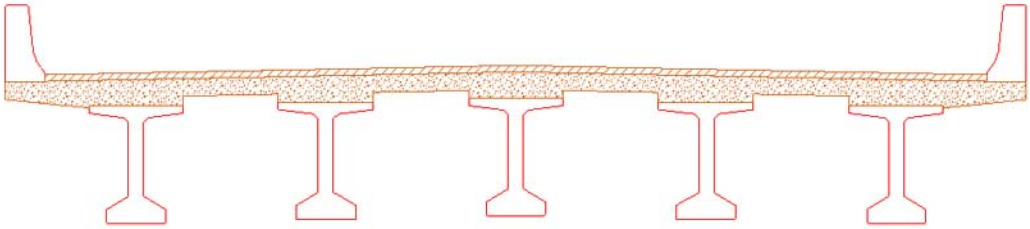
LAB 11 - Draw a Bridge Typical Section

In this lab, you'll practice all of the drawing concepts you've learned so far to create a bridge typical section.



Chapter Objectives:

After completing lab 11, you will know how to:

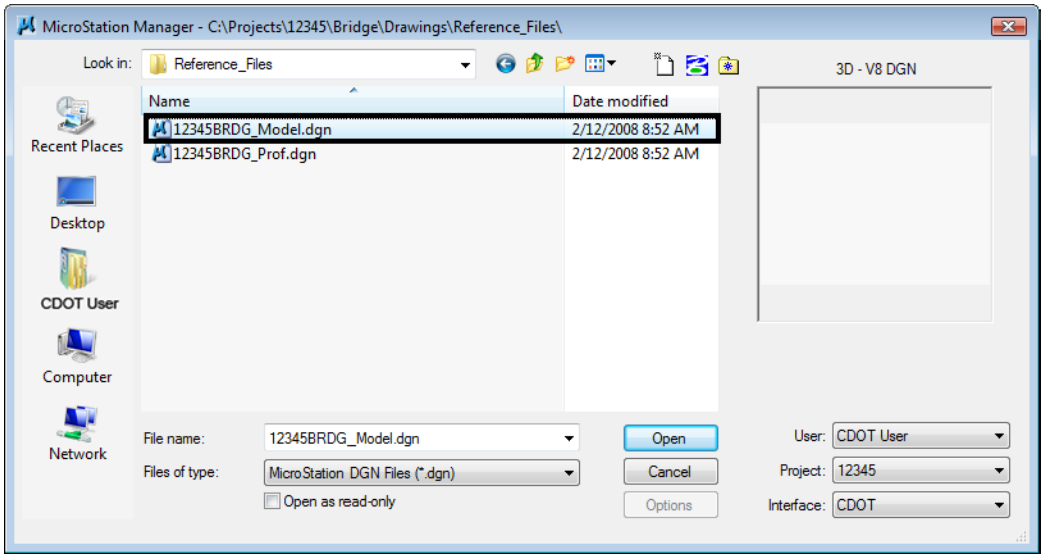
- Use the Bridge Menu to set active attributes (level, color, line style, weight).
- Use basic drawing tools (***AccuDraw***, ***AccuSnap***, ***Modify*** and ***Manipulation*** tools, ***cells***, ***patterns***, etc.) to draw a bridge typical section and a reinforcement detail.
- Use ***Selection Sets*** to group graphics.

Lab 11.1 - Create a Bridge Model file for details

Note: Since you have already selected ***xxMulti-Discipline*** from the ***Select Group*** utility, you have access to all Bridge levels. However, you could also select the Bridge Group before starting MicroStation to limit your levels to just those needed for Bridge.

1. Start MicroStation.
2. In the MicroStation Manager dialog box, re-set ***Project*** to **12345.**
3. Set the directory path to **\Bridge\Drawings\Reference_Files.**

4. Select the file ***12345BRDG_Model.dgn*** and then select **Open**.

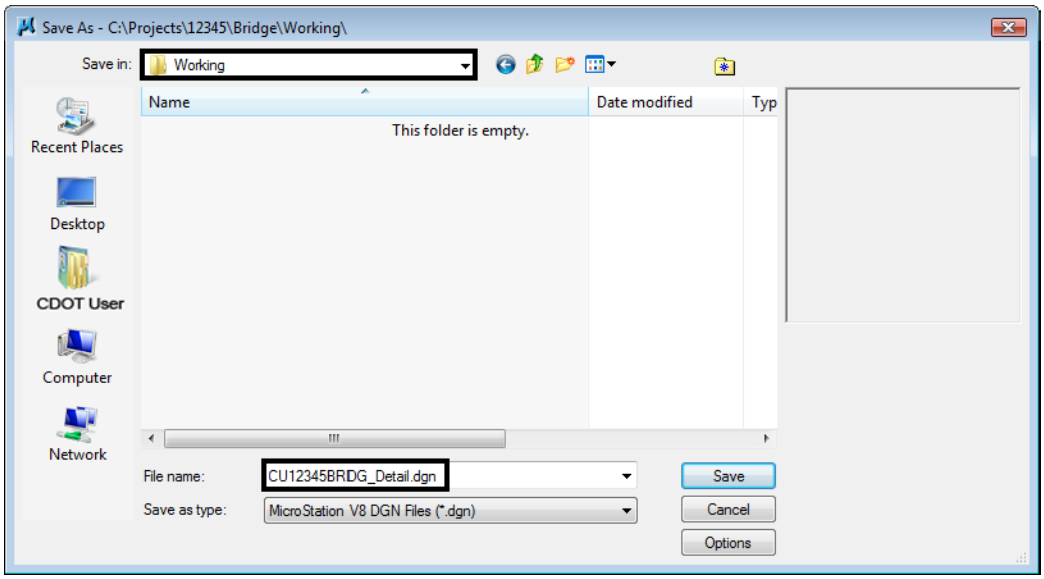


The blank model file opens.

5. Select **File > Save As...** and set the directory to the project's ***\Bridge\Working*** folder.

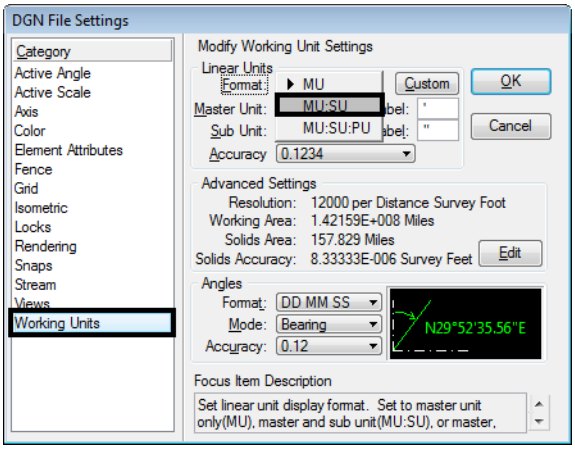
6. Rename the file ***CU12345BRDG_Detail.dgn*** and select **Save**.

Note: Note that you are renaming this file from "***Model***" to "***Detail***".



The file is copied to the working folder with the initials ***CU*** (CDOT User, for training purposes).

7. Select **Settings > Design File > Working Units** and set the ***Format*** to **MU:SU**.



8. Select **OK** to change the coordinate readout. Your readout will now show values in feet and inches.

Lab 11.2 - Draw a bridge typical section

In the next series of steps, you'll use ***AccuDraw*** and MicroStation tools (***drawing tools***, ***manipulation and modify tools***, ***grouping tools***, etc.) to create the bridge typical section shown.

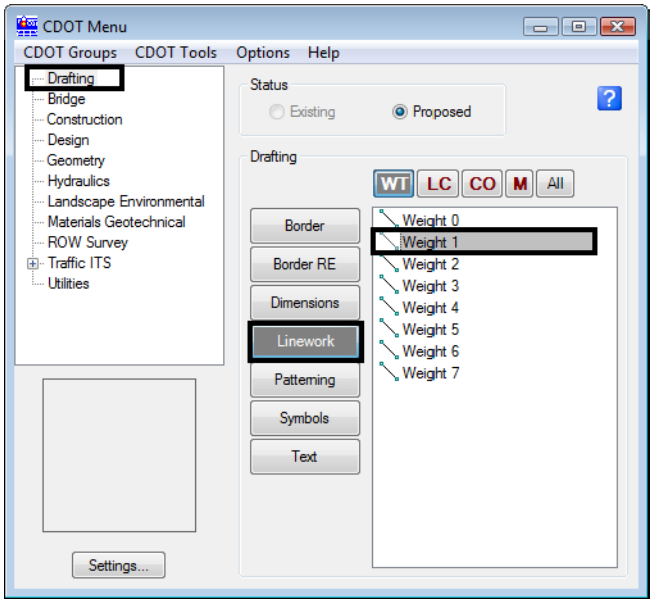
You'll begin by drawing construction lines on a drafting level, and then create the final detail on the appropriate bridge level.

Draw the slab construction lines

You'll draw the right side of the top of slab starting at the crown point of the road. The right side consists of a 12 ft. travel lane and a 6 ft. shoulder, both at a 2% cross slope.

1. On the CDOT Menu ***Drafting*** group select the **Linework** category.

2. Set the filter to **WT** and select **Weight 1**.

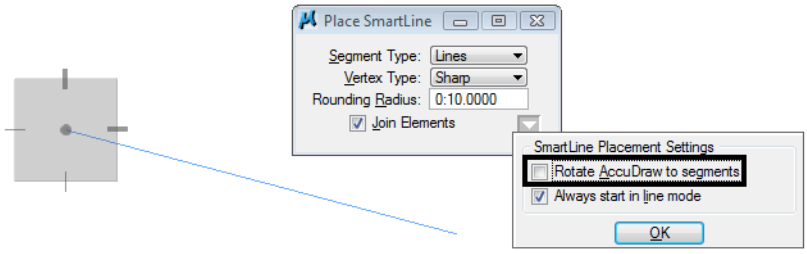


This sets the active level to ***DRAFT_WT-1***.

3. **<D>** anywhere to place the first point.

4. Make sure your ***AccuDraw*** compass is in ***Rectangular*** mode. If it is not press **<spacebar>**.

5. In the ***SmartLine Tool Settings*** box, make sure ***Rotate AccuDraw to Segments*** is turned **Off**.



This will keep the X axis horizontal as you draw ***SmartLine*** segments.

6. Move your cursor down and to the right to establish the direction of the ***SmartLine***.

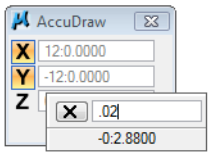
7. In ***AccuDraw***, key in ***12*** for ***X***, then **<TAB>**.

8. In ***AccuDraw***, key in ***12*.02*** for ***Y***, then **<TAB>**.

9. **<D>** to place the first ***SmartLine*** segment.

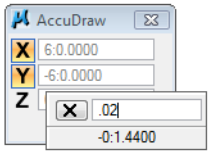
10. **Zoom In** if needed to see the line.

Note: Do not reset out of the ***SmartLine*** command. This will break the ***SmartLine***, which you do not want to do. You want the top slab line to be all one element.



This creates the 12 ft. travel lane at a 2% slope.

11. For the next shoulder segment, move your cursor down and to the right to establish the direction of the ***SmartLine***.
12. In ***AccuDraw***, key in ***6*** for ***X***, then **<TAB>**.
13. In ***AccuDraw***, key in ***6*.02*** for ***Y***, then **<TAB>**.

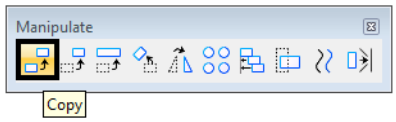


14. **<D>** to place the second ***SmartLine*** segment, this creates the 6 ft. shoulder at a 2% slope.
15. **<R>** out of the ***SmartLine*** command.

Create the bottom slab construction line

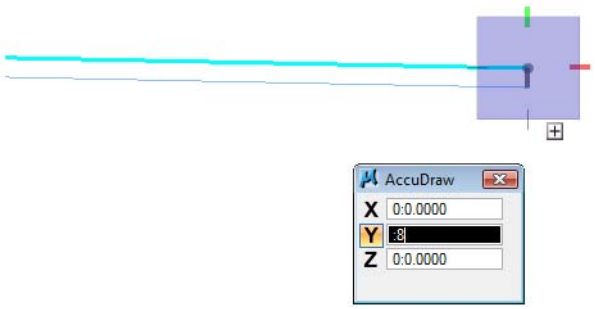
Vertically copy the top slab line down 8 inches for the bottom of slab on the right side.

1. Select the **Copy** command from the ***Manipulate*** toolbar.



2. **AccuSnap** on the right end of the top slab to identify the element to copy.
3. Move your cursor down and lock on to the –Y AccuDraw axis to establish the copy direction. In ***AccuDraw***, key in ***:8*** for ***Y*** and the press **<TAB>** to accept the entry. The value converts to 0.667 feet.

Note: Don't forget to key in the colon before the 8 to specify 8 inches.

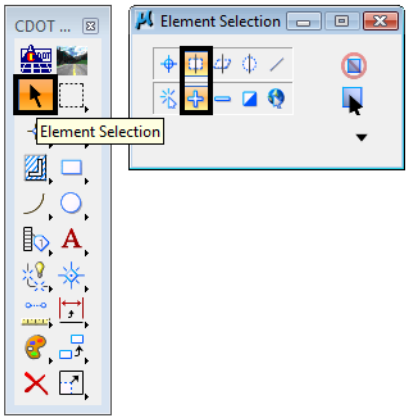


4. **<D>** to place the copy, then **<R>** to complete.

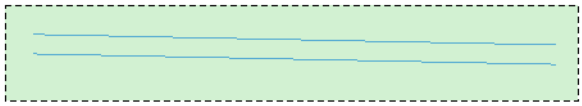
Create the slab left side

Since the right and left sides of the road are symmetrical, you can ***mirror*** the right side to create the left side.

1. Select the **Element Selection** command and set the ***Tool Settings*** as shown.



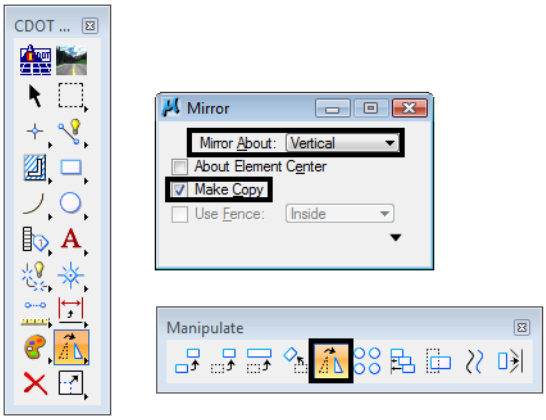
2. Place a fence around the slab graphics (**<D>** for upper left corner and then **<D>** for lower right corner).



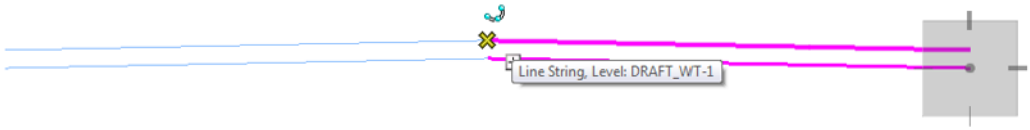
3. Select the **Mirror** command from the ***Manipulate*** toolbar:

   - Set ***Mirror About*** to **Vertical.**

- Toggle on **Make Copy.**

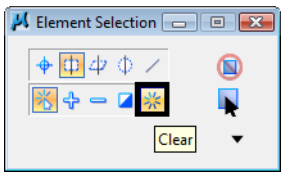


4. **<D>** on the left endpoint of the upper slab line (the crown point) for the mirror copy.



5. **<R>** when done.

6. Select the **Element Selection** command again and select the **Clear** icon from the tool settings window to remove the selection set.



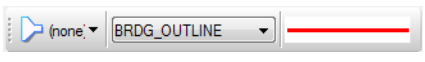
7. **Fit** the view.

Place the girders

1. On the ***CDOT menu***, select the **Bridge** Group.

   - Set the ***Category*** to **Bridge Levels**
   - Set the ***Type*** to **Basic**
   - Select the **Outline** item

   Note: This changes the active level from a ***DRAFT*** level to the ***BRIDGE_OUTLINE*** level for placing the girders.



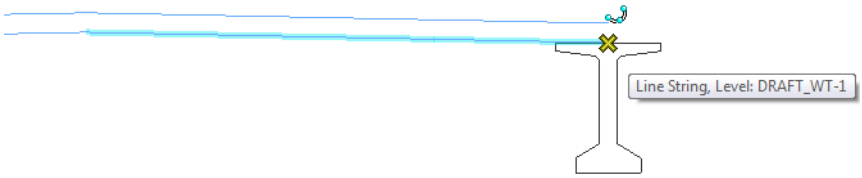
2. On the ***CDOT menu***, select the **Bridge** Group.

   - Set the ***Category*** to **Cells**

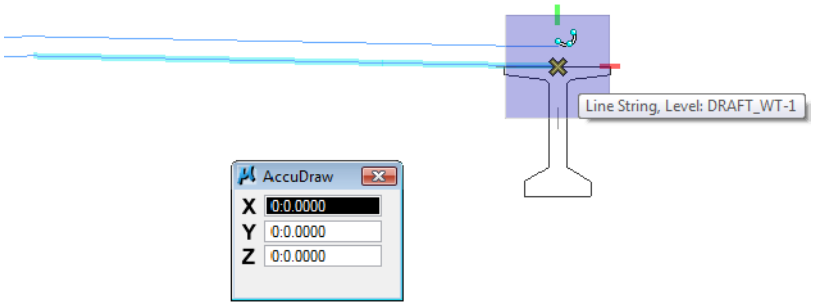
- Set the ***Type*** to **Girders-BT**
- Select the **BT54** item

Note: This automatically selects the correct girder cell from the bridge cell library and activates the ***Place Cell*** command.

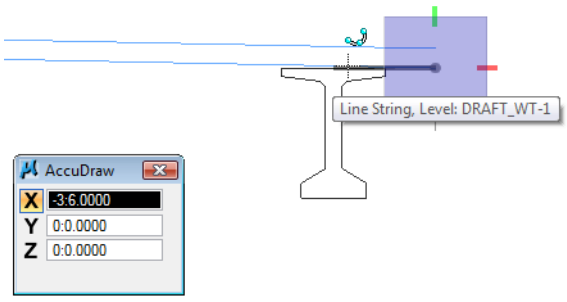
3. On the CDOT menu, select the **Settings** button
   - Set ***Active Scale*** to ***1***
   - Set ***Active Angle*** to ***0***
   - **<D> Close** to exit the Settings window
4. Using AccuDraw we can establish an orientation point from which to place the first girder. With the girder cell attached to your cursor, hover over right endpoint of the bottom slab line (don't ***AccuSnap***, just hover and lock on to the point).



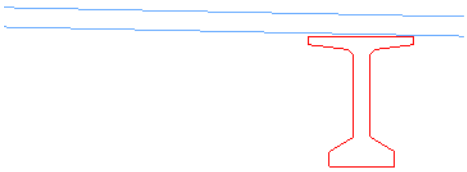
5. Click into the ***AccuDraw*** box to set it active and press the letter ***O*** on the keyboard to move the ***AccuDraw*** compass origin to this point.



6. Move you cursor to the left to establish the placement direction, and key in ***3:6*** in the ***X*** field.



7. With your cursor locked on the ***X*** axis **<D>** to place the girder cell.

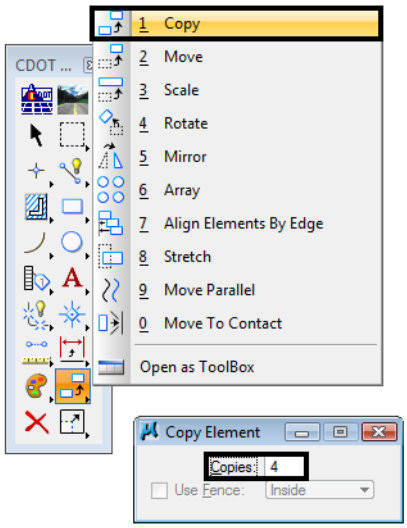


This places the first girder 3 ft. – 6 in. from the right side of the slab. You'll later move the girder down for the proper haunch depth.

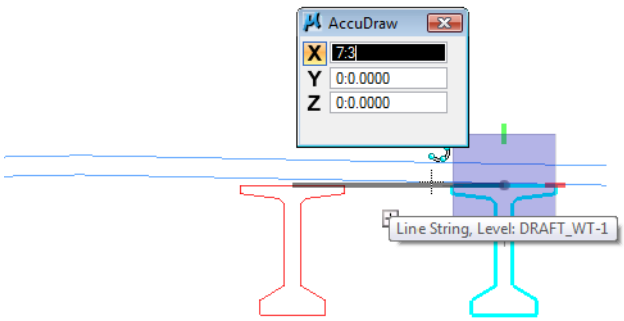
Place additional girders

Copy the girder cells to space them 7 ft. 3 in on center.

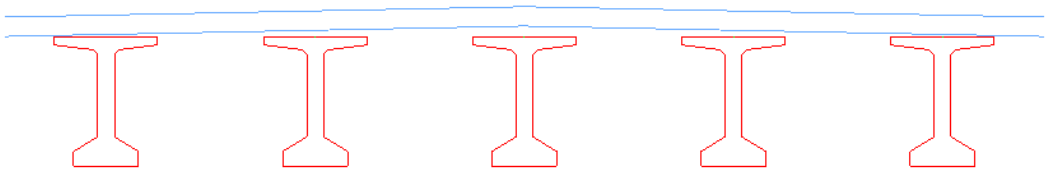
1. Select the **Copy** command.
2. In the ***Tool Settings*** box, key in ***4*** for the number of copies.



3. Click into the ***AccuDraw*** window to set it active.
4. **<D>** on the girder at the top midpoint.
5. Move your cursor to the left to establish the copy direction and key in ***7:3*** in the ***X*** field in ***AccuDraw***.

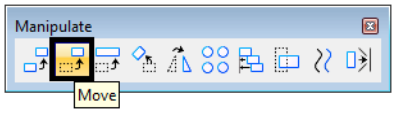


6. With your cursor locked on the ***X axis***, **<D>** to place the copies.

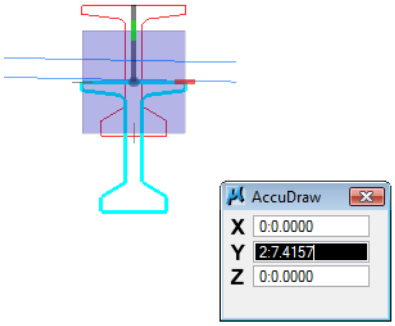


Move the girders down to establish the haunch depth

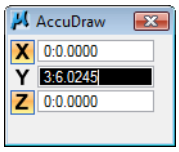
1. Select the **Move** command from the ***Manipulate*** toolbar.



2. Click into the ***AccuDraw*** window to set active.
3. **<D>** on the right end girder at the top midpoint for the move from location.
4. Move your cursor up and lock on the ***Y axis*** to establish the direction, then press **<Enter>** on the keyboard.

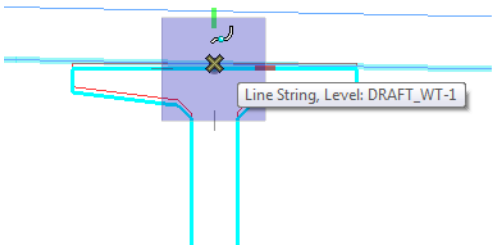


By pressing **<Enter>** you "smartlock" the ***AccuDraw X*** and ***Z*** axes, so that you can only move in the ***Y*** direction.

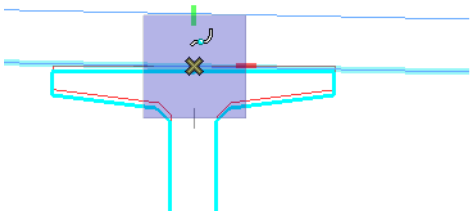


5. Press ***N*** on the keyboard for the ***Nearest*** snap mode.

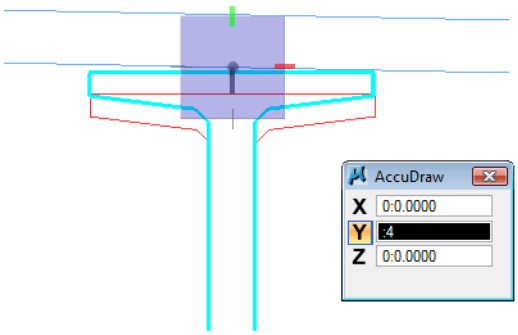
6. ***Hover over*** (do not data point) at the nearest snap point on the bottom slab line.



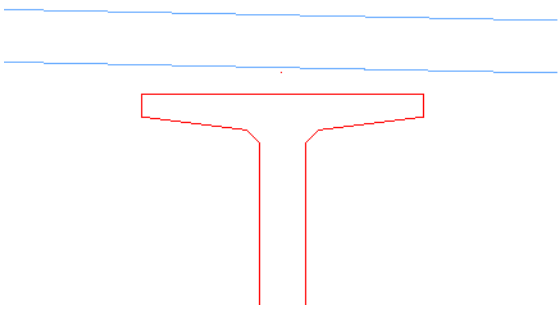
7. Press the letter ***O*** on the keyboard to move the ***AccuDraw*** origin to this point.



8. Move your cursor down to establish the move direction, lock on to the ***-Y*** axis and key in ***:4*** in the ***AccuDraw Y*** field.

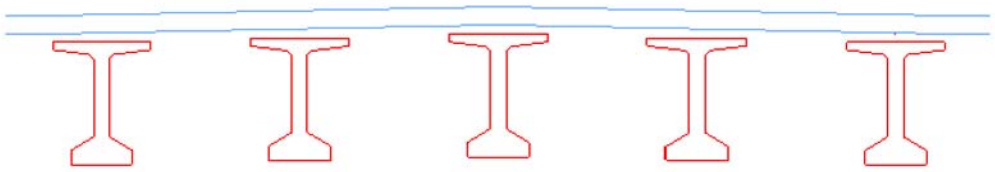


9. **<D>** to move the girder.



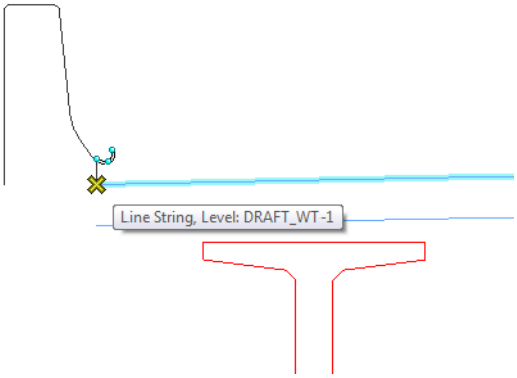
This moves the girder down 4 inches from the bottom of the slab for the correct haunch thickness.

10. Repeat the above steps to vertically move the remaining girders down 4 inches from the bottom of the slab.

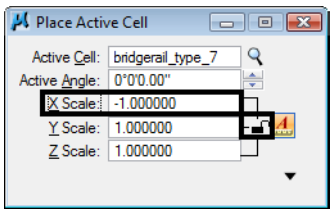


Place the Bridge Rail

1. On the CDOT menu, select the **Bridge** Group.
   - ♦ Set the ***Category*** to **Bridge Rail**
   - ♦ Select the **Rail Type 7** item
2. **AccuSnap** on the left end of the top of slab as shown.

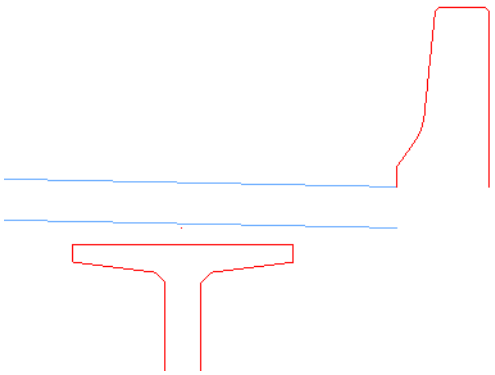


3. For the right-side rail, select the **Place Active cell** command again.
4. In the ***Tool Settings*** box, **Unlock** the ***XYZ lock*** and set the ***X*** scale to ***-1***.



Note: ***-1*** X-axis scale will mirror the cell about the X axis.

5. Place the cell as shown.

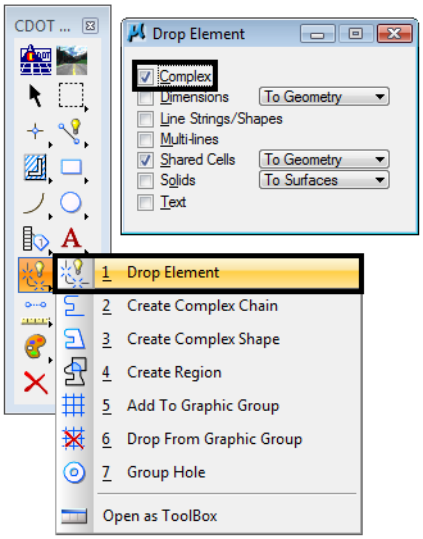


6. **<R>** when done.

Extend elements

Extend the slab lines to join up with the bridge rail. To do this, you'll need to drop the bridge rail cell to its original elements.

1. Select the **Drop** command from the ***Groups*** toolbar.

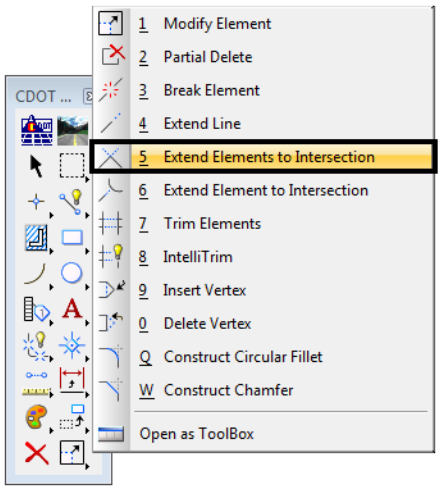


2. Select **Drop Element**, and toggle on **Complex** (the cell is considered a complex element).

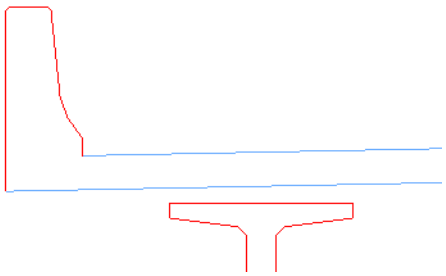
3. **<D>** on the right-side bridge rail cell.

4. The cell is dropped to its original elements.

5. Select the **Extend Elements to Intersection** from the ***Modify*** toolbar.



6. **<D>** on the bottom slab line and then **<D>** on the back of rail line to extend these elements.

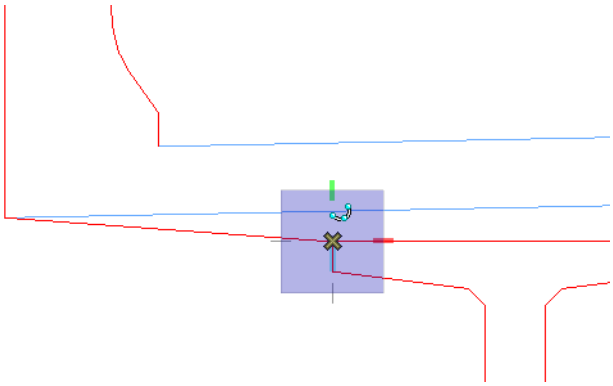


7. Repeat the above steps for the right side.

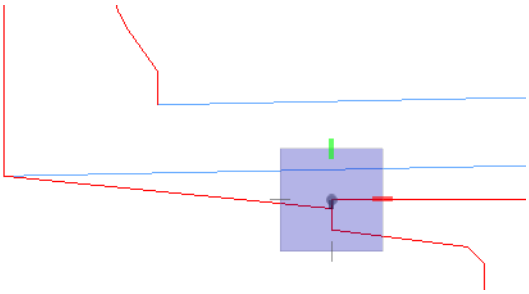
Draw the slab

1. With the active level set to **BRIDGE_OUTLINE**, select the **Place SmartLine** tool.
2. Click in the ***AccuDraw*** window to set it active.
3. Starting on the left side, **AccuSnap** on the bottom of the bridge rail.
4. You want the next point to be 1” below the left-top of the first girder. To do this, you’ll need to move the ***AccuDraw*** origin to the top of the girder and then locate 1” down.

5. Hover over the left-top of the girder as shown, click in the ***AccuDraw*** box and press the letter ***O*** on the keyboard to move the ***AccuDraw*** origin to this point.

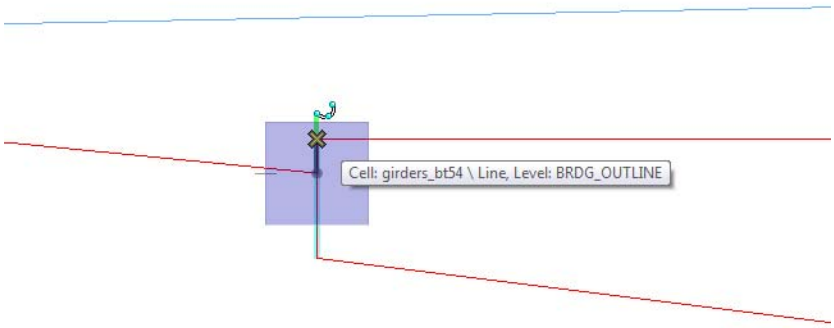


6. Move your cursor down, lock on the ***Y*** axis and key in a value of ***:1*** (1 inch).



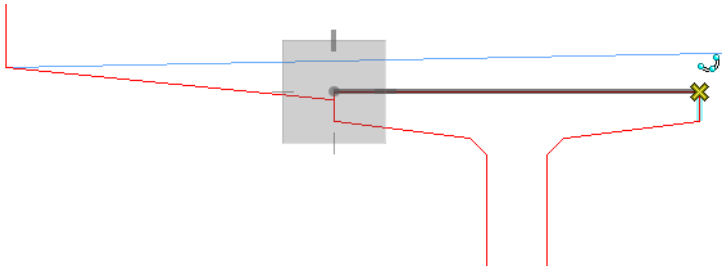
7. **<D>** to place the ***SmartLine*** segment.

8. **AccuSnap** on the left-top of the girder as shown.

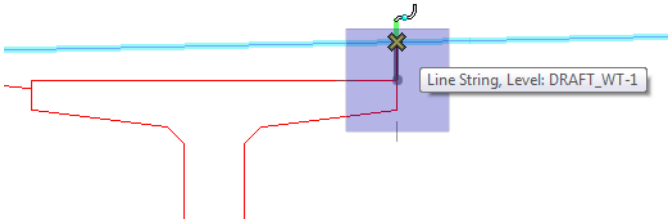


Note: Remember, if you make a mistake, **Undo** the last data point, don't reset out of the SmartLine command.

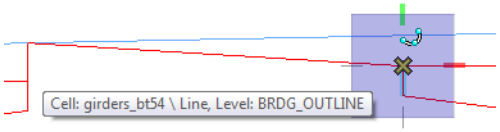
9. **AccuSnap** on the right-top of the girder as shown.



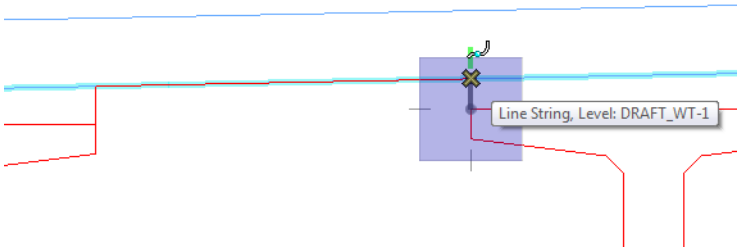
10. Move your cursor up, lock on to the ***Y*** axis and press **<Enter>** to smartlock the axis. You can now only move in the ***Y*** direction.
11. Press ***N*** on the keyboard for the nearest snap point.



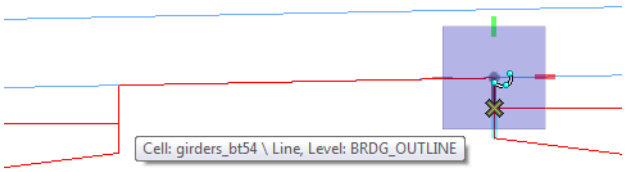
12. **<D>** on the bottom slab line as shown.
13. ***Hover*** over the next girder's top-left endpoint as shown.



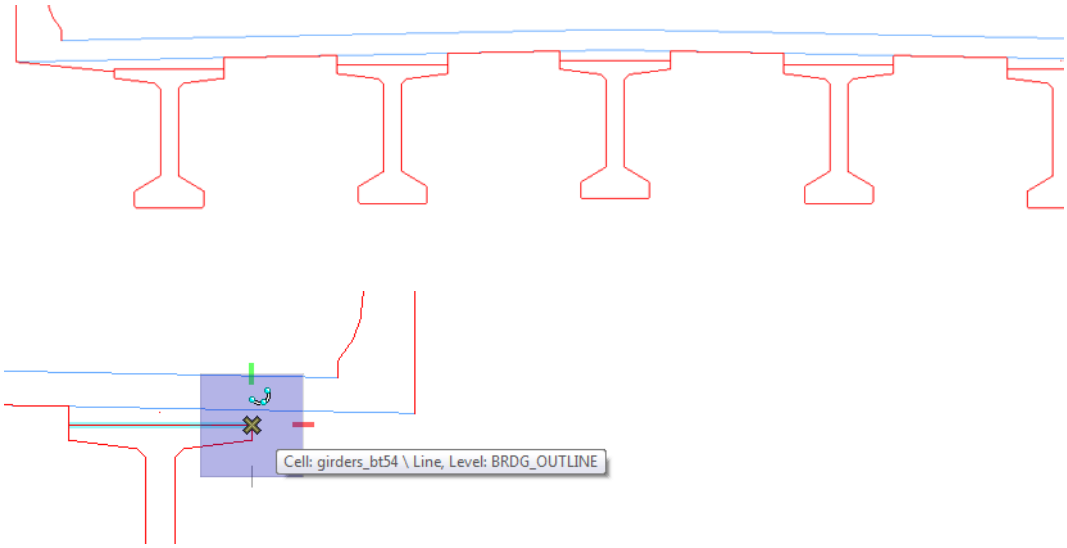
14. Press ***O*** on the keyboard to move the ***AccuDraw*** origin to this point (do not data point).
15. Move your cursor up, lock on to the ***Y*** axis, and press **<Enter>** to smartlock the axis.
16. Press ***N*** for the nearest snap point.
17. **<D>** on the bottom slab line as shown.



18. **<D>** on the top left girder edge as shown.



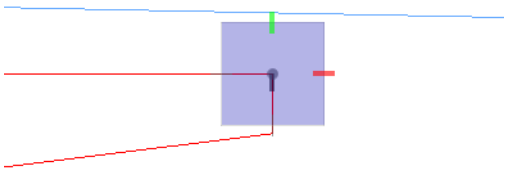
19. Continue these steps on each girder to place ***SmartLine*** segments as shown until you get to the last girder location shown below.



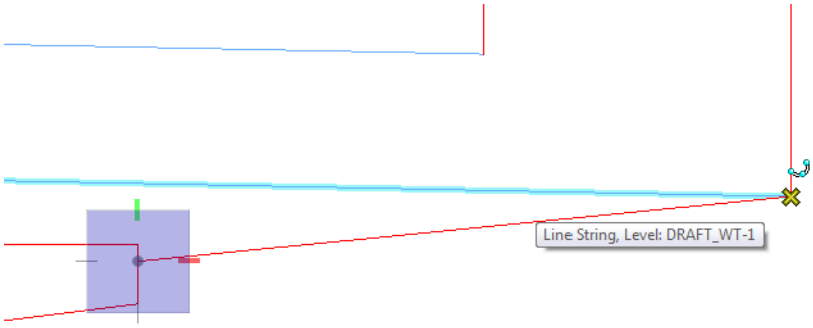
Remember to **Undo**, not reset, if you make a mistake on a segment.

20. On the last girder (far right), move your cursor down, lock on to the ***Y*** axis and key in a Y value of ***:1*** (1 inch).

21. **<D>** to place the point.

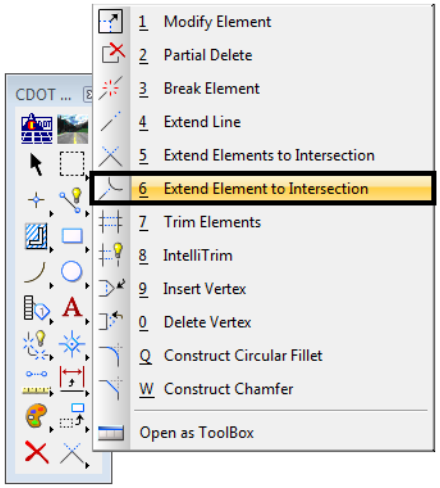


22. **<D>** on the right end of the bottom slab line.

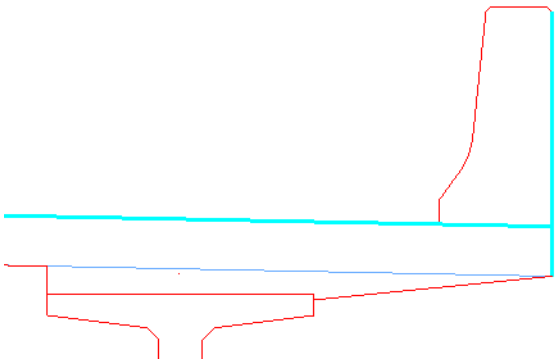


23. **<R>** out of the ***Place SmartLine*** command.

24. Select the **Extend Element to Intersection** tool from the ***Modify*** toolbar.



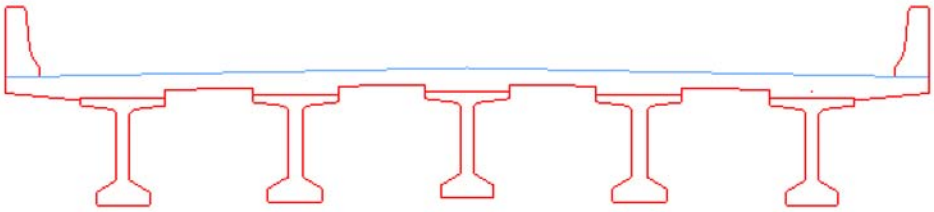
25. **<D>** on the blue top of slab line and then **<D>** on the back of bridge rail line to extend these elements.



26. Repeat for the left side.

27. **Delete** the blue bottom of slab lines.

28. Fit the view.

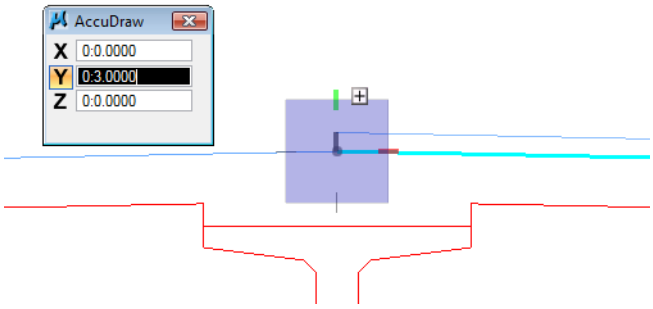


Create the top of pavement

1. **Fit** the view.
2. Select the **Copy** command.
3. **<D>** on the right-side top slab line (blue construction line) at the crown point to select it for copying.

   Note: If you select the bridge slab shape (red element), **<R>** until the top slab line highlights.

4. Move your cursor up and lock-in on AccuDraw's ***Y*** axis.
5. In **AccuDraw**, key in a ***Y*** value of ***:3*** (3 inches).



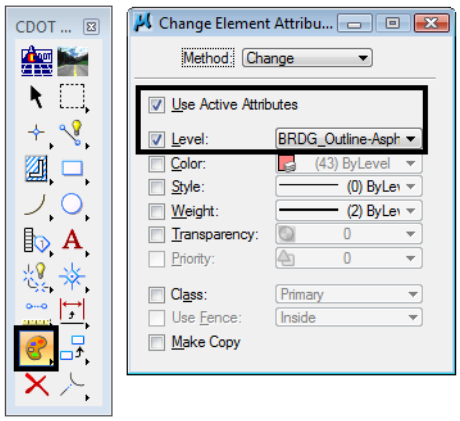
6. **<D>** to copy the top slab line.
7. Repeat for the left side.

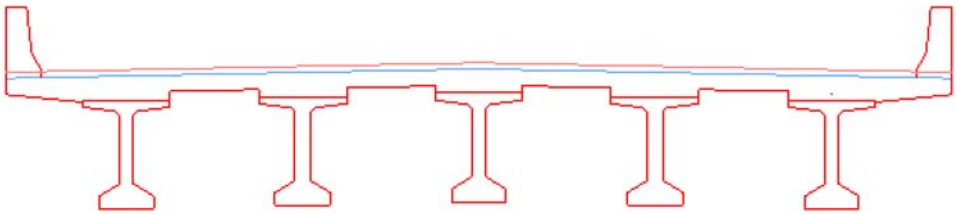
   Note: You can move your cursor up and lock in on the last distance tic mark of 3 inches, eliminating the need to key in the Y value.

8. On the CDOT menu, select the **Bridge** Group.
   - Set the ***Category*** to **Bridge Levels**
   - Set the ***Type*** to **Outline**
   - Select the **Outline-Asphalt** item

This sets the active level to the asphalt level.

9. Change the top of pavement lines to the active asphalt level.

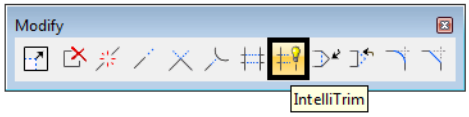




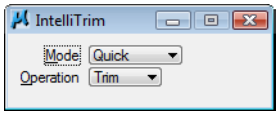
Clean-up lines at the rails

You now need to trim the top of pavement lines that run through the bridge rails, as well as the bottom of the rail that extends below the top of slab.

1. Select the **IntelliTrim** command from the ***Modify*** toolbar.

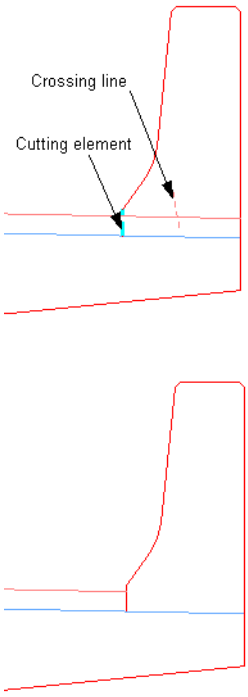


2. Set the ***Mode*** to **Quick** and the ***Operation*** to **Trim**.



3. **<D>** on the vertical edge of the rail to select it as the cutting element, as shown below.

4. Draw a ***crossing line*** on the top of pavement line inside the rail as the portion to trim.



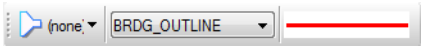
5. Repeat the above steps for the left-side rail.

Lab 11.3 - Complex the bridge rail graphics

Since you dropped the bridge rail cell to trim the graphics it is no longer one entity. Instead it was dropped to individual lines. You will now group the lines into a complex chain.

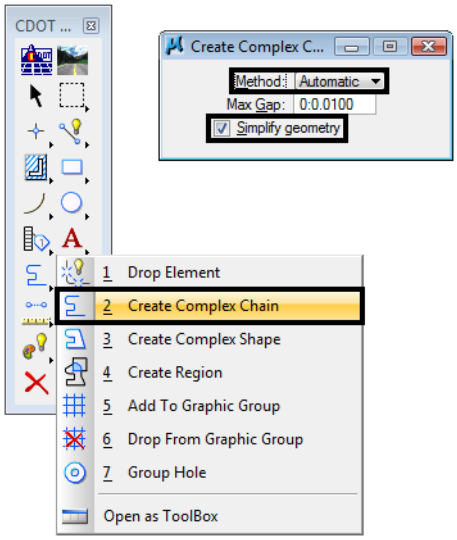
1. Select the **SmartMatch** command and **<D>** on any red bridge line to match it.

This sets the active level to ***Bridge_Outline*** to match the slab.

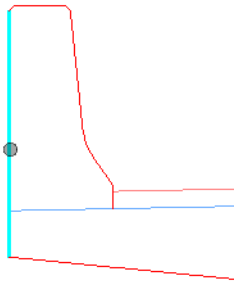


2. Select **Create Complex Chain** from the ***Groups*** toolbar.
3. Set the ***Method*** to **Automatic** and toggle on **Simplify Geometry**.

Note: With the ***Automatic*** method, you do not have to individually identify each element to add to the complex chain. The elements are found automatically within a maximum gap range. ***Simplify geometry*** will make the new element a ***SmartLine*** instead of a complex element.



4. **<D>** on the first segment of the bridge rail as shown.

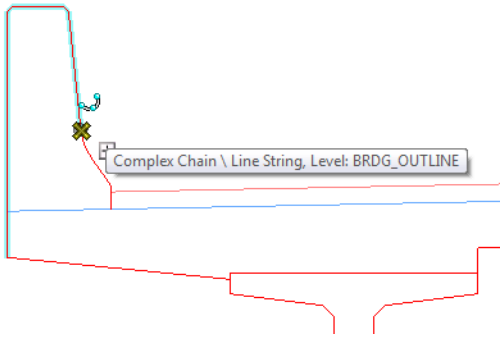


5. **<D>** anywhere above this element to define the direction for adding elements. The remaining bridge rail elements are added to the chain and placed on the active ***Bridge_Outline*** level.

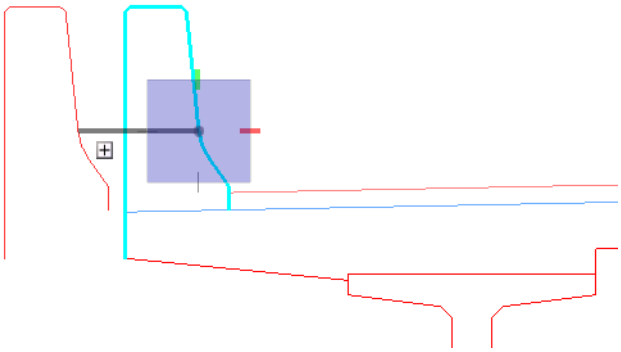
6. **<D>** to accept.

7. Repeat for bridge rail on other side of bridge.

Note: With some MicroStation commands (like the ***Complex Chain*** command), if you hover over the complex element it will still show you the individual elements that make up the chain. However, notice that pop-up information tells you it really is a complex chain. When you use the ***Copy*** command in the next step, you'll see the chained elements behave as one element.



8. Select the **Copy** command from the ***Primary*** toolbar and copy the bridge rail to a clear area of the design file.



The individual graphics are now chained together into one element.

9. **Undo** the copy.

Note: You can use the ***Create Complex Shape*** in a similar fashion to create closed shapes from individual graphics.

Lab 11.4 - Create a Selection Set of the Bridge Section

1. **Fit** the view.
2. Choose the **Element Selection** tool from the ***Main*** toolbar.
3. Hold down the data button **<D>** and drag across the bridge section (corner to opposite corner). Be sure to include all of the section graphics in this area.

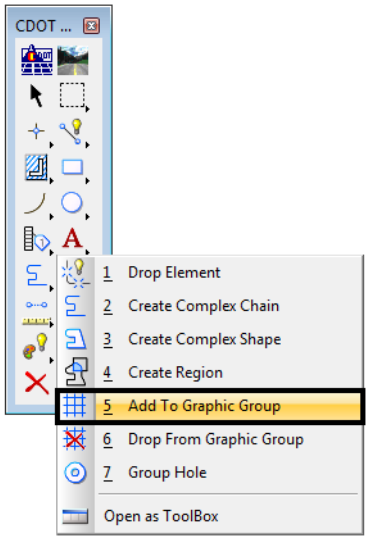
Note: The elements are added to the selection set and are highlighted purple (the selection set color). To change the color, choose **Settings > Design File > Color > Selection Set Color**. The lower right corner of the status bar shows how many elements are now in the selection set.

4. **<D>** in the center of the typical section, hold down the data button and drag the selection set to a new location in the file.
5. Drag the selection set back to its original location.
6. **<D>** anywhere in a clear area of your design file to remove the selection set.

Note: The selection set is a temporary group of graphics until you drop the set.

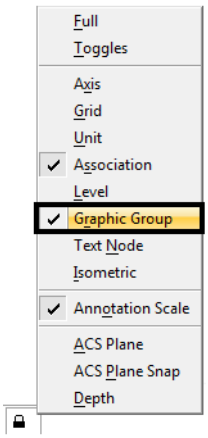
Lab 11.5 - Create a Graphic Group of the Bridge Section

1. Use the **Element Selection** tool and place the bridge typical section graphics into a selection set again.
2. From the ***Groups*** toolbar, select **Add to Graphic Group**.

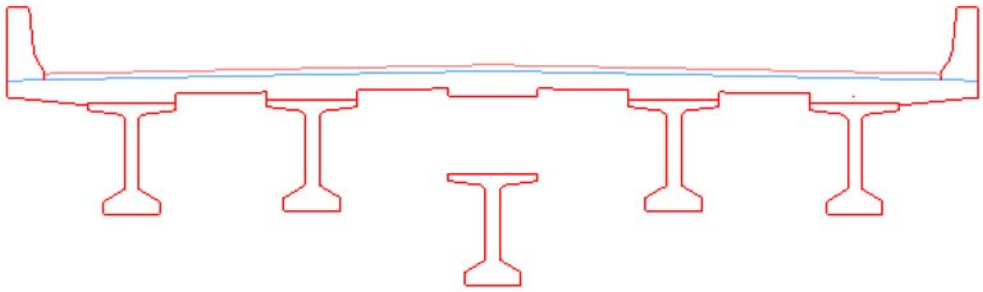


3. **<D>** to accept the selection set element to add to the group.
4. **<R>** out of the command.
5. **<D>** anywhere in a clear area of your design file to remove the selection set. The elements "un-highlight" and return to their normal symbology.

6. On the status bar, check your locks and make sure ***Graphic Group lock*** is **On**.



7. Select the **Move** command.
8. **<D>** on the bridge typical section graphics. All elements in the graphic group highlight.
9. Move the graphics and a new location and **<D>** to accept. With ***Graphic Group lock*** **On**, the elements behave as a group.
10. On the status bar, turn the ***Graphic Group lock*** **Off**.
11. Select the **Move** command again.
12. **<D>** on one of the BT 54 girders. Only the girder highlights.
13. Move it to a new location and **<D>** to accept.



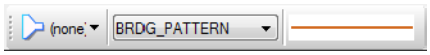
With the ***Graphic Group lock Off***, you can manipulate the individual elements in the group.

14. **Undo** the ***Move*** command on the girder.
15. Turn the ***Graphic Group lock*** back **On**.
16. Move the bridge typical section graphics back to their original location.

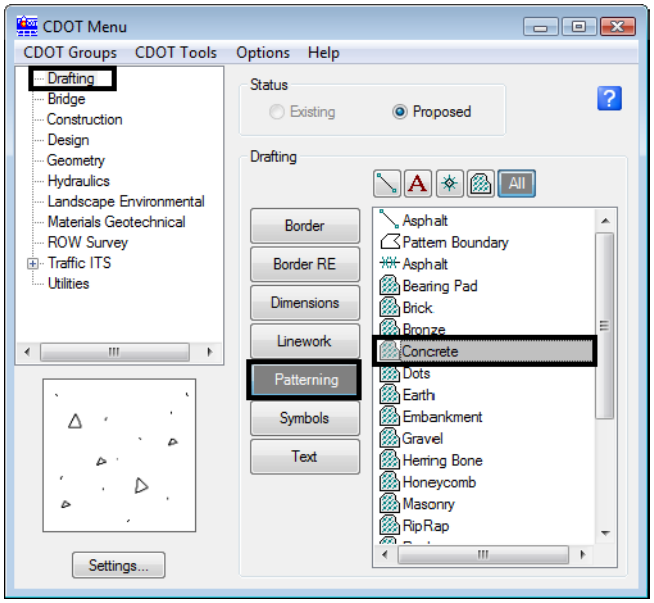
Note: When working in design model files, most InRoads graphics are displayed as graphic groups (*e.g.* contours, profiles, cross sections).

Pattern pavement and slab

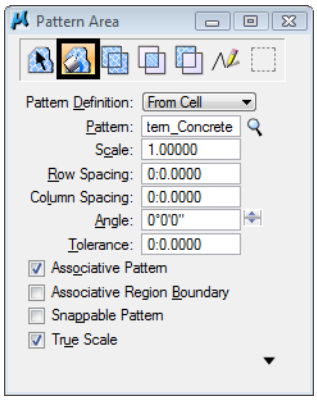
1. **Fit** the view.
2. On the CDOT menu, select the **Bridge** Group.
   - Set the ***Category*** to **Bridge Levels**
   - Set the ***Type*** to **Basic**
   - Select the **Pattern** item to set the active level



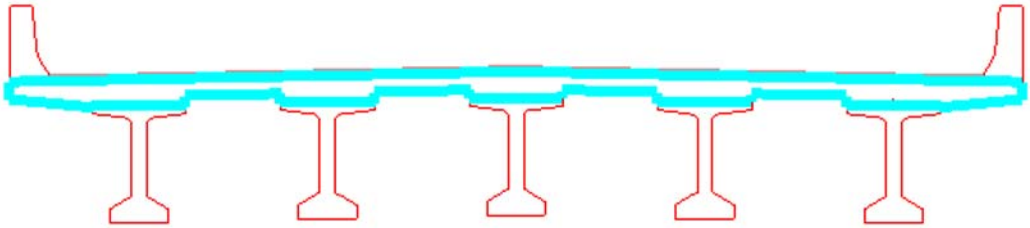
3. From the **CDOT Menu** Explorer:
   - Select **Drafting**.
   - Set the ***Category*** to **Patterning**.
   - Select the **Concrete** item.



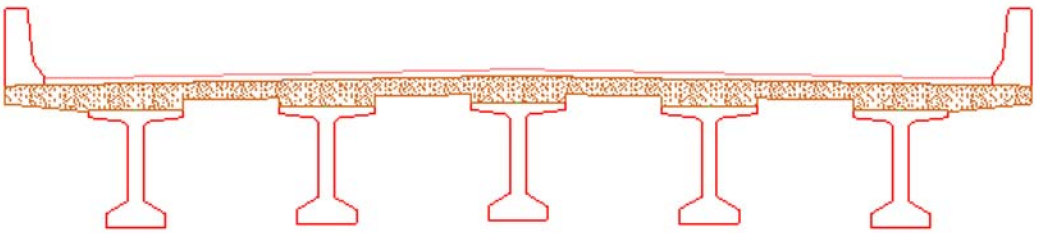
4. In the ***Pattern Area Tool Settings*** box set the ***Method*** to **Flood**, ***Active Scale*** to ***1*** and the ***Active Angle*** to ***0***.



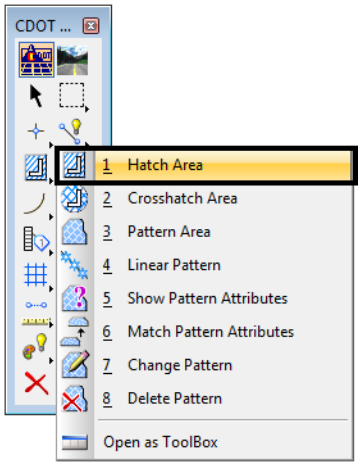
5. Make sure the entire region to flood is shown in your view. Then**, <D>** anywhere inside the bridge slab region. The region to flood with the pattern highlights.



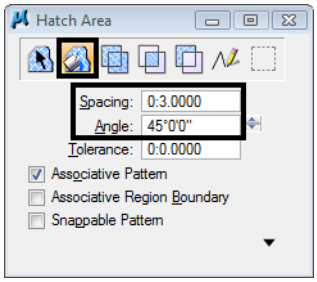
6. **<D>** to accept. The shape is patterned with the concrete cell.



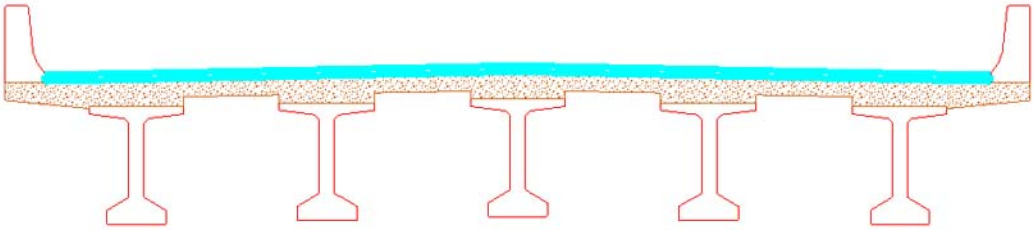
7. Select the **Hatch Area** command from the ***Patterns*** toolbar.



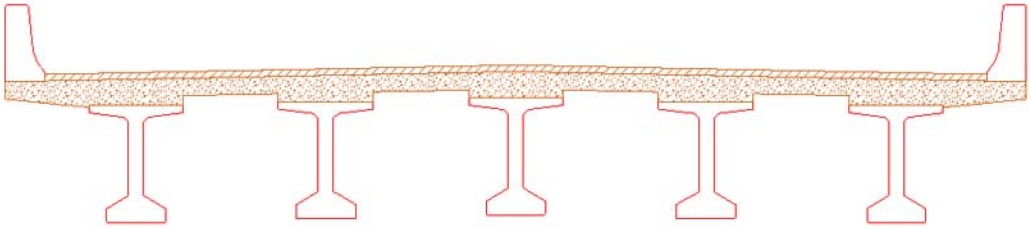
8. In ***Tool Settings***, select the **Flood** method, set ***Spacing*** to ***:3*** and the ***Angle*** to ***45***.



9. **<D>** anywhere inside the pavement area. A dynamic display shows the flooded area.



10. **<D>** to accept. The region is flooded with the hatch pattern.



11. **Save Settings**.
12. **Exit** MicroStation.