Catenary design

Background

You first need to define an alignment and a Rail model in Novapoint.

In this example we will use a double track railway.

Start Novapoint Base and start AutoCAD from Novapoint base

The function is started from the Railway Ribbon in AutoCAD:

The opening dialog

1 - Model info

The active rail model is selected and the calculation basis used for the terrain can be defined. Default from the active rail model.

2 - Catenary parameters

Type of Catenary - supports the two main Norwegian standards S20 and S25. Other standards will be added as required.

Tension in Contact wire - the load applied on the contact wire at the end points. Can be user defined. Used in calculating loss of tension and loads on the masts.

Wind speed - the design wind speed for calculating wind blow out.

Allowed wind Blow out in meters - the maximum blowout allowed. Note the technical notes from the Norwegian Rail Administration has reduced values based on the curvature and on the design speed. These are applied automatically and drawn in the wind blow out charts.

Safety value - the calculated distance between the masts used in the calculation is increased by the safety value. If the physical value is 50m the distance used in the wind blow out calculation is based on 50m plus the safety value.

Track width - width between the tracks.

Show Wind Result Graphics - toggles on and off the wind blow out chart for two spans for single and double track.
3 - Reference for horizontal and vertical alignments

In this selection you define the reference for the alignment, normally for Railway it is the track geometry, center track right track. The vertical alignment is normally read from the same reference alignment and includes the elevation for the lowest track when cant is present. The alignment is used to calculate the insetting point for the masts which is normally top centre foundation or bottom mast.

4 - Tabs

Contact wire calc. tab - controls the parameters that define the x,y,z location of the Contact wire. Note all editing of the mast location is carried out here.

The only initial setting the user needs to enter in this dialogue is the Chainage distance - the initial maximum distance between masts.

The black field are the default values that are used for the calculation. These can be adjusted as required. The DEFAULT variable will read from these values.

The Left and Right Masts Location show the mast locations and the result of the calculation.

A calculation

Select AutoFill:

Adjust the From - To as required and Select OK. The Let app. Suggest zigzag should NOT be used.

The Contact wire is calculated based on the defined mast placement. Zig Zag is applied automatically:

The columns

ID - each mast location is given an ID

Chainage – the chainage for each pair of masts based on the selected alignment and the selected Chainage Distance. These values can be adjusted and locked. Double click on a Chainage and it will turn red and the value is then locked:

After locking 300 by double clicking the Chainage distance was changed to 58 but the mast position at 300 was held.
Segment - the alignment geometry is read and the segment type is shown including the radius for curves.

Chainage Distance - the distance between the masts. The DEFAULT value is shown in the black field. Values can be entered. INHERIT reads the previous value:

Enter I for INHERIT or d for DEFAULT.

Shift - enter a positive or negative value to shift the left mast in relation to the right track (main track):

The left mast with ID 8 is moved 5 meters back in relation the right mast with ID 8. So the left mast is at Chainage 431 while the right mast is at chainage 436.

ZigZag Value - the zigzag is applied automatically. Starts with the default value and always varies between DEFAULT and NEGative DEFAULT. The ZigZag value can be user defined.

(An automatic function to automatically place the zigzag on the outer edge of cures under a user defined radius will be added shortly)

North - the north coordinate for the mast. Can be edited.

East - the east coordinate for the mast. Can be edited.

Spam length - the true distance between two masts.

System Height - the system height. The default vale is automatically filled in based on the selected Type catenary. Can be user defined.

Contact wire Height - the contact wire height over center track. The default vale is automatically filled in based on the selected Type catenary. Can be user defined.

Wind Result - shows the result of the wind blow out – OK or Not (OK). The most common way to meet the requirement is by reducing the distance between masts. The Zigzag can also be adjusted. Click on an ID and turn on the Show Wind Result Graphics:

The result is shown:

The graphics represents two spans for right and left track.

Yellow - cc track

White – contact wire

Green/Red - the wind blow out. Red not OK Green OK within the parameters

Blue - the allowable wind blow out

Cyan dashed - reduced allowable wind blow out from the Norwegian technical tables based on design speed and radius.

Inherit and Default

Inherit and default are active when a selection is taken.

INHERIT takes the value from the row over. Enter I in a cell and it will become Inherit.

Default takes the value from the default row - marked in black. Enter d in a cell and it will become default.

The Left Masts Location Tab

This is the result of the calculation from the Contact wire clc. Tab. An overview of the columns:

ID – read form the Contact Wire calc. tab. Cannot be edited here.

Point Type – filled inn with Endpoint, Fixed Point and Endpoint when the Tension Loss calculation is run. The Fixed point can be moved manually.

Chainage, Segment and Chainage Distance – read form the Contact Wire calc. tab. Cannot be edited here. H-offset - sets the horizontal offset from the reference alignment. For double track the reference alignment is centre of track.

North and East - read form the Contact Wire calc. tab. Cannot be edited here.

H-Distance - sets the vertical offset from the reference alignment. For double track the reference alignment is centre of track, lowest rail.

Elevation – is calculated from the reference alignment.

Block name – the path to the 3D block that is to inserted for the left mast. The block is a DWG file.

Rotation – the block rotation in degrees (360).

Tension Loss Calculation

Select the Tension Loss calculation. Adjust the input parameters as required:

Press OK and an EXCEL sheet is opened with the result. The Endpoint, Fixed point and Endpoint are added to the Point Type column:

Draw to AutoCAD

To Draw to AutoCAD select Draw.

You will be asked if you want to create a back up file of all the parameters. If yes place on the desired location.

The mats and contact wire are drawn in 3D and the wind blow out limits are drawn in 2D:
NCO

Select NCO and select a mast and the dialogue is opened and the parameters can be edited, updated or deleted: