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SolidWorks® Skeleton Sketch Part Method

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Introduction

Abstract

Due to the complexities of projects with definite delivery dates and changing requirements, it is advantageous to produce robust models that handle last minute changes gracefully. After many experiments with two alternatives to the Skeleton Sketch Part method, it has been determined neither are robust for complex modeling. Firstly, linking parts and assemblies through external references does not scale well to large assemblies. However, creating unlinked subassemblies has pitfalls in that any changes must be manually cascaded to all relevant parts and subassemblies. The Skeleton Sketch Part Method breaks down how to have linking between higher-level components to lower-level components in a robust manner.
This manual is a thorough guide on how to produce robust Skeleton Sketch Part assemblies.

Conventions

0.1 Tip Tips are things that will make your something easier, or a new method that has been added to SolidWorks.

0.1 Note Notes are points of interest. A note is more important than a Tip

0.1 Best Practice A Best Practice is a method that needs to be followed and if disregarded could result in an unstable assembly.

0.1 *Warning!* Warnings are used to dissuade practices that could result in unstable assemblies.

Chapter 1

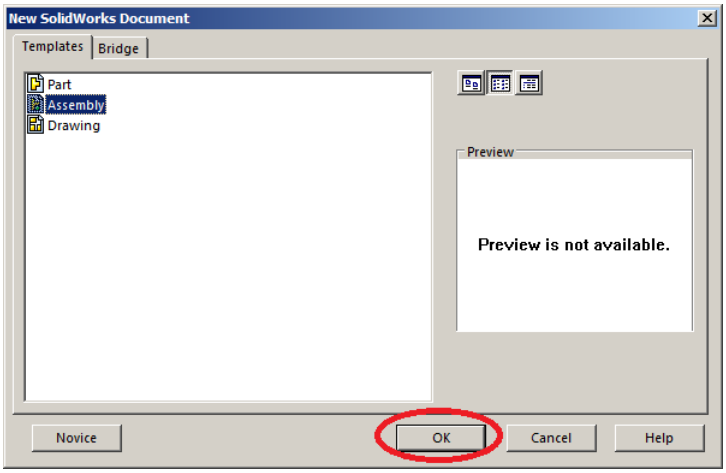
Skeleton Sketch Part Simple Example

1.1 Overview

The Skeleton Sketch Part Method is at its most basic level an assembly of two parts the skeleton sketch part, SSP, and another part driven by this SSP. Multiple parts and assemblies can have the same SSP, but as the the subassemblies get more deeply nested new SSPs need to be created. The basic idea is to keep it simple. Assemblies should not have too many parts and skeleton sketches should have only the basic information needed to drive the parts associated with them. Each skeleton sketch part should only derive information from the next level up. For instance, if we have Master SSP - Sub SSP - Subsub SSP, the Subsub SSP should only be driven from Sub SSP, and not the Master SSP.
While it may seem labor intensive to create these parts and assemblies, it puts the work up front, and makes downstream changes easier to make without the need to fix what can be a very complicated mess of mates in the feature tree.

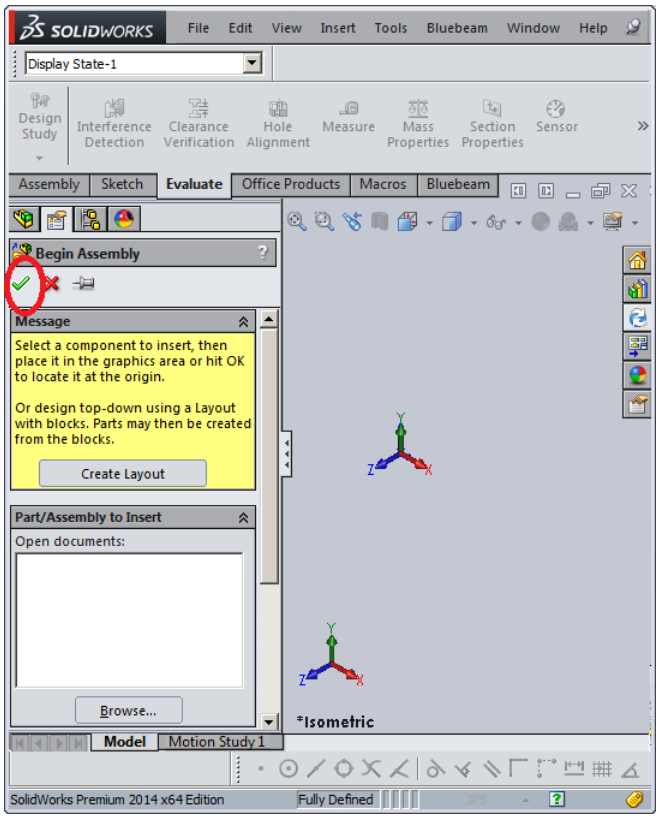
1.2 Simple Example

To present how this works, it is probably best to present a simple example.



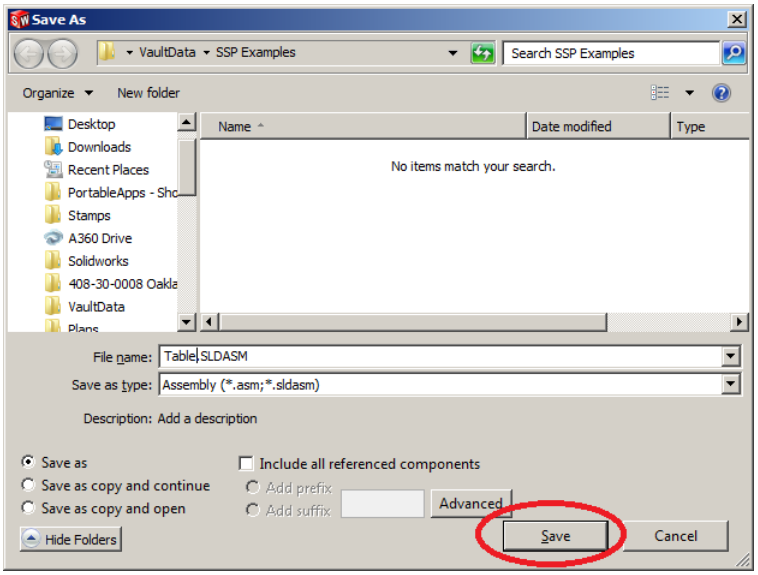
Open SolidWorks and select File New and choose an assembly template and click OK

Figure 1.1: Create Assembly



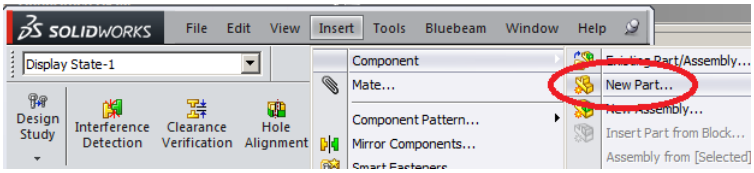
Click the Check Mark to begin the assembly

Figure 1.2: Begin Assembly



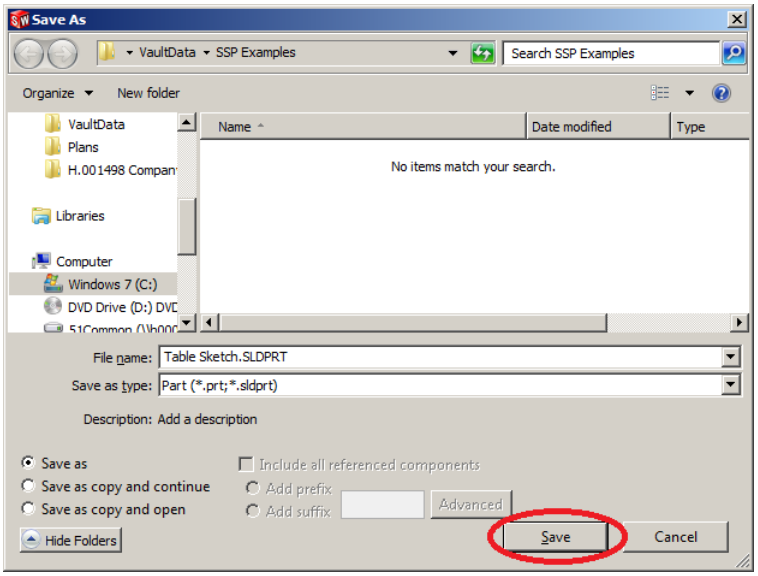
Choose File Save As and save the assembly as *Table*

Figure 1.3: Save Assembly



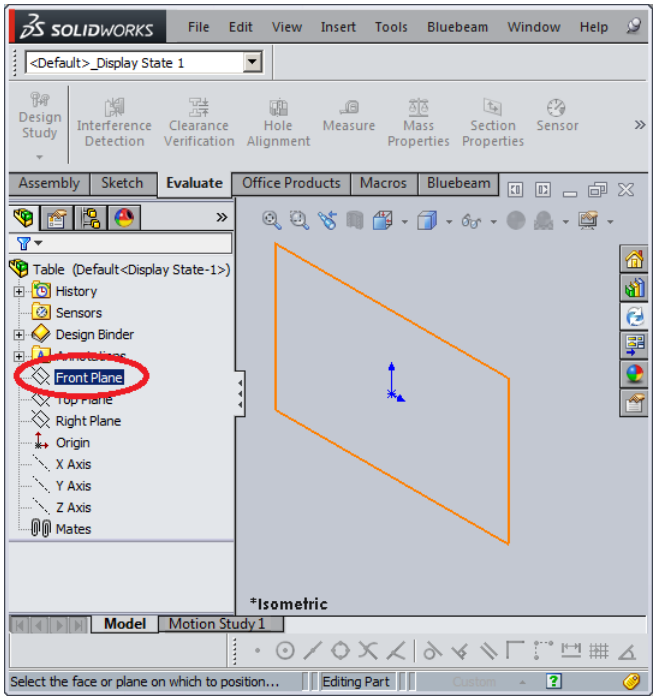
Choose Insert Component New Part

Figure 1.4: Insert Sketch Part



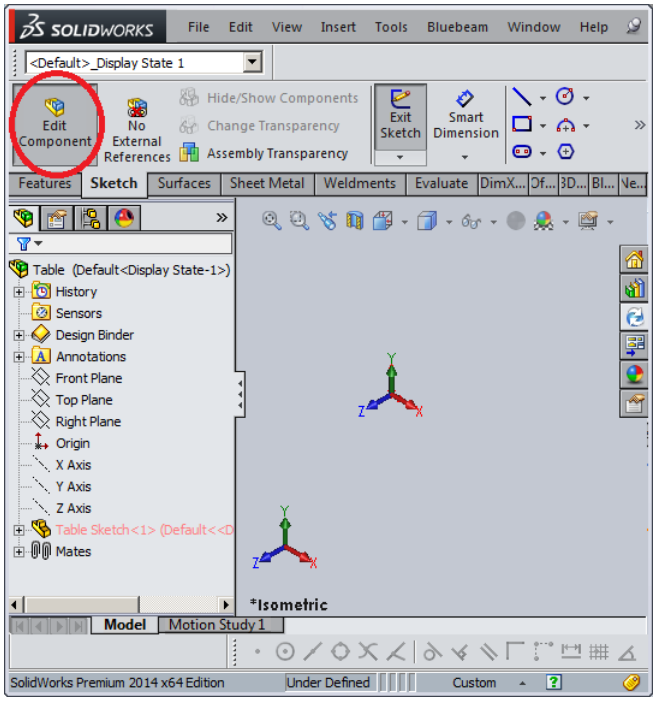
Save the Skeleton Sketch Part as Table Sketch

Figure 1.5: Save Sketch Part



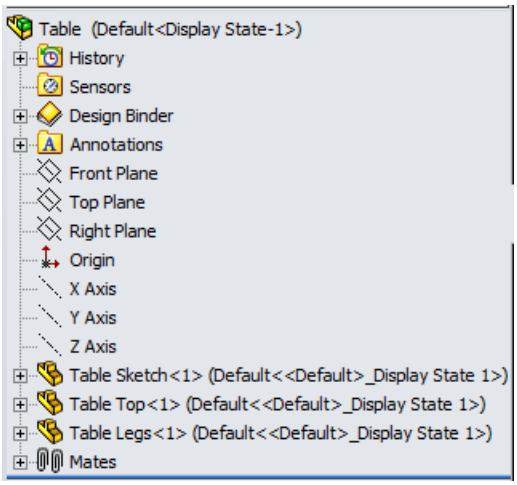
Click on the Front Plane to fix the sketch part in place

Figure 1.6: Fix Sketch



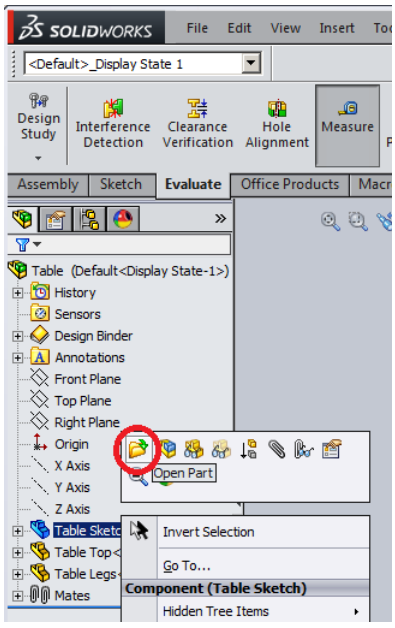
Click the Edit Component icon to exit out of editing the SSP

Figure 1.7: Exit Edit Component



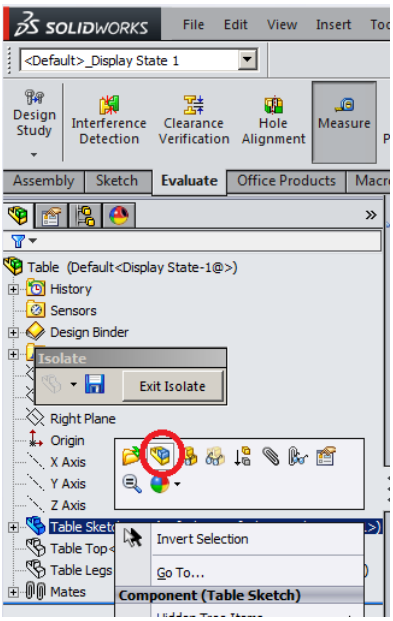
Repeat the above steps to insert the Table Top and Table Legs parts. Make sure that the Skeleton Sketch Part is always at the top of the feature tree. The SSP will always be driving the parts.

Figure 1.8: Assembly Feature Tree



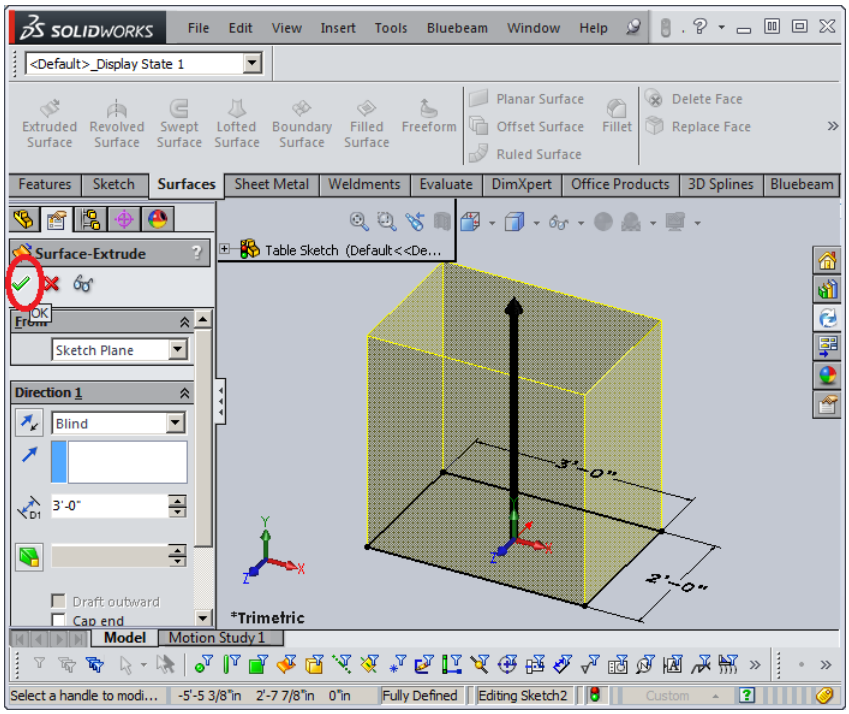
Right Click on the SSP in the Feature Tree and choose .

Figure 1.9: Open SSP



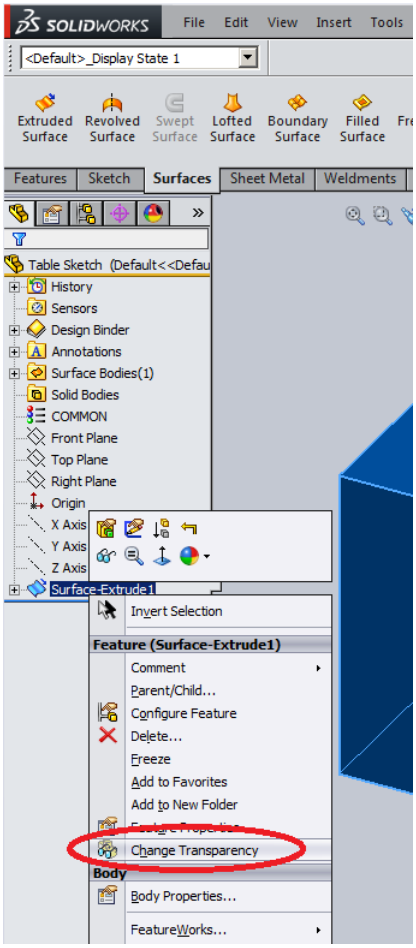
Right Click on the SSP in the Feature Tree and choose Edit Part.

Figure 1.10: Isolate SSP



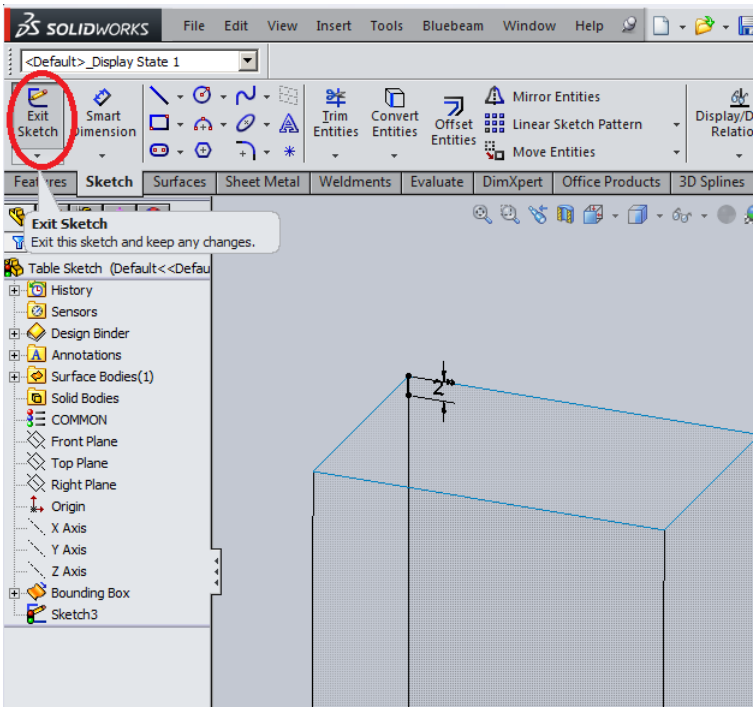
Draw a 3' x 2' rectangle on the Top Plane and fully define it then Extrude Surface to create the bounding box for the Table.

Figure 1.11: Extrude Bounding Box Surface



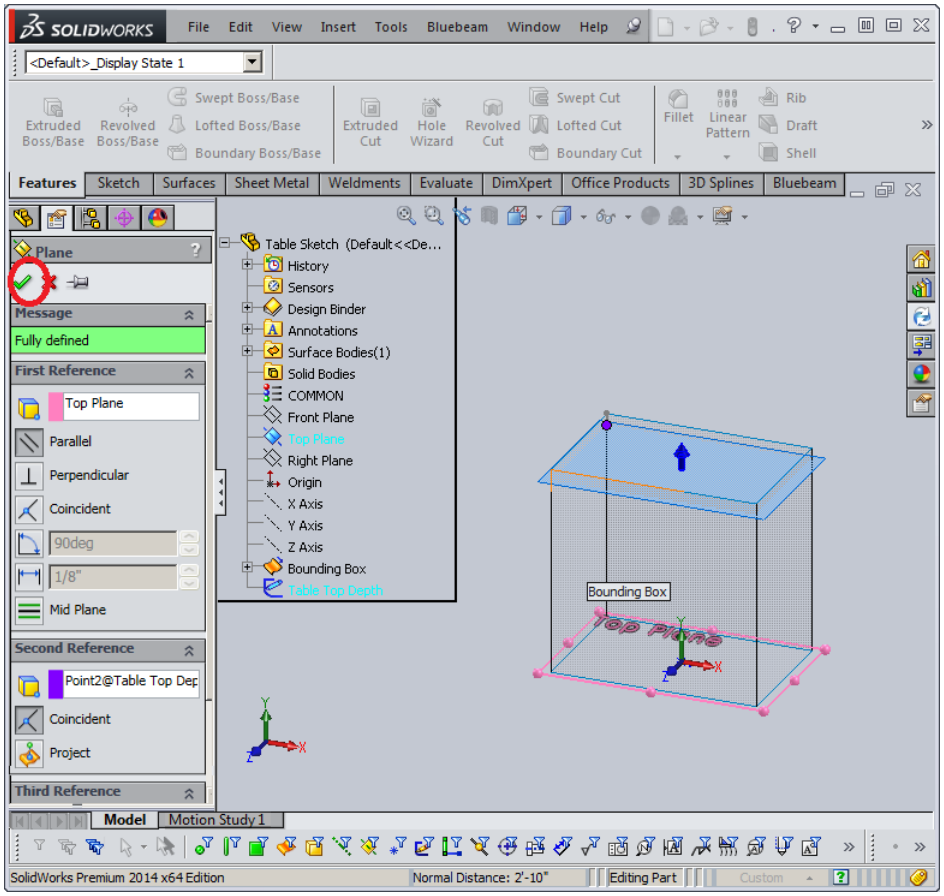
Right Click on the newly created surface and select change transparency. To select any of the surfaces in the future, use the Shift Key and Right Click to select transparent faces.

Figure 1.12: Change Bounding Box Transparency



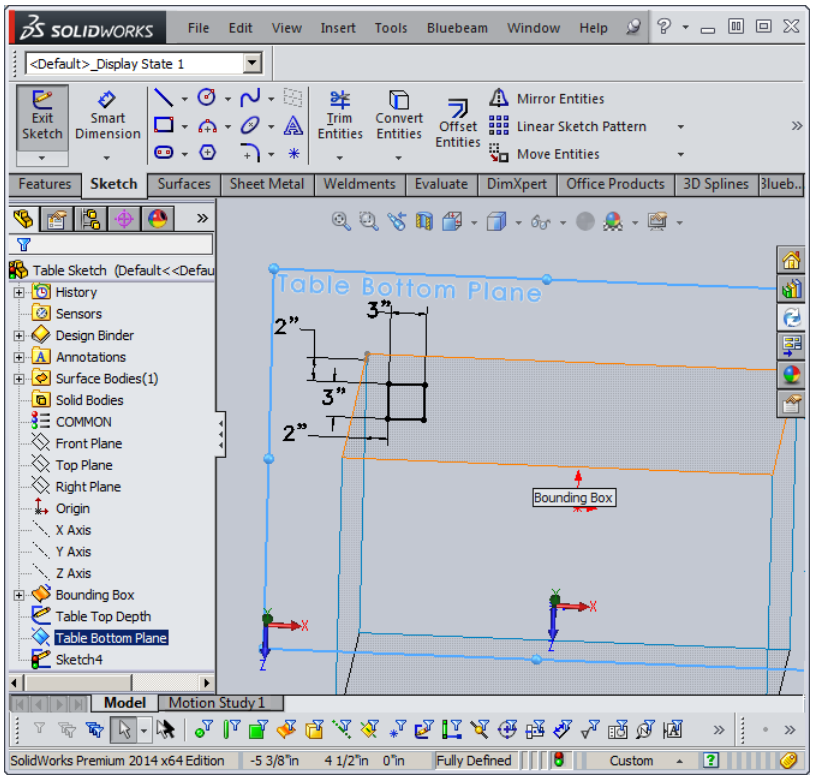
Create a sketch on the back plane of the bounding box and draw a 2" line from one of the corners down. Rename the sketch to Table Top Depth.

Figure 1.13: Create Table Top Depth Sketch



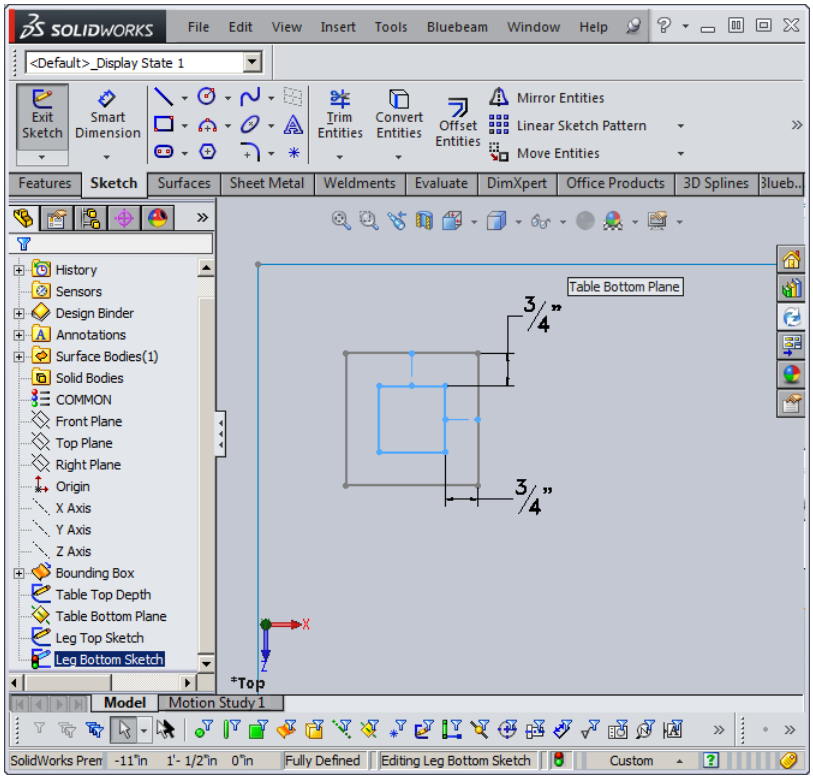
Using the Top Plane and the bottom point of the Table Top Depth Sketch, create a reference plane and name it Table Bottom Plane

Figure 1.14: Create Table Bottom Plane



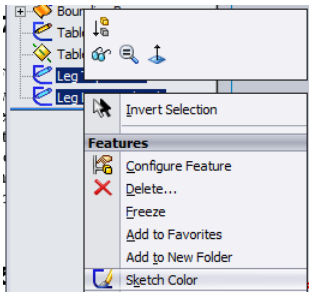
Create a sketch on the back plane of the bounding box and draw a 2" line from one of the corners down. Rename the sketch to Table Top Depth.

Figure 1.15: Create Leg Top Sketch



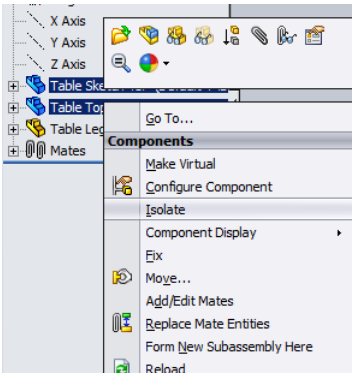
Create the bottom leg sketch on the top plane, making sure to center it on the Leg Top Sketch.

Figure 1.16: Create Leg Bottom Sketch



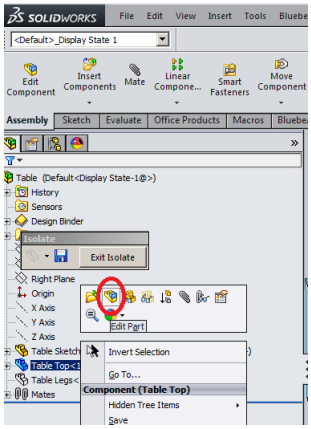
Select both the Leg Top Sketch and Leg Bottom Sketch and Right Click and select Sketch Color and change those sketch colors to green.

Figure 1.17: Change Leg Sketches Color



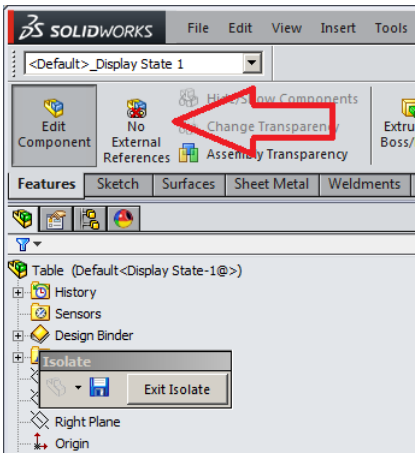
Save and Close SSP. Right Click the Table Top and Table Sketch and Choose Isolate

Figure 1.18: Close SSP. Isolate SSP and Table Top



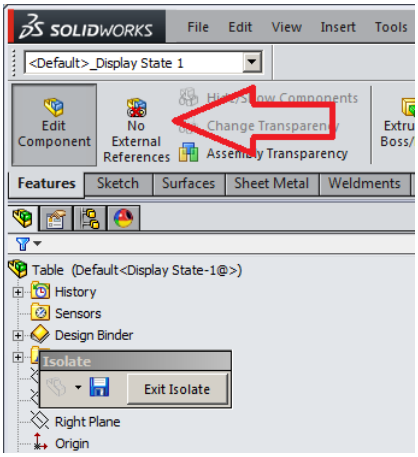
Right Click the Table Top in the Feature Tree and choose Edit Part

Figure 1.19: Edit Table Top



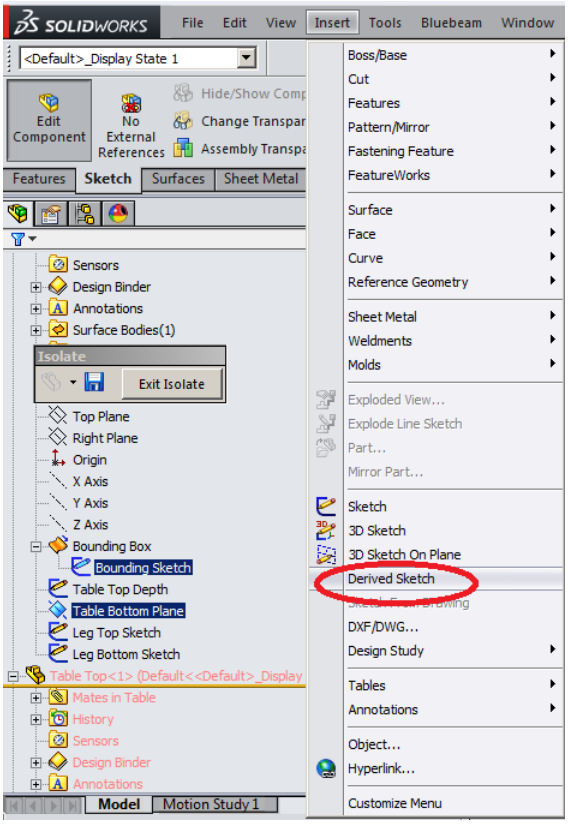
Make sure No External References is not selected. We want external references.

Figure 1.20: Set No External References is Turned Off



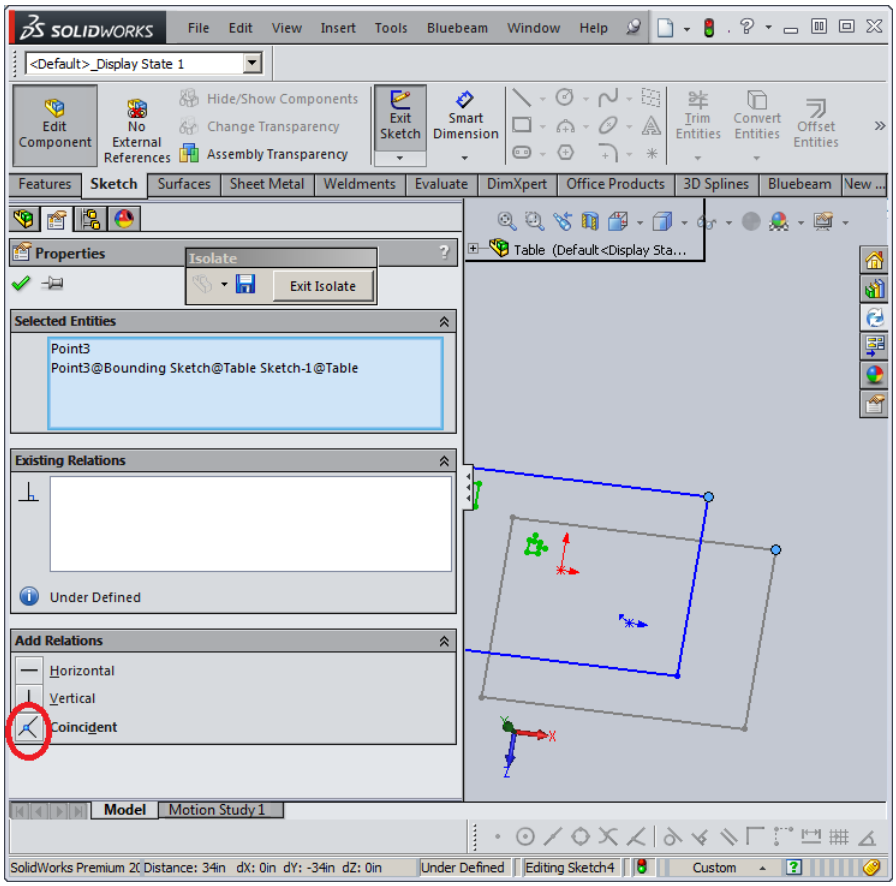
Make sure No External References is not selected. We want external references.

Figure 1.21: Set No External References is Turned Off



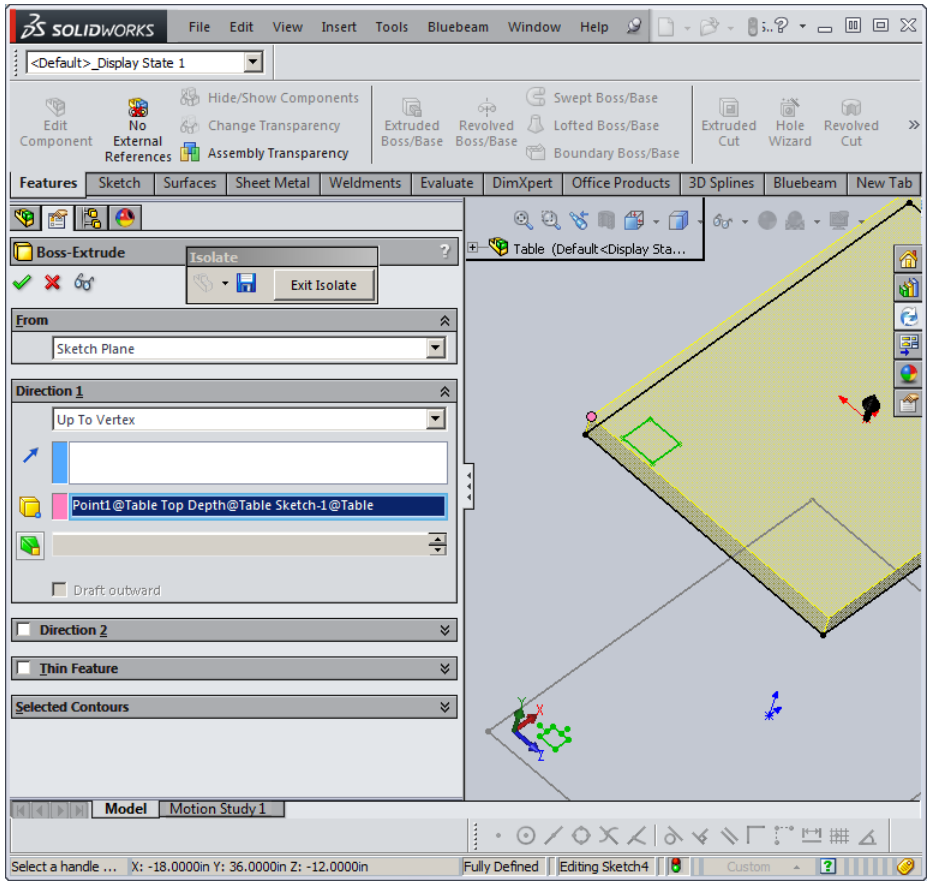
Expand the Feature Tree in the Skeleton and select the Bounding Box Sketch and the Table Bottom Plane

Figure 1.22: Derive Sketch From Skeleton



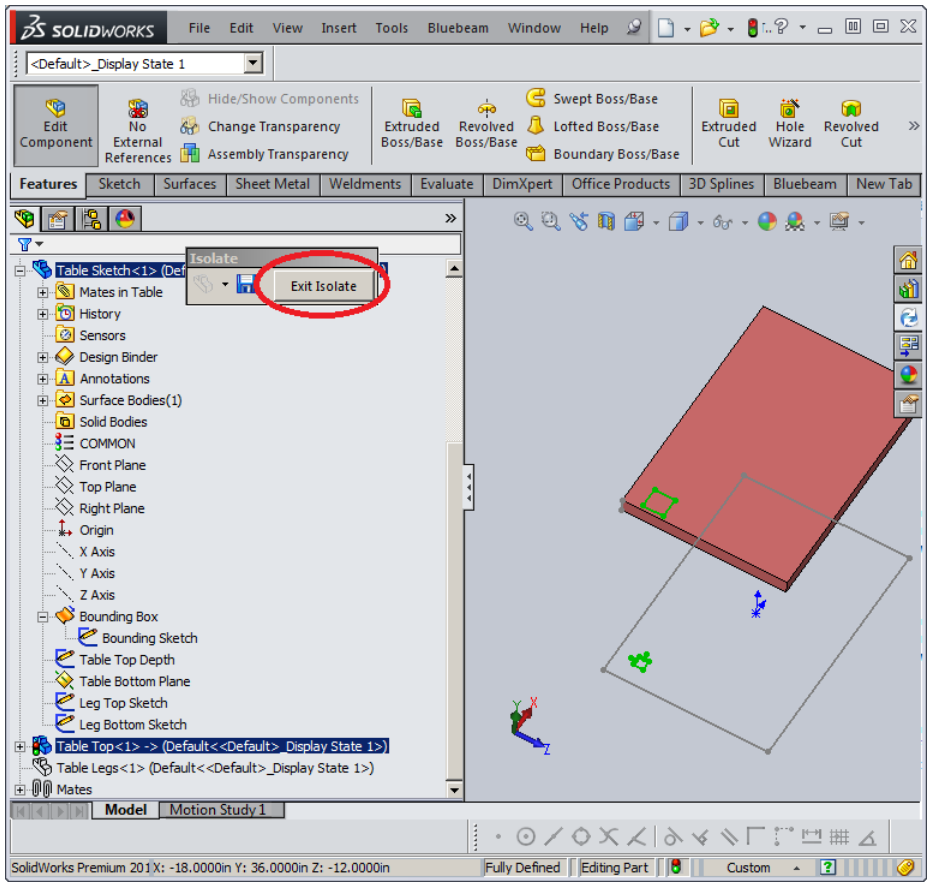
Derived Sketches keep the geometry from which they are derived, but have to be fully defined. Fix two points in the sketch to Skeleton Bounding Box Sketch.

Figure 1.23: Fully Define Derived Sketch



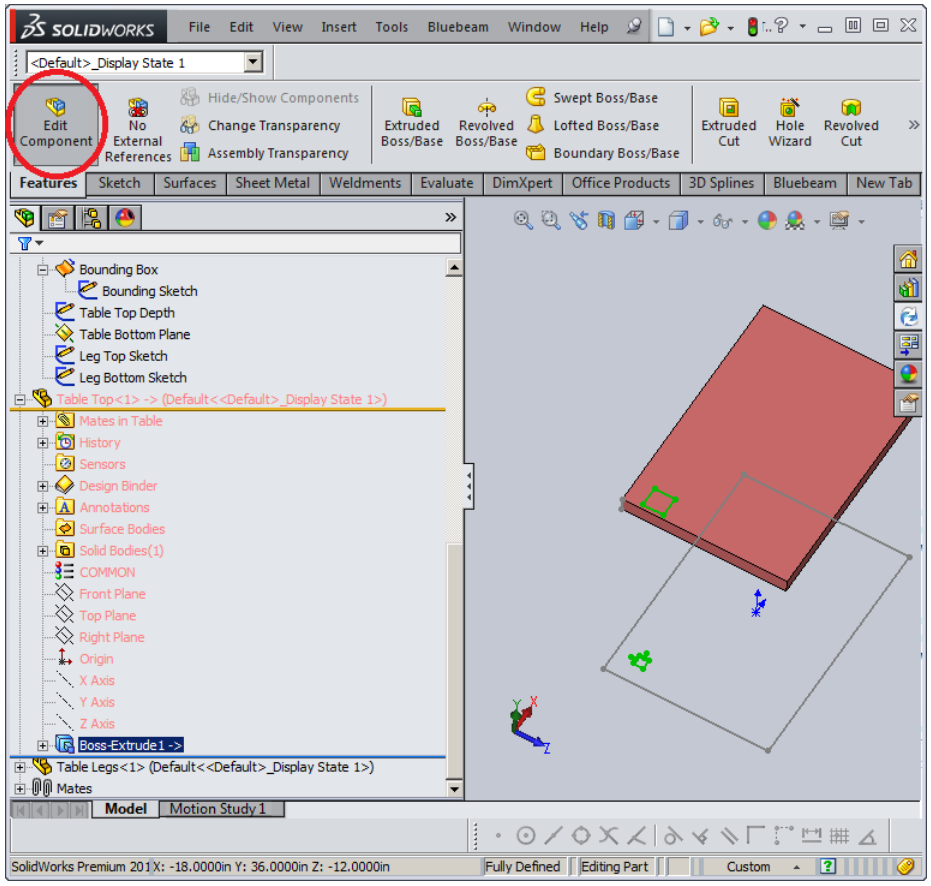
Extrude the Table Top to the Vertex in the Skeleton Sketch as shown

Figure 1.24: Extrude Table Top



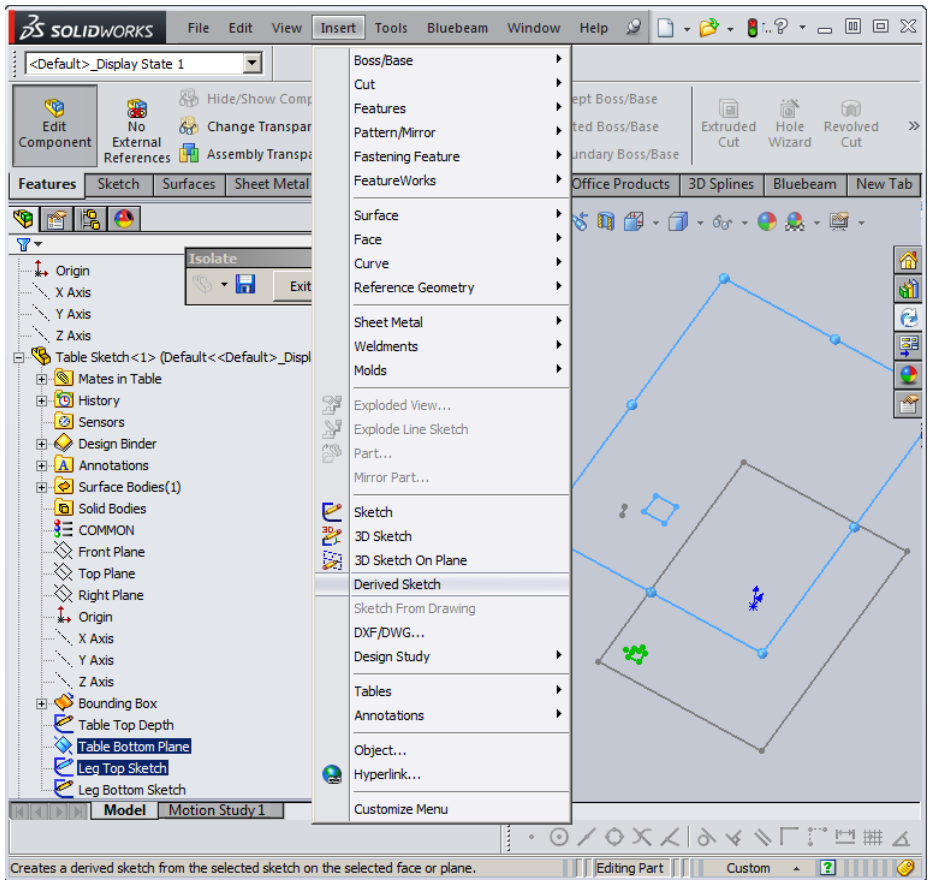
Exit Out of the Isolate

Figure 1.25: Exit Isolate



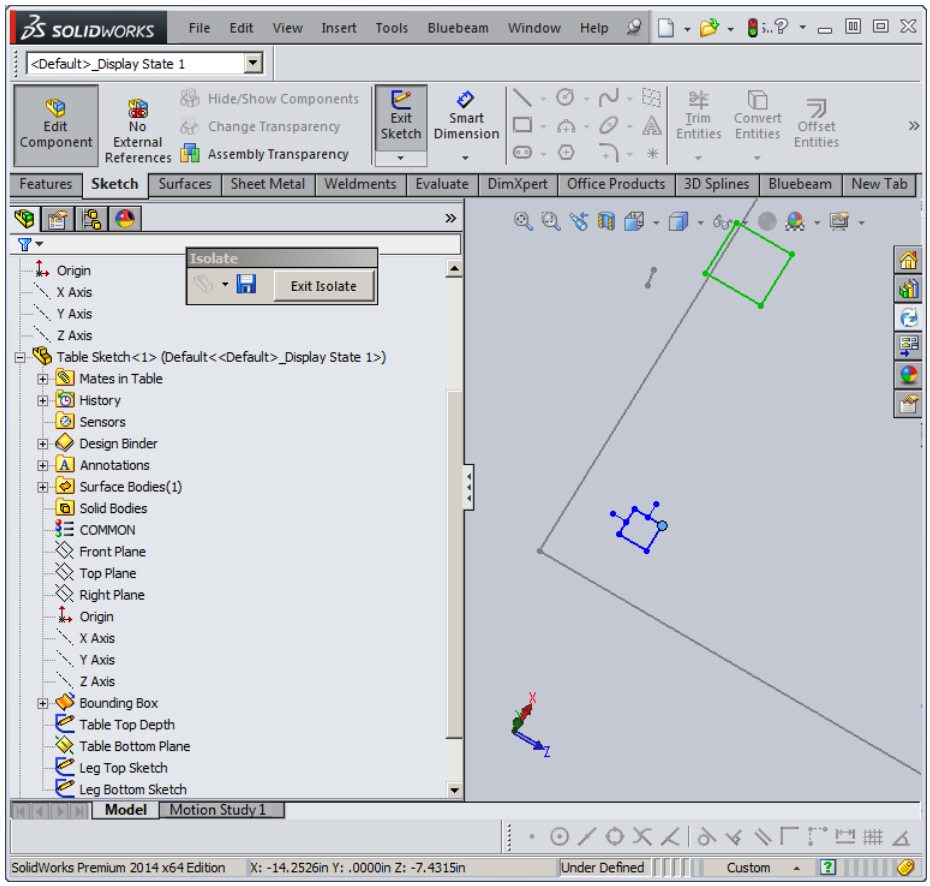
Exit out of editing the Table Top

Figure 1.26: Exit Edit Table Top



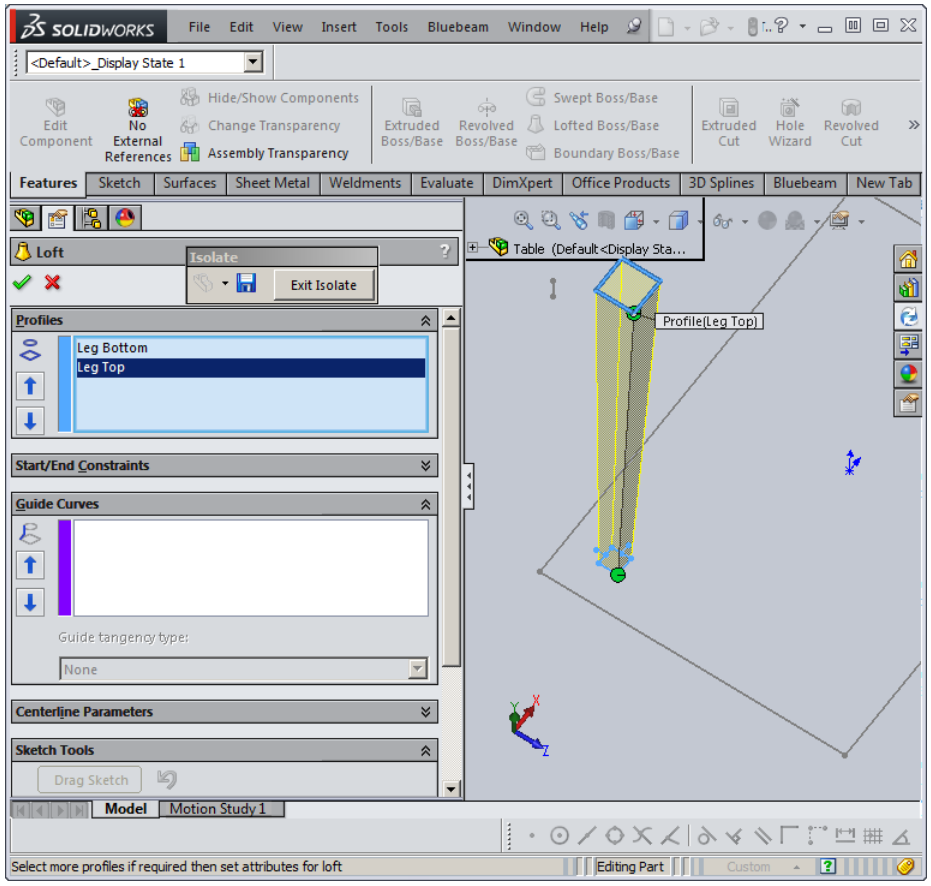
Isolate the Table Leg and Table Sketch as above. Edit the Table Legs as above. Select the Table Bottom Plane and the Leg Top Sketch and create a derived sketch. Make sure to fully define it before closing the sketch.

Figure 1.27: Edit Table Leg Top



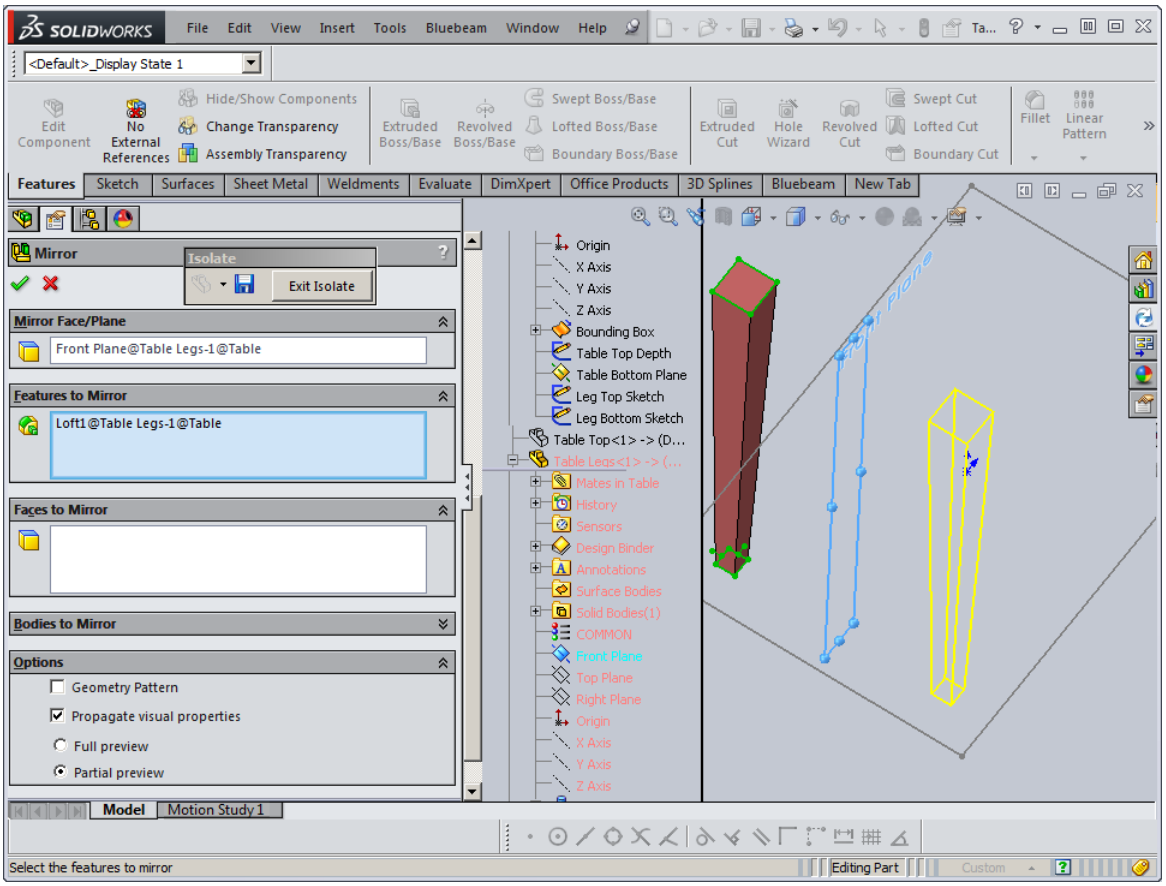
Select the Top Plane and the Leg Bottom Sketch in the Skeleton and create a derived sketch. Make sure to fully define it before closing the sketch.

Figure 1.28: Edit Table Leg Bottom



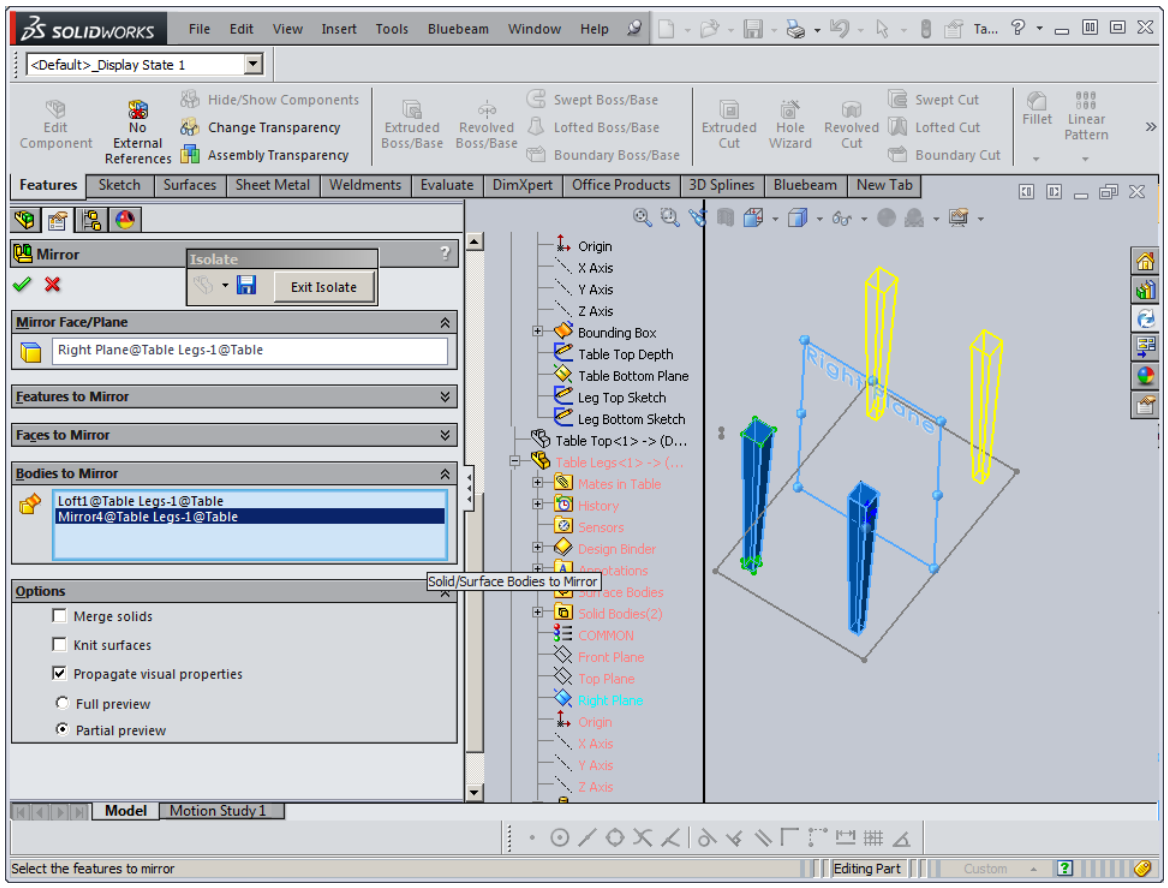
Expand out the Feature Tree in the Table Legs Part. Rename the Sketches to Leg Top and Leg Bottom. Then create a loft between the two sketches.

Figure 1.29: Create Table Leg



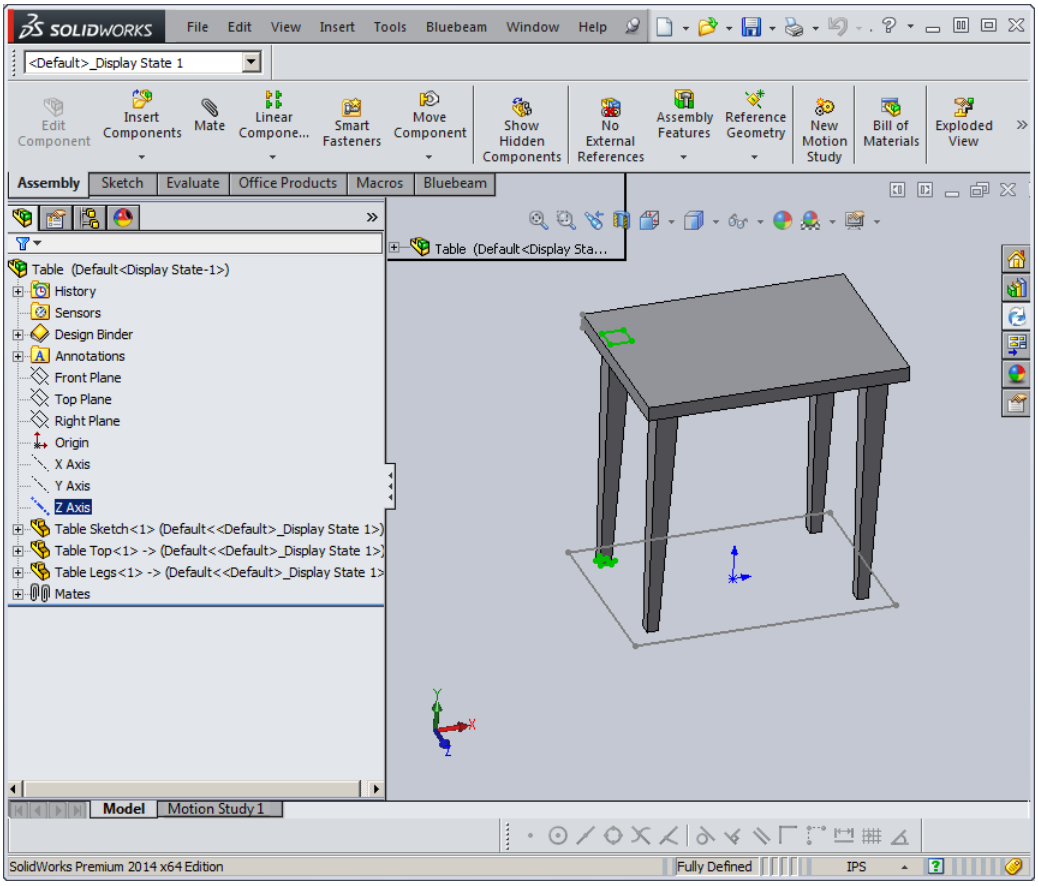
Mirror the Leg about the Front Plane in the Table Legs Part, make sure to use the Bodies to Mirror and unselect Merge Solids

Figure 1.30: Mirror The Leg



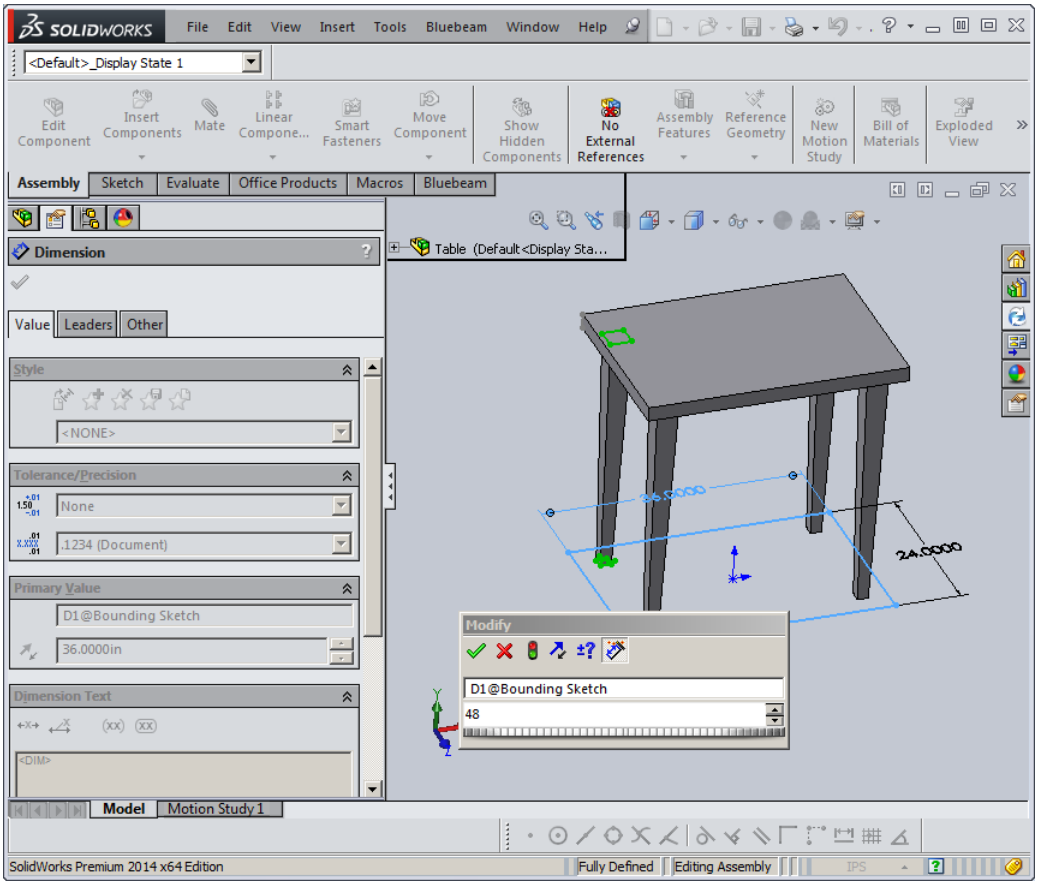
Mirror the Leg and the Mirrored Leg about the Right Plane in the Table Legs Part

Figure 1.31: Mirror The Leg and The Mirror



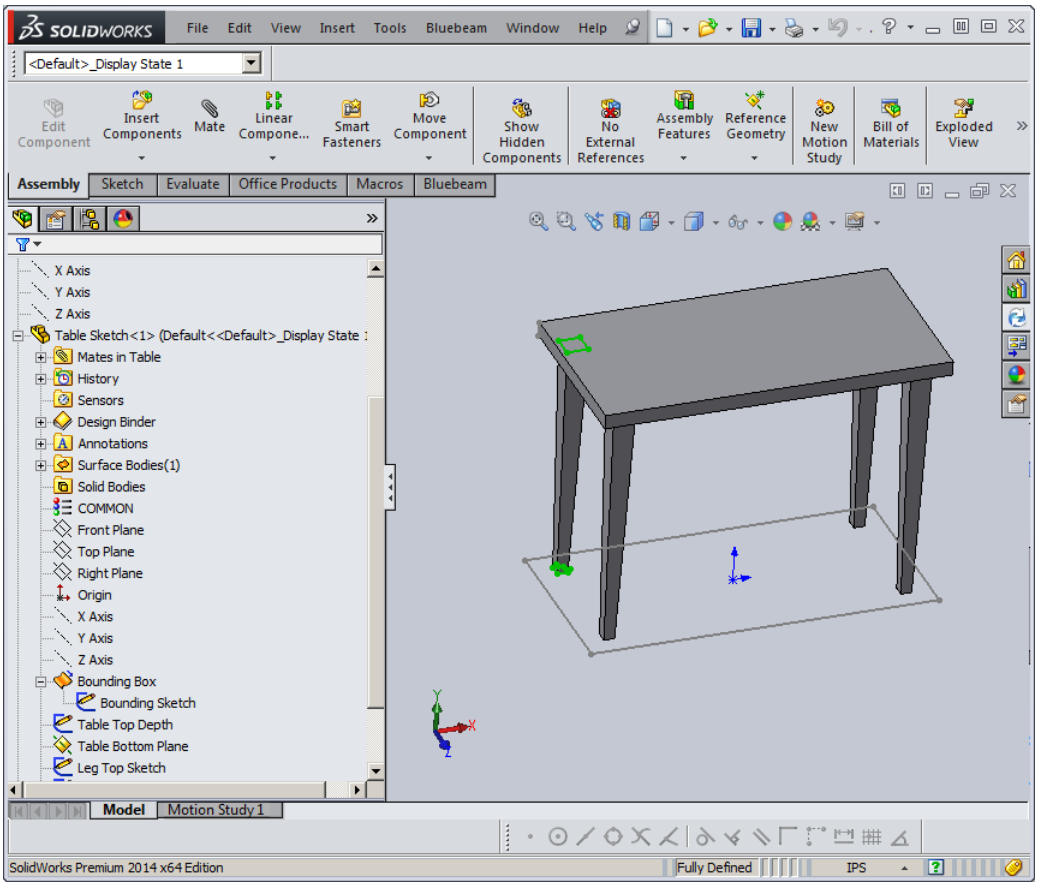
Exit Isolate and Edit Part. The Assembly is now complete.

Figure 1.32: Exit Isolate and Edit Part



Change the 3 foot dimension to 4 foot.

Figure 1.33: Modify Skeleton to See Results



Then hit Ctrl B to see the Result

Figure 1.34: Results

1.3 Lessons Learned

1.1 Best Practice Hierarchy of Propagating Sketch Entities When propagating sketches from the skeleton sketches, it is important to consider the most robust method. Each of the three methods available has its advantages and disadvantages. Sketching over existing information is the easiest, but is also the least robust because it isn't linked to the existing information as well as Convert Entities. Convert Entities is "smarter" than sketching over existing entities, but extra steps are required to fully define a Convert Entities sketch. Derived Sketch takes the most work, but fundamental changes to the underlying sketch get propagated to the derived sketch. Try deleting a line in an underlying sketch using either of the other two methods to see what the results will be. So, unless there is a good reason Derived Sketch should be used whenever possible.

Derived Sketch >Convert Entities >Sketching Over Geometry

Figure 1.35: Propagating Sketch Entities Hierarchy

1.2 Best Practice It is best to only drive sketches one level down. If sketches are driven from more than one level up in the assembly it can create confusion and management issues.

1.1 ***Warning!*** The Skeleton Sketch Part must always reside at the top of the feature tree. If it is below something that is dependent on it this will result in something equating to a circular reference. Not following this will result in slow performance and could cause instability.

1.1 Tip Select the SSP and the part to edit and Right Click and select Isolate to eliminate the possibility of editing the wrong part.

1.3 Best Practice Nested parent child relationships should be kept to a minimum.

Chapter 2

Skeleton Sketch Part Intermediate Example

2.1 Overview

To be developed...

2.2 Intermediate Example

To be developed...

Chapter 3

Skeleton Sketch Part Complex Example

3.1 Overview

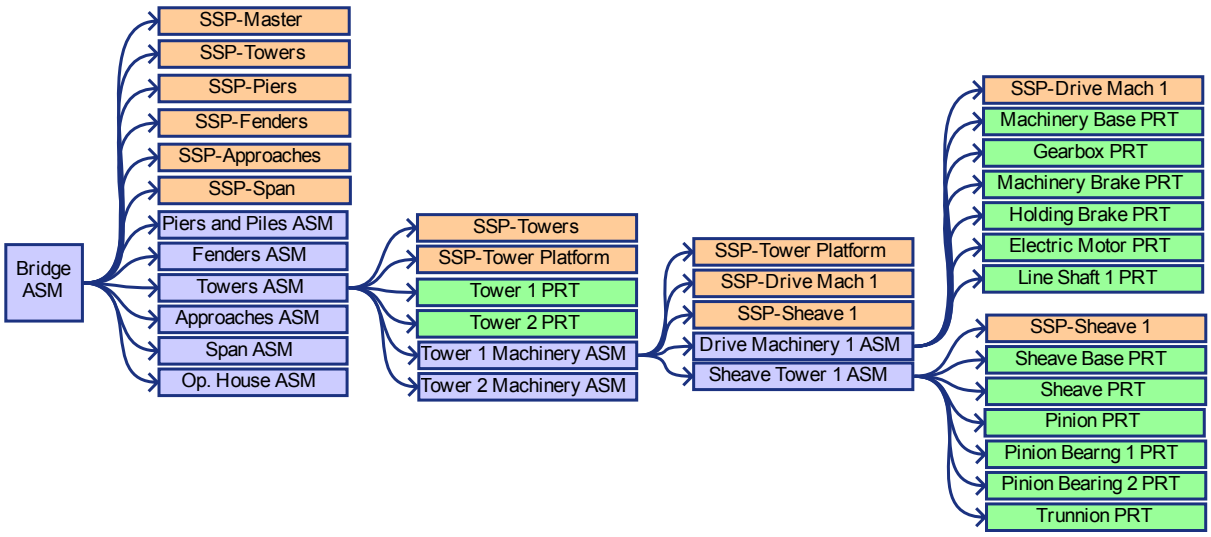
To be developed...

3.2 Vertical Lift Bridge

3.2.1 File Naming Convention

Before proceeding, a file naming convention should be established to make it easier to find assemblies by discipline. We have 4 major disciplines that work on movable bridges, structural, mechanical, electrical and architectural. Therefore, it is broken down by disciplines in Table 3.1.

With the naming convention in mind the a portion of the overall structure of the assembly is broken down in Figure 3.1.



Of special note here is that SSP-Tower will depend on SSP-Master. SSP-Tower Platform will only have dependencies tied to SSP-Tower. This is how 1 level dependencies should be managed.

Figure 3.1: Skeleton Sketch Vertical Lift Bridge Flow Chart

Filename Prefix	**Section**
H.XXXXXX-00-	Bridge Assembly
H.XXXXXX-S1-	Piers and Piles
H.XXXXXX-S2-	Fenders
H.XXXXXX-S3-	Towers
H.XXXXXX-S4-	Approaches
H.XXXXXX-S5-	Movable Span
H.XXXXXX-M1-	Mechanical Assembly
H.XXXXXX-M2-	Tower Deck Machinery
H.XXXXXX-M3-	Sheave Assembly
H.XXXXXX-M4-	Counterweight Rope Assembly
H.XXXXXX-M5-	Skew Selysn Assembly
H.XXXXXX-M6-	Span Lock Assembly
H.XXXXXX-M7-	Buffer Assembly
H.XXXXXX-M8-	Roller Guide Assembly
H.XXXXXX-M9-	Tower Hoist Assembly
H.XXXXXX-M10-	Counterweight Jacking System
H.XXXXXX-M11-	Movable Traffic Barrier
H.XXXXXX-A1-	Operator's House Assembly
H.XXXXXX-A2-	Operator's House Structure
H.XXXXXX-A3-	Operator's House Openings
H.XXXXXX-A4-	Operator's House Storefront
H.XXXXXX-A5-	Operator's House Guardrails
H.XXXXXX-A6-	Operator's House Roofing System
H.XXXXXX-A7-	Operator's House Mechanical
H.XXXXXX-A8-	Operator's House Electrical
H.XXXXXX-E1-	Electrical Assembly
H.XXXXXX-E2-	Electrical Boxes
H.XXXXXX-E3-	Electrical Conduit

Table 3.1: File Naming Convention.