

Junction Design with Civil 3D

Created June 2006

by Jack Strongitharm –

Technical Sales Manager
UK and Ireland

jack.strongitharm@autodesk.com



www.autodesk.co.uk/civil3D

Autodesk®

Introduction

Junctions are essential in Road Design and the design is important especially in 3D to ensure that there is sufficient drainage to eliminate ponding.

Also it is important that there is driver comfort and also the ability to shape the surfacing design on site.

Civil 3D can work with very complex junction shapes and the ability to amend the design without any rework.

This document is a workflow on how to work up a junction and also suggests alternatives in the approach. The example is a simple T Junction. However the theory gained from this example can be applied to any junction.

Contents

Junction Strategy	3
Methods in Creating a Civil 3D Corridor	3
Step by Step Guide to Designing a Simple T Junction –.....	8
Using Method 3.....	8
Step 1. Design the intersecting centrelines	8
Step 2. Using AutoCAD Offset command, offset lane widths and create junction radius fillets.....	8
Step 3. Trim and delete unnecessary linework so that you have two alignments defining the junction channel lines and a bellmouth line	8
Step 4. Convert lines into Polylines using PEDIT	9
Step 5. Create alignments from polylines and give appropriate names	9
Step 6. Design the profile on the main centreline	10
Step 7. Create an assembly to make a corridor surface over points 1, 2 and 3	11
Step 8. Create corridor over the area of the junction	11
Step 9. Create a corridor surface.....	12
Step 10. Design the Side Alignment Profile. Aswell as using the Existing Ground Surface, add the Main Temp Surface you have just created and give it a different style	12
Step 11. Create a corridor and surface as in Steps 9 and 10 on the Side Road Alignment to give points 4 and 5.	14
Step 12. Design the vertical profiles on the Junction Alignments	16
Step 13. For the Bellmouth Alignment you can simply create the profile from the Temporary Main Road surface. There is no need to create a Profile using Geometry, as this defines the slope definition given in the Assembly, i.e. -2.5% (1:40).....	17
Step 14. Create the Junction Assemblies.....	18
Step 15. Create the Junction Corridor.....	21
Step 16. Add remaining Corridors using the Typical Section Assembly ...	27
Step 17. For Presentation, in the Layout tab within a viewport. Hide the Markers and Links Layer to give a clean linework drawing.....	28
Step 18. Check the Surface. Add a Top Surface to the Junction Corridor and give a style to check Slope arrows etc.....	29

Junction Strategy

For the 2D layout, using AutoCAD functionality works fine as you can generate the alignments from these lines.

Alignment Requirements

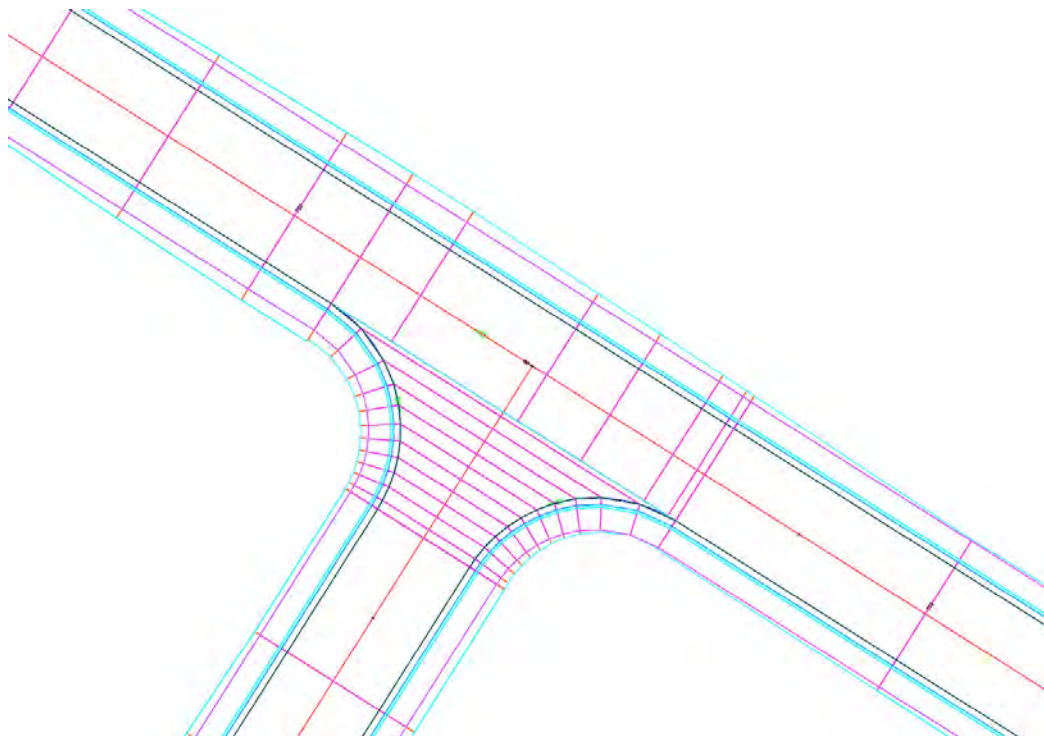
Intersecting Main Centreline Alignments

Alignments to define the channel kerb returns

Alignment for the bellmouth channel line (Optional)

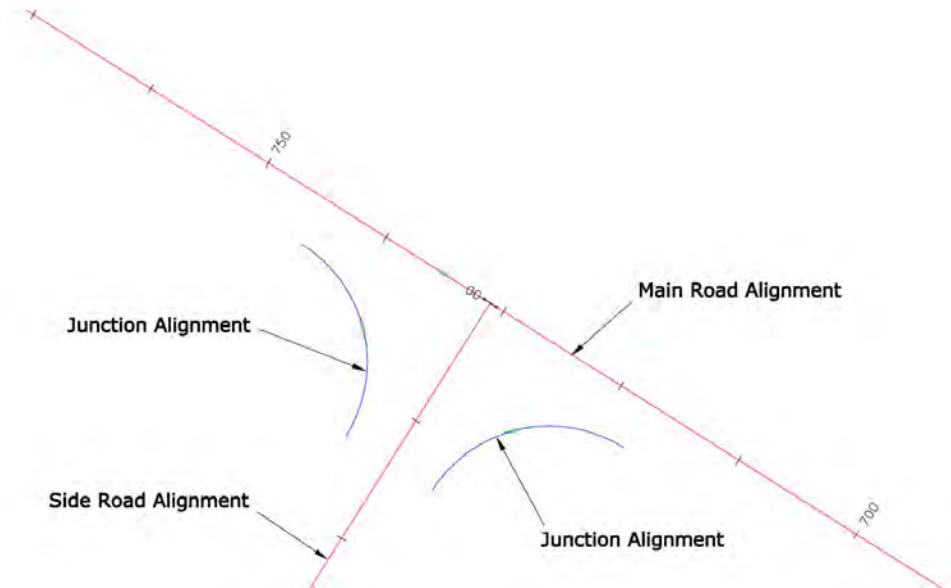
Methods in Creating a Civil 3D Corridor

1. Widen Carriageway from Side Road Centreline out to Junction curves



Requirements

- Two main centrelines
- Two alignments for the junction shape
- Two assemblies



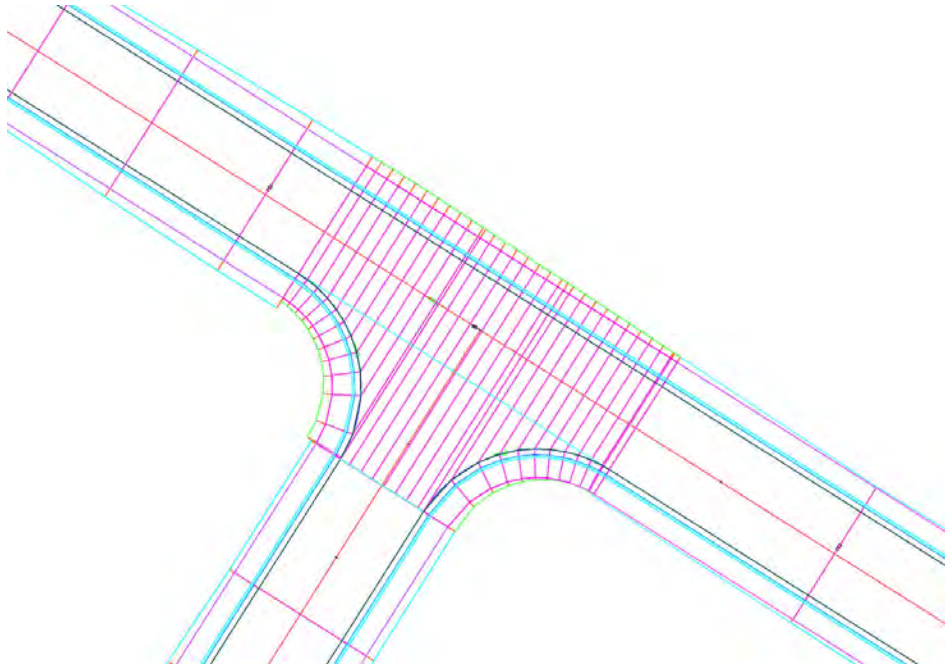
Advantages

- Relatively simple to design with only two assemblies required

Disadvantages

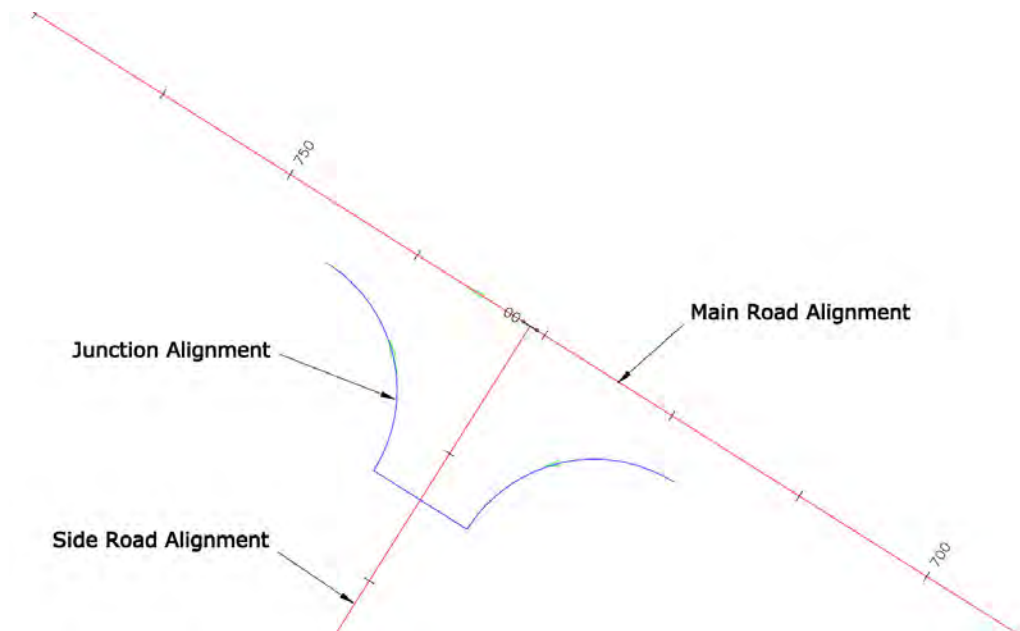
- Only works in cases that are perpendicular to the main alignments
- Requires Assembly Offsets to create true perpendicular offsets from the junction alignments

2. Widen Carriageway from Main Road into Junction Curves



Requirements

- Two main centrelines
- One alignment for the junction shape
- Two assemblies



This method is based on the theory on creating a widening such as lay-bys and turning lanes and therefore is not the most suited approach

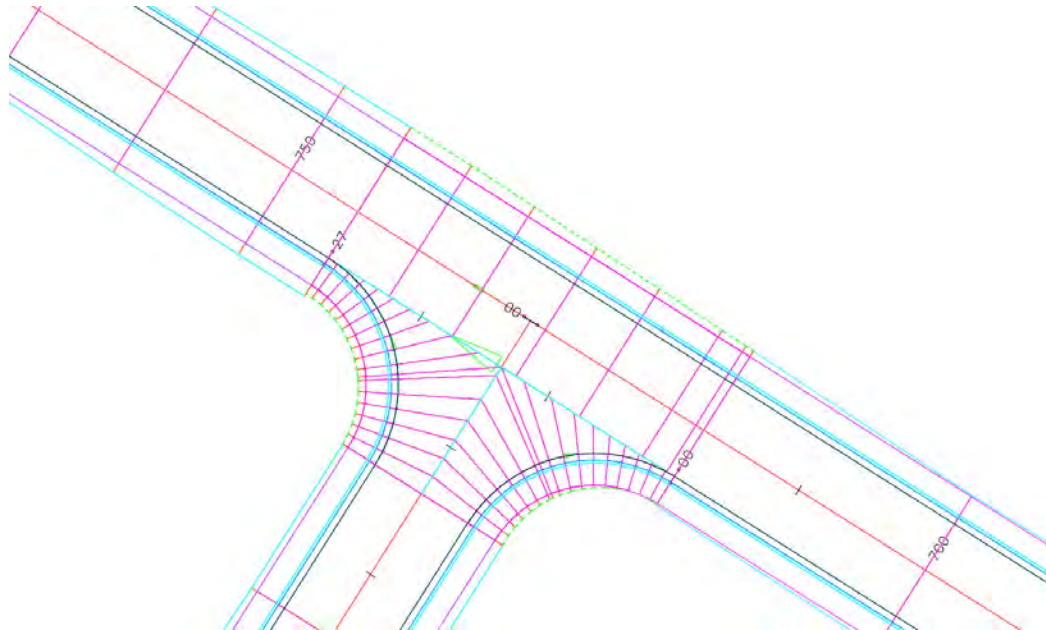
Advantages

- None

Disadvantages

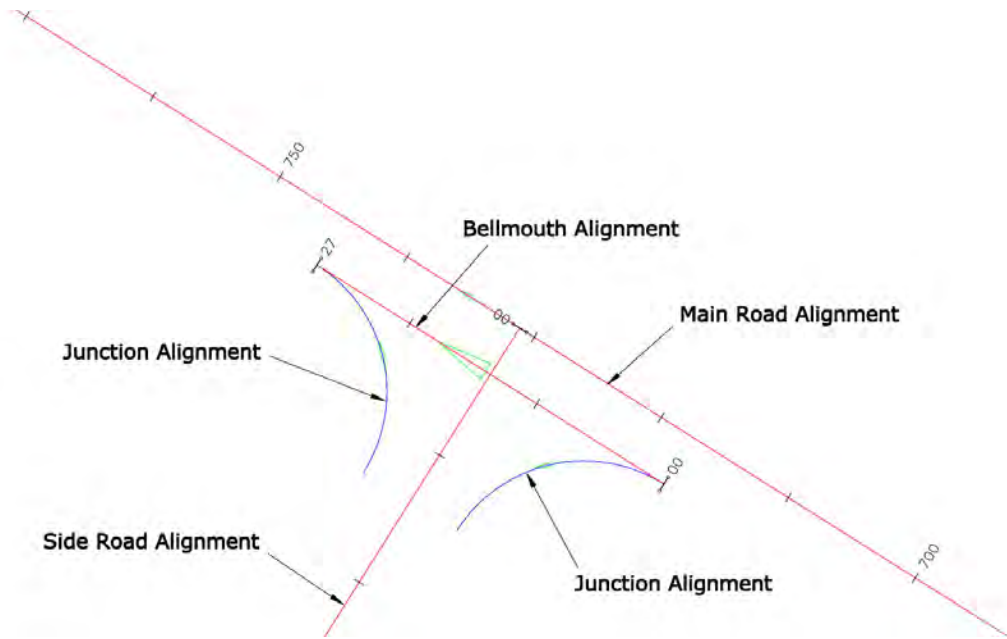
- Complex to model
- Does not give a true surface to how you would require on site
- Also difficult to deal with skewed angles
- Requires Assembly Offsets to create true perpendicular offsets from the junction alignments

3. Create the junction from the junction channel lines



Requirements

- Two main centrelines
- Two alignments for the junction shape
- One Alignment for the bellmouth of the junction
- Three assemblies



Advantages

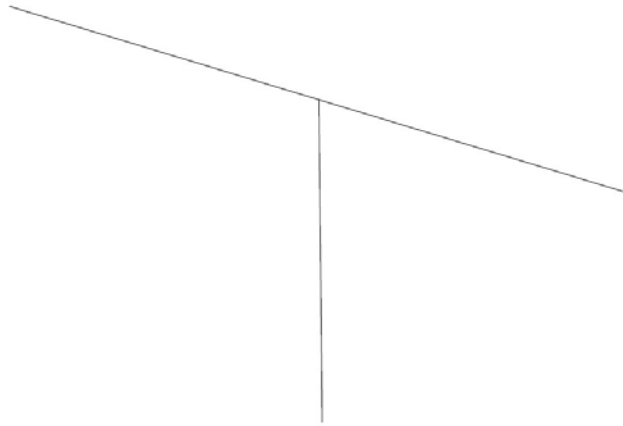
- Logical method
- Would be constructed in this way
- Can cope with any shape of junction

Disadvantages

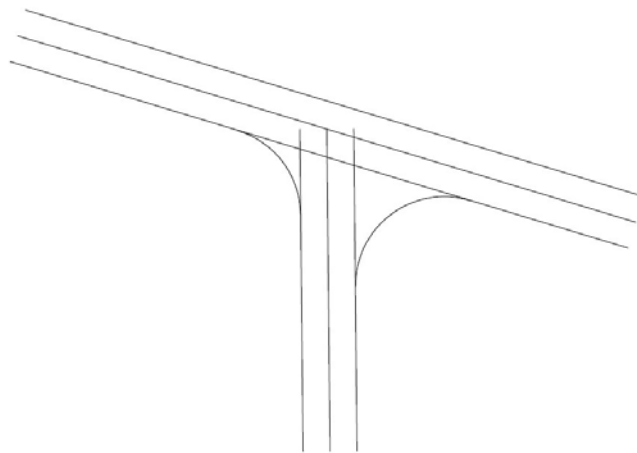
- Most number of alignments

Step by Step Guide to Designing a Simple T Junction – Using Method 3

Step 1. Design the intersecting centrelines

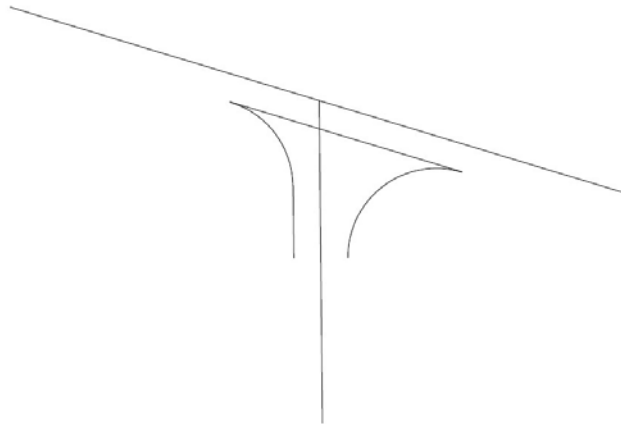


Step 2. Using AutoCAD Offset command, offset lane widths and create junction radius fillets



Step 3. Trim and delete unnecessary linework so that you have two alignments defining the junction channel lines and a bellmouth line

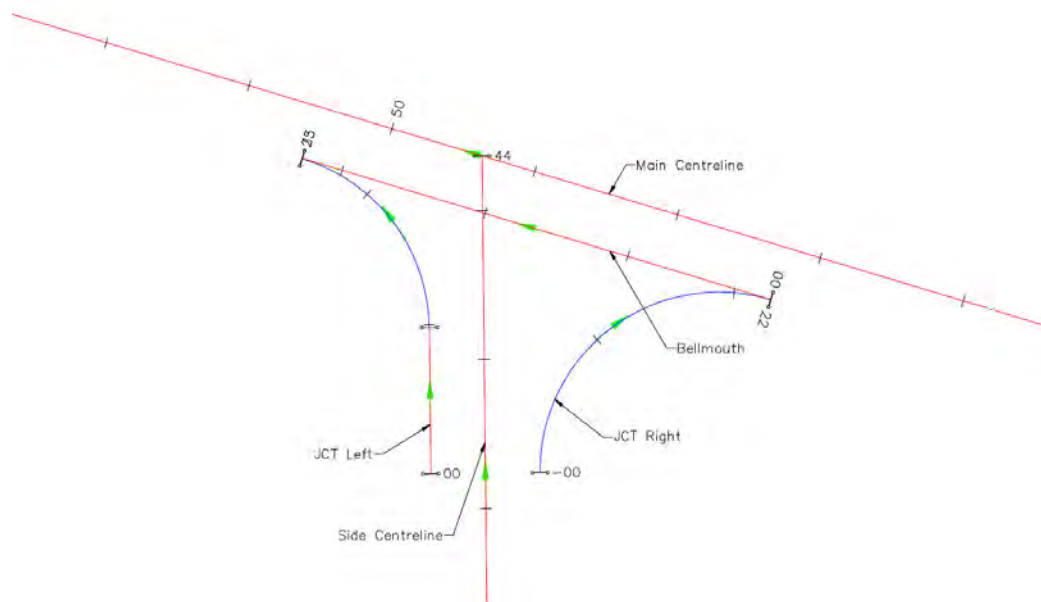
Autodesk®



Note that the junction channel line on the left has a straight as well as the radius. Corridors are based on sections perpendicular from the alignment it is based on.

Step 4. Convert lines into Polylines using PEDIT

Step 5. Create alignments from polylines and give appropriate names



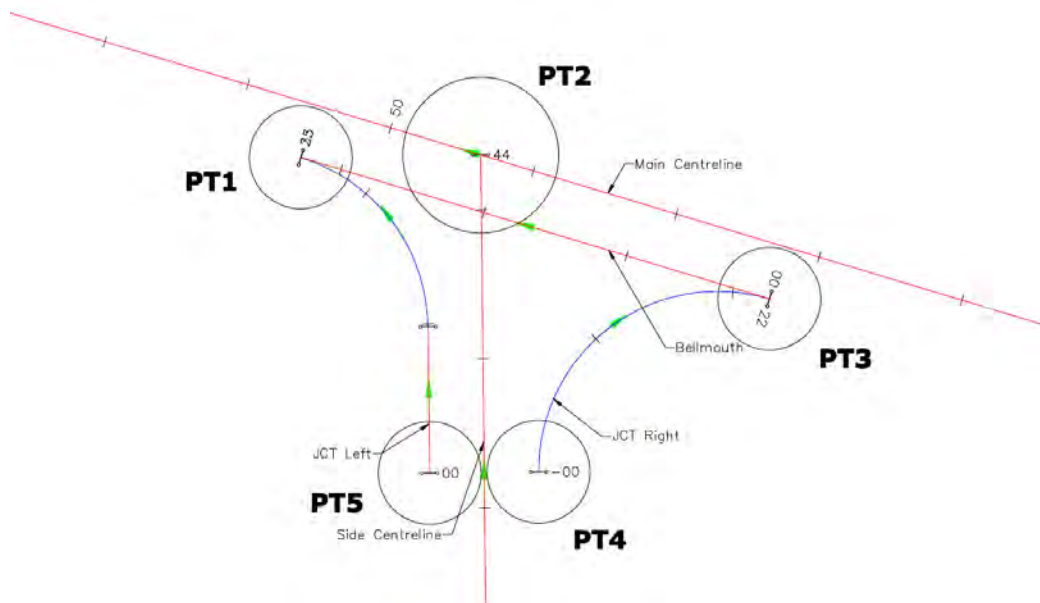
Note.

What is now required is the vertical profile design on these alignments.

There are a number of methods to design them.

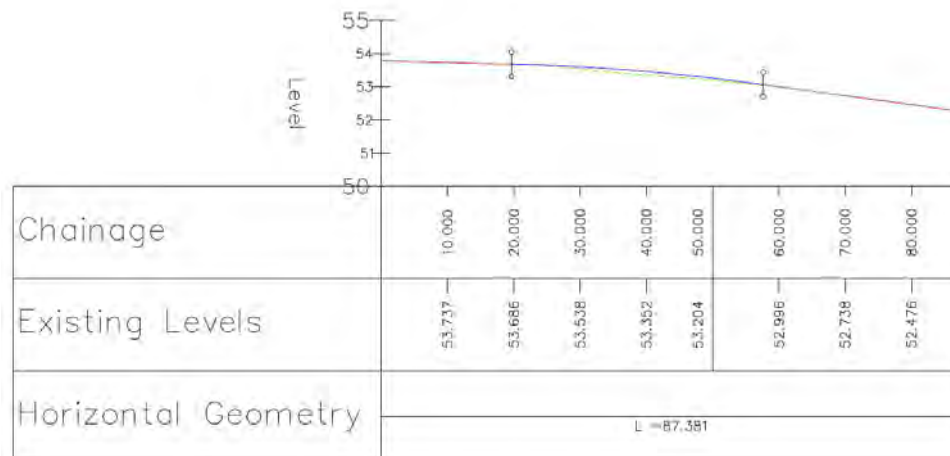
This workflow will use a graphical method in conjunction with the use of temporary surfaces from a corridor to define level information.

Levels are required on the areas circled below to ensure that all alignments tie into one another.



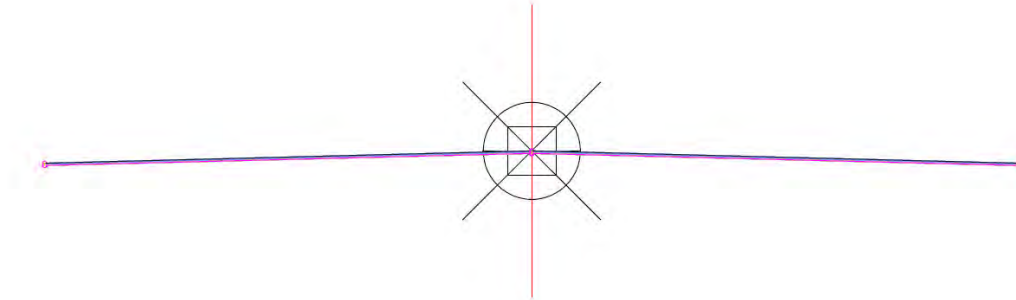
Step 6. Design the profile on the main centreline

MAIN CENTRELINE
SCALE: H 1:250,V 1:50. DATUM: 50.000



Autodesk®

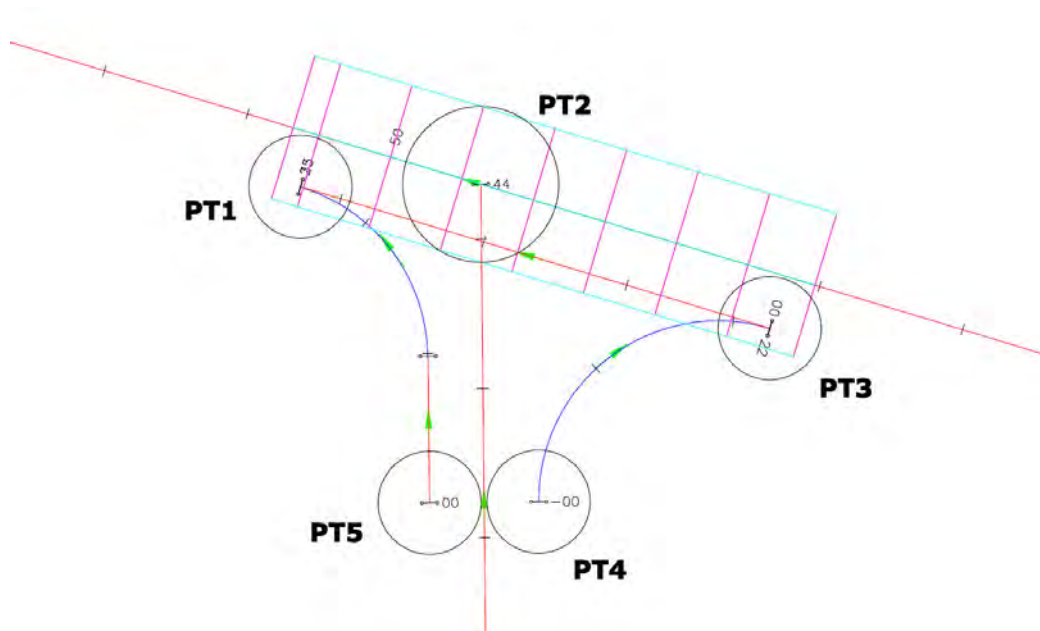
Step 7. Create an assembly to make a corridor surface over points 1, 2 and 3



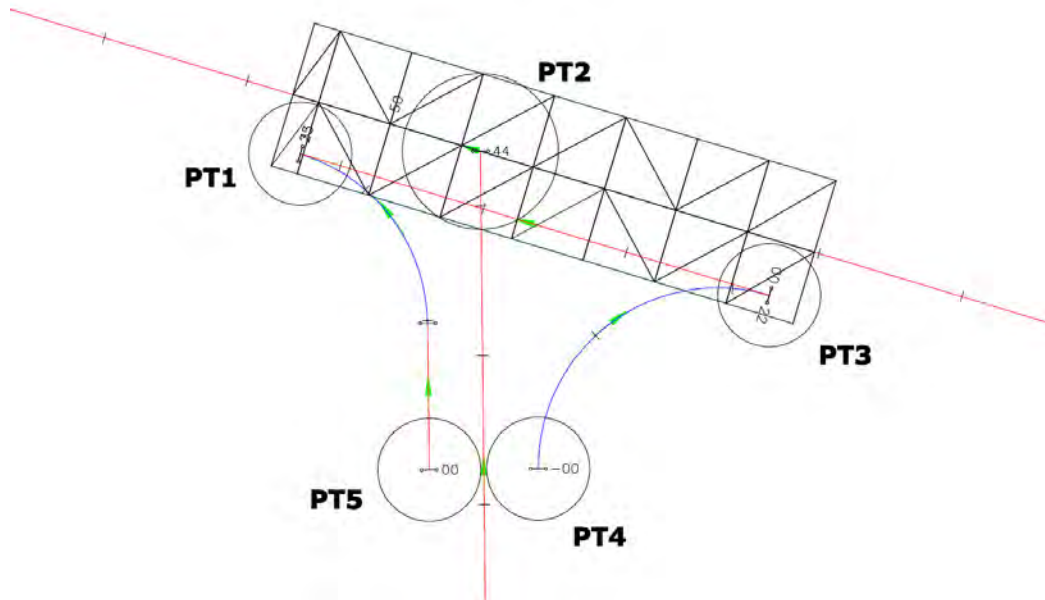
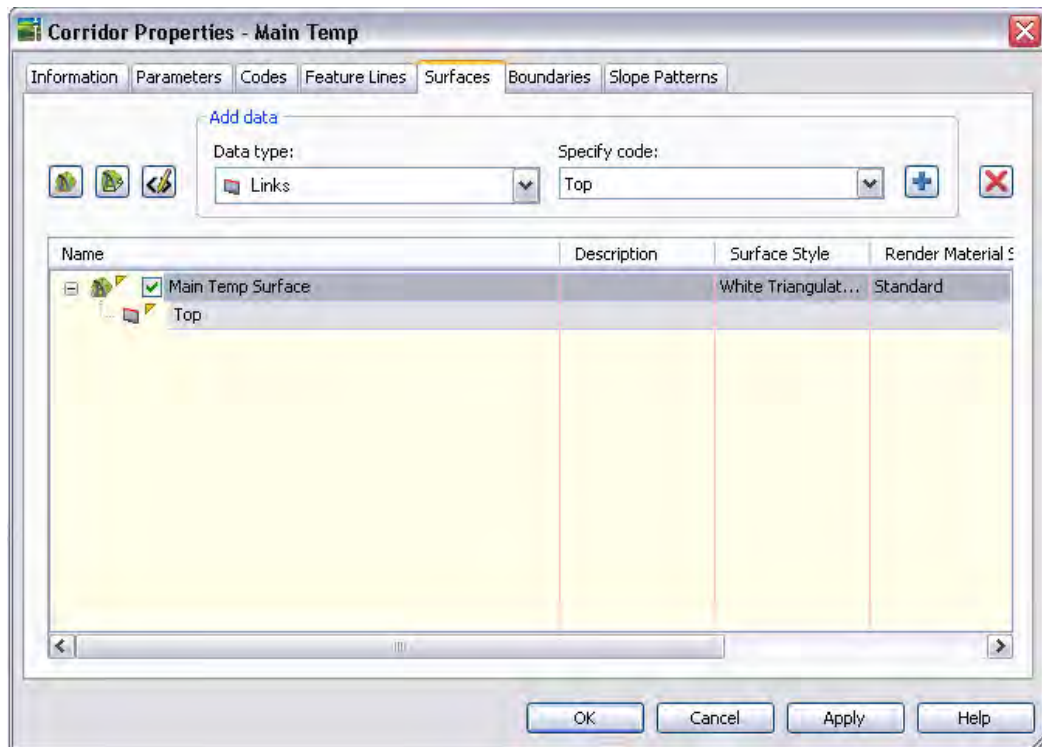
Parameters	
Lane Slope	-2.500%
Version	R2007
Side	Left
Crown Point on ...	No
Width	5.000m
Default Slope	-2.500%
Pave1 Depth	0.025m
Pave2 Depth	0.000m
Base Depth	0.000m
Subbase Depth	0.000m

Using the Lane Outside Super subassembly (as this will apply Superelevation if used)
Give a width wider than the normal lane width.
Also by giving depths of 0 will omit sub layers as they are not required.

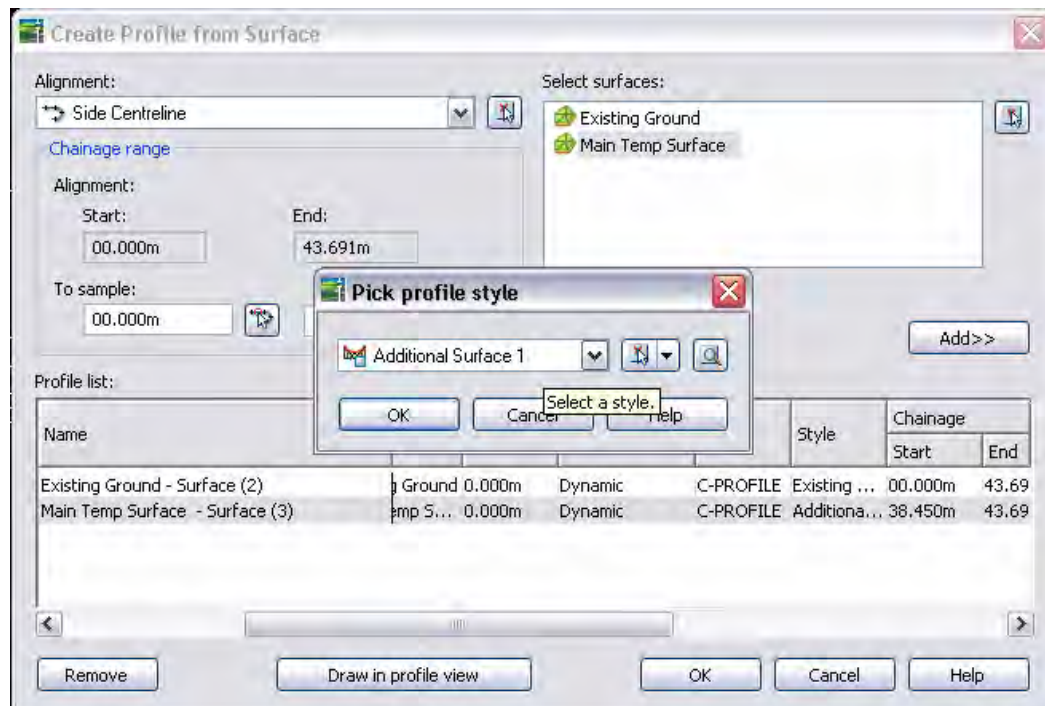
Step 8. Create corridor over the area of the junction



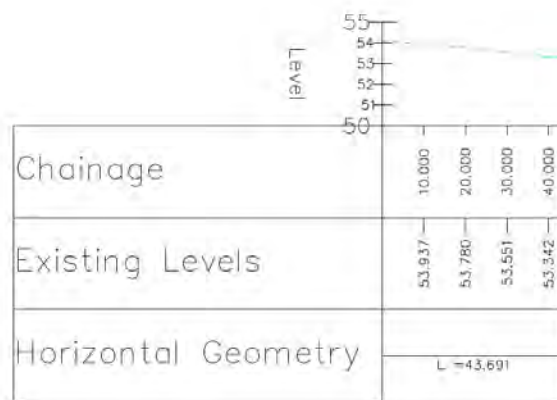
Step 9. Create a corridor surface



Step 10. Design the Side Alignment Profile. Aswell as using the Existing Ground Surface, add the Main Temp Surface you have just created and give it a different style

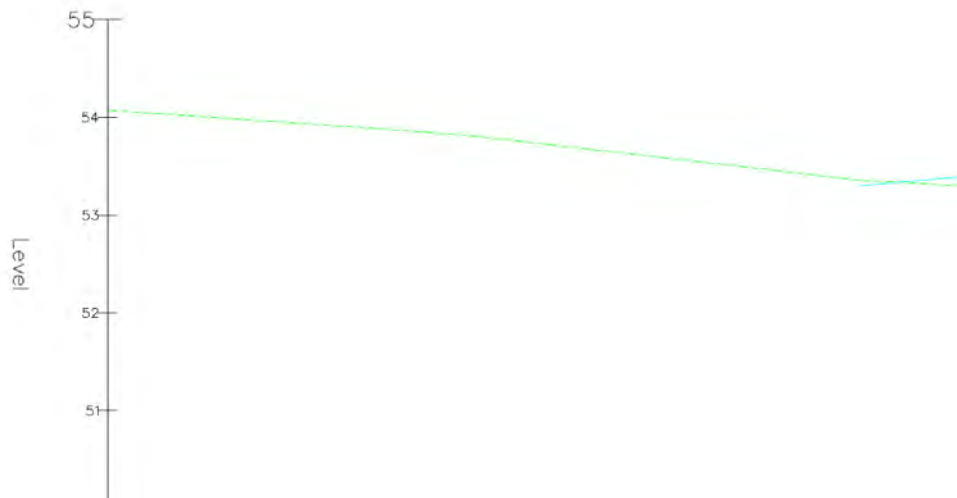


SIDE CENTRELINE
SCALE: H 1:250,V 1:50, DATUM: 50.000

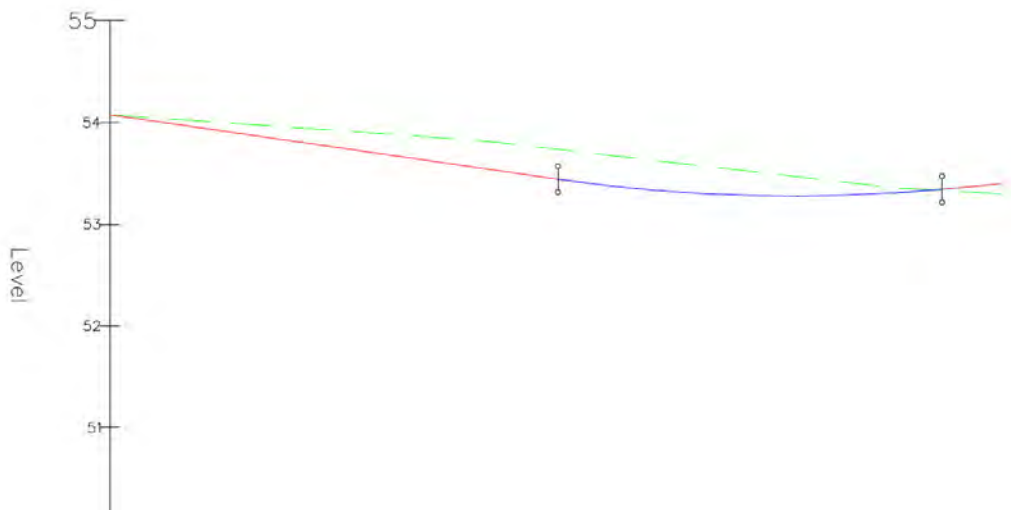


Now you can see the Main Road Lane in Cyan in Profile so that you can now tie in the Side Road Profile.

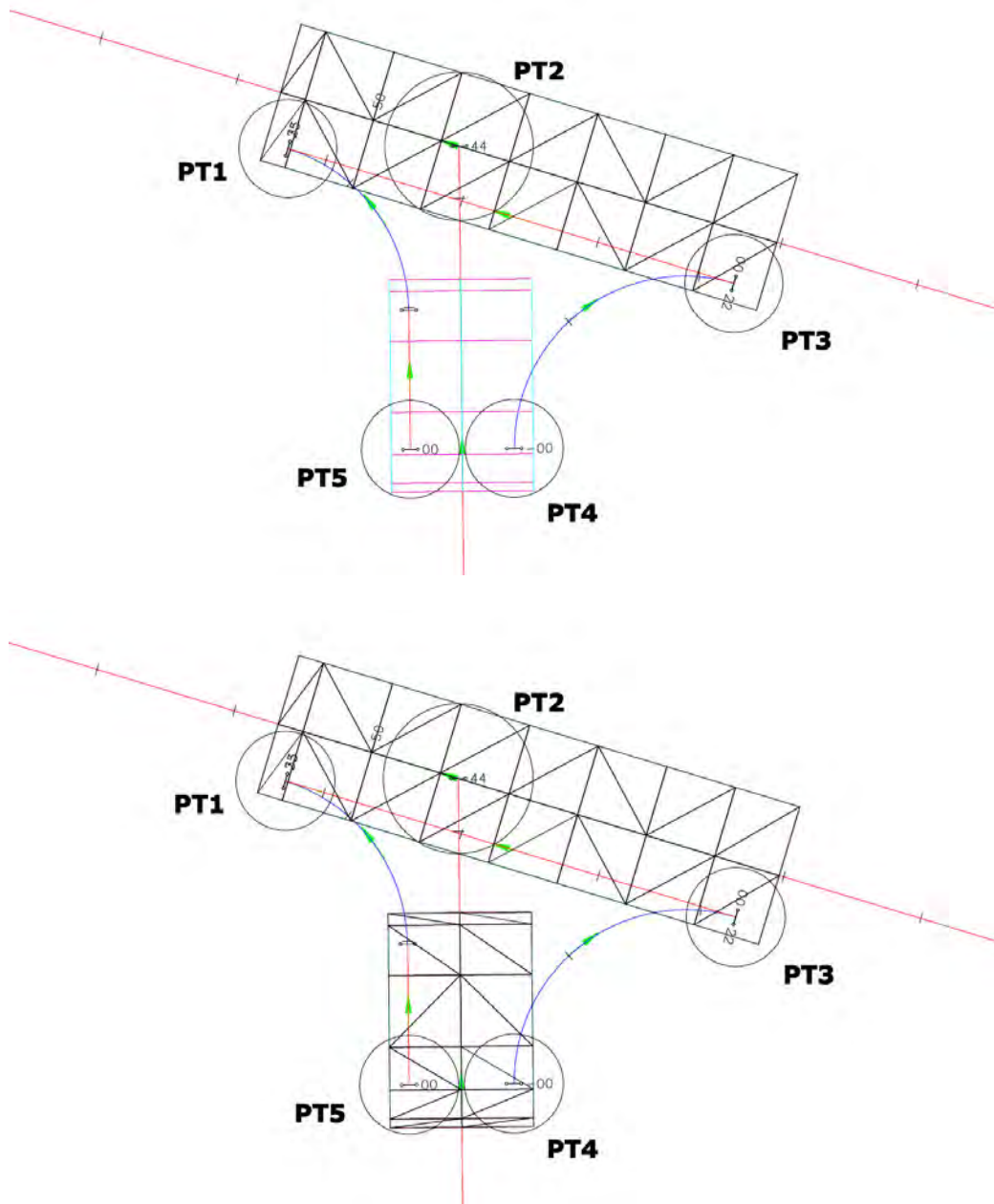
Autodesk®



Using the a Fixed Straight Element draw a straight directly over the Cyan line. Then design accordingly to remaining Vertical Profile design.



Step 11. Create a corridor and surface as in Steps 9 and 10 on the Side Road Alignment to give points 4 and 5.



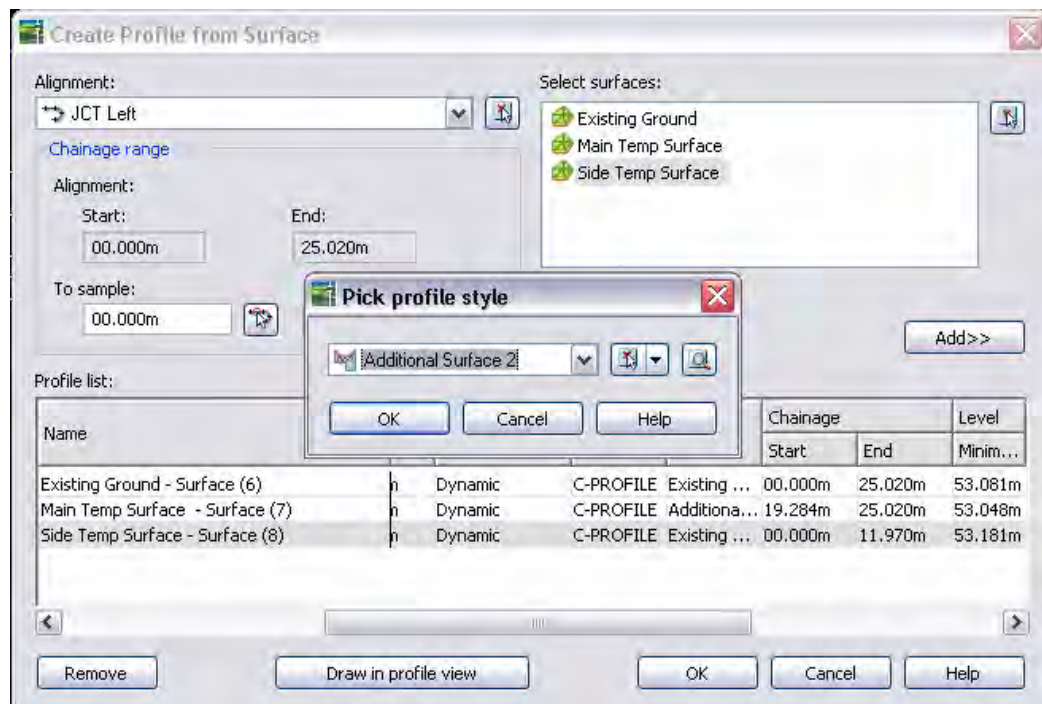
Note. This corridor is long enough to cover the left hand side from the straight and into the horizontal curve of the junction.

You now have surface level information to design the two junction alignments and the Bellmouth alignment.

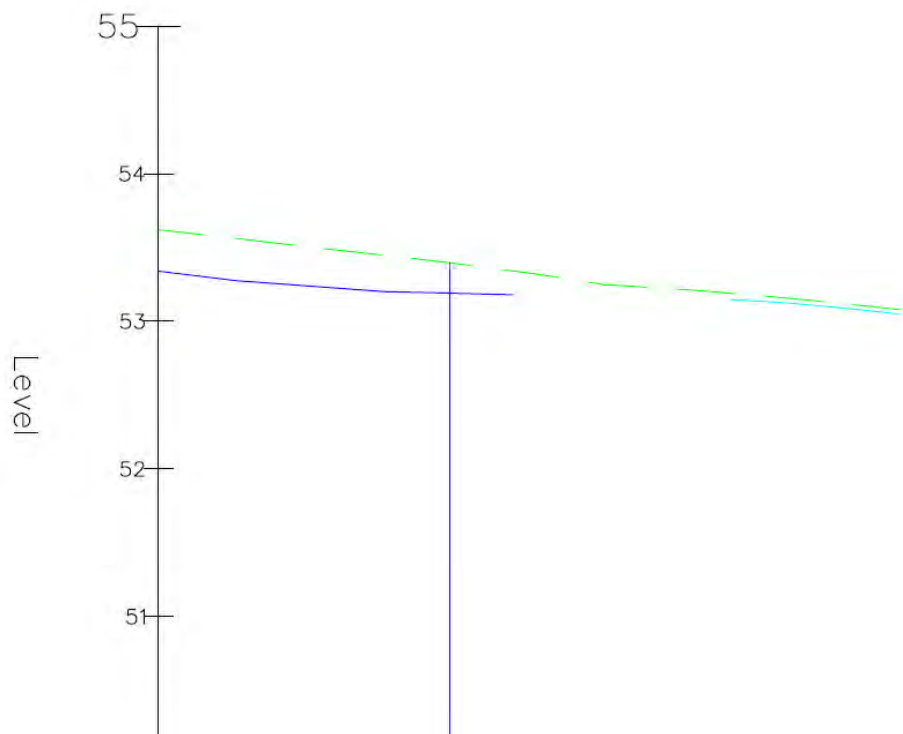
For manipulation later these two temporary corridors can be kept. To hide them, create a Layer, add the corridors and freeze the Layer.

Also have the Automatic Rebuild Option, set to on. These are small Corridors and build in a matter of a couple of seconds.

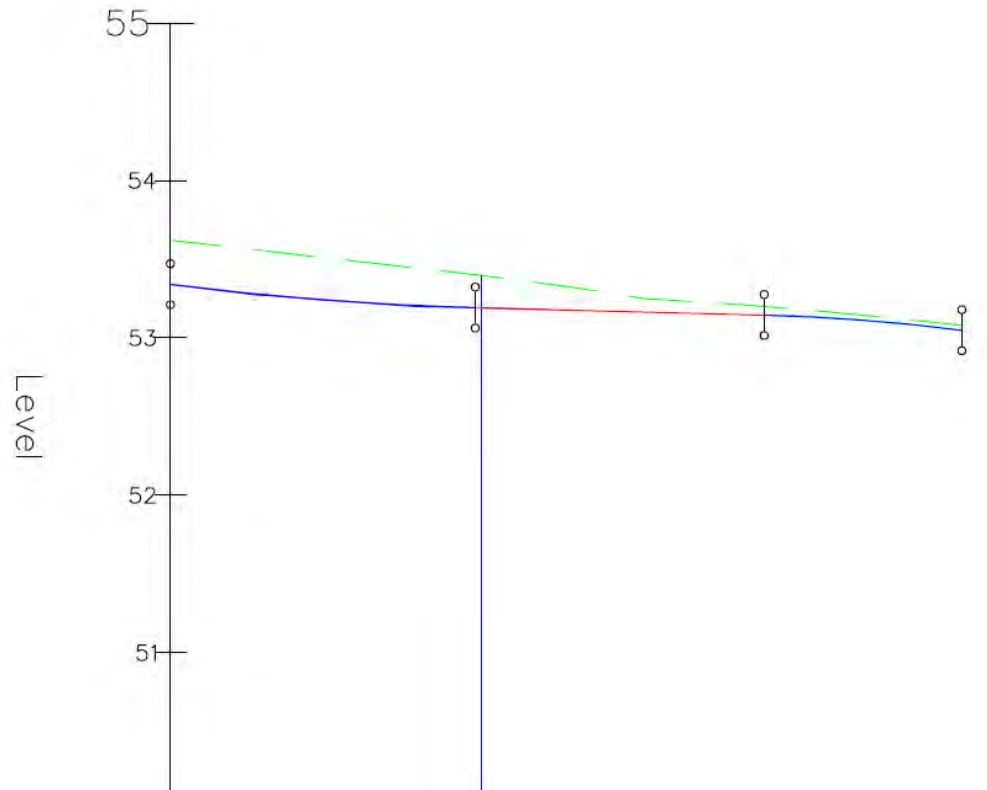
Step 12. Design the vertical profiles on the Junction Alignments



Include the two temporary surfaces aswell as the Existing Ground



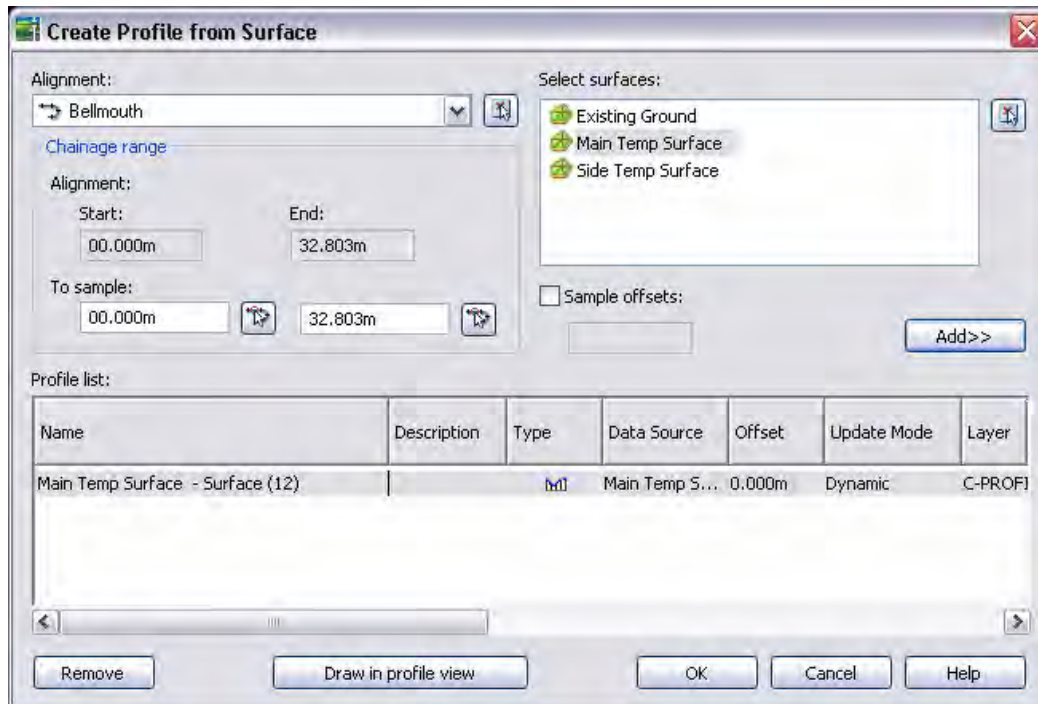
Autodesk®



Depending on how you want to design the channels you can follow the grades in or create straight grades around the junction radius.

Repeat for the second Junction Alignment

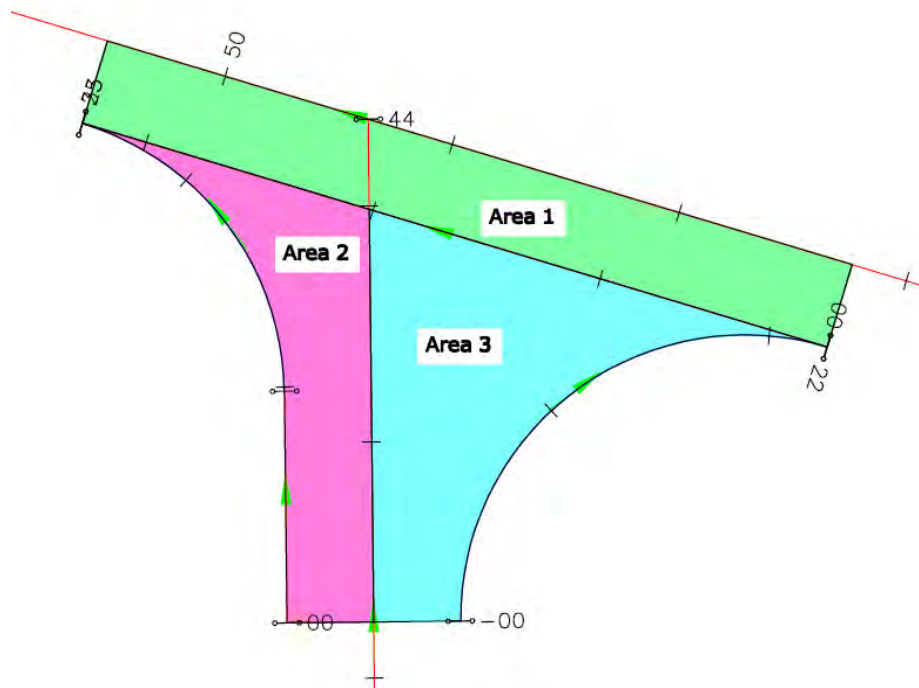
- Step 13.** For the Bellmouth Alignment you can simply create the profile from the Temporary Main Road surface. There is no need to create a Profile using Geometry, as this defines the slope definition given in the Assembly, i.e. - 2.5% (1:40).



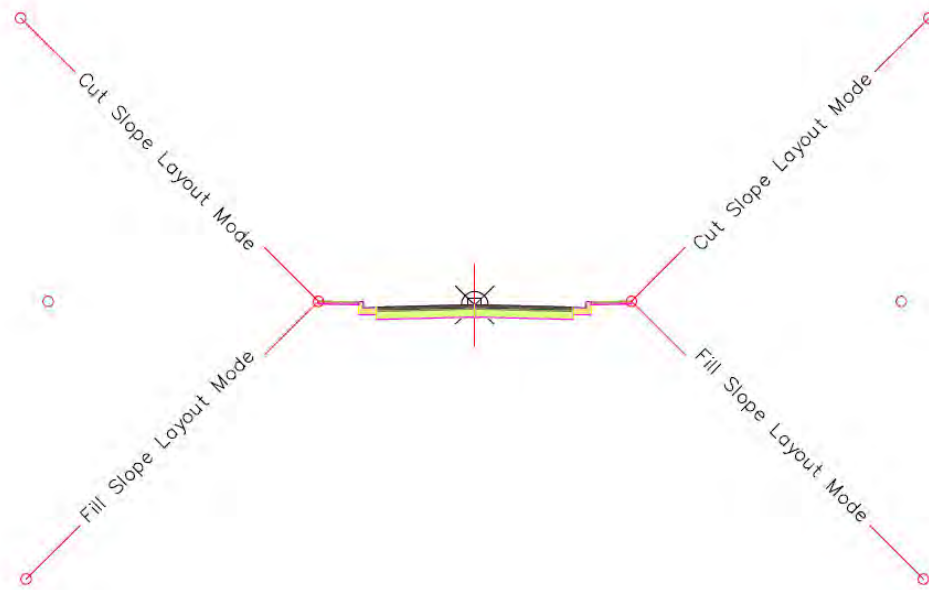
Also there is no need to Draw the profile, simply click OK.

Step 14. Create the Junction Assemblies

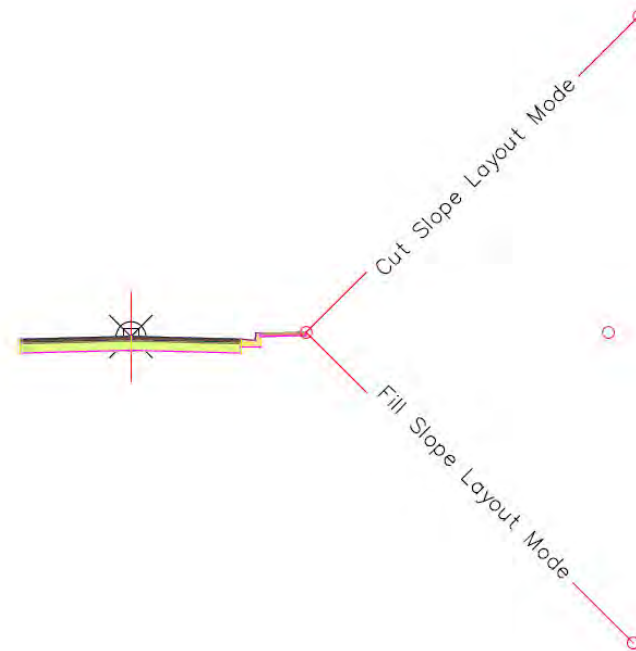
The Junction Corridor will be created in three parts



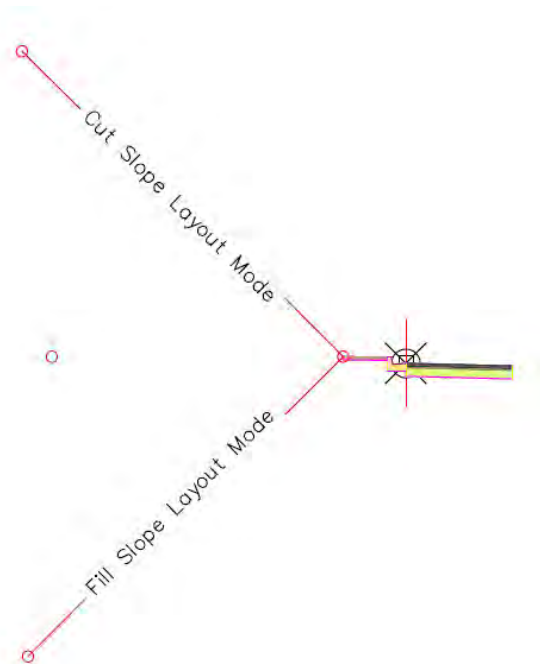
Autodesk®



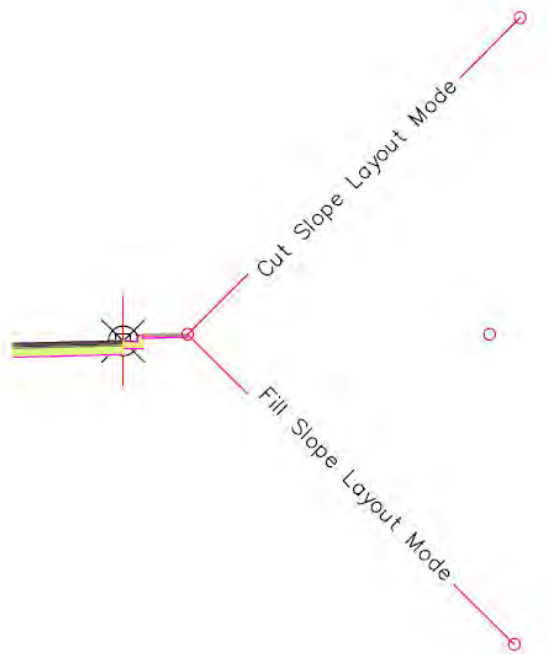
Typical Section, to be used for the corridors joining the junction



Section without kerbs etc on the left



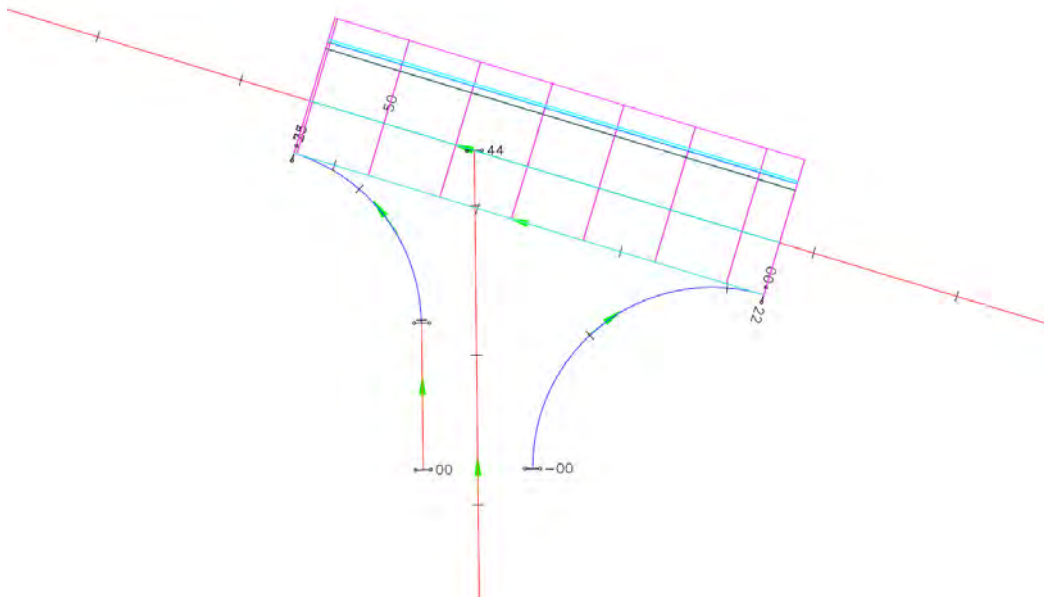
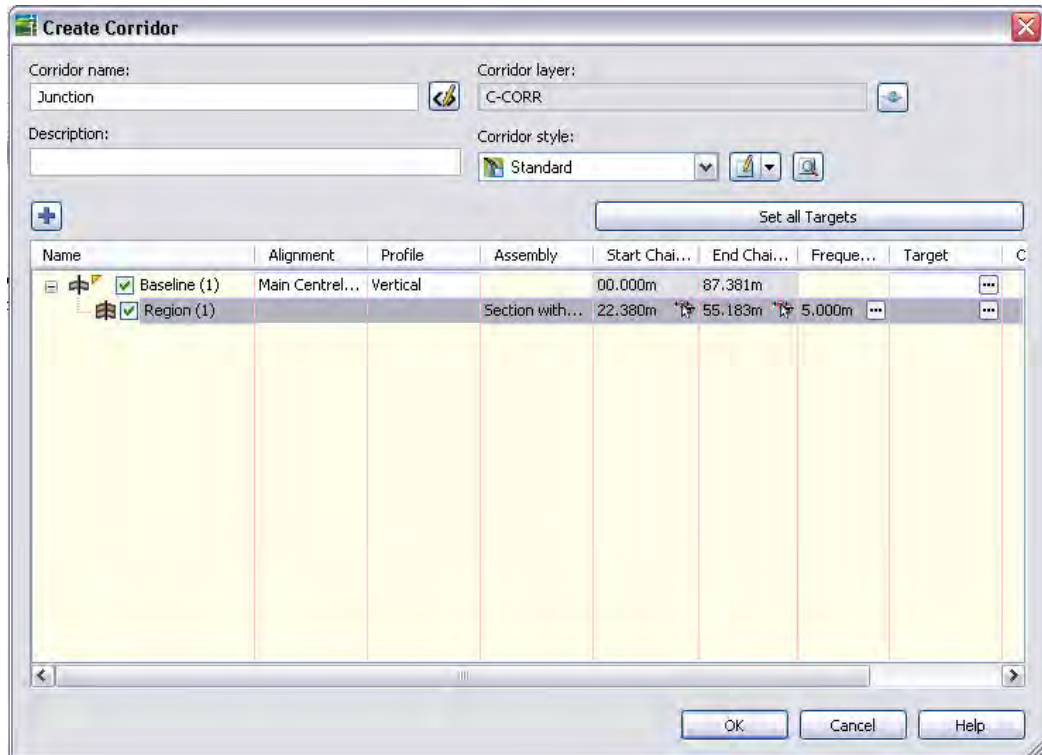
Jct Lane to the Right



Jct Lane to the Left

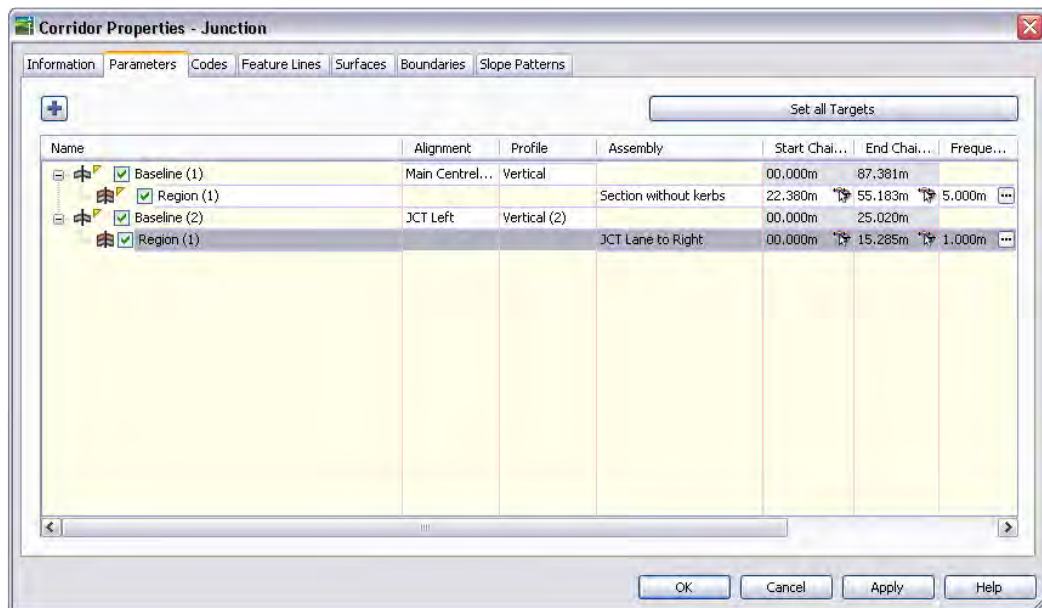
Step 15. Create the Junction Corridor

Area 1 - (Baseline 1)

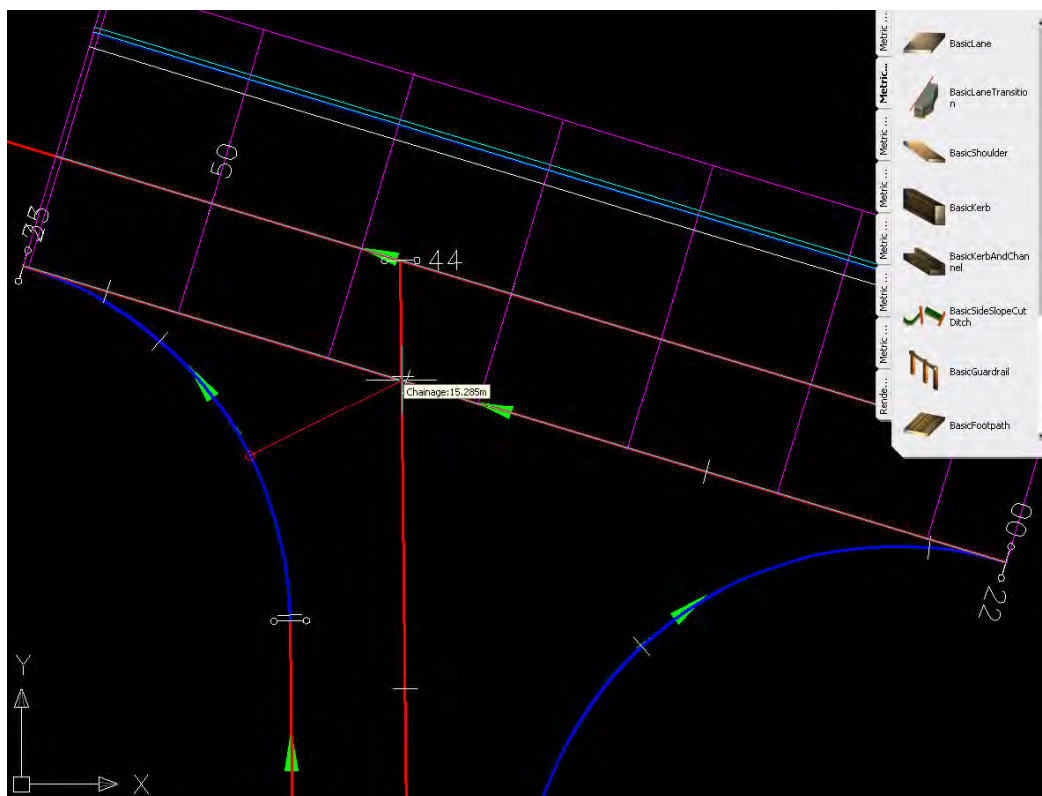


Area 2 - (Baseline 2)

Defined from the Left Junction Alignment, add as a new Baseline to the Corridor properties

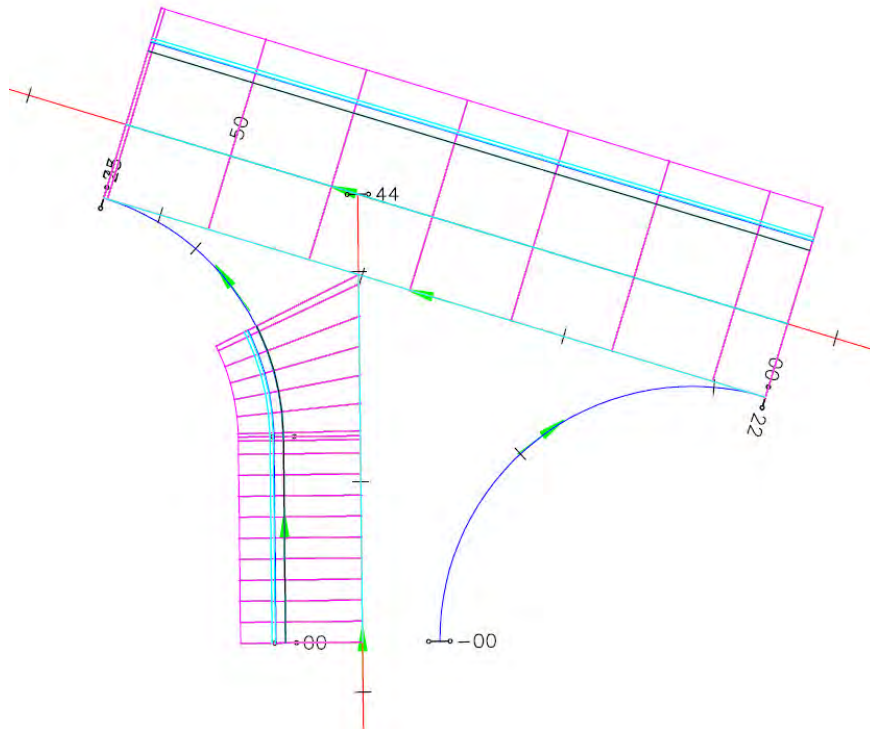
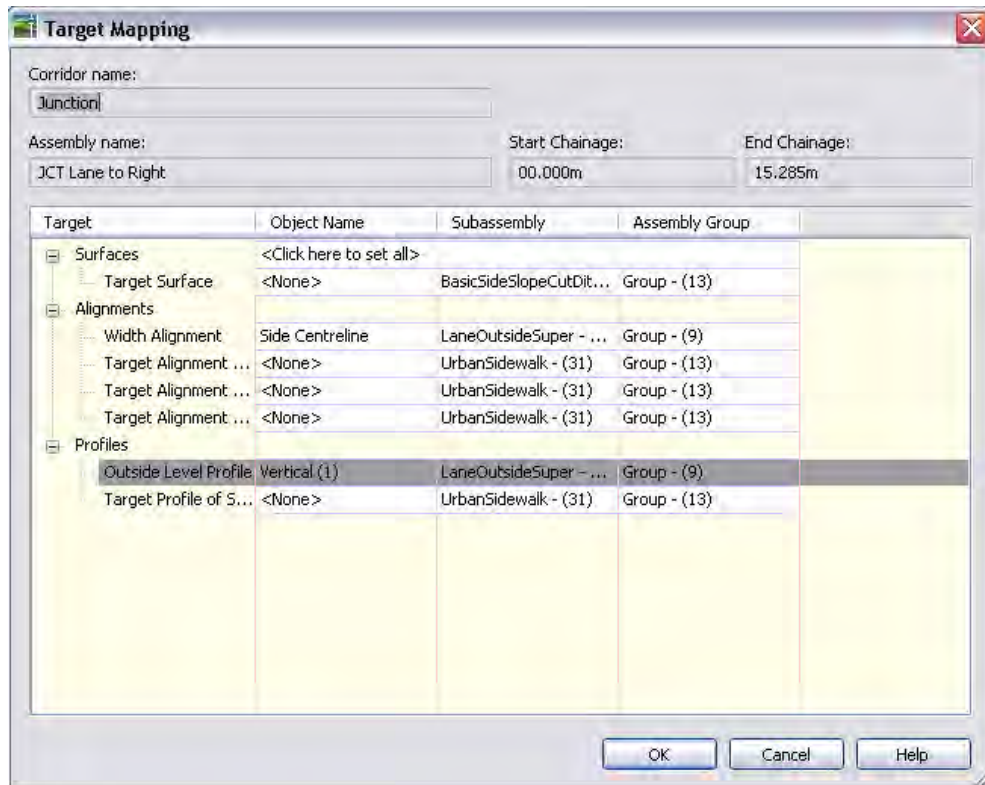


Region 1 will end at the intersection of the Side Road Alignment and the Bellmouth Alignment

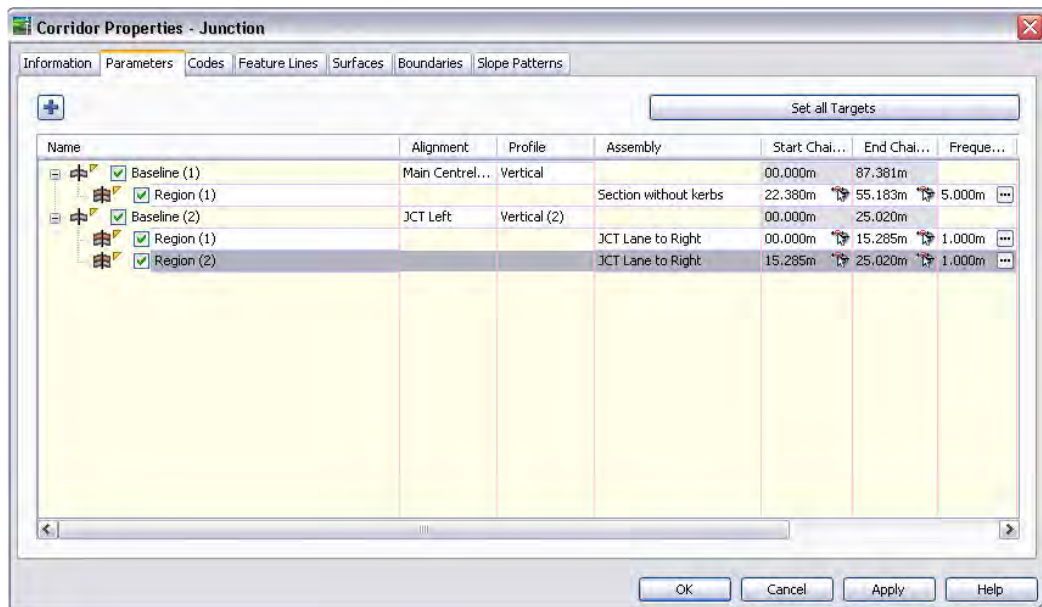
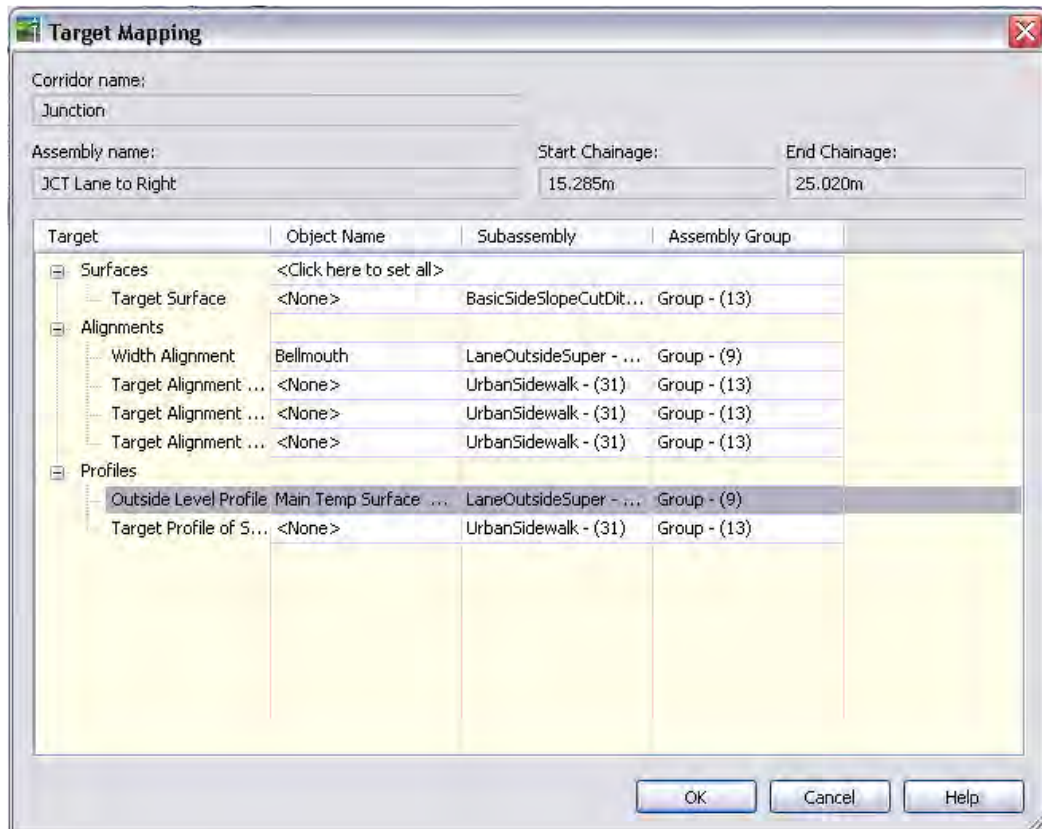


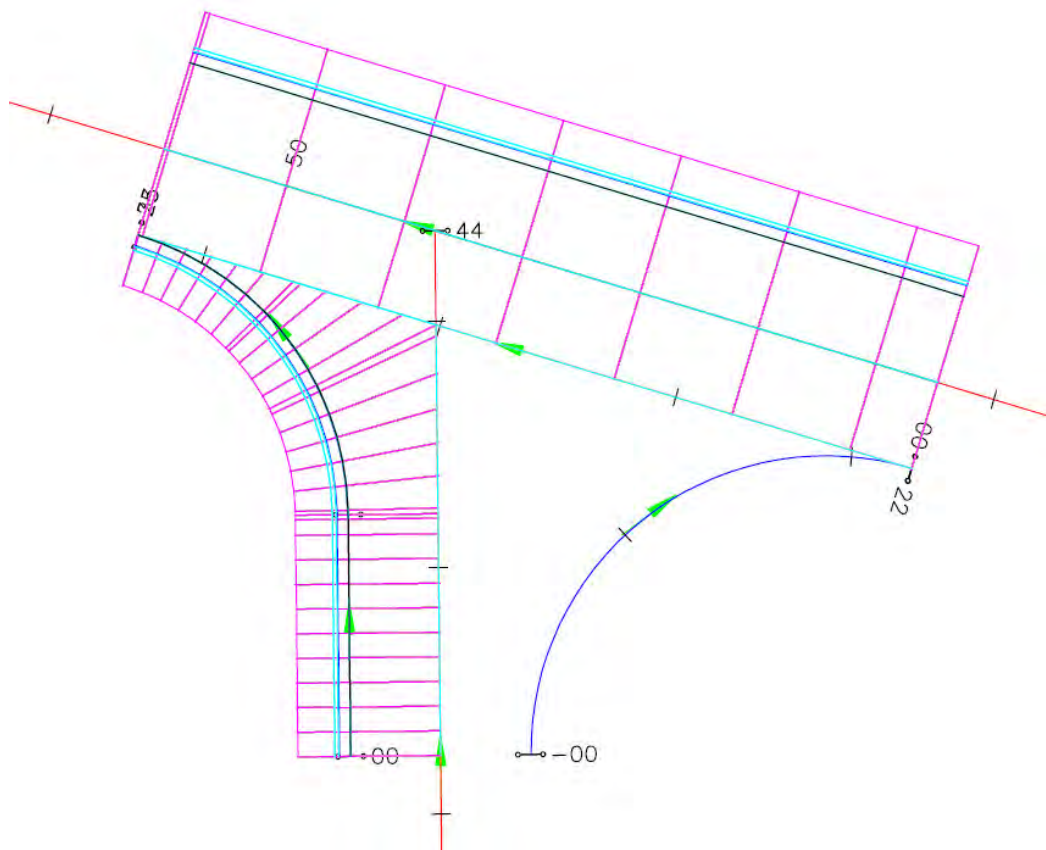
Autodesk

Under Region 1 Targets, set the Width Alignment to the Side Centreline and Profile to its Vertical Design



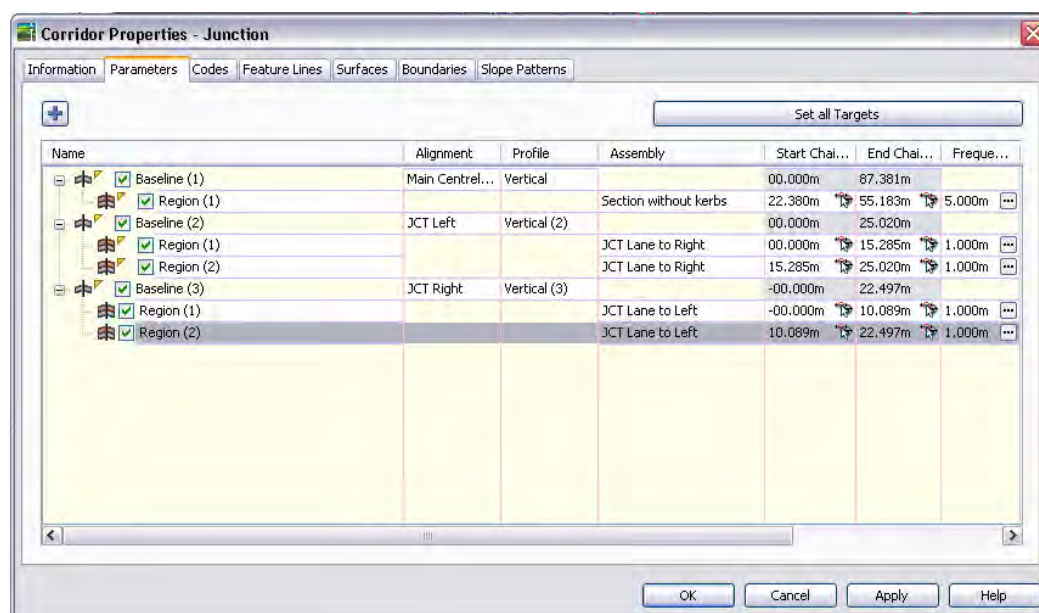
Add Region 2, which will now run until the end of the curve and for its lane width we target the Bellmouth Alignment



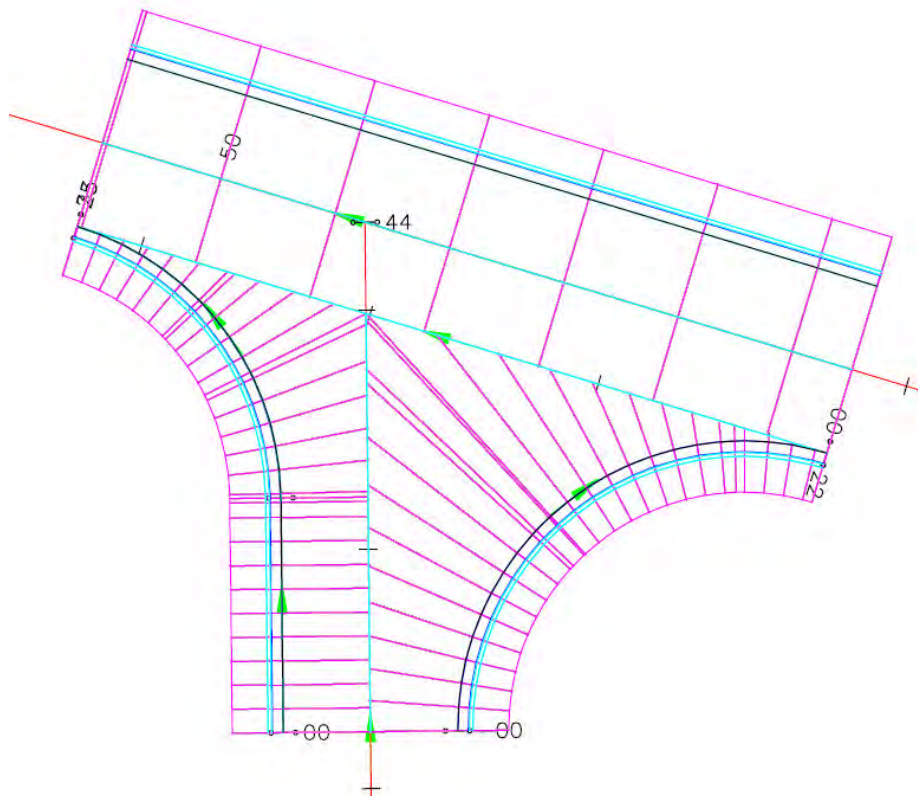


Area 3 – (Baseline 3)

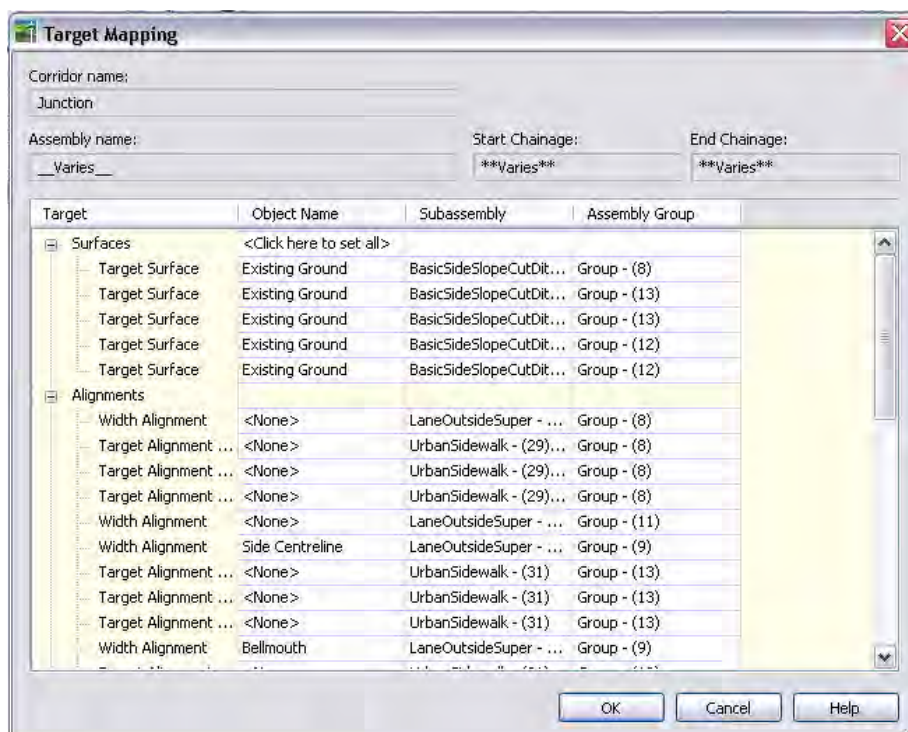
Finally add a third baseline, which is a repeat of the last area but using the Right Junction Alignment



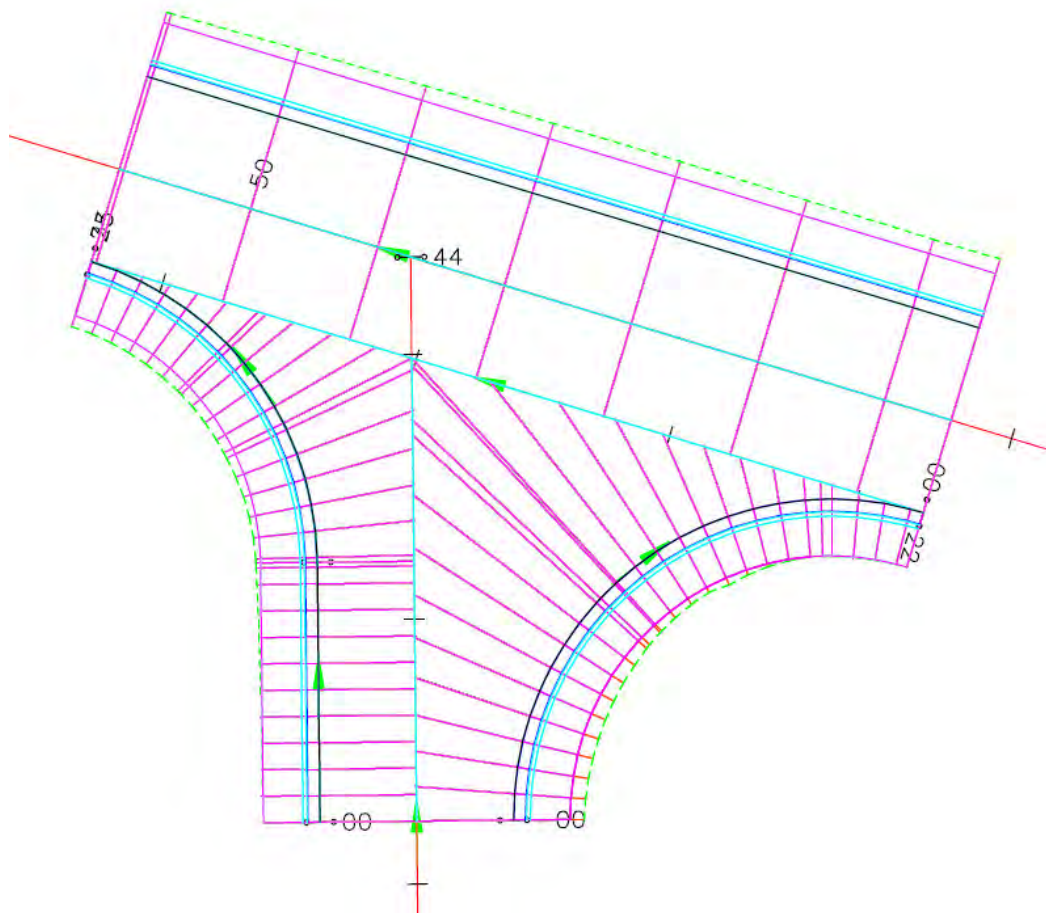
Autodesk



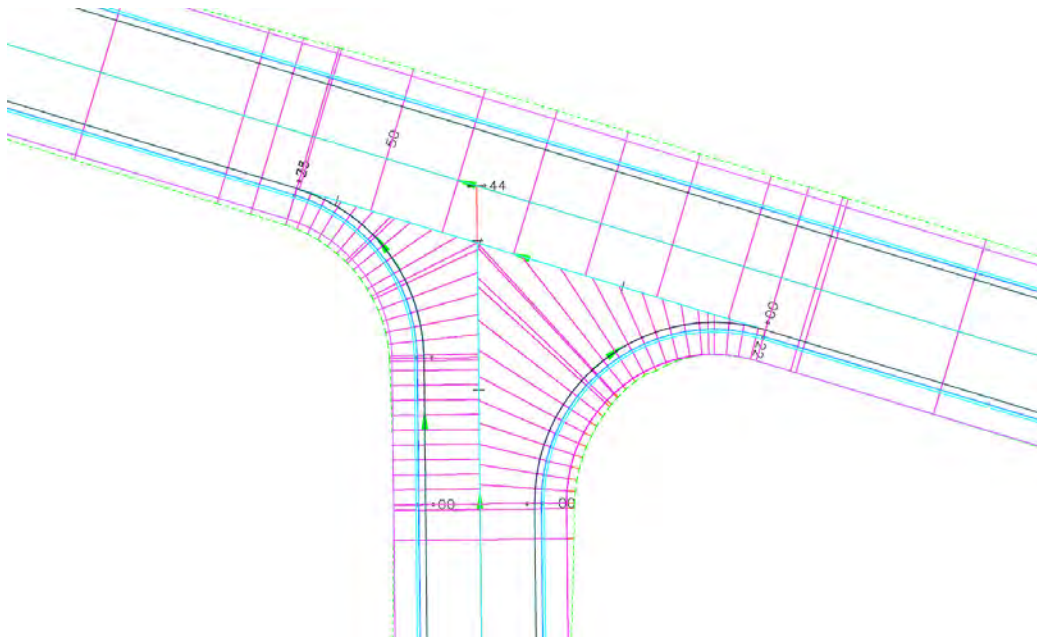
To complete the Junction, under 'set all targets' give the Existing Ground Surface to target the Side Earthwork Slopes



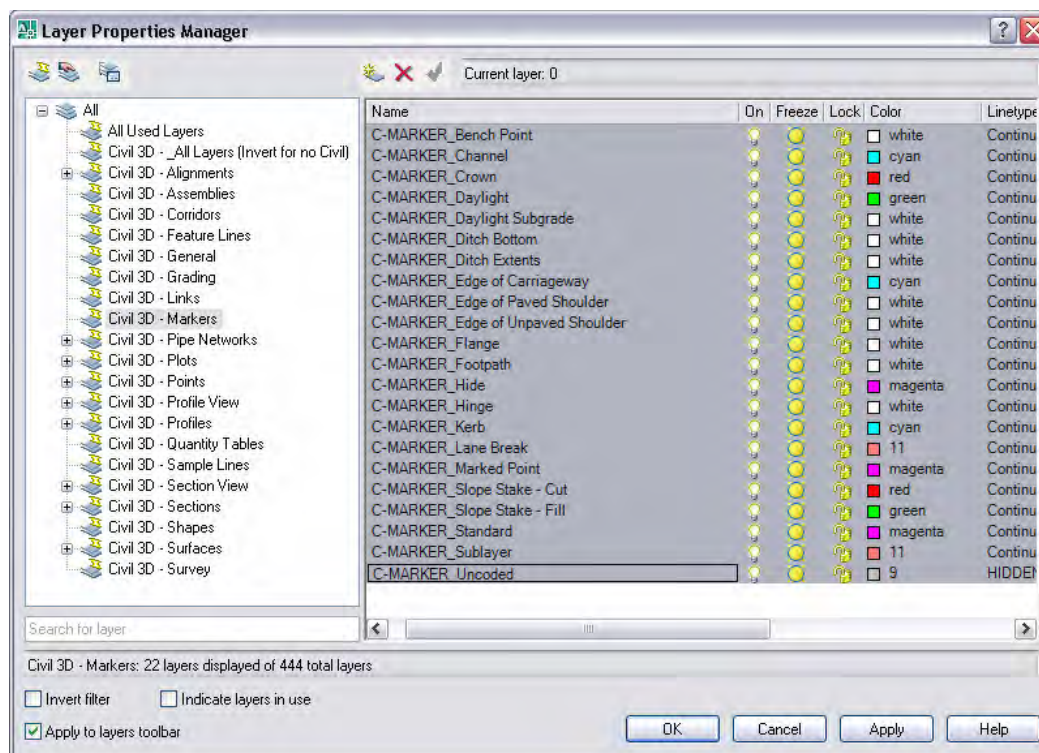
Autodesk®



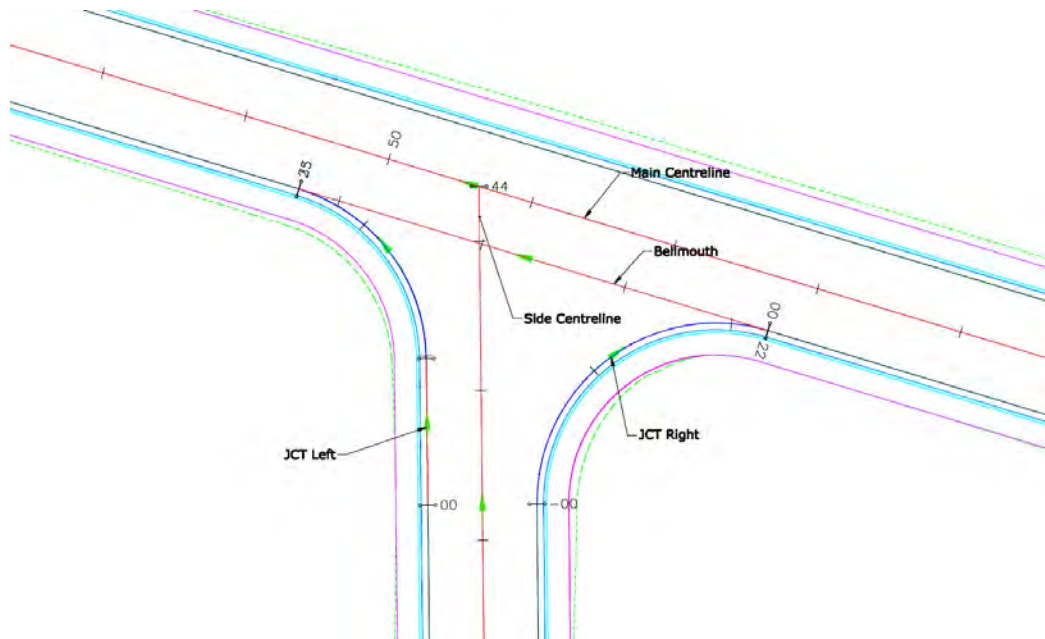
Step 16. Add remaining Corridors using the Typical Section Assembly



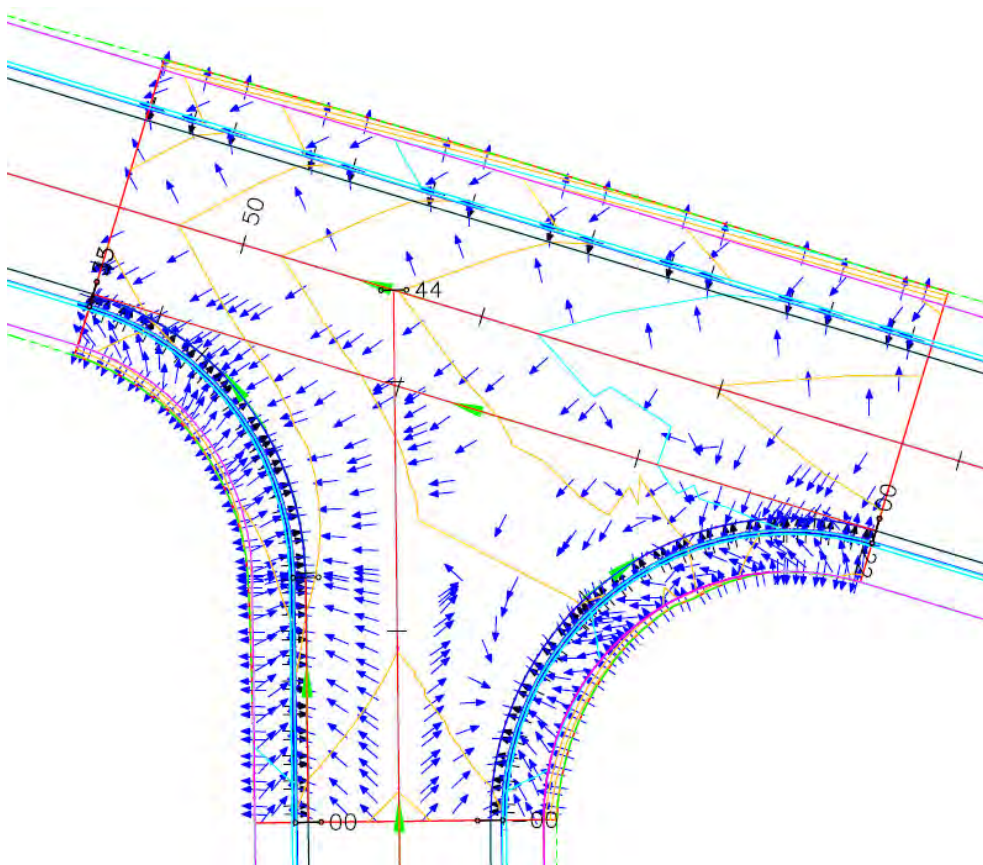
Step 17. For Presentation, in the Layout tab within a viewport.
Hide the Markers and Links Layer to give a clean
linework drawing



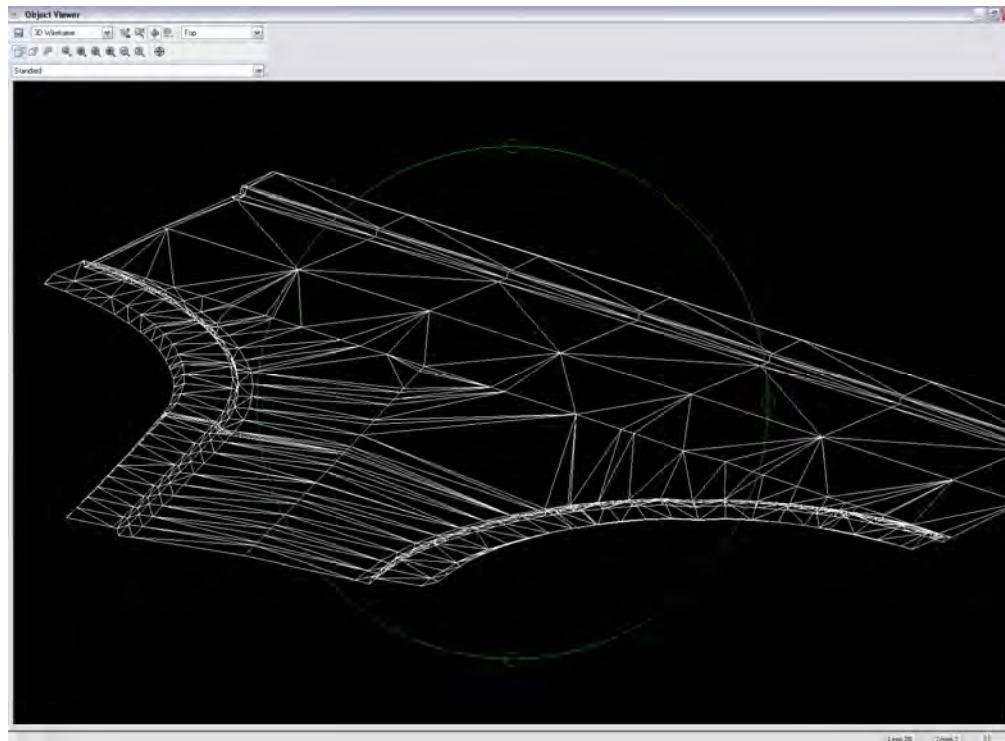
Autodesk



Step 18. Check the Surface. Add a Top Surface to the Junction Corridor and give a style to check Slope arrows etc



Autodesk®



Autodesk

Autodesk [and other products] are either registered trademarks or trademarks of Autodesk, Inc., in the USA and/or other countries. All other brand names, product names, or trademarks belong to their respective holders. Autodesk reserves the right to alter product offerings and specifications at any time without notice, and is not responsible for typographical or graphical errors that may appear in this document.
© 2005 Autodesk, Inc. All rights reserved.

Autodesk®