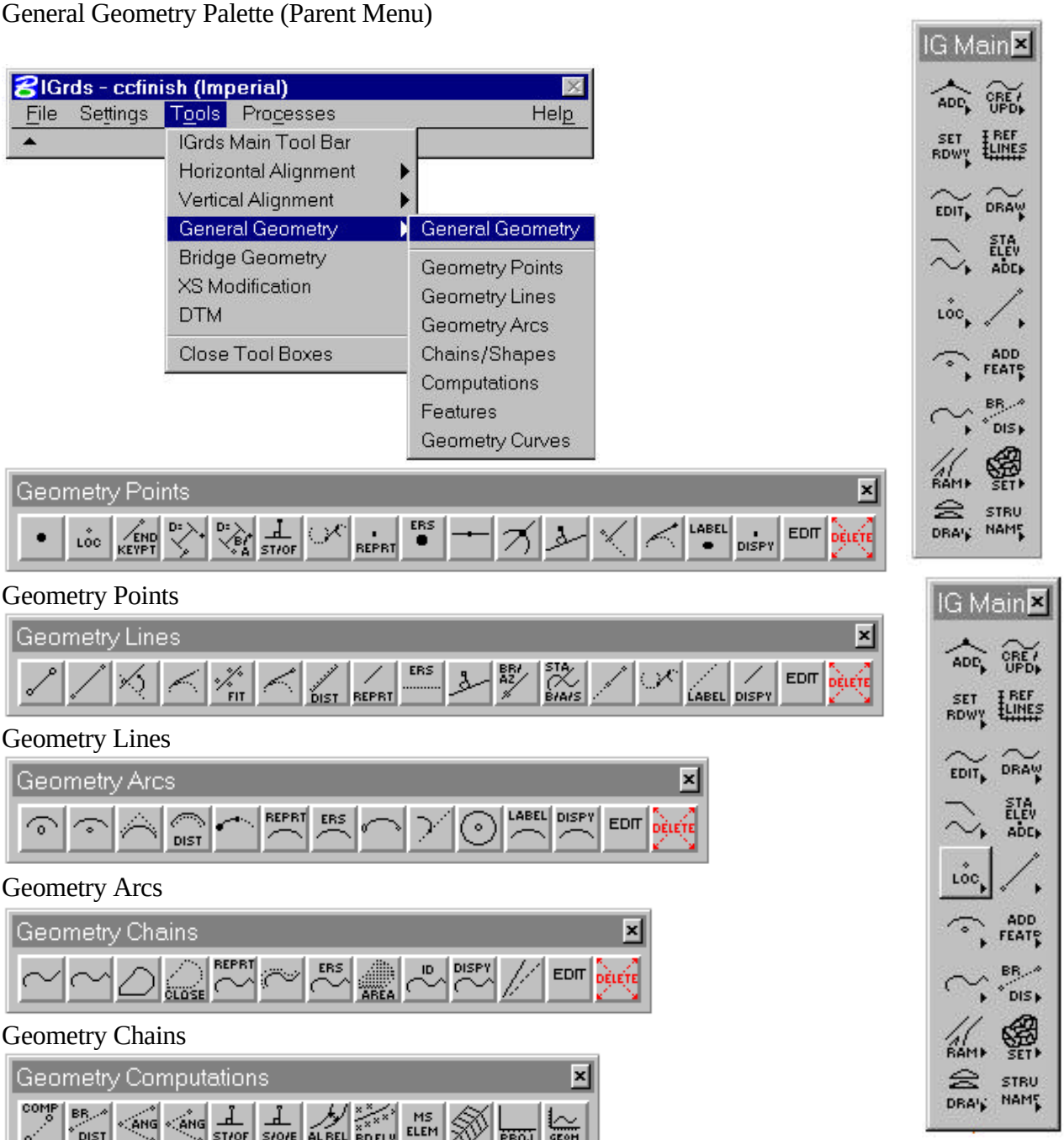
CHAPTER 4

GENERAL GEOMETRY (GEOM) COMMANDS

General Geometry Palette (Parent Menu)



Geometry Points

Geometry Lines

Geometry Arcs

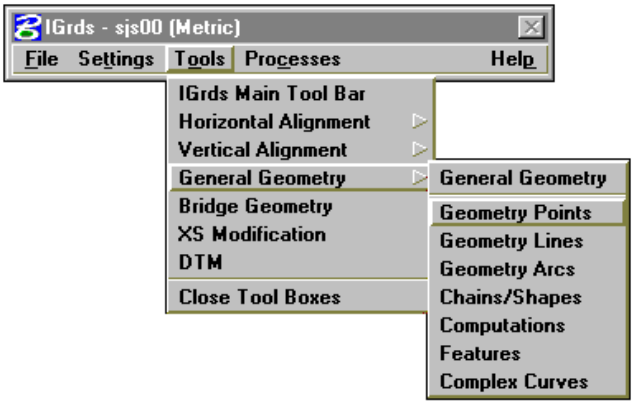
Geometry Chains

Geometry Computations

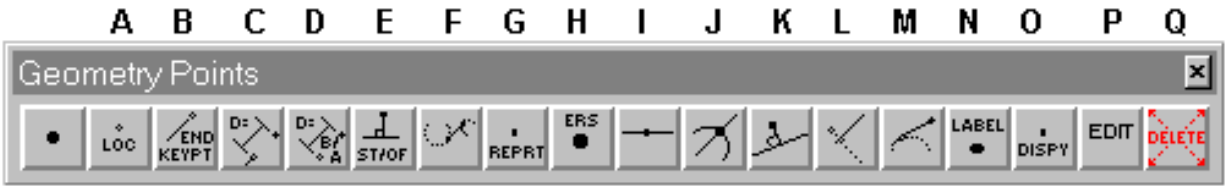
Geometry Features

Geometry Complex Curves

Figure 4-1 - Selecting and Displaying General Geometry Tools



General Geometry Palette
(Parent Menu)



Geometry Points Tool Box

KEY	COMMAND NUMBER	CONTENTS	MANUAL PAGE
A	400	CONSTRUCT POINT AT LOCATION	4-15
B	402	CONSTRUCT POINT AT ENDPOINT/KEYPOINT OF ELEMENT	4-18
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D	406	CREATE POINT AT DISTANCE AND DIRECTION FROM POINT	4-26
E	408	CONSTRUCT POINT AT STATION AND OFFSET	4-31
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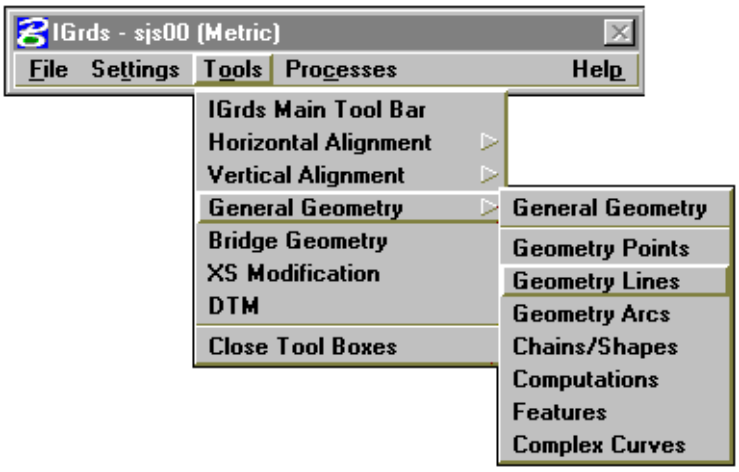
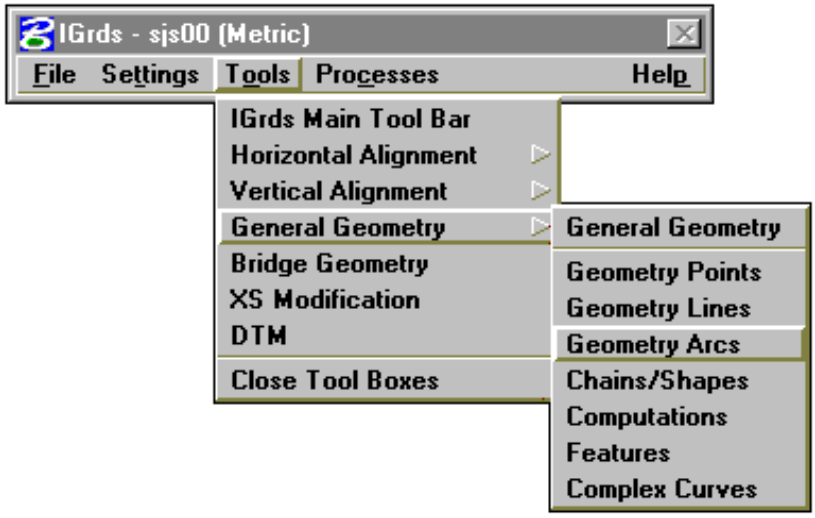
J	403	CONSTRUCT POINT AT INTERSECTION OF TWO ELEMENTS	4-20
K	405	CONSTRUCT POINT PROJECTED TO ELEMENT (PERPENDICULAR)	4-24
L	407	CONSTRUCT POINT BY DISTANCE AND ANGLE	4-28
M	418	CONSTRUCT POINT/LINE TANGENT TO ARC FROM POINT OFF ARC	4-33
N	473	IDENTIFY AND LABEL GEOMETRIC ELEMENTS	4-38
O	492	DISPLAY IGrds GEOMETRY FILE	4-40
P		EDIT POINT	4-42
Q	470	DELETE GEOMETRIC ELEMENT	4-44



General Geometry Palette (Parent Menu)

Geometry Lines Tool Box

KEY	COMMAND NUMBER	CONTENTS	MANUAL PAGE
A	420	CONSTRUCT LINE BETWEEN TWO POINTS	4-46
		3D SHAPE INFORMATION	4-48
B	422	CONSTRUCT LINE AT ANGLE TO ELEMENT	4-52
C	424	CONSTRUCT LINE TANGENT TO ARC AT POINT ON ARC	4-58
D	426	CONSTRUCT LINE THROUGH SERIES OF POINTS	4-63
E	418	CONSTRUCT POINT/LINE TANGENT TO ARC FROM POINT OFF ARC	4-66
F	455	CONSTRUCT LINE/ARC PARALLEL TO EXISTING LINE/ARC	4-71
G	499	CREATE POINT/LINE/ARC REPORT	4-77
H	496	ERASE GEOMETRIC ELEMENTS	4-77
I	421	CONSTRUCT LINE PERPENDICULAR TO ELEMENT	4-50
J	423	CONSTRUCT LINE THROUGH POINT AT BEARING OR AZIMUTH	4-55
K	425	CONSTRUCT LINE AT STATION AND DIRECTION	4-60
L	471	EXTEND OR SHORTEN LINE	4-65
M	419	CONSTRUCT POINTS/LINE TANGENT TO TWO ARCS	4-69
N	473	IDENTIFY AND LABEL GEOMETRIC ELEMENTS	4-73
O	492	DISPLAY IGrds GEOMETRY FILE	4-77
P		EDIT LINE	4-74
Q	470	DELETE GEOMETRIC ELEMENT	4-77



General Geometry Palette (Parent Menu)

Geometry Arcs Tool Box

KEY	COMMAND NUMBER	CONTENTS	MANUAL PAGE
A	440	CONSTRUCT ARC BY CENTER, RADIUS AND ENDPOINTS	4-78
B	442	CONSTRUCT ARC TANGENT TO TWO LINES	4-84
C	455	CONSTRUCT LINE/ARC PARALLEL TO EXISTING LINE/ARC	4-88
D	474	EXTEND OR SHORTEN ARC	4-92
E	499	CREATE POINT/LINE/ARC REPORT	4-96
F	496	ERASE GEOMETRIC ELEMENTS	4-96
G	441	CONSTRUCT ARC BY RADIUS AND ENDPOINTS	4-80
H	443	CONSTRUCT ARC TANGENT TO LINE	4-86
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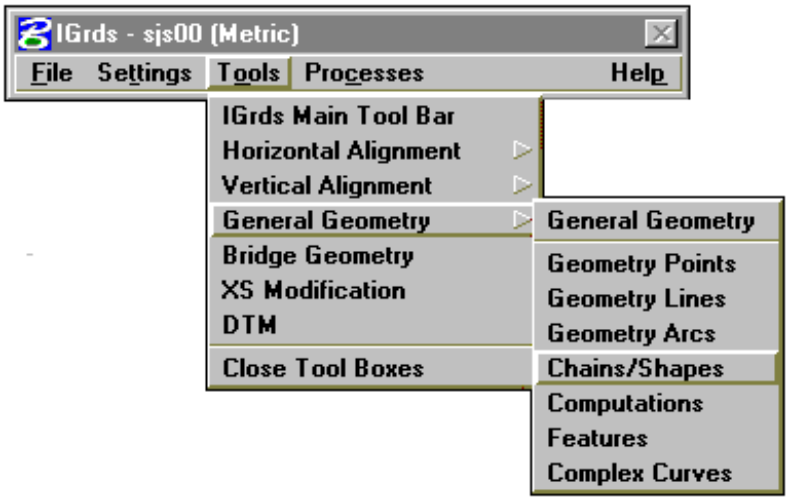
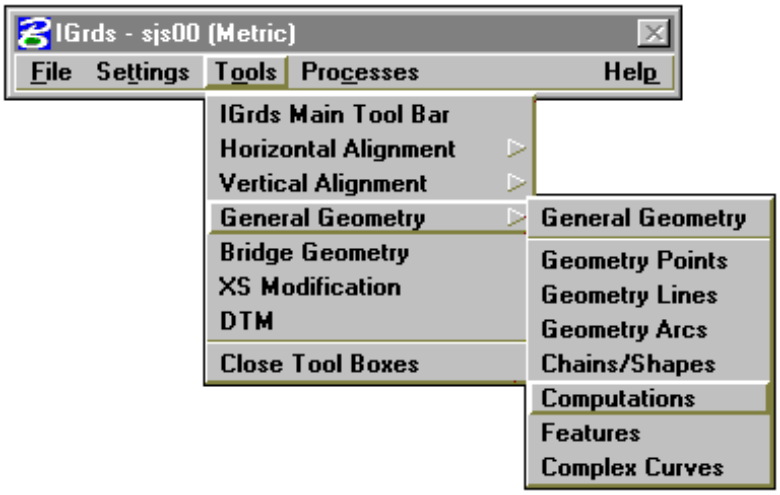
J	473	IDENTIFY AND LABEL GEOMETRIC ELEMENTS	4-96
K	492	DISPLAY IGrds GEOMETRY FILE	4-96
L		EDIT ARC	4-93
M	470	DELETE GEOMETRIC ELEMENT	4-96



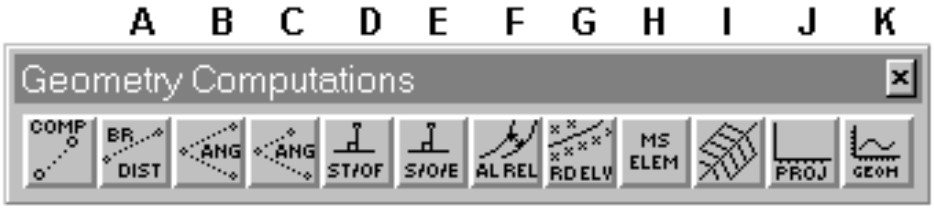
General Geometry Palette (Parent Menu)

Geometry Chains Tool Box

KEY	COMMAND NUMBER	CONTENTS	MANUAL PAGE
A	460	CONSTRUCT CHAIN	4-97
B	461	CONSTRUCT SHAPE	4-100
C	486	CALCULATE CLOSURE OF A SHAPE	4-103
D	487	CREATE CHAIN TRAVERSE REPORT	4-102
E	462	CONSTRUCT CHAIN PARALLEL TO EXISTING CHAIN	4-106
F	470	ERASE GEOMETRIC ELEMENTS	4-113
G	485	CALCULATE AREA OF A SHAPE	4-99
H	473	IDENTIFY AND LABEL GEOMETRIC ELEMENTS	4-113
I	493	DISPLAY IGrds GEOMETRY FILE	4-113
J	464	CREATE CHAIN AT OFFSET TO HORIZONTAL ALIGNMENT	4-104
K		EDIT CHAINS	4-108
L	496	DELETE GEOMETRIC ELEMENT	4-113



General Geometry Palette
(Parent Menu)



Geometry Computations Tool Box

KEY	COMMAND NUMBER	CONTENTS	MANUAL PAGE
A	480	CALCULATE BEARING AND DISTANCE	4-114
C	482	CALCULATE ANGLE BETWEEN TWO LINES	4-116
E	484	CALCULATE STATION, OFFSET, AND ELEVATION	4-118
G		ROADWAY ELEVATIONS TABLES	4-177
		OUTPUT OPTIONS	4-177
		OFFSET OPTIONS	4-178
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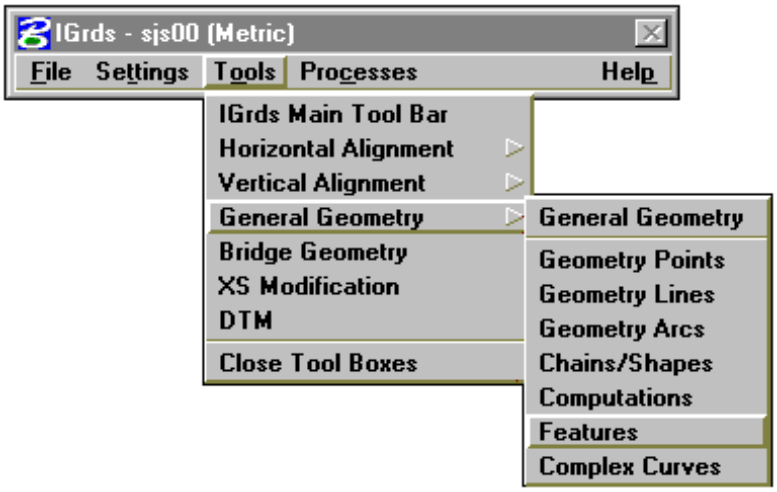
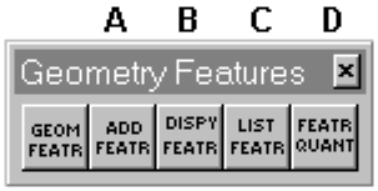
		ROADWAY ELEVATION DIALOG INPUTS	4-178
		OFFSET TABLE MENU IMPORTS	4-181
B	481	CALCULATE ANGLE BETWEEN THREE POINTS	4-115
D	483	CALCULATE STATION AND OFFSET	4-117
F		ALIGNMENT RELATIONS REPORT	4-119
H		CONVERT MICROSTATION ELEMENTS	4-121
I		ROADWAY SURFACE CONTOURS	4-124
		CONTOUR PLOT PARAMETERS	4-127
J		PROJECT TO REFERENCE LINE	4-129
		LOAD GEOMETRY ELEMENT LIST FROM FILE	4-130
		SAVE GEOMETRY ELEMENT LIST TO FILE	4-130
K		GEOMETRY ELEMENT PROFILE	4-131

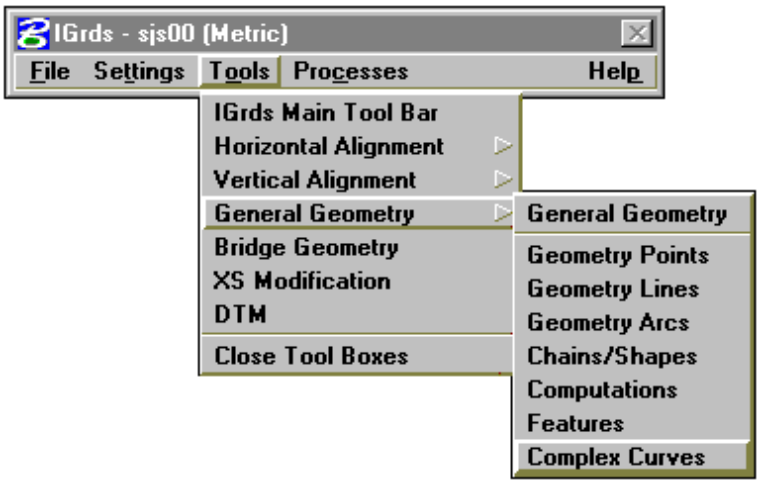


General Geometry Palette
(Parent Menu)

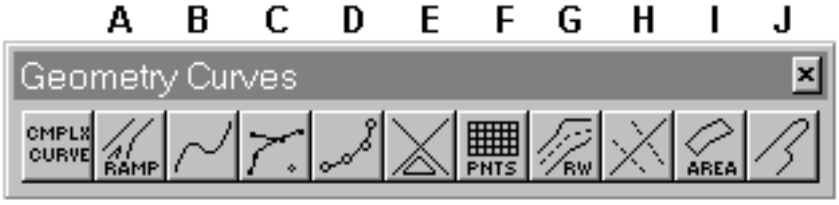


Geometry Features Tool Box

KEY	COMMAND NUMBER	CONTENTS	MANUAL PAGE
A	430	ADD FEATURE CODES TO GEOMETRY ELEMENTS	4-132
		GEOMETRY FEATURES	4-133
B	431	DISPLAY GEOMETRY FEATURES	4-134
C	432	LIST GEOMETRY FEATURE DATA	4-135
D	433	LIST GEOMETRY FEATURE DATA QUANTITIES	4-136



General Geometry Palette (Parent Menu)



Geometry Complex Curves Tool Box

KEY	COMMAND NUMBER	CONTENTS	MANUAL PAGE
A	467	GENERAL RAMP DESIGN	4-142
		SEGMENT EDITING OPTION	4-156
B	465	REVERSE CURVES	4-161
C	498	CREATE GEOMETRY ELEMENTS FROM HORIZONTAL ALIGNMENTS	4-166
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E	468	RADIAL OFFSETS	4-138
F	434	CREATE TABLE OF POINTS	4-140
G	463	RIGHT-OF-WAY STAKEOUT	4-159
H	478	ALIGNMENT INTERSECTION	4-165
I	410	PAVEMENT AREAS	4-167
J	469	MEDIAN END DESIGN	4-171

INTRODUCTION

The General Geometry (GEOM) subsystem of IGrds establishes points, lines, arcs, chains and shapes and displays them on a graphics screen.

These elements can be used in various geometry computations including those related to horizontal alignments.

Commands

General Geometry commands fall into three broad categories:

- create elements
- perform calculations
- user service routines

Use the first group of commands to establish elements from existing elements, and/or user supplied data. You create points, lines, arcs, chains and shapes this way.

Use the second group of commands to make calculations by specifying existing elements and other information.

EXAMPLE: The area of a shape, angle between two lines, or a bearing and a distance between two points.

Use the third group of commands (user service routines) to identify and label elements, delete elements, and transfer points to and from IGrds Working files, etc.

The following geometry commands work directly on a horizontal alignment:

- CONSTRUCT POINT AT STATION AND OFFSET (408)
- CONSTRUCT LINE AT STATION AND BEARING, AZIMUTH OR SKEW ANGLE ON HORIZONTAL ALIGNMENT (425)
- CALCULATE STATION AND OFFSET (483)
- CALCULATE STATION, OFFSET, AND ELEVATION (484)
- CREATE GEOMETRY ELEMENTS FROM HORIZONTAL ALIGNMENT (498).
- ALIGNMENT RELATIONS REPORT
- ROADWAY ELEVATIONS TABLE

- RADIAL OFFSETS
- CREATE TABLE OF POINTS
- RIGHT-OF-WAY STAKEOUT
- ALIGNMENT INTERSECTION
- PAVEMENT AREAS
- MEDIAN END DESIGN
- REVERSE CURVES
- GENERAL RAMP DESIGN
- DIVIDE ELEMENT

Before you use any other GEOM commands on a horizontal alignment, use the CREATE GEOMETRY ELEMENTS FROM HORIZONTAL ALIGNMENT (498) command to break the horizontal alignment into geometric elements. IGrds displays this horizontal alignment on the screen twice: once as a horizontal alignment and once as individual geometric elements.

Geometry File

The IGrds Geometry file is one of the IGrds Working files.

The DISPLAY IGRDS GEOMETRY FILE (492) command retrieves points, lines, arcs, chains and shapes from the IGrds Geometry files and displays them on the graphics screen.

Lines that are created in the AN Option are unbounded. They are stored with a point and direction. When they are displayed in the IG Option, they are bounded at a distance of 100000. Arcs created in the AN Option are displayed in the IG Option as circles.

Element Labels

IGrds places a label at the beginning of each element. This helps you specify + or - for directions, and often eliminates the need to digitize points of direction. Plus (+) appears toward the end or to the right of an element. Minus (-) appears toward the beginning or to the left of an element.

IGrds labels geometry elements with the text height specified in the Parameter file. A Parameter file value also determines the geometry point scale. The distance that the label is placed away from the element is the graphics system line space value.

Geometry Data Considerations

- Any IGrds Geometry command that allows selection of an existing geometry element will also allow selection of MicroStation graphic elements. MicroStation elements that can be selected are points, lines, linestrings, arcs, and chains (composed of simple elements). When MicroStation elements are selected, they are identified as MSln for lines and line strings, MSar for arcs. and MSch for chains. MicroStation elements are converted internally for use in IGrds geometric calculations. For example, the IGrds Point at Intersection command can intersect two MicroStations lines to create an IGrds point. Even though MicroStation Elements are stored internally with integer coordinates, these coordinates are converted to real world coordinates using the precision set in the .dgn file. The IGrds Geometry computations are all performed using double precision.

- You can define 8191 points numbered 1-8191. Re-using a point number replaces the previous point with the same number.

- You may define 8191 lines and arcs (curves) numbered 1-8191. You can use any of the numbers for either a line or an arc, but the same number cannot represent both items simultaneously. Re-using curve numbers also replaces the previous entry.

- Elements are NOT defined hierarchically, that is, defined by other elements.

  EXAMPLE: Point #10 to point #20 initially defines line #1. If you move or redefine point #10, line #1 does not change. If you move line #1, points #10 and #20 do not change.

- You can define 8191 chains and shapes numbered 1-8191. You can use any of the numbers for either a chain or a shape, but the same number cannot represent both simultaneously. Re-using a chain or shape replaces the previous entry.

  A brief list of some of the GEOM features follows.

- Points (locations) can be specified four ways:

  - Digitized point
  - Coordinate entry
  - ID number
  - Screen select

- Elevations of points may be specified three ways:

  - Key entry
  - DTM surface
  - Roadway surface

- Other elements can be specified two ways:
  - ID number
  - Screen select
- Absolute direction can be specified four ways:
  - Azimuth
  - Bearing
  - Line ID number
  - Screen select feature to select a line of the same absolute direction
- Relative direction can be specified three ways:
  - Angle
  - Deflection angle
  - Skew angle
- Radius can be specified eight ways:
  - Type:
    - Radius
    - Degree of curve
    - Arc number of an arc with the desired radius
    - Point number of a point on the arc
    - Coordinates of a point on the arc
  - Select:
    - Arc of desired radius
    - Point on the arc
  - Digitize point on the arc
- The next available element number is displayed as a default. You can enter a number to override. It never overwrites an existing element; a message appears when an entered element number already exists. You can then choose to overwrite the existing element or type a new element number.
- You may delete the display of any geometry elements using the graphics system "erase" commands. To also delete labels, turn on graphic group lock when performing these deletes. To retrieve these "deleted" elements, use the DISPLAY IGRDS GEOMETRY FILE (492) command. Note that the DELETE GEOMETRY ELEMENT (470) command deletes the elements from the IGrds Geometry file and from the display.

Some commands have multiple solutions. Whenever possible, IGrds uses the solution closest to the last element(s) you select. When it cannot find sufficient data to determine one solution, the system asks for additional information. For example, it may ask you to digitize a point near the solution or in the desired direction, or select a tangency option. Intersections of 3D geometry elements will almost always result in multiple solutions. In these cases you are asked to select the appropriate solution.

Although elements are physically bounded on the graphics screen (e.g., a line has two end points), IGrds uses the infinite or unbounded element in all calculations. Thus, a point projected to an element may not actually appear between the end points of the element.

IGrds Feature Codes

IGrds geometry elements can optionally carry a feature code definition. This is in addition to the standard geometry element definition. The purpose of feature codes is to:

- Associate geometric elements with physical features,
- Create alternative planimetric display of geometry elements,
- Create/compute quantity listings of features.

Feature codes can be assigned to geometry elements as they are defined on most geometry tools. Additionally, the ADD FEATURE CODE TO GEOMETRY ELEMENTS (430) command allows the user to assign feature codes to existing geometry elements. The most recent association is retained if more than one feature is assigned to the same geometry element.

This feature is referenced by three other geometry commands: DISPLAY GEOMETRY FEATURES (431), LIST GEOMETRY FEATURE DATA (432), and LIST GEOMETRY FEATURE DATA QUANTITIES (433). Each of these commands searches the geometry file for elements with the selected feature(s). The display command will draw features in the graphics file using the feature symbology defined in the "Feature Table" (see below). The list command summarizes information about a feature(s). The quantities list command summarizes the feature data and converts the results into user-defined units.

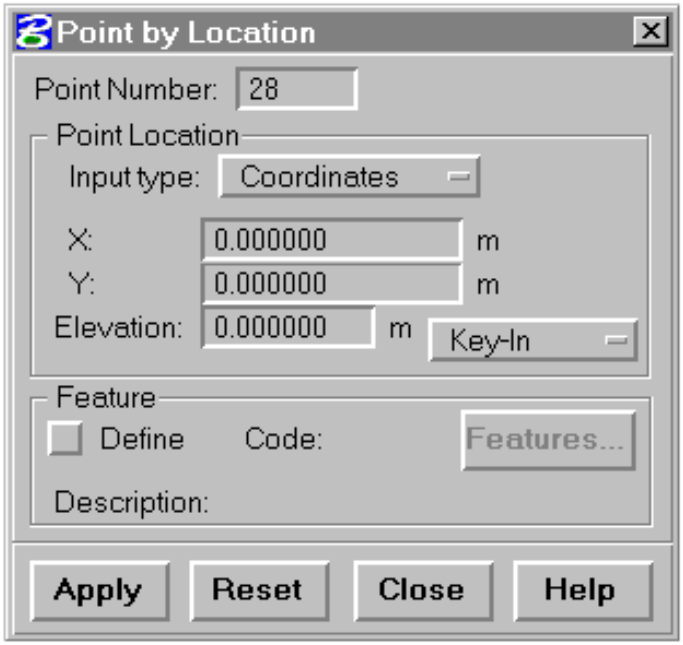
Features are defined via a Feature Table. This table has the name "feat.tab" and is located in the IGrds custom directory.

3D Shapes for Linear Geometry Elements

3D Shapes may be associated with any linear geometry element. See the discussion on page 4-42 of this chapter.

FIELD	COLUMNS	DESCRIPTION
Code	1 - 4	Feature code or name and may be any displayable character.
Type	5 - 7	Feature type: 1 = Point feature (like a tree) 2 = Linear feature (like a guardrail) 3 = Area feature (like a parcel of land)
Level	8 - 10	Feature display level (1-63).
Color	11 - 13	Feature display color (0-255).
Line Code	14 - 16	Feature display line code (0-7).
Line Weight	17 - 19	Feature display line weight (0-31).
Symbol	21 - 26	Feature symbol (Type=1,only). This symbol must be in the currently attached symbol library.
Multi-plier	28 - 39	Quantities multiplier factor converts the results into user-defined units.
Units	41 - 46	Units created by multiplier factor.
Descrip-tion	48 - 71	Description of feature (used in reports and confirming feature) may be any displayable character.

CONSTRUCT POINT AT LOCATION

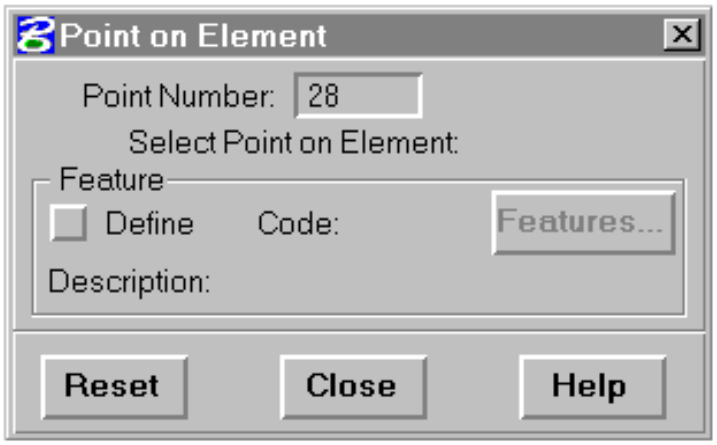


This command creates an IGrds geometry point at a defined location, either with coordinate or digitized entry. The elevation part may be keyed in, obtained from the active DTM surface, obtained from the design roadway surface, or be the MicroStation active depth when digitizing coordinates.

Point Number	ID number for the new point. Default shown is the next available ID number. Enter number to change.
Point Location Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the new point.
Elevation	Enter or digitize an elevation.
	Use the active DTM surface elevation at the given X, Y or N, E coordinates.
	Use the Design Finish Grade elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.
	Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.

Feature Options	
Define	Check this box to define a feature for the new point. The active point feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active point feature code.
Description	Displays the description of the active point feature.
Features	Press to display a list of available point features to replace the current active point feature. (See page 4-104)
Apply	Execute the command.
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

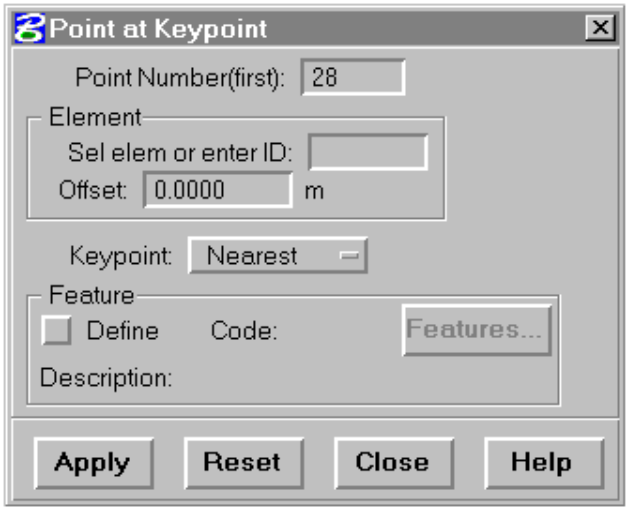
CONSTRUCT POINT ON ELEMENT



This command creates an IGrds geometry point on a selected element. The command places a point directly (mathematically) on an element more accurately than the drafting system display capability. A "snap to" that element yields coordinates which are not truly on the element. This is due to the lower precision used by the drafting system. The elevation of the point is computed at the precise location of the point on the element.

Point Number	ID number for the new point. Default shown is the next available ID number. Enter number to change.
Point on Element	Use the mouse to select the point location on an existing IGrds Geometry element (line, arc, shape, or chain) or a MicroStation element (line, arc, or chain). Selecting executes the command.
Feature Options	
Define	Check this box to define a feature for the new point. The active point feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active point feature code.
Description	Displays the description of the active point feature.
Features	Press to display a list of available point features to replace the current active point feature. (See page 4-104)
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

CONSTRUCT POINT AT ENDPOINT/KEYPOINT OF ELEMENT

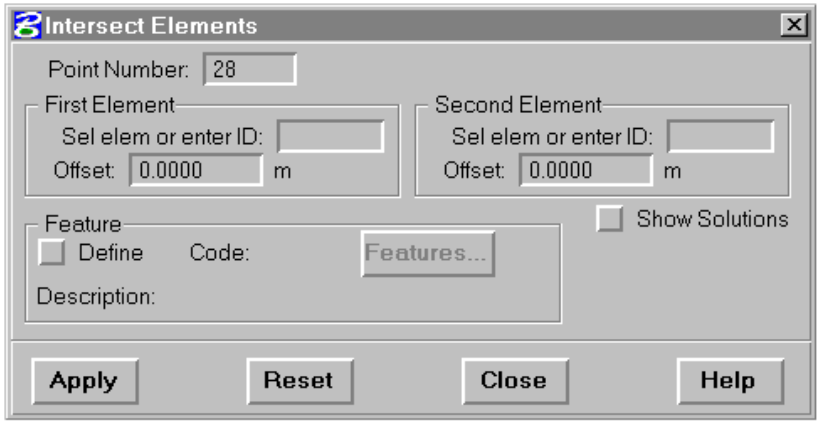


This command creates an IGrds geometry point(s) at the endpoint(s) or at keypoint(s) (such as center point of an arc) of an element or an optional offset element. If an offset is requested, then the elevation of the point is the same as the elevation of the keypoint on the element.

Point Number	ID number for new point. Default shown is the next available ID number. Enter number to change.
Element Definition	
Element ID	Select a geometric element (line, arc, chain, or shape) or MicroStation element in the graphics area or enter its ID.
Offset	Enter the offset from the selected element. Positive value for right offset and negative for left (based on direction of element).
Keypoint:	
Nearest	A new point is located at the begin point of a line or the PC of an arc. This option is not valid for chains.
Begin/PC	A new point is located at the begin point of a line or the PC of an arc. This option is not valid for chains.
End/PT	A new point is located at the end point of a line or the PT of an arc. This option is not valid for chains.

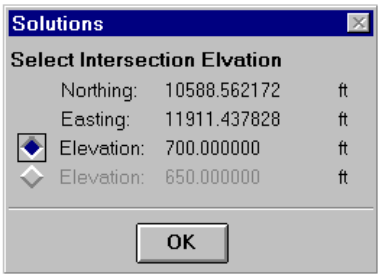
Center	A new point is located at the center point of an arc. This option is not valid for chains.
All	New points are located at the following locations: begin and end point of a line; PC, PT, and center point of an arc; node points of a chain.
Feature Options	
Define	Check this box to define a feature for the new point. The active point feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active point feature code.
Description	Displays the description of the active point feature.
Features	Press to display a list of available point features to replace the current active point feature. (See page 4-104)
Apply	Execute the command.
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

CONSTRUCT POINT AT INTERSECTION OF TWO ELEMENTS



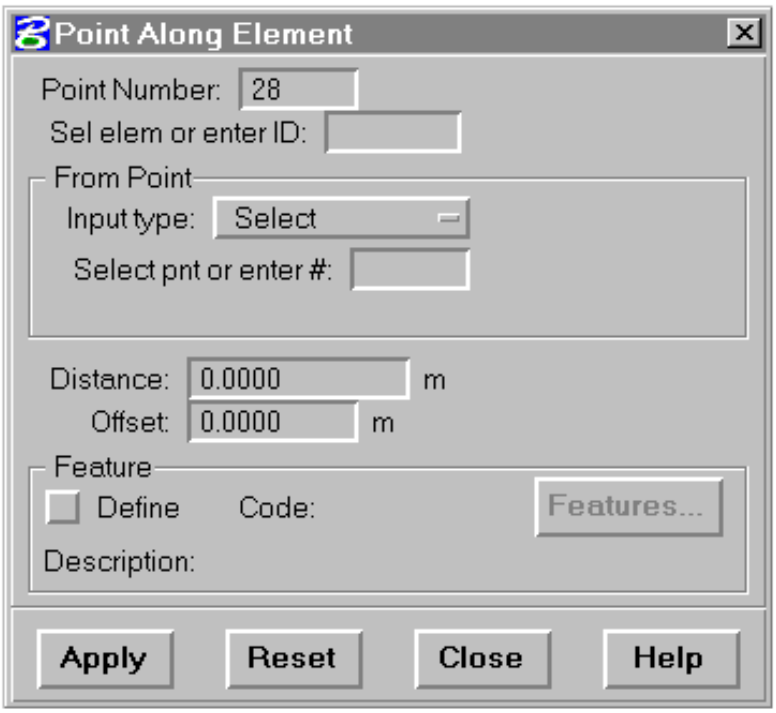
This command creates an IGrds geometry point at the intersection of two elements. In case of multiple intersections, the intersection closest to the point used to select the second element is used. If the second element is defined by ID number, the point at the intersection nearest the point used to select the first element is used. If ID numbers are used to define both elements, an approximate point of inter-section is requested.

Point Number	Enter the ID number for the new point to be placed. The default number shown is the next available ID number.
First Element	
Element ID	Select a geometric element (line, arc, chain or shape) or MicroStation element in the graphics area or enter its ID. Example: A23
Offset	Enter the offset from the selected element. Positive value for right offset and negative for left (based on direction of element).
Second Element	
Element ID	Select a geometric element (line, arc, chain or shape) or MicroStation element in the graphics area or enter its ID.
Offset	Enter the offset from the selected element. Positive value for right offset and negative for left (based on direction of element).



Show Solutions	Enable this option if it is desired to see the two solutions. Choose one of the two elevations of the existing geometric elements and hit OK.
Feature Options	
Define	Check this box to define a feature for the new point. The active point feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active point feature code.
Description	Displays the description of the active point feature.
Features	Press to display a list of available point features to replace the current active point feature. (See page 4-104)
Apply	Execute the command.
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box..
Help	Display Help for this command.

CONSTRUCT POINT ALONG ELEMENT FROM POINT ON ELEMENT



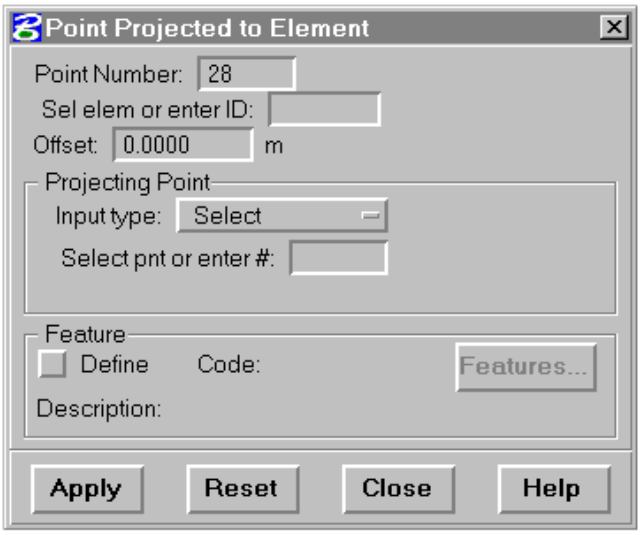
This command creates an IGrds geometry point at a given distance and offset from another point on the element. If an offset is entered, then the elevation of the point is the same as the elevation of the distance along the element.

Point Number	Enter the ID number for the new point to be placed. The default number shown is the next available ID number.
Element ID	Select a geometric element (line, arc, chain, or shape) or MicroStation element in the graphics area or enter its ID. Example: A23
From Point Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the reference point. Example: 761345.238 2352.456
Select	Select an existing geometry point on the graphics area or enter its number. Example: 34

Distance	Enter the distance from the reference point. Positive value in the direction of the element or negative in the opposite direction.
Offset	Enter the offset from the selected element. Positive value for right offset and negative for left (based on direction of element).
Feature Options	
Define	Check this box to define a feature for the new point. The active point feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active point feature code.
Description	Displays the description of the active point feature.
Features	Press to display a list of available point features to replace the current active point feature. (See page 4-104)
Apply	Execute the command.
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box..
Help	Display Help for this command.

Note: The elevation of the constructed point will be the elevation of the element at the specified distance along the element. This elevation is applied to offset locations also.

CONSTRUCT POINT PROJECTED TO ELEMENT (PERPENDICULAR)



This command creates an IGrds geometry point at the perpendicular projection from a selected point to an element. If an offset is given, then the elevation of the point is the same as the elevation of the intersection along the element.

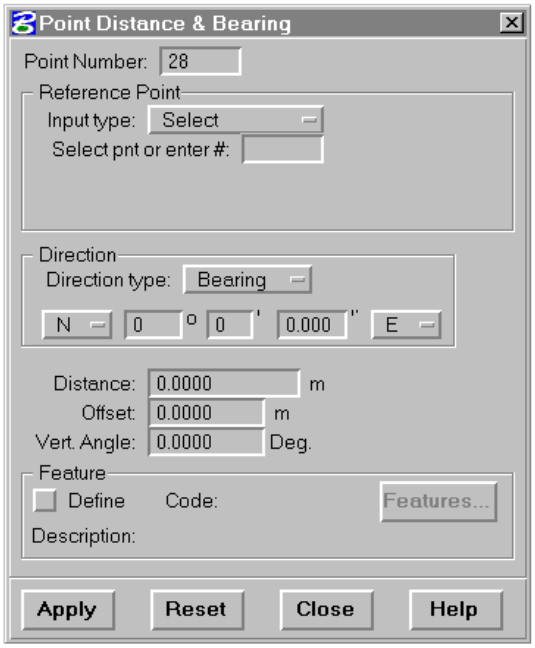
Point Number	ID number for new point. Default shown is the next available ID number. Enter number to change.
Element ID	Select a geometric element (line, arc, chain, or shape) or MicroStation element in the graphics area or enter its ID.
Offset	Enter the offset from the selected element. Positive value for right offset and negative for left (based on direction of element).
Projecting Point Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the projecting point.
Select	Select an existing geometry point on the graphics screen or enter its number.

Feature Options	
Define	Check this box to define a feature for the new point. The active point feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active point feature code.
Description	Displays the description of the active point feature.
Features	Press display a list of available point features to replace the current active point feature. (See page 4-104)
Apply	Execute the command.
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

Note: If the element is a chain, the projected point must be within the bounds of the chain. Where there are multiple solutions, the projection closest to the projecting point is chosen.

The elevation of the constructed point will be the element elevation at the perpendicular projection intersection. This elevation is also applied at any specified offset distances.

CREATE POINT AT DISTANCE AND DIRECTION FROM POINT

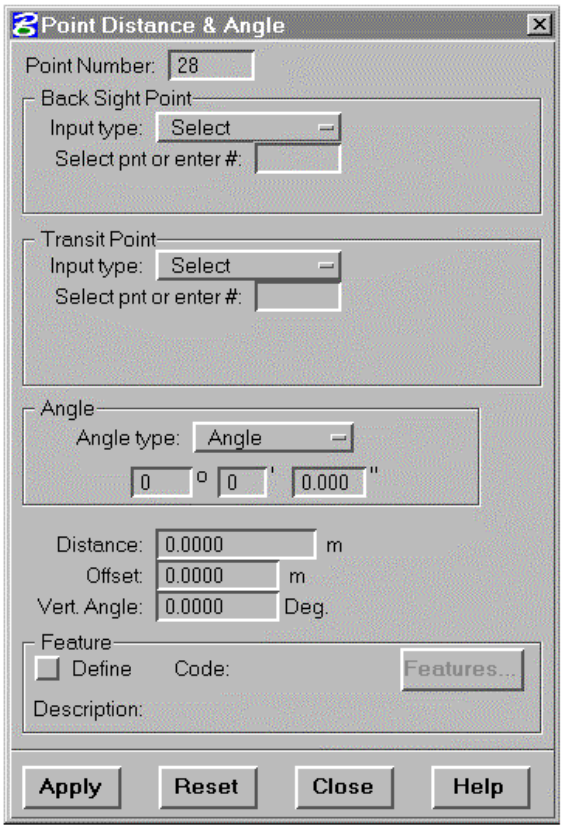


This command creates a new IGrds geometry point at a given distance and direction from a reference point and then at a given vertical angle. This command works in a manner similar to traversing by using the previously constructed point as the new reference point.

Point Number	ID number for the new point. Default shown is the next available ID number. Enter number to change.
Reference Point Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the reference point.
Elevation	Enter or digitize an elevation. Use the active DTM surface elevation at the given X, Y or N, E coordinates. Use the Design Finish Grade elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line. Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.
Select	Select an existing geometry point on the graphics area or enter its number.

Direction Options	
Bearing	Select the bearing directions (N/S,E/W) and enter the angle in degrees, minutes, and seconds.
Azimuth	Enter the azimuth angle in degrees, minutes, and seconds.
Line	Select an existing line on the graphics area or enter its number. The direction of this line is used to define the new point.
Distance	Enter the distance from the reference point. Positive value in the direction specified or negative in the opposite direction.
Offset	Enter the offset from the direction specified. Positive value for right offset and negative for left (based on direction specified).
Vert. Angle	The vertical angle vertex is at a point the specified distance and direction from the reference point. The vertical angle is positive if it is above the horizontal plane containing the specified distance and direction and negative if the vertical angle is below the horizontal plane. The vertical angle is given in degrees and decimals.
Feature Options	
Define	Check this box to define a feature for the new point. The active point feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active point feature code.
Description	Displays the description of the active point feature.
Features	Press to display a list of available point feature to replace the current active point feature. (See page 4-104)
Apply	Execute the command.
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

CONSTRUCT POINT BY DISTANCE AND ANGLE



This command creates a new IGrds geometry point at a distance from a transit point and an angle from the direction defined by a back sight point and then at a given vertical angle. This command works in a manner similar to traversing by using the new point as the transit point and the previous transit point as the back sight point.

Point Number	Enter the ID number for the new point to be placed. The default number shown is the next available ID number.
Back Sight Point Location Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the back sight and/or transit points. Example: 761345.238 2352.456
Select	Select an existing geometry point on the graphics area or enter its number. Example: 34

Transit Point Location Option

Coordinates Enter the X,Y or N,E coordinates or digitize a desired location for the back sight and/or transit points.
Example: 761345.238
2352.456

Select Select an existing geometry point on the graphics area or enter its number.
Example: 34

Angle Options

Deflection Enter the deflection angle in degrees, minutes, and seconds; then select the direction (L/R).

Skew Select the skew directions (R/L, F/B) and enter the angle in degrees, minutes, and seconds.

Angle Enter the angle in degrees, minutes, and seconds; then select the direction (L/R).

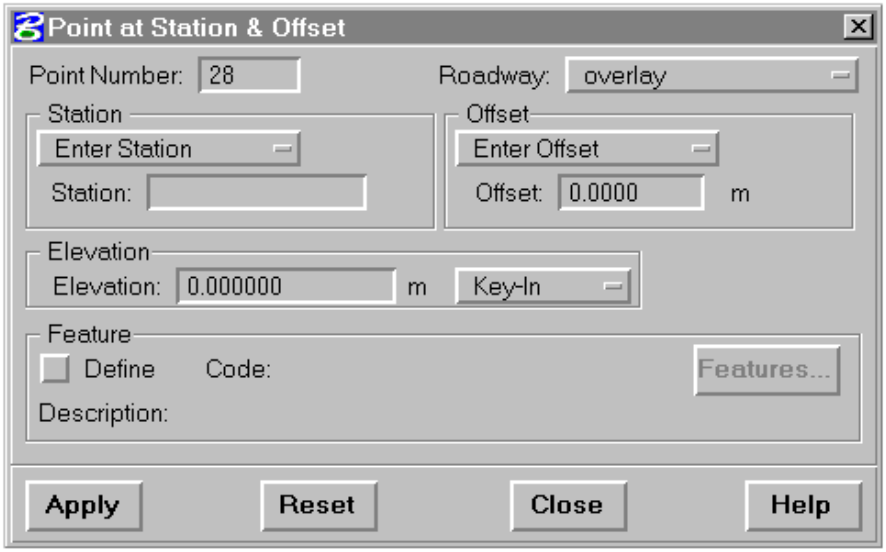
Distance Enter the distance from the transit point. Positive value in the direction specified.

Offset Enter the offset from the direction specified. Positive value for right offset and negative for left (based on direction specified).

Vert. Angle The vertical angle vertex is at a point the specified distance and direction from the transit point. The vertical angle is positive if it is above the horizontal plane containing the specified distance and direction and negative if the vertical angle is below the horizontal plane. The vertical angle is given in degrees and decimals.

Feature Options	
Define	Check this box to define a feature for the new point. The active point feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active point feature code.
Description	Displays the description of the active point feature.
Features	Press to display a list of available point features to replace the current active point feature. (See page 4-104)
Apply	Execute the command.
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

CONSTRUCT POINT AT STATION AND OFFSET

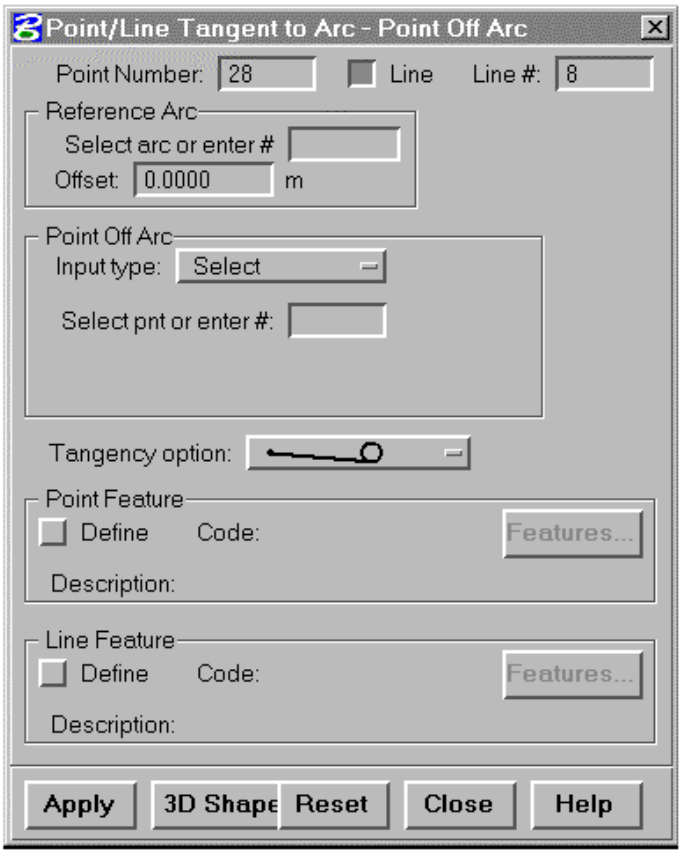


This command creates an IGrds geometry point at a defined station, offset, and elevation from a given horizontal alignment.

Point Number	Enter the ID number for the new point to be placed. The default number shown is the next available ID number.
Roadway	Select the desired roadway. The current active roadway is shown.
Enter Station	Enter the station for the new point. Example: 134+23.45
Select Geom Pt.	Select an existing geometry point to determine the desired station.
Enter Offset	Enter the offset from the selected element. Positive value for right offset and negative for left.
Select Geom Pt.	Select an existing geometry point to determine the desired offset.

Elevation	Enter or digitize an elevation. Use the active DTM surface elevation at the given X, Y or N, E coordinates. Use the Design Finish Grade elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line. Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.
Feature Options	
Define	Check this box to define a feature for the new point. The active point feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active point feature code.
Description	Displays the description of the active point feature.
Features	Press to display a list of available point features to replace the current active point feature. (See page 4-104)
Apply	Execute the command.
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

CONSTRUCT POINT/LINE TANGENT TO ARC FROM POINT OFF ARC



This command creates an IGrds geometry point (and optionally a line) tangent to an arc from a point off that arc. The optional line is defined from the point off the arc to the point of tangency. If an offset is given, then the elevation of the offset point is the same as the elevation of the arc perpendicular to the offset point.

Point Number	Enter the ID number for the new point to be placed. The default number shown is the next available ID number.
Line Option	Enable this option if a line is to be generated.
Line Number	This field is displayed when the line option is enabled. Enter the ID number for the new line to be placed. The default number shown is the next available ID number.
Reference Arc	
Element ID	Select an IGrds Geometry or MicroStation arc on the graphics area or enter its number. Example: 23
Offset	Enter the offset from the selected arc. Positive value for right offset and negative for left (based on direction of arc).

Point Off Arc Options

Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the point off the arc.
Elevation	Enter or digitize an elevation. Use the active DTM surface elevation at the given X, Y or N, E coordinates. Use the Design Finish Grade elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line. Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.
Select	Select an existing geometry point on the graphics area or enter its number.

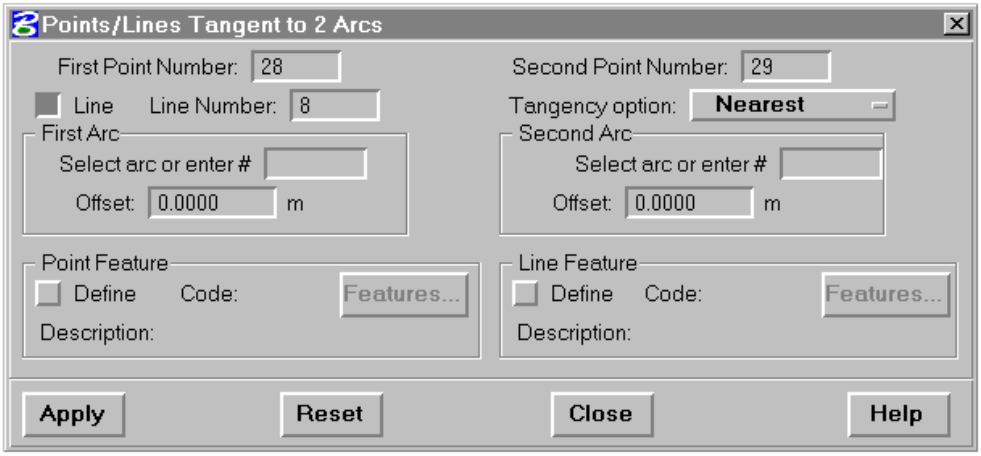
Tangency Point Options	These options are to choose from the two possible solutions when the reference number is entered via keyboard.

Point Feature Options

Define	Check this box to define a feature for the new point. The active point feature is displayed if one is define. Uncheck this box if a feature is not necessary.
Code	Displays the active point feature code.
Description	Displays the description of the active point feature.
Features	Press to display a list of available point features to replace the current active point feature. (See page 4-104)

Linear Feature Options	
Define	Check this box to define a feature for the new line. The active linear feature is displayed if one is define. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active line feature. (See page 4-104)
Apply	Execute the command.
3D Shape	Click to display the 3D Shape Definition dialog box. (See page 4-42). Note: Only available if Line toggle is set.
Reset	Erase the input fields and display the default ID numbers.
Close	Close the dialog box.
Help	Display Help for this command.

CONSTRUCT POINTS/LINE TANGENT TO TWO ARCS

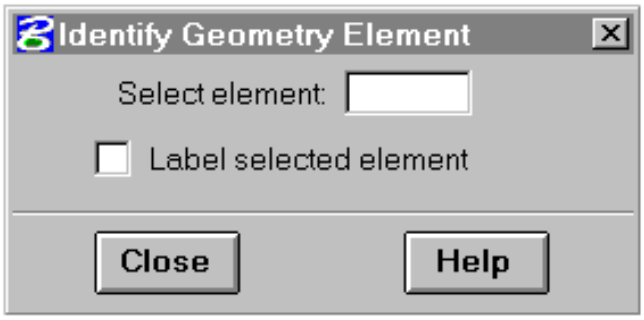


This command creates two IGrds geometry points (and optionally the line between the points) tangent to two specified arcs. If an offset is given, then the elevation of the offset point is the same as the elevation of the arc perpendicular to the offset point.

First Point Number	Enter the ID number for the first new point to be placed. The default number shown is the next available ID number.
Second Point Number	Enter the ID number for the second new point to be placed. The default number shown is the next available ID number.
Line Option	Enable this option if a line is to be generated.
Line Number	This field is displayed when the line option is enabled. Enter the ID number for the new line to be placed. The default number shown is the next available ID number.
First Arc	
Element ID	Select an IGrds Geometry or MicroStation arc on the graphics area or enter its number.
Offset	Enter the offset from the selected arc. Positive value for right offset and negative for left (based on direction of arc).
Second Arc	Follow instructions for first arc.

Tangency Options	These options are to choose from the four possible solutions when either reference arc number is entered via keyboard.
Point Feature Options	
Define	Check this box to define a feature for the new point. The active point feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active point feature code.
Description	Displays the description of the active point feature.
Features	Press to display a list of available linear features to replace the current active line feature. (See page 4-104)
Linear Feature Options	
Define	Check this box to define a feature for the new line. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active line feature. (See page 4-104)
Apply	Execute the command.
3D	Click to display the 3D Shape Definition dialog box. (See page 4-42). Note: Only available if Line toggle is set.
Reset	Erase the input fields and display the default ID numbers.
Close	Close the dialog box.
Help	Display Help for this command.

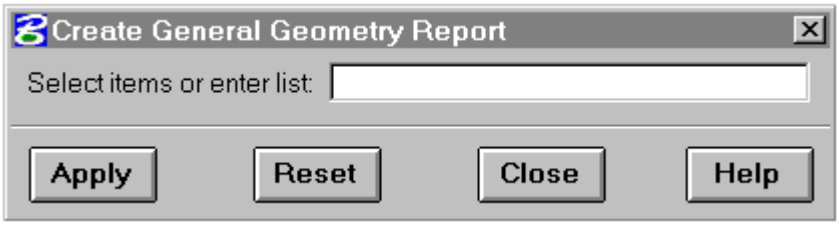
IDENTIFY AND LABEL GEOMETRIC ELEMENTS



This command identifies and labels an IGrds geometric element, and displays information about the element. If this command is used for labeling geometry points, click on the label selected element box before selecting the geometry point.

Select Element	Select a geometric element on the graphics area. The command is executed when the element is selected.
Element Labeling Option	Enable this option to display the label for the selected element.
3D Shape	Displays the profile shape properties of the element when applicable.
Close	Close the dialog box.
Help	Display Help for this command.

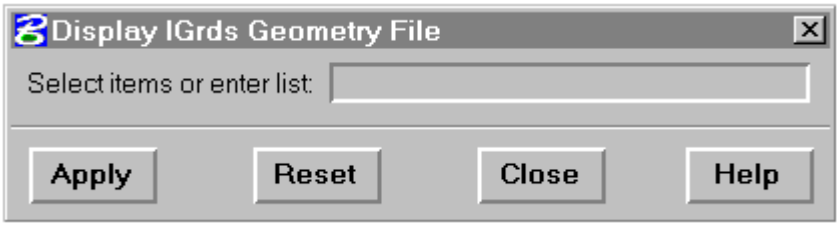
CREATE POINT/LINE/ARC REPORT



This command creates a report of coordinates of IGrds geometry points, selected lines (bearing, distance, beginning and ending coordinates), or selected arcs (arc length, radius, beginning and ending coordinates, and center point coordinates) in the IGrds Geometry files. The report is placed in the temporary report file (.TMP).

Element List	Select the desired elements (points, lines, or arcs) on the graphics area or enter the list of element IDs. The list can contain individual element IDs or ranges of IDs. Example: L12,P10-P20,A34.
Apply	Execute the command.
Reset	Erase the element list.
Close	Close the dialog box.
Help	Display Help for this command.

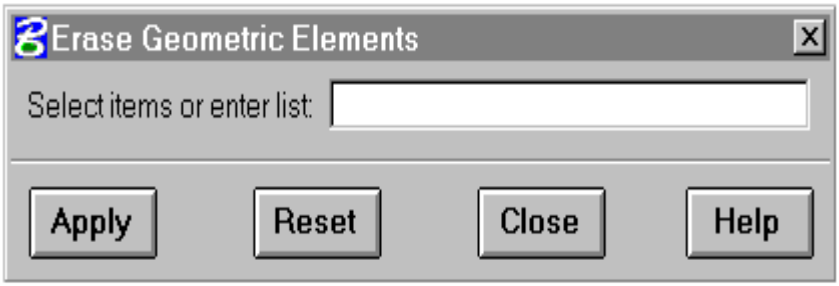
DISPLAY IGrds GEOMETRY FILE



This command retrieves IGrds geometry points, lines, arcs, chains, and shapes from IGrds Geometry files, stores them in the graphics file, and displays them on the graphics screen. This will delete any previous graphical display of the element.

Element List	Select the desired elements (points, lines, or arcs) on the graphics area or enter the list of element IDs. The list can contain individual element IDs or ranges of IDs.
Apply	Execute the command.
Reset	Erase the element list.
Close	Close the dialog box.
Help	Display Help for this command.

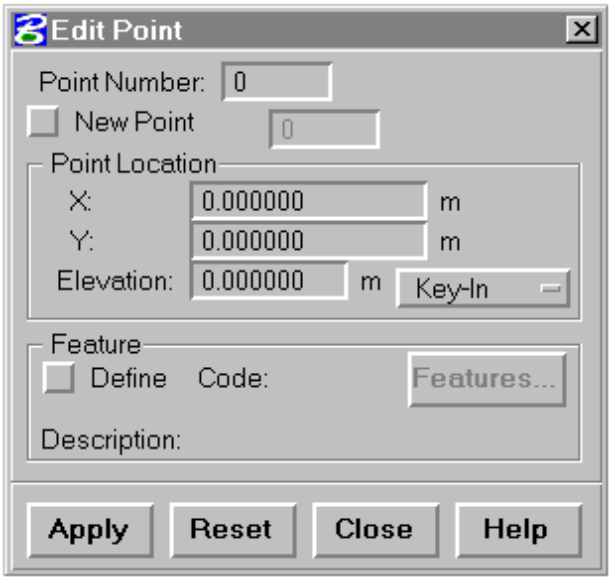
ERASE GEOMETRIC ELEMENTS



This command erases the display of selected IGrds geometry elements from the graphics area.

Element List	Select the desired elements (points, lines, or arcs) on the graphics area or enter the list of element IDs. The list can contain individual element IDs or ranges of IDs.
Apply	Execute the command.
Reset	Erase the element list.
Close	Close the dialog box.
Help	Display Help for this command.

EDIT POINT



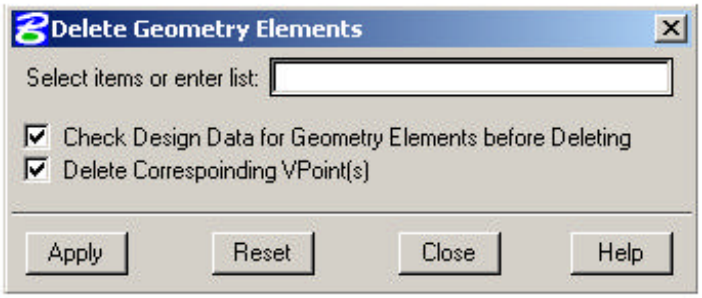
The edit point command allows changes to all data describing an existing geometry point. This includes the planar coordinates, elevation, and feature code data. Optionally, the edited point data can be stored as a new point.

Point Number	Select the point to be edited or enter its ID.
New Element	Check this box to save the edited point data as a new point. The default new point ID appears. Enter a new ID if desired.
Point Location	
Planar Coordinates	Enter the X, Y or N, E coordinates or digitize a location.
Elevation Options	Enter or digitize an elevation.
	Use the active DTM surface elevation at the given X, Y or N, E coordinates.
	Use the Design Finish Grade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.
	Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.

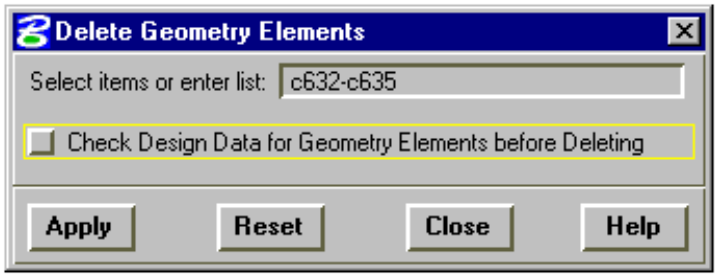
Feature Options	
Define	This box is checked if a feature is assigned to the point. Uncheck this box to remove the feature.
Code	Displays the code of the feature assigned to the point.
Description	Displays the description of the feature assigned to the point.
Features	Press to display a list of available point features to replace the feature assigned to the point. (See page 4-104) This becomes the new active point feature.
Apply	Save the point data as displayed.
Reset	Discard changes and retrieve the current point data from the file again.
Close	Close the dialog box.
Help	Display Help for this command.

DELETE GEOMETRIC ELEMENT

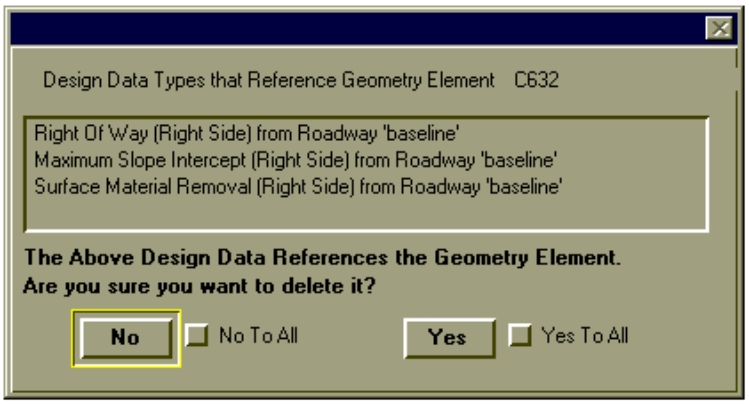
This command deletes IGrds geometric elements from the IGrds geometry file, and removes their displays from the screen.



Geometry Points

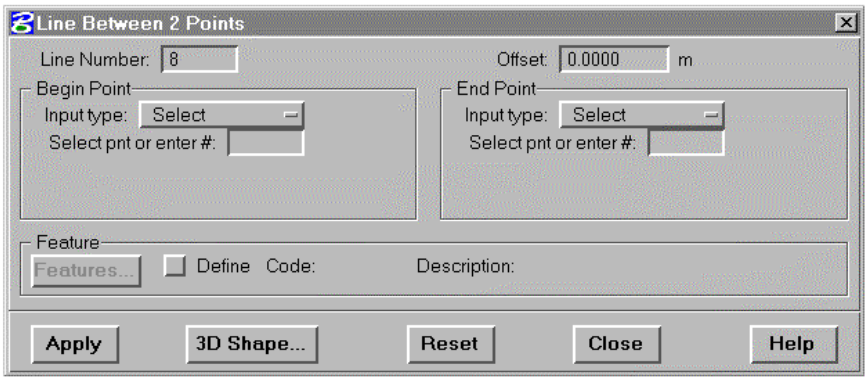


Geometry Lines, Arcs, and Chains



Element List	Select the desired elements on the graphics area or enter the list of element IDs. The list can contain individual element IDs or ranges of IDs.
Check Design Data for Geometry Elements before Deleting	This toggle is available in the Geometry Points, Lines, Arcs, and Chain's palettes. When the toggle is checked, the Design Data is scanned to see if the Geometry Element is referenced. If Design Data does reference the geometry element, a dialog is displayed to the user showing the data types that reference the geometry element. The user is prompted once more for the Delete. If a Range of Geometry Element were given to delete, the toggles "Yes to All" and "No to All" are available so that the user does not have to keep answering the prompts.
Delete Corresponding VPoint(s)	This toggle is available in the Points palette only. When this toggle is checked, the VPoint corresponding to each point on the Element List is deleted.
Apply	Execute the command.
Reset	Erase the element list.
Close	Close the dialog box.
Help	Display Help for this command.

CONSTRUCT LINE BETWEEN TWO POINTS

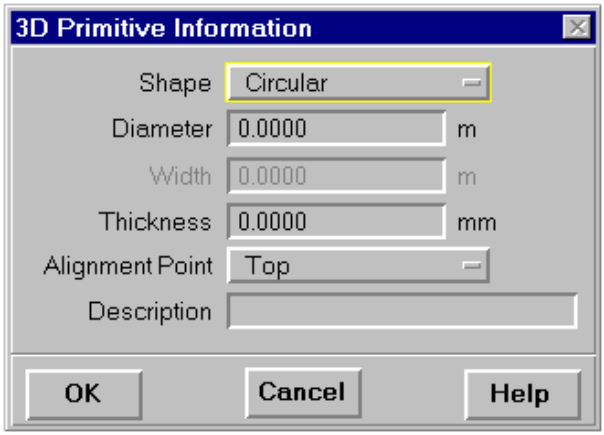


This command creates a new IGrds geometry line between two defined points. When the line is successfully created, the end point is available as the begin point of the next line. If an offset is specified, then the elevations of the two ends of the lines are the same as the entered or calculated elevations at the entered X,Y coordinates.

Line Number	Enter the ID number for the new line to be created. The default number shown is the next available ID number.
Begin Point Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the begin point.
Elevation	Enter or digitize an elevation. Use the active DTM surface elevation at the given X, Y or N, E coordinates. Use the Design Finish Grade elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line. Use the Design Subgrade Surface elevation at the given X, or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.
Select	Select an existing geometry point on the graphics area or its number.

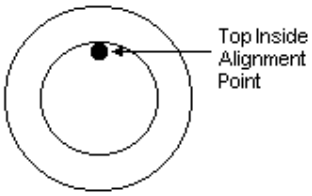
End Point Options	Follow the instructions for begin point.
Offset	Enter the offset from the selected element. Positive value for right offset and negative for left (based on direction of element).
Feature Options	
Define	Check this box to define a feature for the new line. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)
Apply	Execute the command.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

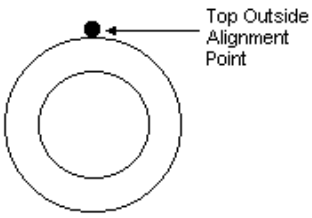
3D SHAPE INFORMATION

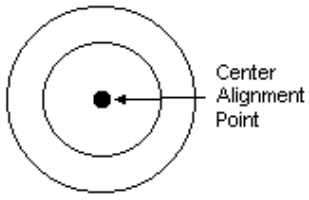


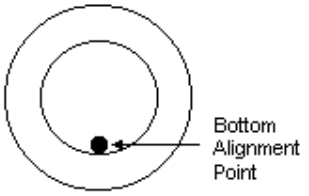
This dialog box appears when the 3D Shape Option button is selected on various geometry commands. The geometry element may be displayed as a right circular cylinder, a right rectangular prism, right ellipsoidal cylinder or a cell. If cells are used, they must be 2D point cells. See the following page for the dialog appearance when the cell option is selected. The next time a 3D Shape is requested, it will use the shape that was last used, unless changed by the user.

← Dialog appearance for Circular, Rectangular, or Elliptical options

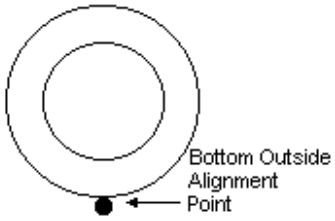




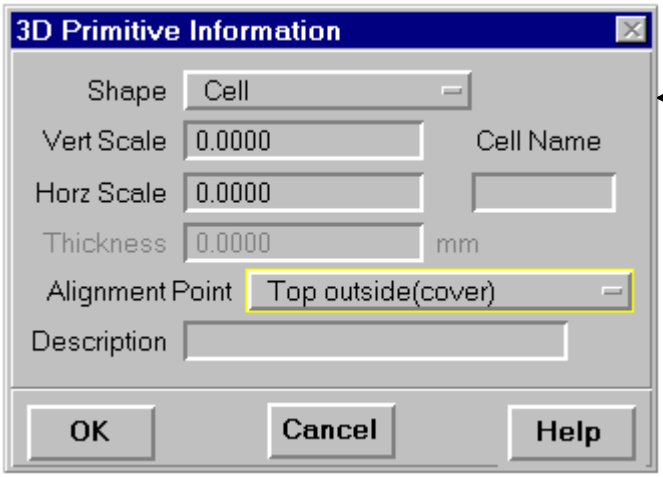




Shape	Circular - Enter the outer diameter for the circle. Rectangular - Enter the height and width of the rectangle. Ellipse - Enter the major and minor axes of the ellipse.
Height/Diameter	If circular, enter the outer diameter; if rectangular, enter the outer height; if elliptical, enter the vertical diameter (major or minor). This option appears for circular, rectangular, and elliptical shapes only.
Width	If circular, no entry; if rectangular, enter the outer width; if elliptical, enter the horizontal diameter (major or minor). This option appears for circular, rectangular, and elliptical shapes only.
Thickness	Enter the wall thickness for all three shapes. This option appears for circular, rectangular, and elliptical shapes only. Note: For imperial projects, enter the thickness in inches; for metric enter in millimeters.



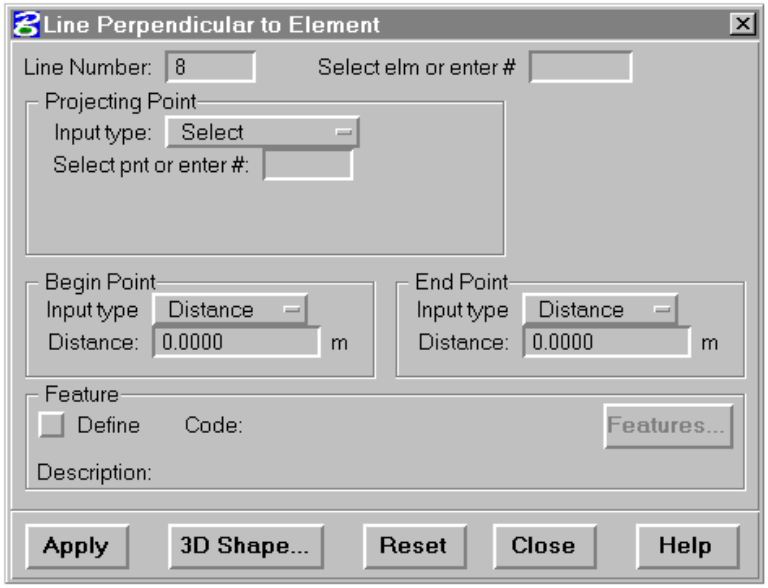
Alignment Point	**Top Inside** - The shape will be applied using the top inside point (see sketch). **Top Outside** (cover) - The shape will be applied using the top outside point (see sketch). **Center of Shape** - The shape will be applied at the middle of the shape (see sketch). **Bottom Inside** (flowline) - The shape will be applied at the bottom inside point (see sketch). **Bottom Outside** - The shape will be applied using the bottom outside point (see sketch).
Descr. (24 char)	24 characters may be used for the description of the 3D Shape.
OK	Click to execute the command. It will not be necessary to click on Apply in the geometry command to execute the command.
Cancel	Click to cancel the dialog box.
Help	Click to display help for this subprocess.



Dialog appearance when Shape is set to Cell.

Vert Scale	Enter the vertical scale to be applied to the cell when it is applied to the geometry element.
Horiz Scale	Enter the horizontal scale to be applied to the cell when it is applied to the geometry element.
Cell Name	Enter the name of the cell to be used. The cell will trace along the geometry element at the cell origin. Cells to be used in this command must be 2D point cells (i.e., point cells created in a 2D .dgn file.

CONSTRUCT LINE PERPENDICULAR TO ELEMENT



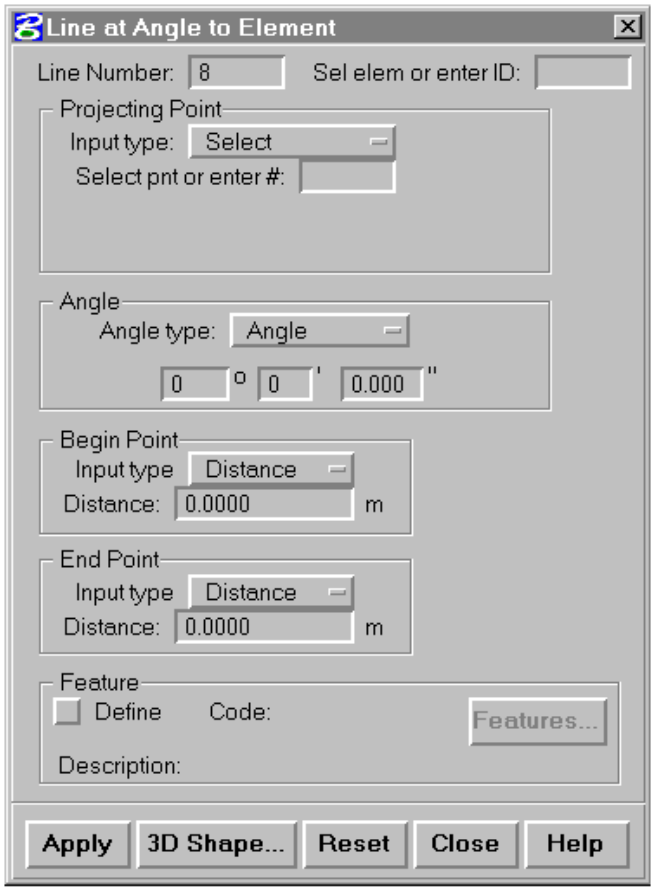
This command creates an IGrds geometry line perpendicular to a line or arc through a given point. The new line is created even when it does not intersect the element.

Line Number	Enter the ID number for the new line to be created. The default number shown is the next available ID number.
Reference Element	Select an IGrds geometric or MicroStation line, arc, or chain on the graphics area or enter its ID. If the reference element is a chain, the new line is perpendicular to the component selected with the mouse. A chain ID may not be entered via keyboard in this field.
Projecting Point Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the projecting point.
Elevation	Enter or digitize an elevation. Use the active DTM surface elevation at the given X, Y or N, E coordinates. Use the Design Finish Grade elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.

	Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.
Select	Select an existing geometry point on the graphics area or enter its number.
Begin Point Options	
Point	Digitize the approximate location of the begin point. This location is projected to the new line to define the begin point.
Distance	Enter the distance from the projecting point to the begin point. Then digitize a point to indicate the direction of the begin point.
End Point Options	Follow the instructions for begin point.
Feature Options	
Define	Check this box to define a feature for the new line. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)
Apply	Execute the command.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID numbers.
Close	Close the dialog box.
Help	Display Help for this command.

Note: See the Concepts Manual, Appendix C, for an explanation of elevation computation methodology.

CONSTRUCT LINE AT ANGLE TO ELEMENT



This command creates an IGrds geometry line at an angle to an element through a given point.

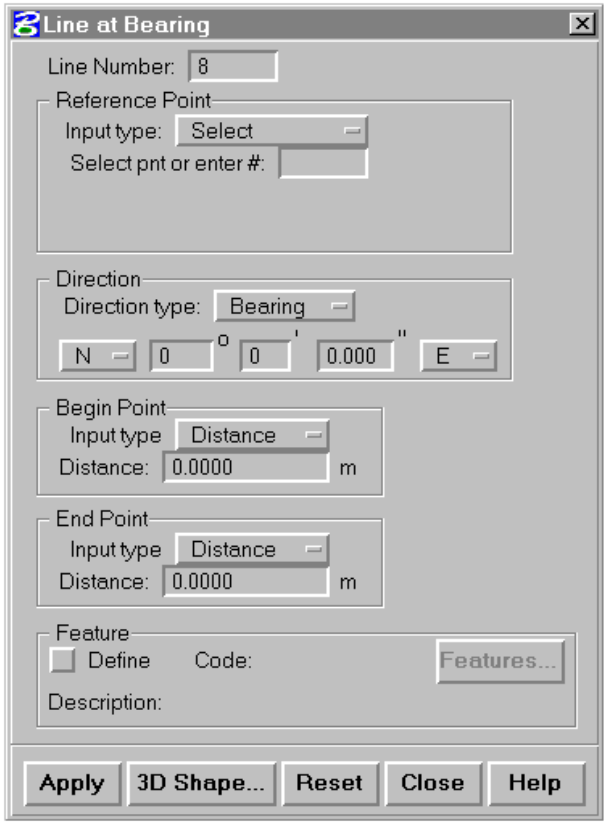
Line Number	Enter the ID number for the new line to be created. The default number shown is the next available ID number.
Reference Element	Select an IGrds geometric or MicroStation line, arc, or chain on the graphics area or enter its ID. If the reference element is a chain, the angle is relative to the component selected with the mouse. A chain ID may not be entered via keyboard in this field.

Projecting Point Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the projecting point.
Elevation	Enter or digitize an elevation. Use the active DTM surface elevation at the given X, Y or N, E coordinates. Use the Design Finish Grade elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line. Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.
Select	Select an existing geometry point on the graphics area or enter its number.
Angle Options	
Deflection	Enter the deflection angle in degrees, minutes, and seconds; then select the direction (L/R).
Skew	Select the skew directions (R/L,F/B) and enter the angle in degrees, minutes, and seconds.
Angle	Enter the angle in degrees, minutes, and seconds; then select the direction (L/R).
Begin Point Options	
Point	Digitize the approximate location of the begin point. This location is projected to the new line to define the begin point.
Distance	Enter the distance from the projecting point to the begin point. Then digitize a point to indicate the direction of the begin point.
End Point Options	Follow the instructions for begin point.

Feature Options	
Define	Check this box to define a feature for the new line. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)
Apply	Execute the command.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID numbers.
Close	Close the dialog box.
Help	Display Help for this command.

Note: See the Concepts Manual, Appendix C, for an explanation of the elevation computation methodology.

CONSTRUCT LINE THROUGH POINT AT BEARING OR AZIMUTH



This command creates an IGrds geometry line at a user defined direction through a point.

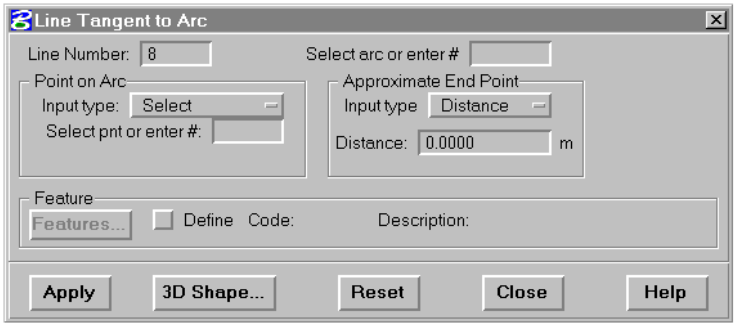
Line Number	Enter the ID number for the new line to be created. The default number shown is the next available ID number.
Reference Point Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the reference point.
Elevation	Enter or digitize an elevation. Use the active DTM surface elevation at the given X, Y or N, E coordinates. Use the Design Finish Grade elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.

	Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.
Select	Select an existing geometry point on the graphics are or enter its number.
Direction Options	
Bearing	Select the bearing directions (N/E,E/W) and enter the angle in degrees, minutes, and seconds.
Azimuth	Enter the azimuth angle in degrees, minutes, and seconds.
Line	Select an existing line on the graphics area or enter its number. The direction of this line is used to define the new line.
Begin Point Options	
Point	Digitize the approximate location of the begin point. This location is projected to the new line to define the begin point.
Distance	Enter the distance from the reference point to the begin point. Then digitize a point to indicate the direction of the begin point.
End Point Options	Follow the instructions for begin point.
Feature Options	
Define	Check this box to define a feature for the new line. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)

Apply	Execute the command.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID numbers.
Close	Close the dialog box.
Help	Display Help for this command.

Note: The elevation of the line is the same as the reference point.

CONSTRUCT LINE TANGENT TO ARC AT POINT ON ARC



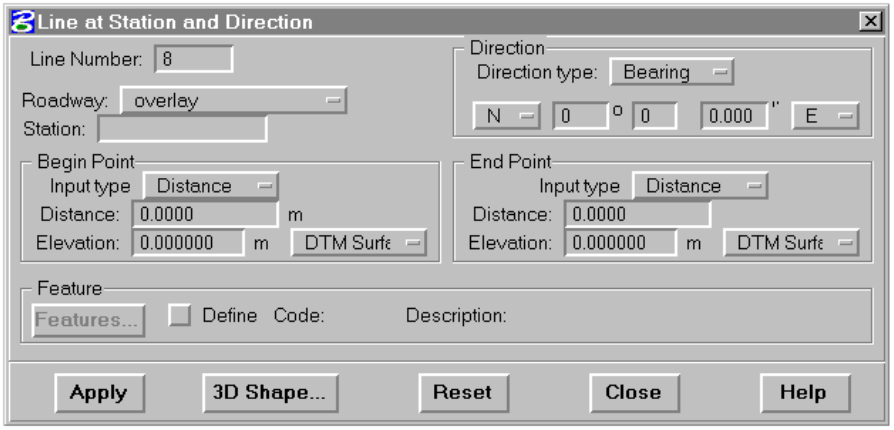
This command creates a tangent IGrds geometry line from a specified point on an arc to another point at a given distance.

Line Number	Enter the ID number for the new line to be created. The default number shown is the next available ID number.
Reference Arc	Select an IGrds geometric or MicroStation arc on the graphics area or enter its number.
Point on Arc Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the point on an arc.
Select	Select an existing geometry point on the graphics area or enter its number.
Approximate End Point Options	
Point	Digitize the approximate location of the end point. This location is projected to the new line to define the end point.
Distance	Enter the distance from the projecting point to the end point. Then digitize a point to indicate the direction of the end point.

Feature Options	
Define	Check this box to define a feature for the new line. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)
Apply	Execute the command.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID numbers.
Close	Close the dialog box.
Help	Display Help for this command.

Note: The elevation of the line is the same as the point on arc when Distance to End Point is entered. If point is selected the elevation displayed for the approximate end point is used for the end of the line. The beginning of the line will be the arc elevation.

CONSTRUCT LINE AT STATION AND DIRECTION



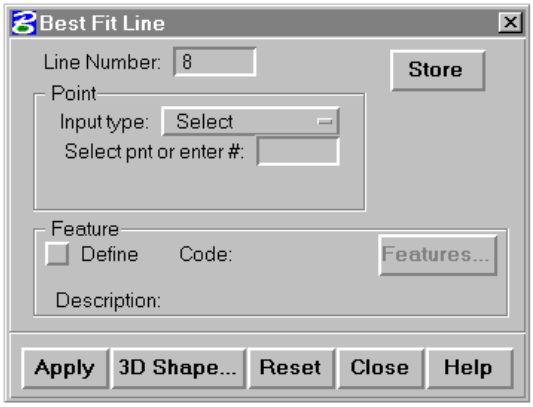
This command creates an IGrds geometry line through a horizontal alignment station at a specified direction.

Line Number	Enter the ID number for the new line to be created. The default number shown is the next available ID number.
Roadway	Select the desired roadway. The current active roadway is shown.
Station	Enter the station of the roadway at which the new line goes through.
Direction Options	
Bearing	Select the bearing directions (N/E,E/W) and enter the angle in degrees, minutes, and seconds.
Azimuth	Enter the azimuth angle in degrees, minutes, and seconds.
Skew	Select the skew directions (R/L,F/B) and enter the angle in degrees, minutes, and seconds.
Line	Select an existing IGrds geometric or MicroStation line on the graphics area or enter its number. The direction of this line is used to define the new line.

Begin Point Options	
Point	Digitize the approximate location of the begin point. This location is projected to the new line to define the begin point.
Distance	Enter the distance from the station of the roadway to the begin point. Then digitize a point to indicate the direction of the begin point.
Elevation	Enter or digitize an elevation. Use the active DTM surface elevation at the given X, Y or N, E coordinates. Use the Design Finish Grade elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line. Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.
End Point Options	Follow the instructions for begin point.
Feature Options	
Define	Check this box to define a feature for the new line. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)

Apply	Execute the command.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID numbers.
Close	Close the dialog box.
Help	Display Help for this command.

CONSTRUCT LINE THROUGH SERIES OF POINTS

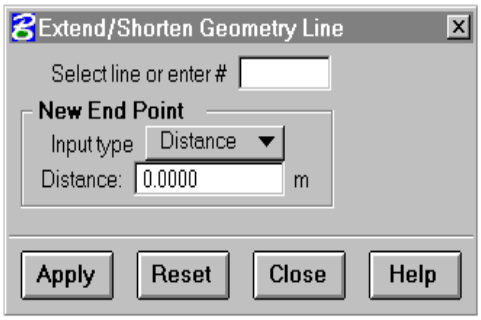


This command creates an IGrds geometry line which is the "least squares" fit through a series of points. The fit is based on north coordinates (Y) only. The east coordinates (X) of the first and last points entered bound the new line. No elevation value is calculated for the line.

Line Number	Enter the ID number for the new line to be created. The default number shown is the next available ID number.
Point Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the new point.
Select	Select an existing geometry point on the graphics area or enter its number.
Store Push Button	Press this button to store the selected point.
Feature Options	
Define	Check this box to define a feature for the new line. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear. (See page 4-104)

Apply	Execute the command. Push this button after all desired points have been stored.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID numbers.
Close	Close the dialog box.
Help	Display Help for this command.

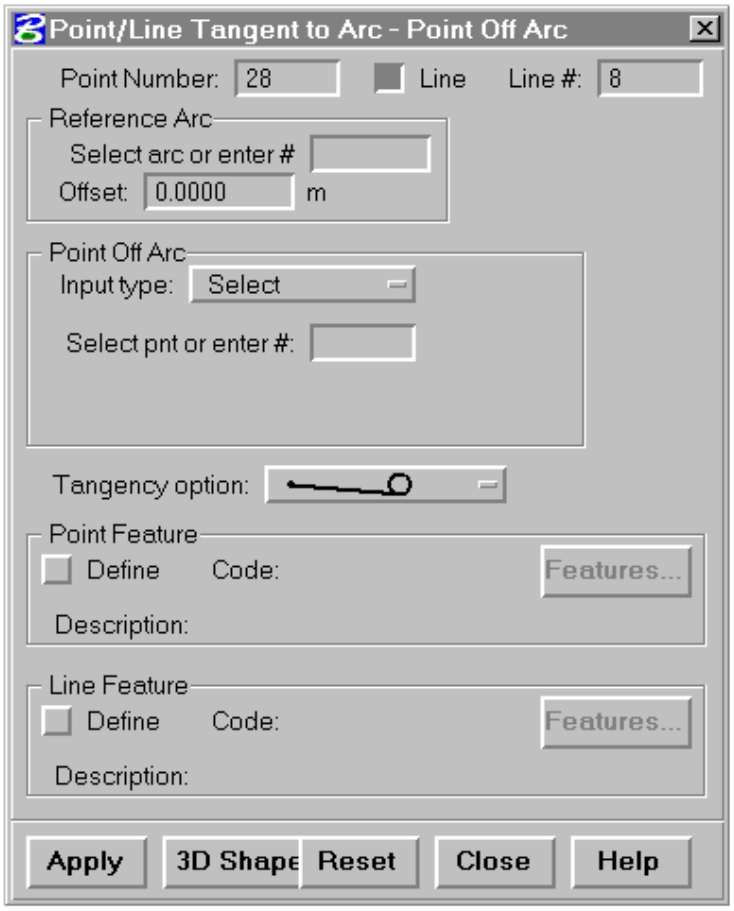
EXTEND OR SHORTEN LINE



This command lengthens or shortens an existing IGrds geometry line.

Reference Line	Select a line (near the end point to shorten or enlarge) on the graphics area.
New End Point Options	
Point	Digitize the approximate location of the end point. This location is projected to the line to define the end point.
Distance	Enter the distance to enlarge or shorten the line. Positive distance to enlarge, negative to shorten.
Apply	Execute the command.
Reset	Erase the input fields.
Close	Close the dialog box.
Help	Display Help for this command.

CONSTRUCT POINT/LINE TANGENT TO ARC FROM POINT OFF ARC



This command creates an IGrds geometry point (and optionally a line) tangent to an arc from a point off that arc. The optional line is defined from the point off the arc to the point of tangency. If an offset is given, then the elevation of the offset point is the same as the elevation of the arc perpendicular to the offset point.

Point Number	Enter the ID number for the new point to be placed. The default number shown is the next available ID number.
Line Option	Enable this option if a line is to be generated.
Line Number	This field is displayed when the line option is enabled. Enter the ID number for the new line to be placed. The default number shown is the next available ID number.
Reference Arc	
Element ID	Select an IGrds geometric or MicroStation arc on the graphics area or enter its number. Example: 23
Offset	Enter the offset from the selected arc. Positive value for right offset and negative for left (based on direction of arc).

Point Off Arc Options

Coordinates Enter the X,Y or N,E coordinates or digitize a desired location for the point off arc.

Elevation Enter or digitize an elevation.

Use the active DTM surface elevation at the given X, Y or N, E coordinates.

Use the Design Finish Grade elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.

Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.

Select Select an existing geometry point on the graphics area or enter its number.

Tangency Point Options These options allow the user to select one of the two possible solutions or the solution closest to the selection point on the arc.

Point Feature Options

Define Check this box to define a feature for the new point. The active point feature is displayed if one is defined. Uncheck this box if a feature is not necessary.

Code Displays the active point feature code.

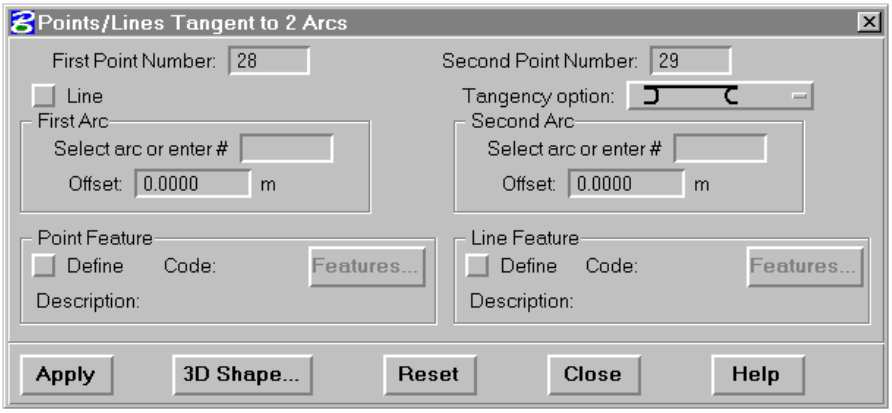
Description Displays the description of the active point feature.

Features Press to display a list of available point features to replace the current active point feature. (See page 4-104)

Linear Feature Options	
Define	Check this box to define a feature for the new line. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active line feature. (See page 4-104)
Apply	Execute the command.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID numbers
Close	Close the dialog box.
Help	Display Help for this command.

Note: The elevation of the end points of the line will be the elevation of the tangent point on the arc and the elevation of the point off the arc.

CONSTRUCT POINTS/LINE TANGENT TO TWO ARCS



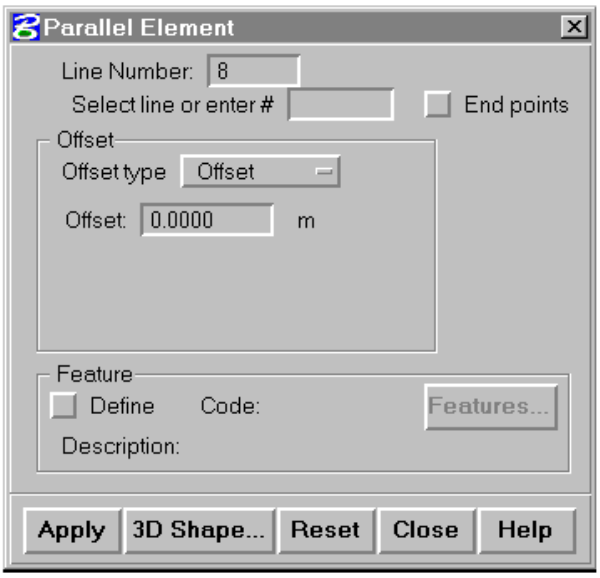
This command creates two IGrds geometry points (and optionally the line between the points) tangent to two specified arcs.

First Point Number	Enter the ID number for the first new point to be placed. The default number shown is the next available ID number.
Second Point Number	Enter the ID number for the second new point to be placed. The default number shown is the next available ID number.
Line Option	Enable this option if a line is to be generated.
Line Number	This field is displayed when the line option is enabled. Enter the ID number for the new line to be placed. The default number shown is the next available ID number.
First Arc	
Element ID	Select an IGrds geometric or MicroStation arc on the graphics area or enter its number.
Offset	Enter the offset from the selected arc. Positive value for right offset and negative for left (based on direction of arc).
Second Arc	Follow instructions for first arc.
Tangency Options	These options are to choose from the four possible solutions when either reference arc number is entered via keyboard.

Point Feature Options	
Define	Check this box to define a feature for the new point. The active point feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active point feature code.
Description	Displays the description of the active point feature.
Features	Press to display a list of available point features to replace the current active point feature. (See page 4-104)
Linear Feature Options	
Define	Check this box to define a feature for the new line. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active line feature. (See page 4-104)
Apply	Execute the command.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42) Note: Only available if Line toggle is set.
Reset	Erase the input fields and display the default ID numbers.
Close	Close the dialog box.
Help	Display Help for this command.

Note: The elevation of the end points of the line will be the same as the tangent points on the arcs.

CONSTRUCT LINE/ARC PARALLEL TO EXISTING LINE/ARC

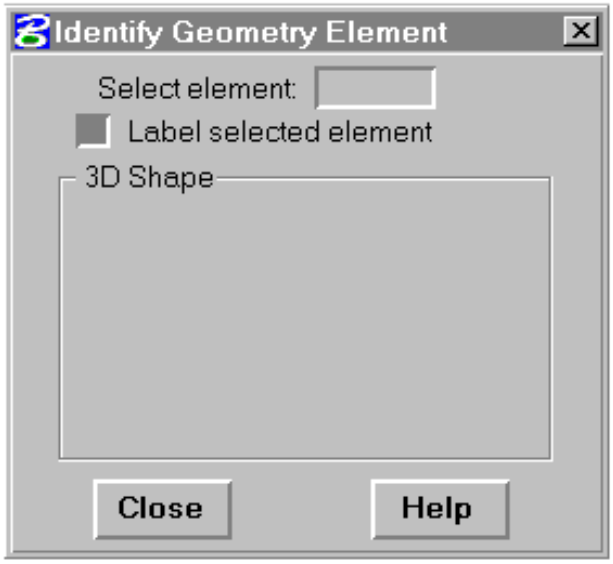


This command constructs an IGrds geometry line or arc parallel to an existing line or arc. If an offset distance is given, the elevation values for the parallel element are the same as the reference element. If a geometry point or entered coordinate and elevation values are used as an offset, then the parallel element goes through the point in elevation as well as horizontal location.

Line Number	Enter the ID number for the new line or arc to be created. The default number shown is the next available ID number.
Reference Line	Select an IGrds geometric or MicroStation line or arc on the graphics area or enter its number.
Offset Options	
Point	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the offset point.
Select	Select an existing geometry point on the graphics area or enter its number.
Offset	Enter the offset from the selected line. Positive value for right offset, negative for left (based on direction of element).
End Points Option	Enable this option to digitize approximate begin and end points. Disable this option to create a line of the same length as the reference line.

Feature Options	
Define	Check this box to define a feature for the new line. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)
Apply	Execute the command.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

IDENTIFY AND LABEL GEOMETRIC ELEMENTS

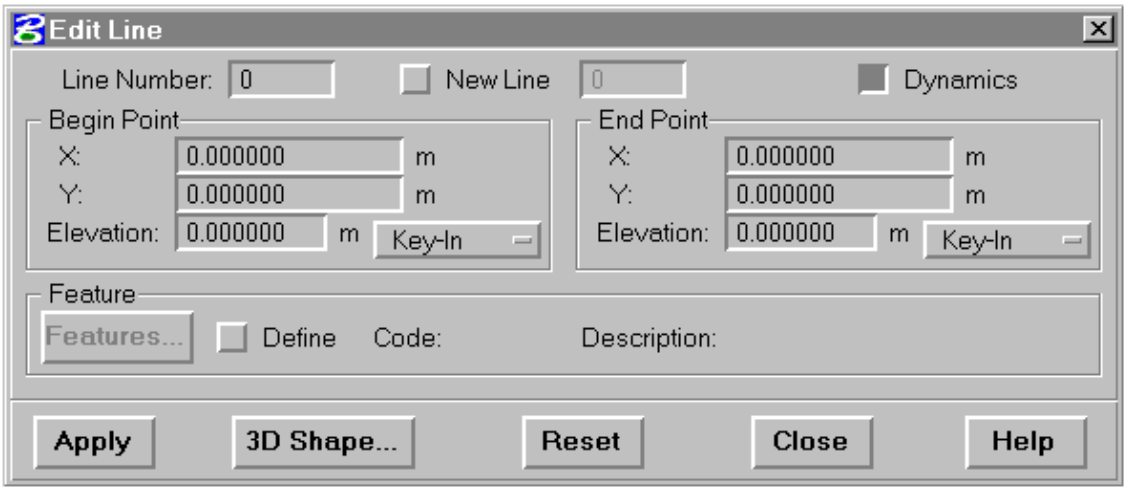


This command identifies and labels an IGrds geometric element, and displays information about the element including 3D primitive information. If this command is used for labeling geometry lines and chains or arcs WITHOUT a text block, click on the label selected element box before selecting the geometry element.

If this command is used with geometry arcs, an additional option for placing a text block appears. Selection of this option allows graphic placement of the arc radius, degree of curve, length, and angle.

Select Element	Select a geometric element on the graphics area. The command is executed when the element is selected.
Element Labeling Option	Enable this option to display the label for the selected element.
3D Shape	Displays the profile shape properties of the element when applicable.
Close	Close the dialog box.
Help	Display Help for this command.

EDIT LINE



The edit line command allows changes to all data describing an existing geometry line. This includes the planar coordinates and elevations of the end points, 3D shape, and feature data. Optionally, the edited line data can be stored as a new line. A temporary display shows the changes to the end point coordinates. Dynamic editing capabilities using rubber banding are optionally available.

Line Number	Select the line to be edited or enter its ID.
New Element	Check this box to save the edited line data as a new line. The default new line ID appears. Enter a new ID if desired.
Dynamics	Check this box to enable dynamic editing.

Begin Point	
Planar Coordinates	Enter the X, Y and N, E coordinates or digitize a location. If dynamic editing is enabled, set focus to one of these fields, then click on one of the end points of the line and move it to a new location. Press the data button to accept the location or the reset button to reject it. This operation does not affect the point elevation.
Elevation Options	Enter or digitize an elevation. If dynamic editing is enabled, set focus to this field, and then select one of the end points of the line and move it to a new elevation. Press the data button to accept the location or the reset button to reject it. This operation does not affect the planar coordinates. Use the active DTM surface elevation at the given X, Y or N, E coordinates. Use the Design Finish Grade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line. Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.
End Point	Follow directions for Begin Point.

Feature Options	
Define	This box is checked if a feature is assigned to the line. Uncheck this box to remove the feature.
Code	Displays the code of the feature assigned to the line.
Description	Displays the description of the feature assigned to the line.
Features	Press to display a list of available linear features to replace the feature assigned to the line (See page 4-104) This becomes the new active linear feature.
Apply	Save the line data as displayed.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Discard changes and retrieve the current line data from the file again.
Close	Close the dialog box.
Help	Display Help for this command.

The following commands are repeated on this palette for convenience. For instructions, refer to the indicated manual pages.

CREATE POINT/LINE/ARC REPORT (Command 499)

This command creates a report of coordinates of IGrds geometry points, selected lines (bearing, distance, beginning and ending coordinates), or selected arcs (arc length, radius, beginning and ending coordinates, and centerpoint coordinates) in the IGrds Geometry files. The report is placed in the temporary report file (.TMP).

See Page 4-36.

DISPLAY IGRDS GEOMETRY FILE (Command 492)

This command retrieves IGrds geometry points, lines, arcs, chains, and shapes from IGrds Geometry files, stores them in the graphics file, and displays them on the graphics screen.

See Page 4-37.

ERASE GEOMETRIC ELEMENTS (Command 496)

This command erases the display of selected IGrds geometry elements from the graphics area.

See Page 4-38.

DELETE GEOMETRIC ELEMENT (Command 470)

This command deletes IGrds geometric elements from the IGrds geometry file, and removes their displays from the screen.

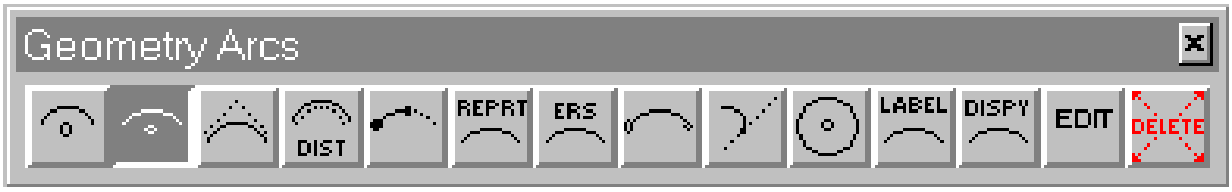
See Page 4-39.

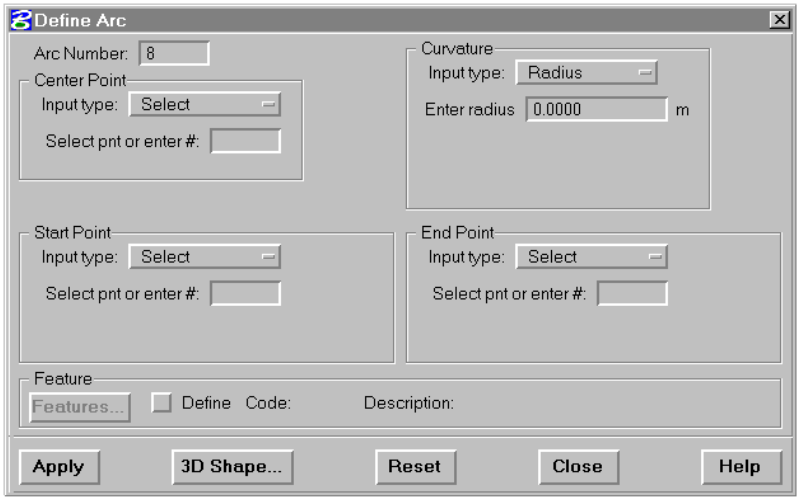
IDENTIFY AND LABEL GEOMETRY ELEMENTS

This command identifies and labels an IGrds element and displays information about the element.

See Page 4-62.

CONSTRUCT ARC BY CENTER, RADIUS AND ENDPOINTS





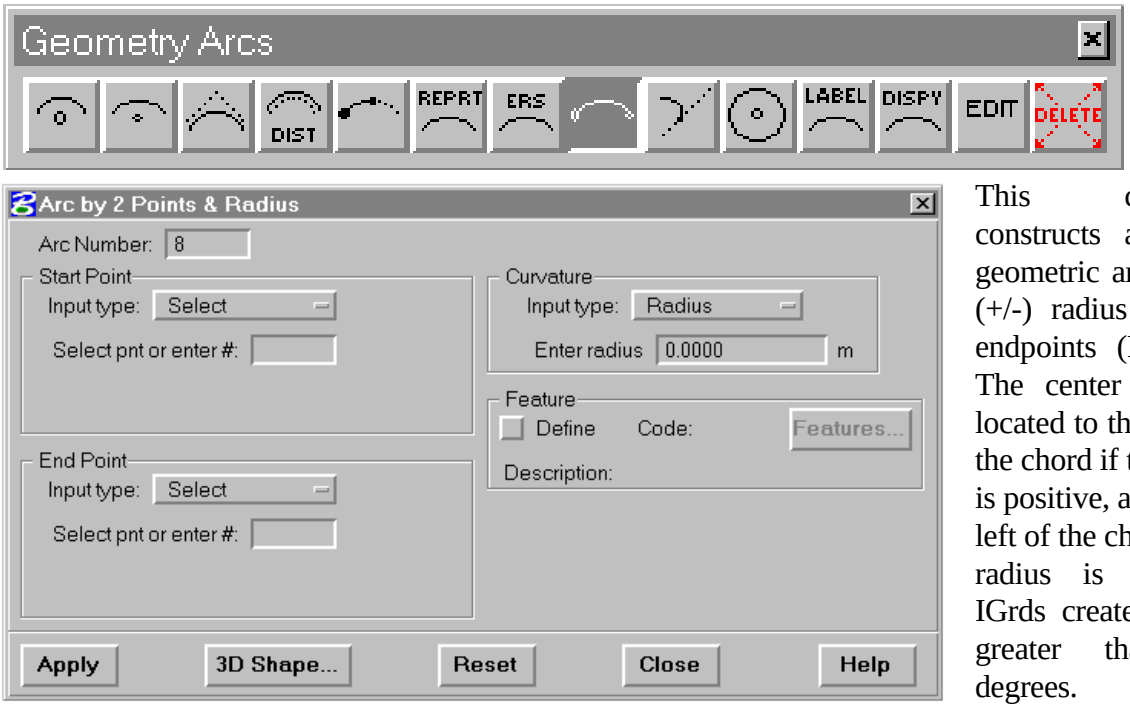
This command creates an IGrds geometry arc from a center point, radius, and two points indicating the endpoints of the arc. IGrds creates no arc greater than 180 degrees.

Arc Number	Enter the ID number for the new arc to be created. The default number shown is the next available ID number.
Center Point Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the center point.
Select	Select an existing geometry point on the graphics area or enter its number.
Curvature Options	
Radius	Enter the radius of the arc.
Degree of Curve	Enter the degree of curve in degrees, minutes, and seconds.
Arc	Select an arc on the graphics area or enter its number. The radius for this arc is used for the new arc.
Point	Follow the instructions for center point. The distance from this point to the center point is used as radius for the new arc.

Start Point Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the start point.
Elevation	Enter or digitize an elevation. Use the active DTM surface elevation at the given X,Y or N,E coordinates. Use the Design Finish Grade elevation at the given X,Y or N,E coordinates. This surface corresponds to one of the design roadways of the active base line. Use the Design Subgrade Surface elevation at the given X,Y or N,E coordinates. This surface corresponds to one of the design roadways of the active base line.
Select	Select an existing geometry point on the graphics area or enter its number.
End Point Options	Follow the instructions for start point.
Feature Options	
Define	Check this box to define a feature for the new arc. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Feature	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)

Apply	Execute the command.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

CONSTRUCT ARC BY RADIUS AND ENDPOINTS



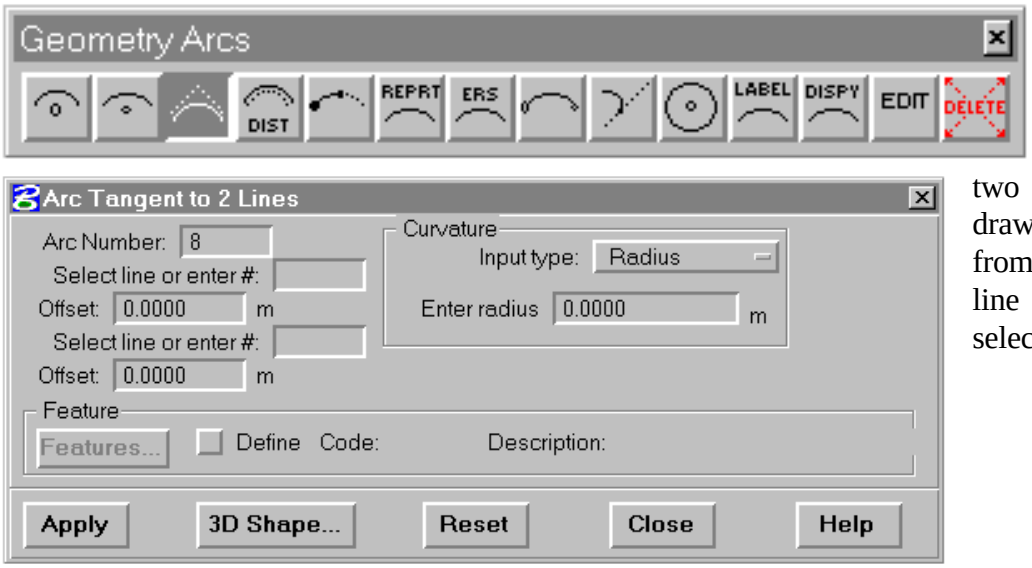
This command constructs an IGrds geometric arc from a (+/-) radius and the endpoints (PC, PT). The center point is located to the right of the chord if the radius is positive, and to the left of the chord if the radius is negative. IGrds creates no arc greater than 180 degrees.

Arc Number	Enter the ID number for the new arc to be created. The default number shown is the next available ID number.
Curvature Options	
Radius	Enter the radius of the arc.
Degree of Curve	Enter the degree of curve in degrees, minutes, and seconds.

Start Point Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the start point.
Elevation	Enter or digitize an elevation. Use the active DTM surface elevation at the given X, Y or N, E coordinates. Use the Design Finish Grade elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line. Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.
Select	Select an existing geometry point on the graphics area or its number.
End Point Options	Follow the instructions for start point.
Feature Options	
Define	Check this box to define a feature for the new arc. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)

Apply	Execute the command.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

CONSTRUCT ARC TANGENT TO TWO LINES



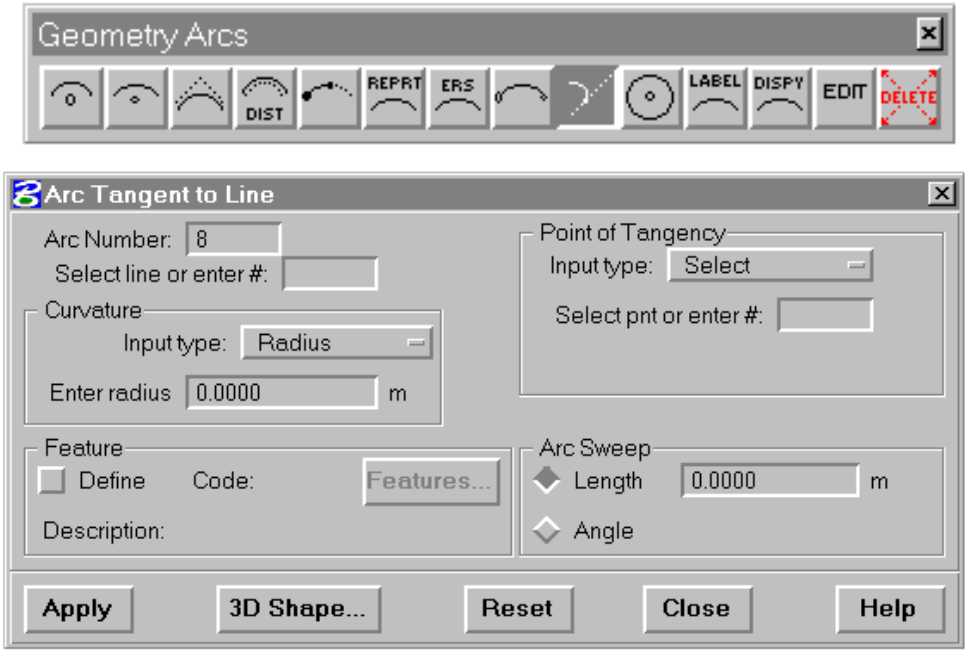
This command constructs an IGrds geometry arc tangent to two specified lines, drawn in the direction from the first selected line to the second selected line.

Arc Number	Enter the ID number for the new arc to be created. The default number shown is the next available ID number.
First Tangent Line	Select an IGrds geometric or MicroStation line from the graphics area or enter its number.
First Offset	Enter the offset from the first tangent line. Positive value for right offset, negative for right (based on direction of line).
Second Tangent Line	Follow the instructions for first tangent line.
Second Offset	Follow the instructions for first offset.
Curvature Options	
Radius	Enter the radius of the arc.
Degree of Curve	Enter the degree of curve in degrees, minutes, and seconds.
Arc	Select an arc on the graphics area or enter its number. The radius or this arc is used for the new arc.

Feature Options	
Define	Check this box to define a feature for the new arc. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)
Apply	Execute the command.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

Note: The elevation of the arc end points will be the same as the elevation of the two lines at the tangent points.

CONSTRUCT ARC TANGENT TO LINE



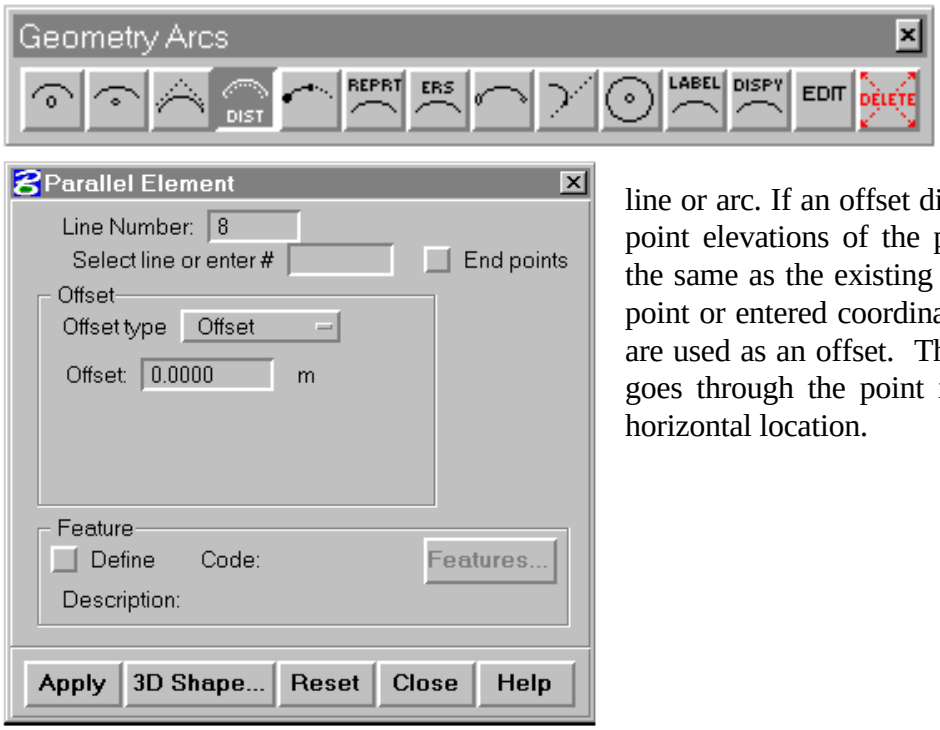
This command constructs an IGrds geometry arc tangent to a line through a point on the line. Digitize a point near the center point of the arc indicating the desired solution. The elevation of the end of the arc away from the line is the same as the element at the tangency point.

Arc Number	Enter the ID number for the arc to be created. The default number shown is the next available ID number.
Reference Line	Select an IGrds geometric or MicroStation line on the graphics area or enter its number.
Curvature Options	
Radius	Enter the radius of the arc.
Degree of Curve	Enter the degree of curve in degrees, minutes, and seconds.
Arc	Select an arc on the graphics area or enter its number. The radius for this arc is used for the new arc.
Point of Tangency Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the tangent point.
Select	Select an existing geometry point on the graphics area or enter its number

Arc Sweep Options	
Length	Enter the arc length.
Angle	Enter the arc angle in degrees, minutes, and seconds.
Feature Options	
Define	Check this box to define a feature for the new arc. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)
Apply	Execute the command. A point digitized indicating the direction of the arc is requested.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

Note: The end points of the arc will correspond with the tangent point on the line and the elevation entered or computed.

CONSTRUCT LINE/ARC PARALLEL TO EXISTING LINE/ARC

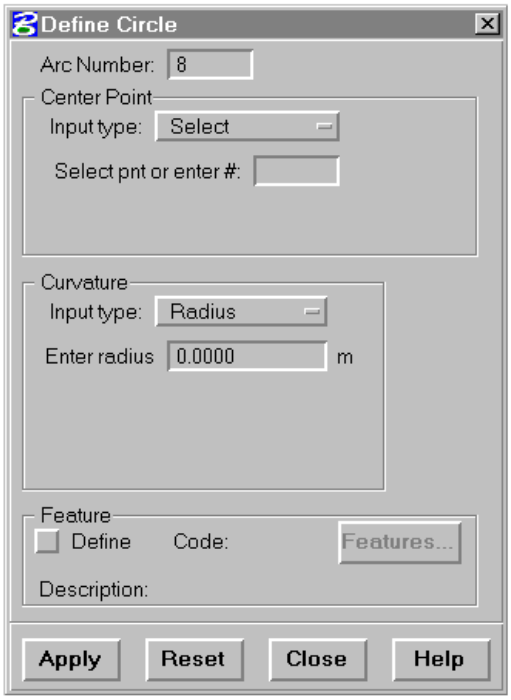


This command constructs an IGrds geometry line or arc parallel to an existing line or arc. If an offset distance is given, the end point elevations of the parallel line/arc will be the same as the existing line/arc. If a geometry point or entered coordinate and elevation values are used as an offset. Then the parallel element goes through the point in elevation as well as horizontal location.

Arc Number	Enter the ID number for the new line or arc to be created. The default number shown is the next available ID number.
Reference Arc	Select an IGrds geometric or MicroStation line or arc on the graphics area or enter its number.
Offset Options	
Point	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the offset point.
Select	Select an existing geometry point on the graphics area or enter its number.
Offset	Enter the offset from the selected arc. Positive value for right offset, negative for left (based on direction of element).
End Points Option	Enable this option to digitize approximate begin and end points. Disable this option to create an arc of the same length as the reference arc.

Feature Options	
Define	Check this box to define a feature for the new arc. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)
Apply	Execute the command.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

CONSTRUCT CIRCLE BY CENTER AND RADIUS



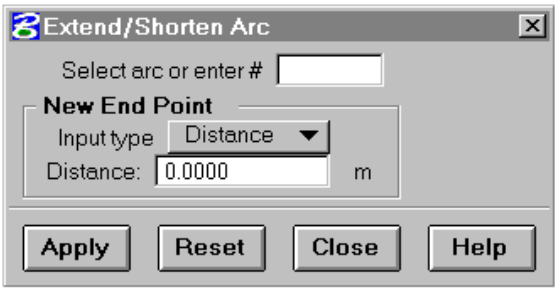
This command constructs an IGrds geometry circle with a specified center and curvature.

Arc Number	Enter the ID number for the new arc to be created. The default number shown is the next available ID number.
Center Point Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the center point.
Elevation	Enter or digitize an elevation. Use the active DTM surface elevation at the given X, Y or N, E coordinates. Use the Design Finish Grade elevation at the given X,Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line. Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.

Select	Select an existing geometry point on the graphics area or enter its number.
Curvature Options	
Radius	Enter the radius of the arc.
Degree of Curve	Enter the degree of curve in degrees, minutes, and seconds.
Arc	Select an arc on the graphics area or enter its number. The radius for this arc is used for the new arc.
Point	Follow the instructions for center point. The distance from this point to the center is used as radius for the new arc.
Feature Options	
Define	This box is checked if a feature is assigned to the arc. Uncheck this box to remove the feature.
Code	Displays the code of the feature assigned to the arc.
Description	Displays the description of the feature assigned to the arc.
Features	Press to display a list of available linear features to replace the feature assigned to the arc. (See page 4-104) This becomes the new active linear feature.
Apply	Execute the command.
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

Note: The elevation of the circle arc is the same as the elevation of the center point.

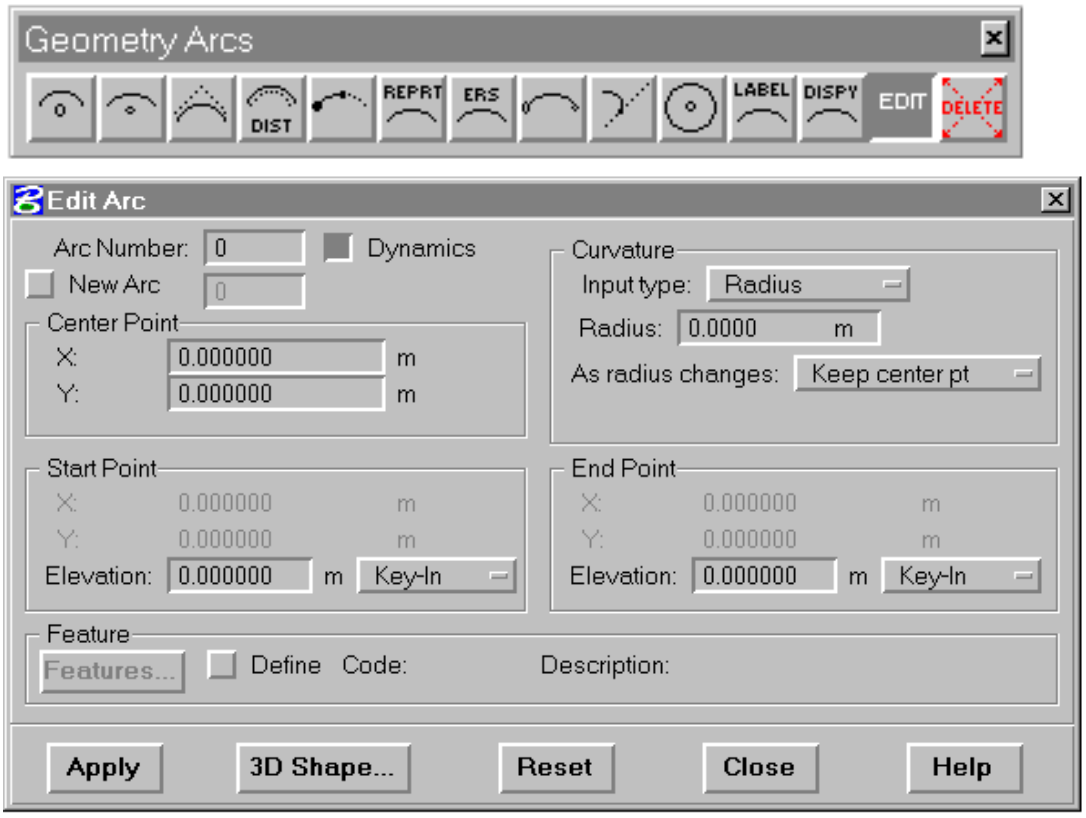
EXTEND OR SHORTEN ARC



This command extends (or shortens) an existing IGrds geometry arc. This command can create an arc with a delta angle greater than 180 degrees.

Reference Arc	Select an arc (near the end point to shorten or enlarge) on the graphics area.
New End Point Options	
Point	Digitize the approximate location of the end point. This location is projected to the arc to define the end point.
Distance	Enter the distance to enlarge or shorten the arc. Positive distance to enlarge, negative to shorten.
Angle	Enter the angle to enlarge or shorten the arc. Positive angle to enlarge, negative to shorten.
Apply	Execute the command.
Reset	Erase the input fields.
Close	Close the dialog box.
Help	Display Help for this command.

EDIT ARC



The edit arc command allows changes to all data describing an existing geometry arc. This includes planar coordinates and elevation of the start, center point, and end points; and also the curvature, 3D shape, and feature data. Optionally, the edited arc data can be stored as a new arc. A temporary display shows the changes to the coordinates and curvature. Dynamic editing capabilities using rubber banding are optionally available.

Arc Number	Select the arc to be edited or enter its ID.
New Element	Check this box to save the edited arc data as a new arc. The default new arc ID appears. Enter a new ID if desired.
Dynamics	Check this box to enable dynamic editing.
Center Point	Enter the X, Y or N, E coordinates or digitize a location. If dynamic editing is enabled, set focus to one of these fields, then click on the arc and move it to a new location without changing its curvature. Press the data button to accept the location or the reset button to reject it.

Curvature

Input Types

Enter the radius of the arc or digitize a point that defines the new arc location to define the radius. If dynamic editing is enabled, set focus to this field, then click on the arc and move it to a new location to define the radius. Press the data button to accept the location or the reset button to reject it.

Enter the desired degree of curve.

As radius changes

The center point is fixed as the radius changes. That is, the end points slide along radial lines.

The end points are fixed as the radius changes. That is, the center point moves to define the new radius.

Start Point

Planar Coordinates

These fields display the X, Y or N, E coordinates as the arc is edited.

Elevation Options

Enter or digitize an elevation. If dynamic editing is enabled, set focus to this field, and then select one of the end points of the arc and move it to a new elevation. Press the data button to accept the location or the reset button to reject it. This operation does not affect the planar coordinates.

Use the active DTM surface elevation at the given X, N or N, E coordinates.

Use the Design Finish Grade elevation at the given X,Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.

Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.

End Point	Follow direction for Start Point.
Feature Options	
Define	This box is checked if a feature is assigned to the arc. Uncheck this box to remove the feature.
Code	Displays the code of the feature assigned to the arc.
Description	Displays the description of the feature assigned to the arc.
Features	Press to display a list of available linear features to replace the feature assigned to the arc. (See page 4-104) This becomes the new active linear feature.
Apply	Save the arc data as displayed.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Discard any changes and retrieve the current arc data from the file again.
Close	Close the dialog box.
Help	Display Help for this command.

The following commands are repeated on this palette for convenience. For instructions, refer to the indicated manual pages.

IDENTIFY AND LABEL GEOMETRIC ELEMENTS (Command 473)

This command identifies and labels an IGrds geometric element, and displays information about the element.

See Page 4-62.

CREATE POINT/LINE/ARC REPORT (Command 499)

This command creates a report of coordinates of IGrds geometry points, selected lines (bearing, distance, beginning and ending coordinates), or selected arcs (arc length, radius, beginning and ending coordinates, and centerpoint coordinates) in the IGrds Geometry files. The report is placed in the temporary report file (.TMP).

See Page 4-36.

DISPLAY IGRDS GEOMETRY FILE (Command 492)

This command retrieves IGrds geometry points, lines, arcs, chains, and shapes from IGrds Geometry files, stores them in the graphics file, and displays them on the graphics screen.

See Page 4-37.

ERASE GEOMETRIC ELEMENTS (Command 496)

This command erases the display of selected IGrds geometry elements from the graphics area.

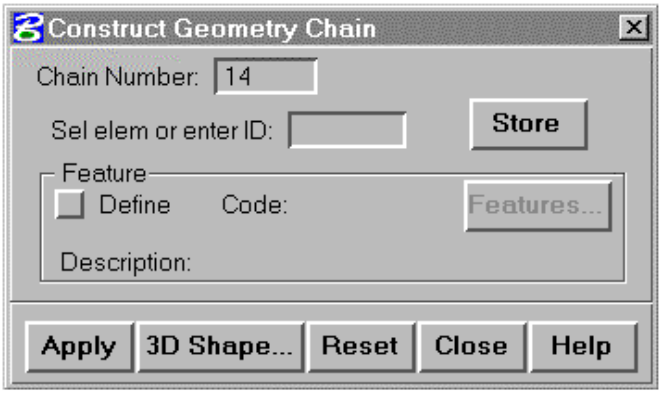
See Page 4-38.

DELETE GEOMETRIC ELEMENT (Command 470)

This command deletes IGrds geometric elements from the IGrds geometry file, and removes their displays from the screen.

See Page 4-39.

CONSTRUCT CHAIN



This command builds an IGrds geometry chain from existing geometric elements (points, lines, arcs, and other chains).

Chain Number	Enter the ID number for the new chain to be created. The default number shown is the next available ID number.
Select Element	Select an IGrds geometric or MicroStation element from the graphics area or enter its ID.
Store Push Button	Press this button to store a new chain component.
Feature Options	
Define	Check this box to define a feature for the new chain. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)

Apply	Execute the command. Push this button after all desired components have been stored.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

Note:

The direction of the chain depends on the method of element data input.

- If an element ID is entered via keyboard, the direction of the chain is the same as the direction of the element

.

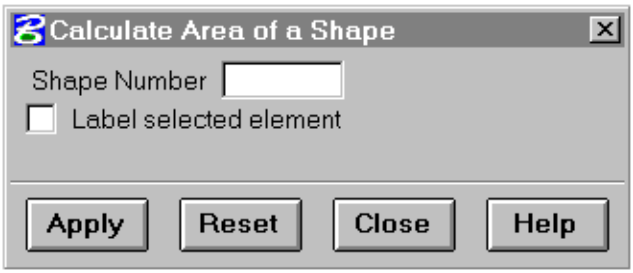
- If a line or arc element is selected from the graphics area, the chain goes from the element endpoint closest to the selected point to the other element endpoint.

- If a chain is selected from the graphics area, the new chain follows the direction of the selected chain.

IGrds fills gaps between elements with line or arc segments. Gaps are distances between elements of 0.0005 feet or greater.

Elevation of the chain elements will be the same as the geometry elements (points, lines, and arcs) that were used to define the chain.

CALCULATE AREA OF A SHAPE

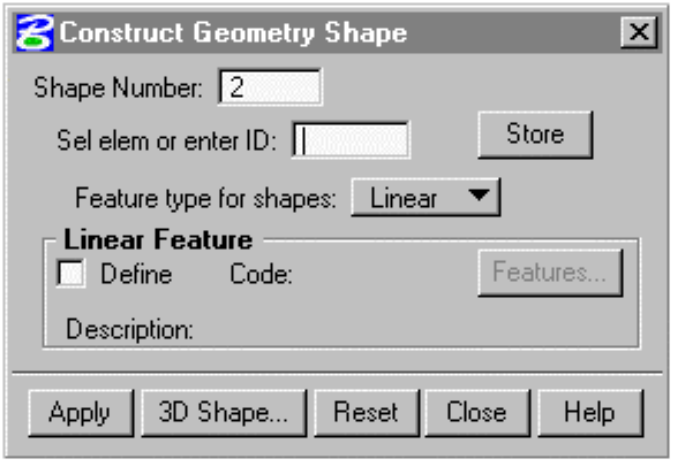


This command calculates the area of a defined IGrds geometry shape and, optionally, labels the shape with the calculated area. The calculated area is based on X,Y (N,E) coordinates only.

This command lists the area of the shape and, for each component, distance, bearing, departure, latitude, X,Y (N,E) coordinates and elevations. For arc components, it also lists arc length, radius, beginning and ending tangent bearings, beginning and ending radial bearings, and central angle. The report is put in the temporary report file (.TMP).

Shape Number	Enter the ID number for the Shape.
Area Labeling Option	Enable this option to label the shape with the calculated area.
Apply	Execute the command. Push this button after all desired components have been stored.
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

CONSTRUCT SHAPE



This command builds an IGrds geometry shape from existing geometric elements (points, lines, arcs, and chains).

Shape Number	Enter the ID number for the new shape to be created. The default number shown is the next available ID number.
Select Element	Select an IGrds geometric or MicroStation element from the graphics area or enter its ID
Store Push Button	Press this button to store a new shape component.
Feature Type Options	
Linear	Select this option to define a Linear feature for the new shape.
Area	Select this option to define an Area feature for the new shape.

Feature Options	
Define	Check this box to define a feature for the new shape. The active linear/area feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear/area feature code.
Description	Displays the description of the active linear/area feature.
Features	Press to display a list of available linear and area features to replace the current active linear/area feature. (See page 4-104)
Apply	Execute the command. Push this button after all desired components have been stored.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

Note:

The direction of the shape depends on the method of element data input.

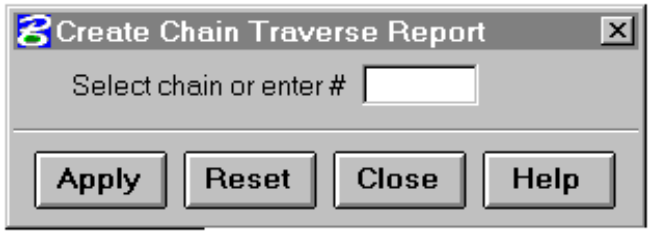
- If an element ID is entered via keyboard the direction of the shape is the same as the direction of the element.

- If a line or arc element is selected from the graphics area, the shape goes from the element endpoint closest to the selected point to the other element endpoint.

- If a chain is selected from the graphics area, the new shape follows the direction of the selected chain. Note: If needed, you can use EDIT chain to reverse the direction of the chain.

IGrds fills gaps between elements with line or arc segments. Gaps are distances between elements of 0.0005 feet or greater.

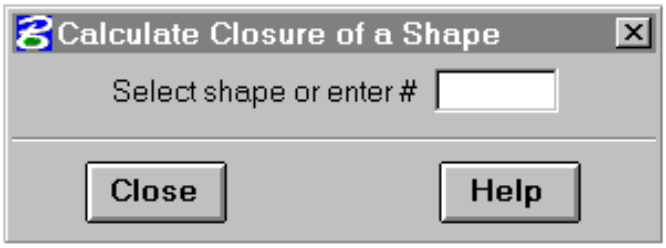
CREATE CHAIN TRAVERSE REPORT



This command lists distance, bearing, arc length, departure, latitude, X,Y (N,E) coordinate, elevations, and radius in a chain. It also lists beginning and ending tangent bearings, beginning and ending radial bearings, and central angle if the component of the chain is arc. IGrds puts the report in the temporary report file (.TMP).

Select Chain	
Select	Select and verify highlighted chain.
or	
Enter	Type Chain ID number.
Close	Close the dialog box
Help	Display Help for this command.

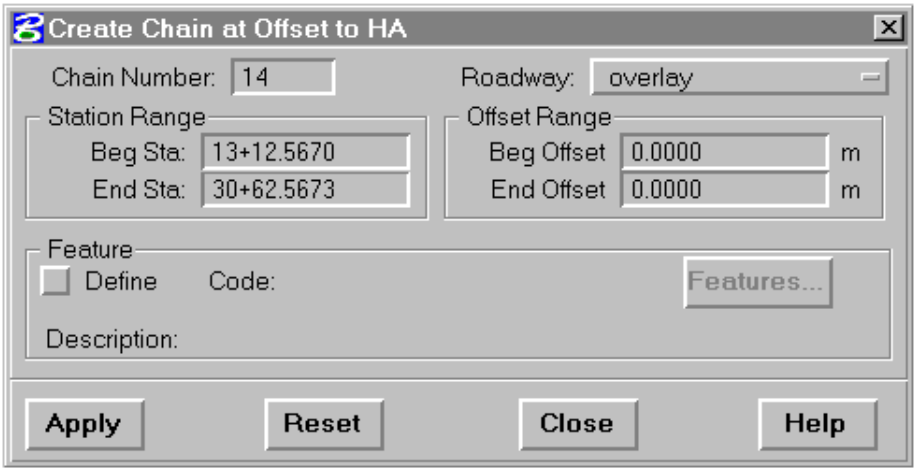
CALCULATE CLOSURE OF A SHAPE



This command computes the closure of an existing shape (latitude error, departure error, and ratio of precision). The calculated closure is based on X,Y (N,E) coordinates only.

Shape Number	Select a shape from the graphics area or enter its number.
Close	Close the dialog box
Help	Display Help for this command.

CREATE CHAIN AT OFFSET TO HORIZONTAL ALIGNMENT

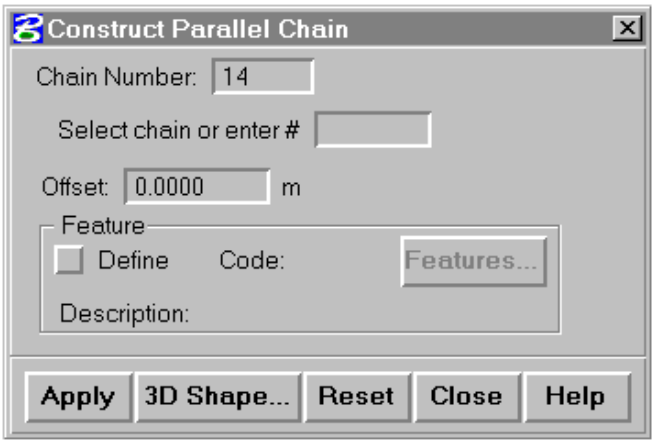


This command builds an IGrds geometry chain at a constantly varying offset to a horizontal alignment between two user-input stations. Spirals and arcs of varying radii are chorded. No elevation value is calculated for the chain.

Roadway	Select the desired roadway. The current active roadway is shown.
Chain Number	Enter the ID number for the new chain to be created. The default number shown is the next available ID number.
Station Range	Enter the beginning and ending stations.
Offset Range	Enter the beginning and ending offsets.
Feature Options	
Define	Check this box to define a feature for the new chain. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)

Apply	Execute the command. Push this button after all desired components have been stored.
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

CONSTRUCT CHAIN PARALLEL TO EXISTING CHAIN

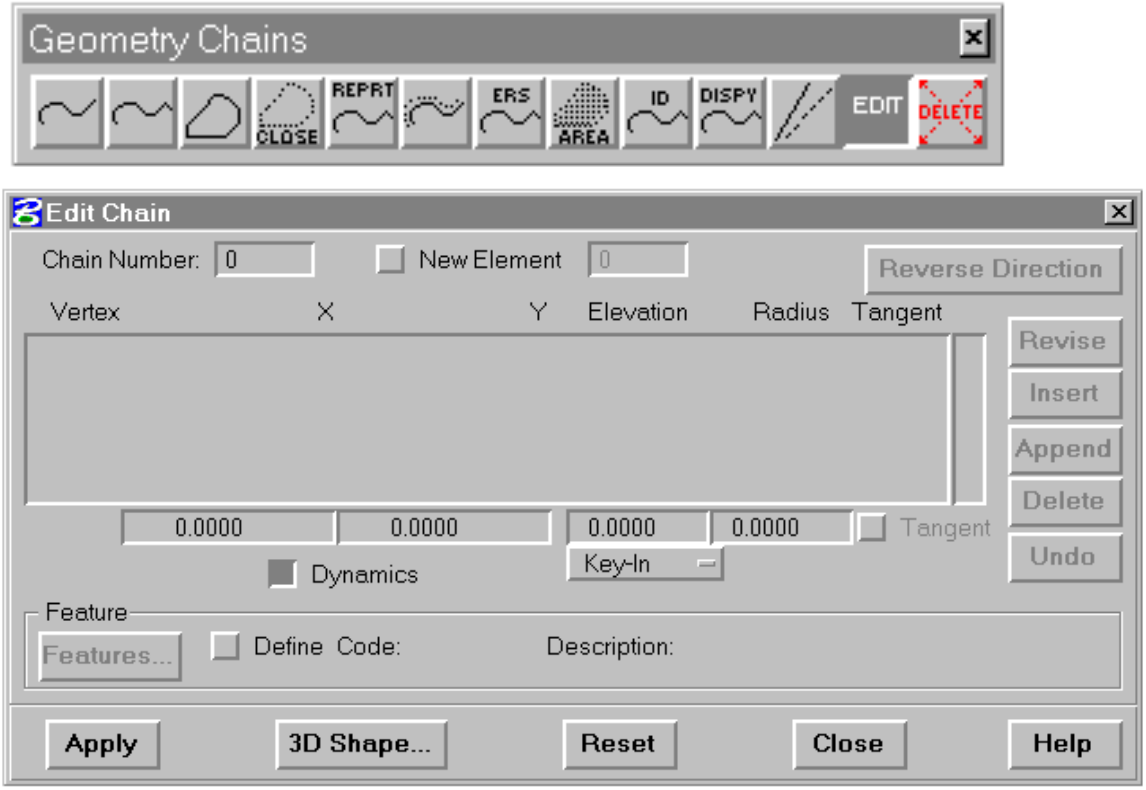


This command constructs an IGrds geometry chain parallel to an existing chain and stores it in the IGrds Geometry file. Perpendicular projections from the original beginning and ending points of the chain bound the constructed chain. Elevation values for the chain components are the same as the reference element.

Chain Number	Enter the ID number for the new chain to be created. The default number shown is the next available ID number.
Element ID	Select an IGrds geometric or MicroStation chain from the graphics area or enter its ID.
Offset	Enter the offset from the selected element. Positive value for right offset and negative for left (based on direction of chain).
Feature Options	
Define	Check this box to define a feature for the new chain. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)

Apply	Execute the command. Push this button after all desired components have been stored.
3D Shape	Click to display the 3D Shape Information dialog box. (See page 4-42)
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

EDIT CHAIN



The edit chain command allows changes to all data describing an existing geometry chain or shape (the term "chain" in this section is equivalent to "chain or shape"). The possible changes include the properties of each component, 3D shape, and feature data. Optionally, the edited chain data can be stored as a new chain. The components of the chain are loaded as a list of vertices. Thus, if the location of a vertex is modified, the end point coordinates of adjacent components are also modified. A temporary display shows the changes to the geometry of the chain. Dynamic editing capabilities using rubber banding are optionally available.

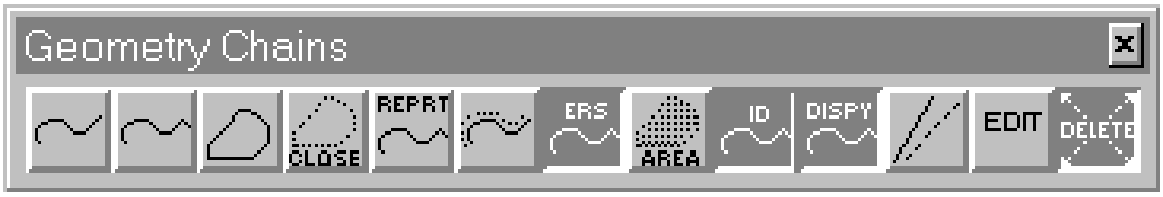
Chain Number	Select the chain to be edited or enter its ID.
New Element	Check this box to save the edited chain data as a new chain. The default new chain ID appears. Enter a new ID if desired.
Reverse Direction	Press this button to reverse the direction of the chain. The last vertex will become the first and all the components of the chain will reverse direction accordingly. This button is enabled when the Dynamics box is unchecked.

Vertex List	The vertex list contains coordinate information for each vertex and curvature information for each arc component. Arc component data appears with coordinates of the start vertex of each arc.
Vertex	This is the order of the vertex within the chain. This value cannot be edited.
Northing or X	This is the north or X coordinate of the vertex. X.
Easting or Y	This is the east or Y coordinate for the vertex. X.
Elevation	This is the elevation of the vertex point.
Radius	Displays the radius of each arc component. Positive radius for curves to the right, negative radius for curves to the left.
Tangent	The word "Tangent" in this field indicates that the corresponding arc must remain tangent to its adjacent components.

Edit Fields	These are fields at the bottom of the vertex list. They display the data corresponding to the currently selected vertex and are used to edit that information.
Planar Coordinates	Enter the X, Y or N, E coordinates or digitize a location. If dynamic editing is enabled, set focus to one of these fields, then click on one of the end points of the chain and move it to a new location. Press the data button to accept the location or the reset button to reject it. This operation does not affect the point elevation.
Elevation Options	Enter or digitize an elevation. If dynamic editing is enabled, set focus to this field, then select one of the end points of the chain and move it to a new elevation. Press the data button to accept the location or the reset button to reject it. This operation does not affect the planar coordinates. Use the active DTM surface elevation at the given X, Y or N, E coordinates. Use the Design Finish Grade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line. Use the Design Subgrade Surface elevation at the given X, Y or N, E coordinates. This surface corresponds to one of the design roadways of the active base line.
Radius	Enter the radius of the arc or digitize a point that defines the new arc location to define the radius. Positive radius for curves to the right, negative radius for curves to the left. If dynamic editing is enabled, set focus to this field, then click on the arc near its midpoint and move it to a new location to define the radius. Press the data button to accept the location or the reset button to reject it.

Tangent	Check this box to enforce tangency between the selected arc and the adjacent components.
Dynamics	Check this box to enable dynamic editing. Uncheck this box to disable dynamic editing and enable the Reverse Direction, Revise, Insert, Append, Delete, Undo, and (if displayed) the All Arcs Tangent buttons.
Revise	Push this button to update the currently selected vertex record with the contents of the edit fields. This button is enabled when the Dynamics box is unchecked.
Insert	Push this button to insert a new vertex before the currently selected vertex or to define an arc at the selected vertex. The new vertex or arc is created using the data contained in the edit fields. If an arc is defined, the arc is tangent to the lines adjacent to the selected vertex. This button is enabled when the Dynamics box is unchecked.
Append	Push this button to add a new vertex after the last vertex of the chain. The new vertex is created using the data contained in the edit fields. This button is enabled when the Dynamics box is unchecked.
Delete	Push this button to delete the currently selected vertex. If this vertex defines an arc, however, the arc is converted into a line component and the vertex is not removed. This button is enabled when the dynamics box is unchecked.
Undo	Push this button to restore the chain to its state before the last Revise operation. This button is enabled when the Dynamics box is unchecked.
All Arcs Tangent	Push this button to force tangency on all arcs of the chain. This button is displayed when the chain contains at least one arc and is enabled when the Dynamics box is unchecked.

Feature Options	
Define	This box is checked if a feature is assigned to the chain. Uncheck this box to remove the feature.
Code	Displays the code of the feature assigned to the chain.
Description	Displays the description of the feature assigned to the chain.
Features	Press to display a list of available linear/area features to replace the feature assigned to the chain. (See page 4-104) This becomes the new active linear/area feature.
Apply	Save the chain data as displayed.
3D Shape	Click to display and edit the 3D Shape Information dialog box. (See page 4-42)
Reset	Discard changes and retrieve the current chain data from the file again.
Close	Close the dialog box.
Help	Display Help for this command.



The following commands are repeated on this palette for convenience. For instructions, refer to the indicated manual pages.

IDENTIFY AND LABEL GEOMETRIC ELEMENTS (Command 473)

This command identifies and labels an IGrds geometric element, and displays information about the element.

See Page 4-62.

DISPLAY IGRDS GEOMETRY FILE (Command 492)

This command retrieves IGrds geometry points, lines, arcs, chains, and shapes from IGrds Geometry files, stores them in the graphics file, and displays them on the graphics screen.

See Page 4-37.

ERASE GEOMETRIC ELEMENTS (Command 496)

This command erases the display of selected IGrds geometry elements from the graphics area.

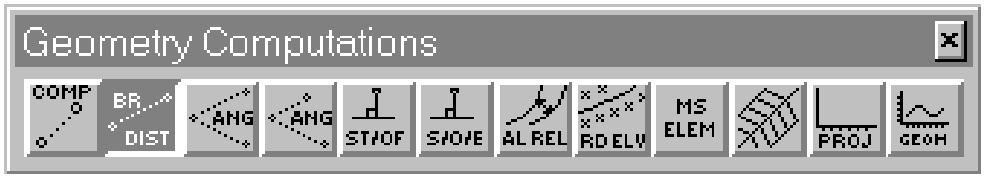
See Page 4-38.

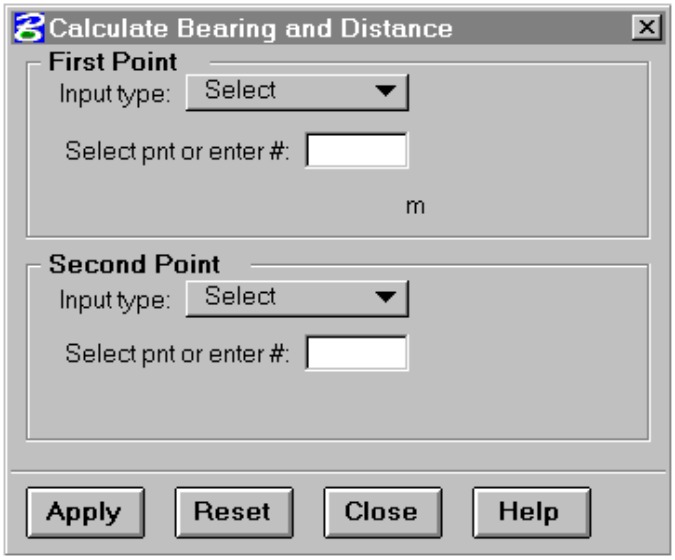
DELETE GEOMETRIC ELEMENT (Command 470)

This command deletes IGrds geometric elements from the IGrds geometry file, and removes their displays from the screen.

See Page 4-39.

CALCULATE BEARING AND DISTANCE

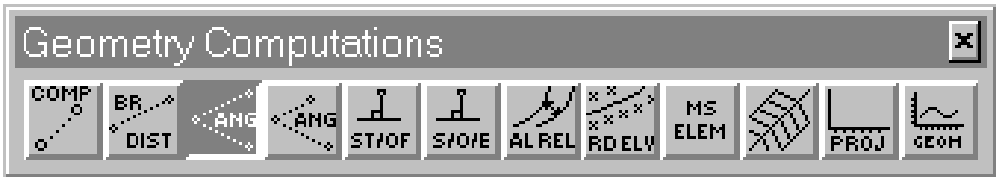


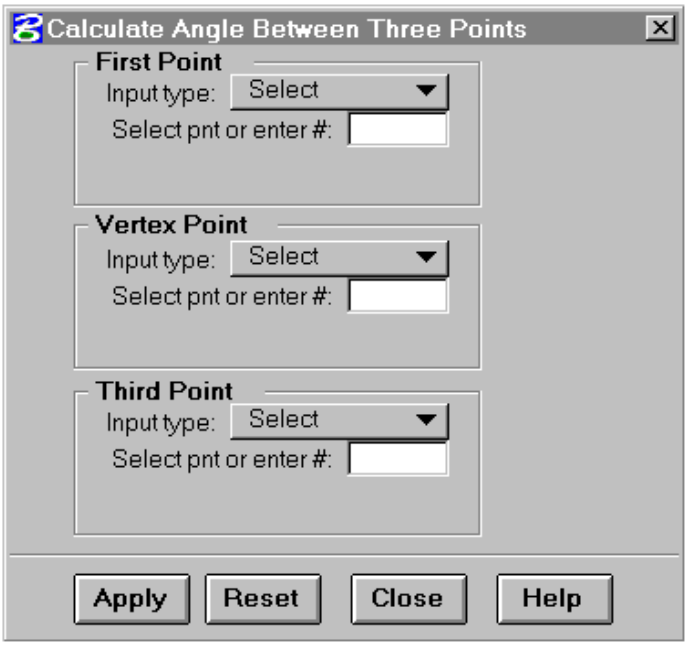


This command calculates the bearing, vertical angle, and slope distance between two defined points. The command uses the second point of the previous calculation as the first point in the next calculation.

First Point Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the new point.
Elevation	Key in an elevation. Use the elevation from the active DTM surface. Use the elevation from the design roadway surface.
Select	Select an existing geometry point in the graphics area or enter its number.
Second Point Options	Follow the instructions for first point.
Apply	Execute the command.
Reset	Erase the input fields.
Close	Close the dialog box.
Help	Display Help for this command.

CALCULATE ANGLE BETWEEN THREE POINTS

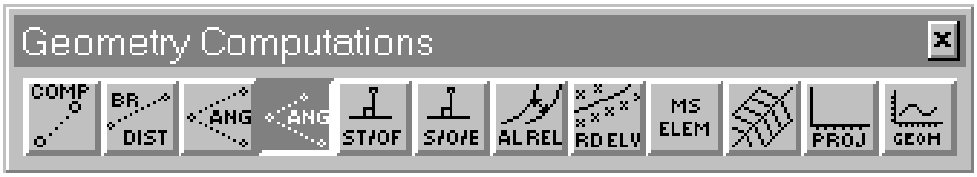


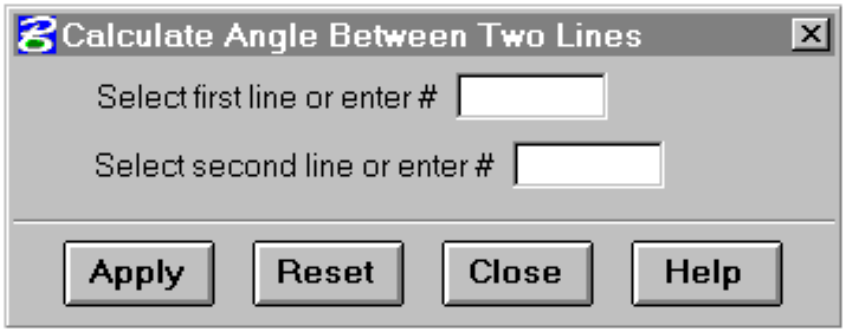


This command calculates and displays the clockwise angle and the counter clockwise angle defined by three specified points. The calculated angle is based on X,Y (N,E) coordinates only.

First Point Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the new point.
Select	Select an existing geometry point on the graphics area or enter its number.
Vertex Point Options	Follow the instructions for first point.
Third Point Options	Follow the instructions for first point.
Apply	Execute the command. Push this button after all desired components have been stored.
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

CALCULATE ANGLE BETWEEN TWO LINES

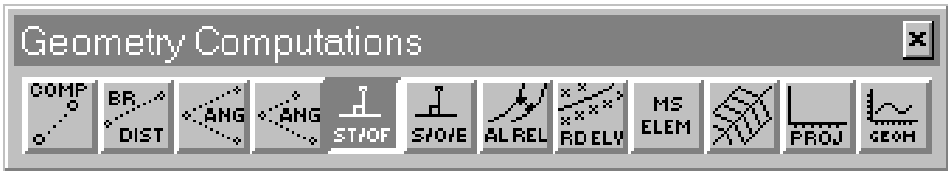


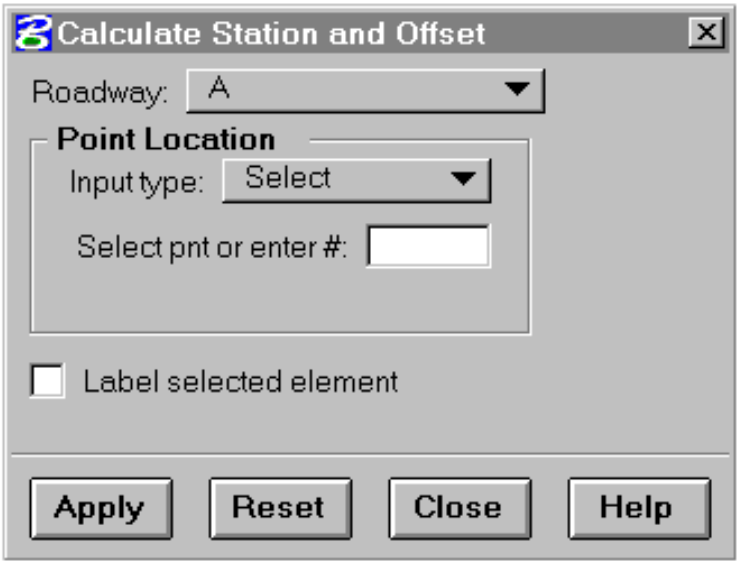


This command calculates and displays the clockwise angle and the counter clockwise angle defined by two specified lines. The calculated angle is based on X,Y (N,E) coordinates only.

First Line	Select an IGrds geometric or MicroStation line from the graphics area or enter its number.
Second Line	Select an IGrds geometric or MicroStation line from the graphics area or enter its number.
Apply	Execute the command.
Reset	Erase the input fields.
Close	Close the dialog box.
Help	Display Help for this command.

CALCULATE STATION AND OFFSET

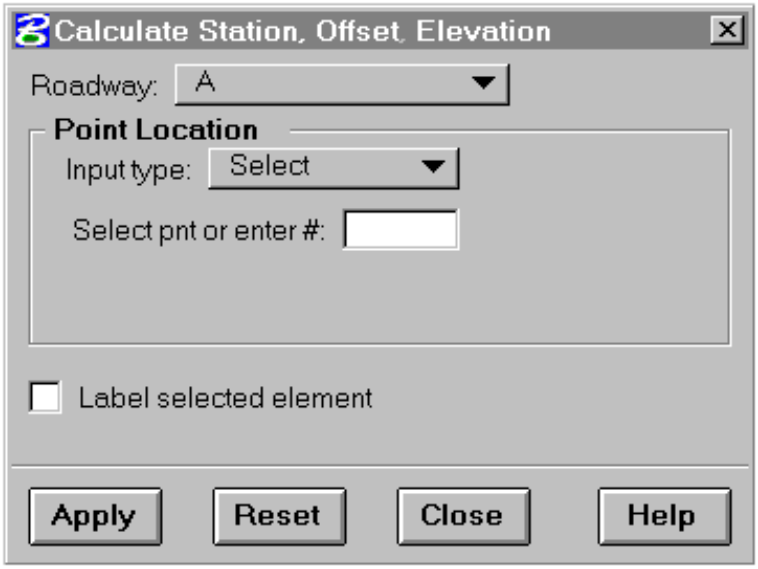




This command computes the station and the offset of a given point relative to a given horizontal alignment and places the station and offset calculation in the form of a text node at a defined location. The text node recognizes IGrds text node parameters and options of LABEL, STACK, LEADER, and TERMINATOR.

Roadway	Select the desired roadway. The current active roadway is shown.
Point Location Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the new point.
Select	Select an existing geometry point on the graphics area or enter its number.
Label Text Node Option	Enable this option to place a label text node containing the station and offset. Then digitize the location of the label.
Apply	Execute the command.
Reset	Erase the input fields.
Close	Close the dialog box.
Help	Display Help for this command.

CALCULATE STATION, OFFSET, AND ELEVATION

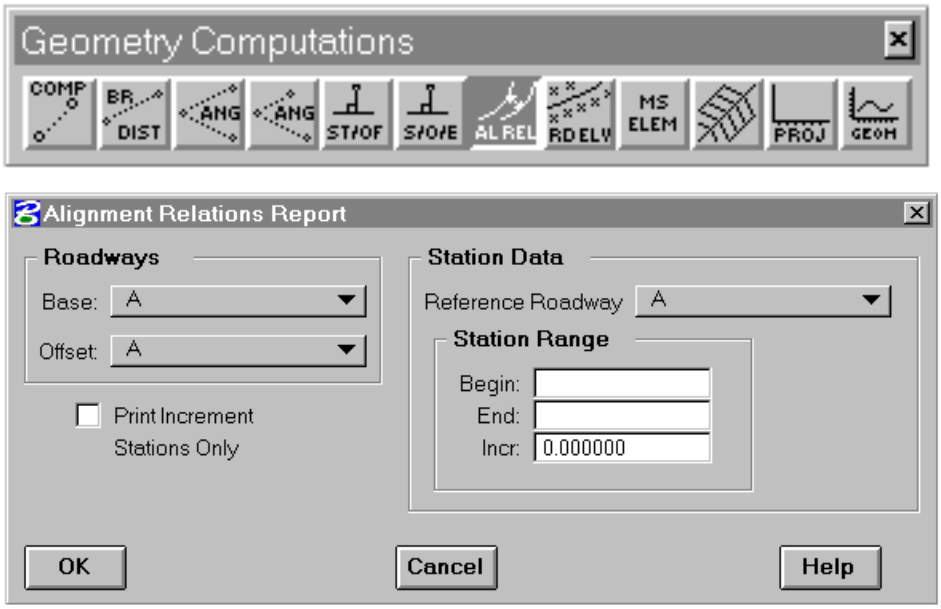


This command computes the station, offset, and elevation of a given point relative to a horizontal alignment and places the results of the calculation in the form of a text node at a defined location. The text node recognizes IGrds text node parameters and options of LABEL, STACK, LEADER, and TERMINATOR.

Roadway	Select the desired roadway. The current active roadway is shown.
Point Location Options	
Coordinates	Enter the X,Y or N,E coordinates or digitize a desired location for the new point.
Elevation	Use the elevation from the active DTM surface. Use the elevation from the design roadway surface.
Select	Select an existing geometry point on the graphics area or enter its number.
Label Text Node Option	Enable this option to place a label text node containing the station, offset, and elevation. Then digitize the location of the label.
Apply	Execute the command.
Reset	Erase the input fields.
Close	Close the dialog box.
Help	Display Help for this command.

Note: Elevations are accurate only between the shoulders of the active roadway.

ALIGNMENT RELATIONS REPORT



The Alignment Relations Report command is used to produce a tabulation of stations, points, offset distances, and skew angles which define the geometric relationships that exist between two alignments at specified stations. A report of these relationships is output to the current temporary file (.tmp).

Either one of the two roadways for which the report is to be generated may be designated as the Base roadway, which then makes the other one the Offset roadway. The relationships that are computed between the two alignments are done so along transverse lines which are always perpendicular to the specified base roadway alignment. The computations that are made can be done for a single station, or over a range of stations. Either one of the two roadways may be designated as the Reference roadway to be used in setting the station range over which the relationships are to be determined. A station increment defines the interval to be used between each transverse computation line.

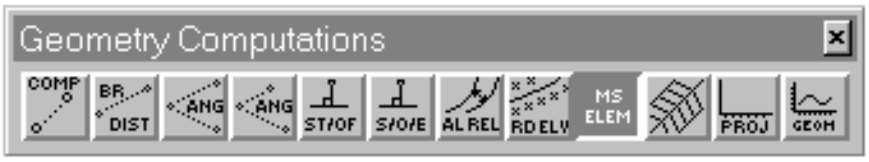
The Alignment Relations Report dialog shown above is accessed by selecting it from the Geometry Computations palette.

Roadways

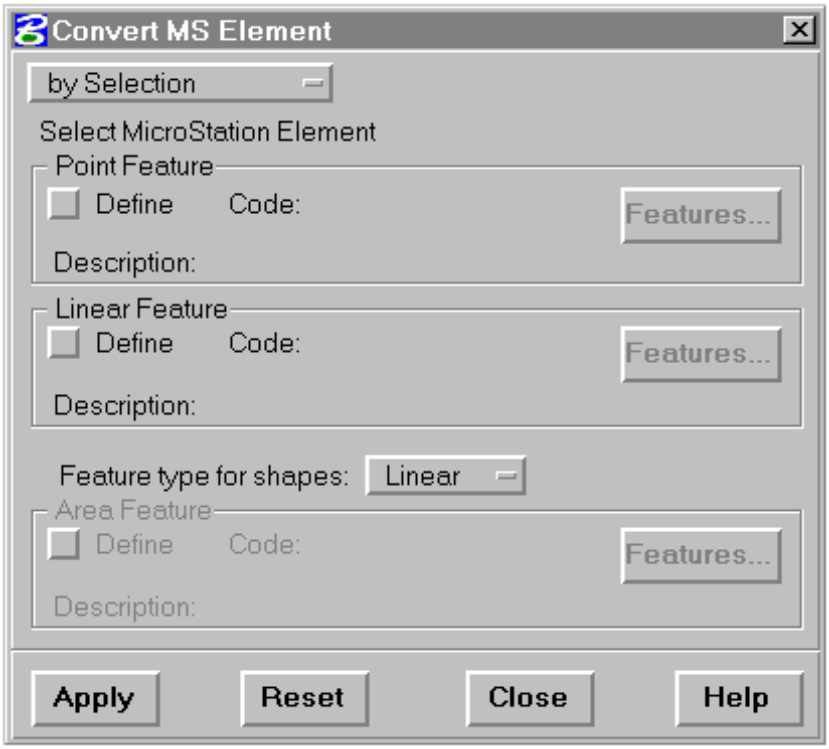
Base Name Button	Select the Base roadway name. The current roadway name is displayed. Click on the Base roadway button and hold the cursor button down to reveal all available roadway names. To select a different roadway, continue holding the cursor button down and move the cursor over the desired name and release the button.
Offset Name Button	Select the Offset roadway name in the same manner as described for the Base roadway. The current name is displayed.

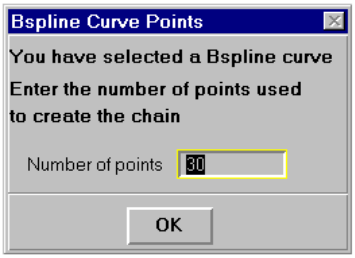
Station Data	
Reference Rdwy Button	Select the name of the roadway that will serve as the station reference roadway for the transverse lines along which the geometry relationships are to be calculated. The current name is displayed. Select the name in the same manner as described for the Base road.
Station Range	
Begin	Enter the beginning station on the Reference alignment where the relation computations are to begin or use the cursor to graphically select this station from the plan display.
End	Enter the ending station on the Reference alignment where the relation computations are to end, or use the cursor to graphically select this station from the plan display. Do not enter data in this field when only a single relationship station is to be determined.
Increment	Enter the station increment to be used in defining the interval of the transverse relationship lines.
Print Increment Stations Only	Click on this toggle button to cause a printout of only those stations that are divisible by the station increment. Default is off for a printout of all stations.
OK	Click on the OK button to produce the Alignment Relations Report.
Cancel	Click on the Cancel button to dismiss this dialog without taking any action.
Help	Click on the Help button to display help for this process.

CONVERT MICROSTATION ELEMENTS



This command will directly convert simple MicroStation graphic elements (points, lines, line strings, arcs, and chains) into IGrds Geometry Elements. Additionally, MicroStation bspline elements can be converted into IGrds chains with user specified number of points. MicroStation Elements can be converted individually or within a fence.





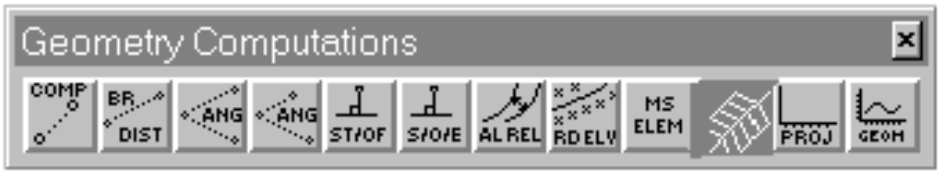
Element Selection Options	
By Selection	Select the MicroStation graphic element to be converted. If the selected element is a bspline, the dialog shown to the left will appear. Enter the number of points to be included in the resultant IGrds chain or select the default of 30. Press OK to execute the command.
With Fence Block	Define a rectangular fence around the elements to be converted.
With Fence Shape	Define an irregular polygon fence around the elements to be converted.

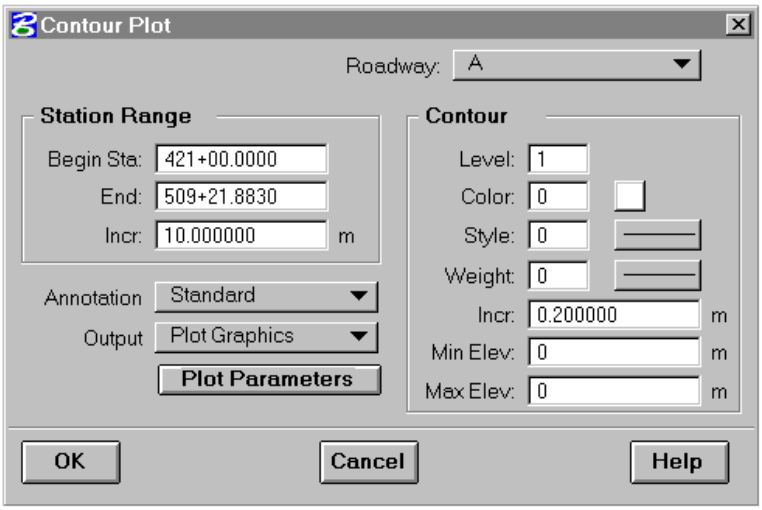
Fence Mode	(This option only appears if fence selection is active.)
Inside	Only convert elements that lie entirely within the fence.
Overlap	Convert elements that lie inside or overlap the fence boundary.
Close Fence	Select this button to generate the last segment of an irregular polygon fence. This option only appears if the Fence Shape option is active.
Point Feature Options	
Define	Check this box to define a feature for new points. The active point feature is displayed if one is defined. Uncheck this box if a feature is not necessary for new points.
Code	Displays the active point feature code.
Description	Displays the description of the active point feature.
Features	Press to display a list of available point features to replace the current active point feature. (See page 4-104)
Linear Feature Options	
Define	Check this box to define a feature for new lines. The active linear feature is displayed if one is defined. Uncheck this box if a feature is not necessary for new lines.
Code	Displays the active linear feature code.
Description	Displays the description of the active linear feature.
Features	Press to display a list of available linear features to replace the current active linear feature. (See page 4-104)

Feature Type for Shape Options	These options are applicable only if MicroStation shape elements are going to be converted to IGrds shapes.
Linear	Select this option to assign the feature specified under Linear Feature Options to the new shape.
Area	Select this option to assign an area feature to the new shapes. This option enables the Area Feature options.
Area Feature Options	
Define	Check this box to define a feature for new shapes. The active area feature is displayed if one is defined. Uncheck this box if a feature is not necessary for new lines.
Code	Displays the active area feature code.
Description	Displays the description of the active area feature.
Features	Press to display a list of available area features to replace the current active area feature. (See page 4-104)
Apply	Execute the command.
Reset	Erase the input fields.
Close	Close the dialog box.
Help	Display Help for this command.

Note: Care should be taken when using the fence options of this command. For example, in the areas of alignments, alignment tics are MicroStation Line Elements and will be converted if they are within or on the fence (overlap option).

ROADWAY SURFACE CONTOURS





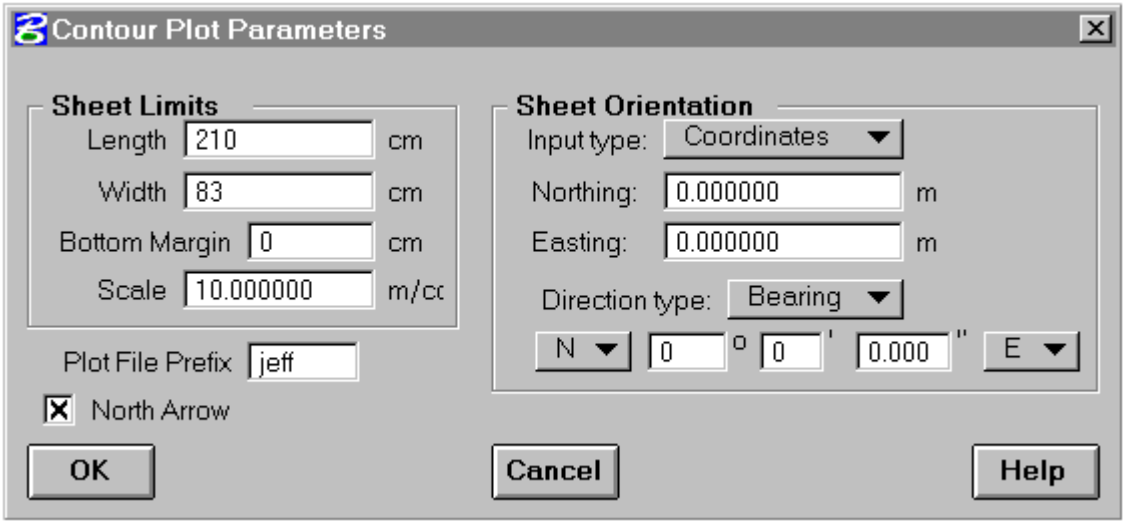
This command will plot roadway surface (shoulder point to shoulder point) contours for specified limits of a roadway. This command uses vertical alignment, templates, geometric template modification, widening, and super-elevation and not the design cross data to compute the contours. This command should be used only for small portions of a roadway, not the entire roadway.

Roadway	Select the desired roadway. The current active roadway is shown.
Station Range	
Begin Sta.	Enter the beginning station for roadway surface contours. The default station is the beginning station of the horizontal alignment.
End	Enter the ending station for roadway surface contours. The default station is the ending station of the horizontal alignment.
Incr.	Enter a station increment to specify the interval at which elevations are to be calculated for the contour interpolation. Since the contours are plotted as straight lines between interpolated points, the accuracy of the contour is dependent on the interval at which elevations are calculated.

Annotation	
Standard	Labels beginning station of contours, draws contours with contour numbers, and the 'X' symbol will be plotted to identify the ridge points on the roadway surface.
Station Elev Summary	Labels beginning station of contours and draws contours with contour numbers.
Beginning Station	Labels beginning station of contours and draws contours with no contour numbers.
Output	
Active Graphics	Annotation will be done in current graphics file.
Plot Graphics	Annotation will be done in a separate plotting graphics file.
Plot Parameters	This option button will be displayed when the PLOT GRAPHICS option is chosen. Click to display the Contour Plot Parameters dialog box. (See Page 4-99)
Contour	
Level	Enter the level on which the contour is to appear. The default level is shown.
Color	Enter the number of or select the color to be applied to the contour line.
Style	Enter the number of or select the line style to be used for the contour line.
Weight	Enter the number of or select the line weight to be used for the contour line.
Incr.	Enter the contour increment.
Min Elev.	Enter the minimum contour elevation. If not used, it is set to 0.
Max Elev.	Enter the maximum contour elevation. If not used, it is set to 0.

OK	Click to execute the process.
Cancel	Click to cancel the dialog box.
Help	Click to display help for the process.

CONTOUR PLOT PARAMETERS

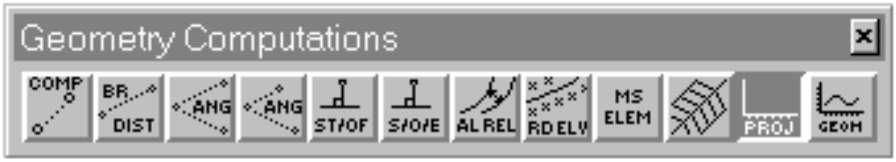


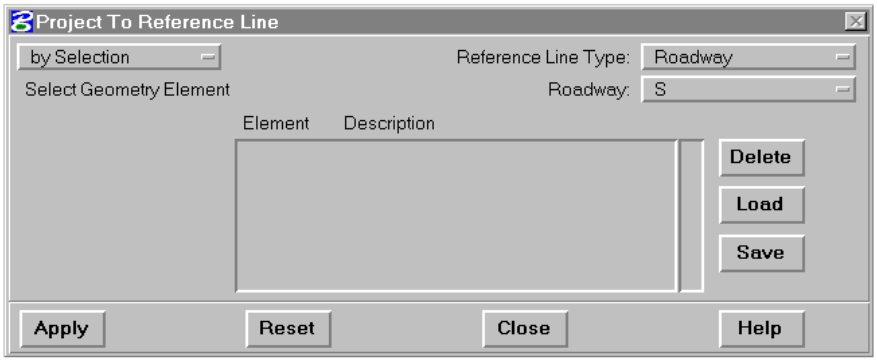
This dialog box appears when the Contour Plot Parameters Option button is selected on the Roadway Surface Contours dialog box. This dialog provides for selecting parameters for the contour plotting sheet.

Sheet Limits	
Length	Enter the length of the plotting sheet.
Width	Enter the width of the plotting sheet.
Bottom Margin	Enter the bottom margin at which the plot will begin.
Scale	Enter the scale of the plot.
Plot File Prefix	Enter the plot file prefix. The default plot file prefix will be the first three letters of the working files. The file name will be xxxplt.dgn.
North Arrow	An 'X' in the box eliminates the north arrow and heading.
Sheet Orientation	
Input Type	
Coordinates	Enter the coordinates of the lower left corner of the plotting sheet.
Select	Select point or enter point number of the lower left corner of the plotting sheet.

Direction Type	
Bearing	Enter the bearing for the direction of the length of the plotting sheet.
Azimuth	Enter the azimuth for the direction of the length of the plotting sheet.
Skew	Enter the skew for the direction of the length of the plotting sheet.
Line	Select line or enter line number for the direction of the length of the plotting sheet.
OK	Click to save current parameters.
Cancel	Click to cancel subprocess without changing parameters.
Help	Click to display Help for the subprocess.

PROJECT TO REFERENCE LINE



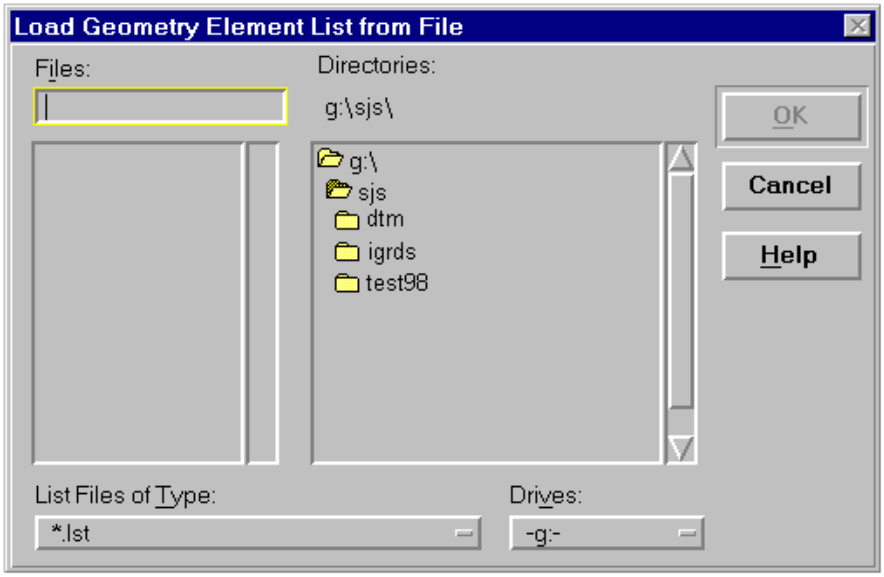


This command allows for the projection of 3D geometry elements into the reference line of the selected roadway. The elements can be selected from the graphic area or recalled from a saved list. The selected elements are projected into the reference line in true relationship to the reference alignment.

Roadway	Select the desired roadway. The current active roadway is shown.
Element Selection Options	By Selection - Point at the element in the graphic area. The element is added to the list box upon confirmation. With Fence Block - Define a rectangular fence in the graphic area. All elements within the fence are added to the list box. With Fence Shape. Define an irregular fence in the graphic area. All elements within the fence are added to the list box.
List Box Options	
Delete	Click to delete the highlighted record from the selection list.
Load	Click to load the list box from a saved file. (See Load Geometry Element List from File, page 4-102).
Save	Click to save the list box elements to a file. (See Save Geometry Element List to File, page 4-102).

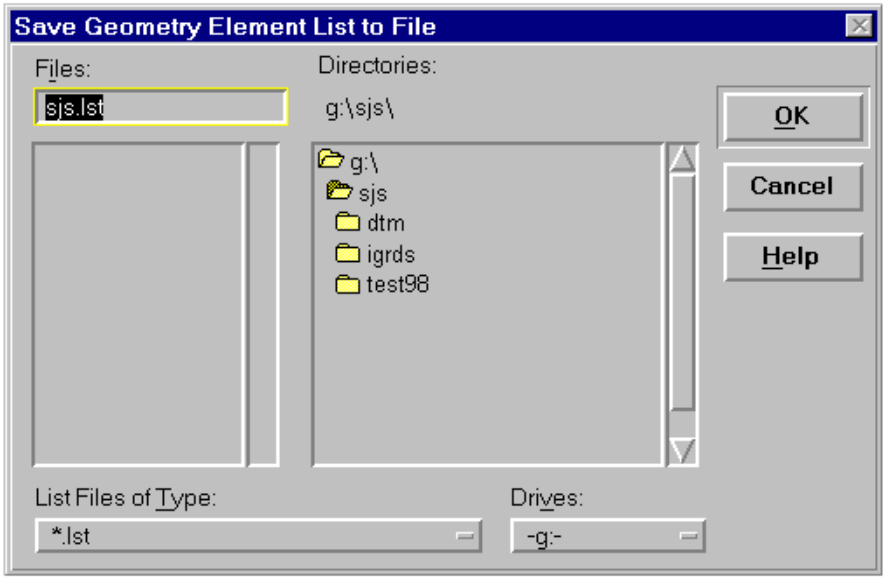
Apply	Execute the command.
Reset	Erase the input fields.
Close	Close the dialog box.
Help	Display Help for this command.

Load Geometry Element List From File



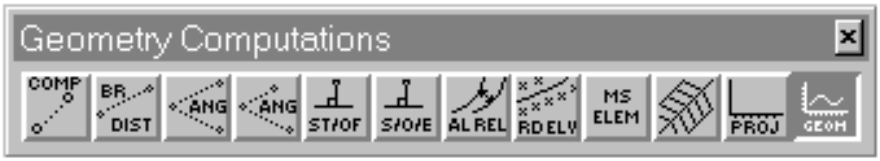
This dialog box is activated when the Load... action button is clicked on the Project to Reference Line Tool Box. It is a standard file open box with .lst as the filter. Select the appropriate file and click OK to load the file into the list box in the Reference Line Tool Box. The contents of the file are appended to the list.

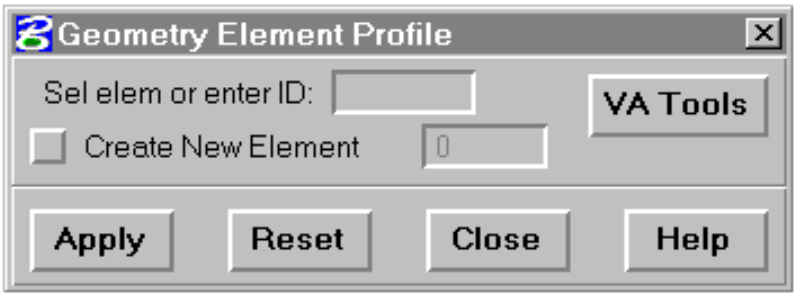
Save Geometry Element List to File



This dialog box is activated when the Save ... action button is clicked on the Project to Reference Line Tool box. It is a standard Save As dialog with .lst as the filter. The name of the working file with .lst as an extension is the default name. When satisfied with the name and directory, click OK to save the contents of the list box in the Reference Line Tool Box to a file.

GEOMETRY ELEMENT PROFILE



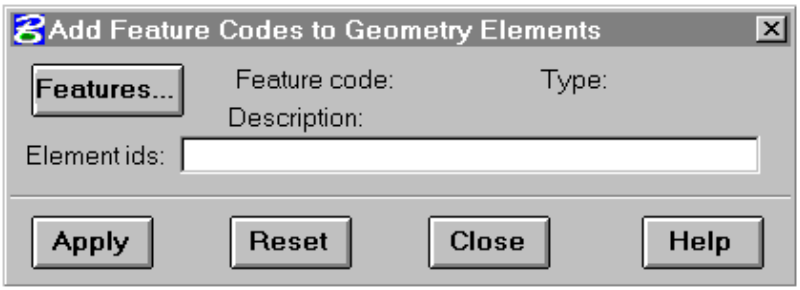


This command allows the user to designate a linear Geometry element (line, arc, chain, or shape) as having a profile associated with it. If desired, a new coincident Geometry element can be created to serve as the profiled element. All VA and Geometry commands can be used and base their computations on the profile data associated with the Geometry element.

Element ID	Select a geometric element (line, arc, chain or shape) or MicroStation element in the graphics area or enter its ID. Example: A23
Create New Element	Enable this option if it is desired to create a new Geometry element coincident with the selected element. The new element will have a profile associated with it, the selected element will not.
VA Tools	Press the VA Tools push button to display the Vertical Alignment command frame.
Apply	Execute the command.
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

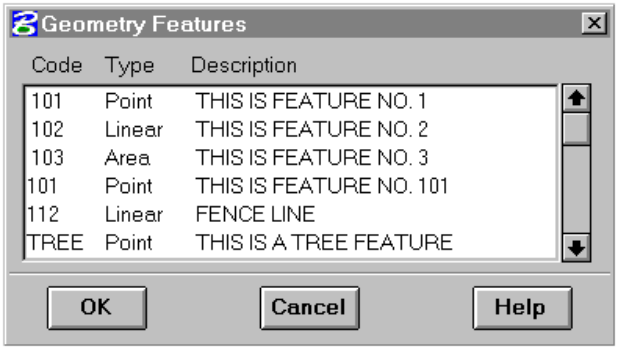
ADD FEATURE CODES TO GEOMETRY ELEMENTS

This command associates a feature code with one or more general geometry elements. The feature code is selected from the feature table. The elements associated with the feature must be compatible (linear elements for a linear feature, etc.). The most recent association is retained if more than one feature is assigned to the geometry element.



Feature Selection	Press the Features push button to display the feature table and select the desired feature. When a feature is selected, the feature code, type, and description are displayed for reference. The Geometry Features display is shown on page 4-104.
Element List	Select the desired elements (points, lines, or arcs) on the graphics area or enter the list of element IDs. The list can contain individual element IDs or ranges of IDs.
Apply	Execute the command.
Reset	Erase the input fields.
Close	Close the dialog box.
Help	Display Help for this command.

GEOMETRY FEATURES



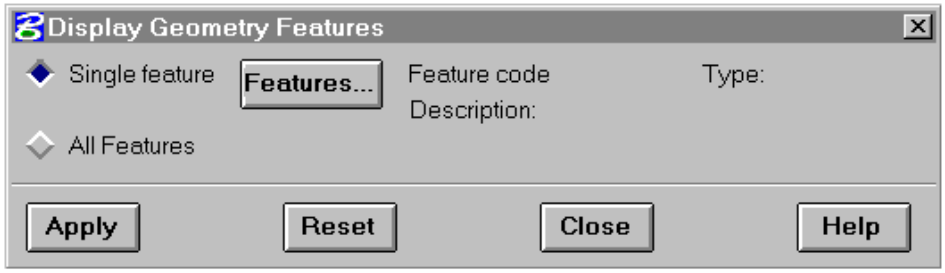
Geometry Features consist of data that specifies the display attributes of selected geometric elements in the IGRDS data base. This information is stored in the feature table, which is a file indicated by the environment variable IGRDS_FEATURE.

Use the scroll bar to locate the desired feature. Then select the desired feature with the mouse.

OK	Use the selected feature.
Cancel	Disregard the selected feature and close the dialog box.
Help	Display Help for this command.

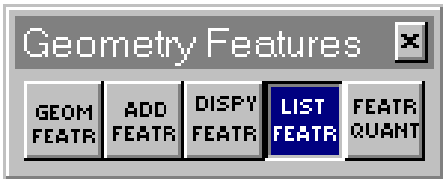
DISPLAY GEOMETRY FEATURES

This command displays geometry elements which have been previously associated with specified features. The elements are displayed using the symbology defined in the feature table.

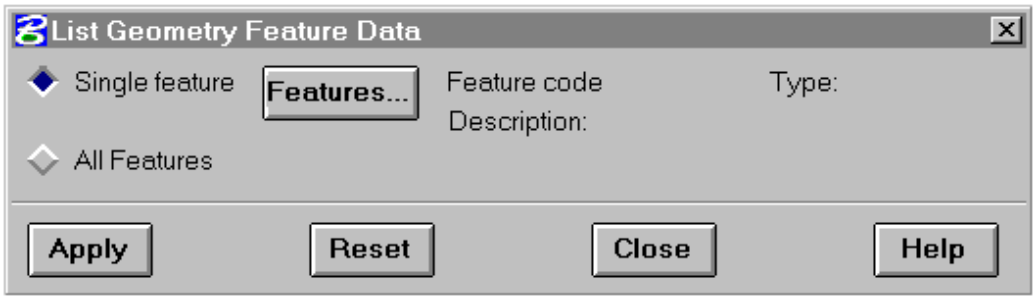


Options	
Single Feature	Select this option to display elements associated with a single feature.
All Features	Select this option to display all geometry elements associated with features.
Feature Selection	Press the Features push button to display the feature table and select the desired feature. When a feature is selected, the feature code, type, and description are displayed for reference. The Geometry Features display is shown on page 4-104.
Apply	Execute the command.
Reset	Erase the input fields.
Close	Close the dialog box.
Help	Display Help for this command.

LIST GEOMETRY FEATURE DATA



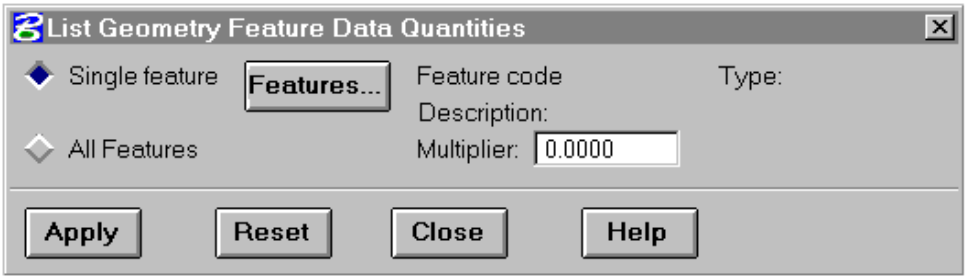
This command lists geometry elements which have been previously associated with specified features. The list is sorted by feature and subsorted by geometry element type. The resulting report is provided in the temporary report file (.TMP).



Options	
Single Feature	Select this option to display elements associated with a single feature.
All Features	Select this option to display all geometry elements associated with features.
Feature Selection	Press the Features push button to display the feature table and select the desired feature. When a feature is selected, the feature code, type, and description are displayed for reference. The Geometry Features display is shown on page 4-104.
Apply	Execute the command.
Reset	Erase the input fields.
Close	Close the dialog box.
Help	Display Help for this command.

LIST GEOMETRY FEATURE DATA QUANTITIES

This command lists the geometry elements and quantities which have been previously associated with specified features. The list is sorted by feature and subsorted by geometry element type and the quantities are computed in user-defined units. The resulting report is provided in the

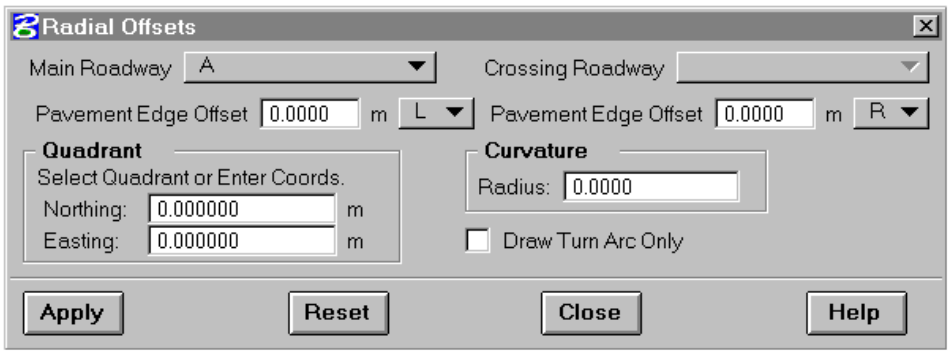


Options	
Single Feature	Select this option to produce a report showing elements associated with a single feature.
All Features	Select this option to produce a report showing all geometry elements associated with features.
Feature Selection	Press the Features push button to display the feature table and select the desired feature. When a feature is selected, the feature code, type, and description are displayed for reference.
Multiplier	Enter the multiplier used to override the multiplier stored in the feature table for the selected feature. Leave the value 0.00 to use the multiplier stored in the feature table.
Apply	Execute the command.
Reset	Erase the input fields.
Close	Close the dialog box.
Help	Display Help for this command.

AUTOMATIC ELEMENT LABELING SWITCH

This command is now part of the Geometry Settings command.

RADIAL OFFSETS



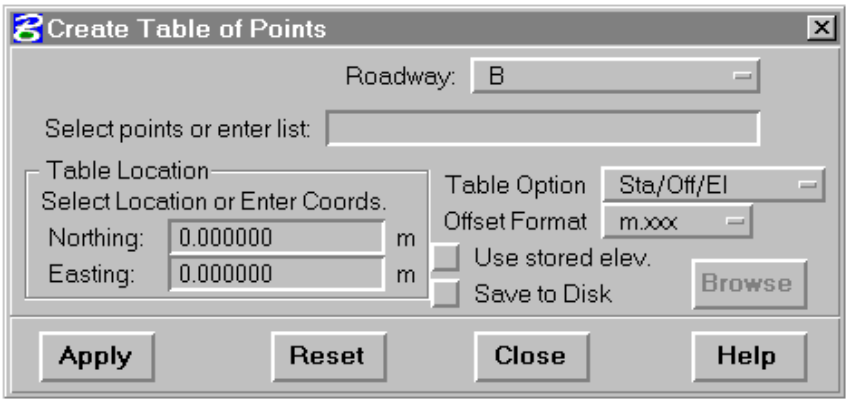
This command provides for the design and display of roadway intersection flare areas or turning arcs. Acceptable designs are stored in the IGrds design files as chains. Since these chains form enclosed shapes, their areas can be computed by the Calculate Area of a Shape command. In addition, if a flare area design is not wanted, the option button may be used to display only the turning arc based on quadrant selection, and offset and radius values entered.

An output record containing the stations and offsets of the beginning and ending points of the turning arc relative to their respective roadway, plus the radius of the arc, and the arc and long chord lengths is automatically placed in the .tmp file during each execution of this command.

Main Roadway	Select the desired roadway. The current active roadway is shown.
Pavement Edge Offset	Enter the offset distance to the edge of pavement or the point of tangency of the turning arc along the main roadway. (Zero offset values are permitted.)
Pavement Edge Offset Direction Option	Select one of the two pavement edge offset direction options (L or R) indicating to which side of the roadway baseline the offset applies. • Select L to indicate that the pavement edge offset distance is measured to the left of the roadway baseline. • Select R to indicate that the pavement edge offset distance is measured to the right of the roadway baseline.

Crossing Roadway	Select the desired roadway. The current active roadway is shown.
Pavement Edge Offset	Enter the offset distance to the edge of pavement or the point of tangency of the turning arc along the crossing roadway.
Pavement Edge Offset Direction Option	Select the pavement edge offset direction option as explained for the Main roadway above.
Quadrant	Select Quadrant or Enter Coordinates: Select Use the cursor to digitize a point in the quadrant of the intersection where the design is to apply. (The coordinates of this point will appear in the NE input boxes.) Northing Enter the Northing value of the coordinate point used to indicate the design quadrant. Easting Enter the Easting value of the coordinate point used to indicate the design quadrant.
Curvature	Radius Enter the value of the radius of the arc that defines the turning arc, curb, or edge of pavement forming the flare area in the quadrant being designed.
Draw Turn Arc Only	Depress the option button to cause a display of the turning arc only. Release the option button to display the flare area design.
Apply	Execute the command with the given data.
Reset	Erase the input fields.
Close	Close the dialog box.
Help	Display Help for this command.

CREATE TABLE OF POINTS

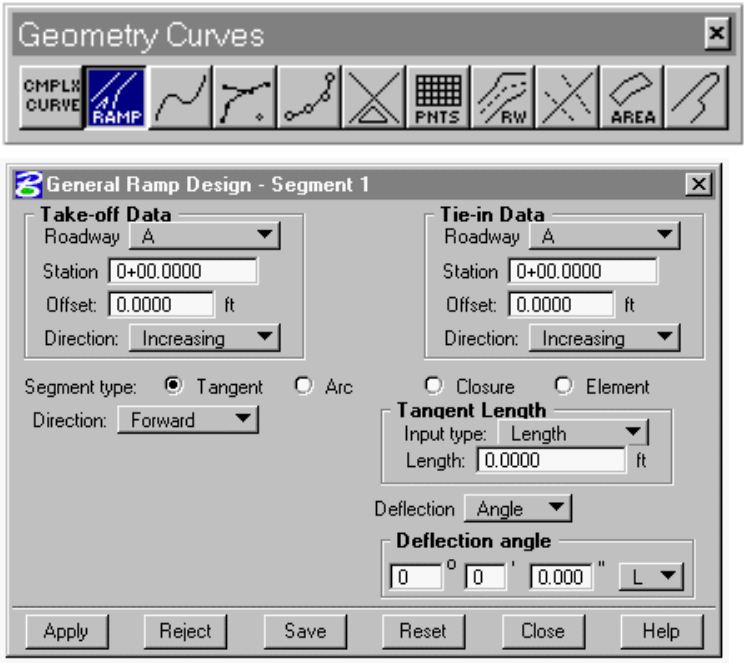


This command generates a table of geometry points in one of six pre-defined formats. Geometry points are added to the table by selection and/or keying. A fixed pitch font must be active in order to use this command.

Roadway	Select the roadway to which station and offset data presented in the table will be related.
Select Items or Enter List	Select a graphic point (its number will appear in the input list), or enter a point number or range of point numbers. Repeat this process until a complete input list is defined.
Table Option	Select one of the Table content options: Sta/Off/El, Sta/Off, NE/Sta/Off/El, NE/Sta/Off, NE, NE/El.
Sta/Off/El	This option creates a point table that will list station, offset, elevation data for the specified points.
Sta/Off	This option creates a point table that will list station and offset data for the specified points.
NE/Sta/Off/El	This option creates a point table that will list Northing, Easting, station, offset, elevation data for the specified points.
NE/Sta/Off	This option creates a point table that will list Northing, Easting, station, and offset data for the specified points.

NE	This option creates a point table that will list Northing and Easting data for the specified points.
NE/El	This option creates a point table that will list Northing, Easting, and elevation data for the specified points.
Offset Format Options	Select one of the output Format options: ft.xxxx, ft-in.
ft.xxxx	Select this option to output the point table data in feet and decimal fraction format.
ft-in	Select this option to output the point table data in feet and inches format.
Use Stored Elev.	Enable this option to use the stored elevation of a point. If this option is not enabled, then it will use the elevation from the design roadway surface. (Elevations are accurate only between the shoulders of the active roadway. The elevation stored in the geometry file does not change.)
Save to Disk	Enable this option to allow the table of points to be exported as an ASCII file.
Browse	Select Browse to select/enter the file in which to save the table of points.
Select Table Location	Digitize a point in the graphics area that will set the origin of the table. (The origin of the table is its upper left hand corner.)
Apply	Execute the command with the given data.
Reset	Reset the input field to its previous condition.
Close	Close the dialog box.
Help	Display Help for this command.

GENERAL RAMP DESIGN



Selection of the Ramp icon on the Geometry Curves palette opens the General Ramp Design dialog box shown at the left.

This command permits the interactive design of roadway interchange loops and ramps of any configuration. Included in the command are constructs for creating and interconnecting tangents, simple curves, three-center compound curves, three-center curves with the center curve reversed, five-center compound curves with the center curve reversed and fitted around an inner loop, and reverse curves. In addition, a previously defined line, arc, or chain can be used as a take-off or tie-in segment.

A ramp roadway is created by sequentially connecting ramp segments consisting of arcs, tangents, or predefined elements as mentioned above. The segments may be created in a forward or reverse direction, that is, starting at the take-off point and proceeding to the tie-in point, or vice versa, or in a combination of the two methods. At some point, however, a final gap of unknown distance will be left to close. To complete the design through such a gap, the command provides the means to define a Closure section which can consist of a simple tangent, curve, reverse curve, or multi-center curves. Ramp designs are limited to ninety-nine (99) segments.

This command also provides an edit capability for modifying a design after it is completed, or during its creation where segments to be changed fall before the current segment, and effecting such a change, would mean rejecting all segments added to get back to the one requiring a change. This is done by selecting the Segments option which will appear on the General Ramp Design menu after the first segment has been created with Apply. The Segments option is described at the end of the basic General Ramp Design menu descriptions which follow.

Take-Off Data	Select and enter data that will define the location of the take-off point: Roadway, Station, Offset.
Roadway	Select the roadway from which the ramp will depart. The current roadway is shown.
Station	Enter the station on the take-off roadway where the ramp will begin.
Offset	Enter the offset distance to the take-off point at the take-off station. (Offsets to the right of the roadway alignment are positive, and to the left negative, as viewed in the direction of increasing stationing. Zero value offsets are also permitted.)
Direction	Select the take-off direction for the ramp: Increasing, Decreasing. Increasing: Selecting Increasing if the ramp takes off in the direction of increasing roadway stations. Decreasing: Select Decreasing if the ramp takes off in the direction of decreasing roadway stations.
Tie-in Data	Select and enter the data that will define the location of the tie-in point: Roadway, Station, Offset.
Roadway	Select the roadway on which the ramp will terminate. The current roadway is shown.
Station	Enter the station on the tie-in roadway where the ramp will end.
Offset	Enter the offset distance to the tie-in point at the tie-in station. (Observe the sign of the offset as defined previously for the take-off point data.)

Direction	Select the tie-in direction for the ramp: Increasing, Decreasing. Increasing: Selecting Increasing if the ramp ties in the direction of increasing roadway stations. Decreasing: Select Decreasing if the ramp ties in the direction of decreasing roadway stations.
Segment Type	Select the type of ramp segment to be defined: Tangent, Curved, Closure.
Tangent	Depress the **Tangent** radio button if a tangent ramp segment is to be defined. The Ramp Design menu will change to provide for the definition of a tangent line.
Arc	Depress the **Arc** radio button if a curved ramp segment is to be defined. The Ramp Design menu will change to provide for the definition of a curved line.
Closure	Depress the **Closure** radio button if the closure segment of the ramp is to be defined. The Ramp Design menu will change to provide for the selection of the type of closure segment to be defined.
Element	Depress the **Element** radio button if a predefined element is to be used as a take-off or tie-in segment.
Direction	Select the direction that the next segment will go: Forward, Reverse.
Forward	Select this option to create a ramp segment that connects to the last forward segment added, or the take-off point if this is the first forward segment.
Reverse	Select this option to create a ramp segment that connects to the last reverse segment added, or the tie-in point if this is the first reverse segment.

Tangent Option Menu Inputs

Tangent Length This data defines a tangent segment: Tangent Length, Deflection Angle.

Input Type Select the method of defining the tangent length: Length, Point.

Length Selecting the Length option causes the Length input box to appear. Enter the desired tangent segment length.

Point Selecting the Point option causes the display of the following message: "Digitize approximate end point." Follow this direction to set an approximate length for the tangent line.

Deflection Options

Angle Enter the direction angle in degrees, minutes, and seconds, and select the direction (Left or Right) of the rotation to be applied to the tangent line at its beginning. Note that clockwise rotations are considered Right, while counter-clockwise rotations are Left.

Taper Enter the taper ratio. For example, if the taper is 12:1, enter 12. Then select the direction (L or R).

Line Select a line whose slope will be used as the slope of the new segment.

Arc Option Menu Inputs

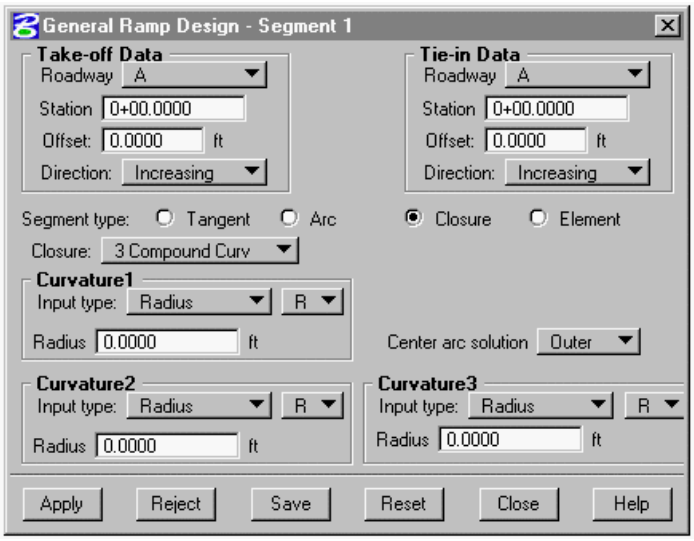
Curve Length This data defines an arc segment: Curve Length, Curvature, Deflection Angle.

Length Selecting the Length option causes the Length input box to appear. Enter the desired curved segment length. See Note 7.

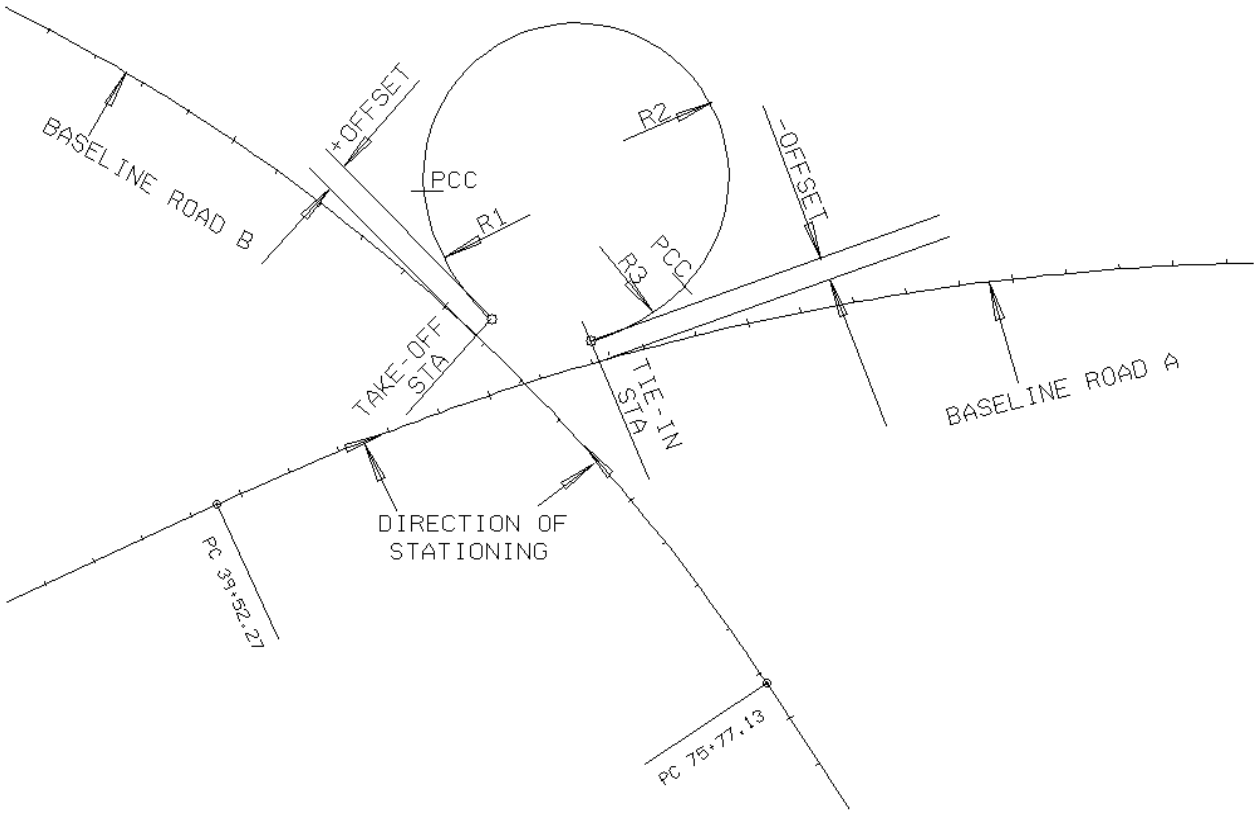
Point Selecting the Point option causes the display of the following message: "Digitize approximate end point." Follow this direction to set an approximate length for the curved line.

Curvature and Direction	Select the method for defining the curve and set its direction: Radius, Degree of Curve, Arc, Left, or Right.
Direction Option	Select the direction option, L or R, to specify in which direction the curve is to turn.
Radius	Enter the radius of the curved segment in the Radius input box.
Degree of Curve	Enter the degree of curve in the degree, minute, and second input boxes.
Arc	Select a geometry arc with an equivalent radius (number will appear in the input box) or enter the number of the arc in the input box.
Deflection Options	
Angle	Enter the direction angle in degrees, minutes, and seconds, and select the direction (Left or Right) of the rotation to be applied to the tangent line at its beginning. Note that clockwise rotations are considered Right, while counter-clockwise rotations are Left.
Taper	Enter the taper ratio. For example, if the taper is 12:1, enter 12. Then select the direction (L or R).
Line	Select a line whose slope will be used as the slope of the new segment.
Closure Option Menu Inputs	
Closure Type	Select the method of closure: Tangent Line, Simple Curve, 3 Compound Curves, 3 Curves Center Reversed, 5 Curves Center Fitted, Reverse Curves.
Tangent Line	No input data is required. This option closes the gap with a straight line. See Note 1.

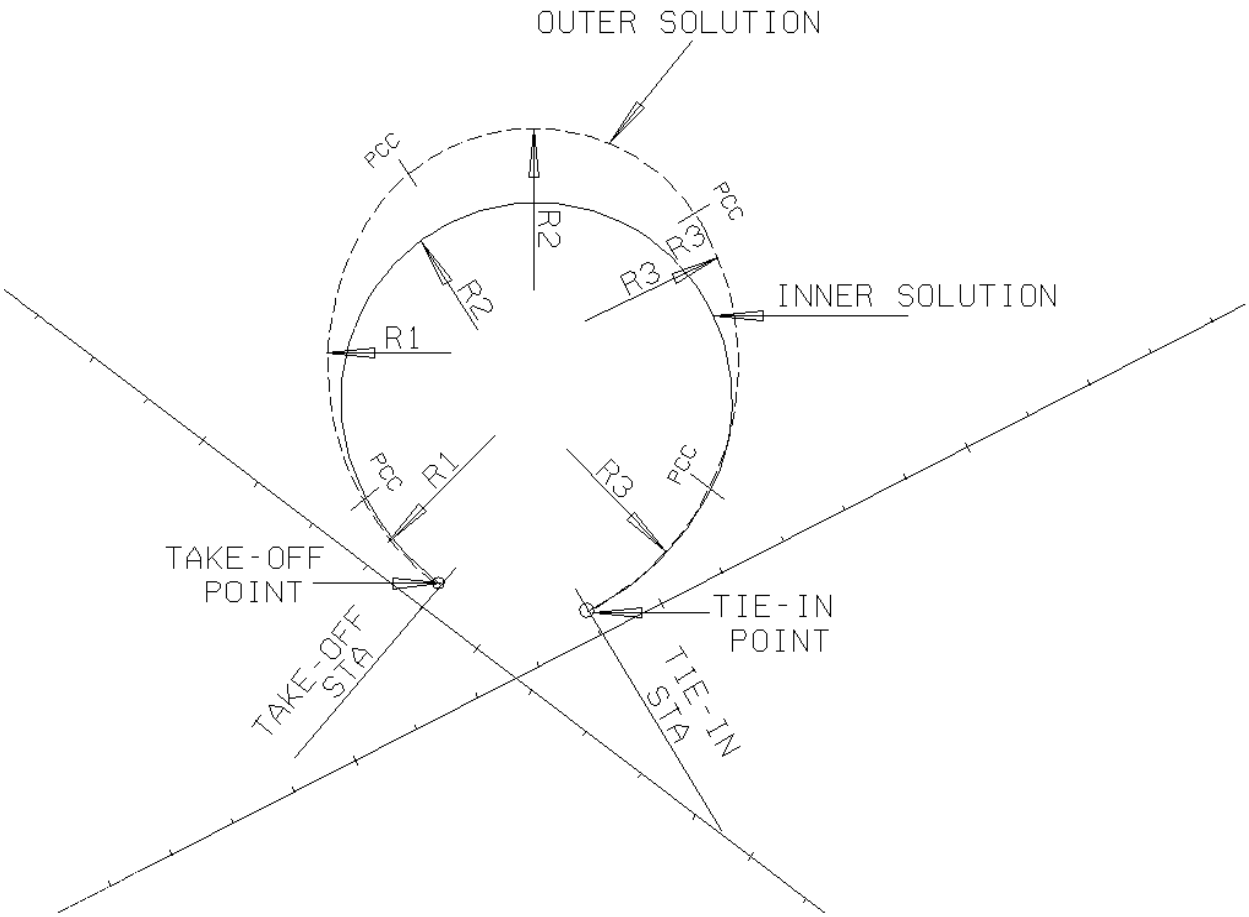
Simple Curve	This option closes the gap between two tangent lines with a circular curve of user defined radius. See Note 2. The Ramp Design menu is updated to include the following Curvature data needed to complete the design.
Curvature and Direction	Select the method for defining the curve and set its direction: Radius, Degree of Curve, Arc, Left, or Right.
Direction Option	Select the direction option, L or R, to specify in which direction the curve is to turn.
Radius	Enter the radius of the curved segment in the Radius input box.
Degree of Curve	Enter the degree of curve in the degree, minute, and second input boxes.
Arc	Select a geometry arc with an equivalent radius (number will appear in the input box) or enter the number of the arc in the input box.



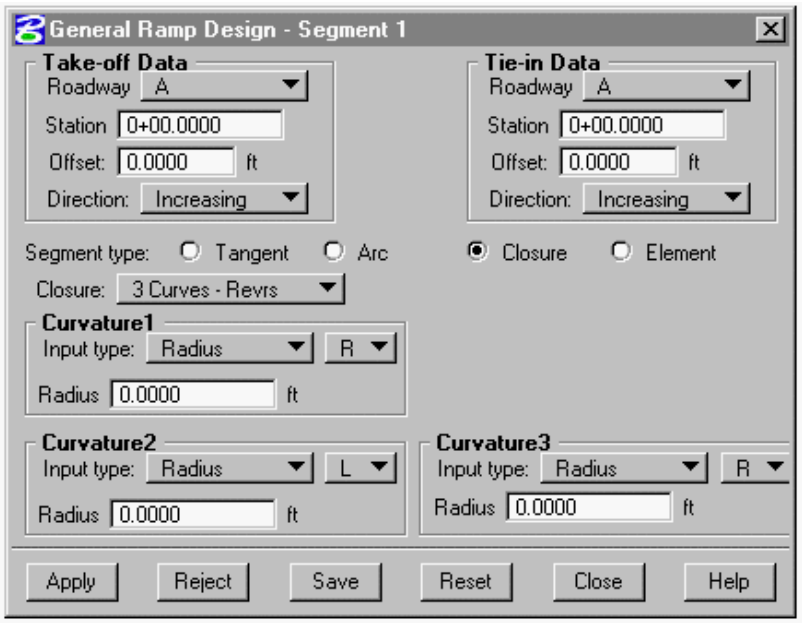
Three Compound Curves	This option closes the gap between two tangent lines with a three-center compound curve as illustrated in Figure 1. See Note 3. The Ramp Design menu is updated to include the following data items necessary to complete the design: Curvature, Curve Length, Center Arc Solution.
Curvature1, Curvature2, and Curvature3	Select the method for defining each of the three compound curves, as required. Follow the input instructions given above for defining a curve and apply them to these arcs.
Curve Direction Options	The curve direction options are not selectable and are set to R for curves turning to the right.
Curve Length	Use the curve length input option as required. See Note 3. Follow the input instructions given above for defining curve length and apply them to this input.
Center Arc Solution	Select one of the solution methods: Inner, Outer.
Inner	A design will be created with the center arc in its innermost position, if possible. See Figure 2.
Outer	A design will be created with the center arc in its outermost position, if possible. See Figure 2.



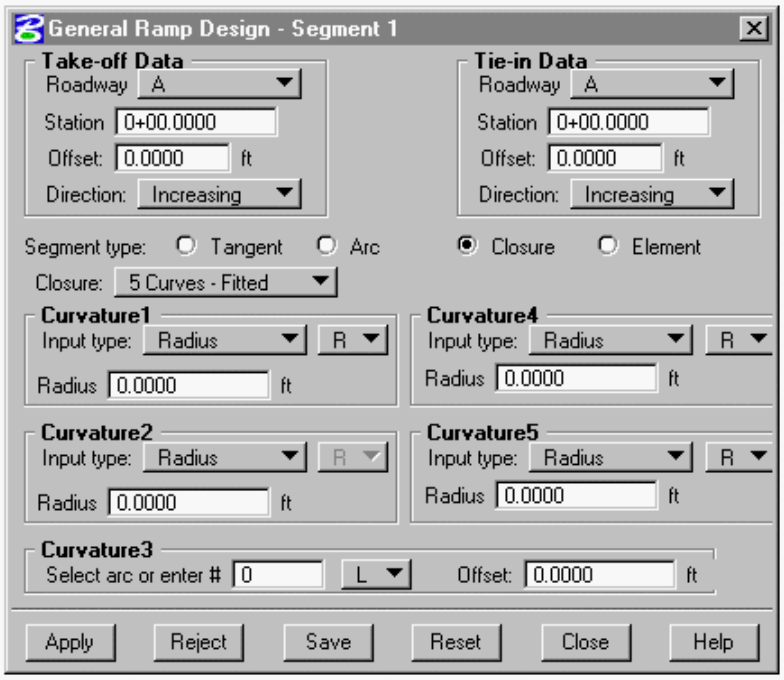
Three-Center Curve Loop Design
Figure 1



Three-Center Curve Solution Options
Figure 2

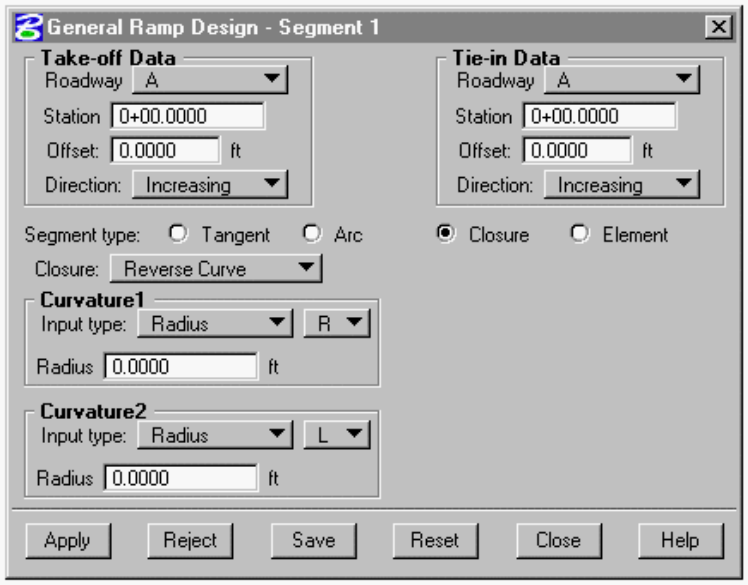


Three Curves Center Reversed	This option closes the gap between two tangent lines with a three-center compound curve whose center curve is reversed. See Note 4. The Ramp Design menu is updated to include the following Curvature data necessary to complete the design.
Curvature1, Curvature2, and Curvature3	Select the method for defining each of the three compound curves, as required. Follow the input instructions given above for defining a curve and apply them to these arcs.
Curve Direction Options	The curve direction options are not selectable and are set to R, L, and R for compound curves that turn right, left, and right.



Five Curves Center Fitted	This option closes the gap between two tangent lines with a five-center compound curve whose center curve is fitted. See Note 5. The Ramp Design menu is updated to include the following Curvature data necessary to complete the design: Curvature1-5.
Curvature1, Curvature2, Curvature4 and Curvature5	Select the method for defining the first and last two curves in the design. Follow the input instructions given above for defining a curve and apply them to these arcs.
Curve Direction Options	The two beginning and two trailing curve direction options are not selectable and are set for arcs turning to the right.

Curvature3	This input defines the center curve which is to be fitted around an existing inner ramp arc of known number. The following data is required: Arc Number, Offset.
Arc Number	Select the arc of the inner ramp that the center curve of the five curve ramp is to be fitted around, or enter its arc number. When selected, the arc number is displayed in the input box.
Direction Option	The direction option for the center reverse curve is not selectable and is set to L for a curve turning to the left.
Offset	Enter the offset distance from the inner loop arc to the fitted arc.



Reverse Curve	This option closes the gap between two tangent lines with a reverse curve. See Note 6. The Ramp Design menu is updated to include the following Curvature data necessary to complete the design: Curvature1, Curvature2.
Curvature1, Curvature2	Select the method for defining the reverse curves: Radius, Degree of Curve, Arc, Compute.
Curve Direction Options	If a curve is defined by a radius, degree of curve, or arc, select the appropriate curve direction option, L or R. Setting one option sets the other curve direction option to the reverse direction, when two radii are being defined.
Radius	Enter the radius of the curved segment in the Radius input box.
Degree of Curve	Enter the degree of curve in the degree, minute, and second input boxes.
Arc	Select a geometry arc with an equivalent radius (number will appear in the input box) or enter the number of the arc in the input box.
Compute	Select the Compute option to have the command compute the curve that will fit the unknown gap. Either one or both of the two reverse curves may be determined by the command. See Note 6.

Apply	Execute the command with the given data. A ramp design segment will be displayed in temporary graphics form.
Reject	Remove the last ramp segment from the display and the design. (May be used again to "back out" of a design.)
Save	Commit the design as displayed to storage in the IGrds working files. A chain is created.
Reset	Remove any temporary design graphics and reset the input fields to their previous condition.
Close	Close the dialog box.
Help	Display Help for this command.

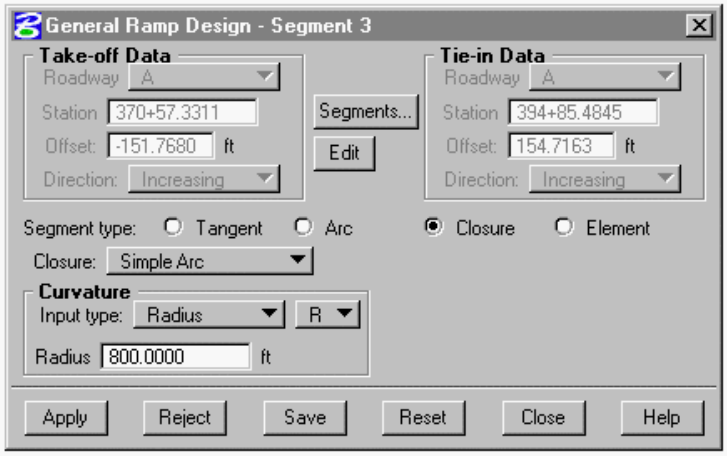
The following menu appears after selecting Save at the completion of a ramp design:

Geometric Elements Created

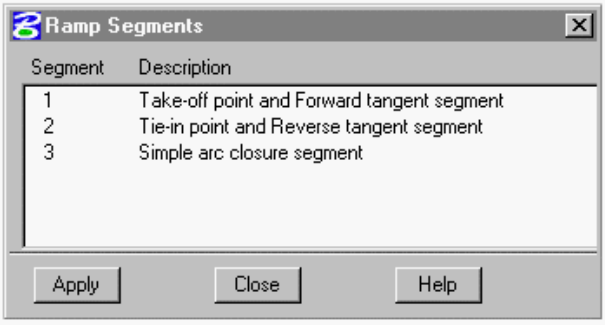
Please confirm or reject.

OK	Select OK to accept the ramp design as displayed, and add it to the current design files.
Cancel	Select Cancel to reject the ramp design and delete it from the current design display. It will be erased from the display.
Help	Display Help for this command.

Segment Editing Option



After the first ramp segment has been created and displayed on the screen, an optional Segments button will appear on the General Ramp Design menu as shown at the left. This option button may be selected at any time during the design of a ramp to change intermediate segments or to change the location of the "take-off" or "tie-in" point, since these two points are not changeable during the regular design process. Clicking on Segments brings up the Ramp Segments menu which is shown below.



Displayed within the Ramp Segments menu is a list of design segments arranged by design sequence followed by a brief description of the type of segment it is.

If any one of the listed segments is to be changed, highlight it by clicking on it and select the Apply button on this menu. This action will cause the data for that segment to be displayed in the Ramp Design menu where it can be edited as desired. After editing, clicking Apply on the Ramp Design menu will cause the entire design to be redisplayed as changed.

In order to change either the "Take-Off" or "Tie-In" points, click on the first segment in the list of Ramp Segments to highlight it and select Apply on this same menu. This action will cause the Take-Off/Tie-in data, which is grayed out during design, to be made editable again. Make the changes to either or both of these points as required, select Apply on that menu, and a revised design will be displayed on the screen.

Select Close on the Ramp Segments menu to close that display box.

Select Help on the Ramp Segments menu to display help for this command function.

Notes:

1. *Selection of the Tangent type closure causes the insertion of a line to close the gap between the last forward and reverse ramp segments. When either of the two ramp segments being connected is itself a tangent line, the closure simply connects to the end of that segment. When one or both of the segments is a curve, the closing tangent line is made to fit to the arc at a computed point of tangency, and the arc is shorted or lengthened to the tangency point as required.*

2. *Selection of the Simple Curve type closure causes an arc, of user defined radius, to be placed tangent to the last forward and reverse ramp segments in the current design. The adjacent ramp segments will be lengthened or shortened to the points of tangency with the curve as required. If the solution does not fall within the limits of the adjacent segments, an error message is issued. Note that an arc or tangent segment must be present on either side of the gap to use this closure method. In other words, you cannot close a gap between a segment and a take-off or tie-in point.*

3. *Selection of the 3 Compound Curve type closure causes insertion of a three-arc compound curve between the last forward and reverse segments of the current ramp design. It can also be inserted between the take-off and tie-in points without the existence of any adjacent segments.*

   If all three radii are to be specified, leave the Curve Length data blank. Radii are ordered in the normal sequence of travel, progressing from take-off to tie-in point.

   If the center radius (radius of curve 2) is to be solved for, then enter values for the radii of curves 1 and 3, and a value for the length of the first arc. The radius of curve 2 should be zero in this case.

4. *Selection of the 3 Curves - Center Reversed type closure causes a three-arc compound curve, with center curve reversed, to be inserted between the last forward and reverse tangent segments of the current ramp design. It can also be inserted between the take-off and tie-in points without the existence of tangent lines. Radii data are ordered in the normal sequence of travel from take-off to tie-in point.*

5. *Selection of the 5 Curves - Center Fitted type closure causes a five curve configuration, with the center curve being reversed and fitted to a previously defined center arc of a loop type ramp, to be inserted between the last forward and reverse tangent segments of the current ramp design. It can also be inserted between the take-off and tie-in points without the existence of tangent lines. Radii data are ordered in the normal sequence of travel from take-off to tie-in point.*

6. *Selection of the Reverse Curve type closure causes a reverse curve to be inserted between the last forward and reverse tangent segments of the current ramp design. It may also be used between the "take-off" and "tie-in" points with or without use of tangents, if a reverse curve solution applies.*

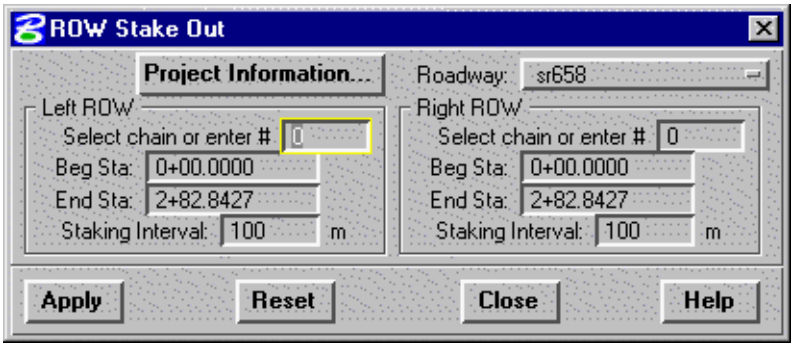
   If no data is entered for the radii, then the command computes a best fit solution for the curves between the ends of the take-off and tie-in tangents.

   If the radius of curve 1 is defined, and not for curve 2, then a best fit solution for the second curve is determined. Conversely, if no data is present for curve 1, and definition is given to curve 2, then a best fit solution is determined for curve 1.

   If definition is given to set the radii of both curves, a rigid solution is formed. In this case, the starting point is held and the ending point will be allowed to "slide" along the tie-in tangent line. If the specified arc radii are too large to permit a fit within the bounds of the terminal tangent, an error will display, and an opportunity will be given to change the values.

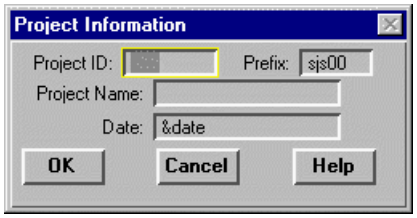
7. *The maximum central angle of a curved segment is 120 degrees. Therefore, any arc segment length entered, that would result in a central angle greater than this, will produce a warning message to shorten the length. If such a condition is required, use two or more shorter segments.*

RIGHT-OF-WAY STAKEOUT

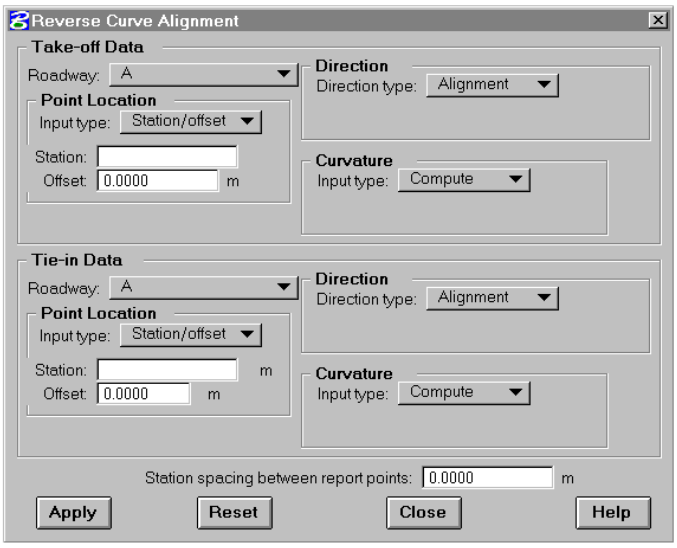


This command generates staking points along Right-of-Way chains on one or both sides of a horizontal alignment. The station range and staking interval for each of the chains is defined by user input. The Right-of-Way chains are defined prior to use by this command. The output of the command consists of a geometry point at each stake position, and a report showing the station and coordinates of the ROW stakes.

Roadway	Select the roadway for which Right-of-Way stakeout points will be generated.
Left ROW	Enter the Left side ROW data: Chain No., Begin Sta., End Sta., Staking Interval.
Chain No.	Select the left side chain (its number will appear in the input window), or enter the number of the chain that defines the ROW on the left. (Leave blank if not defining left side points.)
Beg Sta	Enter or select the station along the chain where generation of ROW staking points is to begin. (The input box displays the current value, which initially is the starting station of the alignment.)
End Sta	Enter or select the station along the chain where generation of ROW staking points is to end. (The input box displays the current value, which initially is the ending station of the alignment.)
Staking Interval	Enter the interval to be used for staking along the ROW chain. (The default value of 100 ft(m) is displayed.)
Right ROW	Enter the Right side ROW data: Chain No., Begin Sta., End Sta., Staking Interval. (Follow the instructions for the Left side ROW, and apply the instructions to the Right side.)

Apply	Click to generate staking points and report.
Reset	Click to reset values.
Close	Click to dismiss the dialog.
Help	Click to display help for this command.
	
Project Information	Click on to review/change Project Information
Project ID	Project Identification (up to 3 characters).
Prefix	Earthwork Output file prefix.
Project Name	Project Name.
Date	Date to be shown on reports. "&date" is the current date.
OK	Click to save and use displayed data.
Cancel	Click to cancel dialog box.
Help	Click to display help for this dialog box.

REVERSE CURVES



Selection of the Reverse Curves icon on the Complex Curves menu opens up the Reverse Curve Alignment menu shown at the left.

This command provides for the design and display of reverse curves that may be inserted between any two points that can be defined on existing roadway design files. Unacceptable designs can be rejected and erased from the display after reviewing the design. Acceptable designs are stored in the design files as chains from which alignments may be generated.

Take-Off Data	Define the design conditions of the reverse curve alignment at the "take-off" Point.
Roadway	Select the desired reference roadway for the take-off point. The current active roadway is displayed.
Point Location Input Type	Select one of the methods available for defining the location of the take-off point: Coordinates, Select, Stat/Offs.
Coordinates (Northing & Easting)	Digitize a point or enter the Northing and Easting coordinates of the point desired to be the PC of the take-off curve. (When digitized, the coordinates selected are displayed in the NE input boxes.)
Select	Select an existing geometry point with the cursor, or enter its point number. This point will be the PC of the take-off curve.
Stat/Offs	Enter the station and offset of the point desired to be the PC of the take-off curve. (Offsets left of the baseline are negative, and offsets right are positive, as referenced in the direction of increasing stations.)

Direction Type	Select one of the methods available for defining the direction of the tangent to the curve at the take-off point (PC): Bearing, Azimuth, Skew, Line, Alignment.
Bearing	Select N or S, enter degrees, minutes, and seconds, and select E or W.
Azimuth	Enter degrees, minutes, and seconds.
Skew Angle	Select L or R, enter degrees, minutes, and seconds, and select F or B.
Line	Select a geometry line with the same direction as the direction of the take-off point (line number will be displayed in the input box), or enter the desired line number.
Alignment	No user input is required. The direction is the same as the direction of the tangent to the alignment at the given take-off station.
Curvature Input Type and Direction	Select one of the methods available be for defining the radius of the curve at the take-off point: Radius, Degree of Curve, Arc, Compute.
Direction Option	Select the direction option, L or R, to specify if the curve turns to the left or right. Setting the curvature direction of one curve automatically sets the direction of the other curve as the reverse.
Radius	Enter the desired radius for the curve to be used at the take-off point.
Degree of Curve	Enter the degree of curve in degrees, minutes, and seconds of the curve to be used at the take-off point.
Arc	Select an existing geometry arc (its arc number will be displayed in the input box) or enter the number of an arc whose radius will be applied as the radius of the curve at the take-off point.

Compute	No user input is required. The radius of the curve starting from the take-off point will be computed as a "best-fit" curve by the command.
Tie-In Data	Define the design conditions of the reverse curve alignment at the "tie-in" point. Follow the instructions given above for the take-off curve conditions, and apply them to the input requirements of the tie-in curve conditions.
Station Spacing Between Report Points	Enter the spacing increment to be used (e.g., 10, 25, 50, etc.) in computing offsets to the reverse curve design, as measured from the take-off roadway between the take-off and tie-in points. If a report is not wanted, leave the default value of 0.0 unchanged.
Apply	Execute the command with the given data.
Close	Close the dialog box.
Help	Display Help for this command.

The following Information message box will appear if one of the radius values is missing and radius input is used as a curvature method:

Please enter a take-off (or tie-in) radius.	
OK	Click on OK to resume command processing. Enter the required radius or change the method of definition.

The following dialog box will appear after the successful display of a design in order to solicit user acceptance or rejection of the design:

Geometric Elements Created	
Please Confirm or Reject	Select one of the option buttons: OK, Cancel, or Help.
OK	Click on OK to accept the design and commit the data to the design files. This menu disappears.
Cancel	Click on Cancel to reject the design and erase it from the display. This menu also disappears.
Help	Display Help for this command.

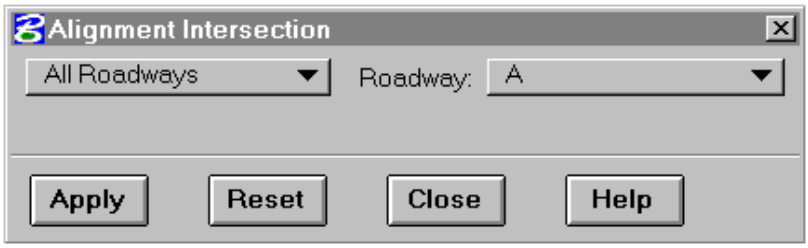
Notes:

1. *When the compute option is used for both the take-off and tie-in curves, the command computes a radius that applies to both curves, and will fit exactly between the take-off and tie-in points.*

2. *When the compute option is used for one curve only, the given radius is used for the other, and a radius is computed that will exactly fit the balance of the design, be it at the take-off or tie-in end.*

3. *When both radii are given for the design, the take-off point is always held, and the tie-in curve is allowed to "slide" along the alignment at the specified offset distance. Depending on the radii given, the PT could fall either before or after the originally defined tie-in point.*

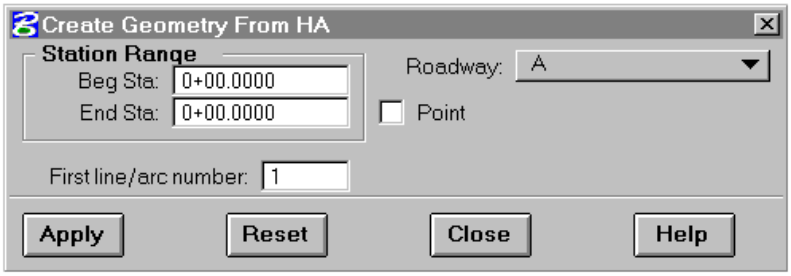
ALIGNMENT INTERSECTION



This command calculates the intersection point of two specified roadways, or one specified roadway and all other roadways that intersect with it. It computes the intersection point coordinates, the station of the intersection point on each of the roadways, the intersection angle, and the bearings of both horizontal alignments at the point of intersection. IGrds displays this information on the design plan and also in a report in the temporary report file (.tmp).

Intersection Option	Select intersection option to be used: All Roadways, Selected Roadway.
All Roadways	Select this option to determine all crossroad intersections with the given main roadway.
Selected Roadway	Select this option to determine an intersection between two given roadways.
Roadway	Select the main roadway for which one or more intersections will be determined.
Intersecting Roadway	Select the name of the crossroad for which intersection data is to be computed relative to the main roadway. (This option button only appears when the Selected Roadway intersection option is selected. All roadways that are graphically displayed will appear in the option button.)
Apply	Execute the command with the given data.
Reset	Reset the input selections to the initial settings.
Close	Close the dialog box.
Help	Display Help for this command.

CREATE GEOMETRY ELEMENTS FROM HORIZONTAL ALIGNMENT

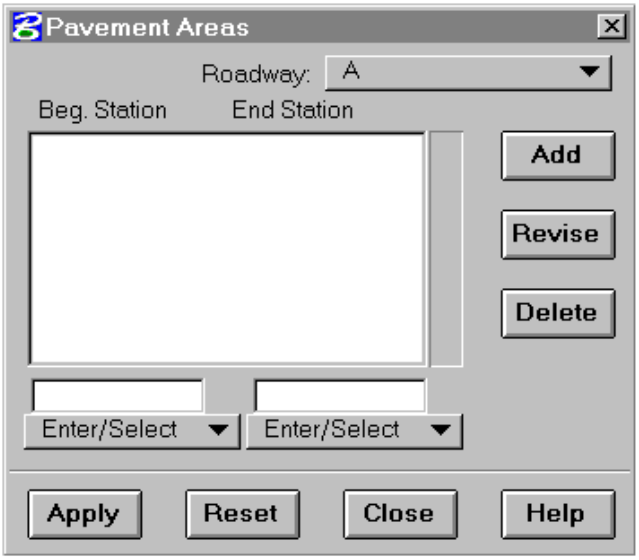


This command creates IGrds geometry elements for all or part of the horizontal alignment for the active roadway. This command does not create spirals if there are spirals contained in the horizontal alignment. Geometry points for the PI, PC, PT, and the center point of arcs may also be created.

Roadway	Select the desired roadway. The current active roadway is shown.
Station Range	Enter Station Range for creating IGrds geometry elements or use default.
Beg Sta.	Enter beginning station or use the default which is the beginning station of the alignment.
End Sta.	Enter ending station or use the default which is the ending station of the alignment.
Point	Enable this option if points are to be generated.
First Point Number	Enter the ID number for the first new point to be placed. The default number shown is the next available ID number.
Point Line/Arc Number	Enter the ID number for the first new line/arc to be placed. The default number shown is the next available ID number.
Apply	Execute the command.
Reset	Erase the input fields and display the default ID numbers.
Close	Close the dialog box.
Help	Display Help for this command.

Note: The IGrds geometry elements created are those tangents (lines), curves (arcs), and points that fall within the specified station range.

PAVEMENT AREAS



This command computes the area of all template segments over one or more ranges of alignment stations. The ending and beginning stations of sequential ranges must not overlap. Station ranges may be entered by keyin or cursor selection.

The output of this command consists of: a report of template segment areas by station range (in square feet and yards or square meters and hectares), a file of these data (.tmp file usable as input to other processes), and a series of lines outlining the perimeters of the computed segment areas.

When this command is selected, the command menu will expand to the form shown at the left. A scrolled area is used to display the station range records defining the limits of the computations along the given roadway. Current data to be entered or edited is displayed in the edit fields below the scrolled area. Clicking on a record in the scrolled area will highlight it for further action, and display its values in the edit fields.

Roadway	Select the desired roadway. The current active roadway is shown.
Record Actions	
Add	Click to add the data in the edit fields to the list of station records displayed in the scrolled area. The new data will be placed in the list according to its Begin station.
Revise	Click to revise the highlighted record with the values displayed in the edit fields.
Delete	Click to delete the record that is currently highlighted in the scrolled area.

Record Data

Begin Station Select Option

- Enter/Select
  Enter the beginning station of the computation range, or select a graphic point to indicate the station.

- Begin
  The beginning station of the roadway will be displayed.

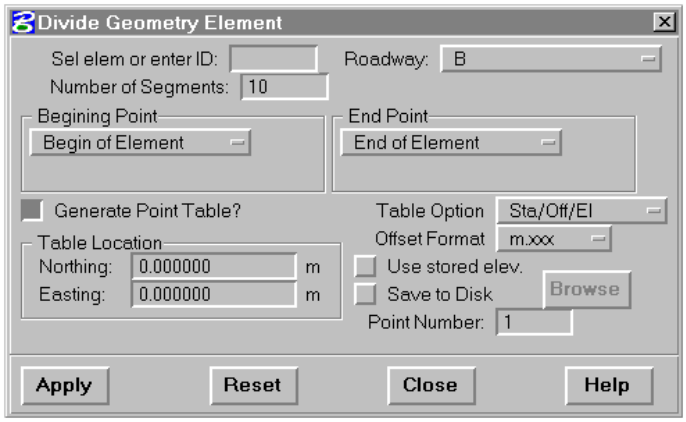
End Station Select Option

- Enter/Select
  Enter the ending station of the computation range, or select a graphic point to indicate the station.

- End
  The ending station of the roadway will be displayed.

Apply	Click to execute the command.
Reset	Click to clear the values from the edit fields and the scrolled area.
Close	Click to dismiss the dialog box.
Help	Click to display help for this command.

DIVIDE GEOMETRY ELEMENT



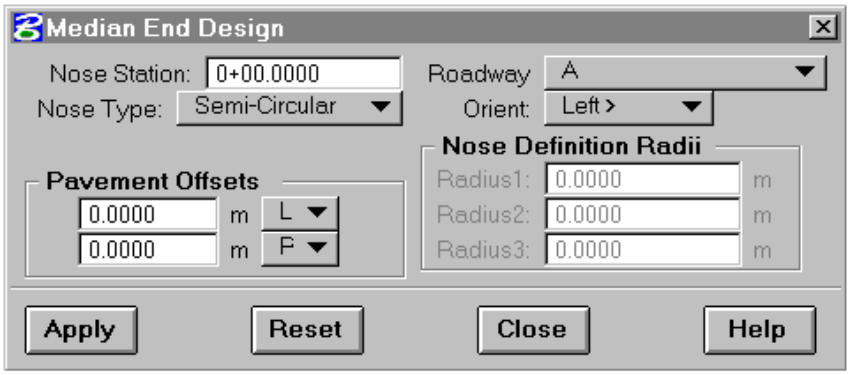
This command divides a linear geometry element (line, arc, chain, or shape) into a user-input number of segments by placing geometry points at the segment ends. The command will optionally create and display a table of the points segmenting the element. A fixed pitch font must be active when creating a table of points.

Roadway	Select the desired roadway. The current active roadway is shown. Computations of stationing and/or elevations are computed from this roadway.
Sel elem or enter ID	Select a geometric element (line, arc, chain, or shape) on the graphics area or enter its ID.
Number of Segments	Enter the number of segments the geometric element is to be divided into or use the default number of segments which is 10.
Beginning Point	Select the beginning point of the geometric element. • Begin of Element Use the beginning point of the geometric element. • Select Begin Point
Select pnt or enter #	Enter or select a geometry point for the beginning point.
End Point	Select the ending point of the geometric element. • End of Element Use the ending point of the geometric element. • Select End Point
Select pnt or enter #	Enter or select a geometry point for the ending point.

Generate Point Table?	Enable this option if a point table is to be generated.
Table Option	Select table type. • Sta/Off/El • Sta/Off • NE/Sta/Off/El • NE/Sta/Off • NE • NE/El
Offset Format	Select offset data format. • ft.xxxx Feet and decimal format for offsets. • ft.-in. Feet and inch format for offsets.
Use Stored Elev.	Enable the option to use the stored elevation of a point. If this option is not enabled, then it will use the elevation from the design roadway surface. (Elevations are accurate only between the shoulders of the active roadway. The elevation stored in the geometry file does not change.)
Prompt **Select Table Location**	Digitize the upper left corner for the table of points.
Save to Disk	Enable this option to allow the table of points to be exported as an ASCII file.
Browse	Select Browse to select/enter the file in which to save the table of points.
Point Number	Enter the ID number for the first new point to be placed. The default number shown is the next available ID number.
Apply	Execute the command.
Reset	Erase the input fields and display the default ID number.
Close	Close the dialog box.
Help	Display Help for this command.

MEDIAN END DESIGN

This command provides for the design and display of four types of median end treatments. The four types are:



- Semi-circular
- Two-arc Taper
- Two-arc Bullet
- Three-arc Bullet Nose

After reviewing a successfully displayed design, it may be rejected and erased, or accepted and placed in the design files as a chain. For a graphic description of the nose treatments designed by this command, see Figure 3.

Nose Station	Enter the station on the active roadway where the tip of the nose is to be located.
Roadway	Select the desired roadway. The current active roadway is displayed.
Nose Type	Select one of the four median end nose types: (The current type is displayed.) • Semi-Circular Select this option to produce a semi-circular median end. • 2-Arc Taper Select this option to produce a two-arc taper median end. • 2-Arc Bullet Select this option to produce a two-arc bullet nose median end. • 3-Arc Bullet Select this option to produce a three-arc bullet nose median end.

Orientation	Select the desired orientation for the nose. (The current orientation is displayed.) • Left > Select this option to orient the open end of the nose toward the start of the roadway alignment (i.e., in the direction of decreasing stations). • < Right Select this option to orient the open end of the nose toward the end of the roadway alignment (i.e., in the direction of increasing stations).
Nose Offset	Enter the offset from the roadway baseline that will locate the tip of the nose between the median edges. (An error message will appear, at the time when the Apply button is selected, if this offset does not fall within the median edges.) See Note below.
Nose Offset Direction Option	Select one of the two nose offset options (L or R) when the pavement offset options are set to L and R or R and L. (Defaults to L or R when both pavement offset options are L or R. Does not apply to Semi-Circular or 2-Arc Bullet nose types.) • Select L to indicate that the nose offset is measured left of the roadway baseline. • Select R to indicate that the nose offset is measured right of the roadway baseline.

Pavement Offsets	Enter the left and right offset distances relative to the roadway baseline, that together define the location and width of the median at this section of the alignment
Pavement Offset Direction Options	After each pavement offset value, select the offset option (L or R) that defines what side of the roadway baseline the distance applies to. • Select L to indicate that the pavement or median edge distance is measured to the left of the roadway baseline. • Select R to indicate that the pavement or median edge distance is measured to the right of the roadway baseline.
Nose Definition Radii	Enter the values for the radii that will define the shape of the nose: • Radius 1 Enter the value of radius 1. (See Note 2 below.) • Radius 2 Enter the value of radius 2. (See Note 3 below.) • Radius 3 Enter the value of radius 3. (See Note 4 below.)
Apply	Execute the command with the given data.
Reset	Erase the input fields.
Close	Close the dialog box.
Help	Display Help for this command.

The following Information message box will appear if the nose radius given is greater than the available median width:

ERROR - NOSE RADIUS > MEDIAN WIDTH	OK: The value entered for the nose radius is detected as too large to fit the median as defined. Click on OK to remove the warning, and return to the input menu to change the data and try again. Check for possible incorrect pavement offset values if the radius is correct.

The following Information message box will appear if the nose offset value is inconsistent with the pavement offsets:

ERROR - INCOMPATIBLE OFFSET DATA	OK: The value of the nose offset is detected as being out of bounds of the median. Click on OK to remove the warning, and return to the input menu to change the data and try again. Check for an improper median offset if the nose offset is correct.

Notes:

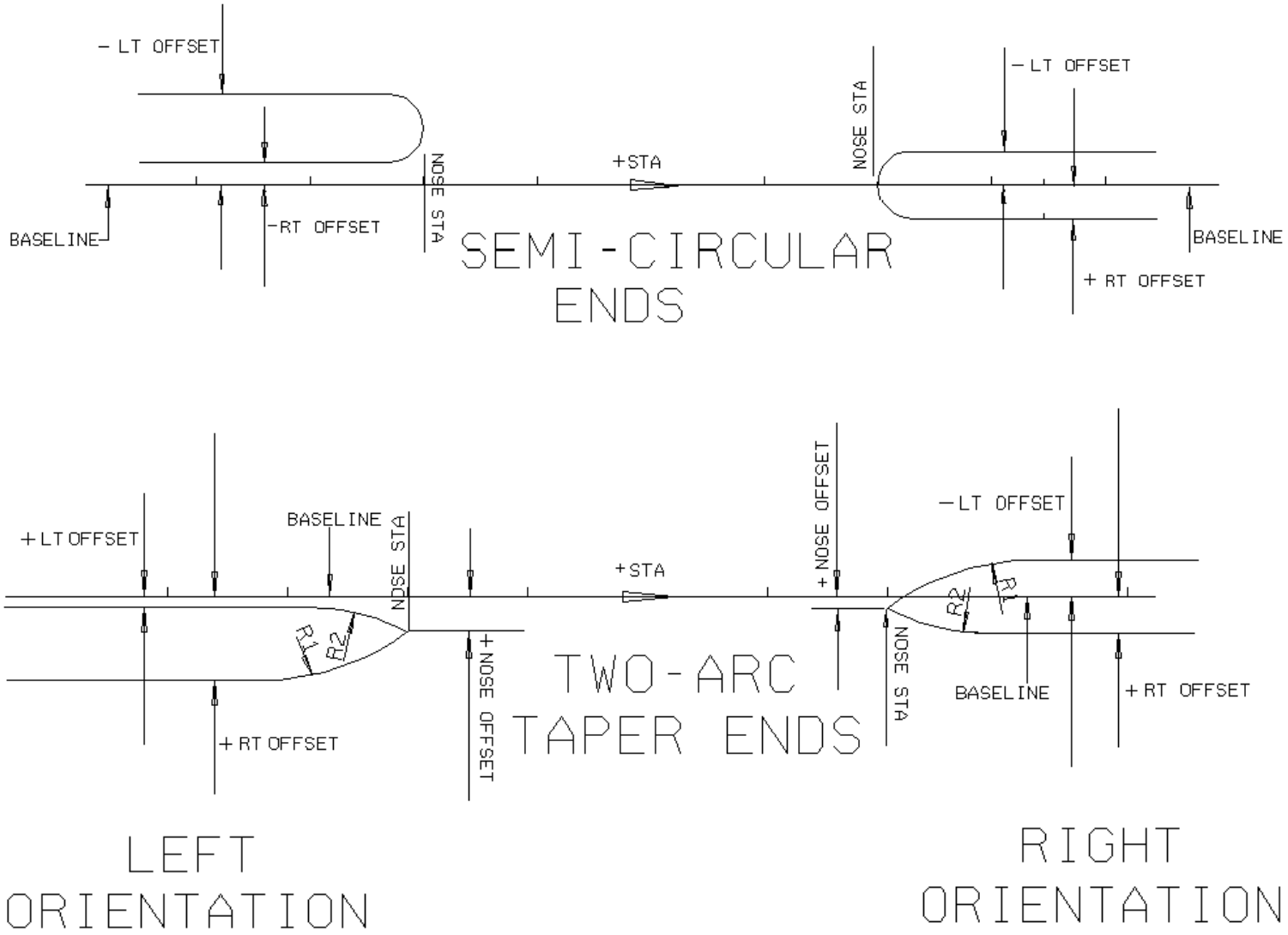
1. *Nose offsets only apply to Two-Arc Taper and Three-Arc Bullet type nose designs. This field is not present for other nose types.*

2. *The input field for Radius 1 is grayed out for the Semi-Circular nose type since by definition its radius is equal to one-half the median width. For all other nose types, enter a radius value for a curve that will begin the transition from the normal lane edge to the tip of the nose or the nose arc.*

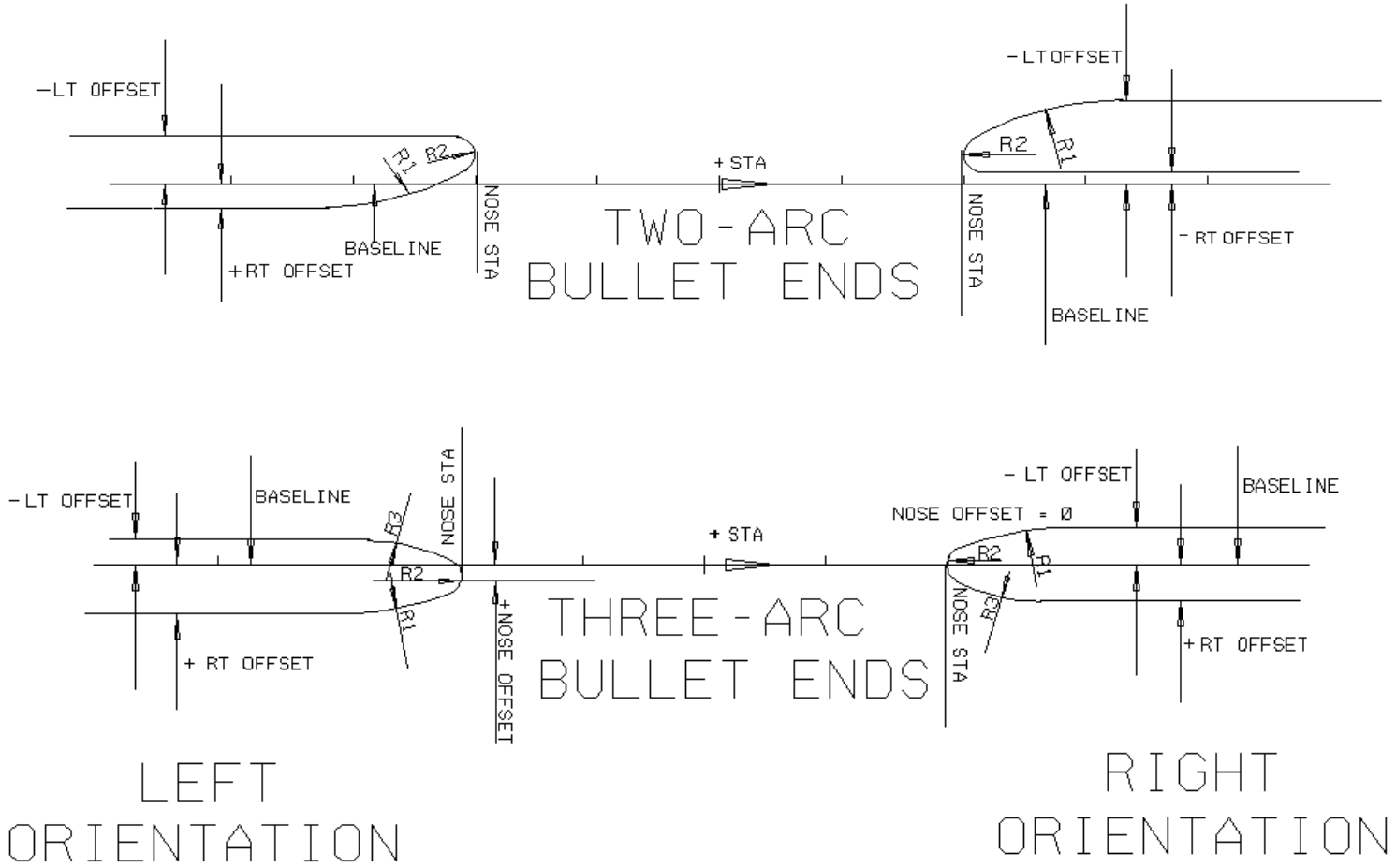
3. *This field is grayed out for the Semi-Circular nose type. For the Two-Arc Taper type, enter the desired design radius to transition back from the tip of the nose to the opposite pavement edge. For the Two-Arc and Three-Arc Bullet nose median types, enter the radius of the tip of the nose. (An error message will be displayed if this radius cannot fit within the given median width.)*

4. *This field is grayed out for all median types except the Three-Arc Bullet nose design. For this type, enter the desired design radius to transition back from the nose radius to the opposite pavement edge.*

5. *This command cannot be used to generate median designs located either wholly or partially within spiraled sections of alignment.*

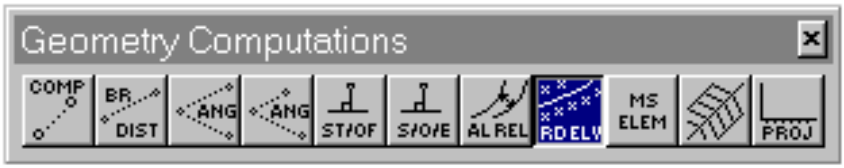


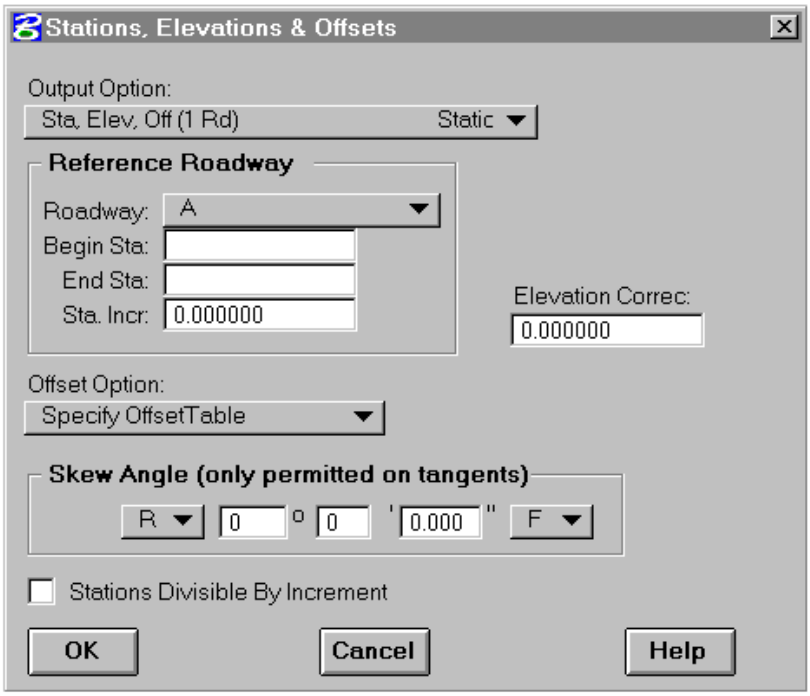
Median End Design Parameters
Figure 3A



Median End Design Parameters
Figure 3B

ROADWAY ELEVATION TABLES





The Roadway Elevation Tables command will produce a tabulation of stations, elevations, and offset distances along an incremented range of stations. Three different tabulations are available based on the Output Option chosen and the roadway(s) specified. These will be discussed later. The output report will be found in the current temporary file (.tmp). A prerequisite to using this command is that a horizontal alignment, design vertical alignment, and roadway design template must exist for each roadway involved in the report.

The Roadway Elevation Tables command menu shown at the left is accessed by selecting it from the Geometry Computations palette of the General Geometry command palette list. (Note: For illustration purposes, this menu depicts all available inputs. In actual use, the additional roadway and skew angle inputs will appear only when applicable.)

Output Options

As stated above, there are three possible output reports that can be produced by this command. The first two are similar and relate to a single road. The third option produces a report when two roads are involved, such as in the case of merging or departing roadways or ramps.

The first output option produces a tabulation of stations, elevations, and offset distances along an incremented range of stations for a single road.

The second output option produces a similar report as that of the first output option, but also prints the cross slope between offsets and the approximate percent grade between station increments.

The third output option produces a report similar to that of the second output option, but applies to two merging roadways in areas where their templates overlap. Elevations are computed using the horizontal alignment, vertical alignment, and roadway template data for one alignment, while the station increments and offsets refer to the other alignment. The report includes station and offset data for both roadways. This tabulation is extremely useful for computing required cross slopes and profile grades for merging roadways.

Offset Options

There are two methods (or options) available for defining the offset distances that pavement elevations are to be computed at. The first Offset Option makes use of a user specified offset table which is applicable to any of the three Output Options. The second Offset Option, which makes use of template ridge lines, is only applicable to single roadway Output Options.

Skew Options

Roadway elevations are generally computed at right angle offset distances to the baseline or centerline. However, under certain circumstances, the computations can be made at a skew angle instead. The following conditions apply:

1. Use of a skew angle is restricted to tangent sections of alignment only;

2. Skew angle computations can only be used with the single roadway Output Option, and;

3. These computations can only be made with a user specified offset table.

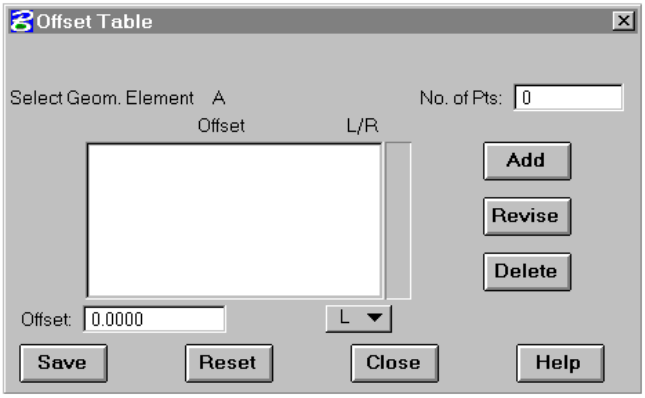
Roadway Elevation Dialog Inputs

Output Option	Select the desired output report option: • Stations, Elevations, Offsets (Single roadway only) • Stations, Elevations, Offsets, Cross Slopes, Grades (Single roadway only) • Stations, Elevations, Offsets, Cross Slopes, Grades (Two roadways)

Reference Roadway	
Roadway	Select the desired reference roadway for specifying stationing.
Begin Sta.	Enter/select the station where pavement elevation computations are to begin.
End Sta.	Enter/select the station where pavement elevation computations are to end.
Sta. Incr.	Enter the station increment to be used for setting the intermediate stations where elevations are to be computed.
Rdwy Used for Elevation Computations	Select the name of the roadway whose template and profile will form the basis for the pavement elevation computations. (This selection button only appears when pavement computations relate to two roadways. Third Output Option.)
Elevation Correction	Enter a positive or negative elevation correction to be algebraically added to the computed surface elevation. (If none, skip over. The default is 0.)
Offset Option	Select the desired Offset Option. • Specify Offset Table (When this option is selected, the Offset Table dialog, described later, is displayed.) • Offsets on Ridge Lines (This option is only available for single roadway applications.) • Use Current Offset Table

Skew Angle (Use On Tangents Only)
(This does not appear on the menu when two roads are involved.)

L/R	Select Option • Select L to specify that the skew angle is to be measured with respect to the left side of the road. • Select R to specify that the skew angle is to be measured with respect to the right side of the road.
Degrees	Enter the degree portion of the angle.
Minutes	Enter the minutes portion of the angle.
Seconds	Enter the seconds portion of the angle in decimal form.
F/B	Select Option • Select F to specify a forward direction of angle measurement. • Select B to specify a backward direction of angle measurement.
Stations Divisible By Increm.	Turn this option on to print the elevation table only at stations divisible by the station increment. Turn this option off (default condition) to print the elevation table for all stations.
OK	Click on the OK button to produce the Roadway Elevation tabulation.
Cancel	Click on the Cancel button to dismiss this dialog without taking any action.
Help	Click on the Help button to display help for this process.



The Offset Table dialog shown at the left is displayed as a result of selecting Specify Offset Table on the main menu as described above.

Offset Table Menu Imports

Reference Roadway	Displays the current Reference Roadway. (Set on main dialog.)
No. of Pts:	Displays the current number of points in the offset table.
Rdwy Offset Edit Fields	
Offset	Enter an offset distance where an elevation should be computed.
Offset Side	Select Option • Select L if the offset value is for the left side. • Select R if the offset value is for the right side. Note: When the offset is zero, this choice does not matter. A blank will be loaded upon selecting Add.
Add	Select Add to add the offset edit field data to the menu list box. If the offset being added already exists for that side, an Alert dialog will appear stating that a duplicate offset cannot be input. Select either OK or Cancel to continue working within the Offset Table menu.
Revise	Select Revise when a highlighted record in the list box will be revised with the data in the edit fields.
Delete	Select Delete to remove a highlighted record from the list box.

Save	Select Save to store the Offset Table in its present form.
Reset	Select Reset to clear out the contents of the Offset Table.
Close	Select Close to close the Offset Table dialog without taking any action. If data exists in the list box table, an Alert dialog will appear checking if the data should be saved or not. If it should, select OK, otherwise select Cancel.
Help	Select Help to display information about this command.