

# Module 10

# Intermediate Corridor Modeling



# Table of Contents

Table o	of Contents	2
Overvi	ew	3
Cor	ridors Ribbon	3
Geo	ometry Ribbon	3
Кеу	Concepts, Tools and Terminology	4
Des	ign Intent	4
Ten	nplate Point Constraint Overrides	4
K	ey Stations	4
Fe	eature Definition Toggle Bar	4
Ci	ivil AccuDraw Toolbar	4
Interm	nediate Corridor Modeling Exercise	5
1.	. Launch OpenRoads Designer CONNECT Edition	5
2.	. Set the Workspace and Workset	5
3.	. Open the Y8 Corridor (CMD) dgn file and zoom in closely to the Y8 Corridor	5
4.	. Review the Y8 Corridor Template	6
5.	. Load Civil AccuDraw and the Feature Definition Toggle Bar	7
6.	. Widen the Y8 Corridor median from 30' to 46' using a Parametric Constraint	8
7.	Add a right turn and bay taper using a Parametric Constraint	10
8.	Add a left turn and bay taper using a Horizontal Feature Constraint	13
9.	Add a right turn and bay taper using a Point Control	25
10	0. Use a Parametric Constraint to shear the template at the edge of travel	30
11	1. Use a Horizontal Feature Constraint to shear the template at the edge of travel	
12	2. Draw Guardrail and TL-3 Anchor units using 3D Linestyles	36
13	3. Widen Grass Shoulder to Accommodate Guardrail and TL-3 Anchor units	42
14	4. Adjust the Guardrail Station Range to Demonstrate Design Intent	47



## Overview

The intent of Intermediate Corridor Modeling is to take a basic model/corridor and further develop it by adding turn lanes, pavement tapers, and non-typical end conditions. The concept of design intent will also be introduced and applied where applicable. In addition to the Corridors Ribbon and the Corridor Objects Dialog, the Geometry Ribbon will also play a major role throughout the Intermediate Corridor Modeling module. During the exercise, various template point overrides will be introduced and applied to override the template point defaults. These overrides will result in the corridor's manipulation.

## **Corridors Ribbon**



## **Geometry Ribbon**

🛐 Oper	nRoads Modeling	- 🐼 - 🗢 🖶 🛃 🗞 🔦 - 🔶 📌	🚔 Ŧ	C:\NCDOT Training\Roadway	y∖Module 8 - Inter	mediate Modeling\Roadv	way\Design\r2635c_rdy_cmd	l.dgn [2D - V8 DGN] -
File	Home Terrain	Geometry Site Corridors	Model Detailing	Drawing Production Drawing U	Jtilities iTwin	View Help	NCDOT Roadway	
<b>~</b> € ∎ ▼ ©	Element Selection	Z Import/Export * Design Elements * Standards *		y ↓ - ↓ Offsets and Tapers * ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓			Lines Curves Element * * Profiles *	Modify Complex Geometry
Primary	Selection	General Tools		Horizontal			Vertical	

## **Corridor Objects Dialog**

Corridor Objects - Y	8				- 0
Femplate Drop	- R × 6 0		•	Template Drop	
Secondary Alignment	Horizonta		Interval	Interval	10.0000'
ey Station	► E	Module 8 Templates\Y8_DF - 2+2 Lanes AUX Raised Median ADSS	10.0000'	Template Name	Module 8 Templates\Y8_DF - 2+2 Lanes AUX
Parametric Constraint				Horizontal Name	
Point Control				Description	
Curve Widening				Station Range	
End Condition Exception				Start Station	10+00.00
				End Station	53+88.39
External Reference					
Clipping Reference					
	<		>		
	Row:  4 4	1 of 1   ▶ ▶			
					C
					C



### 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.

#### **Template Point Constraint Overrides**

The location of a template point can be overridden using the various methods shown below. This functionality allows a single template to produce a number of results.

- **Parametric Constraints** Used to override a default template point constraint within a defined station range.
- Horizontal Feature Constraints Each template point can be assigned one Horizontal Feature Constraint that can be used to override the default template point constraint. Horizontal Feature Constraints will also override Parametric Constraints.
- **Point Controls** Can be applied to any point on a template. A Point Control will force the template point to follow a specific linear geometric element. Point Controls will override **Parametric Constraints** and **Horizontal Feature Constraints**.

#### **Key Stations**

A Key Station may be required when a special circumstance of the project occurs that is not coincident with the template interval, requiring additional processing by the corridor.

#### Feature Definition Toggle Bar

Activates and deactivates settings that impact a variety of Geometry tools.

#### **Civil AccuDraw Toolbar**

Accesses AccuDraw commands.





## **Intermediate Corridor Modeling Exercise**

In this exercise, you will learn how to take a basic model/corridor and further develop it by adding turn lanes, pavement tapers, and non-typical end conditions. You will also be introduced to the concept of Design Intent. Design Intent is the act of preserving the rules and relationships used during the design process in order to maximize the downstream benefits of automatic updates. 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.

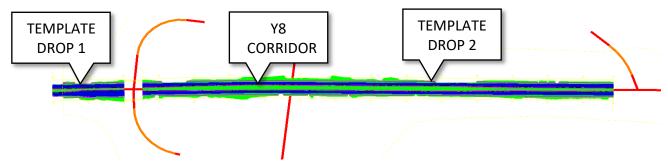
#### 2. Set the Workspace and Workset

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 Y8 Corridor (CMD) dgn file and zoom in closely to the Y8 Corridor
  - A. Click the browse button and path to the **Module 10 (Intermediate Corridor Modeling)** folder and open the *R-2635C-RDY-CMD-Y8.dgn* file.
  - B. Zoom in near the **Y8** alignment 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 Intermediate Corridor Modeling exercise. See the Initial Corridor Modeling Module for detailed instructions for initial corridor development



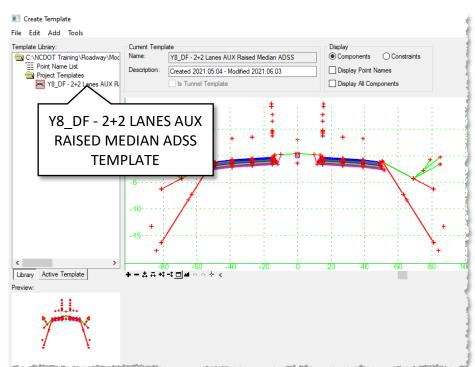
Note: All reference files that are required for the intermediate Corridor Modeling module have already been attached to the R-2635C-RDY-CMD-Y8.dgn file.



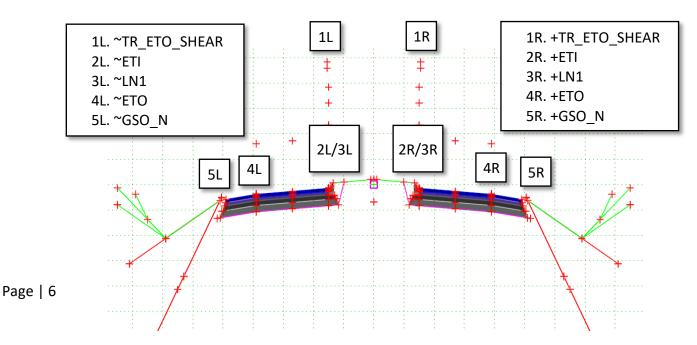


- 4. Review the Y8 Corridor Template
  - A. Click the Create Template button (Corridors > Create > Template > Create Template)
  - B. Under the **Project Templates** folder, select the **Y8\_DF 2+2 Lanes AUX Raised Median ADSS** template as shown below.





C. Notice a few of the key Y8\_DF - 2+2 Lanes AUX Raised Median ADSS template points as shown below. Each of these will be used throughout the Intermediate Corridor Modeling exercise.

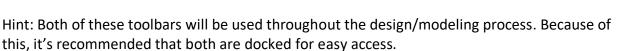




- D. Examine a brief description of each of these key template points below. The following Parametric and Horizonal Feature Constraints associated with these points will be used throughout the Intermediate Corridor Modeling exercise.
  - 1. +/~TR\_ETO\_SHEAR = Target Edge of Travel Outside Shear Null Point
    - Parametric Constraint = PV\_Shear\_Outside RT/LT
    - Horizontal Feature Constraint = CCE\_Target\_Shear\_Out\_RT/LT
  - 2. +/~ETI = Edge of Travel Inside Template Point
    - Parametric Constraint = LN\_AUX Inside Width RT/LT
    - Parametric Constraint = LN\_AUX Inside Slope RT/LT
    - Horizontal Feature Constraint = CCE\_Target\_EOT\_In\_RT/LT
  - 3. +/~LN1 = Lane 1 Template Point
    - Parametric Constraint = MD\_Tie Offset
  - 4. +/~ETO = Edge of Travel Outside Template Point
    - Parametric Constraint = LN\_AUX Outside Width RT/LT
    - Parametric Constraint = LN\_AUX Outside Slope RT/LT
    - Horizontal Feature Constraint = CCE\_Target\_EOT\_Out\_RT/LT
  - 5. +/~GSO\_N Grass Shoulder Outside Normal Template Point
    - Parametric Constraint = SHO\_Width Normal
    - Horizontal Feature Constraint = CCE\_Target\_GS
- E. Close out of the **Create Template** dialog.

#### 5. 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.

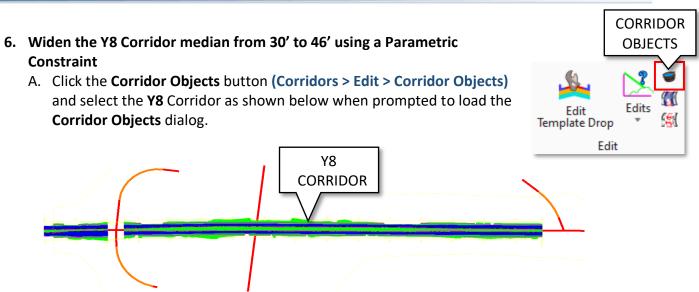




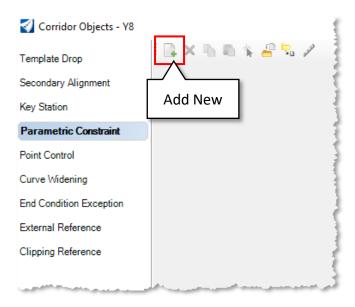








B. From the **Parametric Constraints** row, click the **Add New** button as shown below.



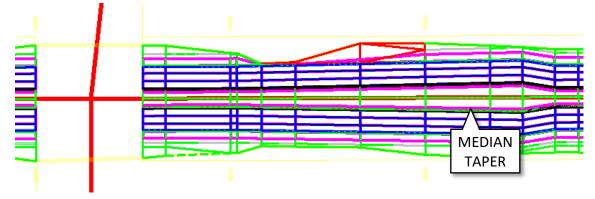
- C. Key the following parameters into the Create Parametric Constraint dialog.
  - Start = 19+10.00
  - End = 23+50.00
  - Constraint Label = MD\_Tie Offset
  - Start Value = 15.0000
  - Stop Value = 23.0000

🔏 Create	Par	—		×
Param	eters			*
Lock To	Start			
Start		19+1	0.00	
Lock To	End			
Stop		23+5	50.00	
Constra	int Labe	MD_	Tie Offse	st 🗸
Start Va	lue	15.0	000	
Stop Va	lue	23.0	000	

Page | 8



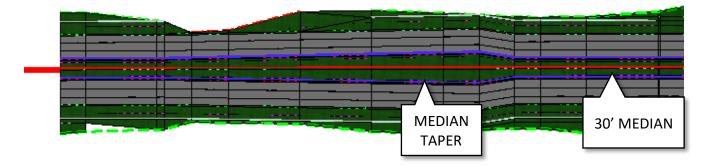
D. This will add a median taper and be the first of two (2) parametric constraints necessary to widen the median to 46'.



E. To better view the changes being made to the Y8 corridor, right-click and hold to load the View Control menu. From there, select the **2 Views Plan/3D** option as shown below.

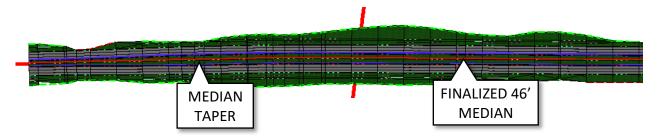
	View Control		1 View
2	Сору		2 Views Plan/3D
	Move		2 Views Plan/XS
	Scale		2 Views Plan/Profile
0	Rotate		2 Views Plan/Superelevation
ã.	Mirror	$\bigcirc$	3 Views Plan/Superelevation/XS
			3 Views Plan/Profile/3D
R	Select Links		3 Views Plan/Profile/XS
63	View Attributes		3 Views Plan/XS/3D
-	Model Properties	0	4 Views Plan/Profile/XS/3D

F. This will load the **View 2**, **Default-3D** view in addition to the standard **View 1**, **Default** view as shown below. As you add parametric constraints, this view can help visualize the changes being made to the Y8 corridor.





- G. Now, add the following parametric constraint to finish widening the Y8 corridor median to 46'
  - Start = 23+50.00
  - End = Lock to End
  - Constraint Label = MD\_Tie Offset
  - Start Value = 23.0000
  - Stop Value = 23.0000
- H. The **46'** median has been finalized as shown below. Keep the Corridor Objects dialog open.



#### 7. Add a right turn and bay taper using a Parametric Constraint

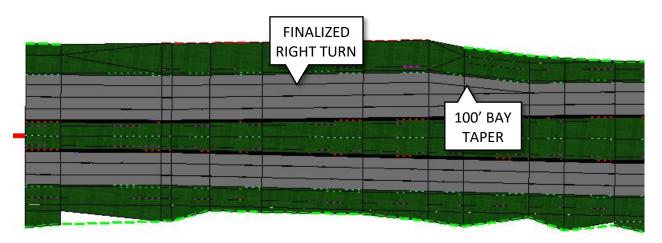
- A. Add the following Parametric Constraint using the Corridor Objects dialog. This will add a 12' turn lane on the outer left side of the corridor.
  - Start = 17+65.00
  - End = 21+65.00
  - Constraint Label = LN\_AUX Outside Width LT
  - Start Value = -12.0000
  - Stop Value = -12.0000

Create Parametri	i – 🗆 X
Parameters	*
Lock To Start	
Start	17+65.00
Lock To End	
Stop	21+65.00
Constraint Label	LN_AUX Outside Width L
Start Value	-12.0000
Stop Value	-12.0000



- 400' RIGHT TURN BAY
- B. Notice the right turn bay has been added to the corridor as shown below.

- C. To finalize the the right turn, add a bay taper using the following Parametric Constraint.
  - Start = 21+65.00
  - End = 22+65.00
  - Constraint Label = LN\_AUX Outside Width LT
  - Start Value = -12.0000
  - Stop Value = 0.0000
- D. The bay taper has been added and the right turn has been finalized. See below.





E. Notice that each of the previous parametric constraints are now listed within the Y8 Corridor Objects dialog as shown below. At any time, these values can quickly be changed to reflect changes to the design.

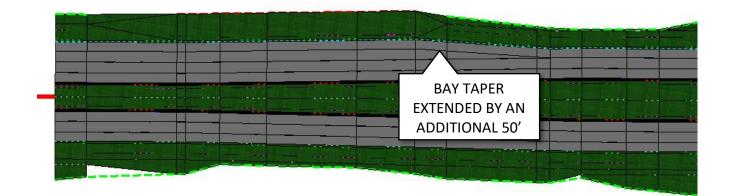
Corridor Objects - Y8									-		×
Template Drop	÷ 📮	🗙 🖒 🖷 🐩 🔐 🐜 🥒					•	Parametric Constraint			*
Secondary Alignment		Constraint Label	Enabled	Start Value	Stop Value	Start Station	End Station	Enabled	$\checkmark$		
		MD_Tie Offset	True	15.0000	23.0000	19+10.00	23+50.00	Constraint Label	LN_AUX Outside Width LT		$\sim$
Key Station		MD_Tie Offset	True	23.0000	23.0000	23+50.00	68+67.72	Start Value	-12.0000		
Parametric Constraint		LN_AUX Outside Width LT	True	-12.0000	-12.0000	17+65.00	21+65.00	Stop Value	0.0000		
Point Control	•	LN_AUX Outside Width LT	✓ True	-12.0000	0.0000	21+65.00	22+65.00		0.0000		
Curve Widening								Station Range			*
-								Start Station	21+65.00		
End Condition Exception								End Station	22+65.00		
External Reference											
Clipping Reference											
	<						>				
	Row	: ▮◀  ◀ │ 4   of 4 │ ▶  ▶									
										C	lose

F. Modify bay taper length by keying in **+50** to the **End Station** parameter as shown below.

Parametric Constraint	^
Enabled	
Constraint Label	LN_AUX Outside Width LT
Start Value	-12.0000
Stop Value	0.0000
Station Range	*
Start Station	21+65.00
End Station	22+65.00+50
	and an and the second s



G. Notice that the End Station parameter now reads as 23+15.00, adding an additional 50' to the end station. This additional 50' is also reflected in the corridor as shown below.



H. Close out of the **Corridor Objects** dialog.

#### 8. Add a left turn and bay taper using a Horizontal Feature Constraint

A. With both 2D and 3D views displayed, load the References dialog as shown below.

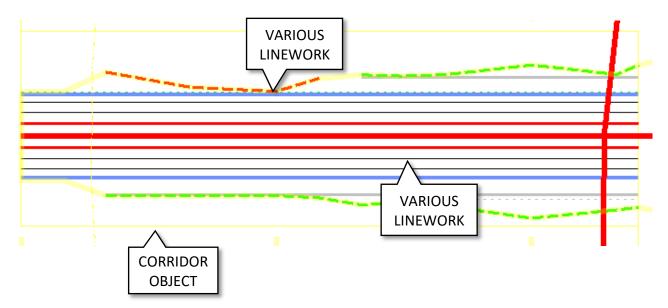
VIEW 1,	References (2 of 2 unique, 2 displayed) —	
DEFAULT	Tools Properties	
DEIMOLI	Ē 🖌 📴 🗞 🖆 🌾 🕼 🖓 👘 🕼 🕺 🖓 👘 🖤	
	Slot 🏴 🗋 File Name Model Description Presentation 🗉 🎜 🕨 🤤	
	1        \Alignment\r2635c_rdy_alg.dgn         Default-3D         Master Model         Wireframe         ✓         ✓           3        \.\Final Survey\R-2635C-RDY-ETM.dgn         Default         Master Model         Wireframe         ✓         ✓	
		VIEW 2, DEFAULT 3D
	Scale 1.00000000 : 1.00000000 Rotation 00 00 00	
	Offset X         0.0000         Y         0.0000         Z         0.0000           Image: Image	
	Display Overrides:   New Level Display:   Georeferenced:	



B. Now, click back and forth between the two (2) views. Notice that the **Refences** dialog switches to display the files attached the current view in focus. With the **View 1, Default** view in focus, turn the display of the **Default-3D** view off as shown below.

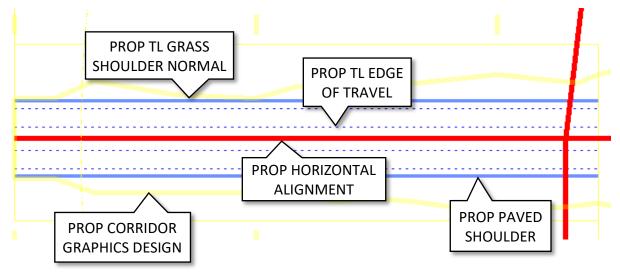
References (3 of 3 unique, 3 displayed)								-	×
Tools Properties									
🗄 • 🖎 🖕 🗅 🛒 🗇 🗇 🗗 🔭	14 To é	в 💾 📦 🗙 ни	te Mode: Hilite	2	•				
Slot 🏴 🗋 File Name	Model	Description	Presentation	٠	Å	k	<u>(</u>		
1\Alignment\r2635c_rdy_alg.dgn	Default	Master Model	Wireframe	$\checkmark$	$\checkmark$	Ý			
2 √ r2635c_rdy_Y8_cmd.dgn	Default-3D		Wireframe	1	1	1			
3\\Final S\R-2635C-RDY-ETM.dgn	Default	Master Model	Wireframe	×	¥	×			
Scale 1.000000000 : 1.000000000	Rotati	on 00°00'00"							
Offset X 0.0000 Y 0.0000									
📔 💽 🎜 🏭 🎞 💭 🖓 🎟 🗞 💡 🖉 📥 🗯	🔒 <u>N</u> ested At	tachments: No Nesting	• • N	esting	Depth	n: 1			
Display Overrides: Allow 🔻 New Level Display: 🖸	onfig Variable	▼ Georeferenced: No	Ŧ						

C. Notice that the 3D model has been turned off, leaving just the linework and the corridor object as shown below.





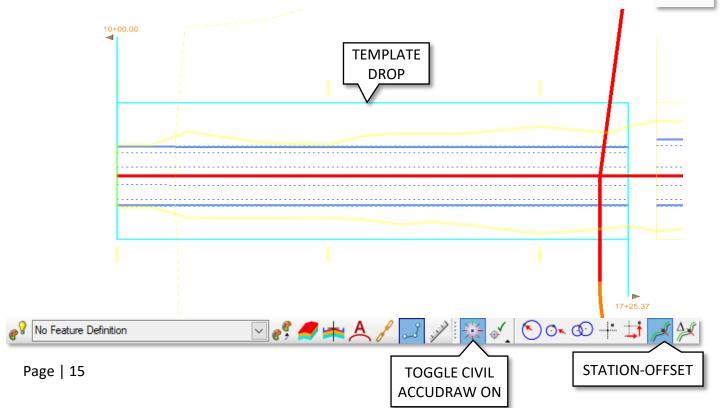
D. Depending on your prefence, you may choose to turn off additional linear elements to avoid confusion as shown below. The levels displayed below are necessary for design/modeling and should remain on as you design/model.



E. Next, click the Toggle Civil AccuDraw button ON, set Station-Offset as the active Read-Out, and select the first template drop that begins at station 10+00.00 using the Element Selection tool as shown below.

Element

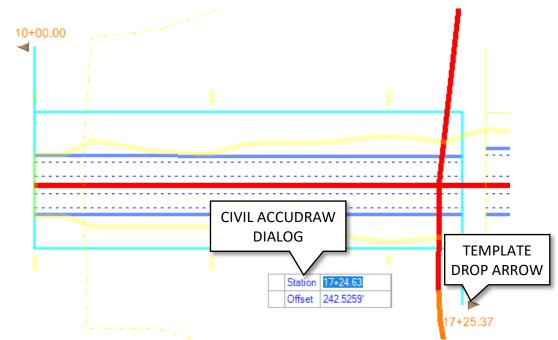
Selection



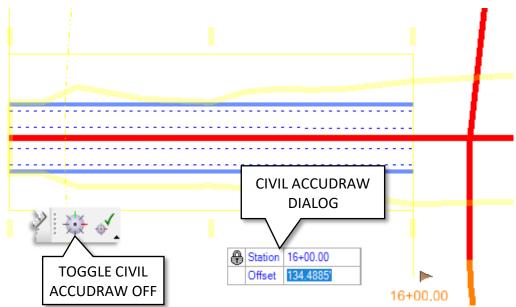


J

F. Now, click on the trailing template drop arrow shown below and drag the template back and forth. Notice the **Civil AccuDraw** dialog displaying the station/offset data as it tracks your movement.

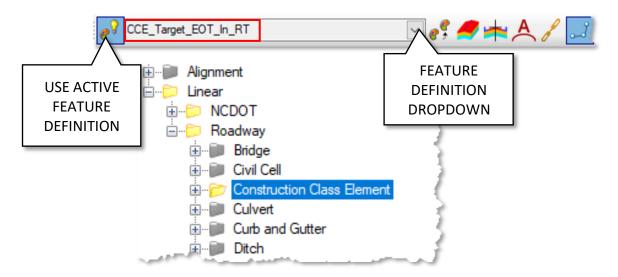


G. Key station 16+00.00 into the Civil Accudraw dialog and press Enter. Notice that the corridor and all linework associated with it now end at station 16+00.00 as shown below. Then toggle Civil Accudraw to OFF.



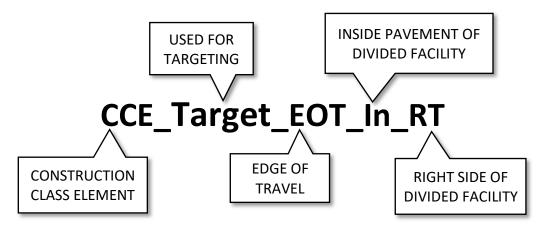


H. From the Feature Definition Toggle Bar, toggle on the Use Active Feature Definition button and then select the CCE\_Target\_EOT\_In\_RT feature from the (Linear > Roadway > Construction Class Element) folder as shown below.



Note: Horizontal features used for targeting are stored within the **Construction Class Element** folder.

I. Notice the **CCE\_Target\_EOT\_In\_RT** feature naming convention as shown below.



#### Note:

**Construction Class Elements** are a type of feature commonly used for corridor manipulation but not considered part of the actual model.



J. From the Geometry tab, select the Single Offset Partial tool (Geometry > Horizontal > Offsets and Tapers > Single Offset Partial) and then select the Y8 alignment when prompted to locate element.

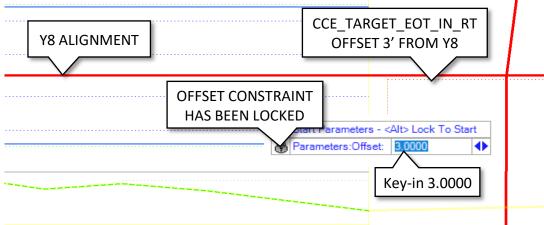
Geometry	Mod	lodel Detailing Drawing			Prod	uction	Drawing	Utilit	ies iTw <u>i</u>		
K Import/Ex	port *	2 <b>.</b> 4	Z	1	0		Ξ¢	Offsets and	d Tapers 🔹	لخسن	المحسر
🛛 🛃 Design Ele	ements *	Civil	Reports	Lines	Arcs	T Point		Single O	ffset Entire El	ement	7 Complex
🔭 Standards	rds *	Toggles *	.*	*	*	*	$\overline{\Box}$	Single O	ffset Partial		Seometry
)	General				F	Variable	Offset Taper				
Lanna and	and the second							Dert	and and a second	_	ليسب

K. After selecting the Y8 Alignment, the heads-up prompt displays and tracks your movements. Notice the two (2) arrows that are included within the prompt. These arrows represent additional constraints. To toggle back and forth between these constraints, simply click the arrow keys on your keyboard. In addition to the heads-up prompt, a Single Offset Partial dialog box also loads. As you toggle back and forth between the constraints, notice that they match the Single Offset Partial dialog constraints. A combination of prompts and dialog boxes similar to the ones shown below will be used throughout the design/modeling process.

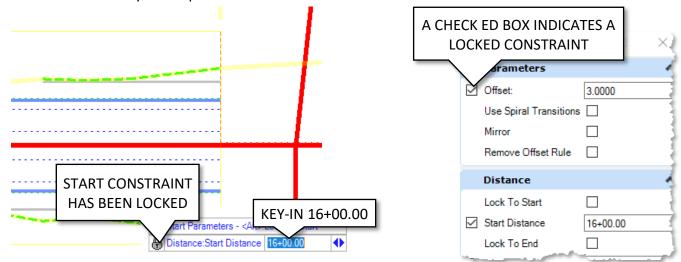
	🔏 Single Offset P –	- 🗆 X
	Parameters	*
HEADS-UP PROMPT	Offset:	-624.7711
	Use Spiral Transitions	
Start Parameters - <alt> Lock To Start</alt>	Mirror	
Parameters:Offset: -268.6318	Remove Offset Rule	
	Distance	*
ADDITIONAL CONSTRAINTS	Lock To Start	
CONSTINUTS	Start Distance	10+00.00
	Lock To End	
	End Distance	68+67.72
	Length	5867.7180
	Feature	*
	Feature Definition	Use Active Feature
	Name	CCET_EOTI-RT



L. With the Parameters Offset prompt toggled on, key-in 3.0000 and press Enter. Notice the Lock that displays after you press Enter as shown below. This indicates that the offset parameter has been locked. As you move your mouse back and forth, notice the red dotted line tracks with your movements but the offset remains at 3'. If you move your mouse to the left side of the alignment, notice that the red line also moves and the offset now reads as -3'. The red dotted line represents the CCE\_Target\_EOT\_In\_RT that was previously set as the active feature.



M. Next, toggle to the **Distance**: **Start Distance** parameter using your keyboard's arrow key, then key in **16+00.00** and click "Enter" to lock the **Start Station** as shown below. Notice that these same **Single Offset Partial** dialog parameters have also been locked. The "End" key can be used to unlock any of the parameters that have focus if needed.



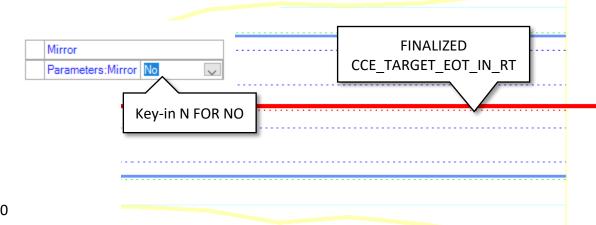
Hints: Either of these can be unlocked or modified using the dialog box as well.



N. After both Single Partial Offset start constraints have been locked, left click the screen to accept. You will then be prompted for a stop location. There are two (2) Stop Constraint options to choose from: Length or Station. Using your keyboard arrow keys, toggle back and forth between the two. In this instance, choose the Distance:End Distance (Station) constraint. Key-in station 13+00.00 and press Enter to lock as shown below.

CCE_TARGET_EOT_IN_RT OFFSET 3' FROM Y8 BEGINS AT STATION 16+00 ENDS AT STATION 13+00	 <ul> <li>Single Offset P</li> <li>Parameters</li> <li>Offset:</li> <li>Use Spiral Transitions</li> <li>Mirror</li> <li>Remove Offset Rule</li> </ul>	3.0000
DISTANCE: END DISTANCE HAS BEEN LOCKED Ind Parameters - <alt> Lock To End Distance:End Distance 13+00.00 Key-in 13+00.00</alt>	Distance Lock To Start Start Distance Lock To End End Distance oth CK ED BOX INDICAT	

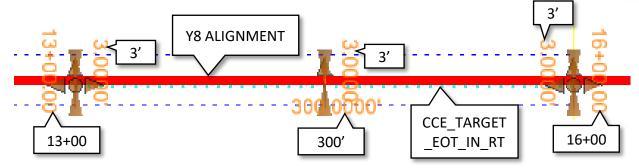
O. Next, left-click the screen to accept the Distance:End Distance constraint. This will place the CCE\_Target\_EOT\_In\_RT linear element and finalize the left turn lane edge of pavement Construction Class Element placement. Immediately after placing this line, you will be asked by the prompt if you would like to Mirror. In this instance, key-in N for no, finishing the Single Offset Partial command.



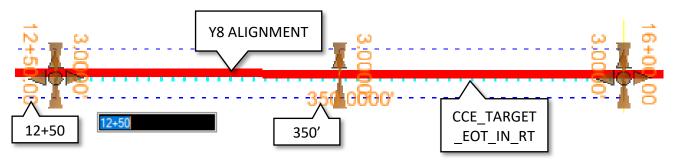


P. Zoom in close to the **CCE\_Target\_EOT\_In\_RT** line that was just placed and click on it using the Element Selection tool. Notice the on-screen constraints displaying stationing, offset, and length in relation to the Y8 Alignment as shown below. Each of these constraints indicate a rule and can be edited on screen by simply clicking and editing the text.

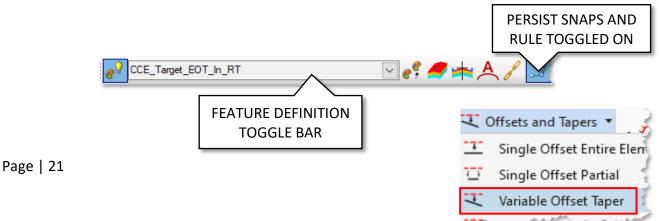




Q. Click on the begin station text that reads 13+00.00 and change it to read 12+50.00. Notice that the CCE\_Target\_EOT\_In\_RT has been extended by an additional 50' and the length label now reads 350' as shown below. All of these pieces of geometry are tied to one another through a rule. Because of this relationship, if one is changed, all of the others are impacted as well. This is the key to rules-based design intent.

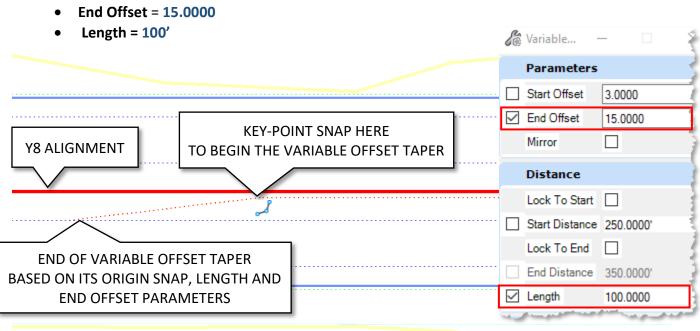


R. Next, check to make sure that the Persist Snaps and Rule button is toggled on as shown below and then select the Variable Offset Taper tool (Geometry > Horizontal > Offsets and Tapers > Variable Offset Taper) and again, select the Y8 alignment when prompted to locate element.



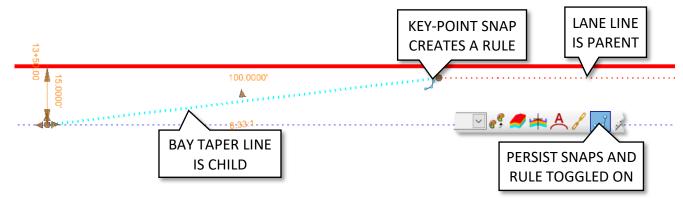


S. Now, **key-point** snap to the end of the previously drawn **CCE\_Target\_EOT\_In\_RT** element and key the following parameters into the **Variable Offset Taper** dialog. Then, left-click on the screen to accept, drawing in the left turn lane bay taper as shown below. Choose not to mirror the bay taper when finishing the **Variable Offset Taper** command.



T. Next, click on the finalized bay taper as shown below and notice the various rule based constraints as well as the Key-Point Snap icon. Any time that you snap to an element while the **Persist Snaps and Rule** button is toggled, you create a rule and a relationship between the two (2) elements. This establishes a parent-child relationship. In this case, the lane line is the parent and the bay taper is the child.

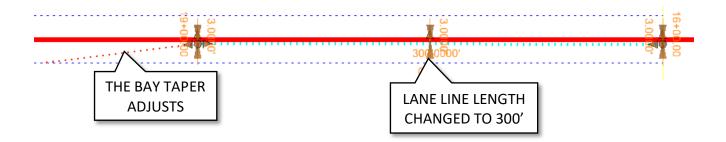




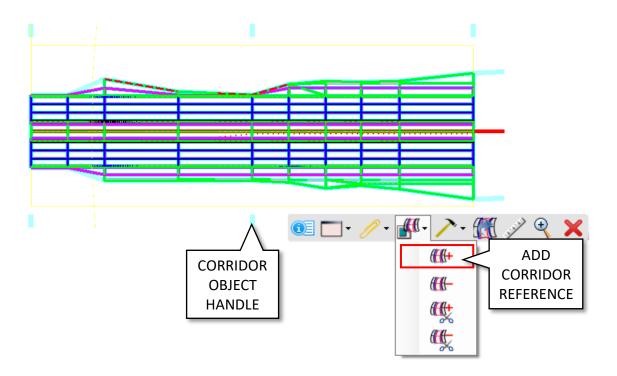
Note: In some scenarios, this parent-child relationship may be less than desirable but the need to snap may still persist. In this case, toggle off the **Persist Snaps and Rule** option.



U. To demonstrate the parent-child relationship between the left turn lane and its bay taper, change the length of the left turn lane to 300' as shown below. Notice that the bay taper is also adjusted. This is based on the rule that was established when the bay taper was snapped to the end of the lane line during its creation.

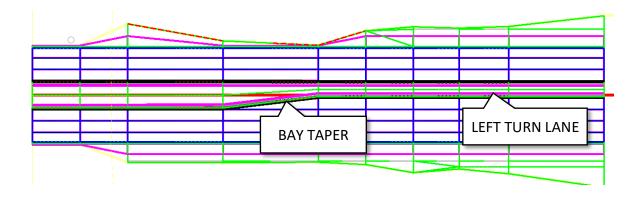


V. After adding the left turn lane and bay taper geometry, turn the Default-3D model back on using the references dialog. Notice that the corridor is not recognizing the new geometry and has not changed. To resolve this, the newly added geometry will need to be added to the corridor as a corridor reference. To add a corridor reference, click and hover over one of the corridor object handles to display the corridor menu. From the menu, select the **Add Corridor Reference** option as shown below.

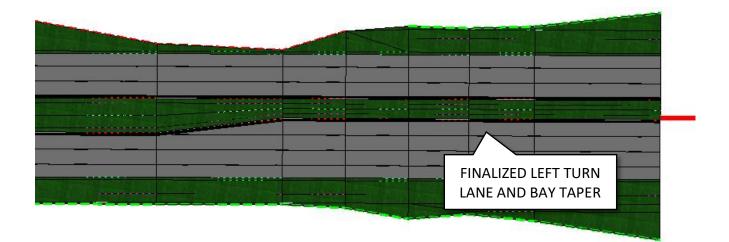




W. Next, select the two (2) new pieces of geometry and then right click to complete. Once the corridor finishes processing, it will be updated to include the left turn lane and bay taper as shown below.

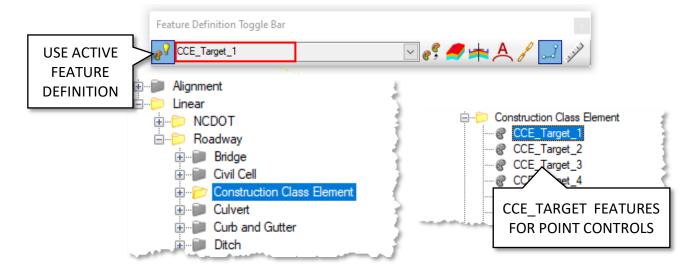


X. The Left turn lane and bay taper have been added to the Y8 corridor using the CCE\_Target\_EOT\_In\_RT horizontal feature constraint. For a better perspective, open the View 2, Default-3D view as shown below.



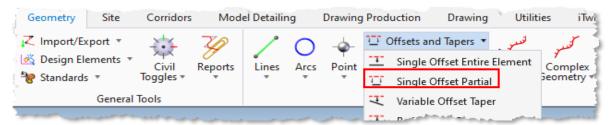


- 9. Add a right turn and bay taper using a Point Control
  - A. From the Feature Definition Toggle Bar, toggle on the Use Active Feature Definition button and then select the CCE\_Target\_1 feature from the (Linear > Roadway > Construction Class Element) folder. Notice the additional CCE\_Target features as shown below.



Note: By definition, the intent of a point control is to control points. Unlike a **Horizontal Feature Constraint**, which is template based and pre-determined, a point control could be used to control any number of the points that make up a template. For this reason, the **CCE\_Target** features provided by **NCDOT** are more generic in nature and a good choice for use with a point control.

B. From the Geometry tab, select the Single Offset Partial tool (Geometry > Horizontal > Offsets and Tapers > Single Offset Partial) and then select the Y8 alignment when prompted to locate element.



Note: Construction class elements used for template targeting should be created using offsets and tapers from the corridor alignment or other non-template based elements to avoid what is known as a circular reference. Circular references cannot be targeted by the template, making them unusable.



- C. Key the following parameters into the Single Offset Partial dialog and then click through the prompts to accept. This will draw the outside edge of travel for the right turn lane.
  - Offset = 51.0000

•

- Use Spiral Transitions = Unchecked
- Start Distance = 16+00.00
- End Distance = **12+00.00**

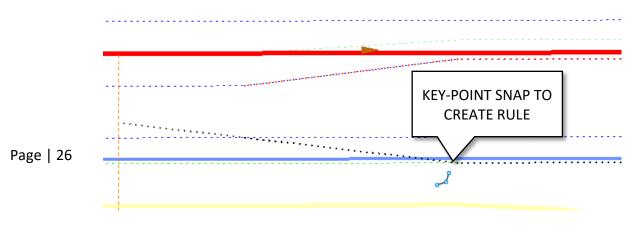
Notice the **Name** attribute within **the Single Offset Partial** dialog as shown below. As you design using the **Open Roads Civil Tools**, civil geometry elements will be named automatically based on the **Feature**.

Fea	ture	
Feature [	Definition	Use Active Feature
Name		CCET_ONE
	AUTOMA	TIC NAMING OF
	GEOMET	RIC ELEMENTS
	BASED	ON FEATURE

- D. Next, select the Ratio Offset Taper tool (Geometry > Horizontal > Offsets and Tapers > Ratio Offset Taper) and again, select the Y8 alignment when prompted to locate element.
- E. Key the following parameters into the **Ratio Offset Taper** dialog or as prompted by the heads-up display.

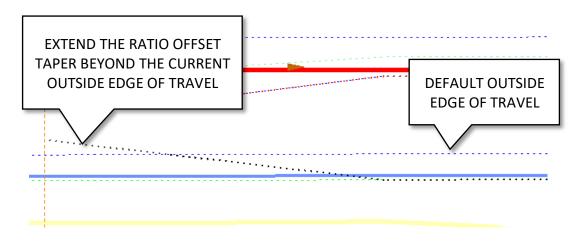


F. Then Key-Point snap to the end of the right turn lane, creating a rule that will control the start location.

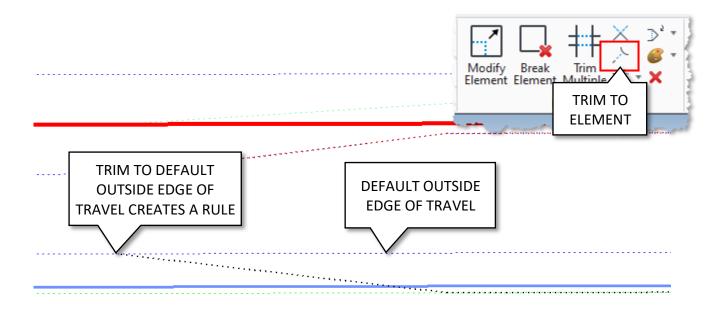




G. Next, drag your mouse to the left beyond the default outside edge of travel and click the screen to finish the **Ratio Offset Taper** command. Again, no need to mirror in this instance.



H. Now, trim the Ratio Offset Taper to the default outside edge of travel using the Trim to Element command (Drawing > Modify > Trim to Element). This will create another rule that dictates that the taper will end at the default outside edge of travel.





 Next, add a point control using the Create Point Control option (Corridors > Edit > Edits > Create Pont Control) as shown below.

Corridors	Model De	tailing	Drawing Produc	tion	Drawi
Copy Ten Mice Import IR	RD	Template	Edit Template Drop	Edits	
Create	113		Edi		Create End Condition Exception Create Key Station
and the second	producer -		مير الاستعماد المحرير	₩	Create Secondary Alignment
				2	Create Parametric Constraint
				1	Create Curve Widening
				+	Create Point Control

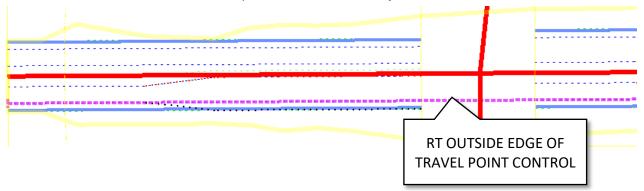
- J. After selecting the Y8 Corridor, key the following parameters into the Create Point Control dialog and click through the prompts to accept.
  - Start = Lock to Start
  - Sop = Lock to End
  - Control Description = RT OUTSIDE EDGE OF TRAVEL
  - Point = +ETO
  - Mode = Horizontal
  - Control Type = Feature Definition
  - Feature Definition = CCE\_Target\_1
  - Range = 0.0000
  - Priority = 1
  - Horizontal Offset Start = 0.0000
  - Horizontal Offset Stop = 0.0000
  - Use as Secondary Alignment = Unchecked

Create Point Control	- 🗆 X
Parameters	*
Lock To Start	
✓ Start	10+00.00
Lock To End	$\checkmark$
✓ Stop	68+67.72
Control Description	RT OUTSIDE EDGE OF TRAVEL
Point	+ETO 🗸
Mode	Horizontal 🗸
Control Type	Feature Definition
Feature Definition	CCE_Target_1
Range	0.0000
Use as Secondary Alignment	
Priority	1
Horizontal Offsets	*
Start	0.0000
Stop	0.0000

Note: This will create a single point control that runs the length of the Y8 Corridor. This point control will be initiated If a piece of geometry is referenced to the corridor with the **CCE\_Target\_1** feature assigned to it.

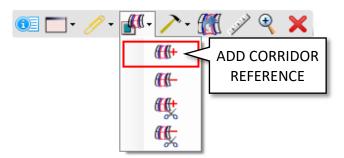


K. Notice the purple dashed line shown below that is now displayed. This line represents the **RT OUTSIDE EDGE OF TRAVEL** point control that was just created.

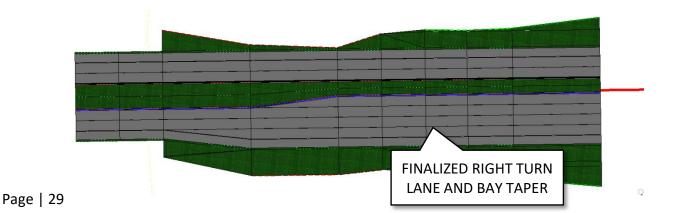


Note: Like other objects created using OpenRoads technology, point controls can easily be edited using the Corridor Objects dialog or by clicking and selecting one of the context menu options.

L. Next, use the **Add Corridor Reference** tool and add the right turn lane and bay taper to the Y8 Corridor as a Corridor Reference.

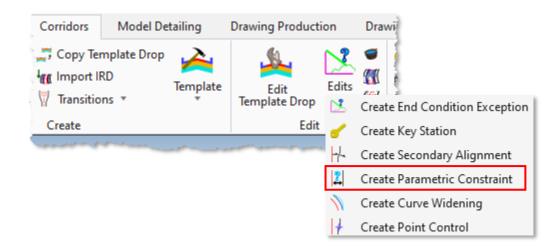


M. In the **View 2, Default-3D** view, notice that the right turn lane and bay taper have been added to the **Y8** corridor as shown below.





- **10.** Use a Parametric Constraint to shear the template at the edge of travel
  - A. Select the Create Parametric Constraint option (Corridors > Edit > Edits > Create Parametric Constraint) as shown below.



B. Click on the Constraint Label drop-down from the Create Parametric Constrain dialog and notice the four (4) PV\_Shear options. Each of these can be used for shearing pavement at the edge on travel. In this instance, select the PV\_Shear Outside RT option as shown below.

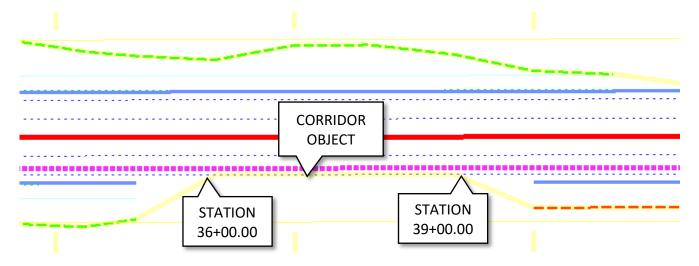
<i>f</i> i (	Create Para	_		×	
F	Parameters			*	
l	Lock To Start				
	Start	45+73.25	5		
l	Lock To End				
	Stop	68+67.72	2		
(	Constraint Label	PV_Shea	ar Outside	R'~	
\$	Start Value		oth Interm		Course
5	Stop Value		th Overlay th Surace	-	e Wedge
			th Surface		-
		PV_Shea	ar Inside I	LT	
		PV_Shea	ar Inside I	RT	
		PV_She	ar Outside	e LT	
		PV_Shea	ar Outside	e RT	
		PVI_Wid	th CG Sh	elf ABC	
		PVI Wid	Hh CG Sh	olf Rae	e Cours
		1 11 11	ui cu si	CII Daa	



- C. After selecting the **PV\_Shear Outside RT** Constraint Label from the drop-down, key the following additional parameters into the **Create Parametric Constraint** dialog and click through the prompts to accept.
  - Start = 36+00.00
  - Stop = 39+00.00
  - Constraint Label = PV\_Shear Outside RT
  - Start Value = 50.0000
  - Stop Value = 50.0000

Sõ	Create Para	—		$\times$
	Parameters			*
	Lock To Start			
	Start	36+00.00	)	
	Lock To End			
	Stop	39+00.00	)	
	Constraint Label	PV_Shea	r Outside	R' ~
	Start Value	50.0000		
	Stop Value	50.0000		

D. Now, zoom in closely to the shear location as shown below. As expected, elements beyond the outside edge of travel have been removed as a result of the PV\_Shear Outside RT parametric constraint. You may notice, however, that the station range of the elements removed does not match the PV\_Shear Outside RT station range. However, the yellow Corridor Object does match the PV\_Shear Outside RT station range.



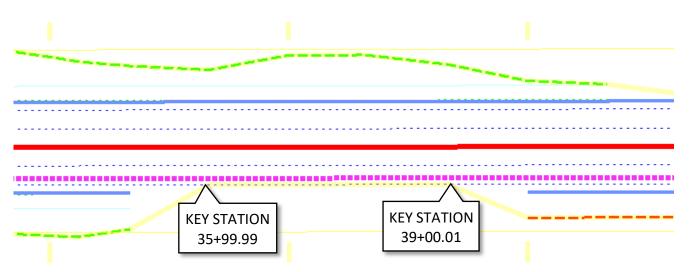
Note: When conditions occur that are not coincident with the project template interval, it might be desirable to include an additional station or stations for processing.



E. This can be resolved by adding what is called a Key Station. Select the Create Key Station option (Corridors > Edit > Edits > Create Key Station) as shown below.

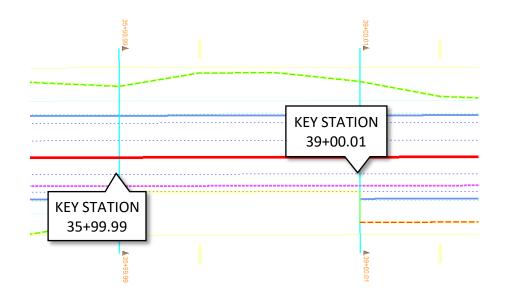
Corridors	Model Det	tailing	Drawing Pro	ducti	on	Drawi
Copy Ten M Import IR	D	Template	Edit Template D	rop	Edits	Create End Condition Exception
Create				Edit	<b></b>	Create Key Station
and the for	Part and a second		and the second secon		1	Create Secondary Alignment
					2	Create Parametric Constraint
						Create Curve Widening
					ł	Create Point Control

- F. Create two (2) **Key Stations** as shown below. Notice that the Key Stations nearly match the station parameters for the **PV\_Shear Outside RT** Horizontal Feature Constraint. Key Stations should be placed as close as possible but not directly on top of conditions that need to be picked up by the corridor.
  - Key Station 1 = 35+99.99
  - Key Station 2 = 39+00.01

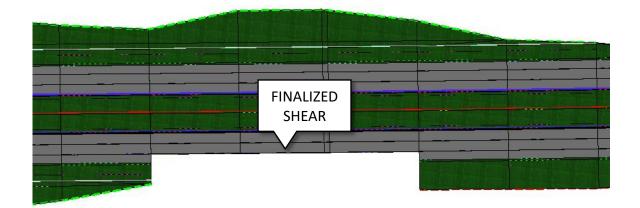




G. Notice that the Key Stations did in fact resolve the issue. The Y8 Corridor now reflects the intent of the **PV\_Shear Outside RT** Parametric Constraint as shown below.

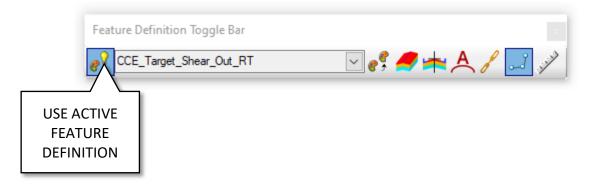


H. The **Y8** Corridor shear has been finalized as shown below.

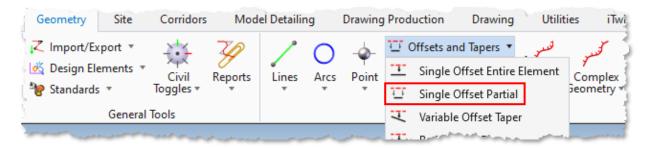




- 11. Use a Horizontal Feature Constraint to shear the template at the edge of travel
  - A. From the Feature Definition Toggle Bar, toggle on the Use Active Feature Definition button and then select the CCE\_Target\_Shear\_Out\_RT feature from the (Linear > Roadway > Construction Class Element) folder.

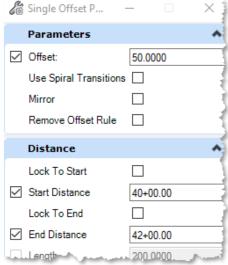


B. Next, select the Single Offset Partial tool (Geometry > Horizontal > Offsets and Tapers > Single Offset Partial) and then select the Y8 alignment when prompted to locate element.



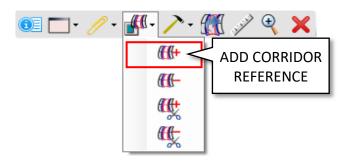
- C. After selecting the Y8 Corridor, key the following parameters into the **Single Offset Partial** dialog and click through the prompts to accept.
  - Offset = 50.0000
  - Start Distance = 40+00.00
  - End Distance = 42+00.00

Note: The offset does not need to be 50'. This number was used for simplicity.





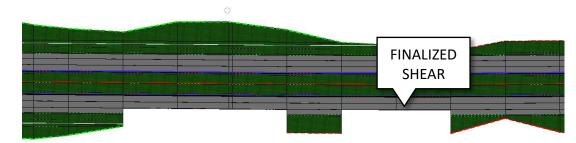
D. Next, use the Add Corridor Reference tool to add the CCE\_Target\_Shear\_Out feature to the Y8 Corridor as a Corridor Reference.



E. Notice that the corridor has been sheared as shown below. Again, notice that the shear does not match the **CCE\_Target\_Shear\_Out** feature perfectly and will require **Key Stations** to be finalized.

•	•	
·····		
EXISTING KEY STATION		
39+00.01		$\frown$
	CCE_TARGET_SH	HEAR_OUT

- F. Create two (2) Key Stations as shown below.
  - Key Station 1 = 39+99.99
  - Key Station 2 = 42+00.01
- G. The **Y8** Corridor shear has been finalized as shown below.



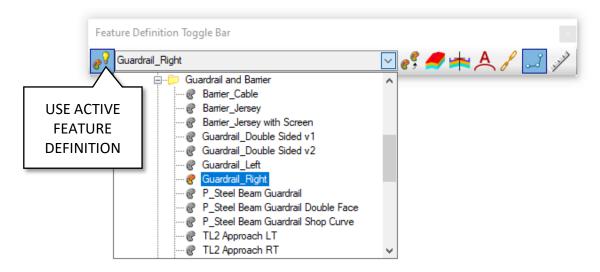




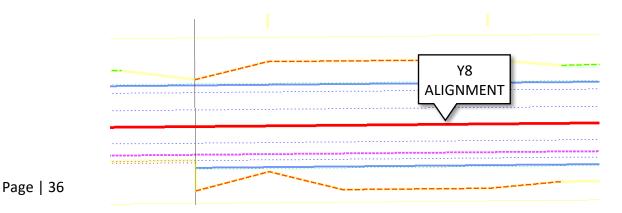
- 12. Draw Guardrail and TL-3 Anchor units using 3D Linestyles
  - A. Select the 2 Views Plan/3D option from the View Control context menu to open the View
     2,Default-3D view in addition to the already opened View 1, Default 2D view.



B. From the Feature Definition Toggle Bar, toggle the Use Active Feature Definition button and set the Guardrail\_Right feature (Linear > Roadway > Guardrail and Barrier > Guardrail\_Right) to active.

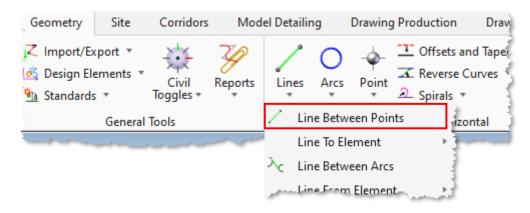


C. In the **View 1, Default** window zoom in closely to the Y8 corridor as show below.





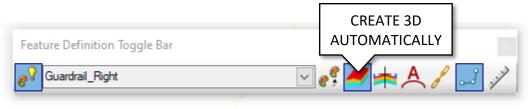
D. Now, select the Line Between Points tool (Geometry > Horizontal > Lines > Line Between Points) as shown below.



E. Next, draw a random line in the **View 1, Default** window as shown below. Notice that model has not been updated to reflect the guardrail in the **View 2, Default-3D** window.

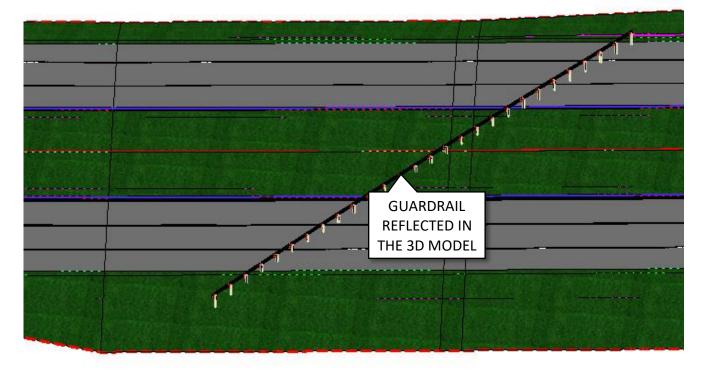
 	,
 	Enter End Point           Parameters:Distance           205.7067
 10 <sup>8</sup>	
 GUARDRAIL DRAWN IN THE 2D VIEW	

F. This can be resolved by toggling on the **Create 3D Automatically** option and then redrawing the guardrail.





G. When the **Create 3D Automatically** option is enabled, the guardrail which was drawn in the 2D view of a model will pick up the vertical attribute from the 3D model automatically as shown below.



- H. Delete the guardrail from the **View 1, Default** window and notice that it is also removed from the 3D model.
- With the Feature still set to Guardrail\_Right and the options still set as shown below, select the Single Offset Partial tool (Geometry > Horizontal > Offsets and Tapers > Single Offset Partial) and then select the Paved Shoulder on the right side of the road when prompted to locate element.





J. After selecting the **Paved Shoulder**, key the following parameters into the **Single Offset Partial** dialog and click through the prompts to accept. This will place the guardrail **.01'** off the paved shoulder line as shown below.

shown below.	Use Spiral Transit	tions 🗌
• Offset = 0.0100	Mirror Remove Offset Ru	le 🗌
<ul> <li>Start Distance = 44+50.00</li> <li>End Distance = 46+50.00</li> </ul>	Distance	
<ul> <li>Ella Distalle – 40+50.00</li> </ul>	Lock To Start	
	Start Distance	44+50.00
	Lock To End	
	End Distance	46+50.00
	- Lowth	and a second
PAVED		
SHOULDER GUARDRAIL		

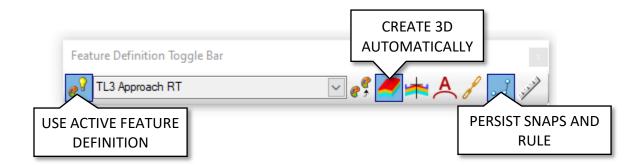
🔏 Single Offset P...

Parameters

57.0000

Offset:

K. Next, set the TL3 Approach RT feature (Linear > Roadway > Guardrail and Barrier > TL3 Approach RT) to active and toggle the options as shown below.





L. Next, select the **Ratio Offset Taper** tool (Geometry > Horizontal > Offsets and Tapers > Ratio Offset Taper) and then select the **Y8** alignment when prompted to locate element.

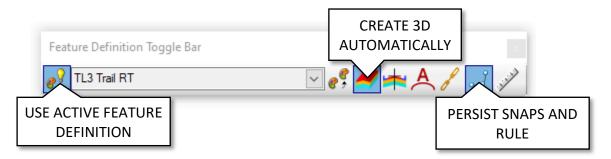
Geometry	Site	Corridors	Mod	el Detailir	ng	Drawing	Production	Drawing	Utilitie
↓ Import/Ex ▲ Design Ele ▲ Standards	ments 🔻	Civil Toggles •	W Reports	Lines	O Arcs		🕂 Single	and Tapers 🔹 Offset Entire E Offset Partial	ليسر Element
	General	Tools					🔍 Variab	le Offset Taper	
							🕄 Ratio	Offset Taper	

M. Then, key the following parameters into the **Ratio Offset Taper** dialog and then **Key-point** snap to the beginning of the guardrail. After snapping to the end of the guardrail, adjust the location of the **TL-3** by moving the mouse back and forth before left-clicking to finalize placement.

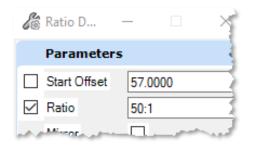
P			60 1	latio D	4
• Offset = 57.0000			F	arameters	
<ul> <li>Length = 62.0000</li> </ul>				Start Offset	57.0000
			V F	Ratio	-50:1
			 N	Mirror	
			C	Distance	1
		1	L	ock To Start	
		KEY-POINT SNAP		Start Distance	3750.0000'
		TO CREATE RULE	 L	ock To End	
			<b>E</b>	End Distance	3812.0000'
	<u> </u>	<u></u>	 ✓ L	.ength	62.0000
TL-3 ANG UNI		End Parameters - <alt< th=""><th>nd</th><th></th><th>ليترو متراسي</th></alt<>	nd		ليترو متراسي



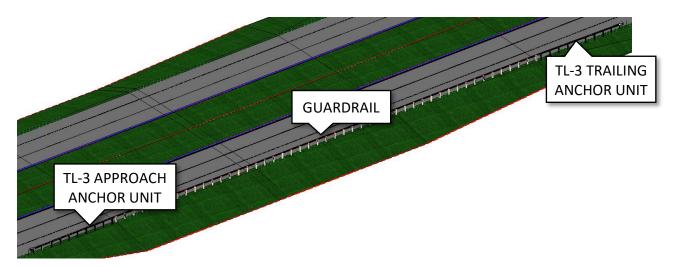
N. After finalizing the TL-3 approach, set the TL3 Trail RT feature (Linear > Roadway > Guardrail and Barrier > TL3 Trail RT) to active and toggle the options as shown below.



O. Now, follow the same steps to draw the **TL-3** Trailing end. Only this time, set the **Ratio** parameter to **50:1** before **Key-Point** snapping to the end of the guardrail.



P. Notice that both **TL-3 Anchor units** along with the guardrail are now visible in the **View 2**, **Default-3D** window as shown below.

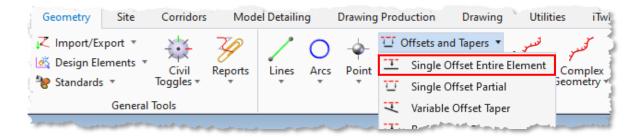




- 13. Widen Grass Shoulder to Accommodate Guardrail and TL-3 Anchor units
  - A. First, set the CCE\_Target\_GS feature (Linear > Roadway > Construction Class Element > CCE\_Target\_GS) to active and toggle the options as shown below.

Feature	Definition Toggle Bar		×
	E_Target_GS	🖂 e <sup>e</sup> , 💋 📩 A	de al sur
USE ACTIVE FEATURE			PERSIST SNAPS AND RULE
DEFINITION			

B. Then, select the Single Offset Entire Element tool (Geometry > Horizontal > Offsets and Tapers > Single Offset Entire Element) and select the guardrail that was added in the previous step when prompted to locate element. This will rule the grass shoulder limits to the match the guardrail.

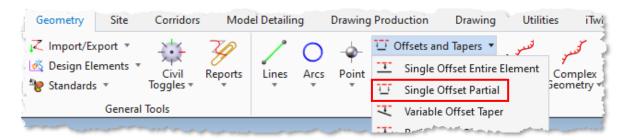


Note: Construction class elements used for template targeting should be created using offsets and tapers from the corridor alignment or other non-template based elements to avoid what is known as a circular reference. Circular references cannot be targeted by the template, making them unusable.



C. Set the <b>Offset</b> parameter to <b>5.0000</b> within the <b>Single Offset</b>	S	Single Offset E	
Entire Element dialog and click through the prompts to accept. The CCE_Target_GS will be used to widen the grass shoulder as		Parameters	
needed to accommodate the guardrail.	$\checkmark$	Offset:	5.0000
		Use Spiral Transitions	
		Mirror	
		Remove Offset Rule	
GUARDRAIL	-		
			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
CCE_TARC	GET_	_GS	

D. Next, select the Single Offset Partial tool (Geometry > Horizontal > Offsets and Tapers > Single Offset Partial) and choose the Y8 alignment when prompted to locate element.



E. Then, set the Length parameter to 65.000 and Key-Point snap to 🔏 Single Offset P... the beginning of the **CCE\_Target\_GS** line that was created in the Parameters previous step. Click through the additional prompts to create a Offset: 62.0000 line that is ruled to be 65' in length from the beginning of the Use Spiral Transitions guardrail. Mirror 65' Remove Offset Rule 8 65 Distance Lock To Start PREVIOUSLY PLACED Start Distance 44+00.00 CCE TARGET GS Lock To End  $\Box$ End Distance 44+65.00 Length 65.0000 NEW 65' **KEY-POINT SNAP TO** CCE TARGET GS END OF THE Page | 43 PREVIOUSLY PLACED CCE TARGET\_GS



F. Next, select the Variable Offset Taper tool (Geometry > Horizontal > Offsets and Tapers > Variable Offset Taper) and again, choose the Y8 alignment when prompted to locate element.

Geometry	Site	Corridors	Mod	el Detailir	ng	Drawing	Prod	uction	Drawing	Utilit	ties iTwi
,∠ Import/Ex	port *		$\overline{\mathcal{A}}$	~	$\circ$		Ξ¢	Offsets and	d Tapers 🔹	لخلس	الم المحسد
🛛 🙇 Design Ele	ements *	Civil	Reports	Lines	Arcs	Point		Single O	ffset Entire E	ement	Complex
😻 Standards	*	Toggles *	*	*	*	*	$\overline{\Box}$	Single O	ffset Partial		Geometry 🛀
	General	Tools					Ţ	Variable	Offset Taper		
and the second second		una.	~~~~			-ma		D	and and a second		لىيىسى

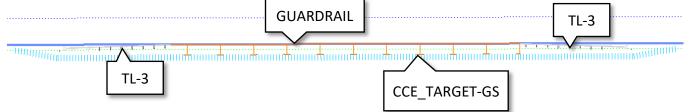
G. Then, key the following parameters into the **Variable Offset Taper** dialog and snap to the beginning of the **CCE\_Target\_GS** line that was just drawn in the previous step.

• End Offset = 59.0000		Variable	- 🗆	3
• Length = 25.0000		Parameters	rameters	
		Start Offset	62.0000	·
8 25.0000'	$\checkmark$	End Offset	59.0000	1
		Mirror		Š.
	-	Distance		······
59 .00 000		Lock To Start		
-		Start Distance	3285.0000'	
KEY-POINT SNAP		Lock To End		-
TO CREATE RULE		End Distance	3310.0000'	-
	$\checkmark$	Length	25.0000	<u> </u>
-8.33:1	_	And a summer		JUUUT

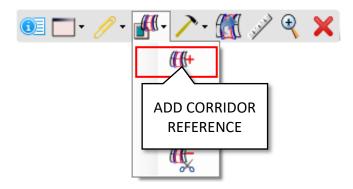
H. Now, follow the same steps to draw the **CCE\_Target\_GS** feature at the **Trailing** end of the guardrail.



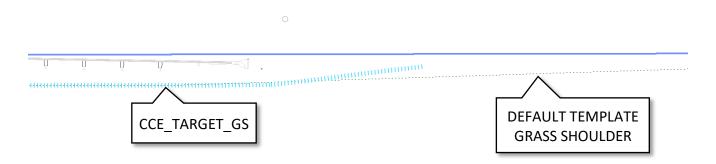
I. The **CCE\_Target\_GS** should now cover the full length of the guardrail and **TL-3** anchor units as shown below.



J. Next, use the Add Corridor Reference tool to add the CCE\_Target\_GS features to the Y8 Corridor as a Corridor Reference.

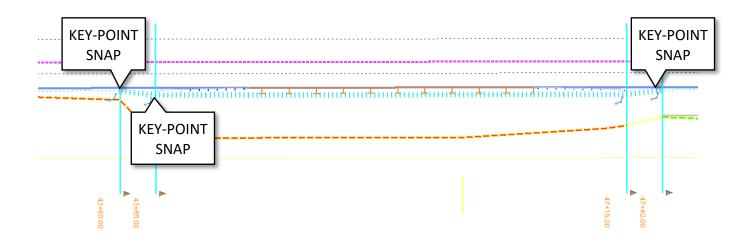


K. Once the Y8 Corridor processes, notice that the corridor did not completely pick up the breaks in the **CCE\_Target\_GS** as shown below.

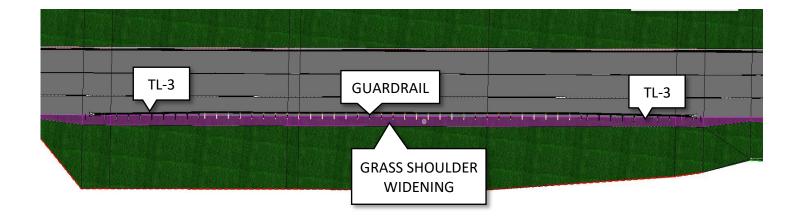




L. To resolve this, add four (4) **Key-Stations** along the **CCE\_Target\_GS** feature at each of the breaks using **Key-Point** snaps as shown below.



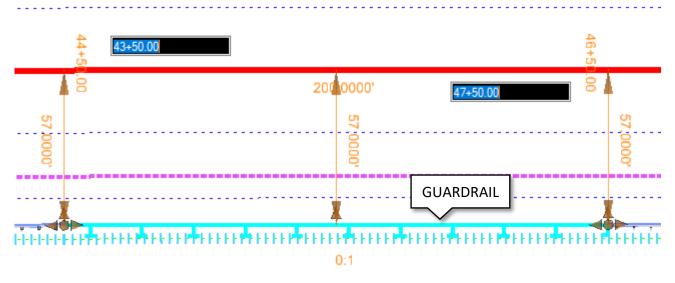
M. In the **View 2, Default-3D** window, notice the finalized guardrail, anchor units and grass shoulder widening as shown below.



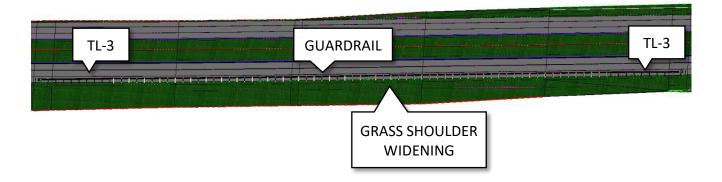


#### 14. Adjust the Guardrail Station Range to Demonstrate Design Intent

A. Select the guardrail element as shown below and adjust the begin station to **43+50.00** and the end station to **47+50.00**.



B. Notice in the **View 2**, **Default-3D** window that not only the guardrail, but also the TL-3 Anchors as well as the grass shoulder that was widened in the previous step, have also been updated. This is due to the **rules-based** design that was leveraged in the previous steps.



Notes:

- Design Intent is not required, but if used properly can be advantageous to the overall design process.
- A Parametric Constraint can also widen the shoulder for Guardrail.