E3-InRoads Geometry Update

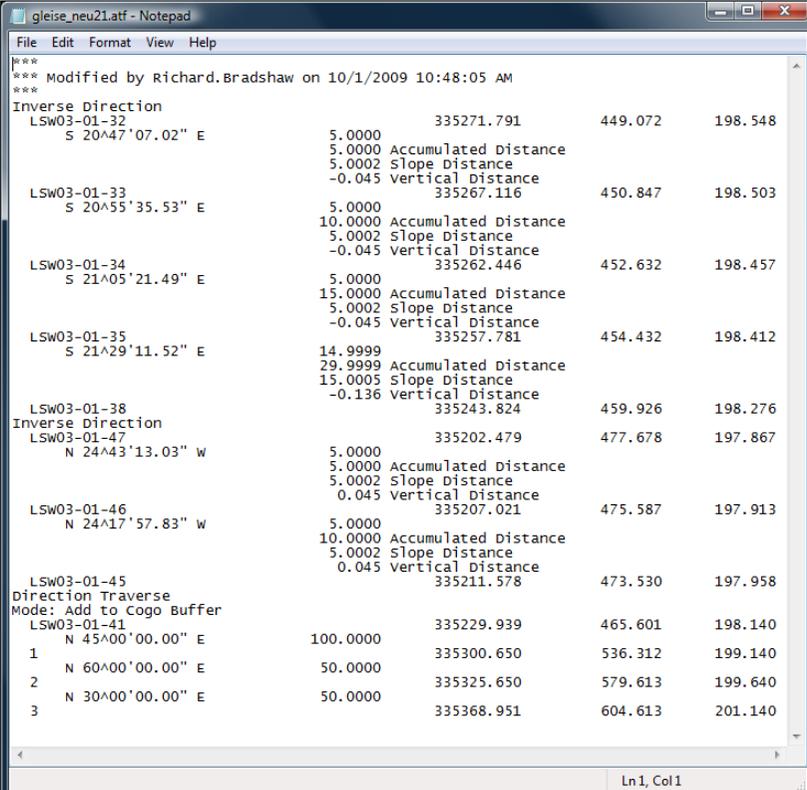Joe Waxmonsky, Bentley Civil

Coordinate Geometry

Coordinate geometry enhancements

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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
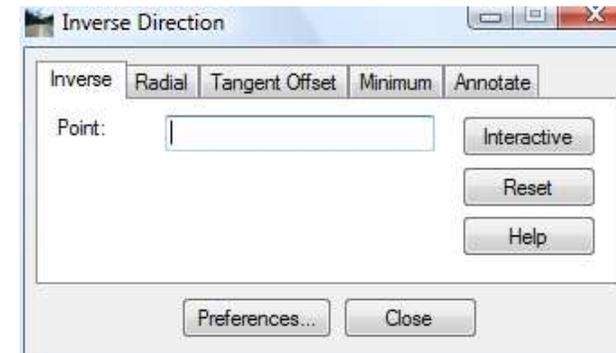 - Who?
  - When?
  - What?

Inverse Direction

- Wildcarding

- Ascending & descending numeric point name series

- Additional textual output
  - Accumulated distance
  - Vertical distance

- Dynamic graphics
  - Temporary

Inverse Direction - Minimum

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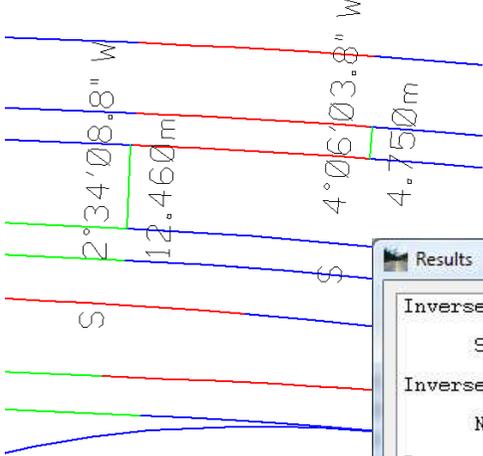
Segment Alignment

- 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
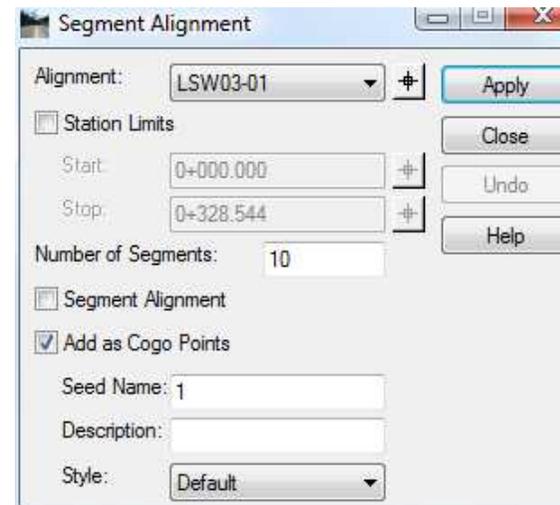
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Extended Description

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

- Reporting

- Annotation
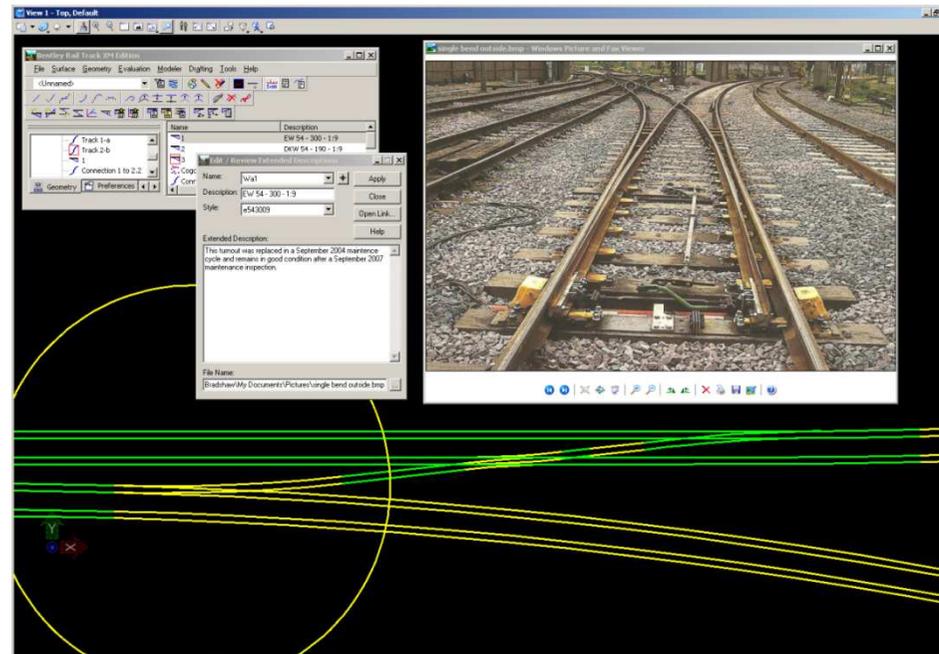
Alignment / Design

Horizontal and vertical alignment / design enhancements

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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.

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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

"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!
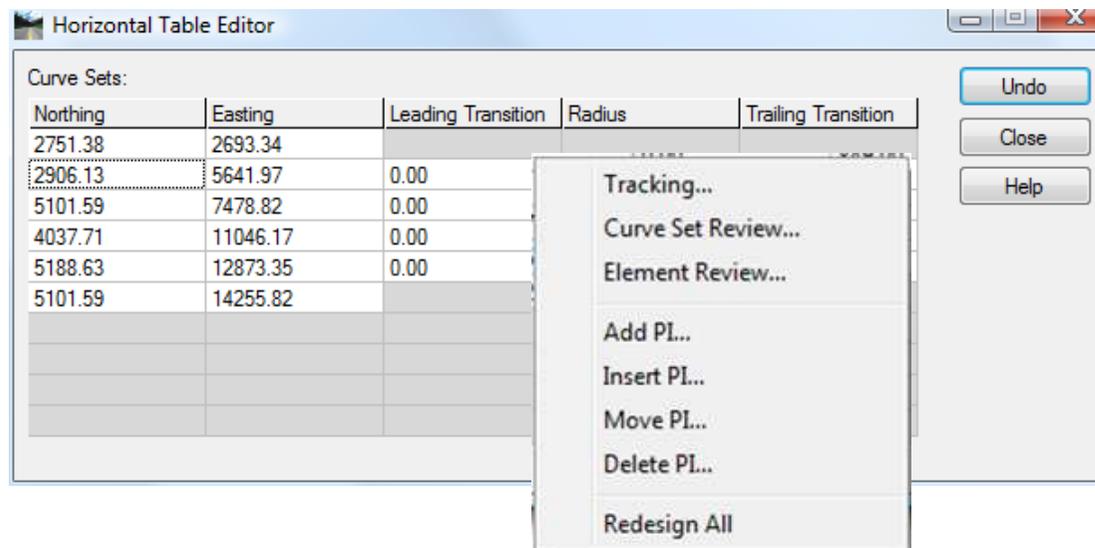
Vertical Design Criteria

- ## Curve Set Based
  - *Add PI & Insert PI*

- ## Looks up K based upon speed / lower or upper limits
  - ..\data\imperial\Vertical Design Checks.txt


```
*  DESIGN       |Crest - Upper| Crest - Lower| Sag - Upper| Sag - Lower| Passing Sight Dist.
*  SPEED        |Stop    K    |Stop    K     |Stop    K   |Stop    K   |Minimum    K
*  (mph)    f   |Dist   Value |Dist   Value  |Dist  Value |Dist  Value |Dist     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

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Vertical Table Editor

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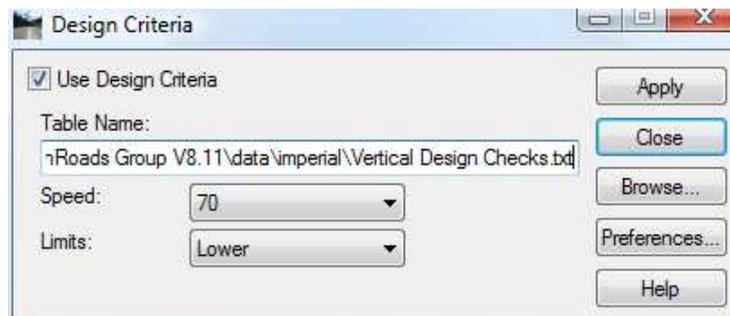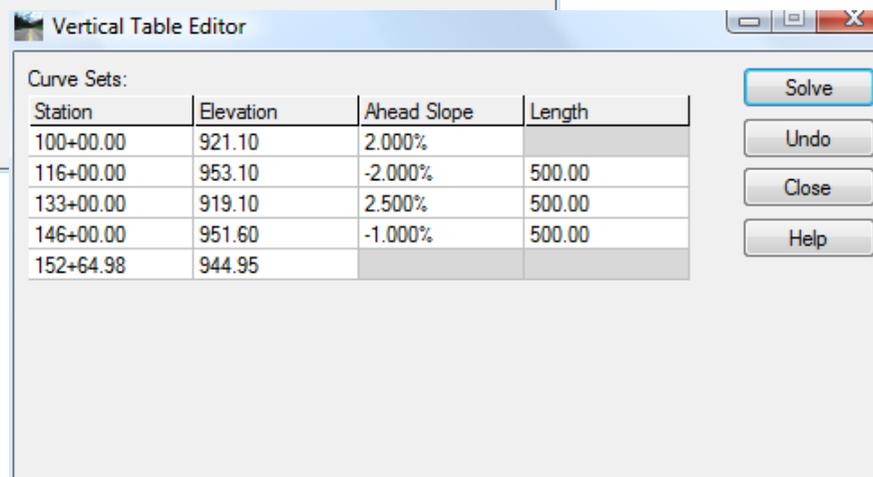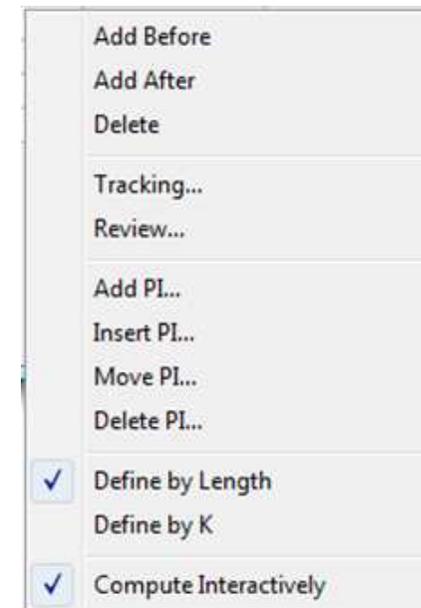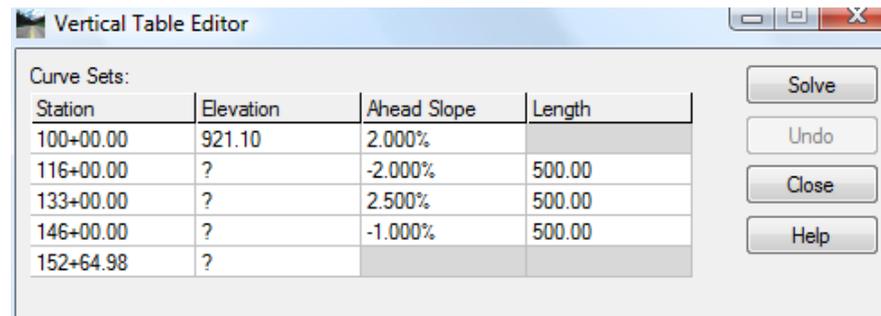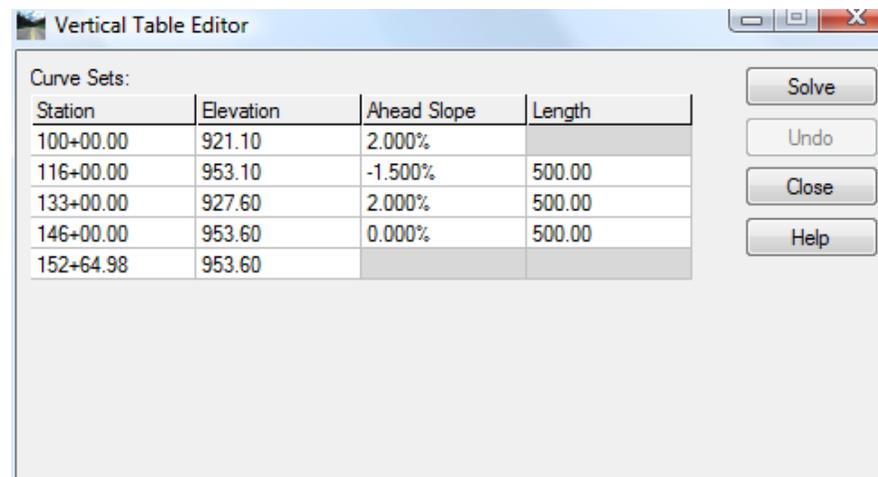 - Or wait and *Solve* for unknown values

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

Vertical Table Editor				
Curve Sets:				
Station	Elevation	Ahead Slope	Length	Solve
100+00.00	921.10	2.000%		Undo
116+00.00	953.10	-1.500%	500.00	Close
133+00.00	927.60	2.000%	500.00	
146+00.00	953.60	0.000%	500.00	Help
152+64.98	953.60			

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"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!

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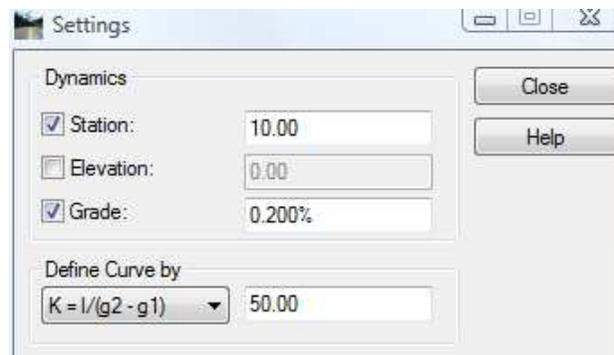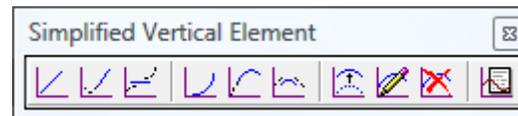
Vertical Healing

- 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!*

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Curve Fitting

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

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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
```

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Design Checking

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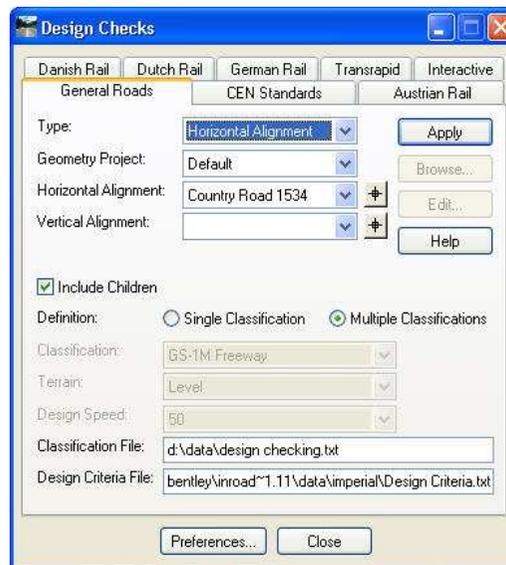

```
Checking stopping sight distances for alignment 'Default'

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
```
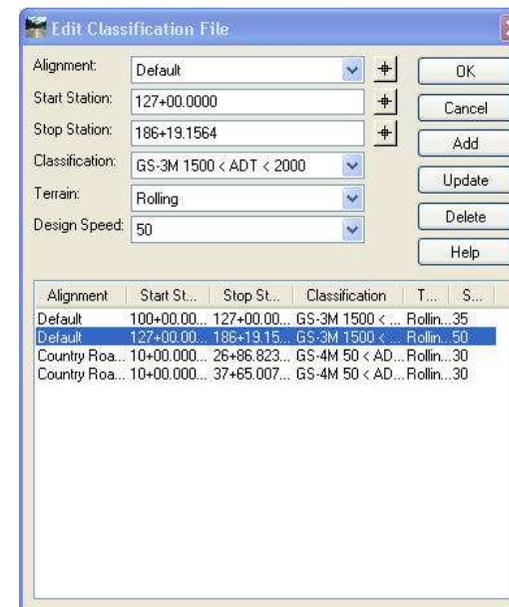
Annotation & Display

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 <u>road baseline</u> would have:
      - Horizontal annotation
      - Stationing
      - Curve set annotation
    - A <u>right of way take</u> would have:
      - Horizontal annotation

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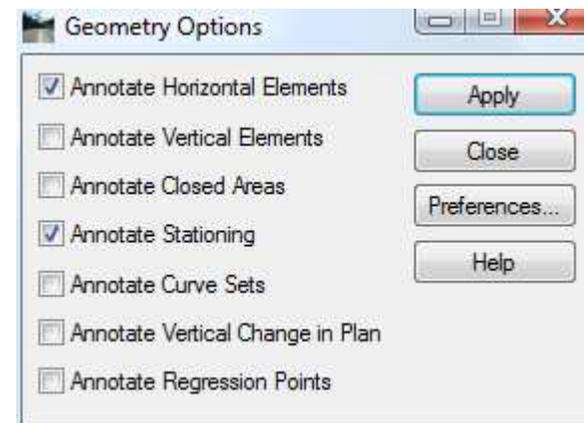
Tree / Leaf User Interface

- 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...

User Interface

User interface enhancements that improve your productivity

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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*
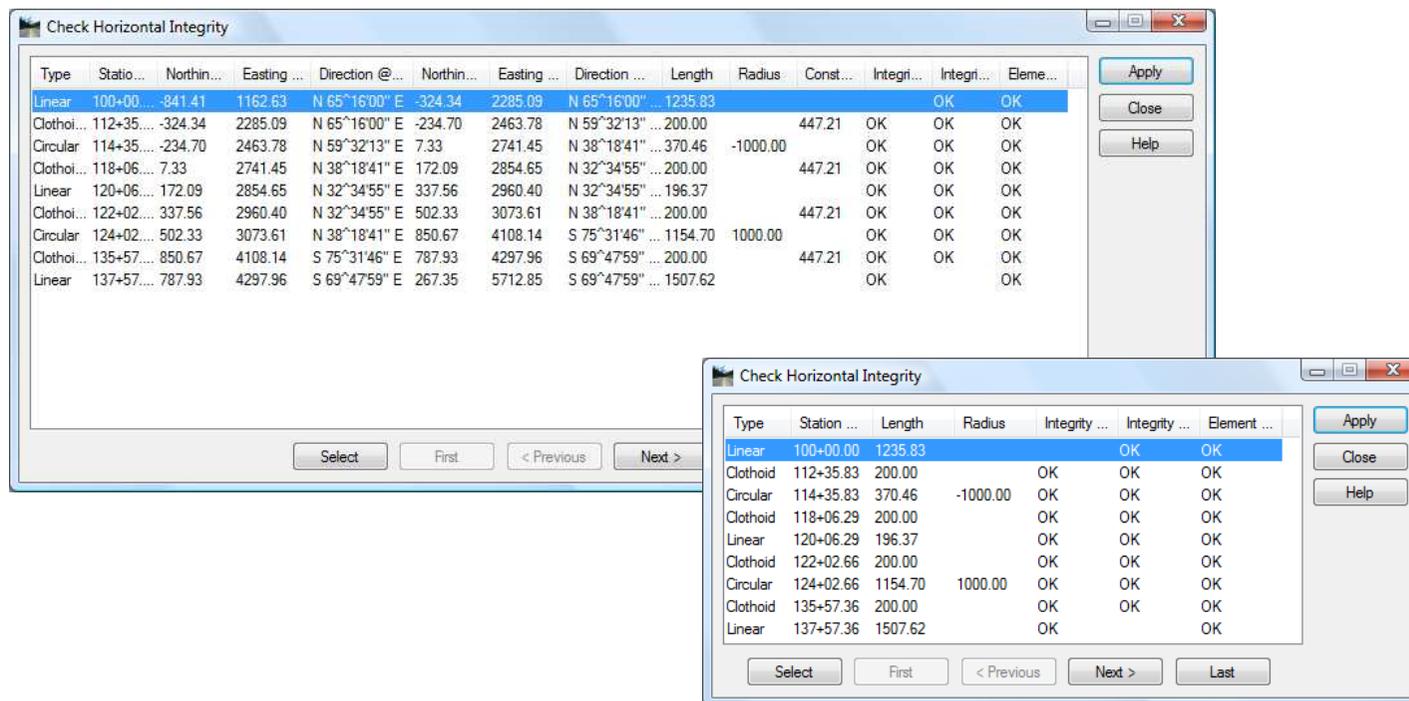
Less Clutter

- Moved buttons to *right click* context sensitive pop-up menus

- Eliminated tabbed dialogs
  - Everything is together in one dialog but still without excess clutter!
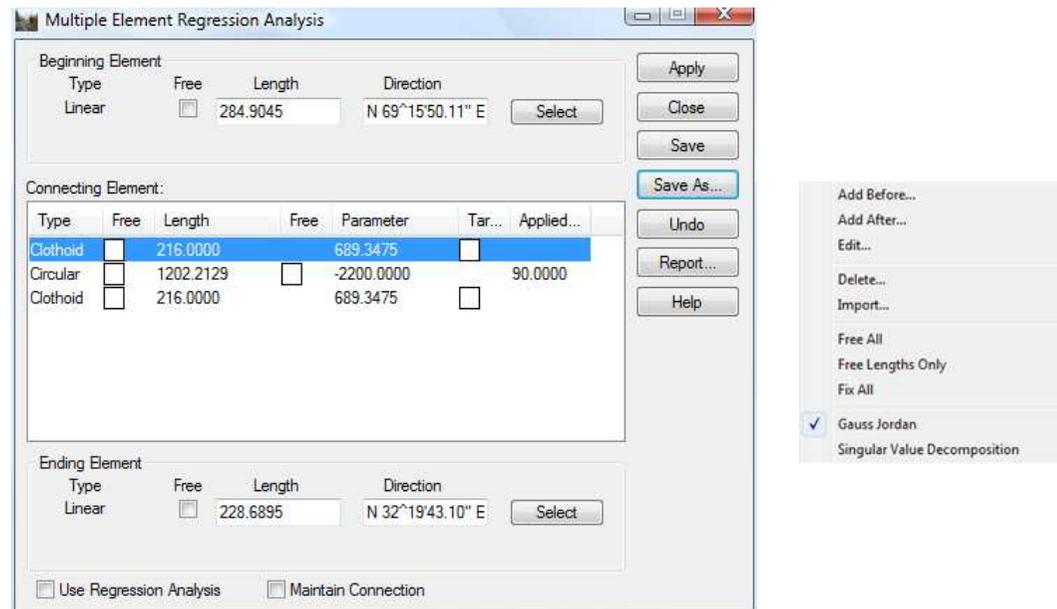
Metes & Bounds

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

Traverse Adjustments

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

Text Import Wizard

- Removed classic support
  - Duplicate and redundant functionality

- Enhanced horizontal to read a multi-line element definition with
  - <u>On</u> alignment points (i.e. PC, PT, TS, SC, CS, ST)
  - <u>Off</u> alignment points (i.e. CC, SPI)

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Localizations / Customizations

Customer specific enhancements, that may work for other users!
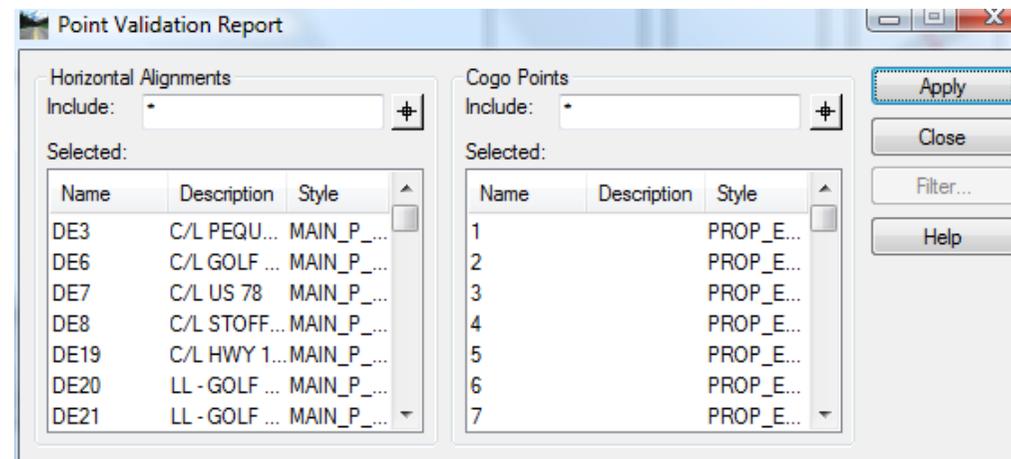
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Chain Points

- Create a xyz horizontal alignment

- Or feature
 - Open or closed shape

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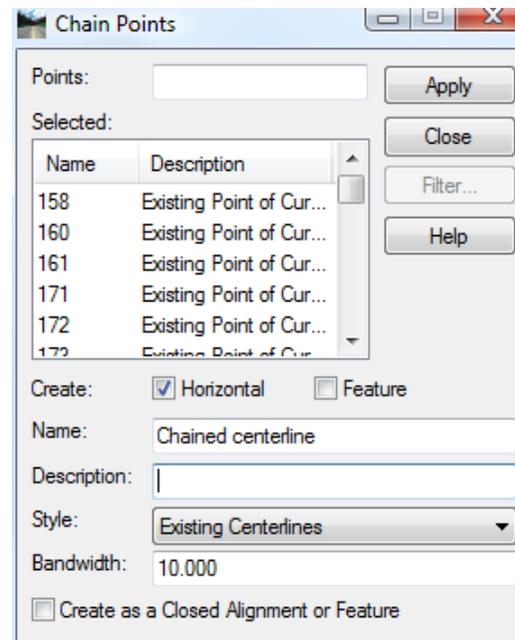
Point Validation

- Moved <u>obscure</u> 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

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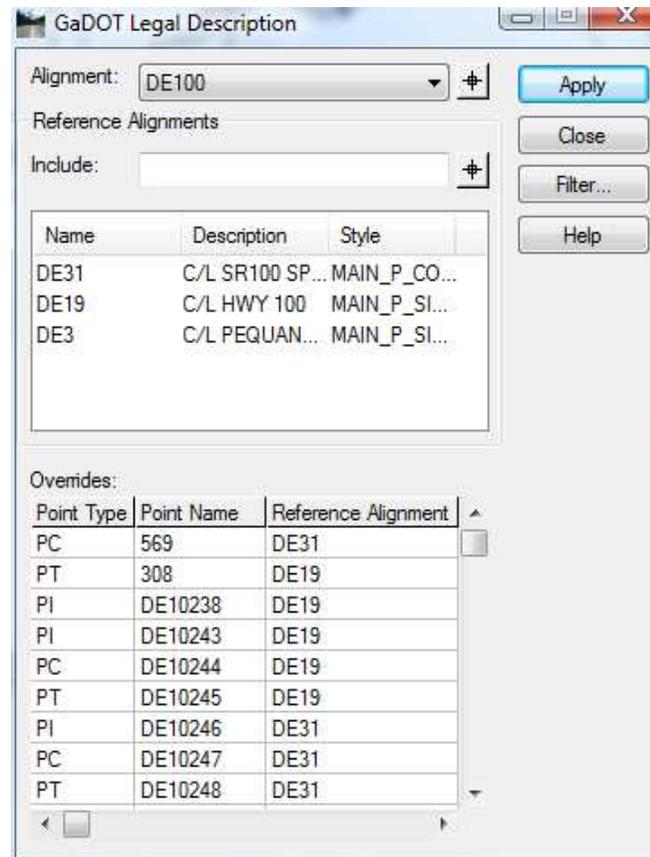
Add Fixed Horizontal Element

- 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

And Finally

- Always working with customers to continually improve the product!

- Questions?

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