

## AutoCAD® Civil 3D®: "Curbing" Your Enthusiasm

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### CI3791

Professionals from every engineering company that works with curb design—from survey to design—should attend this class. With a strong concentration on workflows, this class will demonstrate how to capture existing curb features using high-definition scanning; use the conditional subassemblies functions in AutoCAD Civil 3D software; and automate curb design for driveways, sidewalks, and curb islands. We will explore solutions to place Americans with Disabilities Act-compliant (ADA) ramps into intersection designs and custom workflows to build interactive curb components that update dynamically for use in intelligent models. Site design and roadway design will be taken to a new level. Editing simple edge of pavement grades for site or roadway design will automatically update curb islands and proposed surfaces to complete site design and corridor surfaces. Our years of experience will provide solutions for workflows that are not made obvious. The class will conclude with a 3D model for staking the finished design.

### Learning Objectives

At the end of this class, you will be able to:

- Complete design from existing intelligent model from High Definition Surveying Data
- Easily address the design of driveways, sidewalks, medians, and intersections using conditional subassemblies
- Develop completely interactive components for curb design that can be used for transportation or site design intelligent models
- Use code sets to display design data from an engineering model

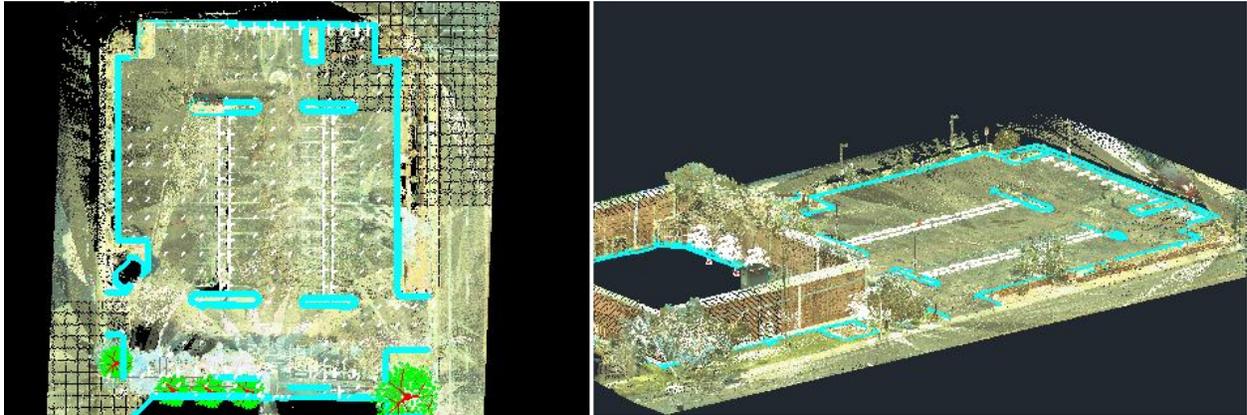
### About the Speaker

Based in Michigan, Chad is author of Civil 3D GURU.com blog, provides customized consulting, training, and implementation services with support for all Autodesk® Infrastructure industrial solutions. He is also a certified HDS instructor for Leica Geosystems and has developed into a leader in the world of High Definition Laser Scanning. By incorporating nine years of industrial experience, and the last ten years understanding the vertical solutions as an Autodesk partner, Chad has become well known in the infrastructure discipline and now applies his knowledge and experience as president of ADSK Solutions. He is no stranger to Autodesk University, and looks forward to everyone joining him for his fourth year as a highly rated speaker.

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## Complete design from High Definition surveying data

Collecting data from Lidar, mobile mapping, and high definition laser scanners are becoming common deliverables. As a Leica GOLD HDS partner I have used Cyclone and Cloudworx to complete my laser scanning (pointcloud) workflows over the last 14 years. Autodesk has built similar tools inside of Civil 3D to handle this data and continue to enhance these workflows.



\*\*Note: Leica software is designed for these workflows and still provides the ROI.

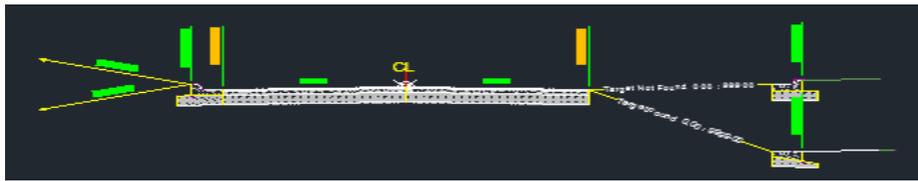
Point Clouds are delivered different formats and e57 file format is a compact, vendor-neutral format for storing point clouds, images, and metadata produced by 3D imaging systems, such as laser scanners. The file format is specified by the ASTM, an international standards organization. Civil 3D does not currently support this file format and most professionals will recommend pts file format, but LAS is a more compressed file format and provides classification during import.

## Easily address the design of driveways, sidewalks, medians, and intersections using conditional subassemblies

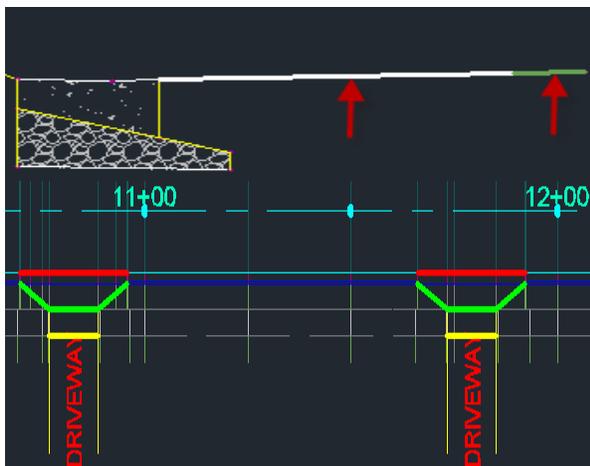
### ConditionalHorizontalTarget

This subassembly automatically applies various subassemblies, such as widening, curb and gutter, ditching, or daylighting, to an assembly based on whether an offset target is found at the corridor station.

For example, when an assembly contains a ConditionalHorizontalTarget subassembly, AutoCAD Civil 3D analyzes the station to determine whether an offset target exists within a specified distance. Depending on the ConditionalHorizontalTarget subassembly parameters, different types of subassemblies are automatically added to the assembly. Graphics below provide a workflow to simplify driveway and sidewalk design during roadway corridor design.



Plan view results applying one assembly. Notice the curb is removed from the drive ways and replaced with gutter. This is accomplished by simply placing polylines at critical locations. The conditional subassemblies have an option to look for the nearest or the farthest target and associating the correct subassembly. The red polylines placed on the driveway applies the gutter subassembly. Start with something simple like I did above. Have fun and remember to place and test the targets are working, before applying the no target subassembly.



Driveway approaches and sidewalks are a little bit more elaborate. The image to the left displays additional targets to plan for driveways and sidewalks. A link is required from back of gutter to the drive. Another link is required between the driveway and sidewalk. Below is a close up of the subassembly being applied. The driveway link points to the green target and the grass link targets the sidewalk alignment.

More elaborate subassemblies can be developed to utilize conditional subassemblies. Attaching multiple corridor baselines will display assemblies in cross sections. Add the sidewalk alignment to the corridor and apply this assembly that turns off the walk at driveways and or intersections. Notice the yellow polyline above.



The image below shows the results if targets and code sets are utilized correctly. With the right codesets and targets a true 3D model of the road design with materials are displayed.

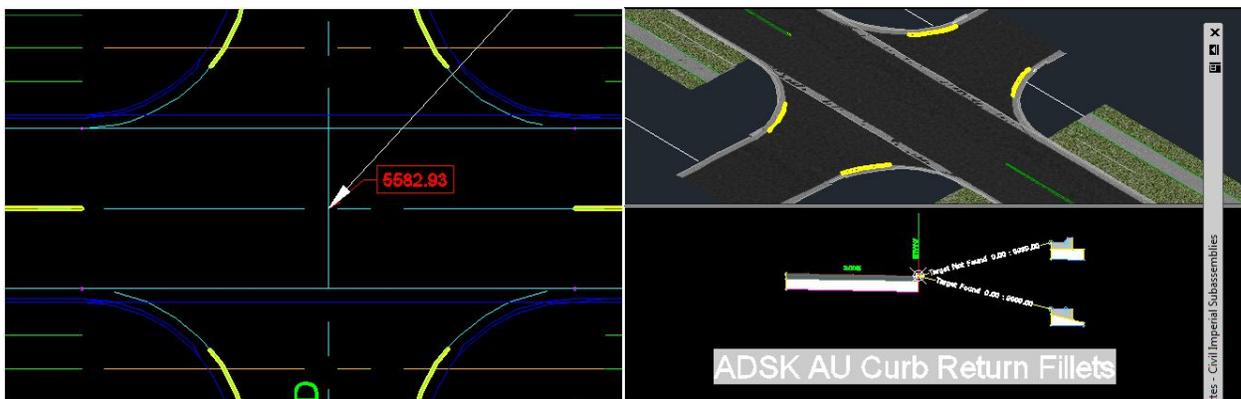


\*\*\*KEY POINTS DURING PRESENTATION

1. Conditional subassembly ConditionalHorizontalTarget
2. Targets must be selected for target found and target not found.
3. No regions are being used
4. Targeted polylines are automatically sampled.
5. Add additional sample lines at .01 to for cleaner transition
6. Saved home view in Object viewer to return to area of concern.

### Conditional Subassemblies for Intersection and ADA ramps

Utilizing ConditionalHorizontalTarget subassemblies and selecting the ramp locations Civil 3D will automatically swap out curb and place gutter subassembly like presented above. Assembly set is a group of assemblies used to create a corridor in an intersection object and can be saved and imported to enhance workflows.



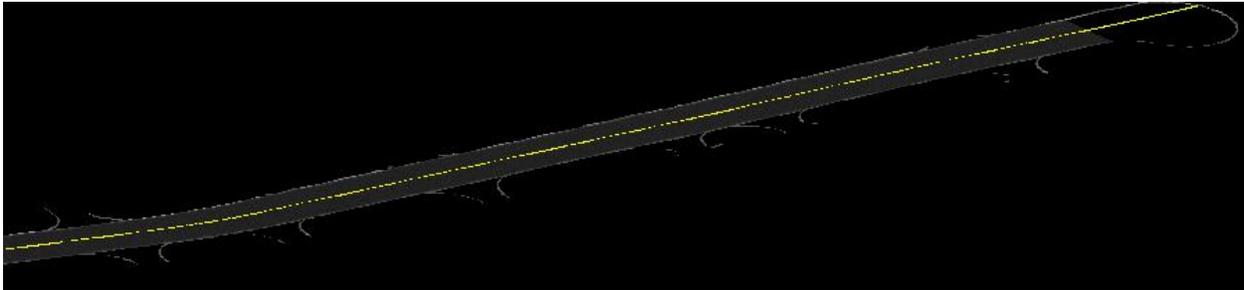
\*\*\*KEY POINTS DURING PRESENTATION

1. Place random point at intersection on corridor surface

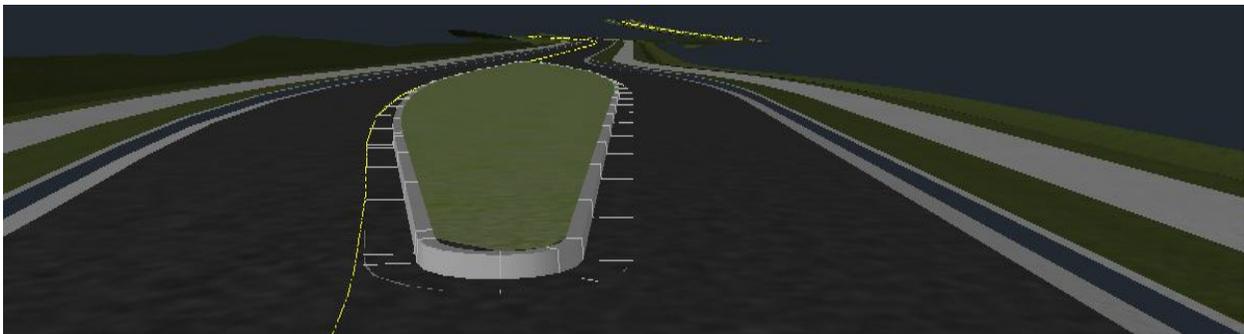
2. Project point to profile view to locate and match elevations
3. Draw polylines at ADA ramp locations and targets these with conditional subassembly
4. Assembly set was saved and applied as a group to create intersection
5. Centerlines show in model view by setting profile style model view to show 3D chain
6. Codesets are utilized to show materials in Object viewer

### Conditional Subassembly advanced workflow

Civil 3D has several workflows that return the same results. The first workflow presented above worked well for driveways. The second workflow utilized the intersection wizard. The third workflow below works well for road reconstruction projects and or if intersections are more complicated. This also provides an easier workflow for projects that do not require a corridor model.



This approach utilizes the tools we learned earlier. Connect the EDGE OF PAVEMENT on the right and left side of the road. Connect the radius of all intersecting roads until it matches existing elevations. Convert them to alignments. Draw targets like we did in the first workflow but mark the curb this time instead of the gutter locations. A corridor is built with assemblies attached to the edge of pavement instead of the centerline.



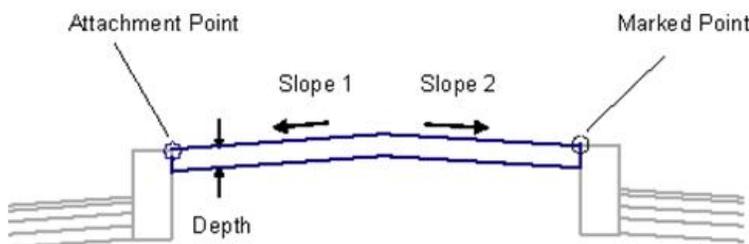
## Corridor Medians

**Develop completely interactive components for curb design that can be used for transportation or site design in intelligent models.**

Medians can be designed with multiple workflows. Each workflow has advantages and disadvantages. I encourage all users to explore each median solution. For transportation most users migrate to subassemblies and start exploring each type of subassembly. The first image below shows one option for working with subassemblies. Another option that is available for site and transportation is creating medians with grading tools. This workflow provides the ability to link a feature line to the corridor surface and the median will update as changes are made to the design. I recommend this workflow for site, and can be used for transportation, but a surface must be created to show the median in section view. A few extra steps are also required to render materials correctly in the model. The workflow I am providing is for transportation projects and is easy to use, it is dynamic, displays in cross section view and materials display correctly in the model.

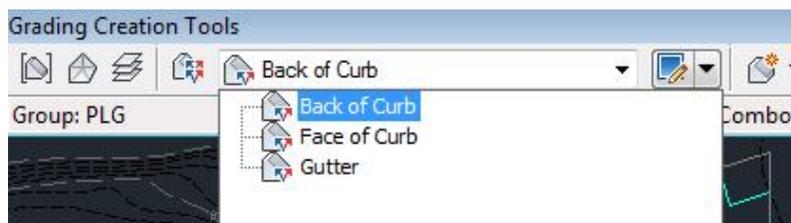
### MedianRaisedWithCrown

This subassembly inserts links for a constant-slope raised median between two points.



Use the MarkPoint subassembly first if the connecting point has not already been marked.

### Grading Objects



### Dynamic Corridor Medians

I like to think of this as a SOLU-AROUND. Although I coined my own term, everyone is familiar with these. It is an innovative idea involving out of the box thinking to develop solutions for problems, or desired results within the software, that were not made obvious by the manufacturer or easily recognized by the user.

This workflow provides solutions for users of all levels. Dynamic medians in a corridor for transportation projects are easy to use, dynamic, displays in cross section view and materials display correctly in the model.

This method of creating medians was not practical until the 2012 version. In version 2012 we can add multiple baselines alignments to a single corridor and all assemblies show up together in cross section view. So why not create alignments from each island and use the corridor surface as the profile? This would be dynamic and update as the corridor changes. Unfortunately Civil 3D corridors will not accept the elevation from the corridor profile. Solu-Around, create a new surface called medians. Now paste the corridor surface into it.

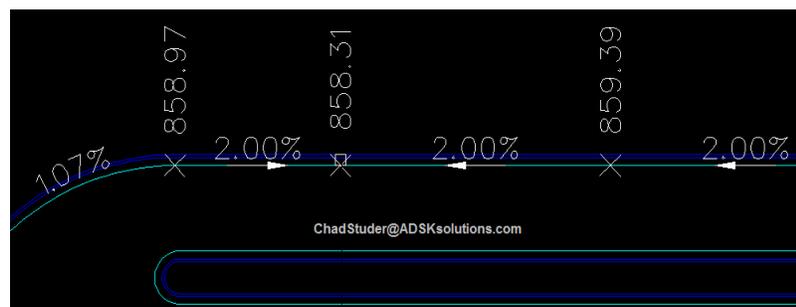
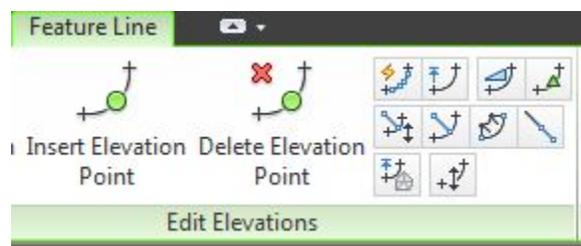
- Create a corridor surface
- Create a surface called medians
- Paste the corridor surface into the medians surface
- Create alignment from the edge of pavement around the median
- Create profile from median surface.
- Create assembly using only curb attached to the assembly
- Add the alignment, profile and assembly to existing corridor

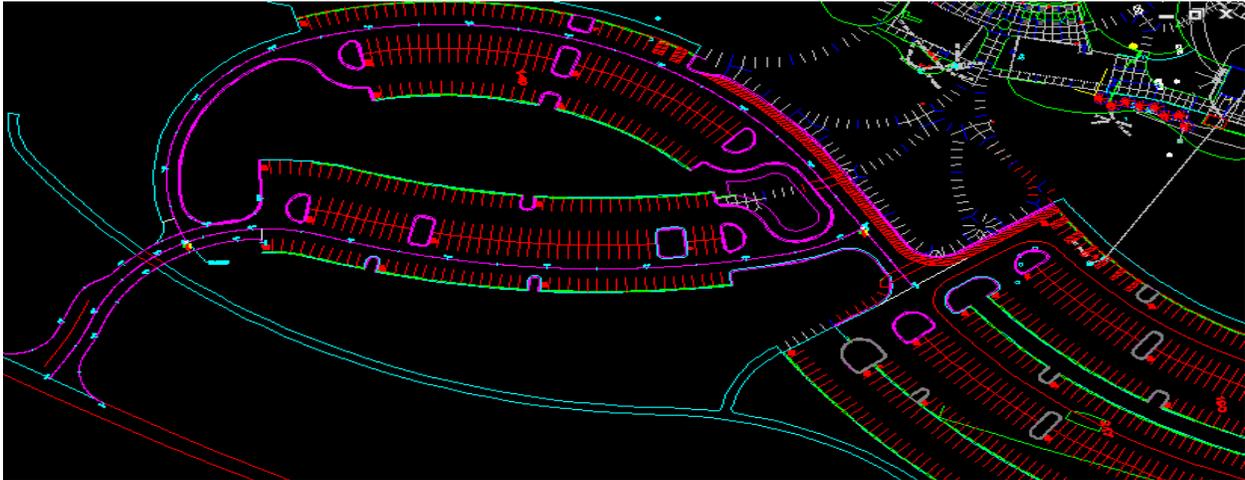
## Site Design

There are multiple approaches to site design. I recommend users choose the approach that they feel the most comfortable with. Beginners should work with feature lines while advanced users can take advantage of corridors. I also recommend utilizing both if the site consist of roads and if designing from centerlines would benefit the project workflow. We will review workflows, tips, styles and an innovative plug in to complete the suggested curb design.

The **MAGIC BLUE TRIANGLE** is the key to curb layout and design; the icon even resembles a curb. Once you find the magic; site design is simplified with feature lines. Once the magic is found, feature lines and corridors are combined to complete the model.

The magic can be completed in planview. To help visualize this design lines and curve labels are utilized to display grades and elevations.



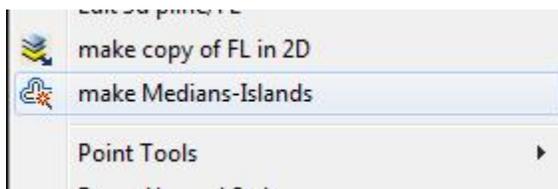


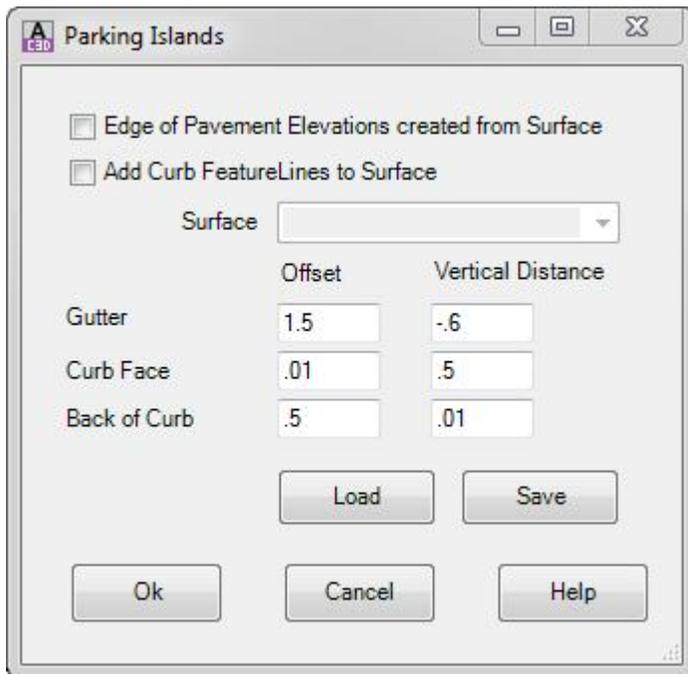
\*\*\*KEY POINTS DURING PRESENTATION

1. Blue triangle is utilized to grade feature lines interactively.
2. Lines and curve labels are placed to display grades and directional arrows.
3. Finish grade profiles are utilized to establish a corridor surface.
4. Curb is projected to simplified corridor surface

**Innovative plug-in - Dynamic Feature lines utilized for curb and median islands**

This innovative plug-in speaks for itself. Typically the magic blue triangle would be used to grade the edge of pavement or any single feature line and stepped offset command would be utilized to create additional curb lines. Unfortunately Civil 3D objects are supposed to be dynamic, but if the feature line grades change and they will offsets have to be created all over again. Solu-Around, select make median-islands command from the plug-in and enter correct offsets. Curb lines are created and are linked to the active feature line. YES, if grades are modified the offsets remain linked and are automatically adjusted to update. I have encouraged and begged Autodesk to add this technology into Civil 3D, but for now at least it is available and you can see it is invaluable.





Additional options are available in this innovative plug-in but we don't have time to discuss all of these. Two additional commands that are useful include the ability to convert and **Flatten survey figure lines**. This command also maintains curve data once the figure is flattened to a lwpolyline.

**Survey Staking** can also be accomplished with this plug-in. With one click points are added to every vertex along the feature line and can be used for staking. These points automatically update if the feature line elevations are modified.

## In Conclusion

Curb design can be completed from simple feature lines and additional curb lines can be made dynamic utilizing innovative plug-in. Corridor design requires a little bit more learning up front but provide a dynamic model that updates as centerlines are modified. Conditional subassembly automates curb design for driveways, sidewalks, and ADA ramps. Medians can be dynamic and accomplished with planning and simple workflows.