

FLH Standard Criteria Files

User's Guide

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Input File Include Sequence

Criteria File	Cross-Section Elements Drawn by Criteria File	Comments
defaults.x08	None.	Required. Initializes global variables used by the standard criteria files.
except.dat	None.	Optional. May be used to specify station ranges for various criteria features such as paved ditch, retaining walls, fixed cut or fill slopes, etc.
fh_pavuc.x08	Pavement structure within the limits of the shapes.	Required. Include for side slope lt only; has no effect when included for side slope rt.
fh_eop.x08	Pavement widening	Required for both sides.
fh_wide.x08	Fixed slope widening	Optional. Use for fixed slope pullouts, etc.
fh_sh1.x08 fh_sh2.x08 fh_sh3.x08 fh_sh4.x08	Gravel shoulder widening	Optional. If included, only one should be used.
c_crb1d.x08 c_crb1s.x08 c_crb2d.x08 c_crb2s.x08 c_crb3d.x08 c_crb3s.x08 c_crb4s.x08 fh_crb1d.x08 fh_crb1s.x08 fh_crb2b.x08 fh_crb2t.x08	Curb or Curb/Gutter	Optional.
c_crbkfd.x08 c_crbkfs.x08	Curb Backfill	Optional. Must immediately follow a c_crb??x08 criteria
c_wlk1d.x08 c_wlk1s.x08 fh_wlk1b.x08 fh_wlk1t.x08	Sidewalk	Optional.
fh_pavd1.x08 fh_pavd2.x08 fh_pavd3.x08	Paved ditch	Optional.
c_gwall2s.x08 c_gwall3d.x08 c_gwall3s.x08	Guardwall	Optional.

Input File Include Sequence

fh_wall2.x08 fh_wall3.x08 fh_wall4.x08 fh_wall7.x08 fh_wall8.x08 c_wall8s.x08	Optional.	Optional.
fh_walcd.x08 fh_walc9.x08	Concrete cut walls	Optional
c_cwal1d.x08 c_cwal1s.x08	Concrete fill walls	Optional
fh_fs1.x08 fh_fs2.x08 fh_fs3.x08 fh_fs5.x08	Pavement structure foreslope	When designing with cut/fill hinge point at subgrade (WFL & CFL) one of these criteria files is usually required. When designing with cut/fill hinge point at top of pavement (EFL) these criteria files should never be used.
c_rkbt1d.x08 c_rkbt1s.x08	Rock buttresses	Optional
fh_specdit1.x08	Special ditches	Optional
fh_ss3.x08	Ditches, cut/fill slopes	This criteria file is required for almost every situation.
fh_ss_uc.x08	Extends pavement and base course layers out to intersect cut fill/lines drawn by fh_ss3.x0	Use this criteria file only when designing with cut/fill hinge point at the top of pavement (rather than at subgrade). (Generally only EFL will use this criteria file.)
fhex_fea.x08	Topsoil, existing pavement, rock layers	Optional.
fh_subx2.x08	Subexcavation	Optional.
fh_x_lim.x08	Excavation limit lines	Optional.
fh_cl.x08	Centerline annotation	Required for red/blue top report. Include on one side or the other, but not both sides.
fh_gr.x08	Guardrail	Optional. Draws picture of guardrail on x-sections.
addtext.x08	Marks additional red/blue top points	Use in separate post-processing run after proposed cross- sections have been drawn. (Optional)

Input File Include Sequence

fh_mark.x08	Places witness line and label	Use to mark on the x-sections the location of features drawn in the plan view file (e.g., right of way lines, utility lines, fence lines, etc.)
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Notes:

In CFL all these criteria files are in l:\criteria. The criterias should be included in the proposed cross-section input file using the directory and pathname rather than copying them into a user directory; this will assure that the user always has the most recent version of the criteria files.

side slope lt

```
include l:\criteria\defaults.x08  
include except.dat  
include l:\criteria\fh_pavuc.x08  
include l:\criteria\fh_eop.x08  
etc.
```

side slope rt

```
include l:\criteria\defaults.x08  
include except.dat  
include l:\criteria\fh_eop.x08  
etc.
```

FLH Standard Criteria Files

Section 2 –

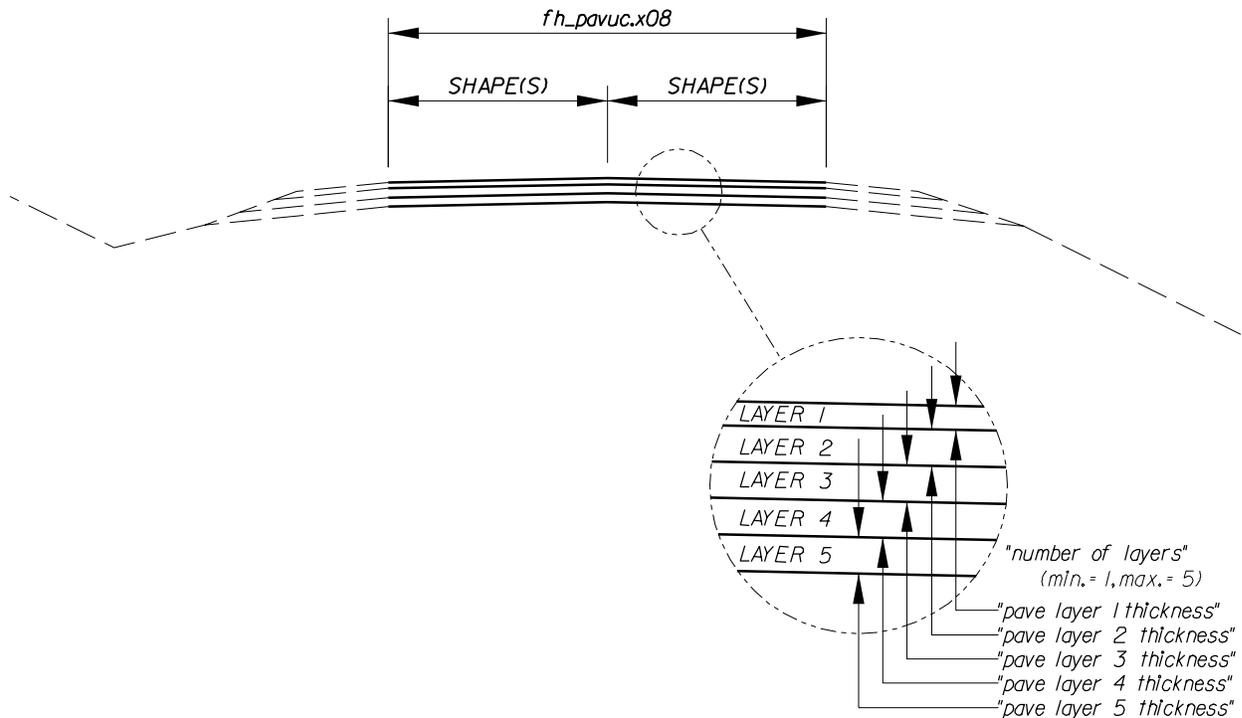
Roadway Structural Section Criteria Files

Roadway Structural Section Criteria Files

Criteria File	Elements Drawn by Criteria File
fh_pavuc.x08	Pavement and base course layers under the superelevation shapes.
fh_eop.x08	Widening of pavement and base course layers to a line drawn in plan view dgn file. Cross slope for all layers is same as the superelevation for the outermost shape.

fh_pavuc.x08

Draws all the pavement and base course layers within the limits of the superelevation shapes. (This criteria must be included in all proposed cross-section input files.)



define variables that must be assigned values in the input data file:

- "number of layers" (min. = 1, max. = 5)
- "pave layer 1 thickness"
- "pave layer 2 thickness"
- "pave layer 3 thickness"
- "pave layer 4 thickness"
- "pave layer 5 thickness"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

None

Notes for fh_pavuc.x08:

1. This criteria file must be included in all proposed cross-section input files.
2. Only include this criteria file in the side slope lt section of the input file. It has no effect if it is included in the side slope rt section.

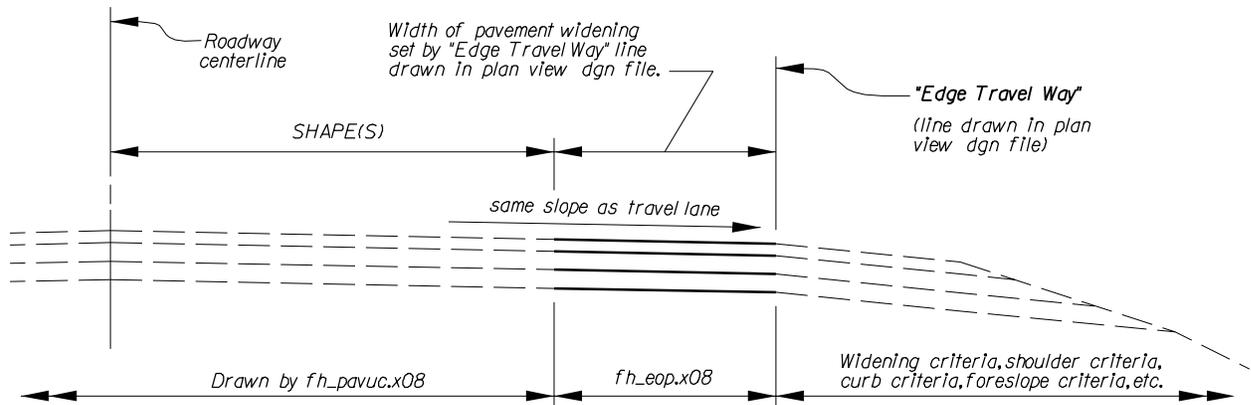
fh_pavuc.x08

Notes for fh_pavuc.x08 (continued):

3. Maximum number of layers that this criteria is written to handle is five. (base course layers plus pavement layers)
4. Draws all the pavement and base course layers within the limits of the superelevation shapes on both sides of the centerline. (Despite the fact that it is included only for the left side.)
5. Maximum number of shapes that this criteria is written to handle is six. The shapes can be located in any configuration (e.g., one shape on either side of centerline, five shapes on the left and one shape on the right side, etc.)
6. By default, a slope label is placed for the superelevation of each shape. If slope labels aren't needed, add a *define "~place super slope labels" 0* statement to the input file to turn them off.
7. Text size for the superelevation slope labels may be set with by adding a *define "text size" nnn* (where nnn is the desired text size) statement to the input file. By default the text size is set to 0.30. (The "text size" value applies to the slope labels created by all the criteria files.)

fh_eop.x08

Draws widening of the pavement and base course to a line drawn in plan view dgn file using the same slope as the outside travel lane. (This criteria must be included in all proposed cross-section input files.)



define variables that must be assigned values in the input data file:

same as for fh_pavuc.x08

define_dgn variables that must be assigned values in the input data file:

"Edge Travel Way"

"approach road match"

Variables that must be defined in exceptions data file:

None

Notes for fh_eop.x08:

1. This criteria file must be included in all proposed cross-section input files in both the side slope lt section and the side slope rt section. Several variables used by subsequent criteria files are initialized here.
2. All pavement and base course layers are widened out to the "Edge Travel Way" line drawn in plan view dgn file. If "Edge Travel Way" line isn't found, then no pavement widening is drawn.
3. Widening of pavement and base course layers is always the same slope as the slope of the outside pavement shape.
4. This criteria is typically used for curve widening, etc.
5. The "first full length layer" parameter has no effect on anything drawn by this criteria (e.g., all layers are full length always).
6. The define_dgn variable "approach road match" is used to force the criteria file to draw a vertical line tying off all the pavement and base course layers of the structural. Nothing further is drawn by any of the criteria files.

FLH Standard Criteria Files

Section 3 –

Fixed-Slope Shoulder Widening Criteria Files

Fixed-Slope Shoulder Widening Criteria Files

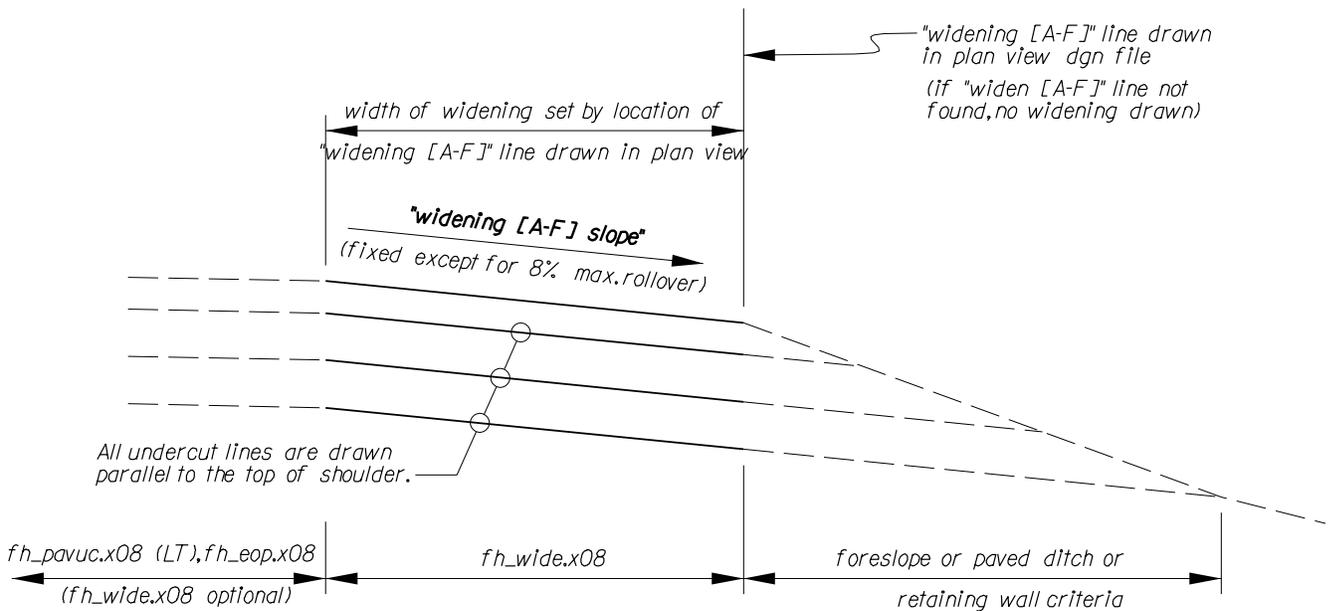
These criteria files will draw up to a maximum of six different fixed slope shoulder widenings. Each of the widenings has its own fixed slope and uses its own line drawn in plan view dgn file to set the widening width and station range.

Criteria File	Rules for Drawing Shoulder Widening
fh_wide.x08	Shoulder widening slopes are fixed (except for 8% maximum rollover from travel lane to shoulder). Shoulder widening widths are set by a lines drawn in plan view dgn file. Undercut layers parallel to shoulder finish grade slope.

fh_wide.x08

Draws up to six different fixed slope/variable width roadway widenings with the following properties:

- each widening is independent
- each widening has its own fixed slope (except as noted in next item)
- any one or all of the widening slopes will be adjusted as required to maintain a maximum rollover of 8% from the travel lane to the shoulder
- each widening uses a line different line drawn in plan view dgn to locate the outside limit of the widening (i.e., its width)
- station ranges for the various widenings are controlled by the location of the widening lines drawn in plan view dgn file
- slope of the undercut layers parallel to shoulder finish grade slope



define variables that must be assigned values in the input data file:

- "widening A slope" (e.g., 10 = 10% down and away from centerline)
- "widening B slope"
- "widening C slope"
- "widening D slope"
- "widening E slope"
- "widening F slope"

define_dgn variables that must be assigned values in the input data file:

- "widening A"
- "widening B"
- "widening C"
- "widening D"
- "widening E"
- "widening F"

fh_wide.x08

Variables that must be defined in exceptions data file:

None

Notes for fh_wide.x08:

1. This criteria file is optional. If the user does decide to include it in the proposed cross-section input file, then values must be assigned in the input file to all fourteen of the variables "widening [A-F]" and "widening [A-F] slope".
2. If none of the "widening [A-F]" lines are found in the plan view dgn file for a given cross-section, then nothing will be drawn by this criteria file at that cross-section.
3. Widening will be drawn only for the first of the "widening [A-F] lines found at a given cross-section. For example, if you have a "widening B" line drawn outside a "widening A" line for a particular cross-section, only the A widening will be found and drawn on the cross-section at that station. (i.e., This criteria won't do "compound" widening.)
4. The slope of all shoulder undercut layers is drawn to match the "widening [A-F] slope".
5. This criteria expects the values the user supplies for "widening [A-F] slope" to be percent values with a positive values meaning a slope down and away from the roadway centerline. (Just the opposite of the standard GEOPAK slope sign convention.)
6. The "first full length layer" variable controls whether the widening is paved ("first full length layer" = 1) or a gravel ("first full length layer" = 2 or more).

FLH Standard Criteria Files

Section 4 –

Roadway Shoulder Criteria Files

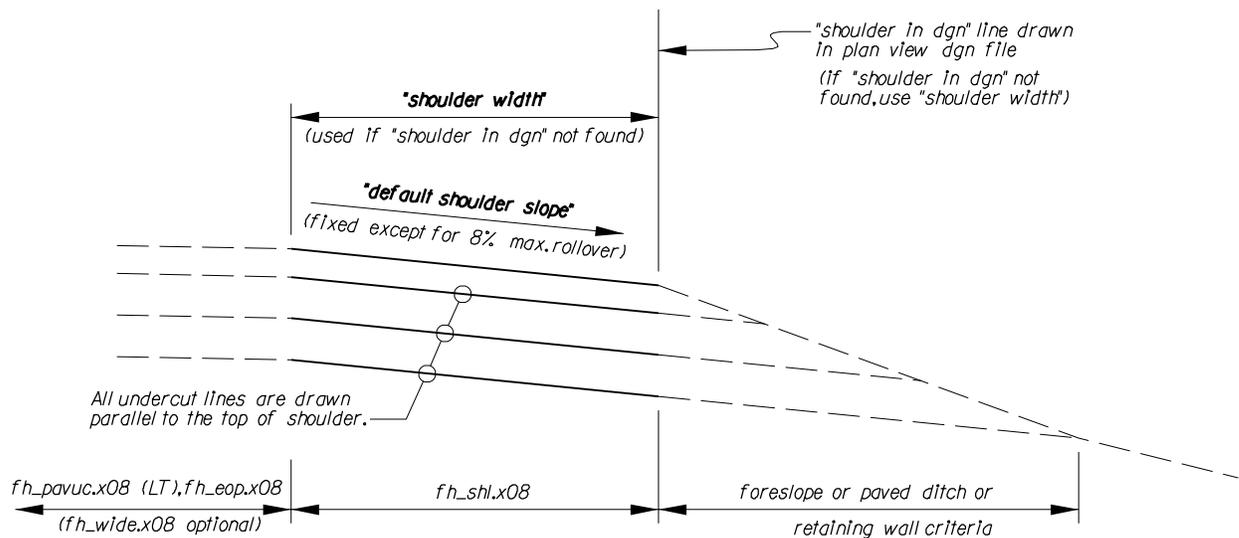
Roadway Shoulder Criteria Files

Criteria File	Rules for Drawing Shoulder
fh_sh1.x08	Shoulder slope is fixed (except for 8% maximum rollover from travel lane to shoulder). Shoulder width set by a line drawn in plan view dgn file. If line representing shoulder width isn't found in plan view dgn, then use default shoulder width. Undercut layers parallel to shoulder finish grade.
fh_sh2.x08	Shoulder slope is fixed (except for 8% maximum rollover from travel lane to shoulder). Shoulder width set by a line drawn in plan view dgn file. If line representing shoulder width isn't found in plan view dgn, then use default shoulder width. Undercut layers parallel to travel lane slope (rather than shoulder slope).
fh_sh3.x08	Shoulder slope is always the same as the travel lane slope. Shoulder width set by a line drawn in plan view dgn file. If line representing shoulder width isn't found in plan view dgn, then use default shoulder width. Undercut layers parallel to shoulder finish grade.
fh_sh4.x08	Shoulder slope is fixed (8% maximum rollover not checked). Shoulder width set by a line drawn in plan view dgn file. If line representing shoulder width isn't found in plan view dgn, then use default shoulder width. Undercut layers parallel to travel lane slope (rather than shoulder slope).
c_sh5.x08	Copy of fh_sh3.x08 with revised blue top point location. Shoulder slope is always the same as the travel lane slope. Shoulder width set by a line drawn in plan view dgn file. If line representing shoulder width isn't found in plan view dgn, then use default shoulder width. Undercut layers parallel to shoulder finish grade.
fh_sh6.x08	Copy of fh_sh3.x08 revised so that if a "guardrail in dgn" line is found then the pavement layer is terminated at the guardrail. Otherwise pavement layer daylights to foreslope. Shoulder slope is always the same as the travel lane slope. Shoulder width set by a line drawn in plan view dgn file. If line representing shoulder width isn't found in plan view dgn, then use default shoulder width. Undercut layers parallel to shoulder finish grade.

fh_sh1.x08

Draws roadway shoulder with the following properties:

- shoulder slope is fixed (except as noted in next item)
- shoulder slope will be adjusted as required to maintain a maximum rollover of 8% from the travel lane to the shoulder
- width of shoulder varies to match a line drawn in plan view dgn file representing the outside of the shoulder
- if the shoulder line in plan view dgn file isn't found, then the width of the shoulder defaults to a fixed value
- slope of shoulder undercut layers parallel to shoulder finish grade slope



define variables that must be assigned values in the input data file:

"shoulder width"

"default shoulder slope" (e.g., 10 = 10% down and away from centerline)

"first full length layer"

define_dgn variables that must be assigned values in the input data file:

"shoulder in dgn"

Variables that must be defined in exceptions data file:

None

Notes for fh_sh1.x08:

1. The slope of the shoulder is fixed except for the case when the rollover from the travel lane to the shoulder is greater than 8%. In that case, the slope of shoulder is adjusted to maintain an 8% rollover from the travel way.

fh_sh1.x08

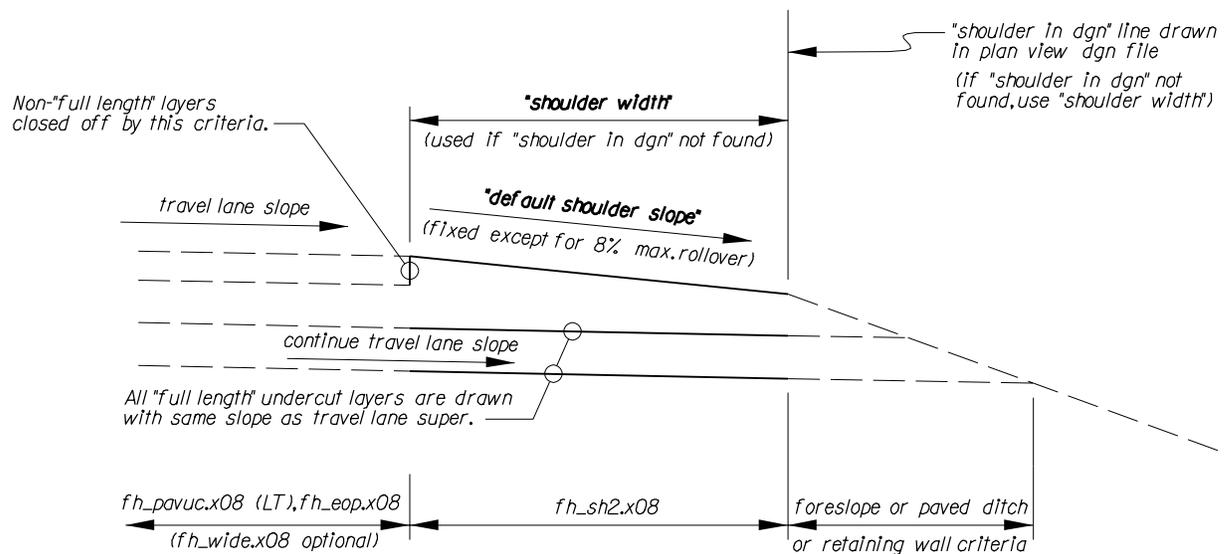
Notes for fh_sh1.x08 (continued):

2. If the "shoulder in dgn" line is found in the plan view dgn file, then widen the shoulder to that line. If "shoulder in dgn" isn't found, then the "shoulder width" is used as the default shoulder width.
3. All the pavement and base course undercut layers are drawn parallel to the finish grade of the shoulder. (Contrast this fh_sh2.x08 which draws undercut layers parallel to the finish grade of the travel lane rather than the finish grade of the shoulder.)
4. The "first full length layer" variable controls whether the shoulder is a paved shoulder ("first full length layer" = 1) or a gravel shoulder ("first full length layer" = 2 or more).
5. To use this criteria file to add shoulder to the roadway cross-section only in specific station ranges, set "shoulder width" to 0 and draw "shoulder in dgn" only in the areas where shoulder is wanted.
6. By default, a slope label is placed for the shoulder. If the slope label isn't needed, add a *define "~place shoulder slope labels" 0* statement to the input file to turn them off.
7. Text size for the shoulder slope label may be set with by adding a *define "text size" nnn* (where *nnn* is the desired text size) statement to the input file. By default the text size is set to 0.30. (The "text size" value applies to the slope labels created by all the criteria files.)
8. This criteria file is optional.

fh_sh2.x08

Draws roadway shoulder with the following properties:

- shoulder slope is fixed (except as noted in next item)
- shoulder slope will be adjusted as required to maintain a maximum rollover of 8% from the travel lane to the shoulder
- width of shoulder varies to match a line drawn in plan view dgn file representing the outside of the shoulder
- if the shoulder line in plan view dgn file isn't found, then the width of the shoulder defaults to a fixed value
- slope of shoulder undercut layers parallel to travel lane slope (rather than parallel to shoulder finish grade slope)



define variables that must be assigned values in the input data file:

- "shoulder width"
- "default shoulder slope" (e.g., 10 = 10% down and away from centerline)
- "first full length layer"

define_dgn variables that must be assigned values in the input data file:

- "shoulder in dgn"

Variables that must be defined in exceptions data file:

None

Notes for fh_sh2.x08:

1. The slope of the shoulder is fixed except for the case when the rollover from the travel lane to the shoulder is greater than 8%. In that case, the slope of shoulder is adjusted to maintain an 8% rollover from the travel way.

fh_sh2.x08

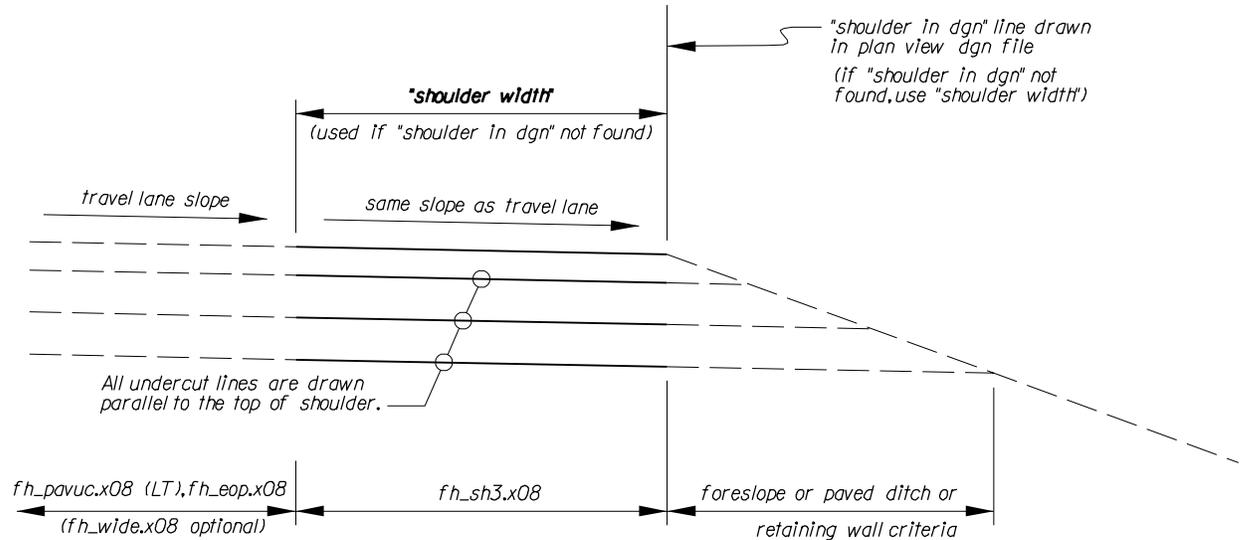
Notes for fh_sh2.x08 (continued):

2. If the "shoulder in dgn" line is found in the plan view dgn file, then widen the shoulder to that line. If "shoulder in dgn" isn't found, then the "shoulder width" is used as the default shoulder width.
3. All the pavement and base course undercut layers are drawn parallel to the travel lane slope (rather than parallel to the top of shoulder finish grade).
4. The "first full length layer" variable controls whether the shoulder is a paved shoulder ("first full length layer" = 1) or a gravel shoulder ("first full length layer" = 2 or more). Normally this criteria would be used for a gravel shoulder ("first full length layer" = 2).
5. To use this criteria file to add shoulder to the roadway cross-section only in specific station ranges, set "shoulder width" to 0 and draw "shoulder in dgn" only in the areas where shoulder is wanted.
6. By default, a slope label is placed for the shoulder. If the slope label isn't needed, add a *define* "*~place shoulder slope labels*" 0 statement to the input file to turn them off.
7. Text size for the shoulder slope label may be set with by adding a *define* "*text size*" *nnn* (where *nnn* is the desired text size) statement to the input file. By default the text size is set to 0.30. (The "text size" value applies to the slope labels created by all the criteria files.)
8. This criteria file is optional.

fh_sh3.x08

Draws roadway shoulder with the following properties:

- shoulder slope is always the same as the travel lane slope
- width of shoulder varies to match a line drawn in plan view dgn file representing the outside of the shoulder
- if the shoulder line in plan view dgn file isn't found, then the width of the shoulder defaults to a fixed value
- slope of shoulder undercut layers parallel to shoulder finish grade slope (and travel lane slope)



define variables that must be assigned values in the input data file:

- "shoulder width"
- "first full length layer"

define_dgn variables that must be assigned values in the input data file:

- "shoulder in dgn"

Variables that must be defined in exceptions data file:

None

Notes for fh_sh3.x08:

1. The slope of the shoulder is always the same as the travel lane slope.
2. If the "shoulder in dgn" line is found in the plan view dgn file, then widen the shoulder to that line. If "shoulder in dgn" isn't found, then the "shoulder width" is used as the default shoulder width.
3. All the pavement and base course undercut layers are drawn parallel to the shoulder finish grade slope (and the travel lane slope).

fh_sh3.x08

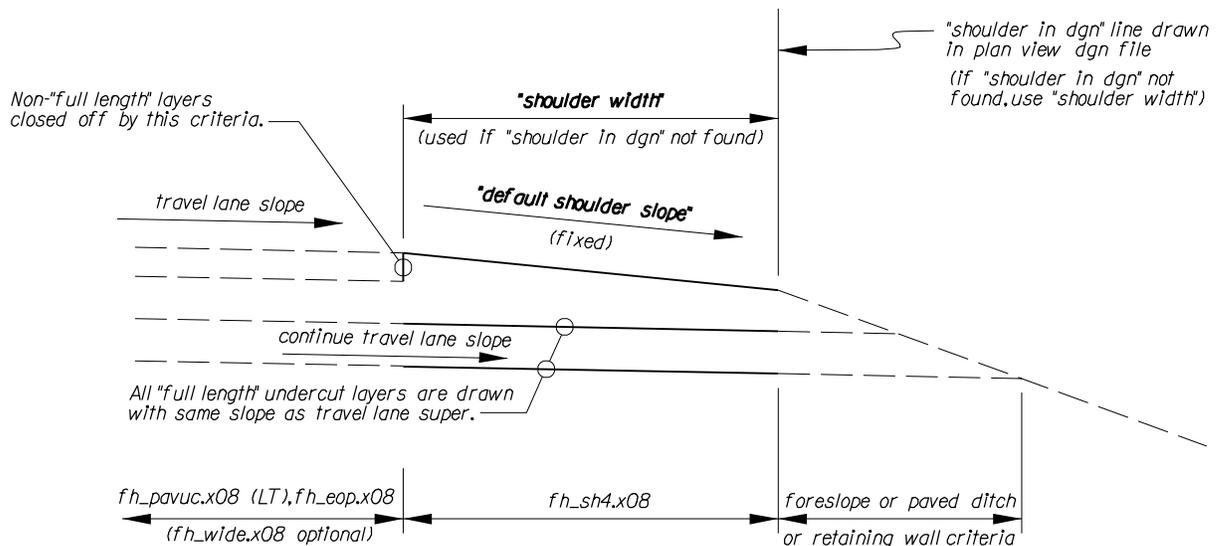
Notes for fh_sh3.x08 (continued):

4. The "first full length layer" controls whether the shoulder is a paved shoulder ("first full length layer" = 1) or a gravel shoulder ("first full length layer" = 2 or more).
5. To use this criteria file to add shoulder to the roadway cross-section only in specific station ranges, set "shoulder width" to 0 and draw "shoulder in dgn" only in the areas where shoulder is wanted.
6. This criteria effectively does the same thing as fh_eop.x08 with the exception that in this criteria the user can specify a default width that will be used when the shoulder line in plan view dgn file isn't found.
7. By default, a slope label is placed for the shoulder. If the slope label isn't needed, add a *define* "*~place shoulder slope labels*" 0 statement to the input file to turn them off.
8. Text size for the shoulder slope label may be set with by adding a *define* "*text size*" *nnn* (where *nnn* is the desired text size) statement to the input file. By default the text size is set to 0.30. (The "text size" value applies to the slope labels created by all the criteria files.)
9. This criteria file is optional.

fh_sh4.x08

Draws roadway shoulder with the following properties:

- shoulder slope is fixed (8% rollover limit from travel lane to shoulder never checked)
- width of shoulder varies to match a line drawn in plan view dgn file representing the outside of the shoulder
- if the shoulder line in plan view dgn file isn't found, then the width of the shoulder defaults to a fixed value
- slope of shoulder undercut layers is parallel to travel lane slope (rather than parallel to shoulder finish grade slope)



define variables that must be assigned values in the input data file:

"shoulder width"

"default shoulder slope" (e.g., 10 = 10% down and away from centerline)

"first full length layer"

define_dgn variables that must be assigned values in the input data file:

"shoulder in dgn"

Variables that must be defined in exceptions data file:

None

Notes for fh_sh4.x08:

1. The slope of the shoulder is fixed. The 8% rollover limit from travel lane to shoulder is never checked.
2. If the "shoulder in dgn" line is found in the plan view dgn file, then widen the shoulder to that line. If "shoulder in dgn" isn't found, then the "shoulder width" is used as the default shoulder width.

fh_sh4.x08

Notes for fh_sh4.x08 (continued):

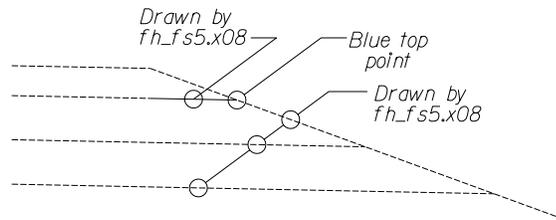
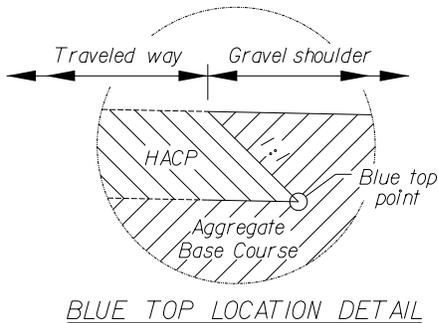
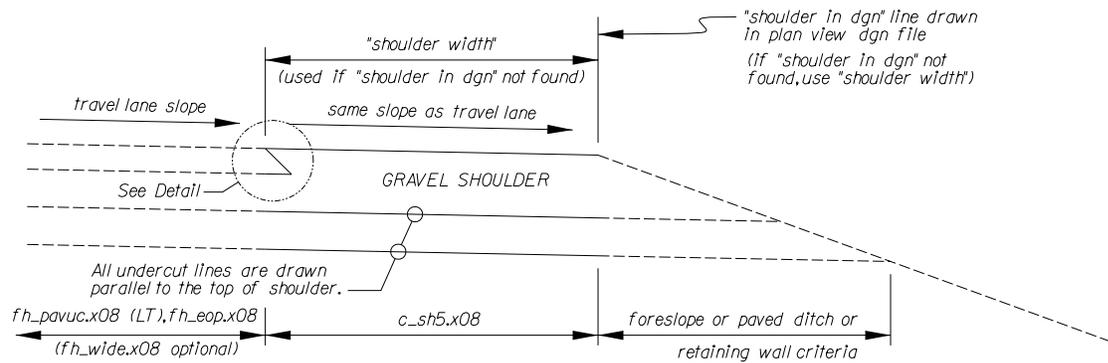
3. All the pavement and base course undercut layers are drawn parallel to the finish grade of the shoulder. (Contrast this fh_sh2.x08 which draws undercut layers parallel to the finish grade of the travel lane rather than the finish grade of the shoulder.)
4. The "first full length layer" variable controls whether the shoulder is a paved shoulder ("first full length layer" = 1) or a gravel shoulder ("first full length layer" = 2 or more). Normally this criteria would be used with a gravel shoulder ("first full length layer" = 2).
5. To use this criteria file to add shoulder to the roadway cross-section only in specific station ranges, set "shoulder width" to 0 and draw "shoulder in dgn" only in the areas where shoulder is wanted.
6. By default, a slope label is placed for the shoulder. If the slope label isn't needed, add a *define* "*~place shoulder slope labels*" 0 statement to the input file to turn them off.
7. Text size for the shoulder slope label may be set with by adding a *define* "*text size*" *nnn* (where *nnn* is the desired text size) statement to the input file. By default the text size is set to 0.30. (The "text size" value applies to the slope labels created by all the criteria files.)
8. This criteria file is optional.

c_sh5.x08

Copy of fh_sh3.x08 with revised blue top point location (see detail below).

Draws roadway shoulder with the following properties:

- shoulder is gravel, not paved
- shoulder slope is always the same as the travel lane slope
- width of shoulder varies to match a line drawn in plan view dgn file representing the outside of the shoulder
- if the shoulder line in plan view dgn file isn't found, then the width of the shoulder defaults to a fixed value
- slope of shoulder undercut layers parallel to shoulder finish grade slope (and travel lane slope)



SPECIAL CASE

For the special case where:

1. "shoulder in dgn" line is not found, AND
 2. "shoulder width" is set to 0
- the bottom of pavement layer is daylighted to the foreslope. (The foreslope criteria used MUST be fh_fs5.x08 for this to work correctly.)

define variables that must be assigned values in the input data file:

"shoulder width"

"first full length layer" (always set this variable to 2 when using this criteria)

define_dgn variables that must be assigned values in the input data file:

"shoulder in dgn"

Variables that must be defined in exceptions data file:

None

c_sh5.x08

Notes for c_sh5.x08:

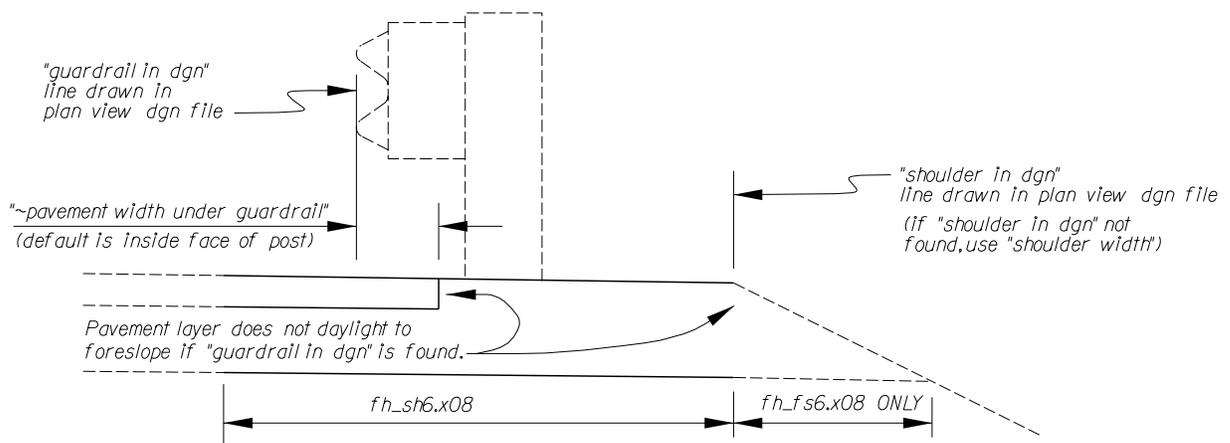
1. This criteria is intended to draw only roadway templates that have gravel shoulders. If you have a paved shoulder, use one of the other shoulder criteria files.
2. This criteria is a revised version of fh_sh3.x08. It was written as per a request from Construction to locate the blue top for roadways with gravel shoulders at a 1:1 slope downward from the nominal edge of pavement. (fh_sh3.x08 locates the blue top point vertically downward from the nominal edge of pavement.)
3. If the "shoulder in dgn" line isn't found and "shoulder width" is set to zero, the pavement layer is daylighted to the foreslope and the blue top point is on the foreslope. (This special case will be drawn correctly only if foreslope criteria fh_fs5.x08 is used.)
4. The slope of the shoulder is always the same as the travel lane slope.
5. If the "shoulder in dgn" line is found in the plan view dgn file, then widen the shoulder to that line. If "shoulder in dgn" isn't found, then the "shoulder width" is used as the default shoulder width.
6. All the pavement and base course undercut layers are drawn parallel to the shoulder finish grade slope (and the travel lane slope).
7. The "first full length layer" controls whether the shoulder is a paved shoulder ("first full length layer" = 1) or a gravel shoulder ("first full length layer" = 2 or more). When using this criteria, "first full length layer" should always be set to 2.
8. To use this criteria file to add shoulder to the roadway cross-section only in specific station ranges, set "shoulder width" to 0 and draw "shoulder in dgn" only in the areas where shoulder is wanted.
9. This criteria effectively does the same thing as fh_eop.x08 with the exception that in this criteria the user can specify a default width that will be used when the shoulder line in plan view dgn file isn't found.
10. By default, no slope label is placed for the shoulder. If the slope label is needed, add a define "~place shoulder slope labels" 1 statement to the input file to turn them on.
11. Text size for the shoulder slope label may be set with by adding a define "text size" nnn (where nnn is the desired text size) statement to the input file. By default the text size is set to 0.30. (The "text size" value applies to the slope labels created by all the criteria files.)
12. This criteria file is optional.

fh_sh6.x08

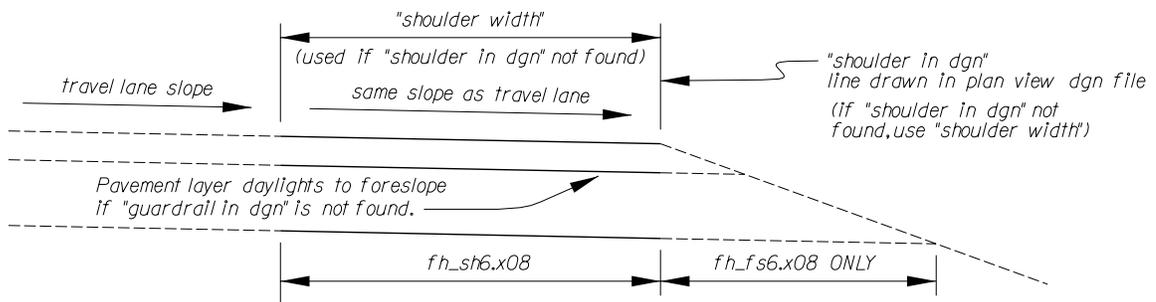
Draws roadway shoulder with the following properties:

- pavement layer is terminated at guardrail post if a "guardrail in dgn" line is found; otherwise pavement layer daylights to foreslope.
- shoulder slope is always the same as the travel lane slope
- width of shoulder varies to match a line drawn in plan view dgn file representing the outside of the shoulder
- if the shoulder line in plan view dgn file isn't found, then the width of the shoulder defaults to a fixed value
- slope of shoulder undercut layers parallel to shoulder finish grade slope (and travel lane slope)

Shoulder as drawn by fh_sh6.x08 if "guardrail in dgn" line is found:



Shoulder as drawn by fh_sh6.x08 if "guardrail in dgn" line is not found:



define variables that must be assigned values in the input data file:

"shoulder width"

define_dgn variables that must be assigned values in the input data file:

"shoulder in dgn"

"guardrail in dgn"

fh_sh6.x08

Variables that must be defined in exceptions data file:

None

Notes for fh_sh6.x08:

1. This criteria was written to address the situation where the designer wants to end the pavement layer at the inside face of the guardrail post for guardrail sections, but for non-guardrail sections wants the pavement to daylight to the foreslope. (This is a modified version of fh_sh3.x08.)
2. This shoulder criteria must be used in combination with foreslope criteria fh_fs6.x08. None of the other foreslope criteria files will work correctly with this shoulder criteria.
3. Unlike all the other shoulder criteria files, this criteria file completely ignores the "first full length layer" variable.
4. The slope of the shoulder as drawn by this criteria is always the same as the travel lane slope.
5. If the "shoulder in dgn" line is found in the plan view dgn file, then widen the shoulder to that line. If "shoulder in dgn" isn't found, then the "shoulder width" is used as the default shoulder width.
6. All the pavement and base course undercut layers are drawn parallel to the shoulder finish grade slope (and the travel lane slope).
7. To use this criteria file to add shoulder to the roadway cross-section only in specific station ranges, set "shoulder width" to 0 and draw "shoulder in dgn" only in the areas where shoulder is wanted.
8. This criteria effectively does the same thing as fh_eop.x08 with the exception that in this criteria the user can specify a default width that will be used when the shoulder line in plan view dgn file isn't found.
9. A hidden variable ("~pavement width under guardrail") in this shoulder criteria file allows the user to specify the distance from the face of the guardrail to where the pavement ends. By default this variable is set to 0.283 meters, which is the outside face of the guardrail post.
10. By default, no slope label is placed for the shoulder. If the slope label is needed, add a *define* "*~place shoulder slope labels*" 1 statement to the input file to turn them on.
11. Text size for the shoulder slope label may be set with by adding a define "*text size*" *nnn* (where *nnn* is the desired text size) statement to the input file. By default the text size is set to 0.30. (The "text size" value applies to the slope labels created by all the criteria files.)
12. This criteria file is optional.

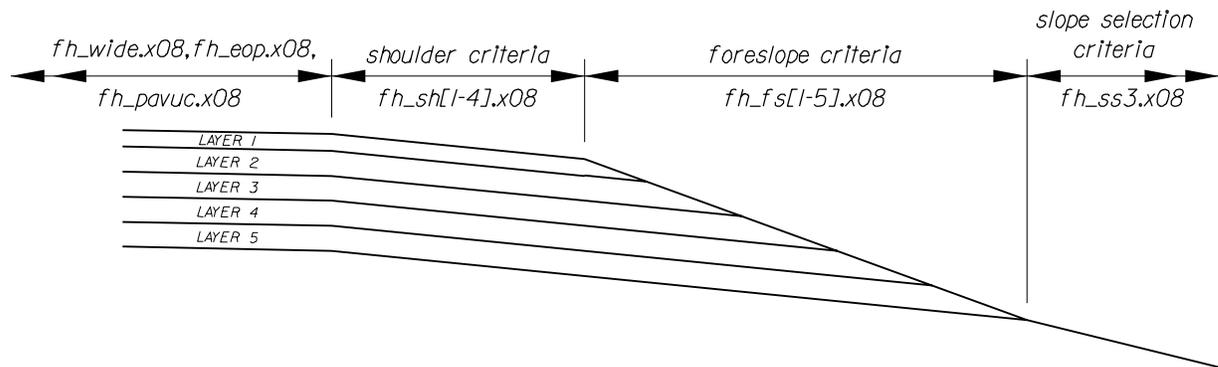
“first full length layer” Details

The purpose of the "first full length layer" variable is to allow the user the option to draw proposed cross-sections with either gravel shoulders or paved shoulders.

- If the user wants a paved shoulder, then "first full length layer" should be set to 1. (See first example below.)
- If the user wants a gravel shoulder, then "first full length layer" should be set to 2. (Or possibly more, see examples two through four below.)
- The shoulder criteria files (fh_sh[1-4].x08) close off all non-"full length layers" (i.e., all layers above the "first full length layer" with a vertical line at the inside edge of the shoulder.
- All criteria files that follow the shoulder criteria files (such as the foreslope or paved ditch criteria files) do not draw any layers above the "first full length layer".

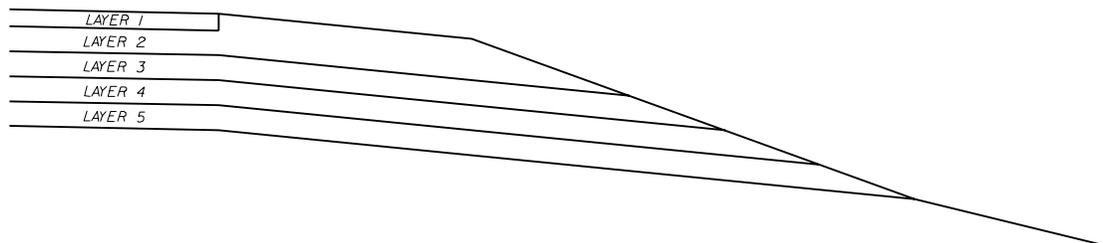
define “first full length layer” 1

All layers extend out to foreslope



define “first full length layer” 2

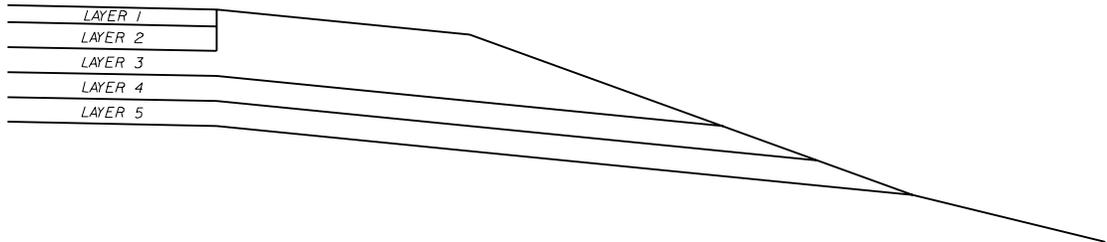
Top layer closed off at inside edge of shoulder criteria (fh_sh[1-4].x08). All other layers extend out to foreslope.



“first full length layer” Details

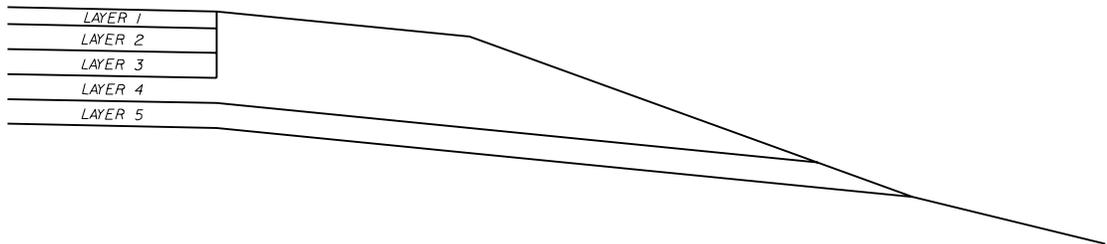
define “first full length layer” 3

Top two layers closed off at inside edge of shoulder criteria (fh_sh[1-4].x08). All other layers extend out to foreslope.



define “first full length layer” 4

Top three layers closed off at inside edge of shoulder criteria (fh_sh[1-4].x080). All other layers extend out to foreslope.



FLH Standard Criteria Files

Section 5 –

Curb/Curb & Gutter Criteria Files

Curb/Curb & Gutter Criteria Files

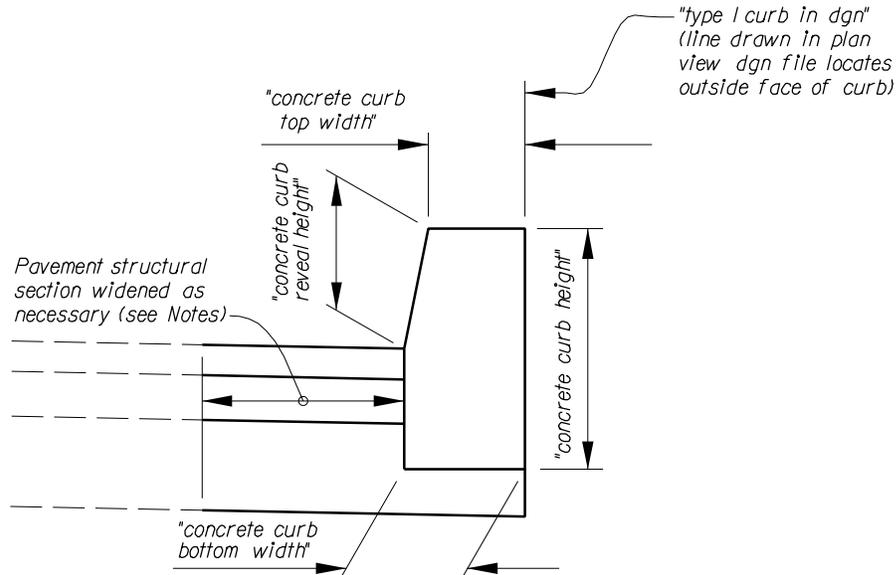
Criteria File	Elements Drawn by Criteria File
c_crb1d.x08	Full depth concrete curb plus base course layers (if any) under curb. Uses line(s) drawn in plan view dgn file to set station ranges for curb and to locate offset for outside face of curb.
c_crb1s.x08	Full depth concrete curb plus base course layers (if any) under curb. Uses exceptions data file to set station ranges for curb.
c_crb2d.x08	Concrete curb/gutter plus base course layers (if any) under curb/gutter. Uses line(s) drawn in plan view dgn file to set station ranges for curb/gutter and to locate offset for outside face of curb.
c_crb2s.x08	Concrete curb/gutter plus base course layers (if any) under curb/gutter. Uses exceptions data file to set station ranges for curb.
c_crb3d.x08	Asphalt curb plus base course layers (if any) under curb. Uses line(s) drawn in plan view dgn file to set station ranges for curb and to locate offset for outside face of curb.
c_crb3s.x08	Asphalt curb plus base course layers (if any) under curb. Uses exceptions data file to set station ranges for curb.
c_crb4s.x08	Widens pavement a fixed distance, then draws curb and curb backfill, pavement and base course layers under curb, and roadway foreslope. Station ranges for curb set using the exceptions data file. Combines the functionality of a typical curb criteria with the functionality of a roadway widening criteria and a foreslope criteria.
c_crb5d.x08	Widens pavement as necessary, then draws curb, pavement section foreslope, construction cut/fill slope, and curb backfill. Station ranges and offset from centerline for curb are set using lines drawn in plan view dgn. Combines the functionality of a typical curb criteria with the functionality of a roadway widening criteria, a foreslope criteria, and a slope selection criteria.
c_crbkfd.x08	Draws backfill embankment behind curb. Uses "in dgn" line for station ranges and hinge point offset from roadway centerline.
c_crbkfs.x08	Draws backfill embankment behind curb. Station ranges set in exceptions data file.
fh_crb1d.x08	Full depth concrete curb plus base course layers (if any) under curb. Uses lines drawn in plan view dgn file to locate station ranges for curb. Closes off any base course layers under curb with vertical lines at outside face of curb. Current point upon completion of criteria is outside top corner of curb.

fh_crb1s.x08	<p>Full depth concrete curb plus base course layers (if any) under curb. Uses station ranges specified in exceptions data file to locate curb. Closes off any base course layers under curb with vertical lines at outside face of curb. Current point upon completion of criteria is outside top corner of curb.</p>
fh_crb2b.x08	<p>Bituminous curb plus pavement and base course layers under curb. Closes off all layers with vertical lines at outside face of curb. Current point upon completion of criteria is outside bottom corner of curb.</p>
fh_crb2t.x08	<p>Bituminous curb plus pavement and base course layers under curb. Closes off all layers with vertical lines at outside face of curb. Current point upon completion of criteria is outside top corner of curb.</p>
c_median.x08	<p>Post-processing criteria to draw a parking area median on top of existing parking area x-sections. Uses "in dgn" lines for station ranges, offset, and width of median. (CFL only)</p>
median2.x08	<p>Post-processing criteria to draw a median with full depth curb onto previously drawn proposed x-sections. Uses "in dgn" lines for station ranges, offset, and width of median. User needs to delete/re-intersect pavement structure lines in x-sections after running this criteria. (CFL only)</p>

c_crb1d.x08

Concrete curb located using line(s) drawn in plan view dgn file. Draws the following elements:

- concrete curb
- base course layers (if any) under the curb
- closes off any base course layers under the curb with vertical lines
- widens pavement structural section as necessary



define variables that must be assigned values in the input data file:

- "concrete curb bottom width"
- "concrete curb height"
- "concrete curb reveal height"
- "concrete curb top width"

define_dgn variables that must be assigned values in the input data file:

- "type 1 curb in dgn"

Variables that must be defined in exceptions data file:

none

Notes for c_crb1d.x08:

1. The station ranges for the curb are determined by lines drawn in a plan view dgn file. Level/symbology for these lines is specified in the proposed cross-section input file using define_dgn variable "type 1 curb in dgn".
2. The offset distance from the roadway centerline to the "type 1 curb in dgn " lines in plan view dgn also controls the distance of the curb from the roadway centerline. The outside (back) face of the curb is placed to match the offset from centerline of the "in dgn" line; the roadway structural section is widened as necessary to accomplish this.

c_crb1d.x08

Notes for c_crb1d.x08 (continued):

3. An optional berm coming off the top of the curb may be drawn by setting the "~type 1 curb berm width" variable equal to the desired berm width. The slope of the berm is controlled by setting the "~type 1 curb berm slope" variable equal to the desired percent slope (up and away from centerline is a positive slope). By default this option is turned off.
4. The "type 1 curb in dgn" line will be found if it is drawn anywhere from the roadway centerline out to a distance of 50 meters off the centerline; this search distance may be adjusted by defining "~max curb search dist" in the input file.
5. If the curb is to be located exactly where the preceding criteria left off, then the "type 1 curb in dgn" line may be drawn anywhere from the centerline out to the theoretical offset distance for the back face of the curb.
6. This criteria file closes off the outside of any base course layers under the curb with vertical lines at the outside face of the curb.
7. c_crb1d.x08 should always be followed by a sidewalk criteria (probably c_wlk1d.x08), or a slope selection criteria.
8. Upon completion of c_crb1d.x08, the current point is the outside top corner of the curb or, if the optional berm is used, the outside point of the berm.
9. Don't use c_crb1d.x08 to draw paved ditch; there are standard paved ditch criteria files for that purpose.
10. The differences between c_crb1d.x08 (this criteria file) and c_crb1s.x08 are:
 - c_crb1d.x08 uses lines in a plan view dgn file to locate the station ranges for the curb
 - c_crb1s.x08 uses the exceptions data file to specify the station ranges for the curb
 - c_crb1d.x08 uses lines in plan view to set the distance from the roadway centerline to the curb (i.e., the distance can be variable)
 - c_crb1s.x08 always places the curb where the preceding criteria left off
11. This criteria is a modified version of fh_crb1d.x08 designed to allow more flexibility and to fix the following problems:
 - curb was drawn using same level/symbology as MSE select backfill lines
 - offset of curb from centerline wasn't controlled by the "in dgn" line
 - no distinct "in dgn" lines for different types of curb meant only one type of curb per project
12. This criteria marks a key point used by the improved sidewalk criterias c_wlk1[d,s].x08.
13. The level/symbology used to draw the curb section will allow the user to get both slope stake books and earthwork quantities. However, in order to accomplish this the earthwork input file and the slope stake report dialog must be set up exactly as follows:

c_crb1d.x08

Notes for c_crb1d.x08 (continued):

In the **earthwork input file**:

- Make sure there is a Proposed Undercut with soil type CONC_CURB and lv=18,19 co=18,19. Set all the multiplication factors to 0.000001.

In the **slope stake report dialog** include only the following level/symbology:

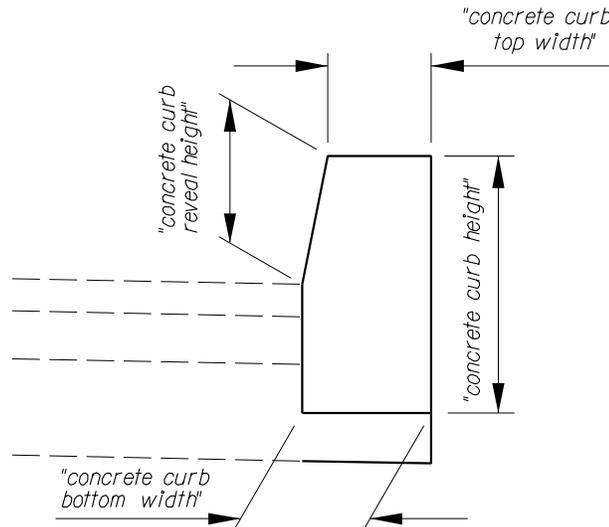
- The level and color of the bottom layer of the pavement section only. Don't include the level/symbology for any of the other pavement layers.
- lv=18 and co=18. These are a part of (but not all of) the curb elements. Don't include the remaining curb elements (lv=2,19 co=0,19).
- lv=10 co=10. These are the cut/fill slope elements.
- lv=10 co=16. These are the ditch foreslope elements.
- If sidewalk is used, then add the level and color of the bottom layer of the sidewalk section. Don't include the level/symbology of any of the other sidewalk levels.
- If the curb backfill criteria was used, then add lv=20 co=20.

c_crb1s.x08

Full depth concrete curb located using station ranges in the exceptions data file.

Draws the following elements:

- concrete curb
- base course layers (if any) under the curb
- closes off any base course layers under the curb with vertical lines



define variables that must be assigned values in the input data file:

- "concrete curb bottom width"
- "concrete curb height"
- "concrete curb reveal height"
- "concrete curb top width"

define_dgn variables that must be assigned values in the input data file:

none

Variables that must be defined in exceptions data file:

- _d_use_type1_curb_lt
- _d_use_type1_curb_rt

Notes for c_crb1s.x08:

1. The station ranges for the curb are set using the _d_use_type1_curb_[lt,rt] variables in the exceptions data file.
2. The curb is drawn at whatever distance from centerline that the preceding criteria file left off
3. This criteria file closes off the outside of any base course layers under the curb with vertical lines at the outside face of the curb.

c_crb1s.x08

Notes for c_crb1s.x08 (continued):

4. An optional berm coming off the top of the curb may be drawn by setting the "~type 1 curb berm width" variable equal to the desired berm width. The slope of the berm is controlled by setting the "~type 1 curb berm slope" variable equal to the desired percent slope (up and away from centerline is a positive slope). By default this option is turned off.
5. *c_crb1s.x08* should always be followed by a sidewalk criteria (probably *c_wlk1s.x08*), or a slope selection criteria.
6. Upon completion of *c_crb1s.x08*, the current point is either the outside top corner of the curb or, if the optional berm is drawn, the outside of the berm.
7. Don't use *c_crb1s.x08* to draw paved ditch; there are standard paved ditch criteria files for that purpose.
8. The differences between *c_crb1s.x08* (this criteria file) and *c_crb1d.x08* are:
 - *c_crb1d.x08* uses lines in a plan view dgn file to locate the station ranges for the curb
 - *c_crb1s.x08* uses the exceptions data file to specify the station ranges for the curb
 - *c_crb1d.x08* uses lines in plan view to set the distance from the roadway centerline to the curb (i.e., the distance can be variable)
 - *c_crb1s.x08* always places the curb where the preceding criteria left off
9. This criteria is a modified version of *fh_crb1s.x08* designed to allow more flexibility and to fix the following problems:
 - curb was drawn using same level/symbology as MSE select backfill lines
 - no distinct *_d_curb_used* variable for different types of curb meant only one type of curb per project
10. This criteria marks a key point that is used by the improved sidewalk criteria files *c_wlk1[d,s].x08*.
11. The level/symbology used to draw the curb section will allow the user to get both slope stake books and earthwork quantities. However, in order to accomplish this the earthwork input file and the slope stake report dialog must be set up exactly as follows:
In the **earthwork input file**:
 - Make sure there is a Proposed Undercut with soil type *CONC_CURB* and *lv=18,19* *co=18,19*. Set all the multiplication factors to 0.000001.In the **slope stake report dialog** include only the following level/symbology:
 - The level and color of the bottom layer of the pavement section only. Don't include the level/symbology for any of the other pavement layers.
 - *lv=18* and *co=18*. These are a part of (but not all of) the curb elements. Don't include the remaining curb elements (*lv=2,19* *co=0,19*).
 - *lv=10* *co=10*. These are the cut/fill slope elements.
 - *lv=10* *co=16*. These are the ditch foreslope elements.

c_crb1s.x08

Notes for c_crb1s.x08 (continued):

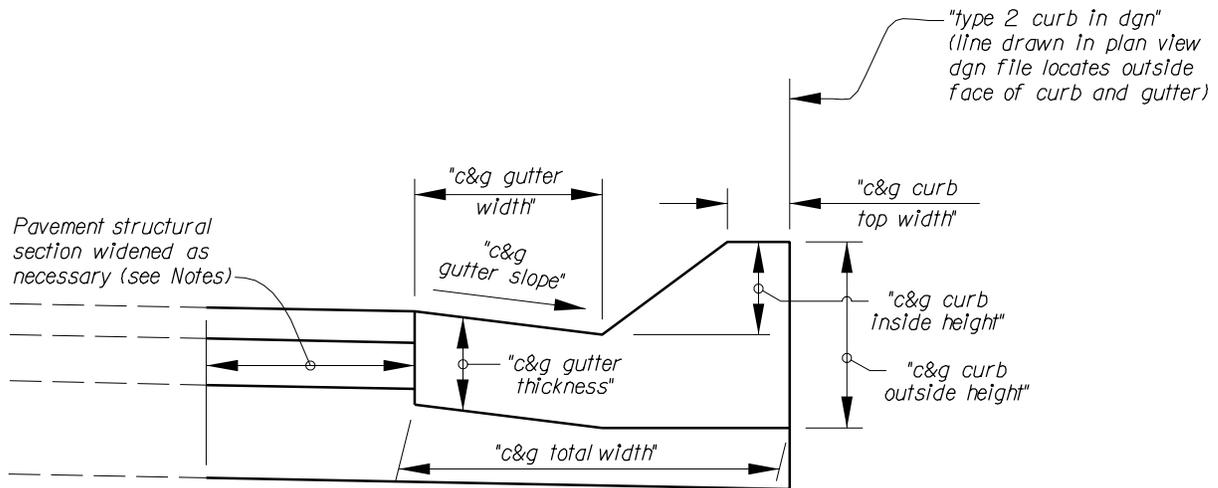
- If sidewalk is used, then add the level and color of the bottom layer of the sidewalk section. Don't include the level/symbology of any of the other sidewalk levels.
- If the curb backfill criteria was used, then add lv=20 co=20.

c_crb2d.x08

Concrete curb and gutter located using lines drawn in plan view dgn file.

Draws the following elements:

- concrete curb and gutter
- base course layers (if any) under the curb and gutter
- closes off any base course layers under the curb and gutter with vertical lines
- widens pavement structural section as necessary



define variables that must be assigned values in the input data file:

- "c&g curb inside height"
- "c&g curb outside height"
- "c&g curb top width"
- "c&g gutter slope"
- "c&g gutter thickness"
- "c&g gutter width"
- "c&g total width"

(Note: the default values for all these variables are set to match CFL standard detail M609-50)

define_dgn variables that must be assigned values in the input data file:

- "type 2 curb in dgn"

Variables that must be defined in exceptions data file:

None

Notes for c_crb2d.x08:

1. The station ranges for the curb and gutter are determined by lines drawn in a plan view dgn file. Level/symbology for these lines is specified in the proposed cross-section input file using define_dgn variable "type 2 curb in dgn".

c_crb2d.x08

Notes for c_crb2d.x08 (continued):

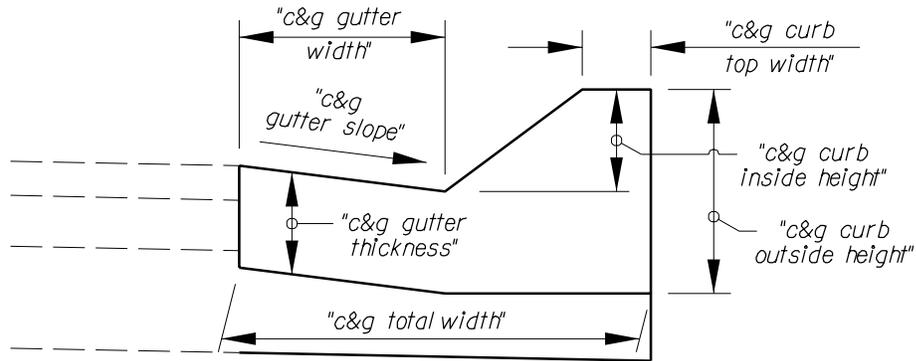
2. The offset distance from the roadway centerline to the "type 2 curb in dgn" lines in plan view dgn also controls the distance of the curb and gutter from the roadway centerline. The outside (back) face of the curb is placed to match the offset from centerline of the "in dgn" line; the roadway structural section is widened as necessary to accomplish this.
3. An optional berm coming off the top of the curb may be drawn by setting the "~type 2 curb berm width" variable equal to the desired berm width. The slope of the berm is controlled by setting the "~type 2 curb berm slope" variable equal to the desired percent slope (up and away from centerline is a positive slope). By default this option is turned off.
4. The "type 2 curb in dgn" line will be found if it is drawn anywhere from the roadway centerline out to a distance of 50 meters off the centerline; this search distance may be adjusted by defining "~max curb search dist" in the input file.
5. If the curb and gutter is to be located exactly where the preceding criteria left off, then the "type 2 curb in dgn" line may be drawn anywhere from the centerline out to the theoretical offset distance for the back face of the curb.
6. This criteria file closes off the outside of any base course layers under the curb with vertical lines at the outside face of the curb.
7. c_crb2d.x08 should always be followed by a sidewalk criteria (probably c_wlk2d.x08), or a slope selection criteria.
8. Upon completion of c_crb2d.x08, the current point is the outside top corner of the curb or, if the optional berm is used, the outside point of the berm.
9. Don't use c_crb2d.x08 to draw paved ditch; there are standard paved ditch criteria files for that purpose.
10. The differences between c_crb2d.x08 (this criteria file) and c_crb2s.x08 are:
 - c_crb2d.x08 uses lines in a plan view dgn file to locate the station ranges for the curb
 - c_crb2s.x08 uses the exceptions data file to specify the station ranges for the curb
 - c_crb2d.x08 uses lines in plan view to set the distance from the roadway centerline to the curb (i.e., the distance can be variable)
 - c_crb2s.x08 always places the curb where the preceding criteria left off
11. This criteria marks a key point used by the improved sidewalk criterias c_wlk1[d,s].x08.

c_crb2s.x08

Concrete curb and gutter located using station ranges in the exceptions data file.

Draws the following elements:

- concrete curb and gutter
- base course layers (if any) under the curb and gutter
- closes off any base course layers under the curb and gutter with vertical lines



define variables that must be assigned values in the input data file:

- "c&g curb inside height"
- "c&g curb outside height"
- "c&g curb top width"
- "c&g gutter slope"
- "c&g gutter thickness"
- "c&g gutter width"
- "c&g total width"

(Note: the default values for all these variables are set to match CFL standard detail M609-50)

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

- `_d_use_type2_curb_lt`
- `_d_use_type2_curb_rt`

Notes for c_crb2s.x08:

1. The station ranges for the curb and gutter are set using the `_d_use_type2_curb_[lt,rt]` variables in the exceptions data file.
2. The curb and gutter is drawn at whatever distance from centerline that the preceding criteria file left off.
3. This criteria file closes off the outside of any base course layers under the curb and gutter with vertical lines at the outside face of the curb.

c_crb2s.x08

Notes for c_crb2s.x08 (continued):

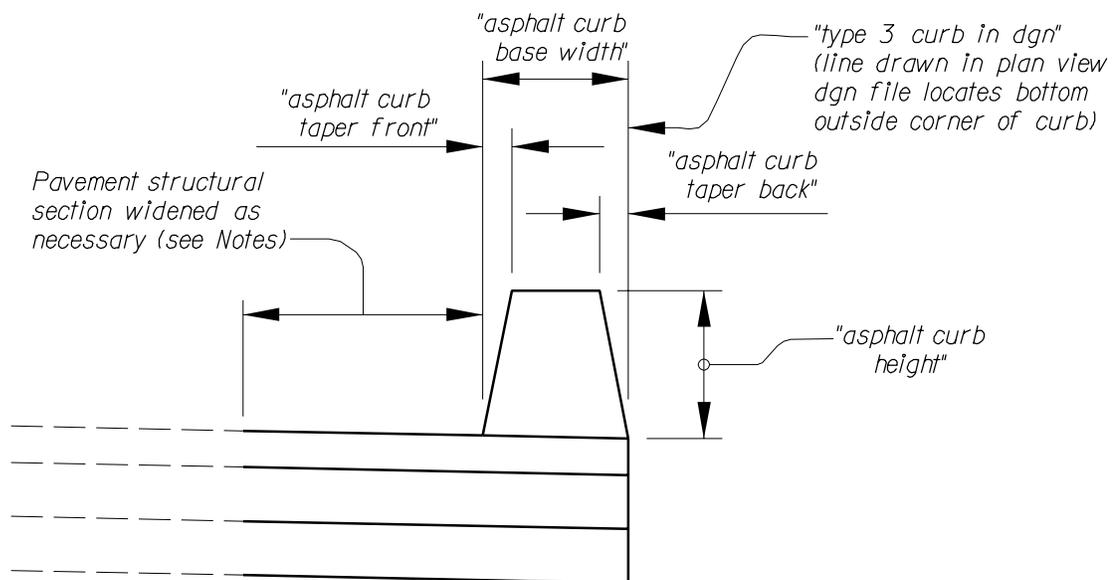
4. An optional berm coming off the top of the curb may be drawn by setting the "~type 2 curb berm width" variable equal to the desired berm width. The slope of the berm is controlled by setting the "~type 2 curb berm slope" variable equal to the desired percent slope (up and away from centerline is a positive slope). By default this option is turned off.
5. c_crb2s.x08 should always be followed by a sidewalk criteria (probably c_wlk1s.x08), or a slope selection criteria.
6. Upon completion of c_crb2s.x08, the current point is either the outside top corner of the curb or, if the optional berm is drawn, the outside of the berm.
7. Don't use c_crb2s.x08 to draw paved ditch; there are standard paved ditch criteria files for that purpose.
8. The differences between c_crb2d.x08 (this criteria file) and c_crb2s.x08 are:
 - c_crb2d.x08 uses lines in a plan view dgn file to locate the station ranges for the curb
 - c_crb2s.x08 uses the exceptions data file to specify the station ranges for the curb
 - c_crb2d.x08 uses lines in plan view to set the distance from the roadway centerline to the curb (i.e., the distance can be variable)
 - c_crb2s.x08 always places the curb where the preceding criteria left off
9. This criteria marks a key point that is used by the improved sidewalk criteria files c_wlk1[d,s].x08.

c_crb3d.x08

Asphalt curb located using lines drawn in plan view dgn file.

Draws the following elements:

- asphalt curb
- base course layers (if any) under the curb
- closes off any base course layers under the curb with vertical lines
- widens pavement structural section as necessary



define variables that must be assigned values in the input data file:

- "asphalt curb base width"
- "asphalt curb height"
- "asphalt curb taper back"
- "asphalt curb taper front"

define_dgn variables that must be assigned values in the input data file:

- "type 3 curb in dgn"

Variables that must be defined in exceptions data file:

None

Notes for c_crb3d.x08:

1. The station ranges for the curb are determined by lines drawn in a plan view dgn file. Level/symbology for these lines is specified in the proposed cross-section input file using define_dgn variable "type 3 curb in dgn".
2. The offset distance from the roadway centerline to the "type 3 curb in dgn" lines in plan view dgn also controls the distance of the curb from the roadway centerline. The outside bottom corner

c_crb3d.x08

Notes for c_crb3d.x08 (continued):

of the curb is placed to match the offset from centerline of the "in dgn" line; the roadway structural section is widened as necessary to accomplish this.

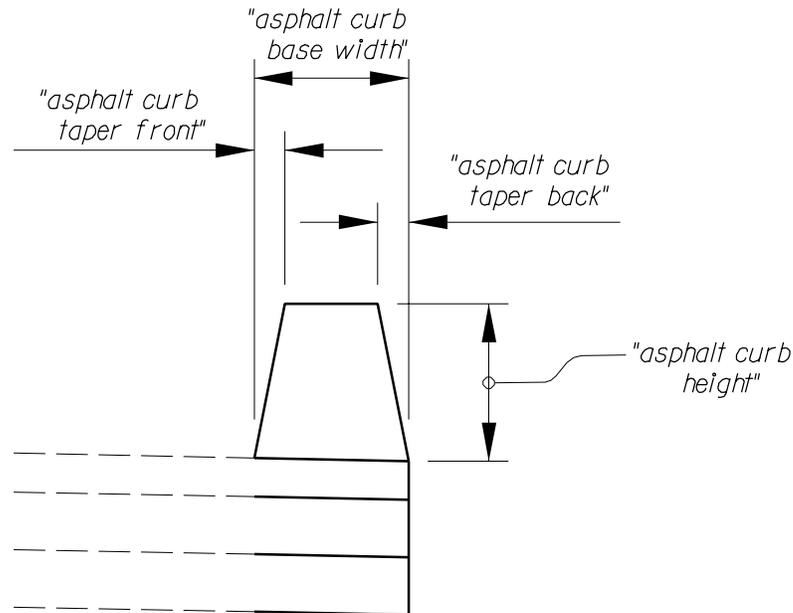
3. An optional berm coming off the top of the curb may be drawn by setting the "~type 3 curb berm width" variable equal to the desired berm width. The slope of the berm is controlled by setting the "~type 3 curb berm slope" variable equal to the desired percent slope (up and away from centerline is a positive slope). By default this option is turned off.
4. The "type 3 curb in dgn" line will be found if it is drawn anywhere from the roadway centerline out to a distance of 50 meters off the centerline; this search distance may be adjusted by defining "~max curb search dist" in the input file.
5. If the curb is to be located exactly where the preceding criteria left off, then the "type 3 curb in dgn" line may be drawn anywhere from the centerline out to the theoretical offset distance for the back face of the curb.
6. This criteria file closes off the outside of any base course layers under the curb with vertical lines at the outside face of the curb.
7. c_crb3d.x08 should always be followed by a sidewalk criteria (probably c_wlk1d.x08), or a slope selection criteria.
8. Upon completion of c_crb3d.x08, the current point is the outside top corner of the curb or, if the optional berm is used, the outside point of the berm.
9. Don't use c_crb3d.x08 to draw paved ditch; there are standard paved ditch criteria files for that purpose.
10. The differences between c_crb3d.x08 (this criteria file) and c_crb3s.x08 are:
 - c_crb3d.x08 uses lines in a plan view dgn file to locate the station ranges for the curb
 - c_crb3s.x08 uses the exceptions data file to specify the station ranges for the curb
 - c_crb3d.x08 uses lines in plan view to set the distance from the roadway centerline to the curb (i.e., the distance can be variable)
 - c_crb3s.x08 always places the curb where the preceding criteria left off
11. This criteria marks a key point used by the improved sidewalk criterias c_wlk1[d,s].x08.

c_crb3s.x08

Asphalt curb located using station ranges in the exceptions data file.

Draws the following elements:

- asphalt curb
- base course layers (if any) under the curb
- closes off any base course layers under the curb with vertical lines



define variables that must be assigned values in the input data file:

- "asphalt curb base width"
- "asphalt curb height"
- "asphalt curb taper back"
- "asphalt curb taper front"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

- `_d_use_type3_curb_lt`
- `_d_use_type3_curb_rt`

Notes for c_crb3s.x08:

1. The station ranges for the curb are set using the `_d_use_type3_curb_[lt,rt]` variables in the exceptions data file.
2. The curb is drawn at whatever distance from centerline that the preceding criteria file left off.

c_crb3s.x08

Notes for c_crb3s.x08 (continued):

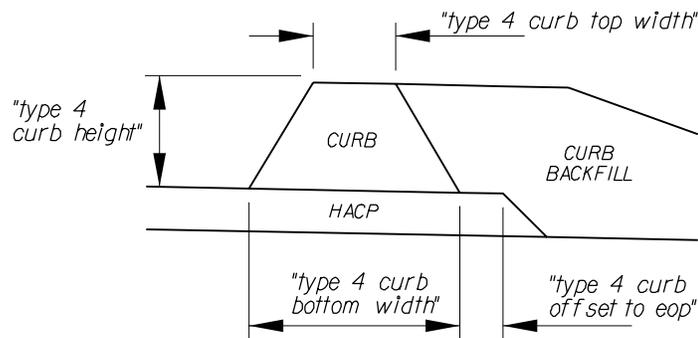
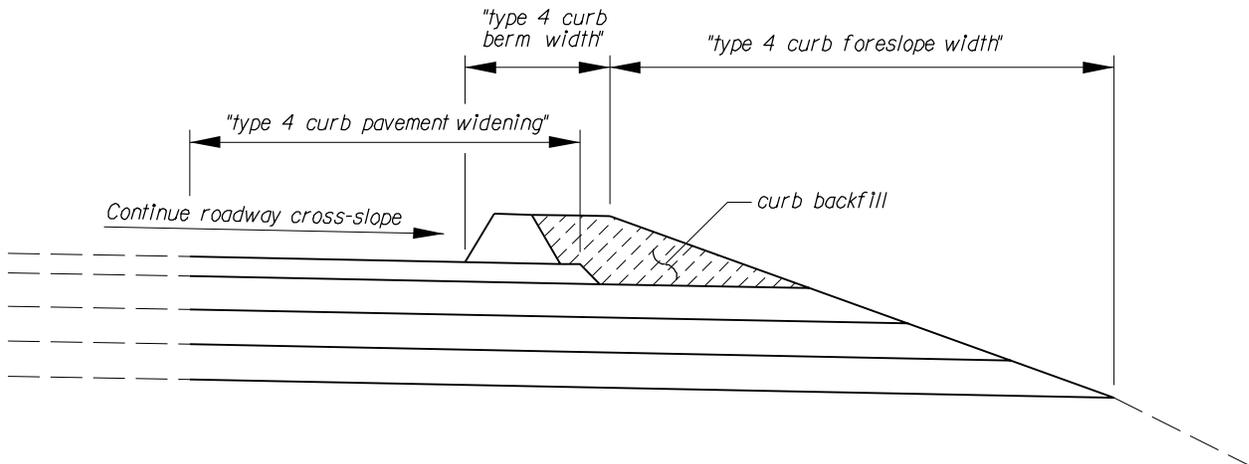
3. This criteria file closes off the outside of any base course layers under the curb with vertical lines at the outside face of the curb.
4. An optional berm coming off the top of the curb may be drawn by setting the "~type 3 curb berm width" variable equal to the desired berm width. The slope of the berm is controlled by setting the "~type 3 curb berm slope" variable equal to the desired percent slope (up and away from centerline is a positive slope). By default this option is turned off.
5. c_crb3s.x08 should always be followed by a sidewalk criteria (probably c_wlk1s.x08), or a slope selection criteria.
6. Upon completion of c_crb3s.x08, the current point is either the outside top corner of the curb or, if the optional berm is drawn, the outside of the berm.
7. Don't use c_crb3s.x08 to draw paved ditch; there are standard paved ditch criteria files for that purpose.
8. The differences between c_crb3d.x08 (this criteria file) and c_crb1s.x08 are:
 - c_crb3d.x08 uses lines in a plan view dgn file to locate the station ranges for the curb
 - c_crb3s.x08 uses the exceptions data file to specify the station ranges for the curb
 - c_crb3d.x08 uses lines in plan view to set the distance from the roadway centerline to the curb (i.e., the distance can be variable)
 - c_crb3s.x08 always places the curb where the preceding criteria left off
9. This criteria marks a key point that is used by the improved sidewalk criteria files c_wlk1[d,s].x08.

c_crb4s.x08

Asphalt curb, curb backfill, and roadway foreslope located using station range(s) in the exceptions data file.

Draws the following elements:

- widens pavement a fixed distance
- trapezoidal curb with curb backfill
- pavement and base course layers under the curb and out to roadway foreslope
- roadway foreslope



CURB DETAIL

define variables that must be assigned values in the input data file:

- "type 4 curb pavement widening"
- "type 4 curb berm width"
- "type 4 curb foreslope width"
- "type 4 curb bottom width"
- "type 4 curb top width"
- "type 4 curb height"
- "type 4 curb offset to eop"

c_crb4s.x08

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

_d_use_type4_curb_lt

_d_use_type4_curb_rt

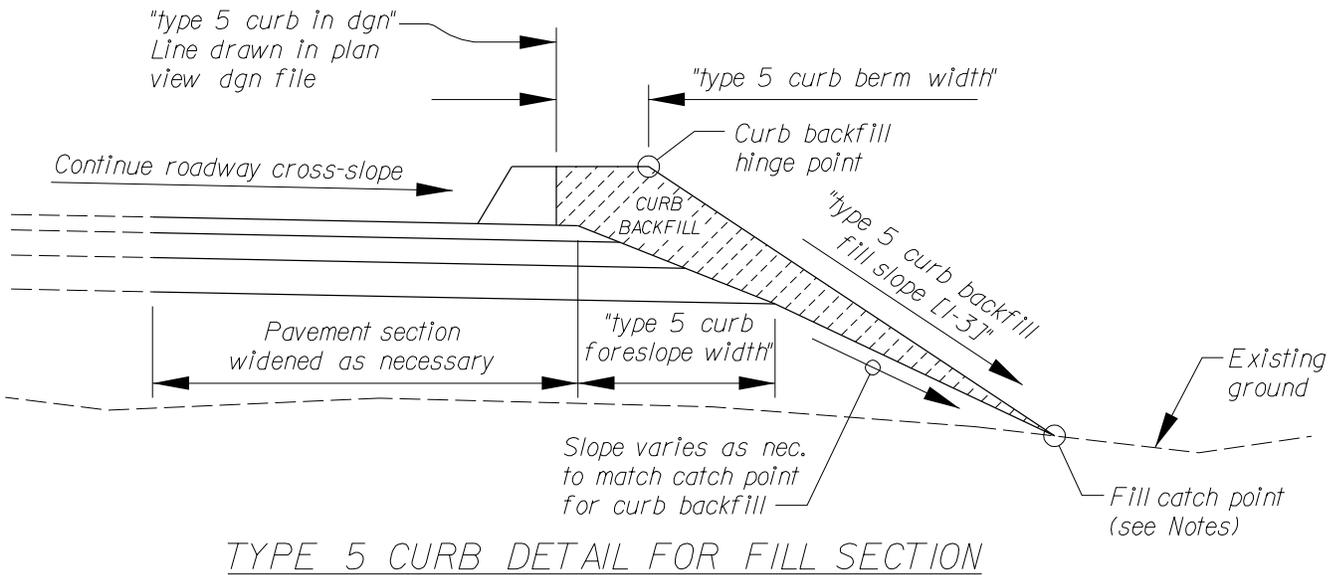
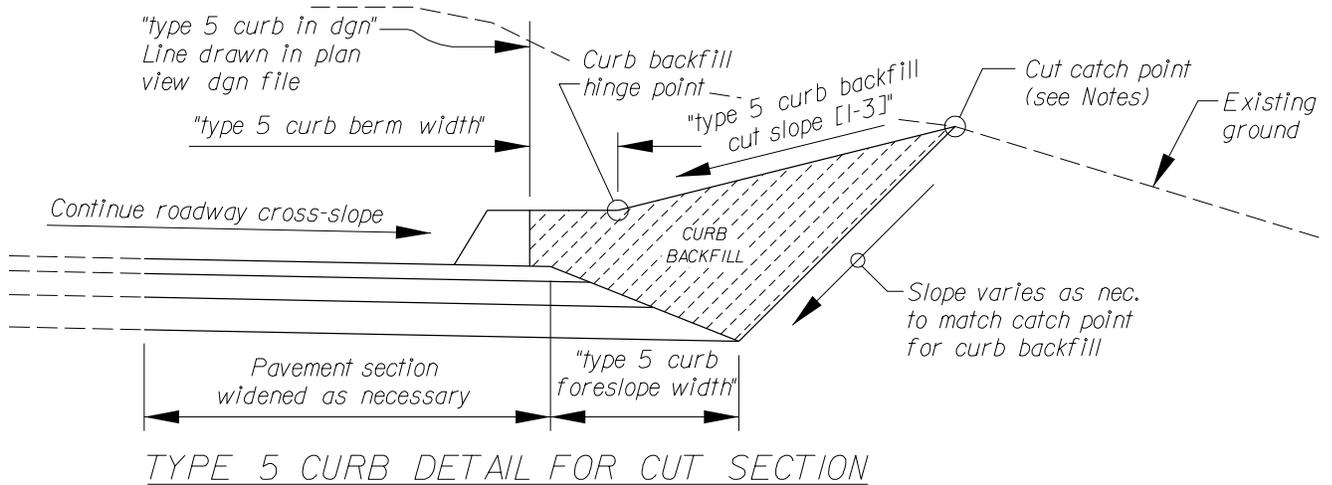
Notes for c_crb4s.x08:

1. This criteria was originally written to match a standard detail for Bryce Canyon NP. Default values for all the variables have been set in the criteria file to match the original detail. If the default values shown below are acceptable, then they don't have to be defined in the input file.
 - "type 4 curb pavement widening" = 1.50
 - "type 4 curb berm width" = 0.45
 - "type 4 curb foreslope width" = 1.90
 - "type 4 curb bottom width" = 0.225
 - "type 4 curb top width" = 0.075
 - "type 4 curb height" = 0.125
 - "type 4 curb offset to eop" = 0.075
2. Combines the functionality of a typical curb criteria with the functionality of a widening criteria and a foreslope criteria.
3. Station ranges for the curb are set in the exceptions data file using the following syntax:

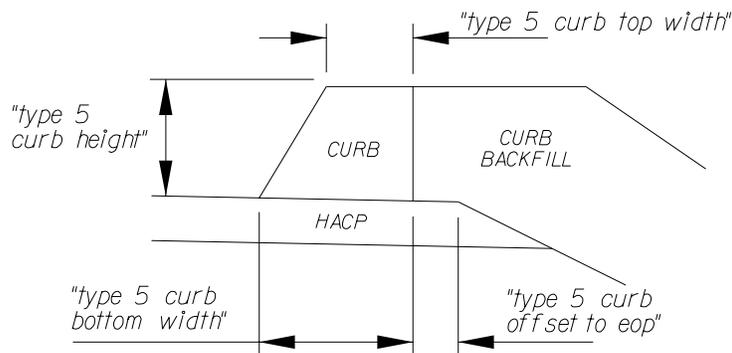
```
if sta >= 10+000 and sta =< 10+140 then
{
  _d_use_type4_curb_lt = 1
}
```
4. Must be included immediately before the foreslope criteria (fh_fs[1-5].x08) in the input file.
5. Level/symbology of cross-section elements drawn by this criteria is set up so that a separate quantity for curb backfill can be calculated in the earthwork procedure. (Proposed undercut, soil type = curb_backfill, lv=17, co=18)

c_crb5d.x08

Draws asphalt curb, pavement structure widening (if any), pavement structure foreslope, cut/fill slope, and curb backfill. Station ranges for curb and distance from roadway centerline to curb are set using lines drawn in plan view dgn file. Works for both cut and fill sections.



c_crb5d.x08



CURB DETAIL

define variables that must be assigned values in the input data file:

- "type 5 curb backfill cut slope [1-3]" (see Typical Cut Slope Details)
- "type 5 curb backfill cut height [1-3]"
- "type 5 curb backfill fill slope [1-3]" (see Typical Fill Slope Details)
- "type 5 curb backfill fill height [1-3]"
- "type 5 curb berm width"
- "type 5 curb bottom width"
- "type 5 curb foreslope width"
- "type 5 curb height"
- "type 5 curb offset to eop"
- "type 5 curb top width"
- "max construction cut slope" (optional, default = 1:1)
- "max construction fill slope" (optional, default = 1:1)

define_dgn variables that must be assigned values in the input data file:

- "type 5 curb in dgn"

Variables that must be defined in exceptions data file:

None

Notes for c_crb5d.x08:

1. Both station ranges and offset from centerline for curb are set using line(s) drawn in a plan view dgn file. Level/symbology for these lines is set in the input file with the define_dgn variable "type 5 curb in dgn".
2. Outside (back) face of curb is drawn to match the offset of the "type 5 curb in dgn" line. The pavement structure is widened as necessary to locate the curb to match the "in dgn" line.
3. When no widening of the pavement section is needed, the designer may draw the "type 5 curb in dgn" line anywhere from the centerline out to its "true" location. The "in dgn" line will be found and the curb section will be drawn from the point where the preceding criteria file left off in this situation. The criteria is written in this way in order to avoid the overlapping elements and

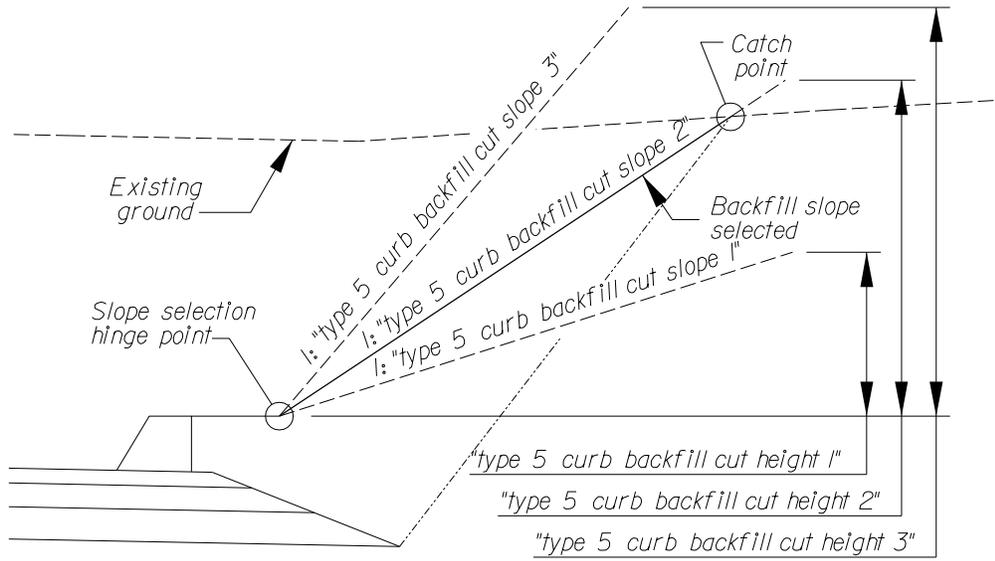
c_crb5d.x08

tolerance problems that can plague criteria files that use "in dgn" lines to locate cross-section features.

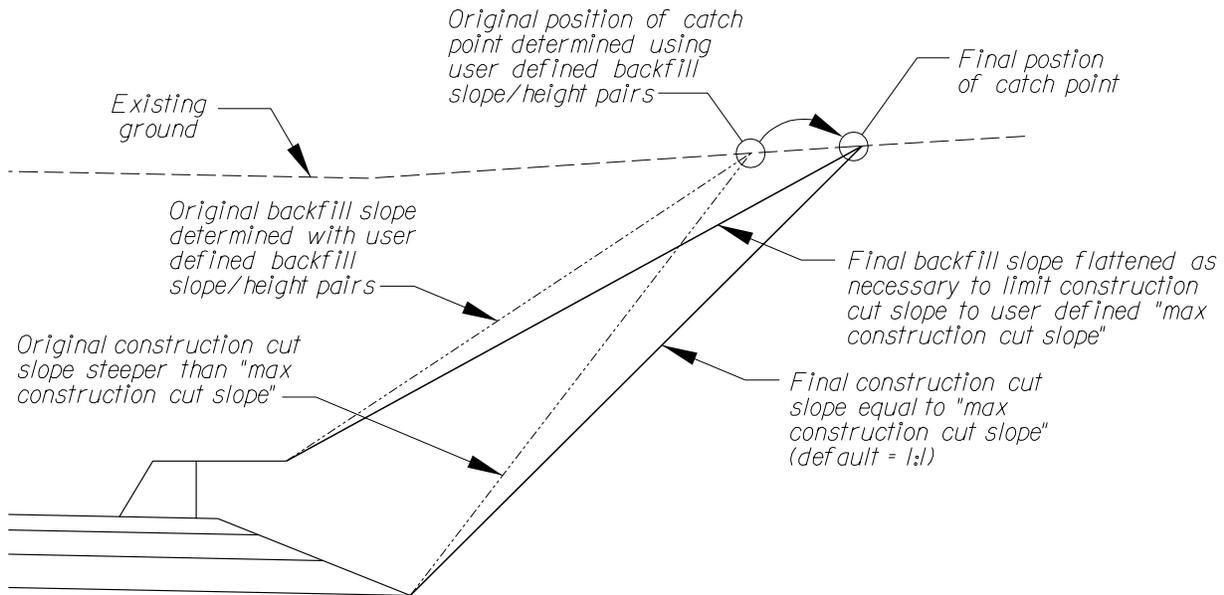
4. The "type 5 curb backfill [cut,fill] slope [1-3]" values are a single positive number corresponding to the RUN portion of a 1:RUN slope specification.
5. The "type 5 curb backfill [cut,fill] slope [1-3]" should be defined from flatter to steeper slopes. For example,

```
define "type 5 curb backfill cut slope 1" 4
define "type 5 curb backfill cut slope 2" 2
define "type 5 curb backfill cut slope 3" 1.5
```
6. The "type 5 curb backfill [cut,fill] height [1-3]" values are the maximum vertical distance from the hinge point for the various slopes. If the slope doesn't catch existing ground within this vertical distance, then the next slope is checked, etc.
7. If the original position of the catch (as calculated with the slope/height pairs) results in a construction cut/fill slope steeper than the "max construction [cut,fill] slope", then this criteria automatically adjusts the catch point outward so that the construction slope is equal to the maximum. By default both "max construction cut slope" and "max construction fill slope" are set to 1:1.
8. This criteria was originally written to match a standard detail for the parking areas at Joshua Tree National Park.
9. This criteria must be included immediately before the foreslope criteria (fh_fs[1-5].x08) and slope selection criteria (fh_ss3.x08) in the input file.
10. This criteria is not set up to calculate separate quantities for curb backfill. (Although it will work for "simple" earthwork and construction reports.)

Typical Cut Slope Selection Details

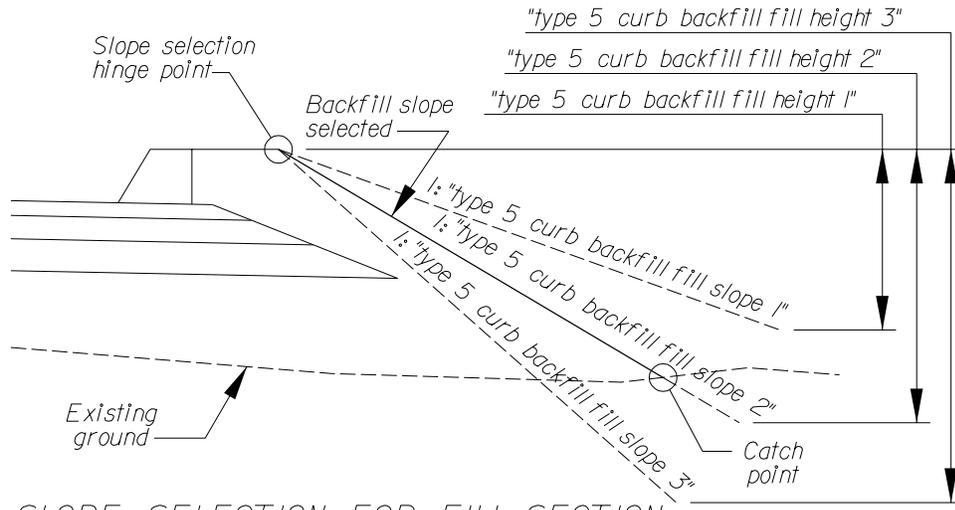


SLOPE SELECTION FOR CUT SECTION

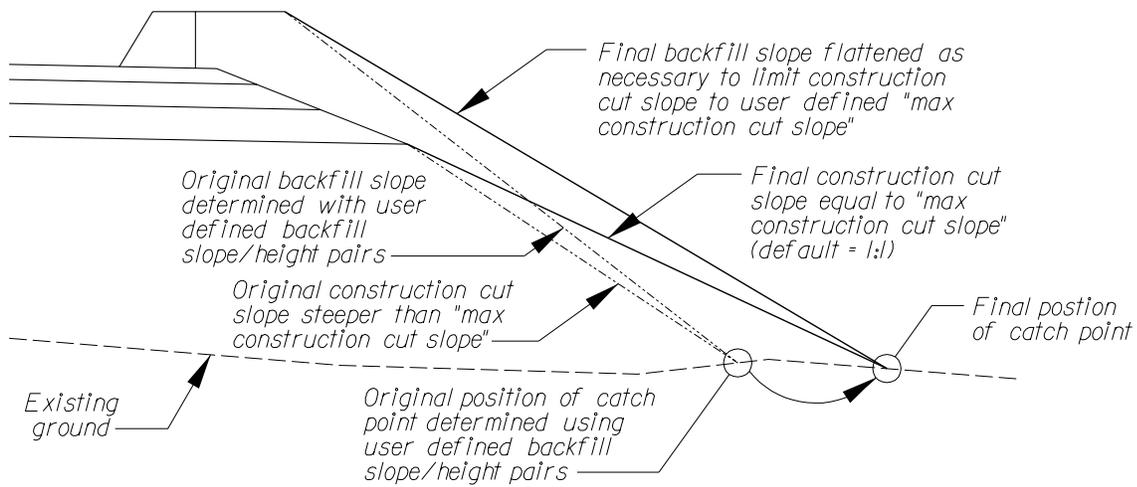


MAXIMUM CONSTRUCTION SLOPE ADJUSTMENT

Typical Fill Slope Selection Details



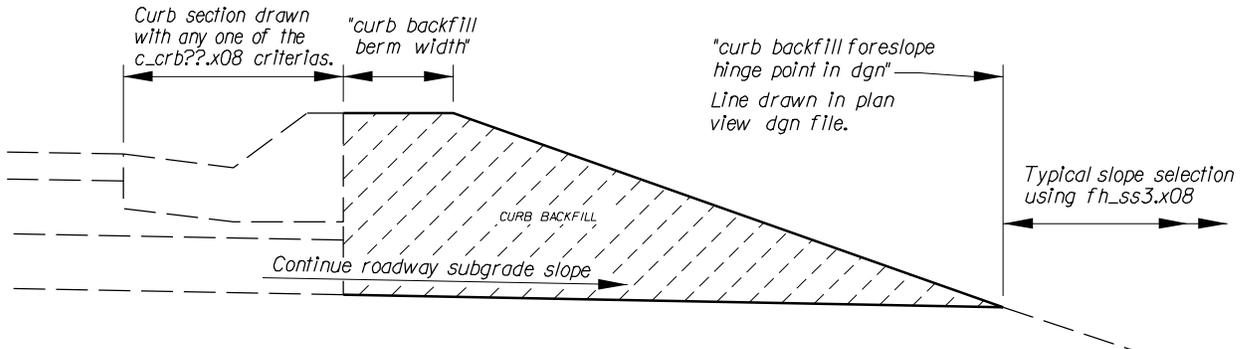
SLOPE SELECTION FOR FILL SECTION



MAXIMUM CONSTRUCTION SLOPE ADJUSTMENT

c_crbkfd.x08

Draws a backfill embankment behind curb or curb and gutter sections drawn with any of the c_crb[1-3]d.x08 criteria files. Both station range(s) for the curb backfill and the offset distance for the subgrade shoulder point are set using lines drawn in a plan view dgn file.



define variables that must be assigned values in the input data file:

"curb backfill berm width"

define_dgn variables that must be assigned values in the input data file:

"curb backfill foreslope hinge point in dgn"

Variables that must be defined in exceptions data file:

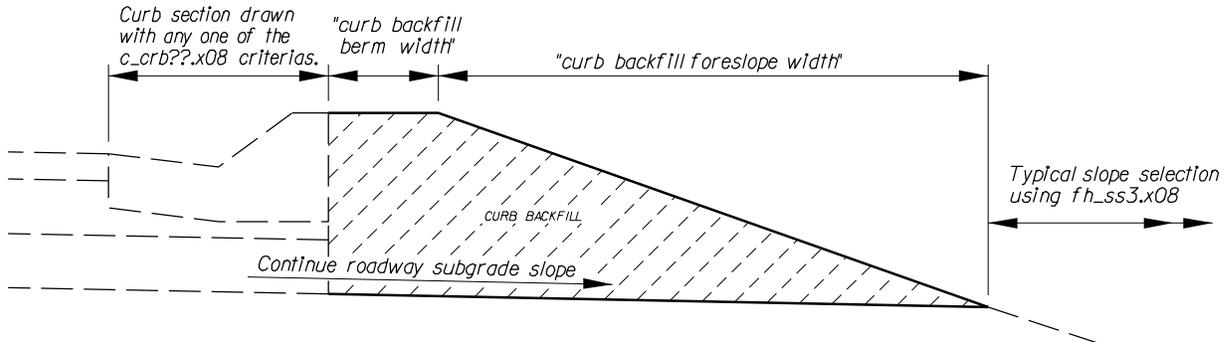
None

Notes for c_crbkfd.x08:

1. This criteria will work correctly only when it immediately follows one of the c_crb[1-3]d.x08 curb/curb and gutter criteria files. (This criteria will not work with any of the fh_crb???.x08 criterias or as a standalone criteria.)
2. Both station ranges for curb backfill and the offset distance for the subgrade shoulder point are set using lines drawn in plan view dgn file.
3. The level/symbology of the elements drawn by this criteria file will allow the user to get a separate earthwork quantity for curb backfill (Proposed Undercut, lv=20 co=20) and also to get slope stake notes, etc.
4. The "curb backfill foreslope hinge point in dgn" line will be found if it is drawn anywhere from the roadway centerline out to a distance of 50 meters off the centerline; this search distance may be adjusted by defining "~curb backfill search dist" in the input file.

c_crbkfs.x08

Draws a backfill embankment behind curb or curb and gutter sections drawn with any of the c_crb[1-3]s.x08 criteria files. Station range(s) for the curb backfill are set in the exceptions data file.



define variables that must be assigned values in the input data file:

"curb backfill berm width"

"curb backfill foreslope width"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

d_use_curb_backfill_lt

d_use_curb_backfill_rt

Notes for c_crbkfd.x08:

1. This criteria will work correctly only when it immediately follows one of the c_crb[1-3]d.x08 curb/curb and gutter criteria files. (This criteria will not work with any of the fh_crb??x08 criterias or as a standalone criteria.)
2. Station ranges for curb backfill are set in the exceptions data file.
3. The level/symbology of the elements drawn by this criteria file will allow the user to get a separate earthwork quantity for curb backfill (Proposed Undercut, lv=20 co=20) and also to get slope stake notes, etc.

fh_crb1d.x08

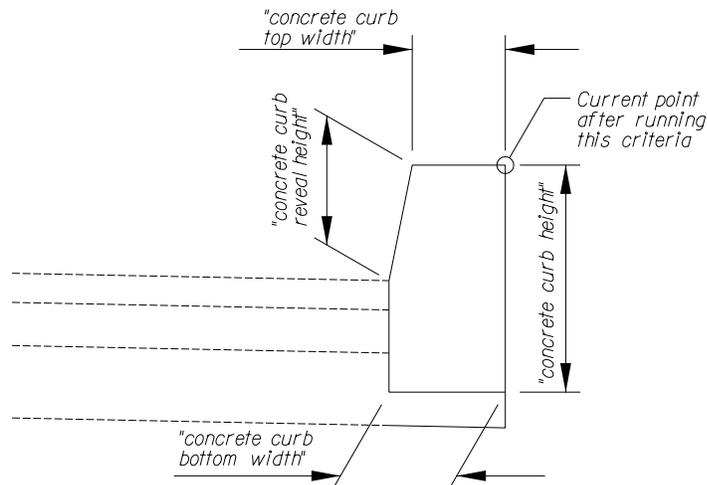
3. This criteria file closes off the outside of any base course layers under the curb with vertical lines at the outside face of the curb.
4. fh_cr1d.x08 should always be followed by a sidewalk criteria (or possibly a slope selection criteria). fh_crb1s.x08 should never be followed by a shoulder, widening, foreslope, or retaining wall criteria file; if this is done it will cause errors in the earthwork quantities because fh_crb1d.x08 closes off all the pavement and base course layers with vertical lines.
5. Upon completion of fh_crb1d.x08, the current point is the outside top corner of the curb.
6. Don't use fh_crb1d.x08 to draw paved ditch; there are standard paved ditch criteria files for that purpose.
7. The only difference between fh_crb1d.x08 (this criteria file) and fh_crb1s.x08 is:
 - fh_crb1d.x08 uses lines in a plan view dgn file to locate the station ranges for the curb
 - fh_crb1s.x08 uses the exceptions data file to specify the station ranges for the curb

fh_crb1s.x08

Draws the following elements:

- concrete curb
- base course layers (if any) under the curb
- closes off any base course layers under the curb with vertical lines
- leaves the current point at the top outside corner of the curb upon completion

Uses station ranges set in the exceptions data file to locate curb.



define variables that must be assigned values in the input data file:

- "concrete curb bottom width"
- "concrete curb height"
- "concrete curb reveal height"
- "concrete curb top width"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

- _d_curb_used_lt
- _d_curb_used_rt

Notes for fh_crb1s.x08:

1. The station ranges for the curb are set in the exceptions data file using the following syntax:

```
if sta > 10+000 and sta < 10+140 then
{
  _d_curb_used_lt = 1
}
```
2. This criteria file closes off the outside of any base course layers under the curb with vertical lines at the outside face of the curb.

fh_crb1s.x08

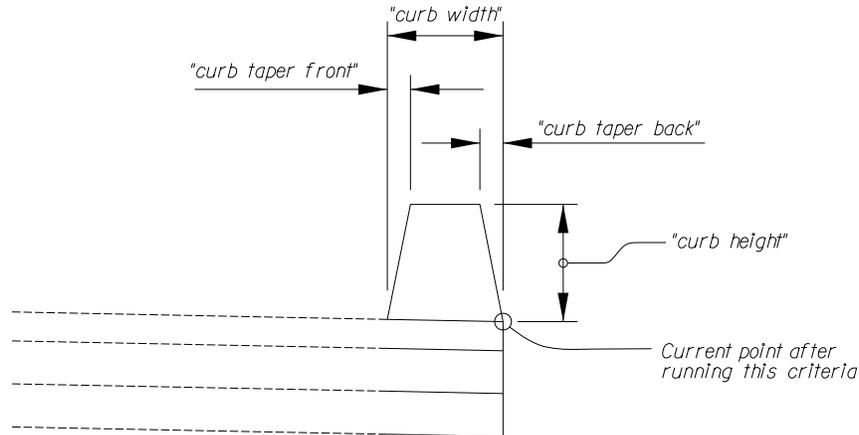
3. fh_crb1s.x08 should always be followed by a sidewalk criteria (or possibly a slope selection criteria). fh_crb1s.x08 should never be followed by a shoulder, widening, foreslope, or retaining wall criteria file; if this is done it will cause errors in the earthwork quantities because fh_crb1s.x08 closes off all the pavement and base course layers with vertical lines.
4. Upon completion of fh_crb1s.x08, the current point is the outside top corner of the curb.
5. Don't use fh_crb1s.x08 to draw paved ditch; there are standard paved ditch criteria files for that purpose.
6. The only difference between fh_crb1s.x08 (this criteria file) and fh_crb1d.x08 is:
 - fh_crb1s.x08 uses the exceptions data file to specify the station ranges for the curb
 - fh_crb1d.x08 uses lines in a plan view dgn file to locate the station ranges for the curb

fh_crb2b.x08

Draws the following elements:

- bituminous curb
- pavement and base course layers under the curb
- closes off the pavement and base course layers with vertical lines
- leaves the current point at the lower outside corner of the curb upon completion (which is the only difference between this criteria and fh_crb2t.x08)

Curb is drawn for the entire length of project.



define variables that must be assigned values in the input data file:

- "curb height"
- "curb width"
- "curb taper front"
- "curb taper back"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

None

Notes for fh_crb2b.x08:

1. There is no way to turn the curb on and off for station ranges built into this criteria. The only way the user could accomplish this would be to use multiple instances of side slope lt/rt blocks with station ranges in the proposed cross-section input file. For example, if the user wanted curb only from Stations 1+500 thru 1+600 on a project that ran from 1+000 to 2+0000 then the following syntax would have to be written into the input file:

side slope lt where sta < 1+500 r 1

[block of include statement without fh_crb2b.x08]

side slope lt where sta >= 1+500 r 1 and sta <= 1+600 r 1

[block of include statements with fh_crb2b.x08]

side slope lt where sta > 1+600 r 1

[block of include statement without fh_crb2b.x08]

fh_crb2b.x08

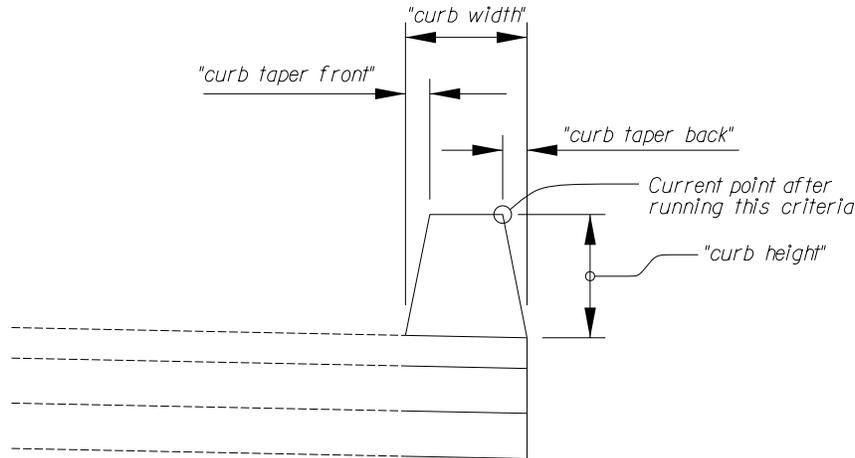
2. This criteria file always closes off the outside of the pavement and base course layers with vertical lines at the outside of the curb.
3. fh_crb2.x08 should always be followed by a sidewalk criteria (or possibly a slope selection criteria). fh_crb2bt.x08 should never be followed by a shoulder, widening, foreslope, or retaining wall criteria file; if this is done it will cause errors in the earthwork quantities because fh_crb2b.x08 closes off all the pavement and base course layers with vertical lines.
4. Upon completion of fh_crb2b.x08, the current point is the outside bottom corner of the curb.
5. Don't use fh_crb2b.x08 to draw paved ditch; there are standard paved ditch criteria files for that purpose.

fh_crb2t.x08

Draws the following elements:

- bituminous curb
- pavement and base course layers under the curb
- closes off the pavement and base course layers with vertical lines
- leaves the current point at the lower outside corner of the curb upon completion (which is the only difference between this criteria and fh_crb2b.x08)

Curb is drawn for the entire length of project.



define variables that must be assigned values in the input data file:

- "curb height"
- "curb width"
- "curb taper front"
- "curb taper back"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

None

Notes for fh_crb2t.x08:

1. There is no way to turn the curb on and off for station ranges built into this criteria. The only way the user could accomplish this would be to use multiple instances of side slope lt/rt blocks with station ranges in the proposed cross-section input file. For example, if the user wanted curb only from Stations 1+500 thru 1+600 on a project that ran from 1+000 to 2+0000 then the following syntax would have to be written into the input file:

side slope lt where sta < 1+500 r 1

[block of include statement without fh_crb2b.x08]

side slope lt where sta >= 1+500 r 1 and sta <= 1+600 r 1

[block of include statements with fh_crb2b.x08]

side slope lt where sta > 1+600 r 1

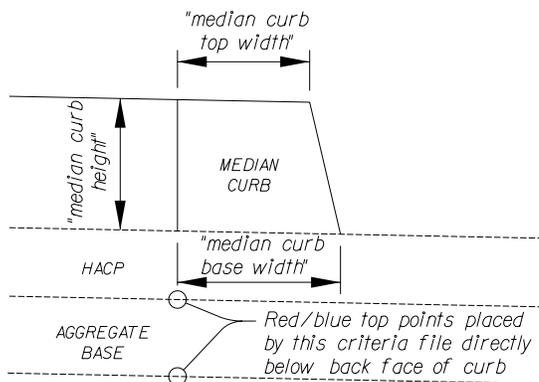
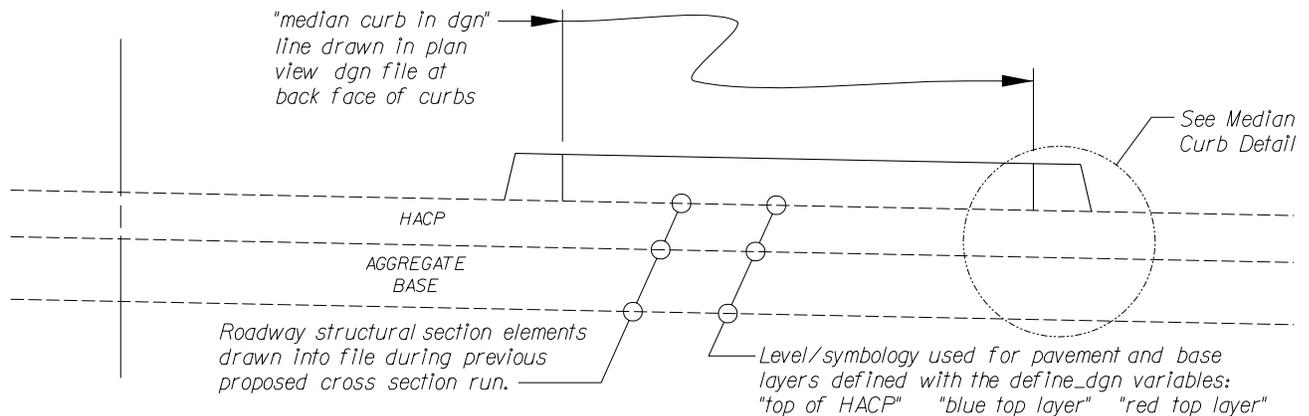
[block of include statement without fh_crb2b.x08]

fh_crb2t.x08

2. This criteria file always closes off the outside of the pavement and base course layers with vertical lines at the outside of the curb.
3. fh_crb2t.x08 should always be followed by a sidewalk criteria (or possibly a slope selection criteria). fh_crb2t.x08 should never be followed by a shoulder, widening, foreslope, or retaining wall criteria file; if this is done it will cause errors in the earthwork quantities because fh_crb2t.x08 closes off all the pavement and base course layers with vertical lines.
4. Upon completion of fh_crb2t.x08, the current point is the outside top corner of the curb.
5. Don't use fh_crb2t.x08 to draw paved ditch; there are standard paved ditch criteria files for that purpose.

c_median.x08

Post-processing criteria file to add a median island on top of previously drawn parking area or roadway x-sections. Station ranges for the median, width of the median, and distance from the base line to the median are set using lines drawn in plan view dgn file. Can't draw a median that straddles the baseline chain.



define variables that must be assigned values in the input data file:

- "median curb base width"
- "median curb top width"
- "median curb height"

define_dgn variables that must be assigned values in the input data file:

- "median curb in dgn" (drawn in plan view dgn file)
- "top of HACP" (drawn in proposed cross-section dgn file)
- "blue top layer" (drawn in proposed cross-section dgn file)
- "red top layer" (drawn in proposed cross-section dgn file)

Variables that must be defined in exceptions data file:

None

c_median.x08

Notes for c_median.x08:

1. This is strictly a post-processing criteria to add a picture of a median island to proposed x-sections that were drawn during a previous proposed x-section run.
2. Station ranges for median, width of median, and distance from base line to median are all controlled using the "median curb in dgn" lines drawn in plan view dgn file. This criteria expects a pair of "median curb in dgn" lines -- one on either side of the median.
3. The "median curb in dgn" lines should be drawn at the back face of the median curb.
4. This criteria will draw at most one median per side of centerline.
5. This criteria will not draw a median that straddles the centerline chain.
6. Red top and blue top text elements are placed directly below the back face of the median curbs at the top of base course undercut layer and at the subgrade undercut layer. Level/symbology used for the undercut layers is set using the "red top layer" and "blue top layer" define_dgn variables.
7. Red/blue top text elements are placed at the four corners of the median curb to allow the designer to pick up elevations at these points if desired.
8. Level/symbology used to draw median is lv=2 co=0 by default. The variables "median curb level" and "median curb color" may be used to override the default level/symbology.
9. Because this is a "post-processing" type criteria file it will be the only criteria in the include sequence. The following input file may be copied from this PDF document into the Windows Clipboard, pasted into an empty file in UltraEdit, edited as necessary, and run from GEOPAK to draw the median sections.

```
/* example input file for criteria c_median.x08 */
define_dgn "median in dgn"   dgn = PLANVIEW.DGN   lv=40   co=40
define_dgn "top of HACP"    dgn = XS.DGN   lv = 2   co = 0
define_dgn "blue top layer"  dgn = XS.DGN   lv = 3   co = 3
define_dgn "red top layer"   dgn = XS.DGN   lv = 4   co = 4

define "median curb height" 0.150
define "median curb base width" 0.185
define "median curb top width" 0.150

xsection
proposed xs
  xs dgn = XS.DGN
  existing ground line
  type=line lv=56 co=2
  pattern dgn = PLANVIEW.DGN
  pattern set
  job number = 000
  baseline = CHAIN_NAME
  horiz scale = 1
  vert scale = 1
  type = line
  lv=50 co=0
  criteria for shape cluster
```

c_median.x08

```
shape cluster baseline = CHAIN_NAME
shape cluster profile = PROFILE_NAME
shape cluster tie = 0

side slope lt
  include l:\criteria\c_median.x08
side slope rt
  include l:\criteria\c_median.x08

plot parameters
  text    lv=61  co=0  tw=0.5  th=0.5

write xs into dgn = XS.DGN
/* don't delete this line from input file */
```

median2.x08

Post-processing criteria file to add a median island onto previously drawn roadway x-sections. Station ranges for the median, width of the median, and distance from the base line to the median are set using lines drawn in plan view dgn file.

The intent of this criteria is only to aid the designer by drawing the median onto the x-sections at the correct locations. There is no way that this criteria can delete out the extra pavement layer lines inside the median; the designer must manually delete these lines using generic MicroStation tools.

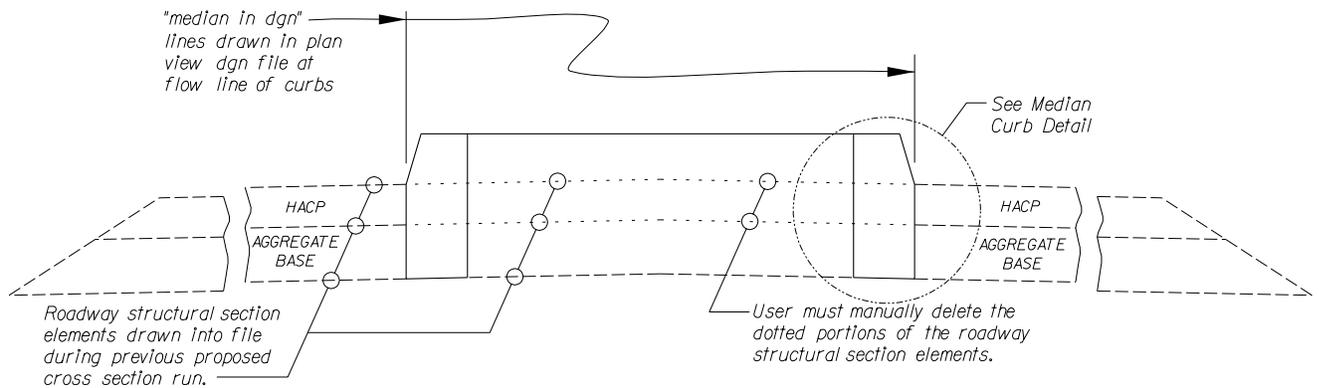


Figure 1 - Roadway cross section immediately after running this criteria file

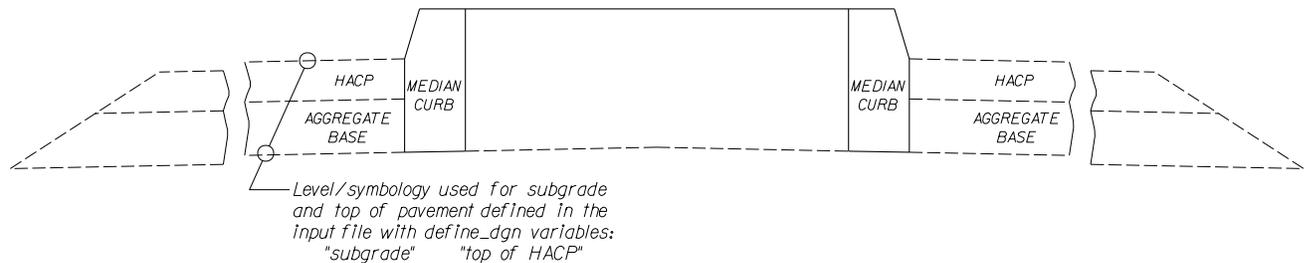


Figure 2 - Roadway cross section after user has manually deleted elements

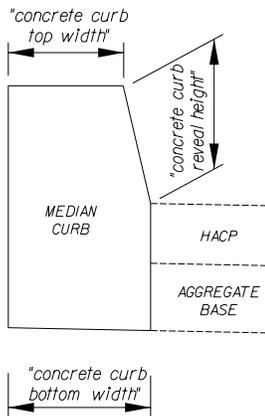


Figure 3 - Median curb detail

median2.x08

define variables that must be assigned values in the input data file:

"concrete curb bottom width"
"concrete curb top width"
"concrete curb reveal height"

define_dgn variables that must be assigned values in the input data file:

"median in dgn" (drawn in plan view dgn file)
"top of HACP" (drawn in proposed cross-section dgn file)
"subgrade" (drawn in proposed cross-section dgn file)

Variables that must be defined in exceptions data file:

None

Notes for median2.x08:

1. This is strictly a post-processing criteria designed to add a median with full depth curbs onto previously drawn proposed x-sections. The intent of this criteria is only to aid the designer by drawing the median onto the x-sections at the correct locations. There is no way that this criteria can delete out the extra pavement layer lines inside the median; the designer must manually delete and re-intersect these lines as shown above using generic MicroStation tools.
2. Station ranges for median, width of median, and distance from base line to median are all controlled using the "median in dgn" lines drawn in plan view dgn file. This criteria expects a single pair of "median in dgn" lines and won't draw the median if it doesn't find exactly two "in dgn" lines.
3. The "median in dgn" lines should be drawn at the flow line of the median curb.
4. This criteria will draw at most one median per x-section.
5. Once the median has been drawn into onto the x-sections it's time consuming to delete several of the median elements because they use the same level/symbology as other pavement layers (to facilitate extracting construction reports).
6. Red/blue top text elements are placed at each corner of the median curb to allow the designer to pick up elevations at these points if desired.
7. Assuming that the designer has deleted and re-intersected the extra pavement layer lines as outline above, earthwork and construction reports will run correctly for median x-sections when the following level/symbology is used:
Slope stake books
lv=4,10,18 co=4,10,16,18
Earthwork
Proposed undercut soil type = CONC_CURB lv=18,19 co=18,19

median2.x08

8. Because this is a "post-processing" type criteria file it will be the only criteria in the include sequence. The following example input file may be copied from this PDF document into the Windows ClipBoard, pasted into an empty file in UltraEdit, edited as necessary, and run from GEOPAK to draw the median sections.

```
/* example input file for criteria file median2.x08 */
define_dgn "median in dgn"   dgn = PLANVIEW.DGN   lv=49   co=49
define_dgn "top of HACP"    dgn = XS.DGN   lv=2   co=0
define_dgn "subgrade"      dgn = XS.DGN   lv=4   co=4

define "concrete curb reveal height" 0.20
define "concrete curb bottom width" 0.15
define "concrete curb top width" 0.10

xsection
proposed xs
  xs dgn = XS.DGN
  existing ground line
  lv = 56
  co = 2
  pattern dgn = PLANVIEW.DGN
  pattern set
  job number = 000
  baseline = CHAIN_NAME
  horiz scale = 10
  vert scale = 10
  type = line, line_string
  lv = 50   co = 0
  criteria for shape cluster
  shape cluster baseline = CHAIN_NAME
  shape cluster profile = PROFILE_NAME
  shape cluster tie = 0

  side slope lt
  include l:\criteria\median2.x08

  plot parameters
  text lv=61   co=6   th=0.1   tw=0.1   just=lb   ft=23

  write xs into dgn = XS.DGN
/* don't delete this line from input file */
```

FLH Standard Criteria Files

Section 6 –

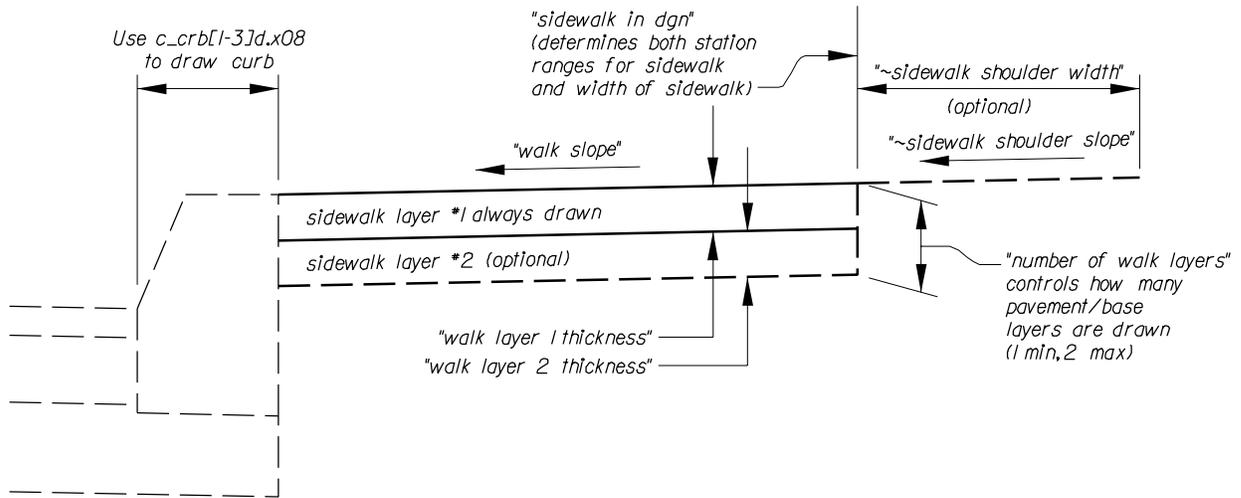
Sidewalk Criteria Files

Sidewalk Criteria Files

Criteria File	Elements Drawn by Criteria File
c_wlk1d.x08	<p>Sidewalk pavement layer plus an optional base course layer. Station ranges for sidewalk set by lines drawn in plan view dgn file. Sidewalk width is variable and is set by lines drawn in plan view dgn file. Optional gravel shoulder may be drawn off outside edge of sidewalk.</p>
c_wlk1s.x08	<p>Sidewalk pavement layer plus an optional base course layer. Station ranges for sidewalk set in exceptions data file. Sidewalk width is fixed. Optional gravel shoulder may be drawn off outside edge of sidewalk.</p>
c_wlk2d.x08	<p>Urban sidewalk or sidewalk plus parkway. Outside edge of sidewalk is forced to match existing ground so that no additional cut/fill is required outside the sidewalk. Inside edge of sidewalk ties to top of curb. Width of and station range(s) for the sidewalk are set by lines drawn in plan view dgn file. Draws sidewalk pavement layer plus an optional base course layer plus optional parkway between sidewalk and roadway curb. (CFL only)</p>
fh_wlk1b.x08	<p>Sidewalk pavement layer plus up to three base course layers. Origin point is inside bottom corner of sidewalk pavement layer. No way to set station ranges for sidewalk.</p>
fh_wlk1t.x08	<p>Sidewalk pavement layer plus up to three base course layers. Origin point is inside top corner of sidewalk pavement layer. No way to set station ranges for sidewalk.</p>

c_wlk1d.x08

Draws sidewalk pavement plus an optional base course layer under the sidewalk. An optional gravel shoulder may be drawn at the outside edge of the sidewalk. Station range(s) for the sidewalk are defined using line(s) drawn in a plan view dgn file. The width of sidewalk is also set by these lines drawn in plan view dgn and therefore the sidewalk width is variable.



define variables that must be assigned values in the input data file:

- "number of walk layers" (min 1, max 2)
- "walk layer 1 thickness"
- "walk layer 2 thickness"
- "walk slope" (%)
- "sidewalk shoulder width"

define_dgn variables that must be assigned values in the input data file:

- "sidewalk in dgn"

Variables that must be defined in exceptions data file:

None

Notes for c_wlk1d.x08:

1. The station range(s) for sidewalk are set using lines drawn in a plan view dgn file as specified by the "sidewalk in dgn" define_dgn variable.
2. The width of the sidewalk is also set by these lines drawn in plan view dgn -- the outside edge of the sidewalk is drawn to match the offset of the "in dgn" line.
3. By default the "sidewalk in dgn" line will be found if it is drawn anywhere within a distance of 50 meters out from the point where the preceding curb criteria file left off. If the "in dgn" line isn't found within this distance, then the sidewalk will not be drawn. The user may adjust the search distance by defining "~max sidewalk search dist" in the input file.

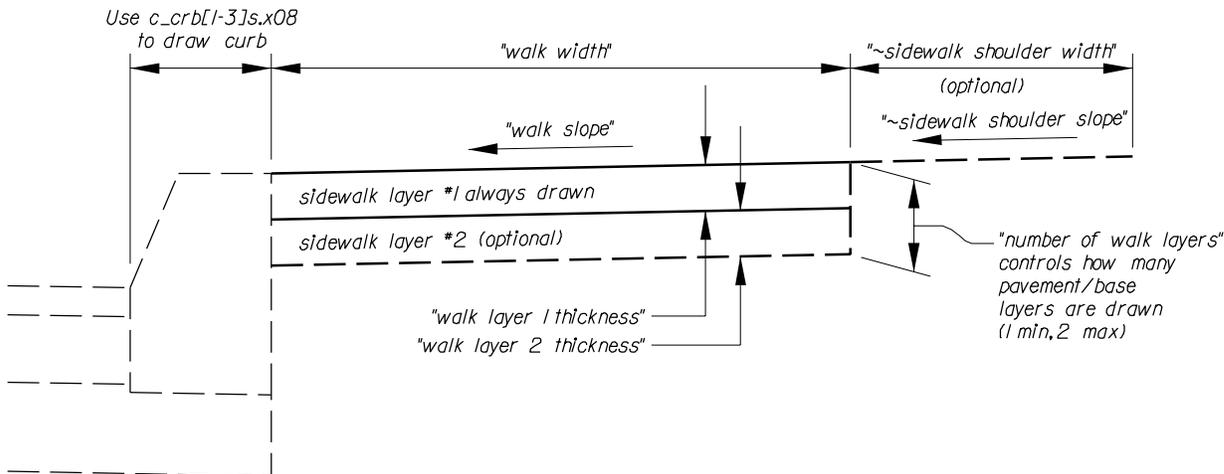
c_wlk1d.x08

4. This criteria always draws the sidewalk pavement layer; the depth of the pavement is equal to "walk layer 1 thickness". Optionally, a single base course layers may be drawn by setting "number of walk layers" to 2. Set "number of walk layers" equal to 1 to not draw any base course layers.
5. An optional (gravel) shoulder may be drawn by setting the "~sidewalk shoulder width" parameter to the desired shoulder width. The slope of this shoulder is set with the "~sidewalk shoulder slope" parameter. By default, "sidewalk shoulder slope" is set to zero so that no sidewalk shoulder is drawn unless the user defines this parameter in the input file.
6. The "walk slope" define variable is a percent value using the standard GEOPAK slope sign convention (i.e., +2.00 is a 2% slope up and away from centerline; -2.00 is a 2% slope down and away from centerline).
7. This criteria should always immediately follow one of the c_crb[1-3]d.x08 criteria files in the include sequence because it uses two marked points (600 and 601) set in those criteria files.
8. The level/symbology used to draw the curb section will allow the user to get both slope stake books and earthwork quantities. However, in order to accomplish this the earthwork input file and the slope stake report dialog must be set up exactly as follows:
In the earthwork input file:
 - Make sure there is a Proposed Undercut with soil type CONC_CURB and lv=18,19 co=18,19. Set all the multiplication factors to 0.000001.In the slope stake report dialog include only the following level/symbology:
 - The level and color of the bottom layer of the roadway pavement section only. Don't include the level/symbology for any of the other pavement layers.
 - lv=18 and co=18. These are a part of (but not all of) the curb elements. Don't include the remaining curb elements (lv=2,19 co=0,19).
 - lv=10 co=10. These are the cut/fill slope elements.
 - lv=10 co=16. These are the ditch foreslope elements.
 - If sidewalk is used, then add the level and color of only the bottom layer of the sidewalk section. (Either lv=14 co=14 or lv=15 co=15.)
9. Differences between this criteria (c_wlk1d.x08) and c_wlk1s.x08:
Station ranges for sidewalk
 - c_wlk1d.x08 -- uses lines drawn in plan view dgn file
 - c_wlk1s.x08 -- uses exceptions data fileWidth of sidewalk
 - c_wlk1d.x08 -- variable width set by lines drawn in plan view dgn file
 - c_wlk1s.x08 -- fixed width set with "walk width" parameter

Sidewalk Criteria Files

c_wlk1s.x08

Draws sidewalk pavement plus an optional base course layer under the sidewalk. An optional shoulder may also be drawn outside the sidewalk. Station range(s) for sidewalk are defined in the exceptions data file. Sidewalk width is fixed.



define variables that must be assigned values in the input data file:

- "number of walk layers" (min 1, max 2)
- "walk layer 1 thickness"
- "walk layer 2 thickness"
- "walk slope" (%)
- "walk width"
- "sidewalk shoulder width"

define_dgn variables that must be assigned values in the input data file:

none

Variables that must be defined in exceptions data file:

- _d_use_sidewalk_lt
- _d_use_sidewalk_rt

Notes for c_wlk1s.x08:

1. The station range(s) for sidewalk are set using the _d_use_sidewalk_[lt,rt] variables in the exceptions data file.
2. The width of the sidewalk is fixed as defined by "walk width".
3. This criteria always draws the sidewalk pavement layer; the depth of the pavement is equal to "walk layer 1 thickness". Optionally, one additional base course layers may be drawn by setting "number of walk layers" to 2. Set "number of walk layers" equal to 1 to not draw any base course layers.

c_wlk1s.x08

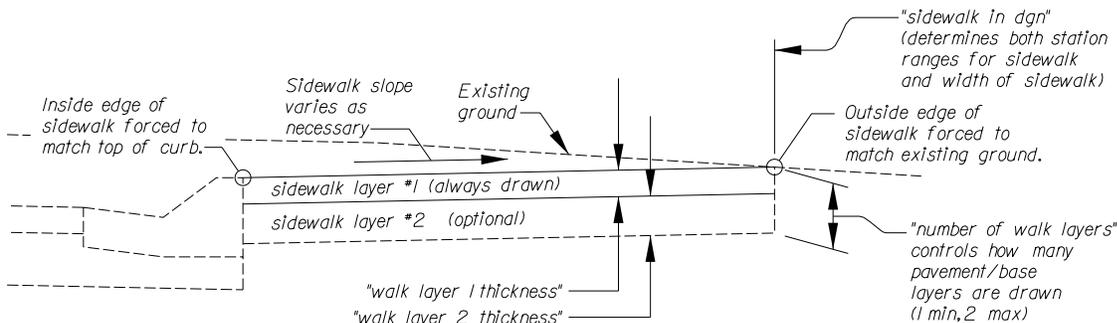
Notes for c_wlk1s.x08 (continued):

4. An optional (gravel) shoulder may be drawn by setting the "~sidewalk shoulder width" parameter to the desired shoulder width. The slope of this shoulder is set with the "~sidewalk shoulder slope" parameter. By default, "sidewalk shoulder width" is set to zero so that no sidewalk shoulder is drawn unless the user defines this parameter in the input file.
5. The "walk slope" define variable is a percent value using the standard GEOPAK slope sign convention (i.e., +2.00 is a 2% slope up and away from centerline; -2.00 is a 2% slope down and away from centerline).
6. This criteria should always immediately follow one of the c_crb[1-3]s.x08 criteria files in the include sequence because it uses two marked points (600 and 601) set in those criteria files.
7. See the Notes section for c_wlk1d.x08 for an outline of the level/symbology to use for earthwork and slope stake books.
8. Differences between this criteria (c_wlk1s.x08) and c_wlk1d.x08:
 - Station ranges for sidewalk
 - c_wlk1d.x08 -- uses lines drawn in plan view dgn file
 - c_wlk1s.x08 -- uses exceptions data file
 - Width of sidewalk
 - c_wlk1d.x08 -- variable width set by lines drawn in plan view dgn file
 - c_wlk1s.x08 -- fixed width set with "walk width" parameter

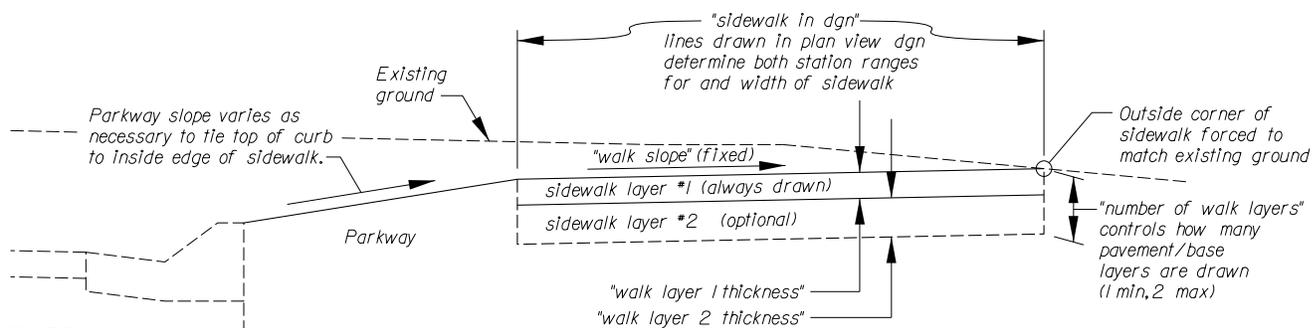
Sidewalk Criteria Files

c_wlk2d.x08

Draws sidewalk pavement plus an optional base course layer under the sidewalk plus optional parkway between roadway curb and sidewalk. Station range(s) for sidewalk, width of sidewalk, and sidewalk only or sidewalk plus parkway are defined using line(s) drawn in a plan view dgn file. Originally written for an urban project where outside edge of sidewalk needed to match exactly the grade of existing yards, business entrances, etc.



CASE I - ONLY ONE "SIDEWALK IN DGN" LINE FOUND



CASE II - TWO "SIDEWALK IN DGN" LINES FOUND

define variables that must be assigned values in the input data file:

- "number of walk layers" (min 1, max 2)
- "walk layer 1 thickness"
- "walk layer 2 thickness"
- "walk slope" (%)

define_dgn variables that must be assigned values in the input data file:

- "sidewalk in dgn"

Variables that must be defined in exceptions data file:

None

c_wlk2d.x08

Notes for c_wlk2d.x08:

1. This criteria file was originally written for an urban section of a project where the outside edge of the sidewalk needed to match exactly the existing grade of yards, business entrances, etc., to minimize the construction area.
2. The station range(s) for sidewalk are set using lines drawn in a plan view dgn file as specified by the "sidewalk in dgn" define_dgn variable.
3. The width of the sidewalk is also set by these lines drawn in plan view dgn -- the outside edge of the sidewalk is drawn to match the offset of the "in dgn" line.
4. The number of "sidewalk in dgn" lines found in the plan view file determines whether the configuration drawn is sidewalk only or sidewalk plus parkway:
 - a. If a single "sidewalk in dgn" line is found then the sidewalk will be drawn from the top of curb out to match the existing ground elevation at the offset of the "in dgn" line.
 - b. If two "sidewalk in dgn" lines are found then a grass parkway will be drawn from the top of curb out to the first "in dgn" line and the sidewalk will be drawn from that point out to match the existing ground elevation at the offset of the second "in dgn" line.
5. This criteria always draws the sidewalk pavement layer; the depth of the pavement is equal to "walk layer 1 thickness". Optionally, a single base course layers may be drawn by setting "number of walk layers" to 2. Set "number of walk layers" equal to 1 to not draw any base course layers.
6. The "walk slope" define variable is a percent value using the standard GEOPAK slope sign convention (i.e., +2.00 is a 2% slope up and away from centerline; -2.00 is a 2% slope down and away from centerline).
7. Notice that "walk slope" is used only for the sidewalk plus parkway case; for the sidewalk only case the slope of the sidewalk varies as necessary to tie the inside edge of the sidewalk to the top of curb and the outside edge of the sidewalk to the existing ground elevation.
8. The slope of the parkway varies as necessary to tie to the top of the curb on the inside and the inside edge of the sidewalk on the outside.
9. This criteria should always immediately follow one of the c_crb[1-3]d.x08 criteria files in the include sequence because it uses two marked points (600 and 601) set in those criteria files.
10. The level/symbology used to draw the curb section will allow the user to get both slope stake books and earthwork quantities. However, in order to accomplish this the earthwork input file and the slope stake report dialog must be set up exactly as follows:

In the earthwork input file:

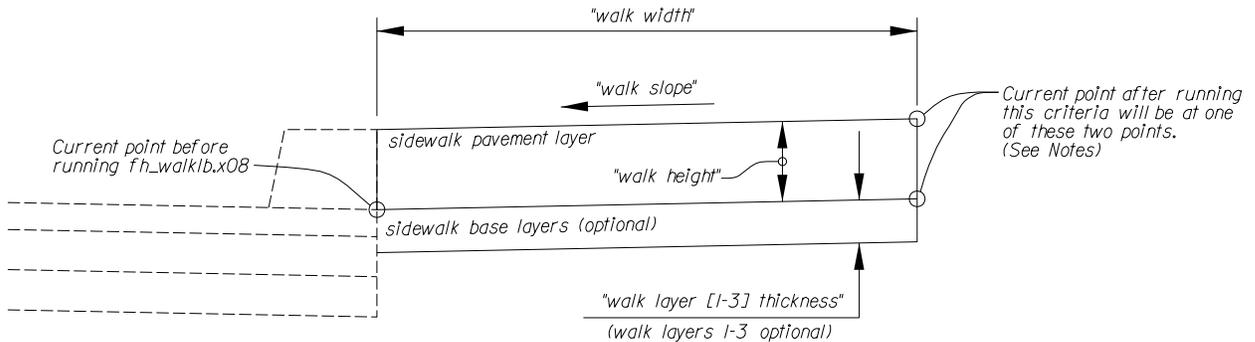
- Make sure there is a Proposed Undercut with soil type CONC_CURB and lv=18,19 co=18,19. Set all the multiplication factors to 0.000001.

In the slope stake report dialog include only the following level/symbology:

- The level and color of the bottom layer of the roadway pavement section only. Don't include the level/symbology for any of the other pavement layers.
- lv=18 and co=18. These are a part of (but not all of) the curb elements. Don't include the remaining curb elements (lv=2,19 co=0,19).
- lv=10 co=10. These are the cut/fill slope elements.
- lv=10 co=16. These are the ditch foreslope elements.
- If sidewalk is used, then add the level and color of only the bottom layer of the sidewalk section. (Either lv=14 co=14 or lv=15 co=15.)

fh_wlk1b.x08

Draws sidewalk pavement layer. Will also, optionally, draw up to a maximum of 3 base course layers under the sidewalk pavement. Origin point for this fh_wlk1b.x08 is the inside bottom corner of the sidewalk pavement layer. (Contrast this with fh_wlk1t.x08, where the origin point is the inside top corner of the sidewalk pavement layer.)



define variables that must be assigned values in the input data file:

- "walk width"
- "walk slope"
- "walk height"
- "walk taper front"
- "walk taper back"
- "number of walk layers"
- "walk layer 1 thickness"
- "walk layer 2 thickness"
- "walk layer 3 thickness"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

None

Notes for fh_wlk1b.x08:

1. There is no method built into fh_wlk1b.x08 to allow the user to turn the sidewalk on and off for station ranges. The only way the user could accomplish this would be to use multiple instances of side slope lt/rt blocks with station ranges in the proposed cross-section input file. For example, if the user wanted sidewalk only from Stations 1+500 thru 1+600 on a project that ran from 1+000 to 2+0000 then the following syntax would have to be written into the input file:

```

side slope lt where sta < 1+500 r 1
    [block of include statement without fh_wlk1b.x08]
side slope lt where sta >= 1+500 r 1 and sta <= 1+600 r 1
    [block of include statements with fh_wlk1b.x08]
side slope lt where sta > 1+600 r 1
    [block of include statement without fh_wlk1b.x08]
    
```

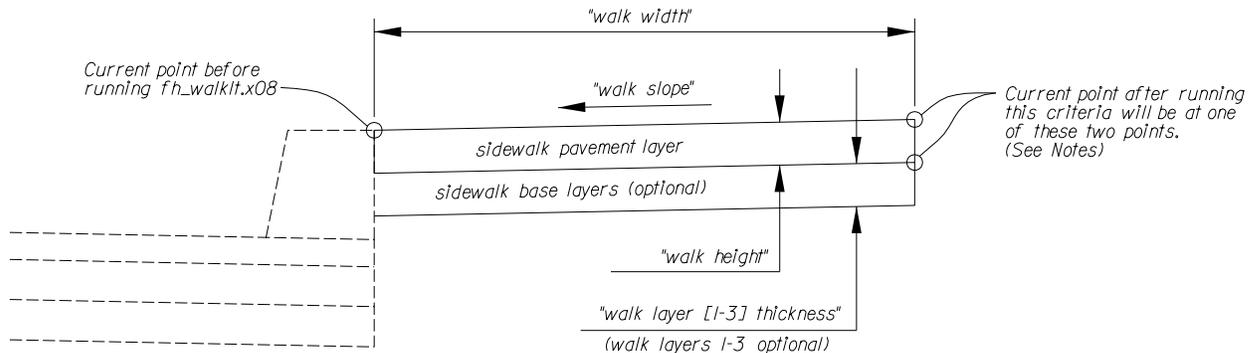
fh_wlk1b.x08

2. fh_wlk1b.x08 always draws the sidewalk pavement layer. Optionally, it will draw up to a maximum of three base course layers (as specified in the input file by the define variables "number of walk layers" and "walk layer [1-3]"); "number of walk layers may be set to zero.
3. The "walk slope" define variable is a percent value using the standard GEOPAK slope sign convention (i.e., +2.00 is a 2% slope up and away from centerline; -2.00 is a 2% slope down and away from centerline).
4. Define variables "walk taper front" and "walk taper back" are provided to allow the user to make the inside and outside edges of the sidewalk pavement something other than vertical. However, these parameters should normally be set to 0 (for vertical pavement edges).
5. Typically fh_wlk1b.x08 should immediately follow one of the curb criteria files (e.g., fh_crb2b.x08 or fh_crb2t.x08) in the input file include sequence.
6. The location of the current point immediately after executing fh_wlk1b.x08 varies depending upon the location of the outside top corner of the sidewalk pavement layer: if the point is below existing ground, then the current point will be the outside top corner of the sidewalk pavement layer, if the point is above existing ground, then the current point will be the outside bottom corner of the sidewalk pavement layer.

Sidewalk Criteria Files

fh_wlk1t.x08

Draws sidewalk pavement layer. Will also, optionally, draw up to a maximum of 3 base course layers under the sidewalk pavement. Origin point for this *fh_wlk1t.x08* is the inside top corner of the sidewalk pavement layer. (Contrast this with *fh_wlk1b.x08*, where the origin point is the inside bottom corner of the sidewalk pavement layer.)



define variables that must be assigned values in the input data file:

"walk width"
"walk slope"
"walk height"
"walk taper front"
"walk taper back"
"number of walk layers"
"walk layer 1 thickness"
"walk layer 2 thickness"
"walk layer 3 thickness"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

None

Notes for fh_wlk1t.x08:

1. There is no method built into *fh_wlk1t.x08* to allow the user to turn the sidewalk on and off for station ranges. The only way the user could accomplish this would be to use multiple instances of side slope lt/rt blocks with station ranges in the proposed cross-section input file. For example, if the user wanted sidewalk only from Stations 1+500 thru 1+600 on a project that ran from 1+000 to 2+0000 then the following syntax would have to be written into the input file:

side slope lt where sta < 1+500 r 1

[block of include statement without fh_wlk1b.x08]

side slope lt where sta >= 1+500 r 1 and sta <= 1+600 r 1

[block of include statements with fh_wlk1b.x08]

side slope lt where sta > 1+600 r 1

[block of include statement without fh_wlk1b.x08]

fh_wlk1t.x08

2. fh_wlk1t.x08 always draws the sidewalk pavement layer. Optionally, it will draw up to a maximum of three base course layers (as specified in the input file by the define variables "number of walk layers" and "walk layer [1-3]"); "number of walk layers may be set to zero.
3. The "walk slope" define variable is a percent value using the standard GEOPAK slope sign convention (i.e., +2.00 is a 2% slope up and away from centerline; -2.00 is a 2% slope down and away from centerline).
4. Define variables "walk taper front" and "walk taper back" are provided to allow the user to make the inside and outside edges of the sidewalk pavement something other than vertical. However, these parameters should normally be set to 0 (for vertical pavement edges).
5. Typically fh_wlk1t.x08 should immediately follow one of the curb criteria files (e.g., fh_crb2b.x08 or fh_crb2t.x08) in the input file include sequence.
6. The location of the current point immediately after executing fh_wlk1t.x08 varies depending upon the location of the outside top corner of the sidewalk pavement layer: if the point is below existing ground, then the current point will be the outside top corner of the sidewalk pavement layer, if the point is above existing ground, then the current point will be the outside bottom corner of the sidewalk pavement layer.

FLH Standard Criteria Files

Section 7 –

Paved Ditch Criteria Files

Paved Ditch Criteria Files

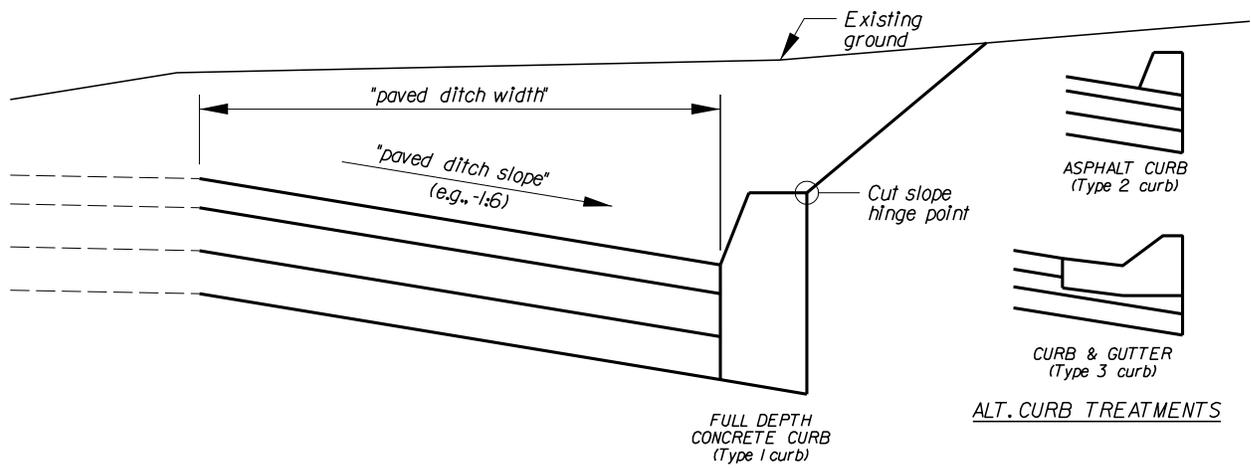
Criteria File	Rules for Drawing Paved Ditch
fh_pavd1.x08	Station range(s) for paved ditch set in exceptions data file. Fixed paved ditch width.
fh_pavd2.x08	Station range(s) for paved ditch set by "paved ditch in dgn" line in plan view dgn. Fixed paved ditch width.
fh_pavd3.x08	Station range(s) and paved ditch width set by "paved ditch in dgn"line in plan view dgn file.

Additional features that may be used with any of the paved ditch criteria files:

- Alternate curb/curb and gutter sections
- Fixed width bench behind paved ditch curb
- Fixed cut slopes
- Force paved ditch slope to match roadway slope on low side of super
- Typical excavation and backfill behind paved ditch curb.
- Special excavation and backfill behind paved ditch curb.

fh_pavd1.x08

Draws a fixed width paved ditch including base course, pavement, curb, and cut/fill slopes using station ranges specified in the exceptions data file.



define variables that must be assigned values in the input data file:

Required:

- "paved ditch width"
- "paved ditch slope" (rise:run, e.g., -1:6)
- "paved ditch curb type" (see Curb/Curb and Gutter Options)

Required when type 1 curb (full depth concrete curb) is used:

- "paved ditch curb height"
- "paved ditch curb top width"
- "paved ditch curb bottom width"

Required when type 2 curb (asphalt curb) is used:

- "paved ditch curb height"
- "paved ditch curb top width"
- "paved ditch curb bottom width"

Required when type 3 curb (concrete curb & gutter) is used:

- "pd c&g total width" (default = 0.60 m)
- "pd c&g gutter width" (default = 0.30 m)
- "pd c&g curb top width" (default = 0.10 m)
- "pd c&g curb inside height" (default = 0.15 m)
- "pd c&g curb outside height" (default = 0.30 m)
- "pd c&g gutter slope" (default = -1:8)
- "pd c&g gutter thickness" (default = 0.15)

Optional:

- "use variable paved ditch slope"
- "paved ditch bench width lt"
- "paved ditch bench width rt"
- "paved ditch fixed cut slope lt"
- "paved ditch fixed cut slope rt"
- "use paved ditch special excavation details"

fh_pavd1.x08

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

_d_draw_paved_ditch_lt

_d_draw_paved_ditch_rt

Notes for fh_pavd1.x08:

1. Station ranges for paved ditch are set in the exceptions data file. (Contrast this with fh_pavd2.x08 and fh_pavd3.x08 which use "paved ditch in dgn" line drawn in a plan view dgn file to specify the station ranges for paved ditch.)
2. The width of the paved ditch is a fixed value ("paved ditch width" defined in the input file). Contrast this with fh_pavd3.x08 which allows for a variable width paved ditch.
3. The "first full length layer" variable determines whether all the base course and pavement layers are drawn for the paved ditch.
4. There are three different curb/curb and gutter options that the user can select from by using the define variable "paved ditch curb type" in the input file. (1 = full depth concrete curb, 2 = asphalt curb, 3 = curb and gutter) By default, the full depth concrete curb section shown above is used. See the Curb/Curb and Gutter Options section below for details. (Revised 8/9/00)
5. In order to maintain backward compatibility, "paved ditch curb type" may be set to 0 to use the old-style method for picking which type of curb/curb and gutter to use. For this case the various combinations of the variables "use pd curb and gutter" and "paved ditch curb full depth" control curb type selected. ("use pd curb and gutter" = 1 plus "paved ditch curb full depth" = anything results in curb and gutter; "use pd curb and gutter" = 0 plus "paved ditch curb full depth" = 1 results in full depth curb; "use pd curb and gutter" = 0 plus "paved ditch curb full depth" = 0 results in asphalt curb.) (Revised 8/9/00)
6. The user has the option to force the slope for paved ditch sections on the low side of super and in normal crown to match the roadway cross-slope setting the define variable "use variable slope paved ditch" to 1 in the input file. By default this option is turned off. See the Variable Paved Ditch Slope Options section below for details.
7. An optional fixed width bench can be drawn behind the paved ditch curb by setting the variables "paved ditch bench width lt" and/or "paved ditch bench width rt" to the desired bench width. This option works only if (1) the old style special excavation details are not used, and (2) the top of curb is below existing ground. By default both of these variables are set to 0 (i.e., no bench is drawn). (Added 8/9/00)
8. An option to force all the cut slopes behind the paved ditch curb to a fixed value can be activated by setting the variables "paved ditch fixed cut slope lt" and/or "paved ditch fixed cut slope rt" to the desired RISE:RUN slope ratio (e.g., 1:2). This option works only if (1) the old style special excavation details are not used, and (2) the top of curb is below existing ground. By default both

of these variables are toggled off (i.e., "normal" slope selection procedure is used to determine the cut slope ratio). (Added 8/9/00)

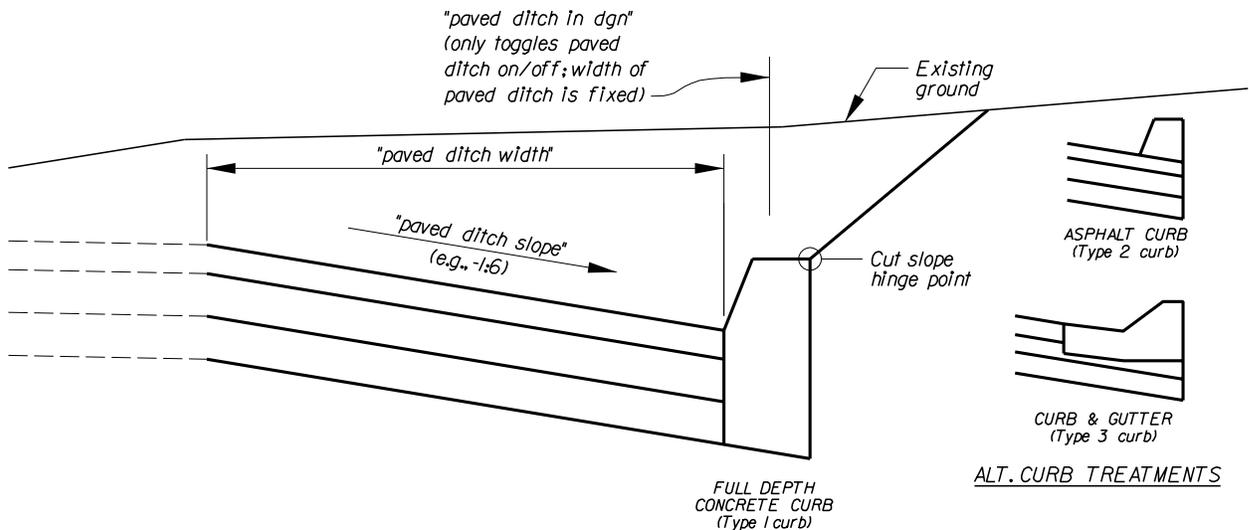
9. The lines representing the back face of curb/curb & gutter and the line tying off the outside of the pavement undercut layers are tilted slightly outward from vertical to work around a continuing bug in the slope stake report procedure. The hidden variable "*~near vertical tilt factor*" is used in the criteria to set the amount of "tilt". The variable is the RISE portion of the RISE:1 slope of the lines. A value of 500 is used by default and should be OK when the MU:SU:PU are 1:1000:10 in the x-section file; this value may be too high if the resolution of the x-section file is lower. (Revised 8/9/00)
10. The slope label for the paved ditch may be toggled off by setting the hidden variable "*~place paved ditch slope labels*" equal to 0 in the input file. The slope label will be placed by default if the variable is not defined in the input file. The size of the slope label text is set by the "*text size*" variable (which controls the text size for all the various slope labels drawn by all the standard criteria files). (Revised 8/9/00)
11. Text is placed at hinge points and catches to allow red/blue top report to be used to create xyz format slope stake reports. (Added 8/9/00)
 - "HPC" at hinge point for cuts
 - "HPF" at hinge point for fills
 - "SSC" at slope stake for cuts
 - "SSF" at slope stake for fills
12. Previous versions of the paved ditch criteria files have allowed the designer to draw fairly detailed excavation and backfill behind the paved ditch curb (referred to hereafter as special excavation/backfill details). Use of these special excavation/backfill features discouraged. A simpler method (referred to hereafter as typical excavation/backfill details) is the preferred method. (See "Design Consistency and Guidance" memo from Haussler and Hirsbrunner.)
13. Despite the fact that the use of the special excavation details is discouraged, they are still available to the designer in order to maintain backward compatibility with older versions of the paved ditch criteria files. The special excavation/backfill details can be activated by defining the "*use paved ditch special excavation details*" to be 1 in the input file. This will cause the paved ditch criteria to behave identically to previous versions. (Revised 8/9/00)
14. When special excavation details are used (see note above), level/symbology of the backfill area behind the curb is set up to allow the earthwork procedure to calculate a separate quantity for paved ditch curb backfill. (Earthwork will not be calculated correctly if the special excavation lines behind the curb are made coincident with the back face of the curb by setting "*paved ditch spec exc width*" to 0 and "*paved ditch spec exc slope*" to 1000:1.)
15. There are several optional variables that can be used to control how the special excavation and backfill behind the paved ditch curb is drawn. All these variables have been assigned reasonable default values. In general, these variables should not be defined in the input file unless the user wishes to override the default values. See the Special Excavation and Backfill section below for

details.

16. By default the cut/fill slopes drawn by this criteria behind the paved ditch curb are labeled with the RISE:RUN slope value. The size of this text is set using the "text size" variable in the input file. If the cut/fill slopes labels aren't needed, they maybe toggled off by setting the "*~place cut/fill slope labels*" variable to 0 in the input file.

fh_pavd2.x08

Draws a fixed width paved ditch including base course, pavement, curb, and cut/fill slopes using a line drawn in a plan view dgn file to locate station ranges where paved ditch is used.



define variables that must be assigned values in the input data file:

Required:

"paved ditch width"

"paved ditch slope" (rise:run, e.g., -1:6)

"paved ditch curb type" (see Curb/Curb and Gutter Options)

Required when type 1 curb (full depth concrete curb) is used:

"paved ditch curb height"

"paved ditch curb top width"

"paved ditch curb bottom width"

Required when type 2 curb (asphalt curb) is used:

"paved ditch curb height"

"paved ditch curb top width"

"paved ditch curb bottom width"

Required when type 3 curb (concrete curb & gutter) is used:

"pd c&g total width" (default = 0.60 m)

"pd c&g gutter width" (default = 0.30 m)

"pd c&g curb top width" (default = 0.10 m)

"pd c&g curb inside height" (default = 0.15 m)

"pd c&g curb outside height" (default = 0.30 m)

"pd c&g gutter slope" (default = -1:8)

"pd c&g gutter thickness" (default = 0.15)

Optional:

"use variable paved ditch slope"

"paved ditch bench width lt"

"paved ditch bench width rt"

"paved ditch fixed cut slope lt"

fh_pavd2.x08

"paved ditch fixed cut slope rt"
"use paved ditch special excavation details"

define_dgn variables that must be assigned values in the input data file:

"paved ditch in dgn"

Variables that must be defined in exceptions data file:

None

Notes for fh_pavd2.x08:

1. Station ranges for paved ditch are set by "*paved ditch in dgn*" line drawn in a plan view dgn file. (Contrast this with fh_pavd1.x08 which uses the exceptions data file to specify the station ranges for paved ditch.)
2. The width of the paved ditch is a fixed value ("*paved ditch width*" defined in the input file). Contrast this with fh_pavd3.x08 which allows for a variable width paved ditch.
3. The "*first full length layer*" variable determines whether all the base course and pavement layers are drawn for the paved ditch.
4. There are three different curb/curb and gutter options that the user can select from by using the define variable "*paved ditch curb type*" in the input file. (1 = full depth concrete curb, 2 = asphalt curb, 3 = curb and gutter) By default, the full depth concrete curb section shown above is used. See the Curb/Curb and Gutter Options section below for details. (Revised 8/9/00)
5. In order to maintain backward compatibility, "*paved ditch curb type*" may be set to 0 to use the old-style method for picking which type of curb/curb and gutter to use. For this case the various combinations of the variables "*use pd curb and gutter*" and "*paved ditch curb full depth*" control curb type selected. ("*use pd curb and gutter*" = 1 plus "*paved ditch curb full depth*" = anything results in curb and gutter; "*use pd curb and gutter*" = 0 plus "*paved ditch curb full depth*" = 1 results in full depth curb; "*use pd curb and gutter*" = 0 plus "*paved ditch curb full depth*" = 0 results in asphalt curb.) (Revised 8/9/00)
6. The user has the option to force the slope for paved ditch sections on the low side of super and in normal crown to match the roadway cross-slope setting the define variable "*use variable slope paved ditch*" to 1 in the input file. By default this option is turned off. See the Variable Paved Ditch Slope Options section below for details.
7. An optional fixed width bench can be drawn behind the paved ditch curb by setting the variables "*paved ditch bench width lt*" and/or "*paved ditch bench width rt*" to the desired bench width. This option works only if (1) the old style special excavation details are not used, and (2) the top of curb is below existing ground. By default both of these variables are set to 0 (i.e., no bench is drawn). (Added 8/9/00)
8. An option to force all the cut slopes behind the paved ditch curb to a fixed value can be activated by setting the variables "*paved ditch fixed cut slope lt*" and/or "*paved ditch fixed cut slope rt*" to

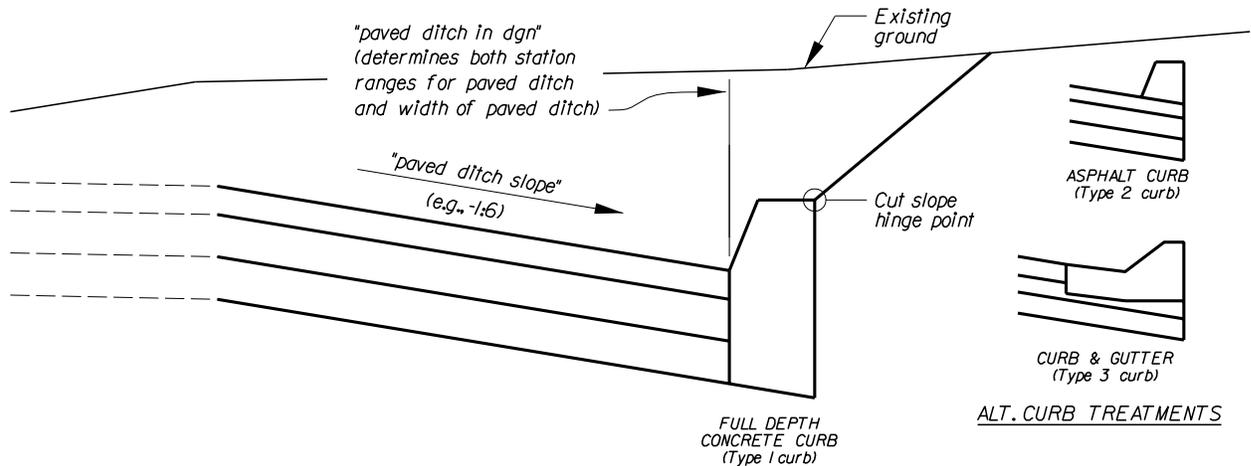
the desired RISE:RUN slope ratio (e.g., 1:2). This option works only if (1) the old style special excavation details are not used, and (2) the top of curb is below existing ground. By default both of these variables are toggled off (i.e., "normal" slope selection procedure is used to determine the cut slope ratio). (Added 8/9/00)

9. The lines representing the back face of curb/curb & gutter and the line tying off the outside of the pavement undercut layers are tilted slightly outward from vertical to work around a continuing bug in the slope stake report procedure. The hidden variable "*~near vertical tilt factor*" is used in the criteria to set the amount of "tilt". The variable is the RISE portion of the RISE:1 slope of the lines. A value of 500 is used by default and should be OK when the MU:SU:PU are 1:1000:10 in the x-section file; this value may be too high if the resolution of the x-section file is lower. (Revised 8/9/00)
10. The slope label for the paved ditch may be toggled off by setting the hidden variable "*~place paved ditch slope labels*" equal to 0 in the input file. The slope label will be placed by default if the variable is not defined in the input file. The size of the slope label text is set by the "*text size*" variable (which controls the text size for all the various slope labels drawn by all the standard criteria files). (Revised 8/9/00)
11. Text is placed at hinge points and catches to allow red/blue top report to be used to create xyz format slope stake reports. (Added 8/9/00)
 - "HPC" at hinge point for cuts
 - "HPF" at hinge point for fills
 - "SSC" at slope stake for cuts
 - "SSF" at slope stake for fills
12. Previous versions of the paved ditch criteria files have allowed the designer to draw fairly detailed excavation and backfill behind the paved ditch curb (referred to hereafter as special excavation/backfill details). Use of these special excavation/backfill features discouraged. A simpler method (referred to hereafter as typical excavation/backfill details) is the preferred method. (See "Design Consistency and Guidance" memo from Haussler and Hirsbrunner.)
13. Despite the fact that the use of the special excavation details is discouraged, they are still available to the designer in order to maintain backward compatibility with older versions of the paved ditch criteria files. The special excavation/backfill details can be activated by defining the "*use paved ditch special excavation details*" to be 1 in the input file. This will cause the paved ditch criteria to behave identically to previous versions. (Revised 8/9/00)
14. When special excavation details are used (see note above), level/symbology of the backfill area behind the curb is set up to allow the earthwork procedure to calculate a separate quantity for paved ditch curb backfill. (Earthwork will not be calculated correctly if the special excavation lines behind the curb are made coincident with the back face of the curb by setting "*paved ditch spec exc width*" to 0 and "*paved ditch spec exc slope*" to 1000:1.)
15. There are several optional variables that can be used to control how the special excavation and backfill behind the paved ditch curb is drawn. All these variables have been assigned reasonable

default values. In general, these variables should not be defined in the input file unless the user wishes to override the default values. See the Special Excavation and Backfill section below for details.

16. By default the cut/fill slopes drawn by this criteria behind the paved ditch curb are labeled with the RISE:RUN slope value. The size of this text is set using the "text size" variable in the input file. If the cut/fill slopes labels aren't needed, they maybe toggled off by setting the "*~place cut/fill slope labels*" variable to 0 in the input file.

Draws a variable width paved ditch including base course, pavement, curb, and cut/fill slopes using a line drawn in a plan view dgn file to locate station ranges where paved ditch is used and to define the width of the paved ditch.



define variables that must be assigned values in the input data file:

Required:

"paved ditch slope" (rise:run, e.g., -1:6)

"paved ditch curb type" (see Curb/Curb and Gutter Options)

Required when type 1 curb (full depth concrete curb) is used:

"paved ditch curb height"

"paved ditch curb top width"

"paved ditch curb bottom width"

Required when type 2 curb (asphalt curb) is used:

"paved ditch curb height"

"paved ditch curb top width"

"paved ditch curb bottom width"

Required when type 3 curb (concrete curb & gutter) is used:

"pd c&g total width" (default = 0.60 m)

"pd c&g gutter width" (default = 0.30 m)

"pd c&g curb top width" (default = 0.10 m)

"pd c&g curb inside height" (default = 0.15 m)

"pd c&g curb outside height" (default = 0.30 m)

"pd c&g gutter slope" (default = -1:8)

"pd c&g gutter thickness" (default = 0.15)

Optional:

"use variable paved ditch slope"

"paved ditch bench width lt"

"paved ditch bench width rt"

"paved ditch fixed cut slope lt"

"paved ditch fixed cut slope rt"

"use paved ditch special excavation details"

fh_pavd3.x08

define_dgn variables that must be assigned values in the input data file:

"paved ditch in dgn"

Variables that must be defined in exceptions data file:

None

Notes for fh_pavd3.x08:

1. Station ranges for paved ditch are set by "*paved ditch in dgn*" line drawn in a plan view dgn file. (Contrast this with fh_pavd1.x08 which uses the exceptions data file to specify the station ranges for paved ditch.)
2. The width of the paved ditch is by "*paved ditch in dgn*" line drawn in a plan view dgn file. (Contrast this with fh_pavd1.x08 and fh_pavd2.x08 which both use a fixed width for the paved ditch.)
3. The "*first full length layer*" variable determines whether all the base course and pavement layers are drawn for the paved ditch.
4. There are three different curb/curb and gutter options that the user can select from by using the define variable "*paved ditch curb type*" in the input file. (1 = full depth concrete curb, 2 = asphalt curb, 3 = curb and gutter) By default, the full depth concrete curb section shown above is used. See the Curb/Curb and Gutter Options section below for details. (Revised 8/9/00)
5. In order to maintain backward compatibility, "*paved ditch curb type*" may be set to 0 to use the old-style method for picking which type of curb/curb and gutter to use. For this case the various combinations of the variables "*use pd curb and gutter*" and "*paved ditch curb full depth*" control curb type selected. ("*use pd curb and gutter*" = 1 plus "*paved ditch curb full depth*" = anything results in curb and gutter; "*use pd curb and gutter*" = 0 plus "*paved ditch curb full depth*" = 1 results in full depth curb; "*use pd curb and gutter*" = 0 plus "*paved ditch curb full depth*" = 0 results in asphalt curb.) (Revised 8/9/00)
6. The user has the option to force the slope for paved ditch sections on the low side of super and in normal crown to match the roadway cross-slope setting the define variable "*use variable slope paved ditch*" to 1 in the input file. By default this option is turned off. See the Variable Paved Ditch Slope Options section below for details.
7. An optional fixed width bench can be drawn behind the paved ditch curb by setting the variables "*paved ditch bench width lt*" and/or "*paved ditch bench width rt*" to the desired bench width. This option works only if (1) the old style special excavation details are not used, and (2) the top of curb is below existing ground. By default both of these variables are set to 0 (i.e., no bench is drawn). (Added 8/9/00)
8. An option to force all the cut slopes behind the paved ditch curb to a fixed value can be activated by setting the variables "*paved ditch fixed cut slope lt*" and/or "*paved ditch fixed cut slope rt*" to the desired RISE:RUN slope ratio (e.g., 1:2). This option works only if (1) the old style special excavation details are not used, and (2) the top of curb is below existing ground. By default both

of these variables are toggled off (i.e., "normal" slope selection procedure is used to determine the cut slope ratio). (Added 8/9/00)

9. The lines representing the back face of curb/curb & gutter and the line tying off the outside of the pavement undercut layers are tilted slightly outward from vertical to work around a continuing bug in the slope stake report procedure. The hidden variable "*~near vertical tilt factor*" is used in the criteria to set the amount of "tilt". The variable is the RISE portion of the RISE:1 slope of the lines. A value of 500 is used by default and should be OK when the MU:SU:PU are 1:1000:10 in the x-section file; this value may be too high if the resolution of the x-section file is lower. (Revised 8/9/00)
10. The slope label for the paved ditch may be toggled off by setting the hidden variable "*~place paved ditch slope labels*" equal to 0 in the input file. The slope label will be placed by default if the variable is not defined in the input file. The size of the slope label text is set by the "*text size*" variable (which controls the text size for all the various slope labels drawn by all the standard criteria files). (Revised 8/9/00)
11. Text is placed at hinge points and catches to allow red/blue top report to be used to create xyz format slope stake reports. (Added 8/9/00)
 - "HPC" at hinge point for cuts
 - "HPF" at hinge point for fills
 - "SSC" at slope stake for cuts
 - "SSF" at slope stake for fills
12. Previous versions of the paved ditch criteria files have allowed the designer to draw fairly detailed excavation and backfill behind the paved ditch curb (referred to hereafter as special excavation/backfill details). Use of these special excavation/backfill features discouraged. A simpler method (referred to hereafter as typical excavation/backfill details) is the preferred method. (See "Design Consistency and Guidance" memo from Haussler and Hirsbrunner.)
13. Despite the fact that the use of the special excavation details is discouraged, they are still available to the designer in order to maintain backward compatibility with older versions of the paved ditch criteria files. The special excavation/backfill details can be activated by defining the "*use paved ditch special excavation details*" to be 1 in the input file. This will cause the paved ditch criteria to behave identically to previous versions. (Revised 8/9/00)
14. When special excavation details are used (see note above), level/symbology of the backfill area behind the curb is set up to allow the earthwork procedure to calculate a separate quantity for paved ditch curb backfill. (Earthwork will not be calculated correctly if the special excavation lines behind the curb are made coincident with the back face of the curb by setting "*paved ditch spec exc width*" to 0 and "*paved ditch spec exc slope*" to 1000:1.)
15. There are several optional variables that can be used to control how the special excavation and backfill behind the paved ditch curb is drawn. All these variables have been assigned reasonable default values. In general, these variables should not be defined in the input file unless the user wishes to override the default values. See the Special Excavation and Backfill section below for

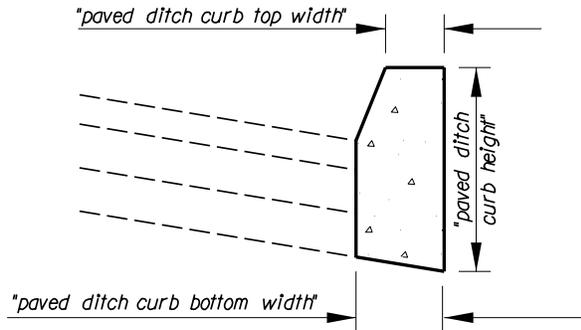
details.

16. By default the cut/fill slopes drawn by this criteria behind the paved ditch curb are labeled with the RISE:RUN slope value. The size of this text is set using the "text size" variable in the input file. If the cut/fill slopes labels aren't needed, they maybe toggled off by setting the "*~place cut/fill slope labels*" variable to 0 in the input file.

Curb/Curb & Gutter Options for Paved Ditch

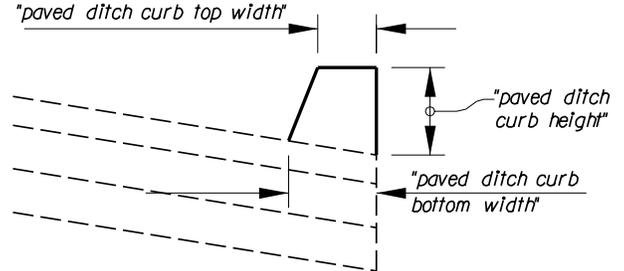
Use the variable "paved ditch curb type" in the input file to select the curb/curb and gutter type:

- 1 = full depth concrete curb (default)
- 2 = asphalt curb
- 3 = concrete curb and gutter



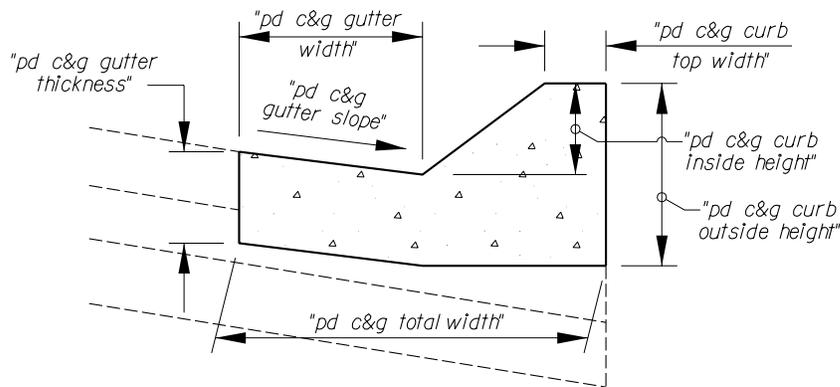
FULL DEPTH CONCRETE CURB

define "paved ditch curb type" 1
 (This curb alternate is the default)



ASPHALT CURB

define "paved ditch curb type" 2



CONCRETE CURB AND GUTTER

define "paved ditch curb type" 3
 (default dimensions from M609-50)

In order to maintain backward compatibility with previous versions of the paved ditch criteria files, "paved ditch curb type" may be set to 0 to enable the old-style method for choosing curb type. For this case the various combinations of the variables "use pd curb and gutter" and "paved ditch curb full depth" control curb type.

define "paved ditch curb type" 0

"use pd curb and gutter"	"paved ditch curb full depth"	Curb type
0	1	Full depth concrete curb
0	0	Asphalt curb
1	anything	Curb and gutter

Curb/Curb & Gutter Options for Paved Ditch

define "paved ditch curb type" 1 or

define "paved ditch curb type" 2

The following define variables are used to set the dimensions for both full depth concrete curb and asphalt curb. The figures above show how these variables control the shape of the curb section. Notice that "paved ditch curb height" has a slightly different meaning for the two types of curb.

"paved ditch curb height"

"paved ditch curb top width"

"paved ditch curb bottom width"

If curb and gutter is being used for the paved ditch, then none of the above variables should be defined in the input file.

define "paved ditch curb type" 3

The following define variables are used to set the dimensions for curb and gutter sections. The figures above show how these variables control the shape of the curb and gutter section.

"pd c&g total width" (default = 0.600)

"pd c&g gutter width" (default = 0.300)

"pd c&g curb top width" (default = 0.100)

"pd c&g curb inside height" (default = 0.150)

"pd c&g curb outside height" (default = 0.300)

"pd c&g gutter slope" (default = -1:8)

"pd c&g gutter thickness" (default = 0.150)

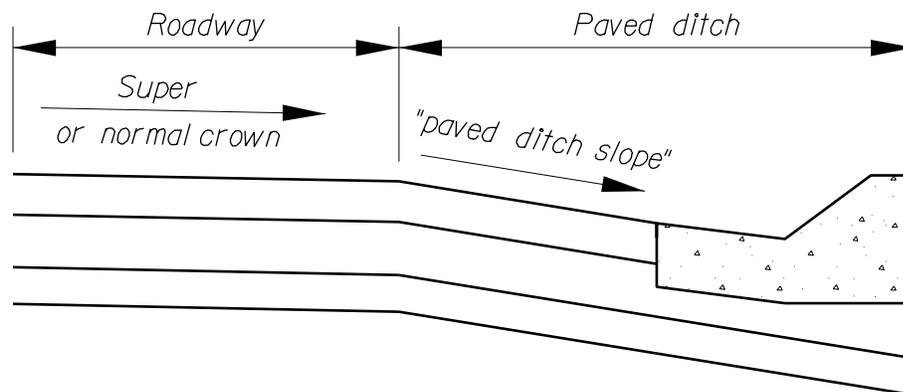
The default values shown above for the curb and gutter dimensions are taken from the CFL standard detail drawing M609-50. The user should put define statements for these variables in the input file only if curb and gutter is being called for and the default dimensions aren't acceptable. Also, if curb and gutter is not being used, then none of these variables should be defined in the input file.

Variable Slope Options for Paved Ditch

By default the slope of paved ditch sections is fixed as the value specified with the "paved ditch slope" variable in the input file. The user can force the slope of paved ditch sections at the low side of super and normal crown to vary to match the roadway cross-slope (rather than the fixed "paved ditch slope") by setting the define variable "use variable paved ditch slope" to 1 in the input file. This variable is toggled off by default, and if the user doesn't want this option then the "use variable paved ditch slope" variable shouldn't be in the input file.

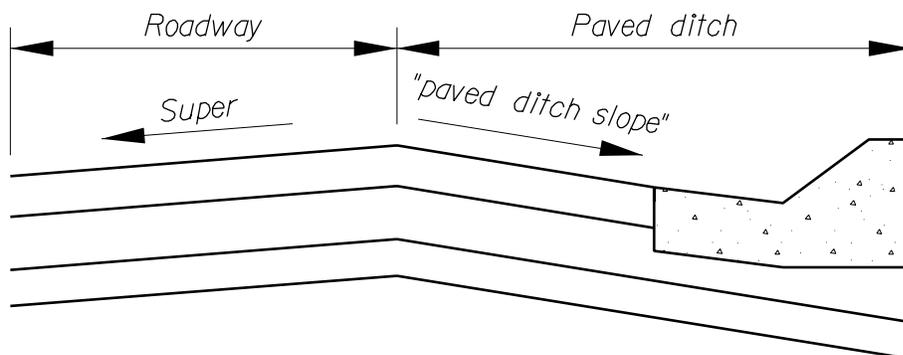
See the examples below for clarification of how setting "use variable paved ditch slope" affects paved ditch sections.

Example of paved ditch on low side of super with "use variable paved ditch slope" not defined in input file. Notice that paved ditch slope is the fixed "paved ditch slope" value.



Normal crown or supered toward paved ditch

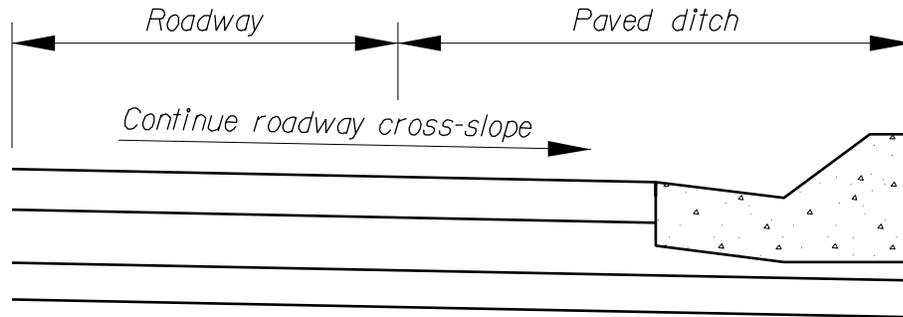
Example of paved ditch on low side of super with "use variable paved ditch slope" set to 1 in input file. Notice that paved ditch slope matches the roadway cross-slope.



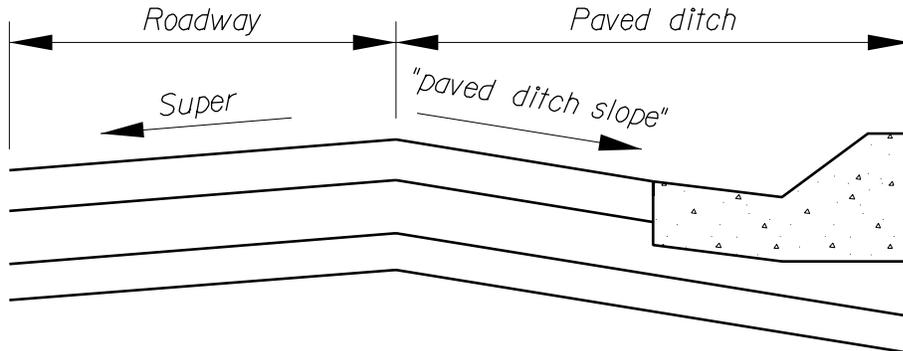
Supered away from paved ditch

Variable Slope Options for Paved Ditch

Example of paved ditch slope on high side of super regardless of whether "use variable paved ditch slope" is used. The slope of the paved ditch on the high side of super will always be the fixed "paved ditch slope" value.



Normal crown or supered toward paved ditch



Supered away from paved ditch

Typical Excavation/Backfill Details for Paved Ditch

For most cases, the designer should use the typical excavation and backfill details as shown below. These details are based on the guidelines outlined in the "Design Consistency and Guidance" memo from Terry Haussler and Heidi Hirsbrunner:

1. Use the top, outside corner of the curb as the hinge point.
2. Do not show on x-sections or calculate quantities for any special "construction" excavation behind the neat line of the curb.
3. Do not calculate separate quantities for curb backfill.

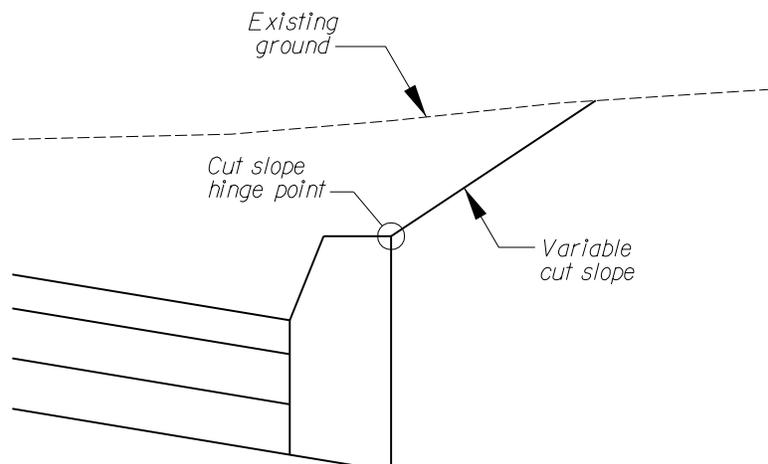
Previous versions of the paved ditch criteria files have allowed the designer to draw fairly detailed special excavation and backfill behind the paved ditch curb and to calculate curb backfill quantities. Use of these special excavation/backfill features is discouraged, however they remain in the criteria files for backwards compatibility. See the Special Excavation and Backfill section below for details on how to invoke these features.

There are several variables that the user may optionally use to control how the excavation and backfill behind the paved ditch curb is drawn. In general, the default values for these variables are reasonable. If the default values are acceptable then there is no point in defining these variables in the input file. If some (or all) of the defaults aren't acceptable, then the designer should define those variables in the input file.

- "paved ditch bench width lt" (default is 0, no bench drawn)
- "paved ditch bench width rt" (default is 0, no bench drawn)
- "paved ditch bench fixed cut slope lt" (RISE:RUN value; default is 0, use normal slope selection)
- "paved ditch bench fixed cut slope rt" (RISE:RUN value; default is 0, use normal slope selection)
- "paved ditch curb backfill max width" (default = 2.00)
- "paved ditch curb backfill slope" (default = 1:20)
- "paved ditch curb embank top width" (default = 0.30)
- "paved ditch curb embank slope" (default = -1:2)

Example showing preferred detail for hinge point location for cut situations.

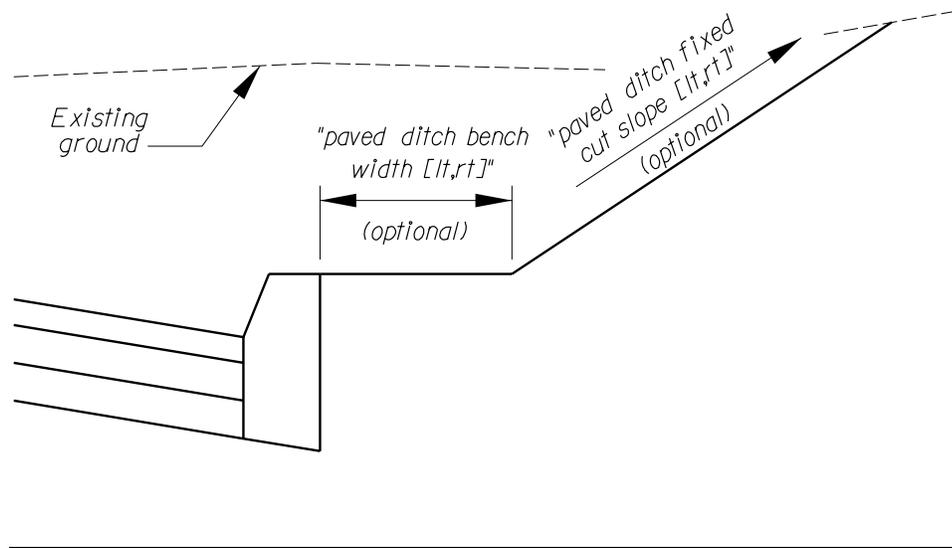
Use the neat line of curb as limit of excavation rather than using the special excavation options to draw additional construction excavation and backfill.



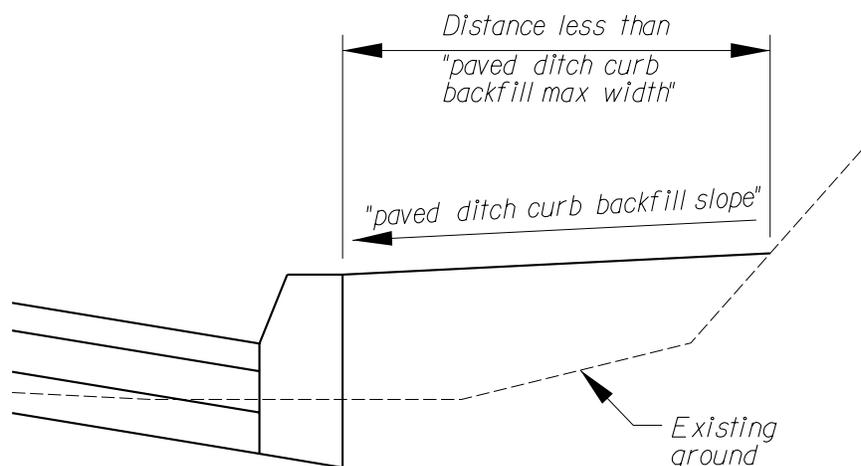
Typical Excavation/Backfill Details for Paved Ditch

Example showing optional paved ditch bench and optional fixed cut slope. By default both of these options are turned off.

To toggle either or both options on, define the "paved ditch bench width *lt*", "paved ditch bench width *rt*", "paved ditch fixed cut slope *lt*", and/or "paved ditch fixed cut slope *rt*" to the desired value(s) in the proposed cross section input file. (If "paved ditch fixed cut slope [*lt*,*rt*]" is used, it should be defined as a RISE:RUN value, e.g., 1:2.)



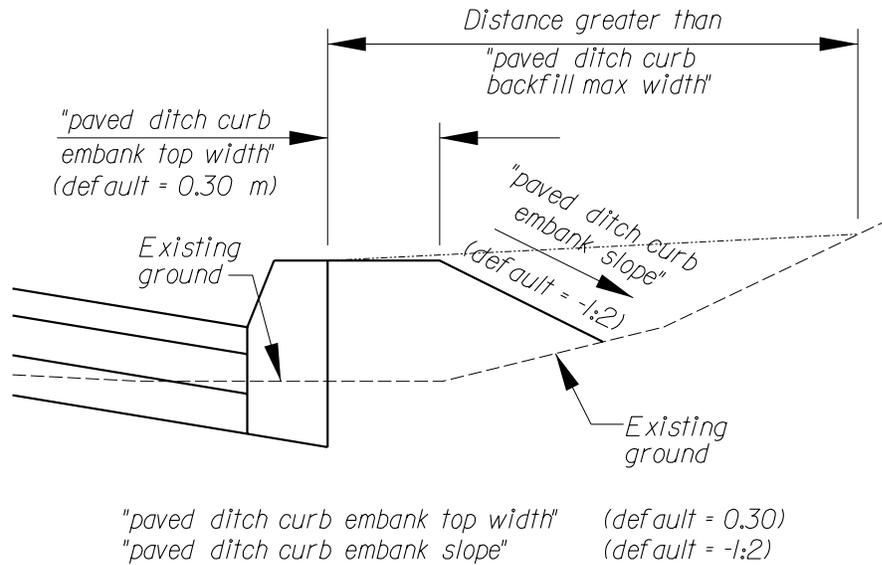
Example showing how "paved ditch curb backfill max width" can be used to force in-sloping backfill for fill situations where existing ground is sloping up and away from the roadway. If backfill slope catches within the "paved ditch curb backfill max width" (default is 2.00) then in-sloping backfill is drawn as shown. Otherwise an embankment is drawn behind the curb as shown in the next example. Define "paved ditch curb backfill slope" in the input file as a RISE:RUN value (default is 1:20).



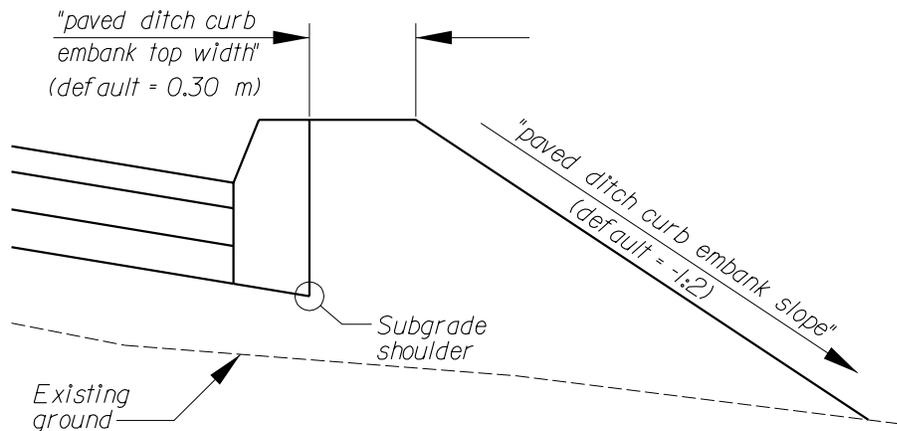
"paved ditch curb backfill max width" (default = 1.50)
"paved ditch curb backfill slope" (default = 1:20)

Typical Excavation/Backfill Details for Paved Ditch

Example showing what is drawn for a fill situation where the "paved ditch curb backfill slope" (default = 1:20) doesn't catch existing ground within the "paved ditch curb backfill max width" distance (default = 2.00).



Example showing how the paved ditch criteria files handle an extreme fill condition.



Special Excavation/Backfill Details for Paved Ditch

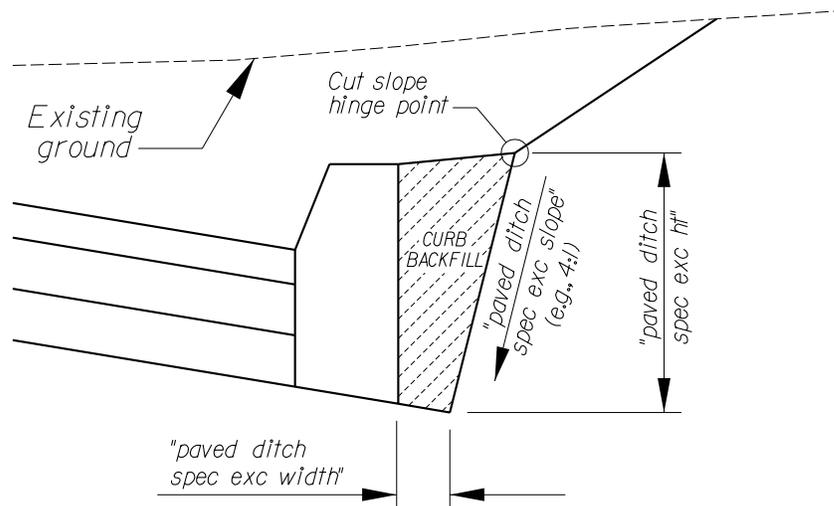
Previous versions of the paved ditch criteria files have allowed the designer to draw fairly detailed special excavation and backfill behind the paved ditch curb and to calculate curb backfill quantities. **Use of these special excavation/backfill features is discouraged.** (See "Design Consistency and Guidance" memo for explanation. See Typical Excavation and Backfill Details section above for the preferred alternative.) However, to maintain backward compatibility with older versions of the paved ditch criteria files, the special excavation/backfill details shown below can be activated by defining the "use paved ditch special excavation details" to be 1 in the input file.

The following variables are used to control how the excavation and backfill behind the paved ditch is drawn. **They have been assigned reasonable default values. In general, these variables should not be defined in the input file unless the user wishes to override the default values for a specific situation.**

"use paved ditch special excavation details" 1
"paved ditch spec exc width"
"paved ditch spec exc ht"
"paved ditch spec exc slope" (e.g., 4:1)
"paved ditch curb backfill max slope" (default = 1:2)
"paved ditch curb backfill max width" (default = 1..50)
"use spec exc ht" (default = 1)
"paved ditch curb backfill slope" (default = 1:20)
"paved ditch curb embank top width" (default = 0.30)
"paved ditch curb embank slope" (default = -1:2)

Example showing special excavation/backfill for any of the paved ditch criteria files.

(Note: Use of these special excavation/backfill details is discouraged. See Typical Excavation/Backfill Details section above for preferred alternative.)



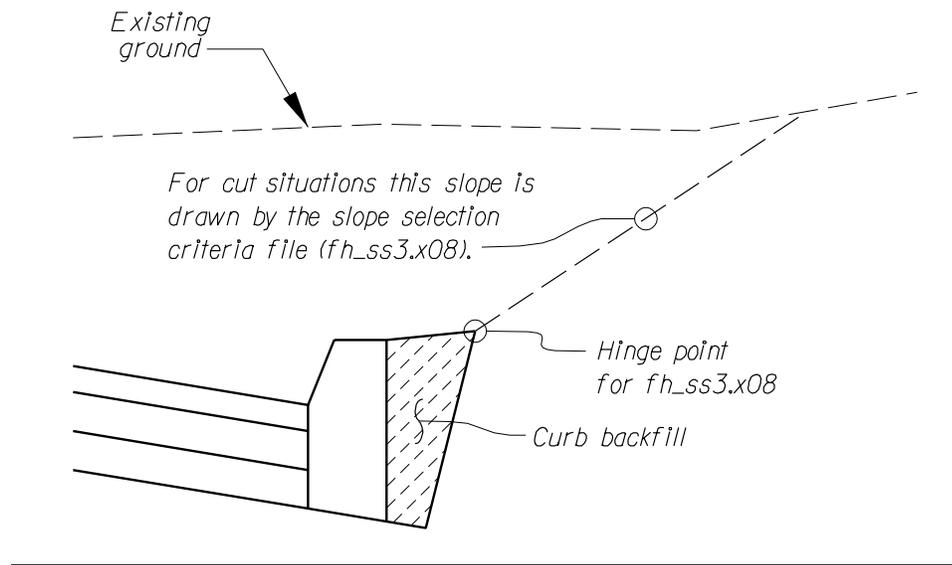
PAVED DITCH WITH OPTIONAL SPECIAL EXCAVATION

Toggle on with "use paved ditch special excavation details" in input file

Special Excavation/Backfill Details for Paved Ditch

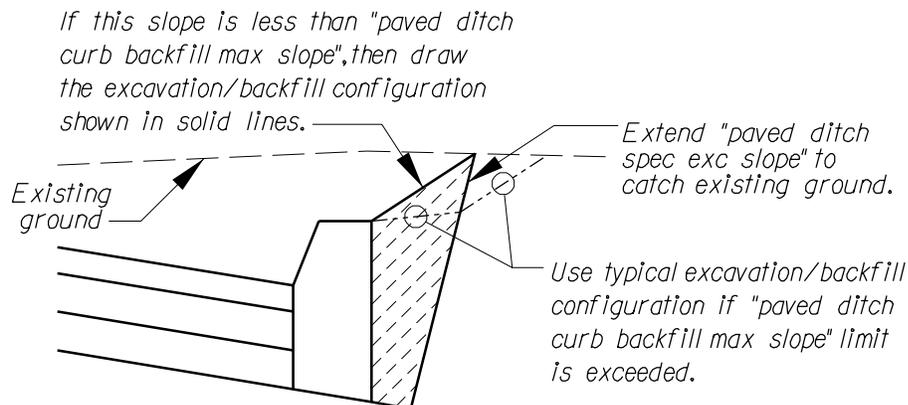
Example showing special excavation/backfill for any of the paved ditch criteria files.

(Note: Use of these special excavation/backfill details is discouraged. See Typical Excavation/Backfill Details section above for preferred alternative.)



Example showing how "paved ditch curb backfill max slope" can be used to force the special excavation behind the curb to daylight rather than creating a shallow compound cut slope.

(Note: Use of these special excavation/backfill details is discouraged. See Typical Excavation/Backfill Details section above for preferred alternative.)

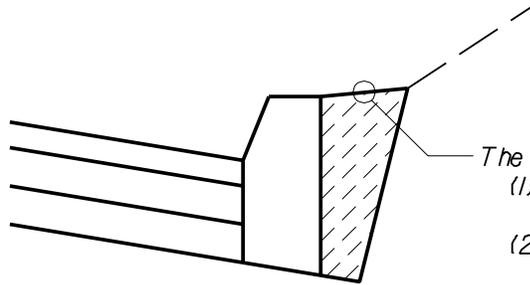


Special Excavation/Backfill Details for Paved Ditch

Example showing the two methods for setting the curb backfill slope:

1. indirectly, by setting "use spec exc ht" to 1 and thereby allowing "paved ditch special exc ht" to control the slope (the default), or
2. directly, by setting "use spec exc ht" to 0 which fixes the backfill slope at "paved ditch curb backfill slope" and forces the special excavation height behind the curb to vary as necessary.

(Note: Use of these special excavation/backfill details is discouraged. See Typical Excavation/Backfill Details section above for preferred alternative.)

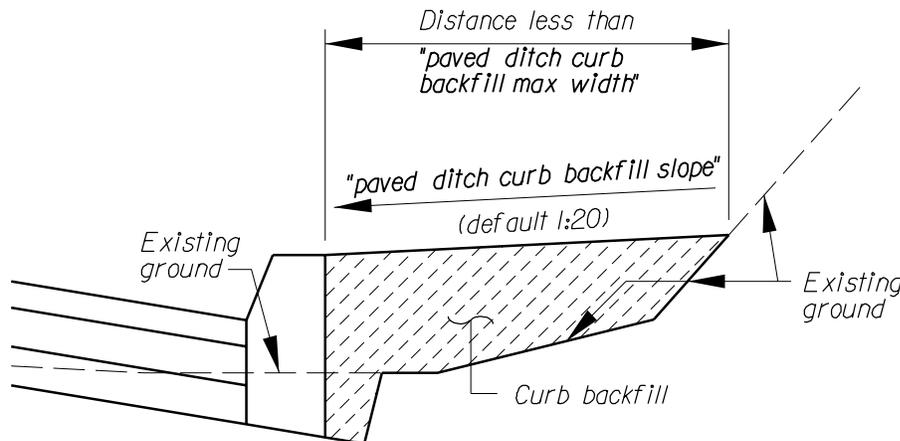


"use spec exc ht" (default = 1)
"paved ditch curb backfill slope"

The slope for the curb backfill can be set in either of two ways:
(1) By default the slope of the curb backfill is set indirectly by defining "paved ditch spec exc ht" in the input file.
(2) Alternatively, the user can set the curb backfill slope directly by defining "use spec exc ht" to be 0 and "paved ditch curb backfill slope" as whatever the desired fixed slope is (e.g., 1:10).

Example showing how "paved ditch curb backfill max width" can be used to force in-sloping backfill in fill situations where existing ground is sloping up and away from the roadway.

(Note: Use of these special excavation/backfill details is discouraged. See Typical Excavation/Backfill Details section above for preferred alternative.)



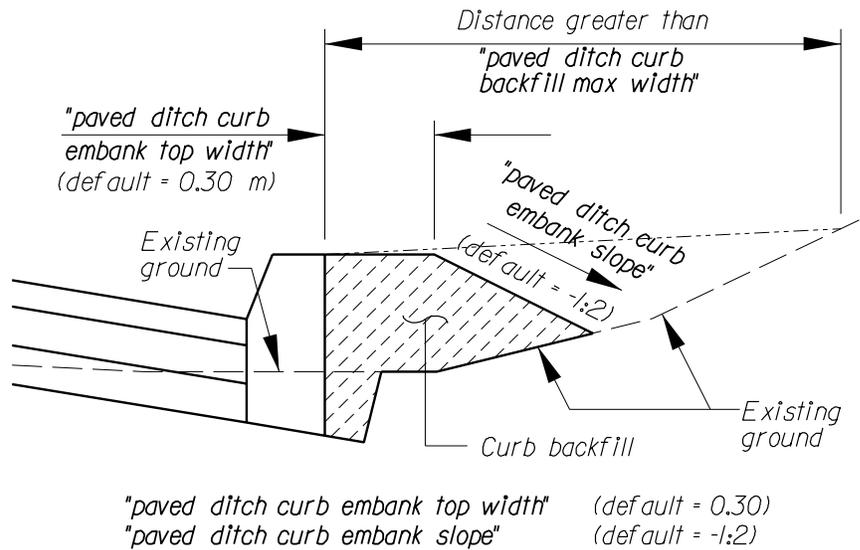
"paved ditch curb backfill max width" (default = 1.50)
"paved ditch curb backfill slope" (default = 1:20)

Special Excavation/Backfill Details for Paved Ditch

Example showing how a typical fill situation is handled by the paved ditch criteria files.

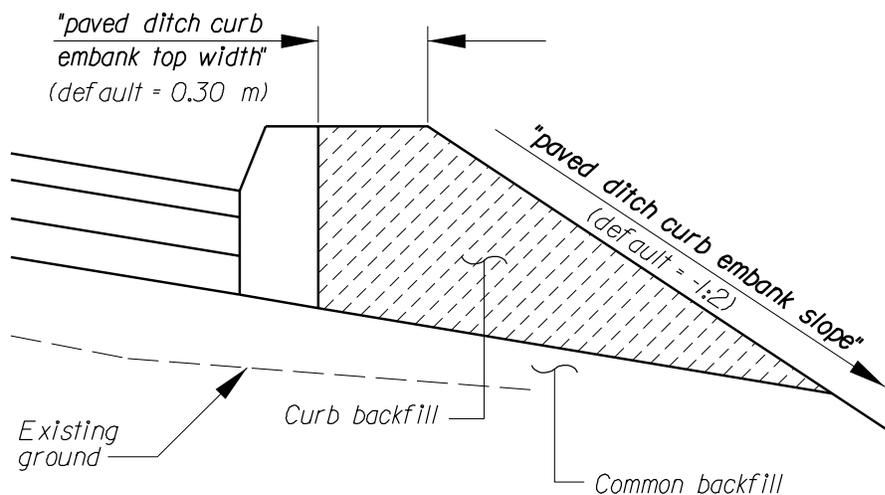
Notice that if the "paved ditch curb backfill max width" variable is set to a large enough value the user can force a constant fill slope from the top of the curb to existing ground in most cases.

(Note: Use of these special excavation/backfill details is discouraged. See Typical Excavation/Backfill Details section above for preferred alternative.)



Example showing an extreme fill situation is handled by the paved ditch criteria files.

(Note: Use of these special excavation/backfill details is discouraged. See Typical Excavation/Backfill Details section above for preferred alternative.)



FLH Standard Criteria Files

Section 8 –

Guardwall Criteria Files

Guardwall Criteria Files

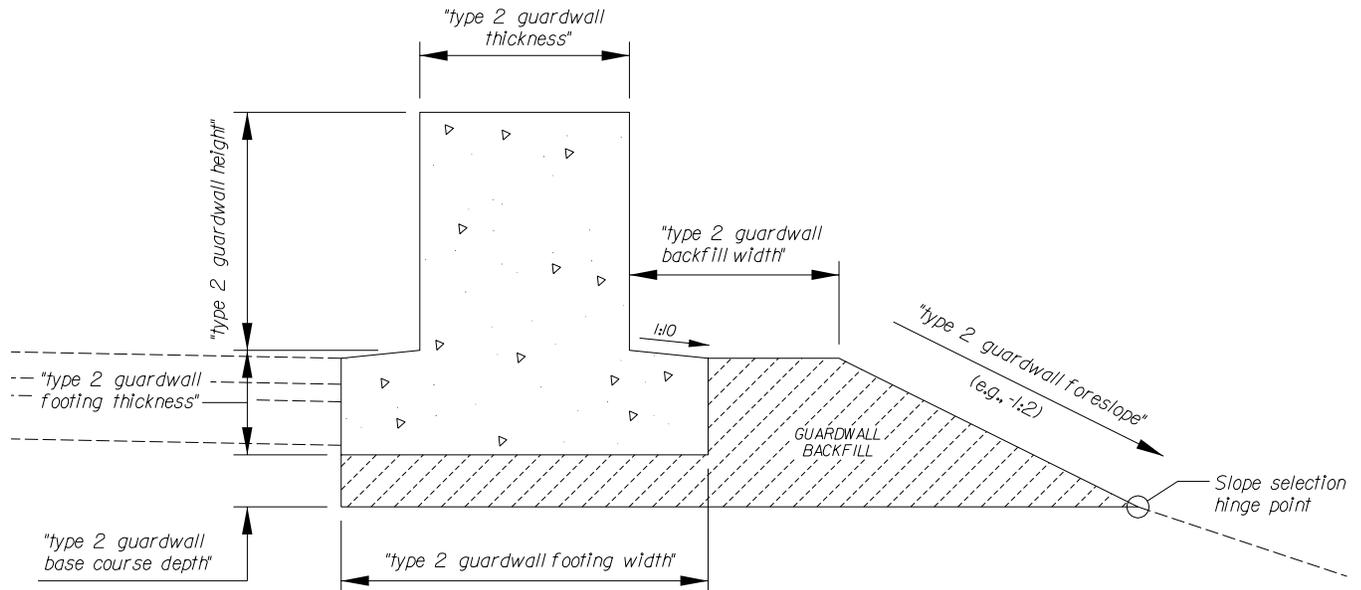
Criteria File	Elements Drawn by Criteria File
c_gwall2s.x08	FLH metric standard precast concrete guardwall (618M) and stone masonry guardwall (620M). Draws guardwall, guardwall footing, backfill and foreslope behind wall. Uses station ranges specified in exceptions data file to locate guardwall.
c_gwall3d.x08	Draws guardwall, guardwall footing, backfill and foreslope behind wall. Uses lines drawn in plan view dgn file to locate guardwall. Closes off base course layers with vertical lines at inside face wall if necessary.
c_gwall3s.x08	Draws guardwall, guardwall footing, backfill and foreslope behind wall. Uses station ranges specified in exceptions data file to locate guardwall. Closes off base course layers with vertical lines at inside face wall if necessary.

c_gwall2s.x08

FLH metric standard precast concrete guardwall (M618) and FLH metric standard stone masonry guardwall (M620).

Draws simple guardwall with footing plus backfill and foreslope behind guardwall.

Uses station ranges specified in the exceptions data file to locate guardwall.



define variables that must be assigned values in the input data file:

- "type 2 guardwall backfill width"
- "type 2 guardwall base course depth"
- "type 2 guardwall footing thickness"
- "type 2 guardwall footing width"
- "type 2 guardwall foreslope" (e.g., -1:2)
- "type 2 guardwall height"
- "type 2 guardwall thickness"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

- _d_use_type2_guardwall_lt (set = 1 to toggle on guardwall)
- _d_use_type2_guardwall_rt

Notes for c_gwall2s.x08:

1. This criteria was written to match the FLH metric standard precast concrete guardwall (M618) and FLH metric standard stone masonry guardwall (M620) dimensions. Default values for all the variables have been set in the criteria file to match the dimensions on the standard drawings. If the default values shown below are acceptable, then they don't have to be defined in the input file.

"type 2 guardwall backfill width" = 0.600

c_gwall2s.x08

```
"type 2 guardwall base course depth" = 0.150  
"type 2 guardwall footing thickness" = 0.300  
"type 2 guardwall footing width" = 1.050  
"type 2 guardwall foreslope" = -1:2  
"type 2 guardwall height" = 0.685  
"type 2 guardwall thickness" = 0.600
```

2. Combines the functionality of a simple guardwall criteria with the functionality of the foreslope criteria. This criteria is written so that it overrides the foreslope used for the typical section (e.g., fh_fs5.x08)
3. Station ranges for the guardwall are set in the exceptions data file using the `_d_use_type2_guardwall_lt` and `_d_use_type2_guardwall_rt` variable and the following syntax:

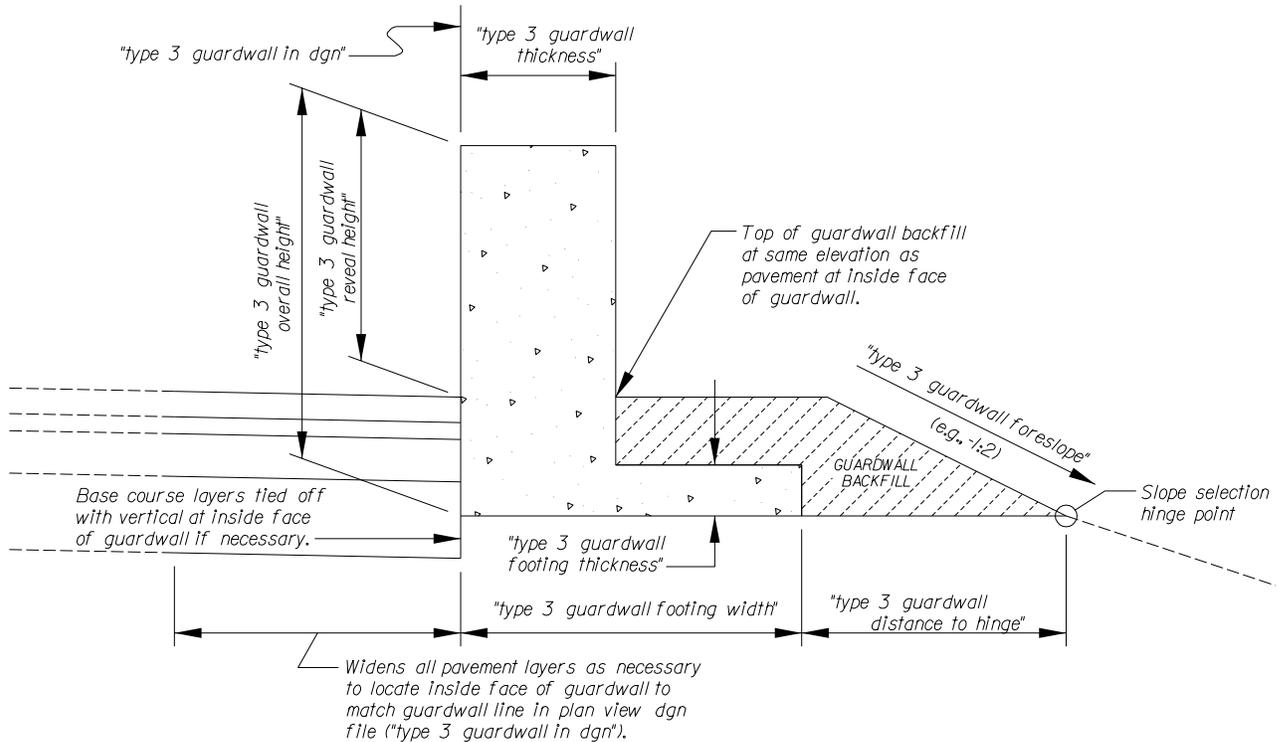
```
if sta >= 1+000 r 1 and sta <= 2+000 r 1 then  
  {  
    _d_use_type2_guardwall_lt = 1  
  }
```
4. This criteria (*c_gwall2s.x08*) and *c_gwall2d.x08* draw basically the same elements. The only differences between the two criteria files are as follows:
 - *c_gwall2d.x08* uses lines drawn in a plan view dgn file to specify the station ranges for guardwall;
 - *c_gwall2s.x08* uses station ranges explicitly specified in the exceptions data file
 - *c_gwall2d.x08* widens the pavement structural section as necessary to locate the inside face of the guardwall at the offset from centerline represented by the lines drawn in plan view dgn file;
 - *c_gwall2s.x08* will never widen the pavement structural section
5. Must be included immediately before the foreslope criteria (fh_fs[1-5].x08) in the input file.
6. All pavement structure undercut layers are terminated at the inside face of the guardwall. If necessary they are closed off with vertical lines.
7. This criteria has no built-in provision for widening the pavement structural section -- it places the inside toe of the guardwall footing at whatever offset from centerline where the preceding criteria left off. Criteria file *c_gwall2d.x08* will do widening in addition to what this criteria file does.
8. Level/symbology of cross-section elements drawn by this criteria is set up so that a separate quantity for guardwall backfill can be calculated in the earthwork procedure. (Proposed undercut, soil type = guardwall_backfill, lv=17, co=18)
9. Slope stake report will work correctly with the elements drawn by this criteria if you include lv=17 co=18 in the finish grade level/symbology. This is due to the "always take the lowest level" rule written into the slope stakes search routine.

10. fh_ss3.x08 is "included" in this criteria, and fh_fs[1-5].x08 is toggled off using the _d_stop_at_approach_road variable.

Guardwall Criteria Files

c_gwall3d.x08

Draws simple guardwall with footing plus backfill and foreslope behind guardwall.
Uses lines drawn in plan view dgn file to locate guardwall. Widens pavement structural section as necessary to locate inside face of guardwall at offset from centerline of line drawn in plan view.



define variables that must be assigned values in the input data file:

"type 3 guardwall distance to hinge"
"type 3 guardwall footing thickness"
"type 3 guardwall footing width"
"type 3 guardwall foreslope" (e.g., -1:2)
"type 3 guardwall overall height"
"type 3 guardwall reveal height"
"type 3 guardwall thickness"

define_dgn variables that must be assigned values in the input data file:

"type 3 guardwall in dgn"

Variables that must be defined in exceptions data file:

None

Notes for c_gwall3d.x08:

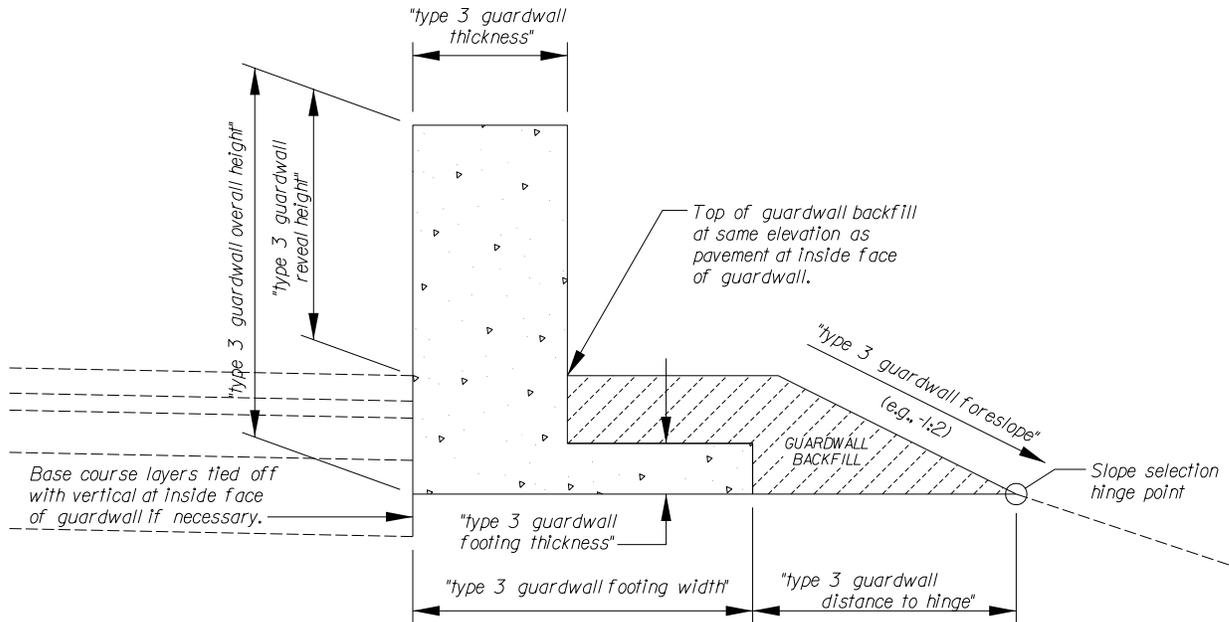
1. This criteria was originally written to match a standard detail for the Chalone Creek project. Default values for all the variables have been set in the criteria file to match the original detail. If the default values shown below are acceptable, then they don't have to be defined in the input file.

c_gwall3d.x08

- "type 3 guardwall distance to hinge" = 0.600
"type 3 guardwall footing thickness" = 0.150
"type 3 guardwall footing width" = 1.000
"type 3 guardwall foreslope" = -1:1.5
"type 3 guardwall overall height" = 1.090
"type 3 guardwall reveal height" = 0.740
"type 3 guardwall thickness" = 0.455
2. Combines the functionality of a simple guardwall criteria with the functionality a widening criteria and a foreslope criteria. This criteria is written so that it overrides the foreslope used for the typical section (e.g., fh_fs5.x08)
 3. Station ranges for the guardwall are set by drawing lines in a plan view dgn file. These lines are also used to locate the offset of the inside face of the guardwall from centerline; the pavement structural section is widened as necessary to locate the guardwall at this offset.
 4. This criteria (c_gwall3d.x08) and c_gwall3s.x08 draw basically the same elements. The only differences between the two criteria files are as follows:
 - c_gwall3d.x08 uses lines drawn in a plan view dgn file to specify the station ranges for guardwall;
c_gwall3s.x08 uses station ranges explicitly specified in the exceptions data file
 - c_gwall3d.x08 widens the pavement structural section as necessary to locate the inside face of the guardwall at the offset from centerline represented by the lines drawn in plan view dgn file;
c_gwall3s.x08 will never widen the pavement structural section
 5. Must be included immediately before the foreslope criteria (fh_fs[1-5].x08) in the input file.
 6. Pavement undercut layers that are lower than the guardwall footing are tied off with vertical lines at the inside face of the guardwall, as shown above.
 7. Level/symbology of cross-section elements drawn by this criteria is set up so that a separate quantity for guardwall backfill can be calculated in the earthwork procedure. (Proposed undercut, soil type = guardwall_backfill, lv=17, co=18)
 8. Slope stake report will work correctly with the elements drawn by this criteria if you include lv=17 co=18 in the finish grade level/symbology. This is due to the "always take the lowest level" rule written into the slope stakes search routine.
 9. fh_ss3.x08 is "included" in this criteria, and fh_fs[1-5].x08 is toggled off using the _d_stop_at_approach_road variable.

Guardwall Criteria Files
c_gwall3s.x08

Draws simple guardwall with footing plus backfill and foreslope behind guardwall.
 Uses station ranges specified in the exceptions data file to locate guardwall.



define variables that must be assigned values in the input data file:

- "type 3 guardwall distance to hinge"
- "type 3 guardwall footing thickness"
- "type 3 guardwall footing width"
- "type 3 guardwall foreslope" (e.g., -1:2)
- "type 3 guardwall overall height"
- "type 3 guardwall reveal height"
- "type 3 guardwall thickness"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

- _d_use_type3_guardwall_lt (set = 1 to toggle on guardwall)
- _d_use_type3_guardwall_rt

Notes for c_gwall3s.x08:

1. This criteria was originally written to match a standard detail for the Chalone Creek project. Default values for all the variables have been set in the criteria file to match the original detail. If the default values shown below are acceptable, then they don't have to be defined in the input file.

- "type 3 guardwall distance to hinge" = 0.600
- "type 3 guardwall footing thickness" = 0.150

c_gwall3s.x08

- "type 3 guardwall footing width" = 1.000
"type 3 guardwall foreslope" = -1:1.5
"type 3 guardwall overall height" = 1.090
"type 3 guardwall reveal height" = 0.740
"type 3 guardwall thickness" = 0.455
2. Combines the functionality of a simple guardwall criteria with the functionality of the foreslope criteria. This criteria is written so that it overrides the foreslope used for the typical section (e.g., fh_fs5.x08)
 3. Station ranges for the guardwall are set in the exceptions data file using the `_d_use_type3_guardwall_lt` and `_d_use_type3_guardwall_rt` variable and the following syntax:

```
if sta >= 1+000 r 1 and sta <= 2+000 r 1 then
{
  _d_use_type3_guardwall_lt = 1
}
```
 4. This criteria (*c_gwall3s.x08*) and *c_gwall3d.x08* draw basically the same elements. The only differences between the two criteria files are as follows:
 - *c_gwall3d.x08* uses lines drawn in a plan view dgn file to specify the station ranges for guardwall;
 - *c_gwall3s.x08* uses station ranges explicitly specified in the exceptions data file
 - *c_gwall3d.x08* widens the pavement structural section as necessary to locate the inside face of the guardwall at the offset from centerline represented by the lines drawn in plan view dgn file;
 - *c_gwall3s.x08* will never widen the pavement structural section
 5. Must be included immediately before the foreslope criteria (fh_fs[1-5].x08) in the input file.
 6. Pavement undercut layers that are lower than the guardwall footing are tied off with vertical lines at the inside face of the guardwall, as shown above.
 7. This criteria has no built-in provision for widening the pavement structural section -- it places the inside face of the guardwall at the offset from centerline where the preceding criteria left off. Criteria file *c_gwall3d.x08* will do widening in addition to what this criteria file does.
 8. Level/symbology of cross-section elements drawn by this criteria is set up so that a separate quantity for guardwall backfill can be calculated in the earthwork procedure. (Proposed undercut, soil type = guardwall_backfill, lv=17, co=18)
 9. Slope stake report will work correctly with the elements drawn by this criteria if you include lv=17 co=18 in the finish grade level/symbology. This is due to the "always take the lowest level" rule written into the slope stakes search routine.
 10. fh_ss3.x08 is "included" in this criteria, and fh_fs[1-5].x08 is toggled off using the `_d_stop_at_approach_road` variable.

FLH Standard Criteria Files

Section 9 –

Mechanically Stabilized Earth Wall Criteria Files

Mechanically Stabilized Earth Wall Criteria Files

These criteria files draw Mechanically Stabilized Earth (MSE) retaining walls including roadway foreslope and special excavation and backfill.

The MSE wall criteria files listed in the table below conform to the December 2000 version of the metric standard detail drawing M255-02.

MSE Wall Criteria Files Conforming to M255-02	
Criteria File	Elements Drawn by Criteria File
fh_wall4.x08	MSE wall including roadway foreslope and associated special excavation and backfill. Station range(s) for wall set in exceptions data file. Offset to face of wall is a fixed distance from pavement shoulder point.
fh_wall5.x08	MSE wall including the roadway foreslope and associated special excavation and backfill. Station range(s) for the wall and offset from the roadway shoulder to the wall face are set by line(s) drawn in plan view dgn.
c_wall9d.x08	MSE wall including roadway foreslope and associated special excavation and backfill. Option for either one- or two-tier wall configuration at any x-section. Station ranges, distance from centerline, and one- or two-tier configuration set with lines drawn in plan view dgn. Top of wall elevation set with COGO profile. Compound slope from pavement to top of wall.

See the table on the next page for additional MSE wall criteria files that were used in the past but have not been updated to conform to the December 2000 revised version of M255-02. These non-conforming criteria files are still available in the criteria files directory for use on an "as-is" basis, but their use is discouraged.

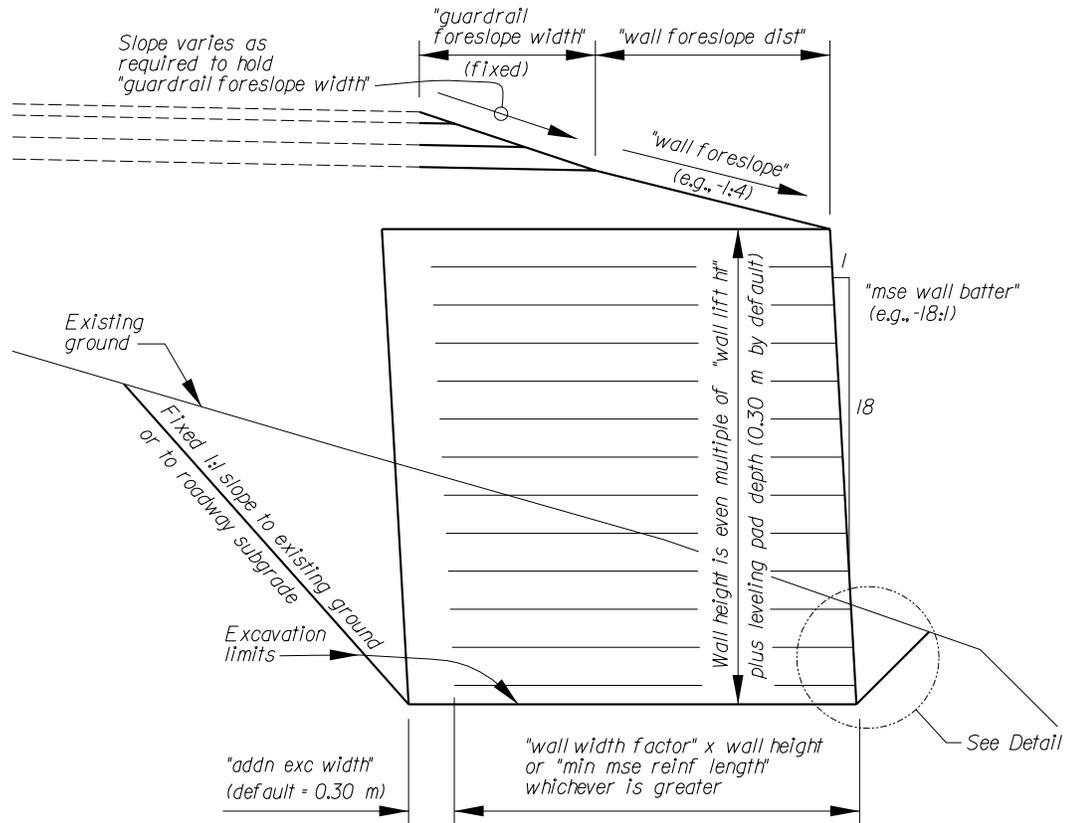
Mechanically Stabilized Earth Wall Criteria Files

Note: The MSE wall criteria files listed in the table below have been used in the past, but have not been updated to conform to the December 2000 version of the metric standard detail drawing M255-02. These non-conforming criteria files are still available in the criteria files directory for use on an "as-is" basis, but their use is discouraged. (See the preceding page for the preferred MSE wall criteria files.)

MSE Wall Criteria Files Not Conforming to M255-02	
Criteria File	Elements Drawn by Criteria File
fh_wall2.x08	MSE wall including roadway foreslope and associated special excavation and backfill. Station range(s) for wall set by line in plan view dgn file. Offset to face of wall set by line in plan view dgn file (pavement structure widened as required). Constant slope from pavement to top of wall.
fh_wall3.x08	MSE wall including roadway foreslope and associated special excavation and backfill. Station range(s) for wall set in exceptions data file. Offset to face of wall fixed distance from pavement shoulder point. Constant slope from pavement to top of wall.
fh_wall7.x08	Simple MSE wall: no roadway or wall foreslope is drawn, no special excavation or backfill associated with wall is drawn. Station range(s) for wall set in exceptions data file. Face of wall is located at the pavement shoulder point.
fh_wall8.x08	MSE wall including roadway foreslope and associated special excavation and backfill. Station range(s) for wall set in exceptions data file. Offset to face of wall fixed distance from pavement shoulder point. Compound slope from pavement to top of wall.
c_wall8s.x08	MSE wall including roadway foreslope and associated special excavation and backfill. Station range(s) for wall set in exceptions data file. Offset to face of wall fixed distance from pavement shoulder point. Compound slope from pavement to top of wall.

fh_wall4.x08

Draws an MSE retaining wall plus associated special excavation and backfill. Location of the retaining wall is set using station ranges and the `_d_wall_used_[lt,rt]` variables in the exceptions data file. (This criteria file conforms to the December 2000 revision to M255-02.)



define variables that must be assigned values in the input data file:

- `"guardrail foreslope width"`
- `"wall foreslope dist"`
- `"wall foreslope"` (e.g., -1:4)
- `"mse wall batter"` (e.g., -18:1)
- `"wall width factor"`
- `"wall lift ht"` (optional, see Notes)
- `"min mse reinf length"` (optional, see Notes)
- `"addn exc width"` (optional, see Notes)
- `"~continuous wall foreslope"` (optional, see Notes)
- `"~leveling pad depth"` (optional, see Notes)
- `"toe to exist ground offset"` (optional, see Notes)

define_dgn variables that must be assigned values in the input data file:

None

fh_wall4.x08

Variables that must be defined in exceptions data file:

`_d_wall_used_lt`
`_d_wall_used_rt`

Notes for fh_wall4.x08:

1. Details match revised standard metric detail M255-02 dated 12/00.
2. Station ranges for the MSE wall are set with the `_d_wall_used_lt` and `_d_wall_used_rt` variables in the exceptions data file as shown below. (`_d_wall_used_lt` and `_d_wall_used_rt` must be set to 1 to make this criteria file work correctly.)
if sta >= 1+000 r 1 and sta <= 1+100 r 1 then
 {
 _d_wall_used_lt = 1
 }
3. This criteria will not do any widening of the roadway structural section. It simply adds the MSE wall section at the point where the preceding criteria file left off.
4. If "wall lift ht" is defined in the input file to be something greater than zero, then the design height of the wall (H in the detail shown above) will be an even number of "wall lift ht" units plus an additional 0.30 meters (see the next note). By default the "wall lift ht" is set to zero in order to make this option transparent for previously designed jobs.
5. The additional 0.30 meters tacked onto the even number of "wall lift ht" units represents the recommended leveling pad depth, and is taken directly from standard detail M255-02. The user may override the default 0.30 meter depth by defining "~leveling pad depth" in the input file.
6. The minimum horizontal distance from the toe of the wall to existing ground is fixed at 1.20 meters in M255-02. Although it is discouraged, this distance can be changed by defining the "toe to existing ground offset" variable to the desired distance in the input file.
7. The "wall width factor" controls the length of soil reinforcement and pervious backfill unless "min mse reinf length" has been set in the input file and it controls (see the next note). Standard M255-02 recommends a minimum value of 0.70 for "wall width factor".
8. If the user defines "min mse reinf length" in the input file to something greater than zero, then the width of the reinforced volume will be either "wall width factor" x wall height or "min mse reinf length", whichever is greater. By default "min mse reinf length" is set to 0 in order to make this option transparent for previously designed jobs.
9. The optional define variable "addn exc width" may be used to control the distance the construction excavation extends past the end of the wall reinforcement. By default this variable is set to 0.30 meters to match the recommended value from M255-02.
10. This criteria will not draw all the lines required by GEOPAK earthwork to automatically calculate all the various subsidiary quantities associated with the MSE wall. Don't expect to take

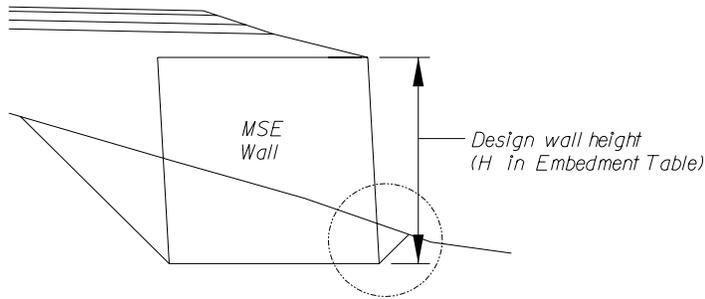
the wall x-sections drawn by this criteria and run them through the earthwork procedure to get structure excavation, select wall backfill, etc., because it won't happen. Although it's theoretically possible to draw all these lines with a criteria file, actually writing a criteria file that does this has proved to be an intractable problem despite the combined efforts of FLH and GEOPAK. If the designer wants the subsidiary quantities for the MSE wall there are only two options available at this time, and both involve using MicroStation to manually draw the necessary earthwork lines onto the x-sections. If the lines are drawn strictly following the rules outlined in the Earthworks section of the manuals (which is not a simple task) then the GEOPAK earthwork procedure will calculate the subsidiary quantities automatically. The other option (and experience has shown this to be the simpler solution), is to manually draw the subsidiary quantity lines with MicroStation without regard to the GEOPAK earthwork rules and to then use the MicroStation "measure area" tool to manually determine the end areas for each x-section and to use a spreadsheet to tabulate the subsidiary quantities.

11. By default the foreslope from the top of the pavement shoulder point to the top point of the wall face will be a compound slope with a break at the roadway subgrade. The slope of the top portion is controlled by "guardrail foreslope width" and the structural section thickness; the slope of the bottom portion is controlled by the variables "wall foreslope dist" and "wall foreslope".
12. The user may optionally force a continuous foreslope from the top of pavement shoulder to the top point of the wall face by adding the following line to the input file:
 define "~continuous wall foreslope" 1
If this option is used, interpretation of the "wall foreslope" and "wall foreslope dist" variables changes from what it is for the default case. For this situation the variables refer to the entire foreslope from top of pavement shoulder to top of wall point rather than to just the lower portion of the foreslope.
13. The user has no control over the assumed structure excavation backslope; it is fixed at 1:1.

fh_wall4.x08

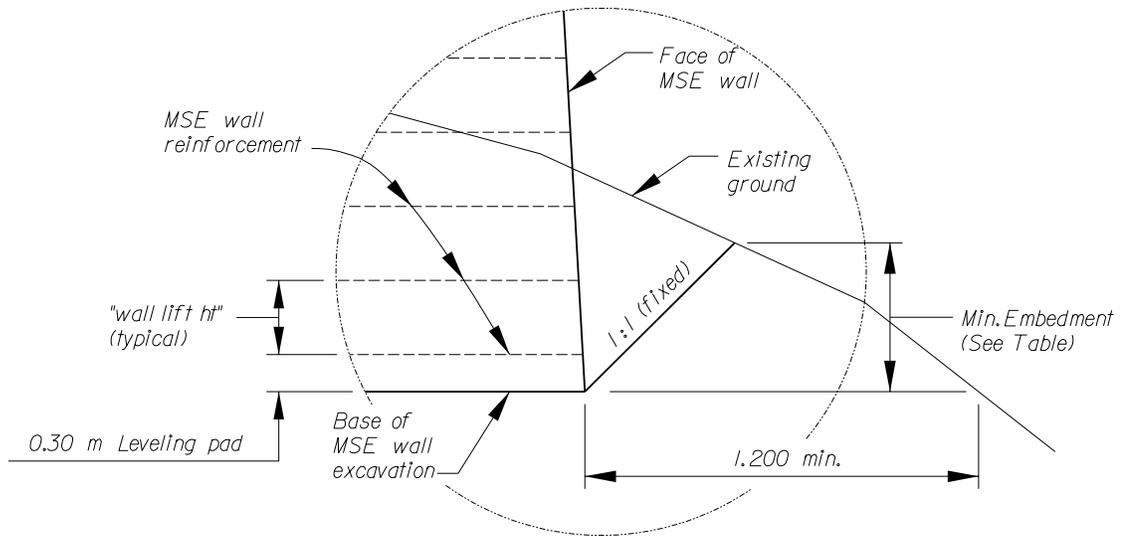
Toe Embedment Details for fh_wall4.x08

Minimum toe embedment depth from standard detail M255-02.



Slope in Front of Wall	Min. Embedment (H = Wall Ht.)
Horiz. (walls)	H/20
Horiz. (abutments)	H/10
Horiz. to 1V:2H	H/10
1V:2H to 2V:3H	H/7
2V:3H and steeper	H/5

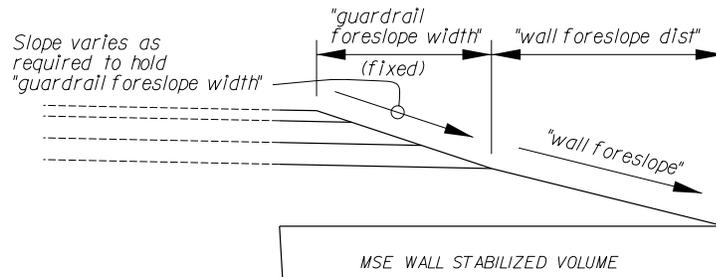
Toe embedment details.



fh_wall4.x08

Foreslope Details For fh_wall4.x08

Default foreslope configuration. The foreslope from the pavement shoulder to the top of the MSE wall is a compound slope with a break in slope at the subgrade shoulder point, as shown below.

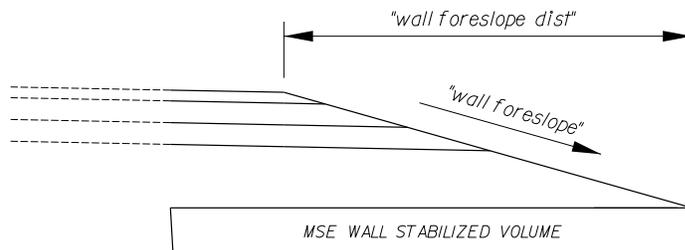


Optional foreslope configuration. The foreslope from the pavement shoulder to the top of the MSE wall is a continuous slope as shown below.

To toggle this option on, include the following line in the input file:

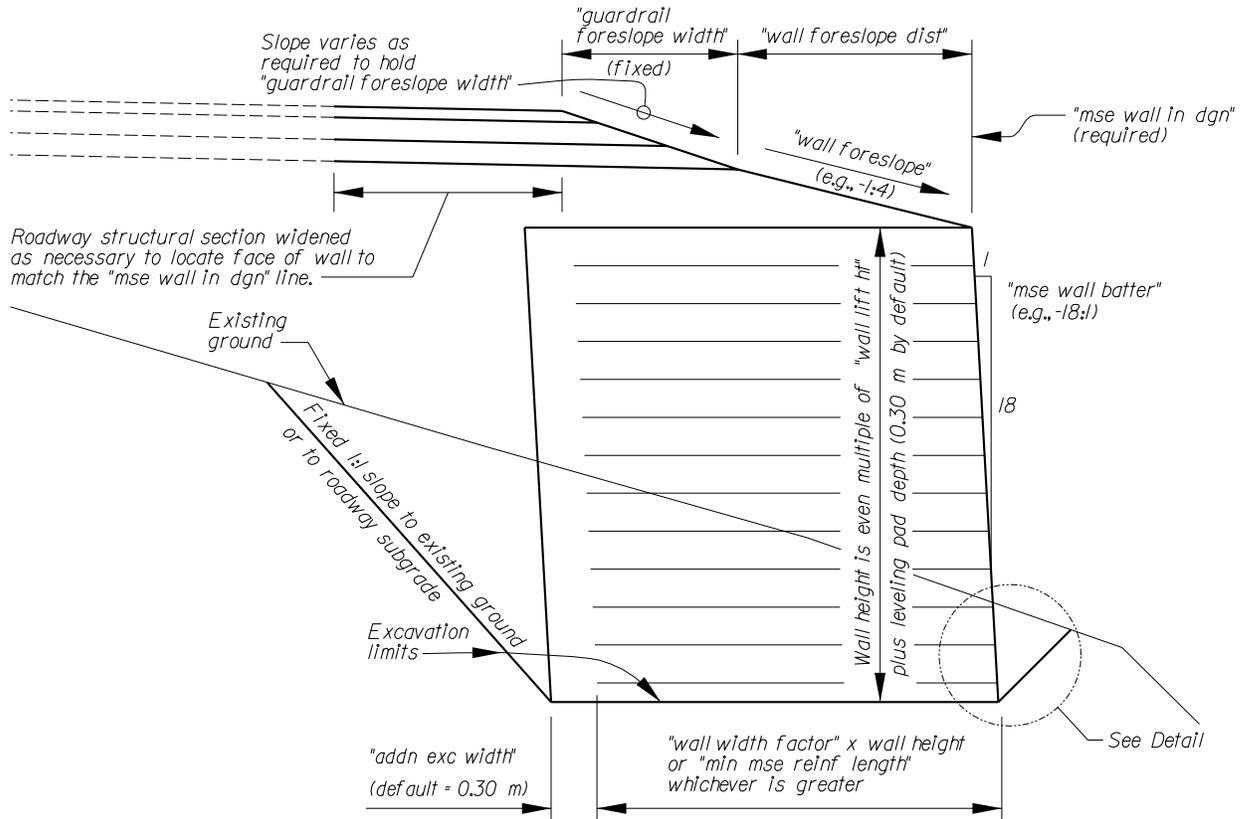
```
define "~continuous wall foreslope" 1
```

Notice that the variables "wall foreslope" and "wall foreslope dist" are interpreted differently when this option is used.



fh_wall5.x08

Draws an MSE retaining wall plus associated special excavation and backfill. Station range(s) for the wall and offset from centerline to the wall face are set by lines drawn in plan view dgn.
 (This criteria file conforms to the December 2000 revision to M255-02.)



define variables that must be assigned values in the input data file:

- "guardrail foreslope width"
- "wall foreslope dist"
- "wall foreslope" (e.g., -1:4)
- "mse wall batter" (e.g., -18:1)
- "wall width factor"
- "wall lift ht" (optional, see Notes)
- "min mse reinf length" (optional, see Notes)
- "addn exc width" (optional, see Notes)
- "~continuous wall foreslope" (optional, see Notes)
- "~leveling pad depth" (optional, see Notes)
- "toe to exist ground offset" (optional, see Notes)

define_dgn variables that must be assigned values in the input data file:

- "mse wall in dgn"

fh_wall5.x08

Variables that must be defined in exceptions data file:

None

Notes for fh_wall4.x08:

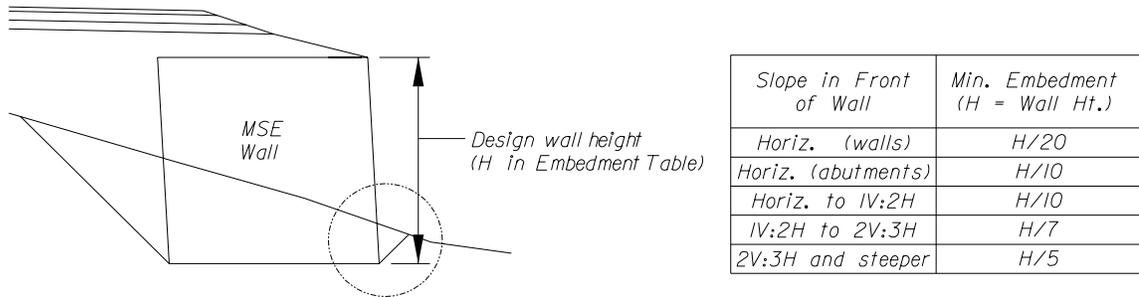
1. Details match revised standard metric detail M255-02 dated 12/00.
2. Both station ranges for the MSE wall and offsets from the roadway shoulder to the face of the MSE wall are set with lines drawn in a plan view dgn file.
3. This criteria will automatically widen the roadway structural section as necessary to match the location of the MSE wall face with the offset of the "mse wall in dgn" line.
4. Previous versions of retaining wall criteria files were plagued with tolerance problems when the user attempted to draw the "mse wall in dgn" line so that there was no additional widening of the roadway when the retaining wall section was drawn. In order to avoid these tolerance problems, this criteria was written so that if the "mse wall in dgn" line is drawn anywhere from the roadway centerline out to the theoretical draw-the-wall-with-no-roadway-widening line then the MSE wall will be drawn on the cross-section without widening the roadway section . So, if you use this criteria and don't want any pavement widening, draw the "mse wall in dgn" line slightly (or not so slightly) inside of where you calculate the face of the wall should be.
5. If "wall lift ht" is defined in the input file to be something greater than zero, then the design height of the wall (H in the detail shown above) will be an even number of "wall lift ht" units plus an additional 0.30 meters (see the next note). By default the "wall lift ht" is set to zero in order to make this option transparent for previously designed jobs.
6. The additional 0.30 meters tacked onto the even number of "wall lift ht" units represents the recommended leveling pad depth, and is taken directly from standard detail M255-02. The user may override the default 0.30 meter depth by defining "~leveling pad depth" in the input file.
7. The minimum horizontal distance from the toe of the wall to existing ground is fixed at 1.20 meters in M255-02. Although it is discouraged, this distance can be changed by defining the "toe to existing ground offset" variable to the desired distance in the input file.
8. The "wall width factor" controls the length of soil reinforcement and pervious backfill unless "min mse reinf length" has been set in the input file and it controls (see the next note). Standard M255-02 recommends a minimum value of 0.70 for "wall width factor".
9. If the user defines "min mse reinf length" in the input file to something greater than zero, then the width of the reinforced volume will be either "wall width factor" x wall height or "min mse reinf length", whichever is greater. By default "min mse reinf length" is set to 0 in order to make this option transparent for previously designed jobs.
10. The optional define variable "addn exc width" may be used to control the distance the construction excavation extends past the end of the wall reinforcement. By default this variable is set to 0.30 meters to match the recommended value from M255-02.

11. This criteria will not draw all the lines required by GEOPAK earthwork to automatically calculate all the various subsidiary quantities associated with the MSE wall. Don't expect to take the wall x-sections drawn by this criteria and run them through the earthwork procedure to get structure excavation, select wall backfill, etc., because it won't happen. Although it's theoretically possible to draw all these lines with a criteria file, actually writing a criteria file that does this has proved to be an intractable problem despite the combined efforts of FLH and GEOPAK. If the designer wants the subsidiary quantities for the MSE wall there are only two options available at this time, and both involve using MicroStation to manually draw the necessary earthwork lines onto the x-sections. If the lines are drawn strictly following the rules outlined in the Earthworks section of the manuals (which is not a simple task) then the GEOPAK earthwork procedure will calculate the subsidiary quantities automatically. The other option (and experience has shown this to be the simpler solution), is to manually draw the subsidiary quantity lines with MicroStation without regard to the GEOPAK earthwork rules and to then use the MicroStation "measure area" tool to manually determine the end areas for each x-section and to use a spreadsheet to tabulate the subsidiary quantities.
12. By default the foreslope from the top of the pavement shoulder point to the top point of the wall face will be a compound slope with a break at the roadway subgrade. The slope of the top portion is controlled by "guardrail foreslope width" and the structural section thickness; the slope of the bottom portion is controlled by the variables "wall foreslope dist" and "wall foreslope".
13. The user may optionally force a continuous foreslope from the top of pavement shoulder to the top point of the wall face by adding the following line to the input file:
 define "~continuous wall foreslope" 1
If this option is used, interpretation of the "wall foreslope" and "wall foreslope dist" variables changes from what it is for the default case. For this situation the variables refer to the entire foreslope from top of pavement shoulder to top of wall point rather than to just the lower portion of the foreslope.
14. The user has no control over the assumed structure excavation backslope; it is fixed at 1:1.

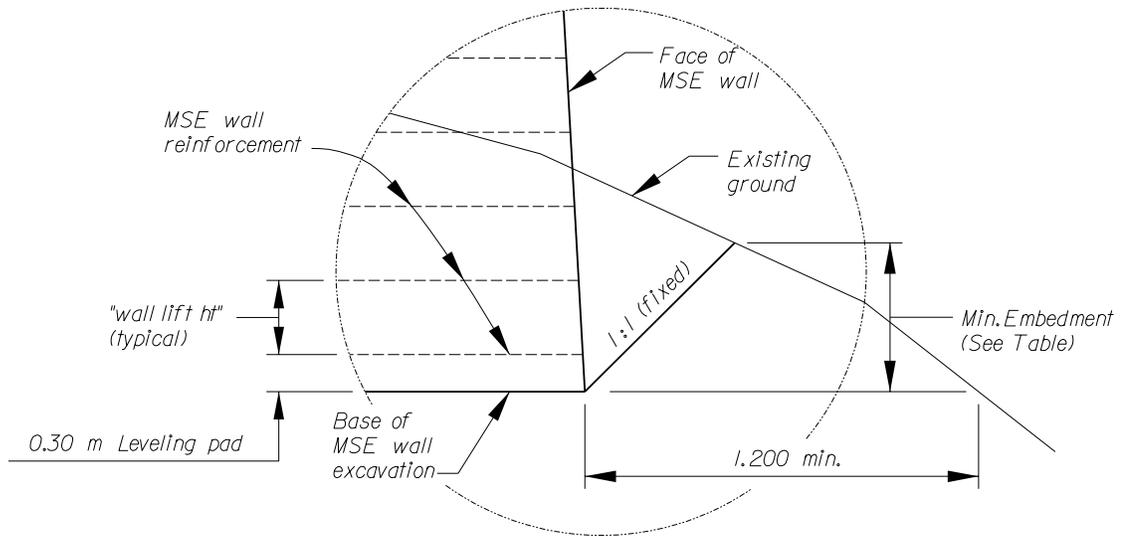
fh_wall5.x08

Toe Embedment Details for fh_wall5.x08

Minimum toe embedment depth from standard detail M255-02.



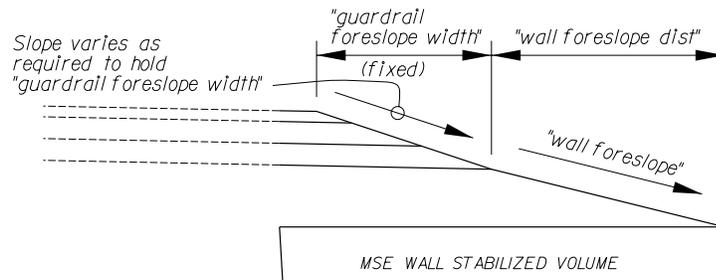
Toe embedment details.



fh_wall5.x08

Foreslope Details For fh_wall5.x08

Default foreslope configuration. The foreslope from the pavement shoulder to the top of the MSE wall is a compound slope with a break in slope at the subgrade shoulder point, as shown below.

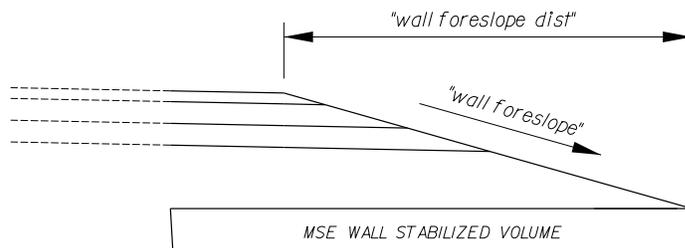


Optional foreslope configuration. The foreslope from the pavement shoulder to the top of the MSE wall is a continuous slope as shown below.

To toggle this option on, include the following line in the input file:

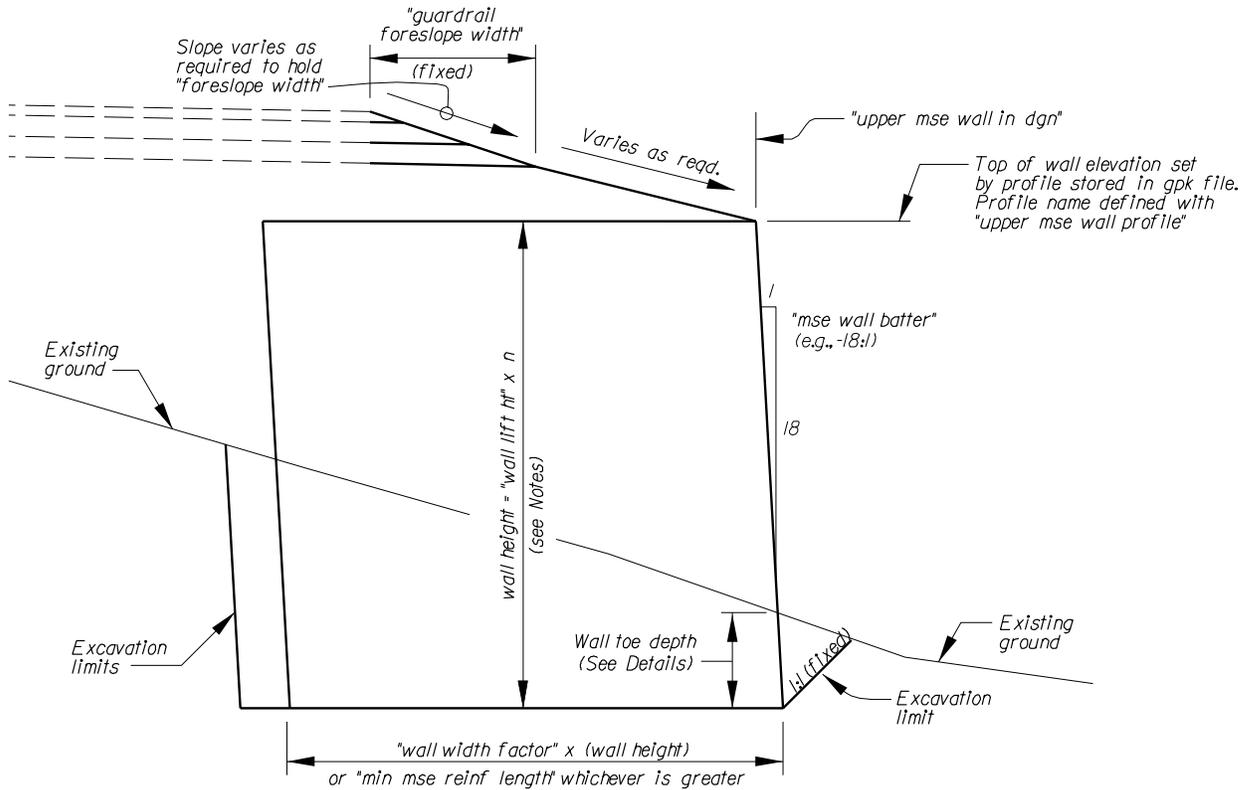
```
define "~continuous wall foreslope" 1
```

Notice that the variables "wall foreslope" and "wall foreslope dist" are interpreted differently when this option is used.



c_wall9d.x08

Draws an MSE retaining wall with either one or two tiers at any x-section. Offset for the wall, station range for the wall, and whether the wall is one or two tiers are all set using "in dgn" lines drawn in a plan view file. Top of wall elevation is set with a COGO profile.



define variables that must be assigned values in the input data file:

- "min mse reinf length" (default = 0)
- "mse wall batter" (e.g., -18:1)
- "toe depth calc method" (default = 1)
- "toe to exist ground offset"
- "upper mse wall profile"
- "upper mse wall tier height"
- "wall lift height"
- "wall width factor" (e.g., 0.75)
- "toe depth [1-5]"
- "max wall ht for toe depth [1-5]"

define_dgn variables that must be assigned values in the input data file:

- "lower mse wall in dgn"
- "upper mse wall in dgn"

Variables that must be defined in exceptions data file:

None

c_wall9d.x08

Notes for c_wall9d.x08:

1. Station range for the MSE wall, distance from the roadway centerline to the face of the MSE wall, and configuration of the MSE wall (i.e., one or two tier) are all controlled by lines drawn in a plan view dgn file. The level/symbology for these "in dgn" lines is defined in the input file with the define_dgn variables "upper mse wall in dgn" and "lower mse wall in dgn".
 - a. If both the "upper mse wall in dgn" line and the "lower mse wall in dgn" line are found at a particular station, then a two-tier wall will be drawn for that x-section. (See Two-Tier Wall Details.)
 - b. If only the "upper mse wall in dgn" line is found at a particular station, then a single tier wall will be drawn for that x-section.
 - c. If only the "lower mse wall in dgn" line is found at a particular station, then no MSE wall will be drawn for that x-section.
 - d. For a single tier wall, the upper corner of the wall face will be drawn in the x-section to match the distance from centerline to the "upper mse wall in dgn" line. (The elevation of the upper corner of the wall face is determined as outlined in Notes #2 and #3 below.)
 - e. For a two tier wall, the upper corner of the upper tier wall face will be drawn in the x-section to match the distance from centerline to the "upper mse wall in dgn" line. The upper corner of the lower tier wall face will be drawn in the x-section to match the distance from centerline to the "lower mse wall in dgn" line. (The elevation of the upper corner of the upper tier wall face is determined as outlined in Notes #2 and #3 below. The elevation of the upper corner of the lower tier wall face is determined as outlined in Note #4 below.)
2. The top of MSE wall elevation (i.e., the point at the top of the wall face) is set using a profile stored in COGO. The variable "upper mse wall profile" in the input file tells this criteria file the name of the COGO profile.
3. The stationing of the COGO profile must match the stationing of the roadway centerline where the wall is needed.
4. For a two-tier wall, the height of the upper tier is a fixed valued set with the "upper mse wall tier height" variable in the input file. (A fixed elevation bench doesn't work very well in practice, especially for a long wall on a constant steep grade section of road.)
5. The overall wall height will always be set to be an even number of "mse wall lift ht" units. This is true for either a one- or two-tier wall section. (Notice that for a two-tier wall the heights of the individual tiers will be even multiples of "mse wall lift ht" only if the user defines "upper mse wall tier height" to be an even multiple of "mse wall lift ht".)
6. The reference point from which minimum toe depth for the wall is calculated may (optionally) be set by the user with the "toe depth calc method" variable in the input file. By default the reference point is on the existing ground a distance of "toe to exist ground offset" from the face of the wall. All the available options for "toe depth calc method" are shown in the figures below. (Note: Despite varying opinions on which is the "correct" method to use, experience has shown that the option chosen has very little effect on the final wall height except when the existing ground is extremely steep.)

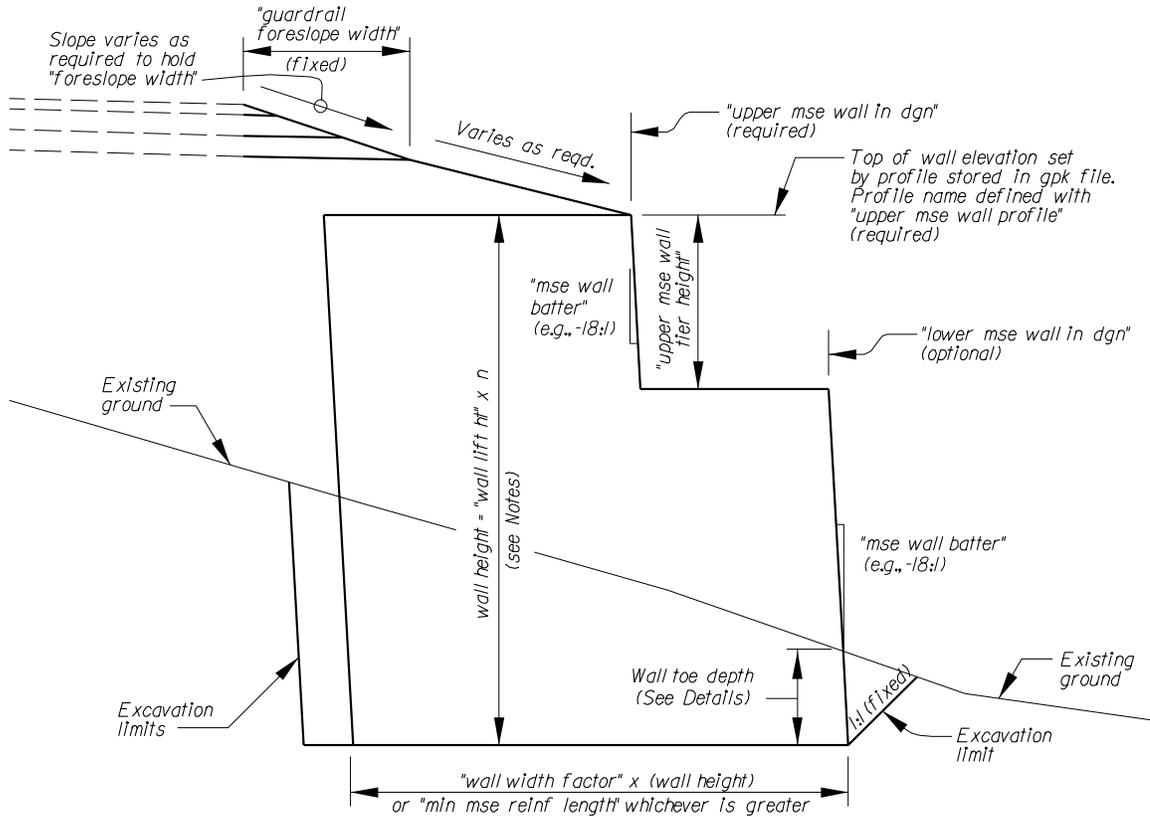
c_wall9d.x08

7. The "toe depth n" and "max wall ht for toe depth n" pairs of variables control the minimum toe depth of the wall. In general, the toe depth increases as the wall height increases. The values listed below are the defaults; if these values are OK then the variables need not be defined in the input file.
 - define "toe depth 1" 0
 - define "max wall ht for toe depth 1" 4.30
 - define "toe depth 2" 0.15
 - define "max wall ht for toe depth 2" 6.10
 - define "toe depth 3" 0.30
 - define "max wall ht for toe depth 3" 7.30
 - define "toe depth 4" 0.45
 - define "max wall ht for toe depth 4" 9.20
 - define "toe depth 5" 0.60
 - define "max wall ht for toe depth 5" 1000
8. The length of soil reinforcement (e.g., geogrid or welded wire fabric) and pervious backfill that is drawn by this criteria file is either the "min mse wall reinf length" value or ("wall width factor" x wall height), whichever is greater. In most cases "wall width factor" will be in the range of 0.70-0.80.
9. c_wall9d.x08 draws additional "earthwork" lines beyond what is required to simply define the wall geometry. These additional lines allow the earthwork procedure to calculate separate quantities for structure excavation and special wall backfill.
10. Special level/symbology for earthwork is as follows:
 - Existing suitable
 - Soil type = STRUCTURE_EXC
 - lv=40 co=40
 - Proposed undercut
 - Soil type = WALL_BACKFILL
 - lv=41 co=41
 - Proposed undercut
 - Soil type = EMBANKMENT
 - lv=42 co=42
11. The user has no control over the assumed structure excavation backslope; it is fixed to match the slope of the face of the wall.

c_wall9d.x08

Two-Tier Wall Details for c_wall9d.x08 (Optional)

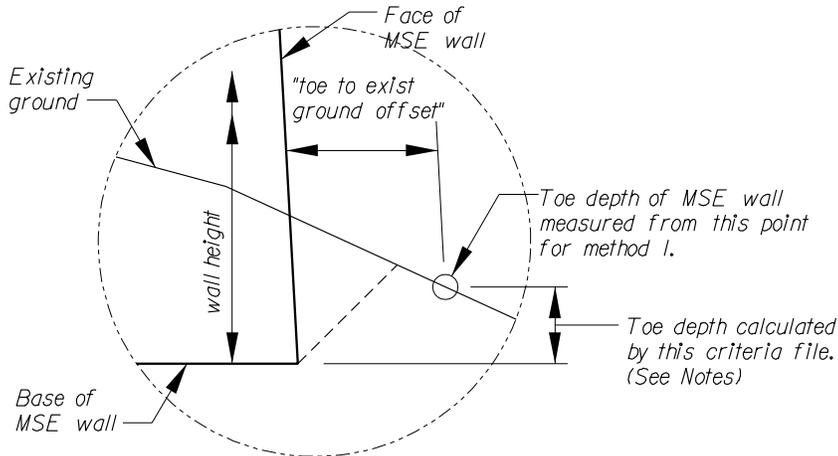
A two-tier wall section is toggled on by drawing a line in a plan view dgn file with the level/symbology specified with the "lower mse wall in dgn" for the station range where two tiers are needed. (Notice that both the "upper mse wall in dgn" and the "lower mse wall in dgn" lines must be drawn in the plan view dgn file in order for two tier wall to be drawn.)



c_wall9d.x08

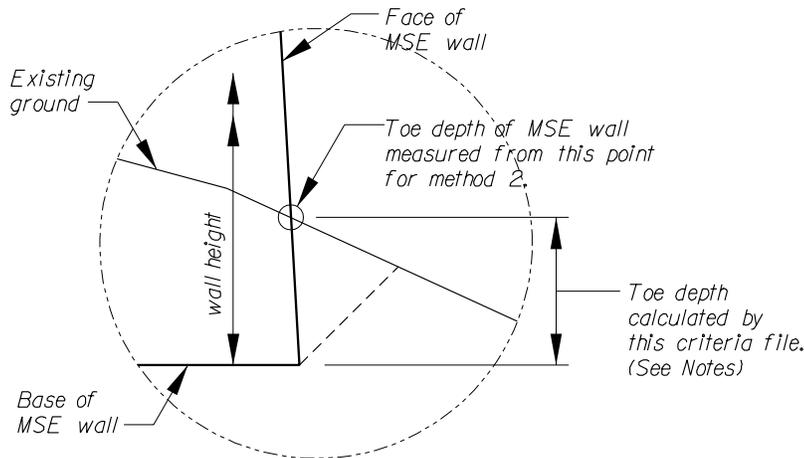
Wall Toe Depth Options For c_wall9d.x08

Use "toe depth calc method" variable in input file to control which method is used. (See Notes)



Toe Depth Calculation Method 1 (default)

`define "toe depth calc method" 1`

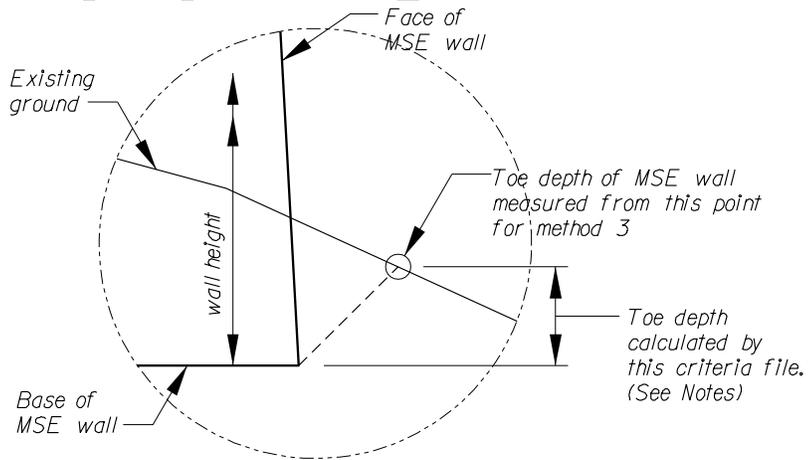


Toe Depth Calculation Method 2

`define "toe depth calc method" 2`

c_wall9d.x08

Wall Toe Depth Options For c_wall9d.x08 (continued)

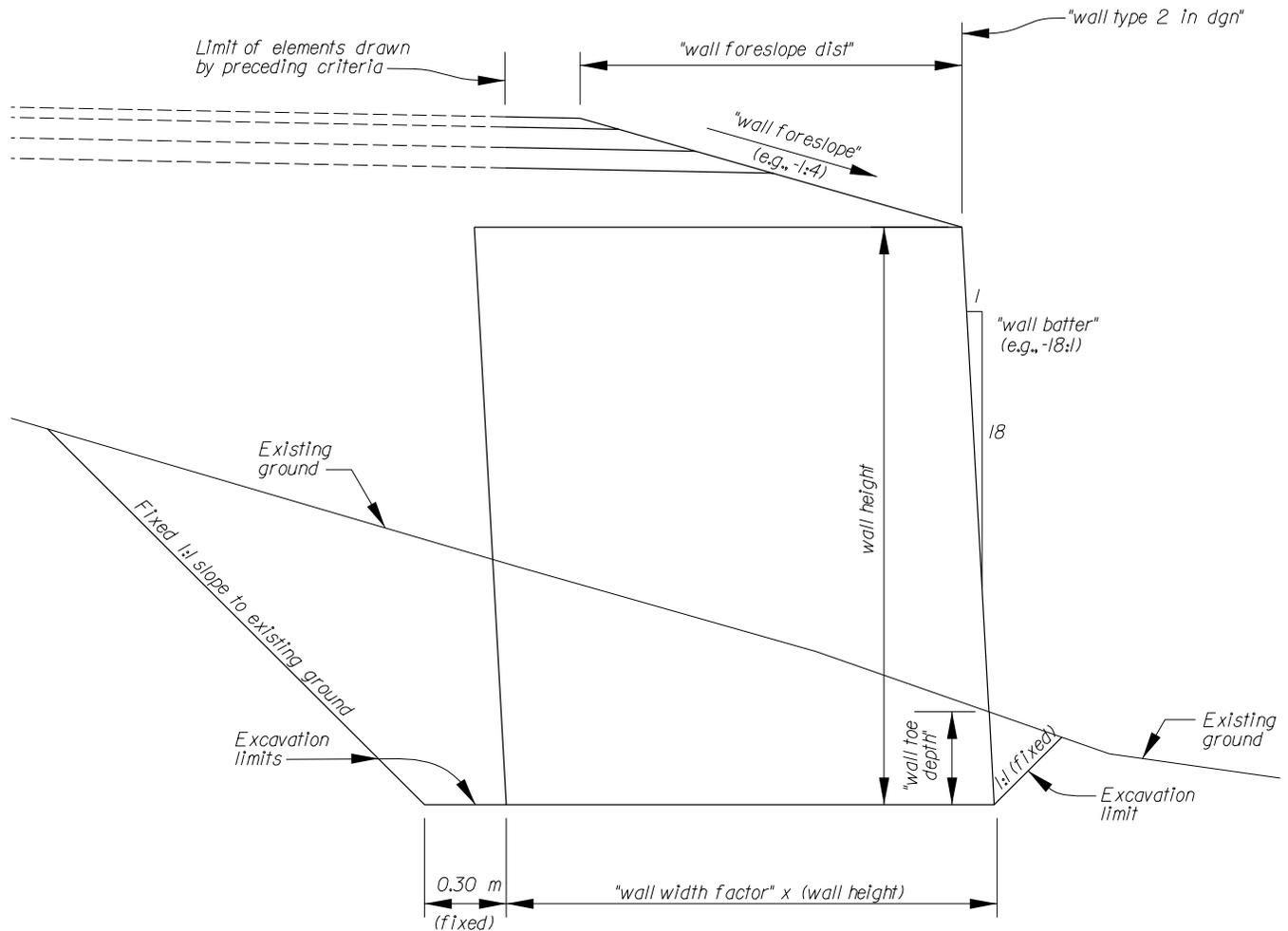


Toe Depth Calculation Method 3

`define "toe depth calc method" 3`

fh_wall2.x08

Draws an MSE retaining wall plus associated special excavation and backfill. Station ranges, side of road, and offset to face of the wall are all set using line(s) drawn in a plan view dgn file.
(This criteria file does not conform to the December 2000 revision to M255-02.)



define variables that must be assigned values in the input data file:

- "wall foreslope dist"
- "wall foreslope" (e.g., -1:4)
- "wall batter" (e.g., -18:1)
- "wall width factor"
- "wall toe depth"

define_dgn variables that must be assigned values in the input data file:

- "wall type 2 in dgn"

Variables that must be defined in exceptions data file:

None

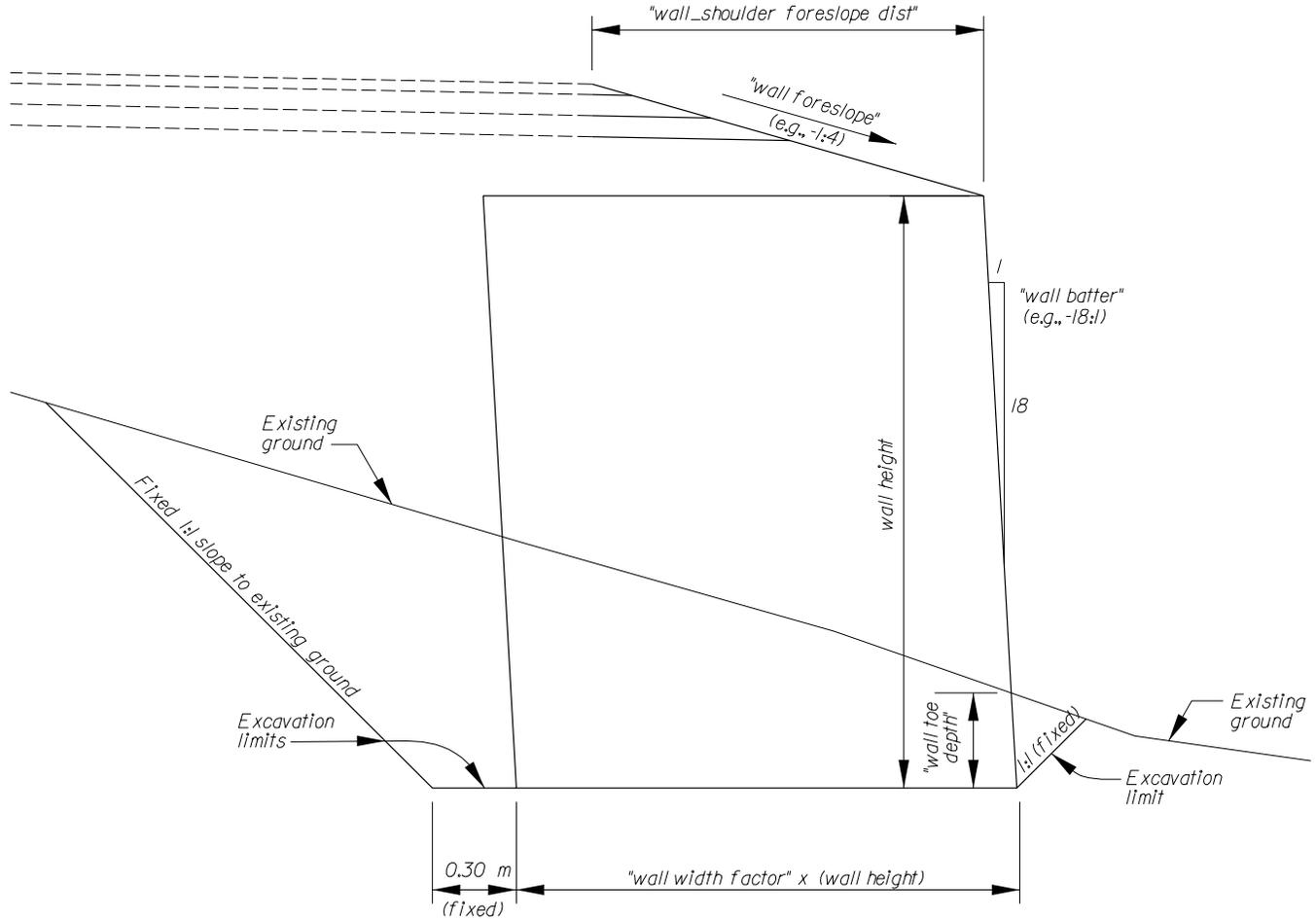
fh_wall2.x08

Notes for fh_wall2.x08:

1. The "wall type 2 in dgn" line(s) drawn in plan view dgn file set the station range and side of the roadway where the MSE wall will be drawn. The "wall type 2 in dgn" lines also set the distance from the roadway centerline to the face of the MSE wall.
2. If the distance from the point where the preceding criteria file left off to the "wall type 2 in dgn" line is less than "wall foreslope distance", then nothing will be drawn.
3. If the distance from the point where the preceding criteria file left off to the "wall type 2 in dgn" line is greater than "wall foreslope dist", then the pavement and base course layers will be extended as necessary to locate the pavement shoulder point exactly "wall foreslope dist" inside the "wall type 2 in dgn" line. Effectively this means that the user can accomplish roadway widening using this criteria.
4. fh_wall2.x08 draws additional "earthwork" lines beyond what is required to simply define the wall geometry. These additional lines allow the earthwork procedure to calculate separate quantities for structure excavation and special wall backfill.
5. The standard level symbology for the "wall type 2 in dgn" define_dgn lines is: lv=?? co=??.
6. The slope from the top of pavement shoulder point to the top point of the wall face is constant. (Contrast this with fh_wall4.x08 and fh_wall8.x08 where the structural section foreslope slope is not necessarily the same as the slope from the subgrade shoulder point to the outside top point of the wall face.)
7. Optional define variable "max dist to dgn" is available to allow the user to limit the maximum distance out from the centerline this criteria will search for the "wall type 2 in dgn" line(s). This is sometimes useful for switchback alignments where the criteria may find "wall type 2 in dgn" lines that belong with other sections of the road. In most cases, the default value of 15 meters should be adequate and the user should not define "max dist to dgn" in the input file.
8. The "wall width factor" controls the length of soil reinforcement (e.g., geogrid or welded wire fabric) and pervious backfill that is drawn by this criteria file. In most cases "wall width factor" will be in the range of 0.70-0.80.
9. The user has no control over the assumed structure excavation backslope; it is fixed at 1:1.

fh_wall3.x08

Draws an MSE retaining wall plus associated special excavation and backfill. Location of the retaining wall is set using station ranges and the `_d_wall_used_[lt,rt]` variables in the exceptions data file. (This criteria file does not conform to the December 2000 revision to M255-02.)



define variables that must be assigned values in the input data file:

- `"wall_shoulder foreslope dist"`
- `"wall foreslope" (e.g., -1:4)`
- `"wall batter" (e.g., -18:1)`
- `"wall width factor"`
- `"wall toe depth"`

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

- `_d_wall_used_lt`
- `_d_wall_used_rt`

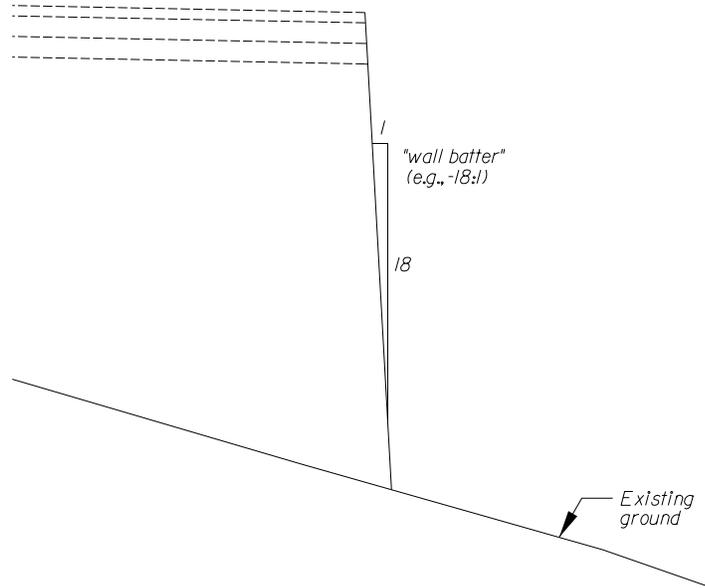
fh_wall3.x08

Notes for fh_wall3.x08:

1. Location of the MSE wall is set using station ranges and the `_d_wall_used_lt` and `_d_wall_used_rt` variables in the exceptions data file. (`_d_wall_used_lt` and `_d_wall_used_rt` must be set to 1 to make this criteria file work correctly.)
2. Nothing will be drawn if the roadway subgrade intersects the face of the MSE wall.
3. `fh_wall3.x08` draws additional "earthwork" lines beyond what is required to simply define the wall geometry. These additional lines allow the earthwork procedure to calculate separate quantities for structure excavation and special wall backfill.
4. The slope from the top of pavement shoulder point to the top point of the wall face is constant. (Contrast this with `fh_wall4.x08` and `fh_wall8.x08` where the structural section foreslope slope is not necessarily the same as the slope from the subgrade shoulder point to the outside top point of the wall face.)
5. The "wall width factor" controls the length of soil reinforcement (e.g., geogrid or welded wire fabric) and pervious backfill that is drawn by this criteria file. In most cases "wall width factor" will be in the range of 0.70-0.80.
6. The user has no control over the assumed structure excavation backslope; it is fixed at 1:1.

fh_wall7.x08

Draws an MSE retaining wall plus associated special excavation and backfill. Location of the retaining wall is set using station ranges and the `_d_wall_used_lt,rt` variables in the exceptions data file. (This criteria file does not conform to the December 2000 revision to M255-02.)



define variables that must be assigned values in the input data file:

"wall batter" (e.g., -18:1)

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

`_d_wall_used_lt`

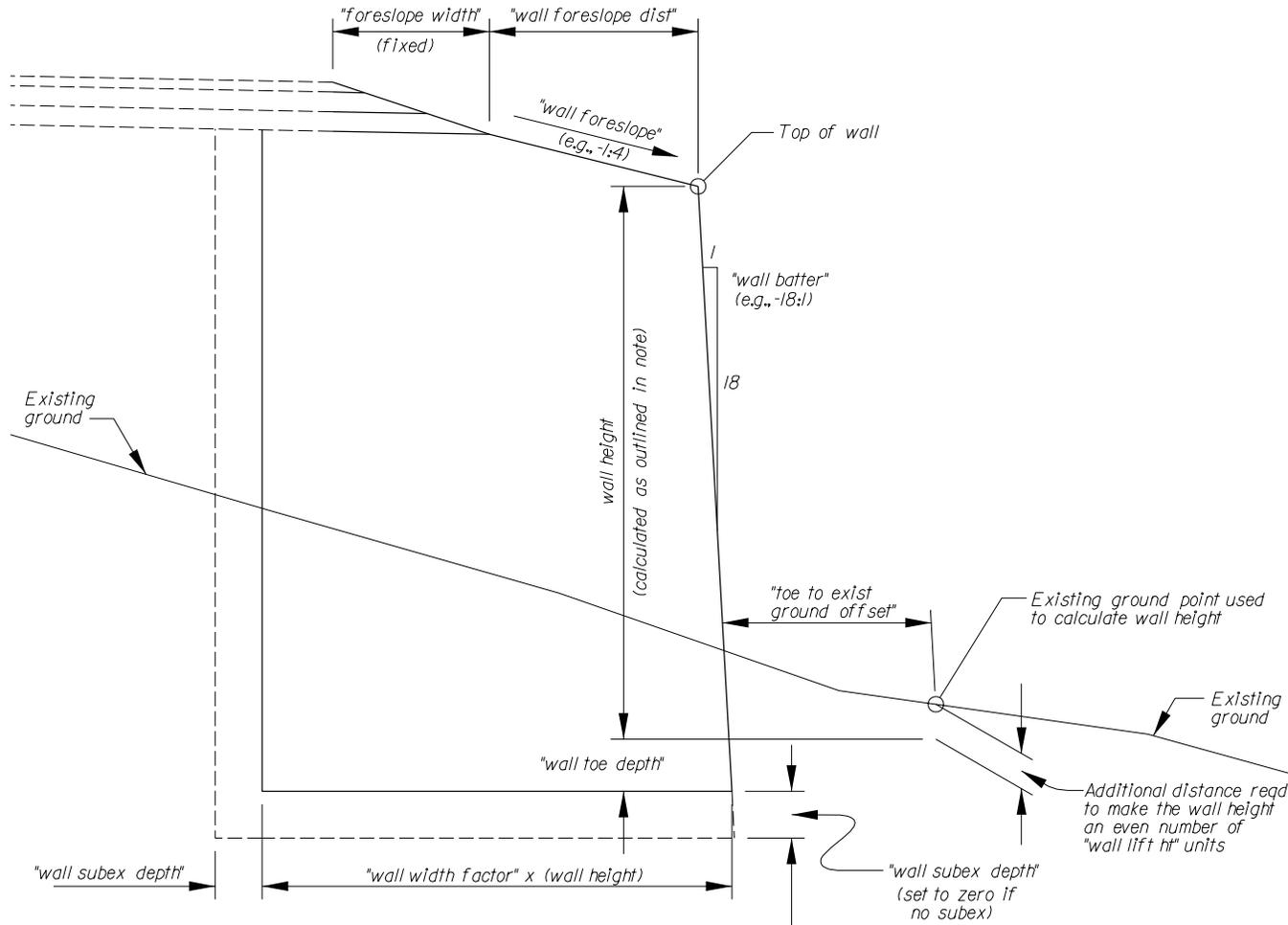
`_d_wall_used_rt`

Notes for fh_wall7.x08:

1. Location of the MSE wall is set using station ranges and the `_d_wall_used_lt` and `_d_wall_used_rt` variables in the exceptions data file. (`_d_wall_used_lt` and `_d_wall_used_rt` must be set to 7 to make this criteria file work correctly.)
2. No earthwork lines are drawn by this criteria, so the earthwork procedure will not calculate separate structure excavation or pervious backfill quantities for wall drawn with this criteria file.

fh_wall8.x08

Draws an MSE retaining wall plus associated special excavation and backfill. Location of the retaining wall is set using station ranges and the `_d_wall_used` [lt,rt] variables in the exceptions data file. (This criteria file does not conform to the December 2000 revision to M255-02.)



define variables that must be assigned values in the input data file:

- "foreslope width"
- "wall foreslope dist"
- "wall foreslope" (e.g., -1:4)
- "wall batter" (e.g., -18:1)
- "wall width factor"
- "wall toe depth"
- "wall subex depth"
- "toe to exist ground offset"

define_dgn variables that must be assigned values in the input data file:

None

fh_wall8.x08

Variables that must be defined in exceptions data file:

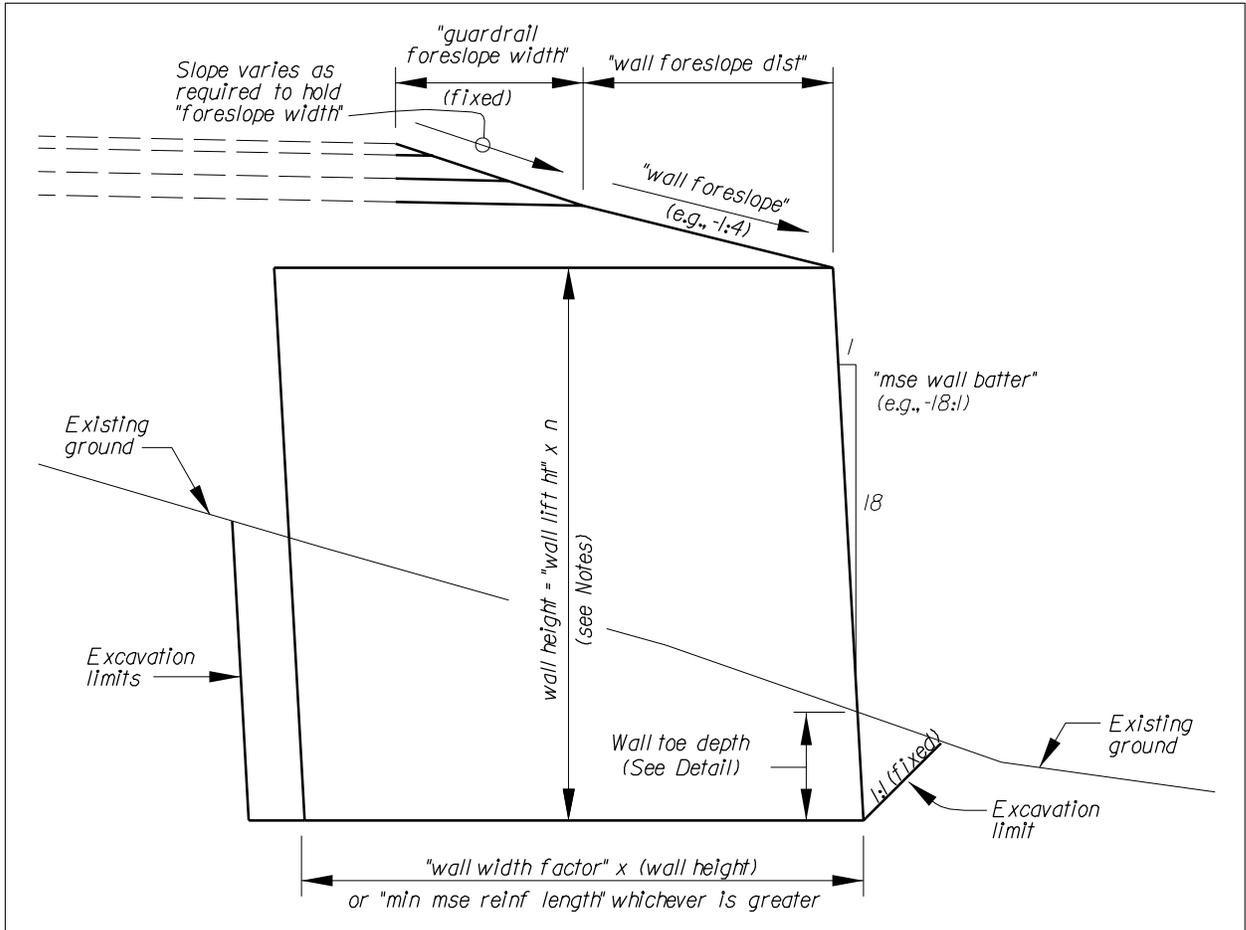
`_d_wall_used_lt`
`_d_wall_used_rt`

Notes for fh_wall8.x08:

1. Location of the MSE wall is set using station ranges and the `_d_wall_used_lt` and `_d_wall_used_rt` variables in the exceptions data file. (`_d_wall_used_lt` and `_d_wall_used_rt` must be set to 8 to make this criteria file work correctly.)
2. `fh_wall8.x08` draws additional "earthwork" lines beyond what is required to simply define the wall geometry. These additional lines allow the earthwork procedure to calculate separate quantities for structure excavation and special wall backfill.
3. The "wall width factor" controls the length of soil reinforcement (e.g., geogrid or welded wire fabric) and pervious backfill that is drawn by this criteria file. In most cases "wall width factor" will be in the range of 0.70-0.80.
4. Notice that "wall foreslope dist" has a different meaning in this criteria than it does in `fh_wall2.x08`.
5. The user has no control over the assumed structure excavation backslope; it is fixed at 1:1.

c_wall8s.x08

Draws an MSE retaining wall plus associated special excavation and backfill. Location of the retaining wall is set using station ranges and the `_d_mse_wall8_used_[lt,rt]` variables in the exceptions data file. (This criteria file does not conform to the December 2000 revision to M255-02.)



define variables that must be assigned values in the input data file:

- "wall foreslope" (e.g., -1:4)
- "wall foreslope dist"
- "mse wall batter" (e.g., -18:1)
- "min mse wall reinf length"
- "wall width factor"
- "wall lift ht"
- "toe depth calc method" (see Notes)
- "toe to exist ground offset"
- "toe depth [1-5]"
- "max wall ht for toe depth [1-5]"

define_dgn variables that must be assigned values in the input data file:

None

c_wall8s.x08

Variables that must be defined in exceptions data file:

`_d_mse_wall8_used_lt`
`_d_mse_wall8_used_rt`

Notes for c_wall8s.x08:

1. Location of the MSE wall is set using station ranges and the `_d_mse_wall8_used_lt` and `_d_mse_wall8_used_rt` variables in the exceptions data file. Set `_d_mse_wall8_used_[lt,rt] = 1` to toggle on the wall.
2. The wall height will always be set to be an even number of "mse wall lift ht" units.
3. The reference point from which minimum toe depth for the wall is calculated may (optionally) be set by the user with the "toe depth calc method" variable in the input file. By default the reference point is on the existing ground a distance of "toe to exist ground offset" from the face of the wall. All the available options for "toe depth calc method" are shown in the figures below.
(Note: Despite varying opinions on which is the "correct" method to use, experience has shown that the option chosen has very little effect on the final wall height except when the existing ground is extremely steep.)
4. The "toe depth n" and "max wall ht for toe depth n" pairs of variables control the minimum toe depth of the wall. In general, the toe depth increases as the wall height increases. The values listed below are the defaults; if these values are OK then the variables need not be defined in the input file.

```
define "toe depth 1" 0
define "max wall ht for toe depth 1" 4.30
define "toe depth 2" 0.15
define "max wall ht for toe depth 2" 6.10
define "toe depth 3" 0.30
define "max wall ht for toe depth 3" 7.30
define "toe depth 4" 0.45
define "max wall ht for toe depth 4" 9.20
define "toe depth 5" 0.60
define "max wall ht for toe depth 5" 1000
```

5. `c_wall8s.x08` draws additional "earthwork" lines beyond what is required to simply define the wall geometry. These additional lines allow the earthwork procedure to calculate separate quantities for structure excavation and special wall backfill.
6. The length of soil reinforcement (e.g., geogrid or welded wire fabric) and pervious backfill that is drawn by this criteria file is either the "min mse wall reinf length" value or ("wall width factor" x wall height), whichever is greater. In most cases "wall width factor" will be in the range of 0.70-0.80.
7. Special level/symbology for earthwork is as follows:

c_wall8s.x08

Existing suitable
Soil type = STRUCTURE_EXC
lv=40 co=40

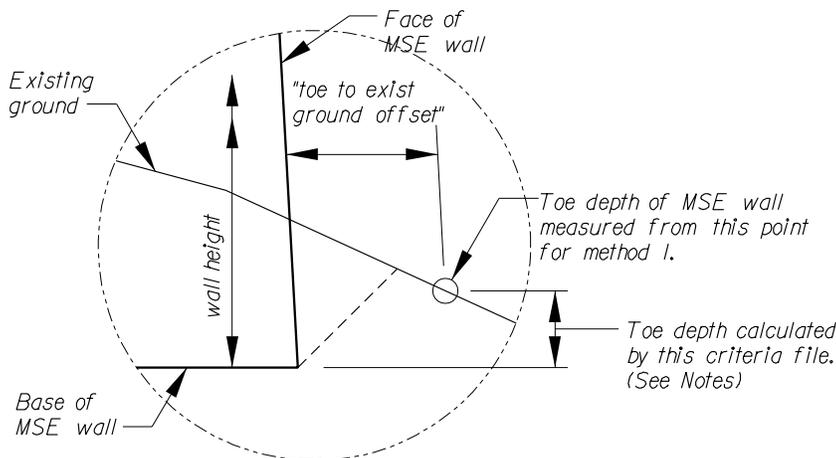
Proposed undercut
Soil type = WALL_BACKFILL
lv=41 co=41

Proposed undercut
Soil type = EMBANKMENT
lv=42 co=42

- 8. Notice that "wall foreslope dist" has a different meaning in this criteria than it does in fh_wall2.x08.
- 9. The user has no control over the assumed structure excavation backslope; it is fixed at 1:1.

Wall Toe Depth Options For c_wall8s.x08

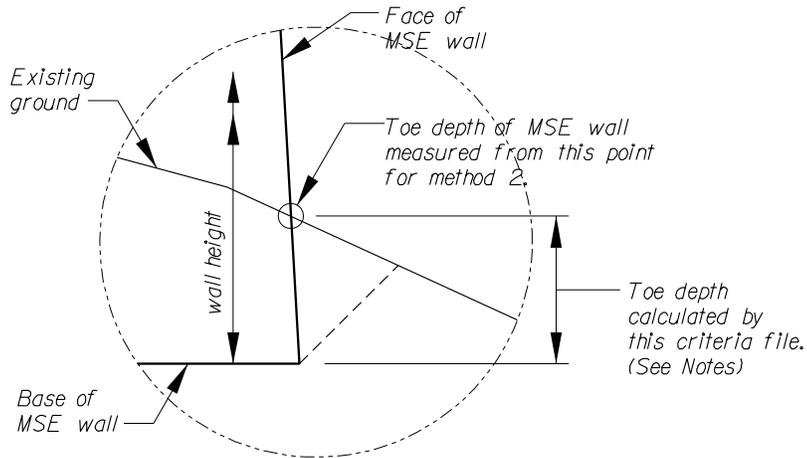
Use "toe depth calc method" variable in input file to control which method is used. (See Notes)



Toe Depth Calculation Method 1 (default)

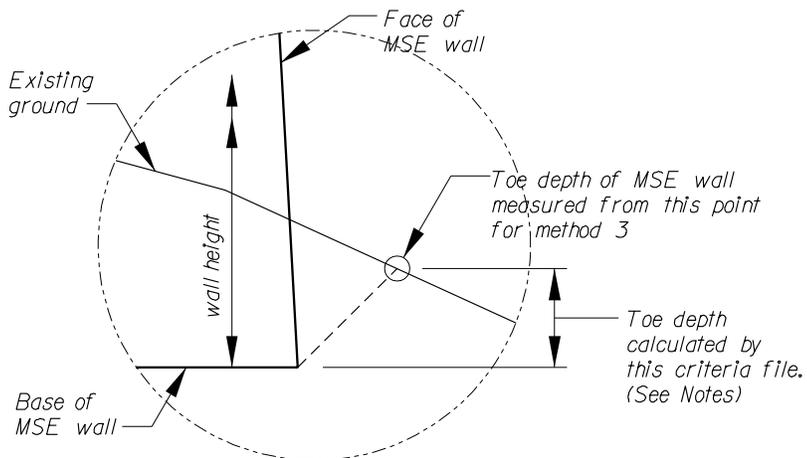
define "toe depth calc method" 1

Wall Toe Depth Options for *c_wall8s.x08* (continued)



Toe Depth Calculation Method 2

define "toe depth calc method" 2



Toe Depth Calculation Method 3

define "toe depth calc method" 3

Revision History

6/12/01 Revised fh_wall4.x08 to match revised M255-02 details. Added continuous foreslope option to fh_wall4.x08. Added fh_wall5.x08 as the "in dgn" counterpart of fh_wall4.x08. Deprecated use of all MSE wall criterias other than fh_wall4.x08 and fh_wall5.x08 (although documentation for other existing criterias is still included).

FLH Standard Criteria Files

Section 10 –

Concrete Cut Wall Criteria Files

Concrete Cut Wall Criteria Files

Criteria File	Elements Drawn by Criteria File
fh_walcd.x08	Cut wall plus associated excavation and backfill. Uses lines in plan view dgn file to set station ranges and side of roadway.
fh_walc9.x08	Cut wall plus associated excavation and backfill. Uses exceptions data file to set station ranges and side of roadway.

fh_walcd.x08

define_dgn variables that must be assigned values in the input data file:

"wall"

Variables that must be defined in exceptions data file:

None

Notes for fh_walcd.x08:

1. The "wall" line(s) drawn in plan view dgn file are used strictly as an on/off toggle for the cut wall; they have nothing to do with the offset of the wall from the roadway centerline. Note #3 outlines how the cut wall is located relative to the other proposed cross-section elements.
2. The "wall" lines in plan view dgn file must be drawn outside the shapes and any widening or shoulders; if they aren't the criteria won't find them and no cut wall will be drawn. Other than that, the offset of the lines from the roadway centerline doesn't matter.
3. The elevation of the base of the cut wall and the offset of the cut wall from the roadway centerline are both using the following rule: the point on the cut wall where the inside face of the wall stem intersects the top of the wall toe is set to coincide with the outside point of the bottom base course layer. (See the diagram above.)
4. fh_walcd.x08 draws additional "earthwork" lines beyond what is required to simply define the wall geometry. These additional lines allow the earthwork procedure to calculate separate quantities for structure excavation and special wall backfill.
5. The standard level symbology for the "wall" define_dgn lines is: lv=?? co=??.
6. fh_walcd.x08 will always draw a wall with "minimum stem height", even if the wall footing is on fill.

fh_walc9.x08

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

_d_wall_used_lt

_d_wall_used_rt

Notes for fh_walc9.x08:

1. The elevation of the base of the cut wall and the offset of the cut wall from the roadway centerline are both using the following rule: the point on the cut wall where the inside face of the wall stem intersects the top of the wall toe is set to coincide with the outside point of the bottom base course layer. (See the diagram above.)
2. fh_walc9.x08 draws additional "earthwork" lines beyond what is required to simply define the wall geometry. These additional lines allow the earthwork procedure to calculate separate quantities for structure excavation and special wall backfill.
3. fh_walc9.x08 will always draw a wall with "minimum stem height", even if the wall footing is on fill.

FLH Standard Criteria Files

Section 11 –

Concrete Fill Wall Criteria Files

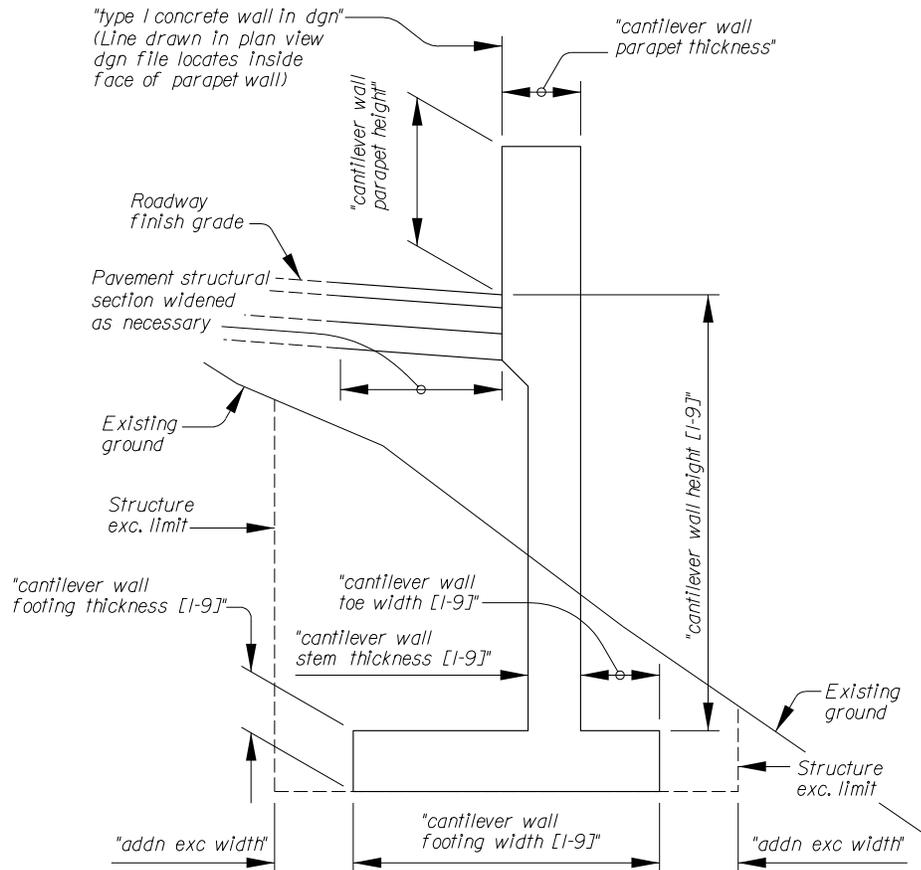
Concrete Fill Wall Criteria Files

These criteria files draw concrete fill walls including associated special excavation and backfill.

Criteria File	Elements Drawn by Criteria File
c_walld.x08	Cantilever concrete fill wall plus associated excavation and backfill. Uses lines in plan view dgn file to set station ranges and offset.
c_walls.x08	Cantilever concrete fill wall plus associated excavation and backfill. Uses exceptions data file to set station ranges and side of roadway.
c_zwalld.x08	Cantilever concrete "zee" wall plus associated excavation and backfill. Uses lines in plan view dgn file to set station ranges and offsets.

c_cwall1d.x08

Draws a cantilever concrete fill wall plus associated special excavation and backfill. Station ranges and offset from the roadway centerline are set using line(s) drawn in a plan view dgn file.
(Contrast this with *c_cwall1s.x08*, where the station ranges and side of the roadway for the cut wall are set in the exceptions data file.)



define variables that must be assigned values in the input data file:

- "addn exc width"
- "cantilever wall footing thickness [1-9]"
- "cantilever wall footing width [1-9]"
- "cantilever wall parapet height"
- "cantilever wall parapet thickness"
- "cantilever wall stem thickness [1-9]"
- "cantilever wall toe width [1-9]"
- "min footing depth" (see Footing Setback Details section below)
- "min footing setback" (see Footing Setback Details section below)

define_dgn variables that must be assigned values in the input data file:

- "type 1 concrete wall in dgn"

Variables that must be defined in exceptions data file:

c_cwall1d.x08

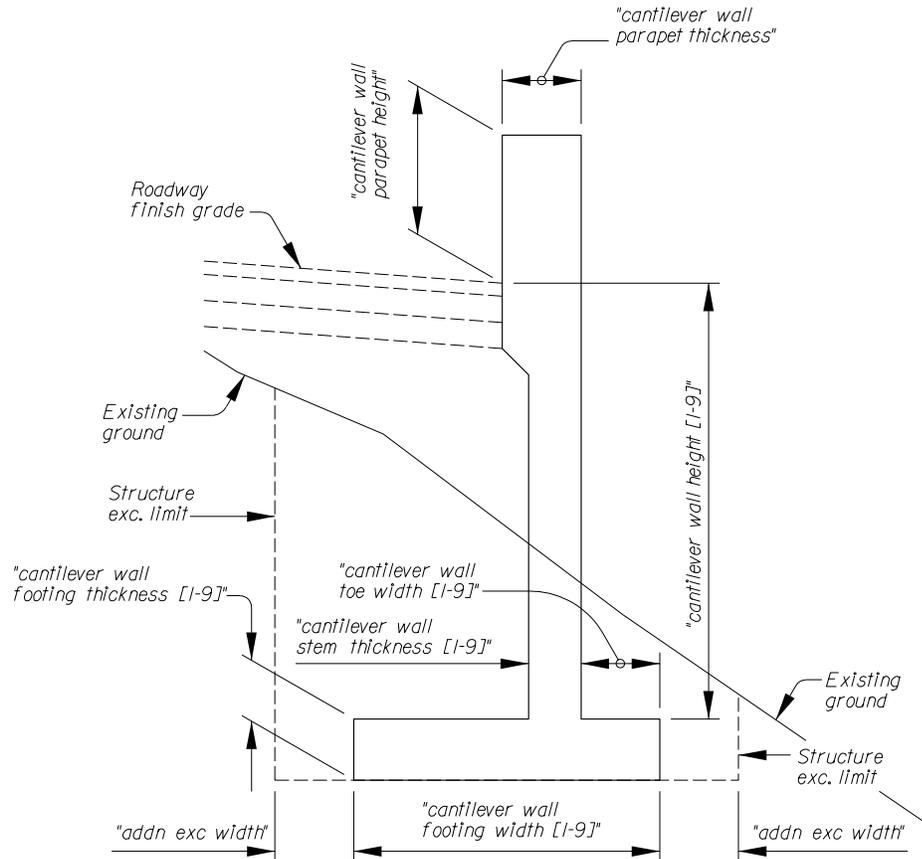
None

Notes for c_cwall1d.x08:

1. Both station ranges and offset from centerline for the wall are set using lines drawn in plan view dgn file (define_dgn variable "type 1 concrete wall in dgn").
2. "type 1 concrete wall in dgn" line defines the offset from roadway centerline to the inside face of the parapet wall. The pavement structural section is widened as necessary to position the wall to match the "in dgn" line.
3. This criteria file is a generalized rewrite of the wall criteria used for Generals Highway at Sequoia National Park.
4. User specifies all the dimensions for each of nine different wall sections ("cantilever wall ... [1-9]") in the input file, with "wall 1" being the shortest progressing to "wall 9", the tallest. By default dimensions for all the wall sections are set in the criteria file itself to the values used for Generals Highway, with the tallest wall ("cantilever wall height 9") being 5.50 meters.
5. Height of wall selected by this criteria is the shortest wall that satisfies both the "min footing depth" and the "min footing setback" requirements. (See Footing Setback Details section below for further explanation of these variables.)
6. Wall will always be drawn where called for, even if the entire wall is below existing ground -- in which case the shortest wall height ("cantilever wall height 1") is used.
7. If none of the specified walls satisfy the minimum footing depth/setback requirements, then a vertical line is drawn from top of pavement down to existing ground. This will allow earthwork and construction reports to be run on the cross-sections.
8. User must specify level/symbology very precisely for earthwork and the slope stake report.
Earthwork
 Finish grade: lv=2,8,10-12 co=0,10,11,16
 Existing suitable (structure exc): lv=46 co=46
 Proposed undercut (wall backfill): lv=47 co=47 soil type=same as proposed finish grade
Slope stake report
 Finish grade: lv=(bottom layer only),10,11 co=(bottom layer only),10,11,16

c_cwalls.x08

Draws a cantilever concrete fill wall plus associated special excavation and backfill. Station ranges and side of the roadway where the cut wall is drawn are set in the exceptions data file.
(Contrast this with *c_cwall1d.x08*, where the station ranges and offset from the roadway centerline for the wall are set using lines drawn in a plan view dgn file.)



define variables that must be assigned values in the input data file:

- "addn exc width"
- "cantilever wall footing thickness [1-9]"
- "cantilever wall footing width [1-9]"
- "cantilever wall parapet height"
- "cantilever wall parapet thickness"
- "cantilever wall stem thickness [1-9]"
- "cantilever wall toe width [1-9]"
- "min footing depth" (see Footing Setback. Details section below)
- "min footing setback" (see Footing Setback Details section below)

define_dgn variables that must be assigned values in the input data file:

None

c_cwalls.x08

Variables that must be defined in exceptions data file:

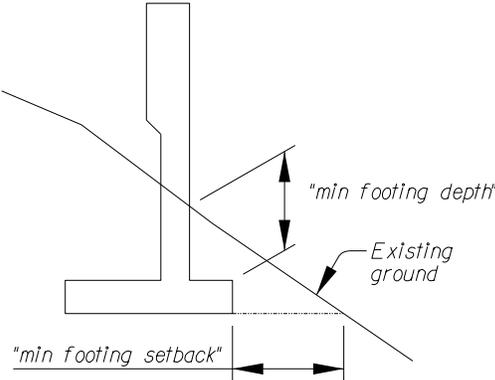
`_d_use_cantilever_wall1s_lt`
`_d_use_cantilever_wall1s_rt`

Notes for c_cwalls.x08:

1. Station ranges and side of road for the wall are set using the `_d_use_cantilever_wall1s_[lt,rt]` variables in the exceptions data file using the following syntax:

```
if sta >= 1+000 r 1 and sta <= 2+000 r 1 then
{
  _d_use_cantilever_wall1s_lt = 1
}
```
2. Wall is drawn at whatever point the preceding criteria file left off drawing; no pavement widening is done by this criteria.
3. This criteria file is a generalized rewrite of the wall criteria used for Generals Highway at Sequoia National Park.
4. User specifies all the dimensions for each of nine different wall sections ("cantilever wall ... [1-9]") in the input file, with "wall 1" being the shortest progressing to "wall 9", the tallest. By default dimensions for all the wall sections are set in the criteria file itself to the values used for Generals Highway, with the tallest wall ("cantilever wall height 9") being 5.50 meters.
5. Height of wall selected by this criteria is the shortest wall that satisfies both the "min footing depth" and the "min footing setback" requirements. (See Misc. Details section below for further explanation of these variables.)
6. Wall will always be drawn where called for, even if the entire wall is below existing ground -- in which case the shortest wall height ("cantilever wall height 1") is used.
7. If none of the specified walls satisfy the minimum footing depth/setback requirements, then a vertical line is drawn from top of pavement down to existing ground. This will allow earthwork and construction reports to be run on the cross-sections.
8. User must specify level/symbology very precisely for earthwork and the slope stake report.
Earthwork
Finish grade: lv=2,8,10-12 co=0,10,11,16
Existing suitable (structure exc): lv=46 co=46
Proposed undercut (wall backfill): lv=47 co=47 soil type=same as proposed finish grade
Slope stake report
Finish grade: lv=(bottom layer only),10,11 co=(bottom layer only),10,11,16

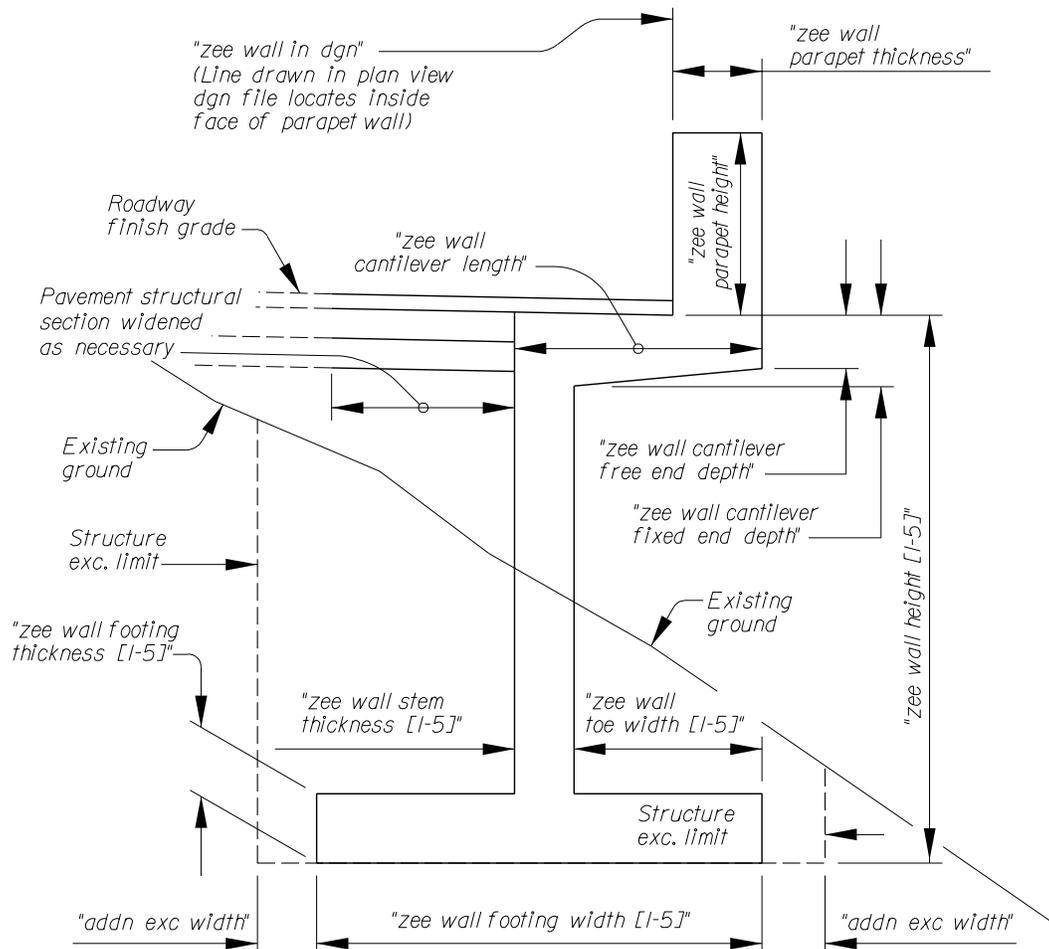
Footing Setback and Depth Details



MINIMUM REQUIREMENTS FOR FOOTING SETBACK AND DEPTH

c_zwalld.x08

Draws a cantilever concrete "zee" wall plus associated special excavation and backfill. Station ranges and offset from the roadway centerline are set using line(s) drawn in a plan view dgn file. User defines five wall heights and associated wall component dimensions.



define variables that must be assigned values in the input data file:

- "addn exc width"
- "min footing depth" (see Misc. Details section below)
- "min footing setback" (see Misc. Details section below)
- "zee wall parapet height"
- "zee wall parapet thickness"
- "zee wall cantilever length"
- "zee wall cantilever fixed end depth"
- "zee wall cantilever free end depth"
- "zee wall footing thickness [1-5]"
- "zee wall footing width [1-5]"
- "zee wall height [1-5]"
- "zee wall stem thickness [1-5]"
- "zee wall toe width [1-5]"

c_zwalld.x08

define_dgn variables that must be assigned values in the input data file:

"zee wall in dgn"

Variables that must be defined in exceptions data file:

None

Notes for c_zwalld.x08:

1. Both station ranges and offset from centerline for the wall are set using lines drawn in plan view dgn file (define_dgn variable "zee wall in dgn").
2. "zee wall in dgn" line defines the offset from roadway centerline to the inside face of the parapet wall. The pavement structural section is widened as necessary to position the wall to match the "in dgn" line. (The width of the concrete cantilever is fixed.)
3. This criteria file is a generalized rewrite of a wall criteria used for Generals Highway at Sequoia National Park 10(2).
4. The height of the wall drawn by this criteria is selected from among five user specified wall heights ("zee wall height [1-5]") in the input file. For each wall height the user also supplies dimensions for the other wall x-section elements. Wall heights should be in increasing order (i.e., "zee wall height 1" should be the shortest wall height and "zee wall height 5" should be the tallest).
5. Default (metric) dimensions for all the wall sections are set in the criteria file itself to match the values used for Generals Highway (see the table below). If the default dimensions are acceptable then the user does not have to define values for these variables in the cross-section input file.

Variable Name	n = 1	n = 2	n = 3	n = 4	n = 5
"zee wall height n"	1.85 m	2.45 m	3.05 m	3.65 m	4.25 m
"zee wall footing thickness n"	0.30 m	0.30 m	0.35 m	0.45 m	0.50 m
"zee wall footing width n"	2.15 m	2.15 m	2.45 m	2.75 m	2.75 m
"zee wall stem thickness n"	0.35 m				
"zee wall toe width n"	0.60 m				

6. Height of wall selected by this criteria will be the shortest of the user specified height that satisfies both the "min footing depth" and the "min footing setback" requirements. (See Misc.Details section below for further explanation of these variables.)
7. If none of the user specified wall heights ("zee wall height 1" thru "zee wall height 5") satisfy the minimum footing depth/setback requirements, then this criteria draws a "non-standard" wall height to fit the existing ground. The height of the wall for this case is determined by setting the toe of the wall footing "min footing depth" below existing ground. The other wall x-section dimensions for this case are the same as for wall height 5.
8. Wall will always be drawn where called for, even if the entire structure is below existing ground

c_zwalld.x08

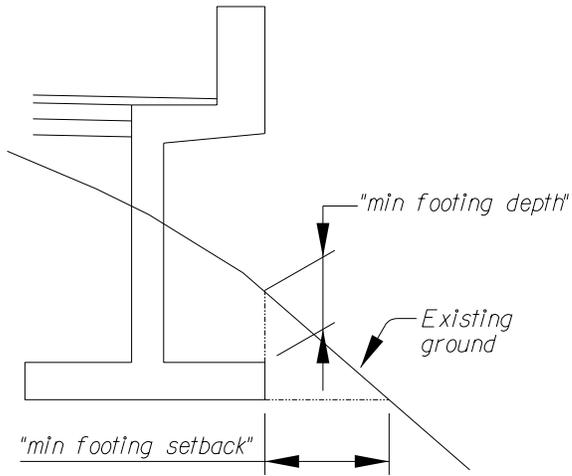
- in which case the shortest wall height ("zee wall height 1") is used.
- 9. The dimensions of the concrete wall cantilever section and the parapet wall are fixed. (i.e., they remain the same regardless of wall height)
- 10. Hidden define variables "~max wall search dist" (default = 20) and "~min pvmt widening" (default = 0.01) are available to fine tune the performance of this criteria.
- 11. User must specify level/symbology very carefully for the cross section reports to work correctly. (Notice that it was necessary to have the criteria draw an "extra" line with level/symbology lv=45 co=45 in order to get the reports to work.)

XS Report	Levels	Colors
Slope Stake Staking Detail	(bottom pavement layer level) + 8,10,45	(bottom pavement layer color) + 10,11,16,45
Red/Blue Top	(all pavement layer levels) + 8,10,45	(all pavement layer colors) + 10,11,16,45

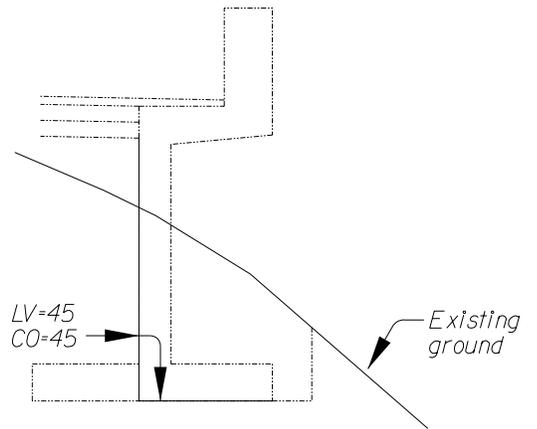
- 12. Level/symbology for earthwork is:

Classification	Levels	Colors
Proposed Finish Grade	2,8,10-12	0,10-12,16
Existing Ground	56	2
Existing Suitable (Structure Excavation)	46	46
Proposed Undercut (same soil type as Proposed Finish Grade)	47	46

Concrete Fill Wall Criteria Files
c_zwalld.x08 Misc. Details



*MINIMUM REQUIREMENTS FOR
FOOTING SETBACK AND DEPTH*



*SPECIAL PURPOSE LINES
FOR SLOPE STAKE AND
RED/BLUE TOP REPORTS*

FLH Standard Criteria Files

Section 12 –

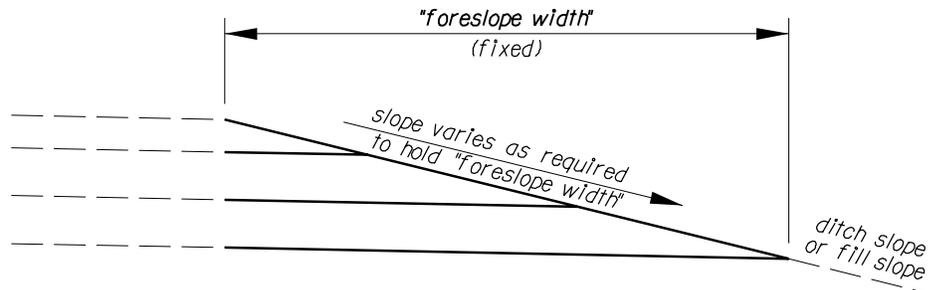
Roadway Foreslope Criteria Files

Roadway Foreslope Criteria Files

Criteria File	Elements Drawn by Criteria
fh_fs1.x08	<p>Draws a <u>fixed width</u> roadway foreslope. Foreslope width is not changed for sections with guardrail. Extends “full length” undercut layers to daylight on foreslope.</p>
fh_fs2.x08	<p>Draws a <u>fixed slope</u> roadway foreslope. Foreslope slope is not changed for sections with guardrail. Extends all “full length” undercut layers to daylight on foreslope.</p>
fh_fs3.x08	<p>Draws a <u>fixed slope</u> roadway foreslope. Different foreslope slope is used for guardrail cross-sections vs. cross-sections without guardrail. Extends all “full length” undercut layers to daylight on foreslope.</p>
fh_fs5.x08	<p>Draws a <u>fixed width</u> roadway foreslope. Different foreslope width is used for guardrail cross-sections vs. cross-sections without guardrail. Extends all “full length” undercut layers to daylight on foreslope.</p>
fh_fs6.x08	<p>Draws a fixed width roadway foreslope. Different foreslope width is used for guardrail cross-sections vs. cross-sections without guardrail. Pavement layer is daylighted to the foreslope for cross-sections without guardrail. Pavement layer is terminated at the guardrail for cross-sections with guardrail. Must be used in combination with shoulder criteria file fh_sh6.x08.</p>

fh_fs1.x08

Draws a fixed width foreslope including base course and pavement layers. Foreslope width is the same with or without guardrail.



define variables that must be assigned values the input data file:

"foreslope width"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

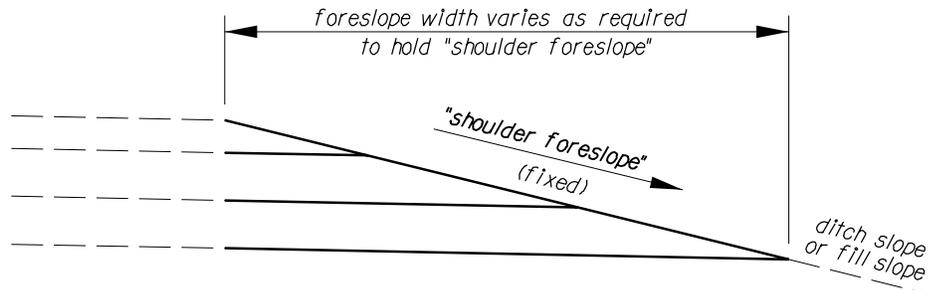
None

Notes for fh_fs1.x08:

1. The foreslope width and slope can't both be fixed -- one or the other has to vary to accommodate changes in superelevation. This criteria draws a fixed width foreslope; the foreslope slope varies as required to maintain structural section thickness.
2. If the foreslope changes (e.g., gets narrower) for cross-sections with guardrail sections, then use fh_fs5.x08 rather than this criteria file.
3. The "first full length layer" variable determines whether all the base course and pavement layers are carried out to daylight on the foreslope.
4. By default, no slope label is placed for the foreslope. If a slope label is needed, add a *define* "*~place foreslope slope labels*" 1 statement to the input file.
5. Text size for the optional slope label may be set with by adding a *define* "*text size*" nnn (where nnn is the desired text size) statement to the input file. By default the text size is set to 0.30. (The "text size" value applies to the slope labels created by all the criteria files.)

fh_fs2.x08

Draws a fixed slope foreslope including base course and pavement layers.
Foreslope slope is the same with or without guardrail.



define variables that must be assigned values in input data file:

"shoulder foreslope" (e.g., -1:4)

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

None

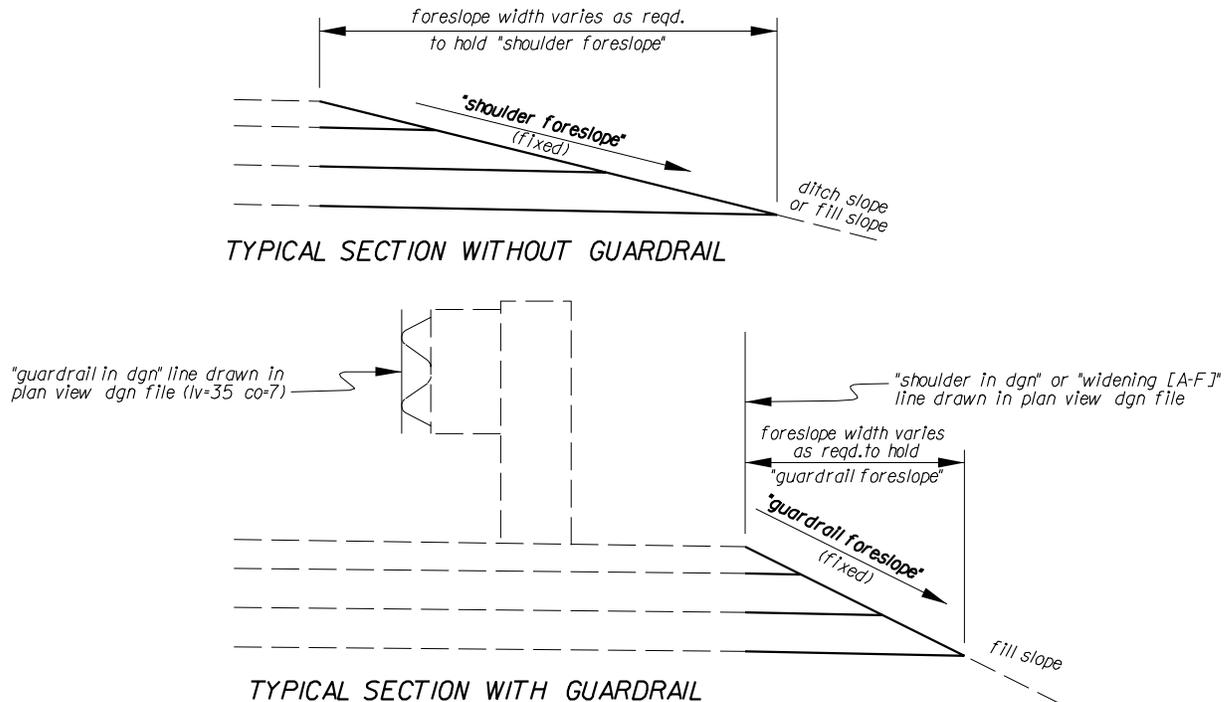
Notes for fh_fs2.x08:

1. The foreslope width and slope can't both be fixed -- one or the other has to vary to accommodate changes in superelevation. This criteria draws a fixed slope foreslope; the foreslope width varies as required to maintain structural section thickness.
2. If the foreslope slope changes (e.g., gets steeper) for guardrail sections, then use fh_fs3.x08 rather than this criteria file.
3. The "first full length layer" variable determines whether all the base course and pavement layers are carried out to daylight on the foreslope.
4. By default, no slope label is placed for the foreslope. If a slope label is needed, add a *define* "*~place foreslope slope labels*" 1 statement to the input file.
5. Text size for the optional slope label may be set with by adding a *define* "*text size*" nnn (where nnn is the desired text size) statement to the input file. By default the text size is set to 0.30. (The "text size" value applies to the slope labels created by all the criteria files.)

fh_fs3.x08

Draws a fixed slope foreslope including base course and pavement layers.

Foreslope for cross-sections with guardrail will have a different slope than cross-sections without guardrail.



define variables that must be assigned values in the input data file:

"shoulder foreslope" (e.g., -1:4)

"guardrail foreslope" (e.g., -1:2)

define_dgn variables that must be assigned values in the input data file:

"guardrail in dgn"

Variables that must be defined in the exceptions data file:

None

Notes for fh_fs3.x08:

1. The foreslope width and slope can't both be fixed -- one or the other has to vary to accommodate changes in superelevation. This criteria draws a fixed slope foreslope; the foreslope width varies as required to maintain structural section thickness.
2. If the "guardrail in dgn" line is found at the current station in the plan view dgn file, then "guardrail foreslope" is used to draw the foreslope. If "guardrail in dgn" line isn't found, then "shoulder foreslope" is used.

fh_fs3.x08

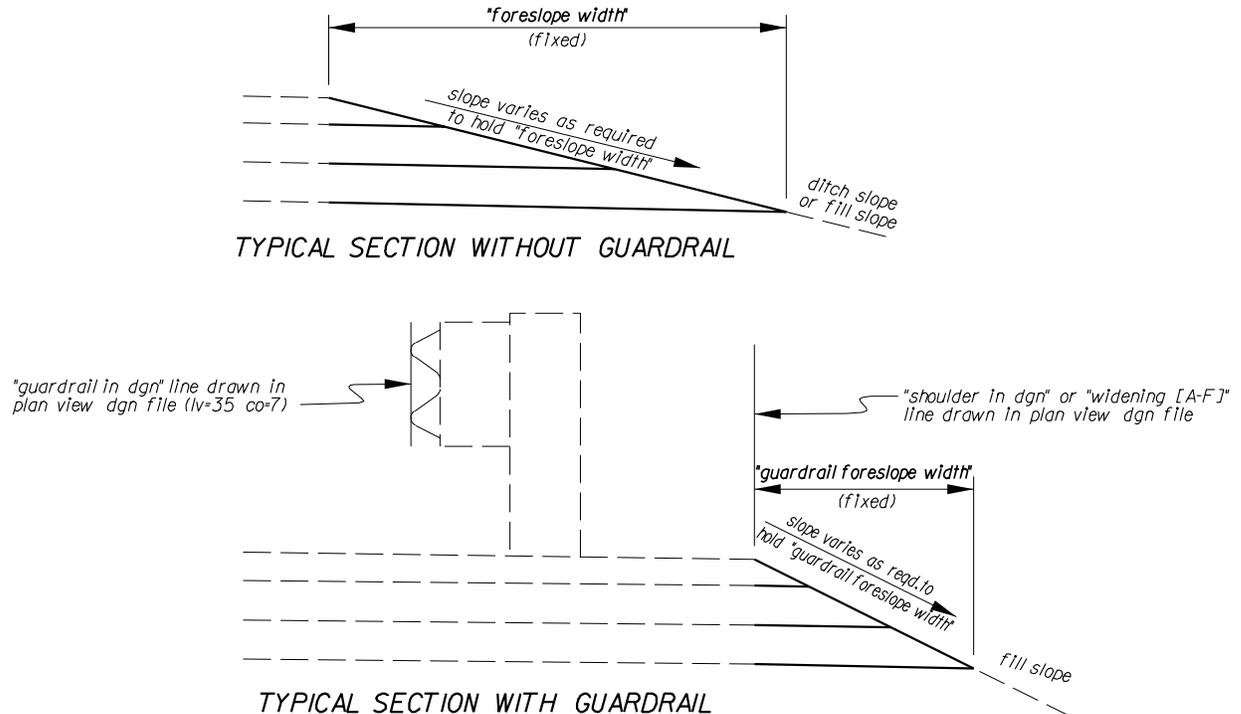
Notes for fh_fs3.x08 (continued):

3. If the foreslope slope doesn't change (e.g., get steeper) for cross-sections with guardrail, then use *fh_fs2.x08* rather than this criteria file.
4. The "first full length layer" variable determines whether all the base course and pavement layers are carried out to daylight on the foreslope.
5. By default, no slope label is placed for the foreslope. If a slope label is needed, add a *define* "*~place foreslope slope labels*" 1 statement to the input file.
6. Text size for the optional slope label may be set with by adding a *define* "*text size*" *nnn* (where *nnn* is the desired text size) statement to the input file. By default the text size is set to 0.30. (The "text size" value applies to the slope labels created by all the criteria files.)

fh_fs5.x08

Draws a fixed width foreslope including base course and pavement layers.

Foreslope width for cross-sections with guardrail will be different from the foreslope width for cross-sections without guardrail.



define variables that must be assigned values in the input data file:

"foreslope width"
"guardrail foreslope width"

define_dgn variables that must be assigned values in the input data file:

"guardrail in dgn"

Variables that must be defined in the exceptions data file:

None

Notes for fh_fs5.x08:

1. The foreslope width and slope can't both be fixed -- one or the other has to vary to accommodate changes in superelevation. This criteria draws a fixed width foreslope; the foreslope slope varies as required to maintain structural section thickness.
2. If the "guardrail in dgn" line is found at the current station in the plan view dgn file, then "guardrail foreslope width" is used to draw the foreslope. If "guardrail in dgn" isn't found, then "foreslope width" is used.

fh_fs5.x08

Notes for fh_fs5.x08 (continued):

3. If the foreslope width doesn't change (e.g., get narrower) for cross-sections with guardrail sections, then use fh_fs1.x08 rather than this criteria.
4. The "first full length layer" variable determines whether all the base course and pavement layers are carried out to daylight on the foreslope.
5. By default, no slope label is placed for the foreslope. If a slope label is needed, add a *define* "*~place foreslope slope labels*" 1 statement to the input file.
6. Text size for the optional slope label may be set with by adding a *define* "*text size*" *nnn* (where *nnn* is the desired text size) statement to the input file. By default the text size is set to 0.30. (The "text size" value applies to the slope labels created by all the criteria files.)

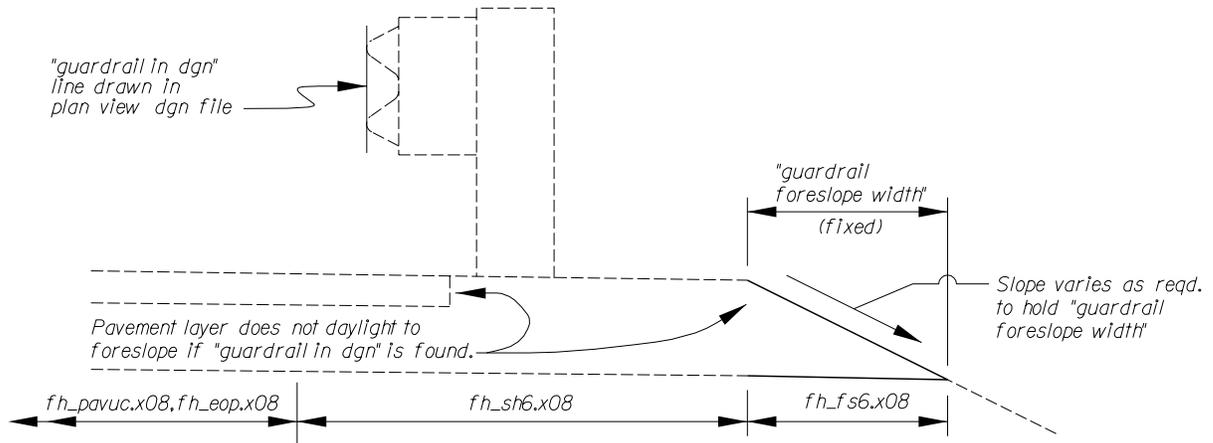
fh_fs6.x08

Draws a fixed width foreslope including base course and pavement layers. Foreslope width for cross-sections with guardrail will be different from the foreslope width for cross-sections without guardrail.

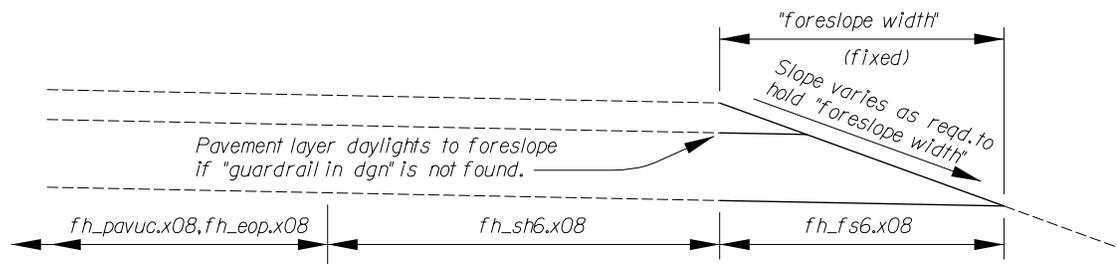
Pavement layer is daylighted to the foreslope for cross-sections without guardrail. Pavement layer is terminated at the guardrail for cross-sections with guardrail.

Must be used in combination with shoulder criteria file fh_sh6.x08.

Foreslope as drawn by fh_fs6.x08 if "guardrail in dgn" line is found:



Foreslope as drawn by fh_fh6.x08 if "guardrail in dgn" line is not found:



define variables that must be assigned values in the input data file:

- "foreslope width"
- "guardrail foreslope width"

define_dgn variables that must be assigned values in the input data file

- "guardrail in dgn"

Variables that must be defined in the exceptions data file:

None

fh_fs6.x08

Notes for fh_fs6.x08:

1. This criteria was written to address the situation where the designer wants to end the pavement layer at the inside face of the guardrail post for guardrail sections, but for non-guardrail sections wants the pavement to daylight to the foreslope. (This is a modified version of fh_fs5.x08)
2. This foreslope criteria must be used in combination with shoulder criteria file fh_sh6.x08. None of the other shoulder criteria files will work correctly with this foreslope criteria.
3. Unlike the all the other foreslope criteria files, this criteria file completely ignores the "first full length layer" variable.
4. The foreslope width and slope can't both be fixed -- one or the other has to vary to accommodate changes in superelevation. This criteria draws a fixed width foreslope; the foreslope slope varies as required to maintain structural section thickness.
5. If the "guardrail in dgn" line is found at the current station in the plan view dgn file, then "guardrail foreslope width" is used to draw the foreslope. If "guardrail in dgn" isn't found, then "foreslope width" is used.
6. By default, no slope label is placed for the foreslope. If a slope label is needed, add a *define* "*~place foreslope slope labels*" 1 statement to the input file.
7. Text size for the optional slope label may be set with by adding a *define* "*text size*" *nnn* (where *nnn* is the desired text size) statement to the input file. By default the text size is set to 0.30. (The "text size" value applies to the slope labels created by all the criteria files.)

FLH Standard Criteria Files

Section 13 –

Cut/Fill Slope Selection Criteria Files

fh_ss3.x08

This criteria file draws the cut/fill slopes from the subgrade shoulder point out to the catch point. Specifically, this criteria can draw the following cases:

- "typical" cut/fill slope selection
- fixed cut or fill slopes for station ranges within a project (optional)
- cut or fill slopes that vary uniformly over station ranges within a project
- different ditch foreslope widths and/or slopes on left and right sides
- ditch foreslope widths and/or slopes that change with station range
- special ditch profiles (optional)
- flat bottom ditches with different widths on left and right sides
- daylight to shoulder cut slopes
- ditch foreslope intercept fill slopes
- forced ditches in areas where ditch foreslope intercepts are not wanted
- cut slope benching (optional)
- compound cut slopes in cross-sections with defined material layers (optional)

define variables that must be assigned values in the input data file:

"cut slope 1" thru "cut slope 9" (e.g., 4 = 1:4 slope up and away from centerline)
"cut height 1" thru "cut height 9"
"fill slope 1" thru "fill slope 9" (e.g., 5 = -1:5 slope down and away from centerline)
"fill height 1" thru "fill height 9"
"ditch foreslope slope lt" (e.g., 4 = -1:4 slope down and away from centerline)
"ditch foreslope dist lt"
"ditch foreslope slope rt" (e.g., 4 = -1:4 slope down and away from centerline)
"ditch foreslope dist rt"
"flat bottom ditch width lt"
"flat bottom ditch width rt"
"flat bottom tolerance"
"daylight slope" (e.g., either -10 or -1:10 yields the same slope)
"daylight width"

define_dgn variables that must be assigned values in the input data file:

"rock"

Variables that must be defined in exceptions data file:

None

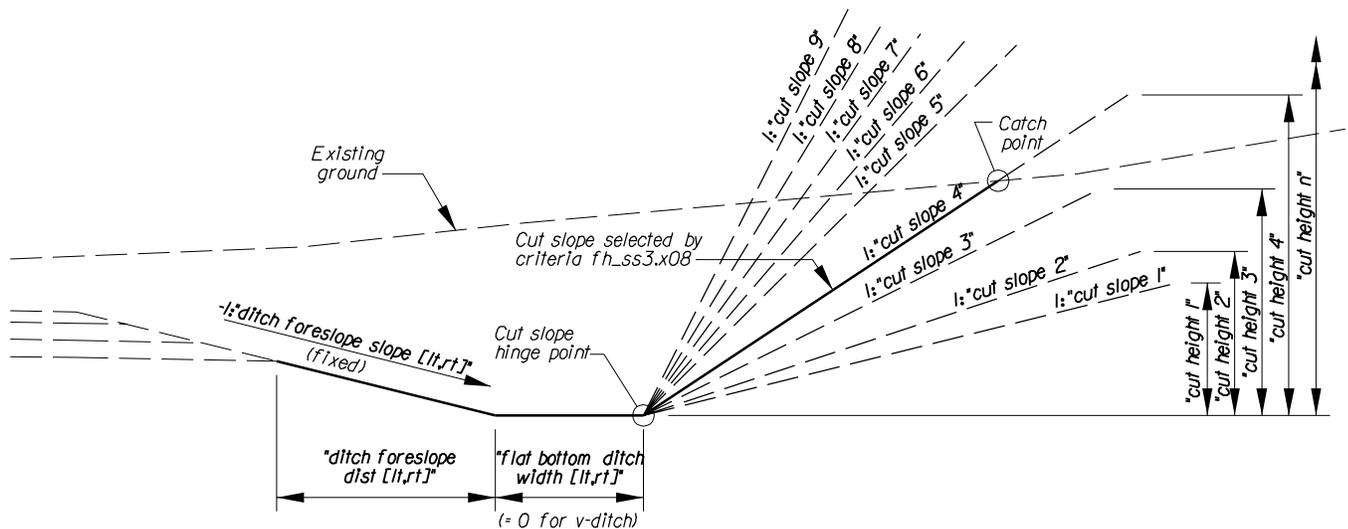
General notes for fh_ss3.x08:

1. All of the variables listed above must be defined in the proposed cross-section input file when fh_ss3.x08 is used. Even if a variable refers to a feature that won't be used, it still must be defined in the input file. In addition to the required variables listed above, there are several optional variables that the user may define in the input file to take advantage of optional features available in fh_ss3.x08 such as benched cut slopes or compound cut slopes. These optional variables are listed in the sections below.
2. All nine "cut slope n"/"cut height n" pairs and all nine "fill slope n"/"fill height n" pairs must be defined in the proposed cross-section input file, even if the user doesn't need to use all of them to

define all the design cut/fill slopes.

3. "cut slope [1-9]" values are the RUN portion of a 1:RUN slope. For example, if "cut slope 1" is assigned a value of 4.00 in the proposed cross-section input file, then the first cut slope checked will be a 1:4 slope up and away from the roadway centerline. The "cut slope [1-9]" values should be defined so that they always go from flatter to steeper slopes.
4. The "cut height [1-9]" values are the maximum vertical height above the ditch hinge point for the corresponding cut slope. If "cut slope n" doesn't catch the existing ground within this height, then "cut slope n+1" is checked, etc., until a cut slope is found that catches within the specified height.
5. The typical slope selection process defined by the "cut slope n"/"cut height n" pairs can be overridden with the `_d_cut_slope_lt` and `_d_cut_slope_rt` in the exceptions data file (for fixed cut slope ratios within a station range) or with the `_d_bench_lt` and `_d_bench_rt` variables in the exceptions data file (for a benched cut within a station range).
6. "fill slope [1-9]" values are the RUN portion of a -1:RUN slope. For example, if "fill slope 1" is assigned a value of 5.00 in the proposed cross-section input file, then the first cut slope checked will be a 1:5 slope down and away from the roadway centerline. (Notice that this is the opposite how the cut slopes are defined, and also the opposite of the normal GEOPAK sign convention for slopes.)

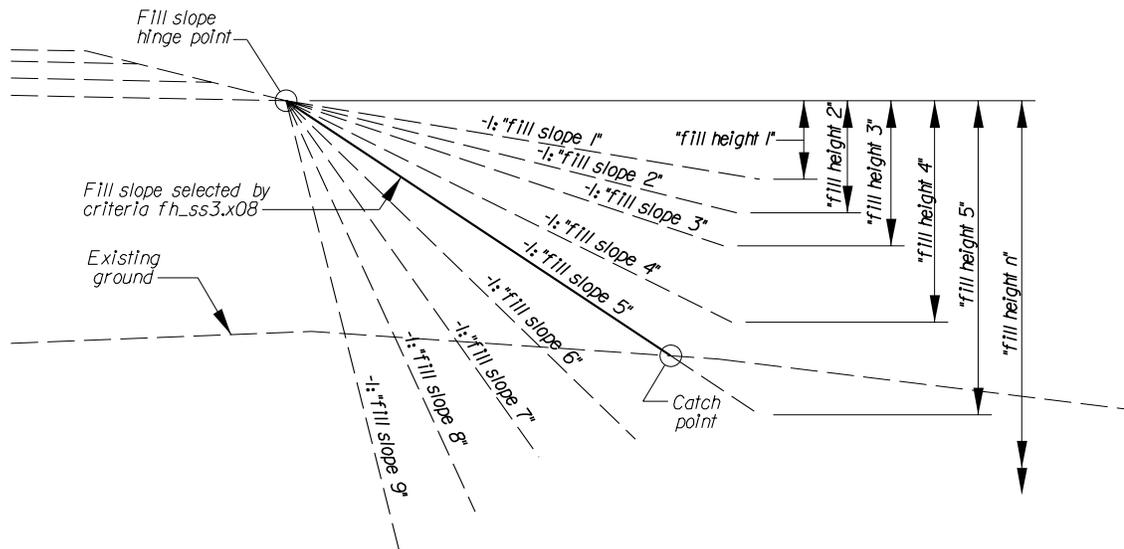
Typical Cut Slope Selection Details for fh_ss3.x08



Notes for typical cut slope selection:

1. There are nine "cut slope n"/"cut height n" pairs, and all nine pairs must be defined in the proposed cross-section input file, even if the user doesn't need to use all of them to define all the design cut slopes.
2. "cut slope [1-9]" values are the RUN portion of a 1:RUN slope. For example, if "cut slope 1" is assigned a value of 4.00 in the proposed cross-section input file, then the first cut slope checked will be a 1:4 slope up and away from the roadway centerline. The "cut slope [1-9]" values should be defined so that they always go from flatter to steeper slopes.
3. The "cut height [1-9]" values are the maximum vertical height above the ditch hinge point for the corresponding cut slope. If "cut slope n" doesn't catch the existing ground within this height, then "cut slope n+1" is checked, etc., until a cut slope is found that catches within the specified height.
4. The typical cut slope selection process defined by the "cut slope n"/"cut height n" pairs can be overridden with the `_d_cut_slope_lt` and `_d_cut_slope_rt` in the exceptions data file (for fixed cut slope ratios within a station range) or with the `_d_bench_lt` and `_d_bench_rt` variables in the exceptions data file (for a benched cut within a station range).

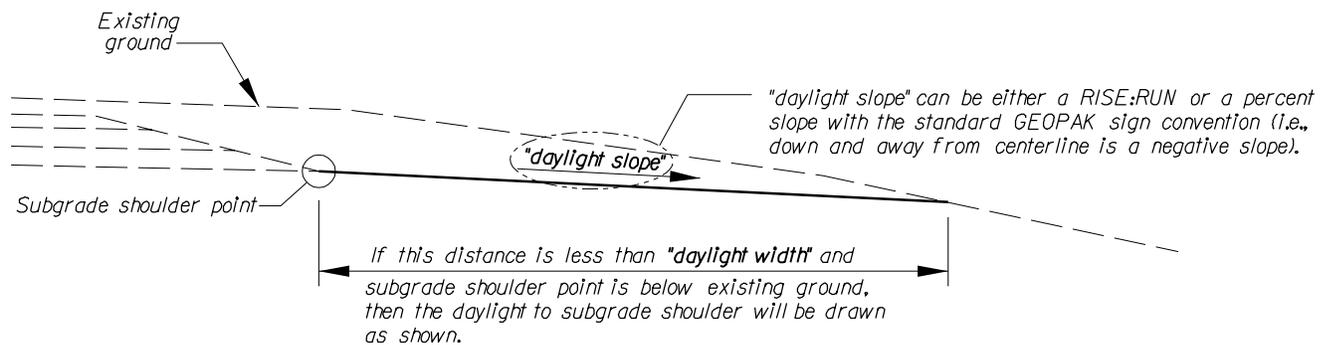
Typical Fill Slope Selection Details for fh_ss3.x08



Notes for typical fill slope selection:

1. There are nine "fill slope n"/"fill height n" pairs, and all nine pairs must be defined in the proposed cross-section input file, even if the user doesn't need all of them to define all the design fill slopes.
2. "fill slope [1-9]" values are a single number corresponding to the RUN portion of a -1:RUN slope. For example, if "fill slope 1" is assigned a value of 4.00 in the proposed cross-section input file, then first fill slope checked will be a -1:4 slope down and away from the roadway centerline. The "fill slope [1-9]" values should be defined so that they always go from flatter to steeper slopes.
3. The "fill height [1-9]" values are the maximum vertical distance below the subgrade shoulder point for the corresponding fill slope. If "fill slope n" doesn't catch the existing ground within this height, then "fill slope n+1" is checked, etc., until a fill slope is found that catches within the specified height.
4. The typical fill slope selection process defined by the "fill slope n"/"fill height n" pairs can be overridden with the `_d_fill_slope_lt` and `_d_fill_slope_rt` in the exceptions data file for fixed fill slope ratios within a station range.

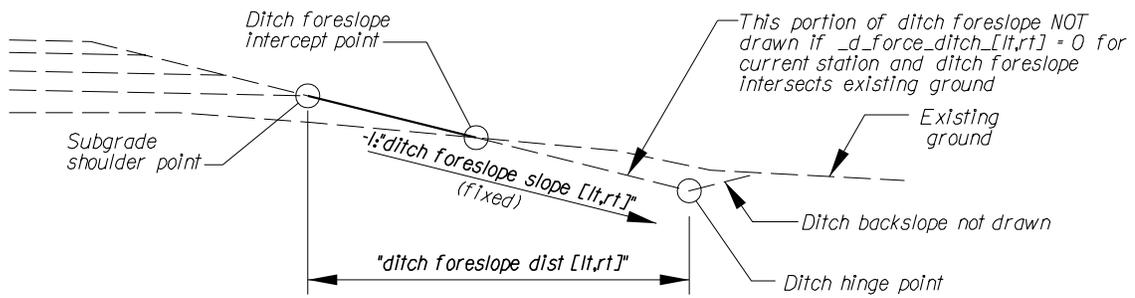
Daylight to Shoulder Details for fh_ss3.x08



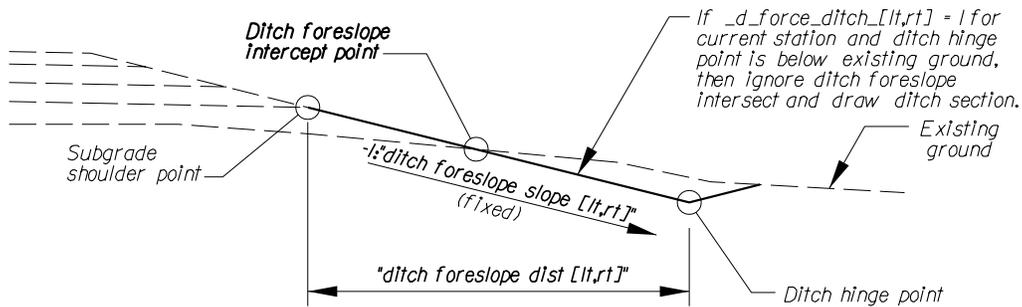
Notes for daylight to shoulder:

1. "daylight slope" can be either a RISE:RUN or a percent slope with the standard GEOPAK sign convention of down and away from centerline is a negative slope.
2. Notice that the user can effectively eliminate all daylights by setting the "daylight width" define variable to a small value (e.g., 0.01).

Ditch Foreslope Intercept Details for fh_ss3.x08



CASE 1 $_d_force_ditch_ [lt,rt] = 0$
(default)



CASE 2 $_d_force_ditch_ [lt,rt] = 1$

Notes for ditch foreslope intercept:

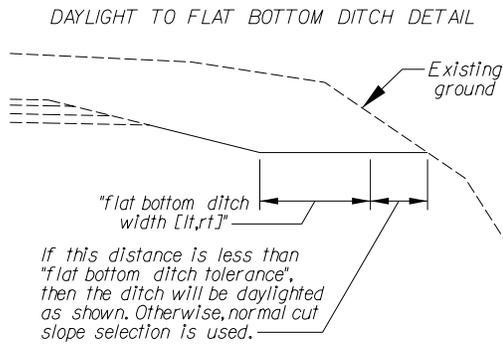
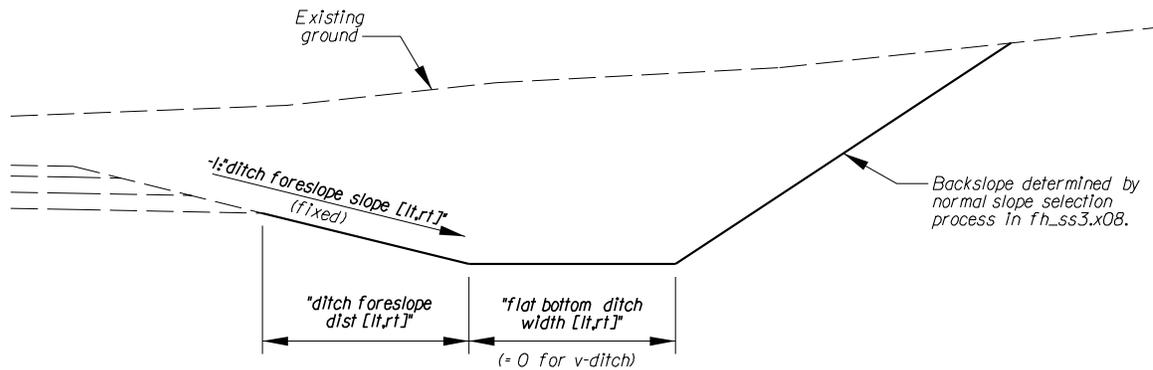
1. The ditch foreslope intercept feature is turned on by default (i.e., Case 1 above). The user may optionally turn this feature off for station ranges by setting $_d_force_ditch_lt$ and/or $_d_force_ditch_rt$ to 1 in the exceptions data file. For example,

```
if sta >= 1+000 r 1 and sta <= 2+000 r 1 then
{
  _d_force_ditch_lt = 1
}
```

in the exceptions data file would turn off the ditch foreslope intercept feature on the left side from Sta. 1+000 thru 2+000.

2. When the ditch foreslope option is turned on (Case 1), it will be drawn only if the following conditions are met:
 - ditch hinge point is below existing ground
 - ditch foreslope intersects existing ground between subgrade shoulder hinge point and ditch hinge point
 - elevation of ditch foreslope intercept point is lower than the elevation of existing ground above the ditch hinge point

Flat Bottom Ditch Details for fh_ss3.x08



Notes for flat bottom ditch:

1. "ditch foreslope lt" and "ditch foreslope rt" are single numbers corresponding to the RUN portion of a -1:RUN slope designation.
2. To use a v-ditch rather than a flat bottom ditch, define "flat bottom ditch width lt" and "flat bottom ditch width rt" to be 0 in the input file.
3. Flat bottom ditch can't be toggled on and off for station ranges. If "flat bottom ditch width lt" or "flat bottom ditch width rt" is defined in the input file as anything other than 0, then flat bottom ditch will be drawn for all cut sections on that side.
4. The bottom of the flat bottom ditch is always drawn horizontally.
5. To avoid getting any daylights to the flat bottom ditch, set "flat bottom ditch tolerance" to a large value (e.g., 100) in the input file.

Fixed Cut/Fill Slope Details for fh_ss3.x08

1. Station ranges for fixed cut or fill slopes are specified in the exception data file. These fixed cut/fill slopes override the normal slope selection process.

2. Four variables are used in the exceptions data file to define fixed slopes:

_d_cut_slope_lt
_d_cut_slope_rt
_d_fill_slope_lt
_d_fill_slope_rt

The values assigned to these variables in the exceptions data file are the RUN portion of a 1:RUN fixed cut slope or a -1:RUN fixed fill slope.

3. If the user specifies a fixed cut or fill slope that doesn't catch at a particular station, then a note to that effect is placed on the cross-section and the criteria reverts back to using the normal slope selection process to find a catch for that cross-section.

4. For example, if the user wanted to use a fixed cut slope of 4:1 on the right side from 5+000 thru 5+100, and a fixed fill slope of 1:1.5 on the left side from 10+000 thru 10+140, then the following lines would appear in the exceptions data file:

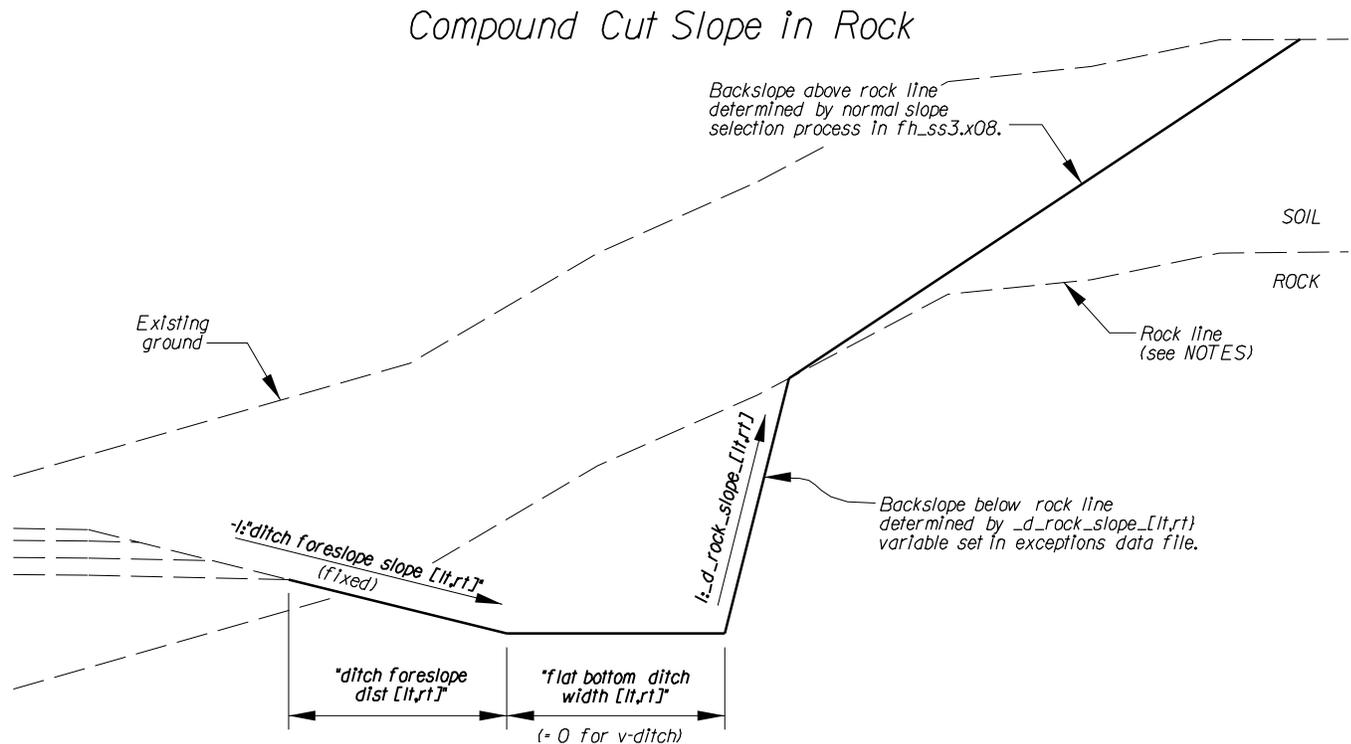
if sta >= 5+000 r 1 and sta < 5+100 r1 then

{
_d_cut_slope_rt = 0.25
}

if sta >= 10+000 r 1 and sta < 10+140 r1 then

{
_d_cut_slope_lt = 1.5
}

Compound Cut Slopes in Rock Details for fh_ss3.x08



All the following variables are optional. If the user doesn't want to use the special compound cut slope in rock feature, then none of these variables need be defined in the proposed cross-section input file or the exceptions data file.

define variables that must be assigned values in the input data file:

None

define_dgn variables that must be assigned values in the input data file:

"rock"

Variables that must be defined in exceptions data file:

_d_rock_slope_lt
_d_rock_slope_rt

Notes for special compound cut slope in rock:

1. The purpose of this option is to draw compound cut slopes in areas where there is a rock layer with soil overburden. The cut slope in rock is set to a user defined fixed value; the cut slope in the overburden is variable using the normal slope selection criteria.
2. The top of the rock layer must be drawn into the cross-section dgn file before the proposed cross-sections run. The rock layer can be drawn manually using MicroStation, or if it's a fixed depth below the existing ground it can be drawn in a separate preprocessing run using criteria file

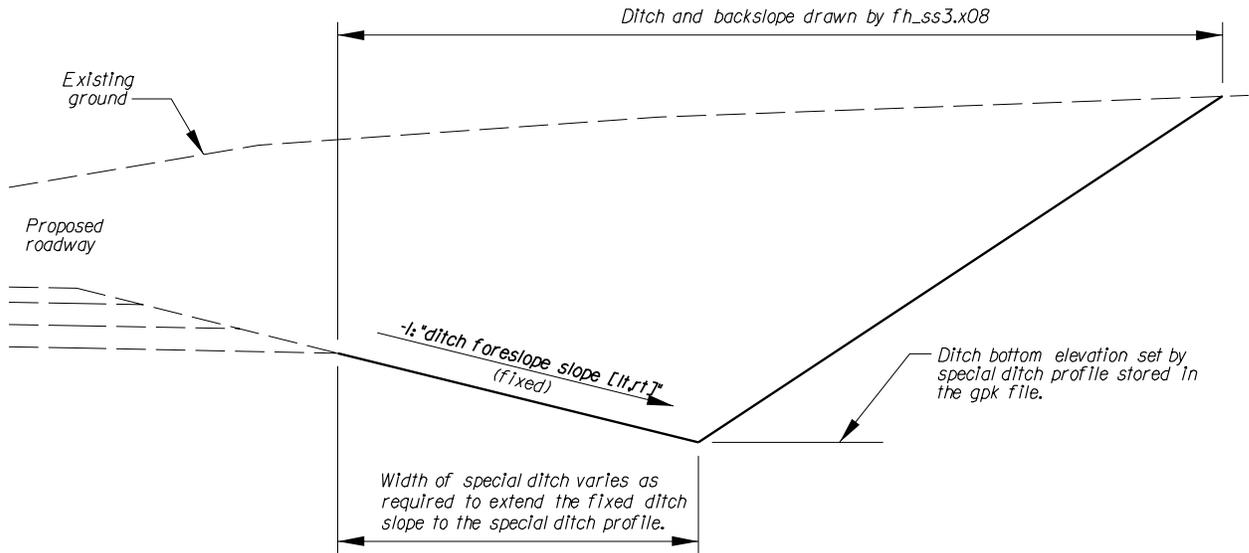
Compound Cut Slopes in Rock Details for fh_ss3.x08

fhex_fea.x08.

3. Station ranges where the special compound rock cut slope is used are set with the variables `_d_rock_slope_lt` and `_d_rock_slope_rt` variables in the exceptions data file.
4. Variables `_d_rock_slope_lt` and `_d_rock_slope_rt` should be defined in the exceptions data file as a single number representing the RUN portion of a 1:RUN slope specification. For example, if the user wants to use a 4:1 rock slope on the left side from station 1+000 thru 2+000 then the following lines would appear in the exceptions data file:

```
if sta >= 1+000 r 1 and sta <= 2+000 r 1 then
{
  _d_rock_slope_lt = 0.25
}
```
5. Notice that just because a rock line is drawn on the cross-section doesn't necessarily mean that compound cut slopes will be used (the station range for those cross-sections must be defined in the exceptions data file also). And conversely, just because a special compound rock cut slope is called for in the exceptions data file doesn't mean it will be drawn on the cross-sections (the rock line must be drawn onto the cross-sections for the station range also).
6. The `define_dgn` variable "rock" refers to the level/symbology of the line(s) drawn in the cross-section `dgn` file representing the top of the rock layer. (Contrast this to the typical use of `define_dgn` variables where they refer to lines drawn in a plan view `dgn` files.)
7. The standard level/symbology for the "rock" in XS `dgn` lines is `lv=57 co=57`.

Special Ditch Profile Details for fh_ss3.x08



The define variables "LT PROF" and "RT PROF" are optional. If the user doesn't want to use the special ditch profile feature, then these variables should not be defined in the proposed cross-section input file.

define variables that must be assigned values in the input data file:

- "LT PROF" (optional)
- "RT PROF" (optional)

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

None

Notes for special ditch profile:

1. The station range and elevation of special ditch(es) drawn with this option are both defined by profile(s) stored into the gpk file from COGO (or the GEOPAK Vertical Alignment Generator).
2. The stationing of the special ditch profile stored in the gpk file must match the roadway stationing, including region number. For example, if the designer wants a special ditch that goes from Sta. 5+000 r 3 thru Sta. 5+500 r 3 on the roadway stationing, then the ditch profile stored into the gpk file must begin at Sta 5+000 r 3 (not "no region" or "r 1" or "r 2") and must end at Sta 5+500 r 3 (same comments).
3. The names of the COGO profiles for the special ditch are referenced in the define "LT PROF" and define "RT PROF" statements in the proposed cross-section input file. For example, if the designer wanted special ditch profiles from elevation 233.00 at Sta. 1+000 to elevation 235.00 at Sta. 1+500 on the left side, from elevation 242.00 at Sta. 2+000 to elevation 244.00 at Sta. 2+300

Special Ditch Profile Details for fh_ss3.x08

also on the left side, and from elevation 234.00 at Sta. 1+200 to elevation 235.00 at Sta. 1+600 on the right side, then the following actions would be required:

- a. Store profiles into the gpk file for each of the three special ditches using the following series of COGO commands:

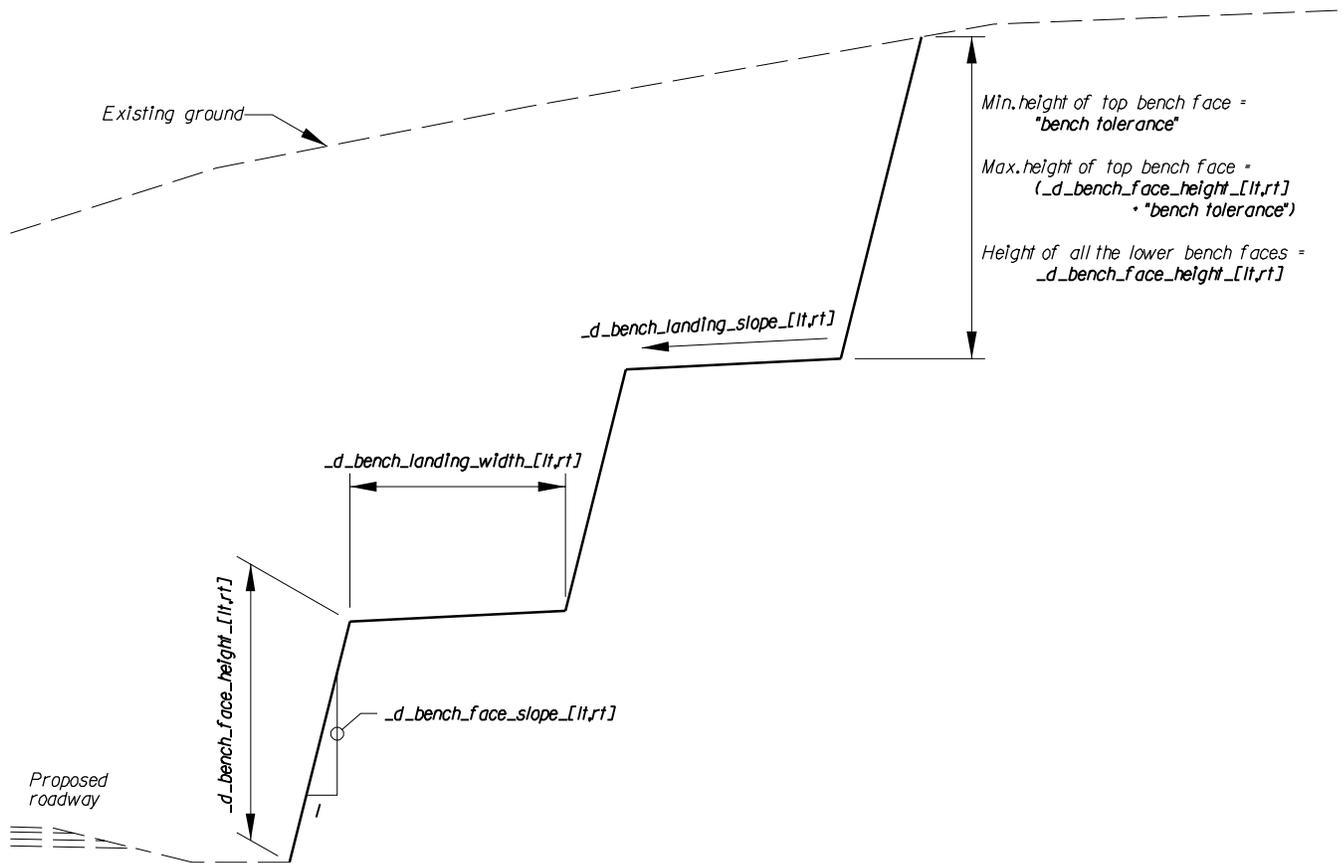
```
S PRO LTDITCH1  
VPI 1 S 1+000 E 233.00  
VPI 2 S 1+500 E 235.00  
END PRO  
STO PRO LTDITCH2  
VPI 1 S 2+000 E 242.00  
VPI 2 S 2+300 E 244.00  
END PRO  
STO PRO RTDITCH  
VPI 1 S 1+200 E 234.00  
VPI 2 S 1+600 E 235.00  
END PRO
```

- b. Include the following lines in the proposed cross-section input file:

```
define "LT PROF" ltditch1, ltditch2  
define "RT PROF" rtditch
```

4. The "ditch foreslope slope lt" and "ditch foreslope slope rt" define variables are the same ones that are used to draw the "typical" ditches.
5. It is possible, although not recommended, to override the "ditch foreslope slope [lt,rt]" variables for station ranges within a project by using the variables `_d_ditch_foreslope_lt` and `_d_ditch_foreslope_rt` in the exceptions data file. (Where `_d_ditch_foreslope_[lt,rt]` is a single number corresponding to the RUN portion of a -1:RUN slope specification.)

Cut Slope Benching Details for fh_ss3.x08



Cut slope benching is optional. If the user doesn't want to use cut slope benching, then these variables should not be defined in the proposed cross-section input file and exceptions data file. On the other hand, if cut slope benching is used, then all these variables must be defined.

define variables that must be assigned values in the input data file:

"bench tolerance"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

- _d_bench_face_height_lt
- _d_bench_face_height_rt
- _d_bench_face_slope_lt
- _d_bench_face_slope_rt
- _d_bench_landing_slope_lt
- _d_bench_landing_slope_rt
- _d_bench_landing_width_lt

Cut Slope Benching Details for fh_ss3.x08

`_d_bench_landing_width_rt`

Notes for cut slope benching:

1. Station ranges for cut slope benching are set in the exceptions data file.
2. The "bench tolerance" variable effects the height of the top bench face only; the face heights of all benches below the top one are set with the `_d_bench_face_height_[lt,rt]` variables. The face height of the top bench is variable and can range between a minimum height of "bench tolerance" and a maximum height of "bench tolerance" + `_d_bench_face_height_[lt,rt]`.
3. The value of the `_d_bench_face_slope_[lt,rt]` variable is the RISE portion of a RISE:1 slope specification. For example, a value of 4 will result in a 4:1 RISE:RUN bench face slope.
4. The `_d_bench_landing_slope_[lt,rt]` variable can be either a RISE:RUN slope specification or a percent slope. For example, either 1:20 or 5 will result in a bench sloping in towards the roadway at a 5% slope.
5. The following is an example of the statements that would appear in the exceptions data file to produce cut slope benching between 1+000 and 1+500 on the left side and between 2+000 and 2+300 on the right side:

```
if sta >= 1+000 r 1 and sta <= 1+500 r 1 then
```

```
{  
  _d_bench_lt = 1  
  _d_bench_face_slope_lt = 4  
  _d_bench_face_height_lt = 3.00  
  _d_bench_landing_slope_lt = 5  
  _d_bench_landing_width_lt = 2.00  
}
```

```
if sta >= 2+000 r 1 and sta <= 2+300 r 1 then
```

```
{  
  _d_bench_rt = 1  
  _d_bench_face_slope_rt = 10  
  _d_bench_face_height_rt = 3.50  
  _d_bench_landing_slope_rt = 5  
  _d_bench_landing_width_rt = 1.50  
}
```

6. Fill slope benching is not currently supported by fh_ss3.x08. Criteria file fh_specdit1.x08 may be used to create fills with a single bench.

FLH Standard Criteria Files

Section 14 –

Special Earthwork Criteria Files

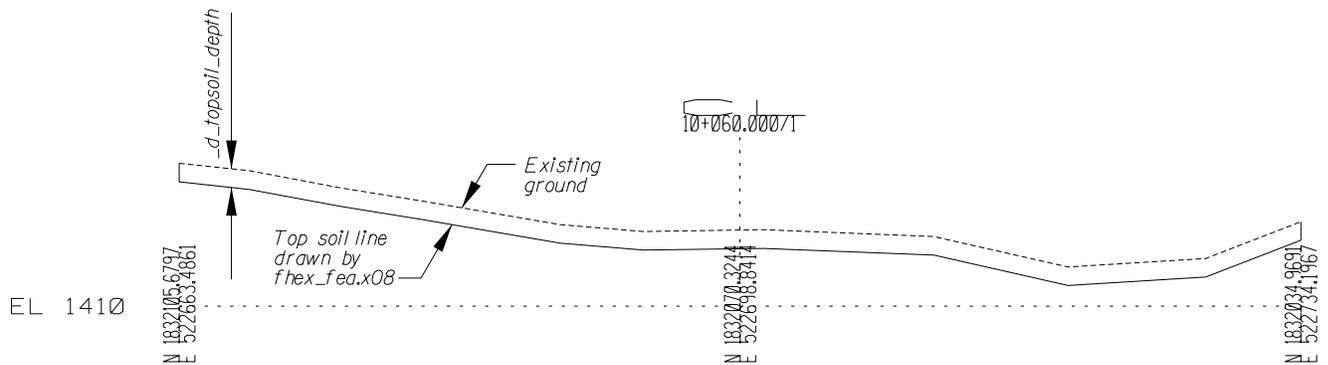
Special Earthwork Criteria Files

Criteria Files	Elements Drawn by Criteria File
fhex_fea.x08	Topsoil, existing pavement, and rock layer limits.
fh_subx2.x08	Subexcavation limits.
fh_x_lim.x08	Excavation limits LT and RT.
c_rkbt1d.x08	Rock buttress plus associated excavation and backfill. Uses lines in plan view dgn file to set station ranges and side of roadway.
c_rkbt1s.x08	Rock buttress plus associated excavation and backfill. Uses exceptions data file to set station ranges and side of roadway.

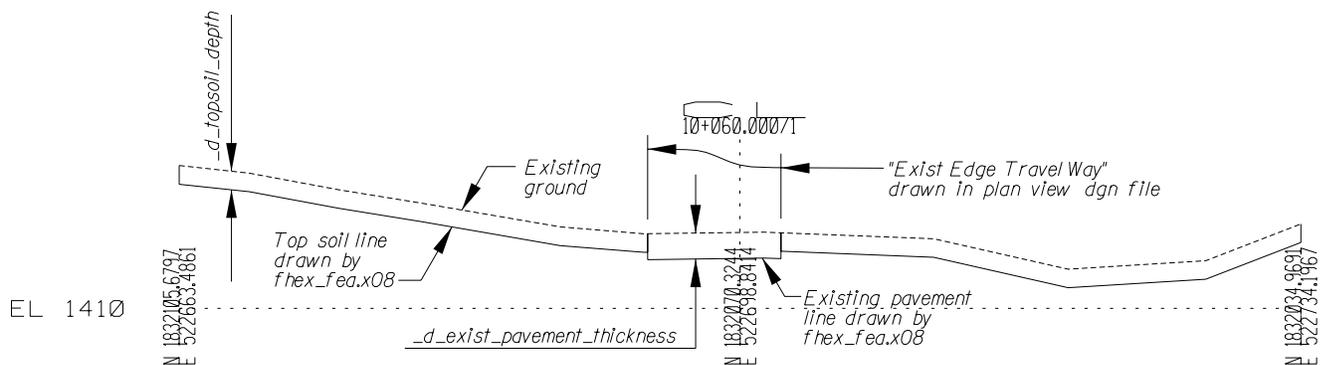
fhex_fea.x08

Draws lines representing the lower limits for topsoil and existing pavement on the proposed cross-sections. These lines are used to by the GEOPAK earthwork procedure to calculate separate quantities for these materials. This criteria file also draws lines representing the upper limit for a rock layer on the proposed cross-sections. These lines are used for two purposes: (1) to allow the slope selection criteria file to draw compound slopes in cross-sections with rock, and (2) to be used the the earthwork procedure to calculate separate quantities for rock excavation.

Example of topsoil only as drawn by fhex_fea.x08



Example of topsoil plus existing pavement as drawn by fhex_fea.x08



define variables that must be assigned values in the input data file:

"maximum existing road width"

define_dgn variables that must be assigned values in the input data file:

"edge existing pavement"

Variables that must be defined in exceptions data file:

_d_exist_pavement_thickness

_d_rock_depth

_d_topsoil_depth

fhex_fea.x08

Notes for fhex_fea.x08:

1. This criteria can be used to draw any combination of these three existing features; you don't have to draw all three. However, even if you're not using it to draw existing pavement you still have to define "maximum existing road width" and "edge existing pavement" in the input file.
2. In the exceptions data file you need to define station ranges only for the variables you are actually using, not for all of them. For example, if you wanted only a 0.15 m topsoil layer drawn, no existing pavement or rock layer, then the exceptions data file would include the following lines:

```
if sta >= 1+000 r 1 and sta <= 2+000 r 1 then
{
  _d_topsoil_depth = 0.15
}
```

No mention of the `_d_exist_pavement_thickness` or `_d_rock_layer` variables would need be included for this example. Also, notice that the information in the exceptions file specifies both the station range(s) and depth(s) for the topsoil, existing pavement, and rock layer, and that this syntax allows for multiple station ranges and depths for these features within a single project.
3. If `fhex_fea.x08` is being used to draw topsoil and/or existing pavement, then it needs to be included only in the side slope `lt` block in the input file; it has no effect if included in the side slope `rt` block. If `fhex_fea.x08` is being used to draw rock layer(s), then it needs to be included in both the side slope `lt` and side slope `rt` blocks in the input file.
4. When `fhex_fea.x08` is used to draw rock layer(s), it must be used in a separate "preprocessing" run to draw these existing features onto the cross-sections prior to running the criteria files to draw the proposed roadway features. This is because the slope selection criteria can't find any elements drawn during the current run, and therefore the compound slope in rock layers feature in the slope selection criteria won't work. When `fhex_fea.x08` is used to draw topsoil and/or existing pavement only, it can be included in the same run as all the other criteria files, or it can be used in a separate preprocessing run.
5. The include sequence for `fhex_fea.x08` should always be somewhere after the slope selection criteria file.
6. In order to get topsoil quantities with the GEOPAK earthwork procedure, use this criteria file (to draw the bottom of the topsoil layer) plus the excavation limit criteria file `fh_x_lim.x08` (to draw the limits left and right of the topsoil removal).
7. An alternate way to draw the topsoil layer (if it is a constant depth for the entire project) is to make a selection set of the existing ground lines in the cross-section file, copy the selection set downward by the topsoil depth, and changing the level/symbology to something different than the existing ground level/symbology.
8. See the Compound Cut Slopes in Rock section of the Slope Selection page to see an example of how a rock layer draw with this criteria is used.
9. When drawing topsoil plus existing road, the criteria will always write an error message similar

to the following into the log file for every cross-section:

Station = 2+000.00, Region = 1

*WARNING: NO INTERSECTION FOUND while attempting
to DRAW TO DEFINE_DGN " EDGE EXISTING PAVEMENT "
from coordinate 159305.5544 558377.2863*

*moving toward coordinate 159347.3170 558354.9270
at line: 247*

This problem has been detected on the LEFT side of cluster with:

baseline = CL,

profile = CL,

tie = 0.000000,

pgl chain = ,

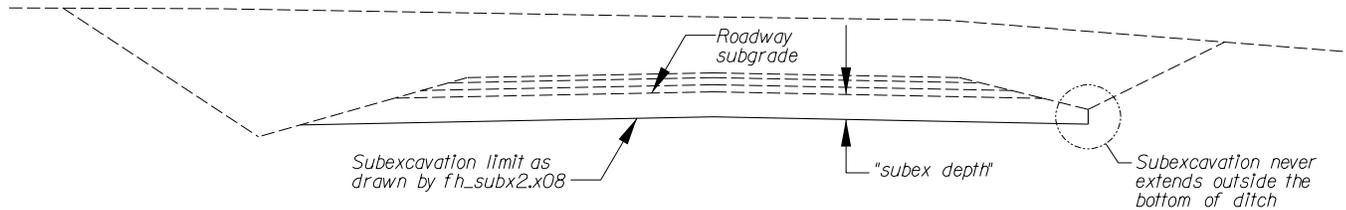
cluster offset = ,

This error message should be ignored; it has no effect on the accuracy of the topsoil and existing road lines drawn by the criteria file.

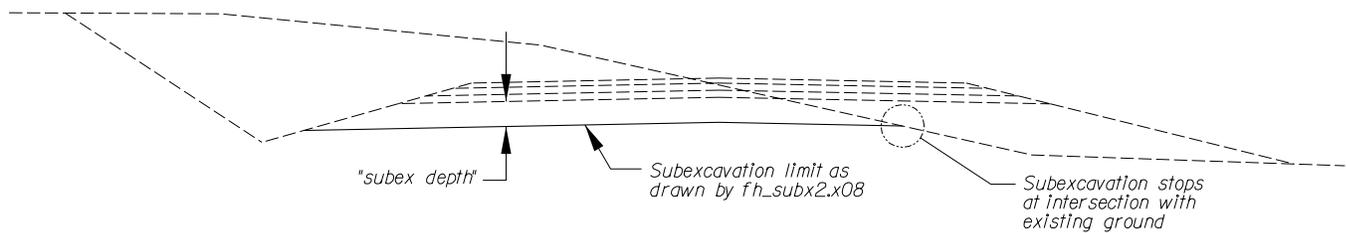
fh_subx2.x08

Draws the bottom of a subexcavation layer.

Example of subexcavation for cut only cross-section.



Example of subexcavation for cut/fill cross-section.



define variables that must be assigned values in the input data file:

"subex depth"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

None

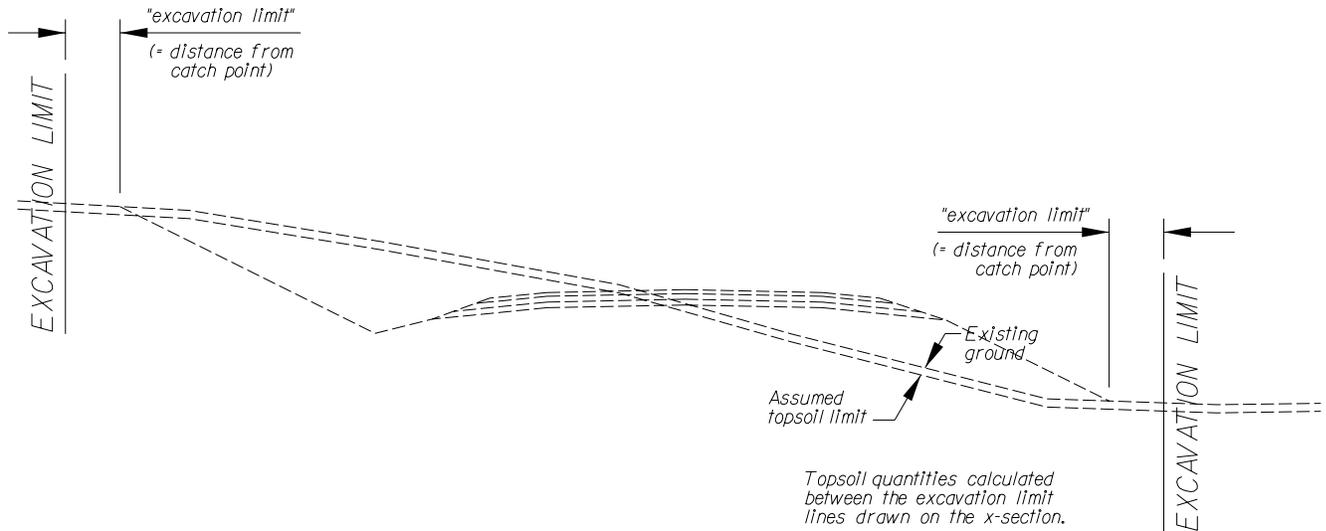
Notes for fh_subx2.x08:

1. Include sequence for fh_subx2.x08 must be somewhere after the slope selection criteria (fh_ss3.x08 or fh_ss_uc.x08).
2. If fh_subx2.x08 is used, it must be included in both the side slope lt and the side slope rt sections in order for it to work correctly.
3. Generally, the subgrade line will mirror the top of pavement slope. However, if the top of pavement has any breaks in slope (such as what's drawn by fh_wide.x08 or fh_sh[1-4].x08), the subexcavation will be drawn parallel to a line from the top of pavement at centerline to the outermost top of pavement point).
4. Currently there is no method built into fh_subx2.x08 to switch subexcavation on and off for station ranges within a project by using the exceptions data file.

5. This criteria is set up to do a maximum of two subexcavation line segments per side (in situations where the existing ground is undulating above and below the theoretical subex line).

fh_x_lim.x08

Draws and labels a vertical line on the cross-section representing the excavation limits. This line may be required to get some earthwork quantities such as topsoil or subexcavation.



define variables that must be assigned values in the input data file:

"excavation limit"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

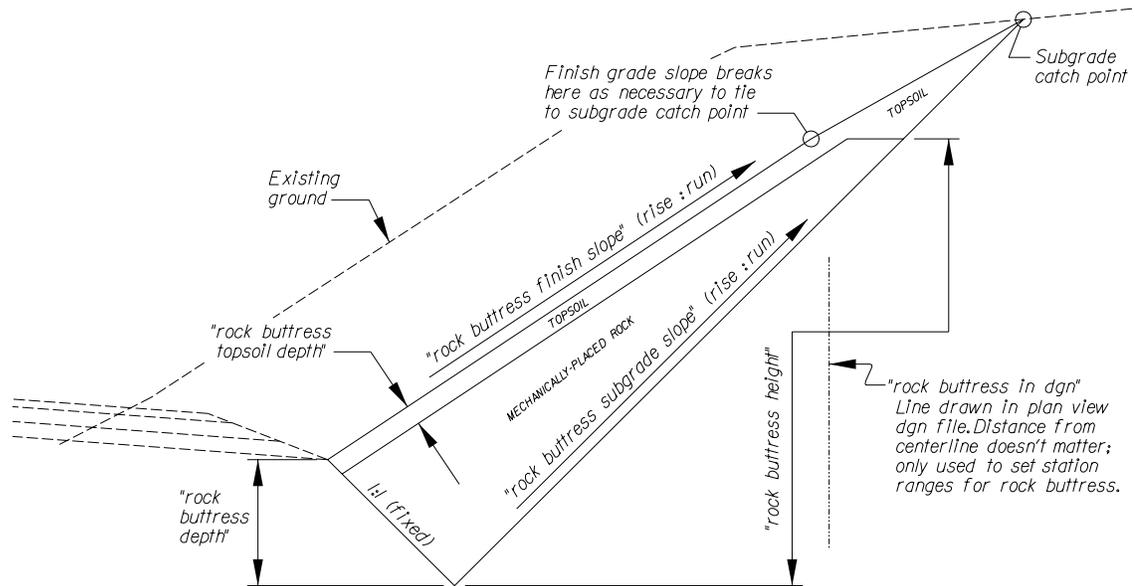
None

Notes for fh_x_lim.x08:

1. Excavation limits are only required if quantities for topsoil and/or subexcavation are going to be calculated from the cross-sections.
2. The value of the define variable "excavation limit" is the distance from the cut/fill catch point to where the line is drawn. In almost all cases "excavation limit" should be set to 0 in the input file (i.e., excavation limits coincide with the cut/fill catch point).
3. The only thing this criteria does is draw a vertical line on lv=9 and co=22, and labels it.

c_rkbt1d.x08

Draws a rock buttress plus associated special excavation and backfill. Station ranges and side of the roadway are set using line(s) drawn in a plan view dgn file.
(Contrast this with *c_rkbt1s.x08*, where the station ranges and side of the roadway for the rock buttress are set in the exceptions data file.)



define variables that must be assigned values in the input data file:

- "rock buttress finish slope" (rise:run, e.g., 1:1.5)
- "rock buttress subgrade slope" (rise:run value, e.g., 1:1.5)
- "rock buttress depth"
- "rock buttress height"
- "rock buttress topsoil depth"

define_dgn variables that must be assigned values in the input data file:

- "rock buttress in dgn"

Variables that must be defined in exceptions data file:

none

Notes for c_rkbt1d.x08:

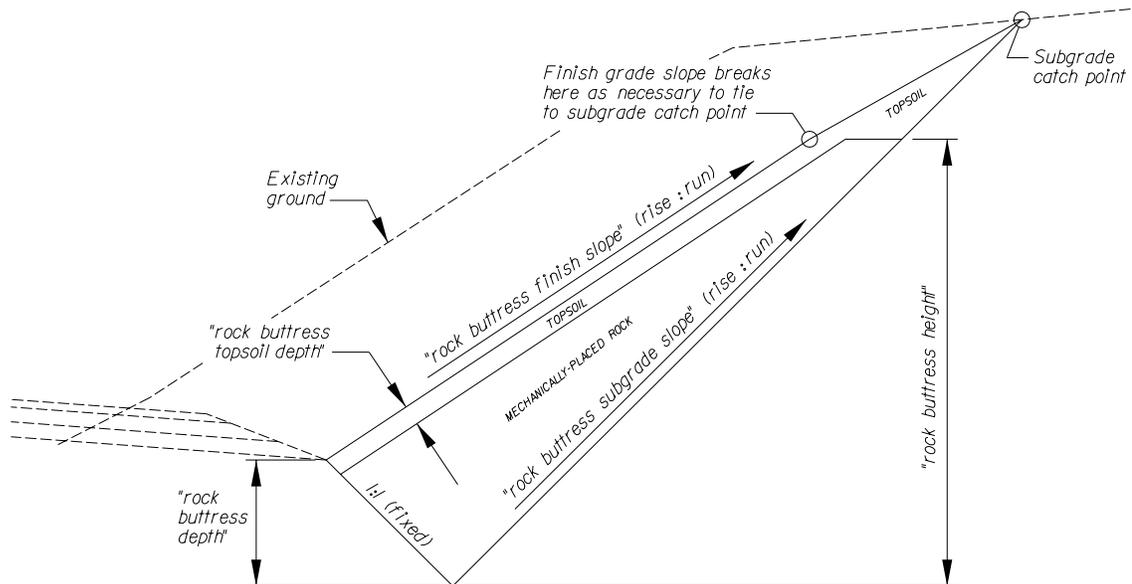
1. Both station ranges and side of roadway for the rock buttress are set using lines drawn in plan view dgn file (define_dgn variable "rock buttress in dgn"). The distance the line is drawn from centerline is irrelevant -- the in dgn line is only used to toggle on drawing the rock buttress.
2. A hidden define variable ("~line in dgn search dist") is used to limit the search distance from centerline for the "rock buttress in dgn" line. By default the search distance is set to 25.

c_rkbt1d.x08

3. The method of setting the station ranges for the rock buttress is the only difference between this criteria file and c_rkbt1s.x08.
4. If the roadway subgrade shoulder is below existing ground but the ground configuration won't allow a full height rock buttress, then a modified version of the buttress (see Misc. Details section below) will be drawn.
5. If the roadway subgrade shoulder is above existing ground, then nothing further will be drawn by this or any subsequent criteria (other than an error message).
6. Both "rock buttress finish slope" and "rock buttress subgrade slope" should be defined as RISE:RUN values using the standard GEOPAK slope sign convention. Therefore these variables should be assigned values like 1:1.5 (not -1:1.5 -- the slopes are up and away from centerline).
7. The level/symbology used by this criteria to draw the rock buttress (together with some "doubled" lines) will allow the user to get both slope stake books and special earthwork quantities for the buttress. However, in order to accomplish this a few minor changes must be made to the "standard" setups as follows:
In the earthwork input file:
 - For the Existing Ground Line classification set the fill multiplication factor to 0.000001. (Set the excavation multiplication factors to 0.90 or whatever Materials has recommended.)
 - Add a Proposed Undercut with soil type BUTTRESS_ROCK and lv=47 co=47. Set all the excavation and fill multiplication factors to 0.000001.
 - Add a Proposed Undercut with soil type BUTTRESS_TOPSOIL and lv=48 co=48. Set all the excavation and fill multiplication factors to 0.000001.
 - Add a Proposed Undercut with the exact same soil type as was associated with Existing Ground. (Typically this would be soil type ROADWAY_EXC.) Set all the excavation and fill multiplication factors to 0.000001.In the slope stake report dialog:
 - Do not include lv=47,48,49 co=47,48,49 in the Proposed Finish Grade level/symbology.
8. The initial cut slope from the roadway shoulder down to the invert of the underdrain at the bottom of the buttress is a fixed 1:1 slope -- the user cannot adjust this.
9. This criteria is a slightly modified version of the rock buttress criteria originally written for the Sequoia National Park project.

c_rkbt1s.x08

Draws a rock buttress plus associated special excavation and backfill. Station ranges and side of the roadway where the rock buttress is drawn are set in the exceptions data file.
(Contrast this with c_rkbt1d.x08, where the station ranges and side of the roadway for the rock buttress are set using lines drawn in a plan view dgn file.)



define variables that must be assigned values in the input data file:

"rock buttress finish slope" (rise:run, e.g., 1:1.5)
"rock buttress subgrade slope" (rise:run value, e.g., 1:1.5)
"rock buttress depth"
"rock buttress height"
"rock buttress topsoil depth"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

_d_draw_rock_buttress_lt
_d_draw_rock_buttress_rt

Notes for c_rkbt1s.x08:

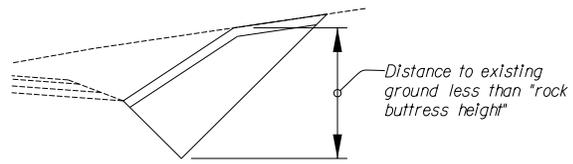
1. Both station ranges and side of roadway for the rock buttress are set by assigning the _d_draw_rock_buttress_[lt,rt] variables a value of 1 in the exceptions data file using the following syntax:

```
if sta >= 1+000 r 1 and sta <= 2+000 r 1 then
{
  _d_draw_rock_buttress_lt = 1
}
```

c_rkbt1s.x08

2. The method of setting the station ranges for the rock buttress is the only difference between this criteria file and c_rkbt1d.x08.
3. If the roadway subgrade shoulder is below existing ground but the ground configuration won't allow a full height rock buttress, then a modified version of the buttress (see Misc. Details section below) will be drawn.
4. If the roadway subgrade shoulder is above existing ground, then nothing further will be drawn by this or any subsequent criteria (other than an error message).
5. Both "rock buttress finish slope" and "rock buttress subgrade slope" should be defined as RISE:RUN values using the standard GEOPAK slope sign convention. Therefore these variables should be assigned values like 1:1.5 (not -1:1.5 -- the slopes are up and away from centerline).
6. The level/symbology used by this criteria to draw the rock buttress (together with some "doubled" lines) will allow the user to get both slope stake books and special earthwork quantities for the buttress. However, in order to accomplish this a few minor changes must be made to the "standard" setups as follows:
In the earthwork input file:
 - For the Existing Ground Line classification set the fill multiplication factor to 0.000001. (Set the excavation multiplication factors to 0.90 or whatever Materials has recommended.)
 - Add a Proposed Undercut with soil type BUTTRESS_ROCK and lv=47 co=47. Set all the excavation and fill multiplication factors to 0.000001.
 - Add a Proposed Undercut with soil type BUTTRESS_TOPSOIL and lv=48 co=48. Set all the excavation and fill multiplication factors to 0.000001.
 - Add a Proposed Undercut with the exact same soil type as was associated with Existing Ground. (Typically this would be soil type ROADWAY_EXC.) Set all the excavation and fill multiplication factors to 0.000001.In the slope stake report dialog:
 - Do not include lv=47,48,49 co=47,48,49 in the Proposed Finish Grade level/symbology.
7. The initial cut slope from the roadway shoulder down to the invert of the underdrain at the bottom of the buttress is a fixed 1:1 slope -- the user cannot adjust this.
8. This criteria is a slightly modified version of the rock buttress criteria originally written for the Sequoia National Park project.

Special Earthwork Criteria Files
Rock Buttress Details



ROCK BUTTRESS SPECIAL CASE
(Used where existing ground
doesn't allow full buttress height)

FLH Standard Criteria Files

Section 15 –

Cross-Section Annotation Criteria Files

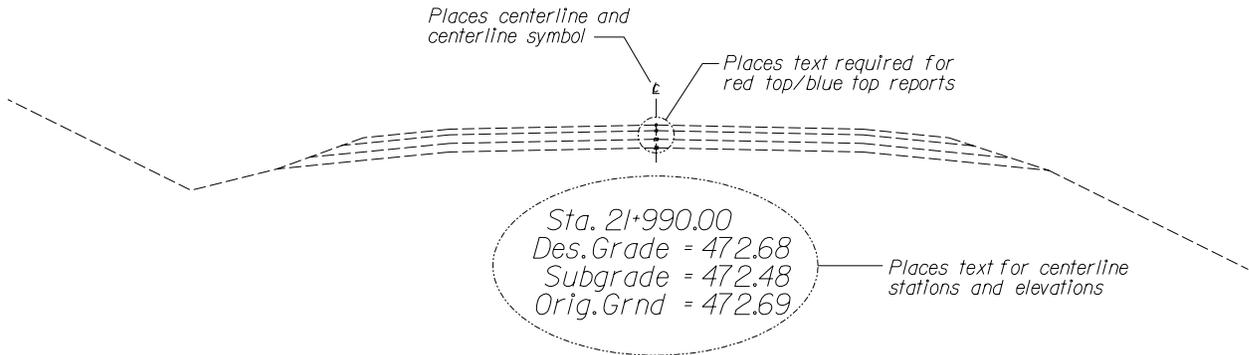
Cross-Section Annotation Criteria Files

Criteria File	Annotation Placed by Criteria File
fh_cl.x08	Places miscellaneous notes on the proposed cross-section.
fh_gr.x08	Places guardrail cells on the proposed cross-sections.
fh_x_lim.x08	Places excavation limit lines on the proposed cross-sections.
addtext.x08	Marks additional red/blue top points for unusually wide cross-sections.
fh_mark.x08	Places a witness line and label showing the location of line(s) drawn in a plan view dgn file.

fh_cl.x08

Draws the following features on the proposed cross-sections:

- note below the cross-section specifying station, design grade elevation, subgrade elevation, and original ground elevation
- centerline and centerline symbol
- text at centerline required for red/blue top reports



define variables that must be assigned values in the input data file:

None

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

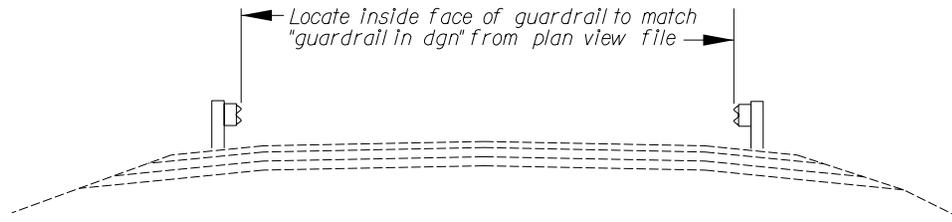
None

Notes for fh_cl.x08:

1. This criteria file is optional, however in most cases it will need to be included because it places text that the red/blue top reports look for.
2. This criteria file should be included only once in the proposed cross-section input file -- either for side slope lt or side slope rt, but not both. If it is included for both sides, it writes double text which will cause problems with the red/blue top reports.
3. A modified version of this criteria called c_cl.x08 allows the user to control the size of the text below the cross-section using a define variable "cl annotation text size" in the input file. This is a useful feature because often when the cross-sections are placed on sheets using the XS Layout procedure, the annotation text is too small to be readable, and it can't be easily resized using tools such as scltxt.ma due to the way the text strings are constructed and located by fh_cl.x08.

fh_gr.x08

Places guardrail cells at the appropriate locations on the cross-sections.



define variables that must be assigned values in the input data file:

```
"gr_left"  
"gr_right"
```

define_dgn variables that must be assigned values in the input data file:

```
"guardrail in dgn"
```

Variables that must be defined in exceptions data file:

```
None
```

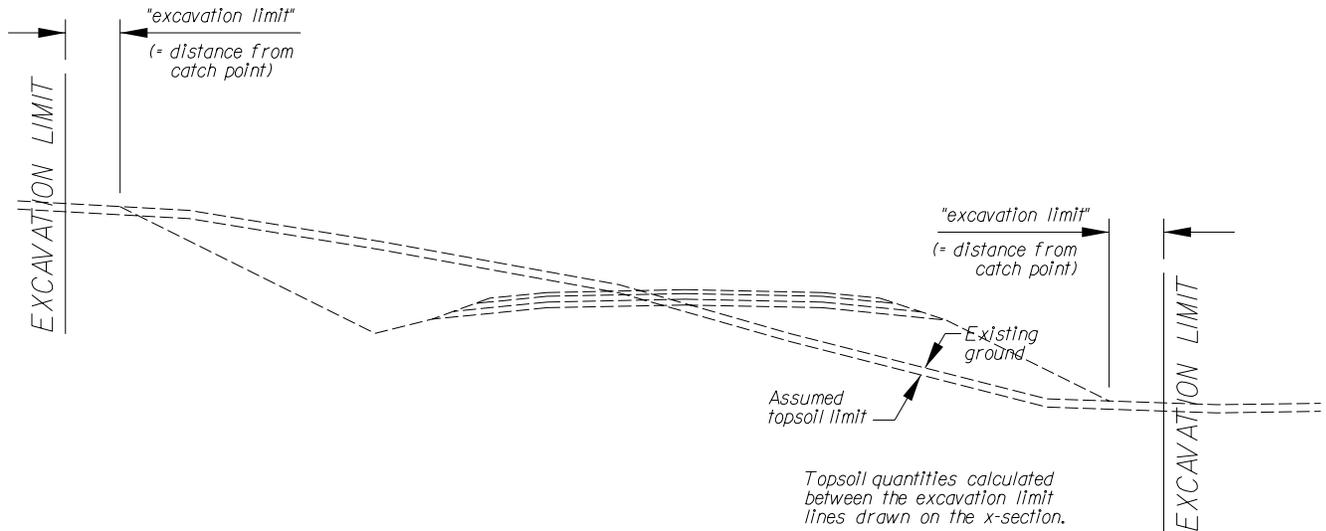
Notes for fh_gr.x08:

1. The syntax for the define "gr_left" and "gr_right" statements in the input file is:

```
define "gr_left" set plot param lv=35 draw cell=g4w_lt xs=1.0 ys=1.0  
define "gr_right" set plot param lv=35 draw cell=g4w_rt xs=1.0 ys=1.0
```
2. Guardrail is placed on the cross-sections as a cell rather than drawing the guardrail as individual elements. Therefore, a cell library with the guardrail cells must be attached to the dgn file before running the criteria files. Cell library geo.cel has cells for W beam guardrail (g4w_lt and g4w_rt).
3. Guardrail cells are placed wherever "guardrail in dgn" is found in the plan view dgn file. The face of the guardrail matches the offset of "guardrail in dgn".
4. The name and scale of the guardrail cells is set with the "gr_left" and "gr_right" define variables in the proposed cross-section input file. The standard guardrail cells g4w_lt and g4w_rt were created assuming MU:SU:PU's in the cross-section file are 1:1000:10. If the MU:SU:PU's in your cross-section file are 1:1000:10, then in the define "gr_lt" and define "gr_rt" statements set xs=1.0 and ys=1.0. If the MU:SU:PU's in your cross-section file are 1:1000:1, then in the define "gr_lt" and define "gr_rt" statements set xs=0.1 and ys=0.1.

fh_x_lim.x08

Draws and labels a vertical line on the cross-section representing the excavation limits. This line may be required to get some earthwork quantities such as topsoil or subexcavation.



define variables that must be assigned values in the input data file:

"excavation limit"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

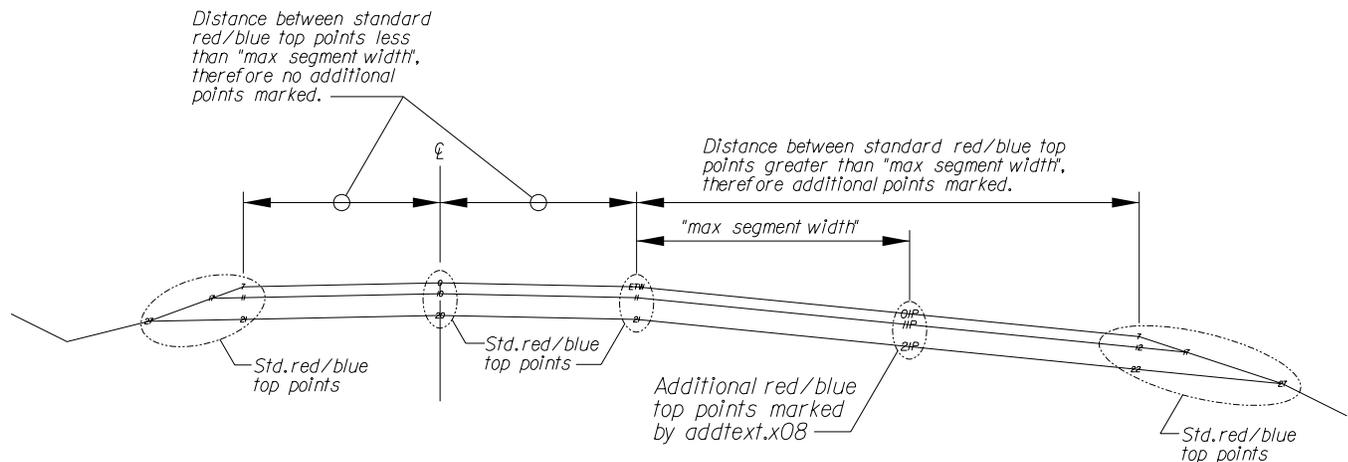
None

Notes for fh_x_lim.x08:

1. Excavation limits are only required if quantities for topsoil and/or subexcavation are going to be calculated from the cross-sections.
2. The value of the define variable "excavation limit" is the distance from the cut/fill catch point to where the line is drawn. In almost all cases "excavation limit" should be set to 0 in the input file (i.e., excavation limits coincide with the cut/fill catch point).
3. The only thing this criteria does is draw a vertical line on lv=9 and co=22, and labels it.

addtext.x08

Marks additional red/blue top points for unusually wide cross-sections.



define variables that must be assigned values in the input data file:

"max segment width"

define_dgn variables that must be assigned values in the input data file:

None

Variables that must be defined in exceptions data file:

None

Notes for addtext.x08:

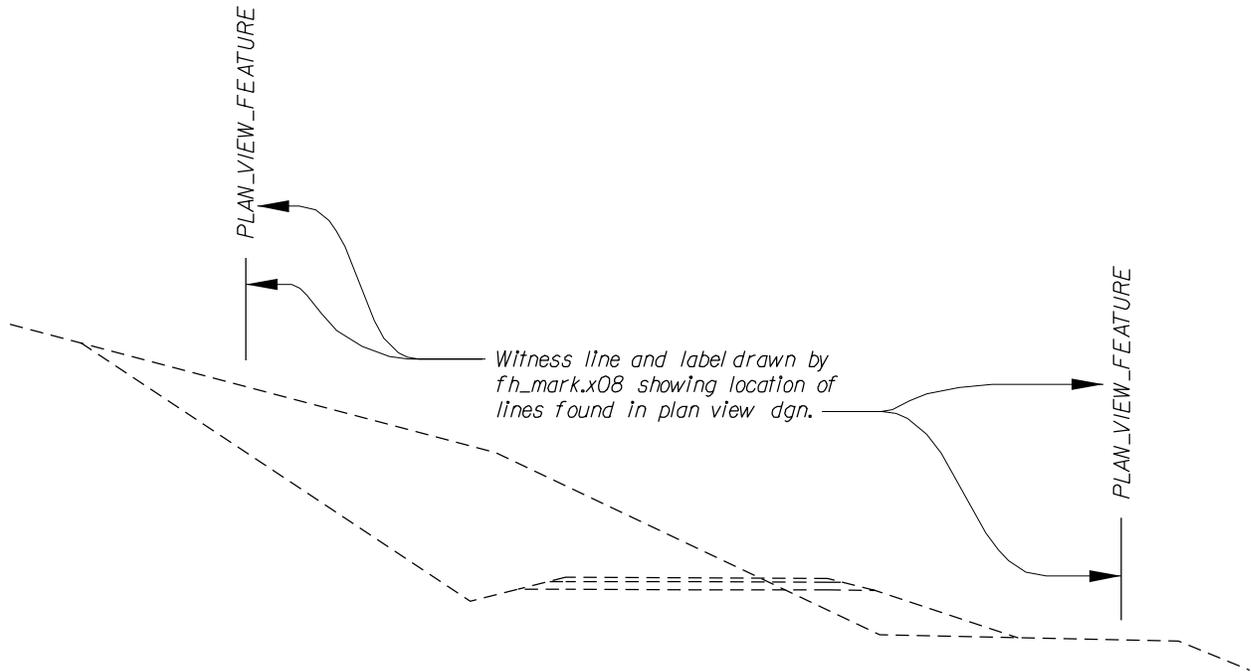
1. The standard criteria files are set up to automatically mark red/blue top points with text elements as the proposed cross-section is drawn. For most cases these marked points will be all that's needed to produce adequate red/blue top notes. However, for situations where the default location of red/blue top points is farther apart than is desired (e.g., an unusually wide pullout) this criteria can be used to mark intermediate points.
2. This criteria must be run in a separate "post-processing" run after the proposed cross-sections have been drawn. Use a copy of the standard input file I:\criteria\addtext.inp for the post-processing run to mark the added red/blue top points. The only changes that need to be made to this input file are to define a value for "max segment width" and to specify the dgn file where the proposed cross-sections are drawn.
3. The "max segment width" variable in the input file controls the maximum distance between red/blue top points. Additional points are marked only when the distance between the standard red/blue top points exceeds this value.
4. Additional points are labeled 11P, 12P, 13P, etc., for the bottom of layer #1; 21P, 22P, 23P, etc., for the bottom of layer #2; and so on for however many layers there are in the pavement structural section.

addtext.x08

5. If additional marked points are required at the top of the pavement layer, then in the input file define the "mark points at top of pavement" as 1. By default no additional points are drawn at the top of the pavement.

fh_mark.x08

Places witness lines and labels showing the location of line(s) drawn in a plan view dgn file.



define variables that must be assigned values in the input data file:

- "planimetric feature label"
- "plan feature text parms" (Optional. Default is th=0.35 tw=0.35 ang=90 just=lc ft=23)
- "plan feature witness line length" (Optional. Default is 5.00)
- "plan feature witness line offset" (Optional. Default is 0.50)

define_dgn variables that must be assigned values in the input data file:

- "planimetric feature in dgn"

Variables that must be defined in exceptions data file:

none

Notes for fh_mark.x08:

1. Finds line(s) drawn in a plan view dgn file and marks the location of those lines on the x-sections with a labeled vertical witness line. Typically this criteria would be used to mark on the x-sections the location of features such as fences, right of way lines, edges of streams, utility, etc., relative to the proposed roadway.
2. Level/symbology for the line(s) draw in plan view dgn is set in the the input file with the define_dgn variable "planimetric feature in dgn".
3. Will find and mark any number occurrences of the "in dgn" line.

fh_mark.x08

4. Include this criteria for both side slope lt and side slope rt if you want it to find "in dgn" lines on both sides of the road.
5. The label for the vertical witness line in the x-section file is user definable with the "planimetric feature label" in the input file. For example, define "planimetric feature label" ROW_LINE. Notice that no spaces are allowed in the label. (By default the label is set to PLAN_VIEW_FEATURE.)
6. The level/symbology of the witness line is fixed as lv=31 co=0 wt=1 lc=0.
7. The witness line is placed relative to the existing ground line using the "plan feature witness line length" and "plan feature witness line offset" parameters.
8. This criteria must be after the slope selection criteria (fh_ss3.x08) in the include sequence.