

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.

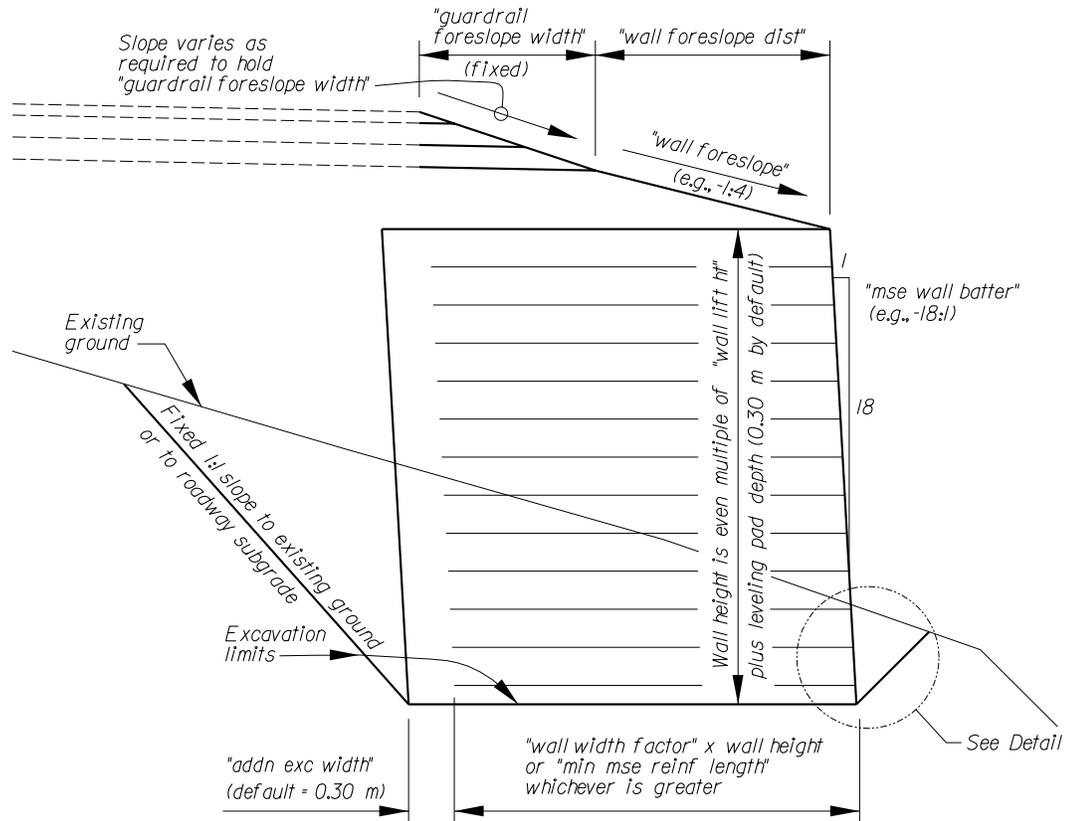
Mechanically Stabilized Earth Wall Criteria Files

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

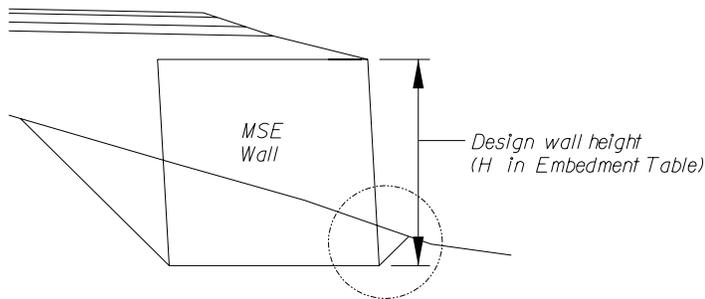
the wall x-sections drawn by this criteria and run them through the earthwork procedure to get structure excavation, select wall backfill, etc., because it won't happen. Although it's theoretically possible to draw all these lines with a criteria file, actually writing a criteria file that does this 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

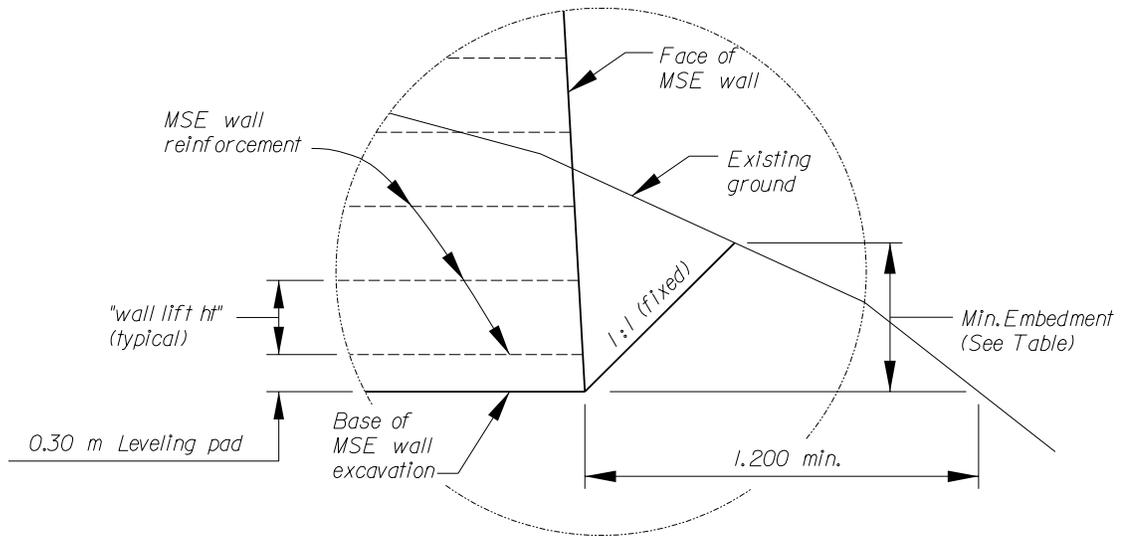
Toe Embedment Details for fh_wall4.x08

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

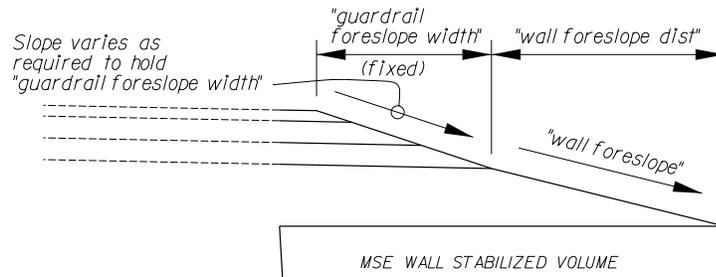
Toe embedment details.



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.

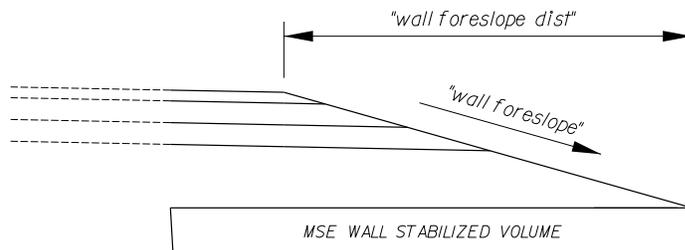


Optional foreslope configuration. The foreslope from the pavement shoulder to the top of the MSE wall is a continuous slope as shown below.

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

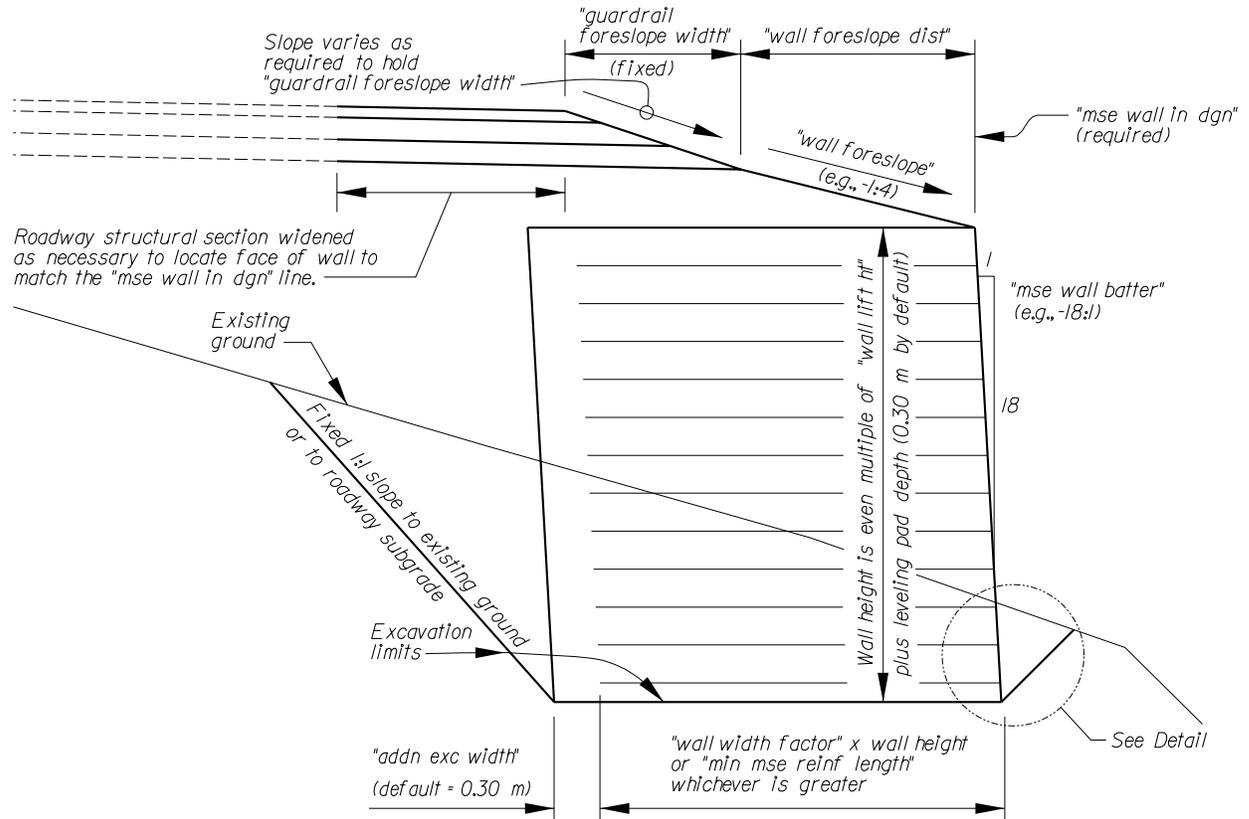
```
define "~continuous wall foreslope" 1
```

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:

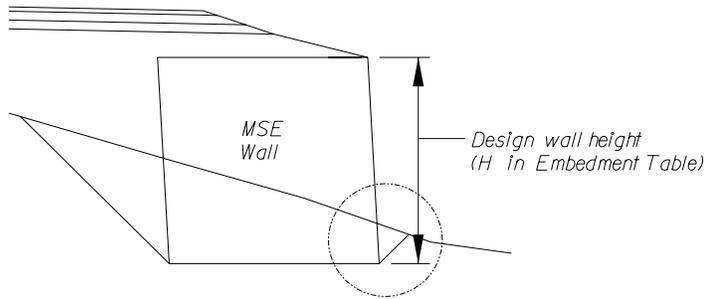
1. Details match revised standard metric detail M255-02 dated 12/00.
2. Both station ranges for the MSE wall and offsets from the roadway shoulder to the face of the MSE wall are set with lines drawn in a plan view dgn file.
3. This criteria will automatically widen the roadway structural section as 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

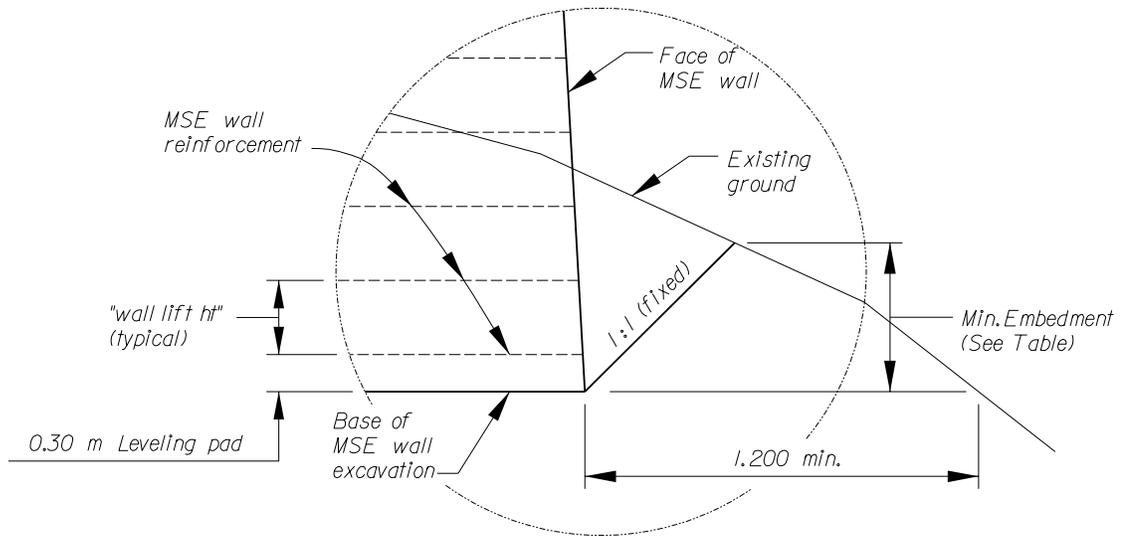
Toe Embedment Details for fh_wall5.x08

Minimum toe embedment depth from standard detail M255-02.



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

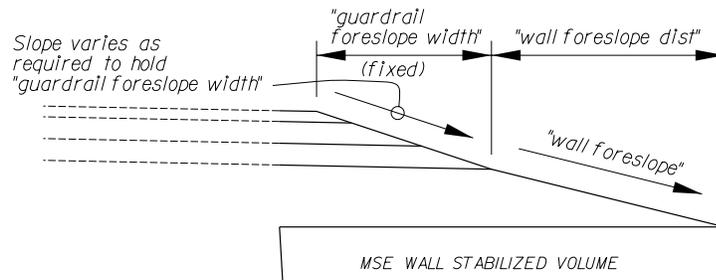
Toe embedment details.



fh_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.

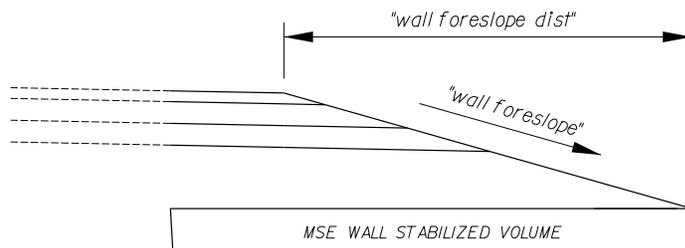


Optional foreslope configuration. The foreslope from the pavement shoulder to the top of the MSE wall is a continuous slope as shown below.

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

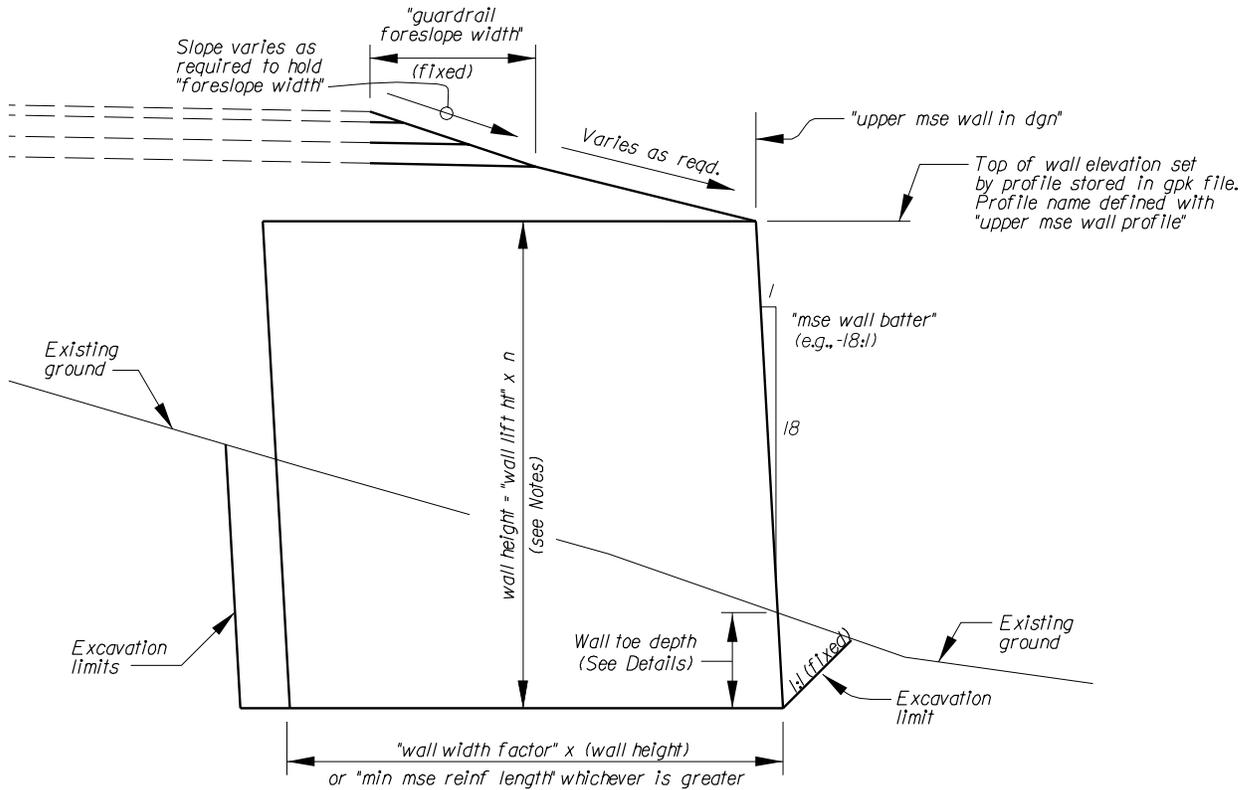
```
define "~continuous wall foreslope" 1
```

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.

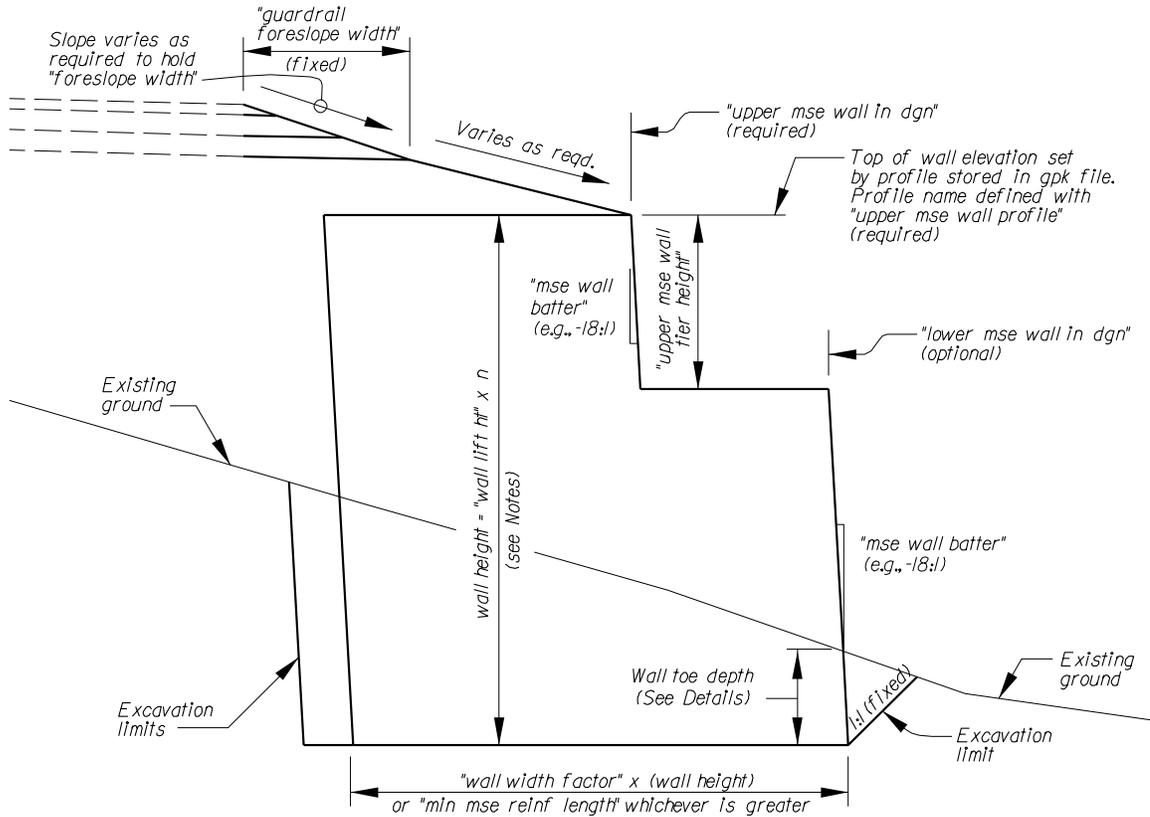
10. Special level/symbology for earthwork is as follows:
 - Existing suitable
 - Soil type = STRUCTURE_EXC
 - lv=40 co=40
 - Proposed undercut
 - Soil type = WALL_BACKFILL
 - lv=41 co=41
 - Proposed undercut
 - Soil type = EMBANKMENT
 - lv=42 co=42

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)

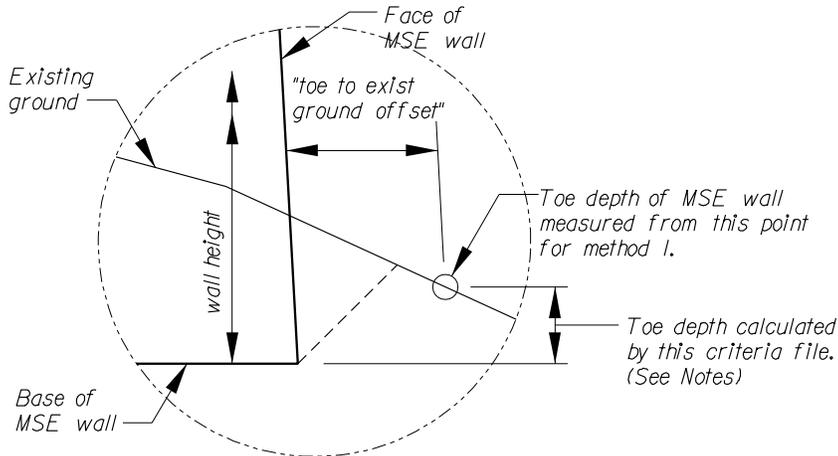
A two-tier wall section is toggled on by drawing a line in a plan view dgn file with the level/symbology specified with the "lower mse wall in dgn" for the station range where two tiers are needed. (Notice that both the "upper mse wall in dgn" and the "lower mse wall in dgn" lines must be drawn in the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



c_wall9d.x08

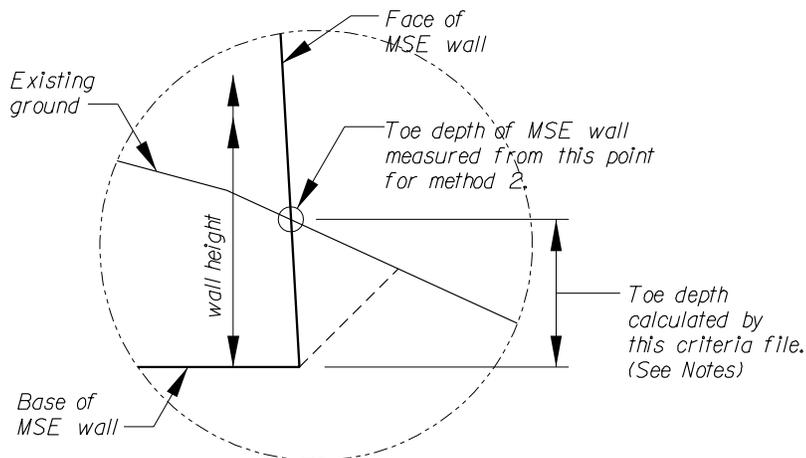
Wall Toe Depth Options For c_wall9d.x08

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`

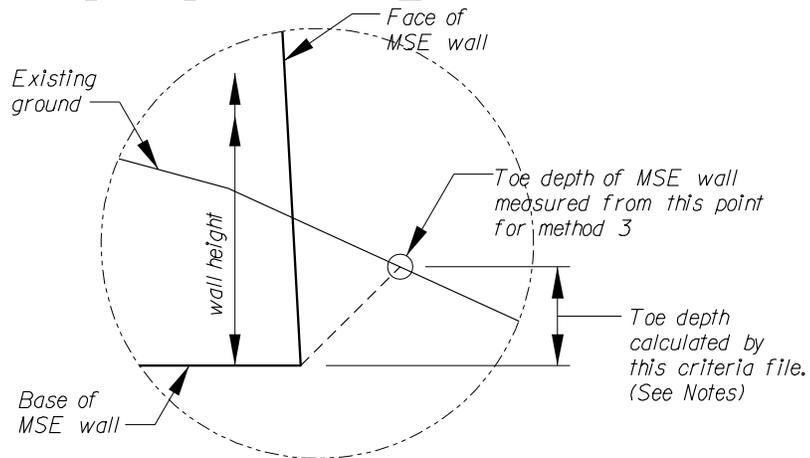


Toe Depth Calculation Method 2

`define "toe depth calc method" 2`

c_wall9d.x08

Wall Toe Depth Options For c_wall9d.x08 (continued)

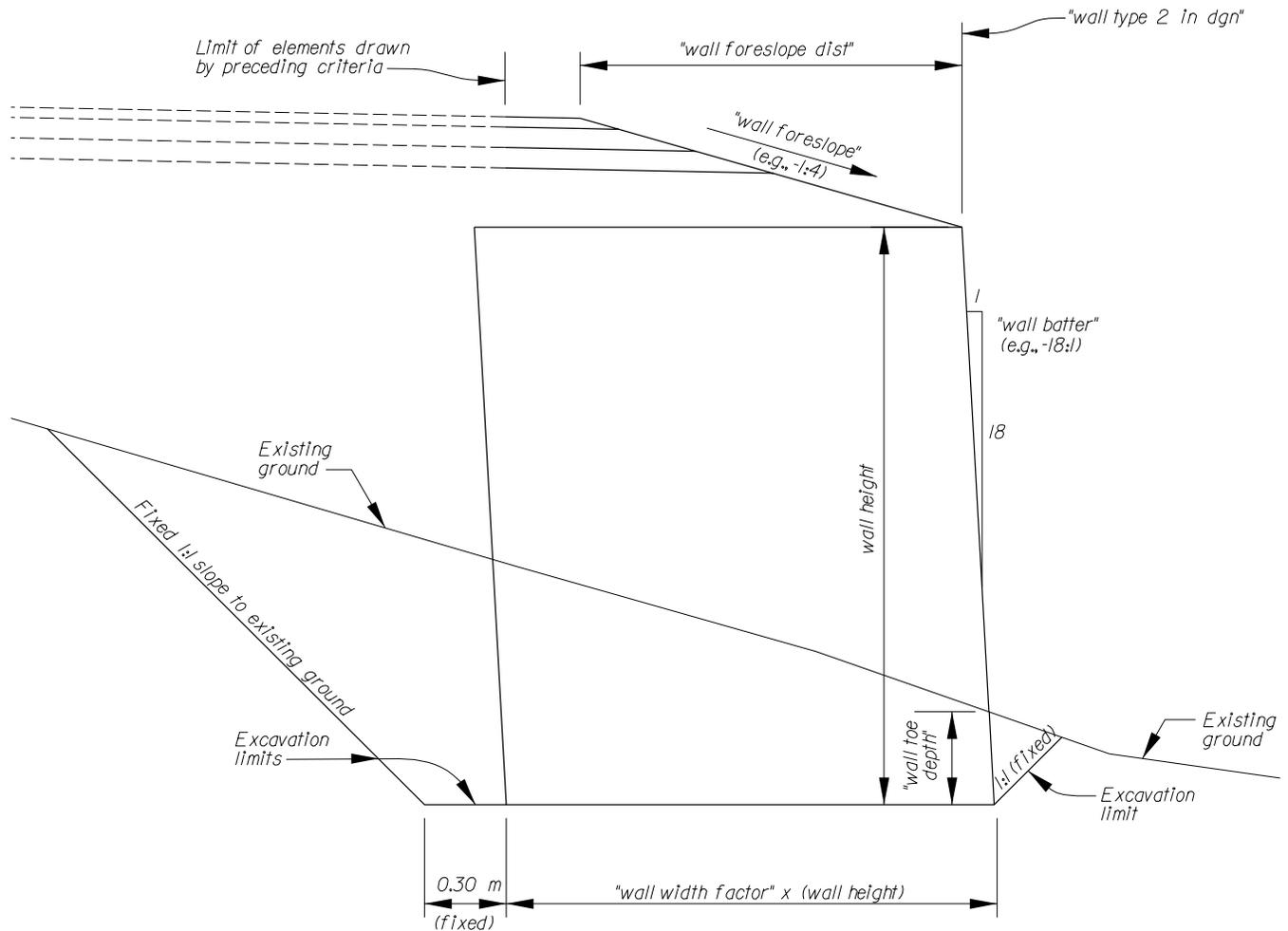


Toe Depth Calculation Method 3

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

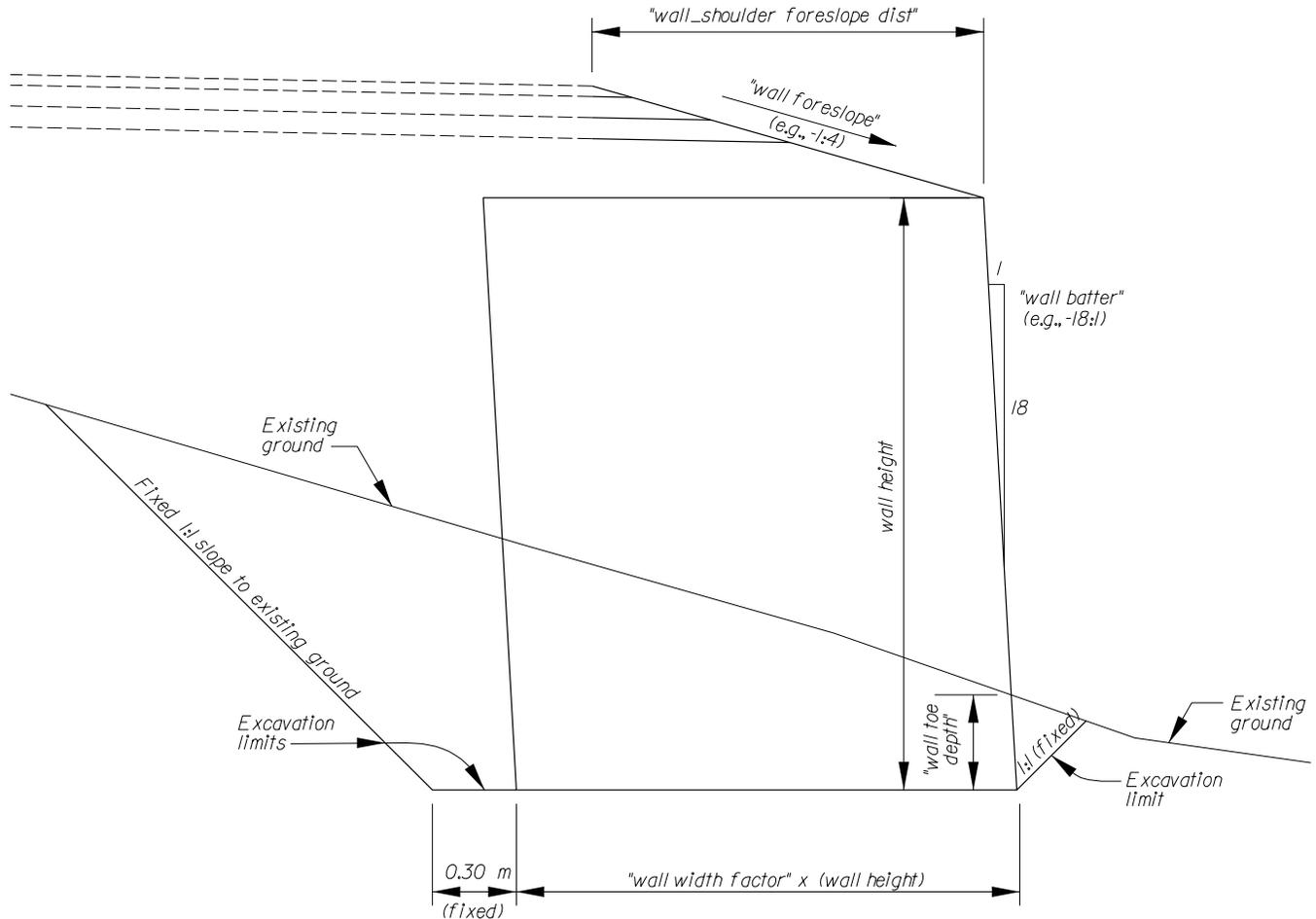
fh_wall2.x08

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`

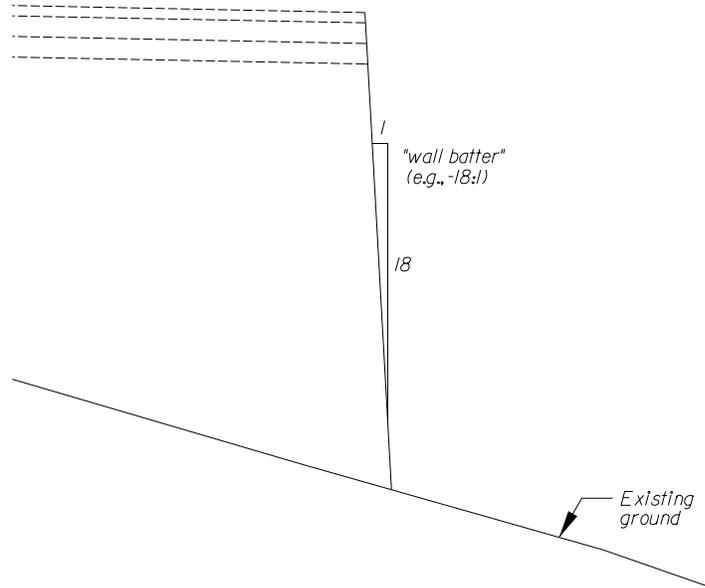
fh_wall3.x08

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`

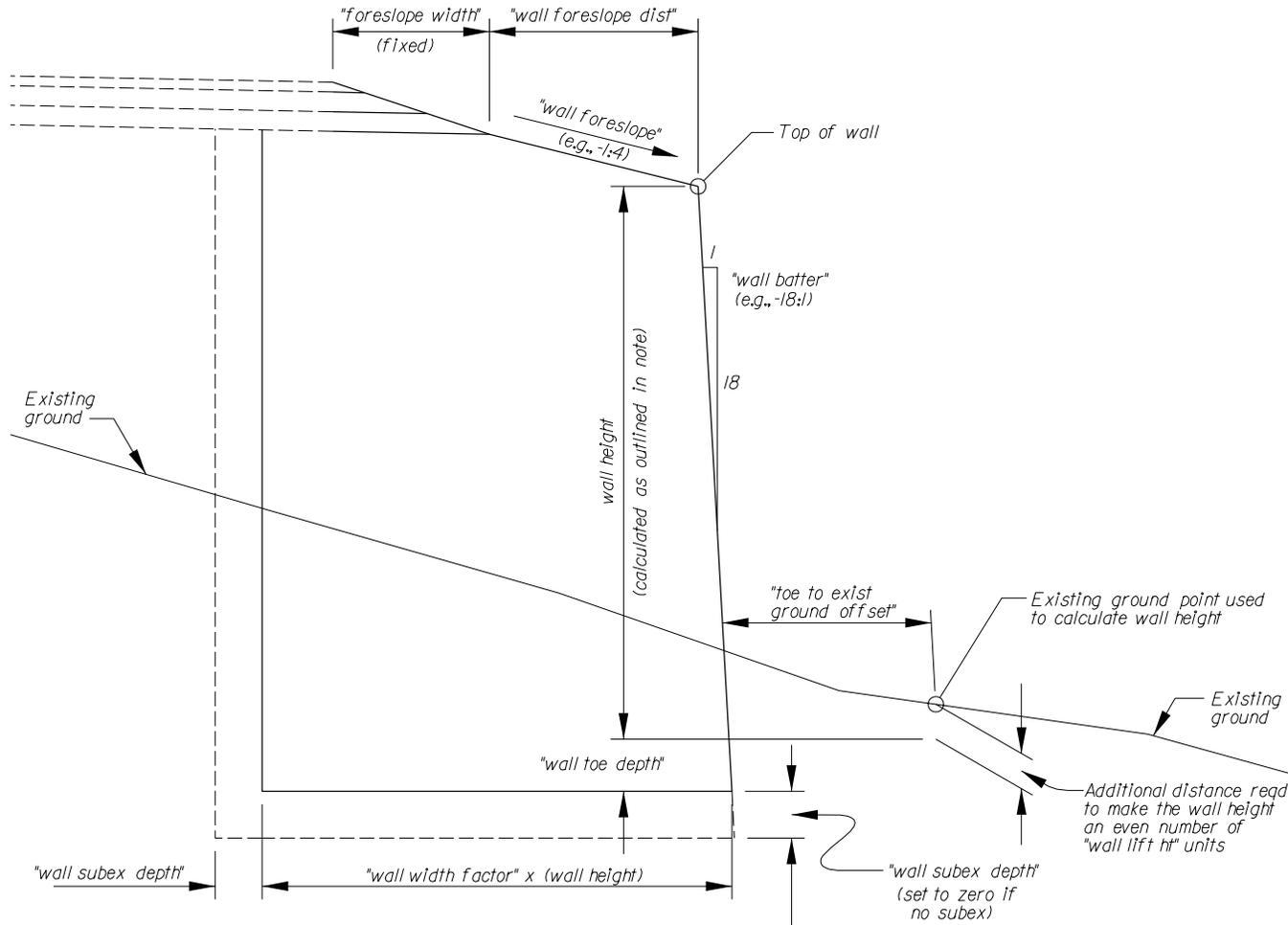
`_d_wall_used_rt`

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:

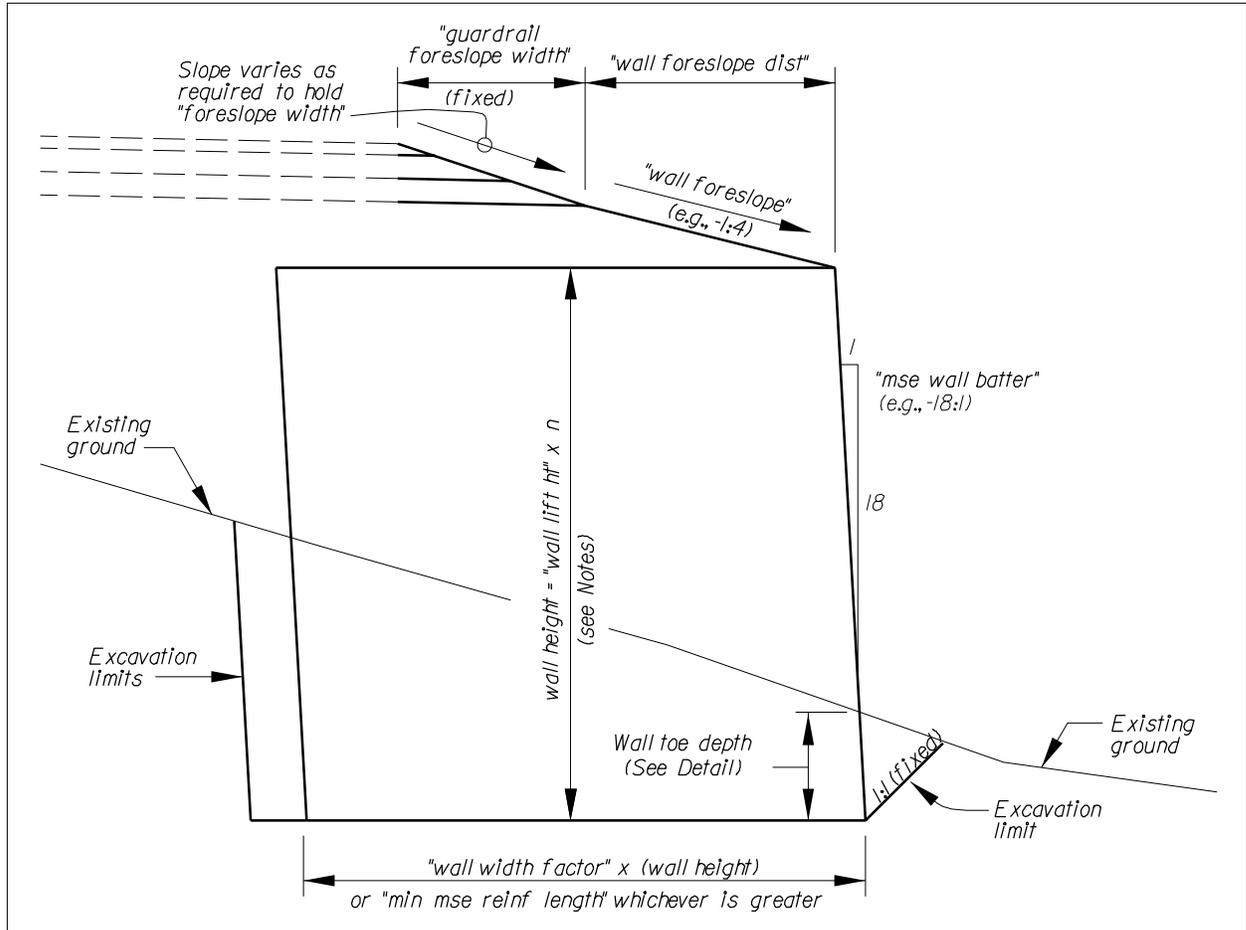
`_d_wall_used_lt`
`_d_wall_used_rt`

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

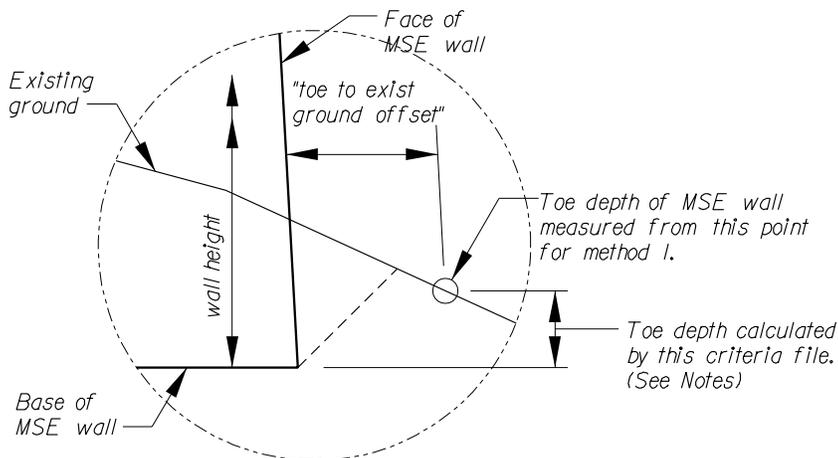
Proposed undercut
Soil type = WALL_BACKFILL
lv=41 co=41

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

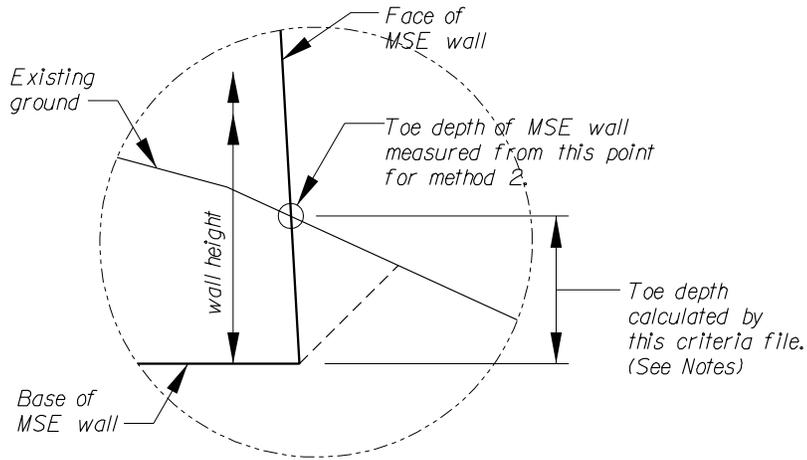
Use "toe depth calc method" variable in input file to control which method is used. (See Notes)



Toe Depth Calculation Method 1 (default)

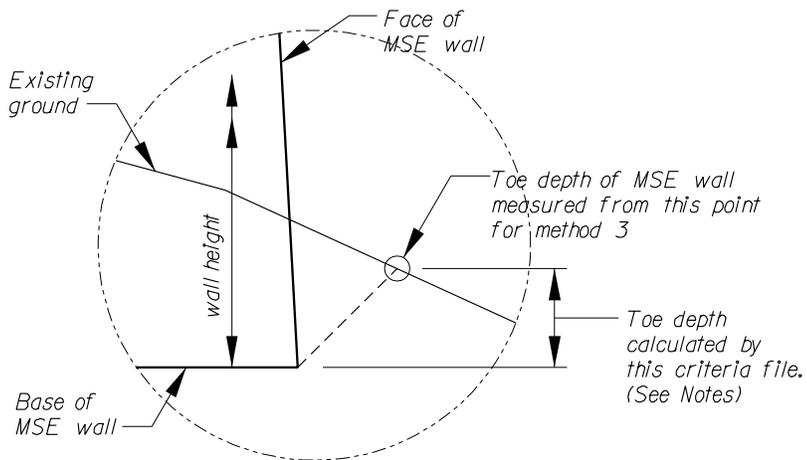
define "toe depth calc method" 1

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).