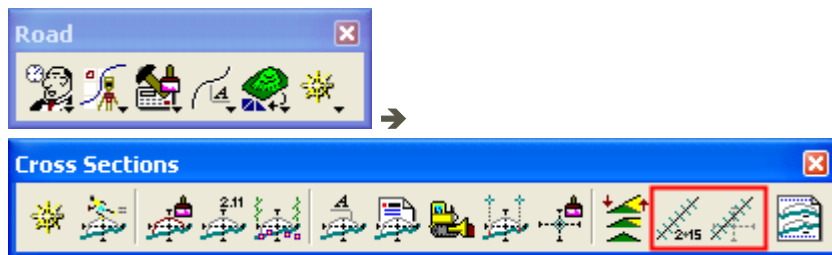


PATTERN LINES

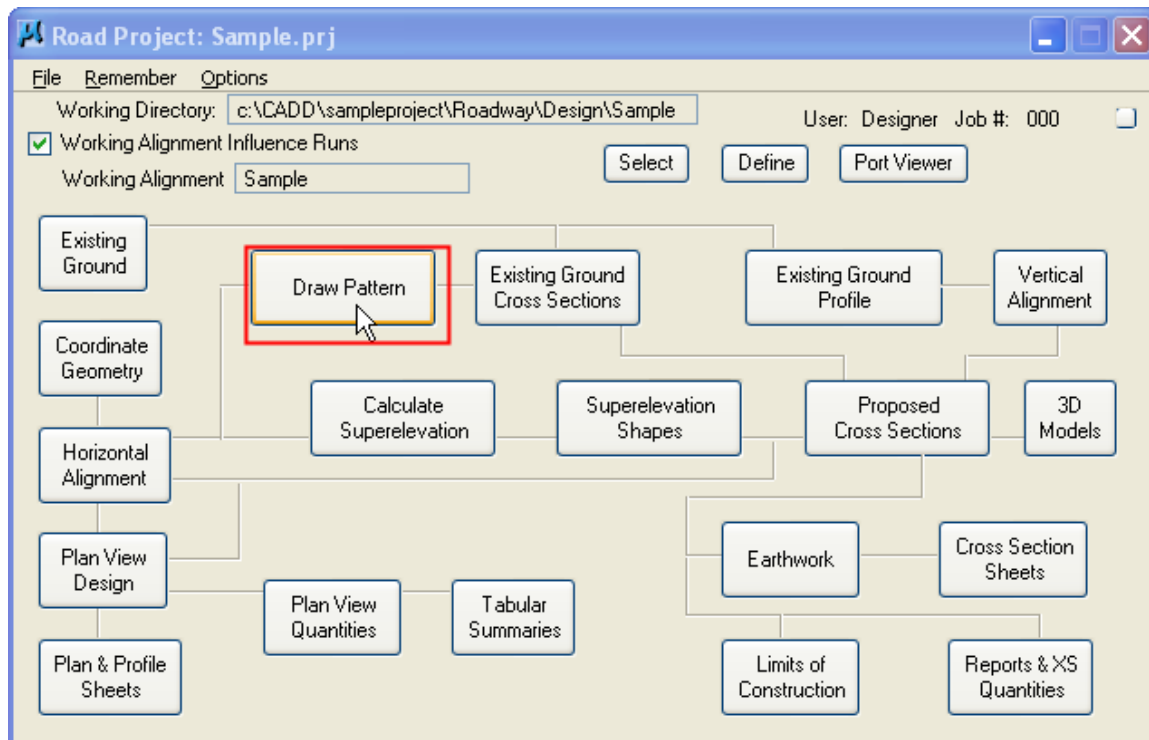
OVERVIEW OF PATTERN LINES:

A pattern line is a plan view representation of where a Geopak Cross Section will be created. Pattern line placement is critical to ensure that there is enough information to stake & construct the project accurately.

The pattern line tools can be accessed through the Geopak Cross Sections palette.



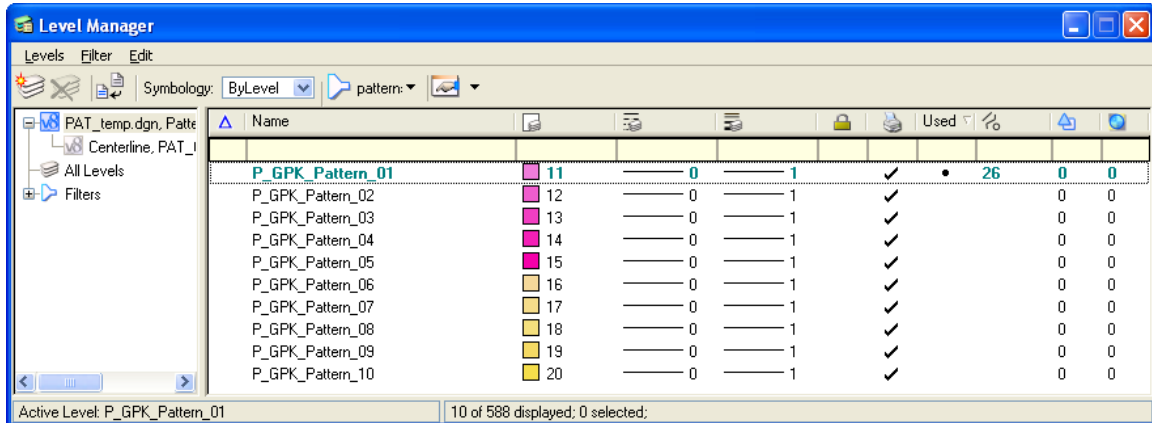
Or, through the Geopak Project Manager:



Or, through the MicroStation Main menu by selecting:
Applications>Geopak>Road>Cross Sections

PATTERN LINE ATTRIBUTES:

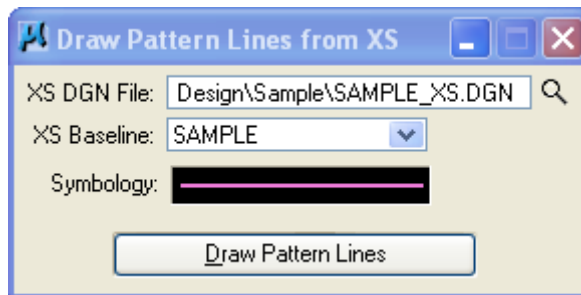
Ten different levels have been created in the FLH Level Library for Pattern lines. Each level has different “by level” attributes. These levels can be used to identify different design uses for pattern lines.



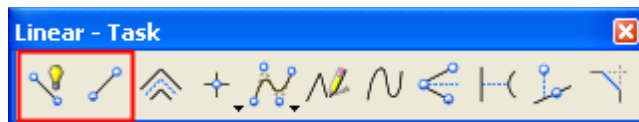
DRAWING METHODS:

Pattern lines can be placed with a few different methods.

1. Pattern line can be placed from existing cross section cells using the **Draw Pattern Lines from XS** tools. This method is rarely used, but is helpful if a cross section file was provided without the corresponding patterns.

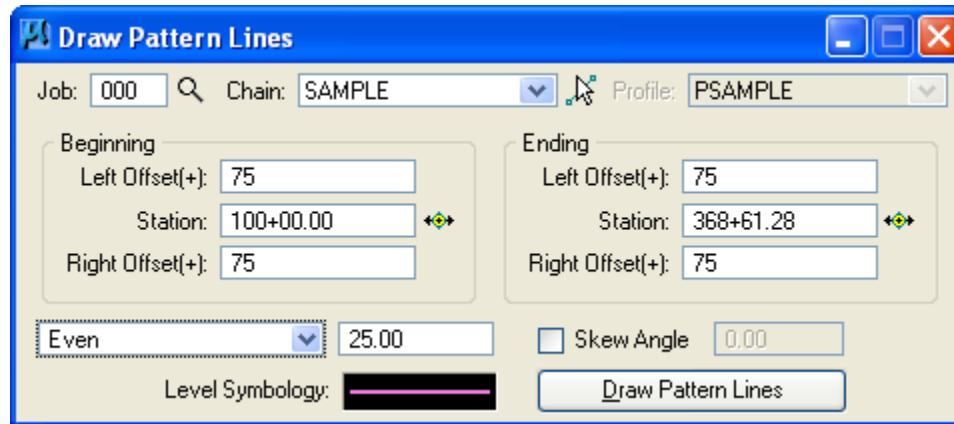


2. Pattern lines can be drawn with normal MicroStation line commands.

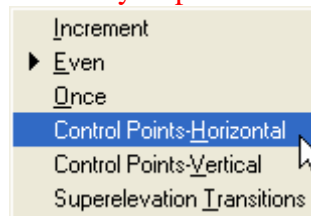


- a. For cross-culvert locations, to follow the flow-line of a preceding flow-line and an exit flow-line, use the **Place Smartline** command. (Note that grouping individual lines as a “chain” does not work for this process.)
- b. For non-typical locations and/or lengths, simply draw a line using the **Place Line** command using the pattern specific symbology as the “active attributes.”

3. The most common method is with the use of the **Draw Pattern Lines** tool.



- a. This tool is easy to use and is flexible on how patterns are to be placed. The user completes the dialog and selects the Draw Pattern Lines button.
- b. Newer in Geopak, are more choices on where patterns are placed. These could be very helpful. (Note that superelevation shapes must be in the active file or referenced to draw by Superelevation Transitions.)



DESIGN PLACEMENT/LOCATIONS:

The most important aspect of the use of patterns is in the placement method, or locations at which patterns are placed. For any method used, there is a judgment for the locations that is made. Items to consider:

1. Engineering Judgment: There is not a “one size fits all” method for where to cut proposed cross-sections. Variations between project types and engineer’s judgment will affect the final locations. Consider these items before determining what level of design/staking is necessary:
 - a. Severity of terrain and terrain classification.
 - b. The client’s needs
 - c. Type of project (3R-plus, 4R, Bridge)
 - d. Project design (large cuts\fills, at grade, ...)
 - e. Structure design (MSE vs. concrete wall, rockeries, designed by others, ...)
2. Pattern line purpose: Some patterns and cross sections are drawn for different purposes. For instance, staking information is not generated from culvert cross sections. This document is focused more on the purpose for creating construction staking information.
3. Preliminary Design (pre-50% or pre-70%): For preliminary design, the locations where cross sections are drawn are based upon the development of the design and to get rough limits of construction, and preliminary earthwork/cost estimates. Generally, pattern lines at 50 ft intervals are sufficient.

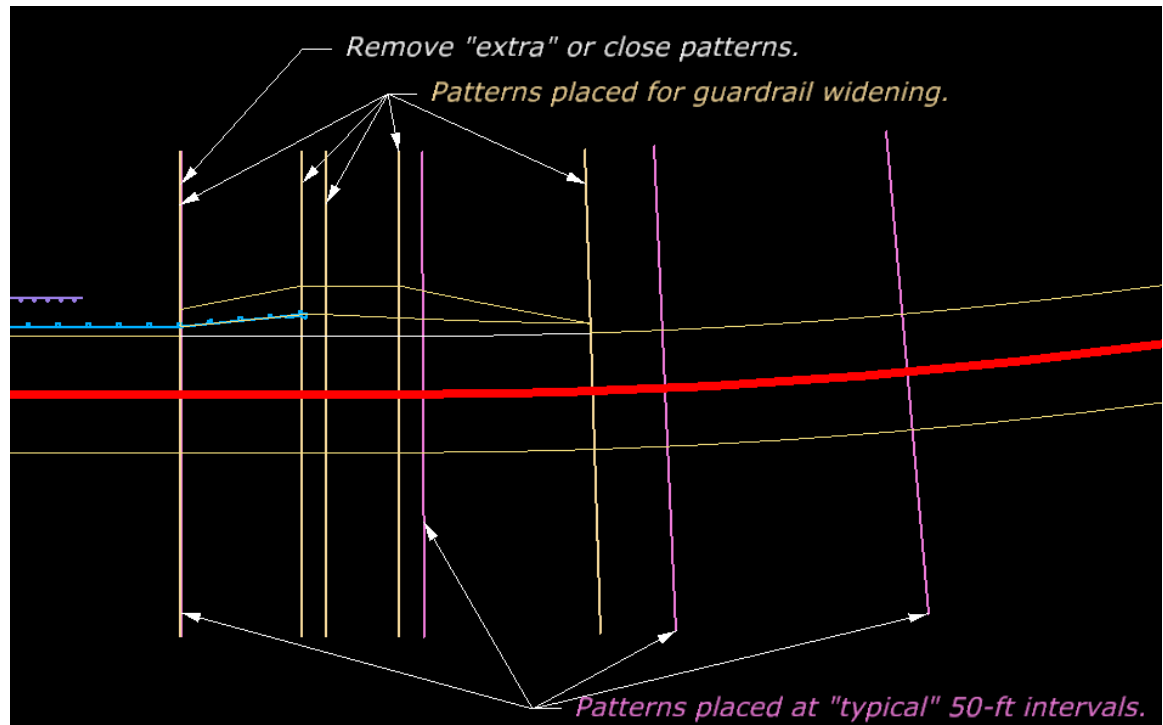
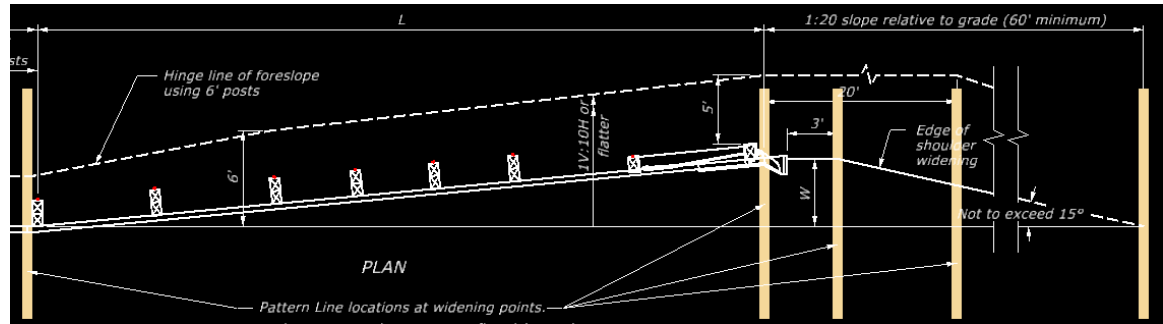
4. **Final Design (70-100%):** The final locations for cross-sections should be collaborated with the CFT and the construction group in particular. Below is a list of locations to consider.
- a. **All changes in sub-grade and pavement widths** (i.e. guardrail terminals, curve widening, pullouts, etc.),
 - b. **Begin/ending points of structural and design features** (i.e. walls, structural fills, bridges, approaches, paved ditches, etc.),
 - c. **Culvert inlets and outlets:** Many of these require extra grading, especially in cut situations,
 - d. Cattleguard locations (Subgrade widening),
 - e. Major cut/fill transitions,
 - f. Superelevation transitions, beginning and ending locations,
 - g. Minimum interval of 50-ft on horizontal tangents,
 - h. Minimum interval of 25-ft on horizontal curves with radii greater than 125-ft and less than 250-ft,
 - i. Minimum interval of 10-ft on horizontal curves with radii less than 125-ft,
 - j. Minimum interval of 25-ft at wall locations,
 - k. Approach road beginning and ending points,
 - l. Vertical Control Points (i.e. VPCs and VPTs), and profile low-points,
 - m. Horizontal Control Points (i.e. PCs and PTs),
 - n. Special environmental conditions and/or features, (i.e. avoiding wetlands, arch-sites, etc.), and
 - o. Other unique grading features (i.e. earth-berms, ditches, erosion fills, etc.).

Once all pattern lines are placed, remove patterns with duplicates or close locations. Consider removing patterns that are less than 5-ft apart. **The pattern line locations listed above are placed in a hierarchy order of importance as a guide for removing patterns. The designer may want to consider color-coding the pattern lines based on purpose to make removing pattern lines easier.**

DESIGN PLACEMENT EXAMPLES:

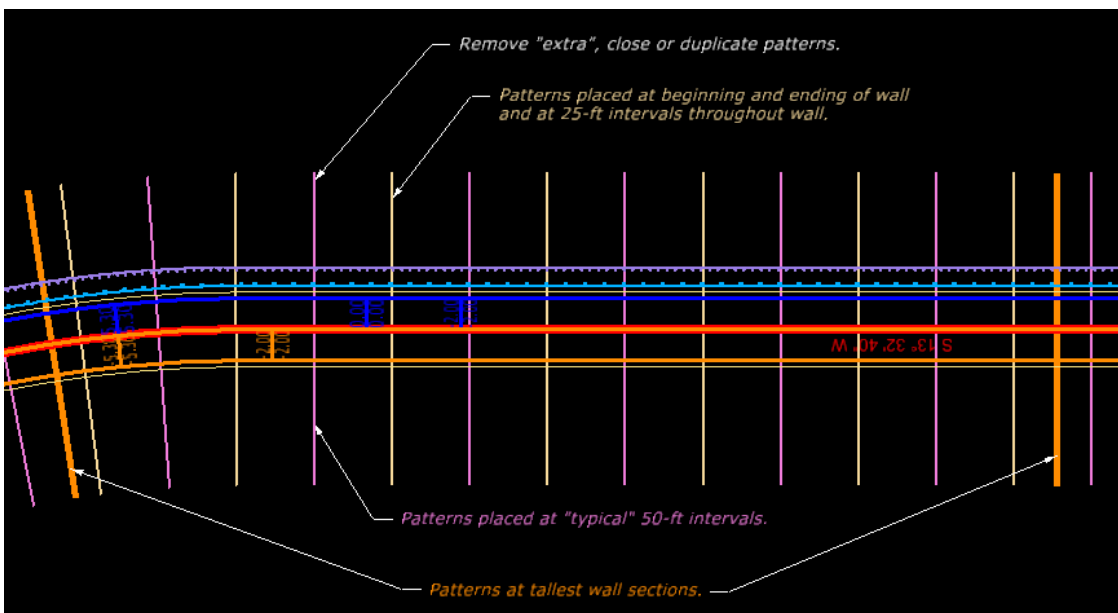
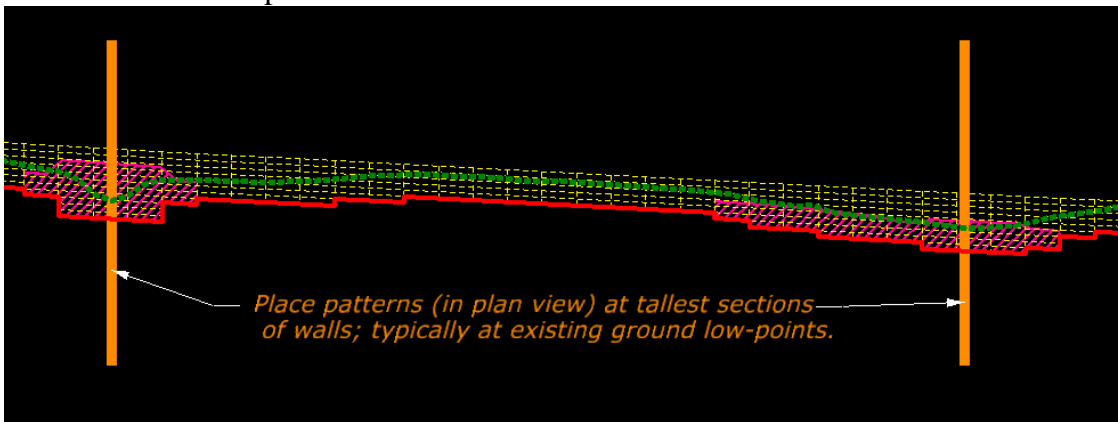
The examples shown below can be used as guidelines on where to place patterns for final design features.

1. Proposed Guardrail: It is important to capture all widening for guardrail and the beginning/ends of tapers (5 total). If a "typical" interval pattern is relatively close, it may be deleted.

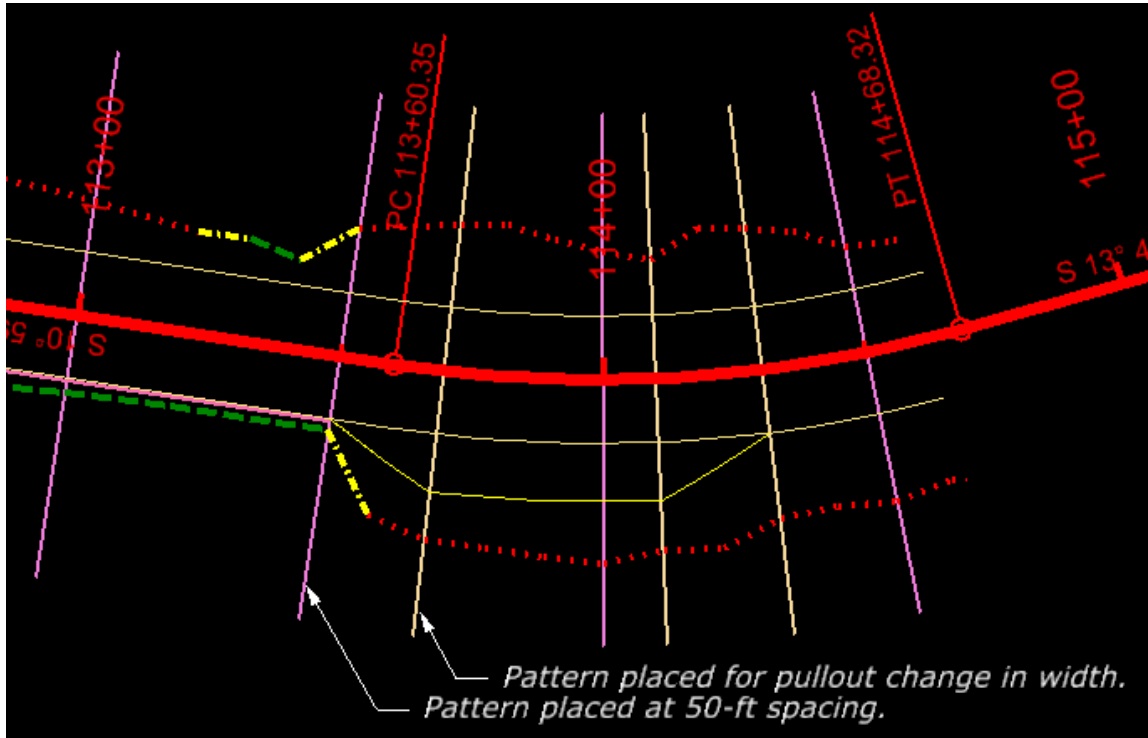


2. Proposed Wall Designs:

- a. Preliminary Design: During the wall development phase, it is recommended to create a cross section file for each individual wall. Pattern lines are placed at small intervals to: ensure a proper design, to find the limits of the wall, and to set a design profile. Use the [wall layout guidelines](#) that are posted on the [cflhd.gov website](#) or the recommendations from the geotechnical engineer. 2-4 ft spacing should be used as a minimum to ensure that at least 2 cross sections are placed on each 8-ft section of wall.
- b. **Final Cross Sections:** A good representation of the wall design is needed. Quantities are also often generated from the final cross sections. Place patterns at:
 - i. 25-ft maximum intervals throughout the wall
 - ii. At the beginning and end points of the wall
 - iii. At wall profile points where the wall heights are the greatest, and typically the existing ground is at a low-point. These locations are to ensure vehicle passage during construction, and to correctly represent the wall construction limits.

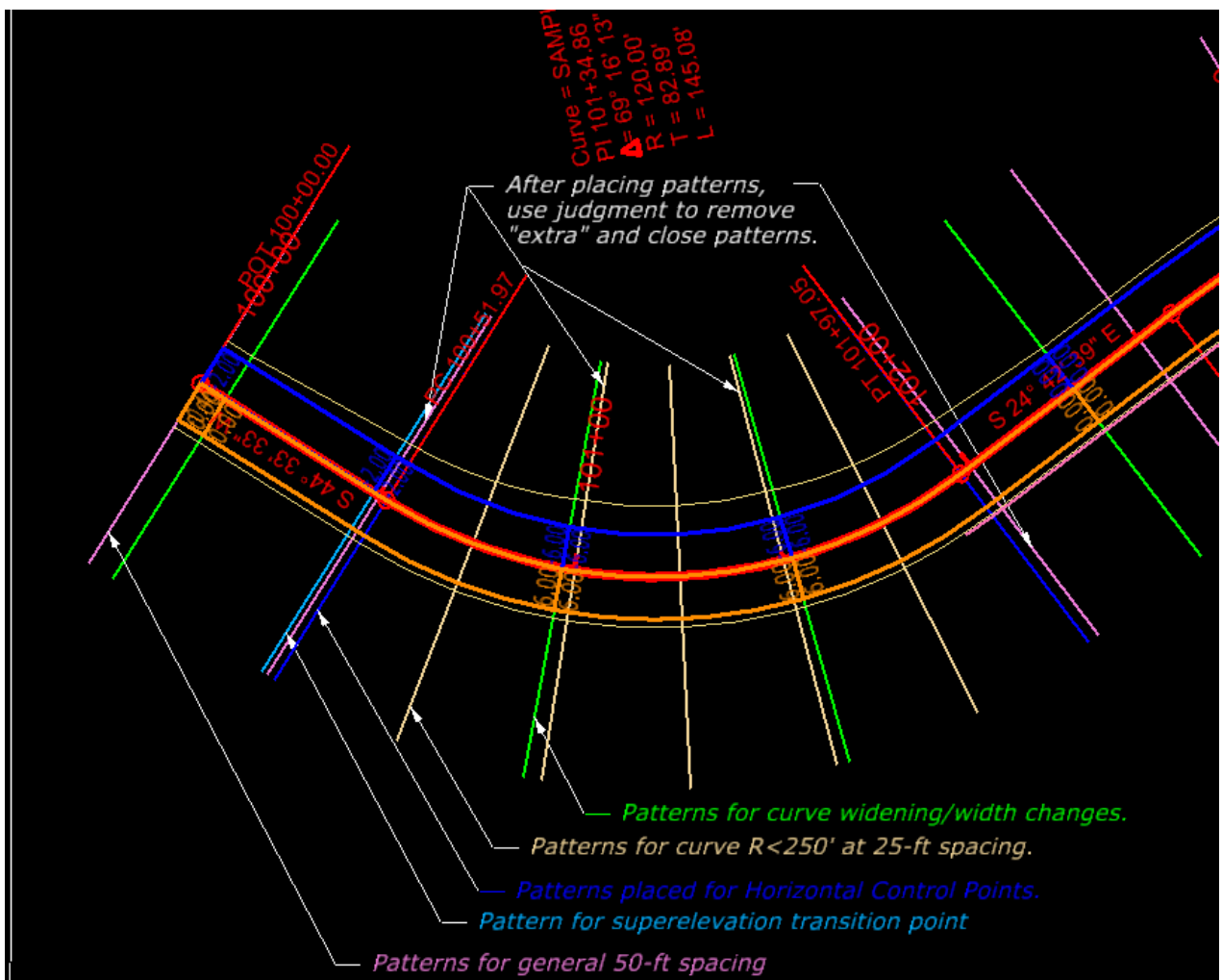


3. Proposed Pullouts: A typical pullout only requires a few extra sections. Place patterns at:
- The ends of tapers and/or changes in width
 - General 50-ft spacing should be sufficient

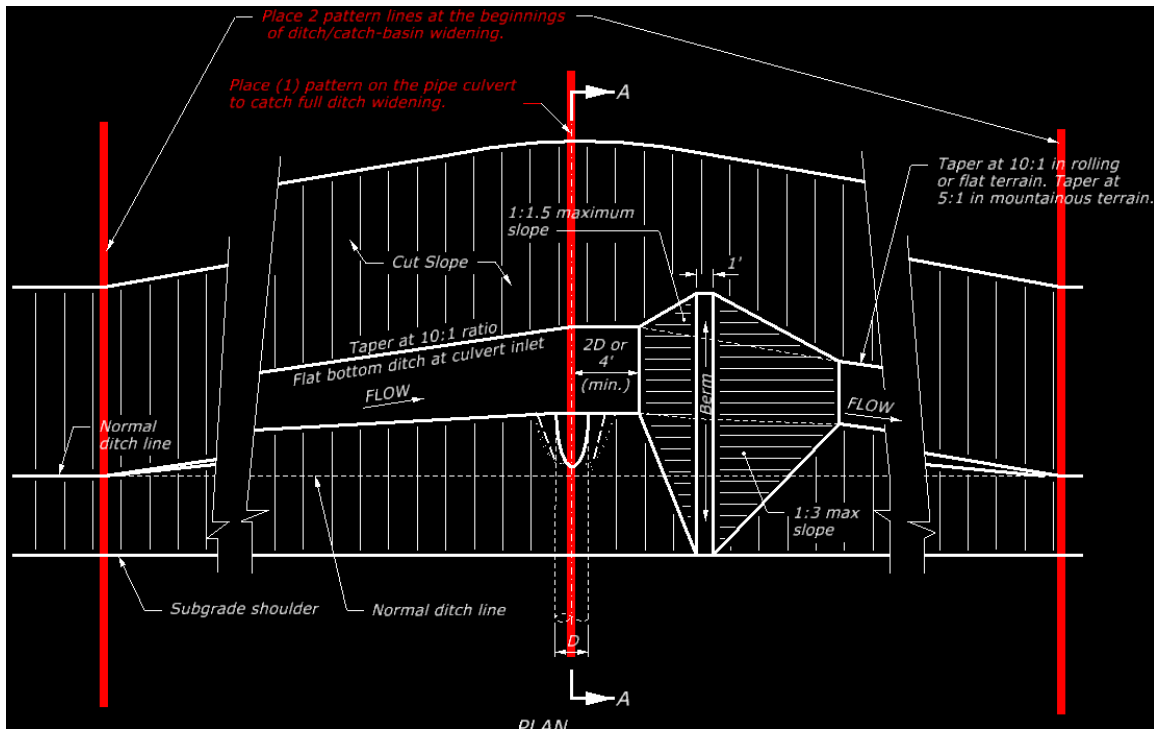


4. Proposed Curve Widening & Curve Superelevation transitions: Curves with small radii and widening create new locations where patterns may be needed. Place patterns at:
 - a. Curve Widening transition points
 - b. Superelevation transitions points
 - c. General 50-ft intervals
 - d. 25-ft intervals, if $125' < R < 250'$
 - e. 10-ft intervals, if $R < 125'$
 - f. Horizontal Control Points (i.e. PC and PT)

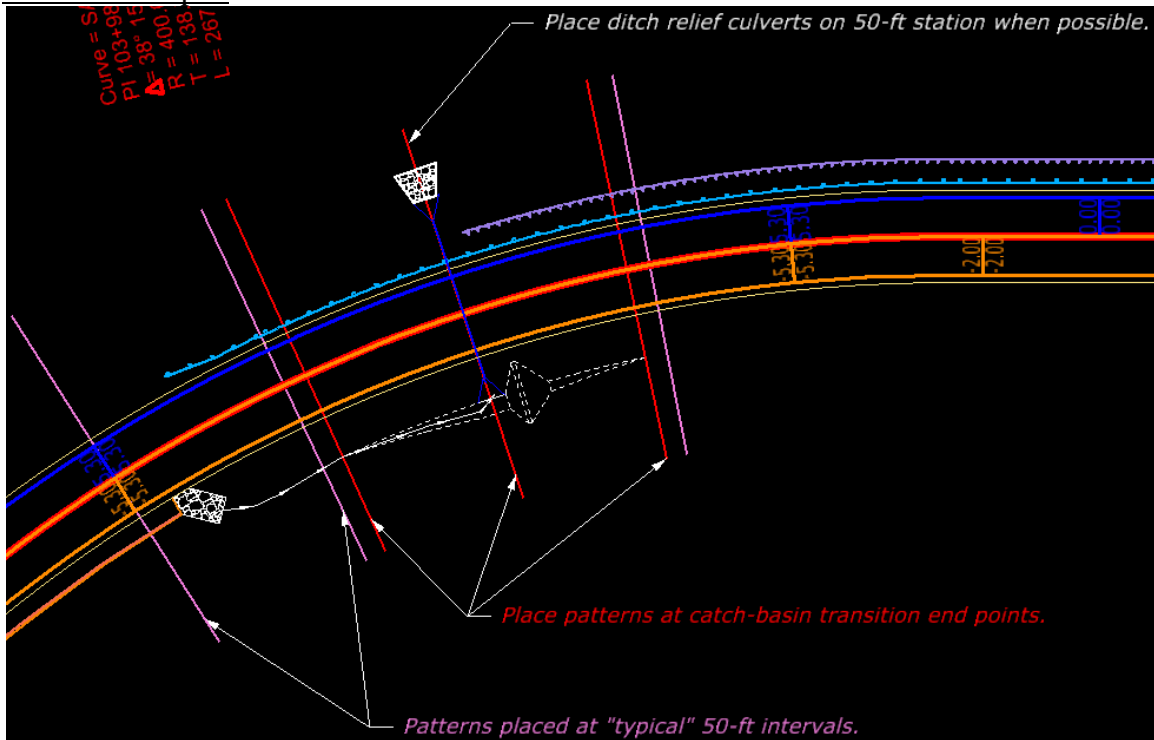
In general, a minimum of 6 to 8 patterns need to be placed at every horizontal curve location.



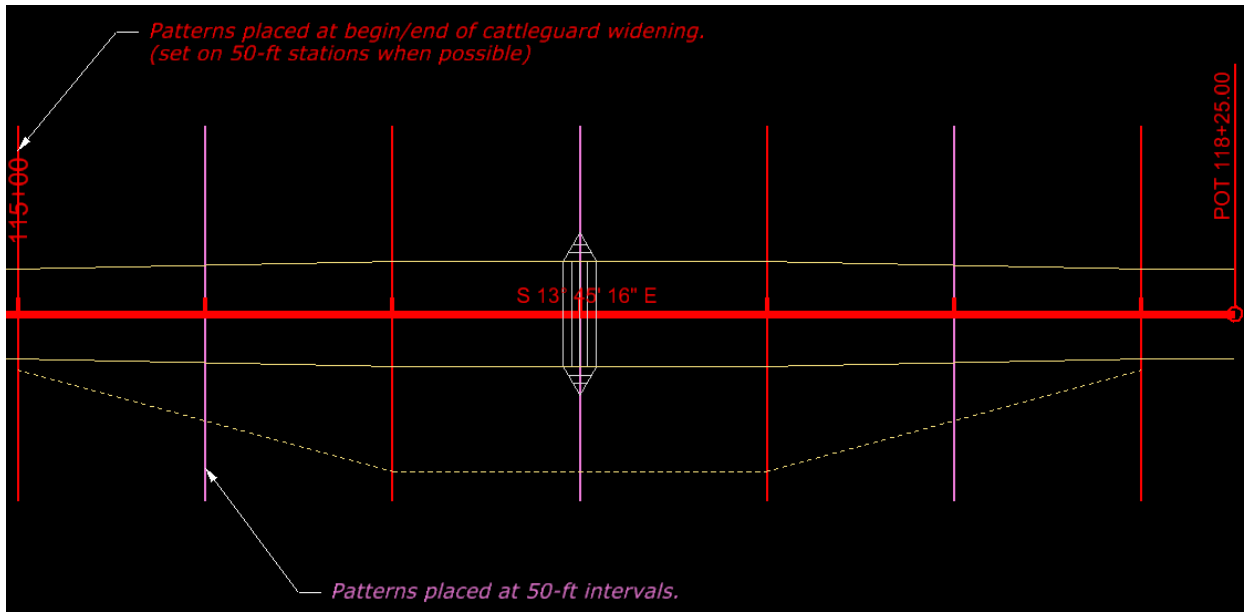
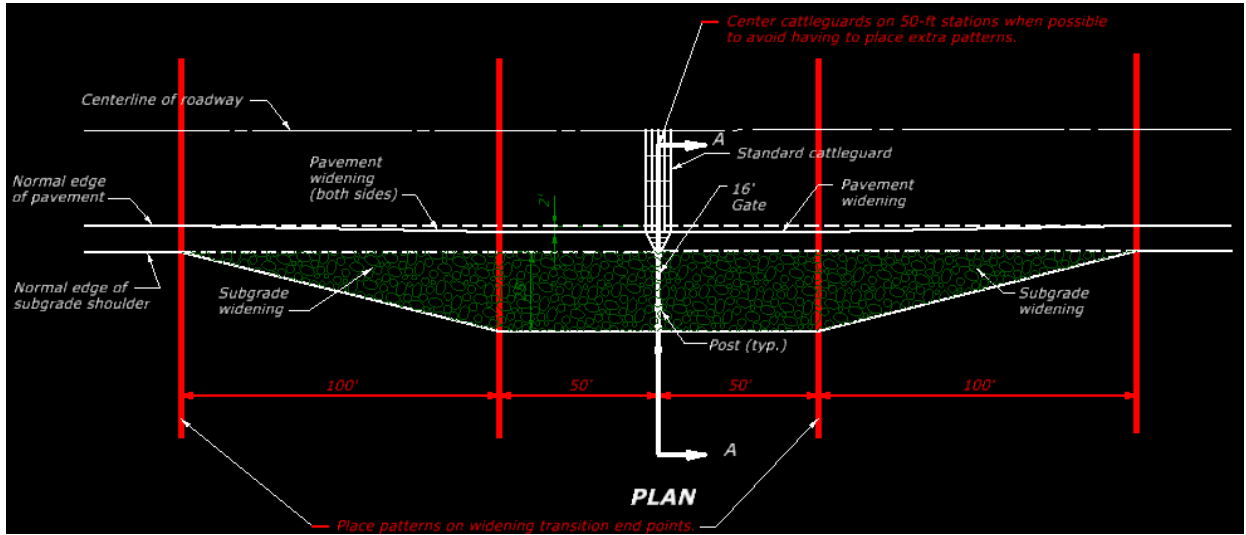
5. Proposed Drainage Features: Drainage features may need special care, especially in cut situations. Often times, features like; catch-basins, flared end-sections, special ditches, paved ditch begin/end points, and run-downs do not get accounted for in the final roadway cross-sections. This can create unnecessary re-work in the field during construction. Place patterns at:
 - a. Ditch relief culvert locations. **Do try to place perpendicular ditch relief culverts on 50-ft stations when possible.**
 - b. Catch-basin/ditch transition points for culverts.
 - c. A drainage feature's begin/end, center-line and/or key-points
 - d. Pattern lines at 5 to 10 foot intervals to cover special grading (i.e. special ditches).



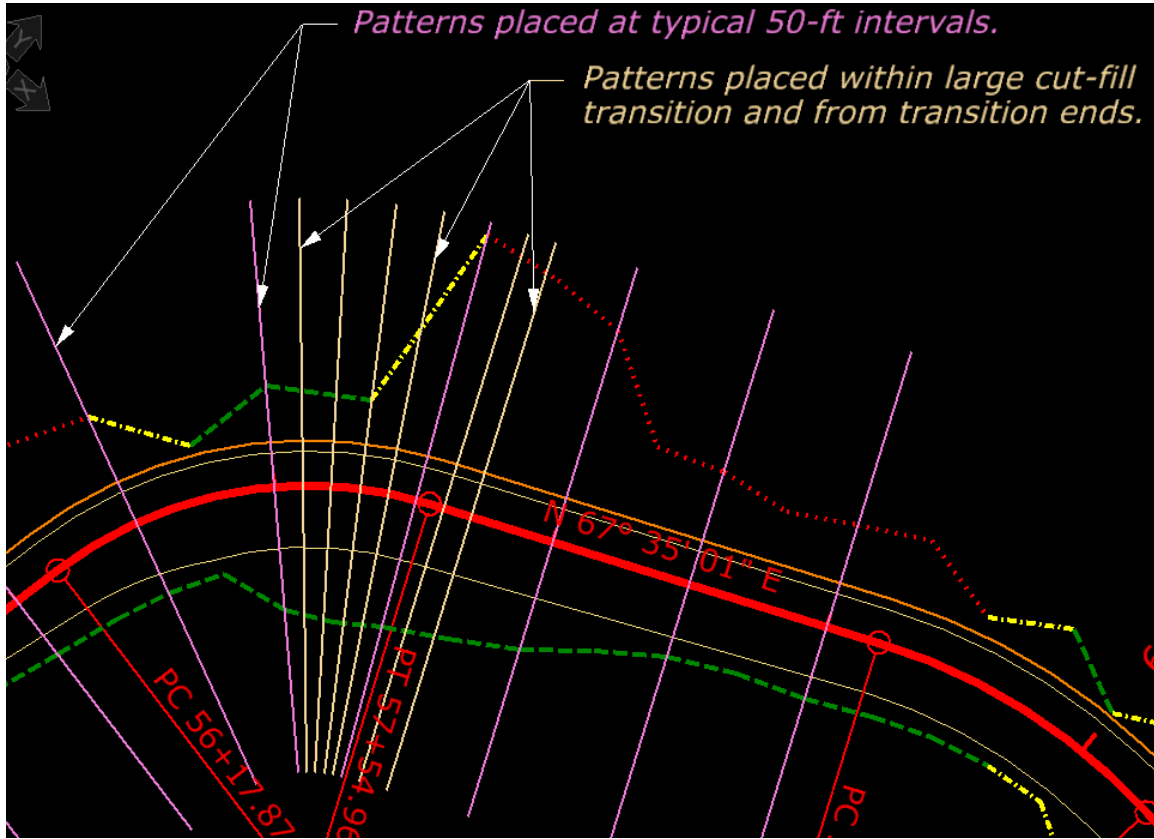
Culvert Example:



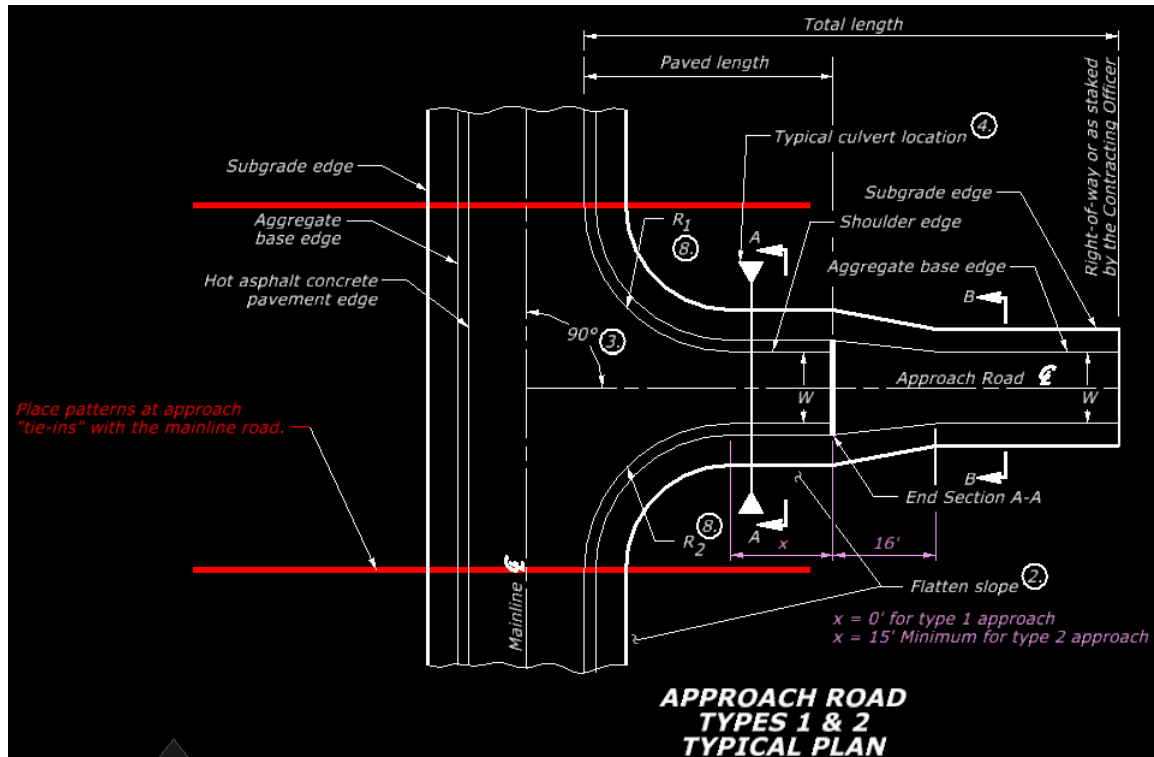
6. Proposed Cattleguards: Cattleguards require both pavement and subgrade widening. These features need to be incorporated into the final design cross-sections: Place patterns at:
 - a. Beginning and ending points of widening transitions. Transitions end points are the same for both pavement and subgrade.



7. Proposed Grading Transitions: Cut-to-fill transitions and the beginning/ending points of large cuts or fills usually need extra cross-sections. Place patterns at:
- 5 or 10 foot intervals covering 10-20 feet from transition ends.
 - 5 or 10 foot intervals within the transition.



8. Approach Road Connections: Ditch relief culverts are generally placed at approach road tie-in locations. Furthermore, quantities are separated between mainline and approach at these locations. Place patterns at:
- Beginning and ending of approach “tie-in”; at PC/PT locations or taper ends (Type 3 approach).



9. Proposed Bridges: Cross-sections at bridge locations are primarily used to correctly represent the earthwork associated with bridges. Pattern lines at bridges should be:
- b. Placed on bridge abutment locations. These may need to be skewed to match the abutment.
 - c. Placed at 50-ft interval stations.
 - d. Deleted where on the bridge. (Earthwork and staking is not generated from these locations).

