Roadway Assemblies and Corridors

Overview

This lesson describes how you create and modify assemblies and create transportation corridors for arterials and freeways. Students also create transportation corridor surfaces and create a four-way intersection using the Create Intersection wizard. In addition, this lesson describes how you create a model that combines an existing surface and a corridor model. It also describes how you view and render a model with photorealistic materials in 3D.

Assemblies for transportation road and highway corridor models are usually more complex than assemblies used for subdivision road corridor models. An assembly for a transportation corridor model involves the application of alignment superelevation and the use of other alignments and profiles to control how you generate the corridor model. Also, assemblies for transportation corridor models usually incorporate daylighting subassemblies, which project match slopes to a target surface in cut and fill conditions. The following illustration shows the subassemblies in a transportation corridor assembly that daylights to a surface and reads the alignment superelevation parameters.

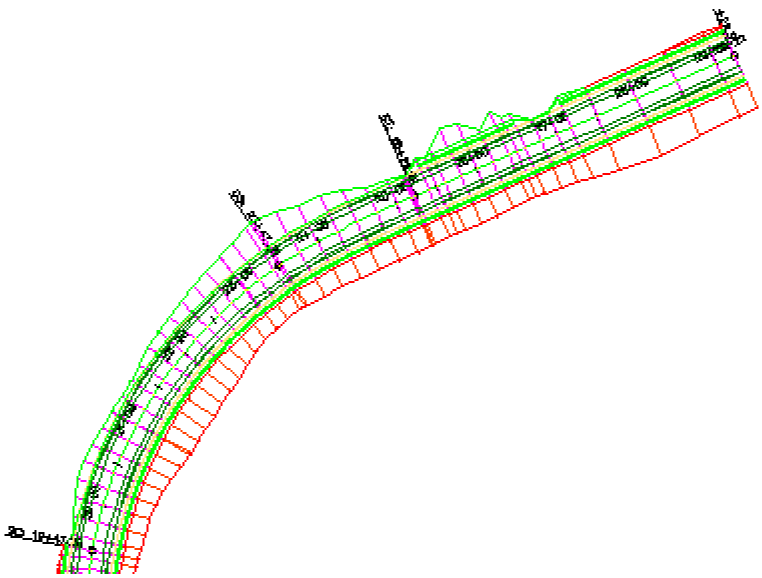
1 Lane

2 Guardrail

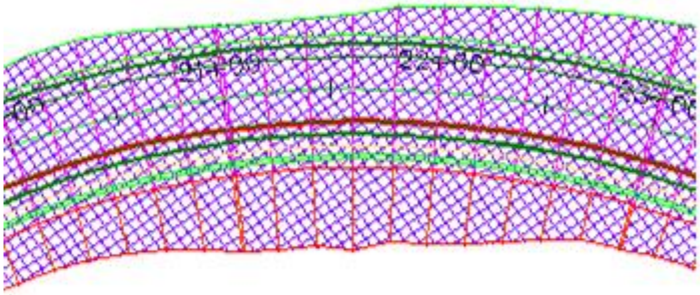
3 Shoulder

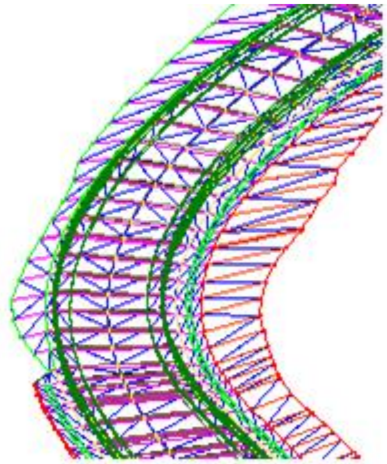
4 Daylight

Transportation corridor models are usually more complicated than subdivision corridor models because they often include more complex subassemblies, daylighting to a surface, and modeling lanes with varying widths and including superelevation. A corridor model for an arterial roadway is shown in the following illustration:

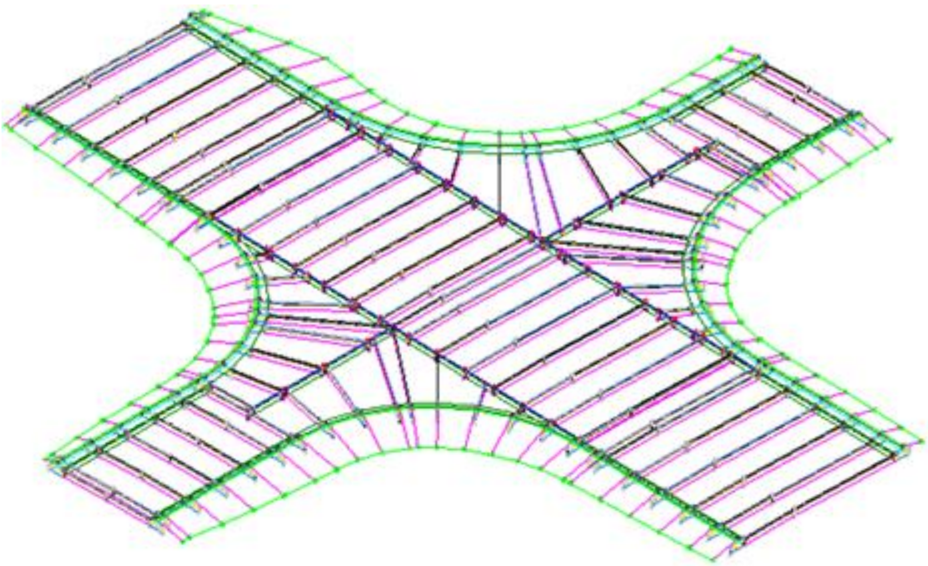


Corridor surfaces can be used for earth cut and fill volume calculations, labeling finished design grades and slopes, and calculating pipe network rim and invert elevations. A corridor surface is shown in 2D and 3D views in the following illustration.

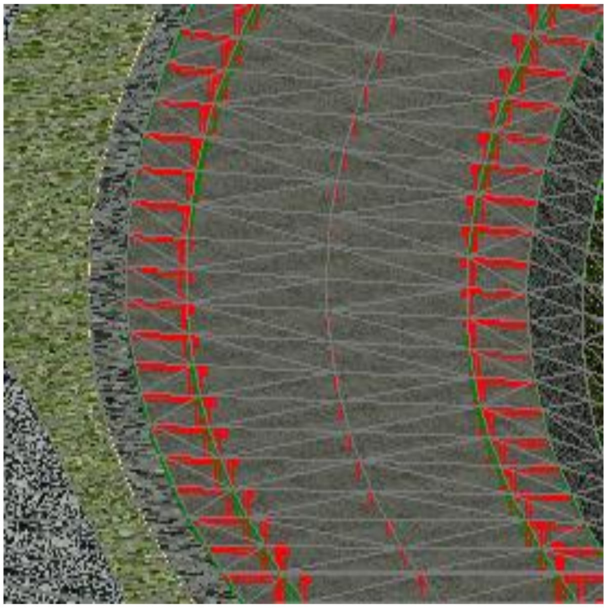




Intersection modeling can be very complex. Horizontal alignments, profiles, and assembly cross falls all require spatial coordination to correctly model an intersection. The Create Intersection wizard automatically generates and coordinates the alignments, profiles, corridor regions, and assemblies required to model the intersection and the entrances and exits. The end result is the creation of a corridor model and intersection object that are directly related to one another. The following illustration shows an intersection with curb returns, viewed in Object Viewer.



Three-dimensional models of a proposed design are very effective when you need to communicate the plan or the design to both the general public and approving agencies. You can easily apply photorealistic materials to corridors that are rendered in 3D for presentation purposes. Furthermore, you can merge the corridor model with the existing ground surface model to enhance the effect. The following illustration shows a 3D view of a road design.



Objectives

After completing this lesson, students will be able to:

- Describe how daylighting is used for matching slopes to surfaces.
- Describe assemblies and subassemblies.
- Create an assembly that consists of lanes, shoulders, guardrails, and match slopes.
- Describe a corridor model and list its components.
- Create a corridor model.
- Map corridor targets.
- View and edit corridor sections.
- Create corridor top and datum surfaces.
- Create an intersection.
- Describe how a code set style assigns rendered material styles to corridor links.
- Create a 3D road design model.

Exercises

The following exercises are provided in a step-by-step format in this lesson:

1. Create and Modify a Transportation Assembly
2. Create a Corridor Model
3. Map Corridor Targets
4. View and Edit Corridor Sections
5. Create Corridor Surfaces
6. Create an Intersection
7. Create a 3D Road Design Model

About Assemblies and Subassemblies

An assembly is an arrangement of cross-section features found on a roadway or other corridor. It represents a typical section of the corridor that you position with an alignment and a profile. You create an assembly using subassembly objects for cross-section elements such as lanes, curbs, sidewalks, shoulders, and side slopes.

A subassembly is the basic building block that makes up an assembly. A subassembly is attached to one or both sides of the assembly's baseline, and subsequent subassemblies are attached to the appropriate points of the previously attached subassemblies. An assembly can be defined by attaching all of the subassemblies to one side of a baseline, and then mirroring these subassemblies to the other side of the baseline.

Subassemblies are intelligent objects that dynamically react to changes in the design environment. Each subassembly has its own set of parameters that you can modify to change its appearance or behavior. Civil 3D provides a library of the most common, generic subassemblies that you may encounter in roadway design.

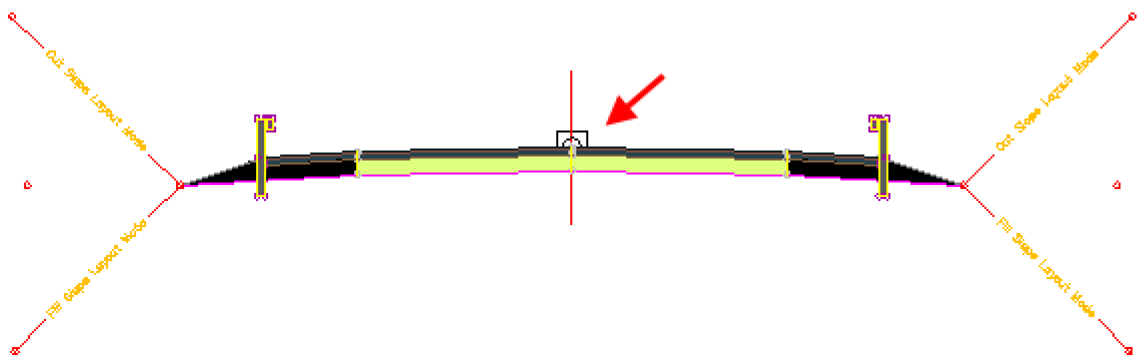
Along with using the predefined subassemblies in Civil 3D, you can also draw your own subassemblies. Civil 3D has the tools to convert your polyline shape into a subassembly. This subassembly has limited logic but can be used like any other subassembly when building an assembly. You can build your own custom subassembly with all of the parameters and functionality (or more) of those supplied in the subassembly catalog.

When you create an assembly, you can make it available for future projects and other users by saving it on a tool palette, or within the drawing template (DWT) file. You can also save collections of assemblies in an assembly set.

An assembly is made up of the following elements.

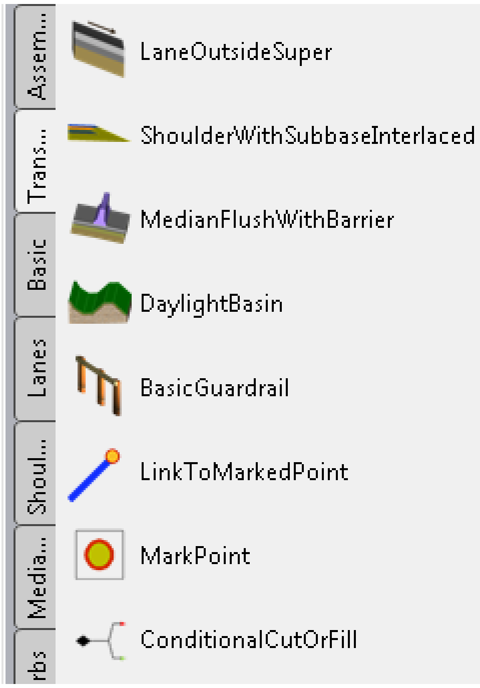
Element	Description
Baseline	The vertical line used as a display reference line for the assembly.
Baseline point	The point to which you attach subassemblies, and the point on the assembly attached to the horizontal and vertical alignment to create the corridor model. Also known as horizontal and vertical control.
Subassemblies	Cross-section element objects such as lanes, curbs, shoulders, and side slopes that you add to the assembly object. The subassemblies are added from the tool palette and attached to the assembly baseline or other subassemblies in the assembly.

The following illustration shows a simple assembly. On either side of the baseline are subassembly objects that represent a lane, shoulder, guardrail, and cut or fill slope. In this example, the subassemblies are arranged starting from the baseline point, which is indicated by the circle with a square inside it at the midpoint of the baseline.



Subassembly Components

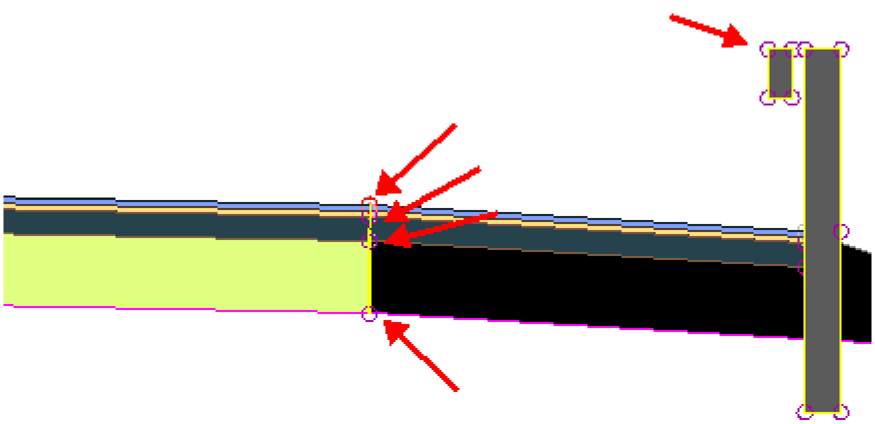
Subassemblies are made up of the following components: points, links, and shapes. Each component has unique code assignments that can be referenced for other purposes such as corridor display, design section labeling, and construction staking point generation. There are many subassemblies that you use primarily to create transportation assemblies. In the example shown in the following illustration, the user created a Transportation palette and copied subassemblies from the other palettes to it.



You use subassembly points when you:

- Generate corridor feature lines.
- Label offsets and elevations on design cross sections.
- Generate Civil 3D point objects that can be exported for construction staking.

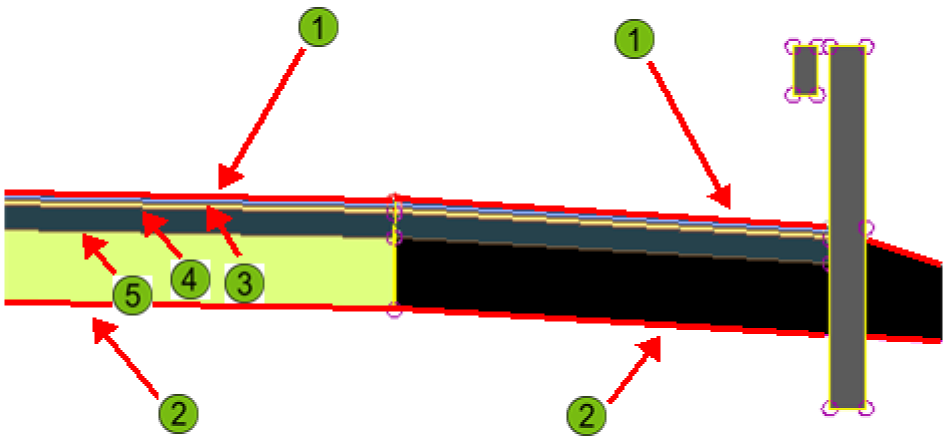
Each subassembly point has a unique identifier. A marker style controls the display of subassembly points. The following illustration shows subassembly points on the LaneOutsideSuper and BasicGuardrail subassemblies.



Subassembly links connect subassembly points. You use subassembly links when you:

- Create corridor surfaces.
- Label slopes on design cross sections.

Each subassembly link has a unique identifier. A link style controls the display of subassembly links. Subassembly links and are shown in the following illustration.



1 Top pave links

2 Datum and subbase links

3 Pave1

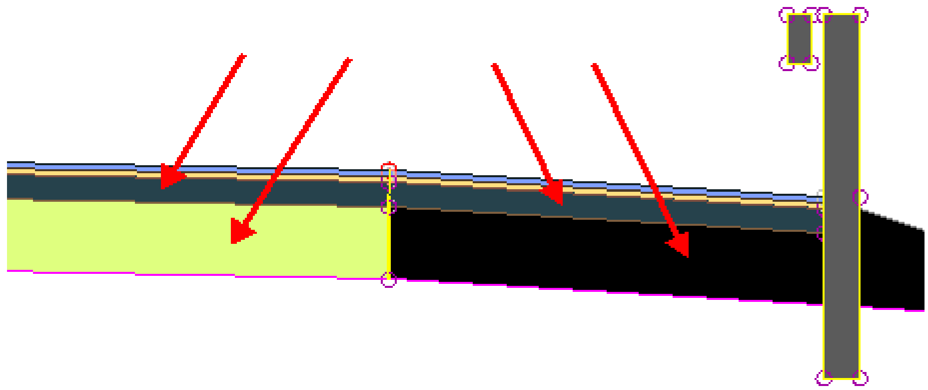
4 Pave2

5 Base

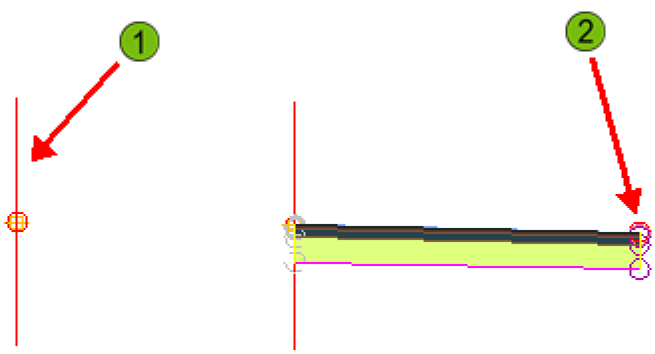
Subassembly shapes are closed areas defined by subassembly links. You use subassembly shapes when you:

- Calculate pavement structure volumes.
- Label pavement structure end areas on design cross sections.

Each subassembly shape has a unique identifier. A shape style controls the display of the subassembly shapes. Subassembly shapes are shown in the following illustration:



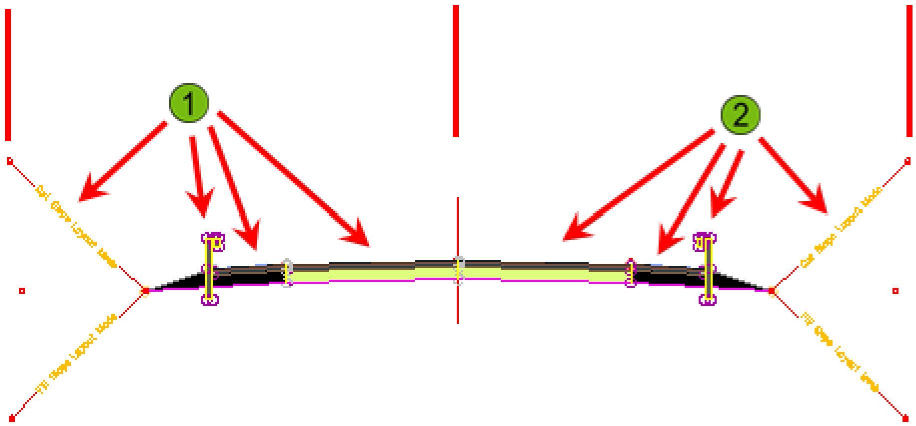
Subassemblies on an assembly are organized in assembly groups. When you add subassemblies to an assembly, you can either select the assembly object, or you can select a marker point on a subassembly that was already added to the assembly. These are shown in the following illustration.



1 Assembly (no subassemblies)

2 Subassembly marker

When you select the assembly object to add the subassemblies, a new assembly group is created. When you select a subassembly marker to add a subassembly, the subassembly is added to an existing assembly group. Most subassemblies have a group for the left-side subassemblies and the right-side subassemblies. This is shown in the following illustration.



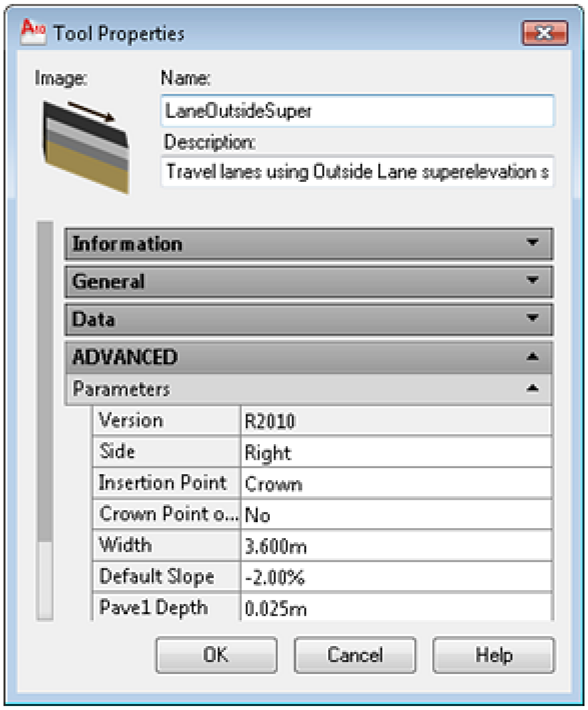
1 Left-side assembly group

2 Right-side assembly group

Subassembly Parameters

Subassemblies have input and target parameters that are used to change their geometric configuration. Subassembly input parameters control the size, shape, and geometry of the subassembly. Custom subassembly input parameters can be saved on a tool palette and also specified when you add the subassembly to an assembly.

For example, the most common subassembly for modeling a lane is the LaneOutsideSuper subassembly. The LaneOutsideSuper subassembly has input parameters that set the general configuration values for the lane such as width, pavement depth, and cross fall. The default input parameters for the LaneOutsideSuper subassembly are shown in the following illustration.



Some subassemblies have required or optional target parameters. Target parameters control how the subassembly functions. The object the subassembly connects to (alignment, profile, or surface) determines the function. Daylighting subassemblies have required surface target parameters. You are required to specify a target surface to which the subassembly daylights.

The lane subassemblies have optional width and elevation target parameters that can be alignments and profiles. You can optionally override the lane width input parameter by targeting an alignment. This is how you vary the width of the lane in a lane taper. You can also optionally override the default slope input parameter by targeting a profile to change the lane cross fall.

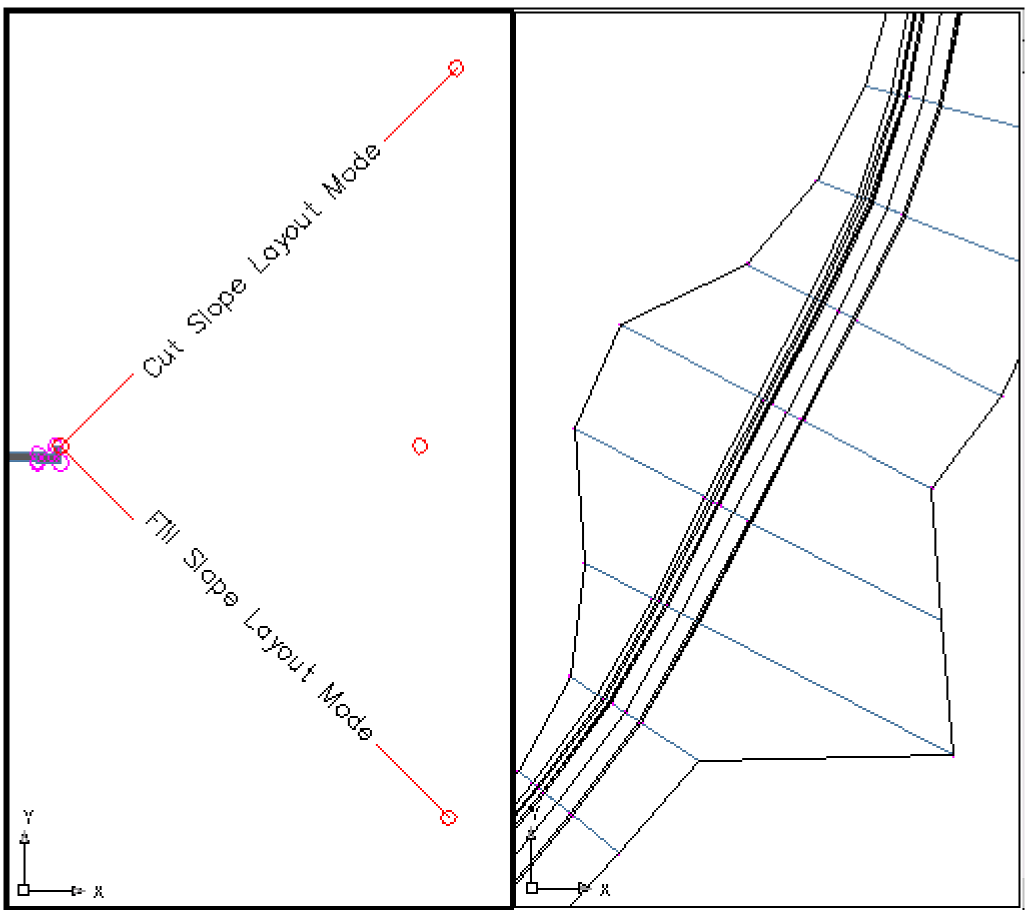
About Daylighting

As with assemblies used for subdivision corridor models, assemblies for transportation corridor models are made from subassemblies. The primary difference is that transportation corridor models usually involve daylighting to a surface, and the optional allowance for cut-and-fill ditches.

Daylighting is a function performed by a specific type of subassembly, where a slope is extended from that subassembly until it intersects with a surface. The point where this slope intersects the surface is called the daylight point, and if all these points were joined together as you traverse down the length of the alignment, the resultant line would be called the daylight line. This daylight line typically represents where the existing model and proposed model meet and is usually the limit of construction.

For daylighting subassemblies that are used to project match slopes to surfaces, you are required to specify a surface model as the target parameter. Without the target parameter, the subassembly would not function. Lane subassemblies have optional target parameters such as lane width. A default input parameter for a lane subassembly is the lane width. The optional lane width target parameter would use another alignment to override the default lane width value. This is useful when pavement widths vary at turning lanes and lane tapers.

The most common subassembly to daylight to a surface is called BasicSideSlopeCutDitch. The BasicSideSlopeCutDitch subassembly has a required target parameter for a surface. When you create the corridor model with an assembly that contains BasicSideSlopeCutDitch, you must specify the target surface for the daylighting subassembly. This is shown in the following illustration.



The image on the left shows the subassembly as part of the right side of an assembly, attached to a curb and gutter. The image on the right shows the result of the logic built into the subassembly when it is used in a corridor model. The width of the slope adjusts to account for changes in the terrain.

Cut and Fill Slope Parameters for Daylighting

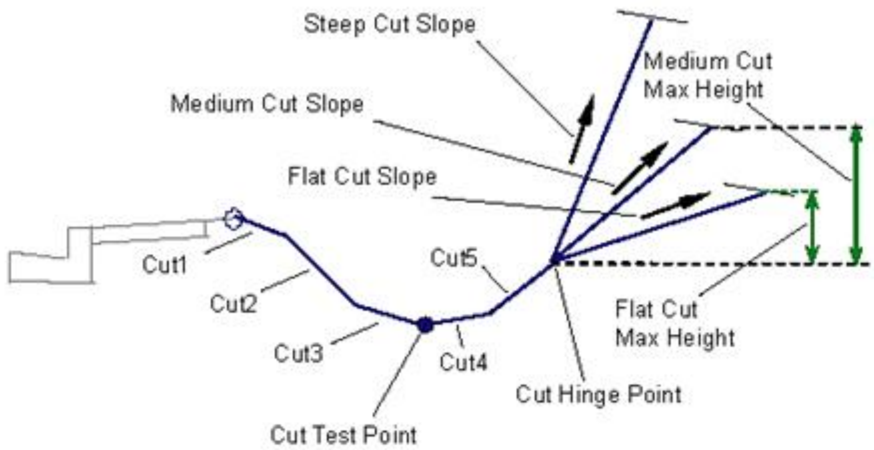
The grade (angle) that the slope line is extended upwards or downwards to intersect the existing surface is determined by the slope assembly's cut slope and fill slope parameter values. To extend the subassembly to the existing surface, the grade is determined by the cut slope and fill slope parameter values of the slope assembly. If the slope subassembly object is located above the existing surface at any particular station along the alignment, then it is considered to be in a fill condition. It projects the slope downward until it intersects the existing surface using the value defined for its fill slope parameter. Conversely, if the slope assembly is located below the existing surface at any particular station, it projects a slope upward toward the existing surface based on its cut slope parameter value.

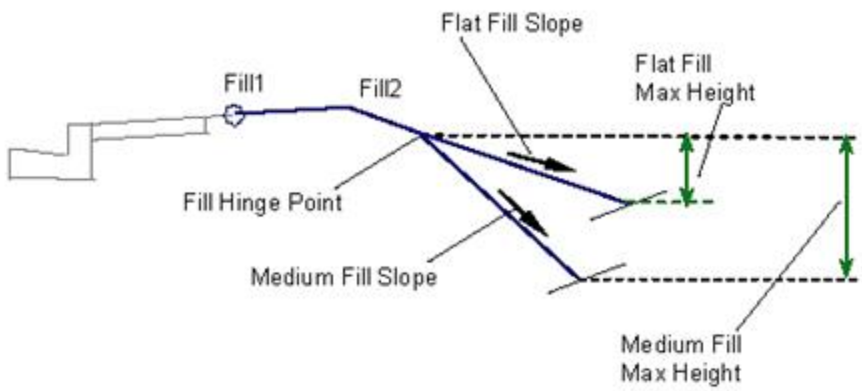
Some slope subassemblies can be very complex in their functionality. In general, these slope assemblies are designed to check for cut or fill conditions before projecting to calculate the daylight point. For example, a slope subassembly might have different cut slope values that depend on the depth of cut at that station. This subassembly might have maximum cut heights for flat, medium, and steep slopes built in. When Civil 3D is evaluating the assembly at a particular station along the alignment, it iterates through these three cut height criteria to determine the appropriate slope to extend toward the existing surface.

- The subassembly first attempts to project a slope specified in the flat cut slope parameter. If that slope intersects the surface, and the height of the daylight point above the subassembly's hinge point is less than the flat cut maximum height, then the daylight point is created. If the height exceeds the allowable flat cut value, Civil 3D starts the process again and uses a steeper slope value as defined by the medium cut slope and projects to the surface.
- If it can find the surface within the height specified by the medium cut/maximum height parameter, the daylight point is established.
- If not, Civil 3D uses the steep cut slope value to project toward the surface and define the daylight line.

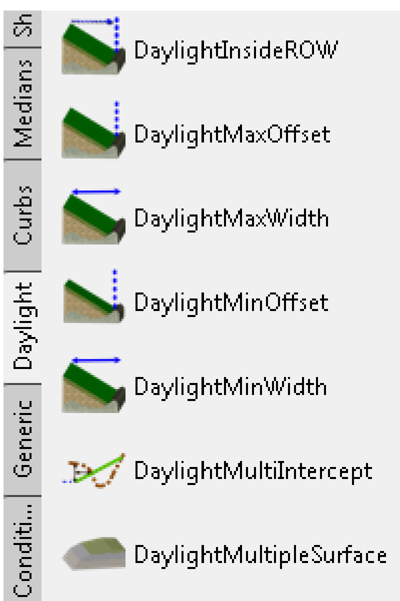
This process is repeated at every station along the alignment where this subassembly exists.

A The following illustration shows how a daylighting subassembly calculates the daylighting in both cut and fill conditions. In cut conditions, you can use different subassembly input parameters to vary the ditch configuration. You can also vary the cut slope based on the depth of cut. In fill conditions you can vary the fill slope based on height of fill.



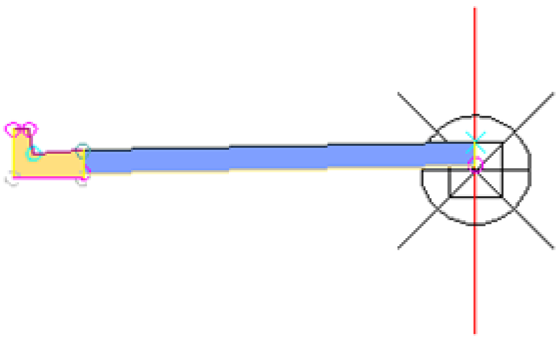


The following illustration shows some daylighting subassemblies:



Creating Assemblies

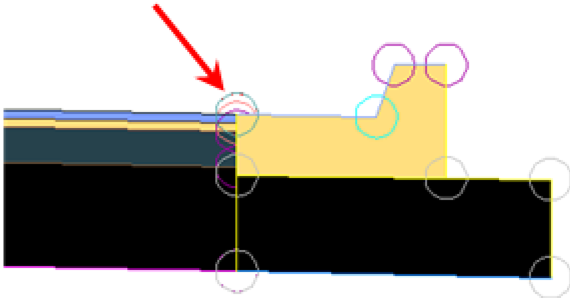
You create an assembly by adding the assembly to the drawing area, and then using the baseline and baseline point as a visual guide for the addition of subassemblies. Sets of subassemblies are included in the tool palettes. You can also select subassemblies from the subassembly catalog and place them on the tool palettes. The following illustration shows a basic assembly with baseline, basic lane, and curb and gutter subassemblies.



Process Description

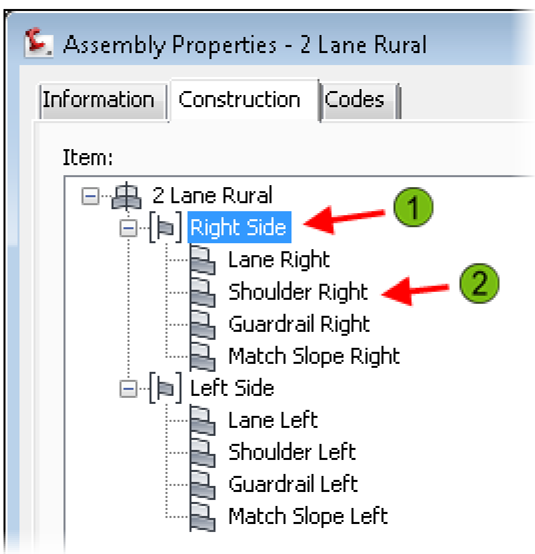
To create an assembly you launch the Create Assembly command from the ribbon, assign a name to the assembly, and insert the assembly to the drawing. The assembly object is shown in the following illustration.

After you insert the assembly object you begin by adding the subassemblies to the assembly. The first subassemblies you add are added to the assembly, and you can pick any part of the assembly object. As you move away from the assembly you need to add subassemblies to other subassemblies. You select the subassembly markers as insertion points for the other subassemblies. In the following illustration, the arrow points to one of subassembly markers.



Modifying Assembly Properties

When you modify the properties of the assembly, you can change subassembly input parameters such as lane width, cross slope, pavement structure depth, and daylight slope. Each subassembly has different input parameters. You can also rename the assembly groups and the subassemblies within the assembly to organize the content of the assembly. The following illustration shows the Assembly Properties window with renamed assembly groups and renamed subassemblies:



1 Assembly group

2 Subassemblies

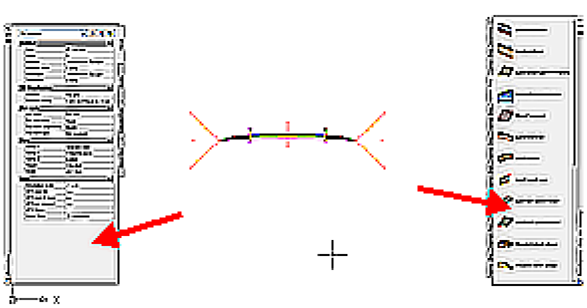
Finally, when you modify the properties of an assembly, you can change the appearance of the assembly by changing the code set style. The code set style is a collection of marker styles, link styles, and shape styles. You can apply a code set style to assemblies, corridors, and design sections.

Guidelines

Keep the following guidelines in mind when you create assemblies.

- For every subassembly that you add to your assembly, you should read the Help file to understand how the subassembly behaves and which default settings you can modify.
- Modify the default subassembly input parameters on the tool palette to suit common design configurations.
- Rename the subassemblies on the tool palette to clearly indicate key geometric properties, such as width, slope, and grade.
- Subassemblies added to the assembly are organized into assembly groups. When you select the assembly object to add subassemblies, a new assembly group is created. When you modify the properties of the assembly, rename the groups with indicative names, such as LEFT, RIGHT, and so on.
- To create a mirror image of a subassembly or group of subassemblies, use the Mirror command, which is available on the shortcut menu.
- Once the assembly is complete, you should go back and rename each of the subassemblies to give them descriptive names. This may not seem important early in a project when you have a simple assembly, but roadway jobs can get very complex. Numerous assemblies can be applied to any one alignment. It is good practice to document the components of an assembly so that other team members working on the project understand the parts and their functions.
- To simplify the assembly creation process, create a workspace that shows the Tool Palettes window on one side of the screen and the Properties window on the other side.

The following illustration shows an assembly creation workspace that displays just the Properties and Tool Palettes windows. This workspace makes it easier and quicker to create an assembly.



About Corridor Models

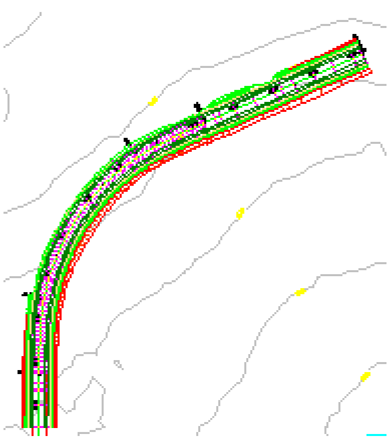
A corridor model is a three-dimensional representation of the design for a roadway, railway, or other transportation facility. Corridors can also be used to model channels, berms, and any other civil engineering feature that can be represented with a typical section. You create a corridor model with an alignment, a layout profile, and an assembly. By incorporating constraints and rules into the corridor design, you can manage and control how the corridor model interacts with the terrain and other alignments and profiles.

When you create a corridor, you can create complex models for transportation facilities such as roads, highways, and railways by adding corridor regions or referencing more than one alignment baseline. Almost any condition that your design may call for can be modeled by using the corridor functionality.

Transportation corridors are complex corridors that:

- Involve surface daylighting.
- Often read superelevation parameters assigned to an alignment.
- Require the use of other horizontal and vertical alignments or polyline geometry to control their configuration.

Subdivision corridor models use assemblies that reference basic lane, curb, and sidewalk subassemblies. In contrast, transportation corridor models use assemblies that reference a number of different subassemblies used for daylighting, shoulder, road reconstruction, and retaining walls. An example of a transportation corridor is shown in the following illustration.



Additional Components

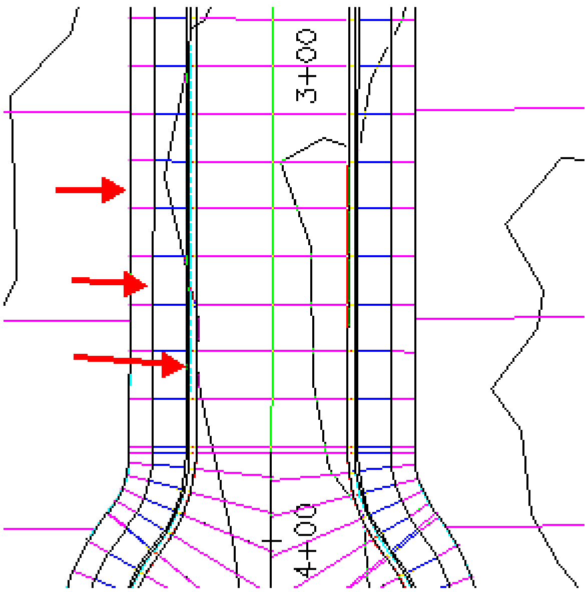
In addition to the alignment, layout profile, and the assembly, corridors also consist of feature lines, regions, and baselines.

Feature lines are the longitudinal lines along the corridor that are used to represent typical cross-section points such as road crowns, pavement edges, gutter flow lines, sidewalk edges, and daylighting lines. Feature lines are part of the corridor model and are created by connecting the subassembly points of the corridor assembly.

Corridor regions are independent station ranges to which you can apply different assemblies to model differing cross-section configurations. A corridor can have many corridor regions.

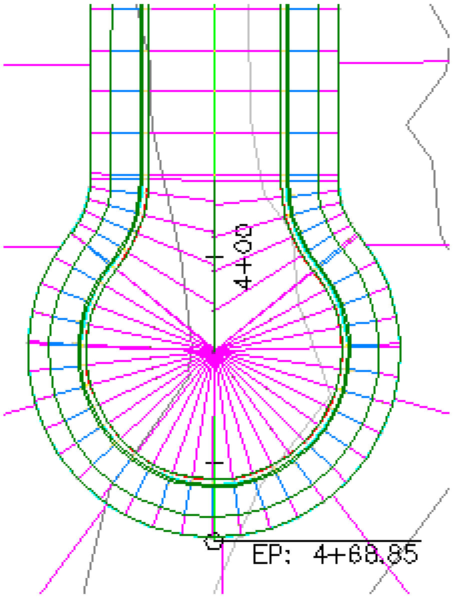
The *baseline* is the alignment that is used to control the creation of a corridor model. A corridor model can be constructed from several baselines. A corridor for a subdivision road with a cul-de-sac uses a centerline alignment baseline for the main section of the road, and an edge of pavement alignment baseline for the cul-de-sac.

No The following illustration shows feature lines on a corridor model for a subdivision road with a cul-de-sac.



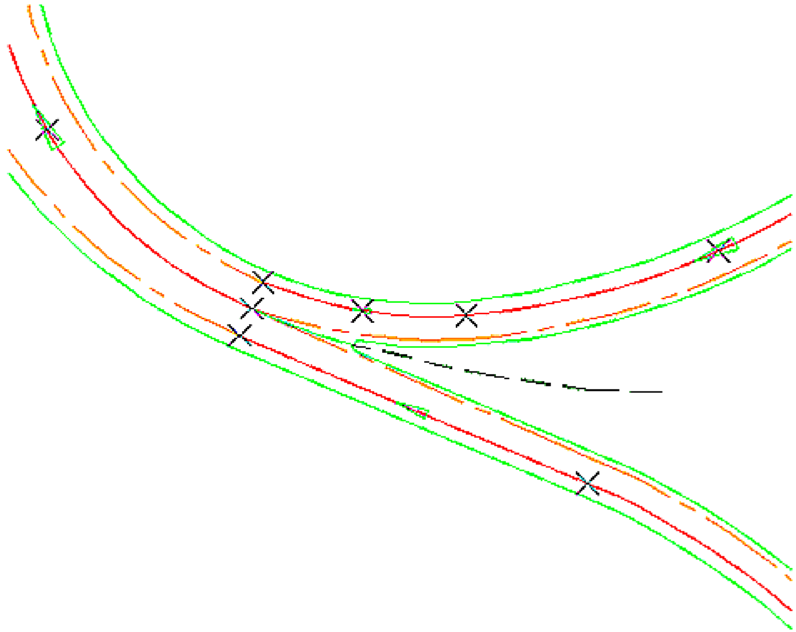
Corridor Examples

A corridor model of a cul-de-sac is shown in the following illustration.



Complex Corridor Examples

The illustration shows three centerline alignments that represent an on-ramp (entering from the top-right corner), an off-ramp, and the two-lane road where the two ramps join. The alignments for the on- and off-ramps end at precisely the same location as the beginning of the two-lane segment, which creates a continuous corridor from the three segments. The illustration shows the same alignments after a corridor is created. Different assemblies are applied along the alignments to create a single corridor with lanes and ditches that merge together seamlessly. Each alignment is associated with the corridor model by using a different baseline entry in the corridor properties. The illustration shows a transition between regions in a corridor. The upper region of the corridor uses an assembly with a plain shoulder. The lower region uses a similar assembly that has a curb and gutter instead of the paved shoulder.



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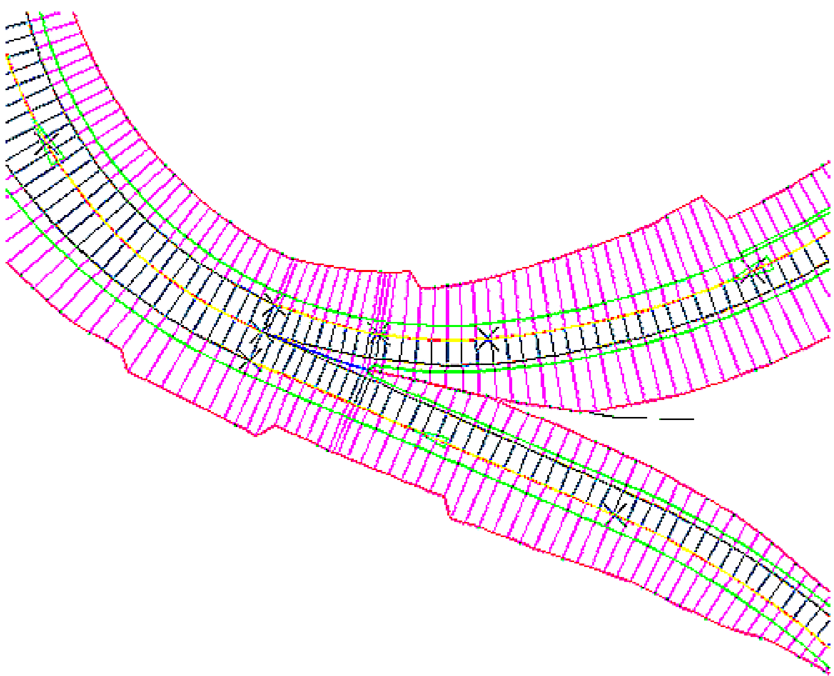
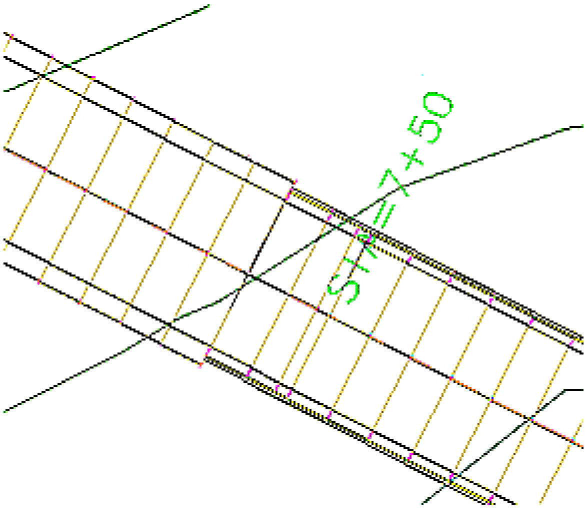
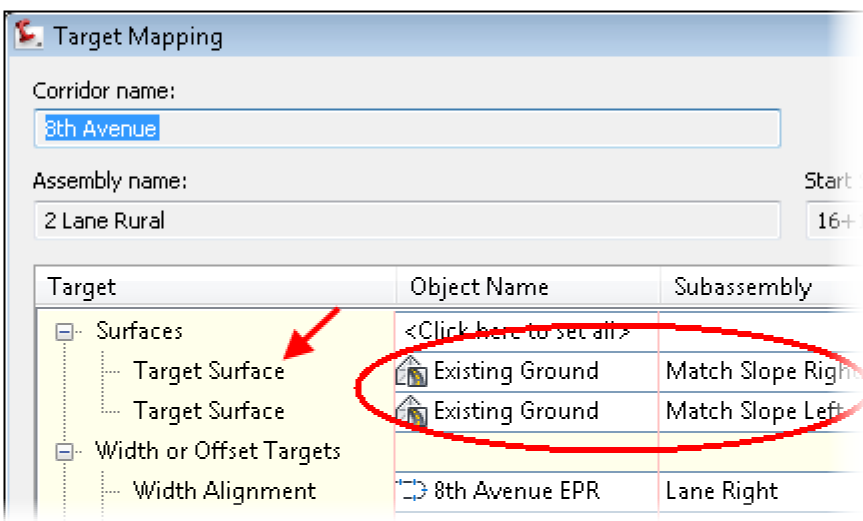


The illustration shows a transition between regions in a corridor. The upper region of the corridor uses an assembly with a plain shoulder. The lower region uses a similar assembly that has a curb and gutter instead of the paved shoulder.

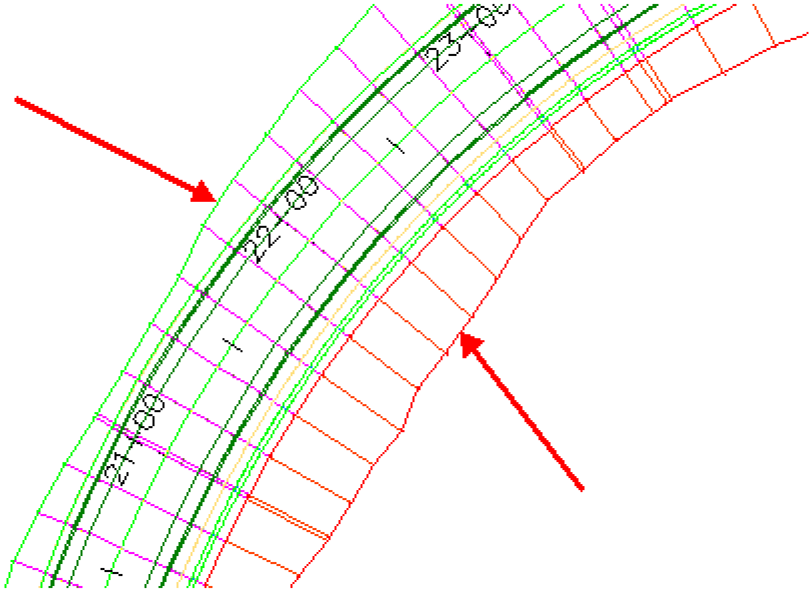


Target Mapping

When you create a corridor model, you assign a specific surface as a target parameter for the daylighting subassemblies. This process is called target mapping and is shown in the following illustration.



When you assign a surface as a target for the daylighting subassemblies, a feature line where the match slopes meet the surface is generated. This is called a daylight feature line and is shown in the following illustration.

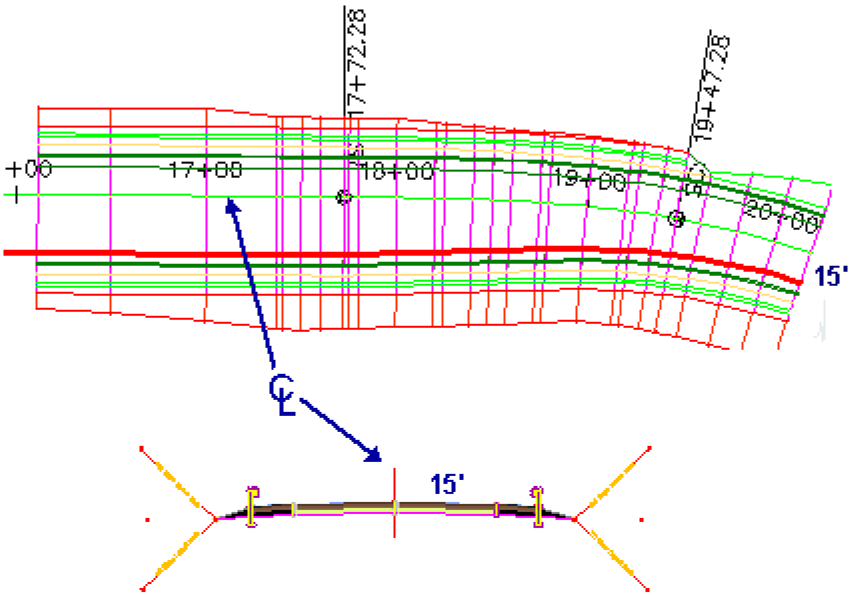


Target mapping for daylighting subassemblies is required because daylighting subassemblies does not work without assigning a surface. If you modify the subassembly properties and change the match slopes, or if the surface changes, the location of the daylight feature lines automatically recalculates.

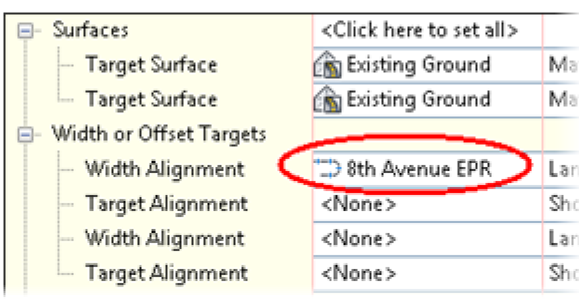
Many of the lane subassemblies can optionally use alignments and profiles as targets to override the default lane width and slope. The Help file for each subassembly indicates the target parameters. The following illustration shows the target segment of the Help file for the LaneOutsideSuper subassembly/.

Parameter	Type	Description	Status
Width	Alignment	May be used to override the fixed lane Width and tie the edge-of-lane to an offset alignment.	Optional
Outside Elevation	Profile name	May be used to override the normal lane slope and tie the outer edge of the travel lane to the elevation of a profile.	Optional

You can model parallel lanes and tapers at intersection locations by assigning a target alignment at the edge of pavement location to the lane subassemblies in the assembly. The result is a corridor model that stretches the lane to accommodate the varying width through the taper and the fixed width at the parallel lane locations. This is shown in the following illustration.

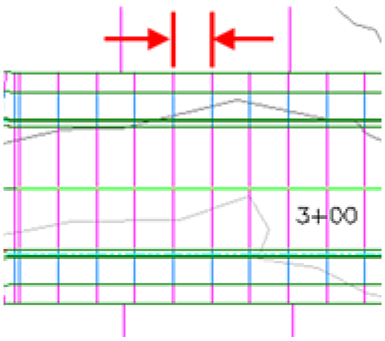


To assign corridor targets, you modify the corridor properties. The illustration shows the Lane Right subassembly targeting the 8th Avenue EPR alignment to vary the width. The illustration also shows the Match Slope subassemblies targeting the Existing Ground surface.



Creating Corridor Models

To create a corridor model, you must specify an alignment, a vertical alignment, and an assembly. The assembly is processed along the horizontal alignment at a prespecified "assembly insertion frequency," which is the increment along the alignment where the assembly is inserted to create the corridor. This is shown in the following illustration.



The assembly insertion frequency is not related to the increment at which cross sections can be created, and can be changed when you modify the properties of the corridor.

The alignment you specify when you create the corridor is called a *baseline*. The baseline is the alignment that is used to control the creation of a corridor model. You can specify multiple baselines when creating a corridor. This is how you create a corridor that incorporates a cul-de-sac. Complex corridor models can incorporate several baselines.

If the assembly you use has subassemblies that require target assignments, such as the daylight subassemblies, when you create the corridor you have the option to specify the targets. The target for a daylight subassembly would be a surface model. Typically, subdivision assemblies do not use daylight subassemblies.

Corridor *regions* are segments of a corridor that are defined by an independent station range and assembly. When you use multiple corridor regions, you can use multiple assemblies to model the corridor over a different station range. This makes it easy to model widely variable cross-section configurations with a single corridor model.

To create a corridor model, you can use the Create Simple Corridor command, or you can use the Create Corridor command. Each command results in the same corridor object. However, the Create Corridor command is generally used when you create corridors that model more complex cross-section configurations.

Most assemblies created for transportation corridor models use daylighting subassemblies to project match slopes to a surface in cut and fill conditions. The daylighting subassemblies use required target parameters to indicate which surface to project to. You can assign targets when you create the corridor, or when you modify the corridor properties.

Keep the following guidelines in mind when you create corridor models.

- When you create a corridor model, be aware of the station limits of the layout profile. For example, if an alignment is 1000 feet long, and the layout profile is 900 feet long, the corridor model should be calculated only over the length of the layout profile. When you modify the properties of a corridor model, change the starting and ending stations for the corridor model to coincide with the limits of the layout profile. When you do this, you do not receive corridor processing errors.

- When creating design profiles for corridor models, it is good practice to extend the design profiles beyond the starting and ending stations of the corridor model in order to eliminate corridor processing errors.

- When you create a corridor model, you can use the Create Corridor command or the Create Simple Corridor command. Both commands result in the same object. However, the Create Simple Corridor commands offers fewer input options to create the corridor.

- When you create the corridor model, make sure that you specify a station range for each region so that you can assign the appropriate target. Ensure that you have layout profile data for the station range over which the corridor regions are created.

- Use representative naming conventions for alignments, profiles, corridors, and corridor regions. This makes it easier to create and manage corridor data.

About Corridor Surfaces

After you create a corridor model, you can create corridor surfaces. A corridor surface represents a finished layer of a corridor design. It is a Civil 3D surface object created from the links or feature lines of a corridor model. Corridor surfaces are dynamic and automatically update when the corridor changes. They are displayed in the Surfaces collection on the Prospector tab of the Toolspace window. Corridor surfaces can be displayed, annotated, and sampled just like regular surfaces.

Corridor surfaces that represent the finished grade are used for the following:

- Labeling finished design spot elevations, grades, and slopes.

- Calculating rim and invert elevations for pipe networks.

- Modeling and creating surfaces that consist of both existing ground and finished design data.

- Corridor surfaces that represent the subgrade are used for calculating earth cut and fill volume calculations.

Creating Corridor Surfaces

You use corridor data to create a corridor surface. When you create a corridor surface, you can use either the subassembly links or the corridor feature lines as corridor data. The most common corridor data is the subassembly links.

To create a corridor surface you modify the corridor properties and use commands available on the Surfaces tab of the Corridor Surface dialog box. The most common corridor surfaces incorporate the Top subassembly links and the Datum subassembly links.

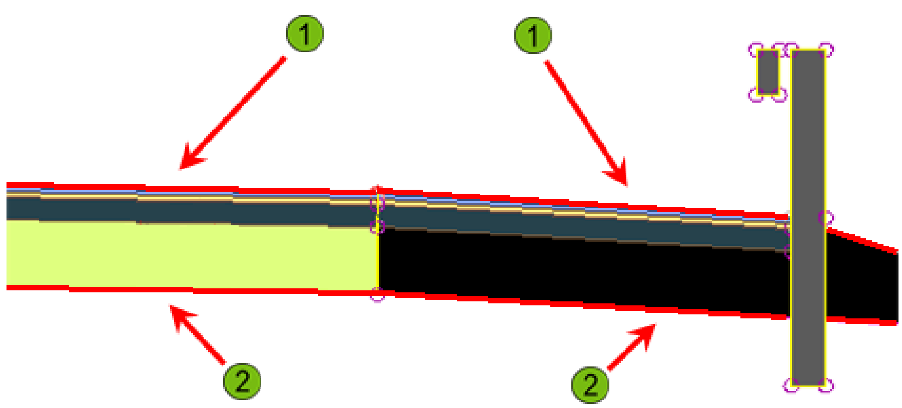
Top Corridor Surface Corridor surfaces using the Top subassembly links can be used for the following:

- Creating finished design contours.
- Labeling finished spot elevations and slopes.
- Creating finished grade construction staking data.

Corridor surfaces using the Datum subassembly links can be used for the following:

- Calculating earth cut and fill quantities.
- Creating subgrade construction staking data.

Top and datum links are shown in the following illustration.

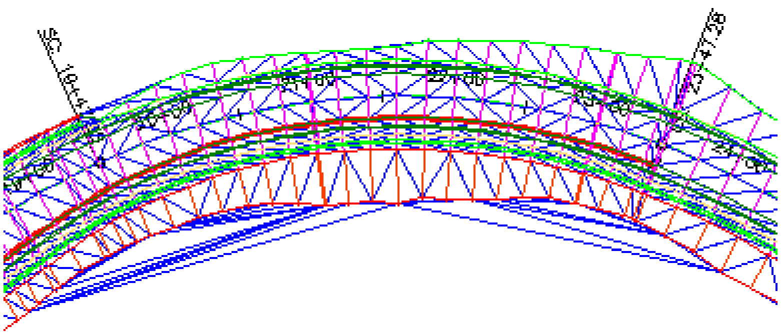


1 Top pave links

2 Datum and subbase links

Corridor Boundaries

When you create a corridor surface that represents the finished ground and the subgrade, you must use boundaries to contain the triangulation within certain limits. Boundaries for finished ground and subgrade corridor surfaces are generally created from the corridor extents. To add corridor surface boundaries, you modify the properties of the corridor model. You can use the corridor extents to define the surface boundary, or you can create your own surface boundary. The following illustration shows a corridor surface without a boundary, created from the datum links.



Guidelines

Keep the following guidelines in mind when you create corridor surfaces.

- You typically create corridor surfaces from either top links or datum links.
- You can use the corridor extents to create an outer boundary for the corridor surface.

About Intersections

Intersections represent the juncture of two roads. They are modeled with a corridor, and are the combination of horizontal and vertical geometry elements, and corridor regions.

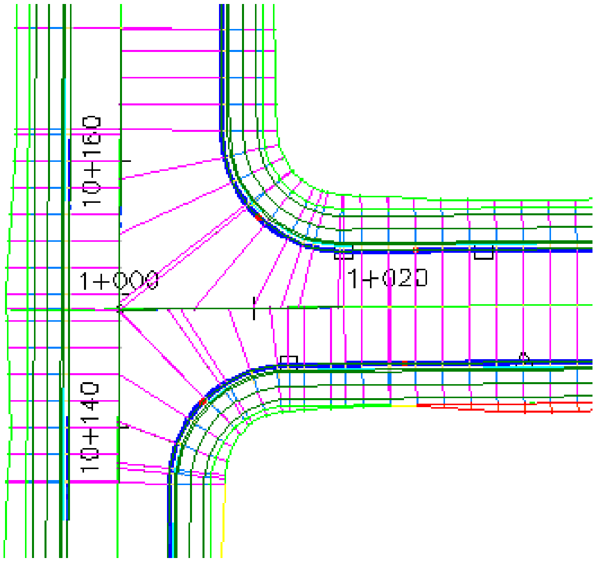
Driving Direction

When you model an intersection, you specify curb return parameters for the intersection incoming and outgoing roads. A four-way intersection is divided into four quadrants, each with an incoming and outgoing direction. The driving direction is used to identify the direction in which the quadrant curb returns are drawn when an intersection is created. The options are Right Side of the Road and Left Side of the Road. For left-side driving, the curb return alignments in intersection objects are drawn starting on the left side of the outgoing road, and ending on the left side of the merging road.

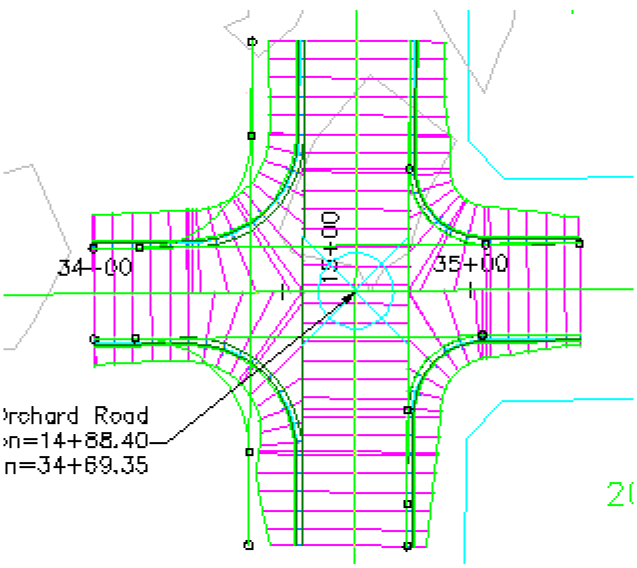
To set the driving direction, you modify the Ambient Settings in Drawing Settings. The default driving direction for a drawing is Right Side of the Road. In jurisdictions where people drive on the left side of the road, make sure you change this drawing setting.

Intersections Examples

The following illustrations show a three-way intersection and a four-way intersection created using the Create Intersection wizard.



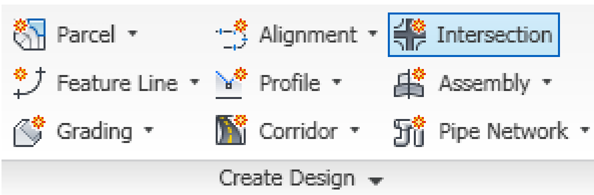
Three-way intersection



Four-way intersection

Create Intersection Wizard

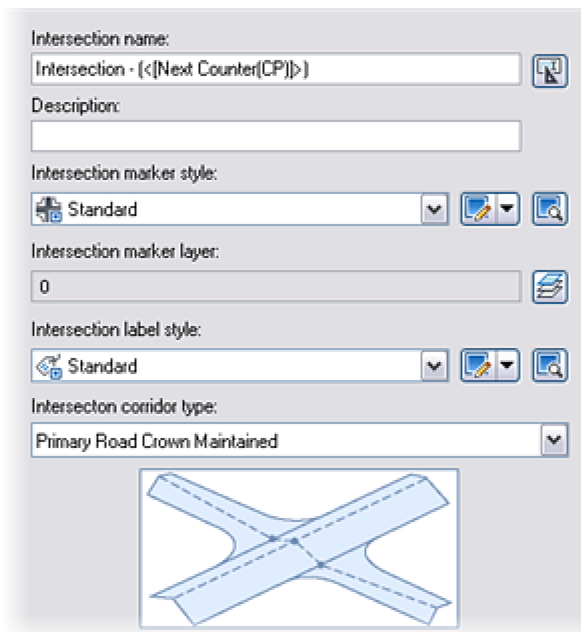
In AutoCAD Civil 3D 2010, the task of creating an intersection has been simplified by the addition of the Create Intersection wizard. The Create Intersection wizard is launched from the ribbon.



There are three pages you configure when working with the wizard.

General Page

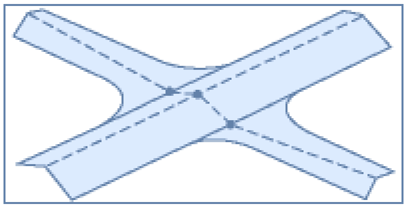
Use the General page to set the basic properties for the intersection, including the intersection name, an optional description, the intersection marker style, the intersection label style, and the intersection corridor type.



Corridor Type

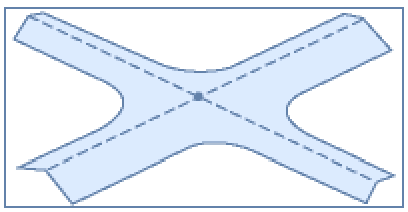
The intersection corridor type value, in the Create Intersection wizard, determines the pavement elevations within the area of the intersection. If the intersection corridor type is Primary Road Crown Maintained, the crown of the primary road is maintained, while the profile (crown) of the secondary road is adjusted to match the edge of the primary road and the intersection point. The crown (profile and edges) is not affected.

The following illustration shows the primary road crown maintained through the intersection.



If the intersection corridor type is All Crowns Maintained, the profile of the side road is adjusted to match the main road elevation at the intersection point. The main road profile is not affected. Curb returns profiles are generated to fit the profiles for the offset alignments.

The following illustration shows all crowns maintained through the intersection.

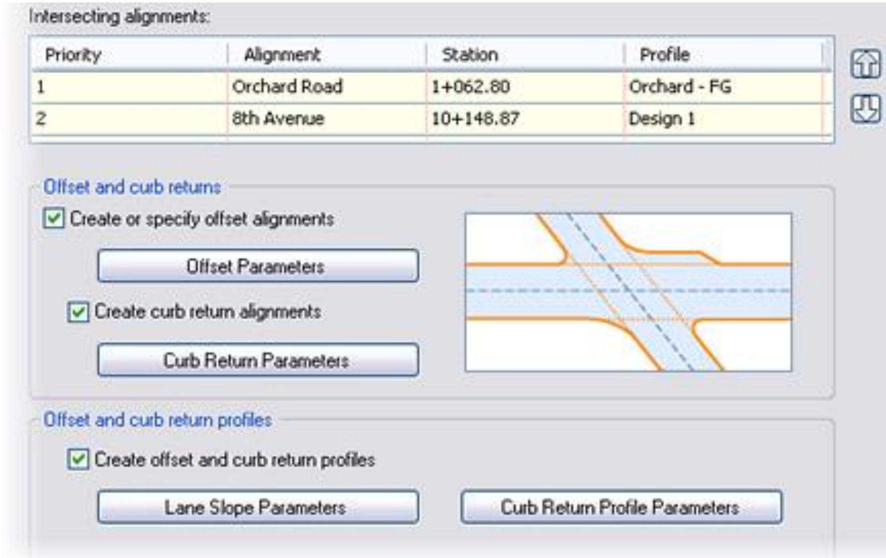


Geometry Details Page

Use the Geometry Details page to specify a variety of details about the geometry of the intersection object. You can:

- Change the priority of an alignment. Once the intersection is created, you cannot change the priority value.
- Specify the Offset Parameters to generate the left and right offset alignments for the primary and secondary roads.
- Specify Curb Return parameters for the geometry and radius of the curb return for each intersection quadrant.
- Specify Lane Slope parameters to calculate design profiles for the offset alignments.
- Specify Curb Return Profile parameters to calculate profiles for curb return alignments.

To set the geometry details for an intersection, you modify the Geometry Details page of the Create Intersection wizard.



Corridor Regions Page

Use the Corridor Regions page to specify details about the corridor regions included in the intersection object. You can:

- Enable the Create Corridors in the Intersection Area option. When this option is selected, new corridor objects are created in the intersection area. When this option is not selected, the rest of the options on this page are not available for editing. You can create a new corridor. Or, you can add to an existing corridor, if your drawing contains corridors. You can also specify the surface to use for daylighting.
- Select an assembly set to import, and therefore use, for creating the intersection.
- Specify the assembly that defines each section in corridor region included in the intersection.

Assembly Sets

A corridor that models an intersection uses several assemblies to model the different areas of an intersection. Assembly sets can be loaded from an external file, or they can be saved in a drawing. You can also create your own custom assembly sets.

For example, an intersection corridor where the primary road crown is maintained makes use of an assembly set for the following intersection corridor region section types:

- Curb Return Fillets
- Primary Road – Through Pavement
- Primary Road Full Section

- Primary Road Part Section – Daylight Left
- Primary Road Part Section – Daylight Right
- Secondary Road Full Section
- Secondary Road Half Section – Daylight Left
- Secondary Road Half Section – Daylight Right

Creating Intersections

When you model intersections in AutoCAD Civil 3D, you create an intersection object and a related corridor model. First, you create the road geometry (centerlines and profiles) for the primary and secondary intersecting alignments. Second, you create an existing ground surface model targeted with the daylighting subassemblies used to model the intersection. Finally, you use the Create Intersection wizard to complete the intersection.

Process Description

To create an intersection, you can start with the following road geometry combinations:

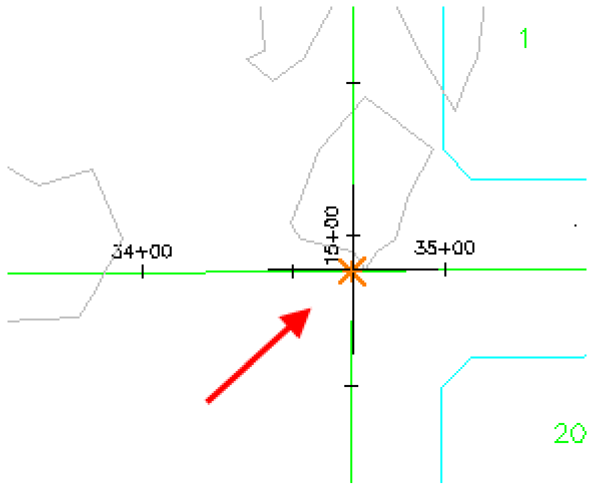
- Two intersecting alignments, and their design profiles.
- Two intersecting alignments and their design profiles; with one or more road edge offset alignments or their profiles, or with both offset alignments and their profiles.

In the first scenario, the alignments and profiles for the offset and curb return alignments are automatically created with user input design parameters such as offset distances and radii. In the second scenario, the offset and curb return alignments and profiles are already created.

Process: Creating an Intersection

To create an intersection, you use the Create Intersection wizard.

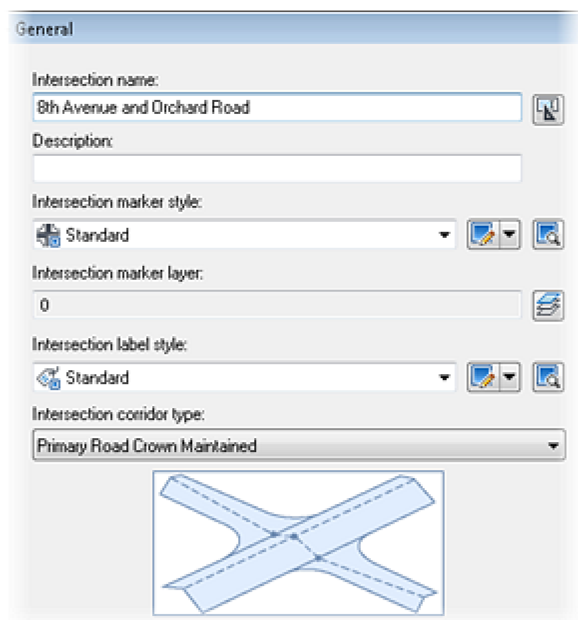
1. Launch Create Intersection command.



   - Select an intersection point for two alignments.
   - Select the main road alignment for which the road crown will be maintained.

   Note: When you create a four-way intersection, you must specify the primary (main) road alignment. If you are creating a three-way (T-shaped) intersection, the through road is automatically selected as the primary road alignment.

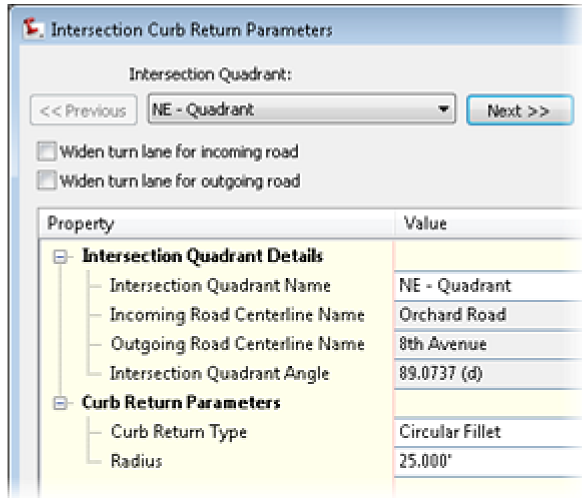
2. Configure the parameters in the General page of the Create Intersection wizard.



   - Provide intersection name and description.
   - Select intersection label styles.
   - Specify corridor intersection type.

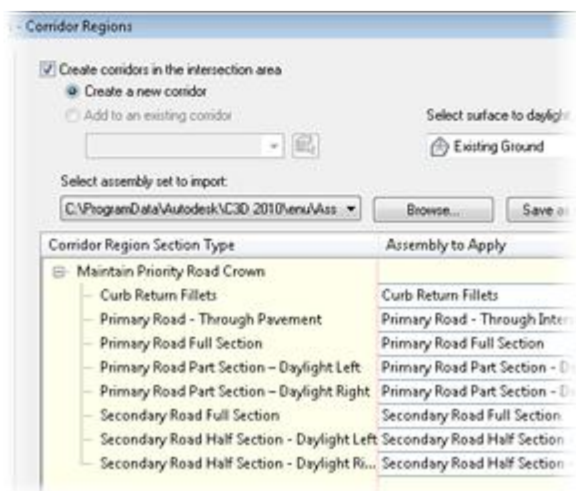
3. Configure the parameters in the Geometry Details page of the wizard.

    - Adjust alignment priority, if necessary.
    - Specify the Offset Parameters to generate the left and right offset alignments for the primary and secondary roads.
    - Specify Curb Return Parameters for the geometry and radius of the curb return for each intersection quadrant.
    - Specify Lane Slope Parameters to calculate design profiles for the offset alignments.
    - Specify Curb Return Profile parameters to calculate profiles for curb return alignments.



4. Configure the parameters in the Corridor Regions page of the wizard.

    - If you are creating corridors for the intersection area, determine whether you will create a new corridor or add to an existing one.
    - Select surface to daylight to.
    - Select assembly set to import.
    - Confirm the assembly assigned to each corridor region section type.



Guidelines

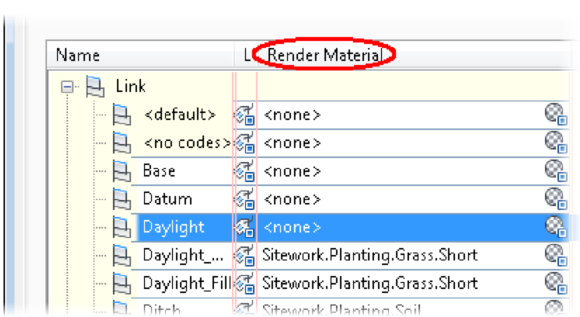
Keep the following guidelines in mind when creating intersections.

- For a four-way intersection, the alignments must physically cross over each other so that an intersection point can be located.
- For a three-way intersection, the endpoint of the secondary road alignment must snap to a point on the primary road alignment. If the secondary alignment extends across the primary alignment, Civil 3D attempts to model a four-way intersection.
- The assembly set must be manually selected in the Create Intersection wizard to ensure that the correct imperial or metric assemblies are used.
- When creating a corridor without the Create Intersection wizard, the intersection object and the offset, curb return alignments and profiles are created. You can create the corridor regions as an independent step.
- If you are creating an intersection for jurisdictions where people drive on the left side of the road, make sure you change the Driving Direction in the Drawing Settings.

Creating a 3D Road Design Model

You create 3D models that combine proposed and existing conditions to help visualize and analyze the impacts your design has on the existing terrain. These models can also be used to create perspective views from different viewpoints. One of the important concepts to understand is a code set style.

A code set style is a collection styles for Markers, Links, Shapes, Render materials, Labels, and Feature lines. A code set style is applied to an assembly, a corridor, and corridor sections. The code set style assigns the render material styles to corridor links. Each link can have a different render material assigned. This means that you do not need to create a surface to create photorealistic rendered images. The following illustration shows the code set styles for various corridor links.



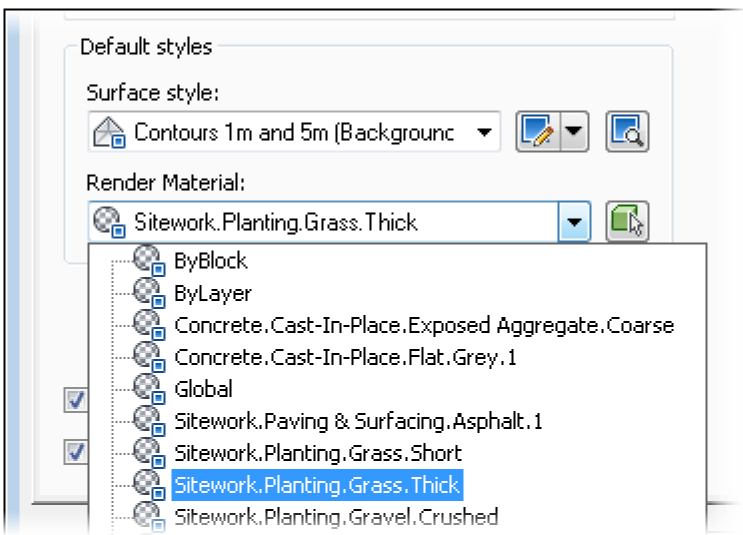
Process Description

The first step in creating a 3D road design model is to create a new surface called EG FG Combined. After you create the EG FG Combined surface, you edit the surface and paste the existing ground surface into the EG FG Combined surface. Now that you have data attached to the surface, you can begin the process for cutting a hole in the surface to remove the surface data inside the corridor model daylight lines. The steps are as follows:

- Create 3D polylines from the daylight feature lines.
- Turn the 3D polylines into 2D polylines and form a closed polyline.
- Add the closed polyline as a hide boundary to the EG FG Combined surface (this deletes the surface data inside the closed polyline).

The final step is to view the corridor model and the EG FG Combined surface in 3D and apply the rendering. In Object Viewer, you change the view to Realistic to show a rendered image.

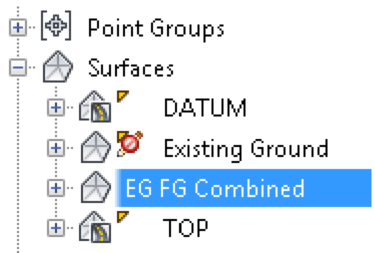
The surface is rendered based on the rendered material style assigned to the surface. The rendered material style is a property of the surface and is shown in the following illustration.



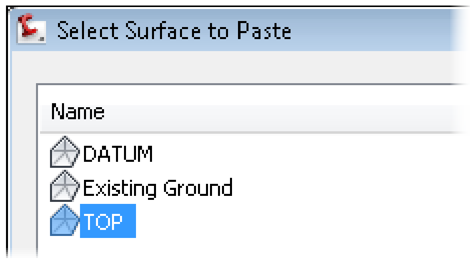
Process: Creating a 3D Road Design Model

The following steps outline the process for creating a 3D road design model.

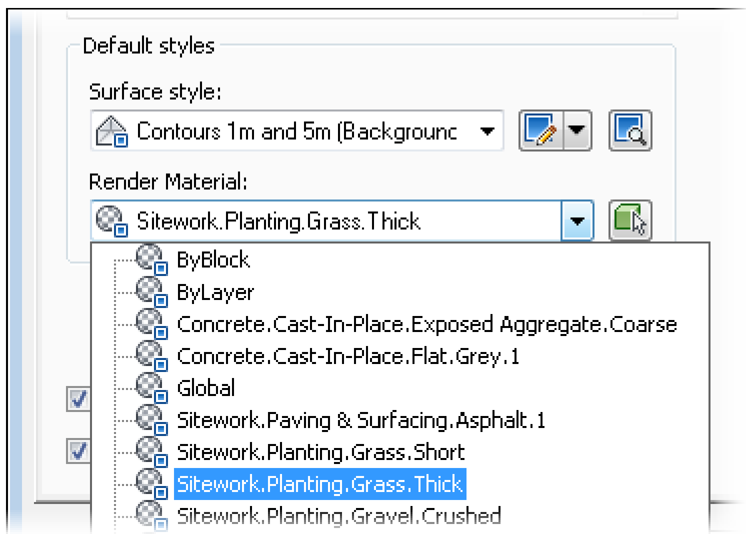
1. Create a new surface called EG FG Combined by copying the Existing Ground Surface.



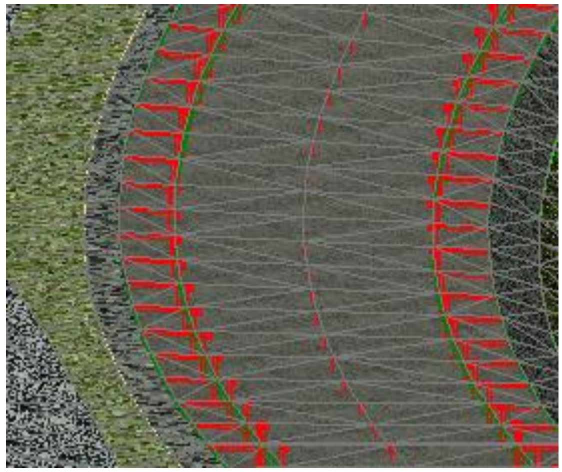
2. Paste TOP into the EG FG Combined by copying the Existing Ground Surface.



3. Apply the render material to the EG FG Combo surface in Surface Properties.



4. View and render the corridor model and the EG FG Combined surface in 3D.



Key Terms

Subassembly	A subassembly represents a single component of a road cross section such as a lane, curb structure, or sidewalk. Subassemblies are assembled to create the assembly. You can choose from over a hundred subassemblies in Civil 3D.
Subassembly Catalog	A library of stock subassemblies that come with AutoCAD Civil 3D.
Assembly	An assembly is created from subassemblies and represents the typical cross section configuration of the proposed road. An assembly for a subdivision road may consist of two lane subassemblies (one for each side), two gutter subassemblies, and two sidewalk subassemblies.
Typical Cross Section	The typical cross section is the engineering detail that shows the configuration of the proposed cross section for a road. These details include widths, depths, slopes, grades, and materials. Offset locations on a typical cross section are referenced from the road centerline. Civil 3D represents typical cross sections with an assembly.
Corridor Model	Corridor models are created from a design horizontal alignment, proposed vertical alignment, and an assembly. A corridor model can represent any linear designed feature, but is most commonly used for road design.
Corridor Surface	Corridor surfaces are design surfaces that can be created directly from a corridor model. You can create surfaces for the different depths of a corridor model. Corridor surfaces are displayed in the Surfaces

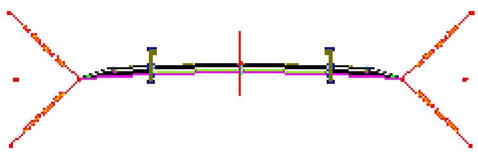
	collection.
Baseline	A baseline is the controlling alignment, profile, and assembly for corridor creation. A corridor can be created using multiple baselines. For example, a corridor model for a road with a cul-de-sac consists of two baselines. One baseline is used to model the main road section and the other baseline is used to model the cul-de-sac.
Region	A corridor region is represented by a station range for a baseline. Baselines can have multiple regions. You can assign a different assembly, assembly insertion frequencies, and targets for corridor regions.
Frequency	The frequency is the interval at which assemblies are inserted to create the corridor model. You can assign different intervals for tangents, curves, spirals, and profiles curves.
Targets	Some subassemblies enable you to assign targets. A target is used to control a specific property of a subassembly. For example, the width of a lane subassembly can vary by assigning a target alignment, or a catch slope subassembly could determine fill or cut conditions based on the target ground surface.
Corridor Feature Line	Corridor feature lines are the 3D longitudinal lines that run the length of the corridor. Corridor feature lines are created from the points on the subassemblies.
Grading Feature Line	A grading feature line is a feature line that is used exclusively for grading purposes. A grading feature line can be created using feature line commands or can be extracted from a corridor model. Grading feature lines are typically created at the property line locations.
Feature Line Style	Used to control the display of corridor feature lines.
Daylighting	The projection of a match slope to a surface. AutoCAD Civil 3D uses a number of subassemblies that can be used for daylighting.
Paste	The surface editing action of combining data from two surfaces.
Subassembly Link	Links connect the subassembly points. Subassembly links are used to create corridor surfaces and can also be used to annotate slopes and grades on design cross sections. You can also assign render materials to subassembly links to quickly create photorealistic renderings of the corridor design.
Subassembly	The singular locations on a subassembly. Examples of subassembly

Point	points include edge of traveled way (ETW) and edge of paved shoulder (EPS). These are connected to create corridor feature lines when the corridor is created. They can also be used to create construction staking points and to label offsets and elevations on design cross sections.
Subassembly Shape	Closed shapes used to represent the structure materials in the subassemblies. Materials include pavement, granular, and concrete. Subassembly shapes are used to calculate material volumes and can be used to annotate end areas on design cross sections.
Subassembly Input Parameters	All subassemblies use editable input parameters that enable you to change the geometric properties of the subassembly including width, slope, grade, and depth.
Target Mapping	Subassemblies use target mapping to control how they function. Subassemblies used for daylighting use a required target to indicate which surface to project the match slope to. Subassemblies for lanes use an optional target alignment to control the width.
Typical Section	The typical section represents the typical cross section configuration for a road or highway design. The typical section is part of the design criteria and indicates the cross section elements (lanes, shoulders, curbs, and so on) and their geometric configuration.

Exercise 1: Create and Modify a Transportation Assembly

In this exercise, students create an assembly that consists of lanes, shoulders, guardrails, and match slopes. Students then modify the properties of the assembly to rename the assembly groups and the subassemblies.

At the end of this exercise, the drawing displays as shown.

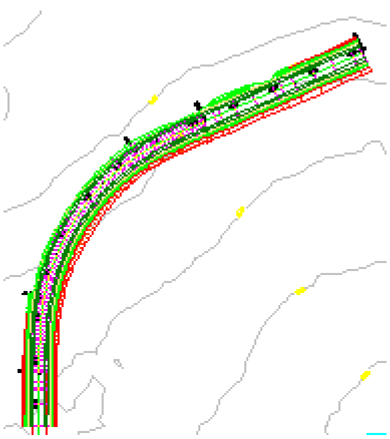


For this exercise open *...\I_AssembliesCorridors-EX1.dwg (M_ AssembliesCorridors -EX1.dwg).*

Exercise 2: Create a Corridor Model

In this exercise, students create a corridor for an arterial road.

At the end of this exercise, the drawing displays as shown.

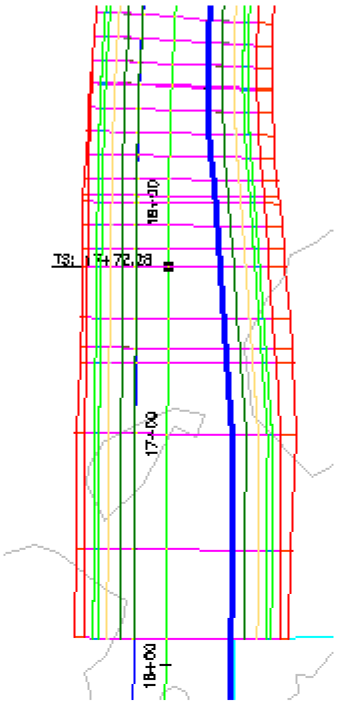


For this exercise, open *...\I_AssembliesCorridors-EX2.dwg (M_AssembliesCorridors-EX2.dwg).*

Exercise 3: Map Corridor Targets

In this exercise, students model an acceleration lane and taper by mapping corridor targets.

At the end of this exercise, the drawing displays as shown.

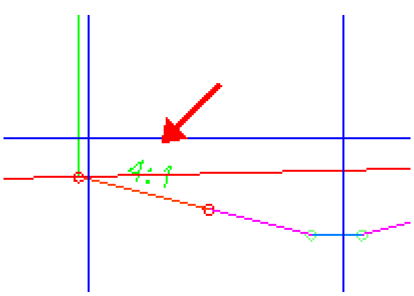


For this exercise, open ...*I_AssembliesCorridors-EX3.dwg (M_AssembliesCorridors-EX3.dwg).*

Exercise 4: View and Edit Corridor Sections

In this exercise, students view and edit corridor sections.

At the end of this exercise, the drawing displays as shown.

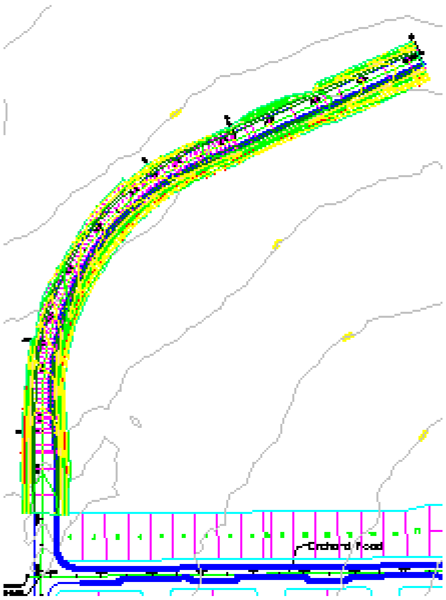


For this exercise, open ...*I_AssembliesCorridors-EX4.dwg (M_AssembliesCorridors-EX4.dwg).*

Exercise 5: Create Corridor Surfaces

In this exercise, students create corridor top and datum surfaces.

At the end of this exercise, the drawing displays as shown.



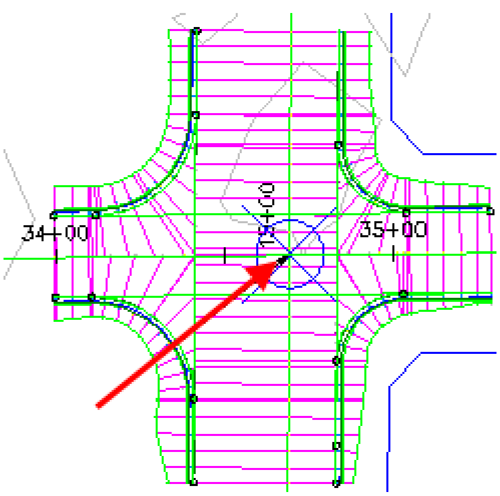
For this exercise, open *...\I_AssembliesCorridors-EX5.dwg (M_AssembliesCorridors-EX5.dwg).*

First, students create a corridor datum surface.

Exercise 6: Create an Intersection

In this exercise, students create a four-way intersection using the Create Intersection wizard. Students start with two intersecting alignments and profiles.

At the end of this exercise, the drawing displays as shown.

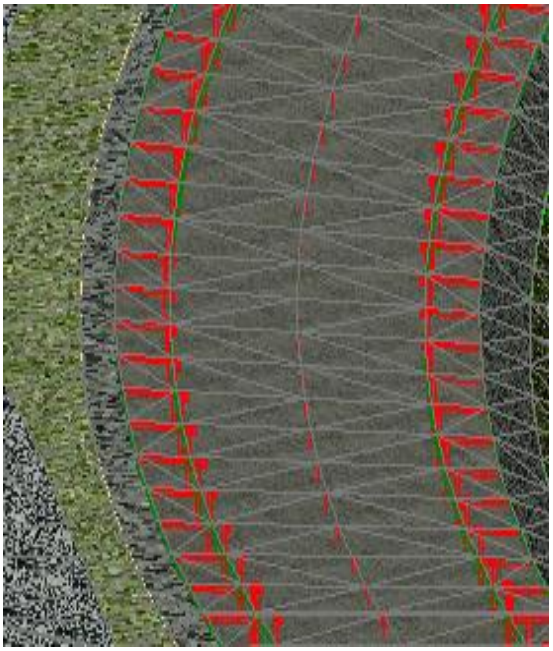


For this exercise, open *...\I_AssembliesCorridors-EX6.dwg (M_AssembliesCorridors-EX6.dwg).*

Exercise 7: Create a 3D Road Design Model

In this exercise, students create 3D model of the completed road design.

At the end of this exercise, the drawing displays as shown.



For this exercise, open *…\I_AssembliesCorridors-EX7.dwg (M_AssembliesCorridors-EX7.dwg).*

First, students make a copy of EG surface.

Assessment

Challenge Exercise

Instructors provide a master or challenge exercise for students to do based on this lesson.

Questions

1. What is the procedure for working with subassemblies to create an assembly?
2. Why would you rename a subassembly on the tool palette?
3. What is the function of subassembly input parameters ?
4. What controls the display of subassembly and corridor points, links, and shapes?
5. What are corridor feature lines and how are they created?
6. What are the functions of subassembly points?
7. What are the functions of subassembly links?
8. Why would you create a corridor top surface?
9. Why would you create a corridor datum surface?
10. What is target mapping?

Answers

1. You copy the desired subassemblies from the Subassembly Catalog to the tool palette. You then modify the properties of the subassemblies on the tool palette. Assemblies are created by adding subassemblies from the tool palette to the assembly object.
2. You rename a subassembly on a tool palette to offer a simplified name to the cross-section elements.
3. Subassembly input parameters are used to vary the geometric properties of the subassembly. Examples of input parameters include width, slope, grade, depth, and material.
4. A marker style controls the display of subassembly/corridor points. A link style controls the display of subassembly links, and a shape style controls the display of subassembly shapes.
5. The corridor feature lines are the longitudinal lines along the corridor. They are created by connecting the subassembly points.
6. Subassembly points are used to create the corridor feature lines, annotate offsets and elevations on design sections, and create Civil 3D points that can be used for construction staking.
7. Subassembly links can be used to create top and datum corridor surfaces, annotate slopes and grades on design cross sections, and assign render materials for photorealistic rendering.

8. Corridor top surfaces are used to create 3D models of a proposed road or highway. They can also be used to calculate manhole rim and invert elevations for storm and sanitary sewer networks.
9. A corridor datum surface is used to calculate earth cut and fill volumes.
10. Target mapping is the process of assigning targets to the subassemblies when you create a corridor. For example, the daylight subassemblies use required targets to indicate which surface to project the match slope. The lane and shoulder subassemblies use optional targets to control widths with alignments.

Lesson Summary

In this lesson, students learned how to work with subassemblies, assemblies, and corridors in AutoCAD Civil 3D. Students created an assembly representing a typical section from the subassemblies. The next step was to create the corridor model from the assembly. The corridor model was created by specifying a design alignment, profile, and assembly. After the corridor was created, students then modified the corridor properties to change the station limits for the region and change the assembly insertion frequencies.

Students modified the corridor to model a lane taper using target mapping. Individual corridor model sections were reviewed, and parameters were modified to alter the corridor for a range of stations. Students created corridor surfaces for a datum and a top surface, each with a boundary of the daylight lines.

Students used the Create Intersection Wizard to develop a four-way intersection, specifying offset and curb return alignment parameters. Students edited offset parameters to revise the intersection design.

The final steps in the module included using the top corridor surface and the existing ground surface, and creating and viewing a 3D rendered model of the final road configuration.