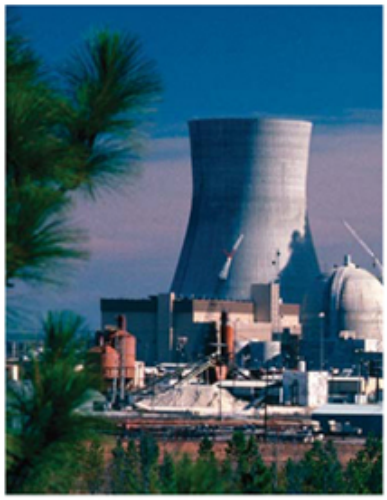
SmartPlant 3D

Tutorials for Electrical

Process, Power & Marine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Session 1: Electrical: An Overview

Objective:

By the end of this session, you will be able to:

- Identify the tasks that can be performed using the **Electrical** task in SP3D.

Prerequisite Session:

- SP3D Overview

Overview:

In SP3D, the **Electrical** task is used to create a three-dimensional (3D) representation or model of various electrical design elements in your plant.

To work in the **Electrical** task, select the **Electrical** option in the **Tasks** menu. Refer to Figure 1. The **Electrical** task consists of tools that allow you to create and modify electrical design elements, such as cable trays, cableways, tray parts, conduits, and cables.

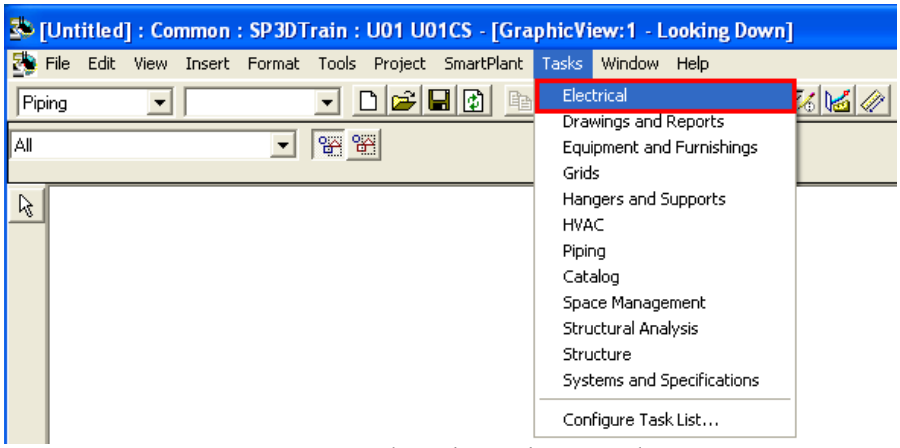


Figure 1: Tasks > Electrical Command

You will learn more about these objects including how to create and modify them in the later sessions.

Common Tasks in the Electrical Environment:

When you are in the **Electrical** environment, you can perform the following tasks by using commands available in the vertical toolbar as shown in Figure 2.

Symbol	Command Name	Function
	Select	Select objects in the model
	Route Cableway	Define new cableways in the model

	Route Conduit	Define conduit runs in the model
	Insert Transition	Place transitions in cableway systems
	Insert Component	Insert electrical components in the conduit and cableway systems
	Auto Connect	Place vertical drop-outs between crossing cableways
	Place Equipment	Place catalog equipments in the model
	Insert Cable	Place cables in the model
	Edit Cable Path	Define the path cables that are in the model
	Insert Cable Marker	Place cable markers at points along cable tray or conduit features
	Insert Split	Divide a length of tray into sections

Figure 2: Electrical Commands on the Vertical Toolbar

- **Create and route cableways**: You can create a new cableway, extend the existing cableways, and route a cableway to or from nozzles and features. You can perform this task by using the **Route Cableway** command on the vertical toolbar.

- The **Multi-Route** tab is used to specify the parameters that multiple cableways need to routed. SP3D supports the routing of multiple cableways, cable tray runs, or multi trays. You can route them in one of two modes: vertical (stacked) or horizontal (side-by-side). To route multi trays, you use the **Route Cableway** button on the vertical toolbar and set the required options on the **Multi-Route** tab of the **New Cableway Properties** dialog box. You simply enter the number of runs above and/or below the master run along with the number of cableways to the left or right of the master run. All the parallel cableways in a vertical arrangement or in a horizontal arrangement have identical properties to those specified in the **New Cableway** dialog box.

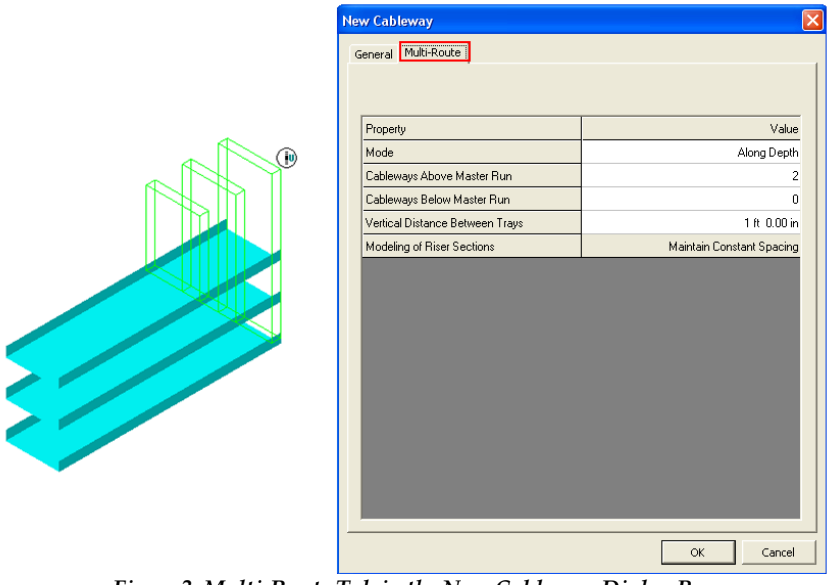


Figure 3: Multi-Route Tab in the New Cableway Dialog Box

- **Two Types of Cableway**:
  - Specification Cableway (Cable Tray)

- Non-Part Specification Cableway

Cableways are reserved space for the cable trays by routing a cross section using a non part specification. SP3D will place cable trays from a part specification at the time of routing cableways. Trays are specified by their width and depth and are placed along the cableway. Part type is dependent upon the cableway feature, size and specification.

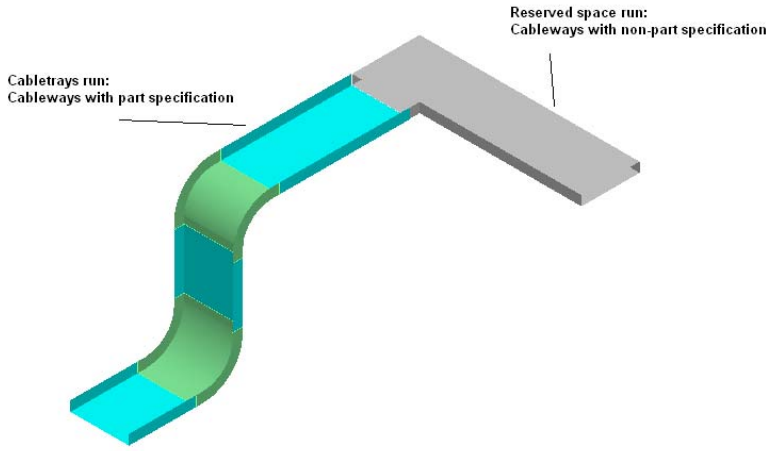


Figure 4: Cableways with Non-Part Specification

- **Create and route conduit runs**: You can create a new conduit run and a branch from a conduit run, extend an existing conduit run, and route a conduit run to or from nozzles and features. You can perform this task by using the **Route Conduit** command on the vertical toolbar.

- **Insert electrical transitions**: You can create cableway transitions by using the **Insert Transition** command. The inserted transition feature modifies the cross-section of a cableway which allows you to change a cableway path to all possible combinations.

- **Insert electrical components in cableway and conduit systems**: You can insert electrical components to create more sophisticated cableway/conduit layouts that divide, branch, and route the cables between equipments. While adding electrical components, SP3D might add necessary mating parts. The **Insert Component** command adds inline components, reducing components, and other components to a cableway/conduit run.

- **Place vertical drop-outs between crossing cableways**: You can model vertical drop-outs with a non-part specification cableway between crossing cableway systems. You can perform this task by using the **Auto Connect** command on the vertical toolbar.

- **Place electrical equipments**: You can select electrical equipments from the SP3D catalog and position them in 3D model. These equipments are referred to as **catalog equipment**. You can perform this task by using the **Place Equipment** command on the vertical toolbar. Electrical equipments can also be modeled directly in the model. In this case a user has to select a type definition from the catalog to determine the property set. These equipments are referred to as **designed equipment**. Both may be composed of

equipment components, ports, and geometric shapes. You need to switch to the **Equipment and Furnishings** task to model designed equipments.

- **Two types of Electrical Equipments**:
  - Catalog Equipment – Catalog Equipment has a predefined values
  - Designed Equipment

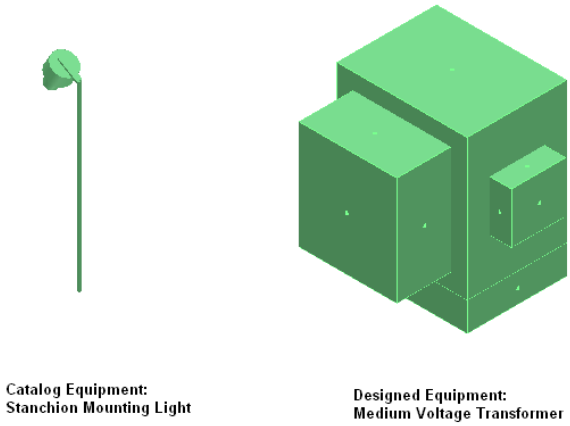


Figure 5: Catalog Equipment and Designed Equipment

- **Add cable objects**: You can create cables and then route those cables through existing conduit and cableway systems. You create cables manually by using the **Insert Cable** command or you can create the cables by retrieving cable data from SmartPlant Electrical (SPEL) using the integrated environment. SPEL is a schematic design application that stores cable schedules. A cable schedule is a list of cables with connectivity information, such as cables connecting two types of equipment like a junction box and an electric motor and the type of cable used to make this connection.

- **Edit cable path**: You can activate auto-routing option, which routes the cable in the shortest path between the starting point and ending point on the cableway. Or, you can manually route the cable. Cables cannot be routed if the "Originating & Terminating Device" does not exist in the model**.** You can perform this task by using the **Edit Cable Path** command on the vertical toolbar.

- **Insert cable marker**: You can place cable markers at points along cable tray or conduit features. After being placed, the cable markers can be used to describe a cable path on a cable-routing report. You can perform this task by using the **Insert Cable Marker** command.

- **Insert splits**: You can divide up a section of tray into the appropriate lengths based upon the catalog data or at whatever location you deem appropriate. If the catalog data is set up to generate them, the **Insert Split** command will model gaps between connecting trays.

The objects with which you work in the **Electrical** environment can be located in a model by using the **Locate Filter** drop-down list in this environment.

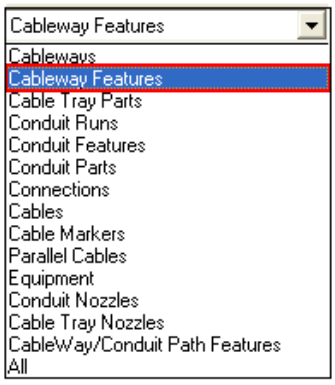


Figure 6: Locate Filter Drop-Down List in the Electrical Task

Electrical systems are a way of organizing electrical objects, such as cableways and conduits, within the System hierarchy of your model and controlling the specifications that can be used within that system, such as conduit, cableway, and cable tray specs. You can create electrical systems in the **Systems and Specifications** task or by right-clicking the objects on the **System** tab in the **Workspace Explorer**. Electrical systems can later be reorganized in the System hierarchy based on your access privileges to the permission groups of the plants. If an electrical system exists in your model, you can route cableways and cable trays and arrange them as children in the System hierarchy.

Before you start modeling, you need to become familiar with the cableway feature model and all the objects that play a role in routing a cableway system. Figure 7 shows a cableway feature model and the relationships between features, which represent a portion of a cableway system.

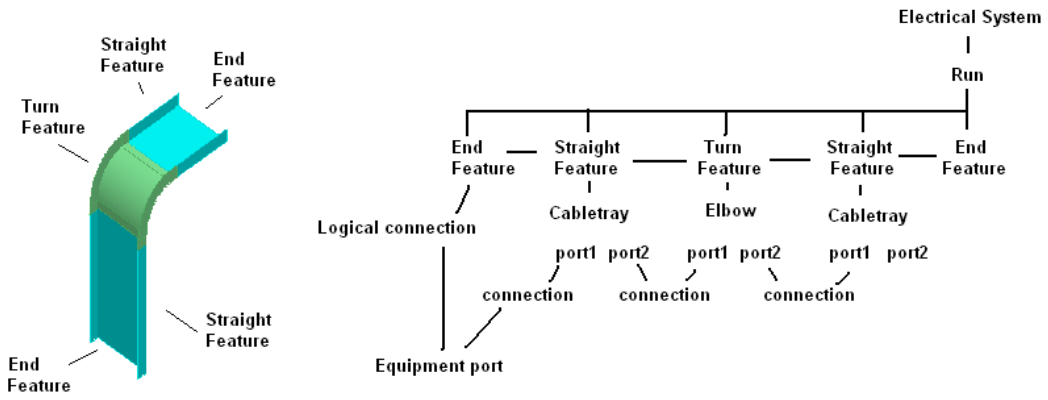


Figure 7: Cableway Feature Model

A cableway feature model would generally consist of the following components:

- **Electrical System:** An electrical system is a way of organizing cableways within the system hierarchy and controlling the specifications that can be used within that system. If an electrical system exists in your model, you can route cableways and arrange them as children in the system hierarchy.
- **Run:** is a collector for features and parts and is typically a child to another system in the **Workspace Explorer**. The run typically specifies the default size and design constraints for features that exist as children to the run and the catalog specification from which the

parts are chosen.

- **Feature**: Feature is a child to a run and a parent to a part. It is not displayed in the **Workspace Explorer** because of the ability for a feature to own several parts and one part can be owned by multiple features. When a designer is routing in the SP3D routing environments, they are defining a series of features based on the feature types listed below. It is via a combination of the run data and the feature data that the software selects the purchasable part to be placed in the model. A feature is defined by the data points provided by the designer, and the data points are provided to describe the overall path of the routing. It is via these data points that the feature is further categorized:
    - **Straight Feature –** It is a feature whose path describes a straight line. This feature is defined by two linear data points from a user. Basic geometric principles dictate that two points define a line, thus the result is a straight feature.
    - **Turn Feature –** It is a feature that represents a deviation in a path resulting in a turn. An example would be three data points provided by a user. The first two data points would generate a straight feature. The third data point, if not 'in-line' with the first set, would constitute a deviation in path from the existing straight projection. The result would be a turn feature.
    - **End Feature –** It is a feature that acts as a place holder for future connections to the run. It is located at the end of a run, where a port exists on a part that is managed by the run. So, it is termed an end feature. When an end feature is connected to a run, it is removed and replaced with another feature based on the nature of the addition to the run. However, at conclusion of the routing, a new end feature will exist should the last part have a second port that is still unallocated. Unlike a tee or a cross, an end feature does not exist by default on a third or fourth port.
    - **Transition Feature –** It is a feature whose path is defined by a transition between cross sections or sizes or other defining constraints that result in the first port of the part being fundamentally different from the second port. The result is a feature that must close the gap between these parts.
    - **Branch Feature –** It is a feature whose path is defined by branching, such as a tee or a cross connection. The 3rd and 4th ports of a branch feature will always (by rule) constitute a new run, independent of the header connections.

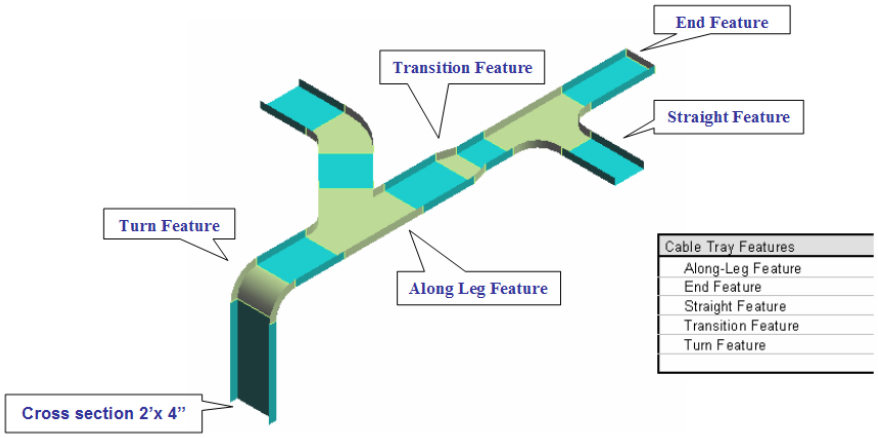


Figure 8: Feature Types

- **Part**: It is a term used to describe a catalog item that has true graphics, as opposed to a feature and a run that are simply managers of the part and skin over the graphics. The part brings with it a catalog basis making it a material item that can be ordered or purchased in most cases and represents a source of information for material take-off reports and the like. However, the selection of the part is primarily an indirect thing, with the designer governing the feature and the run and the part ultimately being selected by the details derived from the feature and the run. Figure 9 shows some examples of tray parts that represent a portion of a cableway system. The highlighted portion in the figure shows a section of the **Workspace Explorer** containing the hierarchy of tray parts.

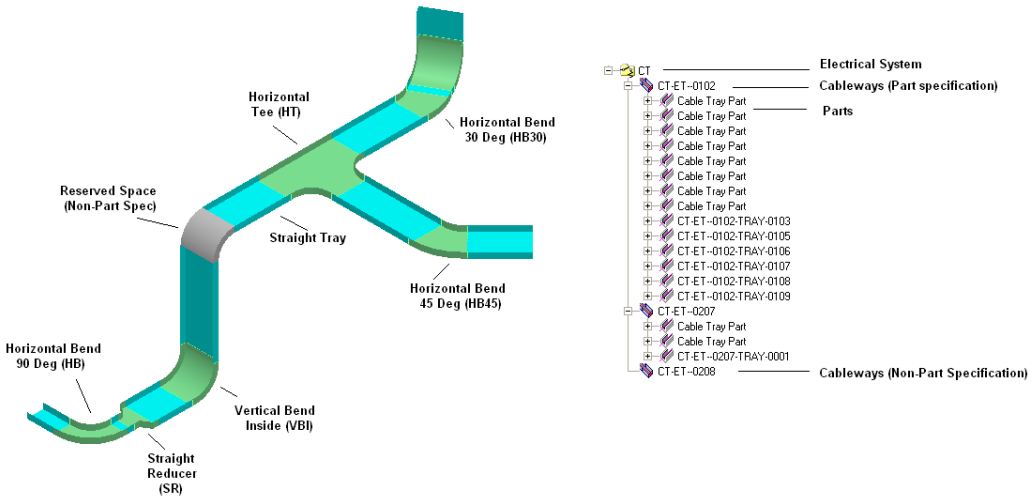


Figure 9: Cableway System Hierarchy

Cardinal Point

When designer defines a data point for routing, this data point lies on the centerline of the cableway profile that is being routed by default. SP3D provides the functionality to route a cableway by the top, sides or bottom of the cableway instead of the cableway centerline. Figure 10 shows the bottom cardinal points with the actual graphical view of the cableway. The same configuration applies to top and side.

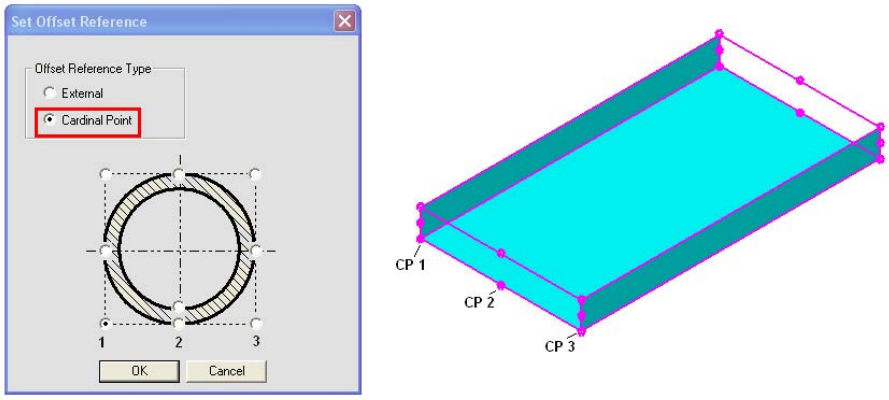


Figure 10: Cardinal Points on a Cable Tray

For more information related to the **Electrical** task, refer to the *Electrical: An Overview* topic in the user guide *ElectricalPrintGuide.htm.*

Quiz:

1. What are the main differences between runs, features, parts, and systems?
2. Which feature type is described by two linear data points?
3. What is a cableway with non-part specification?
4. What is a catalog equipment and designed equipment?

Session 2: Placing Electrical Equipment

Objective:

By the end of this session, you will be able to:

- Place electrical equipment in a model.

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Electrical: An Overview

Overview:

SP3D enables you to place an occurrence of any electrical equipment from the catalog in a model. To place the equipment, you use the **Place Equipment** button on the vertical toolbar.

Figure 1: Place Equipment Button on the Vertical Toolbar

Catalog Equipment

Electrical equipment is a custom assembly that consists of members such as conduit ports, cable ports, geometric shapes, equipment components, etc. You can select electrical equipments from the SP3D catalog and position them in 3D model. These equipments are referred as **catalog equipment.** Catalog equipments are typically driven by properties. The properties can either be fixed to specific values in the catalog, called **Definition Properties** or may be changed after placement in the model, called **Occurrence Properties**. However, the catalog administrator can setup these catalog equipments such that their properties, and dimensions cannot be modify by the user. For example, lighting fixtures are standardized based on the project specification set.

Designed Equipment

Electrical equipments can also be designed directly in the model. In this case you select a type definition from the catalog for the electrical equipment. Type definition determines a set of properties associated with the electrical equipment. Graphical representation of this electrical

equipment is built using primitive shapes defined in the catalog or can also be imported from SAT files or MicroStation files. These equipments are called **Designed Equipment**.

Equipment Catalog Hierarchy

Figure 2 shows all the electrical equipment nodes of the equipment catalog hierarchy.
All these nodes define all the electrical equipment that you can place with the **Place Equipment** command in the **Electrical** task. You need to switch to the **Equipment and Furnishings** task to model designed equipment.

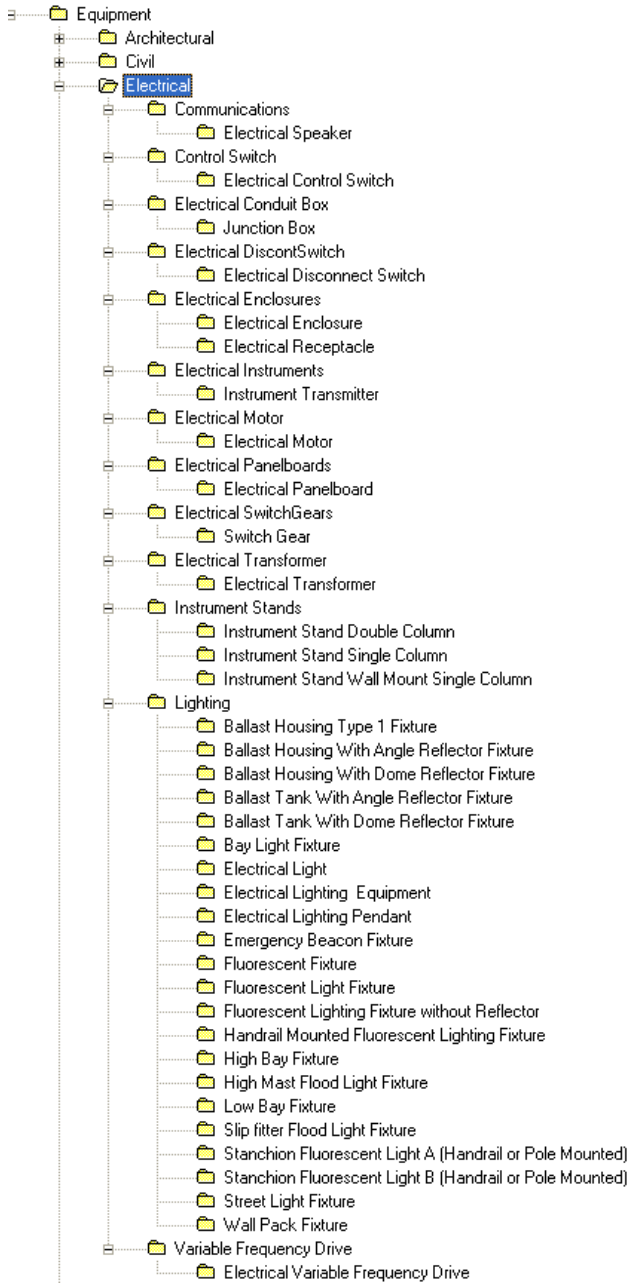


Figure 2: Electrical Equipment Catalog Hierarchy

Place Equipment

The **Place Equipment** ribbon has options to help you graphically position the equipment relative to any other object in the model. When you select equipment object from the catalog, you can identify the geometry of an object in the model so that the software automatically creates a positioning relationship to the geometry of the object that you select. This relationship is called a positioning relationship. If the geometry of an object is not identified by the user during placement then the equipment is placed in free space. Positioning relationships can be created manually by selecting geometry or point on the equipment and other design objects.
The **Place Equipment** command has controls for manipulating positioning relationships.

Figure 3: Place Equipment Ribbon

For example the Connect positioning relationship can be used to precisely locate equipment at certain distance from a steel column surface. The connect relationship forces the origin of the equipment, lighting fixture to be coincident with a point on structure column. Basically, the Connect positioning relationship is an implicit move command.

Notes:

- You can press the left and right arrow keys to rotate the equipment by 90-degree increments at any time during the placement of the equipment. Press the up arrow key to scroll through the three possible axes of rotation.

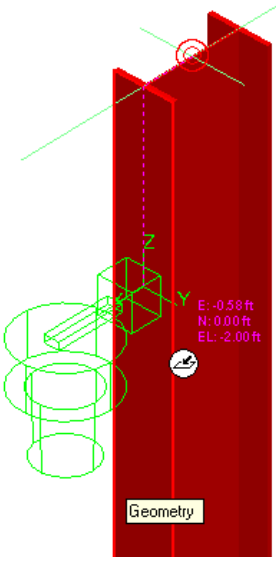


Figure 4: Connect Positioning Relationship

- If you are planning to create positioning relationships among the electrical equipment and design objects in the model, ensure you select the appropriate positioning relationship. You might end up positioning the electrical equipment, as shown in Figure 5.

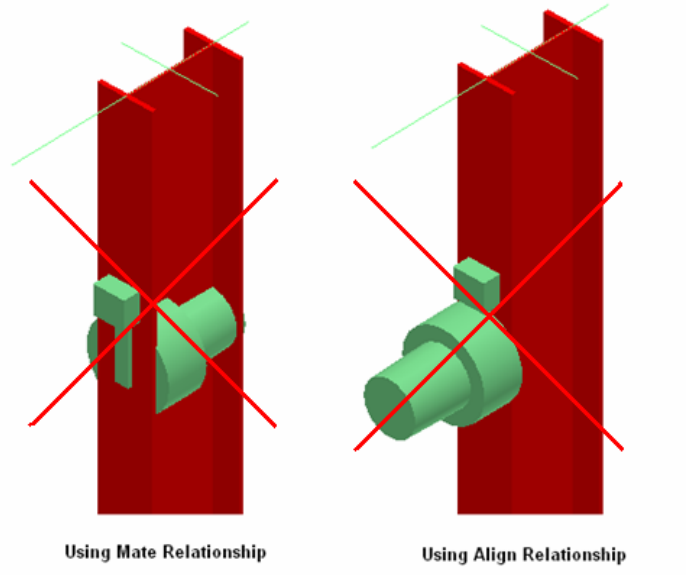


Figure 5: Mate and Align Positioning Relationship

Steps for Placing Electrical Equipment Using Coordinates:

Place three wall mounted electrical lights, **EL-U03-1**, **EL-U03-2, and EL-U03-3** from the SP3D catalog in Area **A2**, Unit **U03** by using the **Place Equipment** button on the vertical toolbar. Position and orient these catalog equipments in the model by using the **Position and Orientation** properties. The placed wall mounted electrical lights will look like the highlighted area in Figure 6.

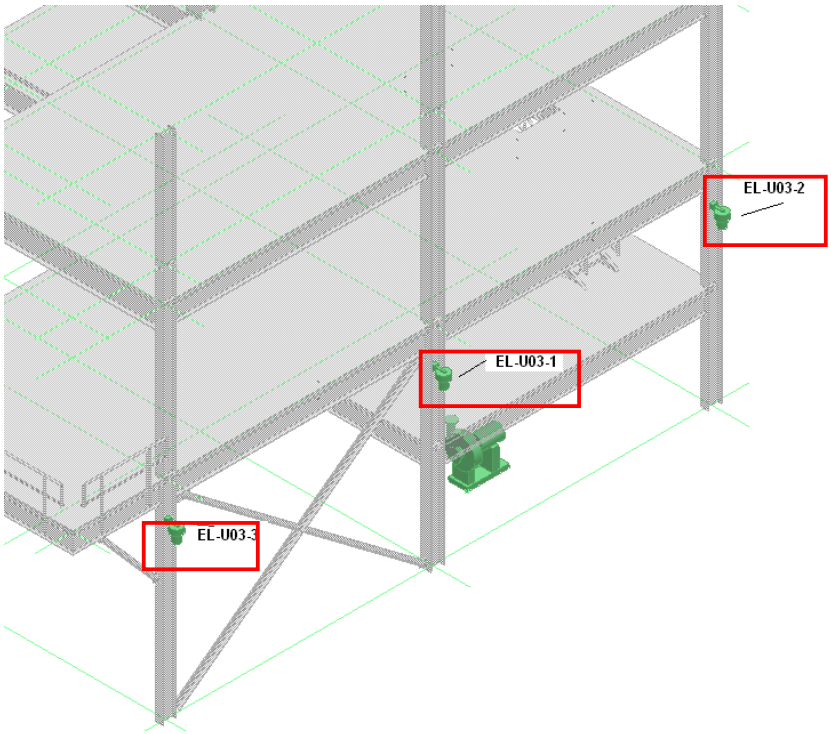


Figure 6: Wall Mounted Electrical Lights

Define your workspace to show Unit **U03** and coordinate system **U03 CS**.

1. If you are not in the **Electrical** task, then select the **Tasks > Electrical** command.

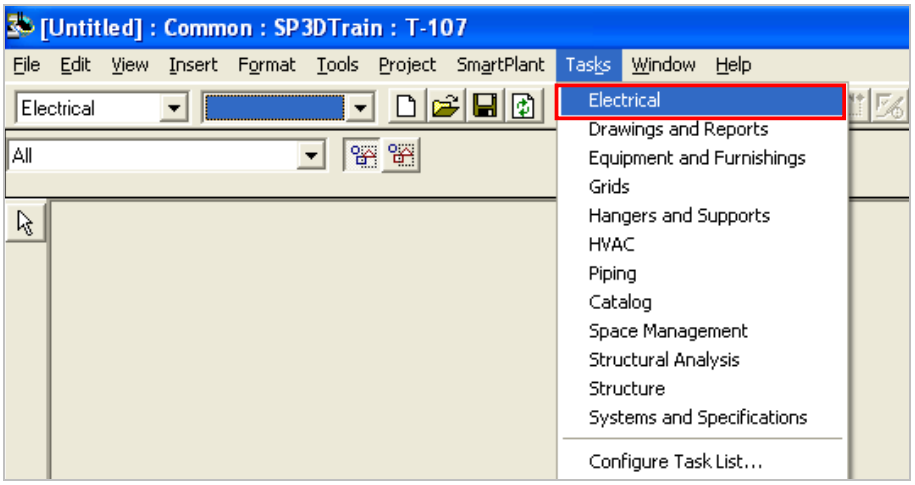


Figure 7: Tasks > Electrical Command

2. In the Active Permission Group drop-down list, select the **Electrical** option**.**

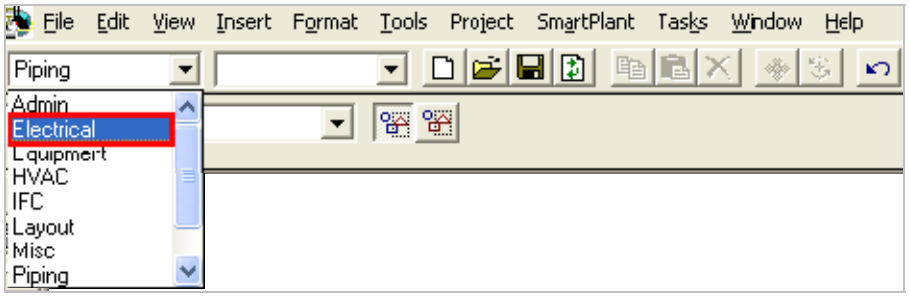


Figure 8: Active Permission Group: Electrical

3. Activate the **PinPoint** ribbon by using the **Tools > PinPoint** command.

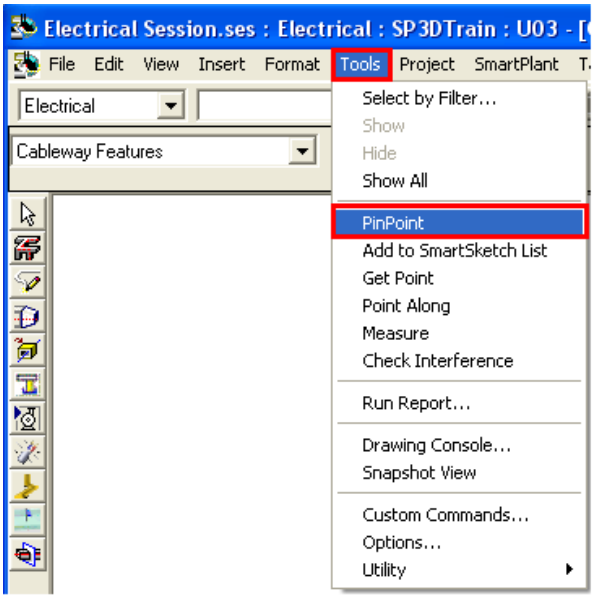


Figure 9: Tools > PinPoint Command

4. Set the active coordinate system to **U03 CS** in the **Coordinate system** drop-down list on the **PinPoint** ribbon.

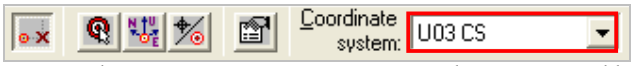


Figure 10: Coordinate System Drop-Down List on the PinPoint Ribbon

5. To move the target to the origin of the current coordinate system, select the **Set target to Origin** button on the **PinPoint** ribbon.

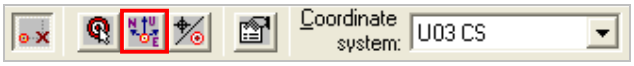


Figure 11: Set Target to Origin Button

Note:

- Selecting the **Set target to Origin** option on the **PinPoint** ribbon changes the 0 target basis for the **PinPoint** command.

6. Click the **Place Equipment** button on the vertical toolbar.

Figure 12: Place Equipment Button on the Vertical Toolbar

7. The **Select Equipment** dialog box appears. In the **Select Equipment** dialog box, expand the folder **\Equipment\Electrical\Lighting\Electrical Lighting Equipment** until you see the part **ElectricalEquip01-E**. Select **ElectricalEquip01-E** and click **OK**.

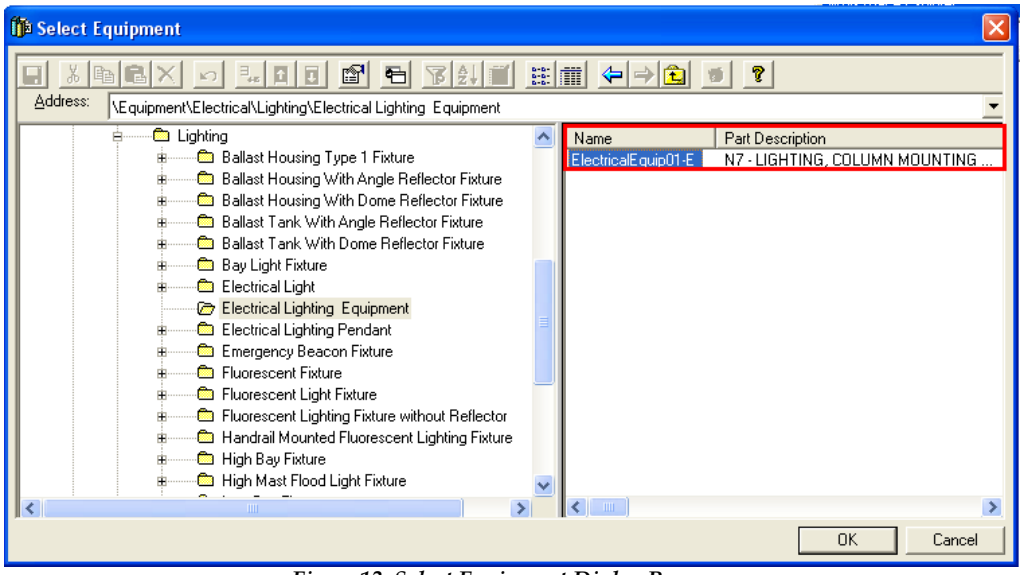


Figure 13: Select Equipment Dialog Box

8. The **Equipment Properties** dialog box appears. In the dialog box, change the name of the equipment by typing **EL-U03-1** in the **Name** field.

9. Change the system to **Equipment** by clicking the **More…** option and selecting **A2 > U03 > Equipment.**

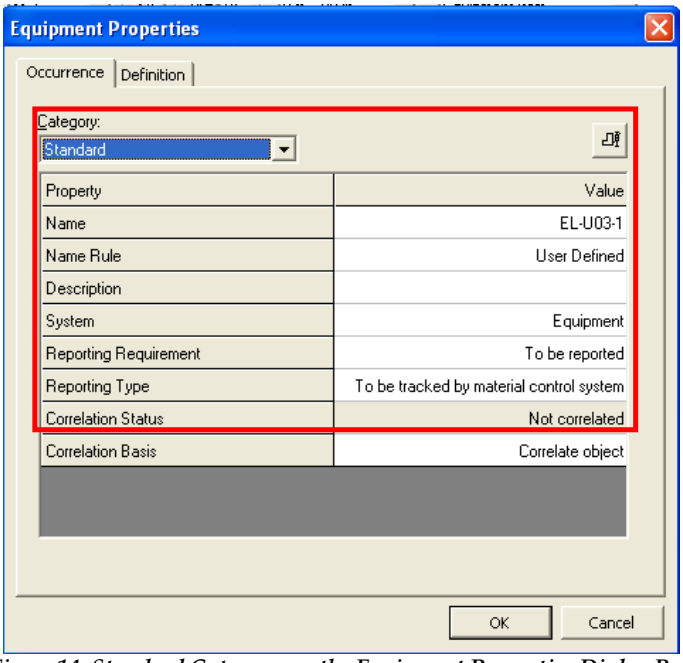


Figure 14: Standard Category on the Equipment Properties Dialog Box

10. In the **Category** drop-down list on the **Occurrence** tab, switch to the **Position and Orientation** category and key in the following properties:

    East: 31 ft
    North: -0ft 0.23in
    Elevation: 14 ft
    Bearing: 180 deg

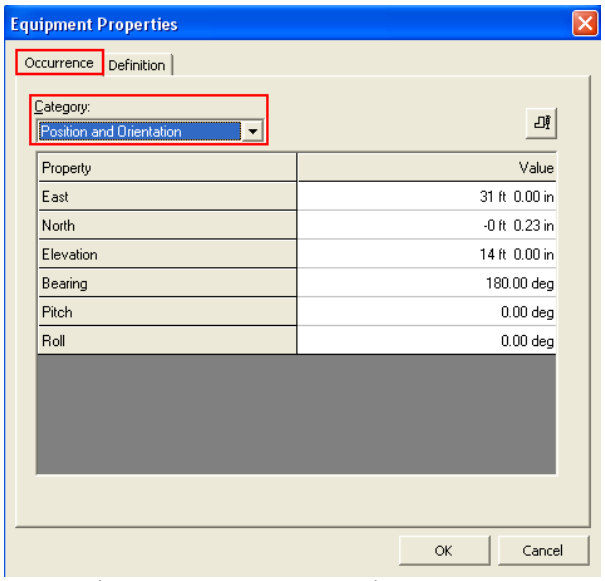


Figure 15: Position and Orientation Category on the Equipment Properties Dialog Box

Tip:

- You can click the  **Preview Button** to view an image of the selected part. To view the image, the image file must be assigned to the part in the reference data. You can also see the dimensional characteristics of the parametric symbol by clicking this button after you key in the specifications.

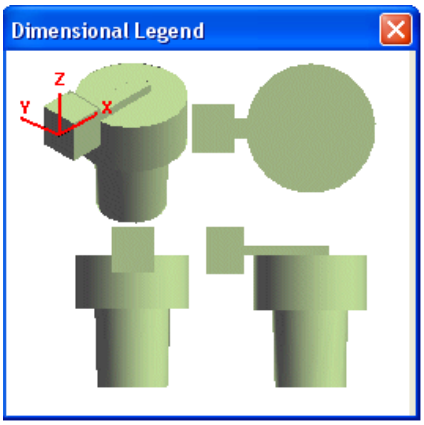


Figure 16: Preview - Dimensional Legend

11. Click **OK** to place the electrical light **EL-U03-1**. The output should now resemble Figure 17.

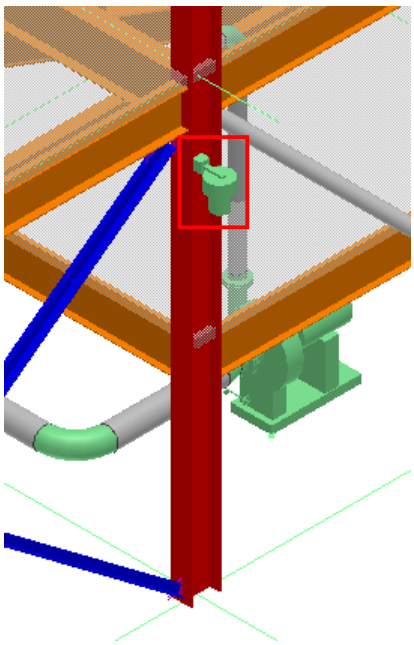


Figure 17: Electrical Light EL-U03-1

Similarly, you can the place the other electrical lights **EL-U03-2** and **EL-U03-3** by using the following specifications:

EL-U03-2:
Position and Orientation:
East: 55 ft
North: -0 ft 0.23 in
Elevation: 14 ft
Bearing: 180 deg

EL-U03-3:
Position and Orientation:
East: 8 ft
North: -0 ft 0.23 in
Elevation: 14 ft
Bearing: 180 deg

Steps for Placing Electrical Equipment by Positioning Relationships:

Place a stanchion mounting electrical light, **ESML-U03-1** from the SP3D catalog in Area **A2**, Unit **U03** by using the **Place Equipment** button on the vertical toolbar. Position and orient the stanchion mounting electrical light in the model by using **Mate Positioning Relationship** and the SmartSketch service. The placed stanchion mounting electrical light will look like the highlighted area in Figure 18.

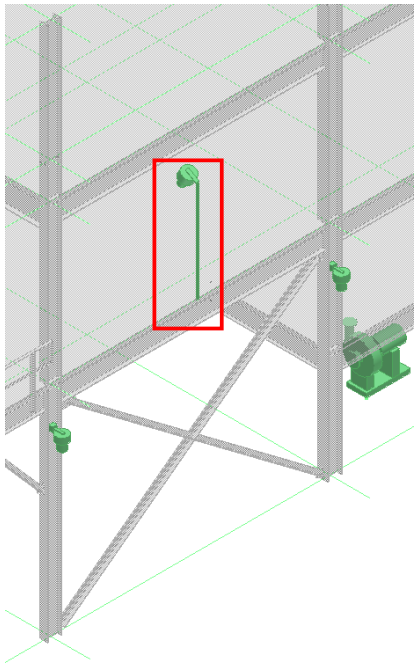


Figure 18: The Placed Stanchion Mounting Electrical Light

Before beginning the procedure for placing electrical equipment by positioning relationships:

- Define your workspace to include all objects located in **Unit U03** system and the coordinate system **U03 CS**. Also select the **Tasks > Electrical** command if you are not in the **Electrical** environment. Familiarize with the objects in the Unit U03 system by using

the **Workspace Explorer**.

- Make sure the Active Permission Group is set to **Electrical**.

1. Activate the **PinPoint** command by clicking the **PinPoint** button on the Common toolbar and set the active coordinate system to **U03 CS** in the **Coordinate system** drop-down list.

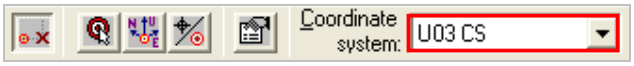


Figure 19: Coordinate System Selected

2. To move the target to the origin of the current coordinate system, select the **Set target to Origin** button on the **PinPoint** ribbon.

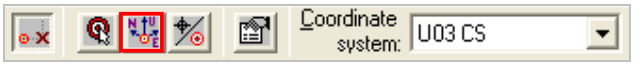


Figure 20: Set Target to Origin Button

3. Select the **Add to SmartSketch List** button on the Common toolbar. This ribbon has SmartSketch options that help you locate precision points of design interest on geometry in the model.

Figure 21: Add to SmartSketch List

4. The **Add to SmartSketch List** ribbon appears.

Figure 22: Add SmartSketch List Ribbon

5. Select SmartSketch option icon on **Add to SmartSketch List** ribbon to display the **SmartSketch Properties** dialog box.

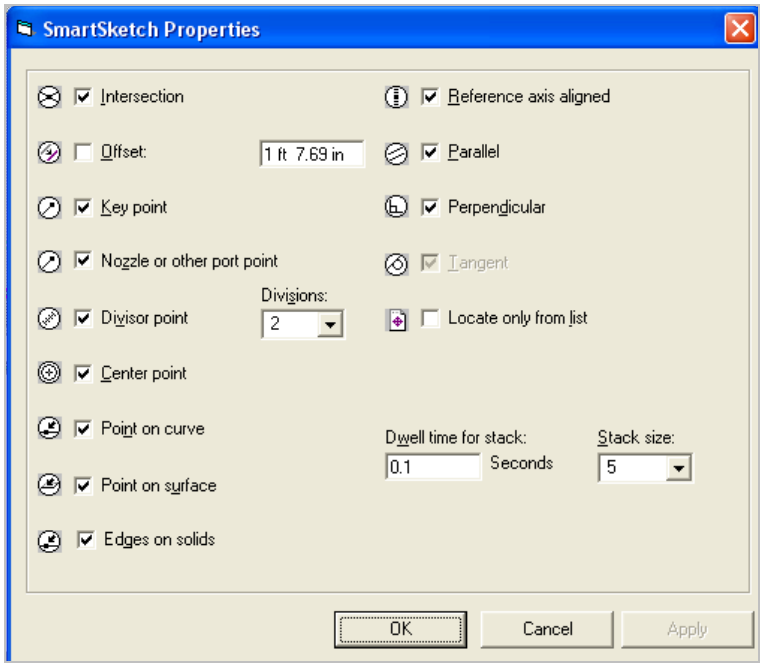


Figure 23: The SmartSketch Properties Dialog Box

6. Check the **Edges on solids** and **Point on surface** options in the **SmartSketch Properties** dialog box.

7. Click **OK** so that you can locate edges on a solid object such as structure members, walls, and slabs.

8. Click **Finish** to close the **Add to SmartSketch List** ribbon.

9. Click the **Place Equipment** button on the vertical toolbar.

10. The **Select Equipment** dialog box appears. In the **Select Equipment** dialog box, expand the folder \ **Equipment** \ **Electrical** \ **Lighting** \ **Electrical Lighting** until you see the part **Electrical01-E**.

11. Select **Electrical01-E** and click **OK**.

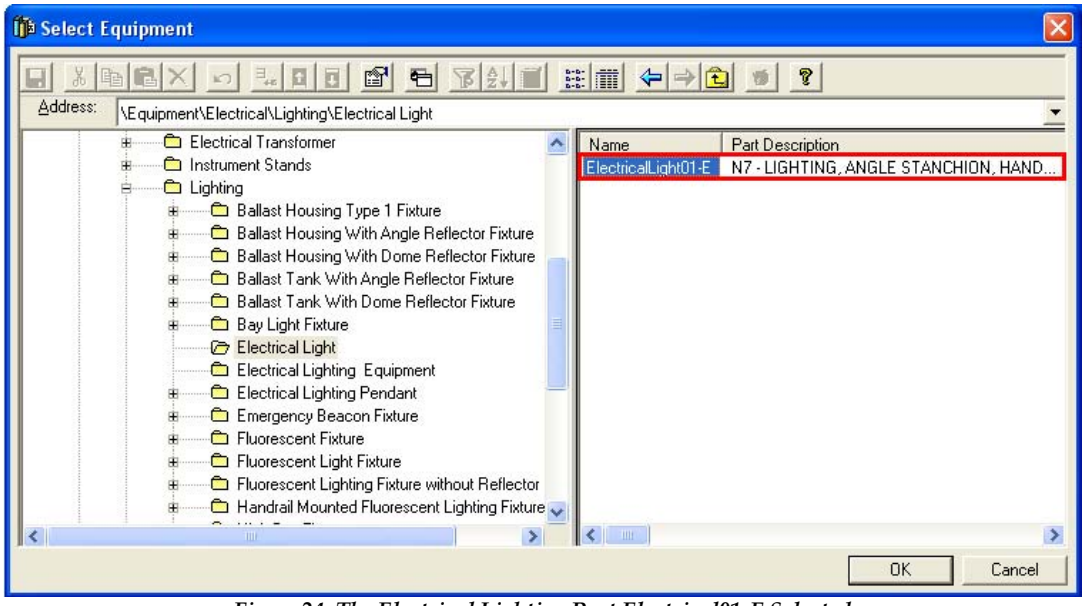


Figure 24: The Electrical Lighting Part Electrical01-E Selected

12. The **Equipment Properties** dialog box appears. In the dialog box, change the name of the equipment by typing **ESML-U03-1** in the **Name** field.

13. Change the system to **Equipment** by clicking the **More…** option and selecting **A2 > U03 > Equipment.**

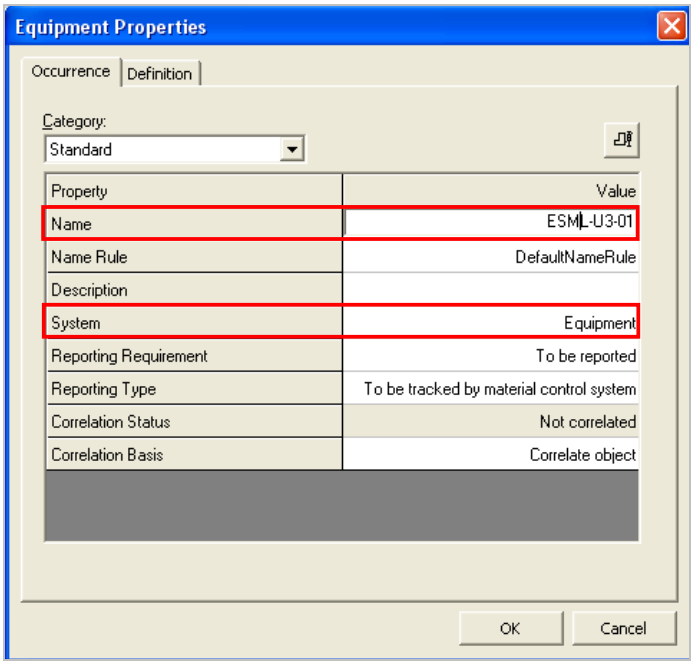


Figure 25: The Name and the System Fields Populated

14. Click **OK** to close the **Equipment Properties** dialog box.

By default the relationship type is **Mate**, however, the ribbon will show last relationship type used in that session.

15. If the relationship type is not **Mate**, click the drop down list to select **Mate**.

16. Use the arrow key to rotate the equipment so that the light is facing North.

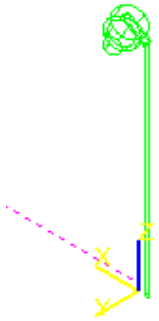


Figure 26: The Rotated Equipment with North Facing Light

Note:

- Any equipment can be rotated dynamically during placement. When in the dynamic mode, select the edge of the active window and press the left or the right arrow keys to rotate it towards a desired direction. You can also switch the axis of rotation by pressing the Up or the Down arrow keys.

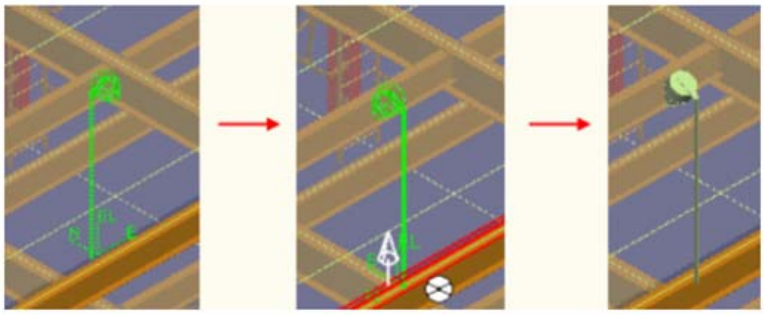


Figure 27: Dynamic Rotation of Equipment During Placement

17. Locate the edge and the top surface of the slab so that the software finds the intersection points between the two planes.

18. On the **PinPoint** ribbon, key in **19 ft 6 in** in the **E** drop-down list to define the placement point, as shown in Figure 28.

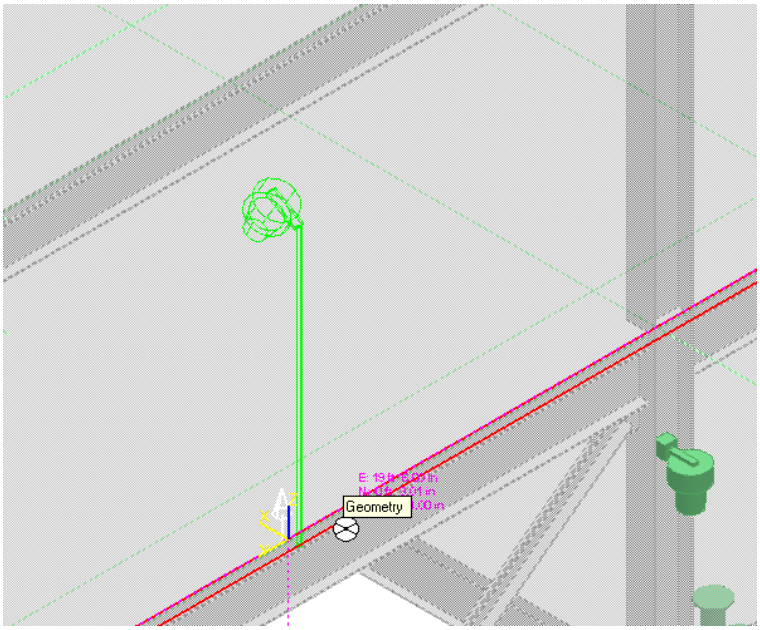


Figure 28: Placement of the Stanchion Mounting Electrical Light Defined

19. Click in the graphic view to place the stanchion mounting electrical light, as shown in Figure 29.

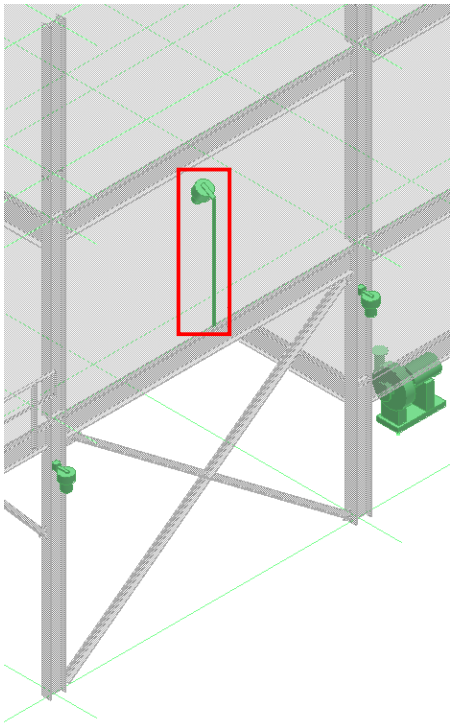


Figure 29: The Placed Stanchion Mounting Electrical Light

Steps for Copying and Pasting Catalog Equipment:

Copy the Stanchion Mounting Electrical Light from Unit **U03** of your workspace and paste it on top of the steel located on the second floor of the building**.** The view of the Stanchion Mounting Electrical Light after pasting it should resemble the highlighted section of Figure 30.

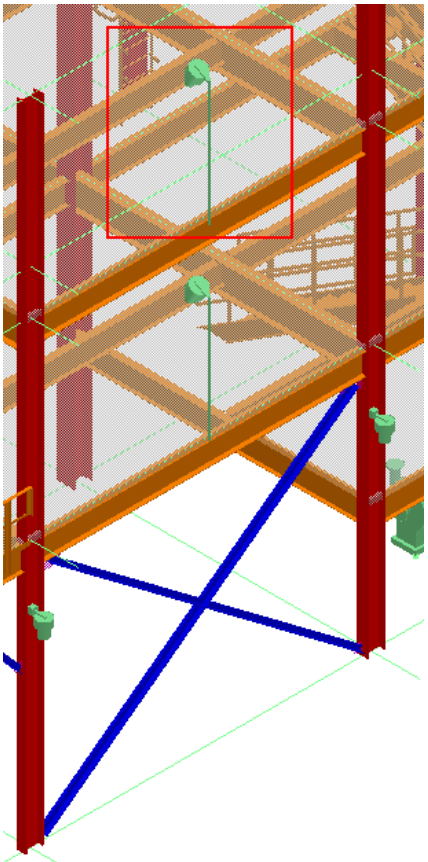


Figure 30: The Copied Stanchion Mounting Electrical Light

1. Select **Equipment** from the **Locate Filter** drop-down list to select only the equipments in the graphic view that you need to copy and paste.

2. Select the **ESML-U03-1** from the graphic view that you need to copy, as shown in Figure 31.

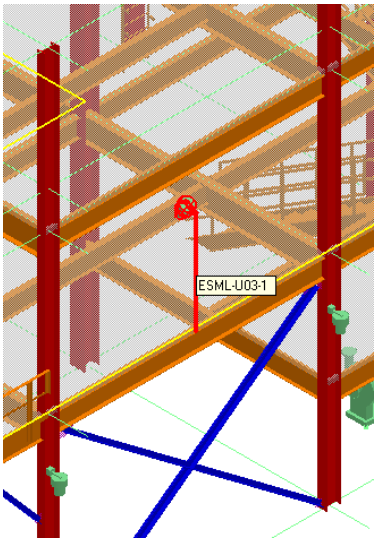


Figure 31: Selected Stanchion Mounting Electrical Light

3. Click the **Copy** button on the **Common** toolbar.

Figure 32: Copy Button on the Common Toolbar

4. Select the end of Stanchion Mounting Electrical Light from the graphic view to define the position from where to copy the Stanchion Mounting Electrical Light.

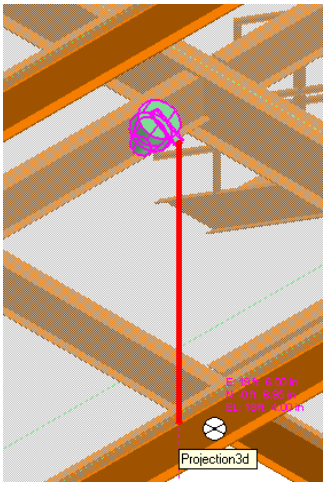


Figure 33: Reference Point - Stanchion Mounting Electrical Light

5. Click the **Paste** button on the **Common** toolbar.

Figure 34: Paste Option on the Common Toolbar

6. The **Paste** dialog box appears. Keep the default parent system for the new objects to be pasted on the model and clear the **Paste in place** check box, as shown in Figure 35. Click

OK in the dialog box.

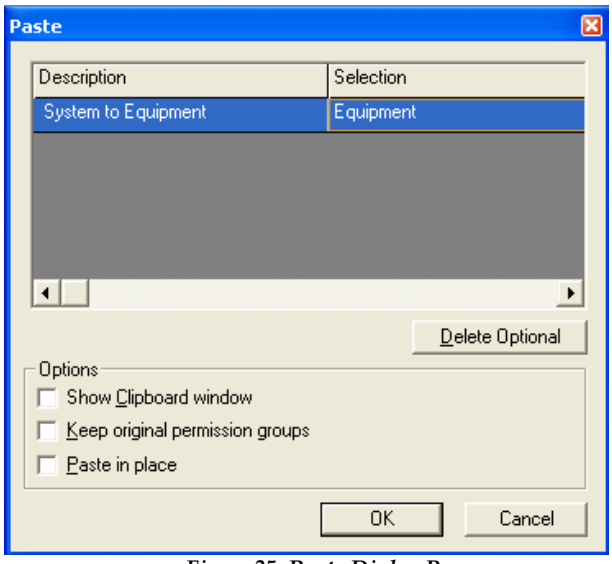


Figure 35: Paste Dialog Box

Notes:

- The **Paste** dialog box shows relationships that can be established between the objects you are pasting and objects in the model. These are the relationships that existed between the objects you copied and design objects that were not in your copy set. There are two categories of such relationships, those required by the objects being pasted and those that are optional. The system parent is an example of a required relationship. All design objects must have a system parent.
- If you are pasting the objects into the same model they were copied from, the **Paste** dialog box will offer the original objects as the defaults for the relationships that will be created on the **Paste** dialog box. In this example, SP3D keeps the original parent system of the copied objects. You can keep the default objects or select the row and identify a different object. When you select the row, the original parent object is highlighted so you can graphically see what type of input is needed in context of the objects you copied. If you decide to place the copied objects on different parent system in the system hierarchy, you must select it in the **Workspace Explorer** under the system hierarchy.
- The **Keep original permission groups** option will assign objects created by the **Paste** command to the same permission group the original object had (mapping by name). However, if the person doing the paste does not have write access to that permission group, then the object will be assigned to the active permission group. If the **Keep in original permission groups** option is not selected, all newly created objects will be assigned to the active permission group.
- The **Paste in place** option will paste the copied objects in exactly the same position as the originals. This option is most often used when pasting objects in a different model from the original.

7. Position the cursor until you get the **Up SmartSketch glyph** which indicates you are aligned to the major Z axis. Click the **Middle Mouse button** to constraint the cursor movement along this axis. Then position the cursor to identify the gridline to get the correct elevation coordinate, as shown in Figure 36.

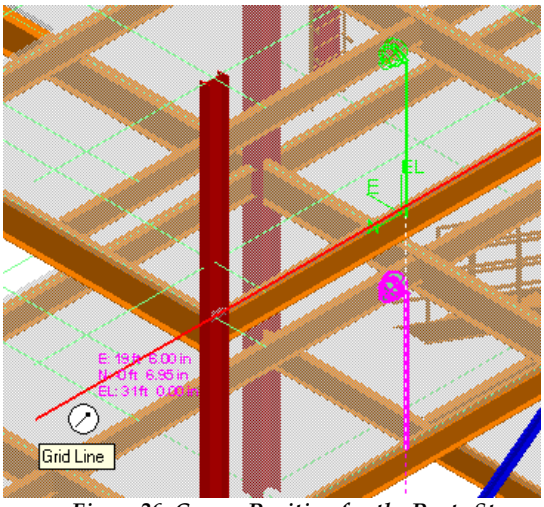


Figure 36: Cursor Position for the Paste Step

8. Click in the graphic view to place the copied Stanchion Mounting Electrical Light, as shown in Figure 37.

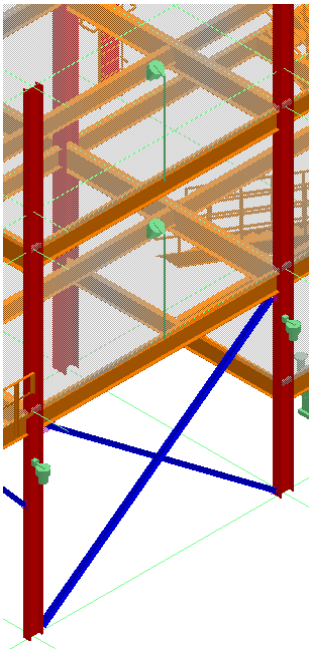


Figure 37: Stanchion Mounting Electrical Light After Pasting

For more information related to manipulating equipment(s) refer to *Copy/Paste, Delete and Edit* topics in the user guide *EquipmentUsersGuide.pdf*:

Steps for Designing a Medium Voltage Transformer:

Design a Medium Voltage Transformer, **MVT-01** under the **A2 > U03 > Equipment** by using the following specifications:

Type	Specifications	Values
Design Equipment	Name	MVT-01
	Equipment type	Electrical Transformer
	Equipment Classification 0	Electrical equipment
	Equipment Classification 1	Electrical equipment
	Equipment Classification 2	Transformer component

Place the Medium Voltage Transformer in Unit **U03**, as shown in Figure 38.

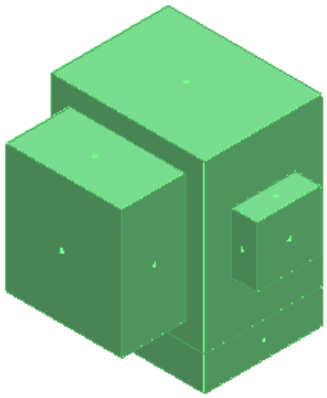


Figure 38: A Medium Voltage Transformer

Before designing the Electrical equipment, define the workspace to show Unit **U03.** Activate the **Equipment and Furnishings** environment by clicking **Tasks > Equipment and Furnishings** on the Common toolbar**.** Set the Active Permissions Group to **Electrical** and activate **Pinpoint** under the **Tools** menu.

1. Select the **Coordinate system** as **U03 CS**.

2. Click the **Set Target to Origin** option on the **Pinpoint** ribbon.

3. Click to select the **Place Designed Equipment** command on the vertical toolbar, as shown in Figure 39.

Figure 39: Place Designed Equipment Command

4. The **Select Equipment Type** dialog box opens. In the dialog box expand **Equipment > Electrical > Electrical Transformer > Electrical Transformer** to select the required design equipment, as shown in Figure 40.

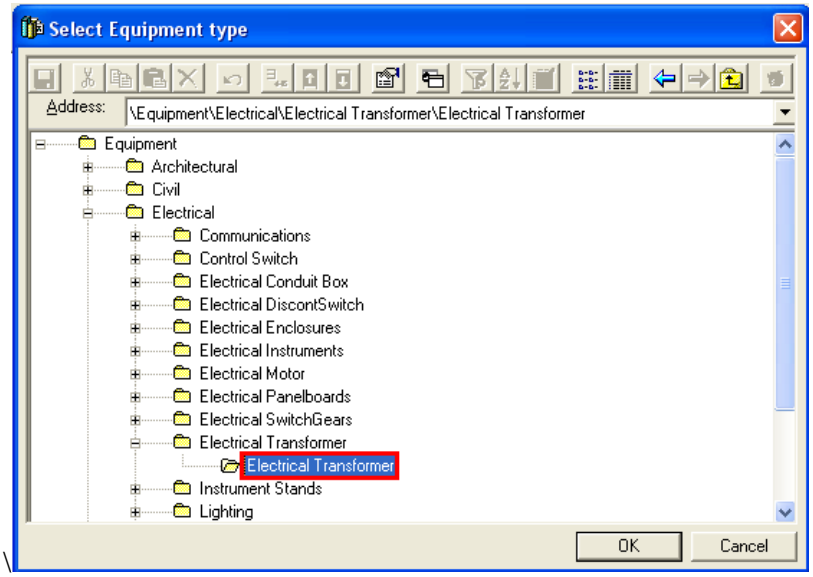


Figure 40: Required Equipment Type Selected

5. Click **OK**. The **Design Equipment Properties** dialog box opens, as shown in Figure 41.

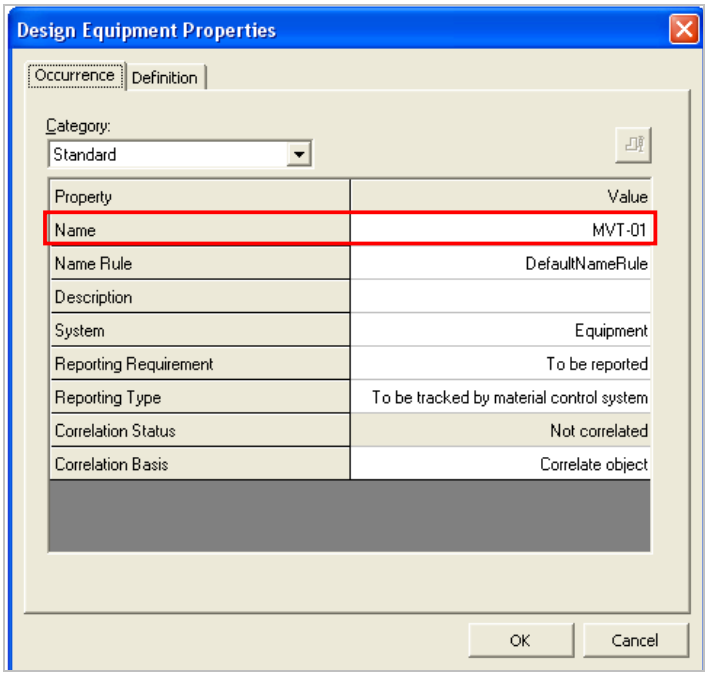


Figure 41: Design Equipment Properties Dialog Box

6. Key in **MVT-01** in the **Name** field to name this equipment.

7. Click the drop-down list in the **System** field and select the **More** option.

8. The **Select System** dialog box opens. In the dialog box expand **A2 > U03 > Equipment** to select the required system and click **OK,** as shown in Figure 42.

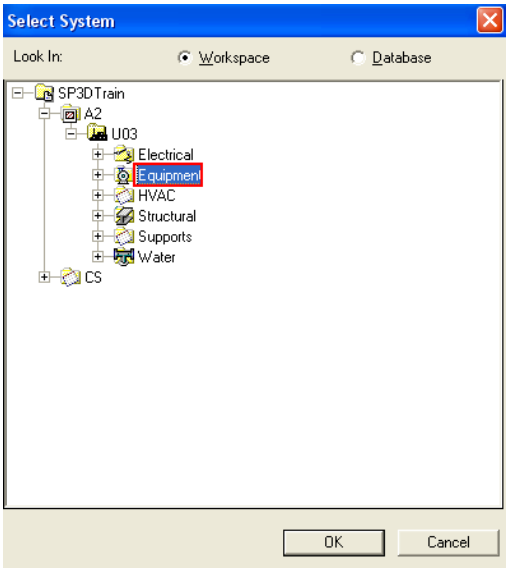


Figure 42: The Select System Dialog Box

9. Select the **Position and Orientation** option in the category drop-down list under the

Occurrence tab to specify the position of the equipment.

10. Key in the values **30 ft** for **E**, **-80 ft** for **N** and **6 ft 7in** for **El,** as shown in Figure 43.

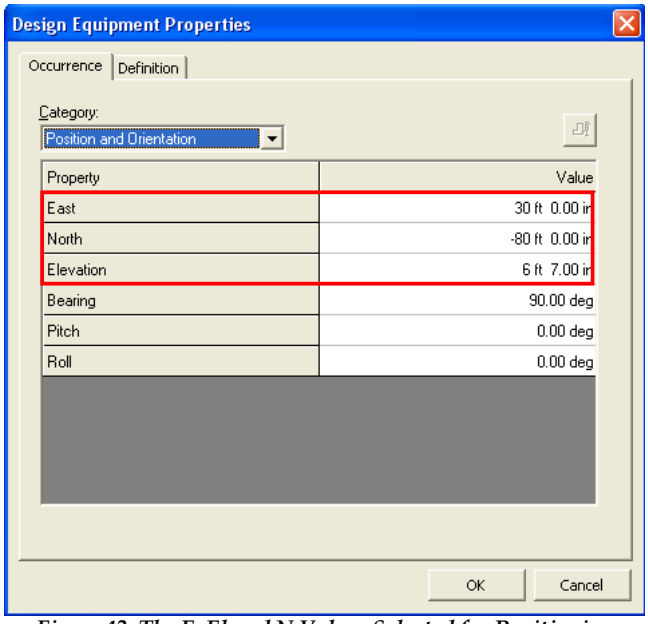


Figure 43: The E, El and N Values Selected for Positioning

11. Switch to the **Definition** tab and set the following parameters to the values listed as below:
    - **Part Number**: **MVT-01**.
    - **Equipment Classification 0**: **Electrical Equipment**
    - **Equipment Classification 1**: **Electrical Equipment**
    - **Equipment Classification 2: Transformer Component**

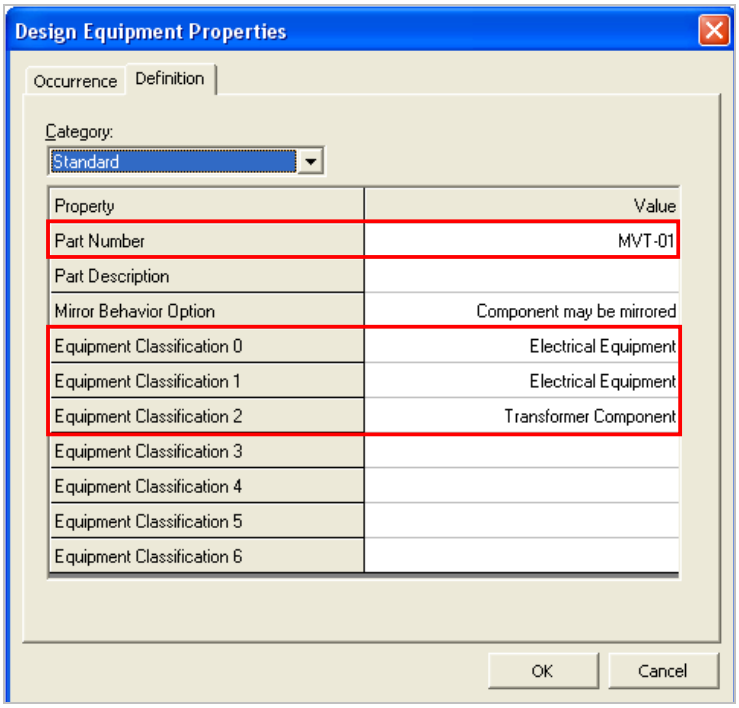


Figure 44: Selected Parameters in the Definition Tab

12. Click **OK**.

13. Click the **Place Shape** button and select the **SolidRectangular 001** to specify the shape of the design equipment. Figure 45 shows the required shape highlighted.

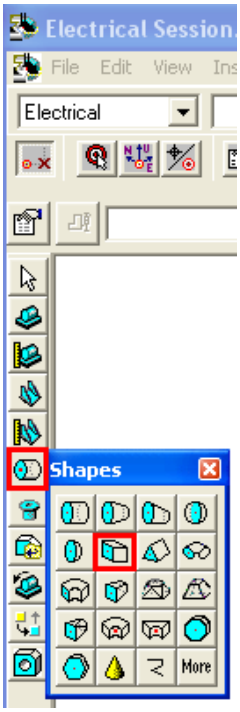


Figure 45: The SolidRectangular 001 Shape Selected

14. The **Shape Properties** dialog box opens. Change the **Name** of the shape to **Body-1** and key in the values: **4 ft 7 in** for **A**, **6 ft** for **B** and **6 ft 6 in** for **C**, as shown in Figure 46.

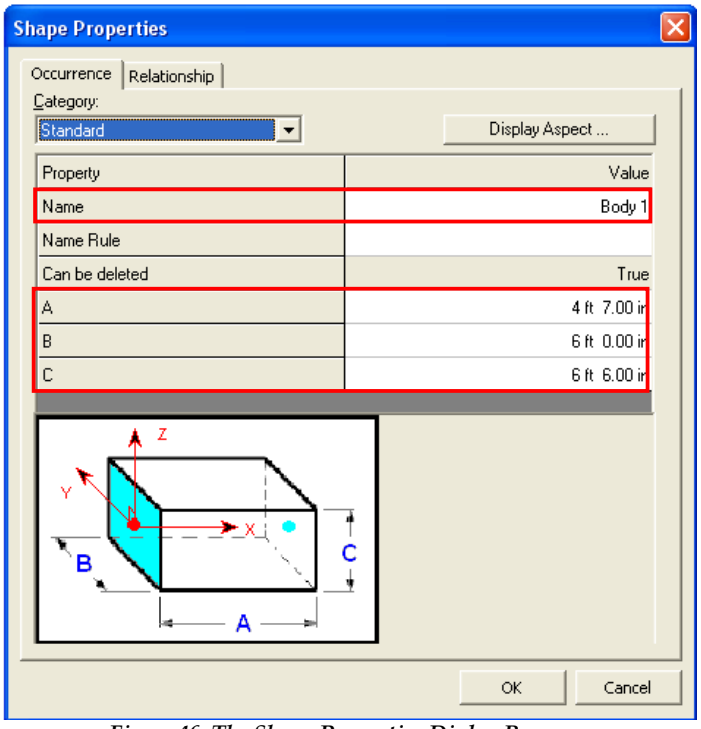


Figure 46: The Shape Properties Dialog Box

15. Click **OK** to close the **Shape Properties** dialog box.

16. Key in **30 ft** for **E**, **-80 ft** for **N** and **6 ft 7 in** for **El** on the pinpoint ribbon and click in the graphic view to place the shape, as shown in Figure 47.

Figure 47: The PinPoint Ribbon

The designed equipment is shown in Figure 48.

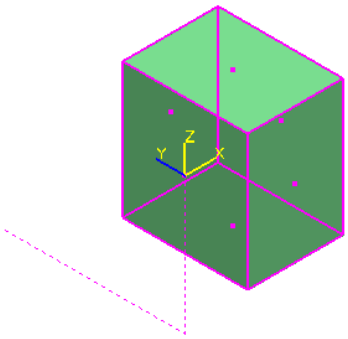


Figure 48: The Designed Equipment

17. Click the **Place Shape** button and select the **SolidRectangular 001** on the shape palette.

18. The **Shape Properties** dialog box opens. Change the **Name** of the shape to **Term Box** and key in the values: **1 ft** for **A**, **2 ft 6 in** for **B** and **2 ft 4 in** for **C**, as shown in Figure 49.

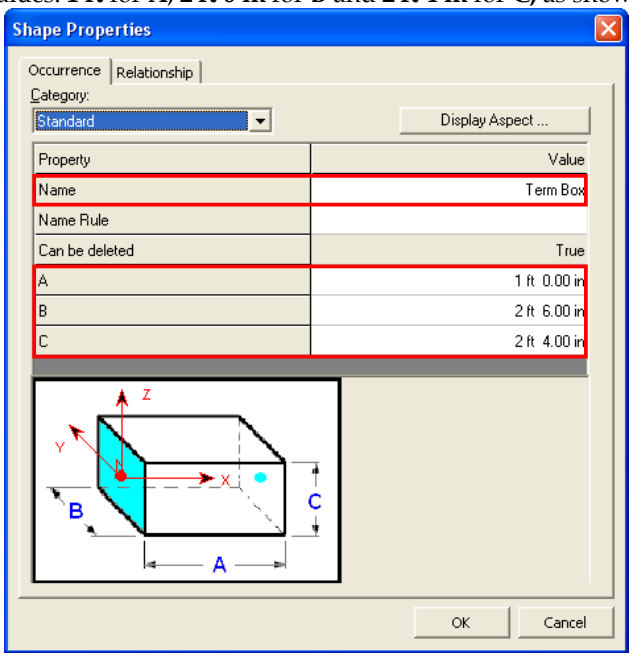


Figure 49: The Shape Properties Dialog Box

19. Click **OK** to close the **Shape Properties** dialog box.

20. Select **Connect** in the positioning relationships drop-down list on the shape ribbon.

21. Use the arrow key to rotate the shape so that the shape x axis is facing South. Move the cursor and locate the center point on the south face of the transformer body, as shown in Figure 50.

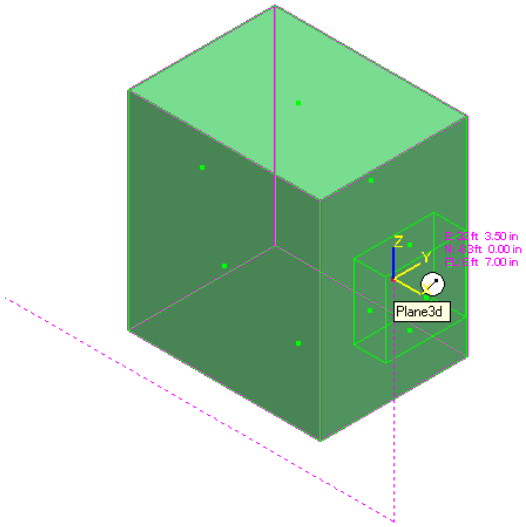


Figure 50: The Shape Rotated Towards South

22. Click in the graphic view to place the shape in the model. The designed equipment is shown in Figure 51.

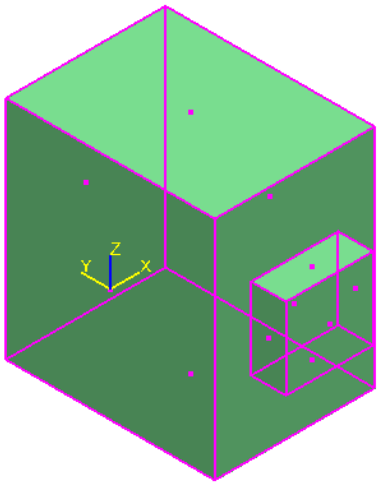


Figure 51: The Placed Term Box

23. Click the **Place Shape** button and select the **SolidRectangular 001** on the shape palette.

24. The **Shape Properties** dialog box opens. Change the **Name** of the shape to **Fin Fan** and key in the values: **2 ft 6 in** for **A**, **4 ft 6 in** for **B** and **5 ft** for **C,** as shown in Figure 52.

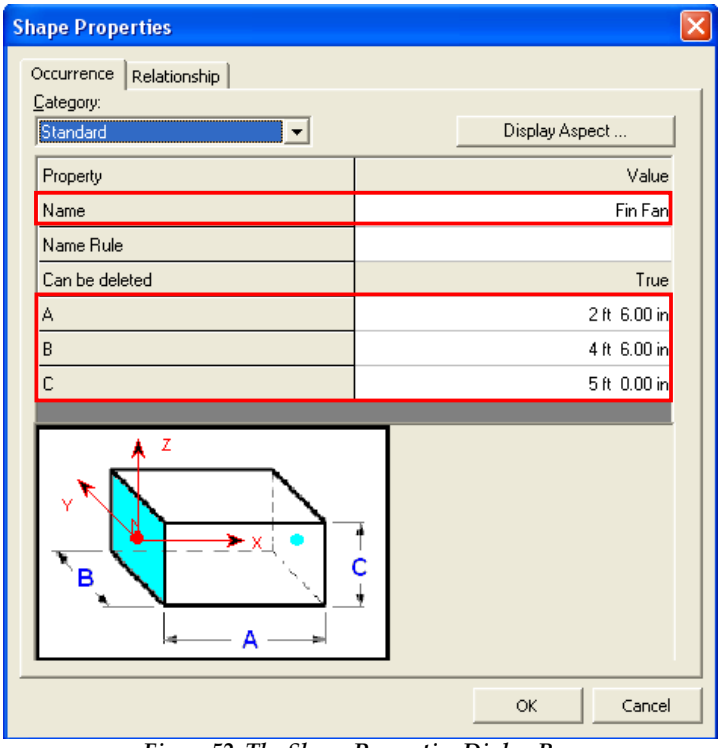


Figure 52: The Shape Properties Dialog Box

25. Use the arrow key to rotate the shape so that the shape x axis is facing West. Move the cursor and locate the center point on the west face of the transformer body, as shown in Figure 53.

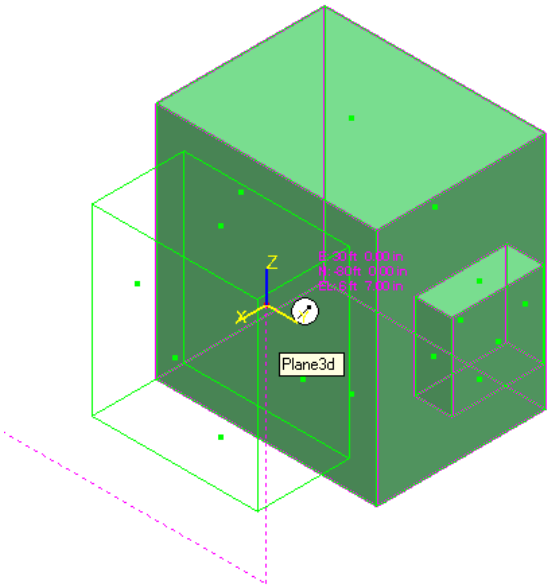


Figure 53: The Shape Rotated Towards West

26. Click in the graphic view to place the shape in the model. The designed equipment is shown in Figure 54.

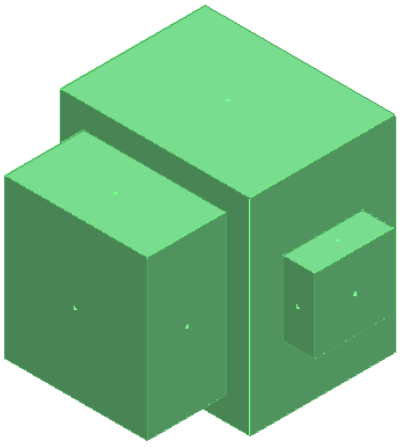


Figure 54: The Placed Design Equipment: FinFan

27. Click the **Place Shape** button and select the **SolidRectangular 001** on the shape palette.

28. The **Shape Properties** dialog box opens. Change the **Name** of the shape to **Base** and key in the values: **1 ft 4 in** for **A**, **4 ft 7 in** for **B** and **6 ft** for **C**, as shown in Figure 55.

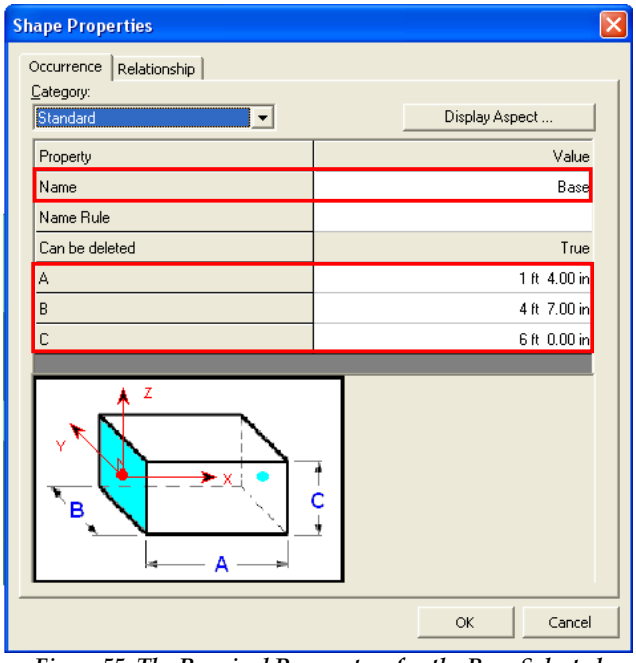


Figure 55: The Required Parameters for the Base Selected

29. Use the arrow key to rotate the shape so that the shape x-axis is facing down.

30. Move the cursor and locate the center point on the bottom face of the transformer body. Toggle the SmartSketch **Surface Locate** option by pressing **F3** on the keyboard. **F3** will toggle the **Surface Locate** option back on when you need to locate points on surface.

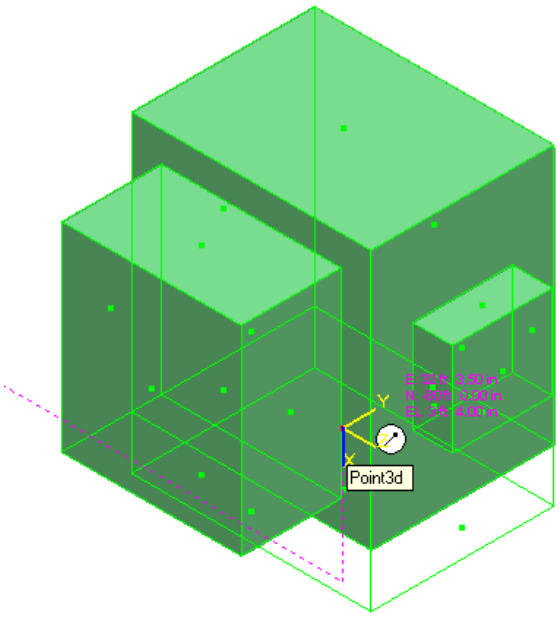


Figure 56: Center Point Located Using SmartSketch

31. Click in the graphic view to place the shape in the model. The designed equipment is shown in Figure 57.

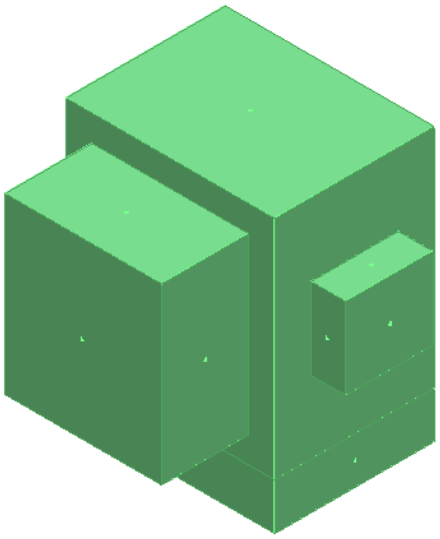


Figure 57: The Placed Design Equipment: Base

For more information related to placing electrical equipment in a model refer to:

- *Session 3: Placing Equipment by Positioning Relationships.*
- *Equipment Properties Dialog Box* topic of the *EquipmentUsersGuide.pdf.*
- *Place Equipment from the Catalog* topic in the user guide *ElectricalUserGuide.pdf.*

Session 3: Routing a Cableway

Objective:

By the end of this session, you will be able to:

- Route a cableway in SP3D.

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Electrical: An Overview

Overview:

Cableway is a channel for enclosing and holding wires, cables, or busbars in a plant. Cableway is a reserved space for cable tray. Cableway does not have physical parts whereas cable tray does have parts.

The **Route Cableway** button on the vertical toolbar allows you to route a cableway or a cable tray network and define its geometry and properties. Using this command, you can create, modify, or extend an existing cableway in a model. You can then add features and components to the cableway or the cable tray network, which are driven by predefined specifications and the catalog.

Note:

- Specifications are defined in the reference data. You can create and customize the specifications to suit your requirements.

When you route an existing cableway or create a new cableway in a model, you have the option to set the default/common properties of the cableway at system level.

Default properties for the new cableway can come from any one of the following:

- The cableway to which you are connecting
- The parent electrical system default properties defined in the **Systems and Specifications** task of SP3D

If default properties are defined on an electrical system, SP3D will use them when you open the **New Cableway** dialog box. The SP3D administrator can setup the default properties based on the project specification set. To access the properties, you right-click **Electrical** system in the **Workspace Explorer** and select the **Properties** option.

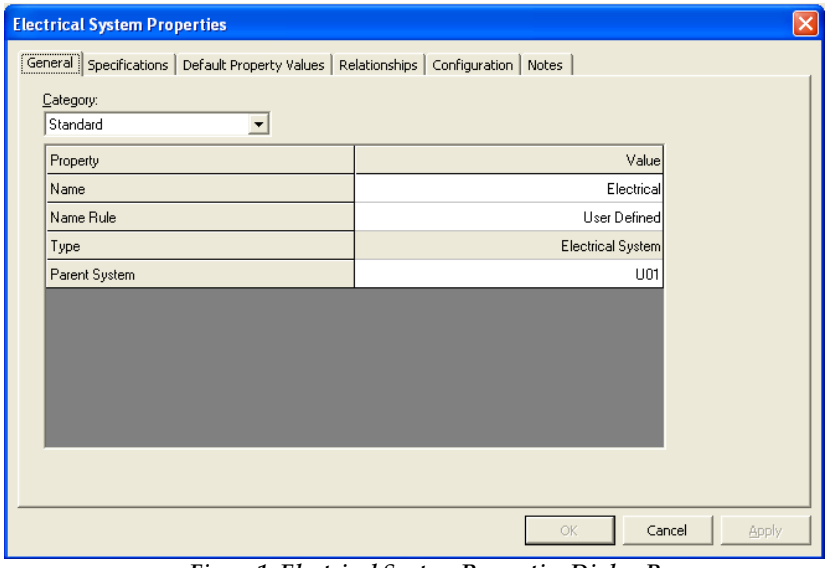


Figure 1: Electrical System Properties Dialog Box

The **New Cableway** dialog box appears when the user creates a new cableway. You can view and make changes to the default properties of a cableway by using the **New Cableway** dialog box. You can select the category for which you want to define values by using the **Category** option, as shown in Figure 2.

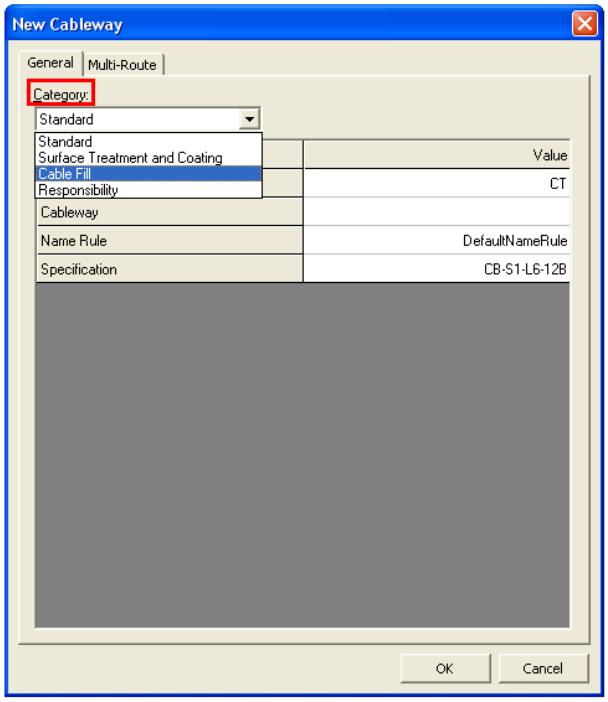


Figure 2: New Cableway Dialog Box

Default cableway properties are divided into different categories:

- **Standard category:** Displays or defines the specification for the cableway. Only those specifications that are allowed in the system that you selected will appear. You define name of a cableway or cable tray under this category.
- **Responsibility category:** Specifies the parties responsible for the cleaning, designing, fabrication, installation, painting, requisition, supply, and testing of cableways.
- **Surface Treatment and Coating category:** Specifies the interior and exterior coating requirements, type, area, and color of a cableway.
- **Cable Fill category:**
  - **Fill Efficiency:** Specifies the efficiency of stacking cables in the cableway.
  - **Signal Type:** Specifies the cable usage, which is used in the cable tray fill calculations. Also, the signal type will be required at a later time for automated cable routing. There are five signal type attributes that can be used on the cableway. The signal type of the cable being placed into a cableway must match one of these values. Otherwise, it cannot be automatically routed through that cableway.
  - **Voltage Grade:** Specifies the voltage grade, which is used in determining the range of voltage that the cableway can transmit. It is the value against which the cable tray fill calculations should be executed and also the value that should be used to match the voltage of the cable against the voltage grade assigned to the cableways. The voltage grade can also be useful for naming conventions utilized by cableway systems.

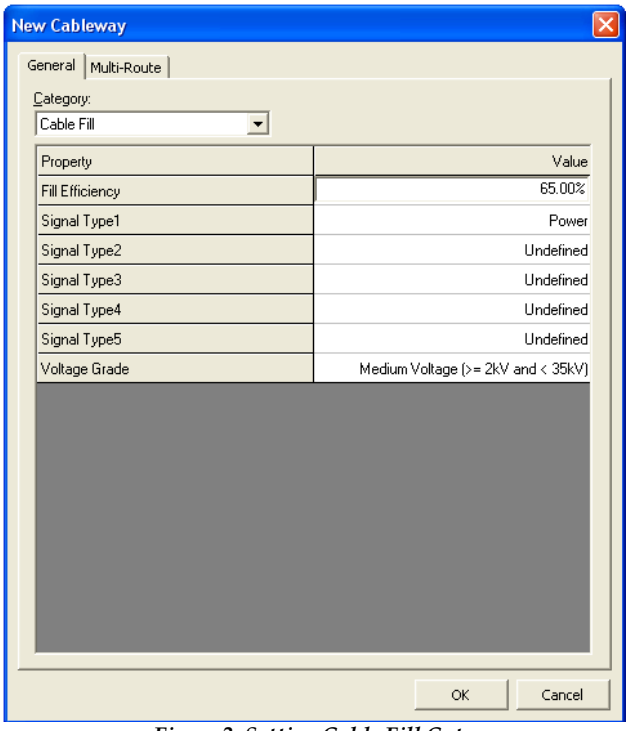


Figure 3: Setting Cable Fill Category

To learn about these properties, refer to the *New Cableway Dialog Box* topic of the *ElectricalUsersGuide.pdf*.

In an **Electrical** task, you can route cableways with a non-part specification. Such routed cableways are referred to as cableway zero-specs. Cableway with a non-part specification is a spec without parts where as the corresponding cable tray spec is one which has parts. By using cableway with a non-part specification to model tight turns and vertical drop outs, you can route cables across the gaps in the cable tray and enable the cable routing to form a contiguous network through which to route the cable.

Note:

- One of the extended uses of a cableway with non-part specification is that you route a cableway to reserve the space in the model, then you change specification by using the property page to a cable tray spec. This allows you to size the tray at a later time, and SP3D will solve for the parts when you flip the spec from a cableway with non-part spec to a cable tray spec. You can also go back to cableways with non-part spec later if you want. It is a reversible process.

This space reservation is intended to reserve space and can report as clashes when the Interference Detection processes the data. You see a hybrid of this effect when you are dealing with a cable tray part spec that has no turn parts. In this case we can route straight sections of tray and the turns will just be space reservations that represent where we think the cable will hang as it passes from one tray straight section to another.

Using cableway with non-part specification, you can route a cable path across the following gap conditions:

- A tight radius turn for which no elbow has been placed
- A longer radius turn
- A gap between two trays in the same plane
- A gap between a horizontal and vertical tray

This session will cover the procedures to:

- Create a new cableway with non-part specification
- Basic cableway routing
- Route and extend multi trays after routing the cableway

Routing a Cableway:

Create a cable tray network by routing one cableway from the coordinate points **E: 5 ft, N: 30 ft, EL: 26** ft and another cableway from the coordinate points **E: 37 ft, N: 50 ft, EL: 34 ft** in Unit **U04.** Extend the first cableway by using its end feature and then connect both the cableways. Extend the free end of the second cableway by changing the size of the cable tray. The routed cableway should resemble Figure 4.

Set the following default properties of cableways before routing them:

Standard category:
System: CT
Name Rule: DefaultNameRule
Cable Fill category:
Fill Efficiency: 60%
Signal Type 1: Control

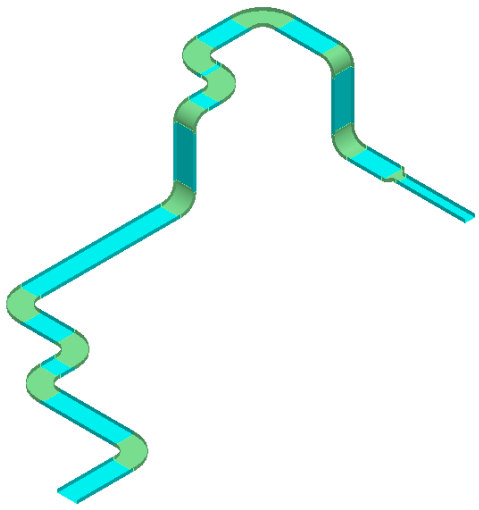


Figure 4: Cable Tray Network

Steps for Basic Cableway Routing with Non-Part Specification:

Place a preliminary reserved space by routing a cableway using SmartSketch and length control

tools in Unit **U04**. Define the origin of the cableway using the following coordinate points on the **PinPoint** ribbon:

E: 5 ft
N: 30 ft
EL: 26 ft

The routed cableway should resemble Figure 5.

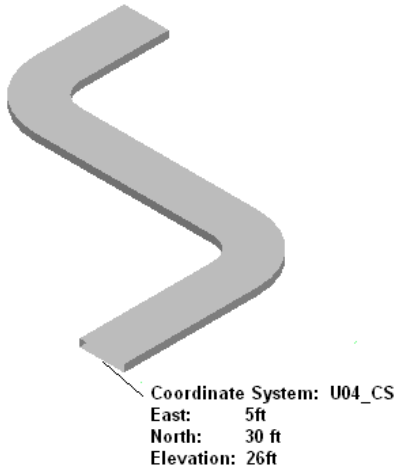


Figure 5: Cableway with non-part Specification

Before beginning the procedure:

- Define your workspace to display Unit **U04** and coordinate system **U04 CS**. In your training plant, select **U04** from **Plant Filters > Training Filters** in the **Select Filter** dialog box.

1. Go to the **Electrical** task by clicking **Tasks > Electrical.**
2. Make sure the Active Permission Group is set to **Electrical.**

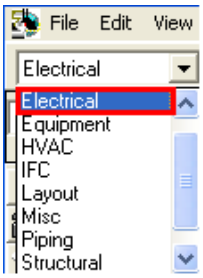


Figure 6: Setting Active Permission Group

3. Activate the **PinPoint** ribbon and set the active coordinate system to **U04 CS** on the **PinPoint** ribbon.

Figure 7: Coordinate System Option on the PinPoint Ribbon

4. Click the **Set Target to Origin** option on the **PinPoint** ribbon, to move the target to the origin of the current coordinate system.

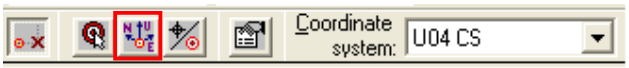


Figure 8: Set Target to Origin Option on the PinPoint Ribbon

5. Click the **Route Cableway** button on the vertical toolbar.

Figure 9: Route Cableway Button

6. Key in the following coordinate specifications on the **PinPoint** ribbon and click in the graphic view:

   E: 5 ft
   N: 30 ft
   EL: 26 ft

Figure 10: Coordinate Specifications on the PinPoint Ribbon

7. The **New Cableway** dialog box appears. Select the **More** option in the **System** drop-down list to specify the system where you want to place the cableway.

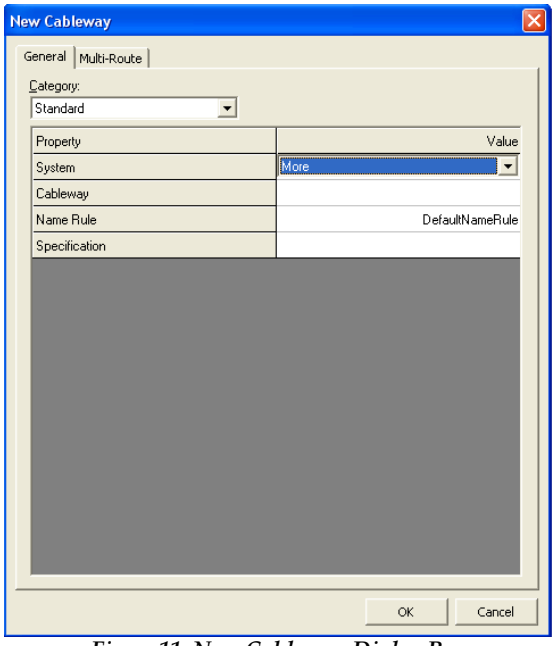


Figure 11: New Cableway Dialog Box

8. In the **Select System** dialog box, select **A2 > U04 > Electrical > Control > CT** and click **OK**.

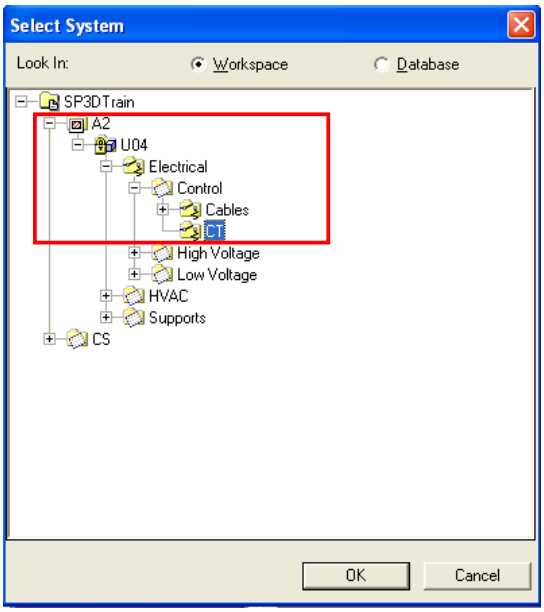


Figure 12: Setting the System for the Cableway

9. In the **New Cableway** dialog box, verify the following cableway specifications:

   System: CT
   Name Rule: DefaultNameRule
   Specification: Cws-0

Notes:

- **Name Rule** specifies the naming rule that you want to use to name the cableway that you are routing. You can select one of the listed rules or select **User Defined** to specify the run name.
- Cableway specification **Cws-0** is a non-part specification and is used to route cableways (reserved space) for tray parts and cables.

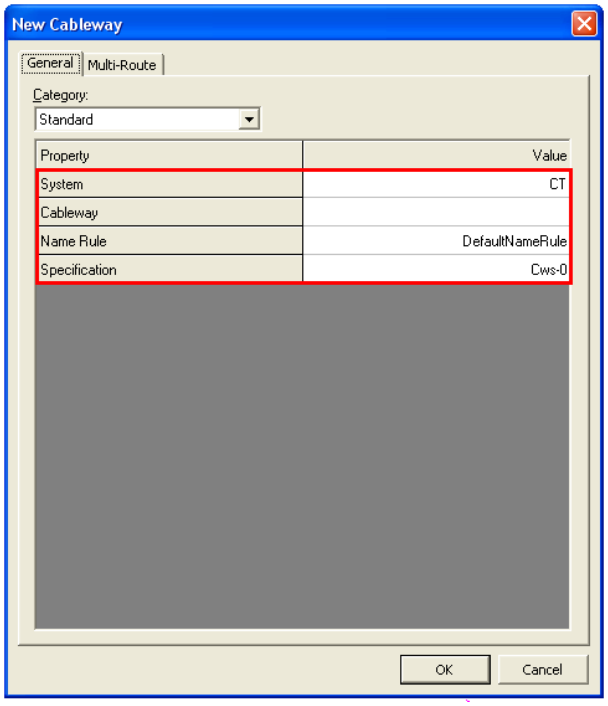


Figure 13: New Cableway Dialog Box

10. Select the **Cable Fill** option in the **Category** drop-down list. Verify the following specifications and click **OK**:

    Fill Efficiency: 60%
    Signal Type 1: Control

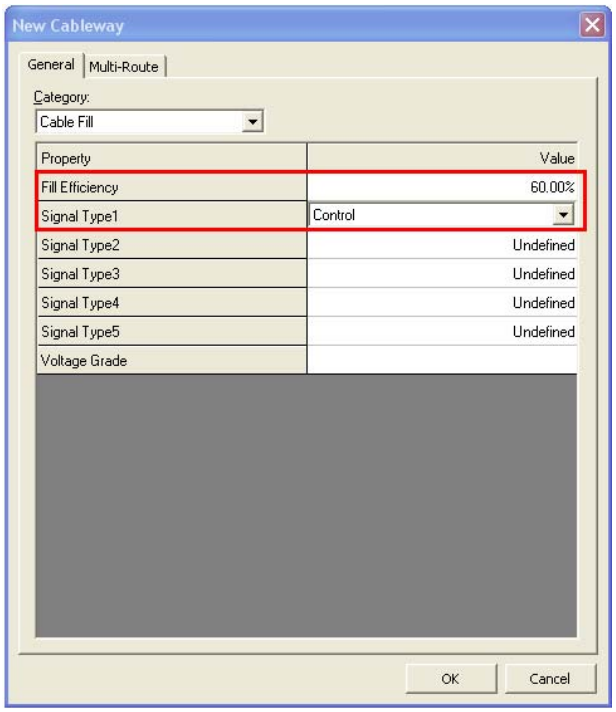


Figure 14: Cable Fill Category for the New Cableway

11. Select the **Set Offset Reference…** option from the **Offset** drop-down list on the **Route Cableway** ribbon, to set options for reference offsets while routing a cableway.

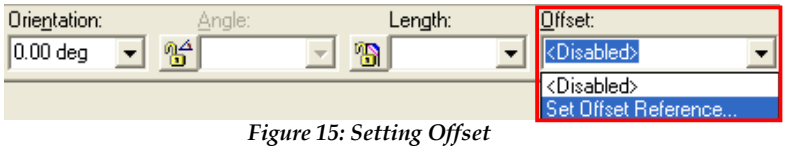


Figure 15: Setting Offset

The **Offset** drop-down list on the **Route Cableway** ribbon displays an offset of the cableway surface from the working plane.

The **Set Offset Reference** dialog box appears. There are two types of offset references available in the **Set Offset Reference** dialog box while routing a cableway:

- **External** - Routes a cableway at a specified distance from another object, such as a cableway running parallel to the cableway you are placing.
- **Cardinal Point** - Routes a cableway by the top, sides, bottom, or invert elevation of the cableway instead of the cableway centerline.

12. Select the following options in the **Set Offset Reference** dialog box and click **OK**:

    Cardinal Point option
    Bottom center option

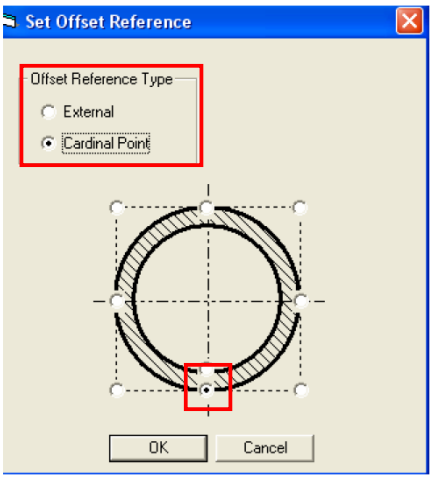


Figure 16: Set Offset Reference Dialog Box

The **Shapes** drop-down list on the **Route Cableway** ribbon sets the offset cross section shape. When you change the cross section shape, the dimensions that you need to specify on the **Route Cableway** ribbon also change. For example, if you select the **Rectangle** or **Flat Oval** shape, all dimensions, such as **Width** or **Depth**, are displayed. If you select the **Round** shape, a box for the diameter appears on the **Route Cableway** ribbon.

13. Select the **Rectangle** shape in the **Shapes** drop-down list and key in the following specifications on the **Route Cableway** ribbon to specify the width and depth of the cross section of the cableway:

    Width: 2 ft
    Depth: 0 ft 4 in
    Length: 8 ft

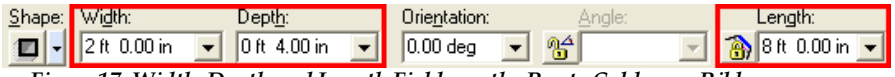


Figure 17: Width, Depth and Length Fields on the Route Cableway Ribbon

The **Plane** drop-down list on the **Route Cableway** ribbon activates options for selecting a working plane for the route path.

Note:

- Width value must be greater than the depth value. SP3D will display an error message if Depth is greater than Width.

14. Select the **Plan Plane** option in the **Plane** drop-down list on the **Route Cableway** ribbon.

Figure 18: Plan Plane Option on the Plane Drop-Down List

15. Position the cursor in the east **E** direction and click to define the end point to place **8 ft** cableway, as shown in Figure 19.

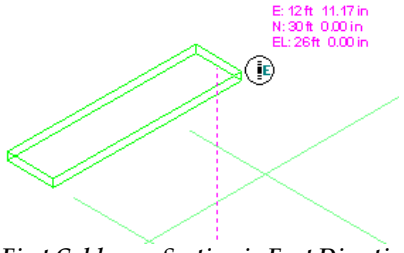


Figure 19: First Cableway Section in East Direction

Note:

- You can use SmartSketch to constraint the cursor movement along the Easting direction. Click the middle mouse button to set this constraint.

16. On the **Route Cableway** ribbon, key in **12 ft** in the **Length** box.
17. Position the cursor in the north **N** direction and click to define the end point to place **12 ft** cableway, as shown in Figure 20.

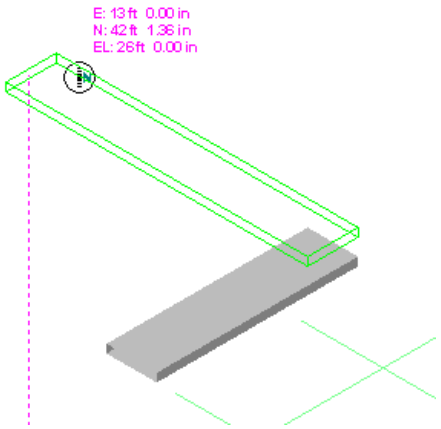


Figure 20: Second Cableway Section in North Direction

18. On the **Route Cableway** ribbon key in **6 ft** in the **Length** box.

19. Position the cursor in the east **E** direction and click to define the end point to place **6 ft** cableway, as shown in Figure 21.

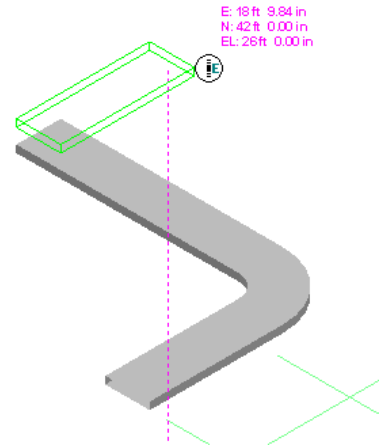


Figure 21: Third Cableway Section in East Direction

20. Right-click the graphic view to terminate the **Route Cableway** command.

Steps for Routing a Cableway by Using PinPoint, Offset, and Cardinal Point:

Route a cableway with part specification using PinPoint, SmartSketch and length control tools in **Unit 04**. Define the origin of the cableway using the following coordinate points on the **PinPoint** ribbon:

E: 37 ft
N: 50 ft
EL: 34 ft

The routed cableway should resemble Figure 22.

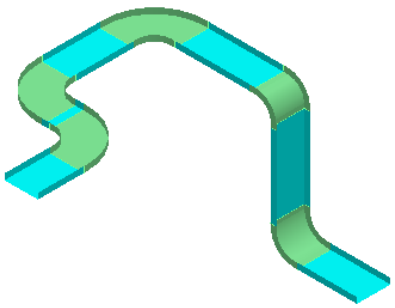


Figure 22: Routed Cableway Using PinPoint, Offset, and Cardinal Point

Before you start routing the cableways, set the following in your workspace:

- Define your workspace to show Unit **U04** and coordinate system **U04 CS**.

1. If you are not in the **Electrical** task, select the **Tasks > Electrical** command.
2. Make sure the Active Permission Group is set to **Electrical**.

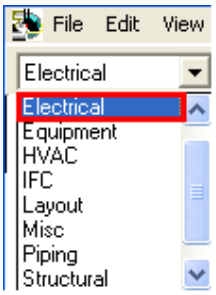


Figure 23: Setting Active Permission Group

3. Activate the **PinPoint** ribbon and set the active coordinate system to **U04 CS** on the **PinPoint** ribbon.

Figure 24: PinPoint Ribbon

4. Click the **Set Target to Origin** option on the **PinPoint** ribbon, to move the target to the origin of the current coordinate system.

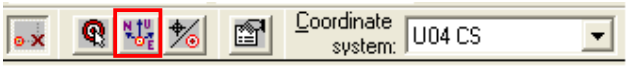


Figure 25: PinPoint Ribbon

5. Click the **Route Cableway** button on the vertical toolbar.

Figure 26: Route Cableway Button

6. Key in the following coordinate specifications on the **PinPoint** ribbon and click in the graphic view:

E: 37 ft
N: 50 ft
El: 34 ft

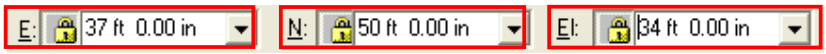


Figure 27: Coordinates for Second Cableway

7. Click in the graphic view to accept the starting point.

8. The **New Cableway** dialog box appears. Select the **More ...** option in the **System** drop-down list of the dialog box to specify the system where you want to place the cableway.

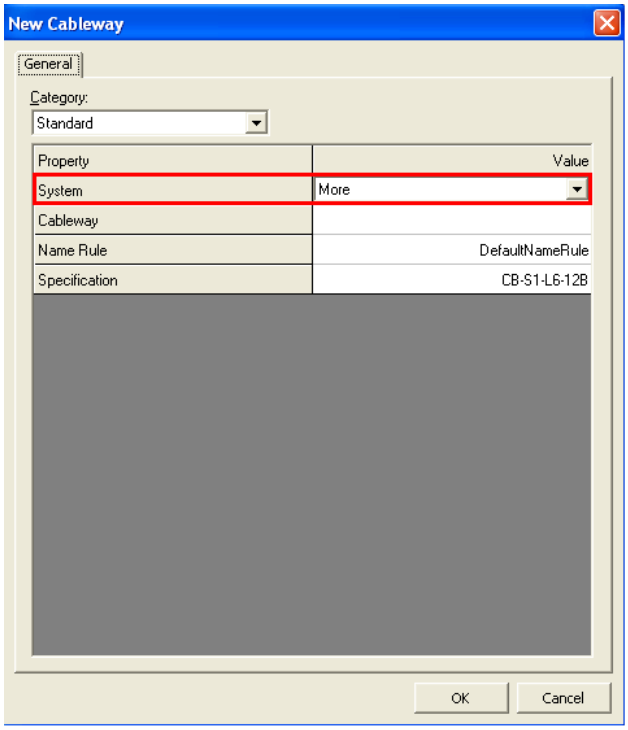


Figure 28: New Cableway Dialog Box

9. In the **Select System** dialog box, select **A2 > U04 > Electrical > Control > CT** and click **OK**, as shown in Figure 29.

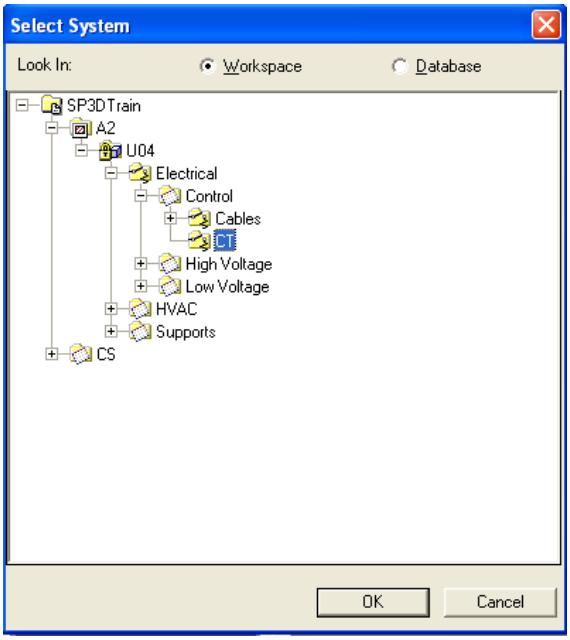


Figure 29: Setting the System for the Cableway

10. In the **New Cableway** dialog box, verify the following cableway specifications:

    System: CT
    Name Rule: DefaultNameRule
    Specification: CB-S1-L6-12B

Note:

- **Name Rule** specifies the naming rule that you want to use to name the cable run that you are routing. You can select one of the listed rules or select **User Defined** to specify the run name.

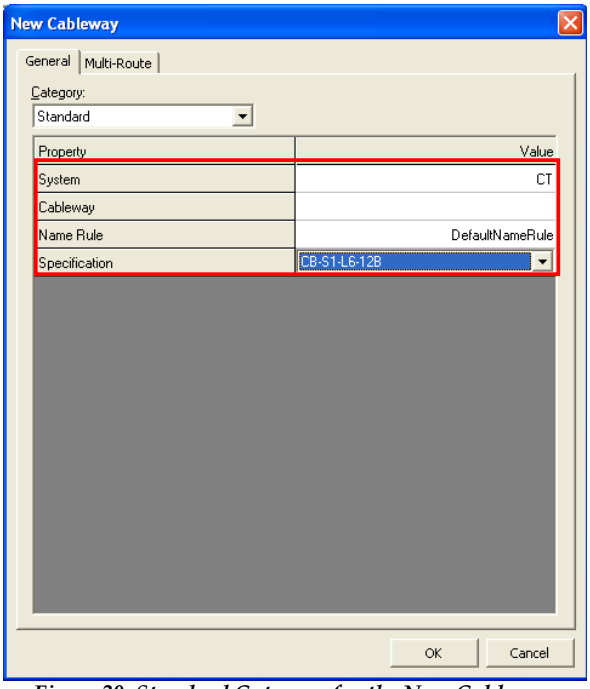


Figure 30: Standard Category for the New Cableway

11. Select the **Cable Fill** option in the **Category** drop-down list and verify the following specifications and click **OK**:

    Fill Efficiency: 60%
    Signal Type 1: Control

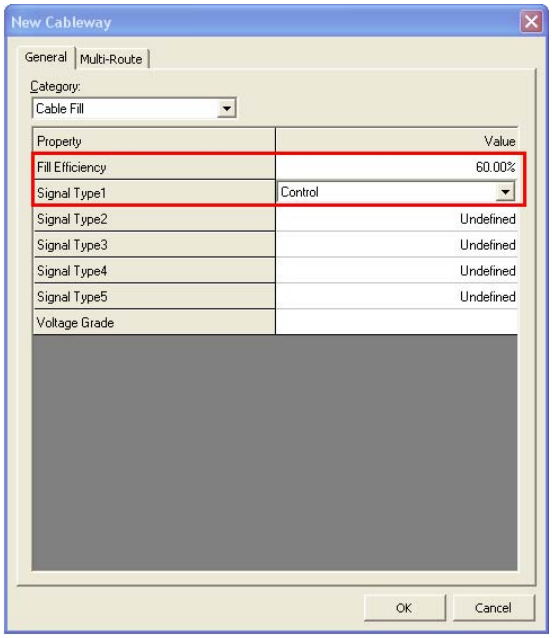


Figure 31: Cable Fill Category for the New Cableway

12. Under **Offset** on the **Route Cableway** ribbon, select the **Set Offset Reference …** option to set options for reference offsets while routing a cableway. The **Offset** drop-down list on the **Route Cableway** ribbon displays an offset of the cable part surface from the working plane.

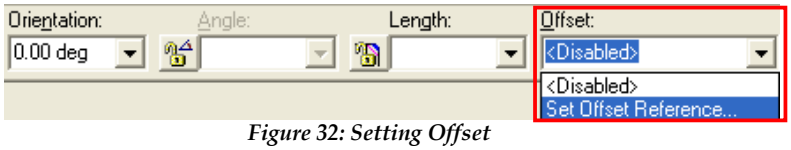


Figure 32: Setting Offset

13. Select the following in the **Set Offset Reference** dialog box and click **OK**:

    Cardinal Point option
    Bottom center option

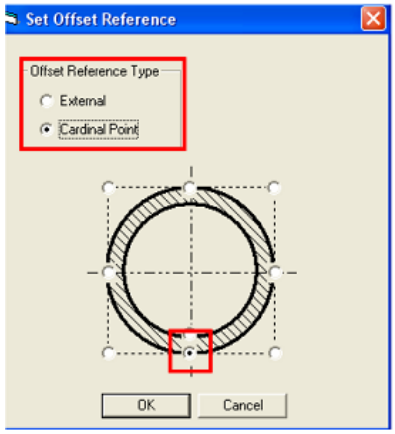


Figure 33: Set Offset Reference Dialog Box

14. Select the **Rectangle** shape in the **Shapes** drop-down list and key in the following specifications on the **Route Cableway** ribbon to specify the width and depth of the cross section of the cable:

    Width: 2 ft
    Depth: 0 ft 4 in

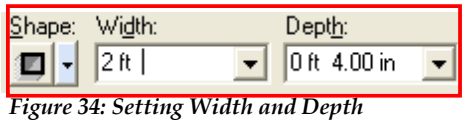


Figure 34: Setting Width and Depth

The **Plane** drop-down list on the **Route Cableway** ribbon activates options for selecting a working plane for the route path.

15. Select the **Plan Plane** option in the **Plane** drop-down list on the **Route Cableway** ribbon.

Figure 35: Plan Plane Option on the Plane Drop-Down List

16. Position the cursor in east **E** direction and specify **5 ft** in the **Length** box on the **Route Cableway** ribbon and click to define the end point.

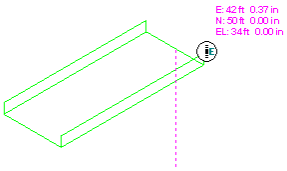


Figure 36: First Cableway Section

17. Position the cursor in the **N** direction to place **5 ft** cableway. Click in the graphic view to accept the position.

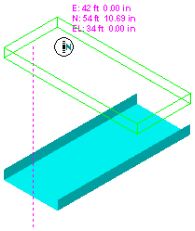


Figure 37: First Cableway Section

18. Change the length to **8 ft** on the **Route Cableway** ribbon, position the cursor in east **E** direction to place the **8 ft** cableway tray, and click the graphic view to accept the position.
19. Position the cursor in the South direction and click in the graphic view to accept the position, as shown in Figure 38.

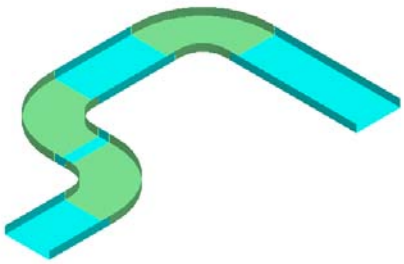


Figure 38: Routed Cableway

20. Select the **Elevation Plane: North-South** option in the **Plane** drop-down list on the **Route Cableway** ribbon.

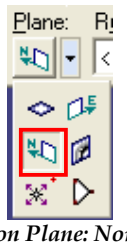


Figure 39: Elevation Plane: North-South Option

21. Position the cursor downwards to place **8 ft** cableway tray going down. Click in the graphic view to accept the position.
22. Change the length to **5 ft** on the **Route Cableway** ribbon and position the cursor in the south direction.
23. Click in the graphic view to place a **5 ft** cableway tray going south. Right-click to terminate the **Route Cableway** command. The routed cableway should resemble Figure 40.

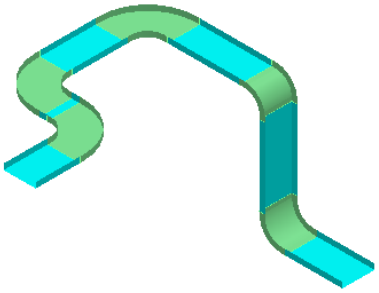


Figure 40: Routed Second Cableway

Steps for Routing a Cableway by Using the End Feature:

24. Click the **Route Cableway** button on the vertical toolbar.
25. Select the **Cableway End Feature** of the cableway with non-zero spec placed earlier in this session, as shown in Figure 41.

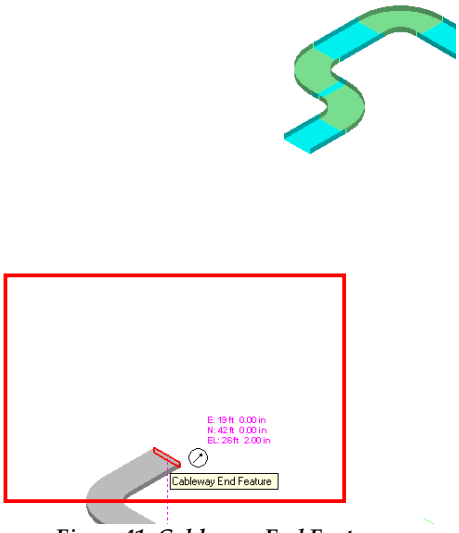
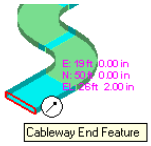


Figure 41: Cableway End Feature

26. Select the **Plan Plane** option in the **Plane** drop-down list on the **Route Cableway** ribbon.
27. On the **Route Cableway** ribbon, select the **<Disabled>** option in the **Offset** drop-down list to disable the **Cardinal Point** option.

    Note:
    - Disable the bottom of the tray (BOT) offset will help to joint the two cableways in later steps. The bottom of the cableway of non-zero spec is located at the correct elevation. As a result, we continue the routing by centerline.

28. Select the **Angle** field and key in **90 deg** in the drop-down list.
29. Move the cursor to the other end feature to get the northing coordinate as show in Figure 42 and click in the graphic view to place the cableway.



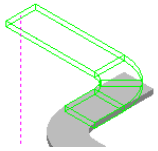


Figure 42: Extending the Cableway

30. Right-click the graphic view to terminate the **Route Cableway** command.

Steps for Connecting the Cableways:

31. Click the **Route Cableway** button on the vertical toolbar.
32. Select the **Cableway End Feature** of the cableway placed earlier in this session, as shown in Figure 43.

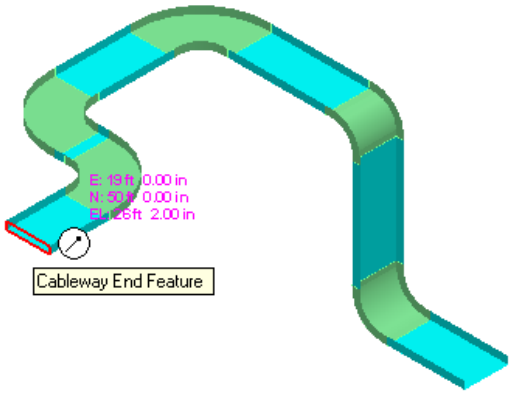


Figure 43: Cableway End Feature

33. Key in **90 deg** in the **Angle** field drop-down list in the **Route Cableway** ribbon.
34. Select the **Elevation Plane: East-West Direction** option in the **Plane** drop-down list on the **Route Cableway** ribbon.

35. Move the cursor to the other end feature of the cableway with non-zero spec to get the elevation coordinate, as show in Figure 44.

Note:

- You should have the cardinal offset set to disabled in this step. Since the end feature of the cableway with non-spec is at the correct elevation, you just need to finish the route by using the centerline option. As a result, SP3D will generate a 90 Horizontal Bend during the connection quite easily. Otherwise, you need to lining up the bottoms cardinal point of the cableways using the **Move** command.

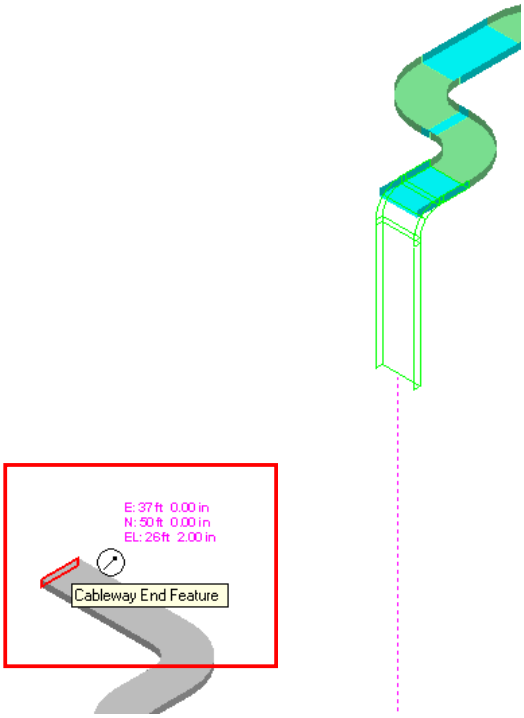


Figure 44: Extending the Cableway

36. Click in the graphic view to define the next data point. Again, move the cursor to the other end feature of the cableway with non-zero spec and click to join the two cableways, as shown in Figure 45.

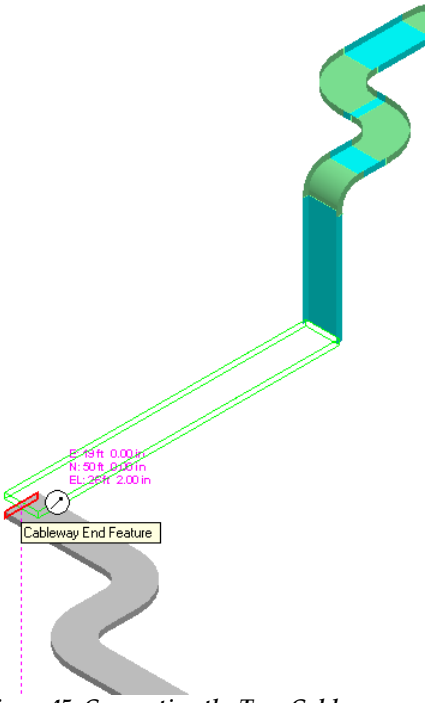


Figure 45: Connecting the Two Cableways

Steps for Changing Cableway to Use Different Specifications:

You can select a cableway with non-part specification and change it to use a part specification. SP3D will generate the tray parts for all the feature type located in the cableway system. If a part cannot be found for a specific feature, then SP3D will generate a To Do List item.

Note:

- It is very important to match the specification of the other cableway so that SP3D will not place any transitions and the parts generated on both cableways are of the same manufacturer, tray type, material, and load span classification.

1. Select the **Cableways** option from the **Locate Filter** drop-down list to select only cableways from the graphic view.

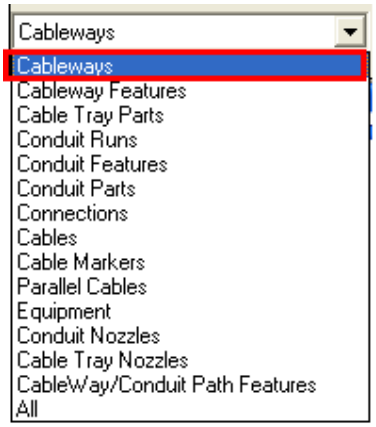


Figure 46: Locate Filter Drop-Down List

2. Select the cableway with non-zero spec from the graphic view, as shown in Figure 47.

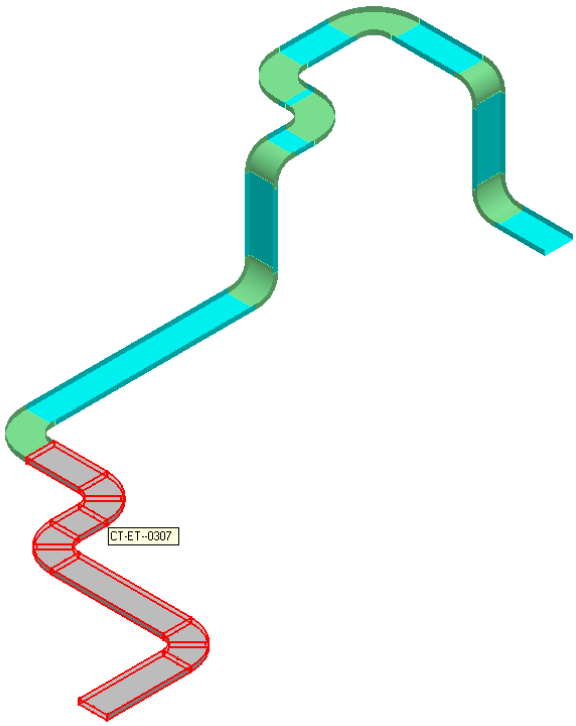


Figure 47: Selected Cableway

3. Right-click the selected cableway to access the **Cableway Properties** dialog box.
4. Select **CB-S1-L6-12B** from the **Specification** drop-down list on the **Cableway Properties** dialog box, as shown in Figure 48.

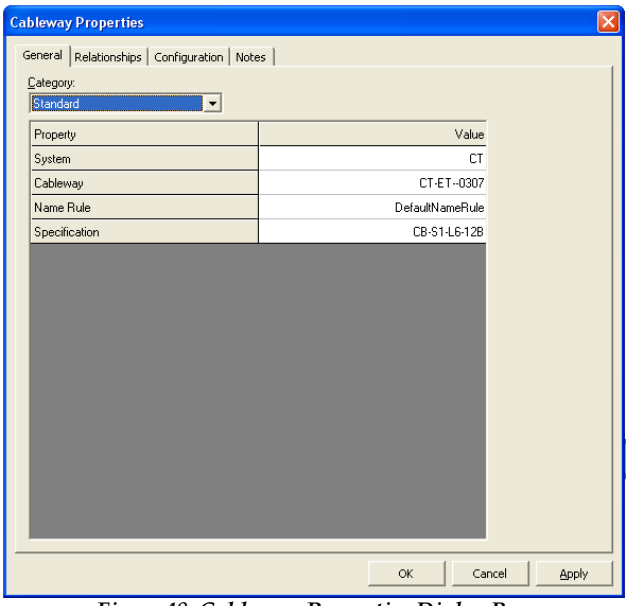


Figure 48: Cableway Properties Dialog Box

5. Click **OK** to apply the modified specification on the cableway.

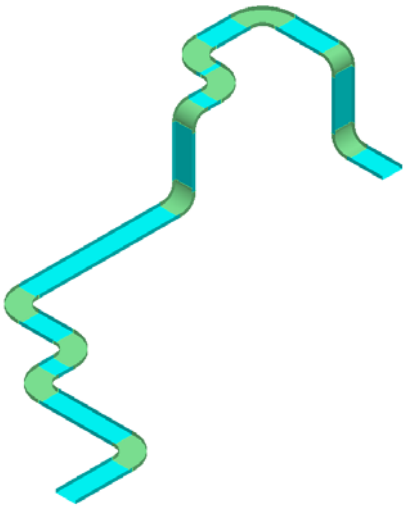


Figure 49: Modified Cableway

Note:

- SP3D use the specification, the size and the feature type to generate the appropriate tray parts for the selected cableway.

Steps for Routing a Cableway with a Size Change:

Note:

- A size change reduces the size of the cableway that you route compared to the existing one.

1. Now click the **Route Cableway** button on the vertical toolbar.
2. Select the **Plan Plane** option in the **Plane** drop-down list on the **Route Cableway** ribbon.
3. Select the **Cableway End Feature** of the cable tray placed earlier in this session.
4. Change the width to **1 ft** and depth to **4 in** and length to **8 ft** on the **Route Cableway** ribbon.
5. Position the cursor towards the south direction in the graphic view, as shown in Figure 50.

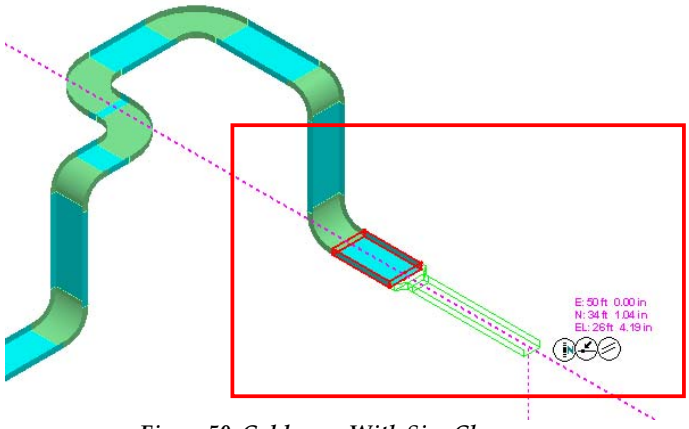


Figure 50: Cableway With Size Change

6. Click the graphic view to accept the position.

   After the size change the cableway network should resemble Figure 51.

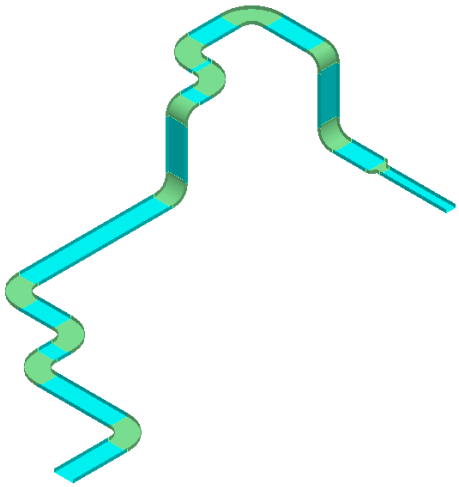


Figure 51: Output: Cable Tray Network

To Do List Items

While routing a cableway if there is any inconsistency in the cableway features they will appear as To Do List items and they need to be resolved.

Steps for Resolving To Do List Items:

1. Click the **Route Cableway** button on the vertical toolbar.
2. Select the **Cableway End Feature** of the cable tray you just placed, as shown in Figure 52.

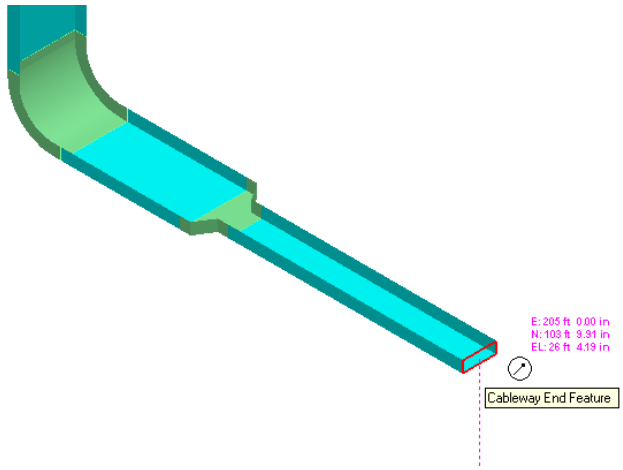


Figure 52: Selected End Feature

3. On the **Route Cableway** ribbon, key in **8 ft** in the **Length** drop-down list and **20 deg** on the **Angle** drop-down list.

Figure 53: Angle and Length Drop-Down List on Route Cableway Ribbon

4. Click in the graphic view to define the next data point. System displays a message dialog box 'No Part Found for a Turn Feature in Catalog Data'. Click **OK** to close the message dialog box.
5. Select **View > To Do List** option to open the **To Do List** dialog box. Review the information column for a description of the error.

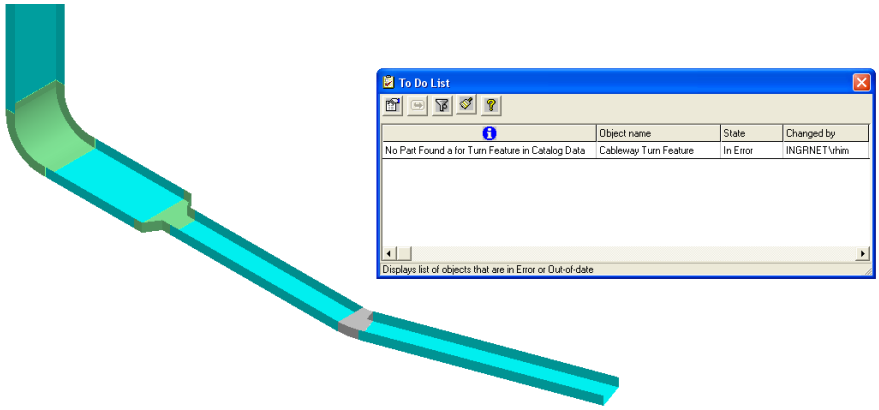


Figure 54: To Do List Item for a Feature Without Part

6. Close the **To Do List** dialog box.

   One option to resolve the **To Do List** is to re-route the cableway path. As an example, let's delete some of the features and re-route the cableway path.

7. Select all features between the transition feature and the straight feature you just placed, as shown in Figure 55.

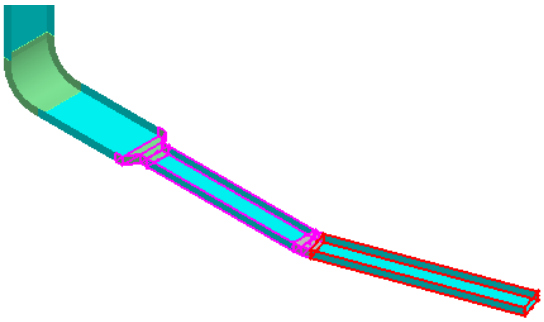


Figure 55: Selected All Features Between the Transition Feature and the Straight Feature

8. Select the **Delete** command to delete the selected features.

9. Click the **Reposition Target** option on the **PinPoint** ribbon and put the target at the free end of the tray as shown in Figure 56.

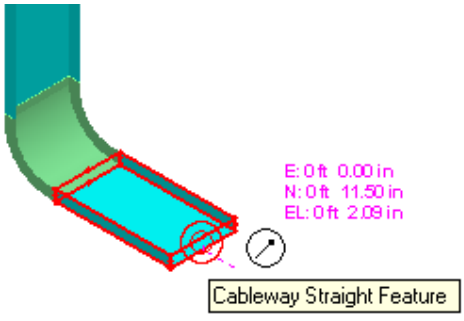


Figure 56: Reposition Target at the End of the Cable Tray

10. Click the **Route Cableway** command on the vertical toolbar.
11. Select the end feature at south end of the tray network to start the route.
12. Click the **Plane** drop-down list on the ribbon and select **Plan Plane** to route the tray.
13. On the **PinPoint** ribbon, key in **10 ft East**, **-10 ft North**.
14. Click in the graphic view to place the tray.
15. Now, you will route the next segment of the cabletray in the **East** direction.
16. In the **Route Cableway** ribbon, unlock the **angle** constraint and key in **15 ft** in the **Length** drop-down list. Move the cursor in the east direction and click in the graphic view to place a **15 ft** cable tray.
17. Right-click in the graphic view to terminate the **Route Cableway Component** command.

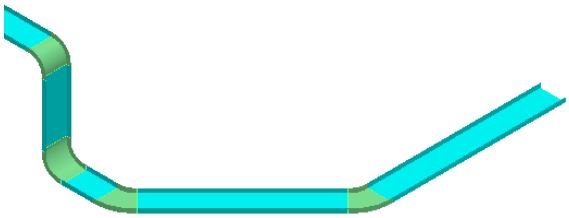


Figure 57: Re-routed Cableway

Routing Multi Trays:

SP3D supports the routing of multiple cableways, cable tray runs, or multi trays. You can route them in one of two modes: **Vertical** (stacked) or **Horizontal** (side-by-side). To route multi trays, you use the **Route Cableway** button on the vertical toolbar and set the required options on the **Multi-Route** tab of the **New Cableway Properties** dialog box. The software creates a master run and several slave runs. You route the master run, and the slave runs follow along.
The cableway runs have identical properties as you route them. Once the cableways are routed, they are individual cableway runs without any relationship with each other. You can change a property on the master run. But it won't affect any of the slave runs.

SP3D maintains the properties based on the users intent when the route path changes or turns. It predicts a stepping order in the turning of each of the trays to maintain the distance gap specified for the multi-tray routing.

Steps for Routing Horizontal Multi Trays:

Route a horizontal multi tray with the following specifications starting from the coordinate points **E: 53 ft 2 in, N: 37 ft 2 in, El: 6 ft** in **U03 CS** of your workspace by using the **Route Cableway** button on the vertical toolbar:

Standard category:
System: CT
Name Rule: DefaultNameRule
Specification: CB-S1-L6-12B

Cable Fill category:
Fill Efficiency: 60%
Signal Type 1: Control

Multi-Route tab:
Mode: Along Width
Vertical Distance Between Trays: 1 ft
Cableways to Left of Master Run: 1
Horizontal Distance Between Trays: 1 ft

Route Cableway ribbon:
Width: 2 ft
Depth: 0 ft 4 in

The view of the model after routing the horizontal multi tray should look like Figure 58.

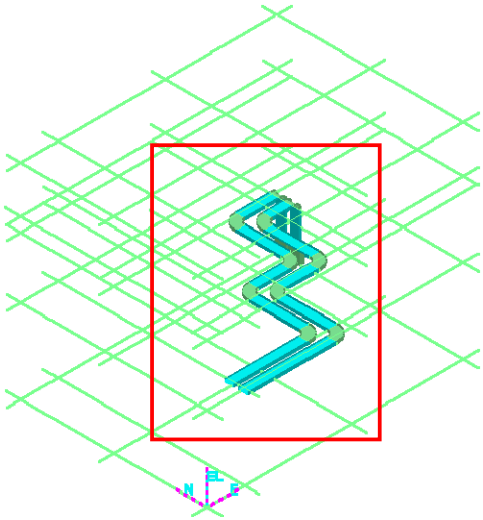


Figure 58: Horizontal Multi Tray

Before you start routing a multi tray, set the following in your workspace:

- Define your workspace to show coordinate system **U03 CS**. In your training plant, select **U03 CS** from **Plant Filters > Training Filters** in the **Select Filter** dialog box.
- If you are not in the **Electrical** task, then select the **Tasks > Electrical** command and set the Active Permission Group to **Electrical.**
- Activate the **PinPoint** ribbon and change the Active Coordinate System to **U03 CS** on the **PinPoint** ribbon.
- Click the **Set target to Origin** option on the **PinPoint** ribbon to move the target to the origin of the current coordinate system.

1. Click the **Route Cableway** button on the vertical toolbar.

2. Specify the following coordinates on the **PinPoint** ribbon as starting points and click

the graphic view:

- **E: 53 ft 2 in**
- **N: 37 ft 2 in**
- **El: 6 ft**

3. The **New Cableway** dialog box is displayed. On the **General** tab, define the cableway specifications as follows:

   Under the **Standard** category:
   System: SP3DTrain\A2\U03\Electrical\Control\CT
   Name Rule: DefaultNameRule
   Specification: CB-S1-L6-12B

   Note:
   - Use **Database** option in the **Select System** dialog box.

   Under the **Cable Fill** category:
   Fill Efficiency: 60%
   Signal Type 1: Control

   Now select the **Multi-Route** tab in the **New Cableway** dialog box, select the following specifications, and click **OK**:

   Mode: Along Width
   Horizontal Distance Between Trays: 1 ft
   Cableways to Left of Master Run: 1
   Cableways to Right of Master Run: 0

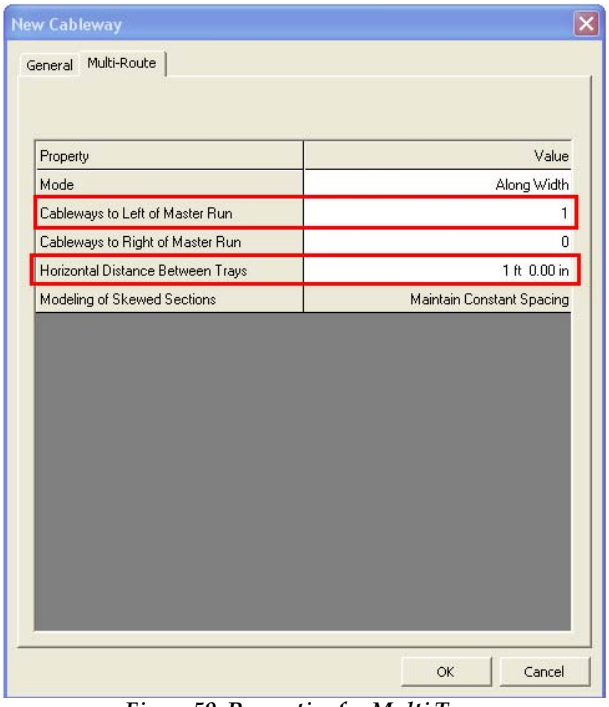


Figure 59: Properties for Multi Tray

Tips:

- If you want to route a vertical multi tray, you can select the Along Depth option in the **Mode** drop-down list in the **New Cableway** dialog box. The rest of the steps for routing vertical multi trays are the same as the steps for routing horizontal multi trays. If you route a vertical multi tray, the multi tray will look like Figure 61.

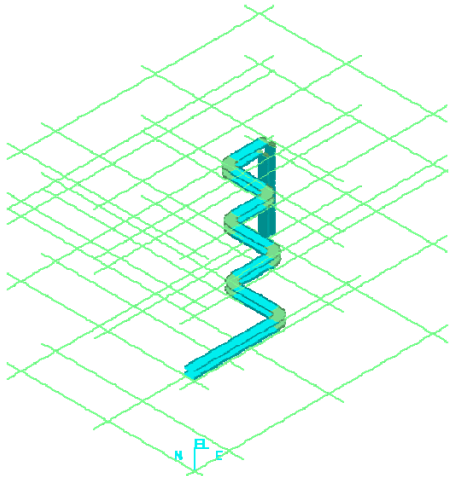


Figure 60: Vertical Multi Tray

- The option **Cableway to Left of Master Run** or **Cableway to Right of Master Run** specifies the number of slave runs above and below or to the left and right of the master run.

4. Specify **2 ft** as the width and **4 in** as the depth on the **Route Cableway** ribbon.

5. Start routing the multi tray starting from the **El** direction about **15 ft,** as shown in Figure 62.

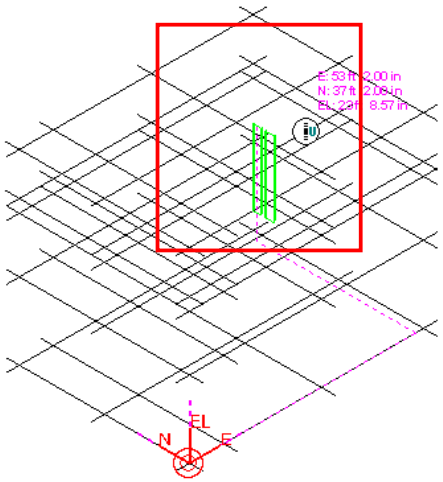


Figure 61: Starting Point for Horizontal Multi Tray

6. Now route the cable in the west direction and then in the south direction three times, as shown in Figure 63.

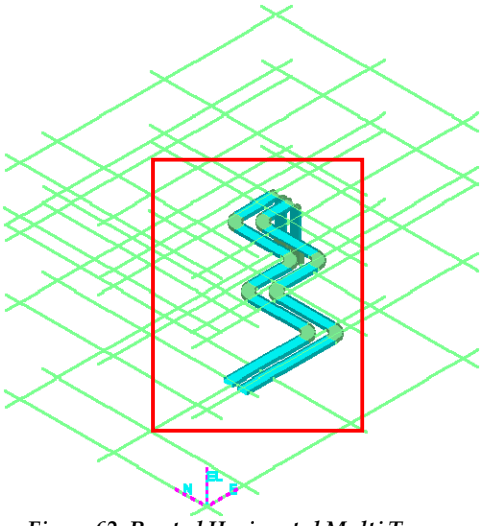


Figure 62: Routed Horizontal Multi Tray

Steps for Extending Multi Trays:

Extend the multi trays that you routed above by **10 ft** in the west direction. The workspace after extending the multi trays should resemble the highlighted area in Figure 64.

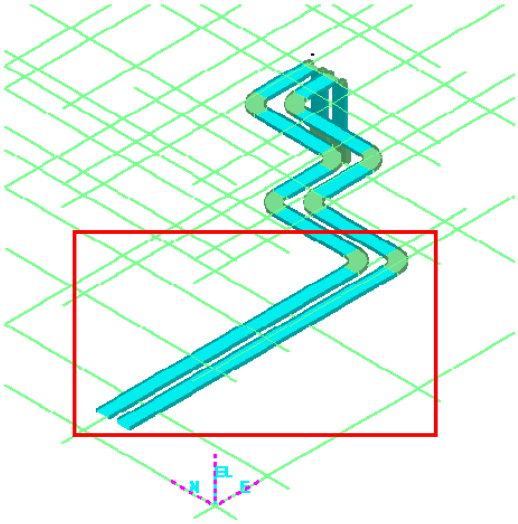


Figure 63: Extended Multi Tray

1. Select the **Cableway Features** option in the **Locate Filter** drop-down list.

2. Select the **Cableway End Feature** of both the cable trays by using the left mouse button in conjunction with the Ctrl-key to do multi-select option or just use the fence inside option.

3. Then use the **Move** command to move the two objects. Recall the common move command requires that when two objects are selected, that a **From** point be set.

4. On the Move ribbon bar, check the Fast move option. Set the **From** point to be the **End Feature** of one of the cable trays.

5. Use **Pin Point** ribbon to set the **E** value to **-9 ft 3.18 in**.

6. Position the cursor in the west direction, as shown in Figure 64.

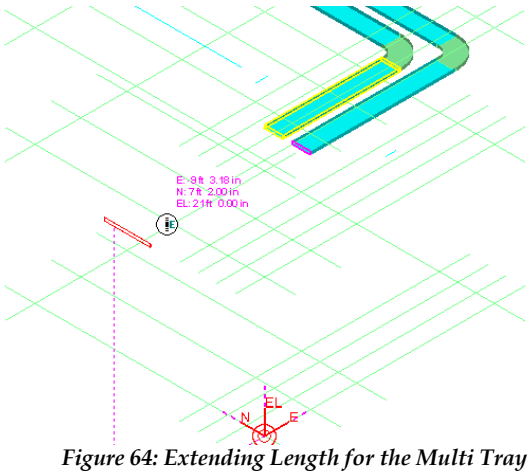


Figure 64: Extending Length for the Multi Tray

7. Click in the graphic view to accept the extension of the multi trays.

Steps for Placing a Vertical Drop Out:

You can model vertical drop outs with a non-part specification cableway between crossing cableway systems using the **Auto Connect** command on the vertical toolbar.

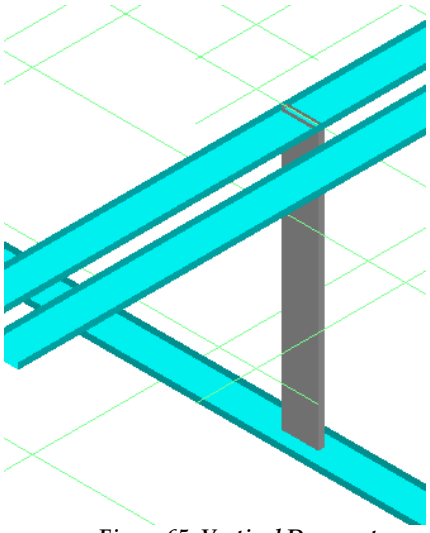


Figure 65: Vertical Drop out

1. Route one cable tray using the last used specification starting at the following coordinates:

   E: 10 ft
   N: 40 ft
   El: 6 ft

2. Specify **2 ft** as the width and **4 in** as the depth on the **Route Cableway** ribbon.

3. Start routing the cableway to the south direction about **50 ft**, as shown in Figure 66.

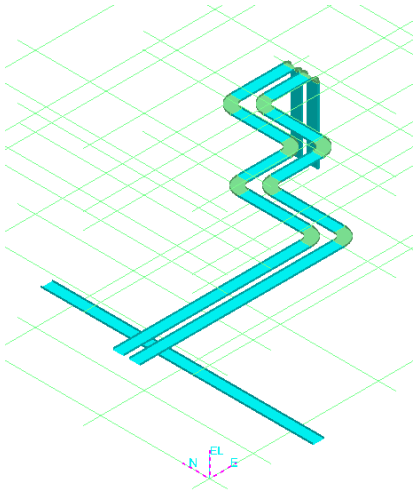


Figure 66: Routed Cableway

4. Right-click the graphic view to terminate the **Route Cableway** command.
5. Click the **Auto Connect** button on the vertical toolbar.

Figure 67: Auto Connect Button on the Vertical Toolbar

6. Select one of the cable tray, as shown in Figure 68 when the system prompts the message 'Select Cableway Runs/Features or Conduit End Features To Connect From'.

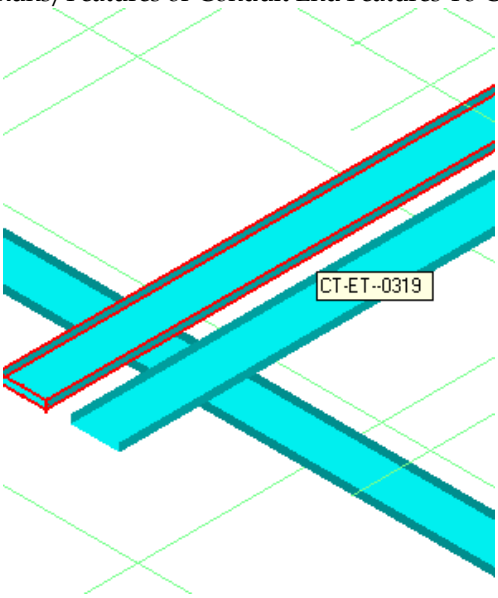


Figure 68: Selected Cableway to Start the Vertical Drop out

7. Click the **Select to Runs** option on the **Auto Connect** ribbon.

Figure 69: Next Step Button on the Auto Connect Ribbon

8. Select the other cable tray when the system prompts the message ' Select Cableway Runs/Features or Conduit End Features To Connect To' and click the **Finish** button on the **Auto Connect** ribbon.

For more information related to routing cableways, refer to the *Routing Cableway: An Overview* topic in the user guide *ElectricalUsersGuide.pdf*.

Session 4: Inserting Components

Objective:

By the end of this topic, you will be able to:

- Insert components from the SP3D catalog in a model.

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Electrical: An Overview
- Routing a Cableway

Overview:

Parts can be inserted into an existing cable tray/conduit routing or added to the ends of existing cable tray paths. A typical way to do this is to use the **Insert Component** command. When you use the **Insert Component** command the software will generate a new part or component and a parent feature for that component. These components can include anything from branches, end components, reducers to turns for cable tray, couplings, and tees for conduits, etc. The principle concept here is that the part that results from the **Insert Component** command is a catalog item that can be purchased and general is reported on a Material Takeoff report for purchasing. Additionally, the software will allow you to add components during initial routing. For example, you could be routing a cableway or conduit by using the **Route Cableway** or **Route Conduit** command. While in the route command, activate the **Insert Component** command and place the component at the current dynamic route location, then reactive the route cable tray/conduit command and continue your standard routing.

SP3D uses the specification and the insertion point to filter the components available for placement. In addition, it also generates any mating and connection parts required to connect the inserted part to adjacent objects. In case of cable tray routing, if the solution mating part does not exist, then a cableways transition will be placed to allow the component to exist in the route.

Note:

- Currently reference data will return all parts that satisfy the specification and the insertion point as opposed to limiting the list to component sizes. Users must familiarize with the naming convention of the parts and the cable tray part hierarchy as shown in Figure 1. The cable tray part hierarchy can be standardized based on the project specification set.

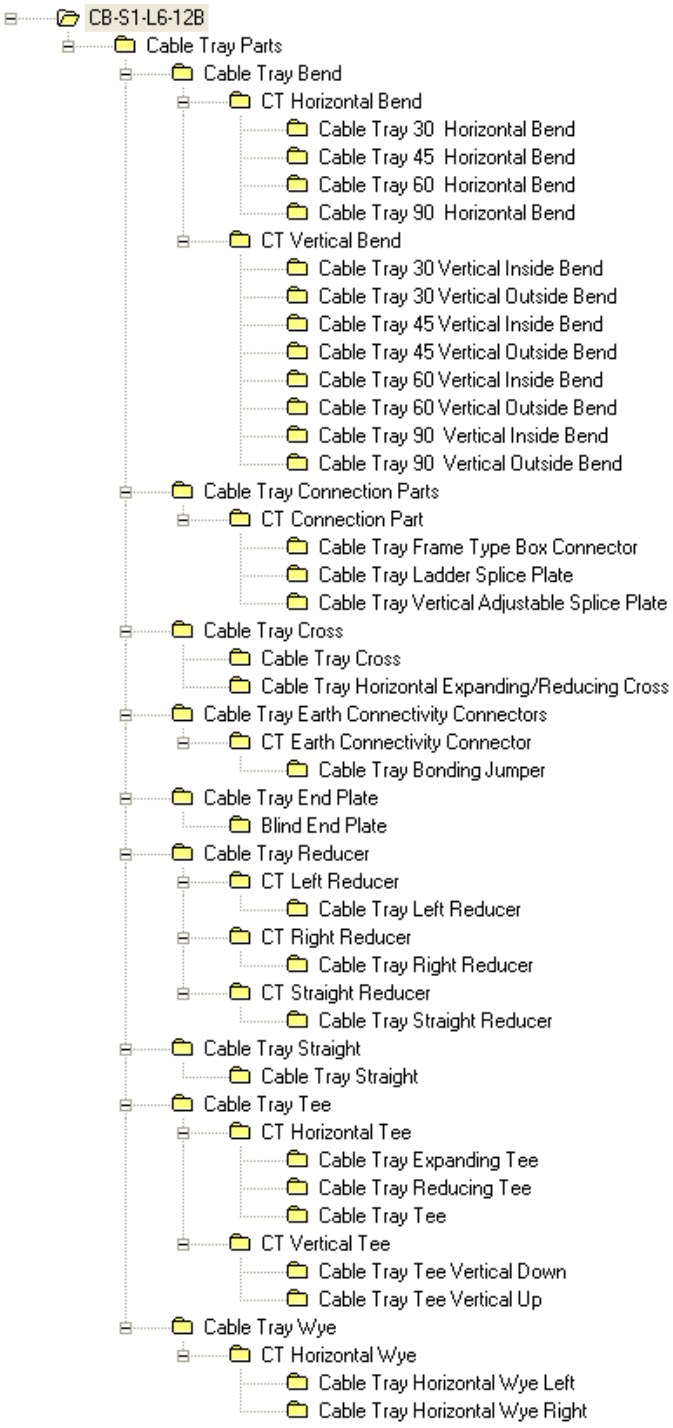


Figure 1: Cable Tray Part Hierarchy

As with other routing environments, precision tools are available to aid you in controlling the route path. When inserting components, you can use **PinPoint** or **Point Along** commands to position the components precisely in the model. Use the **Point Along** command to select an element along which to place the object, either along a certain **E**-, **N**-, or **EL**-coordinate or along

existing cableway/conduit route. Select a starting point along the element from which the software measures the distance. You can use the **Point Along** command to insert a component in between the two cableways.

Steps for Inserting Components from the Catalog:

The following example shows a typical workflow to insert components in a cableway. You first insert a horizontal tee at the end of a cableway. Second, insert a vertical outside and inside bend at the end of this horizontal tee and finally insert another horizontal tee with **Point Along** by using **Insert Component** command.

Inserting the First Horizontal Tee:

Insert a horizontal tee of part number **4P-24-18HT48** from specification **CB-S1-L6-12B** at the end of the cableway by using the **Insert Component** command in Unit **U04**. After inserting the horizontal tee, the workspace should resemble the highlighted section of Figure 2.

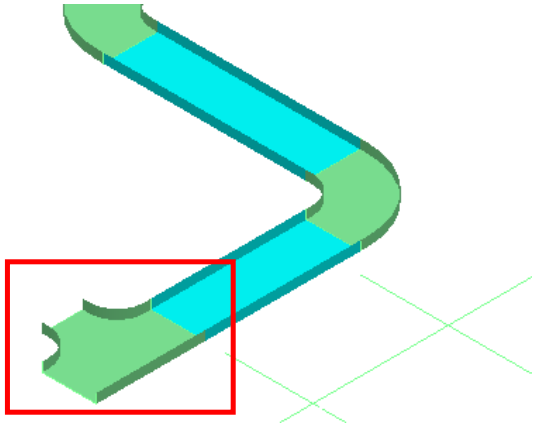


Figure 2: Inserted Horizontal Tee

Before beginning the procedure:

- Define your workspace to display Unit **U04** and coordinate system **U04 CS**. In your training plant, select **U04** from **Plant Filters > Training Filters** in the **Select Filter** dialog box.
- Make sure that you are in **Electrical** task and the Active Permission Group is set to **Electrical.**
- Familiarize with the fitting part number naming convention so that the selection becomes very easy. For example, each section of the part number **4P-24-18HT12** has a different meaning. **4P** specifies the series to which the component belongs. The number **24** specifies the main size and **18** specifies the reducing size. **HT** is the **Horizontal Tee** and the number **12** specifies the turning radius.

12. Click the **Insert Component** button on the vertical toolbar.

Figure 3: Insert Component Button on the Vertical Toolbar

13. Select the **Cableway End Feature** of a cableway as shown in the highlighted section of Figure 4.

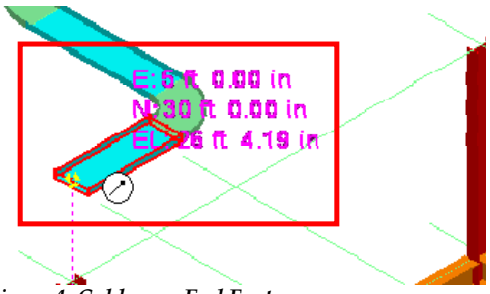


Figure 4: Cableway End Feature

14. Select **More…** option in the **Part** drop-down on the **Insert Component** ribbon to select the component part from the catalog that you want to insert (Refer to Figure 5).

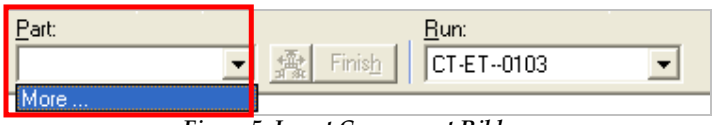


Figure 5: Insert Component Ribbon

15. The **Select Part** dialog box appears. Expand the node **CB-S1-L6-12B\Cable Tray Parts\Cable Tray Tee\CT Horizontal Tee\Cable Tray Reducing Tee** in the left pane of the **Select Part** dialog box. Select the **Part Number 4P-24-18HT12** from the right pane as shown in Figure 6.

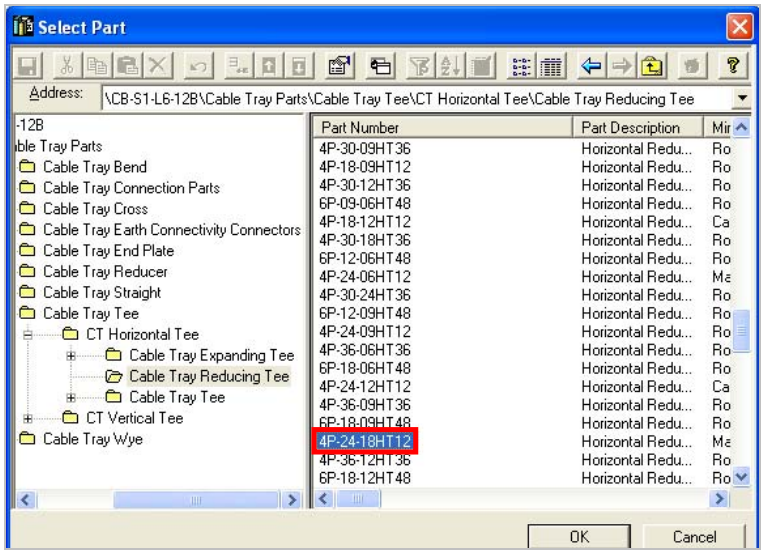


Figure 6: Select Part Dialog Box

Note:

- The **Select Part** dialog box displays all the cable tray parts available in the part catalog for the current cable tray specification. However, it will not let you select a part if the geometry does not belong to the correct feature type during fitting placement.

- The part number in the right pane of the **Select Part** dialog box represents the dimensions of the component that you want to place. After you have understood how parts are numbered, selection becomes very easy. . For example, each section of the part number **4P-24-18HT12** specifies something different. **4P** specifies the series to which the component belongs. The number **24** specifies the main size and **18** specifies the reducing size. **HT** is the **Horizontal Tee** and **12** specifies the turning radius.

16. After selecting the **Part Number** in the **Select Part** dialog box, click **OK**. The horizontal tee in the graphic view resembles the highlighted section of Figure 7.

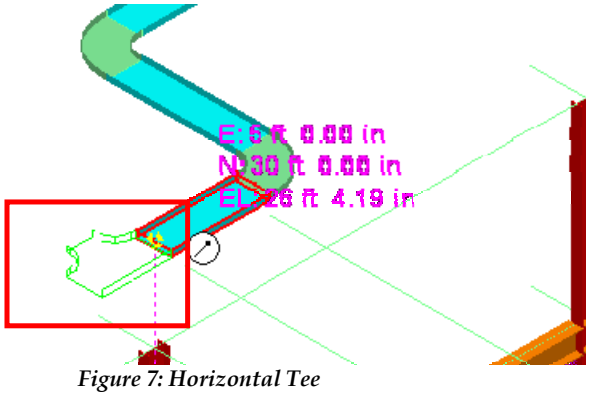


Figure 7: Horizontal Tee

Note:

- During insertion of any component, the **Flip** command toggles through the ports available for the component being inserted. As each port is toggled, the component is oriented such that the selected port is aligned along the axis of the run on which it is being inserted. The Component Reference Position control allows the user to specify insertion of the component by a particular port, by its origin, or by the port of a solver-generated mating part.

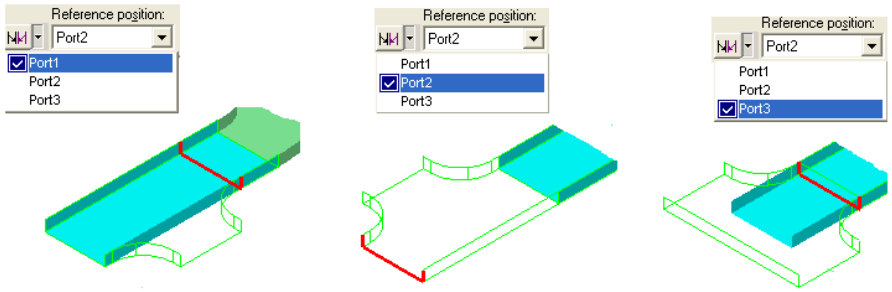


Figure 8: Flip and Reference Position Options

17. Select the **Finish** option on the **Insert Component** ribbon to accept the placement of the component.

Figure 9: Finish Option on the Insert Component Ribbon

18. Right-click in the graphic view to terminate the **Insert Component** command.

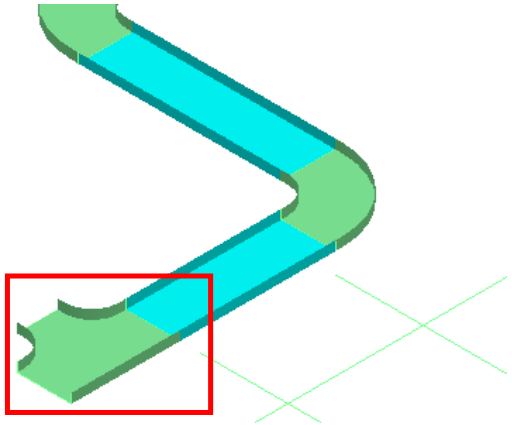


Figure 10: Placed Horizontal Tee

Inserting a Vertical Bend:

Insert an outside vertical bend of part number **4P-24-45VO12** at the end of the horizontal tray that you inserted above and then place an inside vertical bend of part number **4P-24-45VI12** at the end of Outside vertical bend**.** After inserting the vertical bends, the workspace should resemble Figure 11.

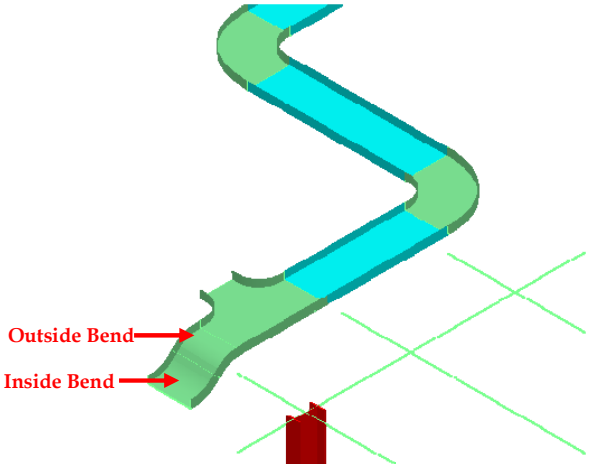


Figure 11: Placed Vertical Bends: Inside and Outside

19. Click the **Insert Component** button on the vertical toolbar.

20. Now, select the end feature of the horizontal tee that you placed as shown in the highlighted section of the Figure 12.

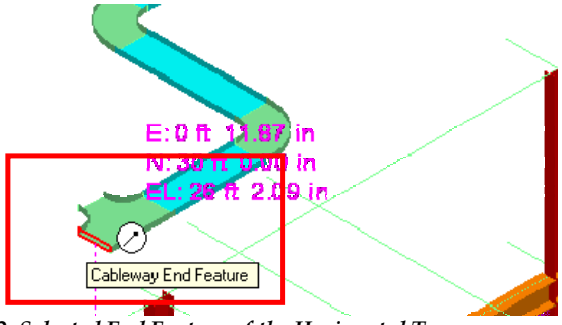


Figure 12: Selected End Feature of the Horizontal Tee

21. Select **More…** in the **Part** drop-down list on the **Insert Component** ribbon to select the component part from the catalog.

22. In the **Select Part** dialog box expand the node **CB-S1-L6-12B\Cable Tray Parts\Cable Tray Bend\CT Vertical Bend\Cable Tray 45 Vertical Outside Bend** in the left pane of the **Select Part** dialog box and select the **Part Number 4P-24-45VO12** from the right pane.

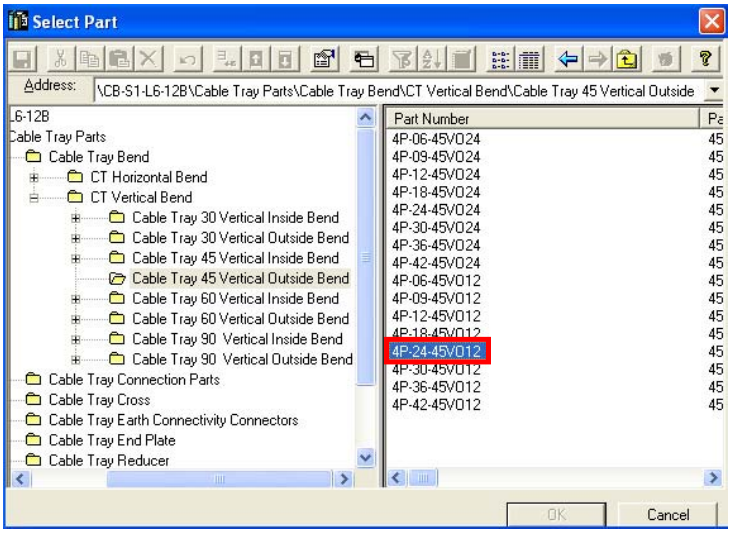


Figure 13: Select Part Dialog Box

23. After selecting the **Part Number** in the **Select Part** dialog box, click **OK**. The vertical bend in the graphic view should resemble the highlighted section of Figure 14.

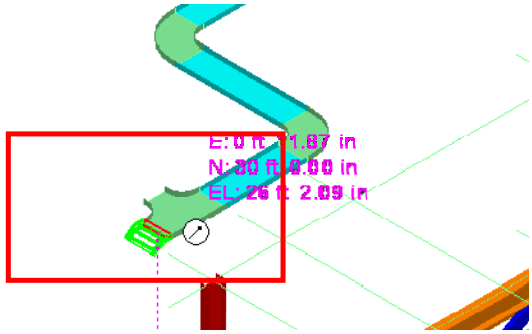


Figure 14: Vertical Bend - Outside

24. Select the **Finish** option on the **Insert Component** ribbon to accept the placement of the component.

25. On the **Insert Component** ribbon, select the **More…** option in the **Part** drop-down to select the component part from the catalog.

26. In the **Select Part** dialog box expand the node **CB-S1-L6-12B\Cable Tray Parts\Cable Tray Bend\CT Vertical Bend\Cable Tray 45 Vertical Inside Bend** in the left pane of the **Select Part** dialog box and select the **Part Number 4P-24-45VI12** from the right pane.

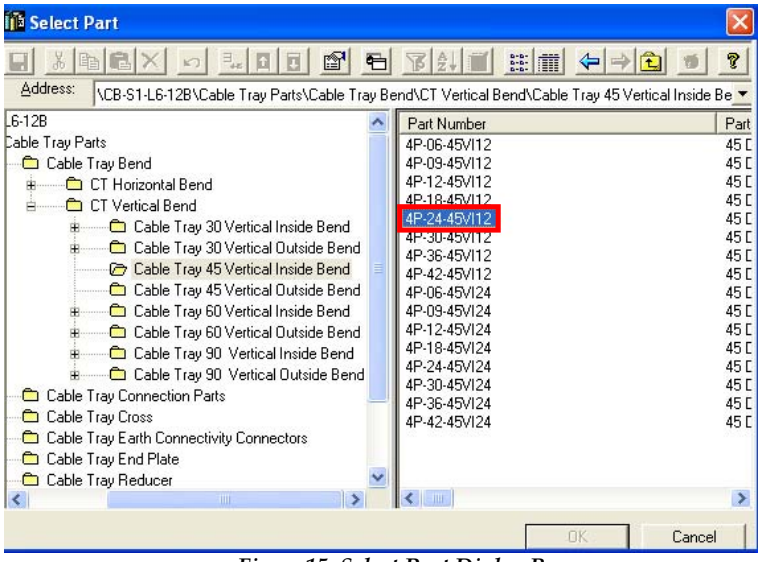


Figure 15: Select Part Dialog Box

27. After selecting the **Part Number** in the **Select Part** dialog box, click **OK**. The vertical bend in the graphic view should resemble the highlighted section of Figure 16.

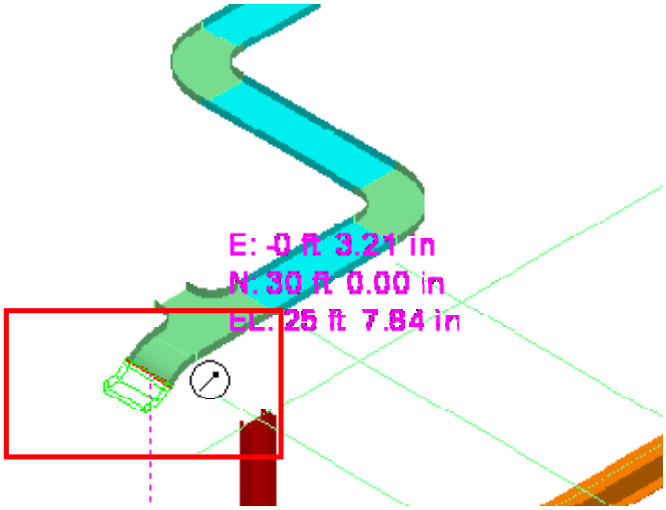


Figure 16: Vertical Bend: Inside

28. Select the **Finish** option on the **Insert Component** ribbon to accept the placement of the component.

29. Right-click in the graphic view to terminate the **Insert Component** command.

Inserting the Second Horizontal Tee by Using Point Along:

Insert another horizontal tee of part number **4P-24-12HT48** with **Point Along** at the other end of the cableway by using **Insert Component** command in Unit **U04**. After inserting the horizontal tee, the workspace should resemble the highlighted section of Figure 17.

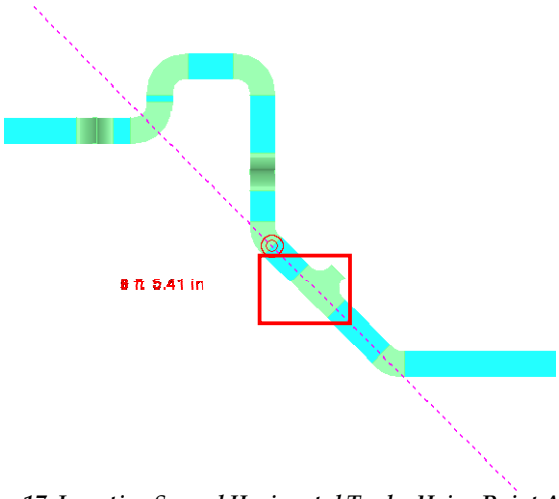


Figure 17: Inserting Second Horizontal Tee by Using Point Along

30. Click the **Insert Component** button on the vertical toolbar**.**

31. Activate **Point Along** ribbon using **Tools > Point Along** command.

32. Select **Reference** option on the **Point Along** ribbon. This option identifies the path along which to measure the placement distance.

Figure 18: Reference Button on the Point Along Ribbon

33. Select the **Cableway Straight Feature** to specify the path along which you want to measure the placement distance of the tee, as shown in the highlighted section of Figure 19.

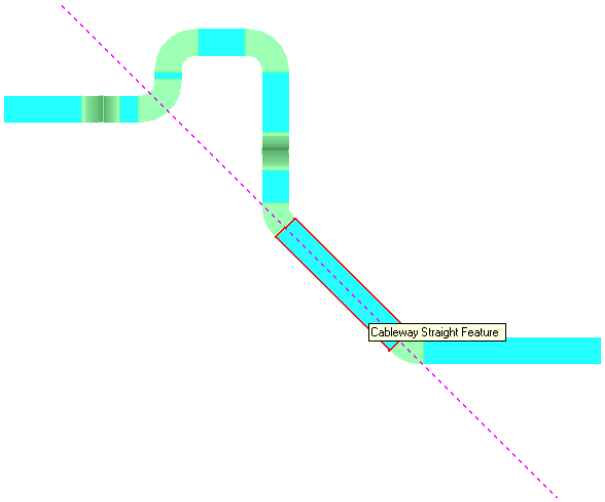


Figure 19: Cableway Straight Feature

34. Select the **Reference Point** option on the **Point Along** ribbon. This option is used to

identify a point from which the distance is measured. The point should be located on the reference element.

Figure 20: Reference Point Option on the Point Along Ribbon

35. Select the **Cableway End Feature** of a cableway to specify the point from which to measure the placement distance as shown in Figure 21.

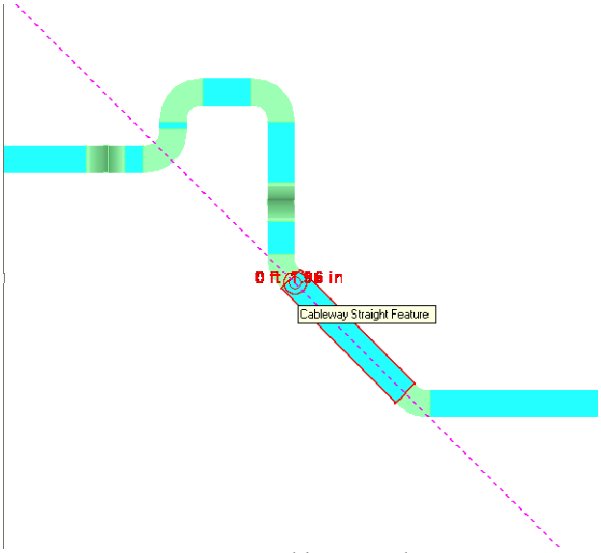


Figure 21: Cableway End Feature

36. Select the **Cableway Straight Feature** of the cableway where you want to insert the tee.

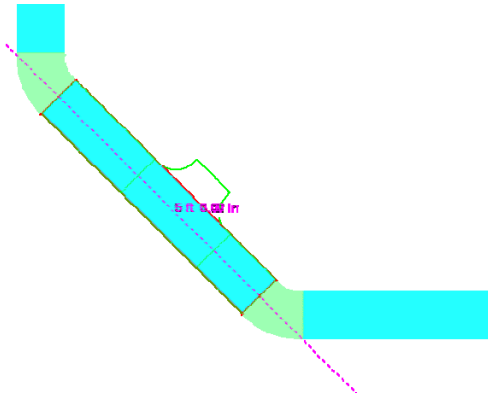


Figure 22: Selected Cableway Straight Feature

37. Select **More…** from the **Part** drop-down list on the **Insert Component** ribbon to select the component part from the catalog that you want to insert.

Figure 23: Insert Component Ribbon

38. The **Select Part** dialog box appears. Expand the node **CB-S1-L6-12B\Cable Tray Parts\Cable Tray Tee\CT Horizontal Tee\Cable Tray Reducing Tee** in the left pane of the **Select Part** dialog box. Select the **Part Number 4P-24-18HT12** in the right pane, as shown in Figure 24.

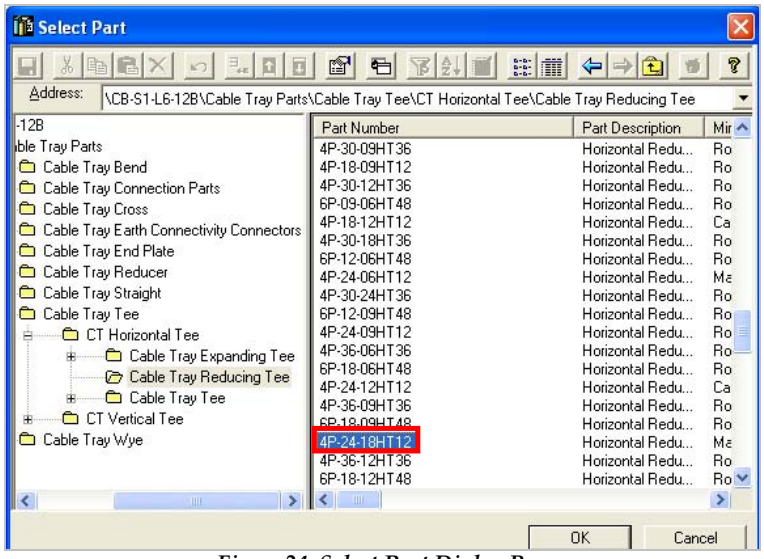


Figure 24: Select Part Dialog Box

39. Click **OK** in the **Select Part** dialog box.

40. Key in **5 ft** in the **Distance** box on the **Point Along** ribbon for specifying the distance of the component from the referred **Cableway End Feature**. The view of the horizontal tee in the graphic view should resemble Figure 25.

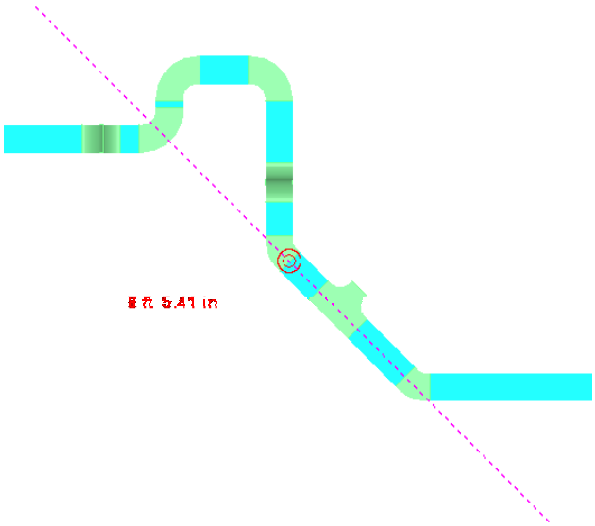


Figure 25: Placed Horizontal Tee

Note:

- **Reference position** slides the component that you are inserting so that its origin

or selected port is positioned at the insertion point. If the selected reference position does not lie along the axis of the leg, then the software projects the position so that it intersects the axis and the component slides so that the projected point is located at the insertion point.

41. Select the **Insert point** option in the **Insert Component** ribbon and click in the active view to accept the data point.

42. Now select the **Finish** option on the **Insert Component** ribbon to accept the placement of the component.

43. Close **Point Along** ribbon using **Tools > Point Along** command.

For more information related to inserting components in a model, refer to *Inserting Components* topic in the user guide *ElectricalUsersGuide.pdf*.

Session 5: Routing Cableways with Non-Part Specifications

Objective:

By the end of this session, you will be able to:

- Route a cableway with non-part specification.
- Route Duct Banks

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Electrical: An Overview
- Routing a Cableway

Overview:

In an Electrical task, you can route cableways with a non-part specification. Such routed cableways are referred to as cableway Zero-Specs. Cableway with a non-part specification is a spec without parts where as the corresponding cable tray spec is one which has parts. By using cableway with a non-part specification you can model duct banks, cable bus, vertical dropouts, and bus ducts.

Notes:

- One of the extended uses of a cableway with non-part specification is that you route a cableway to reserve the space in the model, then you change specification by using the property page to a cable tray spec. This allows you to size the tray at a later time, and SP3D will solve for the parts when you flip the spec from a cableway with non-part spec to a cable tray spec. You can also go back to cableways with non-part spec later if you want. It is a reversible process.
- Cableway with non-part specification can also be used to represent a duct bank, cable bus, and bus duct.

This space reservation is intended to reserve space and can report as clashes when the Interference Detection processes the data. You see a hybrid of this effect when you are dealing with a cable tray part spec that has no turn parts. In this case we can route straight sections of tray and the turns will just be space reservations that represent where we think the cable will hang as it passes from one tray straight section to another.

This session will cover the procedures to use a cableway with non-part specification to represent an underground duct bank.

Steps for Routing an Underground Duct Bank:

Route an underground duct bank using the following specifications:

- **Cableway1:**
  Width: **3 ft**
  Depth: **2 ft**
  Length: **15 ft in north direction**

- **Cableway2:**
  Width: **2 ft**
  Depth: **2 ft**
  Length: **43 ft in north direction**

- **Cableway3:**
  Width: **2 ft**
  Depth: **2 ft**
  Length: **56 ft in east direction**

- **Branched Cableway:**
  Width: **2 ft**
  Depth: **2 ft**
  Length: **56 ft in east direction**
  Starting Point: **E= 0 ft, N= -4 ft, El= -3 ft**

The workspace after routing the underground duct bank should resemble Figure 1.

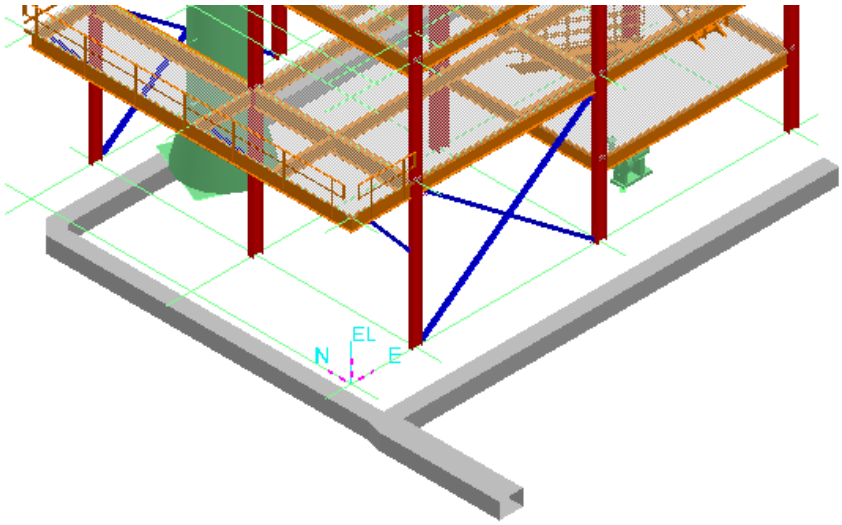


Figure 1: Routed Underground Duct Bank

Before beginning the procedure define your workspace to display Unit **U03** and coordinate system **U03 CS**.

1. Select **All** filter from the **Locate Filter** drop-down list.

2. Click the **System** tab on Workspace Explorer and expand the **System Hierarchy** to **A2 > U03 > Electrical**.

3. Right click on the **Electrical** system and select **New System > New Electrical System** option on the short cut menu.

4. The **Property Pages Dialog** box appears. Key-in **Duct Bank** as the name in the **Name** field and click **OK**.

5. Make sure you are in **Electrical** task and the Active Permission Group is set to **Electrical.**

6. Activate **PinPoint** ribbon and set **U03 CS** as active coordinate system.

7. Click the **Set Target to Origin** option on the **PinPoint** ribbon, to move the target to the origin of the current coordinate system.

8. Click the **Route Cableway** button on the vertical toolbar.

Figure 2: Route Cableway Command on the Vertical Toolbar

9. Key in **0 ft** for easting, **-20 ft** for northing, and **-3 ft** for elevation on the **PinPoint** ribbon to specify the starting point for routing the duct bank.

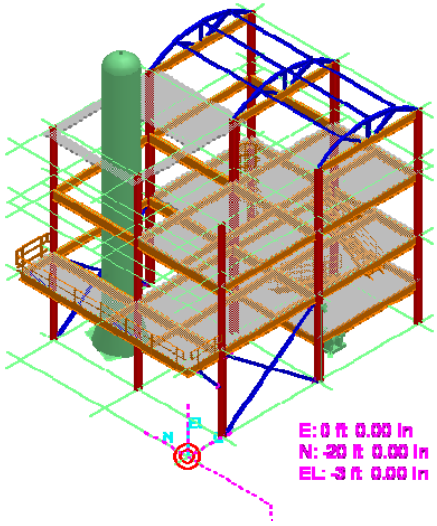


Figure 3: Starting Point for Routing the Duct Bank

10. The **New Cableway** dialog box will appear. Select the following specifications on the

New Cableway dialog box, as shown in the Figure 4 and click **OK**.

- **System**: **A2 > U03 > Electrical > Duct Bank**
- **Name Rule**: **DefaultNameRule**
- **Specification**: **Cws-0**

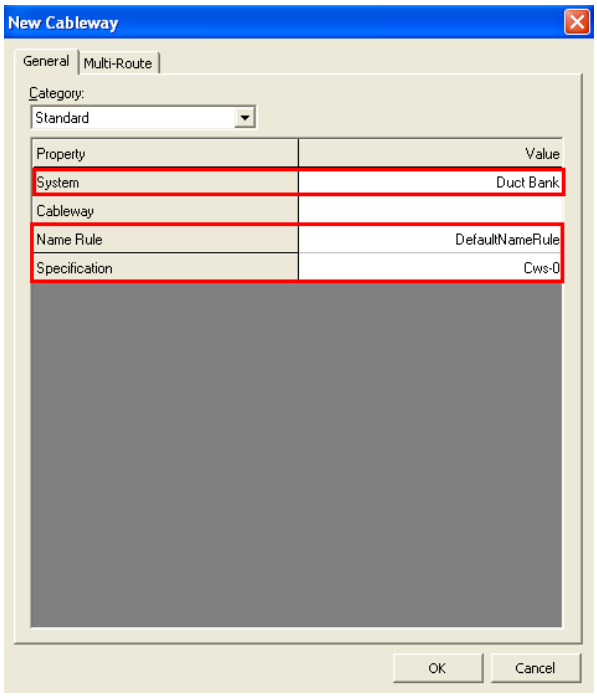


Figure 4: Specifications on the New Cableway Dialog Box

11. Select the **Plan Plane** option in the **Plane** drop-down list on the **Route Cableway** ribbon.
12. Select **Rectangle** from the **Shape** drop-down list and key in **3 ft** for **Width, 2 ft** for **Depth,** and **15 ft** for **Length** on the **Route Cableway** ribbon.
13. Route the duct bank by pointing towards north direction till the **N** SmartSketch glyph appears, as shown in the Figure 5.

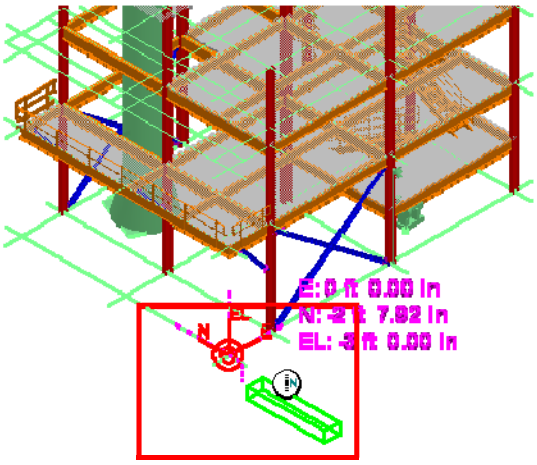


Figure 5: Cableway Routed in North Direction

14. Click the graphic view to place the data point.

15. Key in **2 ft** as **Width**, **43 ft** as **Length,** unlock the **Angle** and position the cursor in north direction to extend the duct bank**,** as shown in Figure 6.

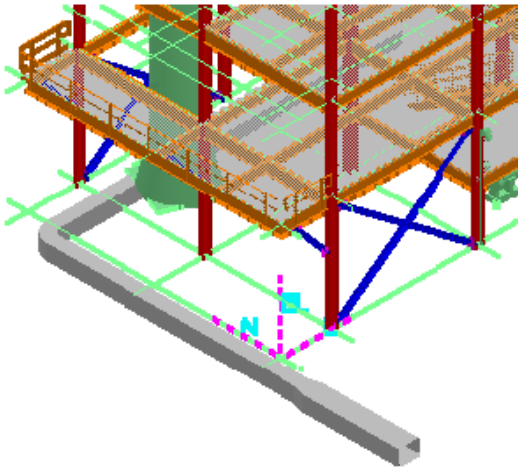


Figure 6: Routed Cableways

16. Click the graphic view to define the next data point.

17. Position the cursor in the east direction and key in **56 ft** in the **Length** box to route a **56 ft** duct bank.

18. Right-click in the view to terminate the command.

19. Click the **Route Cableway** button on the vertical toolbar.

20. Key in the following coordinates on the **PinPoint** ribbon and click in the active view.

    - East: **0 ft**
    - North: **-4 ft**
    - Elevation: **-3 ft**

21. The **New Cableway** dialog box will appear. Keep the default last used values and click **OK**.

22. Position the cursor in the east direction and key in **56 ft** in the **Length** box to create a **56 ft** long branch.

23. Right-click in the graphic view to terminate the command.

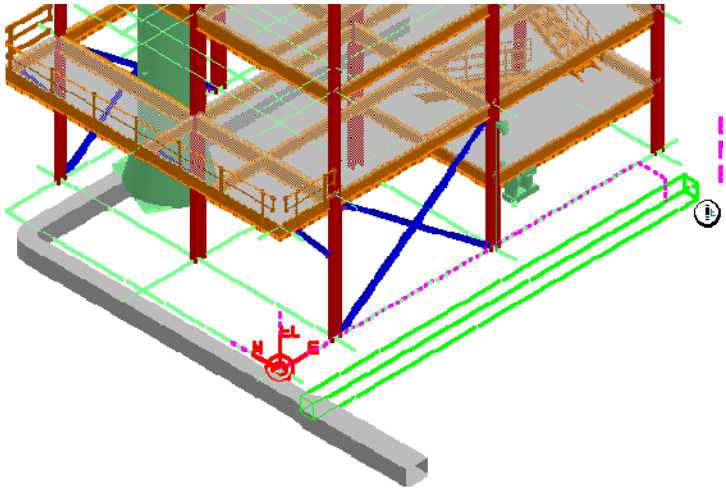


Figure 7: Branched Cableway

24. Select the turn feature, as shown in Figure 8, to open the **Edit** ribbon.

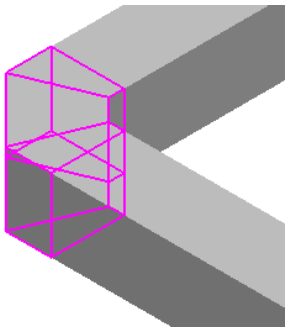


Figure 8: Selected Turn Feature

25. Change from **BEND** to **MITER** on the **Type** drop-down list on the **Edit** ribbon. Then, key in **2** to specify the number of cuts for the Miter elbow.

Figure 9: Turn Feature on the Edit Ribbon

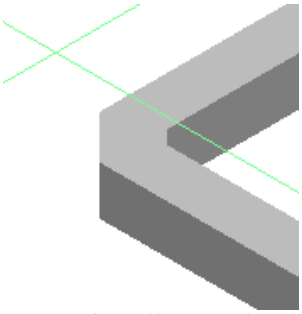


Figure 10: Miter Elbow on the Duct Bank

Notes:

- If the turn feature is a **Miter** type, then another box appears on the ribbon that allows you to choose the number of cut as shown in Figure 11.

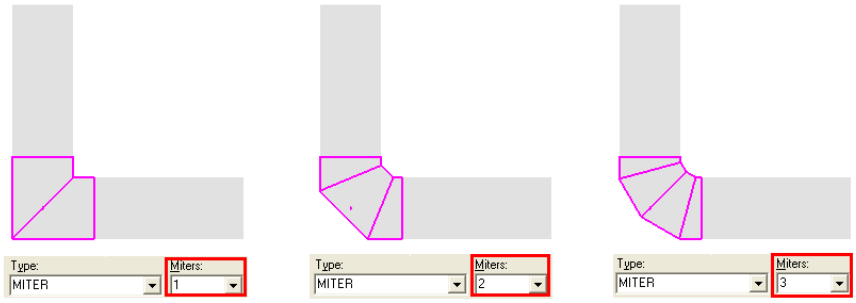


Figure 11: Miter Elbow can be (1-2-3) Configuration

Steps for Placing Electrical Pull-Pit:

Place two Pull-Pits from the equipment catalog using the following specifications:

Height: **5 ft 11 in**
Width **4 ft**
Length **4 ft**
Thickness **2 in**

After placing the Pull-Pits the model should resemble the highlighted portion in Figure 12.

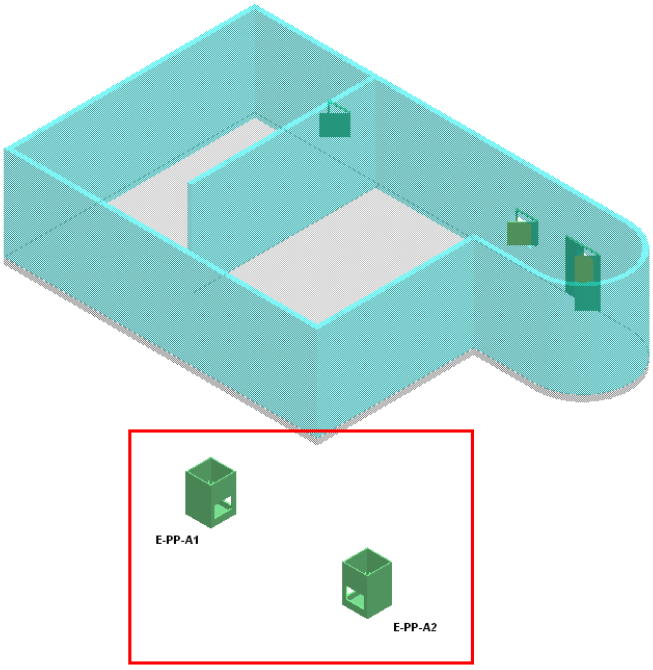


Figure 12: Pull-Pits (E-PP-A1 an d E-PP-A2)

Before beginning the procedure define your workspace to display Unit **U05** and coordinate system **U05 CS**.

1. If you are not in the **Electrica**l environment, then select the **Task > Electrical** command.

2. In the **Active Permission Group** drop-down list, select the **Electrical** option.

3. Active the PinPoint ribbon by using the **Tools > PinPoint** command.

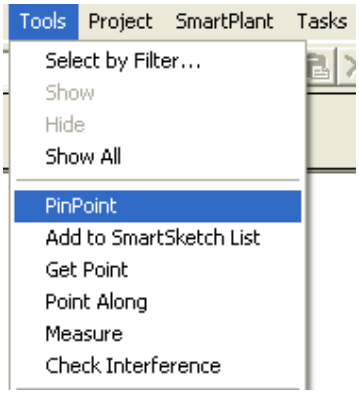


Figure 13: Tools Menu

4. Set the active coordinate system to **U05 CS** in the Coordinate system drop-down list on the PinPoint ribbon.

5. To move the target to the origin of the current coordinate system, select the **Set target to Origin** option on the PinPoint ribbon.

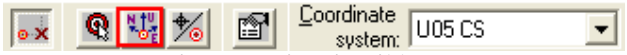


Figure 14: PinPoint ribbon

6. Click the **Place Equipment** button on the vertical toolbar.

7. In the Select Equipment dialog box, expand the folder **Equipment\Civil\Pull Pit or Manhole** until you see the part **PullpitorManhole-01-E**. Select the part and click **OK**.

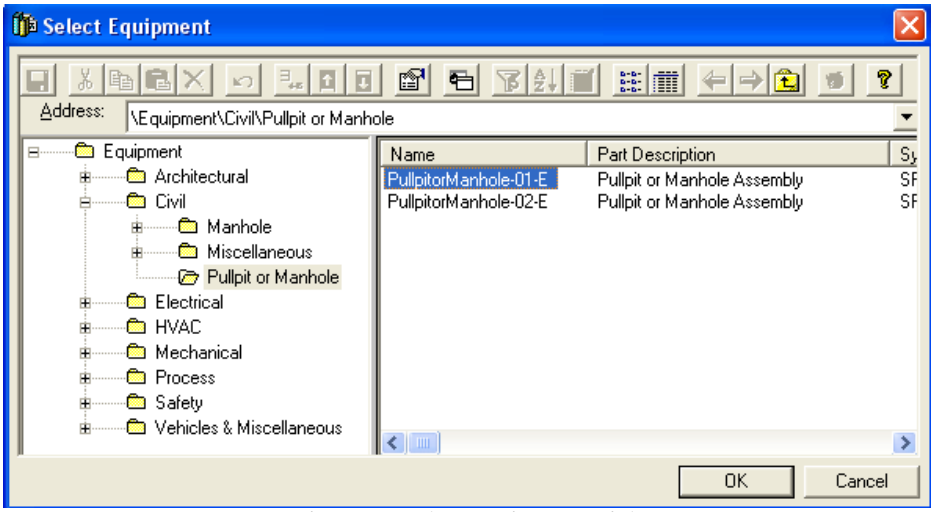


Figure 15: Select Equipment Dialog

8. The Equipment Properties dialog box appears as soon as you select **PullpitorManhole-01-E** part.

9. Key-in **E-PP-A1** in the Name field.

10. Click the System field and select the **More**.. option to specify the system to which the equipment belongs.

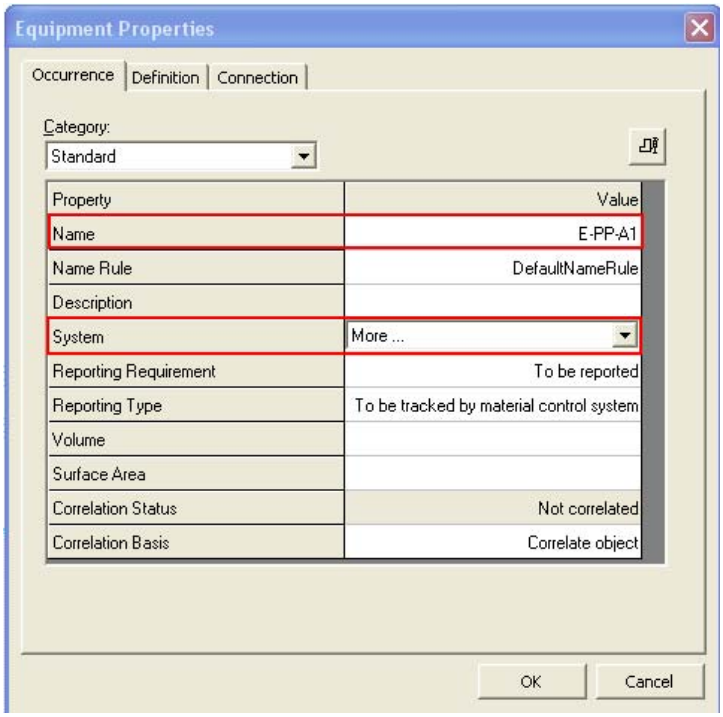


Figure 16: Equipment Properties Dialog

11. Select **Equipment System** under **A2->U05**, as shown below, to indicate where the

object will be placed. Then, click **OK**.

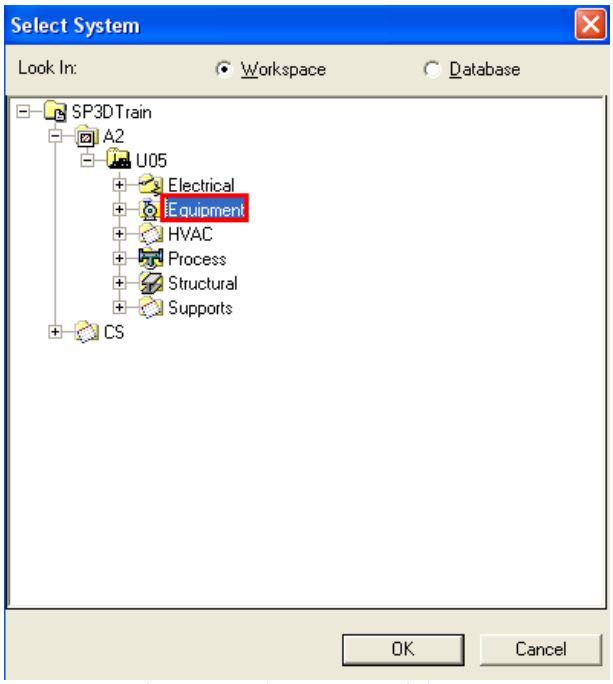


Figure 17: Select System Dialog

12. To define the position of the object, select the **Position and Orientation** category in the Category drop-down list.

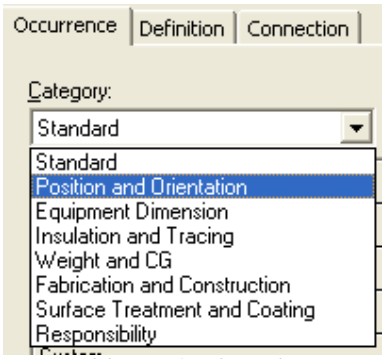


Figure 18: Position and Orientation Category

13. Key in the followings properties:

    East: 50 ft
    North: -35 ft
    Elevation: - 3 ft

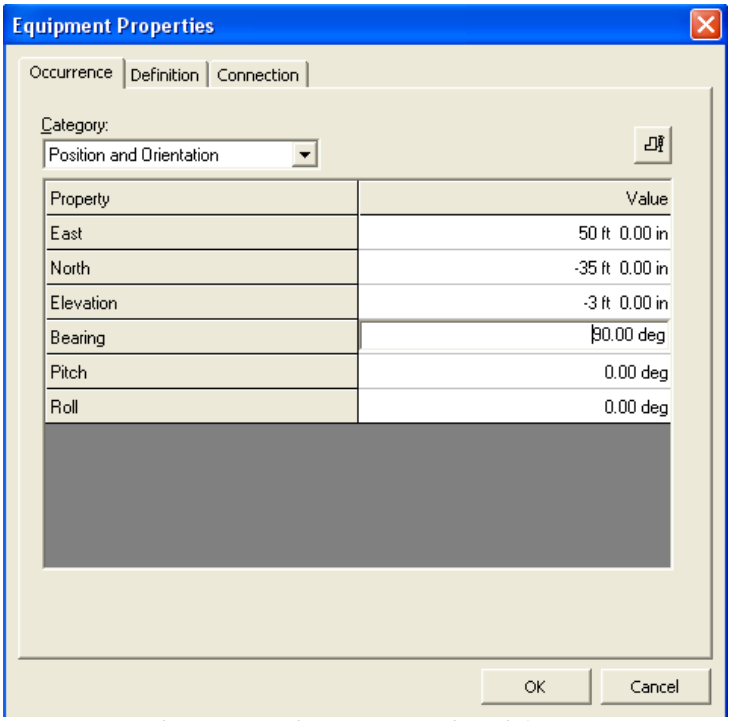


Figure 19: Equipment Properties Dialog

14. Switch to the **Equipment Dimension** category in the Category drop-down list.

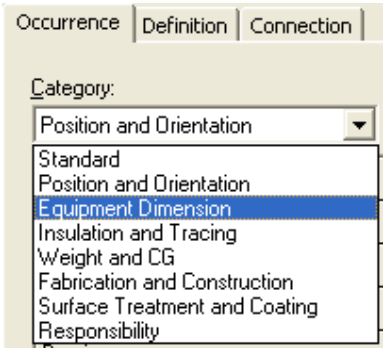


Figure 20: Equipment Dimension Category

15. Click the  **Preview** button to display an image of the selected part as shown below.

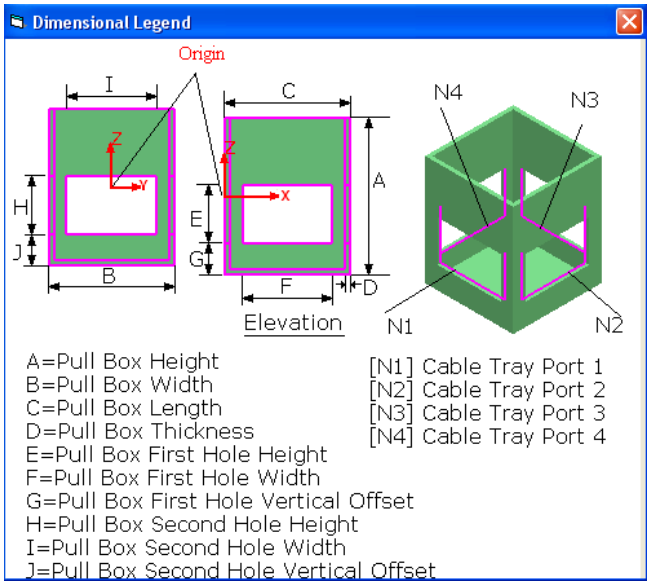


Figure 21: Preview Dialog (Dimensional Legend)

16. Click **[x]** button to close the previous dialog box and change the dimensions as shown below.

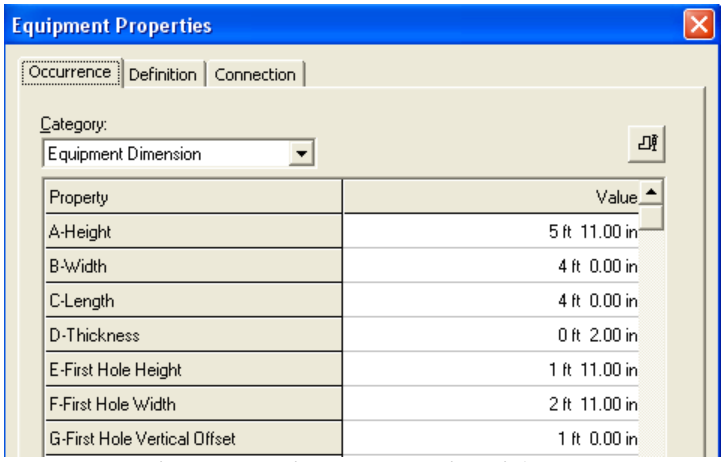


Figure 22: Equipment Properties Dialog

17. Change the **First Hole Penetrates End** and **Second Hole Penetrates End** fields to **False** as shown below.

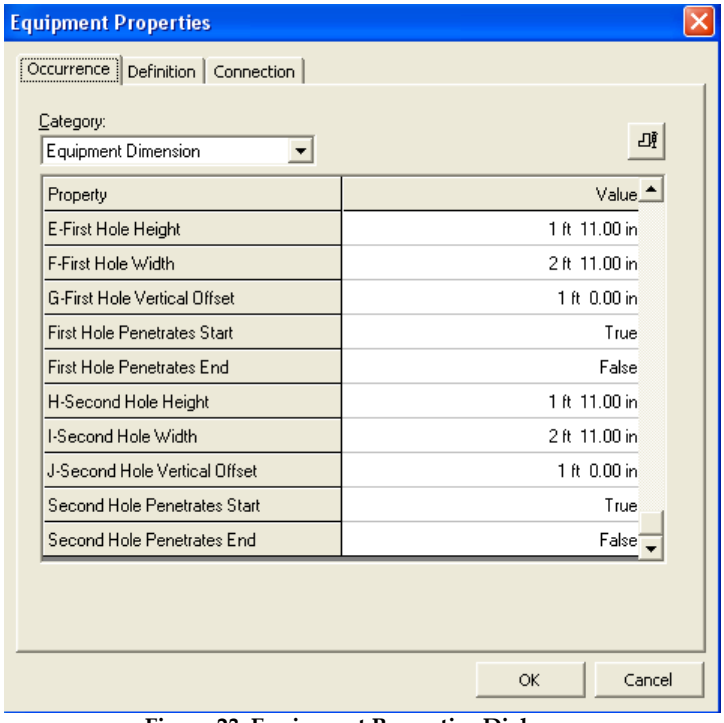


Figure 23: Equipment Properties Dialog

18. Click **OK** on the Equipment Properties dialog box to place the Pull-Pit in the model.

19. Right-click in the active view to de-select the equipment.

20. Select the **View -> Fit** command.

21. Select **All** in the Locate Filter drop-down list.

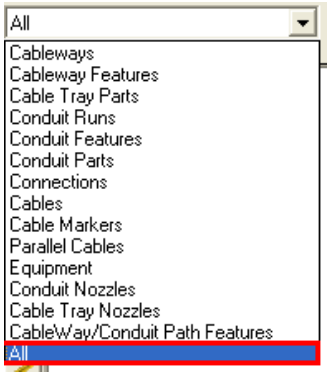


Figure 24: Select Filter Drop-down List

22. Right-click on **Solid (Cable-Pit – Solid)** in the Workspace Explorer and select Properties.

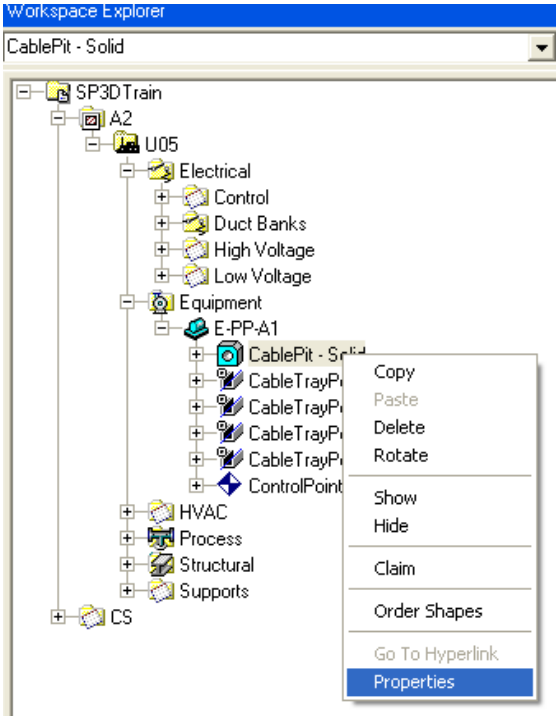


Figure 25: Workspace Explorer

23. On the **Occurrence** tab, the Surface Area and Volume properties are shown.

Surface Area	191.86 ft^2
Volume	15.50 ft^3

Figure 26: Occurrence Tab

24. The material density is required to compute the weight of a Solid. As a result, the density is extracted from the catalog when the user specifies a Material Type and Material Grade. Set the Material Name to **Concrete** and set the Material Grade to **Fc 3000**. Press **Apply**.

Material Name	Concrete
Material Grade	Fc 3000

Figure 27: Occurrence Tab

25. Click **Cancel** to close the Properties page.

Steps for Copying/Pasting The Pull-Pit:

26. Select **Format -> View** in the main menu to open the Format View dialog.

27. Turn the **Reference Geometry Aspect** on in the Format View dialog and click **OK**, as shown in Figure 28.

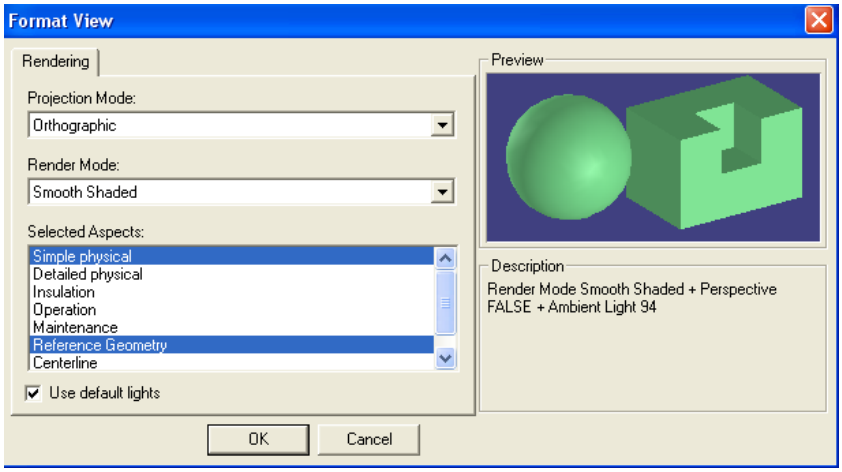


Figure 28: Format View Dialog

28. Select the Pull-Pit **E-PP-A1** graphically or in the Workspace Explorer. Make sure you select the Equipment Assembly (Parent).

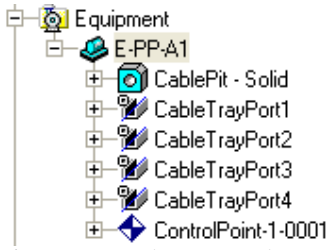


Figure 29: Workspace Explorer

29. Click the **Copy** button on the Common toolbar.

Figure 30: Main Toolbar

30. When prompted for a reference point, select the **Control Point 3D** at the top center of the Pull-Pit.

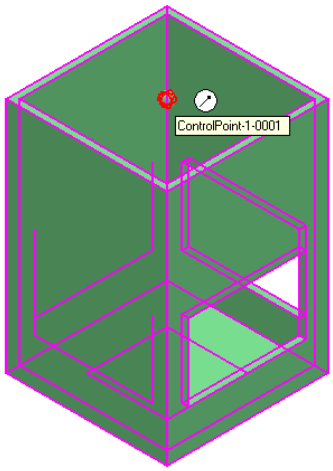


Figure 31: Pull-Pit (E-PP-A1)

31. Click the **Paste** button on the Common toolbar.

Figure 32: Main Toolbar

32. System displays the Paste dialog. The Equipment system folder is already selected as the new system folder in the Workspace Explorer.

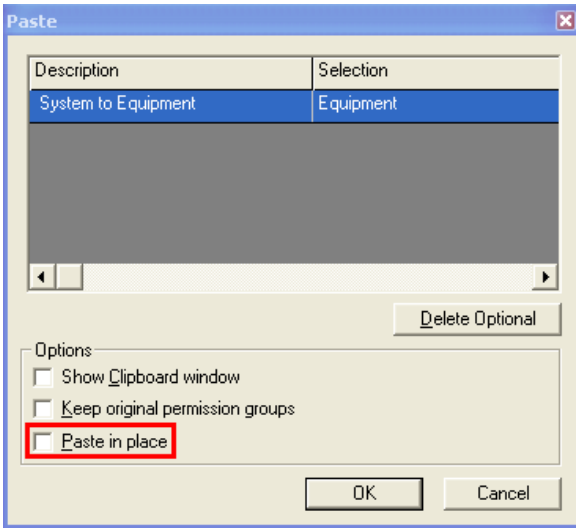


Figure 33: Paste Dialog

33. **Clear** the "Paste in place" check box in the Paste dialog and click **OK**.

34. Key in the following specification on the PinPoint ribbon and click in the active view to enter the **"To"** point for the paste operation:

    East: 52 ft
    North: -10 ft
    Elevation: -0 ft 0.5 in

35. Change the name to **E-PP-A2** by editing the name field on the Equipment Edit ribbon.

Figure 34: Equipment Edit ribbon

36. Click the  button on the Equipment Edit ribbon to open the property page.

37. Switch to the **Equipment Dimension** category in the Category drop-down list

38. Change the **First Hole Penetrates Start** field to **FALSE** and **First Hole Penetrates End** field to **True.** Similarly, change the **Second Hole Penetrates Start** field to **FALSE** and **Second Hole Penetrates End** field to **True** as shown below.

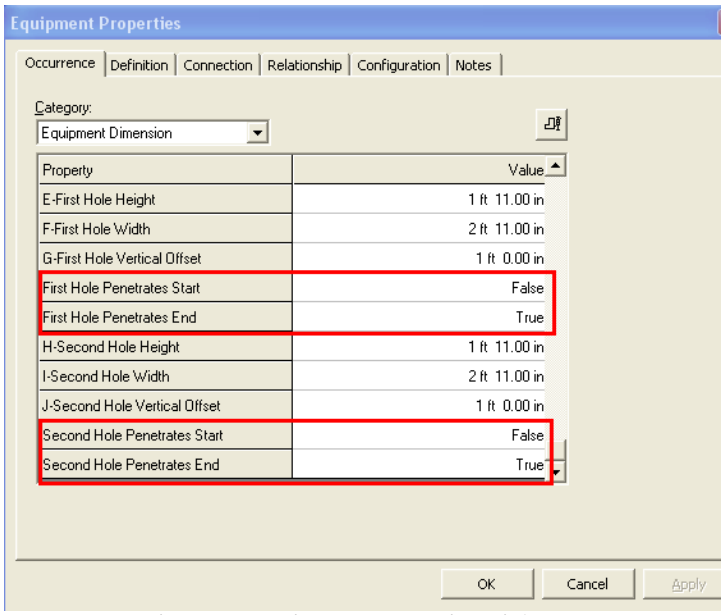


Figure 35: Equipment Properties Dialog

39. Click **OK** on the Equipment Properties dialog box to accept the changes.

Steps for Creating a Duct Bank Layout:

Use the Route Cableway command to route a Duct Bank layout. The Duct Banks will be routed between the Pull-Pits placed in the previous exercise such that valid cable path can be created once the connecting runs are defined within Pits. The workspace after routing the duct bank system should resemble Figure 36.

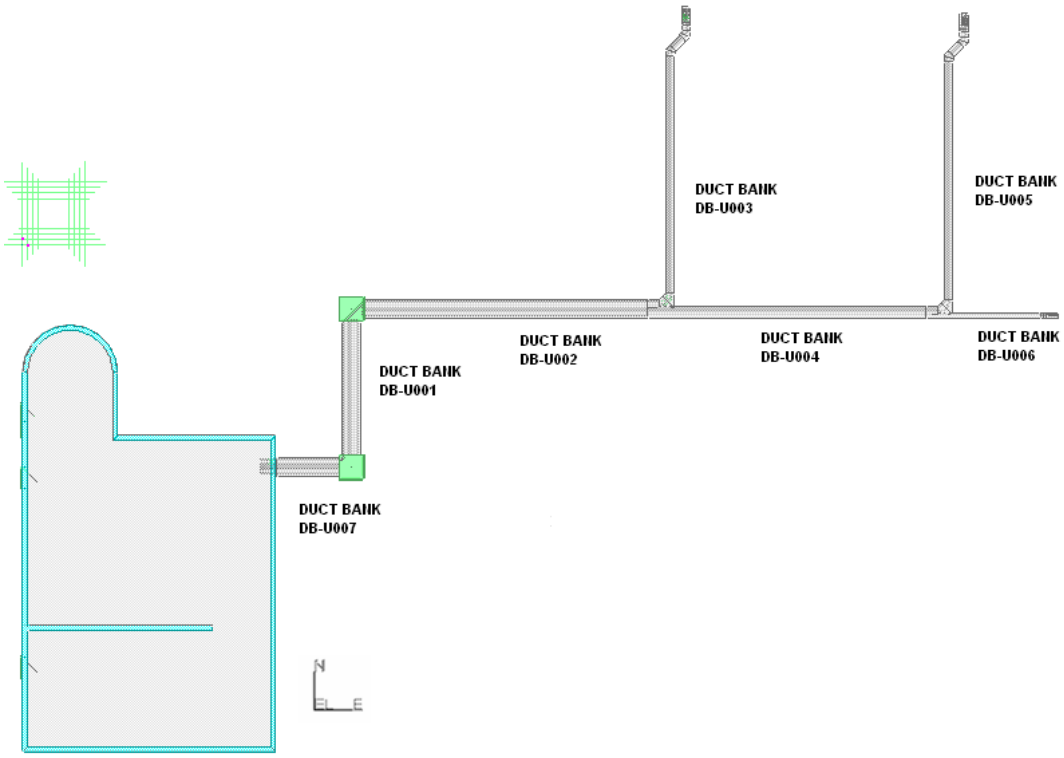


Figure 36: Duct Bank Layout – Plan View

You can start routing the first duct bank system from Pull-Pit (1) to Pull-Pit (2).

1. Locate the Pull-Pit (1) named **E-PP-A1** in the model.

2. Change the view of the model to "**Looking Isometric"** by using the Common View button on the **Common toolbar**. This will enable you to get better view of the cable tray ports on the Pull-Pit (1).

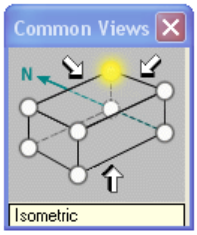


Figure 37: Common View Dialog

3. Select the Route Cableway command button from the vertical toolbar. 

4. Select **cable tray port4** on the Pull-Pit named **E-PP-A1** as the starting point, as shown below.

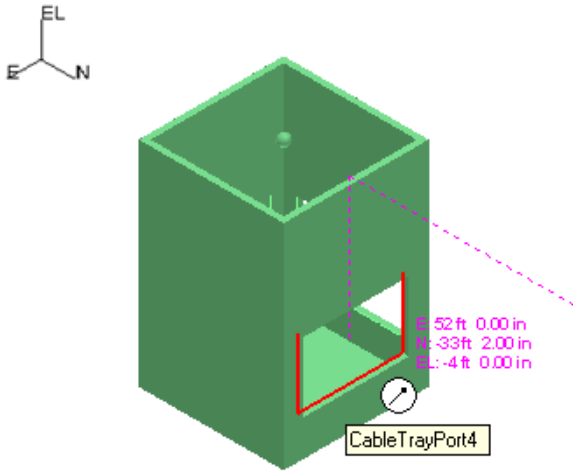


Figure 38: Cable Tray Port 4 from Pull-Pit (1)

Note:

- When any command is in a smartstep prompting you to select a point, SP3D activates the SmartSketch service. If your cursor is close to a SmartSketch point, the geometric object is highlighted and a small glyph near the cursor displays the specific type of point found. You might have to disable SmartSketch "**Point on curve**" so that you can more easily locate the cable tray port.
  Use the SmartSketch tab on the **Tools -> Options** dialog to enable SmartSketch points that you want the software to locate.

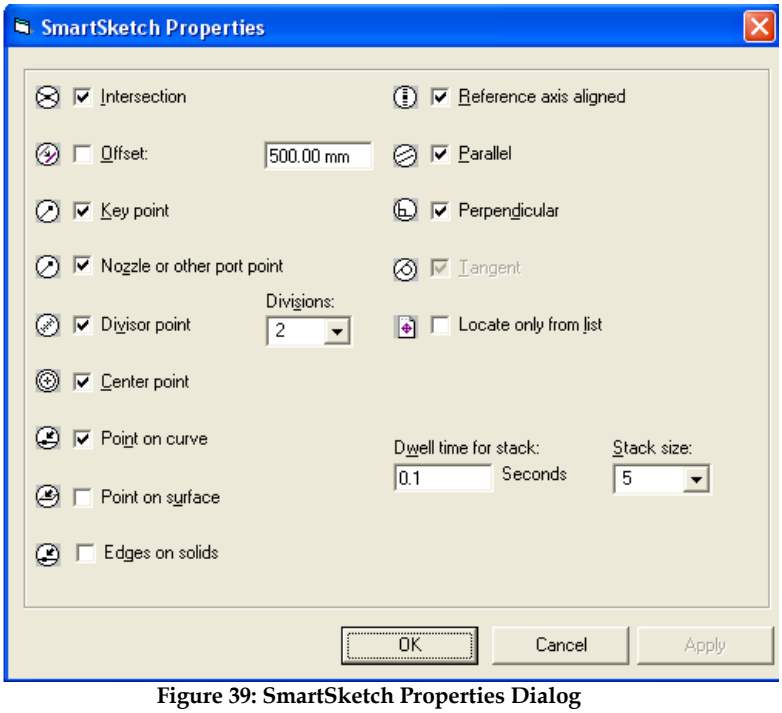


Figure 39: SmartSketch Properties Dialog

5. The New Cableway dialog box appears. Select the **More..** option in the System drop-

down list in the dialog box.

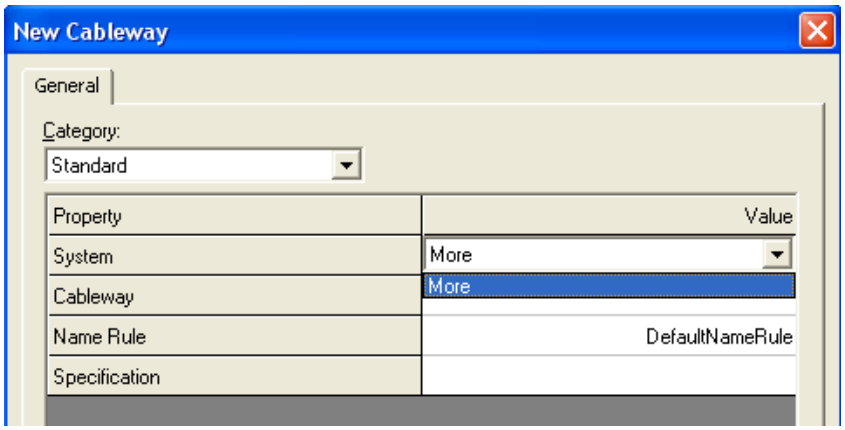


Figure 40: New Cableway Dialog

6. The Select System dialog box appears. Expand the system folder hierarchy **A2->U05->Electrical** and select **Duct Banks** system in the dialog box. Then, click **OK**.

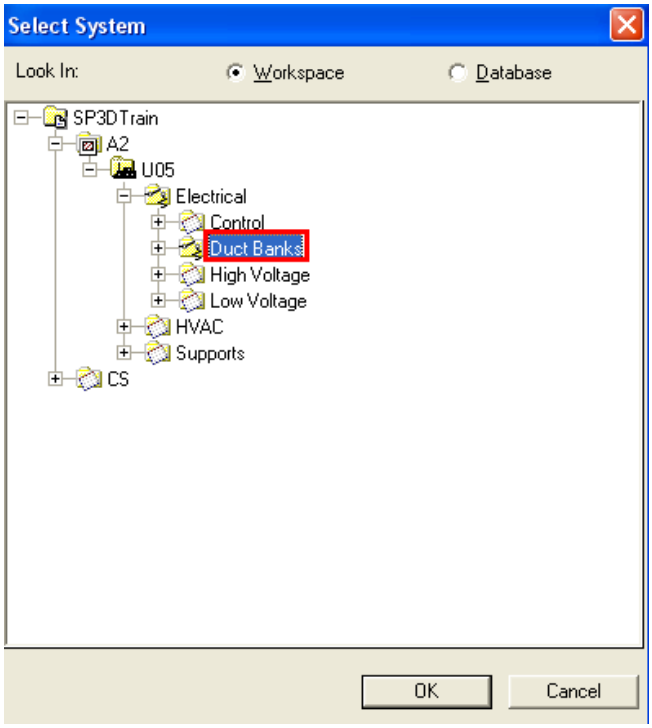


Figure 41: Select System Dialog

7. Key-in **DB-U001** in the Name field.

8. Select **DBS-0** in the Specification field.

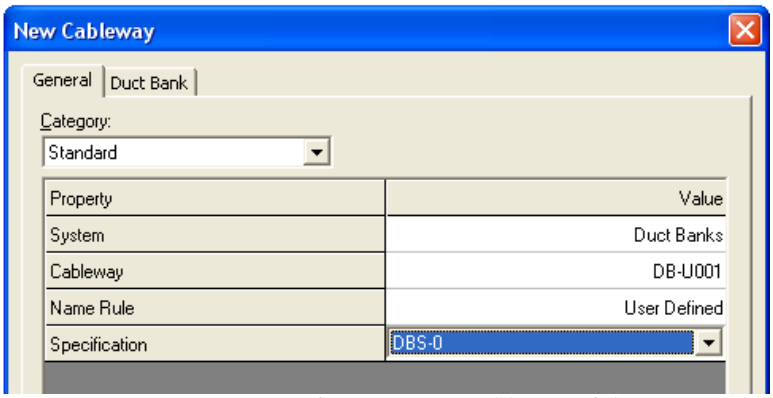


Figure 42: New Cableway Dialog

Note:

- SmartPlant 3D provides the ability to route both the concrete casing modeled as cableway run and conduits inside together while routing the Duct Bank. To route Duct Banks, you need to set the duct bank cross section data and other necessary properties for the auto routing of cables using the Duct Bank tab. To access the Duct Bank tab requires a Duct Bank Specification selected in the **Create New Cableway** dialog.

  Figure 43 shows the new Duct Bank tab on the create **New Cableway** dialog to allow you to define the cross section definition of the duct bank.

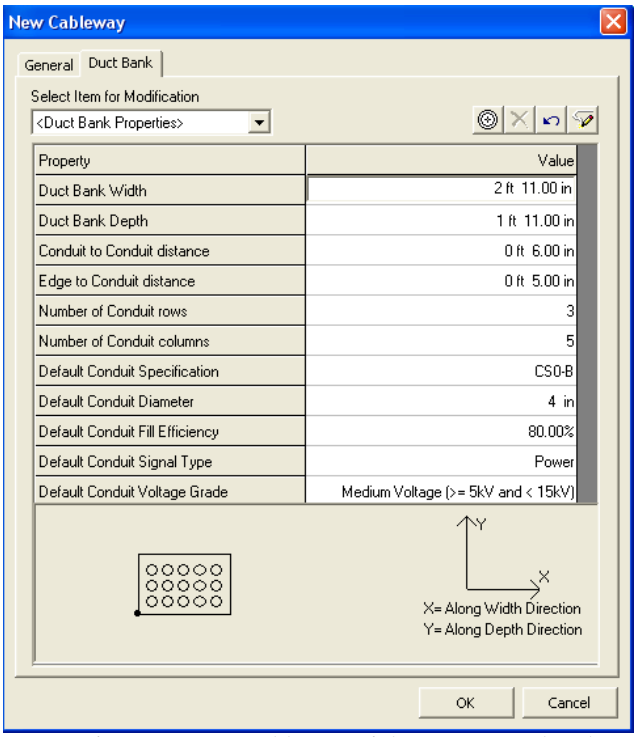


Figure 43: New Cableway Dialog – Duct Bank Tab

9. Select the Duct Bank tab and key in the following cross section specification:

Note:

- System displays a message dialog "The Cross section dimensions are invalid" if the conduits are not inside the duct bank.

Duct Bank Width:	**2 ft 11 in**
Duct Bank Depth:	**1 ft 11 in**
Conduit to Conduit distance:	**0 ft 6 in**
Edge to Conduit distance:	**0 ft 5 in**
Number of Conduit rows:	**3**
Number of Conduit columns:	**5**
Default Conduit Specification:	**CSO-B**
Default Conduit Diameter:	**4 in**
Default Conduit Fill Efficiency	**80.00 %**
Default Conduit Signal Type	**Power**
Default Conduit Voltage Grade	**Medium Voltage (>= 5kV and <= 15kV)**

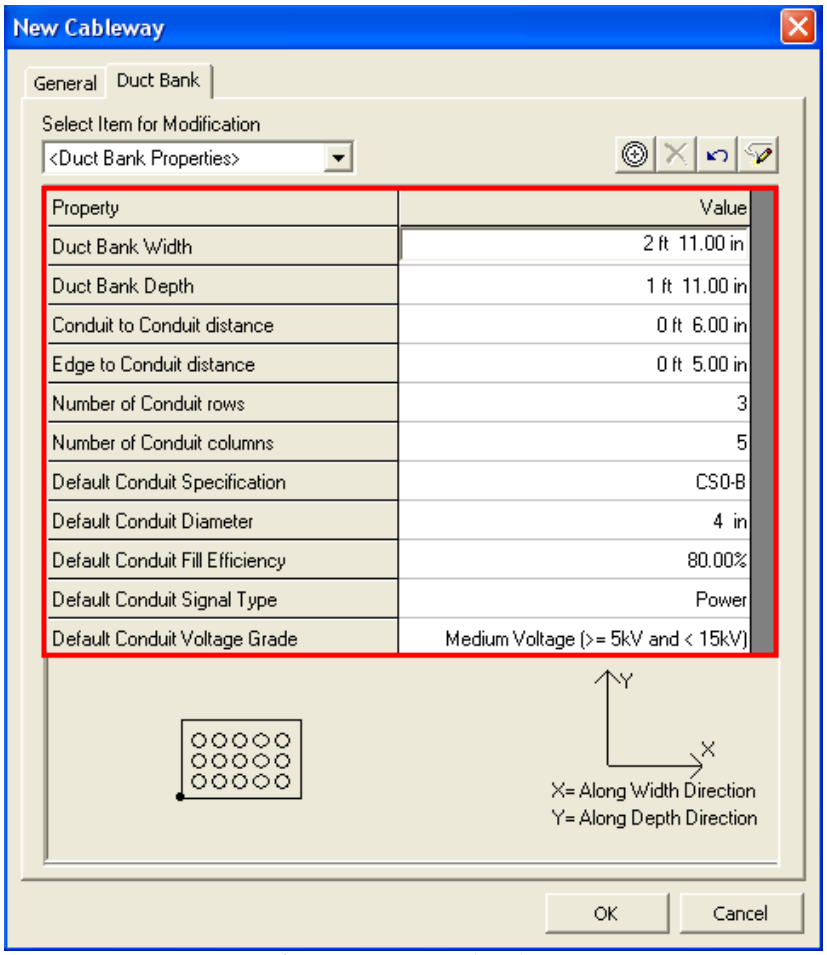


Figure 44: Duct Bank Tab

10. Select **Run 3x1** in the **Select Item for Modification** drop-down list. Key in the following conduit specification:

Conduit Spec: CSO
Conduit Diameter: 3 in
Fill Efficiency: 80 %
Signal Type: Power
Voltage Grade: Medium Voltage (>= 5kV and <= 15kV)

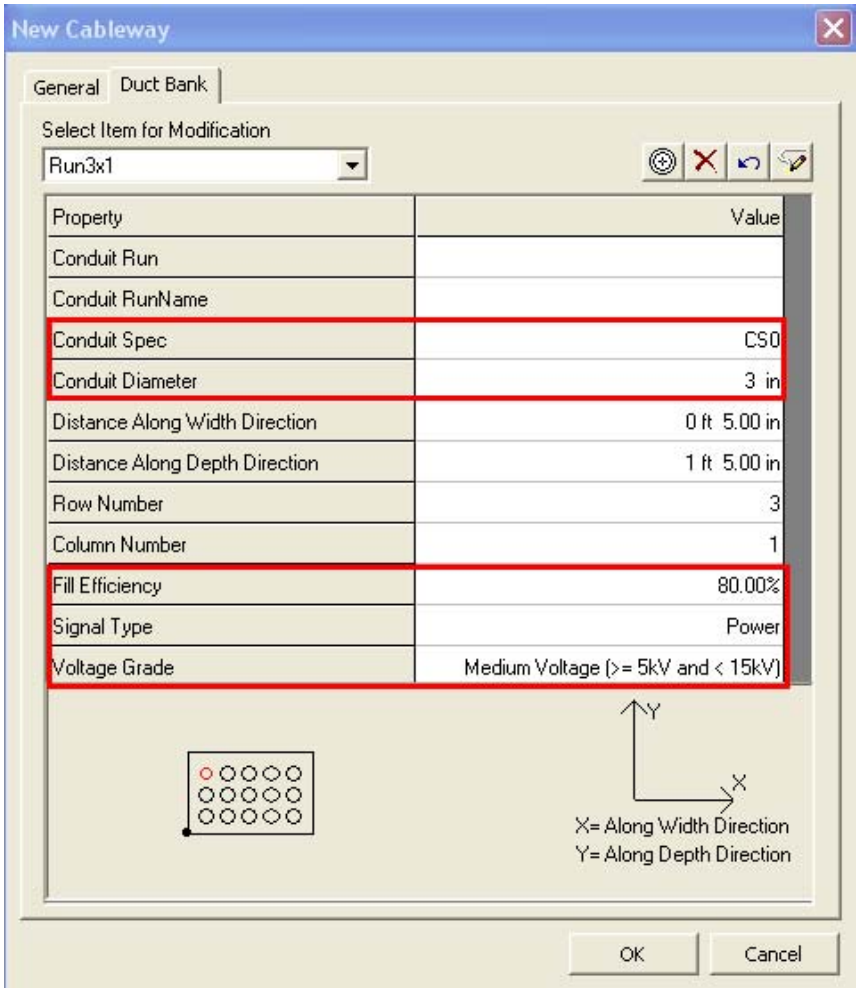


Figure 45: Duct Bank Tab – Run3x1 Conduit Properties

11. Select **Run 3x2** in the **Select Item for Modification** drop-down list. Key in the following conduit specification:

Conduit Spec: CSO
Conduit Diameter: 3 in
Fill Efficiency: 80 %
Signal Type: Power
Voltage Grade: Medium Voltage (>= 5kV and <= 15kV)

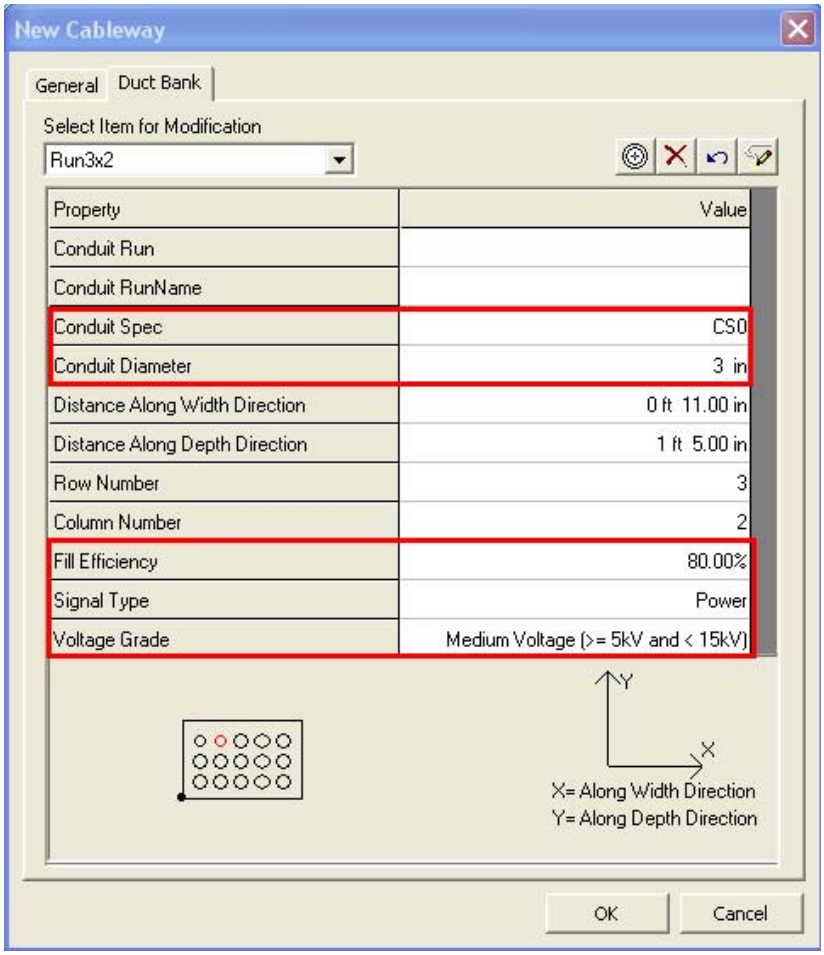


Figure 46: Duct Bank Tab – Run3x2 Conduit Properties

12. Click **OK**.

Note:

- An outline of the duct bank appears in the active view. SP3D locks the angle to **0 deg** and set the route PLANE to **PLAN**.

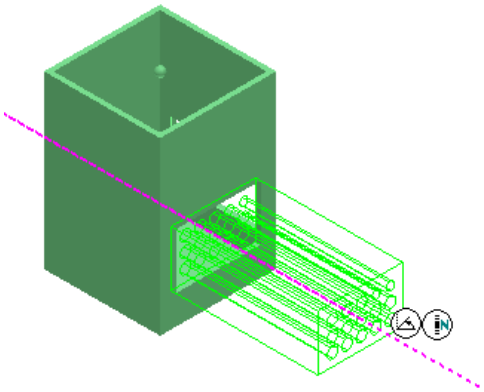


Figure 47: Routed Duct Bank from Pull-Pit (1)

13. Locate the Pull-Pit (2) named **E-PP-A2** in the model.

14. Move the cursor to the **cable tray port2** on Pull-Pit (2) until the **KeyPoint** SmartSketch glyph appears, as shown below.

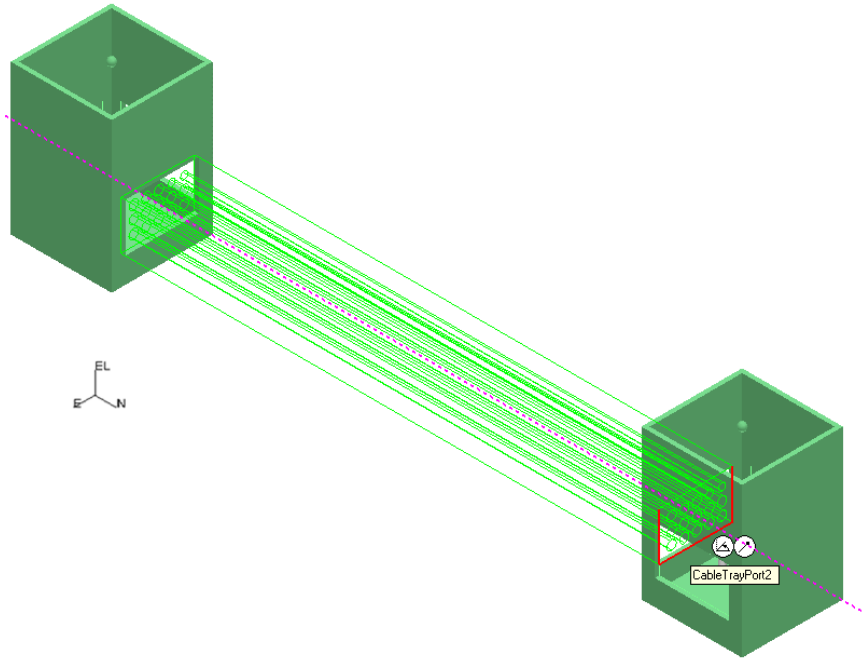


Figure 48: Routed Duct Bank from Pull-Pit (1) to Pull-Pit(2)

15. Click in the active view to place the duct bank. The view of your model should resemble below.

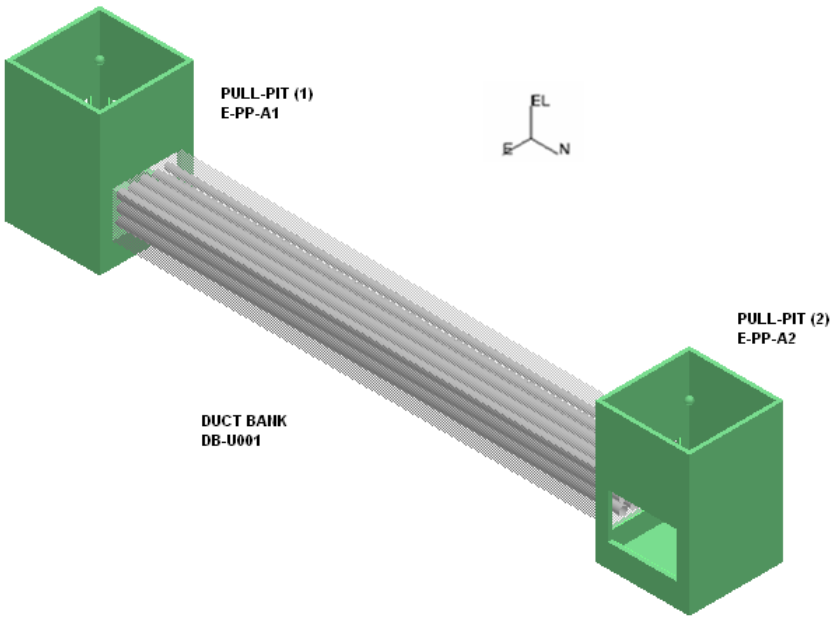


Figure 49: Routed Duct Bank DB-U001

16. You need to route the next part of the duct bank system in the east direction. Select the **Route Cableway** command button from the vertical toolbar. 

17. Select **cable tray port 3** on the Pull-Pit (2) named (E-PP-A2) as the starting point, as shown below.

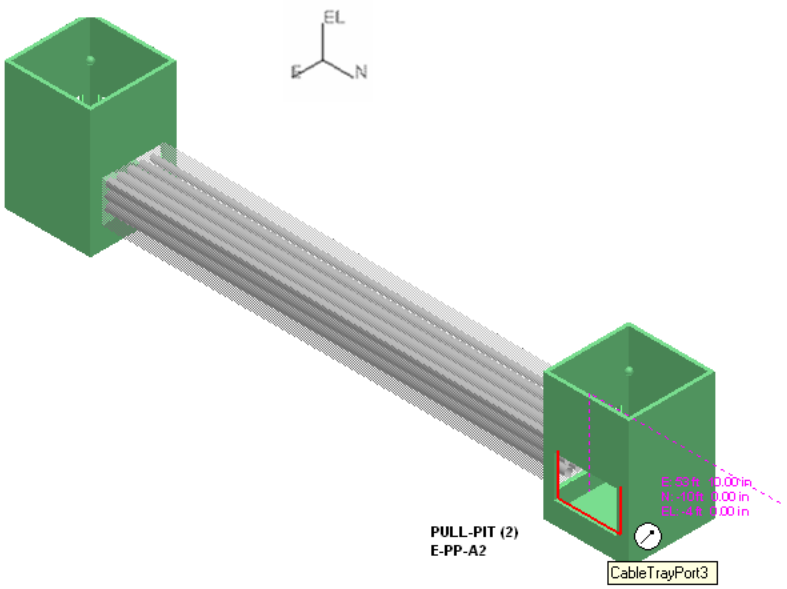


Figure 50: Cable Tray Port3 from Pull-Pit (2)

18. The New Cableway dialog box appears. On the Duct Bank tab, key in the following cross section specification:

Note:

- System displays a message dialog "The Cross section dimensions are invalid" if the conduits are not inside the duct bank.

Duct Bank Width:	**2 ft 11 in**
Duct Bank Depth:	**1 ft 11 in**
Conduit to Conduit distance:	**0 ft 6 in**
Edge to Conduit distance:	**0 ft 5 in**
Number of Conduit rows:	**3**
Number of Conduit columns:	**5**
Default Conduit Specification:	**CSO-B**
Default Conduit Diameter:	**4 in**
Default Conduit Fill Efficiency	**80.00 %**
Default Conduit Signal Type	**Power**
Default Conduit Voltage Grade	**Medium Voltage (>= 5kV and <= 15kV)**

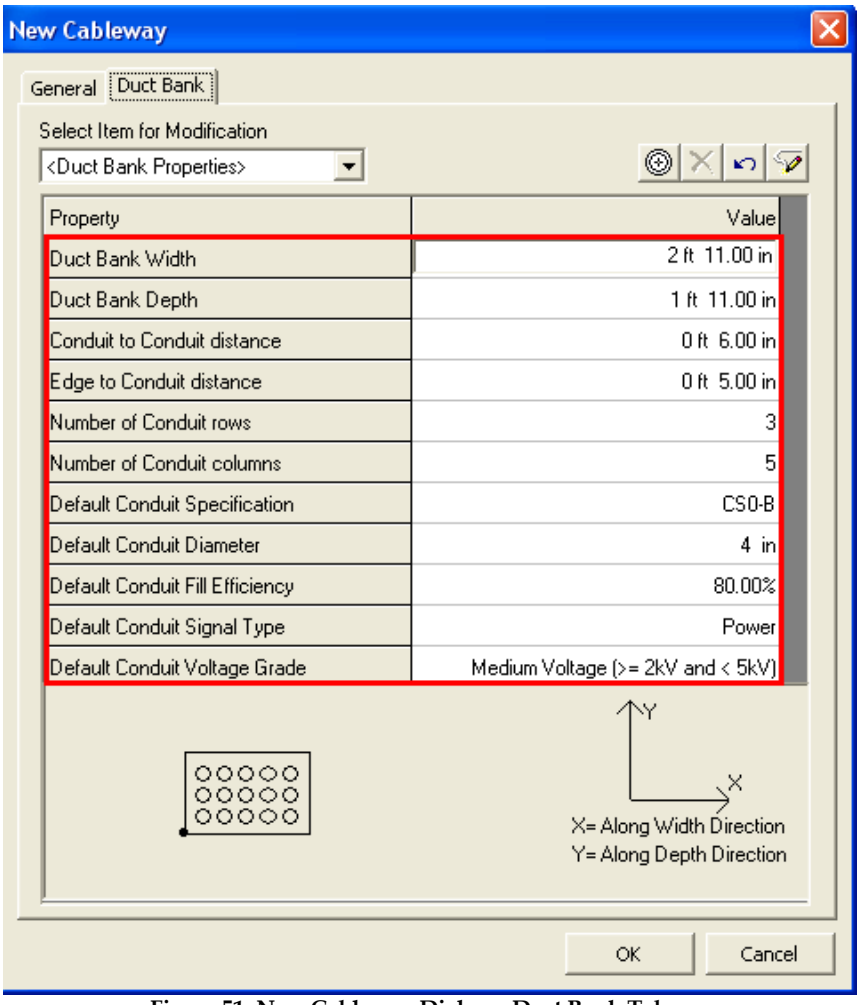


Figure 51: New Cableway Dialog – Duct Bank Tab

19. Select **Run 3x1** in the **Select Item for Modification** drop-down list. Key in the following conduit specification:

    Conduit Spec: CSO
    Conduit Diameter: 3 in
    Fill Efficiency: 80 %
    Signal Type: Power
    Voltage Grade: Medium Voltage (>= 5kV and <= 15kV)

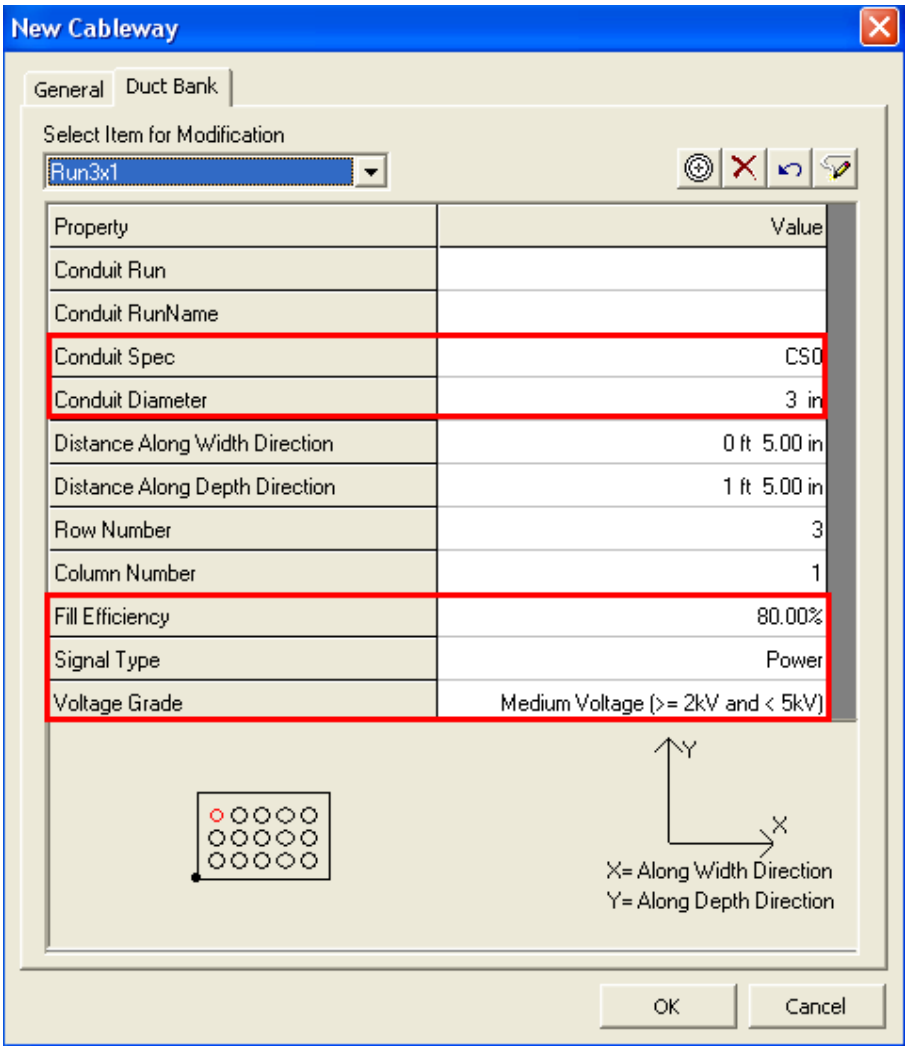


Figure 52: Duct Bank Tab – Run3x1 Conduit Properties

20. Select **Run 3x2** in the **Select Item for Modification** drop-down list. Key in the following conduit specification:

    Conduit Spec: CSO
    Conduit Diameter: 3 in
    Fill Efficiency: 80 %
    Signal Type: Power

Voltage Grade: Medium Voltage (>= 5kV and <= 15kV)

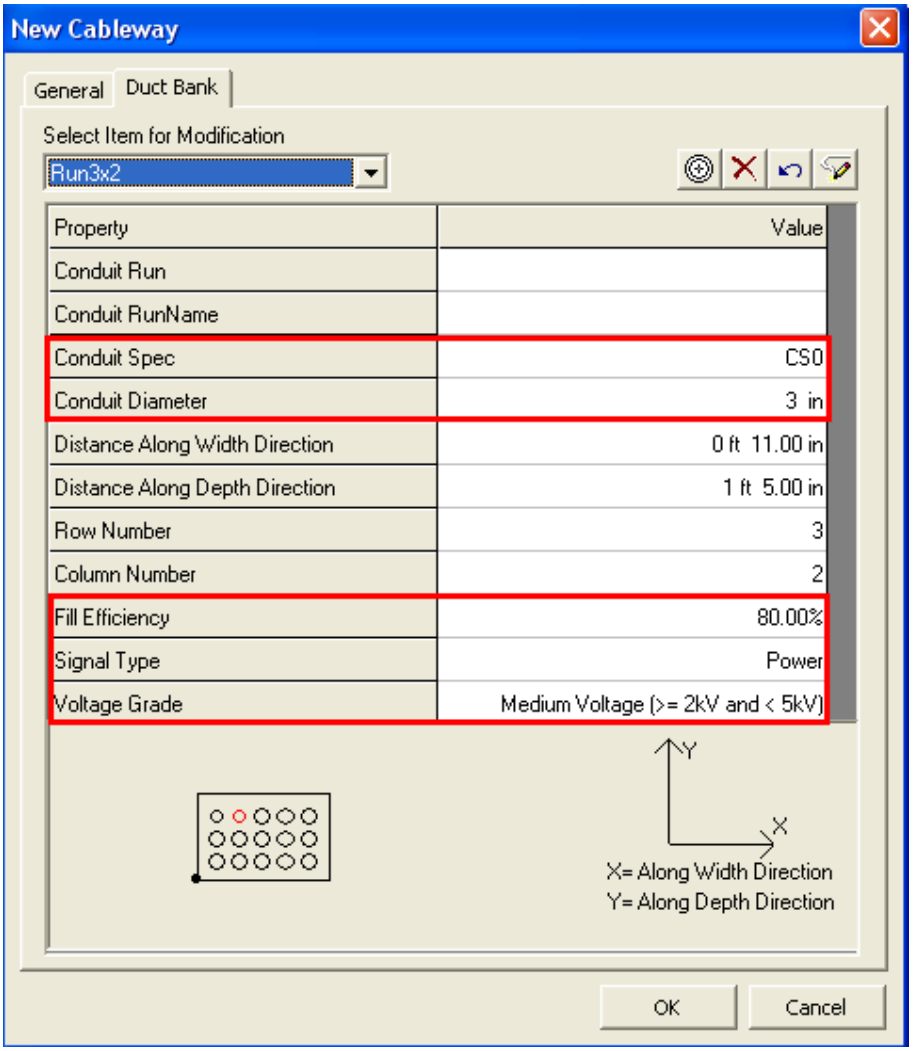


Figure 53: Duct Bank Tab – Run3x2 Conduit Properties

21. Select the **General tab** and key in **DB-U002** in the Name field. Then, click **OK**.

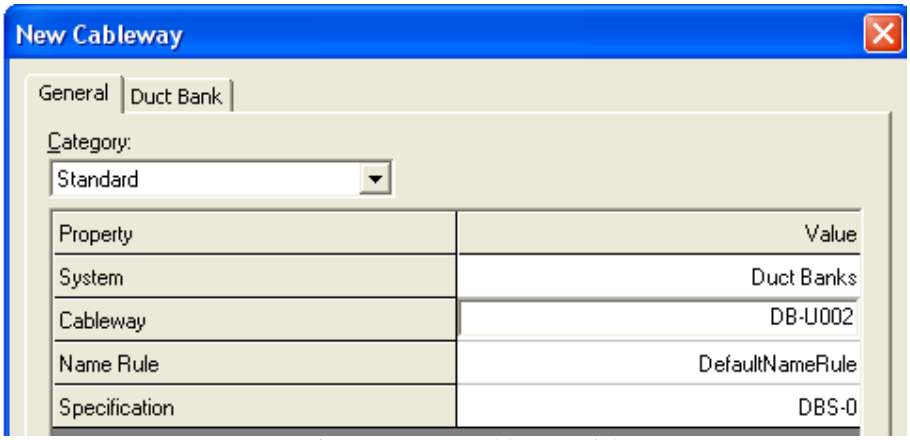


Figure 54: New Cableway Dialog

22. Key in 45 ft in the **length** drop-down list of the cableway ribbon. This will constrain the length of the duct bank to 45 ft.

23. Position the cursor in the East direction until the **E** SmartSketch glyph appears. Click in the active view to accept the placement of the duct bank. The view of your model should resemble below.

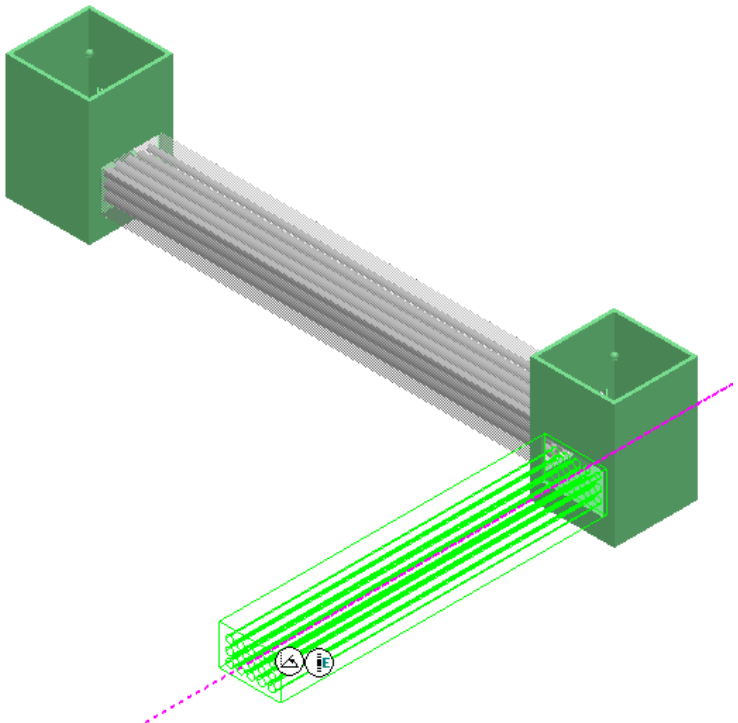


Figure 55: Routed Duct Bank DB-U002

24. Right Click to cancel the command. The view of your model should resemble below.

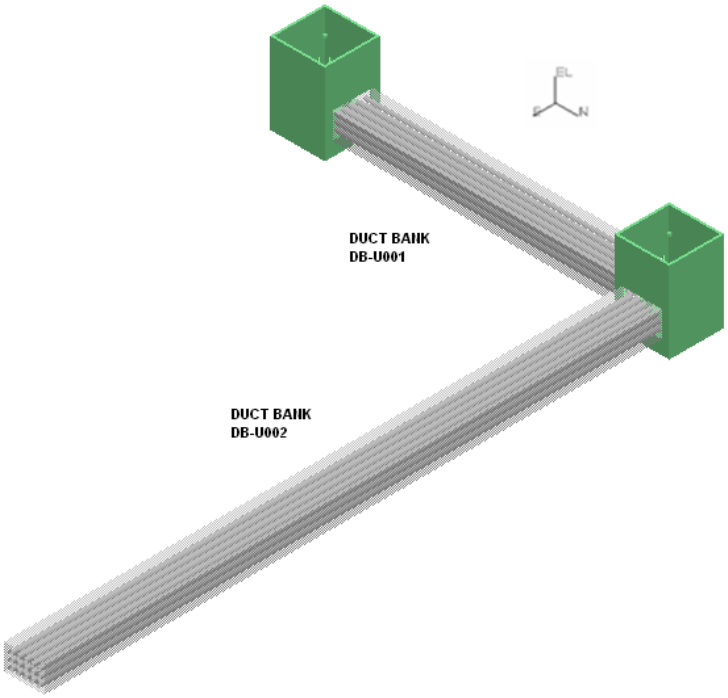


Figure 56: Routed Duct Bank DB-U002

25. You need to route the next part of the duct bank system to the Northing direction. Change the view of the model to "**Looking Isometric"** by using the Common View button.

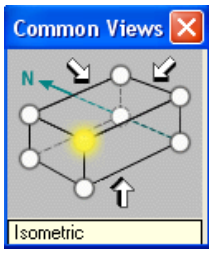


Figure 57: Common View Dialog

26. Zoom in to the end of the routed duct bank. You need to branch out the next part of the duct bank system to the Northing direction.

27. Select **Cableway/Conduit Path Features** in the Locate Filter drop-down list and set the fence mode to inside. It might be easier to select the end features if the fence mode is set to overlap.

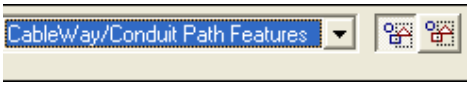


Figure 58: Select Filter Drop-down List

28. Select the End Features as shown below.

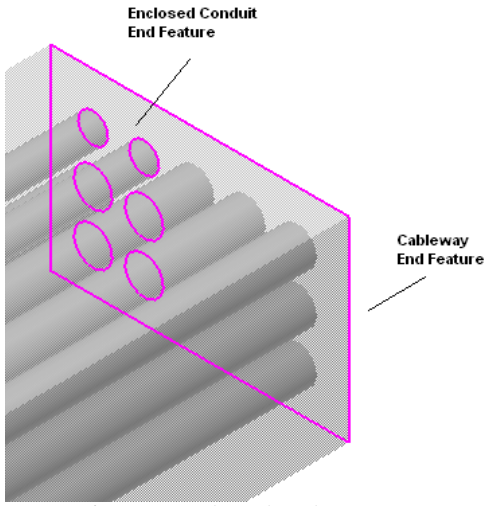


Figure 59: Selected End Features

29. Select the **Route Cableway** command button from the vertical toolbar. 

30. The New Cableway dialog box appears. Select Duct Bank tab and verify the properties of the conduit runs (Run5 and Run6).

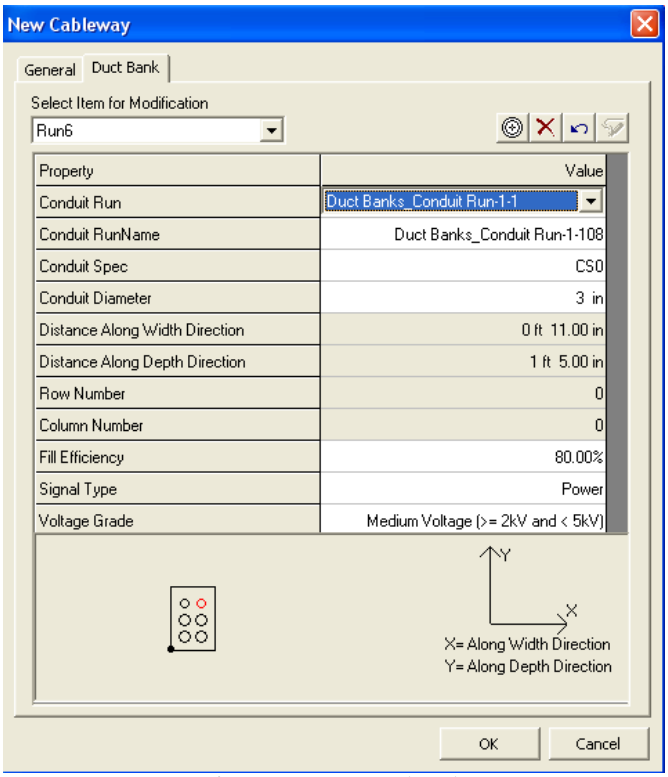


Figure 60: Duct Bank Tab

31. Select General tab and key in **DB-U003** in the Name field.

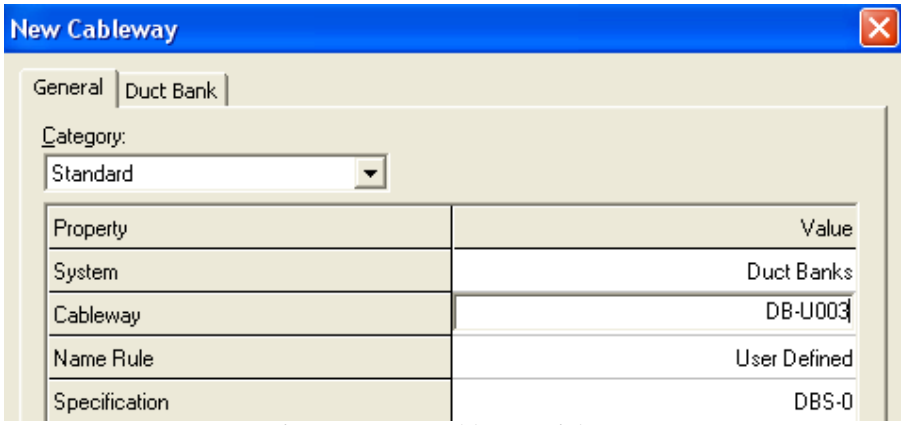


Figure 61: New Cableway Dialog

32. Click **OK.**

33. Key in 3 ft 6 in in the **length** drop-down list of the cableway ribbon. This will constrain the length of the duct bank to 3 ft 6 in.

34. Position the cursor in the Easting direction until the **E** SmartSketch glyph appears. Click in the active view to accept the placement of the duct bank. The view of your model should resemble below.

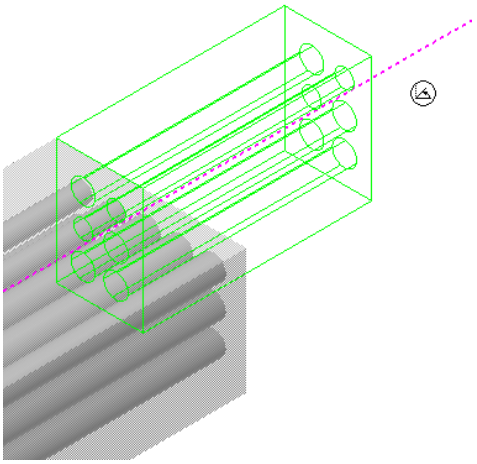


Figure 62: Routed Duct Bank DB-U003

35. Key in 40 ft in the **length** drop-down list of the cableway ribbon. This will constrain the length of the duct bank to 40 ft.

36. Position the cursor in the Northing direction until the **N** SmartSketch glyph appears. Click in the active view to accept the placement of the duct bank. The view of your model should resemble below.

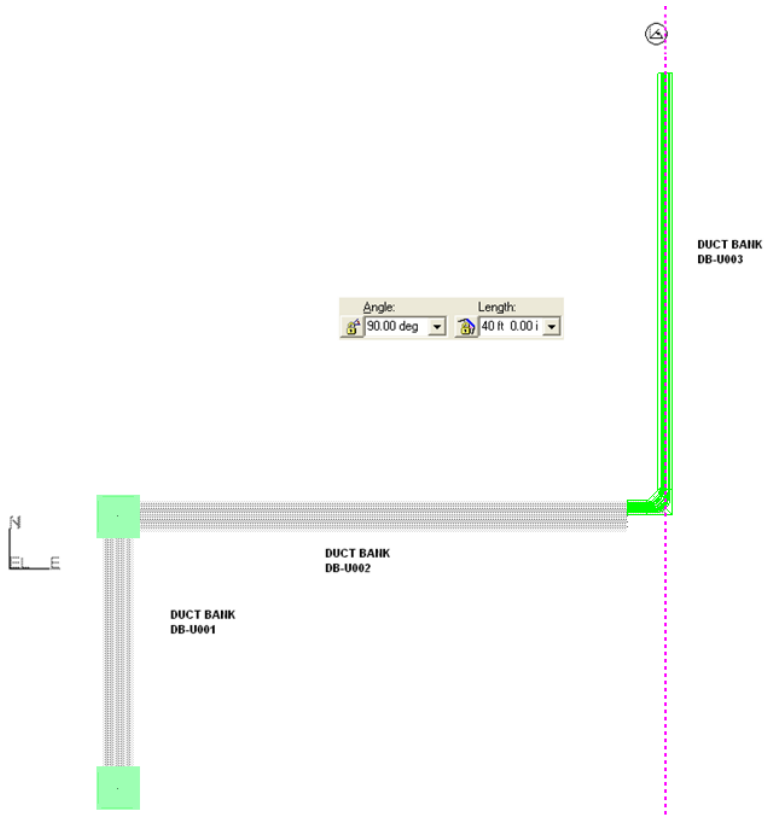


Figure 63: Routed Duct Bank DB-U003

37. Change the view of the model to "**Looking Plan**" by using the Common View button.

38. Key in 3 ft 6 in in the **length** drop-down list of the cableway ribbon. This will constrain the length of the duct bank to 3 ft 6 in.

39. Key in **45 deg** in the **Angle** drop-down list of the cableway ribbon.

40. Position the cursor in the North-East direction and click in the active view to accept the placement of the duct bank. The view of your model should resemble below.

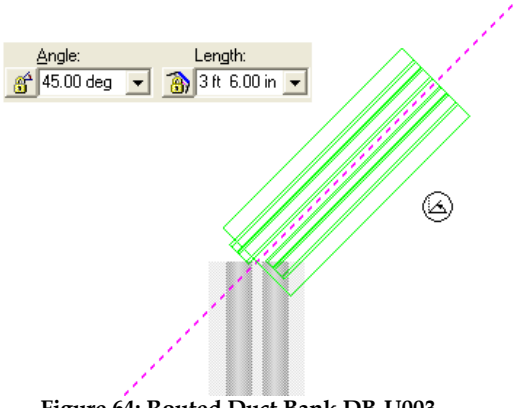


Figure 64: Routed Duct Bank DB-U003

41. Position the cursor in the North direction and click in the active view to accept the placement of the duct bank. The view of your model should resemble below.

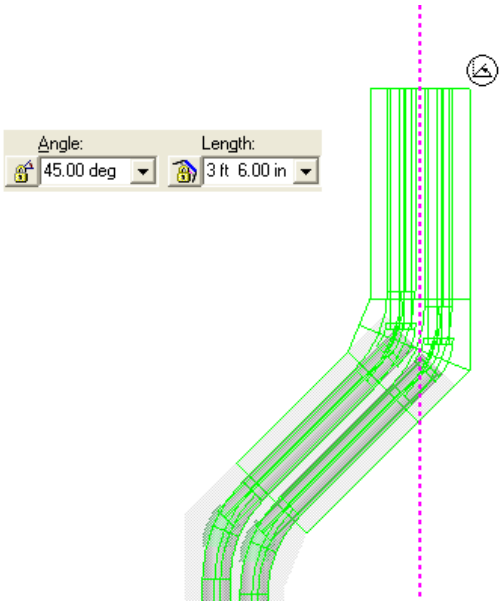


Figure 65: Routed Duct Bank DB-U003

42. Right Click to cancel the command.

43. Change the view of the model to "**Looking Isometric"** by using the Common View button.

44. Select all the **End Features** of the duct bank.

45. Select the **Route Cableway** command button from the vertical toolbar. 

46. Set the route Plane to **North-South**  and key in **90 deg** in the **Angle** drop-down list of the cableway ribbon.

47. Active the PinPoint ribbon by using the **Tools > PinPoint** command.

48. Set the active coordinate system to U05 CS in the Coordinate system drop-down list on the PinPoint ribbon.

49. To move the target to the origin of the current coordinate system, select the **Set target to Origin** option on the PinPoint ribbon.

Figure 66: PinPoint ribbon

50. Key in **0 ft** in the **Elevation** drop-down list of the PinPoint ribbon.

51. Position the cursor **Up** Direction. SmartSketch will display the **U** glyph. Click in the active view to accept the placement of the duct bank.

52. Right Click to cancel the command.

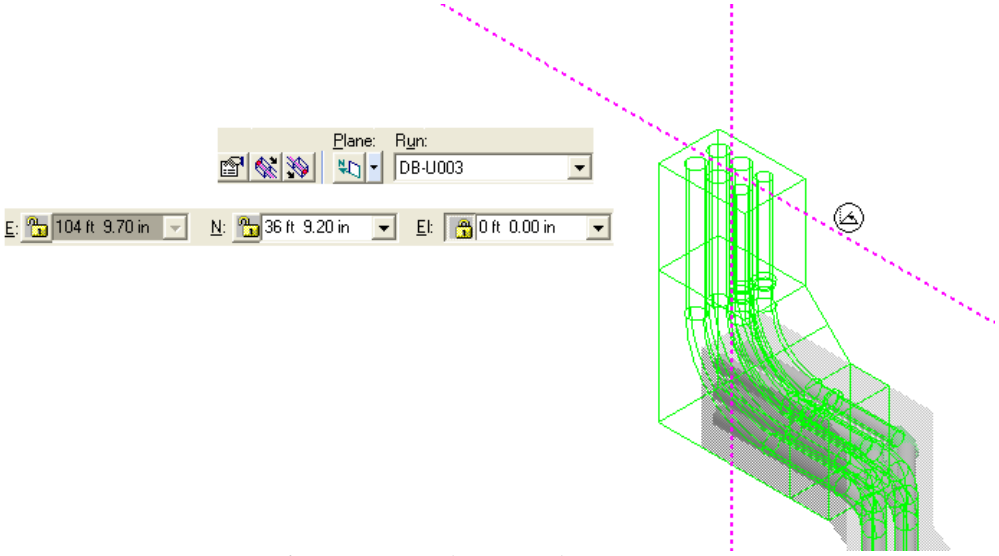


Figure 67: Routed Duct Bank DB-U003

53. The view of your model should resemble below.

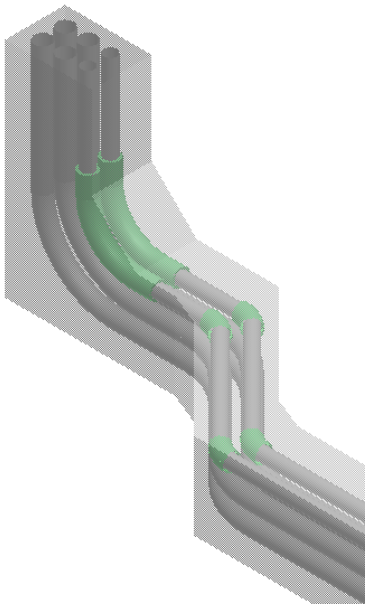


Figure 68: Routed Duct Bank DB-U003

54. Zoom in to the branch point of the routed duct bank. You need to continue route the next part of the duct bank system to the Easting direction.

55. Select **Cableway/Conduit Path Features** in the Locate Filter drop-down list and set the fence mode to overlap.

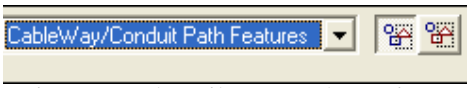


Figure 69: Select Filter Drop-down List

56. Select the **End Features** as shown below.

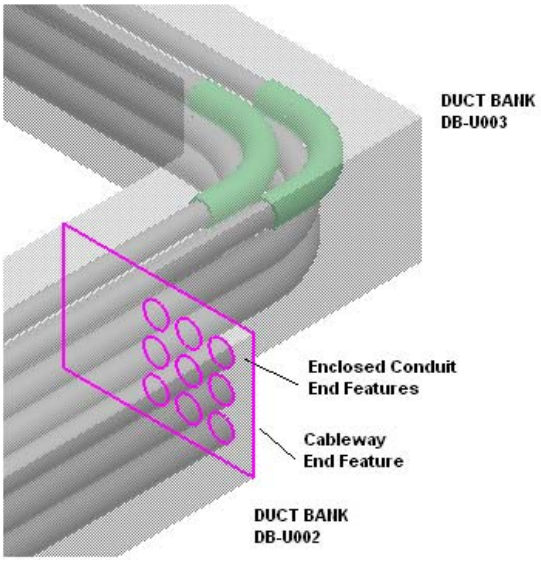


Figure 70: Selected End Features

57. Select the **Route Cableway** command button from the vertical toolbar. 

58. The New Cableway dialog box appears. Select General tab and key in **DB-U004** in the Name field.

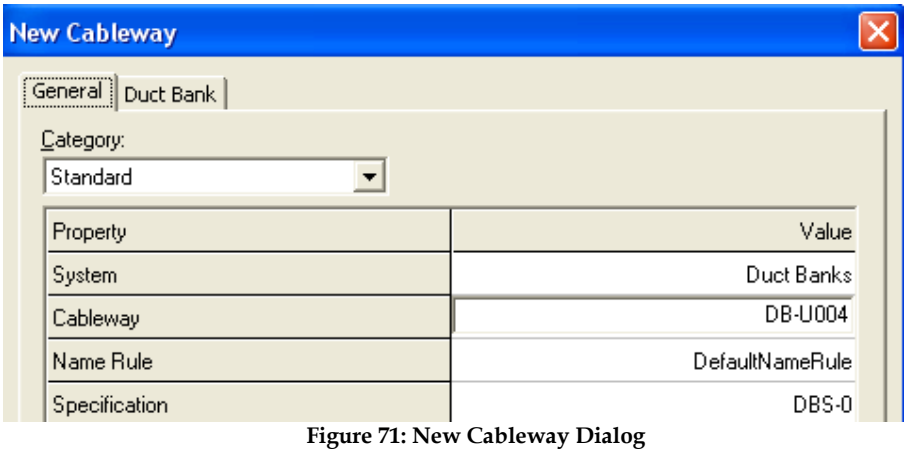


Figure 71: New Cableway Dialog

59. Click **OK.**

60. Set the route Plane to **PLAN** and key in 44 ft in the **length** drop-down list of the cableway ribbon. This will constrain the length of the duct bank to 44 ft.

61. Position the cursor in the Easting direction until the **E** SmartSketch glyph appears. Click in the active view to accept the placement of the duct bank. The view of your model should resemble below.

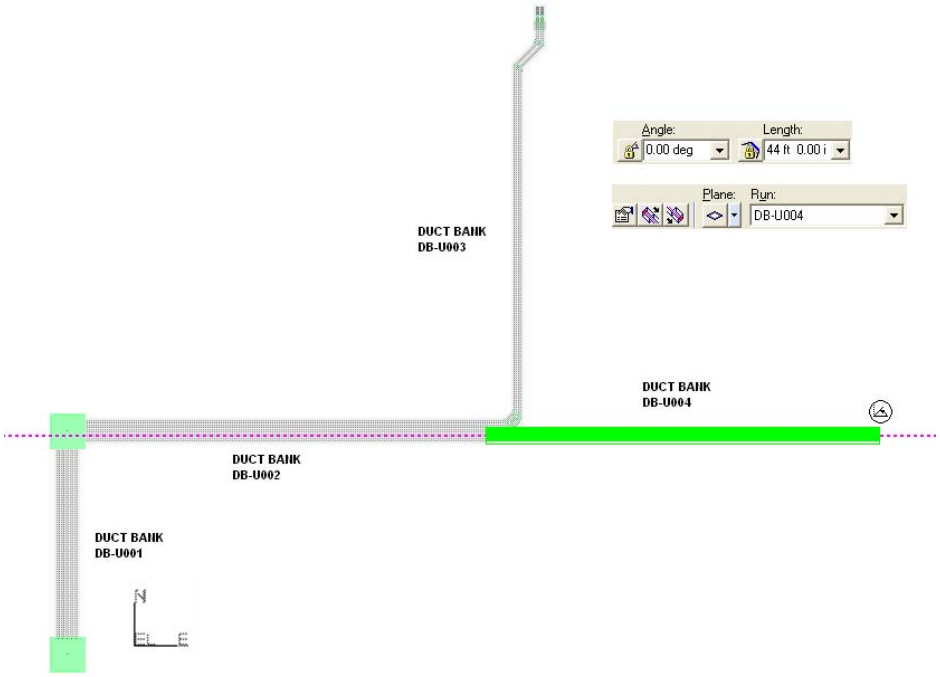


Figure 72: Rouyed Duct Bank DB-U004

62. Right Click to cancel the command.

63. Zoom in to the end of the routed duct bank. You need to branch out the next part of the duct bank system to the Nothing direction.

64. Select **Cableway/Conduit Path Features** in the Locate Filter drop-down list and set the fence mode to overlap.

65. Select the **End Features** as shown below.

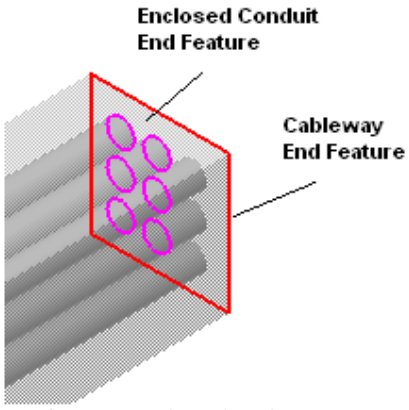


Figure 73: Selected End Features

66. Select the **Route Cableway** command button from the vertical toolbar. 

67. The New Cableway dialog box appears.

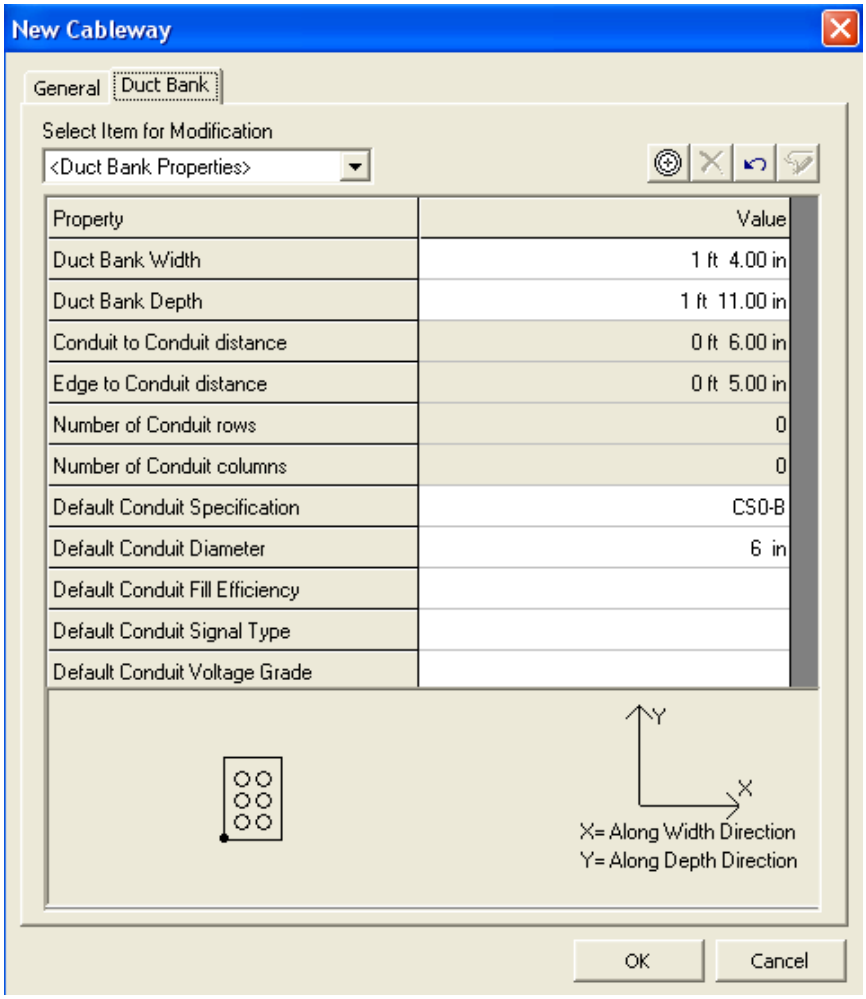


Figure 74: New Cableway – Duct Bank Tab

68. Select General tab and key in **DB-U005** in the Name field.

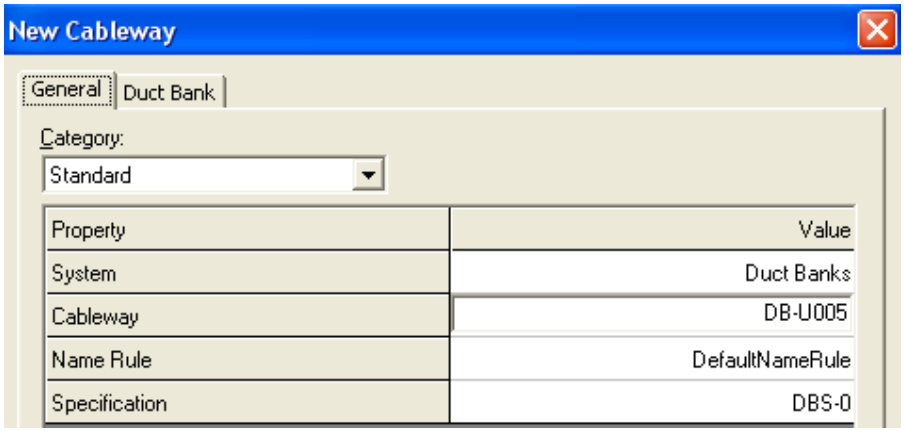


Figure 75: New Cableway Dialog

69. Click **OK.**

70. Key in **3 ft 6 in** in the **length** drop-down list of the cableway ribbon. This will constrain the length of the duct bank to 3 ft 6 in.

71. Position the cursor in the Easting direction until the **E** SmartSketch glyph appears. Click in the active view to accept the placement of the duct bank. The view of your model should resemble below.

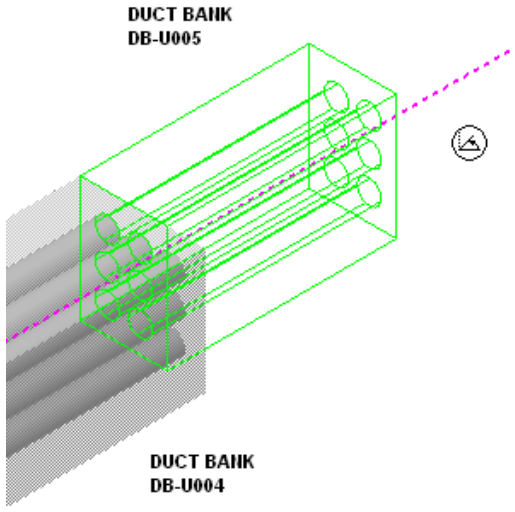


Figure 76: Routed Duct Bank DB-U005

72. Key in **40 ft** in the length drop-down list of the cableway ribbon. This will constrain the length of the duct bank to 40 ft.

73. Position the cursor in the Northing direction until the **N** SmartSketch glyph appears. Click in the active view to accept the placement of the duct bank. The view of your model should resemble below.

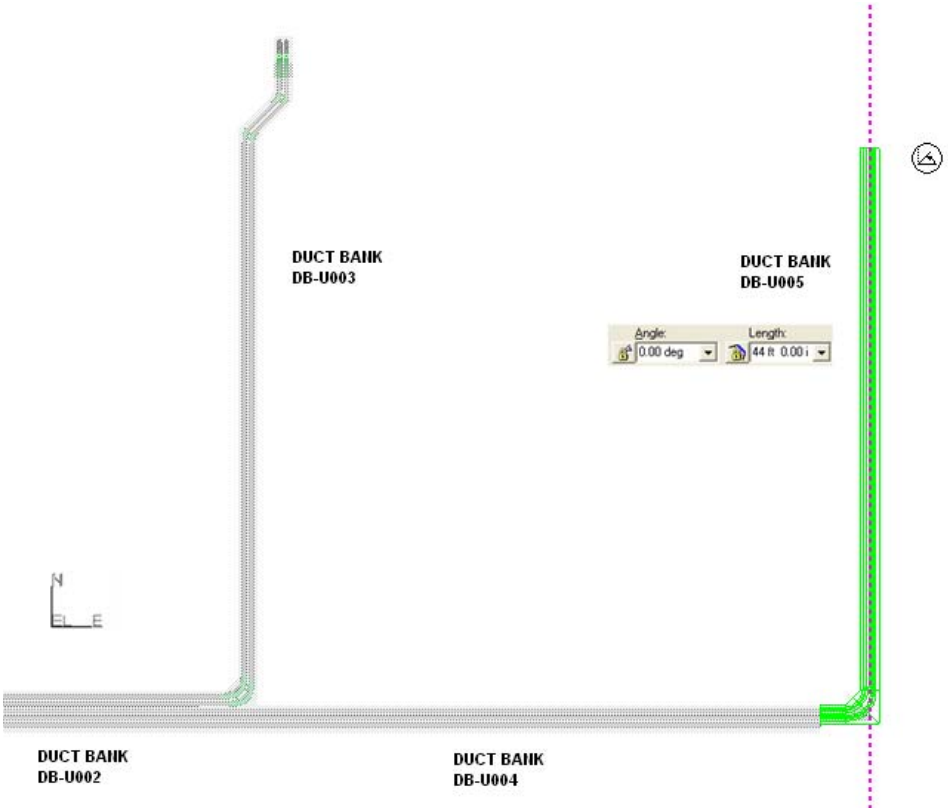


Figure 77: Routed Duct Bank DB-U005

74. Change the view of the model to "**Looking Plan"** by using the Common View button.

75. Key in 3 ft 6 in in the **length** drop-down list of the cableway ribbon. This will constrain the length of the duct bank to 3 ft 6 in.

76. Key in **45 deg** in the **Angle** drop-down list of the cableway ribbon.

77. Position the cursor in the North-East direction and click in the active view to accept the placement of the duct bank as shown in the Figure 78.

78. Position the cursor in the North direction and click in the active view to accept the placement of the duct bank as shown in the Figure 78.

79. Right Click to cancel the command.

80. Change the view of the model to "**Looking Isometric- East/North"** by using the Common View button.

81. Select all the **End Features** of the duct bank.

82. Select the **Route Cableway** command button from the vertical toolbar. 

83. Set the route Plane to **North-South**  and key in **90 deg** in the **Angle** drop-down list of the cableway ribbon.

84. Active the PinPoint ribbon by using the **Tools > PinPoint** command.

85. Set the active coordinate system to U05 CS in the Coordinate system drop-down list on the PinPoint ribbon.

86. To move the target to the origin of the current coordinate system, select the **Set target to Origin** option on the PinPoint ribbon.

87. Key in **0 ft** in the **Elevation** drop-down list of the PinPoint ribbon.

88. Position the cursor **Up** Direction. SmartSketch will display the **U** glyph. Click in the active view to accept the placement of the duct bank.

89. Right Click to cancel the command.

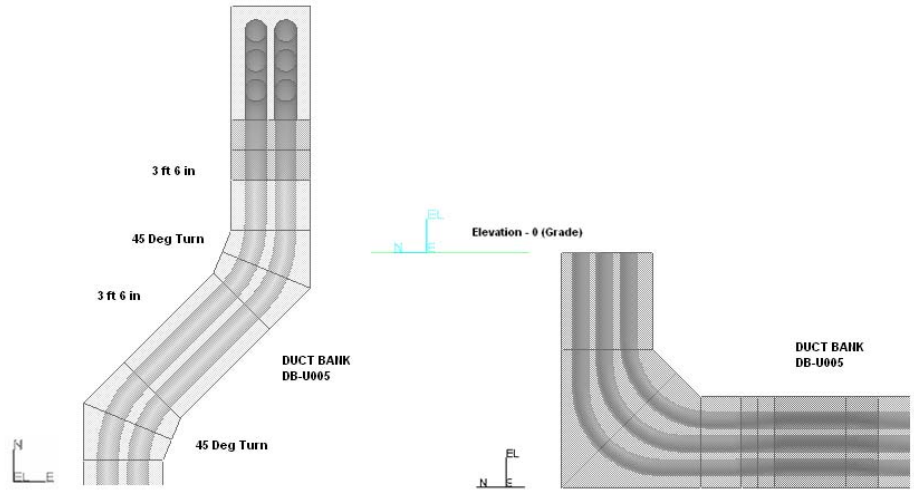


Figure 78: Routed Duct Bank DB005

90. The view of your model should resemble below.

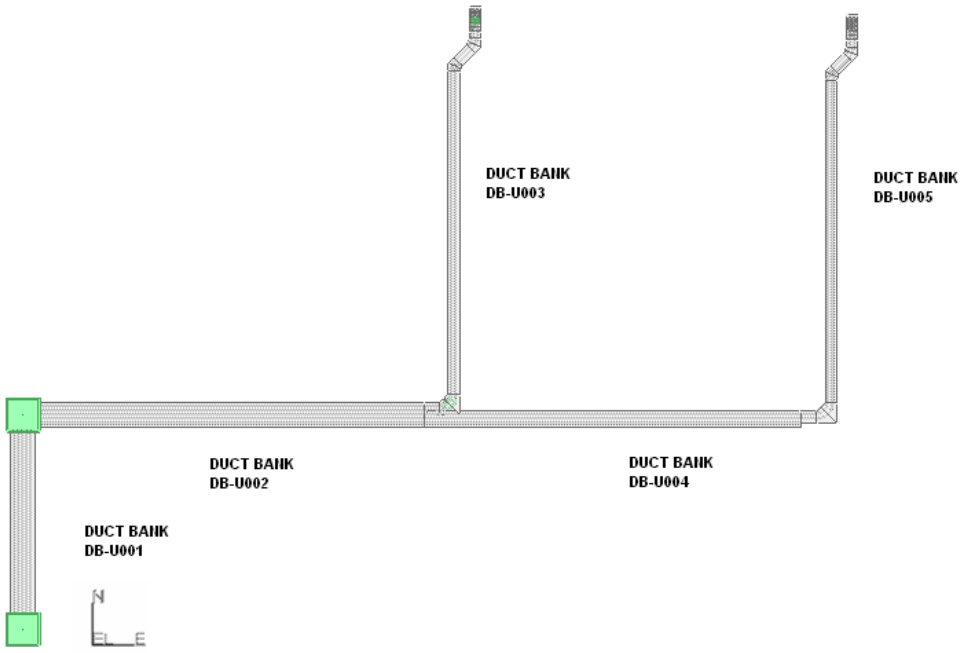


Figure 79: Routed Duct Bank DB-U005

91. Zoom in to the second branch point of the routed duct bank. You need to continue route the next part of the duct bank system to the Easting direction.

92. Select **Cableway/Conduit Path Features** in the Locate Filter drop-down list and set the fence mode to overlap.

93. Select the **End Features** as shown below.

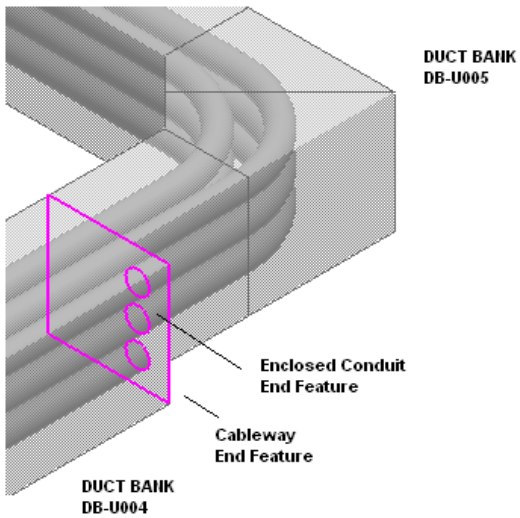


Figure 80: Selected End Features

94. Select the **Route Cableway** command button from the vertical toolbar. 

95. The New Cableway dialog box appears.

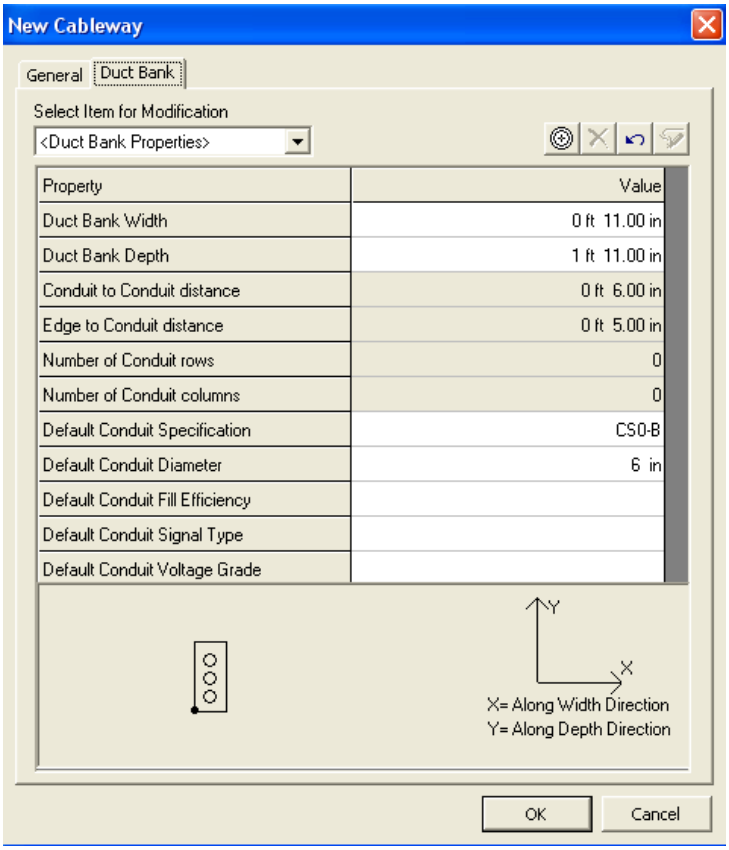


Figure 81: New Cableway Dialog – Duct Bank Tab

96. Select General tab and key in **DB-U006** in the Name field.

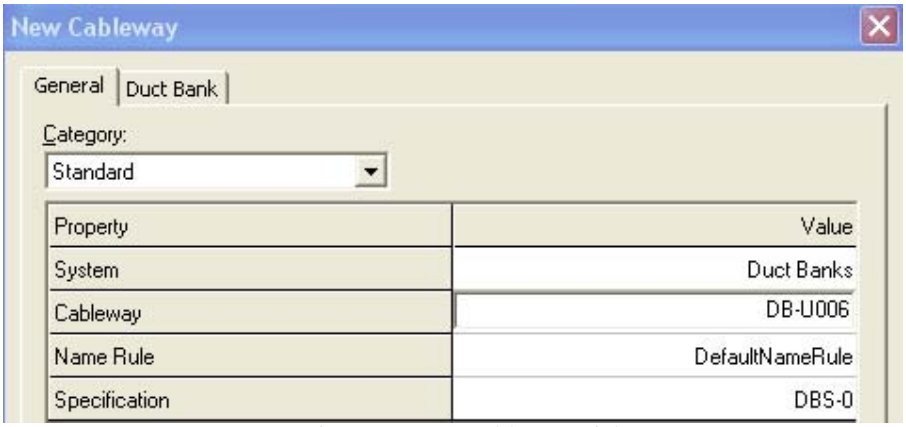


Figure 82: New Cableway Dialog

97. Click **OK.**

98. Set the route Plane to **PLAN** and key in **20 ft** in the **length** drop-down list of the cableway ribbon. This will constrain the length of the duct bank to 20 ft.

99. Position the cursor in the Easting direction until the **E** SmartSketch glyph appears. Click in the active view to accept the placement of the duct bank.

100. Set the route Plane to **East-West** and key in **0 ft** in the **Elevation** drop-down list of the PinPoint ribbon.

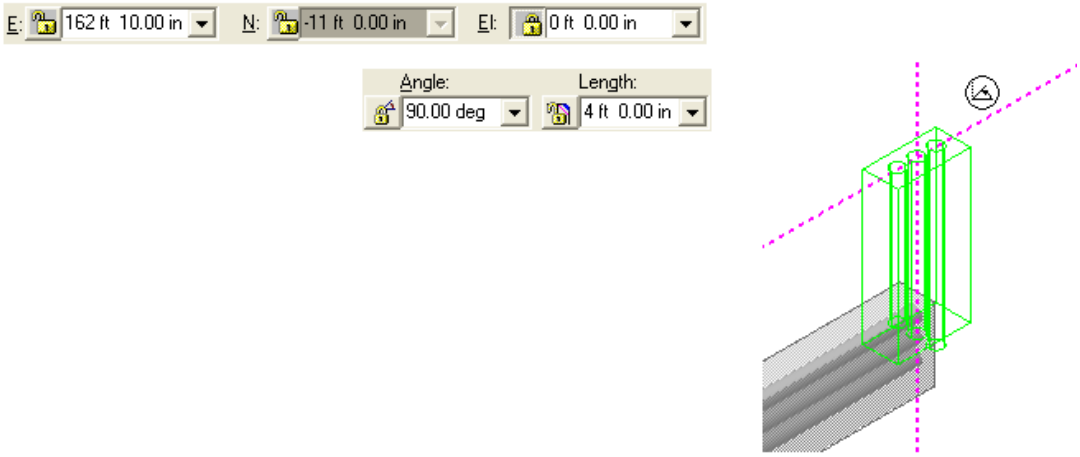


Figure 83: Routed Duct Bank DB-U006

101. Click in the active view to accept the placement of the duct bank.

102. Right Click to cancel the command. The view of your model should resemble below.

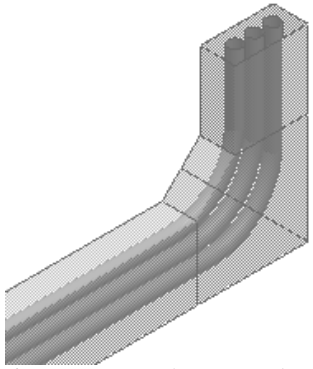


Figure 84 Routed Duct Bank DB-U006

103. Select **All** in the Locate Filter drop-down list and select the Wall System of the building.

104. Hide the wall of the building using the **Hide** command. Select **Cable tray Nozzles** in the Locate Filter drop-down list.

105. Select Cable tray port 1 on Pull-Pit (1) named E-PP-A1 as shown below.

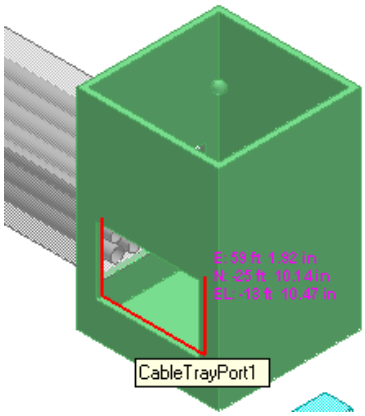


Figure 85: Cable Tray Port 1 from Pull-Pit (1)

106. Select the **Route Cableway** command button from the vertical toolbar. 
107. The New Cableway dialog box appears. On the Duct Bank tab, key in the following cross section specification:

Note:

- System displays a message dialog "The Cross section dimensions are invalid" if the conduits are not inside the duct bank.

Duct Bank Width:	**2 ft 11 in**
Duct Bank Depth:	**1 ft 11 in**
Conduit to Conduit distance:	**0 ft 6 in**
Edge to Conduit distance:	**0 ft 5 in**
Number of Conduit rows:	**3**
Number of Conduit columns:	**5**
Default Conduit Specification:	**CSO-B**
Default Conduit Diameter:	**4 in**
Default Conduit Fill Efficiency	**80.00 %**
Default Conduit Signal Type	**Power**
Default Conduit Voltage Grade	**Medium Voltage (>= 5kV and <= 15kV)**

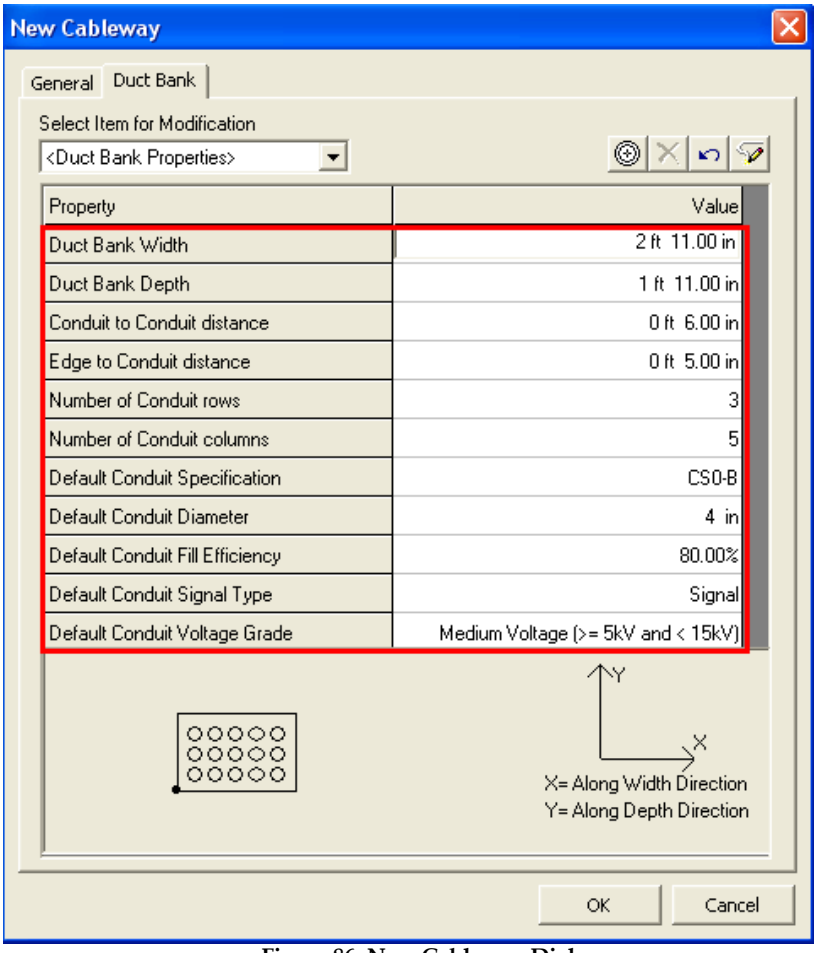


Figure 86: New Cableway Dialog

108. Select **Run 3x1** in the **Select Item for Modification** drop-down list. Key in the following conduit specification:

Conduit Spec: CSO
Conduit Diameter: 3 in
Fill Efficiency: 80 %
Signal Type: Power
Voltage Grade: Medium Voltage (>= 5kV and <= 15kV)

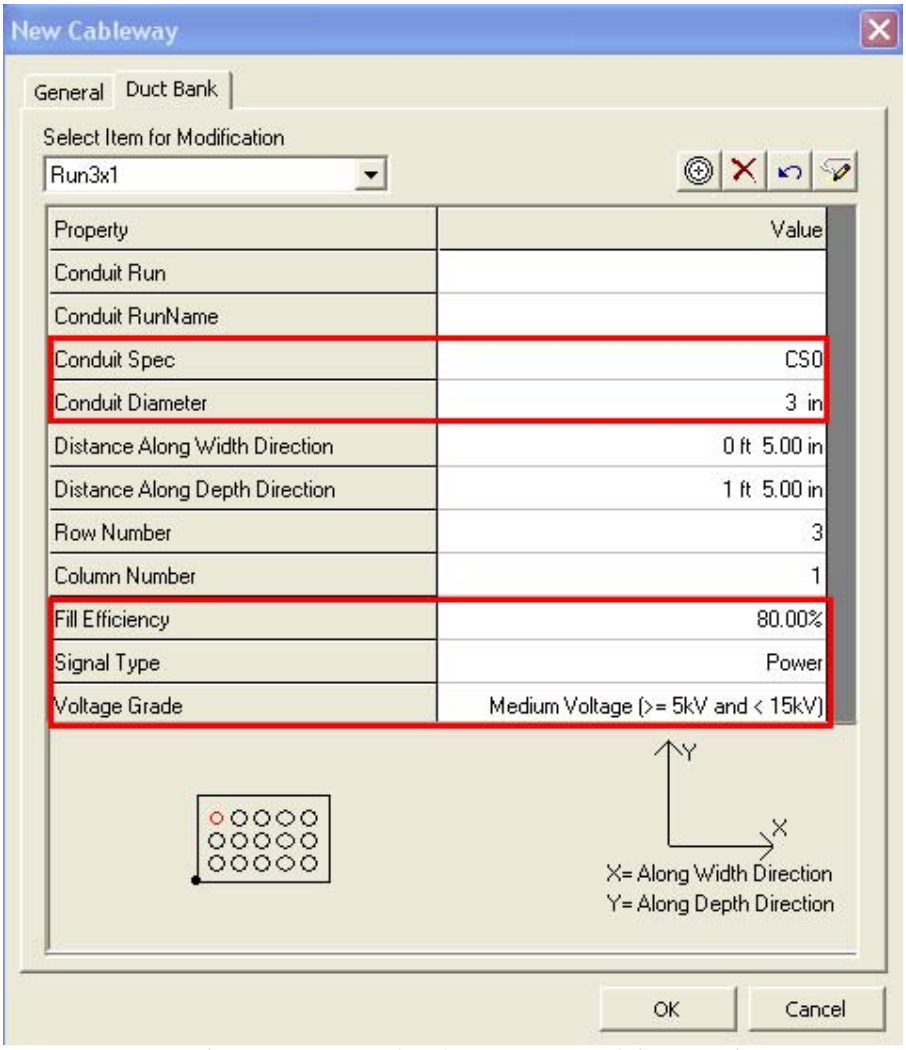


Figure 87: Duct Bank Tab – Run 3x1 Conduit Properties

109. Select **Run 3x2** in the **Select Item for Modification** drop-down list. Key in the following conduit specification:

Conduit Spec: CSO
Conduit Diameter: 3 in
Fill Efficiency: 80 %
Signal Type: Power
Voltage Grade: Medium Voltage (>= 5kV and <= 15kV)

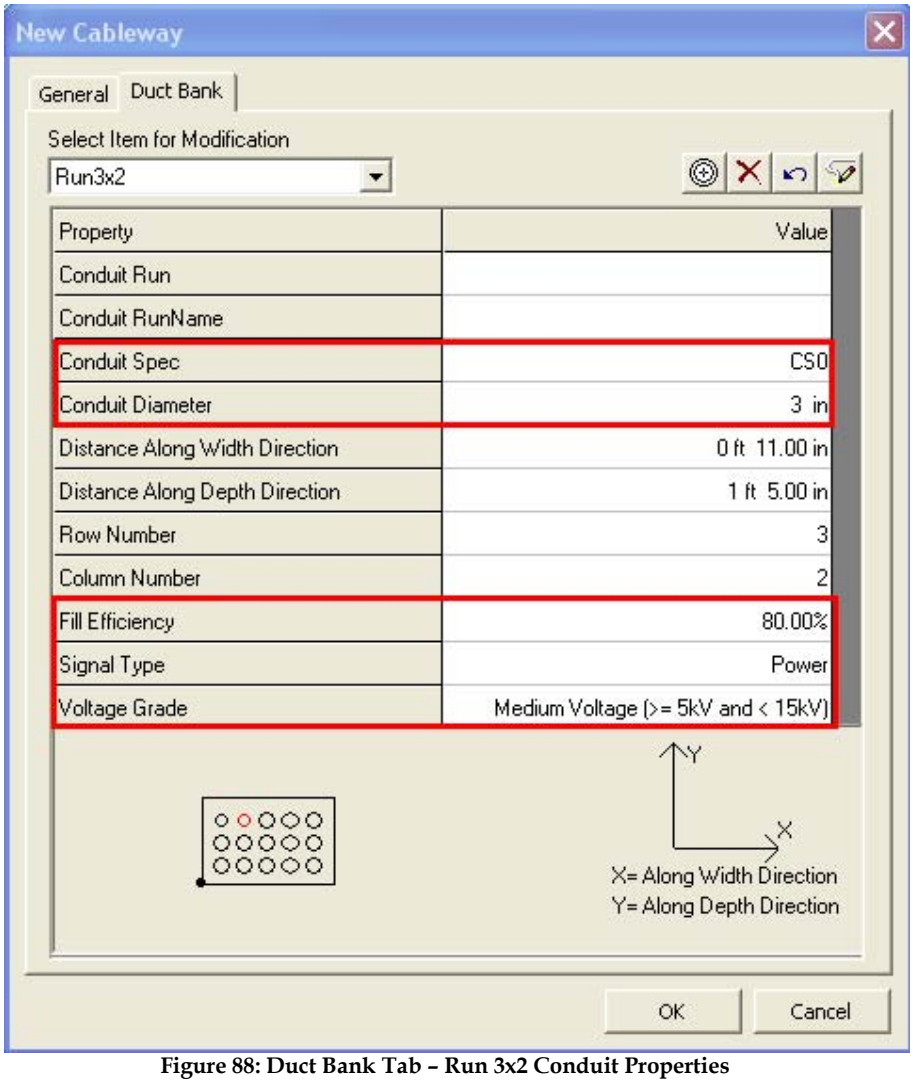


Figure 88: Duct Bank Tab – Run 3x2 Conduit Properties

110. Select the **General tab** and key in **DB-U007** in the Name field. Then, click **OK**.

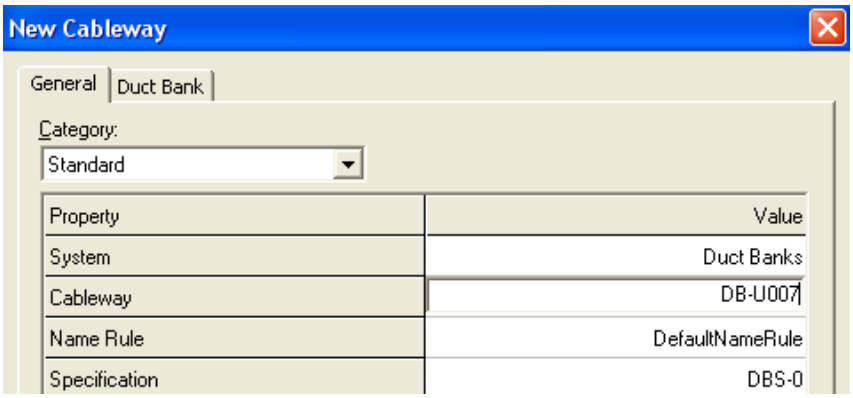


Figure 89: New Cableway Dialog

111. Key in **12 ft** in the **length** drop-down list of the cableway ribbon. This will constrain the

length of the duct bank to 12 ft.

112. Position the cursor in the West direction until the **E** SmartSketch glyph appears. Click in the active view to accept the placement of the duct bank. The view of your model should resemble below.

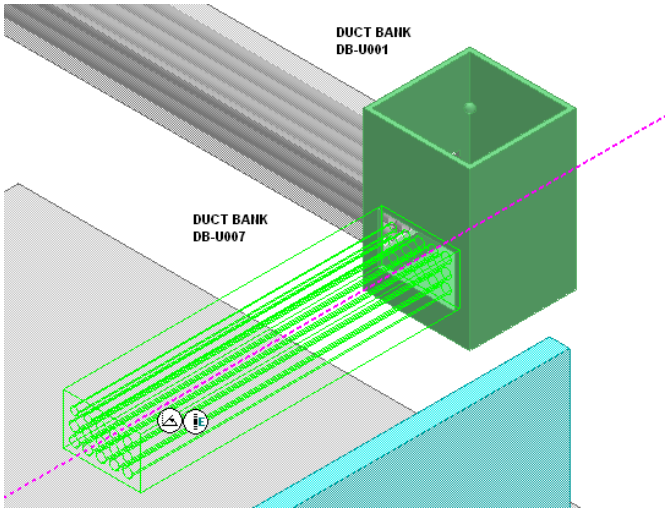


Figure 90: Routed Duct Bank DB-U007

113. Change the view of the model to "**Looking North**" using the **Common View** button.

114. **Unlock** the length using the lock icon. Set the route Plane to **East-West** and key in **0 ft** in the **Elevation** drop-down list of the PinPoint ribbon.

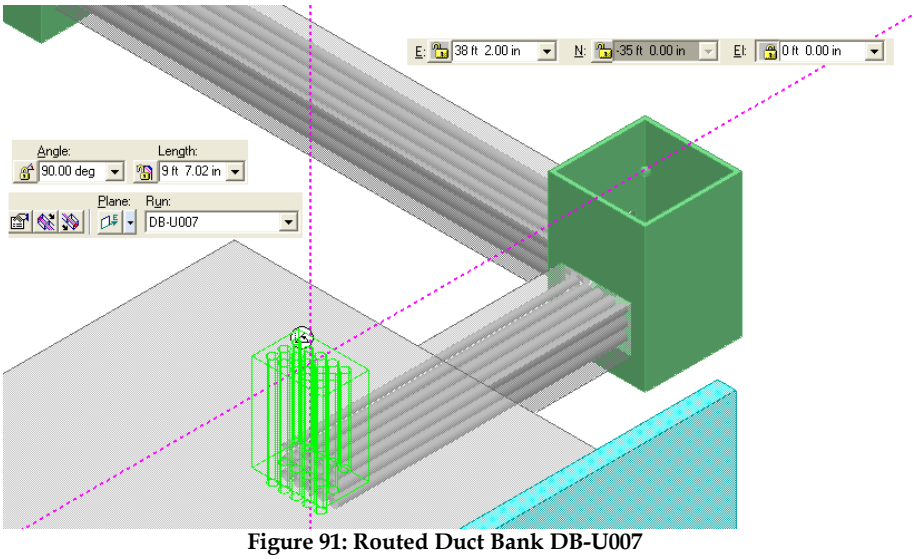


Figure 91: Routed Duct Bank DB-U007

115. Click in the active view to accept the placement of the duct bank.
116. Right Click to cancel the command. The view of your model should resemble below.

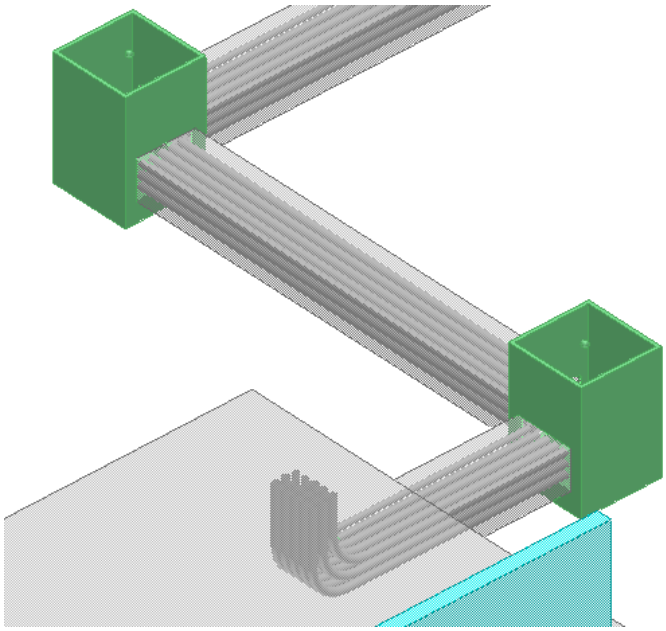


Figure 92: Routed Duct Bank DB-U007

Steps for Connecting Duct Banks within Pull-Pit:

For cable routing to be possible where two or more Duct Banks meet at pull-pit, the cable paths should be continuous. Therefore, conduits that need to exchange cables need to be connected with a "Non-Part Specification" cableway. Cableway with a non-part specification is a specification without parts and is usually refer to as "Zero-Spec". The Cableway Auto Connect command can be used to create the connecting cableways.

1. Locate Pull-Pit (1) named E-PP-A1 in the model and zoom in close to it.
2. Select **Equipment** in the Locate Filter drop-down list.
3. Select Pull-Pit (1) and hide it using the **Hide** command.

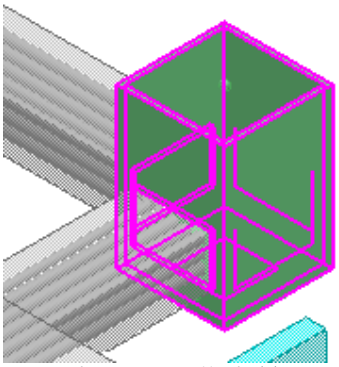


Figure 93: Pull-Pit (1)

4. Select the **Auto Connect** command button in the vertical toolbar. 

5. Select **Conduit End Features** in the drop-down list Locate Filter SmartStep.

Figure 94: Auto Connect Ribbon

6. Select the enclosed 3″ conduit end feature on Duct Bank (DB-U001) as shown below.

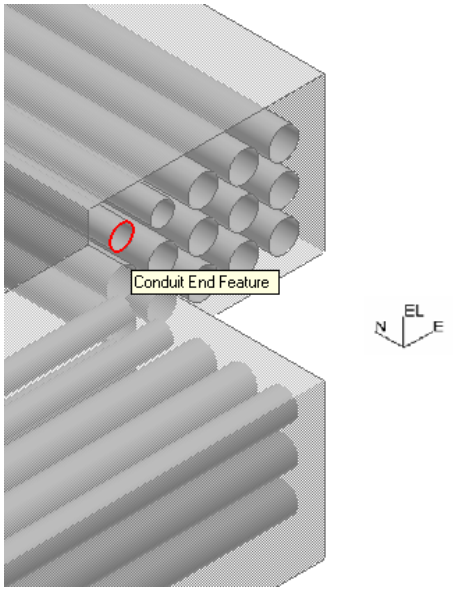


Figure 95: Conduit End Feature on Duct Bank DB-U001

7. Select the next Smartstep, "**To Run**".

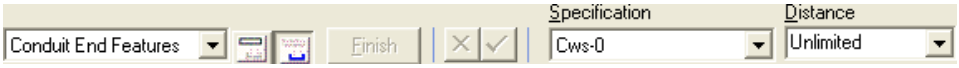


Figure 96: Auto Connect Ribbon

8. Select the enclosed 3″ conduit end feature on Duct Bank (DB-U007) as shown below.

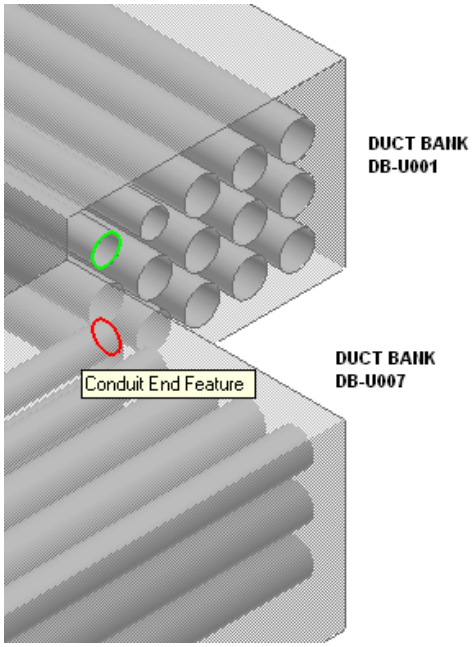


Figure 97: Conduit End Feature on Duct Bank DB-U007

9. System displays the connecting cableway between the selected conduit end features.

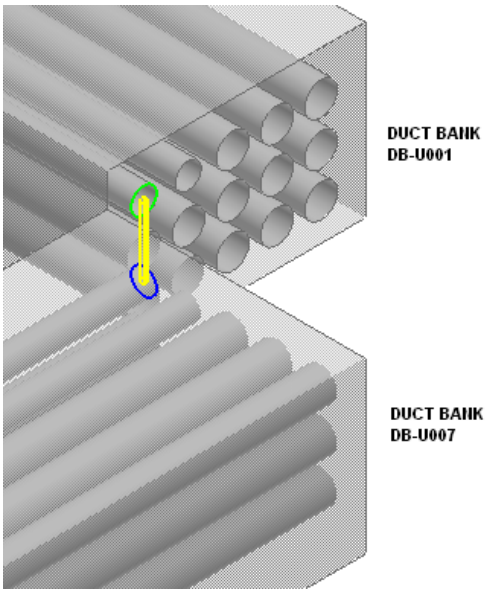


Figure 98: Connecting Cableway between the Conduit End Features

10. Hit **Finish** button to complete the placement of the connecting cableway.

Figure 99: Auto Connect Ribbon

11. Right Click to cancel the command.

The result of the Auto Connect Command should look like the picture shown below.

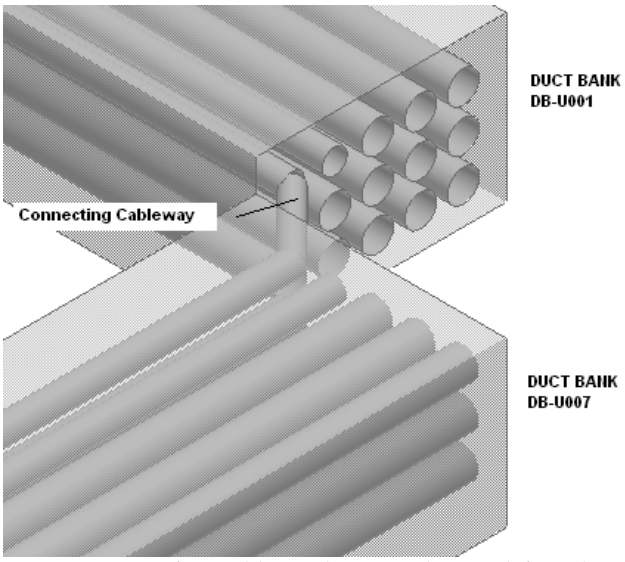


Figure 100: Connecting Cableway between the Conduit End Features

12. Locate Pull-Pit (2) named E-PP-A2 in the model and zoom in close to it.

13. Select Pull-Pit (2) and hide it using the **Hide** command.

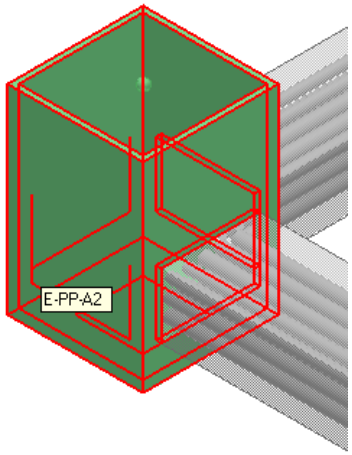


Figure 101: Pull-Pit (2)

14. Select the **Auto Connect** command button in the vertical toolbar. 

15. Select **Conduit End Features** in the drop-down list Locate Filter SmartStep.

Figure 102: Auto Connect Ribbon

16. Select the enclosed 3″ conduit end feature on Duct Bank (DB-U001) as shown below.

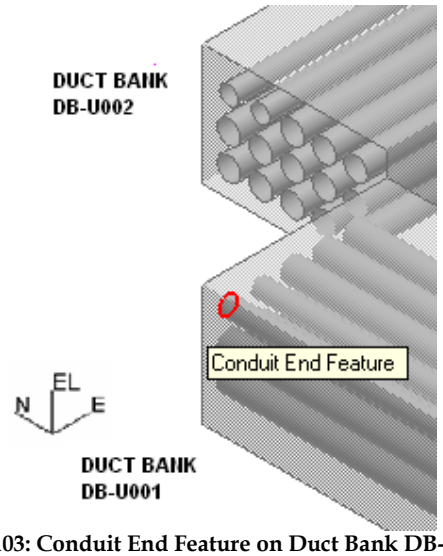


Figure 103: Conduit End Feature on Duct Bank DB-U001

17. Select the next Smartstep, "**To Run**".

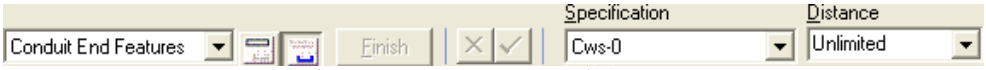


Figure 104: Auto Connect Ribbon

18. Select the enclosed 3" conduit end feature on Duct Bank (DB-U002) as shown below.

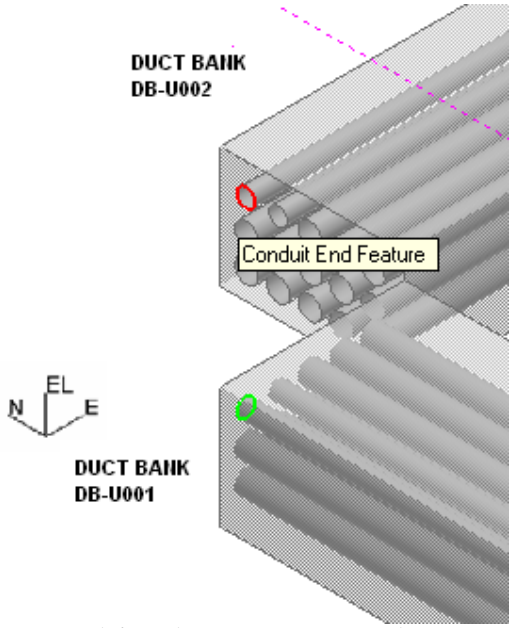


Figure 105: Conduit End Feature on Duct Bank DB-U002

19. System displays the connecting cableway between the selected conduit end features.

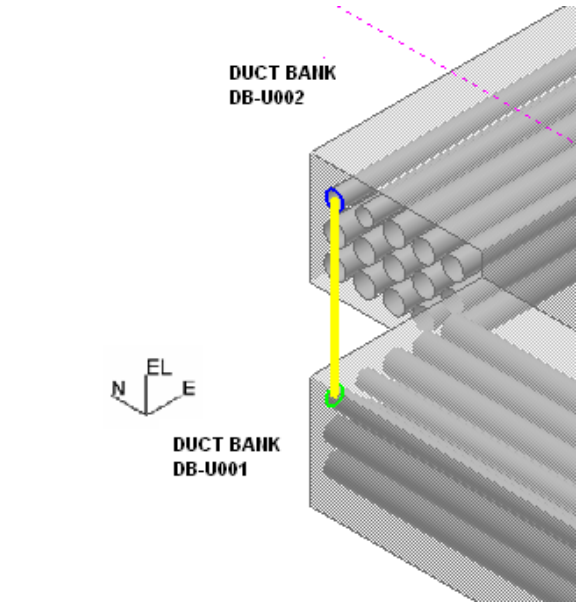


Figure 106: Connecting Cableway between the Conduit End Features

20. Hit **Finish** button to complete the placement of the connecting cableway.

Figure 107: Auto Connect Ribbon

21. Right Click to cancel the command. The result of the Auto Connect Command should look like the picture shown below.

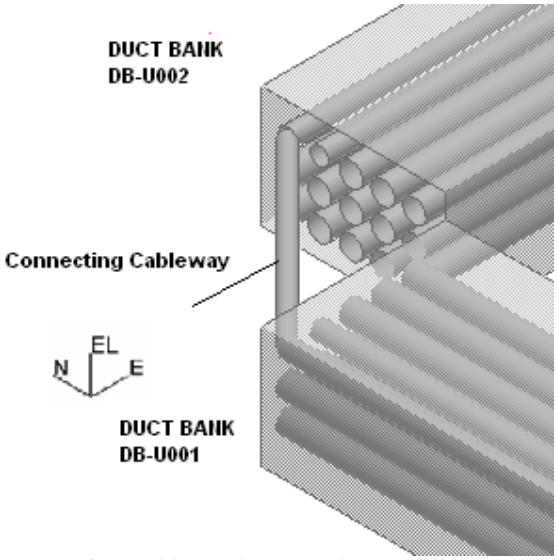


Figure 108: Connecting Cableway between the Conduit End Features

22. Show all the hidden objects by using the **Tools > Show All** command.

23. Fit the active view using the **View > Fit** command.

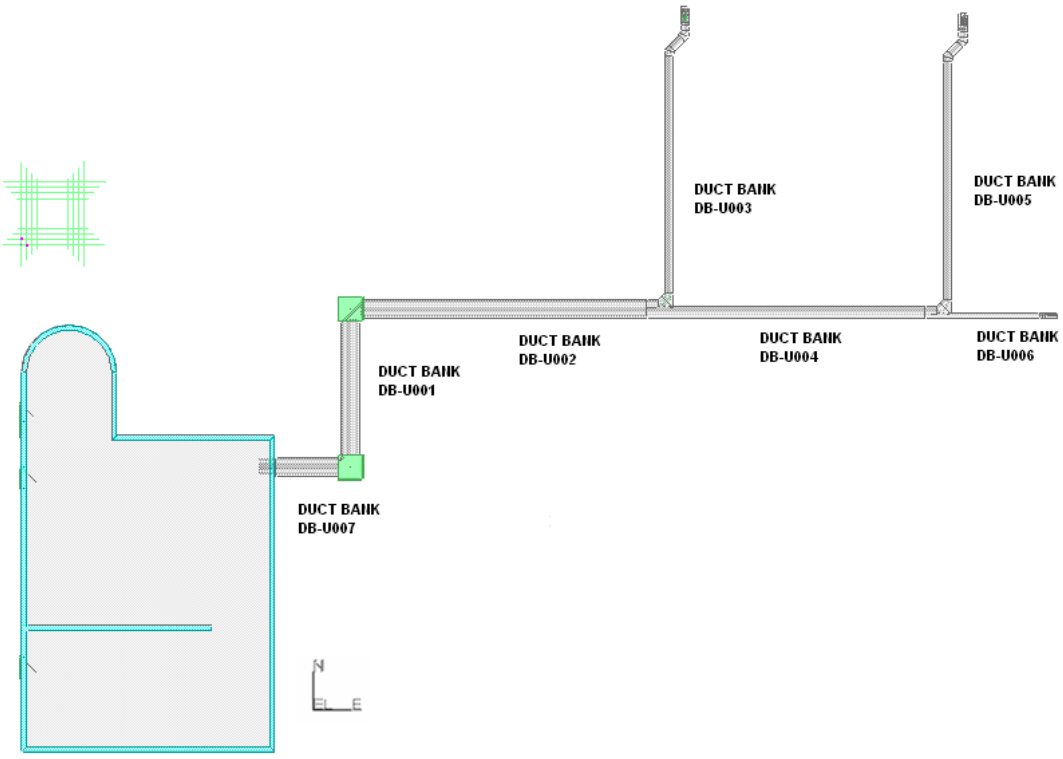


Figure 109: Duct Bank Layout

For more information related to routing cableway spec and inserting transition, refer to the Routing Cableway: An Overview and Insert Transitions: An Overview topics in the user guide ElectricalUsersGuide.pdf.

Session 6: Routing a Conduit

Objective:

By the end of this session, you will be able to:

- Route a conduit

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Electrical: An Overview

Overview

The **Route Conduit**  command allows you to define the geometry and properties of a conduit run. You can create conduit, modify the conduit that you have created, or extend an existing conduit. SP3D allows you to add conduit features and components that are driven by specifications and catalogs such as couplings, unions, and tees. The selection of the catalog part item in the conduit routing is directly attributable to the feature type and the specification on the Conduit Run.

Conduit can place onto cabletray for the purpose of cable drops that may occur along the cabletray route. As a result, you can place conduit onto an existing cabletray in a branching workflow. You can also route conduit within cabletray or place to the ends of cabletray. Additionally, conduit can be routed to/from equipment if the equipment has a conduit port defined on it.

Steps for Routing a Conduit

In following workflow we will route conduit from an Equipment item that has a Conduit nozzle: Notice how that when a nozzle is selected as the start point for routing, the route conduit command defaults to a matching size for the nozzle.

Note:

- Conduits can only be routed from the equipment that has conduit ports.

Route a conduit from **Control Port 4** of the electrical equipment **Electrical Device** in Unit **U01** under area **A2** of your workspace. Route the conduit using the following specifications:

Standard category:

- **System**: **Conduit**
- **Specification**: **CS0**

Cable Fill category**:**

- **Fill Efficiency: 65%**
- **Signal Type 1: Control**
- **Length: 3 ft** in the elevation **EL** direction
- **Length: 2 ft** in the south direction

After placing the Tee, route the conduit using the following specifications:

- **Length: 3 ft** in the east direction
- **Length: 3 ft** in the west direction

After routing the conduit the model should resemble the highlighted portion in Figure 1.

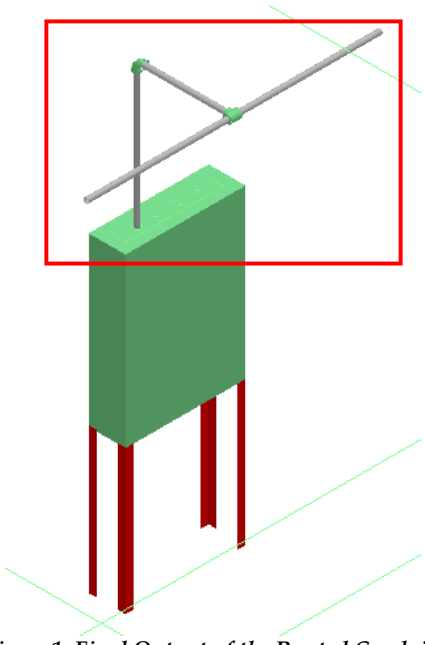


Figure 1: Final Output of the Routed Conduit

Before you start the procedure define your workspace to show Unit **U01** and coordinate system **U01 CS**.

44. Set the active coordinate system to **U01 CS** on the **PinPoint** ribbon and activate the **Set Target to Origin** option.

45. If you are not in the **Electrical** task, then select the **Tasks > Electrical** command and make sure the Active Permission Group is set to **Electrical.**

46. Click the **Route Conduit** button from the vertical toolbar.

Figure 2: Route Conduit Button

47. Select the **Conduit Port 4** on electrical enclosure, **Electrical Device** as the starting location.

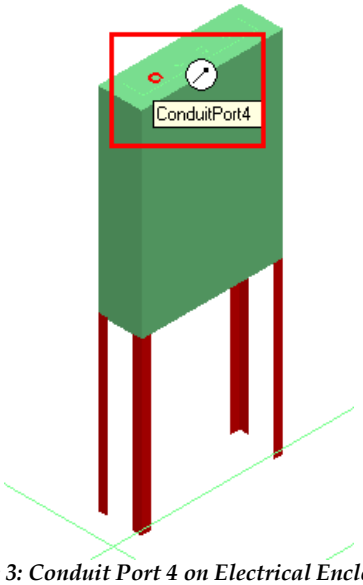


Figure 3: Conduit Port 4 on Electrical Enclosure

48. The **New Conduit Run** dialog box appears. Select the **More…** option on the **System** property option, as shown in Figure 4.

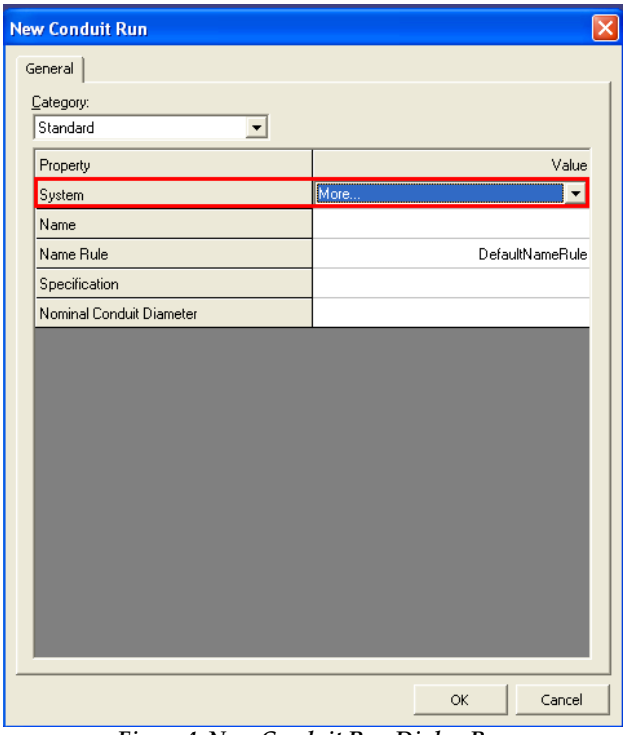


Figure 4: New Conduit Run Dialog Box

49. The **Select System** dialog box appears. Set the system to **A2 > U01 > Electrical > Control > Conduit** and click **OK.**

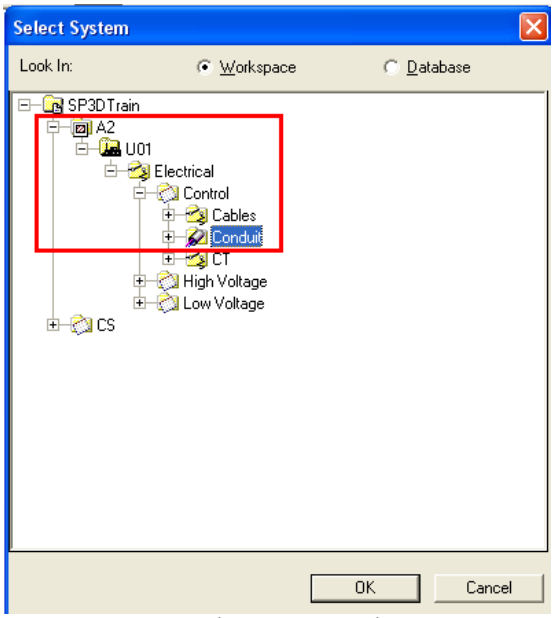


Figure 5: Select System Dialog Box

50. In the **New Conduit Run dialog box,** select the **Specification**: **CS0** from the **Standard**

category.

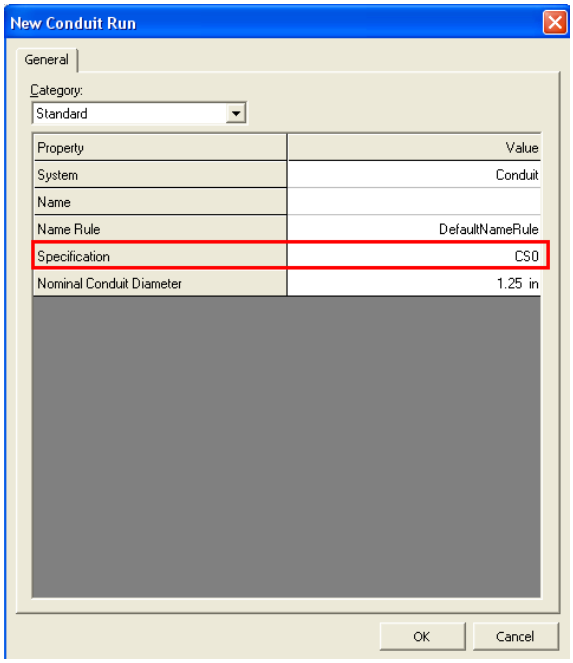


Figure 6: New Conduit Run: Standard Category

51. Switch to the **Cable Fill** category and define the following specifications:
    - **Fill Efficiency: 65%**
    - **Signal Type 1: Control**

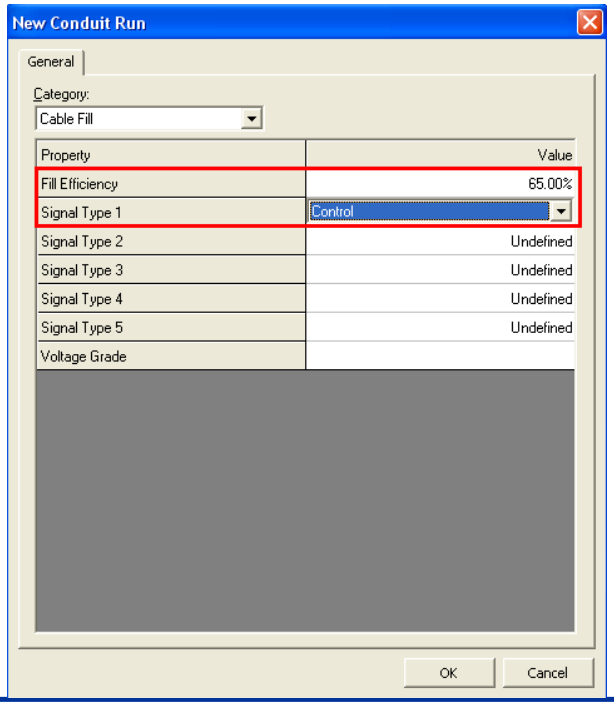


Figure 7: New Conduit Run: Cable Fill Category

52. Click **OK** to close the **New Conduit Run** dialog box. On the **Route Conduit** ribbon key in **3 ft** in the **Length** drop-down list.

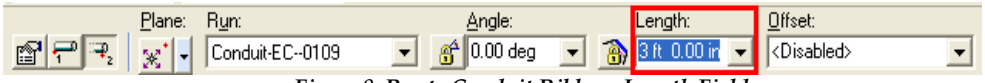


Figure 8: Route Conduit Ribbon: Length Field

53. Click the **Plane** drop-down arrow on the **Route Conduit** ribbon and select **Elevation Plane: East-West** to route the conduit, as shown in Figure 9.

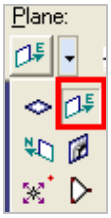


Figure 9: Plane Drop-Down Arrow

54. Move the cursor in the elevation **EL** direction in the graphic view and click in the graphic view to accept the position of the conduit, as shown in Figure 10.

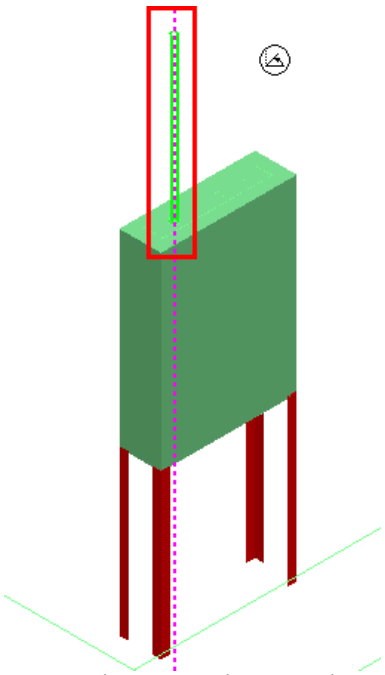


Figure 10: Conduit Run in the Upward Direction

55. Now key in **2 ft** in the **Length** drop-down list. Click the **Plane** drop-down arrow on the **Route Conduit** ribbon and select **Plan Plane** to route the conduit.

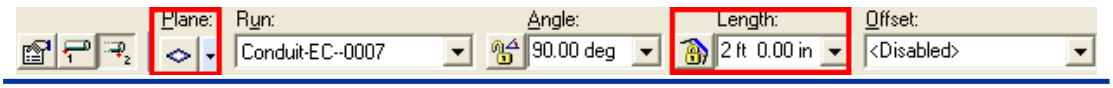


Figure 11: Route Conduit Ribbon: Plane and Length Controls

56. Move the cursor in the South direction in the graphic view and click in the graphic view to accept the position of the conduit as shown in the highlighted section of Figure 12. Right -click to terminate the **Route Conduit** command.

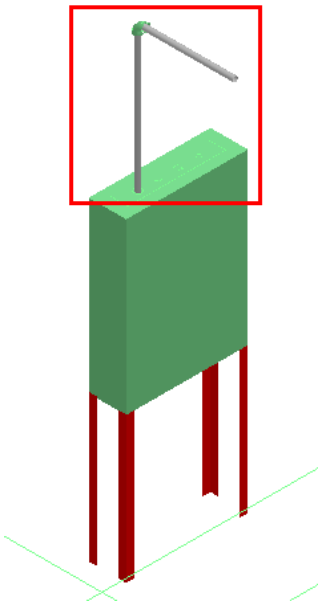


Figure 12: Conduit Run in the South Direction

57. Click the **Insert Component** button from the vertical toolbar.

Figure 13: Insert Component Button

58. Select the **End Feature** of the conduit, as shown in Figure 14.

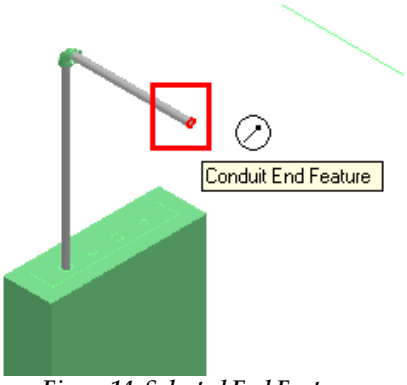


Figure 14: Selected End Feature

59. Select **Tee** from the **Type** drop-down list on the **Insert Component** ribbon, as shown in the Figure 15.

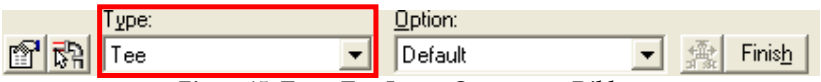


Figure 15: Type: Tee: Insert Component Ribbon

A Tee appears at the end of the End Feature, as shown in the Figure 16.

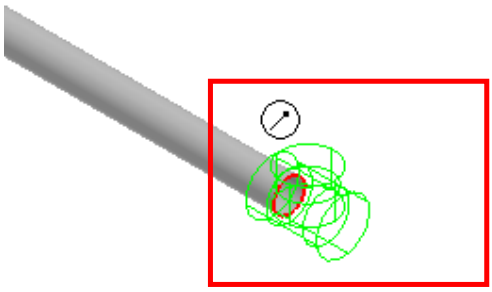


Figure 16: Placing the Tee

60. On the **Insert Component** ribbon, just before **Reference position**, there is a small drop-down arrow called the **Flip** drop-down list, where you can select the port to be used for the placement of a component. Click this arrow and select the third port, **1.25in FTE 3000**, as shown in Figure 17.

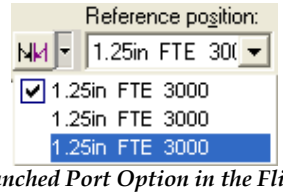


Figure 17: Branched Port Option in the Flip Drop-Down List

61. Select the **<New Conduit Run>** on the **Run** drop-down list.

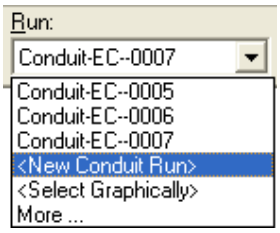


Figure 18: Run Drop-Down List

62. The **New Conduit Run** dialog box appears on the screen. Click **OK** to accept the default values of the new conduit run, as shown in Figure 19.

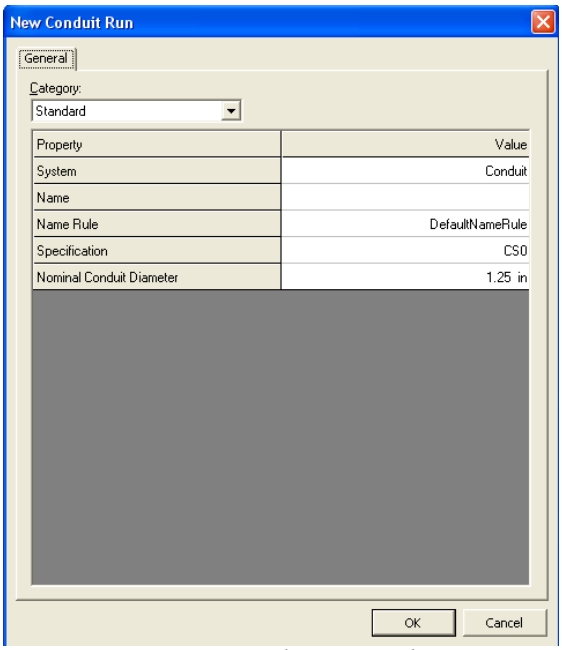


Figure 19: New Conduit Run Dialog Box

63. Key in **90 deg** on the **Angle** drop-down list to rotate the Tee, as shown in Figure 20.

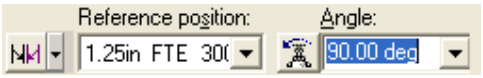


Figure 20: Angle Drop-Down List

You will now see the outline of a tee at the active placement point, as shown in Figure 21.

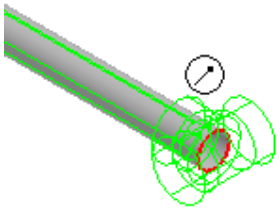


Figure 21: Rotated Tee

64. Click the **Finish** button to place the component.

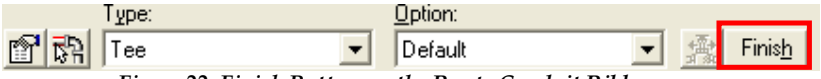


Figure 22: Finish Button on the Route Conduit Ribbon

65. Click the **Route Conduit** button from the vertical toolbar.

66. Select the Tee Port to start routing the conduit, as shown in the Figure 23.

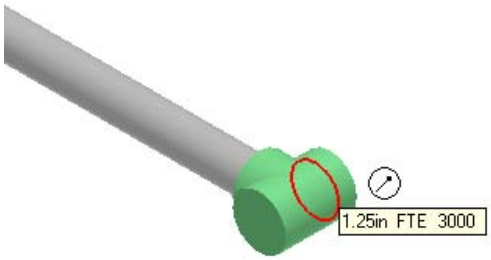


Figure 23: Placed Tee

67. On the **Route Conduit** ribbon, key in **3 ft** in the **Length** box.

Figure 24: Route Conduit Ribbon: Length Control

68. Route the conduit in the East direction, as shown in the Figure 25.

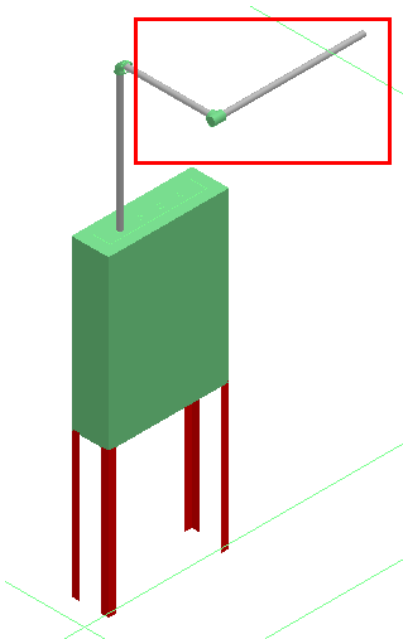


Figure 25: Routed Conduit: East Direction

69. Select the **Start Route Step** in the **Route Conduit** ribbon to re-define the starting point of the next conduit run.

Figure 26: Start Route Step on the Route Conduit Ribbon

70. Select the other Tee Port to start the conduit, as shown in the Figure 27.

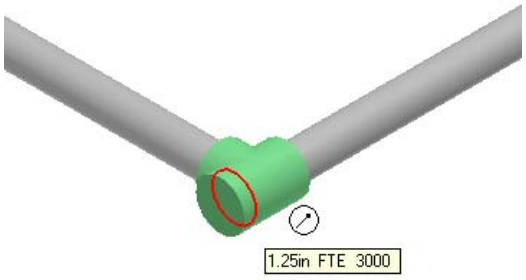


Figure 27: Selected Tee Port

71. Now key in **3 ft** in the **Length** box and route the conduit in the West direction.

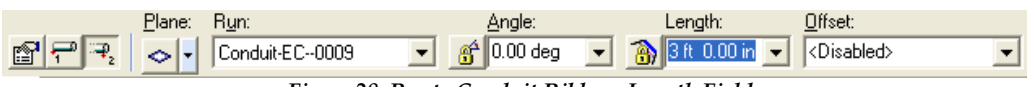


Figure 28: Route Conduit Ribbon: Length Field

72. Right-click in the graphic view to terminate the **Route Conduit** command.

Your graphic view should resemble Figure 29.

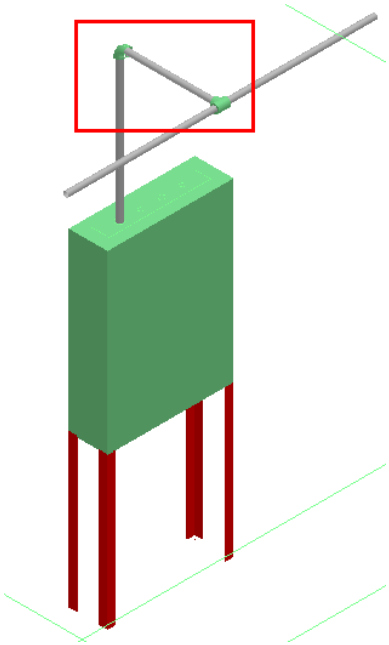


Figure 29: Routed Conduit

For more information related to the routing a conduit in a model, refer to *Routing a Conduit,* topic in the user guide *ElectricalUsersGuide.pdf.*

Session 7: Inserting Splits in a Cableway

Objective:

By the end of this session, you will be able to:

- Insert splits in a cableway by using the **Insert Split** command.

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Electrical: An Overview
- Routing a Cableway

Overview:

The **Insert Split** command allows you to place splits in a cableway or a cable tray. You can insert splits in existing cable trays and cableways so that the model represents purchasable length of tray. By default, the software will report one continuous section of tray. So the split command provides a semi automated method for dividing a long section of a tray into purchasable lengths.

You can choose from two modes of placement, **Single Split** and **Multi Split**:

- In the **Single Split** mode, the software places a split of specified length only once in a cableway or cable tray.
- In the **Multi Split** mode, the software places splits at locations specified by the purchase length of the tray. In this mode the splitted cable tray parts are of equal size.

Steps for Inserting Splits in Cableways:

Insert a single split on the cable tray located at top of the steel frame using the following specifications:

- **Section Length: 24 ft**
- **Gap Width: 0 ft 1 in**
- **Reference Position: Port 1**
- **Split Mode: Single Split**

The view of the trays after inserting the single split should resemble Figure 1.

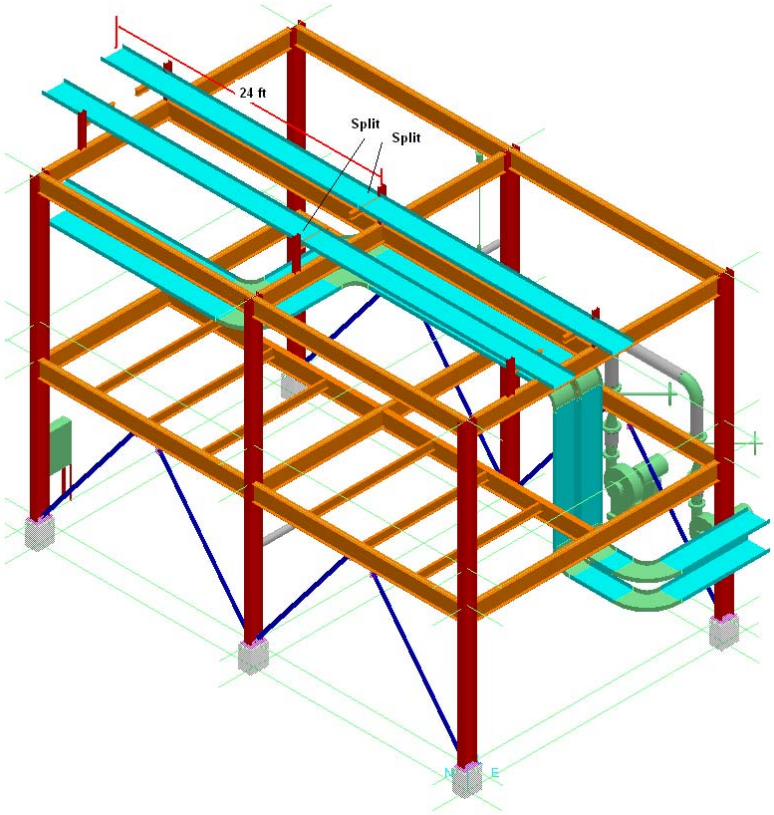


Figure 1: Output-Single Split in a Cable Tray

Before beginning the procedure define your workspace to show Unit **U01** and coordinate system **U01 CS**. In your training plant, select **U01** from **Plant Filters > Training Filters** in the **Select Filter** dialog box.

73. Set the active coordinate system to **U01 CS** on the **PinPoint** ribbon and activate the **Set Target to Origin** option.

74. Click **Tools > Show All** command to show all hidden objects in your workspace. You were instructed to hide some objects in the first SP3D Common Practice lab.

75. Make sure that the **Electrical** task is active and the Active Permission Group is **Electrical**.

76. Click the **Insert Split** button on the vertical toolbar.

Figure 2: Insert Split Button on the Vertical Toolbar

When you click the **Insert Split** button, the **Insert Split** ribbon is displayed. The following options are available on this ribbon to set the specifications of the split that you want to insert:

- **Section Length:** Specifies the purchasable length of a cable tray. If the length of the selected cableway straight feature is less than the specified section length, then the software sets the section length to half the straight feature length.
- **Gap Width:** Specifies the width of the split.
- **Reference Position:** Inserts splits in the selected straight feature starting from either end of the straight feature, Port 1 or Port 2, of a cableway or a cable tray.
- **Split Mode:** Specifies the mode or type for inserting splits. It can be either **Single Split** or **Multi Split**.

77. On the top cableway, select the **Cableway Straight Feature,** where you need to place the split, as shown in the highlighted section of Figure 3.

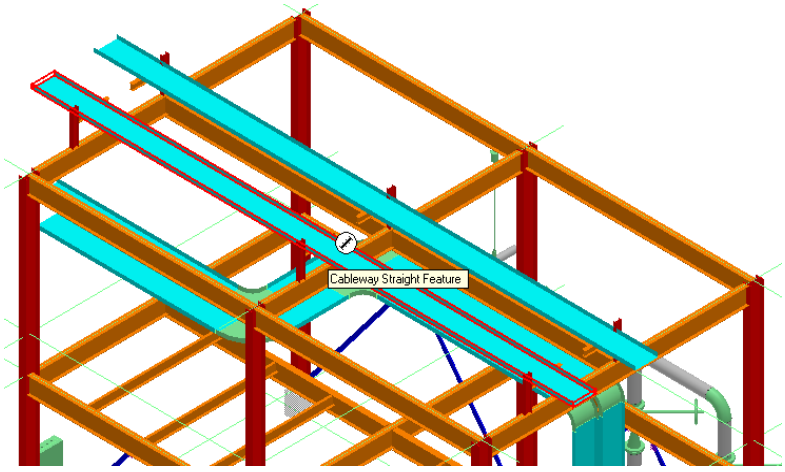


Figure 3: Cableway Straight Feature

78. Set the following specifications on the **Insert Split** ribbon:

- **Section Length**: **24 ft**
- **Gap Width**: **0 ft 1 in**
- **Reference Position**: **Port 1**
- **Split Mode**: **Single Split**

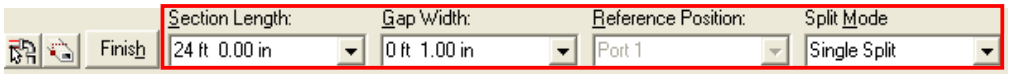


Figure 4: Insert Split Ribbon

79. Click the **Finish** button on the **Insert Split** ribbon to insert the split on the cableway.

Figure 5: Finish Button on the Insert Split Ribbon

6. Repeat steps 4-7 to place a second split on the second cable tray, as shown in Figure 6.

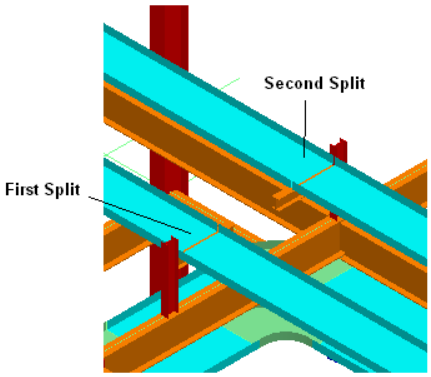


Figure 6: Second Split in a Cable Tray

Notes:

- The procedure to insert multiple splits is similar to the procedure for inserting single split. You can insert multiple splits in a cable tray by clicking the **Insert Split** button on the vertical toolbar and specifying the section length, gap width, and reference position on the **Insert Split** ribbon. The only difference is that the **Split Mode** setting on the ribbon needs to be **Multi Split** instead of **Single Split**.
- Delete a split feature by selecting the split feature (**Cableway Along Leg Feature**) using the **QuickPick** tool and then by using the **Delete** command.

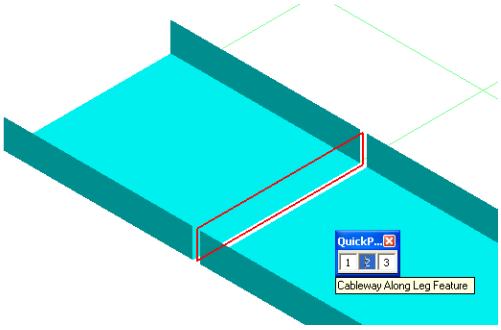


Figure 7: Selecting Split Feature Using the QuickPick Tool

For more information related to inserting splits in a cableway, refer to the *Inserting Cable Tray Splits: An Overview* topic in the user guide *ElectricalUsersGuide.pdf*.

Session 8: Integration with SmartPlant Electrical (SPEL)

Objective:

By the end of this session, you will be able to:

- Describe the process to retrieve cable data from SPEL into SP3D.

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Electrical: An Overview

Overview:

To design or create a plant in SP3D, you might need to reuse data from other design or authoring tools. The SmartPlant integrated environment allows you to retrieve design data from and communicate the data with different design and authoring tools, such as the tools in the SmartPlant Enterprise suite and AutoCAD. For example, you can retrieve and reuse equipment, nozzles, and piping specifications from SmartPlant P&ID. Similarly, you can retrieve cable data from SmartPlant Electrical (SPEL) to route cables along cableways, trays, and conduits in your model.

SPEL is a schematic design application that stores cable schedules. A cable schedule is a list of cables with connectivity information, such as cables connecting two types of equipment like a junction box and an electric motor and the type of cable used to make this connection.

Revision: 1
By: RH
Date: 11/1/97

INTERGRAPH

Cable Schedule

Cable Tag	Cable Category	Cable Specificatoin	Cable Formation	Reference Cable	Rated Voltage	Segregation Level	From Item Tag	From Subclass	From Description	From Process Equipment Item	To Item Tag	To Subclass	To Descriptio	To Process Equipment
CP-T0	Power	Power - NEC	3 x 10 AWG + 2 x 10 AWG	3+2/C-10AWG - (Power / NEC)			G-3	Generator			PDB-2	PDB		
CP-T1	Power	Power - NEC	3 x 10 AWG + 2 x 10 AWG	3+2/C-10AWG - (Power / NEC)			PDB-2	PDB			T-3	Transformer		
CP-T2	Power	Power - NEC	3 x 10 AWG + 2 x 10 AWG	3+2/C-10AWG - (Power / NEC)			T-3	Transformer			MP-162A	Motor		

Figure 1: Cable Schedule Sheet

You can retrieve cable schedules from SPEL into SP3D, using the integrated environment, to route cables. The information retrieved from SPEL is considered the design basis or design data in SP3D. The design basis is a collection of objects that represent pieces of data from different design and authoring tools. SP3D just adds graphical meaning to the design data.

After routing cables in a 3D model, the length of the cable is calculated in SP3D. SP3D then publishes the updated cable information back to SPEL where the cable will be resized or redesigned based on the length information. The process of publishing SPEL data back to SP3D repeats, and then updates the cable in the SP3D model when these cables are retrieved again.

Process of Retrieving Data from SPEL:

All design tools publish and retrieve data through SmartPlant Foundation (SPF). SPF acts as a central repository for data and a medium through which information is shared among other tools, such as SmartPlant Instrumentation, SmartPlant P&ID, and SP3D. In the integrated environment, data is published to and retrieved from a central repository. SPF enables the publishing and retrieval of the following types of data:

- **Piping and Instrumentation Diagrams (P&IDs)**: You can retrieve piping, instrumentation, and equipment data from a P&ID in an integrated environment.

- **SPEL Cable Schedules**: You can view the retrieved data and update or import cables by using the **SmartPlant > View Cable Schedule** … command in the **Electrical** task of SP3D.

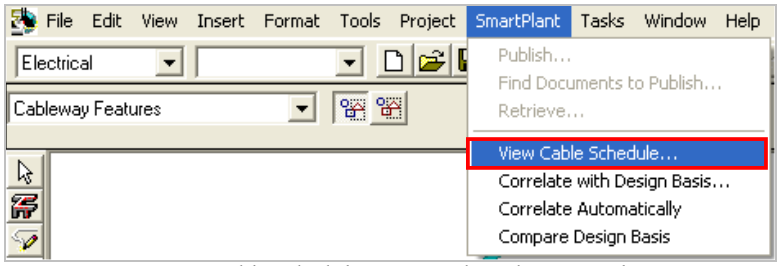


Figure 2: View Cable Schedule Command on the SmartPlant Menu

- **SmartPlant Instrumentation Dimensional Datasheets (DDPs)**: You can retrieve SmartPlant Instrumentation dimensional data for Piping. SP3D retrieves instruments defined in SmartPlant Instrumentation and maps the instruments to a parametric symbol.

- **Plant Breakdown Structure (PBS)**: You can retrieve PBS and project documents to provide information about the plant/ships, areas, units, and projects that need to be created in SP3D. The PBS document published by SPF contains information about the physical plant/ship whose structure consists of plants, areas, and units.

When you retrieve cable data from SPEL, SPEL publishes the data to SPF, and SP3D retrieves the data from SPF. Similarly, when SPEL retrieves the updated cable data from SP3D, SP3D publishes the data to SPF. SPEL then retrieves the data from SPF.

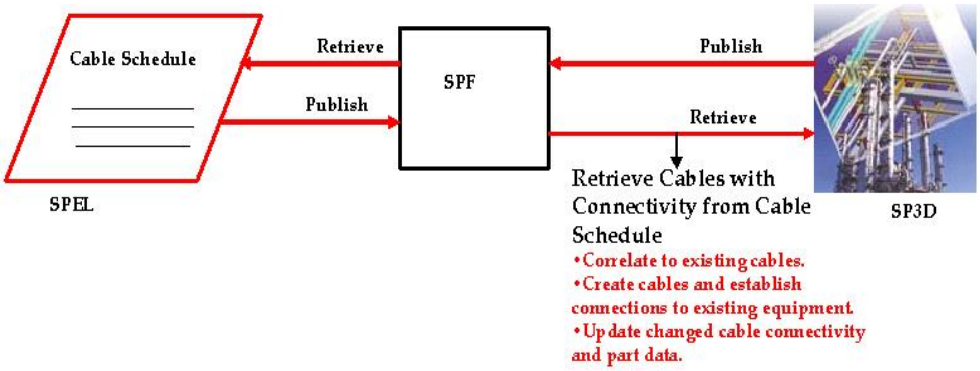


Figure 3: Publishing and Retrieving Cable Schedules to and from SPEL

The **SmartPlant > Retrieve** command is used to retrieve data in SP3D, as shown in Figure 4. This command is enabled when you work in an integrated environment.

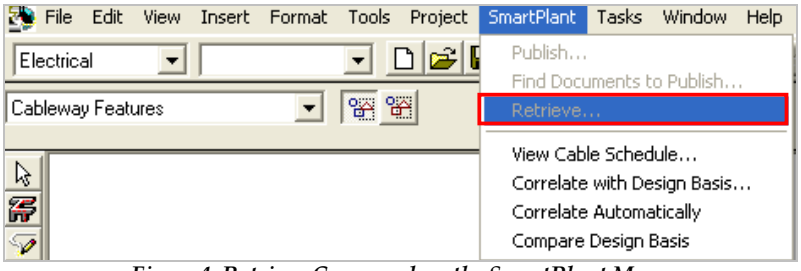


Figure 4: Retrieve Command on the SmartPlant Menu

Comparing Model and Design Data:

The retrieved data and the SP3D design that is derived from the retrieved data are dynamic. They keep changing during the design of the model. So it is often necessary to obtain the updated versions of the retrieved data while the 3D design is evolving. Whenever a new version of the data is retrieved into SP3D, you need to compare the new data with the data that exists in the model. During this comparison, you would want to review the impact of changes on the model.

In SP3D, you can compare the differences in the property and topology values in the model and design data. The purpose of this comparison is to:

- Update the values of the mapped properties of the design and model data on the correlated objects in SP3D.
- Process deleted objects.

Upon comparison, you might find that the SP3D or model data and the design basis object or design data to be in different states:

- Uncorrelated - where the model data is not related to the design data at all.
- Correlated, but the data does not agree - For example, a pump may be black in the model, but white in the pump design basis.
- Correlated and the data agrees or matches.

Comparing the data allows you to manage changes to 3D model objects to match the design basis objects without having to remodel. For example, you can change the pump coating requirement

or the type of pump after comparing the data.

The **SmartPlant > Compare Design Basis** command is used to compare the model and design data in SP3D. The command is also used to resolve discrepancies between the model and design data.

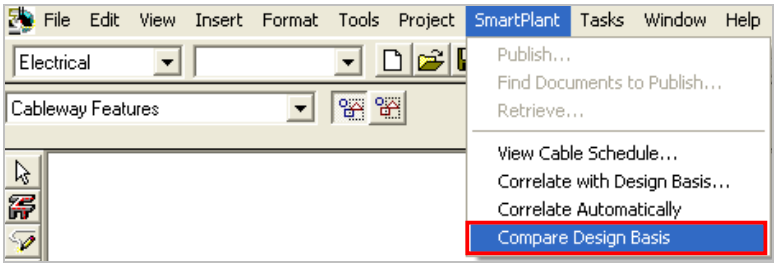


Figure 5: Compare Design Basis Command on the SmartPlant Menu

Steps for Retrieving Cables from SPEL:

Place new cables on the 3D model by using the cable schedule sheet supplied by SmartPlant Electrical. After retrieving the cables, they will appear in the **Workspace Explorer**, as shown in Figure 6.

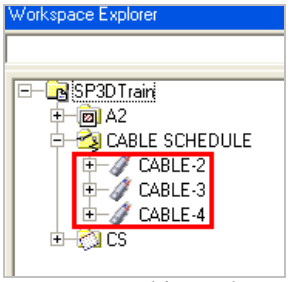


Figure 6: Final Output- New Cables in the Workspace Explorer

Note:

- In an integrated environment, the **Electrical** task and SmartPlant Electrical can share a cable schedule, along with several cable properties.

Before starting the procedure for retrieving cables from SPEL:

- Define your workspace to include all objects located in Unit **U01** system and the coordinate system **U01 CS**. In your training plant, select **U01** from **Plant Filters > Training Filters** in the **Select Filter** dialog box.
- Set the active coordinate system to **U01 CS** on the **PinPoint** ribbon and activate the **Set Target to Origin** option.
- Select the **Tasks > Electrical** command to enable the **Electrical** task.
- Set the Active Permission Group to **Electrical** and assign the objects that you place in the model to the Active Permission Group.
- If the training environment is not setup to have a Foundation server, then skip this step. To retrieve these data you can use the **SmartPlant > Retrieve** command that assists you in retrieving the applicable documents.

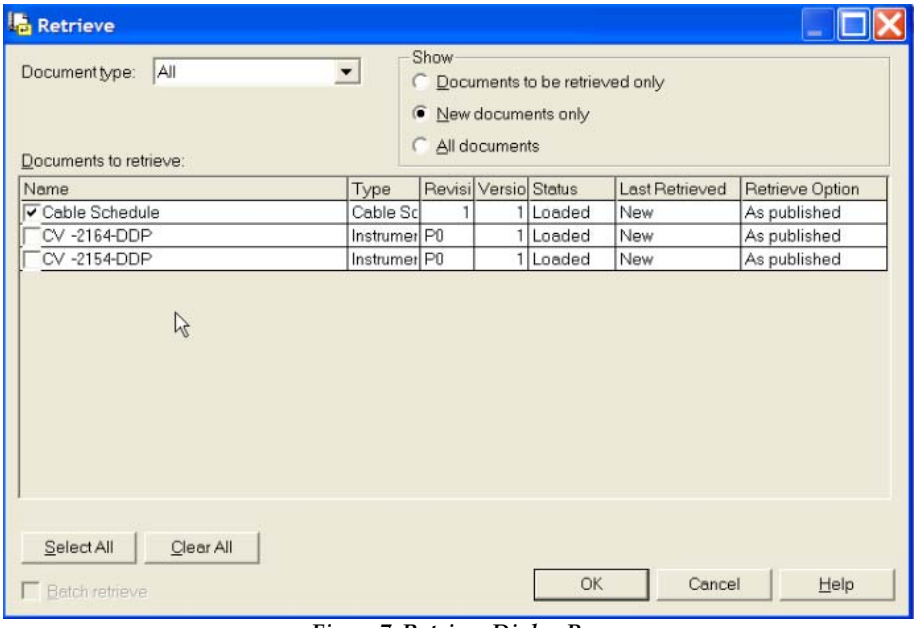


Figure 7: Retrieve Dialog Box

1. Select **SmartPlant > View Cable Schedule ...** command to open the **Cable Schedule Documents** dialog box.

2. Select a **Cable Schedule** document and click **Open**, as shown in Figure 8.

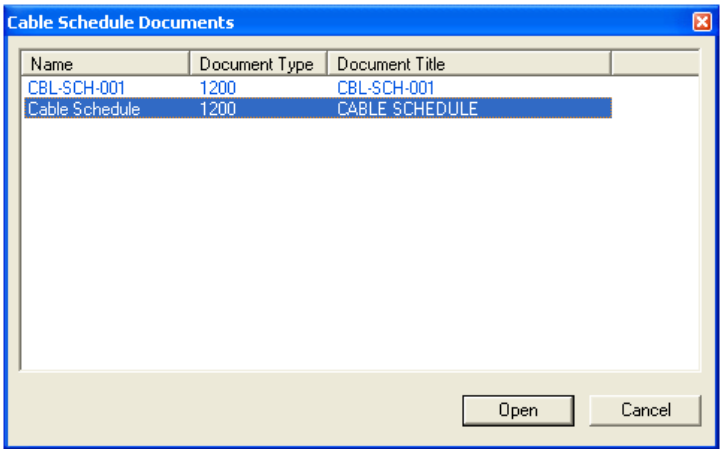


Figure 8: Cable Schedule Documents Dialog Box

3. The **Cable Schedule** dialog box appears. The dialog box displays a list of retrieved cable schedules and their associated specifications. Select the **Select All** check box at the bottom of the dialog box and click **Process**, as shown in Figure 9.

Note:

- SmartPlant Client needs to be installed on your machine in order to display the cables on the cable schedule dialog.

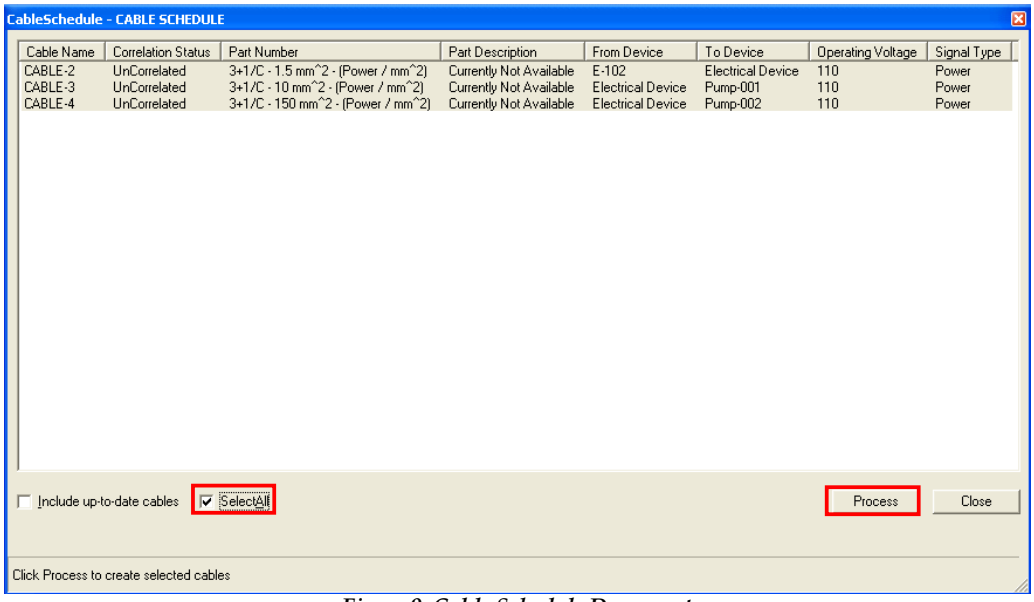


Figure 9: Cable Schedule Document

The retrieved cables are under **SP3DTrain\CABLE SCHEDULE** system as shown in Figure 10.

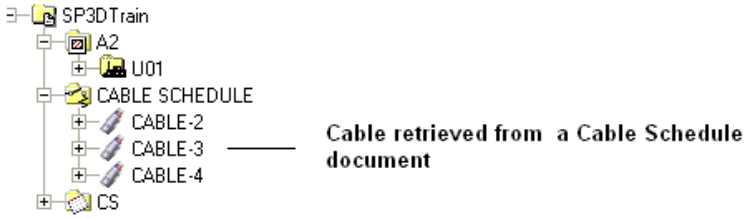


Figure 10: Cables Retrieved from a Cable Schedule

4. SP3D creates relationships between the 3D cable objects and their corresponding design basis objects. Click **Close** and you should see a new electrical system in the **Workspace Explorer** with the new cables.

Note:

- SP3D creates the cables in an electrical system with the same name as the cable schedule document. It creates a new system incase the required system does not exist. SP3D searches the equipment defined in the cable schedule and selects automatically the equipment to which the new cable is connected. If the equipment is not in the model, then the cable will not be created in the model.

Steps for Routing Cables Retrieved from SPEL:

The next step is to route a cable retrieved from SPEL.

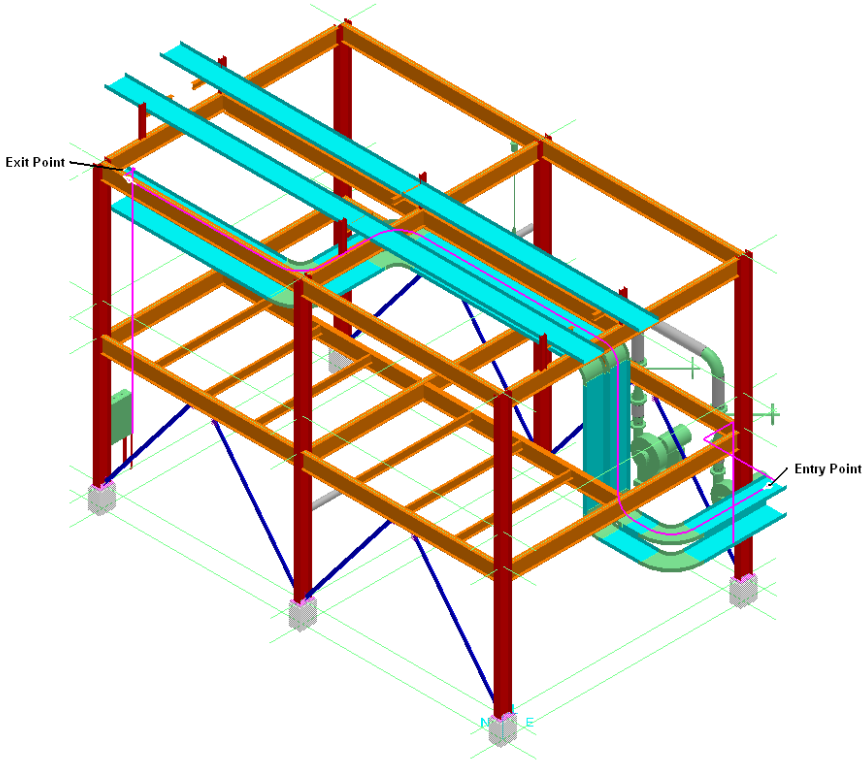


Figure 11: Final output- After Routing a Cable Retrieved from SPEL

5. In the **Locate Filter** drop-down list, select **Cables**. This helps you select cable objects in the model.

Figure 12: Locate Filter Drop-Down List

6. Select **CABLE-3** in the **Workspace Explorer**. SP3D opens the **Edit Cable Path** ribbon and highlights the cable graphically, as shown in Figure 13.

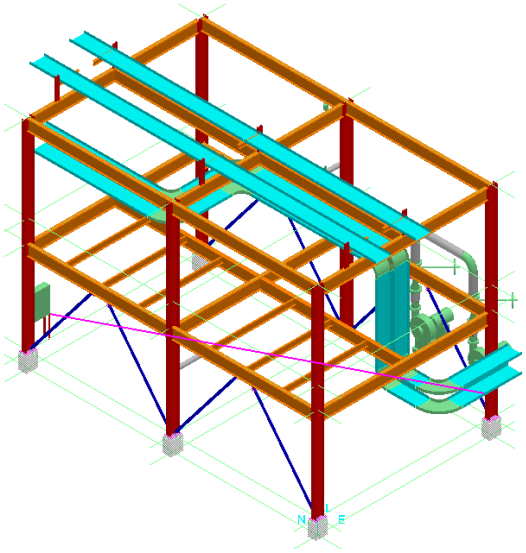


Figure 13: Selected Cable in Unit U01

7. Select the **Entry Point** option on the **Edit Cable Path** ribbon.

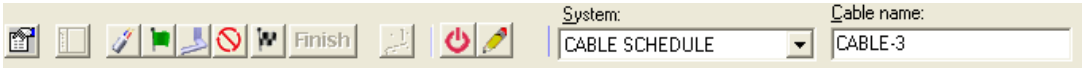


Figure 14: Edit Cable Path Ribbon

8. The system prompts for a position on the cableway for **Entry Point**. Select the **End Feature** of the top tray, as shown in Figure 15.

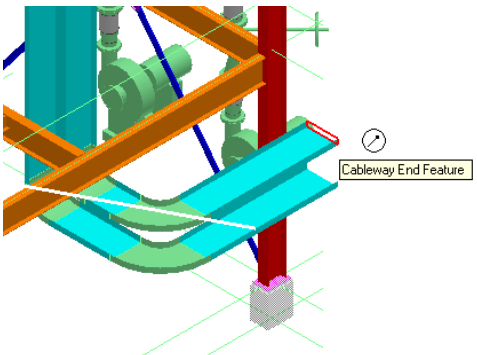


Figure 15: Selected End Feature of Top Tray

The system shows the cable path. Ensure that the cable goes through the top tray.

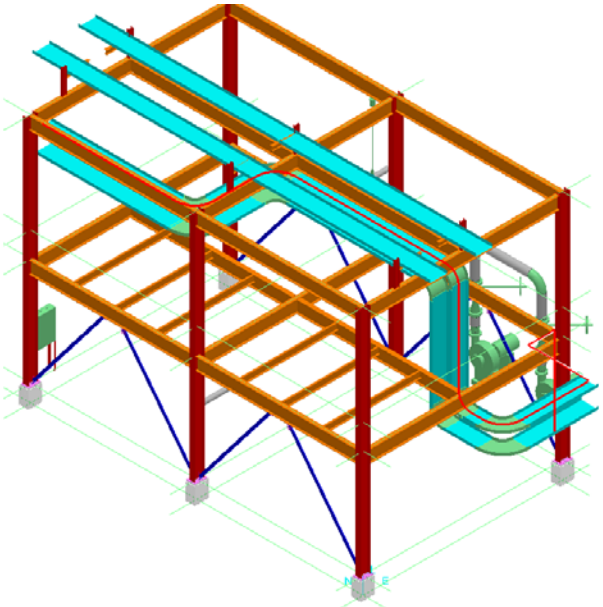


Figure 16: Cable Path

9. Click the Accept Selection button. The system prompts for position on the cableway for **Exit Point**. Select the **End Feature** at the other end of tray as exit point.

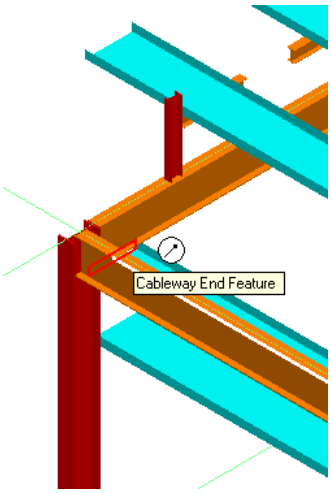


Figure 17: Selected End Feature of Top Tray

10. Click the **Finish** button to define the cable path.

Figure 18: Finish Option on the Edit Cable Path Ribbon

11. Select the cable graphically, as shown in Figure 19.

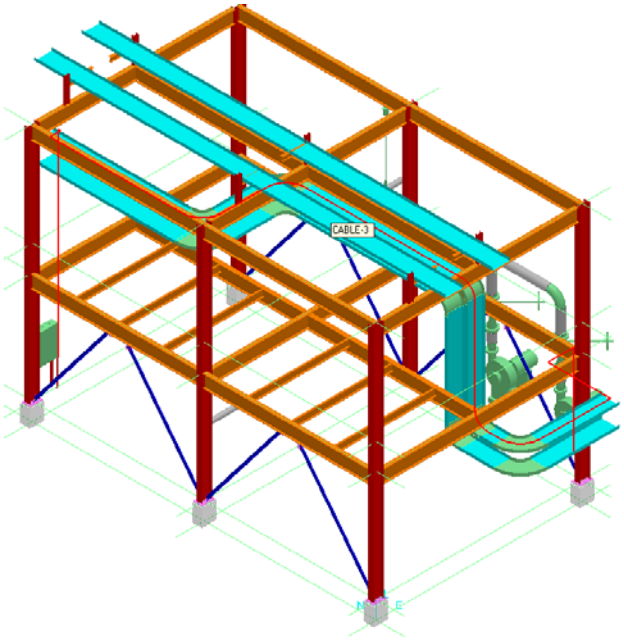


Figure 19: Selected Cable

12. Click the **Properties** button on the **Edit Cable Path** ribbon to open the **Cable Properties** dialog box.

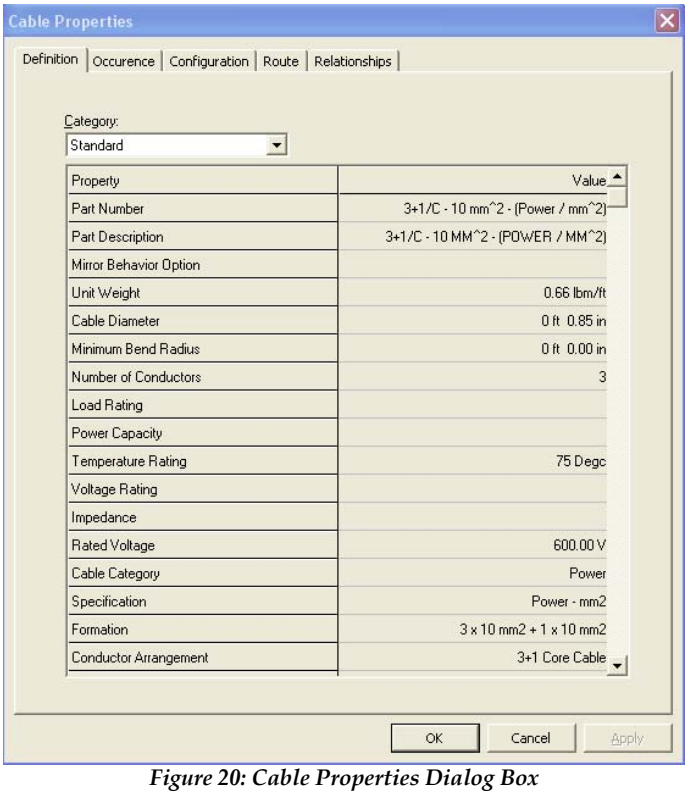


Figure 20: Cable Properties Dialog Box

Notice that the cable part number comes from the cable schedule document.

For more information related to the integration of cables with SPEL, refer to

- *Using SmartPlant 3D in an Integrated Environment: An Overview* topic in the user guide *TEF_SP3D.pdf.*
- *Retrieving Cable Data: An Overview* topic in the guide *ElectricalUsersGuide.pdf.*

Session 9: Routing Cables

Objective:

By the end of this session, you will be able to:

- Route a cable in SP3D.

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Electrical: An Overview
- Integration with SmartPlant Electrical (SPEL)

Overview:

In the SP3D Electrical task, you can create cables and route them through the existing conduit and cableway. To create cables you use the **Route Cable** command to define cable definitions, such as name, part number, and equipment to which the cable is connected or use the **Common Retrieve** command to retrieve cable definitions from SmartPlant Foundation that were defined by the SmartPlant Electrical. For example, you can choose an electrical cabinet and a motor pump to connect them with a cable in the model.

There are two primary workflows to route cables:

- Manual Cable Routing
- Auto Cable Routing

Before you start routing cables, you need to become familiar how cables are created and displayed in the 3D model. Figure 1 shows the cable properties dialog box used to create a single cable or parallel cables in the model.

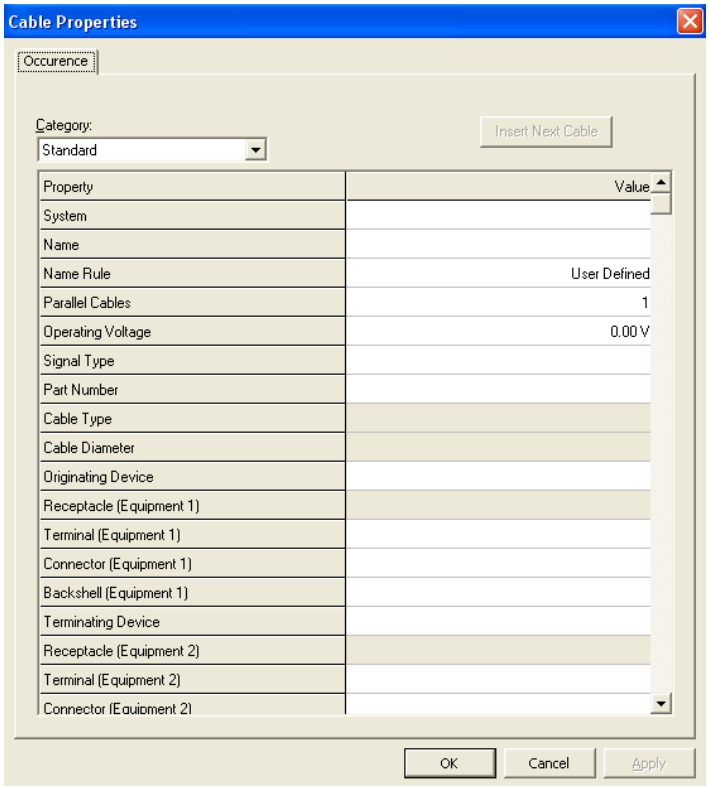


Figure 1: Cable Properties Dialog Box

Cables do not have any persistent graphics of their own. SP3D only displays the cable route generated from the path definition and is a temporary graphics. When a cable is selected, a bold line will show the cable route in the selected color that traces the path of the cable as defined by the cable object. The path is along the centerline of the cableway and conduit and a straight line from the cable exit point to the equipment terminal. A parallel cable is created by entering a number other than 1 in the field **Parallel Cables** in the **Cable Properties** dialog box.

This session will cover the procedure for manual cable routing and auto cable routing.

Manual Cable Routing:

You route a cable manually, if you want to route a cable into a cable tray at some point along the length of the tray. For example, if you want to force the cable to go through a particular cableway or force the cable to detour a particular cableway, you will select manual routing. In this case, the cable needs to exit a conduit and then enter a cable tray. You can specify an entry point or exit point anywhere along a cable tray using the **Set Entry Point** or **Set Exit Point** options on the ribbon. **PinPoint** command is used to assist in precise placement. One possible workflow for this example is to first branch the conduit out of the tray using the **Route Conduit** command. With this command the software creates a connection between the conduit and cableway features. While routing the cable, you select the cableway that owns the tray and then do the same for the conduit run in the **Select Cableways** step. The software recognizes the connection between the two runs and makes the turn for you, trimming the path appropriately.

The highlighted portion in Figure 2 shows the cable path through the cable tray into the equipment terminals.

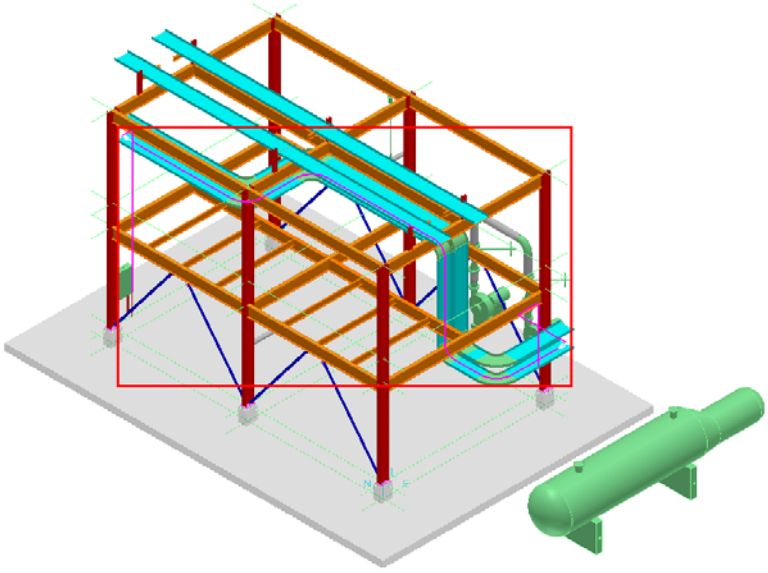


Figure 2: Cable Path Through the Cable Tray into Equipment Terminals

Steps for Routing Cables Manually:

Place a single cable **CC-001** from an electrical device to a pump in Unit **U01** by using the **Edit Cable Path** command.
After routing the cable, the workspace should resemble the highlighted section of Figure 3.

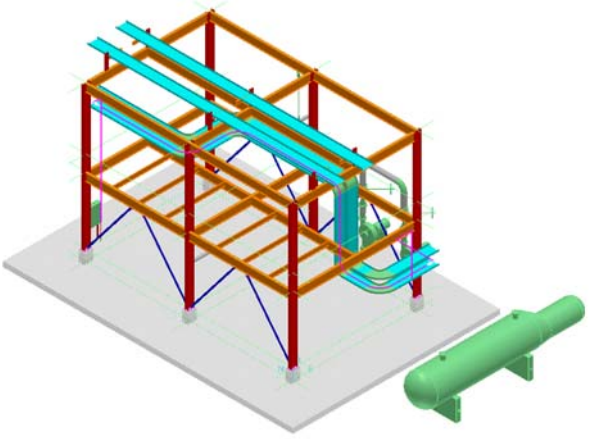


Figure 3: Manually Routed Cable

Before beginning the procedure:

- Define your workspace to display Unit **U01** and coordinate system **U01 CS**.
- Make sure that you are in the **Electrical** task and the Active Permission Group is set to **Electrical.**

1. Click the **Insert Cable** button on the vertical toolbar.

Figure 4: Insert Cable Button on the Vertical Toolbar

2. The **Cable Properties** dialog box will appear. Set the following cable specifications in the **Cable Properties** dialog box, and click **OK**.

    - **System: A2\U01\Electrical\Low Voltage\Cables**
    - **Name: CC-001**
    - **Name Rule: User Defined**
    - **Parallel Cables: 1**
    - **Operating Voltage: 110.0 V**
    - **Signal Type: Power**
    -
    - **Originating Device: Electrical Device**
    - **Terminating Device: Pump-001**

    SP3D automatically selects the created cable and opens the **Edit Cable Path** ribbon.

3. Select the **View > Set View by Cable** command. This command helps you while routing cable by only showing the required objects and hiding the objects that are not required in the model.

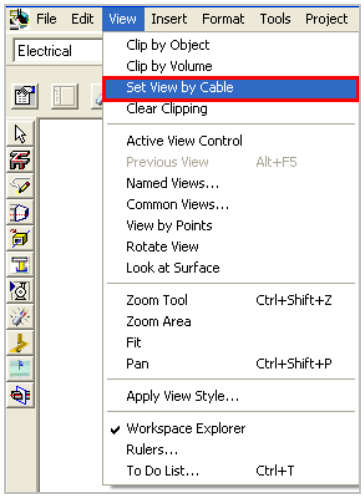


Figure 5: View > Set View By Cable Command

In order to help you in determining the route, this command does the following:

- Hides structural, piping, Heating, Ventilation and Cooling (HVAC), and other objects that you do not need.
- Hides all equipment not associated with the selected cable.
- Displays all conduit and cableways that are in the immediate vicinity of the equipment you are selecting. These objects are the most likely to be used for connecting the equipment with cable.
- Displays all conduits and cableways connected to those in the vicinity. As an extra measure to ensure that a viable cableway or conduit is not left out, the branches are included as well.
- Displays all conduits and cableways that the cable currently runs through.
- Shows hangers supporting these cableways and conduits. These hangers are important reference points for you during routing.
- Automatically zooms to view the volume of interest.

The selected cable is highlighted in the graphic view, as shown in Figure 6, and you can route it manually using the following steps.

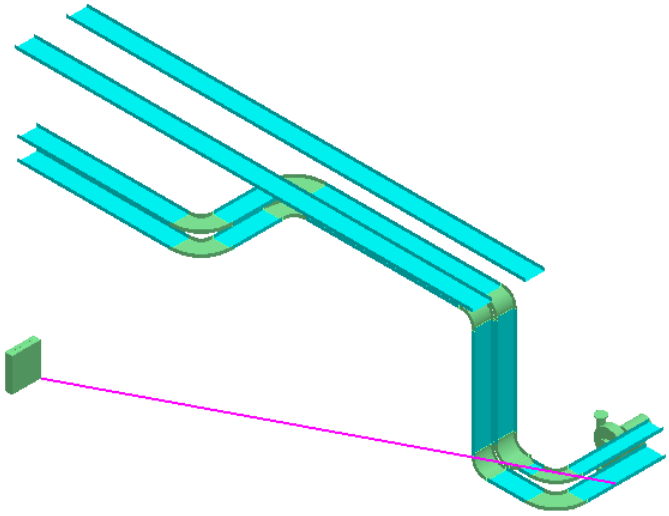


Figure 6: Highlighted Cable by Using the Set View by Cable Command

4. Select the **Set Entry Point** option on the **Edit Cable Path** ribbon.

Figure 7: Set Entry Point Option on the Edit Cable Path Ribbon

5. The system prompts for a position on cableway for entry point. Select the **Cableway End Feature** of the bottom tray, as shown in Figure 8.

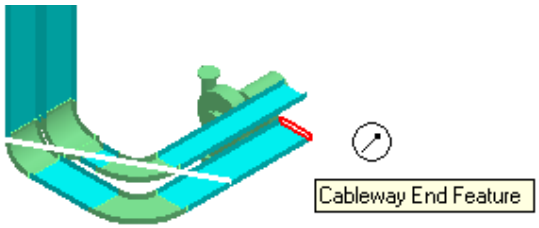


Figure 8: Cableway End Feature of the Bottom Tray

6. The system shows the cableway path. Ensure that the cable goes through the bottom tray. Click the **Accept Selection** option on the **Edit Cable Path** ribbon.

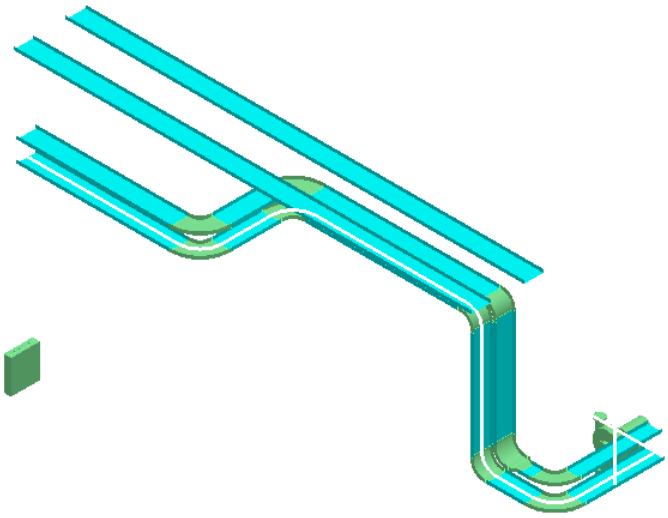


Figure 9: Cable Going Through the Bottom Tray

7. The system prompts for position on the cableway for an exit point. Select the **Cableway End Feature** at the other end of the bottom tray to specify the exit point, as shown in Figure 10.

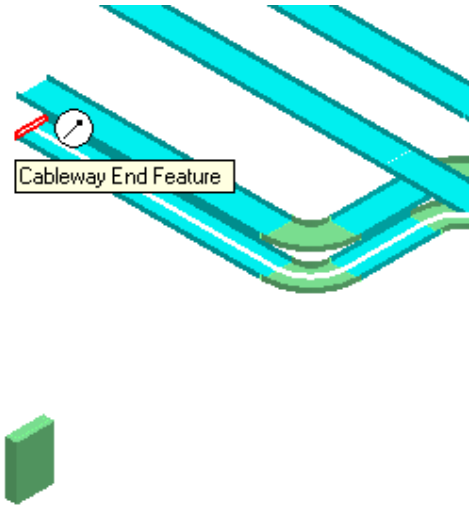


Figure 10: Cableway End Feature Of the Bottom Tray

8. Click the **Finish** button on the **Edit Cable Path** ribbon to complete the cable path.

Figure 11: Finish Button on the Edit Cable Path Ribbon

9. Select cable **CC-001** in the **Workspace Explorer** and review its properties.

10. Select **View > Clear Clipping** command to restore the graphic view to its original state.

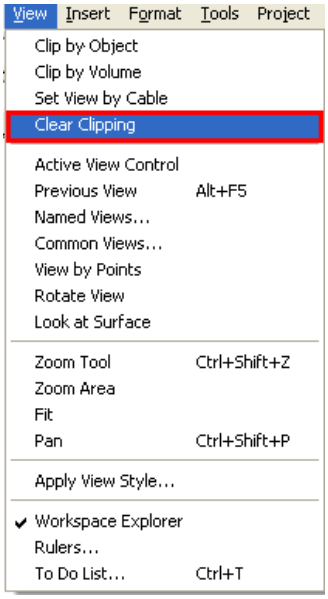


Figure 12: View> Clear Clipping

Tip:

- The **Clear Clipping** command displays any objects in the view that were hidden by the **Clip by Volume** or **Clip by Object** commands. Use this command to restore the view before you define a new clipping volume or object.

11. Select the **Tools > Show All** command.

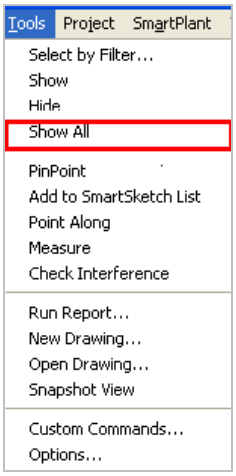


Figure 13: Tools> Show All Command

Your graphic view should resemble Figure 14.

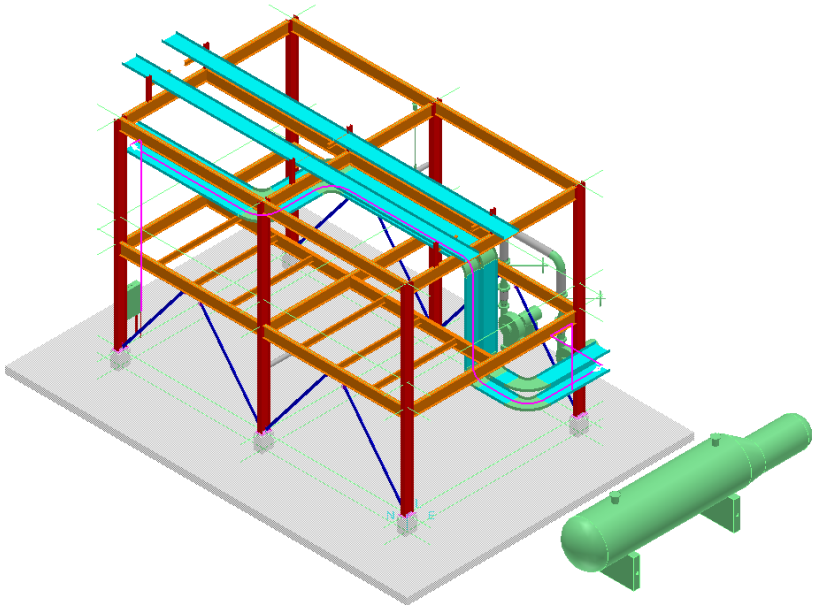


Figure 14: Cables Routed Manually

Parallel Cables:

Cables that are routed together are called parallel cables. Using SP3D, you can create parallel cables when you need to route more than one cable together of the same specification. The software creates a parent object called a parallel cable and child objects called paralleled cables. The parallel cables have the same part number, same entry and exit points in and out of the cableway, and follow the same path in the cableway as the parent object.

Steps for Creating Parallel Cables:

Create two parallel cables in the model in Unit **U01** of the following specifications by using the **Route Cable** command.

Parallel Cable 1:

System: A2 > U01 > Electrical > Low Voltage > Cables
Name: LV-001
Parallel Cables: 3
Operating Voltage: 110 V
Signal Type: **Power**
Part Number: LS3SJ- 16
Originating Device: Electrical Device
Terminating Device: Pump-001

Parallel Cable 2:

Name: LV-002
Parallel Cables: 3
Operating Voltage: 110 V
Signal Type: **Power**
Part Number: LS3SJ- 16

Originating Device: Electrical Device
Terminating Device: Pump-002

The view of your **Workspace Explorer** after defining the cable properties in the **Cable Properties** dialog box should resemble Figure 15.

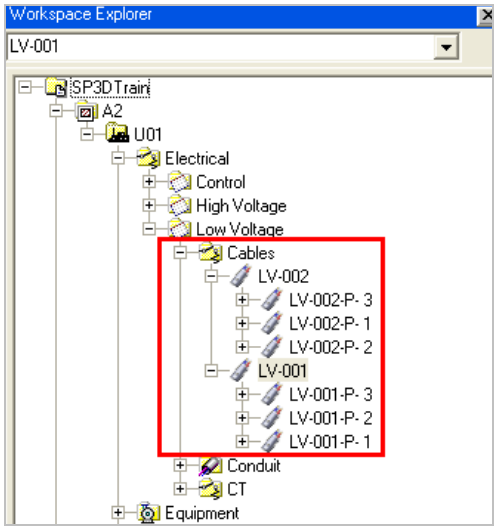


Figure:15: Parallel Cables in the Workspace Explorer

1. Define your workspace to show Unit **U01** and coordinate system **U01 CS**.

2. Click the **Insert Cable** button on the vertical toolbar.

Figure 16: Insert Cable Button on the Vertical Toolbar

3. The **Cable Properties** dialog box appears. Select the **More…** option from the **System** field in the **Cable Properties** dialog box.

4. The **Select System** dialog box appears. Expand **A2 > U01 > Electrical > Low Voltage** and select **Cables**.

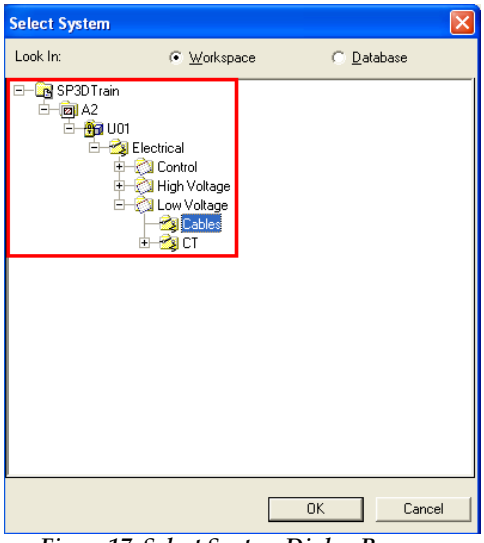


Figure 17: Select System Dialog Box

5. Define the following specifications in the **Cable Properties** dialog box:

   - **Name: LV-001**
   - **Parallel Cables: 3**
   - **Operating Voltage: 110 V**
   - **Signal Type**: **Power**

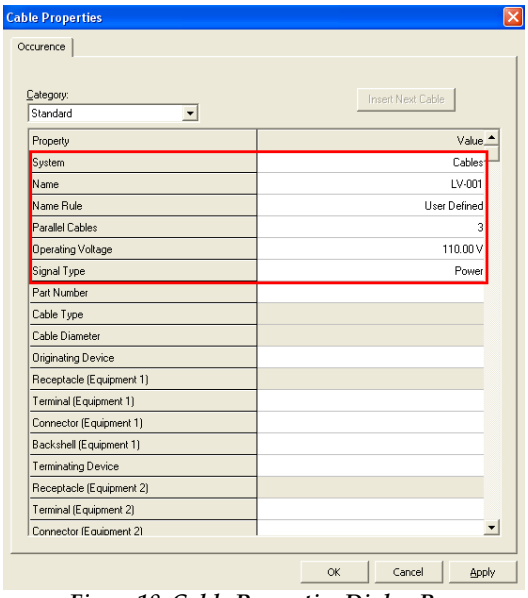


Figure 18: Cable Properties Dialog Box

6. Select the **More…** option from the **Part Number** field in the **Cable Properties** dialog box.

7. The **Select Part Number** dialog box appears. To select the **Part Number** from the **Select Part Number** dialog box, expand the node **Cable\Cables\Power Cables** until you see the part **LS3SJ- 16**. Select the part and click **OK**.

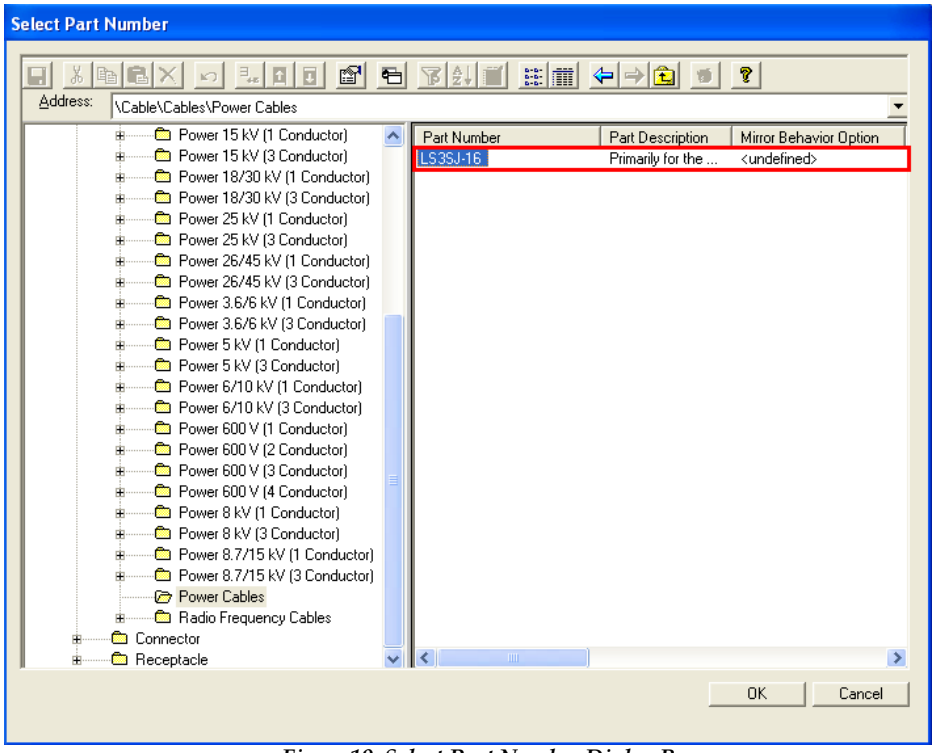


Figure 19: Select Part Number Dialog Box

8. In the **Cable Properties** dialog box, select the **More...** option from the **Originating Device** field and select **A2 > U01 > Equipment > Electrical Device** from the **Select System** dialog box, as shown in Figure 20**.**

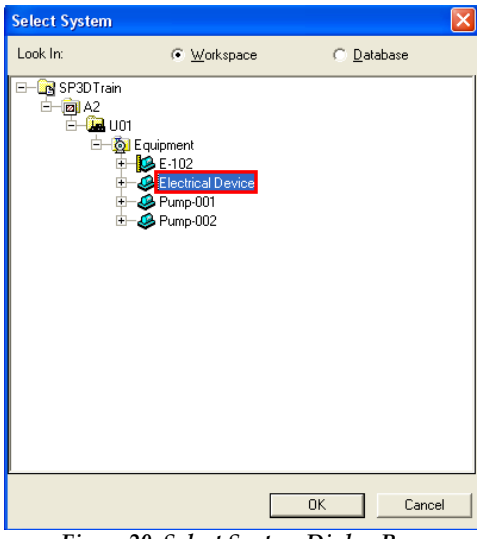


Figure 20: Select System Dialog Box

9. Similarly select **A2 > U01 > Equipment > Pump-001** for the **Terminating Device** option in the **Select System** dialog box and click **OK**.

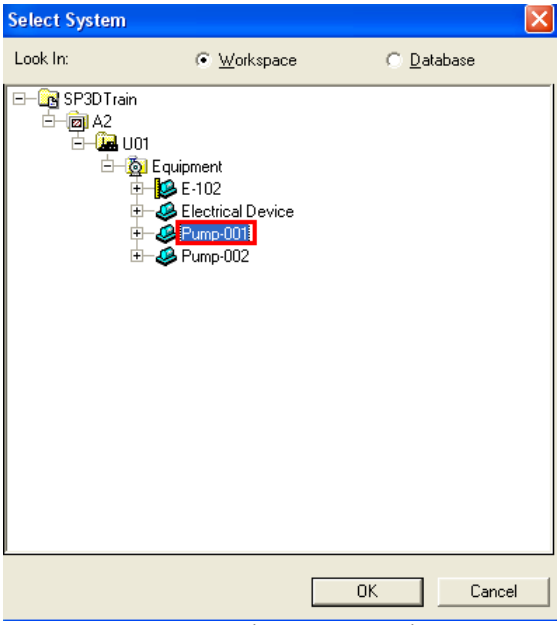


Figure 21: Select System Dialog Box

10. Click the **Apply** button on the **Cable Properties** dialog box.

11. Click the **Insert Next Cable** button in the **Cable Properties** dialog box to specify the properties for the second cable.

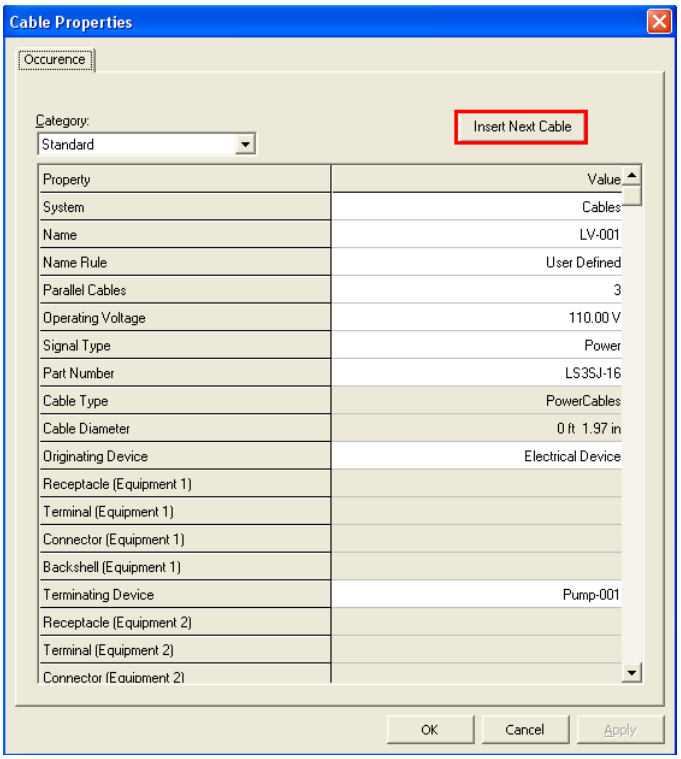


Figure 22: Insert Next Cable Button on the Cable Properties Dialog Box

12. Set the following specifications in the **Cable Properties** dialog box to create the second parallel cable and click **OK**:

    System: **Cables**
    Name: **LV-002**
    Parallel Cables: 3
    Operating Voltage: 110 V
    Signal Type: **Power**
    Part Number: LS3SJ- 16
    Originating Device: **Electrical Device**
    Terminating Device:**Pump-002**

    The new parallel cables will appear in the **Workspace Explorer**, as shown in the highlighted section of Figure 23.

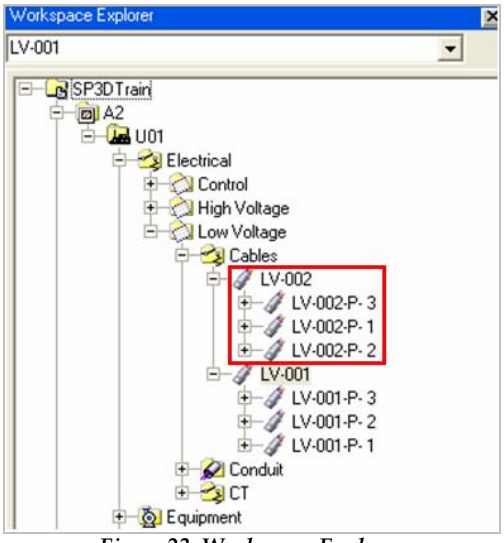


Figure 23: Workspace Explorer

Auto Cable Routing:

SP3D also provides auto-routing functionality, which routes the cable according to the shortest path from the start point to the end point on the cable tray or conduit. Routing is done through duct banks, connecting cableways, cable trays and conduit that have their signal type already defined. You can modify the assigned auto-routed path, if necessary, by specifying additional must-include cable trays for the selected cable. During the auto-routing process, SP3D considers the cable tray fill. You can choose to allow overfilling of the cable trays or to allow real-time fill calculations during the routing process.

Auto-routing is turned off by default. Click the **Auto-Routing** option on the **Edit Cable Path** ribbon to activate auto-routing. When the "AutoRoute" command is picked, the software builds one or more nodal networks representing all cableways *in the workspace*. Each end feature of the cableway, every branch on the cableway, and every cableway run change are nodes. Whenever there are more than two paths between any two nodes, a node is inserted at an arbitrary point (usually a turn) to split one of the paths (see node M in Figure 24). A connection is composed of the *set of features* that make up the path between two nodes. The total length of cableway is recorded for the connection along with the

allowed signal types (read from the feature's parent cableway).

For example, two independent networks represent the following cableway model

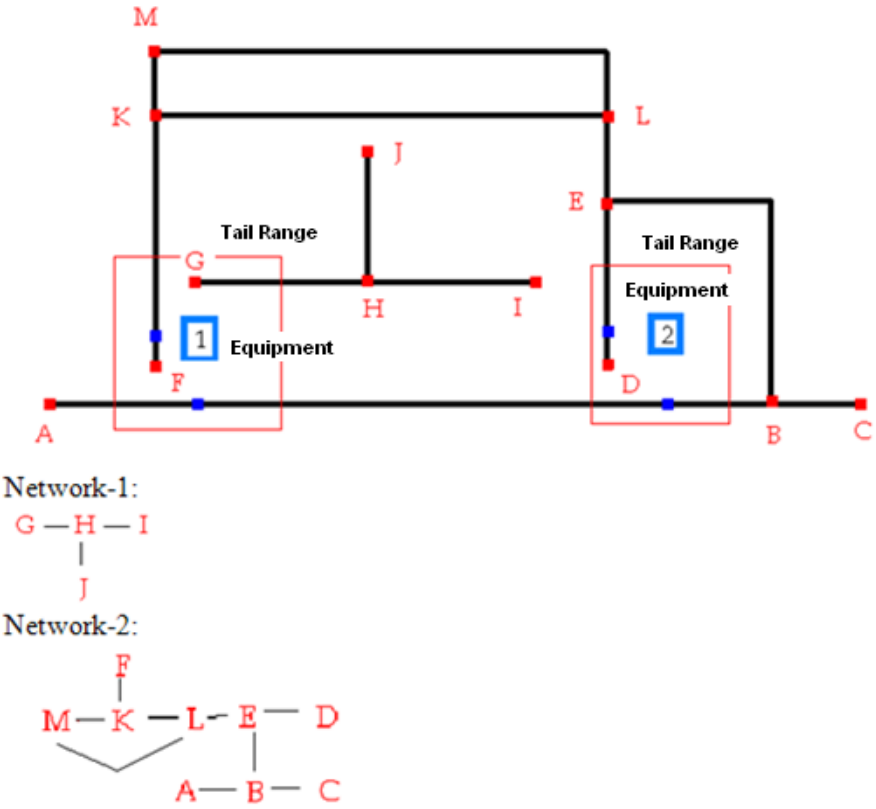


Figure 24: Cableway Model - Two Networks

Steps for Auto Routing the Cables:

Route cables in Unit **U07** of your workspace by using the **Auto Route** command available on the **Edit Cable Path** ribbon. After auto routing the cables the view of the model should resemble Figure 25.

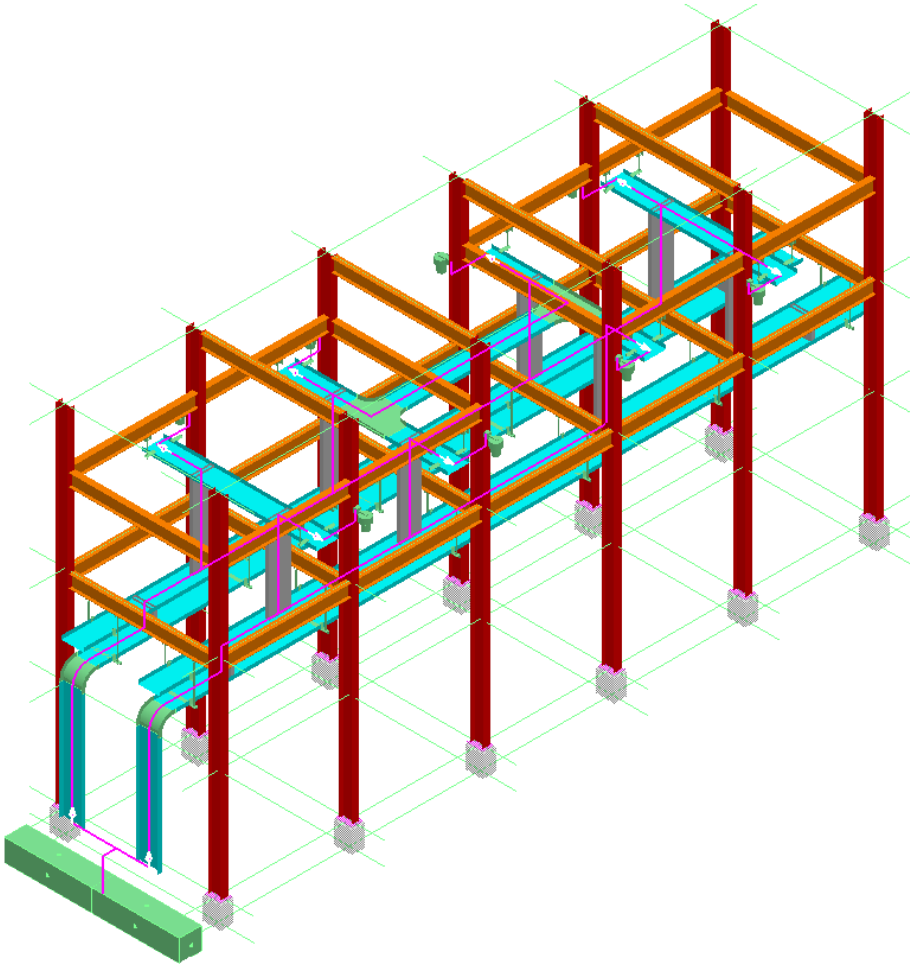


Figure 25: Auto Routed Cables

1. Define your workspace to show Unit **U07** and coordinate system **U07 CS**.
2. Select **Cables** in the **Locate Filter** drop-down list**.**

Figure 26: Locate Filter

3. In the **Workspace Explorer**, select CBL-004A, as shown in Figure 27.

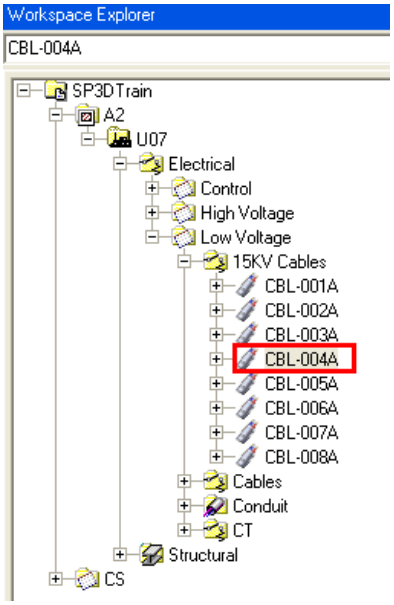


Figure 27: Workspace Explorer

4. Click the **AutoRoute** option  on the **Cable Edit Path** ribbon to route the cable in the shortest path from the starting point to the ending point in the cable tray**.**

Figure 28: AutoRoute Option on the Cable Edit Path Ribbon

The **Autorouting options** dialog box appears which contains the following options:

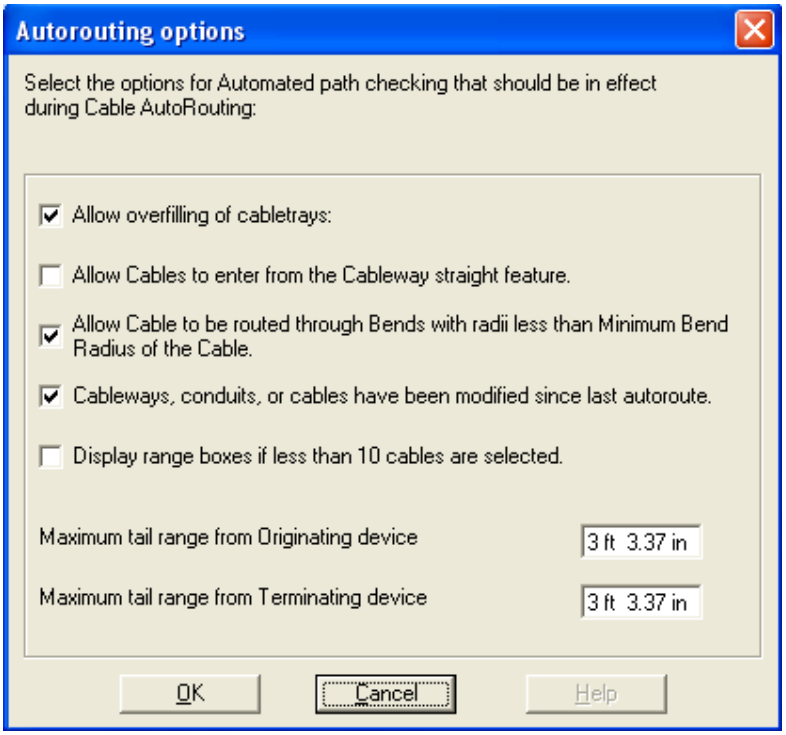


Figure 29: Autorouting Options Dialog

- **Allow Overfilling of Cable Trays** - Allows for routing of cables through cable trays that will be overloaded. Connections between nodes are removed if a feature in a connection is FULL and the "Allow overfilling of cabletrays" option is not selected.

- **Allow Cables to enter from the Cableway straight feature** - Allows cables to enter from a cableway straight feature. If this option is selected and the maximum equipment tail range is as indicated by the red boxes shown in Figure 30: the blue dots represent the automatically selected possible entry/exit points on each cableway of network.

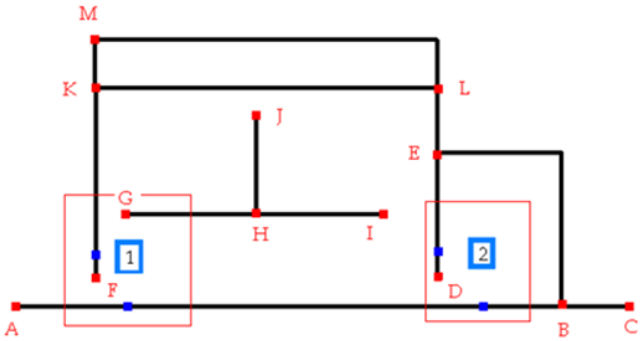


Figure 30: Tail Ranges and Entry/Exit points

- **Allow Cable to be routed through Bends with radii less than Minimum Bend Radius of the Cable** - Allows cable routing through bends that have radius less than

the minimum bend radius of the cable.

- **Cableway, conduits, or cables have been modified since last auto route** - Regenerates new cableway network layout data. If you do not select this option, the software does not regenerate the data, but uses cableway network data from the last auto-routed cable.

- **Display range boxes if less than 10 cables are selected** - Displays a range box around the cable connection location to the equipment, showing a graphical representation of the maximum tail ranges.

- **Maximum tail range from Originating device** - Allows you to set a specific maximum search distance from the originating device.

- **Maximum tail range from Terminating device** - Allows you to set a specific maximum search distance from the terminating device.

5. Select the following options in the **Autorouting options** dialog box and click **OK**:

   - **Allow Overfilling of Cable Trays**
   - **Allow Cables to enter from the Cableway straight feature**
   - **Display range boxes if less than 10 cables are selected**
   - **Set 5 ft tail range from Originating device**
   - **Set 5ft tail range from Terminating device**

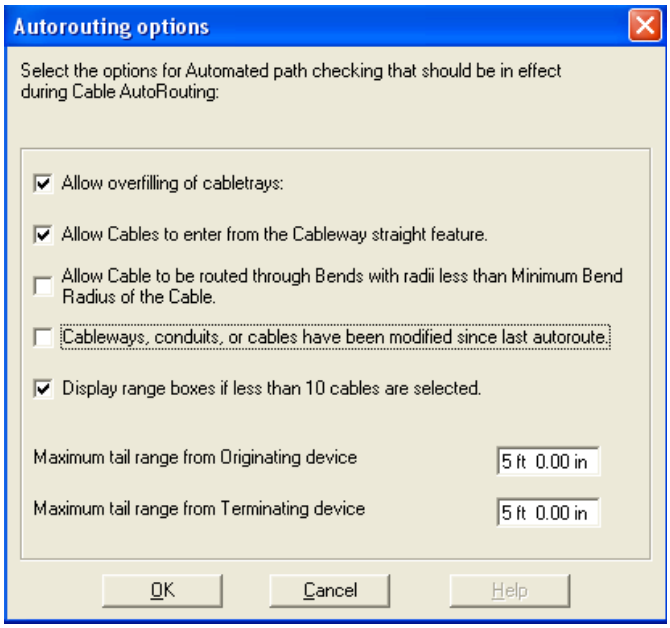


Figure 31: Autorouting options

6. Click the **AutoRoute** command  on the **Edit Cable Path** ribbon.

Figure 32: AutoRoute Command on the Cable Edit Path Ribbon

The SP3D displays the proposed contiguous cable path for the cable, as shown in the highlighted section of Figure 33.

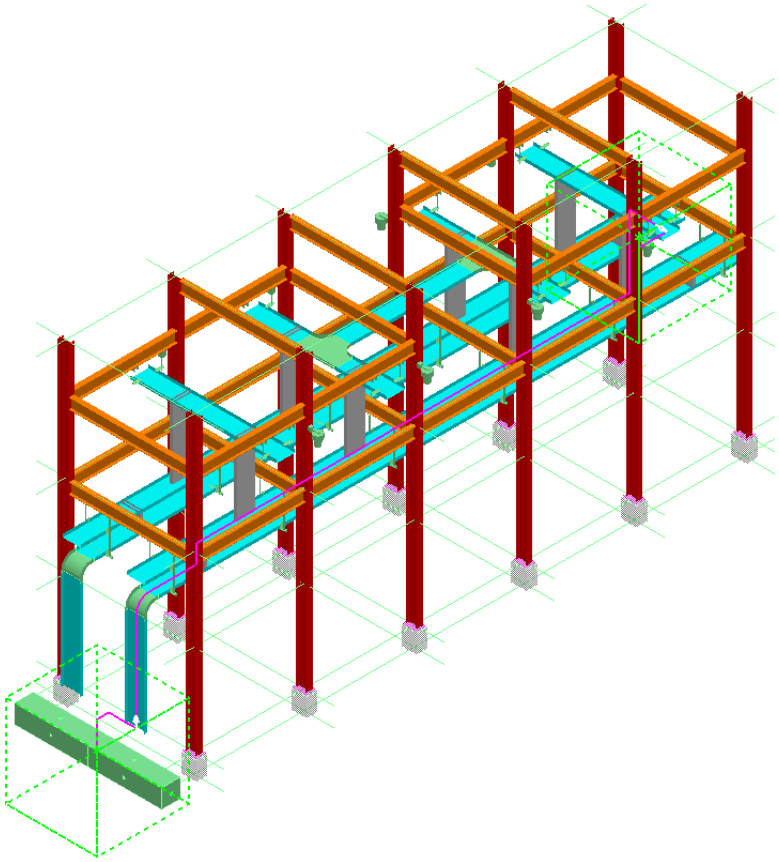


Figure 33: Proposed Contiguous Cable Path – CBL-004A

7. Click the **Select** command to cancel the proposed cable path.

8. Again, select **CBL-004A** cable in the Workspace Explorer. The **Edit Cable path** ribbon appears and SP3D highlights the cable graphically in the active view.

9. Click the **"Select Cableway(s)"** SmartStep  and graphically select the cableway features or way points as shown below.

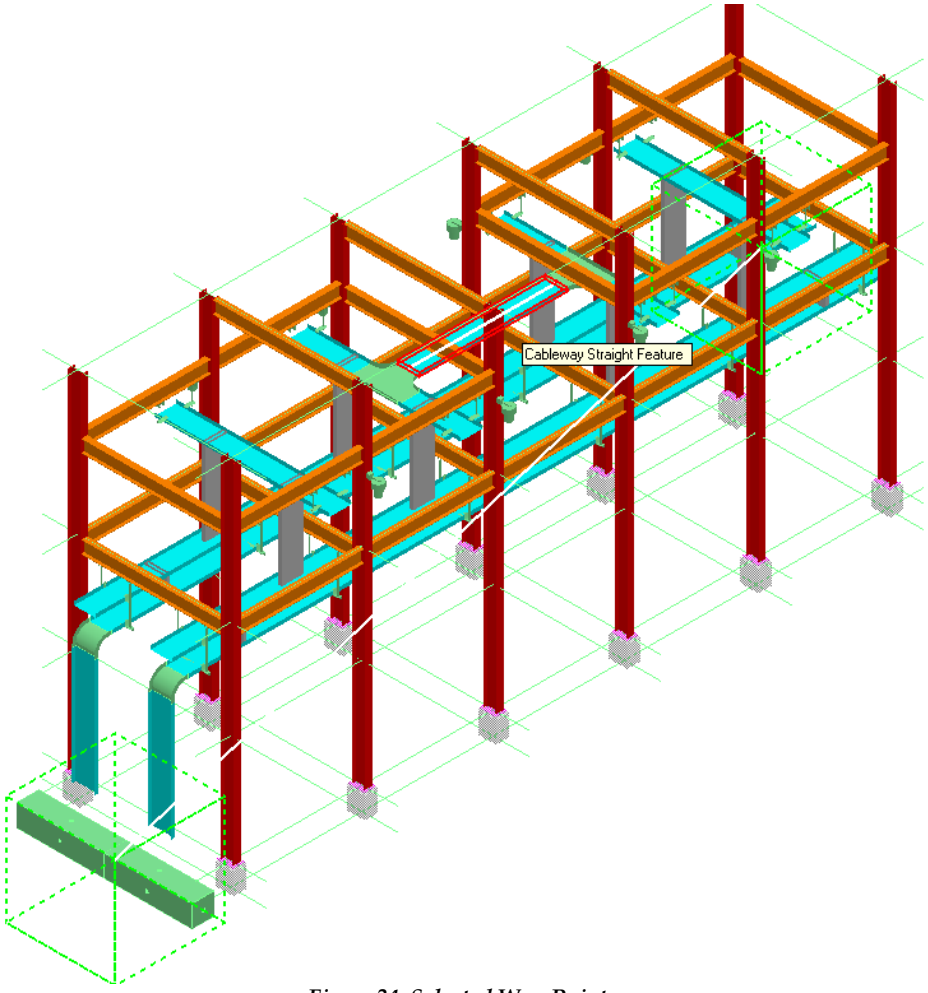


Figure 34: Selected Way Point

Notes:

- Connections between nodes are removed if the user picks a feature in a connection as a member-selected "avoidance point" feature.
- If only one "way point" feature is selected and no path is possible between the entry/exit points that include the "way point" feature, then the autoroute will fail and an error message placed in the log.
- Connections between nodes are removed if the allowed signal type for the cableway of that connection does not match the signal type of the cable being routed.
- If any cableway feature is FULL and "Allow Overfill" option is not selected, the connection containing the feature is removed from the networks.

10. Click the **"Select Avoidance feature(s)**" SmartStep and graphically select the cableway features or avoidance points as shown below.

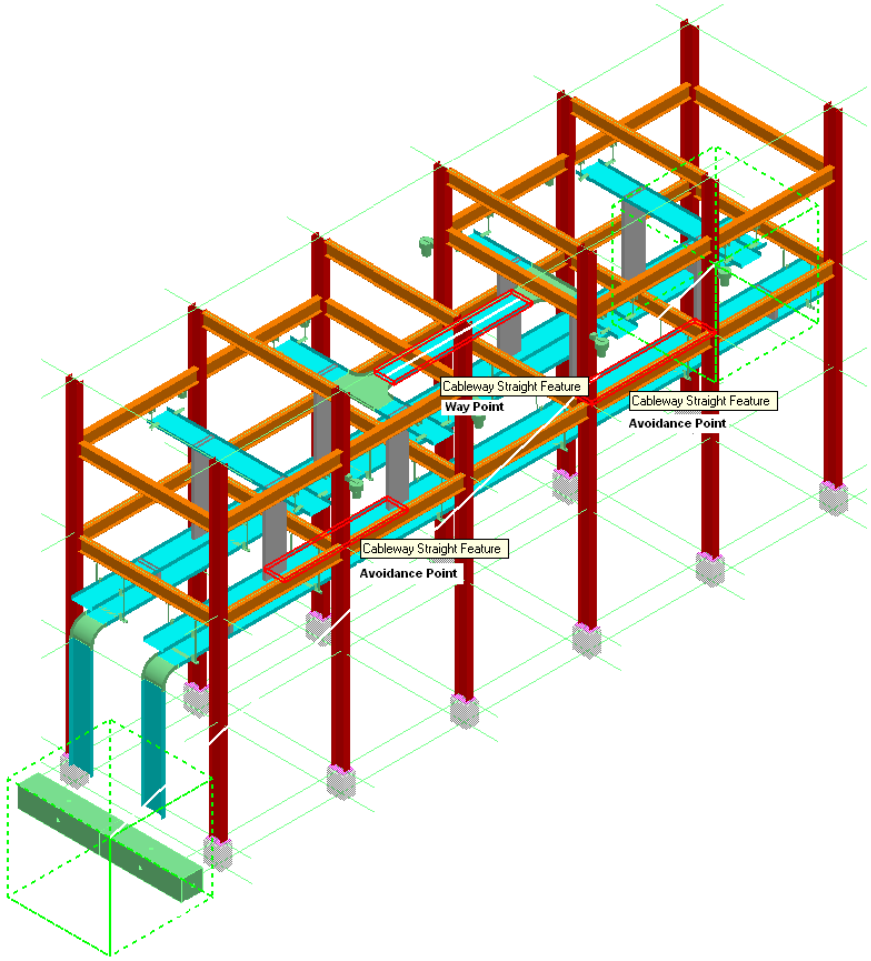


Figure 35: Selected Avoidance Points

11. Click the **AutoRoute** command  on the ribbon.

12. SP3D displays the proposed continuous path for the selected cable from the PDB-101 to the light LG-4 as shown below.

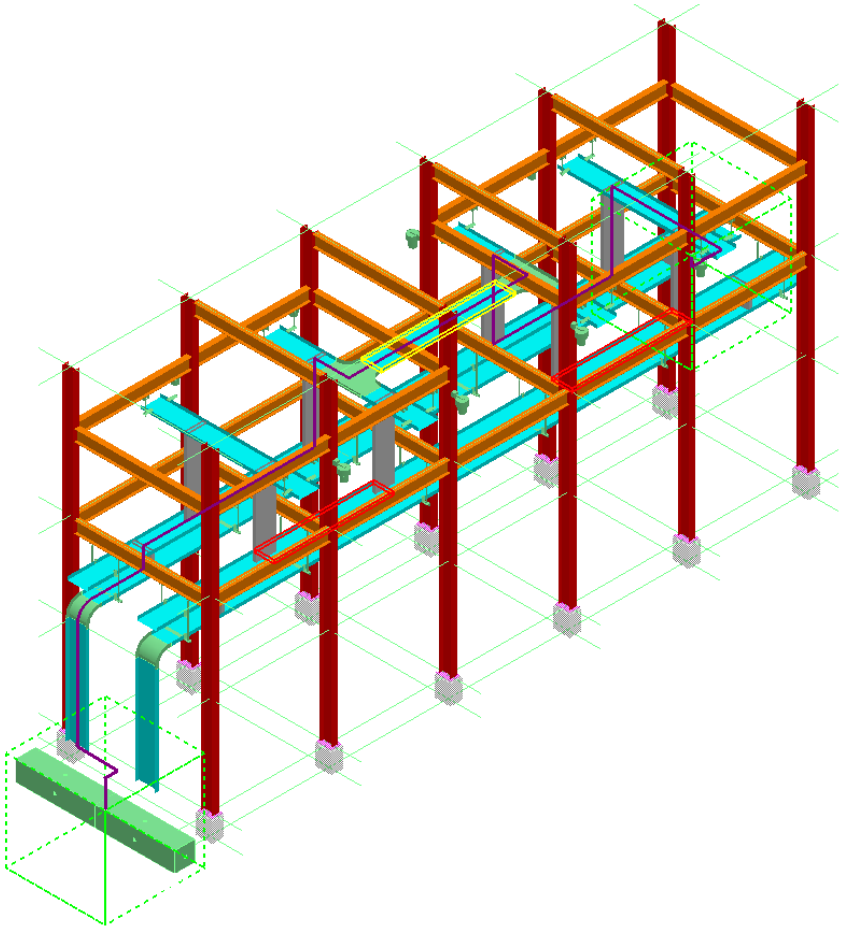


Figure 36: Proposed Contiguous Cable Path – CBL-004A

Notes:

- The networks that have features (that are members of connections that have not been removed/trimmed by above rules) within the "maximum tail length range" of both equipments are selected for autorouting between equipment 1 and 2.

- The minimum length path on the *trimmed* network is computed between each possible pair of entry/exit points. The path with the minimum length that includes the largest number of user-selected "way point" features is chosen.

- The computation of the minimum length path between each pair of possible entry/exit points is accomplished using the network definition and the location of the entry exit points on the network. **Dijkstra's algorithm** is used to process the network to find the minimum length path between them.

13. Click the **Finish** button on the **Edit Cable Path** ribbon to complete the cable path.

Figure 37: Finish Button on the Cable Edit Path Ribbon

14. Select **CBL-001A** cable in the Workspace Explorer. The **Edit Cable path** ribbon appears and SP3D highlights the cable graphically in the active view.

15. Click the **AutoRoute** command  on the **Edit Cable Path** ribbon.

16. The SP3D displays the proposed contiguous cable path for the cable, as shown in the highlighted section of Figure 38.

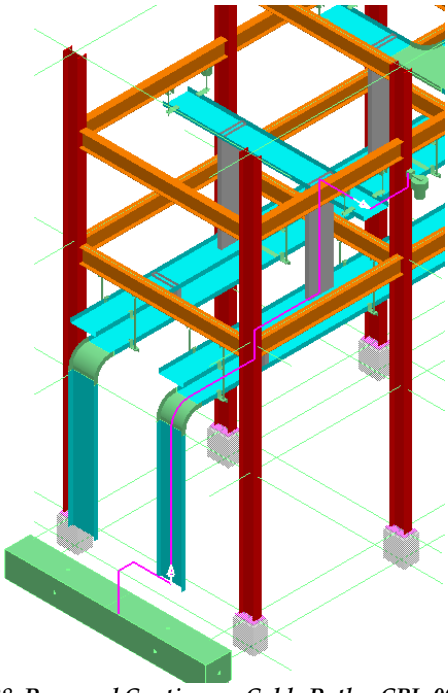


Figure 38: Proposed Contiguous Cable Path – CBL-001A

17. Click the **Finish** button on the **Edit Cable Path** ribbon to complete the cable path.

18. Select **Cableway Features** from the **Locate Filter** drop-down list to select the cableway features in the graphic view.

19. Select the **Cableway Straight Feature** from the bottom cable tray, as shown in Figure 39.

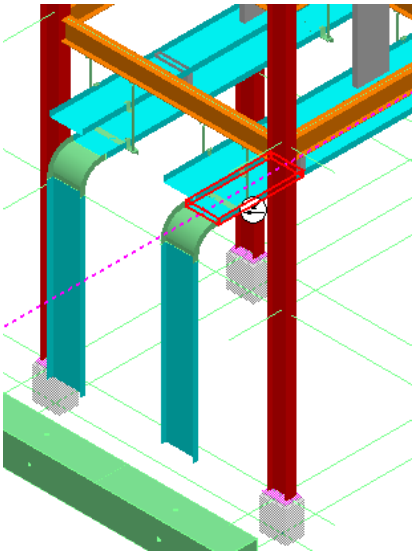


Figure 39: Selected Cableway Feature

The **Edit Cableway** ribbon shows **MaxFill** at **11.95%.**

Figure 40: Feature Edit ribbon

Notes:

The **Cable Fill** category on the cableway run consists of the following options:

- **Fill Efficiency** - Displays or defines the efficiency of the stacking of cables in the cableway. You can enter a real number, integer, or percent. For example, type 0.9, 90, or 90%.
- **Signal Type** - Displays or defines the cable usage, which is used in tray fill calculations.
- **Voltage Grade** - Displays or defines the voltage grade, which is used in determining the range of voltage that the cableway can carry.

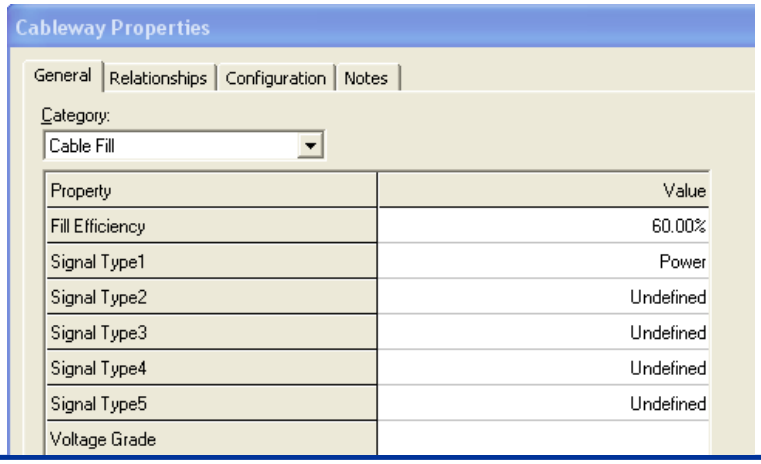


Figure 41: Cable Fill Category

20. Select **CBL-002A** cable in the Workspace Explorer. The **Edit Cable path** ribbon appears and SP3D highlights the cable graphically in the active view.

21. Click the **AutoRoute** command  on the **Edit Cable Path** ribbon.

22. The SP3D displays the proposed contiguous cable path for the cable, as shown in the highlighted section of Figure 42.

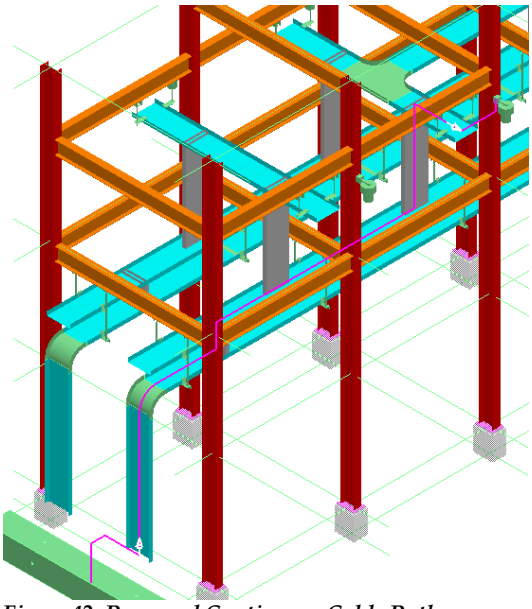


Figure 42: Proposed Contiguous Cable Path

23. Click the **Finish** button on the **Edit Cable Path** ribbon to complete the cable path.

24. Select the **Cableway Straight Feature** from the bottom cable tray, as shown in Figure 43.

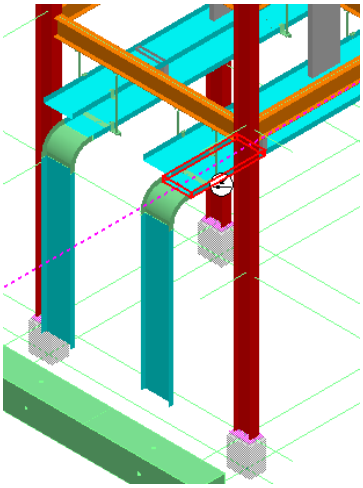


Figure 43: Selected Cableway Feature

The **Edit Cableway** ribbon shows **MaxFill** at **23.18%.**

Figure 44: Feature Edit ribbon

25. Select **CBL-003A, CBL-005A, CBL-006A, CBL-007A, CBL-008A** cables in the Workspace Explorer. The **Edit Cable path** ribbon appears and SP3D highlights the cable graphically in the active view.

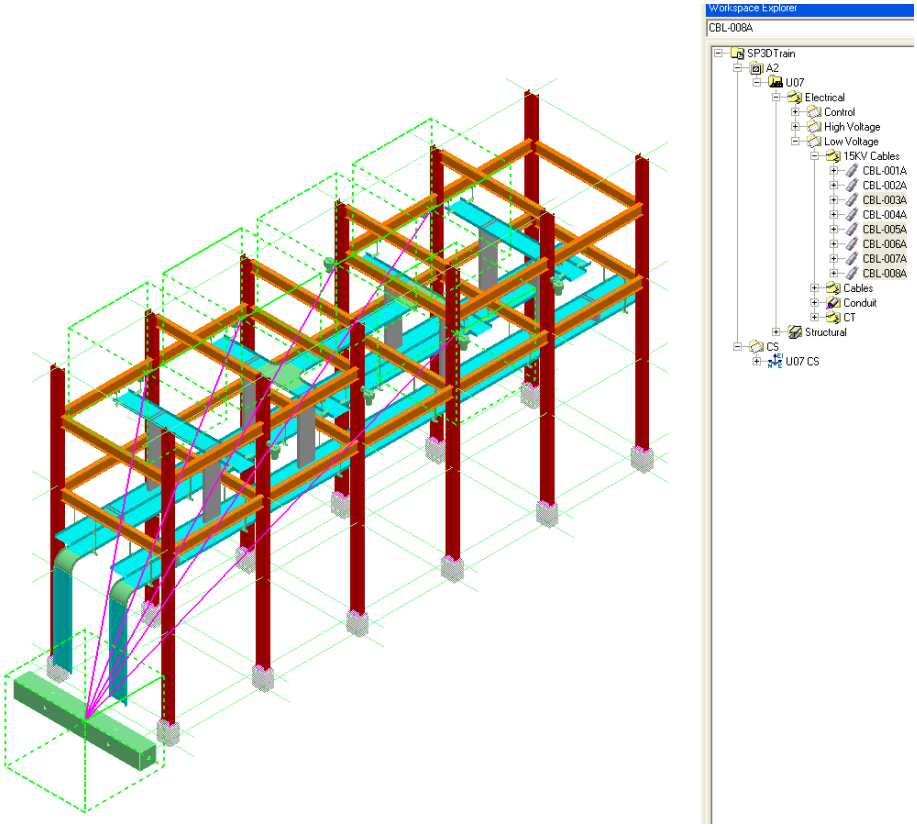
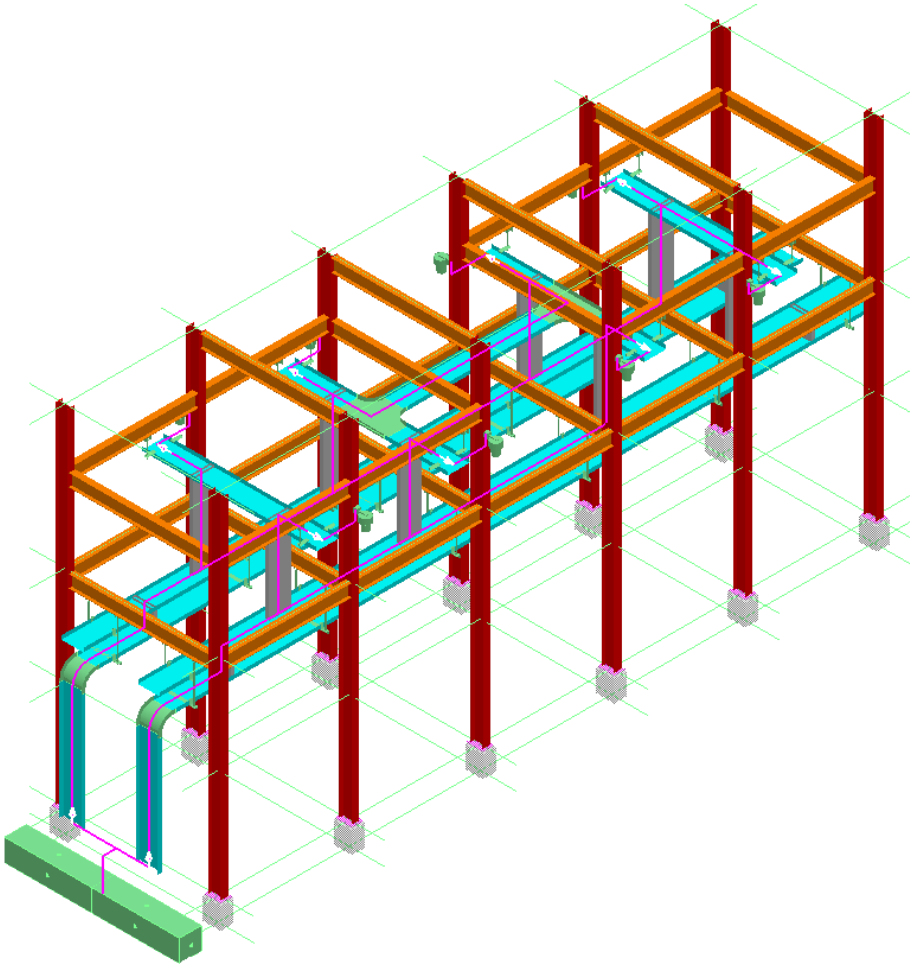


Figure 45: Displayed Tail Range Boxes

26. Click the **AutoRoute** command  on the ribbon to display the proposed continuous paths.

27. Click Finish button on the **Edit Cable Path** ribbon to complete all cable paths.



For more information related to routing cables and cable properties, refer to the following topics topic in the user guide *ElectricalUserGuide.pdf*:

- *Routing Cables*
- *CableProperties Dialog Box*

Session 10: Manipulating Cableways

Objective:

By the end of this session, you will be able to:

- Manipulate a cableway in a model.

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Electrical: An Overview
- Routing a Cableway

Overview:

SP3D provides commands for the manipulation of cableways such as editing properties, copy, move, and delete. These commands require selection of cableways or features as first step by using the **Select** button on the vertical toolbar. Different commands of manipulating a cableway or its feature that are available in SP3D are mentioned below:

- **Move a cableway**: You can move the features of that cableway to alter the routing. Using this ability to move features of a cableway, you can precisely locate each feature in the layout of your cableway systems.
- **Delete a cableway:** Just as you place features in the model, you delete features to remove unwanted parts. You cannot delete parts directly because the software attempts to maintain the design integrity of the model by adjusting all previously connected features.
- **Copy a cableway:** You can copy a cableway or a cable tray to place it in a different position.
- **Edit the Properties of a cableway**: All cableways and its features have properties that you can edit.

Notes:

- You can use manipulating commands of SP3D on all the features of a cableway like straight feature, turn feature, end feature of a cableway network.
- When you move features, you always move the part because the part's location is driven by the feature.

Steps for Moving a Cableway Straight Feature:

Move a **Cableway Straight Feature** of a cableway **5 ft** in the North direction by using the **PinPoint** option in Unit **U04** of your workspace. The view of the cableway after moving the

Cableway Straight Feature should resemble the highlighted section of Figure 1.

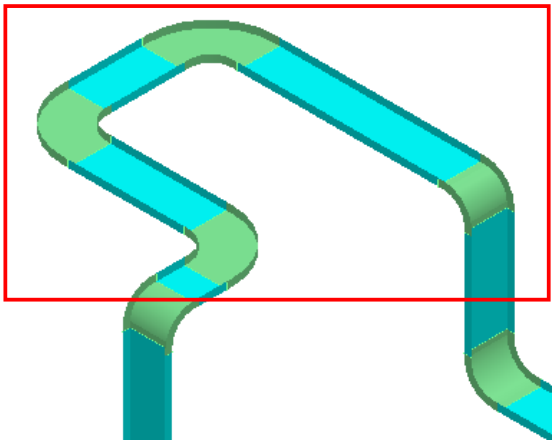


Figure 1: Output-Moving a Cableway Straight Feature

1. Define your workspace to show Unit **U04** and coordinate system **U04 CS**.

2. Activate the **PinPoint** ribbon.

3. Select **Cableway Features** from the **Locate Filter** drop-down list to select only cableway features in the graphic view that you need to move.

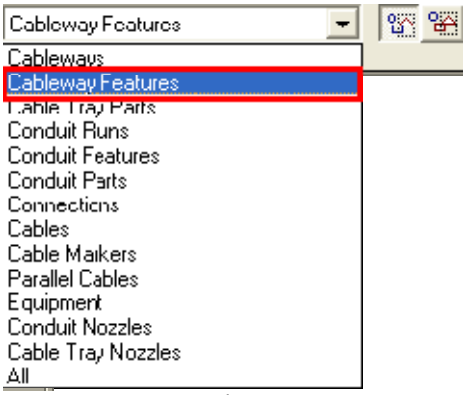


Figure 2: Locate Filter Drop-Down List

4. Select the **Relative Tracking** option from the **PinPoint** ribbon.

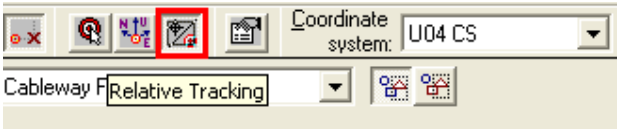


Figure 3: Relative Tracking on Pin Point Ribbon

5. Select the **Cableway Straight Feature** of a cable tray that you need to move, as shown in Figure 4.

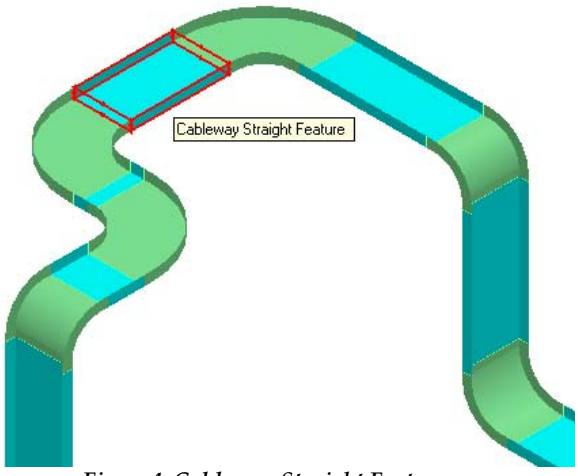


Figure 4: Cableway Straight Feature

Notes:

- While moving a **Cableway Straight Feature** the entire cableway leg to which the feature is connected moves.
- The move direction is always perpendicular to the axis of the **Cableway Straight Feature**.

Tip:

- When moving **Cableway Straight Feature**, you can select one of the cardinal point handles that appear at the end of the **Cableway Straight Feature** to indicate the **Move From** point. These cardinal point handles allow you to move the feature in relation to the edge instead of the centerline.

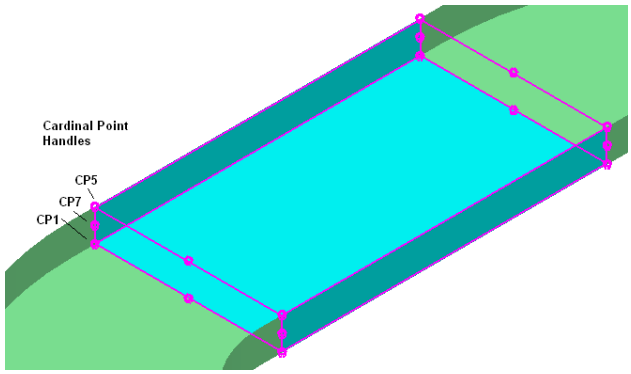


Figure 5: Cardinal Point Handles

6. Select the **Move To** option on the **Edit** ribbon for the cableway.

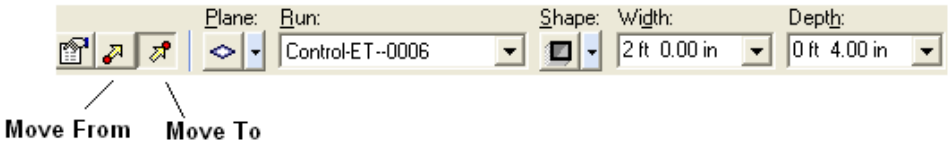


Figure 6: Edit Feature Ribbon

7. Key in **5 ft** on the **N** drop-down list of the **PinPoint** ribbon to specify the North coordinate point of the position where you need to move the cableway feature. After specifying the coordinate points, the view of the cableway should resemble Figure 7.

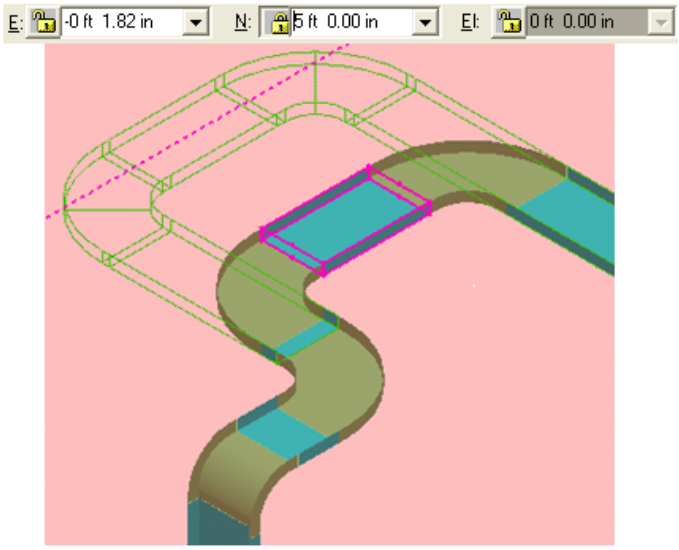


Figure 7: Cableway After Specifying the Coordinate Points

8. Click the graphic view to accept the move of the cableway and right-click to cancel the command.

Steps for Deleting a Cableway Straight Feature:

Delete a **Cableway Straight Feature** of a cableway from Unit **U04** of your workspace. The view of the cableway after deleting the **Cableway Straight Feature** should resemble the highlighted section of Figure 8.

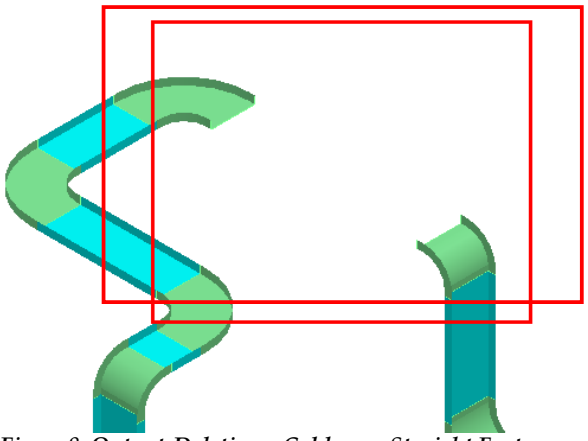


Figure 8: Output-Deleting a Cableway Straight Feature

Notes:

- Deleting a straight feature does not remove connected turn features.
- Deleting a turn feature the straight feature connected by the associated turn feature is extended to the turn point. The turn point, sometimes called the critical point, is the intersection of two ports of the original turn feature's part. This means that the same turn part needs to be inserted or the turn feature be defined again by connecting the existing routes.
- If the straight feature is connected to the third port of a tee-type branching (making the straight feature the defining feature for the branch point), deleting it will result in the deletion of the tee type branching part and the owning branch feature. For tee-type branches, the software replaces the header portion of the branch with a straight feature.
- If the straight feature connects to a component, the software does not delete the component when the straight feature is deleted.

1. Select **Cableway Features** from the **Locate Filter** drop-down list to select only cableway features in the graphic view that you need to delete.

2. Select the **Cableway Straight Feature** from the graphic view that you need to delete, as shown in Figure 9.

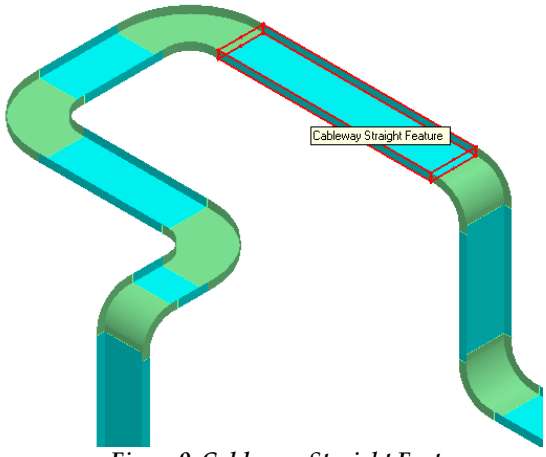


Figure 9: Cableway Straight Feature

3. Click the **Delete** button on the **Common** toolbar to delete the **Cableway Straight Feature**.

Figure 10: Delete Option on the Common Toolbar

Steps for Copying and Pasting a Cableway:

Copy **Cableways** from Unit **U01** of your workspace and paste them on top of the steel**.** The view of the cableways after pasting them should resemble the highlighted section of Figure 11.

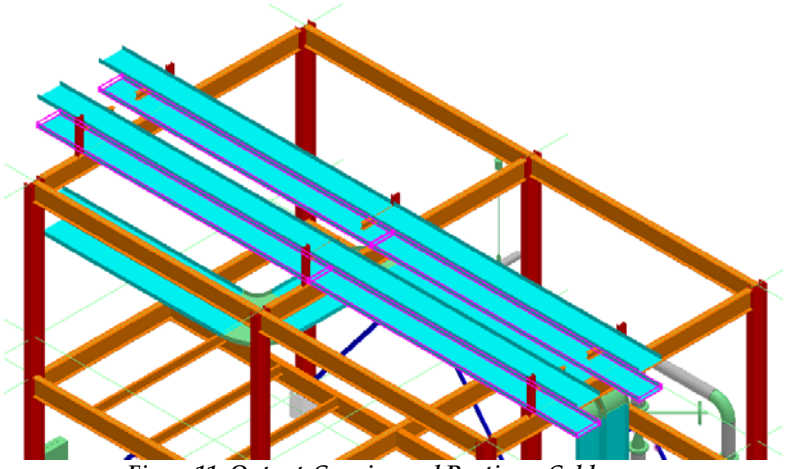


Figure 11: Output-Copying and Pasting a Cableways

9. Define your workspace to show Unit **U01** and coordinate system **U01 CS**.

10. Select **Cableways** from the **Locate Filter** drop-down list to select only cableways in the graphic view that you need to copy and paste.

11. Select the **Cableways** from the graphic view that you need to copy, as shown in Figure 12.

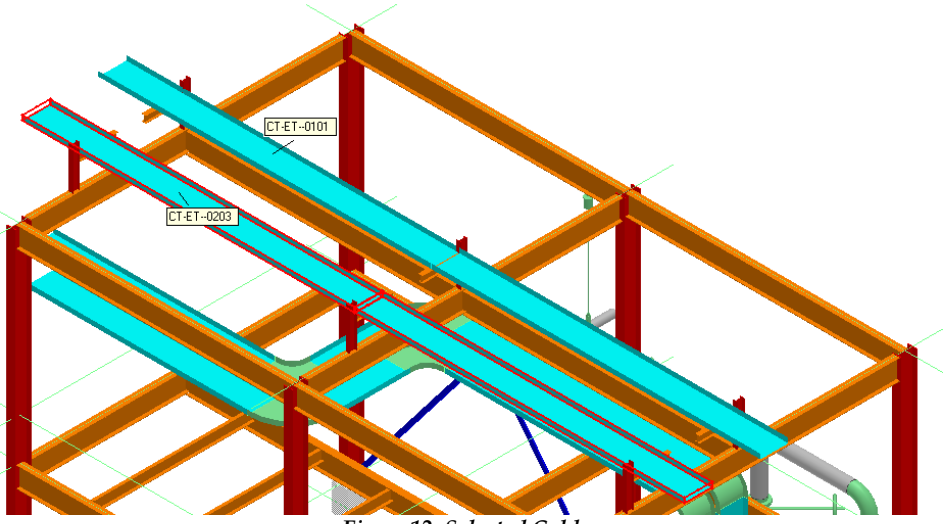


Figure 12: Selected Cableways

12. Click the **Copy** button on the **Common** toolbar.

Figure 13: Copy Button on the Common Toolbar

13. Select the CP1 cardinal point of the cableway from the graphic view to define the position from where to copy the **Cableways.**

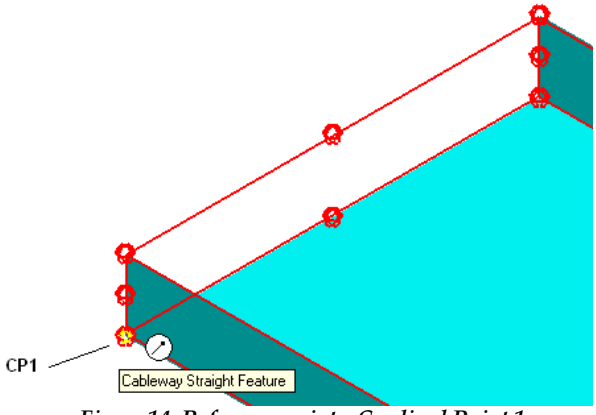


Figure 14: Reference point - Cardinal Point 1

14. Click the **Paste** option on the **Common** toolbar.

Figure 15: Paste Option on the Common Toolbar

15. The **Paste** dialog box appears. Keep the default parent system for the new objects to be pasted on the model, as shown in Figure 16. Clear the **Paste in place** check box in the

Paste dialog box and click **OK.**

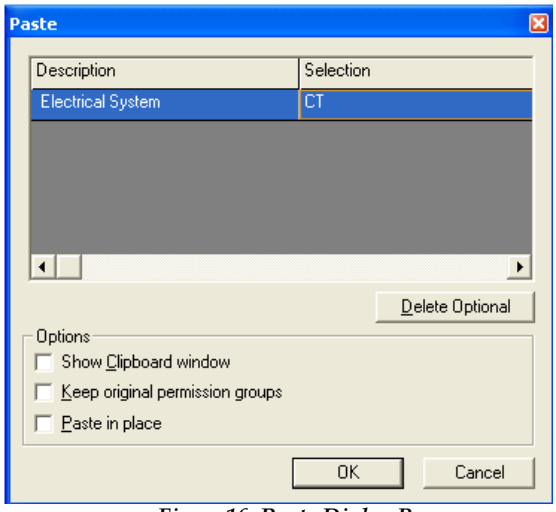


Figure 16: Paste Dialog Box

Notes:

- The **Paste** dialog box shows relationships that can be established between the objects you are pasting and objects in the model. These are the relationships that existed between the objects you copied and design objects that were not in your copy set. There are two categories of such relationships, those required by the objects being pasted and those that are optional. The system parent is an example of a required relationship. All design objects must have a system parent.
- If you are pasting the objects into the same model they were copied from, the **Paste** dialog box will offer the original objects as the defaults for the relationships that will be created on the **Paste** dialog box. In this example, SP3D keeps the original parent system of the copied objects. You can keep the default objects or select the row and identify a different object. When you select the row, the original parent object is highlighted so you can graphically see what type of input is needed in context of the objects you copied. If you decide to place the copied objects on different parent system in the system hierarchy, you must select it in the **Workspace Explorer** under the system hierarchy.
- The **Keep original permission groups** option will assign objects created by the Paste command to the same permission group the original object had (mapping by name). However, if the person doing the paste does not have Write access to that permission group, then the object will be assigned to the Active Permission Group. If the **Keep original permission groups** option is not selected, all newly created objects will be assigned to the Active Permission Group.
- The **Paste in place** option will paste the copied objects in exactly the same position as the originals. This option is most often used when pasting objects in a different model from the original.

16. Position the cursor until you get the **Up** SmartSketch glyph which indicates you are aligned to the major Z axis. Click the middle mouse button to constraint the cursor movement along this axis. Then position the cursor to identify the gridline to get the correct elevation coordinate, as shown in Figure 17.

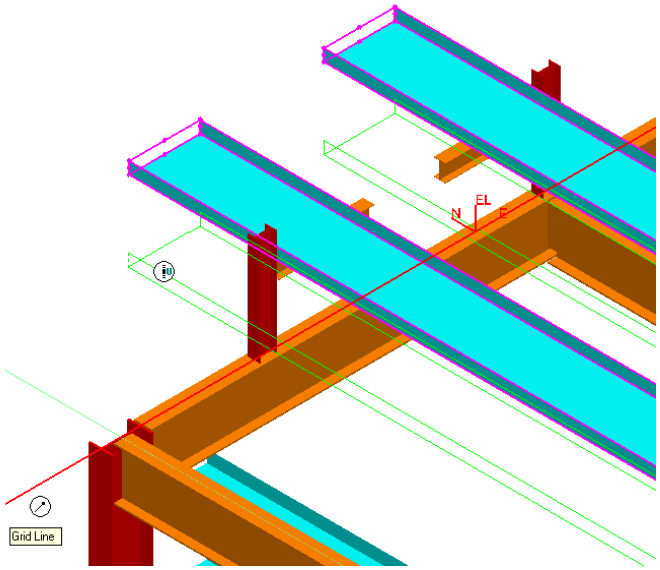


Figure 17: Move Option on the Edit Ribbon

17. Left click in the graphic view to place the copied cableways, as shown in the highlighted section of Figure 18.

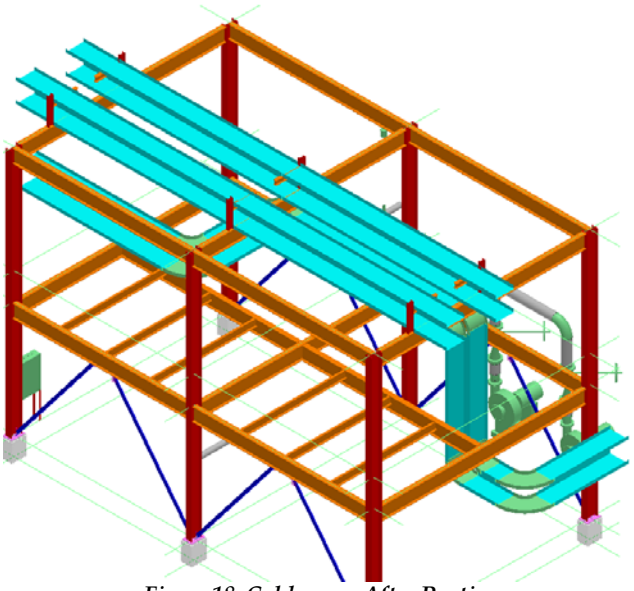


Figure 18: Cableways After Pasting

Steps for Changing the Tray Width:

Edit the width of the selected **Cableway Features** of a cable tray from Unit **U01** of your workspace. The view of the cableway after editing the **Cableway Features** should resemble the highlighted section of Figure 19.

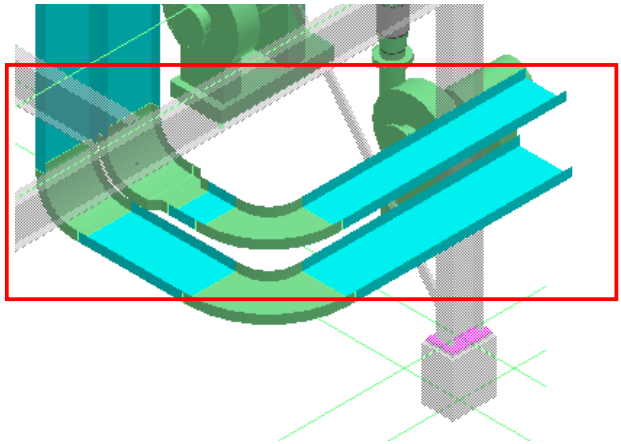


Figure 19: Edited Tray Width

1. Select **Cableway Features** from the **Locate Filter** drop-down list to select only cableway features in the graphic view that you need to edit.

2. Hold down the Shift-key and select the two **Straight Features** from the graphic view that you need to edit or use the **Fence Inside** option, as shown in the highlighted section of Figure 20.

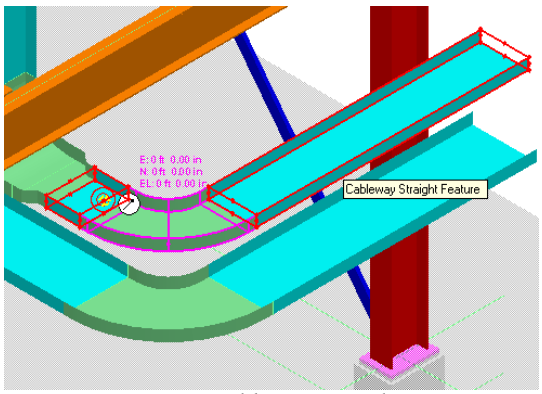


Figure 20: Cableway Straight Feature

Notes:

- Using the Shift-key to multi-select features, SP3D selects all the features along the path between the two selected features.
- Cable tray sizes can only be changed at the feature object.

3. Select the **Properties** option on the **Edit** ribbon.

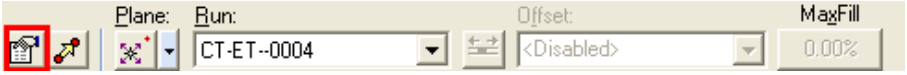


Figure 21: Properties Option on the Edit Ribbon

4. The **Selection Properties** dialog box appears. Make the following change in the dialog box under the **Cross Section** tab:

Width: 2 ft

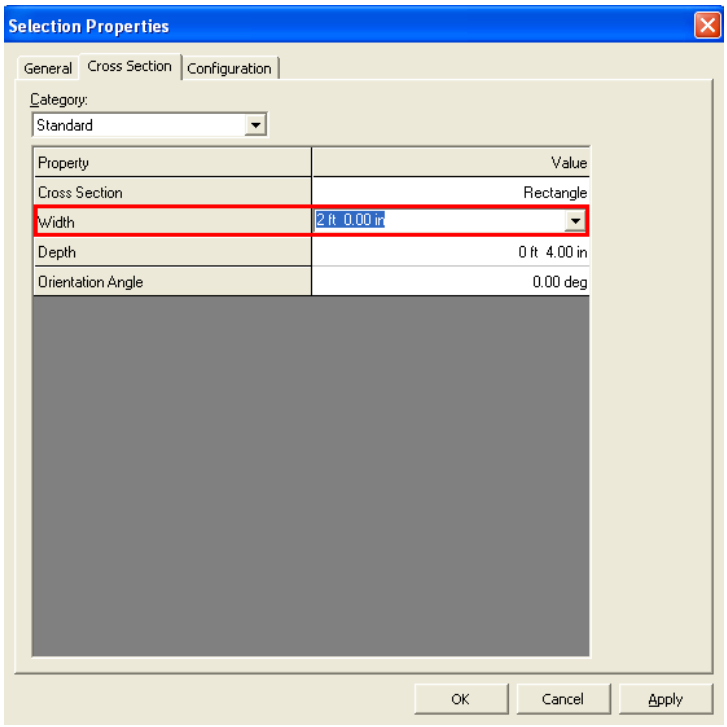


Figure 22: Selection Properties Dialog Box

5. Click **OK** on the **Selection Properties** dialog box.

For more information related to manipulating cableways, refer to following topics in the user guide *ElectricalUsersGuide.pdf*:

- *Moving Feature: An Overview*
- *Deleting Feature: An Overview*
- *Editing Feature: An Overview*