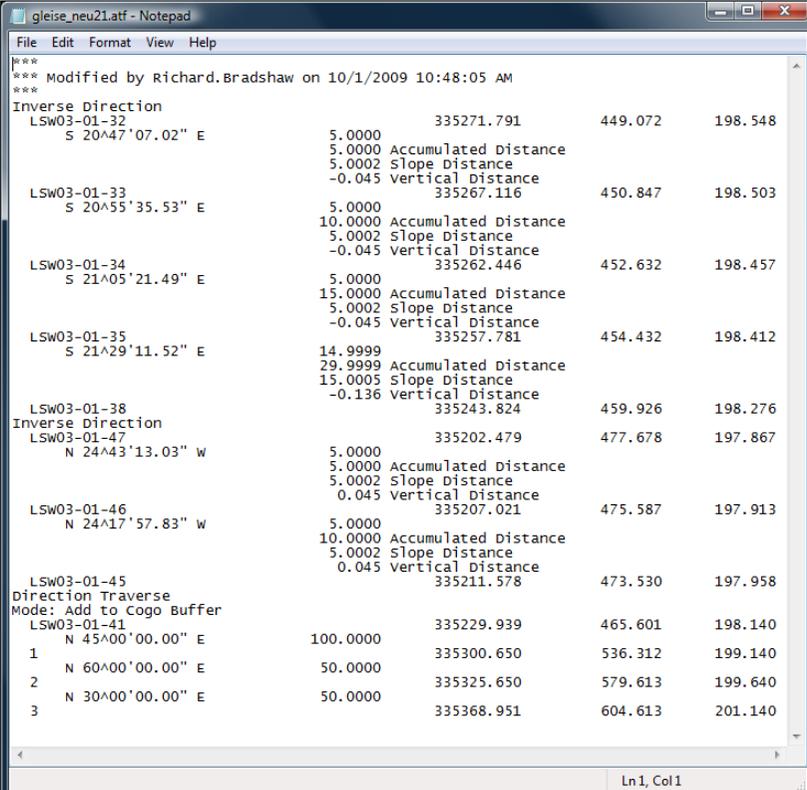


Coordinate Geometry

Coordinate geometry enhancements

Cogo Audit Trail

- Similar to the *Report Lock* for cogo commands, but *independent!*
 - Writes a .atf file to the same folder as the active geometry file.
- Cogo Audit Trail
 - Who?
 - When?
 - What?



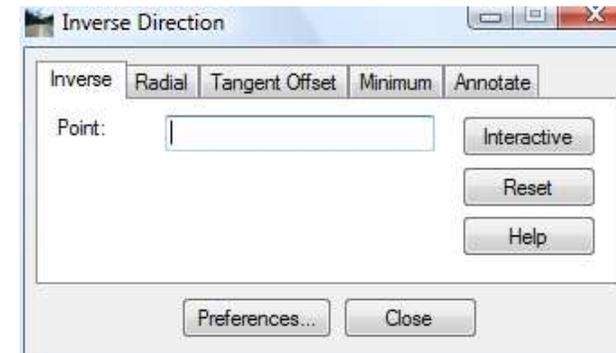
```

*** Modified by Richard.Bradshaw on 10/1/2009 10:48:05 AM ***
Inverse Direction
LSW03-01-32          5.0000      335271.791      449.072      198.548
S 20^47'07.02" E    5.0000 Accumulated Distance
                    5.0002 Slope Distance
                    -0.045 Vertical Distance
                    335267.116
LSW03-01-33          5.0000      450.847      198.503
S 20^55'35.53" E   10.0000 Accumulated Distance
                    5.0002 Slope Distance
                    -0.045 Vertical Distance
                    335262.446
LSW03-01-34          5.0000      452.632      198.457
S 21^05'21.49" E   15.0000 Accumulated Distance
                    5.0002 Slope Distance
                    -0.045 Vertical Distance
                    335257.781
LSW03-01-35          14.9999      454.432      198.412
S 21^29'11.52" E   29.9999 Accumulated Distance
                    15.0005 Slope Distance
                    -0.136 Vertical Distance
                    335243.824
LSW03-01-38          459.926      198.276
Inverse Direction
LSW03-01-47          5.0000      477.678      197.867
N 24^43'13.03" W   5.0000 Accumulated Distance
                    5.0002 Slope Distance
                    0.045 Vertical Distance
                    335207.021
LSW03-01-46          5.0000      475.587      197.913
N 24^17'57.83" W   10.0000 Accumulated Distance
                    5.0002 Slope Distance
                    0.045 Vertical Distance
                    335211.578
LSW03-01-45          473.530      197.958
Direction Traverse
Mode: Add to Cogo Buffer
LSW03-01-41          100.0000     335229.939     465.601     198.140
N 45^00'00.00" E   1          50.0000     335300.650     536.312     199.140
N 60^00'00.00" E   2          50.0000     335325.650     579.613     199.640
N 30^00'00.00" E   3          50.0000     335368.951     604.613     201.140

```

Inverse Direction

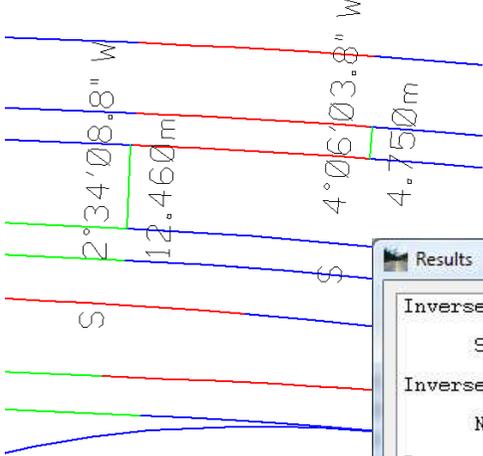
- Wildcarding
- Ascending & descending numeric point name series
- Additional textual output
 - Accumulated distance
 - Vertical distance
- Dynamic graphics
 - Temporary



Point	Bearing	Distance	Accumulated Distance	Slope Distance	Vertical Distance	Other Distance
c1101	N 68°21'37.40" E	18.3459	18.3459	92.8309	91.000	334967.424
c1102	N 64°51'15.63" E	18.3459	36.6918	18.5896	3.000	334974.190
c1103	N 61°20'53.86" E	18.3459	55.0377	18.5896	-3.000	334981.985
c1104	N 57°50'32.09" E	18.3459	73.3836	18.5896	-3.000	334990.782
c1105						335000.546

Inverse Direction - Minimum

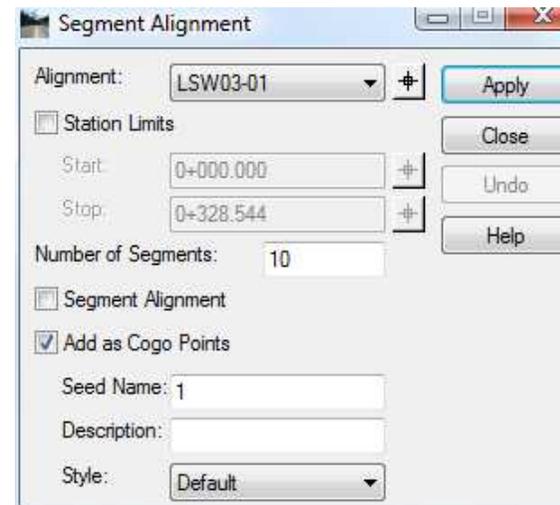
- Minimum
 - Computes minimum distance from an element to another element
 - Interactive



Inverse Minimum Distance			
S 2°34'08.77" W	12.4601	334827.313	2007.060
Inverse Minimum Distance		334814.866	2006.502
N 18°07'23.30" E	5.4894	334767.927	2192.931
Inverse Minimum Distance		334773.144	2194.639
S 4°06'03.81" W	4.7499	334830.011	2043.299
		334825.273	2042.959

Segment Alignment

- Segment an alignment into multiple segments
 - In other words take a line with a length of 100' and replace that line with segments that are 25' in length!
 - Or across multiple elements!
- Create cogo points



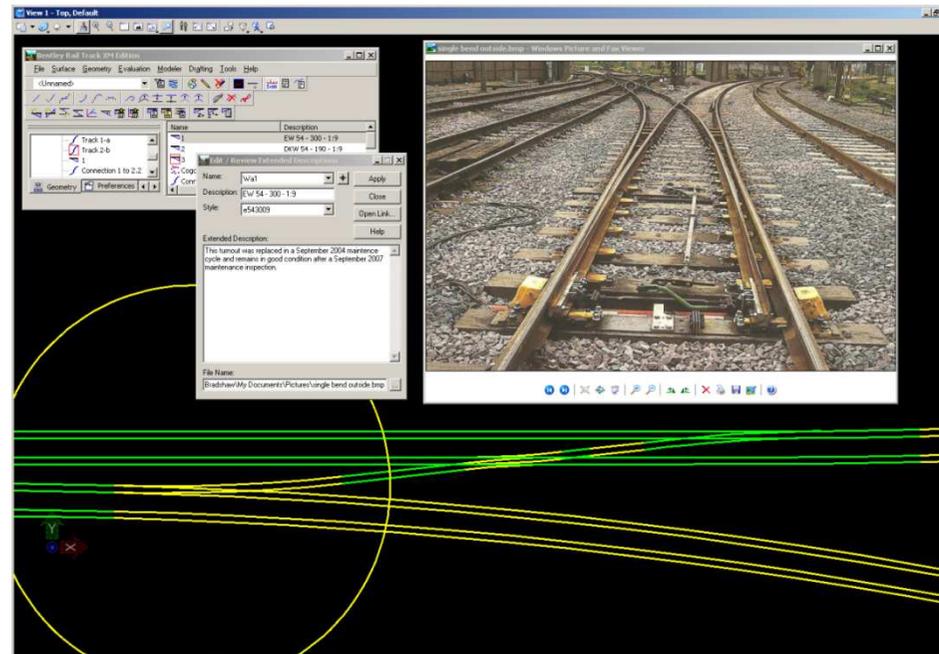
The screenshot shows the 'Segment Alignment' dialog box with the following settings:

- Alignment: LSW03-01
- Station Limits: (unchecked)
- Start: 0+000.000
- Stop: 0+328.544
- Number of Segments: 10
- Segment Alignment: (unchecked)
- Add as Cogo Points: (checked)
- Seed Name: 1
- Description: (empty)
- Style: Default

Buttons: Apply, Close, Undo, Help

Extended Description

- Adding non-graphical data to the design data
 - Digital images
 - External data storage
 - Textual
 - .alg data storage
- Reporting
- Annotation



Alignment / Design

Horizontal and vertical alignment / design enhancements

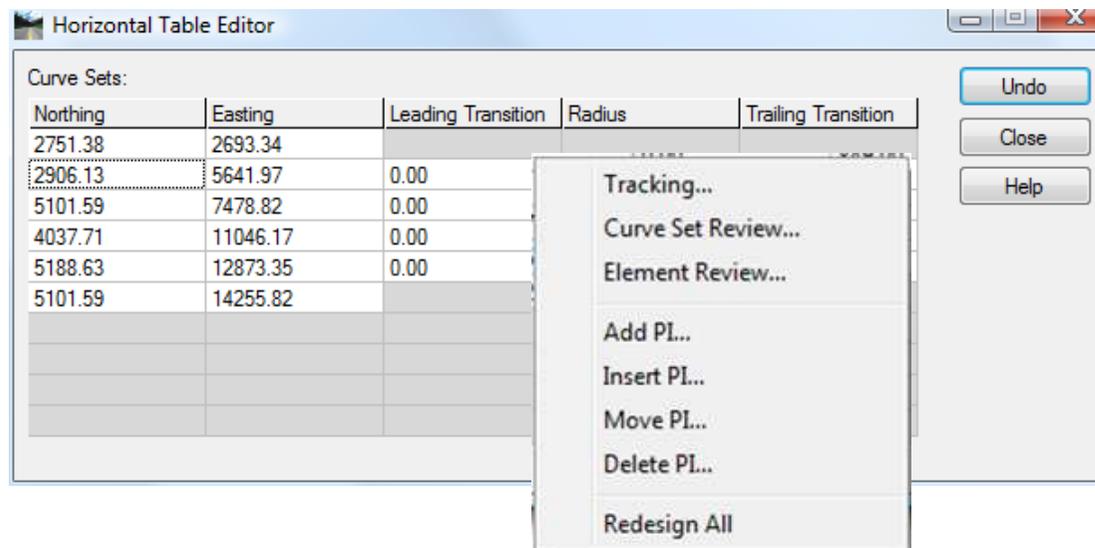
Horizontal Design Criteria

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

* DESIGN 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.

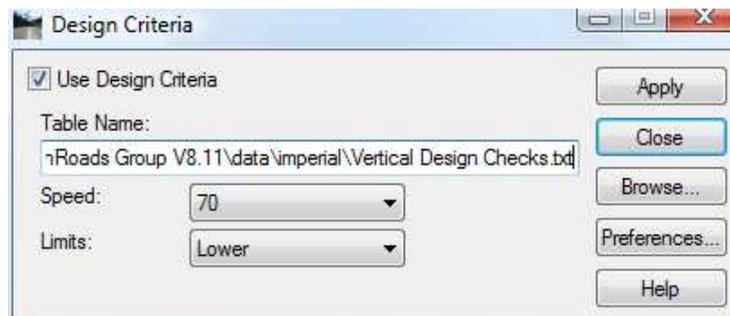
Horizontal Table Editor

- 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 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



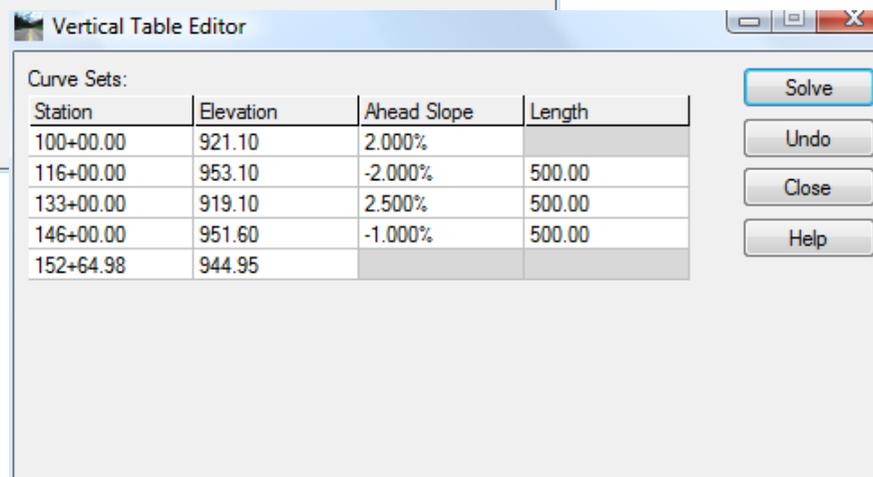
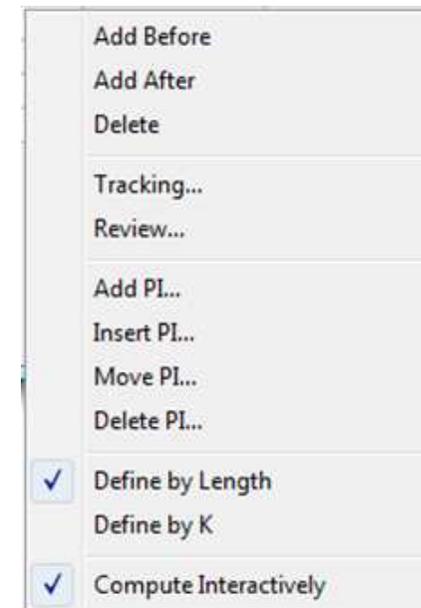
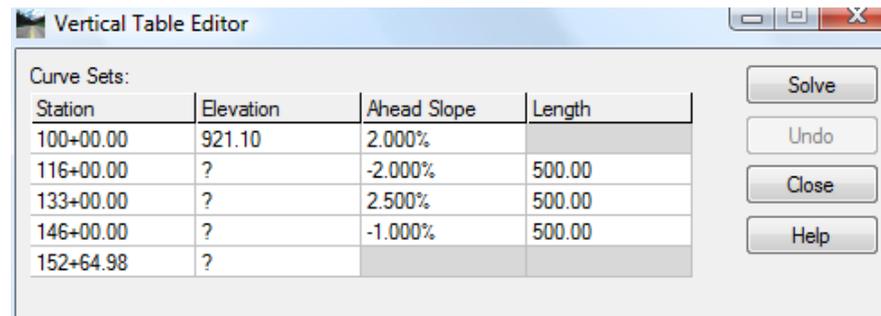
* DESIGN SPEED (mph)	f	Crest Stop Dist	- Upper K value	Crest Stop Dist	- Lower K value	Sag Stop Dist	- Upper K value	Sag Stop Dist	- Lower K value	Passing Minimum Dist	Sight Dist. K Value
20.	.40	125.	10.	125.	10.	125.	20.	125.	20.	800.	210.
25.	.38	150.	20.	150.	20.	150.	30.	150.	30.	950.	300.
30.	.35	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.

Short avi...

- Vertical Design Criteria
- Single dialog for Add, Insert, Move and Delete Vertical PI
- *On the fly* annotation

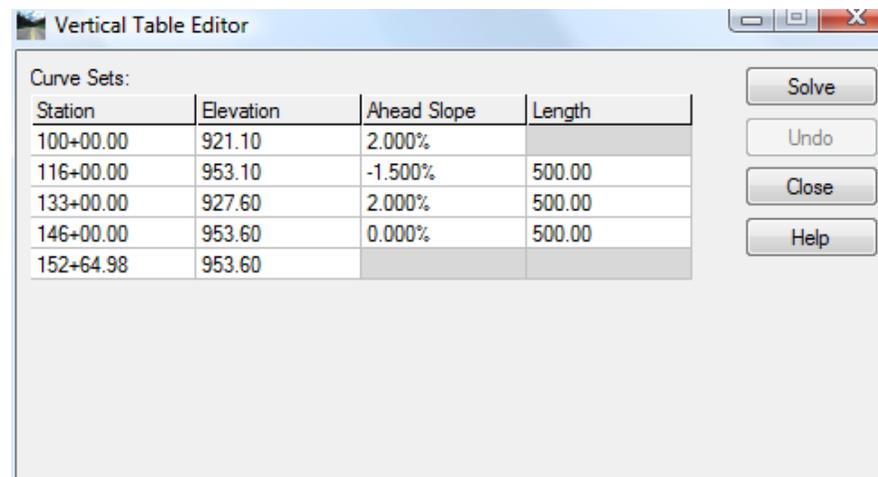
Vertical Table Editor

- Two modes
 - *Compute Interactively*
 - Or wait and *Solve* for unknown values



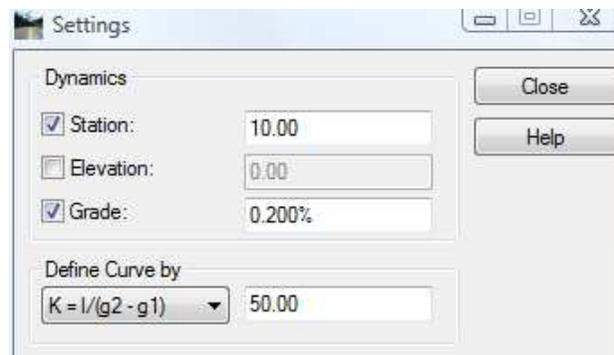
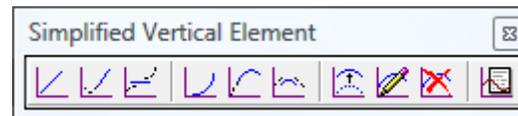
Vertical Table Editor

- 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



“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!



Vertical Healing

- Synchronize / update the vertical alignment when the horizontal alignment has changed
 - The coordinate position of vertical PI's will be held!
 - The user is responsible for potential overlaps
 - The user is responsible for resolving verticals that are beyond the limits of the horizontal
 - Set in *File > Project Options > Geometry*, but it is one of those settings that you should set and remain set!
 - *This is one implementation, others would have been possible!*

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

Rail Specific Transition Spirals

- AREMA transition spiral
 - Chord definition alignment
 - US freight standard
 - *Bentley Rail Track only!*

```

Element: AREMA
  TS (      )      3+37.1050    10191.4712    10277.4501
  SPI (      )      5+37.0953    10305.0631    10442.0496
  SC (      )      6+37.1050    10357.5103    10527.2682
  Entrance Radius:      0.0000
  Exit Radius:      2864.9344
  Length:      300.0000
  Angle:      3^00'00.0" Right
  Constant:      927.0816
  Long Tangent:      199.9902
  Short Tangent:      100.0646
  Long Chord:      299.9634
  Xs:      299.9177
  Ys:      5.2370
  P:      1.3107
  K:      149.9786
  Tangent Direction:      N 55^23'24.1" E
  Radial Direction:      S 34^36'35.9" E
  Chord Direction:      N 56^23'25.4" E
  Radial Direction:      S 31^36'35.9" E
  Tangent Direction:      N 58^23'24.1" E

```

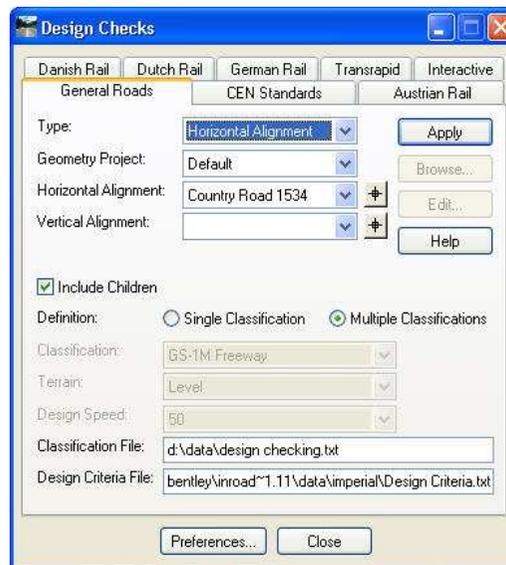
```

Element: Circular
  SC (      )      6+37.1050    10357.5103    10527.2682
  PI (      )      10+99.8233    10600.0368    10921.3357
  CC (      )      7917.6297    12028.8778
  CS (      )      15+54.5718    10706.1755    11371.7164
  Radius:      2864.9344
  Design Speed(mph):      70.0000
  Cant(inches):      5
  Delta:      18^20'57.6" Right
  Degree of Curvature(Chord):      2^00'00.0"
  Length:      917.5133
  Length(Chorded):      917.4667
  Tangent:      462.7183
  Chord:      913.5973
  Middle Ordinate:      36.6515
  External:      37.1265
  Tangent Direction:      N 58^23'24.1" E
  Radial Direction:      S 31^36'35.9" E
  Chord Direction:      N 67^33'52.9" E
  Radial Direction:      S 13^15'38.3" E
  Tangent Direction:      N 76^44'21.7" E

```

Design Checking

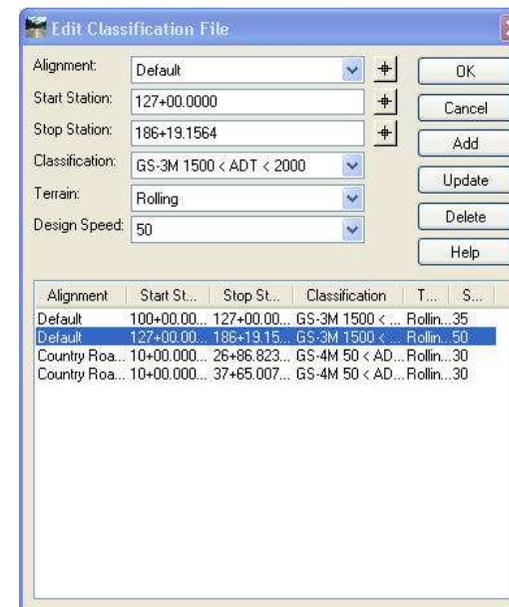
- Not just warnings!
 - Now it also indicates if the geometry is *acceptable!*
 - Good for QC



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

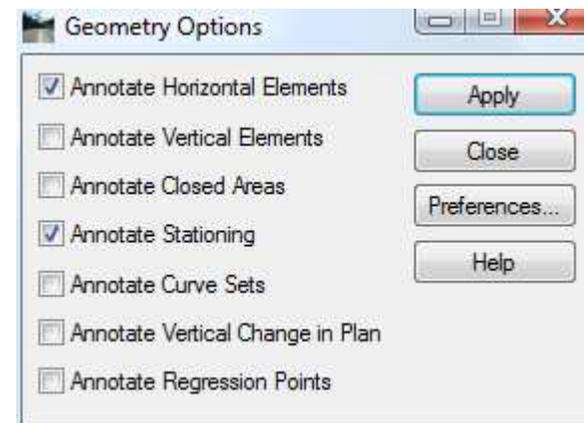


Annotation & Display

Annotation and display enhancements

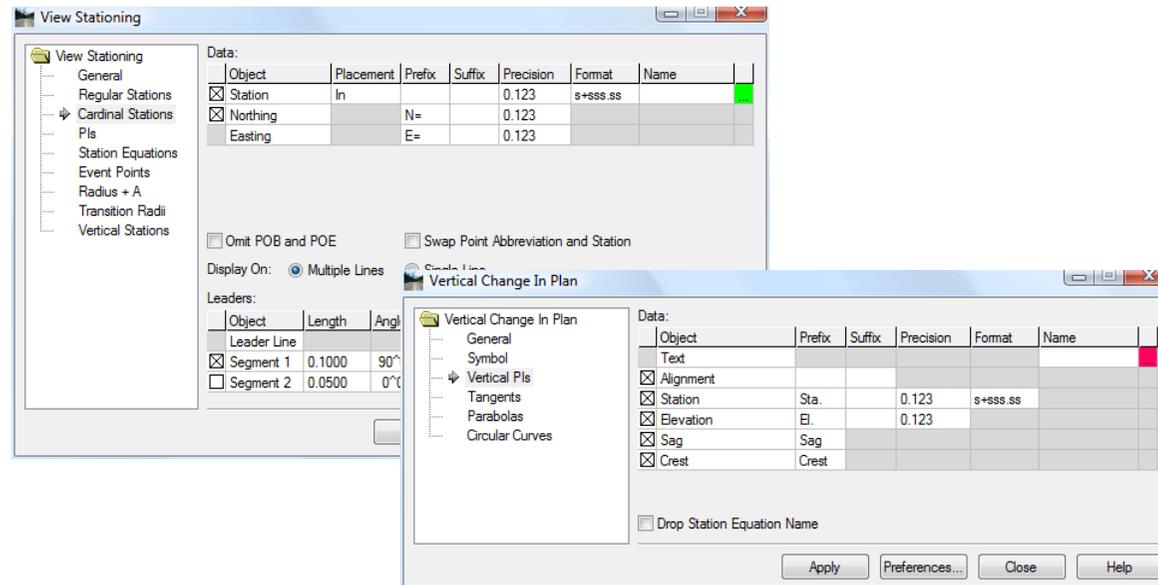
View Options

- 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



Tree / Leaf User Interface

- Converted most commands to tree / leaf
 - Allows greater consistency
 - Allows for potential enhancements
 - Allows for display / annotation during edits!
- You will need to look at preferences!



Just more examples...

The image displays three overlapping software dialog boxes from a CAD application, each showing a configuration table for different annotation types.

Curve Set Annotation Dialog:

Object	Column	Row	Prefix	Suffix	Precision	Format	Name
<input checked="" type="checkbox"/> Line							Prop Horizontal
<input checked="" type="checkbox"/> Point							Prop Horizontal
<input checked="" type="checkbox"/> Text							
<input checked="" type="checkbox"/> Curve Number	1	1	C#				
<input checked="" type="checkbox"/> Station	1	2	Sta=		0.123	s+sss.ss	
<input checked="" type="checkbox"/> Northing	1	5	N=		0.123		
<input checked="" type="checkbox"/> Easting	1	6	E=		0.123		
<input checked="" type="checkbox"/> Radius	1	9	R=	m	0.123		
<input type="checkbox"/> Degree of Curve	1	4	Dc=		0	ddd^mm'ss.ss"	
<input checked="" type="checkbox"/> Delta Left	1	3	Delta=		0.1	ddd^mm'ss.ss"	
<input type="checkbox"/> Delta Right			Delta=				
<input checked="" type="checkbox"/> Arc Length	1	8		m	0.123		
<input type="checkbox"/> Spiral Length	1	9	Ls=	m	0.12		
<input type="checkbox"/> Constant							
<input checked="" type="checkbox"/> Superelevation							
<input type="checkbox"/> Speed							
<input checked="" type="checkbox"/> Tangent Length							
<input checked="" type="checkbox"/> External Distance							

Station Offset Annotation Dialog:

Object	Column	Row	Prefix	Suffix	Precision	Format	Name
<input type="checkbox"/> Name	1	4					
<input type="checkbox"/> Description	1	5					
<input type="checkbox"/> Style	1	6					
<input checked="" type="checkbox"/> Station	1	1			0.123	s+sss.ss	
<input checked="" type="checkbox"/> Offset Left	1	2	Off	L	0.123		
<input type="checkbox"/> Offset Right			Off	R			
<input checked="" type="checkbox"/> Northing	1	6	N		0.123		
<input checked="" type="checkbox"/> Easting	1	7	E		0.123		
<input type="checkbox"/> Elevation	1	3	EI		0.12		

View Closed Areas Dialog:

Object	Prefix	Suffix	Precision	Name
<input checked="" type="checkbox"/> Name				Annotation-Plan
<input checked="" type="checkbox"/> Description				
<input type="checkbox"/> Area in Square Meters		m2	0.12	
<input type="checkbox"/> Area in Hectares		ha	0.12	
<input type="checkbox"/> Perimeter in Meters		m	0.12	
<input checked="" type="checkbox"/> Area in Square Feet	Area	ft2	0	
<input type="checkbox"/> Area in Acres		ac	0.12	
<input checked="" type="checkbox"/> Perimeter in Feet	Perimet	ft	0.123	

User Interface

User interface enhancements that improve your productivity

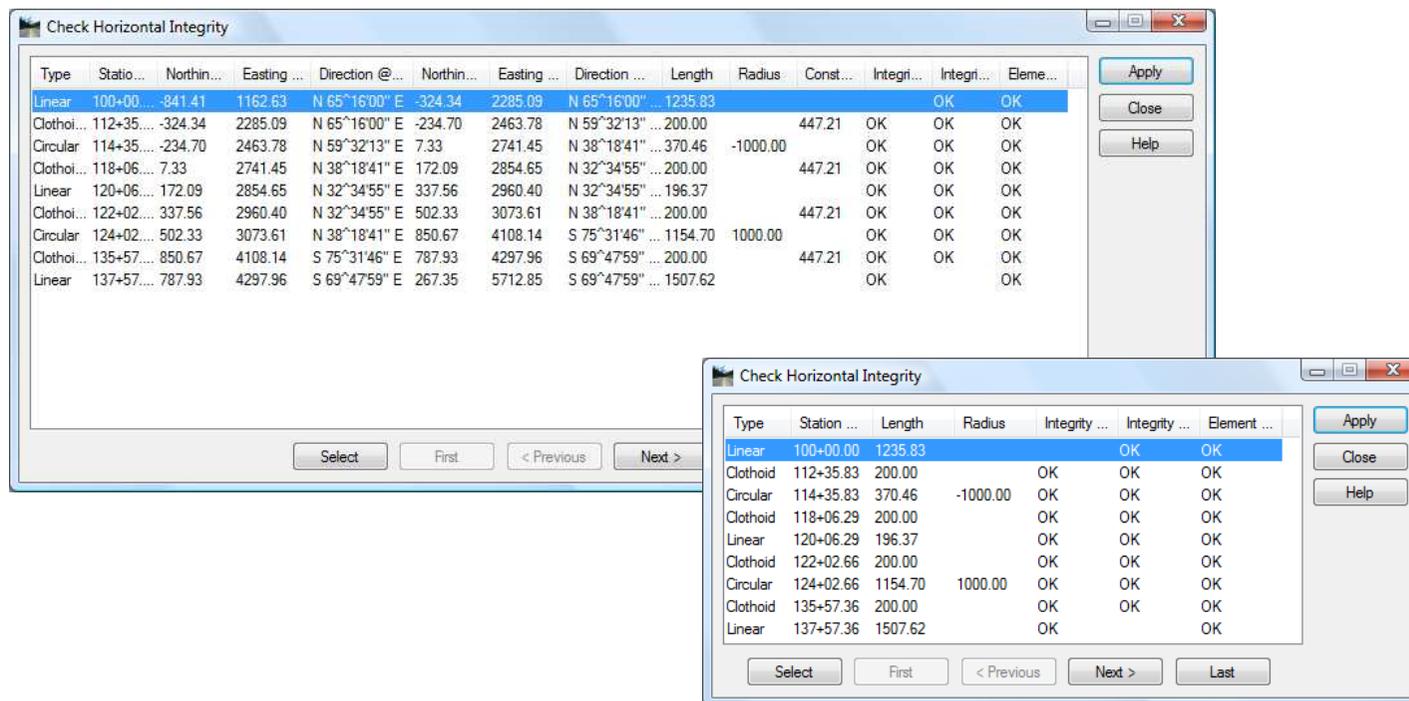
User Interface Enhancements

- Smaller dialogs
- Moved buttons to right-click popup menus
- *And to avoid user panic, an Alert has been added!*



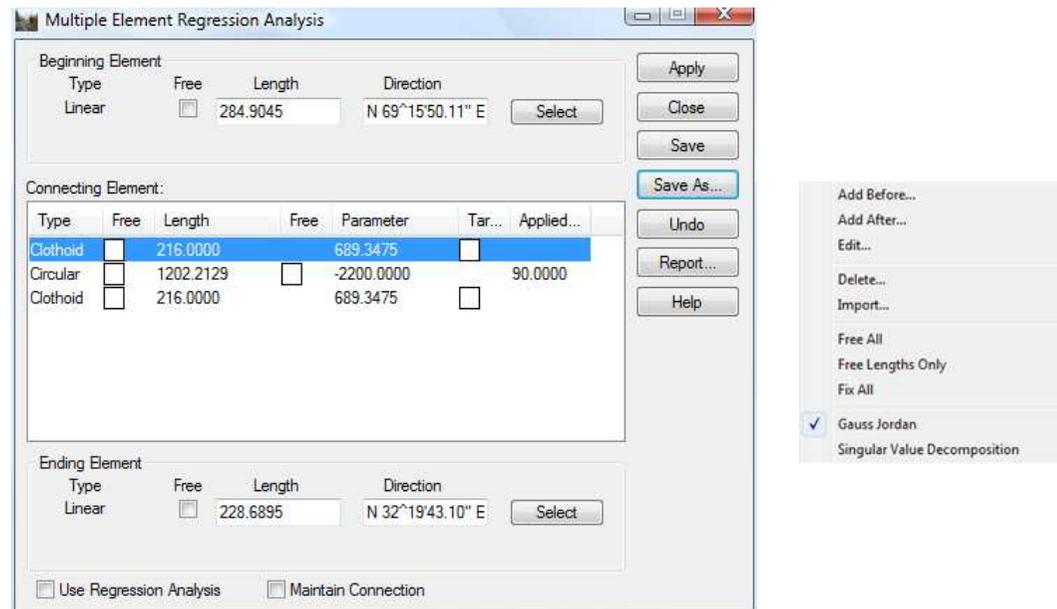
Configurable List View & Dialog Resizing

- Right click in title and select data of interest
 - *Check Integrity*
 - *Review / Edit Regression Points*



Less Clutter

- Moved buttons to *right click* context sensitive pop-up menus
- Eliminated tabbed dialogs
 - Everything is together in one dialog but still without excess clutter!



Metes & Bounds

- Similar to *Traverse Edit*, but all editing is within the grid!
 - Workflow oriented
 - Metes & bounds
 - Simple unspiralized alignments

Metes & Bounds

Name:

Description:

Style:

Starting Point

Name:

Northing:

Easting:

Maintain Tangency

Angular Tolerance:

Scale Factor:

Apply

Close

Undo

Help

Elements:

Type	Direction	Angle	Distance	Radius	Length
Linear	N 37°56'51.0" E	-65°16'09.0"	71.0000		
Linear	N 27°19'18.0" W	14°30'56.0"	36.6000		
Linear	N 12°48'22.0" W	-25°02'13.0"	90.1000		
Linear	N 37°50'35.0" W	21°40'30.0"	62.5000		
Linear	N 16°10'05.0" W	55°30'18.0"	39.5000		
Linear	N 39°20'13.0" E	-66°18'53.0"	20.8000		
Linear	N 26°58'40.0" W	47°33'22.0"	31.0000		
Linear	N 20°34'42.0" E		15.6000		

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:
- Style: traverse
- Starting Point:
 - Name:
 - Northing: 0.000
 - Easting: 0.000
- Closing Point:
 - Name:
 - 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
		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
		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
		205.082	161.952	-125.818	571.100	25.541

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)

Text Import Wizard - Step 2 of 4

Apply Filter to

All Lines

Lines that Start With: PNT

Lines that Include: CC

Segments of Text

Start: Include Start in Import

End: Include End in Import

Exclude Filtered Lines From Import

Original Data Type

Fixed Width - Fields are aligned in columns

Delimited - Characters separate each field

Help

Defined Filters:

Name	Description
Include P...	Include lines that start with 'PNT'
Include B...	Include lines that include 'BC'
Include E...	Include lines that include 'EC'
Include C...	Include lines that include 'CC'

Add Delete Update

D:\ProgramData\CalTrans Demo Data\Horizontal_Alignments-TXT\D1-HA.txt

```
PNT4140 N 2020083.2481 E 6770325.7850 Z 0.000 STA 142+36.02
Distance 1124.347' Bearing N 58°07'56.9" E
CURVE CRV154
BC N 2020676.8551 E 6771280.6603 STA 153+60.37
CC N 2019954.8442 E 6771729.2139
PI N 2020763.3697 E 6771419.9179 STA 155+24.31
TAN 163.943'
```

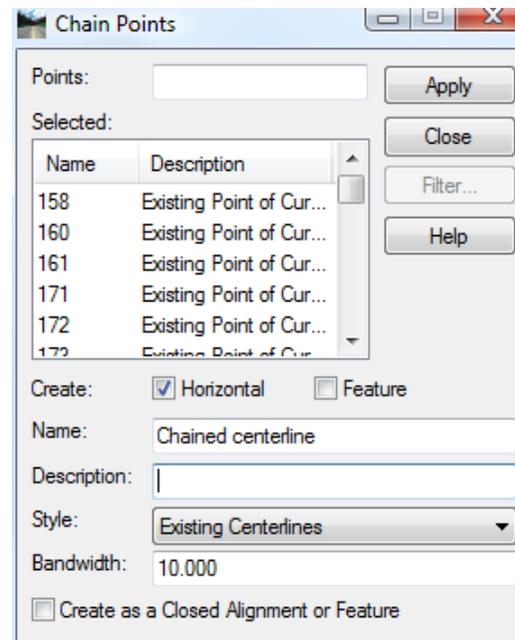
Open... Save Save As... < Back Next > Finish Cancel

Localizations / Customizations

Customer specific enhancements, that may work for other users!

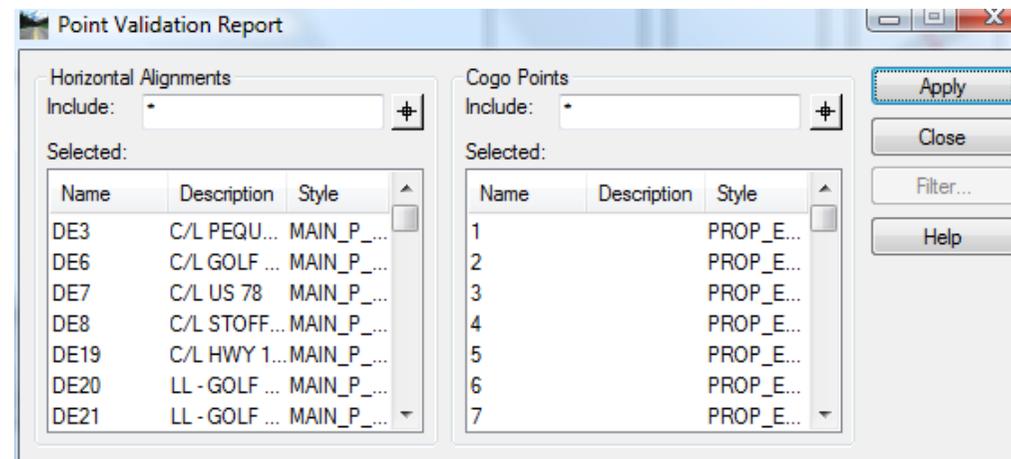
Chain Points

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



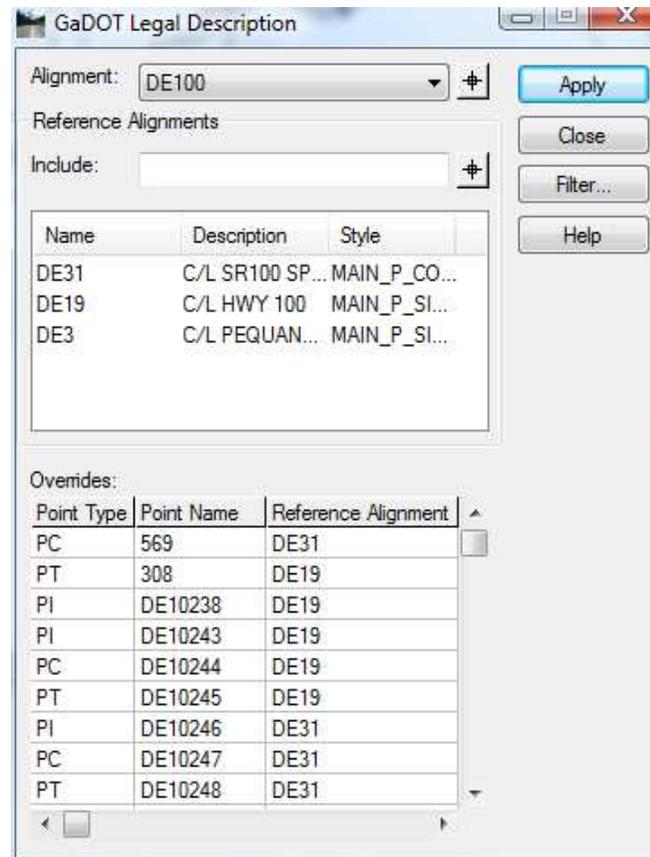
Point Validation

- 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



Legal Description

- Allows multiple reference alignments for a single parcel, which can be further refined by the user



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 a dialog box titled "Add Fixed Horizontal Element" with the following fields and values:

Field	Value
Point 1 Name	
Point 1 Northing	1360189.238
Point 1 Easting	1959176.438
Point 1 Direction	N 65°32'50.0" E
Point 1 Radius	1000.000
Point 2 Name	
Point 2 Northing	0.000
Point 2 Easting	0.000
Point 2 Direction	N 0°00'00.0" E
Point 2 Radius	500.000
Length	200.000
Delta	0°00'00.0"

And Finally

- Always working with customers to continually improve the product!
- Questions?

