# AutoCAD Civil 3D 2010
# Education Curriculum Instructor Guide
# Unit 3: Land Development

Lesson

3

# Horizontal Alignments

## Overview

In this lesson, students learn how to create subdivision road alignments from AutoCAD® entities such as lines, arcs, and polylines. Alignments are a critical component of all subdivision and roadway projects that have linear corridor design elements such as residential and collector roads. Alignments can also be used with creeks and rivers for floodplain analysis and channel design.

The following illustration shows two intersecting alignments:

# Objectives

After completing this lesson, students will be able to:

- Describe alignments and their properties.
- Create alignments using objects.
- Describe alignment tag labels.
- Label alignments and create a table.

# Exercises

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

1. Create an Alignment
2. Label an Alignment

# About Alignments

An alignment is a linear feature in the horizontal plane. An alignment is typically used for features such as road centerlines, pavement edges, and drainage lines. Alignments can represent existing features or proposed features. When used for roadway design, criteria exist to regulate the geometry of alignments based on a variety of factors including roadway classification, design speed, cross slope, pavement type, and many other items. The alignment also serves as the controlling geometry for the layout and construction of the road.

Detailing the particular geometric points of alignments is critical in order for the design engineer to provide clear communication of the engineering data for the client, reviewers, and contractors. Alignment labels and styles are effective tools for providing this communication.

Alignments are the first of the three primary design planes to be laid out and used by the designer. Profiles and cross sections provide the other two design planes necessary for a full three-dimensional description and modeling of proposed roadways.

## The Layout Process

The subdivision layout process is an iterative process where a developer, or the developer's engineer, strives to maximize the use of the land based on zoning, parcel layout, and road design criteria.

In many circumstances, the parcel outline for the subdivision is designed first, and then handed off to a designer who is tasked with designing the roads in the subdivision. Road designers often offset parcel right-of-way lines, polylines, and arcs to create the horizontal

alignment geometry for the subdivision roads. This geometry is converted to polylines, which are then used to create alignment objects for the subdivision roads.

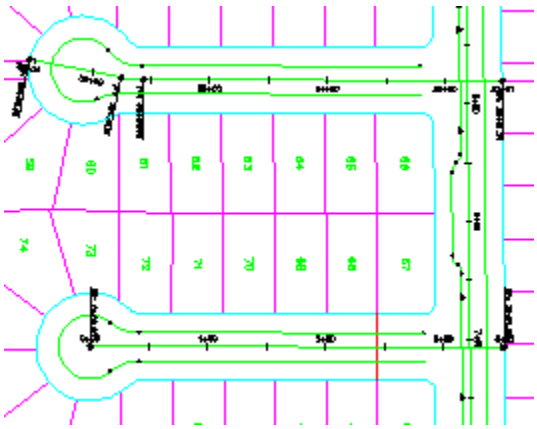
Alignments are a series of coordinates, lines, curves, and spirals used to represent the centerline of linear features such as roads, edges of pavement, sidewalks, and rights-of-way. Alignments can also be used to represent the centerline of a railway, channel, or stream.

## Alignments Example

Horizontal alignments in subdivisions are usually not very complex and consist mostly of tangents and curves. In some instances, lane tapers are modeled using alignments to create acceleration, deceleration, and turn lanes at intersection locations. Subdivision road centerline alignments are most often created by offsetting right-of-way lines by half the width of the right-of-way. Common commands such as Trim, Edit, Extend, and Fillet are used to create the alignment geometry from AutoCAD entities.

Once the geometry is in place, the Polyline Edit command can be used to join the lines and arcs together to form a continuous polyline representing the alignment. The direction of the polyline does not matter because once you create the alignment, you can reverse the direction of the alignment. You can also create alignments from AutoCAD line and arc entities.

Alignments for residential subdivision roads are shown in the following illustration.



Keep the following guidelines in mind when you create alignments:

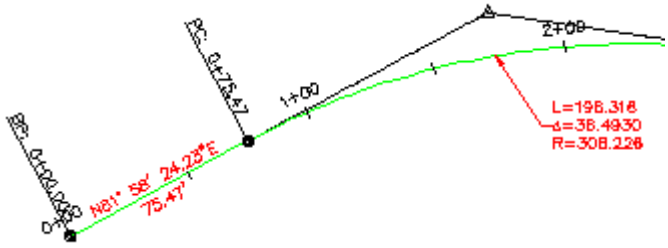
- The direction of the polyline is not important, as you can reverse the direction of an alignment during the alignment creation process. You can also reverse the alignment direction after it has been created.
- When you create an alignment from a polyline with no curves, or from lines, you can automatically add curves between the tangents.

- You can assign a value to the starting station of the alignment, which is the start point of the polyline, line, or arc. Alignment station reference points and base stationing values can be adjusted later.
- Alignments can either be independent or included in a site. Use alignments in a site if you want them to interact with other objects in the site, or if you want to use sites to organize the alignments.

## Labeling Alignments

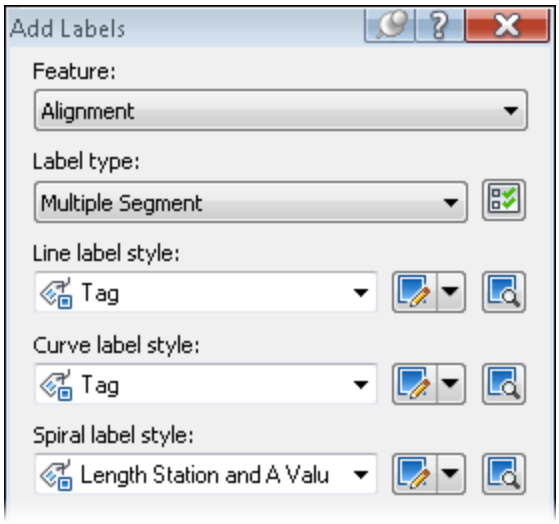
Horizontal alignments are made up of segments, which are lines, arcs, or spirals. There are a number of powerful labeling tools in AutoCAD® Civil 3D® software for labeling horizontal alignment geometry, either on the alignment itself or in a table. When you edit or change an alignment, associated labels and tables automatically update to reflect the new alignment geometry.

The following illustration shows alignment geometry with segment labels.




When plans become difficult to read because of too many geometry alignment labels, you can create tag labels for the alignment segments and show the geometry in a corresponding table. After adding tag labels, you create an alignment table that references the tags. You can create a line, curve, spiral, or segmental table that shows the geometry for the entire alignment. The table can be dynamic. When you edit the horizontal alignment or change the station reference point, the data in the table automatically updates to reflect the new geometry.

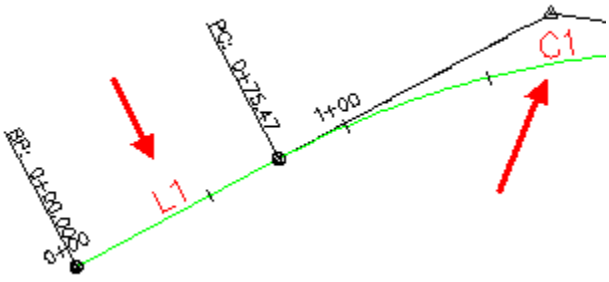
To create tag labels, you select a tag label style from the Add Labels dialog box as shown.




## Definition of Alignment Tag Labels

There are a number of different label types that you can add to a horizontal alignment. To label alignment geometry, you can either label single segments or multiple segments. The multiple segment option enables you to label all segments for the entire alignment. When you choose the label type, you can then specify the corresponding label style.

An alignment with tag labels is shown in the following illustration.




The table shown displays segment numbers (tag label) and its associated details.

| Huckleberry Hill | | | | |
|---|---|---|---|---|
| Number | Radius | Length | Line/Chord Direction | A Value |
| L2 | | 101.87 | S81° 32' 01.01"E | |
| L3 | | 156.94 | S69° 41' 15.00"E | |
| L1 | | 75.47 | N61° 58' 24.23"E | |
| C1 | 308.23 | 196.32 | N80° 13' 11.61"E | |
| C2 | 373.38 | 77.20 | S75° 36' 38.00"E | |

Keep the following guidelines in mind when labeling alignments:

- Use the Alignment command settings to specify default label styles for alignment labeling.
- Use tag labels and tables to simplify the appearance of a drawing. Note that when you create a table for an alignment that already has labels, the labels are automatically converted to tag labels.

## Key Terms

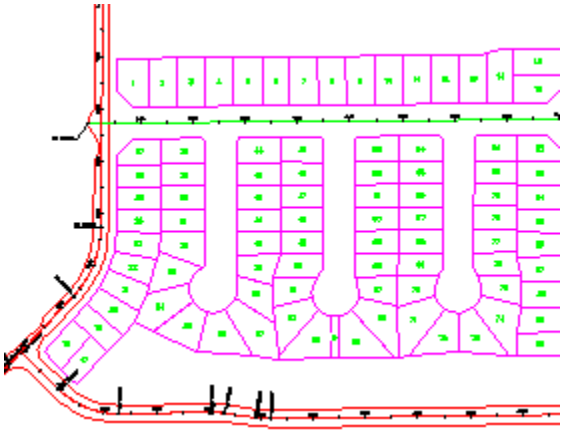
| | |
|---|---|
| Alignment | An alignment is a linear feature in the horizontal plane. An alignment is typically used for features such as road centerlines, pavement edges, and drainage lines. |
| Point of Curvature (PC) | The PC is the transition point on the alignment from a tangent to a curve in the direction of increasing stationing. The PC is sometimes referred to as the beginning of curve. |
| Point of Intersection (PI) | The PI is the point where two tangents that are connected by a curve intersect. The tangents form the approaching and departing directions from the curve. The PI is not on the horizontal alignment, but is a key geometric point necessary to define the curve geometry. |
| Point of Tangency (PT) | The PT is the transition point on the alignment from a curve to a tangent in the direction of increasing stationing. The PT is sometimes referred to as the end of curve. |
| Tangent | A tangent is a straight line section of roadway. |
| Curve | In alignments for road design, a curve is based on horizontal circle geometry defined by a radius, an inscribed angle, and a length. |

| | |
|---|---|
| Tags | Tags, or tag labels, are a shorthand method of labeling lines or curves. A line tag label is normally L1, L2, and so on; and a curve tag label is C1, C2, and so on. Tags reduce the amount of text directly around an alignment, making the drawing more readable. After you label an alignment with tag labels, you create a table that associates alignment geometry and coordinate data with the individual tags. |
| Label Sets | A label set is a collection of alignment station and geometry label styles for an alignment. When you create an alignment, you apply a label set as opposed to selecting individual label styles. |
| Station | Stationing is a form of linear referencing of distance along an alignment. A station is a value of distance from the start point added to the starting station value. The base value for imperial stationing is 100 feet, designated as 1+00. The base value for metric stationing is 1000 meters, designated 1+000. |
| Station Reference Point | The station reference point is the point on the alignment about which stationing is based. When you first create an alignment, the station reference point is the beginning of the alignment. |
| Offset | An offset is a perpendicular distance from an alignment. |
| Station-Offset | A station-offset is a method for identifying the location of a point based on the alignment station and the perpendicular offset that matches the position. |

## Exercise 1: Create an Alignment

In this exercise, students create alignments using polylines.

The completed drawing is as shown.

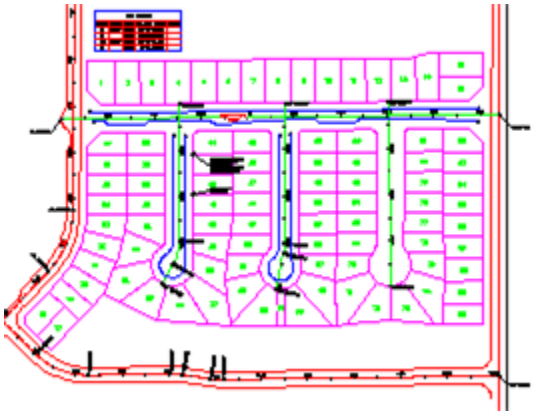


For this exercise, open …*I_Alignments-EX1.dwg (M_Alignments-EX1.dwg).*

## Exercise 2: Label Alignments

In this exercise, students create alignment tag labels and an alignment table.

The completed drawing is as shown.



For this exercise, open …*I_Alignments-EX2.dwg (M_Alignments-EX2.dwg).*

# Assessment

## Challenge Exercise

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

## Questions

1. In a subdivision, what is a common method of locating a road centerline with respect to the right-of-way?
2. Do alignments need to be included in a site?
3. How do you modify the appearance of an alignment linetype in the drawing area?
4. What is a label set?
5. What type of alignment label would you use to label a fire hydrant location that is off to the side of the road?

## Answers

1. Frequently, the road centerline bisects the right-of-way.
2. No. Alignments can either be independent or included in a site. Use alignments in a site if you want them to interact with other objects in the site, or if you want to use sites to organize the alignments.
3. The appearance of the line is controlled by the alignment style. You can either right-click the alignment in Prospector, click Properties, and select a different object style; or you can create your own style on the Settings tab and then set it to be current using the Alignment properties.
4. A label set is a collection of label style settings for an alignment that defines the types of markers and styles used for labeling.
5. You use a Station-Offset Fixed Point label.

# Lesson Summary

In this module, students learned how to work with alignments. Alignments were created using existing polylines. Alignment styles were created and modified to alter the appearance of the important alignment points. Labels of various types were created and a label set was explained. Tags were used for alignment segments and an alignment table with line and curve segment tags was created.