

3D Design of Urban Highways and Interchanges

2009 Bentley Roads & Bridges User Conference

Jane Alden, PE

- Provides Full Service Engineering, Consulting, Constructions and Operations



Communications



Energy



Environmental



Nuclear



Transportation



Water



Facilities

- Design Challenge
- Typical Section Design
- 3D Design
- Design Review & Analysis
- Automating Contract Plans

- Roadway
 - Building Blocks
 - Typical Sections

- End Conditions
 - Individual Design Options
 - Combined Design Options

- End Conditions
 - Combined End Conditions
 - Solved Based on Priorities
 - Leverages Parent Child Component Relationships
 - Option to Use Point Control on Null Points to Daylight within Exist R/W
 - Reduces or Eliminates Display Rules & Switches

- Objective is to Develop “3D Design” or 3D Model to Facilitate
 - Engineering Design Decision Process
 - Contract Plan Preparation
 - Prepare “Field Ready” Data for Construction
- Combination of Facilities Presents Challenges

- Interaction Between Multiple Facilities Can Make It Difficult To Determine Which One Will Actually Control
 - End Treatments Between 2 Facilities, Etc.
- Starting Point Of “Model As Constructed”
- How Much Should Each Facility Actually Model?
 - Avoid Duplication Or Overlap, Etc.

- Multiple Tools Exist That Can Help Streamline The 3D Design/Modeling Process
- Template Techniques
 - Parent Component
 - Component Display Rules * (If Needed)
 - Constraint Label
- Roadway Designer Tools
 - Parametric Constraint
 - Point Control
 - Target Aliasing
 - End Condition Exception

- Order Of Processing (From Lowest To Highest)
 - Location As Drawn On Template
 - Point Constraint
 - Style Constraint
 - Point Control

- Component Display Rules...
 - Do Not Affect Coordinate Determination
 - Are Applied AFTER Coordinates Are Determined

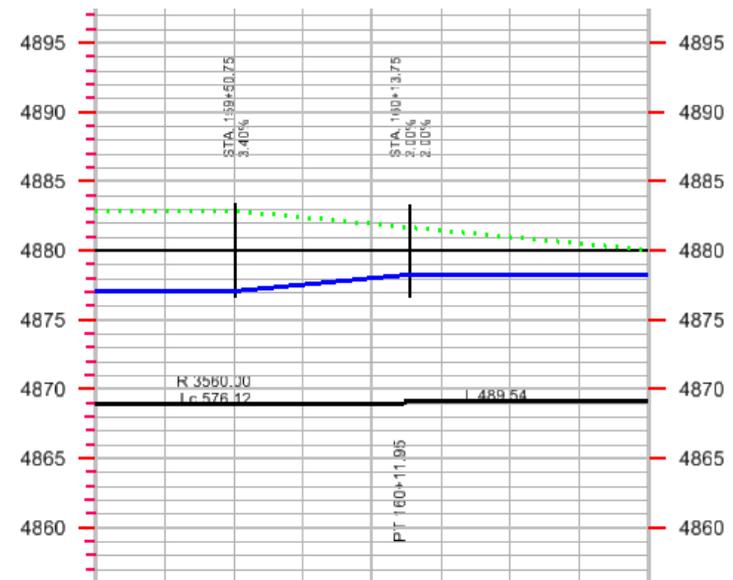
- Corridor Design Workflow
 - Add Typical Sections
 - Compute Superelevation
 - Evaluate R/W Constraints, Apply as Appropriate
 - Display Reference: Existing R/W Alignment
 - Use as a Point Control for Side Slope Design Solutions
 - Review & Evaluate Design, Refine as Needed
 - Create Surfaces
 - FG and SG
 - Cross Sections
 - Display FG and SG Surfaces
 - Components Used for Basis of Earthwork Quantities

- Master File:
 - ***One Master File*** that contains ***ALL*** Profiles/VALs
 - Use for Exhibits, Calculations, Design Notebooks, and QA/QC

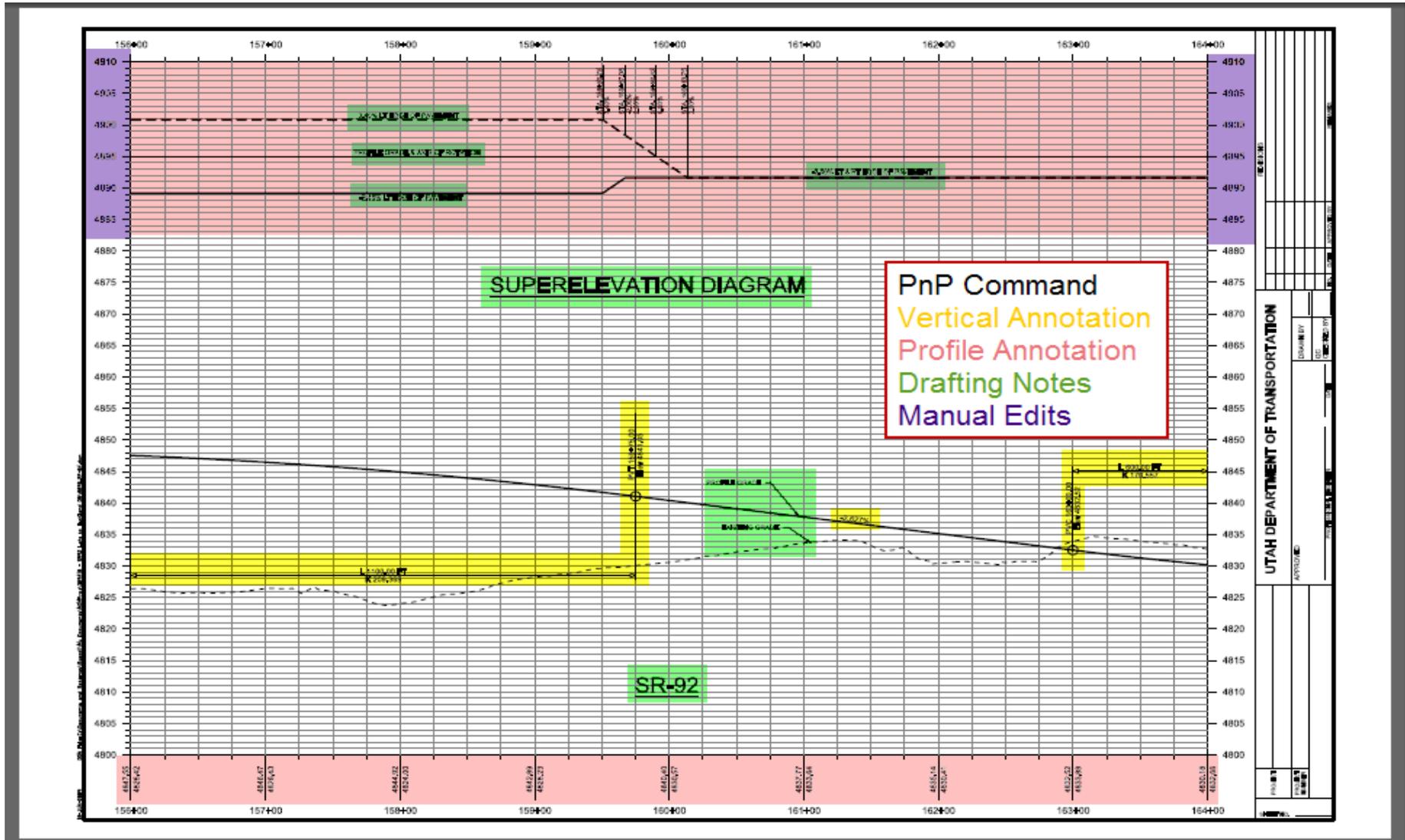
- “Design Review” Command Preferences Created
 - View Vertical Annotation
 - Annotate Profile
 - Alignments to Profile

- View Vertical Annotation
 - SSD
- Annotate Profile
 - Horizontal Cardinal Points, Horizontal Curvature Diagrams, Superelevation
 - Existing Ground and Proposed Elevations Shown on Bottom Axis

Superelevation:
Degree of Curve:
Horizontal Cardinal:



- Master File:
 - A ***Profile Master File Per Profile/VAL***
 - Created by InRoads Plan & Profile Generator
- Automates Profile Sheet Creation and Annotation
- Key Steps
 - Execute Plan and Profile Command
 - View Vertical Annotation (PGL and Alignment Information)
 - Annotate Profile (Superelevation and Elevations)
 - Use Drafting Notes (Additional Plan Content)



- Question & Answer Session

Jane Alden, PE
CH2M HILL
Jane.Alden@ch2m.com