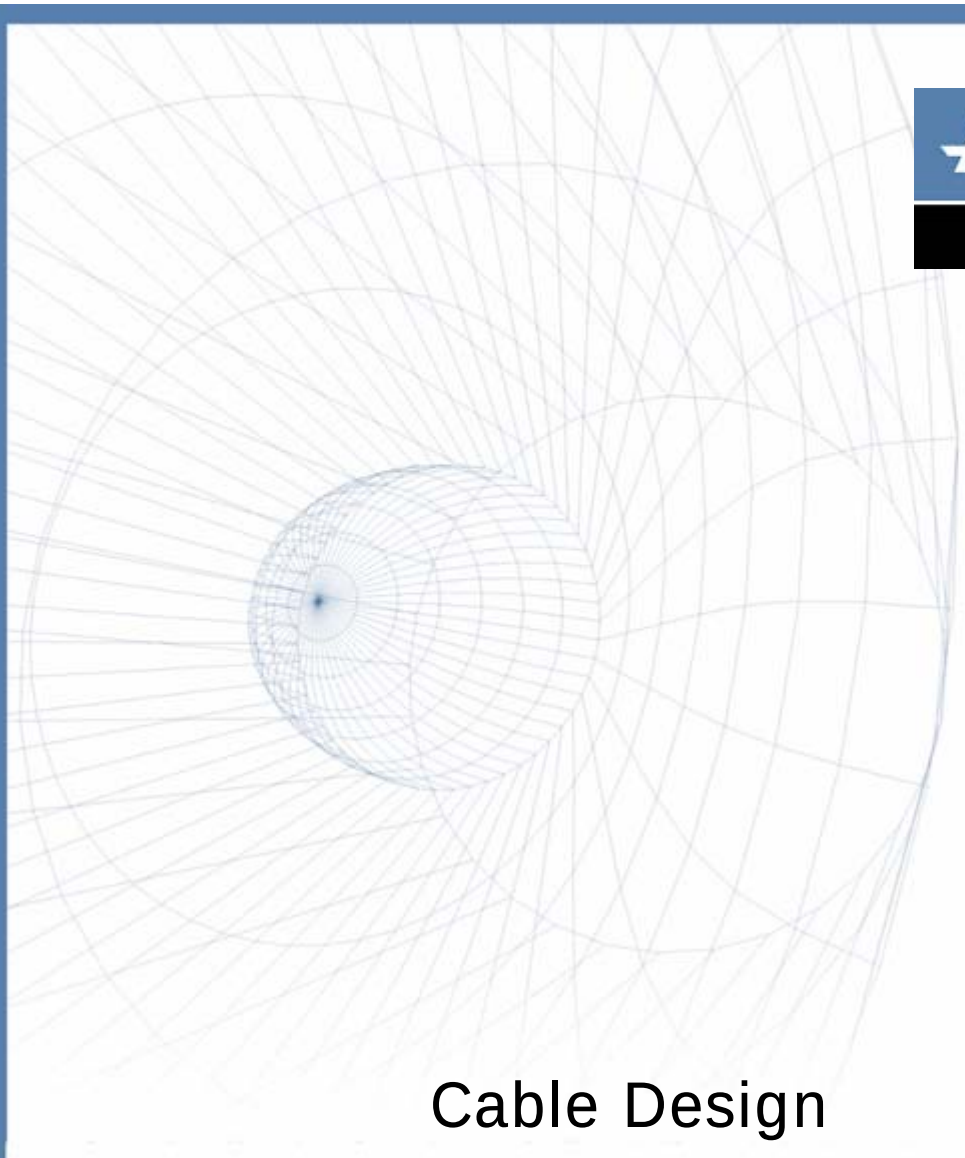

Cable Design

User Guide

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1 Introduction

1.1 About this User Guide

This document provides guidance to the design engineer on designing cables and their associated cable trays using the Cabling System application. It is assumed that the design engineer has an understanding of cable design practices and is familiar with the basic graphical user interface (GUI) features as described in the AVEVA document *Getting Started with OUTFITTING*.

1.2 Overview of the Cabling System Application

The Cabling System application allows you to create and route cables, and if required enclose the routed cables within cable trays.

The application can be divided broadly into three parts, namely, Cableways, Cables and Cable Tray Material. The design process is as follows:

- Cableways are created early in the 3D modelling process to reserve space in the model for the cables and cable trays.
- Cables are selected from the catalogue, optionally connected to equipment, before being joined to a cableway and routed along a cableway.
- Cable tray material is added to the cableways either automatically or manually. There is also an option to perform preliminary dressing of a cableway.

1.3 How the Guide is Organised

This guide is divided into chapters and an appendix, as follows:

Cableway Design	explains how cableways and cableway branches are created, modified and copied. Routing, splitting, merging and connecting cableway branches, and setting reference points on the branches, are also covered.
Cable Design	shows how to create, modify and route cables. Some useful cable utilities are also described.
Cable Tray Design	explains how cable tray material is added to cableway branches either automatically or manually.

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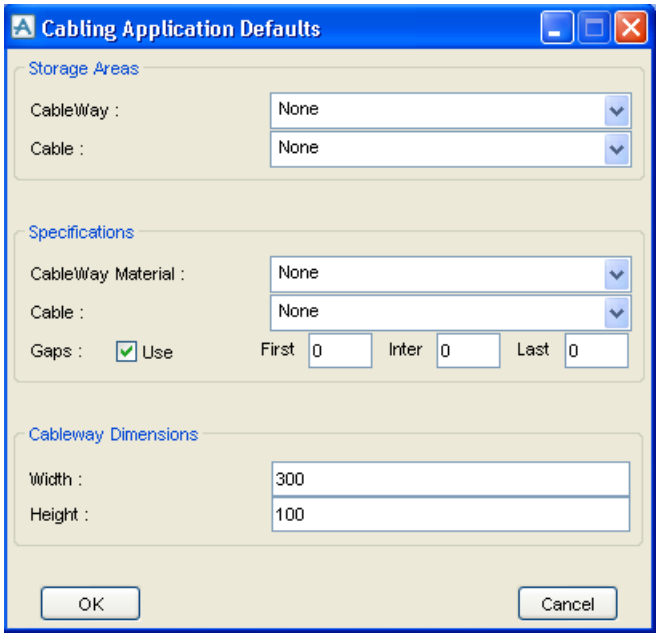
2 Cableway Design

Cableways reserve space for cabling systems in the 3D model. They can be created, modified, copied and deleted.

2.1 Starting the Application

To launch the Cabling System application select **Design > Cabling System.**

The **Cabling Application Defaults** form is displayed on entering the application.



This is where the user sets the default storage areas and the default specifications.

The defaults can be changed at anytime from the menu **Settings > Cabling Defaults** which displays the defaults form.

2.1.1 Cable Shortcut Toolbar

This toolbar, displayed in the main toolbar, allows the main Cabling forms to be accessed directly instead of following a menu path.

Selecting the icon displays a form to carry out the following task:

Create Cableway

Create Cableway Branch

Modify Cableway Branch

Create Cable

Modify Cable

Create Cableway Material

Modify Cableway Material

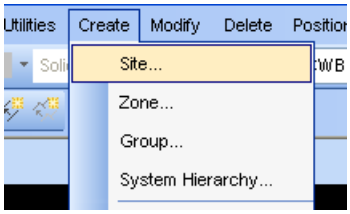
Copy Cable

Copy Cableway element

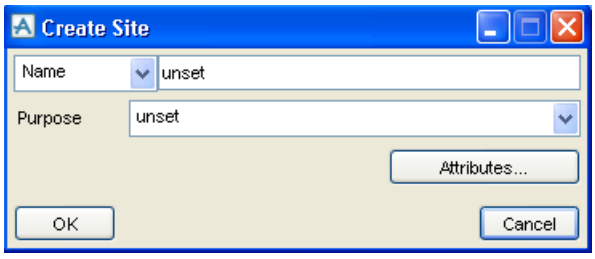
2.1.2 Creating a Site and a Zone

Creating a Site

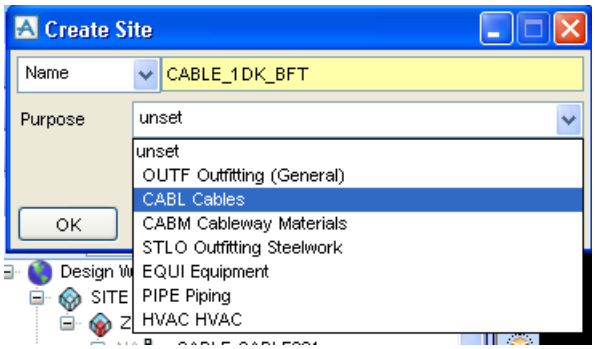
A Site is created for the cabling system by selecting **Create > Site** from the main menu.



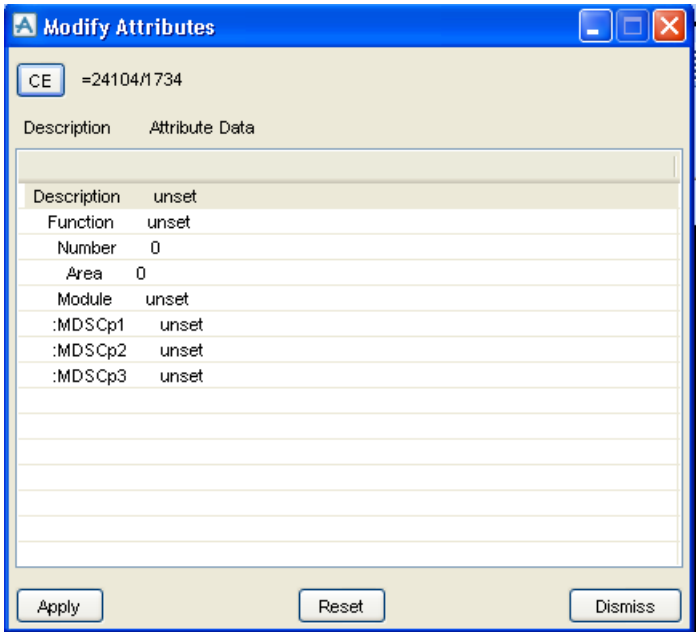
The **Create Site** form is displayed:



As appropriate **Name** for the Site is entered and the **Purpose** selected as **CABL Cables** from the drop-down list.



Selecting the **Attributes** button displays the **Modify Attributes** form allowing the attributes in the list to be modified.

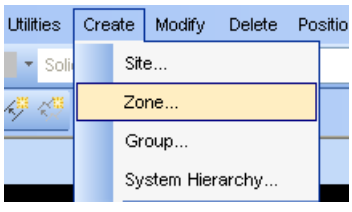


Clicking **OK** creates the Site, which is shown as an element in the Design hierarchy.

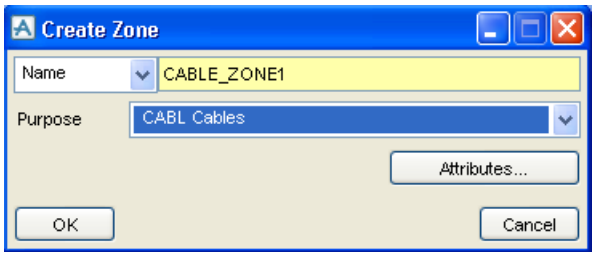
Creating a Zone

To create a Zone, **Create > Zone** is selected from the main menu.

Note: Multiple Zones can be contained within a single Site.



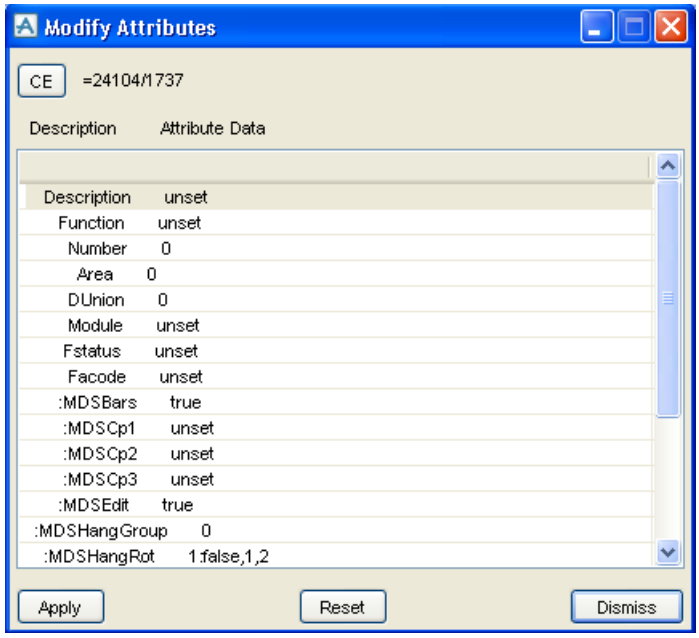
The **Create Zone** form is displayed:



An appropriate **Name** is entered for the Zone and the **Purpose** set to **CABL Cables**.

Selecting the **Attributes** button displays the **Modify Attributes** form allowing the attributes in the list to be modified.

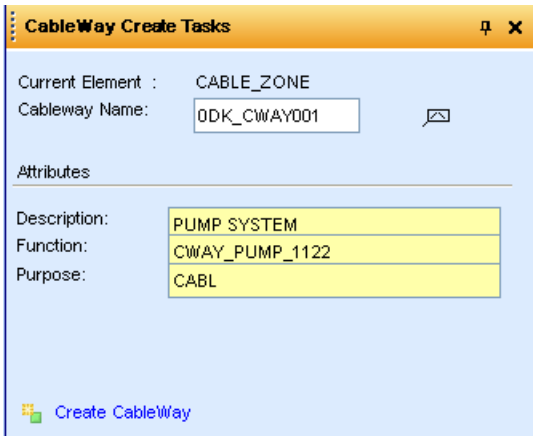
Clicking **OK** creates the Zone, which is shown as an element in the Design hierarchy.



2.2 Creating a Cableway

To create a cableway, either **Create > Cableway** is selected from the main menu or the **Create Cableway** icon is selected on the *Cable Shortcut Toolbar*.

The **CableWay Create Tasks** form is displayed:

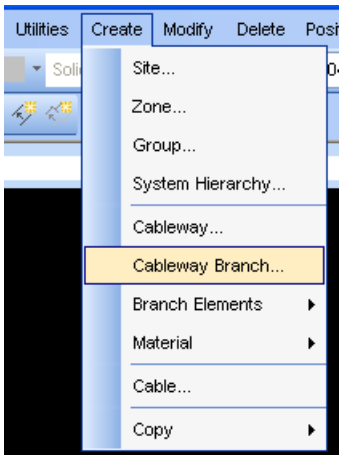


Current Element	Shows the current element selected.
Cableway Name	Enter an appropriate name or click the Autonaming icon to enter an automatically generated name.
Attributes	Enter appropriate attributes in the Description, Function and Purpose fields.
Create Cableway	Actions the creation of the cableway and displays the **CableWay Branch Create Tasks** form. Refer to *Creating and Routing a Cableway Branch*.

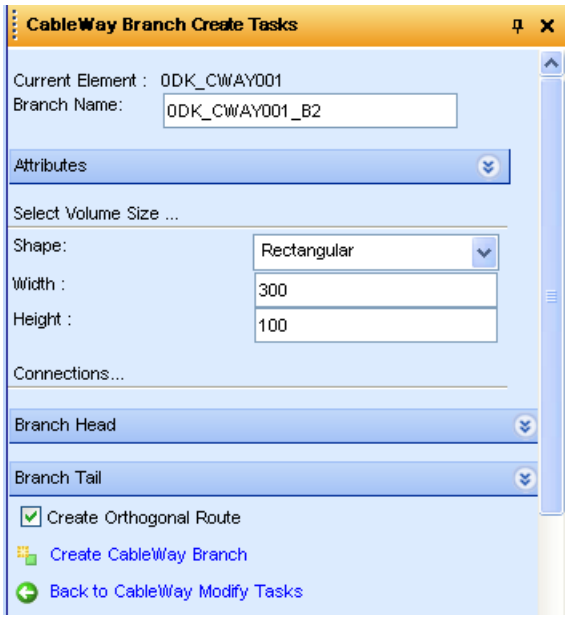
Note: The cableway is not initially visible in the 3D view.

2.3 Creating and Routing a Cableway Branch

A cableway branch is created and routed using the **CableWay Branch Create Tasks** form automatically displayed on creating a cableway. It can also be accessed by selecting the **Create Cableway Branch** icon on the *Cable Shortcut Toolbar* or by calling it from the **Create** menu by selecting **Create > Cableway Branch**.



The **CableWay Branch Create Tasks** form is displayed:



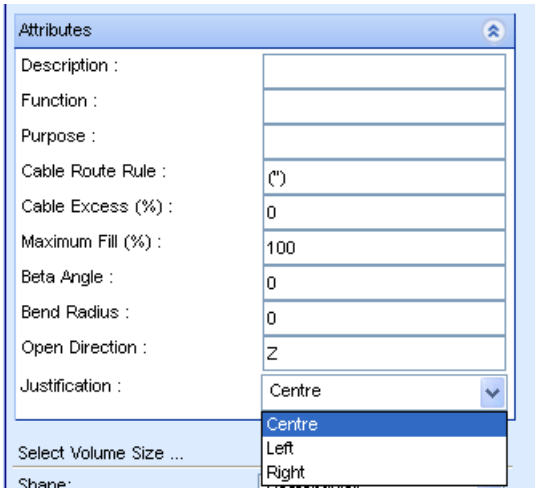
This form allows the user to create and automatically route a cableway branch.

Current Element Shows the current element name.

Branch Name Populated automatically based on the Cableway Name.

Attributes

Allows attributes to be entered.



Description Enter an appropriate Description

Function Enter an appropriate Function

Purpose Enter an appropriate Purpose

Cable Route Rule	Default set. Enter a different Cable Route Rule if required
Cable Excess (%)	Default set. Enter a different value if required
Maximum Fill (%)	Default set. Enter a different value if required
Beta Angle	Default set. Enter a different value if required
Bend Radius	Default set. Enter a different value if required
Open Direction	Default set. Enter a different direction if required
Justification	Select from a drop-down list of options

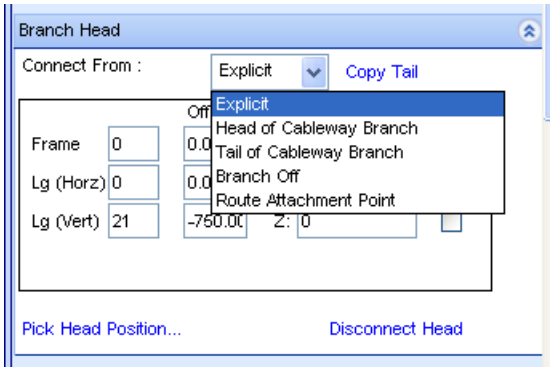
Select Volume Size

Allows the cableway volume to be set.

Shape	Rectangular and Circular options available
Width	Default value set
Height	Default value set

Branch Head

Allows the Head (start position) of the Cableway Branch to be set.



Connect From	Drop-down list of five options:
Explicit	Allows the Branch Head position to be picked with the cursor.
Head of CW Branch	Branch Head positioned at the Head of a selected Cableway Branch.
Tail of CW Branch	Branch Head positioned at the Tail of a selected Cableway Branch.
Branch Off	Branch Head positioned at a selected point on an existing Cableway Branch.
Route Attachment Point	Branch Head positioned at a selected route attachment point.

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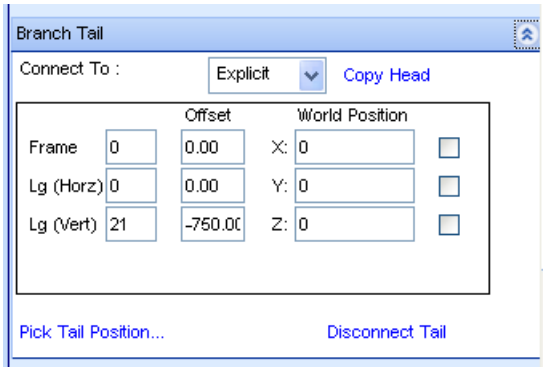
Copy Tail	Copies the Head position for the Tail, so that the Tail can be positioned by entering offset values for any of the three axes of the co-ordinate system. 'Lock' boxes to the right of **World Position**, can be used to stop the Cableway Branch moving on a particular axis.
Co-ordinate Frame	Allows values to be entered for **Offset** and **World Position** to define the Branch Head position. 'Lock' boxes can be used to lock a particular axis.
Pick Head Position	Select to pick the Branch Head position in the 3D view.
Disconnect Head	Disconnects the Branch Head from the Cableway Branch.

Branch Tail

Allows the Tail (end position) of the Cableway Branch to be set.

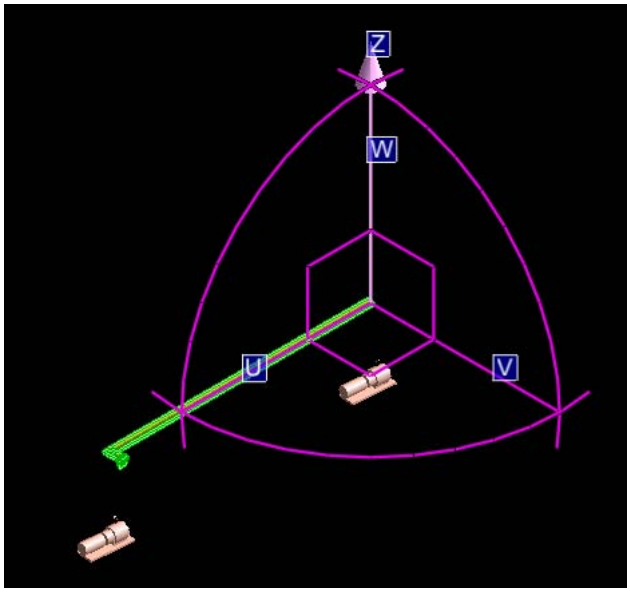


Connect From	Drop-down list of four options:	
	Explicit	Allows the Branch Head position to be picked with the cursor.
	Head of CW Branch	Branch Head positioned at the Head of a selected Cableway Branch.
	Tail of CW Branch	Branch Head positioned at the Tail of a selected Cableway Branch.
	Branch Off	Branch Head positioned at a selected point on an existing Cableway Branch.
Copy Head	Copies the Tail position for the Head so that the Head can be positioned by entering offset values for any of the three axes of the co-ordinate system. 'Lock' boxes to the right of **World Position**, can be used to stop the Cableway Branch moving on a particular axis.	
Co-ordinate Frame	Allows values to be entered for **Offset** and **World Position** to define the Branch Head position. 'Lock' boxes can be used to lock a particular axis.	

Pick Tail Position	Select to pick the Branch Tail position in the 3D view.
Disconnect Tail	Disconnects the Branch Tail from the Cableway Branch.
Create Orthogonal Route	Checking the box constrains the created route to an orthogonal configuration.
Create CableWay Branch	Actions the creation of the Cableway Branch and displays the *Branch Tasks* form.
Back to CableWay Modify Tasks	Displays the **CableWay Modify Tasks** form. Refer to *Modifying a Cableway*.

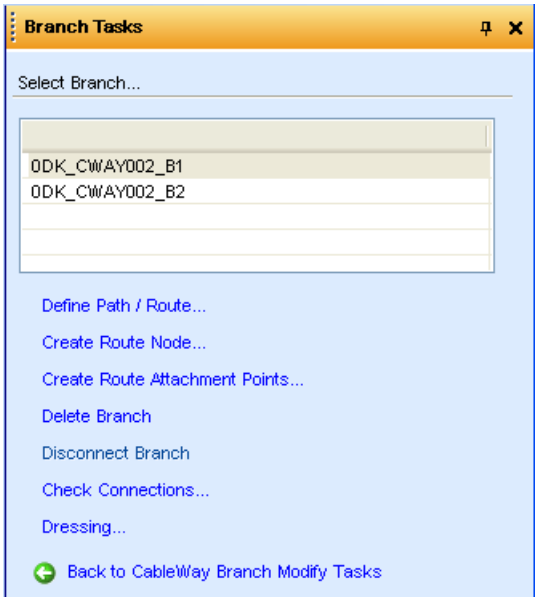
On clicking the **Create CableWay Branch** link, the created Cableway Branch is shown in the 3D view automatically routed along an orthogonal path connecting the Head and Tail positions. The **Branch Tasks** form is displayed automatically.

Note: Moving the Cableway Branch a specified distance in a particular direction can be done by entering the required co-ordinate values and using the 'Lock' boxes on the **CableWay Branch Create Tasks** form before creating the Branch. Alternatively, if the Cableway Branch has been created, the user can select the Branch and move it into the desired position using the Model Editor.



2.3.1 Branch Tasks

Branch Tasks such as defining the path/routing, route node creation, route attachment point creation, and branch deletion can be actioned using the **Branch Tasks** form. This form is displayed automatically on clicking the **Create CableWay Branch** link on the **CableWay Branch Create Tasks** form.



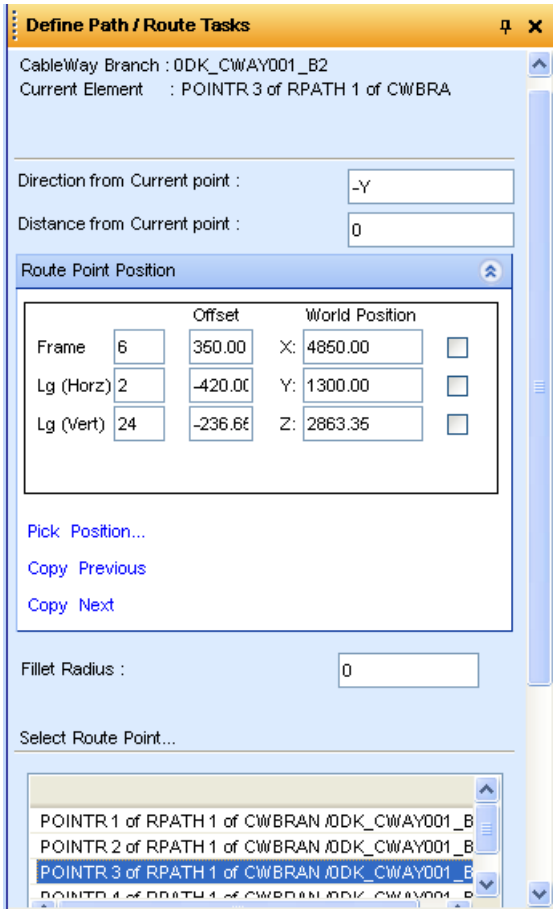
Select Branch	Select the Branch upon which the task(s) are to be actioned.
Define Path/Route	Displays the **Define Path/Route Tasks** form allowing the user to create and position route points (refer to *Defining the Path/Route*).
Create Route Node	Displays the **Route Node Create Tasks** form allowing the user to create and position route nodes (refer to *Creating a Route Node*).
Create Route Attachment Points	Displays the **Route Attachment Points Create Tasks** form allowing the user to create and position route attachment points (refer to *Creating Route Attachment Points*).
Delete Branch	Displays a **Confirm** message box before deleting the branch.
Disconnect Branch	Allows a selected branch to be disconnected from the connection points.
Check Connections	Displays the **Cableway Branch Connections** form. Refer to *Checking Branch Connections*.
Dressing	Displays the **Create Material** form. Refer to *Creating Cableway Branch Material*.
Back to CableWay Branch Modify Tasks	Displays the **CableWay Branch Modify Tasks** form. Refer to *Modifying a Cableway Branch*.

2.3.2 Defining the Path/Route

The **Define Path/Route** Tasks allow route points to be created and positioned on a cableway branch.

A route point is a reference point inserted at a defined position on the cableway branch and provides a reference for routing the branch and for adding cable tray material.

Selecting the branch for path/route definition and either selecting **Create > Branch Elements > Route Point** from the main menu or clicking the **Define Path/Route** link on the **Branch Tasks** form, displays the **Define Path/Route Tasks** form.



This form allows the user to create and position a route point on a selected cableway branch.

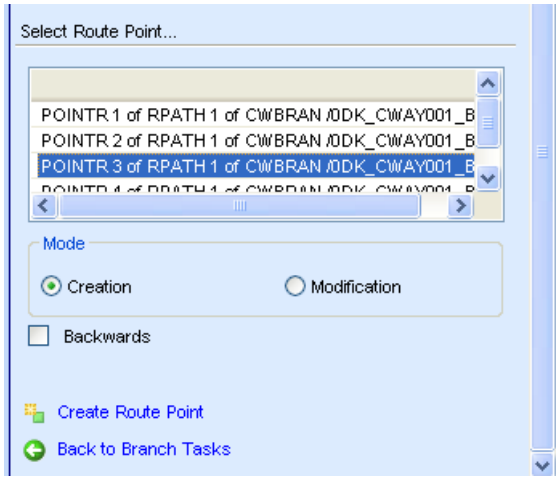
Cableway Branch	Shows the name of the selected cableway branch.
Current Element	Shows the selected route point.
Direction from Current Point	Shows the direction from the selected route point to the point's original position.
Distance from Current Point	Shows the distance from the current route point.

Route Point Position

Allows values to be entered to define the route point position.

Frame	Enter values for **Offset** and **World Position**.
Lg (Horz)	Enter values for **Offset** and **World Position**.
Lg (Vert)	Enter values for **Offset** and **World Position**.
Pick Position	Allows position of a route point on the cableway branch to be picked in the 3D view.
Copy Previous	Copies the position of the previous route point.
Copy Next	Copies the position of the next route point.

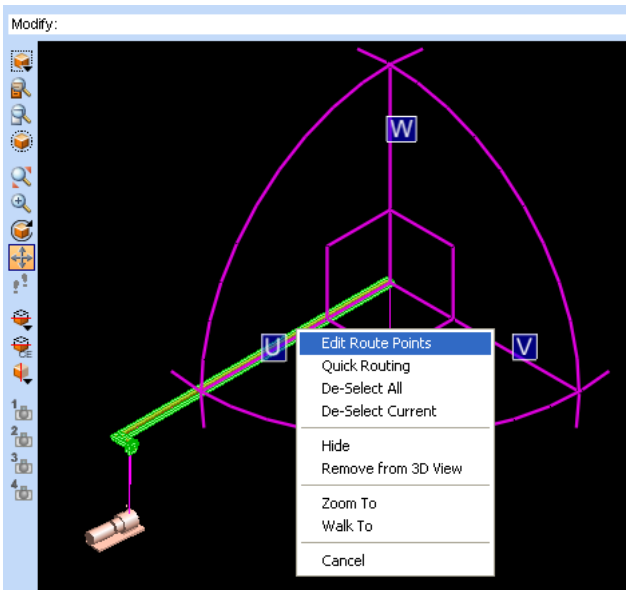
Fillet Radius	Sets the radius of curvature which will replace a right-angled bend with a curve.
Select Route Point	Shows a list of created route points. Selecting a particular route point from the list displays the position of the point in the 3D view.



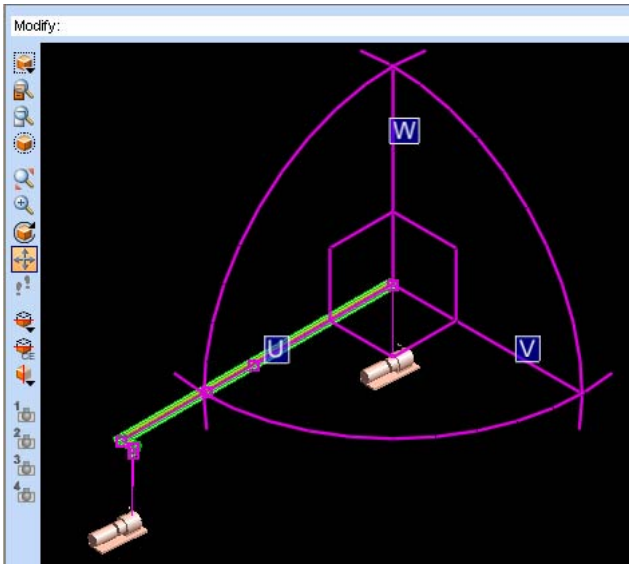
Mode	Option buttons for selecting **Creation** or **Modification** mode.
Backwards	Selecting the checkbox reverses the order of route points on the cableway branch and reorders the **Select Route Point** list.
Create Route Point	Actions the creation of the route point, adding the point to the **Select Route Point** list and showing its position in the 3D view by X Y Z labels.
Back to Branch Tasks	Displays the *Branch Tasks* form.

2.3.3 Manual Routing

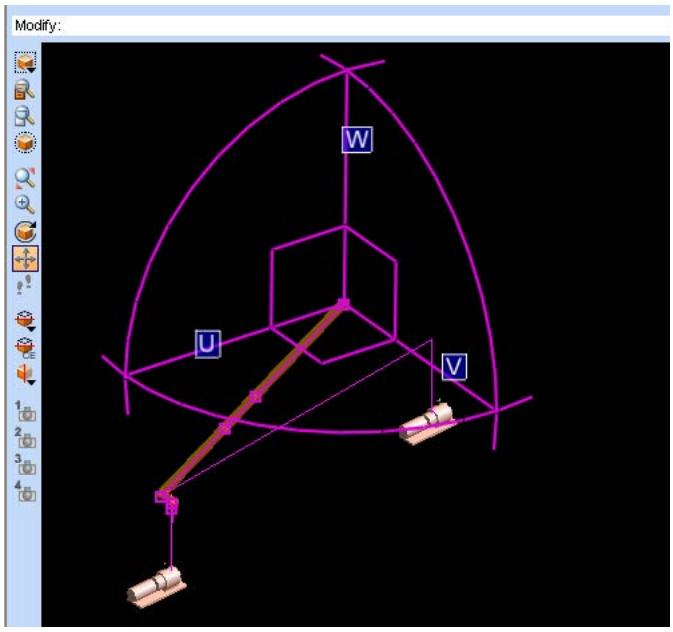
The route of a cableway branch can be altered by using the Model Editor to manipulate the route points.



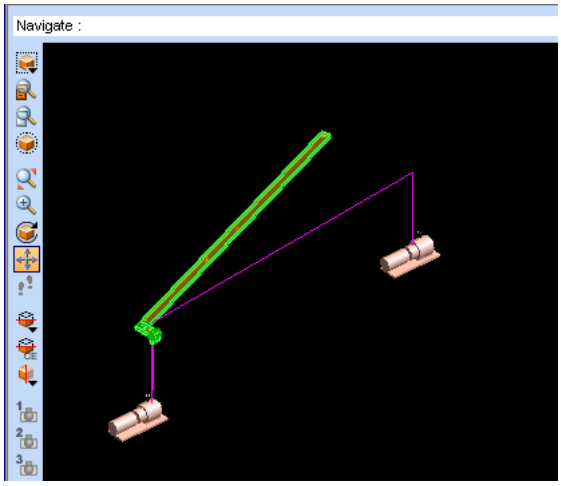
The Model Editor right-click menu has an **Edit Route Points** option which can be used to position the route points on the cableway branch.



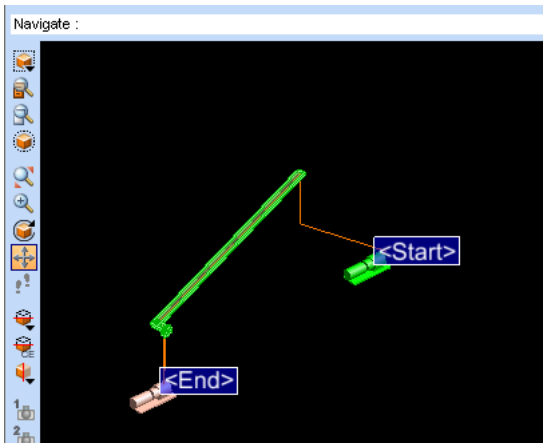
By picking a route point, the user can move the point to a new position using the Model Editor.



The cableway branch moves to the new position.



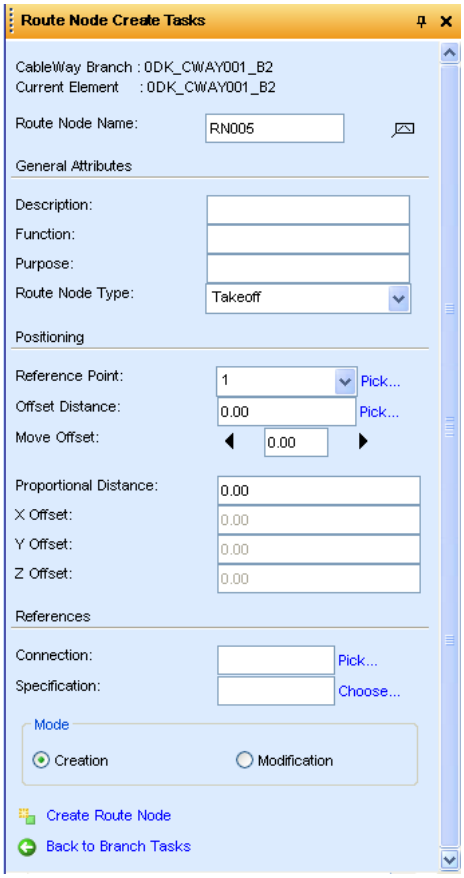
Any cables held within the cableway branch can be re-routed by using the **Auto Routing Options** on the **Modify Cable** form. See *Automatic Routing*.



2.3.4 Creating a Route Node

A route node is a multi-purpose reference point created on the cableway branch, and facilities the implementation of various activities such as material takeoff, offsetting, penetration and reporting.

The **Route Node Create Tasks** form is displayed either by selecting the **Create Route Node** link on the **Branch Tasks** form or calling it from the main menu by selecting **Create > Branch Elements > Route Node**.



This form allows the user to create and position a route node on a selected cableway branch.

Cableway Branch Shows the selected Cableway Branch name.

Current Element Shows the current element name.

Route Node Name Enter an appropriate name or select the **Autonaming** icon to enter an automatically generated name, e.g. RN005.

General Attributes

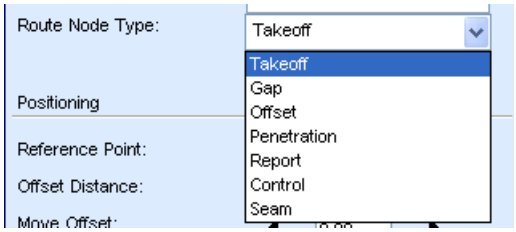
Allows attributes to be entered.

Description Enter an appropriate Description.

Function Enter an appropriate Function.

Purpose Enter an appropriate Purpose.

Route Node Type Select route node type from the drop-down list of options.



Positioning

Allows the position of the route node to be set.

Reference Point Allows a Reference Point to be set from the drop-down list or selected using the **Pick** facility.

Offset Distance Enter an offset distance or use the **Pick** facility. If the Reference Point has been picked, then this field will have been populated automatically.

Move Offset Enter a value in the box and use the right or left arrow to respectively increase or decrease the **Offset Distance** by that value.

Proportional Distance Enter a Proportional distance.

X Offset Enter an X axis offset.

Y Offset Enter a Y axis offset.

Z Offset Enter a Z axis offset.

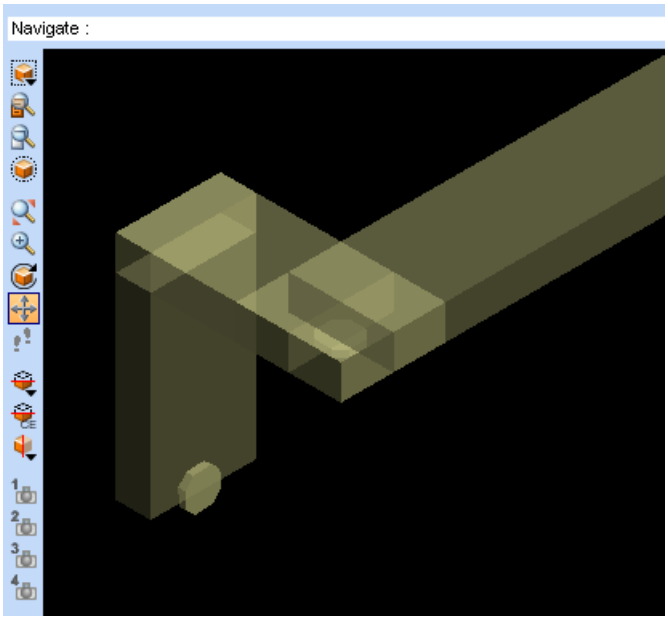
References

Connection Enter a reference or use the **Pick** facility.

Specification Enter a specification or select **Choose** to display the **Choose Route Node** form, from which a specification can be selected.

Mode	Select either the **Creation** or **Modification** button.
Create Route Node	Actions the creation of the route node.
Back to Branch Tasks	Displays the *Branch Tasks* form.

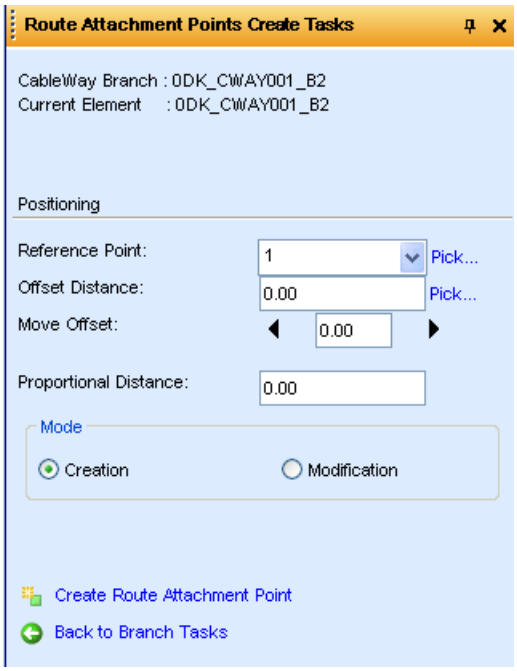
On clicking the **Create Route Node** link, the position of the created routed node on the cableway branch is shown in the 3D view. The **Route Node Create Tasks** form resets, clearing all entries so that more route nodes can be created.



2.3.5 Creating Route Attachment Points

A routing connection attachment point (RATTA) is a reference point which is used to create a connection on the cableway at a position different from the Routing Branch Head or Routing Branch Tail. This allows cables to join the cableway at this point when performing cable routing tasks.

The **Route Attachment Points Create Tasks** form is displayed either by selecting the **Create Route Attachment Points** link on the **Branch Tasks** form or selecting **Create > Branch Elements > Route Attachment Point** from the main menu. When the form displays, a <RATTA> label is shown in the 3D view. The label can be repositioned by selecting a reference point from the drop-down list.



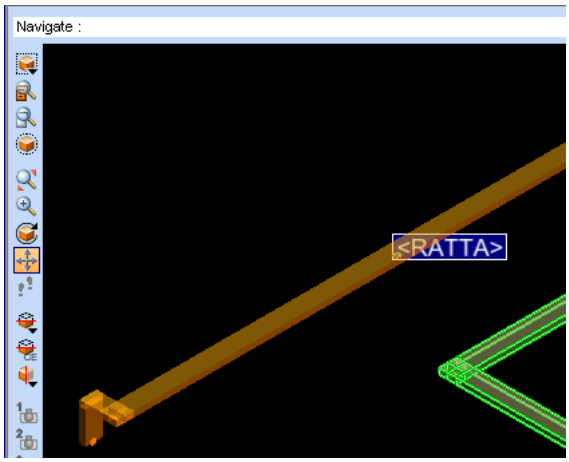
Cableway Branch	Shows the selected Cableway Branch name.
Current Element	Shows the current element name.

Positioning

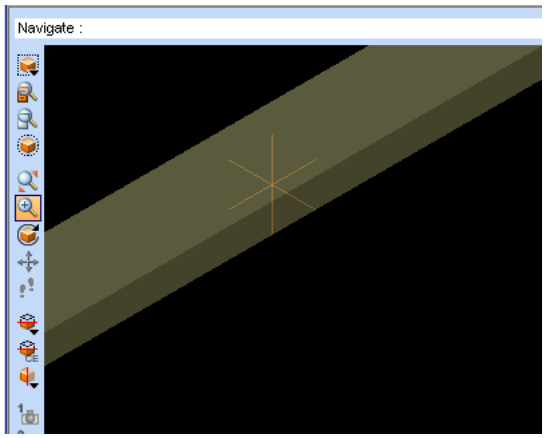
Allows the position of a route attachment point to be set.

Reference Point	Allows the user to select a reference point or to use the **Pick** facility to pick on a branch in the 3D view to set the reference point.
Offset Distance	Populated by picking the reference point above or the offset distance can be picked separately using the **Pick** facility.
Move Offset	Enter a value in the box and use the right or left arrow to respectively increase or decrease the **Offset Distance** by that value.
Proportional Distance	Enter a Proportional distance.

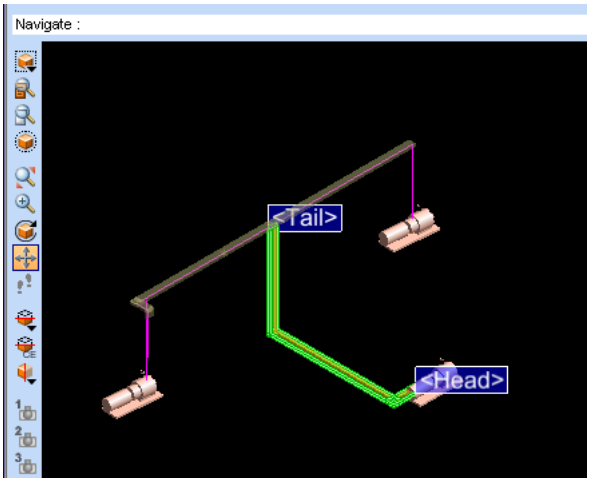
Mode	Select either the **Creation** or **Modification** button.
Create Route Attachment Point	Actions the creation of a route attachment point and resets the form so that more route attachment points can be created.
Back to Branch Tasks	Displays the *Branch Tasks* form.



On clicking the **Create Route Attachment Point** link, the created attachment point is shown in the 3D view by a set of axes.



A cableway branch can be created and connected to another branch at the attachment point.



2.3.6 Deleting a Branch

The cableway branch to be deleted is selected and the **Delete Branch** link clicked on the *Branch Tasks* form.

A **Confirm** message box is displayed requesting the user to confirm that the designated cableway branch is to be deleted. Selecting the **YES** option deletes the branch. If the cableway branch contains cables, then the displayed message informs the user that there are cables routed on the cableway. A branch can also be deleted using the main menu options **Delete > CE** or **Delete > Member > Selection**.

Note: When deleting a branch, any cables routed on the branch will have their status changed to “un-routed”.

2.3.7 Disconnecting a Branch

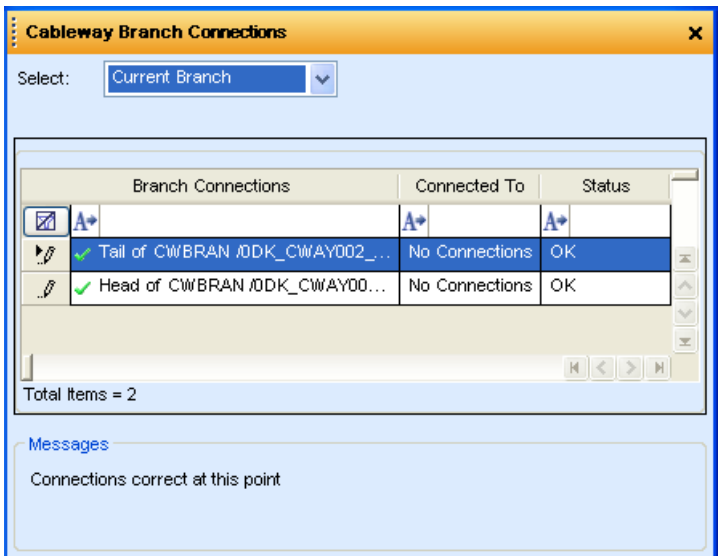
The cableway branch to be disconnected from its connection points is selected and the **Disconnect Branch** link clicked on the *Branch Tasks* form.

Note: Disconnecting cableway branches means that cables will not be routed between the two branches.

2.3.8 Checking Branch Connections

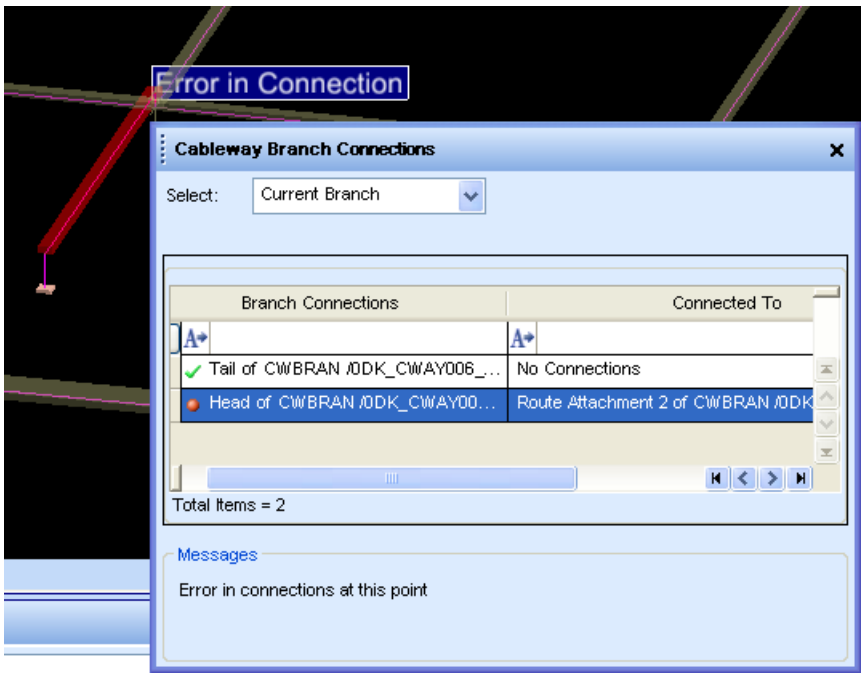
This utility allows the user to check cableway branch connections by using the **Cableway Branch Connections** form, which is accessed either by selecting the **Check Connections** link on the **Branch Tasks** form or from the main menu by selecting **Utilities > Check Branch Connections**.

If no connection errors are found, green ticks will be displayed in the **Cableway Branch Connections** form. A message **Connections correct at this point** is also displayed on the form.



Select	Select from a drop-down list of four options: Current Branch Current Cableway Current Zone Current Site
Branch Connections	Lists the branch connections for the selected option.
Connected To	Shows whether a branch connection is connected to another branch.
Status	Shows the status of the connection as either OK or Error.
Messages	Displays a message informing the user whether or not the connections are correct at this point in the modelling process.

If connection errors are found, red balls will be displayed in the **Cableway Branch Connection** form. A message **Error in connections at this point** is also displayed on the form. The connection errors will also be highlighted in red in the 3D view.

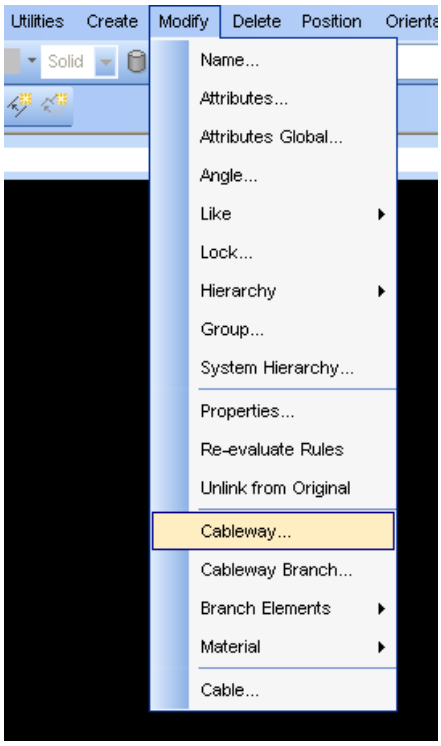


2.3.9 Dressing a Branch with Material

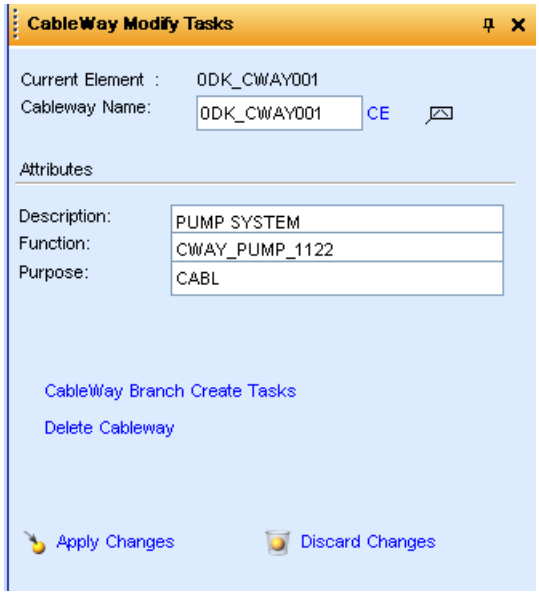
Selecting the **Dressing** link on the *Branch Tasks* form displays the **Create Material** form, which allows the user to add cable tray material to a selected branch. For details of the **Create Material** form and how it is used, refer to *Creating Cableway Branch Material*.

2.4 Modifying a Cableway

Cableway modifications are carried out using the **CableWay Modify Tasks** form accessed either from the link on the **CableWay Branch Create Tasks** form, or called from the main menu by selecting **Modify > Cableway**.



The **CableWay Modify Tasks** form displays with the fields populated, allowing the user to make the required modifications.

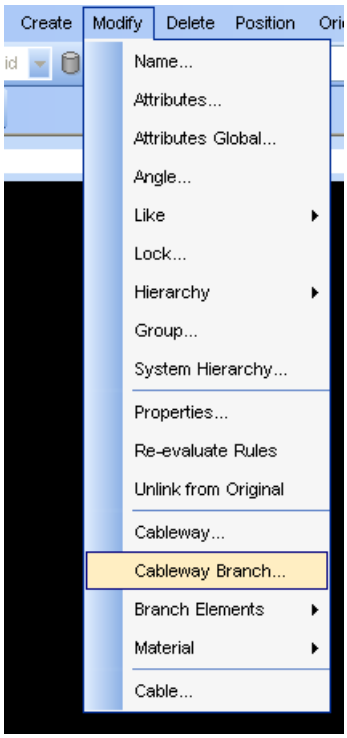


Cableway Branch Create Tasks	Displays the **Cableway Branch Create Tasks** form.
Delete Cableway	Displays a **Confirm** message box. Selecting the **YES** option deletes the cableway.
Apply Changes	Applies the selected modifications.
Discard Changes	Cancels the selected modifications.

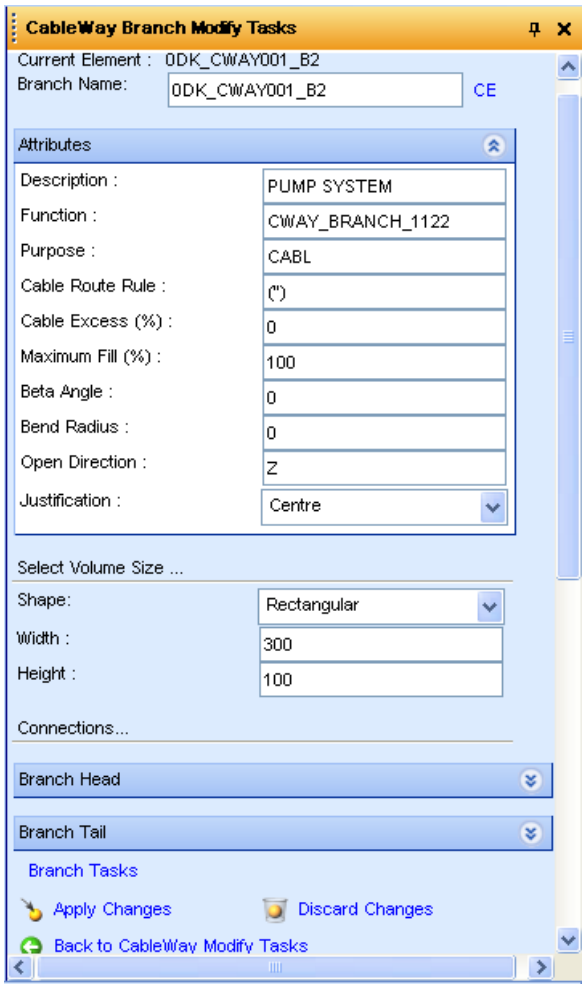
2.5 Modifying a Cableway Branch

Cableway branch modification can be carried out using the **CableWay Branch Modify Tasks** form, which can be accessed in the following ways:

- from the link on the **Branch Tasks** form
- by selecting the **Modify Cableway Branch** icon on the *Cable Shortcut Toolbar*.
- and by calling from the main menu by selecting **Modify > Cableway Branch**.



The **CableWay Branch Modify Tasks** form displays with the fields populated, allowing the user to make the required modifications.

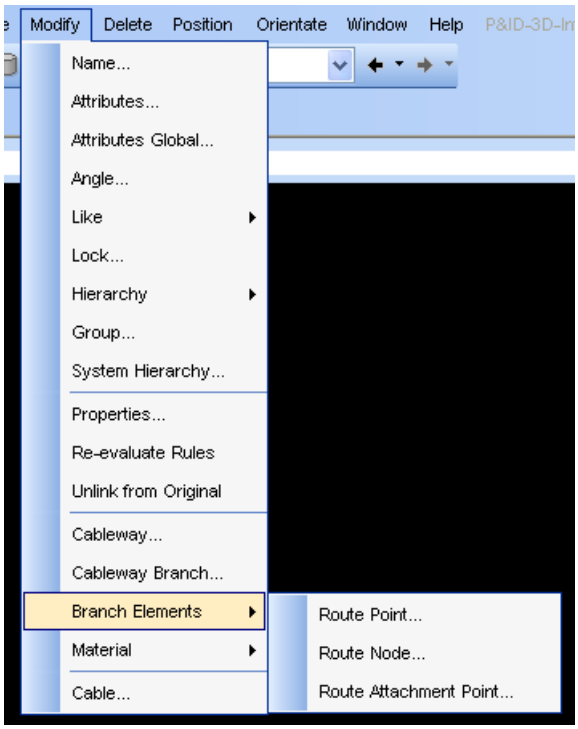


Note: The fields on the **Modify** form are the same as those shown on the **CableWay Branch Create Tasks** form. Refer to *Creating and Routing a Cableway Branch*.

Branch Tasks	Displays the **Branch Tasks** form.
Apply Changes	Applies the selected modifications.
Discard Changes	Cancels the selected modifications.
Back to Cableway Modify Tasks	Displays the **Cableway Modify Tasks** form.

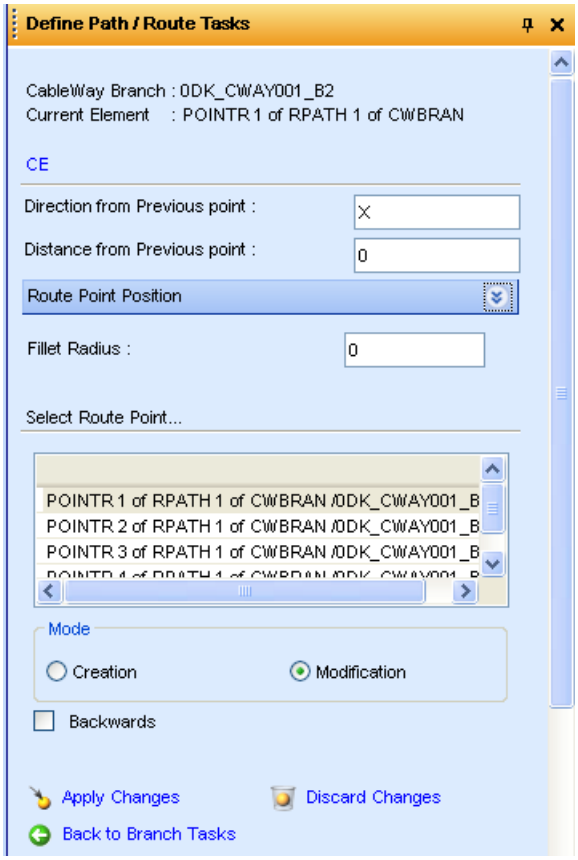
2.6 Modifying Branch Elements

The branch elements route point, route node and route attachment point can be modified by calling the appropriate form from the **Modify** main menu.



2.6.1 Route Points

Selecting **Modify > Branch Elements > Route Point** displays the **Define Path/Route Tasks** form with the **Mode : Modification** button selected and the fields populated allowing the user to make the required modifications.

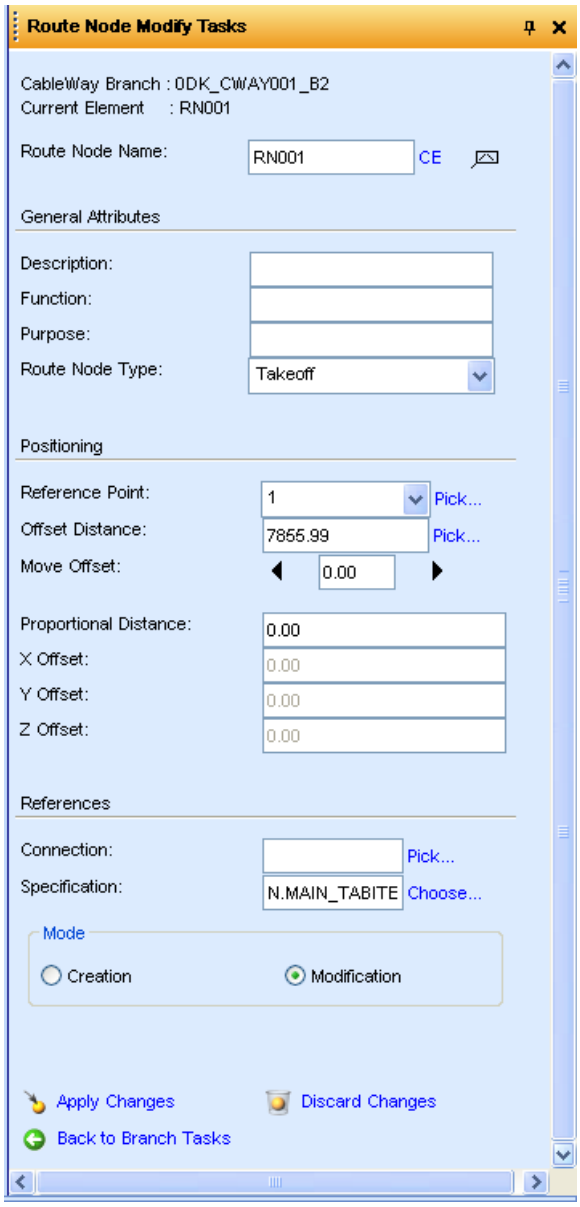


Note: The **Define Path/Route Tasks** form has the same fields as those shown when the form is in Creation mode. Refer to *Defining the Path/Route*.

Apply Changes	Applies the selected modifications.
Discard Changes	Cancels the selected modifications.
Back to Branch Tasks	Displays the *Branch Tasks* form.

2.6.2 Route Nodes

Selecting **Modify > Branch Elements > Route Node** displays the **Route Node Modify Tasks** form with the fields populated, allowing the user to make the required modifications.

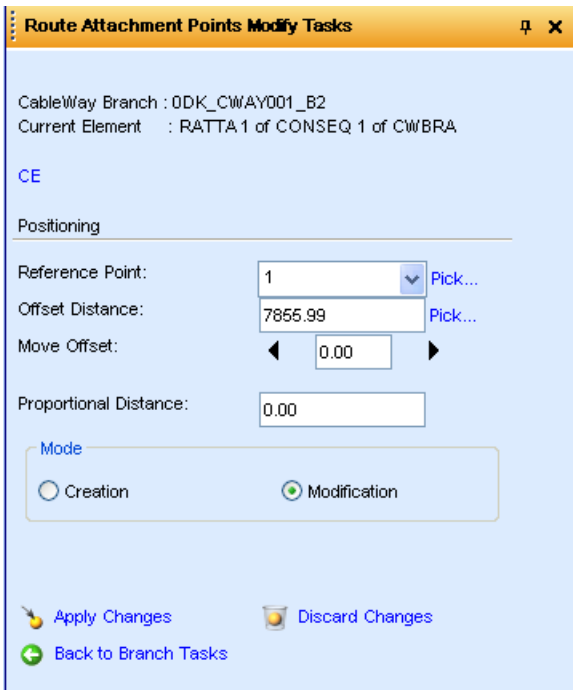


Note: The fields on the **Modify** form are the same as those shown on the **Route Node Create Tasks** form. Refer to *Creating a Route Node*.

Apply Changes	Applies the selected modifications.
Discard Changes	Cancels the selected modifications.
Back to Branch Tasks	Displays the *Branch Tasks* form.

2.6.3 Route Attachment Points

Selecting **Modify > Branch Elements > Route Attachment Point** displays the **Route Attachment Points Modify Tasks** form with the fields populated, allowing the user to make the required modifications.

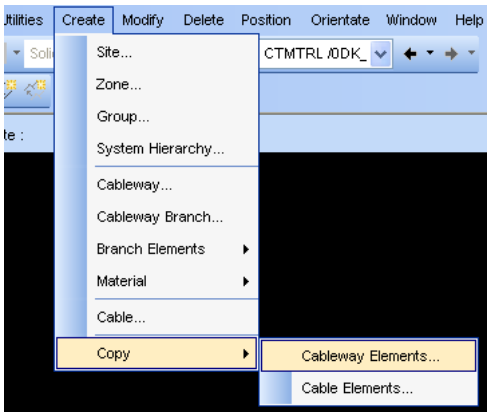


Note: The fields on the **Modify** form are the same as those shown on the **Route Attachment Points Create Tasks** form. Refer to *Creating Route Attachment Points*.

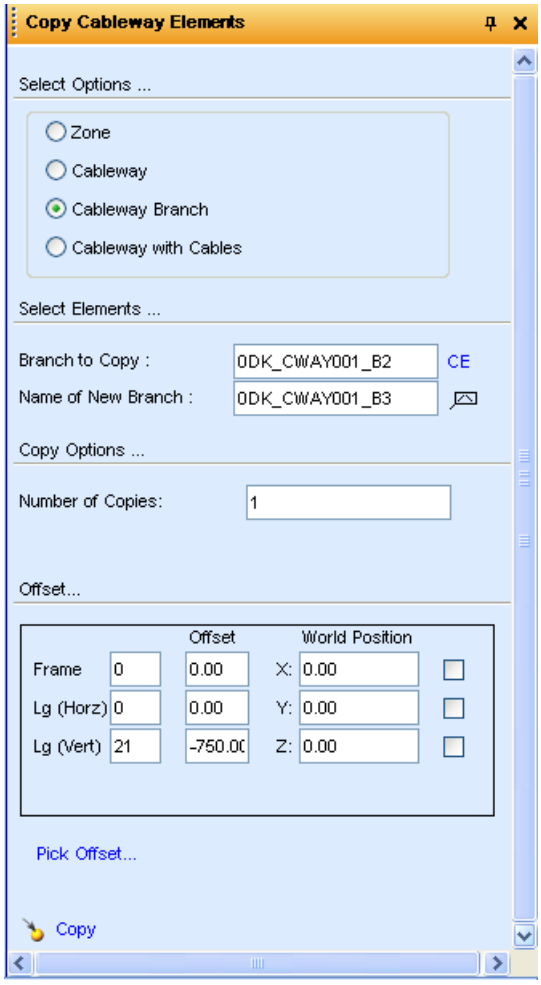
Apply Changes	Applies the selected modifications.
Discard Changes	Cancels the selected modifications.
Back to Branch Tasks	Displays the *Branch Tasks* form.

2.7 Copying Cableway Elements

The **Copy Cableway Elements** form is accessed either by selecting the **Copy Cableway Elements** icon on the *Cable Shortcut Toolbar* or from the main menu by selecting **Create > Copy > Cableway Elements**.



The **Copy Cableway Elements** form displays for a selected Cableway Branch.



Select Options Select one from the options: **Zone, Cableway, Cableway Branch** or **Cableway with Cables**.

Select Elements

Allows the user to select the element to copy.

Branch to Copy Shows the name of the branch selected for copying. Selecting a different branch and clicking **CE** will enter that branch name in the field.

Name of New Branch Enter an appropriate name for the new branch or click the **Autonaming** icon.

Copy Options

Number of Copies Enter the number of copies required.

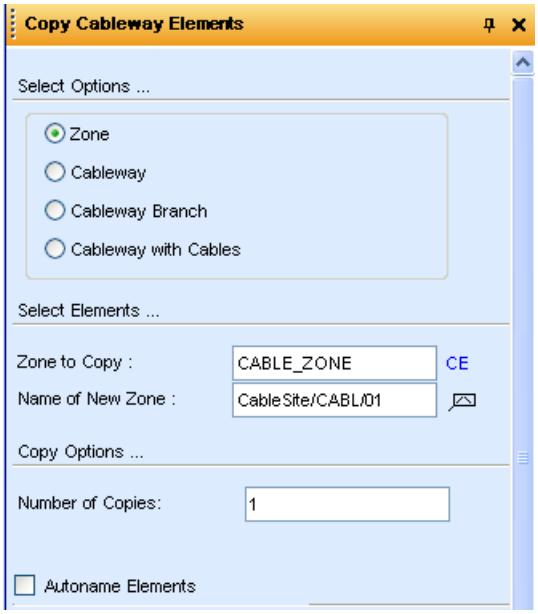
Offset Enter values for required offsets in the **Frame, Lg (Horz), Lg (Vert)** fields.

Pick Offset Select to pick an offset position in the 3D view.

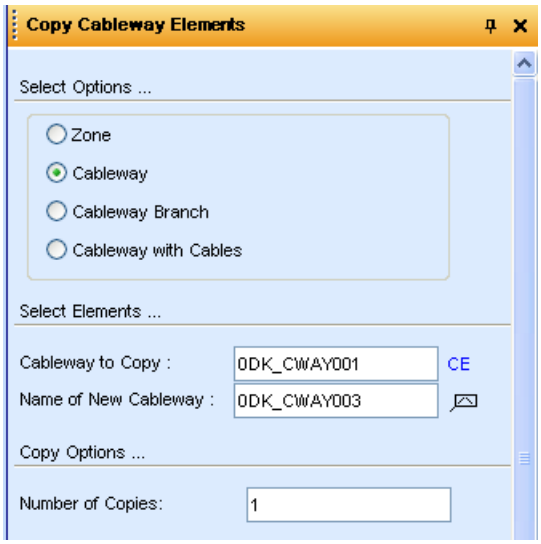
Copy Actions the copying process.

Depending on which of the **Options** is selected, the **Select Elements** and **Copy Options** sections of the form show different fields.

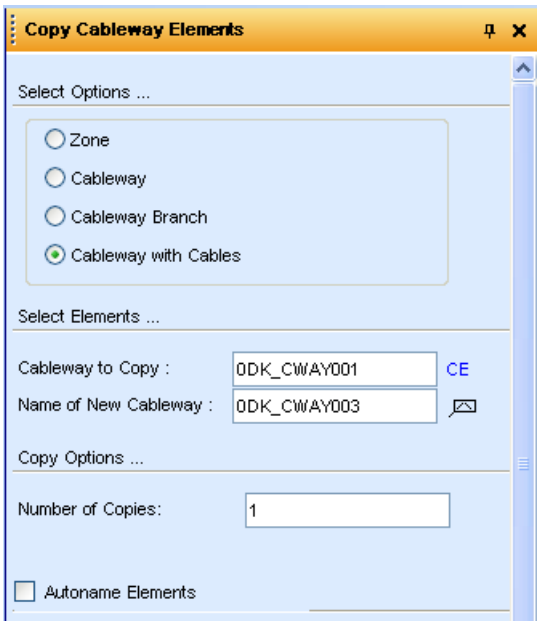
Selecting the **Zone** option displays:



Selecting the **Cableway** option displays:



Selecting the **Cableway with Cables** option displays:



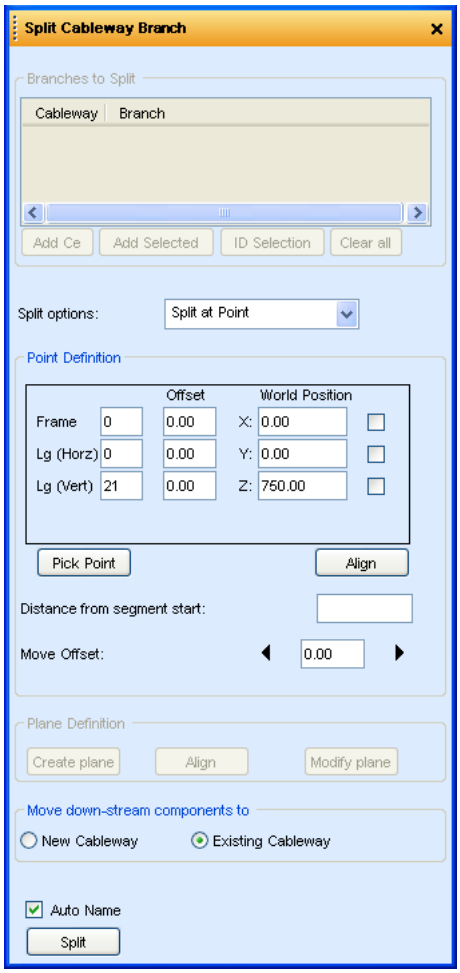
Note: When copying connected cables, the newly created copies of the cables will not have associations with equipment.

2.8 Splitting Cableway Branches

The **Split Branches** utility allows the user to split a cableway branch either at a point or by using a plane.

The utility is accessed by selecting **Utilities > Split Branches** from the main menu to display the **Split Cableway Branch** form.

Split at Point option selected:



Branches to Split — Populates with the branches to split on defining the split point position or picking the split point in the 3D view.

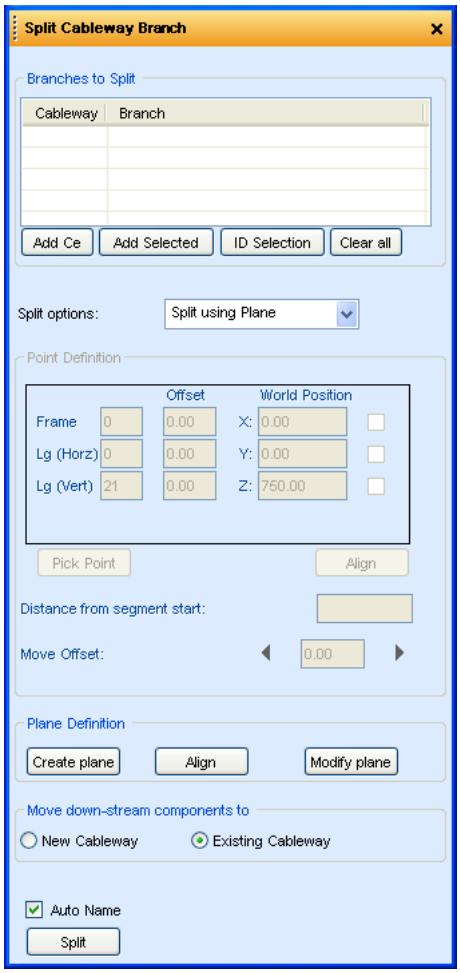
Split options — Allows the **Split at Point** or **Split using Plane** option to be set.

Point Definition

- **Frame** — Enter values for **Offset** and **World Position**.
- **Lg (Horz)** — Enter values for **Offset** and **World Position**.
- **Lg (Vert)** — Enter values for **Offset** and **World Position**.

Pick Point	Allows the user to pick a split point on the cableway branch in the 3D view. The position of the split point on the branch is shown by a <split> label graphical aid.
Align	Aligns the split point with the co-ordinate values entered.
Distance from segment start	Populates with a value on positioning the split point.
Move Offset	Enter a value in the box and use the right or left arrow to respectively increase or decrease the **Frame Offset** and **Distance from segment start** by that value.
Move down-stream components to	Select an option from **New Cableway** and **Existing Cableway**.
Auto Name	Names the split branches automatically. Check box selected by default.
Split	Actions the branch splitting process at the defined point.

Split using Plane option selected:

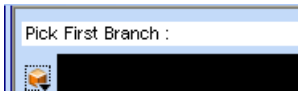


Branches to Split	List populated with branches to split by using the **Add CE**, **Add Selected** and **ID Selection** buttons. The **Clear All** button removes all the branches from the list.
Split options	Allows the **Split using Plane** or **Split at Point** option to be set.
Plane Definition	
Create plane	Allows the user to pick a segment which is to be split by the plane. When the segment is picked, the plane is created and shown in the 3D view.
Align	Allows the user to align the plane for splitting.
Modify plane	Displays the **Modify plane** form which allows the user to modify the position and orientation of the plane.
Move down-stream components to	Select an option from **New Cableway** and **Existing Cableway**.
Auto Name	Names the split branches automatically. Check box selected by default.
Split	Actions the branch splitting process at the defined plane.

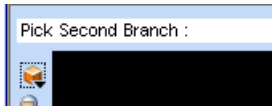
2.9 Merging Cableway Branches

The **Merge Branches** utility allows the user to merge two cableway branches using the **Pick** facility.

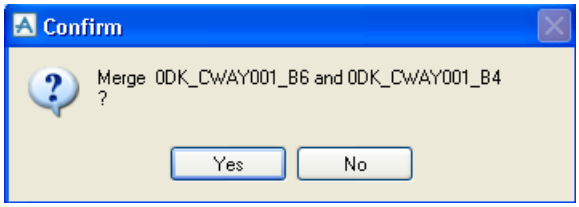
The utility is accessed by selecting **Utilities > Merge Branches** from the main menu. A **Pick First Branch** message is displayed in the top section of the 3D view frame.



After the user has picked the required branch, a **Pick Second Branch** message is displayed.



After picking the second branch, a **Confirm** message box is displayed.

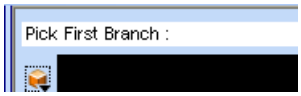


Selecting the **YES** option merges the two cableway branches.

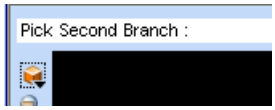
2.10 Connecting Cableway Branches

The **Connect Branches** utility allows the user to connect two cableway branches using the **Pick** facility.

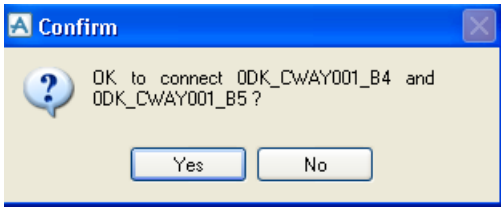
The utility is accessed by selecting **Utilities > Connect Branches** from the main menu. A **Pick First Branch** message is displayed in the top section of the 3D view frame.



After the user has picked the required branch, a **Pick Second Branch** message is displayed.



After picking the second branch, a **Confirm** message box is displayed.



Selecting the **YES** option connects the two cableway branches.

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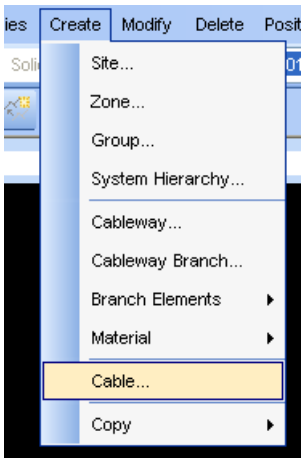
3 Cable Design

Cables are normally created after the layout of the cabling system has been defined by cableways. The created cables are then routed either automatically or manually along the cableways to connect to the equipment. The cable references a cable specification that contains the physical properties of the cable. Some of these properties are:

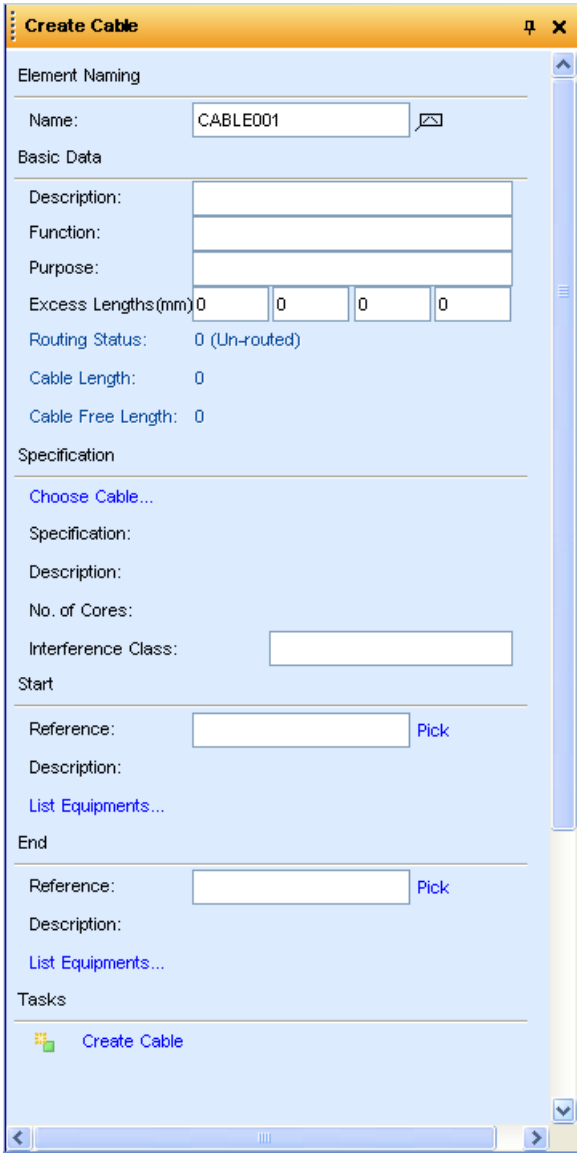
- Outer diameter
- Outer diameter shield
- Number of conductor groups
- Number of cores
- Area of a core
- Resistance /m
- Reactance /m
- Inductance /m
- Weight /m
- Maximum bending radius

3.1 Creating a Cable

The **Create Cable** form is accessed either by selecting the **Create Cable** icon on the *Cable Shortcut Toolbar* or **Create > Cable** from the main menu.



The **Create Cable** form is displayed.



Element Naming

Name Populates automatically with a cable name. Enter a different name for the cable if required.

Basic Data

Description Enter an appropriate Description.

Function Enter an appropriate Function.

Purpose Enter an appropriate Purpose.

Excess Lengths (mm) Enter the Excess Lengths in the four boxes. Two excess lengths are required at each end of the cable.

Routing Status	Populated when the cable is routed.
Cable Length	Populated when the cable is routed.
Cable Free Length	Populated when the cable is routed.

Specification

Shows a cable specification selected from the **Choose Cable** form.

Choose Cable	Displays the **Choose Cable** form, allowing the user to select a cable specification.
Specification	Populated on choosing a cable specification.
Description	Populated on choosing a cable specification.
No. of Cores	Populated on choosing a cable specification.
Interference Class	Populated on choosing a cable specification.

Start

Allows the start position of the cable to be set.

Reference	Enter a Start Reference for the cable or use the **Pick** facility.
Description	Enter a description if required.
List Equipments	Displays the **List of Equipments** form, which lists all the equipment in a selected zone.

End

Allows the end position of the cable to be set.

Reference	Enter an End Reference for the cable or use the **Pick** facility.
Description	Enter a description if required.
List Equipments	Displays the **List of Equipments** form, which lists all the equipment in a selected zone.

Tasks

Create Cable	Actions the creation of the cable and displays the **Modify Cable** form.

Note: The cable will not initially be shown in the 3D view. When it has been routed, the cable will be displayed.

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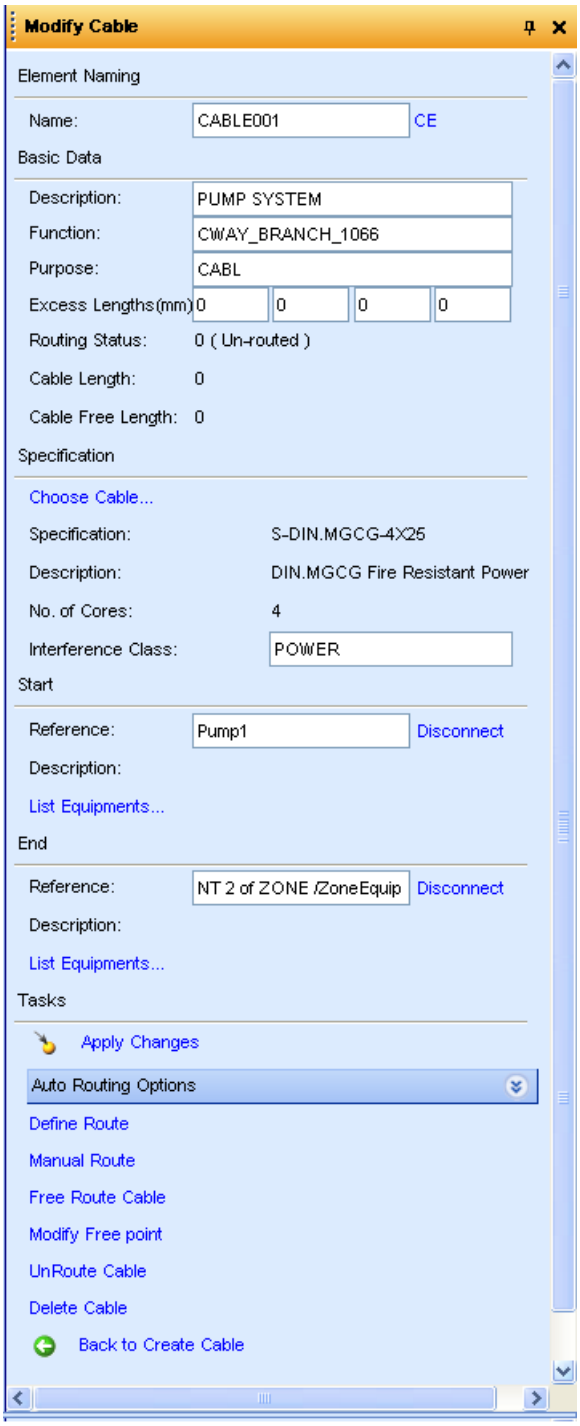
3.2 Modifying a Cable

The **Modify Cable** form can also be accessed by selecting the **Modify Cable** icon on the *Cable Shortcut Toolbar* or calling it from the main menu by selecting **Modify > Cable**.



The **Modify** form has the same fields as the **Create Cable** form (refer to *Creating a Cable*).

The **Modify** form displays with the **Basic Data** and **Specification** fields populated, allowing the user to make required modifications. The **Start** and **End Reference** fields have **Disconnect** links, which can be used to remove the cable from its connection point.

Tasks

Apply Changes	Applies the selected modifications.
Auto Routing Options	Allows the user to automatically route a cable. Refer to *Automatic Routing*.
Define Route	Displays the **Route Cable** form for defining the route by picking cableway branch entry and exit points. Refer to *Defining a Route*.
Manual Route	Displays the **Route Cable** form in Manual Routing mode allowing the user to select the route points through which the cable is routed. Refer to *Manual Routing*.
Free Route Cable	Allows the user to route a cable between two points picked in the 3D view. Refer to *Free Routing a Cable*.
Modify Free point	Displays the **Modify Free Point** form allowing the user to modify a route point. Refer to *Modifying a Route Point*.
UnRoute Cable	Allows the user to unroute a cable and remove it from the 3D view without deleting it. Refer to *Unrouting Cables*.
Delete Cable	Displays the **Delete Tasks** form, from which a selected cable can be detected. Refer to *Deleting Cables*.
Back to Create Cable	Displays the **Create Cable** form. Refer to *Creating a Cable*.

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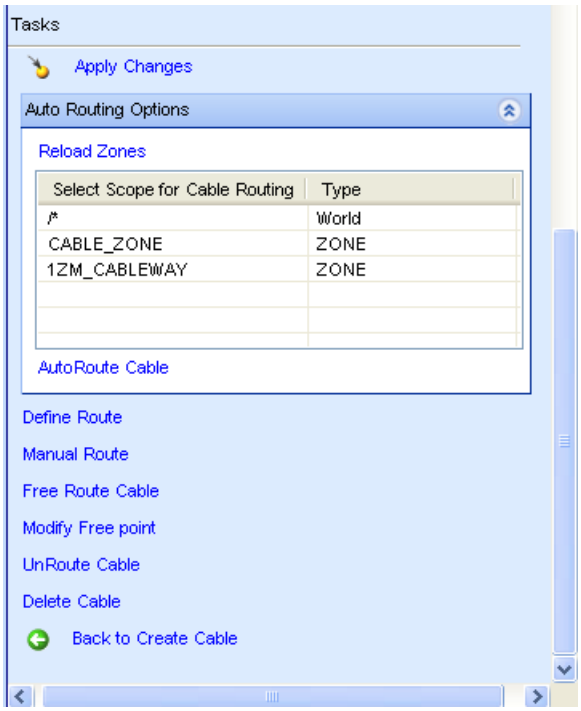
3.3 Routing a Cable

3.3.1 Automatic Routing

The **Auto Routing** Task allows the user to automatically route a created cable between the **Start** and **End** references.

The Task attempts to find the shortest route for the cable along connected cableways in the Zone(s) selected for routing. The cable will be orthogonally routed to the nearest attachment point on a cableway.

Expanding the **Auto Routing Options** panel on the **Modify Cable** form allows the user to perform this Task by selecting the required zone and then the **Auto Route Cable** link.



Auto Routing Options

Reload Zones	Reloads the Zones containing cables.
Select Scope for Cable Routing	Allows the Zone(s) to be selected.
Auto Route Cable	Routes a cable orthogonally between the Start point and End point along the cableway.

3.3.2 Defining a Route

The **Define Route** Task allows the user to modify a cable route by selecting an entry point and exit point on the cableway branch for the cable.

The Task is performed by selecting the **Define Route** link on the **Modify Cable** form to display the **Route Cable** form.

Cableway Branch Entry

Pick Entry Point	Populates the **Select Entry Points** list with the route points contained within the Entry Point Branch. An Entry Point is selected from the list.

Cableway Branch Exit

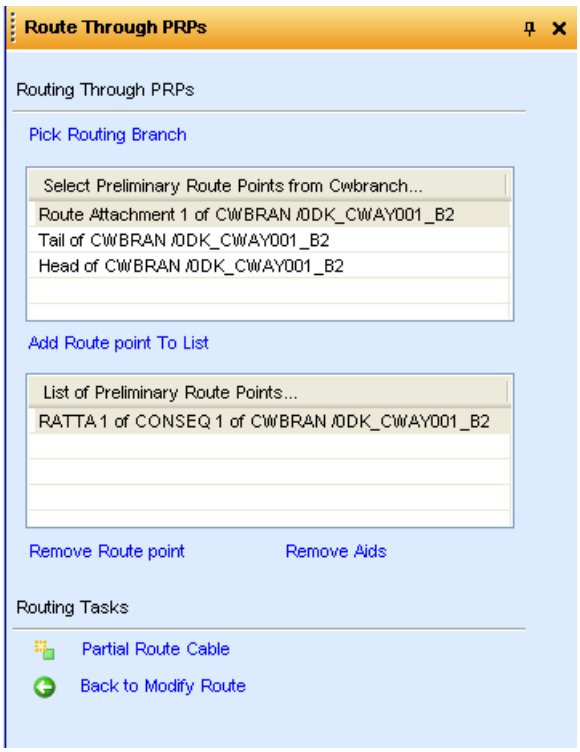
Pick Exit Point	Populates the **Select Exit Points** list with the route points contained within the Exit Point branch. An Exit Point is selected from the list.

Routing Tasks

Auto Route Cable	Routes the cable along the cableway through the Entry and Exit Points.
Define Route Through PRPs	Displays the **Route Through PRPs** form.
Head Free Route	Routes a cable without passing through a HATTA route point.
Tail Free Route	Routes a cable without passing through a TATTA route point.
Back to Modify Cable	Displays the **Modify Cable** form.

3.3.3 Defining a Route Through Preliminary Route Points

This Routing Task allows the user to route a cable through selected Preliminary Route Points (PRPs). To perform the Task, the **Define Route Through PRPs** link on the **Modify Route** form is selected to display the **Route Through PRPs** form.



Routing Through PRPs

Pick Routing Branch	Populates the **Select Preliminary Route Points from Cwbranch** list with route points contained within the picked branch.
Add Route point to List	Adds a route point selected from the branch route points list to the **List of Preliminary Route Points**. The position of the route point is shown in the 3D view by a graphical aid.
Remove Route point	Removes a selected route point from the **List of Preliminary Route Points**.
Remove Aids	Removes graphical aids.

Routing Tasks

Partial Route Cable	Routes the cable through the PRPs on the branch without having to connect to equipment.
Back to Modify Route	Displays the **Route Cable** form. Refer to *Defining a Route*.

3.3.4 Manual Routing

The **Manual Route** Task allows the user to route a cable through a series of selected route points on a cableway branch.

Selecting the **Manual Route** link on the **Modify Cable** form displays the **Route Cable** form, which allows the user to perform the Task.

Manual Routing

Pick Routing Branch	Populates the **Select Route Points from Cwbranch** list with route points contained within the picked cableway branch.
Add Route point	Adds a route point selected from the branch route points list to the **List of Route Points**. The position of the route point is shown in the 3D view by a graphical aid.
Remove Route point	Removes a selected route point from the **List of Route Points**.
Remove Aids	Removes graphical aids.

Routing Tasks

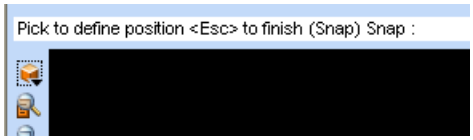
Manual Route Cable	Routes a cable through the selected route points.
Head Free Route	Routes a cable without passing through a HATTA route point.
Tail Free Route	Routes a cable without passing through a TATTA route point.

Back to Modify Cable Displays the **Modify Cable** form. Refer to *Modifying a Cable*.

3.3.5 Free Routing a Cable

The **Free Route Cable** Task allows the user to route a cable between two picked points in the 3D view and is accessed by selecting the link of the **Modify Cable** form.

On selecting the link, a message is displayed in the top section of the 3D view frame requesting that the user “Pick to define position <Esc> to finish”.

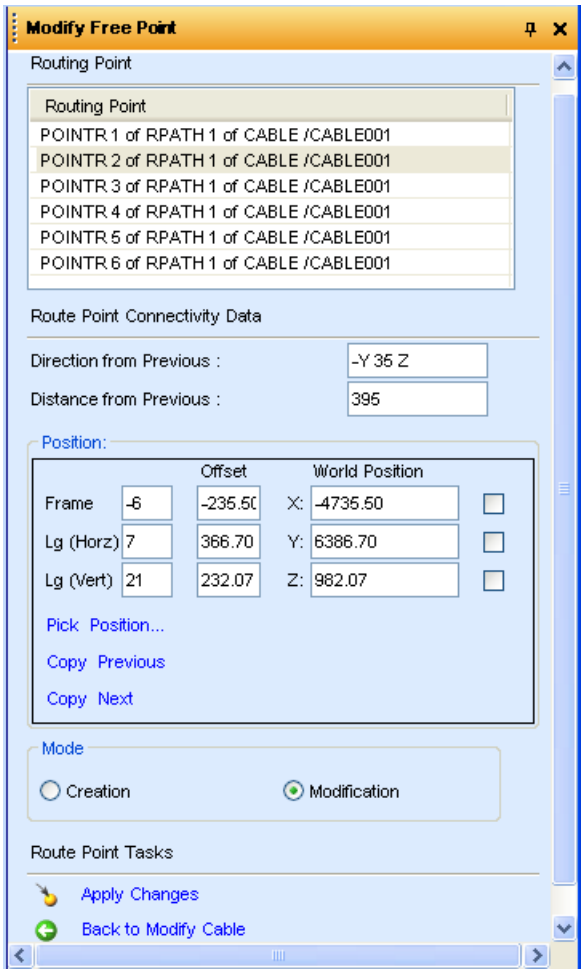


Picking the two points and pressing the **Escape** key displays a **Confirm** message box.

Selecting the **Yes** option routes the cable between the two points and displays the **Modify Free Point** form, which allows the user to modify a route point. Refer to *Modifying a Route Point*.

3.3.6 Modifying a Route Point

The **Modify Free Point** Task allows the user to modify a route point by selecting the link on the **Modify Cable** form to display the **Modify Free Point** form.



Route Point — Lists the route points on a selected cable route. The route point to be modify is selected from the list.

Route Point Connectivity Data

Direction from Previous — Populated on selecting a route point.

Distance from Previous — Populated on selecting a route point.

Position

Allows the new position of the route point to be defined.

Frame — Enter values for **Offset** and **World Position**.

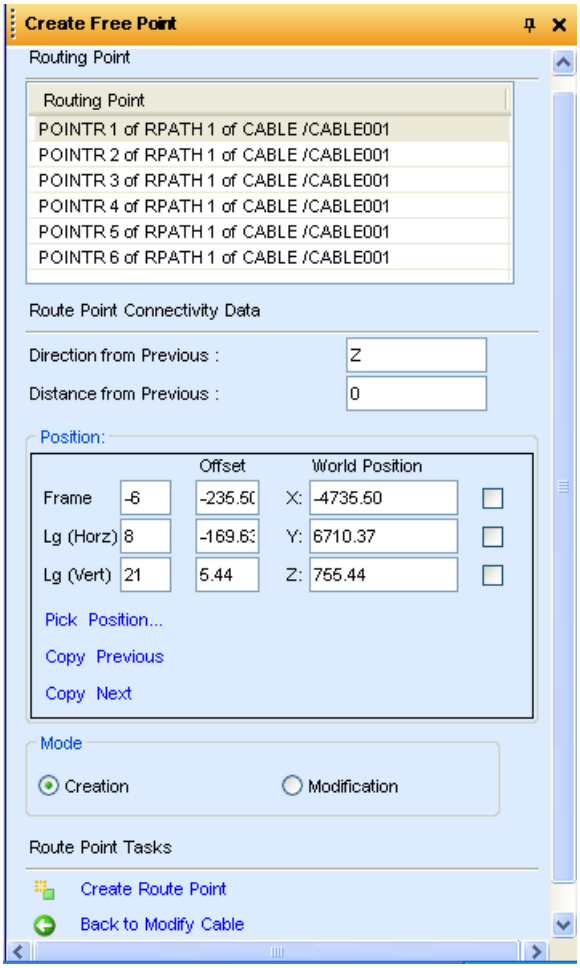
Lg (Horz) — Enter values for **Offset** and **World Position**.

Lg (Vert) — Enter values for **Offset** and **World Position**.

Pick Position	Allows the user to pick a new position for the route point in the 3D view.
Copy Previous	Copies the position of the previous route point.
Copy Next	Copies the position of the next route point.
Mode	Allows the user to select either **Modification** or **Creation** mode. Selecting the **Creation** mode displays the **Create Free Point** form. Refer to *Creating a Route Point*.
Route Point Tasks	
Apply Changes	Applies the selected modifications.
Back to Modify Cable	Displays the **Modify Cable** form. Refer to *Modifying a Cable*.

3.3.7 Creating a Route Point

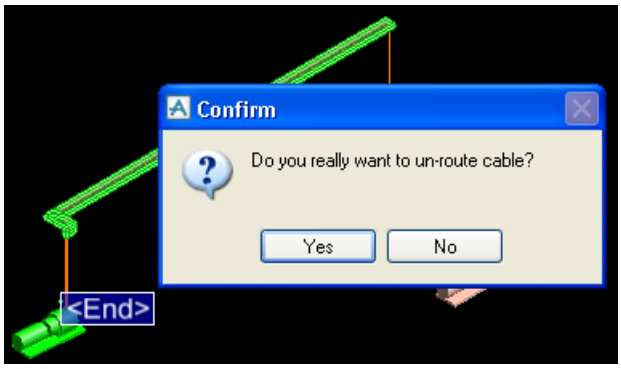
Selecting the **Creation** mode button on the **Modify Free Point** form displays the **Create Free Point** form, allowing the user to create a route point.



The **Pick Position** facility is used to define the position of the new route point on the cable route. Selecting the **Create Route Point** link actions the creation of the route point.

3.3.8 Unrouting Cables

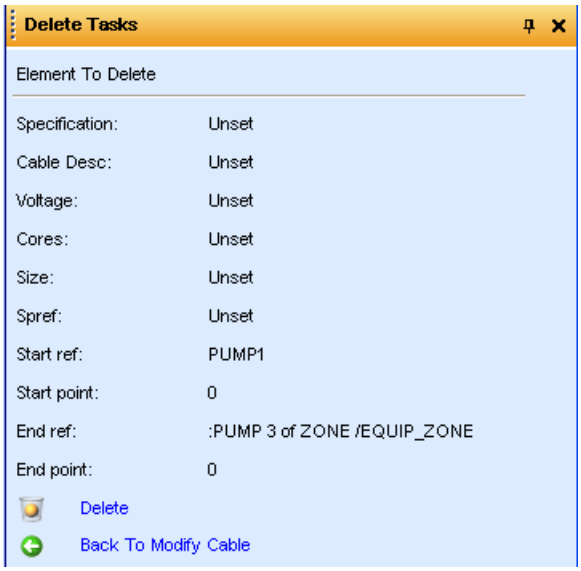
The **UnRoute Cable** Task allows the user to unroute a previously routed cable by selecting the link in the **Tasks** section of the **Modify Cable** form to display a **Confirm** message box.



Selecting the **Yes** option unroutes the cable and removes it from the 3D view. The cable can now be rerouted using one of the available routing methods.

3.4 Deleting Cables

The **Delete Cable** Task allows the user to delete a selected cable. Clicking the **Delete Cable** link on the **Modify Cable** form displays the **Delete Tasks** form which shows the important attributes of the selected cable.

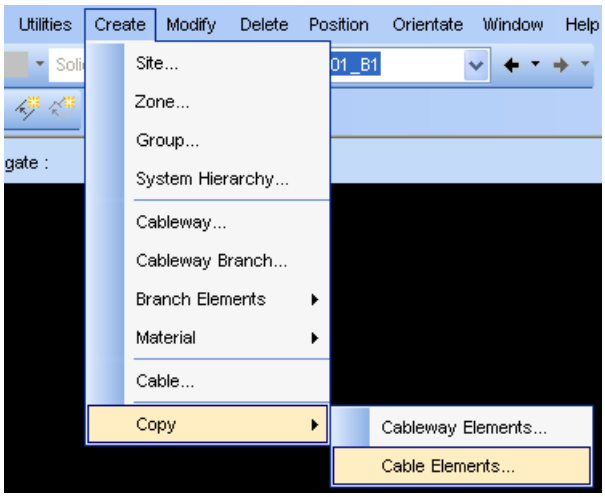


Delete	Displays a **Confirm** message box. Selecting the **YES** option deletes the cable and updates all the references.
Back To Modify Cable	Displays the **Modify Cable** form. Refer to *Modifying a Cable*.

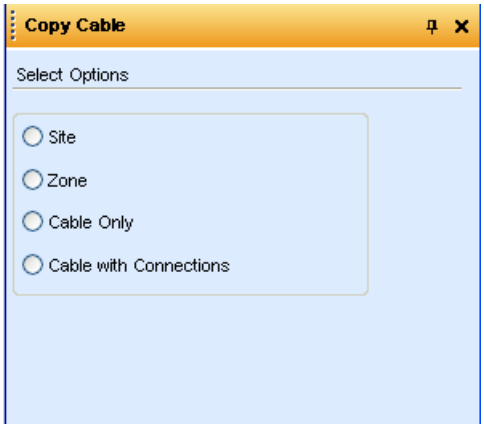
Note: Cables can also be deleted using the main menu options **Delete > CE** or **Delete > Members > Selection**.

3.5 Copying Cables

The **Copy Cable** form can be accessed either by selecting the **Copy Cable** icon on the *Cable Shortcut Toolbar* or from the main menu by selecting **Create > Copy > Cable Elements**.



The **Copy Cable** form is displayed.

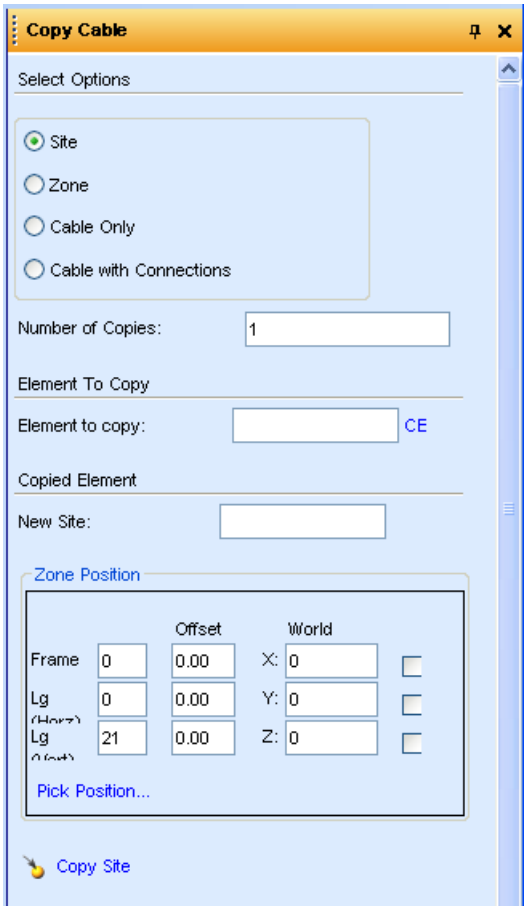


Select Options Select from the four options:

Site
Zone
Cable Only
Cable with Connections

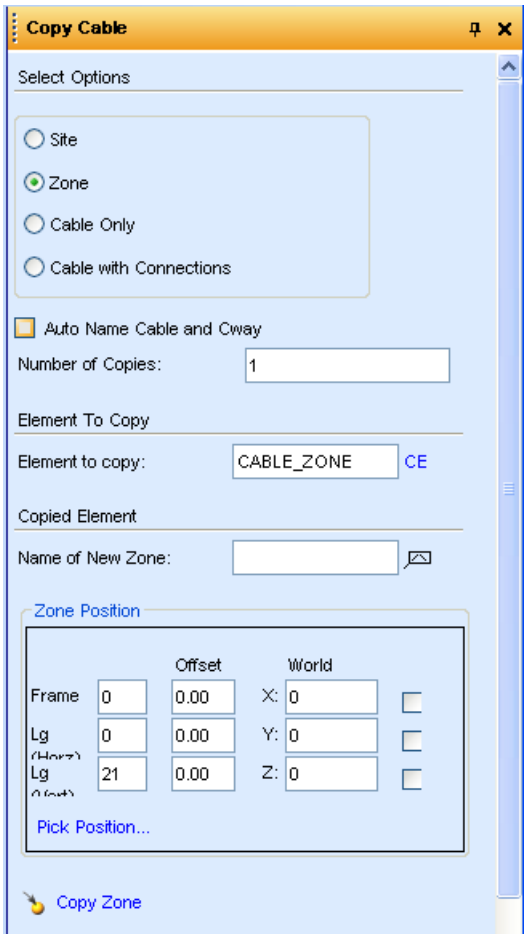
Note: When cables are copied, the newly created copies will not maintain connections.

Copy Cable form with **Site** option selected:



Select Options	**Site** button selected.
Number of Copies	Enter the number of copies required.
Element to Copy	Enter the element to be copied or select **CE** to enter the current element.
Copied Element	
New Site	Enter a name for the new Site.
Zone Position	
Frame	Enter values for **Offset** or **World**.
Lg (Horz)	Enter values for **Offset** or **World**.
Lg (Vert)	Enter values for **Offset** or **World**.
Pick Position	Pick a Zone position in the 3D view.
Copy Site	Actions the copying process.

Copy Cable form with **Zone** option selected:



Select Options	**Zone** button selected.
Auto Name Cable and Cway	Select check box to automatically name the cables and cableways in the new Zone.
Number of Copies	Enter the number of copies required.
Element to Copy	Enter the element to be copied or select **CE** to enter the current element.
Copied Element	
Name of New Zone	Enter a name for the new Zone or select the Autonaming icon.
Zone Position	
Frame	Enter values for **Offset** or **World**.
Lg (Horz)	Enter values for **Offset** or **World**.
Lg (Vert)	Enter values for **Offset** or **World**.
Pick Position	Pick a Zone position in the 3D view.
Copy Zone	Actions the copying process.

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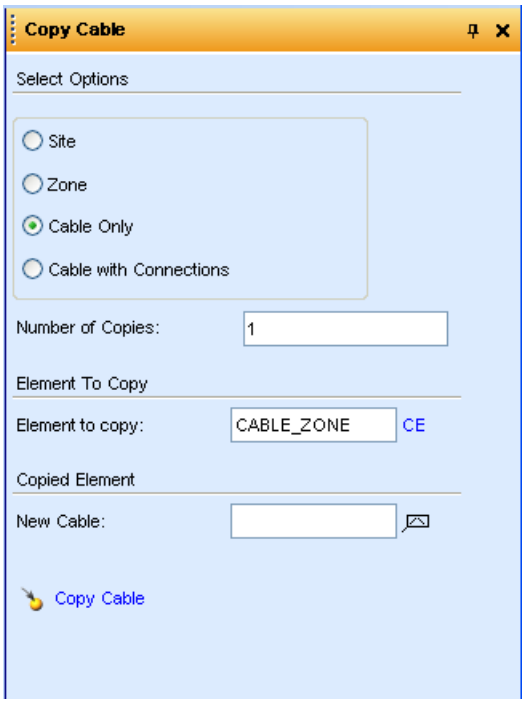
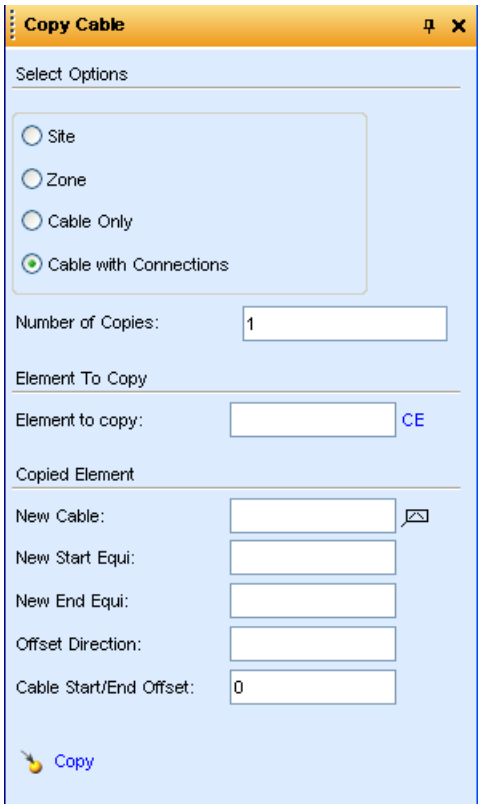
Copy Cable form with **Cable Only** option selected:



Select Options	**Cable Only** option selected.
Number of Copies	Enter the number of copies required.
Element to Copy	Enter the element to be copied or click **CE** to enter the current element.
Copied Element	
New Cable	Enter a name for the new cable or select the Autonaming icon.
Copy Cable	Actions the copying process.

Copy Cable form with **Cable with Connections** option selected:



Select Options	**Cable with Connections** option selected.
Number of Copies	Enter the number of copies required.
Element to Copy	Enter the element to be copied or click **CE** to enter the current element.

Copied Element

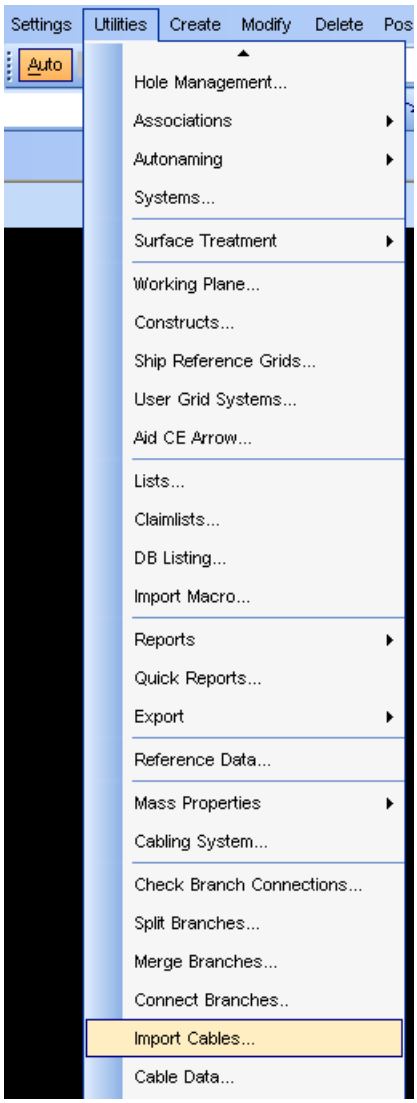
Details of the copied element can be entered here.

New Cable	Enter an appropriate name for the new cable or click the **Autonaming** icon.
New Start Equi	Enter a new start equipment for the cable.
New End Equi	Enter a new end equipment for the cable.
Offset Direction	Enter an offset direction.
Cable Start/End Offset	Enter the cable start/end offset.

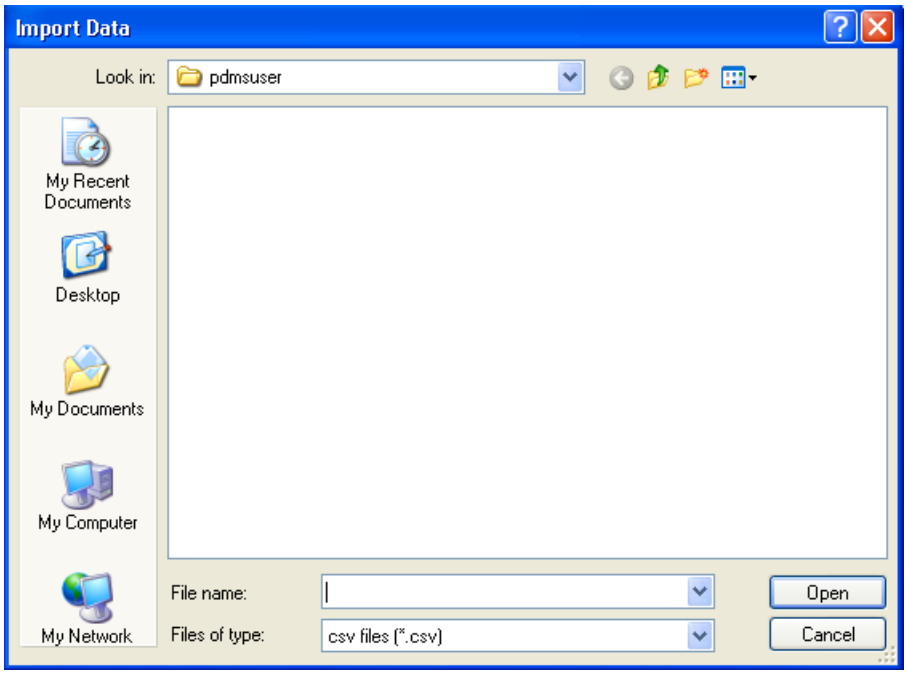
Copy	Actions the copying process.

3.6 Importing Cables

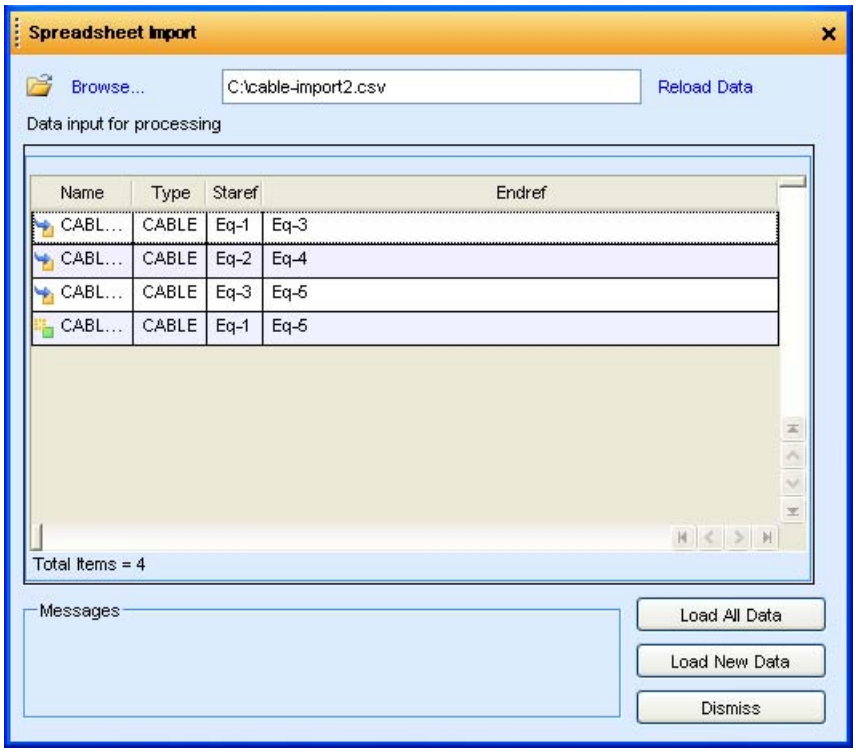
This utility allows you to import cable reference set data and is accessed from the **Utilities** menu by selecting **Utilities > Import Cables**.



The **Import Data** form is displayed.



The file name of the CSV file containing the required Cable data to be imported into the design is entered and the **Open** button is clicked. A spreadsheet of Cable data is displayed from which the imported data can be loaded.



Each column in the spreadsheet corresponds to an attribute of the cables listed in the rows. The attributes will be set on a cable to the value given in the CSV file.

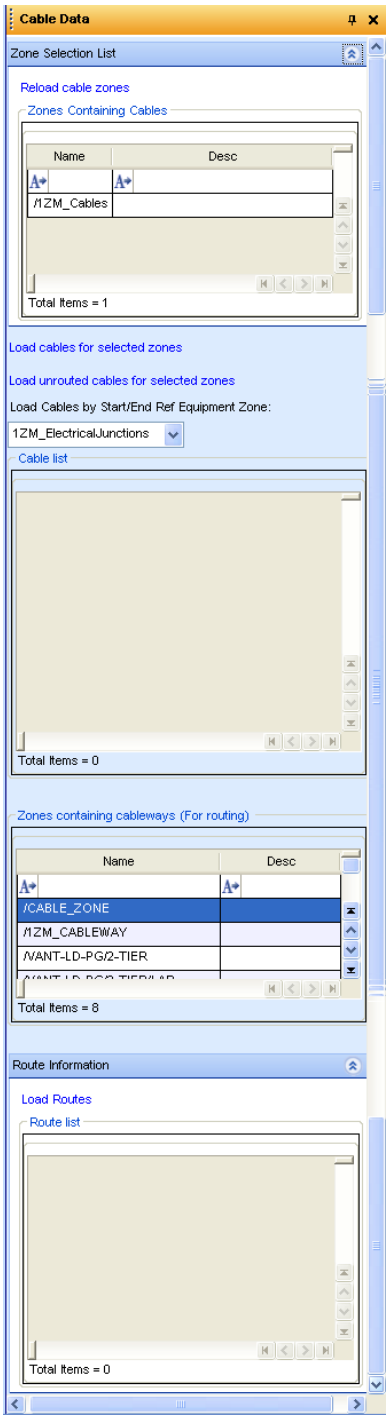
Browse	Allows the user to browse for the required CSV file.
Reload Data	Reloads the data.
Data input for processing	Lists the Cable data for importing in an attribute column format.
Messages	Shows any relevant messages regarding the import data.
Load All Data	Loads all the data contained in the CSV file.
Load New Data	Loads only the new data contained in the CSV file.
Dismiss	Dismisses the form.

3.7 Cable Data

This utility provides cable and route information which can be used to perform various operations including routing a selected cable or routing all cables, i.e. bulk routing, a necessary operation for large-scale cabling systems.

The utility is accessed by selecting **Utilities > Cable Data**.

The **Cable Data** form is displayed.



Zone Selection List

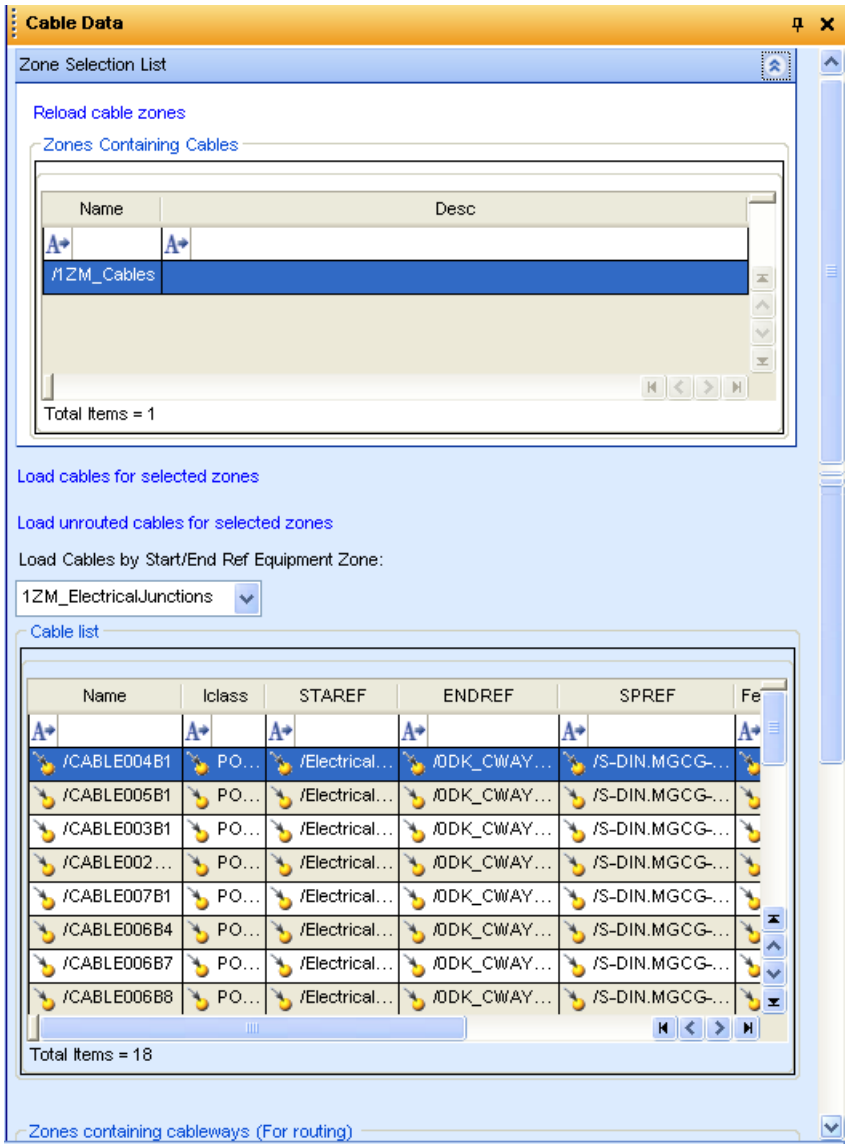
Reload cable zones	Reloads the cable zones.
Zones Containing Cables	Allows cable zones to be selected from a list.
Load cables for selected zones	Loads the cables within the selected zones to populate the **Cable list**.
Load unrouted cables for selected zones	Loads the unrouted cables within the selected zones to populate the **Cable List**.
Load Cables by Start/End Ref Equipment Zone	Loads the cables within the zone selected from the drop-down list to populate the **Cable list**.
Cable list	Lists all the cables in the selected zones, showing the Name, Iclass, STAREF, ENDREF and SPREF for each cable. The Cable List has a right-click shortcut menu of options.
Zones containing cableways (For routing)	Lists the zones containing cableways available for routing the cables.

Route Information

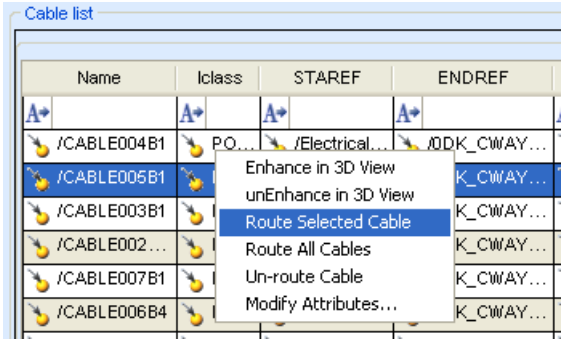
Provides information on the cable routes.

Load Routes	Loads the route of the cable selected in the **Cable list** to populate the **Route List**.
Route list	Shows the route of the selected cable including the Route Element, Element Type and Branch.

Cable Data form populated (top):



The **Cable list** has a right-click shortcut menu:

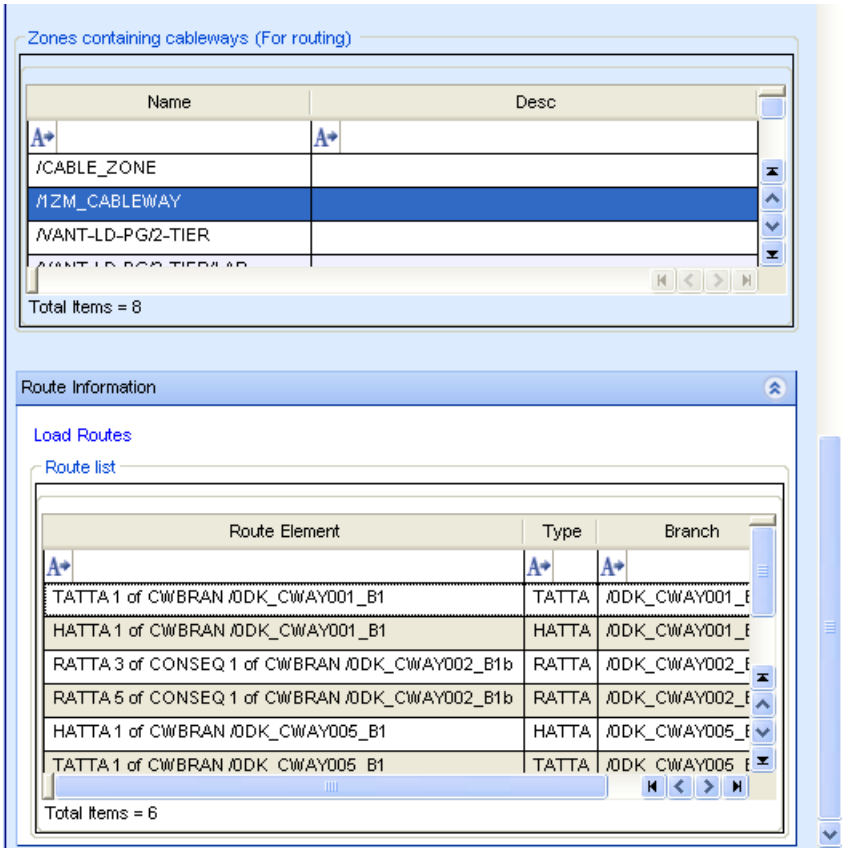


The menu options are:

- Enhance in 3D View
- unEnhance in 3D View
- Route Selected Cable
- Route All Cables
- Un-route Cable
- Modify Attributes

The **Route All Cables** option allows the user to perform bulk routing.

Cable Data form populated (bottom):



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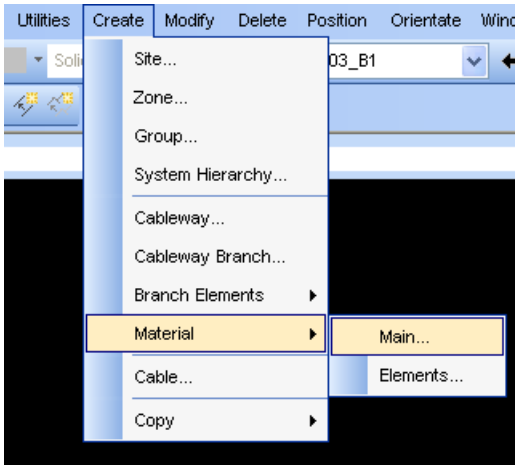
4 Cable Tray Design

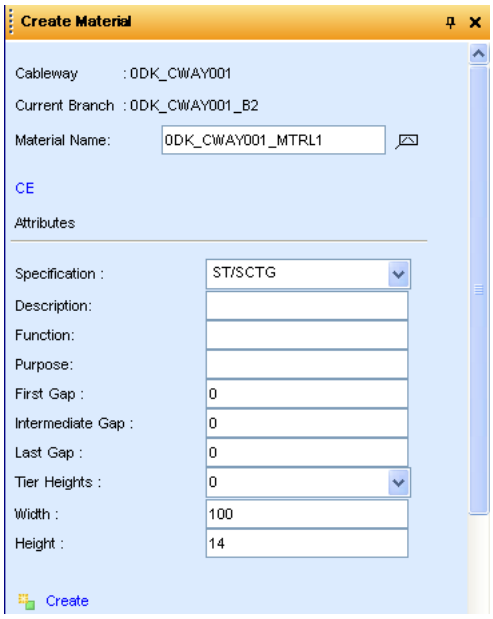
Having routed cableway branches with or without cables routed along them, the branches can then be dressed with cable tray material. The defaults specification selected defines the cross-section used for space reservation and therefore the tray material. In the Design hierarchy the material is situated below Cableway Branch in the Cable Material hierarchy, which owns cableway material elements such as: Straight, Bend, Riser, Tee, Cross and Reducer.

4.1 Creating Cableway Branch Material

The **Create Material** form can be accessed either by selecting the **Create Cableway Material** icon on the *Cable Shortcut Toolbar* or from the main menu by selecting **Create > Material > Main**.



The **Create Material** form is displayed.



This form allows the user to set the attributes for and create cable tray material along the entire selected cableway branch.

Cableway Shows the selected cableway name.

Current Branch Shows the current branch name.

Material Name Enter an appropriate name or click the Autonaming icon.

CE Selecting a material element and clicking the **CE** button displays the **Modify** form for that element.

Attributes

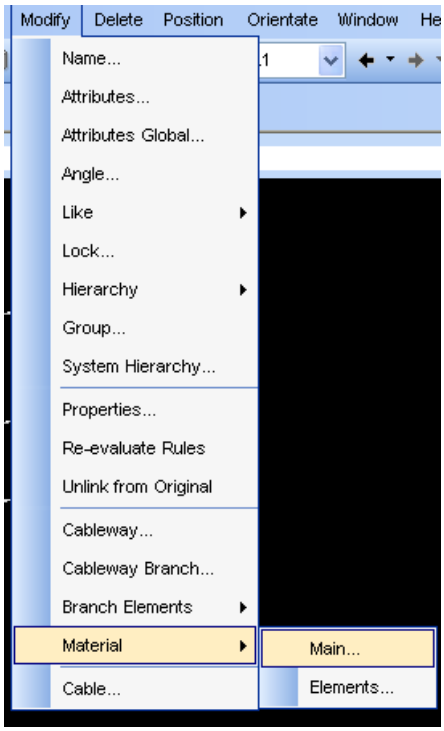
- **Specification** Select a specification from the drop-down list.
- **Description** Enter an appropriate Description.
- **Function** Enter an appropriate Function.
- **Purpose** Enter an appropriate Purpose.
- **First Gap** Sets the gap width for the first cable tray element on the cableway branch.
- **Intermediate Gap** Sets the gap width between intermediate cable tray elements on the cableway branch.
- **Last Gap** Sets the gap width for the last cable tray element on the cableway branch.
- **Tier Heights** Enter a value for the tier height.
- **Width** Default value set. Enter a different value if required.
- **Height** Default value set. Enter a different value if required.

Create Actions the creation of the cable tray material and displays the **Modify Material** form.

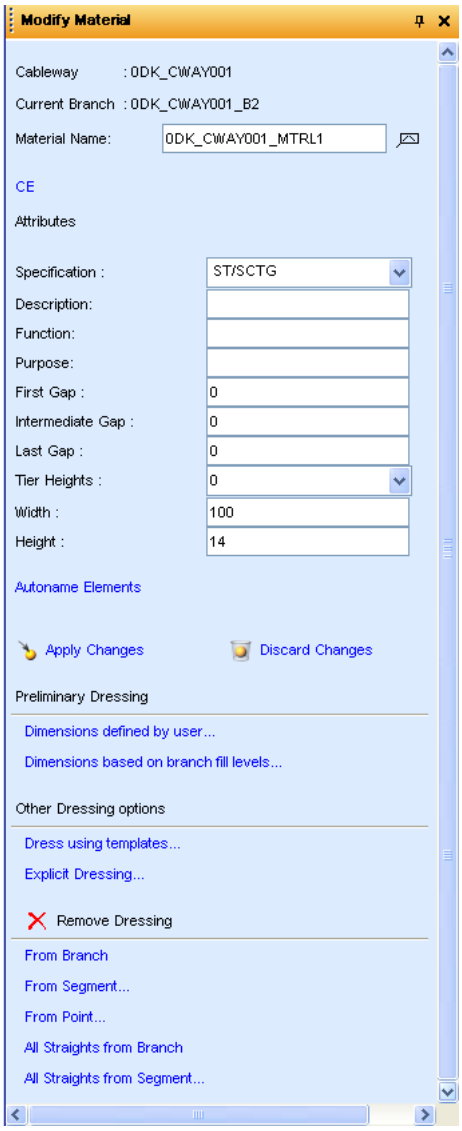
Note: The **Dressing** link on the **Branch Tasks** form also displays the **Create Material** form. Refer to *Dressing a Branch with Material*.

4.2 Modifying Cableway Branch Material

The **Modify Material** form can be accessed either by selecting the **Modify Cableway Material** icon on the *Cable Shortcut Toolbar* or from the main **Modify** menu.



Selecting **Modify > Material > Main** displays the **Modify Material** form, which allows the user to make modifications to the cableway branch material.



Cableway	Shows the selected cableway name.
Current Branch	Shows the current branch name.
Material Name	Populates with the name of the cableway material selected for modification.
CE	Selecting a material element and clicking the **CE** button displays the **Modify** form for that element.
Attributes	Shows the same Attribute fields as on the **Create Material** form (refer to *Creating Cableway Branch Material*).
Autoname Elements	Applies autonaming to the created elements.
Apply Changes	Applies the selected modifications.

Discard Changes	Cancels the selected modifications.
Preliminary Dressing	
Dimensions defined by user	Displays the **Preliminary Dressing (User defined Dimensions)** form, allowing the user to add cable tray material with dimensions defined by the user.
Dimensions based on branch fill levels	Displays the **Preliminary Dressing (Considering Branch fill Levels)** form, allowing the user to add cable tray material with dimensions taking into account the branch fill level.
Other Dressing options	
Dressing using templates	Displays the **Dress using Templates** form, allowing cable tray material to be added using dimensions derived from a template.
Explicit Dressing	Displays the **Create Straight** form, allowing the user to create individual straight components or access Create forms for other components.
Remove Dressing	
From Branch	Removes the cable tray material from the whole cableway branch.
From Segment	Removes the cable tray material from the selected segment.
From Point	Removes the cable tray material from a selected point on the branch.
All Straights from Branch	Removes all the straight elements from the whole branch.
All Straights from Segment	Removes all the straight elements from the selected segment.

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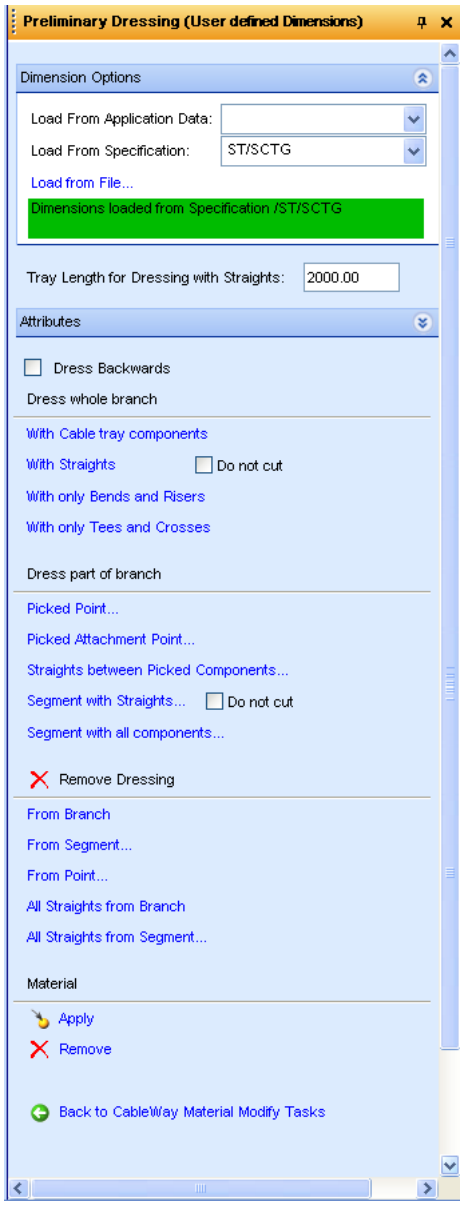
4.2.1 Preliminary Dressing with Dimensions Defined by the User

The **Preliminary Dressing (User defined Dimensions)** form is displayed on selecting the **Dimensions defined by user** link on the **Modify Material** form. The **Dressing** form allows the user to add cable tray material to the cableway branch in various ways and provides options for removing material from the branch. The dimensions for the cable tray elements are derived from the selected specification shown in the **Dimensions Options** panel. The user can set the **Width**, **Height** and **Tier Heights** in the expanded **Attributes** panel.



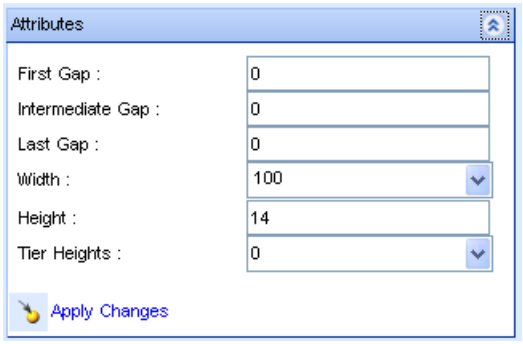
Dimension Options

Load From Application Data	Enter the File name for the Application Data.
Load From Specification	Select a specification from the drop-down list.
Load From File	Loads the data from the designated file or if no file name given opens a browser to locate the file.

Tray Length for Dressing with Straights Populated with the tray length dimension.

Attributes

Allows the user to change the attributes and apply the changes.



Dress Backwards Select checkbox to reverse the direction in which the cableway branch is dressed.

Dress whole branch

- **With Cable tray components** Adds cable tray components to the whole cableway branch, observing any gaps set.
- **With Straights** Adds straight components to the whole cableway branch. Selecting the **Do not cut** checkbox prevents components being cut to fit the designated cable tray length.
- **With only Bends and Risers** Actions the creation of bend and riser components, where appropriate, along the cableway branch. Further elements can then be added using one of the other **Dress** options.
- **With only Tees and Crosses** Actions the creation of tee and cross components, where appropriate, along the cable branch. Further elements can then be added using one of the other **Dress** options.

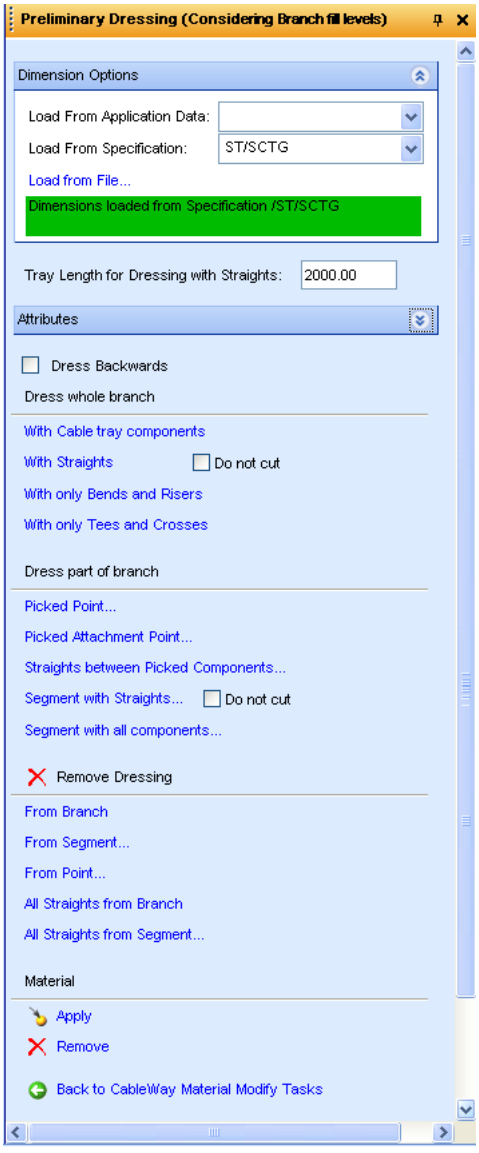
Dress part of branch

- **Picked Point** Allows the user to pick a point on the branch at which a component is to be added.
- **Picked Attachment Point** Allows the user to pick an attachment point on the branch at which a component is to be added.
- **Straights between Picked Components** Adds straight components between the picked components on the cableway branch.
- **Segments with Straights** Adds straight components to a selected segment. Selecting the **Do not cut** checkbox prevents components being cut to fit the segment length.
- **Segment with all components** Adds all the required cabletray components to a selected segment.

Remove Dressing	
From Branch	Removes cable tray material from the whole cableway branch.
From Segment	Removes cable tray material from the whole of the selected segment.
From Point	Removes the cable tray component from a selected point on the cableway branch.
All Straights from Branch	Removes all the straight components from the whole branch.
All Straights from Segment	Removes all the straight components from a selelected segment.
Material	
Apply	Applies the cable tray material to the branch. The tray shape is now shown in the 3D view.
Remove	Removes the cable tray material from the branch and the tray shape from the 3D view.
Back to CableWay Material Modify Tasks	Displays the **Modify Material** form. Refer to *Modifying Cableway Branch Material*.

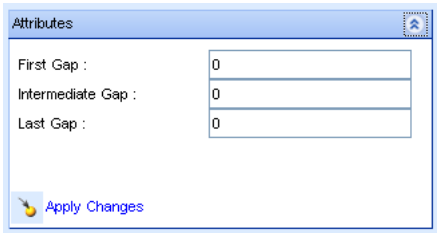
4.2.2 Preliminary Dressing Considering Branch Fill Levels

Selecting the **Dimensions based on branch fill levels** link on the **Modify Material** form displays the **Preliminary Dressing (Considering Branch fill levels)** form. This form allows the user to add cable tray material to the cableway branch in accordance with the branch fill level. Various options are also provided for removing material from the branch.



Except for the **Attributes** panel, the fields on the form are the same as those on the **Preliminary Dressing (User defined Dimensions)** form (refer to *Preliminary Dressing with Dimensions Defined by the User*).

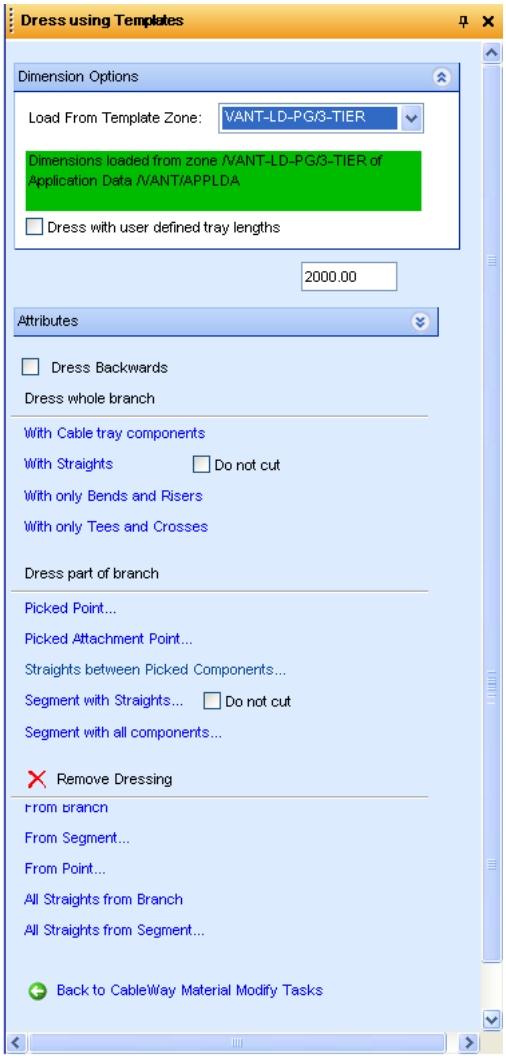
Attributes



This panel allows the user to change only the gap dimensions for the cable tray components.

4.2.3 Dressing using Templates

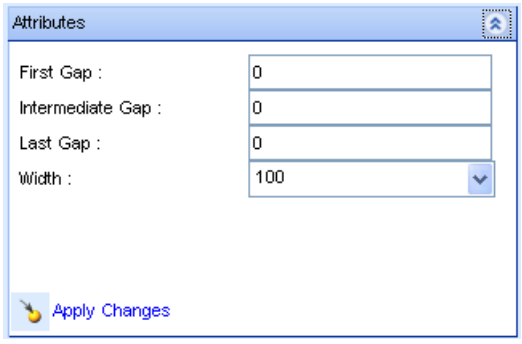
Selecting the **Dress using Templates** link on the **Modify Material** form displays the **Dress using Templates** form. This form allows the user to add cable tray material to the cableway branch or part of the branch using dimensions loaded from a selected template zone. Various options are also provided for removing the material from the branch.



Dimension Options

Load From Template Zone	Select a Template Zone from the drop-down list.
Dress with user defined tray lengths	Select checkbox to dress branch with user defined tray length.
Tray Length for Dressing with Straights	Populated with the tray length dimension.

Attributes



This panel allows the user to enter or change the **Gap** dimensions and change the tray **Width**.

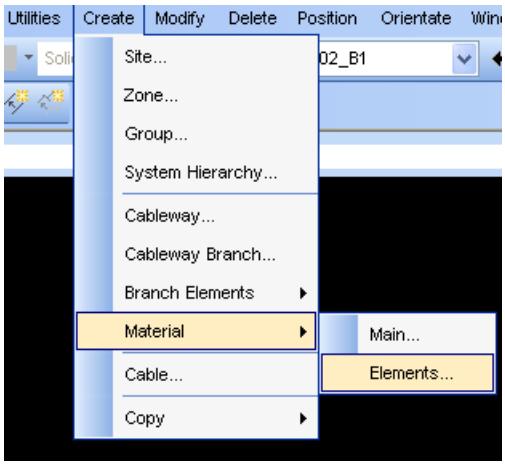
Dress Backwards	Select checkbox to reverse the direction in which the cableway branch is dressed.

The **Dress whole branch**, **Dress part of branch** and **Remove Dressing** sections of the form are the same as those on the **Preliminary Dressing (User Defined Dimensions)** form (refer to *Preliminary Dressing with Dimensions Defined by the User*).

Back to CableWay Material Modify Tasks	Displays the **Modify Material** form. Refer to *Modifying Cableway Branch Material*.

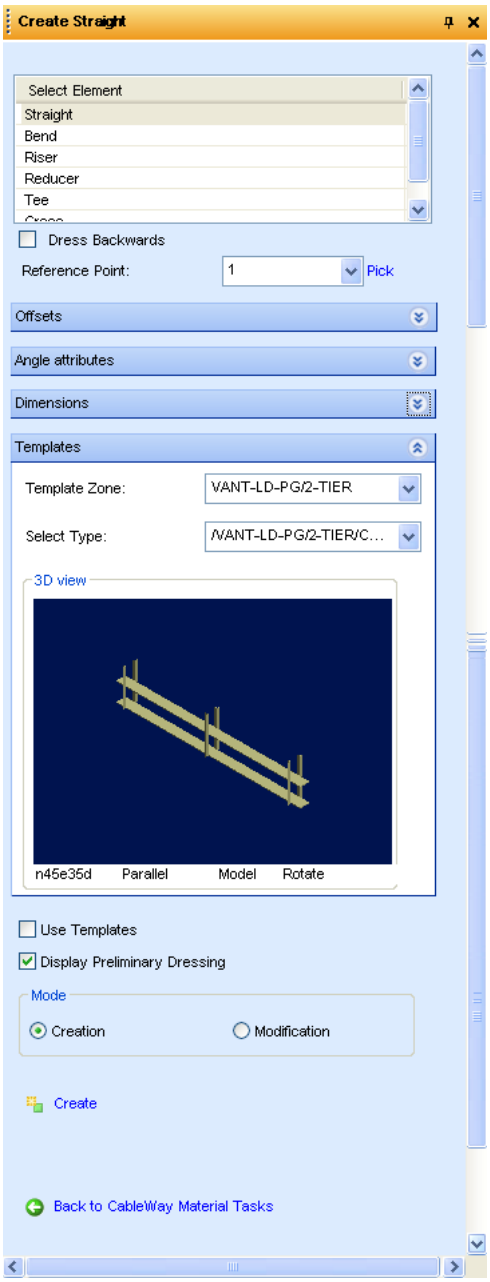
4.3 Creating Cable Tray Material Elements

The **Create** Material Element forms can be accessed by selecting the **Explicit Dressing** link on the **Modify Material** form or from the main menu by selecting **Create > Material > Elements**.



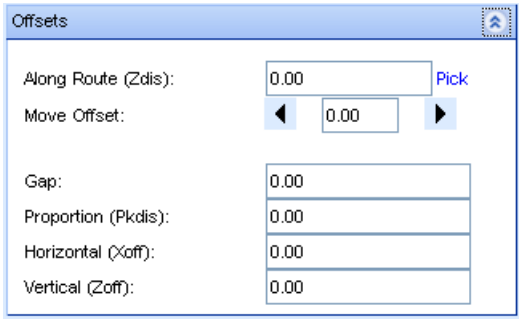
Both methods display the **Create Straight** form from which the other **Create Element** forms can be accessed.

Note: Before you can create individual material elements, a cableway branch material (CTMTRL) element must exist in the Design database.



Select Element	Select an element from the list to display that element's **Create** form.
Dress Backwards	Select checkbox to reverse the direction in which material elements are added to the cableway branch.
Reference Point	Select a reference point from the drop-down list to position the material element or use the **Pick** facility to pick a point in the 3D view.

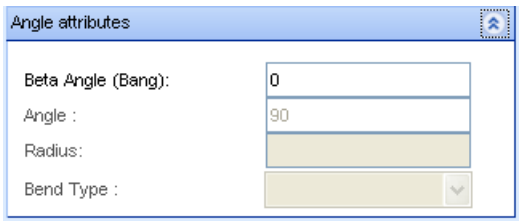
Offsets



This panel allows offsets to be entered.

Along Route (Zdis)	Enter an offset along the cableway route or use the **Pick** facility. The field is automatically populated if the **Reference Point** was picked.
Move Offset	Enter a value in the box and use the right or left arrow to respectively increase or decrease the Zdis offset.
Gap	Enter a gap offset.
Proportion (Pkdis)	Enter a proportional offset.
Horizontal (Xoff)	Enter a horizontal offset.
Vertical (Zoff)	Enter a vertical offset.

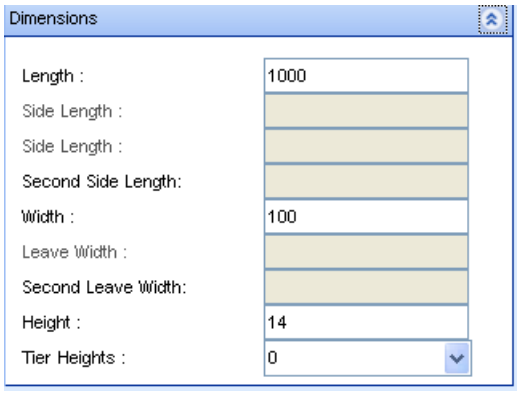
Angle Attributes



This panel allows angle attributes to be entered.

Beta Angle (Bang)	Enter a value for the Beta Angle.

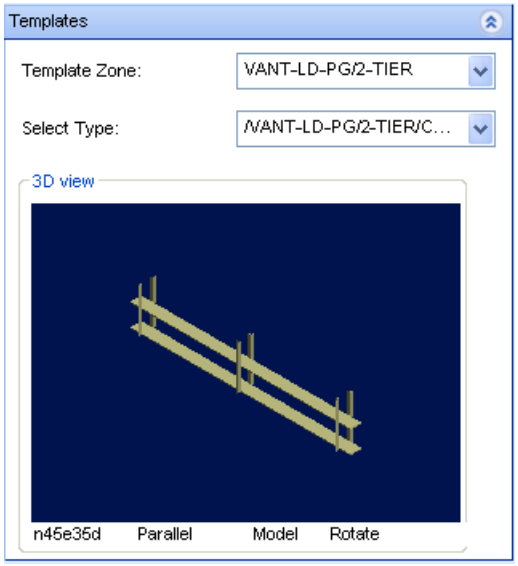
Dimensions



This panel allows the dimensions of the cable tray material element to be entered.

Length	Default value set. Enter a different value for the cable tray material element length, if required.
Width	Default value set. Enter a different value for the cable tray material element width, if required.
Height	Default value set. Enter a different value for the cable tray material element height, if required.
Tier Heights	Enter a value for the tier height.

Templates

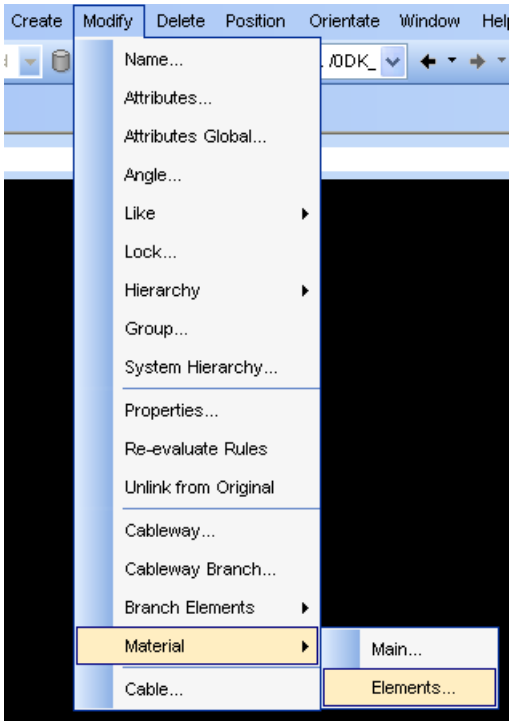


This panel allows the user to select a template for the material element and display the element in the panel 3D view.

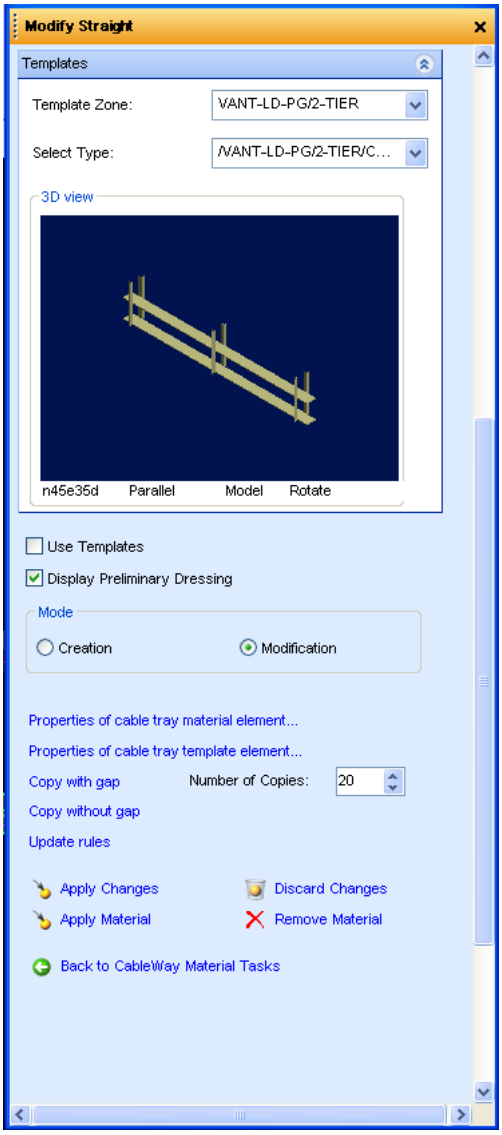
Template Zone	Select the zone in which the template resides from the drop-down list.
Select Type	Select the template type from the drop-down list.
Use Templates	Select checkbox to use the selected template for the cable tray material element.
Display Preliminary Dressing	Shows any Preliminary Dressing of the cableway branch in the main 3D view. The checkbox is selected by default.
Mode	Allows options of **Creation** or **Modification** to be selected. After creating a material element, selecting the **Modification** button displays the corresponding **Modify** Element form.
Create	Actions the creation of the cable tray material element.
Back to CableWay Material Tasks	Displays the **Modify Material** form. Refer to *Modifying Cableway Branch Material*.

4.4 Modifying Cable Tray Material Elements

The **Modify** Material Element forms can be accessed either by selecting the **Modification** button on the **Create** Element form or from the main menu by selecting **Modify > Material > Elements**.



The **Modify Straight** form is displayed, allowing the user to make modifications to a straight element or select an element from the list to display that element's **Modify** form.



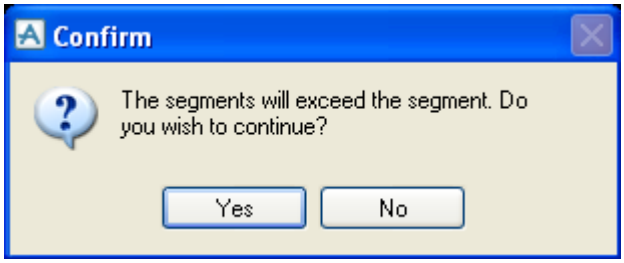
This form has the same expand/collapse panels as the **Create Straight** form (refer to *Creating Cable Tray Material Elements*).

Properties of cable tray material element Allows access to the cable tray material element properties.

Properties of cable tray template element Allows access to the cable tray template element properties.

Copy with gap	Make a copy of the previous material element in the cable tray sequence. If a gap was specified between the previous element then a gap of the same size will be placed between the copied element(s). To create multiple copies of a material element change the value in the **Number of Copies** spin box.
Copy without gap	Make a copy of the previous material element in the cable tray sequence without a gap. To create multiple copies of a material element change the value in the **Number of Copies** spin box.

Note: If the total length of the segment exceeds the total length of the copied elements, then the user is presented with a warning as follows:



Update rules	Updates any rules set for templates.
Apply Changes	Applies the selected modifications.
Discard Changes	Cancels the selected modifications.
Apply Material	Displays a **Choose Tray Element** form allowing the user to select a cable tray element specification.
Remove Material	Removes the cable tray element material from the cableway branch.
Back to CableWay Material Tasks	Displays the **Modify Material** form. Refer to *Modifying Cableway Branch Material*.

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