Superstructure School

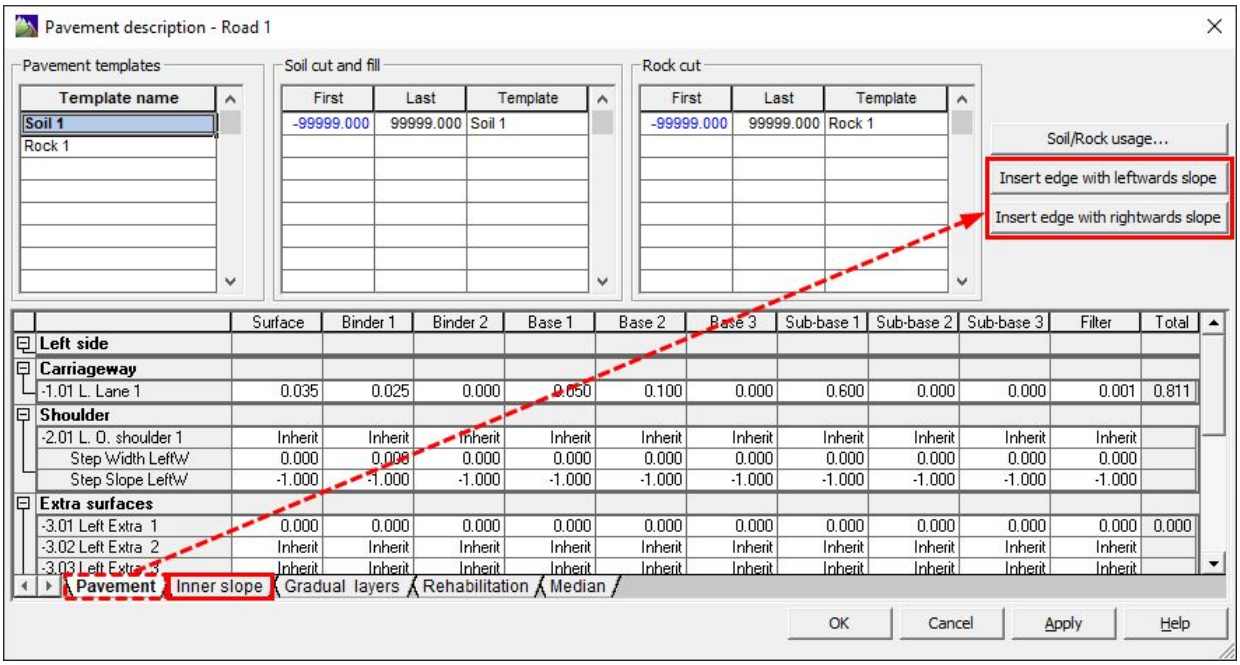
August, 2019

The “Superstructure School” is a documentation of tips and tricks that you can include in your design work. We get support cases every week regarding pavement description, and will by the Superstructure School take a deeper look into some of these, and other issues.

Uses of “Inner fillslope” and “Insert Edge”

The pavement transitions are some of the most important things to get a hand on when designing a road. Here we will look at the use of ‘Inner slope’ and ‘Insert Edge’.

You find both functions inside the general pavement dialogue.



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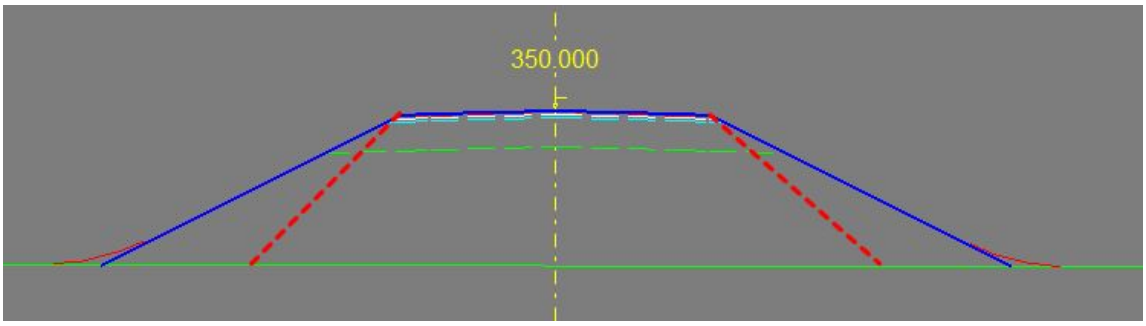
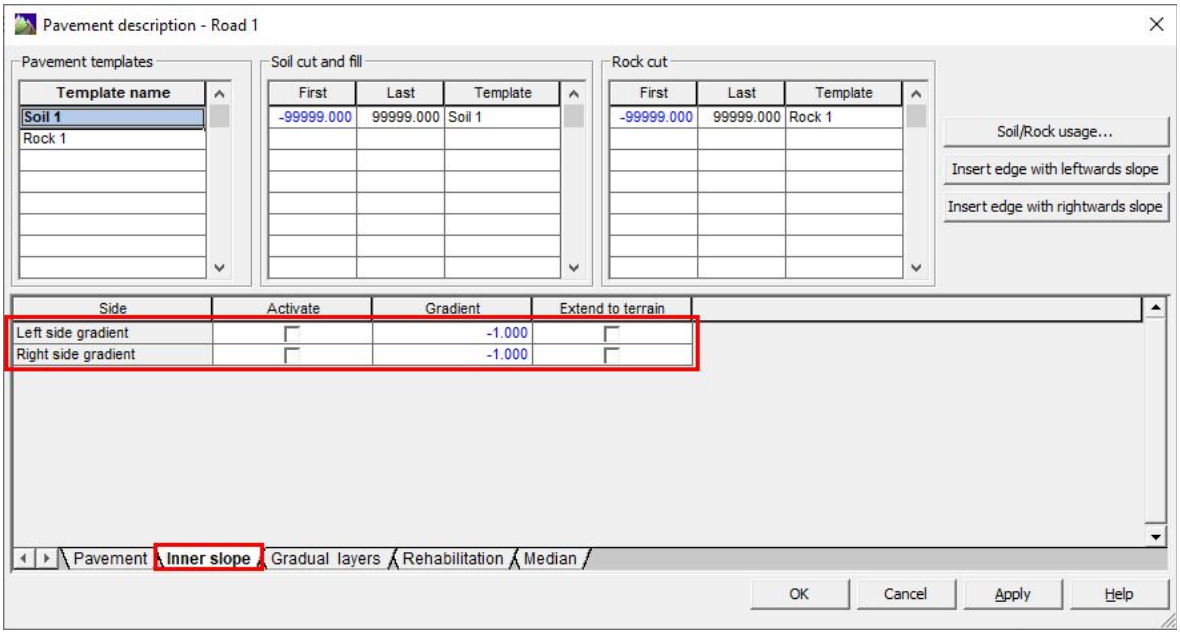
Inner slope

'Inner slope', or 'Inner fill slope' as some might call it is a function used to activate a beam slope down from the last road surface with pavement layers. As a general rule we recommend using inner slope in roadmodels, but note that some designs may not require it.

The inner slope is used to avoid using more expensive materials where they are not needed, either in the pavement or in the embankment fill supporting the road structure.



Normally the inner slope starts from the last road surface within surface group 0 to 3, but not always. Cases where the inner slope doesn't start from the last surface we will cover further down this document.

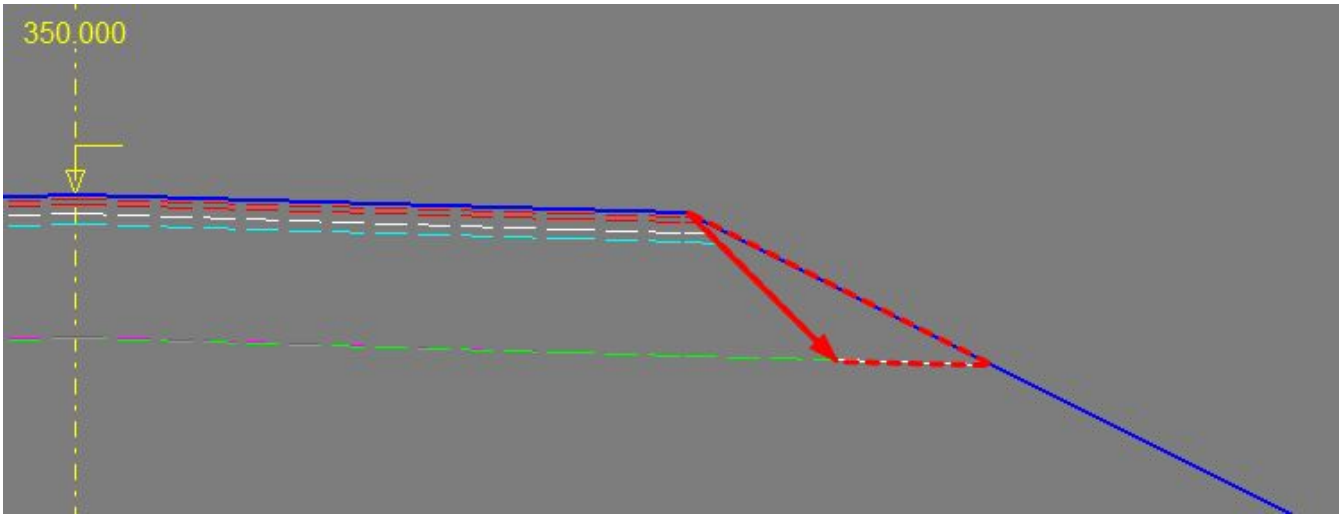


As we see for the inner slope function it is possible to **activate**, set **gradient** and **extend to terrain**. It is possible to activate them separately on the left and right side of the road.

Activate

Use this function to just activate the function for either left or right.

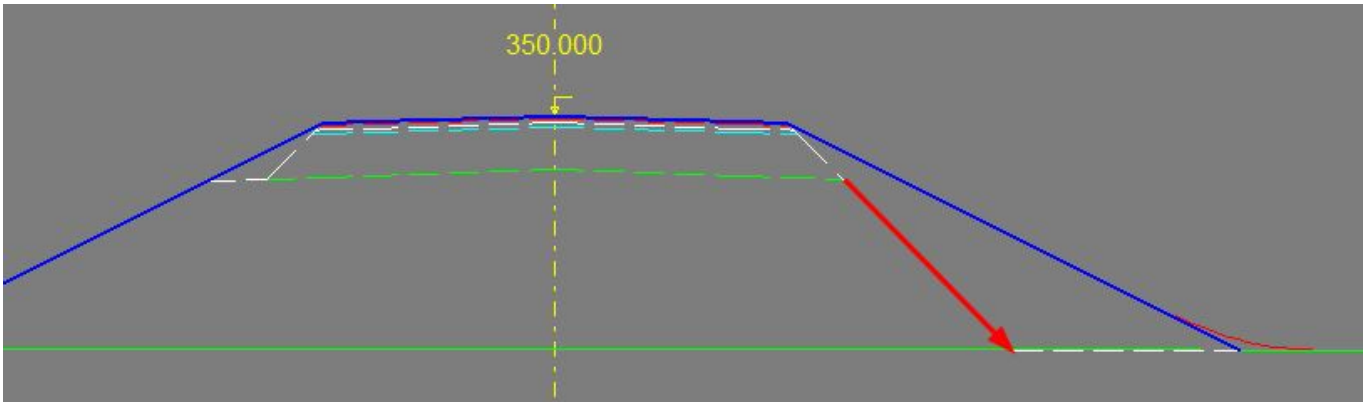
When no other changes is done it will activate the inner slope only for the pavement layers, down to the road bed.



Extend to terrain

When extending to terrain the function will be extended to terrain where it is possible to do so.

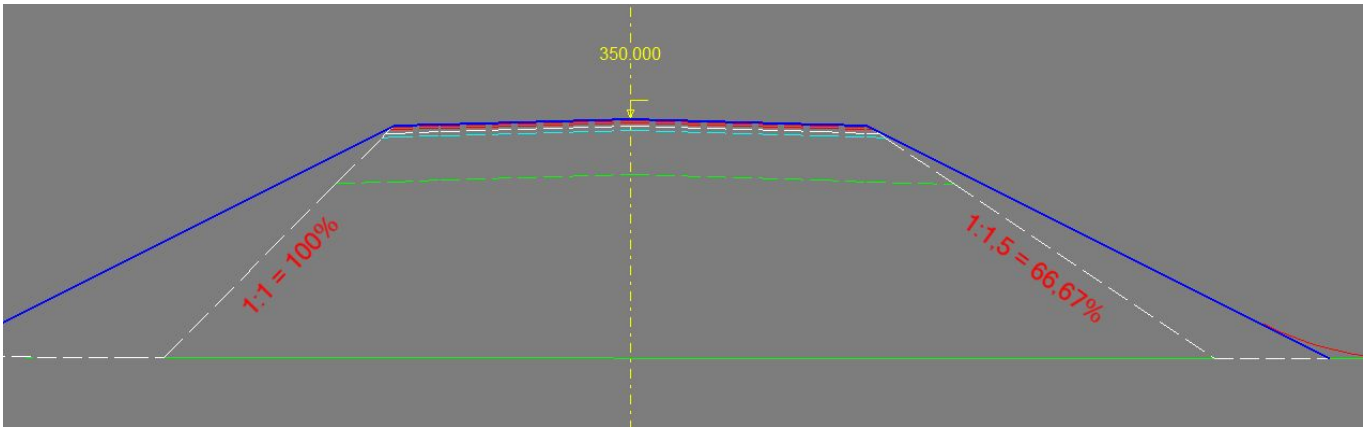
Here we see the inner slope is extended on the right hand side, and not on the left. That is because it is only activated on the right hand side.



Gradient

A change in gradient might be necessary based on the materials used or guidelines you follow.

Here left and right has different slope gradients, left has 100% slope, right has 66,67% slope.



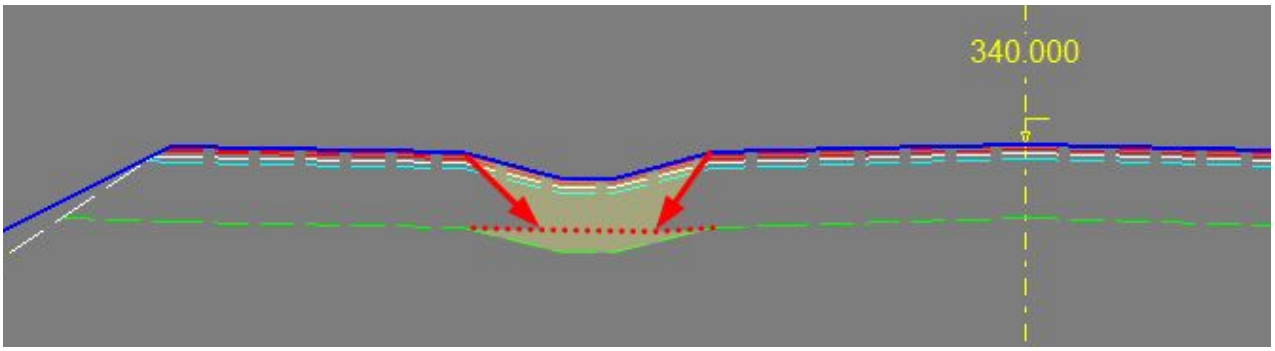
Note that the values used in the dialog are written as decimal numbers.

100% slope is written -1.000. 66,67% slope is written 0,667. Note that there are only 3 decimals available.

Insert edge

In the previous newsletters for 'Superstructure School' you might have seen that we used some functions to handle the pavement layers in the ditch between the road and a walk/bikepath. That was the 'Insert Edge' function.

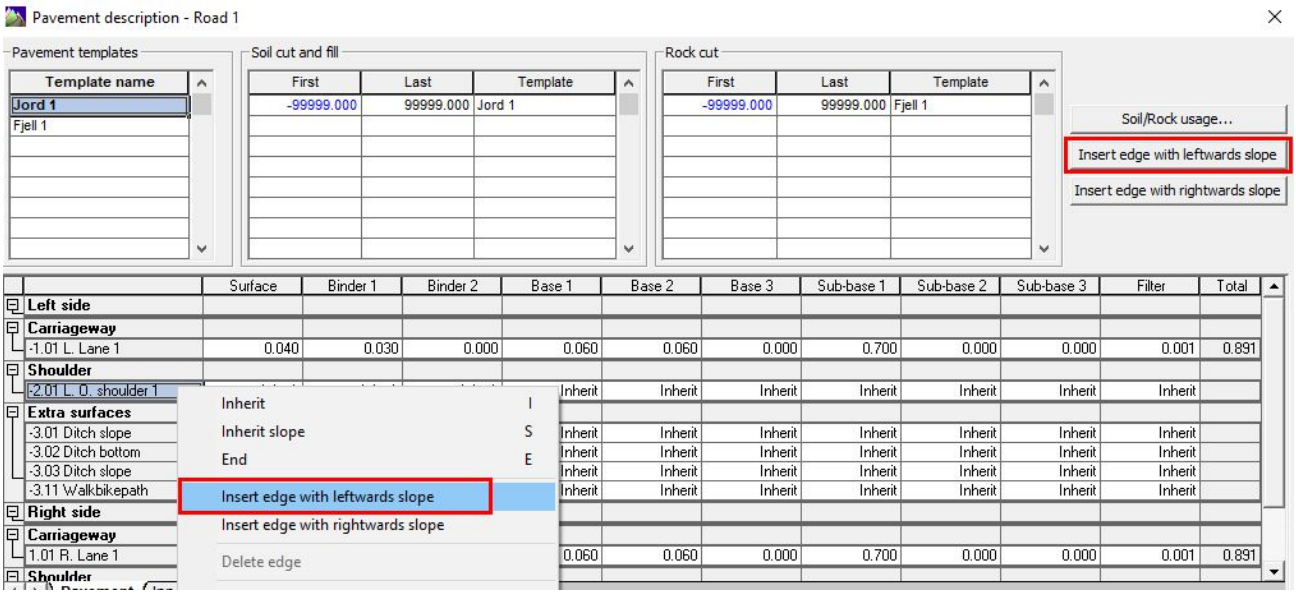
The function is normally used to remove the pavement materials between two traffic areas, f.ex. in a median/traffic separator on a multi-lane road, or in the traffic separator between vehicles and the walk/bikepath. These areas are hatched with a yellow tint in the image below.



Here the pavement layers for carriageway and bikepath are nearly the same thickness, but it doesn't matter if the bikepath is thinner. The method is still the same.

The starting point for the arrow on the right side is the shoulder edge -2.01. Add an insert edge here with the available buttons or by right-clicking the road surface in the pavement dialog.

The inserted edge will be on the left hand side of the assigned road surface, so we use **Insert Edge with leftwards slope**.



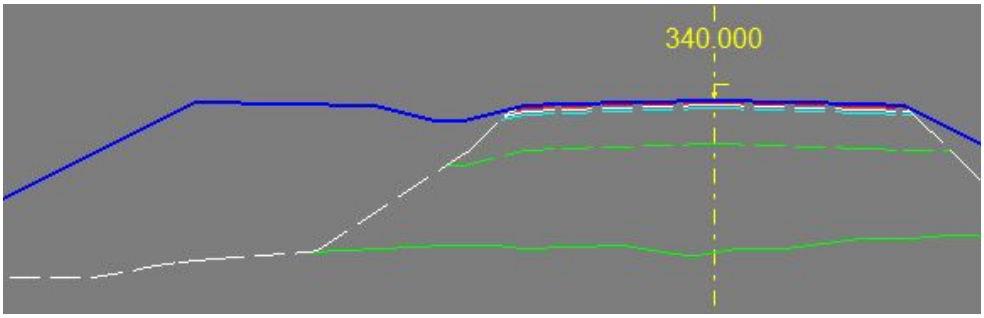
Two new rows will appear in relation to this road surface, one for width and one for slope.

Add these values for all the pavement layers: Width = 0.000

Slope = -1.000

-2.01 L. O. shoulder 1	Inherit	Inherit	Inherit	Inherit
Step Width LeftW	0.000	0.000	0.000	0.000
Step Slope LeftW	-1.000	-1.000	-1.000	-1.000

When we build one cross-section it will show some strange results compared to what you might have expected.



The reason is that we still have pavement descriptions further away from the alignment, after the inserted edge. In our case we want the inserted edge to go back to full pavement for the walk/bikepath, the inserted edge need another 'Insert edge' to work against. You can think in the way that they need to work in pairs, so we have to add the other one.

Add a rightwards insert edge from the roadsurface -3.11 in the pavement description.

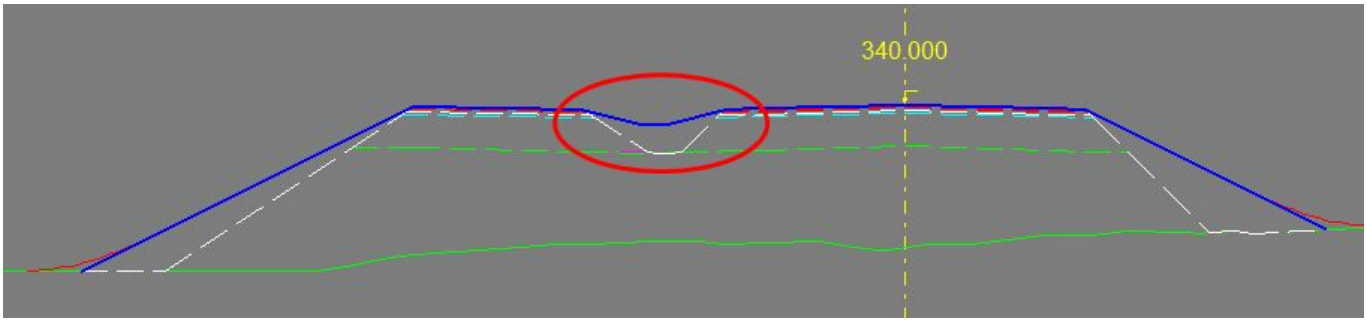
As an example we add the values as seen below:

	Surface	Binder 1	Binder 2	Base 1	Base 2	Base 3	Sub-base 1	Sub-base 2	Sub-base 3	Filter	Total
-1.01 L. Lane 1	0.040	0.030	0.000	0.060	0.060	0.000	0.700	0.000	0.000	0.001	0.891
Shoulder											
-2.01 L. O. shoulder 1	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	
Step Width LeftW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Step Slope LeftW	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	
Extra surfaces											
-3.01 Ditch slope	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	
-3.02 Ditch bottom	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	
-3.03 Ditch slope	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	
-3.11 Walkbikepath	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	
Step Width RightW	0.050	0.050	0.000	0.050	0.050	0.000	0.200	0.000	0.000	0.000	
Step Slope RightW	-3.000	-3.000	-3.000	-3.000	-3.000	-0.667	-0.667	-0.667	-0.667	-0.667	

Note that the inserted edge from the walk/bike path has differences in the width and slope for many of the pavement layers which gives different results than what we saw from the shoulder.

	Surface	Binder 1	Binder 2	Base 1	Base 2	Bas
-3.01 Ditch slope	Inherit	Inherit	Inherit	Inherit	Inherit	
-3.02 Ditch bottom	Inherit	Inherit	Inherit	Inherit	Inherit	
-3.03 Ditch slope	Inherit	Inherit	Inherit	Inherit	Inherit	
-3.11 Walkbikepath	Inherit	Inherit	Inherit	Inherit	Inherit	
Step Width RightW	0.050	0.050	0.000	0.050	0.050	
Step Slope RightW	-3.000	-3.000	-3.000	-3.000	-3.000	

We now have this solution which looks alot better.

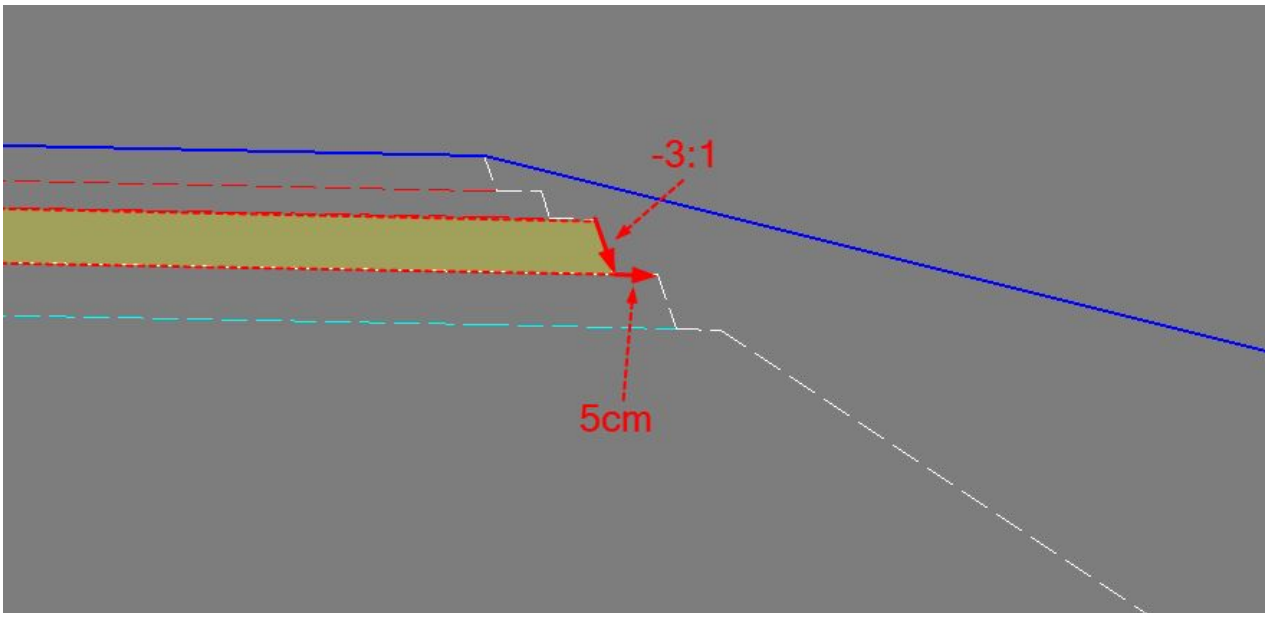


The values in the insert edge function defines how much lateral space the layer needs to be able to be built. The next pavement layer under this use this as a starting point for its own design.

We will use Base course 1 to explain what happens.

The values used are Width = 0,050

Slope = -3,000



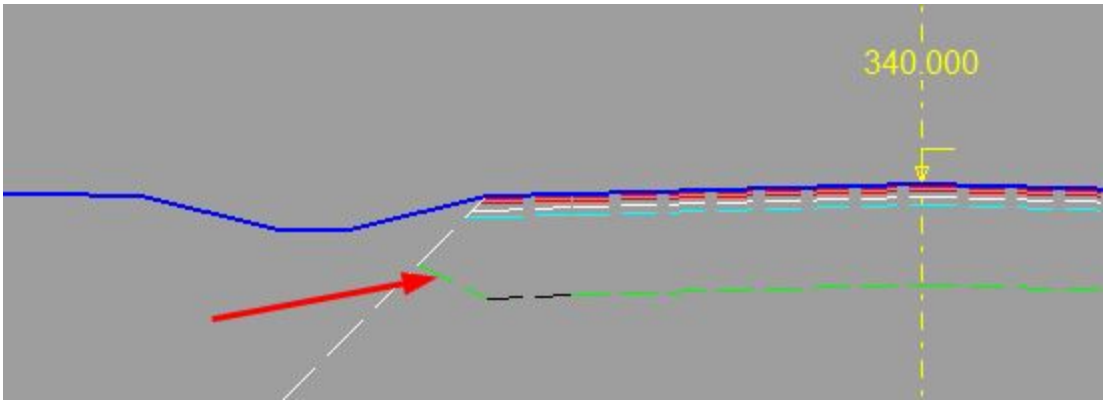
Inner slope starting before the pavement ends

In the previous chapter if we had wanted the pavement to actually stop and go down, as if the walk/bikepath were never there, we can also do that.

We need to:

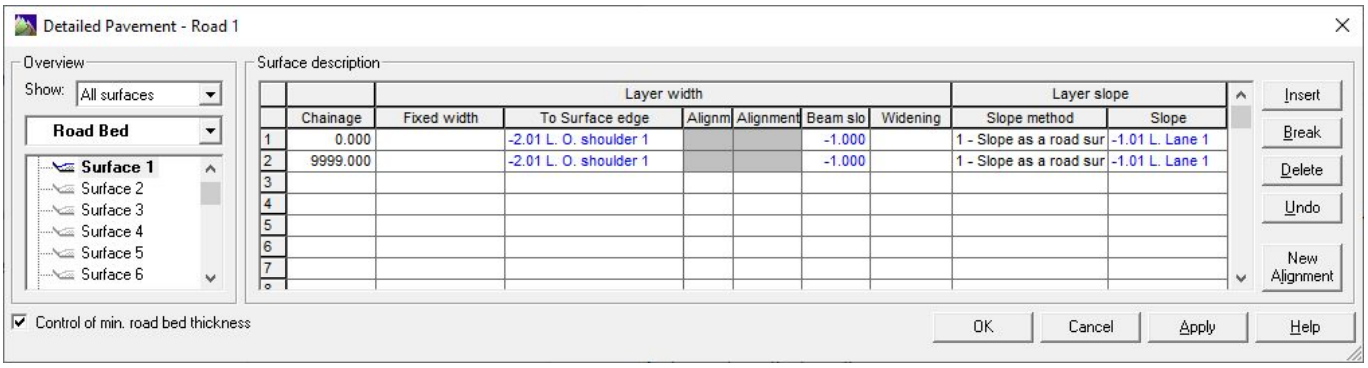
- Remove the insert edge from the walk/bike path
- 'End' the pavement layers on all following layers (note that we have only set End on surface -3.01, and the following layers inherit this)

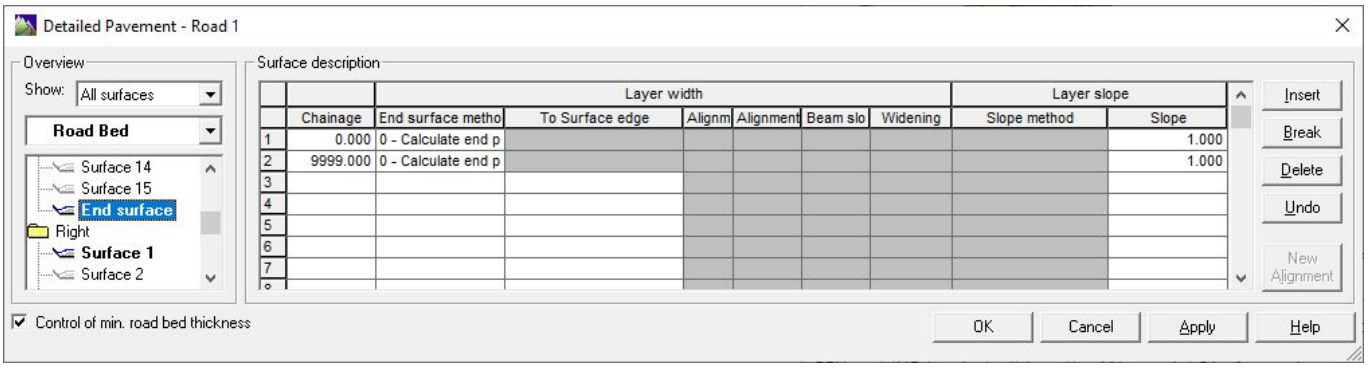
	Surface	Binder 1	Binder 2	Base 1	Base 2	Base 3	Sub-base 1	Sub-base 2	Sub-base 3	Filter	Total
Left side											
Carriageway											
-1.01 L. Lane 1	0.040	0.030	0.000	0.060	0.060	0.000	0.700	0.000	0.000	0.001	0.891
Shoulder											
-2.01 L. O. shoulder 1	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	
Step Width LeftW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Step Slope LeftW	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	
Extra surfaces											
-3.01 Ditch slope	End	End	End	End	End	End	End	End	End	End	
-3.02 Ditch bottom	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	
-3.03 Ditch slope	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	
-3.11 Walkbikepath	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	
~~Step Width RightW~~	~~0.050~~	~~0.050~~	~~0.050~~	~~0.050~~	~~0.050~~	~~0.050~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	
~~Step Slope RightW~~	~~3.000~~	~~3.000~~	~~3.000~~	~~3.000~~	~~3.000~~	~~3.000~~	~~1.000~~	~~1.000~~	~~1.000~~	~~1.000~~	
Right side											
Carriageway											



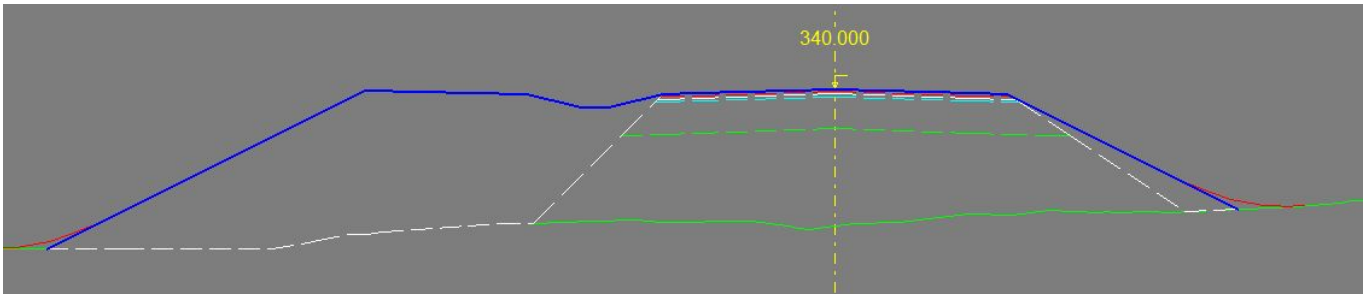
The ending pavement layers will end towards road surface -3.01. This can make some strange results that are handled with a simple Detailed Pavement description.

Example of a simple detailed pavement description:





And we get our final result.



NOTE:

If stopping the pavement was the desired design we would recommend using surface group 4 to design the ditch and walk/bikepath. Surface group 4 will not get pavement, and you wouldn't need to do as many tricks to complete your solution.

With surface group 4 you would only need to apply inner slope and Embankment Ditch function (to force the ditch surfaces to appear above the terrain as the image shows).

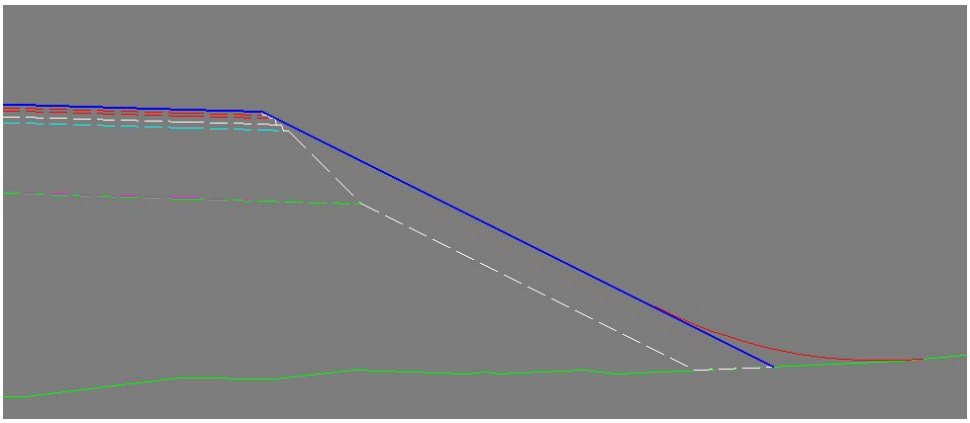
Insert Edge as part of the inner slope design

Sometimes the inner slope is requested to have different gradients for the supporting quality fill, and for the pavement layers, as seen below on our models right hand side.

We do this by applying an Insert Edge to the road shoulder on the right. Make a description with the appropriate slope gradients and/or step widths.

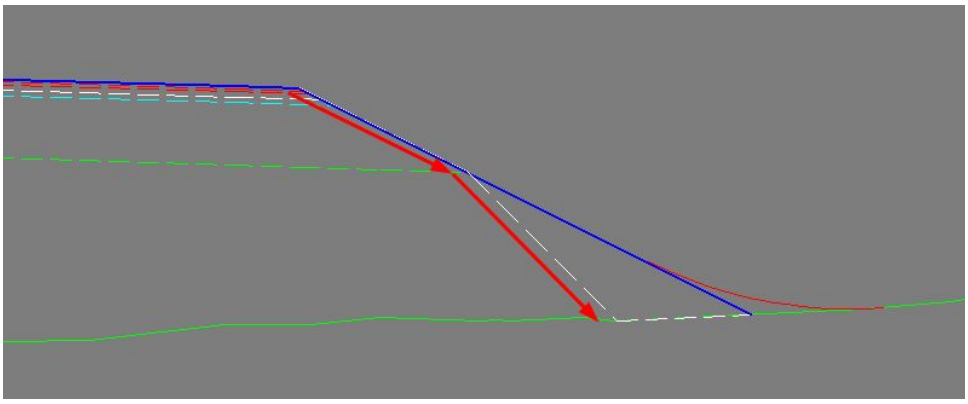
	Surface	Binder 1	Binder 2	Base 1	Base 2	Base 3	Sub-base 1	Sub-base 2	Sub-base 3	Filter	Total
Right side											
Carriageway											
1.01 R. Lane 1	0.040	0.030	0.000	0.060	0.060	0.000	0.700	0.000	0.000	0.001	0.891
Shoulder											
2.01 R. O. shoulder 1	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	Inherit	
Step Width RightW	0.050	0.050	0.050	0.050	0.050	0.050	0.000	0.000	0.000	0.000	
Step Slope RightW	-3.000	-3.000	-3.000	-3.000	-3.000	-3.000	-1.000	-1.000	-1.000	-1.000	

Here we also changed the inner slope gradient to -0,500 to follow the slope of the embankment slope surface 7.11.



Or if you “don’t want” an inner slope for the pavement layers, but only for the supporting fill, you do as follows:

Apply an insert edge with width 0.000 and slope as the embankment slope -0.500. The Insert Edge will “disappear” in the Embankment slope.

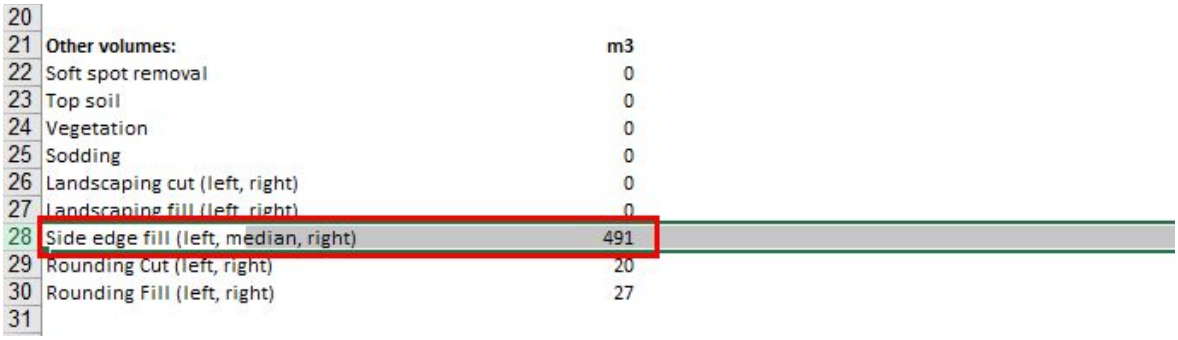


Quantities

Applying inner slope and insert edge can have a massive impact on the quantity calculations and in some projects can become many thousands of cubics of material that doesn't need to be of high grade. The materials can be replaced with local materials (soil/topsoil/vegetation) that is stripped and moved to the side before starting the build, if they are suitable.

Reusing the local materials minimizes unnecessary masshaul and avoid introducing new floral species to the area. A win-win for the project and Mother Earth.

In the Excel quantity report we find the quantities for both 'inner slope' and 'insert edge' in the summary sheet row for 'Side edge fill'.



20		
21	**Other volumes:**	**m3**
22	Soft spot removal	0
23	Top soil	0
24	Vegetation	0
25	Sodding	0
26	Landscaping cut (left, right)	0
27	Landscaping fill (left, right)	0
28	Side edge fill (left, median, right)	491
29	Rounding Cut (left, right)	20
30	Rounding Fill (left, right)	27
31		