

E13 - Advanced Geometry for InRoads V8i Users

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InRoads Horizontal and Vertical Geometry

- Stored in an .ALG geometry project file
- Provides multi-user access via a .LCK lock file
- Contains COGO points Horizontal, Vertical and Cant alignments
- Organized in a parent child data structure

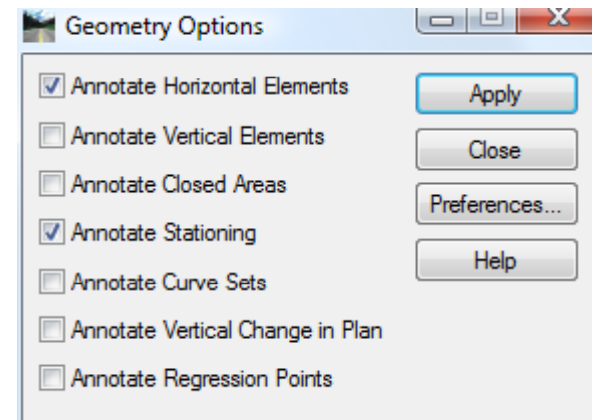


Benefits of InRoads geometry

- Stored in a separate file (can have multiple projects loaded)
- Works with graphic coordinates as well as geometry point coordinates
- Point names are optional (names can be non-numeric)
- Geometry locks ease use and eliminate confusion
- Select buttons provide quick input without need for key-in

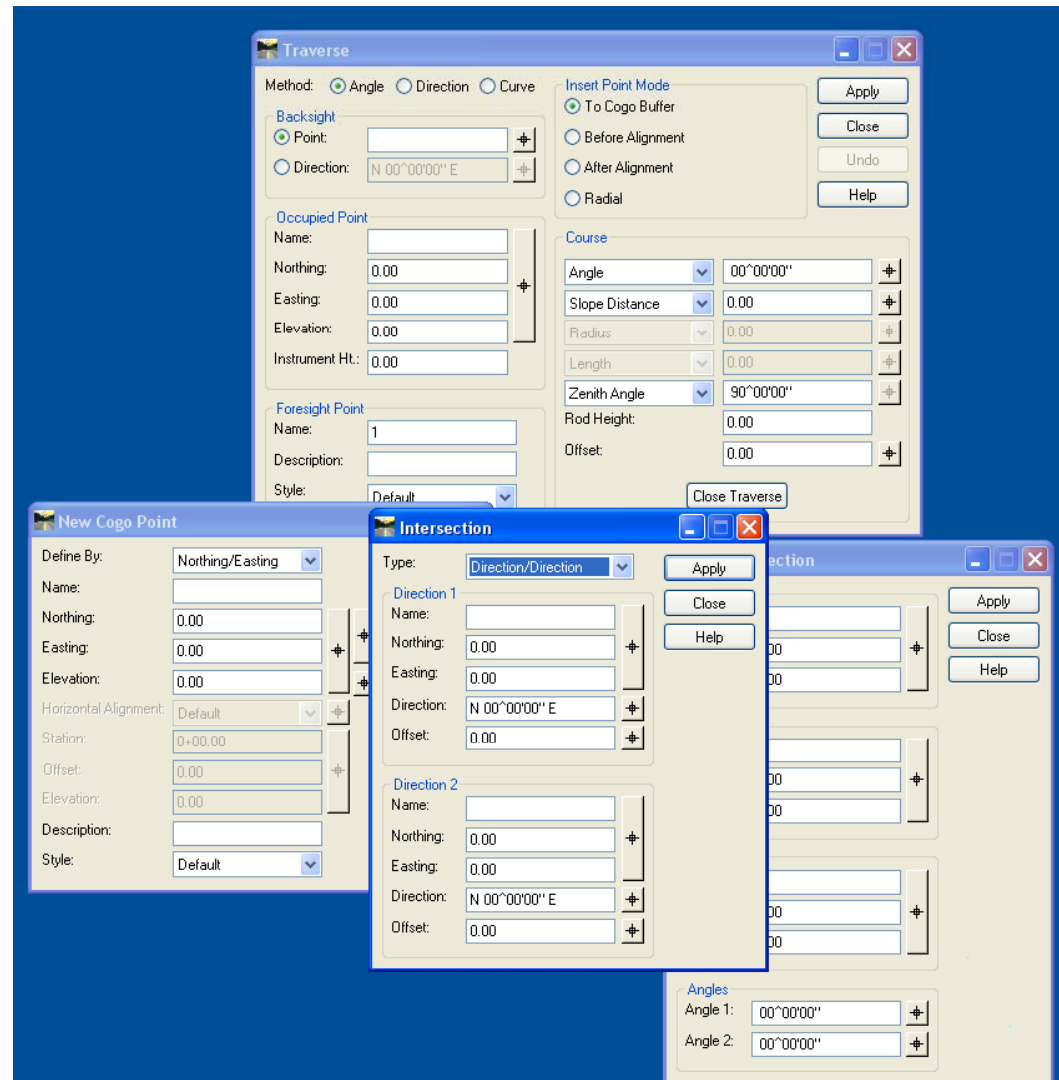
Auto Annotation: View Options

- Update annotation as the geometry is created / edited
 - Based upon
 - Alignment's style
 - Persisted command's preferences
 - Allows different "type of alignments" to display differently
 - A road baseline would have:
 - Horizontal annotation
 - Stationing
 - Curve set annotation
 - A right of way take would have:
 - Horizontal annotation



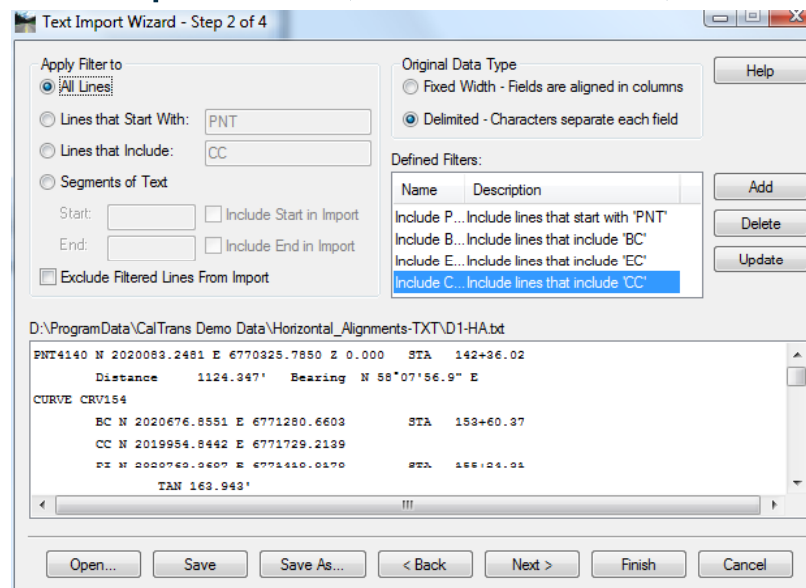
Methods of geometry creation

- Classic Coordinate Geometry COGO commands
 - Store, Locate, Traverse
- ASCII import via TIW



Text Import Wizard

- Removed classic support
 - Duplicate and redundant functionality
- Enhanced horizontal to read a multi-line element definition with
 - On alignment points (i.e. PC, PT, TS, SC, CS, ST)
 - Off alignment points (i.e. CC, SPI)



Traverse Adjustments

- Again similar to *Traverse Edit*, but all editing is within the grid!
 - Workflow oriented
 - *Data Entry > Adjustments > Transformations*

The image displays two screenshots of the 'Traverse Adjustments' software interface. The left screenshot shows the 'Data Entry' tab, and the right screenshot shows the 'Adjustments' tab.

Data Entry Tab (Left Screenshot):

- Name: Traverse
- Description: (empty)
- Style: traverse
- Starting Point:
 - Name: (empty)
 - Northing: 0.000
 - Easting: 0.000
- Closing Point:
 - Name: (empty)
 - Northing: 1050.976
 - Easting: -124.976
- Traverse Table:

Leg	Direction	Distance	Latitude	Departure
1	N 37°56'51.0" E	233.900	184.448	143.835
2	N 27°19'18.0" W	118.290	105.094	-54.294
3	N 12°48'22.0" W	288.740	281.557	-64.000
4	N 37°50'35.0" W	205.082	161.952	-125.818
5	N 16°10'05.0" W	133.559	128.277	-37.190
6	N 39°20'13.0" E	67.939	52.547	43.065
7	N 26°58'40.0" W	104.091	92.764	-47.220
8	N 20°34'42.0" E	47.359	44.337	16.646

Adjustments Tab (Right Screenshot):

- Adjust Angles: 0°00'00.0"
- Method:
 - Compass
 - Crandall
 - Transit
 - None
- Closure Results:
 - Northing Error: -0.877
 - Easting Error: -1.246
 - Closing Direction: N 54°51'41.6" E
 - Closing Distance: 1.523
 - Closed Area: 0.0
 - Perimeter: 1198.961
 - Precision: 786.997
- Traverse Table:

Leg	Direction	Distance	Latitude	Departure	Northing	Easting
1	N 37°56'51.0" E	233.900	184.448	143.835	0.000	0.000
		0.000	0.000	0.000	0.000	0.000
2	N 27°19'18.0" W	118.290	105.094	-54.294	184.448	143.835
	N 27°19'18.0" W	118.290	105.094	-54.294	184.448	143.835
		0.000	0.000	0.000	0.000	0.000
3	N 12°48'22.0" W	288.740	281.557	-64.000	289.542	89.541
	N 12°48'22.0" W	288.740	281.557	-64.000	289.542	89.541
		0.000	0.000	0.000	0.000	0.000
4	N 37°50'35.0" W	205.082	161.952	-125.818	571.100	25.541
	N 37°50'35.0" W	205.082	161.952	-125.818	571.100	25.541

Methods of geometry creation

- Conventional PI based alignment creation
- Design Criteria based
- Design Calculators
- Table Editing

The screenshot displays the Bentley InRoads Suite V8i (SELECTseries 1) interface. Three dialog boxes are open:

- Define Horizontal Curve Set:** Shows 'Horizontal PI' settings. 'Define By' is set to 'Known PI Coordinates'. 'Direction Back' is 'S 86°26'53" E', 'Length Back' is '5623.296', 'Point Name' is empty, 'Northing' is '1525654.801', 'Easting' is '2144165.862', 'Direction Ahead' is 'S 25°06'47" E', and 'Length Ahead' is '1572.509'. Below, 'Horizontal Curve' settings show 'Curve Set Type' as 'SCS', 'Leading Transition' as 'Clothoid' with a radius of '0.000', 'Radius 1' as '03°30'00"' with a value of '1637.022', 'Compound Transition' as 'Clothoid' with a radius of '0.000', and 'Radius 2' as 'Clothoid' with a radius of '0.000'. There are also fields for 'Radius', 'Tangent to Spiral', 'Spiral to Tangent', and 'Point on Curve'.
- Design Criteria:** 'Use Design Criteria' is checked. 'Table Name' is 'C:\Program Files\Bentley\InRoads Group V8.11\data\imperial'. 'Speed' is '55', 'Maximum e' is '8.000', and 'Minimum Radius' is empty.
- Design Calculators:** 'Method' is 'Lookup Speed'. 'Curve Design' settings include 'Speed' (55), 'Maximum e' (4.000%), 'Maximum f' (13.000%), and 'Radius' (1186.000). A 'Select Table Entry' table is shown below.

Horizontal Table Editor

Curve Sets:

Northing	Easting	Leading Transition	Radius	Trailing Transition
1526341.766	2135824.461			
1526003.185	2138553.368	0.000	11459.156	0.000
1525654.801	2144165.862	0.000	1637.022	0.000
1524230.936	2144833.241	0.000	4464.606	0.000
1523328.323	2145481.185			

Horizontal Design Criteria

- Curve Set Based
 - Add PI & Insert PI
- Looks up radius based upon speed / maximum superelevation
 - ..\data\imperial\Horizontal Design Checks.txt

Design Criteria

Use Design Criteria

Table Name: oads Group V8.11\data\imperial\Horizontal Design Checks.txt

Speed: 65

Maximum e: 6.000

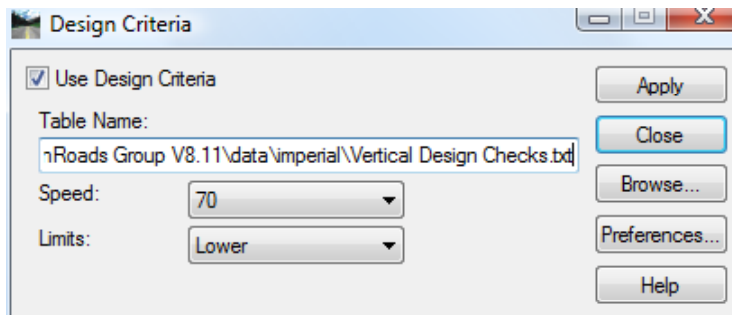
Minimum Radius:

Apply
Close
Browse...
Preferences...
Help

* DESIGN SPEED	MAXIMUM E	MAXIMUM F	MINIMUM RADIUS
20.	.04	.17	127.
30.	.04	.16	302.
40.	.04	.15	573.
50.	.04	.14	955.
55.	.04	.13	1186.
60.	.04	.12	1528.
20.	.06	.17	116.
30.	.06	.16	273.
40.	.06	.15	509.
50.	.06	.14	849.
55.	.06	.13	1061.
60.	.06	.12	1348.
65.	.06	.11	1637.
70.	.06	.10	2083.

Vertical Design Criteria

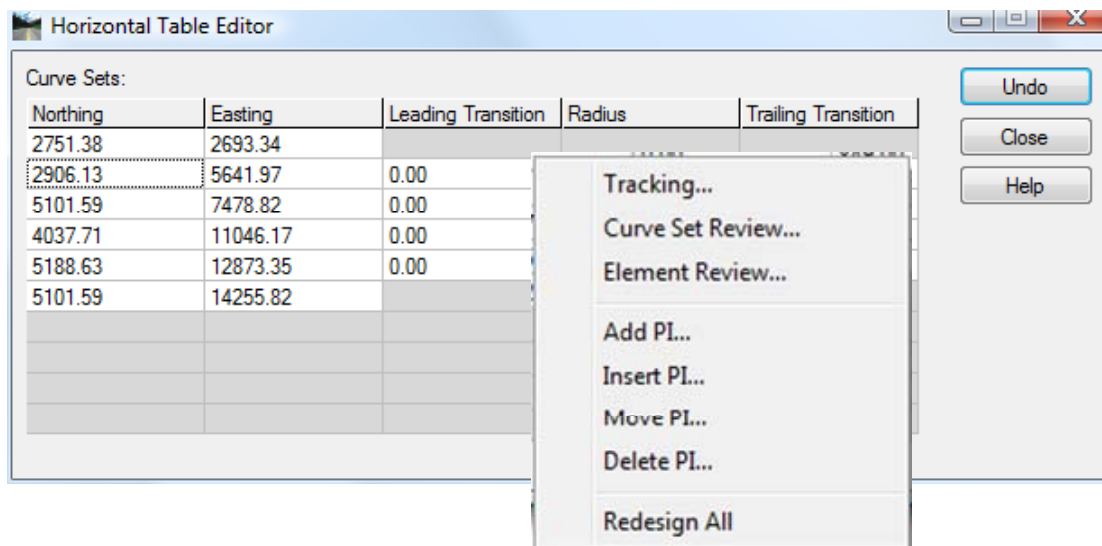
- Curve Set Based
 - Add PI & Insert PI
- Looks up K based upon speed / lower or upper limits
 - ..\data\imperial\Vertical Design Checks.txt



* DESIGN SPEED (mph)	f	Crest Stop Dist	Upper K Value	Crest Stop Dist	Lower K Value	Sag Stop Dist	Upper K Value	Sag Stop Dist	Lower K Value	Passing Minimum Dist	Sight Dist. K Value
20.	.40	125.	10.	125.	10.	125.	20.	125.	20.	800.	210.
25.	.38	150.	20.	150.	20.	150.	30.	150.	30.	950.	300.
30.	.35	200.	30.	200.	30.	200.	40.	200.	40.	1100.	400.
35.	.34	250.	50.	225.	40.	250.	50.	250.	50.	1300.	550.
40.	.32	325.	80.	275.	60.	325.	70.	275.	60.	1500.	730.
45.	.31	400.	120.	325.	80.	400.	90.	325.	70.	1650.	890.
50.	.30	475.	160.	400.	110.	475.	110.	400.	90.	1800.	1050.
55.	.30	550.	220.	450.	150.	550.	130.	450.	100.	1950.	1230.
60.	.29	650.	310.	525.	190.	650.	160.	525.	120.	2100.	1430.
65.	.29	725.	400.	550.	230.	725.	180.	550.	130.	2300.	1720.
70.	.28	850.	540.	625.	290.	850.	220.	625.	150.	2500.	2030.

Horizontal Table Editor

- Invokes *Add*, *Insert*, *Move* and *Delete PI* commands
- *Redesign All*
 - Based up *Horizontal Design Criteria*
 - Either invoke the *Horizontal Design Criteria* command or <Ctrl> right click and change the speed and / or maximum superelevation



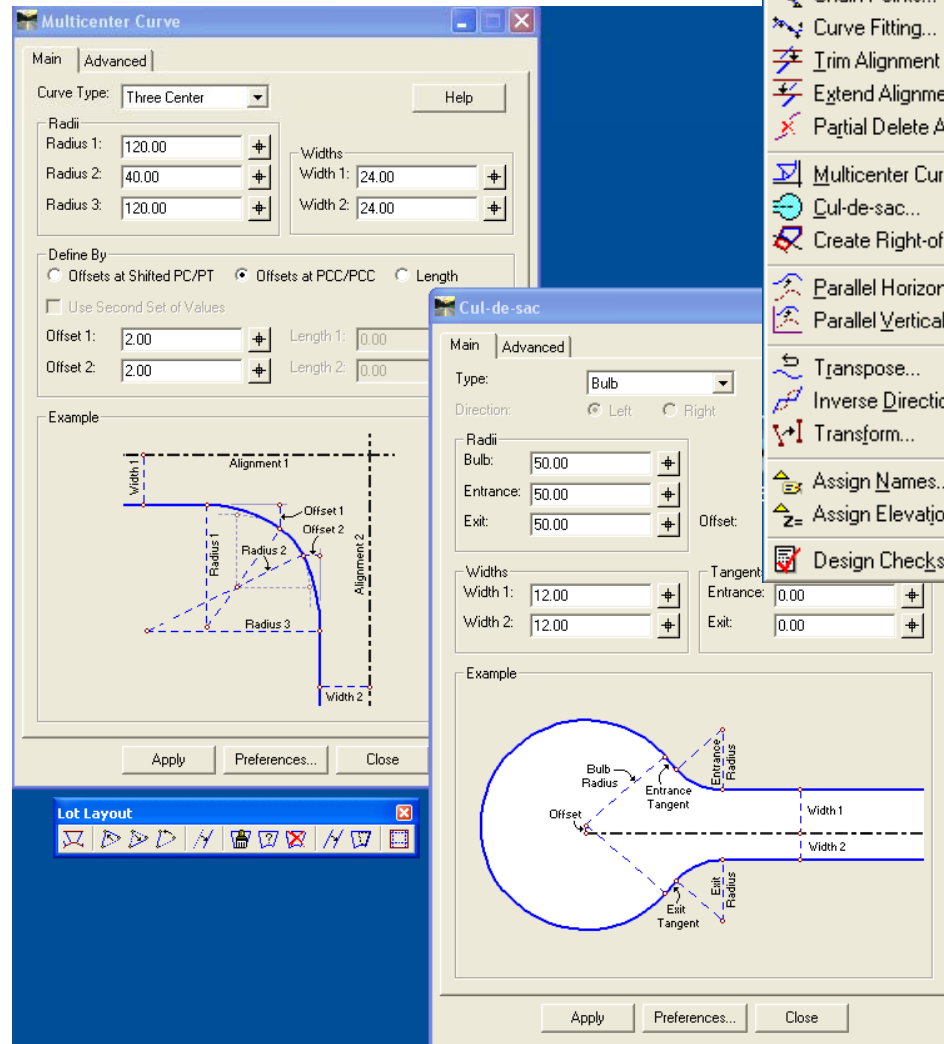
Vertical Table Editor

- Invokes *Add*, *Insert*, *Move* and *Delete PI* commands
- *Redesign All*
 - Based up *Vertical Design Criteria*
 - Either invoke the *Vertical Design Criteria* command or <Ctrl> right click and change the speed and limits

Station	Elevation	Ahead Slope	Length
100+00.00	921.10	2.000%	
116+00.00	953.10	-1.500%	500.00
133+00.00	927.60	2.000%	500.00
146+00.00	953.60	0.000%	500.00
152+64.98	953.60		

Methods of geometry creation

- Specialized tools for geometry creation
 - Curve Fitting
 - Lot Layout, Cul-de-sac commands
 - One, two, three centered curves
 - Parallel, join
 - Copy Geometry



Curve Fitting

- Fit an alignment through a series of points
 - Horizontal & Vertical
 - Horizontal only
 - Vertical only

The screenshot shows the 'Curve Fitting' dialog box with the following settings:

- From:**
 - Primary Control: SV916
 - Secondary Control: SV54
- To:**
 - Create Horizontal
 - Create Vertical
 - Vertical Parent: SV54
 - Alignment Name: Existing Centerline
 - Description: (empty)
 - Style: Default
 - Horizontal Tolerance: 0.500
 - Vertical Tolerance: 0.250
 - Standard Lift: 0.000
 - Vertical Alignment is Lines Only

Buttons: Apply, Close, Help

Chain Points

- Create a xyz horizontal alignment
- Or feature
 - Open or closed shape

The screenshot shows the 'Chain Points' dialog box with the following fields and options:

- Points: [Empty text box]
- Selected: [Table with 2 columns: Name, Description]
- Create: Horizontal Feature
- Name: Chained centerline
- Description: [Empty text box]
- Style: Existing Centerlines (dropdown menu)
- Bandwidth: 10.000
- Create as a Closed Alignment or Feature

Name	Description
158	Existing Point of Cur...
160	Existing Point of Cur...
161	Existing Point of Cur...
171	Existing Point of Cur...
172	Existing Point of Cur...
173	Existing Point of Cur...

Methods of geometry creation

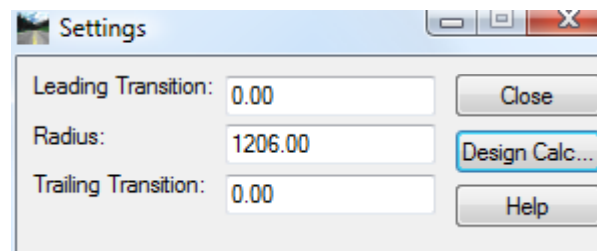
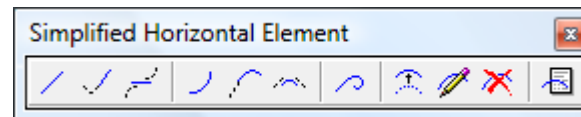
- Element based alignment creation
 - Can be created as discontinuous alignment
 - Advanced Regression tools
 - Simplified element tools

The screenshot displays several overlapping windows from the Bentley software interface:

- Settings**: A dialog box with input fields for 'Leading Transition: 0.000', 'Radius: 1186.000', and 'Trailing Transition: 0.000'. It includes buttons for 'Close', 'Design Calc...', and 'Help'.
- Add Fixed Horizontal Element**: A dialog box for defining a point. 'Point 1' is checked with 'Name: 94', 'Northing: 278606.943', 'Easting: 135184.912', 'Direction: N 00°00'00" E', and 'Radius: 0.000'. 'Point 2' is unchecked. Buttons for 'Apply', 'Close', 'Undo', and 'Help' are present.
- Check Horizontal Integrity**: A table window showing alignment data. A context menu is open over the table, listing actions like 'Make First', 'Move Back', 'Move Forward', 'Transpose', 'Delete', 'Report', and 'Fit'. The table columns include Type, Station, Northing, Easting, Direction, Length, Radius, Constant, and Integrity.
- Edit / Review Horizontal Regression Points**: A table window with columns: Name, Northing, Easting, Style, Include in..., Status, Offset, and Weight. Row 94 is selected, and a context menu with 'Insert', 'Edit', and 'Delete' options is visible.
- Main Menu**: A vertical list of options including 'Add Fixed Line', 'Add Floating Line', 'Add Free Line', 'Add Fixed Curve', 'Add Floating Curve', 'Add Free Curve', 'Define Spiral', 'Move Element', 'Edit Element', 'Delete Element', 'Settings...', 'Add Fixed Element...', 'Edit Element...', 'Delete Element...', and 'Check Integrity...'.

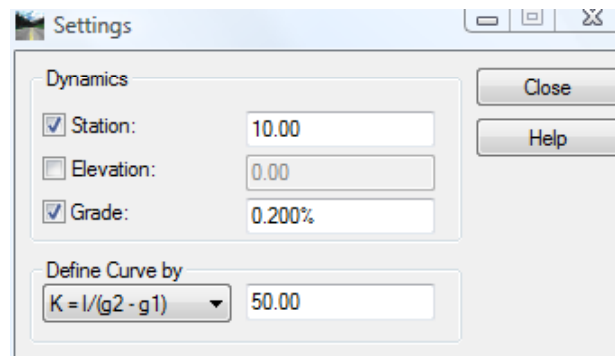
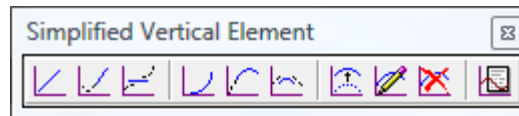
“Simplified” Horizontal Elements

- *Horizontal Elements* without dialogs
 - Well, there is a *Settings* dialog, which defines the radius and optional spiral lengths!
 - This dialog is active even during graphics input
 - *Add Fixed, Float and Free* elements
 - *Move*
 - *Edit*
 - *Delete*
 - MicroStation only functionality!



“Simplified” Vertical Elements

- *Vertical Elements* without dialogs
 - Well, there is a *Settings* dialog, which defines the K or length of curve!
 - This dialog is active even during graphics input
 - *Add Fixed, Float and Free* elements
 - *Move*
 - *Edit*
 - *Delete*
 - MicroStation only functionality!



Add Fixed Horizontal Element

- Add lines, circular arcs and transitions from a single dialog
 - Radii of 0 is a line
 - Equal non-zero radii is a circular arc
 - Unequal radii is a clothoid

The screenshot shows the 'Add Fixed Horizontal Element' dialog box. It is divided into sections for 'Point 1', 'Point 2', 'Length', and 'Delta'. 'Point 1' is selected with a checked checkbox and includes fields for Name, Northing (1360189.238), Easting (1959176.438), Direction (N 65°32'50.0\" E), and Radius (1000.000). 'Point 2' is not selected and has fields for Name, Northing (0.000), Easting (0.000), Direction (N 0°00'00.0\" E), and Radius (500.000). The 'Length' field is checked and set to 200.000, while the 'Delta' field is not checked and set to 0°00'00.0\". On the right side, there are buttons for 'Apply', 'Close', 'Undo', and 'Help'.

Geometry review and reporting

- Can review geometry directly from the Inroads Explorer
- Horizontal review provide alignment, element and curve set view
- Geometry points are reviewed via COGO, alignment, and geometry points
- Reporting is accessed via XML reporting as well as Report/Results dialog
- Design Checks for standards compliance

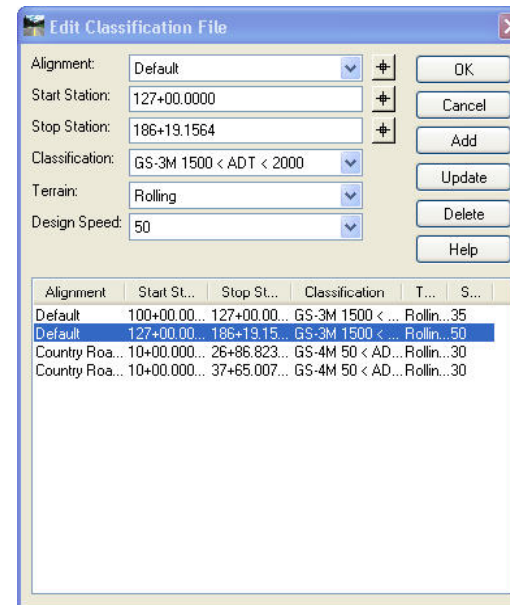
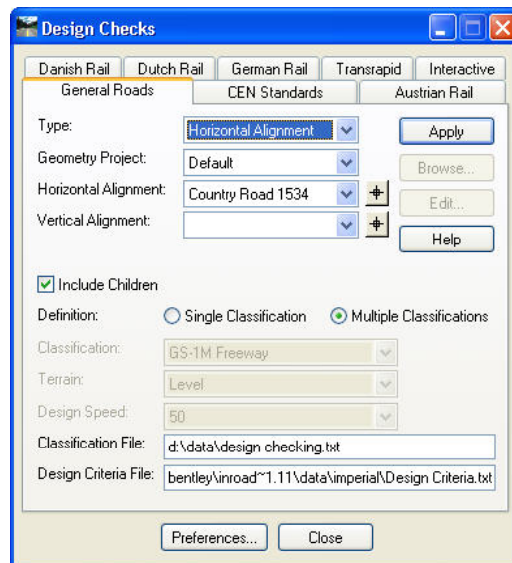
Design Checking

- Not just warnings!
 - Now it also indicates if the geometry is *acceptable!*
 - Good for QC

Checking stopping sight distances for alignment 'default'

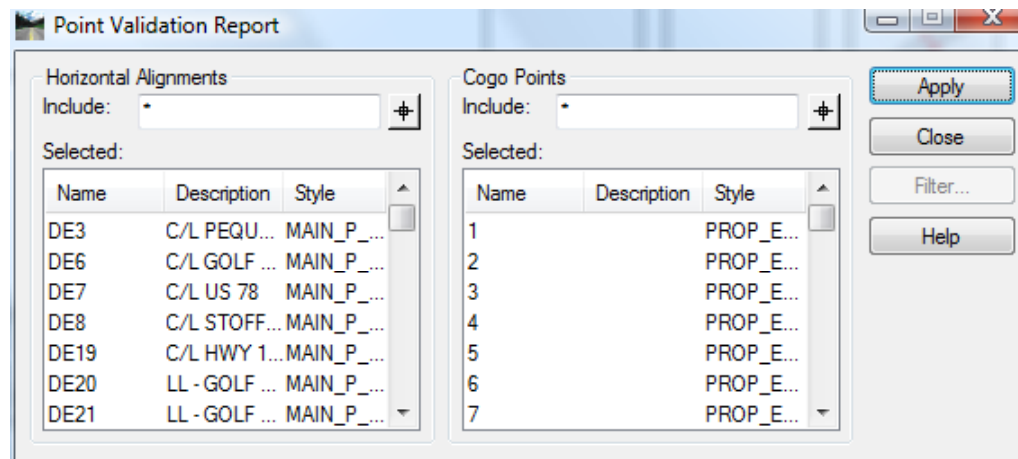
10+550.0000
 Classification: GS-1M Freeway Terrain: Rolling Speed: 60
 Warning: Desirable minimum stopping sight distance exceeded!
 Desirable minimum stopping sight distance: 205.0000
 Desirable minimum length should be: 499.1020
 Actual length: 300.0000

11+050.0000
 Classification: GS-1M Freeway Terrain: Rolling speed: 60
 Acceptable: Actual length is greater than desirable minimum stopping sight distance.
 Desirable minimum stopping sight distance: 205.0000
 Actual length: 300.0000

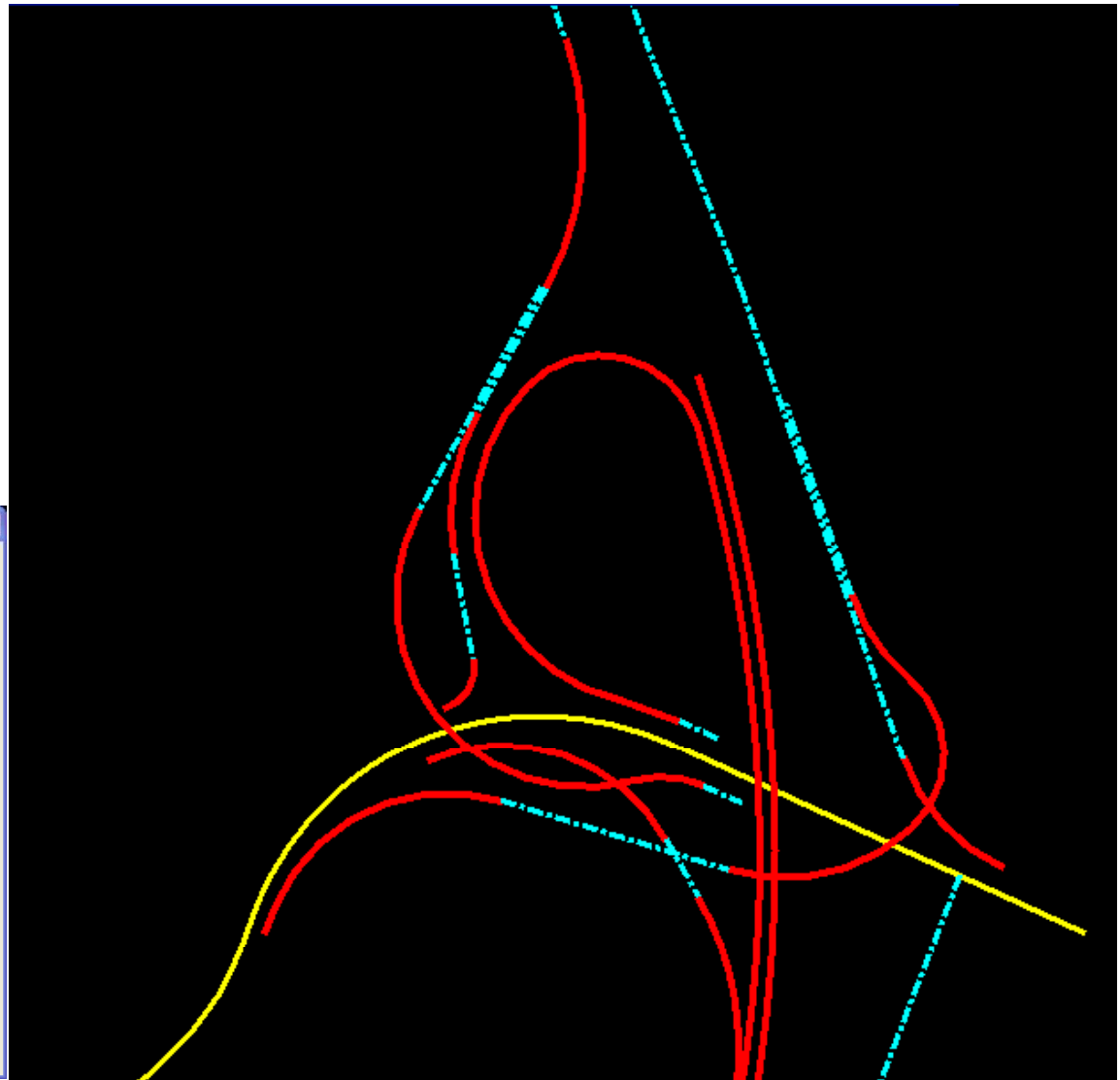
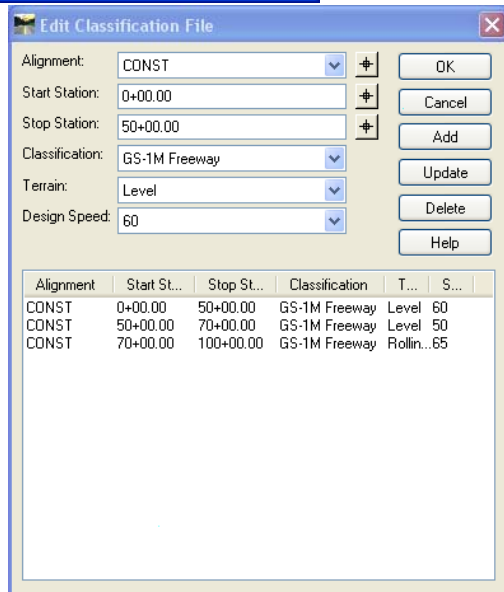
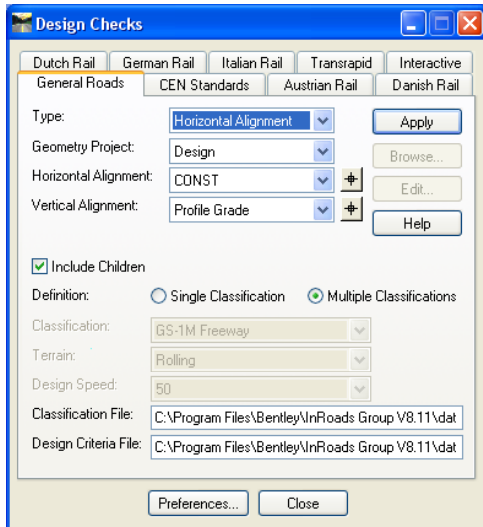


Point Validation

- Moved obscure functionality from *Review Point* to a new *XML Point Validation Report*
 - Uses geometry selection filter
 - Works with alpha-numeric names as numeric
 - Checks for duplicates
 - Validates coordinates for liked named points



Demonstration



Conclusion

- Questions?

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