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### About Retaining Wall Layout Procedures (For CFLHD employees)

The FLH criteria library supports nine wall types; Parapet, MSE, Soil Nail, SMSE, Cut, Fill, Gabion, Guardwall and Rockery. Creating a constructible wall layout is an iterative process, which requires the involvement of the Highway Engineer as well as the Structural and/or Geotechnical Engineer. The process requires two or three phases, depending upon the wall type. The first phase is to create the initial proposed cross sections, using the CFLHD default AdHoc attributes. From these cross sections, several chains and profiles are stored. This information is then given to the Structural/Geotechnical Engineer, to assist in the determination of the appropriate project specific design criteria that will be required. The second phase is to produce proposed cross sections that reflect a constructible wall profile and appropriate site specific design requirements.

# **Workflow: Parapet Wall Layout**

## Phase 1

- 1. Draw pattern lines every five feet through the wall site in the mainline pattern file. Use a different level for the pattern lines than the mainline cross section pattern lines. If the wall is located on a tight switchback curve, three-foot pattern lines will be needed to provide a smooth wall face. Additional cross sections may be required at the beginning and end to determine where the wall should begin and end.
- 2. Cut existing ground cross sections based on the pattern lines created in step 1.
- 3. Run the proposed cross sections. Use the default AdHoc attributes for the parapet wall dimensions, with the exception of the Parapet Thickness. Obtain this dimension from the Structural Engineer, as it will vary depending upon the type of wall facing and rail selected.
- 4. To create the Parapet Wall profiles, click on Reports & XS Quantities from the Road Project Manager dialog box as shown in the figure below.

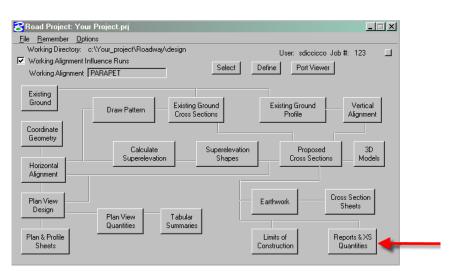


Figure 1-1: Reports & XS Quantities

5. Click on the Profile Grade button in the XS Report dialog box. This will open the Profile Grade Report dialog box. Fill in the Begin and End Station of the parapet wall station range as shown below. Do not include cross sections that do not require a parapet retaining wall.

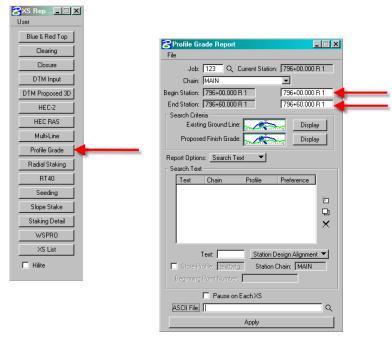


Figure 1-2: Profile Grade and Profile Grade Report

6. Under Search Criteria, click on the button next to Existing Ground Line. Add the Lv Names to the Existing Ground Line dialog as shown in the figure below. The Existing Ground Line dialog box should only have the existing ground level (X\_E\_Ground\_XS) in the Lv Names. Close the dialog box.

8	xisting Gro	und Line
	Lv Names:	X_E_Ground_XS
	v Numbers:	<u>〔</u>
	Colors:	ByLevel 🗖
	Styles:	ByLevel 📩
	Weights:	ByLevel 🗖
H	Match	Display Reset

Figure 1-3: Existing Ground Line Dialog

7. Under Search Criteria, click on the button next to Proposed Finish Grade. Add the Lv Names to the Proposed Finish Grade dialog. The Proposed Finish Grade must travel from

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catch point to catch point, and it must pass through the text points GU and BWFB (See Figure 1-7 for text locations). The following levels must be specified for a parapet retaining wall: X\_P\_Conc\_Wall\_Above; X\_P\_Conc\_Wall\_Below and X\_P\_Conc\_Wall\_Str\_Exc. The existing ground level (X\_E\_Ground\_XS) must also be included, to locate the TWFG text. Close the dialog box.

8 Proposed Finish Grade				
	Lv Name	s: onc_Wall_Str_Exc	も	
	Lv Number	s:	- i	
☑	Color	s: ByLevel	も	
▼	Style	s: ByLevel	も	
	Weight	s: ByLevel	も	
	Match	Undisplay Res	et	

Figure 1-4: Proposed Finish Grade Dialog

8. Pull down the Search Text menu and fill in the text dialog box as shown below. Select Station Text Alignment from the pull down menu. The Beginning Point Number should not be a point used in any other chain. Click on the Add tab to populate the search text field.

<b>8</b> Profile Grade Report		
File		
Job: 123 Q	Current Station: 796+00.000	31
Chain: MAIN	•	
Begin Station: 796+00.000	R 1 796+00.000	31
End Station: 796+60.000	R 1 796+60.000	31
C Search Criteria		
Existing Ground Lin	e: Displa	y l
Proposed Finish Grad	e: Displa	V I
Report Options: Search T	ext 🔻	
Search Text		
Text Chain	Profile Preference	
GU C1GU	P1GU TextAlig	
		Add
		×
Text: GU	Station Text Alignment	
Store Profile: P1GU	Store Chain: C1GU	
Beginning Point Number	c X1	
Pause or	n Each XS	
ASCII File: ur_project\F	?oadway\geopak\wall_test.pgr	Q
	Apply	

Figure 1-5: Add Profile & Chain at Gutterline (GU)

9. Add the search text for the Bottom of Wall Footing Back (BWFB) as shown below. Click on the Add tab to add the text to the search text box. Add the search text for the existing

ground at the wall footing (TWFG). Click on the Apply button to generate the chains and profiles based on the locations of the GU, BWFB and TWFG text (See Figure 1-7).

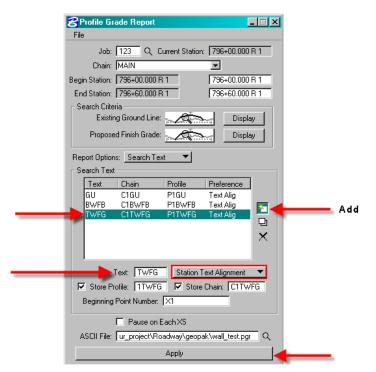


Figure 1-6: Add Profile & Chain at Bottom of Wall at Footing Back (BWFB) and at Existing Ground at Footing of Wall (TWFG)

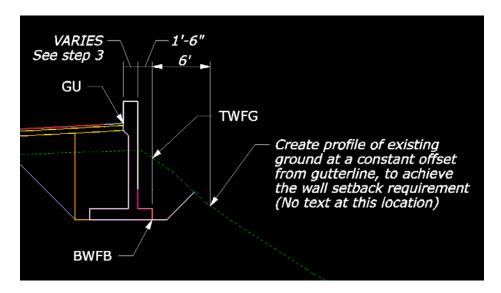


Figure 1-7: Search Text Locations

#### Note: All chains will begin at station 0+00

10. Create a new design file for the wall profiles (See CADD Standards Manual for naming conventions). Open the Draw Profile from the Geopak Road Tools dialog as shown in the figure below.

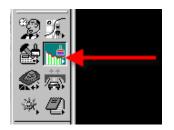


Figure 1-8: Geopak Tool Draw Profile

11. Select the gutterline chain (C1GU) in the Draw Profile Dialog box. Click on the dialog for Profile Cell Control as shown below.

File Edit Update Op			
Job Number:		Label Scale:	
Surfaces COGO Pro	pjection		
Type Neme	Display Sett	ings	Draw
		Q_	
Method.	Triangles 🔻		
Method: Display Settings	Triangles 🔻		
Method: Display Settings By Level Symbologi	Triangles 💙	Filter Toleran Horizontal:	0.300
Method: Display Settings By Level Symbologi Feature: No E	Triangles 💙	Filter Toleran Horizontal Variance:	0.300
Method: Display Settings By Level Symbologi	Triangles	Filter Toleran Horizontal:	0,300 0,100

Figure 1-9: Geopak Tool Draw Profile

12. Select the Active chain. Click on the Place Profile Cell in the Profile Cell Control dialog box as shown in the figure below.

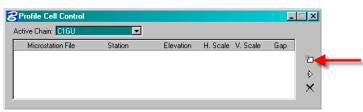


Figure 1-10: Profile Cell Control

13. Enter the beginning station, elevation (lower than proposed cross sections) and 1:1 scale in the Place Profile Cell dialog box. Then place the curser in the View 1 window and click to place the profile cell location as shown in below.

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<b>8</b> Place Profile Cell	<u> </u>	
Station:	0.000	
Elevation:	9000.000	
Horizontal Scale:	1.000000	
Vertical Scale:	1.000000	
	No Gap 🔻	
Cell Range		
Top Delta 🔻	50.000	
Bottom Delta 🔻	0.000	
-		
		123
		CIGU
		0.000000
		9000
		1
		1
		NOGAP

Figure 1-11: Place Profile Cell

14. The Profile Cell Control will appear with the Active Chain information as shown in the figure below. Close the Profile Cell Control box.

D,	Profile Cell Control			_	
	Active Chain: C1GU				
[	Microstation File	Station	Elevation H. Scale V. Scale	Gap	
	<ul> <li>A Active Design</li> </ul>	0+00.000	9000.00000 1.00 1.00		
					~
					<b>&gt;</b>
					$\times$

Figure 1-12: Active Profile Cell Information

15. Click on the COGO tab in the Draw Profile dialog box. Double click on the By Level Symbology field. Change the level symbology as shown below.

<b>2</b> Draw Profile				
File Edit Update Options				
Job Number: 123 Chain: C1GU	I A A Labe I Labe	l Scale: 0.000000		
COGO Projectio	n			
Name Dis	olay Settings	Draw		
Details				
Profile: Vertical Offset: 0		s +++++ 0+00.000 +++++	Symbology -	e 🔀
Display Settings			Level: AU	
By Level Symbology 💌		n Line Style ———	Color: E	3 💌
Feature: Ko Entries	> 🔽 占 🛄 Sea	ale factor: 0.0000	Weight	3 1
			▼ vigne	
VPI	(PI Labels From VPI Circle		ОК	Cancel
	irade Labels *+' and *' *			
		······, )		

Figure 1-13: Draw Profile COGO Tab

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16. Select the gutterline profile (P1GU) and click on the Add COGO Profile Settings as shown below. The gutterline profile will display in the design file.

Craw Profile	_		
File Edit Update Options			
Job Number: 123 💌 🦨 Chain: C1GU 💌	Label Scale: 0.00000	0	_
Surfaces COGO Projection			
Name Display Setting P1GU Lv: AUX_01, C	and Section 2, Wt: ByLevel ☑	Add	
Profile: P1GU Vertical Offset: 0.000			7221
Display Settings By Level Symbology Feature: < No Entries >	Custom Line Style		123 C160 0.880000 900
Coptions	From VPI		1 1 NOGAP

Figure 1-14: Draw Gutterline Profile

17. Click on the Projection tab in the Draw Profile dialog box. Select the chain and profile for the BWFB text. Double click on the By Level Symbology field and select the symbology as shown in the figure below and click on OK.

BDraw Profile	
File Edit Update Options	
Job Number: 123 🔽 🚓 🚰 Label Scale: 0.000000 Chain: C1GU 🔽	
Surraces Curra Projection	
Type Chain Profile/Surfa Display Settings Draw	
Details*	Symbology
Extraction from Surface     Filter Tolerances       TIN File:     Q       Horizontal:     0.300       Wethod:     Triangles	Level: AUX_02  Color: 6 Style: 0 Veight: 2
Display Settings       By Level Symbology       Feature:       No Entries >	DK Cancel

Figure 1-15: Project Profile for BWFB

18. Click on the Add COGO Profile Settings as shown in the figure below. The bottom of wall profile will be displayed in the design file.

8 Draw Profile			
File Edit Update Options			
Job Number: 123 💌 🚽	🕅 🚪 Label Scale: 🛛 0.000000		
Surfaces COGO Projection			
Type Chain Profile/Surfa Cogo C18WF8 P18WF8	i Display Settings Draw Lv: AUX_02, Co:\ 2 ☑ ↓	Add	
Details Type: <u>Cogo Chain</u> ▼ Chain: [C18WFB ▼ Profile: [P18WFB ▼ Vertical Offset: [0.000	Stationing Begin: 0.000 + +++ End: 61.291 ++++ Increment 0.000 POT		1 <u>123</u> C.I.G.U
Extraction from Surface     TIN File:     Method: Triangles	Q         Filter Tolerances           Horizontal:         0.300           Variance:         0.100		0.00000 9000 1. 1.
Display Settings By Level Symbology Feature: < No Entries >	Custom Line Style		▲ NOGAP

Figure 1-16: Draw Bottom of Wall Profile

19. Change the Details in the Draw Profile dialog box to the TWFG profile. Double click on the By Level Symbology field and select the symbology as shown below and click on OK.

8 Draw Profile	
File Edit Update Options	
Job Number: 123 💌 🚓 🚰 Label Scale: [0.000000] Chain: CTGU 💌	
Surfaces COGO Projection	
Type         Chain         Profile/Surfa         Display Settings         Draw           Cogo         C1BWFB         P1BWFB         Lv: AUX_02, Co:\2         ☑         ☑	
Details*         Stationing           Type:         Cogo Chain         Image: Stationing           Chain:         C1TwFG         Image: Stationing           Profile:         P1TwFG         Image: Stationing           Vertical Offset:         0.000         Image: Stationing	Set Feature
POT	Symbology Level: AUX_03
Extraction from Surface     Filter Tolerances       TIN File;     Q,       Method;     Triangles   Variance: 0.100	Color: 2 Style:
Display Settings	▼
By Level Symbology  Feature: < No Entries>	OK Cancel

Figure 1-17: Project Profile for TWFG

*20. Click on the Add COGO Profile Settings as shown below. The existing ground profile at the wall footing will display in the design file.* 

· · · · · · · · · · · · · · · · · · ·	
BDraw Profile	
File Edit Update Options	
Job Number: 123 💌 🥐 🚰 Label Scale: 0.000000	
Chain: C1GU	
Surfaces COGO Projection	
Type Chain Profile/Surfa Display Settings Draw	
Cogo C1BWFB P1BWFB Lv: AUX_02, Co:\2	
Cogo C1TWFG P1TWFG Lv: AUX_03, Co:\ 4 🗹 🖓	
×	
Details	
- Stationing	
Type: Cogo Chain ▼ Chain: C1TWFG ▼ Begin: 0.000 ↔	
Profile: P1TWFG End: 61.291	- - 
Vertical Offset: 0.000	123
POT	C1GU
Filter Tolerances	
TIN File: Q Horizontal: 0.300	0.000000
Method: Triangles Variance: 0.100	9000
Display Settings	5000
By Level Symbology	1
Feature: < No Entries >	4
μ	NOGAP

Figure 1-18: Draw Profile of Existing Ground at Footing Back

21. Create a profile of the existing ground at a constant offset (9-ft) from the gutterline chain (C1GU), (See Figure 1-7 for location). Select the Surfaces tab on the Draw Profile dialog, select the project TIN File, set the Display Settings as shown, add in a horizontal offset and select add to display the profile. To store the profile, select the "store in COGO" icon.

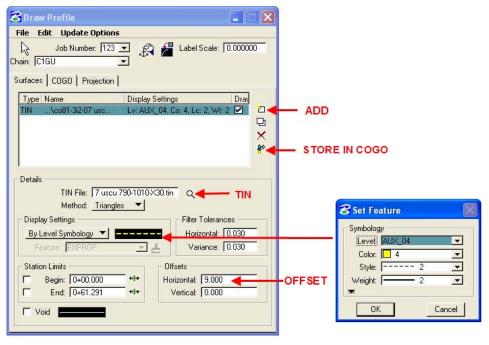


Figure 1-19: Draw Profile at Existing Ground at Offset from Gutterline

Note: Offsets to the left are negative values and offsets to the right are positive.

22. Label the profiles as shown below.

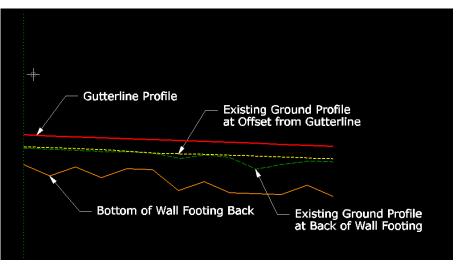


Figure 1-20: Labeled Wall Profiles

23. Send the dgn files with the plan view, profiles and cross sections to the Structural Engineer for the final wall layout design. Provide the Chain and Profile names for the four profiles. Include a print out of the AdHoc attributes used for the parapet wall as shown below.

SAdHoc Attribute Manage File	r		
□ \$° \$ \$ \$ \$ + →			
Name	Туре	Value	
Parapet Thickness	Numeric	1.500000	
Parapet Height	Numeric	2.250000	2
Embedment Depth	Numeric	2.000000	×
Structure Exc Width	Numeric	1.500000	``
Wall Exc Slope Back	String	1:1	
Wall Exc Slope Front	String	1:1	
Wall Backfill Depth	Numeric	2.000000	
BottomFootingProfName	String	none	
GutterlineChainName	String	none	
Foundation Depth	Numeric	0.000000	

Figure 1-21: Printout of AdHoc Attributes used for Phase 1 Parapet Wall Layout

### Phase 2

1. The Structural Engineer will provide a dgn file containing the designed profile for the bottom of the parapet wall footing. Store the profile supplied by the Structural Engineer as P1BFFP, based on the gutterline chain created in Phase 1 (C1GU). Click on Vertical Alignment from the Road Project Manager dialog box as shown below.

😤 Road Project: Your	r Project pri			
File Remember Optio				
	c:\Your_project\Roadw ifluence Runs	ay\design Select	User: sdiccicco Jo Define Port Viewer	b#: 123 🛄
Existing Ground	Draw Pattern	Existing Ground Cross Sections	Existing Ground Profile	Vertical Alignment
Coordinate Geometry Horizontal Alignment	Calculate Superelevat	on Superelevation	Proposed Cross Sections	3D Models
Plan View Design Plan & Profile Sheets	Plan View Quantities	Tabular Summaries	Earthwork	oss Section Sheets Reports & XS Quantities

Figure 2-1: Vertical Alignment

2. From the Settings dialog box, click on Identify Cell or select PGL Chain C1GU. Enter a Horizontal and Vertical Scale of 1. Click on the DP button and tentative snap to the origin of the Profile Cell and accept the data point. Click on OK.

8 Settings	
Job: 123 Q	
Operator Code: sd	
PGL Chain: C1GU  Location and Scales Horizontal Scale: 1.000000 Vertical Scale: 1.000000 Reference Station: 0+00.000 Reference Elevation: 3000.000000 X: 1120.000000 Y: 1120.000000	
Profile Cell           Draw Cell at XY         Identify Cell	
<u> </u>	

Figure 2-2: Vertical Alignment Settings Dialog

3. Click on the Dynamic button on the Profile Generator dialog box. Tentative Snap to the first VPI of the Parapet Wall Footing Profile and accept it. Click on the Insert button and then the Dynamic button. Tentative Snap to the second VPI and accept it. Continue the process until the entire profile has been input.

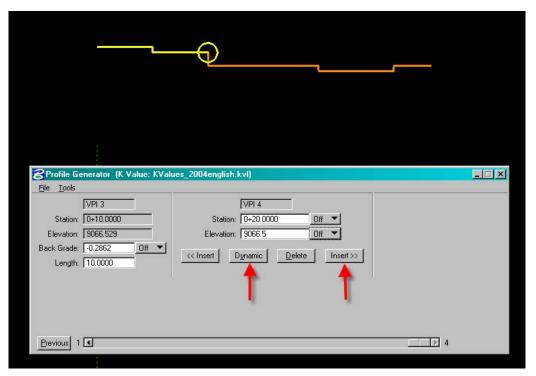


Figure 2-3: Generate Phase 2 Profile for Bottom of Parapet Wall Footing Using Profile Generator

4. Click on File and select Save Profile As. Save the profile as P1BFFP (Profile 1 Bottom of Footing Final Profile). Click on OK.

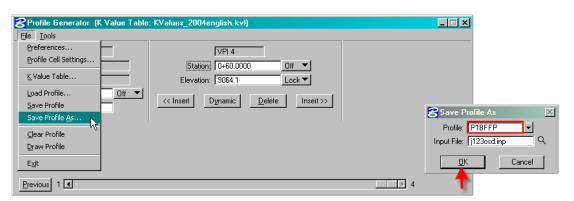


Figure 2-4: Save Phase 2 Profile for Bottom of Parapet Wall Footing

5. Open the proposed plan dgn file *containing the parapet wall AdHoc line. Open the AdHoc Attribute Manager as shown below. Click on File then Preferences. The Set Mode should be set to Replace. Close the Preferences dialog box.* 

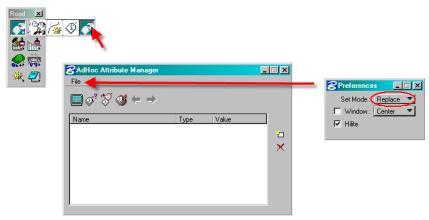


Figure 2-5: AdHoc Attribute Manager

6. Click on the Identify Element button as shown below. Double click on the plan view parapet wall line. The AdHoc Attributes of the line will then be displayed in the field.

SAdHoc Attribute Manager		<b>8</b> AdHoc Attribute Mar	ager		_ 🗆 🗵
File		File			
■		🗆 💽 💥 🚿 🔶	⇒		
Name Identify Element Type Value		Name	Туре	Value	
		Parapet Thickness	Numeric	1.500000	
		Parapet Height	Numeric	2.250000	2
	$\times$	Embedment Depth	Numeric	2.000000	×
	1.2	Structure Exc Width	Numeric	1.500000	
		Wall Exc Slope Back	String	1:1	
		Wall Exc Slope Front	String	1:1	
		Wall Backfill Depth	Numeric	2.000000	
		BottomFootingProfName	String	none	
		GutterlineChainName	String	none	
1		Foundation Depth	Numeric	0.000000	



7. To change any of the values, click on the value and type in the desired change as shown below. Include the bottom of wall footing profile, the gutterline chain and all other design parameters supplied by the Structural Engineer.

CAdHoc Attribute Man	ager		<u> </u>
	⇒		
Name	Туре	Value	
Parapet Thickness	Numeric	1.500000	
Parapet Height	Numeric	2.250000	
Embedment Depth	Numeric	2.000000	× 1
Structure Exc Width	Numeric	1.500000	- C -
Wall Exc Slope Back	String	1:1	
Wall Exc Slope Front	String	1:1	
Wall Backfill Depth	Numeric	2.000000	
BottomFootingProfName	String	P1BFFP	
GutterlineChainName	String	none 🗸	
Foundation Depth	Numeric	0.000000	

Figure 2-7: Adjust the AdHoc Values

8. If the Design and Computation Manager is open, make sure that the 'Place Influence' and 'AdHoc Attributes' are toggled off as shown below.

8609082000 CFL A	sphalt Pav 💶 🗙
Place Influence	
Adhoc Attributes	Match Point Text
🔲 New Element Only	Draw COGO Element
New Element Unly	Draw CUGU Element

Figure 2-8: Toggle Place Influence Off

9. Click on the Set Attributes button as shown below. Click on the Parapet wall line to identify it, and click again to accept the changes. To check if the changes have been stored, use the Identify Element button as described in step 6.

File	🧿 🔐 👉 🛛	<u>.</u>		
Name	Set Attributes		Value	
Parapet Thi		Numeric	1.500000	
Parapet Hei		Numeric	2.250000	7
Embedment	-	Numeric	2.000000	
Structure Ex		Numeric	1.500000	(
Wall Exc Sl	ope Back	String	1:1	
Wall Exc Si		String	1:1	
Wall Backfi		Numeric	2.000000	
BottomFooti	ngProfName	String	P1BFFP	
GutterlineCł	nainName	String	C1GU	
Foundation	Denth	Numeric	0.000000	

Figure 2-9: Change Parapet Wall AdHoc Attributes

- 10. Re-run the proposed cross sections with the new AdHoc attributes.
- 11. Re-draw the profiles as described in the Phase 1 procedures.
- 12. Send the dgn files with the plan view, cross sections and profiles to the Structural Engineer for review. Include a print out of the Adhoc attributes as shown in the figure above. Additional iterations of phase 2 procedures may be required.