U.S. Department
of Transportation
Federal Aviation
Administration

User's Guide

Subject: Airport Design, Taxiway Fillet Design Tool

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CHAPTER 1. INTRODUCTION

1.1 Purpose of this Guide.

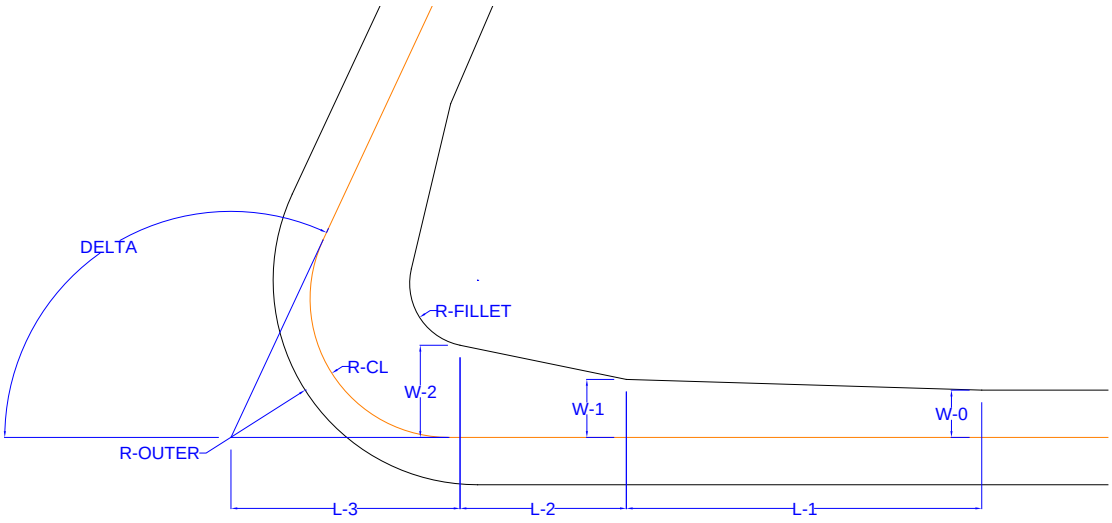
This User's Guide provides the steps for operating the Taxiway Fillet Design Tool. If you have suggestions for improving this User's Guide or the Taxiway Fillet Design Tool, you may use the Feedback Form at the end of this document.

1.2 Overview of the Tool.

The Advisory Circular (AC) 150/5300-13, *Airport Design*, provides dimensions necessary to lay out taxiway turns of "standard" angles (deltas). These are 30, 45, 60, 90, 120, 135, and 150 degrees. However, a turn of a "non-standard" 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 "non-standard" delta. To assist in those situations, AAS-100 has developed computer software that calculates the minimum recommended centerline radius and pavement edge geometry. For deltas of 90 degrees or more, the tool calculates the centerline radius to limit the nose gear steering angle to 50 degrees. For lesser deltas, it chooses the centerline radius to maintain taxiing speed. In all cases, the tool calculates the pavement dimensions that ensures the required Taxiway Edge Safety Margin (TESM) and minimize excess pavement, and the locations of taxiway centerline and edge lights.

Use the FAA Taxiway Fillet Design Tool to design the centerline radius and fillets for turns comprising all deltas between 5 and 175 degrees, including centerline lights and, optionally, edge lights. The design tool determines a more "ideal" layout than provided in AC 150/5300-13, *Airport Design*, in terms of minimizing excess pavement. 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.

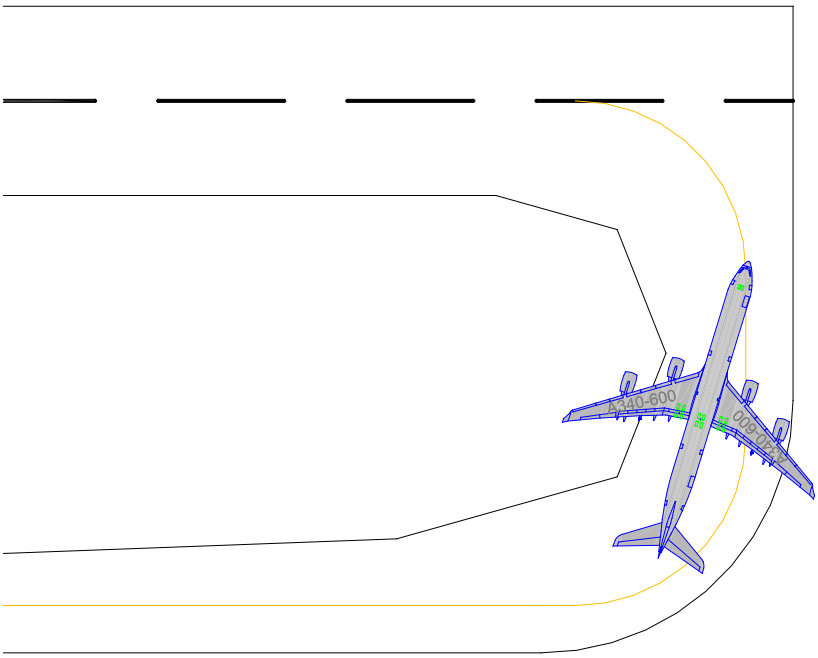
Dimensions used in this tool, as illustrated below, correspond with AC 150/5300-13A:



In addition to displaying pavement dimensions on the user's computer screen, the program creates a CAD drawing in DXF format that virtually any CAD software can import.

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, as shown below.



Note: Because the tool calculates suggested centerline and edge lighting placement, 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 precise, or cover more scenarios, than the values listed in AC 150/5300-13 or AC 150/5340-30.

1.4 Terminology.

1. Main Gear Width (MGW)
   The distance from the outer edge to outer edge of the widest set of main gear tires.
2. 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.
3. R-Fillet Radius of fillet

4. R-CL — Radius of centerline
5. RVR — Runway Visual Range
6. R-Outer — Radius of outer edge
7. 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.
8. 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.

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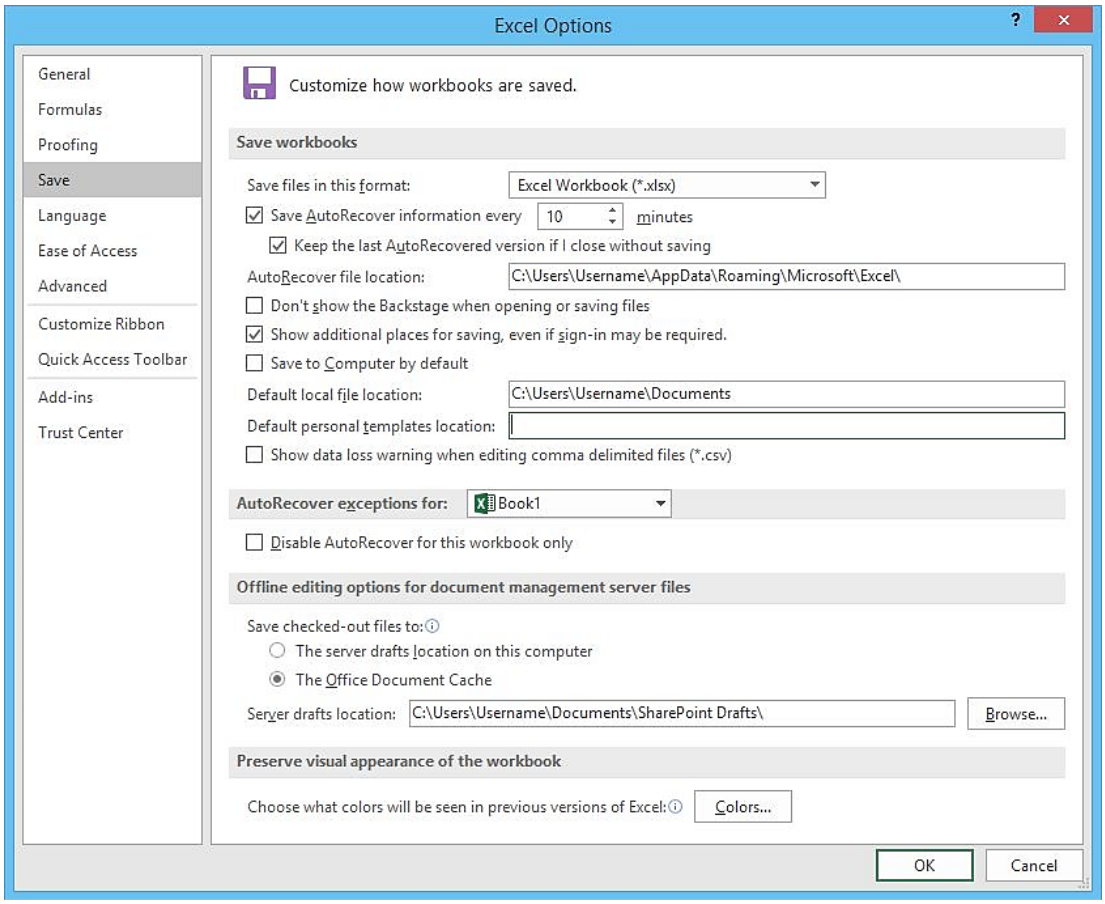
CHAPTER 2. USING THE TOOL

2.1 Prior to Using the Tool.

The Taxiway Fillet Design Tool is EXCEL-based and runs offline, using the local hard drive on individual computers. The tool produces an output file that will be located in the default folder designated by the user 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 then R-CL).

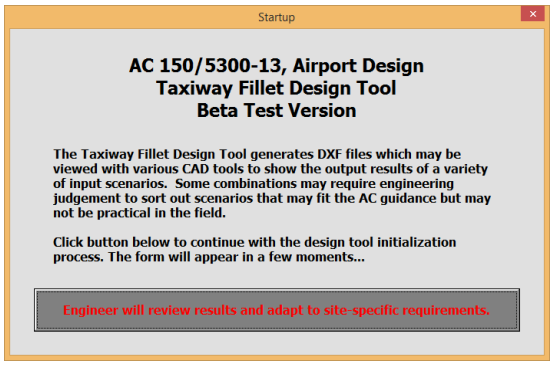
2.2.1 General Notes.

- Follow on-screen instructions, alerts, and progress information.

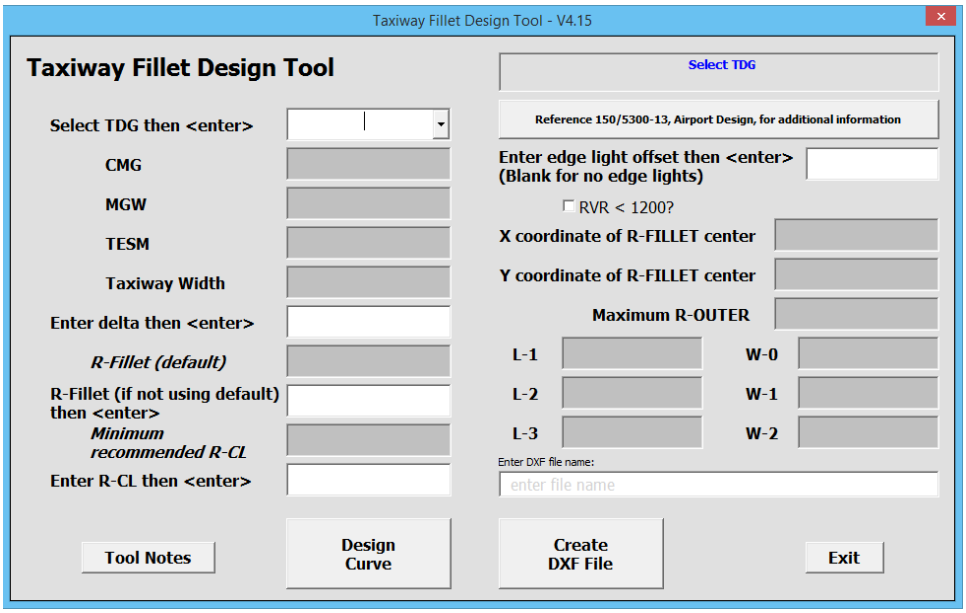
- Results of the tools may vary from the dimensions in AC 150/5300-13. The design tool determines a more "ideal" layout than provided in the AC, in terms of minimizing excess pavement.
- Edge lighting locations may appear strange at very low deltas and in some cases, lights will be shown very close together. The layouts should, however, conform to the standards in AC 150/5340-30, *Design and Installation Details for Airport Visual Aids*. In such cases, use engineering judgment as in the absence of this program.
- Leaving the "edge light offset" field blank, the tool will not plot edge lights. However, the tool always plots the centerline lights. If centerline lights are not part of the design, the centerline lights layer of the DXF can be turned off in your CAD software.

2.2.2 Opening the Tool.

1. Save the tool to your hard drive.
2. Double click to open the tool.
   a. The "opening tool…" screen appears.
   b. Click "Enable Content" if prompted.
   c. The following form appears. Click the gray bar to continue to the tool.

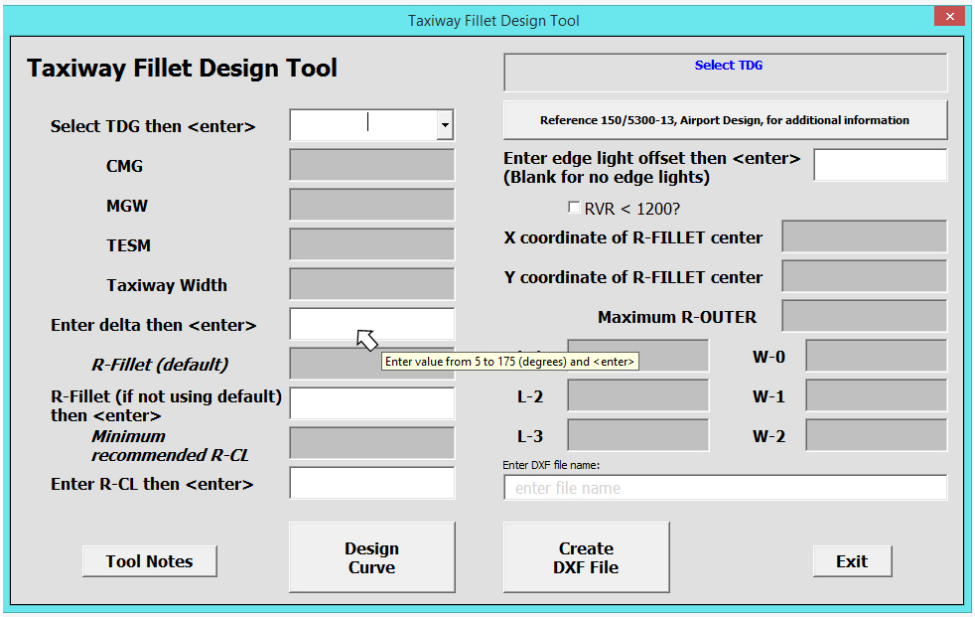


   d. The user form appears after the initialization process is complete. Grayed-out boxes indicate tool-calculated display-only fields. The Status Message box, upper right corner of the form, steps you through the process and provides informative alert information when appropriate. Perform the steps in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

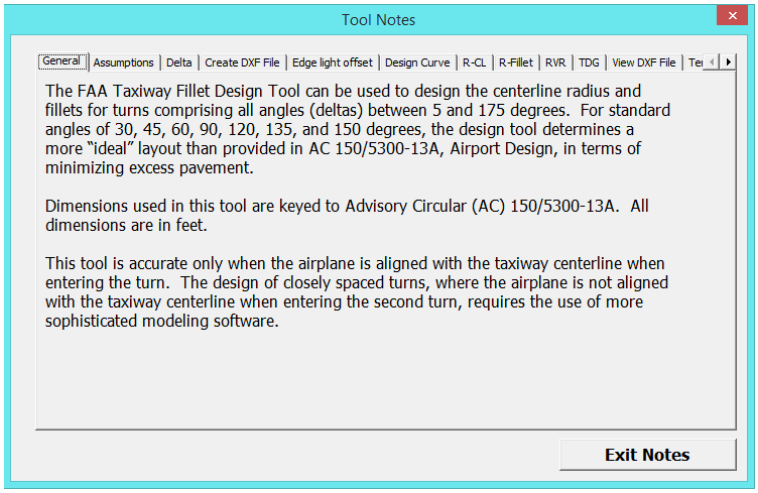


2.2.3 Tool Features.

- The button bar under the status message box (top right) contains a hyperlink that goes to the most current version of the Airport Design AC, for reference.
- Each field on the form contains a tip that displays when you hover the pointer over it as shown below in the example.



- The "Tool Notes" button (lower left) shows a multi-page help file.



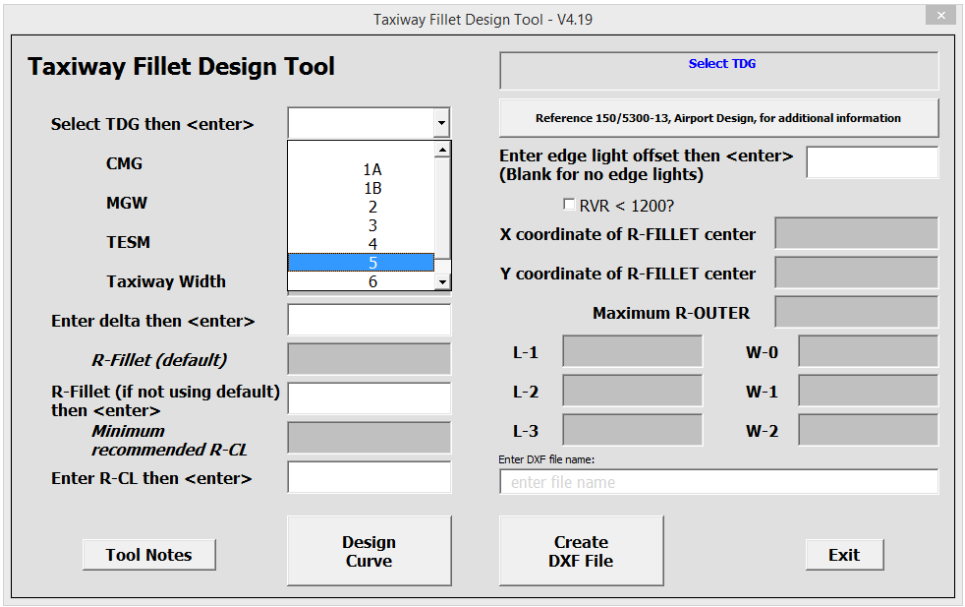
2.2.4 Status Messages.

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

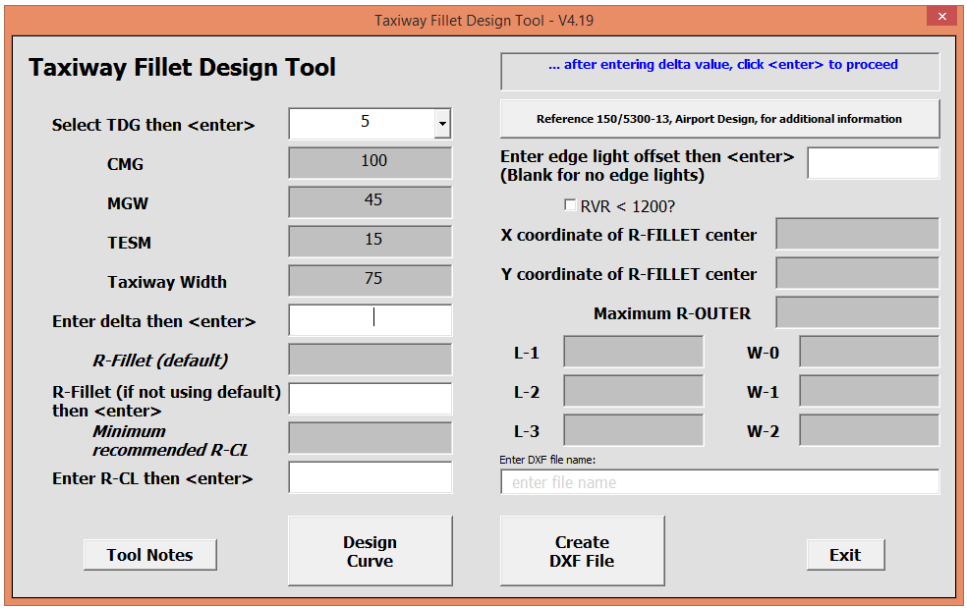
2.3 Steps for Using the Tool.

2.3.1 TDG.

To use the tool, select the desired TDG from the pull-down list and press "Enter.".

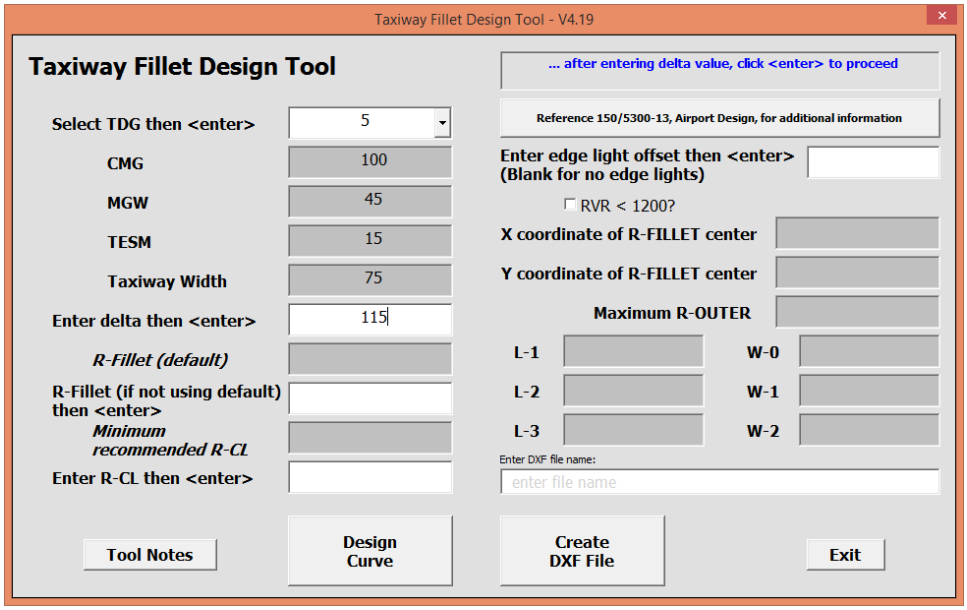


The CMG, MGW, TESM, and Taxiway Width are then displayed and shown. Notice the next step is displayed in the status message box (top right).



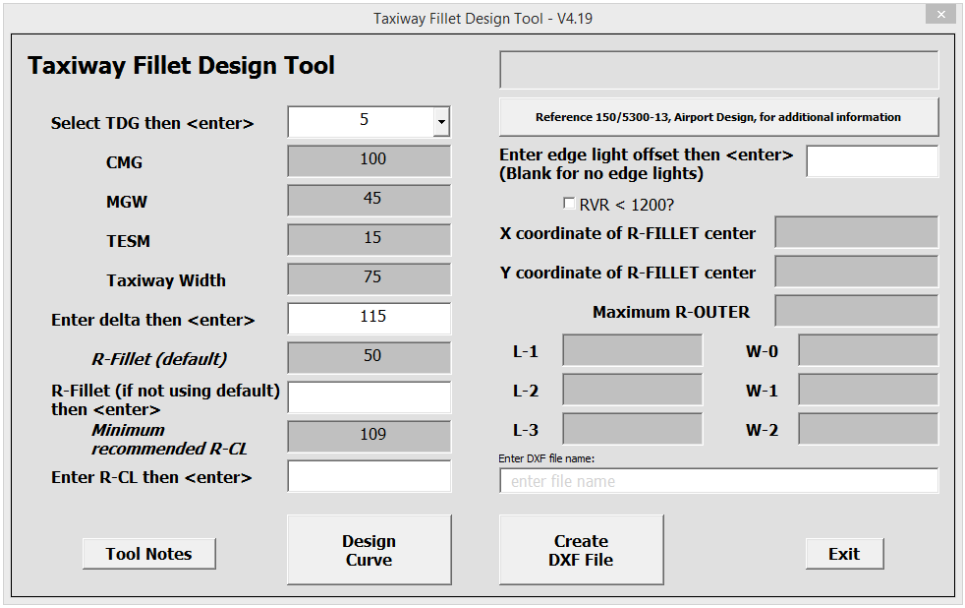
2.3.2 Delta.

Enter the delta value and press "Enter.".

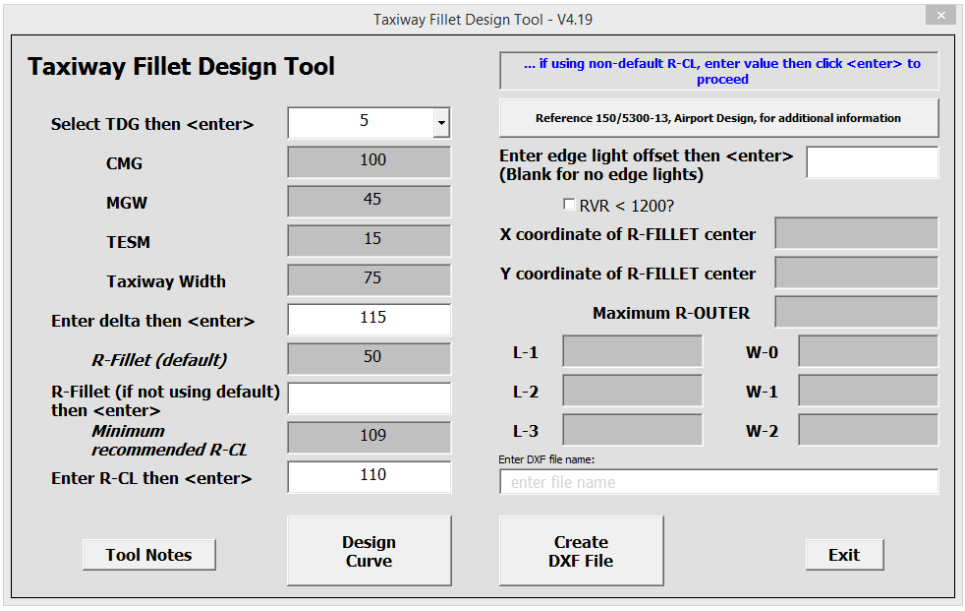


2.3.3 Minimum Recommended R-CL and R-Fillet.

After entering the delta value and pressing "Enter", the "Minimum recommended R-CL" and "R-Fillet (default)" are automatically calculated and displayed.

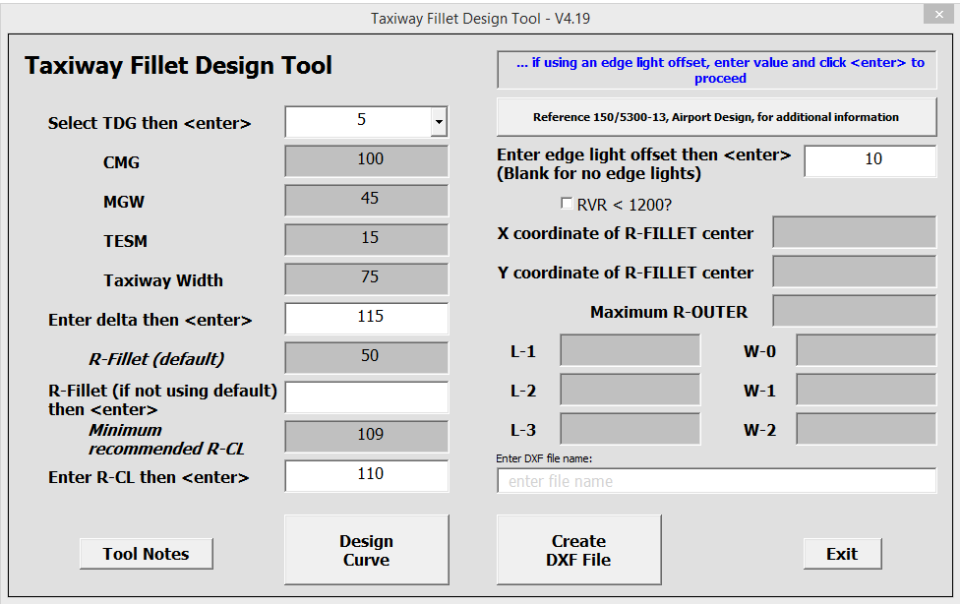


You may enter R-Fillet and/or R-CL, or leave one or both of these fields blank to use the default values. Using a value for R-CL lower than the minimum recommended value will result in a nose gear steering angle of more than the recommended maximum 50 degrees. In such a case, the maximum nose gear steering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



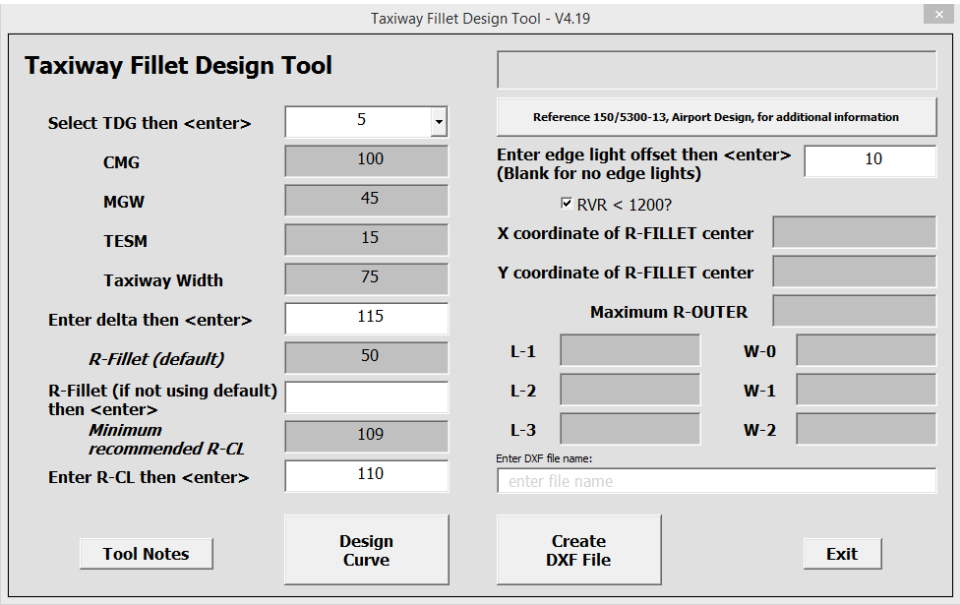
2.3.4 Edge Light Offset.

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



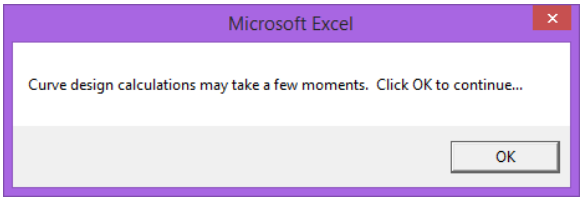
2.3.5 RVR.

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

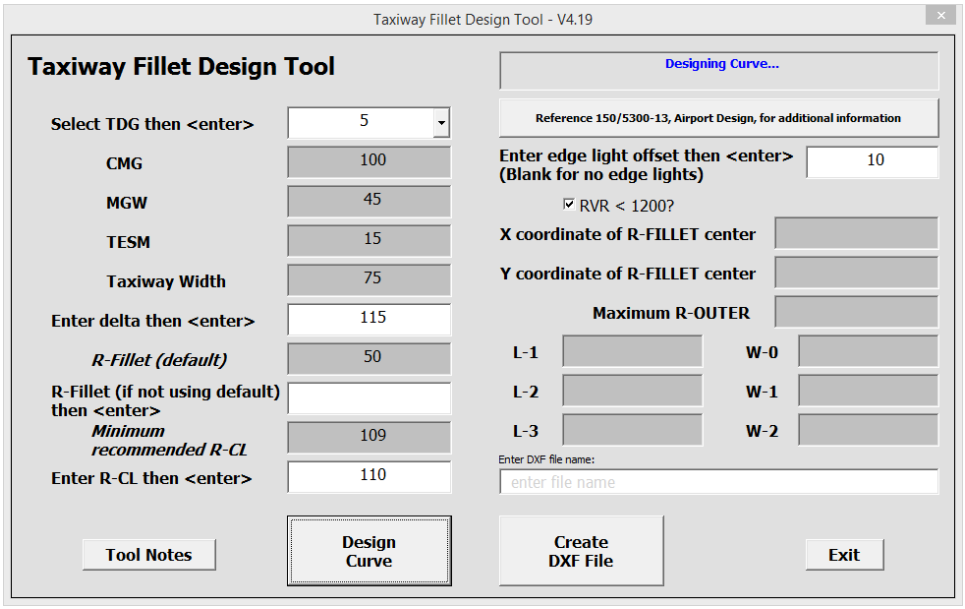


2.3.6 Design Curve.

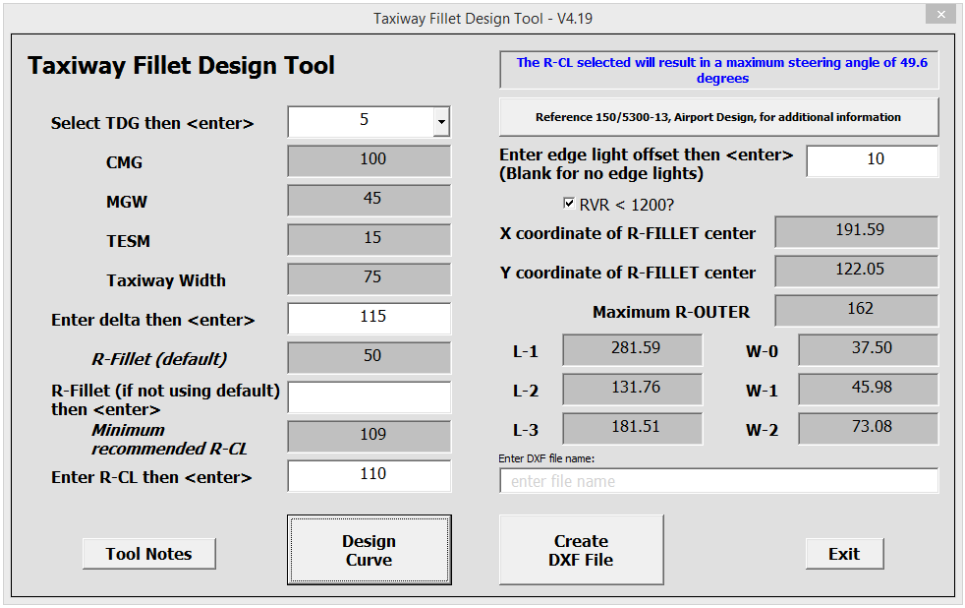
Click "Design Curve." A message box appears to inform the user that the calculations may take a few moments; click ok to continue.



A message appears in status message box while the calculations are in progress.

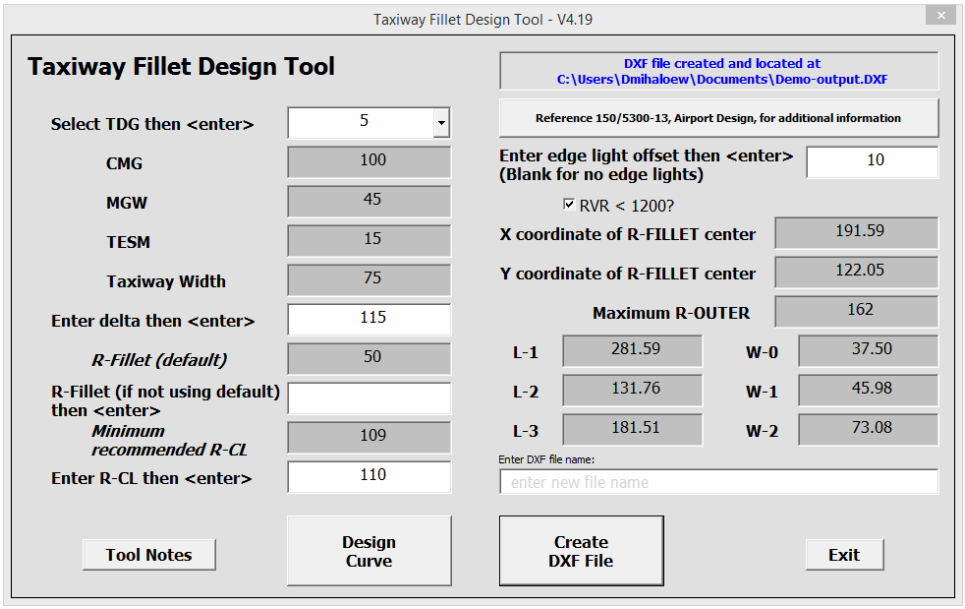


The tool calculates the dimensions necessary to define the fillets. X and Y coordinates are based on the origin at the Point of Intersection of the curve. For high deltas, the calculated R-OUTER may not be ideal since only integer values are considered. In no case does R-OUTER need to be less than R-CL + Taxiway Width/2. This will result in some calculated values of R-OUTER to be shown to 0.5 feet. However, final dimensions used in the output curves are always incremented by one foot. The resulting maximum steering angle appears in the status message box when the design curve calculations are complete.



2.3.7 Create DXF File.

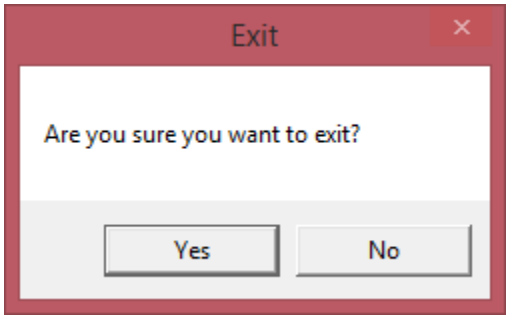
Enter a file name in the file name box to output a DXF file of that name; click on "Create DXF File." The status message box lists the output file location.



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.

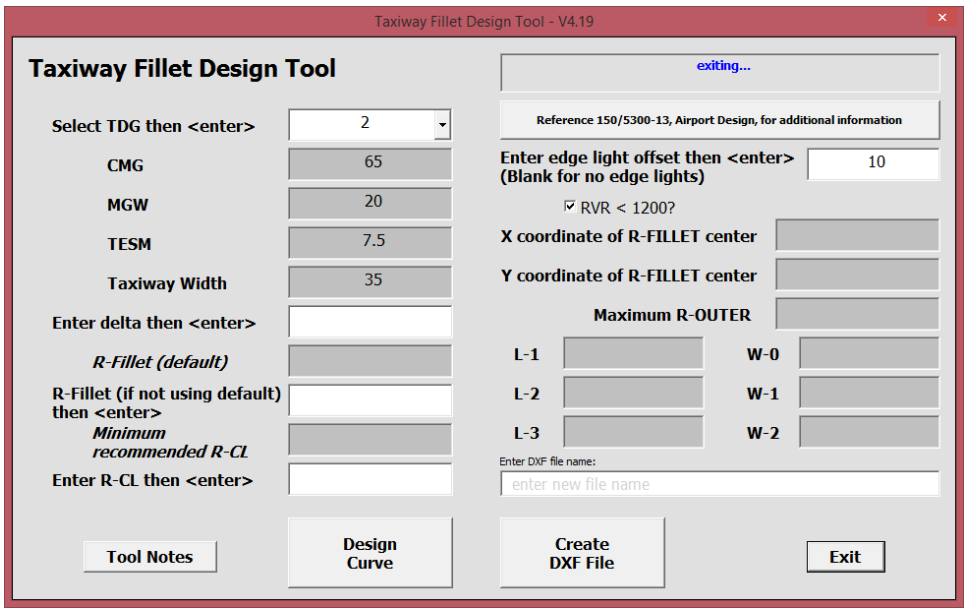
2.3.8 Exiting the Tool.

Use the exit button, lower right, to exit the tool. This button will reset the tool, and takes a moment to complete. Because of this, the user is allowed the option to return to the tool rather than exit.



Note: You cannot use the "X" box in the upper right to exit.

An "exiting…" message appears in the status message box as the tool closes.



2.3.9 Viewing the DXF File.

The DXF files can 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 (looks like a hand, to the right of the zoom button) allows the user to reposition the drawing.
- The features of the output drawing show up 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)
    - "Display" tab
    - "Colors…" button
    - "Color:" button
    - Select "white" from the pull-down menu
    - "Apply and Close" button

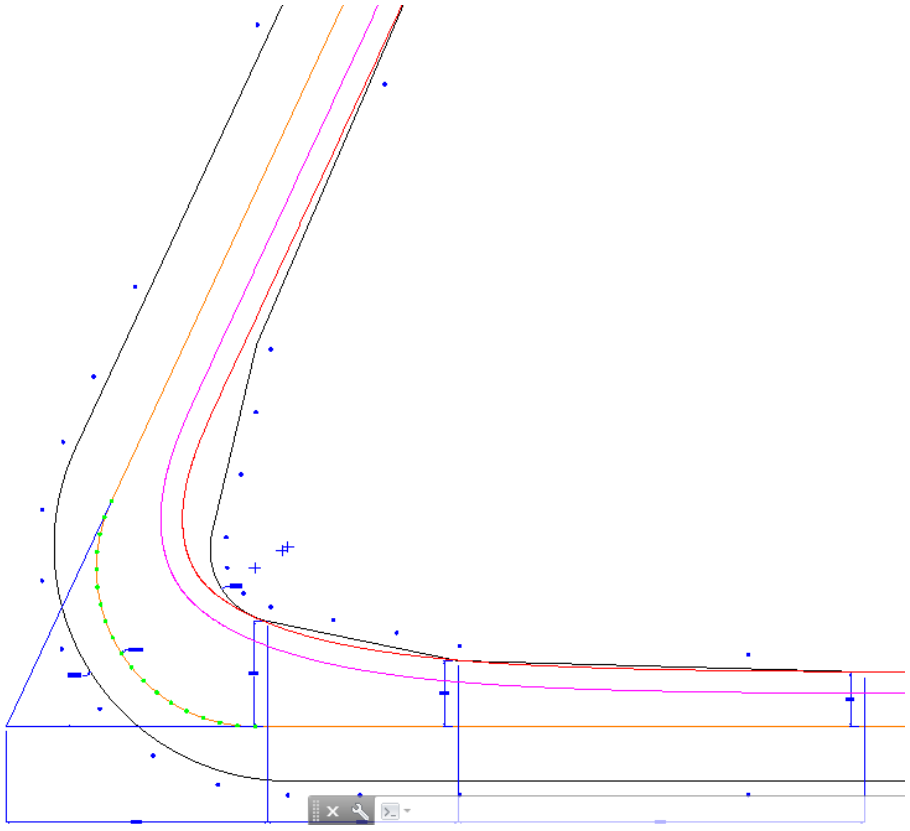
Using CAD software (or viewer), the layout designed by this tool may be scaled and adjusted for constructability and/or placement of lighting. When making such

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

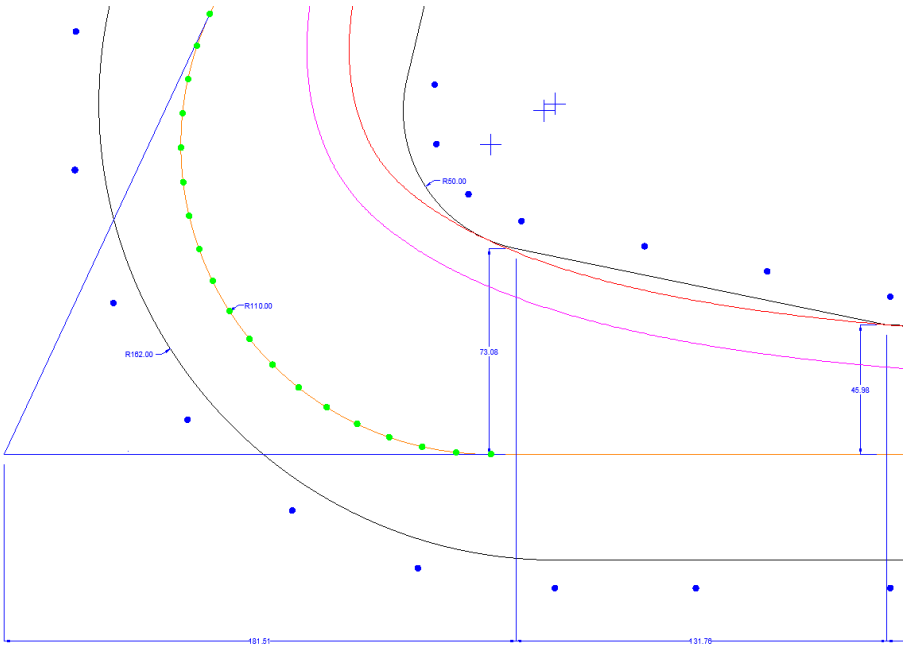
The tool produces a fixed-format DXF file that is readable in AutoCAD or downloadable DXF viewers. Layering is structured as follows:

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

A sample output:



Enlarged details:



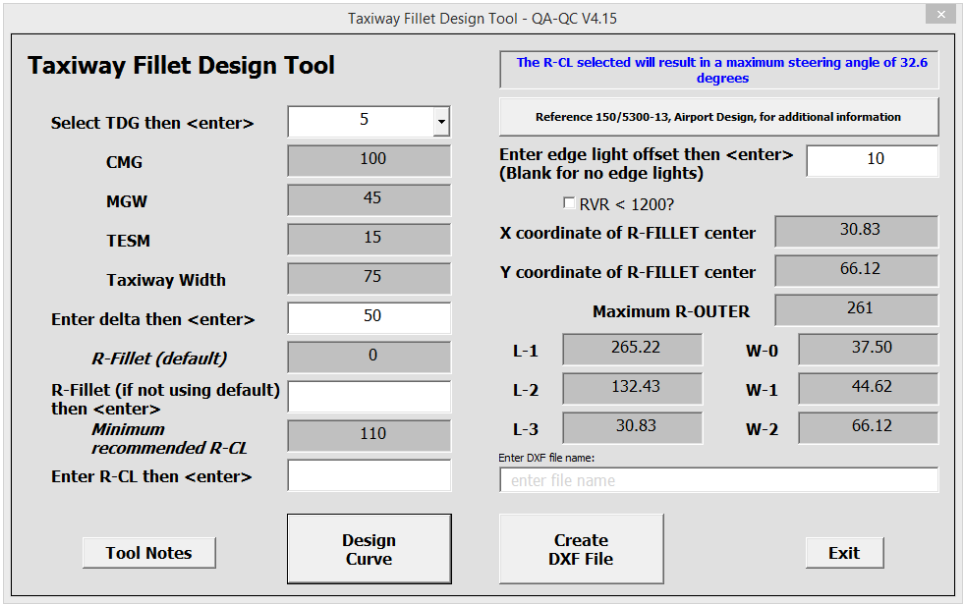
2.4 **Sample Scenarios.**

2.4.1 Example One.

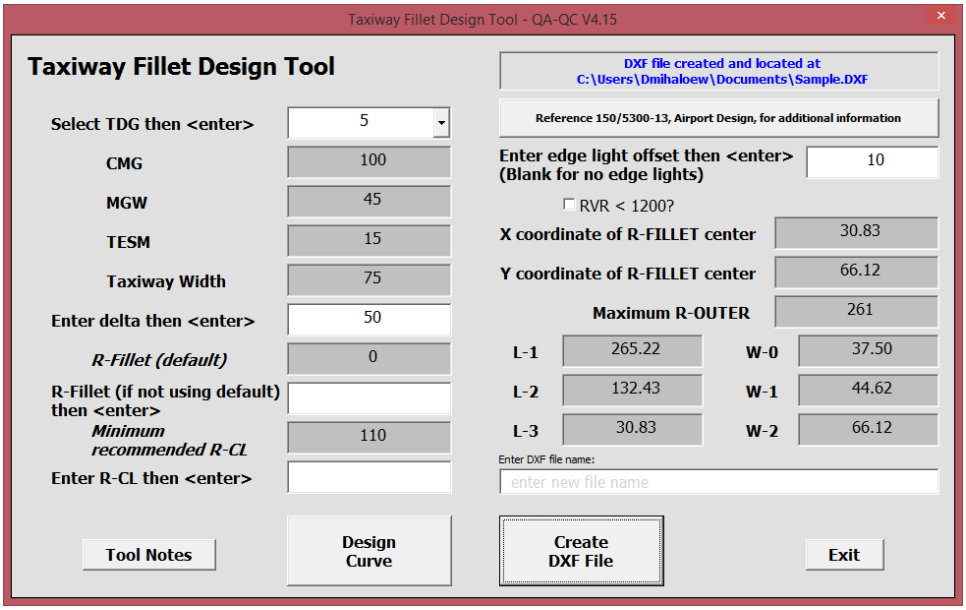
The first example is an angle of less than 90 degrees.

1. Select TDG-5, press <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, press <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. 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.
5. Click the "Design Curve" button, then "ok". The design can take a bit of time, so we see a pop-up message for the user to acknowledge, so that he or she does not think the program has stalled. 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. 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. Since constructability is the goal, it is acceptable to adjust this point to accommodate the size of concrete

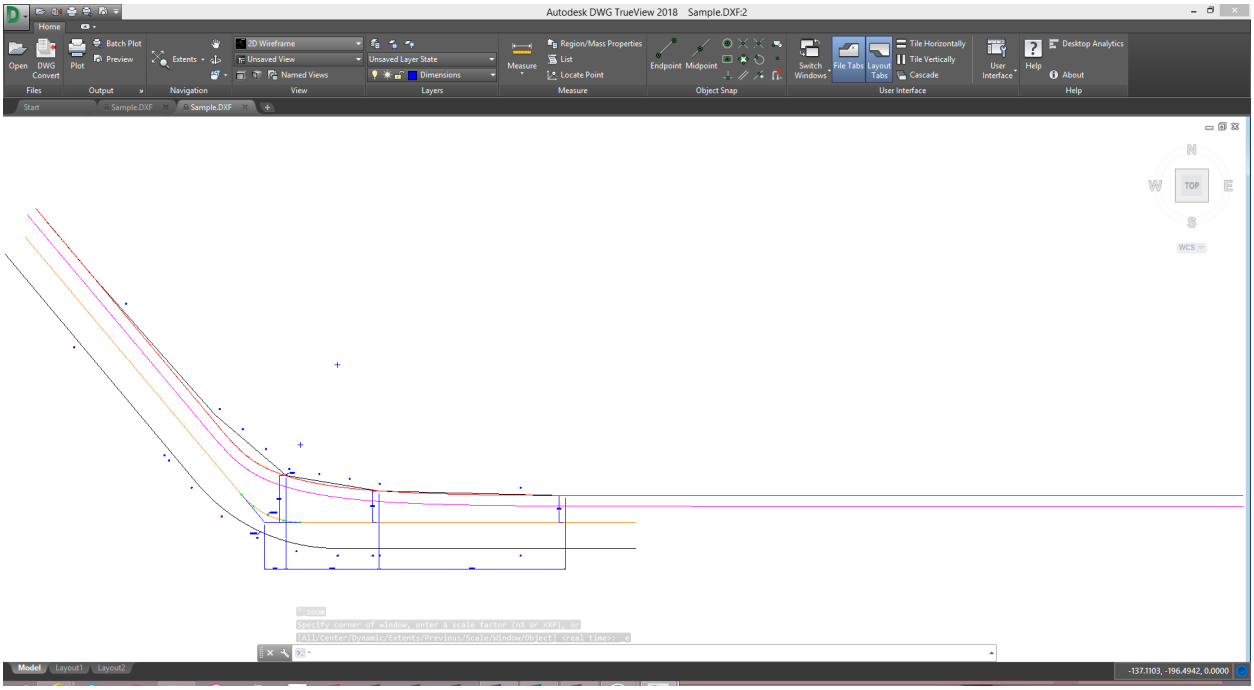
panels. Check that the adjusted point is on or outside the Wheel Track Plus TESM curve.



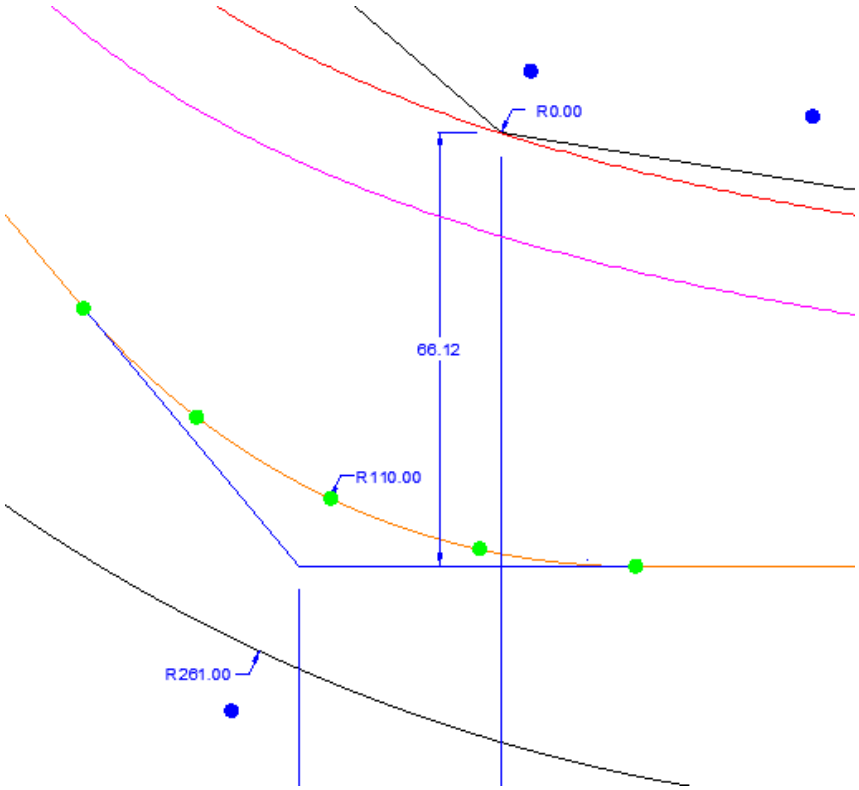
6. Review the displayed dimensions. All the dimensions necessary to lay out the curve are displayed. Note that the maximum nose gear steering angle is considerably less than 50 degrees. This is because for angles less than 90 degrees, a large centerline radius is selected to allow a greater speed through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



9. View the entire drawing.



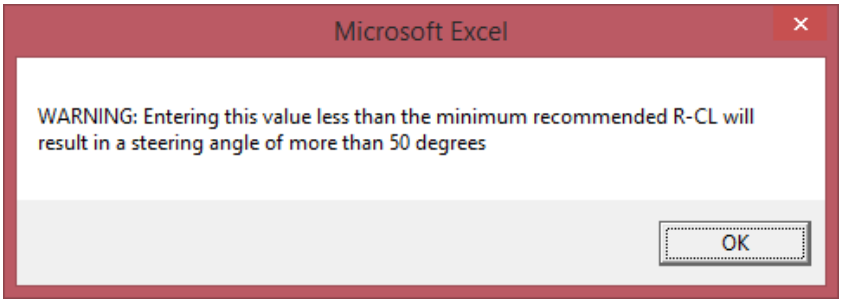
10. Zoom in to view various details.



2.4.2 Example Two.

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 <enter>.
2. Enter delta 100 <enter>. The default radius of the fillet is 50 feet, and the minimum centerline radius is calculated to be 125 feet.
3. After defaults appear, enter R-CL 120 <enter>.
4. A pop-up warning message appears stating that the maximum nose gear steering angle will more than 50 degrees.



Feedback Form

If you find an error in the Taxiway Fillet Design Tool or this User's Guide, have recommendations for improving it, or have suggestions for new items/subjects to be added, let us know by (1) mailing this form to Manager, Airport Engineering Division, Federal Aviation Administration ATTN: AAS-100, 800 Independence Avenue SW, Washington DC 20591, or (2) faxing it to the attention of the Office of Airport Safety and Standards at (202) 267-5383.

Subject: AC 150/5300-13A, Taxiway Fillet Design Tool and User's Guide

Date: _____

Please check all appropriate line items:

☐ An error has been noted in the following location: _____.

☐ Recommend changing as follows:

_____
_____
_____

☐ In a future change to this User's Guide or the Taxiway Fillet Design Tool, please cover the following subject:
(Briefly describe what you want added.)

_____
_____
_____

☐ Other comments:

_____
_____
_____

☐ I would like to discuss the above. Please contact me at (phone number, email address).

_____
_____
_____

Submitted by: _____ Date: _____