

CI225075

Civil 3D Caffeinated Grading

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Learning Objectives

- Use feature lines from corridors
- Manage feature lines from corridors
- Understand plane grading (molded surfaces) and its long-reaching benefits, from conceptual to detailed design
- Use unseen profiles and attach them to corridors for design grading

Description

If you really want to step up your grading game, then this is the class for you. We will uncover some of the most creative ways to grade your site that you haven't seen before. We designed our proven workflows to remain flexible over the lifecycle of a project, despite the inevitable changes that occur during the design process. The first half of the presentation will cover feature lines from corridors. While this may seem basic, we will share several tricks that can dramatically reduce the time needed to produce a highly-detailed site. The latter half of the class will take things to the next level. We will demonstrate how to utilize profiles generated from a plane surface to produce our site. Most attendees may be unfamiliar with this, but we are confident you will want to go back to your room to replicate it immediately after you leave this demo. This is a highly energized class, so come prepared to be caffeinated!

Speakers

David Garrigues - David is the Firmwide CAD Coordinator for Kimley-Horn. He has been in the engineering community for more than 25 years. He worked in the Autodesk Reseller channel for over eight years. Prior to that, he worked for a few large firms, was published by CADalyst and AWWA, and was a popular presenter in many venues, including AU 2005 with his class, "Amazing Grade How Sweet the Ground;" "Civil 3D Grading: It's Not a Slippery Slope" at AU 2006; and AU 2007/2008 "Caffeinated Grading". As a presenter, David's energetic attitude and enthusiasm make him easy to understand and relatable.

John Armendariz - John is a Design Support Specialist and CAD Coordinator for Kimley-Horn. He has been in the Land Development industry for 18 years, 14 of which have been with Kimley-Horn in the Dallas, Texas office. John has worked on a variety of Land Development projects as a designer, from wind farms, to multifamily, to mixed use. He offers an invaluable perspective on practice design workflows, and presents Civil 3D solutions in a clear, practical manner.

Tim Yarris - Tim has been with Autodesk since 2006 and spent several years designing the user experience and producing in-product learning materials for Civil 3D and InfraWorks. In Tim's current role as Civil 3D product manager, he works closely with customers and the development team to define the future of Civil 3D.

Introduction

There are multiple work flows for grading in land development projects—choosing one for all circumstances will be very difficult. Therefore, we will demonstrate multiple examples of how adjusting your workflow and adding the power of corridors to your design will make it easier to decide which workflow to use. We will start with an example with minimal impact to previous workflows using feature lines, then we'll move on to more difficult workflows that provide better flexibility when the inevitable changes to your site happen. This class is not a 'how to' on grading, but a guide to use the software. This class requires knowledge of creating and editing feature lines, alignments, profiles, assemblies, and surfaces.

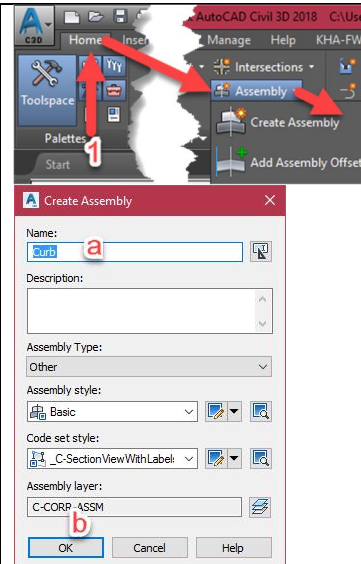
Situation A: Grading from Extracted Feature Lines

This method enables you to continue using feature lines for your design, but use corridors for items such as curbs, retaining walls, and daylighting. We will then extract feature lines from the corridor to use in our surface. This method causes very little disruption to pre-civil 3d 2018 workflows.

A1 – The Design Feature Lines

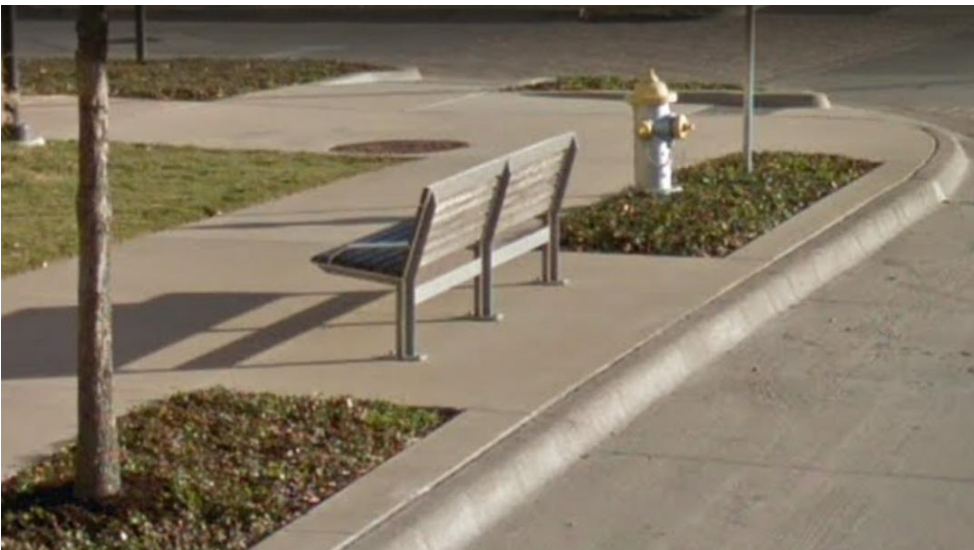
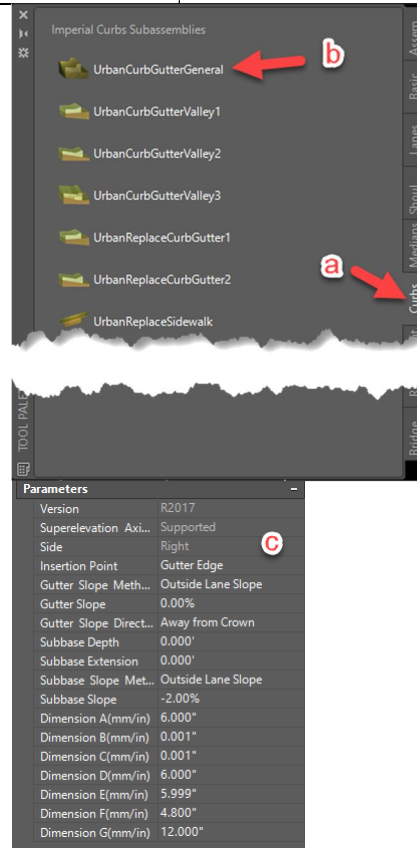
The recommended procedure is to add feature lines at all edge of pavements, building outlines, and all high/low points. This, as mentioned above, is a typical work flow. What changes is the use of corridors with those feature lines to create objects like back of curbs. Assuming you have your feature lines and are ready to create a corridor of your curbs, use the following steps to create a curb assembly.

1. Home->Assembly->Create Assembly
 - a. Name your assembly
 - b. Select OK and pick a spot on the screen to place assembly in drawing.



2. Ctrl+3

- Select Curbs tab
- Select UrbanCurbGutterGeneral
- Enter parameters in window

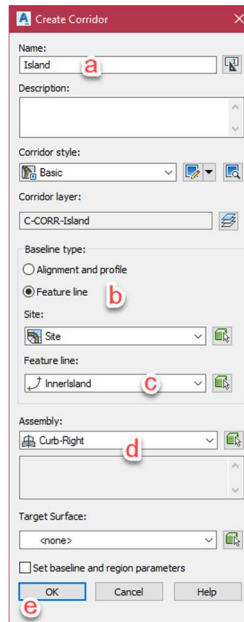
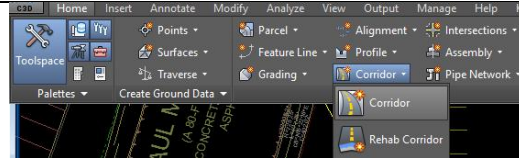


For use in this demo, the curb above is a common curb used in the Dallas Metroplex. It assumes there isn't a gutter pan. Adjust the curb and gutter to work for your projects requirements.

A2 – Creating the Corridor

With all the feature lines in place, it is now time to create your Corridor.

1. Home->Corridor->Corridor
 - a. Name your Corridor
 - b. Choose Baseline Type: Feature Line
 - c. Select the Feature Line
 - d. Assign the Curb as the assembly



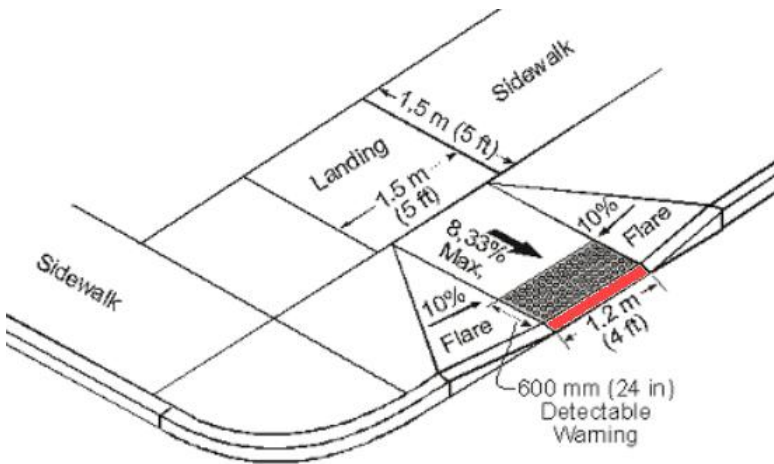
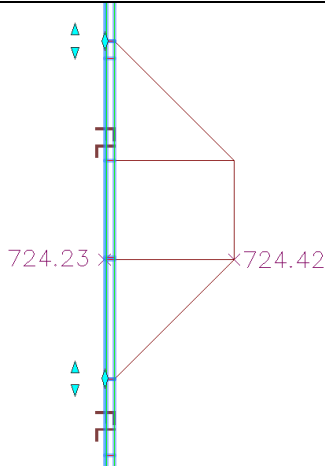
A3 – Modifying the Corridor

Before adding the data to the surface, you should add as many of the edits to the corridors. Edits will include curb ramps, fading curb to 0" curb, etc. We recommend making most of your edits with the conceptual ribbon rather than going into the corridor properties. To access the conceptual ribbon, simply select your corridor and it will appear on your ribbon. The following steps will add a curb ramp to our corridor.

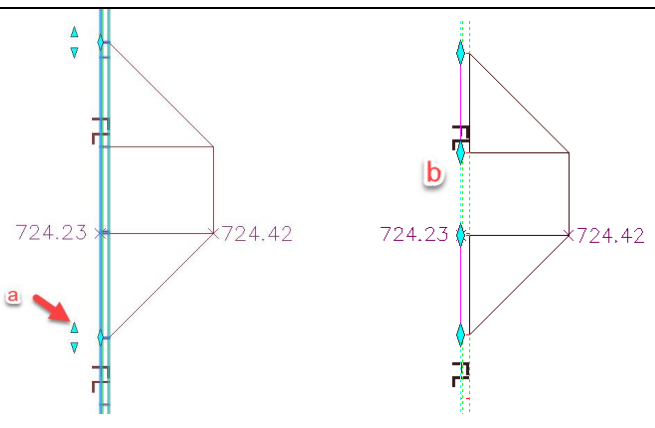
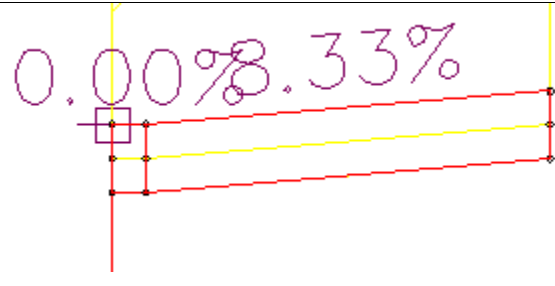
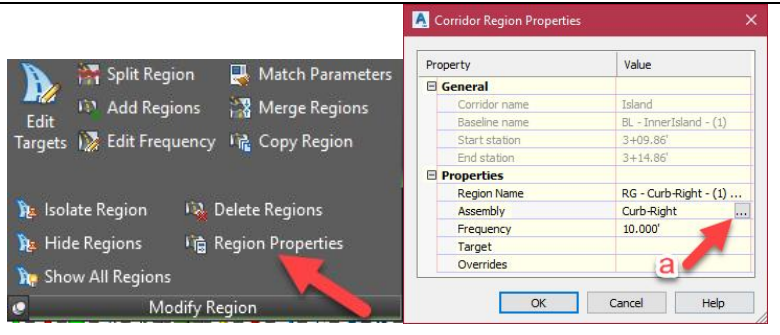
1. Select the corridor.
 - a. On the Modify region panel, select Split Region.
 - b. Select inside the region with your first click.
 - c. Next, pick the point you want the split to occur.
 - d. Continue to pick regions to split (it will leave you inside the command).



2. In this example, the corridor is split twice.



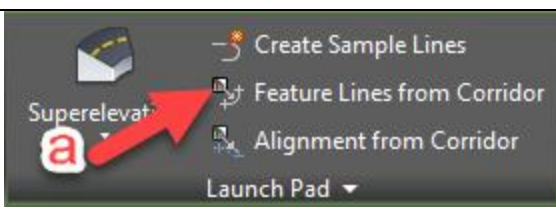
The assembly used has a 0" height curb (shown in red above) with a 6' wide pavement section at 8.33% grade. In most cases, you will find that you do NOT need to model the entire object just enough to let the TIN do the rest for you. In this scenario, we will not model the wings of the ramp, but the transition will happen naturally.

3. Select the corridor and slide the regions to match up with the ramp width. - Select the larger grip first to make the split. - Select the other grip to set the precise location on the ramp.	
4. This is the assembly we will use for the ramp. It is 2 pavement subassemblies. First is 0.5' horizontal and 0% slope, which represents the 0" curb; the other is 6' horizontal and 8.33% slope to represent the ramp.	
5. Select the corridor and go to Region Properties and select in the region that we are converting to a ramp. Select the 3 dots next to the assembly and select the ramp assembly.	

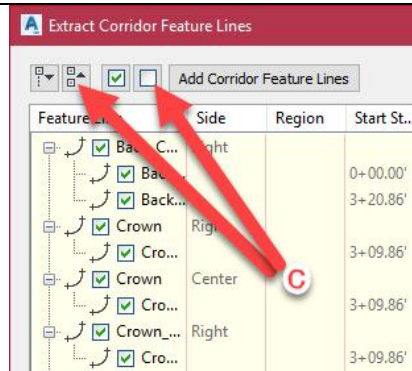
That is just one example of the locations that will require splitting the corridor and replacing the region's assemblies to add ramps to your corridor.

A4 – Creating the Surface

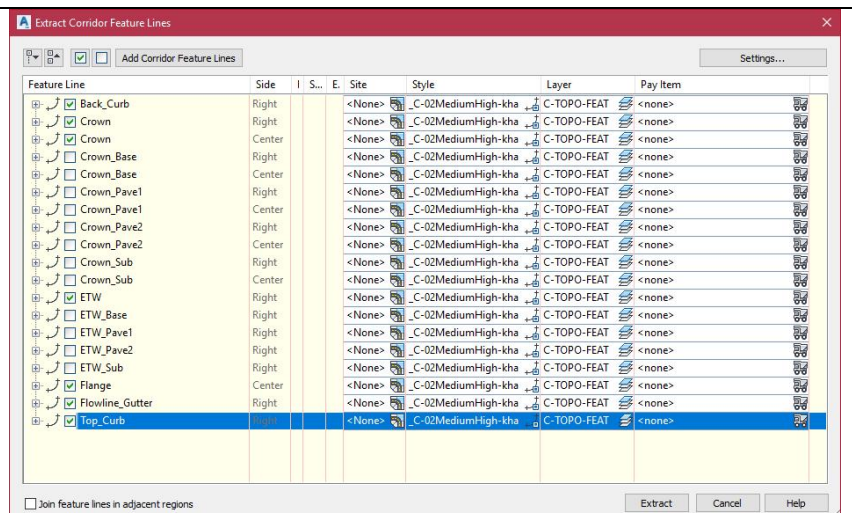
Create Surface Option 1: There are many options to add data to your current surface. As stated above, this is the easiest method to include into your current workflow.

1. Select the corridor and go to the far right of your ribbon on the tab Launch Pad. - Select Feature Lines from Corridor. - Since we are extracting all the feature lines, we will use the All option on your command line.	
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- c. The extract corridor feature lines dialog box can be overwhelming. First hit the Collapse button and the Uncheck All button.



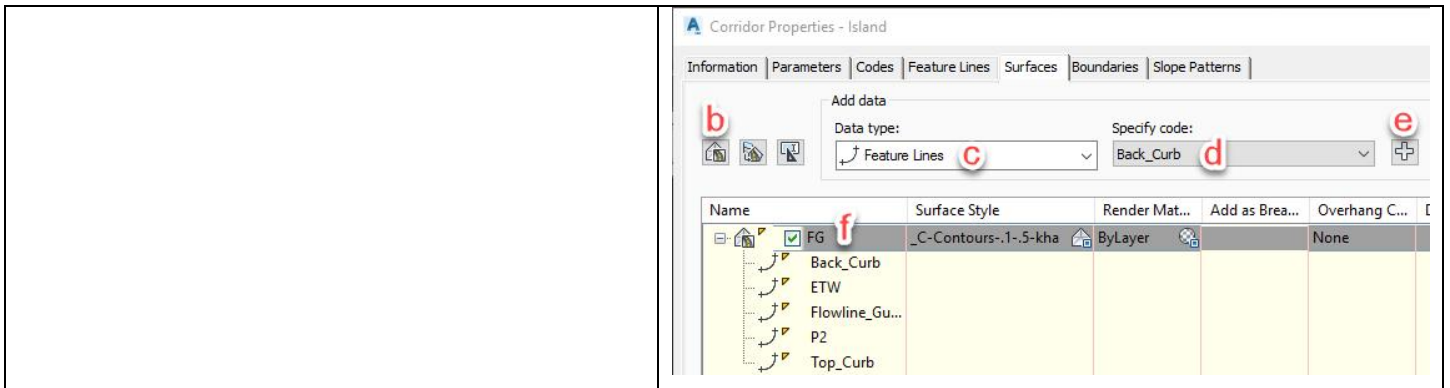
- d. On the left column, you will need to understand the subassemblies you have used. For the most part, what is shown is typical.
- e. Hit Extract to exit out of the dialog box. The extracted feature lines are in your drawing.
- f. Simply add the extracted feature lines to your surface and you are all set.



Create Surface Option 2: We recommend creating a surface from the corridor, then adding additional feature lines as break lines.

1. Select the corridor
 - a. On the modify Corridor tab, select Corridor Properties
 - b. Hit the Create a Corridor Surface button
 - c. Set Data type to Feature Lines
 - d. Select the necessary code
 - e. Hit the plus sign to add the data to the surface
 - f. Rename the Surface





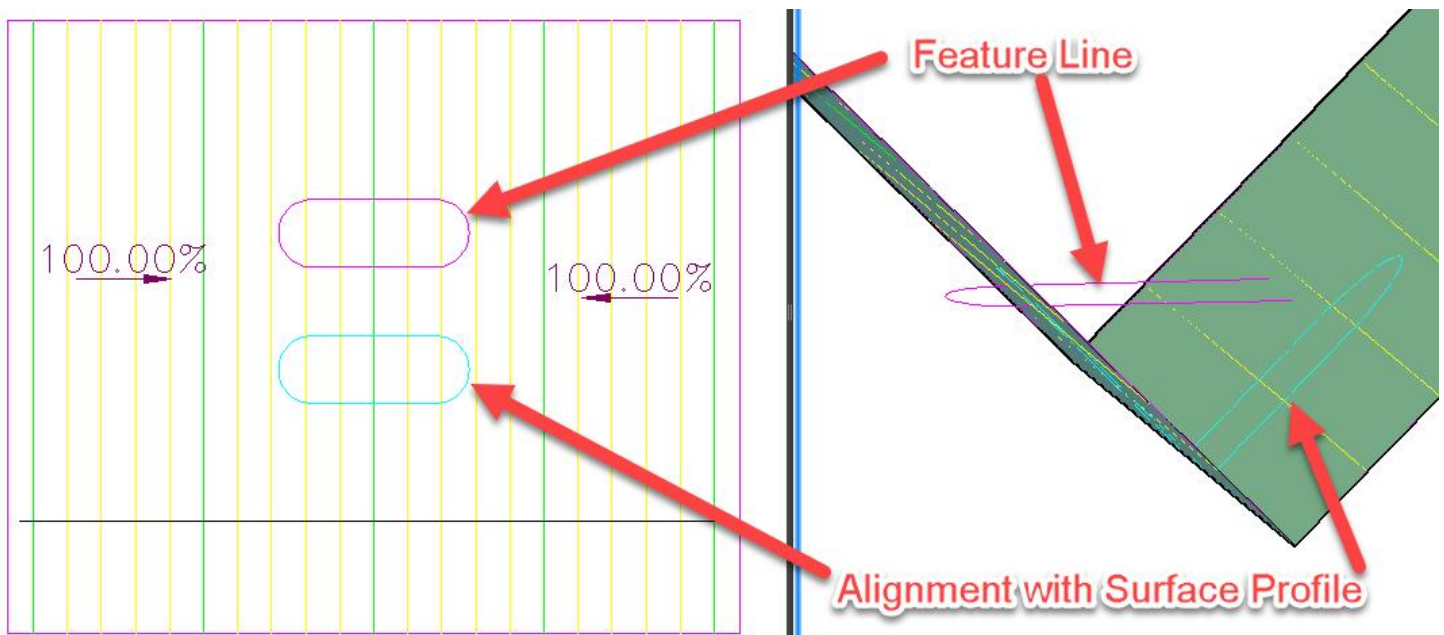
As mentioned above this method offers flexibility, small learning curve and an easy entry point into the use of corridors in site work. The examples shown of curbs and retaining walls are only a few of the many reasons to attach corridors to your feature lines. While it can seem like a waste of time when creating the corridor after a few updates to your vertical you quickly see the power in this method.

Situation B: Grading from a Mold Surface

This method is likely very different from any previous workflows you have used.

B1 – What is a Mold Surface? A mold surface is a surface that mimics the overall general characteristic of a grading site. When we grade, it is often easier to start off looking at surfaces like connected planes. Granted the surface in the end may have a more rolling effect than hard edges, the plane idea is very real and practical. Therefore, we propose to build a surface that shows the direction of water on our site. We can then use this 'mold' to be the building base for our master design. This will involve some trickery. We will show how creating alignments (yes, we know, very odd) will autogenerate a profile that will drape itself on the mold surface. By doing this, we have the two main components needed to create a corridor: an alignment and a profile. Generally, this is a very effective workflow because in design, most of our editing is the vertical—not the horizontal. So yes, it is harder to update if the islands change, but you will see its benefits once you get used to it.

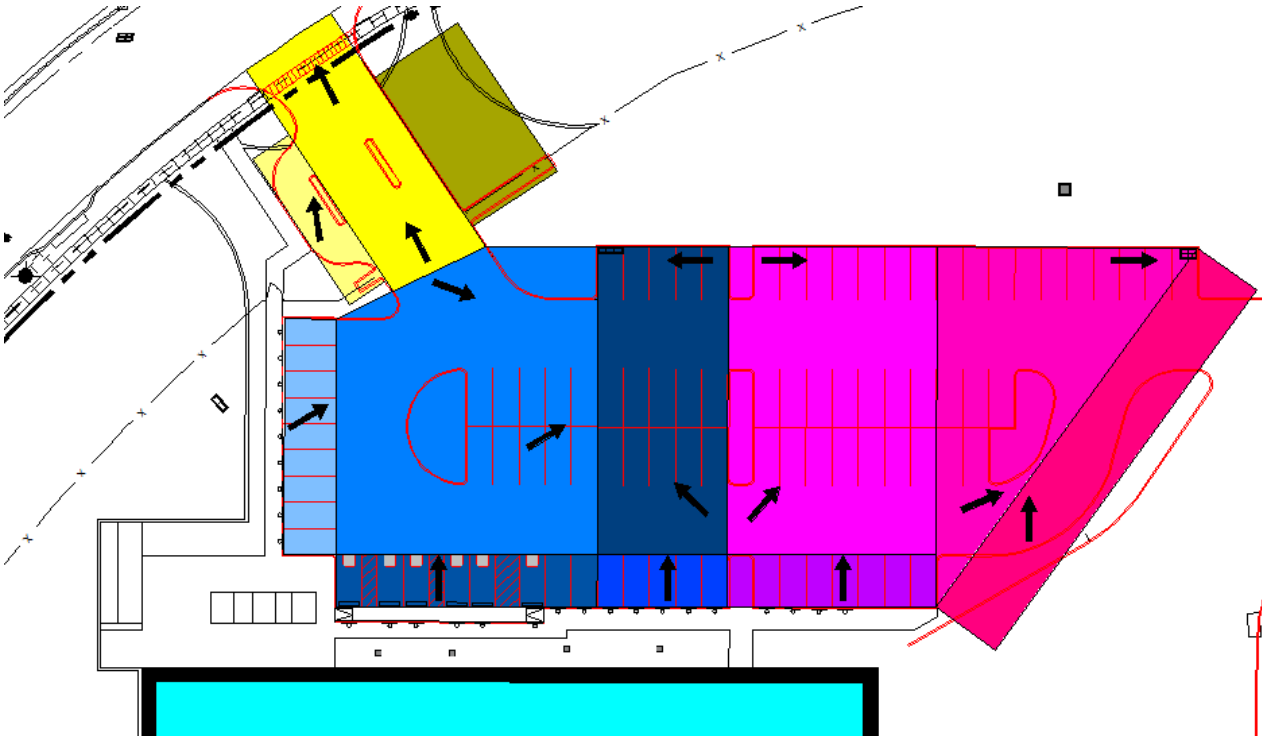
B2 – Why Profiles and Not Feature Lines? This method uses feature lines that are created in sites different from what you would typically add to your FG surface, with caveats. These feature lines are used to create and control mold surfaces that will then drive surface profiles to control your curbs. The key to making this work is using Surface profiles because they will continue to drape perfectly on a mold surface when the surface changes. Feature lines have a Relative Elevation option to follow a surface, however, they only follow the vertices or elevation points and do not drape in any areas between the vertices. For example, the image below shows a feature line that uses the Relative Elevation option. While the vertices are on the surface, the rest of the entity is not riding or draping along the surface like the profile that was created by the alignment location.



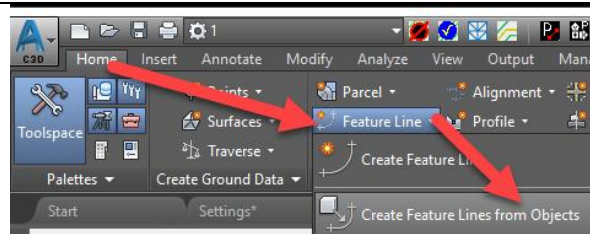
B3 – When to Use Feature Lines

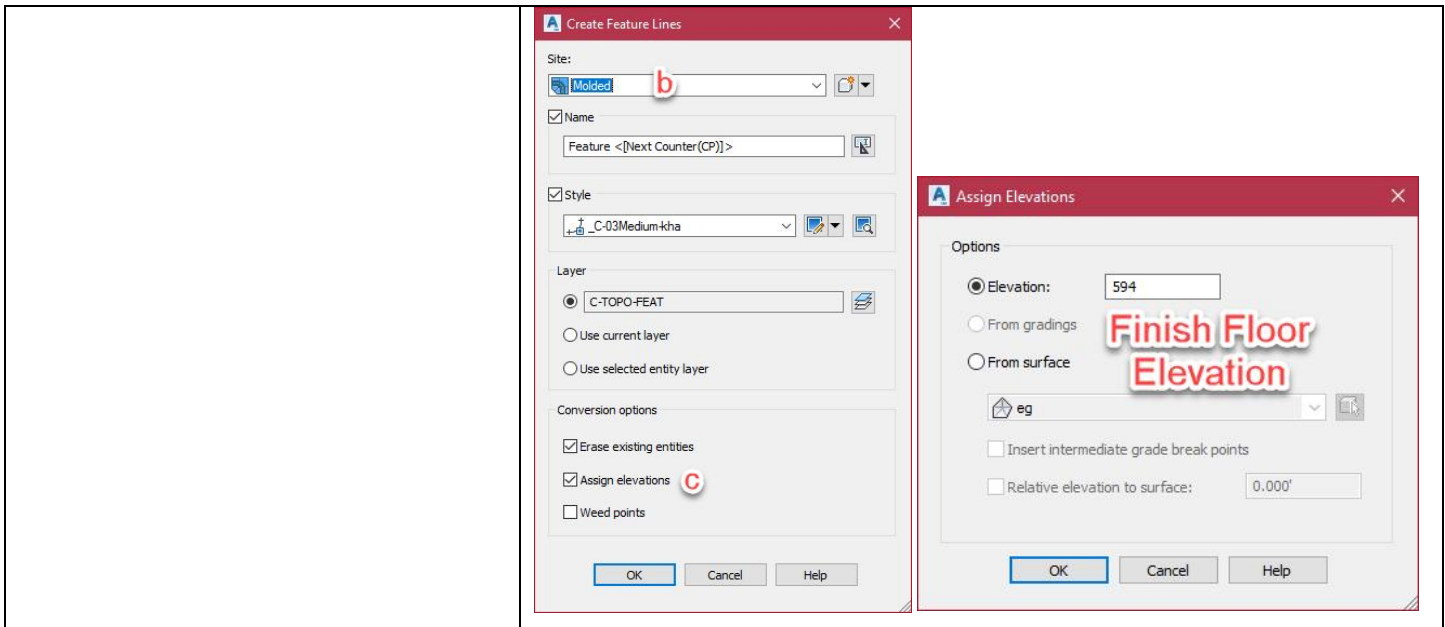
To start, you will need to understand your intent for the grading. The feature lines in this method will be placed at highs, lows, and grade breaks—NOT at the curbs PI's. From the image below, we have a concept of how the grading might work. From studying the existing terrain, you can layout the design feature lines that will control your mold surfaces, which is merely a bunch of "planes." The different colors represent the multiple planes of a single mold surface that will control this project. Each plane has a design feature line as the

boundary of the hatch. Be sure to use a site that will only contain these feature lines. We want to emphasize that all of the colors/boundaries are just feature lines going into one single surface. Also note that all of these plane boundaries are quite basic, which makes them easy to manage and understand while remaining powerful.



1. Home->Feature Line-> Create Feature Line from Objects
 - a. Select polylines of the molds you created.
 - b. Assign the site – As mentioned before, it is important to use a different site than you would typically use in a finished grade surface.
 - c. Assign elevations – it is recommended to set this to existing surface or the finish floor of your building.





B4 – Creating a Mold Surface

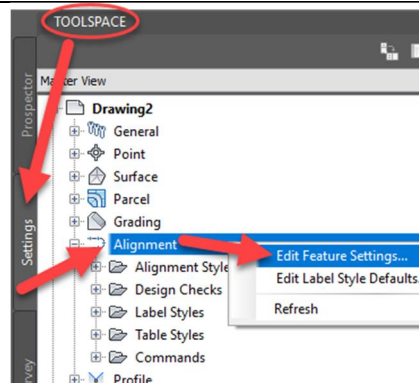
Once you have the feature lines fixed, you need to create the mold surface. This surface will control the design once we've created our corridor. Simply create a surface with the name "Mold." Add the feature lines to this surface as break lines.

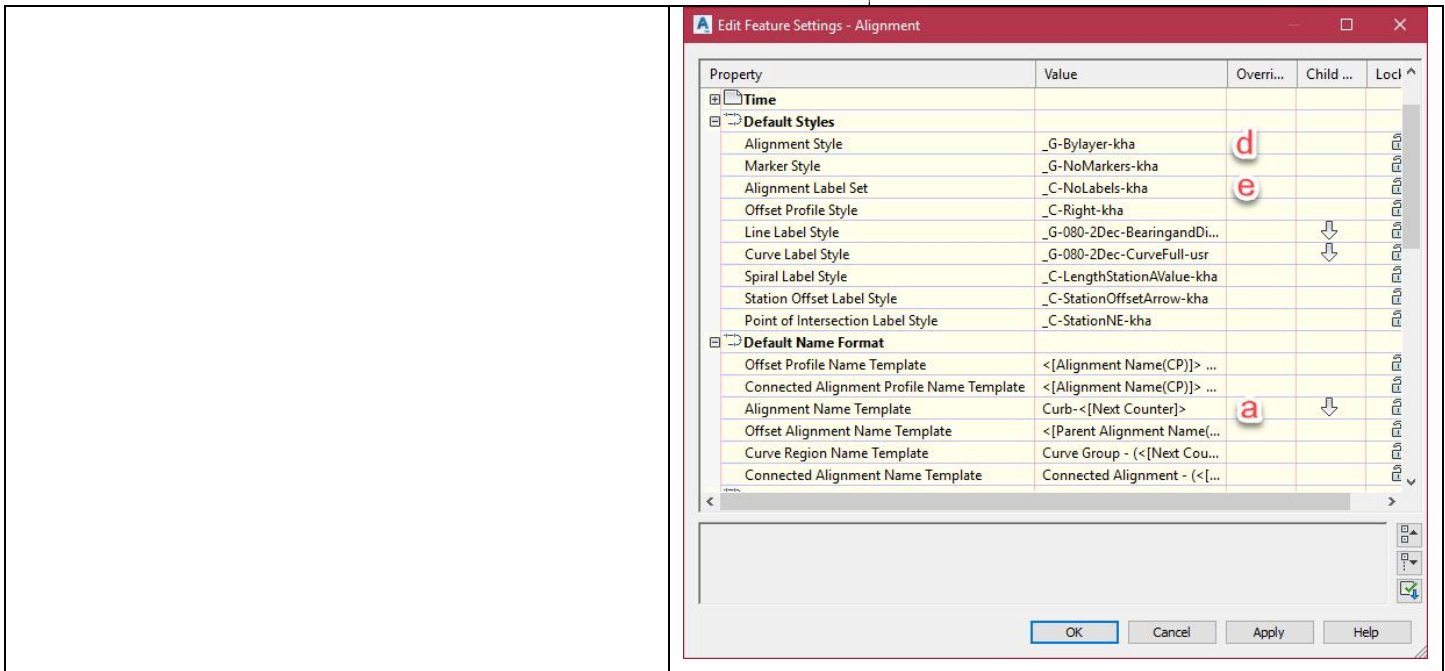
B5 – Alignments and Surface Profiles

The next step is to create alignments for all face of curbs. There are many curbs with a typical site, so it is a good idea to change your Settings to easily create alignments with the proper names and styles to limit the number of clicks and picks. Below are a few recommended changes.

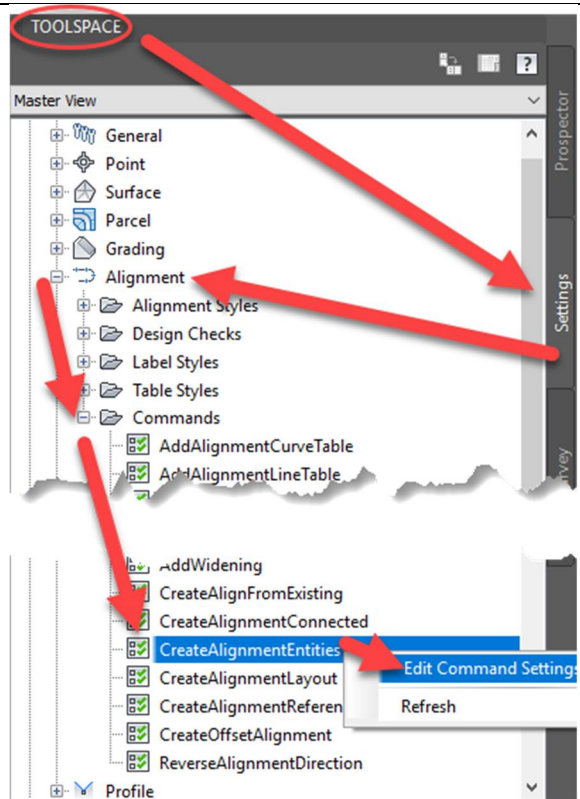
- a. Name – Since this method will create mostly curbs, name the alignments curb with a counter.
- b. Type – If the project will contain other alignments, like roadway, center lines, etc., it is a good idea to place these in Miscellaneous. Another option would be to place these in subfolders.
- c. Site – This method does not need to place alignments on sites.
- d. Alignment style – Set your default style that the alignment will be placed on.
- e. Alignment label set – it is recommended to make a label set that does not include any stations.
- f. Add curves between tangents – you will most likely select your linework from your base to convert to alignments, so no need to add additional curves.
- g. Erase existing entities – Erase the linework from base after it has been converted to an alignment.

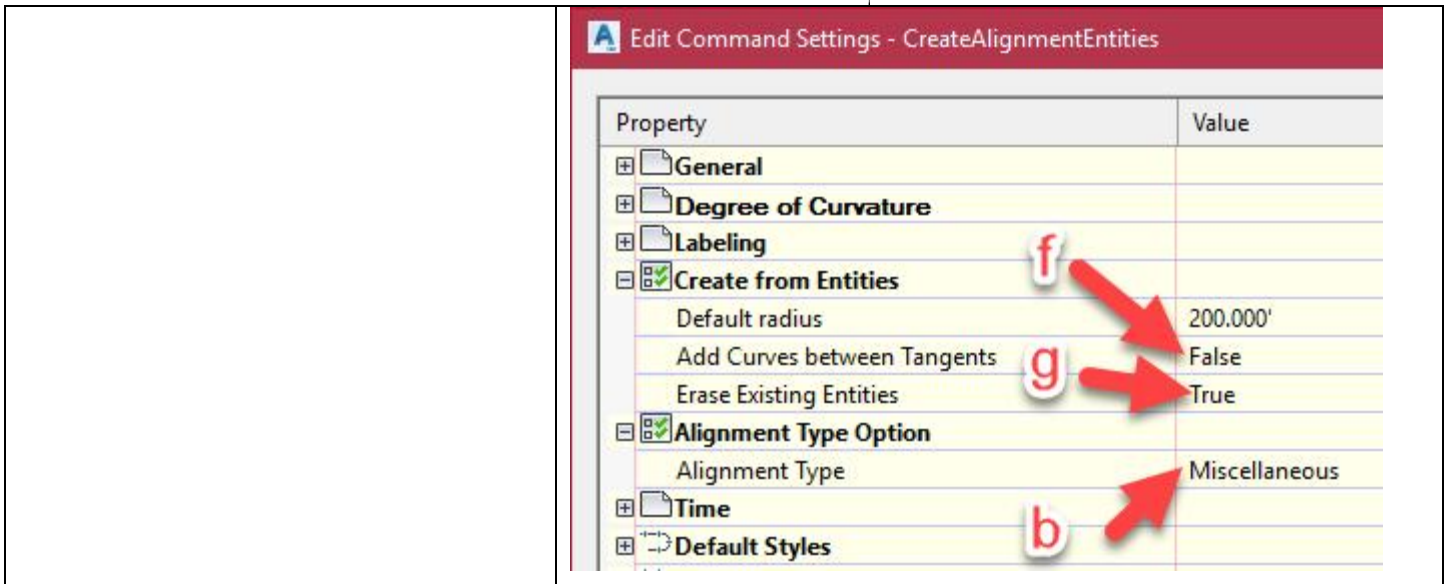
1. Go to Toolspace->Settings->Alignment
2. Right Click and go to Edit Feature Settings





3. Go to Toolspace->Settings->Alignment->Commands->CreateAlignmentEntities
4. Right Click and go to Edit Command Settings





Now that all the default settings are set in the drawing, it is time to begin creating the alignments. This is an easy but tedious process. Copy all the face of curbs (2d polylines) from the base file into your surface drawing. Convert the line work into alignments. With the settings we adjusted above, enter out of the dialog box to accept the defaults. Then create a surface profile from the mold surface for each alignment.

Tip: It is important to only create a surface profile of the mold surface to make it easier to select when creating the corridor.

B6 – Creating the Corridor to Represent the Curbs

With the alignments and surface profiles created, it's time to move onto the corridor. Create a corridor with a horizontal baseline of each of the alignments and use the mold surface profile as the vertical baseline. Add a curb assembly to each base line to make up your corridor.

1. Home->Corridor->Corridor

a. Add Baseline – To speed through, hit the Add Baseline button switch to the next alignment then hit enter twice and repeat this until you have all the baselines.

- b. Vertical Baseline – Click in each vertical baseline and hit enter. This will be a quick process since there is only one surface profile.
- c. Set all frequencies – recommended shown.

Create Corridor Baseline

Baseline name: BL - <[Horizontal Baseline(CP)]> - <[Next]

Baseline type:
☒ Alignment and profile
☐ Feature line

Alignment:
Curb-01

OK Cancel Help

Select a Profile

Select an alignment:
Curb-01

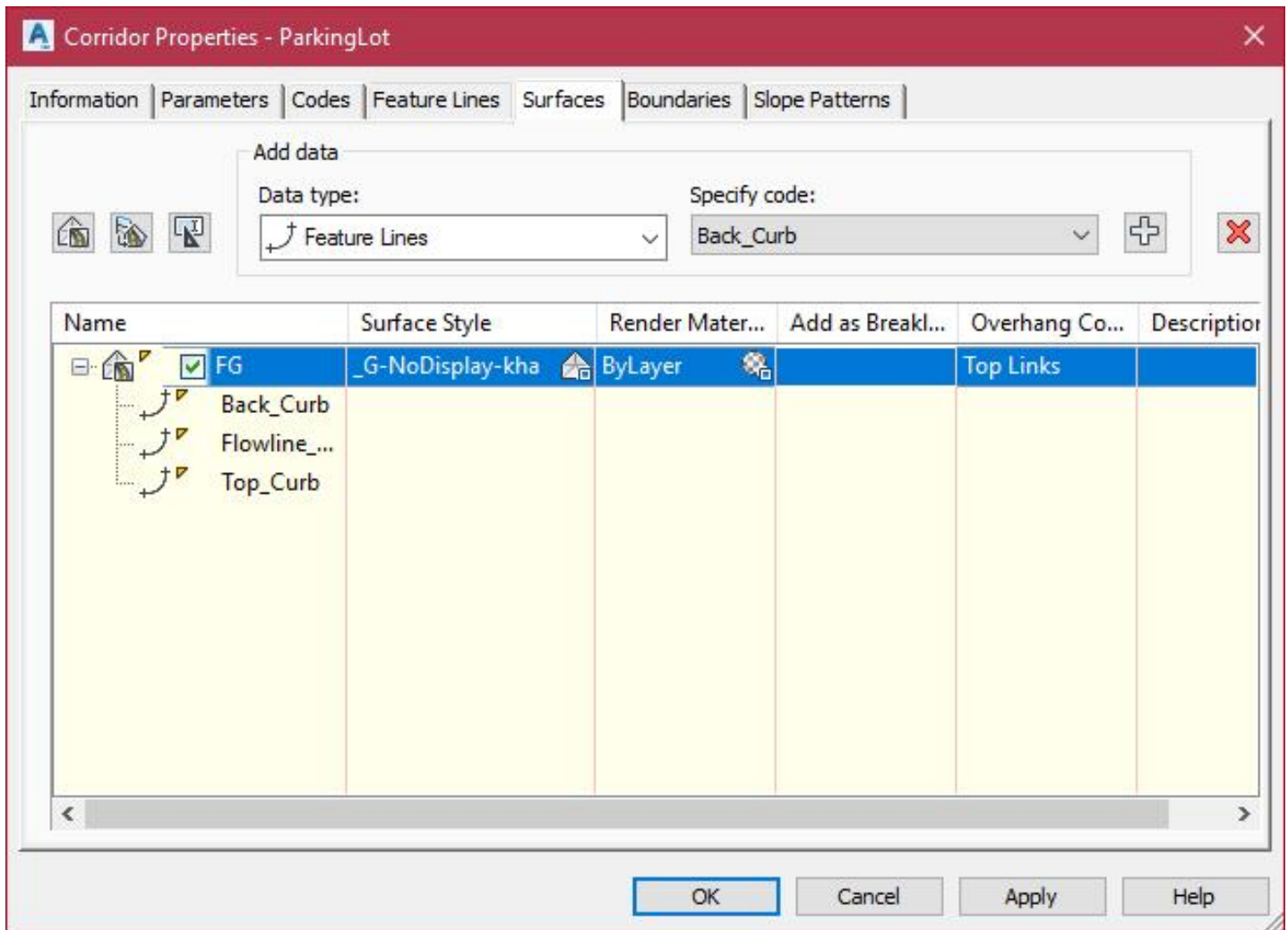
Select a profile:
Molded-Curb-01

OK Cancel Help

Property	Value
Corridor Information	
Horizontal Baseline	
Along tangents	10.000'
Along curves	By curvature
Curve increment	10.000'
Mid-ordinate distance to define ...	0.100'
Along spirals	10.000'
At horizontal geometry points	Yes
At superelevation critical points	Yes
Vertical Baseline	
Along vertical curves	10.000'
At vertical geometry points	Yes
At high/low points	Yes
Offset Target	
At offset target geometry points	Yes
Adjacent to offset target start/...	Yes
Along offset target curves	<None>
Curve increment	25.000'
Mid-ordinate distance to define ...	0.200'

B7 – Final Surface

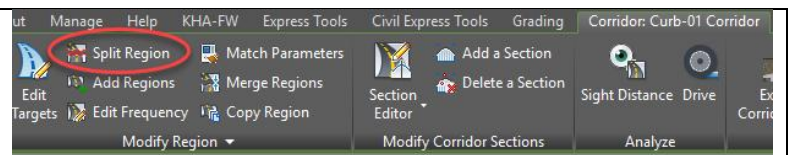
From corridor properties, create a surface using feature lines as the data. Depending on the curb or the subassembly used, it will vary what feature lines to bring into your surface. In the case below, only curbs currently exist in our corridor. The back of curb, flowline, and top of curb are used and need to be added. This will be the finished ground surface used in the project.

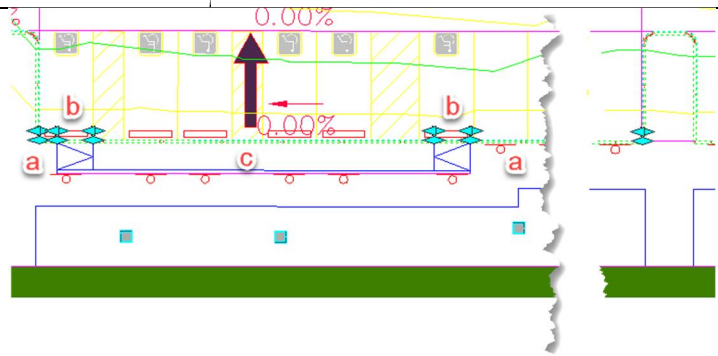


B8 – Detailed Grading

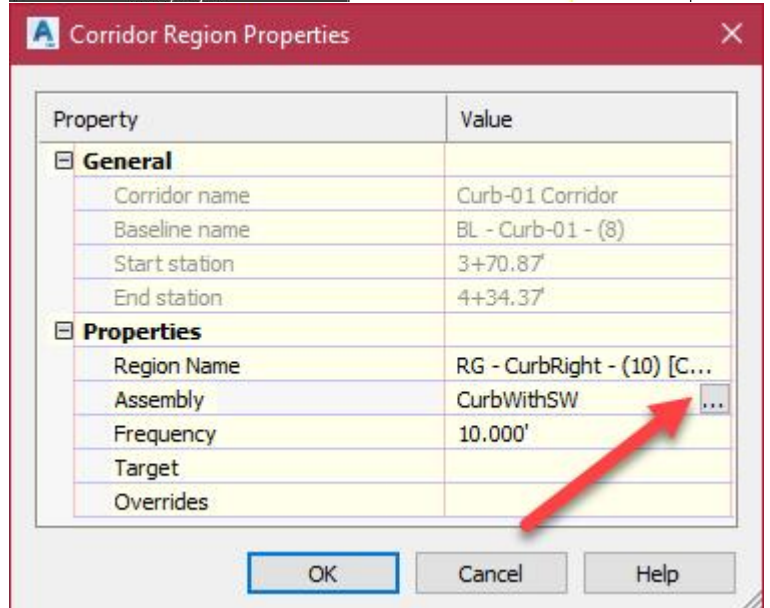
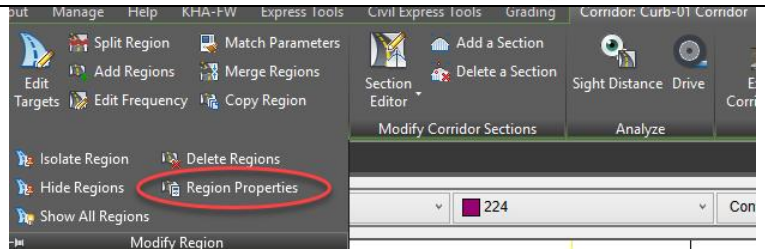
Modify the corridor to add more detail to your surface. In this example, add a curb ramp and sidewalks.

1. Select the corridor and select Split Region
 - a. Split the region for sidewalk
 - b. Split the region for ramp
 - c. Split the region for sidewalk and curb





2. With the corridor selected, select Region Properties.
 - a. Change the assembly of each new region to match your needs.

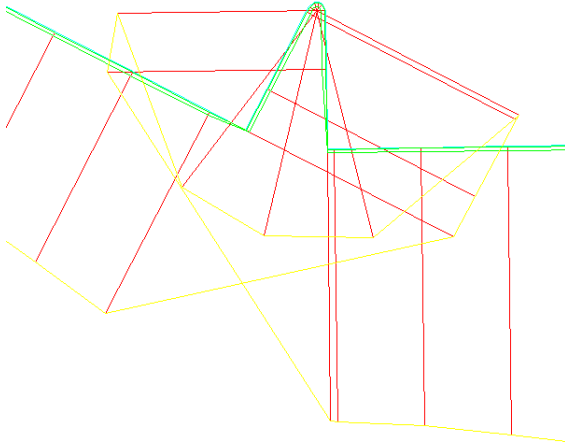


Known Issues

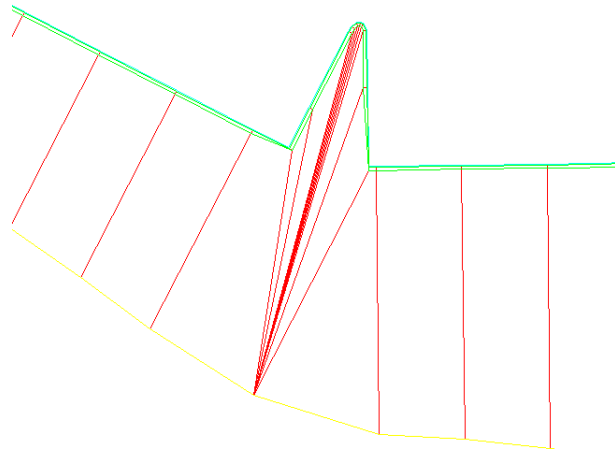
1. Corners

- a. Tight corners require manual bow tie cleanup or a split:

Before Cleanup

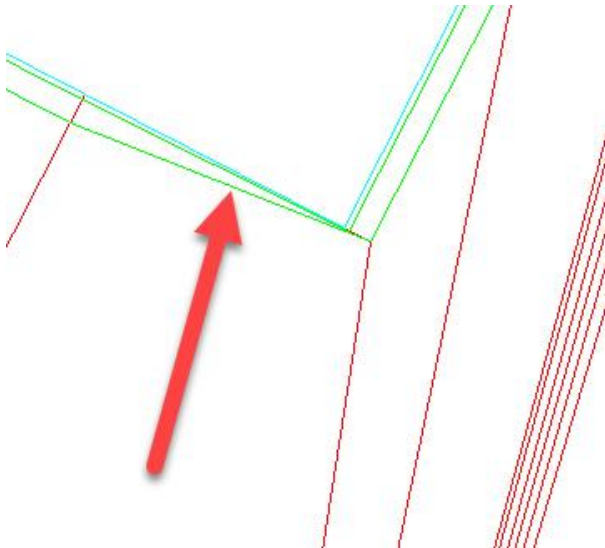


After Cleanup

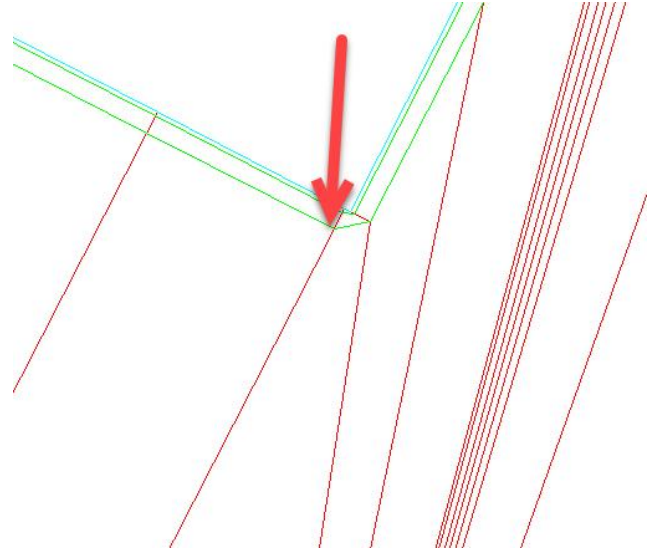


- b. Corners might require manual frequencies. Even with additional frequencies, a hard corner cannot be achieved:

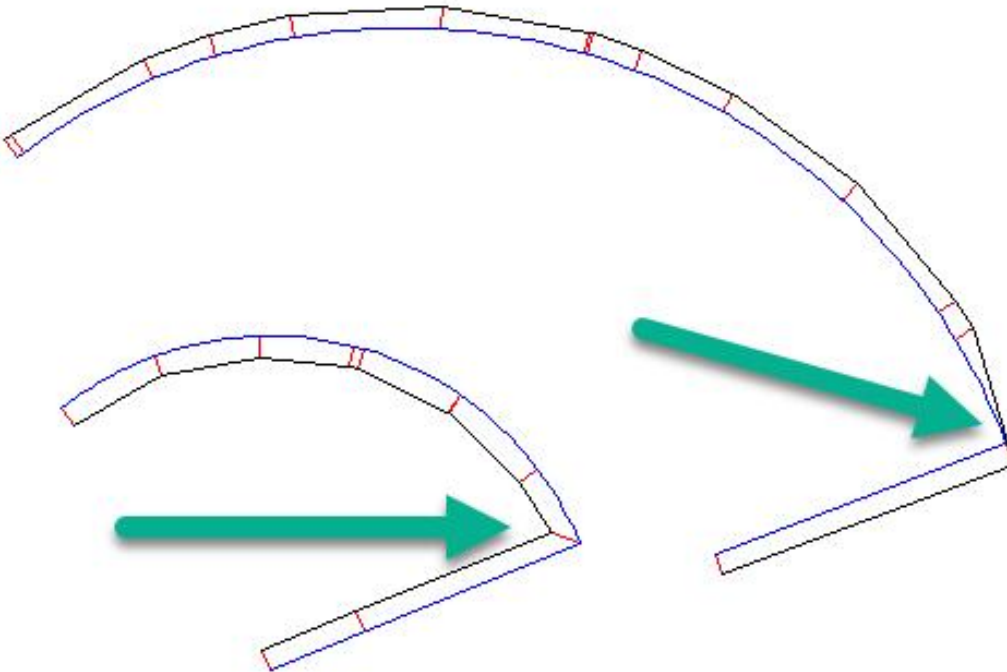
Without additional frequency



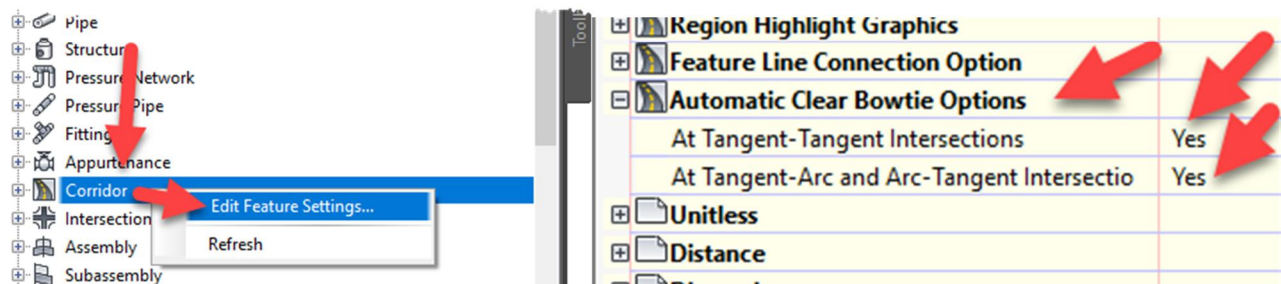
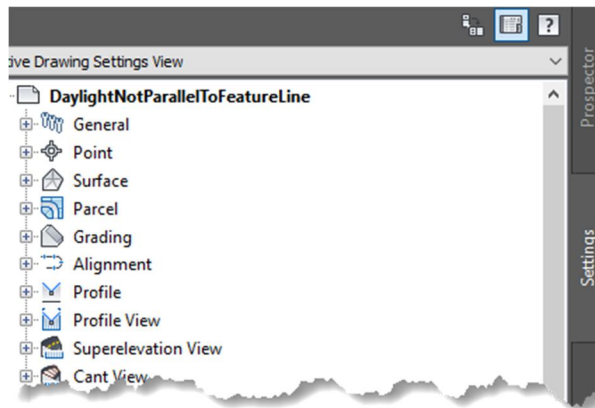
With additional frequency



- c. Corners with tangents and arcs do not cleanup to the outside. The feature lines shown in blue below have two separate regions with the same assembly. In one, the assembly is on the inside; on the other, it is on the outside. When using the outside, you will need an additional frequency near the PI to clean up the corner.



Set your corridor settings to automatically clean up the bowties by changing the settings below.



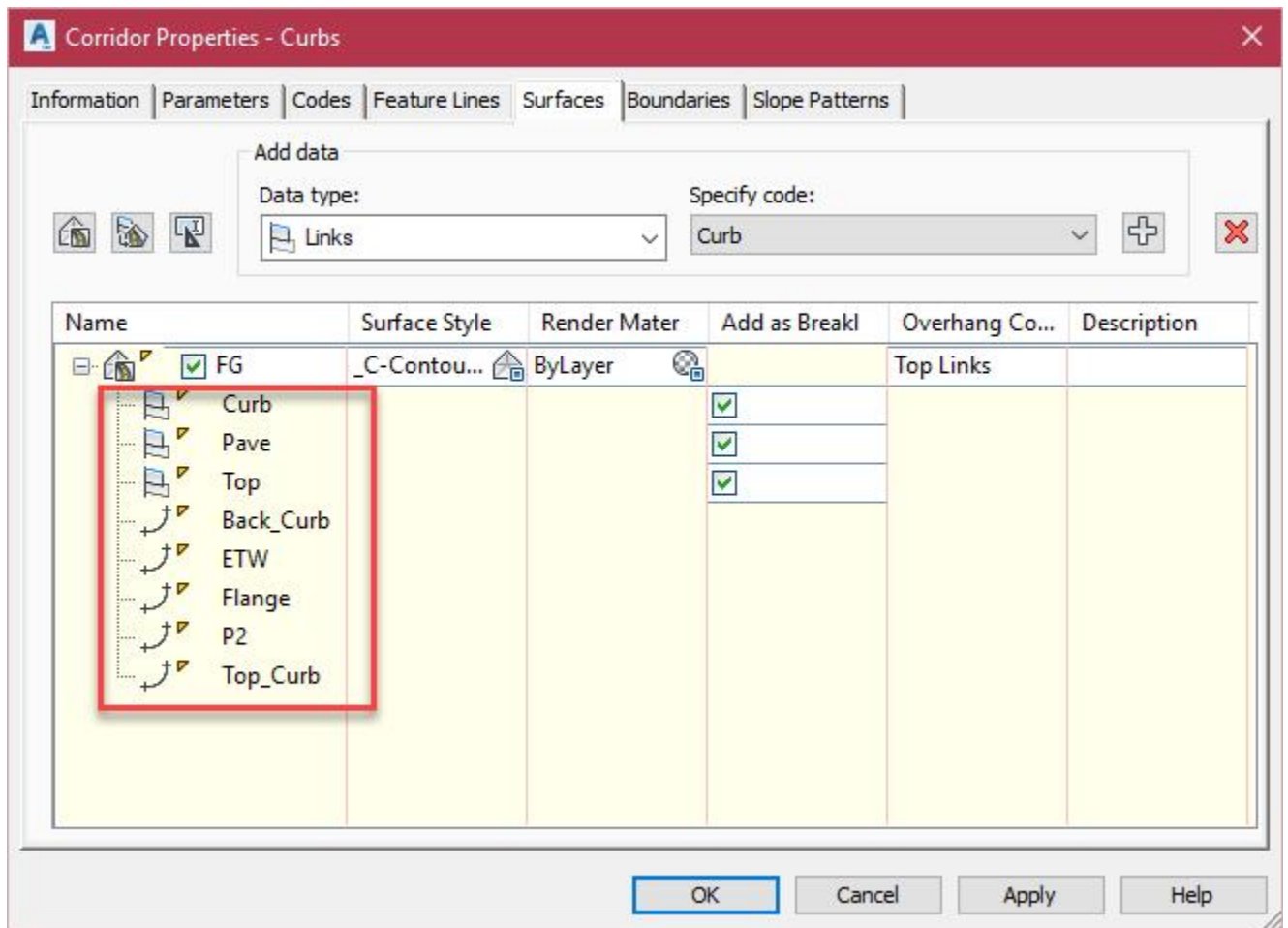
- d. When attempting to slide a region around a corner, there are times when it will stop the slider at the corner. You must stop it at the corner, then resume.

2. Alignments

- When creating alignments from closed polylines, the direction arrow for alignments is not shown. Use the reverse feature line command on the polylines before converting to alignments.
- Do NOT reverse alignments that are already in the corridor as baselines. The stationing for regions will not update correctly.

3. Curbs

- Curb ramps that don't triangulate well will need null assemblies with gaps between the regions stations.
- Curb ramps need feature lines and links as data in surfaces to show up correctly.



As mentioned above this method offers a small learning curve, flexibility and an easy entry point into the use of corridors in site work. The examples shown with curbs and retaining walls are only a few of the many reasons to attach corridors to your feature lines. While at first it may seem like a waste of time when creating the corridor, it will only take a few updates to your vertical till you quickly realize the power in using these methods.