Driveway Quick Guide

Engineering Division
Production Support

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INTRODUCTION

The purpose of this manual is to help Designers understand the horizontal and vertical design of driveways and how to perform the calculations for determining driveway side drain lengths, driveway pavement quantities, and driveway earthwork quantities. The Quick Guide compiles links to all relevant information, so that the designer can easily find what they are looking for.

Driveways appear in roadway plan sets in a variety of places. A typical section for each private drive, business entrance or field entrance will appear on the Typical Sections sheet (2B). A line item for driveways appears in the Grading Quantities table, which is placed on sheet 2B. Proposed driveways appear on the Present Layout sheets (4-10), ROW Details sheets (4A-10A) and Proposed Layouts (4B-10B). Driveway profiles appear on sheets 118 (Private Drive, Business Entrance and Field Entrance Profiles).

1. DRIVEWAY DESIGN

Driveway Vertical Curves

Vertical grade limits vary between rural and urban designs, both for private drives and field entrances and for business entrances. See Table 1-1 for maximum vertical grade limits. Vertical curve K values are 1 for a crest curve and 2 for a sag curve. See, Sections 5.3.1 through 5.3.3 of the Manual for Construction Driveway Entrances on State Highways, 2015 and Roadway Standard Drawing RP-R-1 for additional vertical curve information.

Rural Roadways Vertical Grade Limits	
Private Drives & Field Entrances	15% maximum
Business Entrances	8% Maximum
Urban Roadway Design Vertical Grade Limits	
Private Drives and Field Entrances	10% Maximum
Business Entrances	8% Maximum

Table 1-1
Vertical Grade Limits for rural and urban roadways.

Driveway Horizontal Curves

For private drives, business entrance, and field entrance design on rural roadways, horizontal curve radius limits are 10 ft minimum and 20 ft maximum. For private drives, business entrance and field entrance design on urban roadways, horizontal curve radius limits are 5 ft minimum and 15 ft maximum. See Manual for Constructing Driveway Entrances on State Highways, 2015, Section 5.1.3 and Roadway Standard Drawing RP-R-1 for additional horizontal curve information.

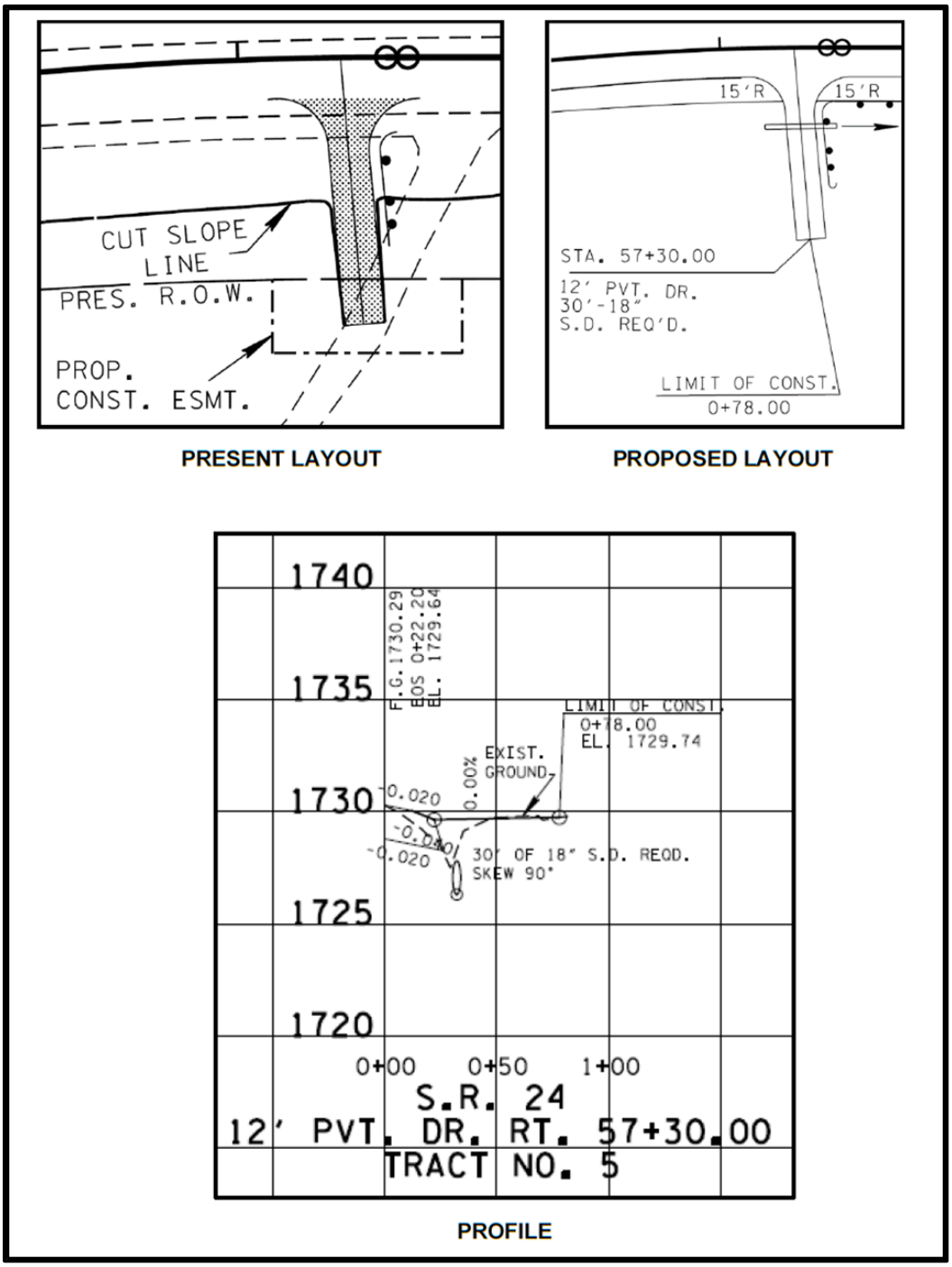

Figure 1-1
Rural Type Projects Typical Driveway Notation

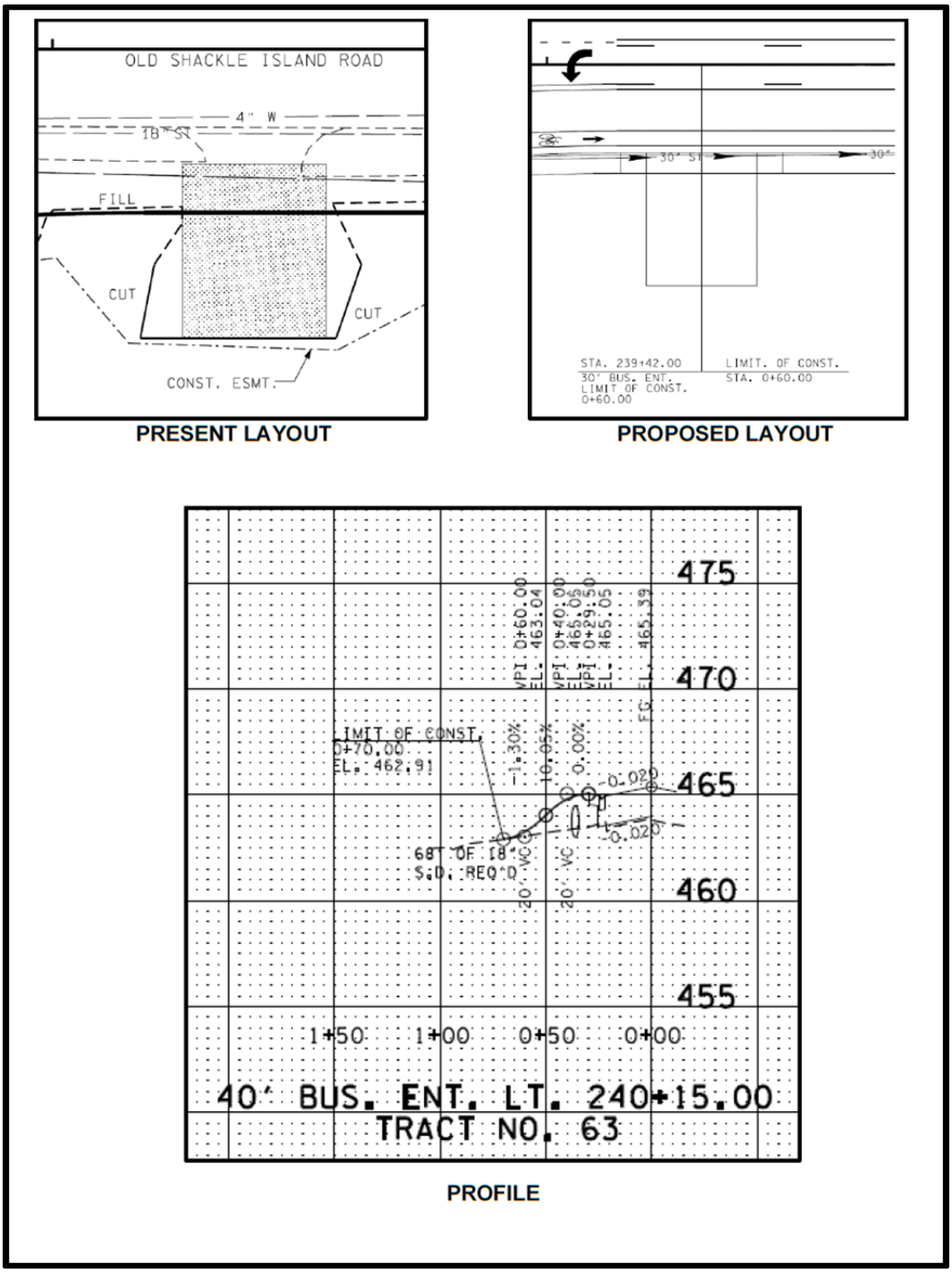

Figure 1-2
Urban Type Projects Typical Driveway Notation

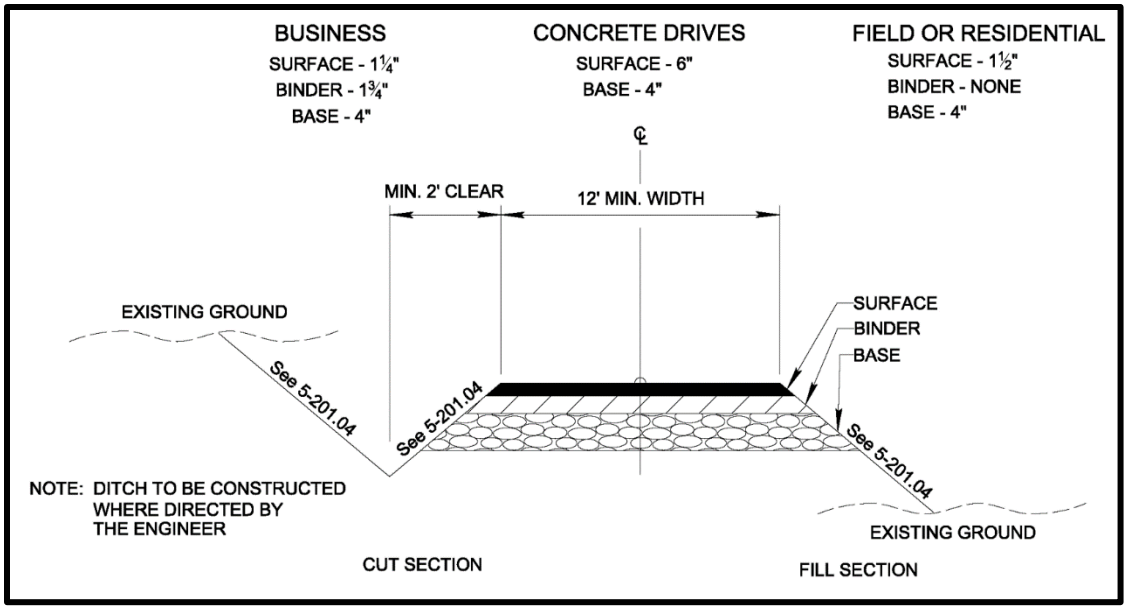

Figure 1-3
Driveway Typical Section

Driveway Cross Slope

Positive drainage should be maintained throughout the length of the driveway. One driveway edge may be higher than the other or the center line may be higher than the edges, creating driveway cross slope. Where the driveway and sidewalk intersect, the driveway cross slope is the same as the sidewalk grade.

Driveway Edge

A driveway edge should be clearly defined and visible to all users. The designer should avoid sudden drop-offs along the edge of drive. Fixed objects such as utility poles, fire hydrants, and drainage inlets should be set back from the edge of the driveway and from the edge of the roadway. If there is a side drain and the side drain is within the clear zone, maintain mainline side slopes through the safety endwall. If a parallel side drain is not required, 2:1 slopes may be used beyond the driveway radius. Designers should review the roadway and driveway slopes to ensure that a non-traversable slope within the clear zone is not created when the drop off is five foot or more.

2. DRIVEWAY SIDE DRAINS

A side drain is a pipe located under a driveway, at the toe of slope in a fill section or in the ditch line in a cut section. The drainage pipe (side drain) shall be a minimum of eighteen inches (18") in diameter. The side drain cover should be 12 inches from the top of pipe to the bottom of the driveway base. Endwalls are required if the drainage pipe falls within the clear zone. The pipe slope should be 0.5% to 2% slope for proper flow. See Roadway Standard Drawings SD-MSE-1, D-SEW-1A, D-SEW-12D, and RP-R-1 for additional information. See the Driveway Manual for additional side drain calculation information. See *Figure 2-1, Typical Section with Side Drain*.

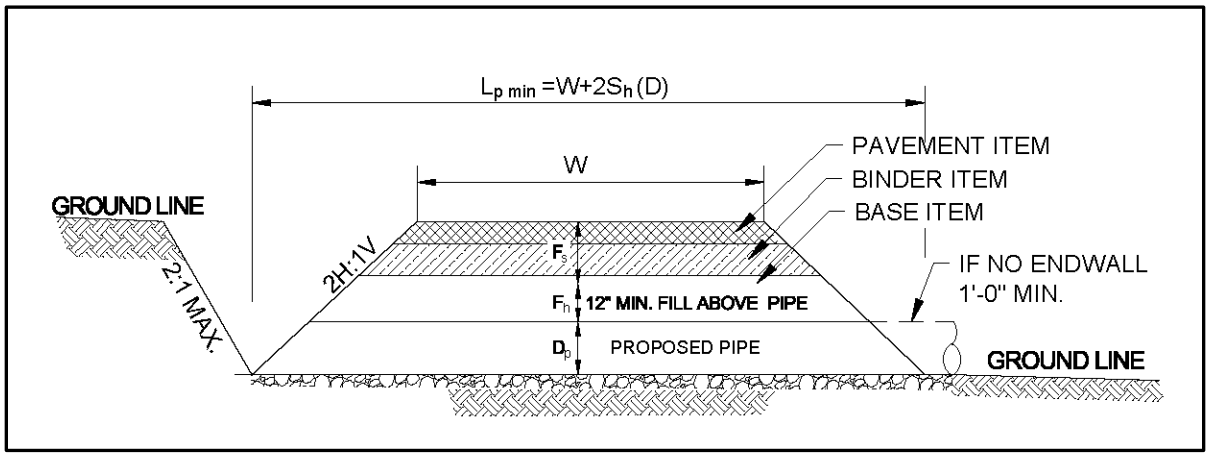

Figure 2-1
Typical Section with Side Drain

$L_{p\ min} = W + 2S_h (D)$

$L_{p\ min}$ = minimum pipe length

W= width of the driveway

S_h= Side slope horizontal units per unit (a 2:1 side slope means 2 horizontal units per vertical unit. S_h for a 2:1 side slope = 2)

D = Total depth in feet

$D = F_s + F_h + D_p$

F_s = Surface depth in feet

F_h= Fill height between roadway base and top of pipe (1'-0" minimum)

D_p= Diameter of pipe in feet

However, if no Endwalls are used, add 1 ft of pipe length beyond intersection of slope line and top of pipe for both sides of driveway which gives an additional 2'-0" of pipe.:

$L_{p\ min} = W + 2S_h (D) + 2'$ (No endwalls)

Example Side Drain length ($L_{p\ min}$) calculation for an asphalt residental drive with an 18" side drain

$L_{p\ min} = W + 2S_h\ (D)$

W = 10 ft, residental

$S_h = 2$

$D = F_s + F_h + D_p$

F_s = (Surface =1 ½", Binder = 0" and Base = 4") = 5.5" (0.46')

F_h = 12" (1')

D_p = 18" (1.5')

$L_{p\ min}$ = 12' + 2(2)(0.46'+1'+1.5') = 23.84 ft round to 24 ft **(With endwalls)**

If no Endwalls, add 1 ft pipe length beyond slope line on both sides = additional 2'-0":

$L_{p\ min} = W + 2S_h\ (D) + 2'$

$L_{p\ min}$ = 24'+2' = 26 ft **(Without endwalls)**

Example Side Drain length ($L_{p\ min}$) Calculation for an asphalt business drive with an 18" side drain

$L_{p\ min} = W + 2S_h\ (D)$

W=24 ft, business

S_h=12

$D = F_s + F_h + D_p$

F_s = (Surface =1 ¼", Binder = 2" and Base = 4") = 7.25" (0.604')

F_h = 12" (1')

D_p = 18" (1.5')

$L_{p\ min}$ = 24' + 2(12)(0.604'+1'+1.5') = 98.50 ft rounded to 99ft (**With endwalls)**

If no Endwalls, add 1 ft pipe length beyond slope line on both sides = additional 2'-0":

$L_{p\ min} = W + 2S_h\ (D) + 2$

$L_{p\ min}$ =99+2' =101ft **(Without endwalls)**

Minimum Pipe length ($L_{p\ min}$) in FT (for 12 ft wide residential and 24 ft wide two-way business driveway)

	2H:1V Residential				12H:1V Business		
Pipe Diameter	**15" (1.25 ft)**	**18" (1.5 ft)**	**24" (2 ft)**	**36" (3 ft)**	**18" (1.5 ft)**	**24" (2 ft)**	**36" (3 ft)**
Total depth (ft) = D	2.71	2.96	3.46	4.46	3.1	3.6	4.6
$L_{p\ min}$	23	24	26	30	99	111	135

Table 2-1
Side Drain Length Calculations

3. DRIVEWAY PAVING AND GRADING QUANTITIES

The following examples are provided to help Designers determine how to calculate paving and grading quantities for driveways.

Paving Quantity Example 1 for a 12' PG64-22 Asphalt Private Drive:

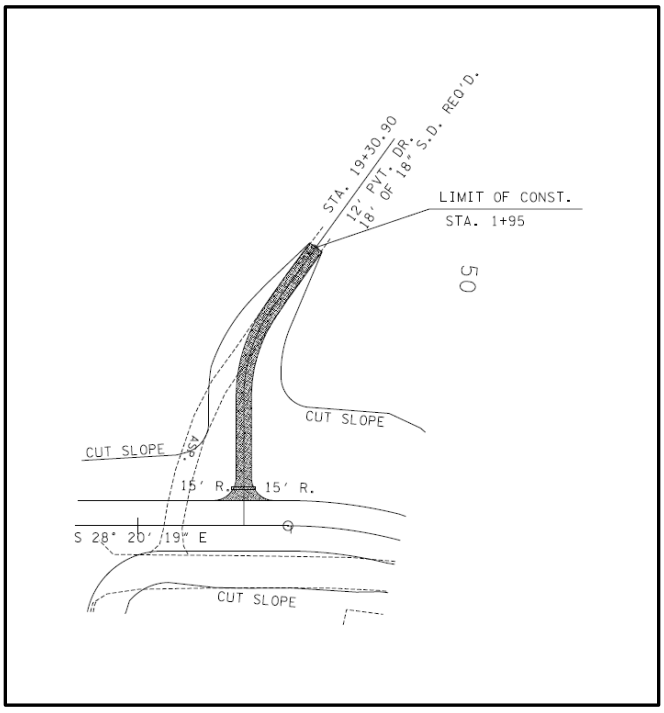

Figure 3-1
Asphalt Private Drive Example

1. Use the *measure shape* command to find the surface area. For this example, the surface area (shaded area in *Figure 3-1, Asphalt Private Drive Example*) is equal to 1600 ft^2.

2. From *Figure 1-3, Driveway Typical Section*, a private drive requires 1.50" of surface and 4" of base.

3. Calculate Surface Quantity:
   a. From RDG Section 4-411.00, *Table 4-2 Computation of 411 Asphalt Surface Mixture Quantities*, 411-01.10, Grading D Surface (PG 64-22), has a density of 3816 LB/CY.
   b. Calculate the Volume (C.Y.): $\frac{1600\ ft^2\ x\ 1.50" x \frac{1}{12"}}{27\ ft^3} = 7.41\ C.Y.$
   c. Convert to Tons: 7.41 C.Y. $* \frac{\left(\frac{3816 lb}{C.Y.}\right)}{2000\ lb}$ =14.14 Tons of 411-01.10 ACS Mix (PG64-22) Grading D

4. Calculate Base Quantity:
   a. From RDG Section 4-303.00, 303-01, Mineral Aggregate Base has a density of 2.03 Ton/C.Y.
   b. Calculate the Volume (C.Y.): $\frac{1600\ ft^2\ x\ 4" x \frac{1}{12"}}{27\ ft^2} = 19.75\ C.Y.$
   c. Convert to Tons: $19.75\ C.Y. * 2.03 \frac{Tons}{C.Y.} = 40.10\ Tons$

Paving Quantity Example 2 for a 24' Concrete Business Entrance:

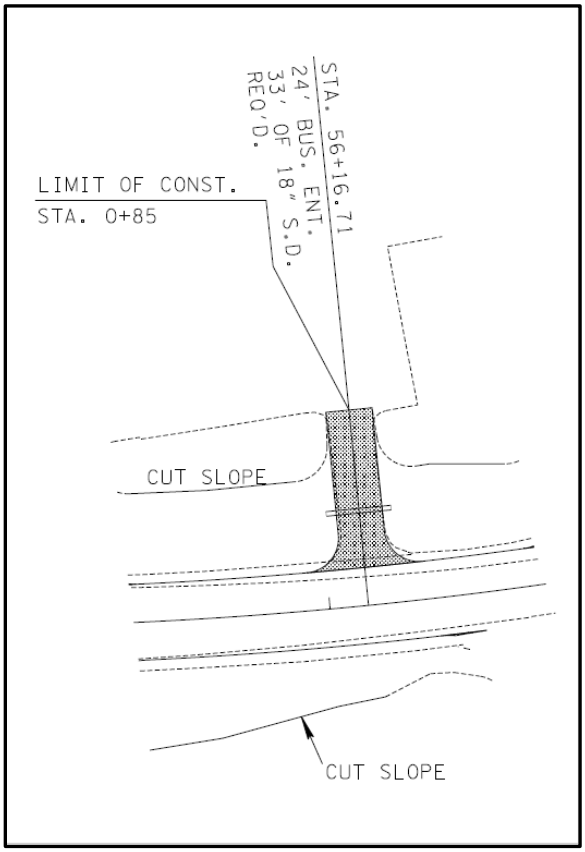

Figure 3-2
Concrete Business Drive Example

1. Use the MicroStation *measure shape* command to find the surface area. For this example, the surface area (shaded area in *Figure 3-2, Concrete Business Drive Example*) is equal to 1730 ft^2.
2. From *Figure 1-3, Driveway Typical Section* and Roadway Standard Drawing RP-D-15-Details of Standard Concrete Driveways, the concrete thickness is 6". The Standard drawing states that concrete driveways are paid for by Item Number 701-02, Concrete Driveway, SF. So, for this example, the quantity is 1730 ft^2.

3. Also, from *Figure 1-3, Driveway Typical Section*, the base thickness is 4". The base is paid by Item No. 303-01 Mineral Aggregate, Type A Base, Grading D (TON).
    a. From RDG Section 4-303.00, 303-01, Mineral Aggregate Base has a density of 2.03 Ton/C.Y.
    b. Calculate the Volume (C.Y.): $\frac{1730\ ft^2\ x\ 4"\ x\frac{1}{12}"}{27\ ft^2} = 21.35\ C.Y.$
    c. Convert to Tons: $21.35\ C.Y. * 2.03\frac{Tons}{C.Y.} = 43.36\ Tons$

Earthwork Quantity Example:

Cross sections are not cut along driveways, but the GEOPAK DTM tools can be used to obtain ground sections at a couple select locations along the driveway. Once a ground section has been established, the driveway template should be manually drawn to obtain a cross section area in order to estimate earthwork cut and fills.

Using the profile of the driveway in the first example, determine where to cut your sections, preferably outside the slope line of the main roadway. In this example, the sections will be located at 0+75 and 1+50. These stations were picked at various points along the driveway to get an average cross section area. (see *Figure 3-4 Driveway Cross Sections*).

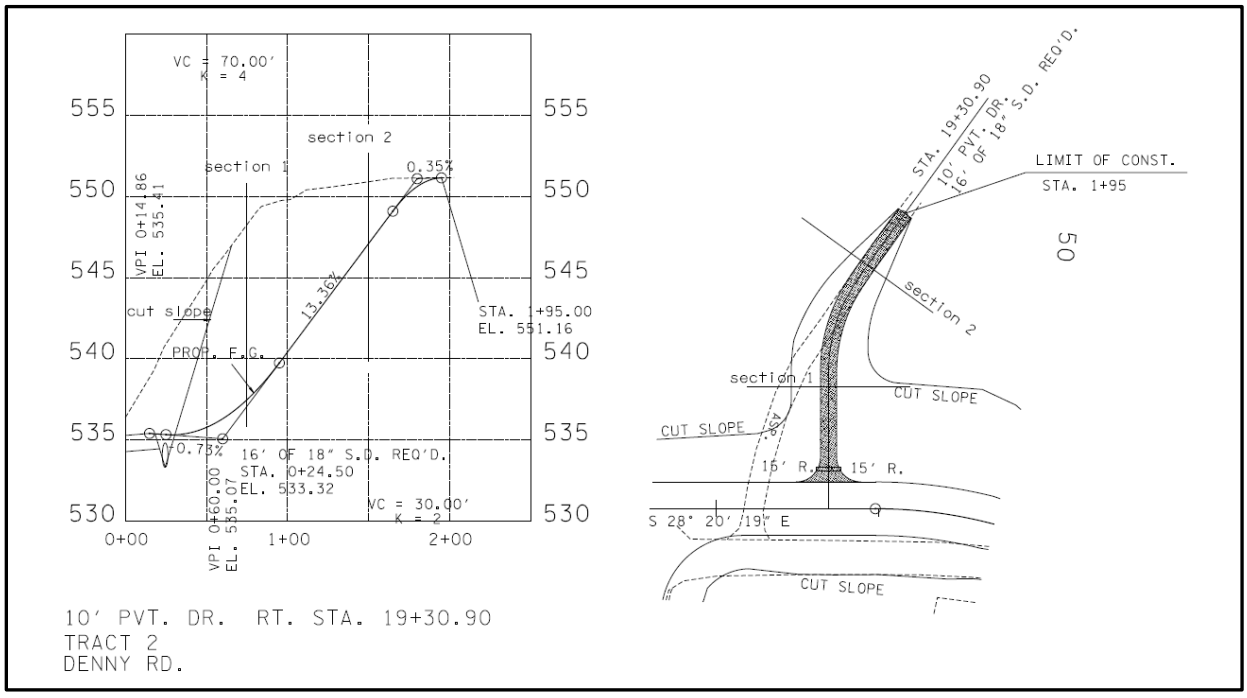

Figure 3-3
Example Driveway

Using the DTM Profile Tool illustrated in Exercise 3(c) of GEOPAK Road Manual draw ground profiles using the lines drawn in the previous step. Then using *Figure 1-3, Driveway Typical Section* as a guide, draw the driveway templates on each section. The finished grade elevations can be determined from the profile. For a rough estimate approach, Designers can measure the cut or fill area and multiply by the driveway length.

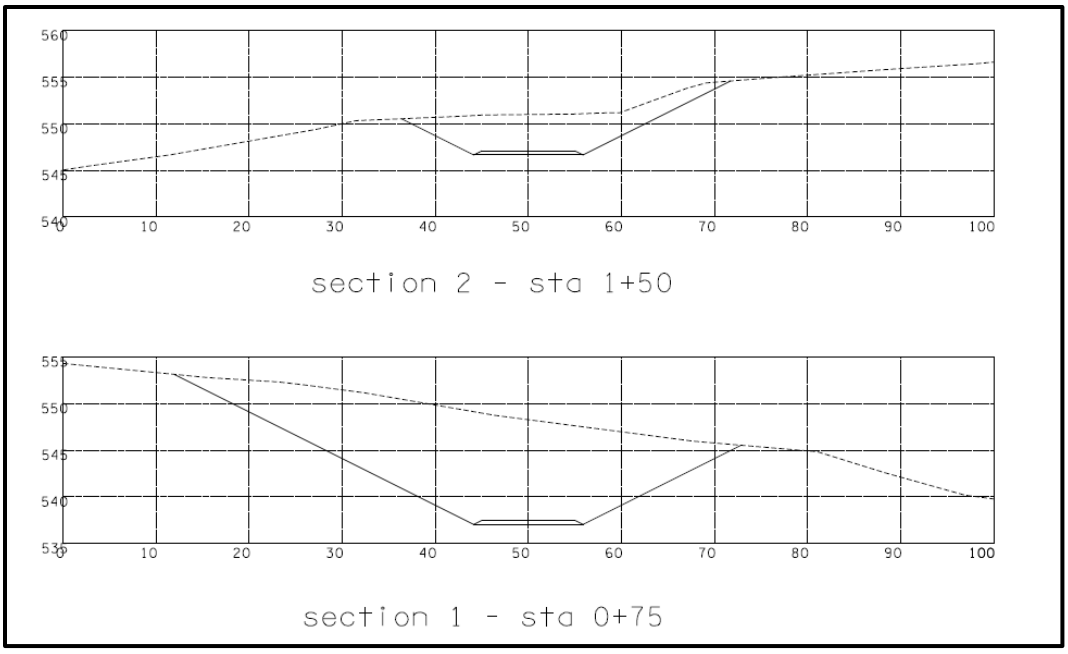

Figure 3-4
Driveway Cross Sections

Using the MicroStation draw shape and measure area tool determine areas for each section (see *Figure 3-5, Driveway Section Areas*):

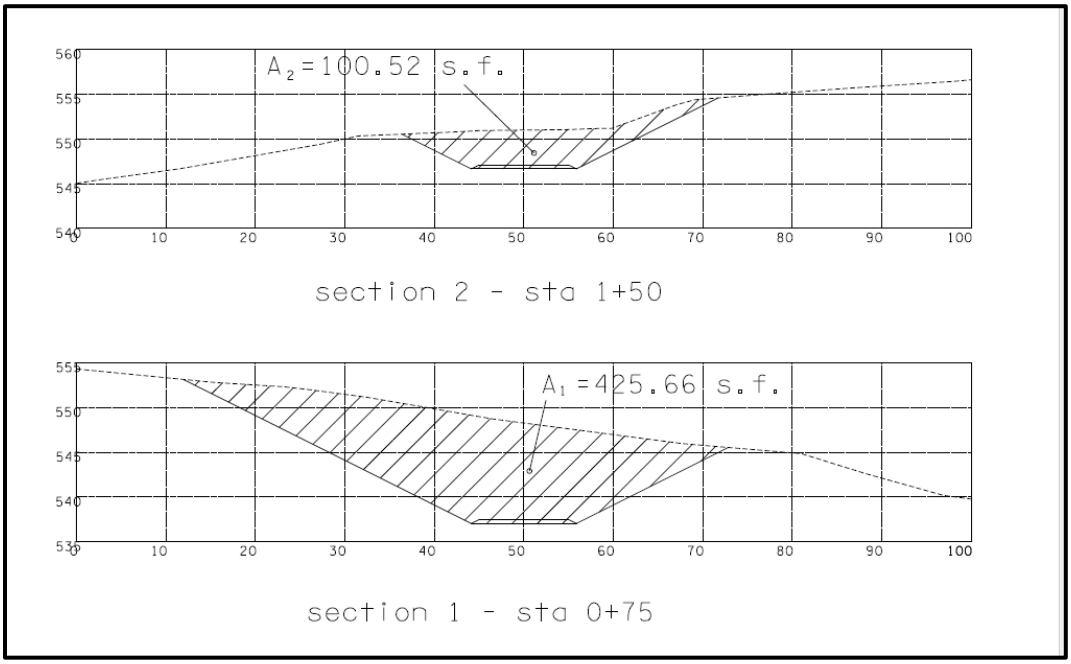

Figure 3-5
Driveway Section Areas

To calculate the earthwork volume for the drive:

From the profile in *Figure 3-3, Example Driveway*, the roadway cut slope crosses the drive profile at station 0+31.

V (in C.Y.) = L (outside roadway slope) x ((A1 + A2)/2)/27
L = 195 - 31 = 164 ft.
= 164 x ((100.52+425.66)/2)/27 = 1598 C.Y. (cut volume)

4. DRIVEWAY QUICK GUIDE

Design Guidelines

Section 2-1500.00

Standard Drawings

RP-D-15

RP-D-16

RP-R-1

D-SEW-1A

D-SEW-12D

SD-MSE-1

TDOT CADD Programs

GEOPAK

OPENROADS DESIGNER

Additional Information

Manual for Constructing Driveway Entrances on State Highways, 2015

Chapter 3 Multimodal Design

Earthwork Design Guide

Private Drive Profiles