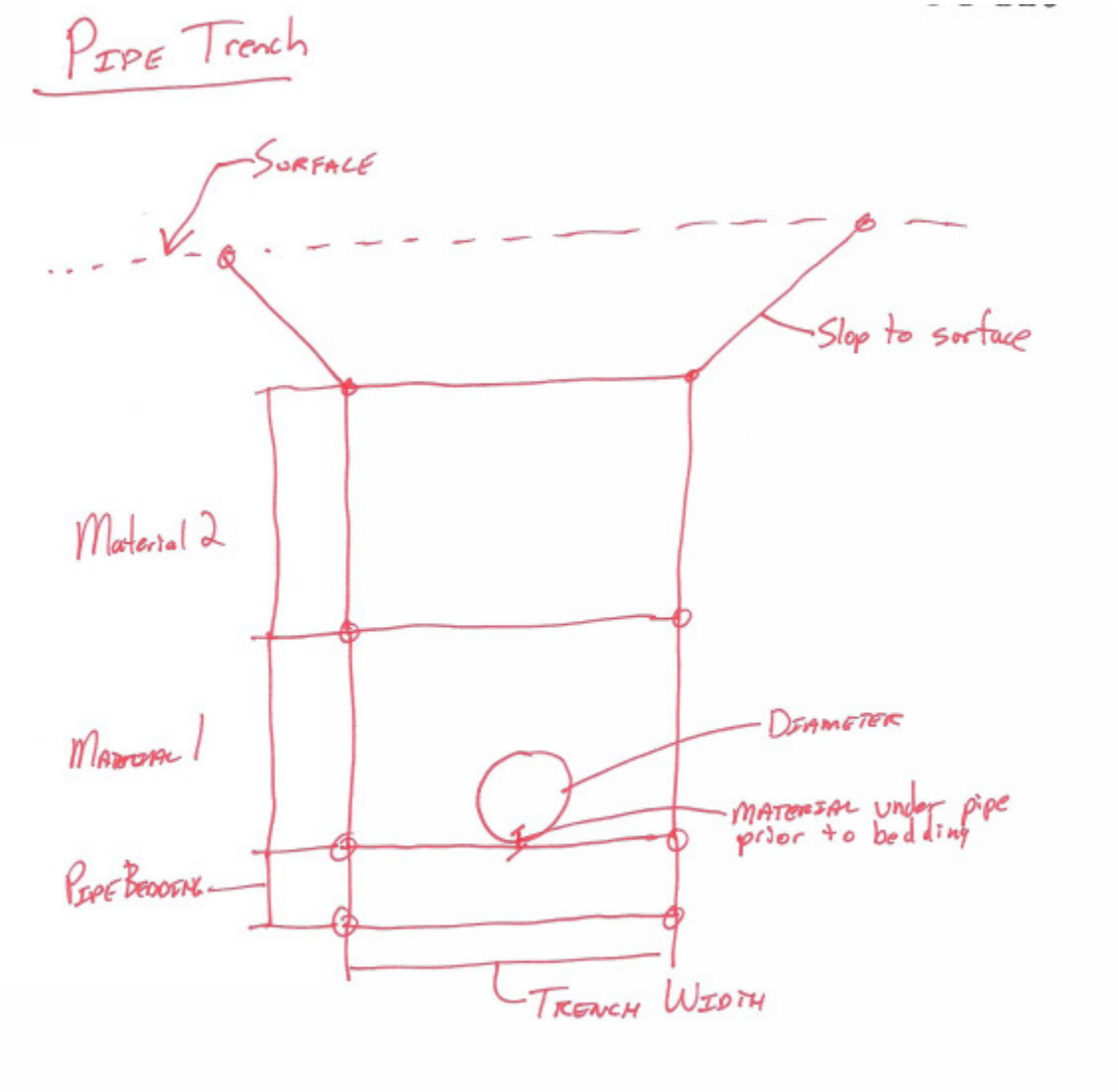

Properties
Point
Point Number
P4
Point Codes
"Daylight"
Point Geometry Type
Type
Delta X and Delta Y
Point Geometry Properties
From Point
AP2
Delta X
0
Delta Y
0
Link
Add Link to From Point
Name
Codes
ApplyAOR
Miscellaneous
Comment

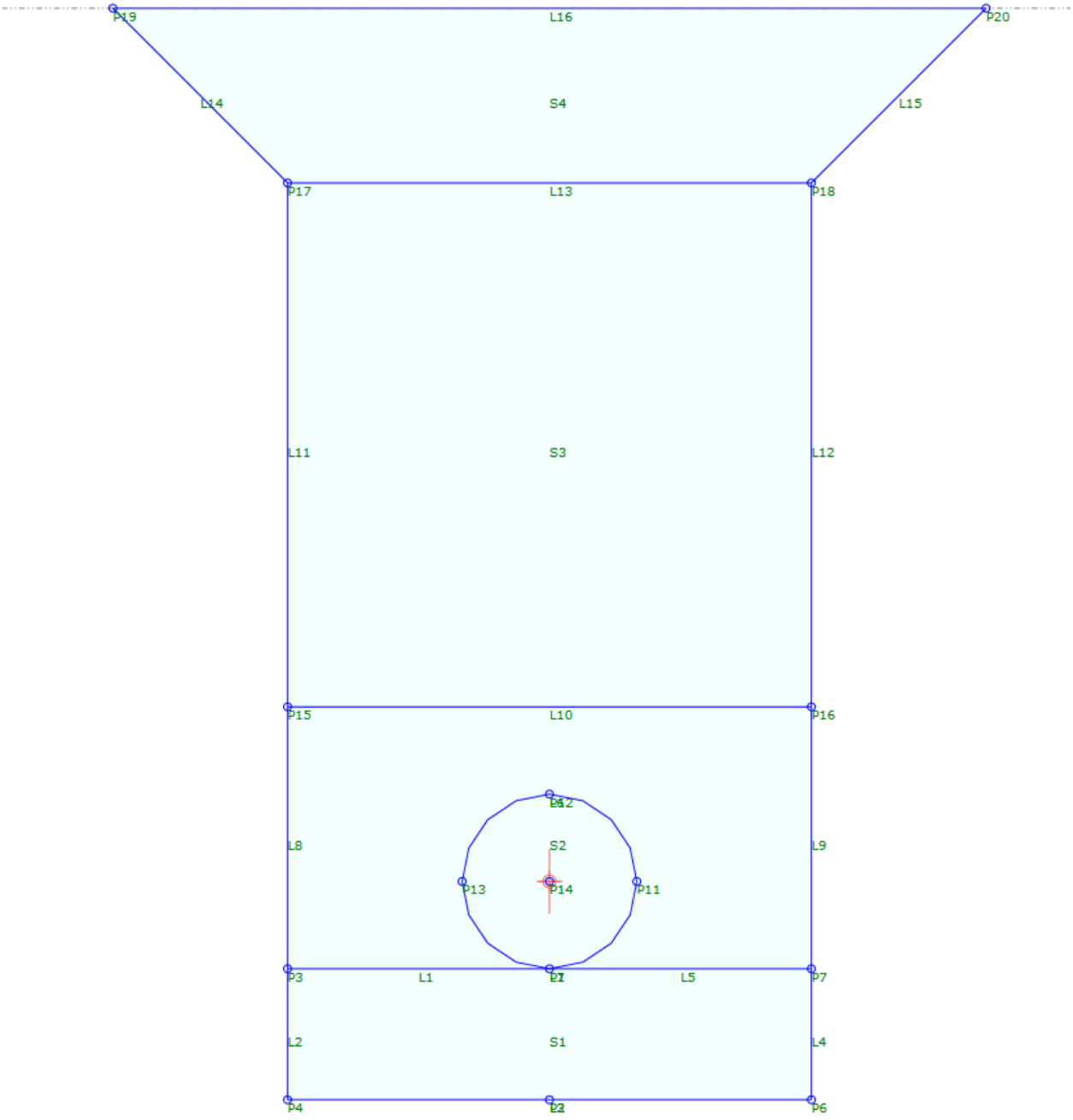

Properties
Link
Link Number
L3
Link Codes
ApplyAOR
Position
Start Point
P3
End Point
P4
Miscellaneous
Comment

Getting Started Example 'C' - (Pipe Trench with Multiple Materials)

If you haven't already, launch Subassembly Composer.

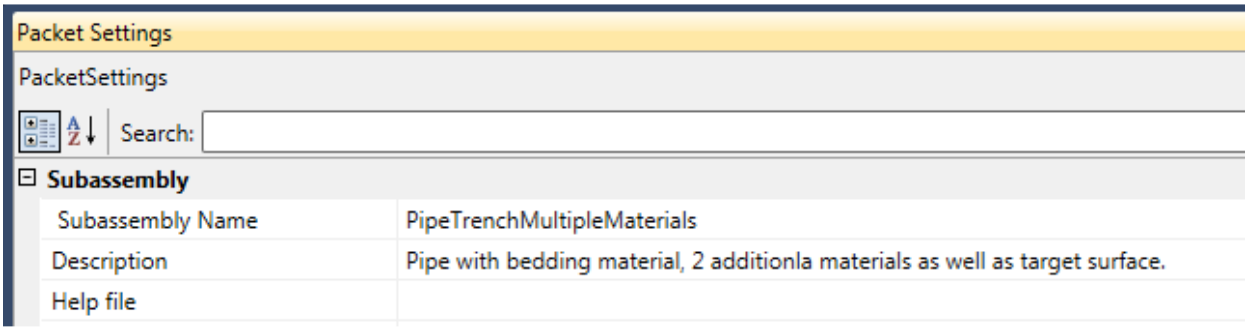
For this example we will be creating a pipe trench, with adjustable pipe diameter and multiple materials options. I sketched it out below.




P19
L16
P20
L14
S4
L15
P17
L13
P18
L11
S3
L12
P15
L10
P16
L8
S2
L9
P13
P14
P11
P3
L1
L5
P7
L2
S1
L4
P4
P6

As always, we will start with the **Packet Settings**

1. For the Subassembly Name, type in **PipeTrenchMultipleMaterials**.
2. Add a description. **Pipe with bedding material, 2 additional materials as well as target surface**.
3. Leave the help file and image file blank for now.

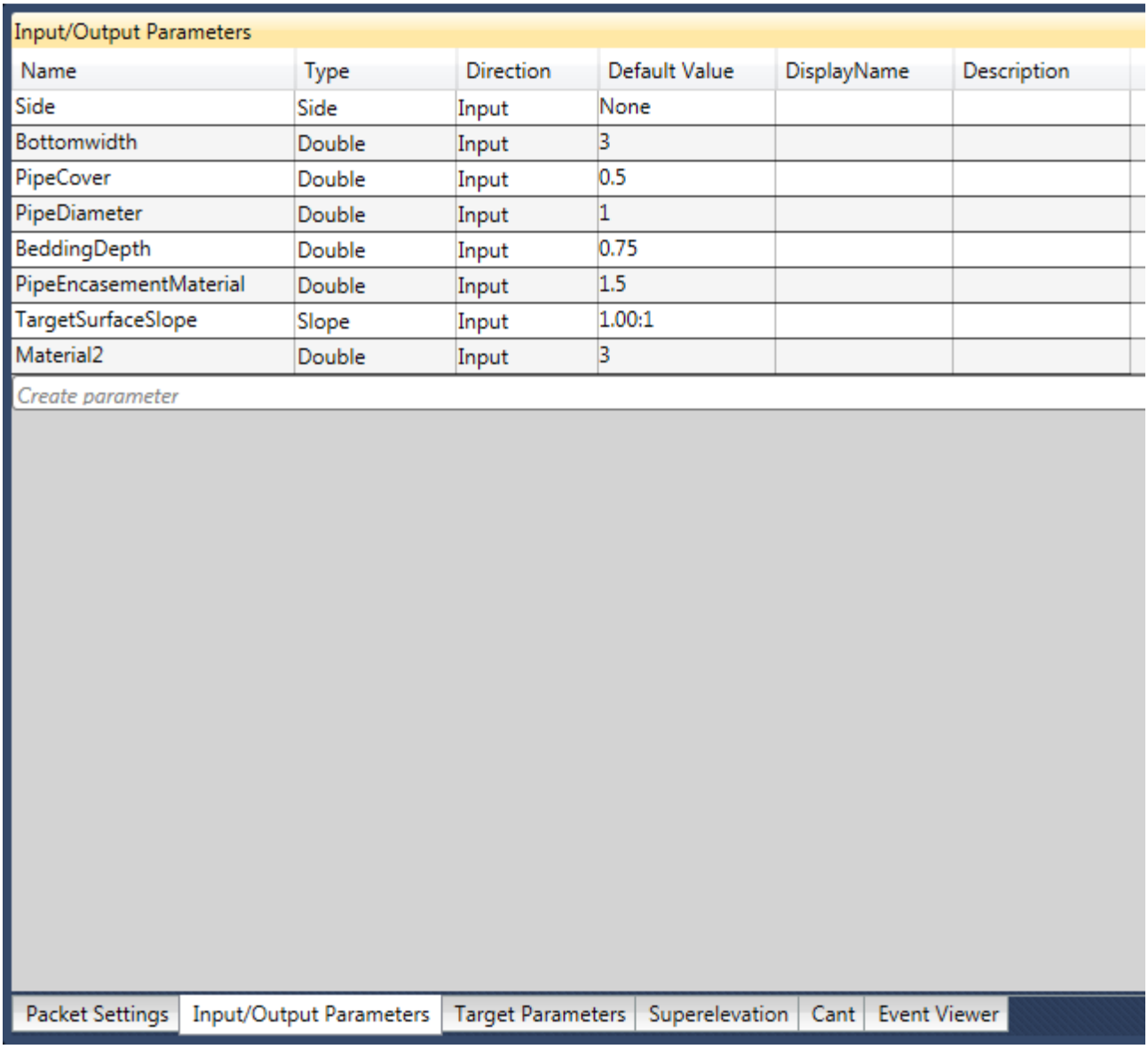


Input/Output Parameters

Refer to your hand sketch if needed. This is where we can really use some power of basic modeling within Subassembly Composer. Here we will create several parameters that we will reference as we build the valley gutter. It is best to put as many as you can up front in here, but you can always go back and Add/Remove.

The SIDE parameter is already there. Change the default value to **LEFT**.

4. To add a parameter, click on **CREATE PARAMETER**.
5. Rename the parameter to **BottomWidth**
6. Type = **Double**
7. Direction = **Input**
8. Default Value = **3**
9. Add in the rest of the parameters shown in the following figure.



Input/Output Parameters

Name	Type	Direction	Default Value	DisplayName	Description
Side	Side	Input	None		
Bottomwidth	Double	Input	3		
PipeCover	Double	Input	0.5		
PipeDiameter	Double	Input	1		
BeddingDepth	Double	Input	0.75		
PipeEncasementMaterial	Double	Input	1.5		
TargetSurfaceSlope	Slope	Input	1.00:1		
Material2	Double	Input	3		

Create parameter

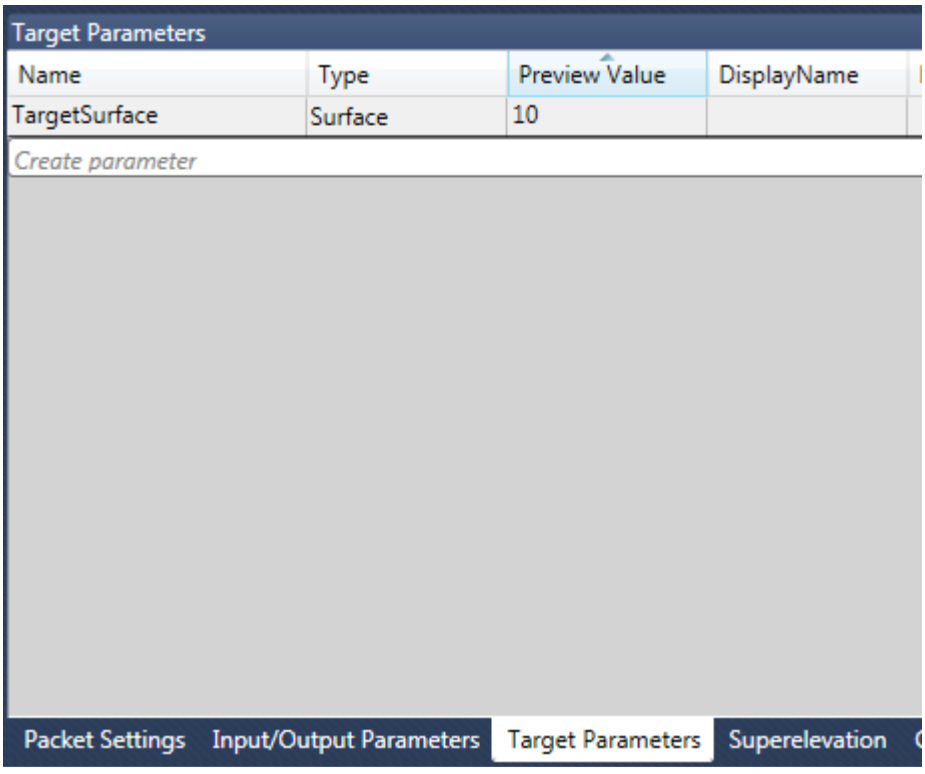
Packet Settings | Input/Output Parameters | Target Parameters | Superelevation | Cant | Event Viewer

Set Target Parameters

We will want to add in a couple Target Parameters, this could be useful when targeting an existing concrete edge and elevation. These are the same target types you currently use in corridor modeling.

10. To add a parameter, click on **CREATE PARAMETER**.

    - Rename the parameter to **TargetSurface**
    - Type = **Surface**
    - Preview Value = **10**

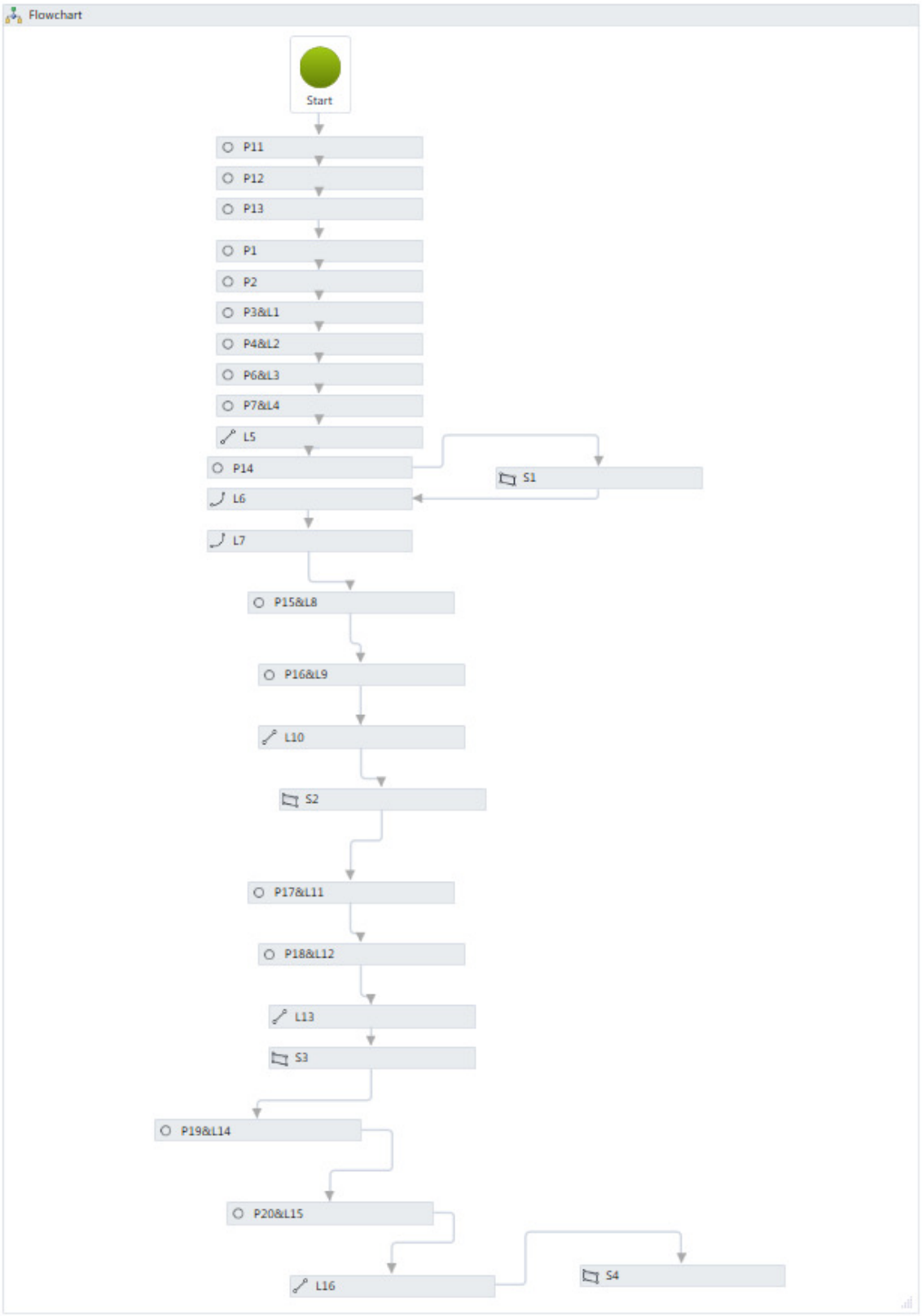


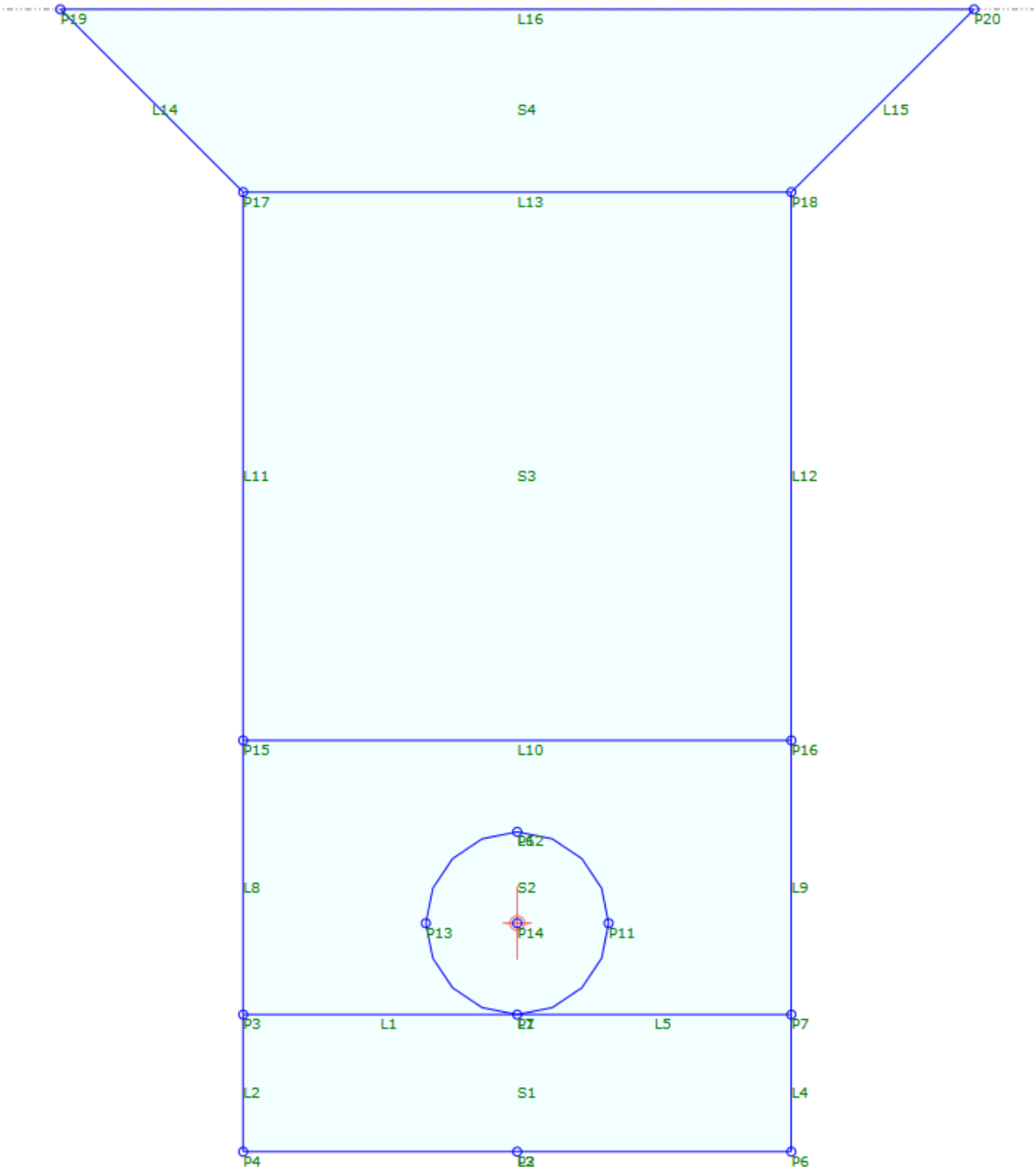
Building the Subassembly Flowchart

The next two images shows the breakdown of this subassembly.

I will walk you through a few of the initial items, but the rest is up to you!!

Now give it a shot!!

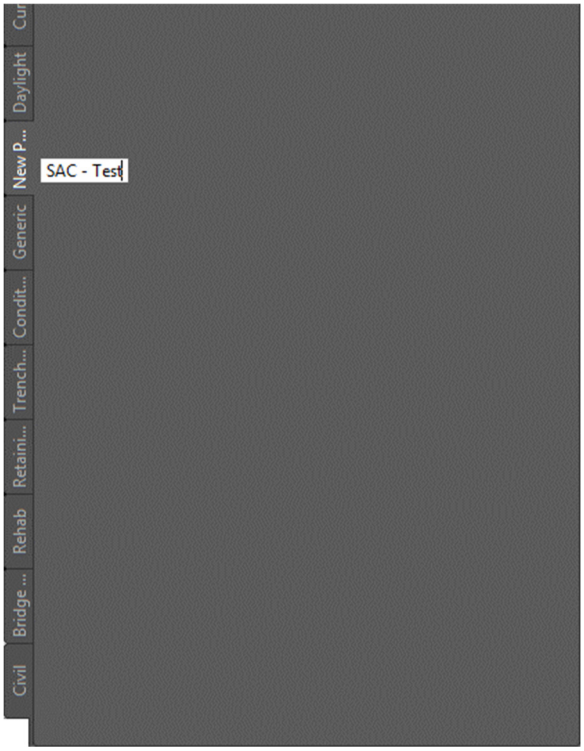

Flowchart
Start
P11
P12
P13
P1
P2
P3&L1
P4&L2
P6&L3
P7&L4
L5
P14
S1
L6
L7
P15&L8
P16&L9
L10
S2
P17&L11
P18&L12
L13
S3
P19&L14
P20&L15
L16
S4

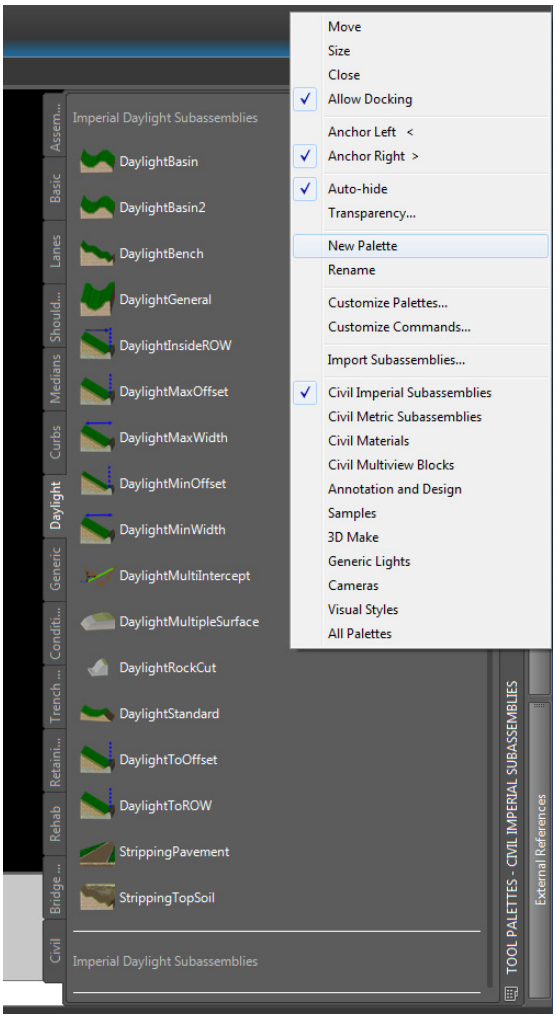

P19
L16
P20
L14
S4
L15
P17
L13
P18
L11
S3
L12
P15
L10
P16
L8
S2
L9
P13
P14
P11
P3
L1
L5
P7
L2
S1
L4
P4
P6

Import into Autodesk AutoCAD Civil 3D

Create a New Pallete

1. Right click on the “spine” of the Subassemblies Tool Palette and select **NEW PALETTE**.
2. Name the new palette, **SAC – Test**, or whatever you want!!





Import Subassemblies

1. Right click on your new palette and select **Import Subassemblies**.
2. Brows to the file, or files, and select the ones you want to import.
3. On the Import Subassemblies dialog box, make sure you have the correct Tool Palette selected.
4. Select OK.