Smart 3D
Electrical Tutorials

Tuesday, August 05, 2014

TSP3D-TP-100104A

PART OF HEXAGON

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Contents

SESSION 1

Electrical 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 Smart 3D.

Prerequisite Session

- Smart 3D Overview

Overview

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

Select **Tasks > Electrical** to work in the **Electrical** task. 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. You will learn more about these objects including how to create and modify them in the later sessions.

Electrical Systems

Electrical systems are a way of organizing electrical objects such as cableways and conduits, within the system hierarchy of your model. You also use the electrical system to control the specifications that can be used within the system, such as conduit, cableway, and cable tray specifications.

You can create and organize electrical systems using any criteria you choose. For example, you could base an electrical system on the area where the objects are located; you could also base an electrical system on the designer who models the cableway.

You create electrical systems in the Systems and Specifications task or by right-clicking the objects on the **System** tab in Workspace Explorer. Electrical systems can later be reorganized in the system hierarchy based on your access privileges to the permission groups of the plants.

Electrical Task

The Electrical task uses point-by-point route design to insert cableway, cable tray, and conduit components into a 3-D model. After routing the cableway, cable tray, and conduit components, you can place cables to route through them. To enhance the view of the electrical parts in your model, you can apply surface style rules. See Create a Surface Style Rule in the *Common User's Guide*.

NOTE A cableway represents a path for a cable tray or bare cables. The cableway has no physical counterpart; it simply reserves space. Cable tray, on the other hand, does have a physical counterpart.

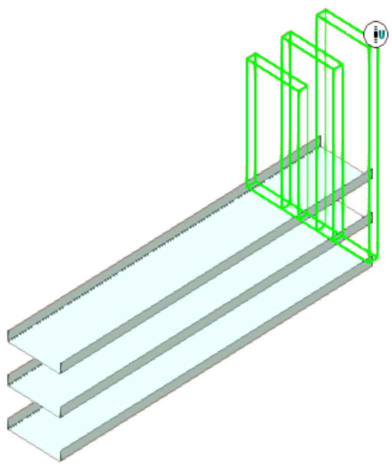
For models that include underground placement of electrical cables, the software provides a duct bank option which allows you to draw the cableway and place conduits at the same time.

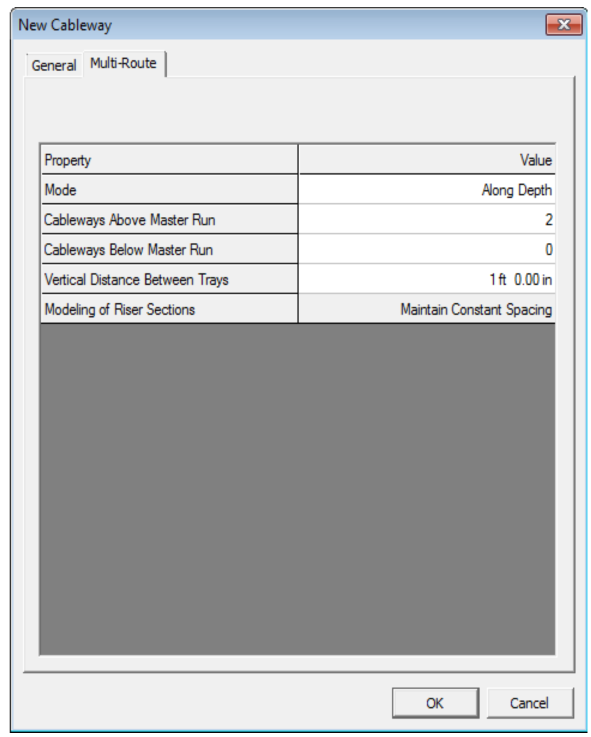
The duct bank object lets you design conduits of the same specifications or individualize each conduit run, if needed.

The Electrical task includes the following commands:

	Select - Resets all commands and allows you to select objects in the model.
	Route Cableway - Creates a new cableway, duct bank, or cable tray; extends an existing run; or routes to an end feature.
	Route Conduit - Creates a new conduit run or extends an existing run.
	Insert Transition - Adjusts the cableway to accommodate combinations of change in shape and size, manually places and modifies a transition, and indirectly changes a cross section in the cableway routing.
	Insert Component - Adds a component into a cableway or conduit run.
	Auto Connect Cableways - Automatically places the fittings needed to connect a cableway. Zero spec cableway (Cws-0) is routed between existing cableways and the new cableway is automatically placed.
	Place Equipment - Selects any equipment from the Catalog and places it in the model and modifies the offset of the equipment and its relationships. You can mate, connect, or align equipment, and precisely position the equipment.
	Insert Cable - Creates a new cable run in the model. You define the properties of the cable run by defining the relationship of the cable run to other objects in the model, such as pieces of equipment or electrical cabinets.
	Edit Cable Path - Routes cables through the various cableway trunks and conduits that exist in the model. You can force the cable to go through a particular cableway or force the cable to detour a particular cableway.
	Insert Cable Marker - Places cable markers at points along cableway or conduit features.
	Insert Split - Places a splice plate or other type of split in the selected cable tray.
	Sequence Objects - Renames objects in the selected conduit, cable tray, or WBS item such that the names are in order, based on topology.
	Set View by Cable - Assists the designer when routing cable by only showing objects of interest and hiding non-applicable objects in the model. This command is located on the **View** menu.
	View Cable Schedule - Displays a list of the retrieved cable schedule documents. This command is located on the **SmartPlant** menu.

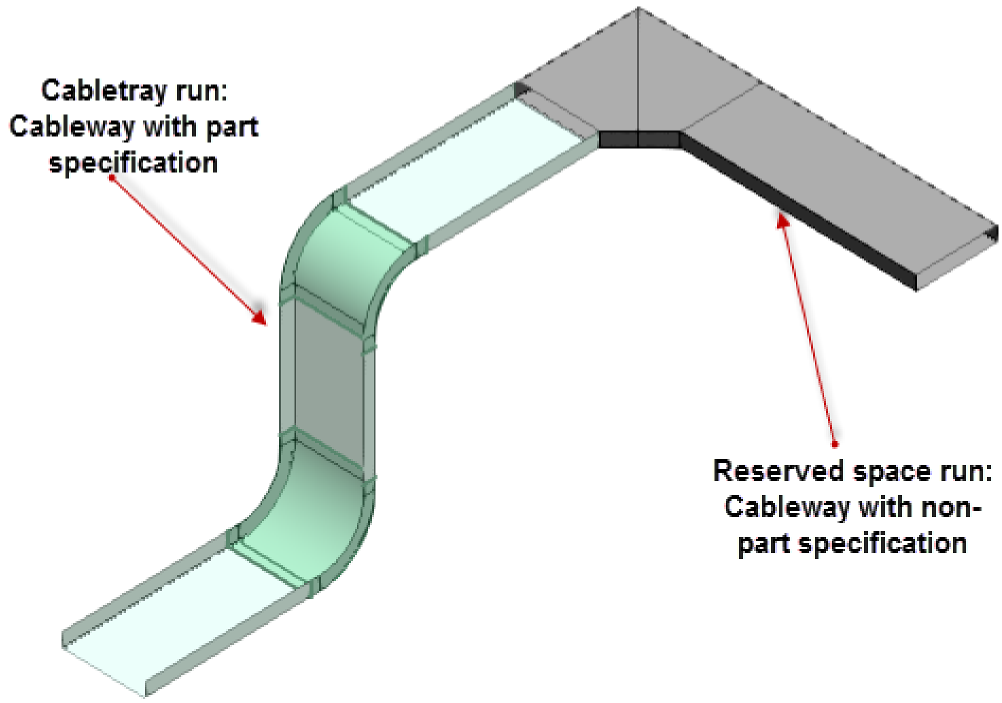
- **Create and route cableways:** You can create a new cableway, extend the existing cableways, and route a cableway to or from nozzles and features. You can perform this task by using **Route Cableway** on the vertical toolbar.
- The **Multi-Route** tab is used to specify the parameters that multiple cableways need to routed. Smart 3D 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 **Route Cableway** 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.





- Two Types of Cableway:
  - Specification Cableway (Cable Tray)
  - Non-Part Specification Cableway

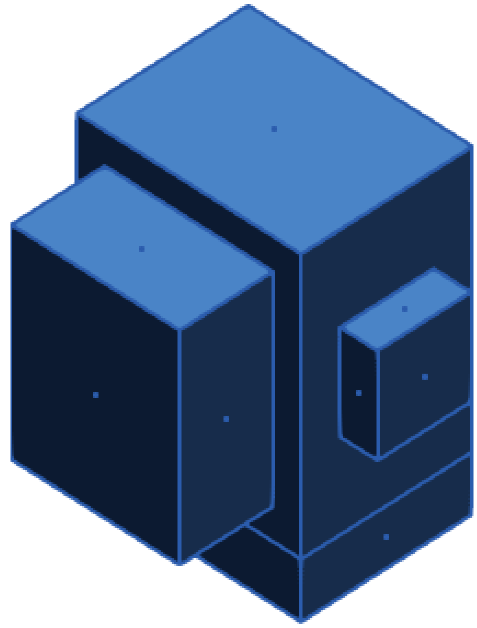
Cableways are reserved space for the cable trays by routing a cross section using a non part specification. Smart 3D places cable trays from a part specification at the time of routing cableways. Trays are specified by their width and depth and are placed along the cableway. Part type is dependent upon the cableway feature, size and specification.



- **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 **Route Conduit** on the vertical toolbar.
- **Insert electrical transitions:** You can create cableway transitions by using **Insert Transition**. 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, Smart 3D 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 **Auto Connect** on the vertical toolbar.
- **Place electrical equipment:** You can select electrical equipment from the Smart 3D catalog and position them in the 3D model. These equipment are referred to as *catalog equipment*. You can perform this task by using **Place Equipment** on the vertical toolbar. Electrical equipment 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 equipment 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 equipment.

Catalog Equipment:
Stanchion Mounting Light



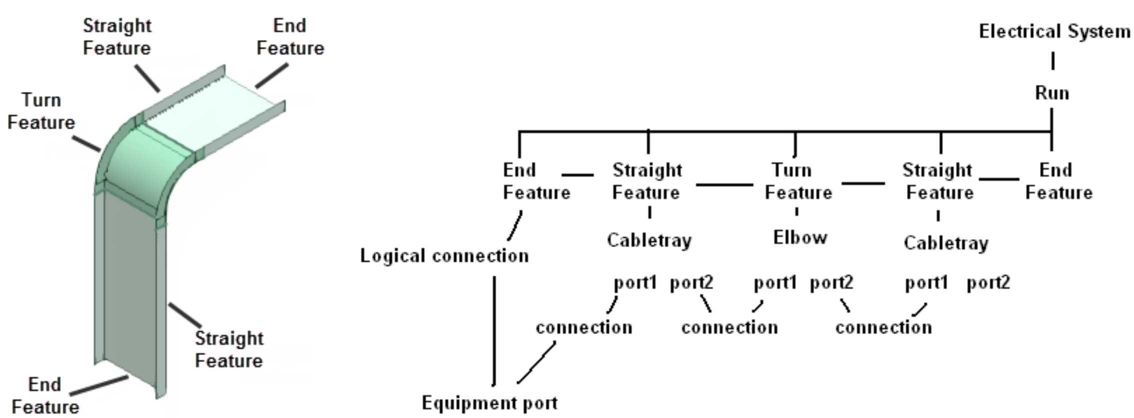
Designed Equipment:
Medium Voltage Transformer

- **Add cable objects:** You can create cables and then route those cables through existing conduit and cableway systems. You create cables manually by using **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 **Edit Cable Path** 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 **Insert Cable Marker**.
- **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.

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. The figure below shows a cableway feature model and the relationships between features, which represent a portion of a cableway system.

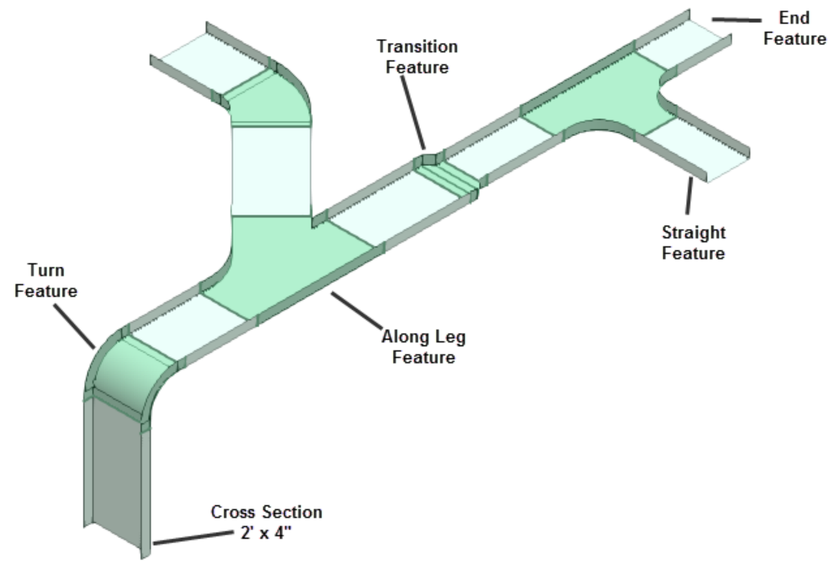


A cableway feature model would generally consist of the following components:

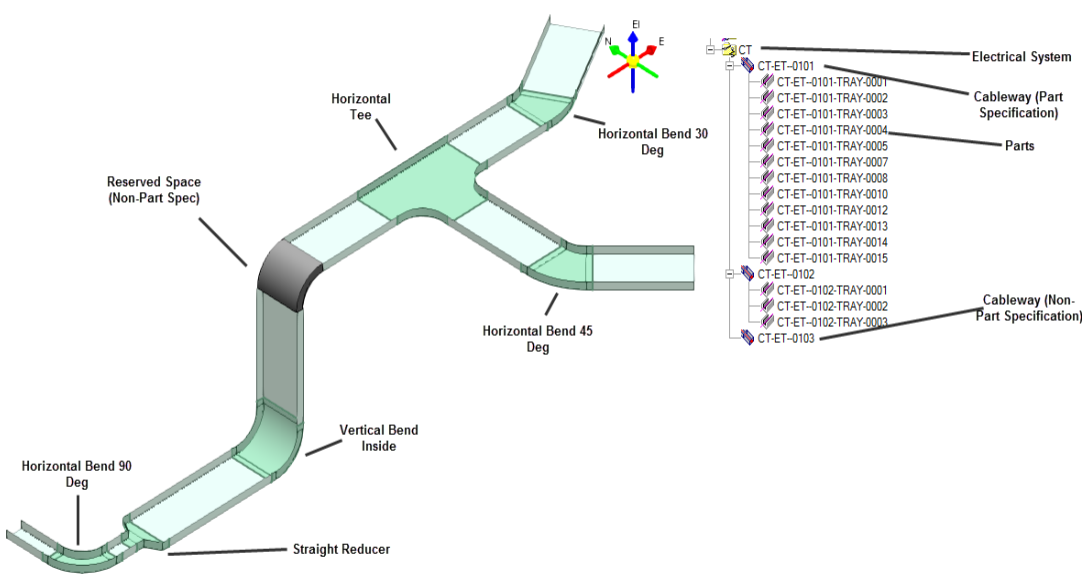
- **Electrical System:** An electrical system is a way of organizing cableways within the system hierarchy and controlling the specifications that can be used within that system. If an electrical system exists in your model, you can route cableways and arrange them as children in the system hierarchy.

- **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 Smart 3D 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.

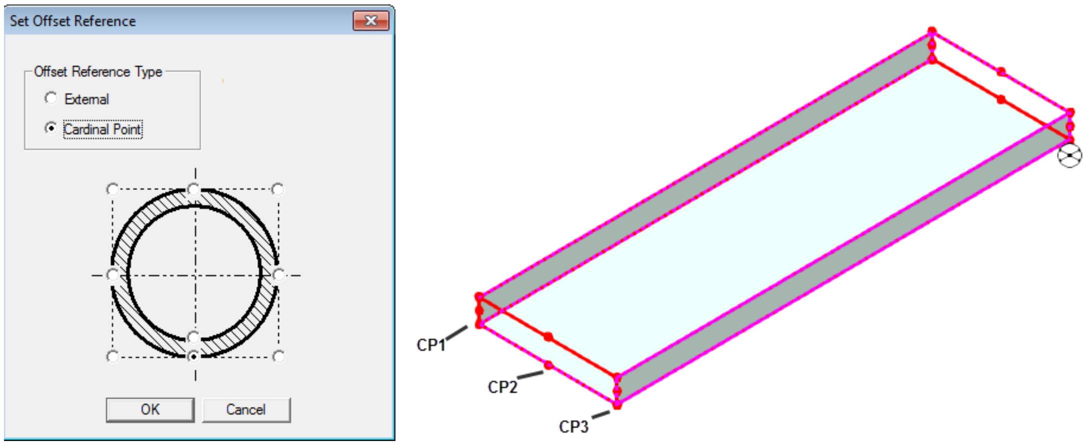


- **Part:** It is a term used to describe a catalog item that has true graphics, as opposed to a feature and a run that are simply managers of the part and skin over the graphics. The part brings with it a catalog basis making it a material item that can be ordered or purchased in most cases and represents 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. The figure below 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.



Cardinal Point

When the designer defines a data point for routing, this data point lies on the centerline of the cableway profile that is being routed by default. Smart 3D provides the functionality to route a cableway by the top, sides, or bottom of the cableway instead of the cableway centerline. The figure below shows the bottom cardinal points with the actual graphical view of the cableway. The same configuration applies to the top and side.



For more information, refer to the Electrical User's Guide.

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?

Placing Electrical Equipment

Objective

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

- Place electrical equipment in a model.

Prerequisite Sessions

- Smart 3D Overview
- Smart 3D Common Sessions
- *Electrical Overview* (on page 7)

Overview

Smart 3D enables you to place an occurrence of any electrical equipment from the catalog in a model. Use the **Place Equipment**  command on the vertical toolbar to place equipment.

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 equipment from the Smart 3D catalog and position them in 3D model. These equipment are referred as catalog equipment. Catalog equipment 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 equipment 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 equipment 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

The figure below 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.

- Equipment
  - Architectural
  - Civil
  - Electrical
    - Communications
      - Electrical Speaker
    - Control Switch
      - Electrical Control Switch
    - Electrical Conduit Box
      - Junction Box
    - Electrical DiscontSwitch
      - Electrical Disconnect Switch
    - Electrical Enclosures
      - Electrical Enclosure
      - Electrical Receptacle
    - Electrical Instruments
      - Instrument Transmitter
    - Electrical Motor
      - Electrical Motor
    - Electrical Panelboards
      - Electrical Panelboard
    - Electrical SwitchGears
      - Switch Gear
    - Electrical Transformer
      - Electrical Transformer
    - Instrument Stands
      - Instrument Stand Double Column
      - Instrument Stand Single Column
      - Instrument Stand Wall Mount Single Column
    - Lighting
      - Ballast Housing Type 1 Fixture
      - Ballast Housing With Angle Reflector Fixture
      - Ballast Housing With Dome Reflector Fixture
      - Ballast Tank With Angle Reflector Fixture
      - Ballast Tank With Dome Reflector Fixture
      - Bay Light Fixture
      - Electrical Light
      - Electrical Lighting Equipment
      - Electrical Lighting Pendant
      - Emergency Beacon Fixture
      - Fluorescent Fixture
      - Fluorescent Light Fixture
      - Fluorescent Lighting Fixture without Reflector
      - Handrail Mounted Fluorescent Lighting Fixture
      - High Bay Fixture
      - High Mast Flood Light Fixture
      - Low Bay Fixture
      - Slip fitter Flood Light Fixture
      - Stanchion Fluorescent Light A (Handrail or Pole Mounted)
      - Stanchion Fluorescent Light B (Handrail or Pole Mounted)
      - Street Light Fixture
      - Wall Pack Fixture
    - Variable Frequency Drive
      - Electrical Variable Frequency Drive

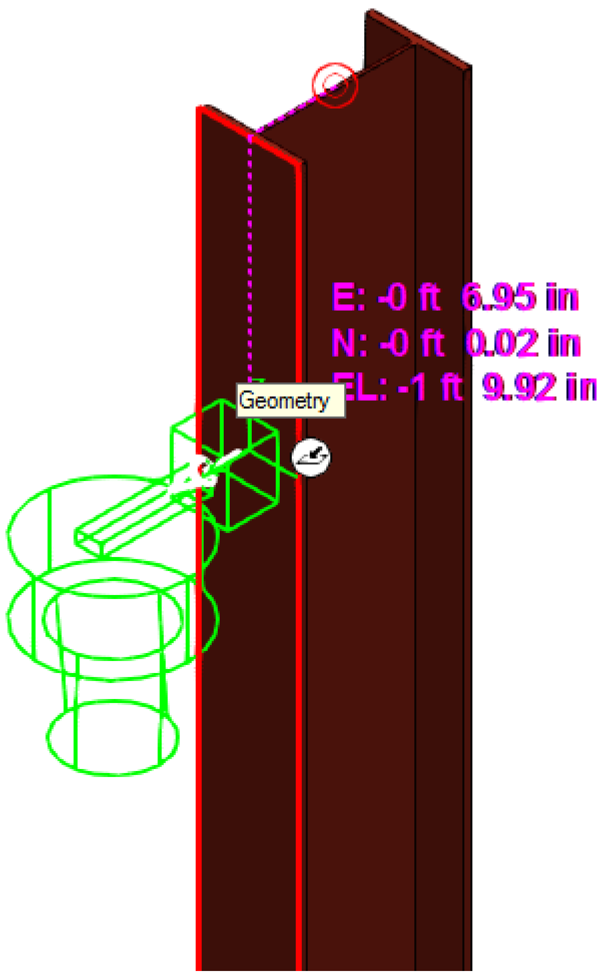
Place Equipment

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.

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.

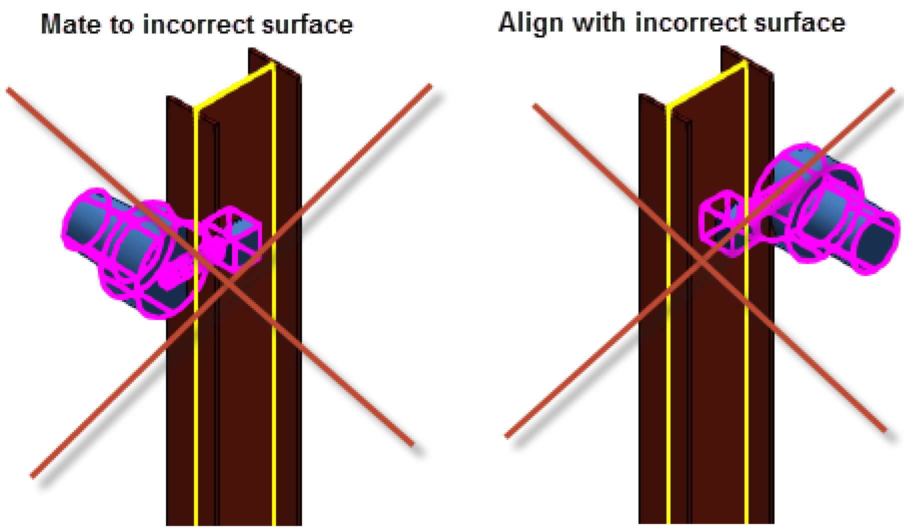
NOTES

- 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.



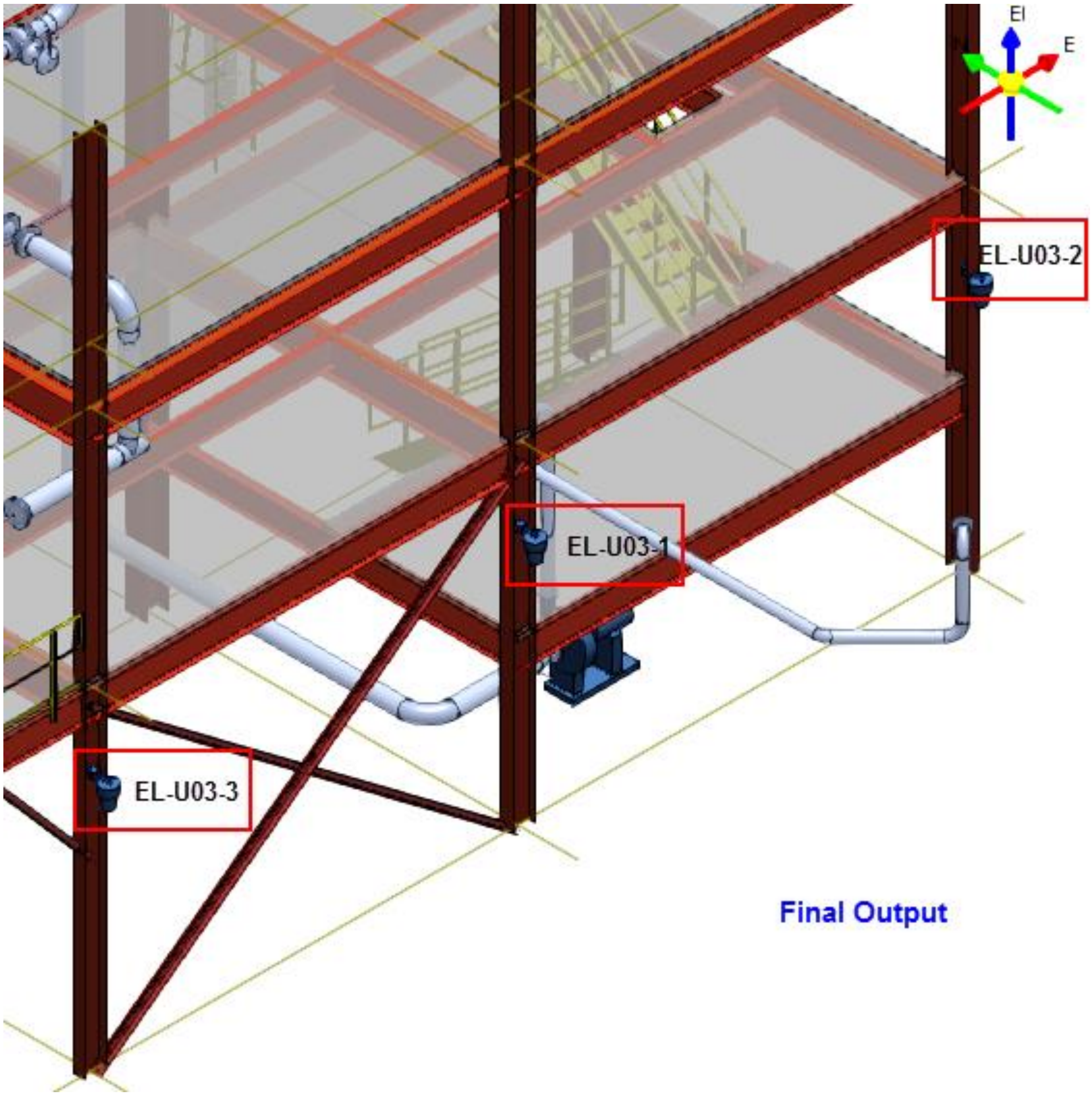
Connect Positioning Relationship

- 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 and the appropriate surface on the design object. You might end up positioning the electrical equipment, as shown below.



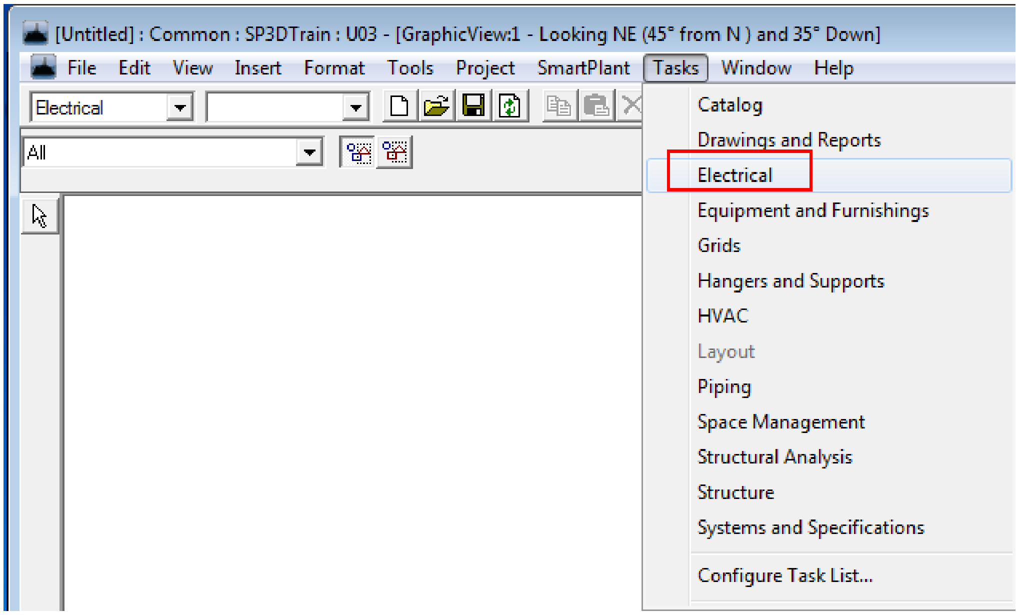
Placing Electrical Equipment using Coordinates

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

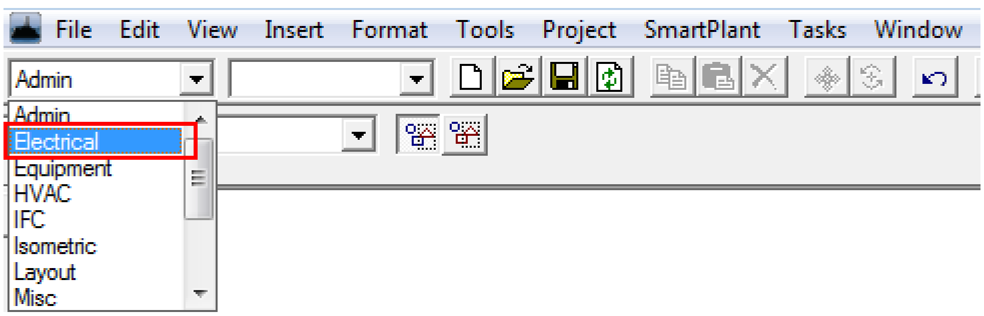


Define your workspace to show Unit U03 and coordinate system U03 CS.

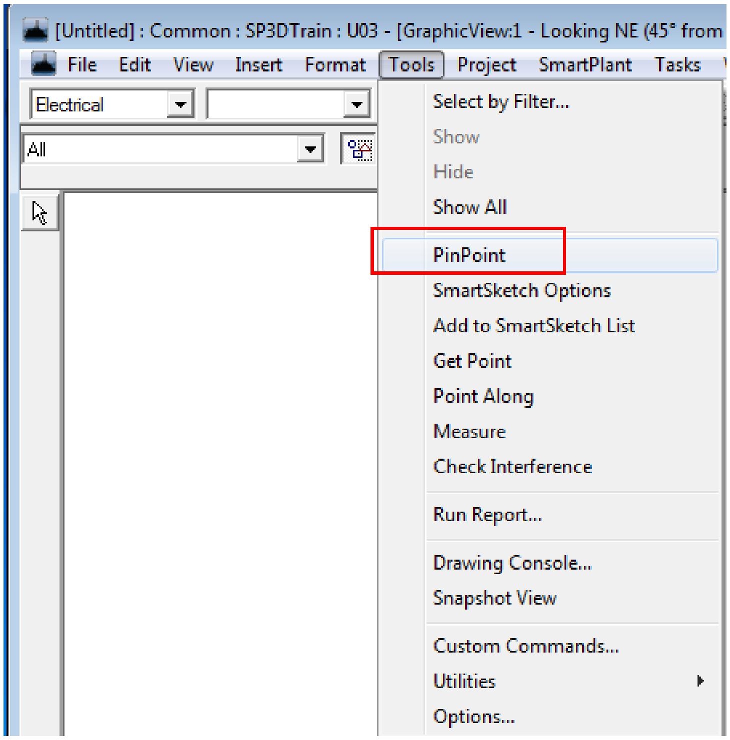
1. If you are not in the Electrical task, then select the **Tasks > Electrical** command.



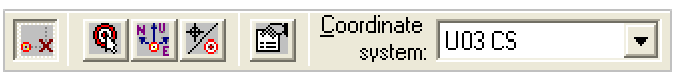
2. In the **Active Permission Group** drop-down list, select the **Electrical** option.



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



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



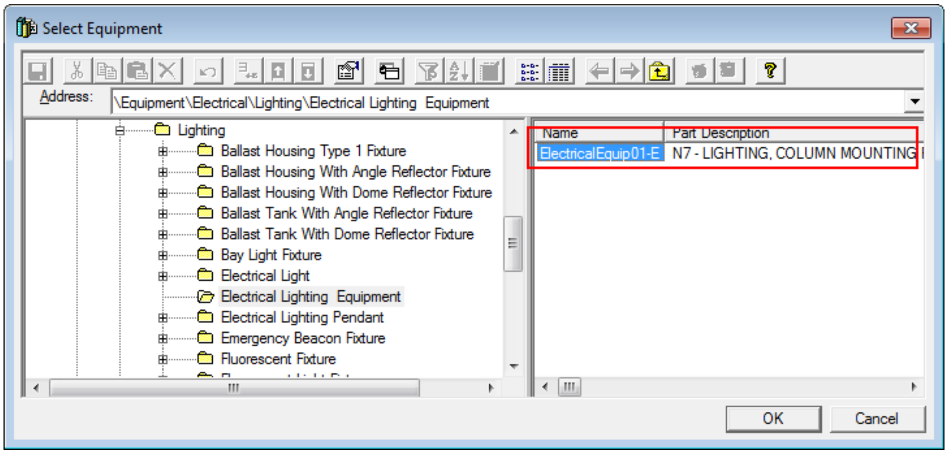
5. To move the target to the origin of the current coordinate system, select the **Set target to Origin** button on the **PinPoint** ribbon.

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

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

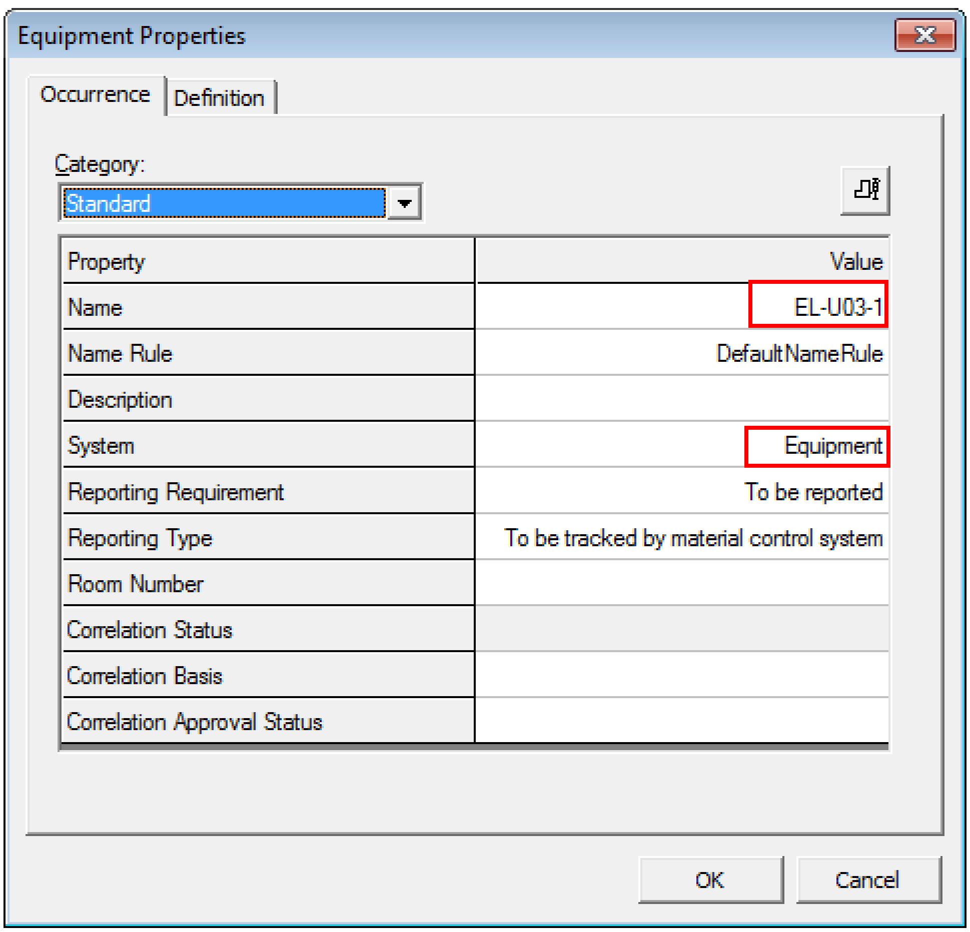
   *The **Select Equipment** dialog box displays.*

7. 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**.



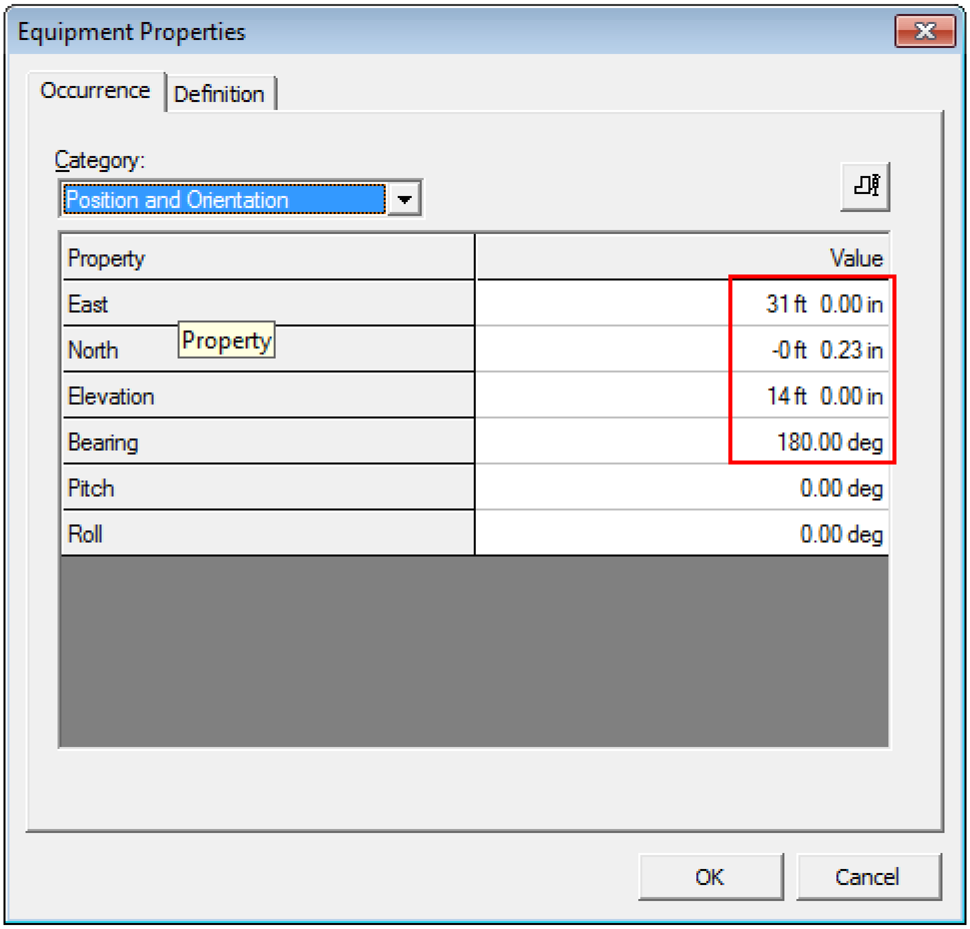
*The **Equipment Properties** dialog box appears.*

8. 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**.

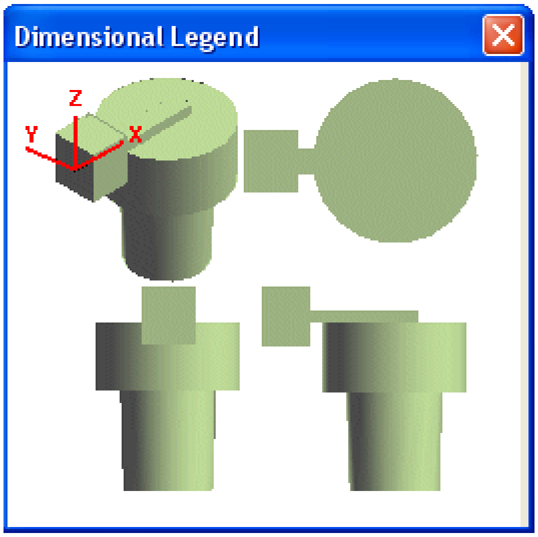


10. In the **Category** drop-down list on the **Occurrence** tab, switch to the **Position and Orientation** category and key in the following properties:

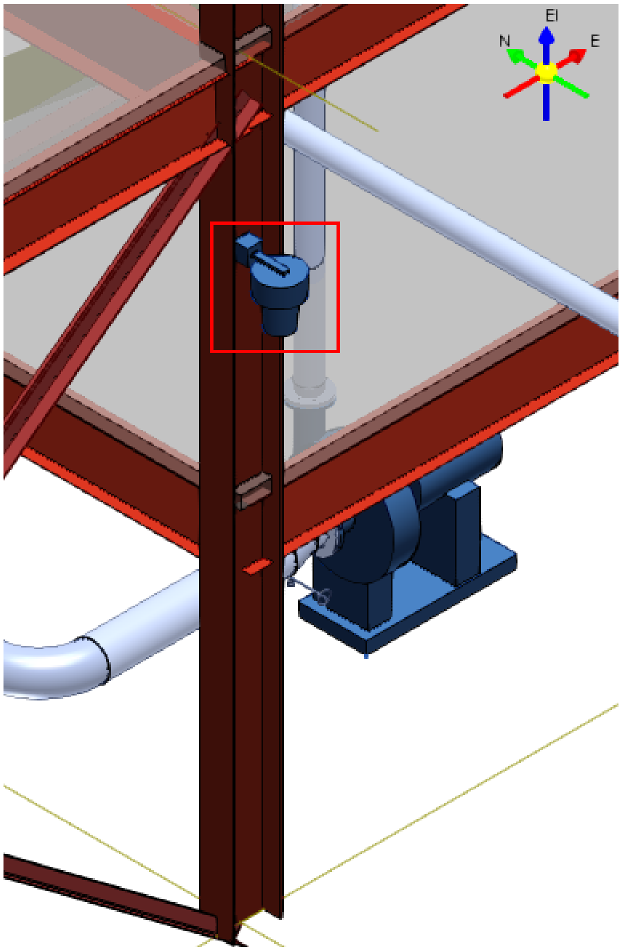
East: 31 ft
North: -0ft 0.23in
Elevation: 14 ft
Bearing: 180 deg



TIP You can click **Preview** 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.



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



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

EL-U03-2:

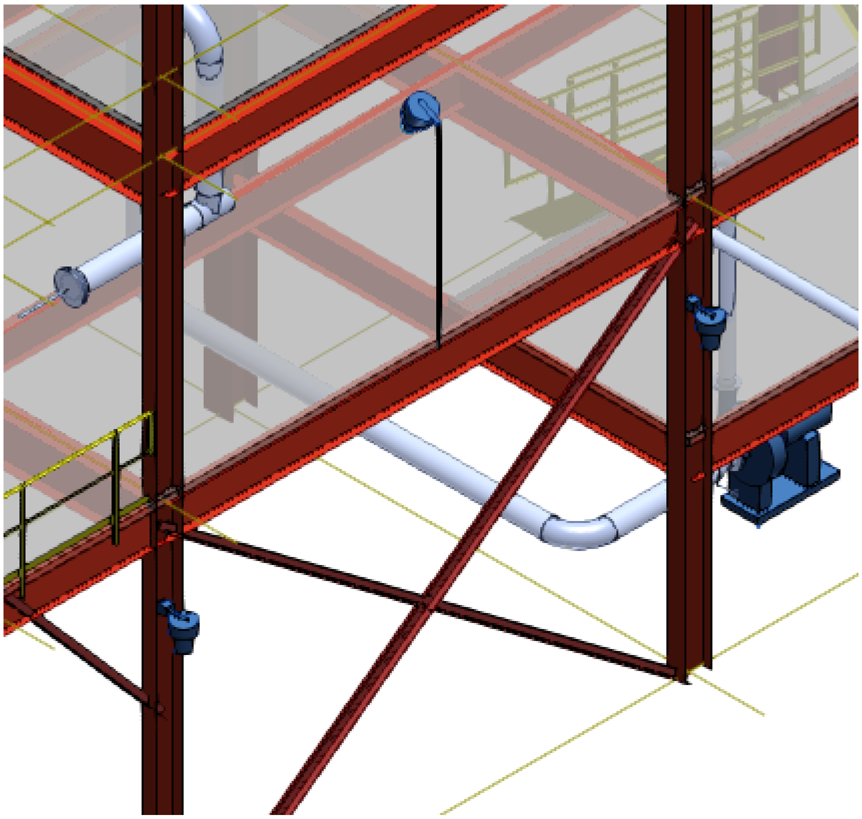
- Position and Orientation:
  - East: 55 ft
  - North: -0 ft 0.23 in
  - Elevation: 14 ft
  - Bearing: 180 deg

EL-U03-3:

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

Placing Electrical Equipment by Positioning Relationships

Place a stanchion mounting electrical light, ESML-U03-1 from the Smart 3D catalog in Area A2, Unit U03 by using Place Equipment 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 this.



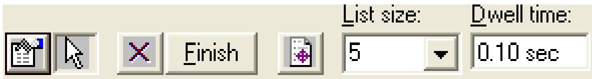
Before beginning the procedure for placing electrical equipment by positioning relationships:

1. 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**.
2. Make sure the **Active Permission Group** is set to **Electrical**.
3. 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.

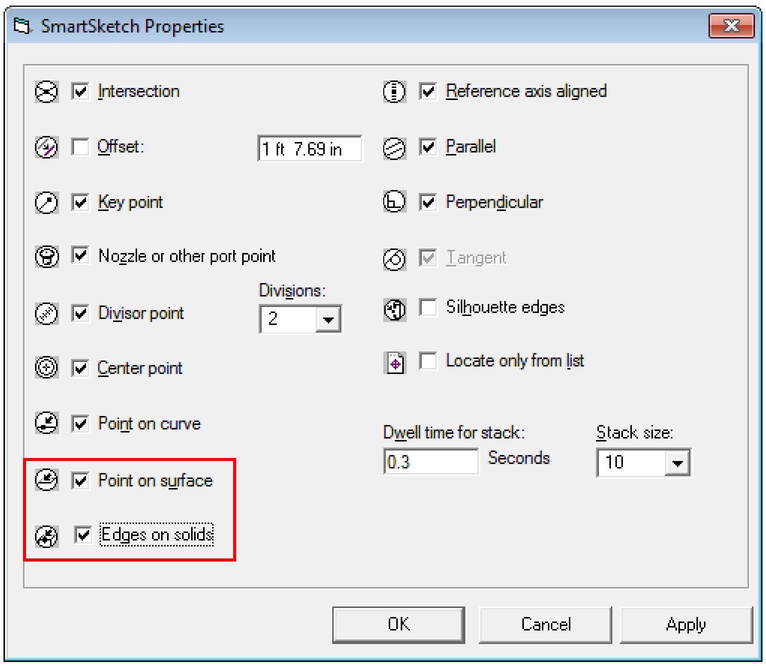
4. To move the target to the origin of the current coordinate system, select the **Set target to Origin** button on the **PinPoint** ribbon.

5. 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.

   The Add to SmartSketch List ribbon appears.

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

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

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

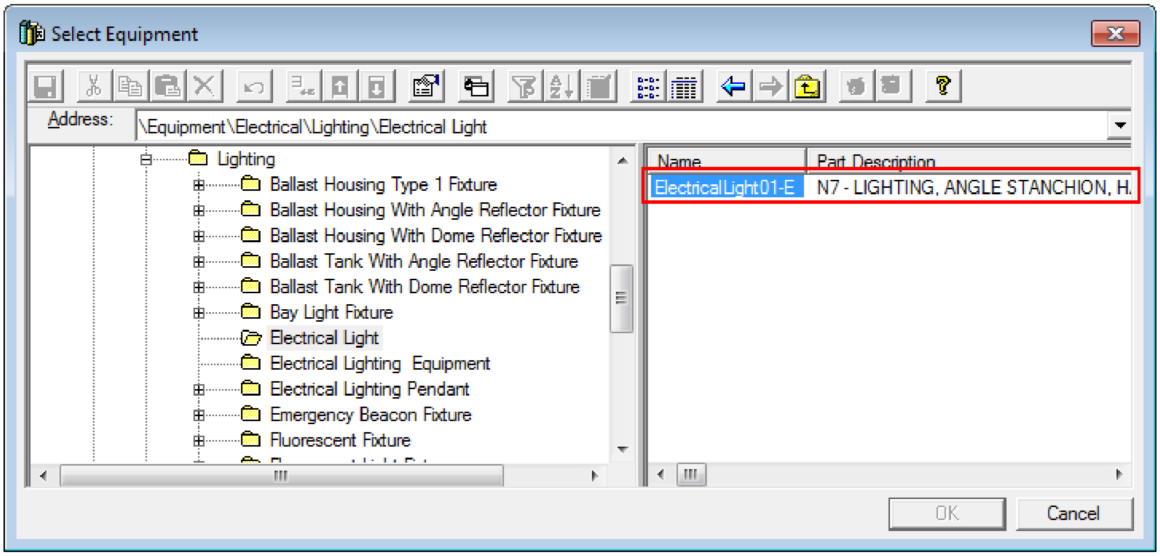
9. Click **Finish** to close the **Add to SmartSketch List** ribbon.

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

    *The **Select Equipment** dialog box appears.*

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

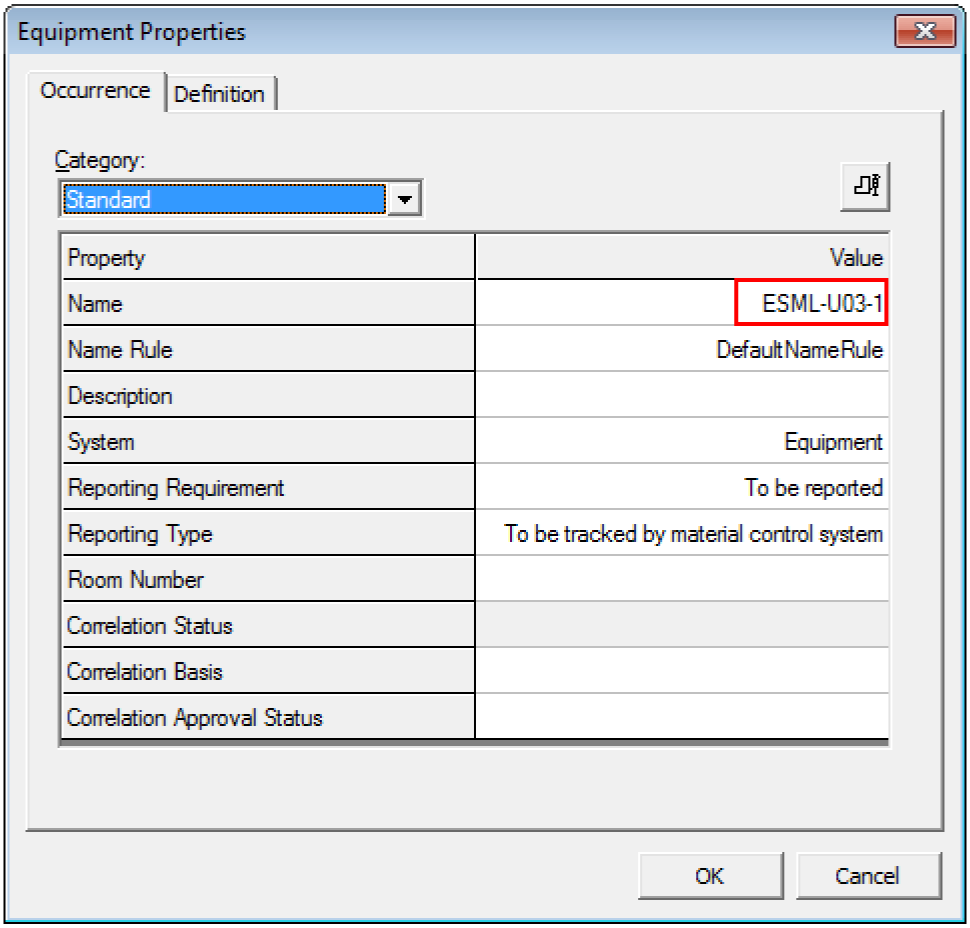
12. Select **Electrical01-E** and click **OK**.



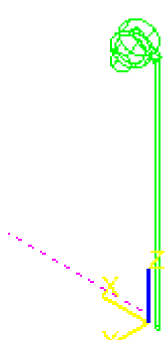
The Equipment Properties dialog box appears.

13. In the dialog box, change the name of the equipment by typing ESML-U03-1 in the **Name** field.

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

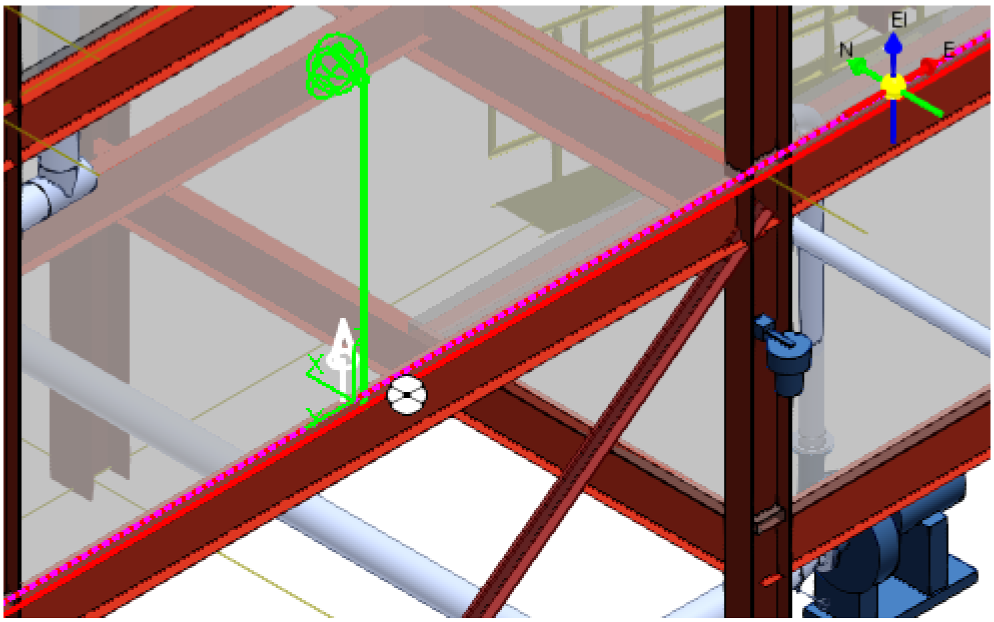


15. Click **OK** to close the **Equipment Properties** dialog box.
16. By default the relationship type is **Mate**, however, the ribbon will show last relationship type used in that session.
17. If the relationship type is not **Mate**, click the drop down list to select **Mate**.
18. Use the arrow key to rotate the equipment so that the light is facing North.

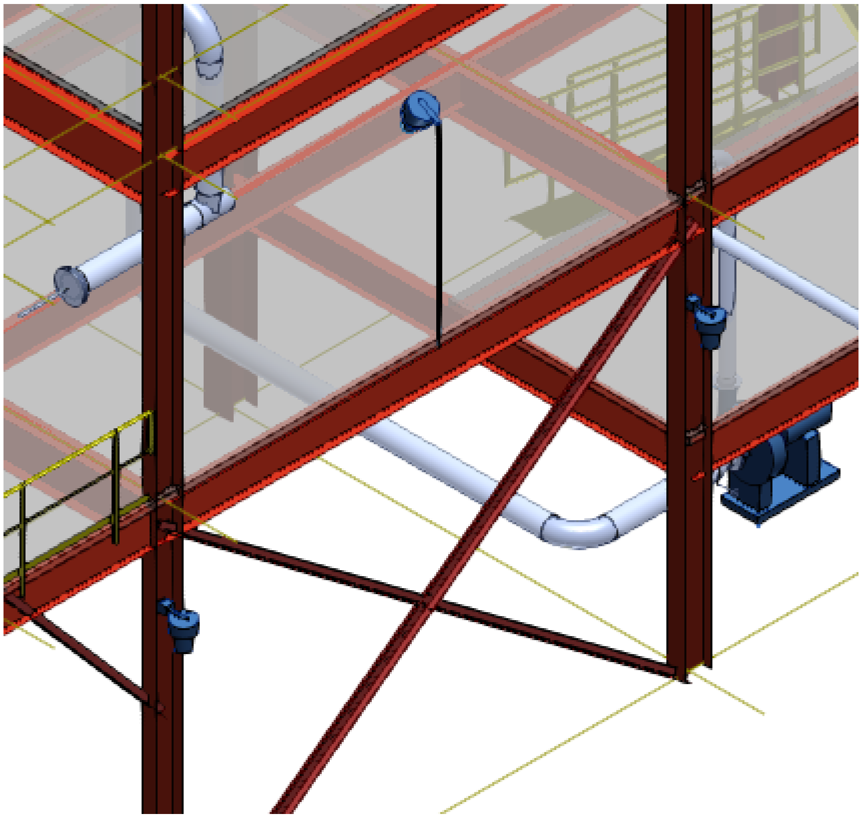


NOTE Any equipment can be rotated dynamically during placement. When in the dynamic mode, select the edge of the active window and press the left or the right arrow keys to rotate it towards a desired direction. You can also switch the axis of rotation by pressing the UP or the DOWN arrow keys.

19. Locate the edge and the top surface of the slab so that the software finds the intersection points between the two planes.
20. On the **PinPoint** ribbon, key in 19 ft 6 in in the E drop-down list to define the placement point, as shown.

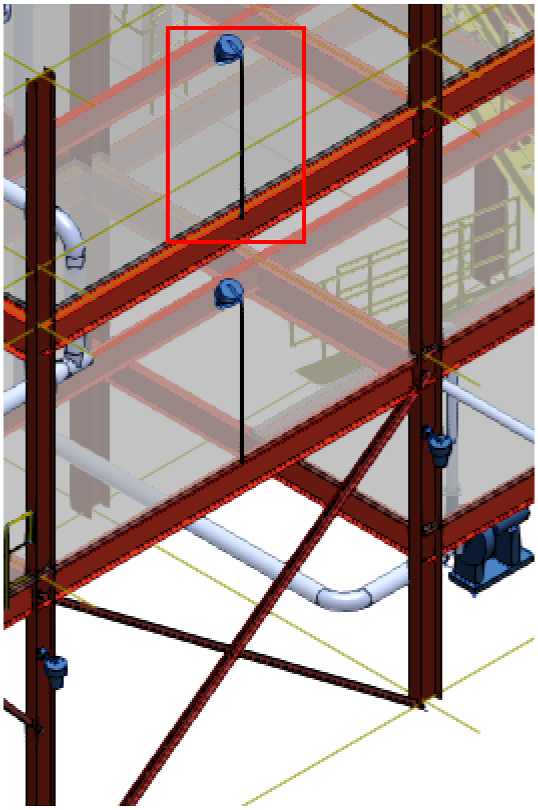


21. Click in the graphic view to place the stanchion mounting electrical light, as shown.



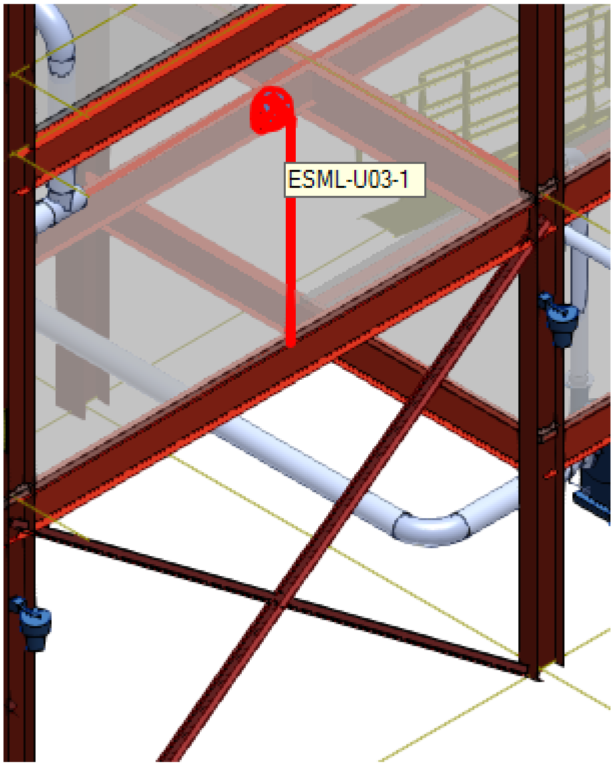
Copying and Pasting Catalog Equipment

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 this.



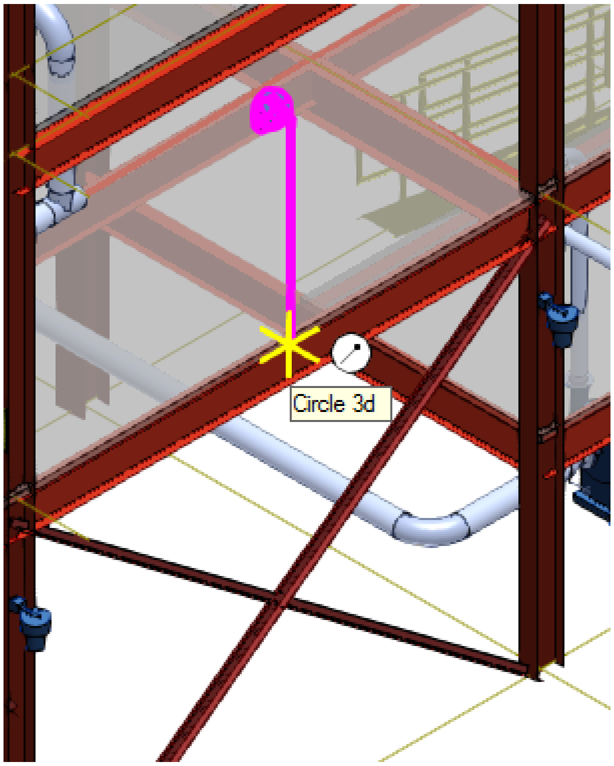
1. Select **Equipment** from the **Locate Filter** drop-down list to select only the equipment in the graphic view that you need to copy and paste.

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



1. Click **Copy** on the Common toolbar.

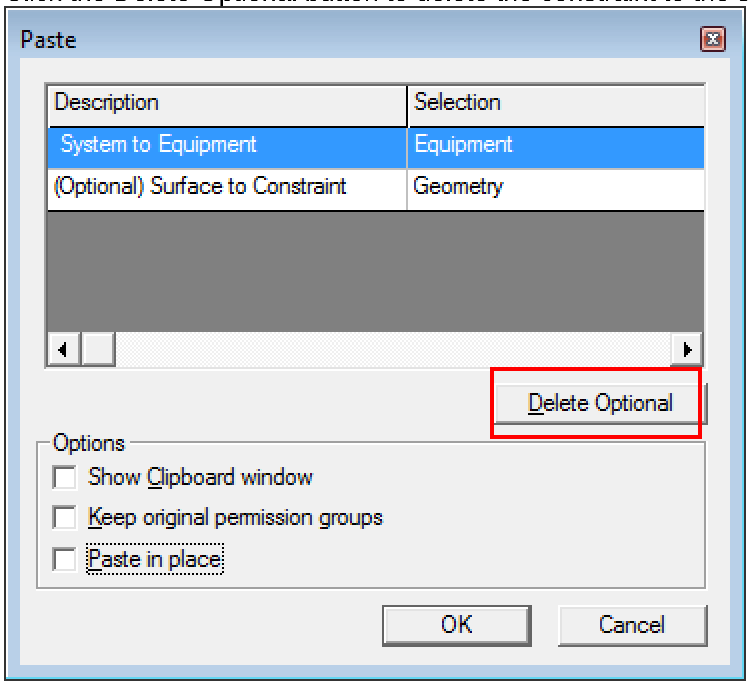
2. Select the end of **Stanchion Mounting Electrical Light** from the graphic view to define the position from where to copy the **Stanchion Mounting Electrical Light**.



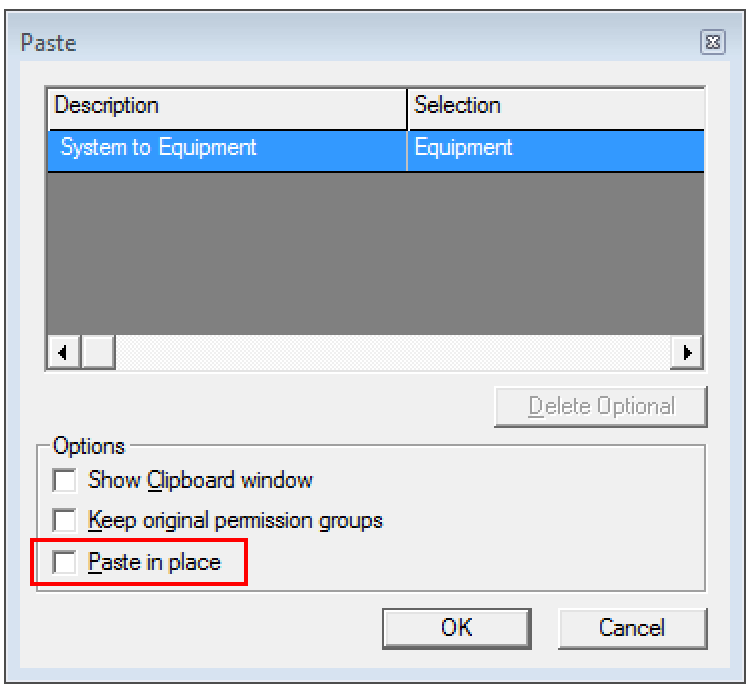
3. Click Paste on the Common toolbar.

*The **Paste** dialog box appears.*

4. Click the Delete Optional button to delete the constraint to the surface



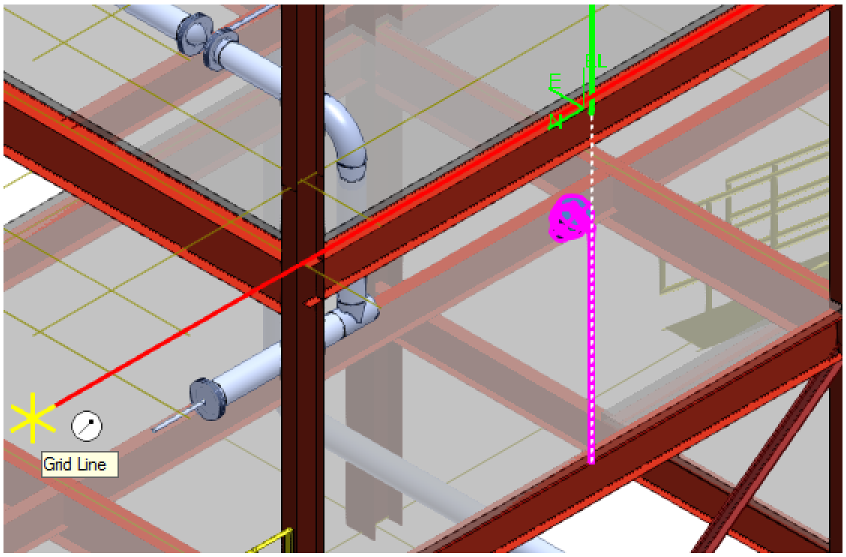
5. Keep the default parent system for the new objects to be pasted on the model and clear the Paste in place check box, as shown. Click **OK** in the dialog box.



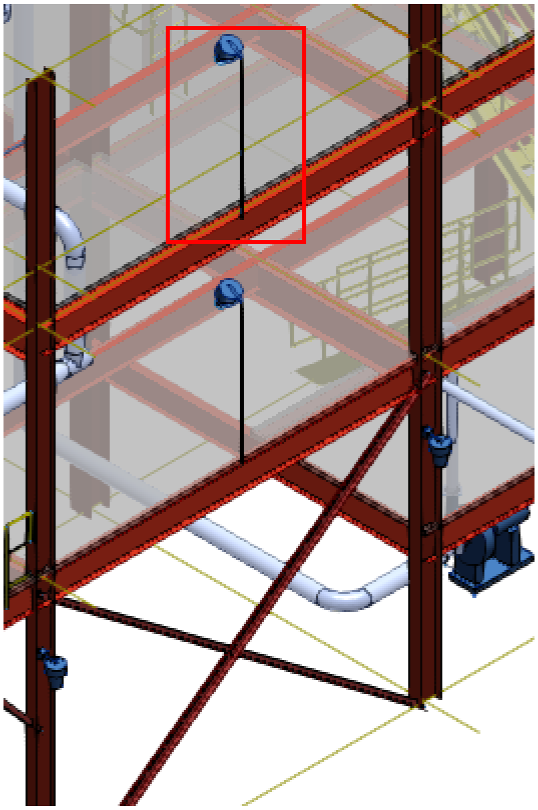
NOTES

- 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, Smart 3D 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.

6. 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.



7. Click in the graphic view to place the copied Stanchion Mounting Electrical Light.



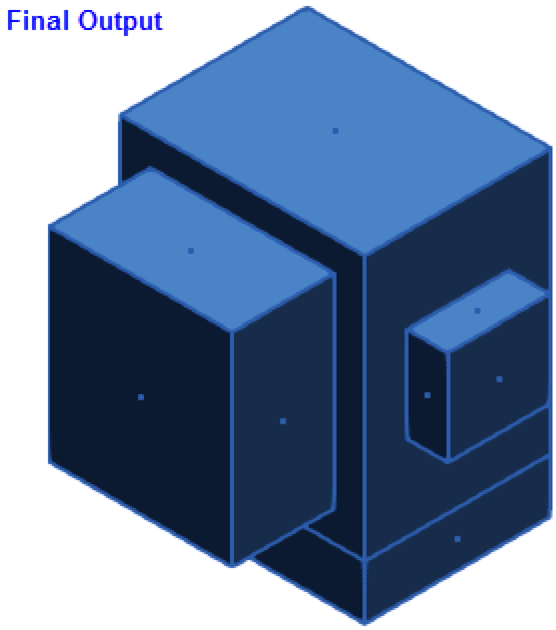
For more information related to manipulating equipment(s) refer to Copy/Paste, Delete and Edit topics in the user guide.

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 below.

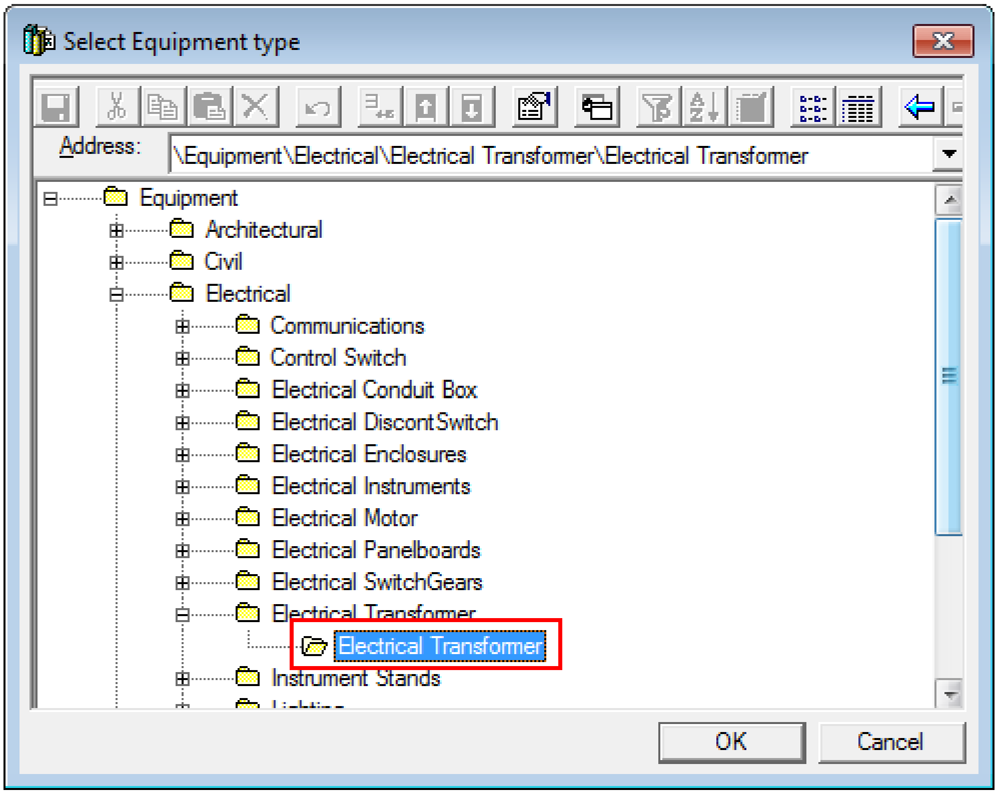


Before designing the Electrical equipment, define the workspace to show Unit **U03**. Activate the **Equipment and Furnishings** task by clicking **Tasks > Equipment and Furnishings** on the Common toolbar. Set the **Active Permissions Group** to **Electrical** and activate **Pinpoint** under the **Tools**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

1. Select the **Coordinate system** as **U03 CS**.
2. Click **Set Target to Origin** on the **Pinpoint** ribbon.
3. Click **Place Designed Equipment** on the vertical toolbar.

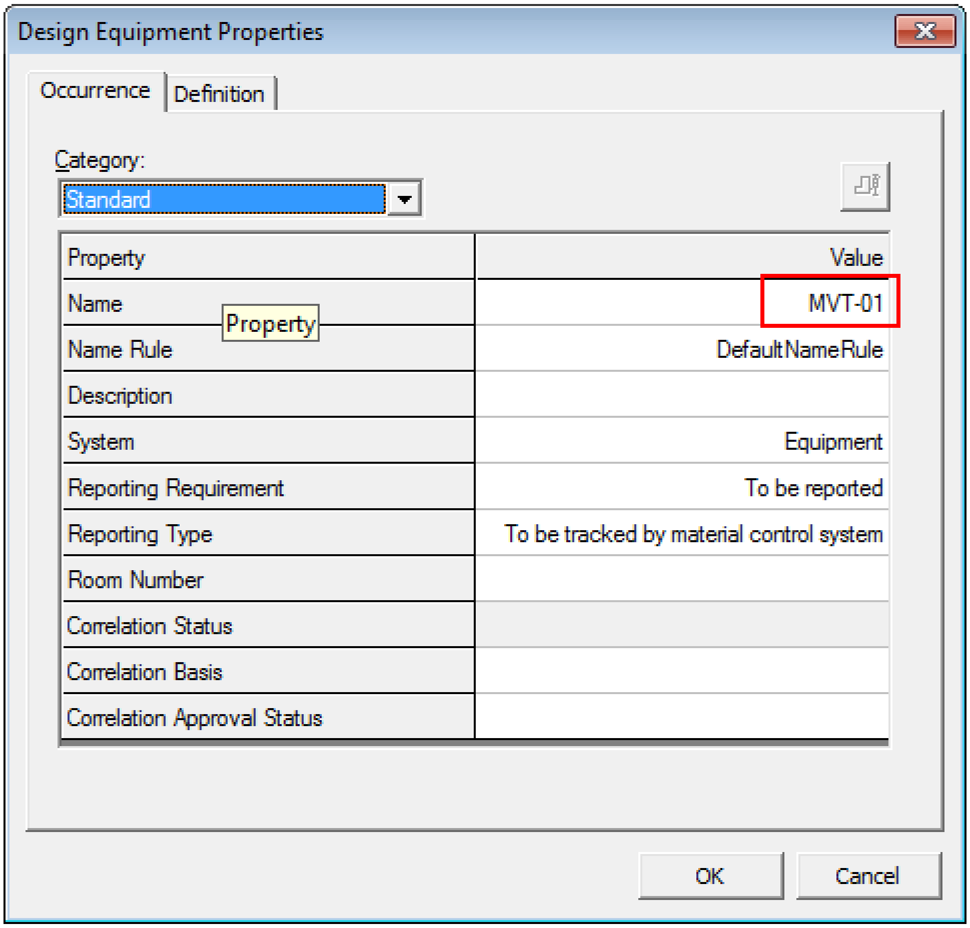
   The Select Equipment Type dialog box opens.

4. In the dialog box, expand **Equipment > Electrical > Electrical Transformer > Electrical Transformer** to select the required design equipment.



5. Click **OK**.

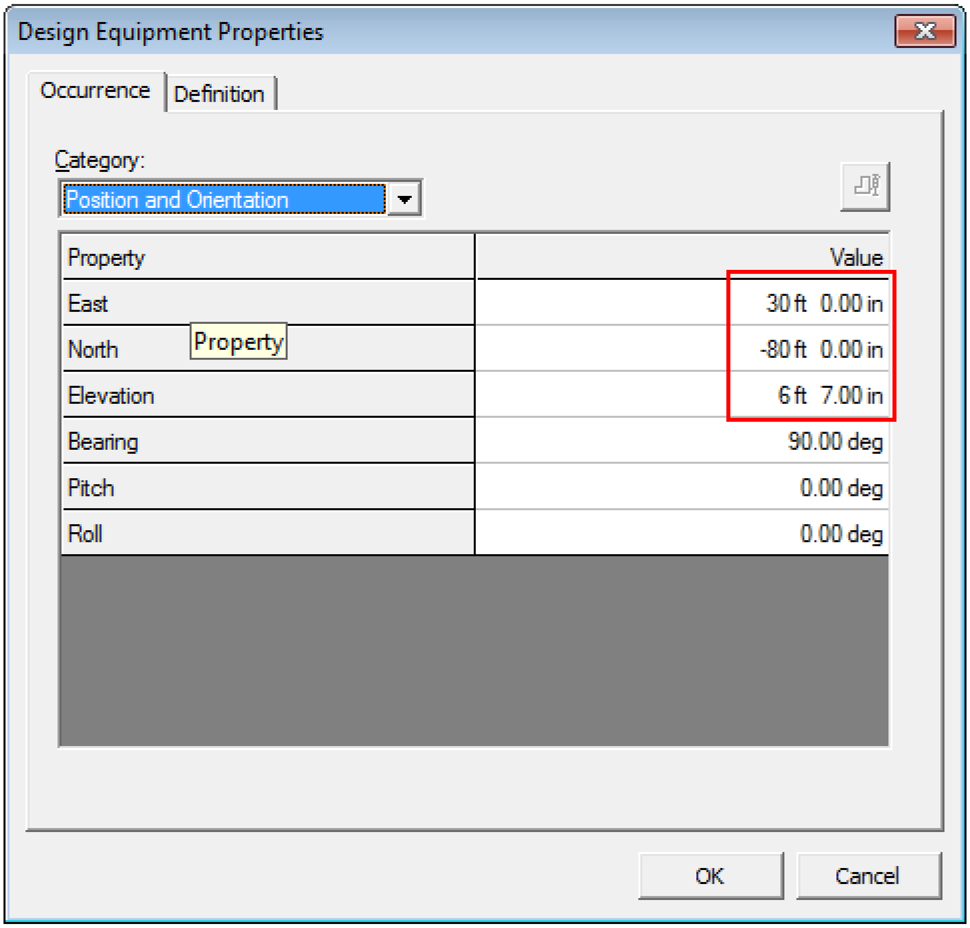
The Design Equipment Properties dialog box opens.



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.

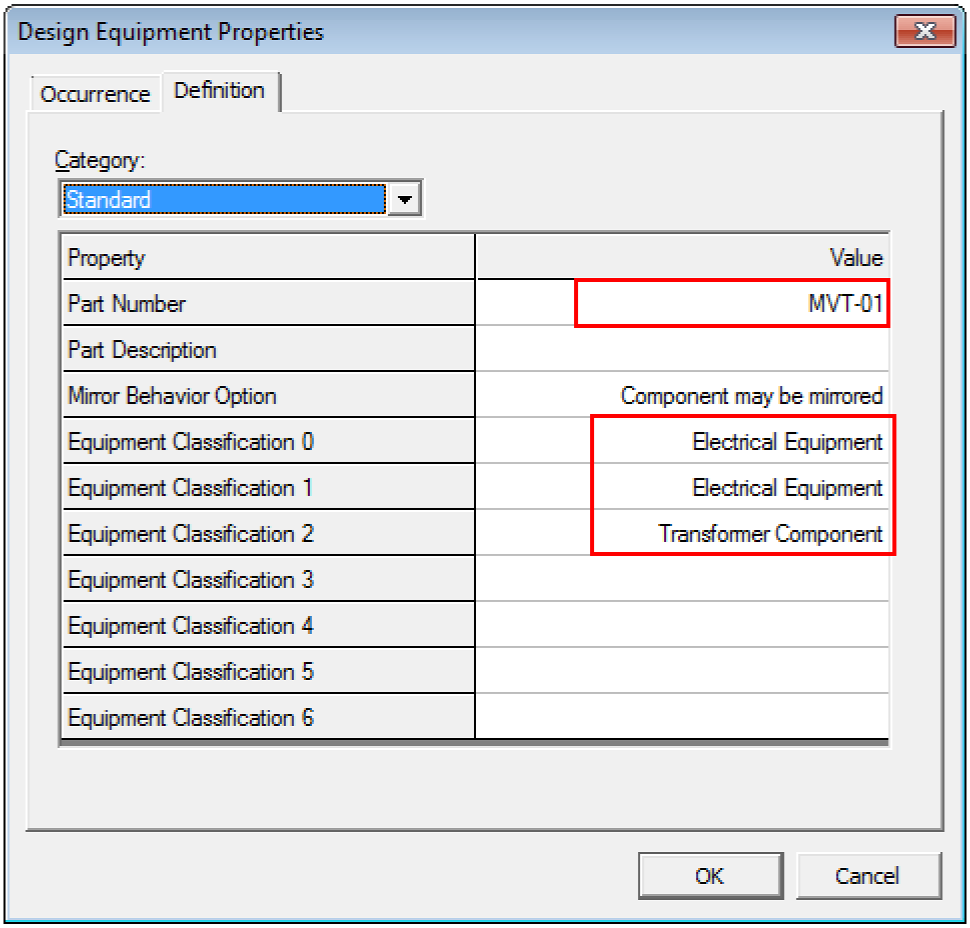
   The Select System dialog box opens.
8. In the dialog box, expand **A2 > U03 > Equipment** to select the required system and click **OK**.
9. Select the **Position and Orientation** option in the category drop-down list under the **Occurrence** tab to specify the position of the equipment.

10. Key in the values 30 ft for E, -80 ft for N and 6 ft 7in for El.



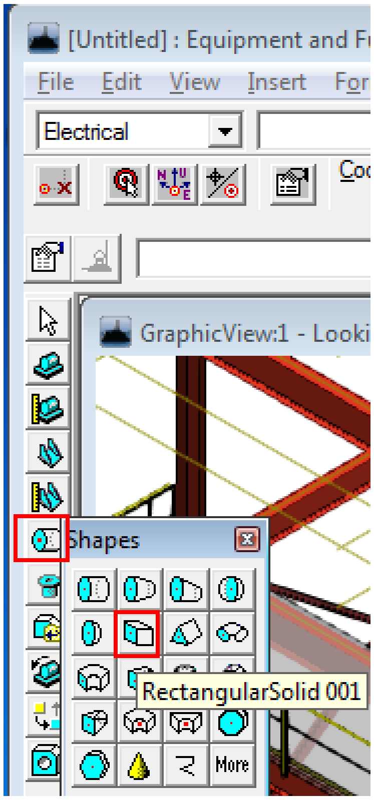
11. Switch to the Definition tab and set the following parameters to the values listed as below:
    - Part Number: MVT-01.
    - Equipment Classification 0: Electrical Equipment
    - Equipment Classification 1: Electrical Equipment

- Equipment Classification 2: Transformer Component



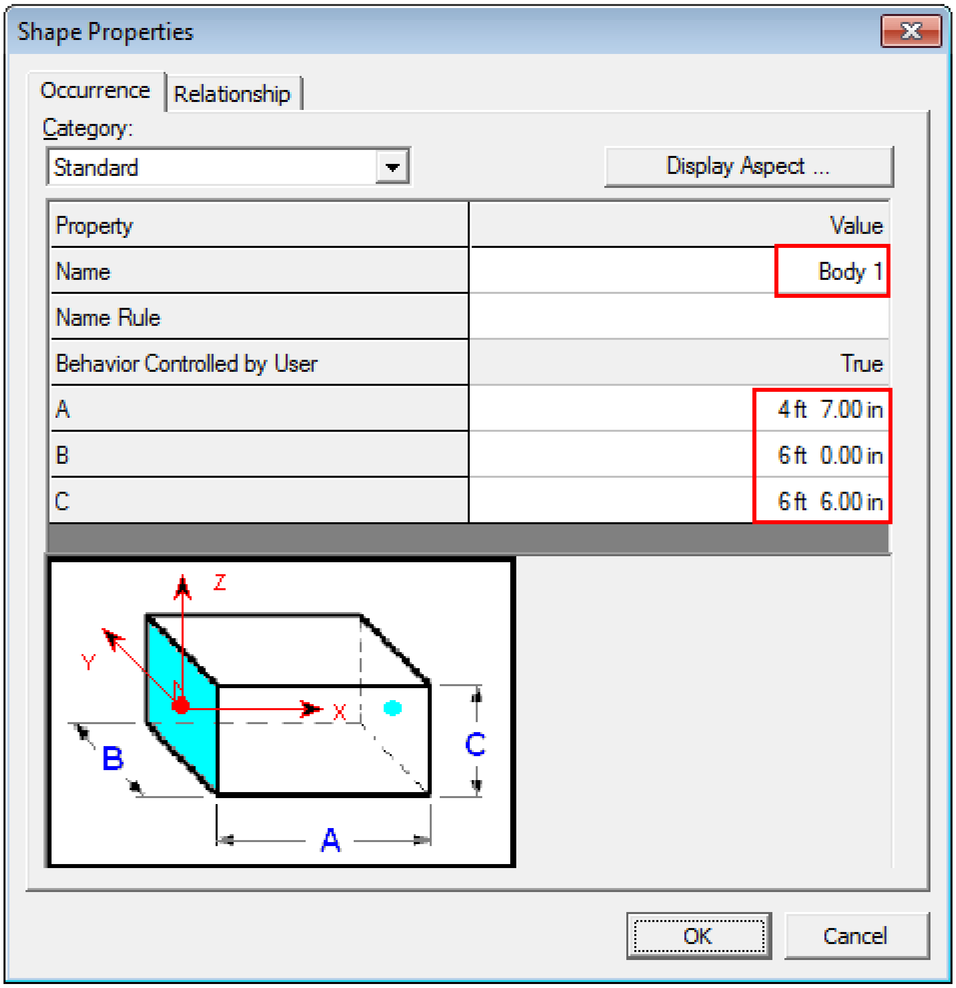
12. Click **OK**.

13. Click **Place Shape** and select the RectangularSolid 001 to specify the shape of the design equipment.



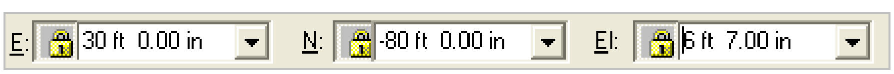
The Shape Properties dialog box opens.

14. 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.

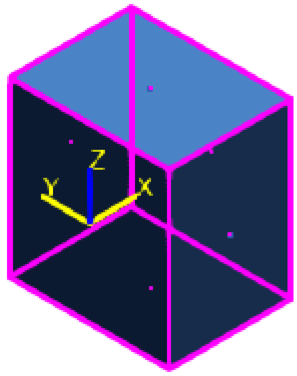


15. Click **OK** to close the **Shape Properties** dialog box.

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.



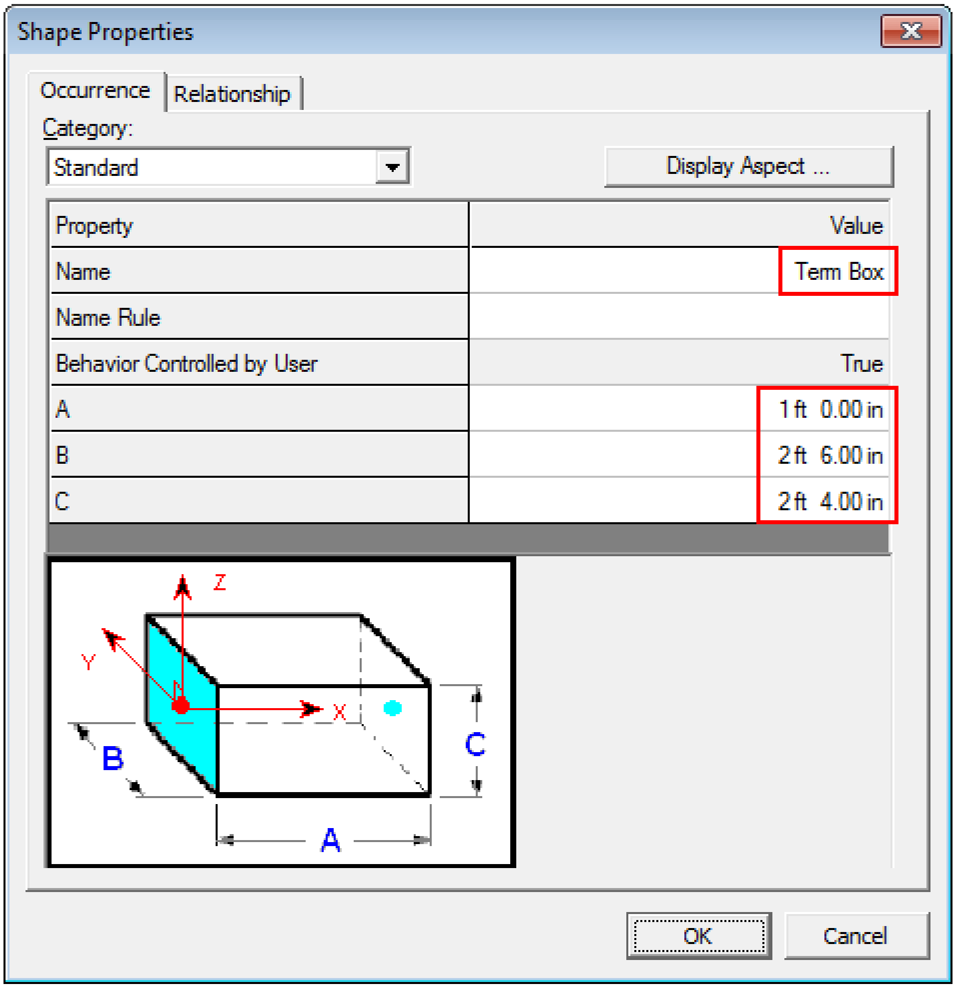
The designed equipment is shown.



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

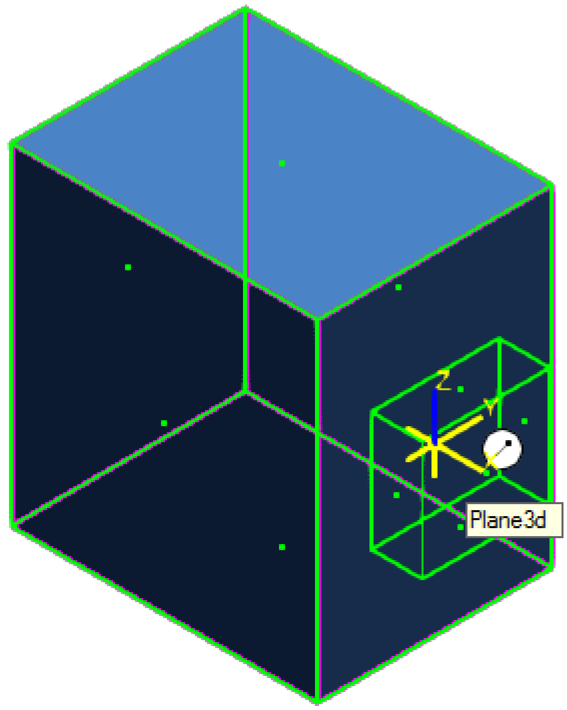
    The Shape Properties dialog box opens.

18. 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.



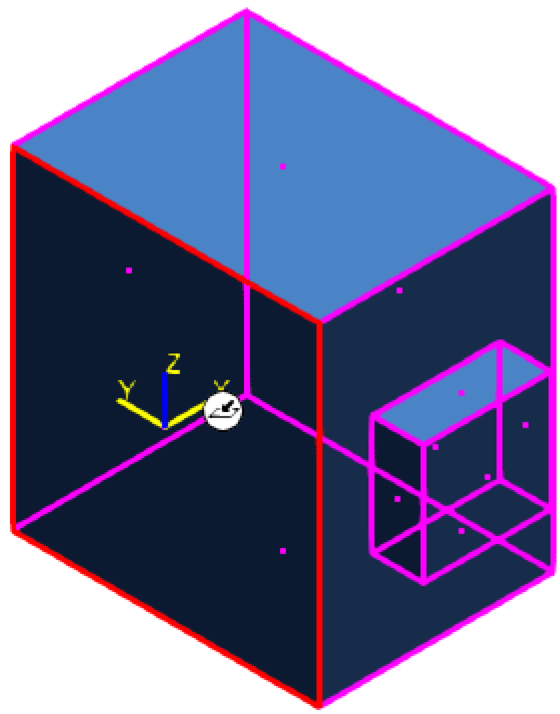
19. Click **OK** to close the Shape Properties dialog box.
20. Select **Connect** in the positioning relationships drop-down list on the shape ribbon.

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.



22. Click in the graphic view to place the shape in the model.

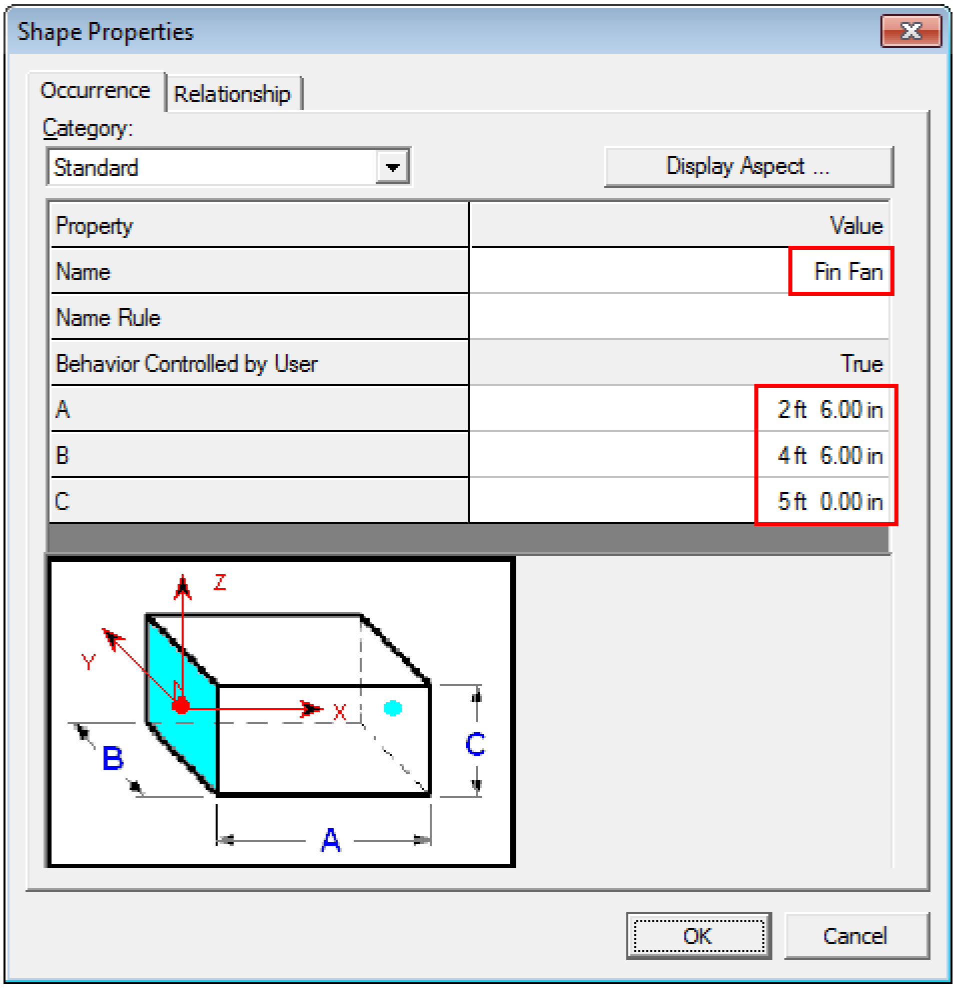
The designed equipment is shown.



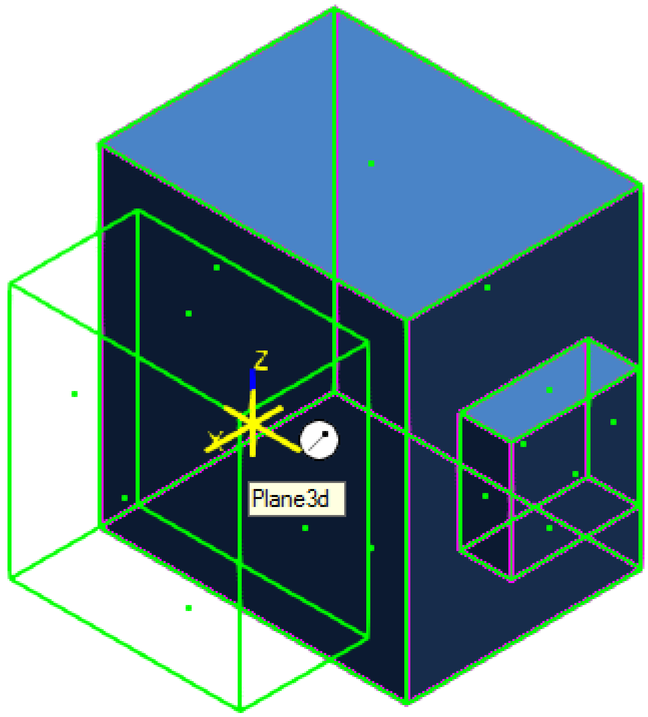
23. Click Place Shape and select the SolidRectangular 001 on the shape palette.

    The Shape Properties dialog box opens.

24. 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.

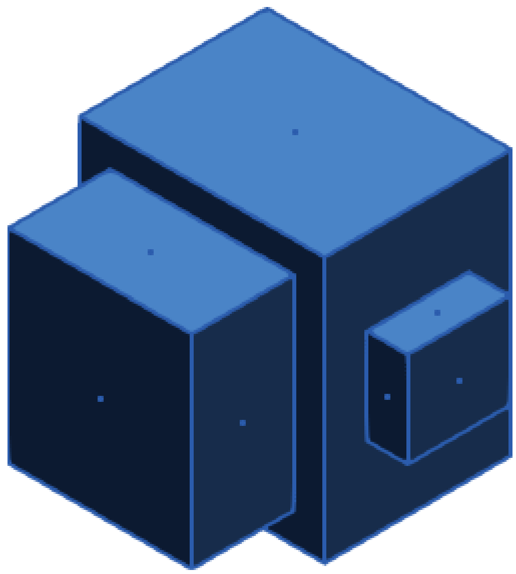


25. Use the arrow key to rotate the shape so that the shape x axis is facing West. Move the cursor and locate the center point on the west face of the transformer body.



26. Click in the graphic view to place the shape in the model.

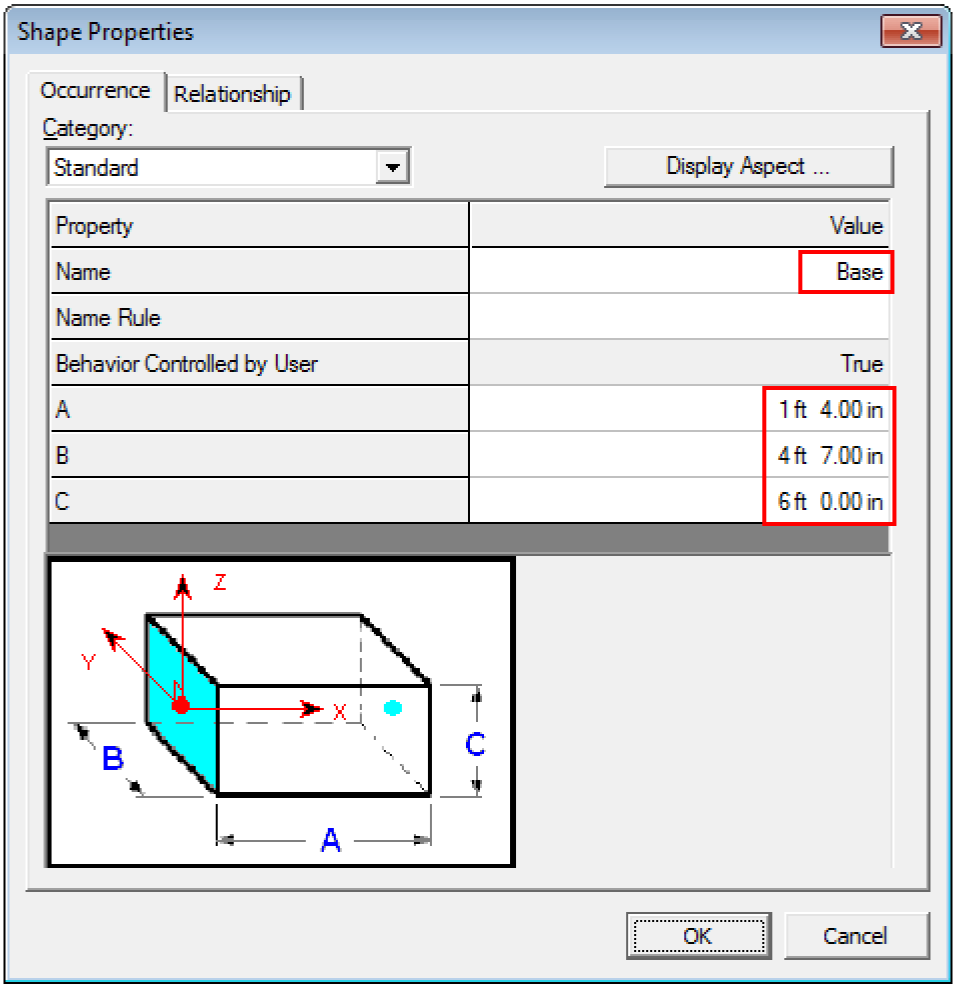
The designed equipment is shown.



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

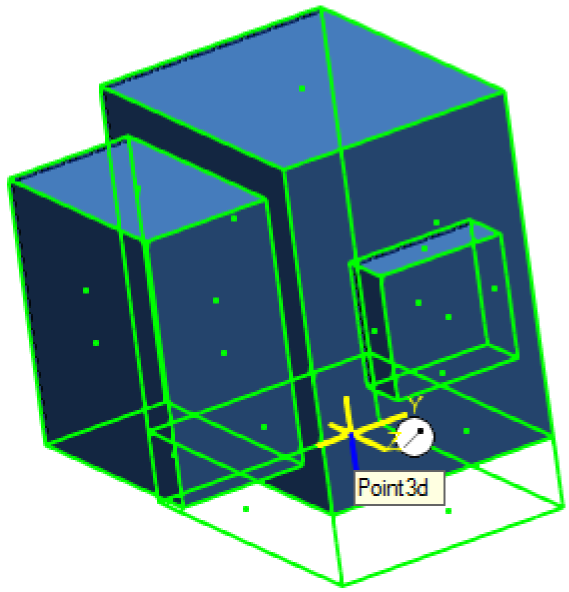
    The Shape Properties dialog box opens.

28. 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.



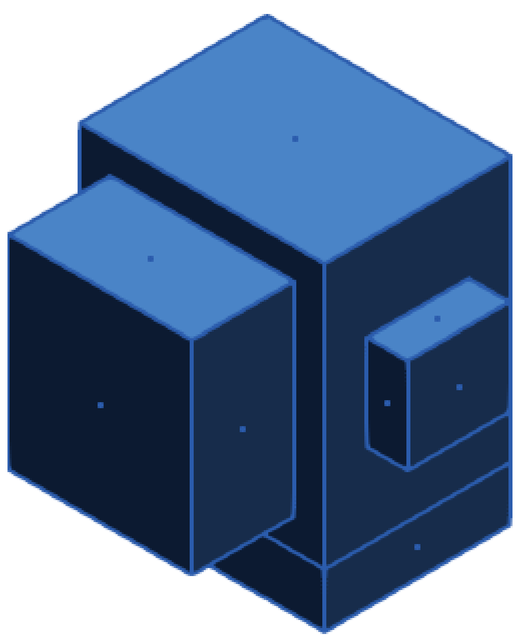
29. Use the arrow key to rotate the shape so that the shape x-axis is facing down.

30. Move the cursor and locate the center point on the bottom face of the transformer body. You may have to rotate the view to clearly locate this point. 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.



31. Click in the graphic view to place the shape in the model.

    The designed equipment should look like this.



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

- *Placing Electrical Equipment by Positioning Relationships* (on page 30)
- Equipment Properties Dialog Box topic of the EquipmentUsersGuide.pdf.
- Place Equipment from the Catalog topic in the user guide ElectricalUserGuide.pdf.

Placing Electrical Equipment (Advanced)

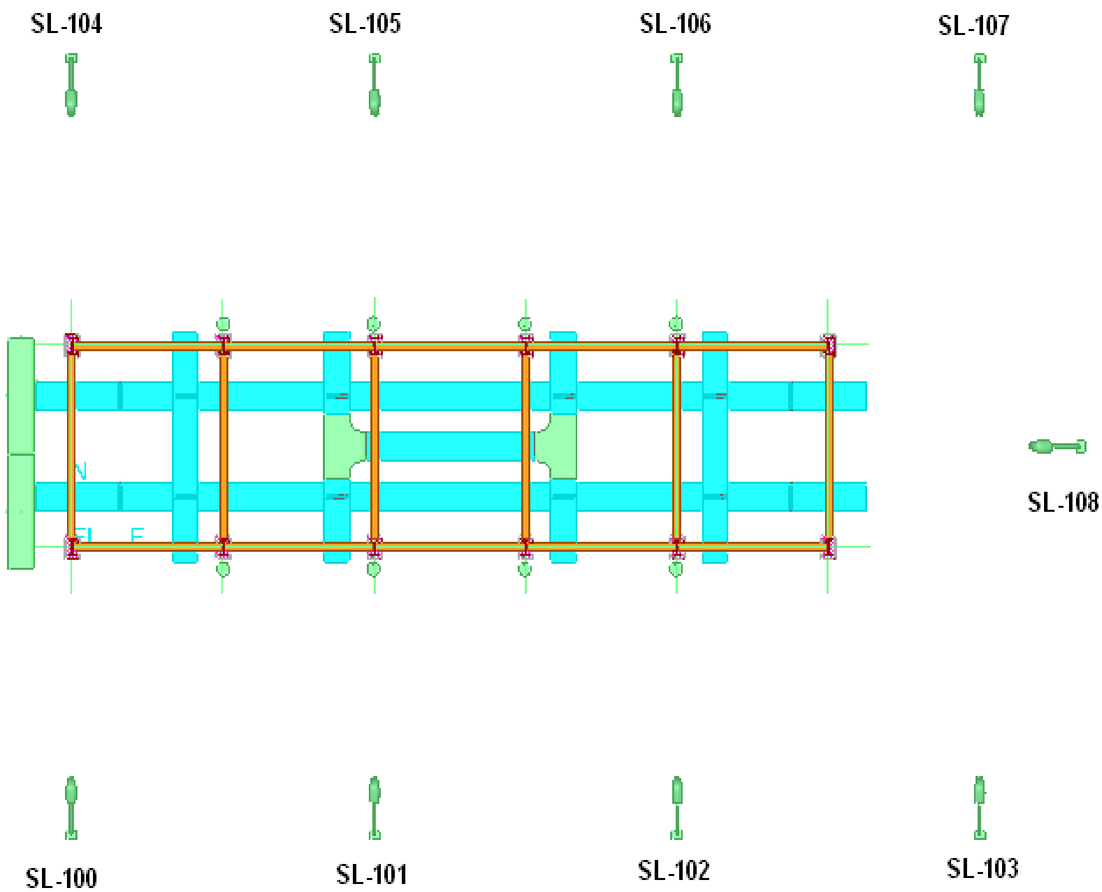
Objective

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

- Select electrical equipment from the catalog for placement
- Position and orient electrical equipment in a model using PinPoint and other positioning methods

Overview

In this exercise you will be placing street lighting fixtures by using the **Place Equipment** command in Unit U07. The workspace will resemble as shown below.



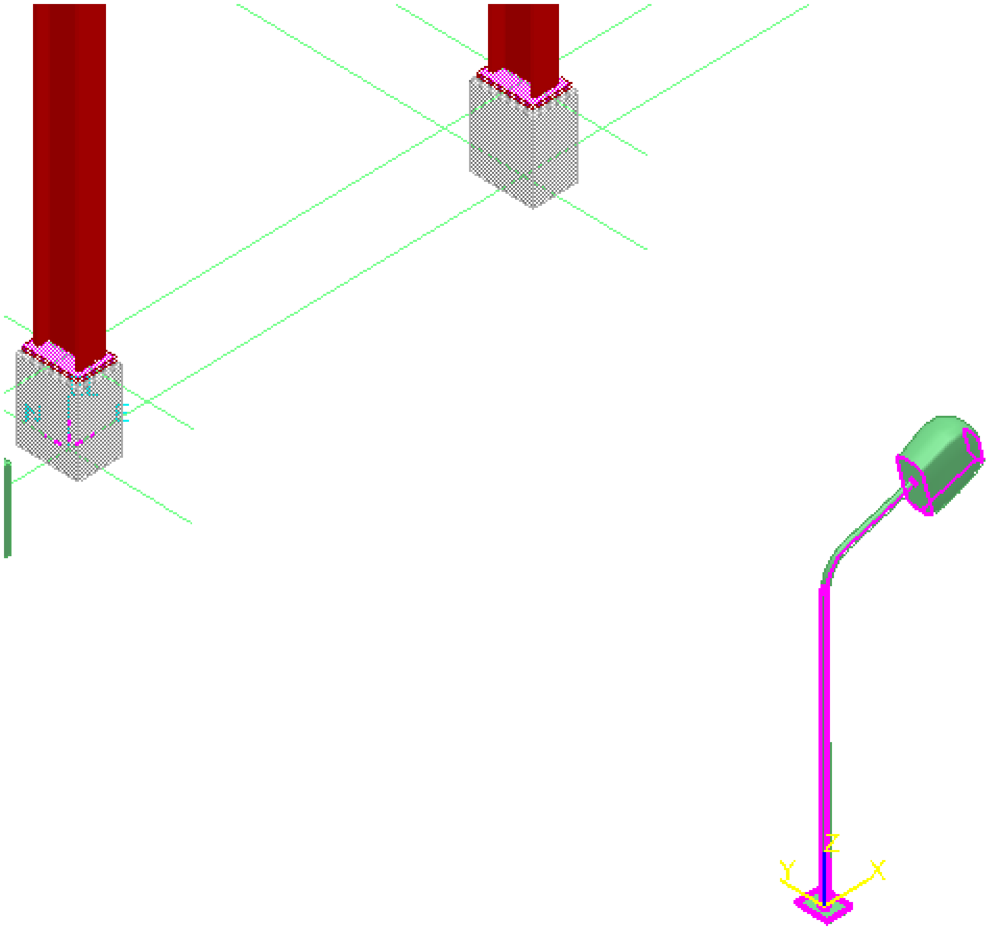
Before you start placing the equipments define your workspace to show Unit U07.

1. Select the **Tasks > Equipment** command.
2. Make sure the **Active Permission Group** is set to **Electrical**.

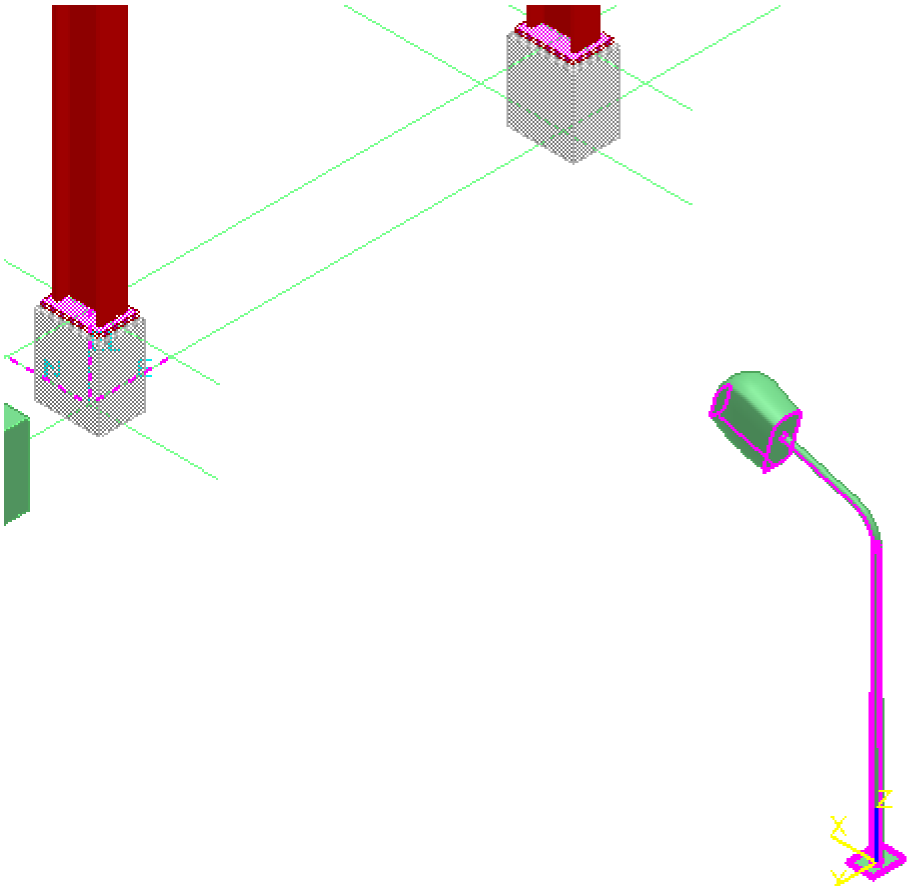
3. Activate the **PinPoint** ribbon and set the active coordinate system to **U07 CS** on the **PinPoint** ribbon.
4. Click **Set Target to Origin**  option on the PinPoint ribbon, to move the target to the origin of the current coordinate system.
5. Click **Place Equipment**  on the vertical toolbar.
6. In the **Select Equipment** dialog box, expand the folder \Equipment\Electrical\Lighting\Street Light Fixture until you see the part StreetLight-E. Select the part, and click **OK**.

   The Equipment Properties dialog box appears.
7. Key-in SL-100 in the **Name** field.
8. Click the **System** field and select **More..** to specify the system to which the equipment belongs.
9. Select **CT System** under **A2->U07->Electrical->Low Voltage**. Then, click **OK**.
10. To define the position of the object, select the **Position and Orientation** category in the **Category** drop-down list.
11. Key in the followings properties:
    - East: -0 ft 0.78 in
    - North: -20 ft
    - Elevation: 0 ft
12. To change the height of the light pole, select the **Equipment Dimensions** category in the **Category** drop-down list.
13. Key in a value of 26 ft 3 in for A - Pole Height.

14. Click **OK** on the **Equipment Properties** dialog to place the equipment SL-100 in the model.



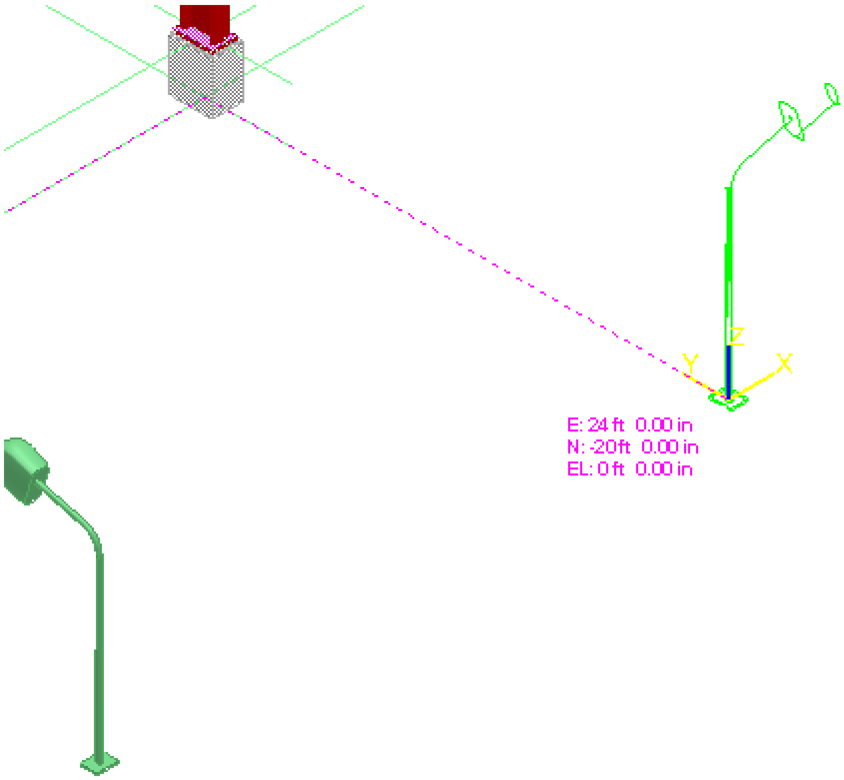
15. Rotate the equipment to the indicated orientation (street light source pointing North) by using the left/right arrow keys.



16. Click **Place Equipment**  on the vertical toolbar.
17. In the Select Equipment dialog box, expand the folder **\Equipment\Electrical\Lighting\Street Light Fixture** until you see the part **StreetLight-E**. Select the part, and click **OK**.

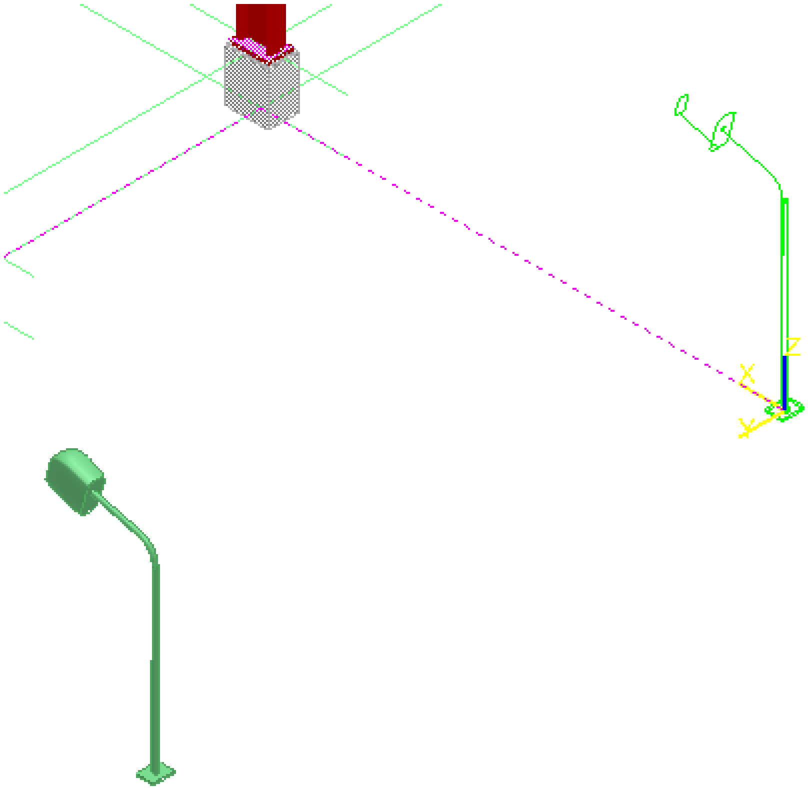
    The Equipment Properties dialog box appears.
18. Key-in SL-101 in the **Name** field.
19. Click the **System** field and select the **More..** option to specify the system to which the equipment belongs.
20. Select **CT System** under **A2->U07->Electrical->Low Voltage**. Then, click **OK**.
21. To change the height of the light pole, select the **Equipment Dimensions** category in the **Category** drop-down list.
22. Key in a value of 26 ft 3 in for **A - Pole Height**. Then click **OK**.
23. Key in the following coordinates on the **PinPoint** ribbon.
    - E: 24 ft

- N: -20 ft
- EL: 0 ft

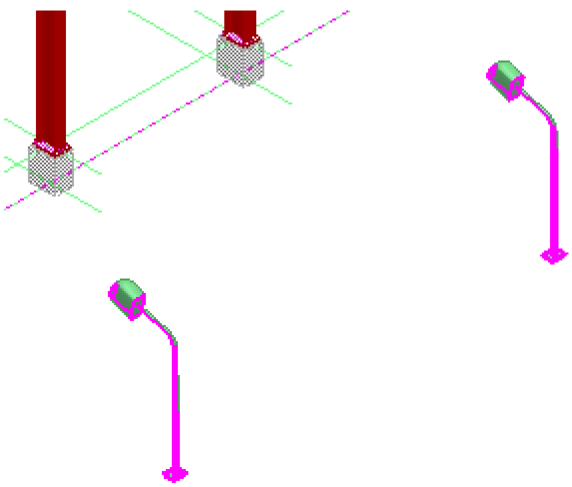

Y
Z
X
E: 24 ft 0.00 in
N: -20ft 0.00 in
EL: 0 ft 0.00 in


E:
24 ft 0.00 in
N:
-20 ft 0.00 in
El:
0 ft 0.00 in

24. Equipment can be rotated while still in the dynamic mode by using the keyboard LEFT and RIGHT arrow keys. Rotate the equipment to the indicated orientation (street light source pointing North) by using the left/right arrow keys.



25. Click in the active view to place the street lighting fixture.
26. Select the two street lighting fixtures from the graphic view that you need to copy.



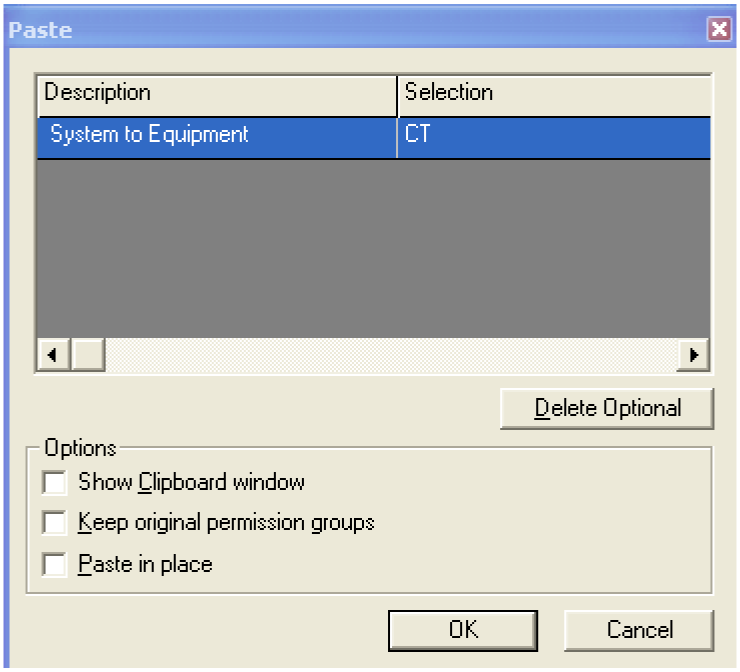
27. Click **Copy**  on the Common toolbar.

28. Select the origin of the fist street lighting fixture from the graphic view to define the position from where to copy the street lighting fixtures.

29. Click **Paste**  on the Common toolbar.

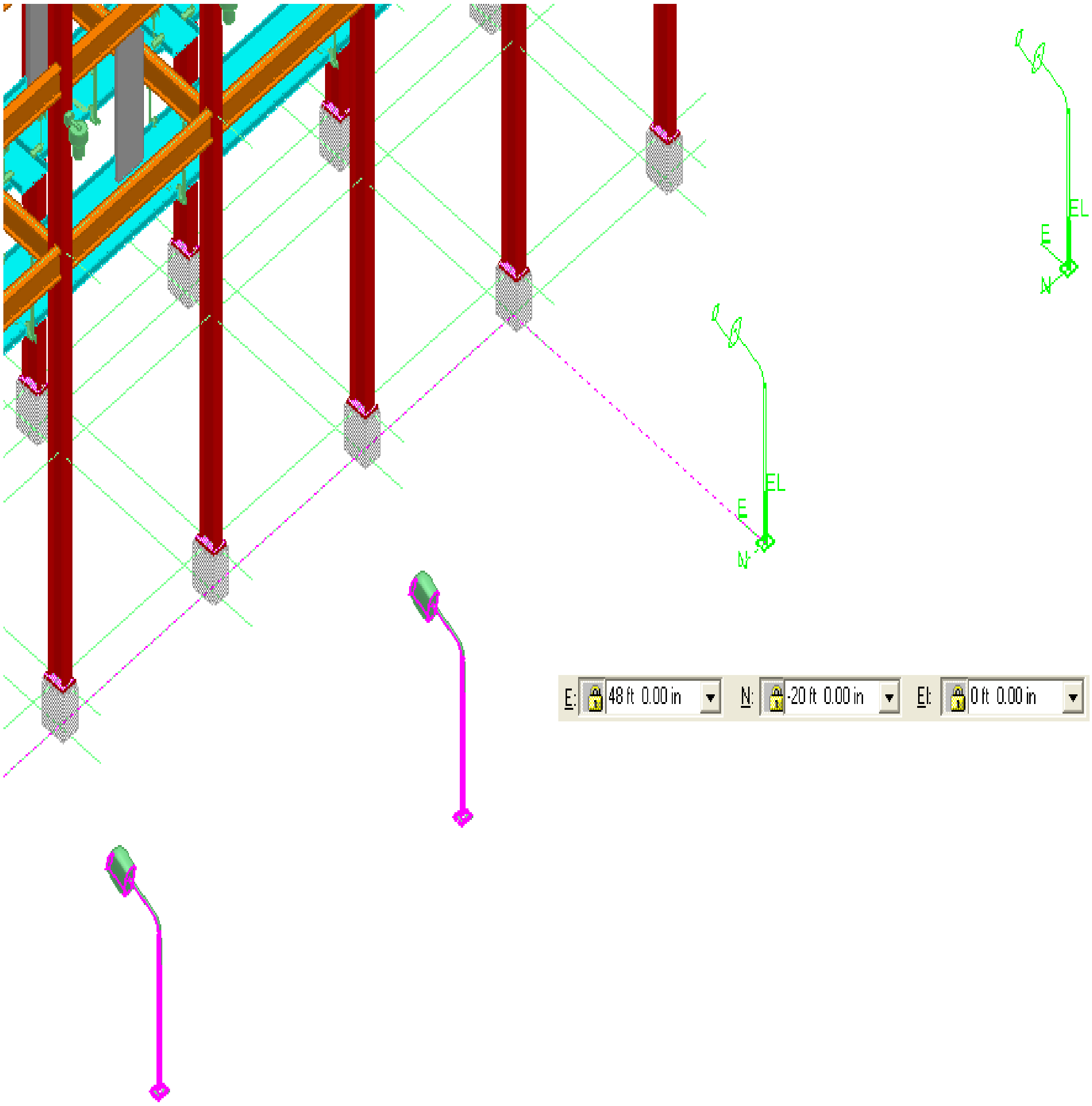
    The Paste dialog box appears.

30. Keep the default parent system for the new objects to be pasted on the model. Clear the **Paste in place** check box in the **Paste** dialog box and click **OK**.



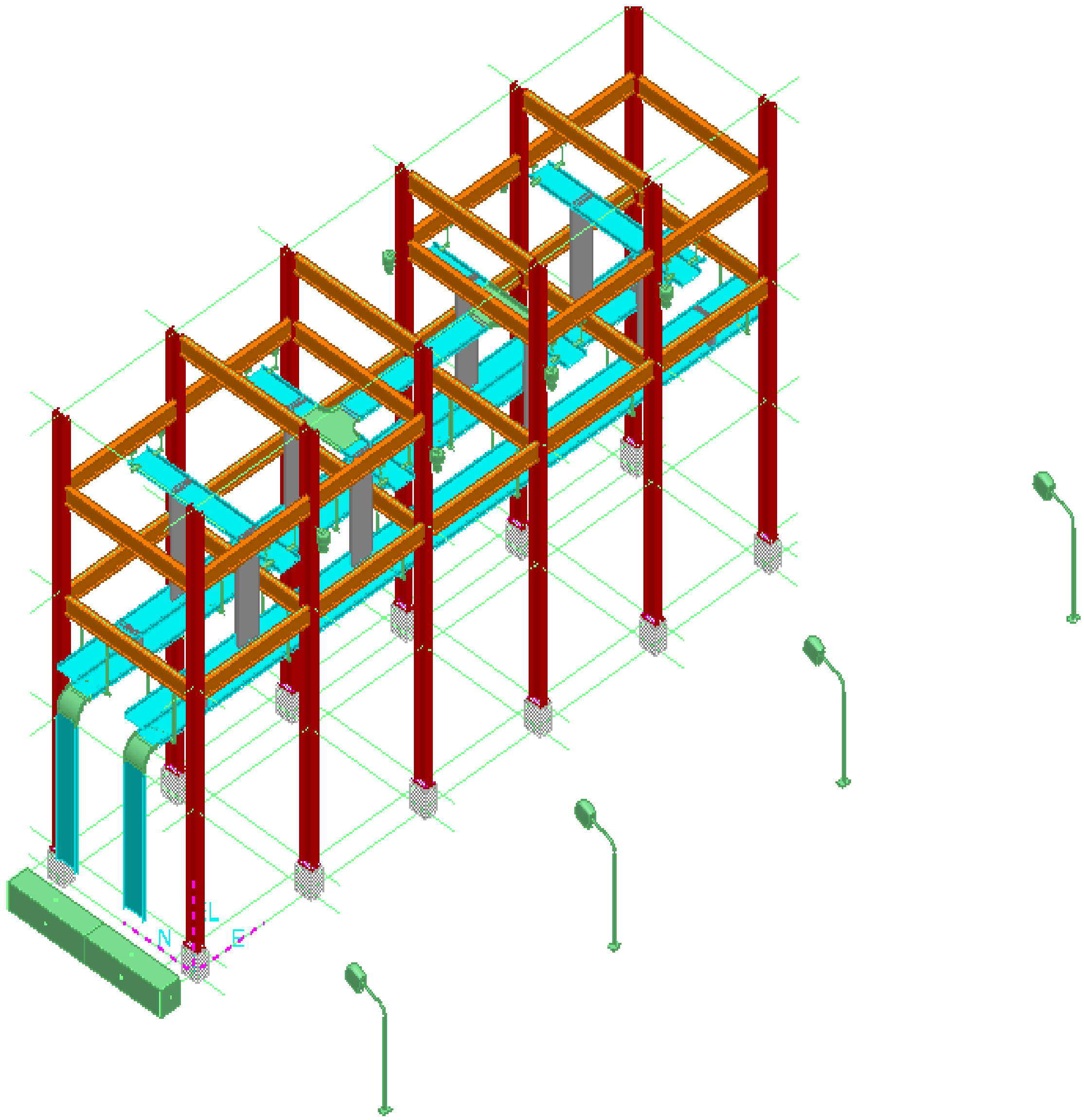
31. Key in the following coordinates on the **PinPoint** ribbon.
    - E: 48 ft
    - N: -20 ft

- El: 0 ft

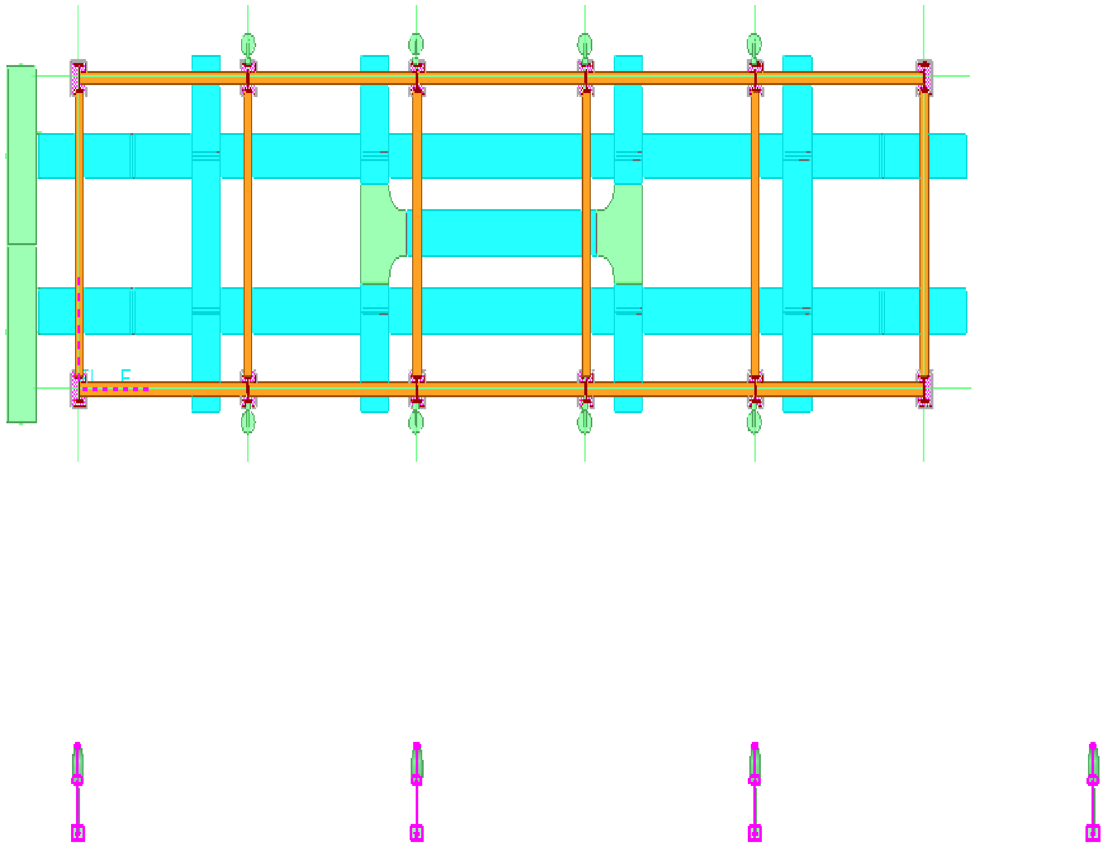


32. Click in the active view to place these street lighting fixtures.

33. Name these street lighting fixtures as SL-102 and SL-103 respectively.



34. Select the four street lighting fixtures from the graphic view that you need to mirror copy.

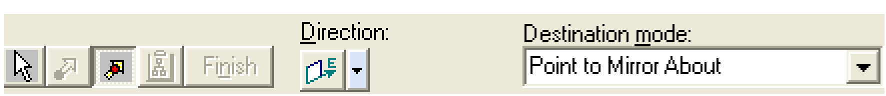


35. Select **Edit > Mirror Copy** to mirror copy the selected objects from the graphic view.

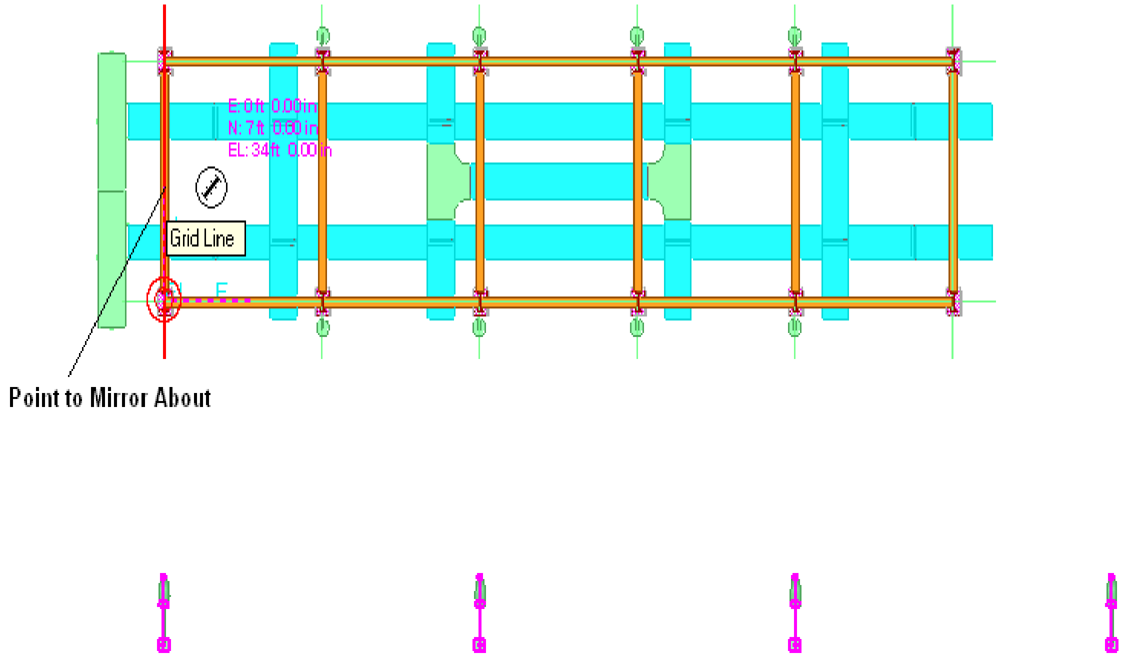
    The Mirror Copy ribbon appears.

36. In this ribbon define the mirror plane and the **Point to Mirror About** in which the selected objects are mirrored.

37. Select the **East-West** option in the **Direction** drop-down list and **Point to Mirror About** as the Destination mode.

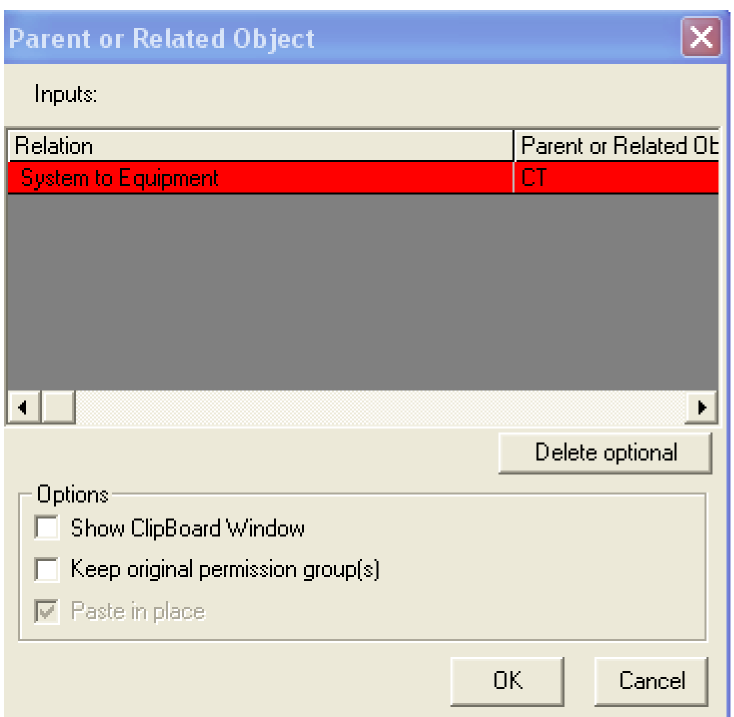


38. Select the midpoint of the beam as the **Point to Mirror About**.



The Parent or Related Object dialog box appears.

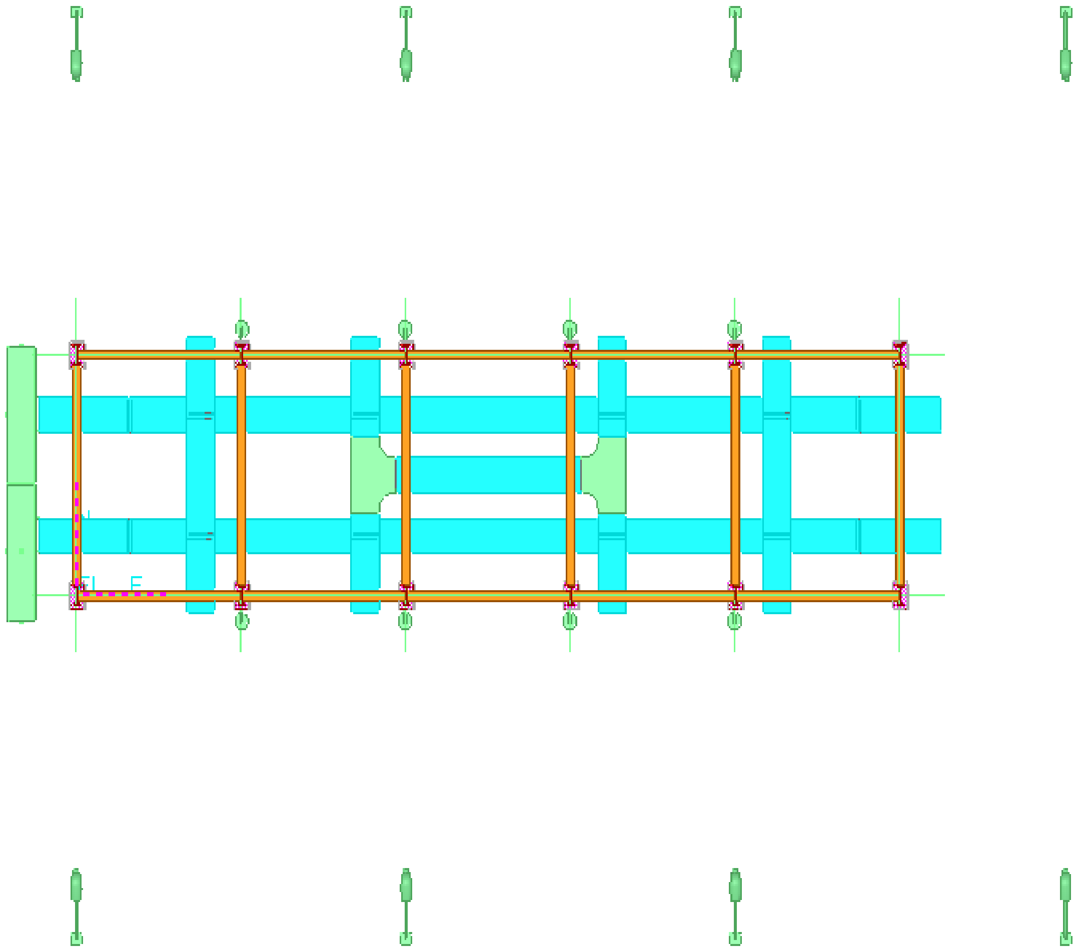
39. Keep the parent system for the equipments from where they have been copied, and click **OK**.



The mirrored objects appear in dynamic mode in the graphic view.

40. Click **Finish** on the **Mirror Copy** ribbon.

    The mirrored objects will appear in the graphic view.

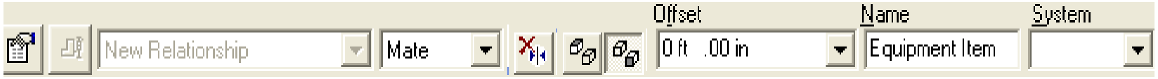


41. Name these street lighting fixtures as SL-104, SL-105, SL-106 and SL-107 respectively.
42. Click **Place Equipment**  on the vertical toolbar.
43. In the **Select Equipment** dialog box, expand the folder **\Equipment\Electrical\Lighting\Street Light Fixture** until you see the part **StreetLight-E**. Select the part, and click **OK**.

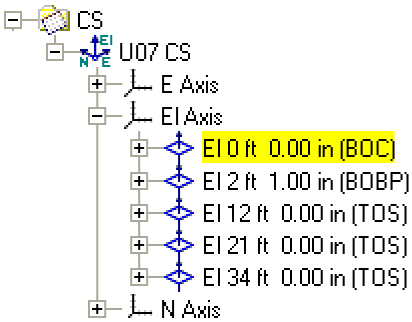
    The Equipment Properties dialog box appears.

44. Key-in SL-108 in the **Name** field.
45. Click the **System** field and select the **More..** option to specify the system to which the equipment belongs.
46. Select **CT System** under **A2->U07->Electrical->Low Voltage**. Then, click **OK**.

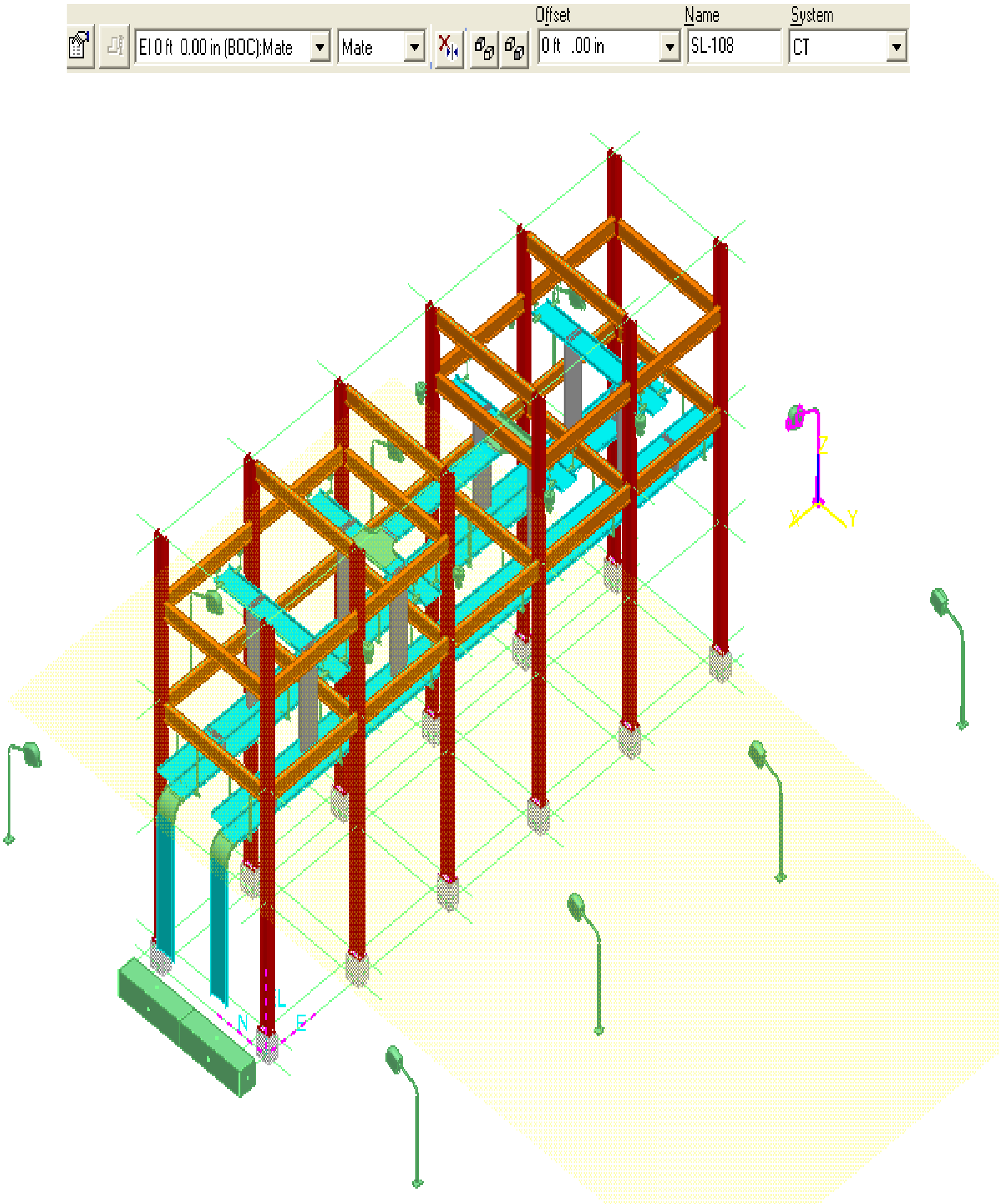
47. On the PinPoint ribbon, key-in 80 ft for East and 7 ft for North.
48. On the **Equipment** ribbon, make sure the positional relation is set to **Mate**.



49. In the **Workspace Explorer**, expand **Coordinate System** and select **U07 CS -> EL Axis**.
50. Click EL-0'-0" to mate the street lighting fixture with elevation 0 ft.



51. Click in the graphic view to place the equipment.
52. Rotate the equipment to the indicated orientation (street light source pointing West) by using the left/right arrow keys.


Offset
Name
System
El 0 ft 0.00 in (BOC):Mate
Mate
0 ft .00 in
SL-108
CT

Routing a Cableway

Objective

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

- Route a cableway in Smart 3D

Prerequisite Sessions

- Smart 3D Overview
- Smart 3D Common Sessions
- *Electrical Overview* (on page 7)

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** command 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.

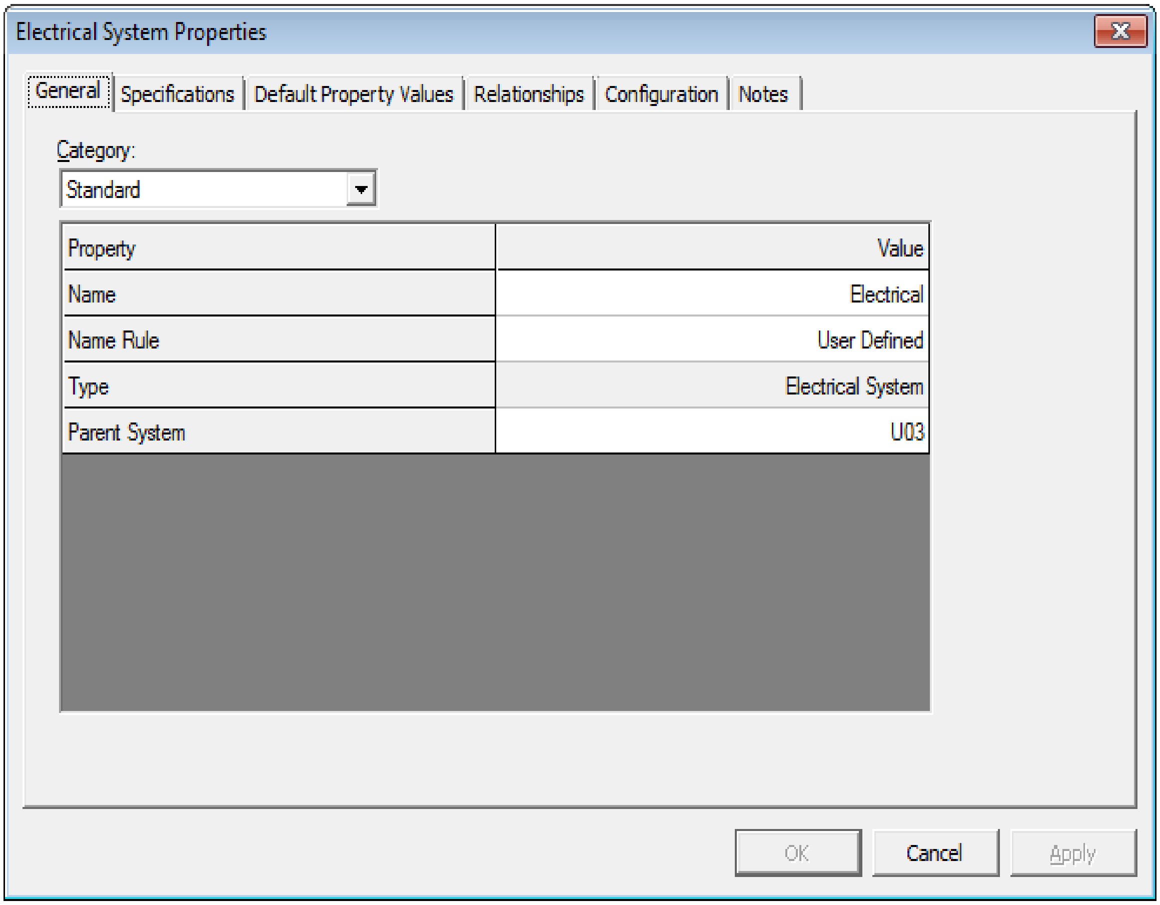
NOTE Specifications are defined in the reference data. You can create and customize the specifications to suit your requirements.

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.

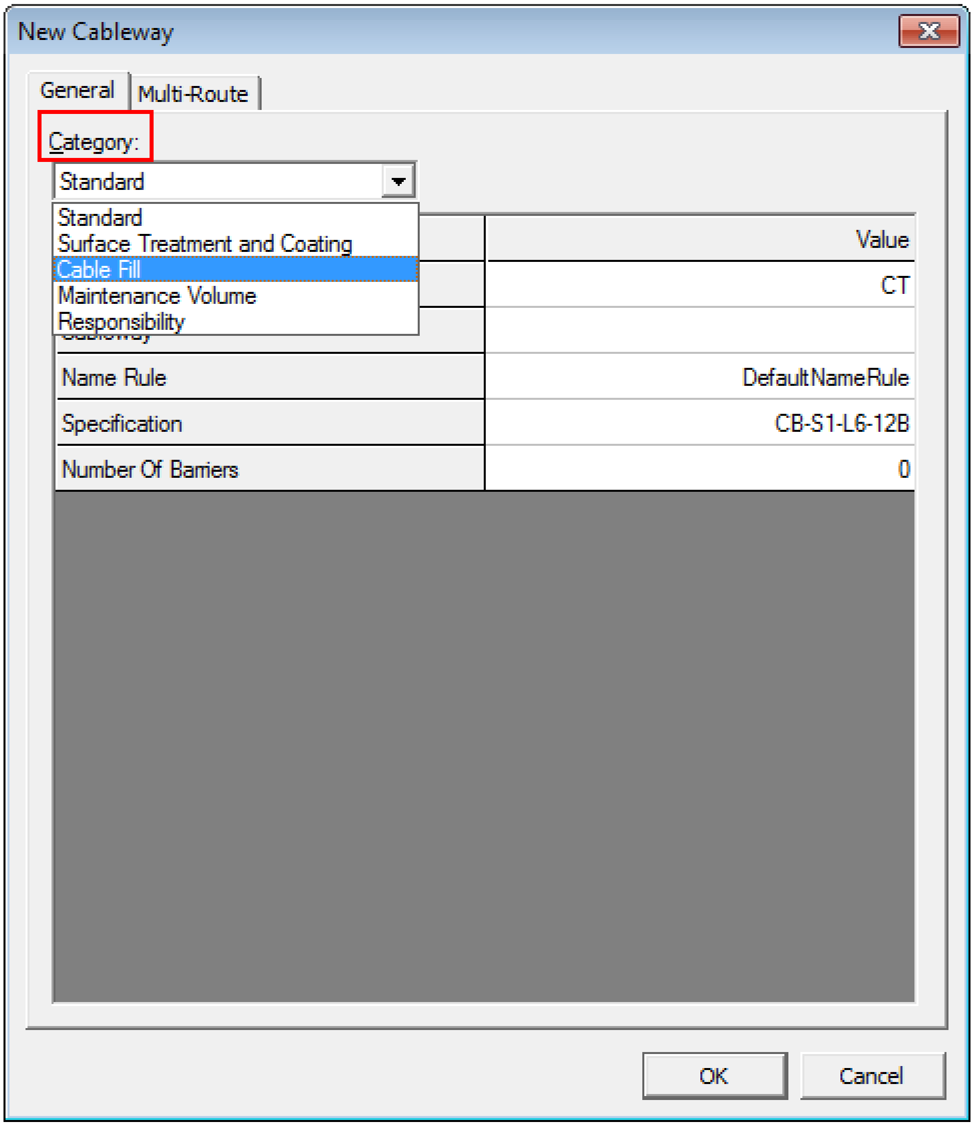
Default properties for the new cableway can come from any one of the following:

- The cableway to which you are connecting.
- The parent electrical system default properties defined in the **Systems and Specifications** task of Smart 3D.

If default properties are defined on an electrical system, Smart 3D uses them when you open the **New Cableway** dialog box. The Smart 3D 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.



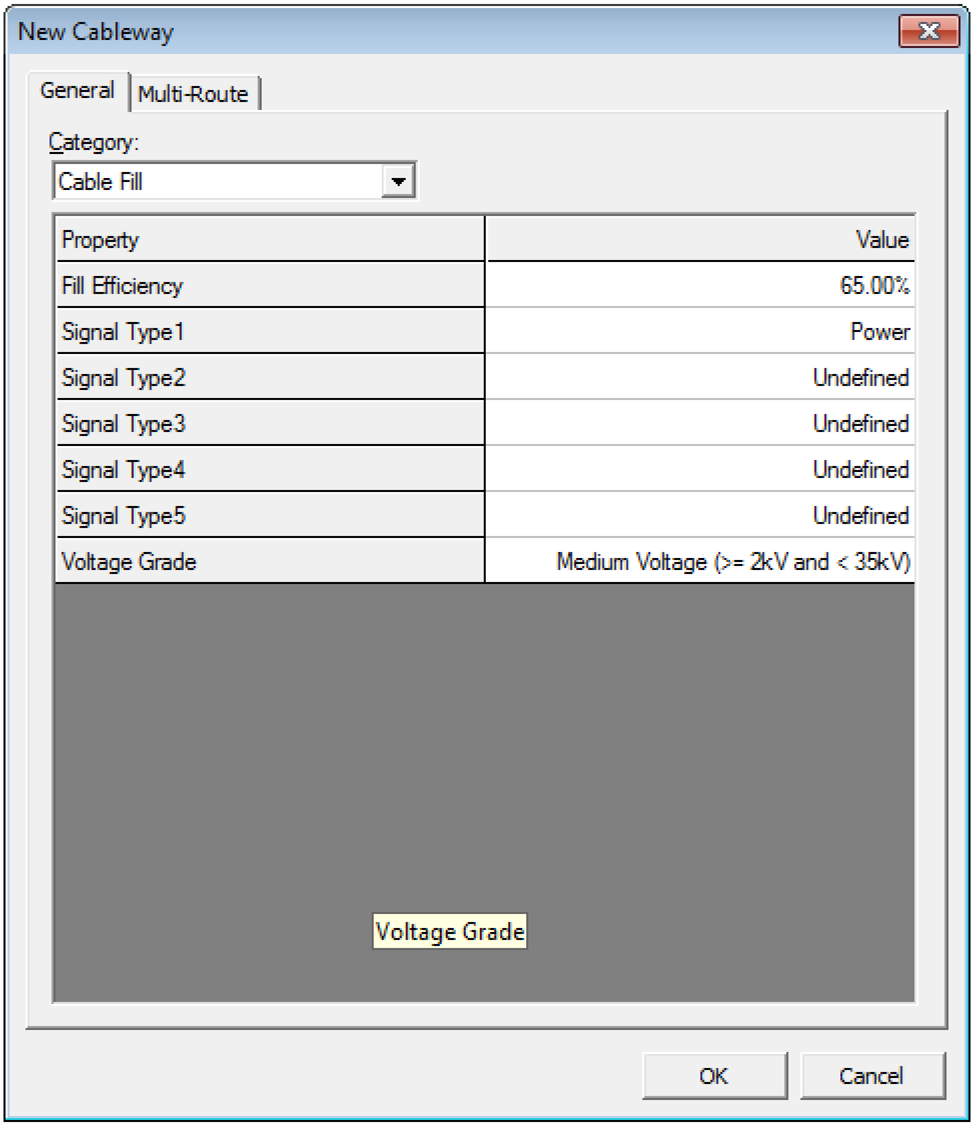
The **New Cableway** dialog box appears when the user creates a new cableway. You can view and make changes to the default properties of a cableway by using the **New Cableway** dialog box. You can select the category for which you want to define values by using the **Category** option.



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.



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

In the **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 below.

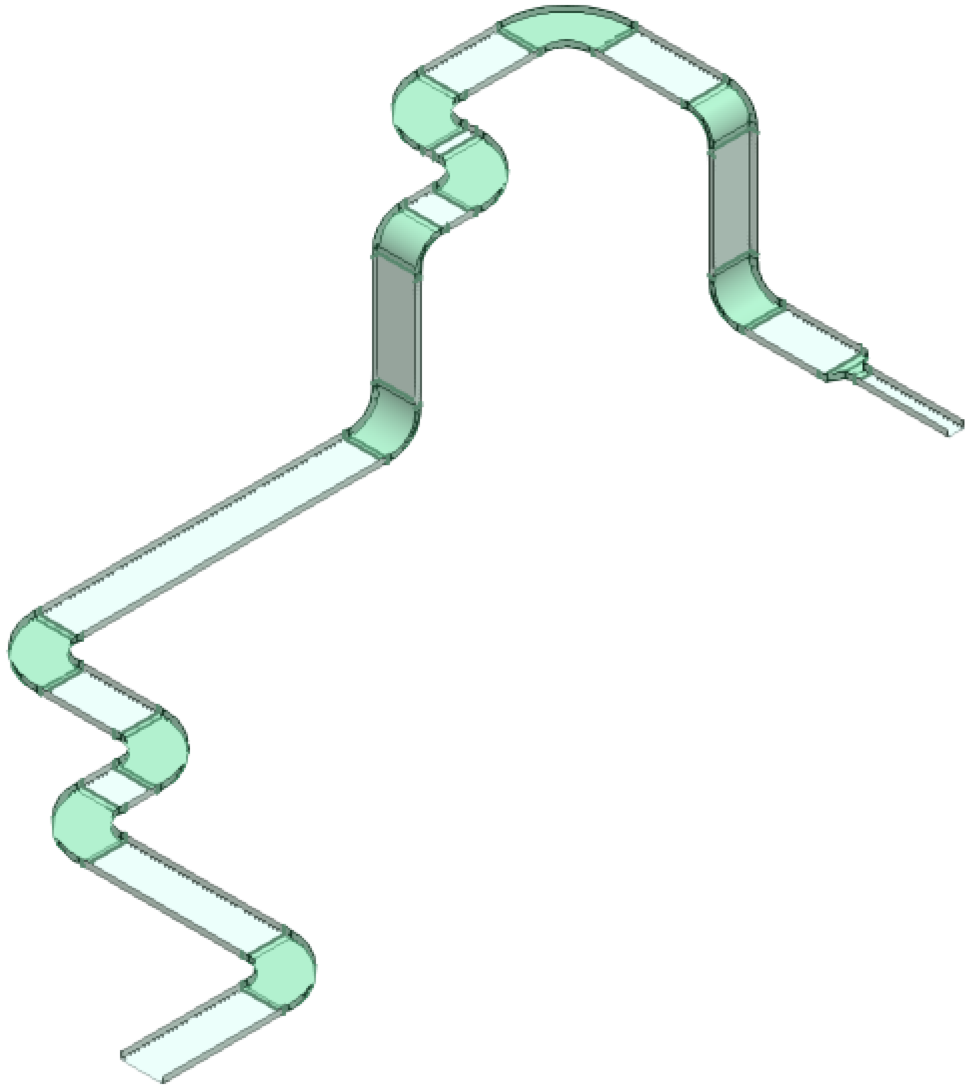
Set the following default properties of cableways before routing them:

Standard category:

System: CT
Name Rule: DefaultNameRule

Cable Fill category:

Fill Efficiency: 60%
Signal Type 1: Control

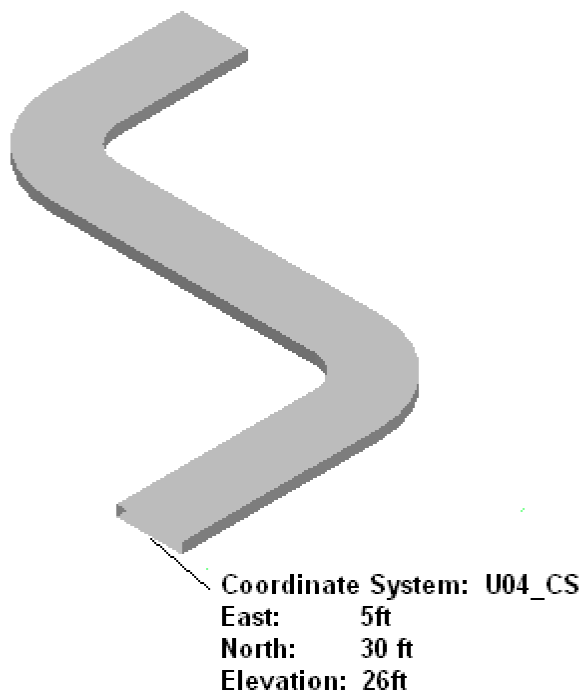


Cableway Routing with Non-Part Specifications

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

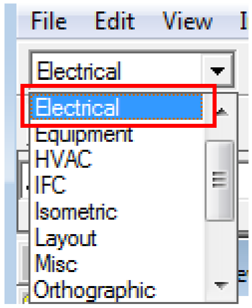
The routed cableway should resemble this.



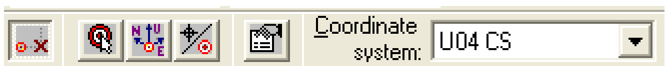
Before beginning the procedure:

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**.



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



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

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

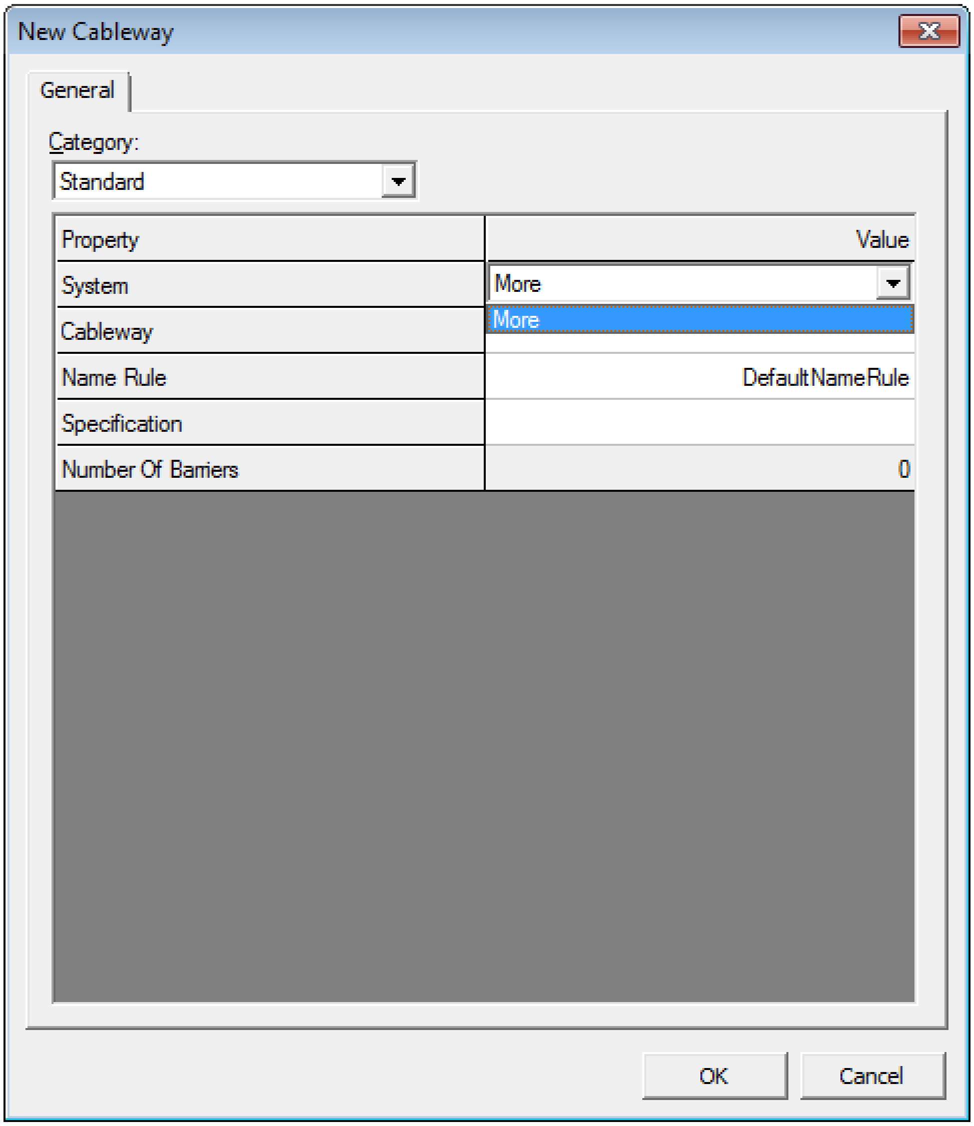
6. Key in the following coordinate specifications on the **PinPoint** ribbon and click in the graphic view:

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

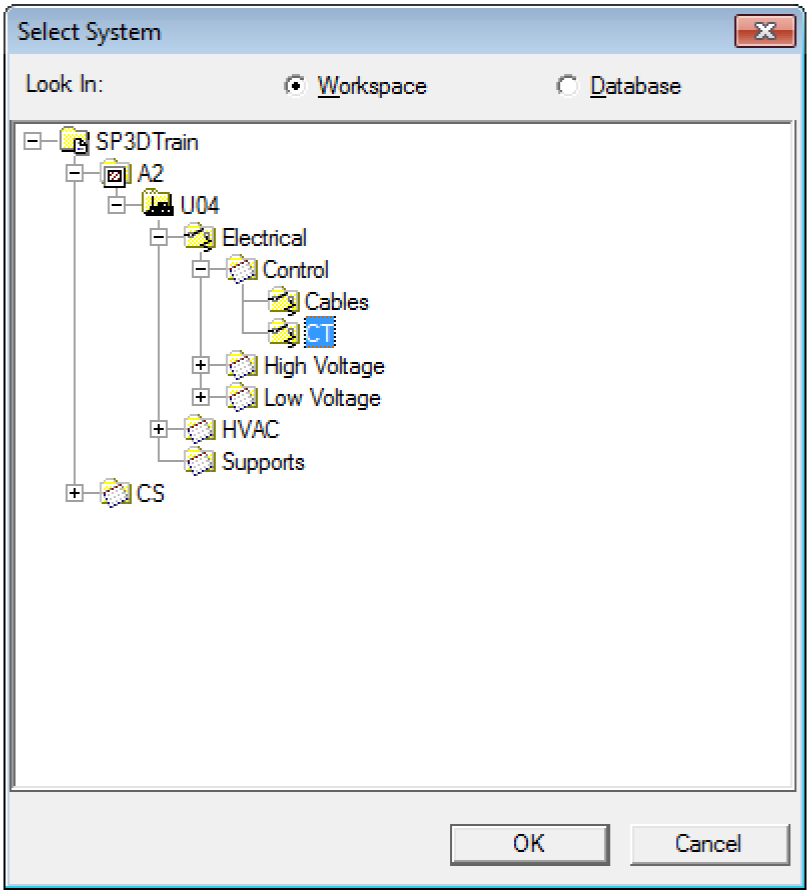
   

   The New Cableway dialog box appears.

7. Select the **More** option in the **System** drop-down list to specify the system where you want to place the cableway.



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

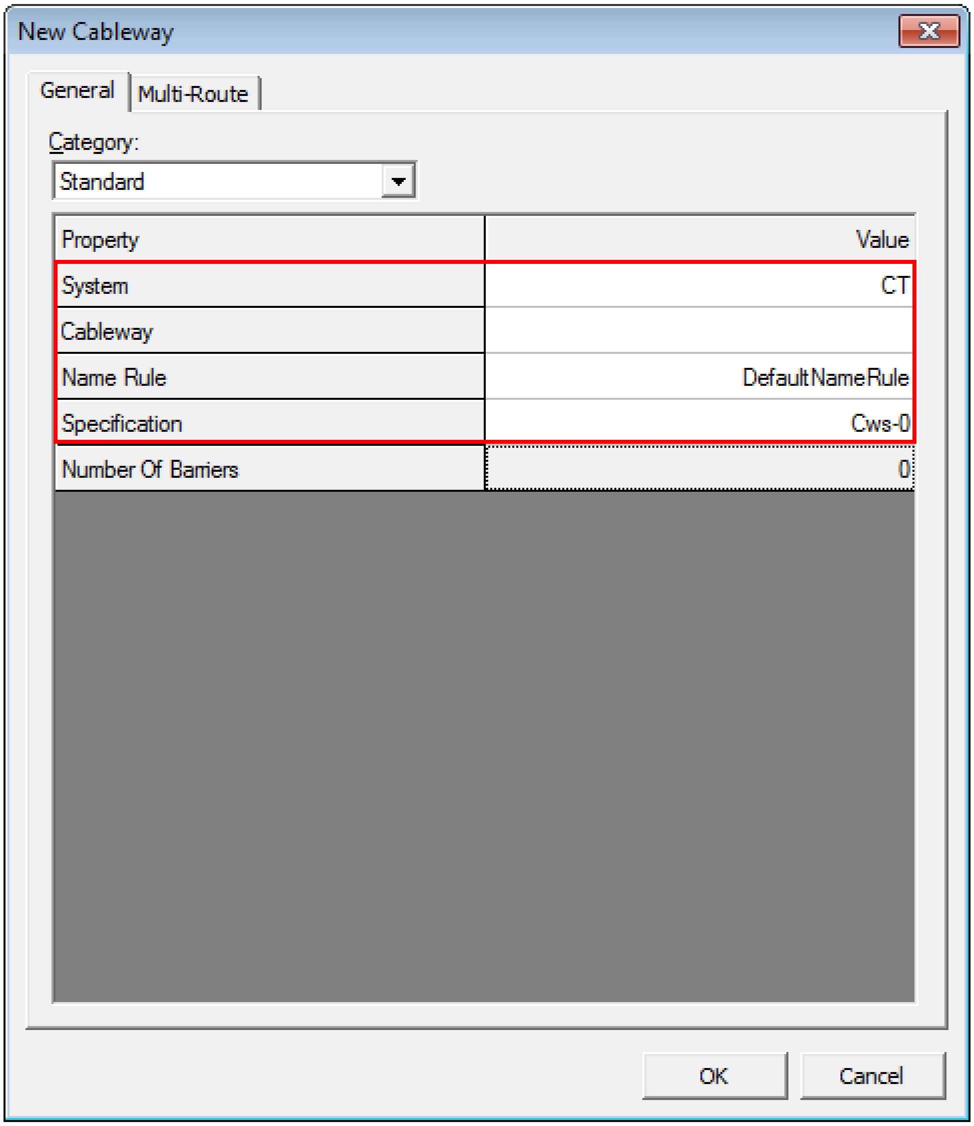


9. In the New Cableway dialog box, verify the following cableway specifications:

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

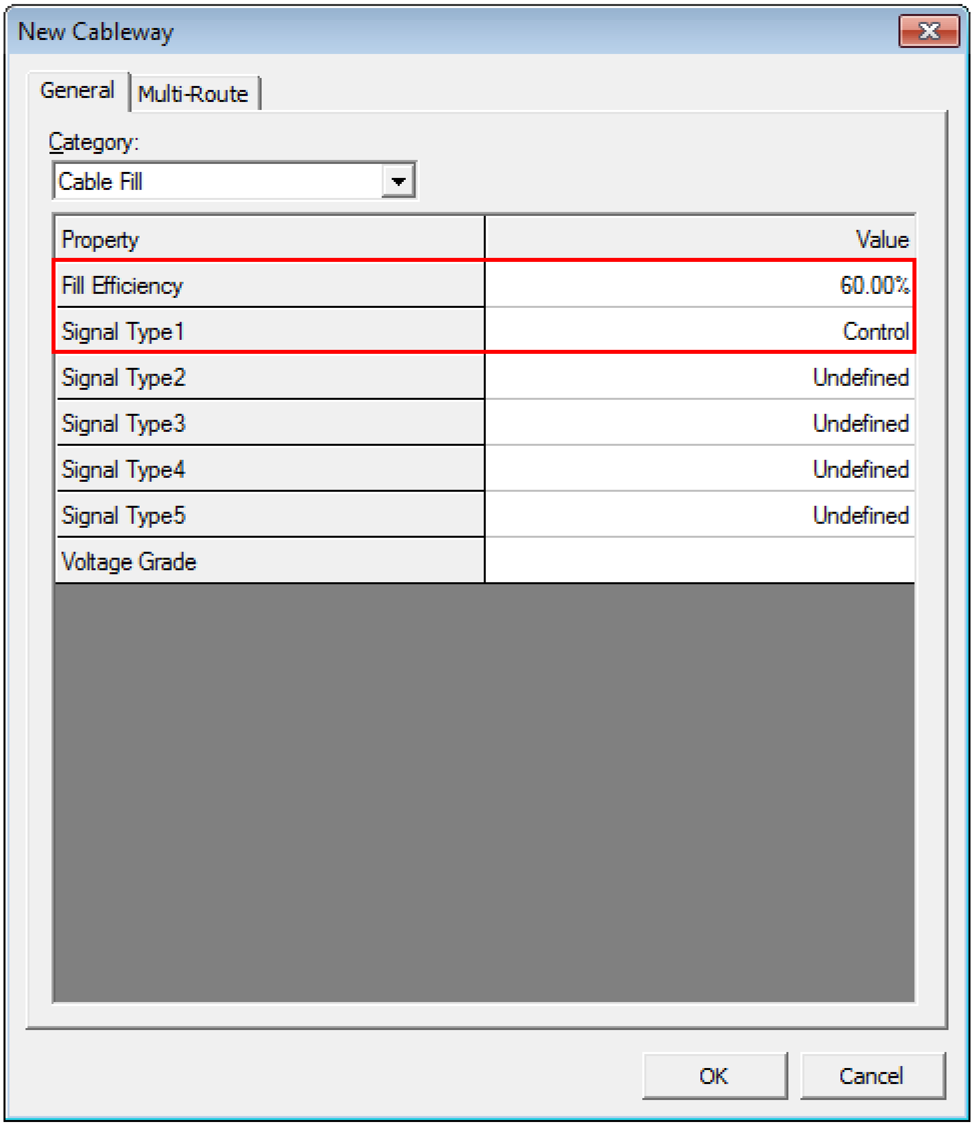
NOTES

- 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.



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

Fill Efficiency: 60%
Signal Type 1: Control



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

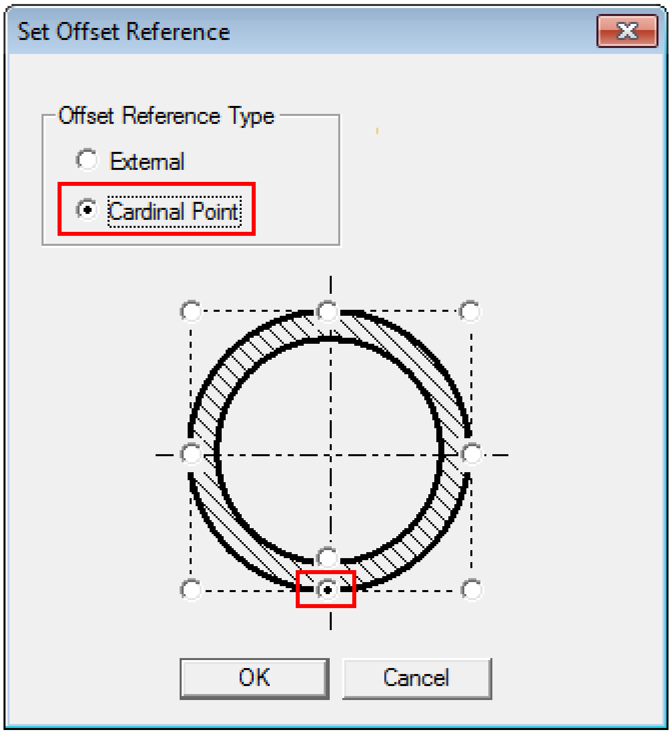
The **Offset** drop-down list on the **Route Cableway** ribbon displays an offset of the cableway surface from the working plane.

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



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.

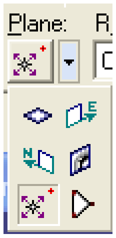
13. Select the **Rectangle** shape in the **Shapes** drop-down list and key in the following specifications on the **Route Cableway** ribbon to specify the width and depth of the cross section of the cableway:

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

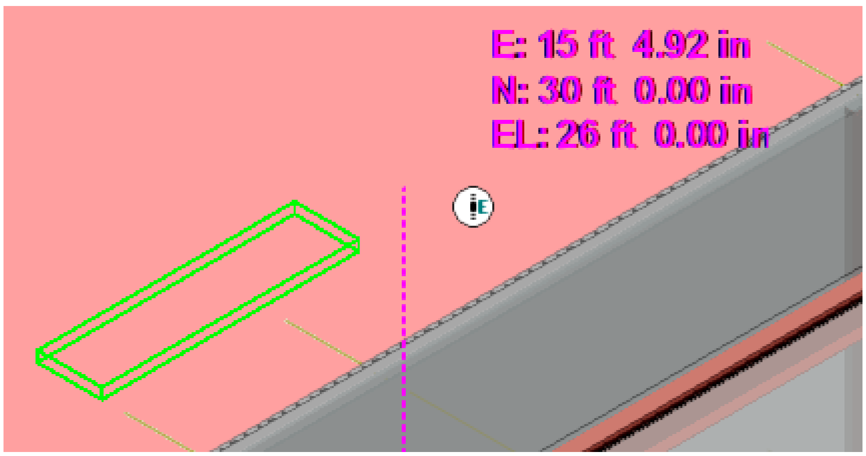
The Plane drop-down list on the Route Cableway ribbon activates options for selecting a working plane for the route path.

NOTE **Width** value must be greater than the depth value. Smart 3D displays 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.



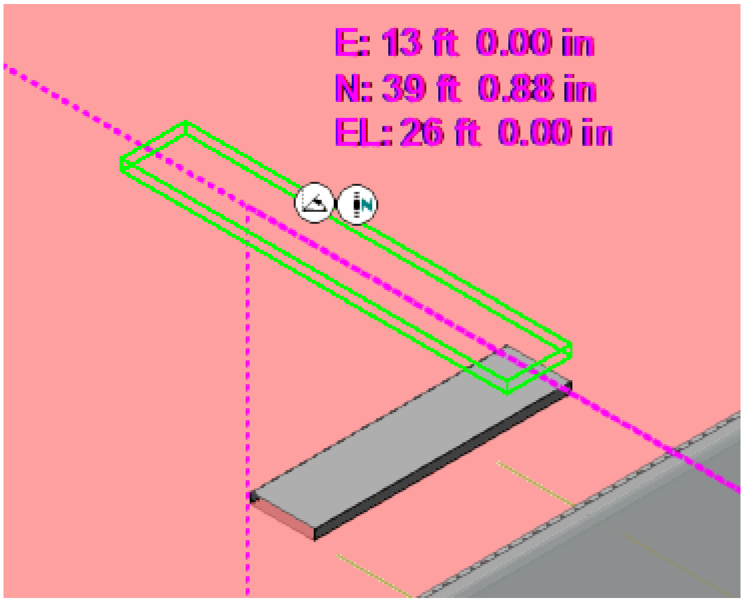
15. Position the cursor in the east **E** direction and click to define the end point to place 8 ft cableway, as shown below.



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

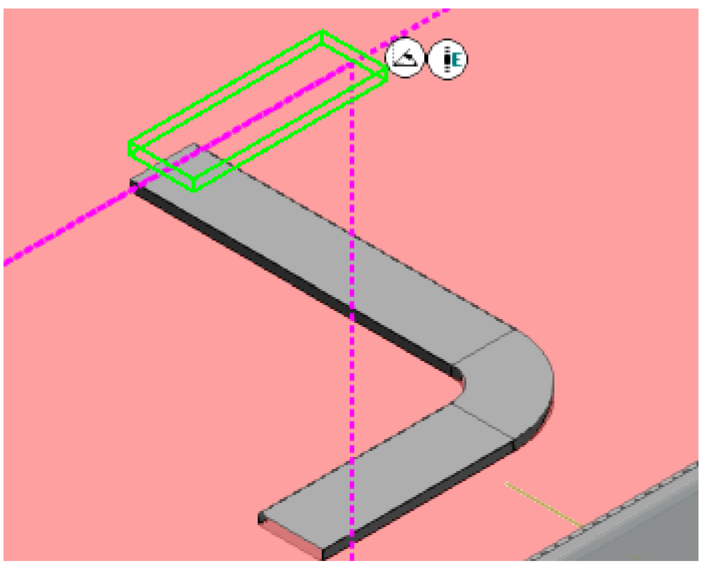
16. On the Route Cableway ribbon, key in 12 ft in the Length box.

17. Position the cursor in the north N direction and click to define the end point to place 12 ft cableway, as shown below.



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 a 6 ft cableway, as shown below.



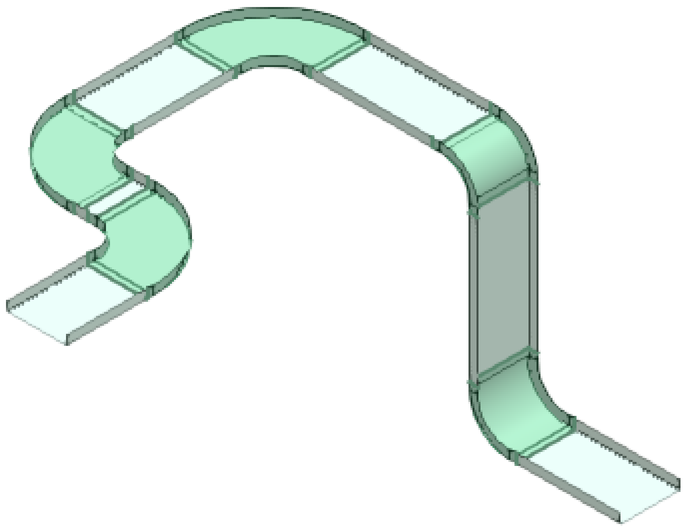
20. Right-click the graphic view to terminate the **Route Cableway** command.

Cableway Routing 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 below.



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**.
3. Activate the **PinPoint** ribbon and set the active coordinate system to **U04 CS** on the PinPoint ribbon.
4. Click **Set Target to Origin**  on the **PinPoint** ribbon, to move the target to the origin of the current coordinate system.
5. Click **Route Cableway**  on the vertical toolbar.
6. Key in the following coordinate specifications on the PinPoint ribbon and click in the graphic view:

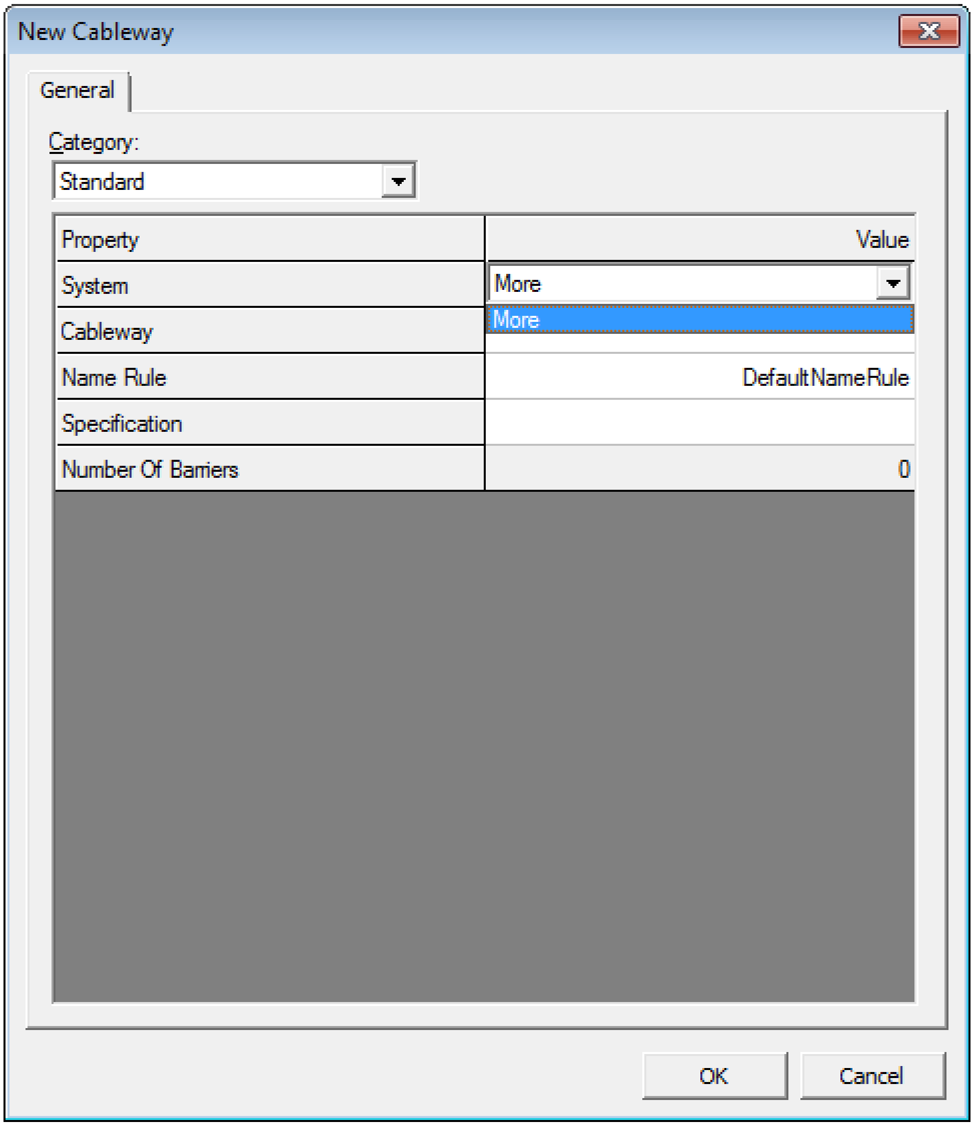
   E: 37 ft
   N: 50 ft
   El: 34 ft

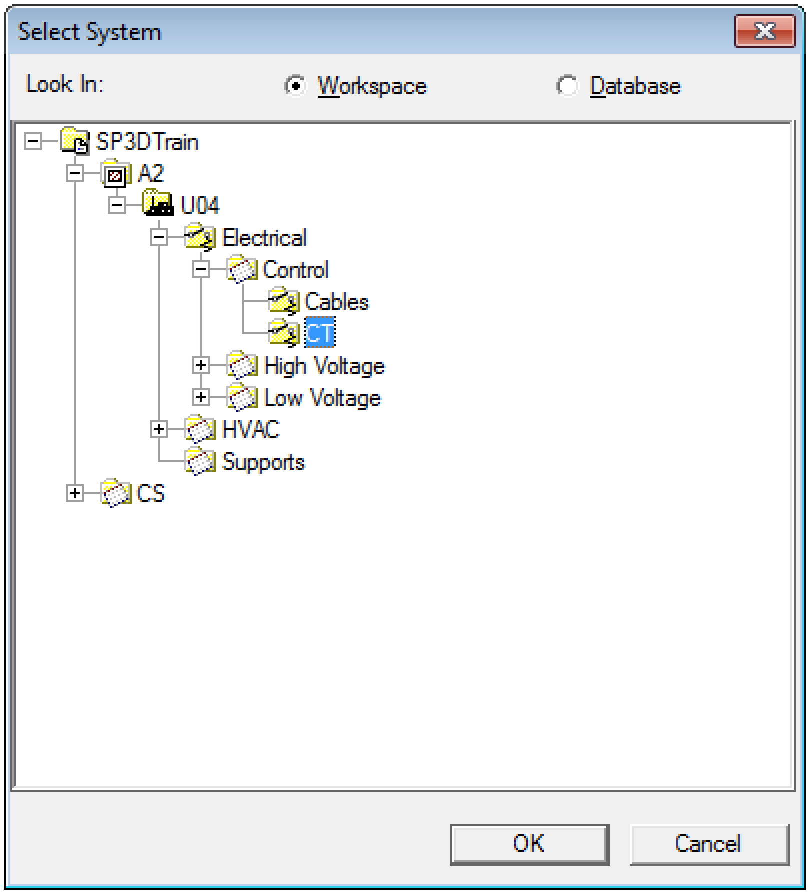
7. Click in the graphic view to accept the starting point.

   The New Cableway dialog box appears.

8. Select **More…** in the **System** drop-down list of the dialog box to specify the system where you want to place the cableway.



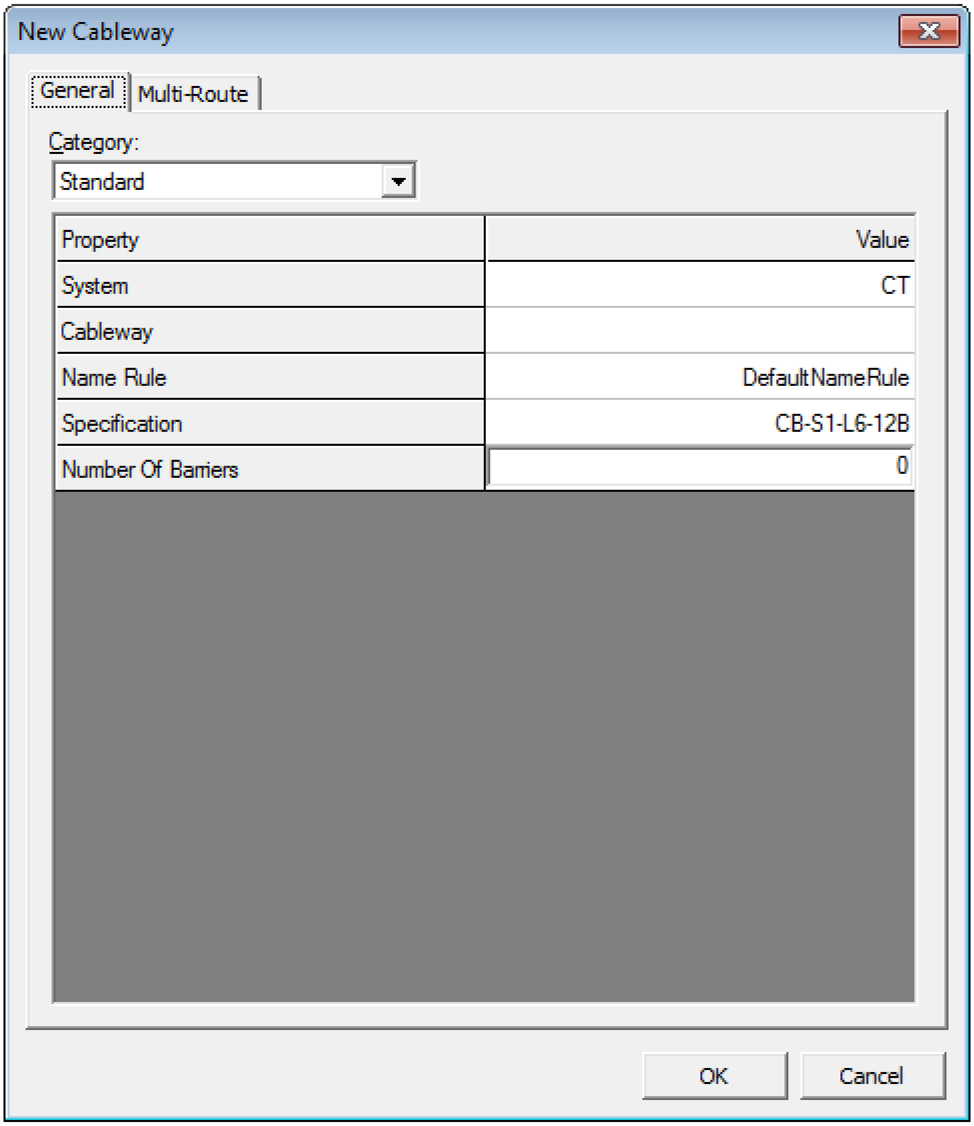
9. In the **Select System** dialog box, select **A2 > U04 > Electrical > Control > CT** and click **OK**.



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

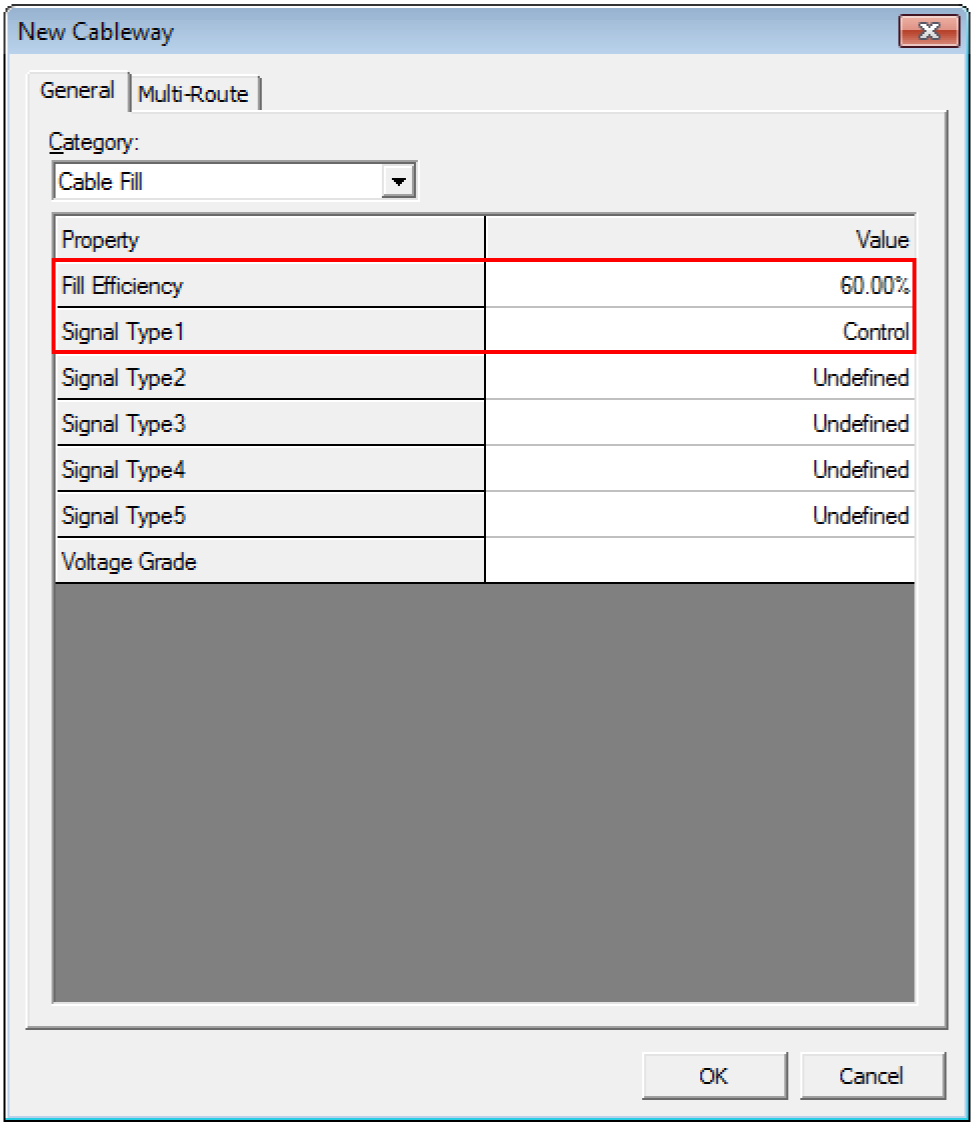
    System: CT
    Name Rule: DefaultNameRule
    Specification: CB-S1-L6-12B
    Number Of Barriers: 0

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.



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

Fill Efficiency: 60%
Signal Type 1: Control

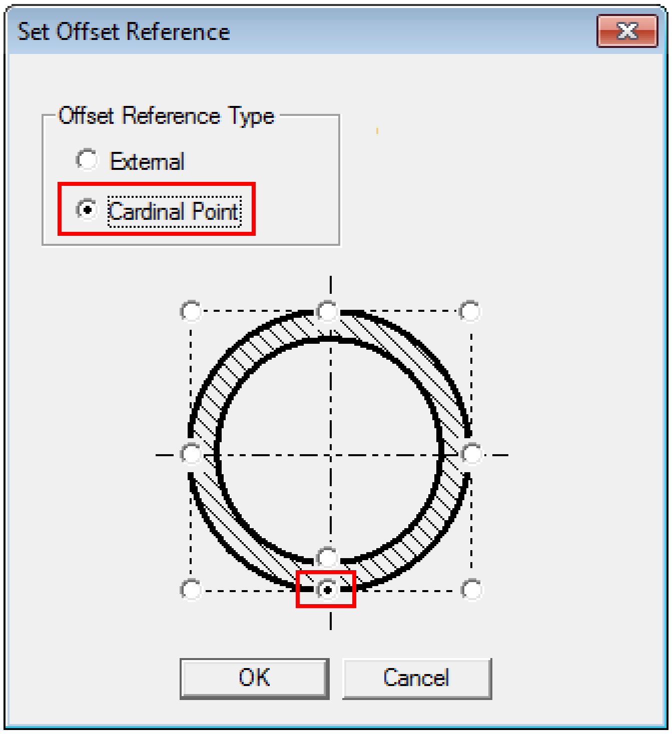


12. Under **Offset** on the **Route Cableway** ribbon, select the **Set Offset Reference…** option to set options for reference offsets while routing a cableway.

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

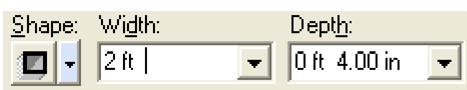
13. Select the following in the **Set Offset Reference** dialog box and click **OK**:

    Cardinal Point option
    Bottom center option



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

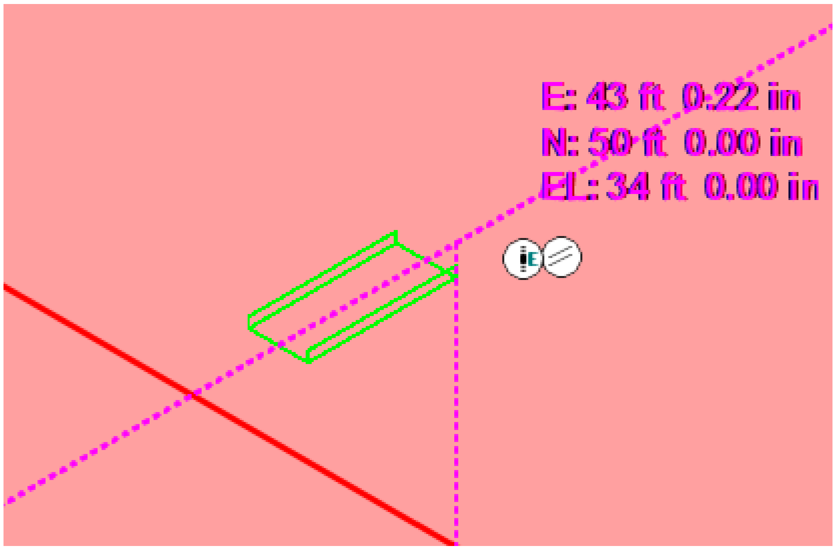
    

    The Plane drop-down list on the Route Cableway ribbon activates options for selecting a working plane for the route path.

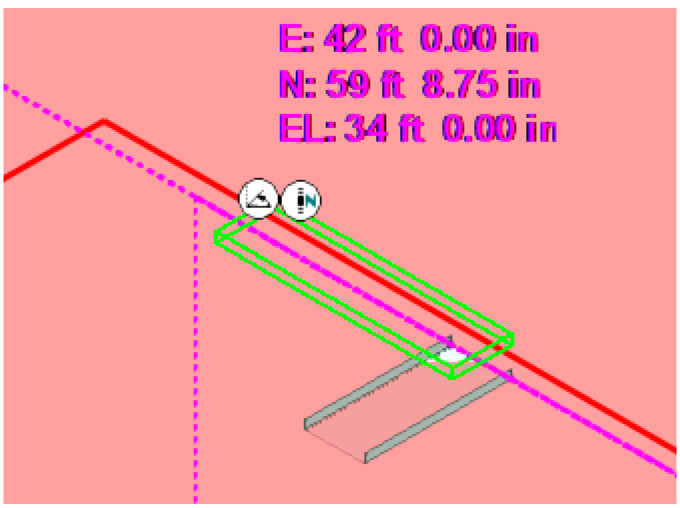
15. Select the **Plan Plane** option in the **Plane** drop-down list on the Route Cableway ribbon.

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.

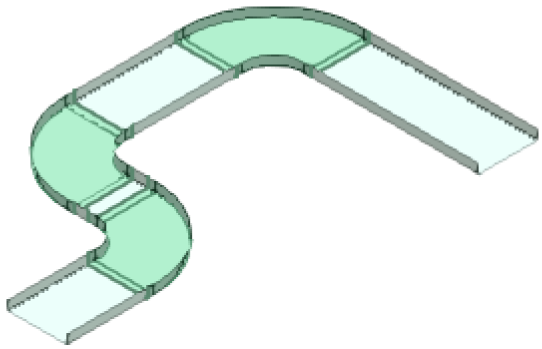


17. Position the cursor in the N direction to place 5 ft cableway. Click in the graphic view to accept the position.

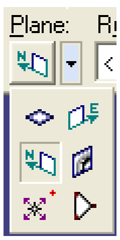


18. Change the length to 8 ft on the Route Cableway ribbon, position the cursor in east E direction to place the 8 ft cableway tray, and click the graphic view to accept the position.

19. Position the cursor in the South direction and click in the graphic view to accept the position, as shown below.

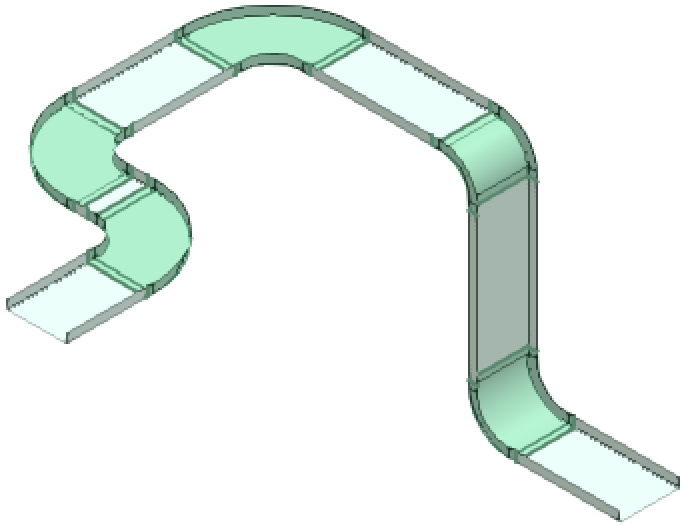


20. Select the Elevation Plane: North-South option in the Plane drop-down list on the Route Cableway ribbon.



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.

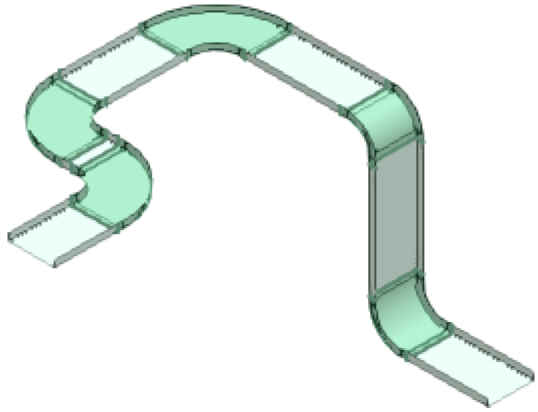
23. Click in the graphic view to place a 5 ft cableway tray going south. Right-click to terminate the Route Cableway command. The routed cableway should resemble Figure 40.

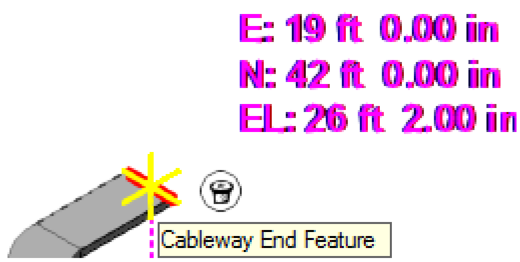


Cableway Routing using the End Feature

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

2. Select **Cableway End Feature** of the cableway with non-zero spec placed earlier in this session.



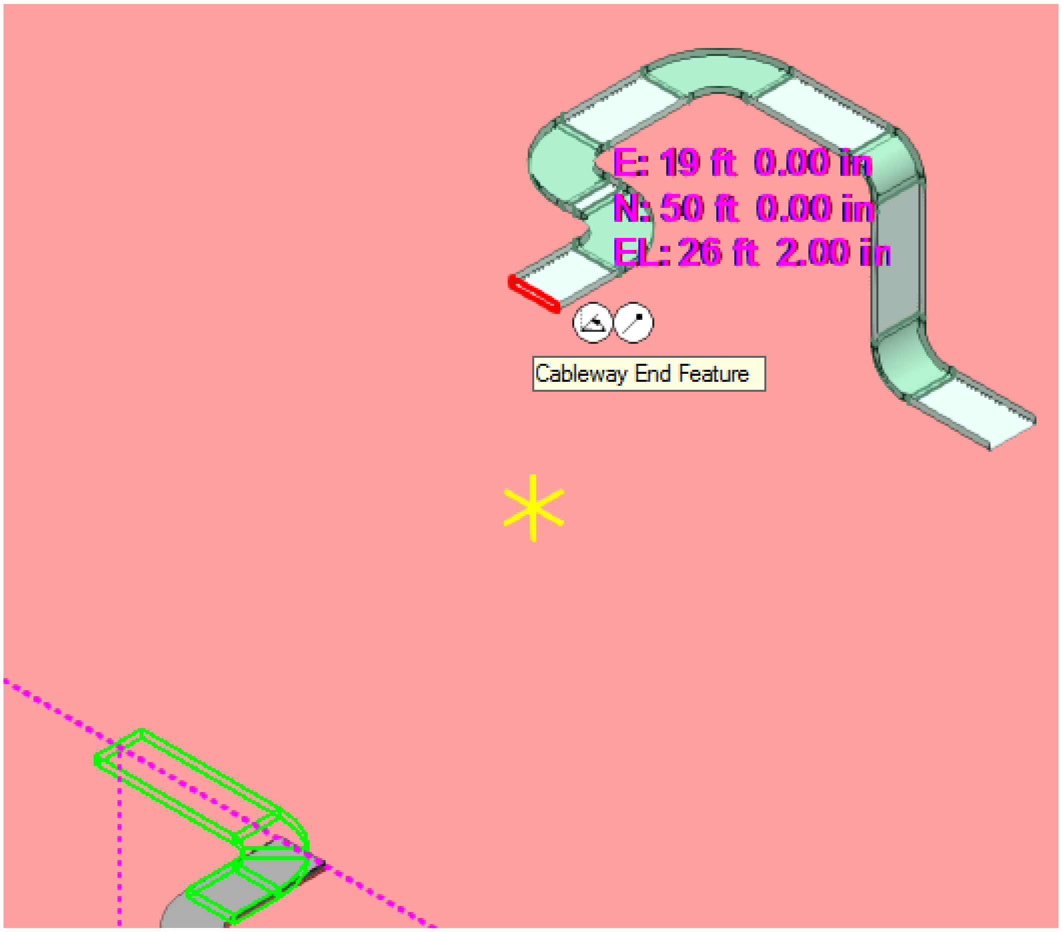


3. Select the Plan Plane option in the Plane drop-down list on the Route Cableway ribbon.
4. On the Route Cableway ribbon, select the <Disabled> option in the Offset drop-down list to disable the Cardinal Point option.

   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.

5. Select the Angle field and key in 90 deg in the drop-down list.

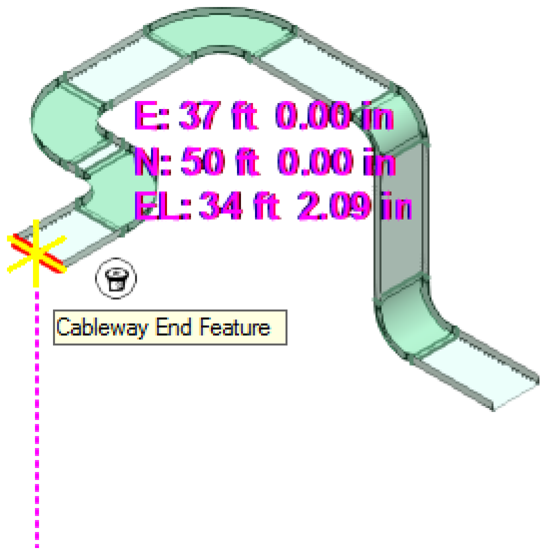
6. Move the cursor to the other end feature to get the northing coordinate as show in Figure 42 and click in the graphic view to place the cableway.



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

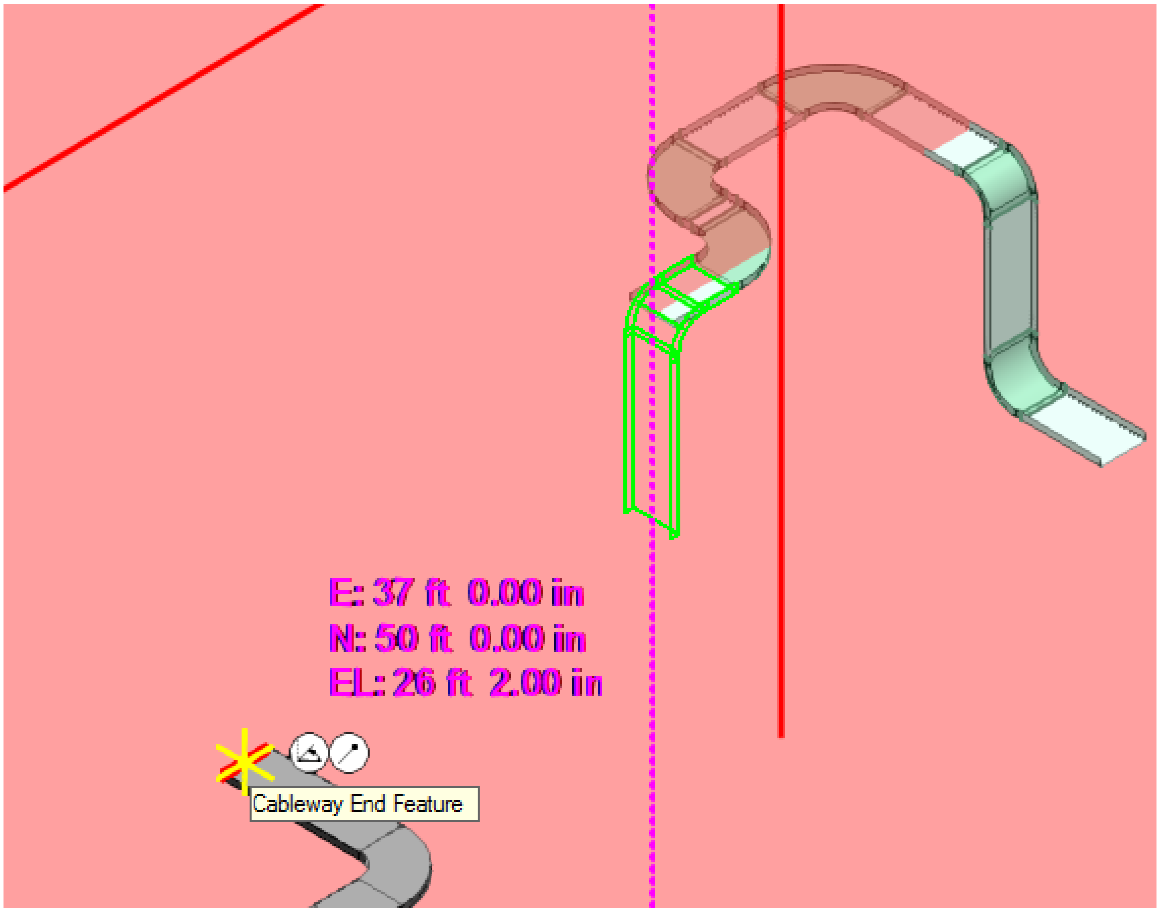
Connecting Cableways

1. Click Route Cableway on the vertical toolbar.
2. Select the Cableway End Feature of the cableway placed earlier in this session.

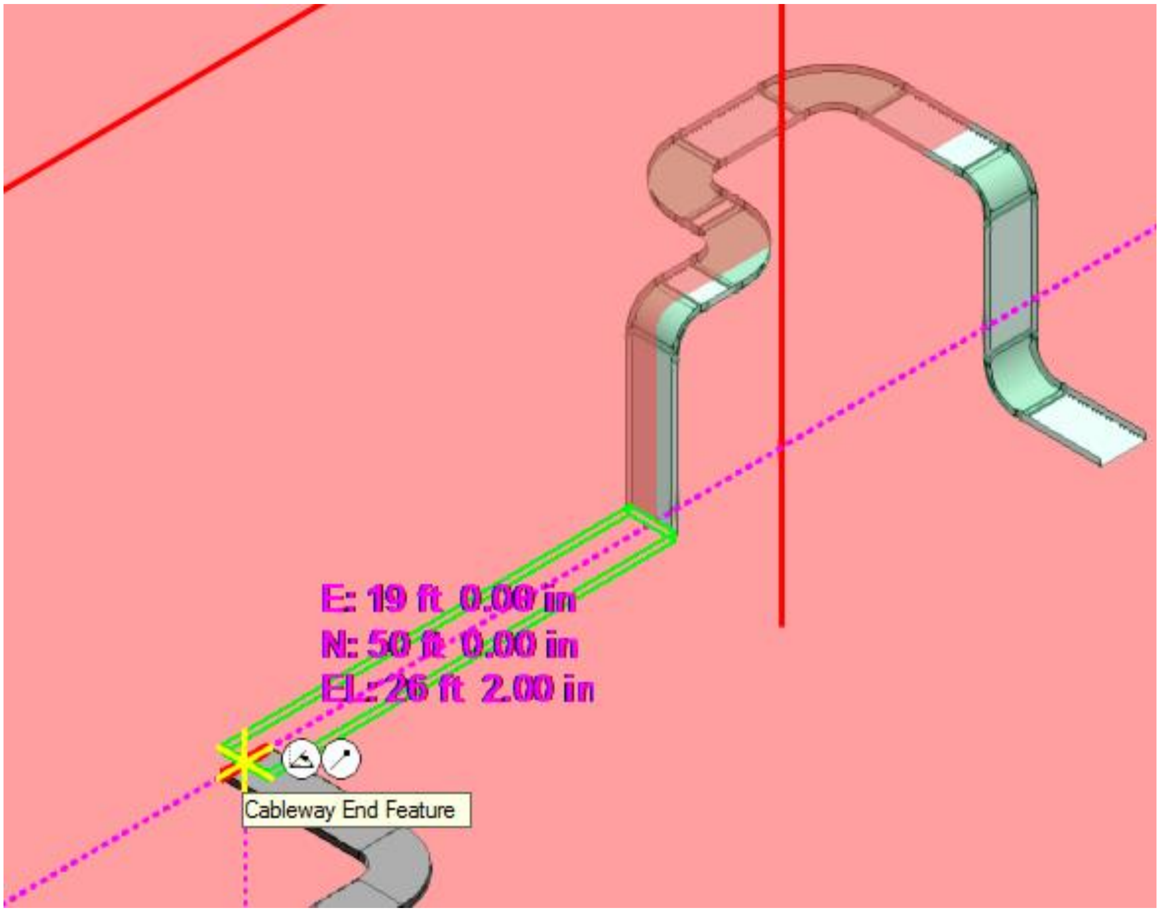


3. Key in 90 deg in the Angle field drop-down list in the Route Cableway ribbon.
4. Select the Elevation Plane: East-West Direction option in the Plane drop-down list on the Route Cableway ribbon.
5. Move the cursor to the other end feature of the cableway with non-zero spec to get the elevation coordinate.

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.



6. 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.

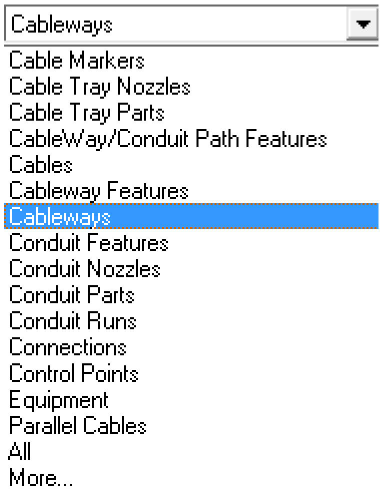


Changing Cableways to a Different Specification

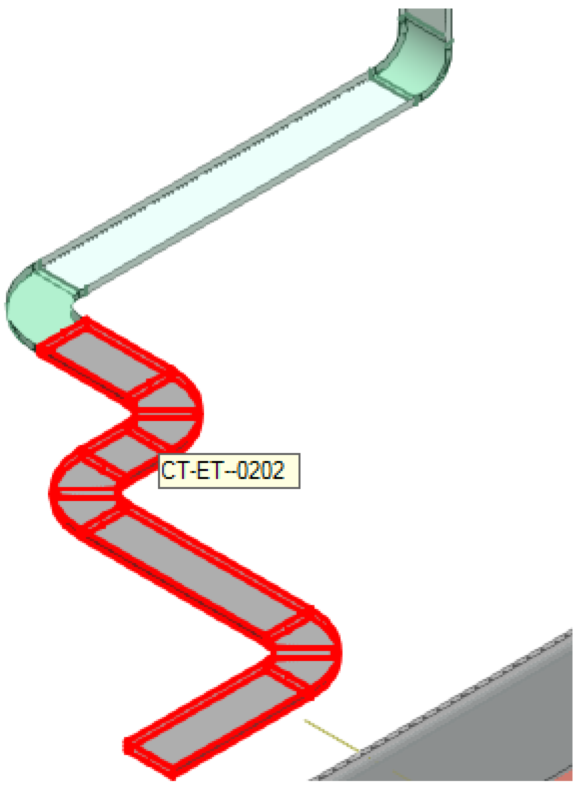
You can select a cableway with non-part specification and change it to use a part specification. SP3D will generate the tray parts for all the feature type located in the cableway system. If a part cannot be found for a specific feature, then Smart 3D will generate a To Do List item.

NOTE It is very important to match the specification of the other cableway so that Smart 3D 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 **Cableways** from the **Locate Filter** drop-down list to select only cableways from the graphic view.

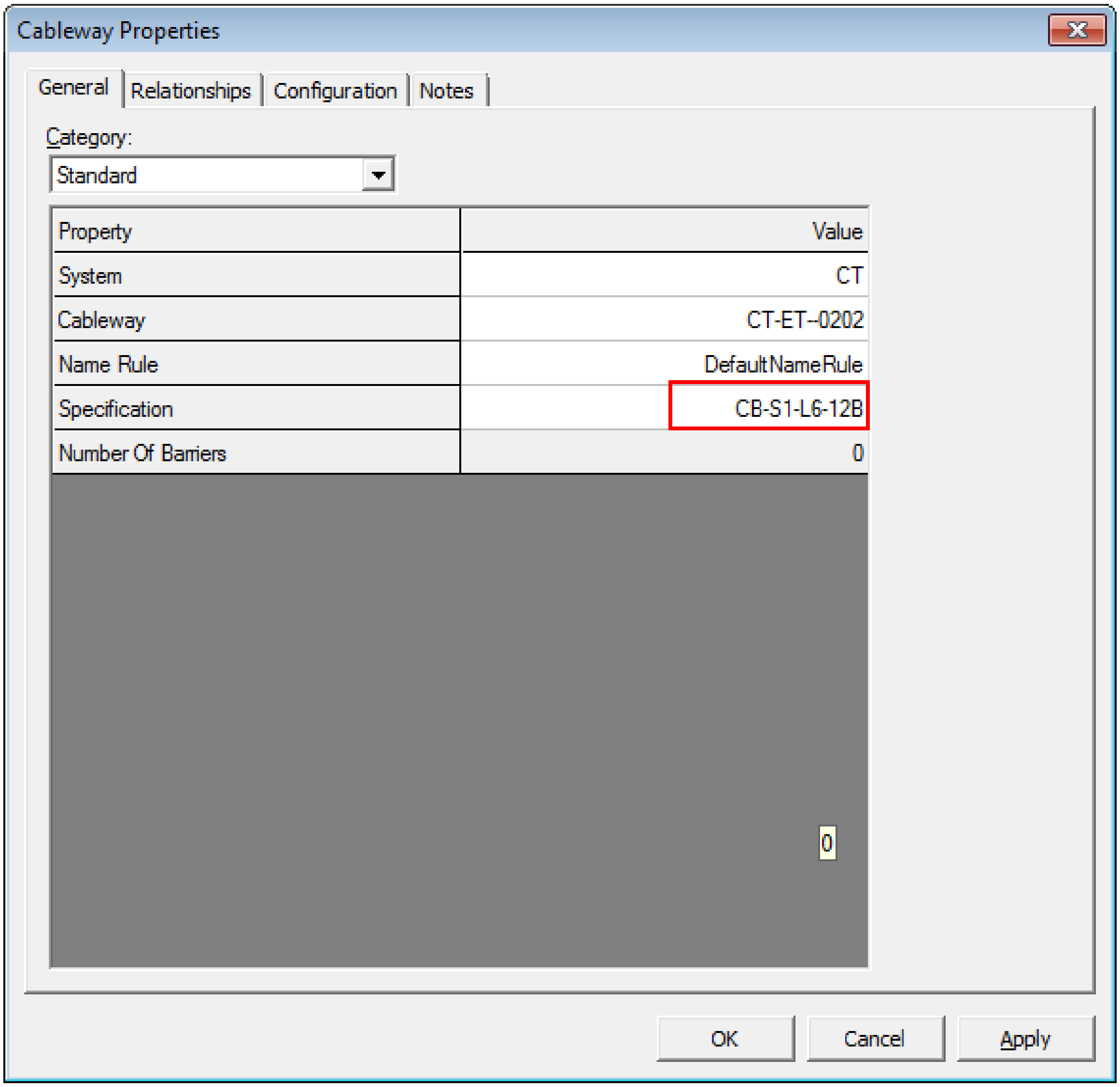


2. Select the cableway with non-zero spec from the graphic view.

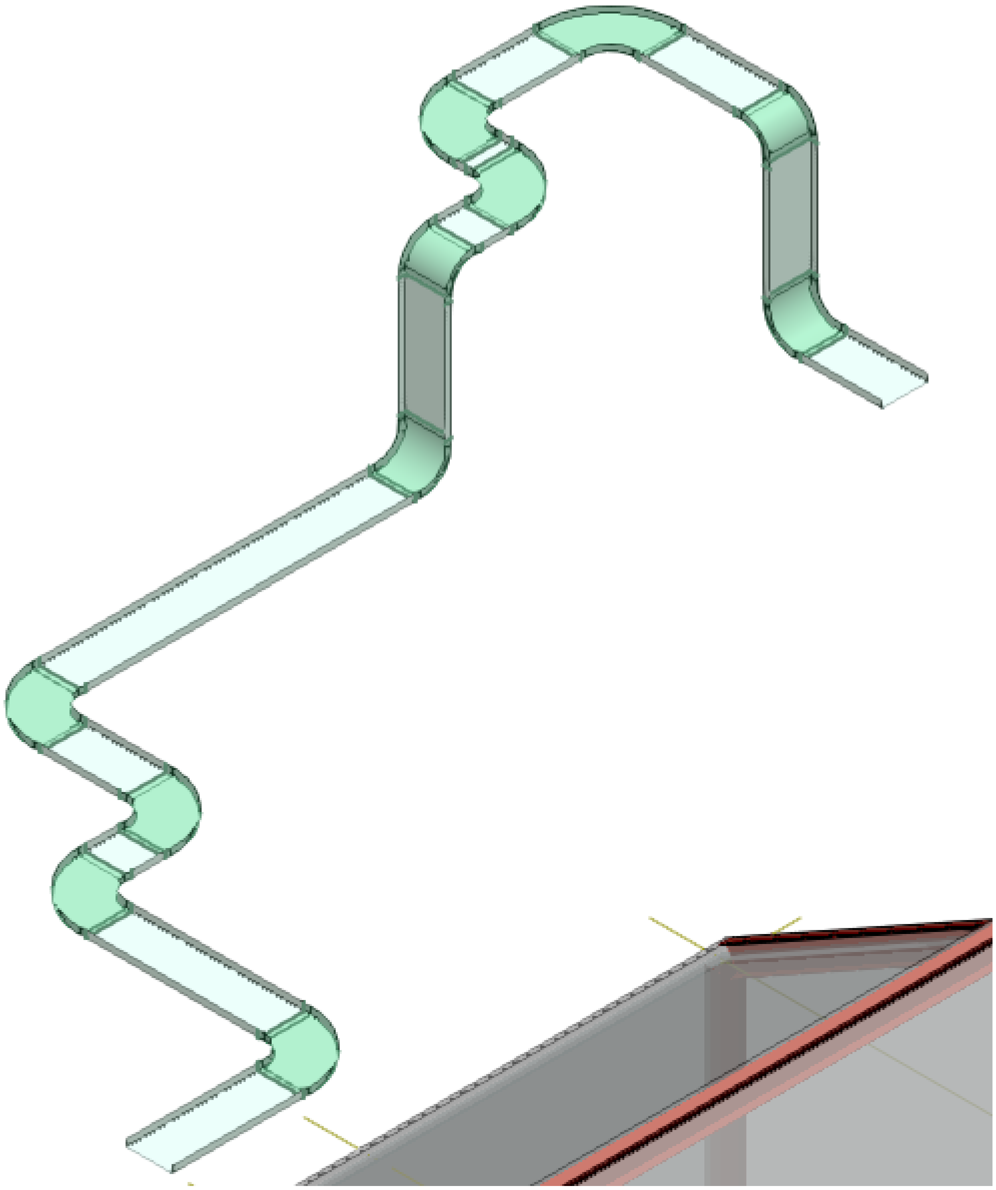


3. Right-click the selected cableway to access the Cableway Properties dialog box.

4. Select CB-S1-L6-12B from the Specification drop-down list on the Cableway Properties dialog box.



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

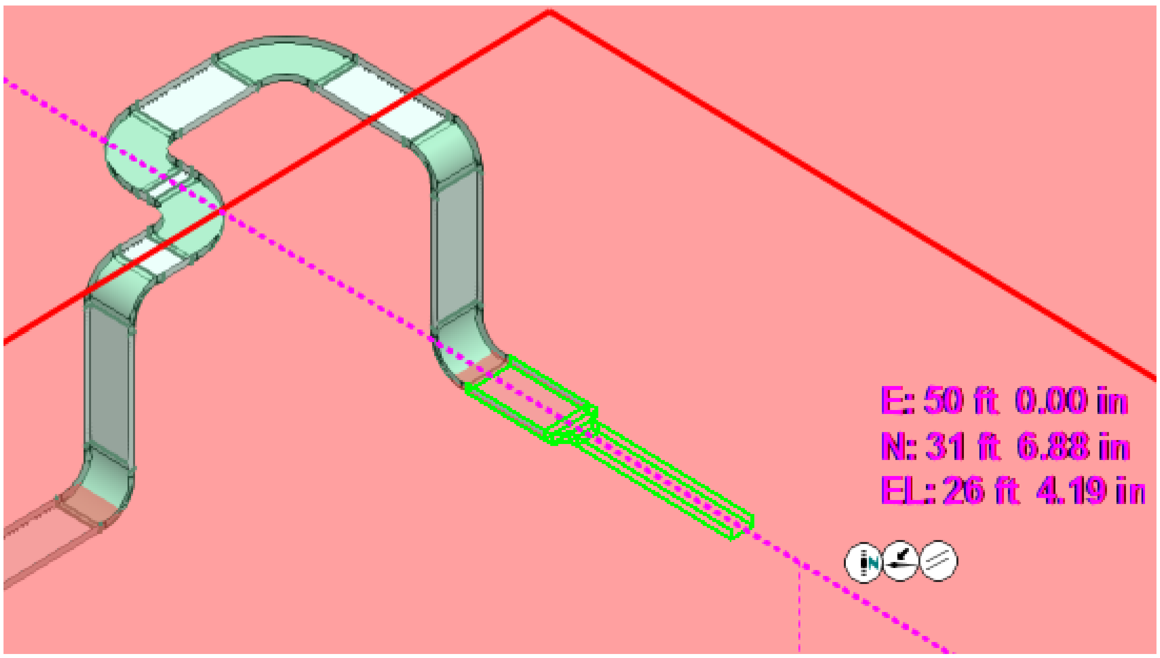


NOTE Smart 3D use the specification, the size and the feature type to generate the appropriate tray parts for the selected cableway.

Cableway Routing with a Size Change

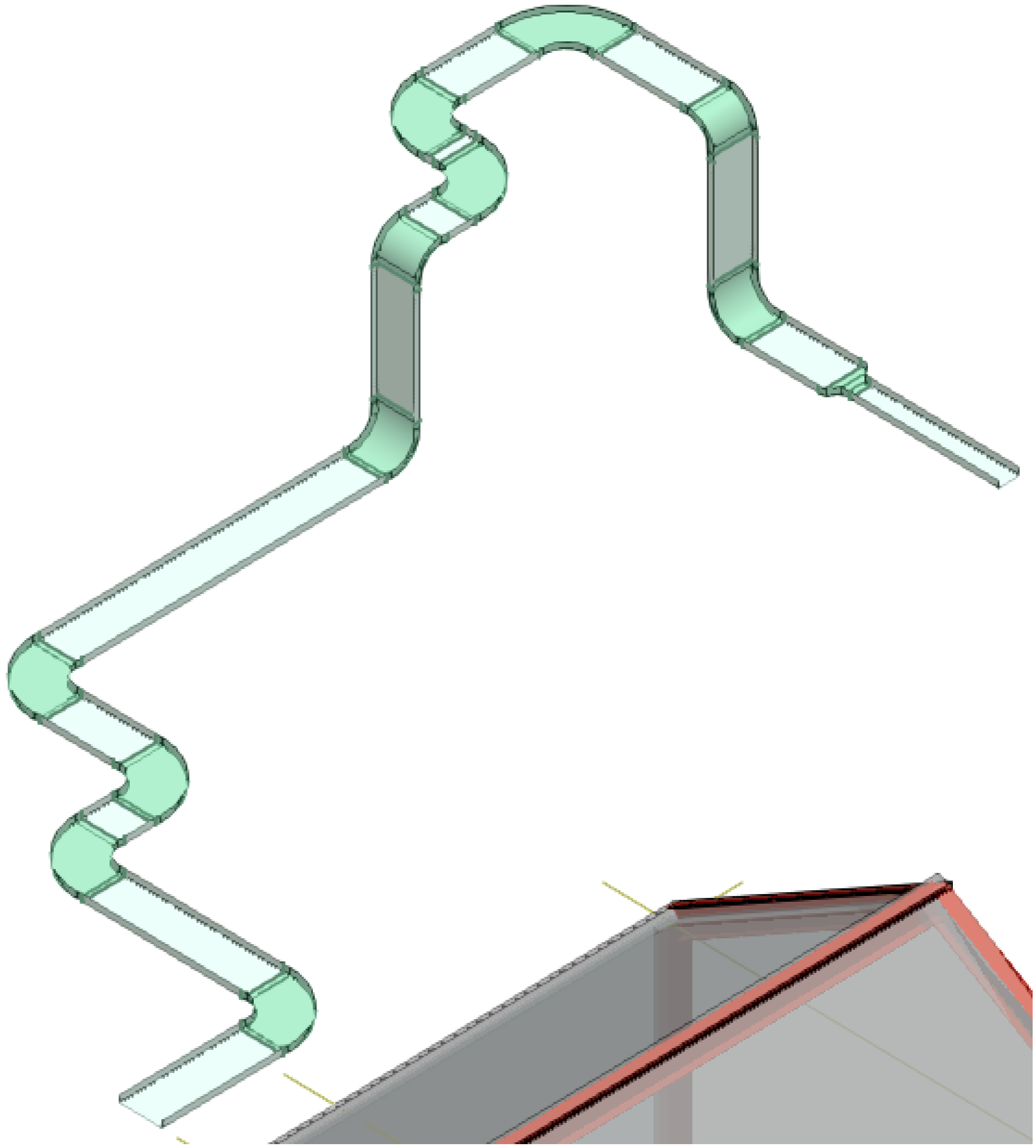
A size change reduces the size of the cableway that you route compared to the existing one.

1. Click Route Cableway  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.



6. Click the graphic view to accept the position.

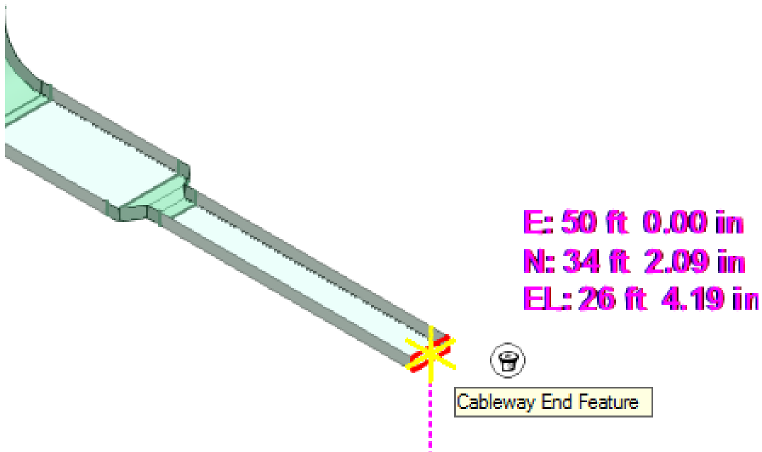
After the size change the cableway network should look like this.



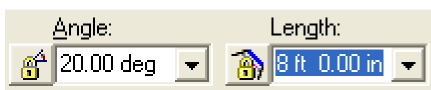
To Do List Items

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.

1. Click **Route Cableway**  on the vertical toolbar.
2. Select **Cableway End Feature** of the cable tray you just placed.

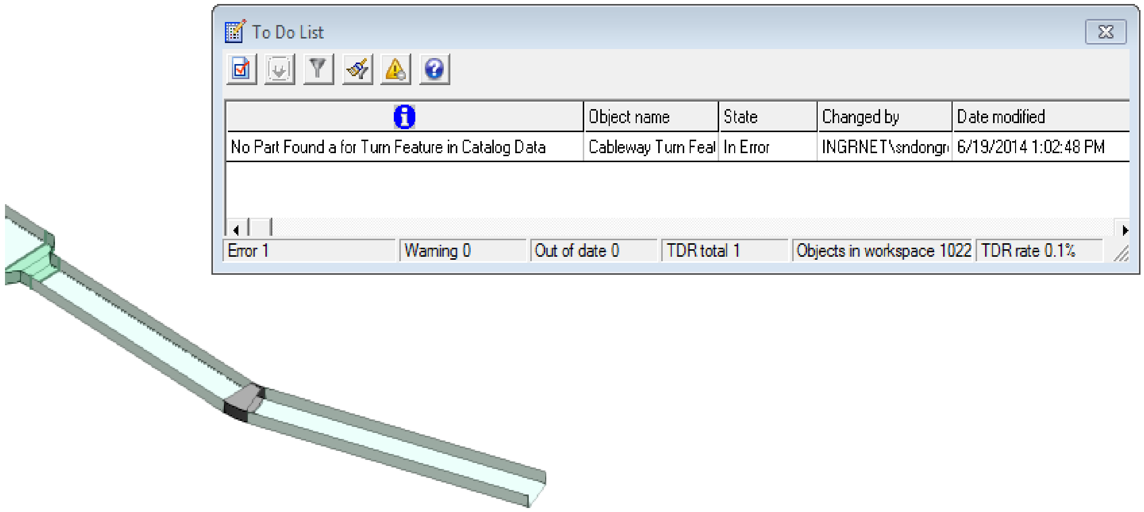


3. On the **Route Cableway** ribbon, key in 8 ft in the Length drop-down list and 20 deg on the Angle drop-down list.

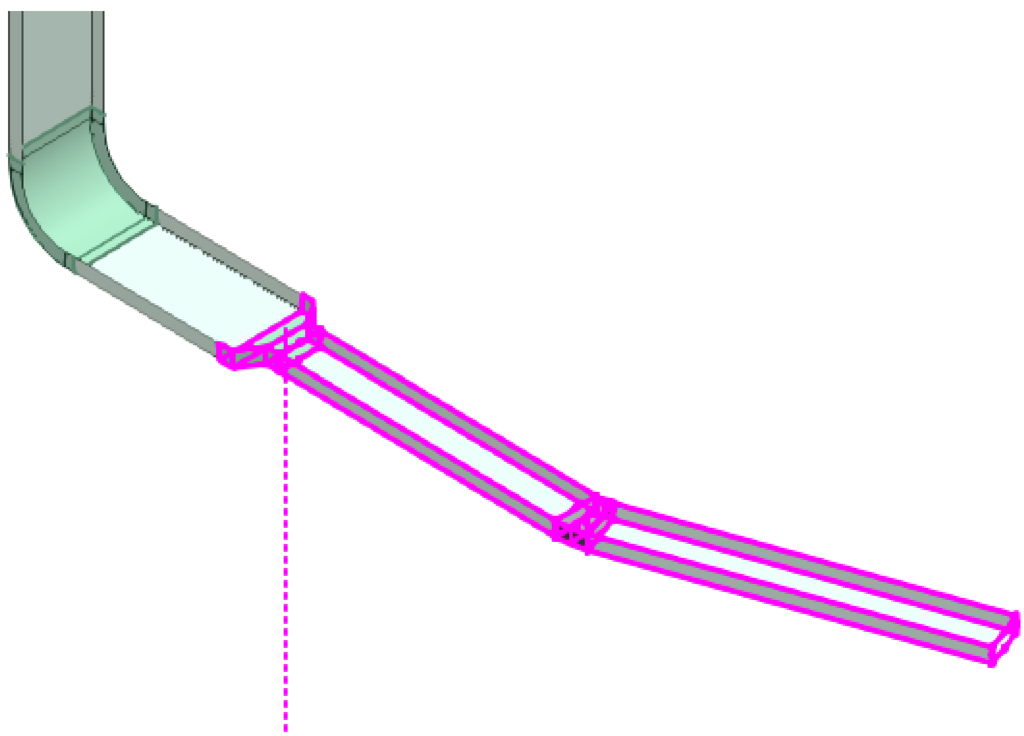


4. Click in the graphic view to define the next data point. System displays a message dialog box 'No Part Found for a Turn Feature in Catalog Data'.
5. Click **OK** to close the message dialog box.

6. Select **View > To Do List** option to open the **To Do List** dialog box. Review the information column for a description of the error.

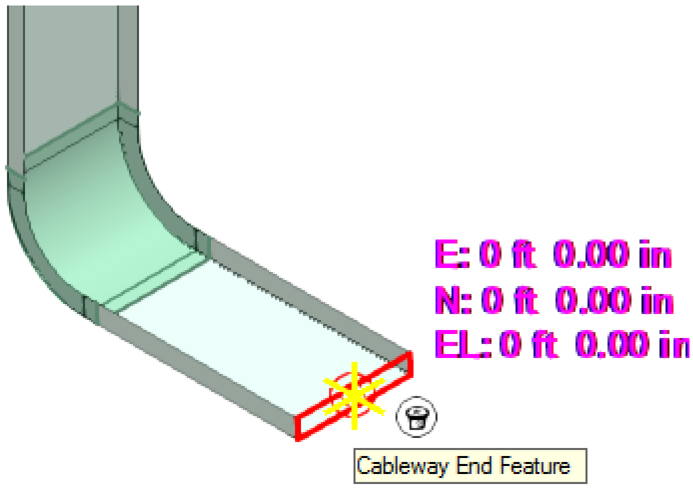


7. Close the **To Do List** dialog box.
8. One option to resolve the **To Do List** is to re-route the cableway path. As an example, let's delete some of the features and re-route the cableway path.
9. Select all features between the transition feature and the straight feature you just placed.

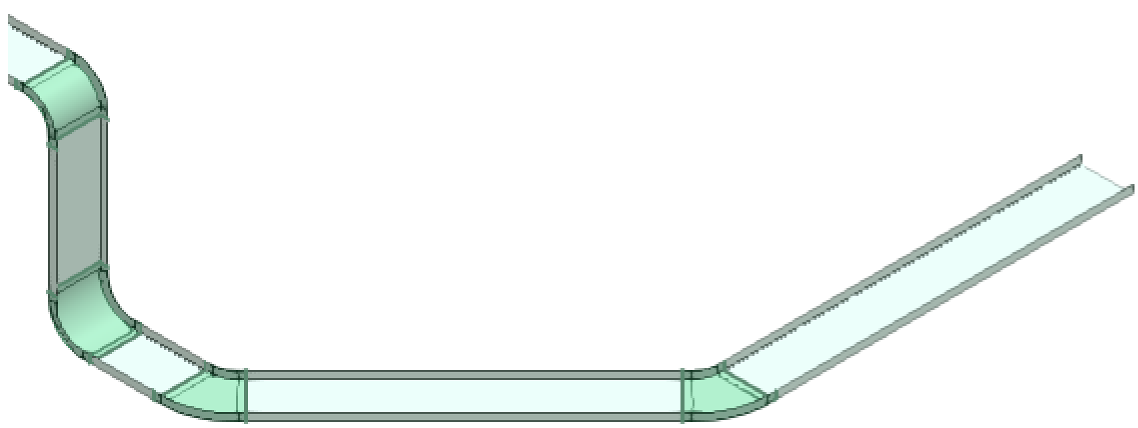


10. Click **Delete** to delete the selected features.

11. Click **Reposition Target** on the PinPoint ribbon and put the target at the free end of the tray.



12. Click **Route Cableway** on the vertical toolbar.
13. Select the end feature at south end of the tray network to start the route.
14. Click the **Plane** drop-down list on the ribbon and select **Plan Plane** to route the tray.
15. On the **PinPoint** ribbon, key in 10 ft East, -10 ft North.
16. Click in the graphic view to place the tray.
17. Now, you will route the next segment of the cabletray in the East direction.
18. 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.
19. Right-click in the graphic view to terminate the command.



Routing Multi Trays

Smart 3D 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 **Route Cableway** 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. After 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.

Smart 3D 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.

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

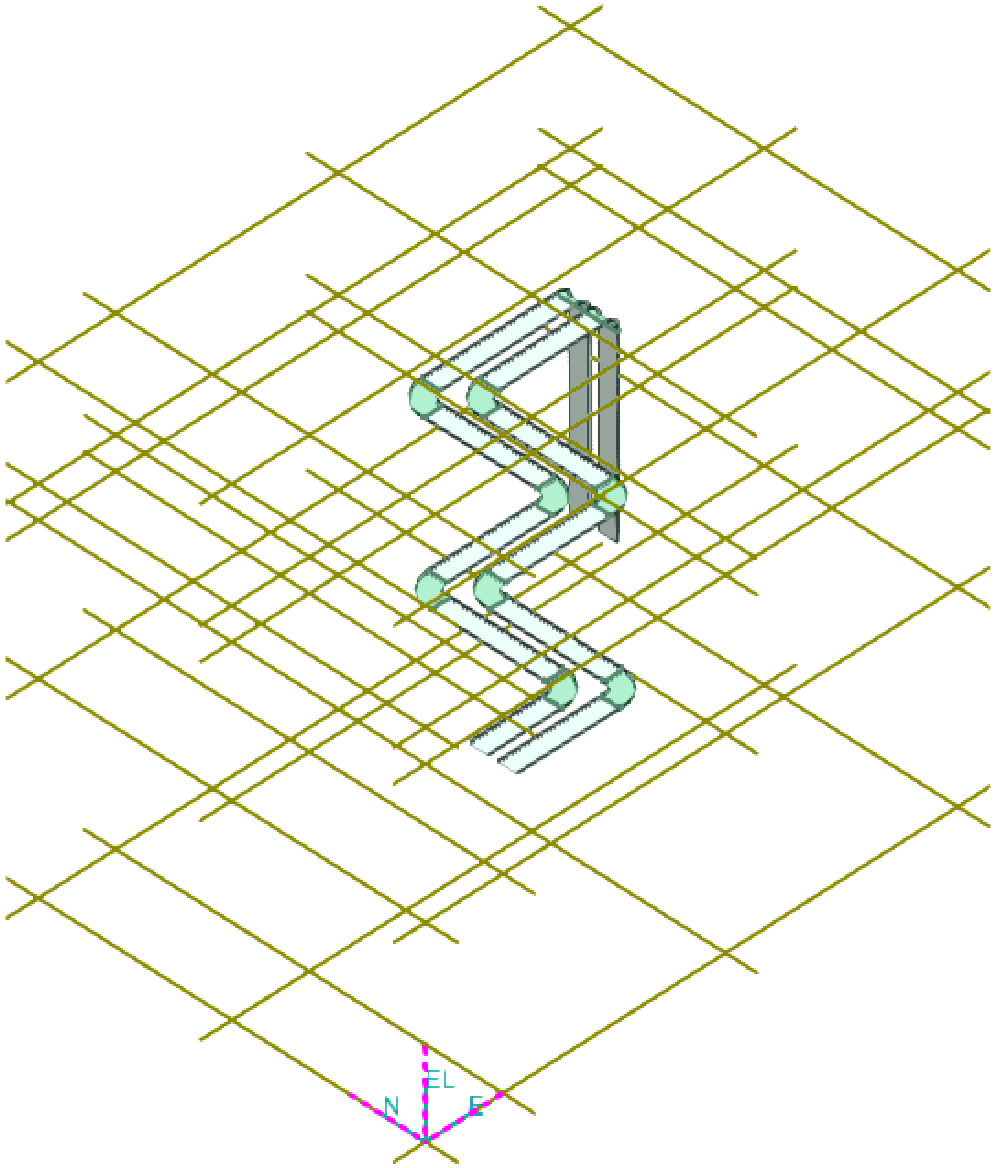
Multi-Route tab:

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.



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 **Set target to Origin** 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

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

   Under the **Standard** category:

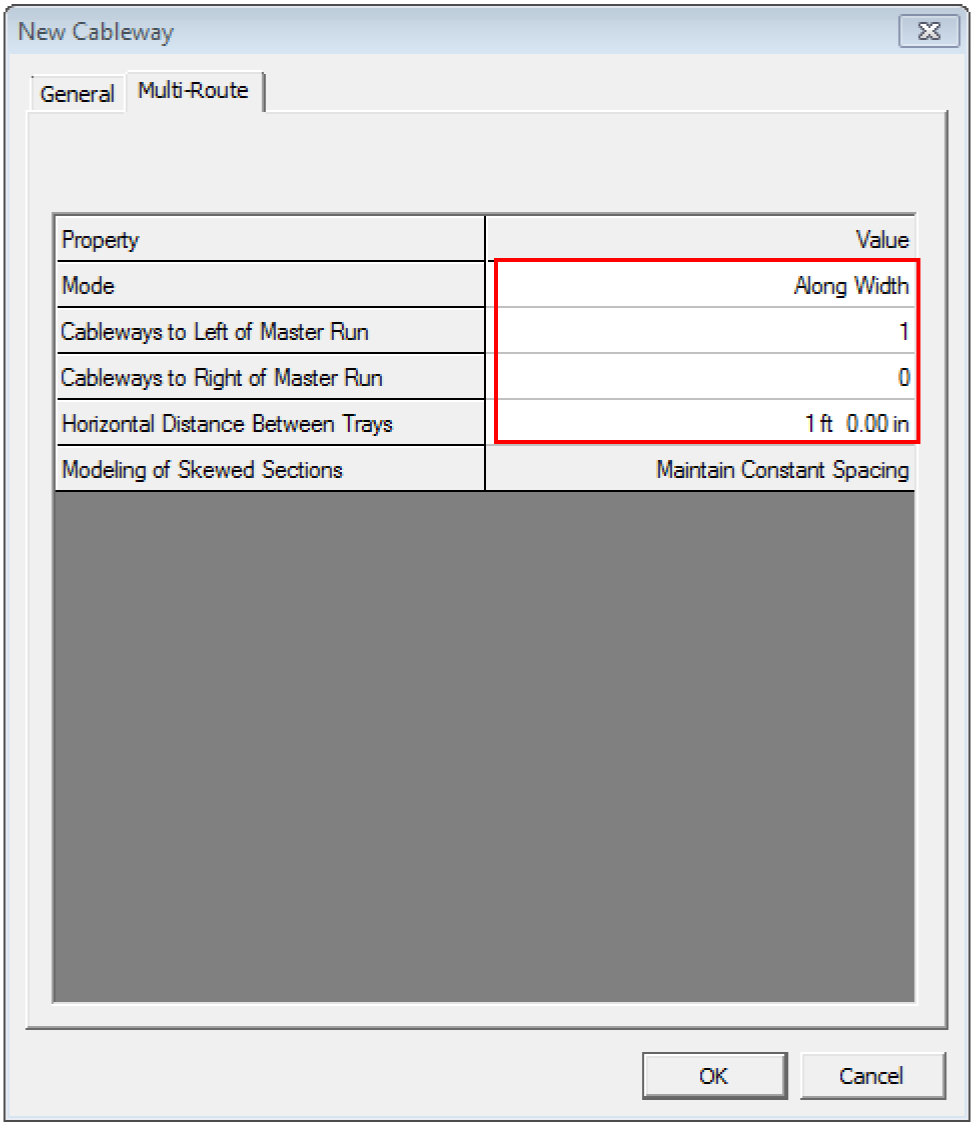
   System: SP3DTrain\A2\U03\Electrical\Control\CT
   Name Rule: DefaultNameRule
   Specification: CB-S1-L6-12B

   NOTE Use **Database** option in the **Select System** dialog box.

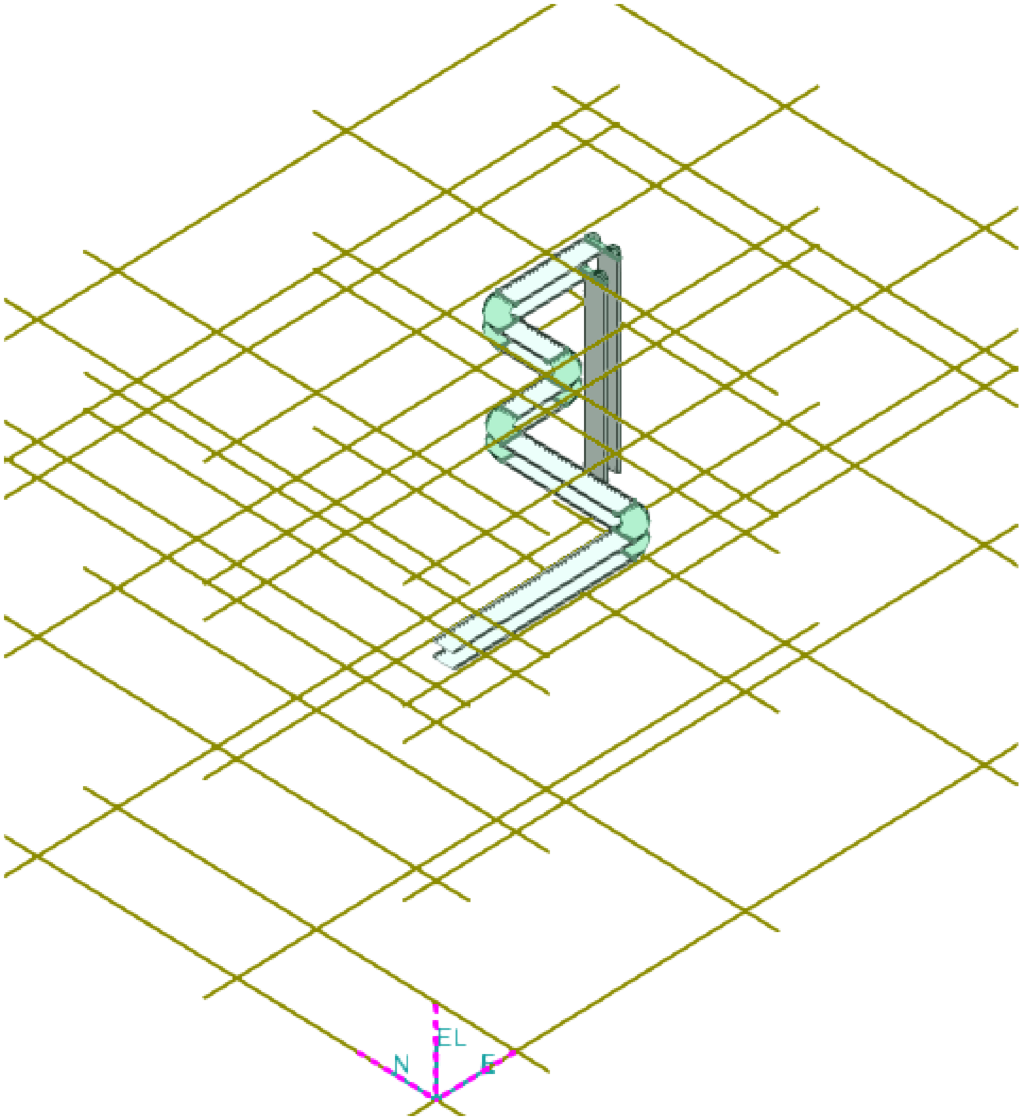
   Under the **Cable Fill** category:

   Fill Efficiency: 60%
   Signal Type 1: Control
4. Now select the **Multi-Route** tab in the **New Cableway** dialog box, select the following specifications, and click **OK**:

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



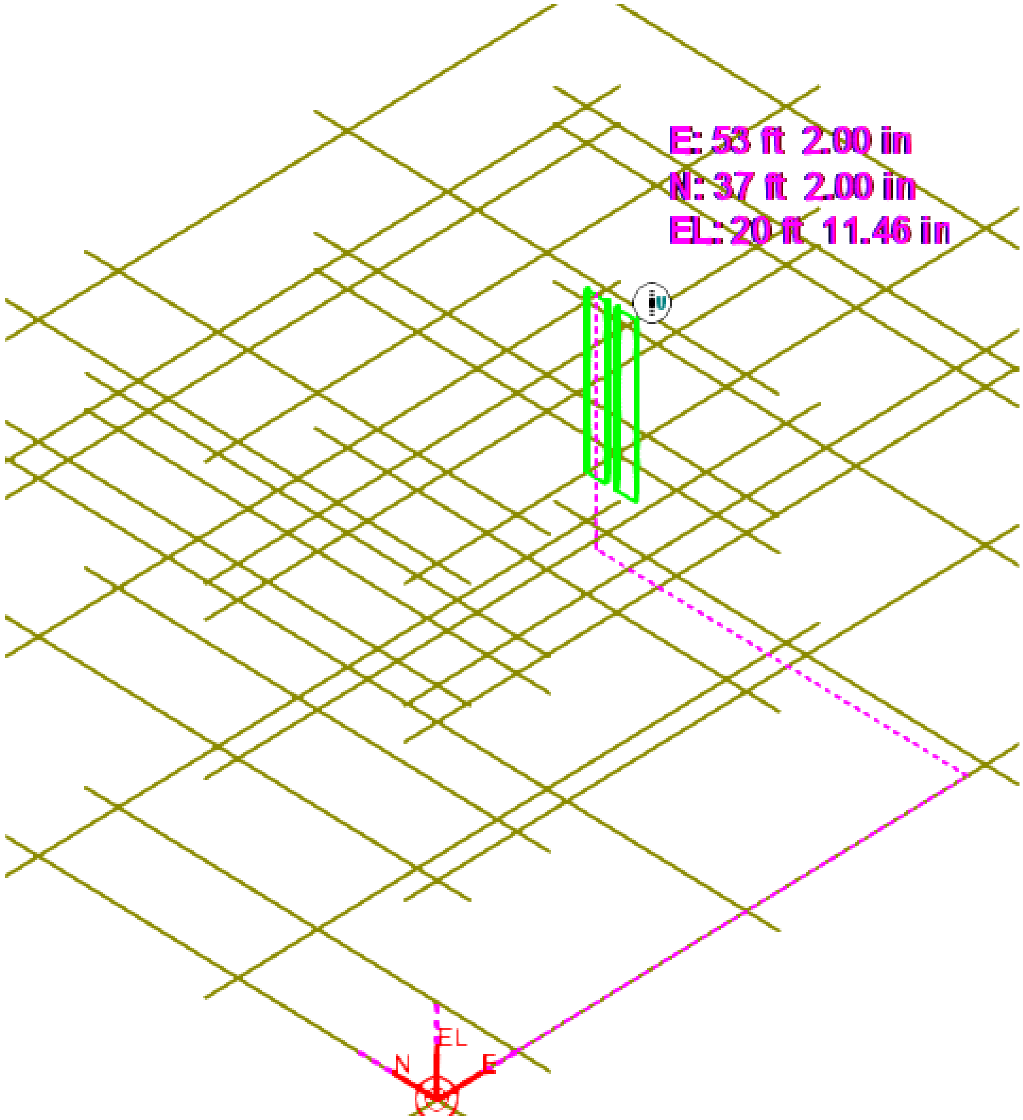
TIP If you want to route a vertical multi tray, you can select the Along Depth option in the Mode drop-down list in the New Cableway dialog box. The rest of the steps for routing vertical multi trays are the same as the steps for routing horizontal multi trays. If you route a vertical multi tray, the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



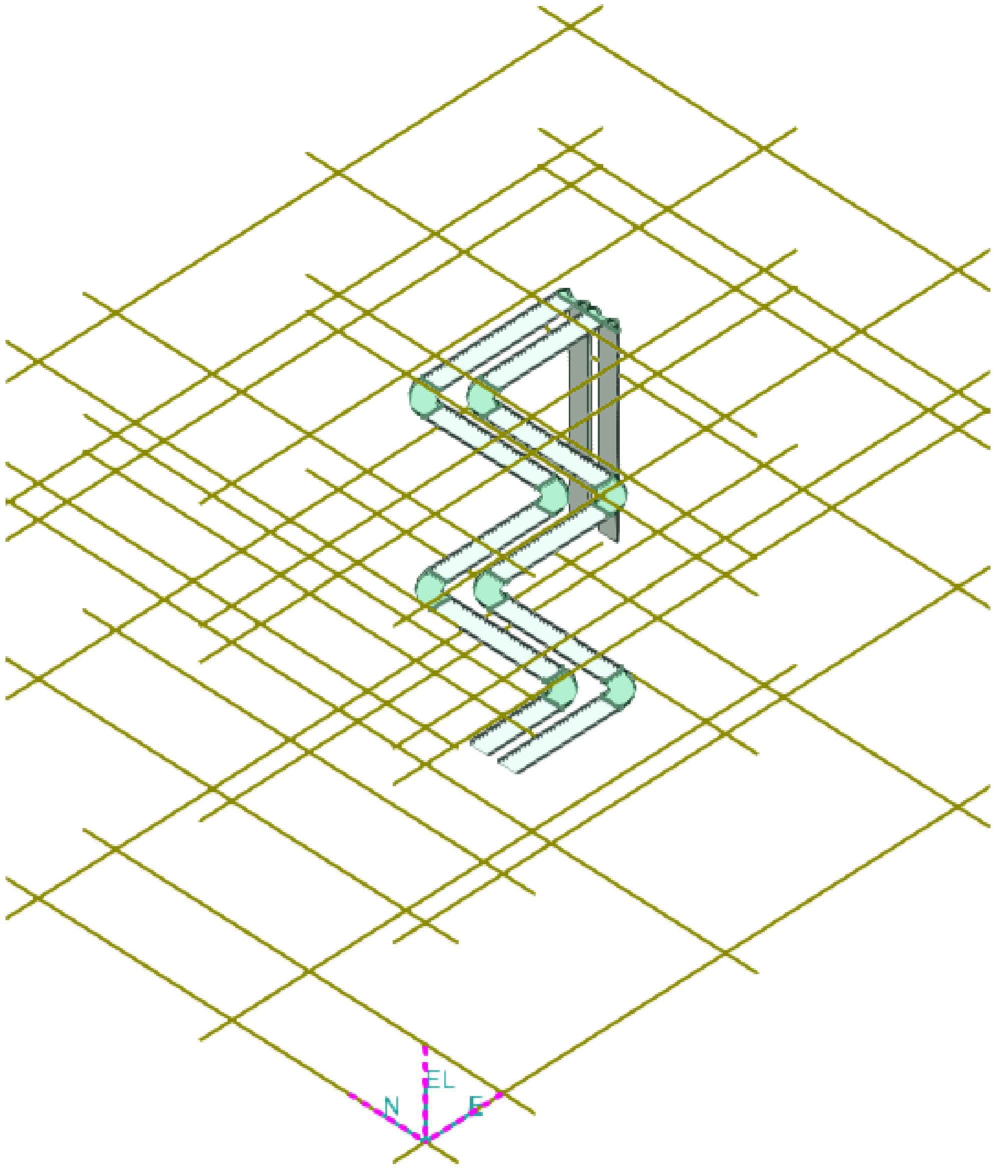
The option **Cableway to Left of Master Run** or **Cableway to Right of Master Run** specifies the number of slave runs above and below or to the left and right of the master run.

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

2. Start routing the multi tray starting from the El direction about 15 ft.

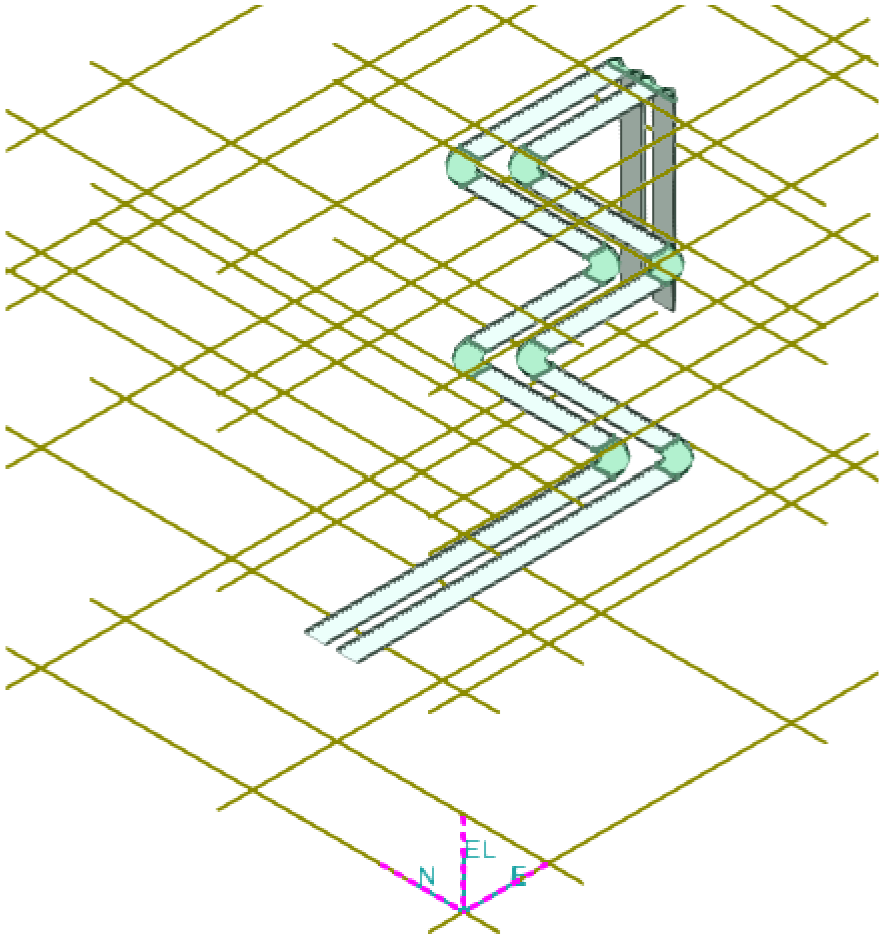


3. Now route the cable in the west direction and then in the south direction three times.

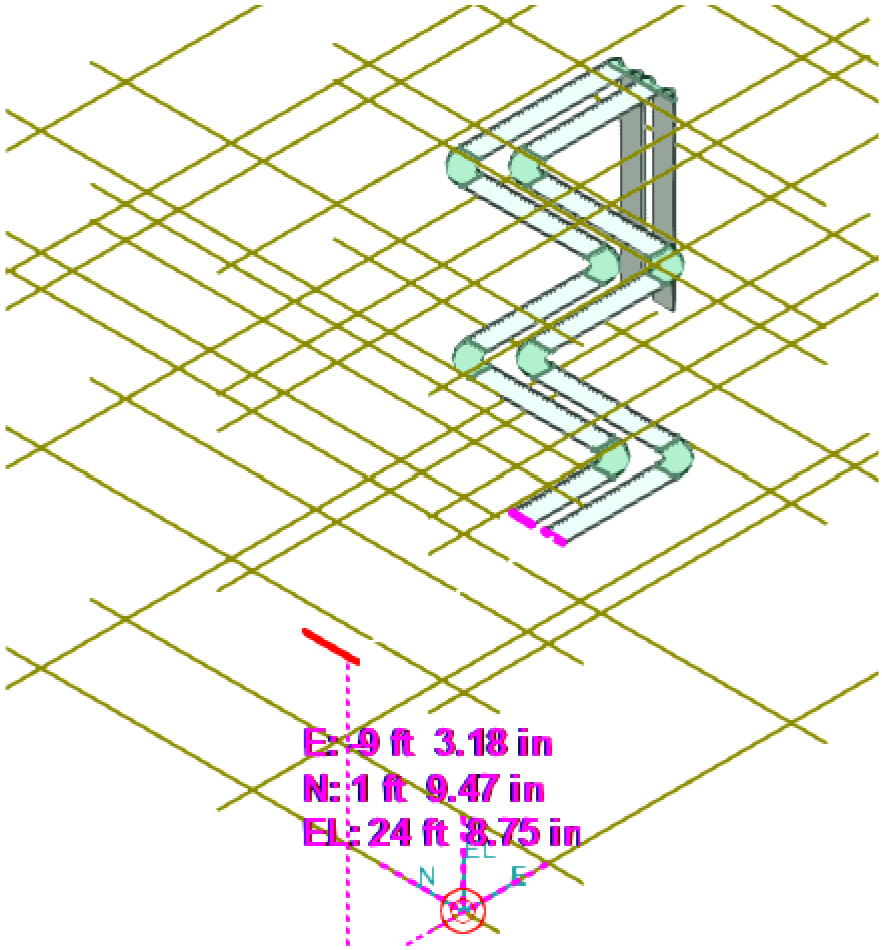


Extending Multi Trays

Extend the multi trays that you routed above by 10 ft in the west direction. The workspace after extending the multi trays should resemble this.



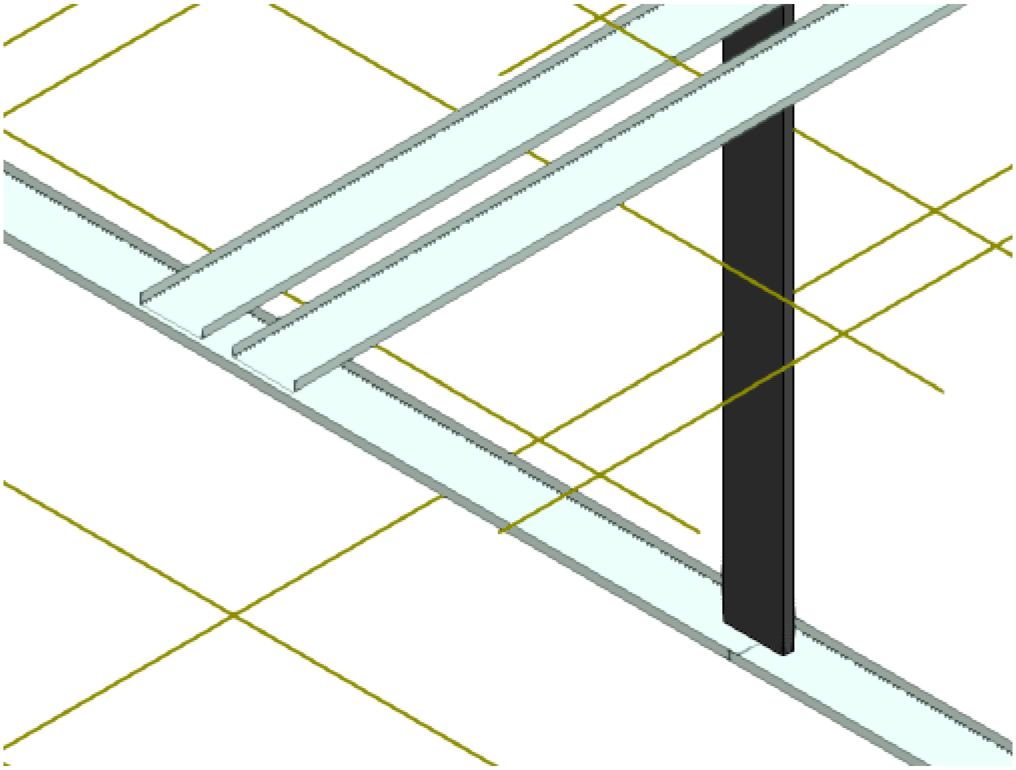
1. Select the **Cableway Features** option in the **Locate Filter** drop-down list.
2. Select the **Cableway End Feature** of both the cable trays by using the left mouse button in conjunction with the Ctrl-key to do multi-select option or just use the fence inside option.
3. Then use **Move** to move 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.



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

Placing a Vertical Drop Out

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

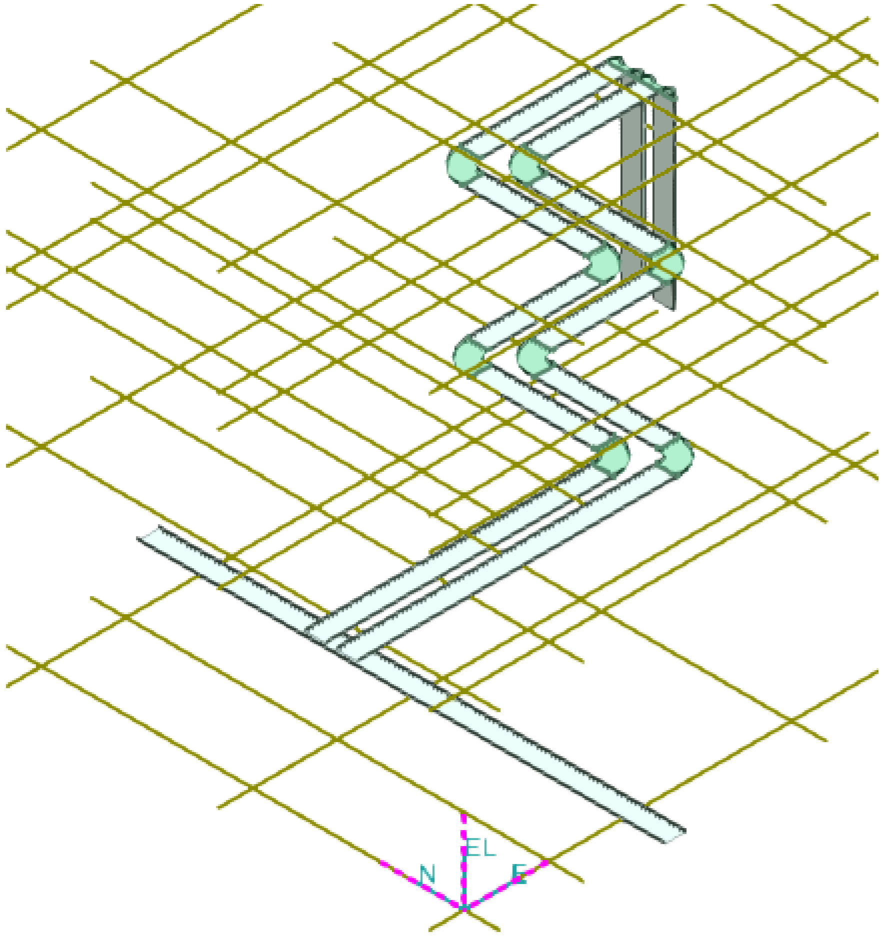


1. Route one cable tray using the last used specification starting at the following coordinates:

   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.

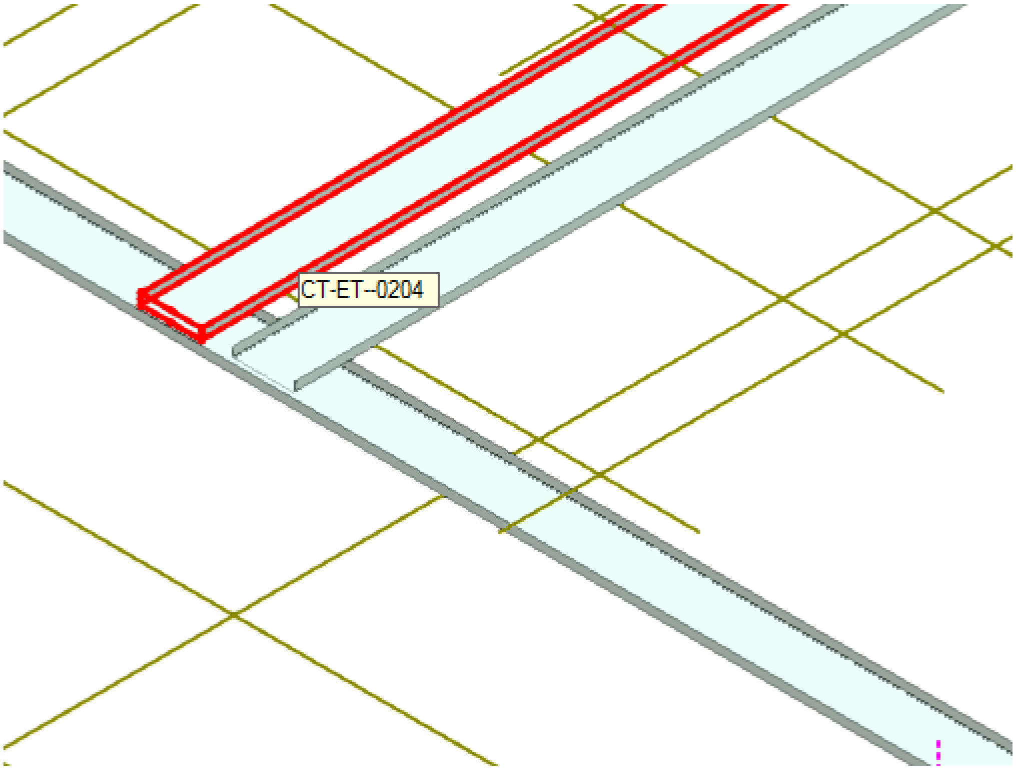


4. Right-click the graphic view to terminate the **Route Cableway** command.

5. Click **Auto Connect** on the vertical toolbar.

   The Select Cableway Runs/Features or Conduit End Features To Connect From prompt displays.

6. Select one of the cable tray.



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

   The prompt Select Cableway Runs/Features or Conduit End Features To Connect To displays.

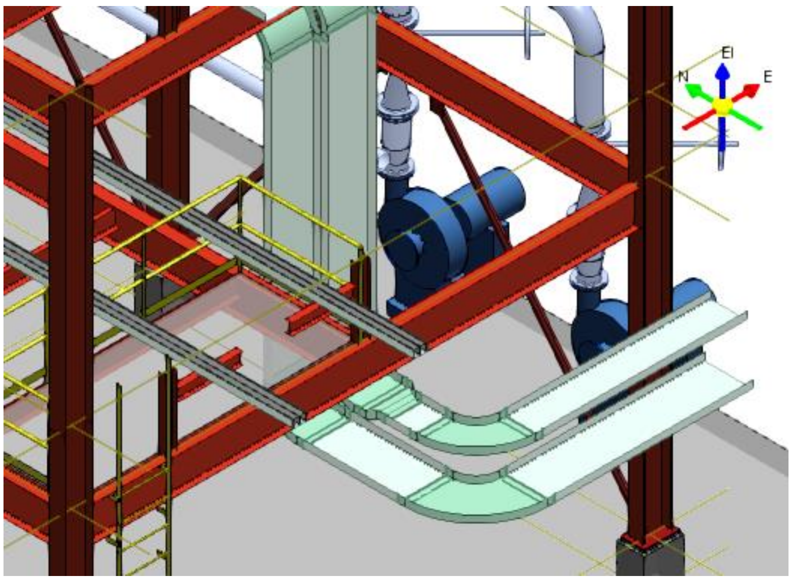
8. Select the other cable tray.
9. Click **Finish**.

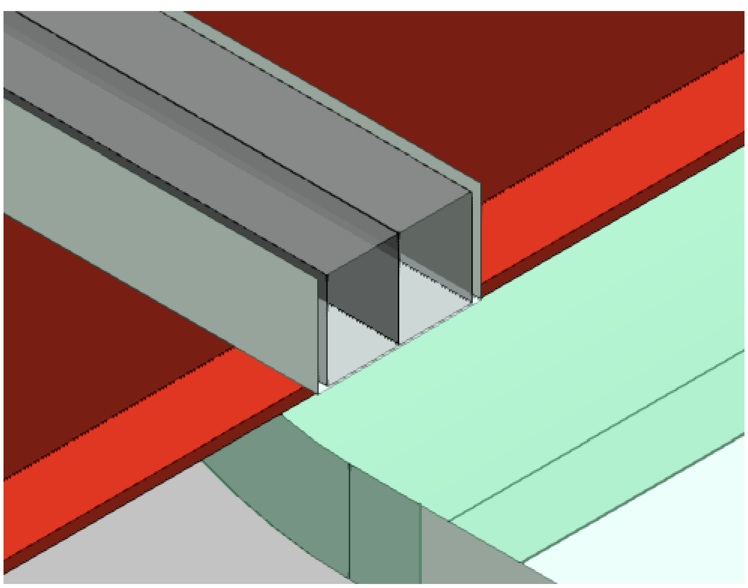
For more information related to routing cableways, refer to the Routing Cableway topic in the user guide ElectricalUsersGuide.pdf.

S E S S I O N

Routing Electrical Cableway with Barriers

Create a cable tray network by routing one cableway from the coordinate points E: 5’ 6", N: 35 ‘, EL: 17’ 3". After creating this cable tray copy the newly created cable tray using the midpoint of the Cable tray supports as from and to points. The routed and copied cable trays should resemble the picture shown below.



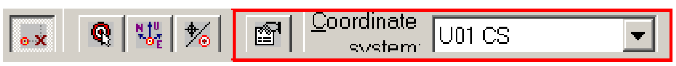


Before Starting this Procedure

- Define your workspace to display **Unit U01** and coordinate system **U01 CS**. In your training plant, select **U01** from **Plant Filters > Training Filters** in the **Select Filter** dialog box.

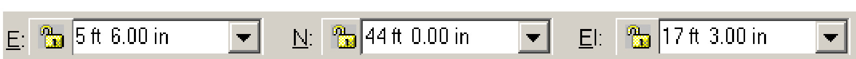
1. Select **Tasks > Electrical** to go to the Electrical task.
2. Make sure the **Active Permission Group** is set to **Electrical**.

3. Activate the **PinPoint** ribbon and set the active coordinate system to **U01 CS** on the PinPoint ribbon.



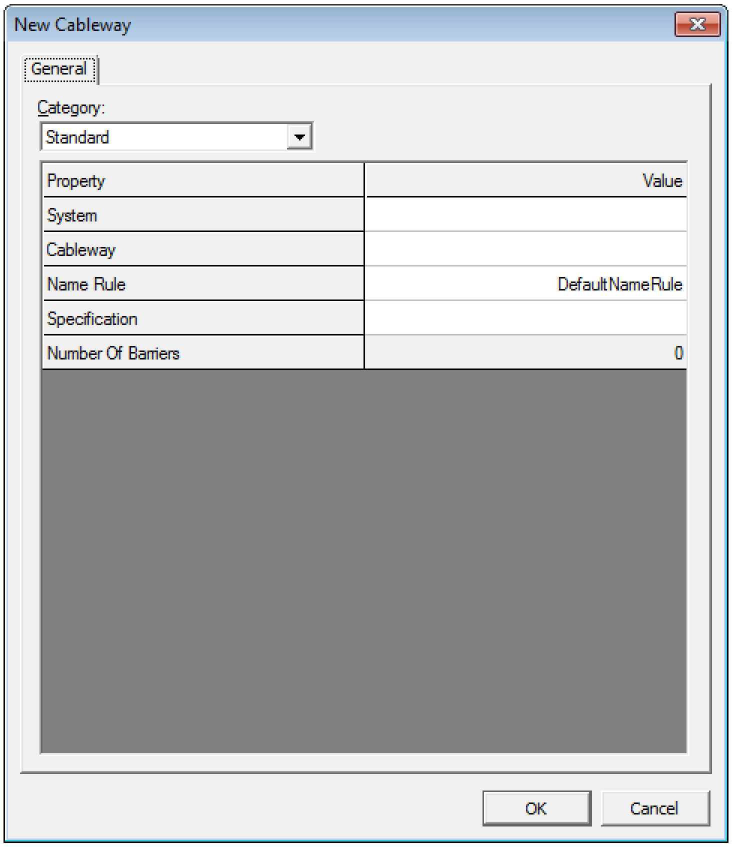
4. Click **Set Target to Origin**  on the **PinPoint** ribbon, to move the target to the origin of the current coordinate system.
5. Click **Route Cableway**  on the vertical toolbar.
6. Key in the following coordinate specifications on the PinPoint ribbon and click in the graphic view:

   E: 5’ 6"
   N: 44’
   EL: 17’3"

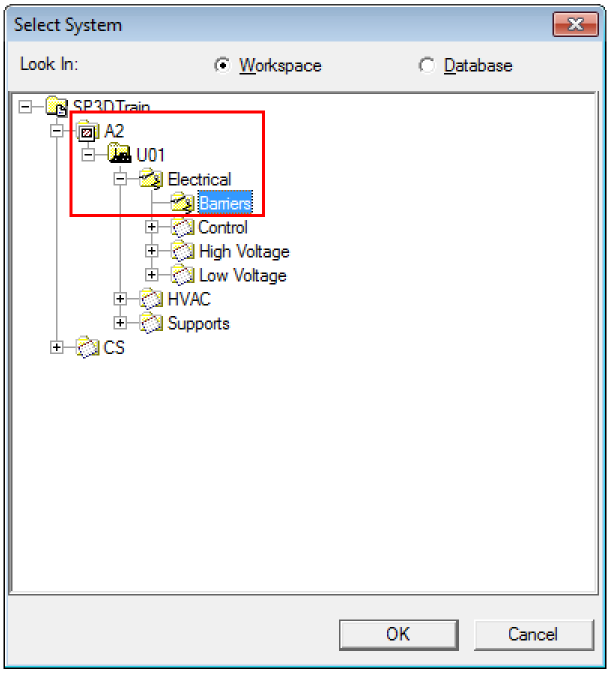


The New Cableway dialog box appears.

7. Select **More** in the **System** drop-down list to specify the system where you want to place the cableway.

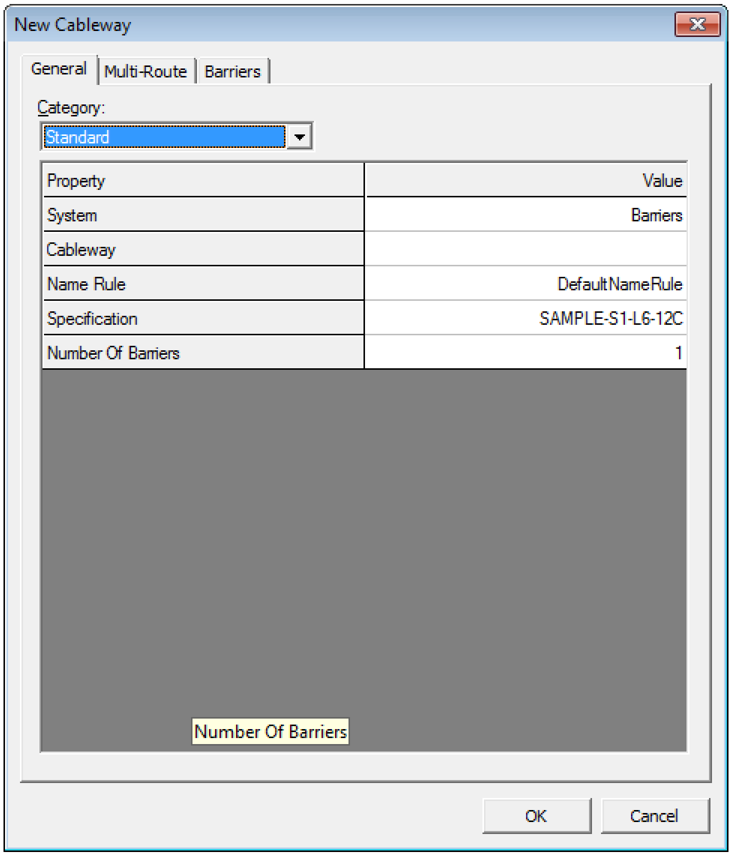


8. In the **Select System** dialog box, select **A2 > U01 > Electrical > Barriers**, and click **OK**.



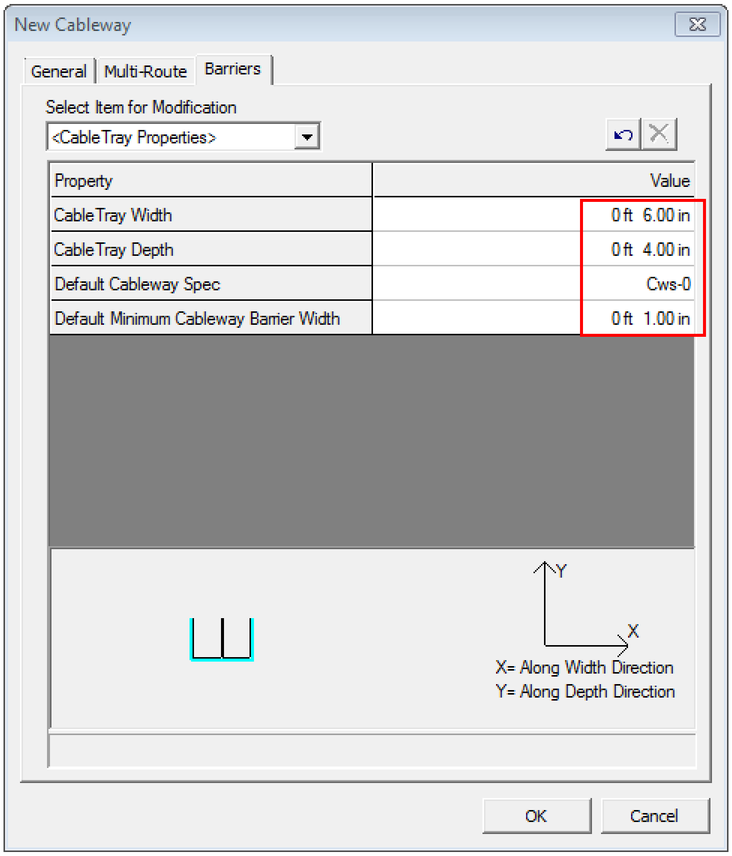
9. In the New Cableway dialog box, verify the following cableway specifications:

System: Barriers
Name Rule: DefaultNameRule
Specification: SAMPLE-S1-L6-12C
Number of Barriers: 1(Select Tab or Enter after Entering # of Barriers)



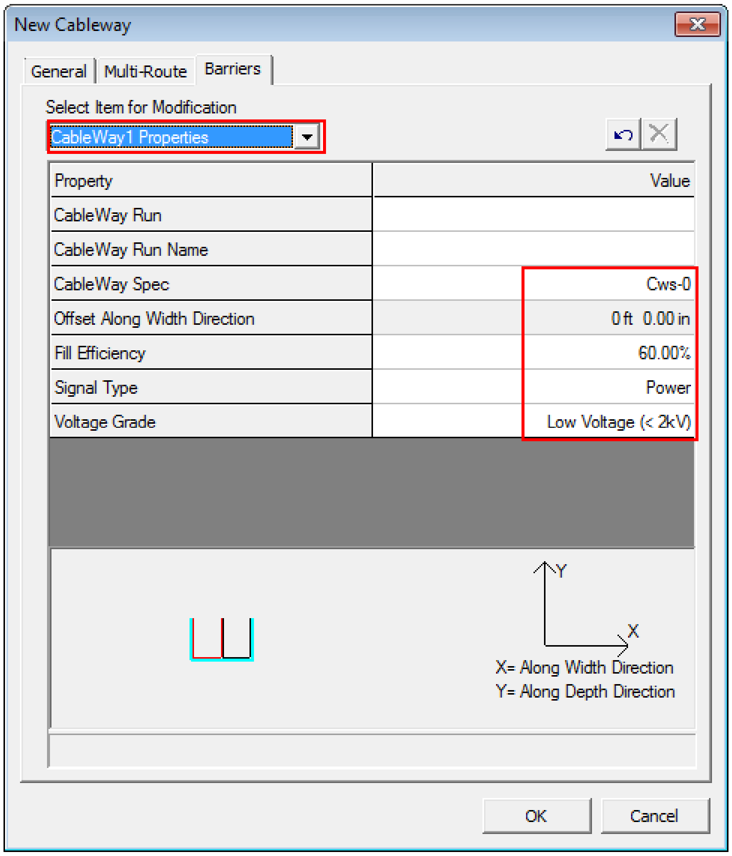
10. Select the **Barriers** tab in the **New Cableway** dialog box
11. Key in the following specifications:

Cable Tray Width: 6in
Cable Tray Depth: 4in
Default Cable Way Spec: Cws-0
Default Min Cableway Barrier Width: 1in



12. Select **Cable way1** from the **Select Item for Modification** drop down menu. Then type the following specifications.

Cable Way Spec: Cws-0
Fill Efficiency: 60%
Signal Type: Power
Voltage Grade: Low Voltage (< 2kV)



13. Continue to enter the following specification for Cableway2, and click **OK**.

    CableWay2
    Cable Way Spec: Cws-0
    Fill Efficiency: 60%
    Signal Type: Control
    Voltage Grade: Low Voltage (600V cables for 480/277V Power)

14. Select **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.

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

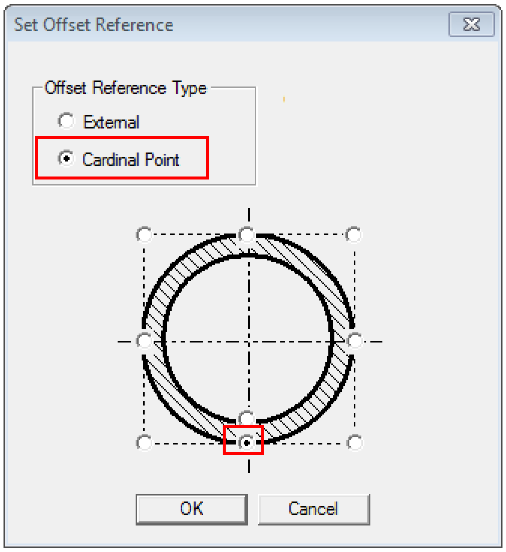
The Set Offset Reference dialog box appears.

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.

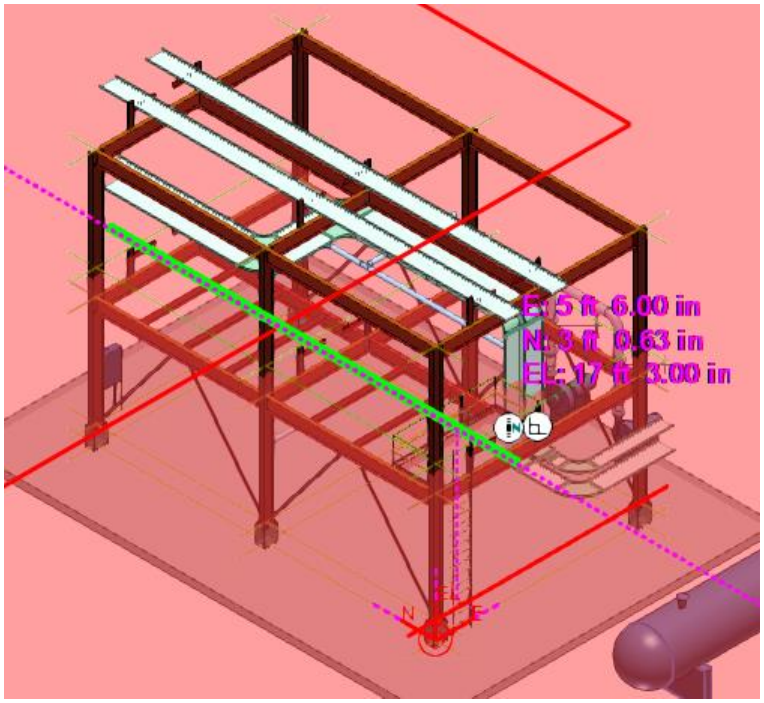
15. Select the following options in the **Set Offset Reference** dialog box, and click **OK**.

    Cardinal Point option
    Bottom center option

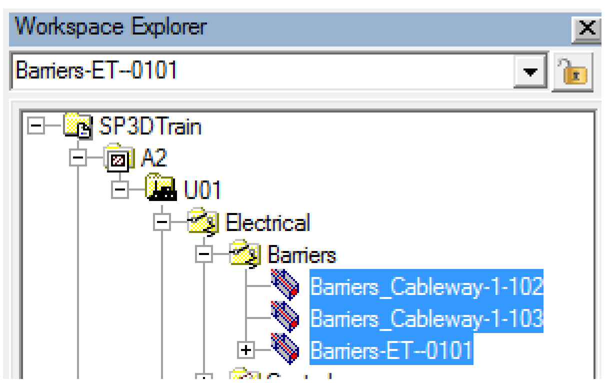
    

16. On the Route Cableway ribbon, key in 48 ft in the Length box

17. Position the cursor in the north N direction and click to define the end point to place 48 ft cableway, a shown.



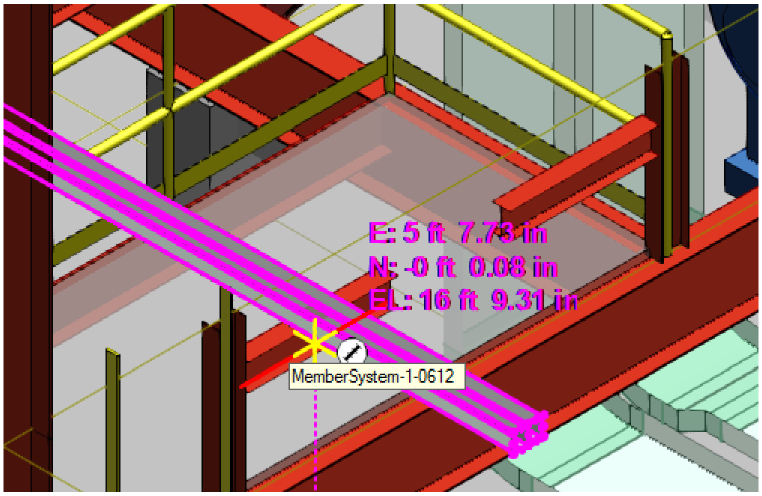
18. Select **Cableways** from the **Locate Filter** drop-down list to select only the (we are selecting Cableways in next step) in the graphic view that you need to copy and paste.
19. Select the three cableways just created from the workspace explorer.



TIP Due to naming rule your cableways will be named uniquely and not name Cableways 1,2,3 and 4)

20. Click **Copy** on the Common toolbar.

21. Select the **Midpoint** of the supporting member as the **Copy from Point**.

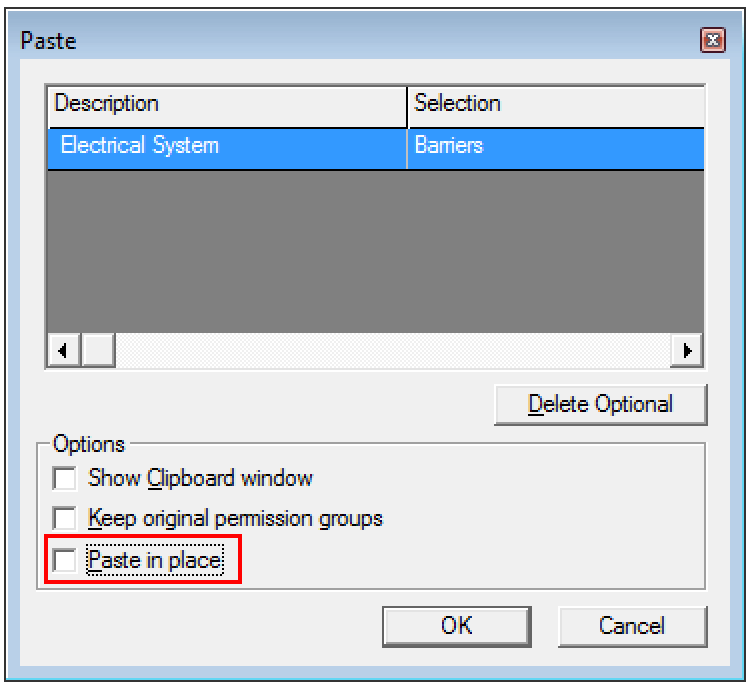


22. Select **Paste** .

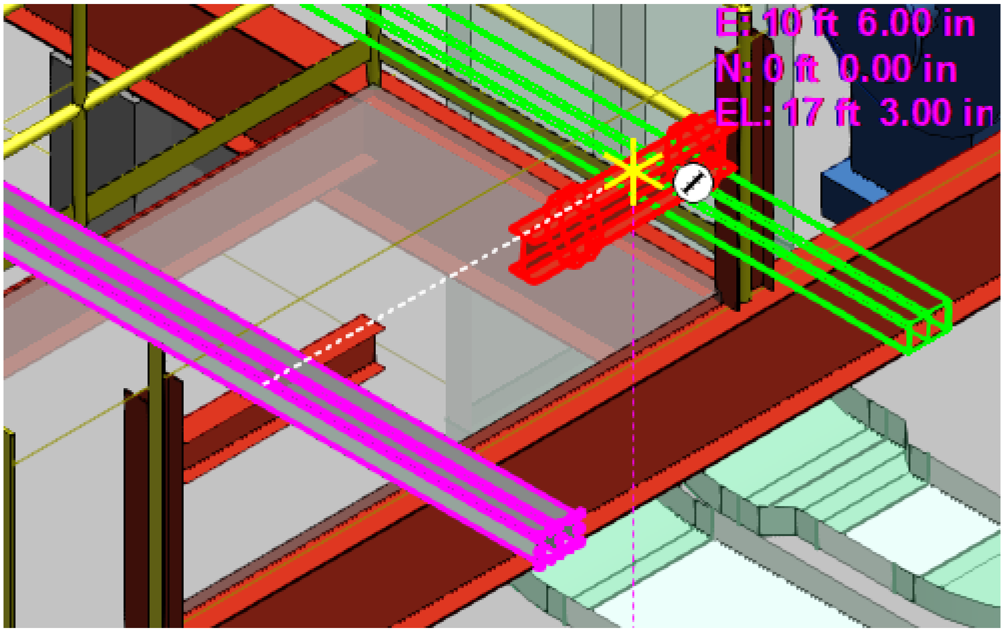
    The Paste dialog box appears.

23. Keep the default parent system for the new objects to be pasted on the model.

24. Clear the **Paste in place** check box in the **Paste** dialog box, and click **OK**.



25. Select the midpoint of the supporting member as the **Paste from** point as shown below.



26. Click in the graphic view to place the Cableways.

Adding Maintenance Volumes to Cableway

Objective

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

- Add maintenance volumes to an existing cableway.

Prerequisite Sessions

- Smart 3D Common Sessions
- *Electrical Overview* (on page 7)
- *Routing a Cableway* (on page 73)

Overview

Maintenance volumes can be added to cableways. These maintenance volumes represent space reserved for installing and maintaining cables in a cable tray and can be defined at the cableway level and optionally overridden at the individual feature level. The same volume can be defined for duct banks to reserve space for a mud mat below the duct bank. Use the **Format > View** command to turn on the **Maintenance** aspect so you can see the maintenance volumes in the model.

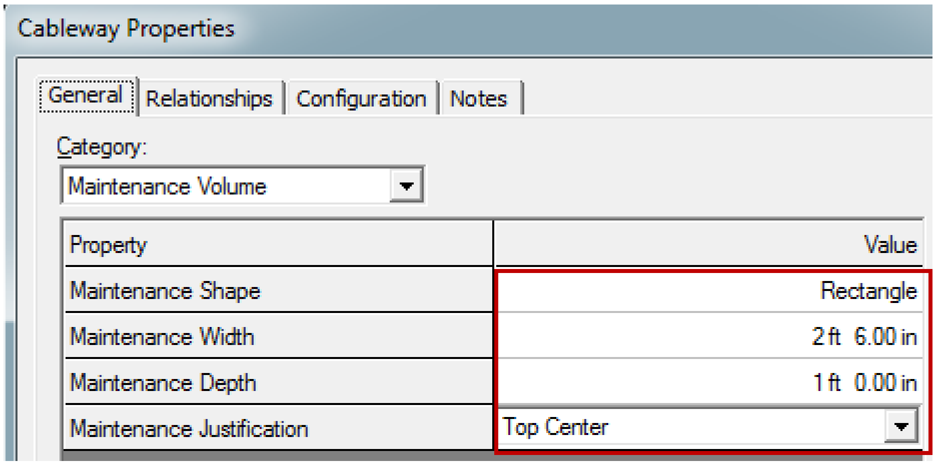
It is possible to specify a shape for the maintenance volume independently of the shape of the cableway being routed and also adjust justification of the volume relative to the cableway.

Before Starting this Procedure

- Define your workspace to display Unit **U01** and coordinate system **U01 CS**. In your training plant, select **U01** from **Plant Filters > Training Filters** in the **Select Filter** dialog box.

1. Select **Cableways** from **Locate Filter** list to select only cableways from the graphic view.
2. Select the cableway **A2 > U01 > Electrical > CT > CT-ET—0001** and select Properties from the ribbon bar.
3. In the **General** tab, select **Maintenance Volume** from the **Category** pick list.
4. Select or key in the values listed below, and then click **OK**.

Maintenance Shape: Rectangle
Maintenance Width: 2 ft 6 in
Maintenance Depth: 1 ft 0 in
Maintenance Justification: Top Center



5. Select **Format > View** and select **Maintenance** in the **Selected Aspects** list, and click **OK**.
6. The final output should resemble the picture below.

Inserting Components

Objective

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

- Inset components from the Smart 3D catalog in a model.

Prerequisite Sessions

- Smart 3D Overview
- Smart 3D Common Sessions
- *Electrical Overview* (on page 7)
- *Routing a Cableway* (on page 73)

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, and so forth. 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.

Smart 3D 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. The cable tray part hierarchy can be standardized based on the project specification set.

- CB-S1-L6-12B
  - Cable Tray Parts
    - Cable Tray Bend
      - CT Horizontal Bend
        - Cable Tray 30 Horizontal Bend
        - Cable Tray 45 Horizontal Bend
        - Cable Tray 60 Horizontal Bend
        - Cable Tray 90 Horizontal Bend
      - CT Vertical Bend
        - Cable Tray 30 Vertical Inside Bend
        - Cable Tray 30 Vertical Outside Bend
        - Cable Tray 45 Vertical Inside Bend
        - Cable Tray 45 Vertical Outside Bend
        - Cable Tray 60 Vertical Inside Bend
        - Cable Tray 60 Vertical Outside Bend
        - Cable Tray 90 Vertical Inside Bend
        - Cable Tray 90 Vertical Outside Bend
    - Cable Tray Connection Parts
      - CT Connection Part
        - Cable Tray Frame Type Box Connector
        - Cable Tray Ladder Splice Plate
        - Cable Tray Vertical Adjustable Splice Plate
    - Cable Tray Cross
      - Cable Tray Cross
      - Cable Tray Horizontal Expanding/Reducing Cross
    - Cable Tray Earth Connectivity Connectors
      - CT Earth Connectivity Connector
        - Cable Tray Bonding Jumper
    - Cable Tray End Plate
      - Blind End Plate
    - Cable Tray Reducer
      - CT Left Reducer
        - Cable Tray Left Reducer
      - CT Right Reducer
        - Cable Tray Right Reducer
      - CT Straight Reducer
        - Cable Tray Straight Reducer
    - Cable Tray Straight
      - Cable Tray Straight
    - Cable Tray Tee
      - CT Horizontal Tee
        - Cable Tray Expanding Tee
        - Cable Tray Reducing Tee
        - Cable Tray Tee
      - CT Vertical Tee
        - Cable Tray Tee Vertical Down
        - Cable Tray Tee Vertical Up
    - Cable Tray Wye
      - CT Horizontal Wye
        - Cable Tray Horizontal Wye Left
        - Cable Tray Horizontal Wye Right

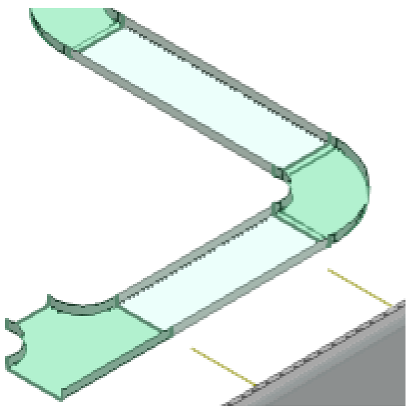
As with other routing environments, precision tools are available to aid you in controlling the route path. When inserting components, you can use PinPoint or Point Along commands to position the components precisely in the model. Use the Point Along command to select an element along which to place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

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 look like this.

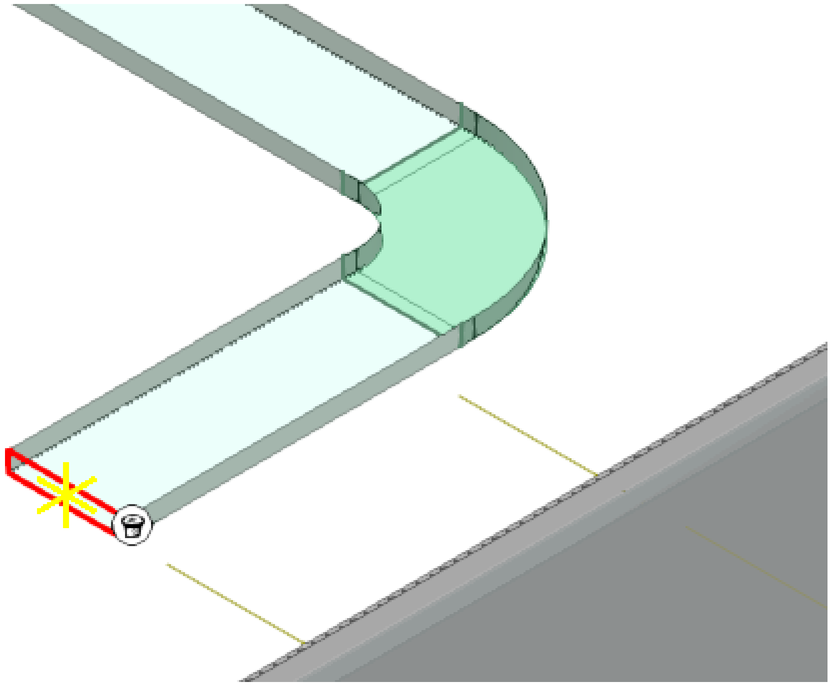


Before Starting this Procedure

- 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.

1. Click **Insert Component**  on the vertical toolbar.

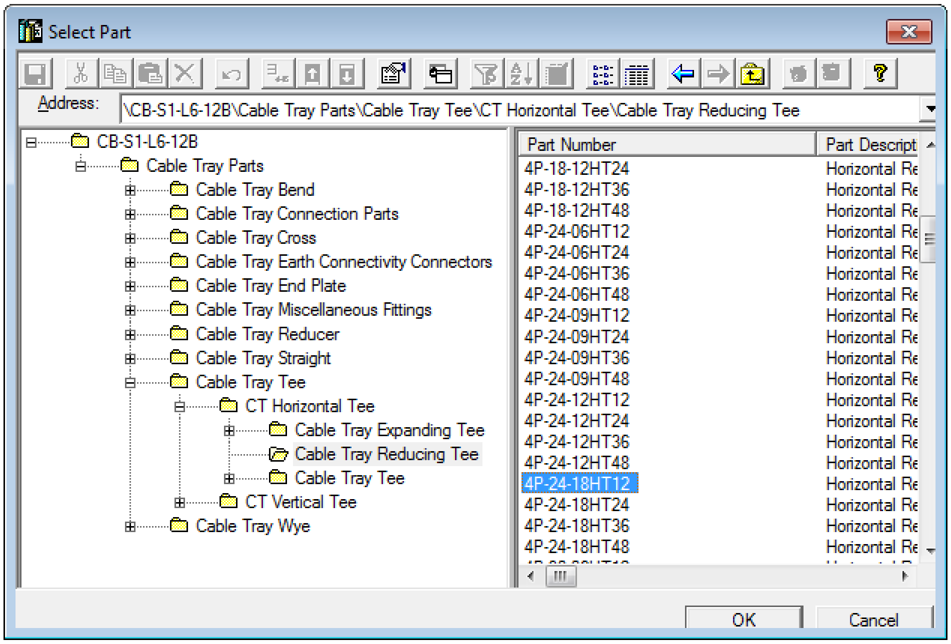
2. Select the **Cableway End Feature** of a cableway as shown.



3. 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.

The Select Part dialog box appears.

4. 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.

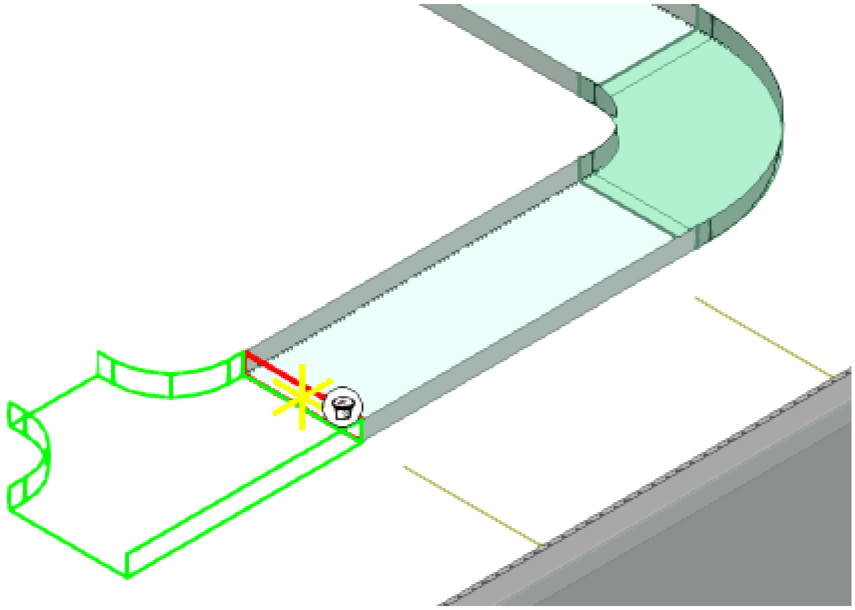


NOTES

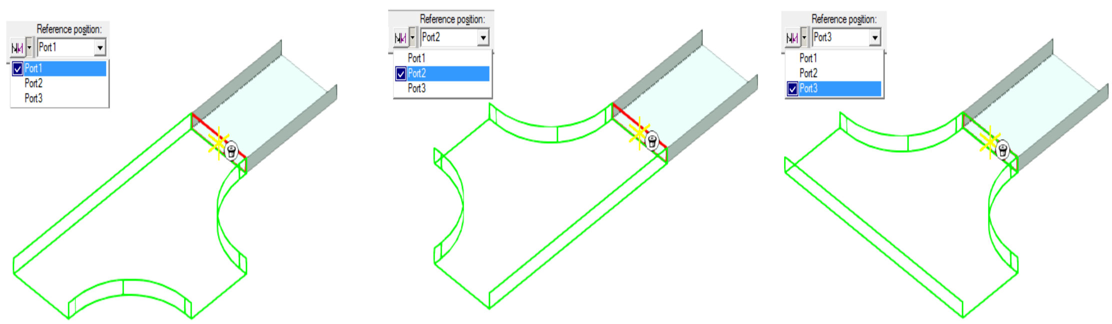
- The **Select Part** dialog box displays all the cable tray parts available in the part catalog for the current cable tray specification. However, it will not let you select a part if the geometry does not belong to the correct feature type during fitting placement.
- The part number in the right pane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

5. After selecting the Part Number in the **Select Part** dialog box, click **OK**.

The horizontal tee displays in the graphic view.

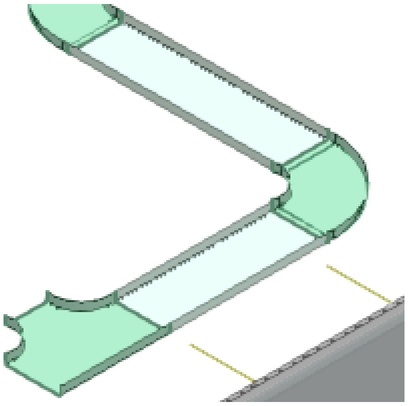


NOTE During insertion of any component, the **Flip** command toggles through the ports available for the component being inserted. As each port is toggled, the component is oriented such that the selected port is aligned along the axis of the run on which it is being inserted. The **Component Reference 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.



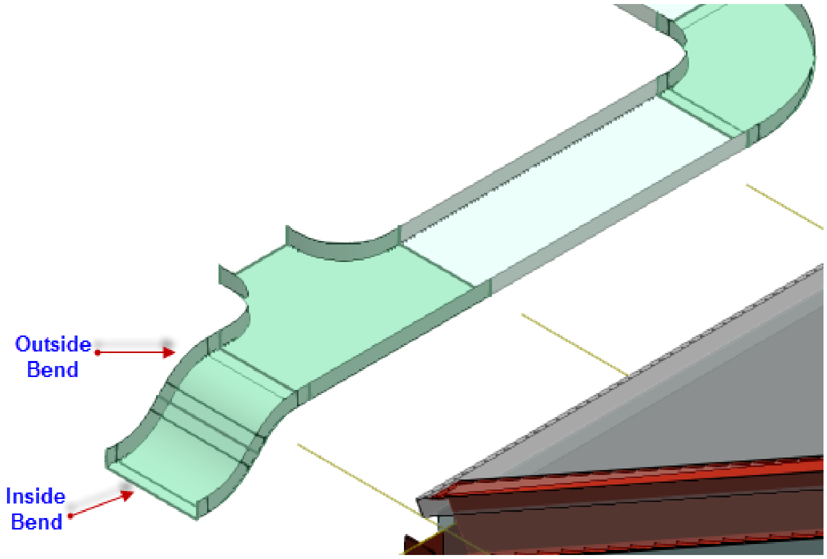
6. Click **Finish** to accept the placement of the component.

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



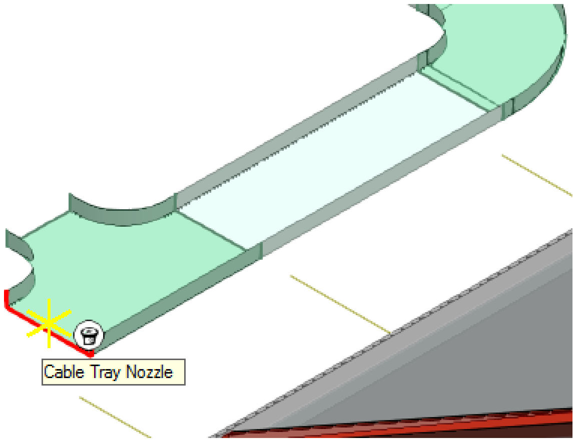
Inserting a Vertical Bend

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 this.



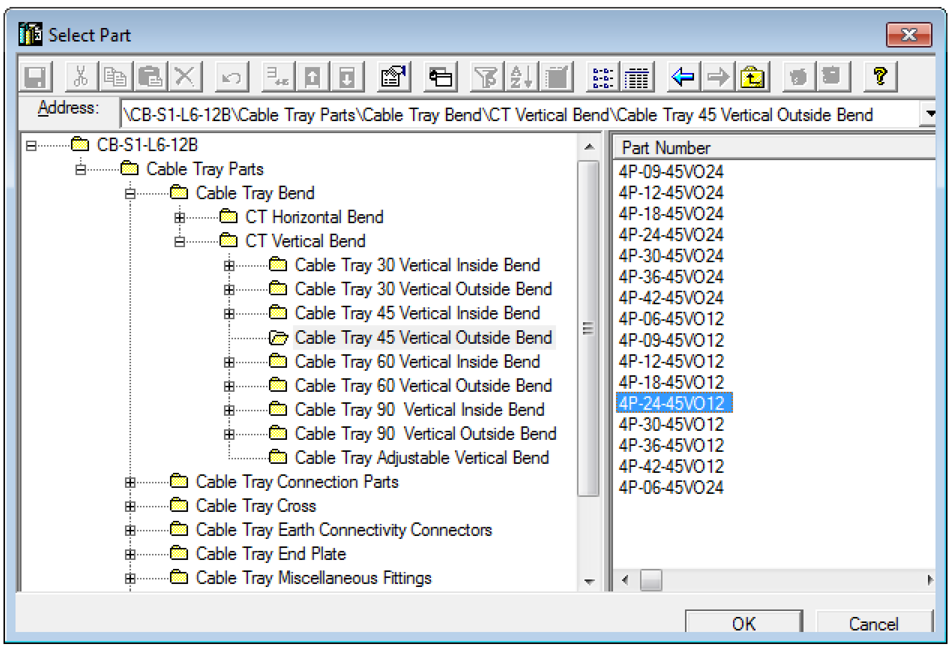
1. Click **Insert Component**  the vertical toolbar.

2. Slect the end feature of the horizontal tee that you placed as shown.



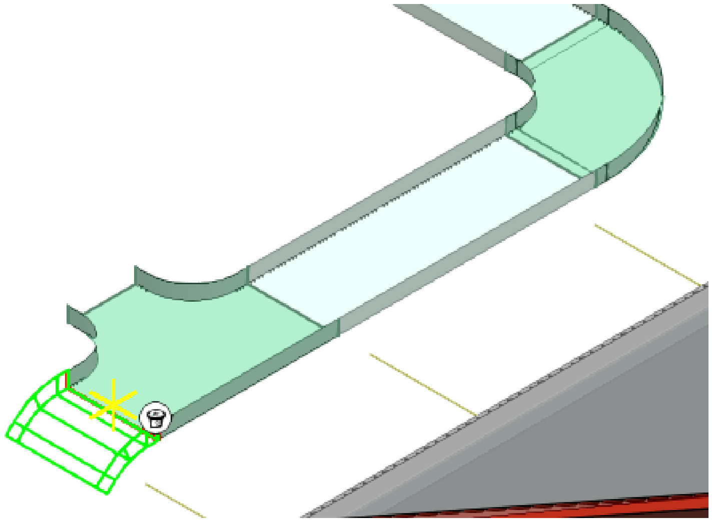
3. Select **More…** in the **Part** drop-down list on the **Insert Component** ribbon to select the component part from the catalog.

4. 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, and select the **Part Number 4P-24-45VO12** from the right pane.

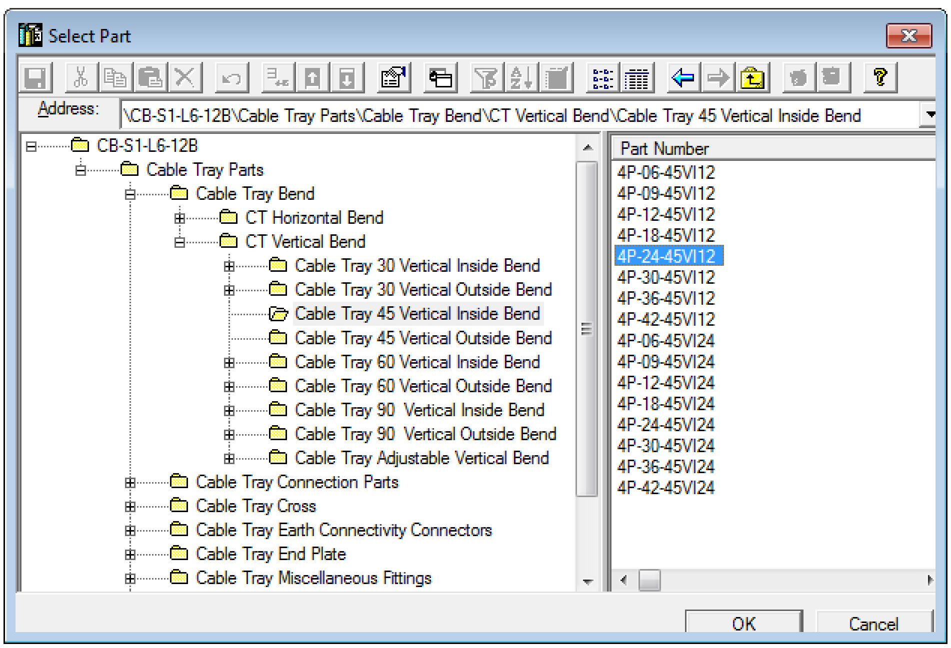


5. After selecting the **Part Number** in the **Select Part** dialog box, click **OK**.

The vertical bend in the graphic view should resemble below.

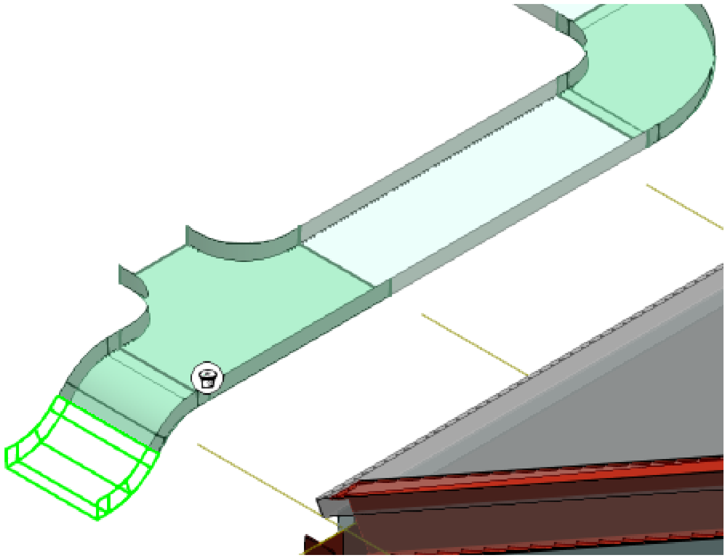


6. Click **Finish** to accept the placement of the component.
7. On the **Insert Component** ribbon, select the **More…** option in the **Part** drop-down to select the component part from the catalog.
8. In the **Select Part** dialog box, expand the node **CB-S1-L6-12B\Cable Tray Parts\Cable Tray Bend\CT Vertical Bend\Cable Tray 45 Vertical Inside Bend** in the left pane, and select the **Part Number 4P-24-45VI12** from the right pane.



9. After selecting the **Part Number** in the **Select Part** dialog box, click **OK**.

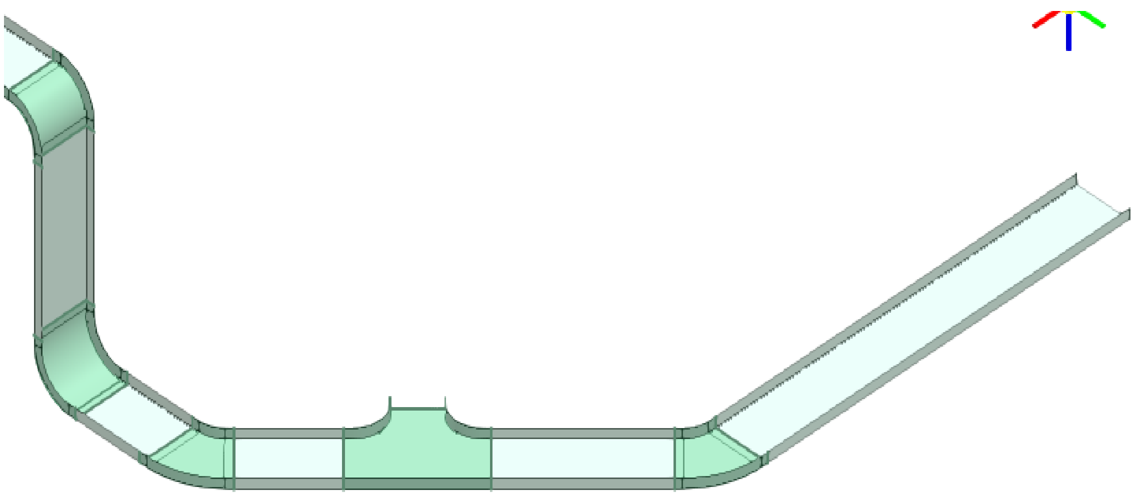
   The vertical bend in the graphic view should resemble below.



10. Click **Finish** to accept the placement of the component.
11. Right-click in the graphic view to terminate the **Insert Component** command.

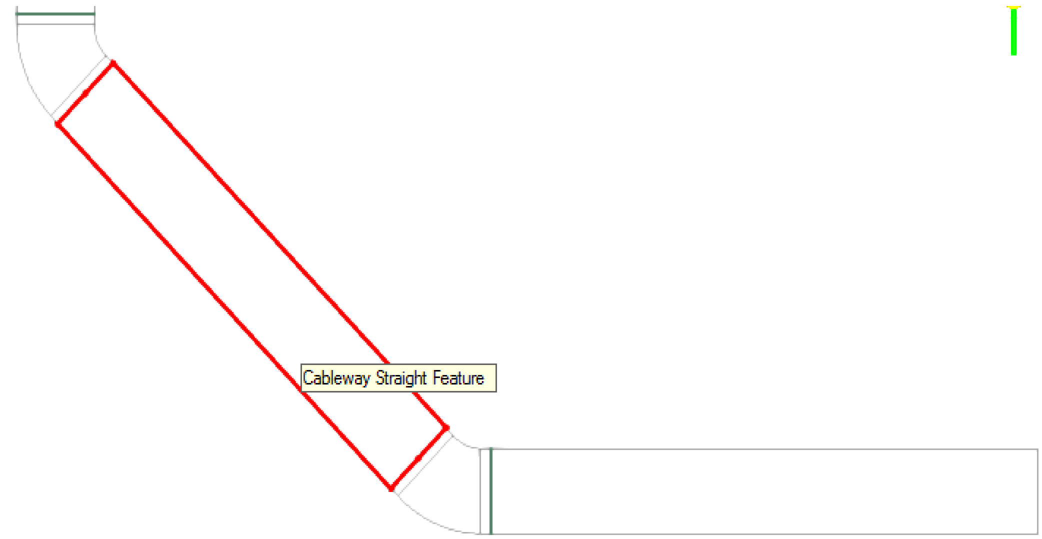
Inserting Horizontal Tee using Point Along

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 this.

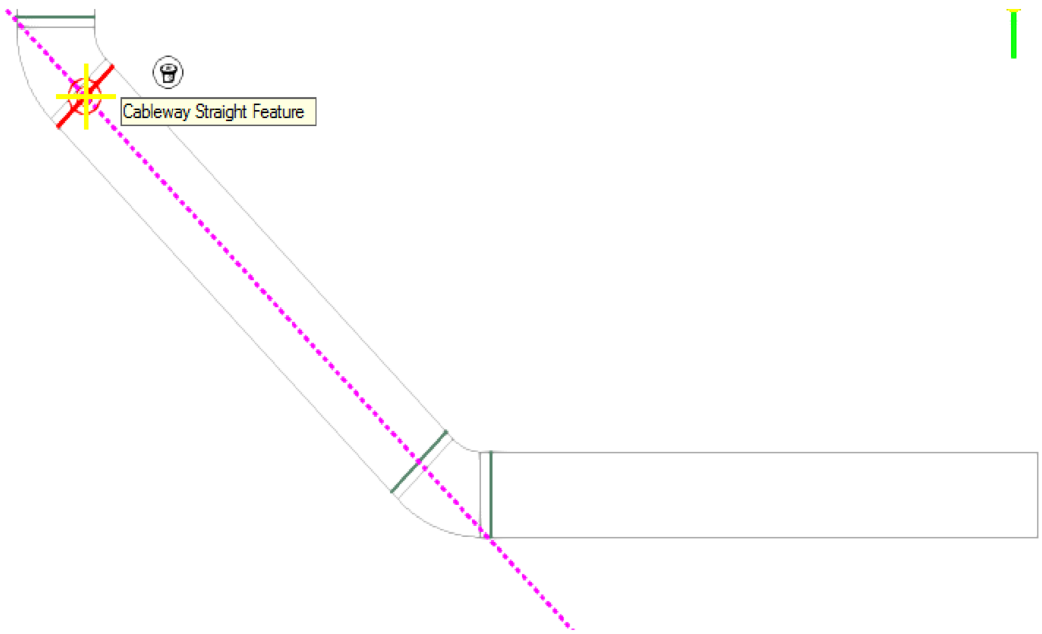


1. Click **Insert Component** on the vertical toolbar.
2. Activate **Point Along** ribbon using **Tools > Point Along** command.
3. Select **Reference** option on the **Point Along** ribbon. This option identifies the path along which to measure the placement distance.

4. Select the **Cableway Straight Feature** to specify the path along which you want to measure the placement distance of the tee, as shown.



5. Select **Reference Point** 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.
6. Select End of **Cableway Straight Feature** of a cableway to specify the point from which to measure the placement distance as shown.



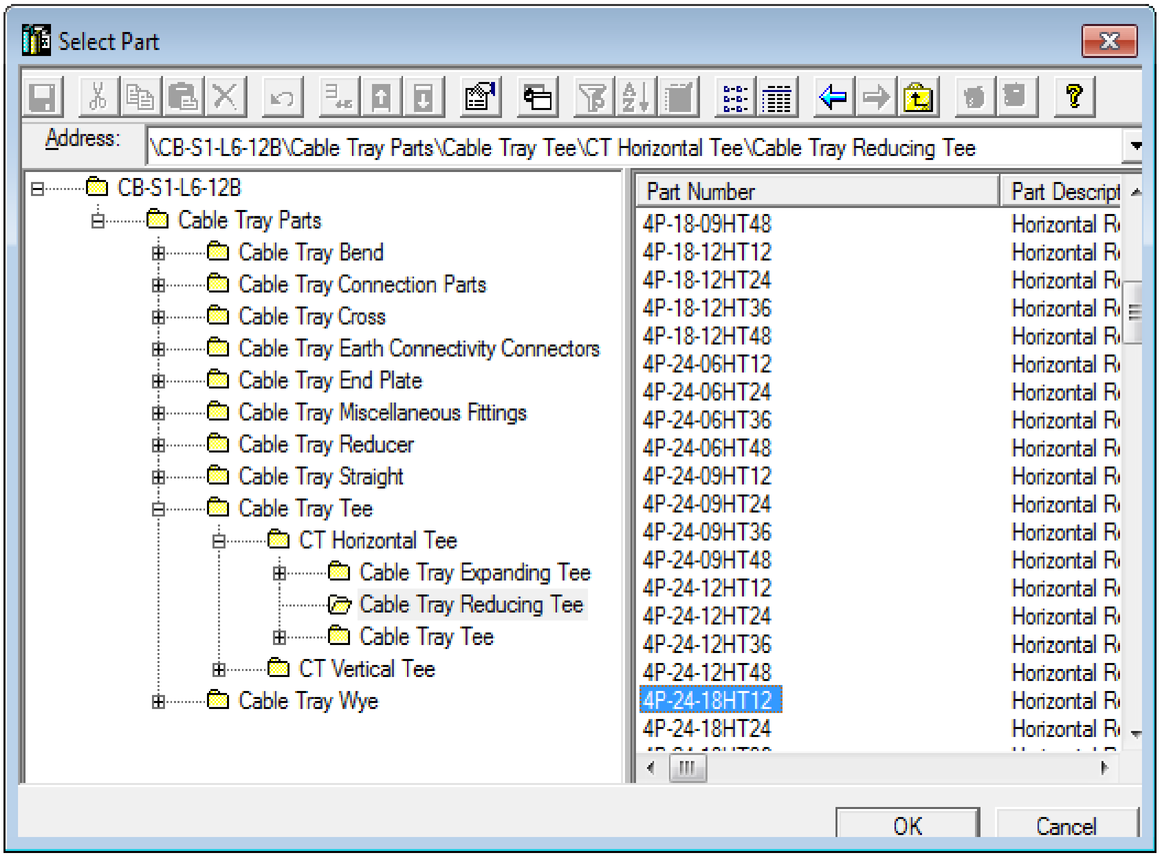
7. Select the **Cableway Straight Feature** of the cableway where you want to insert the tee.

8. 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.

   *The **Select Part** dialog box appears.*

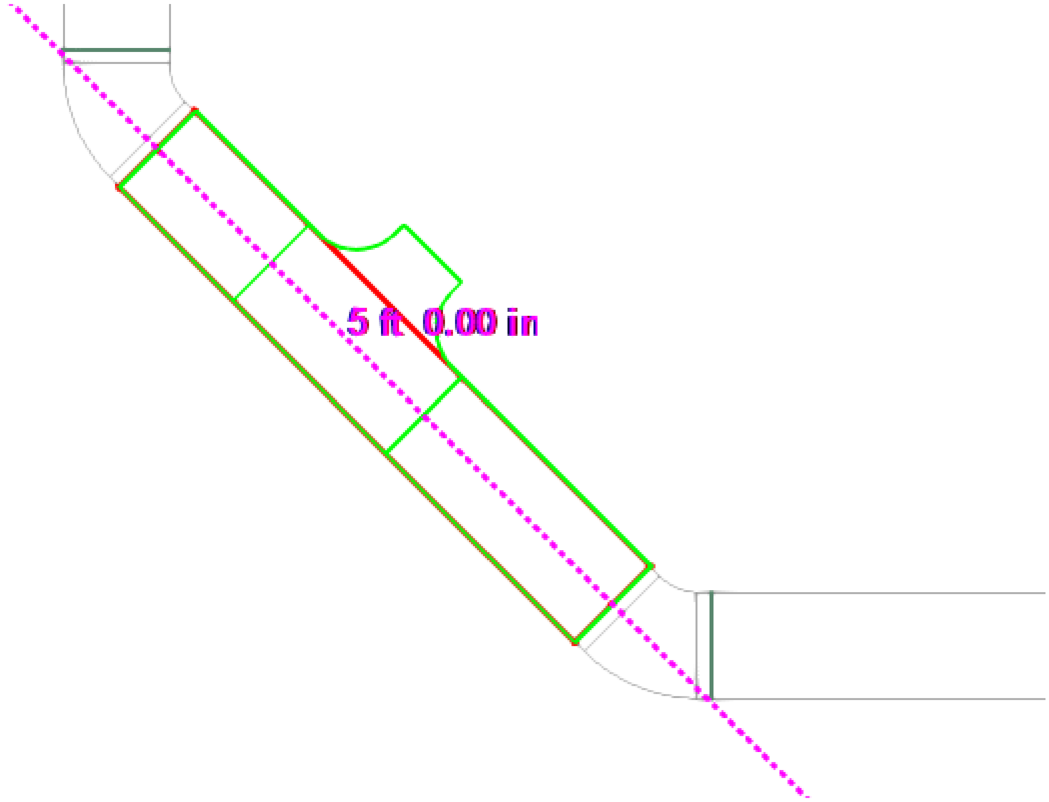
9. Expand the node **CB-S1-L6-12B\Cable Tray Parts\Cable Tray Tee\CT Horizontal Tee\Cable Tray Reducing Tee** in the left pane of the **Select Part** dialog box.

10. Select the **Part Number 4P-24-18HT12** in the right pane.



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

12. 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 this.



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.

13. Select the **Insert point** option in the **Insert Component** ribbon, and click in the active view to accept the data point.
14. Click **Finish** to accept the placement of the component.
15. 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

Routing Cable Trays

Objective

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

- Route cable trays in Smart 3D

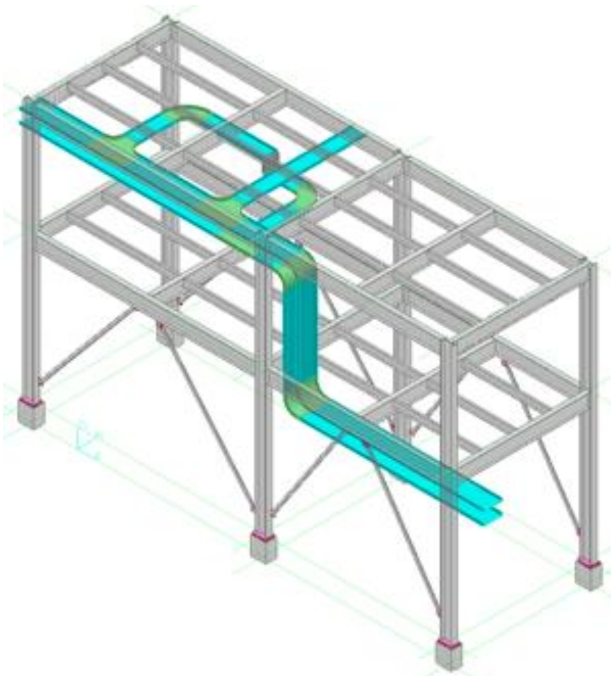
Overview

This lab is focused on getting proper technique on how to create a cable tray network in a building.

- Route Stacked cable trays using top of steel elevation
- Branch from a straight section
- Manually insert components
- Place "Zero-Specs" cableway to connect cable trays
- Group disconnected cable trays into one cableway

Creating Cable Tray Network

Create a cable tray network by routing the cable trays from the coordinate points E: 43 ft, N: 1 ft 8 in, EL: 15 ft 6 in in Unit U02. Place two reducing tees on the top cable tray and then connect the top cable trays with the bottom cable trays using a connecting cableway. Extend the free end of the cable trays by an offset from the top of the steel. All trays and connecting cableway must have "Power" as the signal type for each run. The routed cable trays should resemble this.



Before you start routing the cable trays, define your workspace to show Unit U02.

1. Select **Tasks > Electrical** to enter the **Electrical** task.
2. Verify the **Active Permission Group** is set to **Electrical**.
3. Activate the **PinPoint** ribbon and set the active coordinate system to **U02 CS** on the **PinPoint** ribbon.
4. Click **Set Target to Origin**  option on the **PinPoint** ribbon to move the target to the origin of the current coordinate system.
5. Click **Route Cableway**  on the vertical toolbar.
6. Key in the following coordinates on the PinPoint ribbon and click in the graphic view to accept the starting point:

   E: 43 ft
   N: 1 ft 8 in
   El: 15 ft 6 in

   The New Cableway dialog box appears.
7. Select **More …** in the **System** drop-down list of the dialog box to specify the system where you want to place the cableway.
8. In the **Select System** dialog box, select **A2 > U02 > Electrical > Low Voltage > CT** and click **OK**.
9. In the **New Cableway** dialog box, verify the following cableway specifications:

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

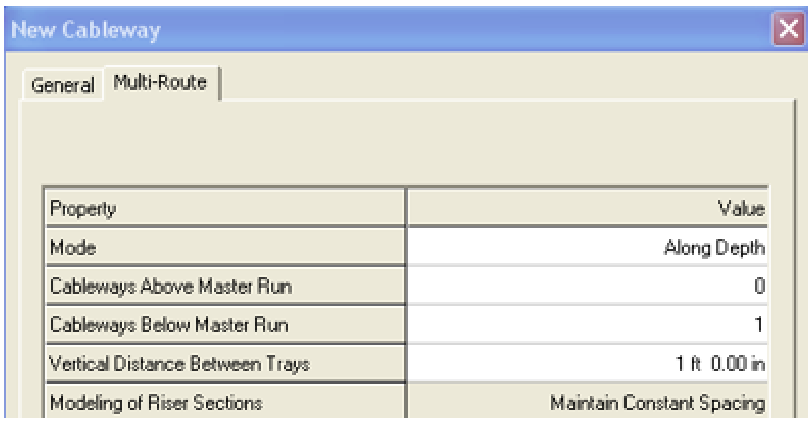
10. Select the **Cable Fill** option in the **Category** drop-down list and verify the following specifications:

    Fill Efficiency: 60%
    Signal Type 1: Power

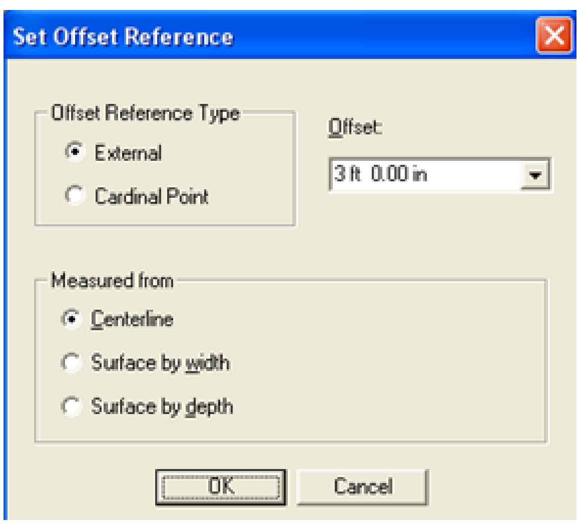
11. Switch to the **Multi Route** tab.

12. Make the following changes:

    Mode: Along Depth
    Cableways above Master Run: 0
    Cableways below Master Run: 1
    Vertical Distance between Trays: 1 ft



13. Set **Offset Reference Type** to **External** and key in 3 ft in the **Offset** drop-down list in the **Set Offset Reference** dialog box.

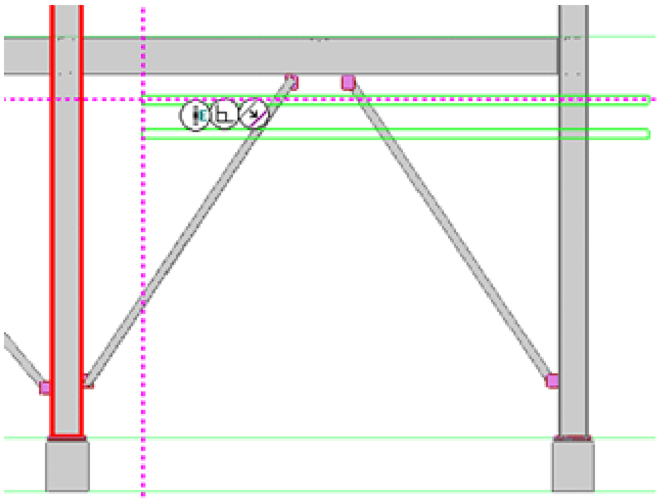


14. Select the **Rectangle** shape in the **Shapes** drop-down list and key in the following specifications on the **Route Cableway** ribbon to specify the width and depth of the cross section:

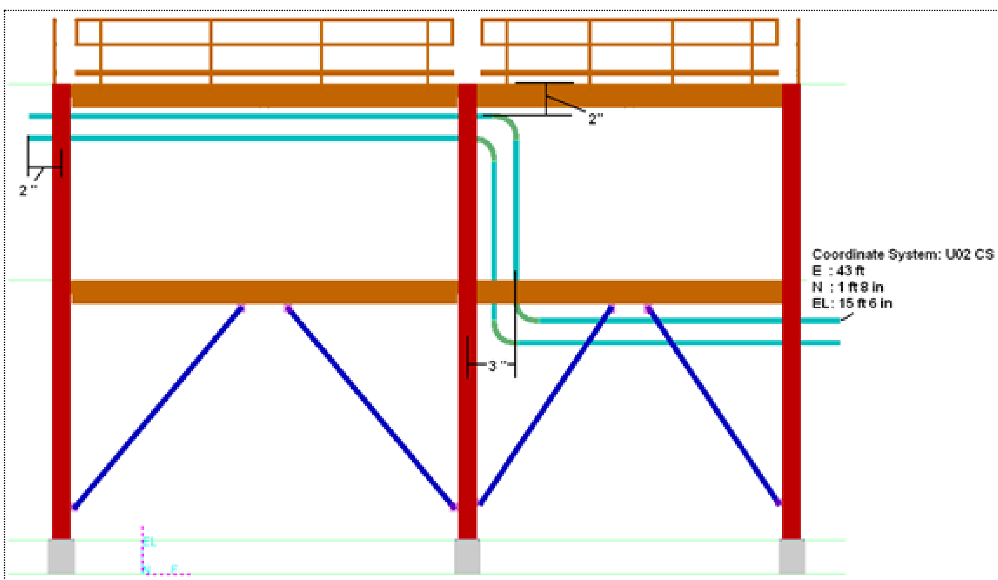
    Width: 2 ft
    Depth: 0 ft 4 in

15. Change the view of the model to **Looking North** by using the **Common Views** dialog.
16. Select the **East-West Plane** option in the **Plane** drop-down list on the **Route Cableway** ribbon.
17. Route the trays as shown below. Pay attention to the offset values from top of steel and column.

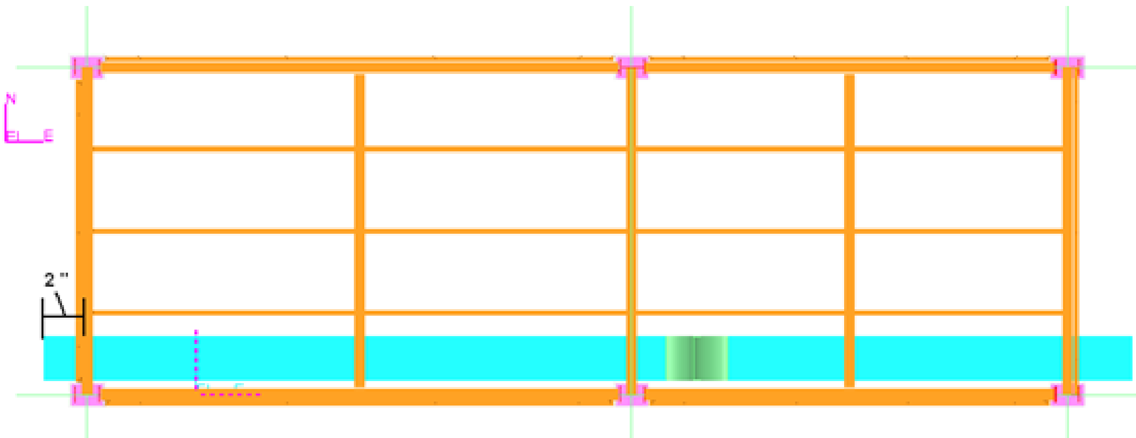
    NOTE To find the offset point, move the cursor over the **Column** until the offset glyph appears and move slowly away from **Column** until perpendicular projection line is displayed.



Projection LIne Indicating 3 ft Offset from Column

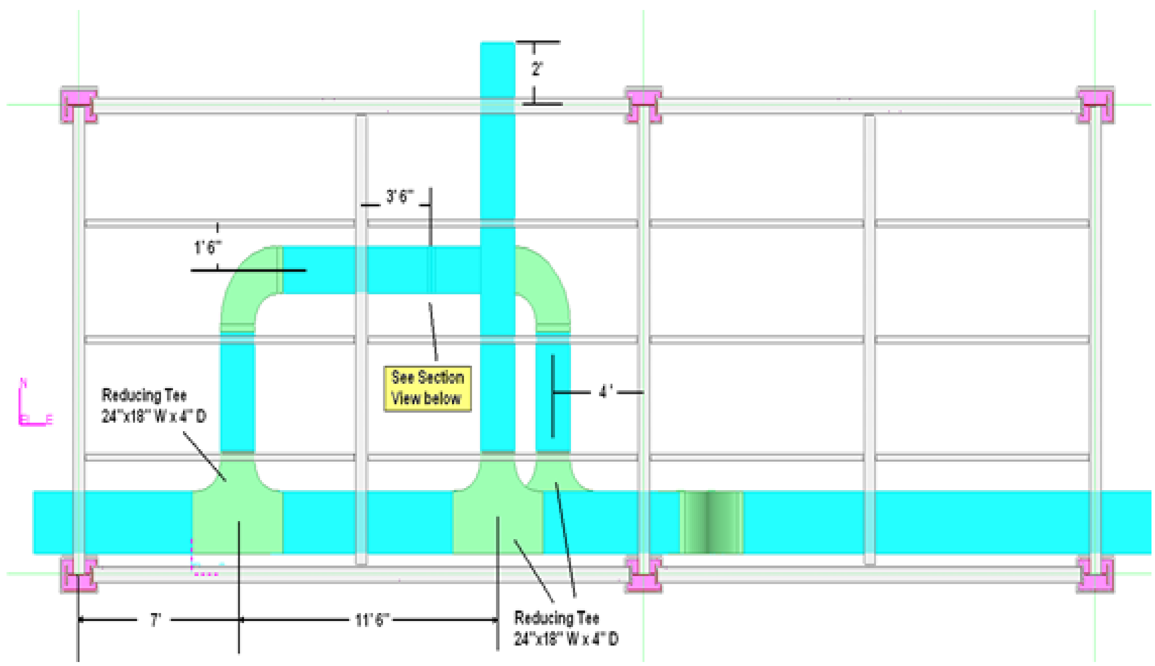


North Elevation View



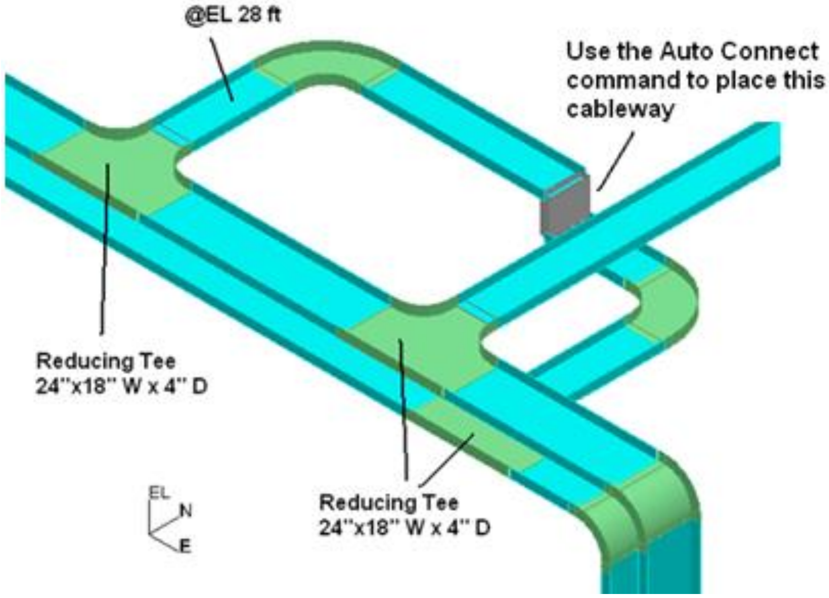
Plan View

18. Continue to route the trays with the following configuration. This is the plan view of the building to give better perspective of the extent and offset of the trays.



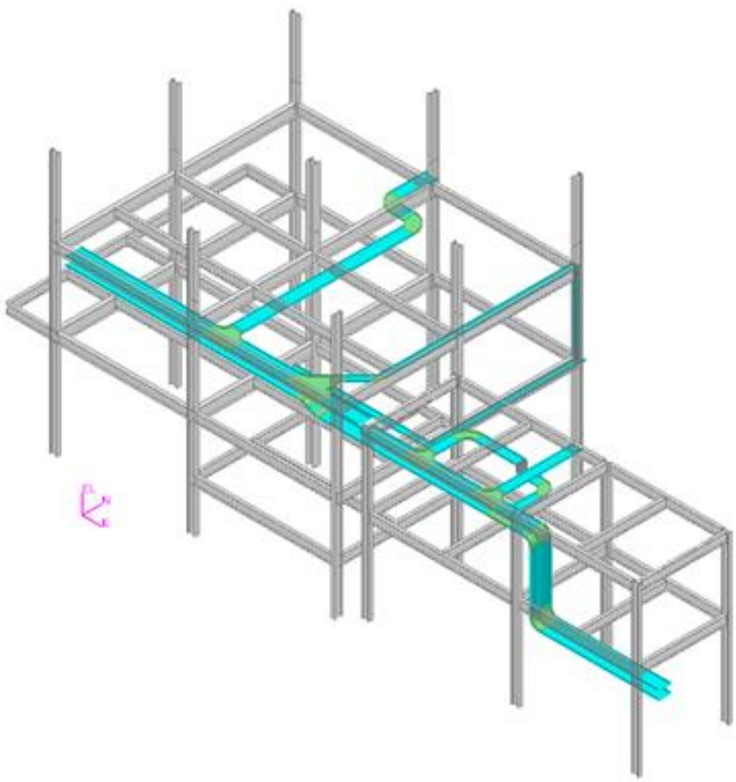
Routed Cable Trays

19. Below is the section view of the elevation change between the stacked trays. Place a “Zero-Specs” cableway section to connect the two trays using the Auto Connect command.



Section View – Cableway section

Create a second cable tray network by routing the cable trays from the coordinate points E: 9 ft, N: 1 ft 10.60 in, EL: 29 ft in Unit U03. Place fittings in these trays and then connect both cable trays networks. Extend the free end of the cable trays by an offset from the steels. All trays and connecting cableway must have "Power" as the signal type for each run. The routed cable trays should resemble this.



Routed Cable Trays

20. Re-define your workspace to show Unit U03.
21. Activate **PinPoint** and set the active coordinate system to **U03 CS** on the PinPoint ribbon.
22. Click **Set Target to Origin**  on the **PinPoint** ribbon, to move the target to the origin of the current coordinate system.
23. Click **Route Cableway**  on the vertical toolbar.
24. Key in the following coordinates on the **PinPoint** ribbon, and click in the graphic view to accept the starting point:

    E: 9 ft
    N: 1 ft 10.60 in
    El: 29 ft

    The New Cableway dialog box appears.
25. Select **More …** in the **System** drop-down list of the dialog box to specify the system where you want to place the cableway.
26. In the **Select System** dialog box, select **A2 > U03 > Electrical > Low Voltage > CT** and click **OK**.
27. In the New Cableway dialog box, verify the following cableway specifications:

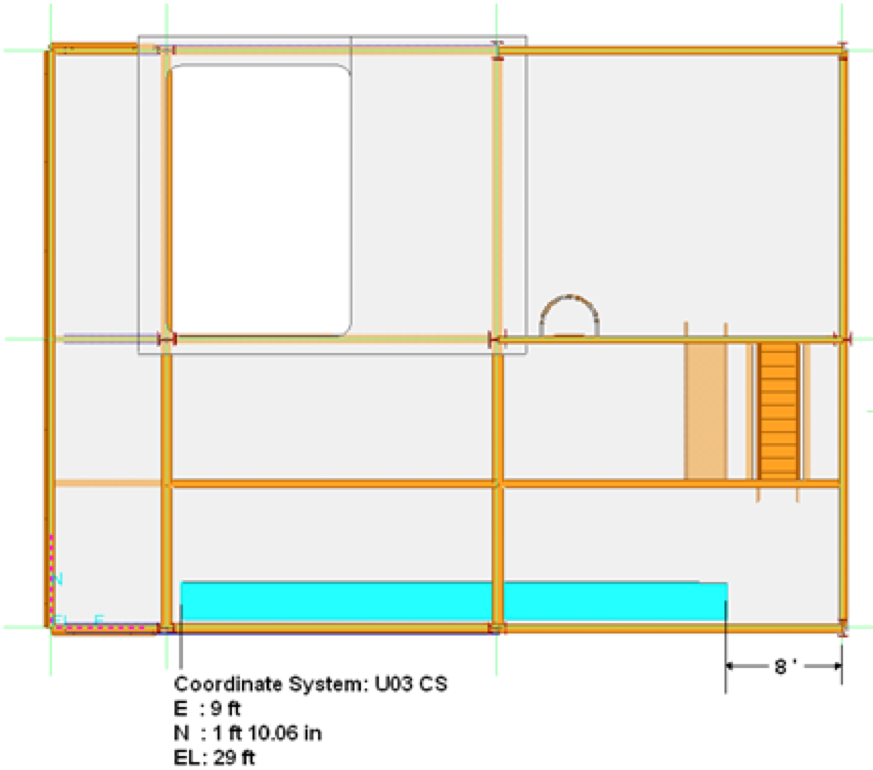
    System: CT
    Name Rule: DefaultNameRule
    Specification: CB-S1-L6-12B
28. Select **Cable Fill** in the **Category** drop-down list and verify the following specifications:

    Fill Efficiency: 60%
    Signal Type 1: Power
29. Switch to **Multi Route** tab.
30. Make the following changes:

    Mode: Along Depth
    Cableways above Master Run: 0
    Cableways below Master Run: 1
    Vertical Distance between Trays: 1 ft
31. Set the **Offset Reference Type** to **External** and key in 8 ft in the **Offset** drop-down list in the **Set Offset Reference** dialog box.
32. 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:

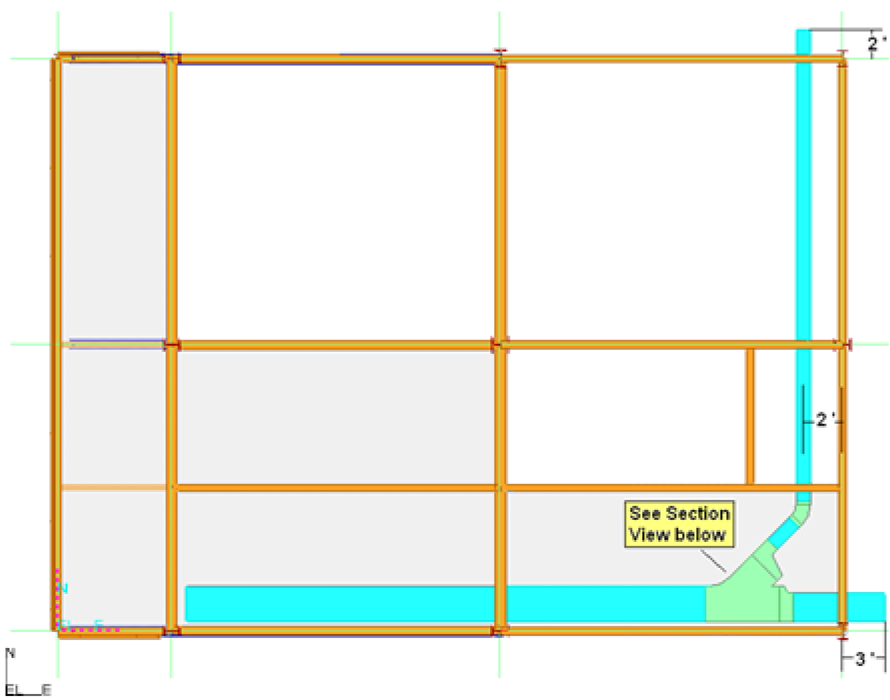
    Width: 2 ft 6 in
    Depth: 0 ft 4 in
33. Change the view of the model to **Looking Plan** by using the **Common Views** dialog.
34. Select the **Plan Plane** option in the **Plane** drop-down list on the **Route Cableway** ribbon.

35. Route the trays as shown below. Pay attention to the offset value from top of steel.



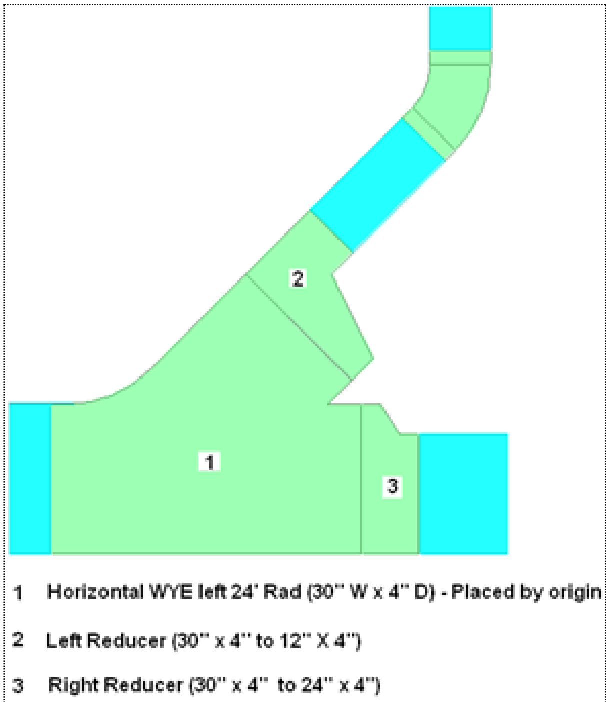
Plan View

36. Finish the top tray routing as shown.



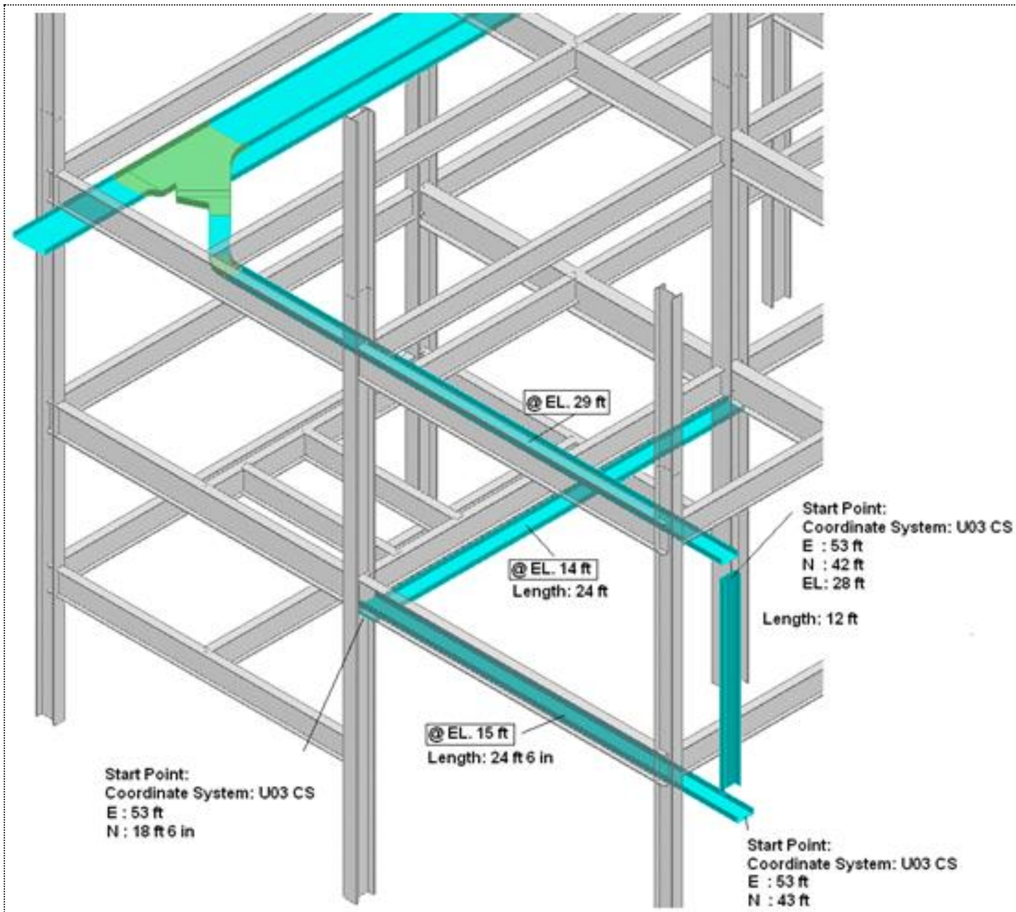
Routed Top Cable Trays

37. Below is the section view of the components placed using the **Insert Component** command.

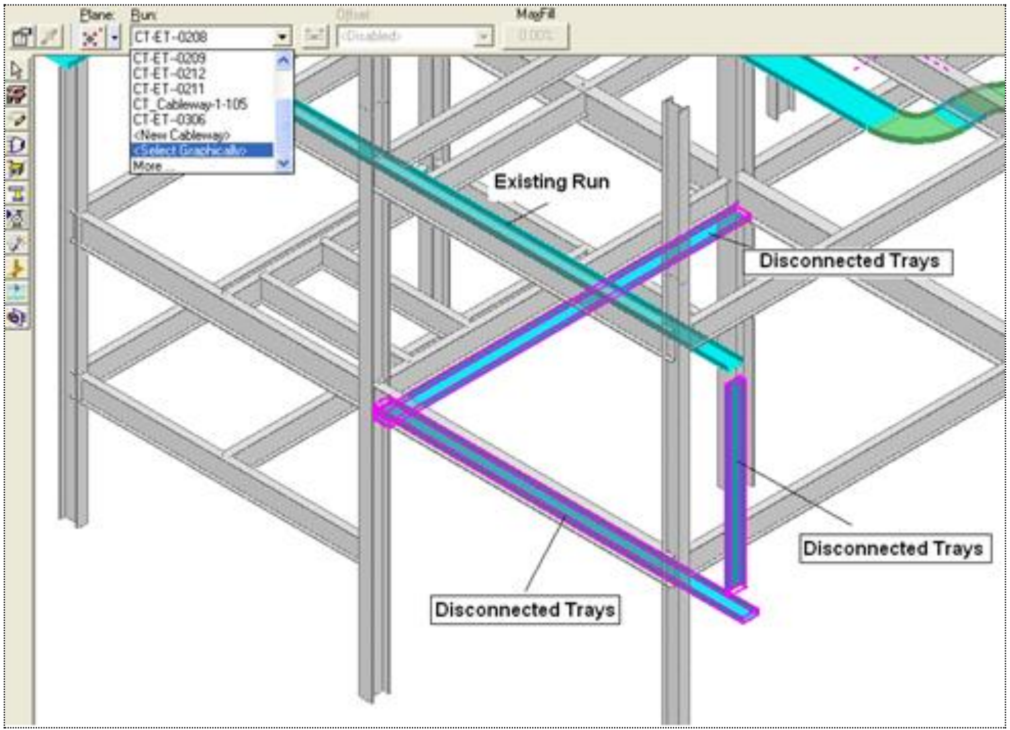


38. Continue routing the trays with the following configuration:

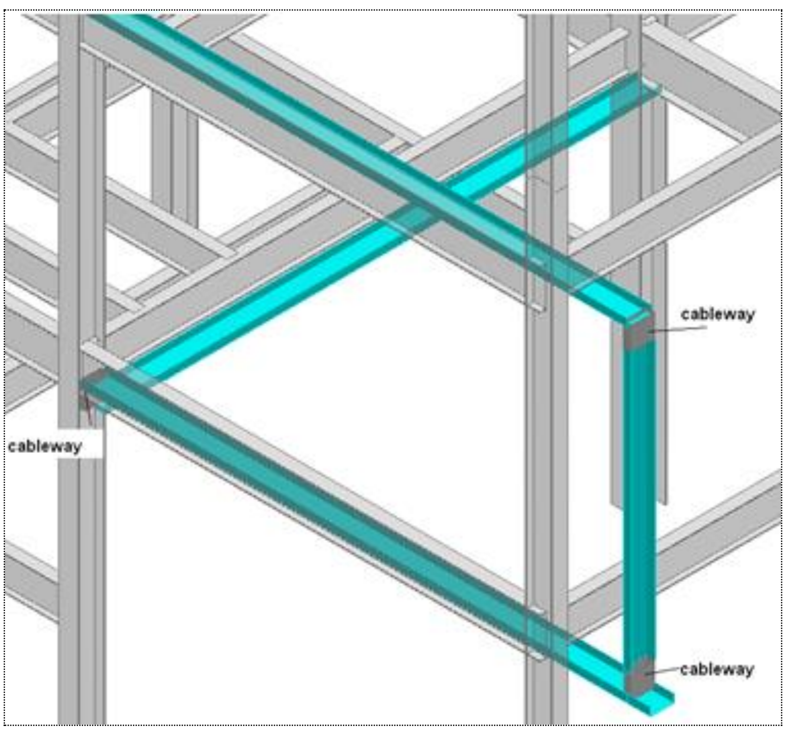
NOTE Cable tray modeling without fitting is a common practice in the industry. All Elevation values are measured from centerline of the trays.



39. Group the three trays into the same cableway run as show below. To do this, select all three straight features (disconnected trays) and use the **Select Graphically** option in the edit ribbon to select the existing run you want to group.

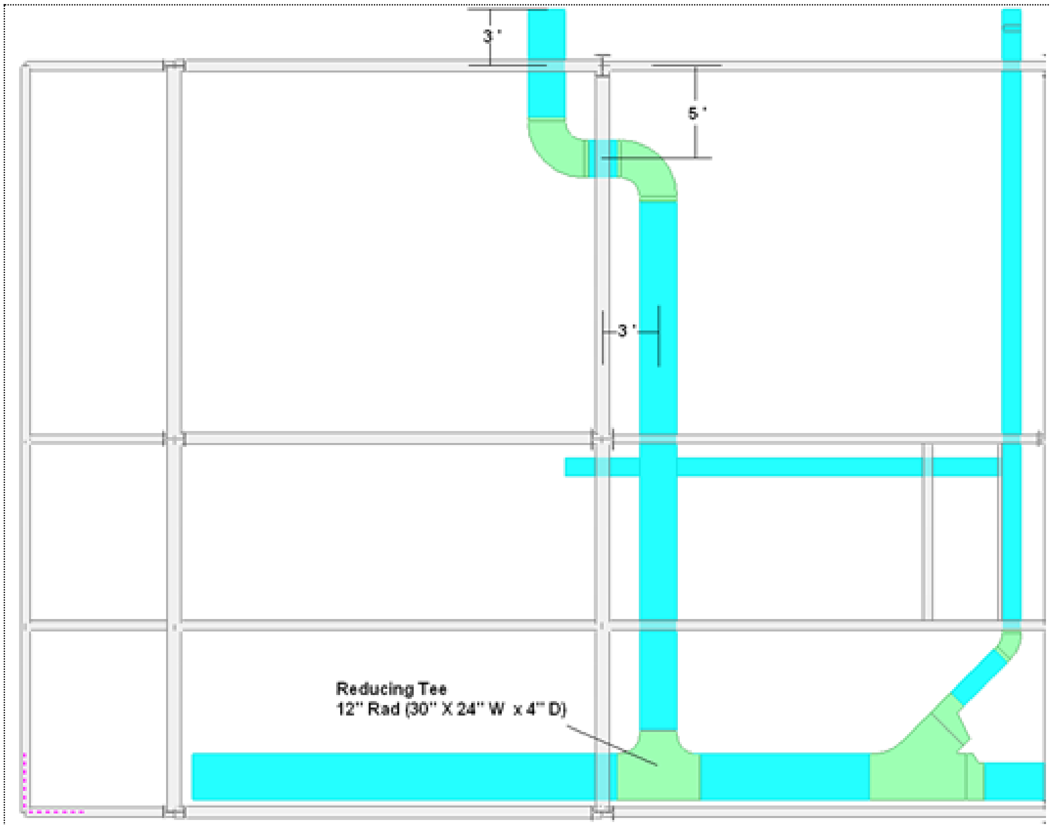


40. Connect the trays using **Zero-Specs** cableway for cable routing to be possible in this cableway. The **Auto Connect** command can be used to create the connecting cableways.



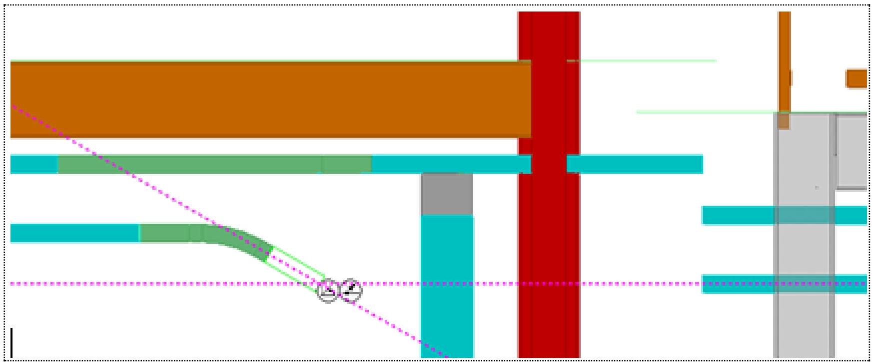
41. Click **Route Cableway** on the vertical toolbar.

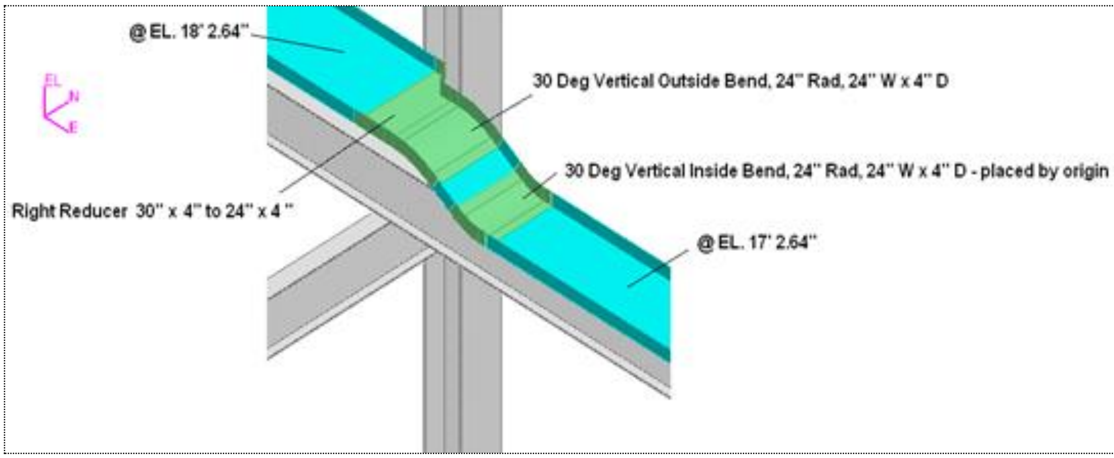
42. Continue to route the top trays with the following configuration:



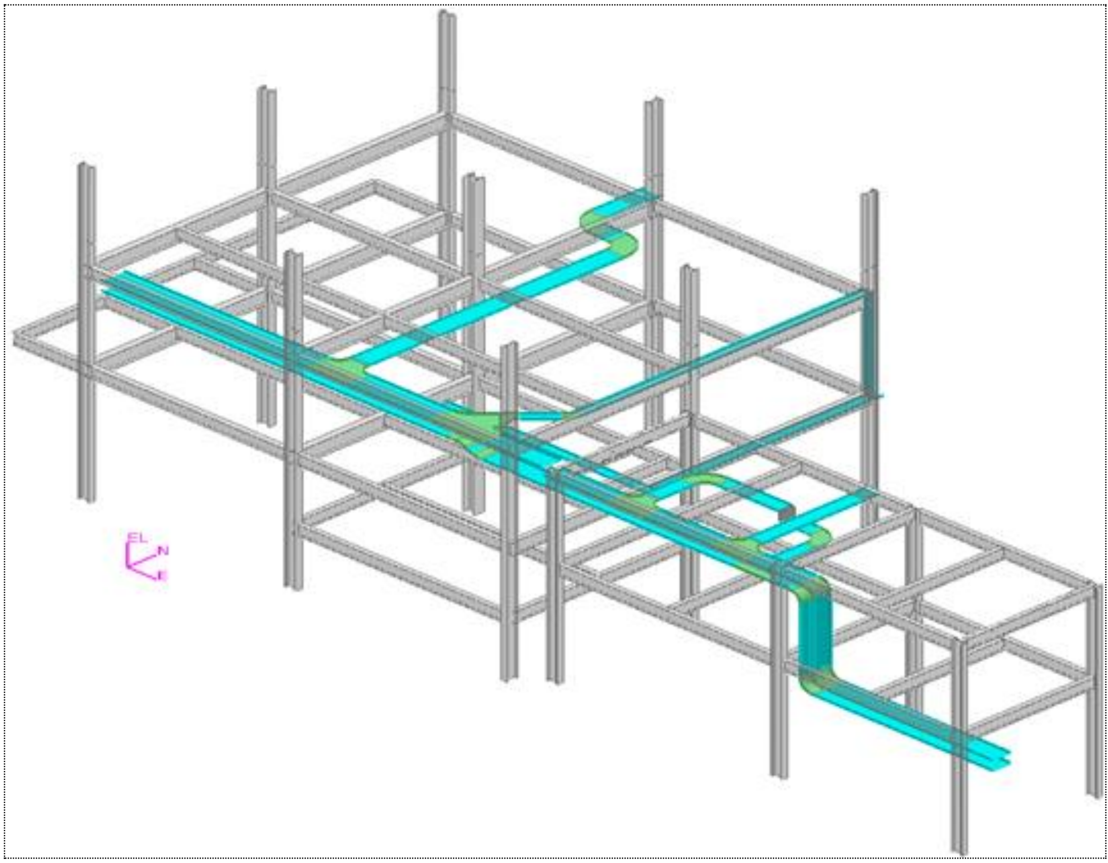
43. Re-define your workspace to display U02 and U03 Units.

44. Connect the bottom trays between the two Units as shown below. To do this, place first the right reducer and the 30 deg vertical outside bend using the insert component command. Then, start routing from the 30 degree bend, and route to same elevation as the bottom tray in U02 Unit. Place the 30 deg vertical inside bend by its origin using the insert component command. Complete the path using the route cableway command.




@ EL. 18' 2.64"
30 Deg Vertical Outside Bend, 24" Rad, 24" W x 4" D
30 Deg Vertical Inside Bend, 24" Rad, 24" W x 4" D - placed by origin
Right Reducer 30" x 4" to 24" x 4"
@ EL. 17' 2.64"

45. After inserting the bends and connecting the trays, the routed cable trays should resemble this.



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

- Smart 3D Overview
- Smart 3D Common Sessions
- *Electrical Overview* (on page 7)
- *Routing a Cableway* (on page 73)

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 whereas 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.

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

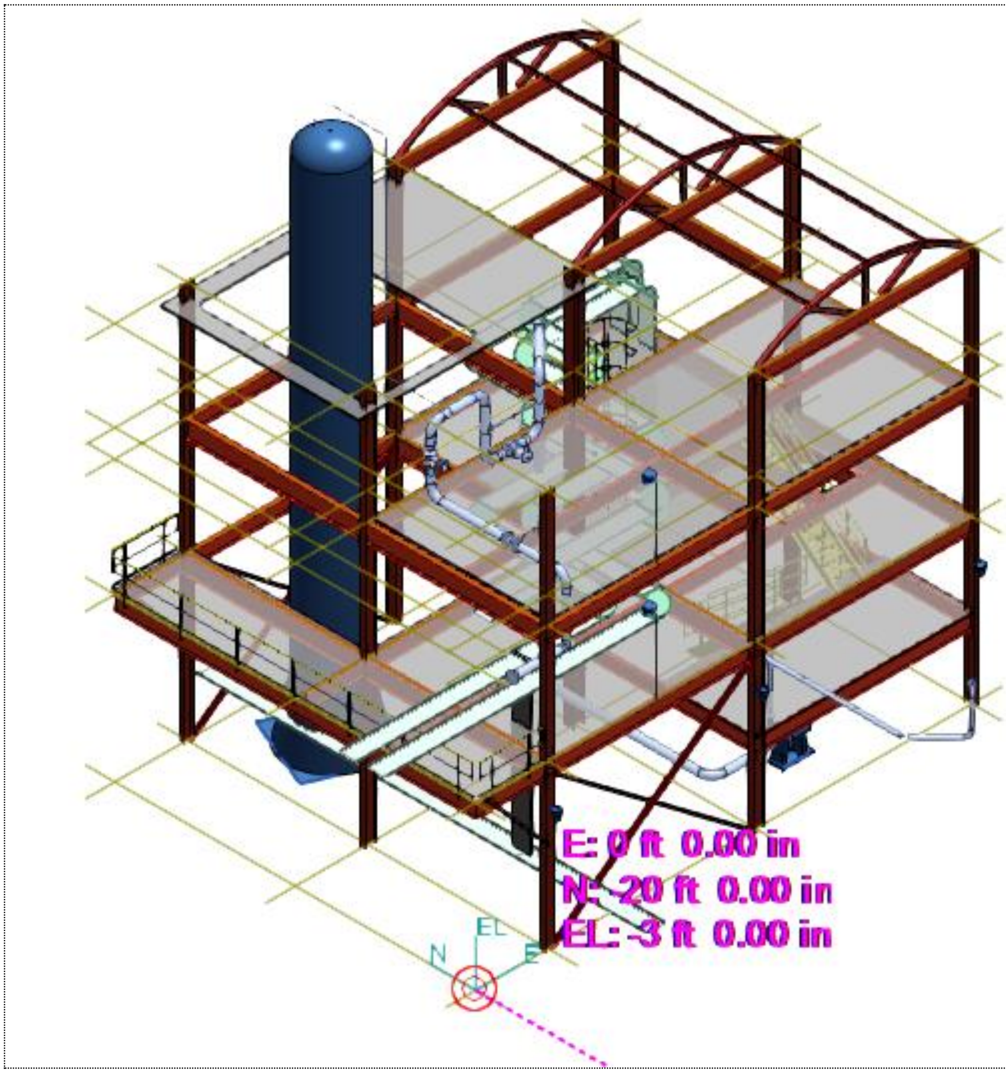
The workspace after routing the underground duct bank should resemble this.

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

1. Make sure you are in **Electrical** task and the **Active Permission Group** is set to **Electrical**.
2. Select **All** from the **Locate Filter** drop-down list.
3. Click the **System** tab on **Workspace Explorer** and expand the **System Hierarchy** to **A2 > U03 > Electrical**.
4. Right click on the **Electrical** system and select **New System > New Electrical System** option on the short cut menu.

   The Property Pages Dialog box appears.
5. Key-in **Duct Bank** as the name in the **Name** field, and click **OK**.
6. Activate **PinPoint** ribbon and set **U03 CS** as active coordinate system.
7. Click **Set Target to Origin** on the **PinPoint** ribbon, to move the target to the origin of the current coordinate system.
8. Click **Route Cableway** on the vertical toolbar.

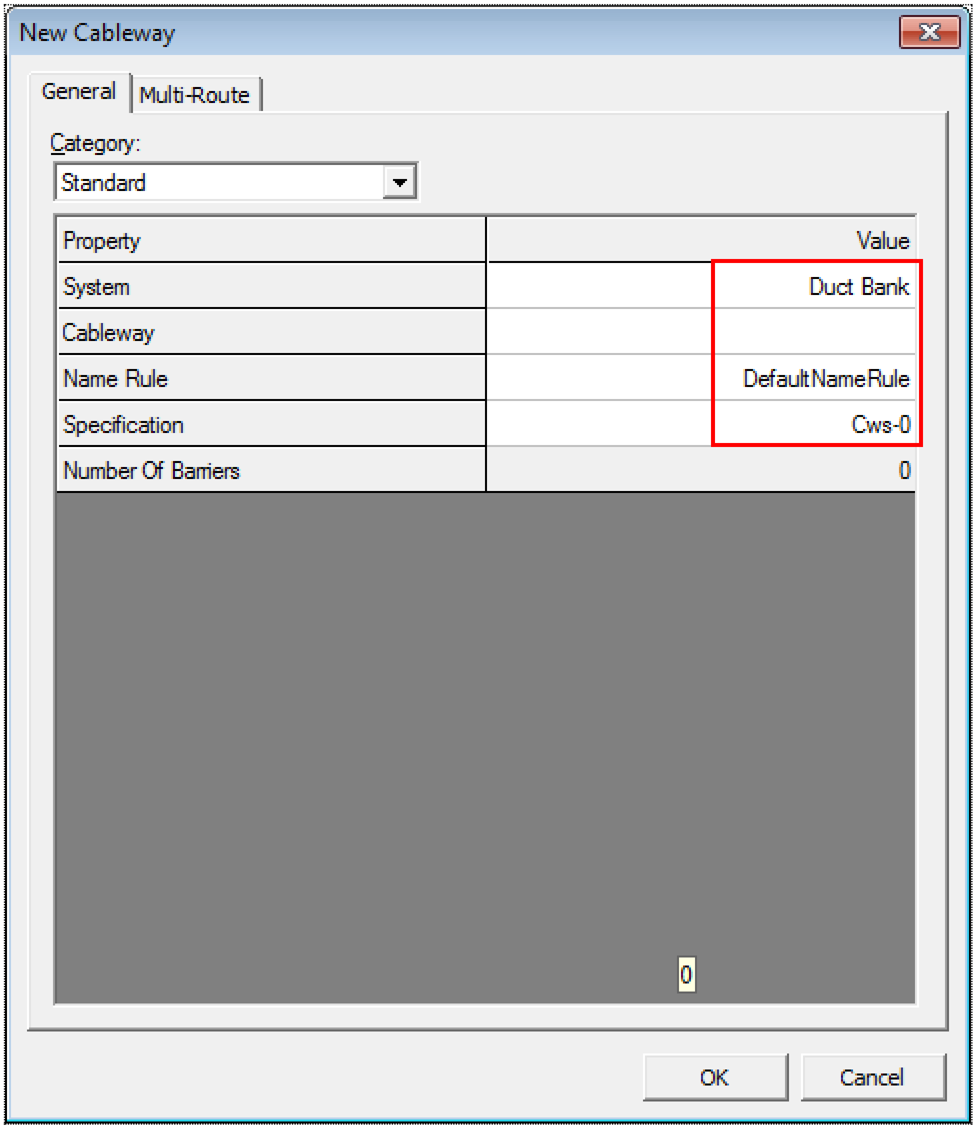
9. Key in 0 ft for easting, -20 ft for northing, and -3 ft for elevation on the **PinPoint** ribbon to specify the starting point for routing the duct bank.



The New Cableway dialog box will appear.

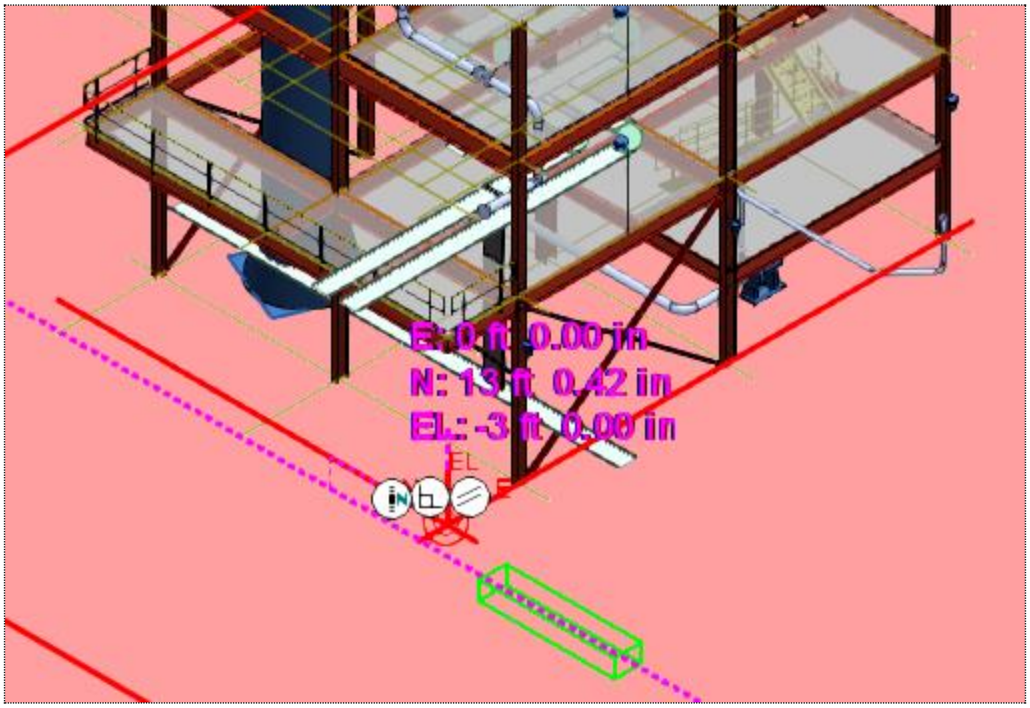
10. Select the following specifications on the **New Cableway** dialog box, and click **OK**.

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

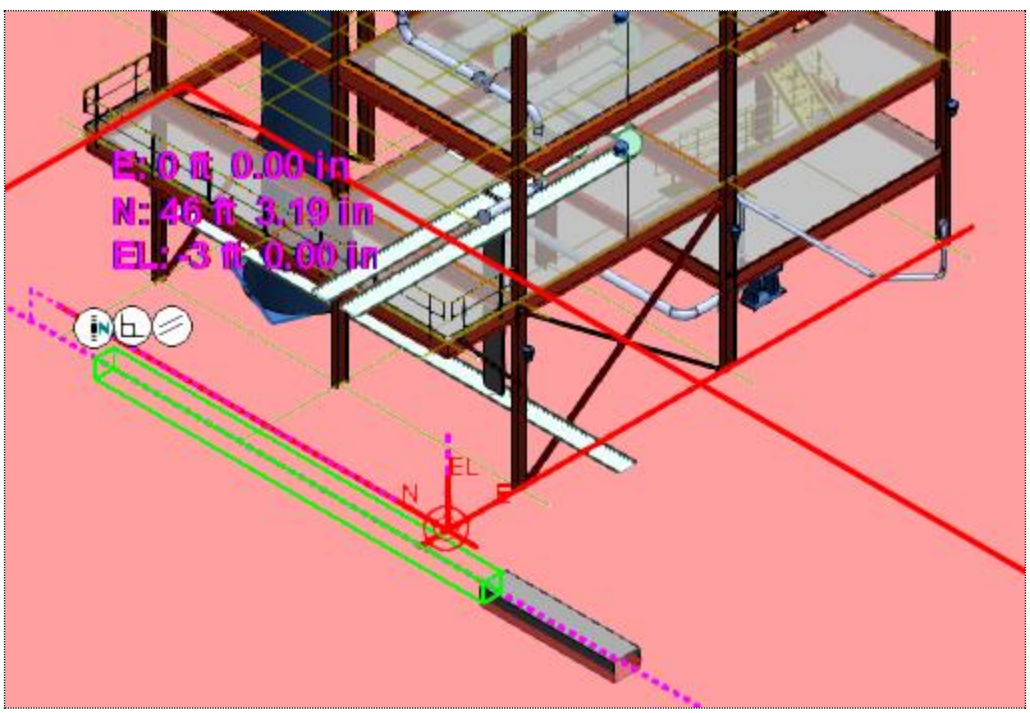


11. Select **Plan Plane** in the **Plane** drop-down list on the Route Cableway ribbon.
12. Select **Rectangle** from the **Shape** drop-down list and key in 3 ft for Width, 2 ft for Depth, and 15 ft for Length on the Route Cableway ribbon.

13. Route the duct bank by pointing towards north direction till the N SmartSketch glyph appears.



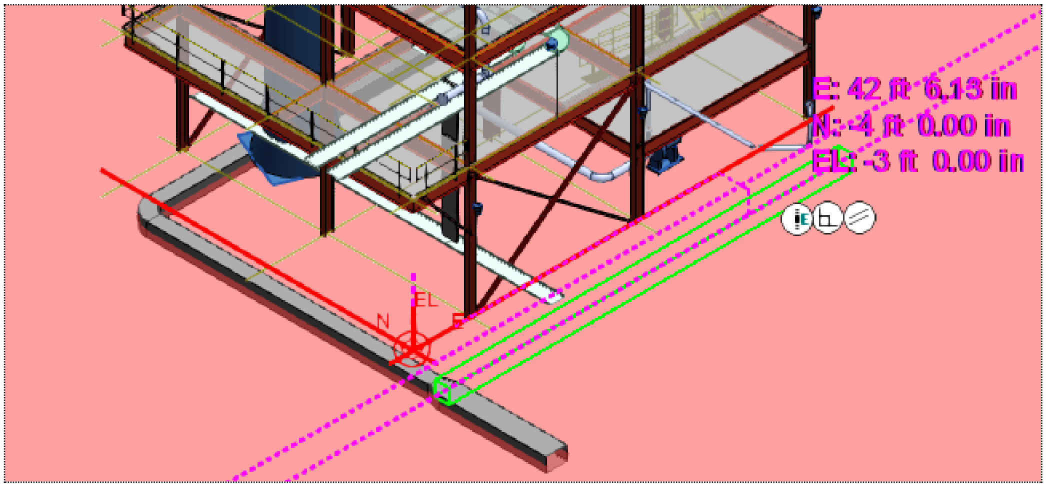
14. Click the graphic view to place the data point.
15. Key in 2 ft as Width, 43 ft as Length, unlock the Angle and position the cursor in north direction to extend the duct bank.



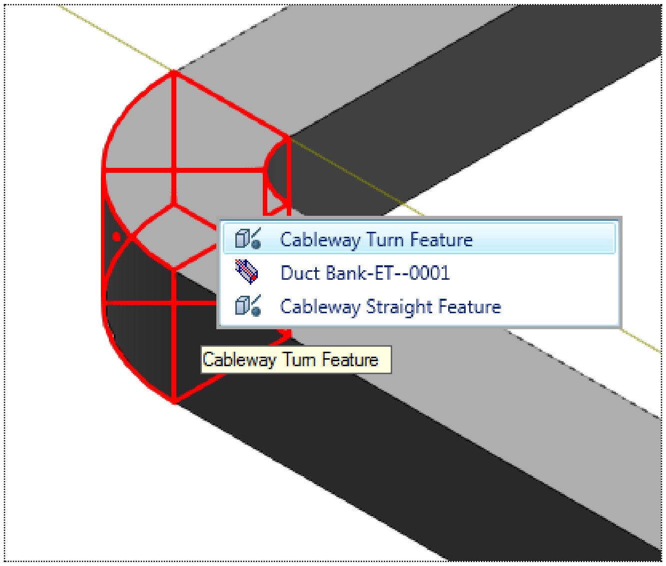
16. Click the graphic view to define the next data point.
17. Position the cursor in the east direction and key in 56 ft in the Length box to route a 56 ft duct bank.
18. Right-click in the view to terminate the command.
19. Click **Route Cableway**  on the vertical toolbar.
20. Key in the following coordinates on the PinPoint ribbon and click in the active view.

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

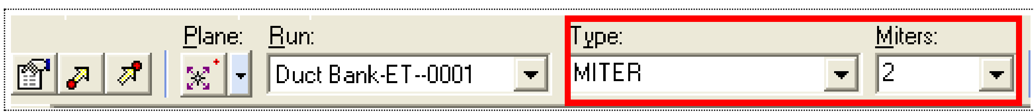
    The New Cableway dialog box will appear.
21. Keep the default last used values, and click **OK**.
22. Position the cursor in the east direction and key in 56 ft in the Length box to create a 56 ft long branch.
23. Right-click in the graphic view to terminate the command.

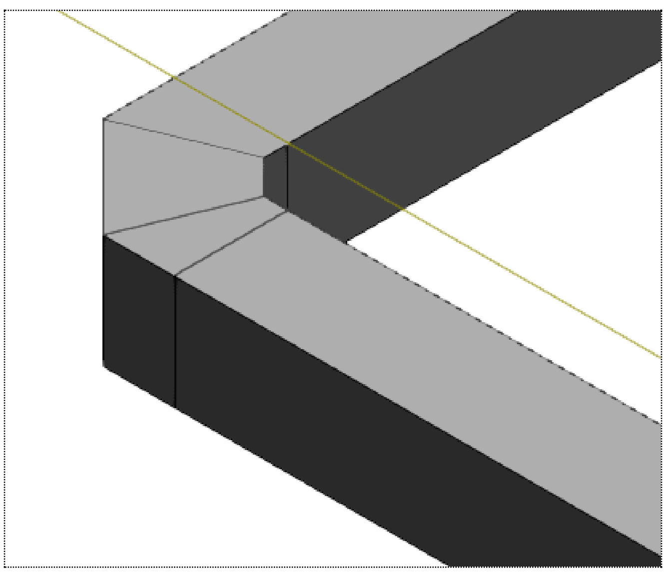


24. Select the turn feature, as shown, to open the Edit ribbon.

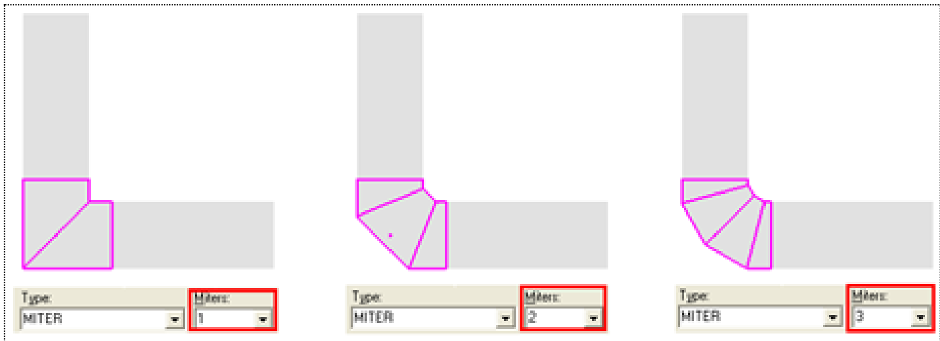


25. Change from BEND to MITER on the Type drop-down list on the Edit ribbon. Then, key in 2 to specify the number of cuts for the Miter elbow.





NOTE 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.

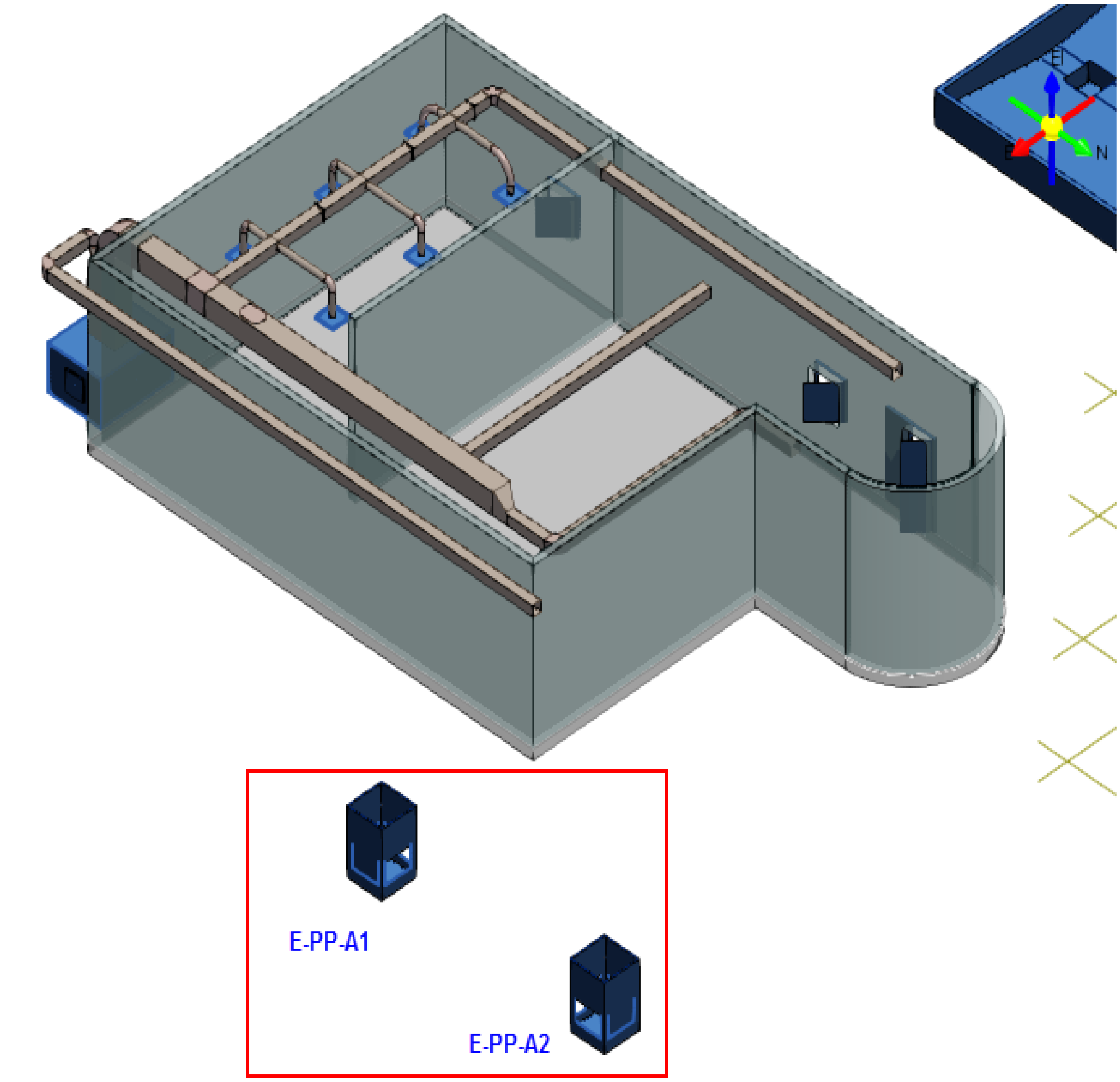


Placing Electrical Pull-Pit

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

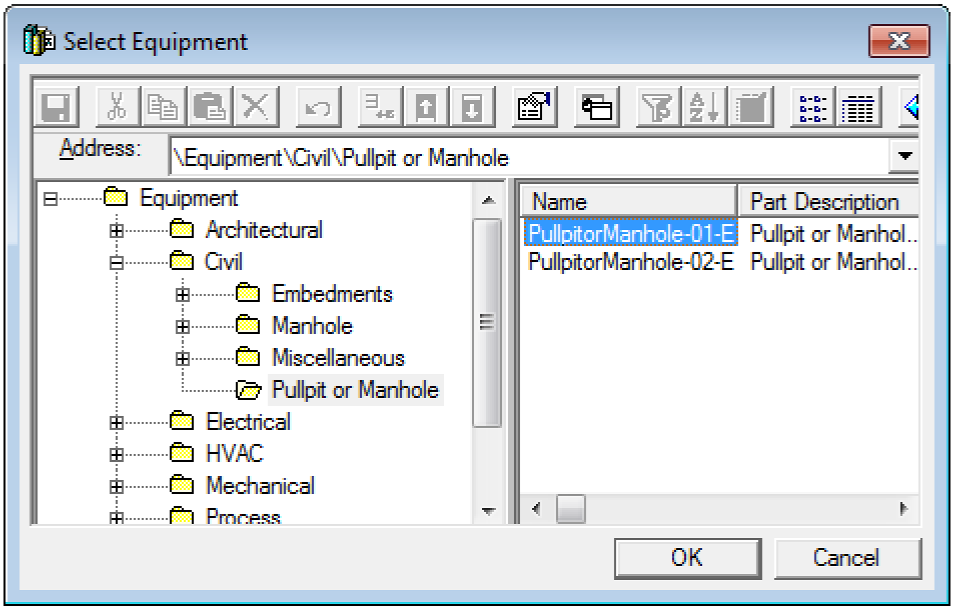
After placing the Pull-Pits the model should resemble the highlighted portion in Figure 12.



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

1. If you are not in the **Electrical** 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.
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 **Set target to Origin** on the PinPoint ribbon.
6. Click **Place Equipment** button on the vertical toolbar.

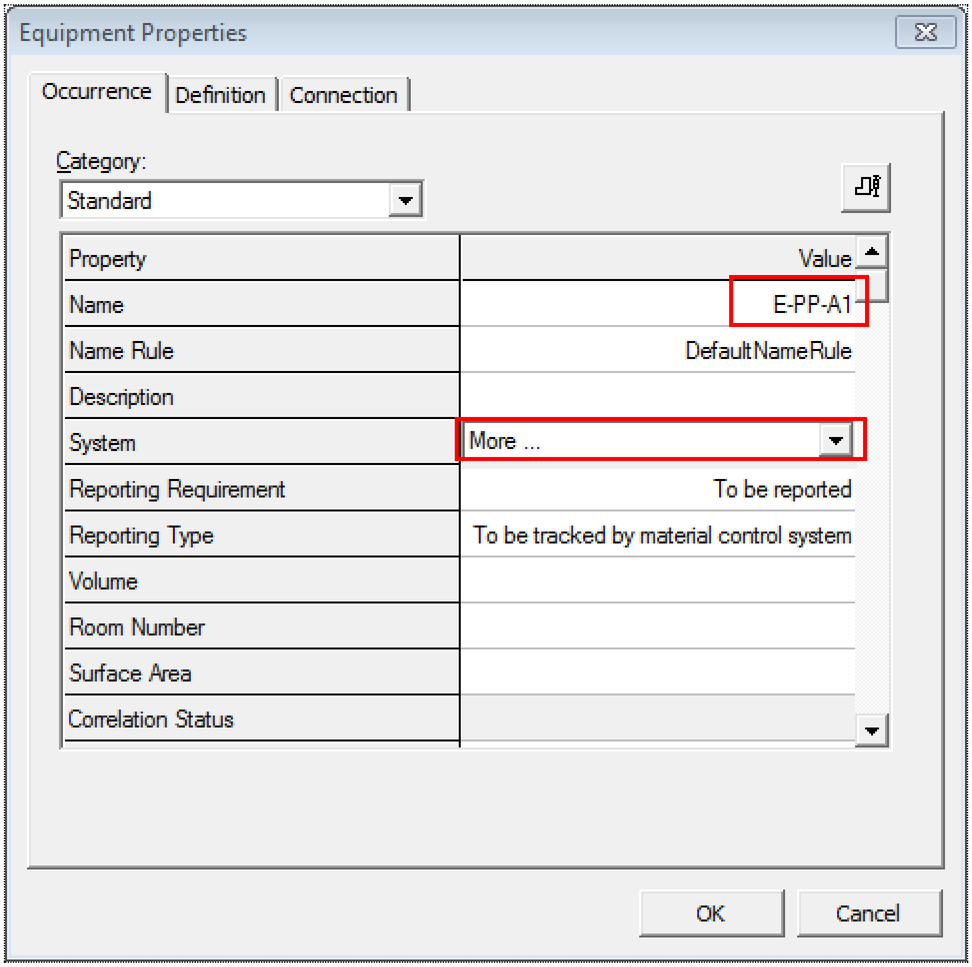
7. In the **Select Equipment** dialog box, expand the folder **Equipment\Civil\Pull Pit or Manhole** until you see the part **PullpitorManhole-01-E**. Select the part, and click **OK**.



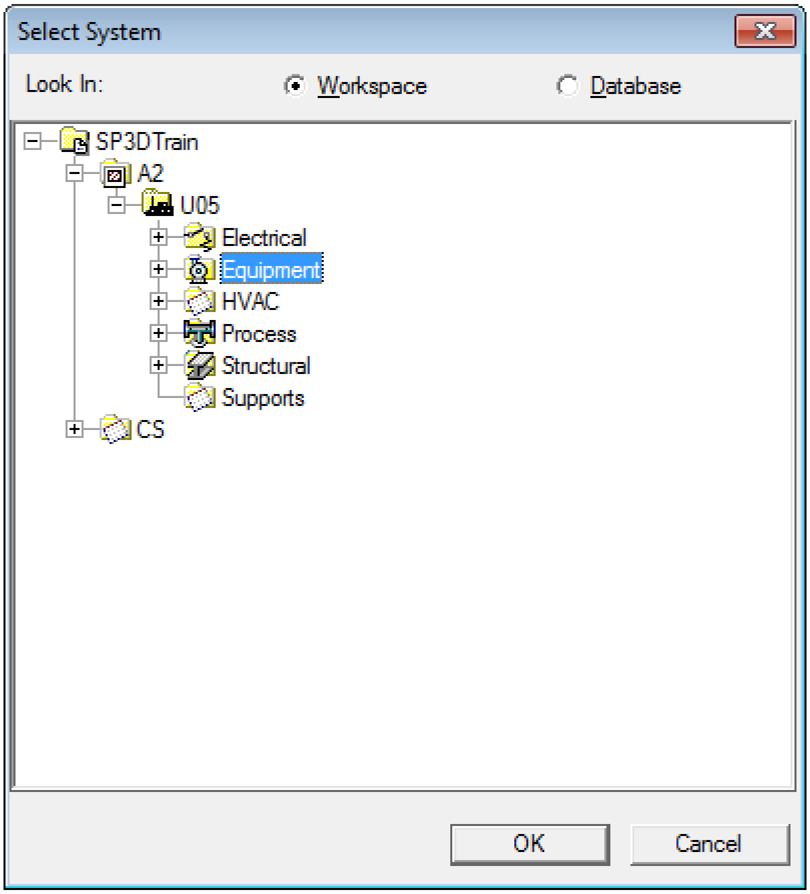
The Equipment Properties dialog box appears as soon as you select PullpitorManhole-01-E part.

8. Key-in E-PP-A1 in the Name field.

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



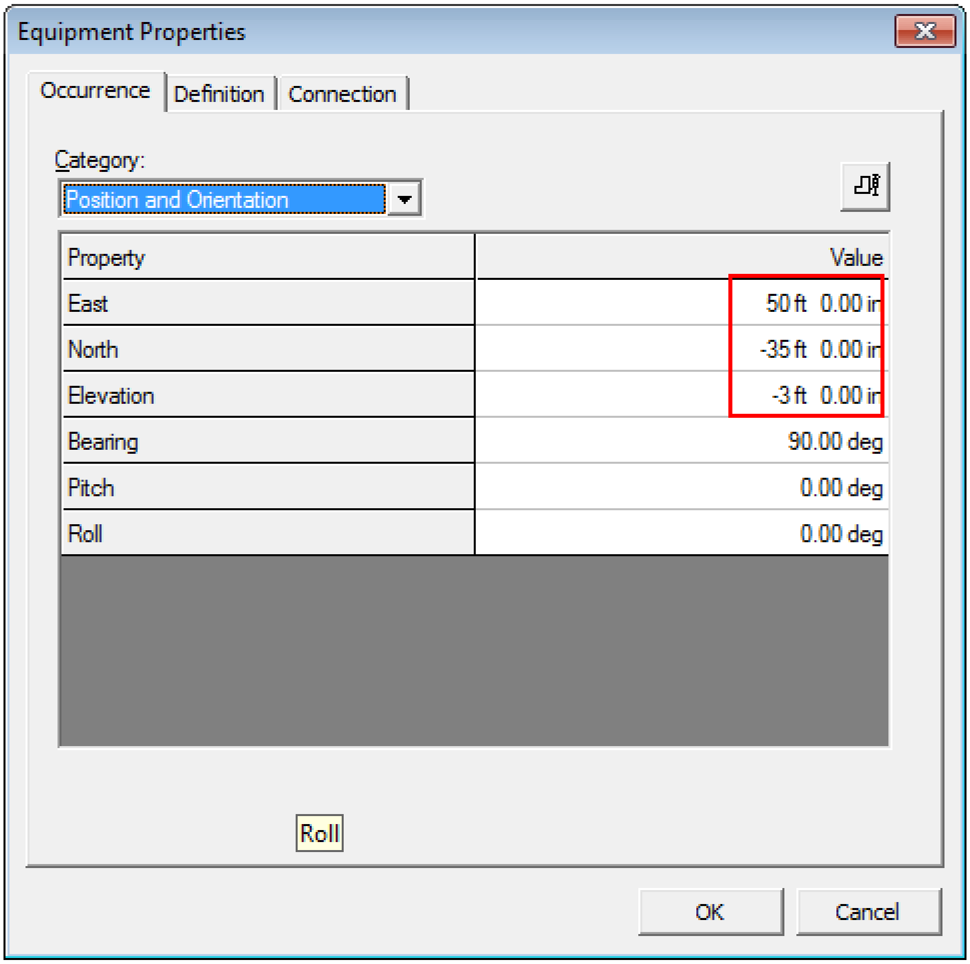
10. Select **Equipment System** under **A2->U05**, as shown below, to indicate where the object will be placed. Then, click **OK**.



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

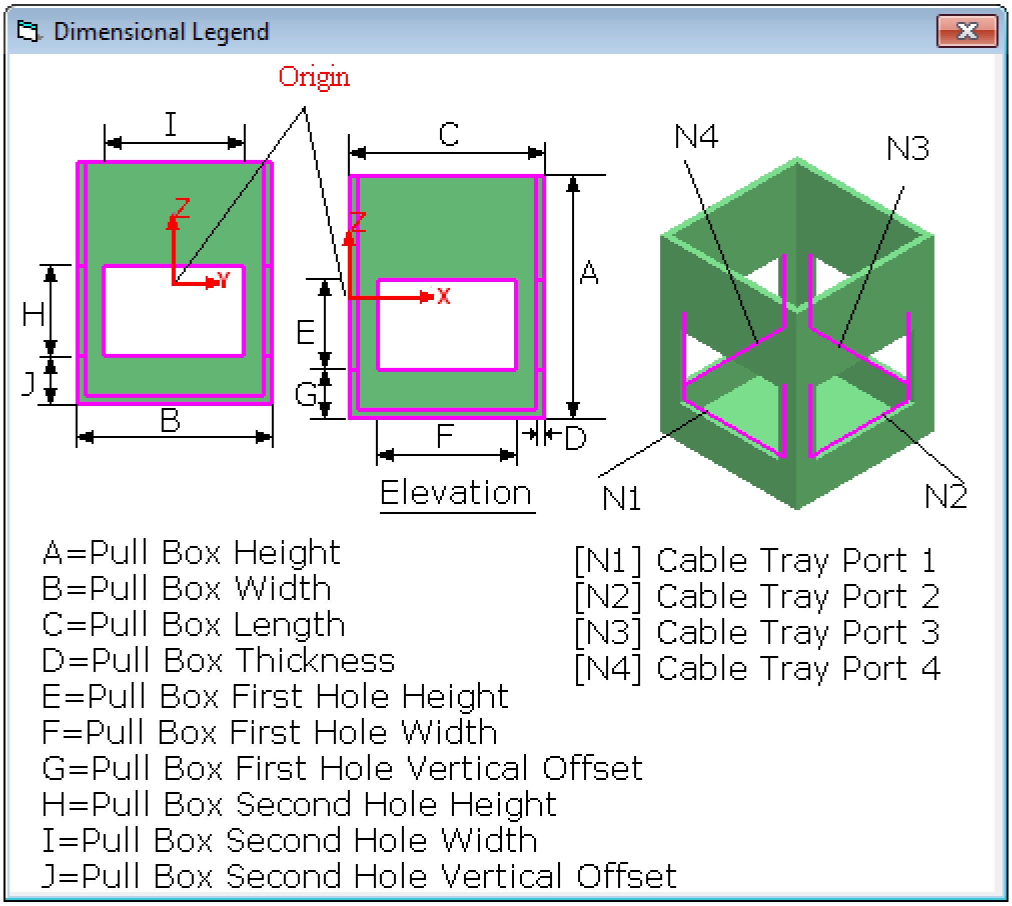
12. Key in the followings properties:

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

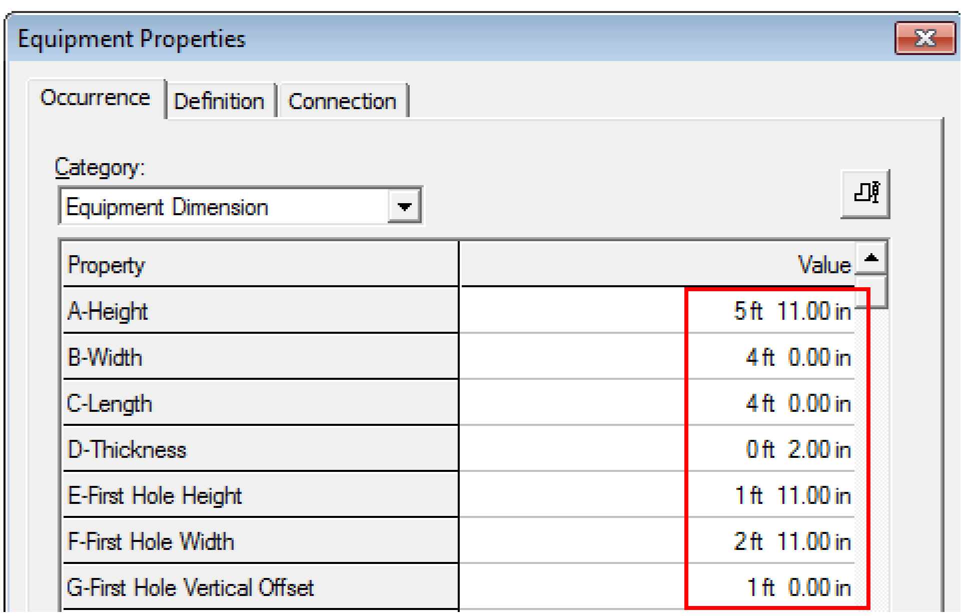


13. Switch to the **Equipment Dimension** category in the **Category** drop-down list.

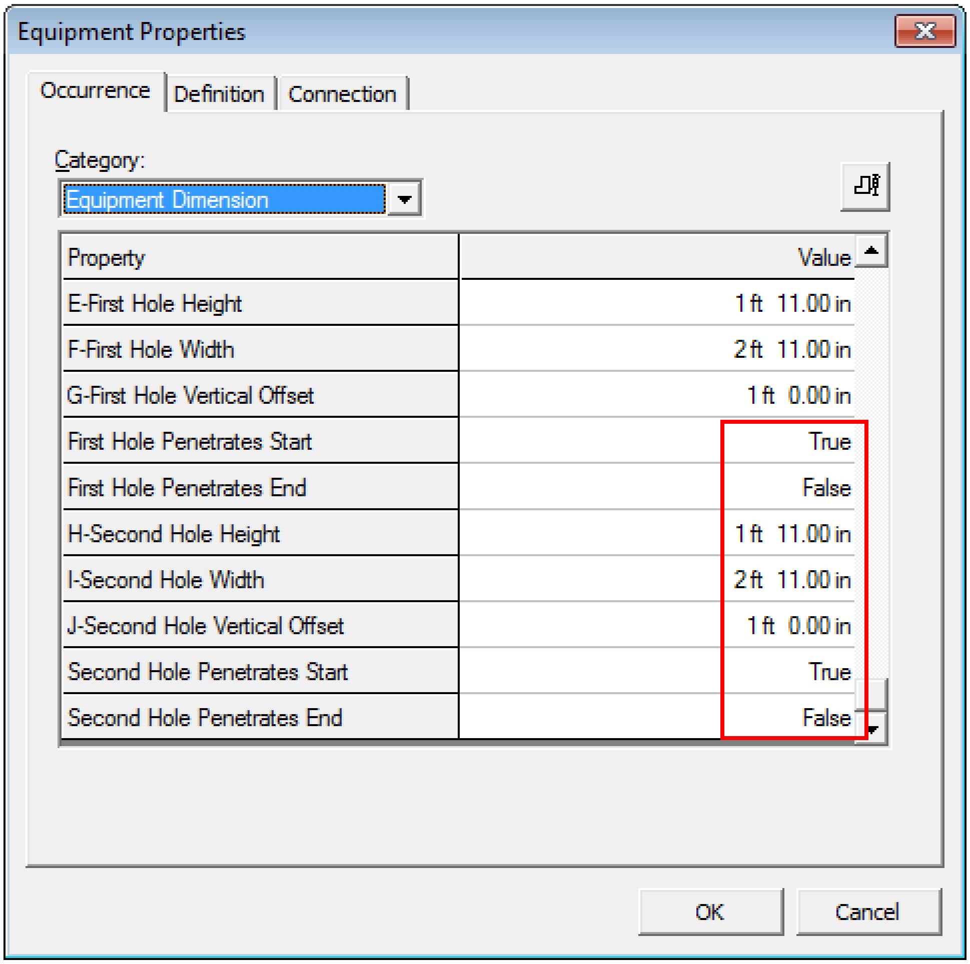
14. Click Preview to display an image of the selected part.



15. Click [x] button to close the previous dialog box and change the dimensions.

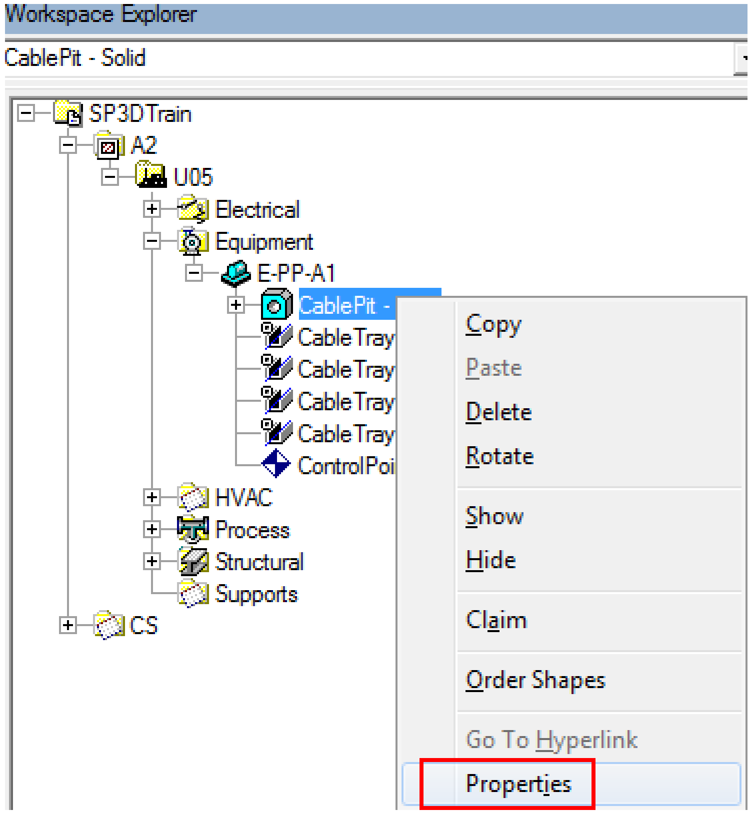


16. Change the **First Hole Penetrates End** and **Second Hole Penetrates End** fields to **False**.



17. Click **OK** on the **Equipment Properties** dialog box to place the **Pull-Pit** in the model.
18. Right-click in the active view to de-select the equipment.
19. Select the **View > Fit** command.
20. Select **All** in the **Locate Filter** drop-down list.

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



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

Surface Area	191.86 ft^2
Volume	15.50 ft^3

23. 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**.

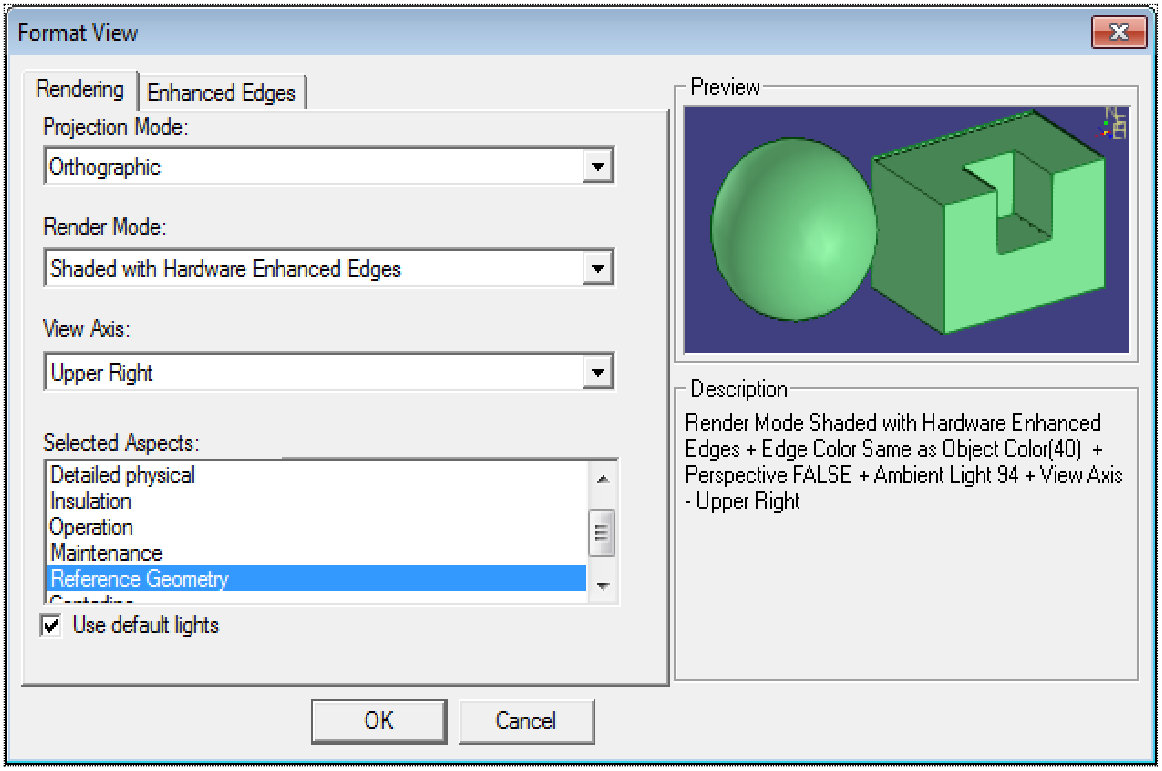
Material Name	Concrete
Material Grade	Fc 3000

24. Click **Apply**.

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

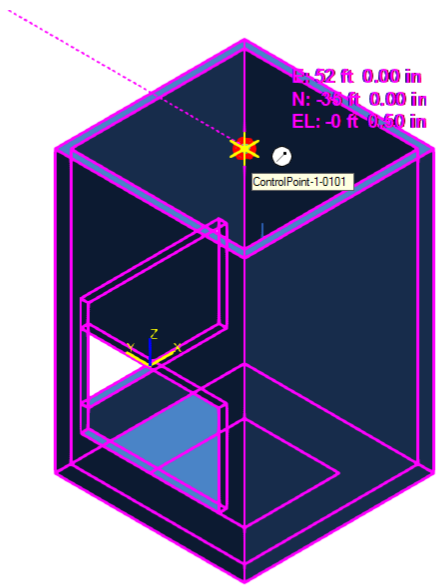
Copying and Pasting the Pull-Pit

1. Select **Format > View** in the main menu to open the **Format View** dialog.
2. Turn on the **Reference Geometry** aspect on in the **Format View** dialog and click **OK**.



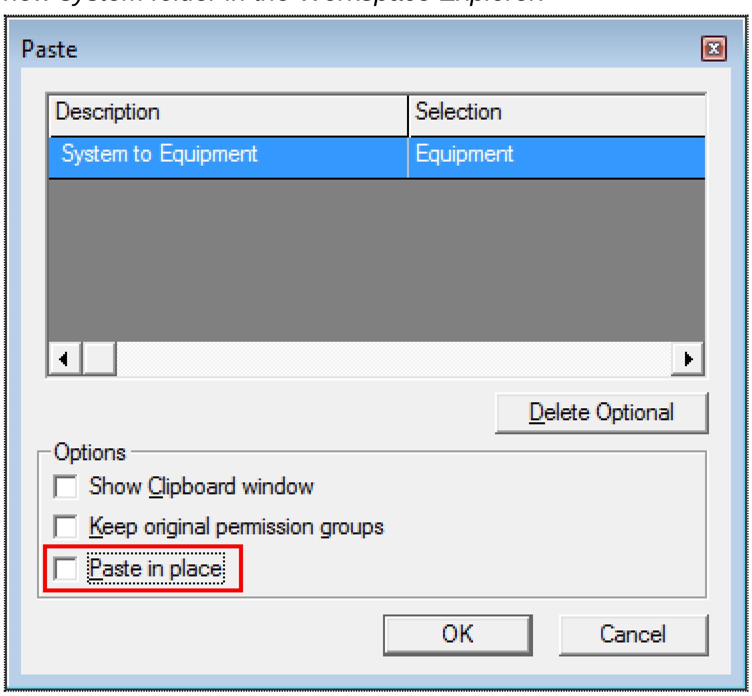
3. Select the **Pull-Pit E-PP-A1** graphically or in the Workspace Explorer. Make sure you select the **Equipment Assembly (Parent)**.
4. Click **Copy** on the **Common** toolbar.

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



6. Click **Paste** on the Common toolbar.

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



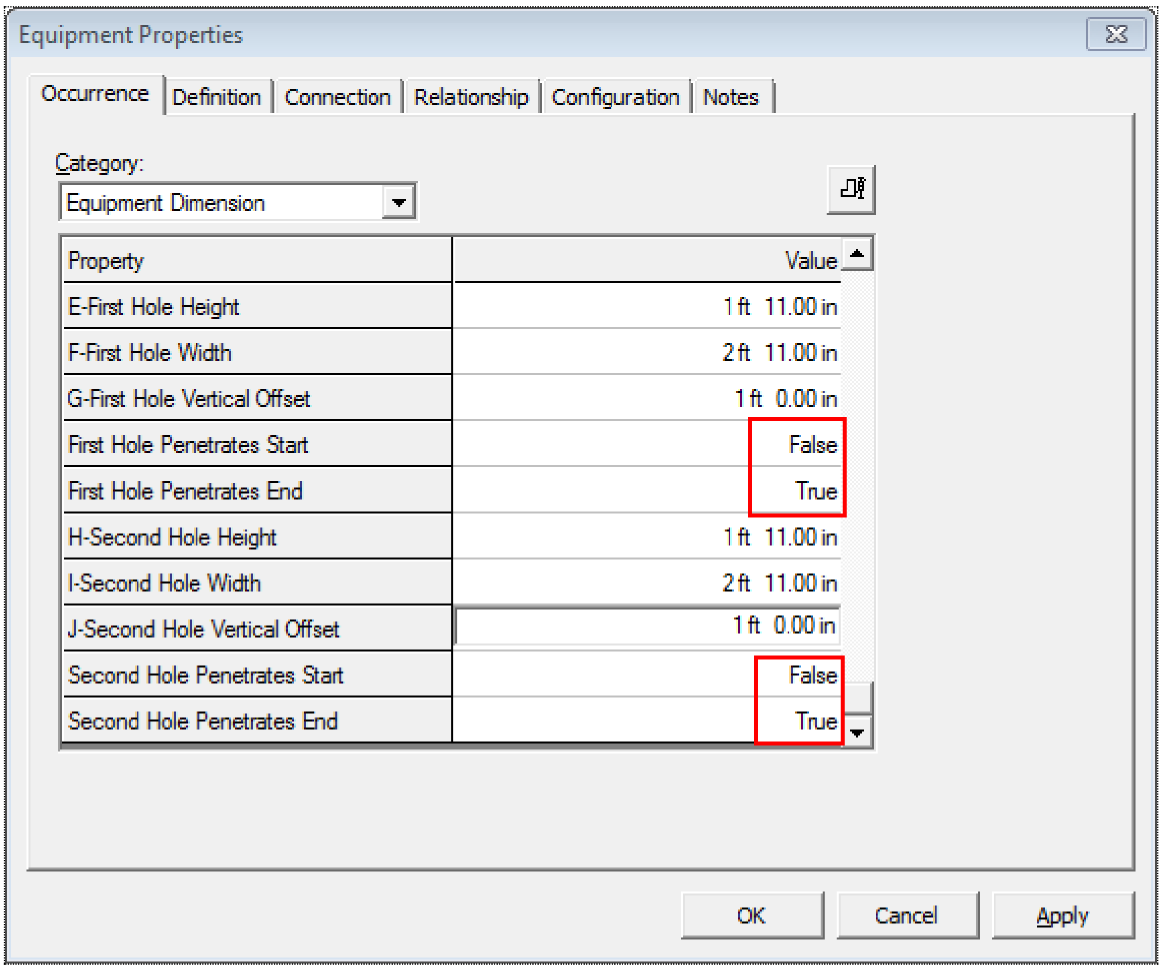
7. Clear the **Paste in place** check box in the **Paste** dialog and click **OK**.

8. 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

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

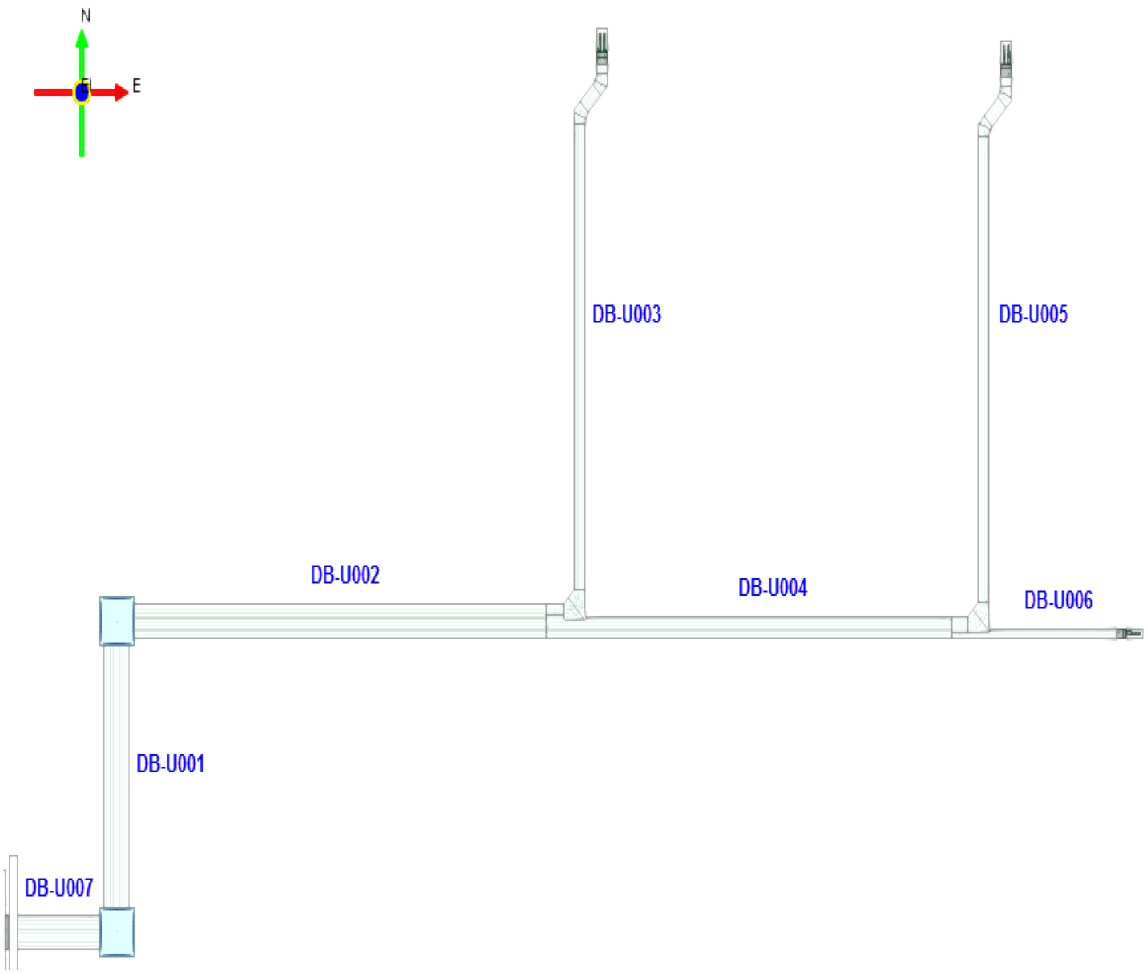
10. Click **Properties** on the **Equipment Edit** ribbon to open the property page.
11. Switch to the **Equipment Dimension** category in the **Category** drop-down list
12. Change the **First Hole Penetrates Start** field to **False** and **First Hole Penetrates End** field to **True**. Similarly, change the **Second Hole Penetrates Start** field to **False** and **Second Hole Penetrates End** field to **True** as shown below.



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

Creating a Duct Bank Layout

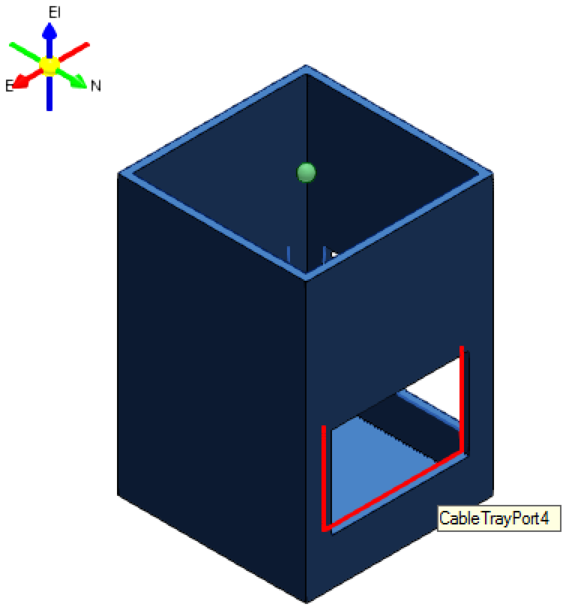
Use the **Route Cableway** command to route a Duct Bank layout. The Duct Banks will be routed between the Pull-Pits placed in the previous exercise such that valid cable path can be created once the connecting runs are defined within Pits. The workspace after routing the duct bank system should resemble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



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 **Common View** on the **Common** toolbar. This will enable you to get better view of the cable tray ports on the Pull-Pit (1).
3. Click **Route Cableway** from the vertical toolbar.

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



NOTE When any command is in a smartstep prompting you to select a point, Smart 3D 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.

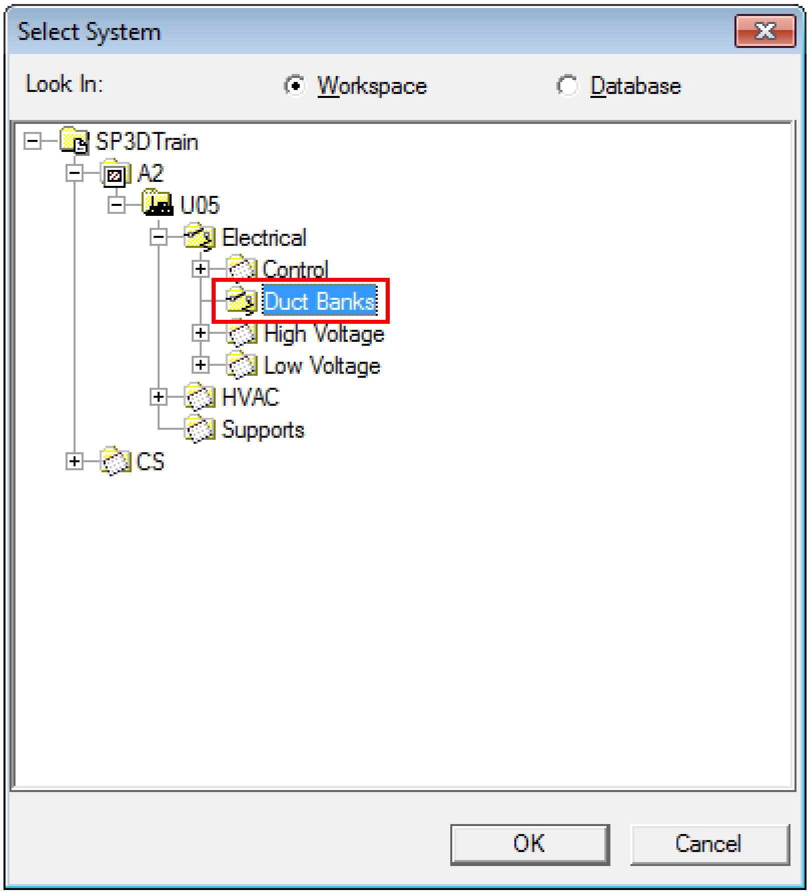
Use the **SmartSketch** tab on the **Options** dialog box or **Tools > SmartSketch Options** to enable SmartSketch points.

*The **New Cableway** dialog box displays.*

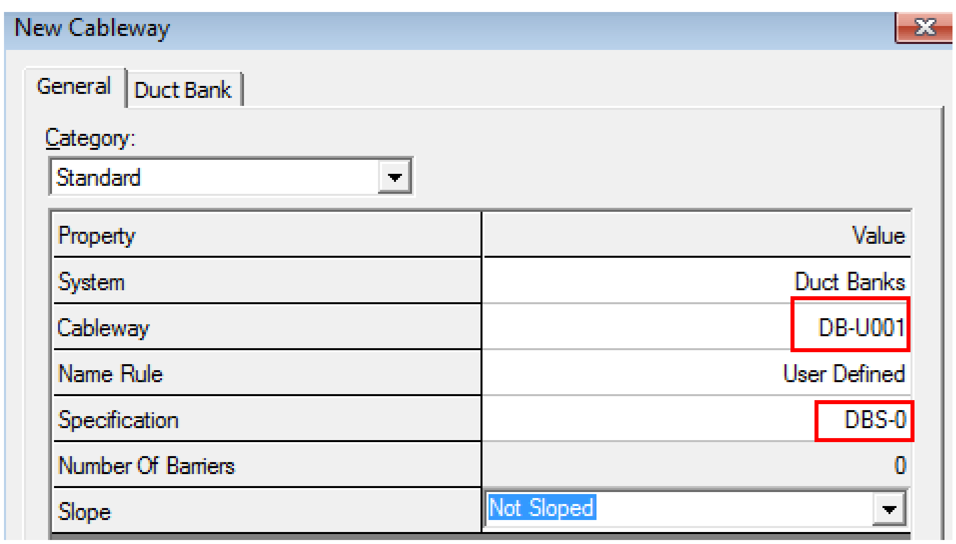
5. Under **System**, select **More...**.

   *The **Select System** dialog box displays.*

6. Select **A2 > U05 > Electrical > Duct Banks**, and click **OK**.



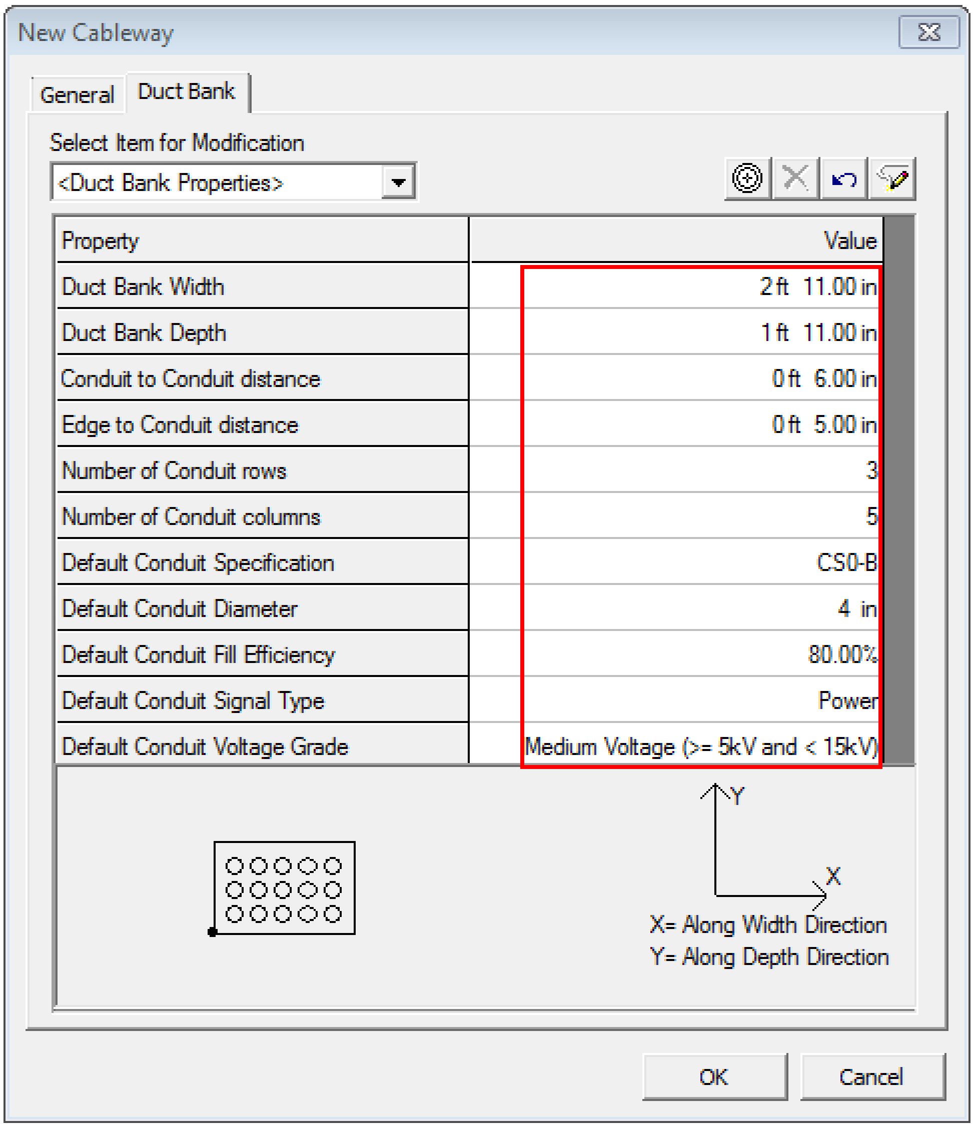
7. Set **Cableway** to **DB-U001** and **Specification** to **DBS-0**.



NOTE Smart 3D allows you to route both the concrete casing modeled as a cableway run and the conduits together while routing the duct bank. To route duct banks, you need to set the duct bank cross section data and other necessary properties under the **Duct Bank** tab. To access the **Duct Bank** tab, you must have a duct bank specification selected in the **New Cableway** dialog box.

8. Switch to the **Duct Bank** tab and define the following values as shown:

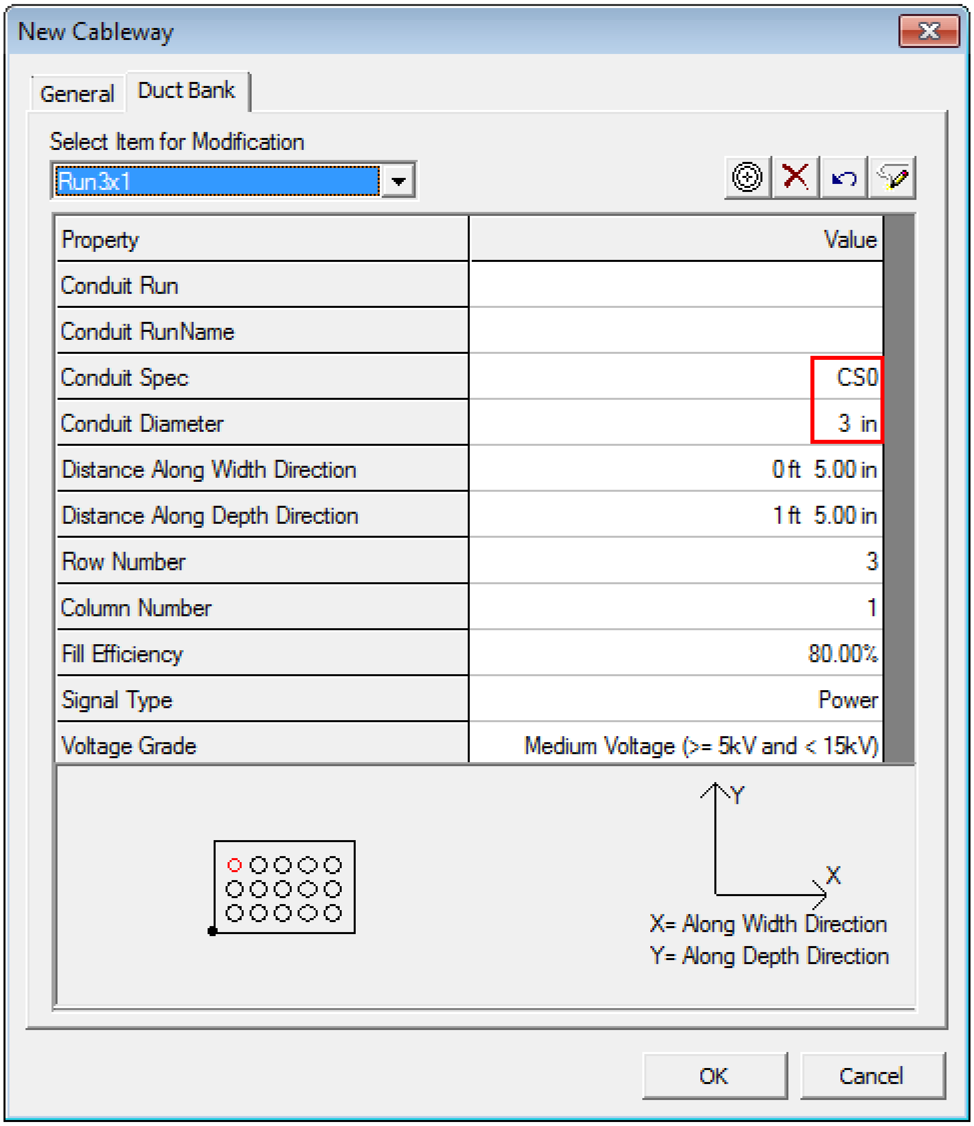
   Duct Bank Width: 2 ft 11 in
   Duct Bank Depth: 1 ft 11 in
   Conduit to Conduit distance: 0 ft 6 in
   Edge to Conduit distance: 0 ft 5 in
   Number of Conduit rows: 3
   Number of Conduit columns: 5
   Default Conduit Specification: CSO-B
   Default Conduit Diameter: 4 in
   Default Conduit Fill Efficiency: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



NOTE If the conduits are not inside the duct bank, an error message displays.

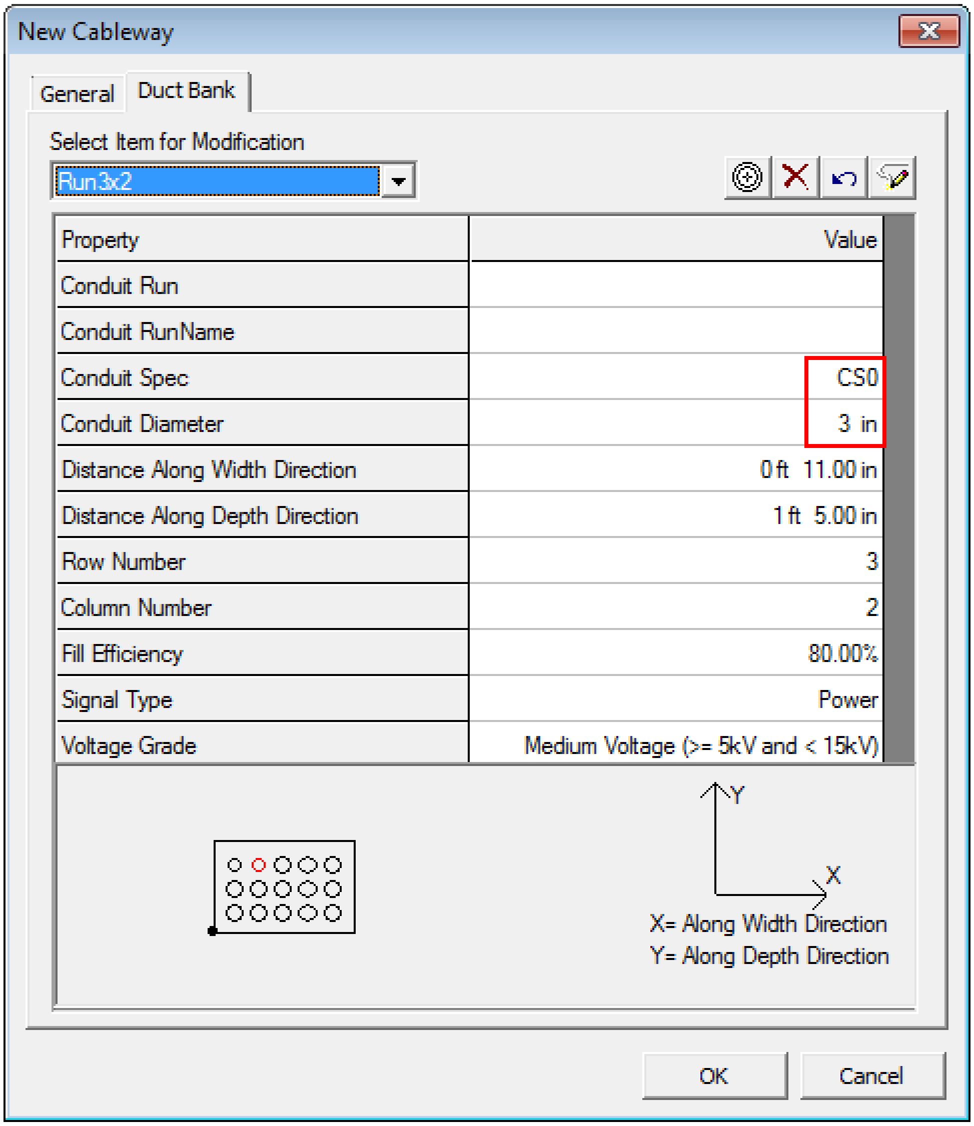
9. Set **Select Item for Modification** to **Run 3x1**, and define the following values as shown:

   Conduit Spec: CS0
   Conduit Diameter: 3 in
   Fill Efficiency: 80 %
   Signal Type: Power
   Voltage Grade: Medium Voltage (>= 5kV and <= 15kV)



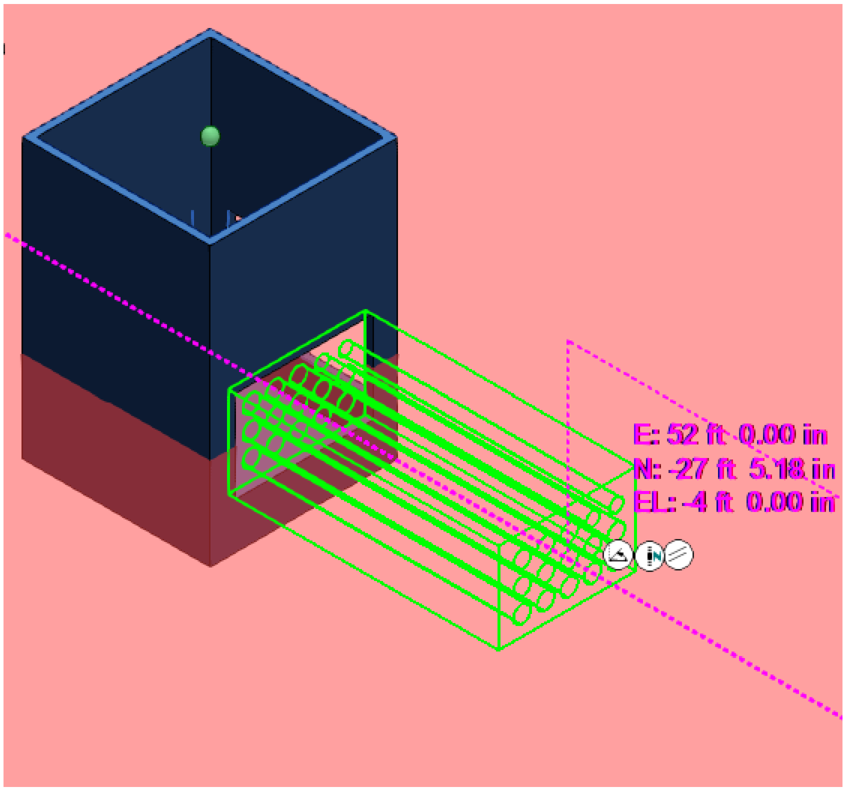
10. Set **Select Item for Modification** to **Run 3x2**, and define the following values as shown:

Conduit Spec: CS0
Conduit Diameter: 3 in
Fill Efficiency: 80 %
Signal Type: Power
Voltage Grade: Medium Voltage (>= 5kV and <= 15kV)



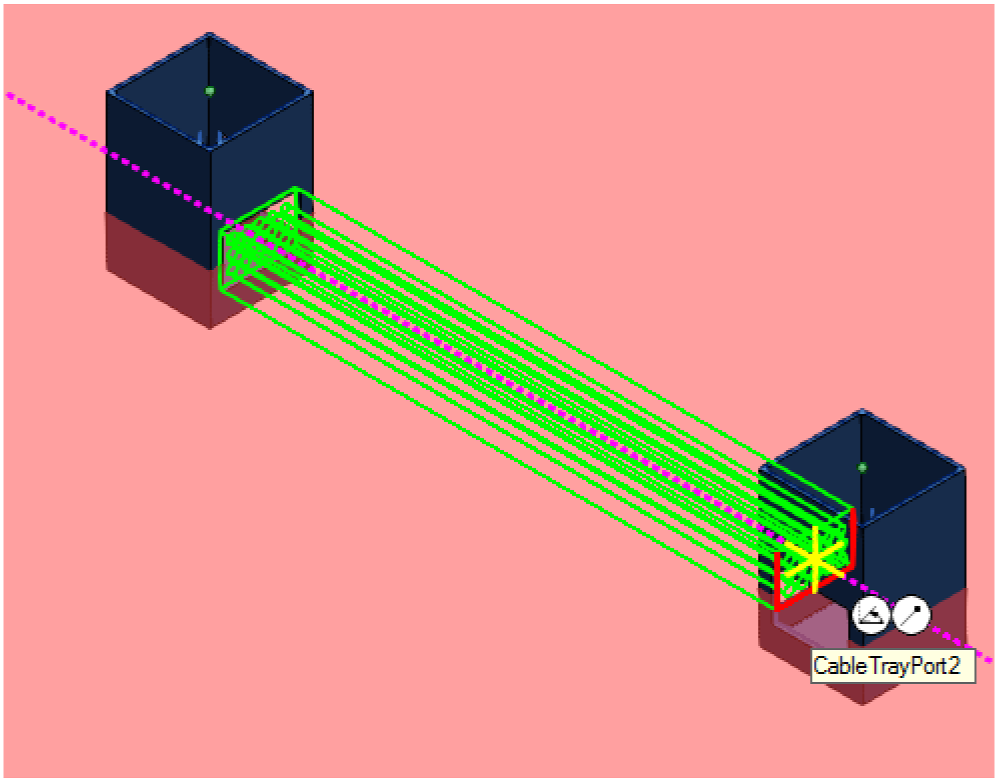
11. Click **OK**.

An outline of the duct bank displays in the active view. Smart 3D locks the angle to 0 deg and set the route PLANE to PLAN.

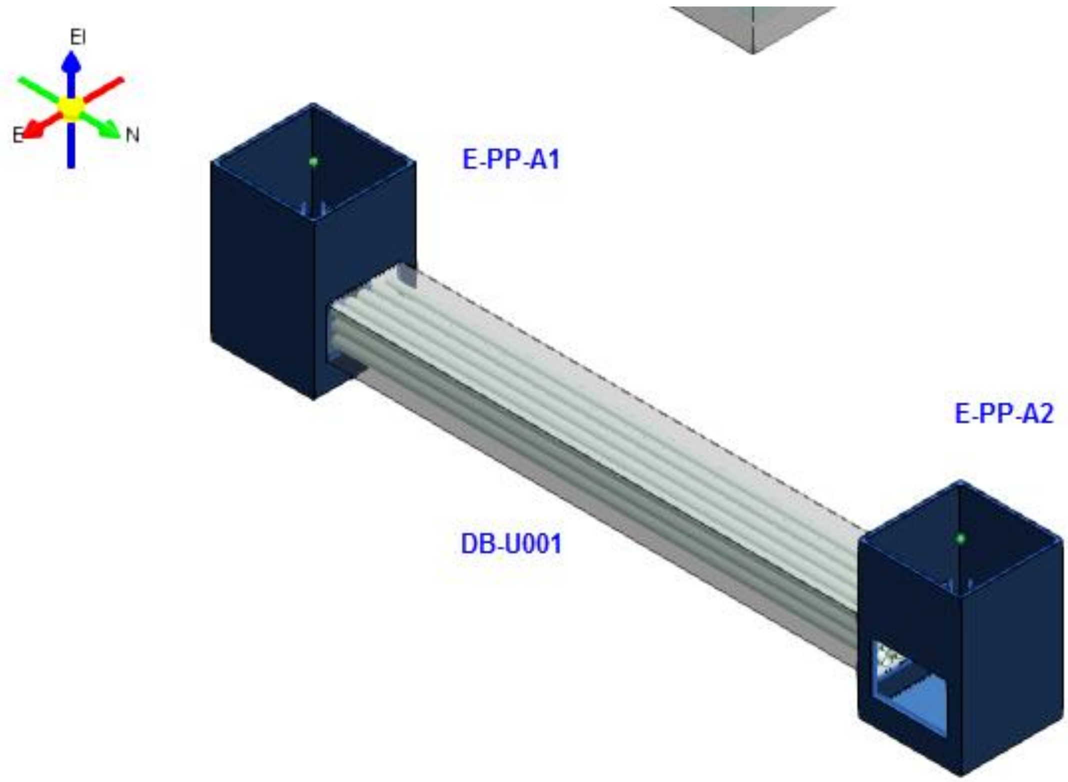


12. Locate the Pull-Pit (2) named **E-PP-A2** in the model.

13. Hover over the **cable tray port2** on Pull-Pit (2) until the **KeyPoint** SmartSketch glyph displays, as shown below.

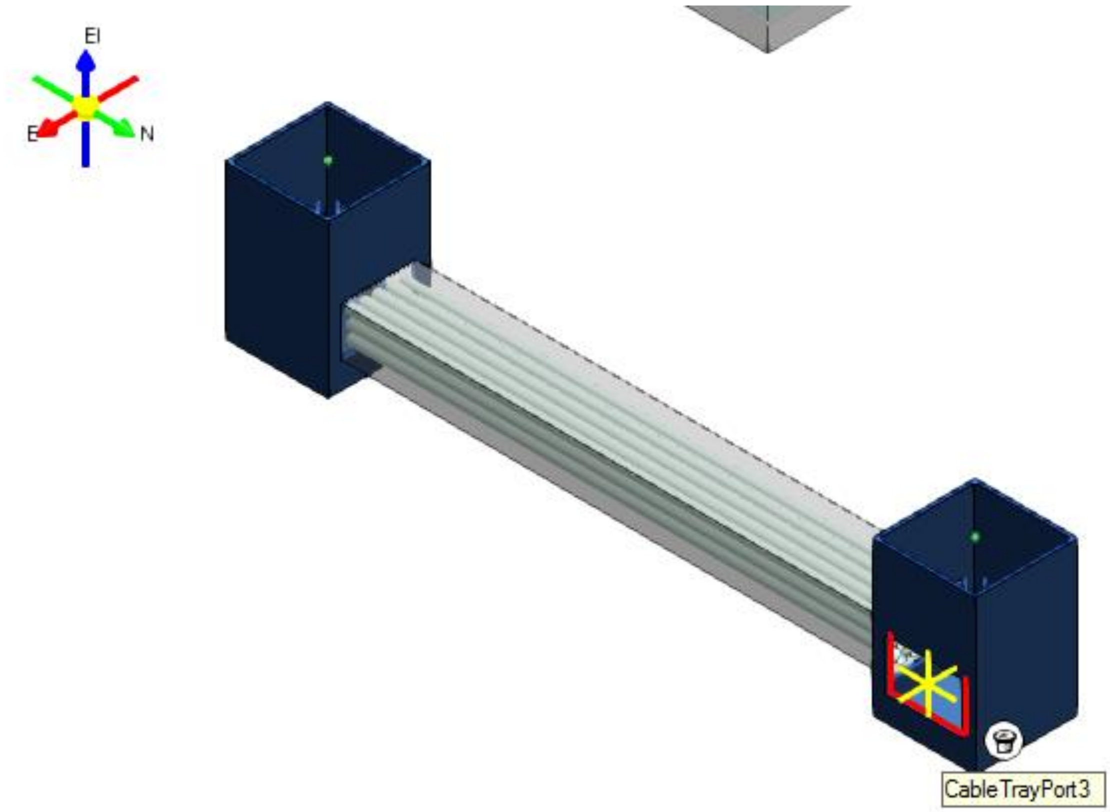


14. Click in the active view to place the duct bank.



15. To route the next part of the duct bank system in the east direction, click **Route Cableway**  on the vertical toolbar.

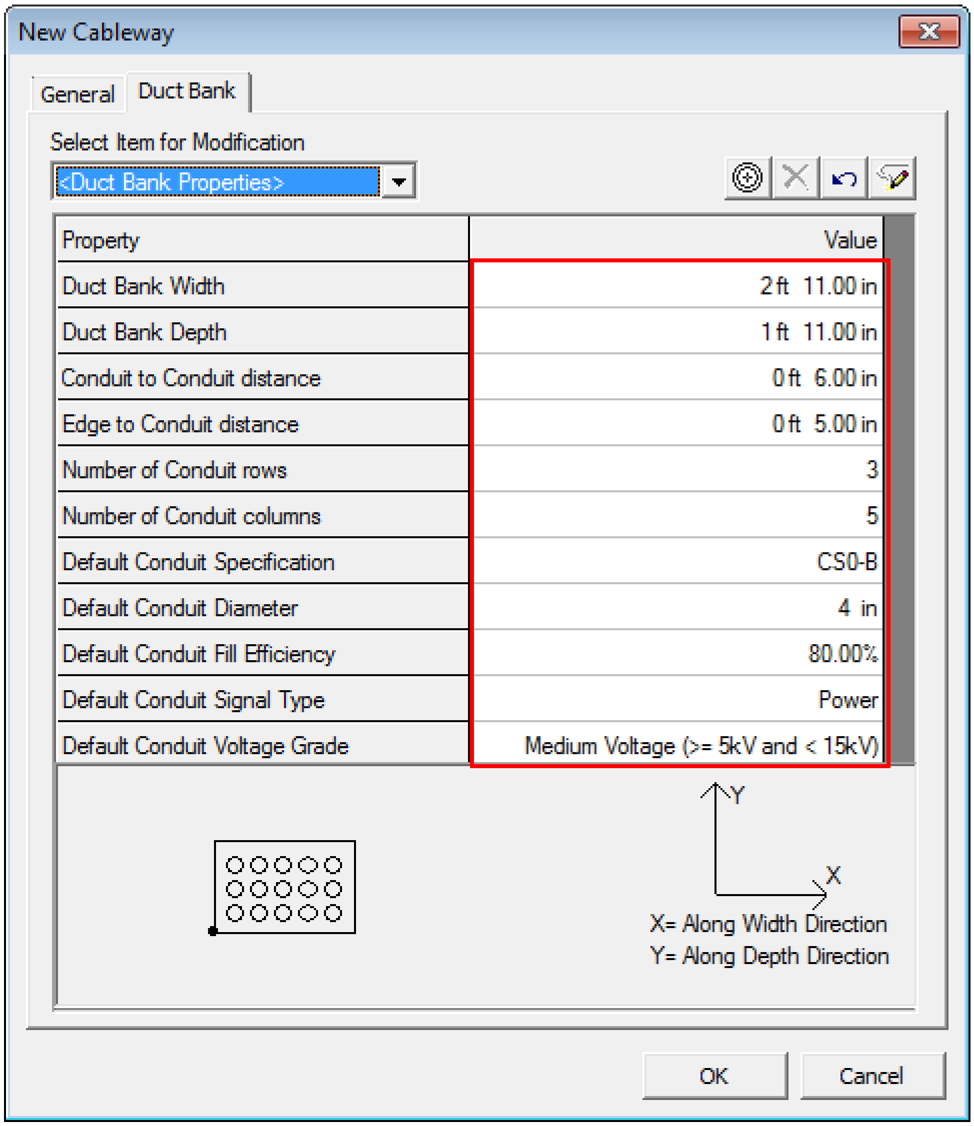
16. Select **cable tray port 3** on the Pull-Pit (2) named (E-PP-A2) as the starting point, as shown below:



*The **New Cableway** dialog box displays.*

17. On the **Duct Bank** tab, define the following values as shown:

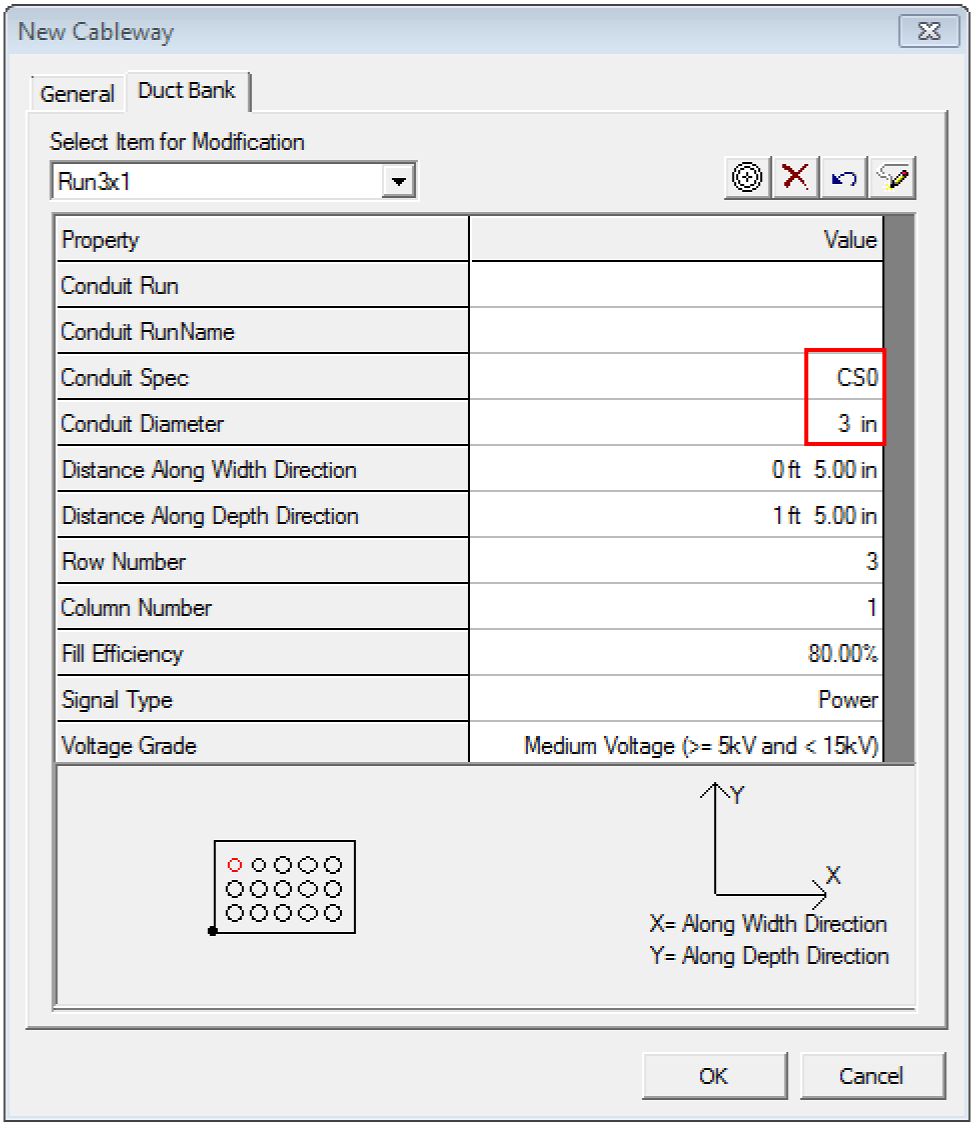
Duct Bank Width: 2 ft 11 in
Duct Bank Depth: 1 ft 11 in
Conduit to Conduit distance: 0 ft 6 in
Edge to Conduit distance: 0 ft 5 in
Number of Conduit rows: 3
Number of Conduit columns: 5
Default Conduit Specification: CSO-B
Default Conduit Diameter: 4 in
Default Conduit Fill Efficiency: 80.00 %
Default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



NOTE If the conduits are not inside the duct bank, an error message displays.

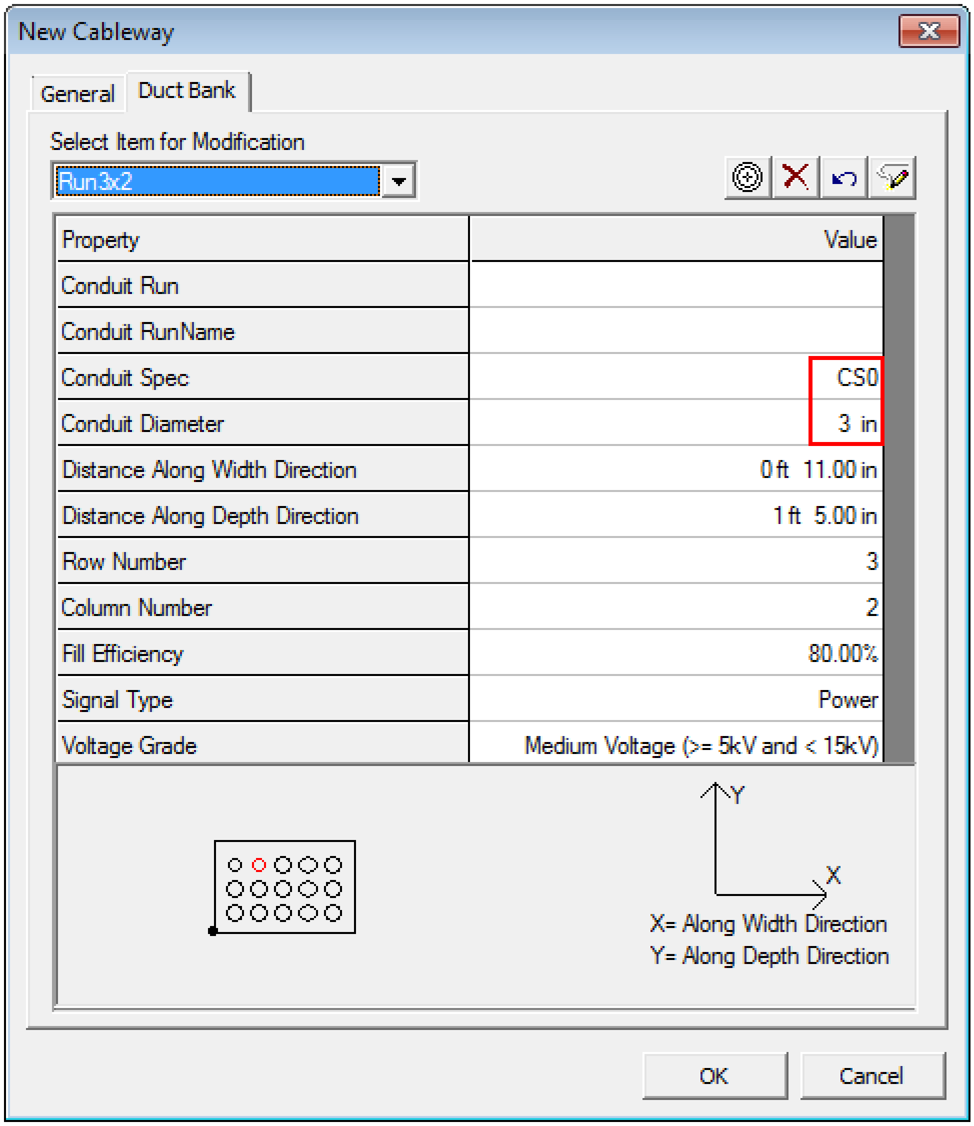
18. Set **Select Item for Modification** to **Run 3x1**, and define the following values as shown:

Conduit Spec: CS0
Conduit Diameter: 3 in
Fill Efficiency: 80 %
Signal Type: Power
Voltage Grade: Medium Voltage (>= 5kV and <= 15kV)

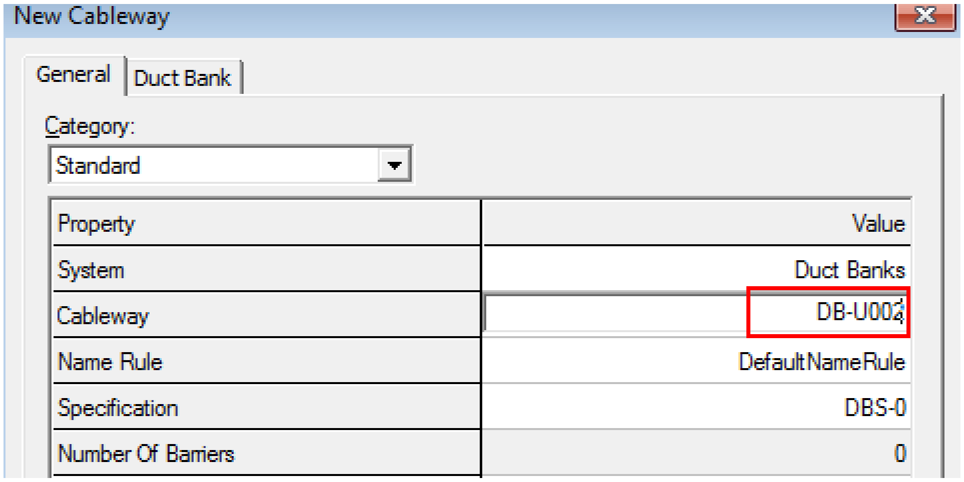


19. Set **Select Item for Modification** to **Run 3x2**, and define the following values as shown:

Conduit Spec: CS0
Conduit Diameter: 3 in
Fill Efficiency: 80 %
Signal Type: Power
Voltage Grade: Medium Voltage (>= 5kV and <= 15kV)

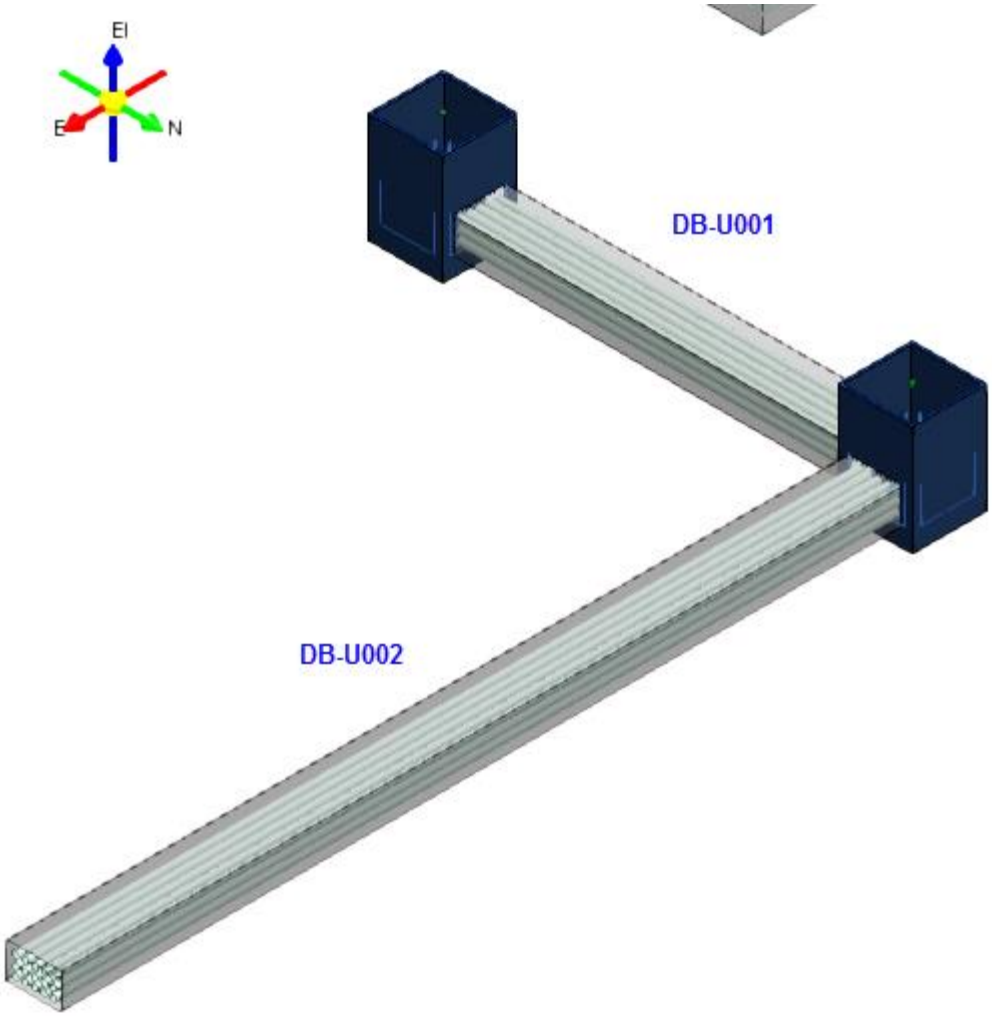


20. Under the **General** tab, set **Cableway** to **DB-U002**, and click **OK**.



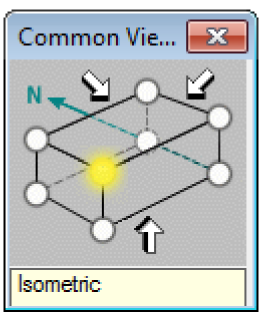
21. On the **Cableway** ribbon, set the **Length** of the duct bank to **45 ft**.

22. Hover over the East direction until the **E** SmartSketch glyph displays. Click anywhere in the active view to place the duct bank.



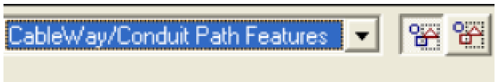
23. Right-click anywhere in the model to close the command.

24. To route the next part of the duct bank system to the North, click **Common View** to change the view of the model to “Looking Isometric.”



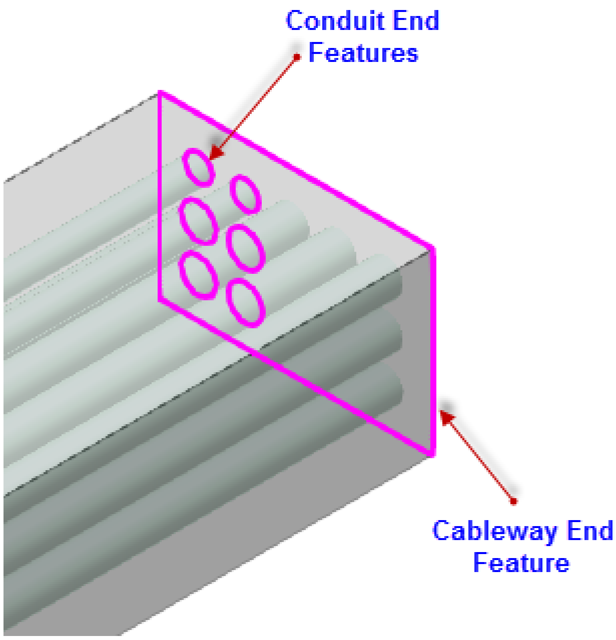
25. Zoom in on the end of the routed duct bank.

26. Under **Locate Filter**, select **Cableway/Conduit Path Features**, and set the fence mode to **Inside**.



NOTE You can also use the **Overlap** fence to select the end features.

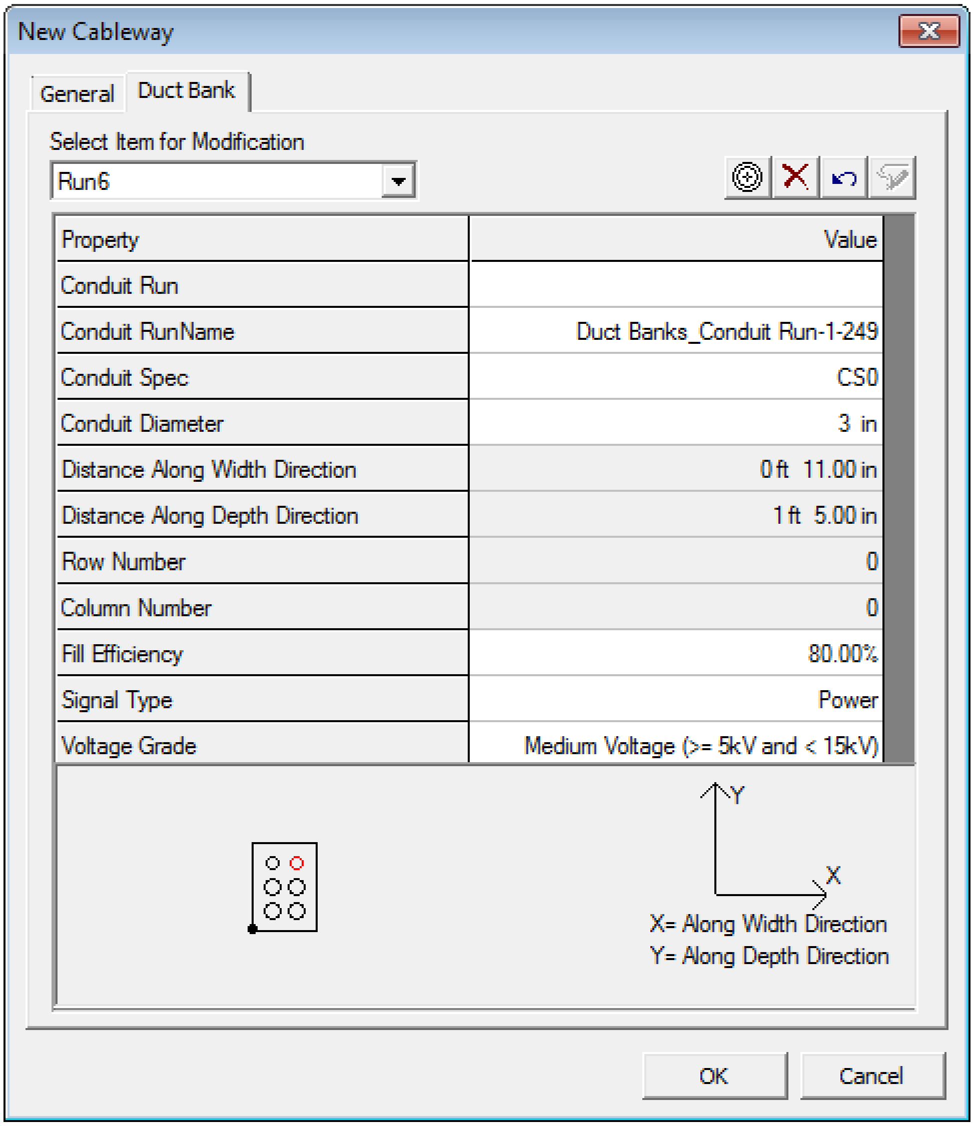
27. Select the end features as shown below:



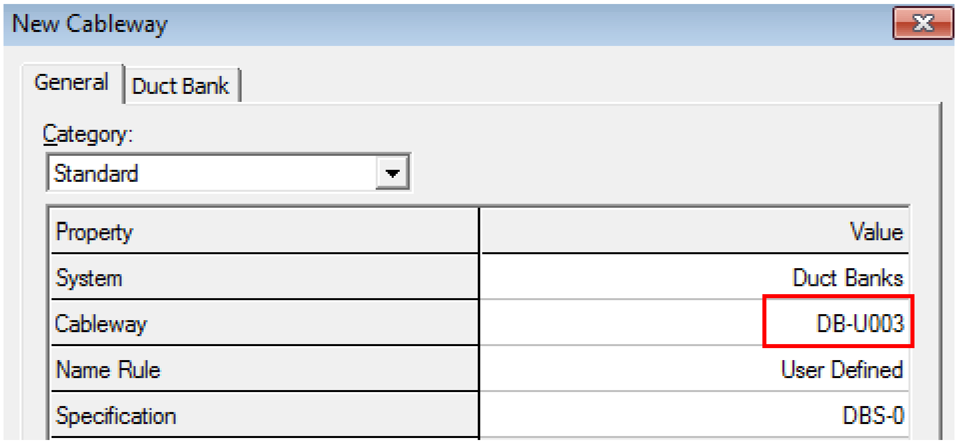
28. Click **Route Cableway**  on the vertical toolbar.

*The **New Cableway** dialog box displays.*

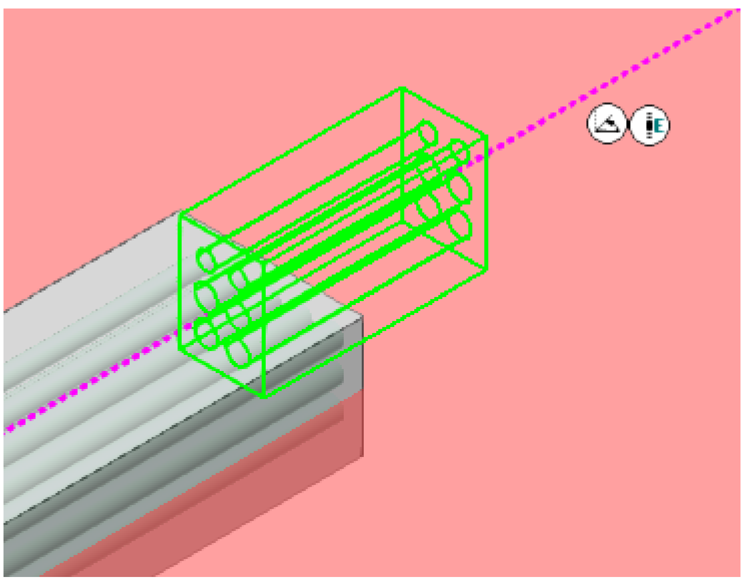
29. Select the **Duct Bank** tab and verify the properties of the conduit runs as shown (Run5 and Run6):



30. Select the **General** tab and type **DB-U003** in the **Cableway** field.

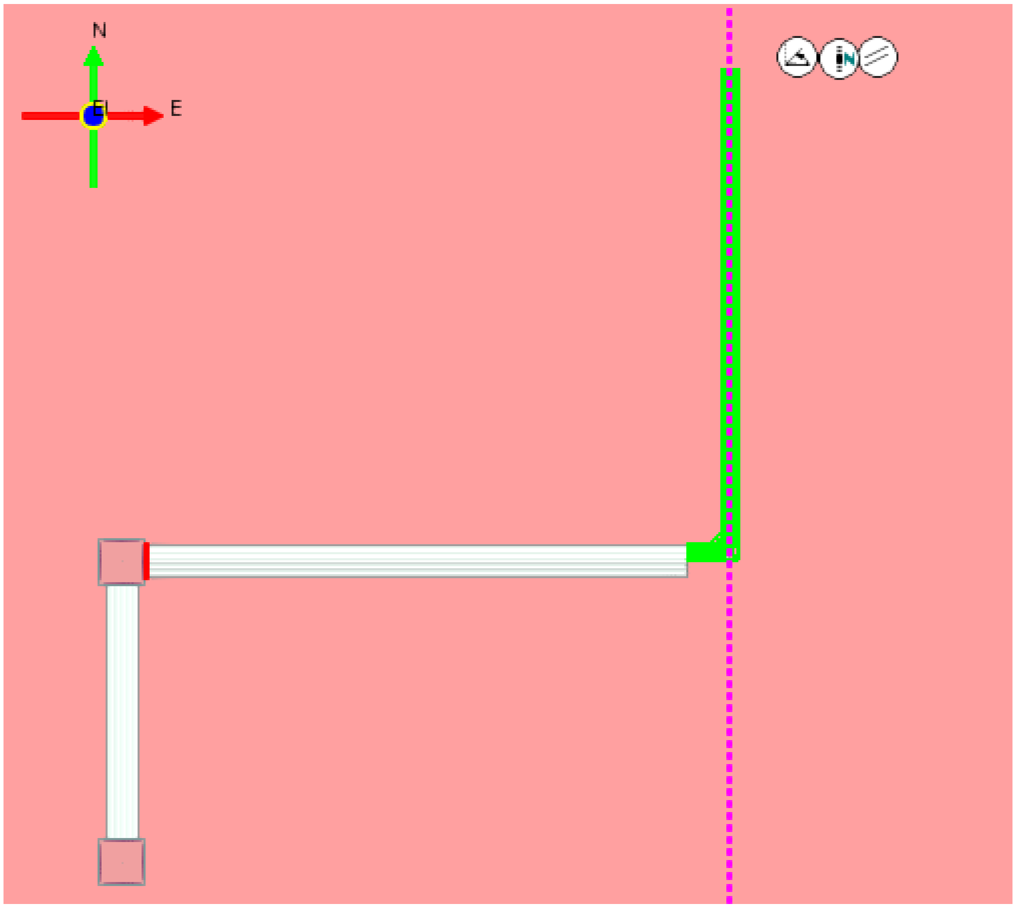


31. Click **OK**.
32. On the **Cableway** ribbon, set the **Length** to **3 ft 6 in**.
33. Hover over the east side of the end features until the **E** SmartSketch glyph appears, and then click anywhere in the active view to place the duct bank.



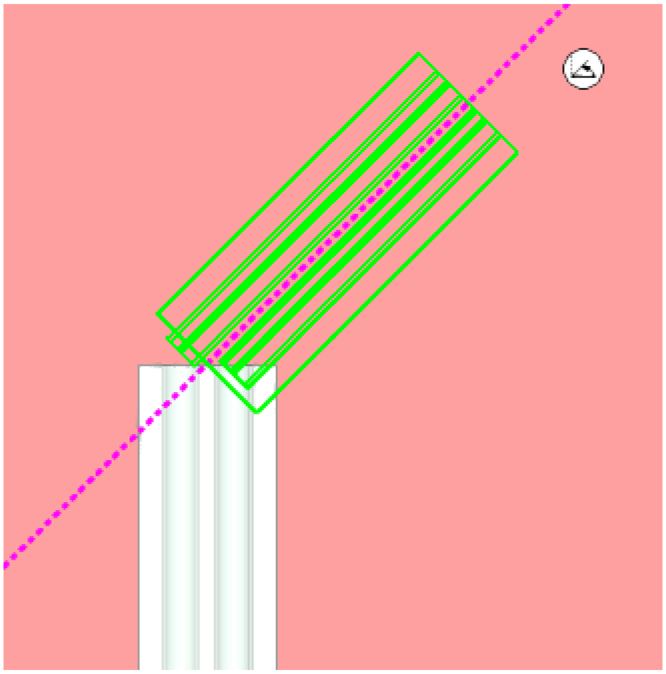
34. On the **Cableway** ribbon, set the **Length** to **40 ft**.

35. Hover over the Northing direction until the **N** SmartSketch glyph displays, and then click to accept the placement of the duct bank.

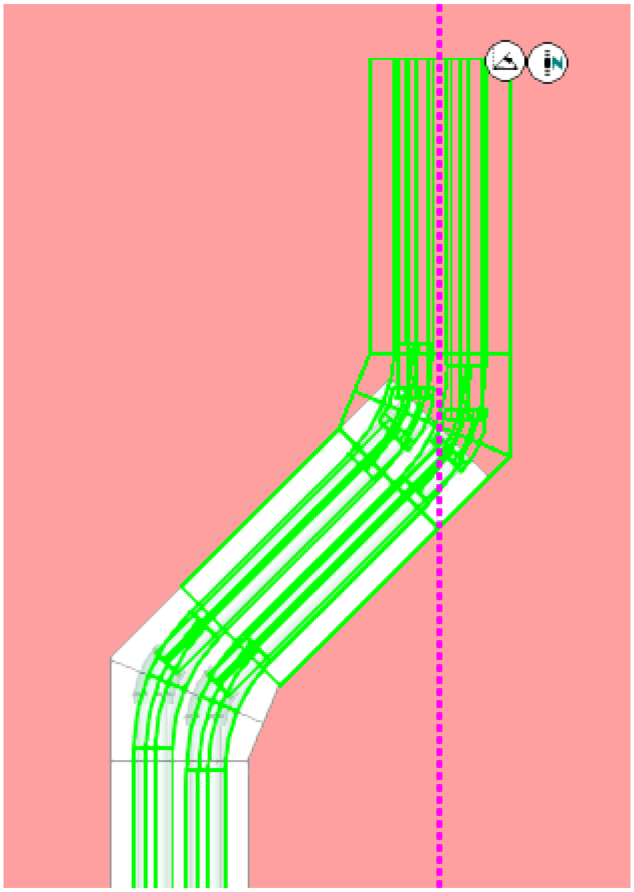


36. Use **Common Views** to change the view of the model to “Looking Plan.”
37. On the **Cableway** ribbon, set the **Length** to **3 ft 6 in** and the **Angle** to **45 deg**.

38. Hover over the North-East direction and click to place the duct bank.



39. Hover over the North direction and click to continue placing the duct bank.

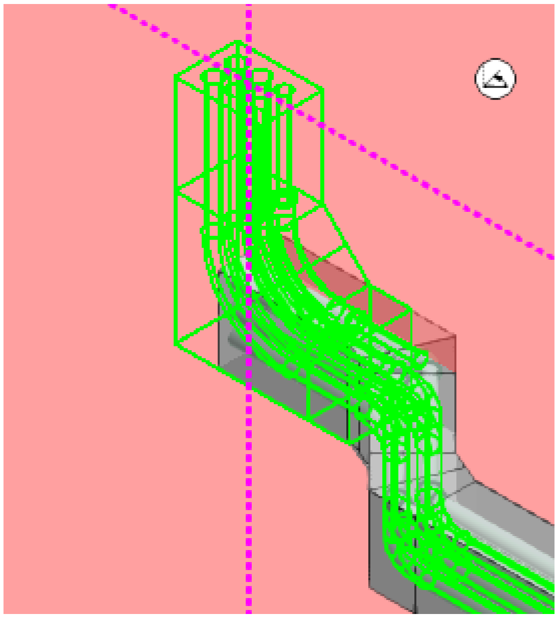


40. Right-click anywhere in the active view to close the command.
41. Use **Common Views** to change the view of the model to "Looking Isometric."
42. Select all the end features of the duct bank.
43. Click **Route Cableway** on the vertical toolbar.
44. Set the route plane to **North-South**, and set the **Angle** to **90 deg** on the **Cableway** ribbon.
45. Select **Tools > PinPoint**.

    *The **PinPoint** ribbon displays.*

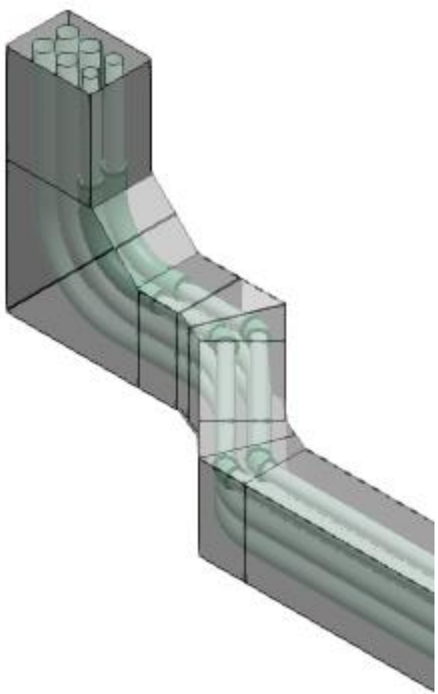
46. Set the **Coordinate System** to **U05 CS**.
47. Click **Set target to Origin**.
48. Set the **Elevation** to **0 ft**.

49. Click in the active view to place the duct bank.



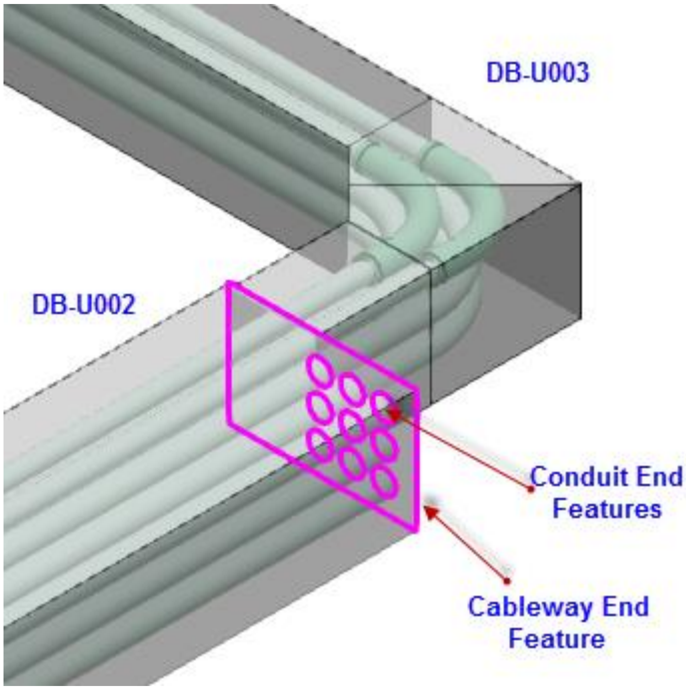
50. Right-click to close the command.

    The view of your model is shown below:



51. Zoom in on the branch point of the routed duct bank to continue to route the duct bank system to the east.

52. Set the **Locate Filter** to **Select Cableway/Conduit Path Features**, and select the end features as shown below:



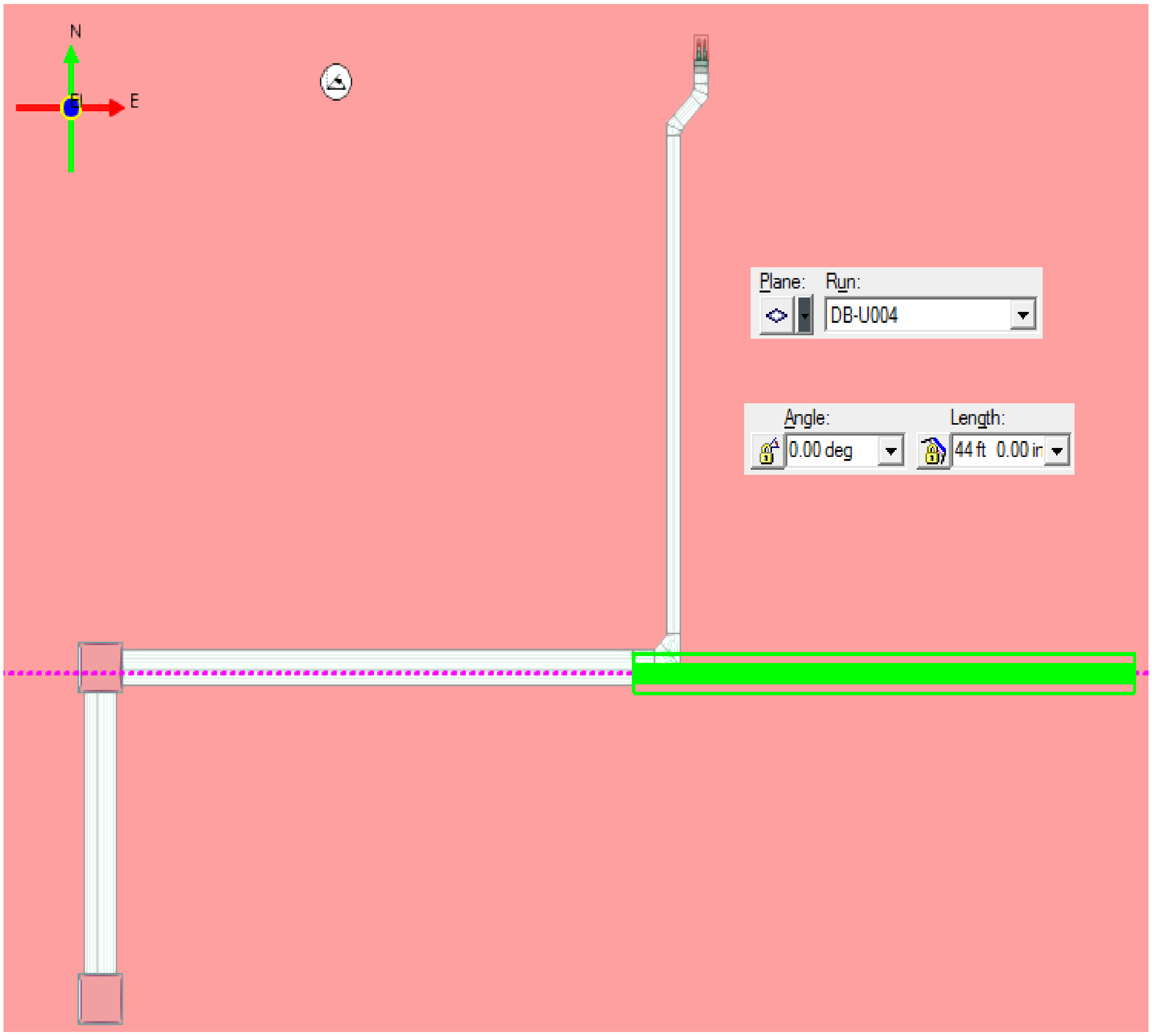
53. Click **Route Cableway** on the vertical toolbar.

    *The **New Cableway** dialog box displays.*

54. Under the **General** tab, set **Cableway** to **DB-U004**, and then click **OK**.

55. Set the route plane to **Plan**, Width to and set the **Length** to **44 ft** on the **Cableway** ribbon.

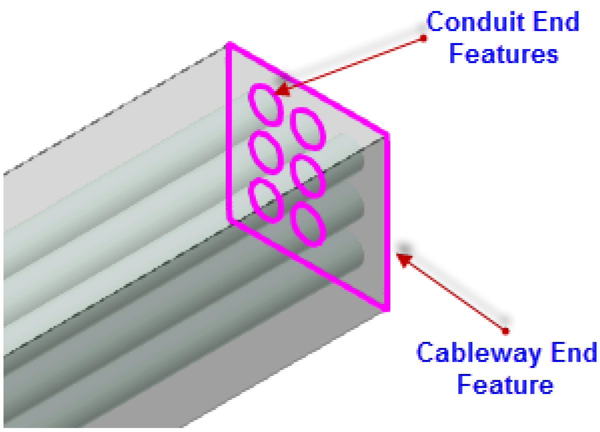
56. Hover over the East direction until the **E** SmartSketch glyph appears, then click in the active view to place the duct bank.



57. Right-click to close the command.

58. Zoom in on the end of the routed duct bank to start routing the next part of the duct bank system to the north.

59. Set the **Locate Filter** to **Select Cableway/Conduit Path Features**, and select the end features as shown below:



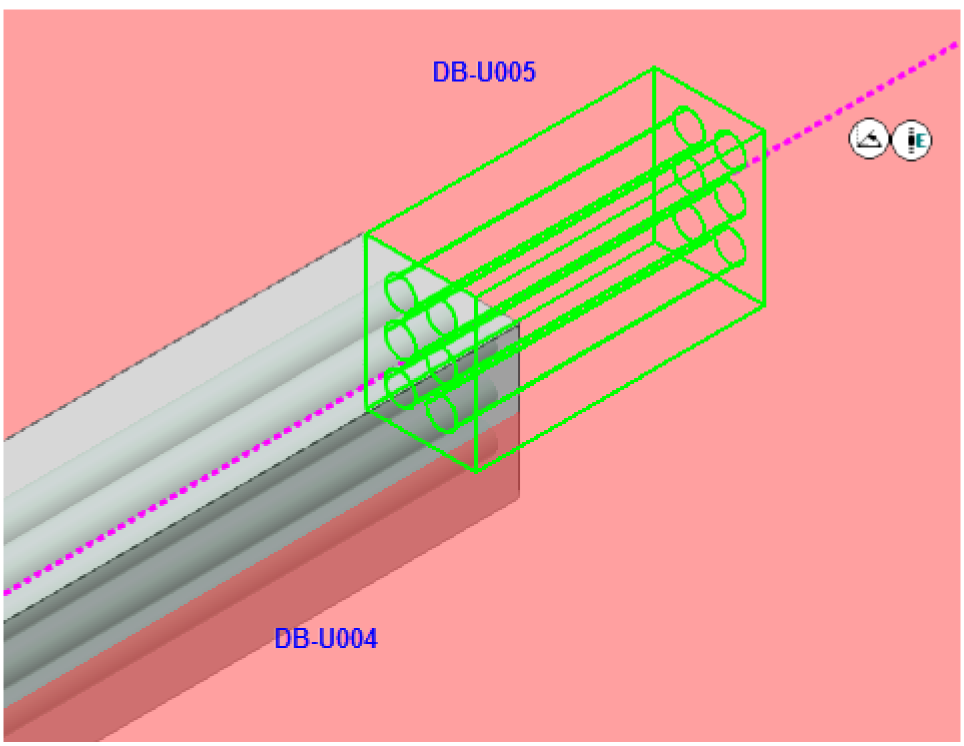
60. Click **Route Cableway** on the vertical toolbar.

    *The **New Cableway** dialog box displays.*

61. Under the **General** tab, set **Cableway** to **DB-U005**, and then click **OK**.

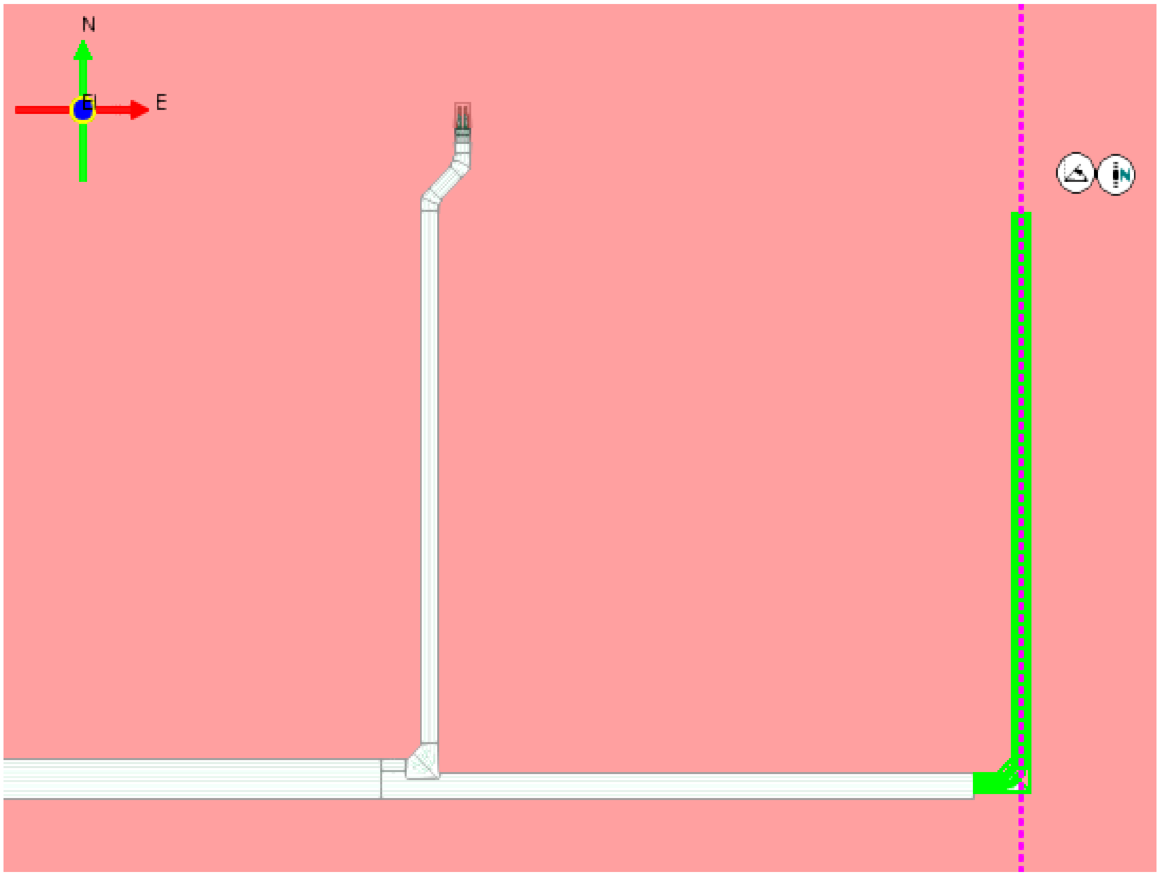
62. On the **Cableway** ribbon, set the **Length** to **3 ft 6 in**.

63. Hover over the east direction until the **E** SmartSketch glyph displays, and then click in the active view to place the duct bank.



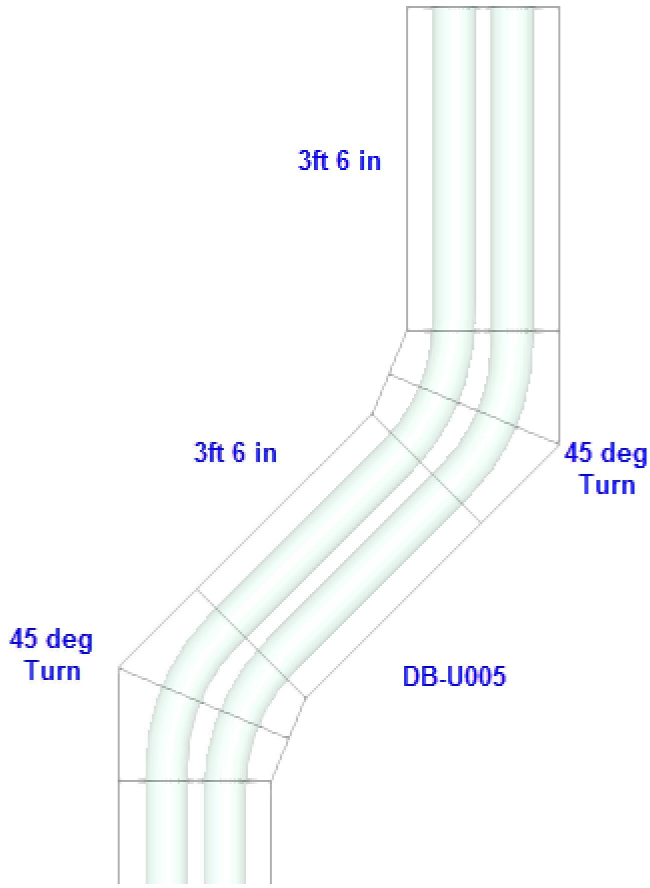
64. On the **Cableway** ribbon, set the **Length** to **40 ft**.

65. Hover over the North direction until the **N** SmartSketch glyph displays, then click in the active view to place the duct bank.



66. Use **Common Views** to change the view of the model to "Looking Plan."
67. On the **Cableway** ribbon, set the **Length** to **3 ft 6 in** and the **Angle** to **45 deg**.
68. Hover over the north-east direction and click in the active view to place the duct bank.

69. Hover over the north direction and click in the active view to place the duct bank.



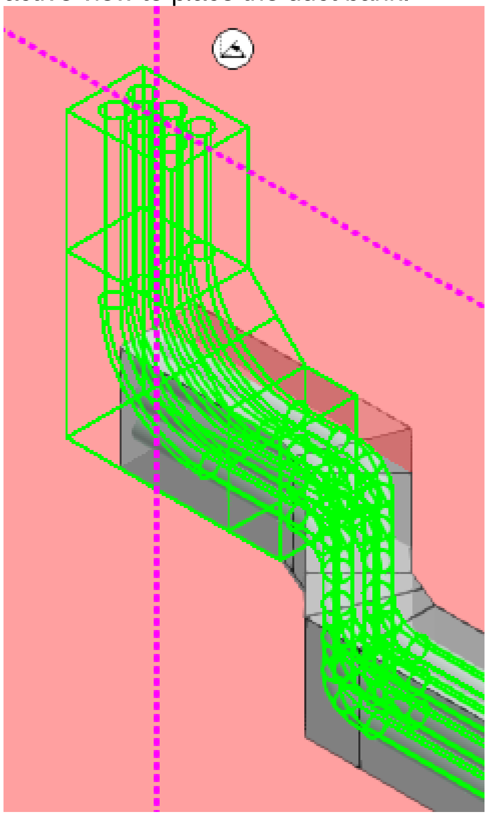
70. Right-click to close the command.
71. Use **Common Views** to change the view of the model to “Looking Isometric - East/North.”
72. Select all the end features of the duct bank.
73. Click **Route Cableway** on the vertical toolbar.

    *The **New Cableway** dialog box displays.*
74. Set the route plane to **North-South** .
75. On the **Cableway** ribbon, set the **Angle** to **90 deg**.
76. Select **Tools > PinPoint**.

    *The **PinPoint** ribbon displays.*
77. Set the coordinate system to **U05 CS**.
78. Click **Set target to Origin** .

79. Set the **Elevation** to **0 ft**.

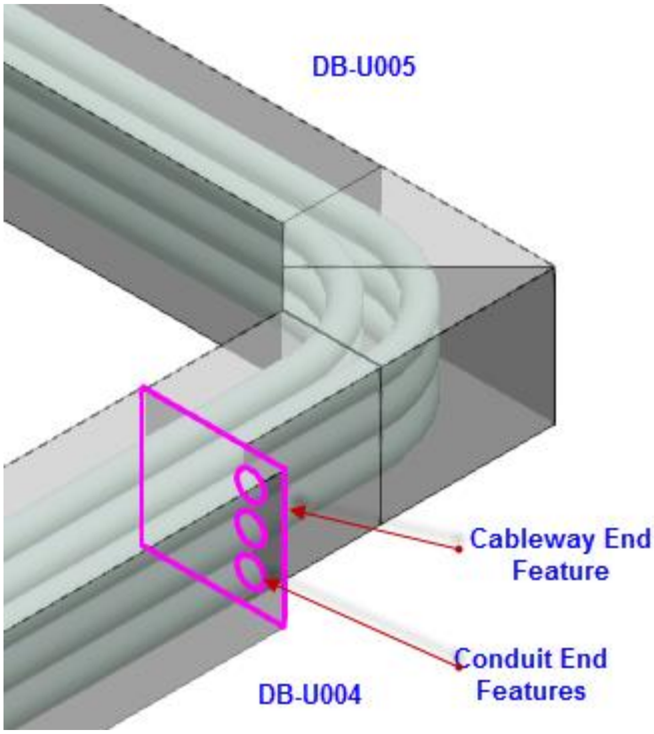
80. Hover over the Up direction until the **U** SmartSketch glyph displays, and then click in the active view to place the duct bank.



81. Right-click to close the command.

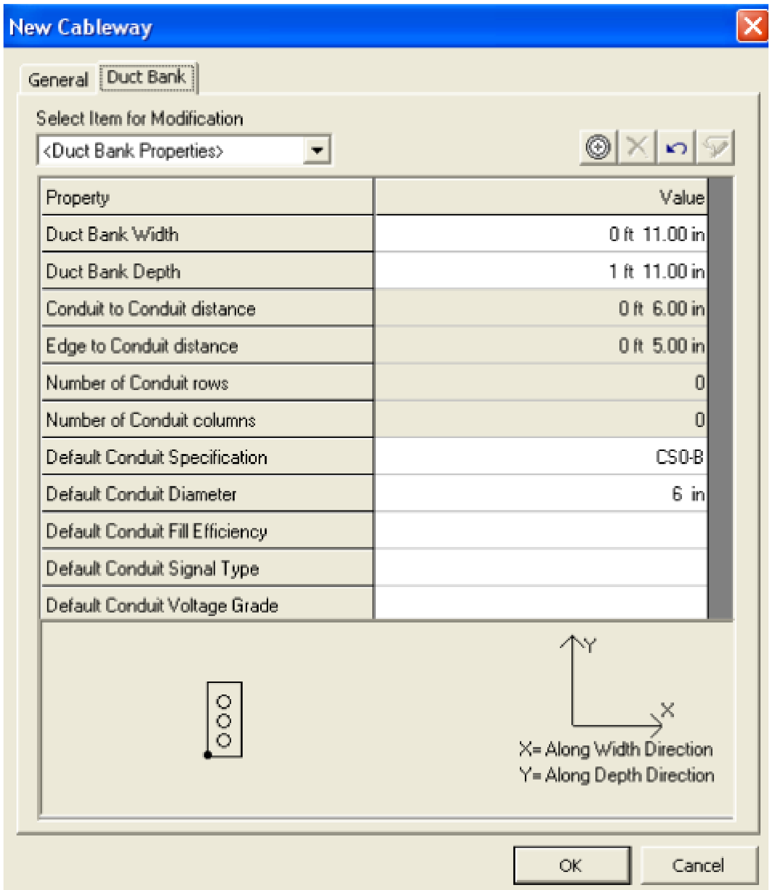
82. Zoom in on the second branch point of the routed duct bank to continue routing the duct bank system in the east direction.

83. Set the **Locate Filter** to **Select Cableway/Conduit Path Features**, and select the end features as shown below:

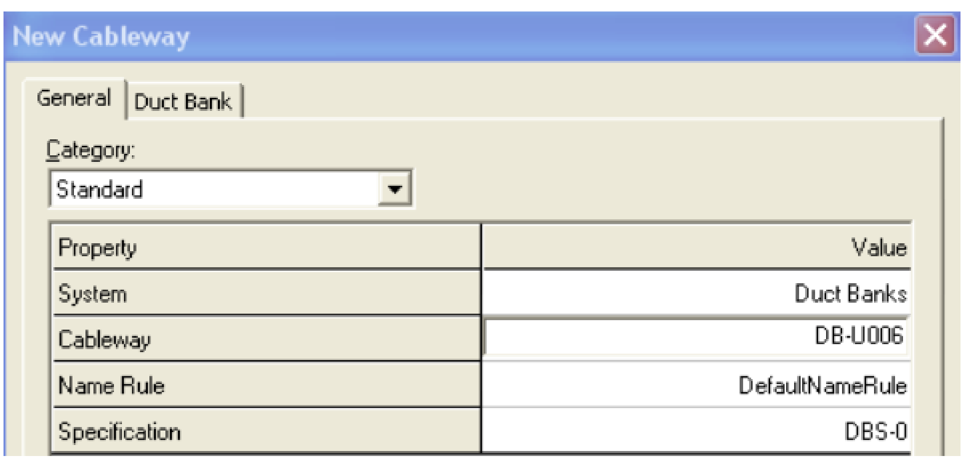


84. Click **Route Cableway**  on the vertical toolbar.

*The **New Cableway** dialog box displays.*



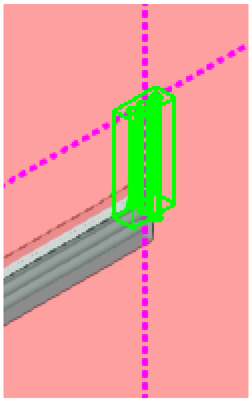
85. Under the **General** tab, type **DB-U006** in the **Cableway** field, and then click **OK**.



86. Set the route plane to **Plan** and set the **Length** to **20 ft** on the **Cableway** ribbon.

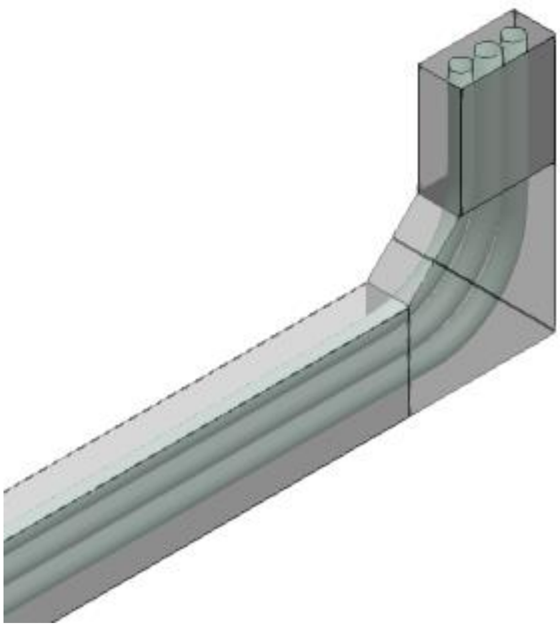
87. Hover over the East direction until the **E** SmartSketch glyph appears, then click in the active view to place the duct bank.

88. Set the route plane to **East-West**.
89. On the **PinPoint** ribbon, set the **Elevation** to **0 ft**.
90. Click in the active view to place the duct bank.



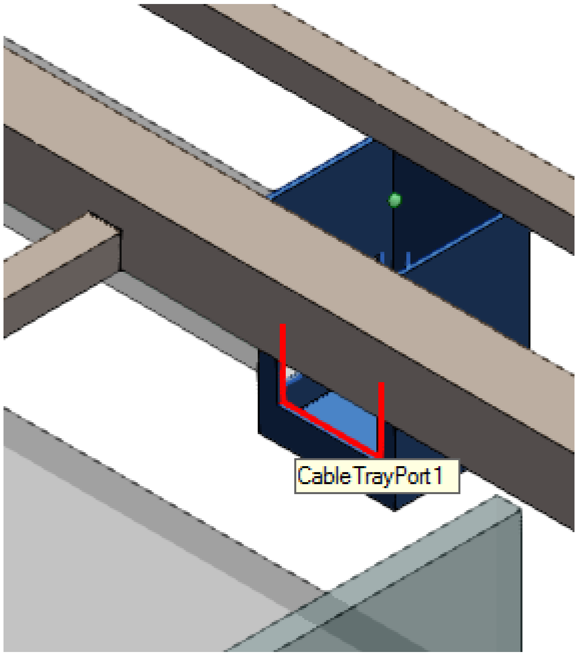
91. Right-click to close the command.

    The view of your model should resemble below:



92. Set the **Locate Filter** to **All**, and then select the **Wall System** of the building.
93. Use **Hide** to hide the wall of the building.
94. Set the **Locate Filter** to **Cable tray Nozzles**.

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

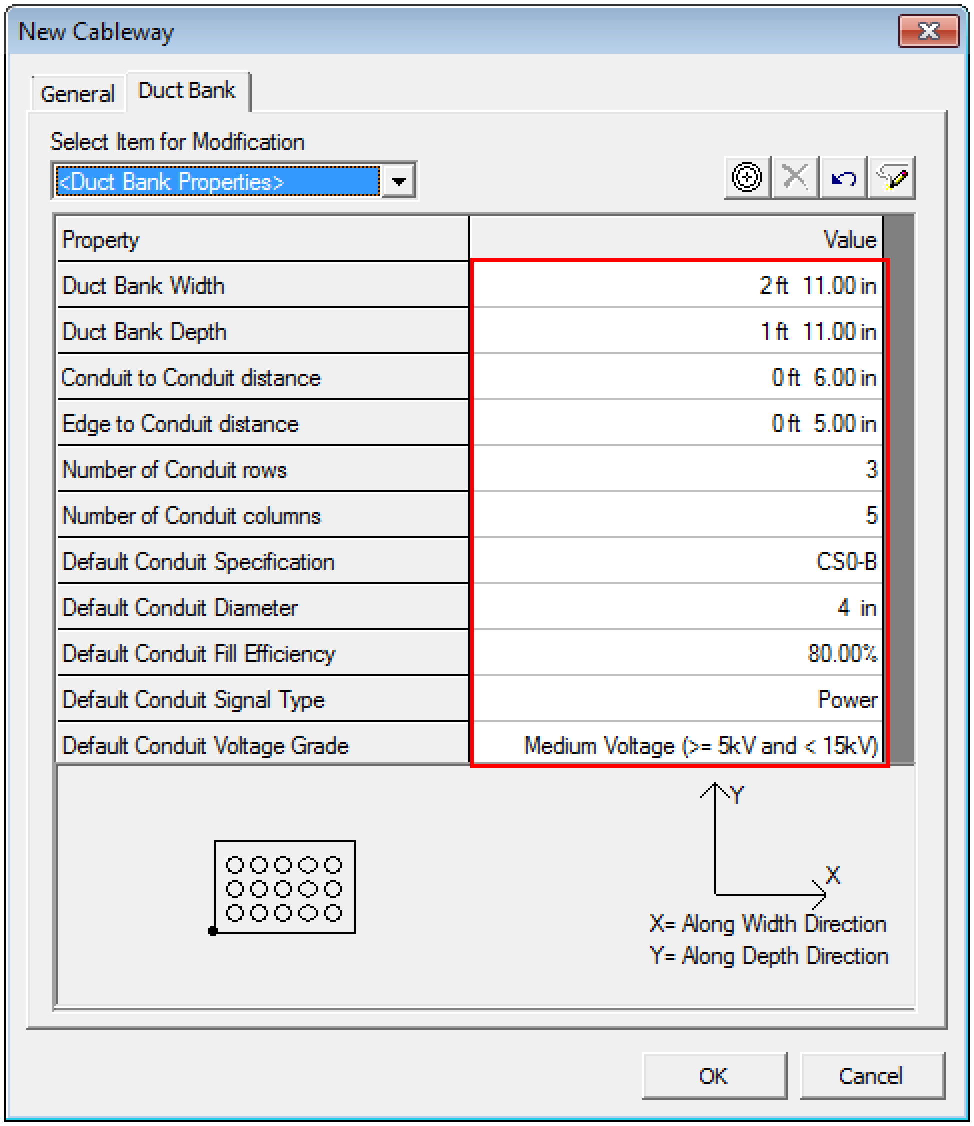


96. Click **Route Cableway**  on the vertical toolbar.

    *The **New Cableway** dialog box displays.*

97. On the **Duct Bank** tab, define the following values as shown:

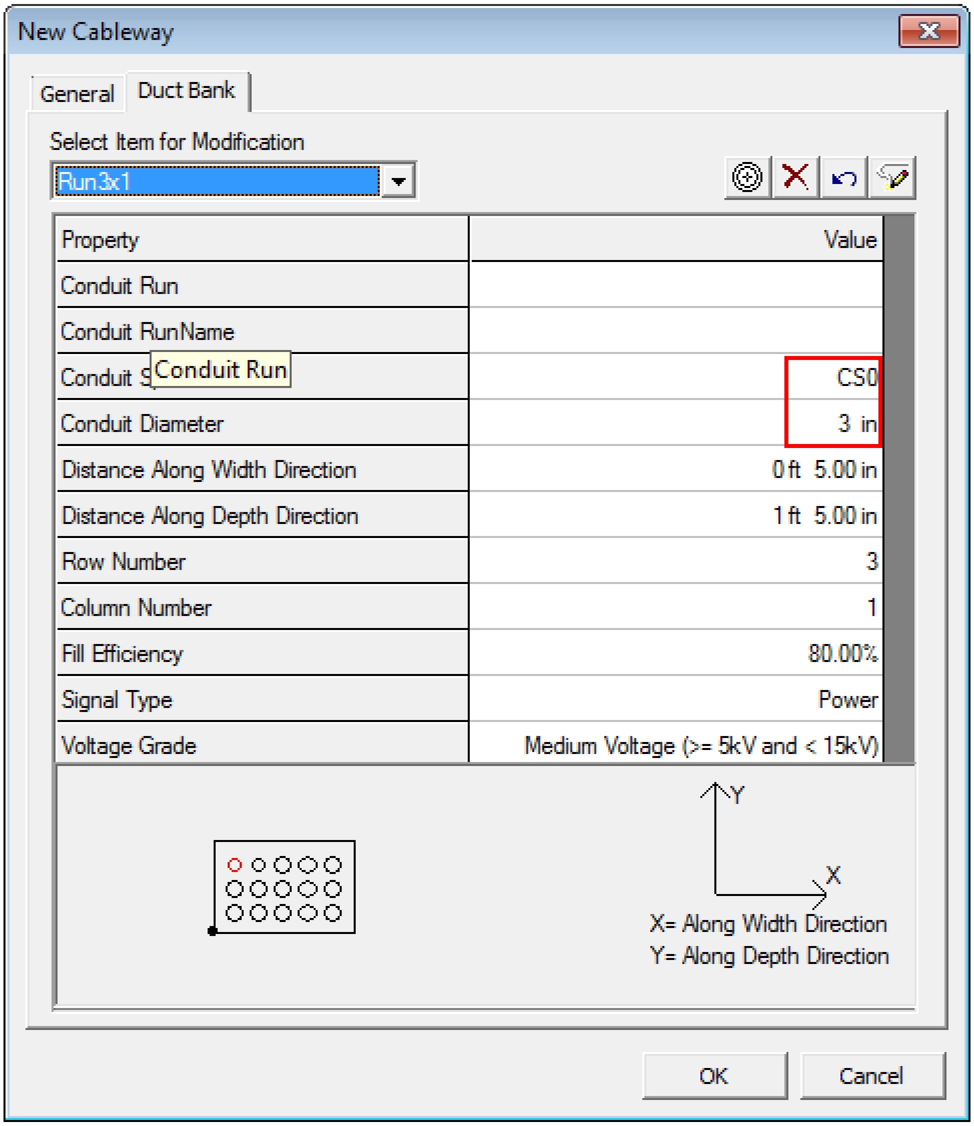
Duct Bank Width: 2 ft 11 in
Duct Bank Depth: 1 ft 11 in
Conduit to Conduit distance: 0 ft 6 in
Edge to Conduit distance: 0 ft 5 in
Number of Conduit rows: 3
Number of Conduit columns: 5
Default Conduit Specification: CS0-B
Default Conduit Diameter: 4 in
Default Conduit Fill Efficiency: 80.00 %
Default Conduit Signal Type: Power
Default Conduit Voltage Grade: Medium Voltage (>= 5kV and <= 15kV)



NOTE If the conduits are not inside the duct bank, an error message displays.

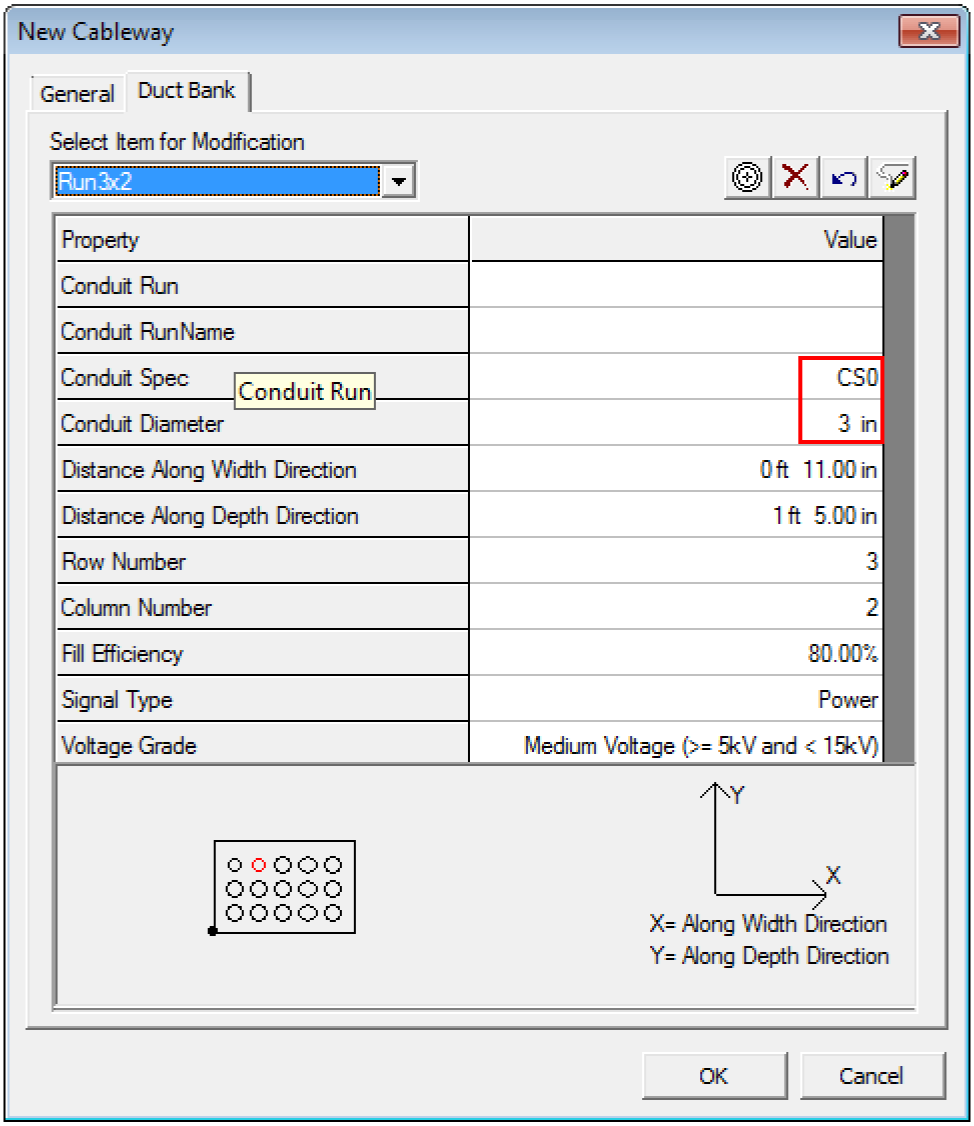
98. Set **Select Item for Modification** to **Run 3x1**, and define the following conduit specifications:

Conduit Spec: CS0
Conduit Diameter: 3 in
Fill Efficiency: 80 %
Signal Type: Power
Voltage Grade: Medium Voltage (>= 5kV and <= 15kV)



99. Set **Select Item for Modification** to **Run 3x2**, and define the following conduit specifications:

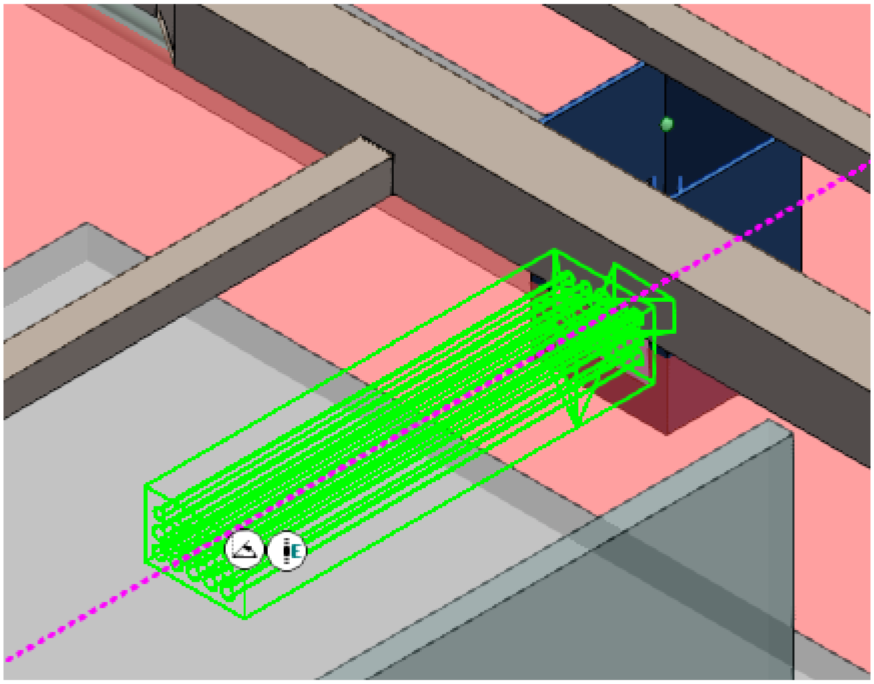
Conduit Spec: CS0
Conduit Diameter: 3 in
Fill Efficiency: 80 %
Signal Type: Power
Voltage Grade: Medium Voltage (>= 5kV and <= 15kV)



100. Under the **General** tab, type **DB-U007** in the **Cableway** field, and then click **OK**.

101. On the **Cableway** ribbon, set the **Length** to **12 ft**.

102. Hover over the west direction until the **E** SmartSketch glyph displays, and then click in the active view to place the duct bank.



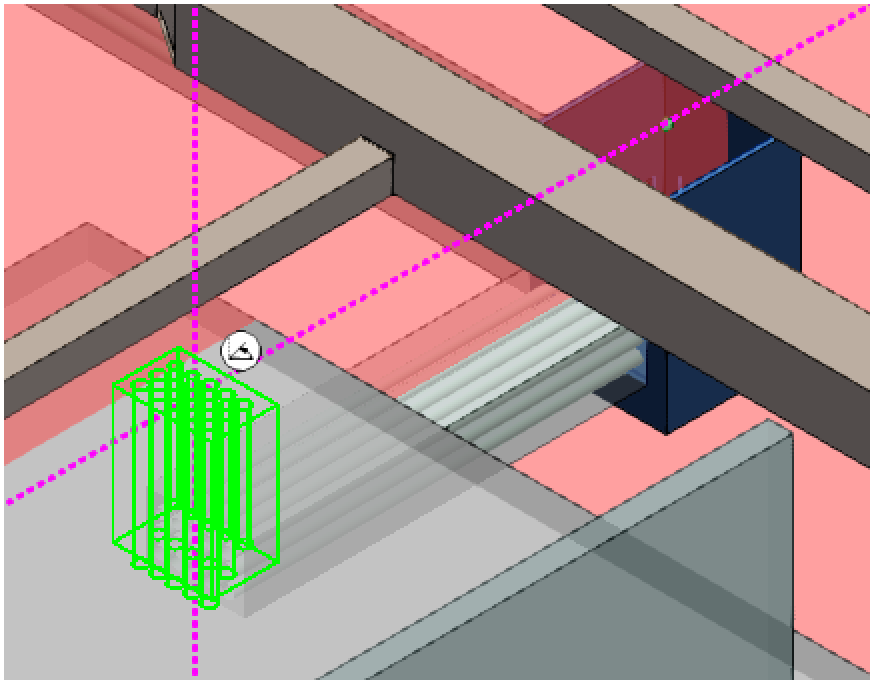
103. Use **Common Views** to change the view of the model to “Looking North.”

104. Click **Unlock** .

105. Set the route plane to **East-West** .

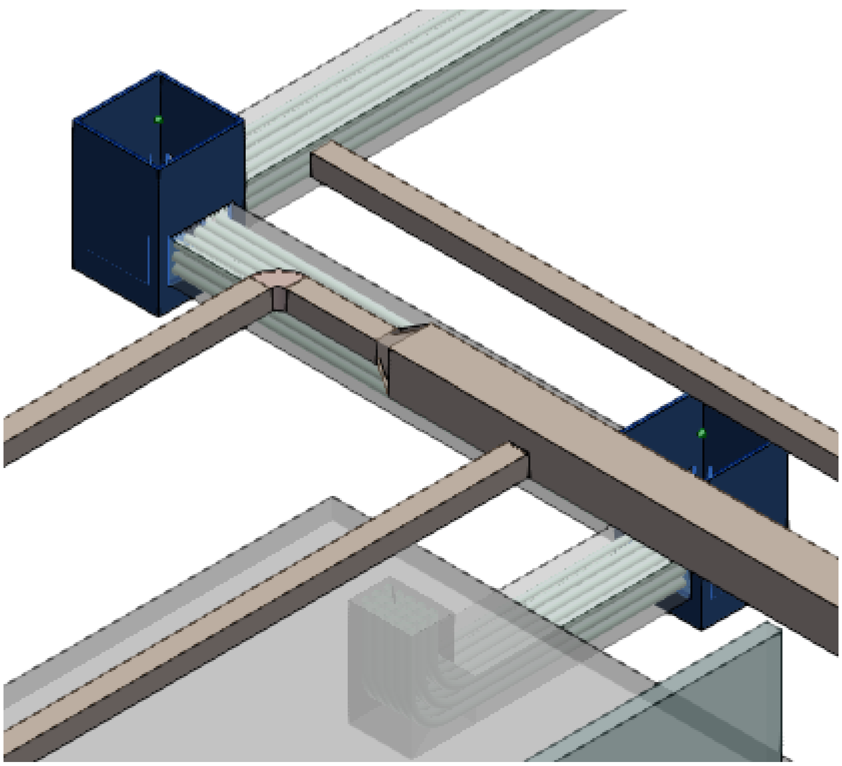
106. On the **PinPoint** ribbon, set the **Elevation** to **0 ft**.

107. Click in the active view to place the duct bank.



108. Right-click to cancel the command.

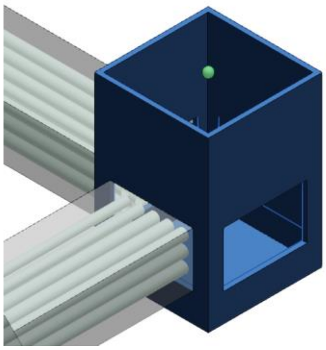
The view of your model displays:



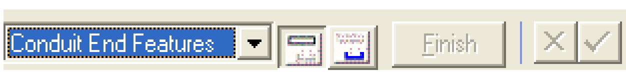
Connecting Duct Banks within Pull-Pit

To route cable paths where two or more duct banks meet at a pull-pit, the cable paths must be continuous. Conduits that need to exchange cables need to be connected by a non part specification cableway. A cableway with a non-part specification is also referred to as "Zero-Spec". **Cableway Auto Connect** allows you to create the connecting cableways.

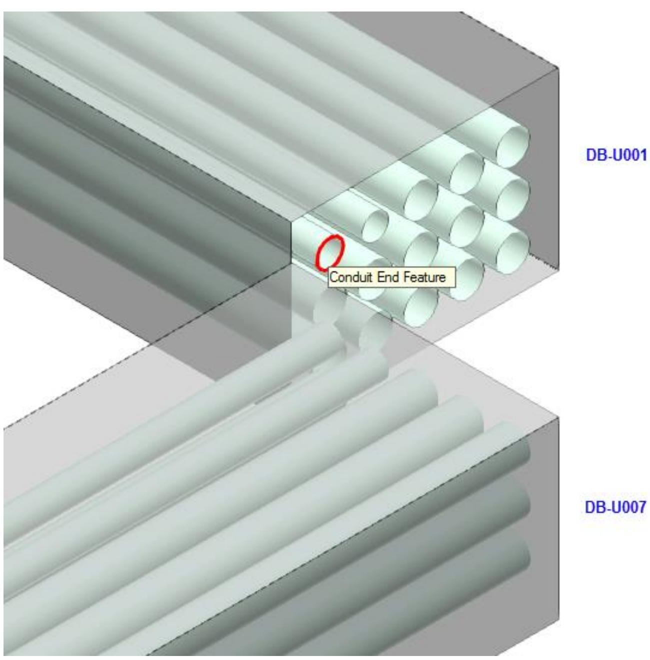
1. Locate the Pull-Pit (1) **E-PP-A1** in the model and zoom in close to it.
2. Under **Locate Filter**, select **Equipment**.
3. Select Pull-Pit (1), and then select **Hide**.



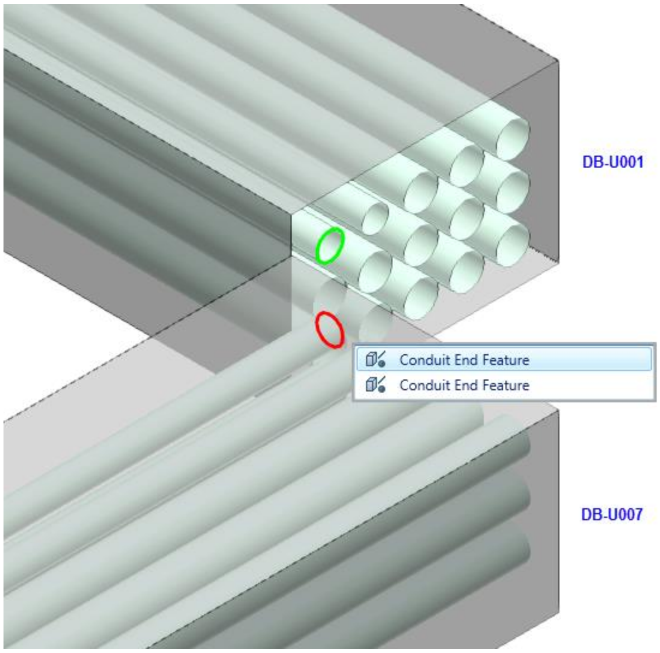
4. Click **Auto Connect**  from the vertical toolbar.
5. Set the **Locate Filter** to **Conduit Features**.



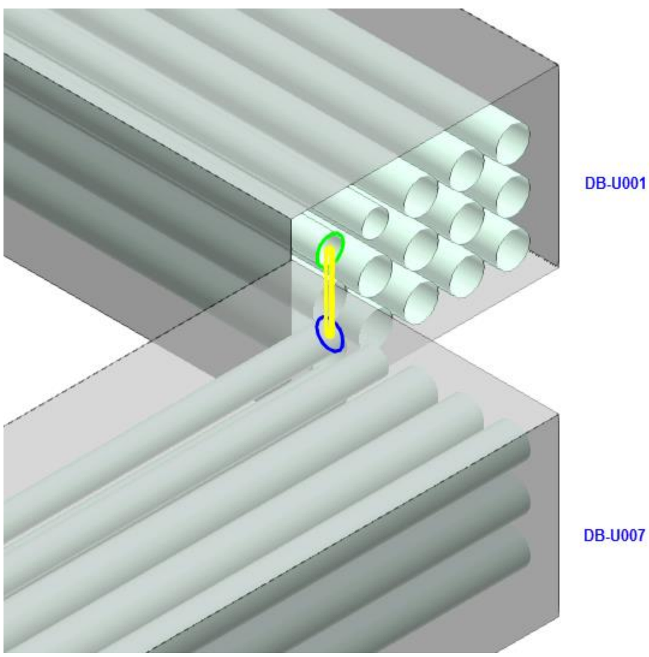
6. Select the enclosed 3" conduit end feature on duct bank DB-U001 as shown below:



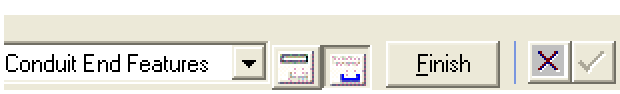
7. Click **To Run** .
8. Select the enclosed 3" conduit end feature on duct bank DB-U007 as shown below:



The connecting cableway between the selected conduit end features displays:

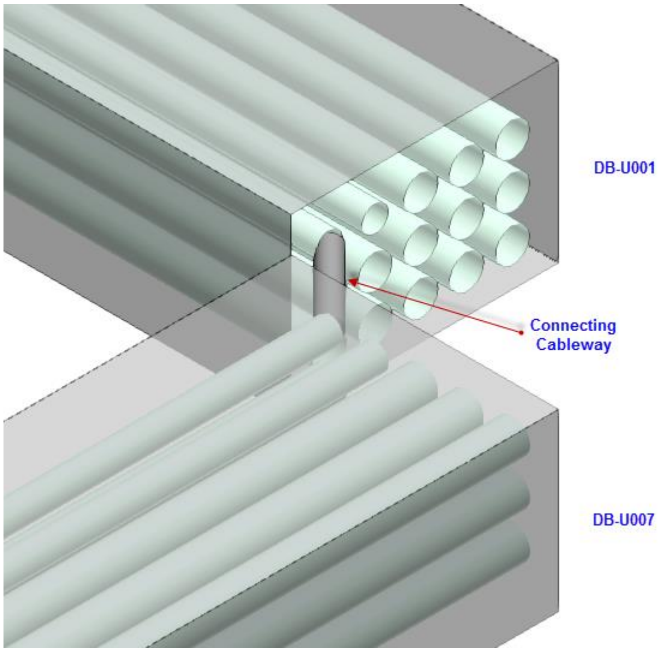


9. Click **Finish** to place the connecting cableway.

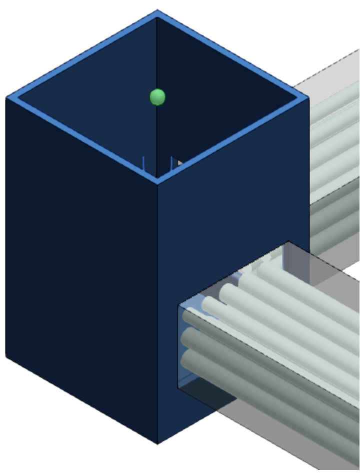


10. Right-click to cancel the command.

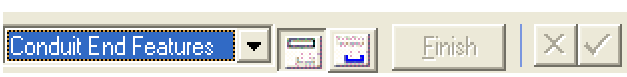
    The connecting cableway is placed:



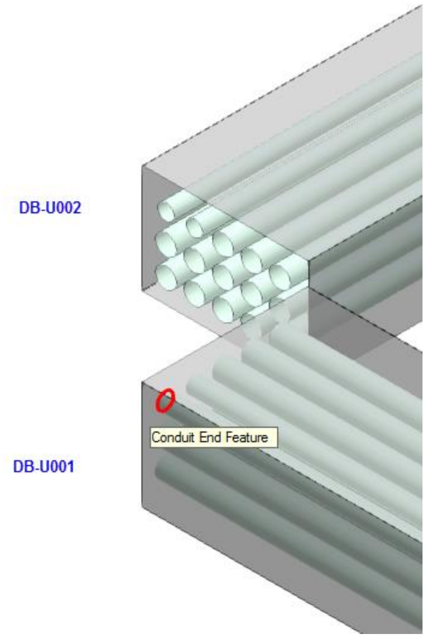
11. Locate the Pull-Pit (2) **E-PP-A2** in the model and zoom in close to it.
12. Select Pull-Pit (2), and then select **Hide**.



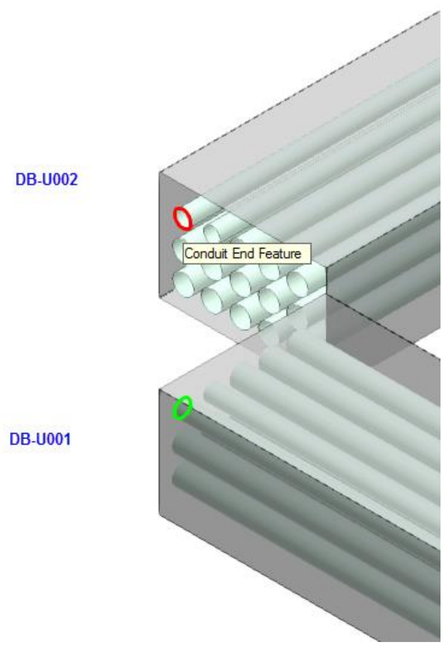
13. Click **Auto Connect** from the vertical toolbar.
14. Set the **Locate Filter** to **Conduit End Features**.



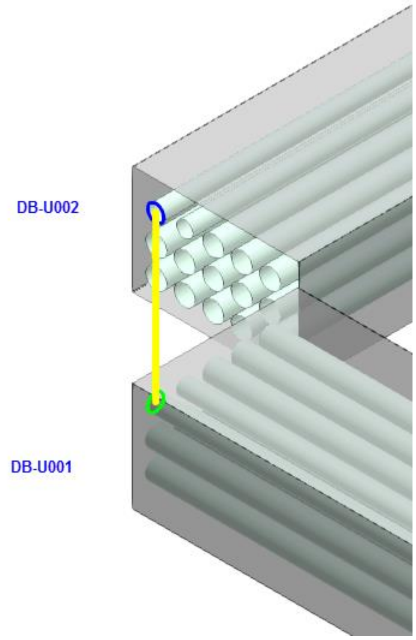
15. Select the enclosed 3" conduit end feature on duct bank **DB-U001** as shown below.



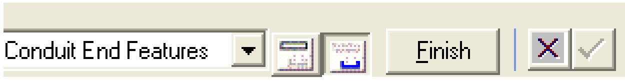
16. Click **To Run** .
17. Select the enclosed 3" conduit end feature on duct bank DB-U002 as shown below:



The connecting cableway between the selected conduit end features displays:

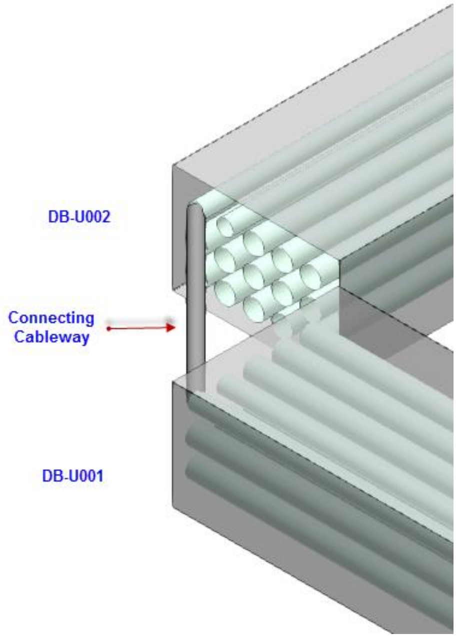


18. Click **Finish** to place the connecting cableway.



19. Right-click to cancel the command.

    The connecting cableway is placed:



20. Select **Tools > Show All** to show all objects in the view.

21. Select **View > Fit** to fit the model in the active view.

For more information related to routing cableway specifications and inserting transitions, see *Routing Cableway: An Overview* and *Insert Transitions: An Overview* in the *Smart 3D Electrical User's Guide*.

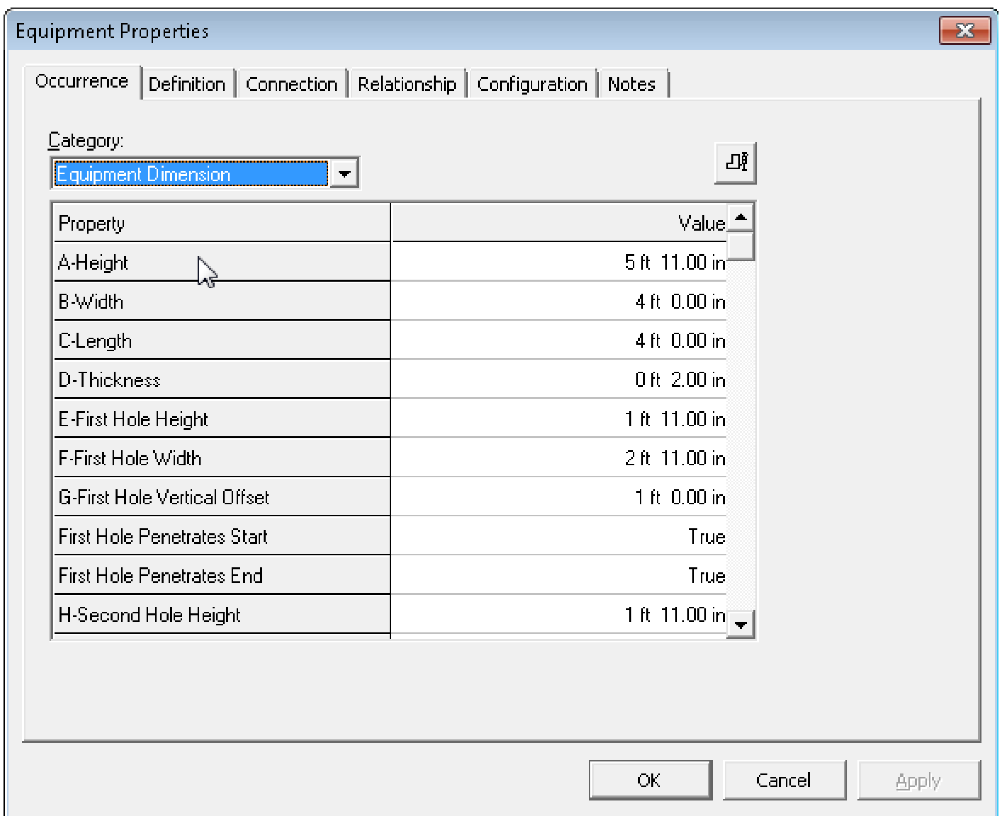
Placing Sloped Duct Banks

To place sloped duct banks in the model, the slope's properties must be defined in the **New Cableway** dialog box.

1. Set the active coordinate system to **Global**.
2. Locate the Pull-Pit (1) **E-PP-A1** in the model.
3. Copy **E-PP-A1**, and paste its copy near the original in the model. Name the copy **E-PP-A3**.
4. Copy and paste **E-PP-A1** again, and name the second copy **E-PP-A4**.
5. Right-click **E-PP-A1** and select **Properties**.

   *The **Equipment Properties** dialog box displays.*

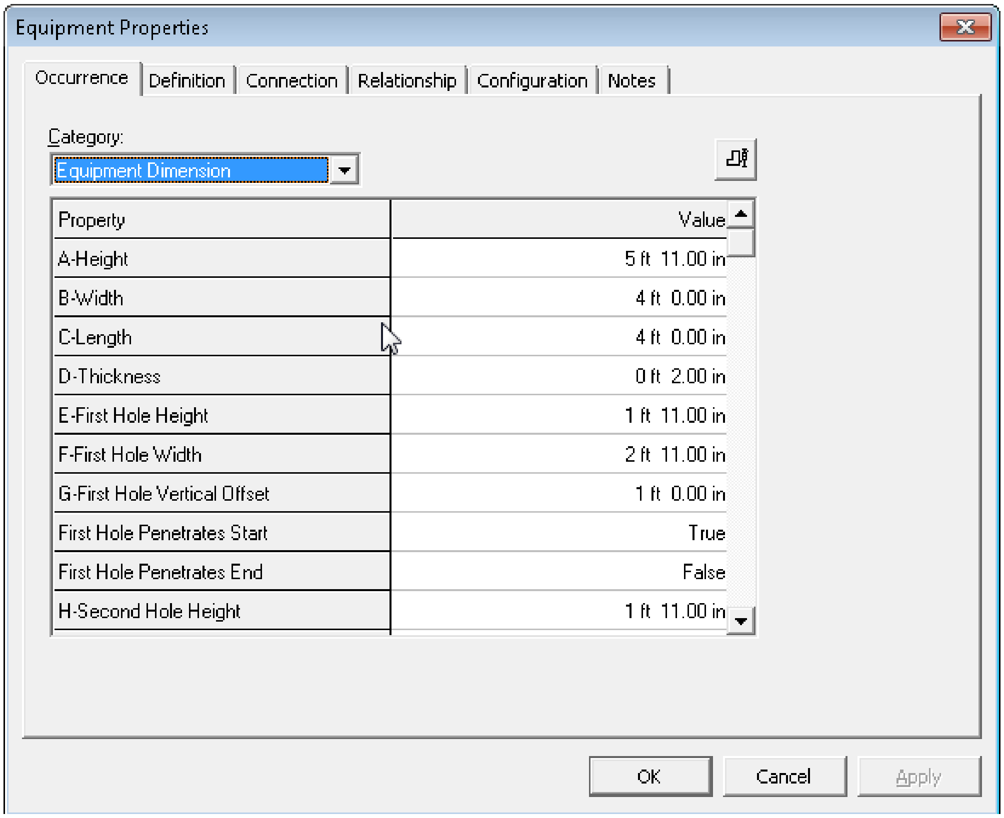
6. Under the **Occurrence** tab, set the **Category** to **Equipment Dimension**, and set **First Hole Penetrates End** to **True**.



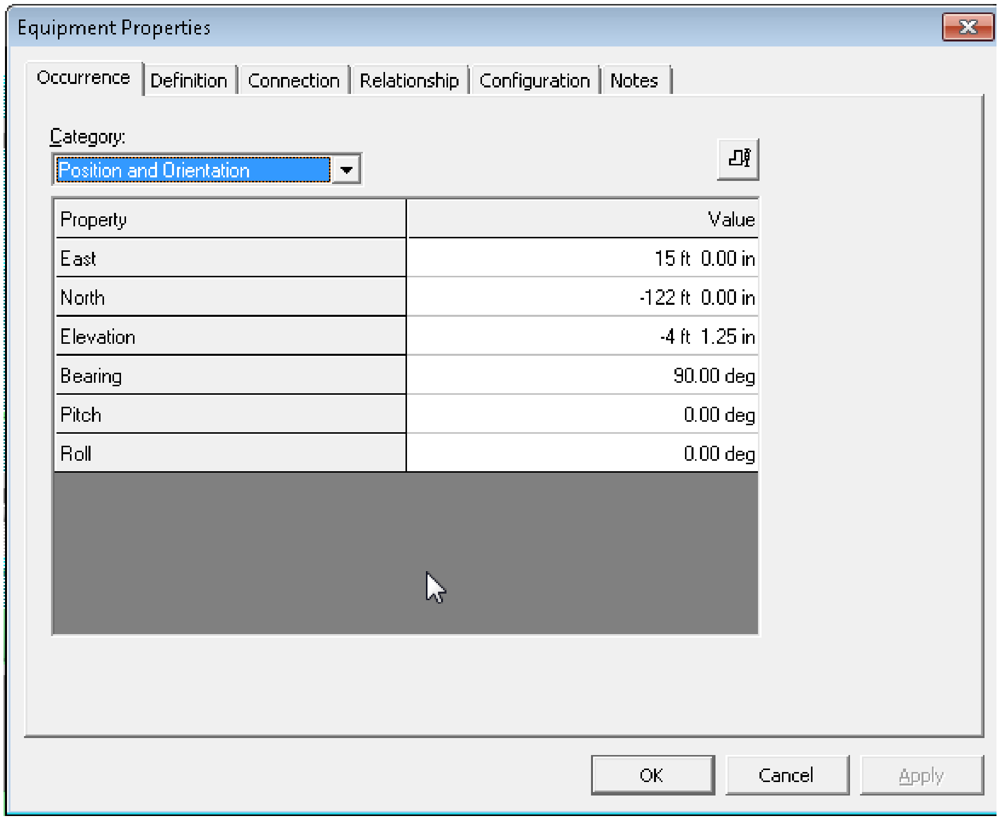
7. Click **OK**.
8. Right-click **E-PP-A3** and select **Properties**.

*The **Equipment Properties** dialog box displays.*

9. Under the **Occurrence** tab, set the **Category** to **Equipment Dimension**, and set **First Hole Penetrates End** to **False**.



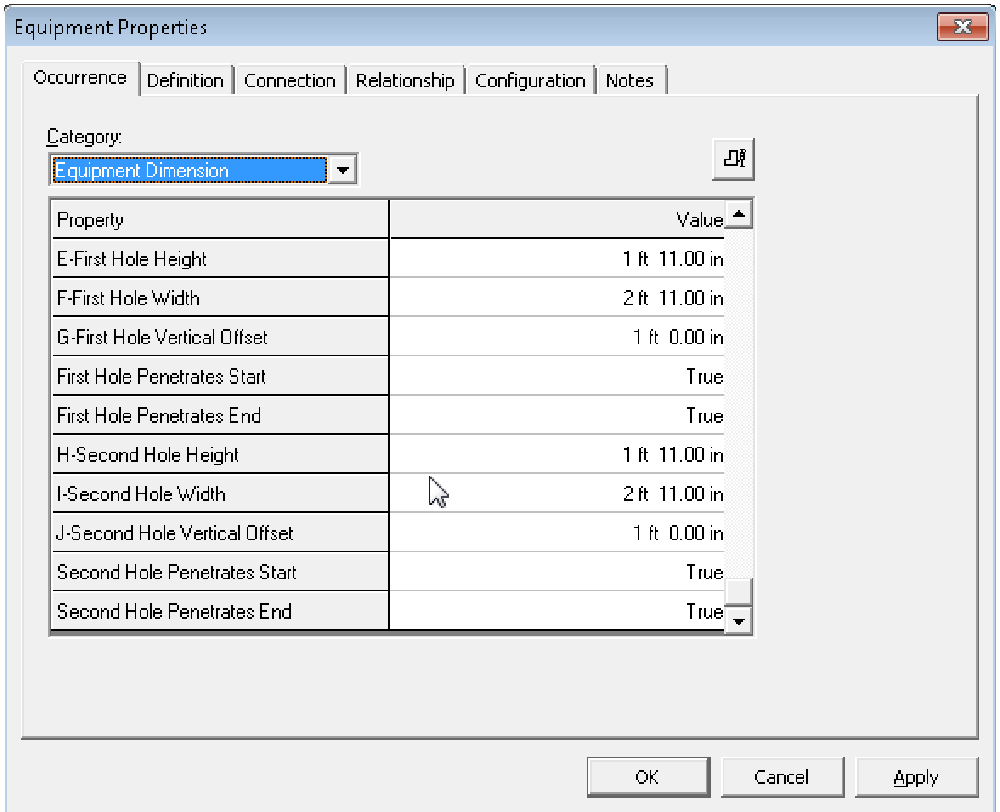
10. Set the **Category** to **Position and Orientation**, and define the properties as shown:



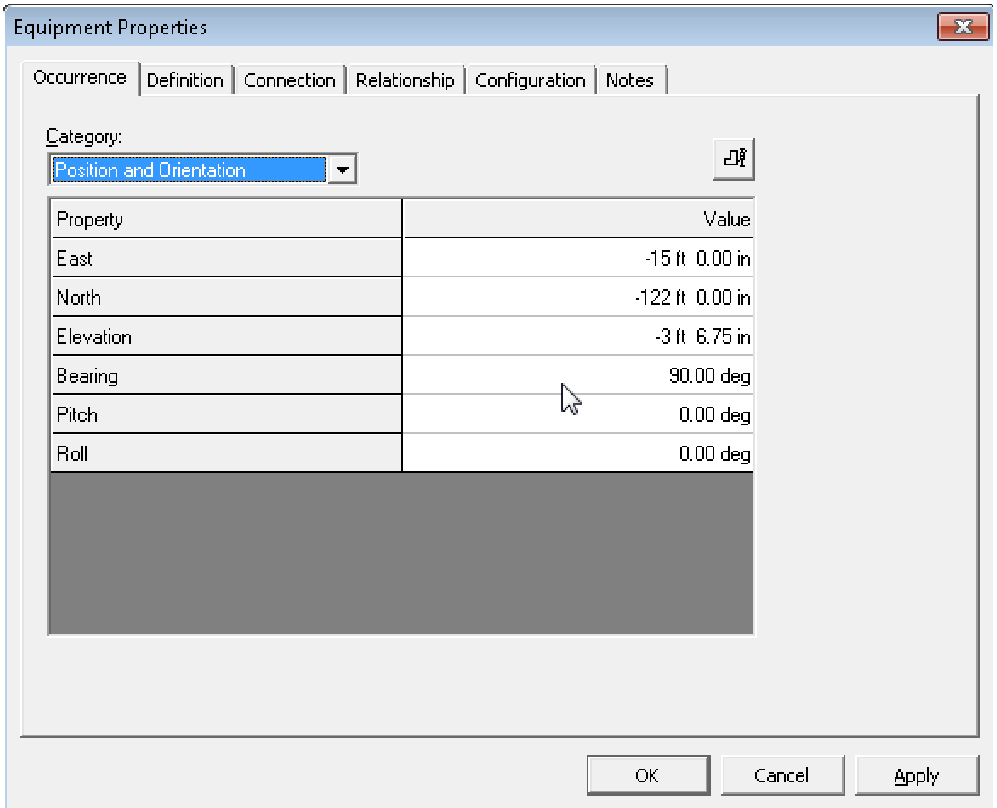
11. Click **OK**.
12. Right-click **E-PP-A4** and select **Properties**.

    *The **Equipment Properties** dialog box displays.*

13. Under the **Occurrence** tab, set the **Category** to **Equipment Dimension**, and set **First Hole Penetrates End** and **Second Hole Penetrates End** to **True**.

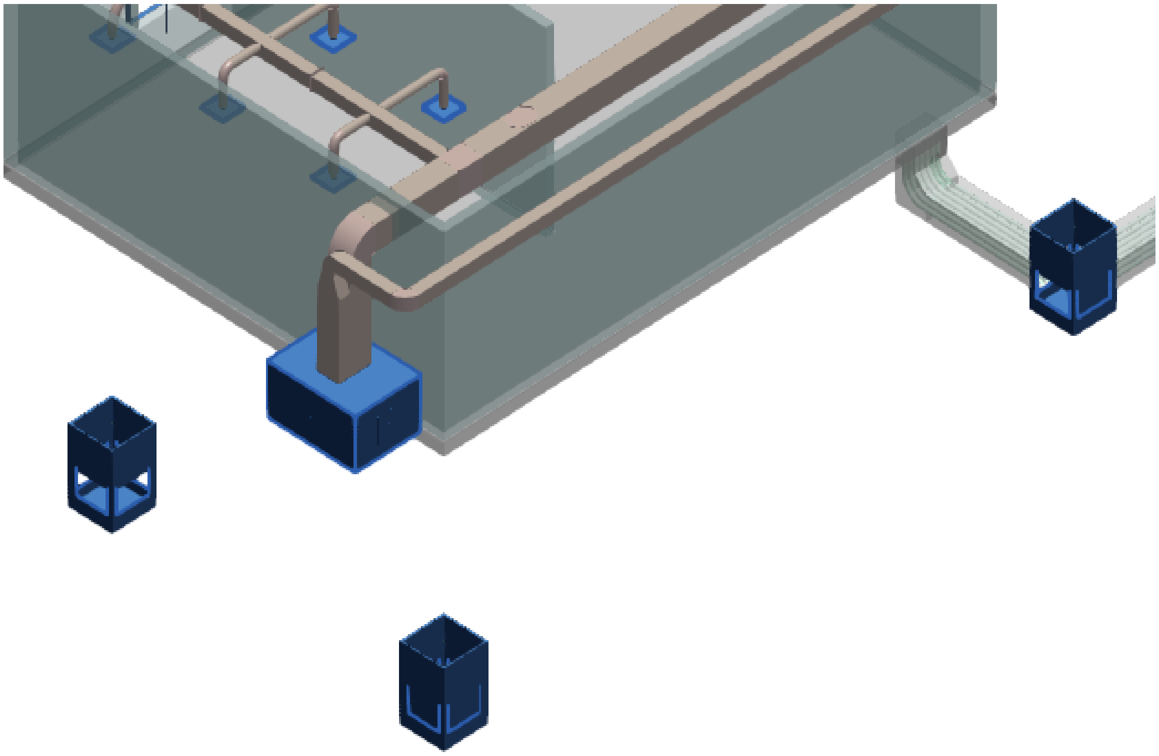


14. Set the **Category** to **Position and Orientation**, and define the properties as shown:

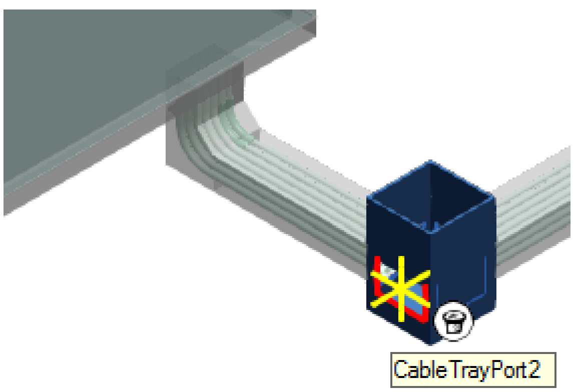


15. Click **OK**.

16. Click **Common View** and change to an isometric view and zoom in on the three pull-pits.

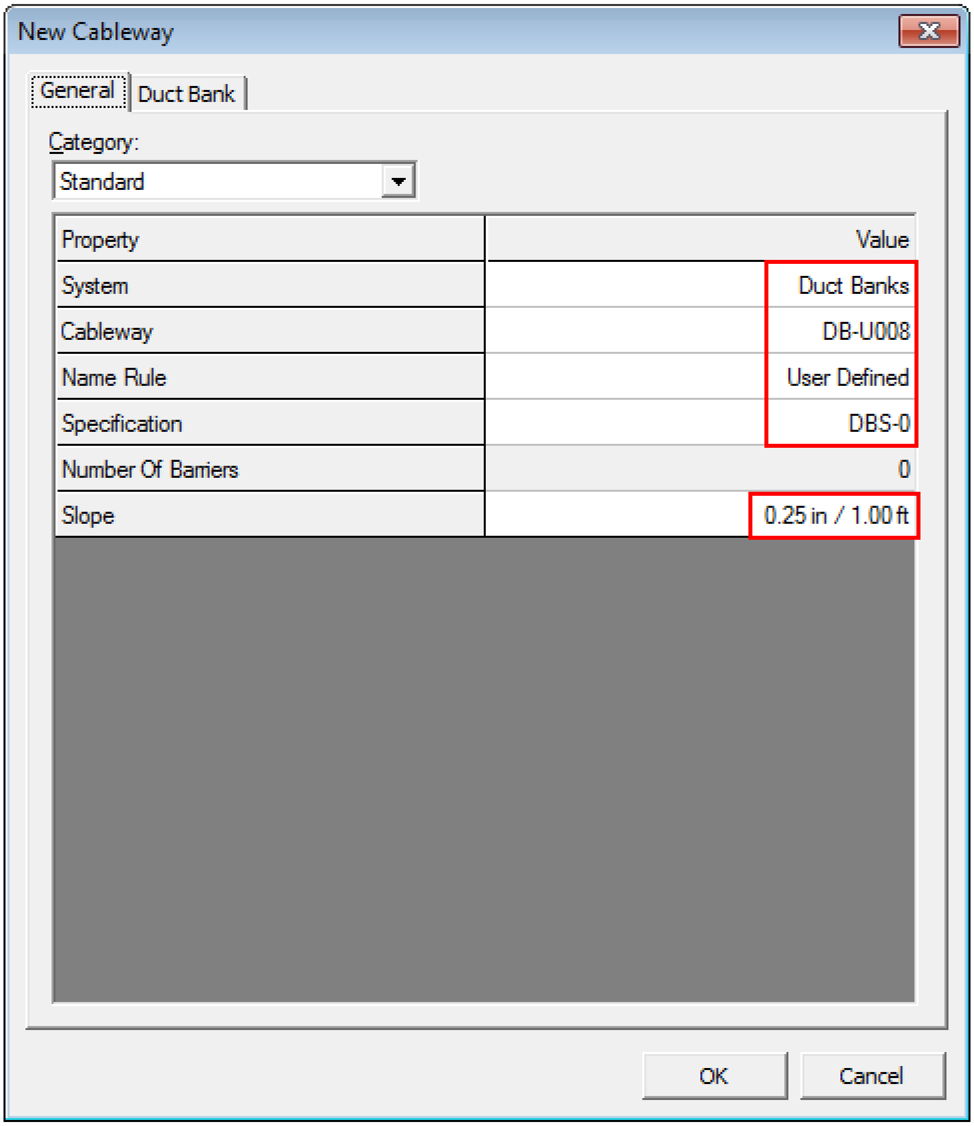


17. Click **Route Cableway**.
18. On **E-PP-A1**, select **Cable Tray Port 2** as the start point of the duct bank.

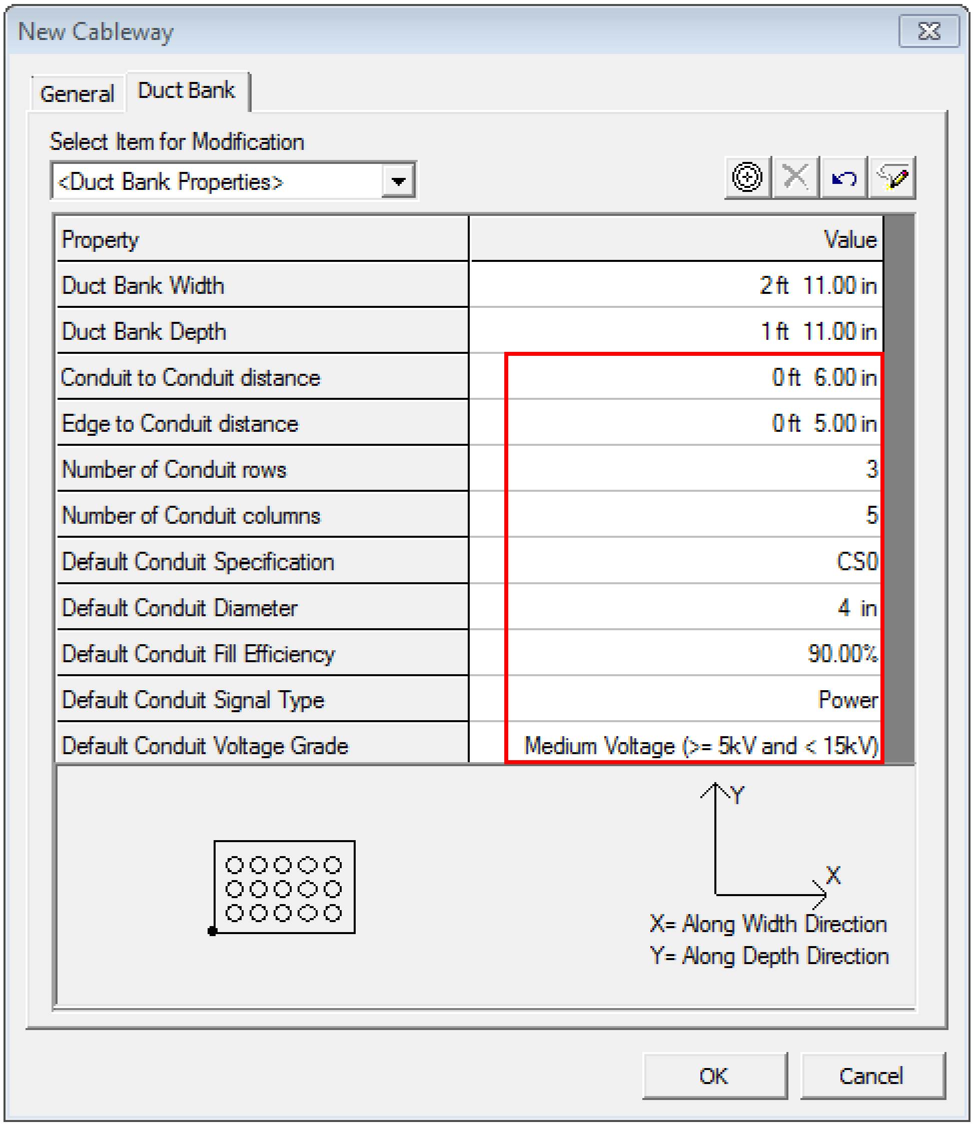


*The **New Cableway** dialog box displays.*

19. Define the property values for as shown:



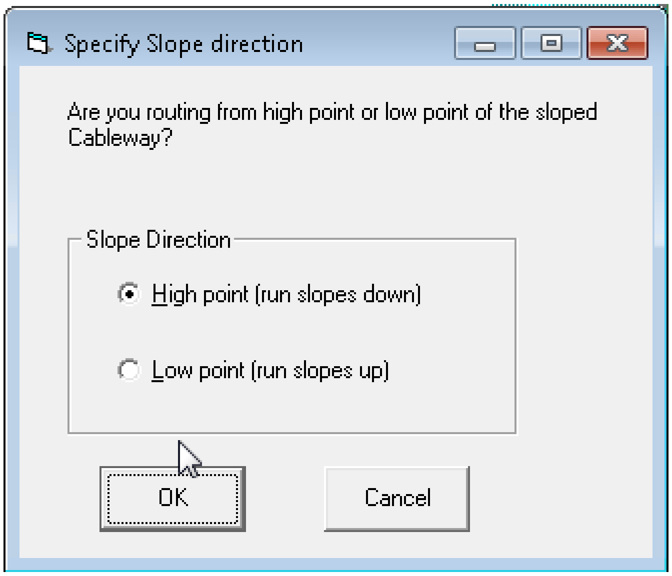
20. Select the Duct Bank tab and enter properties as below



21. Click **OK**.

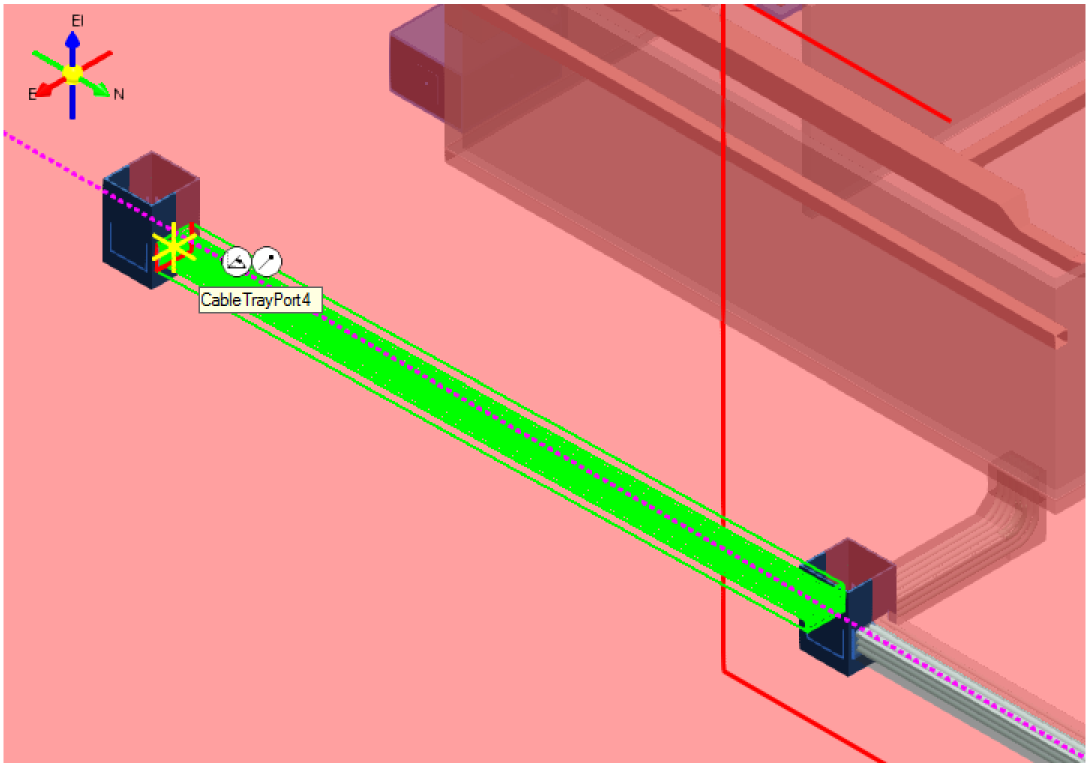
*The **Specify Slope direction** dialog box displays.*

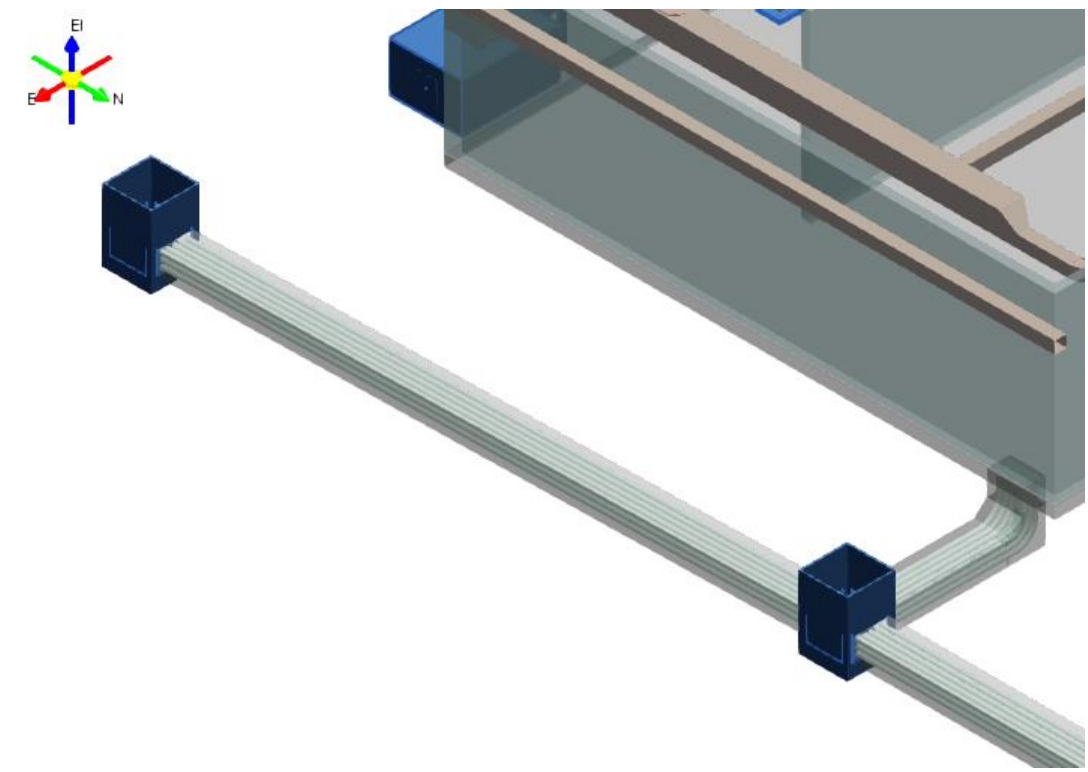
22. Select **High Point (run slopes down)** and click **OK**.



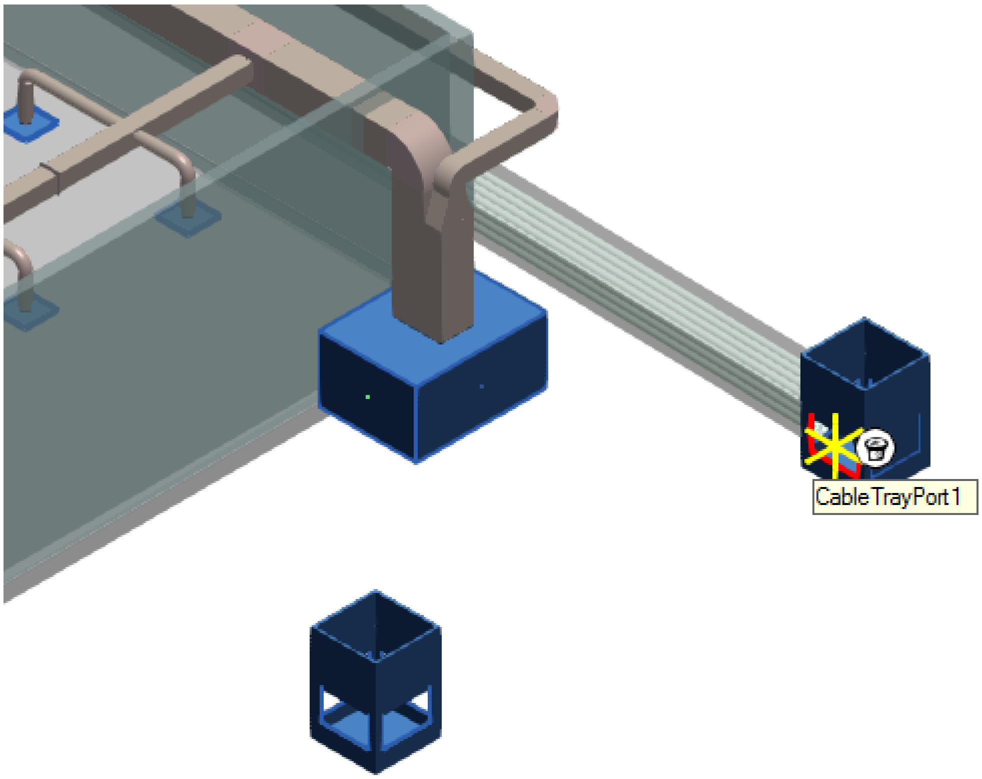
23. Set the route plane to **North-South** .

24. Route the duct bank to **cabletrayport4** on **E-PP-A3**.



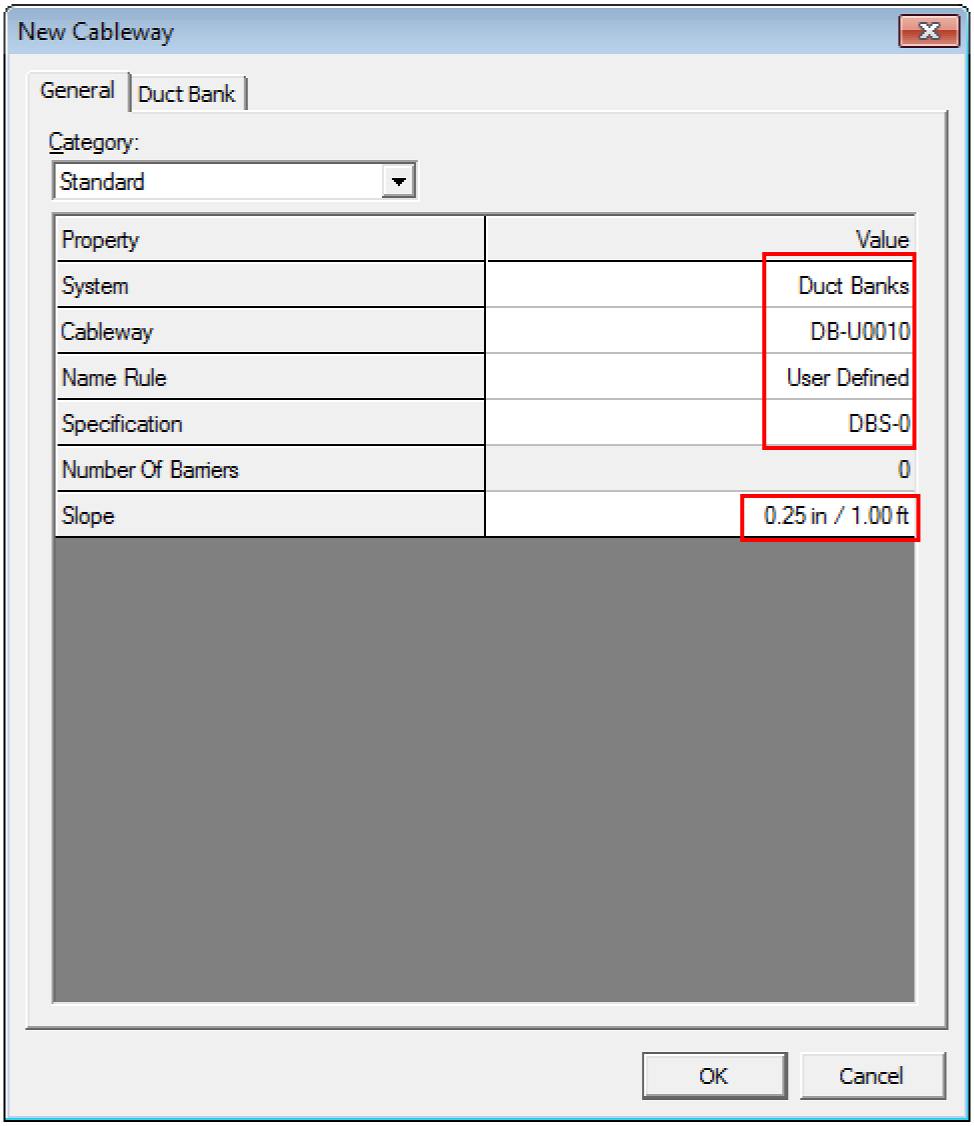


25. Click **Route Cableway** .
26. On E-PP-A3, select **Cable Tray Port 1** as the start point of the duct bank.

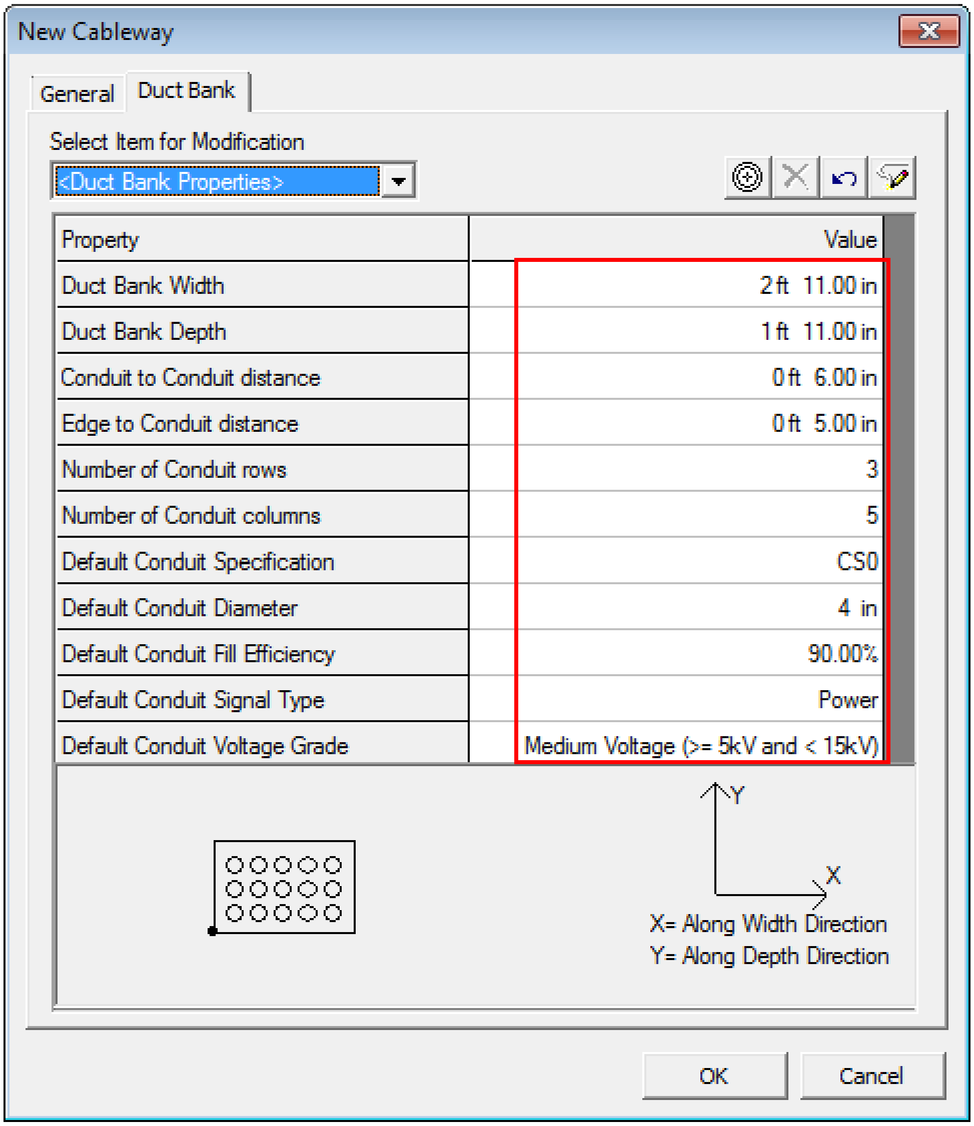


*The **New Cableway** dialog box displays.*

27. Define the property values for the duct bank as shown



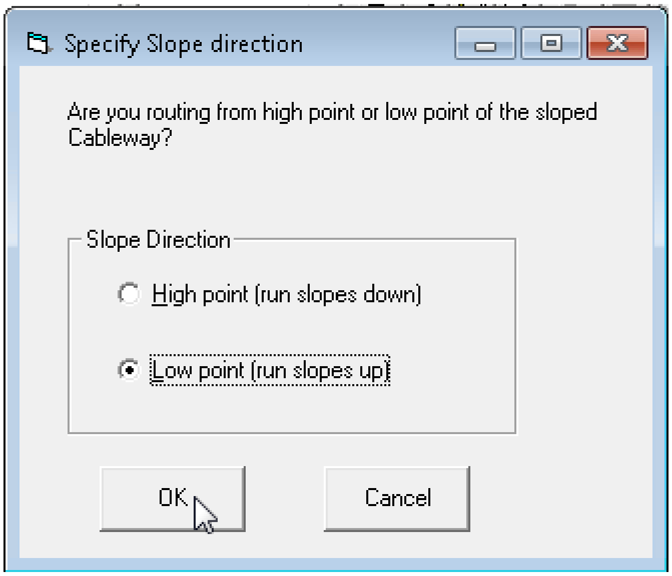
28. Select the Duct Bank tab and enter values as shown



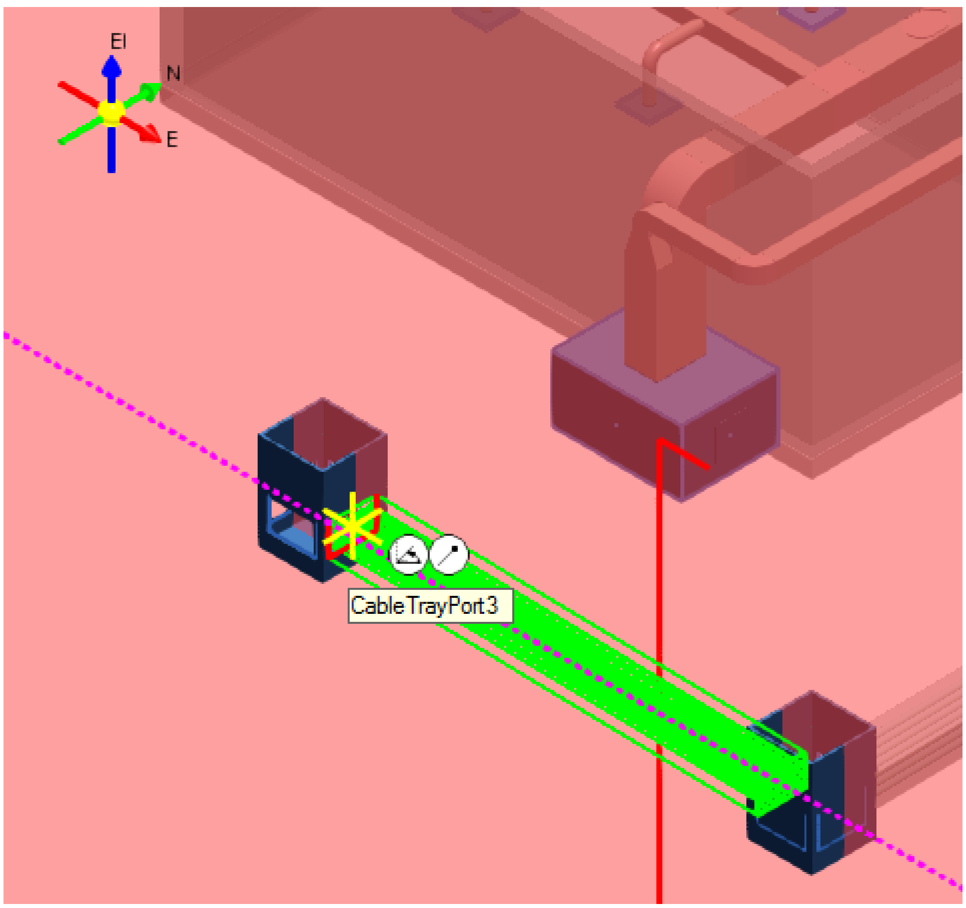
29. Click **OK**.

*The **Specify Slope direction** dialog box displays.*

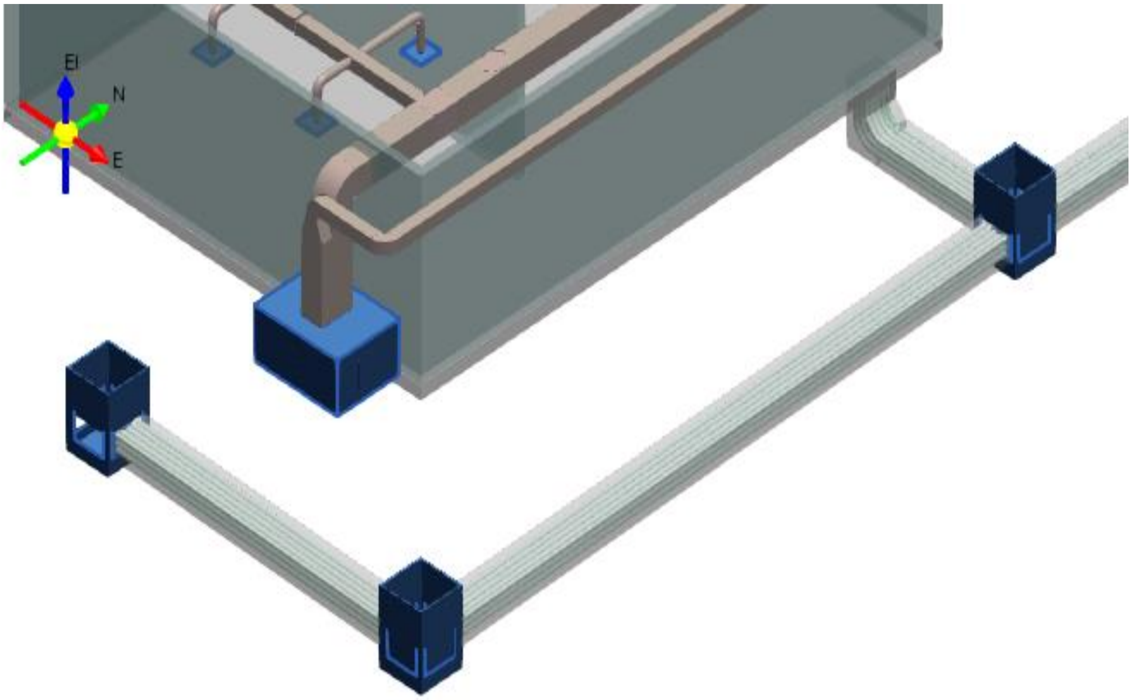
30. Select **Low Point (run slopes up)** and click **OK**.



31. Set the route plane to **East-West** .
32. Route the duct bank to **cabletrayport3** on **E-PP-A4**.



The sloped duct banks are routed in the model:



SECTION 1

Underground Trenches

Objective

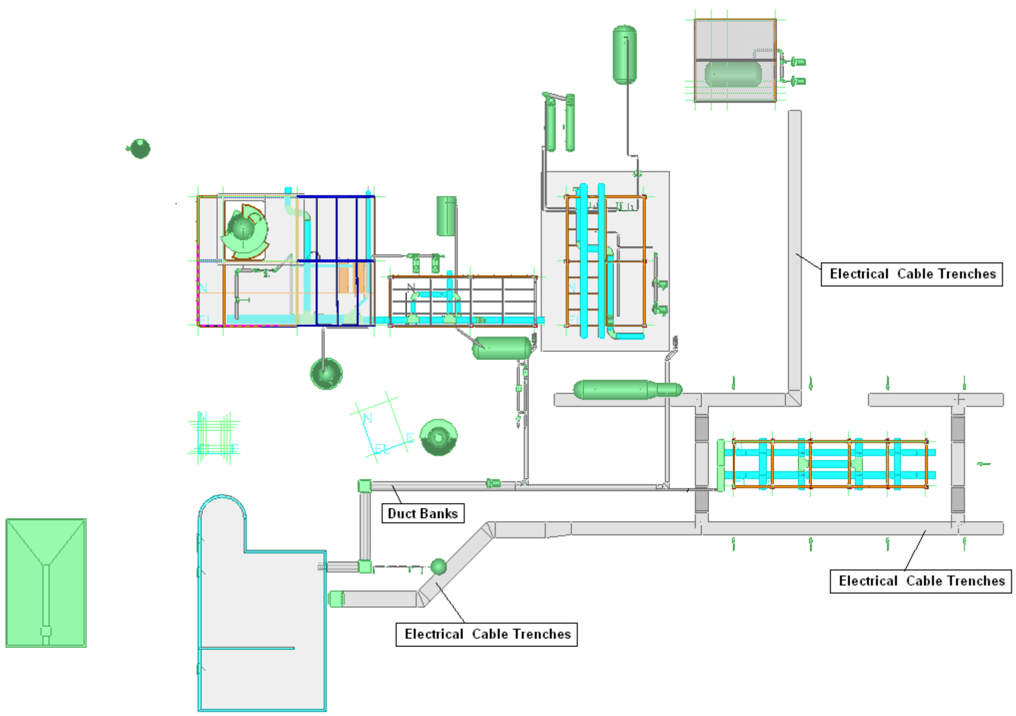
By the end of this session, you will be able to:

- Route underground trenches using "Zero-Specs" cableways

Overview:

In this exercise, you will use **Route Cableway** to route underground trenches in Unit U07. Use the offset reference to define the top elevation of the trenches.

The trench configuration will resemble the below:



Creating Underground Trenches

Create trenches by routing the cableways using Zero Specs. Use **Set Offset Reference** to set the Top of Trench (TOT) while routing a cableway.

Before you start routing the trenches, define your workspace to show Unit U07.

1. Select **Tasks > Electrical**.
2. Set the **Active Permission Group** to **Electrical**.
3. Select **Tools > PinPoint**.

   *The **PinPoint** ribbon displays.*
4. Set the active coordinate system to **U07 CS**.
5. Click **Set Target to Origin** to move the target to the origin of the current coordinate system.
6. Click **Place Equipment** .

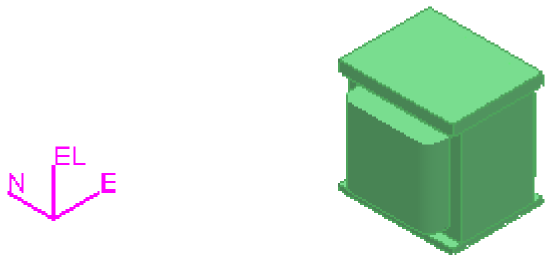
   *The **Select Equipment** dialog box displays.*
7. Select **Equipment > Electrical > Electrical Transformer > Electrical Transformer > ElectricalTransformer01** and click **OK**.

   *The **Equipment Properties** dialog box displays.*
8. In the **Name** field, type **TR-01**.
9. In the **System** field, click **More ...** to specify the system to which the equipment belongs, and select **A2 > U07 > Electrical > Low Voltage > CT System**.
10. Click **OK**.
11. Set the **Category** to **Position and Orientation**, and define the following properties:

    East: -124 ft
    North: -35 ft
    Elevation: 0 ft
12. Set the **Category** to **Equipment Dimension**, and define the following properties:

    Electrical Equipment Height: 5 ft
    Electrical Equipment Width: 4 ft
    Electrical Equipment Length: 5 ft
13. Click **OK**.

*The Equipment **TR-01** is placed in the model.*



14. Select **View > Fit**.
15. Click **Route Cableway**  on the vertical toolbar.
16. On the **PinPoint** ribbon, define the following coordinates, and click in the graphic view to accept the starting point:

    E: -122 ft 6 in
    N: -35 ft
    El: -3 ft 11 in

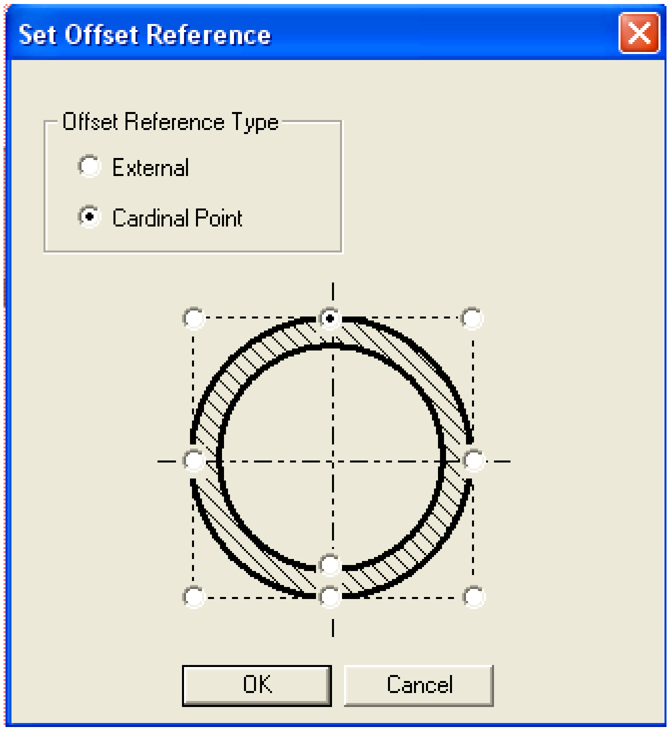
    *The **New Cableway** dialog box displays.*
17. Under **System**, select **More ….**

    *The **Select System** dialog box displays.*
18. Select **A2 > U07 > Electrical > Low Voltage > CT** and click **OK**.
19. In the **New Cableway** dialog box, define the following cableway specifications:

    System: CT
    Name Rule: DefaultNameRule
    Specification: cws-0
20. Set the **Category** to **Cable Fill** and define the following specifications:

    Fill Efficiency: 60%
    Signal Type 1: Power

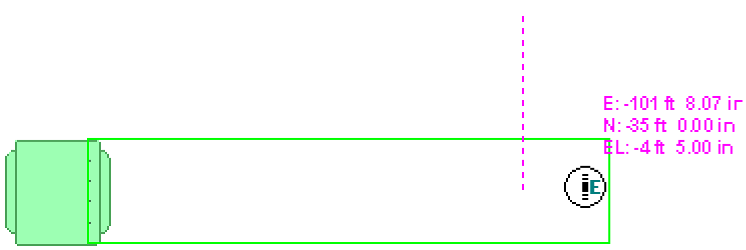
21. Set the **Offset Reference Type** to **Cardinal Point**, set the reference point to the **Top of Trench (TOT)**, and click **OK**.



22. On the **Route Cableway** ribbon, set **Shapes** to **Rectangle** and define the following specifications to specify the width and depth of the cross section:

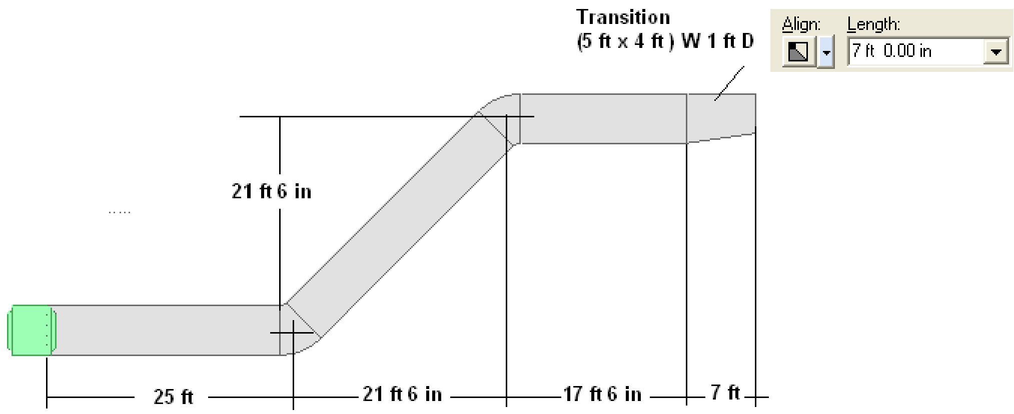
    Width: 5 ft
    Depth: 1 ft

23. Click **Common Views** , and change the view of the model to "Looking Plan."
24. On the **Route Cableway** ribbon, set **Plane** to **Plan Plane**.
25. Set the **Length** to **25 ft**.
26. Hover over the east direction and click to place the cableway.

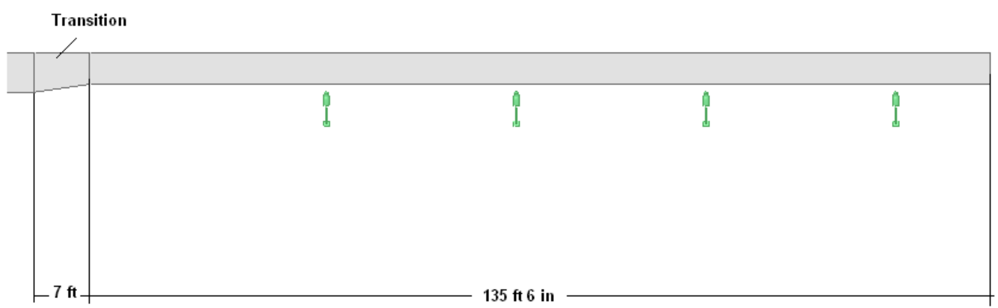


27. Continue to route the trenches as shown below.

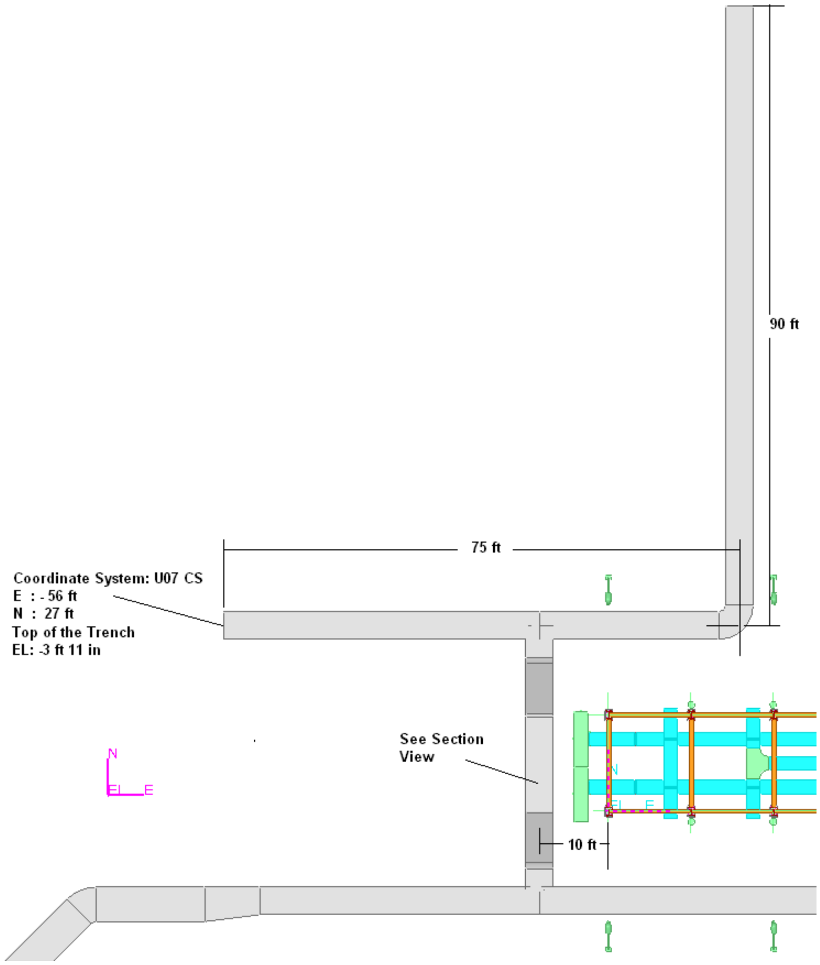
NOTE When a segment size change is required, a transition piece connects the two segments. Use **Insert transition** to place the transition from 5 ft width to 4 ft width.



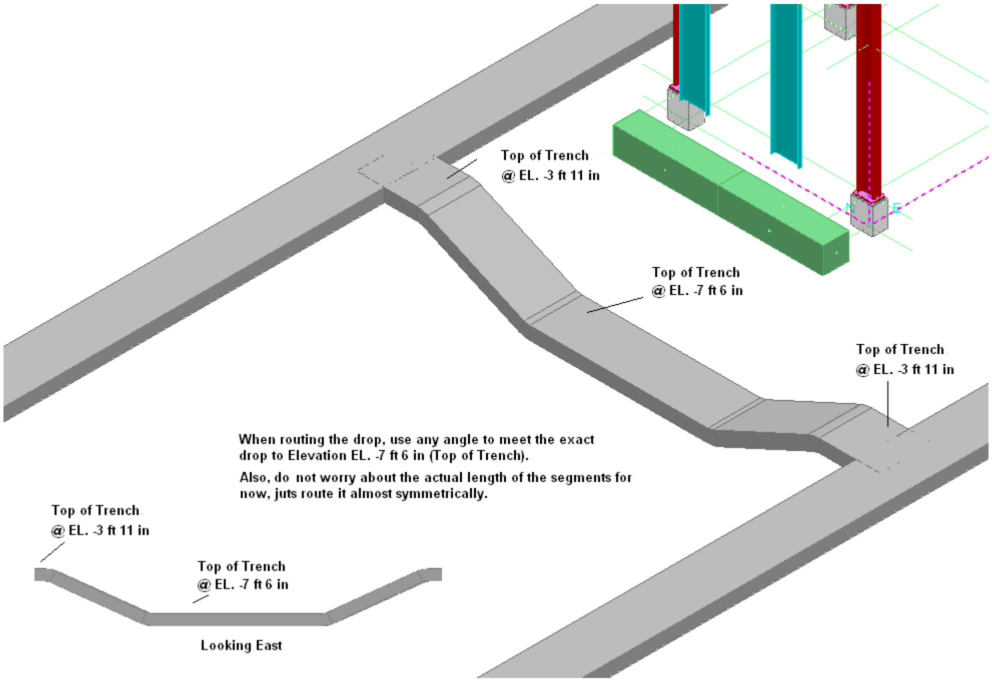
28. Select the end of the transition and continue routing the trenches in the east direction as shown:



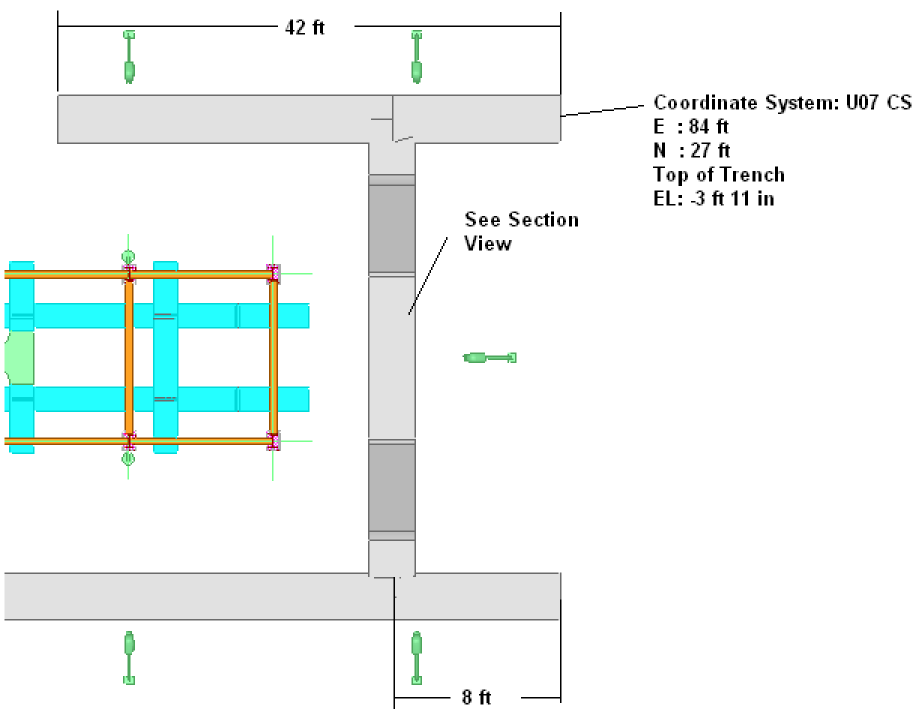
29. Continue to route the trenches as shown:



NOTE When routing the drop, use any angle to meet the exact drop to Elevation – 7 ft 6 inches (Top of Trench). Also, do not worry about the actual length of the segments for now, just route it almost symmetrically.



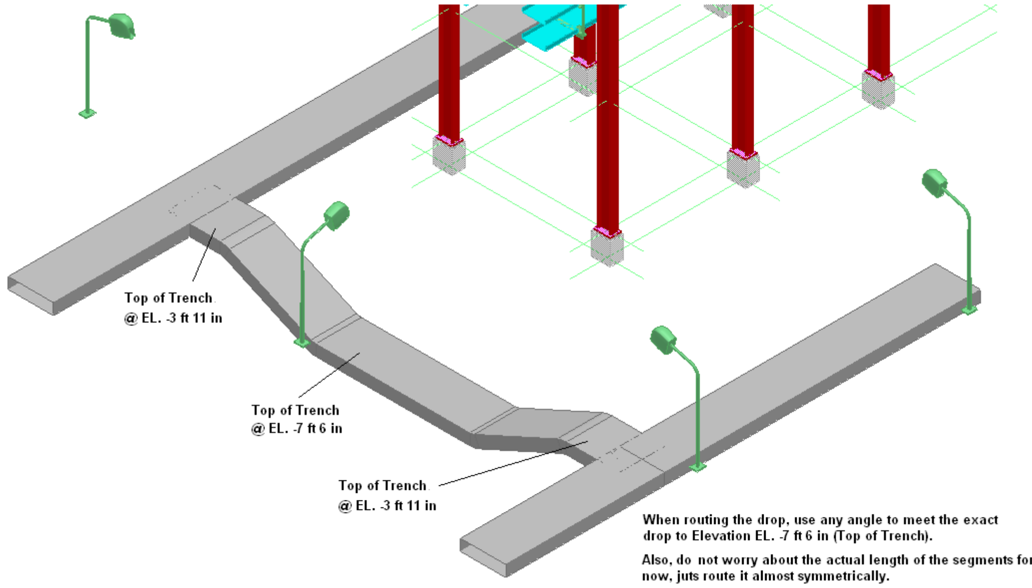
30. Continue to route the trenches as shown:



NOTES

- Disable the **Top of Trench (TOT)** offset to branch into the header trench.
- When routing the drop, use any angle to meet the exact drop to **Elevation EL. – 7 ft 6 inches (Top of Trench)**. For now, do not worry about the actual length of the segments.

Below is the section view of the elevation change between the trenches segments.



31. Change all bend types to **Miter** with one cut:

Smart 3D
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Tuesday, August 05, 2014

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PART OF HEXAGON

INTERGRAPH®

SECTION 2

Routing Conduit

Objective

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

- Route a conduit

Before Starting this Procedure

- Smart 3D Overview
- Smart 3D Common Sessions
- *Electrical Overview* (on page 7)

Overview

Route Conduit 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. Smart 3D 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.

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

Routing a Conduit

In the following workflow, we will route a conduit from an equipment item that has a conduit nozzle. Notice 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 **ConduitPort4** on 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:

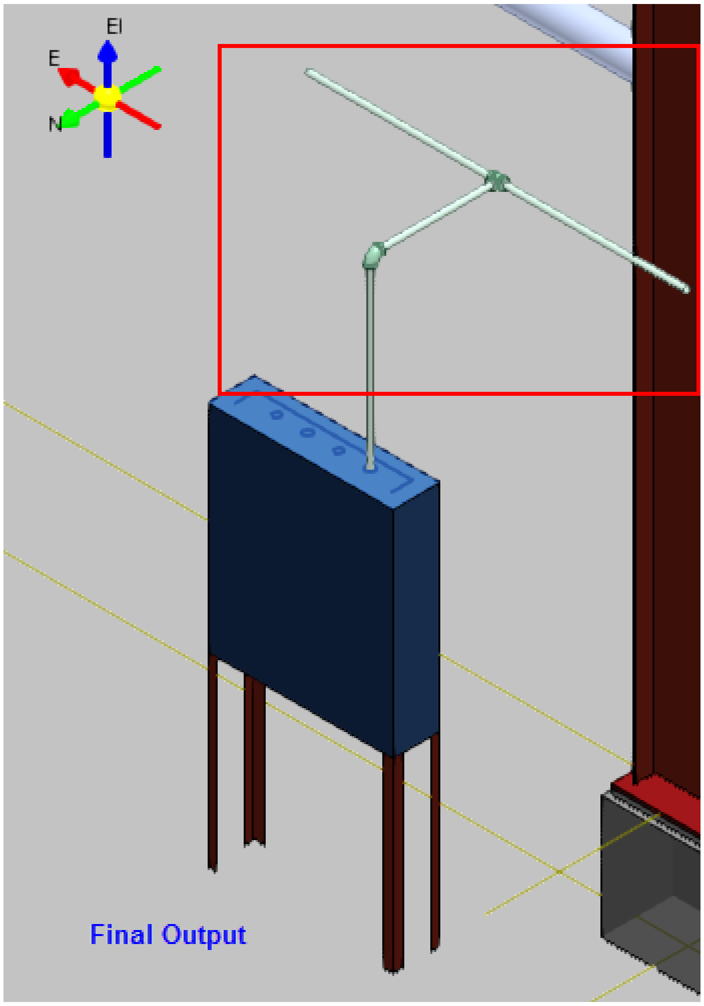
- Fill Efficiency: 65%
- Signal Type 1: Control

- 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

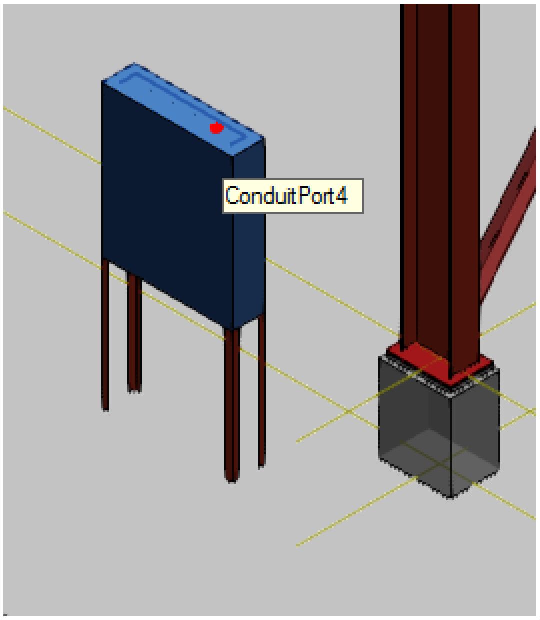
After routing the conduit, the model should display as shown:



Before you begin, define your workspace to show **Unit U01** and coordinate system **U01 CS**.

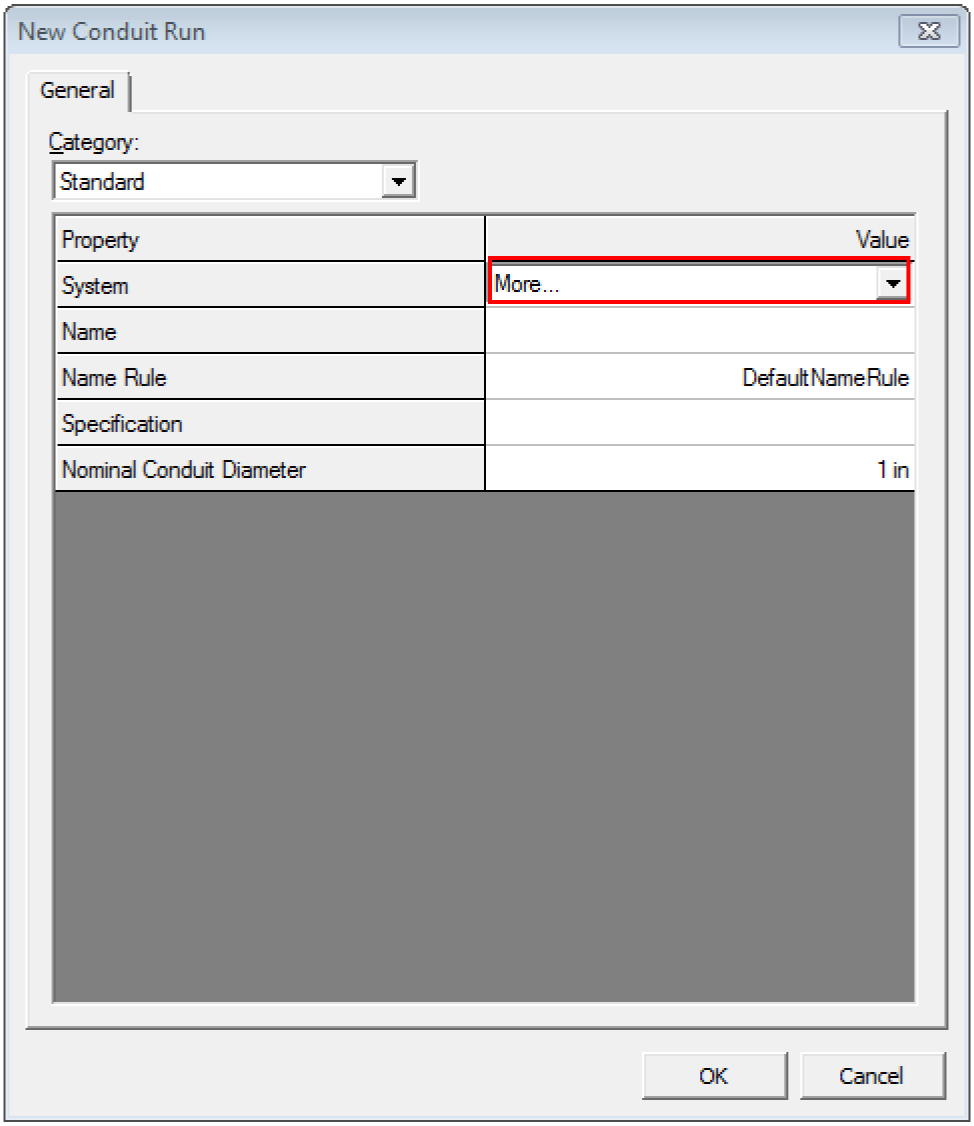
1. On the **PinPoint** ribbon, set the active coordinate system to **U01 CS** and click **Set Target to Origin** .
2. If you are not in the Electrical task, then select **Tasks > Electrical** and set the **Active Permission Group** to **Electrical**.
3. Click **Route Conduit** from the vertical toolbar.

4. Select **ConduitPort4** on the **Electrical Device** equipment as the starting location.



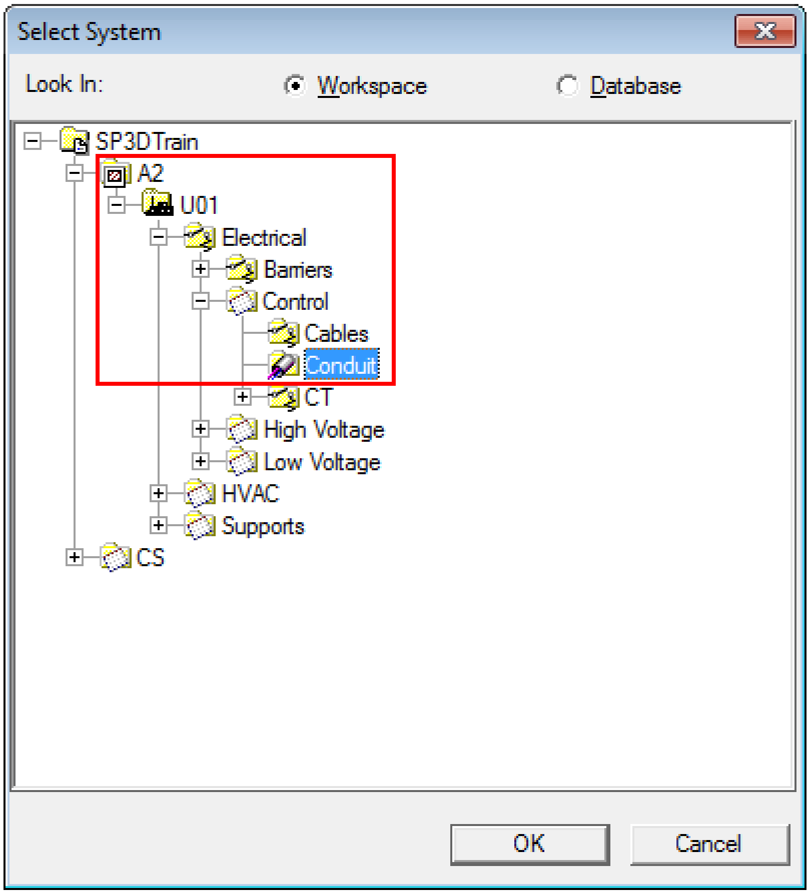
*The **New Conduit Run** dialog box displays.*

5. Under **System**, select **More…**.

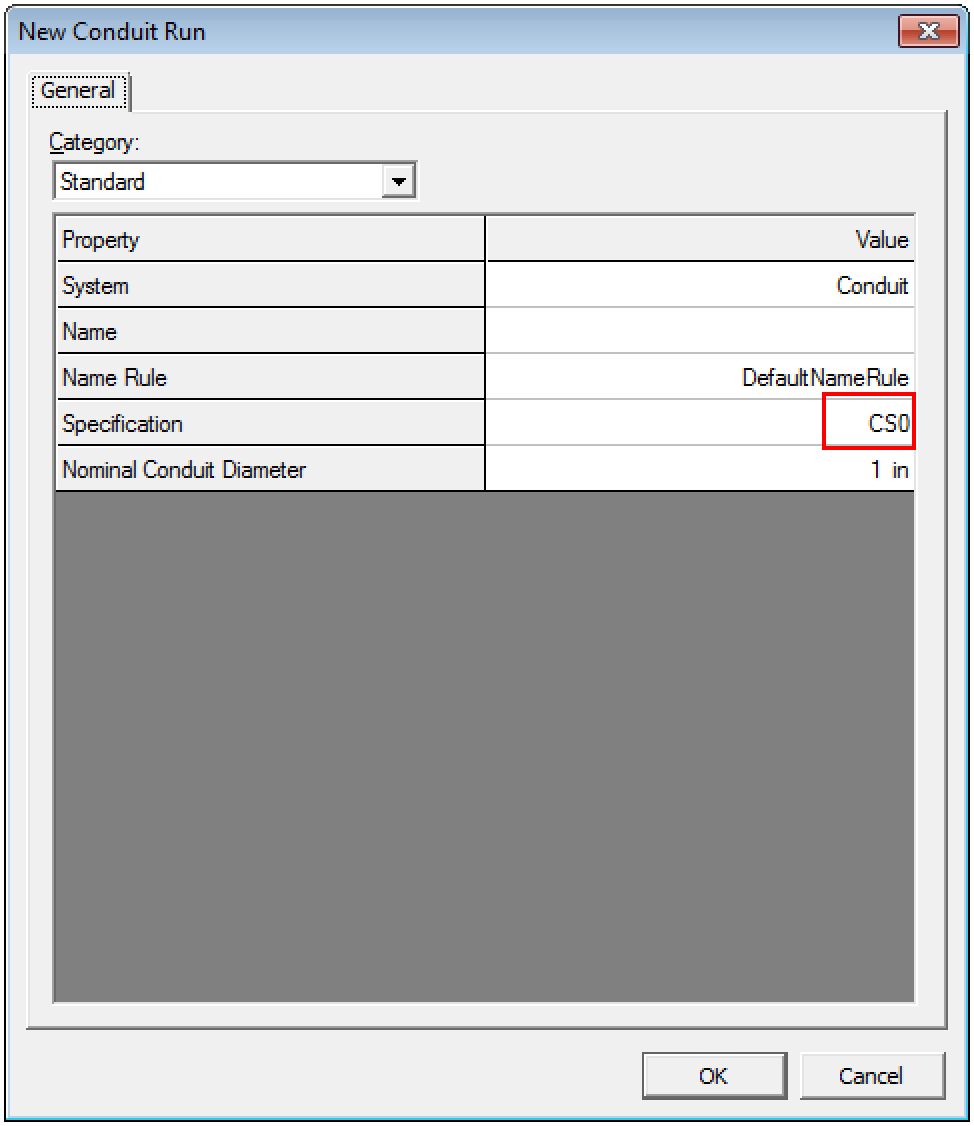


*The **Select System** dialog box displays.*

6. Select **A2 > U01 > Electrical > Control > Conduit** and click **OK**.

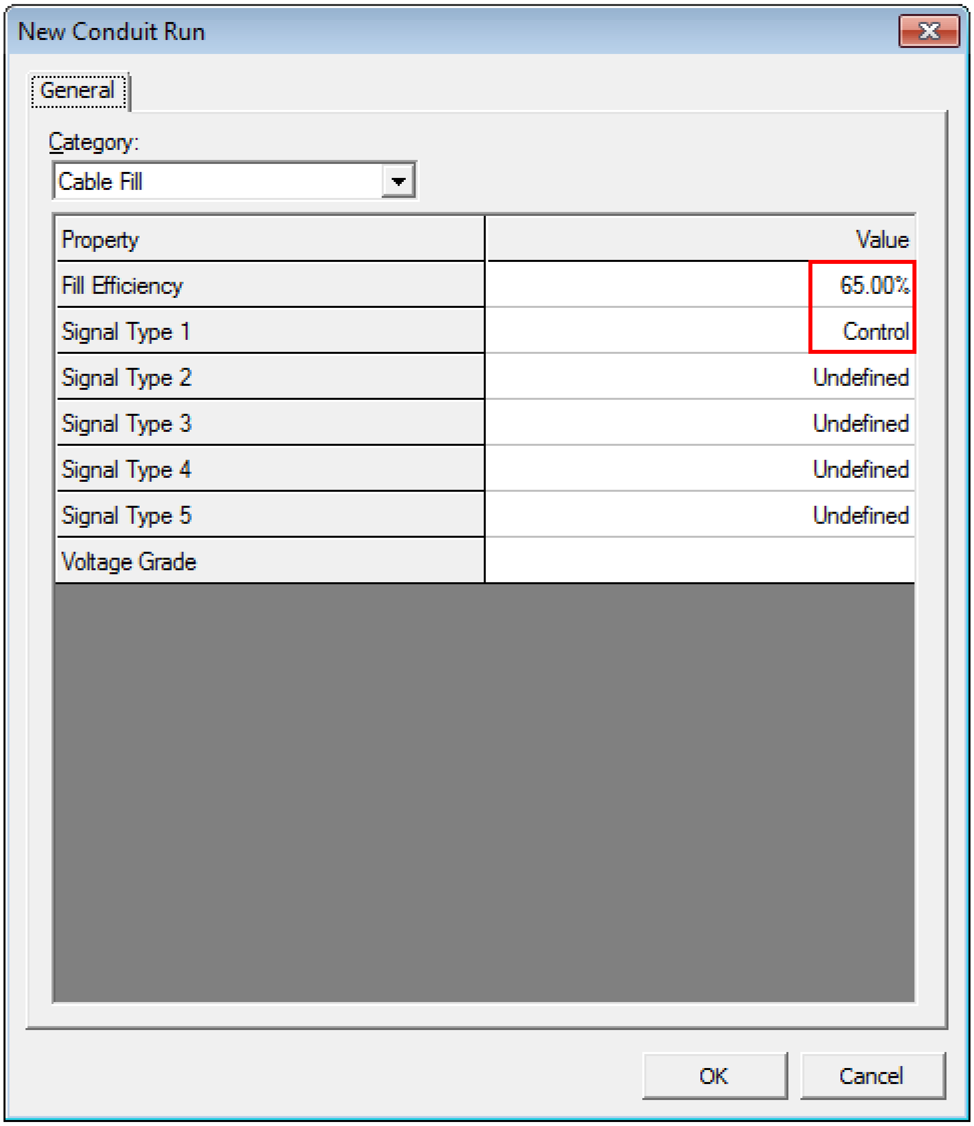


7. In the **New Conduit Run** dialog box, set the **Specification** to **CS0.**



8. Set the **Category** to **Cable Fill** and define the following specifications:

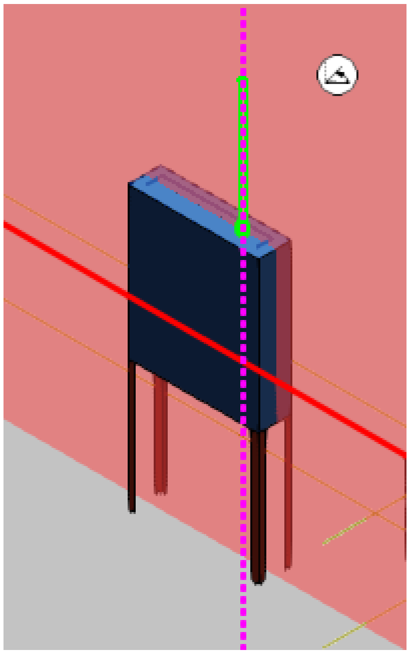
Fill Efficiency: 65%
Signal Type 1: Control



9. Click **OK** to close the **New Conduit Run** dialog box.
10. On the **Route Conduit** ribbon, set the **Length** to **3 ft**.

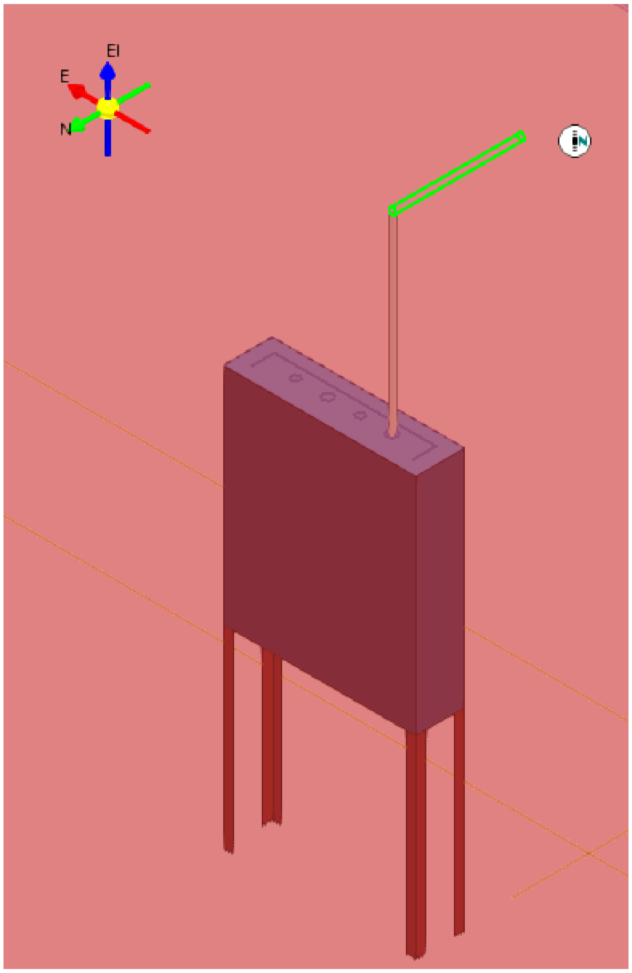
11. Set the route plane to **East-West** .

12. Hover over the elevation direction in the graphic view and click to place the conduit as shown:



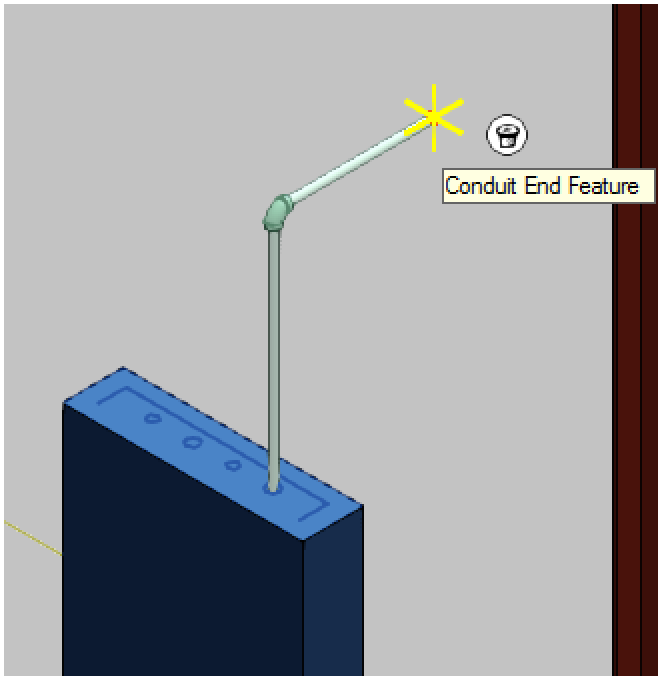
13. Set the **Length** to **2 ft**, and set the route plane to **Plan** .

14. Hover over the south direction in the graphic view and click to place the conduit as shown:



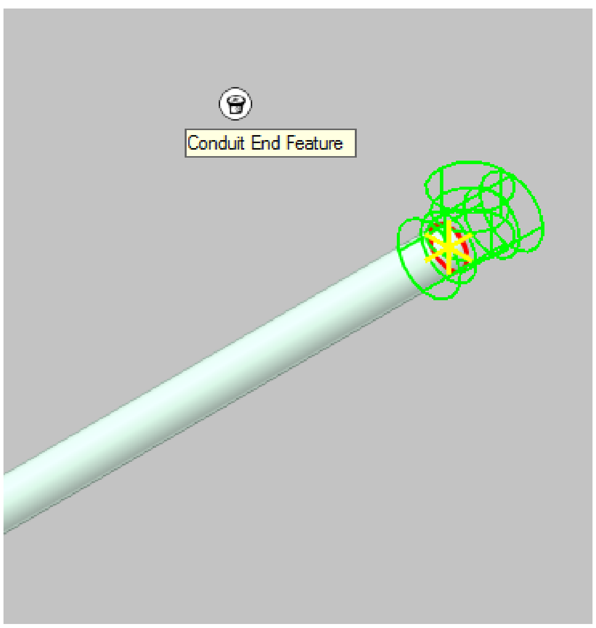
15. Right-click to close the command.
16. Click **Insert Component**  from the vertical toolbar.

17. Select the end feature of the conduit as shown:

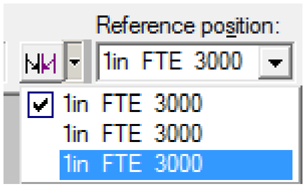


18. Set the **Type** to **Tee**.

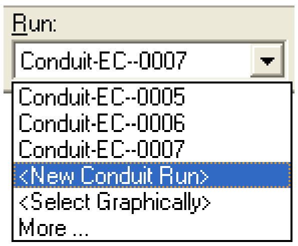
A tee appears at the end of the end feature:



19. On the **Insert Component** ribbon, just before **Reference position**, there is a small drop-down arrow called **Flip** that allows you to select the port to use to place a component. Under Flip, select **1 in FTE 3000**.

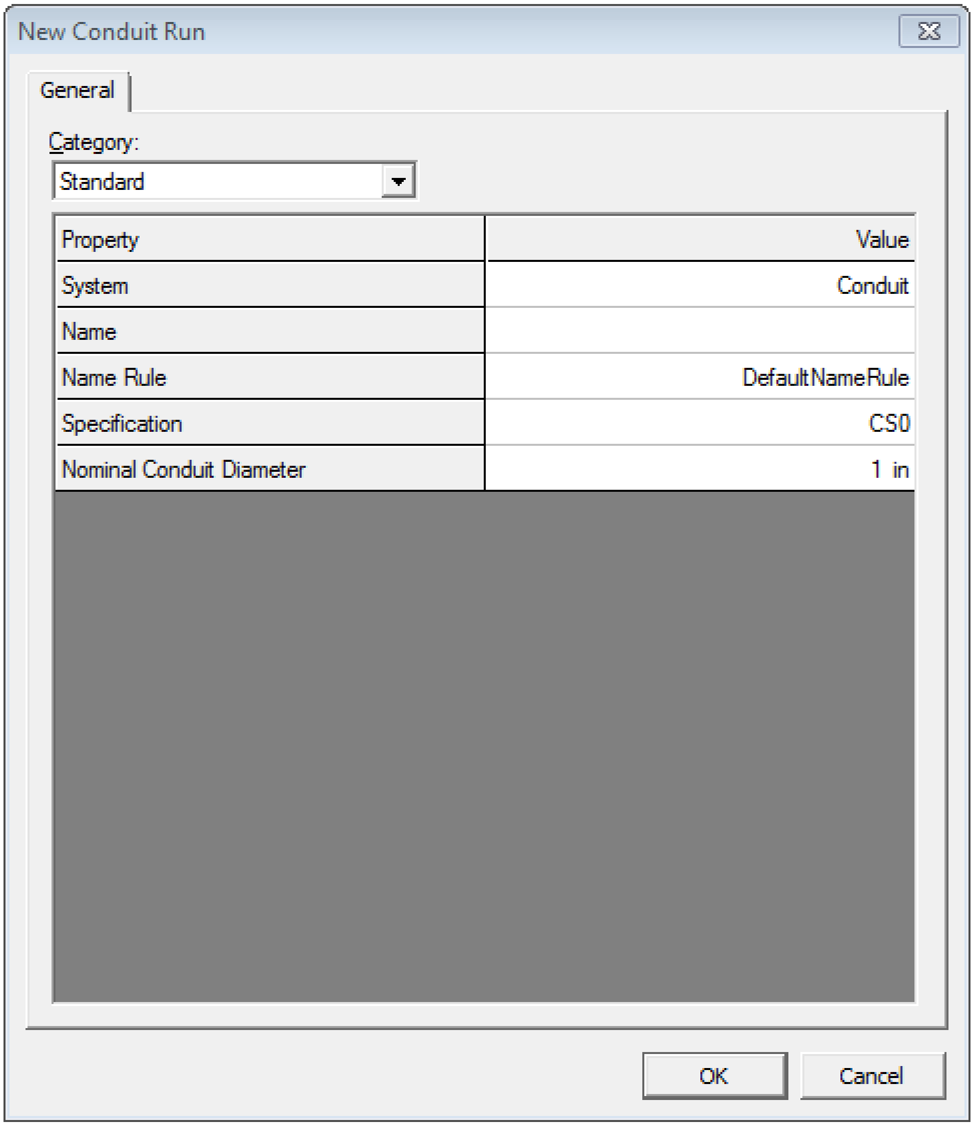


20. Under **Run**, select **<New Conduit Run>**.



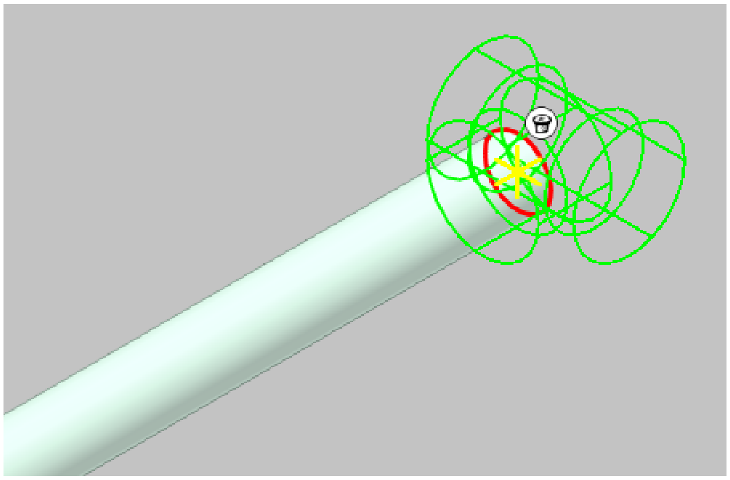
*The **New Conduit Run** dialog box displays.*

21. Click **OK** to accept the default values of the new conduit run.

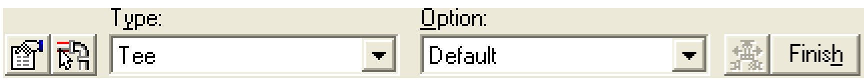


22. Set the Angle to 90.00 deg to rotate the tee.

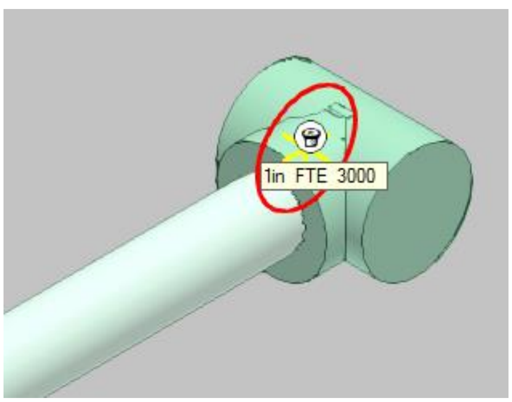
You will now see the outline of a tee at the active placement point.



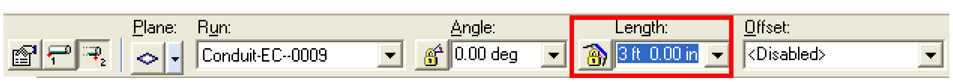
23. Click **Finish** to place the component.



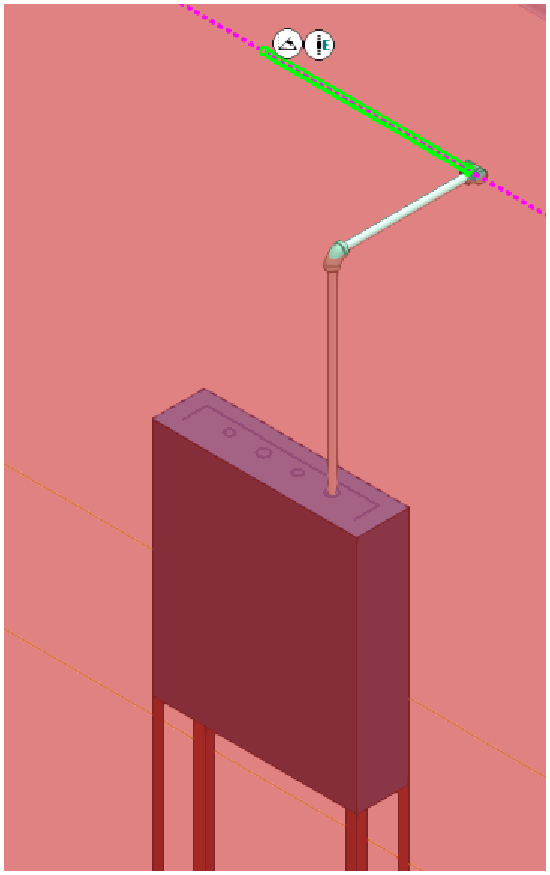
24. Click **Route Conduit**  from the vertical toolbar.
25. Select the tee port to start routing the conduit.



26. On the **Route Conduit** ribbon, set the Length to **3 ft**.

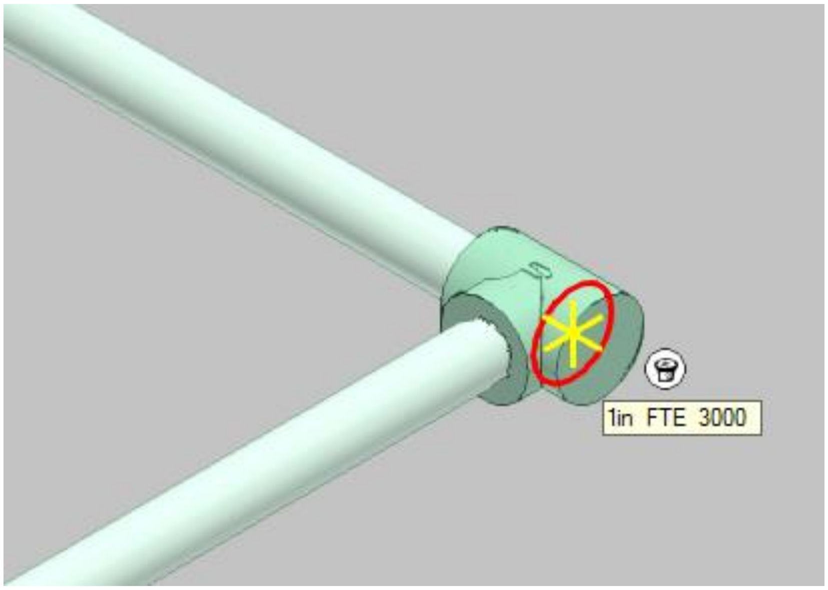


27. Route the conduit in the east direction as shown:

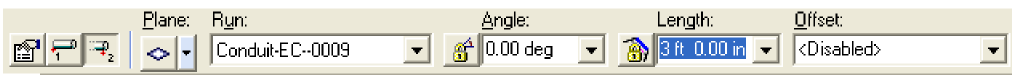


28. On the **Route Conduit** ribbon, select **Start Route Step**  to re-define the starting point of the next conduit run.

29. Select the other tee port to start the conduit.

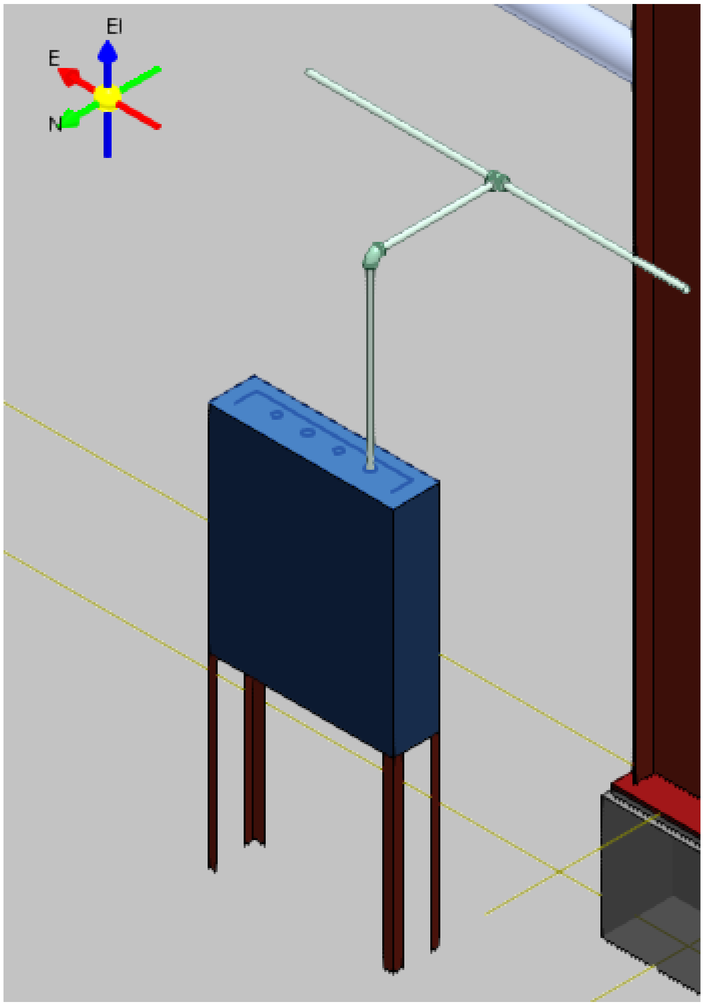


30. Set the **Length** to **3 ft** and route the conduit in the West direction.



31. Right-click in the graphic view to close the command.

The conduits are routed as shown.



For more information related to the routing a conduit in a model, see *Routing a Conduit* in the *Electrical User's Guide*.

SECTION 3

Inserting Splits in a Cableway

Objective

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

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

Before Starting this Procedure

- Smart 3D Overview
- Smart 3D Common Sessions
- *Electrical Overview* (on page 7)
- *Routing a Cableway* (on page 73)

Overview:

Insert Split 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 lengths of trays. By default, the software reports one continuous tray section.

You can choose two modes of placement:

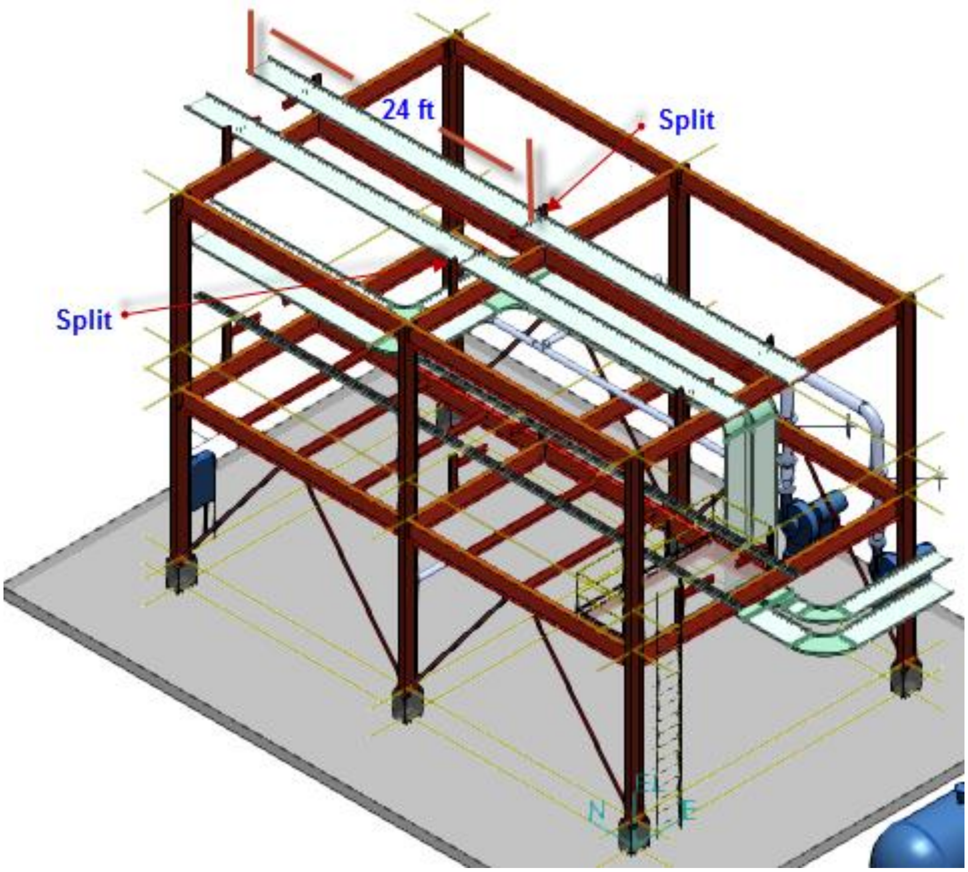
- **Single Split** - The software places one split of a specified length in a cableway or cable tray.
- **Multi Split** - The software places multiple splits at specified locations by the purchase length of the tray. In this mode, the split cable tray parts are of equal size.

Insert Splits in a Cableway

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 is as shown:



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.

1. On the PinPoint ribbon, set the active coordinate system to **U01 CS** and click **Set Target to Origin** .
2. Select **Tools > Show All** to show all hidden objects in your workspace.
3. Make sure that the **Electrical task** is active and the **Active Permission Group** is **Electrical**.
4. Click **Insert Split** on the vertical toolbar.

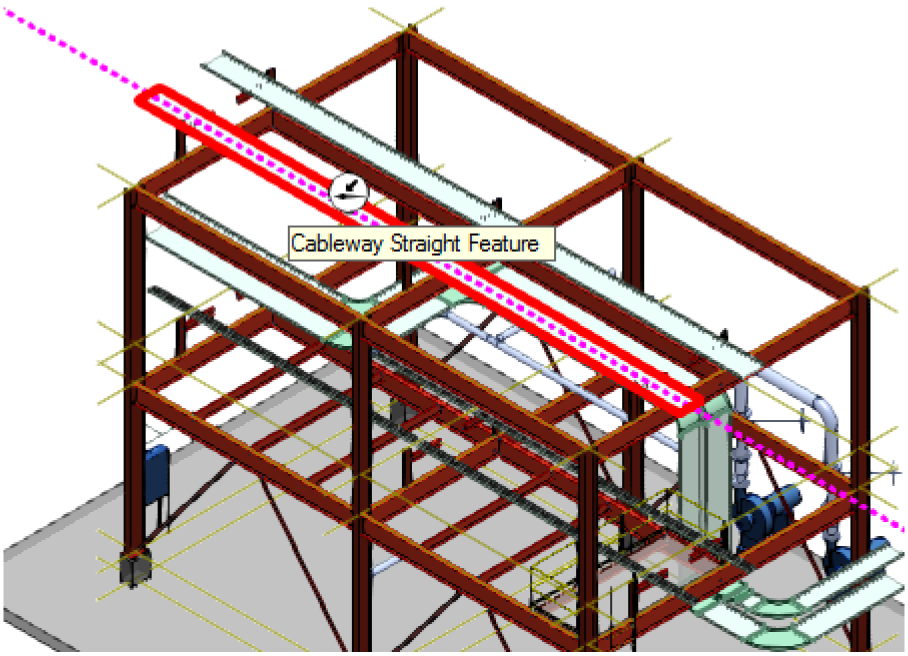
   *The **Insert Split** ribbon displays.*

   The following options are available 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.

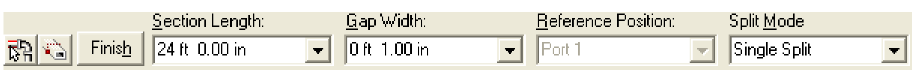
- **Reference Position** - Inserts splits in the selected straight feature starting from either end of the straight feature, Port 1 or Port 2, of a cableway or a cable tray.
- **Split Mode** - Specifies the mode or type for inserting splits. It can be either **Single Split** or **Multi Split**.

5. On the top cableway, select the Cableway Straight Feature where you need to place the split as shown:



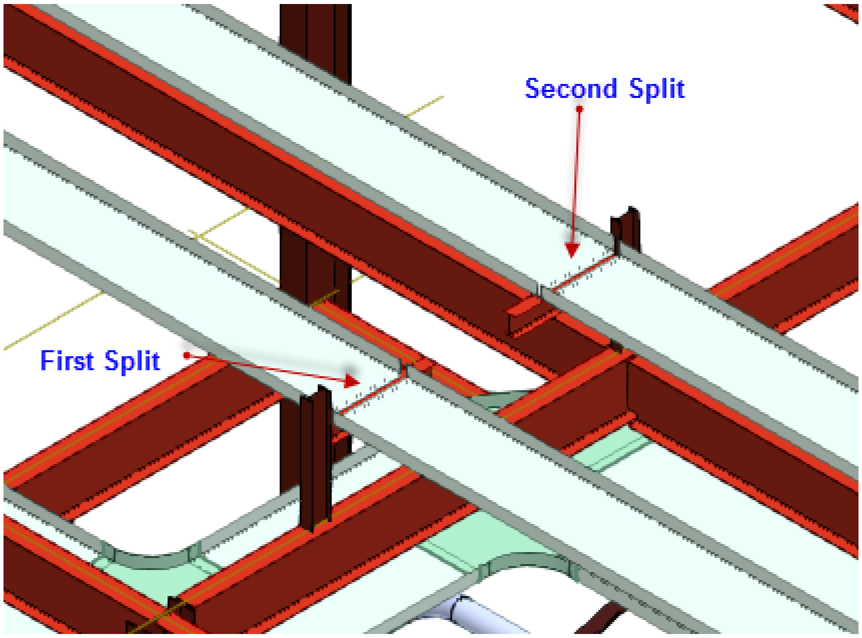
6. Define the following specifications on the **Insert Split** ribbon:

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



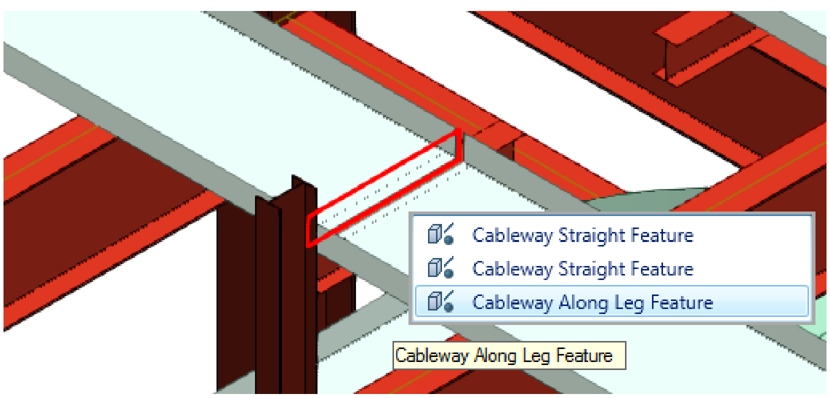
7. Click **Finish** to insert the split on the cableway.

8. Repeat the above steps to place a second split on the second cable tray, as shown:



NOTES

- The procedure to insert multiple splits is similar to the procedure for inserting a single split. You can insert multiple splits in a cable tray by clicking **Insert Split** 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.



For more information on inserting splits in a cableway, see *Inserting Cable Tray Splits: An Overview* in the *Electrical User's Guide*.

SECTION 4

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 Smart 3D.

Before Starting this Procedure

- Smart 3D Overview
- Smart 3D Common Sessions
- *Electrical Overview* (on page 7)

Overview:

To design or create a plant in Smart 3D, 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		

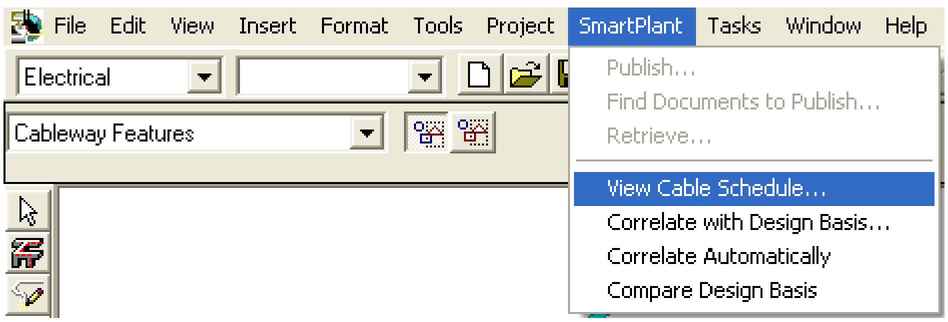
You can retrieve cable schedules from SPEL into Smart 3D to route cables. The information retrieved from SPEL is considered the design basis or design data in Smart 3D. The design basis is a collection of objects that represent pieces of data from different design and authoring tools. Smart 3D just adds graphical meaning to the design data.

After routing cables in a 3D model, the length of the cable is calculated in Smart 3D. Smart 3D 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 Smart 3D repeats, and then updates the cable in the Smart 3D model when these cables are retrieved again.

Retrieving Data from SPEL

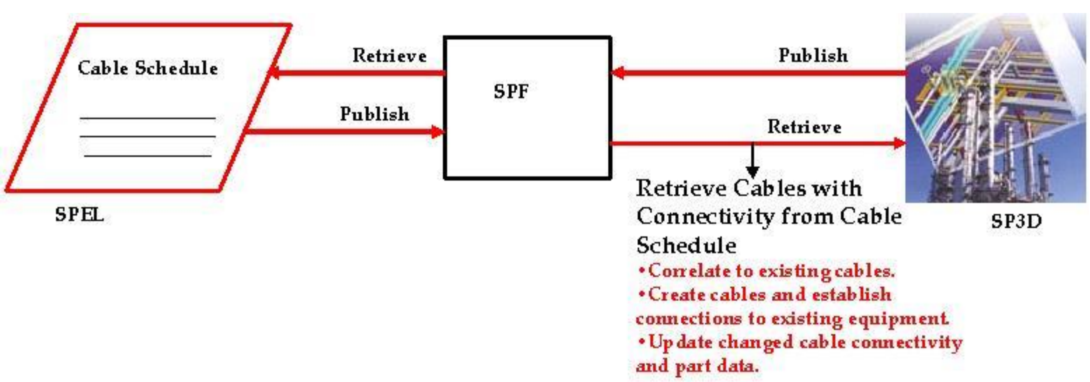
All design tools publish and retrieve data through SmartPlant Foundation (SPF). SPF acts as the central repository for data and a medium through which information is shared among other tools, such as SmartPlant Instrumentation, SmartPlant P&ID, and Smart 3D. In the integrated environment, data is published 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, update cables, and import cables by selecting **SmartPlant > View Cable Schedule…** in the **Electrical** task in Smart 3D.

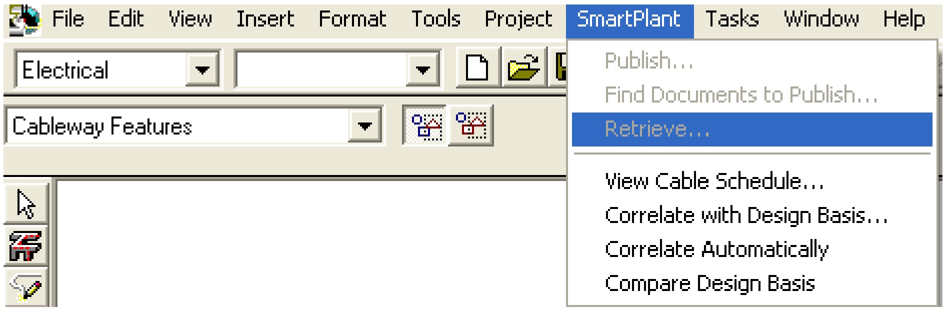


- **SmartPlant Instrumentation Dimensional Datasheets (DDPs)** - You can retrieve SmartPlant Instrumentation dimensional data for piping. Smart 3D retrieves instruments defined in SmartPlant Instrumentation and maps the instruments to a parametric symbol.
- **Plant Breakdown Structure (PBS)** - You can retrieve PBS and project documents to provide information about the models, areas, units, and projects that need to be created in Smart 3D. The PBS document published by SPF contains information about the physical model whose structure consists of plants, areas, and units.

When you retrieve cable data from SPEL, SPEL publishes the data to SPF, and Smart 3D retrieves the data from SPF. Similarly, when SPEL retrieves the updated cable data from Smart 3D, Smart 3D publishes the data to SPF. SPEL then retrieves the data from SPF.



You can select **SmartPlant > Retrieve** to retrieve data in Smart 3D. This command is enabled when you work in an integrated environment.



Comparing Model and Design Data

The retrieved data and the Smart 3D design that is derived from the retrieved data are dynamic. They keep changing during the design of the model. 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 Smart 3D, you need to compare the new data with the data that exists in the model. During this comparison, you want to review the impact of changes on the model.

In Smart 3D, you can compare the differences in the property and topology values in the model and design data. The purpose of this comparison is to:

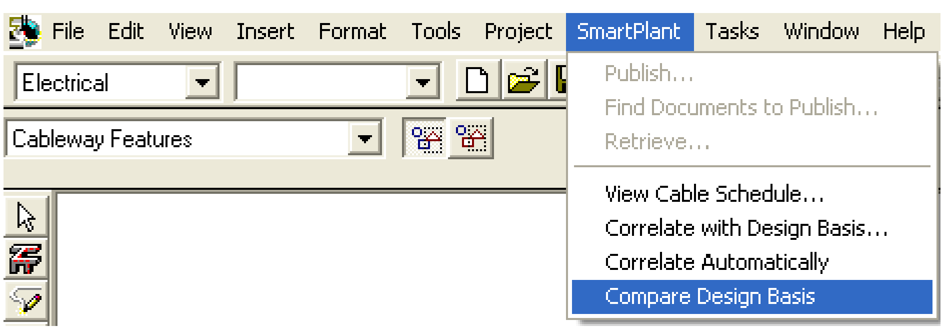
- Update the values of the mapped properties of the design and model data on the correlated objects in Smart 3D.
- Process deleted objects.

Upon comparison, you might find that the Smart 3D or model data and the design basis object or design data are in different states:

- Uncorrelated, when the model data is not related to the design data.
- 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.

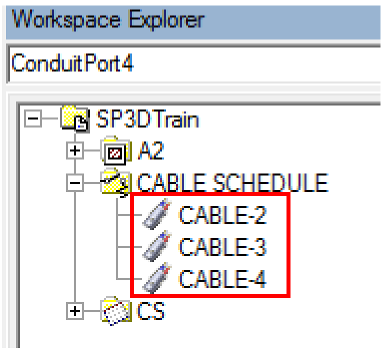
Comparing the data allows you to manage changes to 3D model objects to match the design basis objects without having to remodel. For example, you can change the pump coating requirement or the type of pump after comparing the data.

SmartPlant > Compare Design Basis allows you to compare the model and design data in Smart 3D. It also resolves discrepancies between the model and design data.



Retrieve 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.

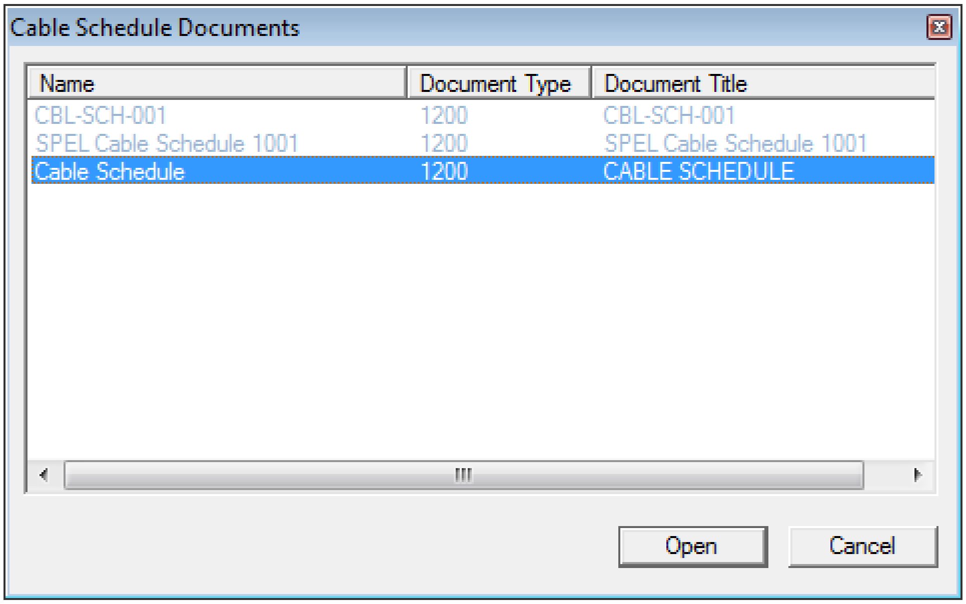


NOTE In an integrated environment, the Electrical task and SmartPlant Electrical can share a cable schedule, along with several cable properties.

1. Define your workspace to include all objects located in **Unit U01** and the coordinate system **U01 CS**. In your training plant, select **Plant Filters > Training Filters > U01** in the **Select Filter** dialog box.
2. On the **PinPoint** ribbon, set the active coordinate system to **U01 CS**, and click **Set Target to Origin** .
3. Select **Tasks > Electrical** to enable the **Electrical** task.
4. Set the **Active Permission Group** to **Electrical** and assign the objects that you place in the model to the Active Permission Group.
5. Select **SmartPlant > View Cable Schedule…**.

   *The **Cable Schedule Documents** dialog box displays.*

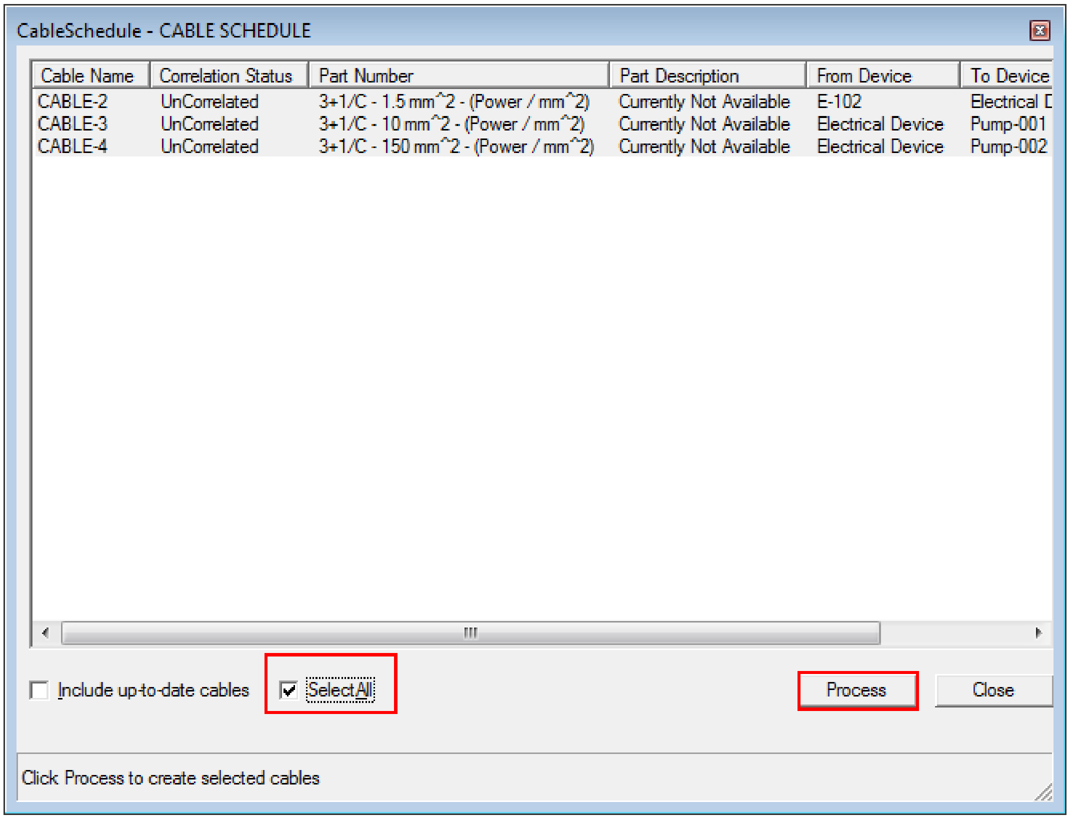
6. Select a cable schedule document and click **Open**.



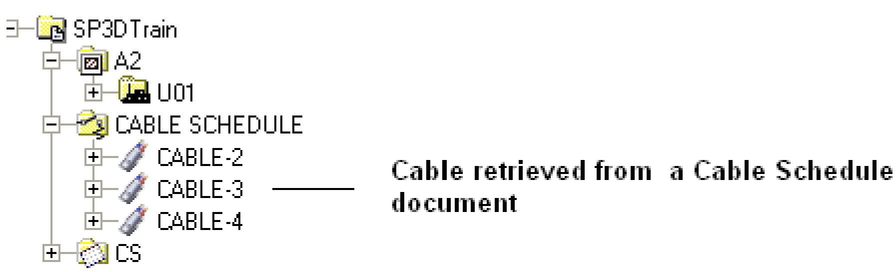
*The **Cable Schedule** dialog box displays a list of retrieved cable schedules and their associated specifications.*

7. Check **Select All** at the bottom of the dialog box and click **Process**.

NOTE To display available cables, you must have SmartPlant Client installed on your machine.



The retrieved cables display on the ***Workspace Explorer*** *under* ***SP3DTrain\CABLE SCHEDULE****.*



Smart 3D creates relationships between the 3D cable objects and their corresponding design basis objects.

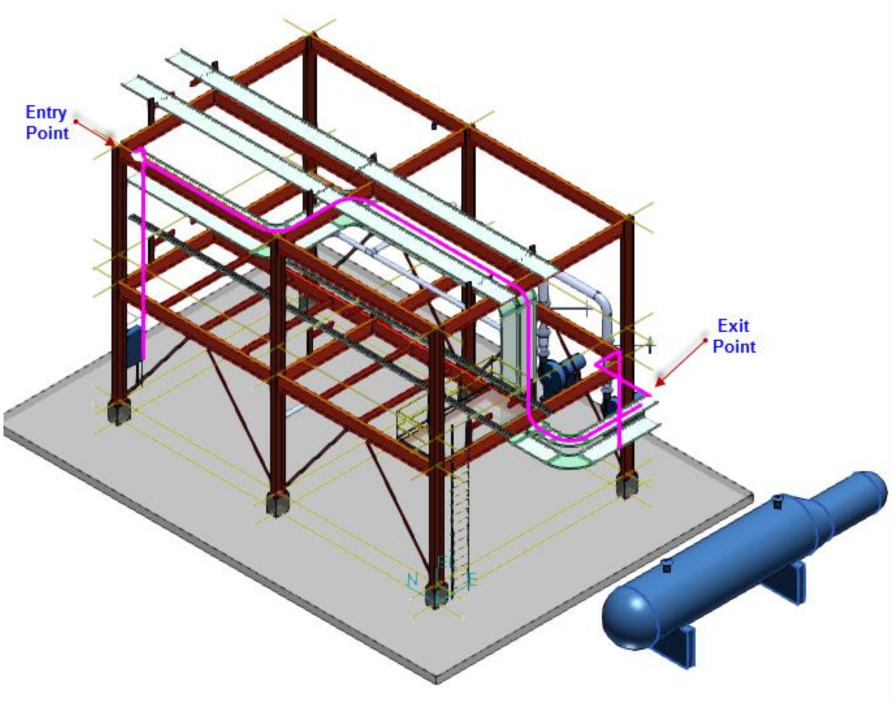
8. Click **Close**.

   A new electrical system displays in the ***Workspace Explorer*** *with the new cables.*

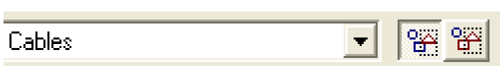
   NOTE Smart 3D creates the cables in an electrical system with the same name as the cable schedule document. It creates a new system in case the required system does not exist. Smart 3D searches the equipment defined in the cable schedule and automatically selects the equipment to which the new cable is connected. If the equipment is not in the model, then the cable is not created in the model.

Route Cables Retrieved from SPEL

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

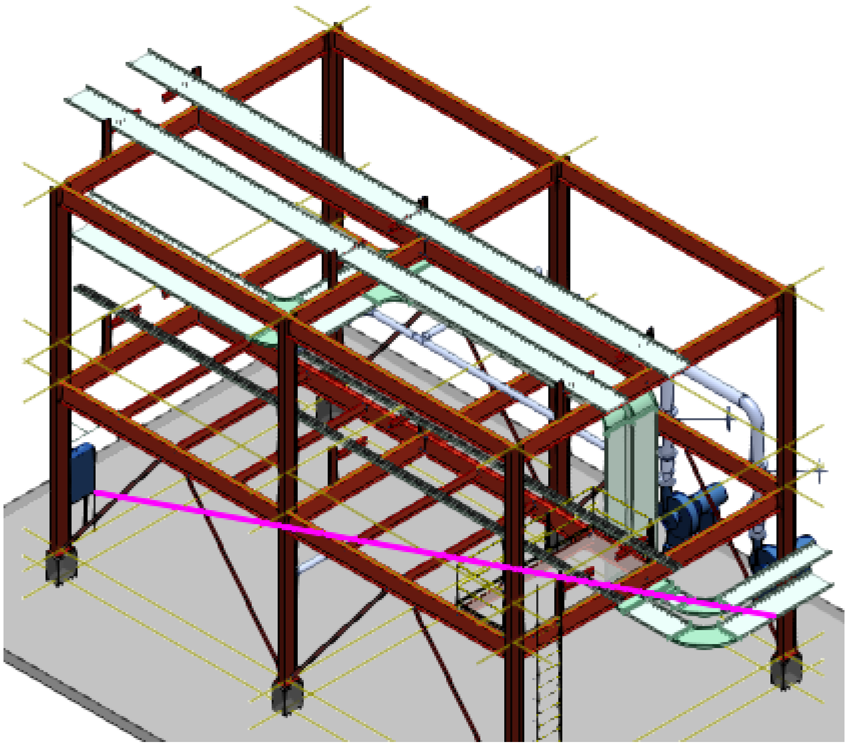


1. Under **Locate Filter**, select **Cables** to select cable objects in the model.



2. In the **Workspace Explorer**, select **CABLE-3**.

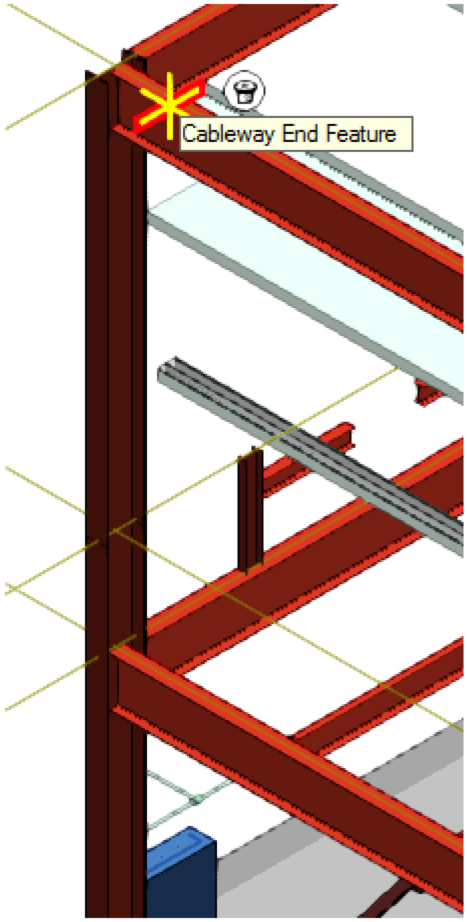
*The **Edit Cable Path** ribbon displays and the cable is highlighted in the model.*



3. Select **Set Entry Point** .

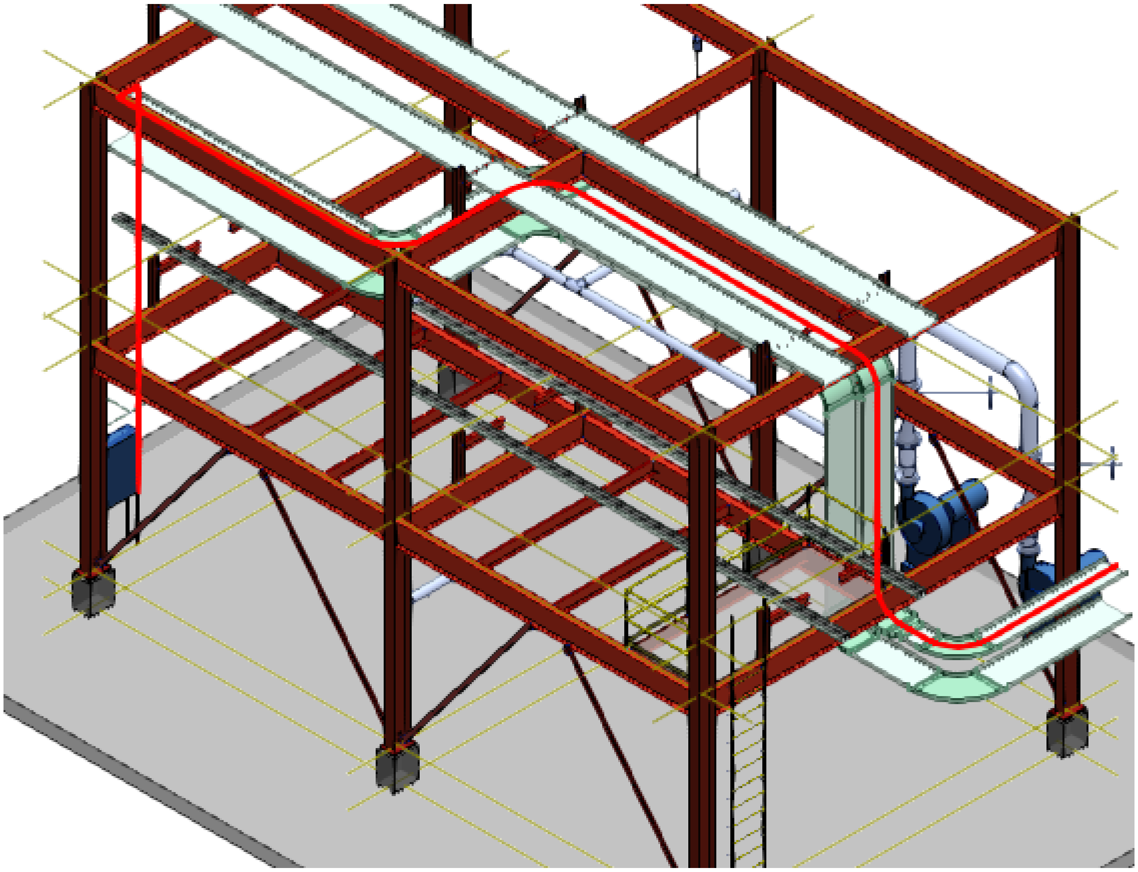
   The system prompts for the entry point position on the cableway.

4. Select the end feature of the top tray above the **Electrical Device**.



The system shows the cable path.

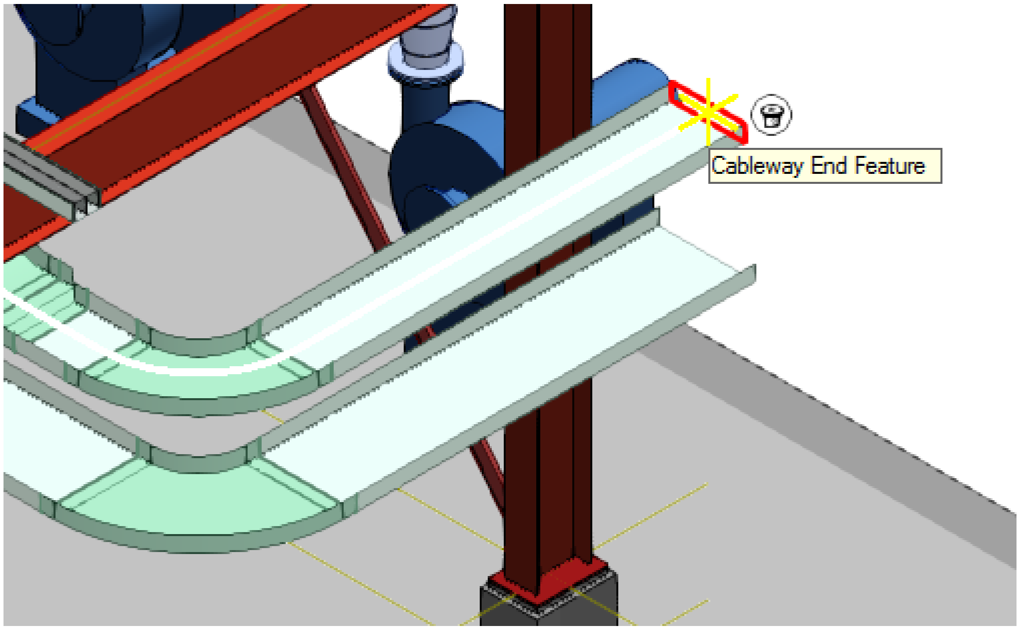
5. Ensure that the cable goes through the top tray.



6. Click **Accept Selection** ✔.

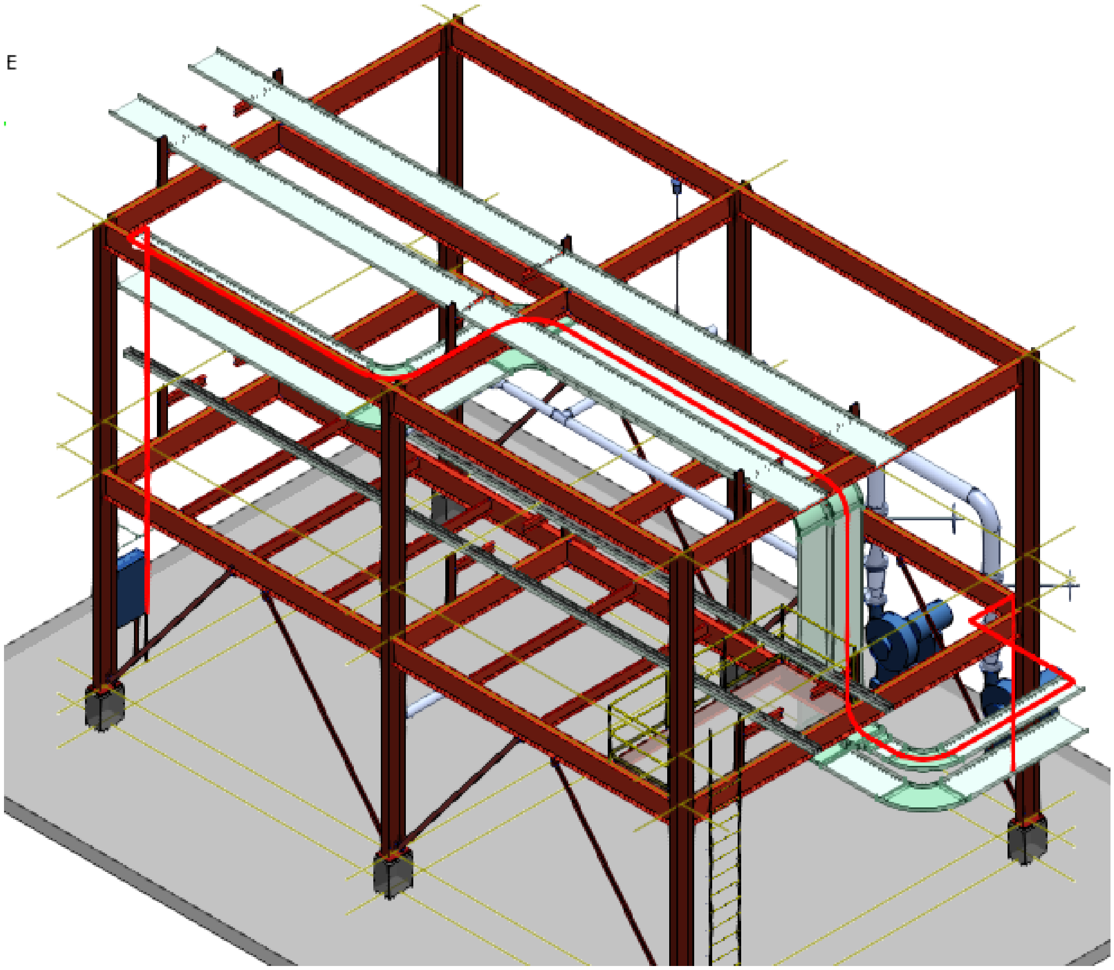
   The system prompts for the exit point position on the cableway.

7. Select the end feature at the other end of tray as the exit point.



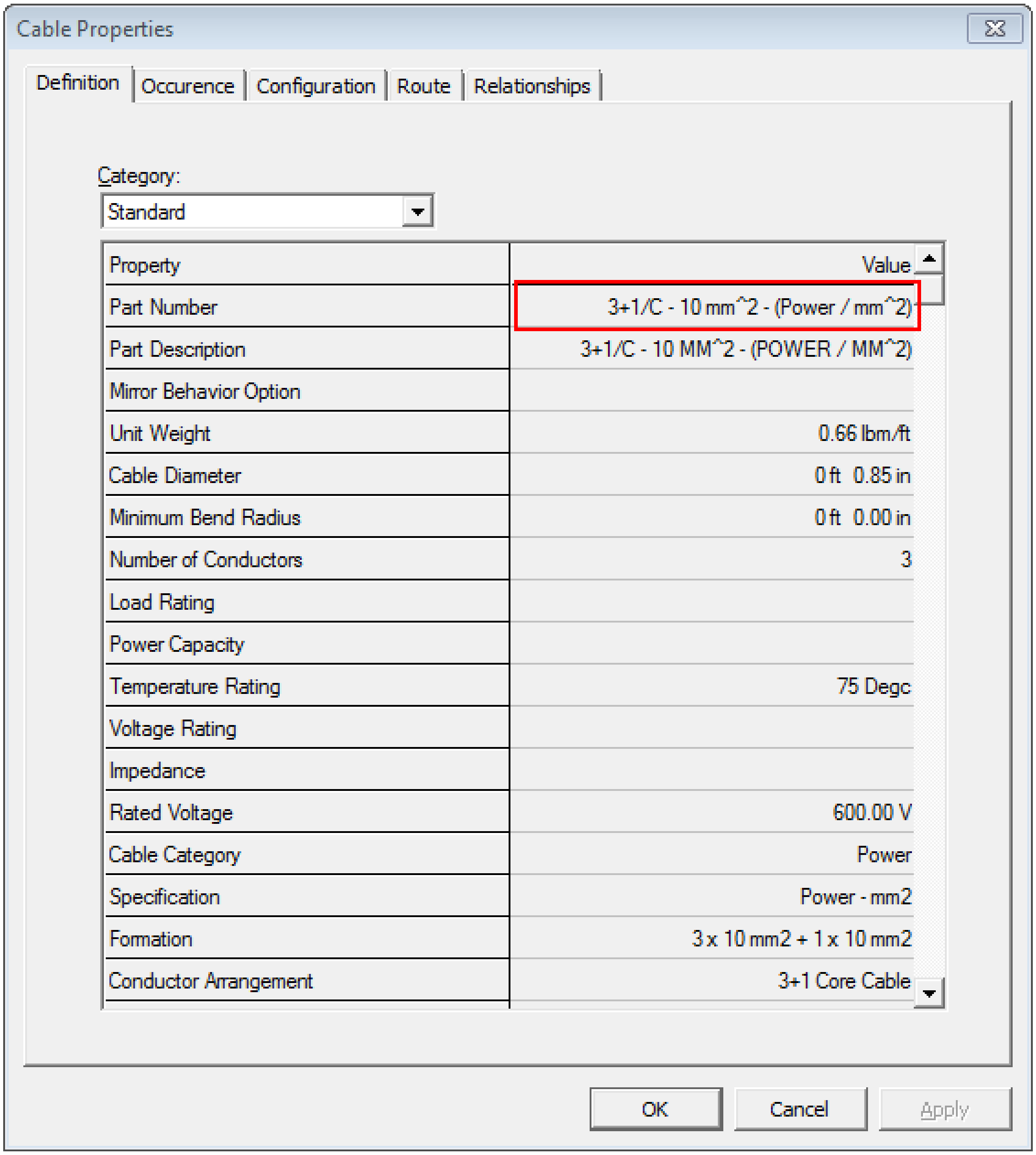
8. Click **Finish** to define the cable path.

9. Select the cable in the model.



10. Click **Properties**.

*The **Cable Properties** dialog box displays.*



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

For more information related to the integration of cables with SPEL, see *Using Smart 3D in an Integrated Environment: An Overview* in the *Smart 3D Integration Reference Guide*, and *Retrieving Cable Data: An Overview* in the *Electrical User's Guide*.

SECTION 5

Routing Cables

Objective

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

- Route a cable in SP3D.

Before Starting this Procedure

- Smart 3D Overview
- Smart 3D Common Sessions
- *Electrical Overview* (on page 7)
- *Integration with SmartPlant Electrical (SPEL)* (on page 25)

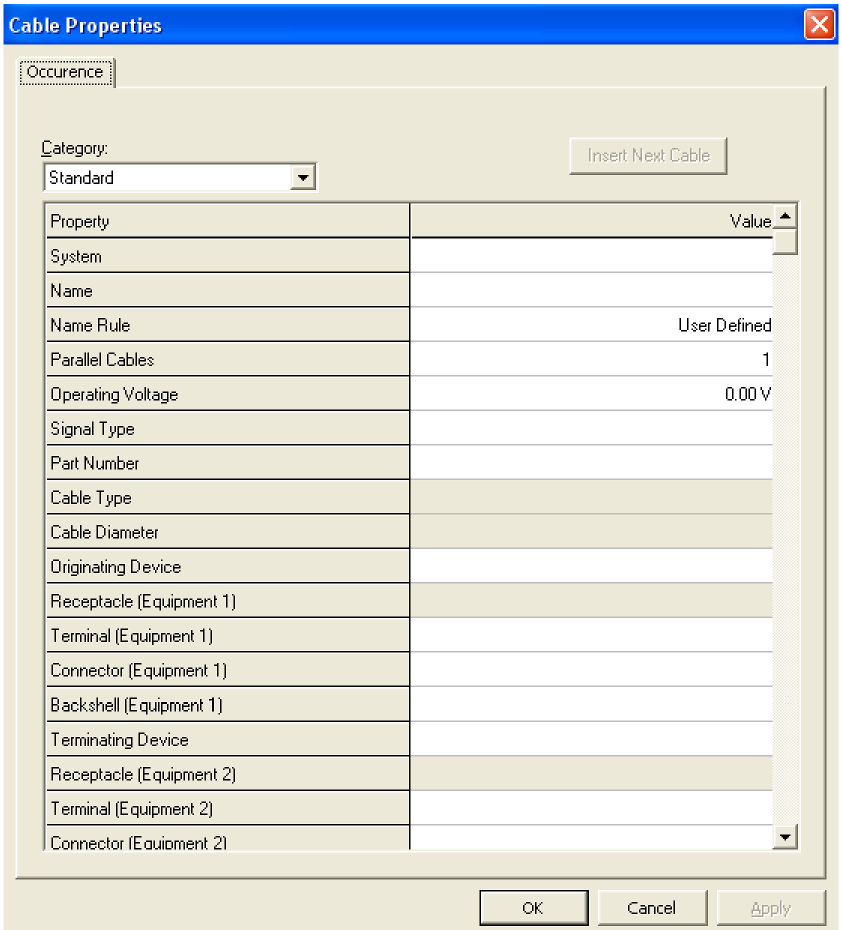
Overview

In the Electrical task, you can create cables and route them through the existing conduits and cableways. **Route Cable**  allows you to define cable properties, such as the name, part number, and equipment to which the cable is connected. You can also use **Retrieve** to return 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 be familiar with how cables are created and displayed in the 3D model. The **Cable Properties** dialog box allows you to create a single cable or parallel cables in the model.



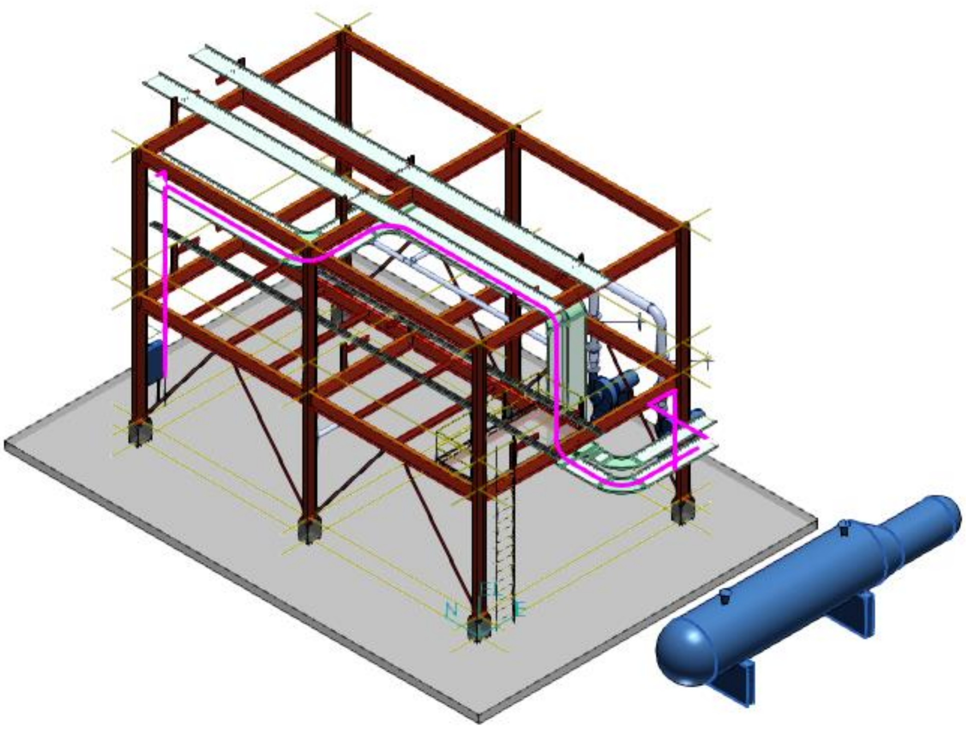
Cables do not have any persistent graphics of their own. Smart 3D uses temporary graphics to display the cable route generated from the path definition. When a cable is selected, a bold line shows the cable route in the selected color that traces the path of the cable as defined by the cable object. The path is along the centerline of the cableway and conduit and is 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 **Parallel Cables** field.

This session covers the procedure for manual cable routing and auto cable routing.

Manual Cable Routing

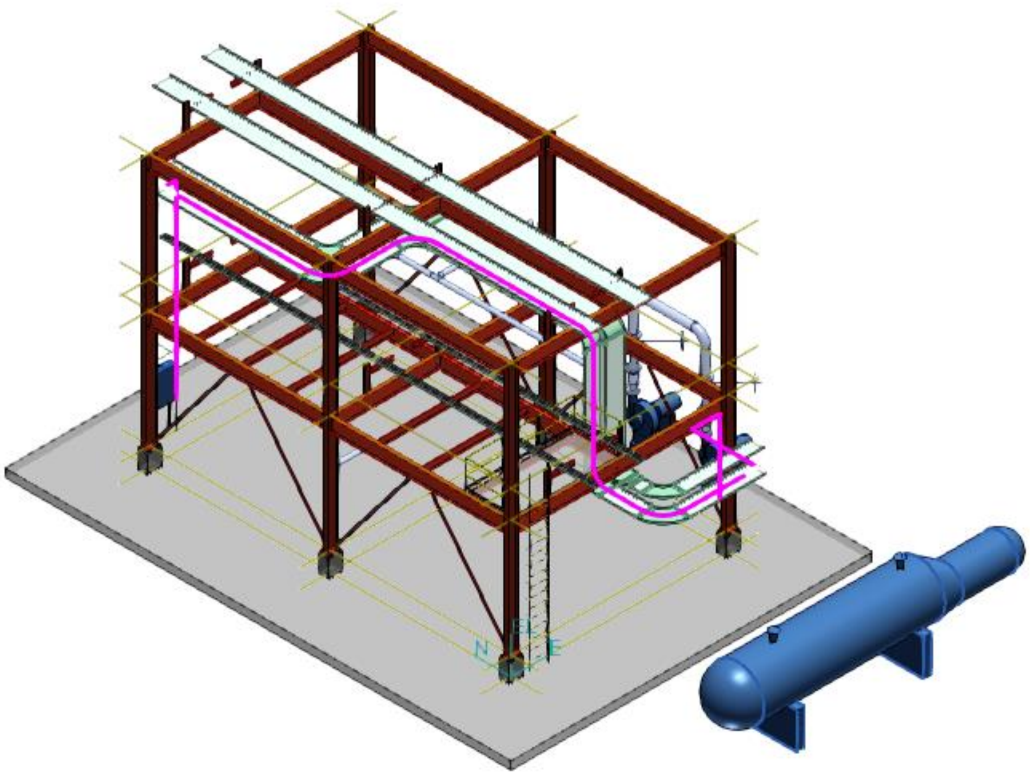
If you want to route a cable into a cable tray at some point along the length of the tray, you need to manually route the cable. For example, if you want to force the cable to go through a particular cableway or force the cable to detour a particular cableway, you manually route the cables. In this case, 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 with **Set Entry Point** or **Set Exit Point**. You can also use **PinPoint** to assist in precise placement. One possible workflow for this example is to first branch the conduit out of the tray using **Route Conduit**. 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 below shows the cable path through the cable tray into the equipment terminals.



Manually Route Cables

Place a single cable, CC-001, from an electrical device to a pump in Unit U01 with **Edit Cable Path** .



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 **Insert Cable** .

   *The **Cable Properties** dialog box displays.*

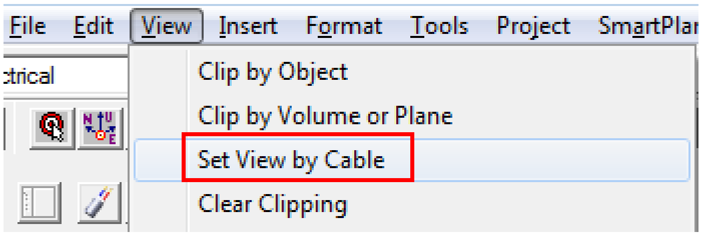
2. Define the following cable specifications, and click **OK**.

   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
   Part Number: Cable\Cables\Power 0.6/1 KV (1 Conductor)\1 x1.5 mm^2 – 0.6/1KV XLPE 90 UA Cu

Originating Device: Electrical Device
Terminating Device: Pump-001

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

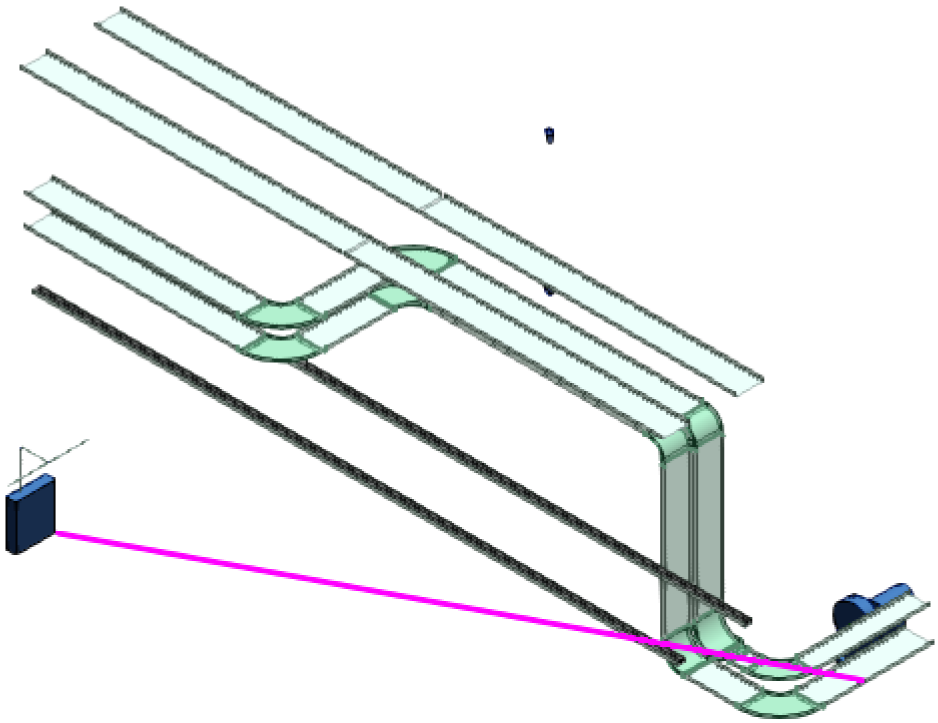
3. Select **View > Set View by Cable** to route cable by only showing the required objects and hiding the objects that are not required in the model.



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

- Hides structural, piping, 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.

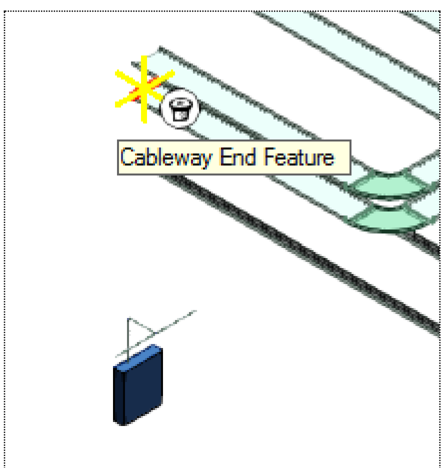
The selected cable is highlighted in the graphic view.



4. Click **Set Entry Point** .

   The system prompts for an entry point position on the cableway.

5. Select the cableway end feature of the bottom tray.

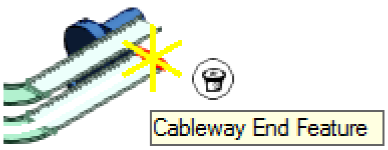


   The system shows the cableway path.

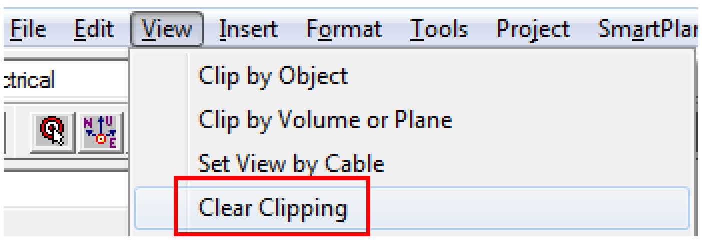
6. Ensure that the cable goes through the bottom tray, and click **Accept Selection** .
7. Click **Set Exit Point**

The system prompts for an exit point position on the cableway.

8. Select the cableway end feature at the other end of the bottom tray to specify the exit point.



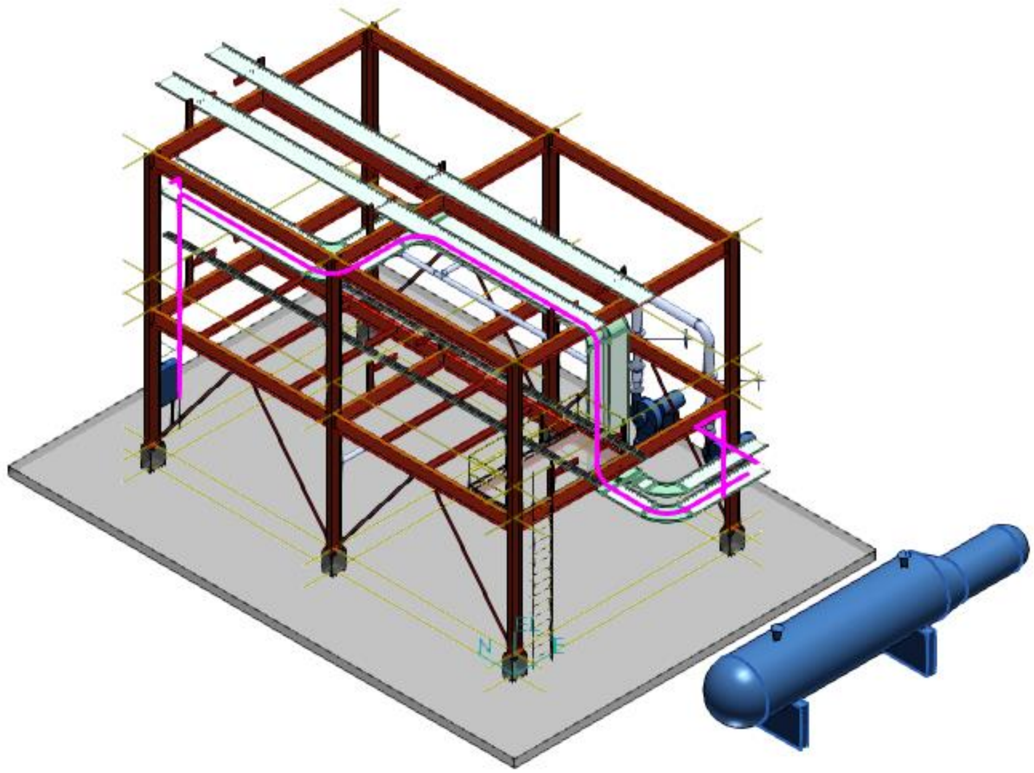
9. Click **Finish**.
10. Right-click cable **CC-001** in the **Workspace Explorer** and review its properties.
11. Select **View > Clear Clipping** to restore the graphic view to its original state.



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

12. Select **Tools > Show All**.

Your graphic view should resemble the below:



Parallel Cables

Cables that are routed together are called parallel cables. Using Smart 3D, 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, entry points, and exit points in and out of the cableway, and follow the same path in the cableway as the parent object.

Create Parallel Cables

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

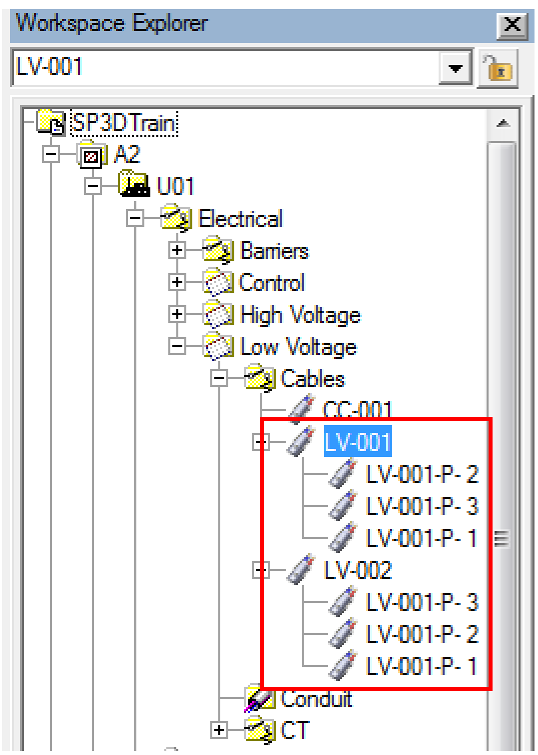
Parallel Cable 1:

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 appear as shown:



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

2. Click the **Insert Cable** .

   *The **Cable Properties** dialog box displays.*

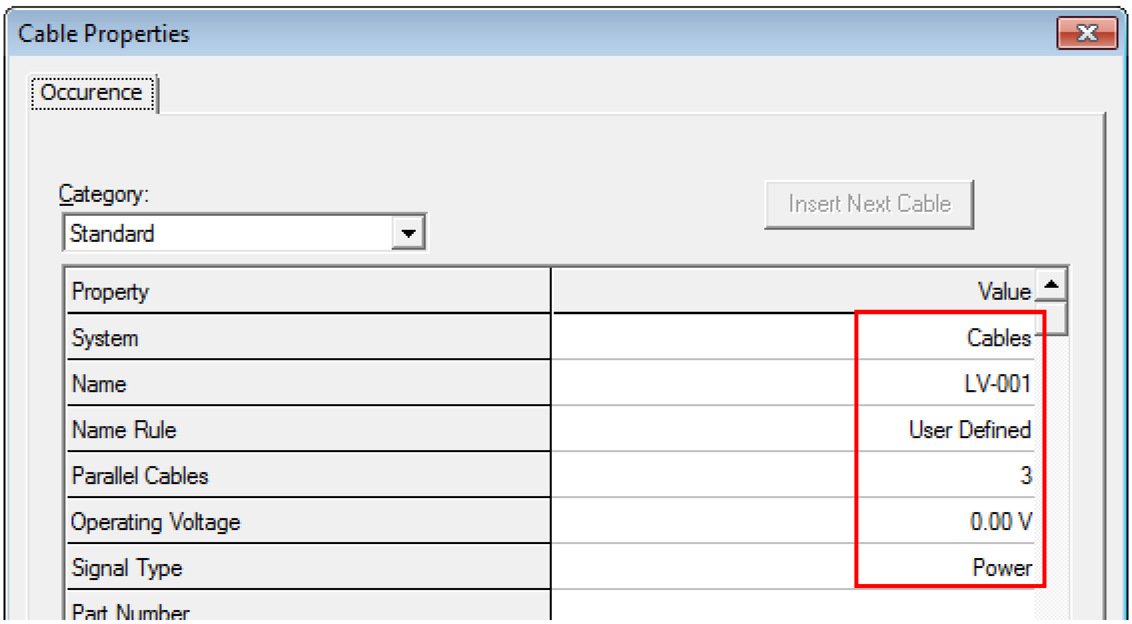
3. Under **System**, select **More…**.

   *The **Select System** dialog box displays.*

4. Select **A2 > U01 > Electrical > Low Voltage > Cables** and click **OK**.

5. Define the following properties:

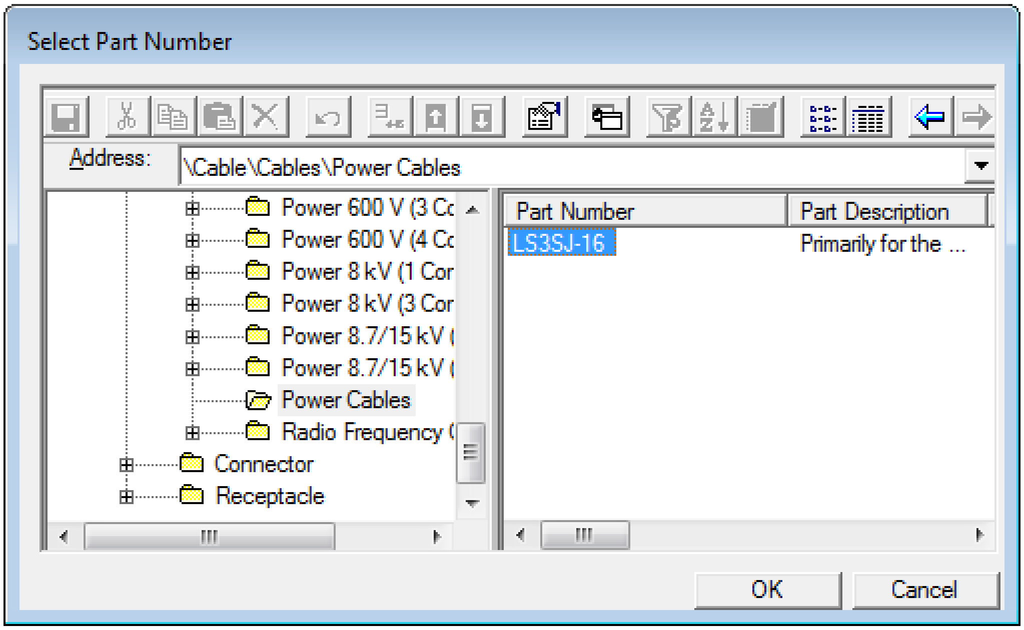
   Name: LV-001
   Parallel Cables: 3
   Operating Voltage: 110 V
   Signal Type: Power



6. Under **Part Number**, select **More…**.

   *The **Select Part Number** dialog box displays.*

7. Select **Cable > Cables > Power Cables > LS3SJ- 16**, and click **OK**.



8. Under **Originating Device**, select **More...**.

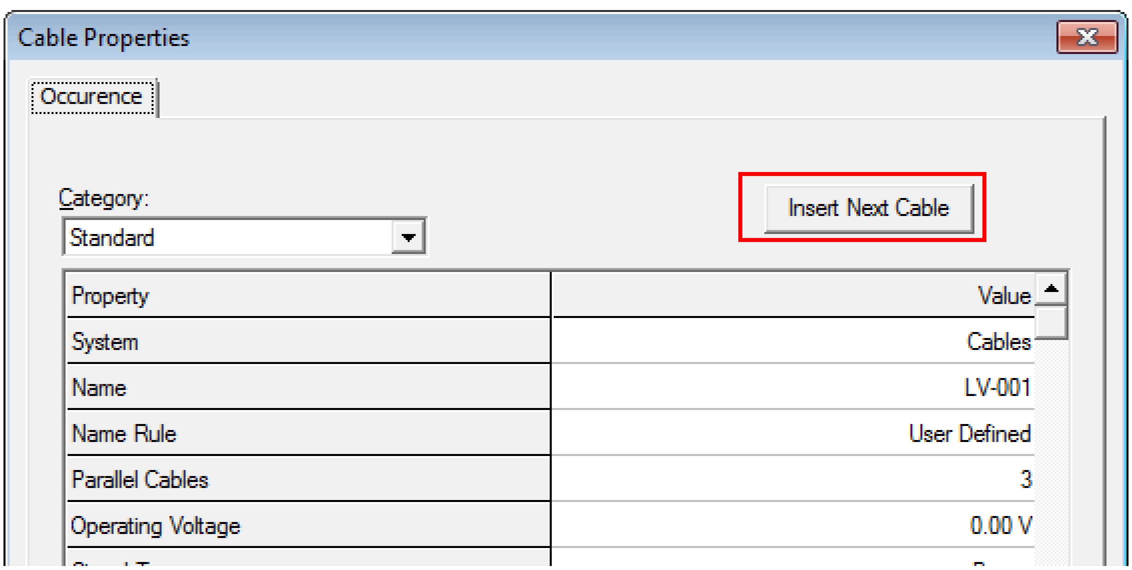
   *The **Select System** dialog box displays.*

9. Select **A2 > U01 > Equipment > Electrical Device**, and click **OK**.

10. Repeat the process for **Terminating Device**, selecting **A2 > U01 > Equipment > Pump-001** for the terminating device.

11. Click **Apply**.

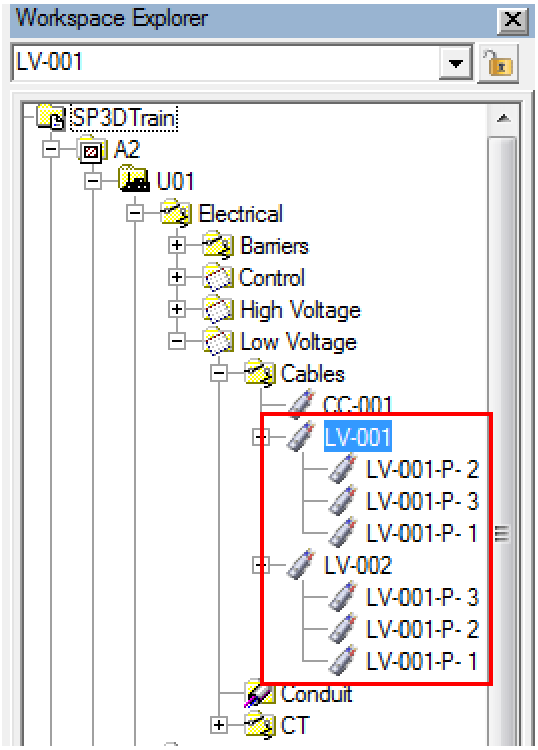
12. Click **Insert Next Cable** to specify the properties for the second cable.



13. Define the following specifications 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 display in the **Workspace Explorer**.*

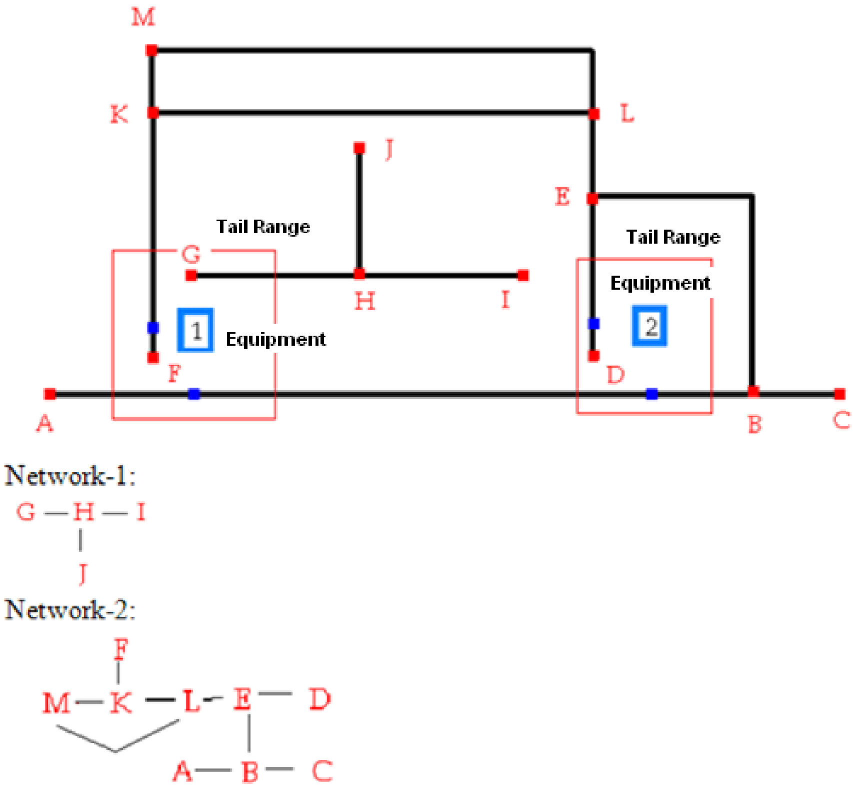


Auto Cable Routing

Smart 3D 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 conduits that have their signal type already defined. You can modify the assigned auto-routed path by specifying additional must-include cable trays for the selected cable. During the auto-routing process, Smart 3D 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.

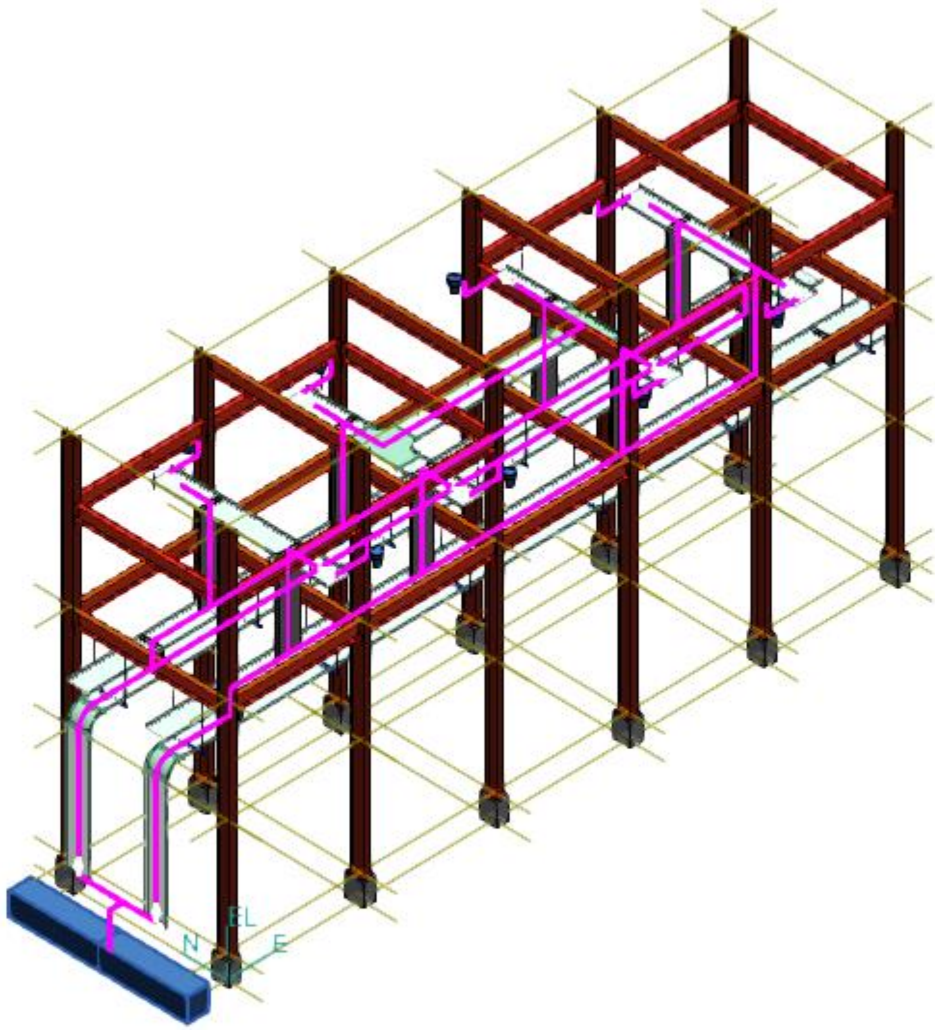
Auto-routing is turned off by default. Click **Auto-Route** on the **Edit Cable Path** ribbon to activate auto-routing. When **AutoRoute** is selected, the software builds one or more nodal networks representing all cableways in the workspace. Each end feature of the cableway, every branch on the cableway, 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 below). 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:

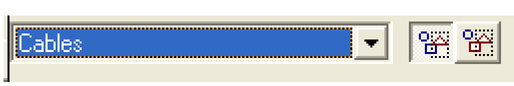


Auto Route Cables

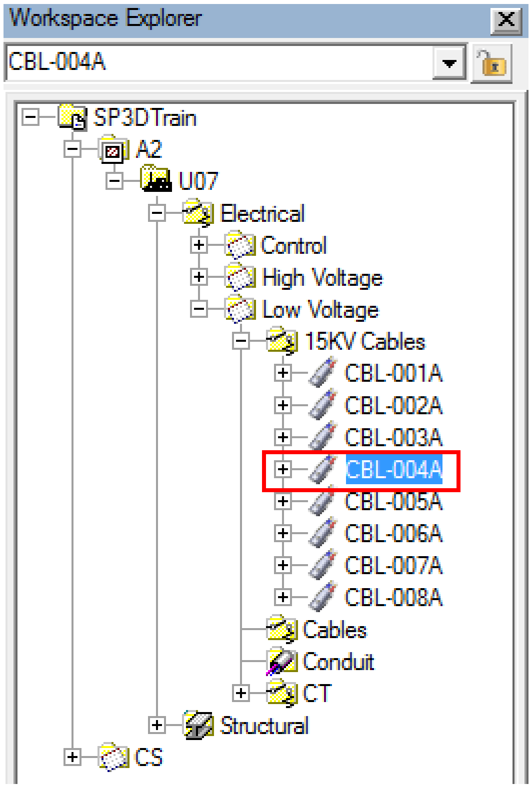
Route cables in Unit U07 of your workspace by using **Auto Route**  on the **Edit Cable Path** ribbon. After auto routing cables, the view of your model should be as shown:



1. Define your workspace to show Unit **U07** and coordinate system **U07 CS**.
2. Under **Locate Filter**, select **Cables**.

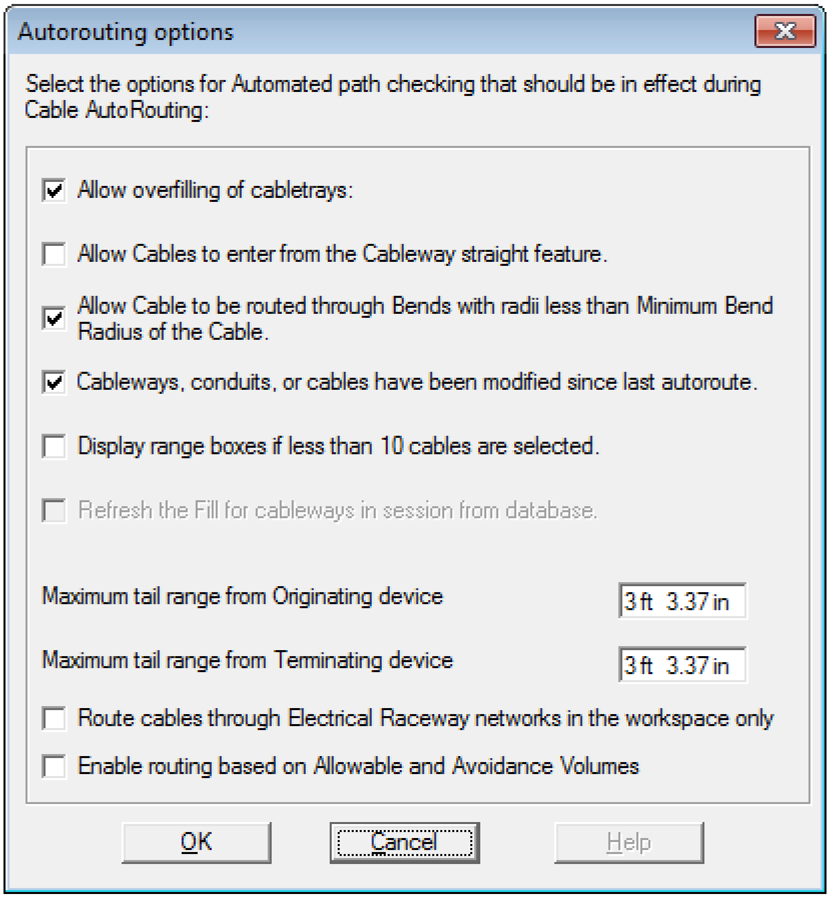


3. In the **Workspace Explorer**, select **CBL-004A**.



4. Click **AutoRoute Options** 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.

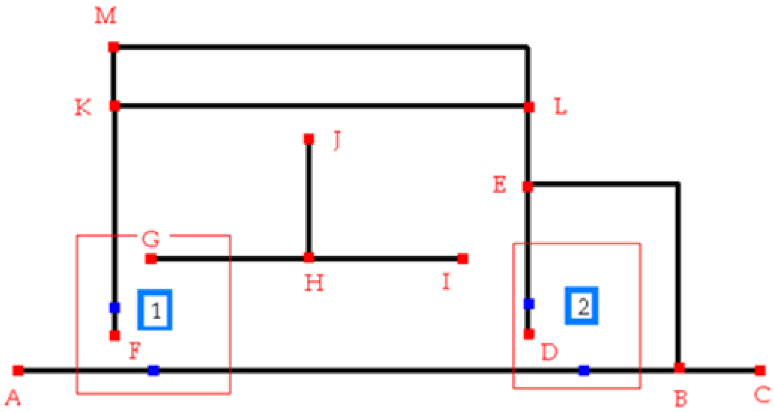
*The **Autorouting options** dialog box displays:*



The following options are available:

- **Allow Overfilling of Cable Trays** - Allows you to route cables through cable trays that can become overloaded. If **Allow Overfilling of Cable Trays** is not selected and a feature in a connection is full, connections between nodes are removed.

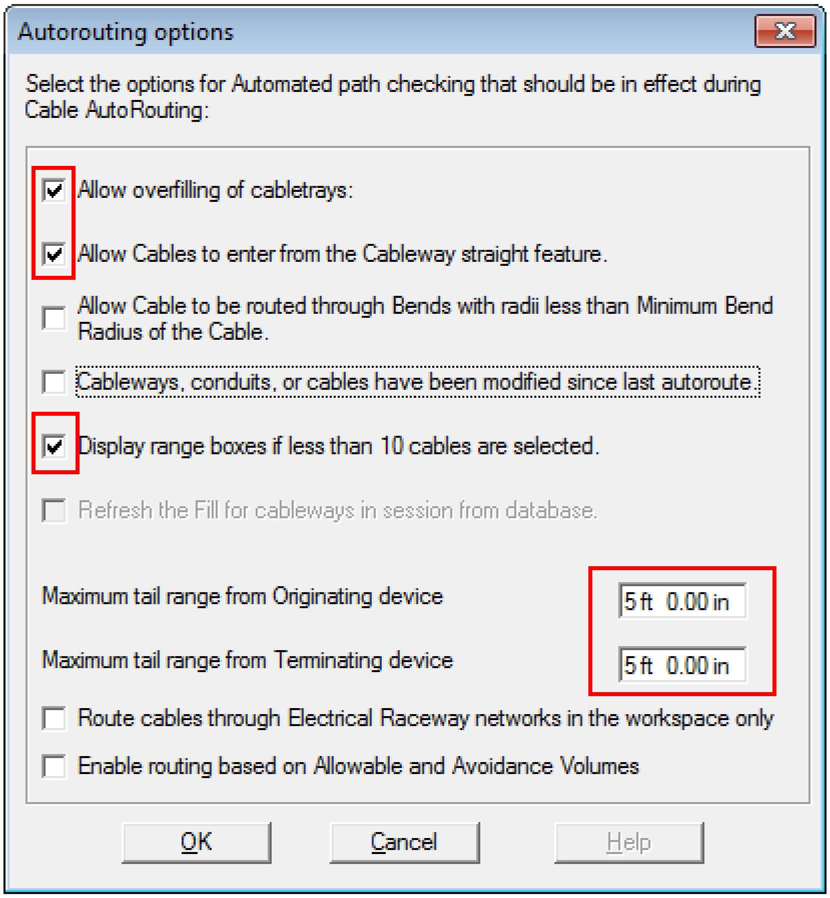
- **Allow Cables to enter from the Cableway straight feature** - Allows cables to enter from a cableway straight feature. If this option is selected, and the maximum equipment tail range is as indicated by the red boxes shown below, the blue dots are automatically selected as possible entry and exit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



- **Allow Cable to be routed through Bends with radii less than Minimum Bend Radius of the Cable** - Allows you to route cable through bends that have a radius value less than the minimum bend radius value 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.
- **Route cables through Electrical Raceway networks in the workspace only** - Routes cables through the electrical raceway networks that are available in the Workspace, rather than through the entire electrical raceways available in the database. Check this option to route through the raceways available only in the workspace. Clear this option to include all the electrical raceways in the database.
- **Enable routing based on Allowable and Avoidance Volumes** - Routes cables through allowable volumes avoiding the avoidance volumes. If you check this option the software routes the cable only in the allowable volumes. However, this path might not be the shortest path. Clear this option to disable routing based on allowable volumes rule.

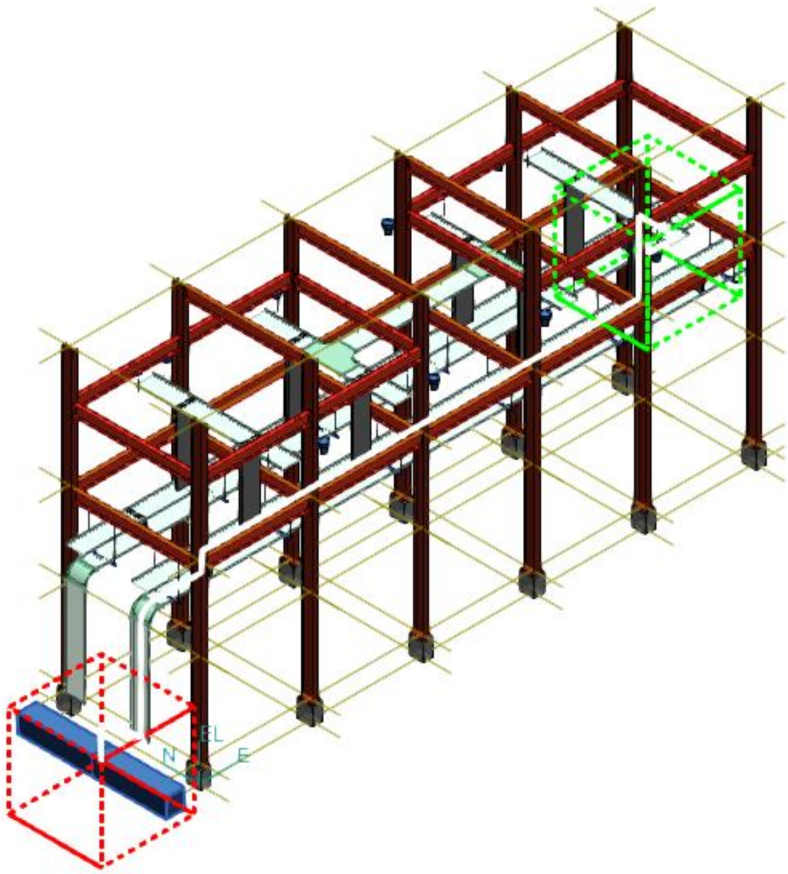
5. Select the following options in the **Autorouting options** dialog box, and click **OK**:

Allow Overfilling of Cable Trays
Allow Cables to enter from the Cableway straight feature
Display range boxes if less than 10 cables are selected
Maximum tail range from Originating device: 5 ft 0.00 in
Maximum tail range from Terminating device: 5 ft 0.00 in



6. Click **AutoRoute** .

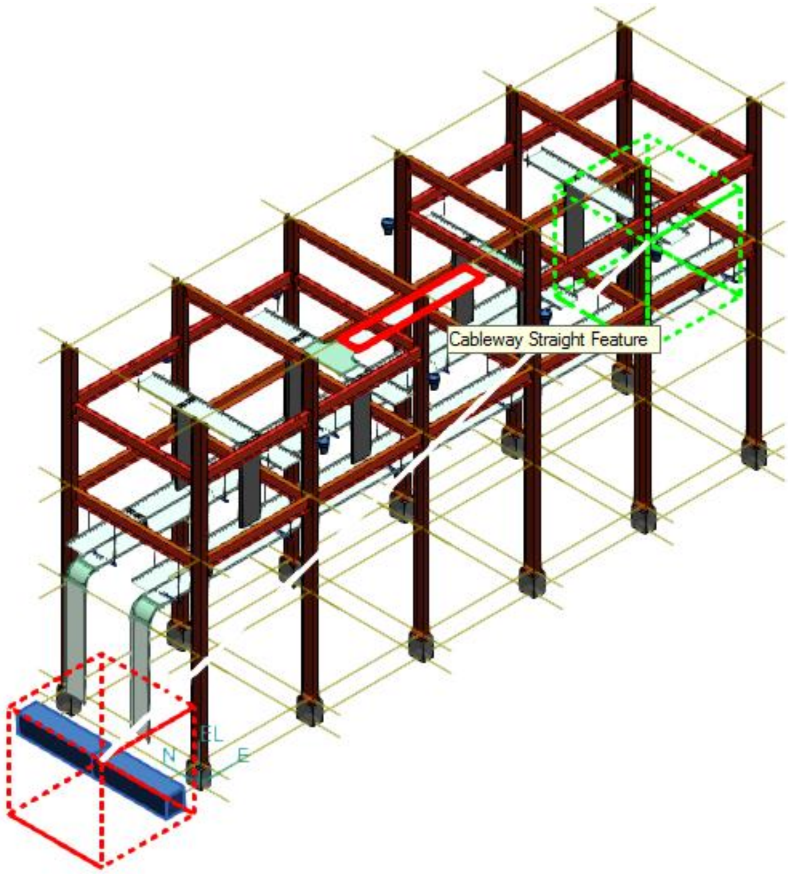
Smart 3D displays the proposed contiguous cable path for the cable in the model.



7. Click **Select** to cancel the proposed cable path.
8. Select **CBL-004A** in the **Workspace Explorer**.

   *The **Edit Cable path** ribbon displays, and Smart 3D highlights the cable in the active view.*

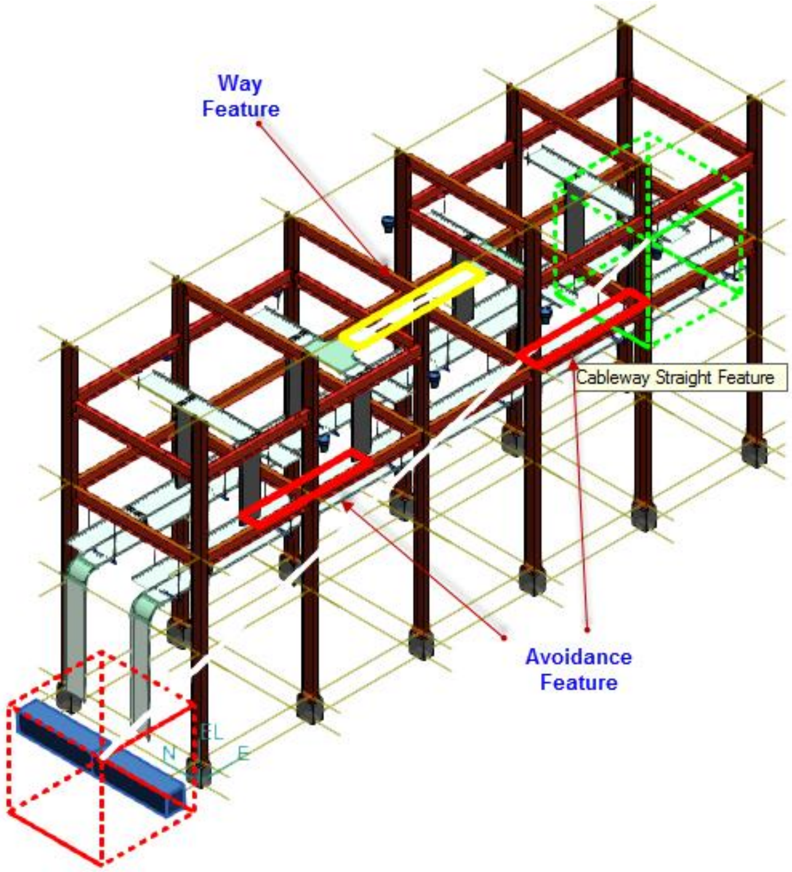
9. Click **Select Way Features** and select the cableway features or way points as shown below:



NOTES

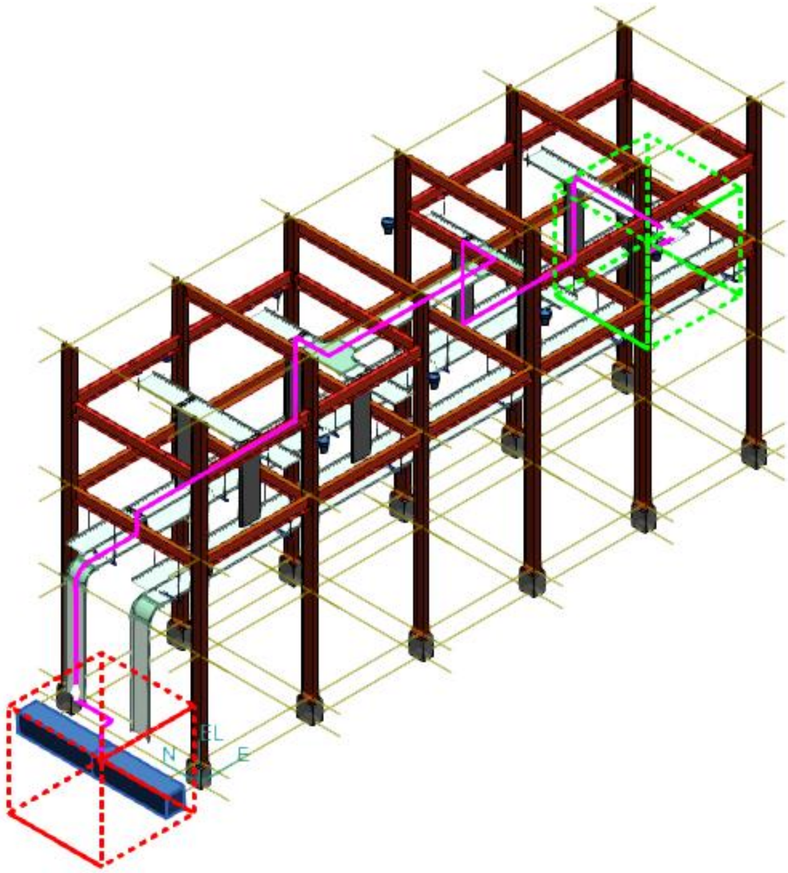
- Connections between nodes are removed if you pick a feature in a connection as a member-selected "avoidance point" feature.
- If only one "way point" feature is selected, and no path is possible between the entry and exit points that include the "way point" feature, then the autoroute fails and an error message is added to the log file.
- 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** is not selected, the connection containing the feature is removed from the networks.

10. Click the **Select Avoidance feature(s)**  and select the cableway features or avoidance points in the model as shown below:



11. Click **AutoRoute** .

Smart 3D displays the proposed continuous path for the selected cable from ***PDB-101*** *to the light* ***LG-4*** *as shown below.*



NOTES

- Networks that have features, members of connections that have not been removed or trimmed by the above rules, within the "maximum tail length range" of both equipments are selected for autorouting between equipments 1 and 2.
- The minimum length path on the trimmed network is computed between each possible pair of entry and exit points. The path with the smallest 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 and 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.

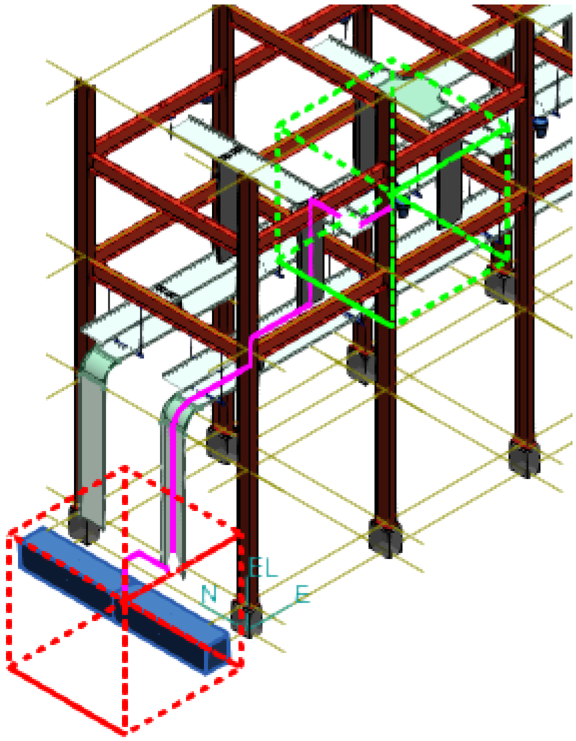
12. Click **Finish** to complete the cable path.

13. Select **CBL-001A** in the **Workspace Explorer**.

    The ***Edit Cable path*** *ribbon displays and Smart 3D highlights the cable in the active view.*

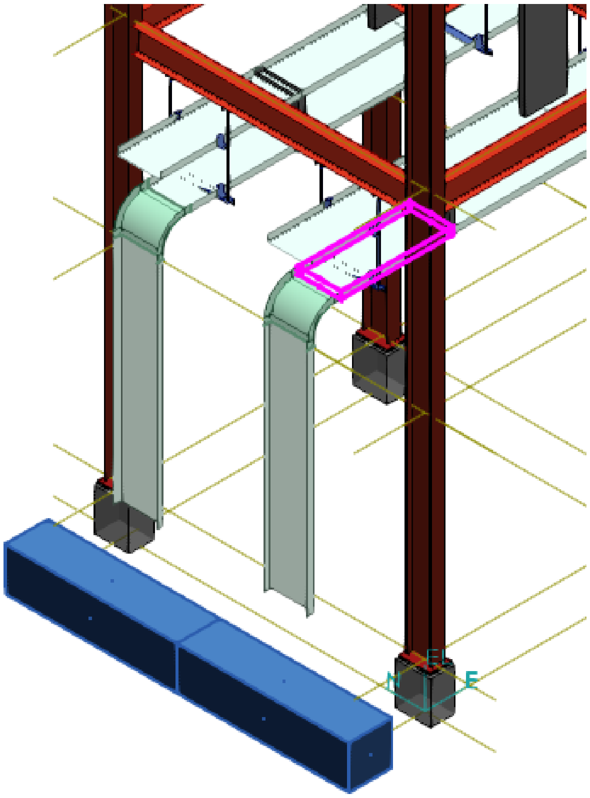
14. Click **AutoRoute** .

    Smart 3D displays the proposed contiguous cable path for the cable as shown:

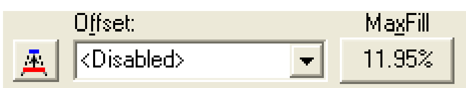


15. Click **Finish** to complete the cable path.
16. Set the **Locate Filter** to **Cableway Features** to select the cableway features in the graphic view.

17. Select the cableway straight feature from the bottom cable tray, as shown:



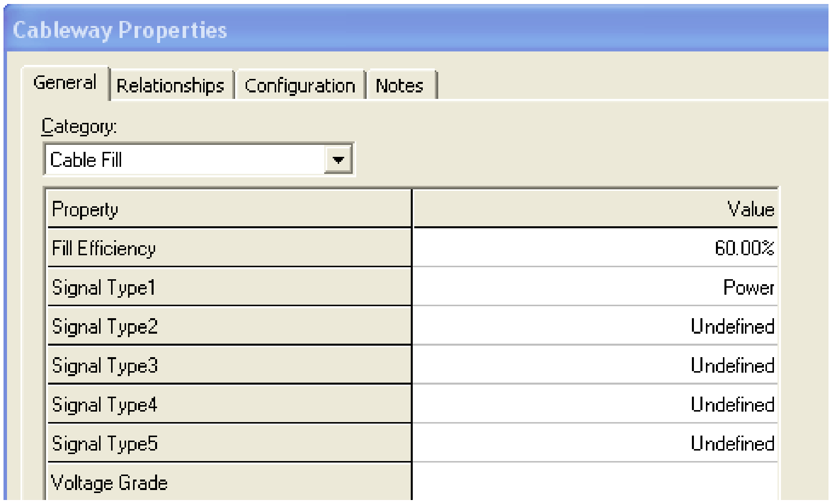
*The **Edit Cableway** ribbon shows **MaxFill** at 11.95%.*



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.

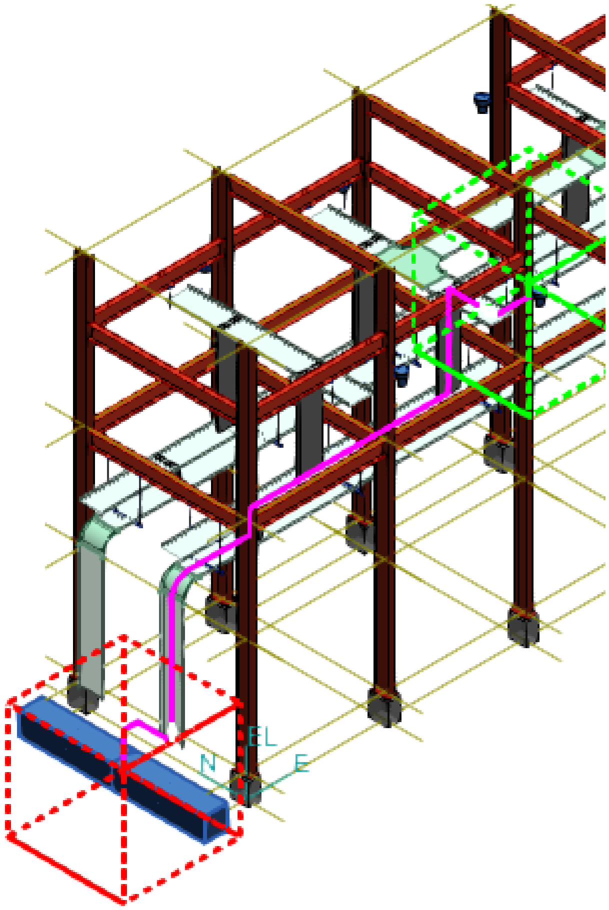


18. Select **CBL-002A** in the **Workspace Explorer**.

    *The **Edit Cable path** ribbon displays, and Smart 3D highlights the cable in the active view.*

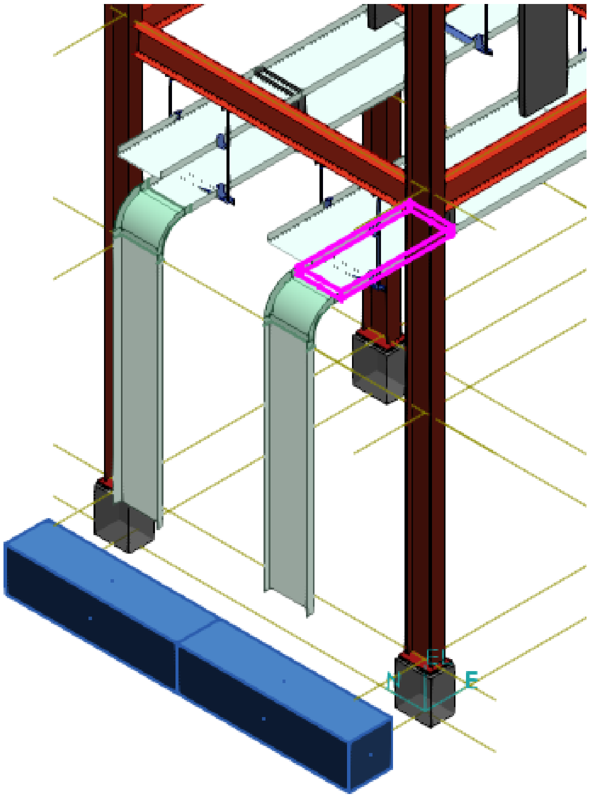
19. Click **AutoRoute** .

Smart 3D displays the proposed contiguous cable path for the cable as shown:

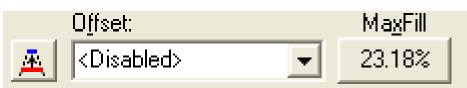


20. Click **Finish** to complete the cable path.

21. Select the cableway straight feature from the bottom cable tray, as shown:

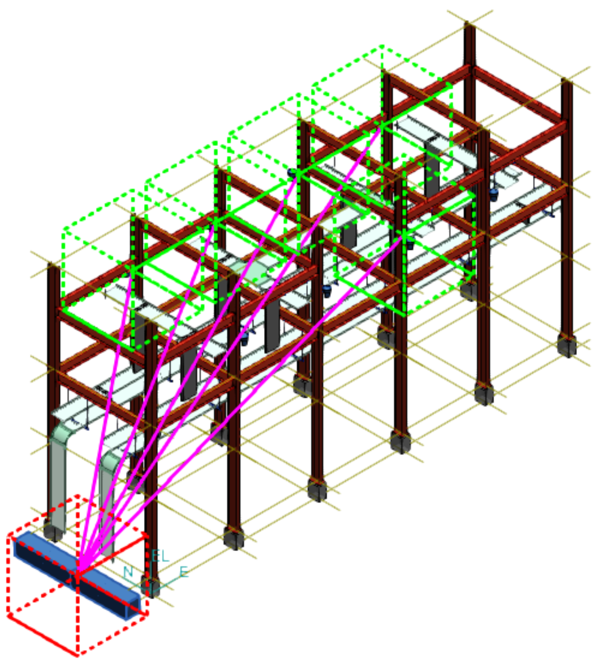


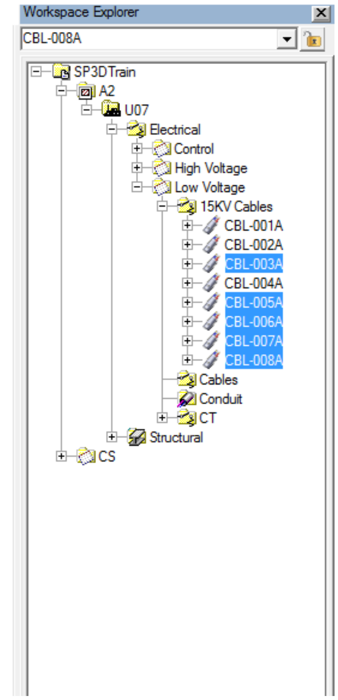
*The **Edit Cableway** ribbon shows **MaxFill** at 23.18%.*



22. Select **CBL-003A**, **CBL-005A**, **CBL-006A**, **CBL-007A**, and **CBL-008A** in the **Workspace Explorer**.

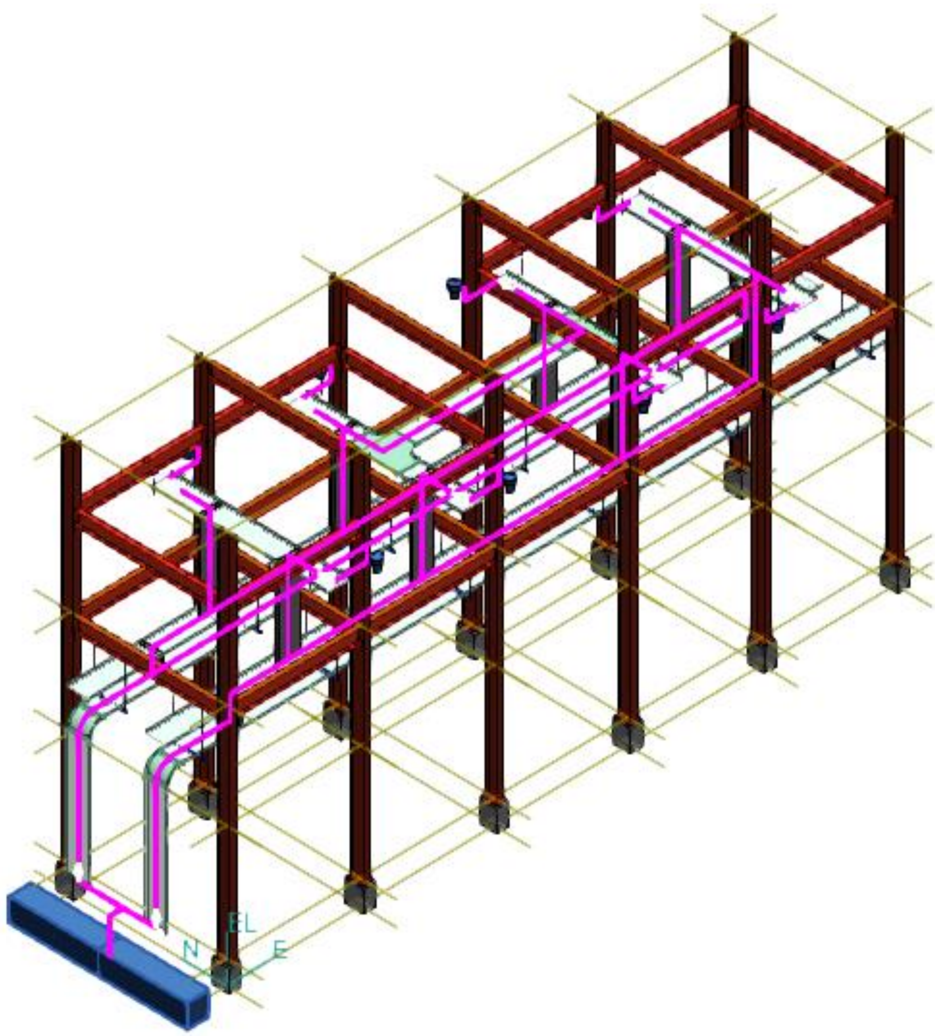
*The **Edit Cable path** ribbon displays, and Smart 3D the cables in the active view.*





23. Click **AutoRoute** to display the proposed continuous paths.

24. Click **Finish** to complete all cable paths.



For more information related to routing cables and cable properties,see *Routing Cables* and *CableProperties Dialog Box* in the *Electrical User's Guide*.

S E C T I O N 6

Manipulating Cableways

Objective

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

Manipulate a cableway in a model.

Before Starting this Procedure

- Smart 3D Overview
- Smart 3D Common Sessions
- *Electrical Overview* (on page 7)
- *Routing a Cableway* (on page 73)

Overview

Smart 3D provides commands to allow you to manipulate cableways, such as editing its properties. These commands require you to select cableways or features with **Select** . Different commands of manipulating a cableway or its feature in Smart 3D are mentioned below:

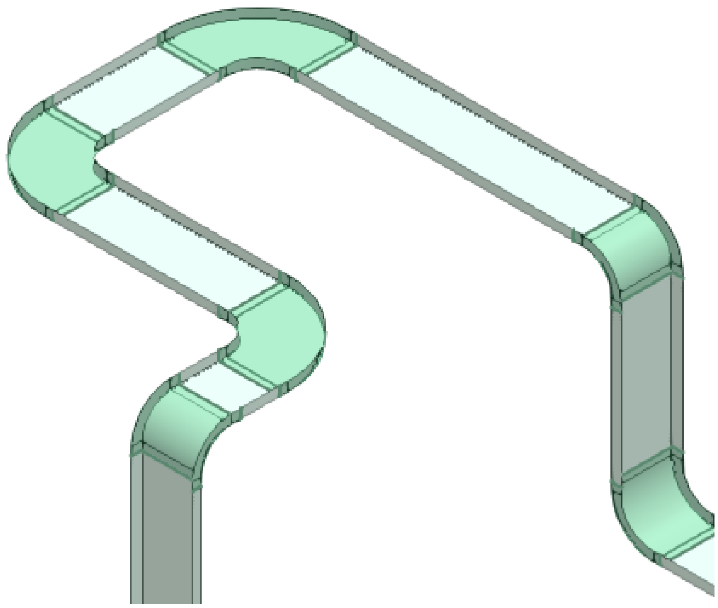
- Move a cableway - You can move the features of the cableway to alter the routing. You can precisely locate each feature in the layout of your cableway systems.
- Delete a cableway - Just as you place features in the model, you can delete features to remove unwanted parts. You cannot delete parts directly 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 editable properties.

NOTES

- You can use manipulating commands in Smart 3D on all features of a cableway, such as straight features, turn features, and end features.
- When you move features, you always move the part because the part's location is driven by the feature.

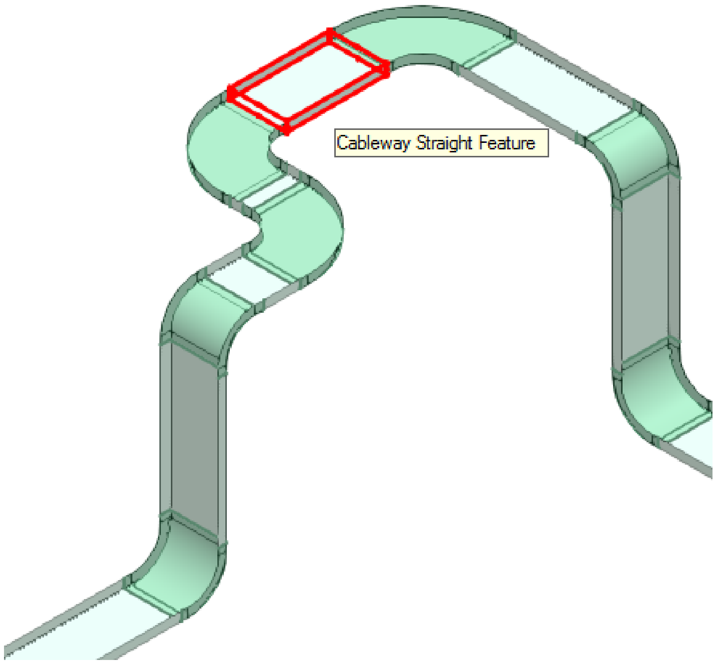
Moving a Cableway Straight Feature

Move a cableway straight feature 5 ft north with **PinPoint** in Unit **U04** of your workspace. The view of the cableway after moving the straight feature should look as shown:



1. Define your workspace to show Unit **U04** and coordinate system **U04 CS**.
2. Activate the **PinPoint** ribbon.
3. Set the **Locate Filter** to **Cableway Features** to select the cableway features in the graphic view that you need to move.
4. Click **Relative Tracking** .

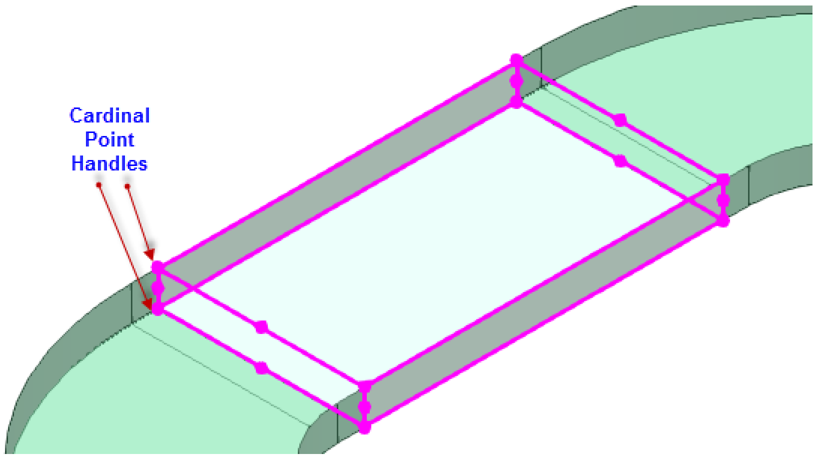
5. Select the cableway straight feature that you need to move.



NOTES

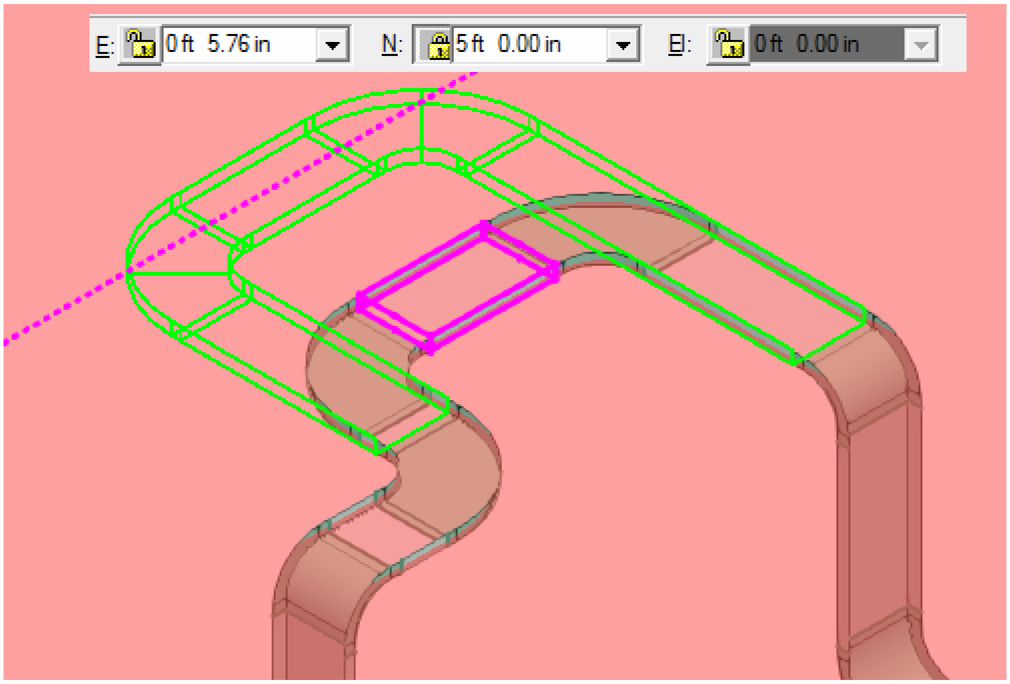
- When you move the cableway straight feature, the entire cableway leg to which the feature is connected moves.
- The move direction is always perpendicular to the axis of the cableway straight feature.

TIP When moving the cableway straight feature, you can select one of the cardinal point handles that appear at the end of the 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.



6. Click **Move To**.
7. On the **PinPoint** ribbon, set the North coordinate to **5 ft** to move the cableway feature.

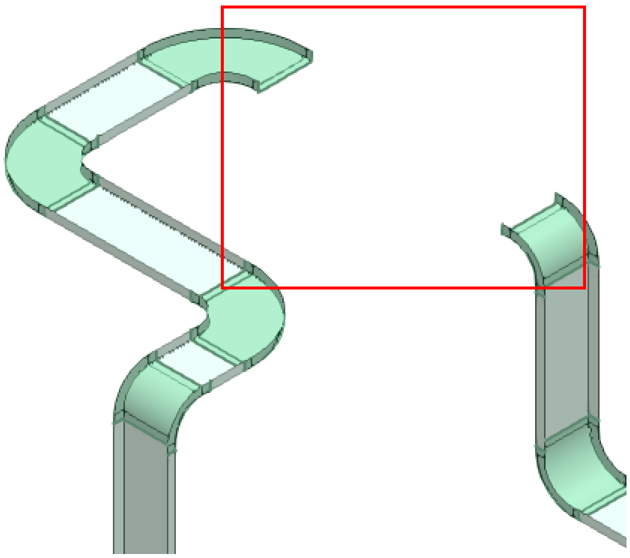
After specifying the coordinate points, the view of the cableway should look as shown:



8. Click the graphic view to accept the new cableway position, and right-click to cancel the command.

Deleting a Cableway Straight Feature

Delete a cableway straight feature from Unit **U04** of your workspace. The view of the cableway after deleting the cableway straight feature should appear as shown:

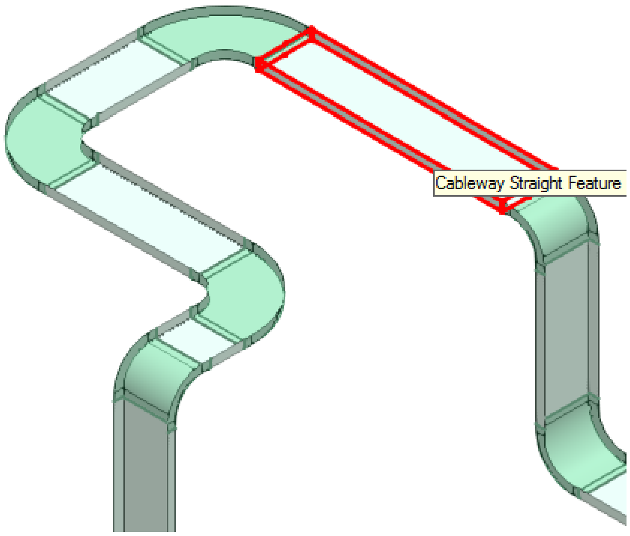


NOTES

- Deleting a straight feature does not remove connected turn features.
- Deleting 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 needs to 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. Set the **Locate Filter** to **Cableway Features** to select only cableway features in the graphic view that you need to delete.

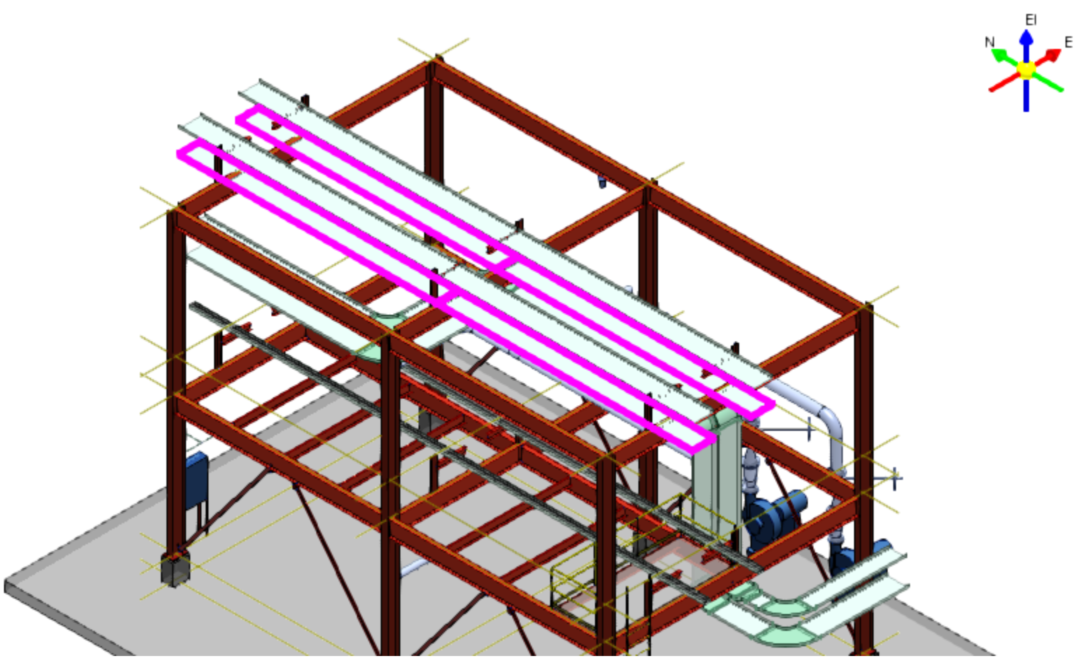
2. Select the cableway straight feature from the graphic view that you need to delete, as shown:



3. Click **Delete**  on the **Common** toolbar to delete the cableway straight feature.

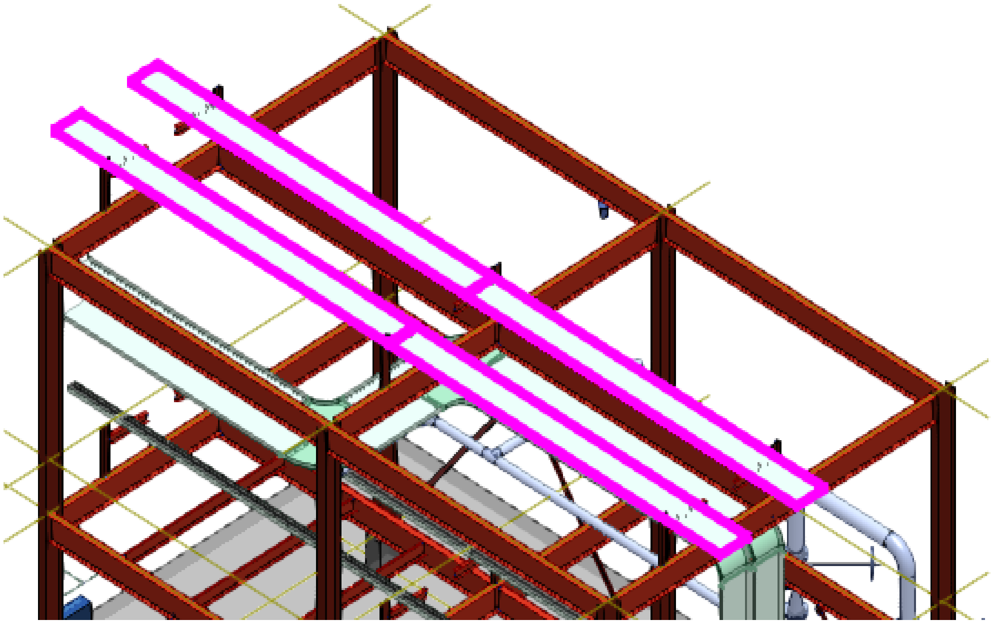
Copying and Pasting a Cableway

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 look as shown:

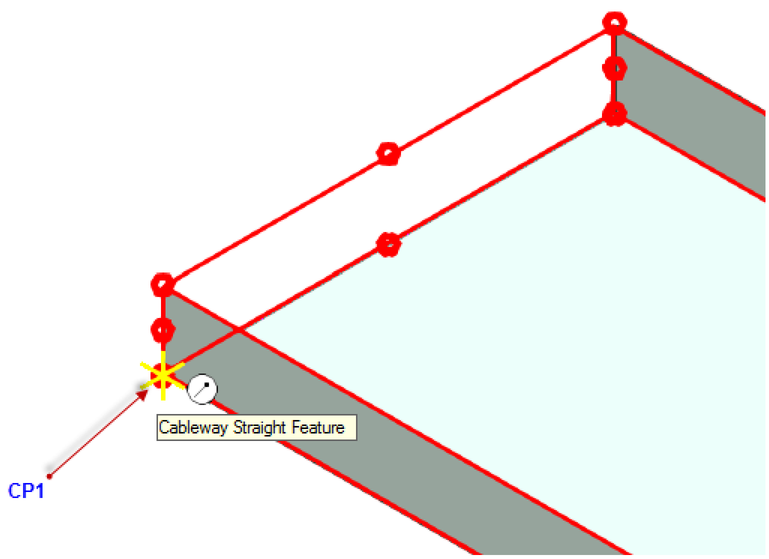


1. Define your workspace to show Unit **U01** and coordinate system **U01 CS**.

2. Set the **Locate Filter** to **Cableways** to select only cableways in the graphic view that you need to copy and paste.
3. Select the cableways from the graphic view that you need to copy, as shown:



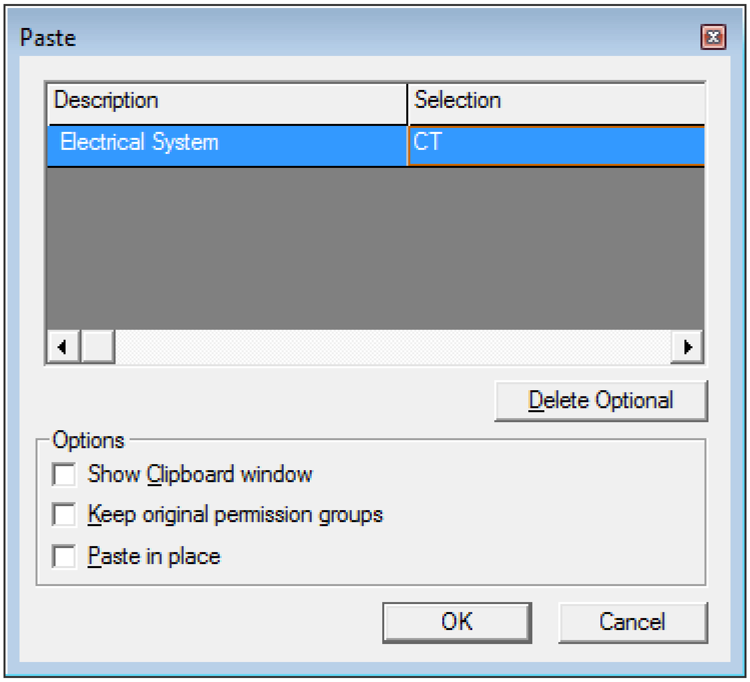
4. Click **Copy** on the **Common** toolbar.
5. Select the **CP1** cardinal point on the cableway to define from where to copy the cableways.



6. Click **Paste** on the **Common** toolbar.

   *The **Paste** dialog box displays.*

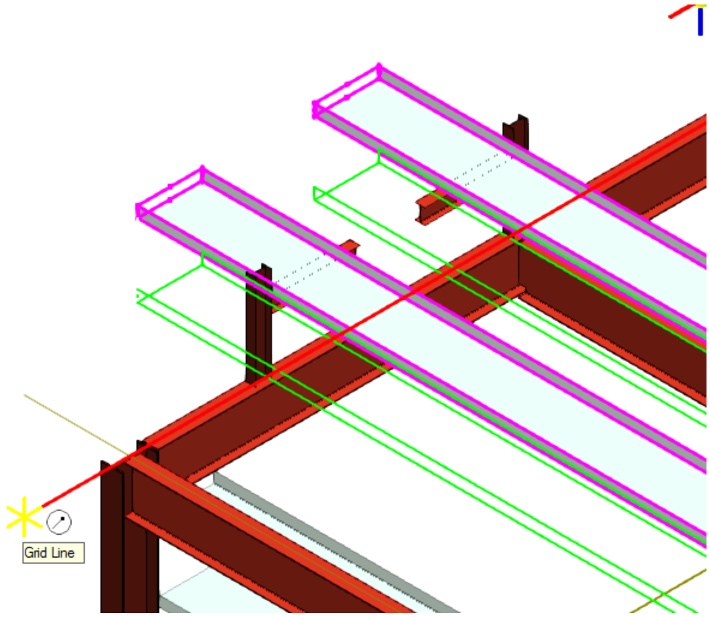
7. Keep the default parent system for the new objects to be pasted on the model, as shown below. Clear the **Paste in place** check box, and click **OK**.



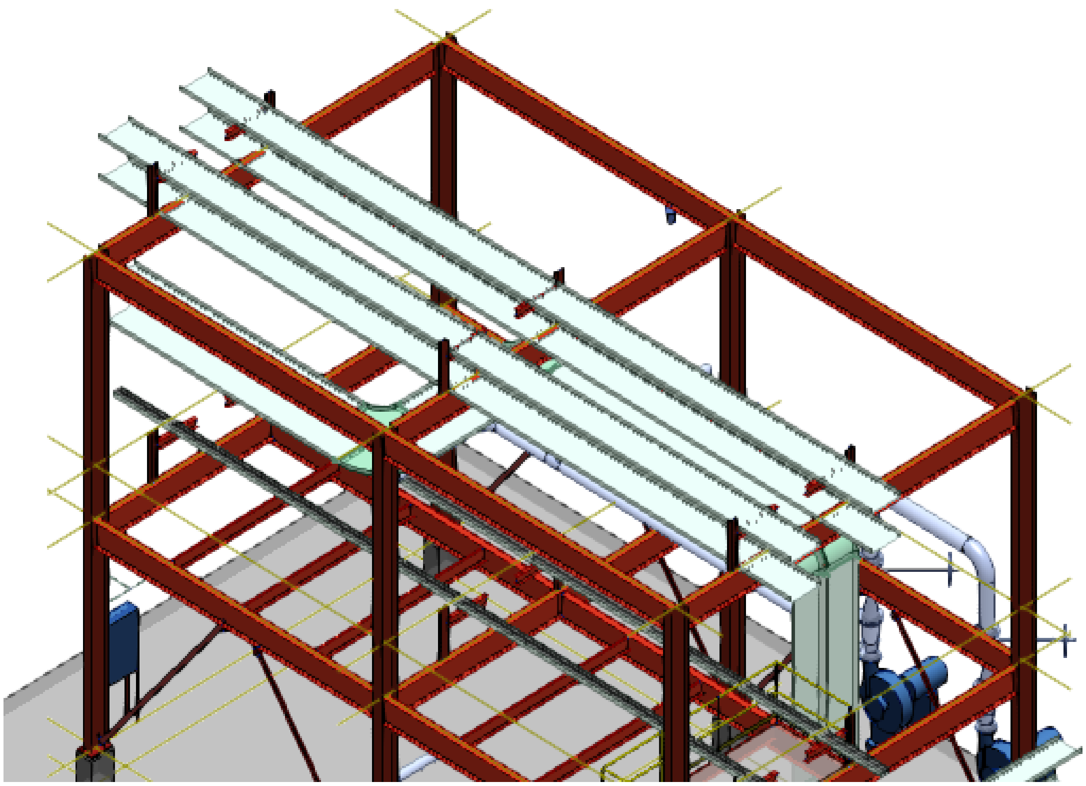
NOTES

- 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 offers the original objects as the defaults for the relationships that are created. In this example, Smart 3D 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.
- **Keep original permission groups** assigns 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 **Keep original permission groups** is not selected, all newly created objects are assigned to the Active Permission Group.
- **Paste in place** pastes 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.

8. Hover until the **Up** SmartSketch glyph displays, indicating you are aligned to the major Z axis. Click the middle mouse button to constrain the cursor movement along this axis. Then, position the cursor to identify the gridline to get the correct elevation coordinate.

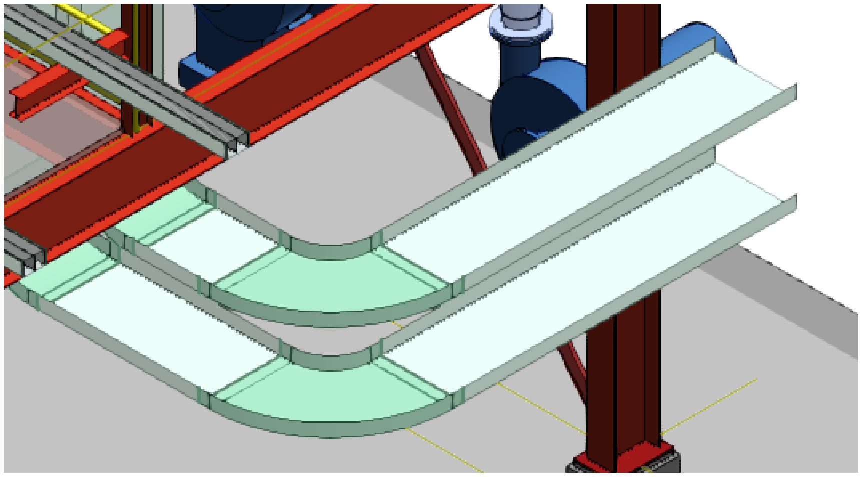


9. Click in the graphic view to place the copied cableways.

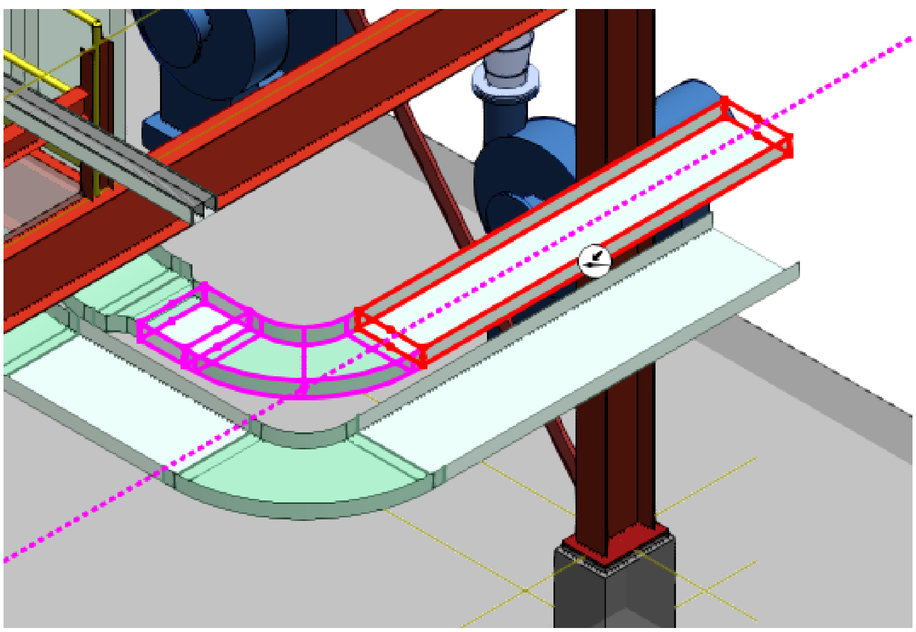


Changing the Tray Width

Edit the width of the selected cableway features from Unit **U01** of your workspace. The view of the cableway after editing the cableway features look as shown:



1. Set the **Locate Filter** to **Cableway Features** to select only the 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. You can also use **Fence Inside** to select the features.



NOTES

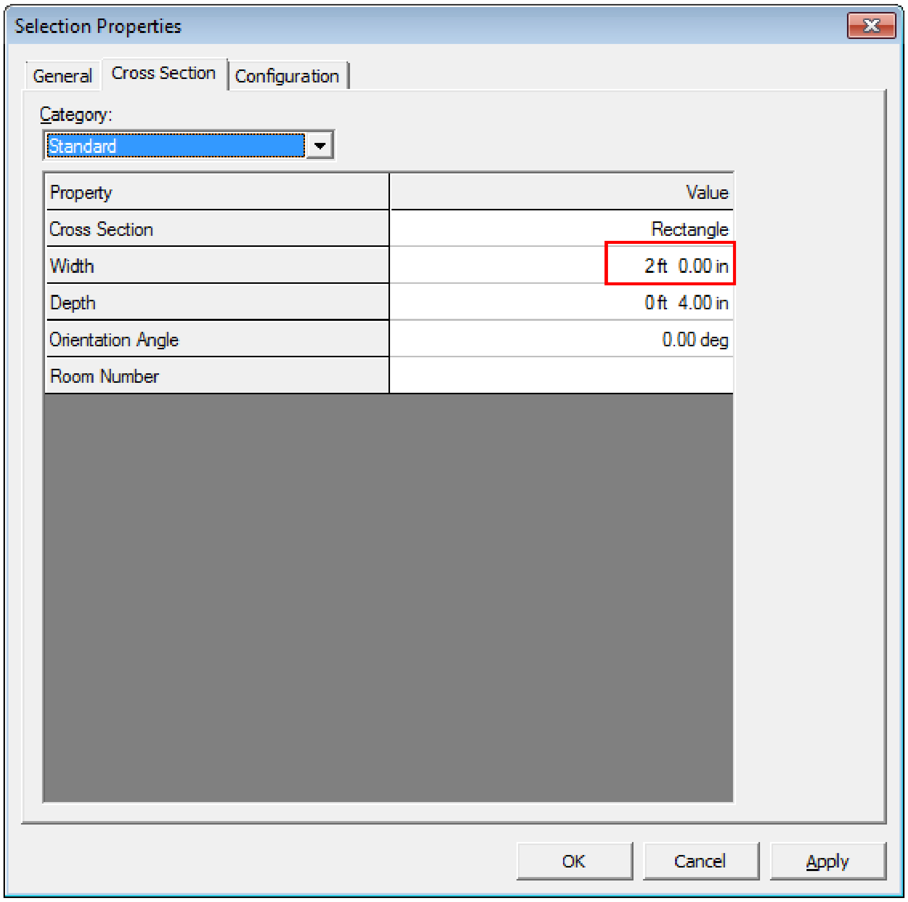
- When you use SHIFT to multi-select features, Smart 3D selects all the features along the path between the two selected features.

- Cable tray sizes can only be changed at the feature object.

3. Click **Properties** on the **Edit** ribbon.

   *The **Selection Properties** dialog box displays.*

4. Under **Cross Section**, set the **Width** to **2 ft**, and click **OK**.



For more information related to manipulating cableways, see *Moving Feature: An Overview*, *Deleting Feature: An Overview*, and *Editing Feature: An Overview* in the *Electrical User's Guide*.