

# Module 11

# **Detailed Modeling**



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About this Practice Workbook...

- The Module 11 Detailed Modeling. Zip file will be provided for download.
- Exact the zip file to the root C:\
- All files are then automatically extracted here: C:\NCDOT Training\Roadway\ Module 11 Detailed Modeling
- With these subfolders:

Name	Date modified	Туре
Final Survey	3/18/2024 7:35 AM	File folder
Roadway	3/18/2024 7:35 AM	File folder
Module 11 - Detailed Modeling	10/4/2021 7:23 PM	Microsoft Edge PDF

The Module 11 – Detailed Modeling PDF will also be located here.

- This PDF file includes bookmarks providing an overview of the document. Click on the bookmark to quickly jump to any section in the file. You may have to turn on the bookmark function in your PDF viewer, such as Adobe Reader.
- The dataset used throughout this module uses English units and US Survey Feet.
- Each module in this series is self-contained. You can jump to any module and begin the exercises.
- The *NCDOT\_WorkSets.inp* on your desktop should be set the following variables:
  - NCDOT\_USE\_LOCAL\_WORKSETS = L2
  - NCDOT\_UNIT\_TRAINING\_WORKSETS = Roadway
- This training module uses the DOT-US North Carolina WorkSpace, R-2635C (Training) WorkSet and NCDOT\_Roadway Role. It is very important that you select the correct WorkSpace, WorkSet and Role.
- For more information on setting up workspaces, <u>click here.</u>
- The tool tips and help were copied from the Bentley Online Help. See this link for the complete list of tools and common usage.
   <u>OpenRoads Designer CE Help (bentley.com)</u>
- NCLUG/NCDOT Bentley ORD Open X presentations from each NCDOT Department: NCLUG - 2022 TECH Talks
- This workbook was written with the release of OpenRoads Designer 10.10.XX.XX (2021) OpenRoads Designer 2021 R2 update:

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OpenRoads Designer Readme (bentley.com) OpenRoads Designer 2021 Release 2 Introduction - YouTube

• This workbook has been updated for the 2023 Release of OpenRoads Designer (23.00.00.129)



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### **Overview**

The intent of the Detailed Modeling module is to move beyond template-based modeling and focus on detail-oriented modeling. Because of the complexity of detail-oriented modeling, the module will focus on a wide range of concepts. This includes traditional corridor modeling, complex plan geometry, proposed terrain model development, and the introduction to a number of additional tools/techniques that fall outside of the traditional template-based modeling scope. By leveraging these tools and techniques, the user can take the traditional template-based corridor to a whole new level of detail and complexity. In addition to the tools that were introduced in the previous Corridor Modeling modules, the Terrain and Model Detailing ribbons will also play a major role throughout the Detailed Modeling module.

#### **Model Detailing Ribbon**

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#### **Terrain Ribbon**

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#### Key Concepts, Tools and Terminology

#### **Design Intent**

Design Intent is the act of preserving rules and relationships established during the design process in order to realize downstream benefits of automatic updates.

#### **Linear Templates**

Templates that can be applied quickly and easily to 3D linear elements but with less functionality when compared to corridor templates.



#### **Surface Templates**

A template made of components with an associated depth. These components are closed shapes such as asphalt, concrete, aggregate, grass etc. Surface Templates are used to apply material thickness to the surface of a terrain.

#### **Terrain Modeling**

A set of three-dimensional triangles mathematically computed from point data collected on the surface being modeled. Models are used to define highly irregular surfaces, particularly the surface of the earth, but can be generated for proposed surfaces, subsurface geotechnical layers, etc. Terrain models are also referred to as digital terrain models (DTMs), triangulated irregular networks (TINs), or triangulated surfaces.

### **Exercise 1 - Street Turnout Modeling**

In this exercise, you will learn how to model a **Side Street Turnout** and **Concrete Channelization Island.** This includes the mainline pavement shearing, horizontal/vertical layout, application of linear templates, proposed terrain model development, surface template application, and various element profiling techniques. Design Intent will continue to be a major focus.

Throughout this exercise you will be working with NCDOT 2D dgn files exclusively. All design and corridor manipulation will be carried out within a 2-dimensional design plane.

#### 1. Launch OpenRoads Designer CONNECT Edition

Double-click on the NCDOT Roadway OpenRoads icon on your desktop to launch OpenRoads Designer into the NCDOT Roadway workspace.



#### 2. Set the Workspace and Workset

Select DOT-US North Carolina from the Workspace menu. Select NCDOT R-2635C (Training) from the Workset menu.

**OpenRoads Designer CONNECT Edition** 

DOT-US North Carolina \* R-2635C (Training) \*

- 3. Open the Exercise 1 Corridor (CMD) dgn file and zoom in closely to the Y8 Corridor
  - A. Click the browse button and path to the **Module 11 (Detailed Modeling)** folder and open the R-2635C-RDY\_CMD\_Exercise1.dgn file.





B. Zoom in near the Y8 Corridor as shown below. Notice that the Y8 alignment already has a base corridor. This base Y8 corridor will serve as a starting point for the Detailed Modeling exercise. See the Initial Corridor Modeling Module for detailed instructions for initial corridor development.

Y8 CORRIDOR	

Note: All reference files that are required for the Detailed Modeling module have already been attached to the R-2635C\_RDY\_CMD\_Exercise1.dgn file.

- 4. Load Civil AccuDraw and the Feature Definition Toggle Bar
  - A. Click on the Civil AccuDraw button (Geometry > General Tools > Civil Toggles > Civil AccuDraw) to load the Civil AccuDraw toolbar.
  - B. Click on the Feature Definition Toggle Bar button (Geometry > General Tools > Standards > Feature Definition Toggle Bar) to load the Feature Definition Toggle Bar.





Tip: Both of these toolbars will be used throughout the design/modeling process. Because of this, it's recommended that both are docked for easy access.

- 5. Adjust the level and reference file display as needed to better facilitate design/modeling
  - A. With the **View 1, Default** view in focus, turn the display of the **Default-3D** view off as shown below.

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#### THE ETM FILE IS BROKEN UP LOADING IN, HAVE TO RE-REFERENCE IT TO MAKE IT WORK IN ADDITION, THE MONOLITHIC ISLAND IS ALREADY MODELED

B. Notice that the 3D model has been turned off, leaving just the linework. Depending on your prefence, you may choose to turn off additional linear elements to avoid confusion.





- 6. Open an additional 3D view to better facilitate 3D modeling
  - A. Right-click within the **View 1**, **Default** view and hold to load the **View Control** menu. From there, select the **2 Views Plan/3D** option as shown below.



B. This will load the **View 2**, **Default-3D** view in addition to the standard **View 1**, **Default** view as shown below. As you continue to develop your model you can now easily visualize it.



C. Then, click the **Tile** button (View > Window > Tile) as shown below to tile the two (2) windows. This will make it easier to focus on both views at the same time.





#### 7. Layout the Horizontal Geometry for the Street Turnout

A. From the Feature Definition Toggle Bar, toggle on the Use Active Feature Definition button and then select the Road\_Edge of Travel feature from the (Linear > Roadway > Pavement) folder as shown below. Keep this Feature active throughout all steps that follow.



B. Next, select the Single Offset Entire Element tool (Geometry > Horizontal > Offsets and Tapers > Single Offset Entire Element) and then select the street turnout centerline (Y8A) when prompted to locate element.





C. Set the **Offset** parameter to **12.0000** and toggle on the **Mirror** option within the **Single Offset Entire Element** dialog and click through the prompts to accept. This will draw the left and right EOT lines for the **Y8A** street turnout.



D. Now, select the Simple Arc tool (Geometry > Horizontal > Arcs > Arc Between Elements > Simple Arc). Set the Radius parameter to 35.0000' and the Trim/Extend parameter to Back within the Simple Arc dialog as shown below.

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			A	Arc Between Elem	nents		



E. When prompted to Locate First Element, select the Left EOT line for the street turnout (Y8A) and then select the Right EOT line for the Y8 Corridor as the Second Element. When selecting the Y8 Corridor Right EOT line you may notice multiple linear elements sitting on top of one another. To resolve this, Right-Click to cycle through them and choose the linear element on level P\_RDY\_TL\_Edge\_of\_Travel. It's very IMPORTANT to select the correct linear element.



F. After selecting both elements, click through the additional prompts to place the **35'** radius as shown below.





G. Now, place a 35' radius return on the other side of the street turnout following the previous steps. This time select the Right EOT of the street turnout (Y8A) when prompted to Locate First Element and then the Right EOT line for the Y8 Corridor as the second.



H. After selecting both elements, click through the additional prompts to place the **35'** radius as shown below.





 Next, select the By Angle From Element tool (Geometry > Horizontal > Lines > Line From Element > By Angle From Element). Set and lock the Skew parameter to 90° 00' 00", the Start Distance parameter to 0.0000, End Distance parameter to -30.0000, and Name to Y8A TIE within the By Angle From Element dialog as shown below.



J. When prompted to Locate Element, select the centerline of the street turnout (Y8A). Drag your mouse just beyond the radius returns and Left-Click the screen when prompted to Enter





**Start Point.** This will define the start point of a line from the **Y8A** alignment at a **90°** skew as shown below.

K. Then, click through the additional prompts to finish placing the **Y8A TIE** line as shown below.



L. Now, click on the line that was just placed and notice the **Small Arrows** that are displayed on the outer end of each side. These **Arrows** can be used to manipulate the element they are associated with.





M. Left-Click and Drag the left side Manipulator Arrow just beyond the Left EOT of the Side Street (Y8A) as shown below.

y8



N. Next, modify the **Y8A TIE** line widths on both sides of the **Y8A** alignment to **-12'** as shown below. The **Y8A TIE** line represents the location where the **Side Street (Y8A)** ties to existing.





O. Next, select the Trim To Intersection tool (Drawing > Modify > Trim To Intersection) and trim the Street Turnout (Y8A) EOT and TIE lines and as shown below.





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8. Demonstrate the Horizontal Design Intent associated with the Street Turnout

A. When the **EOT** lines were **Trimmed** in the previous step, a **Rule** was created. Click the **EOT** line that was drawn at a **90°** degree angle from the **Y8A** alignment as shown below. Notice the **Manipulator Handle** that is displayed in the center.



B. Next, click, hold, and drag the **Manipulator Handle** at the intersection up and down along the **Y8A** alignment and notice that the line moves as well.





C. Now, Toggle **Civil AccuDraw** on and select the **Station-Offset** icon as show below.



D. After activating **Civil AccuDraw**, click, hold, and drag the **Manipulator Handle** at the intersection again. Notice that the **Civil AccuDraw** dialog now loads as well, and is tracking your movement along the **Y8A** alignment as show below.



- E. Key-in **10+75.00** and then left click the screen to place the line as shown above. Notice that the left and right EOT lines move as well because of the rule that was created previously when using the **Trim To Intersection** command.
- F. Toggle **Civil AccuDraw** off as shown below but keep the **Civil AccuDraw** toolbar loaded.





- 9. Shear the Y8 pavement through the Y8A Side Street intersection
  - A. From the Feature Definition Toggle Bar, toggle On the Use Active Feature Definition button and then select the CCE\_Target\_EOT\_Shear\_Out\_RT feature from the (Linear > Roadway > Construction Class Element) folder as shown below.



B. Select the Single Offset Partial option (Geometry > Horizontal > Offsets and Tapers > Single Offset Partial) as shown below and select the Y8 Alignment when prompted to Locate Element.



1	
Y8 ALIGNMENT	





C. When prompted for a **Start Station**, snap to the end of the left-side radius as shown below.

D. Next, snap to the end of the right-side radius as shown below to place the shear line as shown below.





E. Click the **Y8 Corridor** Object Handle, hover for a moment to display the menu, and then select the **Add Corridor Reference** option as shown below.



F. After adding the Shear line as a Corridor Reference, the EOT is sheared as shown below.







G. Notice that the pavement has also been sheared within the **View 2, Default-3D** view as well.

#### **10.** Profile the Side Street (Y8A) EOT lines

A. Click the **Y8A TIE** line shown below, hover for a moment to display the menu, and then select the **Open Profile Model** option.





B. When prompted to Select or Open View, click the View 5 option, within the View Groups group (View > View Groups) and then, left click within the view to open the Y8A TIE line profile view as shown below.



C. Now, Click the existing **Y8A TIE** line shown below, hover for a moment to display the **Profile Menu** as shown below, then select the **Set as Active Profile** option.







D. Notice in the **View 2**, **Default 3D** window that the **Y8A TIE** line is now displayed in the 3D model. This is because it now has a vertical attribute associated with it.

E. Move your mouse **12'** to the left of the **Y8A** alignment and notice the pink line as displayed below. This line represents the **Y8A** left **EOT** line in its original state before it was trimmed. This line acts as a parent to the small, trimmed EOT section that is still visible.





F. Click the **Left EOT** line shown below, hover for a moment to display the menu, and then select the **Open Profile Model** option.



G. When prompted to Select or Open View, click the View 5 option, within the View Groups group (View > View Groups) and then, left click within the view to open the LEFT EOT profile.

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aved Views	5	Window	View Groups	

H. Now, click the existing **Y8A LEFT EOT** line shown below, hover for a moment to display the **Profile Menu** as shown below, then select the **Set as Active Profile** option.



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 Notice in the View 2, Default 3D window that the TRIMMED LEFT EOT line is now displayed in the 3D model. This is because the LEFT EOT now has a vertical attribute associated with it and there is a Parent/Child relationship between the LEFT EOT line and the TRIMMED LEFT EOT line.



J. From the Feature Definition Toggle Bar, toggle on the Use Active Feature Definition button and then select the Road\_Edge of Travel feature from the (Linear > Roadway > Pavement) folder as shown below. Keep this Feature active throughout all steps that follow.





K. Next, select the Quick Profile Transition tool (Geometry > Vertical > Element Profiles > Quick Profile Transition) as shown below.

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L. Then, set the **Quick Transition Method** to **Parabolic**, left click to accept, and then select the **Y8A Left Side Radius** on the left side of the **Y8A** alignment as shown below.





- M. Click the **Y8A Left Side Radius** shown below, hover for a moment to display the menu, and then select the **Open Profile Model** option to open the **Proposed Y8A Radius** profile.

N. Notice the **Proposed Y8A Radius** profile that was created using the **Quick Profile Transition** tool. The **Quick Profile Transition** tool created a best-fit profile for the **Y8A Left Side Radius**.



Note: This profile is dynamic. If the Y8 profile is changed, the Proposed Y8A Left Side Radius will reflect this change.



O. Notice in the **View 2**, **Default 3D** window that the **Proposed Y8A Left Side Radius** is now displayed in the 3D model.



P. After profiling the **Y8A Left EOT** lines, follow these same steps and profile the **Y8A Right EOT** lines to finalize the **Side Street (Y8A)** vertical as shown below.





Note: The methodology used to profile the Y8A EOT lines is just one of several ways using OpenRoads Designer. See the Vertical Alignment module for more detailed information on OpenRoads Designer Vertical Geometry tools and methodology.

#### 11. Complex the Side Street (Y8A) EOT lines

A. Select the Complex By Element tool (Geometry > Horizontal > Complex Geometry > Complex By Element) as shown below.



B. Then, Key the following parameters into the **Create Complex Element** dialog and select the small tangent EOT as shown below. When selecting the EOT line, make sure the Directional **Arrow** is pointing in the correct direction before accepting.



- Method = Automatic .
- Name = Y8A RIGHT EOT





C. This creates a new complex element called **Y8A RIGHT EOT** as shown below.

D. Click the **Y8A Right EOT** shown below, hover for a moment to display the menu, and then select the **Open Profile Model** option to open the **Y8A Right EOT** profile.





E. Select the Profile Complex By Element tool (Geometry > Vertical > Complex Geometry > Profile Complex By Element) as shown below.

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					Profile	Offset Transition

- F. Then, similar to how the horizontal Y8A Right EOT was complexed, Key the following parameters into the Create Complex Profile Element dialog and select the small tangent EOT as shown below. When selecting the EOT line, make sure the Directional Arrow is pointing in the correct direction before accepting. It may be helpful to turn the existing ground line off if you have trouble selecting the tangent EOT.
  - Method = Automatic
  - Name = Y8A RIGHT EOT





G. This creates a new complex vertical element called **Y8A RIGHT EOT** as shown below. Set **Y8A Right EOT** as the **Active Profile**.



H. After complexing the **Y8A Right EOT** lines, follow these same steps and complex the **Y8A Left EOT** lines.

#### 12. Apply Linear Templates to the Left and Right Y8A EOT lines

- A. Select the Apply Linear Template tool (Model Detailing > Apply Linear Template).
- B. Key the following parameters into the Apply Linear Template dialog.
  - Start = Lock To Start
  - End = Lock To End
  - Exterior Corner Sweep Angle = 05° 00' 00"
  - Template = LNT C&G Berm Catch Slopes
  - Feature Definition = Design
  - Name = Y8A LEFT EOT



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Project Templates
🖨 Linear
- Concrete Island Template
- Concrete Island Template Linear
- LNT- C&G Berm Catch Slopes
LNT- C&G Berm Catch Slopes with SW
Roadway Templates
Surface Templates

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	Lock To End		
	End Station	0.0000'	
	Exterior Corner Sweep Angle	05°00'00"	
	Mirror Reflect		
	Template	Project Templates\Linear\LNT- C&G Berm Catch Slopes	
	Description		
	Feature		^
	Feature Definition	Conceptual	$\sim$
	Name	Y8A LEFT EOT	





C. When prompted to **Locate Element To Apply Template**, select the **Y8A LEFT EOT** and begin clicking through the prompts. When prompted to **Select Side**, move your cursor as shown below and then continue clicking through the prompts to place the **Linear Template**.



D. Notice in the **View 2, Default 3D** window that the **Y8A Left EOT Linear Template** is now displayed in the 3D model as shown below.




E. After applying the Linear Template to Y8A Left EOT, follow these same steps and apply the to the same Linear Template to Y8A Right EOT as shown below.



- 13. Create a Proposed Terrain for the Side Street (Y8A)
  - A. First, select the Project Profile To Element tool (Geometry > Vertical > Profile Creation > Project Profile to Element) as shown below.

Geometry	Geometry Site Corridors Model Detailing							Drawing	Utilit	ies Collabo	orate	View	Help	NC	DOT Roa
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B. When prompted to Select Element To Project, select the Right EOT line for the Y8 Corridor. When selecting the Y8 Corridor Right EOT line you may notice multiple linear elements sitting on top of one another. To resolve this, Right-Click to cycle through them and choose the linear element on level P\_RDY\_TL\_Edge\_of\_Travel. It's very IMPORTANT to select the correct linear element.



C. Then select the **Shear Line** on level **Draft\_RDY\_Construction\_Element** when prompted to **Select Plan Element To Project Onto.** 



D. Notice in the **View 2**, **Default 3D** window that the **Shear Line** is now displayed in the 3D model matching the **Y8 EOT** as shown below.





E. Now, select the Element Selection tool (Terrain > Selection > Element Selection) and Toggle ON the Add option as shown below.





F. Then, select he four (4) elements **Highlighted** in **Blue** below. Because there are multiple elements sitting on top of one another, you may need to **Right-Click** through the elements to select the ones you need. If your still having trouble, try turning off some of the additional levels.



G. Now, select the Create Terrain From Elements tool (Terrain > Create > From Elements) as shown below.





- H. Still keeping those four (4) elements selected, key the following parameters into the Create Terrain From Elements dialog.
  - Feature Type = Boundary
  - Edge Method = None
  - Feature Definition = PT\_Triangles

Parameters   Feature Type   Boundary   Edge Method   None   Feature   Feature Definition   PT_Triangles   Name   Prop   - @ PT_Boundary   - @ PT_Contours   - @ PT_Contours and Triangles   - @ PT_Drainage Contours   - @ PT_Thematic Height   - @ PT_Thematic Slope   - @ PT_Triangles	Create T	- 🗆	×	
Feature Type Boundary   Edge Method None     Feature     Feature Definition PT_Triangles   Name     Prop     PT_ Boundary     PT_ Contours     PT_ Contours and Triangles   PT_ Drainage Contours   PT_ Thematic Height   PT_ Thematic Slope   PT_ Triangles	Parameter	S	^	
Feature       Image: Constraint of the second	Feature Type Edge Method	Boundary None	<ul> <li></li> </ul>	
Feature Definition       PT_Triangles         Name       Exist         Prop       Prop         PT_Contours       PT_Contours and Triangles         PT_Drainage Contours       PT_Thematic Height         PT_Thematic Slope       PT_Triangles	Feature		^	
	Feature Definition Name	PT_Triangles	Boundary Contours Contours and Triangle Drainage Contours Thematic Height Thematic Slope Triangles	¢,

I. Finally, Left-Click through the prompts to create the Side Street (Y8A) Terrain Model as shown below.



- 14. Apply Pavement Surface Template to the Side Street (Y8A) Terrain Model
  - A. Select the Apply Surface Template tool (Model Detailing > Surface Templates > Apply Surface Template) as shown below.





- B. Then, key the following parameters into the **Apply Surface Template** dialog as shown below and select the **Y8A Terrain Model** from within the **View 2**, **Default 3D** window when prompted to **Locate Terrain Model**.
  - Template = SFT-Pavement
  - Feature Definition = Disable Linear Features

Capply Surface Template	e — 🗌	Pick Template
General		C:\NCDOT Training\Roadway\Training-RD_R-2635C\Module 11 - De
Template Apply External Clip Boundary	Project Templates\Surface Templates\SFT-Paveme	
Feature		Surface Templates
Feature Definition	Disable Linear Features	SFT-Concrete Monolithic Island-Simple
Name	NoLF	SFT-Pavement
		ERRAIN MODEL

C. Continue left clicking through the prompts to apply the **SFT-Pavement Surface Template** to the **Y8A Terrain** as shown below.







D. Turn off the Terrain Levels to better see the SFT-Pavement Surface Template as shown below.

- 15. Add a Concrete Channelization Island to the Side Street (Y8A)
  - A. From the Feature Definition Toggle Bar, toggle on the Use Active Feature Definition button and then select the Monolithic Island feature from the (Linear > Roadway > Intersection) folder as shown below. Keep this Feature active throughout all steps that follow.

e?	Monolithic Island	🕑 🦸 🍂 🖊 🙏 📝
	🖃 🖻 Roadway	
	⊞ I Bridge	
	🕀 🔎 Civil Cell	
<u>()</u>	Element	
	🖃 🔎 Culvert	
	🕀 🔎 Curb and Gutter	
	🕀 🔎 Ditch	
	🕀 🍽 Existing	
	E Fence	
	🕀 🔎 Guardrail and Barrier	
	Interesection	
	Intersection	
	Monolithic Island	

- B. Next, select the Single Offset Entire Element tool (Geometry > Horizontal > Offsets and Tapers > Single Offset Entire Element) and key the following parameters into the as shown below.
  - Offset = **12.0000**
  - Use Spiral Transitions = Unchecked
  - Mirror = Unchecked
  - Remove Offset Rule = Unchecked







C. Then, select the two (2) **Y8A EOT** radius returns and follow the prompts to place the two (2) **Island Edges** as shown below.



D. Change the **Offset** value to **4'** within the **Single Offset Entire Element** dialog, this time selecting the **Y8 Right Shear Line** as shown below to place the 3<sup>rd</sup> and final **Island Edge** line.





E. Next, select the Simple Arc tool (Geometry > Horizontal > Arcs > Arc Between Elements > Simple Arc). Set the Radius parameter to 2' and the Trim/Extend parameter to Both within the dialog as shown below.

		el Detailing	J	Drawing Production	Drawing	Utiliti	es Co	llaboi	rate View	Help
		Lines	O Arcs	↓     T Offsets a       ↓     ✓       Point     ✓       ↓     ✓       ↓     ✓       ↓     ✓	nd Tapers 🔻 Curves 🔻	نسبو Modify	کسر Comple» Geometry	<	⊞ Open Profile	e Model rofile tion *
Sim —			0	Circle						
Parameter	s 🔺	° 🔟 🦸	<u>(</u>	Arc Between Points						
Trim/Extend	Both 🗸			Arc To Element			Þ			
🔽 Radius	2.0000'		$\overline{}$	Arc Between Arcs						
Loop				Arc From Element			Þ			
Feature	^			Arc Between Elements			Þ		Simple Arc	
Feature Definition	Use Active Feature		N	Complex Transition be	tween Any el	ement an	d Arc	P	Spiral Arc Spir	al
Name	MI							2	Taper Arc Tape	r
								43	3 Center Arc	
								1/2	2 Center Arc	
								4	Arc Between E	lements

F. Now, use the **Simple Arc** tool to fillet the three (3) corners of the concrete island as shown below.





G. Select the Complex By Element tool (Geometry > Horizontal > Complex Geometry > Complex By Element). Set the Method to Automatic and click on the Concrete Island when prompted.



- H. Click through the additonal prompts to complex the **Concrete Island**, making it a single complex element.
- Next, select the Quick Profile From Surface tool (Geometry > Vertical > Profile Creation > Quick Profile From Surface) and select the Concrete Island when prompted to Locate Reference Element.





J. Then, select the **Side Street (Y8A) Terrain Model** when prompted to **Locate Reference Surface**. Right click to reset and finalize the command.



K. Click the **Concrete Island** shown below, hover for a moment to display the menu, and then select the **Open Profile Model** option to open the **Proposed Concrete Island** profile.



L. Notice the proposed Concrete Island profile that was created using the Side Street (Y8A) Terrain Model as shown below. Set this as the Active Profile and then close out of the profile window.







M. Notice in the View 2, Default 3D window that the Proposed Concrete Island is now displayed in the 3D model matching the surface of the Side Street (Y8A) Terrain Model as shown below.

N. Select the Apply Linear Template tool (Model Detailing > Apply Linear Template) and key the following parameters into the Apply Linear Template dialog.



- Start = Lock To Start
- End = Lock To End
- Exterior Corner Sweep Angle = 05° 00' 00"
- Template = Concrete Island Template Linear
- Feature Definition = Design
- Name = Y8A ISLAND



O. When prompted to Locate Element To Apply Template, select the Concrete Island and begin clicking through the prompts. When prompted to Select Side, move your Cursor to the inside of the Concrete Island as shown below and then continue clicking through the prompts to place the Linear Template.



P. Notice in the **View 2**, **Default 3D** window that the **Y8A Concrete Island Linear Template** is now displayed in the **3D Model** as shown below.





Q. Next, select the Element Selection tool (Terrain > Selection > Element Selection) and select the top of the Y8A Concrete Island Linear Template. See the element highlighted in blue below.



in diue below.	
MI9: ~MI_TOP	
Belongs To: MI9 Level: Draft_RDY_Construction (Phantom)	TOP OF Y8A CONCRETE ISLAND TEMPLATE
	The second se

Tip: Zoom in closely and right click to tab through until you get the correct line.

R. Now, select the Create Terrain From Elements tool (Terrain > Create > From Elements) as shown below.



- S. Still keeping the **Concrete Island Linear Template** selected, key the following parameters into the **Create Terrain From Elements** dialog.
  - Feature Type = Boundary
  - Edge Method = None
  - Feature Definition = PT\_Triangles





T. Left click through the prompts to create the **Y8A Concrete Island Terrain Model** as shown below.



- U. Select the Apply Surface Template tool (Model Detailing > Surface Templates > Apply Surface Template).
- V. Then, key the following parameters into the **Apply Surface Template** dialog as shown below and select the **Y8A Concrete Island Terrain Model** from within the **View 2, Default 3D** window when prompted to **Locate Terrain Model**.
  - Template = SFT-Concrete Monolithic Island-Simple
  - Feature Definition = Disable Linear Features





W. Continue left clicking through the prompts to apply the **SFT\_Concrete Monolithic Island-Simple Surface Template** to the **Y8A Concrete Island Terrain** as shown below.



X. Turn off the Terrain Levels to better see the applied **SFT\_Concrete Monolithic Island-Simple Surface Template.** 





## 16. Adjust the berms and slopes of the Side Street (Y8A) Radius Returns to match Y8

A. Notice that the berm and slopes of the **Side Street (Y8A)** do not match the **Y8** as shown below. This can easily be resolved by using **Parametric Constraints**.



B. Select the Create Parametric Constraint option (Corridors > Edit > Edits > Create Parametric Constraint) and then select the Side Street (Y8A) radius return Corridor Object when prompted to Locate Corridor.





- C. Key the following Parameters into the Create Parametric Constraint dialog and click through the prompts to set the BM\_Width Parametric Constraint and transition the Berm Width from 8' to 10' over the length of the Radius Return to match the Y8 Berm.
  - Start = Lock to Start
  - Stop = Lock to End
  - Constraint Label = BM\_Width
  - Start Value = 8.0000
  - Stop Value = 10.000



- D. Next, use the SS\_Slope Fill Parametric Constraint to transition the Y8A Fill Slope from 2:1 to 4:1 over the length of the Radius Return to match the Y8 Fill Slope.
  - Start = Lock to Start
  - Stop = Lock to End
  - Constraint Label = SS\_Slope Fill
  - Start Value = -50.00%
  - Stop Value = -25.00%
- E. Now, follow these same steps and do the same for the other **Y8A Radius Return** as shown below.







## 17. Clean up the breaks in the intersection using Key-Stations

A. Notice the breaks in the intersection model as shown below. This can be resolved by adding **Key Stations**.



- B. Select the Create Key Station tool (Corridors > Edit > Edits > Create Key Station) and add the following two (2) Key Stations.
  - Key Station 1 = 12+12.99
  - Key Station 2 = 13+07.01

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Corridors	Model Detailin	g	Drawir	ng Product	ion	Drav	ving	Utilities	Collab
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< 🥑 🗯	A 8 3 4	» 🗄	× 4,		5	Create	e Key	Station	
		-			14	Create	e Sec	ondary Alignr	nent
					2	Create	e Par	ametric Constr	aint
- <b></b>					$\mathbb{N}$	Create	e Cur	ve Widening	
					1	Create	e Poi	nt Control	

C. This finalizes the Side Street (Y8A) intersection model as shown.





## **Exercise 2 – Directional Crossover with Median U-Turns Modeling**

In this exercise, you will learn how to model a **Directional Crossover with Median U-Turns**. This includes pavement shearing, median/pavement switching, bulb-outs, directional median cross-over modeling, intersection radius modeling, application of linear templates, proposed terrain model development, surface template application, and various element profiling techniques. Design Intent will continue to be a major focus.

Throughout this exercise you will be working with NCDOT 2D dgn files exclusively. All design and corridor manipulation will be carried out within a 2-dimensional design plane.

- 1. Launch OpenRoads Designer CONNECT Edition Doble-click on the NCDOT Roadway OpenRoads icon on your desktop to launch OpenRoads Designer into the NCDOT Roadway workspace.
- 2. Set the Workspace and Workset

Select DOT-US North Carolina from the Workspace menu. Select NCDOT R-2635C (Training) from the Workset menu.

**OpenRoads Designer CONNECT Edition** 

DOT-US North Carolina \* R-2635C (Training)

- 3. Open the Exercise 2 Corridor (CMD) dgn file and zoom in closely to the Super Street Intersection
  - A. Click the browse button and path to the **Module 11 (Detailed Modeling)** folder and open the R-2635C-RDY\_CMD\_Exercise2.dgn file.
  - B. Zoom in close to the intersection as shown below. For the sake of time and the avoidance of redundancy a number of elements have already been modeled. The end result after finishing **Exercise 2** will be a completed **Super Street** model.





Browse



C. In addition to the preemptive modeling, notice that some of the 2D linework has already been designed allowing this module to focus more on **Detailed Modeling**. See the **Plan Geometry Module** for detailed instructions on 2D plan geometry development.



- 4. Remove the grass median and display pavement within the Super Street Intersection limits
  - A. Notice that a portion of the Y8 Corridor has a grass median within the limits of the Super Street Intersection. This can be adressed using Paramtric Constraints that are included within the attached NCDOT template.

B. Select the Corridor Objects "The Bucket" tool (Corridors > Edit > Corridor Objects) and then select the Y8 corridor when prompted to Locate Corridor.



C. Notice the three (3) Parametric Constraints that have already been defined as shown below.

🜍 Corridor Objects - Y8										- (	
Template Drop	I 📭	🗙 🗅 🛍 🐐 🔐 🖏 🧪		Parametric Constraint							
Secondary Alignment		Constraint Label	Enabled	Start Value	Stop Value	Start Stat	End Stati		Enabled	~	
Key Station	•	_Median_X_Over_Switch ~	True	1.0000	1.0000	20+87.00	30+37.86		Constraint Label	PV_Median_X_O	ver_Switch
Key Station		PV_Shear Inside LT	True	-1.0000	-1.0000	20+87.00	30+37.86		Start Value	1.0000	
Parametric Constraint		PV_Shear Inside RT	True	1.0000	1.0000	20+87.00	30+37.86		Stop Value	1.0000	
Point Control									Station Pange		~
Curve Widening									Station Kange		
End Condition Exception									Start Station	20+87.00	
External Reference									End Station	30+37.86	
Clipping Reference	Rov	v: 🕅 🖣 1 of 3 🗍	> >I								
											Close

- **PV\_Shear\_Inside LT** = Shears the left Inside curb and median when set to -1
- **PV\_Shear\_Inside RT** = Shears the right inside curb and median when set to 1
- **X\_Over\_Switch** = Displays the median pavement when set to 1

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D. Adjust the start station value for all three (3) Parametric Constraints to 13+27.86 as shown below. This will remove the median and display the pavement throughout the limits of the Super Street Intersection.

Template Drop	1	X 🗅 🗎 🕻 📥 🔨 🥖	•	Parametric Constraint							
Secondary Alignment		Constraint Label	Enabled	Start Value	Stop Value	Start Stat	End Stati		Enabled	<b>~</b>	
Key Station		PV_Median_X_Over_Switch	True	1.0000	1.0000	13+27.86	30+37.86		Constraint Label	PV_Shear Inside RT	~
Parametric Constraint		PV_Shear Inside LT	True	-1.0000	-1.0000	13+27.86	30+37.86		Start Value	1.0000	_
Point Control	•	PV_Shear Inside RT	True	1.0000	1.0000	13+27.86	30+37.86		Stop Value	1.0000	
									Station Range		^
									Start Station	13+27.86	
End Condition Exception									End Station	30+37.86	
External Reference											
Clipping Reference	Ro	w: 📢 🍕 3 🛛 of 3	P PI								
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	_										
						·	GRAS	S MEDIAN	REMOVED AND PA	VEMENT RESTO	RED
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										and the local data is a second s	

- 5. Model the bulb-out on the right side of the Y8 corridor
  - A. From the Feature Definition Toggle Bar, toggle on the Use Active Feature Definition button and then select the Road\_Edge of Travel feature from the (Linear > Roadway > Pavement) folder as shown below. Keep this Feature active throughout all steps that follow.



B. Use the Complex By Element tool (Geometry > Horizontal > Complex Geometry > Complex By Element) to complex the individual 2D Elements that make up the bulb-out as shown below. Combining these and making a single complex element will be more efficient for modeling.







C. Next, select the Profile By Slope From Element tool (Geometry > Vertical > Element Profiles > Profile By Slope From Element) and select the Complexed Bulb-Out Element when prompted to Locate First Element To Profile. Then Right-Click to Reset And Complete.

Geometry Site Corri	idors Model Detailing Draw	ing Production Drawing Util	ities Collaborate View	Help NCDOT Roadway	/
✓ Import/Export ▼ ✓ Design Elements ▼ ✓ Civ ▲ Standards ▼ Toggle	il Reports Lines Arcs Poi	TOffsets and Tapers *	Complex Geometry *	e Model Lines Curves Ele tion * * * * Prot	Modify Complex * Geometry Transform Tools *
General Tools		Horizontal		Vertical 📕	Quick Profile Transition
× "f	🧧 📥 🙏 🗾 🥜 🔆 💰	-		1	Profile By Constant Elevation
					Define Profile By Slope From Point
	~				Profile By Slope From Element
2 <b></b> €	<u>e</u>				Profile By Variable Slope From Element
				-	Profile By Vertical Offset From Element
					Profile By 3D Element
<b>\</b>					
$\mathbf{X}$					
$\sim$					
$\sim$					
		Locate First Element To Profile			
		Complex Element: RD_EOT Feature: Linear\Roadway\Pa	1 vement\Road Edge of Travel		
		No Active Profile \ Line			

D. When prompted to Locate Reference Element, select the Right EOT line for the Y8 Corridor. When selecting the Y8 Right EOT line you may notice multiple linear elements sitting on top of one another. To resolve this, Right-Click to cycle through them and choose the linear element on level P\_RDY\_TL\_Edge\_of\_Travel. It's very IMPORTANT to select the correct linear element.





- E. Then, key the following parameters into the **Profile By Slope From Element** dialog and click through the prompts to **Profile** the **Bulb-Out** element using a -2.5% slope from the **Y8 EOT** as shown below.
  - Point Selection = All
  - Profile Adjustment = None
  - Vertical Offset = 0.0000
  - Slope = -2.50%





- 6. Shear the Y8 pavement through the Bulb-Out limits
  - A. From the Feature Definition Toggle Bar, toggle On the Use Active Feature Definition button and then select the CCE\_Target\_EOT\_Shear\_Out\_RT feature from the (Linear > Roadway > Construction Class Element) folder as shown below.



B. Select the Single Offset Partial option (Geometry > Horizontal > Offsets and Tapers > Single Offset Partial) as shown below and select the Y8 alignment when prompted to Locate Element.

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C. When prompted for a **Start** and **End Location**, snap to the following locations as shown below. This places the **Shear Line**.



D. Then, follow the same steps to add two (2) additional Shear Lines that match the limits of the 20' tangent lines at the beginning and end of the Bulb-Out as shown below.



Note: These shear lines are broken up because the longer one in the middle will be used to build a terrain later in the module.

E. Next, click the **Y8 Corridor** Object Handle, hover for a moment to display the menu, and then select the **Add Corridor Reference** option and add the three (3) **Shear Lines** as shown below.





F. The **Y8** corridor pavement has been sheard to accommodate the proposed **Bulb-Out** as shown below.



- 7. Apply a Linear Template to the proposed Bulb-Out linear element
  - A. Select the Apply Linear Template tool (Model Detailing > Apply Linear Template).
  - B. Key the following parameters into the **Apply Linear Template** dialog.
    - Start = Lock To Start
    - End = Lock To End
    - Exterior Corner Sweep Angle = 05° 00' 00"
    - Template = LNT C&G Berm Catch Slopes
    - Feature Definition = Design
    - Name = Y8 Bulb-Out 1



Apply

Linear Template



C. When prompted to **Locate Element To Apply Template**, select the proposed **Bulb-Out** and begin clicking through the prompts. When prompted to **Select Side**, move your cursor as shown below and then continue clicking through the prompts to place the **Linear Template**.



D. Notice in the **View 2, Default 3D** window that the **Y8 Bulb-Out 1 Linear Template** is now visible in the 3D model as shown below.



- 8. Create a Proposed Terrain for the Proposed Bulb-Out
  - A. First, select the Project Profile Range To Element tool (Geometry > Vertical > Profile Creation > Project Profile Range To Element) as shown below.

Geometry	Site	Corridors	Mod	el Detailin	g	Drawing	g Production	Drawing	Utilit	ties Collabo	orate	View	Help	NC	DOT Roa
ズ Import/Ex M Design Ele 物 Standards	port • ements •	Civil Toggles •	Reports	Lines	O Arcs	-ф- Point	⊡ Offsets ar ∡ Reverse C ⊋ Spirals ▼	nd Tapers 🔻 urves 🔻	نستور Modify	Complex Geometry •	) (	Open Profile Set Active Pro Profile Creati	Model ofile on ▼	Lines	Curves
	Genera	l Tools					Horizo	ntal			h	Profile Fro	m Surfa	ice	
											÷	Quick Prof	ile From	n Surfac	e
Dess	<b>~</b> ~											Project Pro	file To E	Element	
Page	62											Project Pro	file Ran	ige To E	lement
											Ł~~	Project Ext	ended F	Profile	
											μ	Profile Inte	rsectior	n Point	



B. When prompted to Select Element To Project, select the Right EOT line for the Y8 Corridor. When selecting the Y8 Corridor Right EOT line you may notice multiple linear elements sitting on top of one another. To resolve this, Right-Click to cycle through them and choose the linear element on level P\_RDY\_TL\_Edge\_of\_Travel. It's very IMPORTANT to select the correct linear element.



C. When prompted to **Select Plan Element To Project Onto**, select the **Shear Line** that was placed in the previous step. Use the **Alt-Key** to Lock the **Start/End** locations of the **Shear Line** and click through the prompts to finalize the profile projection.



D. Notice in the **View 2, Default 3D** window that the **Shear line** is now visible in the 3D model as shown below. This will be used to produce a proposed terrain for the **Bulb-Out**.





E. From the Feature Definition Toggle Bar, toggle On the Use Active Feature Definition button and then select the Draft\_DNC feature from the (Linear > Roadway > Miscellaneous) folder as shown below.



F. Select the Single Offset Partial option (Geometry > Horizontal > Offsets and Tapers > Single Offset Partial) as shown below and then set the Offset parameter within the Single Offset Partial dialog to 1.000.



G. Select the **Bulb-Out EOT** when prompted to **Locate Element** and **Snap** to the **Beginning** and **End** locations of the shear line when prompted for a **Start** and **End Location** as shown.





H. This will place a **Draft\_DNC** construction class element with a **1'** offset from the **Bulb-Out** along the length of the **Shear Line** as shown below.



Note: The 1' offset is temporary and was used to make it easier to work with the Draft\_DNC element.

 Next, select the Profile By Slope From Element tool (Geometry > Vertical > Element Profiles > Profile By Slope From Element) as shown below.



J. Select the Draft\_DNC element when prompted to Locate First Element To Profile, then Right-Click to Reset And Complete. When prompted to Locate Reference Element, select the Bulb-Out EOT element.





K. Then, key the following parameters into the **Profile By Slope From Element** dialog and click through the prompts to **Profile** the **Bulb-Out** element using a **0.00%** slope from the **Bulb-Out EOT** as shown below.



- Point Selection = All
- Profile Adjustment = None
- Vertical Offset = 0.0000
- Slope = 0.00%



 Next, select the Element Selection tool (Terrain > Selection > Element Selection).
 Select the Shear Line and Draft\_DNC elements as shown below. Be sure to select the Shear Line. See Tip below.





Tip: Zoom in closely and right click to tab through until you get the correct line.



- M. Then, select the Create Terrain From Elements tool (Terrain > Create > From Elements) as shown below.
- Terrain Geometry Corridors Model Detai Site 🔘 🗔 👻 0.0 🐣 From File  $\bigcirc$ 🚟 From Graphical Filter 🤊 Additional Торо ۲ Reprose Elements Methods • Import • ction Create
- N. Still keeping the Shear Line and Draft\_DNC elements selected, key the following parameters into the Create Terrain From Elements dialog.
  - Feature Type = Boundary
  - Edge Method = None
  - Feature Definition = PT\_Triangles

🔏 Create T	- 🗆	×		
Parameters		^		
Feature Type Edge Method	Boundary None	~ ~		
Feature		^		
Feature Definition	PT_Triangles	$\sim$		
Name	Exist     Prop			

O. Left click through the prompts to create the **Bulb-Out Terrain Model** as shown below.





Q. Notice that the **Bulb-Out Terrain Model** has been adjusted and now runs along the **Bulb-Out EOT** line as shown below.



R. Next, select the Apply Surface Template tool (Model Detailing > Surface Templates > Apply Surface Template) as shown below.



- S. Then, key the following parameters into the **Apply Surface Template** dialog as shown below and select the **Bulb-Out Terrain Model** from within the **View 2**, **Default 3D** window when prompted to **Locate Terrain Model**.
  - Template = SFT-Pavement
  - Feature Definition = Disable Linear Features



T. Continue left clicking through the prompts to apply the **SFT-Pavement Surface Template** to the **Bulb-Out Terrain Model** as shown below.





U. Use a combination of **Key-Stations** and **Parametric Constraints** to seamlessly connect the **Bulb-Out** to the **Y8 Corridor** as shown below.



- 9. Model the Concrete Islands for Median U-Turns
  - A. From the Feature Definition Toggle Bar, toggle on the Use Active Feature Definition button and then select the Monolithic Island feature from the (Linear > Roadway > Intersection) folder as shown below. Keep this Feature active throughout all steps that follow.



B. Next, select the Complex By Element tool (Geometry > Horizontal > Complex Geometry > Complex By Element), set the Method Parameter to Manual and complex the elements highlighted in purple as shown below.





C. Next, select the Quick Profile From Surface tool (Geometry > Vertical > Profile Creation > Quick Profile From Surface) and select the Complexed Concrete Island when prompted to Locate Reference Element.



D. Then, select the **Y8 Corridor** when prompted to **Locate Reference Surface**. **Right-click** to reset and finalize the command.





E. Now, open the **Profile View** for the **Complexed Concrete Island** and set the new profile to **Active** as shown below.



F. Notice in the **View 2, Default 3D** window that the **Concrete Island** is now displayed in the 3D model as shown below.





G. Next, select the Apply Linear Template tool (Model Detailing > Apply Linear Template) and key the following parameters into the Apply Linear Template dialog.



- Start = Lock To Start
- End = Lock To End
- Exterior Corner Sweep Angle = 05° 00' 00"
- Template = Concrete Island Template Linear
- Feature Definition = Design
- Name = Y8 ISLAND

Pick Template
🚍 Linear
Concrete Island Template
Concrete Island Template Linear
- LNT- C&G Berm Catch Slopes
LNT- C&G Berm Catch Slopes with SW
Roadway Templates
E Surface Templates

🔏 Apply Linear Template	—		$\times$
Parameters			^
Lock To Start			
Start Station	0.0000'		
Lock To End			
End Station	0.0000'		
Exterior Corner Sweep Angle	05°00'00"		
Mirror			
Reflect			
Template	Project Templates\Linear\Concrete Island Templa	te Linear	
Description			
Feature			^
Feature Definition	Conceptual		~
Name	Y8 ISLAND		

H. When prompted to Locate Element To Apply Template, select the Concrete Island and place the Linear Template as shown below.



 From the Feature Definition Toggle Bar, toggle On the Use Active Feature Definition button and then select the Draft\_DNC feature from the (Linear > Roadway > Miscellaneous) folder as shown below.




J. Select the Single Offset Entire Element option (Geometry > Horizontal > Offsets and Tapers > Single Offset Entire Element) as shown below. Then set the Offset parameter within the Single Offset Partial dialog to 1.000 and click the single portion of the Concrete Island when prompted to Locate Element.



K. Next, select the Extend Line tool (Drawing > Modify > Extend Line) and shorten the Draft\_DNC element that was just offset in the previous step by -0.765 from both ends to match the width of the top portion of the Concrete Island.



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L. In the **View 2**, **Default 3D** window, **Snap** to the **Beginning** and **End** of the **Concrete Island** to determine the elevation at the top linear element. This will be used to set a **Profile** for the remaining section of the **Concrete Island**.



M. Next, select the Profile By Constant Elevation tool (Geometry > Vertical > Profile Creation > Profile By Constant Elevation). Set the Elevation parameter to 348.17 and select the remaining section of the Concrete Island when prompted to Locate Element.





N. Notice in the **View 2, Default 3D** window that the final edge of the **Concrete Island** is now visible in the 3D model and matches the width and elevation of the previously modeled portion.



O. Next, select the Element Selection tool (Terrain > Selection > Element Selection) and select the Concrete Island linear elements as shown below.



P. Then, select the Create Terrain From Elements tool (Terrain > Create > From Elements) as shown below.





- Q. Still keeping the Concrete Island elements selected, key the following parameters into the Create Terrain From Elements dialog.
  - Feature Type = Boundary
  - Edge Method = None
  - Feature Definition = PT\_Triangles

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Parameter	s	^
Feature Type Edge Method	Boundary None	<ul><li></li><li></li></ul>
Feature		^
Feature Definition Name	PT_Triangles      Exist     Prop     @ PT     @ PT	Boundary     Contours     Contours and Triangles     Drainage Contours     Thematic Height     Thematic Slope     Triangles

R. Left click through the prompts to create the Concrete Island Terrain Model as shown below. Notice that the Terrain Model doesn't look correct along the edge that was Offset by 1'. To correct this, simply change the Offset to 0'.



Note: The 1' offset was temporarily used to make it easier to manipulate the element. S. After changing the **Offset** to **0'** the **Terrain Model** has been corrected as shown below.





T. Select the Apply Surface Template tool (Model Detailing > Surface Templates > Apply Surface Template) as shown below.



- U. Then, key the following parameters into the **Apply Surface Template** dialog as shown below and select the **Concrete Island Terrain Model** when prompted to **Locate Terrain Model**. This finalizes the **Concrete Island**.
  - Template = SFT-Concrete Monolithic Island-Simple
  - Feature Definition = Disable Linear Features





V. Using the skills taught throughout the **Detailed Modeling Module**, model the final **Concrete Island** that runs along the **Y8 Corridor** as shown below.

- 10. Layout the Radius Returns for the Northern side of the Y8/Y18 Intersection
  - A. Zoom in closely to the Northern side of the Y8/Y18 Intersection.



Note: Both Corridors are contained within a single CMD file for training purposes only. Typically, Detailed Intersection Modeling would be carried out within the Secondary Corridor CMD file. See File Management module for detailed information.

B. From the Feature Definition Toggle Bar, toggle on the Use Active Feature Definition button and the Persist Snaps and Rule option. Select the Road\_Edge of Travel feature from the (Linear > Roadway > Pavement) folder as shown below. Keep this Feature active throughout all steps that follow.





C. Now, select the Simple Arc tool (Geometry > Horizontal > Arcs > Arc Between Elements > Simple Arc). Set the Radius parameter to 75.0000' and the Trim/Extend parameter to Back within the Simple Arc dialog as shown below.



D. When prompted to Locate First Element, select the Y18 Left EOT line and then select the Y8 Left EOT line as the Second Element. When selecting the EOT lines you may notice multiple linear elements sitting on top of one another. To resolve this, Right-Click to cycle through them and choose the linear element on level P\_RDY\_TL\_Edge\_of\_Travel. It's IMPORTANT to select the correct linear element. Continue Left-Clicking through the additional prompts that follow to place the 75' Radius Return as shown below.





E. Now, adjust the beginning of the **Y18-2 Corridor** by **Snapping** to the end of the **75' Radius Return**.



F. Next, select the Quick Profile Transition tool (Geometry > Vertical > Element Profiles > Quick Profile Transition) and click the 75' Radius Return to Profile it and add to the 3D Model as shown below.





G. Then, select the Single Offset Partial tool (Geometry > Horizontal > Offsets and Tapers > Single Offset Partial and click the Y18 Centerline when prompted to locate element.



H. Set the following parameters within the Single Offset Partial dialog and then Snap to the end of the Y18 Right EOT line as shown below when prompted for a Start location. Click through the additional prompts to finalize and place EOT line.



- Offset = 12.0000



 Next, select the Project Profile To Element tool (Geometry > Vertical > Profile Creation > Project Profile To Element) and click the Right EOT line from the Y18-2 Corridor as shown below when prompted to Select Element To Project.



J. When prompted to **Select Plan Element To Project Onto**, click on the previously placed **20' EOT** line as shown below.





K. Then, open the **Profile** view for the **20' EOT** line and notice the **Projected Y18 Right EOT Profile** as shown below.



L. Next, select the Tangent Profile Line From Element tool (Geometry > Vertical > Lines > Profile Line From Element > Tangent Profile Line From Element). Set the Trim/Extend parameter to None and the Length parameter to 20.000.

Geometry	Site	Corridors	Mod	el Detaili	ng	Drawing	g Production D	rawing	Utiliti	ies Collab	orate View	Help	NC	DOT Ro	adway						
,∠ Import/Exp iš Design Ele i Standards	port • ements •	Civil Toggles •	Reports	Lines	Arcs		<ul> <li>☑ Offsets and Ta</li> <li>☑ Reverse Curve</li> <li>② Spirals ▼</li> </ul>	ipers 🔻	لنستور Modify	کسو Complex Geometry •	<ul> <li>Dpen Profile</li> <li>Set Active P</li> <li>Profile Creation</li> </ul>	e Model rofile tion ▼	Lines	Curves	Element Profiles *	Modify	Co Geo	omplex metry *	Transform Tools *	Simplify Geometry	Complex Redefine
	General	Tools					Horizontal						$\$	Profile L	ine Between	Points				Com	nmon Tool
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M. Then, select the Projected Y18 Right EOT Profile when prompted to Locate Element and Snap to the end of the Projected Y18 Right EOT Profile when prompted for a Start Point. Left-click through the additional prompts to place the new 20' Y18 Right EOT Profile element as shown below.



N. Click on the new **Y18 Right EOT** profile and make it **Active**. This will add it to the **3D Model** as shown below.





O. Now, select the Simple Arc tool (Geometry > Horizontal > Arcs > Arc Between Elements > Simple Arc). Set the Radius parameter to 35.0000' and the Trim/Extend parameter to Back within the Simple Arc dialog as shown below.



P. When prompted to Locate First Element, select the 20' Y18 Right EOT line and then select the Y8 Left EOT line as the Second Element. When selecting the Y8 Left EOT line you may notice multiple linear elements sitting on top of one another. To resolve this, Right-Click to cycle through them and choose the linear element on level P\_RDY\_TL\_Edge\_of\_Travel. It's very IMPORTANT to select the correct linear element. Continue Left-Clicking through the additional prompts that follow to place the 35' Radius Return as shown below.



Q. Next, select the Quick Profile Transition tool (Geometry > Vertical > Element Profiles > Quick Profile Transition) and click on the 35' Radius Return to Profile and add it to the 3D Model as shown below.

Geometry	Site	Corridors	Mod	el Detailir	ng	Drawing	g Production	Drawing	Utilit	ies Collab	orate	View He	o NO	DOT Roa	dway			
,∠ Import/Ex i Design Ele i Standards	ements *	Civil Toggles •	Reports	Lines	Arcs	-ф- Point	⊡ Offsets ar ∡ Reverse C シ Spirals ▼	nd Tapers 🔻 Jurves 🔻	لنستور Modify	Complex Geometry 🔻	⊞ Ope iš Set	en Profile Mod Active Profile ofile Creation 🔻	Lines	Curves	Element Profiles •	Modify	Complex Geometry •	Transform Tools *
	General	Tools					Horizo	ontal						Vertica	💾 Qu	ick Profile	Transition	
															본 Pro	file By Co	nstant Elevatio	ı
															🞼 De	fine Profil	e By Slope Fron	n Point
															💌 Pro	file By Slo	pe From Eleme	nt
Pag	e   8	4													😒 Pro	file By Va	riable Slope Fro	m Element
															🔄 Pro	file By Ve	rtical Offset Fro	m Element
															Pro	file By 3D	Element	





11. Apply Linear Templates to the Radius Returns for the Northern side of the Y8/Y18 Intersection

- A. Select the Apply Linear Template tool (Model Detailing > Apply Linear Template).
- B. Key the following parameters into the Apply Linear Template dialog.
  - Start = Lock To Start
  - End = Lock To End
  - Exterior Corner Sweep Angle = 05° 00' 00"
  - Template = LNT C&G Berm Catch Slopes
  - Feature Definition = Design



Project Templates

- Concrete Island Template

Concrete Island Template Linear

🖮 Linear

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C. When prompted to Locate Element To Apply Template, select the **75' Radius Return** and place the Linear Template as shown below.



D. Then do the same for the **35' Radius Return** and short **Tangent** section that it connects to.





- 12. Create Terrain Model for the Northern side of the Y8/Y18 Intersection
  - A. Select the Project Profile Range To Element tool (Geometry > Vertical > Profile Creation > Project Profile Range To Element) and click the Y8 Left EOT line when prompted to Select Element To Project. When selecting the Y8 Left EOT line you may notice multiple linear elements sitting on top of one another. To resolve this, Right-Click to cycle through them and choose the linear element on level P\_RDY\_TL\_Edge\_of\_Travel. It's very IMPORTANT to select the correct linear element.



B. When prompted to **Select Plan Element To Project Onto**, select the **Shear Line** as shown below. Use the **Alt-Key** to Lock the **Start/End** locations of the **Shear Line** and click through the prompts to finalize the profile projection.





C. Open the **Shear Line Profile View** and set the **Projected Profile To Active**. This will add it to the **3D Model** as shown below.



D. Now, from the Feature Definition Toggle Bar, toggle On the Use Active Feature Definition Persist Snaps And Rule buttons. Then select the Draft\_DNC feature from the (Linear > Roadway > Miscellaneous) folder as shown below.





E. Then, select the Line Between Points tool (Geometry > Horizontal > Lines > Line Between Points) and Snap to the end of the two (2) Y18-2 Corridor EOT Lines as shown below.



F. Next, select the Quick Profile From Surface tool (Geometry > Vertical > Profile Creation > Quick Profile From Surface) and select the 24' Draft\_DNC line placed in the previous step when prompted to Locate Reference Element.





G. Then, select the **Y18-2 Corridor** when prompted to **Locate Reference Surface**. **Right-click** to reset and finalize the command.



H. Open the Draft\_DNC Profile View and set it as the Active Profile. This will add it to the 3D
 Model as shown below. If the profile does not appear, you may have to offset the DNC line by .01 towards the corridor.





 Next, select the Element Selection tool (Terrain > Selection > Element Selection) and select the Linear Elements from the Northern Side of the Y8/Y18 Intersection as shown below.



J. Then, select the **Create Terrain From Elements** tool **(Terrain > Create > From Elements)** as shown below.



- K. Still keeping the Y8/Y18 Intersection elements selected, key the following parameters into the Create Terrain From Elements dialog and Left-Click through the prompts to create the Terrain Model as shown below.
  - Feature Type = Boundary
  - Edge Method = None
  - Feature Definition = PT\_Triangles







L. Next, select the Add Features tool (Terrain > Edit > Add Features), set the Feature Type to Break Line and select the Y8/Y18 Intersection Terrain Model when prompted to Locate Terrain Model To Add Elements.





I COULD NOT GET THE BREAK LINE TO APPEAR UNLESS I ADDED A SEGMENT MATCHING THE Y18 ALIGNMENT FOR THE BREAKLINE SECTION. IT WOULD BREAK THE TERRAIN TRIANGLES, BUT NOT IN THE WAY IT WAS SUPPOSED TO. HENCE THE OLD PICTURES. 2023 ISSUE?

M. When prompted to **Locate Element To Add**, select the **Y18 Alignment** and **Click** through the prompts to add the **Break Line** to the **Terrain Model** as shown below.



- 13. Apply Pavement Surface Template to the Y8/Y18 Intersection Terrain Model
  - A. Select the Apply Surface Template tool (Model Detailing > Surface Templates > Apply Surface Template) as shown below.



- B. Then, key the following parameters into the **Apply Surface Template** dialog as shown below and select the **Y8/Y18 Intersection Terrain Model** when prompted to **Locate Terrain Model**.
  - Template = SFT-Pavement





## • Feature Definition = Disable Linear Features

C. Continue clicking through the prompts to apply the **SFT-Pavement Surface Template** to the **Y8/Y18 Intersection Terrain Model** as shown below.



D. Use a combination of **Key-Stations** and **Parametric Constraints** to seamlessly connect the **Y8/Y18 Intersection** to the **Y8 Corridor** as shown below.

14. Add Concrete Channelization Island to the Northern side of the Y8/Y18 Intersection

 A. From the Feature Definition Toggle Bar, toggle on the Use Active Feature Definition button and then select the Monolithic Island feature from the (Linear > Roadway > Intersection) folder as shown below. Keep this Feature active throughout all steps that follow.





B. Next, select the Single Offset Entire Element tool (Geometry > Horizontal > Offsets and Tapers > Single Offset Entire Element), set the Offset parameter to 15.0000 and select the 75' Radius Return to place one (1) edge of the Concrete Island as shown below.



C. Then, continue using the **Single Offset Entire Element** tool and **Offset** the **Shear Line** by **4'** as shown below.





- D. For the third Concrete Island edge, select the Single Offset Partial tool (Geometry > Horizontal > Offsets and Tapers > Single Offset Partial), set the following parameters within the Single Offset Partial dialog, select the Y18 Alignment, and click through the prompts to place the third Concrete Island edge.
  - Offset = 0.0100
  - Start Distance = 28+50.00
  - End Distance = 29+00.00



E. Next, select the Simple Arc tool (Geometry > Horizontal > Arcs > Arc Between Elements > Simple Arc). Set the Trim/Extend parameter to Both within the dialog as shown below.





F. Now, use the **Simple Arc** tool to fillet the three (3) corners of the **Concrete Island** as shown below.



G. Use the Complex By Element tool (Geometry > Horizontal > Complex Geometry > Complex By Element), set the Method to Automatic and Complex the individual 2D elements that make up the Concrete Island as shown below.



H. Next, select the Quick Profile From Surface tool (Geometry > Vertical > Profile Creation > Quick Profile From Surface) and select the Complexed Concrete Island when prompted to Locate Reference Element.





I. Then, select the **Y8/Y18 Intersection Terrain Model** when prompted to **Locate Reference Surface**. **Right-click** to reset and finalize the command.



J. Open the **Concrete Island Profile View** and set it as the **Active Profile**. This will add it to the **3D Model** as shown below.



K. Next, select the **Apply Linear Template** tool **(Model Detailing > Apply Linear Template)** and key the following parameters into the Apply Linear Template dialog.





L. When prompted to Locate Element To Apply Template, select the Concrete Island and place the Linear Template as shown below.



M. Next, select the **Element Selection** tool (Terrain > Selection > Element Selection) and select the **Top Edge** of the **Concrete Island** as shown below.



I WAS UNABLE TO SELECT THE TOP EDGE OF THE CONCRETE ISLAND UNTIL I RESET THE PROGRAM. NOT SURE WHY, MODELERS IN RDY WEREN'T EITHER, MAY BE 2023 ISSUE?



N. Then, select the Create Terrain From Elements tool (Terrain > Create > From Elements) as shown below.



- O. Still keeping the **Concrete Island** elements selected, key the following parameters into the **Create Terrain From Elements** dialog and **Left-Click** through the prompts to create the **Terrain Model** as shown below.
  - Feature Type = Boundary



- Edge Method = None
- Feature Definition = PT\_Triangles



P. Select the Apply Surface Template tool (Model Detailing > Surface Templates > Apply Surface Template) as shown below.



Q. Then, key the following parameters into the **Apply Surface Template** dialog as shown below and select the **Concrete Island Terrain Model** when prompted to **Locate Terrain Model**. This finalizes the **Concrete Island**.



- Template = SFT-Concrete Monolithic Island-Simple
- Feature Definition = Disable Linear Features



15. Finalize the Directional Crossover with Median U-Turns Modeling by using a combination of Key-Stations and Parametric Constraints to seamlessly connect all the Corridors as shown below.

