



# **A Practical Guide to Carlson Survey 2021**

**Douglas L. Aaberg, PLS**  
**Rick Ellis**  
**Duke Gardner**



A CADapult Press Publication

---

## Copyright

Copyright © CADapult Press, Inc. 2020

All rights reserved. No part of this publication may be reproduced in any form, or by any means electronic, mechanical, recording, photocopying, or otherwise, without written permission from the publisher, except for brief quotations used in reviews, or for marketing purposes specific to the promotion of this work.

ISBN: 978-1-934865-54-5

Although CADapult Press has made every attempt to ensure the accuracy of the contents of this book, the publisher and author make no representations or warranty with respect to accuracy or completeness of the contents in this book, including without limitation warranties of fitness for a particular purpose. The datasets included in this book are for training purposes only.

Carlson Survey and Carlson Civil are registered trademarks of Carlson Software. AutoCAD Civil 3D, AutoCAD Map 3D, and AutoCAD® are registered trademarks of Autodesk, Inc. All other trademarks are the property of their respective owners.

Published in the United States of America by:

CADapult Press, Inc,

(503) 829-8929

books@cadapult-software.com

Printed and manufactured in the United States of America

## About the Author

**Douglas L. Aaberg, PLS** is a licensed Professional Land Surveyor in the Commonwealth of Massachusetts and in the State of Colorado. His career in the Land Surveying/Civil Engineering business spans four decades. Having used Carlson Software exclusively since 1998, Doug is a recognized expert in applying the continually expanding capability of Carlson's programming to the everyday "work flow" of land surveyors and engineers. After owning and operating his own company for fifteen years, Doug now works directly for Carlson Software as their Survey Product manager. Besides being involved in development, he dedicates his time consulting to both large and small land survey and engineering firms through on-site training, remote support and individually tailored documentation.

Doug can be reached at: [daaberg@carlsonsw.com](mailto:daaberg@carlsonsw.com)

**Rick Ellis** has worked with and taught Civil/Survey CAD software since the mid-90s. He is the Author of several critically acclaimed books on AutoCAD Map 3D and other CAD packages. He continues to work on projects in a production environment, in addition to teaching classes to organizations both large and small.

This practical background and approach has made him an award winning speaker at Autodesk University, a member of the national speaker team for the AUGI CAD Camps and a sought after instructor by organizations around the world.

Rick can be reached at: [rick@cadapult-software.com](mailto:rick@cadapult-software.com)

**Duke Gardner** has served the land surveying and civil engineering communities for over 35 years in a wide variety of support roles. His focus on the theory as well as the practice skills needed to achieve successful implementation made him an excellent partner in the author team for this guide.

## Acknowledgements

Thank you to Carlson Software for their cooperation. A special thanks to Gary Rosen and Lauren Lax from Carlson Software for their assistance and encouragement. Without it this book would not have been possible.

## Exercise Data

We would like to thank the City of Springfield, Oregon and McKenzie Engineering Group from Norwell, Massachusetts for providing the data for parts of this book. The dataset provided is for illustration purposes only. While it is based on real world information to add relevance to the exercises, it has been altered and modified to more effectively demonstrate certain features as well as to protect all parties involved. The data should not be used for any project work and may not represent actual places or things. It is prohibited to redistribute this data beyond your personal use as a component of training.

# **A Practical Guide to Carlson Survey 2021**

## **Introduction**

Congratulations on choosing this course to help you learn how to use Carlson Survey 2021. The term “practical” is used in the title because this course focuses on what you need to effectively use Carlson Software, and does not complicate your learning experience with unnecessary details of every feature in the product.

Each lesson contains the concepts and principles of each feature to provide you with the background and foundation of knowledge that you need to complete the lesson. You then work through real world exercises to reinforce your understanding and provide you with practice on common tasks that other professionals are performing with Carlson Survey in the workplace every day.

You can take the lessons in this course in whatever order is appropriate for your personal needs. If you want to concentrate on specific features, the lesson for those features does not require that you complete prior lessons. With this course organization, you can customize your own individual approach to learning Carlson Survey.

When you complete this course, you will have the background and knowledge to apply Carlson Survey to your job tasks, and become more effective and productive in your job.

## **Course Objectives**

The objectives of this course are performance based. In other words, once you have completed the course, you will be able to perform each objective listed. If you are already familiar with Carlson Software, you will be able to analyze your existing workflows, and make changes to improve your performance based on the tools and features that you learn and practice in this course.

After completing this course, you will be able to:

- Navigate the Pull-down Menus and Ribbon Menus
- Set up Carlson Software to use the Project approach
- Utilize various COGO tools
- Enter Raw Survey Data at the Command Prompt
- Enter Raw Survey Data in the Carlson Raw Data Editor
- Adjust a Traverse with Compass and Angle Balance
- Adjust a Traverse with Carlson SurvNet
- Enter Deed Data to Create a Deed File
- Perform a Deed Correlation with Field Data
- Create and Edit Lots and Areas
- Utilize Carlson LotNet to Generate Lots and Setbacks
- Edit and Annotate LotNet Lots
- Setup Field to Finish Codes and Generate 2D and 3D Geometry
- Utilize Various Critical Coordinate File Utilities
- Utilize the Point History to Record all Edits to Coordinate Files
- Use Special Linetypes for Map Creation

## Prerequisites

Before starting this course, you should have a basic working knowledge of CAD. While a deep understanding of all CAD functionality is not required, but you should be able to:

- Pan and Zoom in the drawing screen.
- Describe what layers are and change the current layer.
- Create basic CAD geometry, such as lines, polylines and circles.
- Use Object Snaps.
- Describe what blocks are, and how to insert them.
- Perform basic CAD editing functions such as Erase, Copy, and Move.

If you are not familiar with these functions, you can refer to the Help system throughout the course to gain the fundamental skills needed to complete the exercises.

This text builds on the foundation of knowledge established in *A Practical Guide to Carlson Software Fundamentals 2021*. While a mastery of the material in that book is not mandatory to the successful completion of this text, it is highly recommended as a prerequisite to this courseware. Those topics include:

- Working with Points and Point Data
- Managing Point Groups
- Working with Surfaces
- Generating and Labeling Contours
- Performing Basic Drawing and Editing in CAD
- Importing and Exporting Land XML Data
- Working with Google Earth and World files
- Generating Linework Labels

## Conventions

The course uses the following icons and formatting to draw your attention to guidelines that increase your effectiveness in Carlson Software, or provide deeper insight into a subject.



The magnifying glass indicates that this text provides deeper insights into the subject.



The compass indicates that this text provides guidance that is based on the experience of other users of Carlson Software. This guidance is often in the form of how to perform a task more efficiently.

# Downloading and Installing the Datasets

In order to perform the exercises in this book, you must download a zip file and install the datasets.

Type the address below into your web browser to load the page where you can download the dataset.

**[www.cadapult-software.com/data](http://www.cadapult-software.com/data)**

## Unzip the Files

Unzip the file **APG\_SURVEY2021.zip** directly to the C drive. The dataset will be copied to the folder:

**C:\Carlson Projects\**

A folder called **APG Survey 2021 Data** is created that contains several folders with source data for the exercises in this book.

There are folders called **APG Survey 2021 Chapter X** These folders contain project files and drawings that are used to start the corresponding Chapters.

There are also folders created called **APG 2021 Lesson X\_X** These folders contain project files and drawings where the lesson number of the folder corresponds to the lesson numbers in the book. This will allow you to jump in at the beginning of many of the lessons in the book, and do just the specific exercises that you want, if you do not have time to work through the book from cover to cover.

## Exercises

The exercises in this course have been designed to represent common tasks that are performed by civil engineers, surveyors, designers and drafters. The data included in the exercises are typical drawings, point files and other data used by professionals like you. Exercises provide higher level process information throughout the exercise tasks. You are given information about not only what to do, but why you are doing it. Many images are included to help guide you.

# Table of Contents

<b>Chapter 1</b>	<b>A First Look at Carlson Survey 2021</b>	<b>1</b>
1.1	Lesson: A Guided Tour through the Pull-down Menus	2
1.2	Lesson: A Guided Tour through the Ribbon Menus	14
<b>Chapter 2</b>	<b>Working with Coordinate Geometry and Survey</b>	<b>19</b>
2.1	Introduction to Coordinate Geometry	20
2.2	Lesson: Setting up and Configuring Carlson Survey	24
2.2.1	Setting up Carlson Survey to Work with External Data	28
2.2.2	Create a New Drawing	32
2.2.3	Configure General Settings and Points Default Settings	35
2.3	Lesson: Two Methods for Entering Field Survey Data	38
2.3.1	Entering Traverse and Sideshot Data Using Carlson COGO	42
2.3.2	Entering Data Using the Carlson Raw Data Editor	50
2.4	Lesson: Adjusting and Modifying Field Data	54
2.4.1	Adjusting a Traverse	55
2.5	Lesson: Entering Deeds and Record Information	60
2.5.1	Setting up Deed Defaults	62
2.5.2	Entering Record Deed Information	63
2.6	Lesson: Creating a "Fit"	70
2.6.1	Creating New Points for Record Locations	71
2.6.2	Making an Initial Analysis of Field vs Record Data	74
2.6.3	Deed Correlation	75
<b>Chapter 3</b>	<b>Data Collectors and Post Processing</b>	<b>83</b>
3.1	Lesson: Introduction to Data Collectors	84
3.1.1	Working with the Data Collector Programs	88
3.2	Lesson: Working with the Raw Data Editor	93
3.2.1	Processing, Editing and Reporting a Traverse Closure	94
3.3	Lesson: SurvNET	100
3.3.1	Creating a SurvNET Project	108
3.3.2	Processing Data with SurvNET	115
3.3.3	Adding Additional Traverse Data	121
3.3.4	Constraining the Network	124
3.3.5	Add Sideshot Ellipses	129
3.3.6	Generating Final Coordinates	131

<b>Chapter 4</b>	<b>Area/Layout</b>	<b>133</b>
4.1	Lesson: Offsets, Intersections and Cul-De-Sacs	134
4.1.1	Creating Right of Way and Offset Lines	137
4.1.2	Creating a Cul-De-Sac	139
4.2	Lesson: Creating and Sizing Lots	141
4.2.1	Selection Cycling	143
4.2.2	Creating Lots	144
4.2.3	Resizing Lots with Hinged Area	145
4.2.4	Resizing Lots with Sliding Side Area	146
4.2.5	Modify a lot by using AutoCAD Grips	147
4.3	Lesson: Lot Areas, Annotations and Setback Lines	148
4.3.1	Setting the Area Defaults	150
4.3.2	Annotating the Lot Areas	154
4.3.3	Setting up the Auto Annotate by Layer defaults Geometry ( <i>by Layers</i> )	155
4.3.4	Alternate Setup - Load the Supplied Default Settings	176
4.3.5	Annotating the Plan	179
4.3.6	Cleaning up The Annotations	180
4.3.7	Creating Setback Lines	188
<b>Chapter 5</b>	<b>LotNET</b>	<b>191</b>
5.1	Lesson: The Automated Process of Creating Lots and Roadways	192
5.1.1	Setting up LotNET	194
5.1.2	Designing a Subdivision	199
5.2	Lesson: Modifications and Redesign	207
5.2.1	Modifying Lots Created by LotNET	209
5.2.2	Checking your Design for Conformance	214
5.2.3	Storing your design as an external .LOT file	214
5.3	Lesson: Annotations, Cleanup and Subareas	218
5.3.1	Annotating the Subdivision	219
5.3.2	Renumber Lots	221
5.3.3	Sub-Areas	222
<b>Chapter 6</b>	<b>Working with Field to Finish</b>	<b>225</b>
6.1	Lesson: Introduction to Field to Finish	226
6.2	Lesson: Setting up Field to Finish Codes and Settings	229
6.2.1	Creating a New Drawing for Field to Finish	236
6.2.2	Creating a Field to Finish Code File (.FLD file)	239
6.2.3	Creating/Editing a Field to Finish Code	242



6.2.4	Printing the Code List .....	249
6.2.5	Setting the Special Codes .....	252
6.3	Lesson: Drawing with Field to Finish .....	255
6.3.1	Drawing Field to Finish Entities .....	258
6.4	Lesson: Using the Field to Finish Inspector .....	260
6.4.1	Using the Field to Finish Inspector .....	262
6.5	Lesson: Using the Tree Feature .....	264
6.5.1	Drawing a User Defined Tree Feature .....	269
6.6	Lesson: High Octane Field to Finish .....	282
6.6.1	Adding Multiple Codes.....	287
6.6.2	Advanced Special Codes .....	299
6.6.3	Working with Offset Codes .....	302
6.6.4	Using Fixed Parameters .....	303
6.6.5	Working with Companion Codes .....	305
6.6.6	Cleaning Up Linework with the GAP and JPN Special Codes .....	309
6.6.7	Customizing Special Codes.....	311
6.6.8	Working with Templates .....	313
6.7	Lesson: Annotating with Field to Finish .....	319
6.7.1	Field Code Table Using Attributes.....	322
6.7.2	Creating a Block with Custom Attributes .....	335
6.7.3	Using a Block with Custom Attributes .....	338
6.7.4	Field Code Table Using Text.....	343
6.7.5	Adding Text from Field Notes.....	349
6.7.6	Adding Equations to Notes .....	353
6.8	Lesson: Editing the Plan .....	357
6.8.1	Setting Drawing Orientation.....	358
6.8.2	Controlling the Display with Layer Filters .....	360
6.8.3	Editing a Plan with Attribute Labels.....	362
6.8.4	Setting Drawing Orientation.....	365
6.8.5	Controlling the Display with Layer Filters .....	367
6.8.6	Editing a Plan with Text Labels .....	369
6.9	Lesson: Another Example of What Can be Done with Field to Finish .....	375
6.9.1	Putting it all Together.....	376
6.10	Special Codes Appendix .....	385
<b>Chapter 7</b>	<b>Ten More Essential Tools.....</b>	<b>393</b>
7.1	Lesson: Using the Carlson Survey Inverse Command .....	395
7.1.1	Inverse Between Two Points .....	397

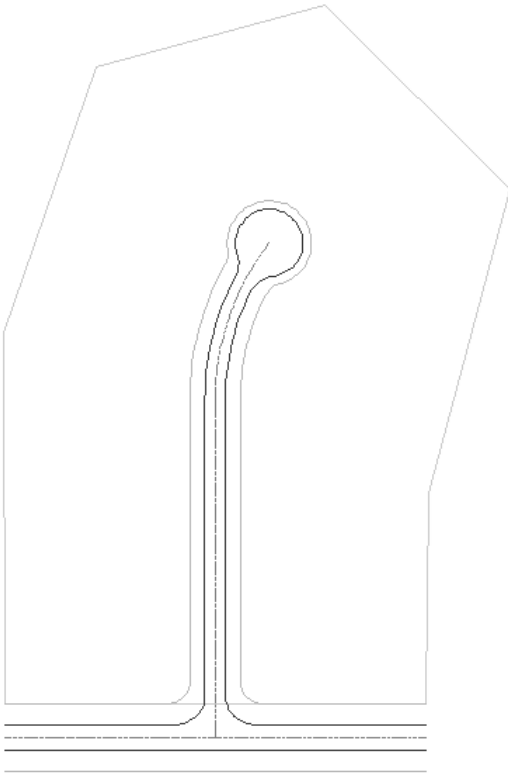
7.2 Lesson: Creating a Coordinate File from an Existing Drawing.....	400
7.2.1 Update CRD from Drawing .....	402
7.3 Copying or Merging Two Coordinate Files .....	406
7.3.1 The Copy/Merge CRD File Command.....	408
7.3.2 Updating the Drawing.....	412
7.4 Lesson: Creating a Point Comparison Report.....	414
7.4.1 Creating a Point Comparison Report.....	416
7.5 Lesson: Point History and the QA/QC of Coordinate Files .....	419
7.5.1 Reviewing Point History .....	420
7.6 Lesson: Aligning Geometry to Points .....	428
7.6.1 The 2D Align Command.....	429
7.7 Lesson: Calculating Curves.....	431
7.7.1 Using Curve Calc .....	433
7.7.2 Plotting a Curve.....	434
7.8 Lesson: Creating and Editing Polylines .....	436
7.8.1 Using Join Nearest.....	439
7.8.2 Editing Polylines.....	440
7.9 Lesson: Drawing Special Line Types .....	444
7.9.1 Change Polyline Linetype .....	446
7.9.2 Create a Tree Line .....	448
7.10 Lesson: Legal Description Writer.....	449
7.10.1 Creating a Legal Description.....	456
<b>Index .....</b>	<b>459</b>

# Sample Lesson

## 4.1 Lesson: Offsets, Intersections and Cul-De-Sacs

### Introduction

Much time is often spent creating roadways and cul-de-sacs. In this lesson you will learn how to utilize some of Carlson's design commands to highly automate these processes and work much more efficiently.



### Key Concepts

- Creating offsets and intersections
- Creating cul-de-sacs

### Objectives

After completing this lesson you will:

- Be able to efficiently create drawing geometry for roadways and cul-de-sacs using Carlson tools.

## Introduction

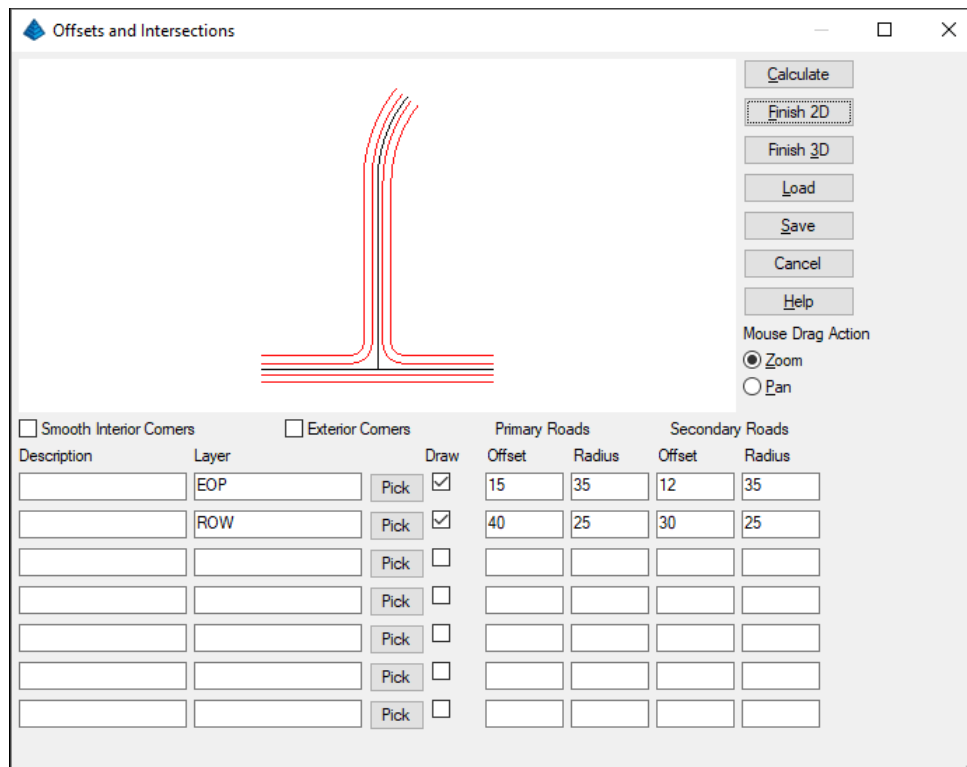
For the surveyor, calculating lot lines within an existing boundary can be a tedious and time consuming task. In days not so long ago, a surveyor or design engineer would sit and "number crunch" entering in COGO commands like bearing/bearing intersections or bearing/distance intersections to create lines, arcs and offsets.

In today's CAD climate, you have graphic tools that can perform those same tasks in a fraction of the time. However, the design of a subdivision (*Roads and Lots*) is still a constantly changing environment, with modifications from clients, overlaying regulations and budget constraints.

It is imperative to learn the many methods of designing a subdivision utilizing every tool available to ensure that the process is completed as quick and accurate as possible and that the inevitable revisions can be made easily.

It is important to mention that in a later chapter, you will be introduced to a powerful program called LotNET. LotNET combines all of the steps in creating roads and lots, automates the process and ties it directly to other civil design programs such as RoadNET.

## Offsets and Intersections



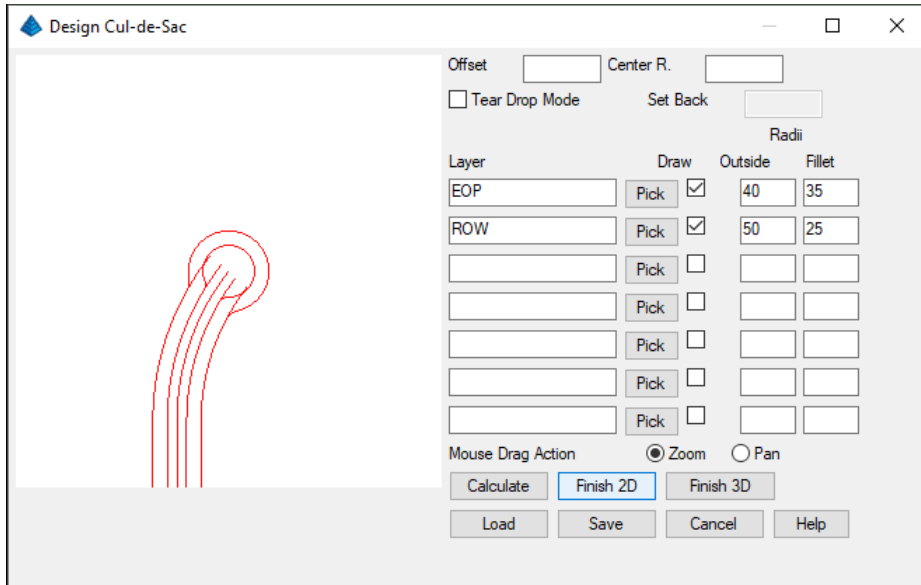
The *Offsets and Intersections* layout utility automates the process of creating geometry for roads, including intersections, based on selected centerlines.

The *Layer column* is the layer on which each offset will be created. In this case the default is **EOP** (edge of pavement) and **ROW** (right of way).

The Primary Roads column has two sub columns: **Offset** is the offset distance from the centerline for the corresponding layer. **Radius** is the return radii created at each intersection of roads for the corresponding layer.

The Secondary Roads columns are set up identically to the primary roads. Additional offsets and layers may be created as desired.

## Design Cul-de-Sac



The *Design Cul-de-Sac* layout utility automates the process of creating geometry for Cul-de-Sacs. Similar to the Offsets and Intersection dialog box, this dialog box is where you set the desired geometric properties for the cul-de-sac.

The **Offset** field is for creating an offset cul-de-sac. The offset is calculated from the picked point in the previous step and is measured perpendicular to the incoming tangent bearing.

The **Center R.** creates an island at the center of the cul-de-sac at the specified radius.

**Tear Drop Mode** creates a tear drop style cul-de-sac at the specified Set Back.

Under the **Radii** column:

**Outside** specifies the outside radius for each of the corresponding layers

**Fillet** specifies the return radii where the cul-de-sac meets the incoming offset lines

## Exercises: Create Right of Ways and a Cul-De-Sac

Creating right of way lines and cul-de-sacs can be done easily by setting factors like offset widths and radii in the Carlson Offset and Intersection command.

You do the following:

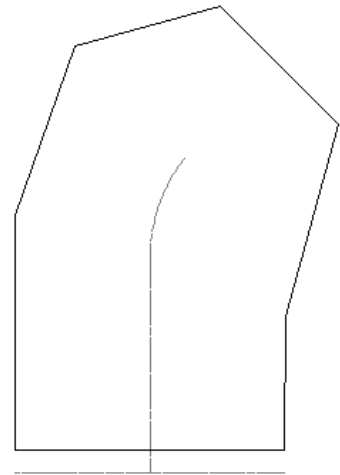
- Open a supplied drawing
- Create Right of Way lines from centerlines
- Create a Cul-de-Sac

### 4.1.1 Creating Right of Way and Offset Lines

In this exercise you will create right of way and edge of pavement offset lines at specified distances with connecting radii. You will use the Carlson Area/Layout Utilities' Offsets and Intersections command.

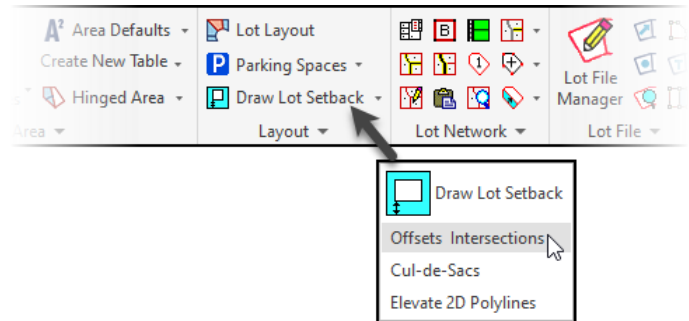
1. Open the drawing: **C:\Carlson Projects\APG Survey 2021 Chapter 4\DWGS\Lots.dwg**

The drawing file contains a perimeter boundary line and two centerlines.

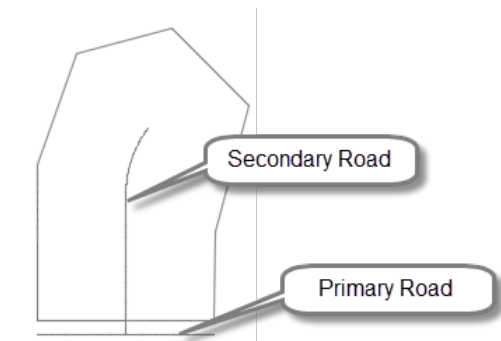


2. Select **Ribbon: Area/Layout ⇒ Layout ⇒ Offsets & Intersections.**

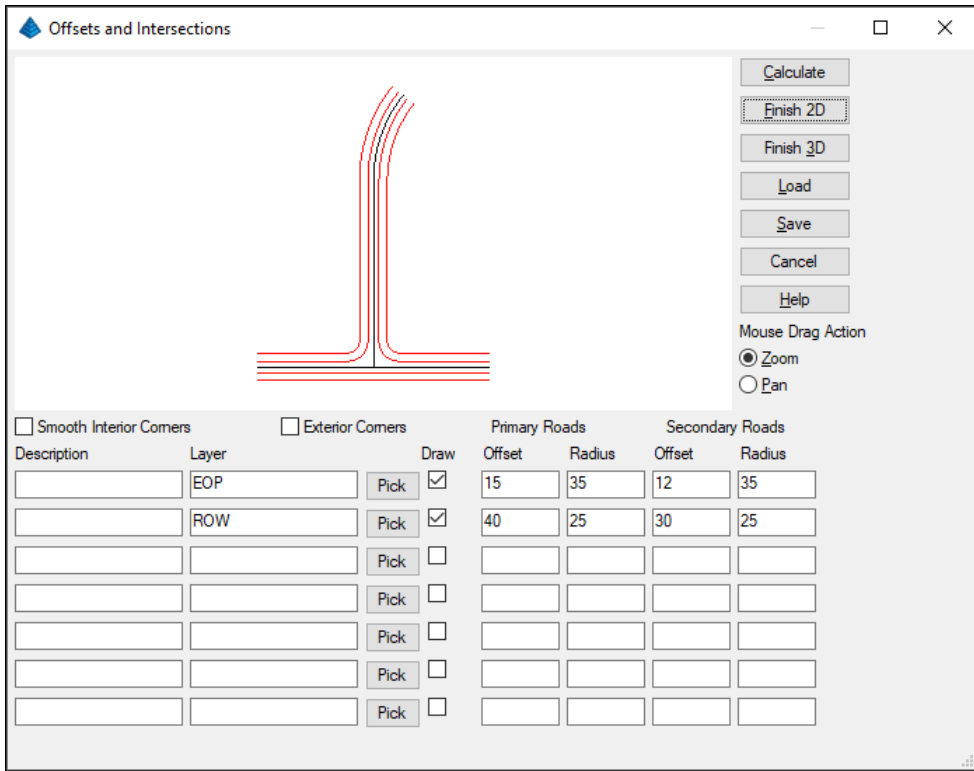
Alternatively, from the pull-down menu:  
Select: **Area/Layout ⇒ Layout Utilities ⇒ Offsets & Intersections.**



3. At the command line prompt: *Select all PRIMARY road polylines* select the **Horizontal Polyline on the south side of the boundary.**
4. Press **[Enter]** to complete the selection.
5. At the command line prompt: *Select all SECONDARY road polylines* select the **Vertical Polyline within the boundary.**
6. Press **[Enter]** to complete the selection.



This opens the *Offsets and Intersections* dialog box.



7. Enter the offset dimensions as shown:

Primary Roads

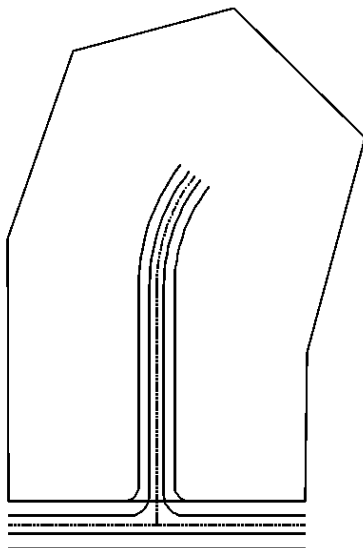
- EOP Offset 15 Radius 35
- ROW Offset 40 Radius 25

Secondary Roads

- EOP Offset 12 Radius 35
- ROW Offset 30 Radius 25

8. Click <<Finish 2D>>.

The 2D polylines representing the Right of Way and Edge of Pavement lines are placed in the drawing and look like the graphic below.



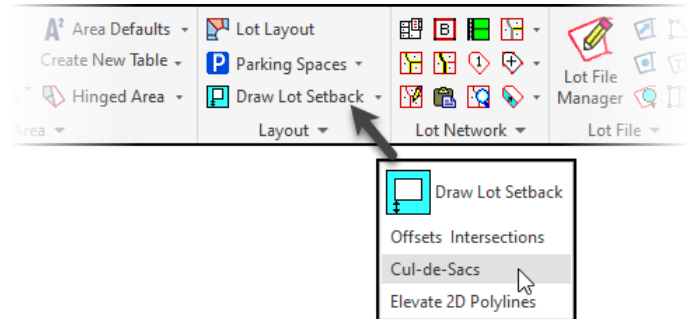


### 4.1.2 Creating a Cul-De-Sac

In this exercise you will attach a cul-de-sac to the dead end road centered within the boundary lines.

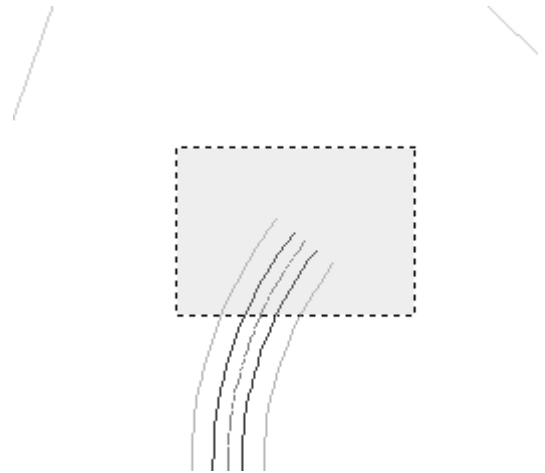
1. Continue working in the drawing from the previous exercise.
2. Select **Ribbon: Area/Layout ⇒ Layout ⇒ Cul-de-Sacs**.

Alternatively, from the pull-down menu:  
Select **Area/Layout ⇒ Layout Utilities ⇒ Cul-De-Sacs**.



3. At the command line prompt: *Select all offset polylines to end with cul-de-sac* Select by a crossing window (upper right to lower left) the 5 lines at the end of the roadway.
4. Press **[Enter]** to complete the selection set.

These are the lines created in the previous step that correspond to ROW and EOP as well as the original centerline.

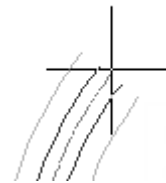


5. At the command line prompt: *Pick cul-de-sac center projection onto centerline*: Select the **End Point** at the end of the centerline.

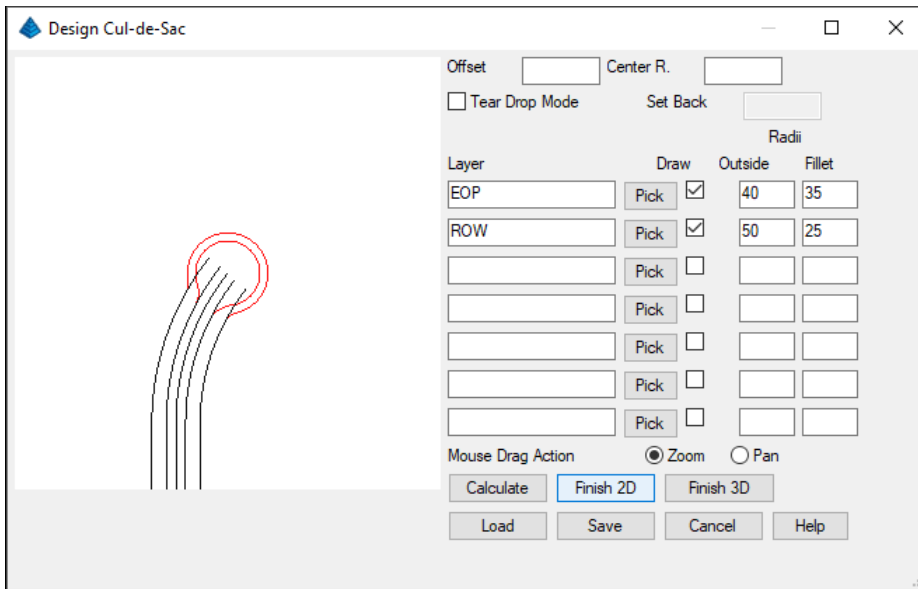
This represents the base point of the cul-de-sac.



Note the **End Point** object snap is provided by the program automatically.



This opens the *Design Cul-De-Sac* dialog box.



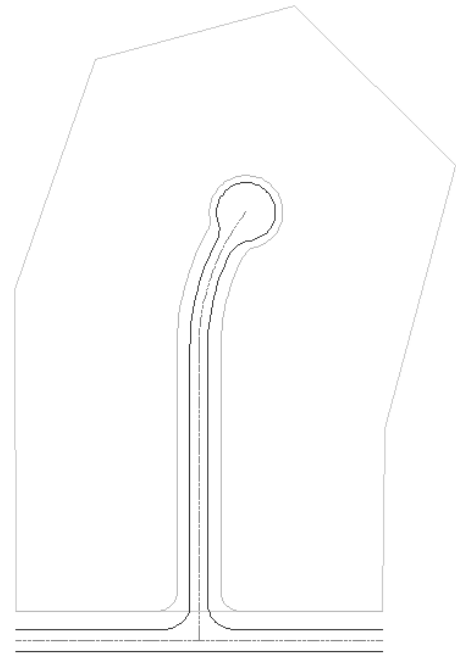
6. Set the EOP **Outside** offset to **40**.
7. Set the EOP **Fillet** to **35**.
8. Set the ROW **Outside** offset to **50**.
9. Set the ROW **Fillet** to **25**.

**Note:** It is important the layers used are the same as those in the previous exercise.

10. Click <<**Finish 2D**>>.

The resulting cul-de-sac is placed in the drawing and is connected to the previous entities to create a continuous polyline.

11. **Save** the drawing.



**Lesson Review:**

In this lesson you created right of way lines, edge of pavement lines and a cul-de-sac all from two existing centerlines.



# Index

AAN file	149	Field to Finish Inspector	260, 261
Add or Remove Lot line Edges	208	File Menu	3
Add, Remove or modify Lot Line points	208	File Tab	15
ADF file	149	Fit	71
Aligning Entities	429	Fixed Folder	26
Angles	21	Fixed Parameters	284, 303
Annotate Menu	11	GIS Menu	12
Annotating	319	Inquiry Menu	6
Annotating a Line	182	Instances	261
Annotating Arcs	185	IntelliCAD	1
Annotating Areas	149	Inverse	74, 395, 396
Annotating Lot Areas	154	Inverse Options	396
Annotating Point to Point	183	Join Nearest	437
Annotation	219	LAY file	149
Area/Layout Menu	11	Layer Filters	360, 367
Area/Layout Tab	17	Legal Description Writer	449
attribute	320	Lot Layout	142
Auto-Annotate by Layer	149	Lot Line Modifications	208
Begin Codes	284	LotNET	193
C&G Survey Menu	13	LTN file	194
Carlson COGO	39, 42	Merge Points	407
Carlson Raw Data Editor	50	Moving Annotations with Leaders	183
Centerline Menu	10	Multiple Codes	283
closing angle	49	Nearest Found	234
COGO	22	Notes	349
COGO Menu	10	Offset Codes	284, 302
Companion Codes	285, 305	Offsets and Intersections	135
Compare Points	415	PDD File	61
Compass Rule	57	Point History	419
Constraining the Network	124	Points Menu	8
Create or modify a lot by a predetermined area	208	Points Tab	16
Creating Lots	144	Polyline Editing Tools	437
Cul-de-Sac	136	Polyline Linetypes	445
Curve Calculator	432	Project Folder	25
Custom Attributes	335	Project Sub-Folders	26
Data Collector Programs	85	Raw Data Editor	39
Data Folder Setup	25	Raw Data Editor Menus	40
Data Type Sub-Folders	26	Raw Data Toolbars	39
<b>Deed Correlation</b>	75	Renumber Lots	221
Deed Defaults	62	Renumbering Lots	219
Deed File	61	Resizing Lots	143, 145
Draw Field to Finish	256	Ribbon	15
Draw Menu	6	RoadNET	193
Drawing Folder	25	RW5	22
Drawing Orientation	358, 365	Setting Standard Errors	124
Edit Menu	4	Settings Folder	27
Edit Point Attributes	8	Settings Menu	7
End Codes	284	Setup Tab	16
Entering Record Deed Information	63	Sideshot Ellipses	129
Equations	353	Special Codes	235, 252, 285, 299, 311
Field to Finish	225, 226, 227, 255	Special Codes Appendix	385
Field to Finish Codes	230	Startup Project/Data Folder	27

Sub-Areas	219, 222	Traverse in the Raw Data Editor	94
Surface Menu	12	Tree Description Codes	267
Surface Tab	18	Tree Entity Options	265
SurvCE	86	Tree Feature	264
SurvCom	85	Tree Input Values	266
Survey Menu	9	Tree Labels	268
Survey Tab	17	Tree Line	448
SurvNET	101	Tree Survey Settings	265
Templates	286, 313	Update a CRD File from Drawing	401
The .FLD File	230	View Menu	5
Traverse Adjustment	55		