

Glossary of CAE Terms

The terms below are commonly used in each of our CAE applications. Some of these items are used in more than one application, but with different definitions.

InRoads Terms

Term	Definition
ALG	An ALG is a geometry file containing horizontal and vertical alignments, coordinate information and superelevation for a specific geometry project.
Alignment	An alignment is a chain of tangents, curves, and transition spirals that describes a centerline.
Backbone	The backbone is a portion of the corridor that lies between the template hinge points. The backbone is typically the roadway template excluding the side slopes.
Breakline	A breakline is a surface feature consisting of a collection of spatial coordinates that have an implied linear relationship. No triangle side in the triangulated surface can cross over a breakline.
Chainage	Chainage is the distance along a horizontal alignment measured from some reference point on the alignment. Also referred to as station.
Clipping boundary	A clipping boundary is an element that defines the size and shape of a reference (model) file view.
COGO	COGO within InRoads typically refers to basic geometric commands for defining horizontal geometric data. This refers to locate, intersect, traverse and create commands for individual or joined groups of points.
Component	A component is a closed shape or end condition that defines a roadway element, such as a lane, curb, sidewalk, retaining wall, etc. Collections of components are used to create roadway templates.
Cross section	A cross section is a graph showing the surface elevation extracted perpendicular to a defined path (such as a centerline). Cross sections can display surface features such as utilities, drainage, and curbs.
DTM	A digital terrain model is a database within a project that defines a 3D mathematical model of the shape of a surface. The represented surface may be an existing terrain, proposed grade surfaces, or a combination of both. The DTM includes random points, breaklines, interior and exterior limits. The DTM may also include non-triangulated features such as signs, fence lines, culverts, etc. for display in plan, profile and cross section views.

Element	Elements are the basic building blocks of a geometric figure; also completed geometric figures such as lines, shapes, circles, and so forth.
Event point	An event point is a specific named location along a horizontal or vertical alignment. Event points are used to indicate significant stations. Some commands that perform a task at regular intervals or at even stations can perform that task also at event points. For example, cross sections can be extracted every 50 feet AND at stations corresponding to event points.
Feature	A feature is a single instance of a 3D geometric representation in the Digital Terrain Model (DTM). A feature can be one of five types, corresponding to the type of DTM points contained: random, breakline, exterior boundary, interior boundary, or contour. Features are groups of DTM points -- each group is given a name and assigned a feature style. Benefits to organizing the DTM into features include the ability to identify different features by name, select and edit them using filters and independently control their display characteristics. Features can also be targets for design decisions in templates.
Feature style	A feature style is assigned to individual features to determine whether points, line segments, or annotation for that feature can be displayed in plan view, in cross sections, or in profiles. Feature styles can also be used in filters for grouping in display and editing. Within the survey environment feature code and feature style are synonymous.
Figure	A figure is a sequence of coordinate geometry point numbers that represents an alignment.
Isopach	An Isopach surface contains data derived from two other surfaces. The Isopach data is obtained by subtracting the elevations in one surface from those in the other surface.
Hinge	The hinge is one of two points on a template that define the backbone of a template. It is the point by which end conditions 'hinge' about.
Parcel	InRoads does not distinguish between Parcels and Alignments and generally treats parcels as alignments. The only exceptions to this rule are specific commands developed for lot (parcel) creation and ROW takes. Even then the information is stored as alignments.
Pen order	Pen order is the sequence of pen up/pen down control information in the ASCII file. If the pen order is set to One then Zeroes, a 1 in the last column in the ASCII file represents the beginning of a line, and 0 represents points on the line. The opposite is true of the setting Zero then Ones.
Plan And Profile Generator	The Plan and Profile Generator automatically generates plan views and profile views, assembles the alignment-based sheets, and then stores their definitions in an ASCII file called the View Definition File (VDF).

Planimetric lines	Planimetric lines are a series of graphical representations of where cross sections and profiles were extracted. These can be created in MicroStation or InRoads and can be edited to represent custom cross sections with multiple vertexes.
Point names	Point names are transition control names that points define roadway transition and features when the Roadway Designer model is generated.
Profile grade line	The profile grade line is established from a horizontal and a vertical alignment. The typical section is applied at the profile grade line using the defined widths and slopes in the template.
Profile	A profile is a graph showing elevation extracted from one or more surfaces along a defined path, such as along an alignment. Vertical alignments are also defined within the Profile view.
Project	A project is a collection of surfaces, geometry projects, template libraries, roadway libraries, drainage databases, survey fieldbooks and preferences files, all identified in a single file with an RWK extension. The RWK file is in ASCII format and allows users to save a group of files with file location pointers.
Random	Random is one type of point used to define a digital terrain model. Random points are discrete points that have no relation to other points.
Regression analysis	This is a method in which a best fit line or arc is developed through a series of points.
Rollover	Rollover is the difference in slope between the road and the shoulder during superelevation.
RWK	A project file containing the paths to the surfaces, typical section libraries, coordinate geometry projects, roadway design libraries, drainage databases, survey fieldbooks and preference files related to a particular project. There is a distinction between a project and a geometry project - a project can contain one or more geometry projects.
Roadway Design Library	A roadway library file contains roadway modeling definitions. This file stores station and typical section information used by the Roadway Designer to create surface models along a horizontal alignment.
Tag	Tags are additional information that may be attached to graphical elements to provide more intelligence to the graphical elements. Tags may be applied manually within MicroStation or automatically within InRoads.
Template	A template is a cross section of the design surface showing special features such as the median and drainage ditches. Templates can be saved in the typical section library. A template library stores definitions for components, templates, tables and transitional control features.

Template library	A template library is a typical section library file.
Vertical alignment	A vertical alignment is a child of the horizontal alignment. It typically contains vertical definition via VPI's and curve definitions. The vertical alignment is stored in the ALG geometry file with horizontal alignments and other geometric definitions.
XML	Extensible Markup Language is a web-ASCII data format for reporting project information. This format is also a basis for LandXML, which is project data that can be ported between engineering applications according to an industry defined schema.
XSD	The XSD file format is a style sheet. This is the format that defines how XML data will be displayed. The XML is the underlying data, and the style sheet can be configured to show, format, or highlight some or all of the data. This is usually output to HTML or a text file.

Survey Terms

Term	Definition
Auto Track	Total Stations with the Auto Track option can lock onto and track a reflective prism and allow the operator to not have to look through and point the scope.
Azimuth	An azimuth is the angle to a line of sight, typically measured clockwise from a north meridian.
Backsight	A backsight is a reading taken on a position of known coordinates. Since a survey progresses from a point of known position to points of unknown position, a backsight is a reading looking "backward" along the line of progress. The first reading of almost any survey job should be a backsight onto a fixed point of reference, usually a benchmark.
Baseline	A baseline is a line used for reference in a survey job. It is often a centerline or a street line. A baseline is not necessarily straight; e.g., the centerline of a street or pipeline will often curve. The important aspect is that the baseline can be precisely located, then used for referencing other measurements on the job site. Selection of a baseline is entirely arbitrary. However, judicious selection can make the rest of the job much easier.
Bearings	Bearings are used to indicate angular orientation with respect to the earth. Bearings consist of three components: The cardinal direction of the nearest end of the meridian (N or S); The angle measured from the nearest end of the meridian; The cardinal point indicating the direction of deflection from the meridian (E or W). The angular measure is always within the range of 0-90 degrees.
Benchmark	A benchmark (BM) is permanent marker, usually a bronze disk, at a point of determined location (elevation and possibly horizontal coordinates). It is a point of fixed location, like a mark on a bridge abutment, a foundation, or a rock face. It can be used as a reference point for surveys in its locality. Descriptions of benchmark locations and their elevations are published by government agencies. A temporary benchmark (TBM) is a point of fixed location that is used as a reference for a short-duration project. Its elevation may or may not be determined with respect to a larger coordinate system. A TBM could be something like a nail in a tree or fencepost, a mark on a curb, or a sturdy stake driven in an out-of-the-way area of a project site.
Control Point	Control Points are fixed points of known coordinates, either elevation-only or they can include all coordinates. Control points are determined by high-accuracy surveys. Control points for a construction project can be established conveniently around the project area using high-accuracy procedures. These points would then be used throughout the project for referencing subsequent survey work, such as locating foundations, pipes, etc.

Datum	A datum is a fixed starting point of a scale. For example, the datum-level for elevation is typically taken as mean sea level. The datum for latitude is the prime meridian (through the Royal Observatory in Greenwich, England). Every datum is arbitrary. However, judicious selection of a datum can make life easier.
DGPS	A technique to improve GPS accuracy that uses errors measured at a known location to improve the measurements made by other GPS receivers within the same general geographic area.
EDM	Electronic Distance Measurement device, the instrument used by modern surveyors that replaces the use of measurement chains. It determines distance by measuring the time it takes for light to reflect off a prism on top of a rod.
Foresight	A foresight is a reading taken on a position of unknown coordinate(s). Since a survey progresses from a point of known position to points of unknown position, a foresight is a reading looking "forward" along the line of progress. Foresights may be taken on the "main circuit" of the survey or on additional points of interest. Readings on additional points of interest are sometimes called <i>sideshots</i> or <i>intermediate foresights</i> to distinguish them from the readings that form the main circuit of the survey.
GPS	Global Positioning System. A constellation of 24 satellites that were conceived, implemented and are operated by the Department of Defense that orbit the earth at a nominal altitude of 11,000 miles. GPS satellites transmit signals that allow the accurate determination of GPS receiver locations. Receivers can be located at fixed locations, moving on the earth's surface, in the earth's atmosphere, or in low-Earth orbit. GPS is used in air, land and sea navigation, mapping, surveying and other applications where precise positioning is necessary. The GPS signal is provided free of charge to anyone on or near the planet with a GPS receiver and an unobstructed view of the satellites
Hand Level	A hand level is a small scope fitted with a spirit level that is visible while looking through the scope. It is used to make rough estimates of relative elevations.
Magnetic Declination	Magnetic declination is the horizontal angle between true north (i.e., the geographic meridian) and magnetic north (i.e., the magnetic meridian).
Manual	Total Station that must be rotated and pointed manually with the tangent screws.
Meridian	A north-south reference line. It may be taken through the position of the instrument, or, in special cases, through a reference point (such as the Royal Observatory in Greenwich, England, which designates the Prime Meridian - 0° longitude).
Occupied Point	The physical point over which the instrument (level, transit, total station, etc.) is set up. It is the point from which any measurements taken while at that point are reckoned.
Orders of Surveys	The <i>order</i> of a survey is a way of expressing the accuracy of the work. The order of the survey can have two levels of designators, namely, <i>Order</i> and <i>Class</i> .

Pacing	<p>Pacing is a "quick and dirty" method for estimating distances. One simply walks from one point to another, counting steps. Knowing the length of one's step allows a quick estimation of the distance. With practice, pacing estimates will typically be accurate to within 2%.</p> <p>Pacing is most reliable on even terrain without obstructions. The more uneven or unstable the surface (such as plowed ground or loose sand), the lower the accuracy. Pacing upslope tends to shorten the step and pacing down slope tends to lengthen the step. Use another method if better accuracy is required.</p>
Plane Surveying	<p>Plane surveying is a subset of the general field of surveying in which it is assumed that a Cartesian coordinate system is applicable or appropriate. The methods of plane surveying are appropriate for most construction and planning tasks that are relatively small in scale.</p> <p>Plane surveying is used to approximate the conditions on small portions of the surface of the earth (which is, of course, spherical). You must assess the amount of curvature that will be involved in a project and make the judgment as to whether or not it can be ignored, or what sort of corrective procedures should be incorporated.</p>
Project Datum	A coordinate system developed by WSDOT to allow a survey of a project to be surveyed using ground level distances and still be referenced to the State Plane Coordinate System
Robotic	Total Stations that allow the operation to be done from a remote location via a radio link.
RTK	The DGPS procedure whereby corrections are transmitted in real time from a reference station to the user's roving receiver.
SDR33	Model of Electronic Data collector manufactured by Sokkia that has been the WSDOIT standard since 1992.
Servo	Total Station that can be driven to preset directions with electronic servo motors on board the instrument.
State Plane Coordinates	The State Plane Coordinate System is a method devised that assumes the earth is flat for a small and defined area. Localized surveys can use this system without correction factors but larger surveys need to have all survey points projected to a Project Datum.
Static	Location determination when the receiver's antenna is presumed to be stationary in the earth. This allows the use of various averaging techniques that improve the accuracy.
Survey Adjustments	<p>Since all real measurements are imperfect, some amount of error will accumulate in the course of a survey. That error can be logically distributed throughout the survey by various adjustment procedures (i.e., manipulation of the data to produce a more logical result). Adjustments can and should be done with any set of measurements for which error can be assessed.</p> <p>Adjustment procedures do not correct the errors in the measurements. They simply produce a set of data that is self-consistent (e.g., the starting and ending points of a closed-loop leveling circuit have the same elevation - which is physical reality). The adjusted values are not necessarily <i>true</i> - they are just likely to be closer to the true values than the original measurements.</p>

Total Station	Surveying tool that provides angular measurements as well as distance measurements.
Traverse	A traverse is a series of consecutive line segments whose lengths and directions are determined by field measurements. A closed traverse either closes back upon its starting point, or begins and ends on stations of known positions. An open traverse does not close on either itself or a station of known position. As such, an open traverse does not provide any means for checking for errors and mistakes. Open traverses should generally be avoided. If an open traverse must be used, the procedure should be repeated to provide a check of accuracy.

MicroStation Terms

Term	Definition
AutoTURN	AutoTURN is a design tool used within MicroStation to track turning movements in an alignment. The user is able to access different types of vehicles (as well as being able to create custom vehicle specs) and “drive” then through the alignment to determine turning radius needs. This third party software is a regional resource.
Base map	The base map file contains all of the horizontal alignment information for a highway project. This file is also known as a working file or an alignment file. Views are referenced from this to the sheet file so that the base alignment is only developed once.
Bentley	The company, founded by Keith Bentley, that owns the copyright to the MicroStation software. Bentley translated the Intergraph Unix-based CADD software to the DOS/Windows-based MicroStation software.
Cells and Cell Libraries	Cells are groups of elements that are saved as a single element to be used repeatedly. Cells must exist in a library and so we have English and metric cell libraries in the WSDOT workspace. Users can also build their own libraries that contain their commonly used cells.
Color table	The color table is used to assign a certain color to a number in MicroStation.
Descartes	Third party software that works within MicroStation to manipulate raster images.
DGN	Short for ‘design’, DGN is the type of file and its extension that is produced by MicroStation. MicroStation V8 uses this file extension, although the previous MicroStation V7 file format is incompatible with V8. V8 translates older file versions to its format but MicroStation/J or V7 cannot read V8 files.
Element Symbology	All elements in MicroStation have 4 attributes: Color Weight (thickness of an element) Line type (solid, dashed, dotted, etc.) Level
File Fixer	This third-party software is used to search MicroStation file elements for errors and repair them.
Intergraph	The company that originally created the CADD system that evolved into MicroStation.

Levels	<p>MicroStation has the ability to separate elements onto levels. By toggling these levels off and on, different attributes can be displayed such as paving, alignment and illumination plans. The Plan Preparation Manual contains the standard level structure used at WSDOT. By using the WSDOT menu, different plan elements are automatically placed on the correct level.</p> <p>The WSDOT CAE expanded level structure contains over 1600 levels, with each element having its own level.</p>
Linear elements	Linear elements are items such as lines and arcs that make up the majority of elements in a file.
Macros	These are small programs that the user can implement to perform tasks in MicroStation. For example, converting Metric files to English is a frequently used macro.
MDLs	This MicroStation Development Language was the programming platform for developing custom macros in earlier versions of MicroStation. MicroStation V8 and XM use the Visual Basic programming language.
MicroStation	The CADD software that WSDOT uses to develop contract plan sheets.
Pen table	A pen table controls aspects of a file during plotting. One example would be the thickness a line is plotted.
Raster Images	Raster images are comprised of individual pixels that form an image. Typically these are photos or anything that has been scanned.
ProjectWise	ProjectWise is a project management system in a distributed environment that allows users to manage and share Bentley project documents and data.
Reference file	In MicroStation, this term describes the process of applying information from one file to another. Typically, information from the base file is referenced to the sheet file. The sheet file then would “refer” to the base file for information. Any changes to the base file are reflected in the sheet file.
Resource files	Resource files are developed and maintained by WSDOT coordinators for design office CADD operators. These include cell libraries, linestyle resource files, MDLs and macros.
Sheet file	A file that contains plan sheets with alignment information “referenced” to it. Sheet files are needed for plotting final plans. These are also known as plot files.
V8	The current generation of MicroStation. With V8, MicroStation changed its file format to eliminate the restrictions, including the level structure. With V8 there are no limits on the number of levels we can use and this allows the users more flexibility with their design files.
Vector Elements	Vector elements are defined mathematically in a CADD file. A line would be described by its start and end point coordinates. A circle would be defined by its center point and radius.

Working units	Working units define the unit of measure in the file. Our English units are feet (master units) and thousands (sub units). Metric files are meters and millimeters.
WSDOT Menu	The WSDOT pull-down menu is used to access WSDOT resources.
XM	Bentley civil platform for MicroStation, ProjectWise and InRoads.

For questions or comments on this tech note, contact your regional CAE Support Coordinator or the WSDOT CAE Help Desk at (360) 709-**8013**.