# Chapter 5

# Alignments

## Learning Objectives

***After completing this chapter, you will be able to:***

- *Create alignment and its components*
- *Understand factors affecting an alignment*
- *Understand methods of creating alignments*
- *Use alignment layout tools*
- *Use different methods of editing alignment*
- *Create best fit alignment entities*
- *Understand and create superelevation view*

# ALIGNMENTS

An alignment is a linear Civil 3D object with coordinates and consists of lines, curves, and spirals. The alignment represents features such as the center line of a road, highway, tunnel, pavement edges, sidewalks, pipe lines, and so on. Alignment can represent existing or proposed features. It helps surveyors and engineers in creating the layouts of the projects easily and effectively. Defining the alignment is the first and basic step in designing a road or a pipeline. While starting up a new transportation project, the alignments should be designed carefully as they also serve as the geometries that control the layout and construction of the highway. A well designed road alignment reduces the cost of maintenance and vehicle operations. It also provides comfortable driving and road safety.

In AutoCAD Civil 3D, an alignment can exist as an independent object or as an object dependent on other Civil 3D objects such as profiles, cross-sections, and parcels. Alignments are dynamic in nature implying that the changes made by the user are dynamically reflected in all inter-related Civil 3D objects. In AutoCAD Civil 3D, the process of drafting and modifying an alignment layout is easy.

## Types of Alignments

Alignments can be categorized into two types: vertical and horizontal. Horizontal alignment represents the geometry of an object in a plan view. It includes geometry of the object along straight paths and curves in a horizontal plane. Vertical alignment represents the elevation of points along the length of the object. The vertical alignment is represented by the longitudinal profile of the object and it includes the vertical curves and gradients.

The vertical and horizontal alignments should meet the required design standards so as to yield maximum efficiency. The criterion for designing alignments is discussed next.

## Key Points for Designing an Alignment

Creating an alignment requires careful and thorough study of the area. The key points which should be considered while designing a road alignment are discussed next.

1. Designed alignment should be short and straight. The construction along the designed alignment should require minimum cutting and embankment. It should also avoid region with poor soil structure for a stable foundation of the structure.

2. An alignment should be safe for construction, operation, and maintenance from the stability point of view of the constructed structure. It should also be safe for the traffic operation and must have smooth curves and gradients.

3. An alignment should be designed on a higher ground so as to allow good drainage. Also, it should have a minimum number of cross drainages along its length.

4. The structure when constructed along the proposed alignment should add to the aesthetic beauty of the region.

5. Finally, the alignment should be such that the cost of construction, maintenance, and operation of the project is economized leading to a good project cost benefit ratio.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Components of Alignment

The two main components of an alignment are stations and offsets. Stations represent segments or distances into which an alignment is divided. Each alignment starts and terminates at a station. Each station is represented by a value that specifies the distance of that station from the start or the first station of the alignment. For example, the value 5+40 denotes that the station is located at 540' from the start of the alignment. The specification of the first station in an alignment depends on its length or the project requirement. The values of the stations automatically increase toward the last station of the alignment.

Offsets, the other important components of an alignment, represent the location of the existing or proposed objects in the site. These offsets help the surveyors to locate the nearby objects by taking the alignment as the reference or the base line. If we take the direction of the increasing stations as the reference then the offsets on the right of the alignment have a positive value and the offsets on the left have a negative value. For example, a tree with a station 2+50 and an offset -16.3 indicates that it is located at a distance of 250' from the first station and at a distance of 16.3' to the left of the alignment.

## Factors Affecting an Alignment

The factors that control the alignment are discussed next.

### Traffic

The alignment should comport with the traffic requirements and should be designed keeping the traffic flow, future expansions, and the shortest paths in mind.

### Control Points

The control points or the obligatory points are the points through which the alignment should or should not pass. The obligatory points such as an intermediate towns or settlements through which the alignment should connect or pass can cause the alignment to deviate from the shortest path. The obligatory points through which the alignment should not pass such as monuments, graveyards, and so on can also cause the alignment to deviate from the straight and the shortest paths. Figure 5-1 shows the alignment deviating from the straight path AB to a longer path ACB to include the obligatory point C, which represents an intermediate town.

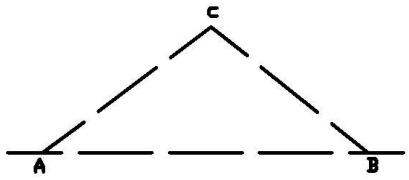



***Figure 5-1*** *Alignment deviating from the straight path AB*

### Geometric Design

The geometric design factors that affect the design of an alignment are gradient, radius of curve, and sight distance. While aligning a road or highway, the gradient should be flat as far as possible and should be less than the design gradient. The sight distance is the actual distance at which an obstruction, stationary or moving, is clearly visible to the driver for the safe and smooth running

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

of vehicles on the roads. In other words, the sight distance represents the distance at which the fast moving vehicles can stop or overtake safely. The alignment of a road or a highway should be designed in such a way that the sight distance requirements are fulfilled.

### Economy

The alignment, apart from fulfilling the above requirements should also be economical. In other words, while designing an alignment, the initial cost of construction, cost of maintenance, and the cost of vehicle operation should be kept in mind.

The cost of construction can be controlled if the alignment is designed to balance the total cut and fill ratio of the surface in which it is created.

Apart from these, the other factors that affect the design of an alignment are the drainage, hydrological, and topographical features. The drainage considerations can control the vertical alignment of a road or highway in particular.

## CREATING ALIGNMENTS

You can create alignments from polylines or by using the **Alignment Layout** tools. You can also create an alignment from the pipe network or by importing the data from landXML files. The basic information required to create an alignment are the name, type, and the style of the alignment. Civil 3D also allows you to use the criteria-based designs for creating alignments.

Once an alignment is created, it is added to the **Alignment** node in the **Prospector** tab of the **TOOLSPACE** palette.

### Creating Alignments Using Polylines

**Ribbon:** Home > Create Design > Alignment drop-down > Create Alignment from Objects
**Command:** CREATEALIGNMENTENTITIES



The simplest and the most common method of creating an alignment is by using polylines. Using this method, you can automatically add curves between the tangents in the alignments. You can create an alignment from a polyline in two steps. The first step is to sketch the polyline and the second step is to convert the polyline into an alignment. To sketch the polyline, invoke the **Polyline** tool from the **Draw** panel of the **Home** tab; you will be prompted to specify the start point of the polyline. Click in the drawing area to specify the start point of the polyline. Click again when prompted to specify the next point. You can continue clicking to specify the points or press ENTER to terminate the command. On exiting the command, a polyline will be created. Now to convert this polyline into an alignment, choose the **Create Alignment from Objects** tool from the **Create Design** panel; you will be prompted to select a line, an arc, or a polyline object. In the drawing, select the polyline that you have drawn. Also, you can enter **X** in the command line to select the polyline from within the Xref drawing. On selecting the polyline from the drawing or from the Xref drawing, you will be prompted to press ENTER to accept the alignment direction or to enter **R** to reverse the direction. Press ENTER to accept the default alignment direction; the **Create Alignment from Objects** dialog box will be displayed, as shown in Figure 5-2. This dialog box is used to specify the information about the alignment. The options in this dialog box are discussed next.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

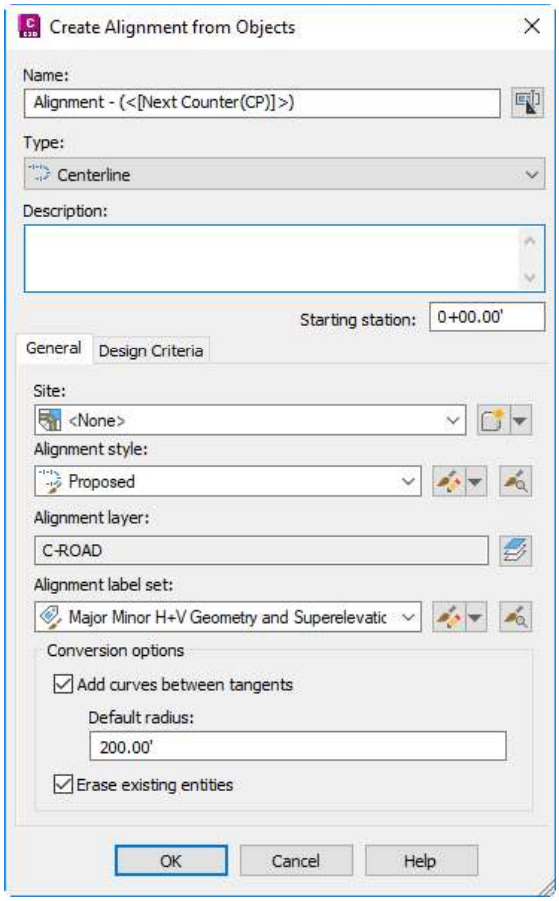



***Figure 5-2*** *The* ***Create Alignment from Objects*** *dialog box*

## Name

The **Name** edit box displays the default name of the alignment. To specify a name for the alignment, choose the button on the right of this edit box; the **Name Template** dialog box will be displayed. Enter a name in the **Name** edit box of this dialog box and choose the **OK** button. Note that if you do not specify a name, Civil 3D will automatically name the alignment and number it. By default, **Alignment (1)** will be the default name assigned to the first alignment you create.

## Description

The **Description** text box is used to specify optional description about the alignment. Specify a short description in this text box, if required. The name and description of the alignment help you easily identify different alignments in a drawing with multi-alignment.

## Starting station

The **Starting station** edit box displays the station value of the starting station. The **0+00.00'**

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

value is the default starting station value and can be changed to any user specific value. For example, to assign a value of 50' to the start station, enter **0+50.00** in the edit box.

## General Tab

The options in this tab are used to specify the information about the alignment such as its site name, alignment style, and layer.

The **Site** drop-down list in this tab is used to select the required site associated with the alignment. Alternatively, you can select the site directly from the drawing or create a new site by choosing the down arrow on the right of the **Site** drop-down list to display a flyout. Choose the **Pick from Drawing** option to select the site from the drawing or choose the **Create New** option from the flyout to create a new site. On selecting the **Pick from Drawing** option, you will be prompted to select an object from the site. Select the object created in the site; the **Create Alignment - From polyline** dialog box will be displayed again and the site name will be selected in the **Site** drop-down list.

The **Alignment style** drop-down list displays the default alignment style. The alignment styles control the display of various alignment components such as lines, curves, tangents, and curve extension. Select the required alignment style from this drop-down list. You can also create a new style or edit the existing alignment style by choosing the required option from the flyout that is displayed when you choose the down arrow on the right of the **Alignment style** drop-down list.



**Tip**

***<None>*** *is the default option displayed in the* ***Site*** *edit box. This means that the alignment will not interact with other Civil 3D objects. Accept this option if you do not want the alignment to interact with other objects such as parcels or profiles. The alignment will be added to the* ***Alignment*** *collection of the* ***Prospector*** *tab.*



**Note**

*The alignment styles are available in the drop-down list only if there are some predefined alignment styles. The availability of the style depends on the type of template that you have selected.*

The **Alignment layer** text box displays the default layer (**C-ROAD**) on which the alignment will be created. To select a new layer, choose the button on the right of the **Alignment layer** text box; the **Object Layer** dialog box is displayed. You can use this dialog box to select a new layer for the alignment.

The **Alignment label set** drop-down list in the **Create Alignment from Objects** dialog box displays the default label set. Select the required **Alignment label set** from this drop-down list. Alternatively, you can choose the down arrow on the right of this drop-down list to display a flyout. Choose the required option from the flyout to create a new label set or edit the existing label set. The alignment label set helps you to label different components of an alignment such as the major and minor stations and the station equations, both simultaneously.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com



**Note**

*The options in the **Alignment styles and Alignment label set** drop-down lists vary depending upon the template selected at the start of the project and the alignment style and alignment label sets defined by the user in the drawing.*

The **Conversion options** area in the **Create Alignment from Objects** dialog box consists of two check boxes. If the **Add curves between tangents** check box is selected, you can automatically add curves between the tangents. The radius of these curves will be equal to a fixed percentage of the tangent length and the deflection angle. Select the **Erase existing entities** check box to delete the entities such as polylines that are used to create the alignment. Clear the check box to retain the entity.

### Design Criteria Tab

You can use the options in this tab to specify the design criteria settings for the alignment. You can select and apply the required design criteria, superelevation attainment method, design speed, and other design parameters in this tab to create a design-based alignment. The options in this tab and the method of creating a design-based alignment are discussed later in this chapter.

After specifying the required information in the **Create Alignment from Objects** dialog box, choose the **OK** button; the dialog box will be closed and the selected polyline entity will be converted into an alignment without any design criteria.

## Creating Alignments Using the Alignment Layout Tools

**Ribbon:** Home > Create Design > Alignment drop-down > Alignment Creation Tools
**Command:** CREATEALIGNMENTLAYOUT

AutoCAD Civil 3D allows you to create an alignment based on some intricate designs by using the alignment layout tools. These tools can be accessed from the **Alignment Layout Tools** toolbar. These tools enable you to incorporate your engineering designs in the alignment and create an alignment according to the design criteria. For example, if you want the alignment curve to pass through a particular point, you can create the layout of the alignment accordingly by using the required curve tool from the toolbar. These sophisticated layout tools help you create an alignment layout using the curves, spirals, points of intersection (PIs), and so on.

Creating an alignment using the alignment layout tools is a two-step process. The first step includes naming the alignment, specifying the site on which the alignment will be created, selecting the alignment style, and the alignment label style. The second step involves the use of the alignment layout tools to draft the alignment.

To create an alignment using the layout tools, choose **Alignment Creation Tools** from the **Create Design** panel; the **Create Alignment - Layout** dialog box will be displayed, as shown in Figure 5-3. The options in this dialog box are the same as those discussed earlier for the **Create Alignment from Objects** dialog box.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

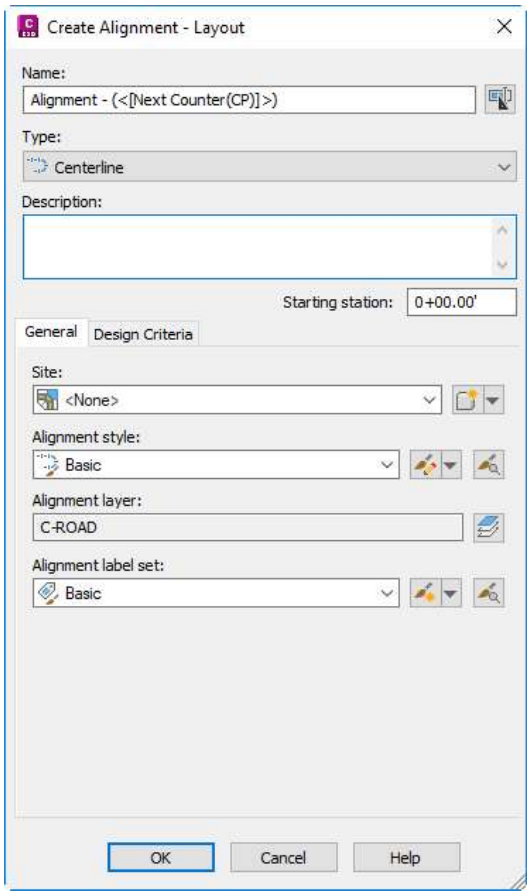



***Figure 5-3*** *The* ***Create Alignment - Layout*** *dialog box*

After specifying the required information about the alignment and the design criteria in the **Create Alignment - Layout** dialog box, choose the **OK** button; the **Alignment Layout Tools - <alignment name>** toolbar will be displayed. This will conclude the initial step of setting an alignment. The second step is to create the alignment using the alignment layout tools from the **Alignment Layout Tools** toolbar. The tools in this toolbar will be discussed in detail in the next section.

The **Alignment Layout Tools** toolbar provides you with a wide range of tools to design and edit the alignment. The constraint-based alignment entities such as curves, spirals, tangents, and lines can be used to solve various design problems by adding design constraints. These tools help you to be more creative by enabling you to use fixed, floating, or free entities, while designing the alignments. These layout tools also help you convert the AutoCAD lines and arcs to alignment entities. The wide range of curves, tangents, lines, and spiral tools in this toolbar help you design not only the road alignments but also the railway alignments. The components that constitute an alignment (curves, lines, spirals, and tangents) can be divided into three different entities, which are discussed next.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Fixed Entity

The fixed entity is the one whose properties remain static even if the properties of the other alignment entities are changed. A fixed entity is defined by specifying its points or radius. It is not dependent on another entity for its geometry or tangency. Therefore, you can add a fixed entity as and when required. Figure 5-4 shows a fixed curve entity that is created independent of any other entity by specifying the start, second, and the end points of the fixed curve.

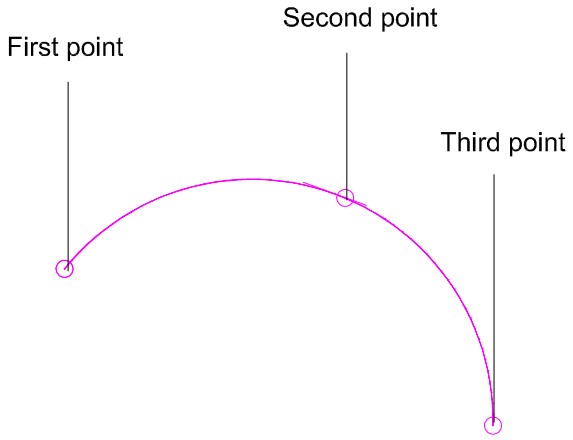



***Figure 5-4*** *A fixed curve entity created by using three points*

## Floating Entity

A floating entity is defined as the entity that is always tangent to one of the entities to which it is connected. The geometry of such entity is defined by the set of parameters provided or is dependent on the other entity. A floating entity can be attached only to a fixed entity or another floating entity. Figure 5-5 shows a fixed curve entity with a floating curve attached to it and passing through a point in a specified direction.

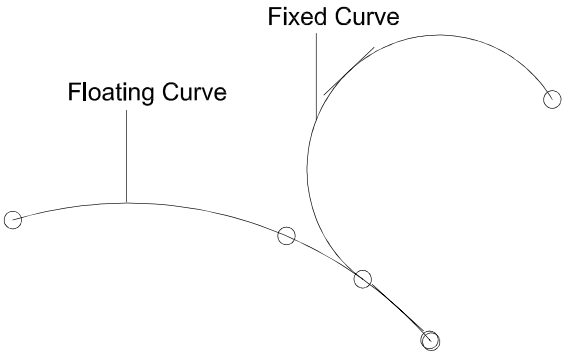



***Figure 5-5*** *A floating curve attached to a fixed curve entity*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

### Free Entity

A free entity is an entity which is always tangent to the attached entities at its start point and end point. It is defined by a set of user specified parameters. A free entity can be added to two fixed, two floating, or one fixed and floating entity. Figure 5-6 shows a free line added between two fixed curves.

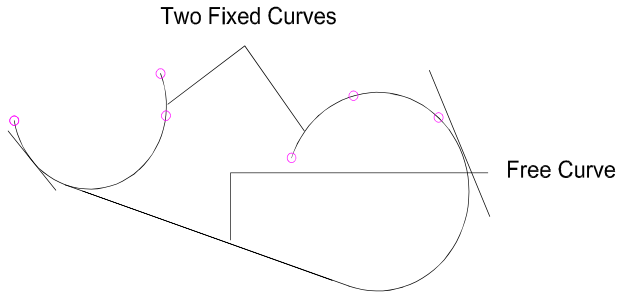



***Figure 5-6*** *A free line entity added between two fixed curve entities*



**Note**

*Every time you move the cursor near the* ***Alignment Layout Tools*** *toolbar, a tooltip with the name of the tool is displayed.*

## ALIGNMENT LAYOUT TOOLS TOOLBAR

The tools in the **Alignment Layout Tools** toolbar are used to design an alignment using various constraints explained earlier. You can invoke this toolbar to edit the alignment geometry. To do so, select the alignment from the drawing and then right-click; a shortcut menu will be displayed. In this shortcut menu, choose the **Edit Alignment Geometry** option; the **Alignment Layout Tools - <alignment name>** toolbar will be displayed. The tools available in this toolbar are discussed next. Figure 5-7 shows the **Alignment Layout Tools - <alignment name>** toolbar.

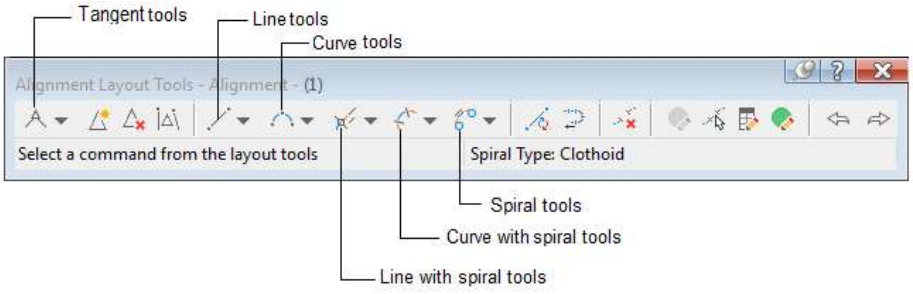



***Figure 5-7*** *The* ***Alignment Layout Tools - Alignment - (1)*** *toolbar*

### Tangent Tools

The **Tangent** tools can be accessed by choosing the down arrow on the right of the first tool in the toolbar. The **Tangent** tools are discussed next.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

### Tangent-Tangent (No curves)



This tool is used to create an alignment that consists of tangents without curves. The alignment is created by selecting and joining the consecutive points end-to-end. To invoke this tool, choose the **Draw Tangent-Tangent without Curve** button from the **Alignment Layout Toolbar**; you will be prompted to specify the start, intermediate, and end point. Click in the drawing area to specify the points and press ENTER to end the command.

### Tangent-Tangent (With curves)



This tool is used to create a tangent-tangent alignment with curves by selecting points in the drawing. To create the tangent-tangent alignment, invoke the **Tangent-Tangent (With curves)** tool from the **Draw Tangent Tangent without curve** drop-down; you will be prompted to specify the start, intermediate, and the end point. Click in the drawing area to specify the points and press ENTER to end the command.

### Curve and Spiral Settings



This tool is used to specify the curve settings to create an alignment consisting of curves and spirals. To create an alignment, invoke **Curve and Spiral Settings** tool from the **Draw Tangent-Tangent without Curve** drop-down; the **Curve and Spiral Settings** dialog box will be displayed. You can select the type of spiral to be added to the alignment from the **Type** drop-down list. There are eight different types of spirals in this list that you can use in your design. The **Clothoid** is the most commonly used type of spiral for both highways and railways.



**Tip**

*In AutoCAD Civil 3D, the type of modified cubic parabola is added. You can define the settings for the modified cubic parabola by selecting the **NSW Cubic Parabola** option from the **Type** drop-down list. This option has been added to meet the requirements of New South Wales (Australia) standards.*

## Point of Intersection Tools (PI)

The **Point of Intersection** tools can be used to add, delete, or break apart the PI of the tangents. The PI tools are discussed next.



**Note**

*The **Point of Intersection** tool is used to add points. These points can be added only when **Dynamic Input** and **Object Snaps** options are turned off.*

### Insert PI



This tool is used to create a point of intersection (PI) by breaking a fixed line into two adjacent fixed lines. To insert PI, choose the **Insert PI** button from the **Alignment Layout Tools** toolbar; you will be prompted to pick a point near to PI to insert the PI. Click at the location where you want to add the PI. Figure 5-8 shows a PI added to a fixed line.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

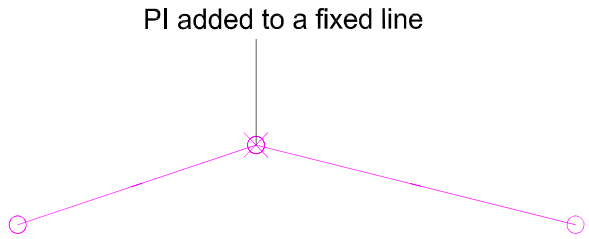



***Figure 5-8*** *PI added to a fixed line*

## Delete PI



This tool is used to delete a point of intersection and create a single tangent from two adjacent tangents. If you remove a PI between two tangents, the result will be a combination of the two tangents. To delete a PI, choose the **Delete PI** button from the **Alignment Layout Tools** toolbar; you will be prompted to pick a point near the PI that you want to delete. Click in the drawing area near a PI; the PI will be removed. Press ENTER to end the command.

## Break-apart PI



This tool is used to separate the point of intersection at which the endpoints of two tangents meet resulting in two separate tangents. To do so, choose the **Break-apart PI** button from the **Alignment Layout Tools** toolbar; you will be prompted to pick a point near a PI that you want to split. Click in the drawing near the PI, and then specify the distance by which you want to split it by specifying the points in the drawing or by entering the distance in the command line; the tangent or the fixed line will split into two different parts. Figure 5-9 shows the two split parts of the fixed line split up using the **Break-apart PI** tool.

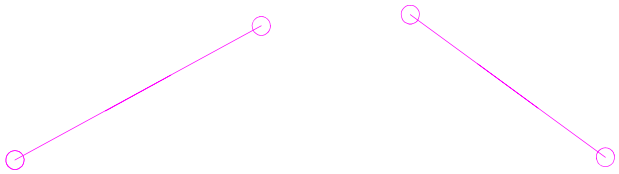


***Figure 5-9*** *Fixed line after breaking apart from the PI*

# Line Tools

The Line tools in the **Alignment Layout Tools** toolbar can be used to add a fixed, floating, or free line for creating an alignment geometry. Some of the line tools are discussed next.

## Fixed Line (Two Points)



This is the default line tool that is used to add a fixed line between two specified points. To invoke this tool, choose the **Fixed Line (Two Points)** drop-down list from the **Alignment Layout Tools** toolbar; you will be prompted to specify the start point. Click in the drawing to specify the start point and then specify the next point. Press ENTER to end the command.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Fixed Line (From curve end, length)



This tool is used to add a fixed line by selecting the end point and direction of a fixed or a floating curve entity and then specifying the length of the line to be created. To invoke this tool, choose the down arrow on the right of the **Fixed Line (Two Points)** drop-down list in the **Alignment Layout Tools** toolbar and select the **Fixed Line (From curve end, length)** tool; you will be prompted to select the entity for specifying the start point and the direction. Select a fixed or floating curve and then specify the length for the line by picking two points in the drawing or entering the length in the command line. Figure 5-10 shows a fixed line added to a fixed curve entity.

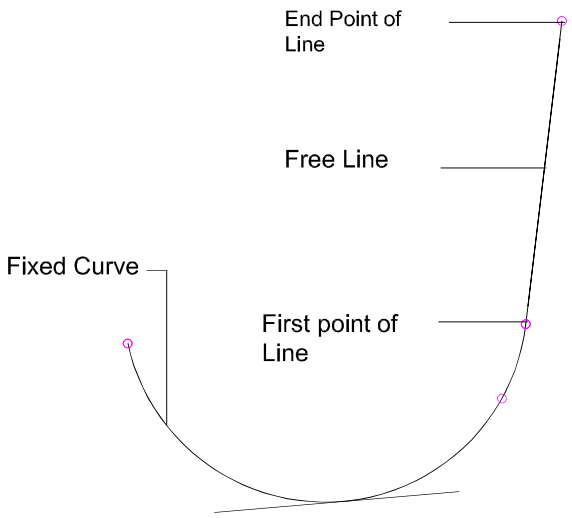



***Figure 5-10*** *Fixed line added to a fixed curve entity*

## Floating Line (From curve, through point)

This tool is used to add a floating line from a point which is on the existing curve to the specified point. To invoke this tool, choose the down arrow on the right of the **Draw Fixed Line (Two points)** tool and select the **Floating Line (From curve, through point)** tool from the drop-down menu; you will be prompted to select the entity to which the line needs to be attached. Select the entity in the drawing and then click to specify a point, through which the floating line passes when prompted to specify the end point in the command line, as shown in Figure 5-11.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

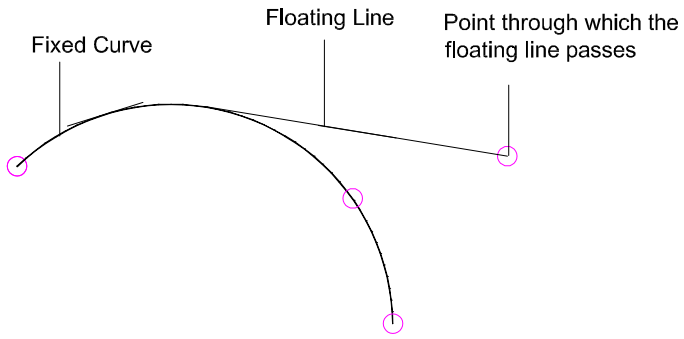



***Figure 5-11*** *Floating line added to a fixed curve entity*

### Free Line (Between two curves)

This tool is used to add a free line between two fixed or floating curves and is tangent to the curves at both the ends. To invoke this tool, choose the down arrow on the right of the **Draw Fixed Line-Two Points** tool and select **Free Line (Between two curves)** from the drop-down menu; you will be prompted to select the entity from which the free line is to be added. Select the first entity in the drawing and then select the second entity to which the free line is to be added. Figure 5-12 shows a free line added between two fixed curve entities.

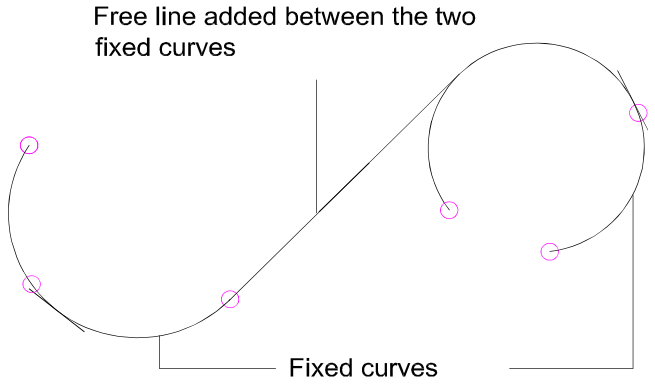



***Figure 5-12*** *Free line added between the two fixed curve entities*

## Curve Tools

The curve tools are used to add fixed, floating, or free curves to the alignment geometry. Some of the curve tools are discussed next.

### Fixed Curve (Three points)

This tool is used to add a fixed curve to the alignment geometry by specifying three points in the drawing. This tool is similar to the AutoCAD three point arc command. To draw a fixed curve, choose the default **Add Fixed Curve- (Three points**) tool from the **Alignment Layout Tools - <alignment name>** toolbar; you will be prompted to specify the start point. Click in the drawing to specify the start point and then follow the prompts displayed in the command line to add a fixed arc.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

There are other types of fixed curve tools to add the fixed curves to the alignment. To access them, choose the down arrow on the right of the **Fixed Curve (Three points)** tool and select **More Fixed Curves** from the drop-down menu; a flyout with different curve tools will be displayed. Select the required tool from the cascading menu and follow the prompts displayed in the command line to add the curve to the alignment.

**Note**

*You can use more the **Fixed Curve** tool as a fixed circular or fixed parabolic vetical curve by specifying a high or low point.*

### Floating Curve (From entity, radius, through point)



This tool allows you to add a floating curve that will be tangent to the entity it is attached to. This curve is added by specifying the radius, a pass through point, and the angle range (less than or greater than 180 degrees). To add a floating curve, choose the down arrow on the right of the **Add Fixed Curve - Three points** tool and select it from the drop-down; you will be prompted to select the entity to which the floating curve will be attached. Next, specify the radius of the curve by picking two points in the drawing or by entering the radius in the command line. Next, specify the angle less than 180 degrees by accepting the default **<Less than180>** value or enter **G** in the command line and press ENTER to choose the **<Greater than180>** value to specify the angle more than 180 degrees. Next, specify the type of curve by accepting the default **<Compound>** value or entering **R** in the command line to choose the **Reverse** curve type.

There are other tools also that can be used to add the floating curves to the alignments. To view these tools, choose the down arrow on the right of the default tool, **Add Fixed Curve-Three point**, in the **Alignment Layout Tools** toolbar and select **More Floating Curves** from the drop-down; a flyout will be displayed. You can choose the required tool from the cascading menu to add the floating curve.

### Free Curve Fillet (Between two entities, radius)



This tool is used to add a free curve between two fixed or floating entities by specifying the radius for the curve. To add a free curve, choose the drop down arrow on the right of the **Floating Curve (From entity, radius, through point)** tool and select **Free Curve Fillet (Between two entities, radius)** from the drop-down; you will be prompted to select the entity to start the curve. First, select the entity in the drawing to start the curve and then the entity at which the curve will end. Next, specify the angle range, the curve type, and then radius of the curve. A free curve will be added between the two entities and it will always be tangent to these entities.

## Line with Spiral Tools

These tools help you add a floating line with a spiral. There are two such types of tools available in the toolbar and these are discussed next.

### Floating Line with Spiral (From curve, through point)



This tool is used to attach a floating line with a spiral to a curve or a line passing through a point. On choosing this tool, you will be prompted to select the entity to attach the spiral. Once you select the entity, you will be prompted to specify the spiral length and a pass through point.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

### Floating Line with Spiral (From curve end, length)


Use this tool to attach a floating line to a spiral that starts from the end of a curve. While using this tool, you need to specify the length of the floating line and spiral.

## Curve with Spiral Tools

These tools help you add a spiral and a floating curve to the alignment. One such type of tool is discussed next.

### Free Spiral - Curve - Spiral (Between two entities)


This tool is chosen by default and is used to add a spiral between two entities by specifying the in and out lengths, curve type, and the radius of the spiral. Choose the down arrow on the right of this tool in the **Alignment Layout Tools** toolbar; a flyout with different tools will be displayed. You can choose the required tool from the flyout and add a curve with a spiral to the alignment.

## Spiral Tools

Spiral tools are used to add fixed, free, or floating spirals to the alignment geometry. These tools can be accessed from the flyout that will be displayed on choosing the down arrow on the right of the **Free Compound Spiral - Spiral (Between two curves)** tool. Some of the spiral tools are discussed next.

### Free Compound Spiral - Spiral (Between two curves)

This tool is chosen by default and is used to add a compound spiral between two curves. Invoke this tool and select the entities in the drawing between which you want to add a spiral. If the curves are not in the same direction, a warning will be displayed on the screen. Choose **Yes** to continue or **No** to start the command again. While using this tool, you cannot specify the spiral length.

### Fixed Spiral


This tool is used to add a fixed spiral to the alignment. To add a fixed spiral, choose the down arrow on the left of the **Free Compound Spiral-Spiral (Between two curves)** tool; a drop-down will be displayed. Choose the **Fixed Spiral** tool from the drop-down; you will be prompted to select an entity to specify the start point and direction of the spiral. Select the entity in the drawing. Next, press ENTER to accept the default spiral type **Incurve**. Alternatively, enter **O** for the **Outcurve**, **P** for the **Point**, and **C** for the **Compound** spiral types in the command line. Next, press ENTER to accept the default curve direction **<Clockwise>** or enter **O** in the command line to choose the counterclockwise direction. Next, specify the spiral length by picking two points in the drawing or entering the value in the command line. Similarly, specify the radius for the spiral; the spiral will be added to the entity and will always be tangent to the alignment.

### Free Reverse Spiral-Spiral (Between two curves)


This tool is used to add a free reverse spiral between two curves. Choose this tool and select the entities between which you want to add a reverse spiral. Note that you cannot specify the spiral lengths in this case.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Convert AutoCAD line and arc



**Convert Autocad line and arc** tool is used to convert the AutoCAD lines and arcs into an alignment entity.

## Reverse Sub-entity Direction



This tool is used to reverse the direction of a fixed line, curve, or an unconnected segment of the alignment. Invoke this tool, press and hold the CTRL key, and select the required single sub-entity; the directions of the entity will be reversed. Figures 5-13 and 5-14 show the direction of a fixed curve before and after using the **Reverse Sub-entity Direction** tool.

## Delete Sub-entity



This tool is used to delete an alignment sub entity. To delete an alignment sub entity, choose the **Delete Sub-entity** tool; you will be prompted to select the sub entity to be removed. Select the sub entity and the entity will be removed from the drawing.

## Edit Best fit data for all entities



This tool is available only when the alignment consists of sub-entities that are created using the best fit tools. On invoking this tool, a table with the original regression data of the best fit sub-entities in the alignment will be displayed. You can edit the values in the data based on the design. The best fit entities are explained later in this chapter.

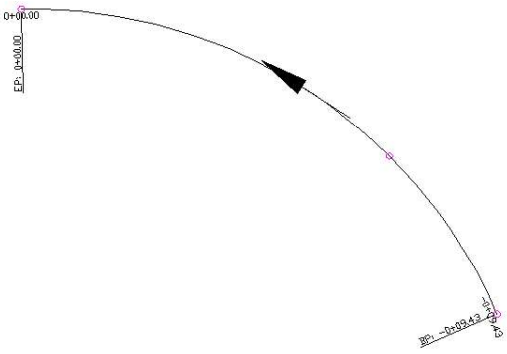


***Figure 5-13*** *The direction of the fixed curve entity before reversing the direction*

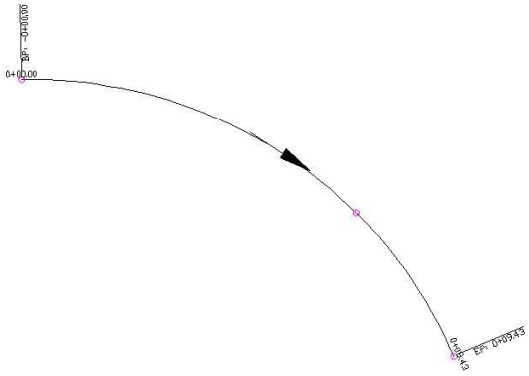


***Figure 5-14*** *The direction of the fixed curve entity after reversing the direction*

## Pick Sub-entity



The **Pick Sub-entity** tool is used to pick an alignment entity as well as to view and modify its parameters in the **Alignment Layout Parameters** window. Choose the **Pick Sub-entity** tool from the **Alignment Layout** toolbar; the **Alignment Layout Parameters** window will be displayed and you will be prompted to select the sub-entity. Select the required entity from the drawing; the parameters and their values will be displayed in the respective **Parameter** and the **Value** columns of the **Alignment Layout Parameters** window. You can view the parameters of the selected entity and also modify the values that are active.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Sub-entity Editor



This tool is used to view and edit the parameters of the selected sub-entity of an alignment. Choose the **Sub-entity Editor** tool from the **Alignment Layout Tools** toolbar; the **Alignment Layout Parameters** window will be displayed. Next, invoke the **Pick Sub-entity** tool and select the required alignment sub-entity whose parameters you want to view and edit. On doing so, the **Alignment Layout Parameters** window will be populated with the parameters of the selected sub-entity. You can edit all the parameters that are displayed in black.

## Alignment Grid View



This tool is used to view an alignment entity in a table view. You can modify the values of the features that appear in boldface letters in the **PANORAMA** window. Choose the **Alignment Grid View** tool from the **Alignment Layout Tools** toolbar; the **PANORAMA** window with the **Alignment entities** tab will be displayed, as shown in Figure 5-15. The alignment entities will be displayed in rows and their features will be listed in columns. You can numerically edit all features that appear in bold.

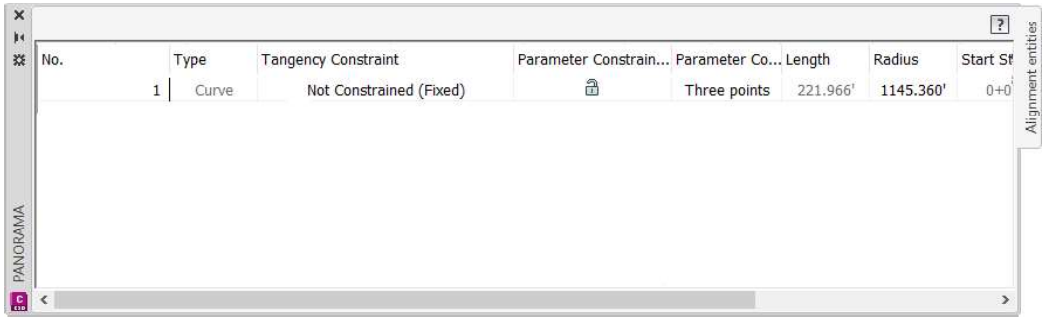



***Figure 5-15*** *The* ***PANORAMA*** *window with the* ***Alignment entities*** *tab*

Note that if the alignment consists of the sub-entities created from the best fit, the **PANORAMA** window with an extra **Regression Data** tab will be displayed, as shown in Figure 5-16.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

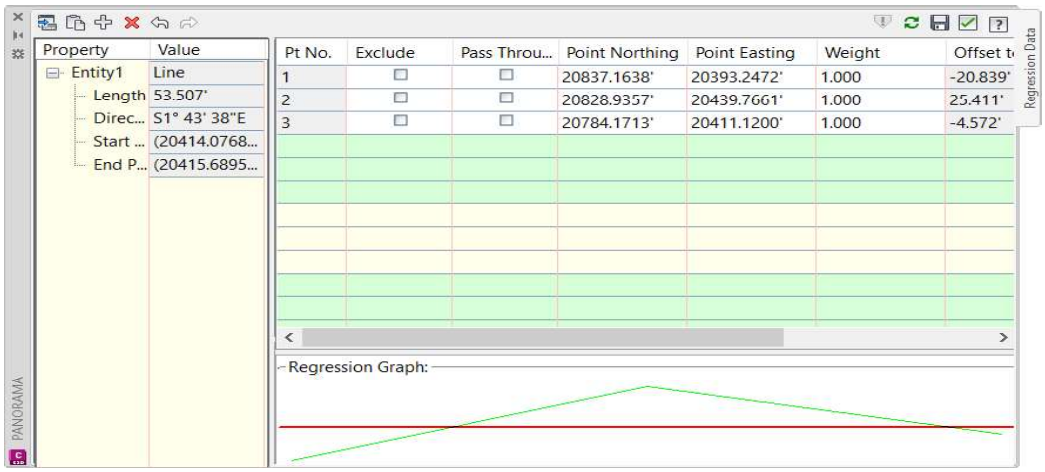



***Figure 5-16*** *The* ***PANORAMA*** *window with the* ***Regression Data*** *tab showing the regression data from the* ***Best Fit*** *alignment entities*

This tab displays the regression data from the best fit entities. It also displays the regression graph at the bottom of the window and the attributes of the best fit entity in a tree structure in the left panel of this window. The **Regression Graph** displays the relationship between the regression data and the best fit entity created. The red line indicates the regression points and the green line represents the best fit entity. Some of the options in the **PANORAMA** window are discussed next.

**Add more points**

Choose the **Add more points** button to add more points by using various import options in the **Best Fit** dialog box.

**Delete Selected Points**

Choose the **Delete Selected Points** button to delete the selected points from the regression table. This tool will be activated only when you select a row in the regression table.

**Click here to empty current regression sample data**

Choose the **Click here to empty current regression sample data** button to clear the data in the regression table.

**Click here to create entity and continue to edit the data**

Choose the **Click here to create entity and continue to edit the data** button to create the line, arc, or parabola based on the data after editing the data in the regression table. The **PANORAMA** window will be displayed for further editing of the data if required.

**Press to dismiss this vista**

On choosing the **Press to dismiss this vista** button from the **PANORAMA** window, the entity is created using the data in the table and the **Regression Data** vista will be closed.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

The **Undo** and **Redo** tools of the **Alignment Layout Tools** toolbar help you revert to the last edit operation made in the alignment entity. Thus, you can use the required tools from the toolbar to create the alignment based on the design requirement.

# CREATING ALIGNMENTS USING THE BEST FIT METHOD

The best fit method is used to get the best fitting alignment using the various Civil 3D objects such as the COGO points, AutoCAD points, lines, and arcs. You can access the tools for creating the best fit entities from the **Best Fit** drop-down in the **Draw** panel of the **Home** tab. You can use these tools to easily complete the complex alignment designs. Besides polylines, Civil 3D also allows you to convert lines and curves into an alignment.

The tools in the **Best Fit** drop-down help you create lines, arcs, and parabolas from various AutoCAD entities. You can also create a best fit alignment by picking points from the screen. These tools are especially used for the rehabilitation projects where you need to resurvey the existing road. In these type of projects, the existing survey data may not match with the original survey data. This situation demands that you create an alignment from the available data. You can use the tools from the **Best Fit** drop-down to edit the lines and curves to match the actual survey data in the best possible way. These tools can also be used for both alignments and profiles. To access these tools, click on the down arrow next to the **Best Fit** drop-down in the **Draw** panel. On doing so, a list of tools will be displayed, as shown in Figure 5-17. Invoke the required tool from the drop-down. These tools are discussed next.

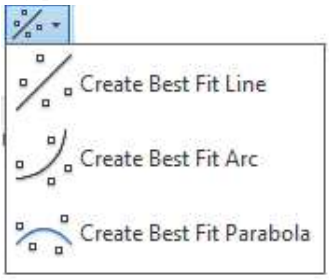



***Figure 5-17*** *The tools in the* ***Best Fit*** *drop-down*

## Creating Lines, Arcs, and Points as Entities by Using the Best Fit Entities Tool

| | |
|---|---|
| **Ribbon:** | Home > Draw > Best Fit drop-down > Create Best Fit Line / Create Best Fit Arc / Create Best Fit Parabola |
| **Command:** | CREATELINEBYBESTFIT / CREATEARCBYBESTFIT / CREATEPARABOLABYBESTFIT |

To create a line of best fit, choose the **Create Best Fit Line** tool from the **Draw** panel; the **Line by Best Fit** dialog box will be displayed, as shown in Figure 5-18. You can create the best fit entity by selecting one of the four different options available in this dialog box.

To create a line using the Civil 3D points, select the **From COGO points** radio button from the **Line by Best Fit** dialog box and then choose the **OK** button; the **Line by Best Fit** dialog box will close and you will be prompted to select the point objects. Select the point objects in the drawing and press ENTER; the **PANORAMA** window with the **Regression Data** will be displayed. You can edit the regression data in the **PANORAMA** window as required and choose the **Create Entity** button to create a line of best fit.

To create a line from the middle of an entity, select the **From entities** radio button; the **Mid-ordinate tolerance** edit box will be enabled in which you can specify the mid-ordinate distance.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

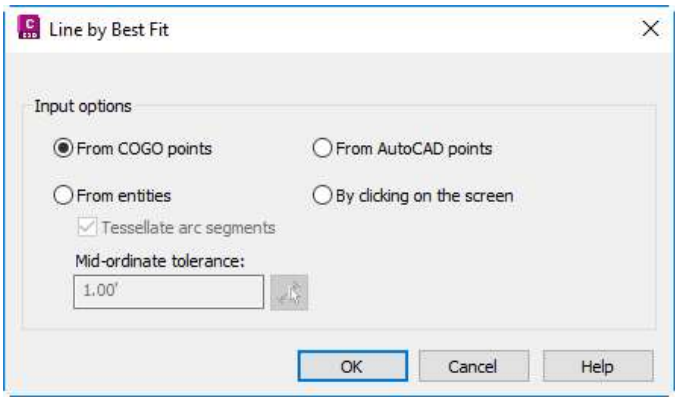



***Figure 5-18** The **Line by Best Fit** dialog box*

Similarly, you can create the best fit arc and parabola entities by choosing the **Create Arc/Create Parabola** tool from the **Draw** panel. The steps involved in creating these entities are the same as those explained for creating the line entity.

To convert the **Best Fit** entities into an alignment, choose the **Convert AutoCAD line and arc** tool from the **Alignment Layout Tools** toolbar and select the required line and arc to convert them into an alignment.

# CRITERIA-BASED ALIGNMENT DESIGN

In AutoCAD Civil 3D, the criteria-based design feature ensures that the design meets the required project standards. Before you understand the workflow of creating the criteria-based alignment design, it is important to understand various design criteria.

## Design Criteria

The design criteria file is an XML file within AutoCAD Civil 3D that consists of the common and minimum design criteria for creating alignments and profiles. The design criteria values are specified for design speeds, minimum speed, superelevation, curve radius, and length of the individual alignment entities. There are two design criteria files available in Civil 3D, one in **Metric Units** and other in **Imperial Units**. These design criteria are based on AASHTO (American Association of State and Highway Transport Officials) standards. The design criteria files can be customized to match the required standards for the project and then saved on a local server. A design file on a server can be accessible to all members of the team. The design criteria for creating profiles and alignment are discussed next.

### Minimum Radius at the Specified Design Speed

This criterion specifies a set of values for the minimum curve radius at different vehicle speed for a given superelevation. Figure 5-19 shows a Civil 3D design criteria file based on AASHTO standards for the minimum radii at the specified design speed for a fixed superelevation of 6%.

### Superelevation Attainment Method

This criterion specifies the superelevation applied and the method used to calculate it. Civil 3D

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

supports two methods to calculate superelevation, **Standard** and **Planar**. The **Standard** method is used to calculate superelevation for undivided crowned roads and divided roads. It also involves removal of the adverse crown. On the other hand, the **Planar** method does not involve the removal of the crown and is used only for the panel-section roads without crown. Each of these methods specifies the formulas to calculate the distance between the transition points. You will learn about superelevation in detail later in this chapter. Figure 5-20 shows the superelevation attainment method table created from the design criteria file to calculate the transition.

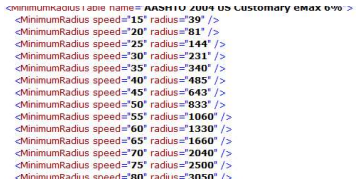



***Figure 5-19*** *The minimum radius table from the design criteria file*

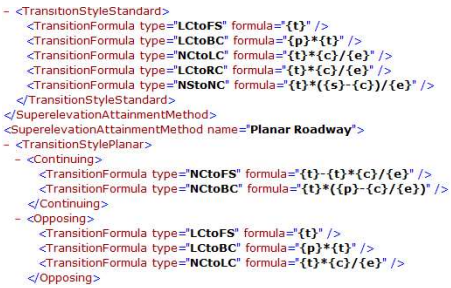



***Figure 5-20*** *The superelevation attainment method table from the design criteria file*

## Superelevation Rate at a Given Radius

This criterion specifies a set of values for superelevation and radii for a given speed. Figure 5-21 shows a reference from the design criteria file showing the superelevation rate at a fixed speed of 30 and varying curve radii.

## Minimum Radius Length at a Given Radius

This criterion specifies the minimum transition length required at a given radius. The transition length varies according to the curve radius at a given speed. For example, at a road design speed of 15 and a curve radius of 605, the required transition length will be 34. On the other hand, if the curve radius is 496 and the road design speed is the same then the transition length will be 40. Figure 5-22 shows a reference from the design criteria file showing different transition lengths required at a fixed speed of 15 and varying curve radii.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

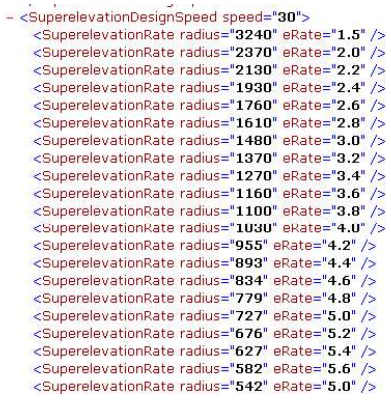



***Figure 5-21*** *The superelevation rate table from the design criteria file for the design speed*

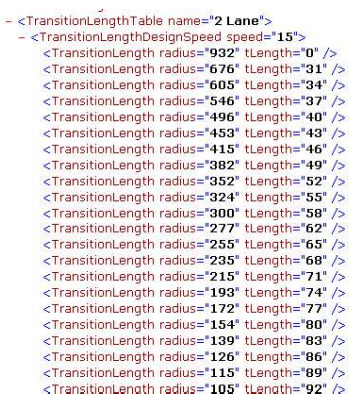



***Figure 5-22*** *The transition length table from the design criteria file*

The design criteria files contain many tables specifying different design values based on the AASHTO standards. AutoCAD Civil 3D will display a warning symbol in the drawing if these standards are violated while creating the alignment. When you create an alignment from the **Alignment Layout Tools** toolbar, the minimum criteria values will be displayed automatically in the command line. You can accept the default values or enter new ones.



**Note**

*AutoCAD Civil 3D provides predefined and country-specific* ***Country Kits*** *or design templates. To download these templates, visit* ***www.autodesk.com****, enter* ***Country Kits*** *in the* ***Search*** *field and then press ENTER. Next, click on the* ***AutoCAD Civil 3D Services & Support - Templates & Libraries*** *link; the* ***Templates and Libraries*** *page will be displayed. Scroll down the page to view the country kits and download the required country kit. These lists are basically .exe files consisting of country specific drafting and design standards that you can use to create your designs.*

## Creating Connected Alignments

**Ribbon:** Home > Create Design > Alignment drop-down > Create Connected Alignment
**Command:** CREATEALIGNMENTCONNECTED

The new connected alignment capabilities in AutoCAD Civil 3D 2020 allow you to create a new dynamically linked alignment and profile that enables transitions between two intersecting alignments and their profiles. You can use this feature to create a curb return, an exit ramp, a merging/diverging road, or to connect an existing road with a proposed road.



Choose the **Create Connected Alignment** tool from the **Alignment** drop-down in the **Create Design** panel of the **Home** tab; first you will be prompted to select the first alignment and then the second alignment from the drawing. Now, you will be prompted to pick a location for connected alignment and then press ENTER to accept the location; the **Create Connected Alignment** dialog box will be displayed, as shown in Figure 5-23.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

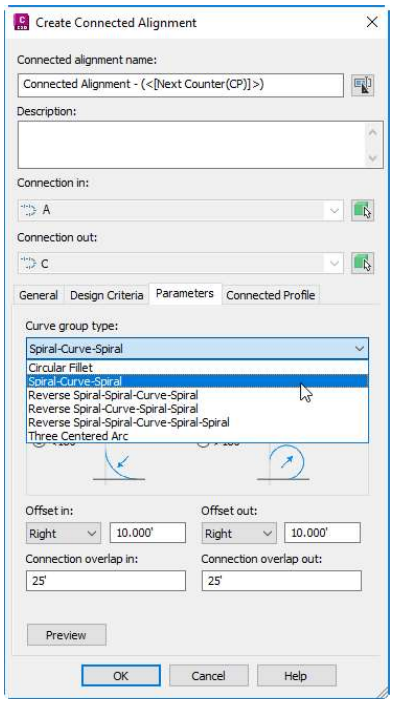



***Figure 5-23*** *The* ***Create Connected Alignment*** *dialog box*

In this dialog box, you need to make the required settings or accept the default settings. In this dialog box, a new tab, **Parameters**, is added. Select **Spiral-Curve-Spiral** from the **Curve group type** in this tab and then choose the **OK** button; the connected alignment will be created, as shown in Figure 5-24. Connnected alignment is defined as a connection between two alignments. Figure 5-24 shows connected aligmnent between two different alignments.

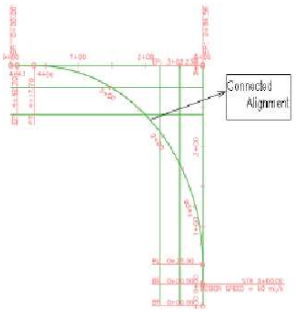



***Figure 5-24*** *The connected alignment between two different alignment*

## Design Checks

Design checks are created to check the criteria which are not included in the in-built design criteria files. These checks are basically mathematical expressions defined to verify that the alignment entities such as lines, curves, and spirals comply with the criteria set for the alignment.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

You can create individual design checks for lines, spirals, curves, and tangents and save them in a design check set that can be applied to an alignment. As explained earlier, a design check set is a collection of different design checks. You can create a new design check set or edit an existing one by choosing **Alignment > Design Checks > Design Check Sets** in the **Settings** tab in the **TOOLSPACE** palette. The detailed method of creating the design checks is discussed next.

## Creating a Design Check

To create a new design check, choose the **Settings** tab and expand **Design Checks** sub node in **Alignment** node; you will notice different entities listed in the **Design Checks** node. You can create the design checks for any of those listed entities. To create a design check for the line sub-entity of an alignment, right-click on the **Line** subnode; a shortcut menu will be displayed. Choose **New** from the shortcut menu; the **New Design Check - New Alignment Design Check** dialog box will be displayed, as shown in Figure 5-25. The options in this dialog box are discussed next.

### Name

Use the **Name** edit box to specify the name for the current design check.

### Description

Enter a short description about the design check in this text box.

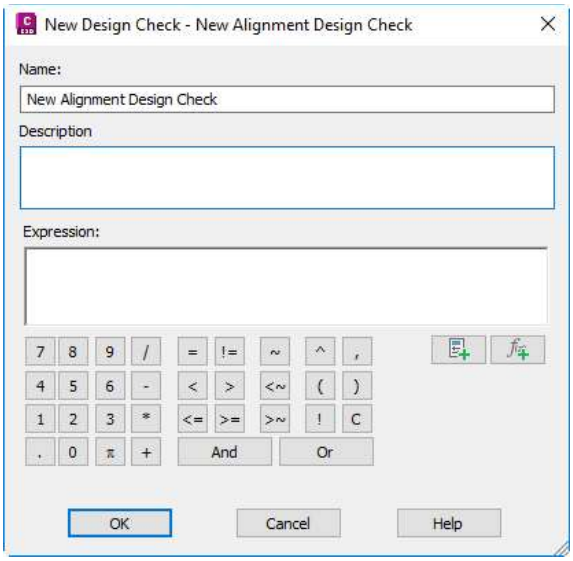



*Figure 5-25 The **New Design Check - New Alignment Design Check** dialog box*

### Expression

The **Expression** edit box is used to enter the mathematical expressions for the design check using functions, properties, buttons, and logical operators. The different operators that can be used to create design checks are listed next.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

| Operator | Operation |
|---|---|
| = | logical equals |
| != | logical not equals |
| ! | logical not |
| < | logical less-than |
| > | logical greater-than |
| <= | logical less-than or equals |
| >= | logical greater-than or equals |
| ~ | logical approximately equal |
| <~ | logical less-than or approximately equal |
| >~ | logical greater-than or approximately equal |

| Operator | Operation |
|---|---|
| + | binary addition |
| - | binary subtraction |
| * | binary multiplication |
| / | binary division |
| AND | boolean **AND** |
| – | unary minus |
| + | unary plus |
| ^ | power |

### Insert property



The **Insert property** button is used to insert a property in the design check. Choose this button; a flyout with different options will be displayed. Choose the required property from the flyout to add it to the **Expression** edit box. For example, if you want that the length of any sub-entity of an alignment should be equal to or greater than 100, choose the **Insert property** button and then choose **Length** from the flyout and add the **>=** logical operator by choosing the respective button from the dialog box. You can also use the parenthesis at the start and end of the design check expression.

### Insert function



The **Insert function** button is used to add a function in the design check expression. Choose the **Insert function** button; a flyout will be displayed. Choose the required function from the flyout to add it to the design check expression. Some of the functions are as follows:

| Function | Description |
|---|---|
| ACOS(x) | Returns arccosine of x |
| ABS(x) | Returns absolute value of x |
| ASIN(x) | Returns arcsin of x |
| ATAN(x) | Returns arctangent of x |
| ATAN2(y,x) | Returns arctangent of y/x in the correct quadrant based on signs of x and y |
| COS(theta) | Returns the cosine of theta |
| SEC(theta) | Returns the secant of theta |
| COSH(theta) | Returns the hyperbolic cosine of theta |
| SECH(theta) | Returns the hyperbolic secant of theta |

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

| | |
|---|---|
| DEG2GRD(theta) | Converts theta in degrees to gradients |
| DEG2RAD(theta) | Converts theta in degrees to radians |
| EXP(x) | Returns exponential of x |
| TAN(theta) | Returns the tangent of theta |
| COT(theta) | Returns the cotangent of theta |
| TANH(theta) | Returns the hyperbolic tangent of theta |
| COTH(theta) | Returns the hyperbolic cotangent of theta |
| TRUNC(x) | Truncates x to an integer value |
| IF(test,true_val,false_val) | Evaluates test, if test is non-zero evaluates and returns true_val. Else, evaluates and returns false_val. True_val and false_val can be any expression |

After you have created the design check expression, choose the **OK** button to close the **New Design Check - New Alignment Design Check** dialog box. The created design check will now be added to the **Line** node in the **Settings** tab. Similarly, you can create a design check for the curve, spiral, and tangent intersection entities listed in the **Design Checks** collection of the **Settings** tab. You can then add these design checks in a design check set and use them for creating alignments.

## Working with Design Checks in a Design Check Set

To add a design check in a design check set, choose the **Settings** tab and expand the **Alignment** node. Now, choose the **Design Check Sets** subnode to view the default name of the design check set. Next, right-click on the **Design Check Sets** and choose **New** from the shortcut menu displayed; the **Alignment Design Check Set - New Alignment Check Set** dialog box will be displayed. The **Information** tab will be chosen by default in this dialog box. In this tab, enter a name of the check set in the **Name** edit box. Next, choose the **Design Checks** tab. In this tab, select the required option from the **Type** and **<Geometry Type> Checks** drop-down lists. Next, choose the **Add** button to add the selected design check and type in the respective columns, refer to Figure 5-26. Then, choose the **OK** button to close the dialog box.

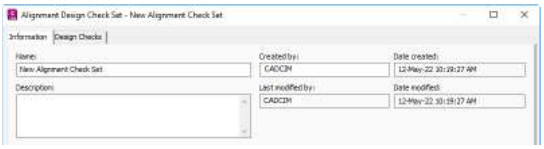



***Figure 5-26** The partial view of the **Alignment Design Check Set - New Alignment Check Set** dialog box showing some design checks*

To edit an existing design check sets, right-click on the required design check in the **Alignment Design Check Set** dialog box; a shortcut menu will be displayed. In the shortcut menu, choose the **Edit** option; the **Alignment Design Check Set - <Name>** dialog box will be displayed. On completion of edits, choose the **OK** button to save changes and exit the dialog box.

To assign a design check while creating the alignment, select the required design check set from the **Use design check set** drop-down in the **Design Criteria** tab of the **Create Alignment - Layout** or the **Create Alignment - From Object** dialog box.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Creating a Design-based Alignment

**Ribbon:** Home > Create Design > Alignment drop-down > Alignment Creation Tools
**Command:** CREATEALIGNMENTLAYOUT

To create a design-based alignment, choose the **Alignment Creation Tools** tool in the **Create Design** panel from the **Home** tab; the **Create Alignment - Layout** dialog box will be displayed. Choose the **Design Criteria** tab in this dialog box. The **Design Criteria** tab is used to specify the options for creating the criteria-based alignment. The options in this tab are discussed next.

### Starting design speed

The **Starting design speed** edit box displays the default value of the design speed at the starting station of the alignment. Enter the starting design speed in the edit box. If you do not specify the design speed for other stations in the alignment, the design speed specified at the first station will be applied throughout the alignment.

### Use criteria-based design

Select the **Use criteria-based design** check box to apply the design criteria to the alignment; the options in the **Use design criteria file** area will be activated.

### Use design criteria file

The **Use design criteria file** check box is selected by default if the **Use criteria-based design** check box is selected. Also, a design criteria file is selected by default and displayed in the textbox of the **Use design criteria file** area. This design criteria file is located in the Autodesk installation folder C:*Program data\Autodesk\C3D 2026\enu\Data\Corridor Design Standards\Imperial_Autodesk Civil 3D Imperial (2011) Roadway Design Standards.xml*

To choose a different design criteria file, click the browse button; the **Select Design Speed Table** dialog box will be displayed. Browse and open the required design criteria file. From this file, you can specify the superelevation attainment method, minimum radius, and transition (spiral) length in their respective tables.

### Default criteria

The **Default criteria** table displays the properties and default values included in the criteria file. You can change the default values of these properties by clicking in the corresponding **Value** field of the properties and selecting an option from the drop-down list displayed, as shown in Figure 5-27.

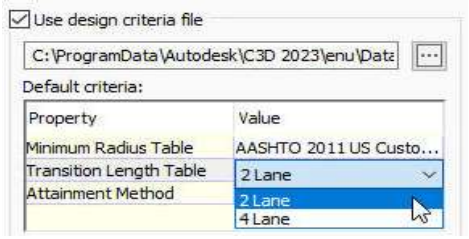



***Figure 5-27*** *Selecting an option from the drop-down list displayed*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

### Use design check set

The **Use design check set** check box is selected by default. As a result, you can use and select an alignment design check set. Select the required design check set from the drop-down list below this check box. While drafting an alignment, if the design parameters of any sub-entity do not comply with the minimum values specified in the design criteria file, Civil 3D will display a warning symbol on that sub-entity, as shown in Figure 5-28.

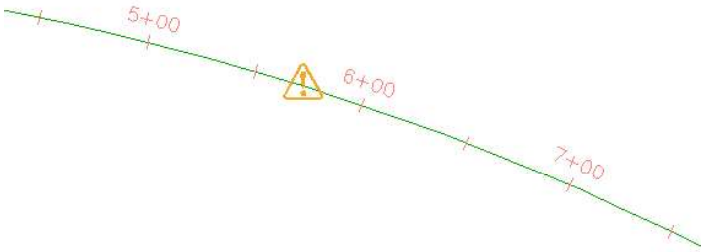



***Figure 5-28*** *The warning symbol displayed on the curve*

If you hover the cursor over the warning symbol, a tooltip will be displayed showing the standard that has been violated and also the values that are required to rectify the violation. The warning message is also displayed in the **Alignment Entities** tab of the **PANORAMA** window displayed on choosing the **Alignment Grid View** tool from the **Alignment Layout Tools** toolbar.

## Editing the Design Criteria

You can edit and customize the design criteria according to your required standards. To edit design criteria, select the required alignment in the current drawing; the **Alignment:<Alignment name>** tab will be displayed. In this tab, choose the **Design Criteria Editor** tool from the **Modify** panel; the **Design Criteria Editor - <design criteria file name.xml>** dialog box will be displayed, as shown in Figure 5-29.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

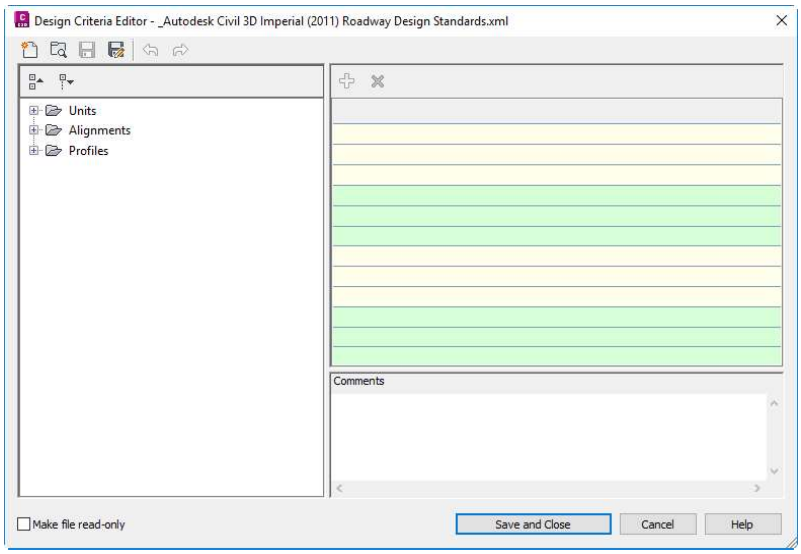



***Figure 5-29** The **Design Criteria Editor - _Autodesk Civil 3D Imperial (2011) Roadway Design Standards.xml** dialog box*

On the left pane of this dialog box, three collections are displayed: **Units**, **Alignments**, and **Profiles**. Expand the **Alignments** collection; four sub-collection will be displayed namely the minimum radius tables, superelevation attainment methods, superelevation tables, and widening methods. You can expand the required sub-collection for which you want to edit the design criteria. For example, to change the minimum radius in the design, expand the **Minimum Radius Table** sub-collection and select any of the tables listed in it. On doing so, the values of different design speeds and the minimum radii will be displayed in columns on the right pane of the dialog box. Click on the required radius value and change it at the specified design speed according to the design criteria.

Similarly, expand other sub-collections. Select them to display the design parameters in columns on the right pane of the dialog box. You can edit the values as required. You can also modify the units for the design criteria file by using the **Units** collection. The **Profiles** collection allows you to edit the profile criteria if the alignment consists of any profiles. This will be discussed later in the chapter. The different buttons in the **Design Criteria Editor** dialog box are discussed next.

## New



Choose the **New** button to create a new design criteria file; an empty file without any design parameter will be displayed.

## Open



The **Design Criteria Editor** dialog box is displayed with the default design criteria in a file. If you want to edit the design criteria of any other design criteria file that you have customized, choose the **Open** button; the **Select a Design Criteria File** dialog box will be displayed. Select and open the required design criteria file using this dialog box.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

### Save



This button is activated only after you edit a design parameter. Choose the **Save** button to save the changes made in the design criteria file.

### Save As



Choose the **Save As** button to save the current design criteria file using a different file name; the **Enter a file name to save** dialog box will be displayed. Enter a name in the **File name** edit box and choose the **Save** button to save the file.

### Add



Choose the **Add** button to add a new row above the selected row or at the end of the parameters table if you have not selected one.

### Delete



Choose the **Delete** button to delete the required rows from the table.



**Note**

*The **Undo** and **Redo** buttons can be used to revert to the change made recently in the design parameter value and the recent undo operation performed.*

### Comments

The **Comments** text box is used to add a comment about the selected design parameters from the left pane of the dialog box. These comments will be saved with the file and are displayed every time you select the design criteria.

### Make file read-only

Select the **Make file read-only** check box to prevent the design criteria file from being modified. On selecting this check box, the values displayed on the right pane will be deactivated.

### Save and Close

Choose the **Save** and **Close** button to save the changes made in the design criteria and close the **Design Criteria Editor- <design criteria file name>** dialog box, respectively.

## ALIGNMENT PROPERTIES

| | |
|---|---|
| **Ribbon:** | Alignment > Modify > Alignment Properties drop-down > Alignment Properties |
| **Command:** | EDITALIGNMENTPROPERTIES |

To view and edit the alignment properties, select the required alignment from the drawing; the **Alignment:<Alignment Name>** tab will be displayed. Next, choose the **Alignment Properties** tool from the **Modify** panel; the **Alignment Properties - <alignment name>** dialog box will be displayed. This dialog box is used to assign new name and object style, and set station equations, design criteria, and superelevation properties to an alignment. You can also view the profile information if the alignment consists of profiles. You will learn about the profiles in the next chapter. The tabs in this dialog box are discussed next.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com



**Tip**

*You can also select the required alignment name from the **Alignments** collection in the **Prospector** tab of the **Toolspace** palette and right-click to display the shortcut menu. Choose **Properties** from the shortcut menu to display the **Alignment Properties** dialog box.*

## Information Tab

The **Information** tab displays the name and object style of the selected alignment. You can modify the name by using the **Name** edit box. The style can be changed by selecting an option from the **Object style** drop-down list.

## Station Control Tab

This tab help you to change the station reference point and add station equations along an alignment. The options in this tab are discussed next.

### Reference point Area

The **Reference point** area displays the XY coordinates of the default station reference point and displays the starting station of the alignment. By default, the starting station of the alignment is considered as the station reference point and its coordinates are displayed in the **X** and **Y** edit boxes, as shown in Figure 5-30.

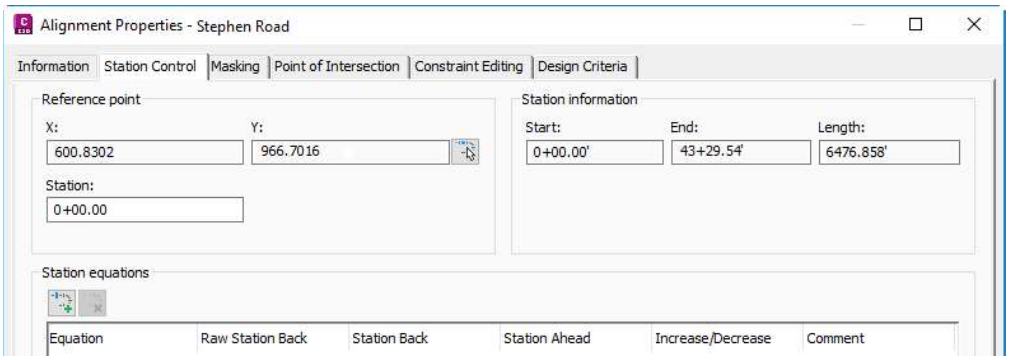



***Figure 5-30** The coordinates displayed in the **X** and **Y** edit boxes in the **Reference point** area*

You can modify the reference point for the alignment. To do so, choose the **Pick reference point** button on the right and specify the reference point by picking a station along the alignment from the drawing. To change the default station value of the alignment, enter the required station value in the **Station** edit box of this area. Note that the information displayed in the **Station information** area changes according to the values entered in the **Station** edit box.



**Note**

*The start station of the alignment can be specified before creating the alignment by entering the value in the **Starting station** edit box of the **Create Alignment - Layout/from Objects** dialog boxes. However, if you did not specify the start station in the beginning, you can do it in the **Alignment Properties** dialog box.*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

### Station equations Area

This area allows you to display and create the station equations. To create a new station equation, choose the **Add station equation** button; the **Alignment Properties** dialog box will disappear and you will be prompted to specify a station along the alignment. Pick the required station from the alignment; the **Alignment Properties** dialog box will be displayed again and the information will displayed in the **Station equations** area. You can change the values in the **Raw Station Back**, **Station Ahead** and **Increase/Decrease** columns by clicking in the respective column cells. To add more station equations, choose the **Add station equation** button again; the new station equation will be added before the previously added station. Note that the station equation added first becomes your last station equation.

**Note**

*The **Autodesk Autocad Civil 3D** warning message box will be displayed, if any changes are done in the **stations control** tab. Choose **OK** to continue or choose **Cancel** to terminate the command.*

## Design Criteria Tab

This tab is used to assign or edit the design criteria and speeds. This tab can also be used to assign variable speed limits for stations along an alignment. However, only one design speed can be assigned to any given station.

### Design Speeds Area

The **Design Speeds** area allows you to specify the design speeds at a station. Note that a default design speed is already added in the **Design Speed** column of this area. To change the default value, double-click on it in the **Design Speed** column and enter the value you require. Next, specify the station at which you want to assign the speed by clicking in the **Start Station** column and choosing the pick button displayed there; you will be prompted to specify the station. Select the required station from the drawing; the selected station will be displayed in the **Start Station** column.

To add a new design speed at a station, choose the **Add design speed** button; a new record is added to the table. Edit the values for **Start Station** and **Design Speed**. To delete a record for design speed, select the record and then choose the **Delete design speed** button.

You can also add a comment or instructions about the design speeds in the **Comment** column. To apply a design criterion, select the **Use criteria-based design** check box. If the criterion is already assigned, you can change the design criteria file and the design check set.

**Note**

*If you select the **Use criteria-based design** check box without assigning a single design speed, Civil 3D will display a warning message box informing you to assign a design speed. This message is displayed because you need to specify at least one design speed to create a design-based alignment. Choose the **Yes** button from the dialog box to proceed further.*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

# ALIGNMENT STYLES

Alignment styles help you control the appearance of the objects, labels, and tables of an alignment. AutoCAD Civil 3D consists of various in-built styles that are applied automatically to alignment objects. You can also create new alignment styles and control the display of alignment objects, alignment labels, and tables as required. The alignment styles are created and managed in the **Settings** tab of the **TOOLSPACE** palette.

## Creating an Alignment Style

The alignment styles control the visual display of the alignment entities such as lines, arcs, curves, and tangents. To create alignment styles, choose the **Settings** tab of the **TOOLSPACE** palette and expand the **Alignment** node. Right-click on the **Alignment Styles** option and choose **New** from the shortcut menu displayed; the **Alignment Style - New Alignment Style** dialog box will be displayed, as shown in Figure 5-31. The tabs in this dialog box are discussed next.

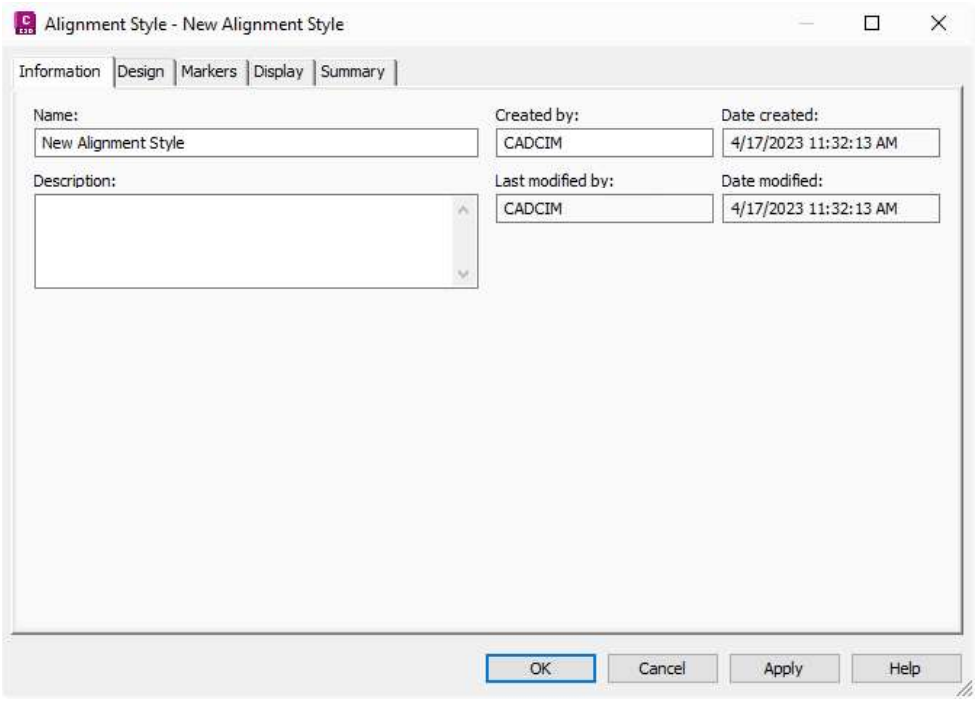



***Figure 5-31** The **Alignment Style - New Alignment Style** dialog box*

### Information Tab

This tab is used to specify the name and description of the alignment style. Use the **Name** and **Description** edit boxes to specify the name and description of the alignment style.

### Design Tab

This tab is used to specify the grip behavior for alignment curves while editing the alignment. Select the **Enable radius snap** check box in the **Grip edit behavior** area to enable the cursor to snap to a specified increment value of the free curve while editing; the **Radius snap value**

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

edit box will be displayed. Enter the radius snap value in the **Radius snap value** edit box. The cursor will snap to the specified radius value when you grip edit the curves in the alignment. For example, if you enter the value 5 when the radius is 100, the cursor will snap to the position where the radius value is equal to 105. The snap value is always a whole number such as 10, 20, 100 and so on. The cursor will not snap to the values given in the decimal form such as 105.5.

## Markers Tab

This tab is used to specify the appearance for alignment points such as PI, start point and end point, spiral curve and mid points. The **Name** column in the **Alignment points** list box displays various alignment points. The **Marker Style** column specifies the marker style for the points. Double-click in the **Marker Style** column; the **Pick Marker Style** dialog box will be displayed. You can select a marker style for the point or create a new style using the options in this dialog box. The **Arrowhead** area displays various options to specify the appearance of the arrowhead used for the alignment direction arrows. You can select any type of arrowhead from the **Type** drop-down list. On selecting the style for the arrowhead, you can also specify the size of the arrowhead using the **Size options** drop-down list and enter the value in the **inches** edit box in the **Arrowhead** area.

## Display Tab

This tab is used to specify the display characteristics and visibility for the alignment components such as lines, arcs, curves, and so on. The options in this tab are discussed next.

### View Direction

You can view the drawing in two dimensions and three dimensions with different display settings of the components. You can also specify the display settings for both two and three dimensions. To select a specific view for the display setting, select the **Plan**, **Section**, or **Model** options from the **View Direction** drop-down list in the **Display** tab.

### Component display area

The **Component display** area lists the names and the display properties of the alignment components in different columns. The alignment components such as lines, arrows, curves, and spirals are listed in the **Component Type** column. You can set the visibility, color, lineweight, and linetype of the alignment components in the view direction selected. Note that the properties for the component displayed are configured for the selected view direction only. For example, if you have selected **Plan** from the **View Direction** drop-down list and set the color of the **Line** component to red, the line component of the alignment will be displayed in red only in the plan view of the alignment.

## Summary Tab

The options in this tab display the summary of the settings made in the other tabs of the **Alignment Style** dialog box. For example, the **Information** node displays the name, description, and other information about the style and the **Direction Arrow** node specifies the arrow head style. The **Design** collection displays the information about the specifications made in the **Design** tab. Similarly, the **Marker** node shows the settings defined in the **Marker** tab. Set the required options in the **Alignment Style** dialog box and choose the **OK** button; the alignment style will be created and added in the **Alignment Styles** subnode of the **Alignment** node of the **Settings** tab.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Editing the Current Alignment Style

| | |
|---|---|
| **Ribbon:** | Alignment > Modify > Alignment Properties drop-down > Edit Alignment Style |
| **Command:** | EDITALIGNMENTSTYLE |

To edit an existing style, select the alignment from the drawing; the **Alignment:<Alignment Name>** tab will be displayed. Next, choose the **Edit Alignment Style** tool from the **Modify** panel; the **Alignment Style** dialog box with the alignment style name will be displayed. Edit the alignment style as required and choose the **OK** button to close the dialog box.



**Tip**

*You can also edit the alignment style using the **Settings** tab. To do so, choose the **Settings** tab and expand the **Alignments** node. In this node, expand the **Alignment Styles** sub node. Next, right-click on the existing alignment style name and choose **Edit** from the shortcut menu displayed.*

# ALIGNMENT LABLE STYLES




The alignment style is created to control the display of the alignment objects whereas the alignment label styles are created to control the display of text and labels of these alignment objects. The alignment labels are automatically generated in Civil 3D along the alignment at some specified points such as start and end points of the alignment, major and minor stations, at the point of intersections, and so on. The display of the alignments is controlled by the alignment styles. Civil 3D has a number of in-built label styles to label different components of an alignment such as stations, station offsets, lines, curves, spirals, points of intersections, and so on. You can manage alignment label style by specifying the required alignment label set. A label set is a group of label styles that are defined for various alignment components. The label set is created by using the options in the **Settings** tab of the **TOOLSPACE** palette.

## Creating an Alignment Label Style

To create a label style, expand the **Alignment** collection and then expand the **Label Styles** node. You will see that the **Label Styles** node consists of different subnodes of various alignment objects such as stations, station offsets, lines and curves. Each of these alignment objects has varied label styles.

The first step to create an alignment label style is to define a label style for each of these elements and then add these label styles to the label set. The label set is a combination of different label styles that you want to apply to the alignment. It helps you easily assign the labels to the alignment.

To create a label style, expand the **Alignment** node from the **Settings** tab and then expand the **Label Styles** node; the different subnodes will be displayed. Expand the required subnode for which you want to define the label style. For example, to define a label style for the stations and the station offsets of the alignment, expand the **Station** and **Station Offsets** subnodes; the **Station** subnode consists of different elements such as the major and minor stations, geometry points and the design speeds for which you need to define the label styles. You can define labels for all

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

the elements or the required elements. For example, to define a label style for the major station, select and right-click on **Major Station** and then choose **New** from the shortcut menu displayed; the **Label Style Composer - New Major Station Label Style** dialog box will be displayed, as shown in Figure 5-32.

The dialog box consists of five tabs, which are discussed next.

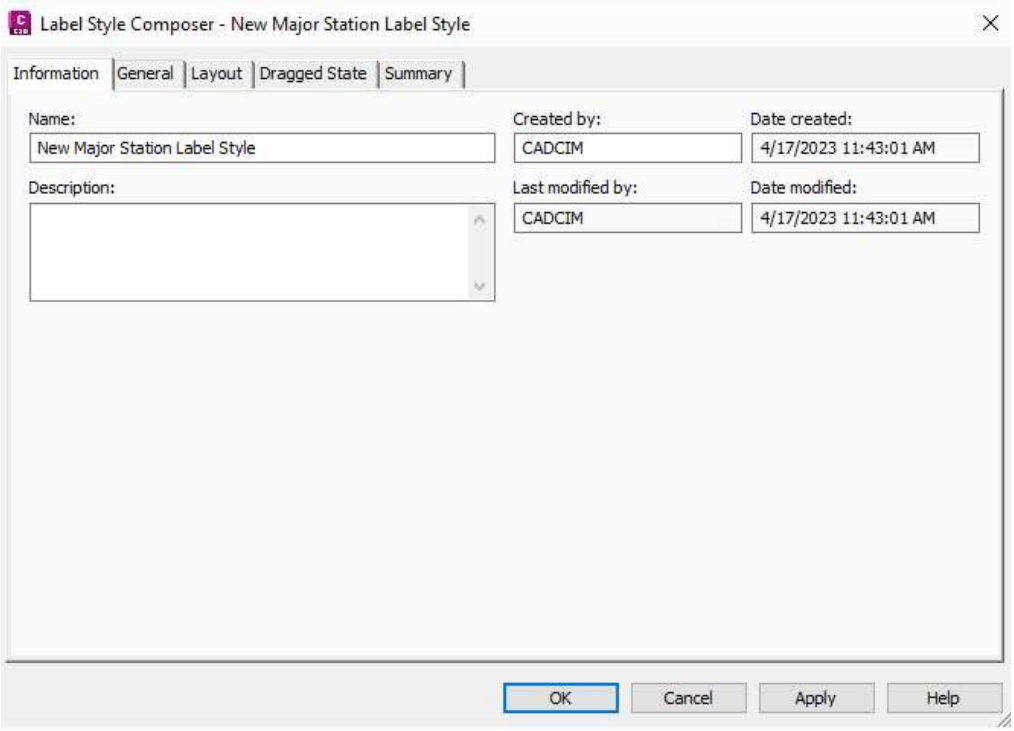



***Figure 5-32** The **Label Style Composer - New Major Station Label Style** dialog box*

## Information Tab

This tab is used to specify the name of the label style. Specify the name of the label style in the **Name** edit box.

## General Tab

The **General** tab is used to define the label text visibility, orientation, location, and label text settings. This tab consists of a **Preview** window that displays the current label style.

The label style properties and their values are listed in the **Property** and **Value** columns under three categories, **Label**, **Behavior**, and **Plan Readability**. You can expand or collapse the respective categories by clicking on the **+/-** sign on the left of each category. The properties in the **Label** category control the label text style, visibility, and layer. The properties in the **Behavior** category control the location and orientation of the label whereas the properties in the **Plan Readability** category help you define the settings for the label to be visible in the plan view.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Layout Tab

The **Layout** tab is used to create a label style for the components. The **Layout** tab consists of a **Preview** display box that shows the preview of the existing style and the **Component name** drop-down list to select the component for which you want to create the label style. The **Create Text component**, **Copy component**, **Delete component**, and **Component draw order** buttons are available on the right of the **Component name** drop-down list, refer to Figure 5-33.

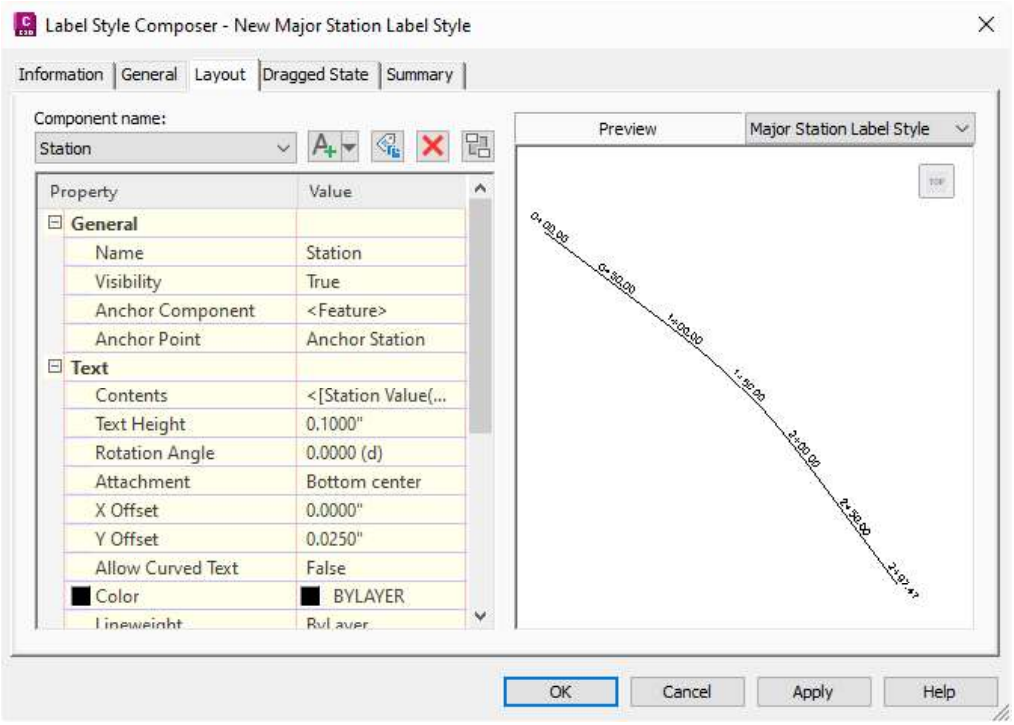



***Figure 5-33*** *The* ***Layout*** *tab of the* ***Label Style Composer - New Major Station Label Style*** *dialog box*

In the first step, you will create a component and then modify its properties that are displayed in the **Property** and **Value** columns of the dialog box. You can choose the main alignment label components such as **Text**, **Line**, **Block**, **Tick**, and **Reference Text** from the flyout that is displayed on choosing the **Create Text component** button. Once you add a component, it will be added to the **Component name** drop-down list and the properties and values of the component will be displayed accordingly in the **Property** and **Value** columns. The properties displayed in the **Property** column vary according to the component added. They are displayed in the three categories: **General**, **Text**, and **Border**.

The properties in the **General** category help you define the name and visibility of the component. The **Anchor Component** property in this category specifies the anchor component to which the component will be attached. The **Anchor Point** property specifies the point on the anchor component to which the selected component will be attached.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

The properties in the **Text** category help you specify the content of the label text, text height, color weight, and so on. You can click in the property field of the **Value** column and modify the values of the label style properties. You can define the color, lineweight, layer, text height, rotation, and also the point where the label text would be attached to the anchor point by using the **Attachment** property.

You can add or change the content of the label style using the **Text Component Editor-Contents** dialog box. To invoke this dialog box, click in the value field of the **Contents** property in the **Text** category and choose the button displayed on the right; the **Text Component Editor - Contents** dialog box will be displayed, as shown in Figure 5-34. There are two tabs in this dialog box: **Format** and **Properties**. It also has a text editor window on the right where you can type the text. The **Properties** tab is chosen by default and is used to add property fields to the label style. Select the property of the feature from the **Properties** drop-down list. Every property has some modifier associated with it, listed in the **Modifier** column. The values of these modifiers can be changed to create a customized label text. For example, to change the value of the **Unit** modifier, click in the **Value** field corresponding to this modifier; a drop-down list will be displayed on the field. Select the required unit from the drop-down list to modify the existing value.

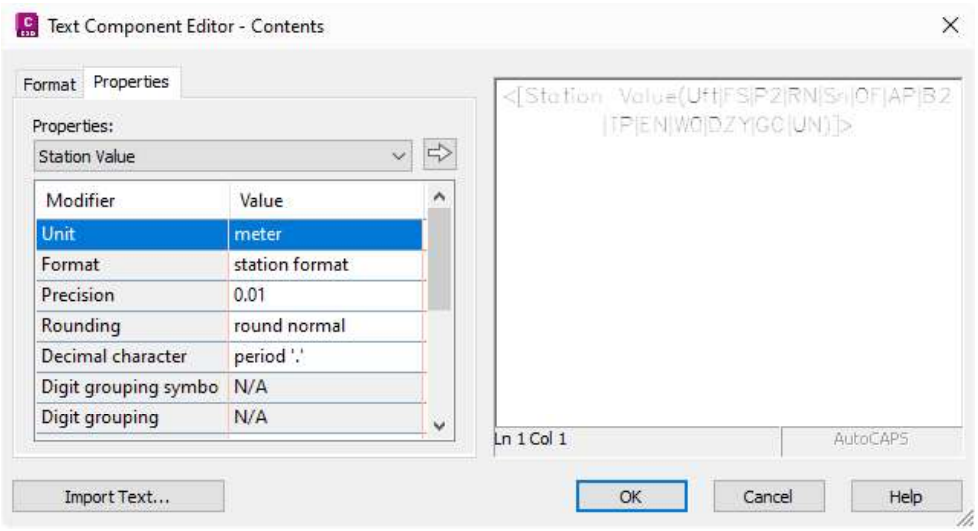



***Figure 5-34*** *The* ***Text Component Editor - Contents*** *dialog box*

Once you have set the values of the modifiers, choose the right arrow button on the right of the **Properties** drop-down list; the property field with the coding will be added to the Text Editor window, as shown in Figure 5-35.

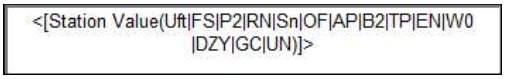



***Figure 5-35*** *The* ***Station Value*** *property added to the Text Editor window*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

The codes of the property field added in the Text Editor window are actually the abbreviations of the modifiers and their values. For example, the **Station Value** property code added in the text editor window is *<[Station Value(Uft|FS|P2|RN|Sn|OF|AP|B2|TP|EN|W0|DZY|GC|UN)]>*. Some of the abbreviations and values in this code are:

| Abbreviation | Modifier | Value |
|---|---|---|
| Uft | Unit | Foot |
| FS | Format | Station |
| P2 | Precision | 2 |
| RN | Rounding | Normal |
| AP | Decimal Character | Period |
| Sn | Sign | Negative |
| OF | Output | Full |

The characters such as **<**/, **(**,**)**, **|**, and **/>** are used to specify the beginning and end of the property field, modifier, and the modifier separator. You can add the text manually in the beginning. To edit the text added manually, right-click in the text editor window and choose the required editing options from the shortcut menu.



**Note**

*While adding the text manually, do not use the characters such as <>.*

To set the formatting of the label text, choose the **Format** tab. The **Justification**, **Font**, and **Color** options in this tab are used to align the label text, select a font, and select the color for the text, respectively. The **Text Style** is the same as set in the **General** tab and cannot be modified in this tab.

Once you have added the label text component and set other parameters in the **Text Component Editor - Contents** dialog box, choose the **OK** button to return to the **Label Style Composer - New Major Station Label Style** dialog box.

The properties in the **Border** category help you set the display of a border around the label or the component to be edited. In this category, set the value for the **Visibility** property to **True** to make the border visible. You can select the type of border in the **Type** property of this category. You can add a rectangular, rounded rectangular, or a circular type of border to the labels or the components using this property. The properties in the **Border** category also help you display a background mask by setting the value of the **Background Mask** to **True**. The background mask is used to hide the objects in the background of the label. You can set the distance between the text and the border of the label by entering the required value in the **Value** column of the **Gap** property. You can also modify the color, linetype, and lineweight of the border in the respective **Value** columns. Similarly, you can add the **Line**, **Block**, **Tick**, and **Reference Text** components from the flyout that is displayed by choosing the **Create Text component** button. You can also modify the properties displayed on the **Property** column based on the component added.

To delete a component from the label, select the component from the **Component name** drop-down list and choose the **Delete Component** button represented by the red cross mark

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

on the right of the **Component name** drop-down list. To set the order of various components in the label, choose the **Component draw order** button. On doing so, the **Component Draw Order** dialog box with various components of the label will be displayed. Set the draw order of these components using the **Top** and **Bottom** arrows displayed on the right of this dialog box and choose the **OK** button to return to the **Label Style Composer** dialog box.

### Dragged State Tab

This tab is used to specify the appearance for the label in the dragged state when it is dragged or moved from its original position. The dragged state properties of the label are listed under two categories: **Leader** and **Dragged State Components**.

The properties in the **Leader** category help you make the leader visible or invisible when the label is dragged. Set the value of the **Visibility** property to **True** or **False** to make the leader visible or invisible in the dragged state. You can also set the properties of the **Arrow Head Style**, **Color**, **Linetype**, **Lineweight**, and so on in their respective **Value** fields.

The **Display** property in the **Dragged State Components** category helps you specify the display of the label after it is dragged. Click in the **Value** field of this property and select **As Composed** from the drop-down list to view the original settings of the label. On selecting this option, other properties will become unavailable and you will not be able to modify them. Select the **Stacked Text** option for the **Display** property to display the text components of the label in a vertically stacked way. On selecting this option, all blocks, ticks, and direction arrows will be removed and the label components will be stacked according to the draw order specified in the label style. Similarly, specify the values for the other properties as required. Once you have defined the settings for the label in the dragged state, select the label in the drawing and drag it to a new location using the grips and view the label in the dragged state.

### Summary Tab

This tab is used to review and modify the settings of the label style. You can modify only those values that appear in bold. Expand the required categories in the **Summary** tab to view or modify the settings.

After creating the label style of the required alignment components, the next step is to group these styles using the **Label Sets** to make it easy to apply various styles to the alignment.

## Creating a Label Set

To create a label set, expand the **Alignment** node from the **Settings** tab. Next, expand the **Label Styles** node and right-click on the **Label Sets**; a shortcut menu will be displayed. Choose **New** from the shortcut menu; the **Alignment Label Set - New Alignment Label Set** dialog box will be displayed. This dialog box consists of two tabs, **Information** and **Labels**, which are discussed next.

### Information Tab

This tab is used to specify the name for the label set as well as to review the information associated with it such as the date when it was created or modified, and so on. You can specify the name in the **Name** edit box.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Labels Tab

This tab is used to specify the labels to the label types to be included in the set. The options in this tab are discussed next.

### Type

The **Type** drop-down list provides you with the label types options that can be selected or added to the label set. You can configure and select the label type to add to the label set.

### Major Station Label Style

The **Major Station Label Style** drop-down list contains the set of available styles for the selected type. The options in this drop-down list are type dependent. Once you select a label type from the **Type** drop-down list, the corresponding label styles will be displayed in the **Major Station Label Style** drop-down list.

### Style selection



This button is used to create a new label style, copy or edit the existing style of the label type, or pick the style from the drawing. Choose the down-arrow on the right of this button to display a flyout. You can choose an option from the flyout to select the style. To view the style of the label type, choose the button on the right of this button. On doing so, the **Style Detail** dialog box will be displayed with the preview of the label style in the **Preview** window.



### Add

Once you have selected the label type and the label style, choose the **Add** button to add them in the label set. These selected types and styles will be listed in the **Type** column and the **Style** column in the **Labels** tab. To remove the label type from the label set, select it from the **Type** column and choose the button on the right of the **Add** button. On doing so, the selected label type and label style will be deleted from the **Type** and **Style** columns.

The **Increment** column specifies the increment values at which the major and minor station labels can be added. This column is available only for the station labels. Click in the **Increment** column and specify the increment value for stations.

Once you have specified the name for the label set in the **Information** tab, select the label types, the label styles, and specify the increment values if required, and then choose the **OK** button. On doing so, the **Alignment Label Set - New Alignment Label Set** dialog box will be closed and the label set will be added to the **Label Sets** subnode under the **Label Styles** node in the **Settings** tab of the **TOOLSPACE** palette.

To apply a label set to an alignment you have created, select the required alignment from the drawing and right-click. Choose the **Edit Alignment Labels** option from the shortcut menu displayed; the **Alignment Labels - <alignment name>** dialog box will be displayed. Choose the **Import label set** button located at the lower right of the dialog box; the **Select Label Set** dialog box will be displayed. Select the required label set you have created from the drop-down list and choose the **OK** button; the label types and the corresponding styles will be displayed in the dialog box. Choose the **Apply** button from the **Alignment Labels - <alignment name>** dialog box to view the changes or the **OK** button to assign the label set to the alignment.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Adding Alignment Labels

**Ribbon:** Annotate > Labels & Tables > Add Labels drop-down > Alignment > Add Alignment Labels
**Command:** ADDALIGNLABELS

Once you have created and configured your own styles for the alignment objects, you can add them in the drawing. To do so, choose the **Add Alignment Labels** from the **Labels & Table** panel; the **Add Labels** dialog box will be displayed, as shown in Figure 5-36.

Select the object to be labeled from the **Feature** drop-down list. Next, select the required label type and choose the **Add** button; you will be prompted to select the object to be labeled. You can label a single alignment segment or all segments together by selecting the **Single Segment** or **Multiple Segment** option from the **Label type** drop-down list. Similarly, you can select the **Station Offset**, **Station Offset-Fixed Point**, and other options to add labels to offset stations and tangent intersection points in the alignment. After selecting the label type, choose the **Add** button and follow the prompts to label the alignment segments. Next, choose the **Close** button to close the **Add Labels** dialog box.

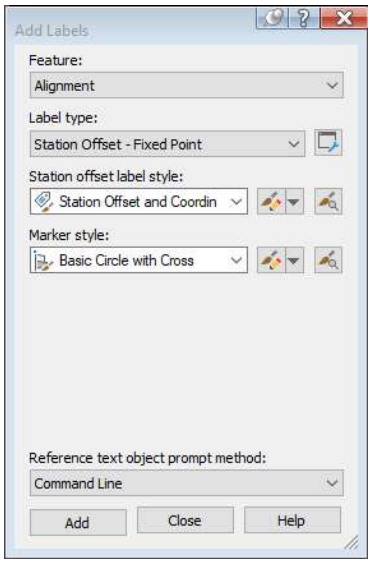



***Figure 5-36*** *The* ***Add Labels*** *dialog box*

## Working with Label Tag Numbering

Label tag numbering in Civil 3D allows you to organize and manage object identification systematically. Tags are assigned numbers that can be automatically or manually adjusted to maintain sequential order and avoid duplicates. This feature ensures that every labeled element within a drawing maintains a clear, consistent numbering system.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Renumber Tags

In Autodesk Civil 3D, the **Renumber Tags** feature allows you to update tag numbers quickly and maintain a sequential labeling system. You can select individual or multiple tags in the desired order for renumbering. To do so, click **Object** from the drawing, then select the **Renumber Tags** from the **Labels & Tables** panel. In the drawing area, select a tag to renumber. The starting number is determined by the **Table Tag Renumbering** settings. If a duplicate number already exists in the drawing, you will be prompted to either skip to the next available number or create a duplicate. By default, duplicate tags are not created unless you allow it. After making the changes, click **OK**, and when finished, enter **END** to close the command.

To control the table tag starting numbers and increments, right-click the drawing name from the **Settings** tab of the **TOOLSPACE** palette; a shortcut menu will be displayed. Select the **Table Tag Numbering** option from this shortcut menu; the **Table Tag Numbering** dialog box will be displayed, as shown in Figure 5-37. In this dialog box, specify the default starting number and increment value.

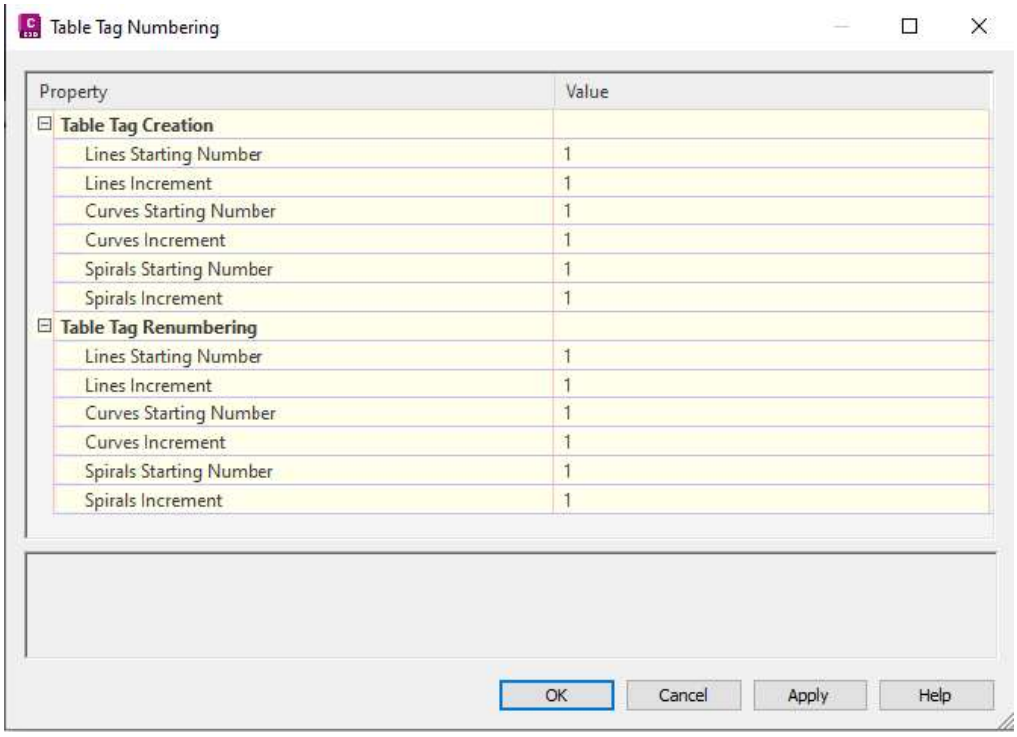



***Figure 5-37*** *The* ***Table Tag Numbering*** *dialog box*

Duplicate tags are not created unless you manually allow them through the renumbering tool. If a duplicate number occurs, the system automatically increases the value by the defined increment until an unused number is found. The starting number then updates automatically to the next number in sequence based on the defined increment.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com



**Note**

You can select multiple tags to renumber and should select them in the sequential order in which you want to create them. If an invalid label type is selected or the label is not in the tag mode, you will be prompted to try again.



**Tip**

*At the command line, you can enter A to automatically renumber tags or S to open the **Table Tag Numbering** dialog box. In this dialog box, you can set the starting number and increment for different label types such as line, curve, or spiral.*

# EDITING ALIGNMENTS

You can edit an alignment using grip editing, the **PANORAMA** window, and the **Alignment Layout Tools** toolbar. Different methods of editing an alignment are discussed next.

## Editing an Alignment Layout Using the Geometry Editor

| | |
|---|---|
| **Ribbon:** | Alignment > Modify > Geometry Editor |
| **Command:** | EDITALIGNMENT |

You can edit the alignment geometry by using different tools from the **Alignment Layout Tools** toolbar. You can do so by adding curves, spirals, tangents, and other sub-entities to the alignment. To edit the alignment geometry, select the required alignment from the drawing; the **Alignment:<alignment name>** tab will be displayed. Choose the **Geometry Editor** tool from the **Modify** panel; the **Alignment Layout Tools - <alignment name>** toolbar will be displayed. Figure 5-38 shows the alignment and the two points of intersection of tangents and Figure 5-39 shows the alignment after using the **Break - apart PI** tool to break the point of intersection.

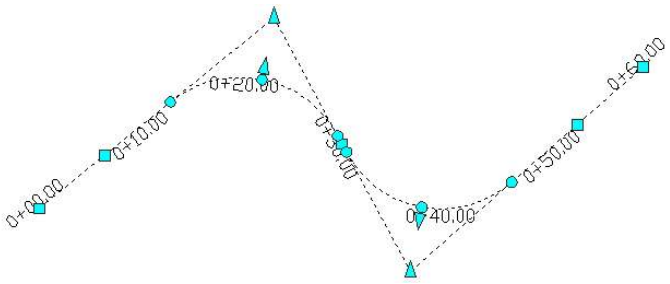



***Figure 5-38*** *The alignment and the two points of intersection of the tangents*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

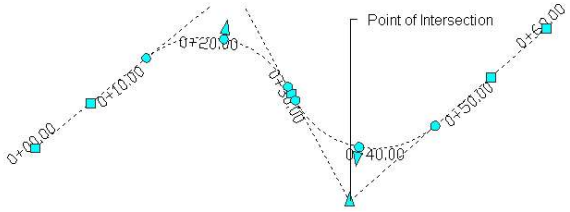



***Figure 5-39*** *The alignment after using the* ***Break- apart PI*** *tool*



**Tip**

*You can also display the* ***Alignment Layout Tools*** *toolbar using shortcut menu. To do so, select the alignment from the drawing and right-click; a shortcut menu will be displayed. Next, choose* ***Edit Alignment Geometry*** *from the shortcut menu; the* ***Alignment Layout Tools*** *toolbar will be displayed.*

Similarly, you can use other tools from the toolbar. For instance, if you want to delete any entity from the alignment, choose the **Delete Sub-entity** tool from the **Alignment Layout Tools** toolbar; you will be prompted to select the sub-entity to be removed. Press the CTRL key and click on the sub-entity to remove it. If you want to delete the point of intersection, choose the **Delete PI** tool from the **Alignment Layout Tools** toolbar. Figure 5-40 shows the alignment after removing the bottom PI.

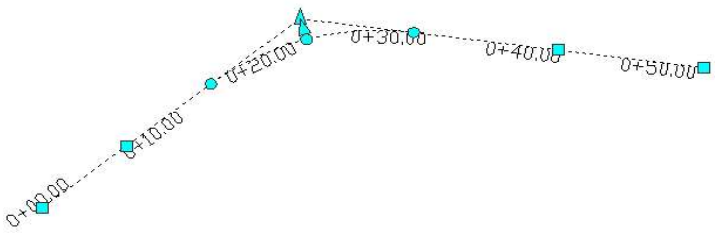



***Figure 5-40*** *The alignment after deleting the PI using the* ***Delete PI*** *tool*

## Editing the Alignment Using the Layout Parameters Dialog Box

You can edit the alignment geometry by changing the values of the design parameters of the alignment entity in the **Alignment Layout Parameters** dialog box. To do so, select the alignment from the drawing and right-click; a shortcut menu will be displayed. Choose the **Edit Alignment Geometry** option from the shortcut menu; the **Alignment Layout Tools** toolbar will be displayed. Choose the **Sub-entity Editor** tool from this toolbar; the **Alignment Layout Parameters** dialog box will be displayed. Note that this dialog box will be activated only if a sub-entity is selected. To select the sub-entity, choose the **Pick Sub-entity** tool; you will be prompted to select the sub-entity. Click to select the entity. On doing so, the design parameters will be displayed in the **Alignment Layout Parameters** dialog box. Note that you cannot modify those parameters in the dialog box that are displayed faded.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

Figure 5-41 shows the **Alignment Layout Parameters** dialog box for the selected entity of the alignment. You can modify the values related to the tangency constraint and pass through point parameters of the selected entity in this dialog box.

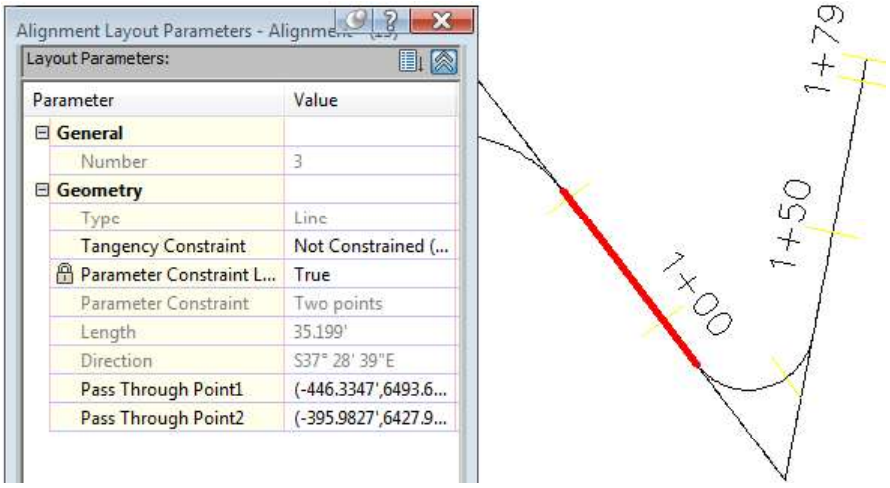



***Figure 5-41*** *Partial view of the* ***Alignment Layout Parameters*** *dialog box for the selected entity of the alignment*

## Editing the Alignment Using the PANORAMA Window

Another method used for editing the alignment is the **Alignment Entities** tab of the **PANORAMA** window. To do so, choose the **Alignment Grid View** tool from the **Alignment Layout Tools** toolbar; the **PANORAMA** window will be displayed. This window displays the entities and the properties in separate rows. You can numerically edit the values that are highlighted in black, as shown in Figure 5-42. To edit a value, first unlock the **Parameter Constraint** subnode of a particular entity then double-click on it and enter a new value. For example, if you want to edit the length of the curve entity, double click on the curve length displayed in the **Length** column and enter a new value for the curve length.

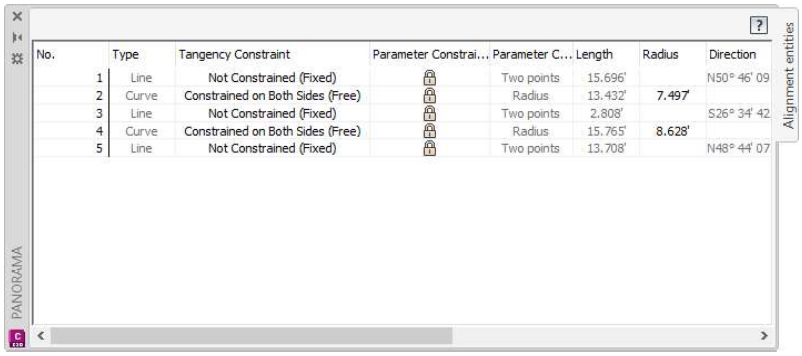



***Figure 5-42*** *The* ***Alignment entities*** *tab of the* ***PANORAMA*** *window for editing the values displayed in black*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com



**Note**

*An inactive **PANORAMA** window can be activated by selecting an entity from it.*

## Changing the Direction of the Alignment and Sub-entities

| | |
|---|---|
| **Ribbon:** | Alignment > Modify drop-down > Reverse Direction |
| **Command:** | REVERSEALIGNMENTDIRECTION |

AutoCAD Civil 3D allows you to change and reverse the original direction of an alignment or an individual sub-entity irrespective of the method used for creating the alignment. Changing the direction of an alignment will change direction of all the objects that are dependent and associated with it.

To reverse the direction of an alignment, choose the **Reverse Alignment Direction** tool from the **Modify** panel; you will be prompted to select the alignment. Select the alignment from the drawing. Alternatively, press ENTER; the **Select Alignment** dialog box is displayed. Select the alignment from this dialog box and choose the **OK** button; the **Autodesk AutoCAD Civil 3D 2026** message box will be displayed, as shown in Figure 5-43. Choose **OK** to change the direction or choose **Cancel** to terminate the command.

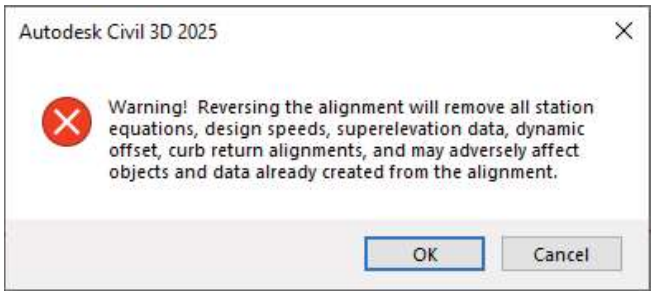



***Figure 5-43** The **Autodesk Civil 3D 2026** message box*

Figure 5-44 shows the original direction of the alignment and the sub-entity. Figure 5-45 shows the alignment and the sub-entity after reversing the direction. You can also reverse the direction of non-fixed entities of an alignment by choosing **Alignment > Reverse Alignment Direction** from the menu bar. Select the required curve or a line entity from the alignment; a warning dialog box will be displayed. Choose **OK** to proceed and change the direction of the selected sub-entity.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

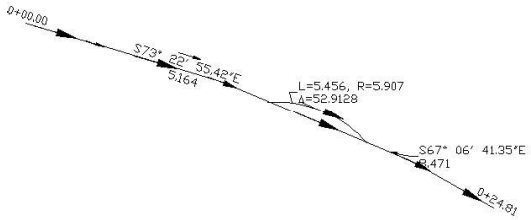



***Figure 5-44*** *Partial view of the alignment and its direction*

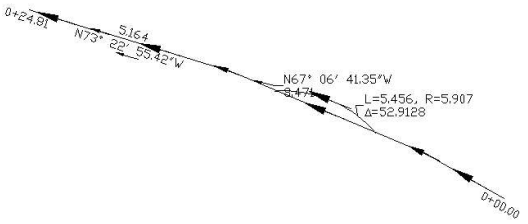



***Figure 5-45*** *The alignment after reversing its direction*

## Editing the Alignment Using the Grip Edits

The simplest way of editing the alignment is by using the AutoCAD tools such as **Rotate**, **Move**, **Stretch**, and **Grip edits**. Every alignment has some grips that are displayed when you select it. The grips are displayed at the point of intersections, start points, end points, and center points of the curves and lines. To graphically edit the alignment, click on the grips and drag them to the required position; the alignment will be updated and redrawn. Figure 5-46 shows the alignment being redrawn after grip editing the point of intersection.

The alignment grips are useful in graphically editing the alignment curves and tangents. The following table displays the types of grips and their functions:

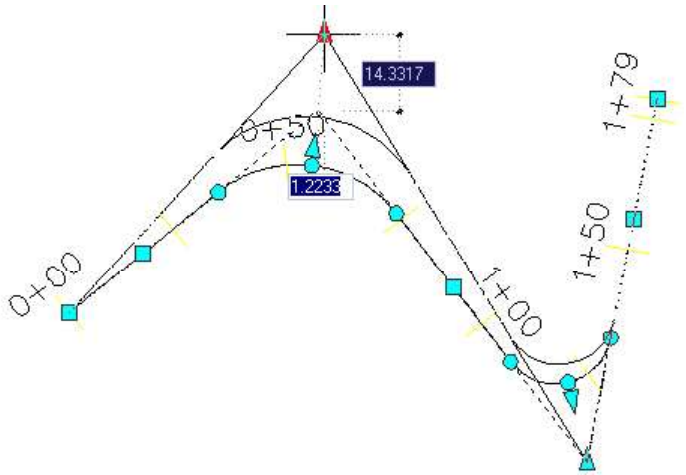



***Figure 5-46*** *The alignment after grip editing the point of intersection*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

| Grip Shape | Function |
|---|---|
|  Square Grip | Moving the square grip located at the end of the line helps you to modify the length and angle of the line. If the grip is located at end of the curve then on moving the grip, the radius of the attached entity is affected. If the square grip is located at the center of the line, you can use this grip to change the location of the entire line. |
|  Circular Grip | This grip, if located at the center of the curve, helps you move or change the center point of the curve to the required location. If the circular grip is displayed at a pass-through point then you can modify the pass-through point, thereby changing the radius of the curve. |
|  Triangular Grip | This grip is displayed at the point of intersection of tangents and helps you modify the location of the PI. If the triangular grip is displayed at the end of the curve or line, you can use it to change the length of the directly editable lines and curves. |
|  Triangular Grip and Circular Grip | This grip is used to edit the radius or the pass-through circular grip point of the curve. The triangular grip is displayed for the curves whose radius can be edited directly but the direction cannot be changed. The circular grip changes the location of the pass-through point and the radius of the curve. |

## Editing Alignment Styles and Label Styles

To edit an existing alignment style and alignment label styles, expand the **Alignment** node and then the **Alignment Styles** or **Label Styles** subnode in the **Settings** tab. Select the existing alignment style or the existing label style and right-click; a shortcut menu will be displayed. Choose the **Edit** option from the shortcut menu; the **Alignment Style** or **Alignment Label Sets** dialog box will be displayed. Modify the properties of the alignment style or labels style as required and choose the **Apply** button to view the changes in the drawing. Choose **OK** to accept the changes and close the dialog box.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

# ADDING ALIGNMENT TABLES

**Ribbon:** Annotate > Labels & Tables > Add Tables drop-down > Alignment

The alignment tables help you display the information about the alignment components such as the lines, curve, spiral, and segment of the alignment. The table for each component helps you to display the information in an organized way. You can create your own table styles and add the tables in the drawing.

**Note**

*Before you add tables in the drawing, ensure that all alignment entities are labeled as you cannot create tables without labeling the alignment entities.*

To add alignment tables for a line, choose the **Alignment** option from the **Add Tables** drop-down, as shown in Figure 5-47; a flyout will be displayed. Choose the **Add Line** tool from the flyout; the **Table Creation** dialog box will be displayed, as shown in Figure 5-48.

In the **Table Creation** dialog box, the **Table style** drop-down list displays the default table style for the line component. You can also create a new table style by choosing the down arrow on the right of the **Table Style** drop-down list to display a flyout. Choose **Create New** from the flyout; the **Table Style - New Alignment Line Table Style** dialog box will be displayed. You can use this dialog box to create your own table style and specify the data to be displayed. The table style name will be added in the **Table Style** drop-down list. The **Table layer** text box displays the layer on which the table will be created. To change the layer of the table to be created, choose the button on the right of this text box; the **Object Layer** dialog box will be displayed. Now, select a new layer from this dialog box.

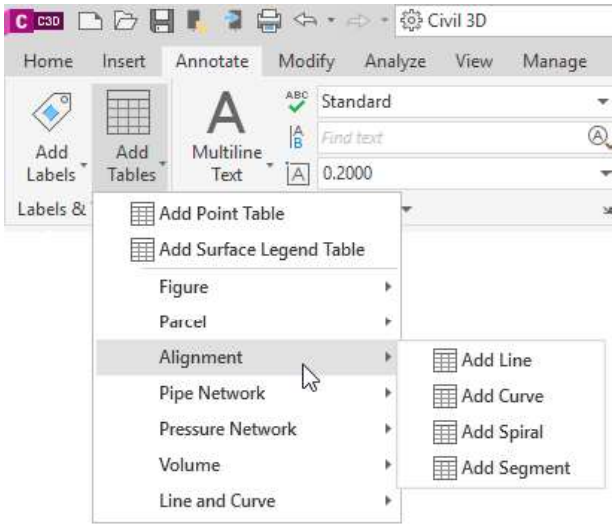



***Figure 5-47*** *Choosing the* ***Alignment*** *option from the* ***Add Tables*** *drop-down*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

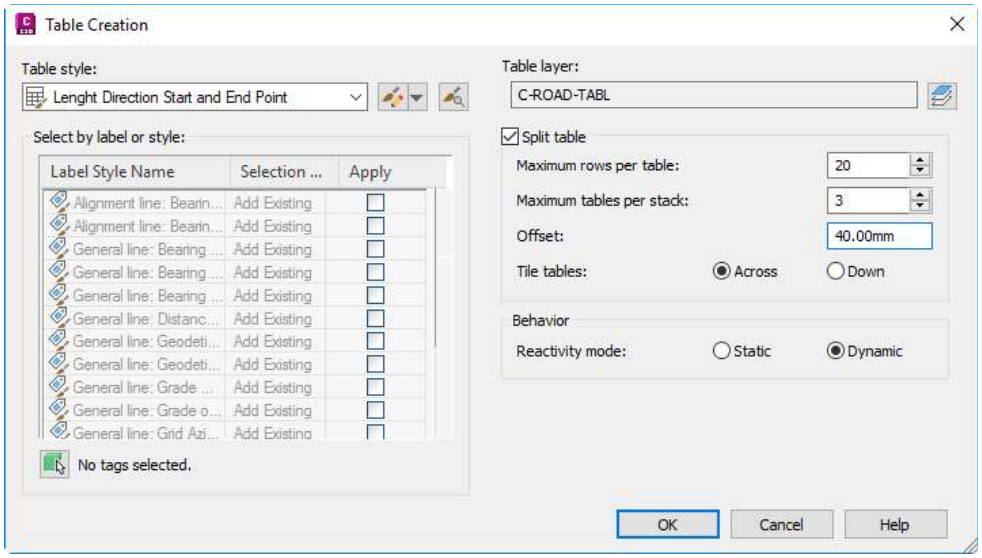



***Figure 5-48*** *The* ***Table Creation*** *dialog box*

The **Select by label or style** area of the **Table Creation** dialog box helps you to add data to the table from the objects labeled in the drawing. To do so, you need to select the label or the label style from which the data will be obtained and added to the table. Remember that the alignment entities should be labeled prior to creating the tables. The label style for the line will be displayed in the **Select by label or style** area. You can select the check box in the **Apply** column to select an existing label style. The **Pick On- Screen** button in this area helps you select the labels of only those entities that you want to add to the table. Choose this button and select the labels for the required alignment entities from the drawing. Next, press ENTER; the number of tags or labels selected will be displayed next to the **Pick On-Screen** button in the **Table Creation** dialog box. You can use the options in the **Split table** area of the **Table Creation** dialog box to specify the table format. In the **Behavior** area, the **Dynamic** radio button is selected by default. It means that the table will be updated automatically if the alignment entities are modified. To retain the table data irrespective of the modifications made to the alignment entity, select the **Static** radio button. Now, choose the **OK** button from the **Table Creation** dialog box; the dialog box will be closed and you will be prompted to select the upper left corner of the table. Click in the drawing area at the required location to add the table. The information about the alignment entities will be displayed in the table. For example, if you have added a line table, all the line entities with their start points, end points, direction, and so on will be listed in the table. The data added in the table will vary according to the type of table added. Figure 5-49 shows the Line Table displaying information about the line component of an alignment.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

| Line Table: Alignments | | | | |
|---|---|---|---|---|
| Line # | Length | Direction | Start Point | End Point |
| L4 | 5.127 | N74° 18' 57.25"W | (17.8109,10.1993) | (12.8748,11.5853) |
| L3 | 4.183 | N68° 46' 02.13"W | (21.7533,8.6699) | (17.8540,10.1849) |
| C1 | 1.066 | N06° 39' 18.63"E | (21.9294,6.6942) | (22.0527,7.7506) |

***Figure 5-49*** *The Line Table*

Similarly, to add data for other components of the alignment, choose the tool corresponding to the alignment component from the **Add Tables** drop-down.




# SUPERELEVATION

Superelevation is the tilting of the road surface, achieved by raising the outer edge of the pavement over the inner edge. Superelevation helps in countering the centrifugal force that can cause the vehicle to overturn or skid when moving along a curve. As mentioned earlier in this chapter, the AASHTO standards have been included in Civil 3D as the XML design criteria files. These design files contain the minimum superelevation, curve radii, design speeds, and other required values under different tables. The amount of superelevation is inversely proportional to the radius of the curve. This means that the shorter the radius of the curve, the greater will be the amount of superelevation required to maintain the design speeds. Superelevation rate is expressed in percent.

The following table shows the minimum curve radii recommended for 6% superelevation for various design speeds. Note that with the increase in design speed, the length of the curve radii also increases.

-<MinimumRadiusTable name=**"AASHTO 2011 US Customary eMax 6%"**>
<MinimumRadius radius=**"15"** speed=**"10"**/>
<MinimumRadius radius=**"39"** speed=**"15"**/>
<MinimumRadius radius=**"81"** speed=**"20"**/>
<MinimumRadius radius=**"144"** speed=**"25"**/>
<MinimumRadius radius=**"231"** speed=**"30"**/>
<MinimumRadius radius=**"340"** speed=**"35"**/>

The methods used for analyzing and creating a view of superelevation are discussed next.

Autodesk Civil 3D 2026 introduces notifications that alert users during the import of superelevation data from CSV files when alignments with station equations require station adjustments. This improvement enhances data accuracy and ensures consistent alignment management.

## Analyzing Superelevation

In Civil 3D, you can analyze superelevation for a given alignment. You can calculate the superelevation of the alignment using the **Calculate/Edit Superelevation** tool. To modify the

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

superelevation of the alignment, you can use the **View Tabular Editor** tool. The **Superelevation Curve Manager** can be used to specify the design criteria and edit the same for the recalculation of the superelevation. The tools for analyzing superelevation are discussed next.

## Calculating Superelevation

| | |
|---|---|
| **Ribbon:** | Alignment (Contextual Tab) > Modify > Superelevation drop-down > Calculate/Edit Superelevation |
| **Command:** | CALCEDITSUPERELEVATION |

The **Calculate/Edit Superelevation** tool is used to calculate the superelevation for an alignment. This tool can also calculate the superelevation for a particular curve of the alignment. To calculate the superelevation, select the alignment from the drawing; the **Alignment:<alignment name>** tab will be displayed. Choose the **Calculate/Edit Superelevation** tool from the **Modify** panel of the **Alignment:<alignment name>** tab; the **Edit Superelevation - No Data Exists** message box will be displayed. In this message box, select the **Calculate superelevation now** option; the **Calculate Superelevation** wizard with the **Roadway Type** page will be displayed, as shown in Figure 5-50. The different pages of this wizard are discussed next.

### Roadway Type Page

This page is used to specify the road type. Select the required road type radio button to specify the road type to be used for the calculation of superelevation. For example, if you select the **Undivided Crowned** radio button then you need to specify the pivot method. To specify the pivot method, select an option from the **Pivot Method** drop-down list. Similarly, if you select the **Undivided Planer** road type then the **High Side Location** drop-down list will be displayed. In this case, you need to define both the pivot method and the high side location. To define the high side location, select an option from the **High Side Location** drop-down list. Choose the **Next** button to go to the **Lanes** page.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

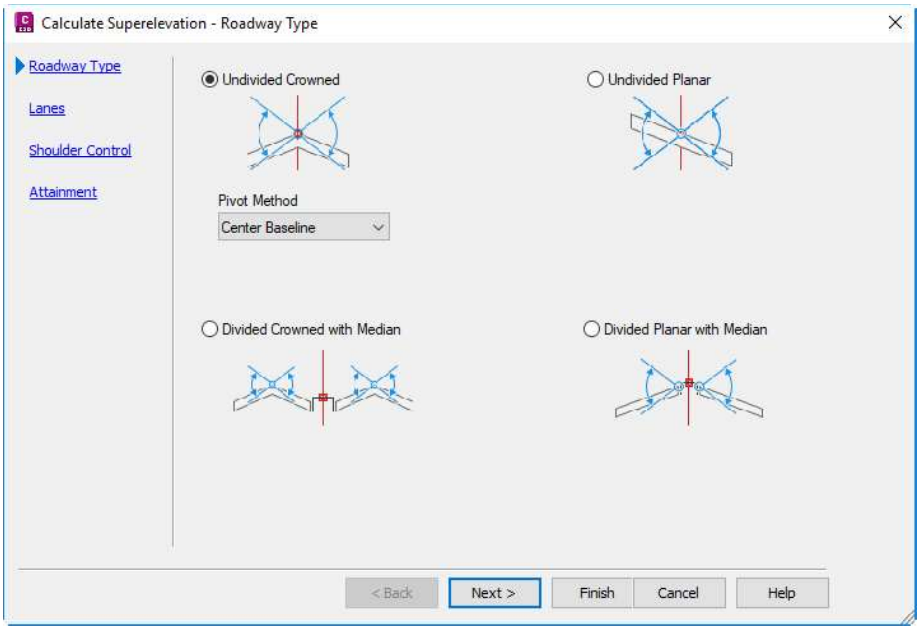



***Figure 5-50*** *The* ***Calculate Superelevation*** *wizard with the* ***Roadway Type*** *page*

### Lanes Page

The **Lanes** page is used to specify the number of lanes for the road type selected in the **Road Type** page. The properties to be defined in this page will depend upon the type of road selected in the **Road Type** page. For example, if you select the undivided planar road type then you need to define the number of lanes, normal lane width, and normal lane slope. To define the number of lanes, select the required option from the **Number of lanes right** drop-down list. To define the normal lane width, enter the value in the **Normal lane width** edit box. Similarly, to define the normal lane slope, enter the value in the **Normal lane slope** edit box. Choose the **Next** button to go to the **Shoulder Control** page.

### Shoulder Control Page

This page of the **Calculate Superelevation** wizard is used to define the properties of the shoulder. The portion which is beyond the edge of the road and is occasionally used for vehicular traffic is known as shoulder. The properties to be defined for the shoulder would depend upon the type of road selected. For example, if the undivided planar road type is selected, then the **Inside median shoulders** area will not be active. But if you select the divided planar with median road type then the **Inside median shoulders** area will be active. If you want to calculate the superelevation for the median shoulder, you need to select the **Calculate** check box and enter the values for various properties in the **Inside median shoulders** area. Similarly, to calculate the superelevation for the outside edge shoulders, you need to select the **Calculate** check box and enter the values for various properties in the **Outside edge shoulders** area. Choose the **Next** button to go to the **Attainment** page.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

### Attainment Page

This page is used to specify the design criteria file for the superelevation calculation. You can also specify the superelevation rate table, transition length table, and attainment method in this page.

To define the design criteria file, select the browse button next to the **Design criteria file** text box; the **Open** dialog box will be displayed. In this dialog box, select the relevant design file and choose the **Open** button; the design file will be displayed in this text box. To define the superelevation rate table, select an option from the **Superelevation rate table** drop-down list. To define the transition length table, select the required option from the **Transition length table** drop-down list. The options available in this drop-down list will depend upon the type of superelevation rate table selected. To define the attainment method, select the required option from the **Attainment Method** drop-down list. The options available in this drop-down list depend upon the type of road selected in the **Road Type** page.

In the **Transition formula for superelevation runoff** area of this page, you need to specify the percentage of transition length for the tangent. The transition length is the length for the tangent where the tangent is followed by a curve or vice-versa. Enter the value in the **% on tangent for tangent-curve** edit box. If a spiral is followed by a curve or vice-versa then you need to specify the transition length by entering a relevant value in the **% on spiral for spiral-curve** edit box.

You can also apply smoothing to a curve. To do so, select the **Apply curve smoothing** check box in the **Transition formula for superelevation runoff** area. This will make the **Curve length** edit box active. Enter a value in this edit box to specify the curve length. To avoid the overlapping in the alignment, you need to select the **Automatically resolve overlap** check box. Choose the **Finish** button to exit the wizard.

## Editing Superelevation

| | |
|---|---|
| **Ribbon:** | Alignment > Modify > Superelevation drop-down > View Tabular Editor |
| **Command:** | CALLSETTABULARVIEWONALIGN |

Once you have calculated the superelevation, you can use the **View Tabular Editor** tool to display or edit the calculated superelevation curve data in tabular format. To do so, choose the **View Tabular Editor** tool from the **Modify** panel; the **Superelevation Tabular Editor** tab will be displayed in the **PANORAMA** window, as shown in Figure 5-51.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

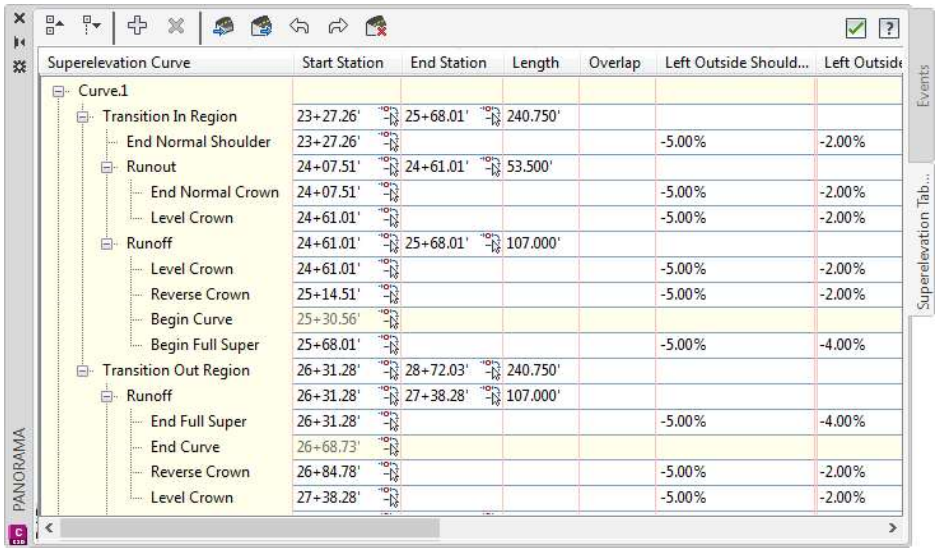



***Figure 5-51** The **Superelevation Tabular Editor** tab of the **PANORAMA** window*

The **Superelevation Tabular Editor** tab shows the details of the transition in region and the transition out region. You can edit the properties in these regions. For example, you can change the start station for the runout. To do so, click in the **Value** field of the **Runout** property in the **Start Station** column and enter the value. Alternatively, to change the start station for the runout, click on the button next to the **Value** field of the **Runout** property; you will be prompted to select the station along the alignment. Select the station; the **Superelevation Tabular Editor** tab will be displayed. Similarly, you can change or view other properties. To close this window, clear the check box on the upper right corner of the **PANORAMA** window.

## Creating Superelevation View

**Ribbon:** Alignment > Modify > Superelevation drop-down > Create Superelevation View
**Command:** CREATESUPERELEVATIONVIEW

The **Create Superelevation View** tool is used to display the superelevation graphically. Choose this tool from the **Modify** panel and select the required alignment; the **Create Superelevation View** dialog box will be displayed, as shown in Figure 5-52. In this dialog box, click on the button next to the **Superelevation view name** edit box; the **Name Template** dialog box will be displayed. Enter a name in the **Name** edit box and choose the **OK** button to close the dialog box. Next, select an alignment from the **Alignment** drop-down list. Alternatively, you can select the alignment by using the **Select from the drawing** button. To do so, choose the **Select from the drawing** button on the right of the drop-down list; you will be prompted to select an alignment from the drawing. Select the alignment from the drawing; the **Create Superelevation View** dialog box will be displayed. To specify the superelevation layer, choose the button next to the **Superelevation view layer** text box. Next, to specify the style for the superelevation, select an option from the **Superelevation view style** drop-down list.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

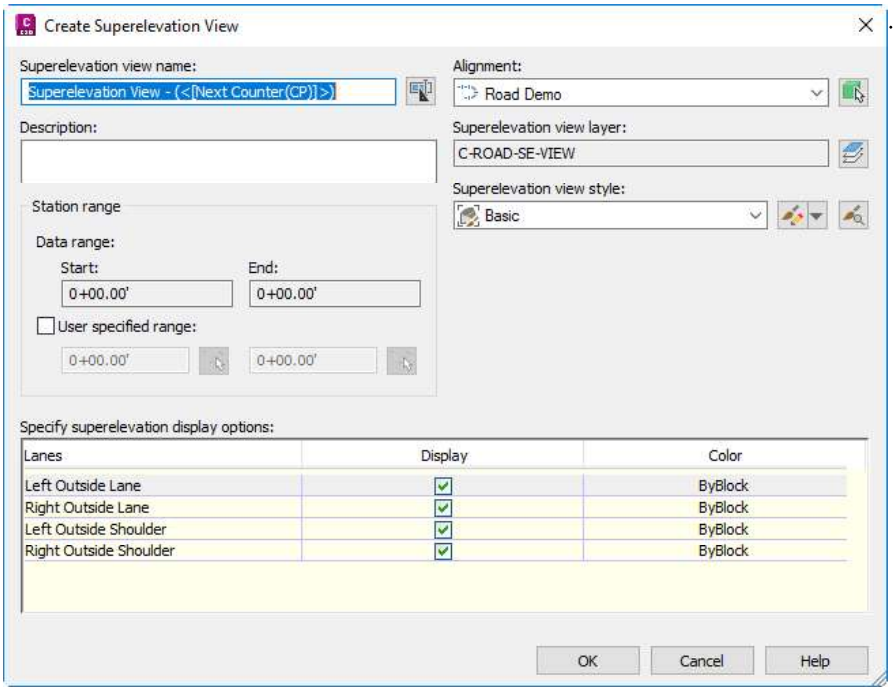



***Figure 5-52*** *The* ***Create Superelevation View*** *dialog box*

In the **Station range** area, select the **User specified range** check box to specify the start and end stations of the selected alignment. You can clear this check box to retain the default start and end stations. In the **Specify superelevation display options** list box, the **Lanes** column will list all the lanes in the alignment. You can clear the check box in the **Display** column corresponding to a particular lane if you do not want that lane to be displayed in the **Superelevation Tabular Editor** tab in the **PANORAMA** window. You can also specify the color for the lanes to be displayed in the superelevation view. To do so, select the **Color** column and specify the color for the selected lane. Then choose the **OK** button; the **Create Superelevation View** dialog box will be closed and you will be prompted to select the superelevation view origin in the drawing area. Specify the origin; the superelevation will be created, as shown in Figure 5-53.

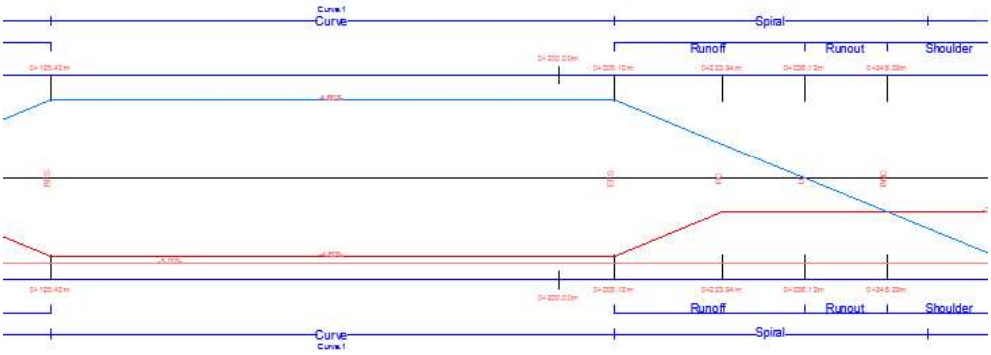



***Figure 5-53*** *Partial view of the superelevation created*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Importing Superelevation Data

**Ribbon:** Alignment > Modify > Superelevation drop-down > View Tabular Editor
**Command:** VIEWTABULAREDITOR

The **View Tabular Editor** tool is used to import superelevation data from a CSV file directly into an alignment. Select the alignment from the drawing; the **Alignment** tab will be displayed. Choose the **View Tabular Editor** tool under the **Superelevation** drop-down from the **Modify** panel of the this tab; the **PANORAMA** window will be displayed. Next, choos the **Import superelevation data from file** icon; the **Superelevation Import** dialog box will be displayed, as shown in Figure 5-54. In this dialog box, click on the button next to the **File to Import** edit box; the **Import superelevation file** dialog box will be displayed. Enter a name in the **File name** edit box and choose the **Open** button to open the CSV file.

If superelevation data already exists, Civil 3D will show a warning that it will be replaced. The CSV file must use the same column order as the Tabular Editor (for example: Superelevation Region, Station, Description, Lane and Shoulder values for both sides, and so on).

After selecting the file, click **OK**. The table will be filled with the imported values for each region. If your alignment has a station equation, Civil 3D will display a message suggesting that station adjustments may be needed. You can also manually edit any cell in the table after importing to make corrections or updates.

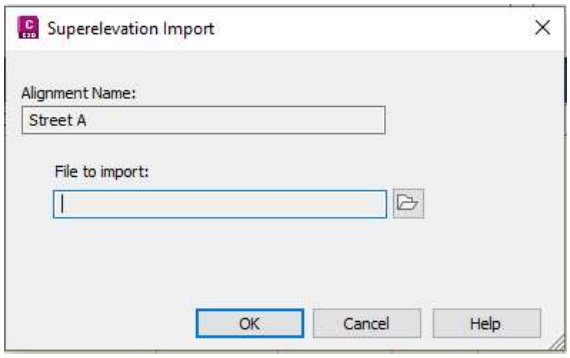



***Figure 5-54*** *The* ***Superelevation Import*** *dialog box*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

# TUTORIALS

1. Download the *c05_c3d_2026_tut.zip* file from *http://www.cadcim.com*, as explained in Chapter 2.

2. Now, save and extract the downloaded file at the following location:

   *c:\c3d_2026*

The first and second tutorial of this chapter is available in video format.

**Note**

*While opening the tutorial file, the **PANORAMA** window with an error message may appear. Close this window to proceed further.*

## Tutorial 1 Alignment from Polyline

In this tutorial, you will create an alignment from a polyline, as shown in Figure 5-55. You will also create and apply a new alignment style. **(Expected time: 30 min)**

The following steps are required to complete this tutorial:

a. Open the file.
b. Create alignment from a polyline.
c. Create a new alignment style.
d. Apply the new style to the alignment.
e. Save the file.

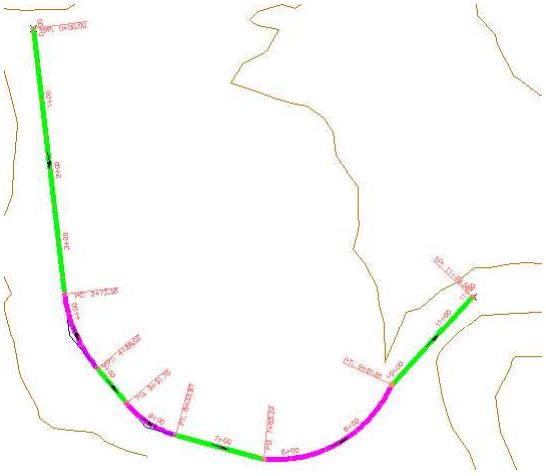


***Figure 5-55** The **Street A** alignment*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

**Video**

*You can view the video of this tutorial by using the following link: https://www.cadcim.com/civil-3d-2026-ch-5-tutorial1.*

## Opening the File

1. Choose **Open** from the **Application Menu**; the **Select File** dialog box is displayed.

2. In the dialog box, browse to the location *C:\c3d_2026\c05_c3d_2026_tut* where you have saved the tutorial file.

3. Select the file *c05_c3d_2026_tut01.dwg* and then choose the **Open** button to open the file. Ignore any error message, if displayed.

## Creating an Alignment Polyline

1. To create an alignment from a polyline, choose the **Create Alignment from Objects** tool from **Home > Create Design > Alignment** drop-down; you are prompted to select the first line/arc/polyline or [Xref].

2. Select the red color polyline in the drawing and then press ENTER; you are prompted to specify the alignment direction.

3. Press ENTER again to select the default alignment direction; the **Create Alignment from Objects** dialog box is displayed.

4. Enter **Street A** as the alignment name in the **Name** edit box.

5. Select **Layout** from the **Alignment style** drop-down list.

6. Choose the **OK** button; the polyline is converted into an alignment with all geometry points and stations, as shown in Figure 5-56.

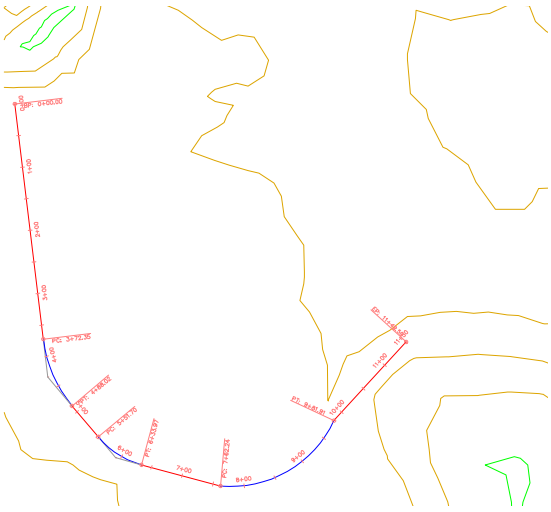


***Figure 5-56*** *Alignment of* ***Street A*** *created from polyline*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Creating a New Alignment Style

1. Choose **Alignment > Alignment Styles** from the **Settings** tab of the **TOOLSPACE** palette. You will notice a triangular symbol on the left of the **Layout** option indicating the current alignment style.

2. Select **Alignment Styles** and right-click on it; a shortcut menu is displayed.

3. Choose **New** from the shortcut menu; the **Alignment Style - New Alignment Style** dialog box is displayed.

4. Choose the **Markers** tab; various options in this tab are displayed.

5. Double-click on the button in the **Marker Style** column corresponding to the **Begin of Alignment** option; the **Pick Marker Style** dialog box is displayed.

6. Select the **Basic X** option from the drop-down list in this dialog box, as shown in Figure 5-57. Choose the **OK** button.

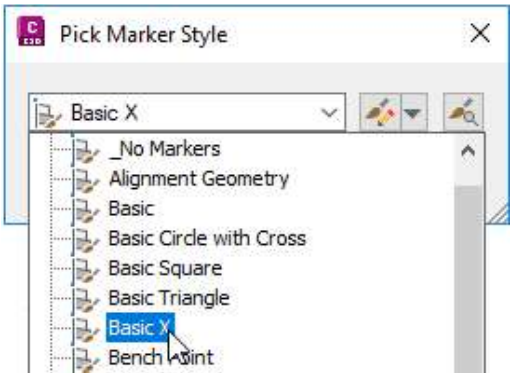



***Figure 5-57*** *Selecting the* ***Basic X*** *option from the drop-down list*

7. Repeat the procedure followed in steps 5 and 6 and make **Basic X** as the marker style for the **End of Alignment** option.

8. Next, choose the **Display** tab. Change the color for the **Line** component to **green**, **Curve** to **magenta,** and **Line Extensions** to **blue** in the **Color** column.

9. Change the lineweight of **Line**, **Curve**, and **Line Extensions** to **0.5** mm in the **Lineweight** column.

10. Choose the **OK** button to close the **Alignment Style - New Alignment Style** dialog box; the **New Alignment Style** is added to the **Alignment Styles** node in the **Settings** tab.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Applying the Alignment Style

1. Select the **Street A** alignment from the drawing and right-click; a shortcut menu is displayed.

2. Choose **Alignment Properties** from the shortcut menu; the **Alignment Properties - Street A** dialog box is displayed.

3. In the **Information** tab, select the **New Alignment Style** option from the **Object style** drop-down list.



**Tip**

*You can also display the **Alignment Properties - Street A** dialog box from the **Prospector** tab of the **Toolspace** palette. To do so, expand the **Alignments** node and the **Centerline Alignments** sub node. Then, right-click on **Street A** node to display a shortcut menu. Choose **Properties** from the shortcut menu to display the **Alignment Properties - Street A** dialog box.*

4. Choose the **Apply** button to apply the style to the alignment.

5. Then, choose the **OK** button; the **Alignment Properties - Street A** dialog box is closed and the alignment style is assigned to the **Street A** alignment.

6. Now, choose the **Show/Hide Lineweight** button from the status bar at the bottom right of the screen; the alignment entities are displayed with the assigned lineweight (0.5mm), as shown in Figure 5-58.

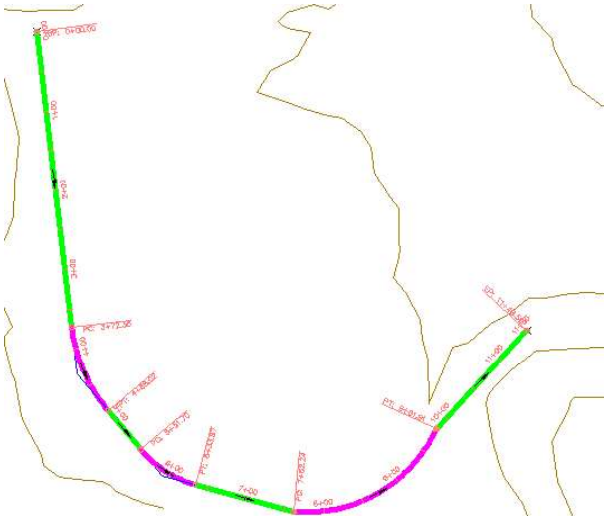


***Figure 5-58*** *The **Street A** alignment after assigning the New Alignment Style to it*

## Saving the File

1. Choose **Save As** from **Application Menu**; the **Save Drawing As** dialog box is displayed.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

2. In this dialog box, browse to the following location:

*C:\c3d _2026\c05_c3d_2026_tut*

3. In the **File name** edit box, enter **c05_tut01a**.

4. Choose the **Save** button; the file is saved with the name *c05_tut01a.dwg* at the specified location.

## Tutorial 2 Criteria-Based Alignment Layout

In this tutorial, you will create a criteria-based alignment, as shown in Figure 5-59 using the **Alignment Layout** tools from the **Alignment Layout Tools** toolbar. Also, you will rectify the violation errors. **(Expected time: 30 min)**



***Figure 5-59*** *The criteria-based* ***Road A*** *alignment layout*

The following steps are required to complete this tutorial:

a. Open the file.
b. Name the alignment and assign the alignment style.
c. Assign a design speed and design criteria.
d. Create the alignment.
e. Add the best fit curve.
f. Add free spiral to the alignment.
g. Add the fixed spiral curve.
h. View and correct the alignment design criteria violations.
i. Save the file.

### Opening the File

1. Choose **Open** from the **Application Menu**; the **Select File** dialog box is displayed.

2. In the dialog box, browse to the location *C:\c3d_2026\c05_c3d_2026_tut* where you have saved the file.

3. Select the file *c05_c3d_2026_tut02.dwg* and then choose the **Open** button to open the file. Ignore the error message if displayed. The file consists of a surface border and a series of circles.

### Naming the Alignment

1. Choose the **Alignment Creation Tools** tool from **Home > Create Design > Alignment** drop-down; the **Create Alignment - Layout** dialog box is displayed.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

2. Enter **Road A** in the **Name** edit box.

3. Select the **New Alignment Style** option from the **Alignment style** drop-down list.

## Assigning the Design Speed and Design Criteria

1. Choose the **Design Criteria** tab from the **Create Alignment - Layout** dialog box. This tab is used to specify the design speed and design criteria.

2. In the **Starting design speed** edit box, change the design speed to **55 mi/h**. This is the design speed at the first station of the alignment.

3. Select the **Use criteria-based design** check box.

4. Choose the browse button from the Use design criteria file area; the **Select Design Speed** Table dialog box is displayed.

5. Select the **_Autodesk Civil 3D Imperial (2011) Roadway Design Standards.xml** file and choose the **Open** button to open this file and exit the dialog box. On doing so, you have selected the in-built design criteria file to create an alignment using the design standards specified in this file.

6. In the **Default criteria** area, click in the **Value** field of the **Minimum Radius Table** property and select the **AASHTO 2011 US Customary eMax 10%** table from the drop-down list.

7. Ensure that the **Use design check set** check box is selected and then choose the **OK** button; the **Create Alignment - Layout** dialog box is closed and the **Alignment Layout Tools - Road A** toolbar is displayed, as shown in Figure 5-60.

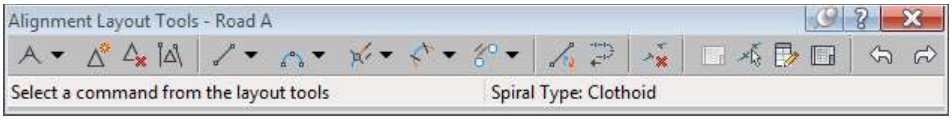



***Figure 5-60*** *The* ***Alignment Layout Tools - Road A*** *toolbar*

8. Enter **OSNAP** at the command bar and press ENTER; the **Object Snap** tab in the **Drafting Settings** dialog box is displayed. Ensure that the check box for the **Center** option for object snapping is selected.

9. Choose the **OK** button to close the **Drafting Settings** dialog box.

10. Zoom in the surface to view the circle A on the left of the surface.

## Creating the Alignment

1. Choose the **Tangent-Tangent (No curves)** tool from the **Alignment Layout Tools - Road A** toolbar; you are prompted to specify the start point.

2. Snap to the center of the circle A and click to specify the start point, as shown in Figure 5-61

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

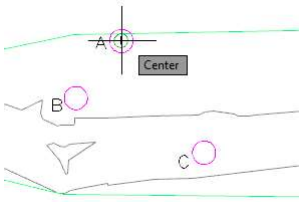



***Figure 5-61*** *Specifying the start point at the center of the first circle*

3. Next, click on the center of the circle B; the section of the alignment is created between the center of the circles A and B.

4. Continue creating the alignment between the circles C, D, E, and F (leave the last one which is circle G). Press ENTER to terminate the command at the circle F. The alignment is created, as shown in Figure 5-62.

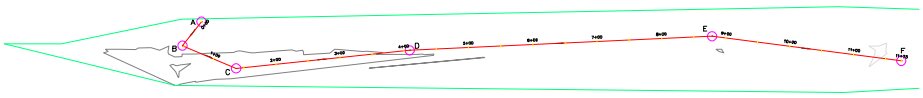


***Figure 5-62*** *The **Road A** alignment created*

## Adding the Best Fit Curve

1. Zoom in the start of the alignment and choose the down arrow on the right side of the **Fixed Curve (Three point)** tool from the **Alignment Layout Tools - Road A** toolbar; a flyout is displayed.

2. Choose the **Free Curve - Best Fit** option from the flyout, as shown in Figure 5-63; you are prompted to select the first entity.

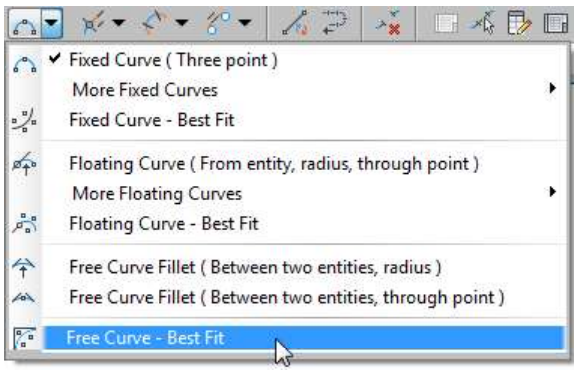



***Figure 5-63*** *Choosing the **Free Curve - Best Fit** option from the flyout*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

3. Select the alignment section between circles A and B; you are prompted to specify the next entity.

4. Select the alignment section between circles B and C; the **Curve by Best Fit** dialog box is displayed.

5. Select the **By clicking on the screen** radio button from the dialog box and choose the **OK** button; the dialog box is closed and you are prompted to specify a point.

6. Click at the tick mark of the first station, **0+00**; an arc segment is displayed, as shown in Figure 5-64. Also, you are prompted to specify the next point of the arc.

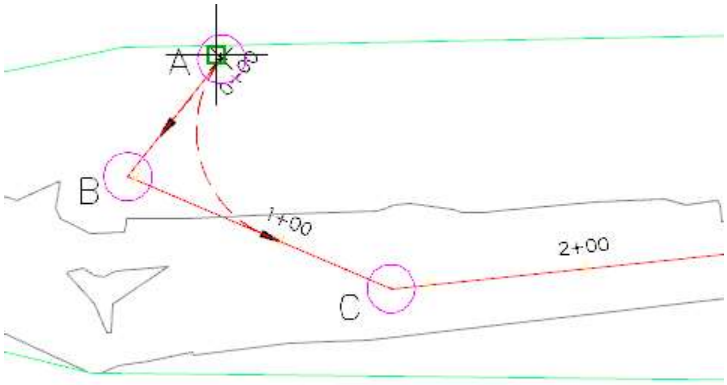



***Figure 5-64*** *The arc segment displayed on specifying the first point*

7. Now, click at the tick mark of station **2+00** and press ENTER; the **PANORAMA** window with the **Regression Data** tab is displayed, as shown in Figure 5-65.

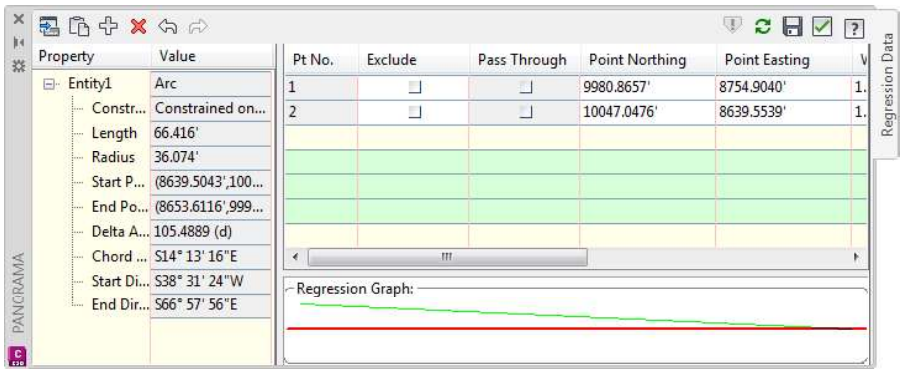



***Figure 5-65*** *The **PANORAMA** window with the **Regression Data** tab chosen*

8. Choose the **Save** button in the **PANORAMA** window to create the entity. 

9. In the **Pass Through** column, select the first row; a cross mark and a line are displayed to graphically represent the location of the regression point in the **Regression Graph** area.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

10. Choose the button with green tick mark to exit the **PANORAMA** window; the best fit curve is created and displayed on the alignment, as shown in Figure 5-66.

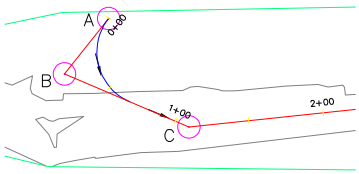



***Figure 5-66*** *The best fit curve added to the* ***Road A*** *alignment*

## Adding Free Spiral to the Alignment

1. Zoom in the end of the alignment.

2. In the **Alignment Layout Tools - Road A** toolbar, choose the down-arrow on the right of the **Free Compound Spiral-Spiral (Between two curves)** tool and choose the **Free Spiral (Between two entities)** tool from the flyout displayed; you are prompted to select an entity.

3. Select the alignment section on the left of the circle E; you are prompted to specify the next entity. Select the alignment section on the right of the circle E; you are prompted to select the spiral type in the command line.

4. Press ENTER to accept the default **<Incurve>** option; you are prompted to specify the spiral length.

5. Press ENTER to accept the default **<200.000'>** spiral length; a spiral is added between two tangents. A violation symbol is displayed on the spiral indicating that the design criterion has been violated. Press ESC to exit the command.

6. To check the criterion that has been violated, move the cursor over the violation symbol in the drawing; a tooltip stating the type of violation is displayed, as shown in Figure 5-63.

**Note**

*The tooltip shows that the criterion for the* ***Transition Length*** *in the spiral is violated. In this case, the tool tip shows the current spiral length and the minimum transition length for the selected design speed, which is 200.000' and 255.000', respectively, refer to Figure 5-67.*

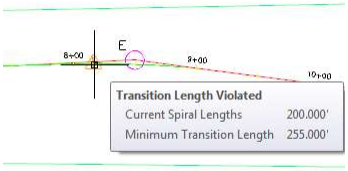



***Figure 5-67*** *The tooltip displaying the violation type*

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Adding a Fixed Spiral

1. Choose the down arrow on the right of the **Free Spiral (Between two entities)** tool; a flyout is displayed. Choose the **Fixed Spiral** option from the flyout; you are prompted to select an entity to specify the start point and direction.

2. Select a segment of the alignment lying between station 10+00 and 11+00; you are prompted to specify the spiral type, as shown in Figure 5-68.

3. Select the **Point** option from the dynamic input; you are prompted to select the spiral.

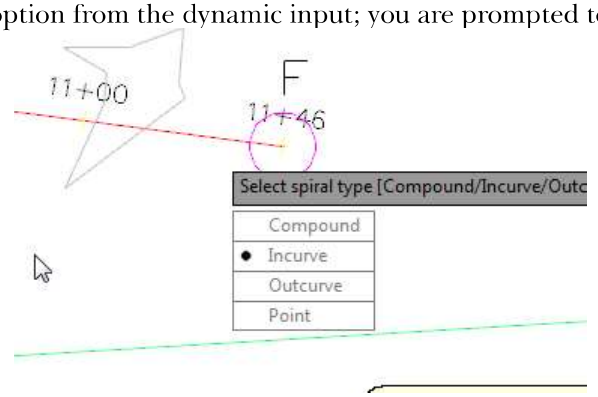



***Figure 5-68*** *Dynamic input prompted for selecting spiral type*

4. Press ENTER to select the **Incurve** type; you are prompted to specify the end point of the spiral. Click at the center of the circle G to specify the end point of the spiral, as shown in Figure 5-69.

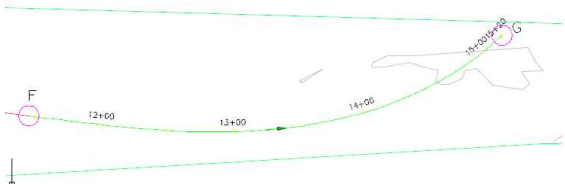



***Figure 5-69*** *Specifying the end point to add a fixed spiral*

5. Press ENTER to terminate the command. You have now created a design-based alignment between circles A and G using different tools from the **Alignment Layout Tools** toolbar.

## Correcting the Criteria Violation

1. Invoke the **Sub-entity Editor** tool from the **Alignment Layout Tools - Road A** toolbar; the **Alignment Layout Parameters - Road A** dialog box is displayed.

2. Invoke the **Pick Sub-entity** tool from the toolbar and select the green line curve between circles E and F containing the warning sign; the **Alignment Layout Parameters - Road A** dialog box is populated with different spiral parameters, as shown in Figure 5-70.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

**Note**

*If the **Alignment Layout Tools - Road A** toolbar is not displayed, select the alignment from the drawing and then right-click; a shortcut menu is displayed. Choose the **Edit Alignment Geometry** option from the shortcut menu; the **Alignment Layout Tools - Road A** toolbar is displayed.*

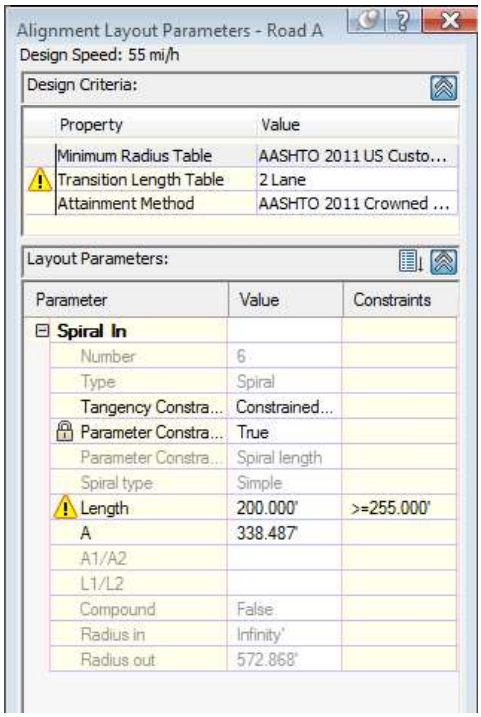



***Figure 5-70** Partial view of the **Alignment Layout Parameters - Road A** dialog box*

**Tip**

*To hide/show the violation symbol, enter **OP** in the command prompt to display the **Option** dialog box and clear the **Drafting** check box from the **Solution Tips** area in the **AEC Editor** panel.*

3. Click in the value field of the **Length** parameter displayed in the **Value** column and change the length parameter to **500.000'** and then press ENTER; the violation symbol disappears and the violation error is rectified.

4. Close the **Alignment Layout Parameters - Road A** dialog box to view the alignment.

5. Zoom and pan to the free spiral and note that the violation symbol is removed, Figure 5-71 shows the **Road A** alignment after it is created.

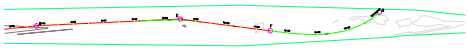


***Figure 5-71** The **Road A** alignment*

### Saving the File

1. Choose **Save As** from the **Application Menu**; the **Save Drawing As** dialog box is displayed.

2. In this dialog box, browse to the following location:

   *C:\c3d _2026\c05_c3d_2026_tut*

3. In the **File name** edit box, enter **c05_tut02a**.

4. Next, choose the **Save** button; the file is saved with the name *c05_tut02a.dwg* at the specified location.

## Tutorial 3 Customizing Design Criteria

In this tutorial, you will apply a design criteria to an existing alignment and calculate the superelevation values. Also, you will create design criteria, label styles, and label set for different alignment entities. Figure 5-72 shows the alignment created. **(Expected time: 1 hr)**

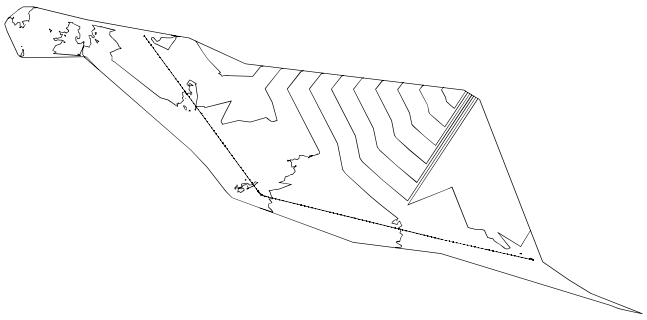


***Figure 5-72*** *The* ***Palkins Street*** *alignment*

The following steps are required to complete the tutorial:

a. Open the file.
b. Apply the design criteria file and calculate superelevation values.
c. Grip edit the alignment.
d. Create the design criteria.
e. Create label styles for major stations and minor stations.
f. Create a label set.
g. Save the file.

### Opening the File

1. Choose **Open** from the **Application Menu**; the **Select File** dialog box is displayed.

2. In the dialog box, browse to the location *C:\c3d_2026\c05_c3d_2026_tut* folder.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

3. Select the file *c05_c3d_2026_tut03.dwg* and then choose the **Open** button to open the file. Ignore the error message if displayed.

This file consists of a surface and an alignment named Palkins Street. You will now assign a design criteria and calculate superelevation values.

## Applying the Design Criteria and Calculating Superelevation Values

1. Select the **Palkins Street** alignment from the drawing if it is not selected and right-click; a shortcut menu is displayed.

2. Choose the **Alignment Properties** option from the shortcut menu displayed; the **Alignment Properties – Palkins Street** dialog box is displayed.

3. Choose the **Design Criteria** tab from the dialog box, if it is not selected by default.

4. Select the **Use criteria - based design** check box located on the right of the dialog box; the default design criteria file is applied to the alignment. Note that the default design speed is **60 mi/h**. Choose the **OK** button to close the dialog box.



**Note**

*The **_Autodesk Civil 3D Imperial (2011) Roadway Design Standards.xml** file is the default design criteria file applied to the alignment. You can access this file from the **Imperial** folder at C:\Documents and Settings\All Users\Application Data\Autodesk\C3D 2026\enu\Data\Corridor Design Standards\Imperial.*

5. Choose the **Calculate/Edit Superelevation** tool from **Alignment: Palkins Street > Modify > Superelevation** drop-down; the **Edit Superelevation - No Data Exists** window is displayed.

6. Choose the **Calculate superelevation now** option; the **Calculate Superelevation** wizard with the **Roadway Type** page is displayed.

7. Retain the default settings in this page and choose the **Next** button; the **Lanes** page is displayed. In the **Lanes** page, select the **2** option from the **Number of lanes right** drop-down list and retain the other default settings. Then, choose the **Next** button; the **Shoulder Control** page is displayed.

8. In the **Shoulder Control** page, enter **3** in the **Normal shoulder width** edit box and retain other default settings. Choose the **Next** button; the **Attainment** page is displayed.

9. In the **Attainment** page, choose the browse button next to the **Design criteria file** text box; the **Open** dialog box is displayed. Select the ***_Autodesk Civil 3D Imperial (2011) Roadway Design Standards.xml*** file and choose the **Open** button. The file path is displayed in the **Design criteria file** text box.

10. Now, select the **AASHTO 2011 US Customary eMax 4%** option from the **Superelevation rate table** drop-down list, if it is not selected by default.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

11. Select the **2 Lane** option from the **Transition length table** drop-down list and the **AASHTO 2011 Crowned Roadway** option from the **Attainment method** drop-down list, if it is not selected by default.

12. Next, enter **65%** in the **% on tangent for tangent-curve** edit box and retain the default value in the **% on spiral for spiral-curve** edit box. Choose the **Finish** button; the **Calculate Superelevation** dialog box is closed and the **PANORAMA** window with the **Superelevation Tabular Editor** tab is displayed, as shown in Figure 5-73. Close the **PANORAMA** window.

13. The violation symbols are displayed at the curves. Move the cursor over the violation symbols and read the tooltip displaying the minimum radius violation message.

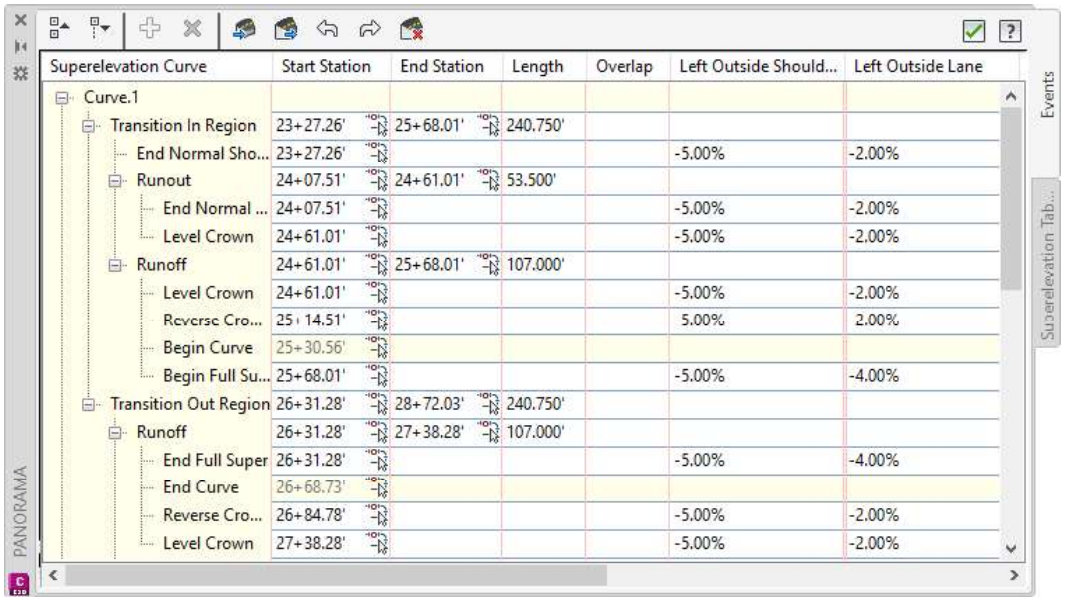



***Figure 5-73*** *The* ***Superelevation Tabular Editor*** *tab in the* ***PANORAMA*** *window*

## Grip Editing the Alignment

1. Select the **Palkins Street** alignment and right-click; a shortcut menu is displayed.

2. Choose the **Edit Alignment Geometry** option from the shortcut menu; the **Alignment Layout Tools - Palkins Street** toolbar is displayed.

3. Zoom and pan to the first violation symbol. 

4. Invoke the **Pick Sub-entity** tool; you are prompted to select the sub entity. Select the curve on which the violation symbol is displayed; the **Alignment Layout Parameters- Palkins Street** dialog box is displayed with relevant values, as shown in Figure 5-74.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

5. Right-click in the drawing and select the alignment to display the alignment grips. Move the triangular grip on the curve toward the upper right direction. As you continue moving the grip, the radius value in the **Alignment Layout Parameters - Palkins Street** dialog box changes accordingly.

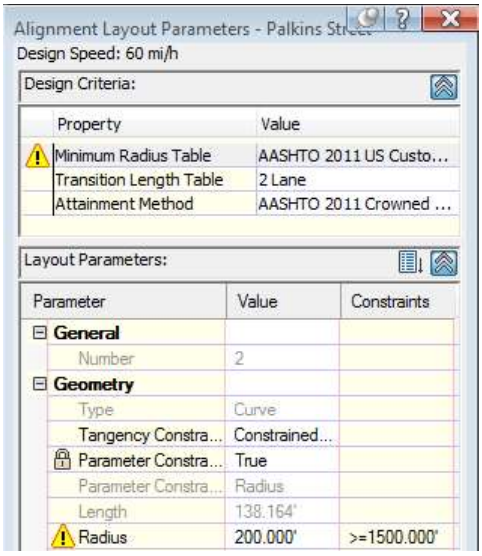



***Figure 5-74*** *The* ***Alignment Layout Parameters - Palkins Street*** *dialog box*

6. Click when the violation symbol disappears from the dialog box and the radius value displayed in the **Value** column is greater than **1500.000'** as per the design criteria.

7. Zoom and pan to the next violation symbol and select the triangular grip on the curve.

8. Move the grip upward till the violation symbol in the **Alignment Layout Parameters - Palkins Street** dialog box disappears and the value for the **Radius** parameter is greater than or equal to the minimum curve radius required.

**Note**

*While using grip edit, make sure that you select the triangular grip ( ) on the curve.*

9. In the **Palkins Street** alignment, you will notice two violation symbols that appear due to out-of-date superelevation. To remove the symbols, select the alignment and then choose the **Calculate/Edit Superelevation** tool from **Alignment: Palkins Street > Modify > Superelevation** drop-down; the **SUPERELEVATION CURVE MANAGER - PALKINS STREET** window will be displayed. In this window, choose the **Recalculate** button; the **SUPERELEVATION CURVE MANAGER - PALKINS STREET** window will be closed and the violation symbols will be removed.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Creating the Design Criteria

1. Select the **Palkins Street** alignment from the drawing; the **Alignment: Palkins Street** tab is displayed.

2. Choose the **Design Criteria Editor** tool from the **Modify** panel of the **Alignment:Palkins Street** tab; the **Design Criteria Editor - _Autodesk Civil 3D Imperial (2011) Roadway Design Standards.xml** dialog box is displayed.

3. Choose the **Save As** button to display the **Enter a file name to save** dialog box. 

4. Enter **Palkins Street Standards** in the **File name** edit box and then browse to *C:\c3d_2026\c05_c3d_2026_tut*.

5. Choose the **Save** button to save the default design criteria file with a different name before making any change in the file. The default design criteria file is saved with a different name at the specified location.

   Next, you will edit the design criteria file.

6. In the left pane of the **Design Criteria Editor - Palkins Street Standards.xml** dialog box, expand **Alignments > Minimum Radius Tables** to view the existing minimum radius tables.

7. Right-click on **Minimum Radius Tables**; a shortcut menu is displayed. Choose the **New Minimum Radius Table** option from the shortcut menu; a new table is added in the **Minimum Radius Tables** subnode with the name **New Minimum Radius Table**.

8. Double-click on the table **New Minimum Radius Table** and change the name to **Palkins Street at eMax 5%**. Then press ENTER; a new minimum radius table is created, as shown in Figure 5-75.

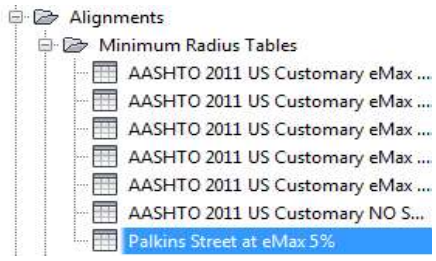



***Figure 5-75** The **Palkins Street at eMax 5%** table added in the **Minimum Radius Tables** subnode*

9. In the right pane of the dialog box, select the first row in the **Speed** column and click; a drop-down list is displayed.

10. Select **10** from the drop-down list.

11. Double click again in the **Speed** column in the second row and select **20** from the drop-down list.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

12. Similarly, add **30**, **40**, **50**, **60**, and **70** values in the **Speed** column.

13. Click in the first row in the **Radius** column and enter **50** as the radius value.

14. Click in the second row in the **Radius** column and enter **100** as the radius for the speed value of **20** miles per hour.

15. Similarly, enter values **200**, **250**, **300**, **350**, and **400** as **Radius** for the **Speed** values of **30**, **40**, **50**, **60**, and **70**, respectively, as shown in Figure 5-76.

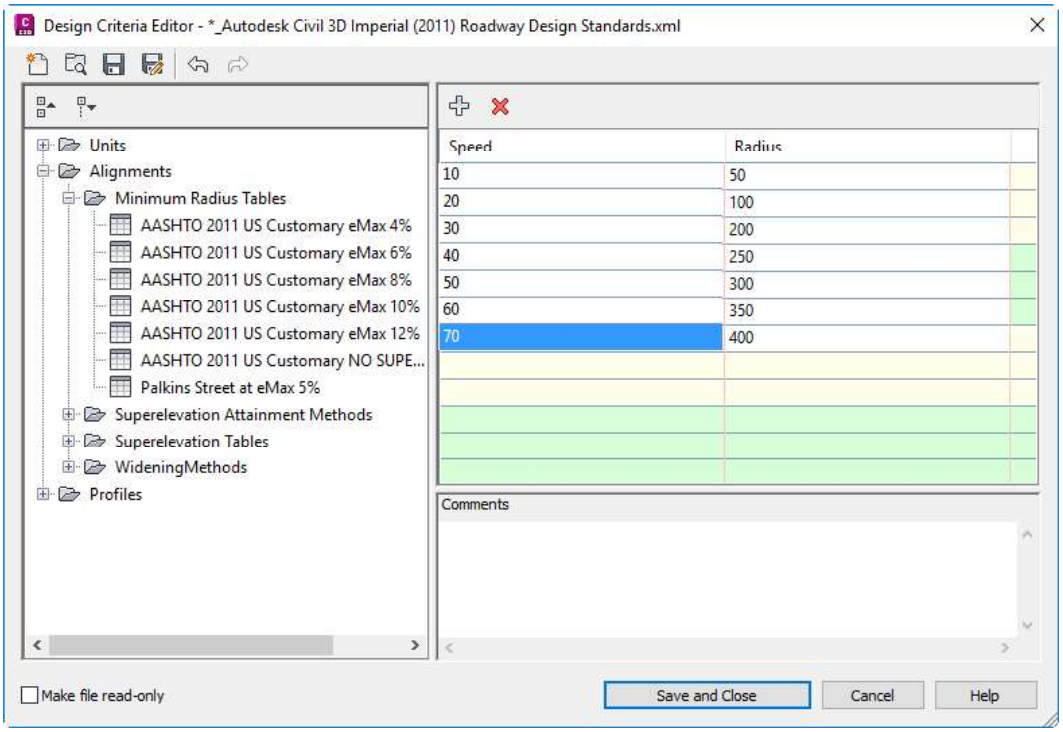



***Figure 5-76*** *The radius defined for various design speeds*

16. Choose the **Save and Close** button, a **Design Criteria Editor - Unsaved Changes** dialog box will appear. Choose the **Save changes and exit** button to exit the **Design Criteria Editor – Palkins Street Standards.xml** dialog box. You have created a new design criteria by customizing the default design criteria file. Next, you will create label styles and label set.

## Creating the Label Style for Major Stations

1. Expand **Alignment > Label Styles > Station** subnode in the **Settings** tab of the **TOOLSPACE** palette.

2. Select the **Major Station** subnode in the **Station** node and right-click; a shortcut menu is displayed.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

3. Choose **New** from the shortcut menu; the **Label Style Composer - New Major Station Label Style** dialog box is displayed.

4. Enter **Palkins-major** as the style name in the **Name** edit box of the **Information** tab.

5. Next, choose the **Layout** tab.

6. In the **Layout** tab, set the values of the properties in the **Text** collection as given below:

   Text height: **10.000"** Color: **blue** Lineweight: **0.18mm**

7. Next, choose the **Dragged State** tab.

8. In the **Leader** category, set the color of the leader to **Red**.

9. In the **Dragged State Components** category, set the color of the dragged state component to **red**.

10. Choose the **OK** button; the **Label Style Composer – Palkins-major** dialog box is closed.



**Tip**

*The **Palkins-major** label style for the major station will be listed under the **Major Station** subnode of the **Station** node in the **Settings** tab.*

## Creating the Label Style for Minor Stations

1. Expand **Alignments > Label Styles > Station** subnode in the **Settings** tab of the **TOOLSPACE** palette, if it is not expanded already.

2. Select the **Minor Station** subnode in the **Station** node and right-click to display a shortcut menu.

3. Choose the **New** option from the shortcut menu; the **Label Style Composer - New Minor Station Label Style** dialog box is displayed.

4. Enter **Palkins-minor** as the style name in the **Name** edit box of the **Information** tab.

5. Choose the **Layout** tab and set the values of the properties in the **Text** collection as given below:

   Text Height: **5.000"** Color: **magenta** Lineweight: **0.15mm**

6. Choose the **OK** button to close the **Label Style Composer – Palkins - minor** dialog box.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Creating the Label Set

1. Expand the **Alignment > Label Styles** subnode in the **Settings** tab of the **TOOLSPACE** palette.

2. Select the **Label Sets** subnode in the **Label Styles** node and right-click; a shortcut menu is displayed.

3. Choose **New** from the shortcut menu; the **Alignment Label Set - New Alignment Label Set** dialog box is displayed.

4. Enter **Palkins-Set** in the **Name** edit box of the **Information** tab.

5. Choose the **Labels** tab. Next, select the **Major Stations** option if not selected from the **Type** drop-down list. Select the **Palkins-major** option from the **Major Station Label Style** drop-down list.

6. Choose the **Add** button to add **Major Stations** in the **Type** column and the style name in the **Style** column.

7. Select the **Minor Stations** option from the **Type** drop-down list and the **Palkins-minor** option from the **Minor Station Label Style** drop-down list.

8. Choose the **Add** button to add the **Minor Stations** in the **Type** column and the **Palkins-minor** label style in the **Style** column.

9. Choose the **OK** button in the **Alignment Label Set - Palkins-Set** dialog box; the **Palkins-Set** label set is added to the **Label Sets** subnode in the **Settings** tab.

10. Select the alignment in the drawing and right-click; a shortcut menu is displayed.

11. Choose **Edit Alignment Labels** from the shortcut menu; the **Alignment Labels - Palkins Street** dialog box is displayed.

12. Choose the **Import label set** button in the dialog box; the **Select Label Set** dialog box is displayed.

13. Select **Palkins-Set** option from the dialog box if not selected by default and choose the **OK** button to close the dialog box.

14. Again, choose the **OK** button to close the **Alignment Labels - Palkins Street** dialog box. The major and minor stations of the **Palkins Street** alignment are labeled according to the **Palkins-major** and **Palkins-minor** label styles added on the **Palkins-Set**, as shown in Figure 5-77.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com




***Figure 5-77*** *The* ***Palkins Street*** *alignment with the label style added*

## Saving the File

1. Choose **Save As** from the **Application Menu**; the **Save Drawing As** dialog box is displayed.
2. In this dialog box, browse to the location *C:\c3d_2026\c05_c3d_2026_tut*
3. In the **File name** edit box, enter **c05_tut03a**.
4. Next, choose the **Save** button; the file is saved with the name *c05_tut03a.dwg* at the specified location.

# Self-Evaluation Test

**Answer the following questions and then compare them to those given at the end of this chapter:**

1. The simplest method of creating an alignment is by using the _____ tool.
2. When you create an alignment using the _____ toolbar, you can set the parameters for design criteria.
3. The _____ tools from **Alignment Layout Toolbar** are used to add a fixed line between two points for creating an alignment geometry.
4. _____ is one of the commonly used methods of editing an alignment manually.
5. The _____ tool is used to calculate superelevation for a given alignment.
6. Creating an alignment using the **Alignment Layout Tools** toolbar is a two-step process. (T/F)
7. The fixed entity is not a dynamic entity and its properties remain static even if the properties of other alignment entities are changed. (T/F)
8. A free entity is defined by using the parameters that you specify and is not dependent on the other two entities for its geometry. (T/F)

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

9. The **Pick Sub - entity** tool is used to select a sub-entity and edit its parameters. (T/F)

10. The **PANORAMA** window displays information only about the selected sub-entity of the selected sub-entity of the alignment. (T/F)

## Review Questions

**Answer the following questions:**

1. Which of the following input options can be used to create an alignment entity using the **Best Fit** method?

   a) From COGO points
   b) AutoCAD Points
   c) From feature lines
   d) All of the these

2. Which of the following road types is listed in the **Calculate Superelevation - Roadway Type** page?

   a) Undivided Crowned
   b) Undivided Planner
   c) Divided Crowned with Median
   d) All of the these

3. The _____ tool from the **Alignment Layout Tools** toolbar is used to create an alignment that consists of tangents without curves.

4. Choose the _____ tool from the **Alignment Layout Tools** toolbar to display the **PANORAMA** window with the **Alignment Entities** tab chosen.

5. Choose the _____ tool from the **Alignment Layout Tools** toolbar to display the **Alignment Layout Parameters** dialog box.

6. Changing the _____ alignment style results in the change of display appearance of a given alignment.

7. Design criteria cannot be applied unless you select the _____ check box in the **Create Alignment- Layout** dialog box.

8. The _____ tool is used to change the direction of an alignment.

9. The _____ symbol displayed on the alignment indicates violation of design criteria.

10. The position or layout of the center line of a highway and road on the ground is called an alignment. (T/F)

11. Stations represent the segments or the distances into which an alignment is divided. (T/F)

12. A floating entity can be attached only to a fixed entity or another floating entity. (T/F)

13. A design criteria file also contains superelevation attainment method. (T/F)

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

14. The **Best Fit** command help you create lines, arcs, and parabolas using only the AutoCAD points. (T/F)

15. Before creating a table, the respective alignment entities should be labeled. (T/F)

# EXERCISES

1. Log on to *www.cadcim.com* and browse to *Textbooks>Civil/GIS>AutoCAD Civil 3D>Exploring AutoCAD Civil 3D 2026>Exercise Files & Instructor Guide*. Next, *click on c05_c3d_2026 exer.zip* file to download the file.

2. Now, save and extract the downloaded folder to the following location: *C:\c3d_2026*



**Note**

*While opening the exercise files, the **PANORAMA** window may appear with an error message. Close this window to proceed further.*

## Exercise 1

Open the *c05_c3d_2026_ex01.dwg* file and create an alignment using the **Create Alignment from Objects** tool. Also, calculate the superelevation values at the superelevation rate of 10%. Use the following parameters: **(Expected time: 30 min)**

1. Alignment name: **Lane 1**
2. Alignment style: **Basic**
3. Alignment label set: **Major and Minor only**
4. Design speed: **55mi/hr**
5. Minimum radius table: **AASHTO 2001 eMax 10%**
6. Save the file as *c05_ex01a.dwg*.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

## Exercise 2

Open the *c05_c3d_2026_ex02.dwg* file and complete the alignment by using the **Alignment Creation Tools**. Use the tools from the **Alignment Layout Tools** toolbar to add the sub-entities. Also, create a label style for major and minor stations of the alignment and add them to a label set. Use the following parameters: **(Expected time: 30 min)**

1. Choose the **Fixed Curve** tool to add a curve using the top vertices of the first three polygons.

2. Using the **Floating Curve (from entity end, through point)** tool, add a floating curve at the end of the alignment by using the last segment as the entity and top vertex of the last polygon as the pass-through point.

3. Design Speed: 60mi/h (**Design Speed** tab)

4. Major Station label Name: **Major ST**
   Text height: **0.2000"**
   Color: **green**

5. Minor Station Label Name: **Minor ST**
   Text height: **0.1000"**
   Color: **blue**

   Save the file as *c05_ex02a.dwg*.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

**Answers to Self-Evaluation Test**

**1. Create Alignment from Objects**, **2. Alignment Layout Tools**, **3. Fixed Line (Two Points)**, **4. Grip editing**, **5. Calculate/Edit Superelevation**, **6.** T, **7.** T, **8.** F, **9.** T, **10.** F