F7 - Exploring Constraints and Using Display Rules in Roadway Designer

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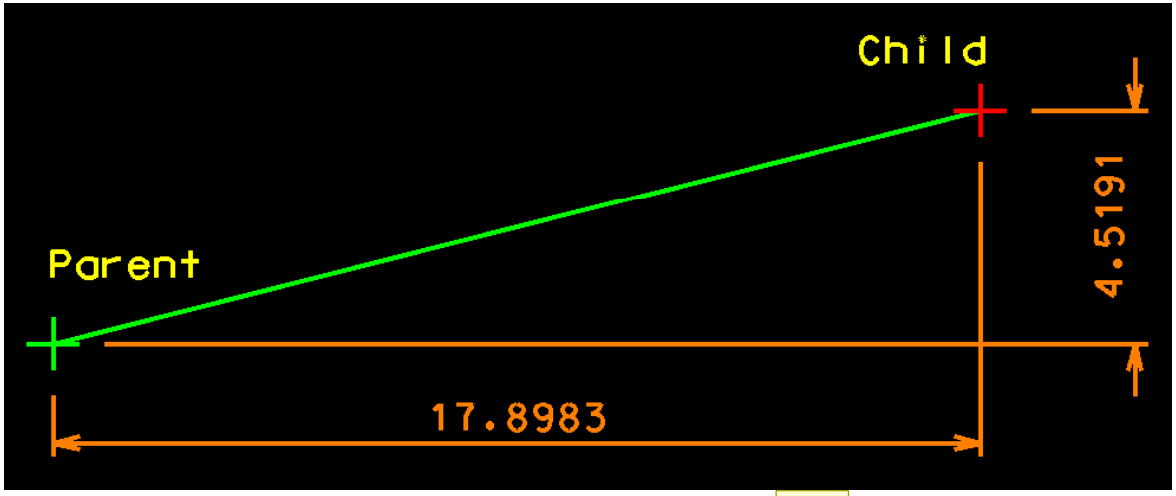
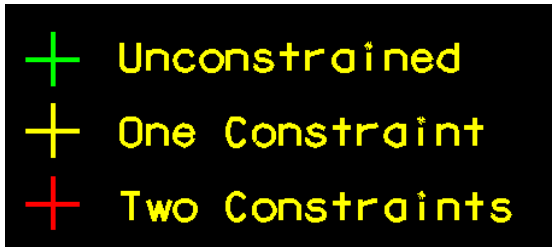
This presentation will cover:

- Constraint types
- Parametric/Style constraints
- Parent/Child
- Component Display Rules

What are Template Constraints?

- Constrains one point to one or more points
- Parent-Child relationship
- Multiple ways to assign
- Visual feedback





Slide 3

RG2 The 1st Topic/title slide shown here should outline the specific features to be demonstrated using the software product etc. Additional slides can be inserted beyond this slide and used during this topic demonstration. Instructors can either give a brief explaination of all feature topics at once or flip between the software program as each feature topic is covered.

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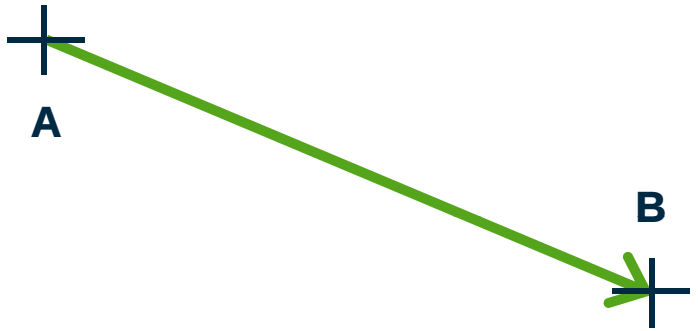
Constraints on Template Points

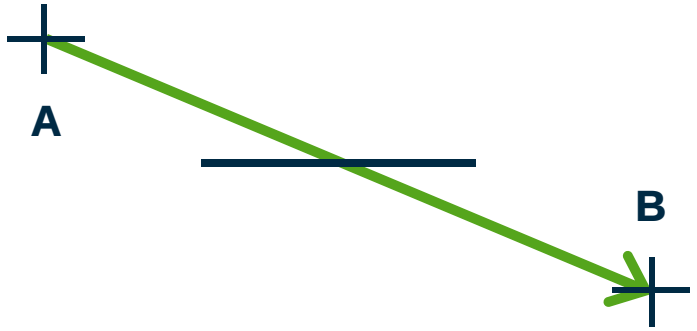
- Constraints
  - Manage Behavior of Template Points
    - How points move with respect to one another
    - Point can have up to 2 constraints
- Fully Constrained Points
  - Red +
  - Two constraints
- Partially Constrained Points
  - Yellow +
  - One constraint
- + Unconstrained Points
  - Green +
  - No constraints

Constraints on Template Points

- Parent-Child point relationship
  - Point B is the Child of Parent point A
  - Arrow points from Parent point to Child point

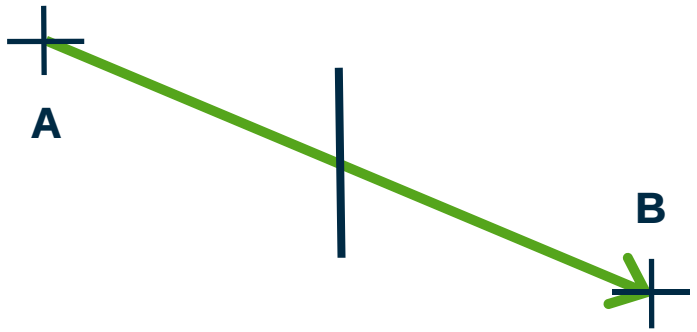


- Horizontal Constraint
  - Child is horizontally constrained to parent

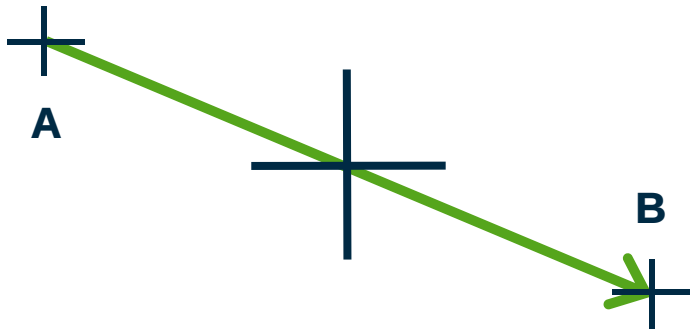


Constraints on Template Points

- Vertical Constraint
  - Child is vertically constrained to Parent



- Horizontal and Vertical Constraint
  - Child is horizontally and vertically constrained to Parent



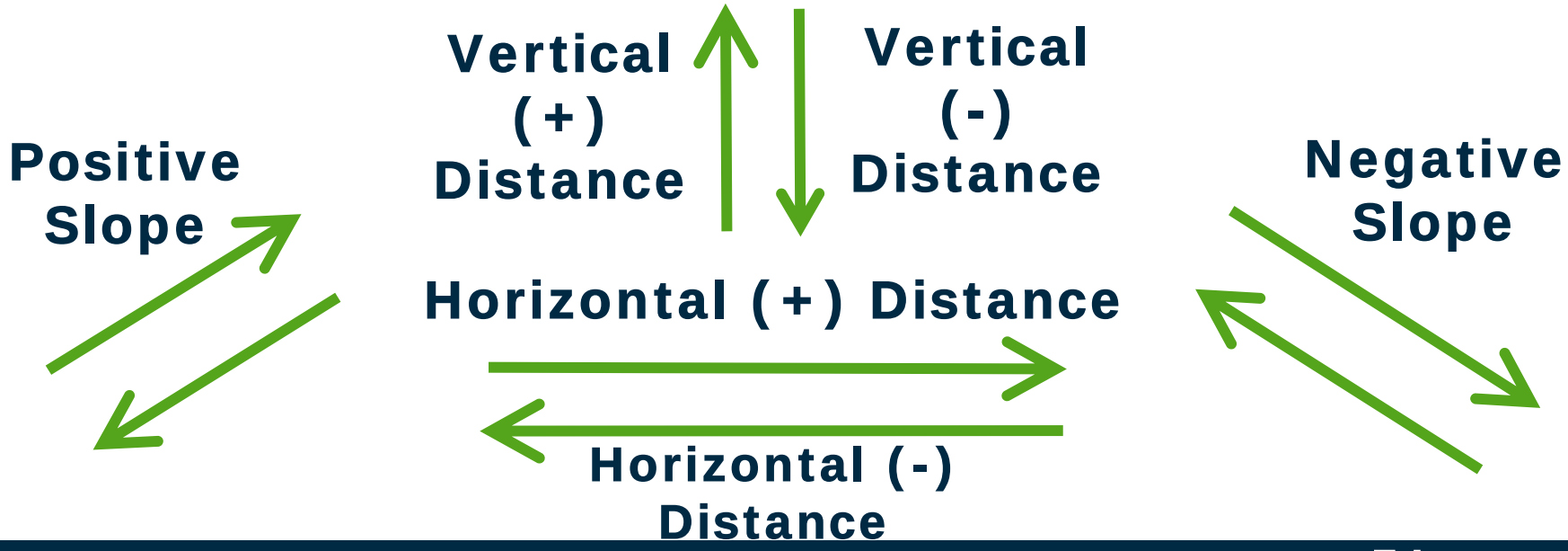
- Slope Constraint
  - Child is constrained by slope to the Parent

Constraints on Template Points

- Adding and Deleting Constraints Graphically
  - Right-click on points to add and delete constraints
  - Horizontal and vertical constraints are important
    - Pavement layers
    - Superelevation
    - Transitioning
  - Helps to relocate points

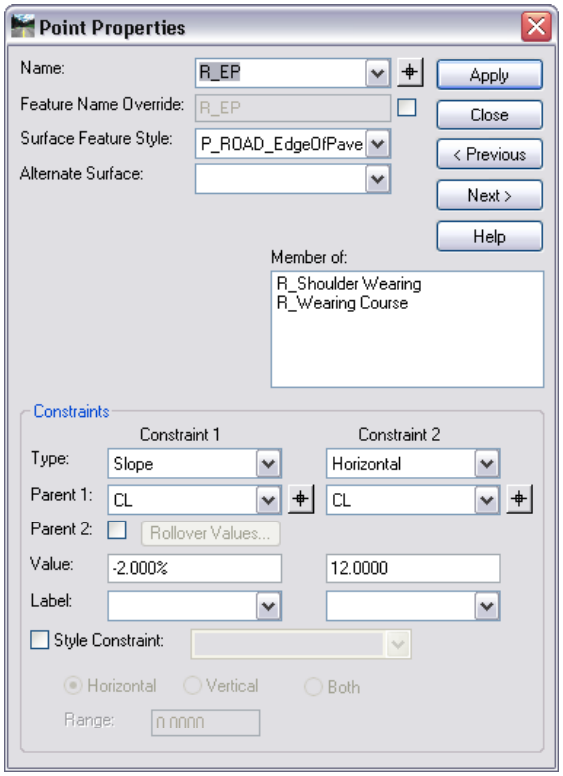
Component Slopes and Distances

- Parent point is placed first
  - Child placed to the right of Parent is positive distance
  - Child placed to the left of Parent is negative distance
  - Child placed above the Parent is positive distance
  - Child placed below the Parent is negative distance
- Slope is algebraic slope



How to assign Template Constraints

- Right Click on a Point
  - Context Menu
- Edit Point Dialog
- Creating Components
  - Creating Simple Component
  - Creating Constrained Component



RG3

Slide 9

RG3 The 2nd topic/title slide should outline the features to be demonstrated for this section using the software product etc. The presenter should repeat the process as outlined for the remaining slides and add additional slides as needed for this presentation.
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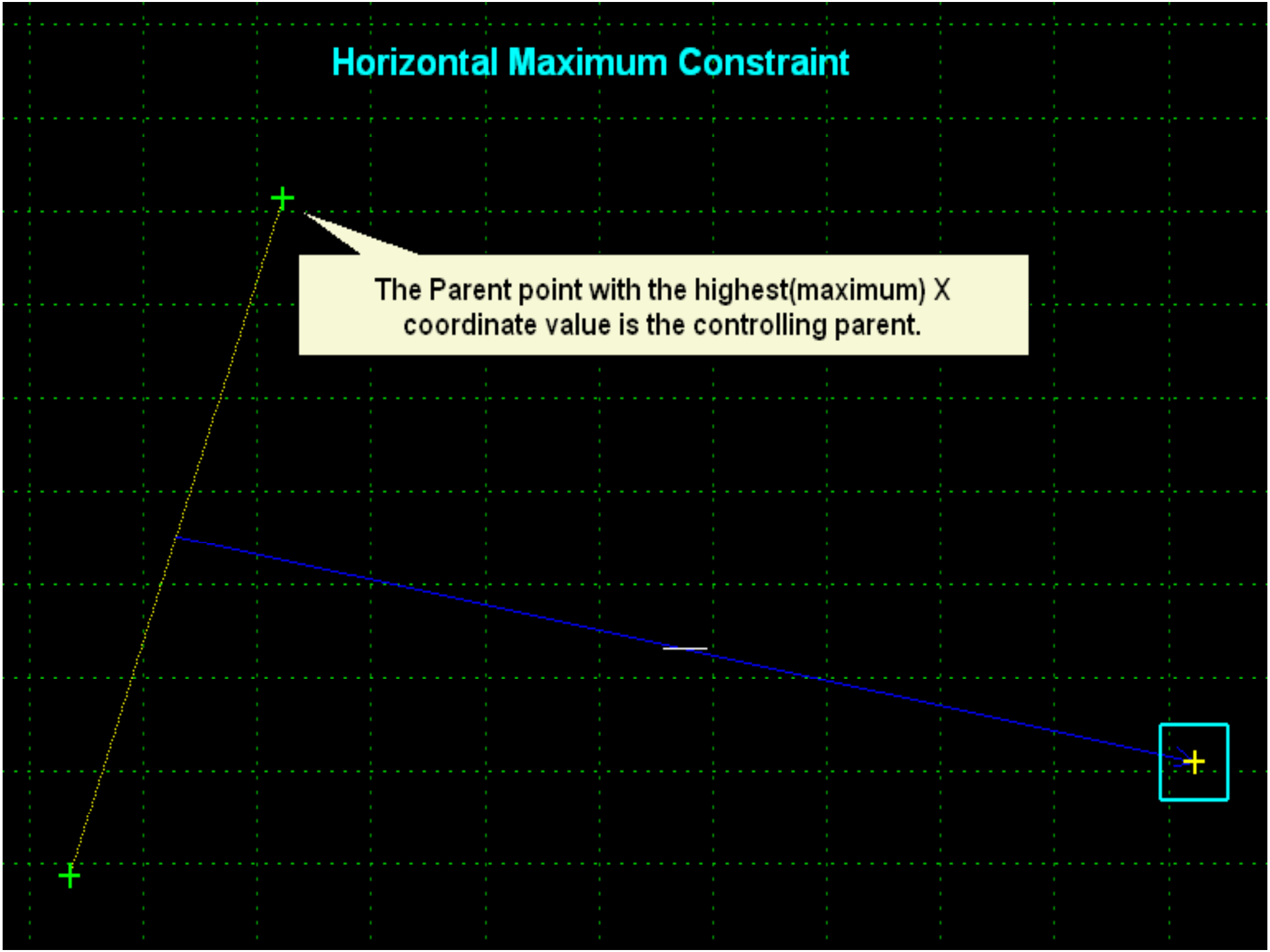
Type of Template Constraints

- Horizontal
- Vertical
- Slope
- Vector Offset
- Project To Surface
- Project To Design
- Horizontal Minimum
- Horizontal Maximum
- Vertical Minimum
- Vertical Maximum
- Angle Distance
- New! Formula

Two Parent Constraint Types

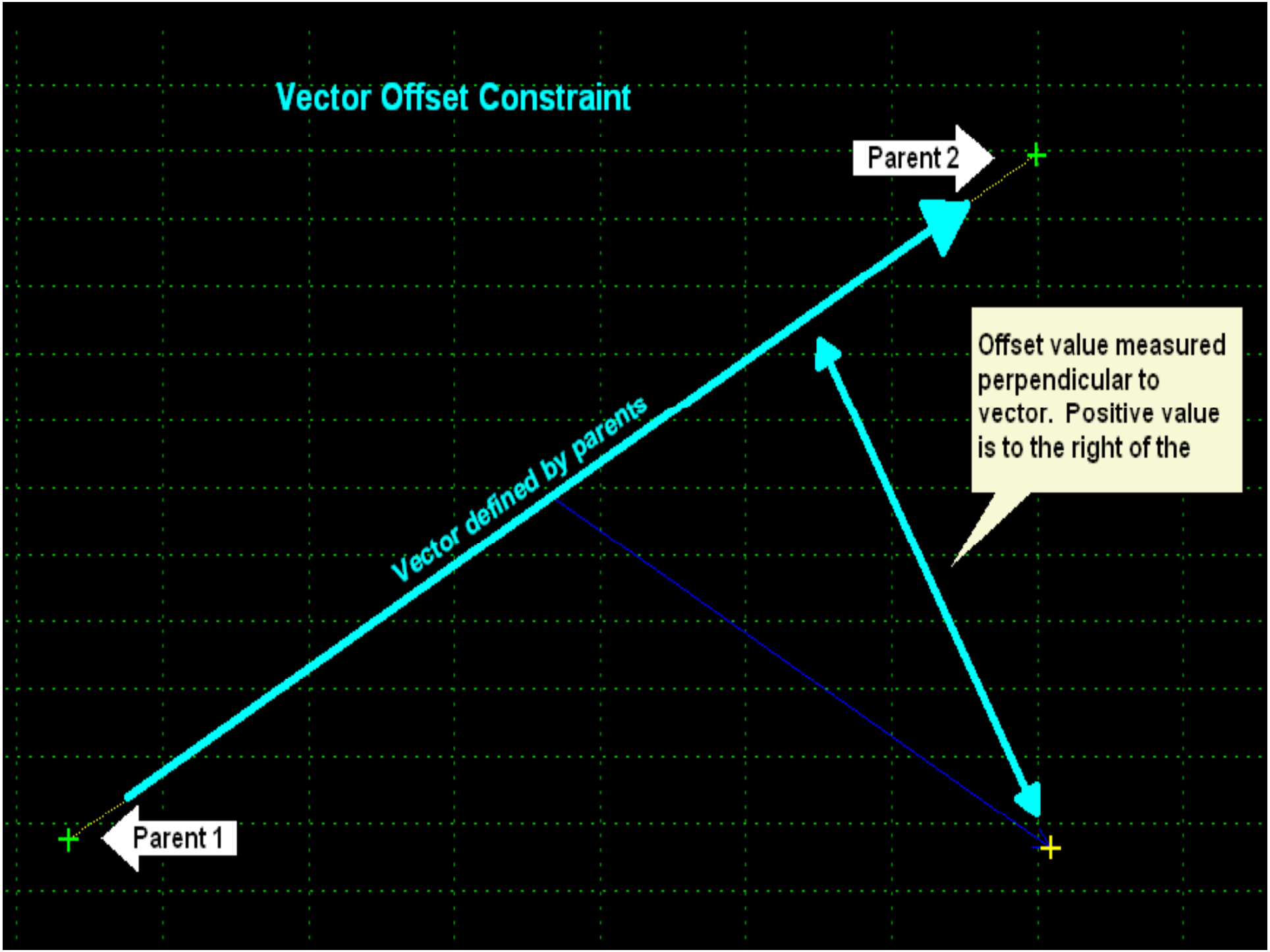
- Max/Min constraints
  - Takes the parent with the lowest coordinate value (Min) or highest coordinate value (Max) and applies a single parent constraint from that controlling parent.

*****Hint: Can be used as Switch


Horizontal Maximum Constraint
The Parent point with the highest(maximum) X coordinate value is the controlling parent.

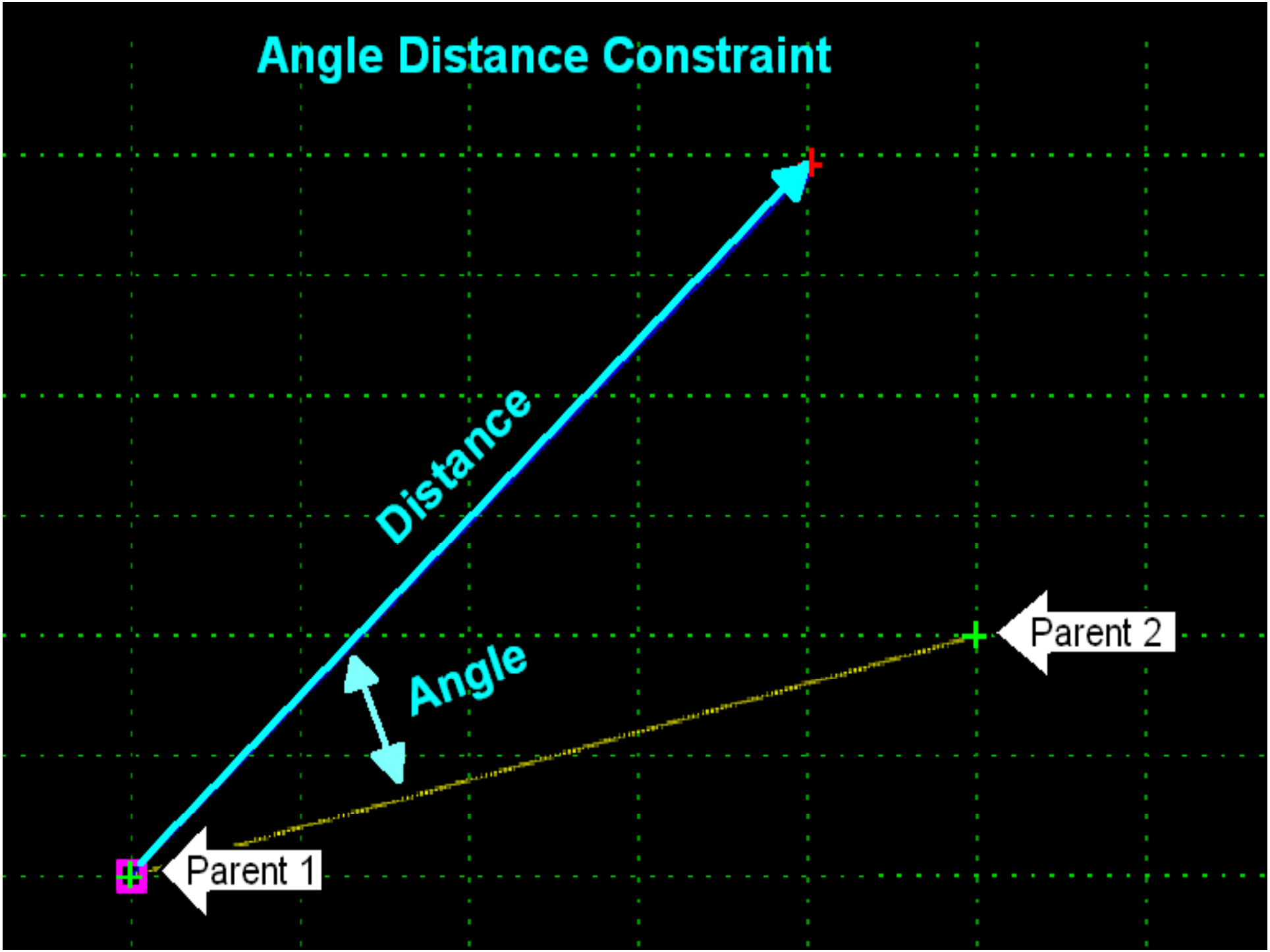
Two Parent Constraint Types

- Vector-Offset constraint
  - The two parent points define the vector, and the offset is measured perpendicular from that vector.


Vector Offset Constraint
Parent 2
Offset value measured perpendicular to vector. Positive value is to the right of the
Vector defined by parents
Parent 1

Two Parent Constraint Types

- Angle-Distance constraint
  - The two parent points define a baseline direction. The angle is relative to the baseline, and the distance is along the vector define by the angle. This constraint allows for rigid body rotation of the vector, and the offset is measured perpendicular from that vector.
  - An angle distance constraint fully constrains a point.

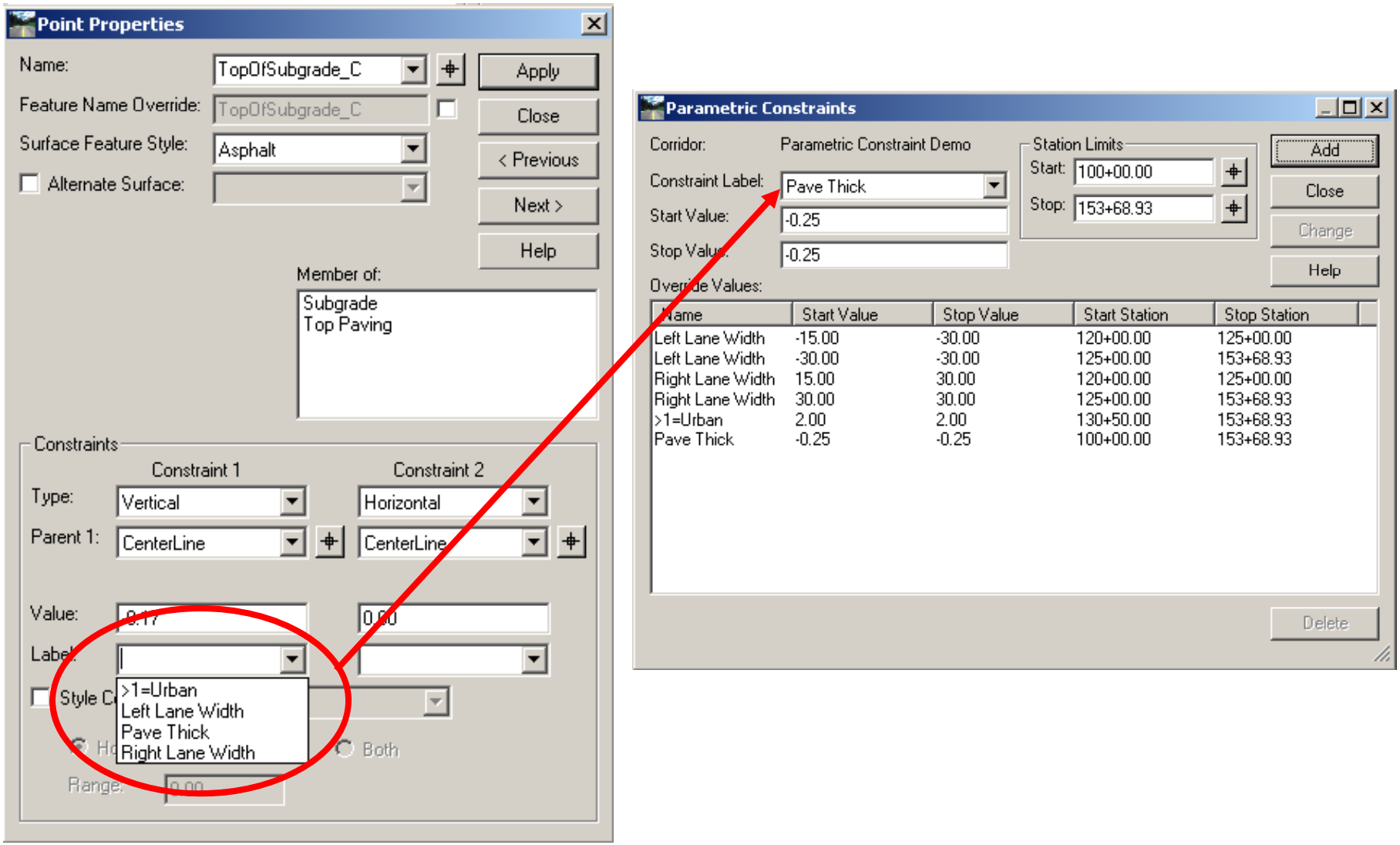

Angle Distance Constraint
Distance
Angle
Parent 2
Parent 1

Project to Surface / Project to Design constraints

- The “Project to Surface” and “Project to Design” are special constraints.
- They need one other constraint on the point to determine the projection vector.
- The only place they can be applied is in the Point Properties dialog.

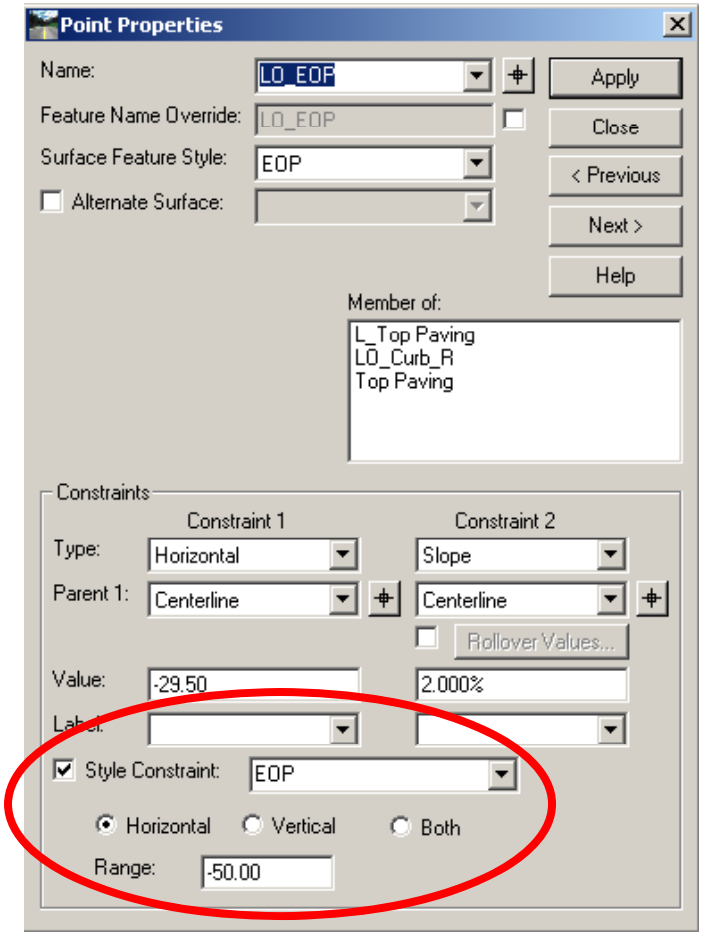
Parametric constraints

- What are parametric constraints?
  - Standard constraints with a parametric label
  - Can be changed along a corridor
- What are some applications?
  - As transitions for road widening
  - As switches for template changes
  - To change pavement thickness



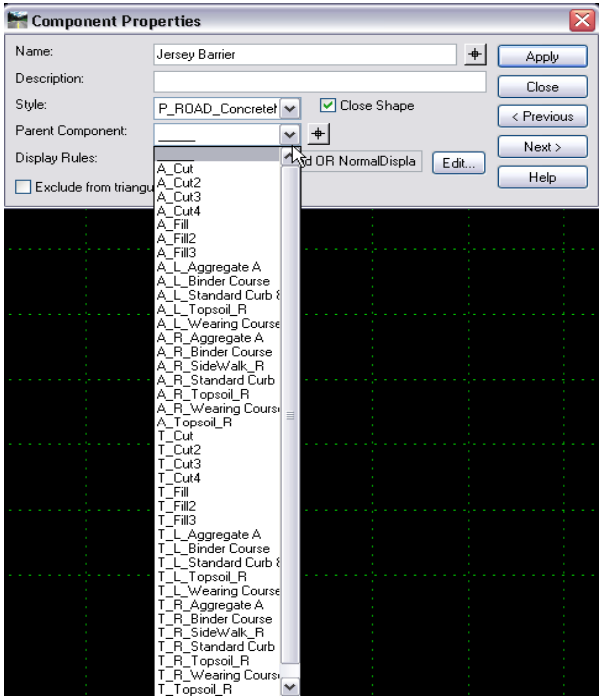
Style Constraint

- Similar to a Point Control.
- Overrides Horizontal and/or Vertical constraints on a point.
- Applied when:
  1. A feature or horizontal alignment is found in the active surface or geometry project that has the specified style.
  2. The feature or alignment with the matching style intersects the cross section within the horizontal distance specified.



Parent-Child Relationships

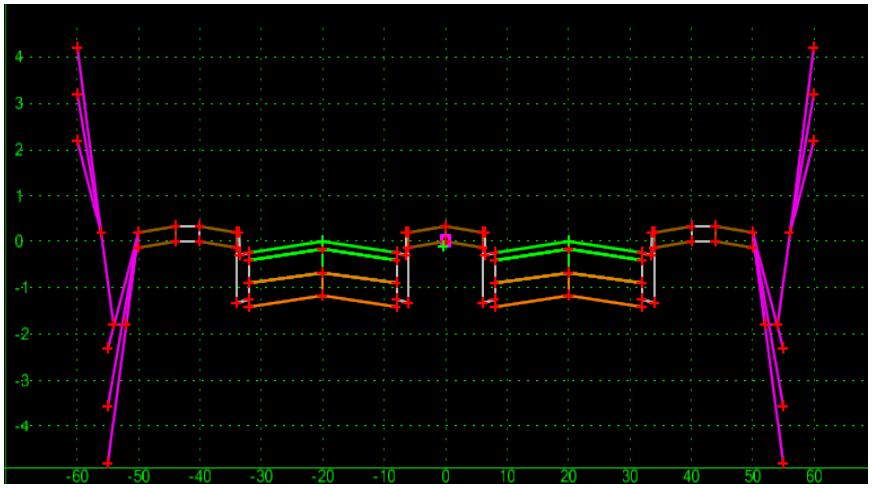
- From the Edit Component Dialog
- Pick Parent Component from pull down or graphically
- Only one Parent
- Can't be Recursive
- Child "follows" the Parent
  - EC's
  - CDR's

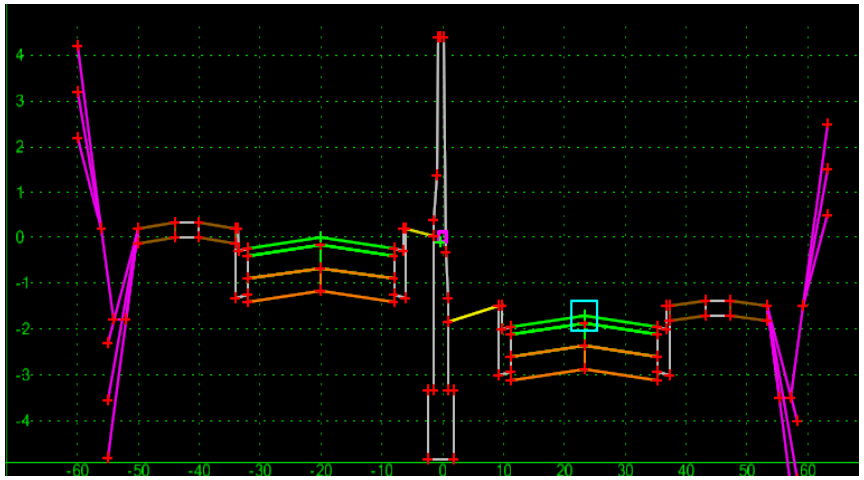


Demonstration

What are Display Rules?

- Geometric Comparison: any points, every station
- Is a Component Displayed?
- Turns a component off if a component has an expression that fails





RG4

Slide 23

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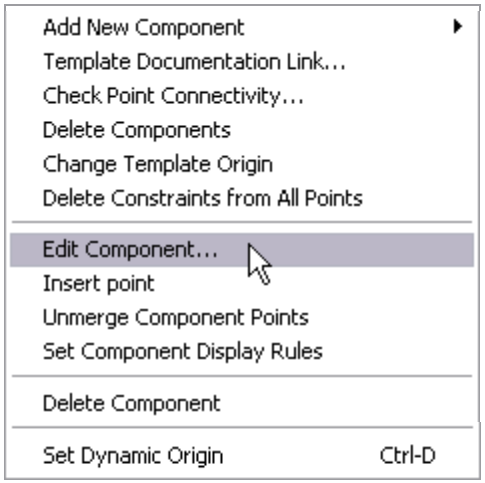
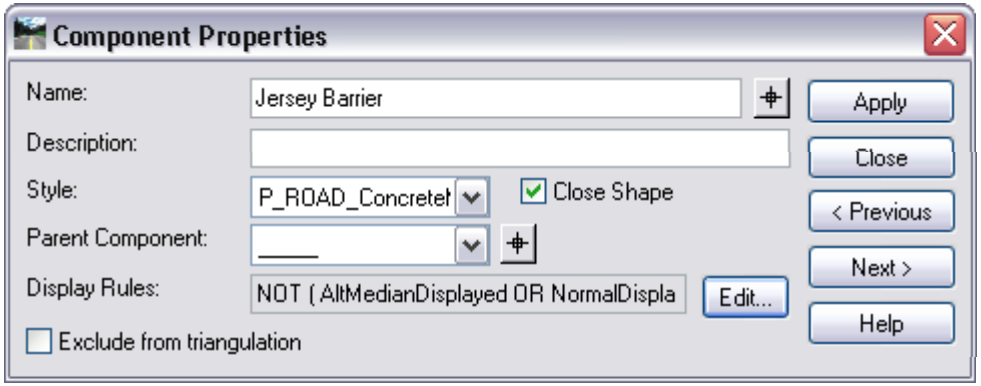
Type of Component Display Rules

- Horizontal – Returns the horizontal distance between two points
- Vertical – Returns the vertical distance between two points
- Absolute Horizontal – Returns the absolute horizontal distance between two points
- Absolute Vertical – Returns the absolute vertical distance between two points
- Slope – Returns the slope between two points
- Absolute Slope – Returns the absolute slope between two points
- Component is Displayed – Returns True of False

How to assign Display Rules

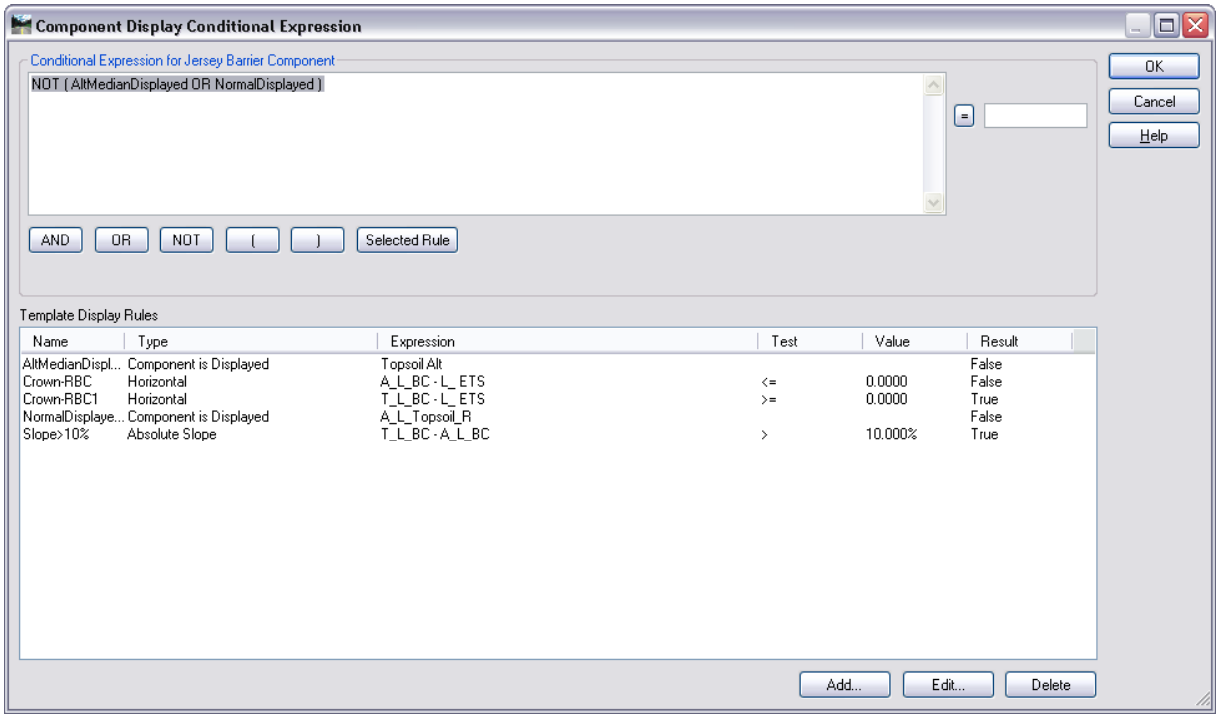
- Right Click on a Component
- Double Click on Component
- Select the Edit Button
  - Takes you to Component Display Conditional Expression





How to assign Display Rules

- Setup up Rules
- Set up Conditional Expressions using Rules



Interaction between constraints and external controls

- How are point coordinates determined?
- When an external control is applied, what happens to the point constraints?

How are point coordinates determined?

- Order of processing (from highest to lowest)
  1. External control
  2. Style constraint
  3. Point constraint
  4. Location as drawn

What happens when an external control is applied?

- If the control is both horizontal and vertical then all constraints are deleted because the control fully defines the point location.
- If the control is only horizontal or only vertical, then one constraint will be deleted.
- Which constraint is deleted?
  - The constraint deleted is the one that most closely matches the external control.
  - If there is ambiguity about which constraint is most like the control, then the second constraint is deleted.

Demonstration

Summary

- Normal constraints can be used to create templates that solve complex problems
- Parametric constraints and style constraints can be used to modify the behavior of templates in a roadway design file.
- The combination of constraints, along with display rules, can be used to significantly reduce the number of templates required to design a road.

Conclusion

- Questions?

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