Bentleyuser.dk Årsmøde 2008

Nordic Civil 2008

10.-12. November 2008, Munkebjerg Hotel, Vejle

Workshop - X5
Bentley Rail Track Design Tips

Presenter: Robert Nice, Bentley Systems UK, Solutions Engineer

Bentley Systems, Incorporated
685 Stockton Drive
Exton, PA 19341
www.bentley.com

Workshop 1 Template creation

Introduction

Bentley Rail Track offers many possibilities for defining templates, modeling ballast, sub grades etc.

But:

KEEP IT SIMPLE!

All templates are stored in template libraries. Templates are built up from components and these components are also stored in the template library.

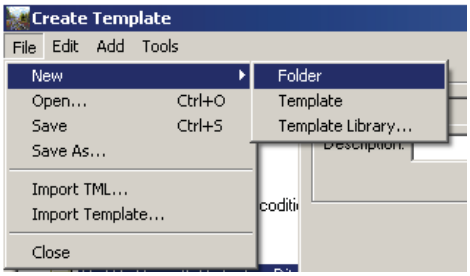
Start **Bentley Rail Track** and open the file ……**\01 Create Templates\HLProfil_101work.dgn.**

Go to **File > Project Defaults** and load the configuration **Workshop 1 Create Templates**

All layers/level should be turned off, except Schotter, Tragschicht & PSS.

Open the file **……\01 Create Templates\Workshop1.rwk.**

Go to **Modeler > Create Template** and create a new folder called **HL**



The easiest way to create a template is to import the template data from existing graphical information.

NOTE: - The templates for the upper components e.g. ballast, sub grade etc are usually closed shapes. Make sure only the levels below are displayed in the microstation file.

Schotter (Ballast)

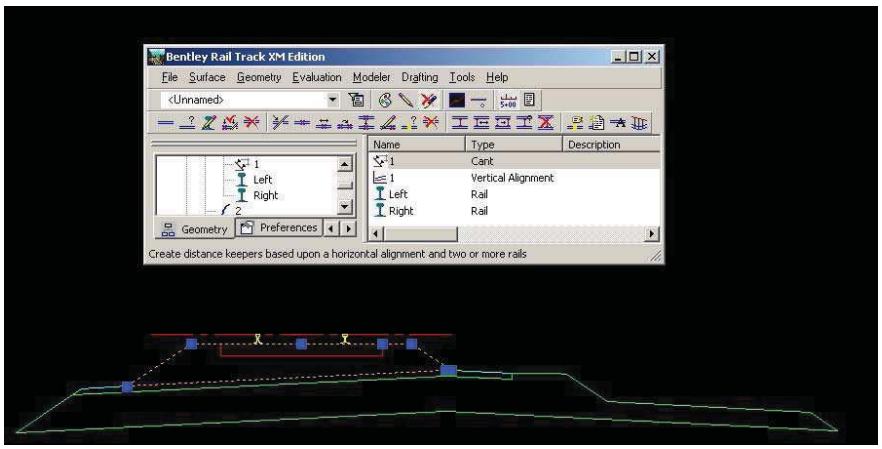
PSS (Protection Layer)

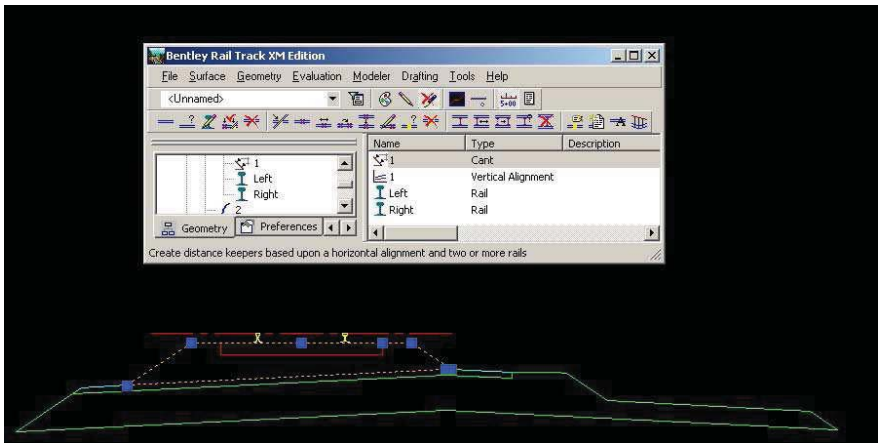
Tragschicht (Sub Grade Layer)

Schiene-UIC (Rails)

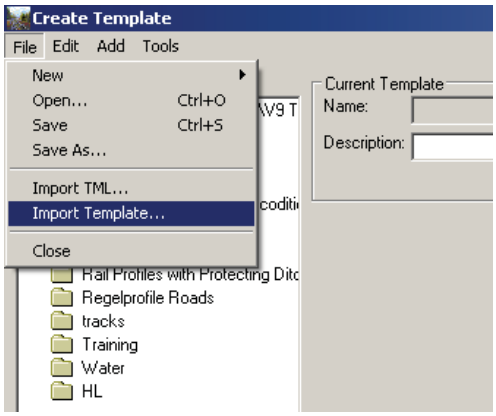
Import templates from graphic

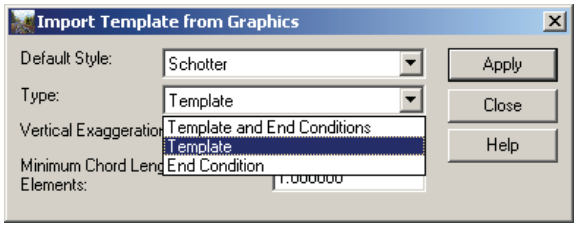
Select the layer **Schotter** (Ballast) using a Microstation selection set.





In template library go to **File > Import Template**





Set the style to **Schotter**

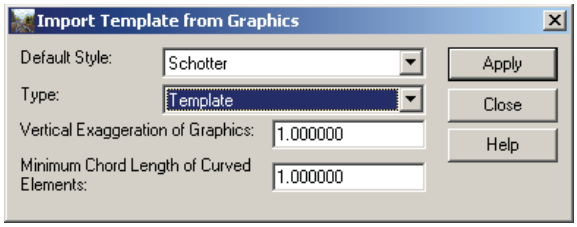
Specify the type of the template, there are three options:

Template & End conditions

Template

End Conditions

Set then type to **Template**



Click **Apply** and you will be prompted to select the origin if the template.

Identify the track center. At this time it is insignificant whether you identify exactly the track center as this can be specified later.

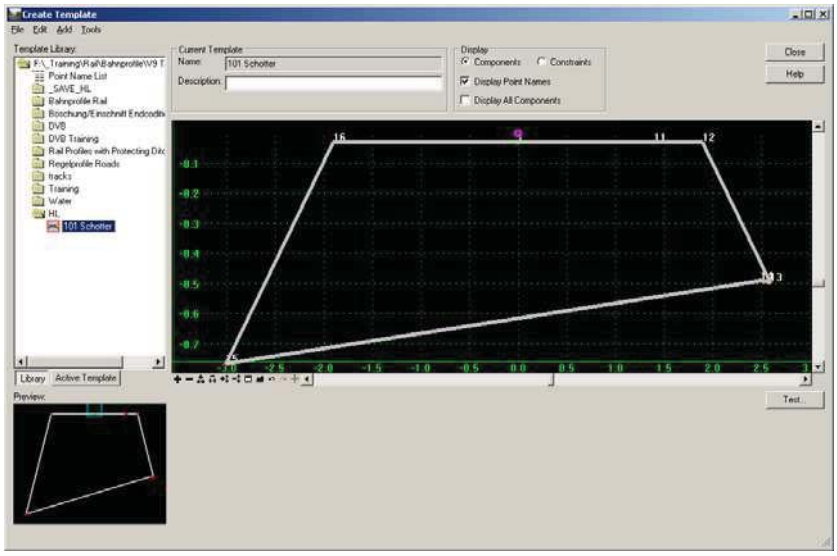
Close the Import Template dialog box.

The template for the ballast is now imported into the library and given a default name (**New Template**).

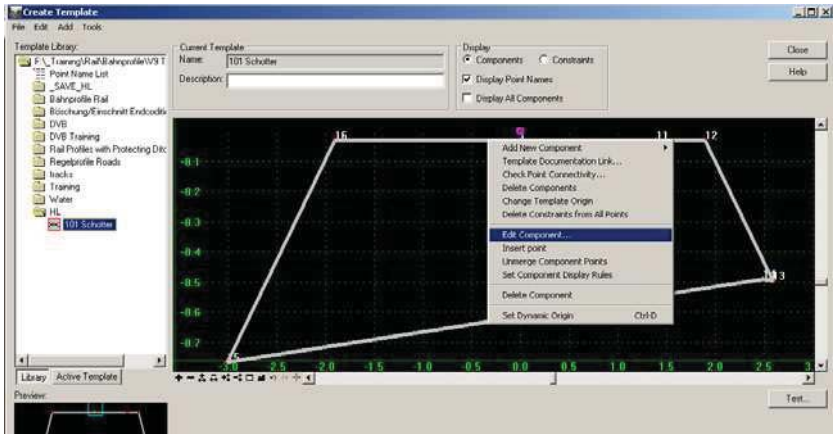
Move the template to the **HL** folder (by using drag & drop).

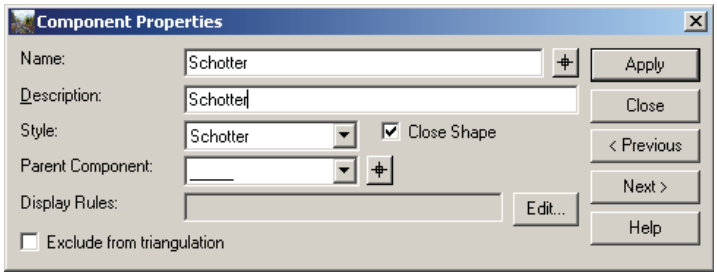
Open the folder **HL** and right mouse click on the new template and select **Rename**.

Change the name to **101 Schotter** and double click on the template to see it in the Current Template view.



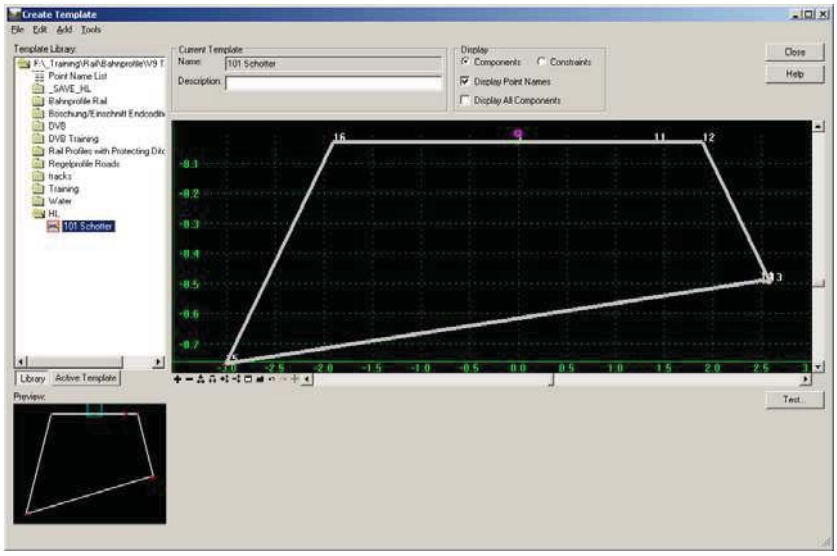
In the current template view right mouse click on the template and select **Edit Component**





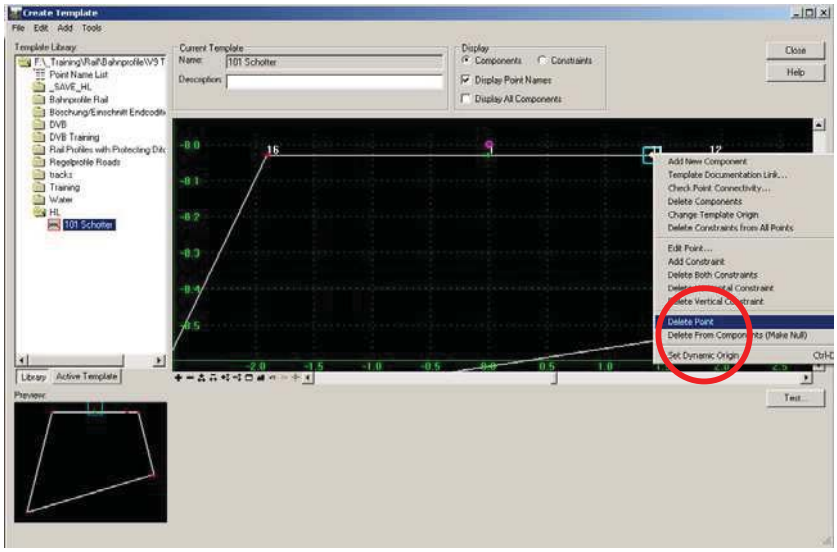
For the component enter a name, description and style of **Schotter**.

Apply and **close** the dialog box.

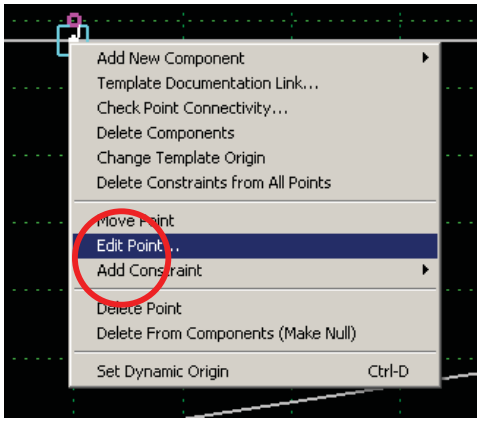


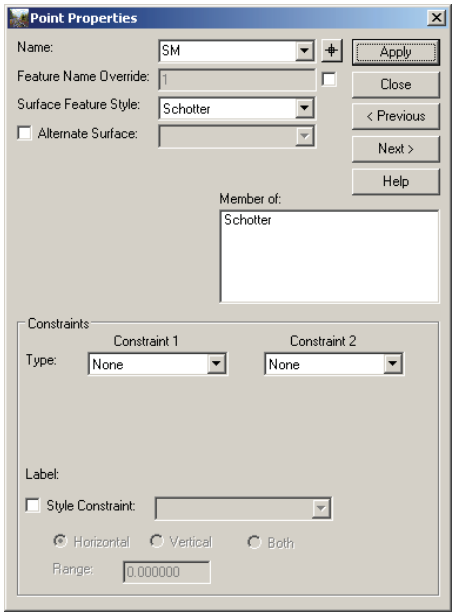
Point **11** on the template is not necessary and can be deleted.

Right mouse click on point **11** and select **Delete Point**



The centre point on the template needs to have a known name assigned to it. Right mouse click on the centre point and select **Edit Point**.



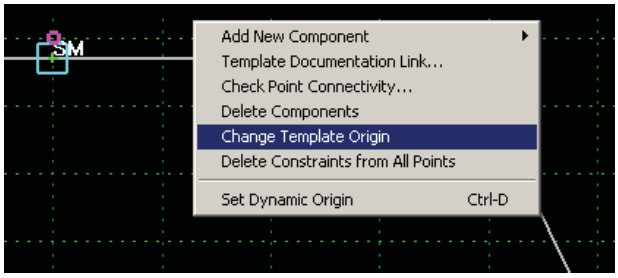


Key in the name **SM**

Apply and **close** the dialog box.

We need to change the Template Origin to **0,0**.

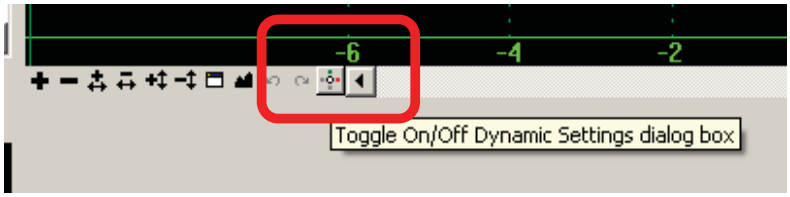
Right mouse click on the point **SM** and select **Change Template Origin.**



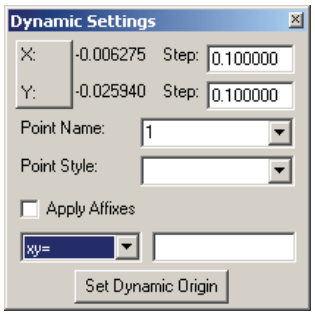
Save the template library.

Create a new template in the HL folder and give it the name **101 Rails**.

Turn on the Dynamic Settings.



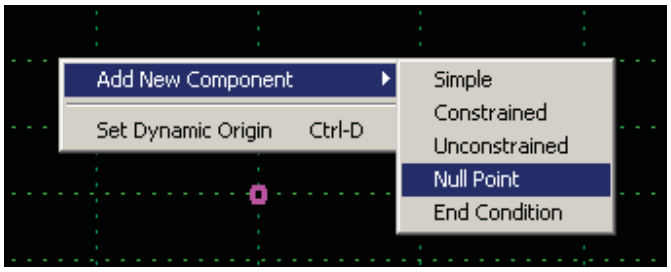
Set the dynamic settings as follows:

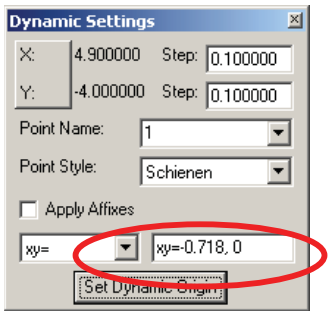


Placing Null Points

Null Points are specific points of a component within a template. When used in modeling these points are objects in the DTM.

Right mouse click in the template window and select **Add New Component > Null Point**.





In the Dynamic Settings dialog box select the Style **Schienen**

Set the input to xy= and type in **-0.718, 0**

Data the enter key on the keyboard and point 1 is placed.

Repeat this procedure for the track centre and the right rail.

Track Centre xy=**0,0**

Right Rail xy=**0.718, 0**

Change the point names

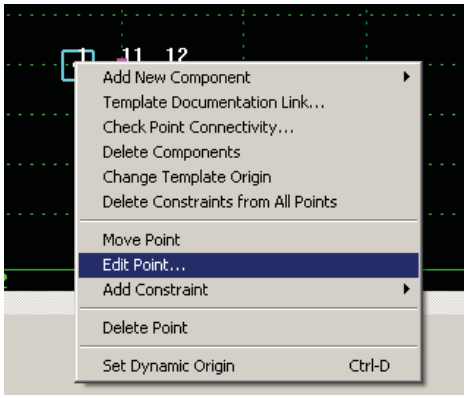
We now need to change the point names.

1→ SL

11→ GM

12→ SR

Right mouse click on the point and select **Edit Point**, change the names to match those above.

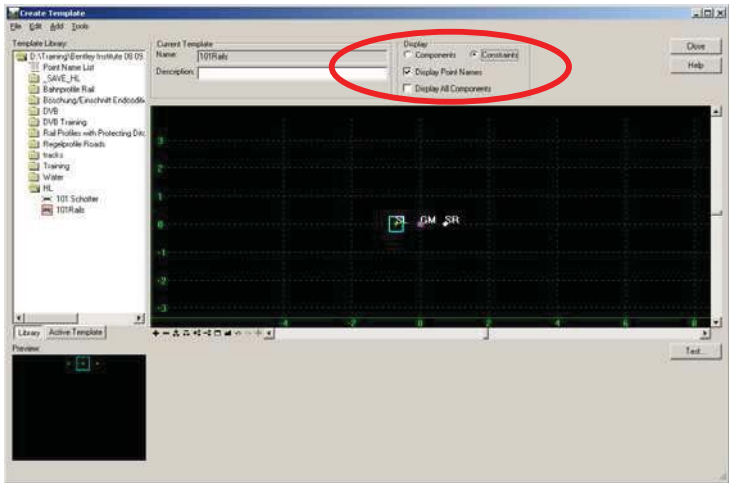


Save the template library.

Constraints

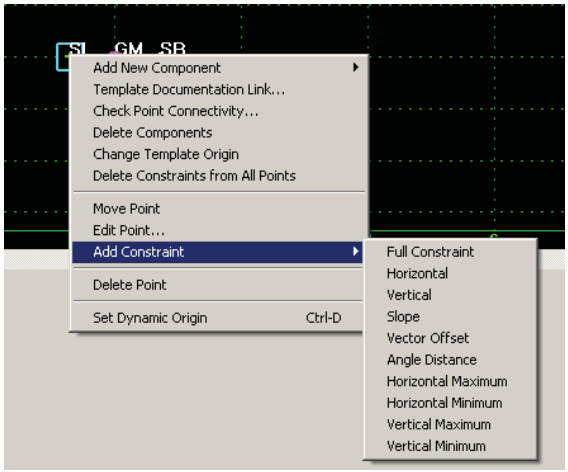
Point Constraints are used to manage the behavior of template points. They are used so that if a point is moved in a template, either by the user editing the point or by the application of point controls during design processing, all the points related to the point being moved will behave in a predictable manner.

Set the template display to **Constraints**:



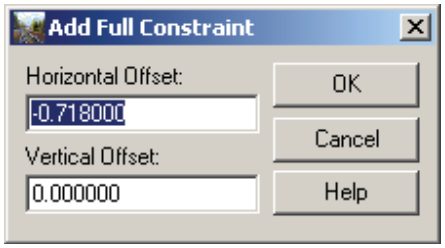
We need to add constraints to the rail points.

Right mouse click on point **SL** and select **Add Constraint > Full Constraint**

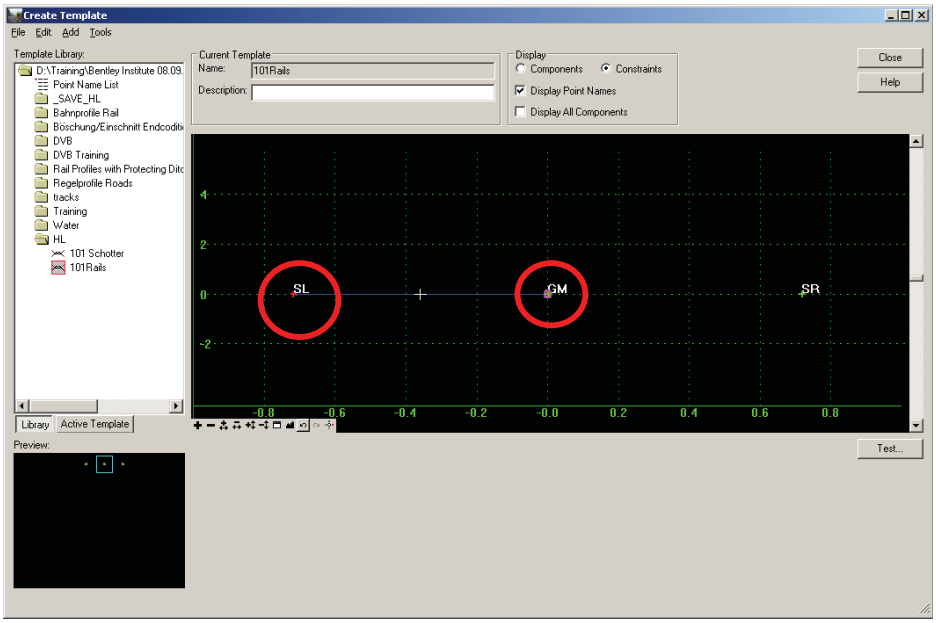


You are prompted to identify the Parent point.

Data the point **GM** and the following dialog box will appear.



Accept with **OK**.

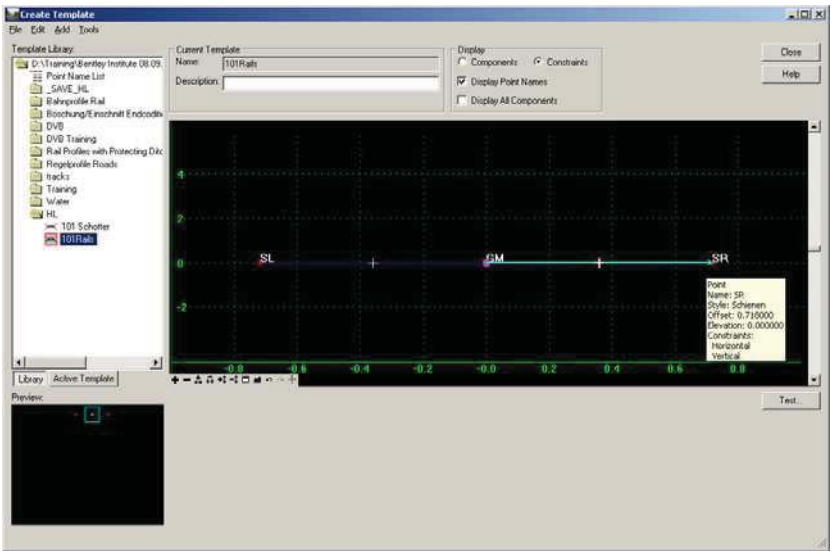


You will now see the connection between point **GM** and **SL**. The point **SL** is connected with a Constraint (horizontal & vertical) (blue arrow).

Points that are fully constrained display as a red **+**.

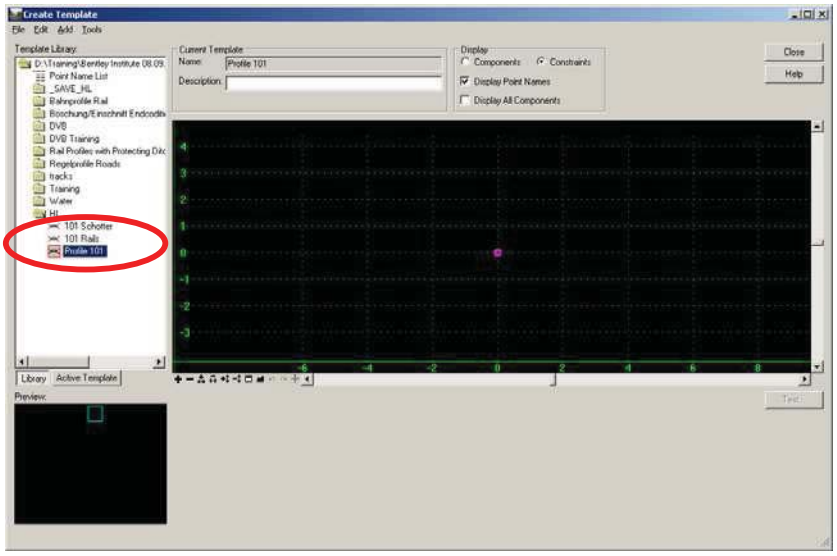
Points that are only constrained in one direction will display as a yellow **+**.

Repeat this procedure for the point **SR** and save the template library.

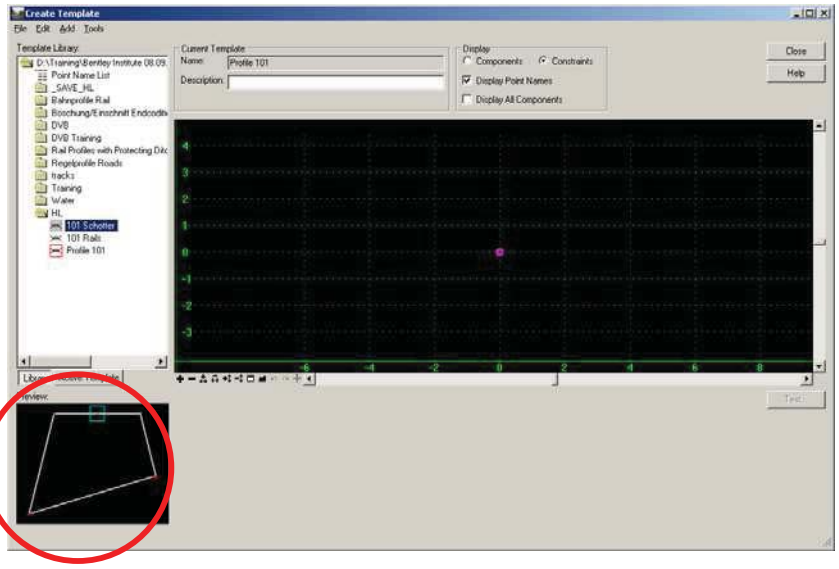


Completing a templates

Create a new template in the **HL** folder and name it **Profile 101**.

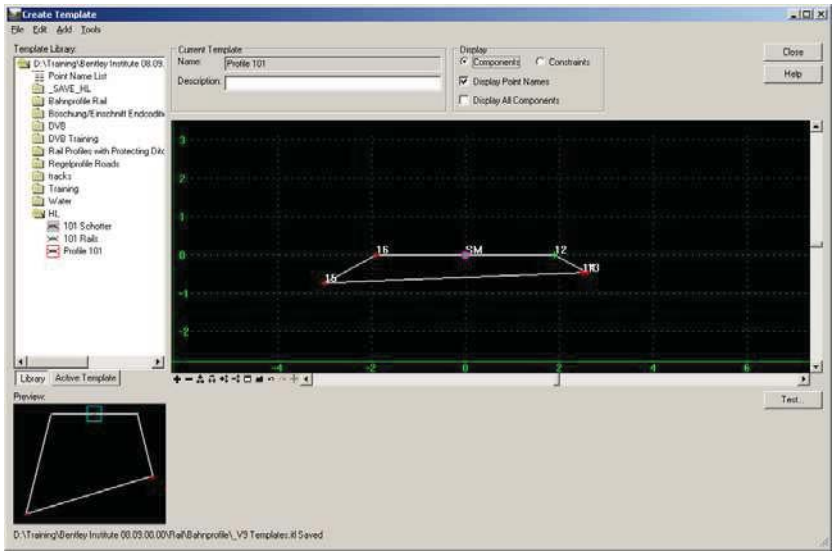


Single click on the template **101 Schotter** to view the template in the preview window. (The profile is to appear only in the preview window).



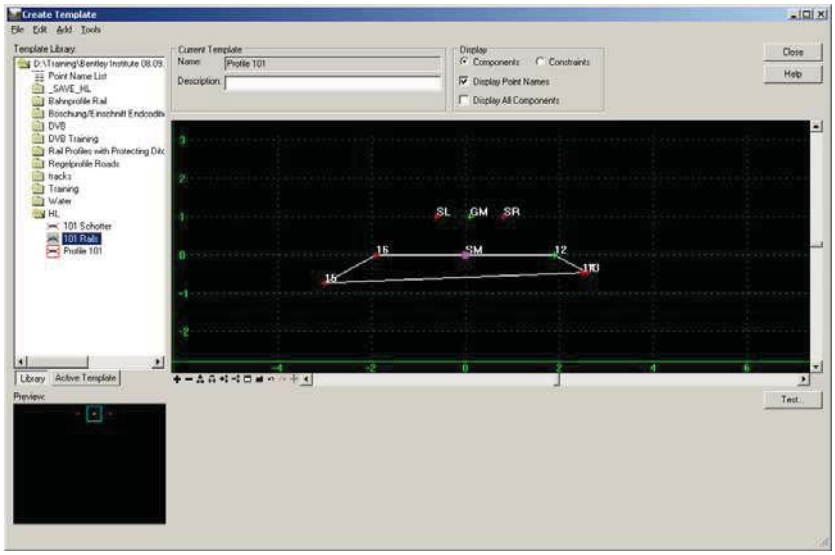
Drag and drop the component **101 Schotter** from the preview window into the main window and place it at the **0,0** origin.

Toggle the display to **Components**.



Save the template library.

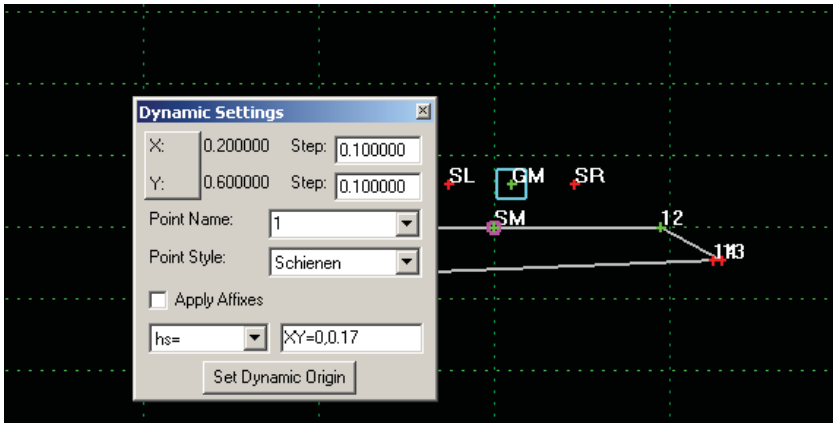
Single click now on the **101 Rails** component and drag and drop this into the main window. Place this just above the **101 Schotter** component.

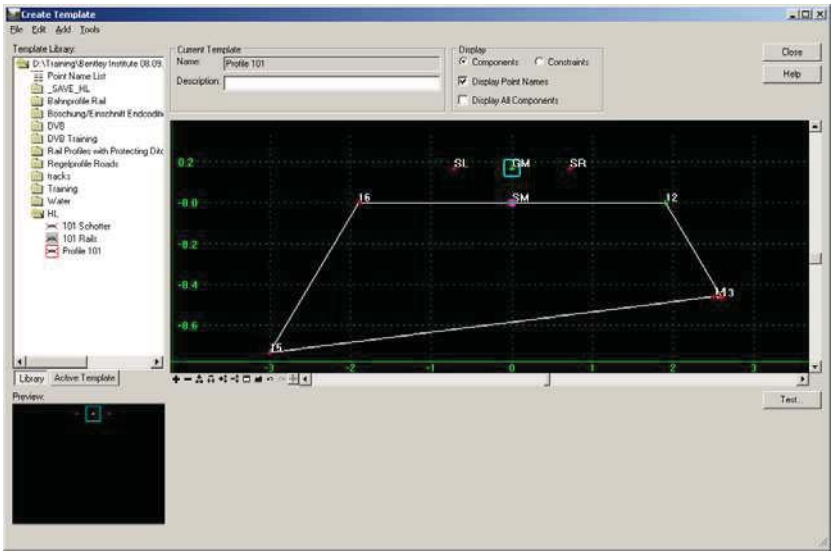


Right mouse click on the point **GM** and select **Move Point**.

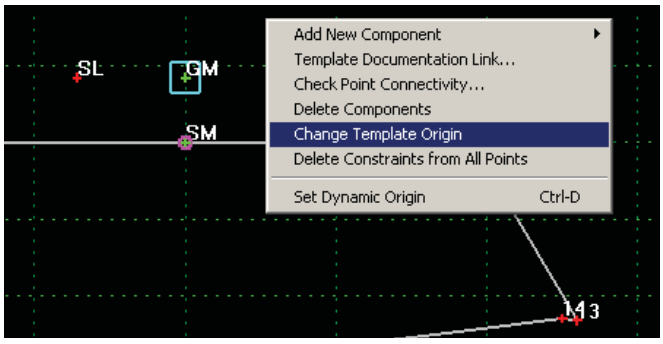
In the Dynamic Settings dialog box set the input to xy= and type in **0,0.17**

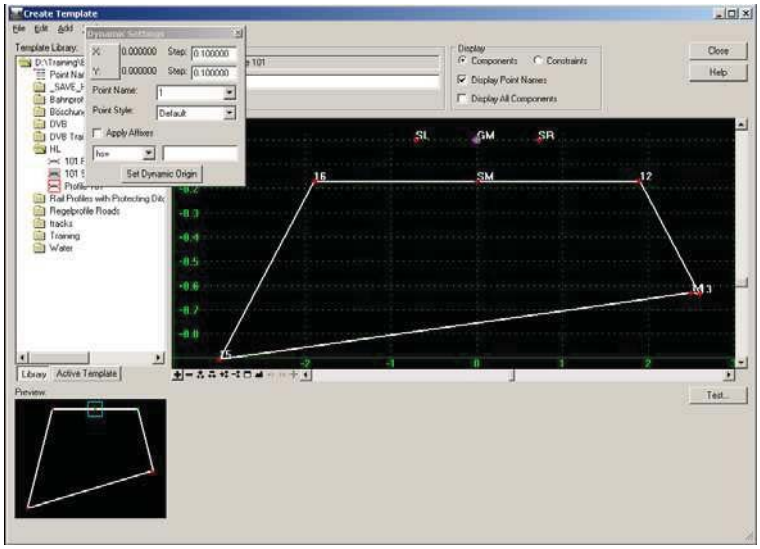
Data the enter key on the keyboard and the component is moved.





We need to specify the new origin for the template, right mouse click in the template window and select **Change Template Origin**.



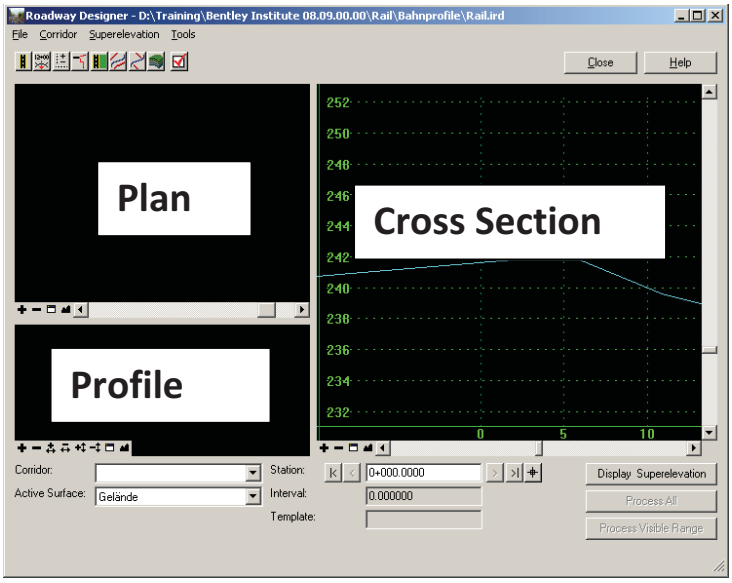


Save the template library and close the Create Template dialog box.

Create a new roadway library

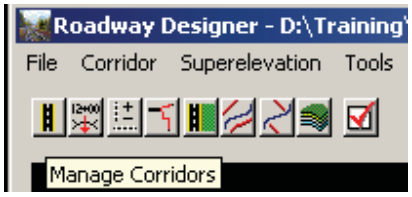
Go to **Modeler > Roadway Designer** to open the roadway designer dialog box.

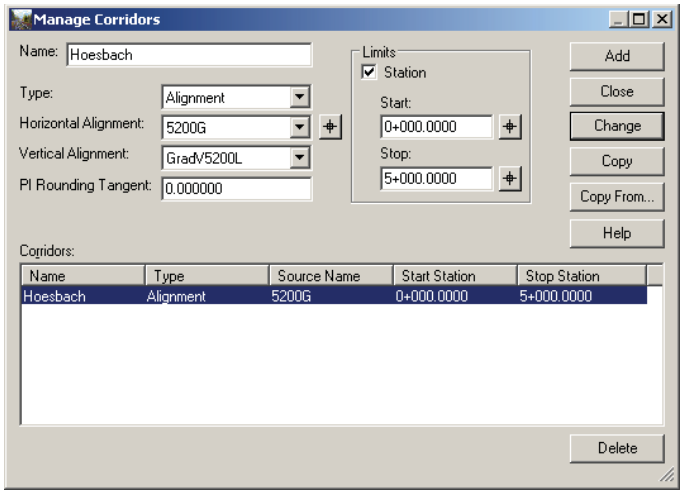
Go to **File > New** and type in the name **Hoesbach** for the roadway designer file name and data the save button.



Create a corridor

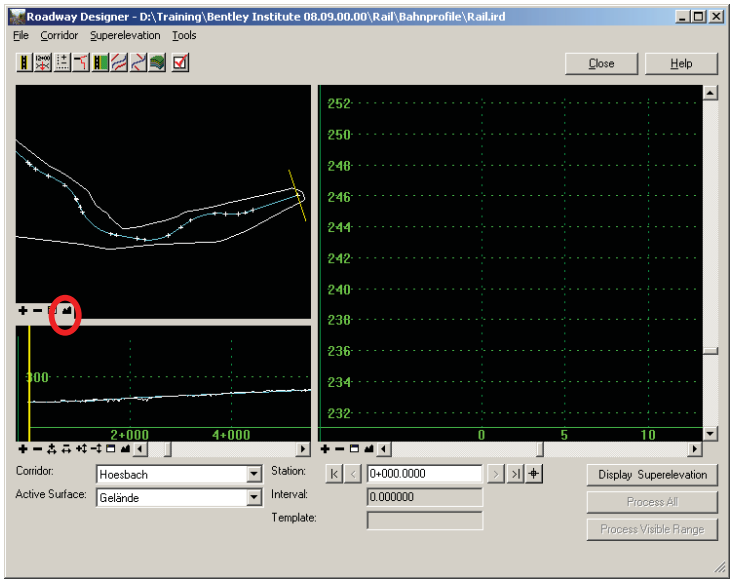
Select **Corridor > Manage Corridors** (or select from the toolbar)





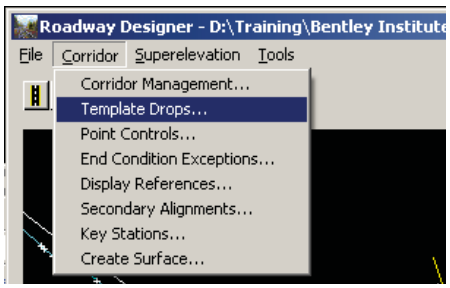
Enter **Hoesbach** for the corridor name, data the **Add** button then close the dialog box.

In the plan view click on fit view

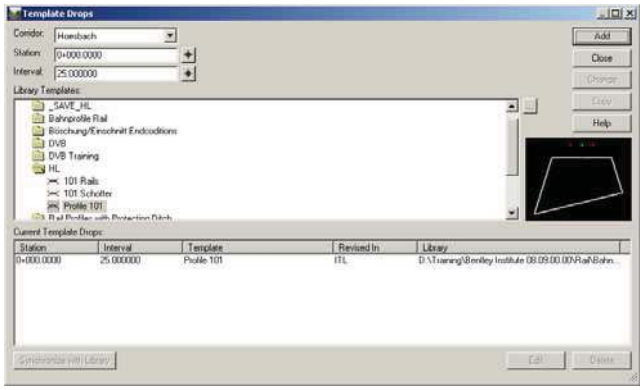


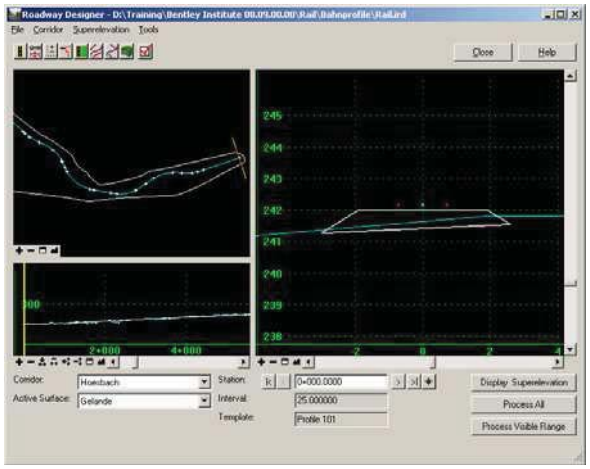
Template placement

Select **Corridor > Template Drops**



Select the template **Profile 101**, set the interval to **25** and click the **Add** button.





The template is now visible in the cross section view.

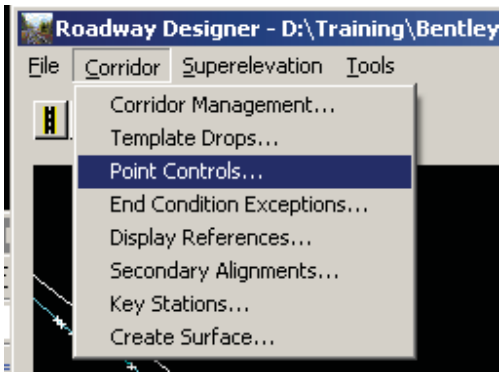
Data the **Process All** button

Define Point Controls

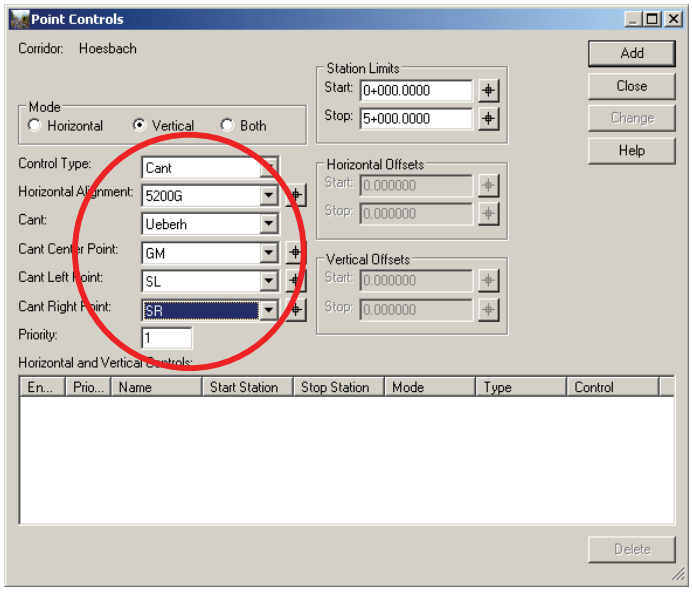
Point controls are used to modify the behavior of points in a template. These controls take precedence (they override) over existing constraints on the point.

This command includes colored text to indicate a condition of the design data. Orange station text indicates there is a conflict between two or more point control stations. Red station text indicates the geometry of the alignment has been modified and the station value is no longer valid

Select **Corridor > Point Controls**



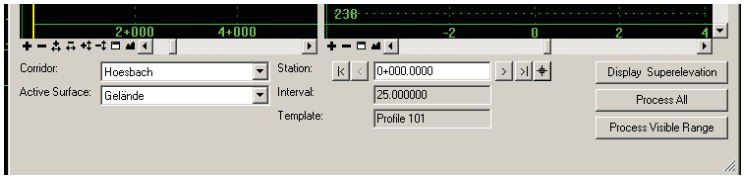
Change the dialog box to match the settings below.



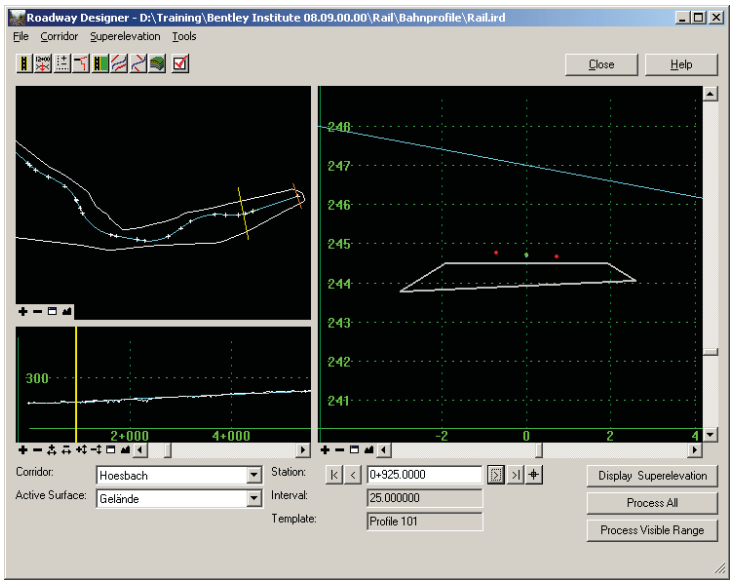
Click the **Add** button.

Close the dialog box and save the Roadway Library.

Data the **Process All** button



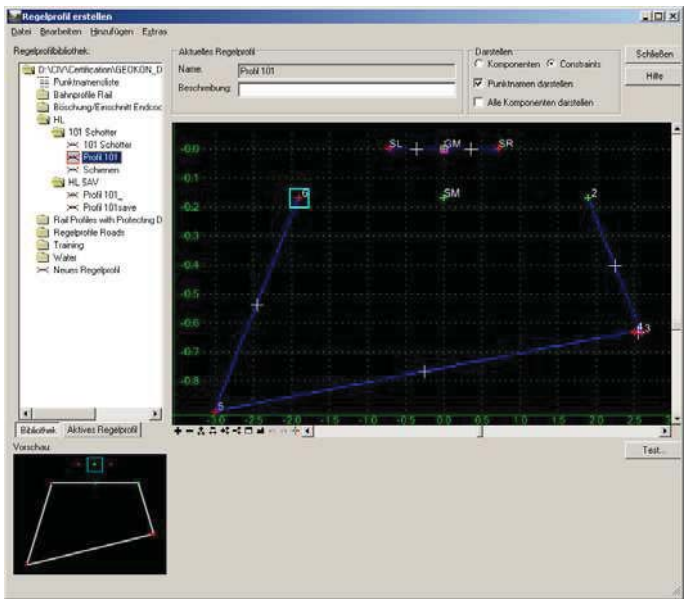
Using the station buttons you can scroll along the roadway. Note the template does not rotate to suit the cant this is because there are no constraints between the ballast and the rails.



Save the roadway designer library and close the dialog box.

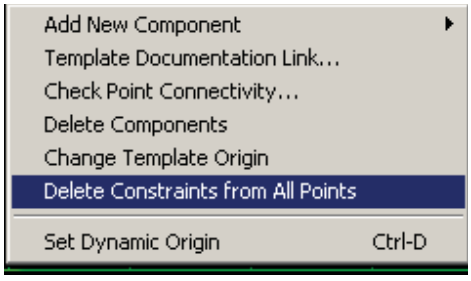
Constraints within a compound template

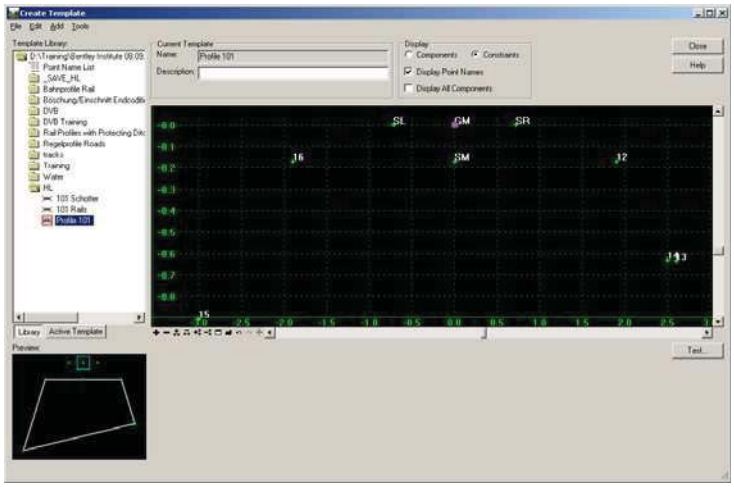
Open the Template Library (**Modeler > Create Template**) and select the template **Profile 101**



Toggle the display to **Constraints**.

Right mouse click in the main window and select **Delete Constraints from All Points**.



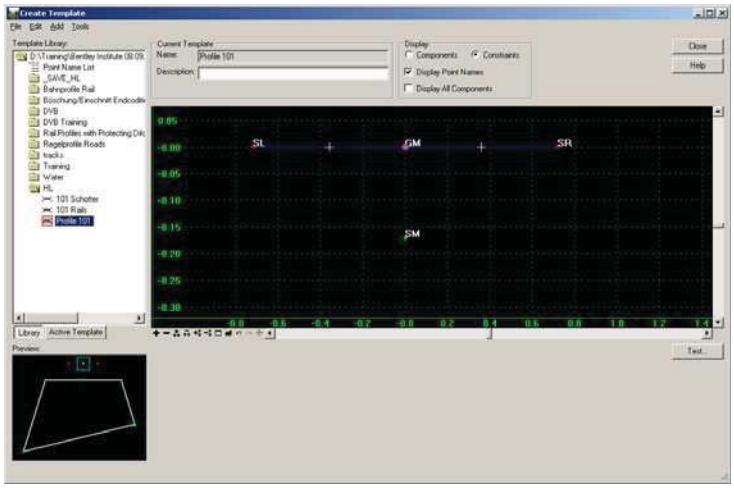


Right mouse click on point **SL** and select **Add Constraint > Full Constraint**

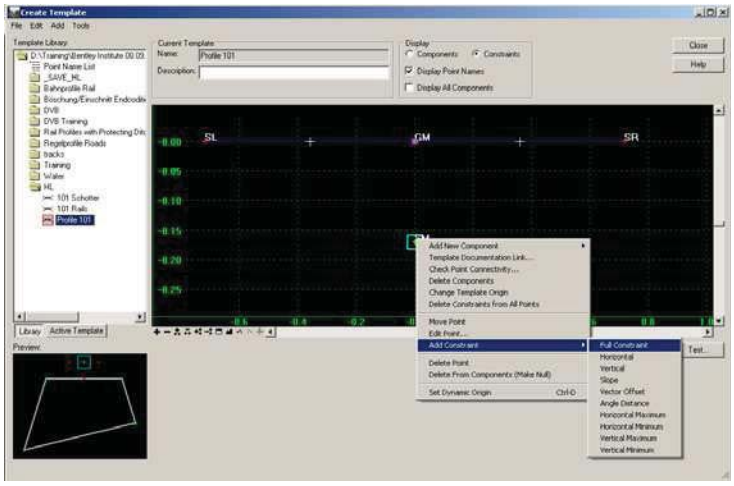
You are prompted to identify the Parent point.

Data the point **GM** and Accept with **OK**.

Repeat for the **SR** point.

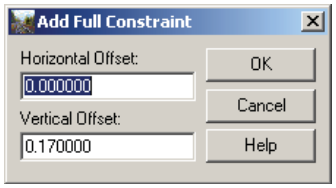


Right mouse click on the point **SM** and select **Add Constraint > Full Constraint**.

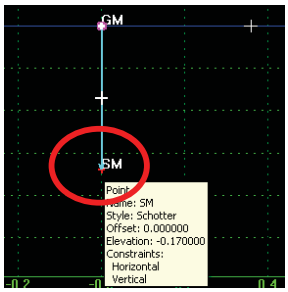


You will be prompted to identify the Parent Point .

Select the point **GM**.

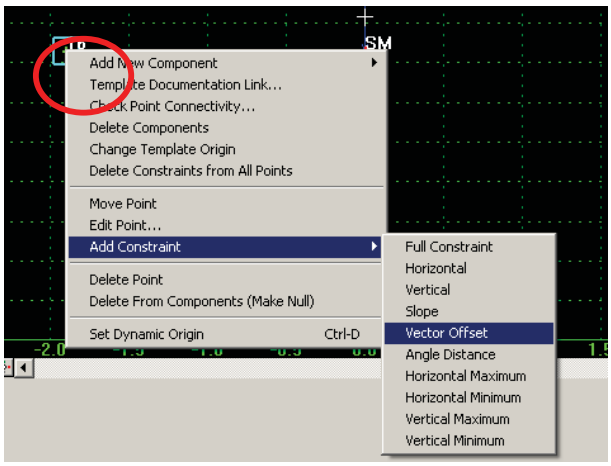


Click to OK.



We will now constrain **GM** to **16** and **GM** to **12** using a Vector Offset Constraint

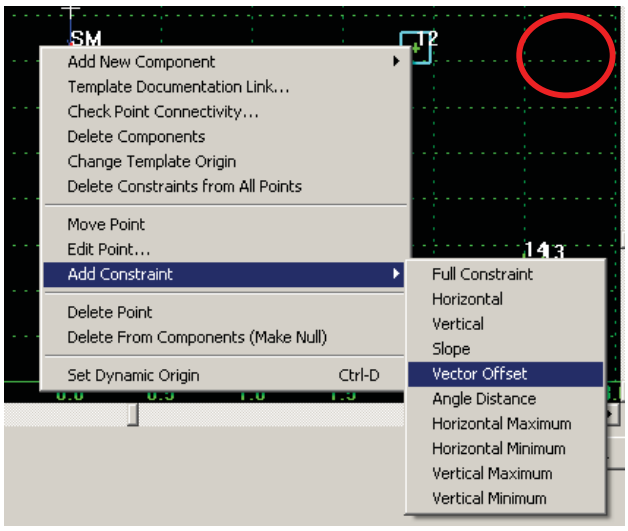
Right mouse click on point **16** and select **Add Constraint > Vector Offset**



You will be prompted to select the parent point, data on point **SL** as the first parent point and **SR** as the second parent point.

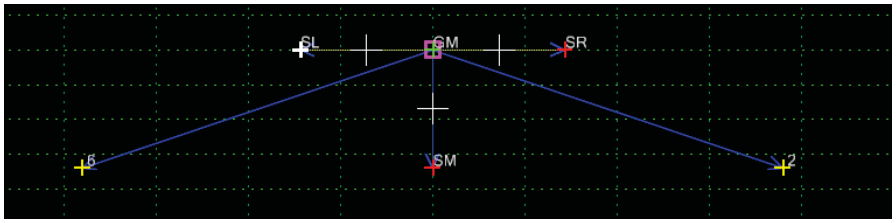
Data the **OK** button on the Add Vector Constraint dialog box.

Right mouse click on point **12** and select **Add Constraint > Vector Offset**



You will be prompted to select the parent point, data on point **SR** as the first parent point and **SL** as the second parent point.

Data the **OK** button on the Add Vector Constraint dialog box.



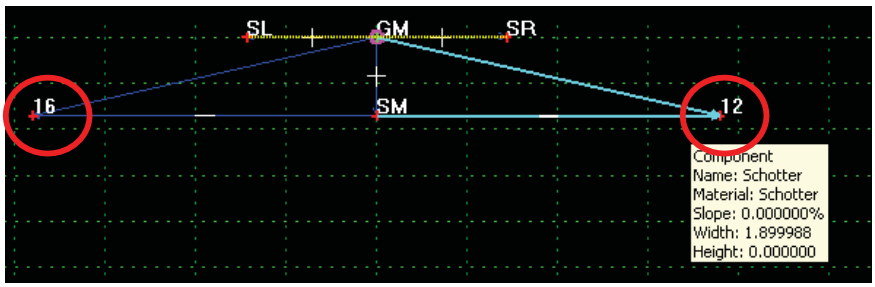
The points **16** and **12** are constrained in one direction (They are able to move in the horizontal direction).

Right mouse click on point **16** and select **Add Constraint > Horizontal**

You will be prompted to select the parent point, data on point **SM.**

Data the **OK** button on the Add Horizontal Constraint dialog box.

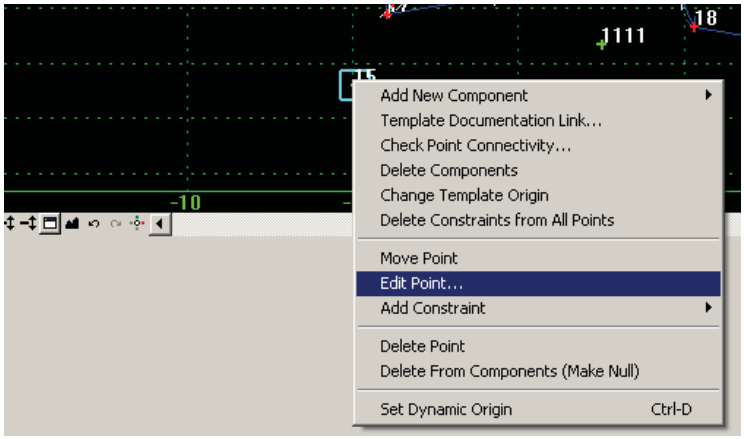
Repeat this for point **12**



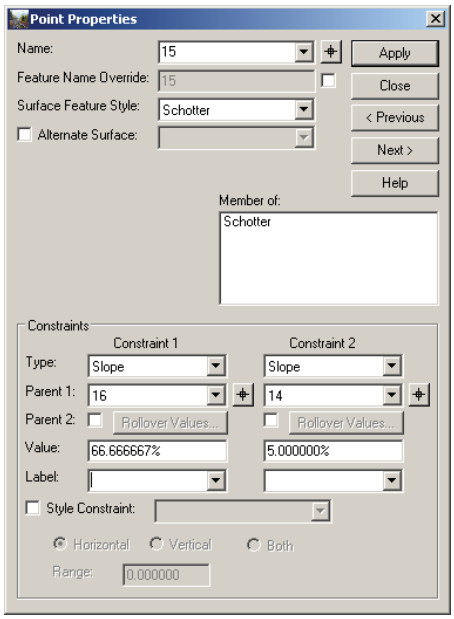
Points **16** and **12** are now in **RED**. This indicates the points are fully Constrained.

The points **13**, **14** and **15** must now be connected with appropriate Constraints

Right mouse click on point **15** and select **Edit Point**



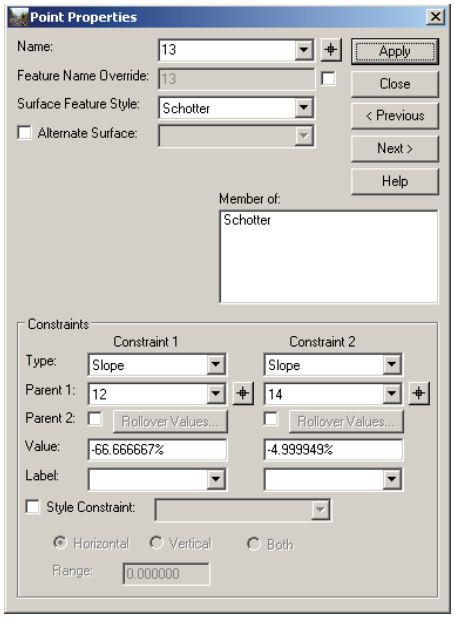
Make the following settings:



Click on **Apply**.

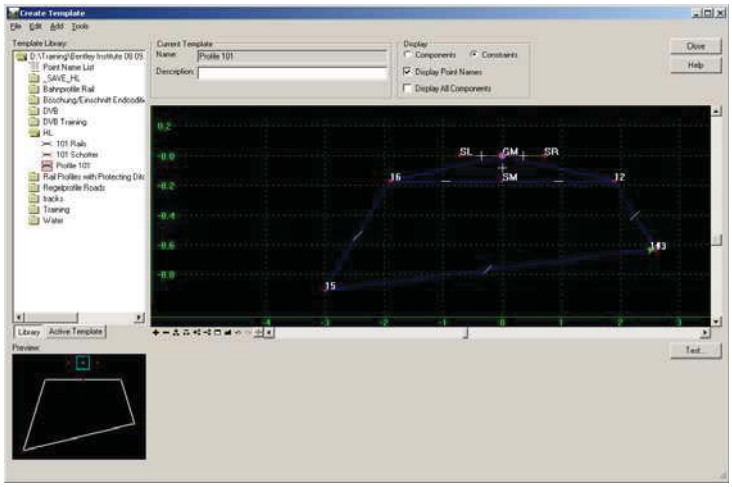
Right mouse click on point **13** and select **Edit Point**

Make the following settings:



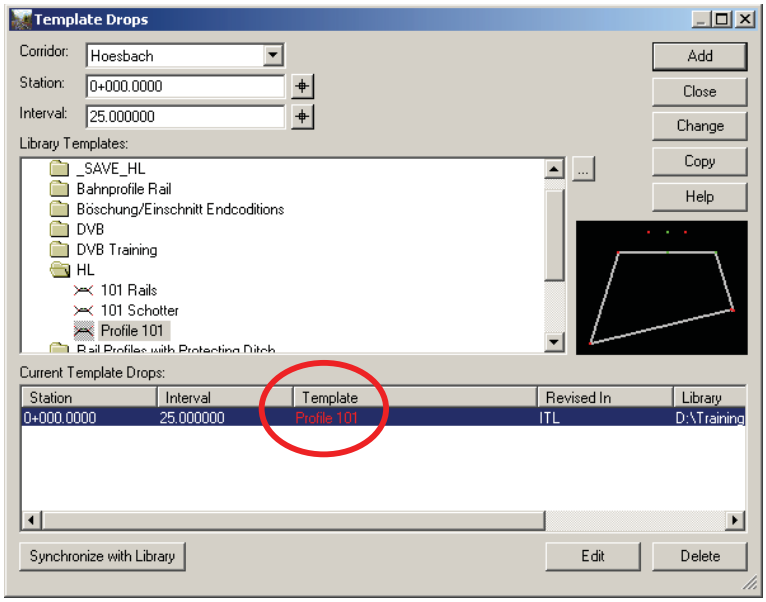
Click on **Apply**

Save the template library.



If any changes are made to templates in the template library and these templates are being used in roadway designer then you can synchronize these changes.

Go to **Modeler > Roadway Designer** and go to **Corridor > Template Drops**.

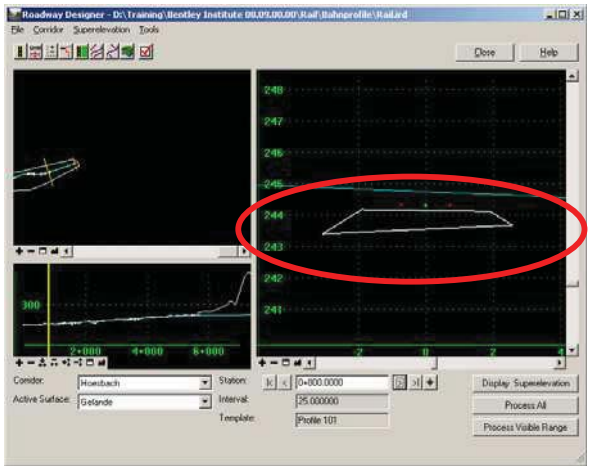


The template Profile 101 appears in **RED**, because changes were made.

Select the template and data the **Synchronize with Library** button.

Close the dialog box.

In the Roadway Designer data the **Process All** button.



The template now follows the cant.

Save the roadway designer file and close the Roadway Designer.

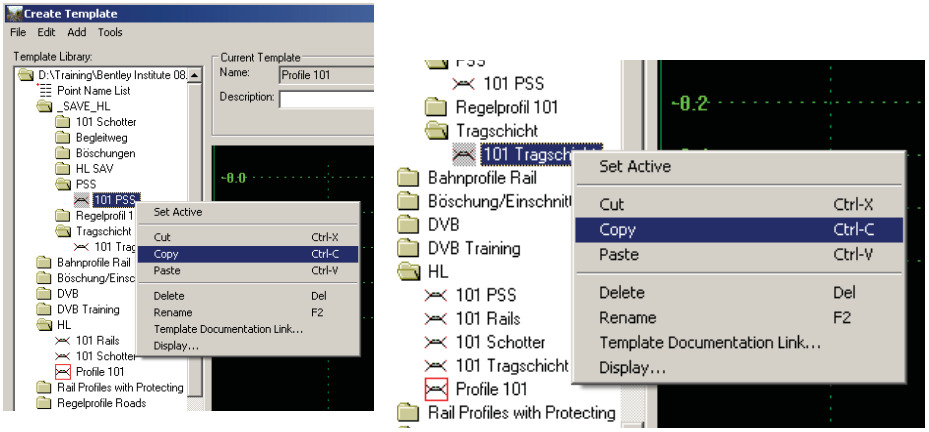
Build a complete template

You can easily repeat this previous session with all other subgrade layers but to save time we are going to use some pre defined components.

Open the template library **Modeler > Create Template**.

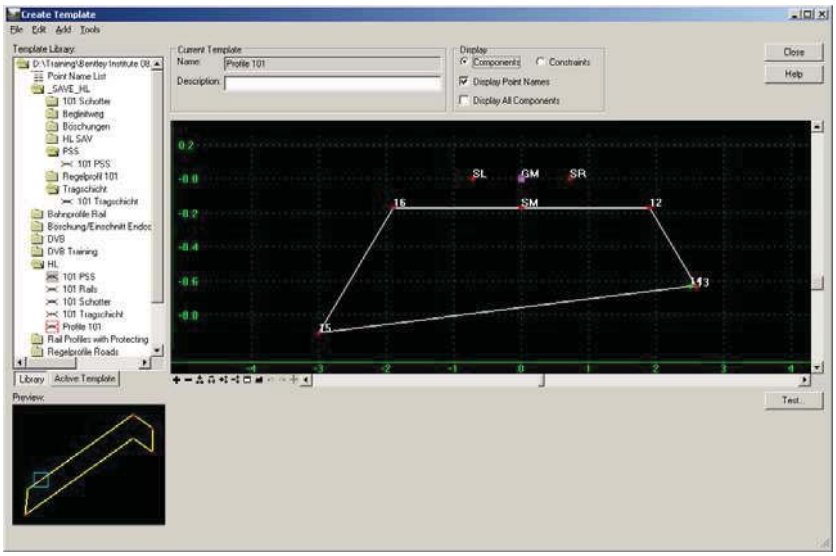
In the template library you will see a folder called **HL SAVE** in this you will find subfolders **PSS** and **Tragschicht**, these folders contain the sub layer components.

Copy the templates **101 PSS** & **101 Tragschicht** to the **HL** Folder (use right mouse click to copy and paste)

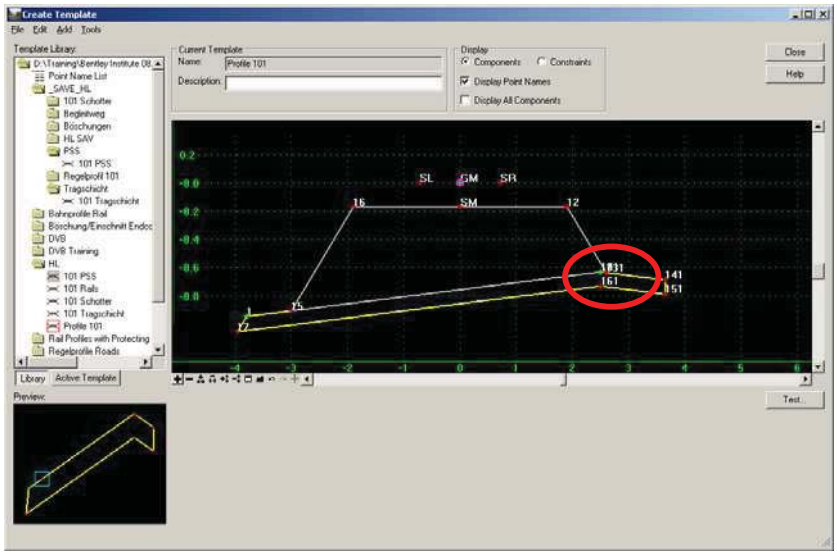


Set the display to **Components**

Activate the template **Profile 101** and click on **101 PSS** so it appears in the Preview window.

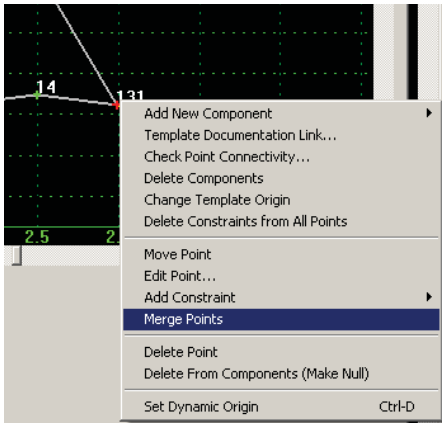


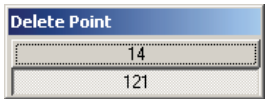
Drag the template **101 PSS** onto point **15** of the **Profile 101** template



On the right hand side you will see some duplicate points, we must merge these points

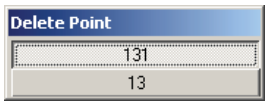
Right mouse click on point **14** and select **Merge Points**.



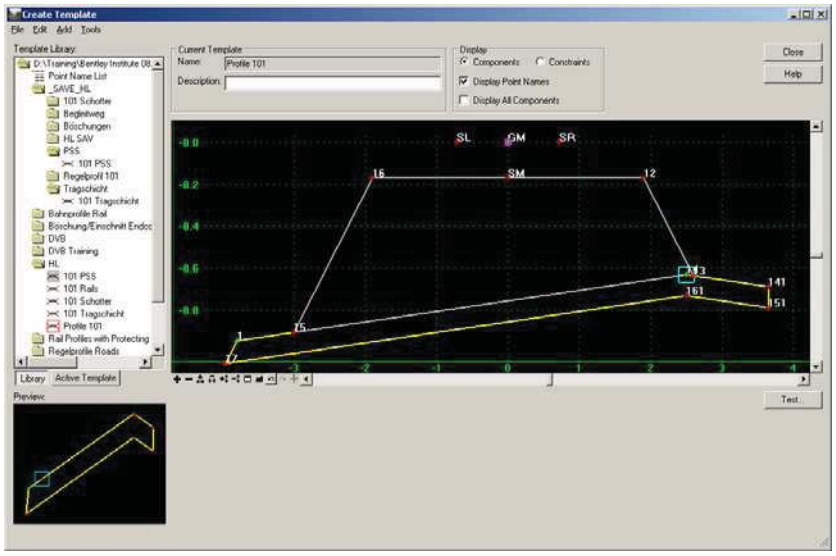


Delete Point **121**

Right mouse click on point **13** and select **Merge Points**

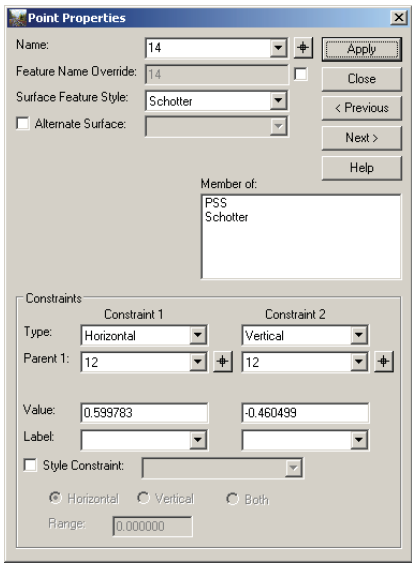


Delete Point **131**



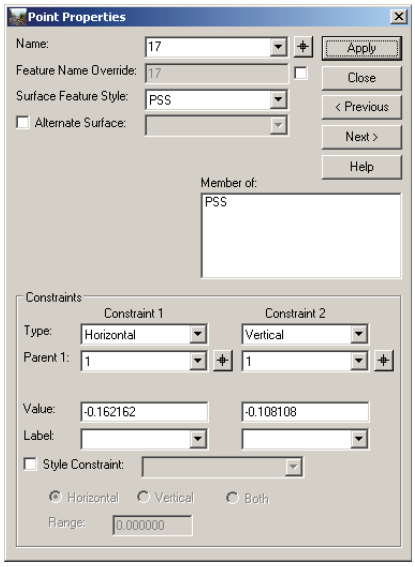
Right mouse click on the point **14** and select **Edit Point**

Set the Constraints as follows:



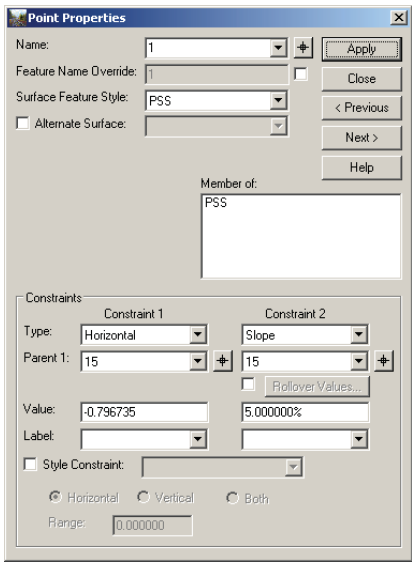
Data the target button next to the point name field and select point **17**

Set the Constraints as follows:



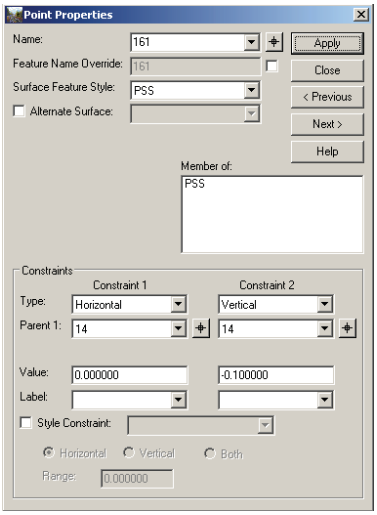
Data the target button next to the point name field and select point **1**

Set the Constraints as follows:



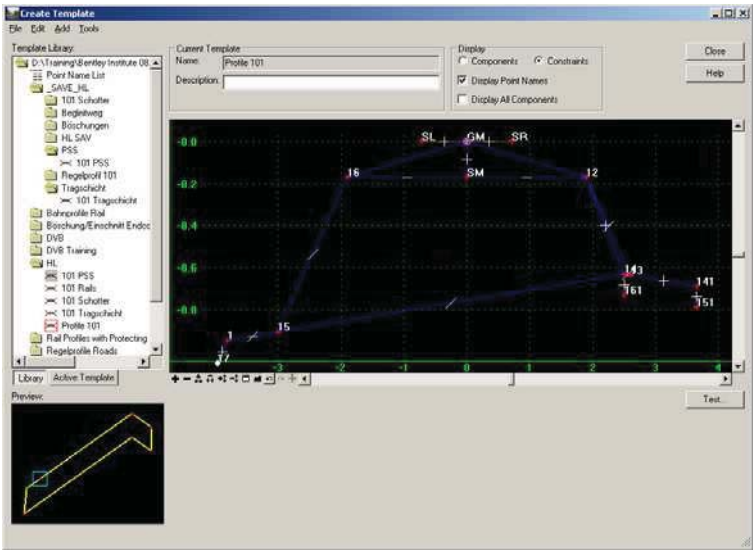
Data the target button next to the point name field and select point **161**

Set the Constraints as follows:



Close the Point Properties dialog box.

The result should look as follows:



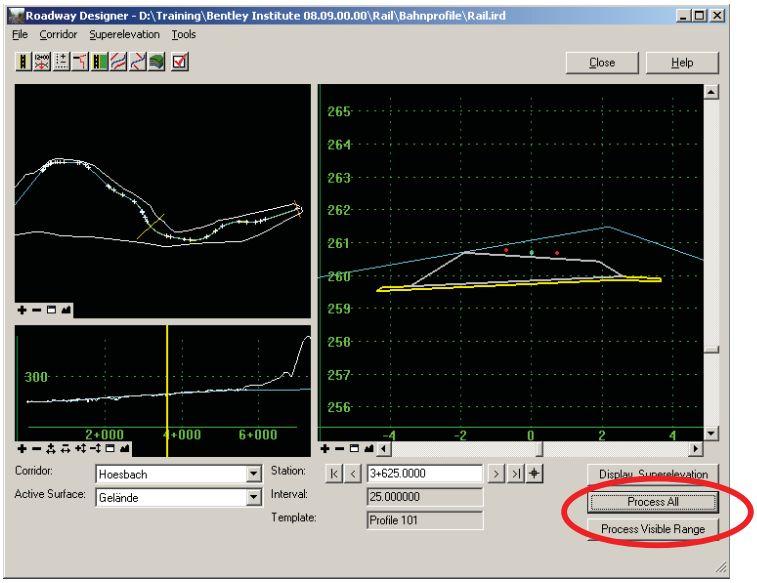
Save the template library and close the create template dialog box

Go to **Modeler > Roadway Designer** and go to **Corridor > Template Drops**.

Select the template and data the **Synchronize with Library** button.

Close the dialog box.

In the Roadway Designer data the **Process All** button.

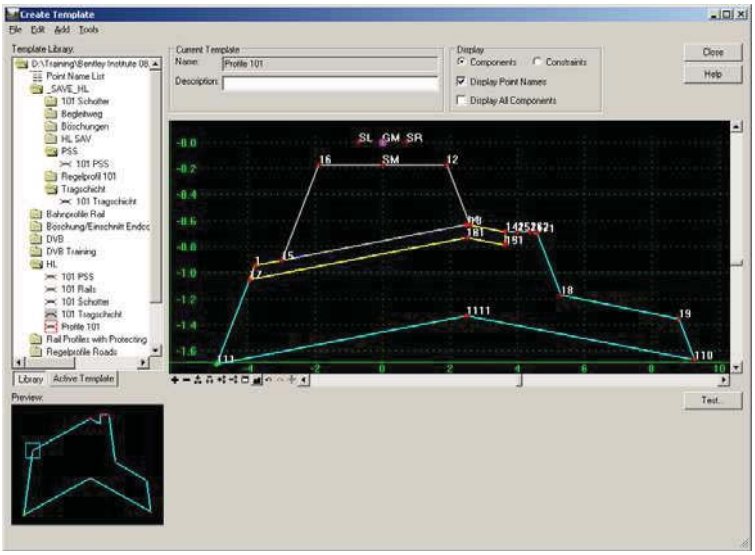


Save the roadway designer file and close the dialog box.

Go to **Modeler > Create Template**

Activate the template **Profile 101** and click on **101 Tragschicht** so it appears in the Preview window.

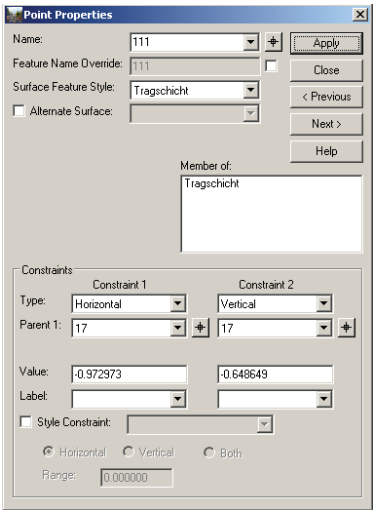
Drag the template **101 Tragschicht** onto point **17** of the **Profile 101** template



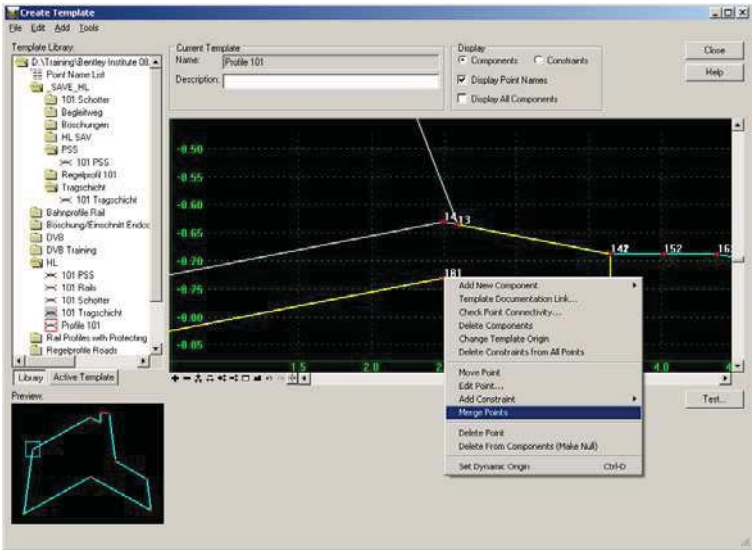
We need to create constraints for point **111**

Right mouse click on the point **111** and select **Edit Point**

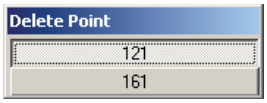
Set the Constraints as follows:



We must merge the duplicate points (NOTE – This will not be needed in V8i)

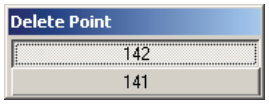


Right mouse click on point **161** and select **Merge Points**



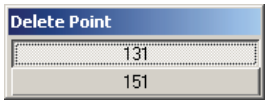
Delete **121**

Right mouse click on point **141** and select **Merge Points**



Delete **142**

Right mouse click on point **151** and select **Merge Points**



Delete **131**

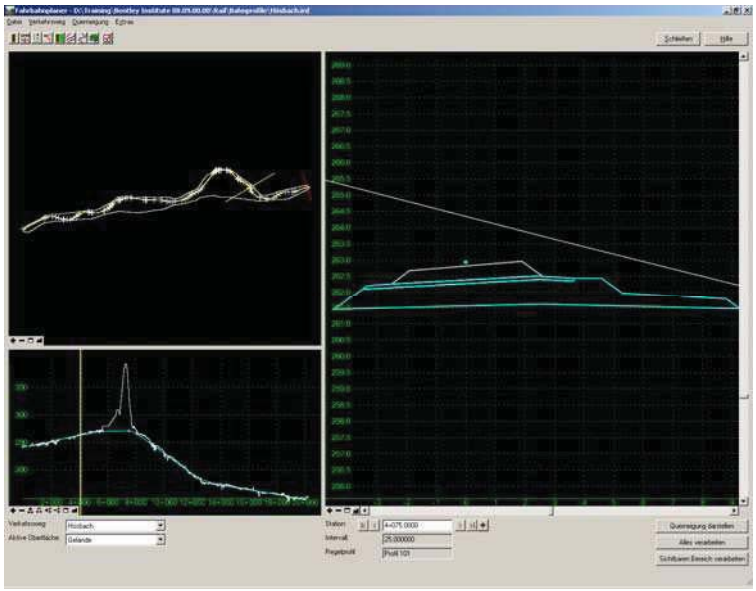
Save the template library and close the Create Template dialog box.

Go to **Modeler > Roadway Designer** and go to **Corridor > Template Drops**.

Select the template and data the **Synchronize with Library** button.

Close the dialog box.

In the Roadway Designer data the **Process All** button.



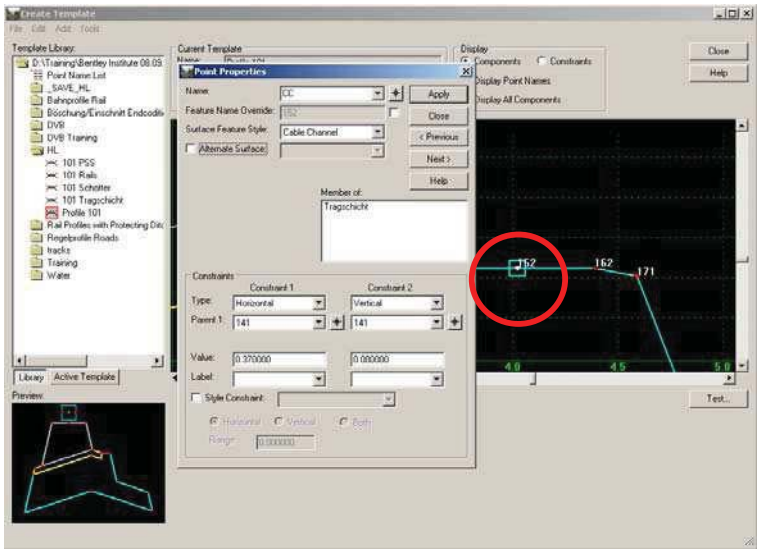
Save the roadway designer file and close the Roadway Designer dialog box.

Open the template library **Modeler > Create Template**.

Activate the template **Profile 101**

On the right side of the template is a cable channel. We can use point symbology to make the channel display automatically as a cable channel in cross section.

Right mouse click on point **152** and select **Edit**



Change for the name to **CC** and the type of surface feature style to **Cable Channel**.

Click **Apply** and close the dialog box.

Save the template library and **close** the Create Template Dialog box.

Go to **Modeler > Roadway Designer** and go to **Corridor > Template Drops**.

Select the template and data the **Synchronize with Library** button.

Close the dialog box.

In the Roadway Designer data the **Process All** button.

End conditions

End conditions are template components which are used to model cut and fill treatments. They are added to the end of simple, constrained and unconstrained components.

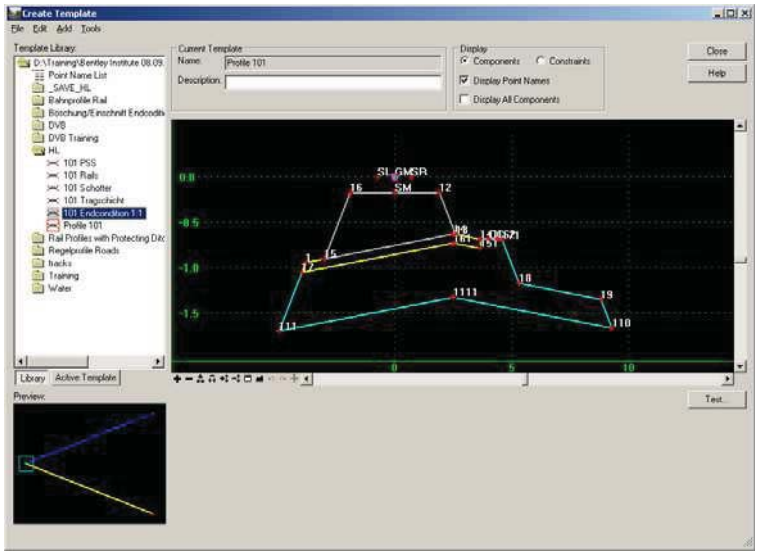
End conditions consist of template points and individual components and appear as line segments. They are different to other components because they have the ability to target surfaces, elevations, alignments and surface features.

Open the template library **Modeler > Create Template**.

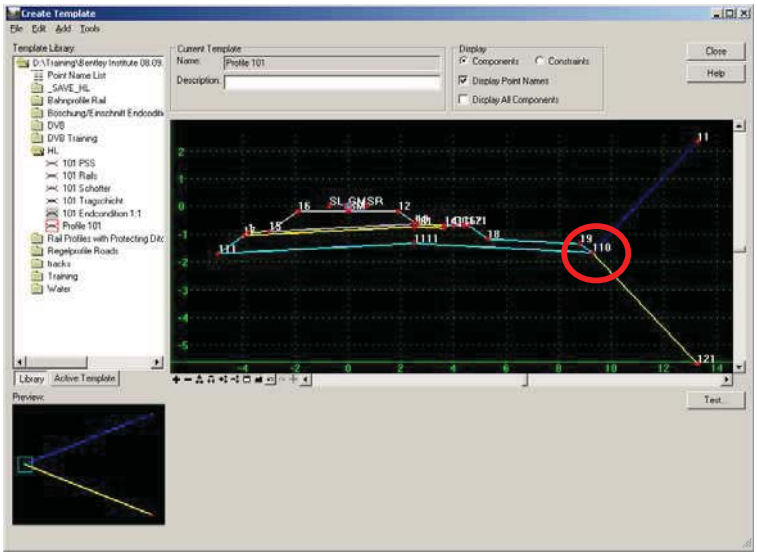
In the template library you will see a folder called **HL SAVE** in this you will find a subfolder called **End Conditions**.

Copy the template **101 Endcondition 1:1** to the **HL** Folder (use right mouse click to copy and paste)

Activate the template **Profile 101** and click on **101 Endcondition 1:1** so that it appears in the Preview window.

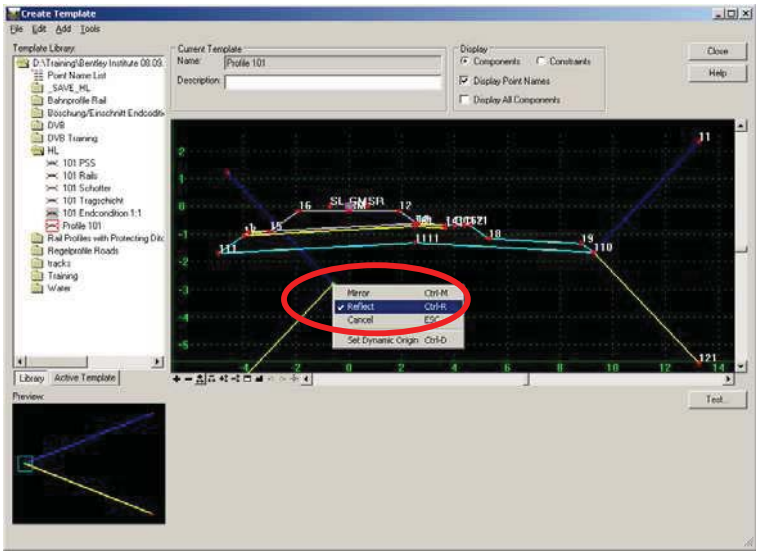


Drag the component **101 Endcondition 1:1** onto point **110** of the **Profile 101** template



Fit the template view

Drag and drop the component **101 Endcondition 1:1** again but right mouse click whilst holding down the left mouse button and select **Reflect**, place the component on point **111.**



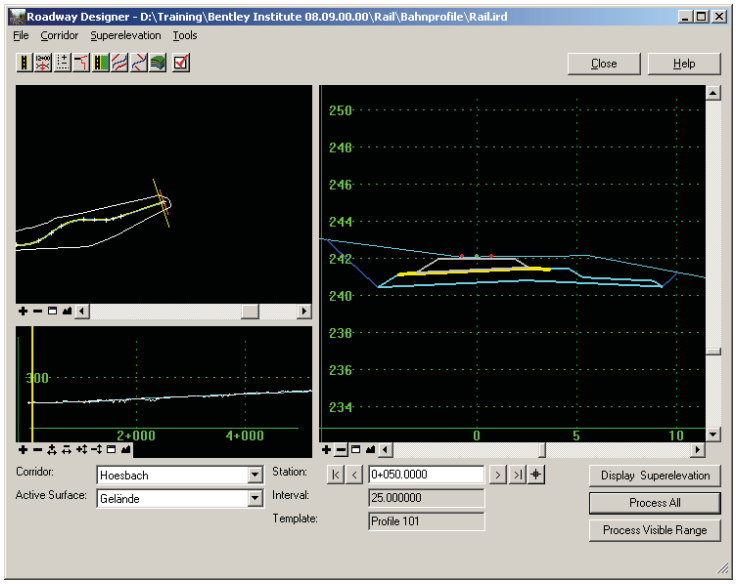
Fit the template view and **Save** the template library and close the create template dialog box.

Go to **Modeler > Roadway Designer** and go to **Corridor > Template Drops**.

Select the template and data the **Synchronize with Library** button.

Close the dialog box.

In the Roadway Designer data the **Process All** button.



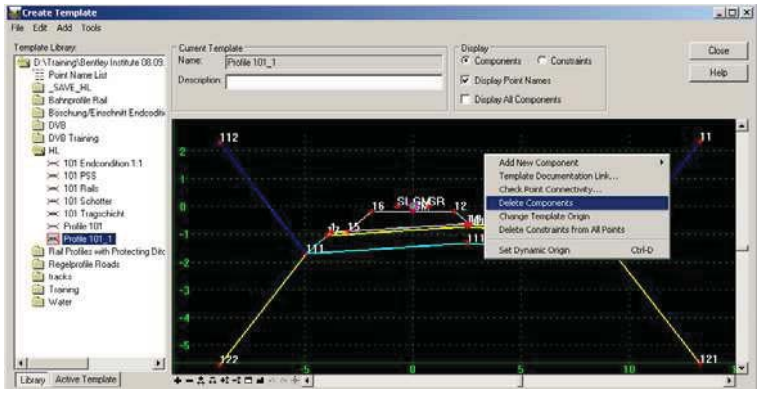
Delete components

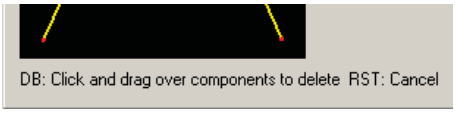
Copy the template **Profile 101** in the **HL** folder and rename it to **Profile 101_1**

Double click on template **Profile 101_1** to make it the active template

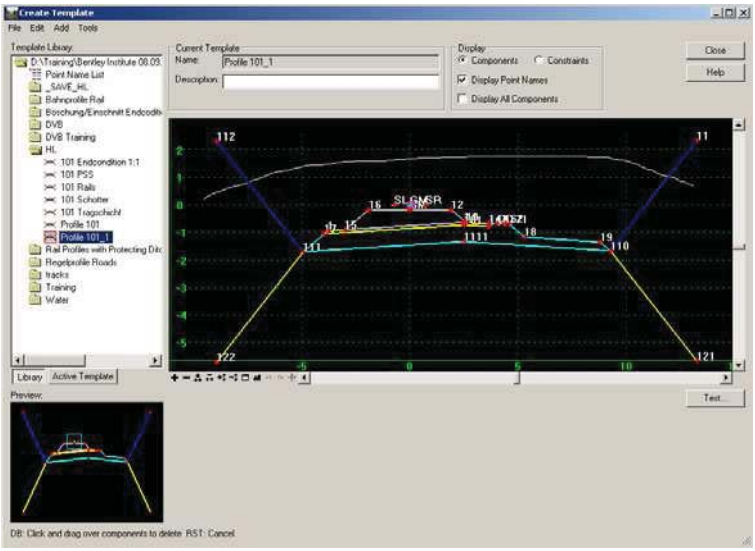
Save the template library

Right mouse click in the active view and select **Delete Components**





Hold the left mouse button down and drag the drawn line over the **Cut** end condition components (only the **CUT** end conditions)



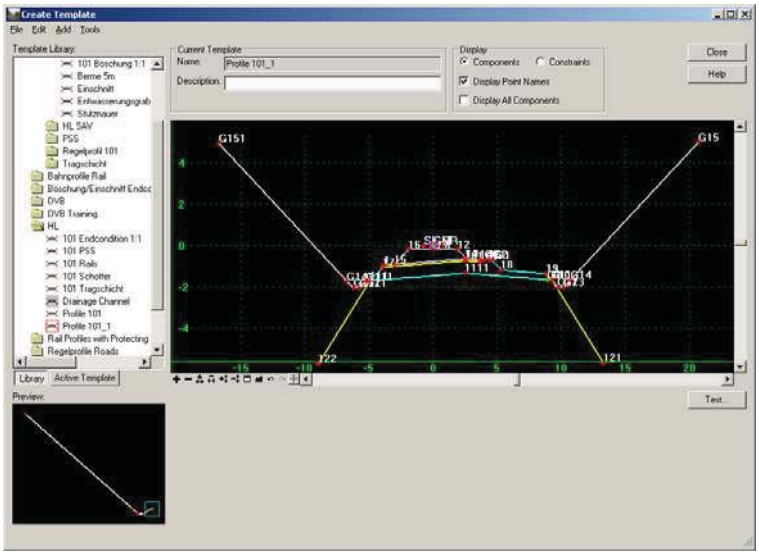
Template with a drainage channel

In the template library you will see a folder called **HL SAV** in this you will a find subfolder called **End Conditions**

Copy the templates **Drainage Channel** to the **HL** Folder (use right mouse click to copy and paste)

Activate the template **Profile 101_1** and click on **Drainage Channel** so it appears in the Preview window.

Drag the template **Drainage Channel** onto point **110** of the **Profile 101_1** template repeat for point **110** (remember to toggle off Reflect)



Test the template. Notice that the cut slope ends at approx 5 M. this is because the height was limited when the end condition was defined.

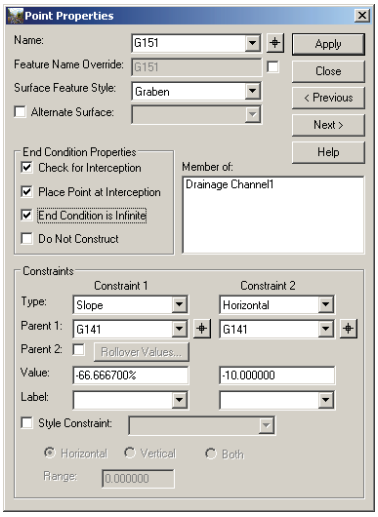
In order to change end conditions we must edit points **G15** and **G151**.

Right mouse click on point G**151** and select Edit Point.

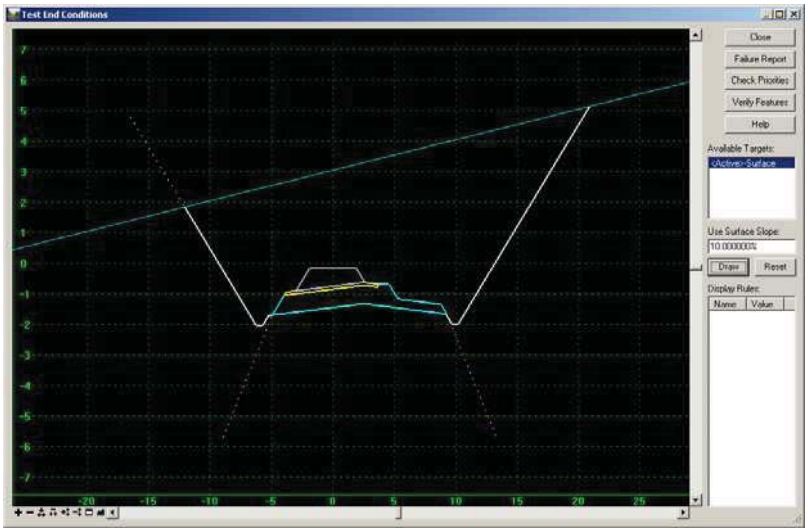
Toggle on **End Condition is Infinite**

Apply and close the dialog box.

Repeat for point **G15.**

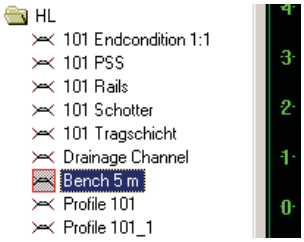


You can test now the process of the endconditions.



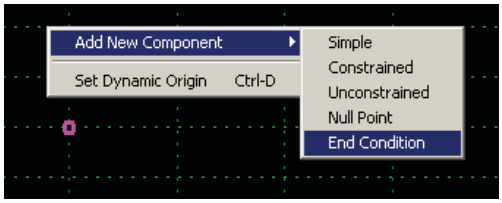
Creating Benches

In The **HL** folder create a template with the name Bench 5 m

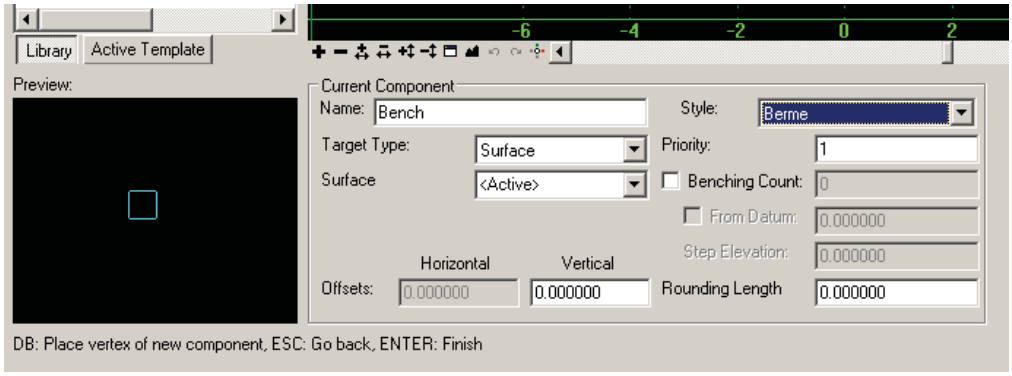


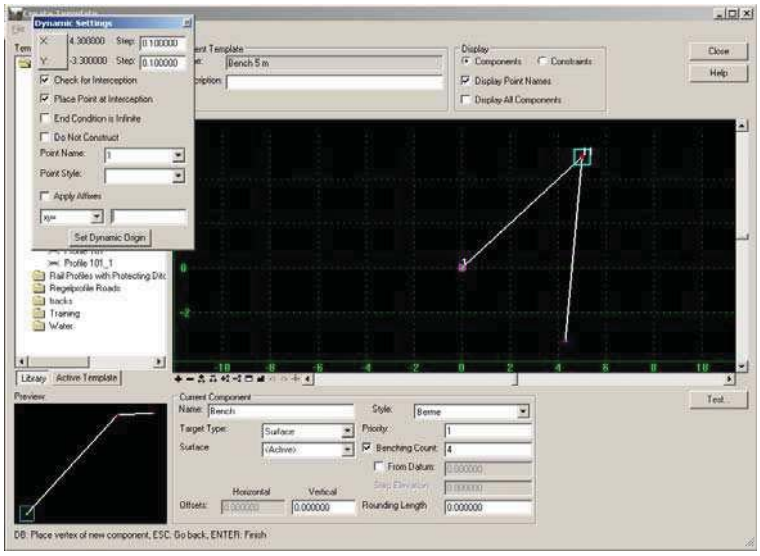
Turn on the Dynamic Settings dialog box.

Right mouse click in the template view and select **Add New Component > End Condition**



For the component name type in **Bench** and set the style to **Berme**





In the dynamic settings dialog box set the input to xy= and type in **0, 0** and **Enter** on the keyboard

Toggle on Bench Counting and set the counter to **4**

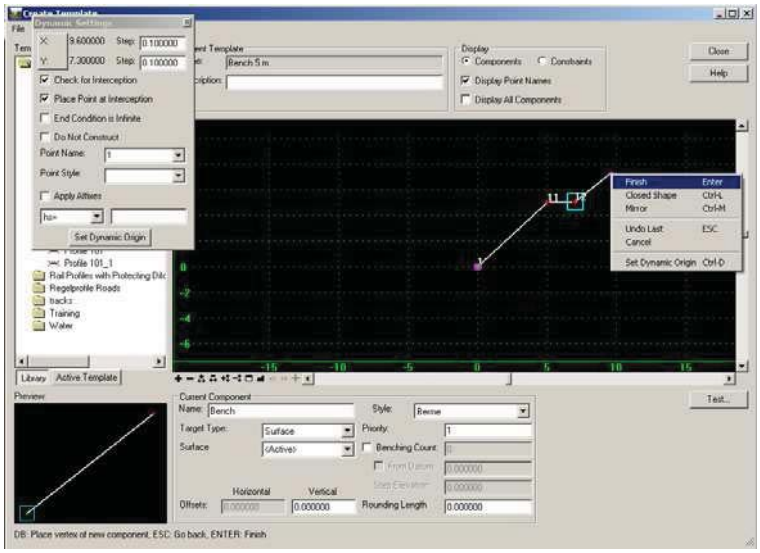
Key in xy=**5, 5**

Enter

Key in HS=**2.2, 5%**

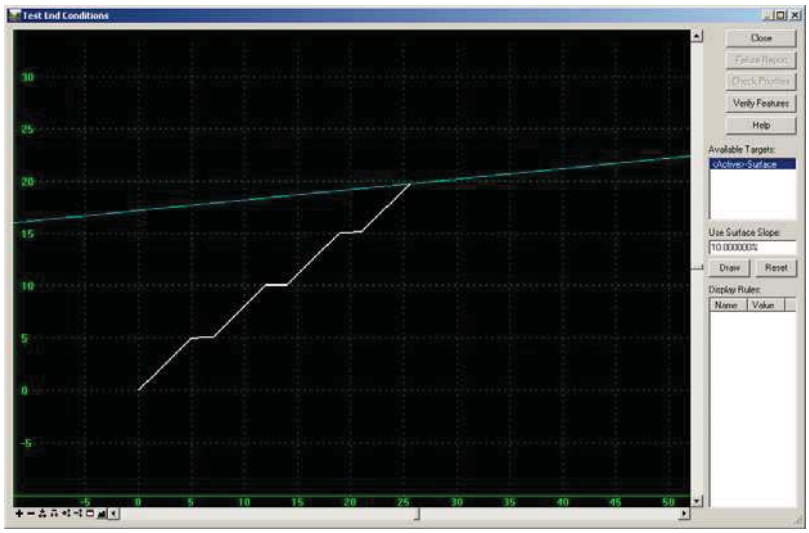
Enter

Right Mouse click and Select **Finish**



Save the template library

Click the Test button and you will see 4 benches can be created.

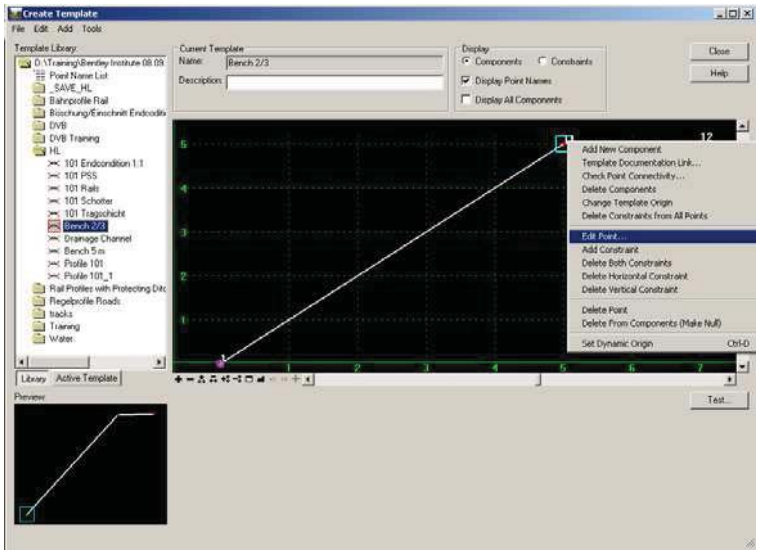


Cases of endconditions/decision tables

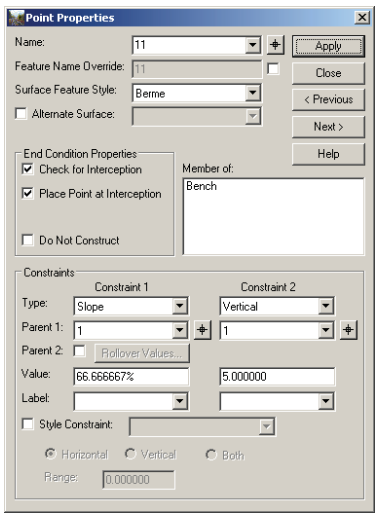
Copy the template **Bench 5M** in the **HL** folder and rename it **Bench 2/3**

Make the template **Bench 2/3** active

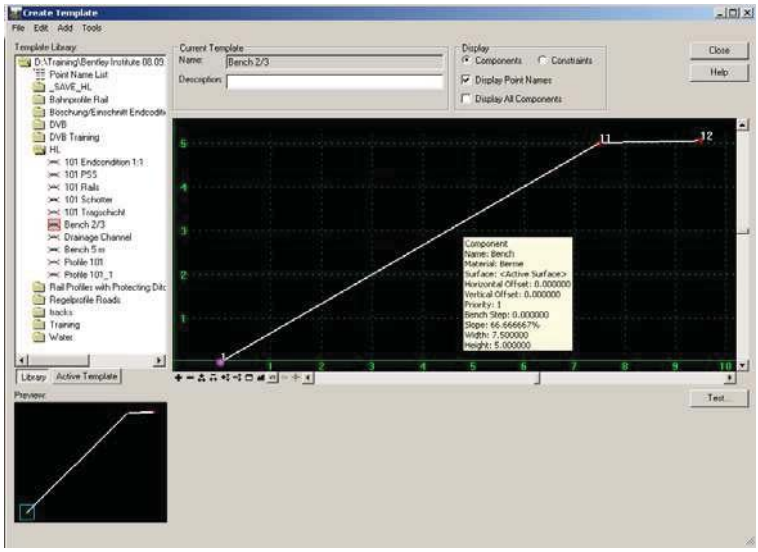
Right mouse click on point **11** and select **Edit**



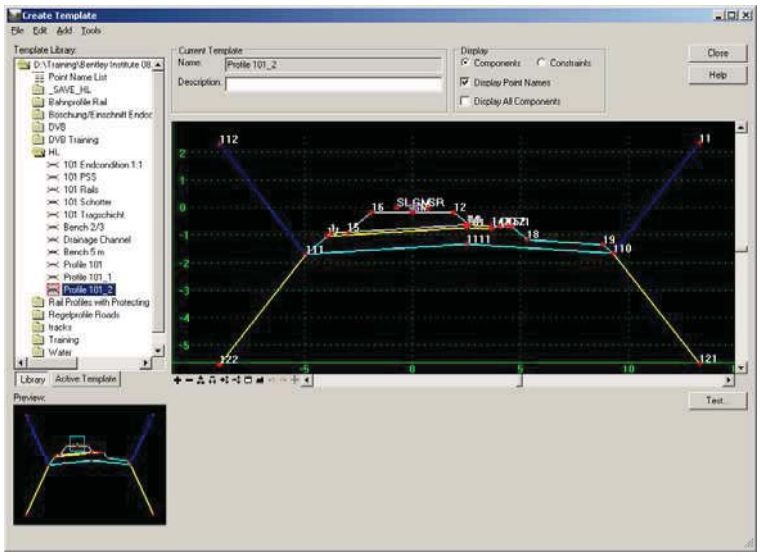
Set the constraint to point **1** to be **Slope** and the value **2/3**



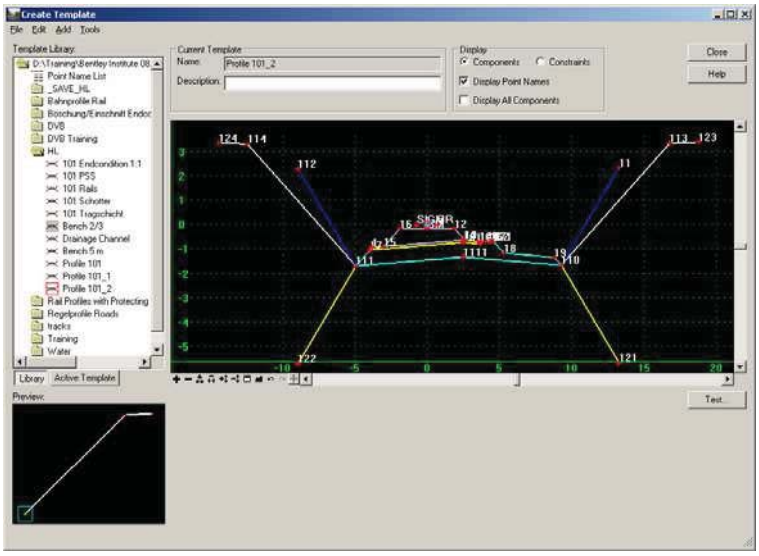
Apply the changes and close the dialog box.



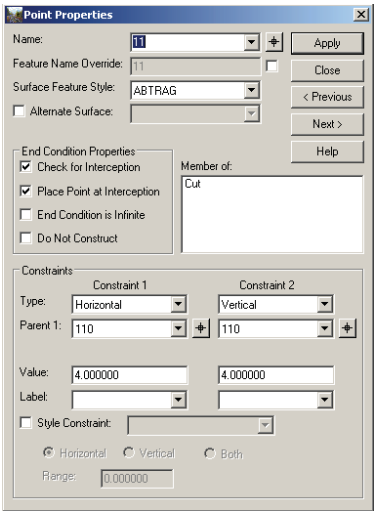
Copy the template **Profile 101** in the **HL** folder and rename to **Profile 101_2** and set it to be the active template.



Add the template **Bench 2/3** to the left and right side at point **110** and **111**.



Edit point **112** and **11** and toggle OFF End Condition is Infinite.

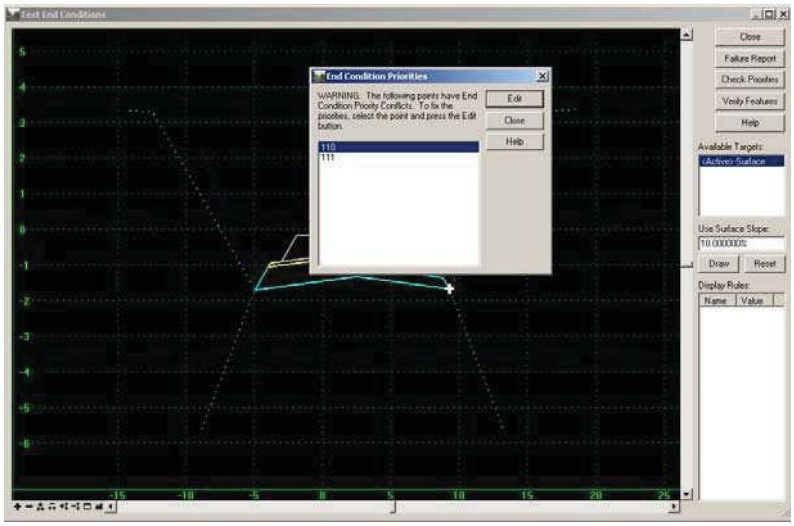


Apply the changes and close the dialog box.

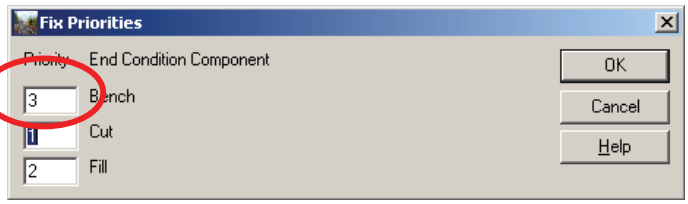
Use the Test button to check the endconditions.

To fix the problem click **OK**.

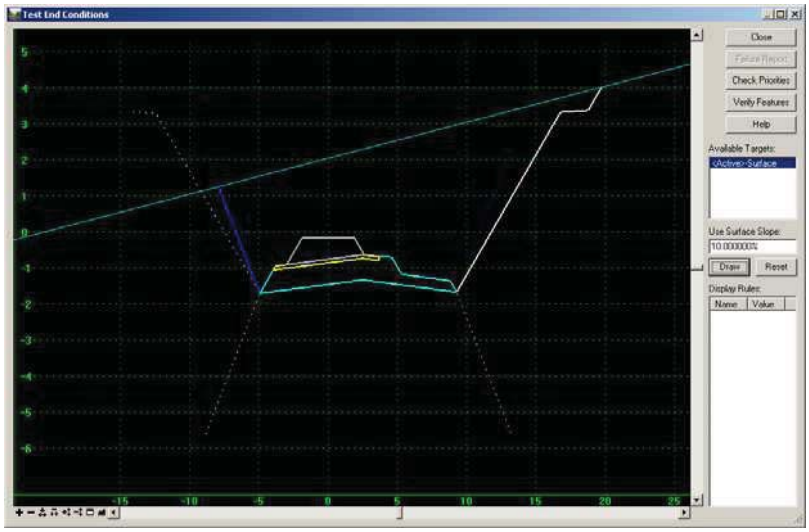
Go to Check Priorities.



Make sure that the Bench is set to priority 3 on both sides



Test the end conditions.



Close the dialog box.

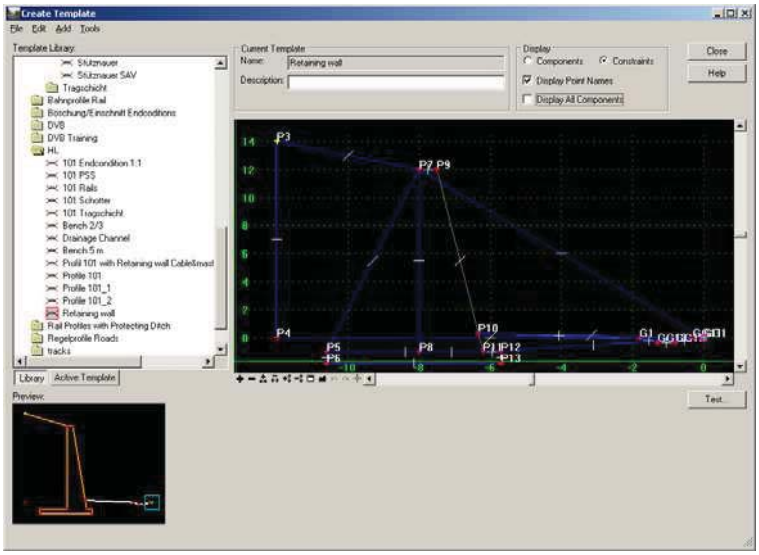
Result: Benches are only used in this case if the cut height of the end condition 1:1 is exceeded.

End conditions with retaining walls.

In the template library you will see a folder called **HL SAV** in this you will find a subfolder called **End Conditions**.

Double click on the template **Retaining wall**

Toggle the view to Constraints.



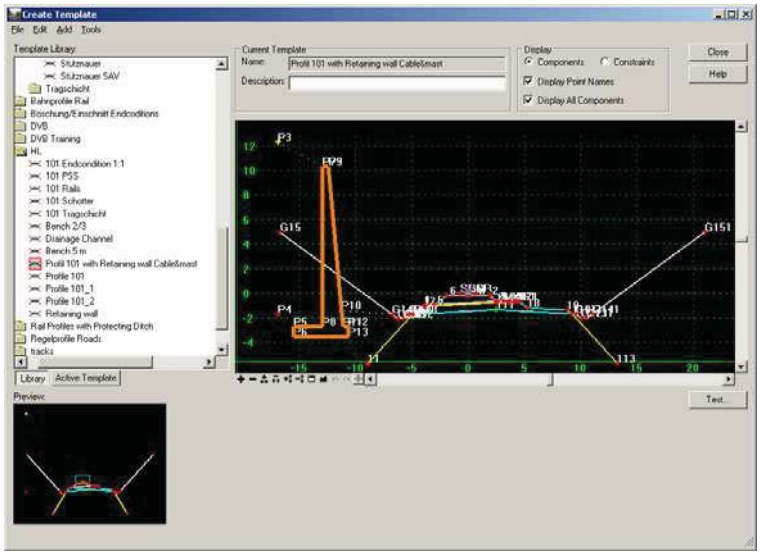
Right mouse click on point **P3** and select move.

Move the point to to see how the template is constrained.

Open the folder **HL SAV**

Copy the template **Profil 101 with Retaining wall Cable&Mast** to the **HL** Folder (use right mouse click to copy and paste)

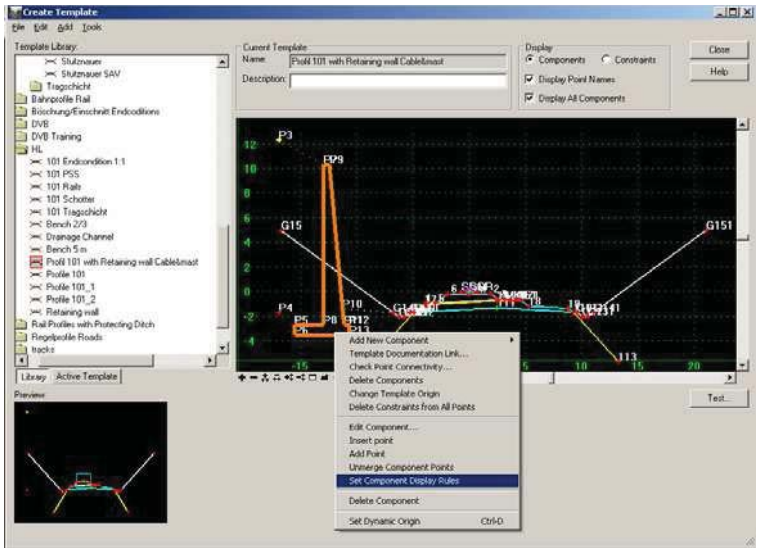
Double click on the template **Profil 101 with Retaining wall Cable&Mast**

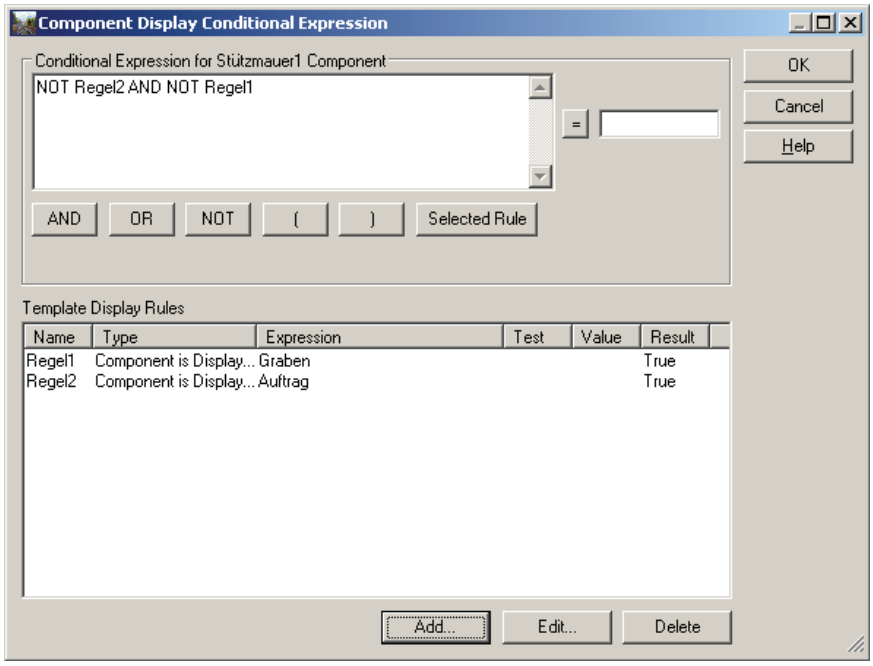


Component Display Rules

Component display rules make it possible to represent components under certain defined rules. That is a retaining wall is placed only if the end condition height is > 5m. Component display rules are defined on the components and stored in the template. If you delete the components the rules are not deleted, since they are stored in the template.

Right mouse click on the retaining wall component and select **Set Component Display Rules**





These Rules are driving the retaining wall and tell it when it appears or disappears.

Data the test button

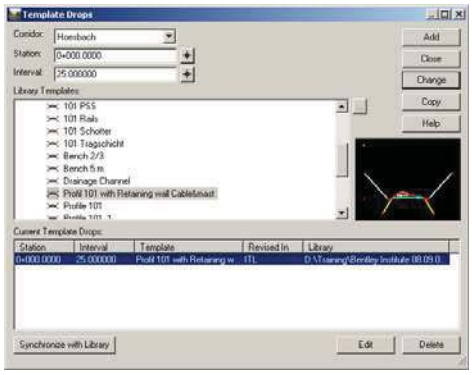
Close the test window and save the template library.

Close the Create Template dialog box.

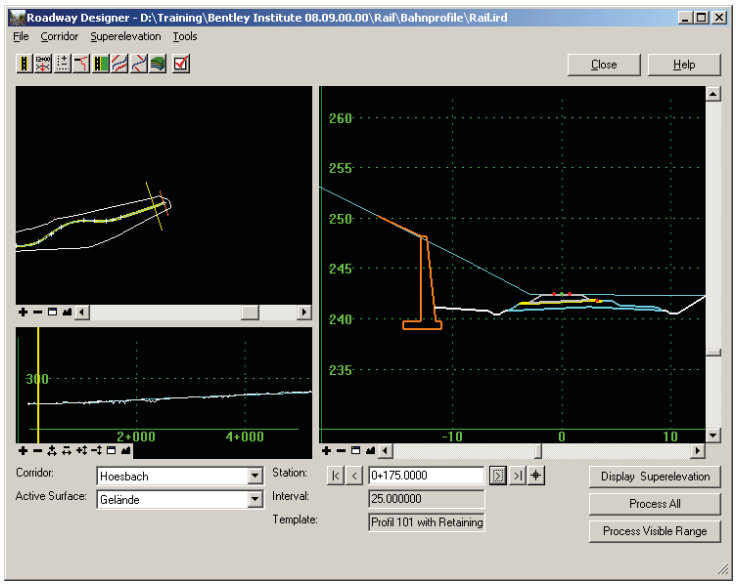
Go to **Modeler > Roadway Designer** and go to **Corridor > Template Drops**.

Highlight the original template drop and select the template **Profil 101 with Retaining wall Cable&Mast** for the HL directory.

Data the change button



Close the template drop dialog box



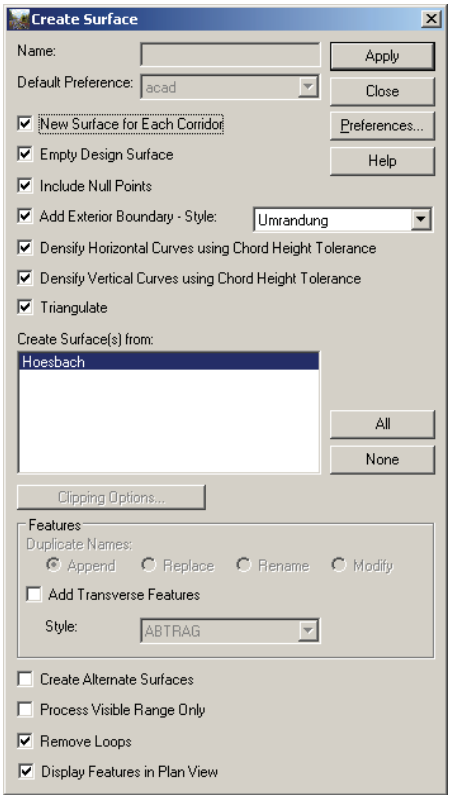
Data the process all button.

Save the roadway designer file.

Finally we can produce a new DTM.

Go to **Corridor > Create Surface**

Set the dialog box as below



Click **Apply**.

Close all dialog boxes.

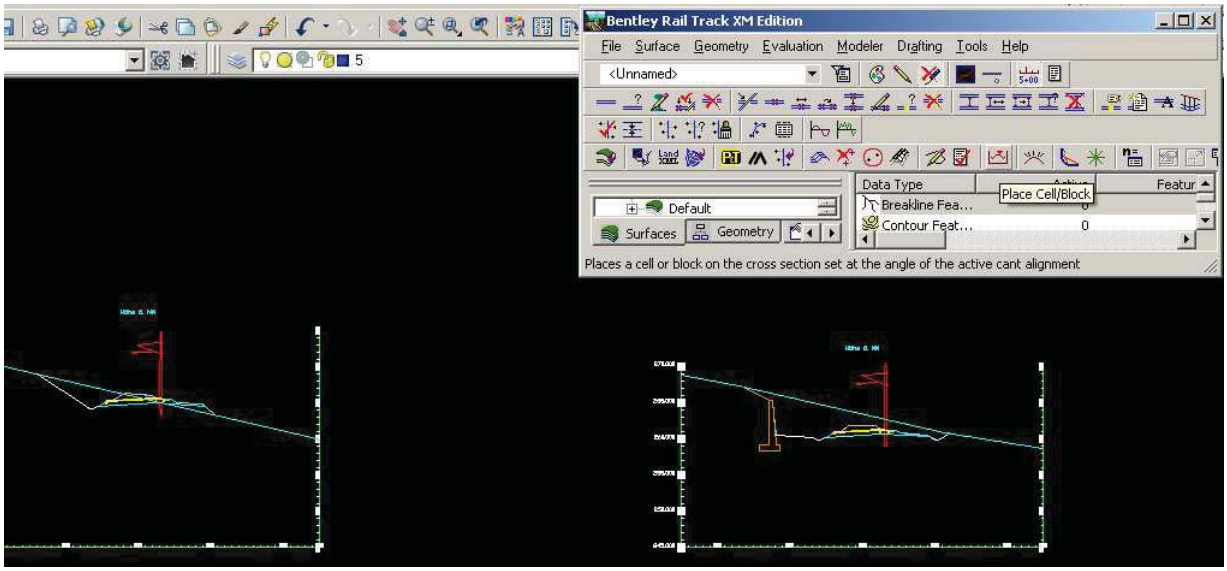
In Microstation open the drawing **xsect2008.dgn.**

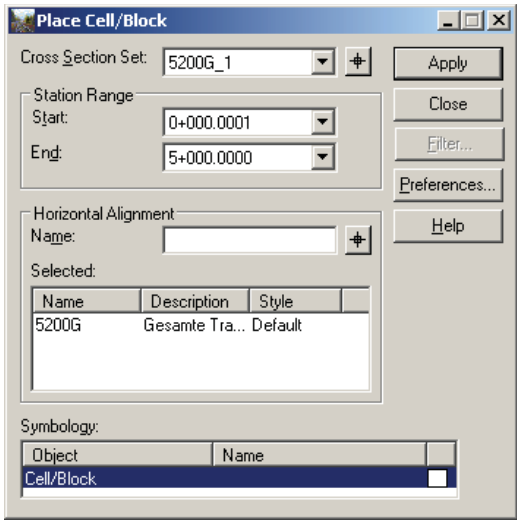
In Bentley Rail Track go to **Evaluation > Create Cross Section**

Leave the settings as default.

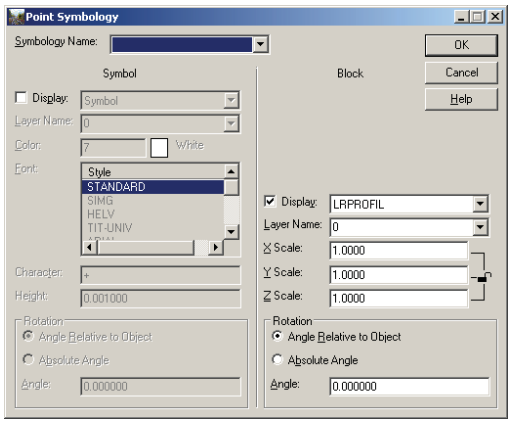
Apply and place the cross sections in the Microstation drawing

To add the train profile to the cross sections go to **Evaluation > Place Cell/Block**



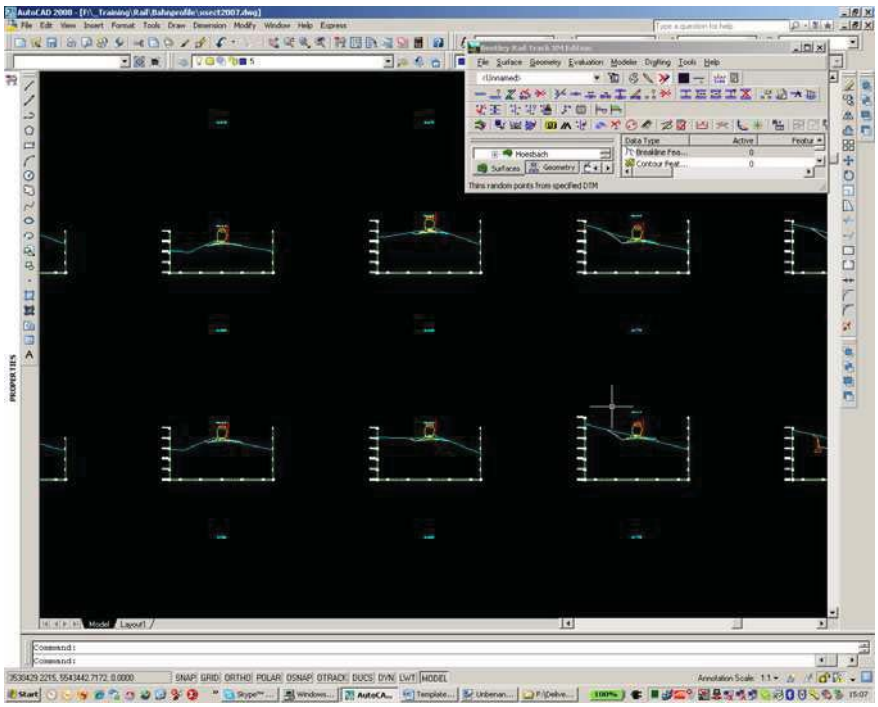


Double click **Cell/Block**



Toggle on Display Cell and select the cell LRPROFIL.

Data OK & Apply.



From here you can proceed with annotation and volume calculation.

Close Bentley Rail Track and Microstation.

Workshop 2 Multi Track Template

You can design single or double tracks using the standard templates but how do we design a siding situation when the tracks from a single to a double tracks?

Start **Bentley Rail Track** and open the file **……\02 Multi Track\Data\Multi Track.dgn**

Go to File > Project Defaults and load the configuration **Workshop 2 Multi Track**

Open the file **……\02 Multi Track\RWK\Multi Track.rwk**

Go to **Modeler > Create Template** and in the typical sections folder double click on the template **Multi Track.**

Toggle on the **Dynamic Settings**

Right mouse click on the centerline of the rail point (**LCL**) and select **Move Point**, move the point to the left and notice the way the template moves.

Right mouse click to reset the template and close the Create Template dialog box

Go to **Modeler > Roadway Designer**

Select **Process All** and view the results.

Go to **Corridor > Create Surface** and **Apply**

Close the report and the create surface and roadway designer dialo

Create cross sections.

Close Bentley Rail Track and Microstation.

Workshop 3 Platform Setting Out Template

Using a template for the setting out of a new platfo

Start **Bentley Rail Track** and open the file **……\03 Platform Setting Out\Data\Platform Setting Out.dgn**

Go to **File > Project Defaults** and load the configuration **Workshop 3 Platform Setting Out**

Open the file **……\03 Platform Setting Out\RWK\Platform Setting Out.rwk**

Go to **Modeler > Create Template** and in the typical sections folder double click on the template **Rails and Platform**

Toggle on the **Dynamic Settings**

Double click on the point Rail Edge Left, note the **Angle Distance** constraint.

This constraint takes two parent points, a distance, and an angle. The selected point is then fully constrained to the location defined by the first parent, and the angle from the first parent relative to the vector defined by the two parent points. This constraint creates a rigid-body rotation which is ideal in this case for setting out a platform edge which must be at a fixed horizontal and vertical dimension but must also take into account the cant on the rails.

Close the Create Template dialog box.

We have loaded a surface called Rail level, this contains the features for the left and right rails, these were created using the View rails command. We will use the features as point controls for the left and right rail points on the template.

Go to **Modeler > Roadway Designer** and go to **Corridor > Point Controls** (Note the control type is set to feature).

Go to **Corridor > Create Surface** and **Apply**

Close the report and the create surface and roadway designer dialo

Create cross sections.

Close Bentley Rail Track and Microstation.

Workshop 4 Delivered V8i Templates

Start **Bentley Rail Track** and open the file **……\04 Delivered V8i Templates\Delivered V8i Templates.dgn**

Go to **File > Project Defaults** and load the configuration **Workshop 4 Delivered V8i Templates**

Open the file **……\04 Delivered V8i Templates \ Delivered V8i Templates.rwk**

Go to **Modeler > Create Template** and in the typical sections folder double click on the template **Rails and Platform**

Toggle on the **Dynamic Settings**

Double click on the template Double Track – Concrete Sleepers

Right mouse click in the template window and select **Template Documentation Link** click on the **Open Link** button

A pdf file will open giving design details of the template.

Close the pdf and the create template dialog box

Close Bentley Rail Track and Microstation.

Workshop 5 what's New in V8i

Let's look at some examples of some new functionality in V8i which may be interesting.

Place Turnouts

Move Turnouts (movie)

Quick Regression (Movie)

Turnout Healing (Movie)

View Regression Points in mm

View Stationing – Cant

Multiple Regression – Edit Start and End Element, Geometric Freedoms maintained

Table Editor