



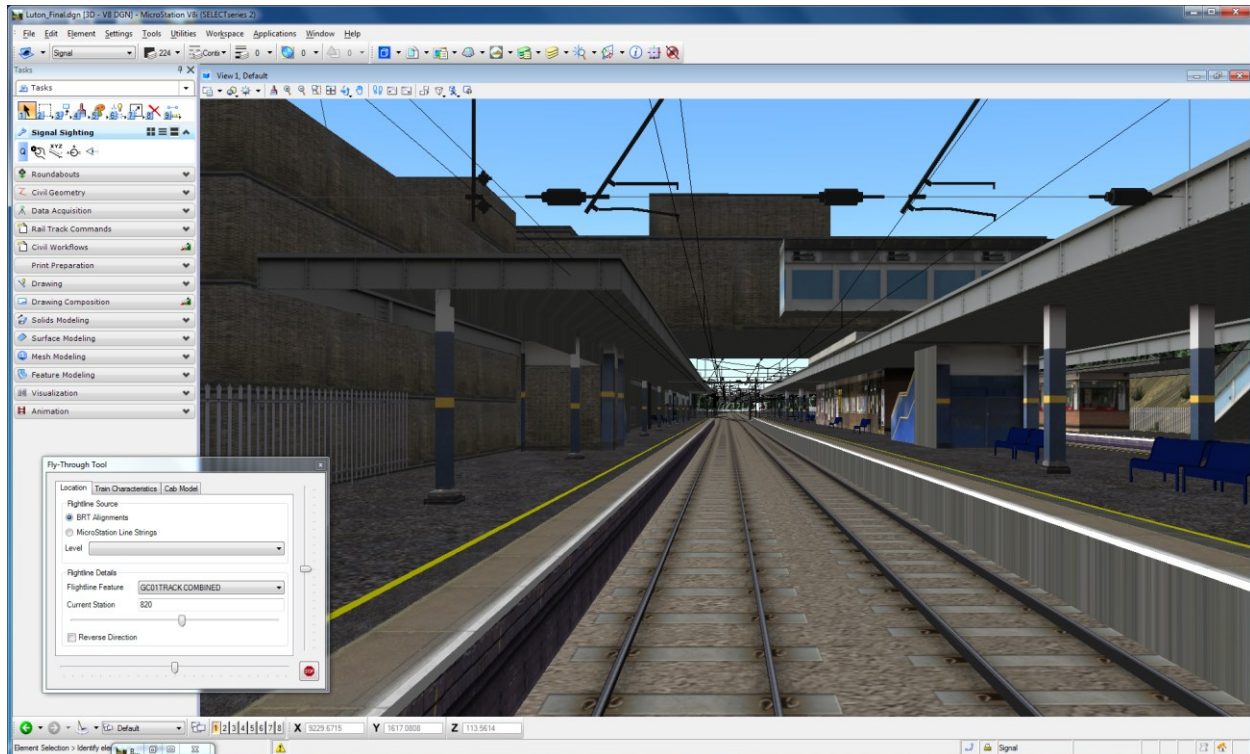
## Usage notes for Bentley Signal Sighting

4<sup>th</sup> October 2010 00v02

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## 1.0 Introduction

Bentley Systems (UK) has released a new version of their Signal Sighting toolkit. This new version runs purely within MicroStation (on top of Bentley Rail Track). A sample screenshot is shown below:



The toolkit allows the following tasks to be performed:

- Design new signals / edit existing signals
- Place signals using a variety of linear referencing techniques
- Configure signals
- Fly through the model, following user defines paths

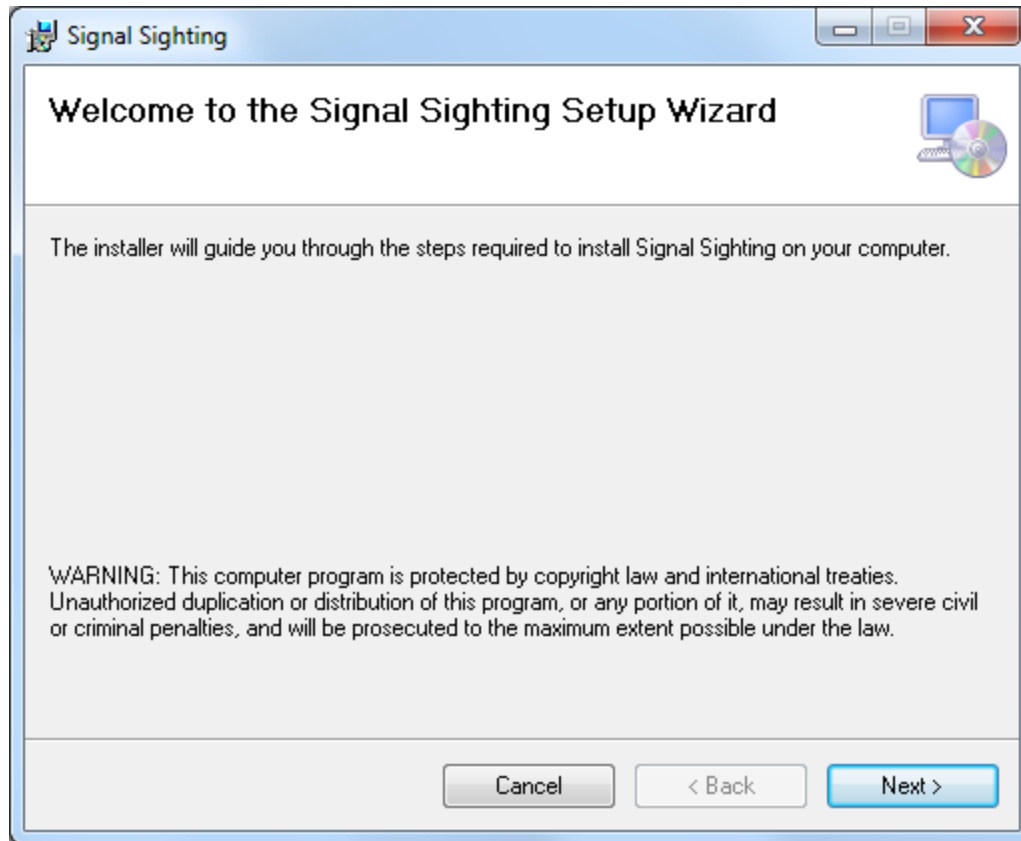
Each of these tasks shall be described within this document.

## 2.0 Installation

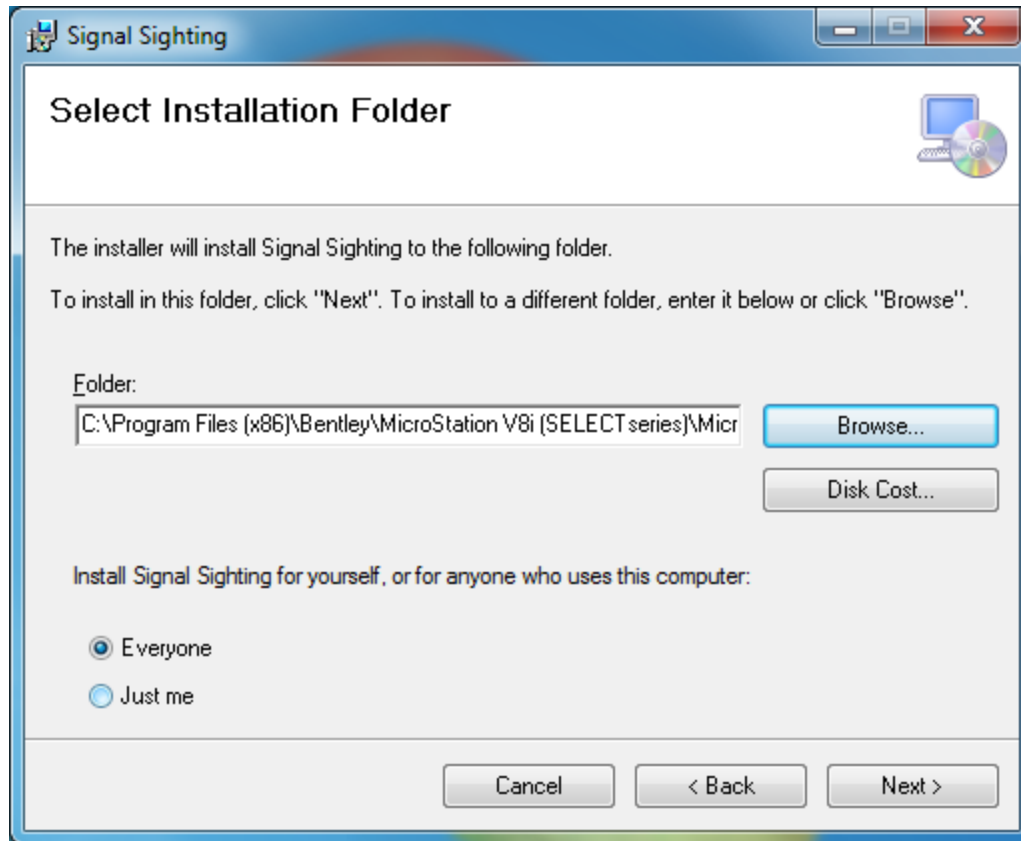
To install Signal Sighting, first ensure that the prerequisites are met:

- MicroStation v8i SELECTseries 2
- Bentley Rail Track SELECTseries 2
- Logged in to the target PC as administrator

Insert the CD (or other installation media) into the target PC, and run “setup.exe”. The following dialog should appear:



Press “Next >”.  
The following dialog should now appear:

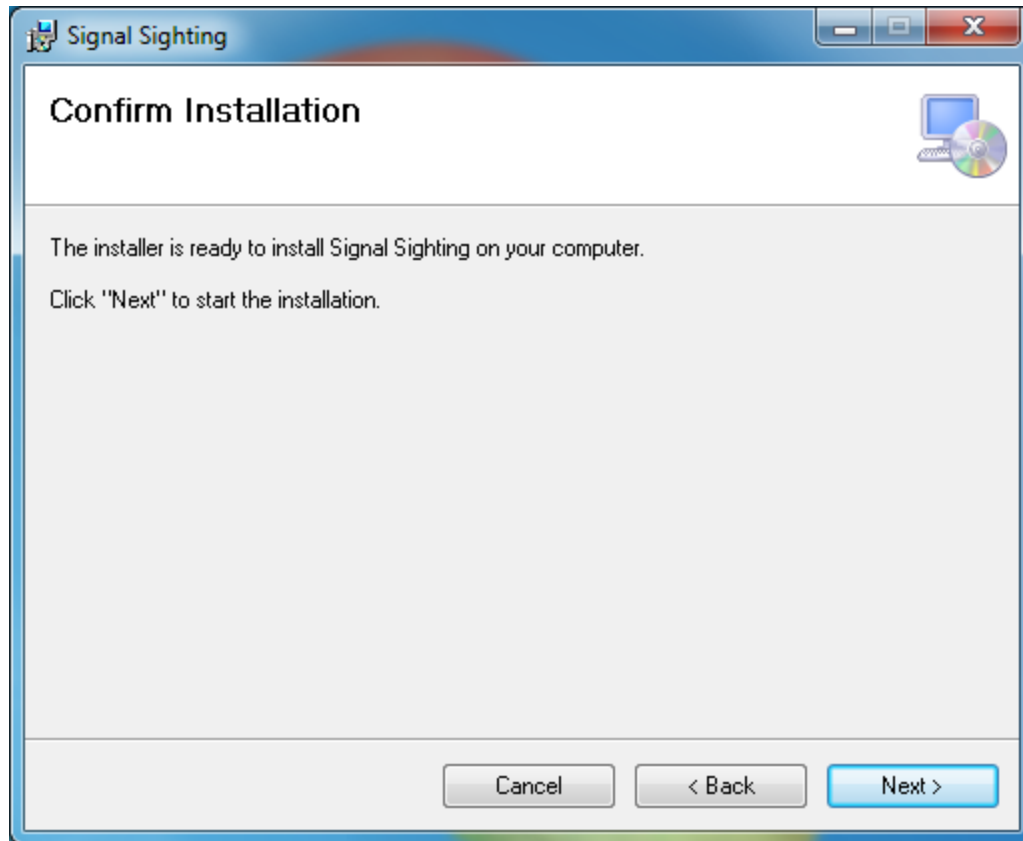


The folder to install must be the folder which contains “ustation.exe” (the MicroStation installation directory).

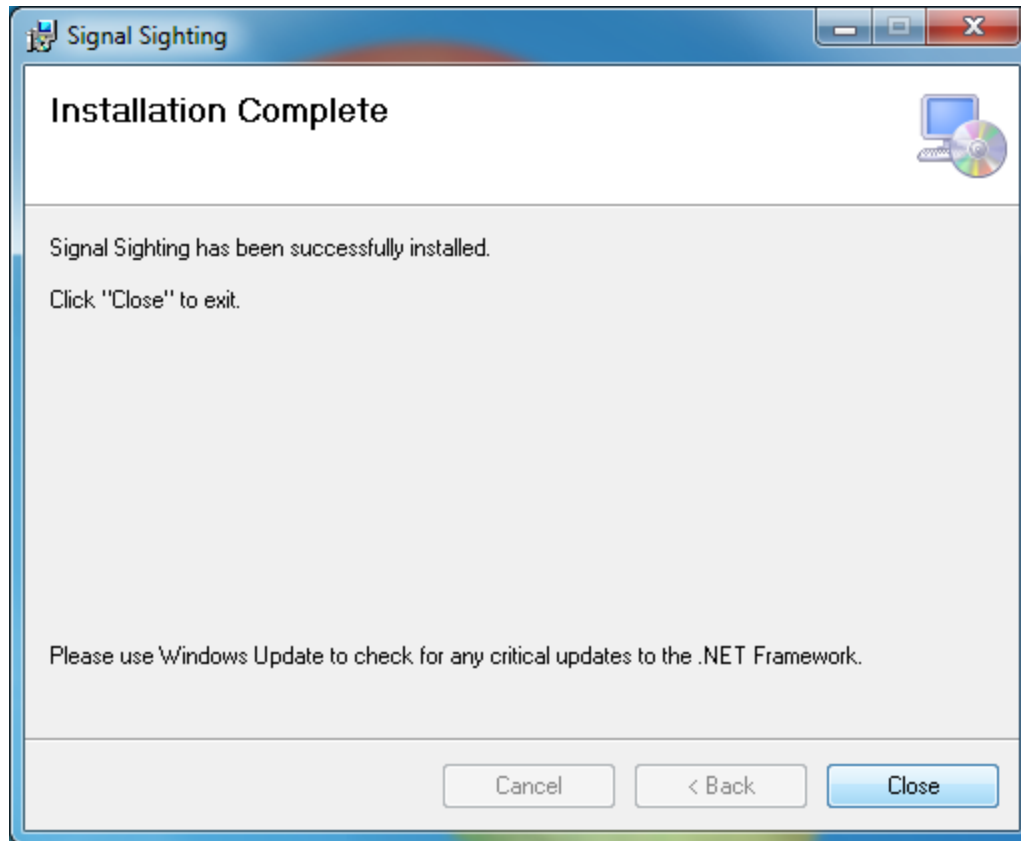
By default, this can be found at “c:\Program Files (x86)\Bentley\MicroStation v8i (SELECT series)\MicroStation”. Select this directory, and then press “Next >”.

It is also possible to select whether Signal Sighting shall be available for all users of the PC, or just the user performing the installation.

The following dialog should now appear:



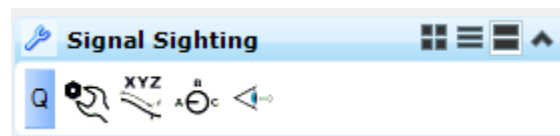
Press "Next >".  
The following dialog should now appear:







Press “Close”. The installation should now be complete.

### 3.0 Usage


The Signal Sighting toolkit is divided into 4 sections. All of these sections are available from the Signal Sighting toolbar from within MicroStation:



These tools are as follows:

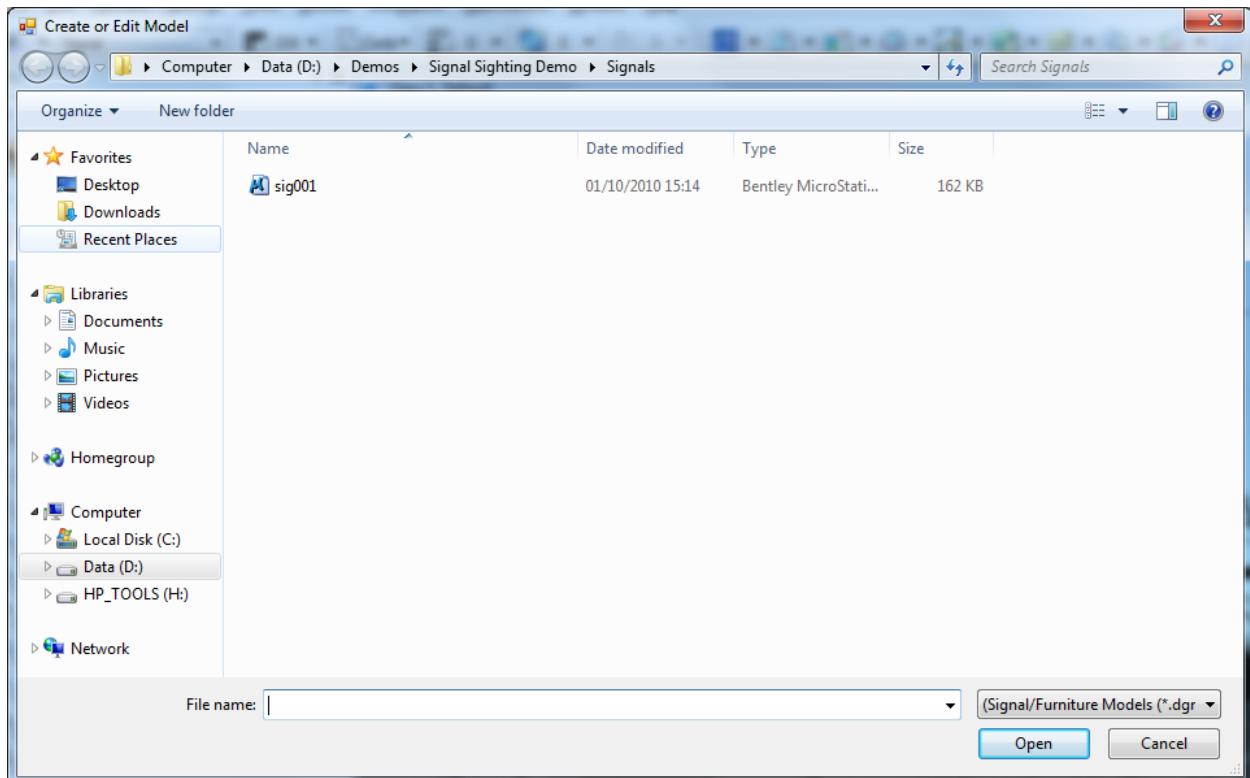
-  (Edit Furniture Models)
-  (Place Furniture Instances)
-  (Edit Furniture Instance properties)
-  (Driver's Eye Flythrough)

### 3.1 Edit Furniture Models

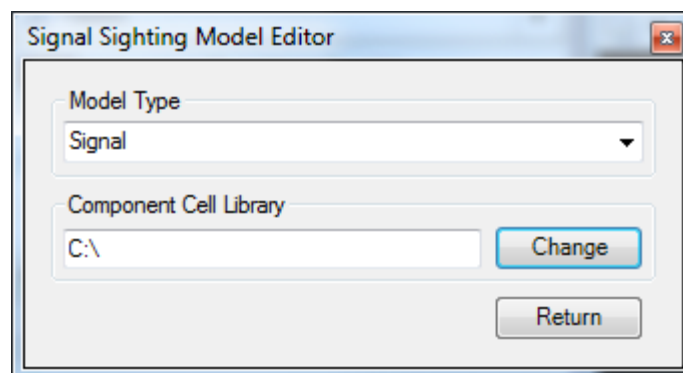
-  (Edit Furniture Models)

This option allows the creation of a new DGN containing furniture, or the editing of the definition of an existing piece of furniture.

Initially, the user will be asked to identify the DGN to contain the furniture, with a standard file open dialog:



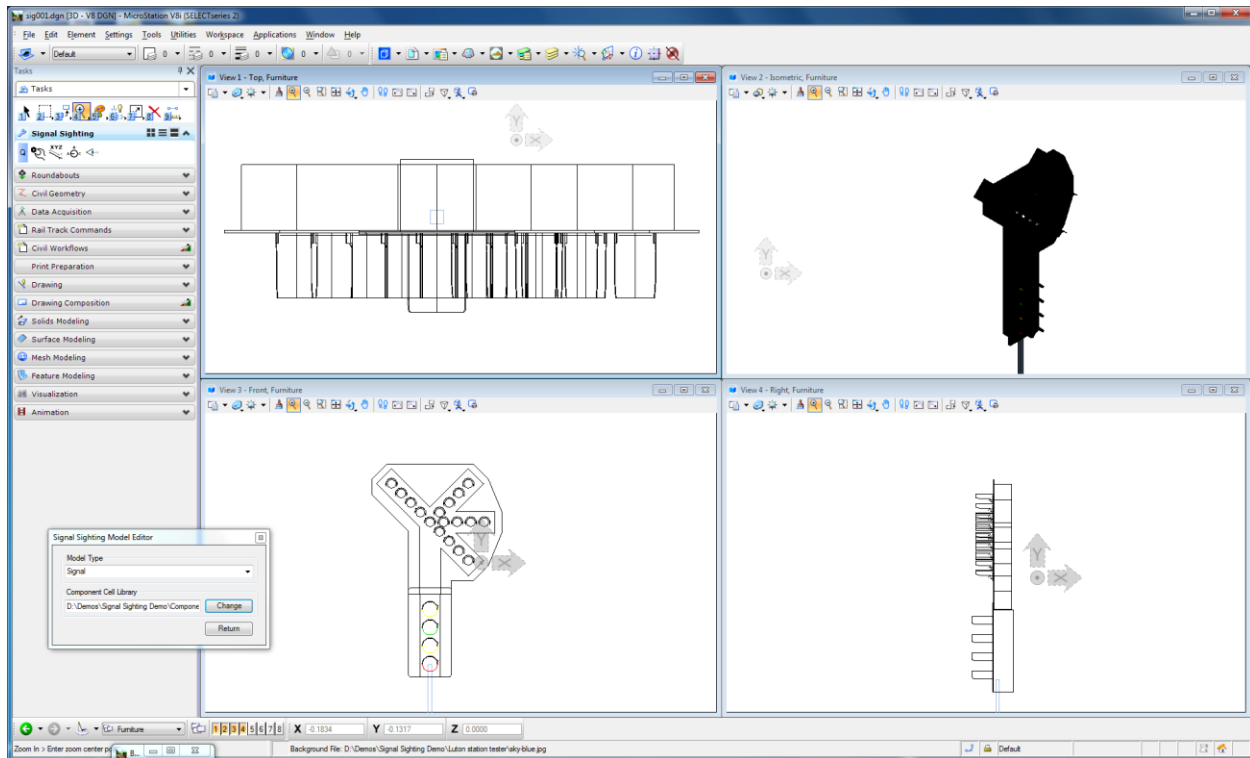
Once the DGN has been selected, the following dialog is displayed:





The user must specify the Model type. This is just a name for the group which the furniture is a part of. It could be any piece of text e.g. “Signals”, “Mileposts”, “Trees”, “Northbound Mainline Signals”. It is used later on to distinguish between different groups of furniture.

The user must also define the location of a cell library containing the cells which can be used for building signals. This cell library can be extended by the users to add more signal components if required. The convention in place for cells in this cell library is that the origin of all components is relative to the centre of the red aspect of a signal.

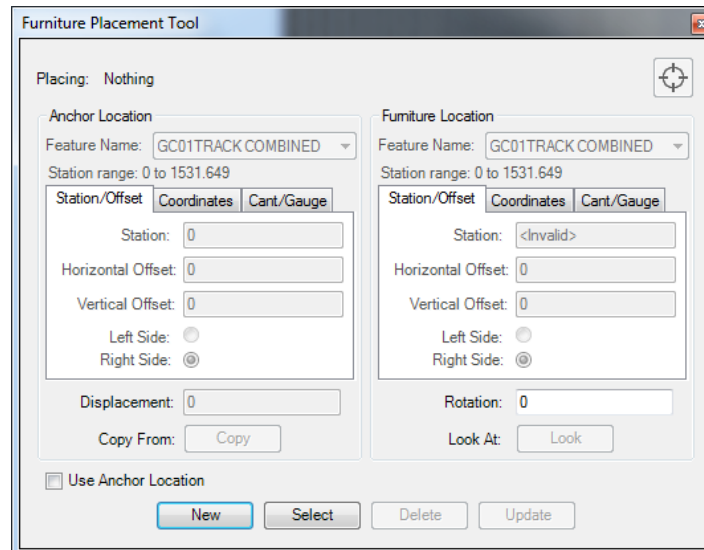


Signal Sighting then open the DGN representing the piece of furniture for editing, and attaches the requested cell library. Editors can use any items from the cell library in conjunction with any other design capabilities within MicroStation to produce the required furniture. Once the design has been completed, pressing the “Return” button switches back to the previous DGN.

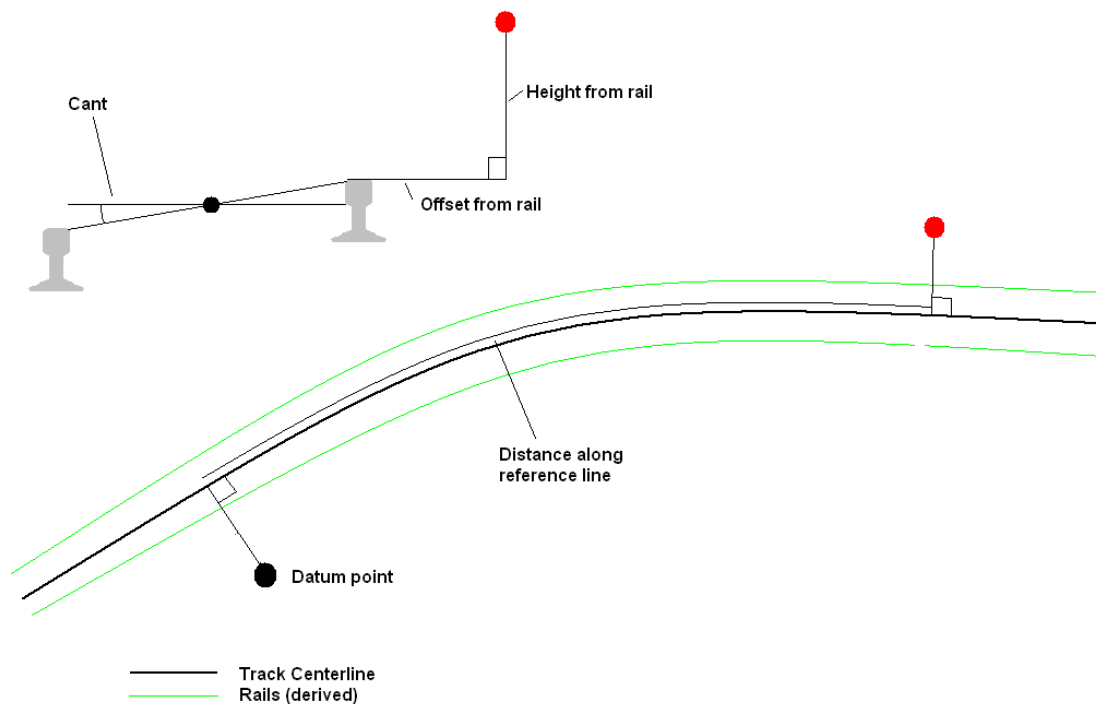
### 3.2 Place Furniture Instances

-  (Place Furniture Instances)

Furniture can be placed by a variety of mechanisms, using the “Place Furniture Instances” tool shown below:



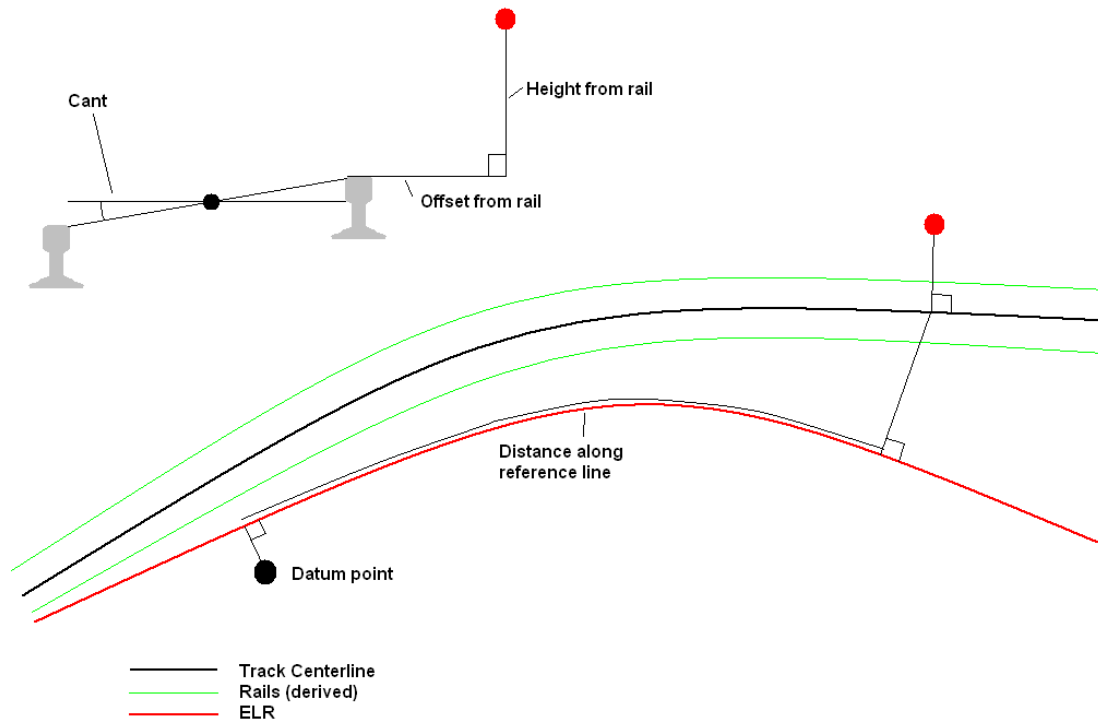
Furniture can be placed relative to a linear asset in two different ways, as follows:



In the above example, a piece of furniture (the red dot) is placed at a distance along a linear asset. In Signal Sighting, this can either be measured by a meterage from the start of the linear asset, or as a meterage from a datum point.

The datum point can be an XYZ location, or the defined point of any other piece of furniture. In particular, mileposts can be used to place signals relative to, and signals can be used to place AWS magnets relative to.

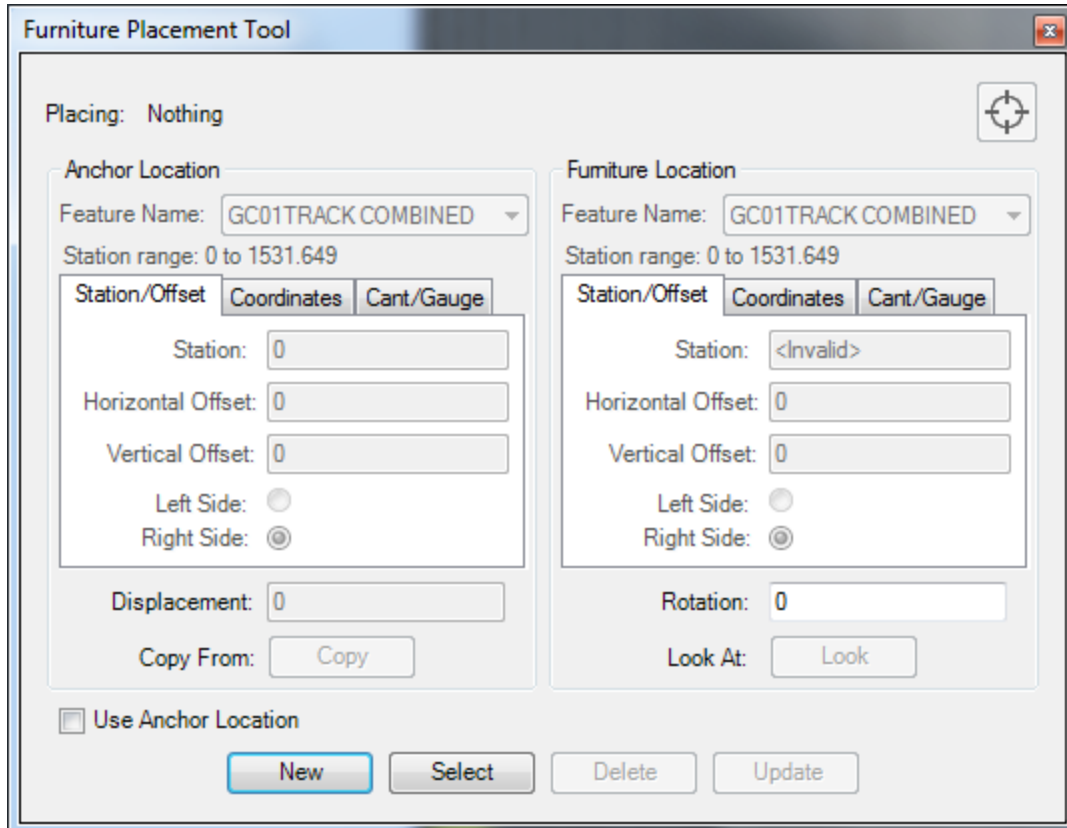
All meterages are measured against the same linear asset. This would normally be the track centerline. Once the final track location has been identified, a horizontal and vertical offset are applied. This can either be relative to the track centerline, or relative to the near rail (in which case cant is also taken onto account)



In the above example, a datum line has been introduced as well. These are often used to ensure that linear measurements along multiple tracks are consistent.

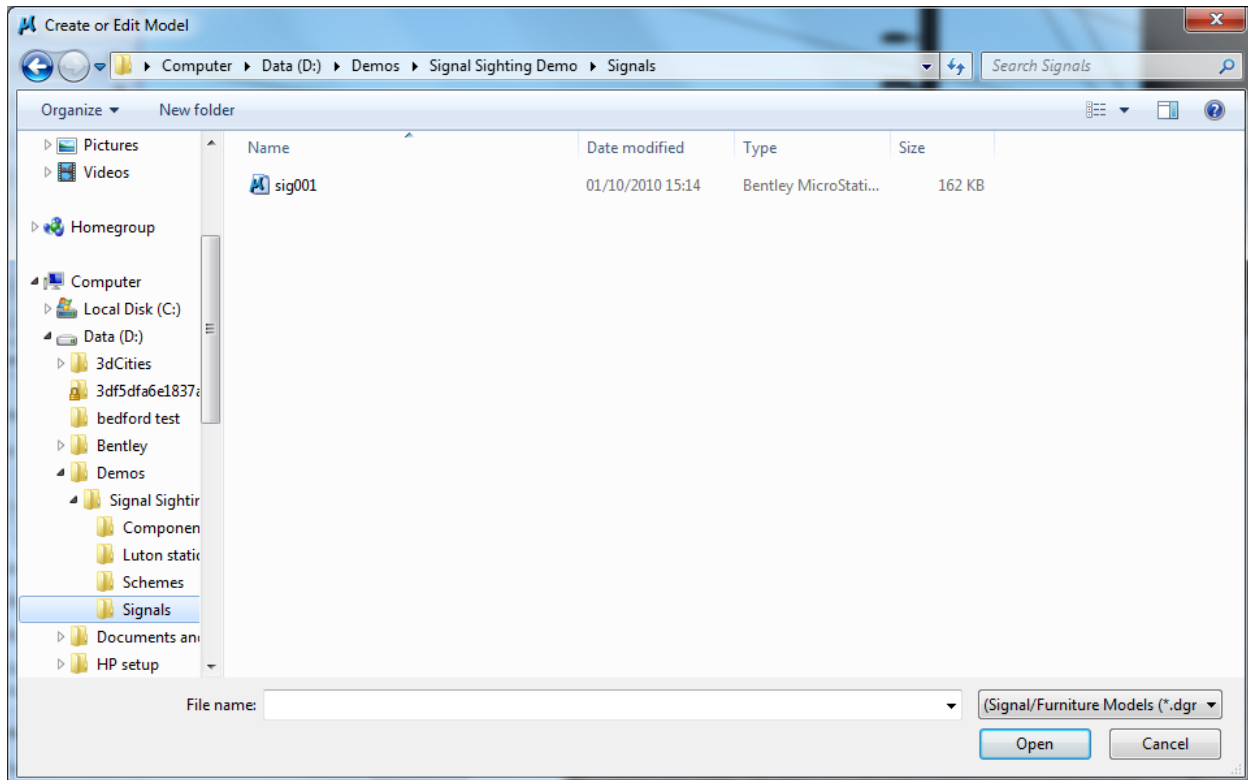
In this case, the datum is located against the reference line (e.g. Engineers Line Reference alignment), and the distance along the reference line is calculated. A normal is then dropped from the reference line to the track.

Once the final track location has been identified, a horizontal and vertical offset are applied. This can either be relative to the track centerline, or relative to the near rail (in which case cant is also taken onto account).



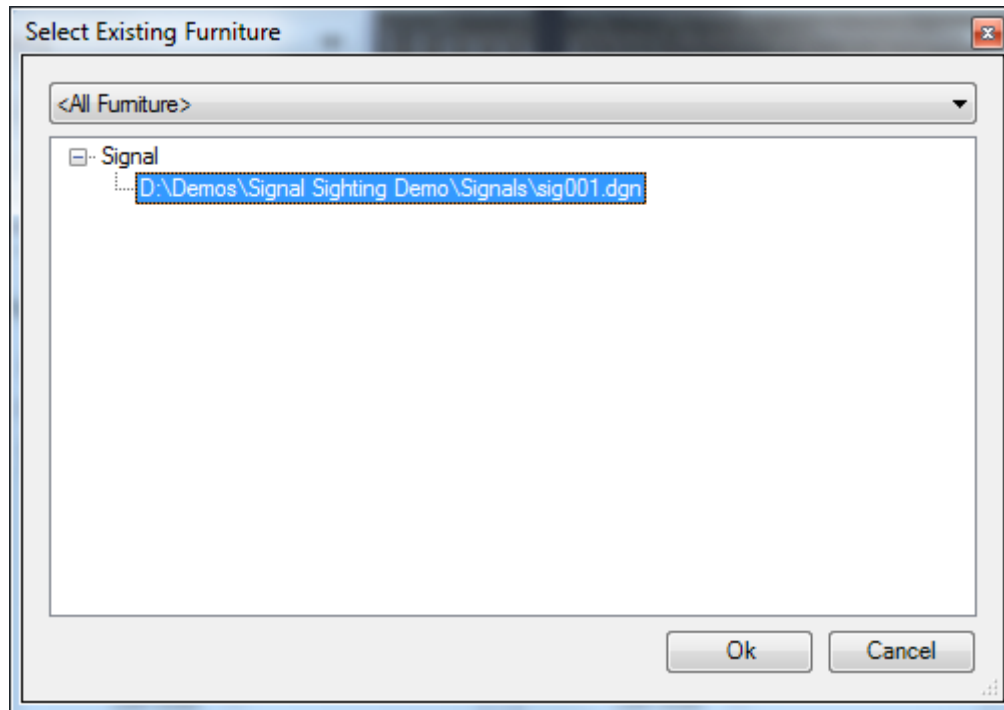
The image shows a software dialog box titled "Furniture Placement Tool". It has a standard Windows-style title bar with a close button. The main area is divided into two columns: "Anchor Location" on the left and "Furniture Location" on the right. Both columns have a "Placing: Nothing" status at the top. Each column contains a "Feature Name" dropdown menu set to "GC01TRACK COMBINED", a "Station range: 0 to 1531.649" label, and three tabs: "Station/Offset", "Coordinates", and "Cant/Gauge". The "Station/Offset" tab is active in both. Under this tab, there are input fields for "Station" (0), "Horizontal Offset" (0), and "Vertical Offset" (0). Below these are radio buttons for "Left Side" (unselected) and "Right Side" (selected). At the bottom of the "Anchor Location" column is a "Displacement" field (0) and a "Copy From:" button labeled "Copy". The "Furniture Location" column has a "Station" field set to "<Invalid>", and the same "Horizontal Offset" (0) and "Vertical Offset" (0) fields. It also has "Left Side" (unselected) and "Right Side" (selected) radio buttons. Below these are a "Rotation" field (0) and a "Look At:" button labeled "Look". At the bottom of the dialog is a checkbox labeled "Use Anchor Location" which is unchecked. Below the checkbox are four buttons: "New" (highlighted in blue), "Select", "Delete", and "Update".

To place new furniture, select “New”. This brings up the following dialog:

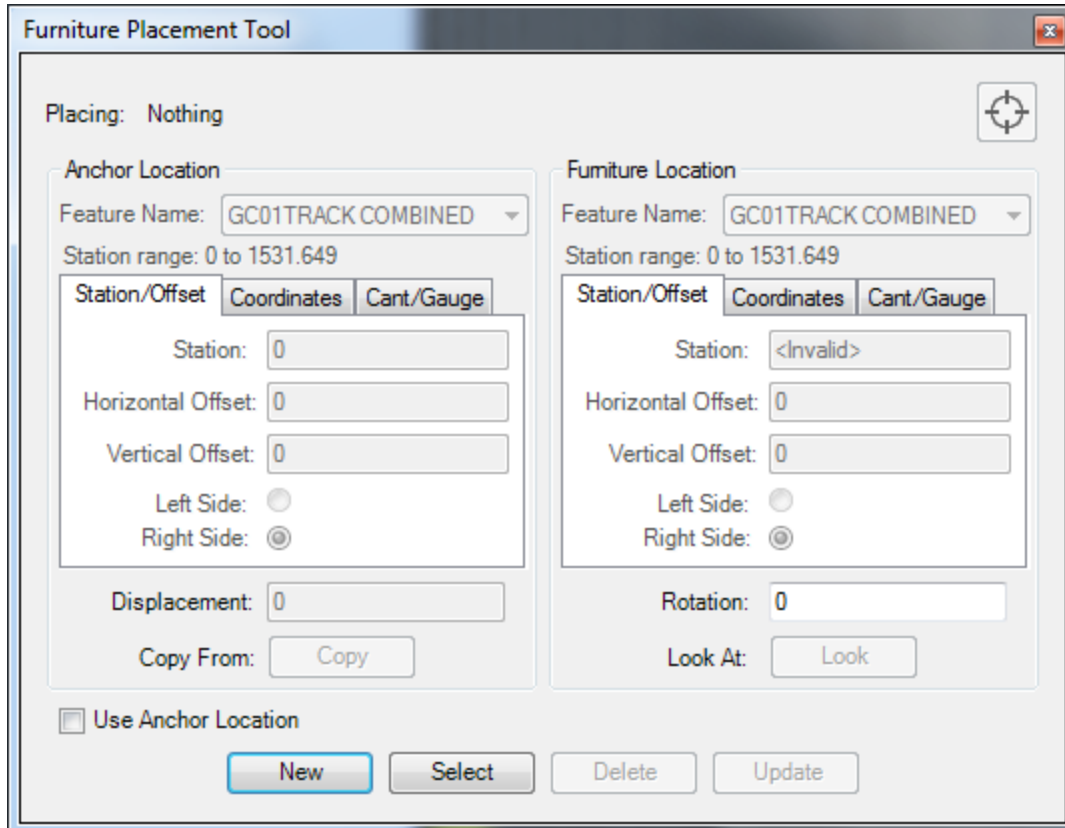


The user selects the dgn representing the signal to place (it must previously have been designed using the “Edit Furniture Models” tool).

Alternatively, to edit an existing signal, select “Select”. This then brings up the following dialog:



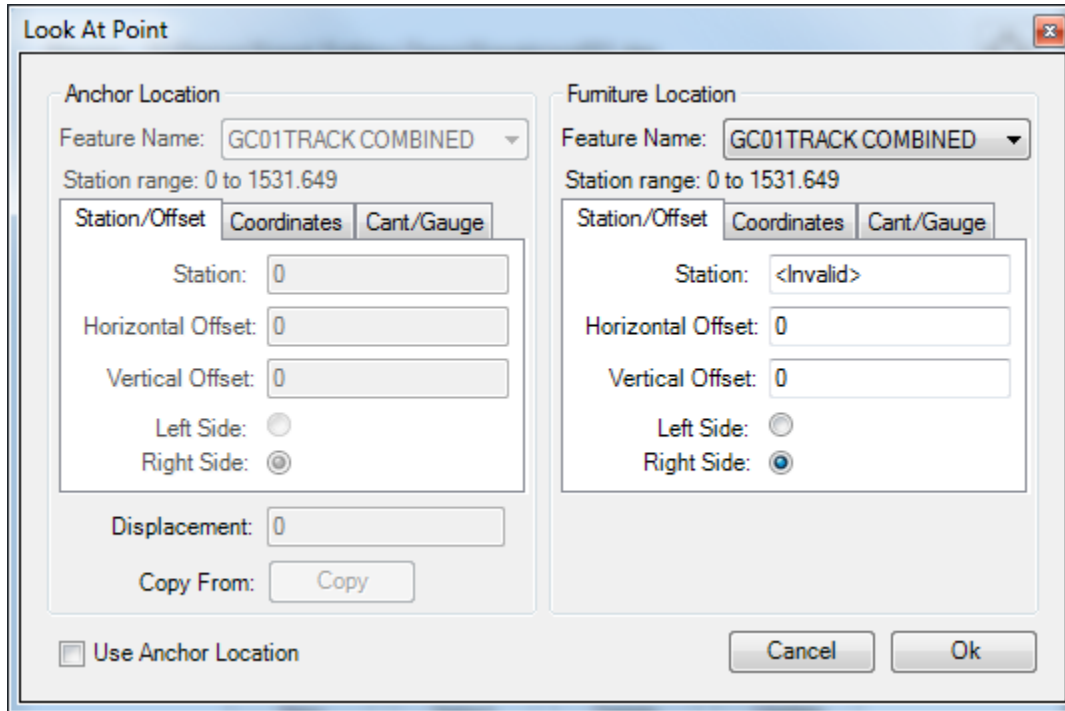
The dialog shows all of the signals currently in the drawing, and allows the user to select one of them. Once the signal to place has been defined, the user can proceed to place it.



To place a piece of furniture at an offset along a linear feature use only the right hand side of the form. The feature name (for the linear asset to measure along) is in the drop-down at the top of the form. Once selected, the linear range for the feature is displayed (for information only – in this case 0 to 1531.649 meters).

A value can then be typed into the “Station” textbox, for the distance along the linear feature (from its start) to place the furniture. The horizontal and vertical offsets can also be defined.

The default angle is 0: this is measured relative to the track, and is not an absolute rotation. An angle can be entered in degrees to rotate the furniture relative to the track. Alternatively, the furniture can be rotated to point at another nominated point on the track – this is often used for signals. Selecting the “Look” option brings up the following dialog:

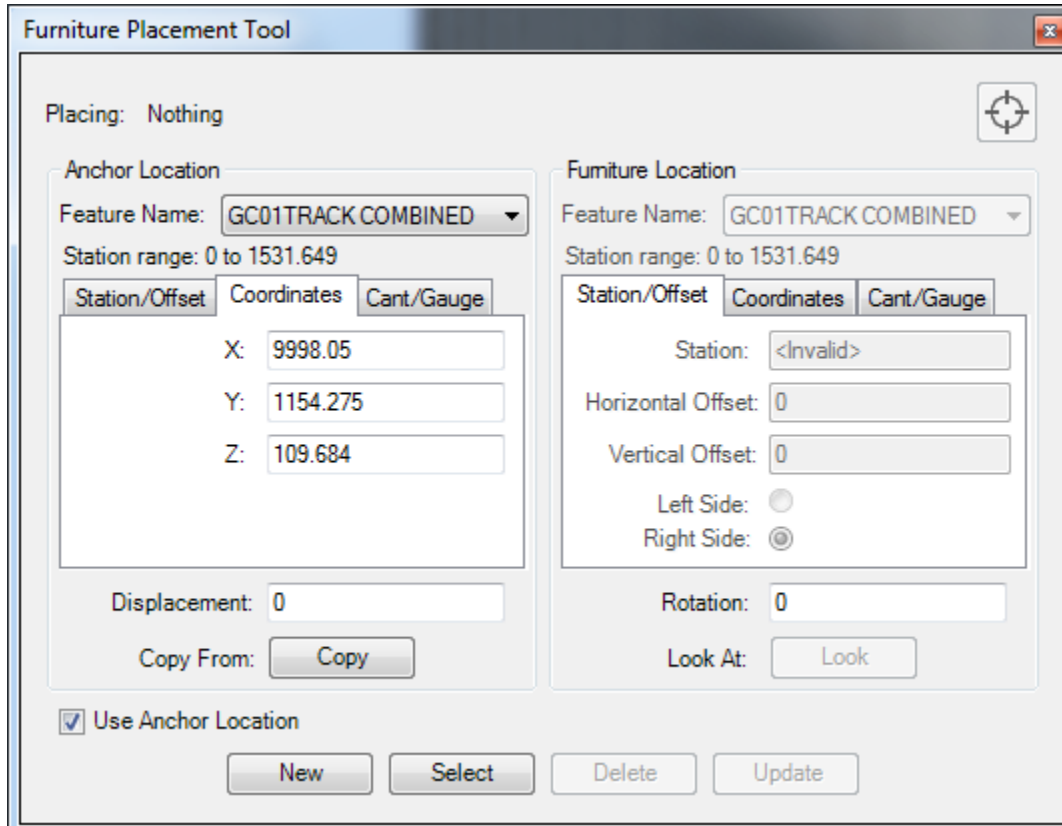


The "Look At Point" dialog box is divided into two main sections: "Anchor Location" and "Furniture Location". Both sections have a "Feature Name" dropdown menu set to "GC01TRACK COMBINED" and a "Station range" of "0 to 1531.649". Each section contains three tabs: "Station/Offset", "Coordinates", and "Cant/Gauge". The "Station/Offset" tab is active in both. In the "Anchor Location" section, the "Station" field is "0", "Horizontal Offset" is "0", "Vertical Offset" is "0", "Left Side" is unselected, "Right Side" is selected, "Displacement" is "0", and there is a "Copy From" button. In the "Furniture Location" section, the "Station" field is "<Invalid>", "Horizontal Offset" is "0", "Vertical Offset" is "0", "Left Side" is unselected, "Right Side" is selected, and there is no "Displacement" field. At the bottom left, there is a checkbox labeled "Use Anchor Location" which is currently unchecked. At the bottom right, there are "Cancel" and "Ok" buttons.

In this dialog the user defines the location at which the furniture is to point. It is used in the same way as the define furniture location tab (described elsewhere). Defining a linear point and then pressing “OK” will point the furniture at the defined point.

If furniture is to be located at an offset from a datum point, then the “Use Anchor Point” option should be selected (bottom left in the following screenshot).





**Furniture Placement Tool**

Placing: Nothing

**Anchor Location**

Feature Name: GC01TRACK COMBINED

Station range: 0 to 1531.649

Station/Offset Coordinates Cant/Gauge

X: 9998.05

Y: 1154.275

Z: 109.684

Displacement: 0

Copy From: Copy

☒ Use Anchor Location

**Furniture Location**

Feature Name: GC01TRACK COMBINED

Station range: 0 to 1531.649

Station/Offset Coordinates Cant/Gauge

Station: <Invalid>

Horizontal Offset: 0

Vertical Offset: 0

Left Side: ☐

Right Side: ☒

Rotation: 0

Look At: Look

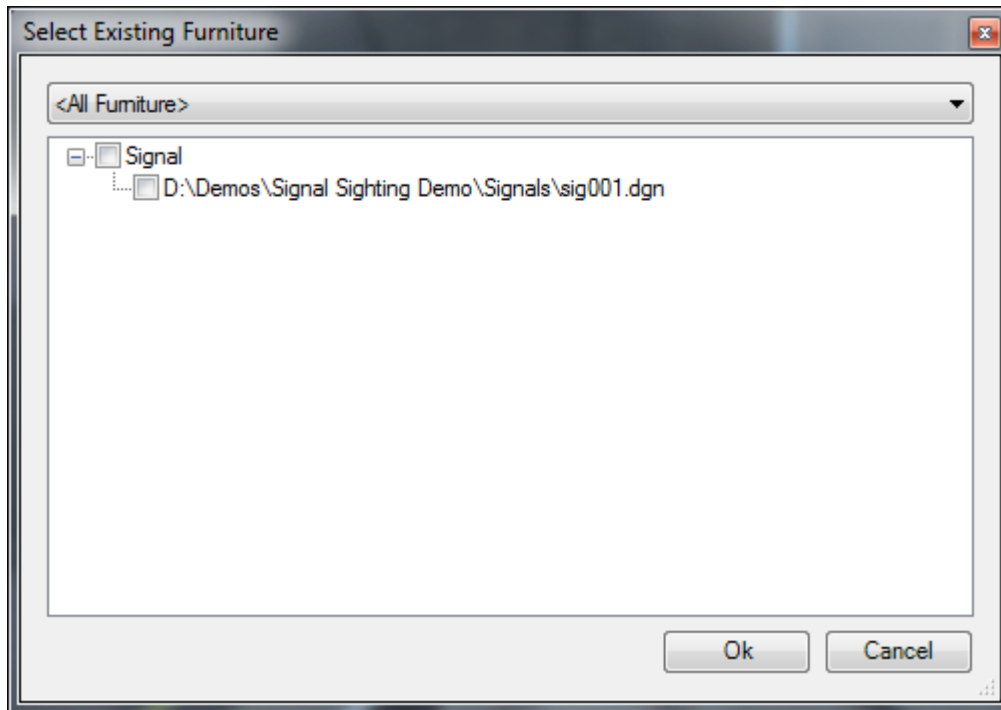
New Select Delete Update

The left hand side of the dialog is now used to define the datum point, and the right hand side<sup>4</sup> is used to define the location of the furniture. The “Displacement” textbox is used to define the distance along the linear feature from the datum to the furniture.

If the feature names for the left and right side of the dialog are the same, then only a single linear feature is used – this is the first case listed at the top of this section.

If two different feature names are used, then the feature name on the left is the name of the reference line, and the feature name on the right is the name of the track line.

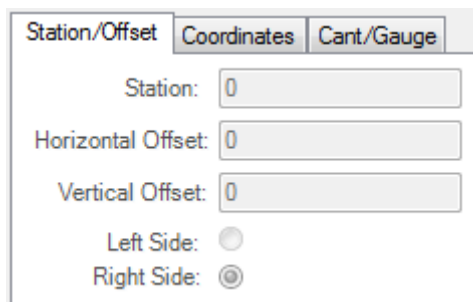
To select the location of an existing piece of furniture (e.g. a signal or a milepost) to use as the datum point, select the “Copy” button. This opens the following dialog:



From this dialog select the piece of furniture to use as the datum, and press “OK”. The coordinates of the furniture selected will be placed into the dialog.

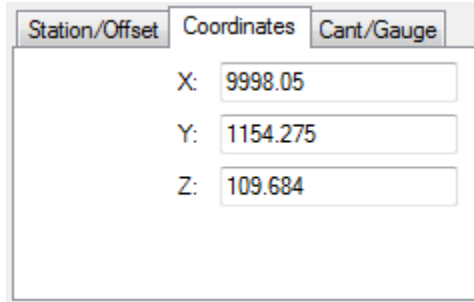
The point selection dialogs all contain the same control, with three tabs. This is described below:

### 3.2.1 Tab 1



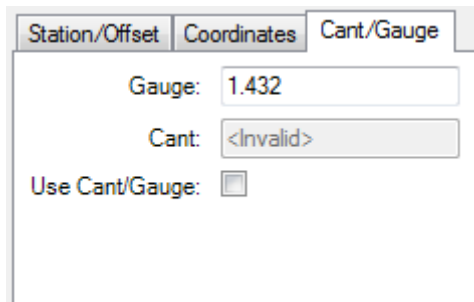
This tab is used to select a location along a linear feature by station (distance from start). The horizontal and vertical offset from this point can also be selected, as well as which side of the linear feature is used.

### 3.2.2 Tab 2



This tab shows the location as X, Y and Z coordinates. These can be edited by the user if required, and will update the values in the other tabs if possible and appropriate.

### 3.2.3 Tab 3



This tab is used to determine if Gauge and Cant need to be applied or are available in the source data. Gauge is measured in meters, and will default to 1.432m. Cant is read from the alignment used for the track, if it is available.

## 3.3 Edit Furniture Instance properties

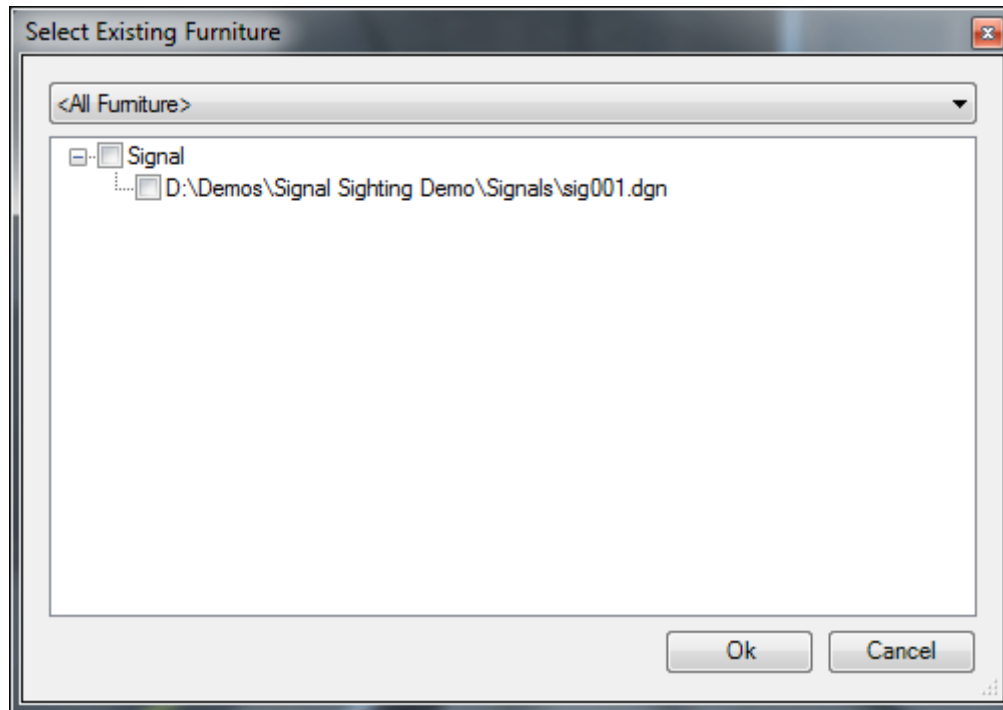
-  (Edit Furniture Instance properties)

Furniture in Signal Sighting uses a fixed naming convention to allow the Signal Sighting application to interact with the models (described later in this document).

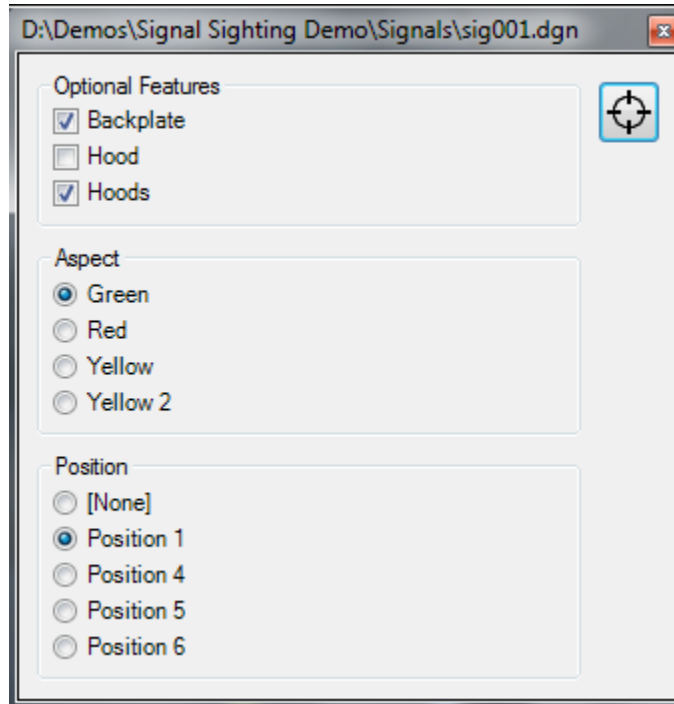
The Signal Sighting application reads these layer names, and uses them to determine what configurable elements exist within a piece of furniture.

Initially, the furniture to be edited must be selected.

On selecting the tool from its icon, the following dialog appears:




This dialog allows the user to select either specific pieces of furniture (single or multiple), or entire types of furniture. For example, the user could select a single signal to set its lights to Green, or the user may select all signals on the up line, and set them all to red at the same time. Once the furniture to be edited have been selected, the user presses “OK”, and a dialog looking similar to the following dialog appears:



Note that this dialog is created based upon the configurable elements available within the selected furniture, so the detail of the look of the dialog will vary from furniture to furniture.

The dialog lists all of the configurable elements of the furniture. Selecting items in the dialog will immediately update the corresponding elements in the furniture in the display.

The button labelled “” will snap the view to the currently selected piece of furniture (assuming that only 1 piece of furniture has been selected to be edited).

When the user has finished editing the piece of furniture, the user can simply close down the dialog.

### 3.4 Driver’s Eye Flythrough

-  (Driver’s Eye Flythrough)

This tool allows the MicroStation view to be driven as though travelling along a user nominated piece of track.

The tool is divided into 3 tabs – each shall be discussed in turn.

#### 3.4.4 Location

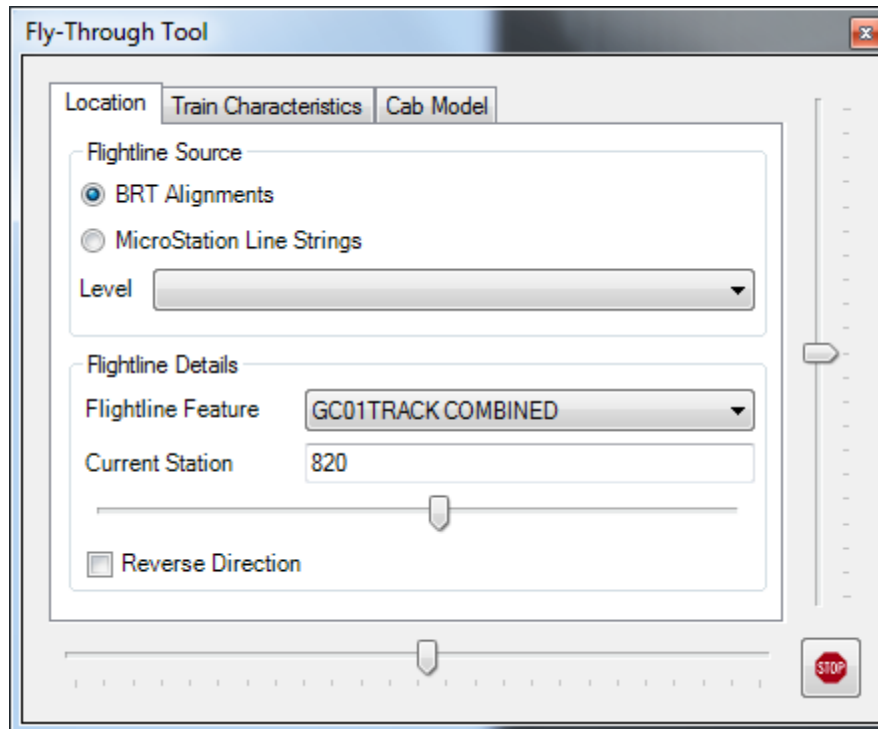
The first tab of the Fly-through tool allows the user to select which MicroStation entity is to be flown along. The options are:

- BRT Alignments (from the currently active ALG file)
- MicroStation line strings (from a user specified level)

The list of options for strings is displayed in the “Flight line Feature” dropdown.

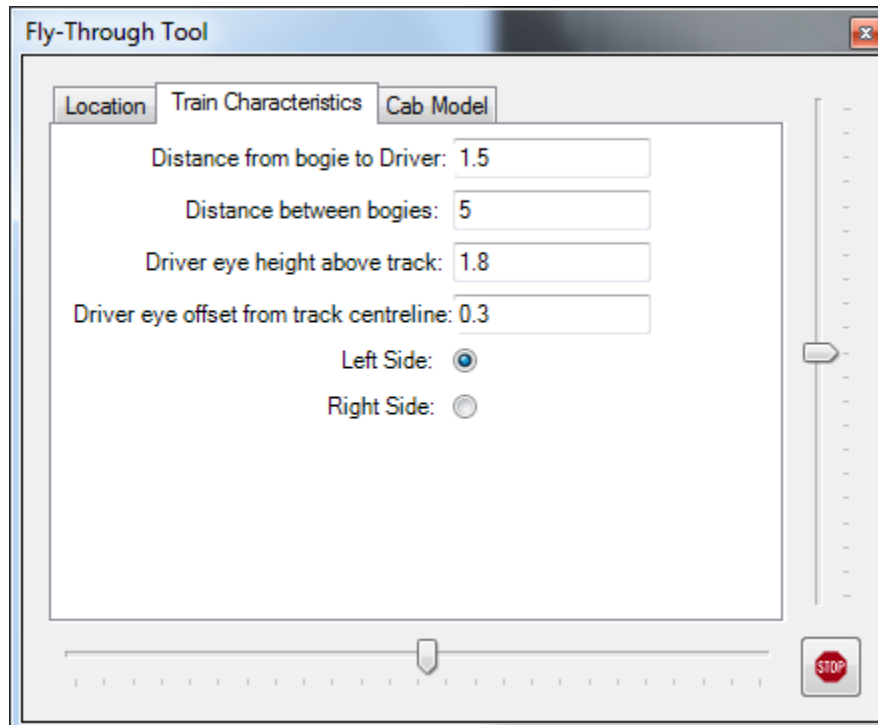
The current station can be entered (shown in meters from the start of the currently selected entity).

The slider bar underneath the “Current Station” textbox allows the user to scroll along the entire length of the currently selected entity. This also updates the current station value in the text box.



Reverse direction allows the user to traverse the currently selected entity in the opposite direction. The slider bar at the very bottom of the dialog allows the user to look left and right. The default is straight forwards. If a cab model is displayed, it is not rotated with the view, the effect being as though the driver was turning their head inside the cab to look out of the side windows. The vertical slider bar at the right of the dialog is used for driving through the model at a user specified speed. The further up the slider is, the faster the train goes forwards. The further down the slider goes, the faster the train goes backwards. There is a “Stop” button in the bottom right corner, which resets the speed slider back to 0.

### 3.4.5 Train Characteristics



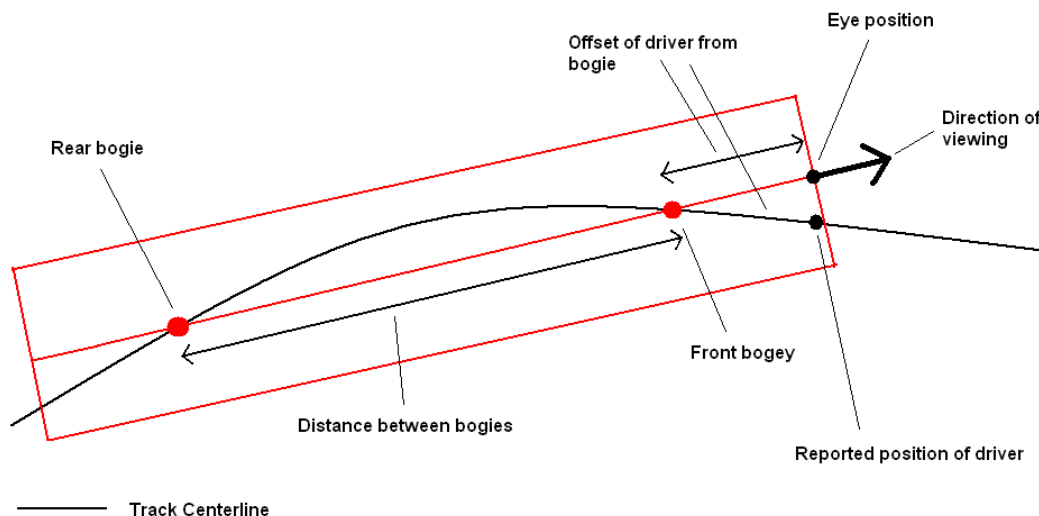
The driver's eye position is shown taking into account end-throw of the train being displayed. The following items need to be configured in order to correctly display the view for the driver:

- The horizontal distance (in meters) from the driver's eye to the front bogie of the vehicle
- The horizontal distance (in meters) between the front and rear bogie
- The distance above the track to view from (actually the distance above the chosen flight line, which is generally expected to be the track centerline)
- The offset of the driver's eye from the track centerline
- Whether the driver's offset is to the left or the right of the track centerline

The driver's eye position is calculated from the reported position of driver along the track ALG as follows:

- Go back along the track ALG from the chainage of the reported position of driver by the “offset of driver from bogie” – this is the position of the front bogie
- Go back along the track from the chainage for the front bogie by the “distance between bogies” – this is the position of the rear bogie
- Draw a straight line between the 2 bogies
- Extend this straight line out beyond the front bogie, by the “offset of driver from bogie” value
- This is the location of the drivers eye
- The direction the driver is facing is the same as the direction of the line drawn between the two bogies.

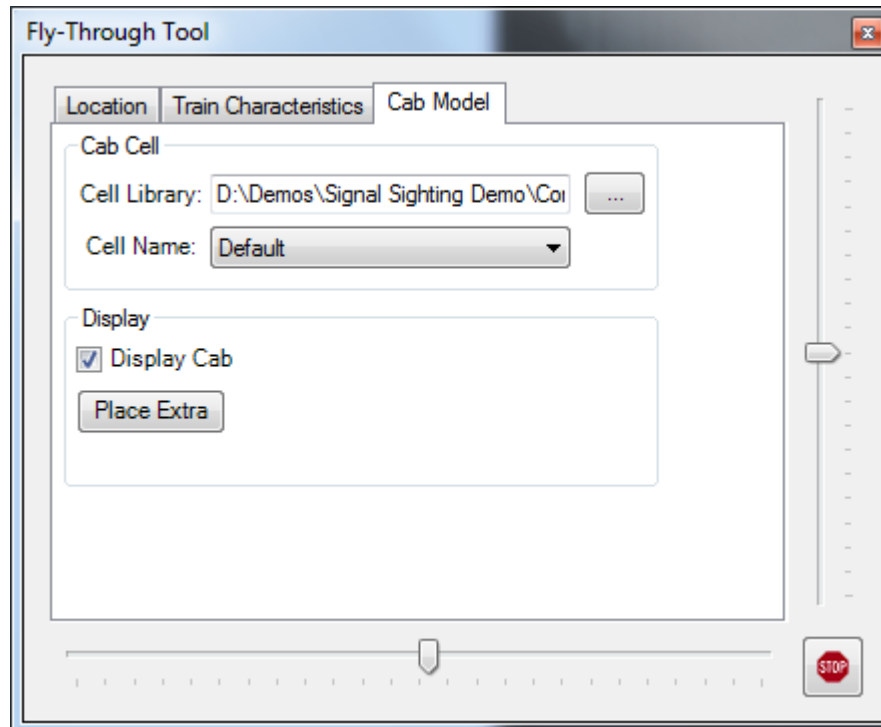
The following diagram shows this process:



Whilst in this tab, the ability to look left and right, accelerate forwards and backwards and stop are still available from the horizontal and vertical slider bars at the bottom and right of the dialog.

### 3.4.6 Cab Model





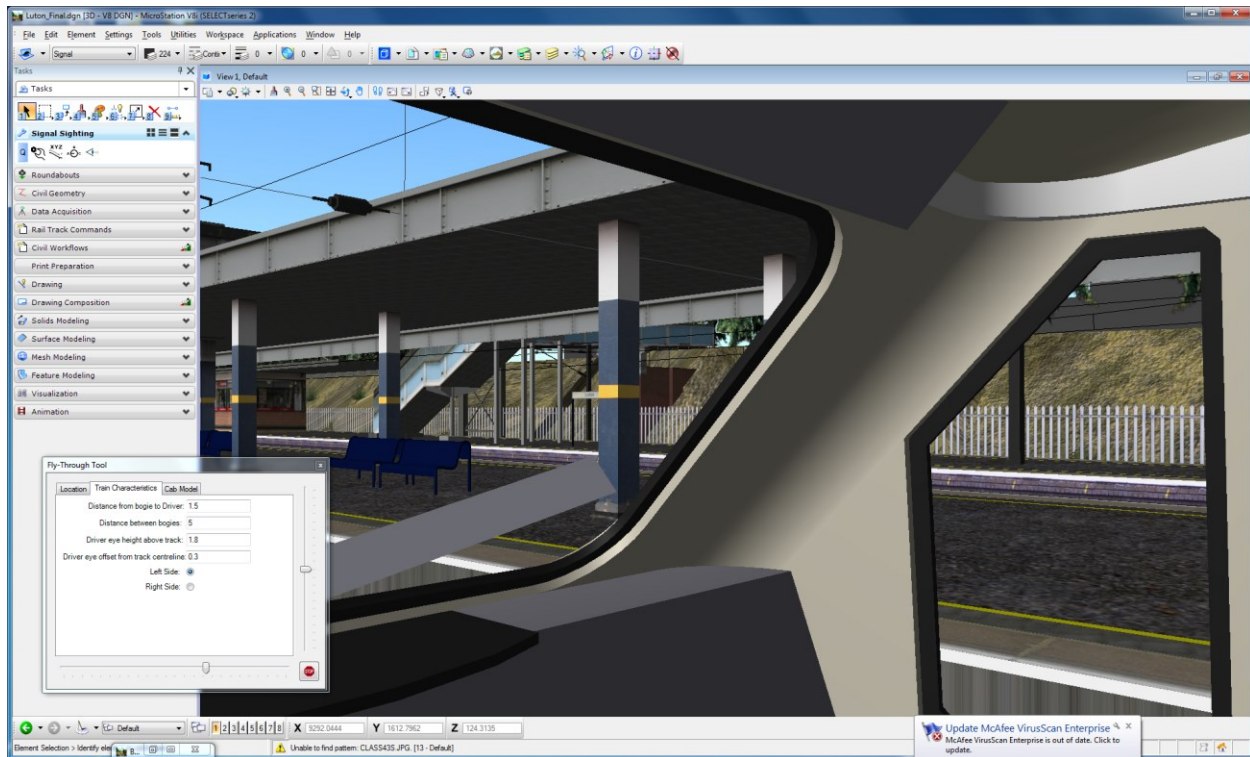
This tab is used to add a cab model to the view. The cab is defined as a cell, with its origin at the point where the front bogie meets the track centerline.

The user selects the cell library and cell name which contains the cab model.

If “Display Cab” is selected, then the cab model the user has selected is displayed, and updated whenever the user uses the Fly through tool to move around the model. Note that if the user uses other MicroStation tools to move around the model, the cab model is not updated.

The “Place Extra” button is provided to allow the user to place additional cab models in the model (at the current position). These models must be deleted using MicroStation when they are no longer needed, and Signal Sighting does not keep a record of them). This option can be used to place cab models on adjacent lines for visualization purposes (assuming that the cab model is of the entire car).

Whilst in this tab, the ability to look left and right, accelerate forwards and backwards and stop are still available from the horizontal and vertical slider bars at the bottom and right of the dialog.



The above screenshot shown a sample dataset with a cab turned on, and the drivers eve rotated to look out of the right window.

## 4.0 Layer naming convention

## 4.5 Outline

### 4.5.7 Objectives

In order to control the display of signal models in different states, the application needs to be able to distinguish between the different components. For example, a signal may have an arm that can be in either a raised or lowered position, and it will have one or more lights that can either be on or off.

The naming convention needs to be able to allow the application to distinguish between:

- Levels that should always be displayed.
- Levels that should never be displayed.
- Levels which can be optionally displayed.
- Levels which contain special features such as light cones.
- Groups of levels, in which one must be displayed at a time.
- Groups of levels, in which zero or one must be displayed at a time.

Additionally, the naming convention must allow for additional attributes or flags to be given to levels so that future functionality can take advantage of them.

#### **4.5.8 Restrictions**

The names of MicroStation layers can reach 511 characters in length, and may not contain the following characters: < > . / \ “ ? \* | = ‘ &

For user-friendliness, all parts of the naming structure should use recognizable English words wherever possible, rather than values represented by encoded character strings.

#### **4.5.9 Component Overlap**

There is not a one-to-one correspondence between components and levels. Each component may contain elements on more than one level, and multiple components can contain elements on the same level. Therefore the naming convention can only give indicators to the behavior of levels, not to the behavior of whole components.

### **4.6 Naming Convention**

#### **4.6.10 General Structure**

Each level name consists of one or more *sections*, each separated by an open bracket character ('['). Leading/trailing spaces either side of the bracket are optional, and will be ignored if present, as will a trailing close bracket (']'). Ending each section with a closing bracket is not necessary for the application to read the sections, but makes the model name more user friendly.

The first section of the level name is free text, and contains the user-friendly name of the level. Whenever the level is listed to within the application, except in places where levels with the same user-friendly name need to be distinguished, this name will be used. The user-friendly name of a level is case-sensitive; and spaces, except for any leading/trailing spaces, are not ignored.

In cases where there is no instance of a '[' in the level name, the entire level name will be considered to be the first section, and consequently the entire level name will be considered to be the user-friendly name of the level.

All sections other than the first section are treated independently as *attributes*. A level name can have as many attributes as there is room for within the 511 character limit, and attributes can appear in any order. Attributes are not case-sensitive, and spaces within them are ignored (for example, “NoDisplay”, “NODISPLAY”, “No Display” and “NO Display” are all considered to be the same attribute). Any close bracket character (‘]’) within an attribute will also be ignored.

#### 4.6.11 Pre-Defined Attributes

The following attributes are pre-defined, and will be recognized by the application.

##### 4.6.11.1 Display Attributes

Display attributes determine the circumstances under which a level should be displayed.

**“NoDisplay”** – Levels with this attribute will never be displayed when the signal is drawn.

**“Optional”** – Levels with this attribute may or may not be displayed. When the user is setting the state of a signal within the application, they will be prompted with the user-friendly name of the level and a check-box, allowing them to turn the level on and off. Multiple levels with the same user-friendly name that are all marked as optional will be turned on and off together, even if they have other attributes that differ.

**“Select\_X”** – This is not a single attribute, but a series of attributes consisting of “select\_” plus a name provided by the user. Levels with an identical “Select\_X” attribute will be grouped together. When first loaded, the level or levels in the group with the first user-name (alphabetically) will be displayed and the others in the group will not be displayed. When the user is setting the state of a signal within the application, they will be prompted with a list of the user-friendly names of all the levels in the group, and may select any one from the list to display.

**“Optional Select\_X”** – This is not a single attribute, but a series of attributes consisting of “optional select\_” plus a name provided by the user. Levels with an identical “Optional Select\_X” attribute will be grouped together. When first loaded, none of the levels in the group will be displayed. When the user is setting the state of a signal within the application, they will be prompted with a list of the user-friendly names of all the levels in the group, and may select any one from the list to display. The list will also contain the text “None”, which the user can select to display none of the levels.

**“Display”** – Levels with this attribute will always be displayed when the signal is displayed. This attribute is optional, and levels with no display attributes will be displayed according to MicroStation rules.

##### 4.6.11.2 Lighting Attributes

Lighting attributes are used by the application to determine which components are lights and light cones for purposes of sighting calculations.

**Light** – Levels with this attribute are treated as being lights for the purposes of sighting calculations. This attribute will NOT be used in the initial version – it is included for future-proofing only. When this attribute is eventually used, it will be in association with a vector representing the location of the light and the direction it is pointing.

**LightCone** – Levels with this attribute are treated as being light cones for the purposes of sighting calculations. This attribute will NOT be used in the initial version – it is included for future-proofing only..

#### 4.6.12 Unrecognized Attributes

Any attributes that are not recognized by the application will be ignored.

#### **4.6.13 Unattributed Levels**

Any level with no attributes will be displayed according to MicroStation rules.

## 4.7 Examples

### 4.7.14 Name without attributes

Signal Post  
Light Box #123

Each of the above level names will be treated in its entirety as the user-friendly name of the level. The levels will be assumed to have an implicit [Display] attribute, and will therefore always be displayed.

### 4.7.15 Simple attributes

Red Light Cone [LightCone][NoDisplay]

This level will not be displayed, since it has a [NoDisplay] attribute. It will also be picked up by the application as representing a light cone for the purposes of sighting calculations since it has a [LightCone] attribute.

Extended Face Plate [Optional]

This level will be displayed by default, but when the user chooses to configure the state of the signal, the user-friendly name (“Extended Face Plate”) will be offered to them along with a check-box so that they can turn its display on or off.

### 4.7.16 Combination attributes

Warning Light Lit [Select\_WarningLight]  
Warning Light Unlit [Select\_WarningLight]

These two levels will be grouped together by the application because they both have the same [Select\_X] attribute. The “Warning Light Lit” level will be displayed by default, since that is alphabetically first. When the user chooses to configure the state of the signal, they will be presented with a drop-down containing both the user-friendly names so that they can choose which one to display.

### 4.7.17 Unknown attributes

Signal Symbol [PlanSymbol][NoDisplay]

This level will not be displayed by the application since It has a [NoDisplay] attribute. The other attribute ([PlanSymbol]) will not be recognized by the application, and will therefore be ignored.