

Resurfacing and Overlay Made Easy with New Overlay Tools in Roadway Designer

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Why Overlay?



Why Overlay?

- Accommodate wedging / leveling
- Milling
- Widening
- Crown correction
- Longitudinal smoothing
- Superelevation correction
- Cost minimization

What To Expect...

- Optimized vertical alignment without the “washboard effect”.
- Leveling / stripping components
- Corrected superelevation
- Distinct volumes to minimize construction cost
- Several tolerance settings for overlay design

Why New Tools?

- A majority of all roadway construction projects today require overlay and or widening (rehabilitation) versus new construction.
- Machine control construction becoming the “norm” even with rehabilitation projects.
- Need new tools in Roadway Designer to better optimize quantities and follow specific standards like minimum overlay thickness or max. overlay depths.
- Need ability to optimize proposed profiles to lessen the “washboard effect”.
- Need ability to “*match what’s out there*” to minimize cost.

What Abilities Will These Tools Provide?

- Existing cross slope optimization with slope and elevation tolerances
- Minimum overlay thickness / maximum milling (scarification) depth analysis examining template points and optionally all ground points
- “Smooth” the vertical profile.
- Apply the adjusted profile.
- Crown correction / match existing milling
- Bituminous and Milling estimate of cost based on unit rates.

Introducing Roadway Designer's Overlay Toolset

Roadway Designer - C:\Conference and Training Data\2009 RBC\EP-9 RD - Resurfacing and Overlay made Easy\Data\overlay.ird

File Corridor Superelevation Tools **Overlay Tools**

Overlay tools

- Cross Slope Optimization....
- Vertical Adjustment Settings...
- Smooth Adjusted Vertical Alignment...
- Apply Adjusted Vertical Alignment...

Close Help

Overlay Adjustment = 0.2238

Corridor: Overlay & Level & Grind & Wide

Active Surface: OG

Station: 10+30.00

Interval: 10.0000

Template: Overlay & Grind & Level

Display Mode: Normal Superelevation Overlay

Process All

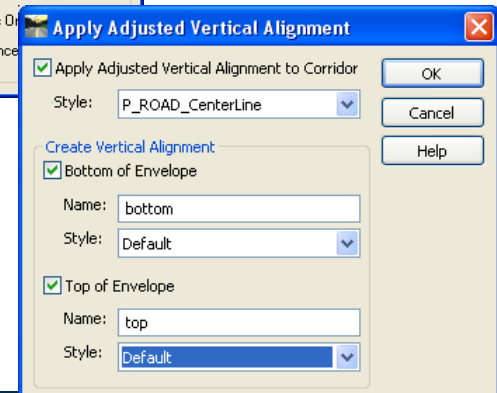
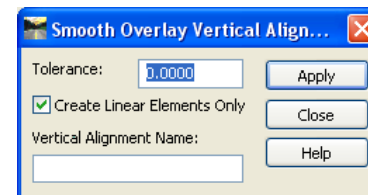
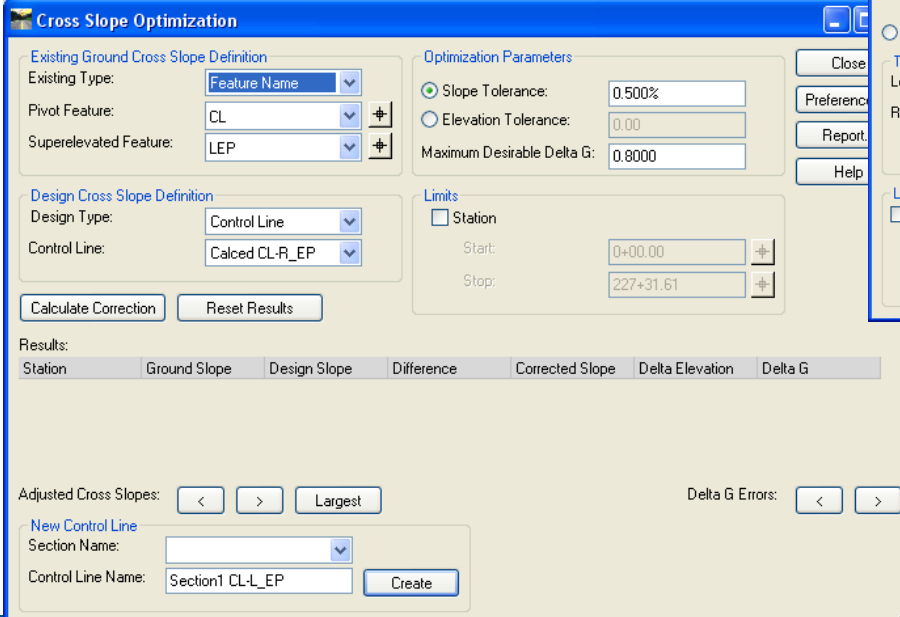
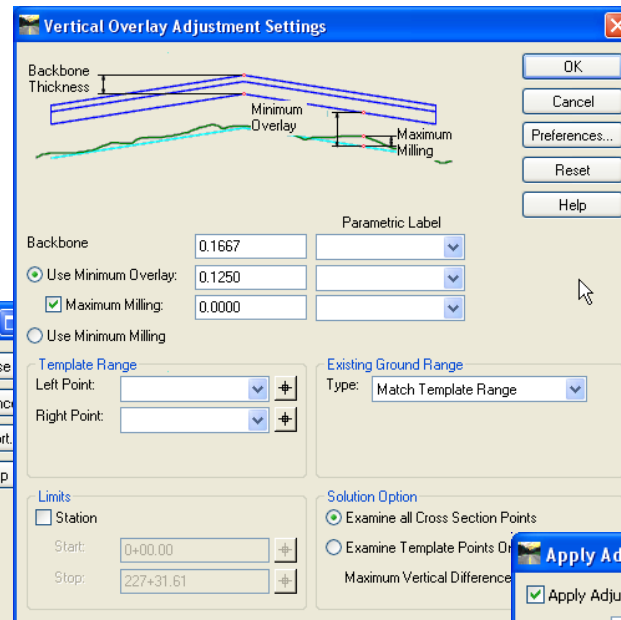
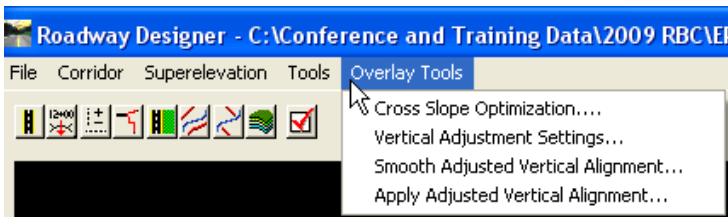
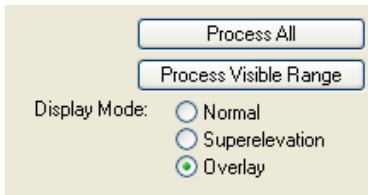
Process Visible Range

Overlay Mode

Overlay Display Mode

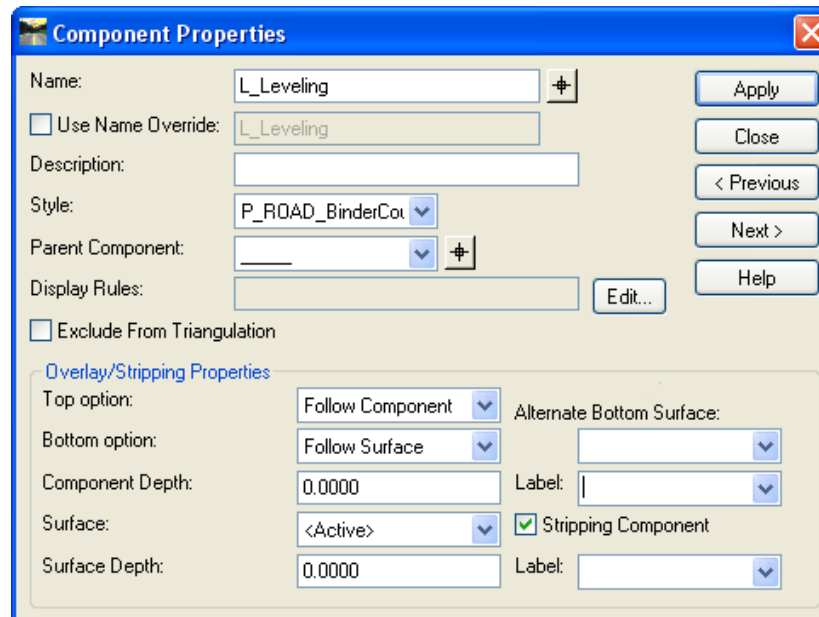
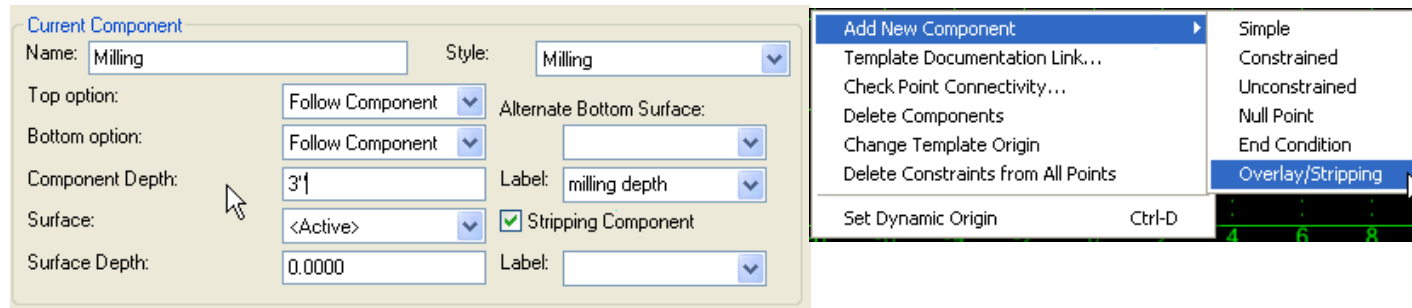
A new Display Mode has been added to Roadway Designer

In the "Overlay" Display Mode, the "Overlay Tools" drop down menu entry becomes active



New Component Type

A new component type → Overlay / Stripping



Vertical Optimization with Superelevation correction

- Designer first applies the required superelevation based on project standards.
- Optimize the vertical profile utilizing the design superelevation

The screenshot displays the Bentley software interface for vertical optimization. The main window is titled "Vertical Overlay Adjustment Settings" and contains several control panels:

- Backbone Thickness:** A diagram showing a cross-section of a road with a backbone and minimum overlay.
- Backbone:** Value: 0.1667
- Use Minimum Overlay:** Value: 0.1250
- Maximum Milling:** Value: 0.0000
- Use Minimum Milling:**
- Template Range:** Left Point: L_EP, Right Point: R_EP
- Existing Ground Range:** Type: Match Template Range
- Limits:** Station Start: 0+00.00, Stop: 227+31.61
- Solution Option:** Examine all Cross Section Points, Examine Template Points Only
- Maximum Vertical Difference:** 0.0000

The interface also features two main graphs:

- Top Graph:** A vertical profile showing elevation (210 to 240) versus stationing (12+00 to 34+00). A white curve represents the design profile, and a yellow vertical line is positioned at station 22+40.00.
- Bottom Graph:** A graph showing superelevation (e.g., 0.04, 0.02, 0.00, -0.02, -0.04) versus stationing. It includes vertical curve points labeled BC and EC.

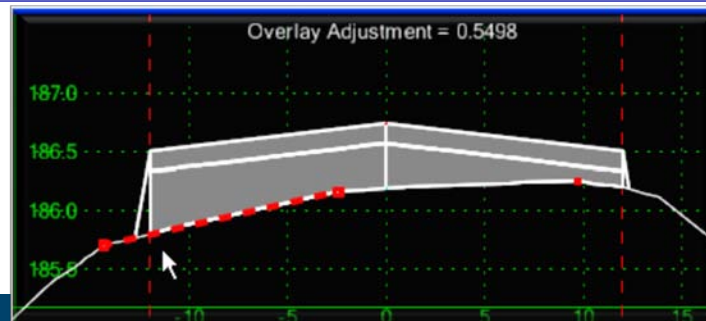
At the bottom, there are additional controls:

- Corridor:** Rehab & Leveling
- Active Surface:** OG
- Station:** 22+40.00
- Interval:** 10.0000
- Template:** Rehab
- Display Mode:** Normal, Superelevation, Overlay

Cross Slope Optimization

- Analyzes the existing cross slope and Delta G between sections.
- Takes into account theoretical design standard superelevation.
- Adjust the proposed cross slope based on user defined tolerances.
- Creates new point control lines.
- Allows for user interaction to manually adjust computed slopes.

Station	Ground Slope	Design Slope	Difference	Corrected Slope	Delta Elevation	Delta G
74+80.00	-3.456%	-2.000%	1.456%	-2.956%	0.0599	0.2755
74+90.00	-3.570%	-2.000%	1.570%	-3.070%	0.0598	0.2765
75+00.00	-3.685%	-2.000%	1.685%	-3.185%	0.0597	0.2776
75+10.00	-3.741%	-2.000%	1.741%	-3.241%	0.0596	0.1375
75+20.00	-3.795%	-2.000%	1.795%	-3.295%	0.0596	0.1306
75+30.00	-3.849%	-2.000%	1.849%	-3.349%	0.0595	0.1308
75+40.00	-3.903%	-2.000%	1.903%	-3.403%	0.0595	0.1310
75+50.00	-3.957%	-2.000%	1.957%	-3.457%	0.0594	0.1312
75+60.00	-4.012%	-2.000%	2.012%	-3.512%	0.0594	0.1314
75+70.00	-4.066%	-2.000%	2.066%	-3.566%	0.0593	0.1316



Cross Slope Optimization Report

Cross Slope Optimization Station Report

Report Created: 4/29/2009
Time: 9:46am

Corridor: Overlay Sample

File Name: C:\NCDOT Overlay\Overlay Sample.ird

Input Grid Factor: 1.000000

Note: All units in this report are in feet unless specified otherwise.

Existing Ground Data: Type: Alignment

Pivot: L

Superelevated: It_ex_eop

Design Data: Type: Control Line

Control Line: Section1 CL-EEOP_L

Optimization Parameters: Tolerance Type: Slope

Slope Tolerance: 2.00%

Station	Existing Slope/Elevation	Design Slope/Elevation	Difference Slope/Elevation	Corrected Slope/Elevation	Delta G
20+20.00	0.18% 0.02	-1.95% -0.21	-2.13% -0.23	-1.82% -0.20	0.00
20+30.00	-1.76% -0.19	-1.14% -0.13	0.62% 0.07	-1.14% -0.13	0.71

Vertical Overlay Adjustment

- Design via minimum overlay and optional maximum milling.
- Design via minimum milling
- Utilize Parametric Constraint labels to vary depths throughout a project
- Examine template points only or all points including existing ground
- Multiple choices when setting offset limits for analysis

Vertical Overlay Adjustment Settings

Backbone Thickness

Minimum Overlay

OK

Cancel

Preferences...

Reset

Help

Backbone: 0.1667

Parametric Label

Use Minimum Overlay: 0.1250

Maximum Milling: 0.0000

Use Minimum Milling

Template Range

Left Point: L_EP

Right Point: R_EP

Existing Ground Range

Type: Match Template Range

Match Template Range

Match Existing Ground Features

Match Existing Alignments

Match Existing Styles

Fixed Offsets

Limits

Station

Start: 0+00.00

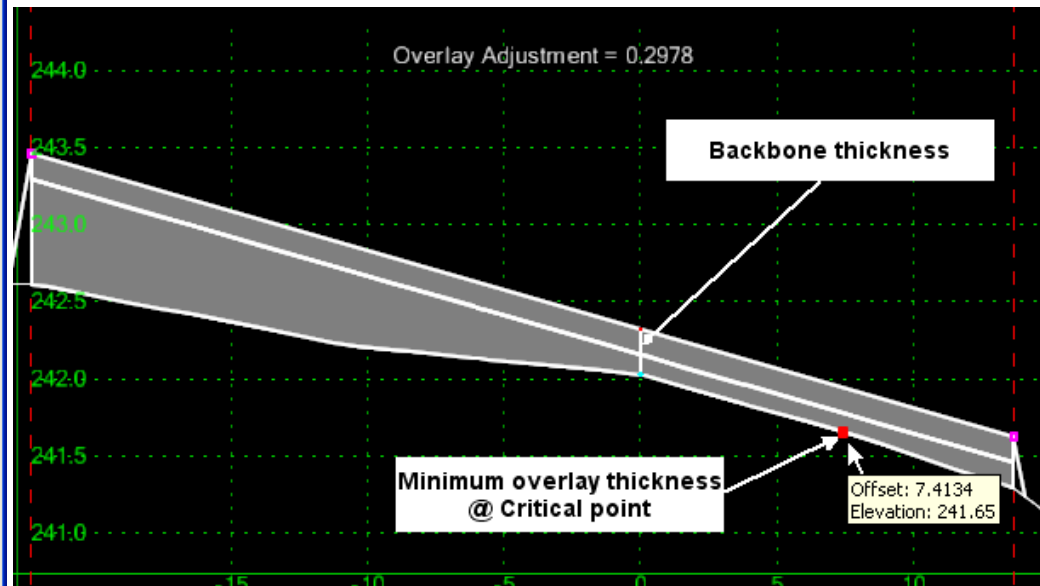
Stop: 227+31.61

Solution Option

Examine all Cross Section Points

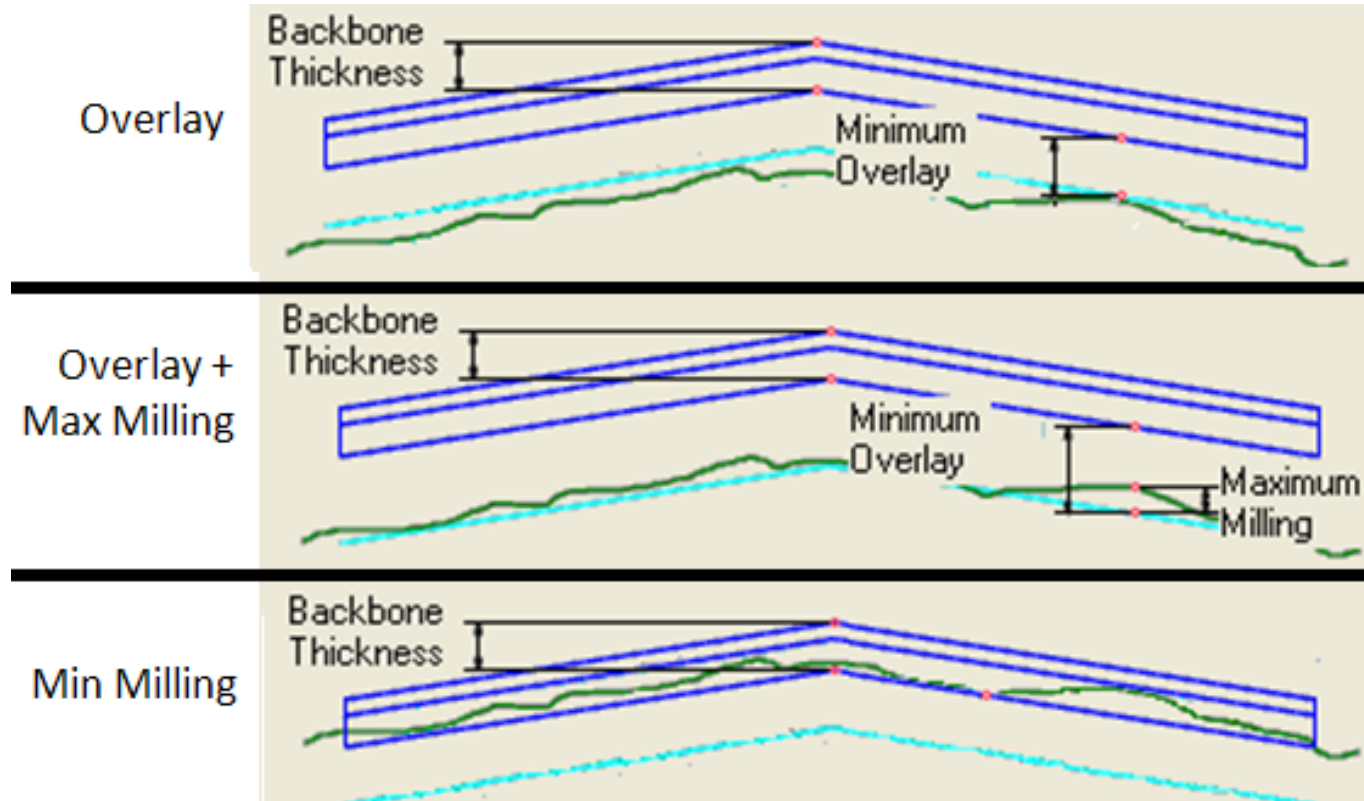
Examine Template Points Only

Maximum Vertical Difference: 0.0000



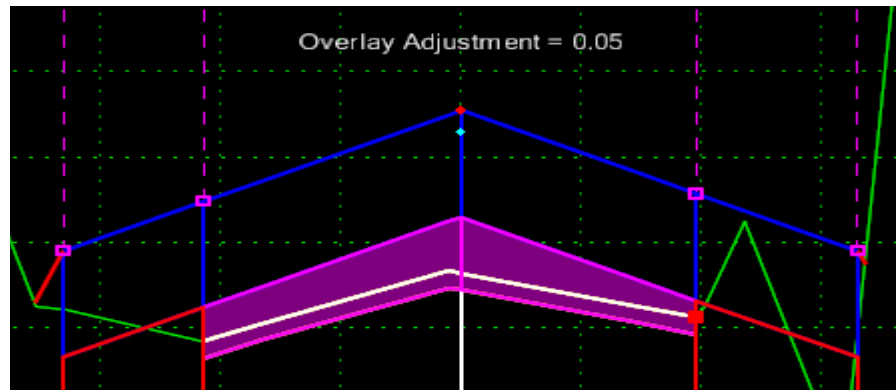
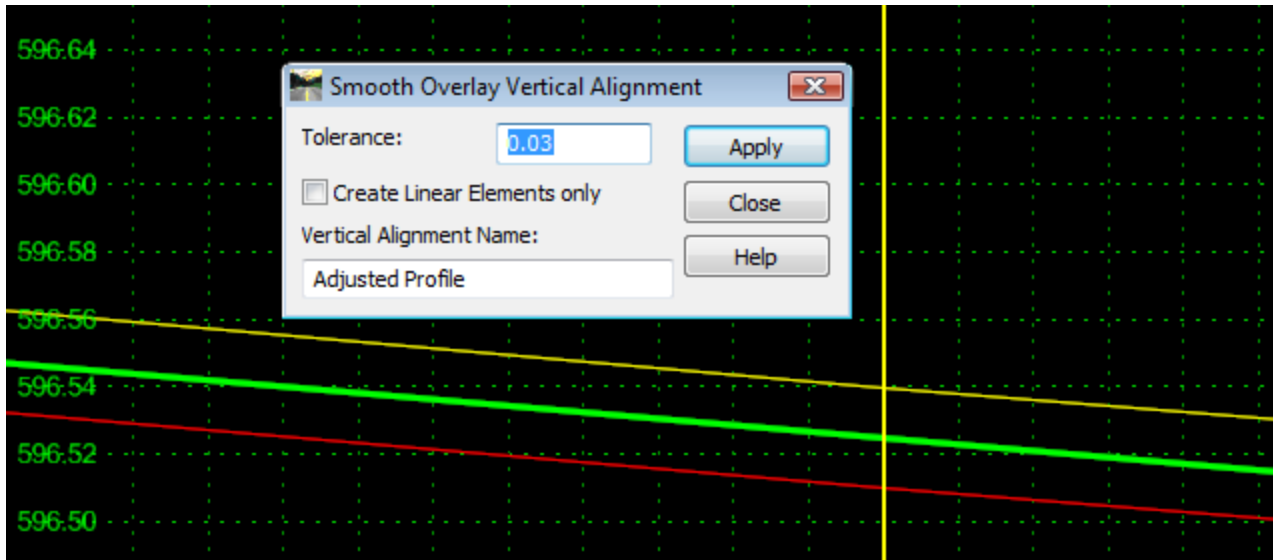
Vertical Adjustments: 3 Scenarios

- Adjusts for three Resurfacing Types



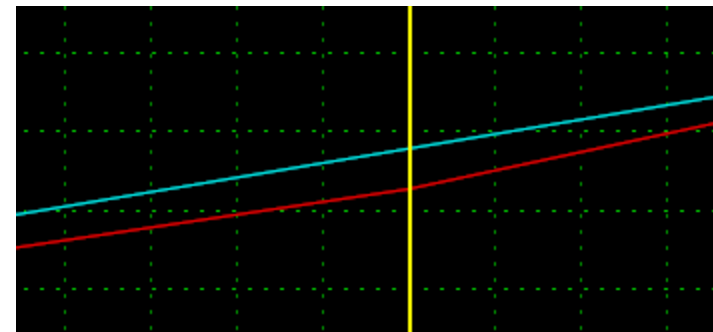
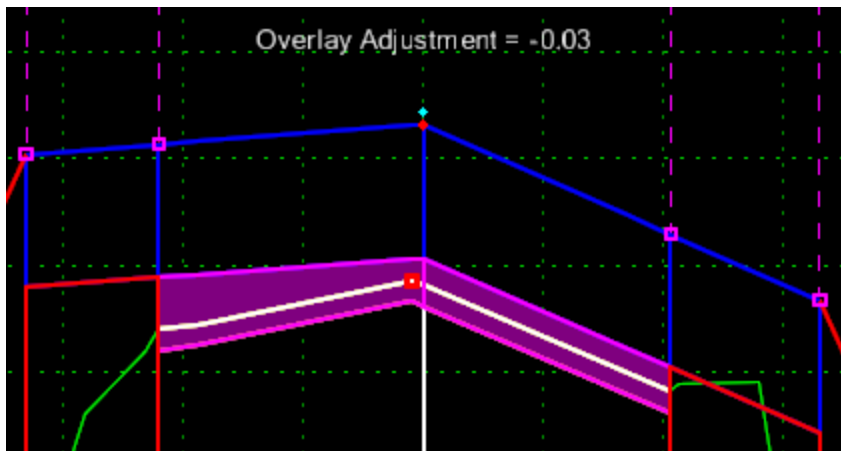
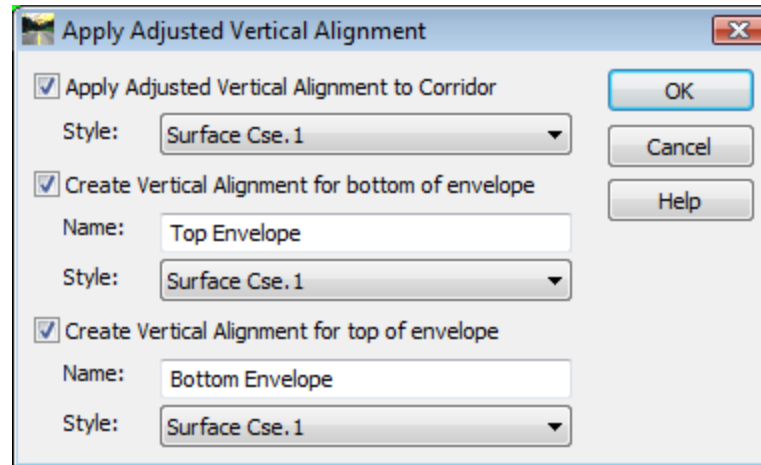
Vertical Overlay Adjustment

- Creates a vertical profile design window.
- Linear Regression is utilized to “best fit” the design profile.



Vertical Overlay Adjustment

- Applies adjusted profile automatically.
- Allows designer to store top and bottom envelope profile for manual tweaking.



Corrected Superelevation

- Combine Optimized Vertical with Theoretical Superelevation

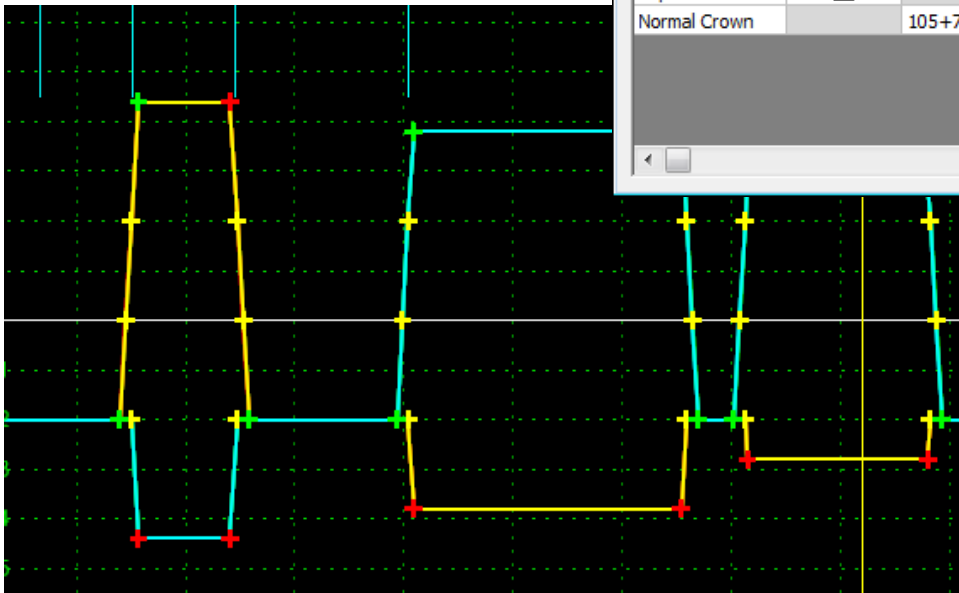
Superelevation Control Curve Set Station Edit

Section Name: Section1

Curve Set: 2 Show Curve Set Information

Type	Constrained	Station	Cross Slope	Length	Grade
Normal Crown		93+96.96	-2.000%		2.385%
Super Runoff	<input checked="" type="checkbox"/>	94+50.14	-0.000%	53.18	1.308%
Reverse Crown	<input checked="" type="checkbox"/>	95+03.32	2.000%	53.18	0.666%
Full Super		95+67.14	4.400%	63.82	0.666%
Full Super	<input checked="" type="checkbox"/>	104+06.81	4.400%	839.67	-3.374%
Reverse Crown	<input checked="" type="checkbox"/>	104+70.63	2.000%	63.82	-3.374%
Super Runoff	<input checked="" type="checkbox"/>	105+23.81	-0.000%	53.18	-3.007%
Normal Crown		105+76.99	-2.000%	53.18	-3.007%

Apply
Undo
Close
Help



End Area Quantities / Material Cost

- User definable Unit Cost
- Computes end areas and volumes of each component
- Streamlines the design / cost analysis

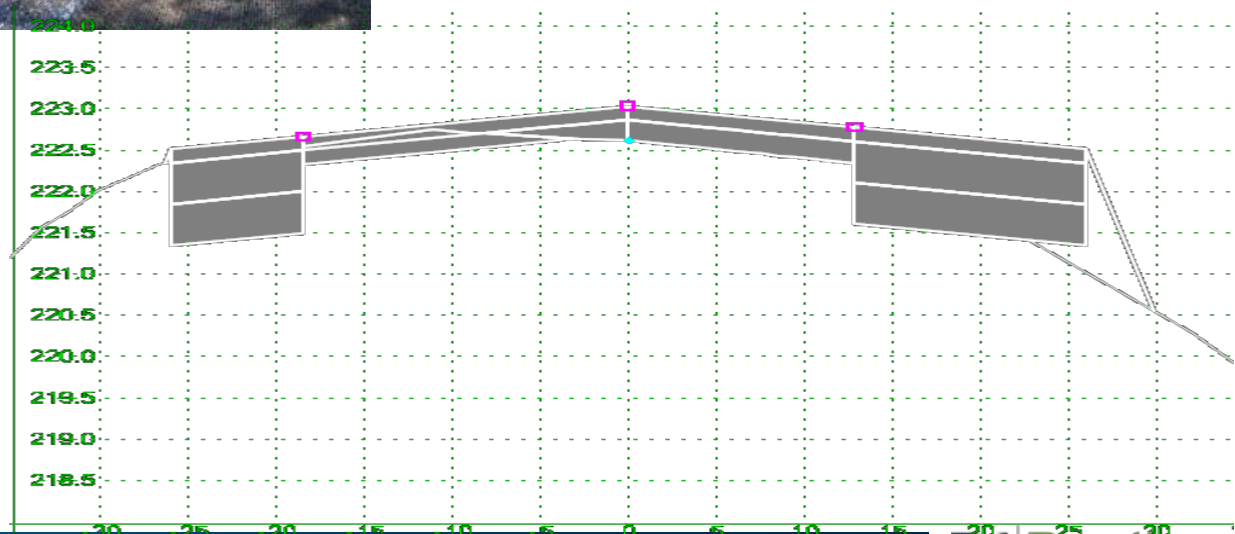
The screenshot displays the Bentley Roadway Designer interface. The 'Tools' menu is open, highlighting 'Approximate Component Quantities...'. A dialog box titled 'Approximate Component Quantities' is shown in the foreground, containing a table of material quantities and a total estimated cost.

Material	Surface Area	Volume	Units	Unit Cost	Total Cost/Material
P_ROAD_Wearir		28051.9	CF	1.20	33662.34
Leveling		39542.5	CF	1.90	75130.75
Milling		6561.7	CF	0.85	5577.41
P_ROAD_Fill	5948.8		SF	0.50	2974.39

Total Estimated Cost: 117344.89

Below the dialog box, a cross-section view of a roadway is shown with an 'Overlay Adjustment = 0.3568'. The vertical axis is labeled with values 239.5, 240.0, and 240.5.

Live Demonstration



Questions?