



FAA
AAS-100

AC 150/5300-13B, Airport Design, Taxiway Fillet Design Tool

User's Guide

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1 INTRODUCTION

1.1 Purpose of this Guide.

This User's Guide provides the steps for operating the Taxiway Fillet Design Tool.

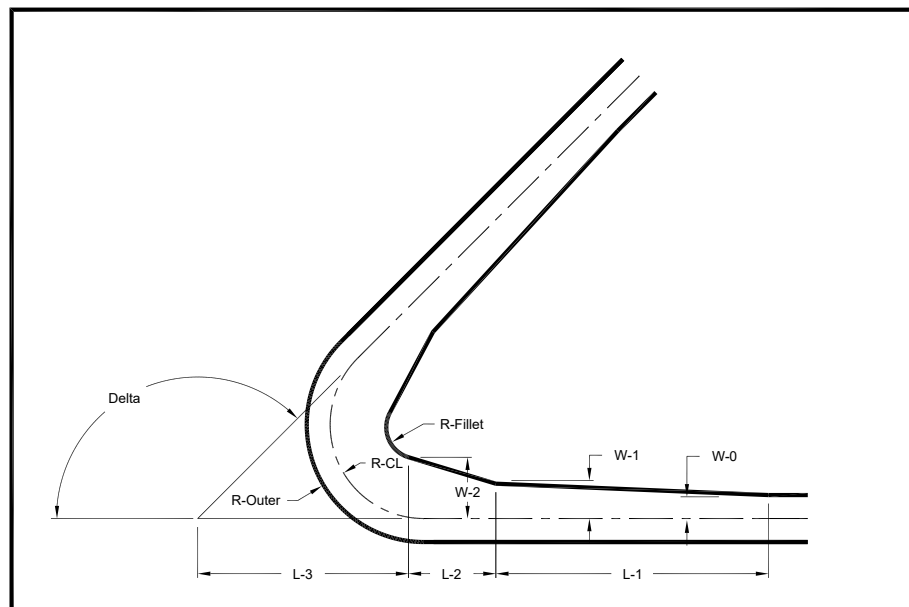
1.2 Tool Overview.

The Advisory Circular (AC) [150/5300-13](#), *Airport Design*, provides dimensions necessary to lay out taxiway turns of what we call “common” angles (deltas). These angles are 30, 45, 60, 90, 120, 135, and 150 degrees. But in many cases, a turn of a different delta may be upgraded to the new standards based on Taxiway Design Group (TDG), or it may be necessary to build a new taxiway turn with a different delta.

To help in those situations, the Office of Airport Safety and Standards, Engineering Division (AAS-100) has developed computer software that calculates the minimum recommended centerline radius. For deltas of 90 degrees or more, the centerline radius is calculated to limit the nose gear steering angle to 50 degrees. For lesser deltas, the centerline radius is chosen to maintain taxiing speed. In all cases, the tool calculates the pavement dimensions to ensure the required Taxiway Edge Safety Margin (TESM) and minimize excess pavement, and the locations of taxiway centerline and edge lights.

The FAA Taxiway Fillet Design Tool can be used to design the centerline radius and fillets for turns comprising all deltas between 5 and 175 degrees including centerline lights and, optionally, edge lights. With thousands of calculations running in the background, the Taxiway Fillet Design Tool accomplishes in minutes what would ordinarily take hours to achieve by hand.

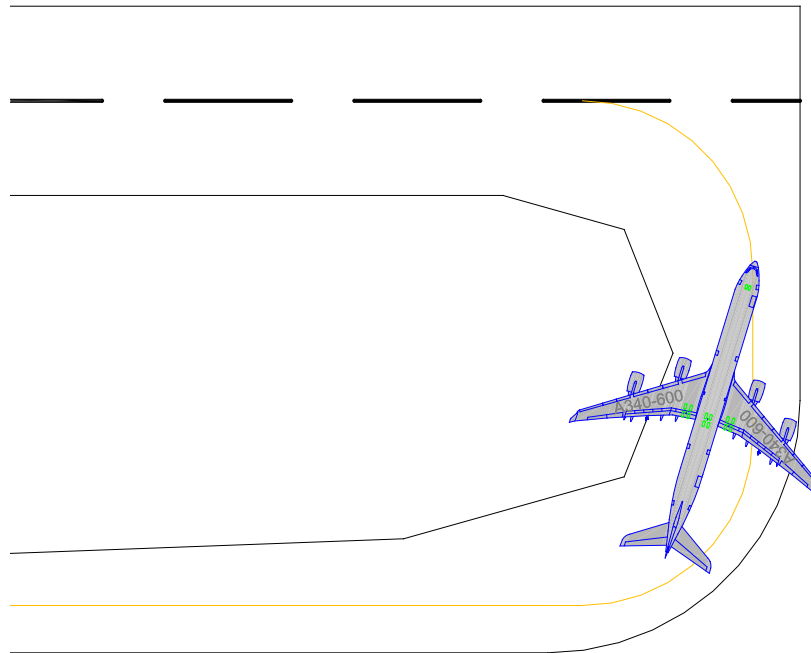
Dimensions used in this tool, illustrated below, are keyed to [AC 150/5300-13](#).



In addition to displaying pavement dimensions on the user's computer screen, the program creates a computer-aided design (CAD) drawing in DXF format that can be imported by virtually any CAD software.

1.3 Tool Accuracy.

This tool is accurate only when the airplane is aligned with the taxiway centerline when entering the turn. The design of closely spaced turns, where the airplane is not aligned with the taxiway centerline when entering the second turn, requires the use of more sophisticated modeling software. An example of this situation often occurs at runway entrance taxiways, shown below.



Note: Because suggested centerline and edge lighting placement are calculated in the tool, the tool must also adhere to the guidance in AC 150/5340-30, *Design and Installation Details for Airport Visual Aids*. Calculations may be more accurate, or cover more scenarios, than the values listed in AC 150/5300-13 or AC 150/5340-30. Where the tool shows edge lights very close to one another, contact the appropriate FAA Airports office for guidance.

1.4 Terminology.

1. Cockpit to Main Gear Distance (CMG)
The distance from the pilot's eye to the main gear turn center.
2. Main Gear Width (MGW)
The distance from outer edge to outer edge of the widest set of main gear tires.

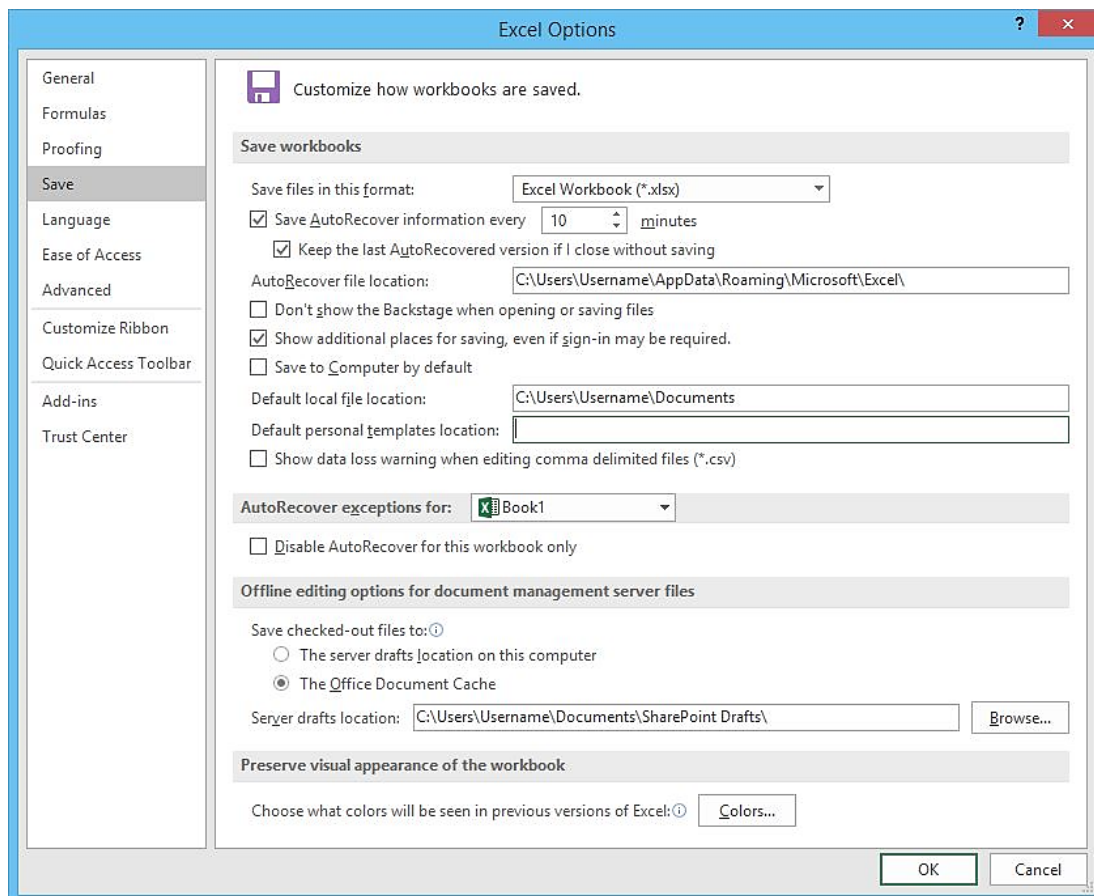
3. Taxiway Edge Safety Margin (TESM)|
The distance between the outer edge of the landing gear of an airplane with its nose gear on the taxiway centerline and the edge of the taxiway pavement.
4. R-Fillet Radius of fillet
5. R-CL Radius of centerline
6. RVR Runway Visual Range
7. R-Outer Radius of outer edge
8. L-1, W-0, W-1 At the start of the turn, the taxiway is widened on the inside of the turn for a length L-1, with the distance from the taxiway centerline to the pavement edge tapering from W-0 to W-1.
9. L-2, L-3, W-2 As the airplane continues, the distance from the taxiway centerline to the pavement edge taper must be increased further, for a length L-2, from W-1 to W-2, ending at a distance L-3 from the point of intersection.

2 USING THE TOOL

2.1 Prior to Using the Tool.

The Taxiway Fillet Design Tool is EXCEL-based and runs offline from the hard drive on individual computers. The tool produces an output file located in the default folder designated in EXCEL.

Prior to operating the tool, verify the default folder location by opening any EXCEL file, selecting the Options menu from the File tab, then the Save menu where the “Default local file location” is listed (as shown in the following figure). A typical default file location, replacing “Username” with the actual username, is C:\Users\Username\Documents.



2.2 Getting Started.

The Taxiway Fillet Design Tool is designed to work on Windows-based computers when input is entered in the order intended (TDG, Delta, R-Fillet, and R-CL).

2.2.1 General Notes.

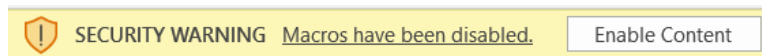
- Follow on-screen instructions, alerts, and progress information.
- Edge lighting locations may appear strange at very low deltas. The layouts should, however, conform to the standards in AC 150/5340-30. In such cases, engineering

judgment must be used, just as it would be in the absence of this program. Contact the appropriate FAA Airports office for guidance

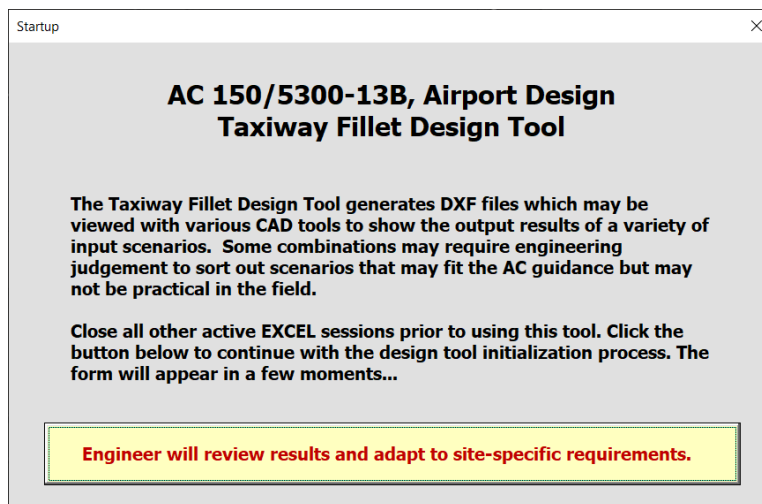
- Leaving the “edge light offset” field blank will result in no edge lights being plotted. Centerline lights, however, are always plotted. If centerline lights are not to be installed, turn off the drawing layer of the DXF file in your CAD software.

2.2.2 Opening the Tool.

1. Save the tool to your hard drive.
2. Click to open the tool.
 - a. The “Opening Tool...” screen appears.
 - b. If prompted, click Enable Content.



- c. The following dialog box displays. Click the button to continue to the tool.

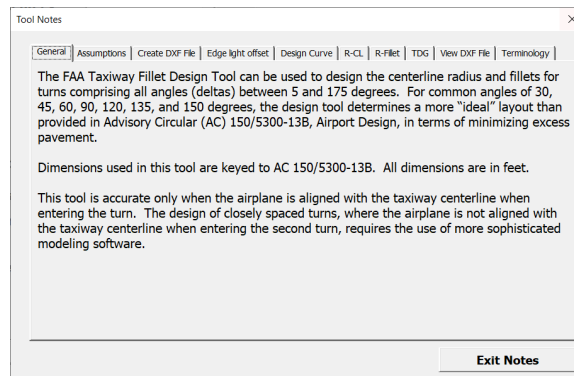


- d. The user form appears after the initialization process is complete. Grayed-out boxes indicate calculated display-only fields. The Status information box, in the upper right corner of the form, steps you through the process and provides informative alert information when appropriate. Perform the steps in order, as indicated. Wait for each step to complete before proceeding.

2.2.3 Tool Features.

- The button under the Status information box, top right, contains a hyperlink to the most current version of the Airport Design AC, for reference.
- Each field on the form displays a tip when hovered over.

The “Tool Notes” button, lower left, provides a multi-page help file.



2.2.4 Status Messages.

Status messages, including any noted parameters outside the capabilities of the program, are displayed in the Status information box in the upper right corner of the form. Blue text is informational, and red text indicates a warning or error message.

2.3 Steps for Using the Tool.

2.3.1 TDG.

To use the tool, select the desired TDG from the pull-down list and click <enter>.

A screenshot of the "Taxiway Fillet Design Tool" interface. The window has a title bar and a close button. The main area is divided into several sections. On the left, there's a "Select TDG then <enter>" section with a list of options: CMG, MGW, TESM, and Taxiway Width (with a dropdown menu showing 1A, 1B, 2A, 2B, 3, 4, and 5). Below this is an "Enter delta then <enter>" field. Further down is an "R-Fillet (default)" field, followed by an "R-Fillet (if not using default) then <enter>" field, and a "Minimum recommended R-CL" field. At the bottom left is an "Enter R-CL then <enter>" field. In the center, there's a "Design Curve" button. On the right, there's a "Select TDG" section with a "Reference 150/5300-13, Airport Design, for additional information" button. Below this is an "Enter edge light offset then <enter> (Blank for no edge lights)" field, followed by a checkbox for "RVR < 1200?". Below that are fields for "X coordinate of R-FILLET center", "Y coordinate of R-FILLET center", and "R-OUTER". At the bottom right, there's a section for "Enter DXF file name:" with a text input field. The bottom of the window features four buttons: "Tool Notes", "Design Curve", "Create DXF File", and "Exit".

The CMG, MGW, TESM, and Taxiway Width are then displayed and shown. Notice the next step is mentioned in the Status information box, top right.

Taxiway Fillet Design Tool

Select TDG then <enter> 5

CMG 100

MGW 47

TESM 14

Taxiway Width 75

Enter delta then <enter>

R-Fillet (default)

R-Fillet (if not using default) then <enter>

Minimum recommended R-CL

Enter R-CL then <enter>

... after entering delta value, click <enter> to proceed

Reference 150/5300-13, Airport Design, for additional information

Enter edge light offset then <enter> (Blank for no edge lights)

☐ RVR < 1200?

X coordinate of R-FILLET center

Y coordinate of R-FILLET center

R-OUTER

L-1 W-0

L-2 W-1

L-3 W-2

Enter DXF file name:

enter file name

Tool Notes Design Curve Create DXF File Exit

2.3.2 Delta.

Enter the delta value. Click <enter>.

Taxiway Fillet Design Tool

Select TDG then <enter> 5

CMG 100

MGW 47

TESM 14

Taxiway Width 75

Enter delta then <enter> 115

R-Fillet (default)

R-Fillet (if not using default) then <enter>

Minimum recommended R-CL

Enter R-CL then <enter>

... after entering delta value, click <enter> to proceed

Reference 150/5300-13, Airport Design, for additional information

Enter edge light offset then <enter> (Blank for no edge lights)

☐ RVR < 1200?

X coordinate of R-FILLET center

Y coordinate of R-FILLET center

R-OUTER

L-1 W-0

L-2 W-1

L-3 W-2

Enter DXF file name:

enter file name

Tool Notes Design Curve Create DXF File Exit

2.3.3 Minimum Recommended R-CL and R-Fillet.

After entering the delta value and clicking <enter>, the “Minimum recommended R-CL” and “R-Fillet (default)” automatically calculate and display.

Taxiway Fillet Design Tool

Taxiway Fillet Design Tool

Select TDG then <enter> 5

CMG 100

MGW 47

TESM 14

Taxiway Width 75

Enter delta then <enter> 115

R-Fillet (default) 50

R-Fillet (if not using default) then <enter> |

Minimum recommended R-CL 109

Enter R-CL then <enter> |

Reference 150/5300-13, Airport Design, for additional information

Enter edge light offset then <enter> (Blank for no edge lights)

☐ RVR < 1200?

X coordinate of R-FILLET center

Y coordinate of R-FILLET center

R-OUTER

L-1 W-0

L-2 W-1

L-3 W-2

Enter DXF file name: enter file name

Tool Notes Design Curve Create DXF File Exit

You may enter R-Fillet and/or R-CL, or leave one or both of these fields blank to use the default values. Using a value for R-CL lower than the minimum recommended value will result in a nose gear steering angle of more than the recommended maximum 50 degrees. In such a case, the maximum nose gear steering angle display in the Status information box in the upper right corner. In the example, R-CL has been entered, rounded up to 110 feet by the user.

Taxiway Fillet Design Tool

Taxiway Fillet Design Tool

Select TDG then <enter> 5

CMG 100

MGW 47

TESM 14

Taxiway Width 75

Enter delta then <enter> 115

R-Fillet (default) 50

R-Fillet (if not using default) then <enter> |

Minimum recommended R-CL 109

Enter R-CL then <enter> 110

... if using non-default R-CL, enter value then click <enter> to proceed

Reference 150/5300-13, Airport Design, for additional information

Enter edge light offset then <enter> (Blank for no edge lights)

☐ RVR < 1200?

X coordinate of R-FILLET center

Y coordinate of R-FILLET center

R-OUTER

L-1 W-0

L-2 W-1

L-3 W-2

Enter DXF file name: enter file name

Tool Notes Design Curve Create DXF File Exit

2.3.4 Edge Light Offset.

Enter an edge light offset value of 2-10 ft. Click <enter>. Leave the field blank for no edge lights.

Taxiway Fillet Design Tool

Taxiway Fillet Design Tool

Select TDG then <enter> 5

CMG 100

MGW 47

TESM 14

Taxiway Width 75

Enter delta then <enter> 115

R-Fillet (default) 50

R-Fillet (if not using default) then <enter>

Minimum recommended R-CL 109

Enter R-CL then <enter> 110

... if using an edge light offset, enter value and click <enter> to proceed

Reference 150/5300-13, Airport Design, for additional information

Enter edge light offset then <enter> (Blank for no edge lights) 10

☐ RVR < 1200?

X coordinate of R-FILLET center

Y coordinate of R-FILLET center

R-OUTER

L-1 W-0

L-2 W-1

L-3 W-2

Enter DXF file name:

enter file name

Tool Notes Design Curve Create DXF File Exit

2.3.5 RVR.

For RVR values less than 1200 ft, click the checkbox.

Taxiway Fillet Design Tool

Taxiway Fillet Design Tool

Select TDG then <enter> 5

CMG 100

MGW 47

TESM 14

Taxiway Width 75

Enter delta then <enter> 115

R-Fillet (default) 50

R-Fillet (if not using default) then <enter>

Minimum recommended R-CL 109

Enter R-CL then <enter> 110

Reference 150/5300-13, Airport Design, for additional information

Enter edge light offset then <enter> (Blank for no edge lights) 10

☒ RVR < 1200?

X coordinate of R-FILLET center

Y coordinate of R-FILLET center

R-OUTER

L-1 W-0

L-2 W-1

L-3 W-2

Enter DXF file name:

enter file name

Tool Notes Design Curve Create DXF File Exit

2.3.6 Design Curve.

Click Design Curve. A message box stating the user that the calculations may take a few moments. Click ok to continue.

Microsoft Excel

Curve design calculations may take a few moments. Click OK to continue...

OK

A Status information appears while calculation of the necessary dimensions to define the fillets is in progress.

Taxiway Fillet Design Tool

Select TDG then <enter> 5

CMG 100

MGW 47

TESM 14

Taxiway Width 75

Enter delta then <enter> 115

R-Fillet (default) 50

R-Fillet (if not using default) then <enter>

Minimum recommended R-CL 109

Enter R-CL then <enter> 110

Designing Curve...

Reference 150/5300-13, Airport Design, for additional information

Enter edge light offset then <enter> (Blank for no edge lights) 10

☒ RVR < 1200?

X coordinate of R-FILLET center

Y coordinate of R-FILLET center

R-OUTER

L-1 W-0

L-2 W-1

L-3 W-2

Enter DXF file name: enter file name

Tool Notes Design Curve Create DXF File Exit

X and Y coordinates are based on the origin at the Point of Intersection of the curve. The resulting maximum steering angle appears in the Status information box when the design curve calculations are complete.

Taxiway Fillet Design Tool

Select TDG then <enter> 5

CMG 100

MGW 47

TESM 14

Taxiway Width 75

Enter delta then <enter> 115

R-Fillet (default) 50

R-Fillet (if not using default) then <enter>

Minimum recommended R-CL 109

Enter R-CL then <enter> 110

The R-CL selected will result in a maximum steering angle of 49.6 degrees

Reference 150/5300-13, Airport Design, for additional information

Enter edge light offset then <enter> (Blank for no edge lights) 10

☒ RVR < 1200?

X coordinate of R-FILLET center 191.59

Y coordinate of R-FILLET center 122.05

R-OUTER 147.5

L-1 281.59 W-0 37.50

L-2 131.76 W-1 45.98

L-3 181.51 W-2 73.08

Enter DXF file name: enter file name

Tool Notes Design Curve Create DXF File Exit

2.3.7 Create DXF File.

Enter a file name in the file name box to output a DXF file of that name. Click Create DXF File. The output file location is listed in the Status information box.

The screenshot shows the 'Taxiway Fillet Design Tool' window. It contains several input fields and buttons. On the left, there are fields for 'Select TDG then <enter>' (value 5), 'CMG' (100), 'MGW' (47), 'TESM' (14), 'Taxiway Width' (75), 'Enter delta then <enter>' (115), 'R-Fillet (default)' (50), 'R-Fillet (if not using default) then <enter>' (blank), 'Minimum recommended R-CL' (109), and 'Enter R-CL then <enter>' (110). On the right, there is a status box indicating 'DXF file created and located at C:\Users\jdoe\Documents\Demo-output.DXF' and a reference to 'Reference 150/5300-13, Airport Design, for additional information'. Below this, there is a field for 'Enter edge light offset then <enter>' (value 10) with a checkbox for 'RVR < 1200?'. Further right, there are fields for 'X coordinate of R-FILLET center' (191.59), 'Y coordinate of R-FILLET center' (122.05), and 'R-OUTER' (147.5). At the bottom right, there are fields for 'L-1' (281.59), 'L-2' (131.76), 'L-3' (181.51), 'W-0' (37.50), 'W-1' (45.98), and 'W-2' (73.08). At the bottom left, there is a field for 'Enter DXF file name:' with a placeholder 'enter new file name'. At the bottom center, there are three buttons: 'Tool Notes', 'Design Curve', and 'Create DXF File'. At the bottom right, there is an 'Exit' button.

The DXF file includes the taxiway centerline and taxiway edges with associated dimensions. It also shows the path taken by the main landing gear adjusted for the TESM. This file is placed in your default documents directory.

2.3.8 Exiting the Tool.

Use the exit button, lower right, to exit the tool. It is programmed to reset the tool and will take a moment to complete. Because of this, the user is provided the option to return to the tool rather than exit.

The screenshot shows a small 'Exit' dialog box with a close button (X) in the top right corner. The text inside the dialog box asks 'Are you sure you want to exit?'. At the bottom, there are two buttons: 'Yes' and 'No'.

An “exiting...” message appears briefly in the Status information box as the tool closes.

2.3.9 Viewing the DXF File.

DXF files may be imported into most CAD software. In addition, websites are available to upload DXF files into for viewing or to download free viewer software. AutoCAD has a free viewer (DWG TrueView available online at <https://www.autodesk.com/products/dwg/viewers#> (select DWG TrueView).

AutoDesk DWG TrueView Tips:

- The “Extents” option on the Extents/Zoom button will display and center the entire diagram in the TrueView window. Zoom options are in the pull-down menu for that button.
- The “pan” tool allows you to reposition the drawing. It resembles a hand, located to the right of the zoom button.
- The features of the output drawing display best on a white background. To change the background color to white in TrueView:
 - Click the big green/blue “D” at the top left
 - Choose “Options”, bottom of the box next to Exit
 - Click “Display” tab
 - Click “Colors...” button
 - Click “Color:” button
 - Select “white” from the pull-down menu
 - Click “Apply and Close” button

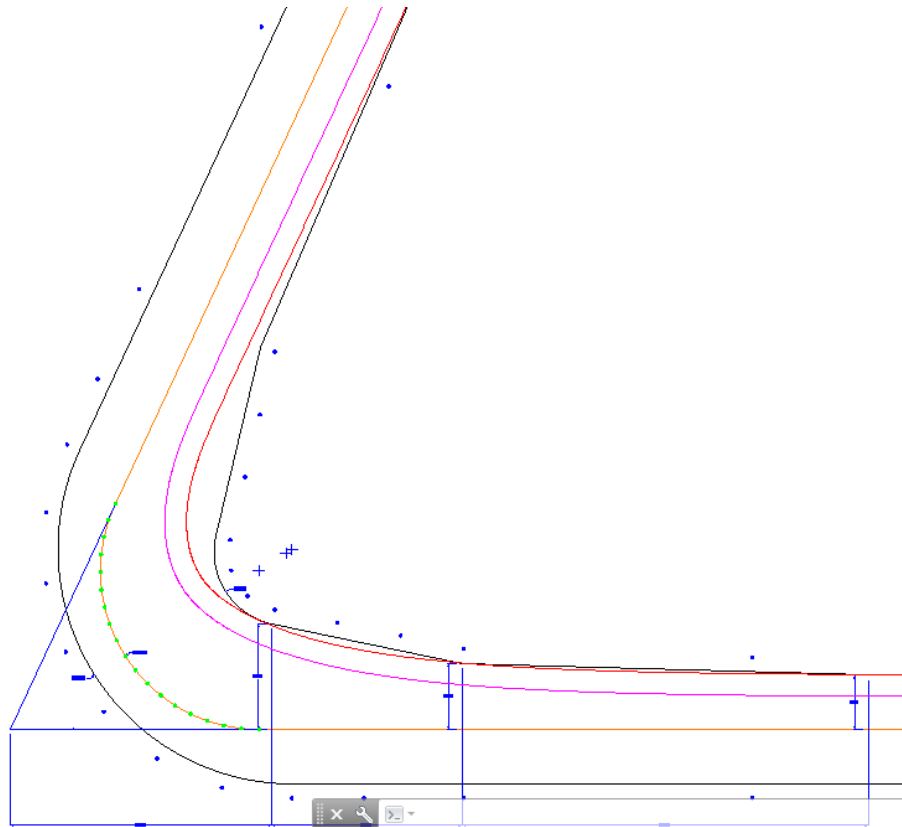
Using CAD or viewer software, the layout designed by this tool may be scaled and adjusted for constructability and/or placement of lighting. When making such

adjustments, locate the L1/L2 intersection point along the red “wheel track + TESM” curve to ensure meeting TESM requirements.

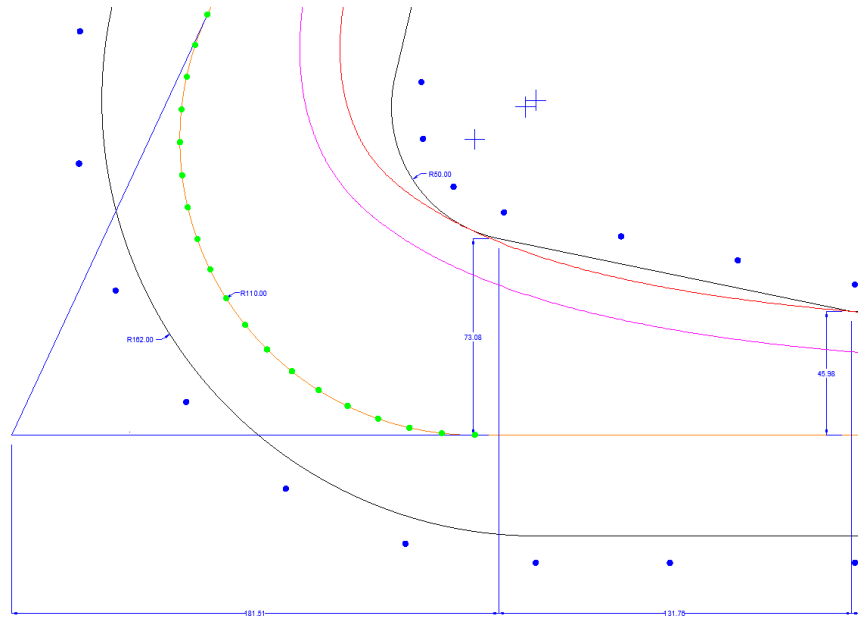
The tool produces a fixed-format DXF file readable in AutoCAD or downloadable DXF viewers. Layering is structured as follows:

- Centerline (orange)
- Centerline lights (green)
- Dimensions (blue)
- Edge (black)
- Edge lights (blue)
- Wheel track (magenta)
- Wheel track + TESM (red)

A sample output.



Enlarged detail.



2.4 Sample Scenarios.

2.4.1 Example One.

The first example is an angle of less than 90 degrees.

1. Select TDG-5. Click <enter>. This results in a display of the CMG, MGW, TESM, and standard taxiway width. These cannot be overridden, since taxiways should always be designed for a specific TDG.
2. Enter Delta of 50 degrees. Click <enter>. Notice that the calculated fillet radius is zero, and the minimum recommended centerline radius is 110 feet. In fact, the fillet radius for all deltas of 90 degrees or less is always zero. Either of these values can be overridden. For now, accept the defaults.
3. Enter a value between 2 and 10 feet for edge light offset. If this field is left blank, then edge lights will not be shown in the output drawing. For this example, enter an edge light offset of 10 feet.
4. Leave RVR checkbox unchecked. Leave the check box for RVR less than 1200 blank.
5. Click “Design Curve”. Click “ok”. The design can take a while, so a pop-up message appears for the user to acknowledge. The long calculation time is because of the program determining the optimum location of the inflection point between the “L-1” taper and the “L-2” taper.
6. The pavement between the Wheel Track Plus TESM curve and the pavement edge is technically unnecessary. Straight pavement edges are specified for ease of construction. The program determines the location of the inflection point where the total area of unnecessary pavement is a minimum. But since constructability is the goal, it is perfectly acceptable to adjust this point, say, to accommodate the size of

concrete panels. Just be sure the adjusted point is on or outside the Wheel Track Plus TESM curve.

Taxiway Fillet Design Tool

The R-CL selected will result in a maximum steering angle of 32.6 degrees

Reference 150/5300-13, Airport Design, for additional information

Select TDG then <enter> 5

CMG 100

MGW 47

TESM 14

Taxiway Width 75

Enter delta then <enter> 50

R-Fillet (default) 0

R-Fillet (if not using default) then <enter>

Minimum recommended R-CL 110

Enter R-CL then <enter>

Enter edge light offset then <enter> (Blank for no edge lights) 10

☐ RVR < 1200?

X coordinate of R-FILLET center 30.83

Y coordinate of R-FILLET center 66.12

R-OUTER 147.5

L-1 265.22 W-0 37.50

L-2 132.43 W-1 44.62

L-3 30.83 W-2 66.12

Enter DXF file name: enter file name

Tool Notes Design Curve Create DXF File Exit

7. Review the displayed dimensions. All the dimensions necessary to lay out the curve display. But note that the maximum nose gear steering angle is considerably less than 50 degrees. This is because for angles less than 90 degrees, a large centerline radius is selected to allow a greater speed through the turn.
8. Enter the DXF filename. The DXF file will be placed in the user's EXCEL default local file folder.
9. Click Create DXF File. The location of the file that has been generated is shown in the Status box, top right.

Taxiway Fillet Design Tool

DXF file created and located at C:\Users\jdoe\Documents\Sample.DXF

Reference 150/5300-13, Airport Design, for additional information

Select TDG then <enter> 5

CMG 100

MGW 47

TESM 14

Taxiway Width 75

Enter delta then <enter> 50

R-Fillet (default) 0

R-Fillet (if not using default) then <enter>

Minimum recommended R-CL 110

Enter R-CL then <enter>

Enter edge light offset then <enter> (Blank for no edge lights) 10

☐ RVR < 1200?

X coordinate of R-FILLET center 30.83

Y coordinate of R-FILLET center 66.12

R-OUTER 147.5

L-1 265.22 W-0 37.50

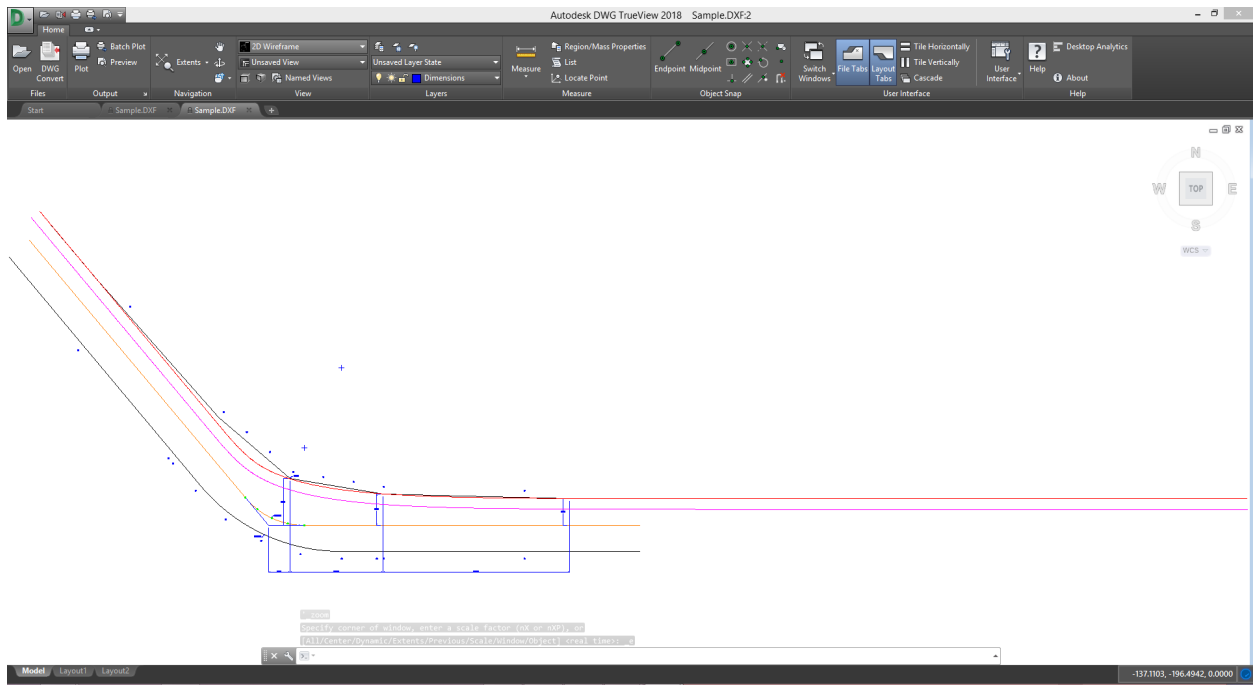
L-2 132.43 W-1 44.62

L-3 30.83 W-2 66.12

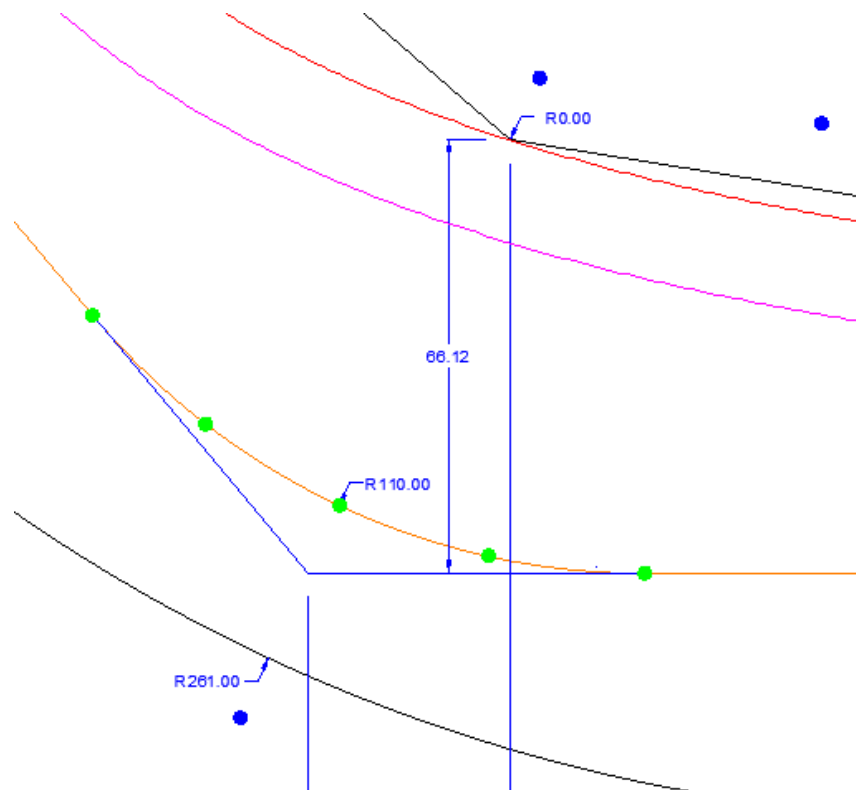
Enter DXF file name: enter new file name

Tool Notes Design Curve Create DXF File Exit

10. View the entire drawing.



11. Zoom in to view various details.



2.4.2 Example Two.

In some cases, it may be necessary to use a centerline radius lower than the minimum recommended. The second example generates a warning message.

1. Select TDG-6. Click <enter>.
2. Enter delta 100. Click <enter>. The default radius of the fillet is 50 feet, and the minimum centerline radius is calculated to be 135 feet.
3. After defaults appear, enter R-CL 120. Click <enter>.
4. A pop-up warning message appears stating that entering an R-CL value less than the minimum recommended R-CL will result in a steering angle of more than 50 degrees.

