LAB 12 - Point Controls, Secondary Alignments, and Parametric Constraints

This lab demonstrates the use of various controls to modify a template during processing. It will highlight various settings in point controls, illustrate the effects of a secondary alignment, and demonstrate the use of parametric constraints.

Chapter Objectives:

- Create a Horizontal Point Control to add an additional lane using offsets.
- Create a Horizontal and Vertical Point Control to add a scab-on detour.
- Create a Horizontal Point Control using a Secondary Alignment.
- Use Parametric Constraints to widen the road surface.

Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\Preferences\CDOT_Civil.xin
- C:\Projects\12345\Design\InRoads\12345DES_Geometry.alg
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\12345DES.ird
- C:\Projects\12345\Design\InRoads\DES12345_Templates.itl

Lab 12.1 - Adding an Additional Lane with Offset Point Controls

In this exercise the corridor created in the previous lab is modified by adding an additional lane to the right side of the template using a standard point control. This control is based on the centerline (SH 86) alignment and uses offset distances from this alignment to modify the template. Three control entries are required to complete the transition.

- 1. Select Modeler > Roadway Designer from InRoads.
- 2. Verify that the *12345DES* corridor is active.

The first point control transitions from two lanes to three lanes.

3. In the *Roadway Designer* dialog box, select **Corridor** > **Point Controls** from the menu

bar or $\langle D \rangle$ the point controls button $\stackrel{!!!}{=}$.

4. In the *Point Controls* dialog box, select **RT_HMA_Lift1_EOP-Top** for the point. Use the

```
drop down menu or <D> the "target" \clubsuit button and then <D> the point in the template view to make the selection.
```

5. Toggle on **Horizontal** for the *Mode*.

6. Set the *Horizontal Alignment* to SH 86.

ſ	M Point Contro	ls		- • •
	Corridor: 12345 Point:	DES	Station Limits Start: 203+80.28 +	Add Close
	Mode Horizontal	Vertical O Both	Stop: 260+43.16	Change
	Control Type: Horizontal Alignm	Alignment	Horizontal Offsets Start: 0.00 + Stop: 0.00 +	Help

- 7. Key in *220+00.00* in the *Station Limits Start* field.
- 8. Key in 222+50.00 in the Station Limits Stop field.
- 9. Key in *24* in the *Horizontal Offsets Start* field.
- 10. Key in **36** in the **Horizontal Offsets Stop** field.
- 11. **<D> Add**. The entry is added to the *Horizontal and Vertical Controls* list.

This creates the beginning transition for the additional lane.

Corridor: 12345DE	ç					
Point: Mode	RT_HMA_Lift1_E0	OF • + Sta		+ +		Add Close Change
Control Type:	Alignment		orizontal Offsets			Help
Horizontal Alignment:	SH 86	• + Sta	art: 24.00 20: 36.00	+		
		Sic	op: 0.00	+		
Horizontal and Vertic	1 al Controls:	12				
Horizontal and Vertic	al Controls:	Start Station	Stop Station	Mode	Туре	Control
Horizontal and Vertic E. P. Name X 1 LT_HMA_	al Controls:	Start Station 203+80.28	Stop Station 260+43.16	Mode Vertical	Superelevation	Section 1 LT_HMA_Lft
Horizontal and Vertic E. P. Name X 1 LT_HMA_ X 1 LT_HMA_	uft 1_EOP-Top	Start Station 203+80.28 203+80.28	Stop Station 260+43.16 260+43.16	Mode Vetical Vetical	Superelevation Superelevation	Section 1 LT_HMA_Lf Section 1 HMA_Lft 1_0
X 1 LT_HMA_ X 1 LT_HMA_ X 1 RT_HMA	Lift 1_EOP-Top Lift 1_Laneline-Top Lift 1_Laneline-Top	Start Station 203+80.28 203+80.28 203+80.28 203+80.28	Stop Station 260+43.16 260+43.16 260+43.16	Mode Vertical Vertical	Superelevation Superelevation Superelevation	Section 1 LT_HMA_Lift Section 1 HMA_Lift 1_0 Section 1 HMA_Lift 1_0
Horizontal and Vertic E. P. Name X 1 LT_HMA_ X 1 LT_HMA_ X 1 RT_HMA_ X 1 RT_HMA_ X 1 RT_HMA	Lift 1_EOP-Top Lift 1_EOP-Top Lift 1_Laneline-Top Lift 1_Laneline-Top Lift 1_EOP-Top	Start Station 203+80.28 203+80.28 203+80.28 203+80.28 203+80.28	Stop Station 260+43.16 260+43.16 260+43.16 260+43.16	Mode Vertical Vertical Vertical	Superelevation Superelevation Superelevation Superelevation	Section 1 LT_HMA_Lift Section 1 HMA_Lift 1_(Section 1 HMA_Lift 1_(Section 1 RT_HMA_Lift 1_(
Horizontal and Vertic E. P. Name X 1 LT_HMA_ X 1 LT_HMA_ X 1 RT_HMA_ X 1 RT_HMA_ X 1 RT_HMA	Lift 1_EOP-Top Lift 1_Laneline-Top Lift 1_Laneline-Top	Start Station 203+80.28 203+80.28 203+80.28 203+80.28	Stop Station 260+43.16 260+43.16 260+43.16	Mode Vertical Vertical	Superelevation Superelevation Superelevation	Section 1 LT_HMA_Lift Section 1 HMA_Lift 1_0 Section 1 HMA_Lift 1_0

The Point, Mode, Control Type, and Horizontal Alignment stay the same for the two remaining entries. Only the Stations and Offsets change. the second point control maintains the third lane.

12. Key in 222+50.00 in the Station Limits Start field.

- 13. Key in *229+00.00* in the *Station Limits Stop* field.
- 14. Key in *36.00* in the *Horizontal Offsets Start* field.
- 15. Key in **36.00** in the **Horizontal Offsets Stop** field.
- 16. **<D> Add**. This entry maintains the full width of the additional lane.

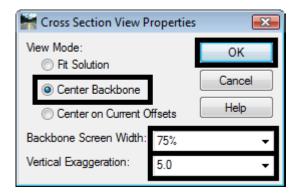
The third point control transitions from three lanes back to two lanes.

- 17. Key in 229+00.00 in the Station Limits Start field.
- 18. Key in *231+50.00* in the *Station Limits Stop* field.
- 19. Key in *36.00* in the *Horizontal Offsets Start* field.
- 20. Key in *24.00* in the *Horizontal Offsets Stop* field.
- 21. <D> Add. This entry transitions the template back to its normal width.
- 22. **<D> Close** to dismiss the *Point Controls* dialog box.

Ena	Priority	Name	Start Station	Stop Station	Mode	Туре	Control	
(1	RT_HMA_LIft1	.220+00.00	222+50.00	Horizontal	Alignment	SH 86	
<	1	RT_HMA_Lift1	222+50.00	229+00.00	Horizontal	Alignment	SH 86	
< C	1	RT_HMA_LIR1	229+00.00	231+50.00	Horizontal	Alignment	SH 86	-

This series of steps sets the display in the template view to a specific size. This makes it easier to see the transitions occur when scrolling through the stations.

- 23. <R> in the template view of the Roadway Designer dialog box and select **Display Properties** from the menu.
- 24. Toggle on Center Backbone.
- 25. Key in **75%** (.75) for the *Backbone Screen Width*.
- 26. Select 5 for the Vertical Exaggeration.
- 27. **<D> OK**. This makes the template change easier to see when scrolling through the stations.



- 28. Scroll through the stations between 220+00.00 and 231+50.00 and notice how the template behaves.
- 29. Select **File > Save** from the Roadway Designer menu bar.

Lab 12.2 - Creating a Scab-On Detour using Point Controls

In this exercise a scab-on detour is added to the left side of the existing pavement from station 206+00 to 215+00. This requires a new corridor, template drop, and two sets of point controls. One is a horizontal and vertical control that follows the existing edge of pavement. The second is a horizontal offset control that transitions the detour to its full width.

1. Select Corridor > Corridor Management from the Roadway Designer menu bar or

<D> the Manage Corridors button

- 2. In the *Manage Corridors* dialog box, key in *Scab-on Detour* for the *Name*.
- 3. Toggle on the *Station Limits*.
- 4. Key in *206+00.00* for the *Start* station.
- 5. Key in *215+00.00* for the *Stop* station.
- 6. **<D> Add**.
- 7. **<D> Close**.

Manage Corri Name: Scab-on [Limits V Station	Add
Type:	Alignmen		Start:	Close
Horizontal Alignme Vertical Alignment:	51100	<u>+</u> ▼	206+00.00 Stop:	Change Copy
PI Rounding Tang	ent: 0.00		215+00.00	+ Copy From
Corridors:				Help
Corridors: Name	Туре	Source Name	Start Station	Help Stop Station
	Type Alignment	Source Name SH 86	Start Station 203+80.28	
Name				Stop Station

This corridor could have been built on the edge of pavement feature from the dtm, but by using the alignment it will be easier to locate stations.

- 8. Select Corridor > Template Drops from the Roadway Designer menu bar or <D> the
 Template Drops button
- 9. In the *Template Drops* dialog box, key in *206+00.00* for the *Station*.
- 10. Key in *25* for the *Interval*.
- Expand the C:\Projects\12345\Design\InRoads\DES12345-Templates.itl >

 Templates folder in the *Library Templates* area and highlight the Scab-on Detour template.
- 12. **<D> Add**.
- 13. **<D> Close**.

🐂 Templat	e Drops			- • •
Corridor:	Scab-on Det	our 🔻		Add
Station: 2	206+00.00		•	Close
Interval:	25.00		+	Change
Library Temp	olates:		_	
×	HMA_Full_ HMA_Litba Scab-On D	led_TypeA_4Lane Depth_Widening_2La n_4Lane etour avement nd Conditions		Copy Help
Current Tem	plate Drops:			
Station	Interval	Template	Revised	Library
206+00.00	25.00	Scab-On Detour	ITL	C:\Projects\12345\Design\ln
Synchroniz	e with Librar	У		Edit Delete

The first point control moves the origin of the template from the SH 86 alignment to the left edge of pavement feature in the 12345 Existing Ground surface.

- 14. In the Roadway Designer dialog box, select **Corridor > Point Controls** from the menu bar or **<D>** the point controls button.
- 15. In the *Point Controls* dialog box, select HMA_Lift1_Shoulder-Top for the *Point*.

- 16. Toggle on **Both** for the *Mode*.
- 17. Select **Feature** for the *Control Type*.
- 18. Select **T_Traffic Single Solid White386** for the feature (This is the 18th T_Traffic Single Solid in the pull down list).
 - **Note:** Creating a feature filter will make it easier to locate the desired feature. The filter should *Start With* **None**, use the **Name** *Attribute*, and have a *Value* of **386**. See the module "*Initial Surface Procedures*" of the "*Practical Guide for InRoads V8i*" for more information in feature filters.
 - **Note:** The 12345 existing ground surface is the only dtm loaded so it is selected by default.
- 19. **<D> Add**.

Comdor: Scab-on De	tour						Add
Point:	HMA_Lift1_Shoulder -	+ Station L	imts 06+00.00	-			Cose
Mode Horizontal	Vetical @ Both		15+00.00	++			Ounge
	Feature -	Horizont	al Offsets				Help
Surface:	12345 existing grour ·	Start: 0		+			
Feature:	T_Traffic Single Solk ·	+ Stop: 0.	00	++++			
Use as Secondary /		Vertical (-			
		Start: 0		* +			
		Stop: 0	00	+			
Priority: Horizontal and Vertical	1 Controls:						
Enabled Priority	Name	Start Station	Stop Station	Mode	Type	Control	
K 1 F	IMA_Lift1_Shoulder-Top	205+00.00	215+00.00	Both	Feature	12345 existing ground T_Traffic Sing	e Sold White38

Notice that the template has moved to approximately 12 feet to the left. Next, a horizontal point control is created that transitions the detour to its full width.

- 20. In the *Point Controls dialog* box, set the *Point* to LT_HMA_Lift1_EOP-Top.
- 21. Toggle on **Horizontal** for the *Mode*.
- 22. Set the *Control Type* to Alignment.
- 23. Set the *Horizontal Alignment* to SH 86.
- 24. In the *Station Limits* area, key in *206+00.00* for the *Start* station.
- 25. Key in *208+50.00* for the *Stop* station.
- 26. In the *Horizontal Offsets* area, key in *-11.93* for the *Start* offset.
- 27. Key in *-24.00* for the *Stop* offset.

28. **<D> Add**.

The Point, Mode, Control Type, and Horizontal Alignment stay the same for the two remaining entries. Only the Stations and Offsets change. The steps below create a point control that maintains the detour's full width.

- 29. Key in 208+50.00 in the Station Limits Start field.
- 30. Key in *212+50.00* in the *Station Limits Stop* field.
- 31. Key in -24.00 in the Horizontal Offsets Start field.
- 32. Key in -24.00 in the Horizontal Offsets Stop field.
- 33. **<D> Add**. This entry maintains the full width of the additional lane.

The final point control transitions from the full width to the end of the detour.

- 34. Key in *212+50.00* in the *Station Limits Start* field.
- 35. Key in **215+00.00** in the **Station Limits Stop** field.
- 36. Key in -24 in the Horizontal Offsets Start field.
- 37. Key in -12.22 in the Horizontal Offsets Stop field.
 - **Note:** The offset distances entered are measured from the specified Horizontal alignment and not from the origin of the template.
- 38. <D> Add.

	and Vertica	al Controls:			11:02:5200	ST SCOOL M	
Enabled	Priority	Name	Start Station	Stop Station	Mode	Туре	Control
x	1	HMA_Lift1_Shoulder-Top	206+00.00	215+00.00	Both	Feature	12345 existing ground
x	1	LT_HMA_Lift1_EOP-Top	206+00.00	208+50.00	Horizontal	Alignment	SH 86
x	1	LT_HMA_Lift1_EOP-Top	208+50.00	212+50.00	Horizontal	Alignment	SH 86
X	1	LT_HMA_Lift1_EOP-Top	212+50.00	215+00.00	Horizontal	Alignment	SH 86

39. **<D> Close** to dismiss the *Point Controls* dialog box.

Scroll through the stations and notice how the template behaves. From station 206+00 to station 208+50 the template expands from the existing edge of pavement until it reaches its full width. Then it maintains that width from station 208+50 to station 212+50. Finally, it contracts back to the pavement edge from station 212+50 to station 215+00.

40. Select **File > Save** from the Roadway Designer menu bar.

Lab 12.3 - Using Horizontal Point Control and a Secondary Alignment

Alignments other than the design centerline can be used for horizontal controls. Typically, they are used to modify the width of the template. They can also be used to change the direction (in relation to the design centerline) that the template components are placed. When an alignment is used in this manner, it is called a secondary alignment.

This exercise uses a secondary alignment to create the beginning of an off ramp. A new corridor is created using the SH 86 alignment.

- 1. Select Corridor > Corridor Management from the Roadway Designer menu bar or <D> the Corridor Management button.
- 2. In the *Manage Corridors* dialog box, key in *Off Ramp* for the *Name*.
- 3. Toggle on the *Station Limits*.
- 4. Key in *205+00.00* for the *Start* station.
- 5. Key in *215+00.00* for the *Stop* station.
- 6. **<D> Add**.
- 7. **<D> Close**.

Name: Off Ramp			Limits V Station	Add
Туре:	Alignment	-	Start:	Close
Horizontal Alignme	nt: SH 86	• +	205+00.00	+ Change
Vertical Alignment:	SH 86 V	•	Stop:	Сору
PI Rounding Tang	ent: 0.00		215+00.00	+ Copy From.
				Help
Corridors: Name	Туре	Source Name	Start Station	Help Stop Station
Corridors: Name Scab-on Detour	Type Alignment	Source Name SH 86	Start Station 206+00.00	
Name				Stop Station

A single template drop is required for this corridor.

- 8. Select **Corridor** > **Template Drops** from the Roadway Designer menu bar or <**D**> the **Template Drops** button.
- 9. In the *Template Drops* dialog box, key in *205+00.00* for the *Start* station.

- 10. Key in *25* for the *Interval*.
- Expand the C:\Projects\12345\Design\InRoads\DES12345-Templates.itl > 1- Templates folder in the *Library Templates* area and highlight the CONC_4Lane_Right-Side_Only template.
- 12. <D> Add.
- 13. **<D> Close**.

🕌 Templ	ate Drops			- • •
Corridor:	Off Ramp		•]	Add
Station:	205+00.00		+	Close
Interval:	25.00		+	Change
Library Ter	-			
	CONC_Barr ← CONC_Rarr ← HMA_Crowr ← HMA_Divide ← HMA_Full_[← HMA_Urbar	ned_B10 ed_TypeA_4Lane Depth_Widening_ n_4Lane		Help
•		tour	- F	7
Current Te	mplate Drops:			
Station	Interval	Template	Revise	d Library
205+00.0	0 25.00	CONC_4Lane_F	Right ITL	C:\Projects\12345\De
•				
Synchron	nize with Library			Edit Delete

A horizontal point control is used to widen the template and reposition its components perpendicular to the Off Ramp alignment.

- 14. In the Roadway Designer dialog box, select **Corridor > Point Controls** from the menu bar or **<D>** the point controls button.
- 15. In the *Point Controls* dialog box, select **RT_Conc_Shoulder-Top** for the *Point*.
- 16. Toggle on **Horizontal** for the *Mode*.
- 17. Select Alignment for the *Control Type*.
- 18. Select Off Ramp for the *Horizontal Alignment*.

- 19. In the Station Limits area, key in *205+00.00* for the *Start* station.
- 20. Key in *215+00.00* for the *Stop* station.
- 21. Make sure the *Horizontal Offsets* are set to *O*.
- 22. Toggle on Use as Secondary Alignment.
- 23. **<D> Add**.
- 24. **<D> Close**.

Point Controls					- • •
Corridor: Off Ramp				[Add
Point: RT_Conc_Shot	lder ▼ +	Station Limits Start: 205+00	0.00	+	Close
Mode Horizontal O Vertical O	Both	Stop: 215+00		÷ (Change
Control Type: Alignment	.	Horizontal Off	sets		Help
Horizontal Alignment: Off Ramp	→ +	Start: 0.00		÷	
on hanp	<u> </u>	Stop: 0.00		÷	
Use as Secondary Alignment		Vertical Offset Start: 0.00 Stop: 0.00	5) ÷	
Priority: 1 Horizontal and Vertical Controls:					
E P Name	Start Station	Stop Station	Mode	Туре	Control
X 1 RT_Conc_Shoulder-Top	205+00.00	215+00.00	Horizontal	Alignment	Off Ramp
•					•
				[Delete

- 25. Scroll through the stations between 205+00.00 and 215+00.00 and notice how the template behaves. The orange line in the plan view and the template view represents the Off Ramp alignment. Notice how the template line (the yellow line in the plan view) outside the Off Ramp alignment changes so that it is perpendicular to the Off Ramp alignment.
- 26. Select File > Save from the *Roadway Designer* menu bar.

Lab 12.4 - Using Parametric Constraints to Widen the Road Surface

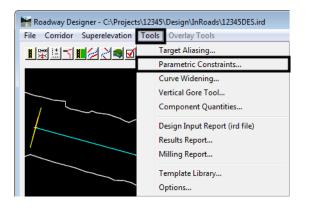
Parametric Constraints are used to modify the value of the constraint. This option allows greater flexibility of what can be modified during processing as slopes and vector/offsets can be modified in addition to the usual horizontal and vertical controls. In this exercise, the *Horizontal Constraint* of a template point is modified to widen the template on the left side. This is done in a similar manner to the first exercise.

The corridor used in Lab 6.1 is also used here.

1. In the Roadway Designer dialog box, select **12345DES** for the corridor.

+- <u>+</u> ++	-+ 🗖 🖬	+	•				4
Corridor:	12345DES -	Station:	< <	203+80.28	> > +		Process All
Active Surface:	12345 existing ground 🔹 🗖	Interval:		25.00			Process Visible Range
		Template:		HMA_Crowned_B10		Display Mode:	Normal
							 Superelevation Overlay

2. Select **Tools > Parametric Constraints** from the Roadway Designer menu bar.



- 3. In the *Parametric Constraints* dialog box, select LT_EOP-Top-Horiz for the *Constraint Label*.
- 4. Key in -36 for the Stop Value (the Start Value stays the same for this entry).
- 5. In the *Station Limits* area, key in *237+00.00* for the *Start* station.
- 6. Key in *239+50.00* for the *Stop* station.
- 7. <D> Add.

🐂 Parametric C	onstraints				- • •
Corridor:	12345DES		Station Limits		Add
Constraint Label:	LT_EOP-Top-Horiz	-	Start: 237+00.00	*	Close
Start Value:	-24.00		Stop: 239+50.00	+	Change
Stop Value:	-36.00				Help
Override Values:					Lich
Name	Start Value	Stop Value	Start Station	Stop S	Station
LT_EOP-Top-Ho	ri24.00	-36.00	237+00.00	239+50	0.00

- 8. Key in -36 for the Start Value (the Stop Value stays at -36).
- 9. In the *Station Limits* area, key in *239+50.00* for the *Start* station.
- 10. Key in *252+50.00* for the *Stop* station.
- 11. **<D> Add**.
- 12. Key in -24 for the Stop Value (the Start Value stays at -36).
- 13. In the *Station Limits* area, key in *252+50.00* for the *Start* station.
- 14. Key in *255+00.00* for the *Stop* station.
- 15. **<D> Add**.
- 16. **<D> Close**. This dismisses the *Parametric Constraints* dialog box.

Parametric Constraints				
Corridor:	12345DES		Station Limits Start: 252+50.00	Add Close
Constraint Label:				
Start Value:	-36.00		Stop: 255+00.00	+ Change
Stop Value:	-24.00			
Override Values:				
Name	Start Value	Stop Val	ue Start Station	Stop Station
LT_EOP-Top-Hori	z -24.00	-36.00	237+00.00	239+50.00
LT_EOP-Top-Hori	z -36.00	-36.00	239+50.00	252+50.00
LT_EOP-Top-Hori	z -36.00	-24.00	252+50.00	255+00.00
Export	Import			Delete

- 17. Scroll through the stations between 237+00.00 and 255+00.00 and notice how the template behaves.
- 18. Select File > Save from the *Roadway Designer* menu bar.
- 19. **<D> Close** to dismiss the Roadway Designer dialog box.

Chapter Summary:

- In *Lab 12.1 -Adding an Additional Lane with Offset Point Controls* Horizontal Point Controls were used to add an additional lane to the design. The control was based off the design centerline with offset distances measured from that alignment.
- Lab 12.2 -Creating a Scab-On Detour using Point Controls a Horizontal and Vertical Point Control was created to locate a template on the edge of the existing pavement. The edge of pavement feature from the existing ground surface was used to locate the template. A horizontal control based off the design centerline was also used to transition the template, creating the scab-on detour.

- In *Lab 12.3 Using Horizontal Point Control and a Secondary Alignment* a Horizontal Point Control using a Secondary Alignment was created. By changing the angle of the components outside of the secondary alignment, their shape is maintained around curves making this option ideal for ramps and street returns.
- Lab 12.4 -Using Parametric Constraints to Widen the Road Surface used Parametric Constraints to widen the road surface. The results were similar to those achieved in the first exercise but a different method was used.