

# DWY\_UNCB.X – version 07.04.10

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## Description

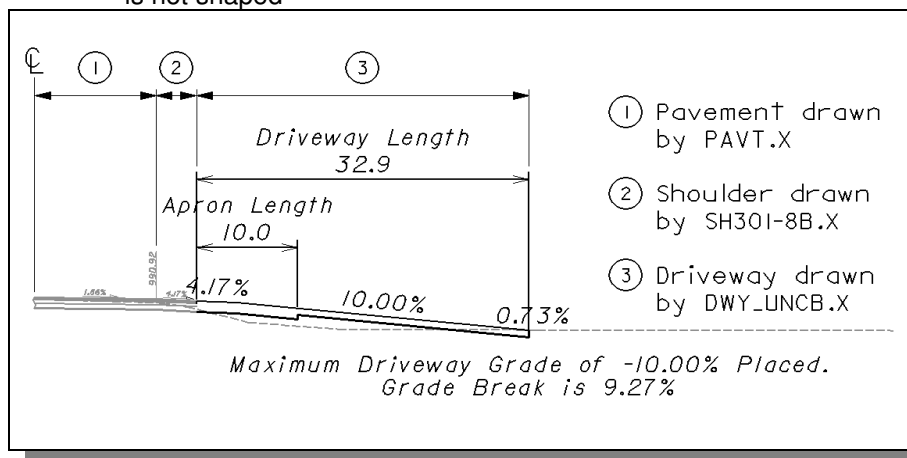
This criteria is used to draw driveway profiles adjacent to uncurbed highways according to the Location and Design Manual, Volume One, Section 804.1, and the bottom of Figure 803-2 as shown from the right of the walk. The best available driveway profile (slopes) will be placed within the user defined maximum driveway length, based on design criteria. If the driveway profile cannot be placed within the maximum driveway length, the criteria will draw the drive profile using the maximum driveway slope, as specified by the designer, until it intersects the existing ground.

The criteria will place pavement buildups for either residential and commercial driveways according to Volume One of the Location and Design Manual, Section 805. A user definable pavement buildup is also available.

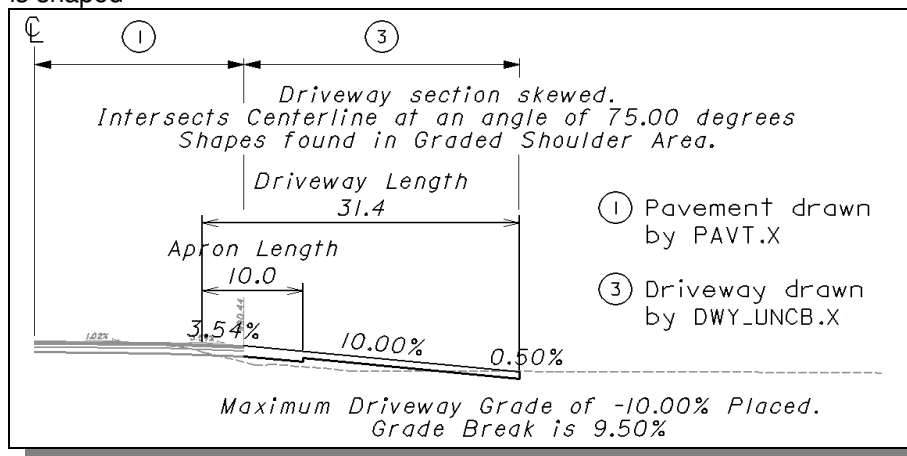
The criteria cannot place any vertical curves or rounding. The criteria will inform the user of the grade break with the existing ground. If the grade break is larger than allowed, the criteria places a note informing the designer to manually place a vertical curve.

The file **DWY\_UNCB.X** is for English Units only. Two examples of a driveway for a section are shown below in Figures 1 and 2.

**Figure 1:** Example of driveway section not skewed and the graded shoulder is not shaped



**Figure 2:** Example of a driveway section on a skew and the graded shoulder is shaped



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## Inclusion Sequence

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ODOT's criteria files are written so that each individual file is responsible for drawing only a specific component of the proposed cross section design. This allows for greater flexibility when utilizing the criteria files to accommodate a wide variety of design scenarios. When a criteria run is processed, the user will specify the individual criteria files that will be used to draw each component. The order in which these components are specified is significant. Criteria files must be included in the order that they will process from the centerline out. For example, the pavement criteria must be included before the shoulder criteria which must be included before the side slope criteria. Each criteria file will start drawing where the previous criteria file ended.

The ODOT Standard criteria file DEFINE.X contains default definitions for some of the Define Variables used by ODOT's criteria files. DEFINE.X must always be included first in any criteria run.

In order to process DWY\_UNCB.X, a pavement and a shoulder criteria file must be included in the criteria run previous to DWY\_UNCB.X. The following ODOT standard pavement and shoulder criteria files are available on the ODOT GEOPAK Support Website:

### Pavement Criteria

PAVT.X  
PAVT\_EXIST.X  
PAVT\_OVERLAY1.X  
PAVT\_SHAPELESS.X  
PAVT\_WIDEN.X

### Shoulder Criteria

SH301-8.X  
SH301-8B.X  
SH301-9.X

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## Initial Considerations

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### **Set-up:**

Prior to processing the DWY\_UNCB.X criteria file, the placement of the graphical driveway elements, the design file location and placement of the GEOPAK pattern lines and GEOPAK Roadway Shapes is critical to obtaining the correct results. Depending on the design file location of these elements, the user will need to know the limitations and expectations of the criteria file when it processes.

One limitation is that the software can not process cross sections on a skew accurately outside of the GEOPAK Roadway Shapes. The software can calculate the slope placement for a section on a skew based on the angle of the skew but this assumes the roadway has no vertical profile (roadway profile grade = 0). Depending on the amount of skew and steepness of the roadway profile grade, the results can have a significant impact on the driveway profile design. **Important:** For this reason the criteria file has been hardcoded to ALWAYS Remove the Skew Effect. Warning messages and notes are placed in the design file to alert the designer if the driveway section is on a skew. The **Remove Skew Effect** is discussed on page 21.

To obtain accurate slopes for driveways on a skew the user will have to shape the graded shoulder area. This is described and detailed in the **Shaping the graded shoulder area** section on page 26.

To obtain accurate driveway sections that are skewed, the user **MUST** shape the graded shoulder area.

Another very important issue prior to processing the criteria file, is deciding which design file to place the driveway items necessary for processing in. Ultimately, the set up will be up to each individual user and their CADD preferences and abilities. However the user decides to set up the design files, the criteria will run the following tests before the driveway is placed:

<b>Table 1</b>
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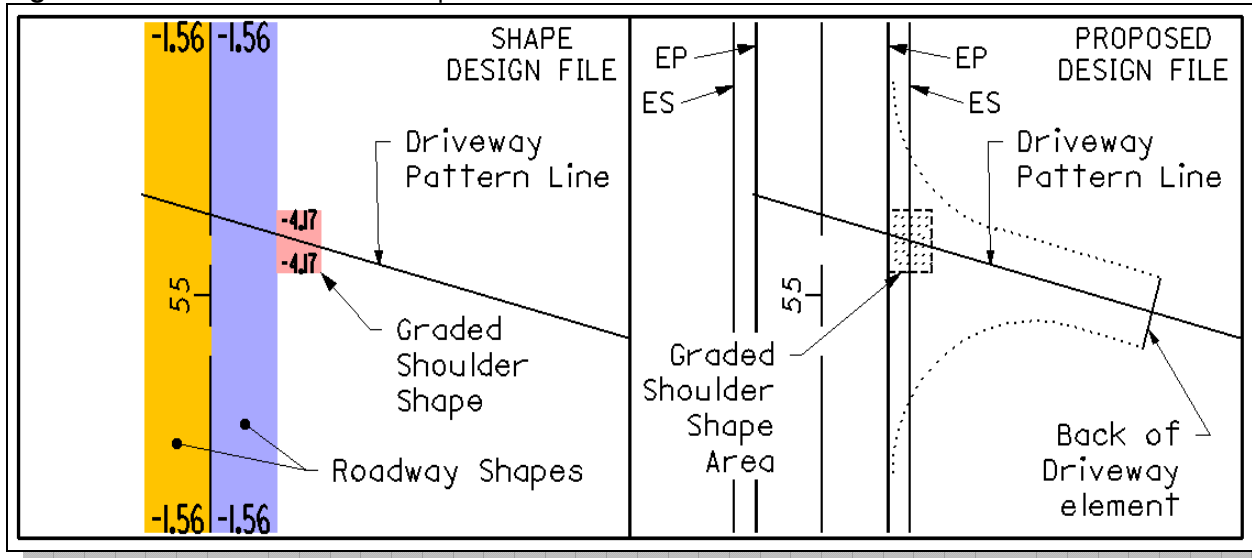
Table 1			
Is there a back of driveway graphic present in the proposed design file?	Yes	Based on the symbology of the graphics found will determine which driveway is present, either residential or commercial (see <b>Back of driveway</b> section on page 15), and will set the pavement buildup used for the driveway. Next, the criteria file will determine the skew angle, if any, for the section.	
	No	Do not process the driveway criteria file.	
Is the driveway section on a skew?	Yes	Is there an edge of shoulder graphic present at the section outside of marked point 1 set by PAVT.X?	No, Criteria file will proceed assuming the graded shoulder area was shaped.
			Yes, Criteria places warning message stating driveway section on a skew and to verify slopes and elevations.
	No	Proceed with the processing of the criteria file as described on page 17.	
How does the criteria know the graded shoulder is shaped?	The following criteria files were included in the processing of the driveways for both LT and RT sides: DEFINE.X PAVT.X SH301-8B.X DWY_UNCB.X	The criteria file PAVT.X will process to the edge of the last GEOPAK shape (or edge of pavement graphics if outside of the shape) found at the section and will mark point 1. The SH301-8B.X criteria file will start processing at marked point 1 which is set by PAVT.X. If no edge of shoulder graphics is found outside of this point, it will not process. The DWY_UNCB.X criteria file will also start at marked point 1. It will check to see if an edge of shoulder graphic exists outside of marked point 1. If no graphic is found for the edge of shoulder, the DWY_UNCB.X criteria file will assume the graded shoulder area was shaped.	

Whether the driveway sections are skewed or not will dictate how the items necessary to process the DWY\_UNCB.X criteria file are placed and in which design file they are located. Listed In Table 2 are the requirements for processing the DWY\_UNCB.X criteria file.

Table 2				
Graded Shoulder Shaped in DGN with Roadway Shapes	Edge of Pavement Graphics Present in Proposed DGN outside of last shape	Edge of Shoulder Graphics Present in Proposed DGN outside of last shape	Driveway Graphics in Proposed DGN Essential to Process Criteria File	Example Figure
Yes	No	No	Back of driveway	3
No	Yes	Yes	Back of driveway	5

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Figure 3: Graded Shoulder area shaped

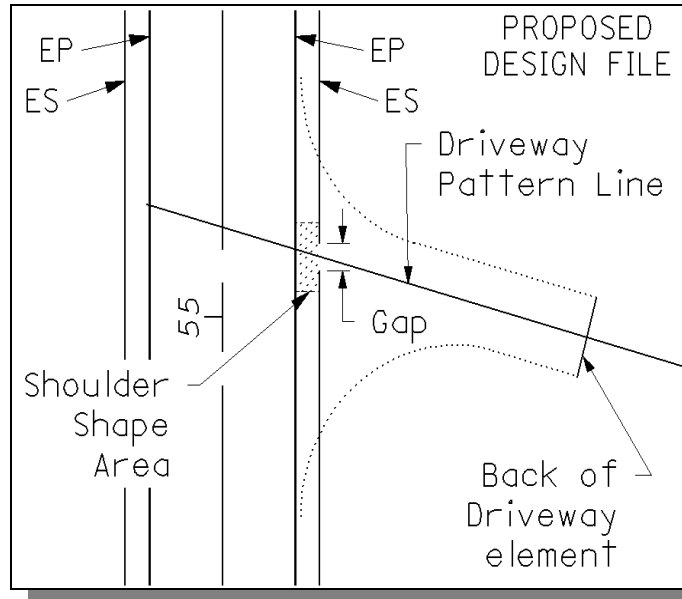


### Designer Notes for Figure 3:

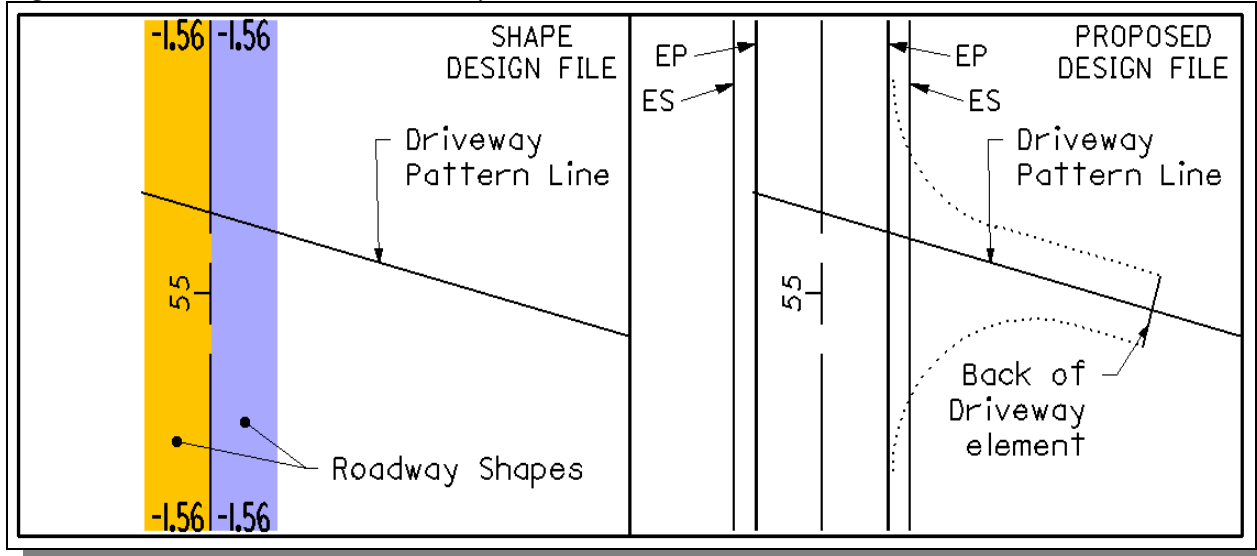
- The back of driveway element must be present in the proposed design file in order for the DWY\_UNCB.X criteria file to process. This graphic is what the criteria file will look for to determine if a driveway exists at the pattern line. If no graphic is found matching the back of driveway symbologies, the criteria file will not process at the section.
- When creating the graded shoulder shape, the shape needs to be long enough so the pattern line crosses each side to process correctly.
- Place the Graded Shoulder Shapes on a different level from the Roadway Shapes. This will enable the user and the software to differentiate between the Roadway Shapes and the Graded Shoulder Shapes for other processing purposes.
- The driveway pattern line MUST NOT intersect the edge of pavement (EP) or edge of shoulder (ES) graphics outside of the GEOPAK shapes. If the Roadway Shapes and the Graded Shoulder Shapes limits are beyond the graphics, nothing needs to be done as shown in Figure 3. If the Graded Shoulder Shapes are at the same location or inside of the edge of shoulder (ES) graphics, the graphics must be deleted (gapped) across the pattern line as shown in Figure 4. The gap does not need to be as large as shown in the figure. Just make sure that the gap is large enough that the software will not find these graphics when it process. When in doubt or if the criteria file will not process correctly, gap the graphics and reprocess the criteria file.

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**Figure 4:** Shoulder graphics gapped across the pattern line. Case where paved shoulder width = graded shoulder width



**Figure 5:** Graded shoulder area not shaped



Designer Notes for Figure 5:

- The back of driveway element must be present in the proposed design file in order for the DWY\_UNCB.X criteria file to process. This graphics is what the criteria file will look for to determine if a driveway exists at the pattern line. If no graphic is found matching the back of driveway symbologies, the criteria file will not process at the section.
- The driveway pattern line MUST intersect the edge of pavement (EP) and/or edge of shoulder (ES) graphics as shown in Figure 5.



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### Working Alignment

Within each GEOPAK project there may be several horizontal alignments, vertical profiles, cross sections, etc., each representing the individual roads of the project. In order to better organize this information, GEOPAK provides the concept of the **Working Alignment**. This concept can also be applied to processing driveways.

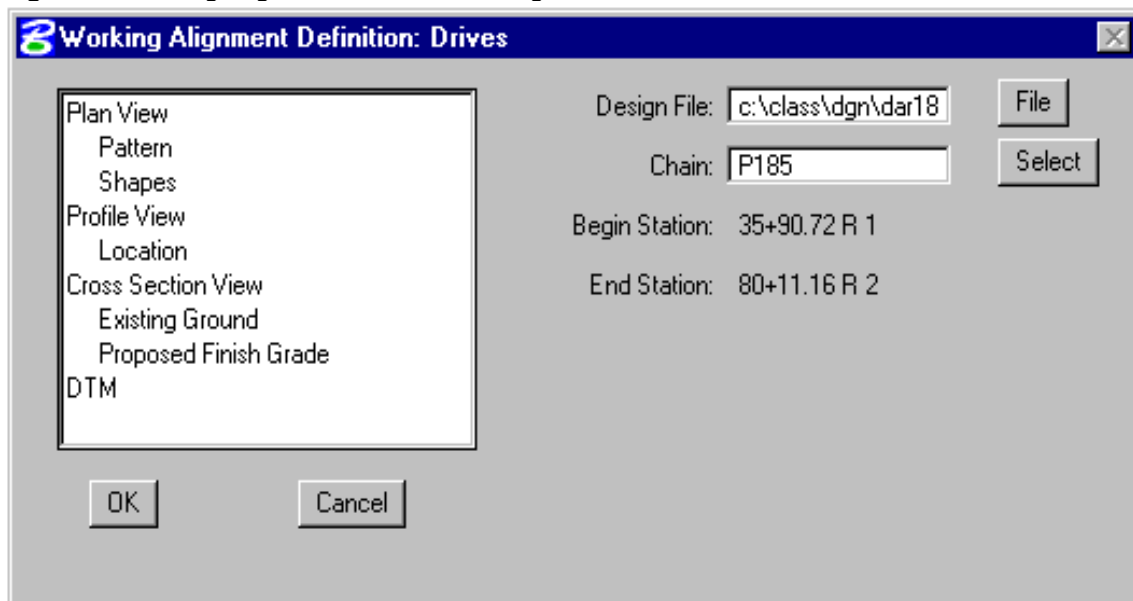
The purpose of the Working Alignment is to save information specific to each alignment within your project in one place. These settings are shared with other dialog boxes within GEOPAK. For example, the first item in the Working Alignment is the **Plan View** item. This item is used to store the name of the **Design File** that contains the proposed graphics for the project, and the name of the **Chain** in the Coordinate Geometry database that is used for the centerline of the road.

When accessing the various functions of the GEOPAK *Road Project* dialog box, the settings and parameters of the current Working Alignment run are shared with the dialog boxes for the various functions if the parameters have been specified in the Working Alignment and if the **Working Alignment Influence Runs** toggle is active. This eliminates the need to repetitively key in the same data in every dialog box.

No matter how the driveways are set up to process, using the Working Alignment will help manage the items related to the driveways.

Most of the information used for the mainline processing will be identical to that for the drives. Table 3 on page 10 shows the items within the Working Alignment that might need to be modified.

**Figure 6:** Working Alignment Definition Dialog



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Table 3	
Working Alignment Parameter	Item to Modify
Plan View	Design File: <i>full path and name</i>
Pattern	Design File: <i>full path and name</i>
	Pattern Line Symbology: <i>Levels, Weights, Colors, Styles, Types</i>
Shapes	Design File: <i>full path and name</i>
	Shape Symbology: <i>Levels, Weights, Colors, Styles, Types</i>
Cross Section View	XS DGN File: <i>full path and name</i>

### Items Necessary to Process DWY\_UNCB.X Criteria File

The following items must exist prior to processing the criteria file. Again, the design file location will be up to each individual user.

- **Driveway Graphical Elements Necessary to Process the Driveway.** These are MicroStation elements that the GEOPAK pattern line (Driveway centerline) intersects (searches for) during processing. The back of driveway element is necessary to process the criteria file which is discussed on page 15. The other elements the criteria file will search for are discussed in detail on the pages 14, 15 and 16 and include back of apron and maximum driveway length. These elements are not the plan view elements that indicate driveway shape and design. The plan view elements can be placed prior to processing the criteria file but they are not necessary.
- **Driveway Pattern Lines.** These are the MicroStation line elements the software will use to create the existing ground cross sections as well as process the proposed driveway profile.
- **GEOPAK Roadway Shapes.** These are the shapes the software will use to determine and place the pavement slopes in the section. These slopes are then used to determine the grades for the driveway profile.
- **GEOPAK Graded Shoulder Shapes:** If the driveways are placed on skews, to obtain accurate driveway profiles it will be necessary to place additional shapes in the graded shoulder areas adjacent to the Roadway Shapes. The Graded Shoulder Shapes will need to be placed in the same design file as the Roadway Shapes. Shaping the graded shoulder area is detailed on page 26.

### Remove Skew Effect

The criteria file has been hardcoded to ALWAYS Remove the Skew Effect. If a driveway is on a skew, the slopes will not be recalculated based on the angle of the skew. If the graded shoulder area is not shaped, the criteria file will place warning messages and notes informing the user that the driveway is on a skew and to verify the slopes and elevations for the section. If the graded shoulder area has been shaped, the slopes placed will not be affected by the skew angle. In this case, the actual slope placed for the section outside of the graded shoulder area is also accurate. To learn more about this effect please see the **Remove Skew Effect** section on page 21.

### Driveway Location:

GEOPAK Pattern Lines are used to specify the location of each driveway centerline in a MicroStation design file. Each pattern line must be placed at the appropriate skew angle for each individual driveway.

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Pattern lines can be placed utilizing the GEOPAK *Draw Patterns* dialog, or placed with MicroStation's *Place Line* tool. MicroStation line or line string elements are valid elements to be used as GEOPAK pattern lines. Centerlines consisting of arcs or curves are not valid pattern line elements for GEOPAK.

The criteria file will process best if the pattern line for each driveway crosses the edge of pavement shape on the opposite edge of the roadway. Figure 7 below shows sample settings to place a pattern line for a driveway centerline placed 100 master units (feet) to the left of the centerline chain and 13 master units (feet) to the right of the centerline. See Figure 8 on the following page for the plan view display of the pattern line placed using these settings.

**Figure 7:** GEOPAK *Draw pattern Lines* Dialog

Job: 185  
Chain: P185 [Select]

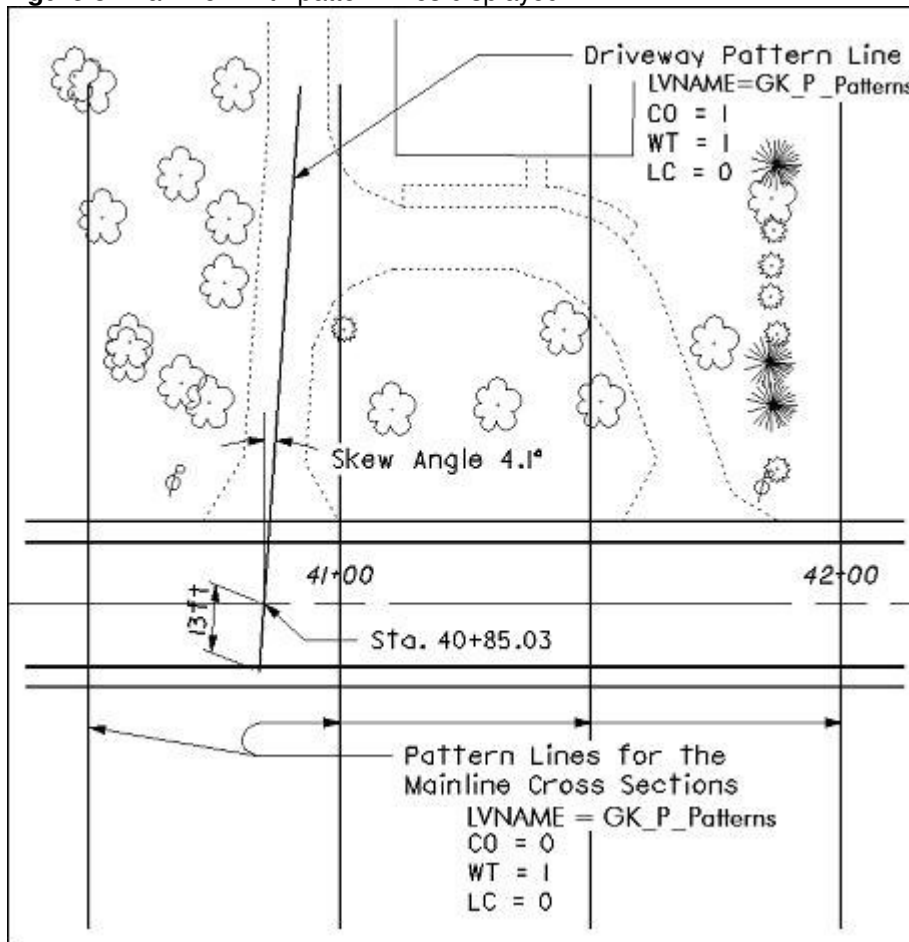
**Beginning**  
Offset LT: 100  
Station: 40+85.03 R 1 [DP]  
Offset RT: 13

**Ending**  
Offset LT: 100  
Station: 80+11.16 R 2 [DP]  
Offset RT: 100

Once: 50.000000  
Skew:  4.100000  
Level: GK\_Pa  
Color: 1 [Blue square]  
Style: 0  
Weight: 1  
[Apply]

Figure 8 on the following page illustrates a driveway centerline drawn with the GEOPAK *Draw Pattern Lines* tool, using the dialog box settings shown in Figure 7 above.

Figure 8: Plan view with pattern lines displayed



If you use MicroStation's *Place Line* or *Place Linestring* tools to place pattern lines at the driveway centerline locations, take the following steps to ensure that the element crosses the opposite edge of pavement:

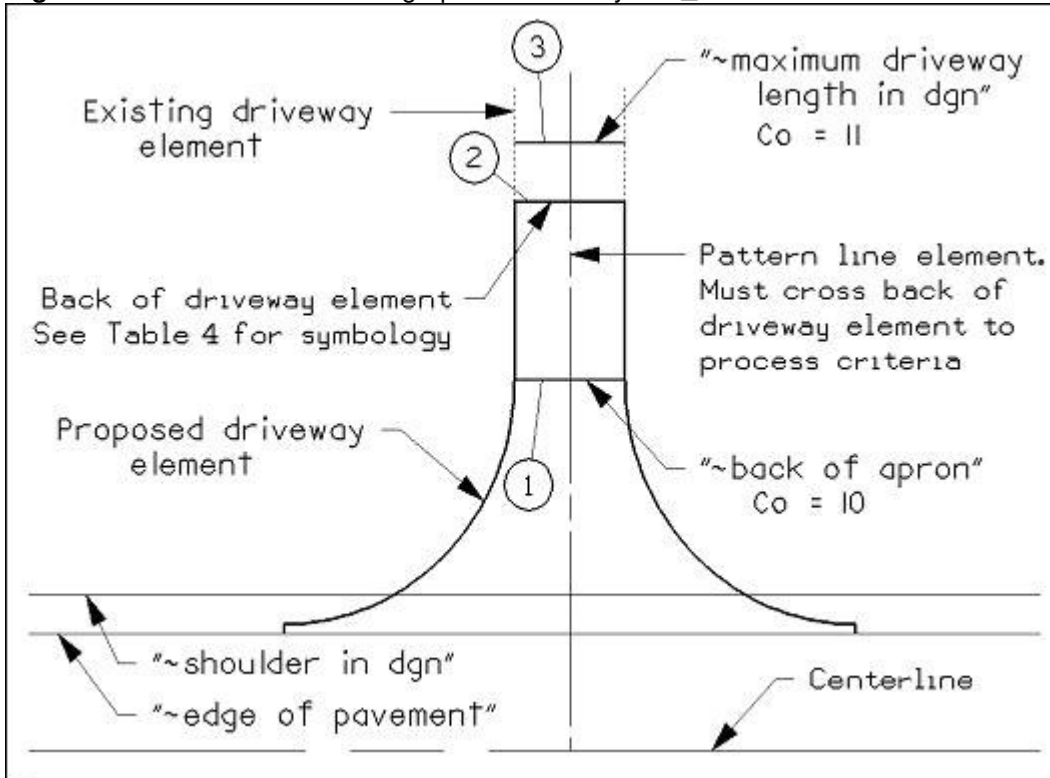
- Use the MicroStation *Extend Line to Intersect* tool to ensure that the line or line string intersects the opposite edge of pavement.
- Use the MicroStation *Extend Line* tool to extend the line at least 0.1 master units beyond the intersection with the edge of pavement graphics.

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### Plan View MicroStation Graphics Utilized by DWY\_UNCB.X :

In addition to placing GEOPAK Pattern Lines at the location of each driveway, there are three more MicroStation elements that DWY\_UNCB.X will look for in your proposed MicroStation plan view design file ("proposed dgn file name") in order to draw the driveway profiles. These elements are (1) the driveway apron, (2) the back of the proposed driveway and (3) the maximum length for the back of the proposed driveway as shown in Figure 9. We'll take a look at each of these in more detail on the following pages.

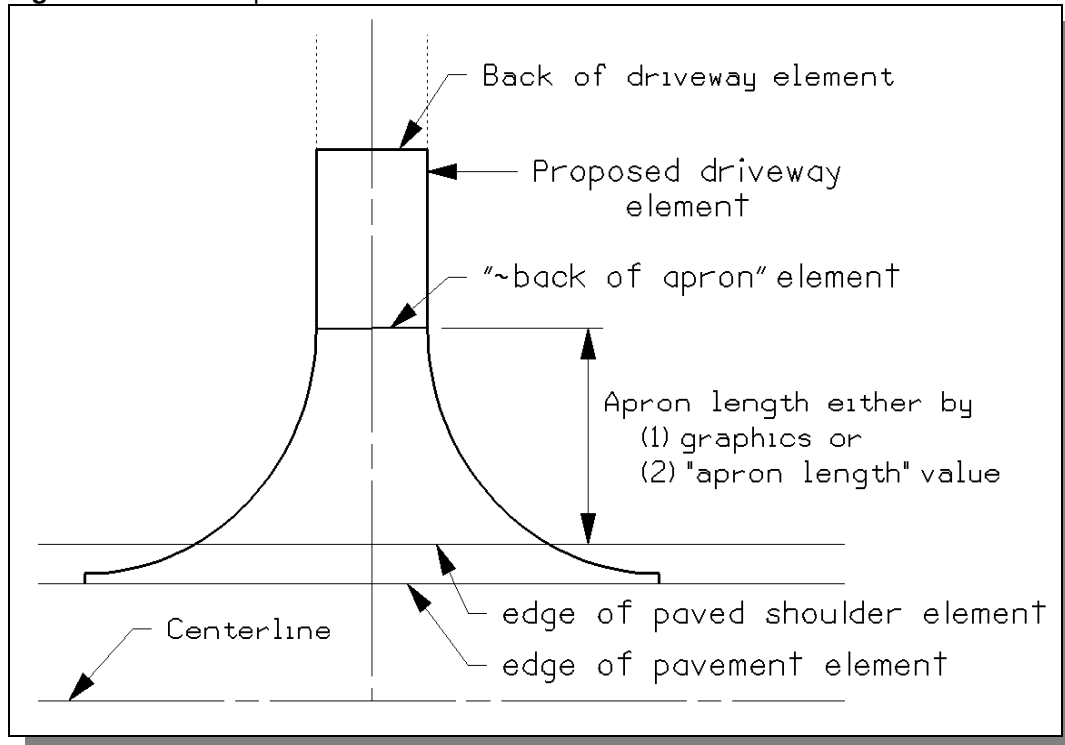
**Figure 9:** Plan view MicroStation graphics utilized by DWY\_UNCB.X



### Back of Apron:

The apron length is measured from the back of the proposed shoulder as shown in Figure 10 below. The apron length can be specified in two ways as detailed below:

**Figure 10:** Back of apron



#### Method 1 - Graphical location

The criteria file will first look for a line in the proposed plan view MicroStation design file representing the back of the apron. This method should be utilized if your driveways all have different apron lengths. See the **Define\_DGN Variables** section on starting on page 37 of this documentation for more information.

#### Method 2 - Offset value

If the criteria file does not find a line representing the back of the apron in the proposed plan view MicroStation design file, it will use the value of the define variable "**apron length**". This method should be utilized if all or a majority of your driveways have the same apron length. See the **Define Variables** section starting on page 37 of this documentation for more information.

### Back of Driveway:

The criteria will search for a line in the proposed plan view MicroStation design file representing the back of the driveway, as shown in Figure 9 on the page 13. The back of driveway line is used by the criteria to determine which pavement buildup will be used for each individual driveway. The table below shows which pavement buildup will be used on the drive profile (cross section) depending on the symbology for the back of driveway line that is encountered in the design file:

Table 4		
Residential Pavement Buildup	Level	Color
805.2 A	PV_P_Drive	0
805.2 B	PV_P_Drive	1
805.2 C	PV_P_Drive	2
805.2 D	PV_P_Drive	3
User Defined	PV_P_Drive	4
Commercial Pavement Buildup	Level	Color
805.3 A	PV_P_Drive	16
805.3 B	PV_P_Drive	17
805.3 C	PV_P_Drive	18
805.3 D	PV_P_Drive	19
User Defined	PV_P_Drive	20

It is important to note that the location of the line at the back of the driveway is not used by the criteria to determine the length of the proposed driveway. The driveway length will be determined by the criteria file in the cross section based on the values that you assign for the define variables, described later in this documentation.

### Maximum Length for the Proposed Driveway:

The criteria will attempt to place driveway profiles using a "**preferred maximum driveway grade**" defined by the user as long as this grade can be placed within the limits of the maximum driveway length. The maximum driveway length is measured from the back of the proposed paved shoulder as shown in Figure 11 on page 16. The maximum driveway length can be specified in two ways:

#### Method 1 - Graphical location

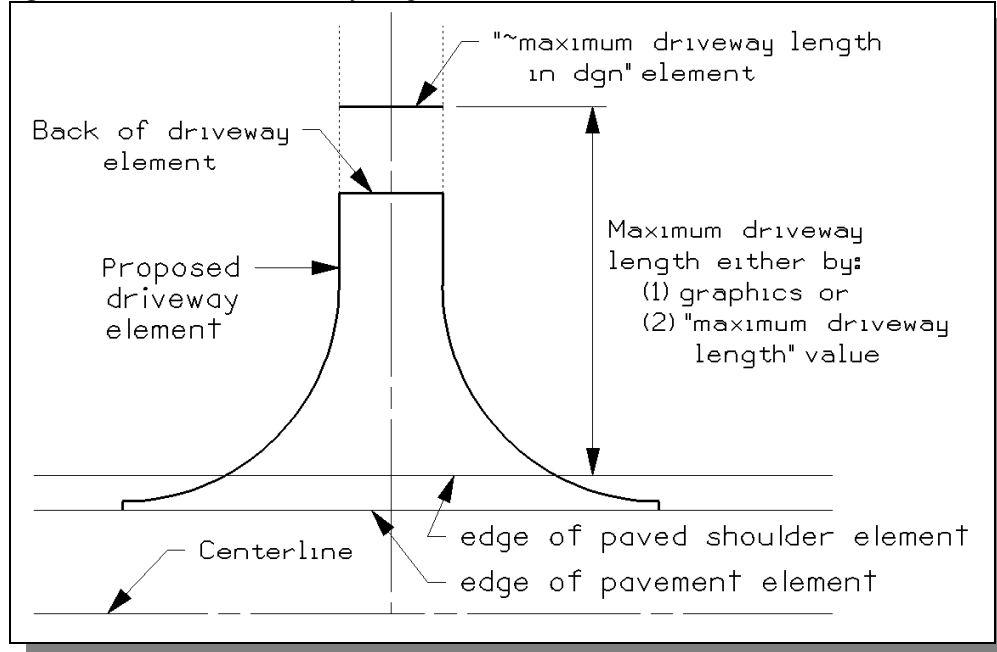
The criteria file will look for a line in the plan view MicroStation design file representing the maximum driveway length. This method should be utilized if your driveways all have different maximum lengths. See the **Define\_DGN Variables** section on page 37 of this documentation for more information.

#### Method 2 - Offset value

If the criteria file does not find a line representing the maximum driveway length in the proposed plan view MicroStation design file, it will use the value of the define variable "**maximum driveway length**". This method should be utilized if all or a majority of your driveways will have the same maximum length. See the **Define Variables** section on page 37 of this documentation for more

information.

**Figure 11: Maximum driveway length**



### Summary:

- To process the criteria file, the pattern line element must cross the reference chain. It is good practice to extend the pattern line so it crosses the edge of pavement shape on the opposite side of the roadway by at least 0.1.
- The pattern line must intersect the back of driveway element. This element must be placed using the symbology in Table 4 on page 15. The criteria will determine the pavement buildup of the driveway based on the symbology of the back of driveway line encountered. The location of this element is not used to determine the length of the proposed driveway. The criteria file will determine the actual location of the back of the driveway in the cross section. After processing the criteria, be sure to update the driveway graphics in your plan view MicroStation design file to reflect this distance.
- The back of apron element is not necessary to process the criteria. It allows the designer the capability of extending the shoulder pavement buildup to any location along the driveway. It can be defined graphically for an individual driveway(s), or by a set offset value that will be used for driveways without a back of apron graphic.
- An element representing the maximum length of the proposed driveway is not necessary to process the criteria. It can be defined graphically for an individual driveway(s), or by a set offset value that will be used for driveways without a maximum length of driveway graphic.



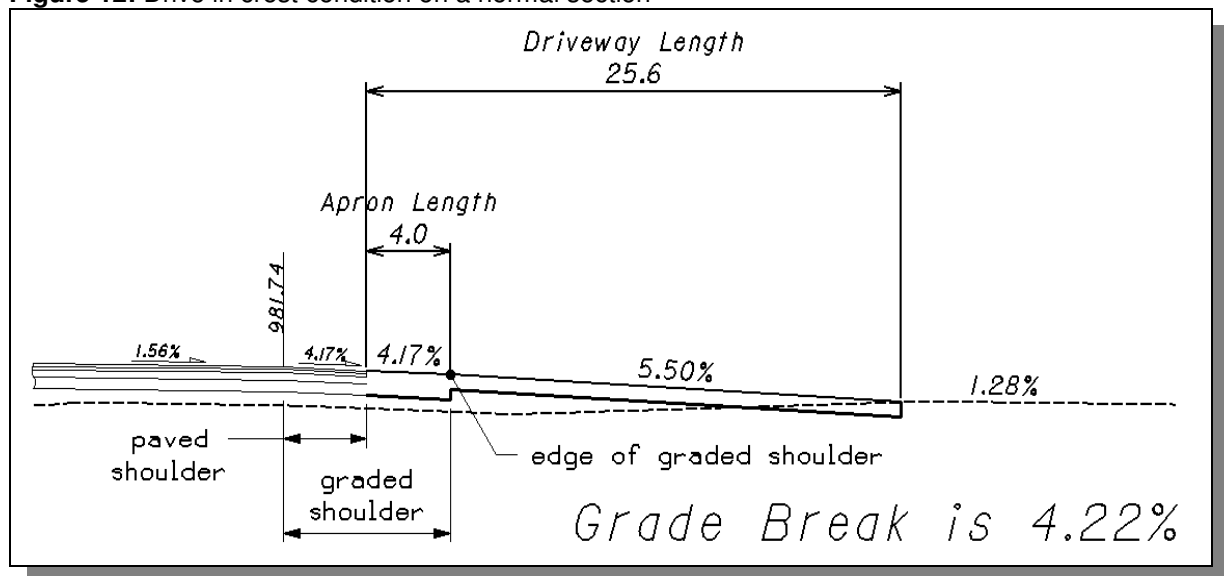
**Additional Processing Notes**

**Drives in Crest Condition - Normal Section:**

Driveways in a crest condition are placed according to the Location and Design Manual, Volume One, Figure 803-2, as shown from the right of the side walk. The drive profile initially slopes down and away from the treated (paved) shoulder at the same slope (“**shoulder slope**” set to 0) until it reaches the edge of graded shoulder. The driveway profile is then developed outside this point.

The criteria file will place the first (best) slope which intersects the existing ground within the distance determined for the maximum length of the driveway. In Figure 12 below, a -5.50% slope was placed.

**Figure 12:** Drive in crest condition on a normal section



The criteria file will determine the grade break between the proposed driveway profile and the existing ground. A note is placed in the file for your reference on level 62 as shown in Figure 12.

**Note:** The criteria file cannot place any vertical curves or rounding. If the grade break is larger than allowed, the designer must manually place any rounding that is required. According to Figure 803-2, the maximum sag grade break is 12.0%. The grade break shown in Figure 12 above is 4.22%. Therefore, the designer would not be required to place a vertical curve if this driveway profile is to be used.

The pavement buildup of the driveway is based on the graphical element in the design file placed at the back of the driveway.

**Drives in Crest Condition - Superelevated Section:**

Driveways in a crest condition on a Superelevated Section are placed the same as described in the Normal Section except it is likely there will be an additional grade segment placed. This grade segment will be determined from the adjoining shoulder slope.

In the following example, the pavement cross slope is 8.0%. Since the cross slope is greater than 5.9%, the shoulder will be placed as shown in Figure 301-8 of the Location and Design Manual. The criteria file will

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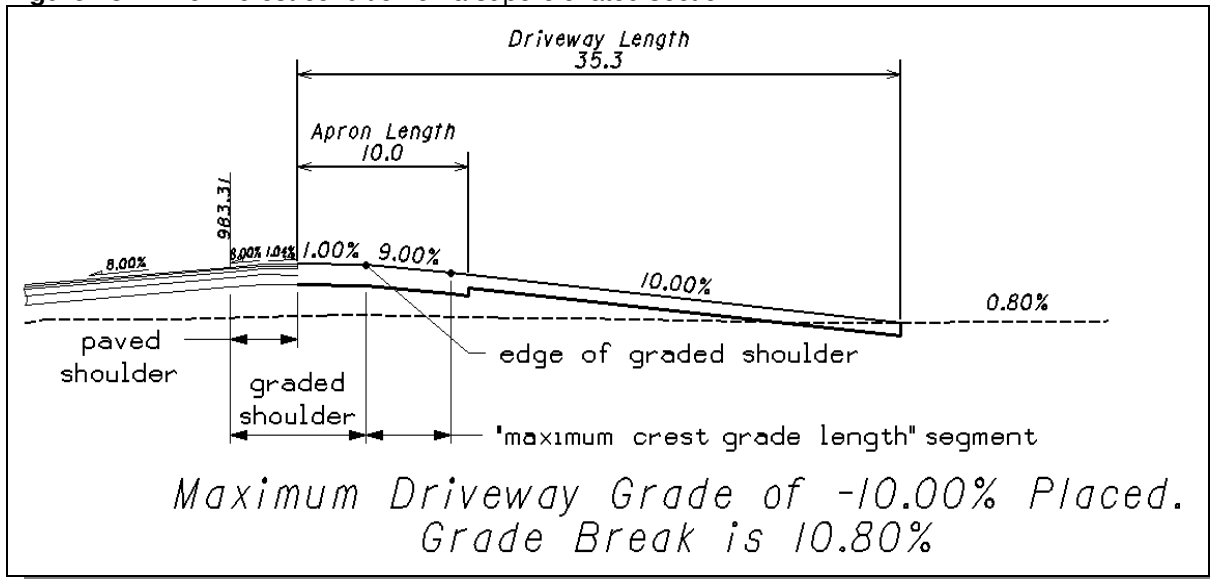
determine the shoulder slope that was placed and will use this to determine the initial driveway slope to be used. The driveway slope is determined by using the shoulder slope and the value set by the variable **“maximum crest grade break”** as shown in the example below

The following values were used to process the criteria for Figure 13 below:

<b>“apron length”</b>	= 10.0 ft	<b>“maximum driveway grade”</b>	= 10.0%
<b>“maximum crest grade break”</b>	= 8.0%	<b>“maximum driveway length”</b>	= 30.0 ft
<b>“minimum crest grade length”</b>	= 5.0 ft	shoulder slope placed	= -1.0 %

driveway slope placed from the edge of graded shoulder in a crest condition  
 = shoulder slope placed - “maximum crest grade break”  
 = (-1.0%) - 8.0%  
 = -9.0 %

**Figure 13:** Drive in crest condition on a superelevated section



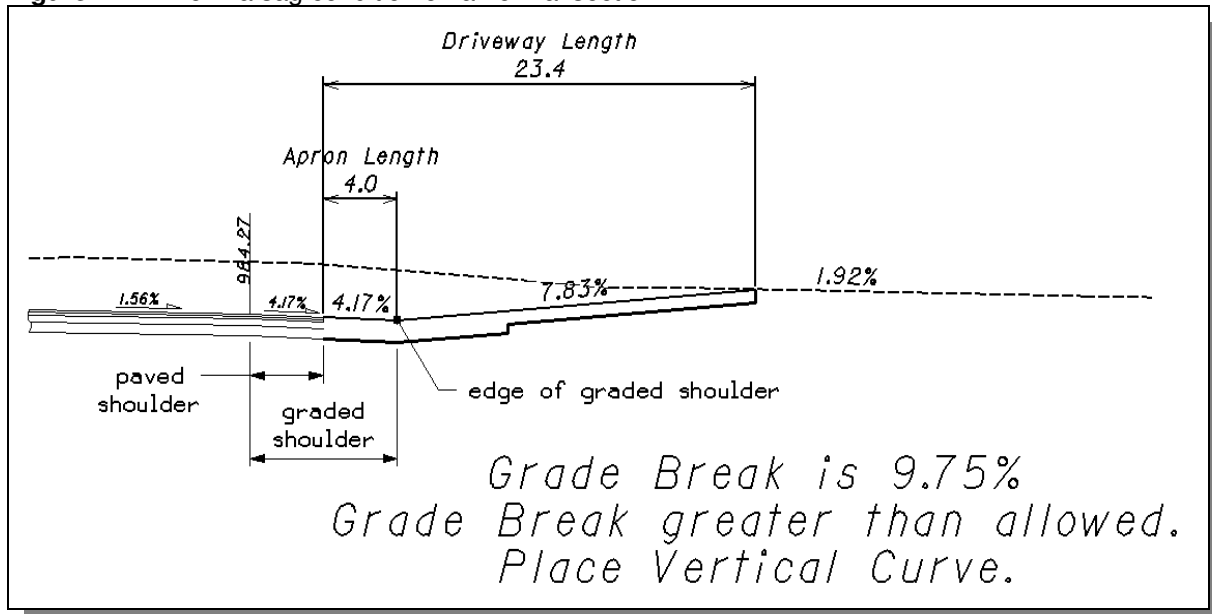
If the driveway slope does not intersect the existing ground within the maximum driveway length, the criteria file will place a segment of the driveway slope (-9.0 %) for the distance set by the **“minimum crest grade length”** (5.0 ft). At this point, the criteria file will test slopes starting with the previously placed slope (-9.0 %) until the **“maximum driveway grade”** slope value is reached. This is shown in Figure 13 above.

As mentioned in the previous section the criteria file can not place any vertical curves or rounding. If the grade break is larger than allowed, the designer must manually place any rounding that is required. Since the grade break shown in Figure 13 above is 10.80% (< 12.0% **“maximum sag grade break”**), the designer would not be required to place a vertical curve if this driveway profile is to be used.

**Drives in Sag Condition - Normal Section:**

Driveways in a sag condition are placed according to the Location and Design Manual, Volume One Figure 803-2, as shown from the right of the side walk. The drive profile initially slopes down and away from the treated (paved) shoulder at the same slope until it reaches the edge of graded shoulder. The driveway profile is then developed outside this point.

**Figure 14:** Drive in a sag condition on a normal section



The first slope placed will be based on the “**maximum sag grade break**” (the default is 12.0%) unless the value of “**preferred maximum driveway grade**” or “**maximum driveway grade**” is less than this value. In this case, the value of “**preferred maximum driveway grade**” or “**maximum driveway grade**” will be used instead.

In Figure 14 above, the treated shoulder slope is -4.17% and given the maximum sag grade break of 12.0%, the first allowable slope to be placed is +7.83% (-4.17% + 12.0% = +7.83%).

Driveway slopes will be placed within minimum grade lengths (in sag conditions the “**minimum sag grade length**” = 10 ft.).

In a sag condition, the criteria file will extend the first slope (+7.83% shown in Figure 14 above) to existing ground. If this slope is within the “**maximum driveway length**”, the criteria will draw this slope. If not, the criteria file will then place the first slope for the “**minimum sag grade length**”. From this location the criteria will place the first (or best) slope which intersects the existing ground within the “**maximum driveway length**”. If all slopes fail, up to the “**preferred maximum driveway grade**”, the criteria will place the “**maximum driveway grade**”.

The criteria file will determine the grade break between the proposed profile and the existing ground and place a note for reference on level 62. Since the grade break shown in Figure 14 above is 9.75% (> 8.0% “**maximum crest grade break**”), the designer would be required to place a vertical curve if this driveway profile is to be used.

The pavement buildup of the driveway is based on the graphical element in the design file placed at the back of the driveway.

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### Drives in Sag Condition - Superelevated Section:

Driveways in a sag condition on a superelevated section are placed the same as described in the Normal Section except it is likely there will be an additional grade segment placed. This grade segment will be determined from the adjoining shoulder slope.

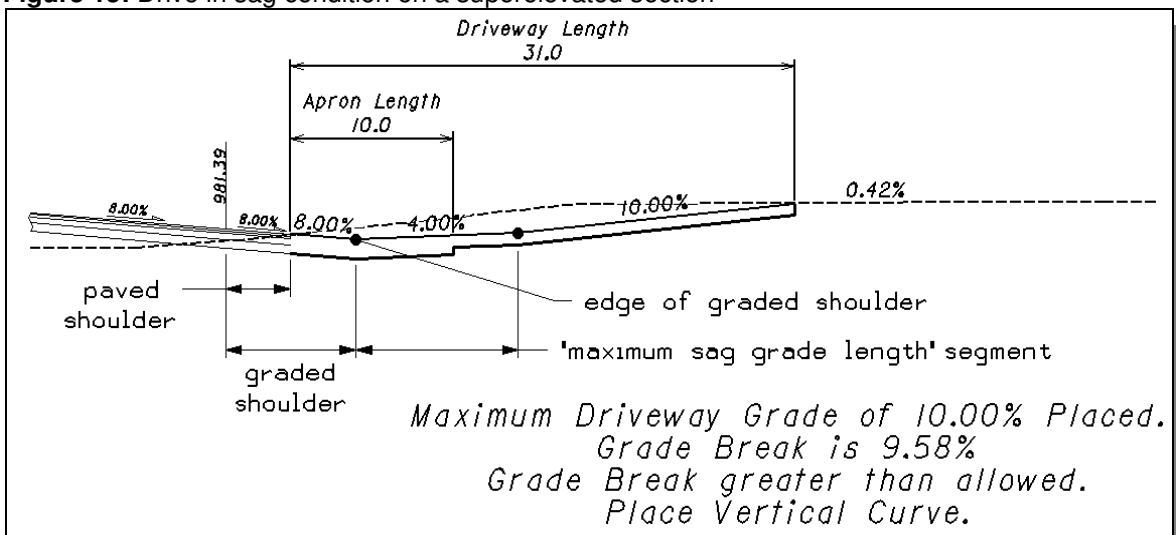
In the following example, the pavement cross slope is 8.0%. Since the pavement cross slope is greater than 4.17%, the shoulder will be placed with the rate of super (8.0%) as described in Figure 301-8 of the Location and Design Manual. The criteria file will determine the shoulder slope that was placed and will use this to determine the initial driveway slope to be used. The driveway slope is determined by using the shoulder slope and the value set by the variable “**maximum sag grade break**” as shown in the example below.

The following values were used to process the criteria for Figure 15 below:

“ <b>apron length</b> ”	= 10.0 ft	“ <b>maximum driveway grade</b> ”	= 10.0%
“ <b>maximum sag grade break</b> ”	= 12.0%	“ <b>maximum driveway length</b> ”	= 30.0 ft
“ <b>minimum sag grade length</b> ”	= 10.0 ft	shoulder slope placed	= -8.0%

driveway slope placed from the edge of graded shoulder in a sag condition  
= shoulder slope placed + “maximum sag grade break”  
= (-8.0%) + 12.0%  
= 4.0%

**Figure 15:** Drive in sag condition on a superelevated section



If the driveway slope does not intersect the existing ground within the maximum driveway length, the criteria file will place a segment of the driveway slope (+4.0%) for the distance set by the “**minimum sag grade length**” (10.0 ft). At this point, the criteria file will test slopes starting with the previously placed slope (+4.0%) until the “**maximum driveway grade**” slope value is reached. This is shown in Figure 15 above.

As mentioned in the previous sections the criteria file can not place any vertical curves or rounding. If the grade break is larger than allowed, the designer must manually place any rounding that is required. Since the grade break shown in Figure 15 above is 9.58% (> 8.0% “**maximum crest grade break**”), the designer would be required to place a vertical curve if this driveway profile is to be used.

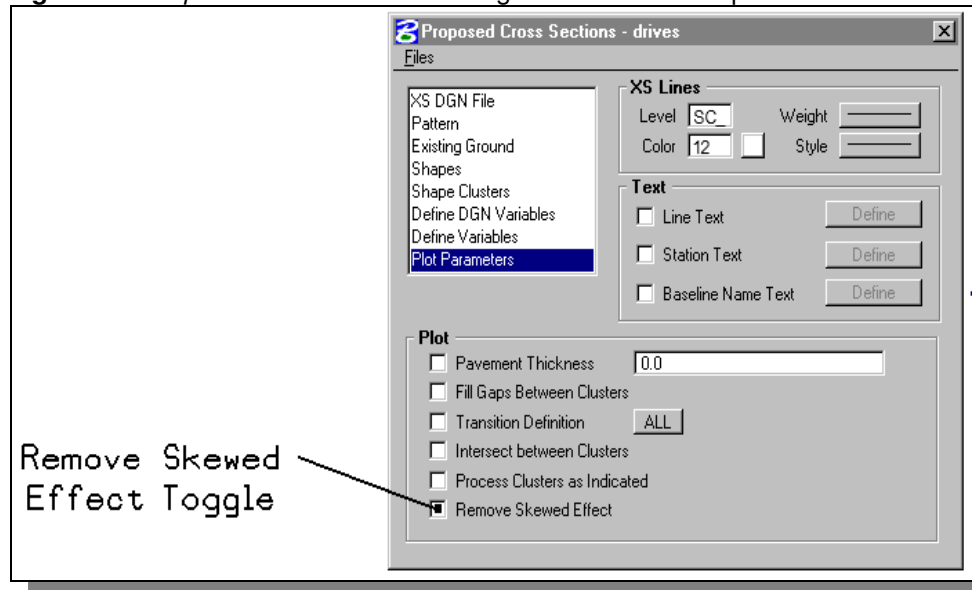
### Remove Skewed Effect:

The criteria file is hardcoded to always remove the skew effect. The discussion below explains the effects of the toggle on a section. **Important:** This toggle will have no effect on the processing of the criteria file. The

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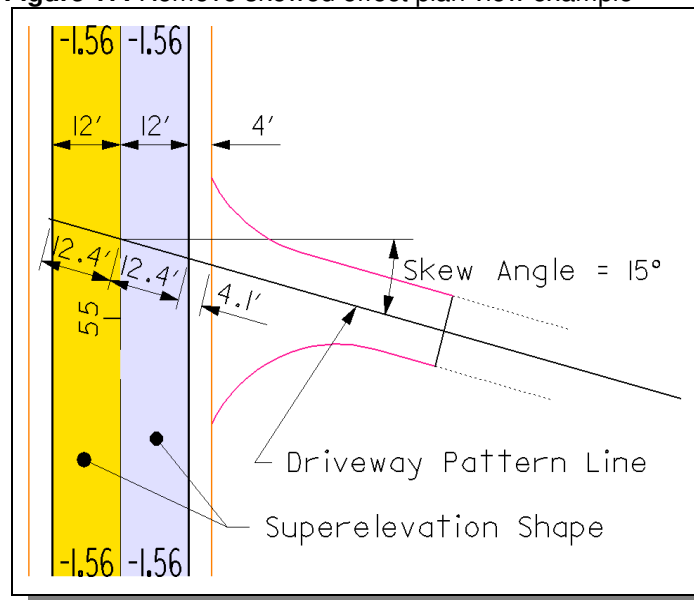
skew effect will ALWAYS be removed when processing. If the user does not shape the graded shoulder area on a skewed driveway, a note is placed in the design file informing the user to verify the slopes and elevations of the section.

**Figure 16:** Proposed Cross Section Dialog Plot Parameters option



GEOPAK draws proposed cross section elements sensitive to skew angles. Depending on the circumstances, the designer may not want to utilize this skew angle. The easiest explanation for this effect is an example.

**Figure 17:** Remove skewed effect plan view example

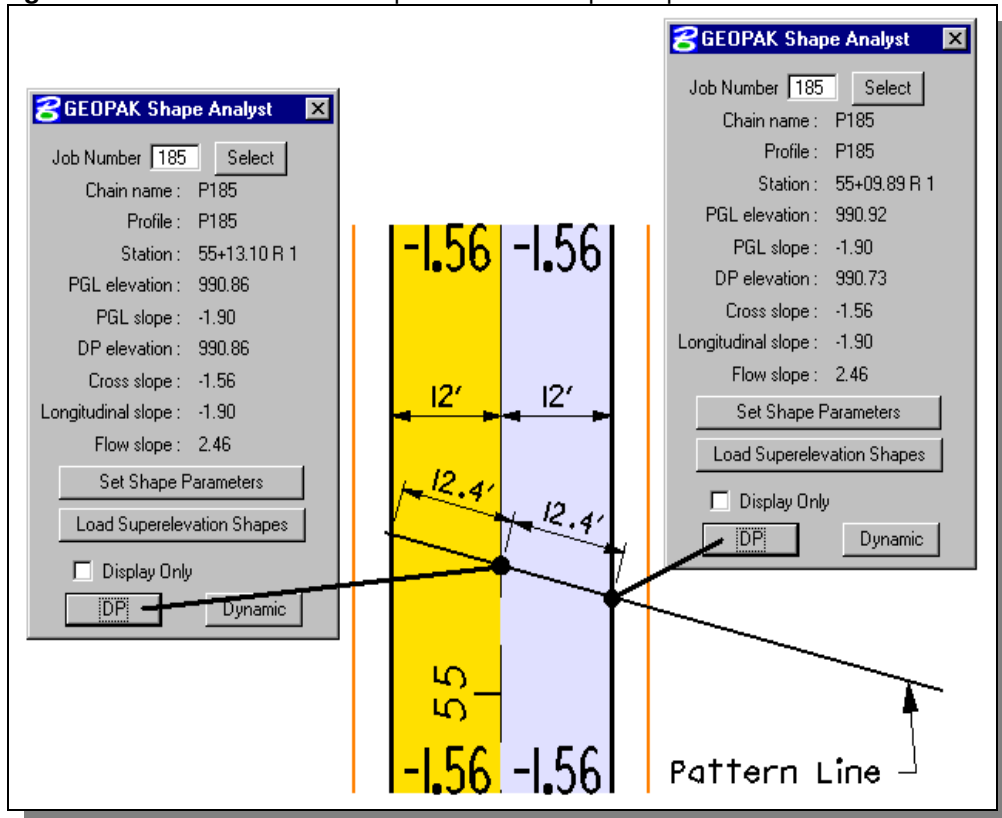


When the pattern line is skewed to a plan view element or the edge of a shape, GEOPAK determines the angle between the pattern line and the plan view element or shape edge as depicted in the graphic on the previous page. It will then utilize that angle when drawing subsequent criteria.

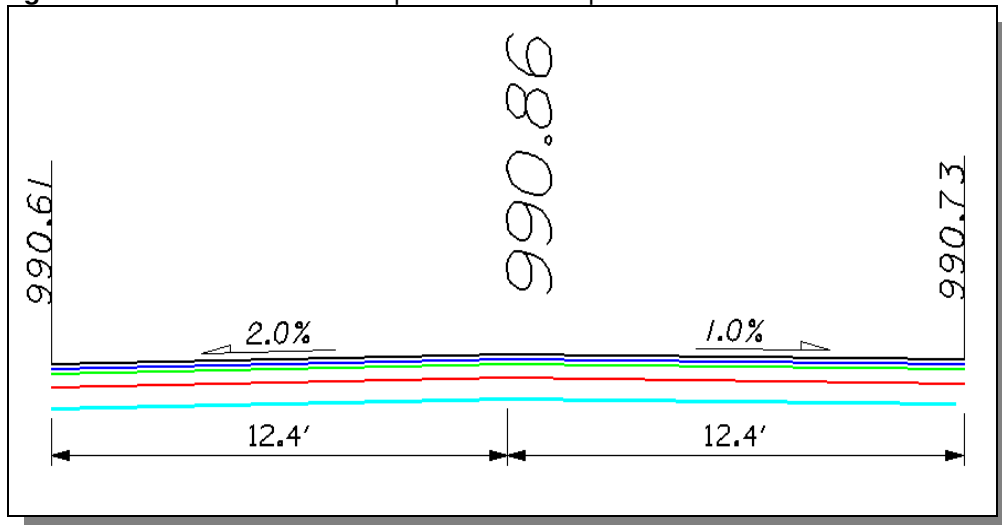
**Skew Effect Across the Superelevation Shapes**

In the above example, the criteria will use the superelevation shapes to determine the cross slope between the edges of the shape that the pattern line crosses. The software will use the shape parameters to determine the actual slope across the shape as shown below in Figure 18 and 19.

**Figure 18: Skew effect across superelevation shapes in plan view**



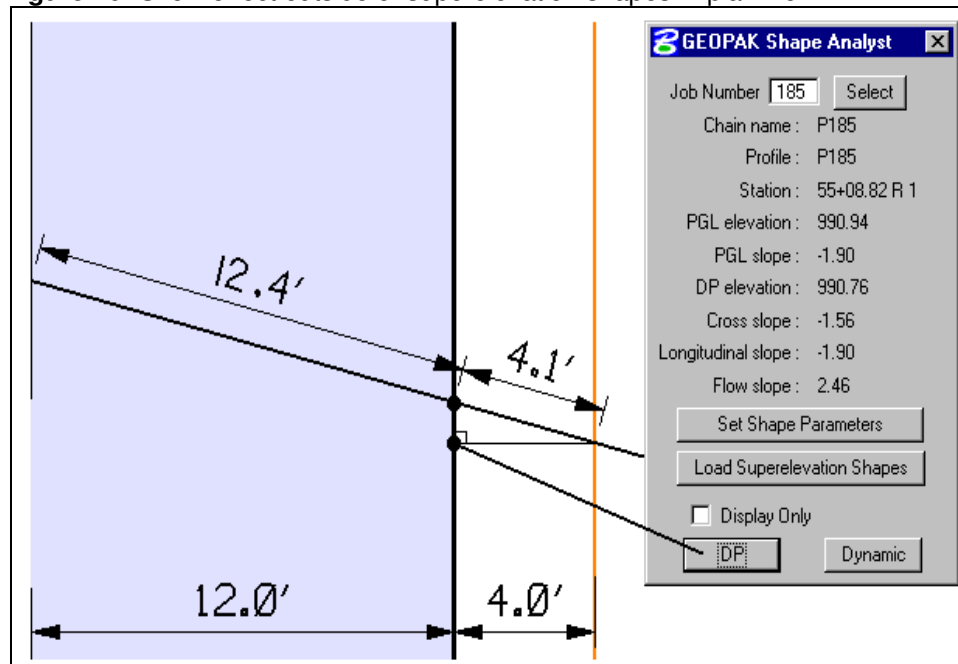
**Figure 19: Skew effect across superelevation shapes in cross section**



**Skew Effect Outside of the Superelevation Shapes**

In this example, if the criteria specifies drawing a 4.17% shoulder slope, GEOPAK will draw a flatter slope based on the degree of the skew angle. In this case, the cross section will be drawn accurately, as the 4.17% shoulder slope would assume being perpendicular to the edge of pavement. The problem is the software does not consider the profile of the roadway after the skew effect has been encountered. In this case, the skew effect is applied to the roadway as if the roadway is on the same horizontal plane (roadway profile grade = 0%). As a result, the shoulder slope shown in the cross section may differ from what is calculated by hand as shown below. This difference will be dependent on the value of the skew angle and the slope of the roadway. In our example with a skew angle of 15°, the shoulder slope should be 4.03% (= cosine 15° x 4.17%) when the **Remove Skewed Effect** is toggled off.

**Figure 20:** Skew effect outside of superelevation shapes in plan view



From the Roadway Data:

Elevation at Sta. 55+09.89, 12' Rt = 990.73  
 Elevation at Sta. 55+08.82, 12' Rt = 990.76  
 Shoulder Cross Slope = 4.17%  
 Shoulder Width = 4.0 ft

Elevation at edge of shoulder by hand calculation:  
 = 990.76 - [0.0417 x 4.0]  
 = 990.59

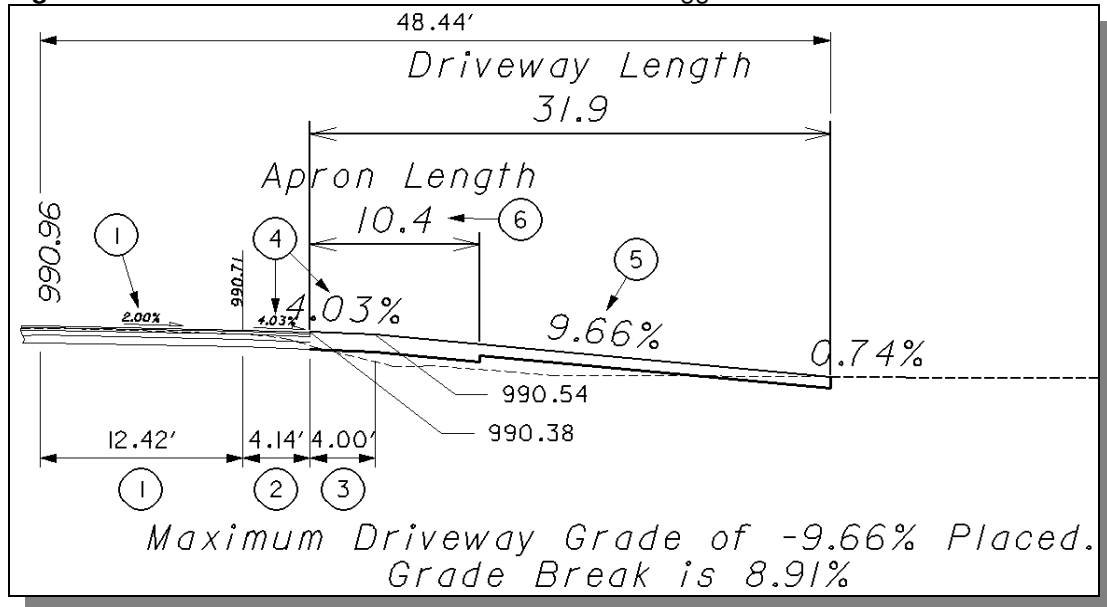
Shoulder Slope:  
 = [990.59 - 990.73] ÷ 4.0  
 = -0.035  
 = -3.50%

On the following page are the results from processing the proposed cross sections with the Remove Skew Effect Toggle On and with the Remove Skew Effect Toggle Off.

Remove Skewed Effect Toggled Off

Remove Skewed Effect

Figure 21: Cross section with Remove Skewed Effect Toggled Off



The following distances and slopes are not affected by the toggle being on or off:

- ① The distance and slope is obtained from the GEOPAK Roadway Shapes.
- ② The distance is obtained graphically from the plan view MicroStation element.

The following have the skew effect (15° angle) applied to the value when placed in the cross section:

- ③ This distance is determined from the following equation:  

$$= \text{"graded shoulder width lt"} - (x1 - x5)$$

$$= 8.0' - 4.14'$$

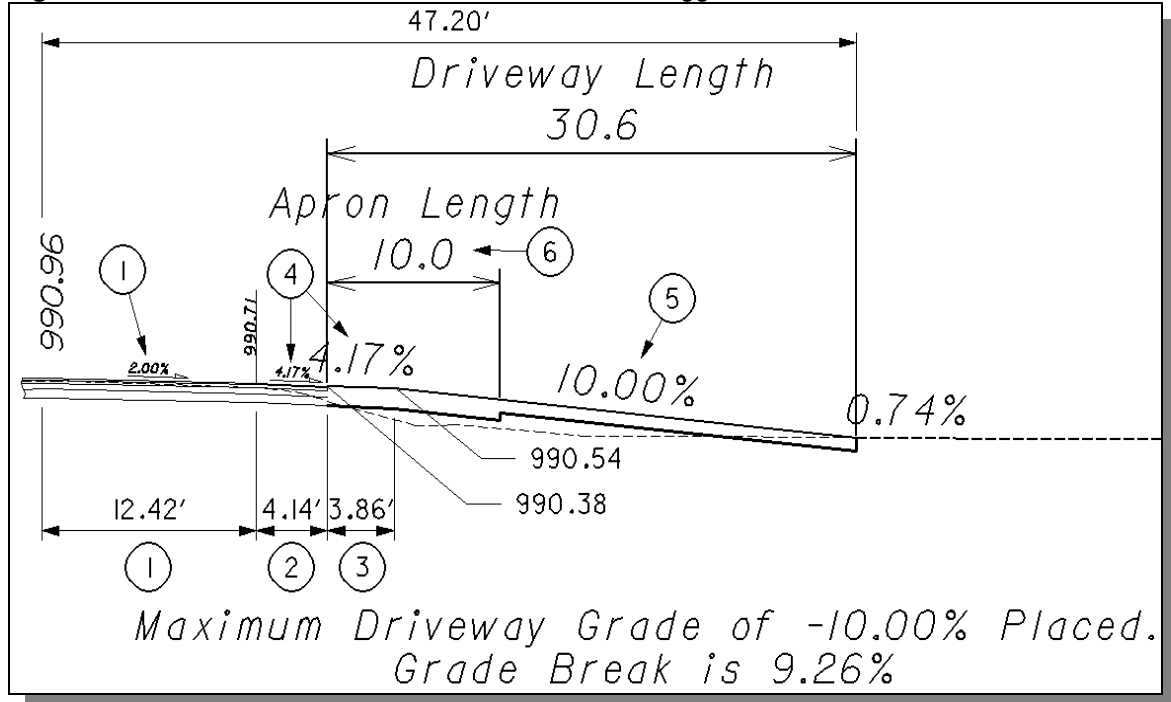
$$= 3.86'$$
 but with skew effect applied the value is 4.00' ( $= 3.86' \div \cos 15^\circ$ )
- ④ Shoulder slope = 4.17%  
 Skew effect applied when placed = 4.03% ( $4.17\% \times \cos 15^\circ$ )
- ⑤ "maximum allowable slope" = 10.00%  
 Skew effect applied when placed = 9.66% ( $10.00\% \times \cos 15^\circ$ )
- ⑥ "apron length" = 10.0'  
 Skew effect applied when placed = 10.4' ( $10.0' \div \cos 15^\circ$ )



Remove Skewed Effect Toggled On

Remove Skewed Effect

Figure 22: Cross section with Remove Skewed Effect Toggled On



The following distances and slopes are not affected by the toggle being on or off:

- ① The distance and slope is obtained from the GEOPAK Roadway Shapes.
- ② The distance is obtained graphically from the plan view MicroStation element.

The following do not have the skew effect (15° angle) applied to the value when placed in the cross section:

- ③ This distance is determined from the following equation:  

$$= \text{"graded shoulder width } l'' - (x1 - x5)$$

$$= 8.0' - 4.14'$$

$$= 3.86'$$
- ④ Shoulder slope = 4.17%
- ⑤ "maximum allowable slope" = 10.00%
- ⑥ "apron length" = 10.0'

As you can see from Figures 21 and 22, the graded shoulder slopes do not match what was calculated by hand on page 23.

If the driveway intersection angle is something other than perpendicular (90°) to the centerline, this toggle becomes important. If toggled on, the criteria will place the driveway as if it is perpendicular to the chain and it will ignore the skew angle of the pattern lines. In other words, the criteria will "force" the section to be placed as if it were perpendicular (90°) to the centerline chain.

If you require the actual lengths of the driveway, then toggle the **Remove Skewed Effect** to off. The driveway

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will be drawn according to the driveway intersection angle it was created with.

**In both cases, the slopes outside of the GEOPAK shapes will be inaccurate in areas within the graded shoulder limits. For this reason, the criteria file has been hardcoded to always remove the skew effect.**

An option is available to obtain accurate distance and slope information within the graded shoulder limits. This option is to place GEOPAK shapes within the graded shoulder limits. This option is discussed in the following section.

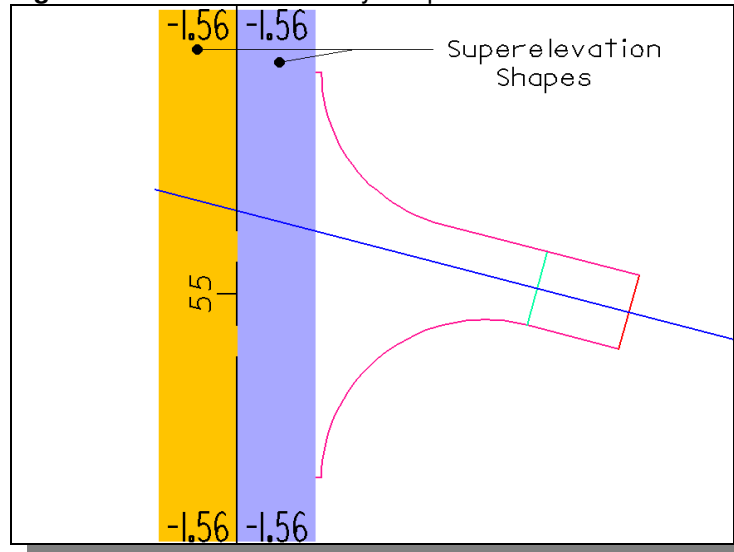
### Shaping the Graded Shoulder Area

The process to obtain the actual slope across the graded shoulder area when processing driveways with the DWY\_UNCB.X criteria file is place a shape(s) across this area. To do this, the designer can use the GEOPAK Shape Maker tool as outlined below. To use the DWY\_UNCB.X, the sections noted as **CRUCIAL** must be followed exactly as described or the criteria file may process incorrectly.

The designer must create a GEOPAK shape that will provide the software with the cross slope information for the driveway in the graded shoulder area. You can use the GEOPAK Shape Maker tool to place this shape as described below.

### GEOPAK Shape Maker Tool Process:

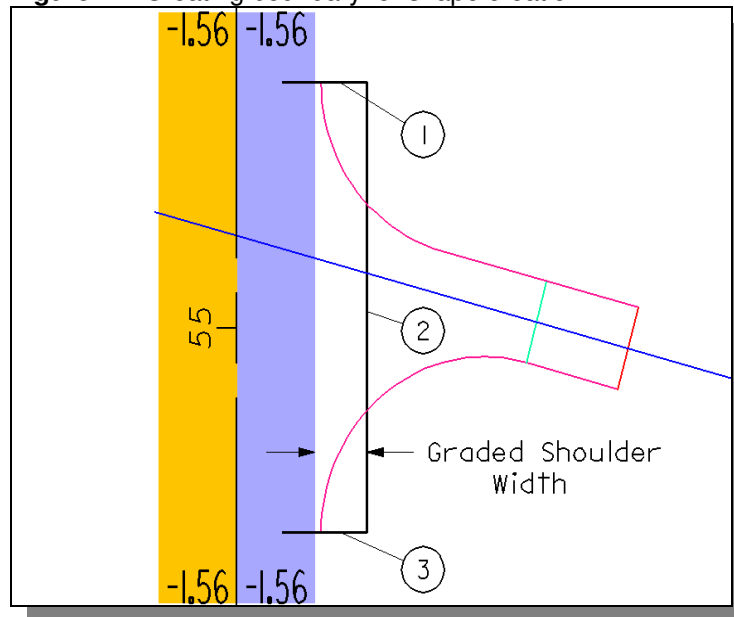
Figure 23: GEOPAK Roadway Shapes at drive location



The first step is to create the boundary of the shape in the MicroStation design file containing the Roadway GEOPAK shapes. The shaping of the graded shoulder will be placed on the driveway example previously described. Beginning with the driveway shown in Figure 23, the following MicroStation lines 1, 2 and 3 have been added as shown in Figure 24.

The location is not important as long as both longitudinal edges of the shape are crossed by the driveway pattern line. It is not necessary to place a line at the edge of pavement location if there is an adjoining shape at this location. The software will use the existing shape edge as the fourth boundary of the new shape.

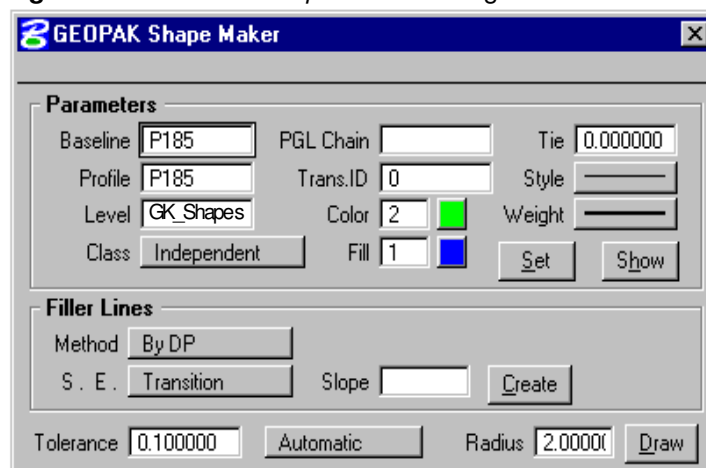
Figure 24: Creating boundary for shape creation



**CRUCIAL:** The driveway pattern line must cross both longitudinal edges of the graded shoulder shape or the criteria file will not process correctly.

The **Shape Maker** tool is invoked by pulling down **Applications > GEOPAK Road > Cross Sections > Shape Maker** or from the *Project Manager* dialog under **Superelevation Shapes**. The following dialog box will appear.

Figure 25: GEOPAK Shape Maker Dialog

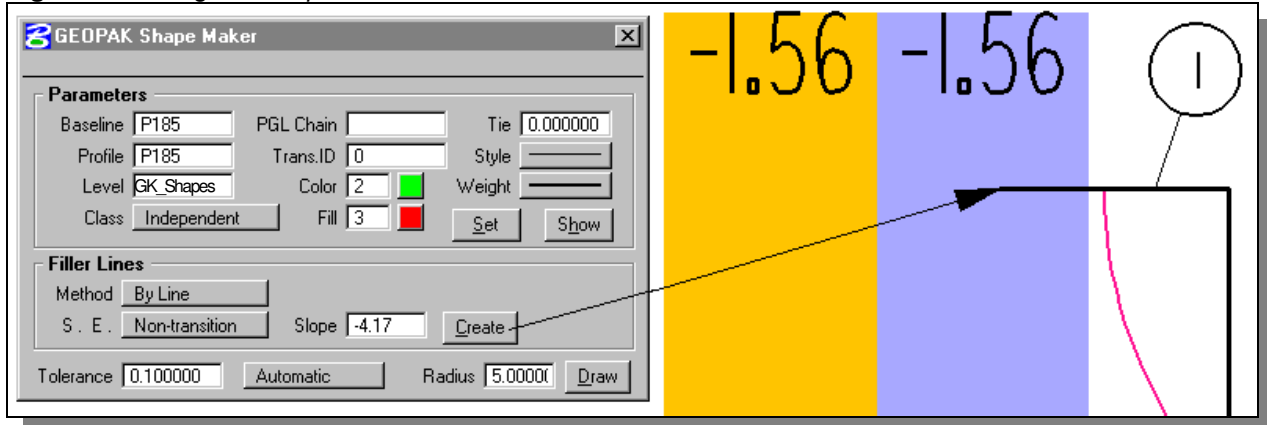


This example will step you through creating a shape in the graded shoulder area. It is not intended to detail the **Shape Maker** tool and its parameters. A detailed description of this tool and Superelevation Shapes are available via the GEOPAK on-line help. Select **Applications > GEOPAK Road > Help > Cross Sections and Earthworks**.

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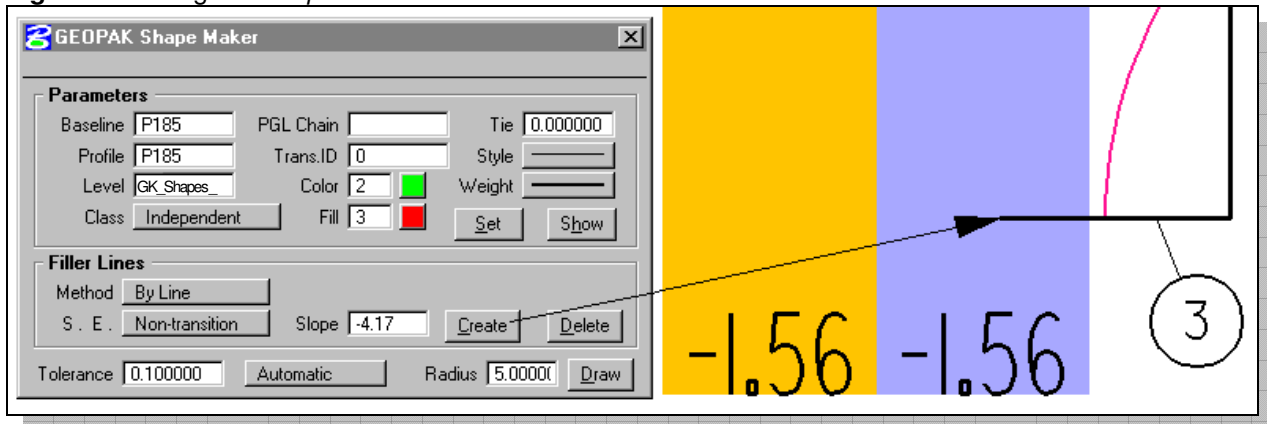
First, the dialog is set as shown in Figure 26. Next, select the **Create** button and choose line 1 as the first filler line in the shape creation process.

**Figure 26:** Using the *Shape Maker* tool to create the first filler line

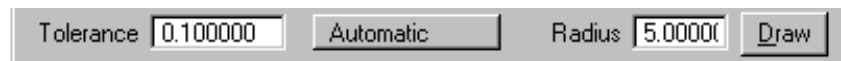


The dialog will update as shown in Figure 27. Since this area of graded shoulder will have the same cross slope (Non-transition) throughout the driveway, it is not necessary to select line number 3 shown. In this example though, the **Create** button was selected and the line number 3 is picked.

**Figure 27:** Using the *Shape Maker* tool to create the second filler line

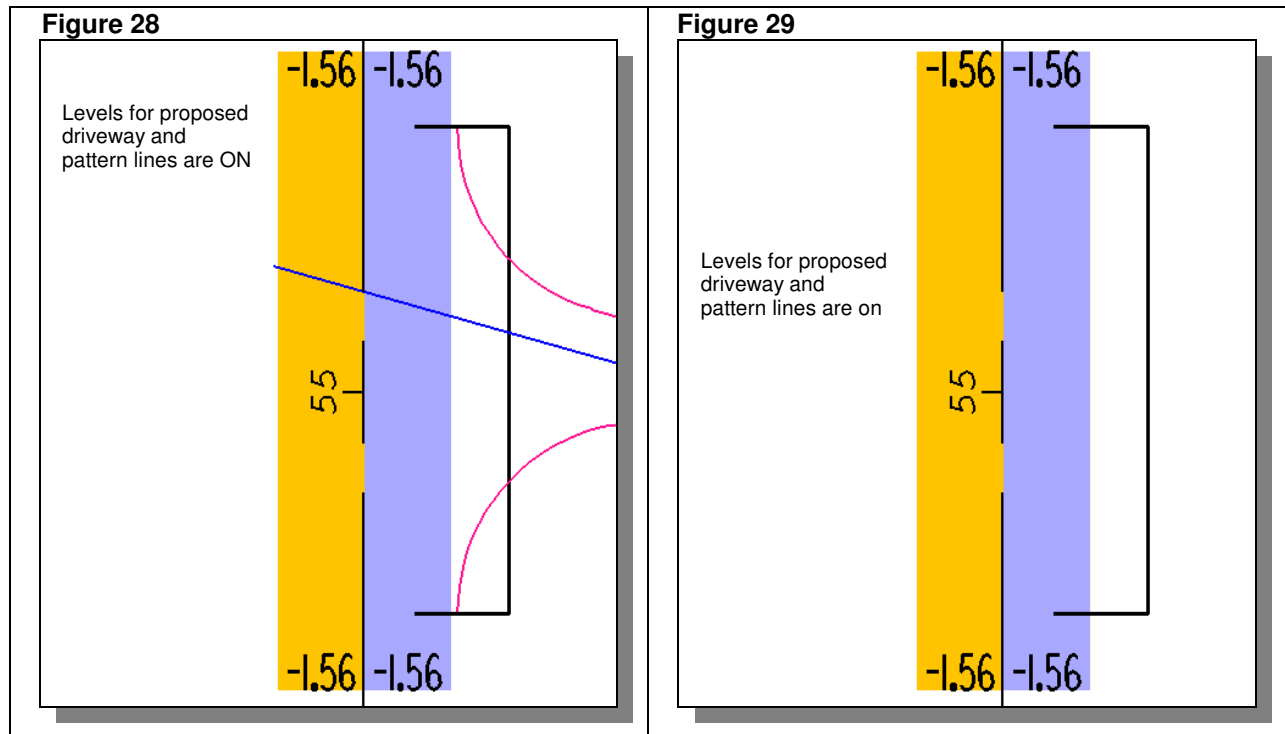


Once the Filler Lines have been created, the next step is to draw the GEOPAK shape. This is accomplished by using the bottom of the Dialog box as shown below. There are different modes available to create the shape but in this example it will be done using the Automatic mode.



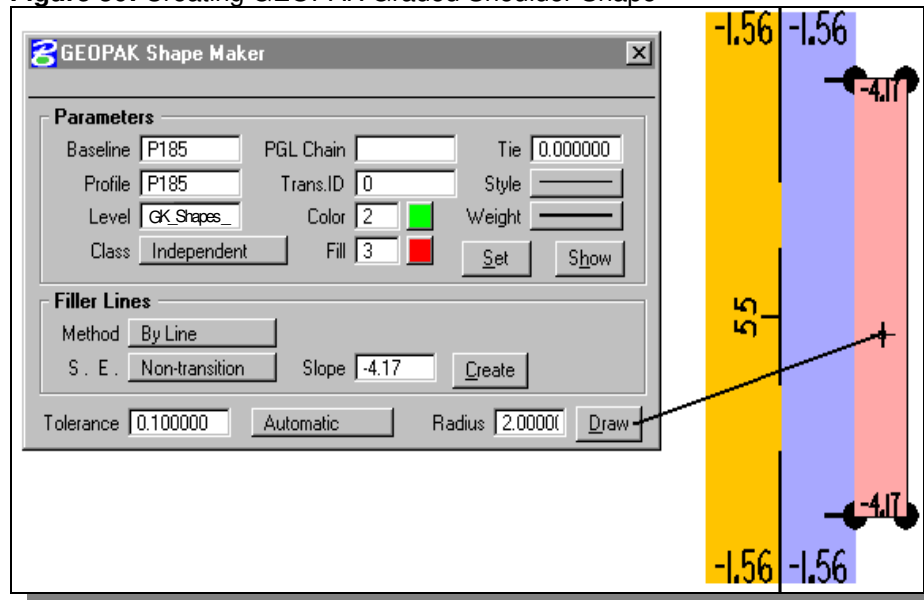
**CRUCIAL:** Prior to creating the shape, make sure all unneeded MicroStation lines are not present before proceeding. Figure 28 below left shows the driveway as it looks initially with the driveway graphics and pattern line. Figure 29 below right shows the same driveway as it should look when creating the GEOPAK shape. Notice how the driveway lines have been turned off (design file and/or reference file levels) and what remains is the actual outline of the shape to be created. If these lines were not turned off, the software would not be able to create the shape as desired.

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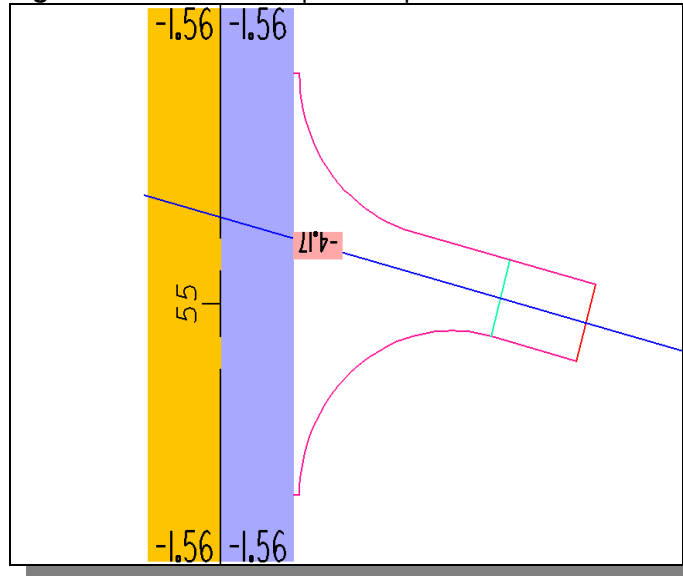
Once the design file is set as shown in Figure 30, select the **Draw** button on the lower right corner of the dialog. Select a data point within the shape area and accept. The shape will be created as shown in Figure 30 below.

Figure 30: Creating GEOPAK Graded Shoulder Shape



**CRUCIAL:** The shape in Figure 30 was created at the limits of the driveway. The shape created for the graded shoulder does not need to be this large. As long as the pattern line for the driveway crosses both edges of the shape the criteria file will process correctly. The shape could be as small as shown in Figure 31.

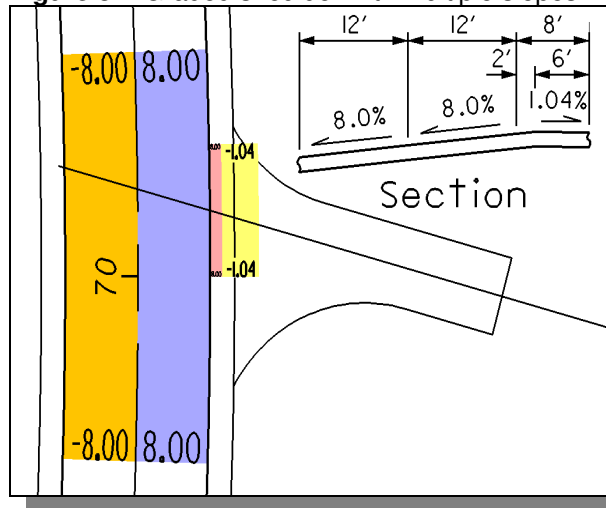
Figure 31: Minimum shape example



**CRUCIAL:** The criteria file will read the shape and use this information when processing the cross section. The criteria file will use this shape in determining the slope within the graded shoulder area. The location of the edge of the graded shoulder shaped will be used as the starting point for the driveway profile and **WILL ALWAYS BE CONSIDERED TO BE THE EDGE OF GRADED SHOULDER.**

**Important:** If the design requires the graded shoulder area to contain multiple slopes the designer must place GEOPAK Shapes for all of these areas. Two examples of this would be (1) one slope for the paved shoulder width and one for the untreated shoulder area or (2) on the high side of superelevation when the shoulder contains a shoulder break. An example of this is shown below in Figure 32. The criteria file will use the slope determined from the last shape encountered to determine the beginning driveway slope

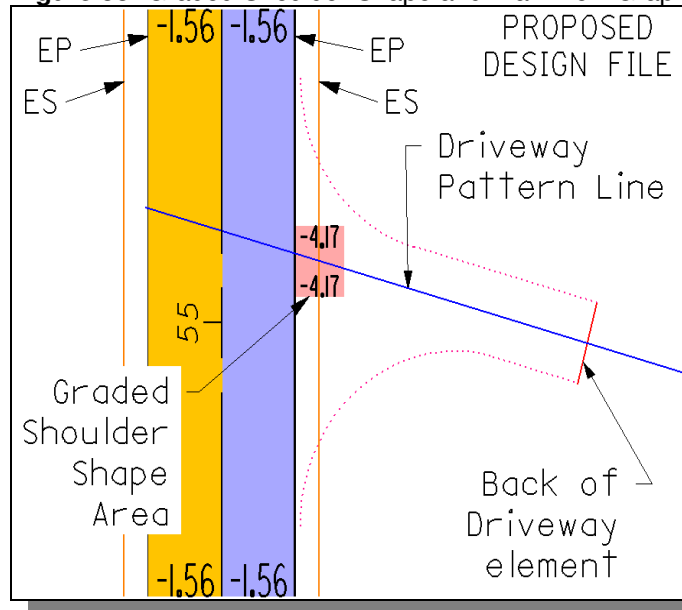
Figure 32: Graded shoulder with multiple slopes



## Processing the cross section with the graded shoulder shaped:

Before the user can process the driveway section with the graded shoulder shaped, the proposed basemap must be checked to ensure that there are no edge of pavement and edge of shoulder graphics outside of the GEOPAK Roadway and Graded Shoulder Shapes. If the graphics are inside or at the same location of the shapes as shown in Figure 33, the user should be okay to process the proposed cross section run.

**Figure 33: Graded Shoulder Shape and Plan View Graphics**



If the graphics are outside of the last GEOPAK shape, the user must manually remove a segment of the MicroStation graphics across the pattern line location. This can be accomplished by using the MicroStation Delete Part of Element tool.

### Define Variables

---

The following variables must be defined by the user before processing.

**“graded shoulder width lt”**

This variable defines the graded shoulder width to be used without barrier or foreslope is less than (lt) or equal to 6:1. See Figure 301-7 Graded and Treated Shoulder Widths for the usage of this variable. For recommended dimensions for this variable, see Figure 301-3 under the Graded Width Without Barrier, 6:1 or Flatter Foreslope column.

**“graded shoulder width gt”**

This variable defines the graded shoulder width to be used with barrier or foreslope is greater than (gt) 6:1. See Figure 301-7 Graded and Treated Shoulder Widths for the usage of this variable. For recommended dimensions for this variable, see Figure 301-3 under the Graded Width With Barrier or Foreslope Steeper Than 6:1 column.

**“paved shoulder width”**

This variable defines the paved (treated) portion of the graded shoulder width. This variable will only be used in cases where the graded shoulder area is shaped. If no shapes exist in the graded shoulder area, the graphical element representing the edge of shoulder will be used and this variable will be ignored.

The following variables have been assigned default values as noted below. If you wish to change the default values, you will need to modify the value of the variable in the cross section run.

### Design File Variables

**“PROPOSED DGN FILE NAME”**

**“XS DGN FILE NAME”**

These variables are used by the DEFINE\_DGN variables to identify the base map MicroStation design file that contains the existing, proposed, and cross section graphics. The default value for each variable has been defined using a relative path as follows:

```
define "PROPOSED DGN FILE NAME" ..\roadway\basemaps\nnnnnBP###.dgn
define "XS DGN FILE NAME" ..\roadway\basemaps\nnnnnXC###.dgn
```

By default GEOPAK will look for design files in the Working Directory assigned for the project. Using the directory structure defined in the [ODOT CADD Engineering Standards Manual](#), Section 302, Project Directory Structure, the GEOPAK Working Directory should be defined as the `geopak` folder.

The “.” syntax will instruct GEOPAK to look for the proposed design file by starting in the Working Directory, and then go up the project folder path one directory. From there, go into the `\roadway\basemaps` folder to find the file.

The name of the design file must be edited to reflect the name of the plan view design file for your project. See the [ODOT CADD Engineering Standards Manual](#), Section 304 File Naming Conventions for design file names.



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### “apron length”

This variable defines the apron length of the driveway, measured from the edge of shoulder, as shown in Figure 34 on page 33. The default value is 0.

The apron length to be placed in the cross section can also be set by placing a graphical line at the limit of the apron length in the proposed plan view MicroStation design file (for more information on the graphical line to be used please see the **DEFINE\_DGN VARIABLE** section under the define\_dgn variable “~back of apron” on page 37).

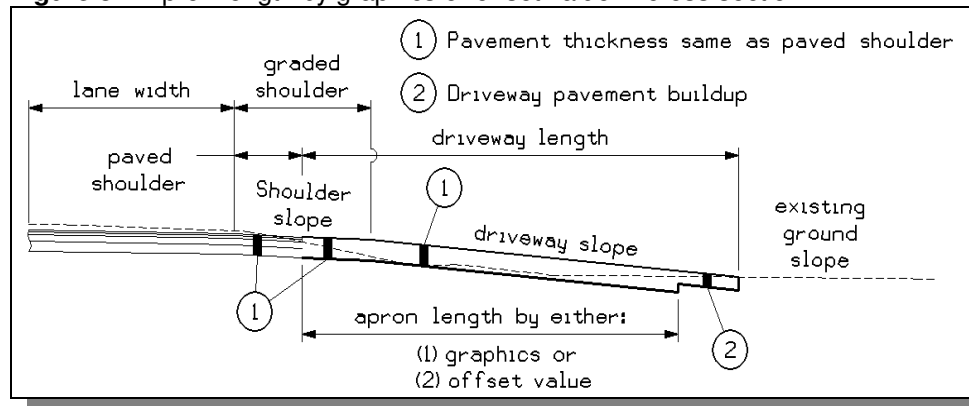
During placement of the apron length, the criteria file will first determine if there is a graphic placed in the proposed design file matching the symbology of the “~back of apron” DEFINE\_DGN variable. If no graphic is found the criteria file will use the value set by the variable “apron length” to draw the width in the cross section. See Figures 34 and 35 on the following pages for the usage of this variable.

If a distance of 0 is given, the criteria will use the edge of the graded shoulder as the limit of the apron.

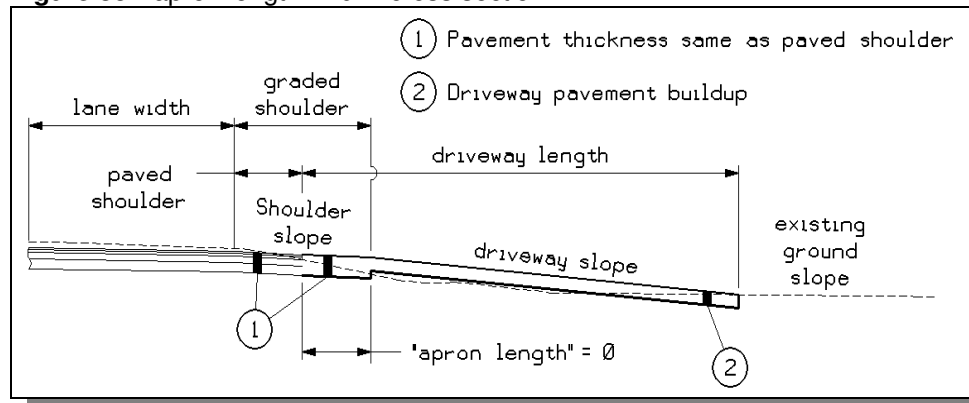
Please note: if a value is given, this value will be used for every driveway that does not have a graphic. To set each driveway apron length individually, the user must place a graphical element at these locations.

The apron will be constructed with the same thickness as the paved shoulder, as shown in Figures 34 and 35 below.

**Figure 34:** Apron length by graphics or offset value in cross section



**Figure 35:** “apron length” = 0 in cross section



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### “maximum crest grade break”

This variable defines the maximum allowable crest grade break for driveway profiles for both residential and commercial drives. The value is entered as percent. The default value is 8.

### “minimum crest grade length”

This variable defines the minimum allowable crest grade length for driveway profiles in crest conditions for both residential and commercial drives. The default value is 5 ft.

### “maximum sag grade break”

This variable defines the maximum allowable sag grade break for driveway profiles for both residential and commercial drives. The value is entered as percent. The default value is 12.

### “minimum sag grade length”

This variable defines the minimum allowable sag grade length for driveway profiles in sag conditions for both residential and commercial drives. The default value is 10 ft.

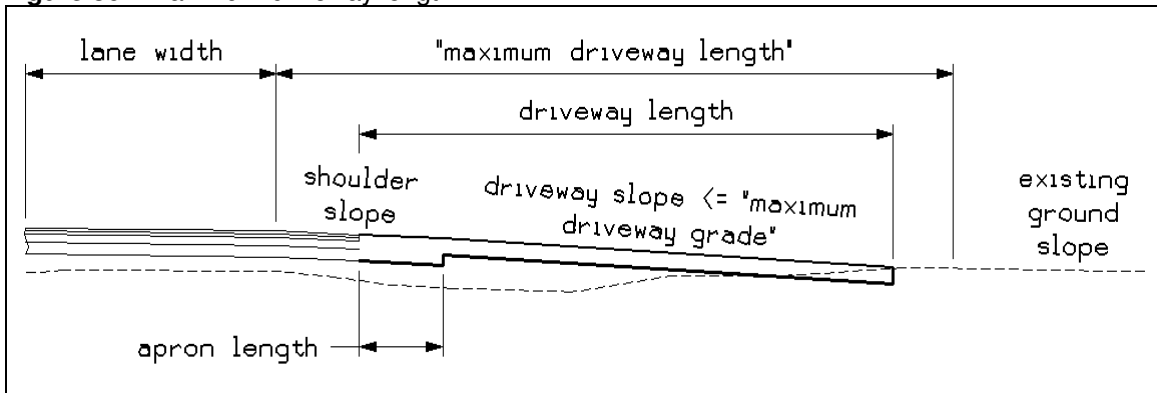
### “maximum driveway grade”

This variable defines the absolute maximum allowable grade for both residential and commercial driveway profiles. See the Location and Design Manual, Volume One, Roadway Design, Section 804.1. The value is entered as percent. The default value is 10. This slope will be placed if all other driveway slopes, including “preferred maximum driveway grade”, fail to be placed within the “maximum driveway length”. See Figures 37 and 38.

### “maximum driveway length”

This variable is used to define the maximum length of the driveway that will be drawn, as long as the driveway slope to be placed is less than or equal to the value of “maximum driveway grade”. The length is measured from the edge of pavement as shown in Figure 36 below. The default value is 30 ft.

Figure 36: “maximum driveway length”



In order to define the maximum driveway length, the criteria file will first determine if there is a graphic placed in the proposed design file matching the symbology of the “~maximum driveway length in dgn” DEFINE\_DGN variable. If no graphic is found the criteria file will use the value set by the variable “maximum driveway length”.

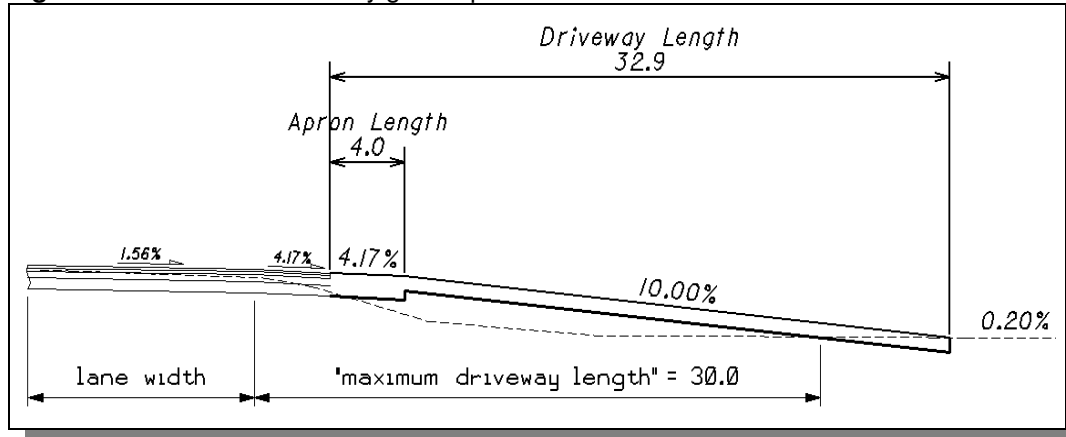
The criteria file will place the best driveway slope that intersects existing ground within this maximum length. If the criteria file cannot place a driveway using a slope less than the value of “maximum driveway grade” within the limits of the maximum driveway length, the criteria file will attempt to place a driveway using the “maximum driveway grade” until it intersects existing ground. In this case, the maximum driveway length is ignored. Consider Figure 37 on page 38. The following values were used to process the criteria for Figure 37 and 38 on the following page:

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**“maximum driveway grade”** = 10  
**“preferred maximum driveway grade”** = 8  
**“maximum driveway length”** = 30.0

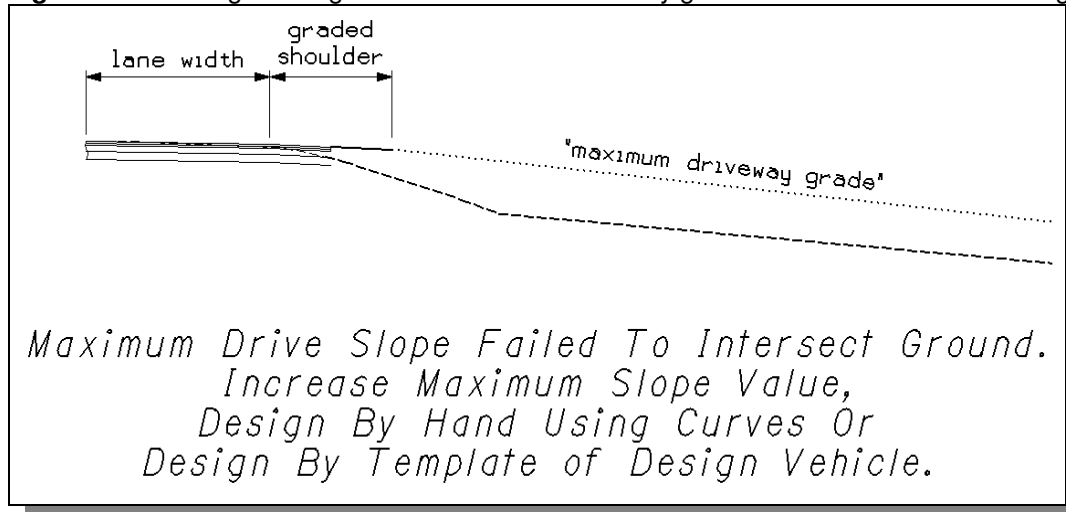
In this case, the criteria was unable to place a driveway using a slope less than the preferred value of 8% within the limits of the maximum driveway length. The driveway was placed using the maximum driveway grade of 10% ignoring the location of the maximum driveway length.

**Figure 37:** “maximum driveway grade” placed in the cross section



If the **“maximum driveway grade”** of 10% does not intersect existing ground, the user is notified that the driveway must be designed manually using vertical curves. An example of this case is shown in figure 38.

**Figure 38:** Warning message when “maximum driveway grade” does not intersect existing ground



### **“preferred maximum driveway grade”**

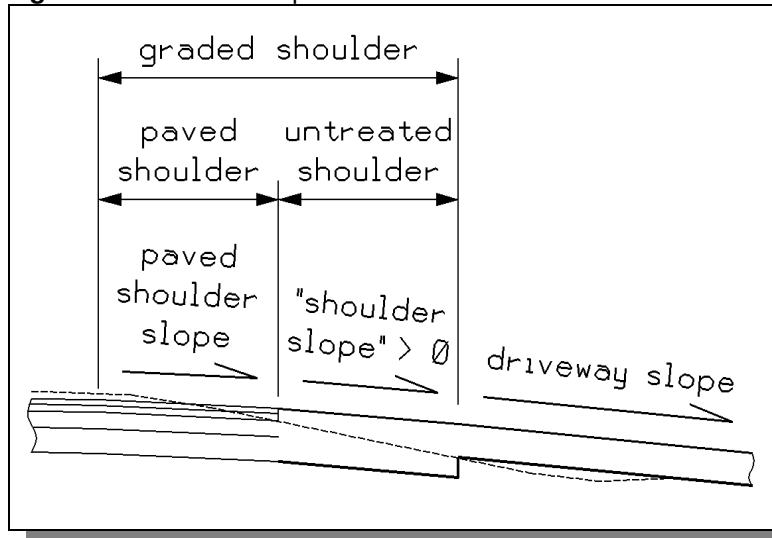
This variable defines the preferred maximum allowable grade for driveway profiles under normal conditions for both residential and commercial drives. See the Location and Design Manual, Volume One, Roadway Design, Section 804.1. The value is entered as percent. The default value is 8. This slope will be used if it can be placed within the limits of the **“maximum driveway length”**. If this slope cannot be placed within the **“maximum driveway length”**, the criteria will place the driveway slope using the **“maximum driveway grade”**. See Figure 37 and 38.

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### “shoulder slope”

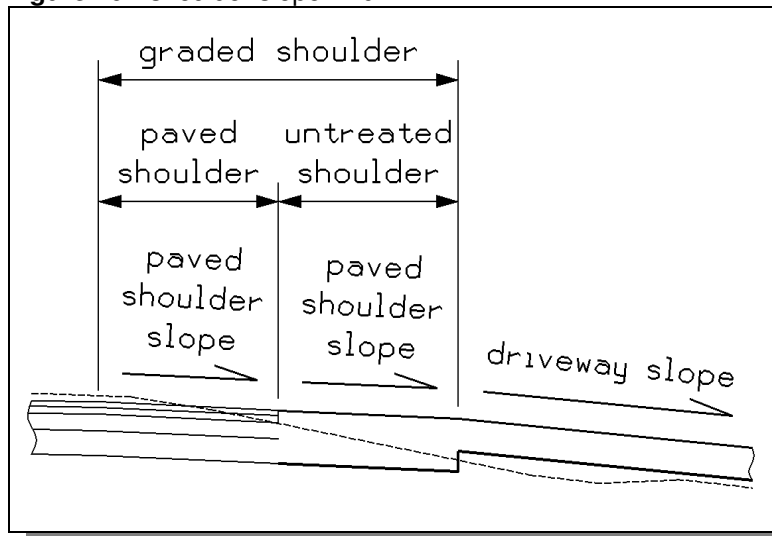
This variable is used to define the shoulder slope, in percent, that will be placed for the untreated portion of the graded shoulder as shown on Figure 39 below. The default value is zero (0).

**Figure 39:** “shoulder slope” set to a value > 0



Processing Note: When the value is set to the default of zero, the criteria file will draw the untreated shoulder using the same slope as the paved shoulder as shown in Figure 40. If the designer wishes to force the untreated shoulder slope to be a fixed value, for example 8%, modify the value of this variable to reflect the change.

**Figure 40:** “shoulder slope” = 0



### “user defined thickness commercial”

The criteria will draw the pavement buildup for the proposed driveway according to the Location and Design Manual, Volume 1, Section 805. The pavement buildup for each driveway is determined by the symbology of the back of driveway line. If the pattern line crosses a back of driveway line meeting the symbology for the DEFINE\_DGN variable “~commercial buildup user”, the pavement buildup for the driveway will be drawn using the value of “user defined thickness commercial”. The value is entered as feet. The default value is

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1.5. See the **Define\_DGN Variables** section for more information.

### “user defined thickness residential”

The criteria will draw the pavement buildup for the proposed driveway according to the Location and Design Manual, Volume 1, Section 805. The pavement buildup for each driveway is determined by the symbology of the back of driveway line. If the pattern line crosses a back of driveway line meeting the symbology for the DEFINE\_DGN variable “**~residential buildup user**”, the pavement buildup for the driveway will be drawn using the value of “**user defined thickness residential**”. The value is entered as feet. The default value is 1.0. See the **Define\_DGN Variables** section for more information.

---

## Define DGN Variables

---

The following DEFINE\_DGN variables are used by the criteria to locate the MicroStation elements that FILENAME.X will search for in order to draw the

These variables have been defined with the values listed below in accordance with ODOT standards and should never be redefined by the user.

Additionally, these variables have been defined as “hidden” variables and will not show up in the DEFINE\_DGN Variables portion of the Proposed Cross Sections dialog box when preparing a criteria run.

### “~back of apron”

This variable is used to define the symbology for the MicroStation element representing the proposed back of apron for the driveway. This is the graphical representation of the define variable “**apron length**”. This variable has been defined as follows:

```
define_dgn "~back of apron" \  
dgn = "proposed dgn file name" \  
lvname = PV_P_Driveway \  
co = 10
```

The criteria will look in the file specified by the define variable “**proposed dgn file name**” for the elements that represent the “**~back of apron**”.

It is not necessary to draw a line representing the back of apron in the plan view design file. If the pattern line for the driveway does not intersect a back of apron line, the value of “**apron length**” will be used to draw the apron.

### “~maximum driveway length in dgn”

This variable is used to define the symbology for the MicroStation element representing the maximum driveway length at the back of the driveway. This is the graphical representation of the define variable “**maximum driveway length**”. This variable has been defined as follows:

```
define_dgn "~maximum driveway length in dgn" \  
dgn = "proposed dgn file name" \  
lvname = PV_P_Driveway \  
co = 11
```

The criteria will look in the file specified by the define variable “**proposed dgn file name**” for the elements that represent the “**~maximum driveway length in dgn**”.

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It is not necessary to draw a line representing the maximum back of driveway in the plan view design file. If the pattern line for the driveway does not intersect a maximum back of driveway line, the value of “**maximum driveway length**” will be used.

### “~commercial buildup a”

This variable is used to define the symbology for the back of driveway element as shown in Figure 9. If the pattern line for the driveway crosses a MicroStation line meeting the symbology for “~commercial buildup a”, the driveway will be drawn using pavement buildup A for a commercial driveway as defined in the Location and Design Manual, Volume 1, Section 805.3 as follows:

Layer	Thickness, ft	Material
1	0.6667 (8 in.)	Item 452 Plain Portland cement concrete

The symbology for this variable has been defined as follows:

```
define_dgn "~commercial buildup a" \  
dgn = "proposed dgn file name" \  
lvname = PV_P_Driveway\  
co = 16
```

The criteria will look in the file specified by the define variable “**proposed dgn file name**” for the elements that represent the back of driveway for “~commercial buildup a”.

### “~commercial buildup b”

This variable is used to define the symbology for the back of driveway element as shown in Figure 9. If the pattern line for the driveway crosses a MicroStation line meeting the symbology for “~commercial buildup b”, the driveway will be drawn using pavement buildup B for a commercial driveway as defined in the Location and Design Manual, Volume 1, Section 805.3 as follows:

Layer	Thickness, ft	Material
1	0.1042 (1 ¼ in.)	Item 404 Asphalt Concrete
2	0.1458 (1 ¾ in.)	Item 402 Asphalt Concrete
3	0.6667 (8 in.)	Item 304 Aggregate Base

This variable has been defined as follows:

```
define_dgn "~commercial buildup b" \  
dgn = "proposed dgn file name" \  
lvname = PV_P_Driveway\  
co = 17
```

The criteria will look in the file specified by the define variable “**proposed dgn file name**” for the elements that represent the back of driveway for “~commercial buildup b”.

### “~commercial buildup c”

This variable is used to define the symbology for the back of driveway element as shown in Figure 9. If the pattern line for the driveway crosses a MicroStation line meeting the symbology for “~commercial buildup c”, the driveway will be drawn using pavement buildup C for a commercial driveway as defined in the Location and Design Manual, Volume 1, Section 805.3 as follows:

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Layer	Thickness, ft	Material
1	0.1042 (1 ¼ in.)	Item 404 Asphalt Concrete
2	0.3958 (4 ¾ in.)	Item 301 Bituminous Aggregate Base

This variable has been defined as follows:

```
define_dgn "~commercial buildup c" \  
dgn = "proposed dgn file name" \  
lvrname = PV_P_Driveway\  
co = 18
```

The criteria will look in the file specified by the define variable **"proposed dgn file name"** for the elements that represent the back of driveway for **"~commercial buildup c"**.

### **"~commercial buildup d"**

This variable is used to define the symbology for the back of driveway element as shown in Figure 9. If the pattern line for the driveway crosses a MicroStation line meeting the symbology for **"~commercial buildup d"**, the driveway will be drawn using pavement buildup D for a commercial driveway as defined in the Location and Design Manual, Volume 1, Section 805.3 as follows:

Layer	Thickness, ft	Material
1	0.8333 (10 in.)	Item 411 or 304 Aggregate Base

This variable has been defined as follows:

```
define_dgn "~commercial buildup d" \  
dgn = "proposed dgn file name" \  
lvrname = PV_P_Driveway\  
co = 19
```

The criteria will look in the file specified by the define variable **"proposed dgn file name"** for the elements that represent the back of driveway for **"~commercial buildup d"**.

### **"~commercial buildup user"**

This variable is used to define the symbology for the back of driveway element as shown in Figure 9. If the pattern line for the driveway crosses a MicroStation line meeting the symbology for **"~commercial buildup user"**, the driveway will be drawn using pavement buildup as defined by the user with the variable **"user defined thickness commercial"**.

Layer	Thickness, ft
1	<b>"user defined thickness commercial"</b>

This variable has been defined as follows:

```
define_dgn "~commercial buildup user" \  
dgn = "proposed dgn file name" \  
lvrname = PV_P_Driveway\  
co = 20
```

The criteria will look in the file specified by the define variable **"proposed dgn file name"** for the

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elements that represent the back of driveway for "**~commercial buildup user**".

### "~residential buildup a"

This variable is used to define the symbology for the back of driveway element as shown in Figure 9. If the pattern line for the driveway crosses a MicroStation line meeting the symbology for "**~residential buildup a**", the driveway will be drawn using pavement buildup A for a residential driveway as defined in the Location and Design Manual, Volume 1, Section 805.2 as follows:

Layer	Thickness, ft	Material
1	0.5000 (6 in.)	Item 452 Plain Portland cement concrete

This variable has been defined as follows:

```
define_dgn "~residential buildup a" \  
dgn = "proposed dgn file name" \  
lvname = PV_P_Driveway\  
co = 0
```

The criteria will look in the file specified by the define variable "**proposed dgn file name**" for the elements that represent the back of driveway for "**~residential buildup a**".

### "~residential buildup b"

This variable is used to define the symbology for the back of driveway element as shown in Figure 9. If the pattern line for the driveway crosses a MicroStation line meeting the symbology for "**~residential buildup b**", the driveway will be drawn using pavement buildup B for a residential driveway as defined in the Location and Design Manual, Volume 1, Section 805.2 as follows:

Layer	Thickness, ft	Material
1	0.1667 (2 in.)	Item 404 Asphalt Concrete
2	0.5000 (6 in.)	Item 304 Aggregate Base

This variable has been defined as follows:

```
define_dgn "~residential buildup b" \  
dgn = "proposed dgn file name" \  
lvname = PV_P_Driveway\  
co = 1
```

The criteria will look in the file specified by the define variable "**proposed dgn file name**" for the elements that represent the back of driveway for "**~residential buildup b**".

### "~residential buildup c"

This variable is used to define the symbology for the back of driveway element as shown in Figure 9. If the pattern line for the driveway crosses a MicroStation line meeting the symbology for "**~residential buildup c**", the driveway will be drawn using pavement buildup C for a residential driveway as defined in the Location and Design Manual, Volume 1, Section 805.2 as follows:

Layer	Thickness, ft	Material
1	0.1042 (1 ¼ in.)	Item 404 Asphalt Concrete
2	0.3125 (3 ¾ in.)	Item 301 Bituminous Aggregate Base



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---

This variable has been defined as follows:

```
define_dgn "~residential buildup c" \  
dgn = "proposed dgn file name" \  
lvname = PV_P_Driveway\  
co = 2
```

The criteria will look in the file specified by the define variable “**proposed dgn file name**” for the elements that represent the back of driveway for “**~residential buildup c**”.

### “~residential buildup d”

This variable is used to define the symbology for the back of driveway element as shown in Figure 9. If the pattern line for the driveway crosses a MicroStation line meeting the symbology for “**~residential buildup d**”, the driveway will be drawn using pavement buildup D for a residential driveway as defined in the Location and Design Manual, Volume 1, Section 805.2 as follows:

Layer	Thickness, ft	Material
1	0.6667 (8 in.)	Item 411 or 304 Aggregate Base

This variable has been defined as follows:

```
define_dgn "~residential buildup d" \  
dgn = "proposed dgn file name" \  
lvname = PV_P_Driveway\  
co = 3
```

The criteria will look in the file specified by the define variable “**proposed dgn file name**” for the elements that represent the back of driveway for “**~residential buildup d**”.

### “~residential buildup user”

This variable is used to define the symbology for the back of driveway element as shown in Figure 9. If the pattern line for the driveway crosses a MicroStation line meeting the symbology for “**~residential buildup user**”, the driveway will be drawn using pavement as defined by the user with the variable “**user defined thickness residential**”.

Layer	Thickness, ft
1	“user defined thickness residential”

This variable has been defined as follows:

```
define_dgn "~residential buildup user" \  
dgn = "proposed dgn file name" \  
lvname = PV_P_Driveway \  
co = 4
```

The criteria will look in the file specified by the define variable “**proposed dgn file name**” for the elements that represent the back of driveway for “**~residential buildup user**”.

### “~existing ground”

The criteria has the capability of determining the existing ground slope at the location where proposed

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grading intersects the existing in the cross section MicroStation design file. This variable is used to define the symbology for the existing ground line. The variable has been defined as follows:

```
define_dgn "~existing ground" \  
dgn = "xs dgn file name" \  
lvname = XS_Ground_line_X \  
co = 0,2,ByLevel\  
wt = 1,ByLevel\  
lc = 3,ByLevel
```

---

### Marked Points

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GEOPAK has a simple, yet very important way of "remembering" where the location of various points are during the drawing process. This is accomplished with marked points.

Some marked points are stored during the criteria processing that are only used temporarily and do not need to be "remembered" as processing continues. These points can be subsequently redefined by another criteria file. There are, however, certain key locations that are referred to by subsequent criteria files. The following marked points must be previously defined by the pavement and shoulder criteria files in order for DWY\_UNCB.X to process correctly:

Edge of pavement	x1 y1
Edge of paved shoulder	x5 y5
Outside bottom of shoulder (shape)	x14 y14

**Labeling**

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<b>Table 5</b>	
<b>Labeling</b>	<b>Level</b>
Driveway Text	XS_Annotation_P
Warning Messages	XS_Text_WarningMsg_P
Error Messages	XS_Text_WarningMsg_P

Note: Before processing the proposed cross sections the active attached cell library must be ODOT\_Symbols.cel.