



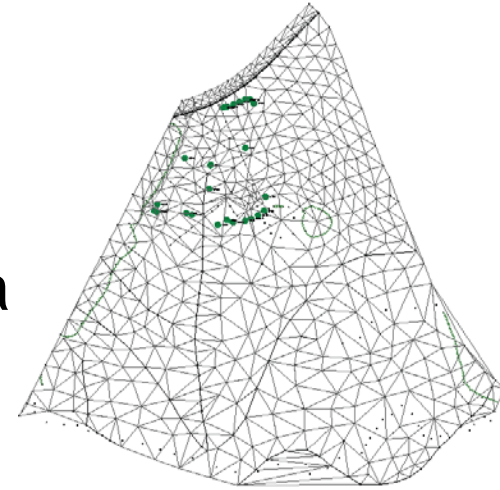
C3D – Introduction

An Introduction to:

- Surfaces
- Profiles
- Alignments
- Corridors

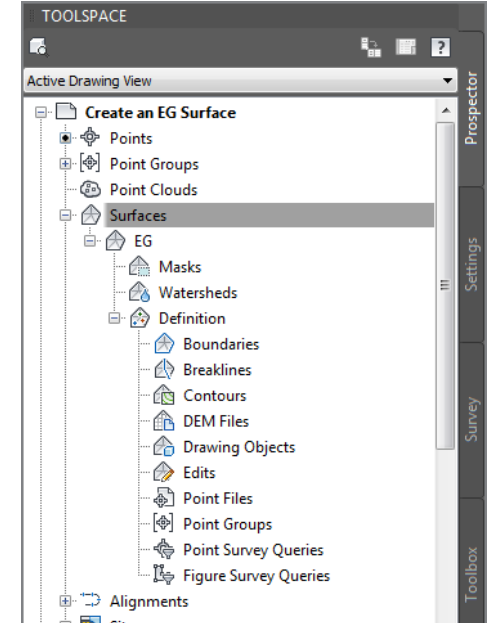
Understanding Surfaces

- Typically start with point data (survey data).
- Then a surface is made using a TIN (Triangular Irregular Network) algorithm.
- The TIN algorithm fills in the spaces between the points.
- This enables an elevation to be approximated anywhere within the surface.
- Surfaces are key components of nearly every land development project.



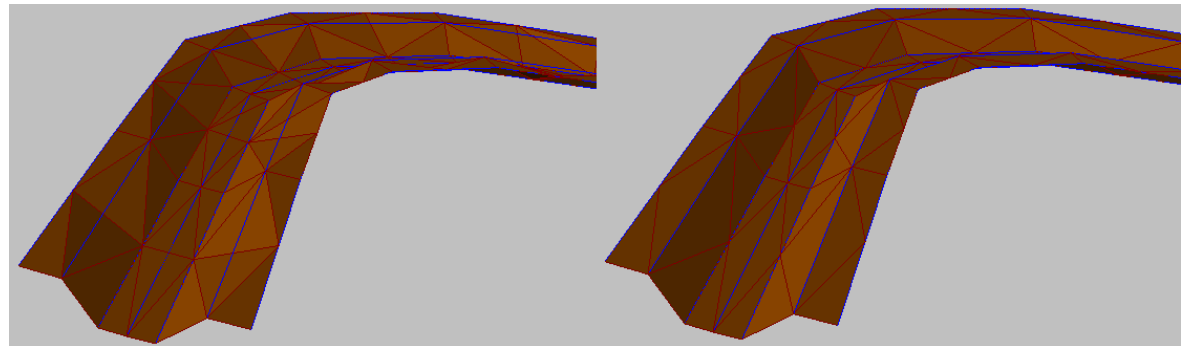
Components of a Surface

- Boundaries: Control where the surface *is*
- Breaklines: Control the alignment of TIN lines
- Contours
- DEM files: Large-scale Digital Elevation Models
- Drawing objects: Lines, arcs, circles, and so on
- Point files (text files)
- Point groups



Breaklines

- Points alone do not make an accurate surface.
- You must control how the lines are drawn between those points to make a truly accurate representation of the ground.
- Breaklines establish “hard edges” within the surface along curb lines, edges of pavement, embankment edges, and so on.

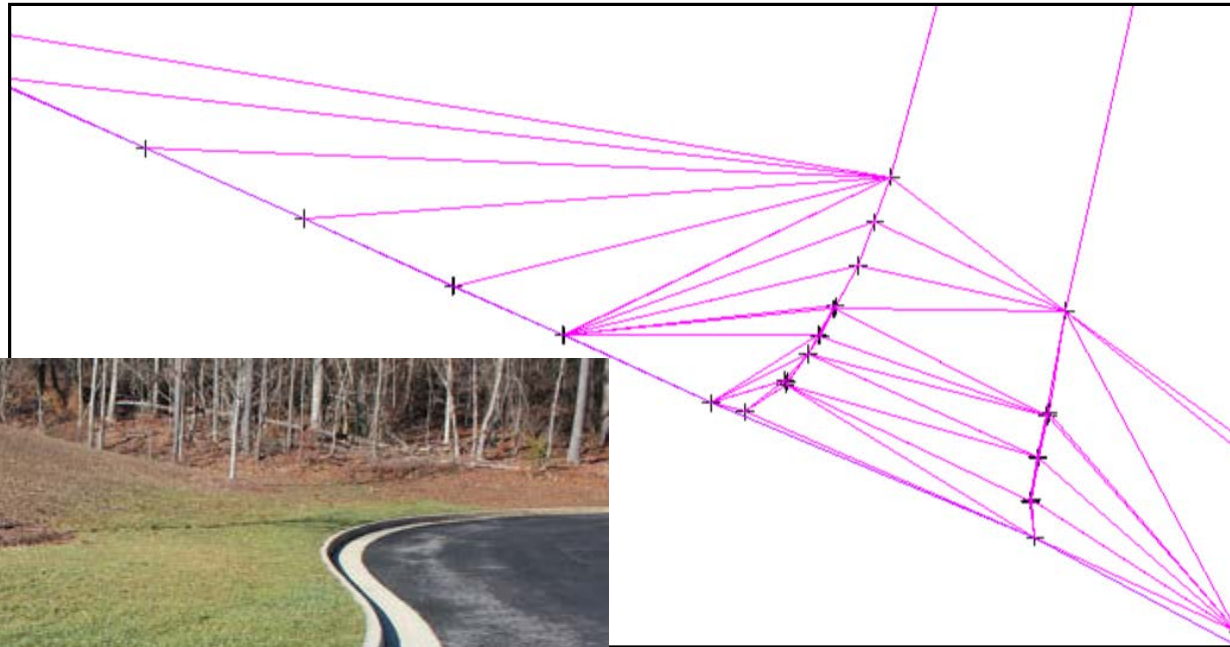


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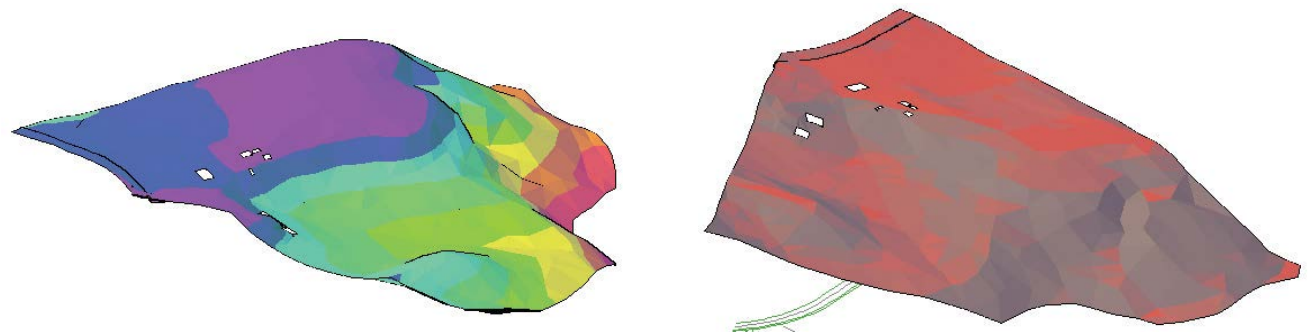
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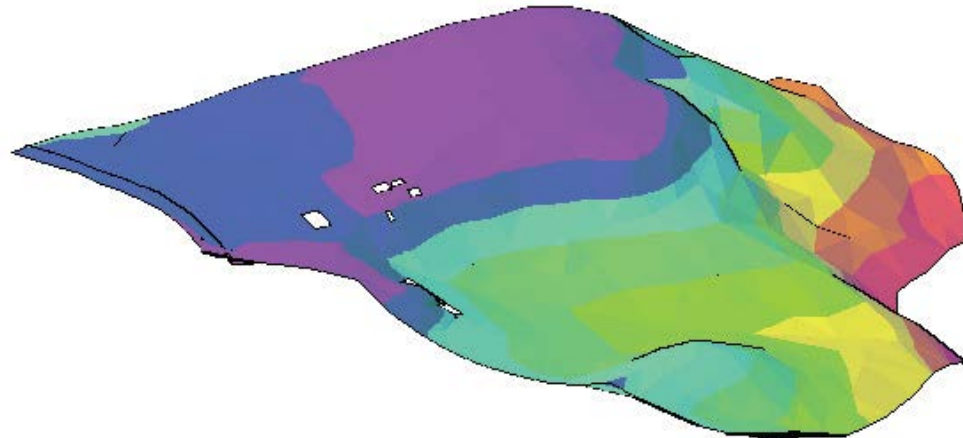
Display and Analyze a Surface

- One way to leverage the dynamic surface model is through display and analysis.
- The surface can “tell its story” in ways other than contours.



Elevation Analysis

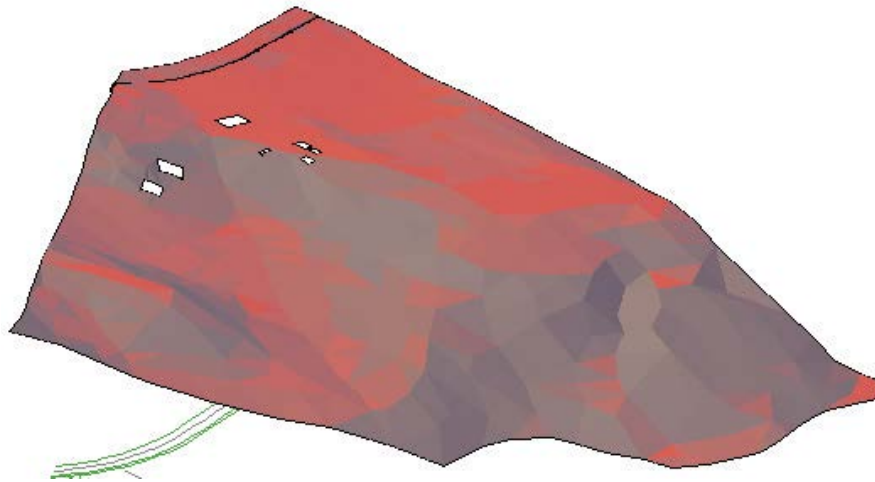
- Divides the surface into ranges of elevation
- Displays each range as a different color
- Great for helping someone visualize terrain who doesn't know how to read topo maps





Slope Analysis

- Divides the surface into ranges of slope
- Displays each range as a different color
- Great for identifying areas with excessively steep or flat slopes





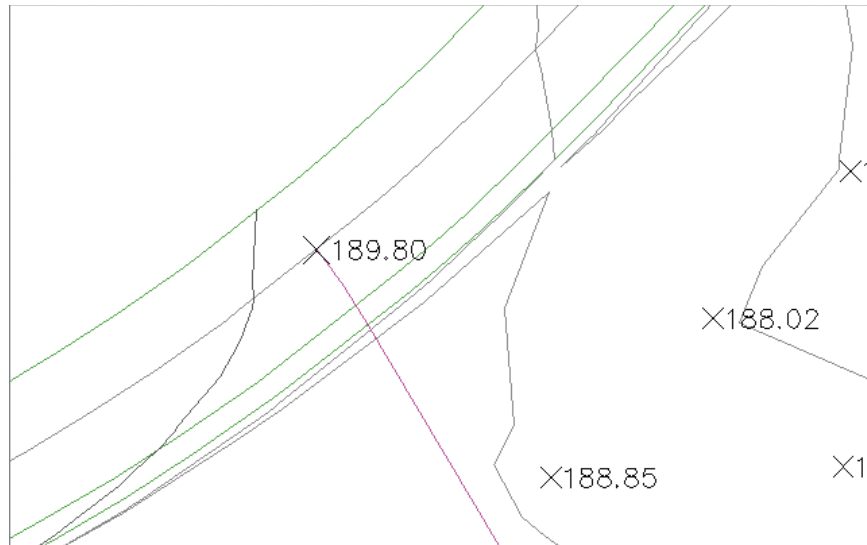
Other Types of Analysis

- Contours
 - Contours are color-coded based on elevation.
 - A legend shows the area/volume of each contour.
- Directions
 - These are visual representations of surface slopes.
 - For example, which parts of your surface flow to the south, and which flow to the north?
- User-Defined Contours
 - These are used for “odd” contours between regular intervals.
- Watersheds
 - These are areas within the surface where rainfall runoff flows to a certain point or in a certain direction.

Spot Elevation Labels

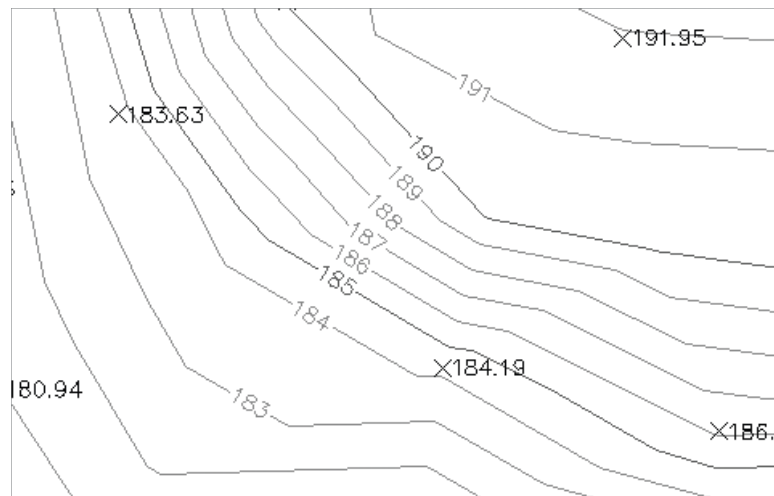


- Used to label key elevations or flat areas where contours are sparse
- Update automatically when they are moved or copied
- Update automatically when the surface changes



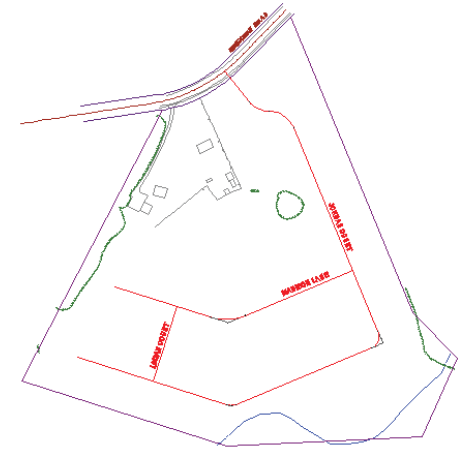
Contour Labels

- Created by drawing a line across one or more contours
 - Labels appear wherever the line crosses a contour.
 - Labels move as line moves.
 - Lines can be made invisible so that only labels can be seen and plotted.
- Major and minor labels stylized separately

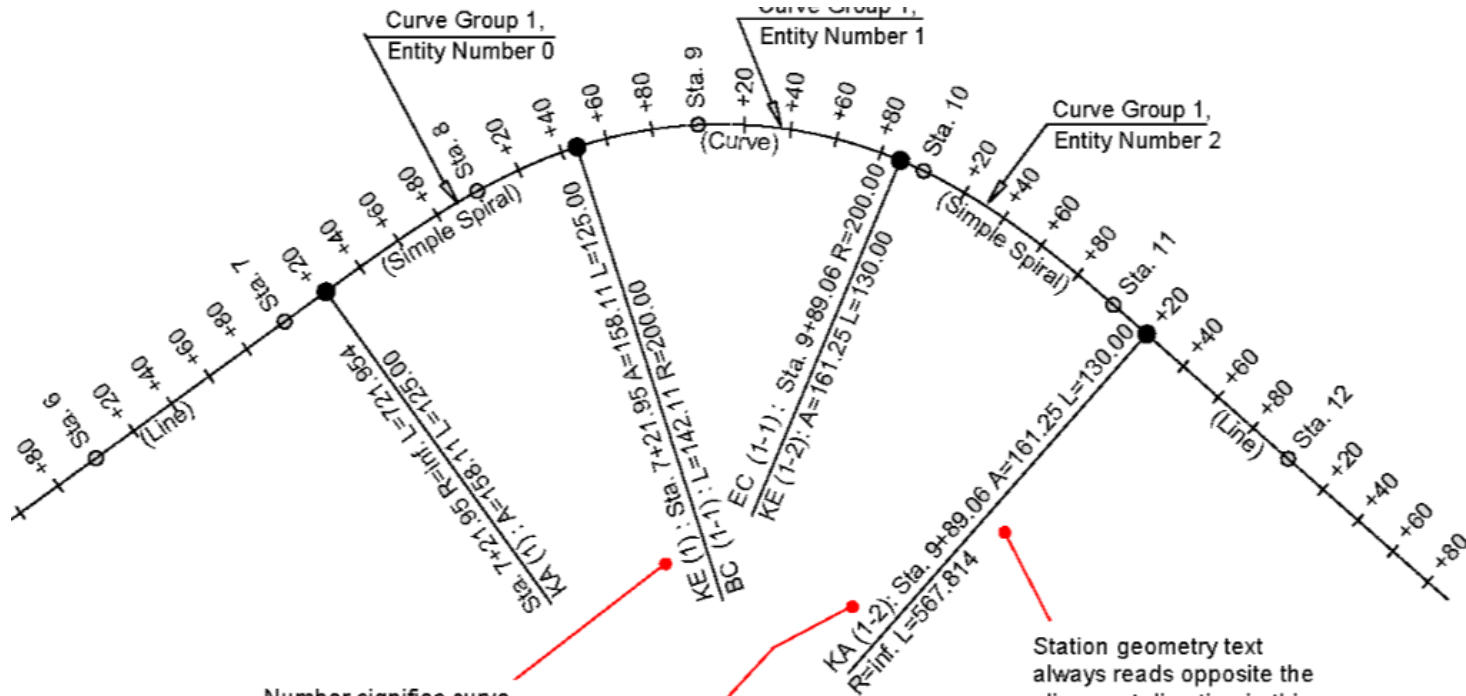


Understanding Alignments

- For long, linear designs such as roads, railroads, channels, and pipelines
- The initial single-line version of a linear feature
- Serve as the “backbone” for other parts of the design such as the following:
 - Profiles
 - Cross sections
 - Corridors
 - Others



Alignment

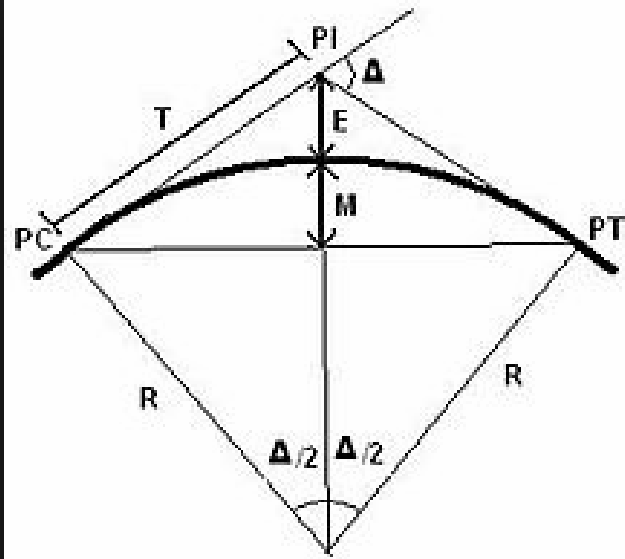


Number signifies curve group number 1 and entity number 0. Note that zero is not annotated.

Numbers signify curve group number 1 and entity number 2

Station geometry text always reads opposite the alignment direction in this example. This can be controlled in the geometry point label styles.

Alignment Terminology



ALIGNMENT TERMINOLOGY

Before jumping into the next exercise, you may want to review the following list of terms that you will find throughout the Alignment Creation Tools commands as well as other places within Civil 3D.

Tangents (alignment segments) The straight line portions of an alignment

Tangent (geometric condition):

- ▶ Touching or passing through at a single point
- ▶ In the case of a line and arc: perpendicular to a line drawn from the intersection point to the center point of the arc
- ▶ In the case of two arcs: intersecting in such a way that a line drawn from the center point of one arc to the center point of the other arc passes through the intersection point

Curves The curved portions of an alignment that have a constant radius

Spiral The curved portions of an alignment that change in radius from one end to the other

PI (point of intersection) The place where two tangents intersect or would intersect if they were extended

PC (point of curvature) The place where the curve begins

PT (point of tangency) The place where the curve ends

Free A line, curve, or spiral that is dependent on another alignment segment at both ends

Floating A line, curve, or spiral that is dependent on another alignment segment at one end

Fixed A line, curve, or spiral that is not dependent on another alignment component at either end

Creating Surface Profiles

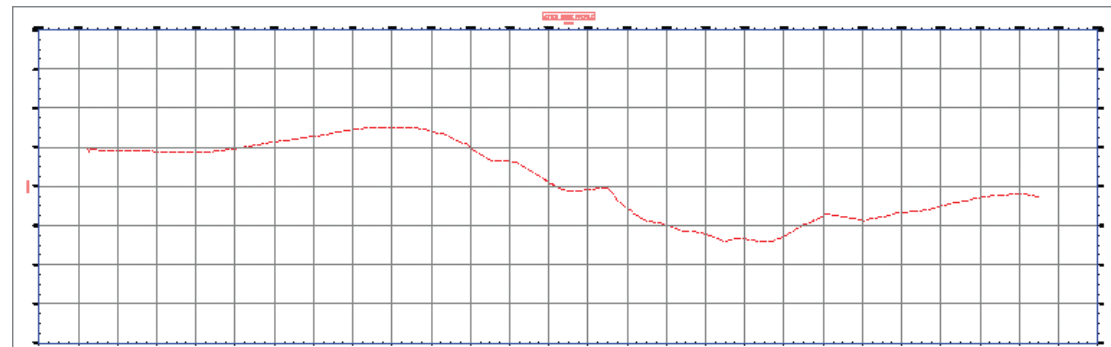
- Before designing a profile (e.g., for a road), you need to see what the existing profile looks like by creating the surface profile.
- The surface profile is the existing ground topography at the proposed alignment location.
- Surface profiles are dynamically linked to the surface and alignment.
 - If the alignment changes – the profile will change automatically
 - If the surface changes – the profile will change automatically.





Profile Views (Profile of Existing Ground)

- Profiles cannot exist on their own; they must be displayed within a profile view.
- The profile view provides the grid backdrop and annotation for the profile(s). Stations, Elevations.
- Profile views have their own styles; in fact, they're one of the most sophisticated types styles.



Profile Terminology

PROFILE TERMINOLOGY

Familiarizing yourself with the following terms will be helpful as you work with design profiles:

Tangent The straight-line portions of a profile.

PVI Point of vertical intersection; the location where two tangents intersect.

PVC: Point of vertical curvature; in other words, the beginning of a vertical curve.

PVT Point of vertical tangency; in other words, the end of a vertical curve.

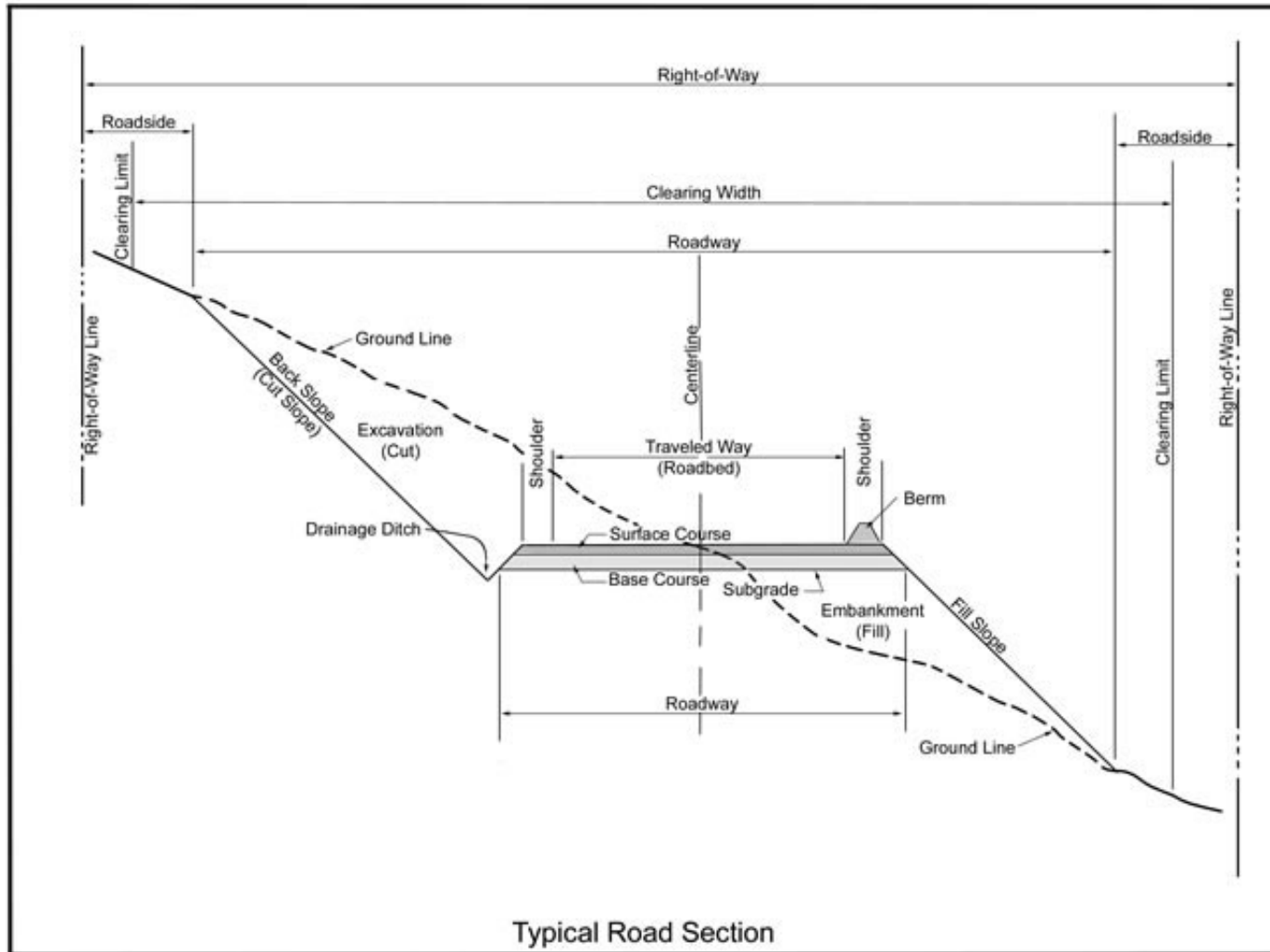
Parabolic curve A vertical curve that does not have a constant radius and follows the shape of a parabola.

Circular curve A vertical curve that has a constant radius.

Asymmetric A vertical curve that is created from two back-to-back parabolic curves.

Crest curve A vertical curve at the top of a hill where the grade leading into the curve is greater than the grade leading out. The PVI is located above the curve.

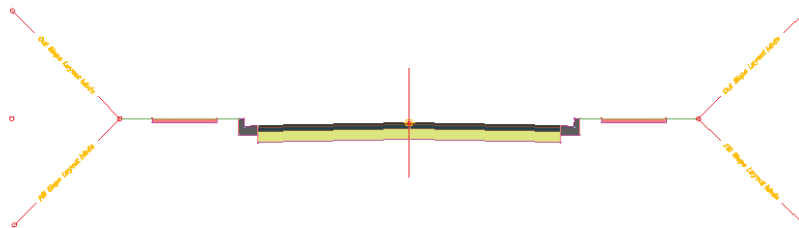
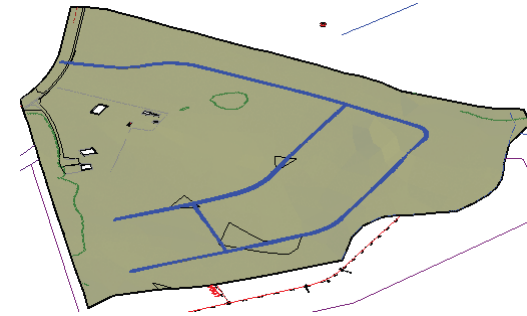
Sag curve A vertical curve at the bottom of a valley where the grade leading into the curve is less than the grade leading out. The PVI is located below the curve.





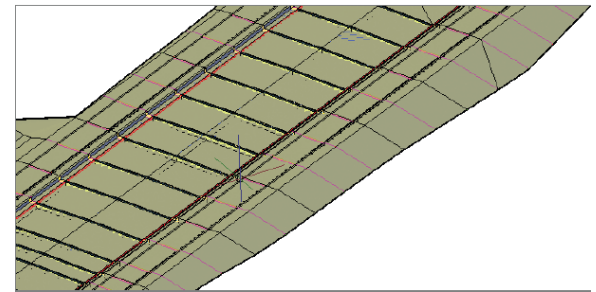
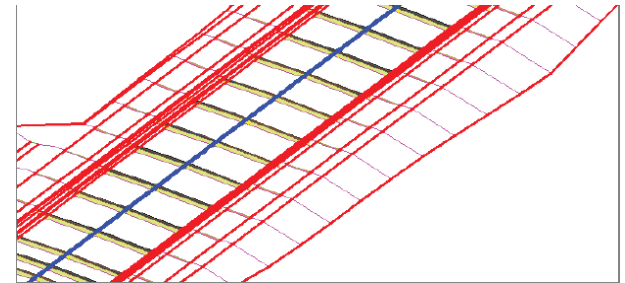
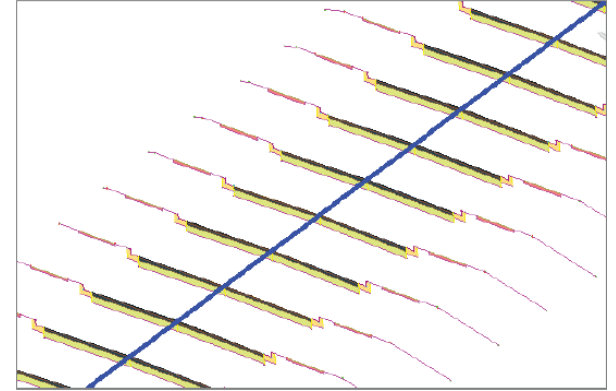
Corridors

- Corridors use:
- 3D chains and assemblies:
- A 3D chain is the combination of an alignment and profile to form a 3D path.
- An assembly is a typical cross section of a feature such as a road.



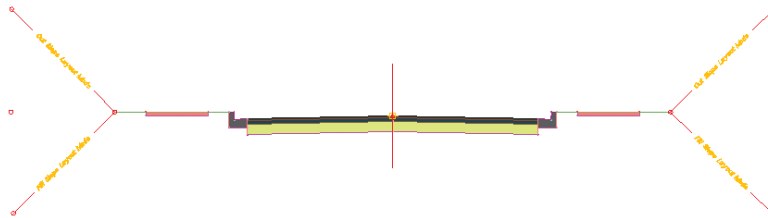
Understanding Corridors

- When you repeatedly insert assemblies along a 3D chain, you get a corridor.
- Feature lines connect like points in a longitudinal direction.
- A corridor surface is the “fuselage” that wraps around framework provided by the assemblies and feature lines.



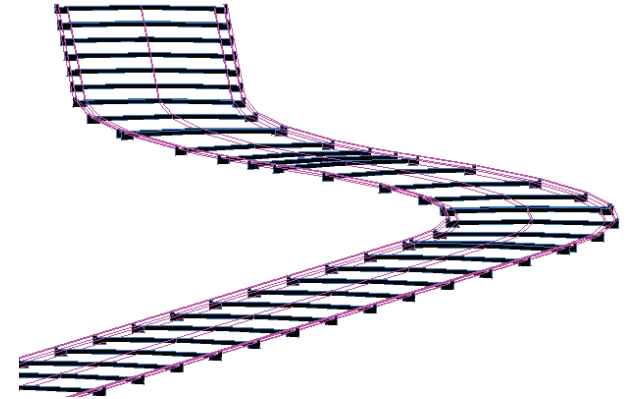
Creating Assemblies

- An assembly begins as a simple vertical baseline.
- Then you access tool palettes and attach subassemblies to the baseline and to each other.
- Subassemblies represent components of the design such as lanes, curbs, ditches, and so on.



Creating a Corridor

- Once an alignment, surface profile and assembly are in place, creating a corridor is just a matter of launching the Create Corridor command and selecting.



- You can select the alignment, profile, and assembly by clicking them in the drawing or selecting them from a list.

