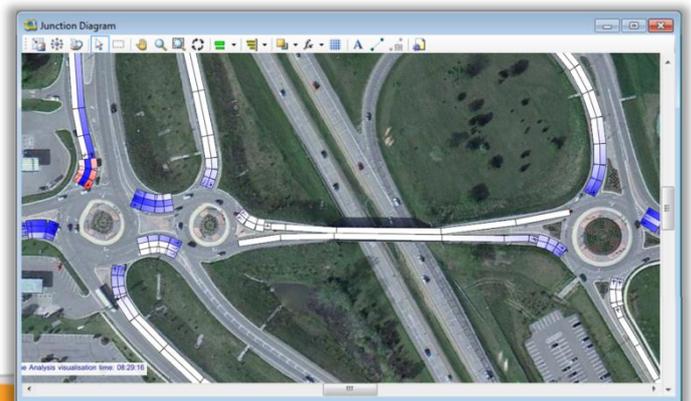


ARCADY 8 Training Course

Roundabout Module

For GDOT
March 25, 2013
V1.0



Presented by



An Introduction to ARCADY 8

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EXERCISES

You can consult the ARCADY 8 help system at any time by pressing F1.

Ensure that you have specified your chosen, local preferences.

General Graphical User Interface (GUI) Operation

- Most program operations can be performed either by clicking on icons or by using the menus on the main toolbar. Menus are shown here as, e.g., *File>New*, which would mean clicking on the *File* main menu and then clicking the *New* menu option. (This operation could also be performed by clicking the *New* icon on the main toolbar.)
- Many items can be selected 'long-hand' via the **Data Outline**. These are shown as, e.g. *Data Outline>Roundabout Network>Roundabout 1>Arms>Arm 1*, which means you should open the Data Outline, find the *Roundabout Network* section and then expand it until you reach the relevant *Leg*.
- It is common to have many windows open at once. Editing data on one window will automatically update any dependent windows. You can rapidly close all windows down by clicking *Window>Close All Windows*.

Performance

- Depending on the specification of the PCs being used, you may find that the program responds quicker if you close down screens that you are not using. This is because all screens are always updated and synchronized, even if they are behind other windows.

Saving the File

- You can save the file at any point. A temporary folder for saving files may be provided, or you can use your own disk or just use the desktop. Ask the course tutor if in doubt.
- ARCADY 8 files have an **.ARC7** extension.

Output Files

There is **not a separate output file** in ARCADY 8. Instead, the results are saved within the file, and are also re-generated every time you load in the data file and run it.

Main Horizontal toolbar



From left to right, the buttons on the horizontal toolbar are:

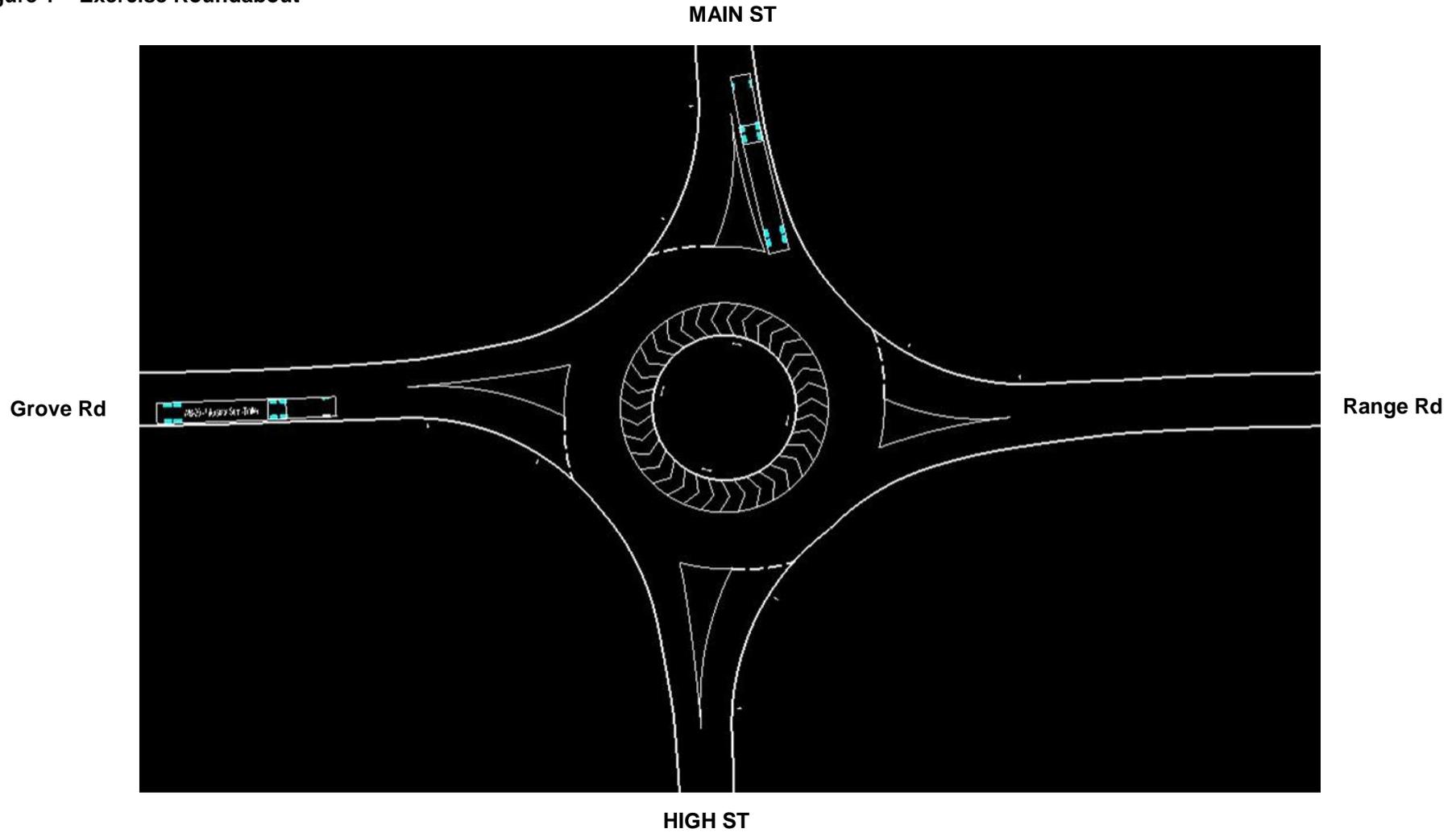
New File
Open File
Save File
Copy to Clipboard
Paste
Print
Print Preview
Undo
Redo
Show Data Outline
Show Data Editor
Show a new Data Grid
Show Task List
Windows Manager
Back
Forwards
Previous Item
Next Item
Previous
Toggle Auto-Run
Run File
Generate Report
User Guide
Glossary

Main Vertical toolbar

From top to bottom, the buttons on the vertical toolbar are (note that in *Basic Mode* you will see less buttons):

 Diagram	Show a new Intersection Diagram window
 Junction	Jump to the general Intersection options
 Geometry	Jump to the Geometric Parameters
 Crossings	Jump to Pedestrian Crossing options
 Turning	Show/hide/enter Turning Counts
 Flows	Show/hide/enter Flows
 Veh Mix	Show/hide/enter Truck and Heavy Vehicle data
 Lanes	Enter Lane Simulation Mode
 Geo Delay	Jump to Geometric Delay options
 Safety	Jump to Safety Prediction options
 Results	Jump to individual Time Segment Results
 Summary	Show/hide the Summary Results screen
 Analyser	Show/hide the Analyzer screen

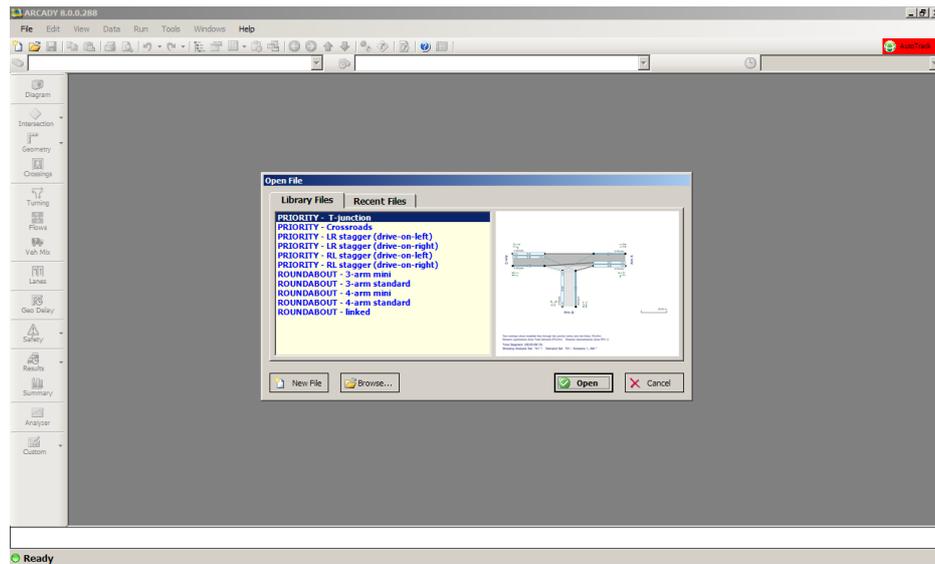
Figure 1 – Exercise Roundabout



Exercise 1.

Creating a simple roundabout

1. Launch ARCADY 8. If you already have it running, either close it down and start again, or, click *New File*.



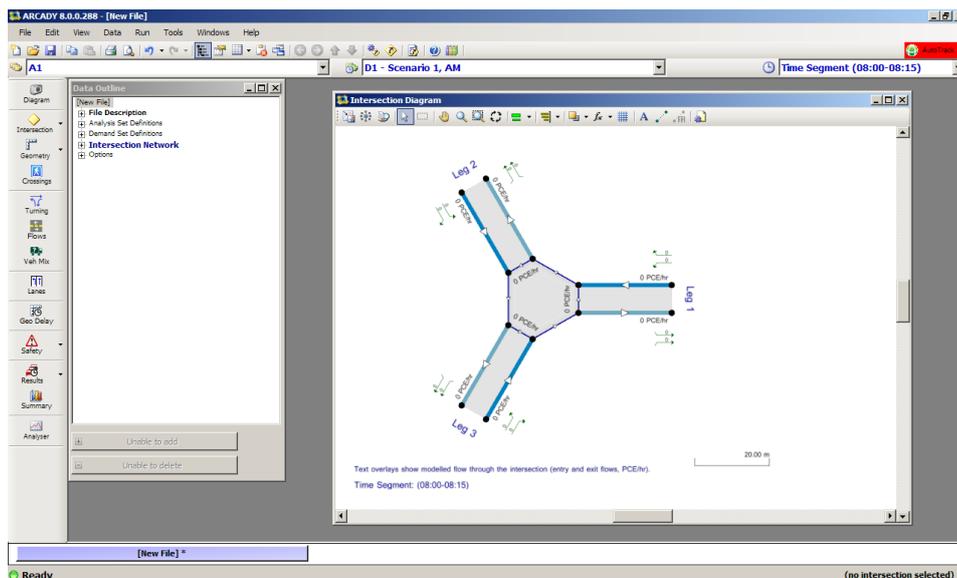
In a new file the screen will be blank apart from the **Data Outline** screen, which shows a tree style view of the current file. Click on the + and – signs to expand/collapse sections.

You can view most ARCADY data via the Data Outline, but there are lots of shortcuts and buttons to make the most common data easier to access, which we will explore throughout these exercises.

2. Press the **Run** button  on the main toolbar. This runs the file (i.e. analyzes the roundabout) and will show the Summary Results screen. We'll return to this later but, for now, note that the default file contains three legs and will run without error. In other words, the skeleton file used when you start a new file is 'ready to run'. Building an ARCADY 8 file is a matter of overwriting, and adding to, the default data.

Close the Summary Results screen.

3. Press the **Diagram** button to show the Intersection Diagram. Don't worry about trying to organize windows; they will get on top of each other but you can easily bring windows to the top by either clicking on them or by just re-selecting them from the main toolbars. (See the User Guide for details of the window organizing features available.)



You don't need to use the Intersection Diagram, but it's useful for confirming the layout and for selecting legs etc.

*The layout of the roundabout in the diagram **does not** affect the model.*

The default roundabout in ARCADY 8 consists of three legs with arbitrary flows and geometries.

Hover the mouse over the icons at the top of this screen to check the name of each icon.

4. Click on any leg in the Intersection Diagram and you should see it highlighted in orange. The Data Outline will automatically jump to the relevant item, and you can then use various tools to edit that item. Double-clicking will usually launch (or switch to) an appropriate data screen, and right-clicking will show a more detailed menu.

The whole of ARCADY 8 works using this system; i.e., click on something to make it the 'active item', and all appropriate screens will update and synchronize to show data for that item.

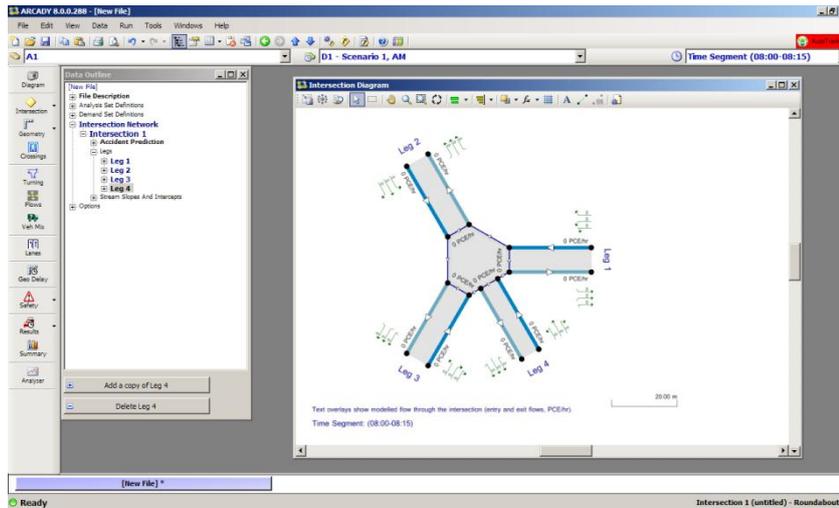
If at any time you make a mistake, simply click on the Undo button on the main toolbar. You will probably also want to save the file every now and again whilst working on these exercises.

5. In the diagram, each leg has a separate entry and exit section, although the leg is still considered to be a single entity. Experiment with clicking, double clicking and dragging on different parts of legs.
6. Experiment briefly with zooming and panning in the Intersection Diagram.
 - *Zoom in/out by clicking on the Zoom icon on the NetCon toolbar and then dragging the mouse up/down in NetCon. The other modes work in a similar way.*
 - *You can also zoom in/out using the mouse wheel.*
 - *If you are zoomed in, pan around by clicking on the Pan icon and then dragging the mouse.*

- You can also pan by moving the mouse with the middle button held down.
- To cancel zoom/pan mode, either click on the arrow icon, or right-click anywhere in the diagram.
- To show the whole roundabout, click the Fit To Window icon.

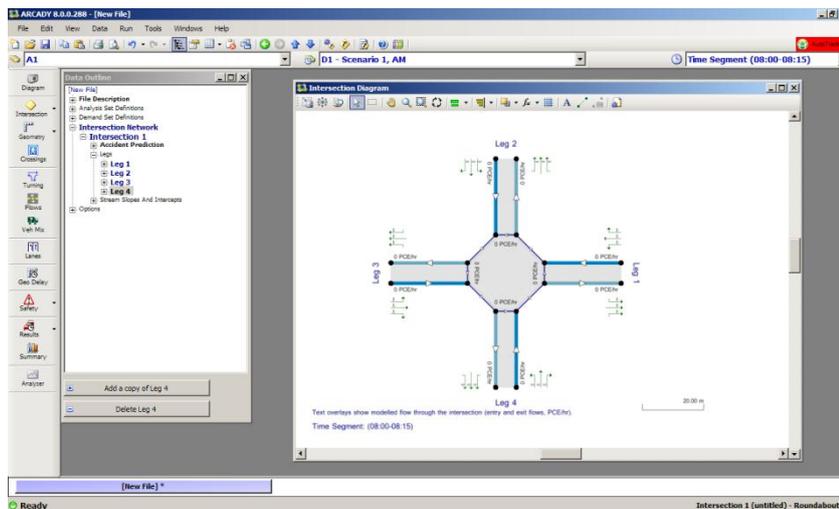
7. The roundabout currently only has three legs. Referring to the picture at the start of this document, the roundabout we’re modeling has four legs.

Click on any leg so that it is highlighted. In the Data Outline, click the *Add a copy of Arm...* button to add the fourth leg.



If the key in the bottom left of the diagram obscures the diagram, right-click in a blank area and then toggle *View>Show Key*.

8. The new leg will be inserted in an arbitrary position. So far we haven’t named or properly allocated legs, so this doesn’t really matter. To ‘tidy’ the positions of the legs, click the **Auto-Arrange** icon in the Intersection Diagram.



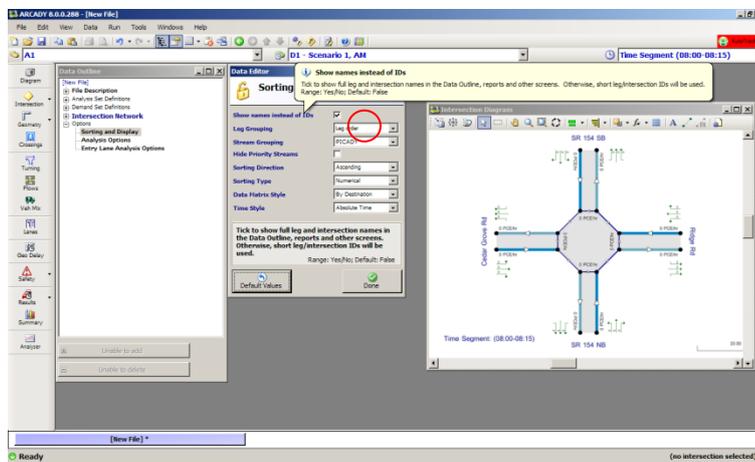
- Like all previous versions of ARCADY, ARCADY 8 needs to know the **order of legs**, so that it can calculate circulating flows.

If the current order is not what you want, you can change it graphically via the diagram and then click *Tools>Set Leg Order From Intersection Diagram*.

Alternatively, click the **Intersection** button on the main vertical toolbar to show properties for the roundabout in the **Data Editor**, one of the properties is **Leg Order**.

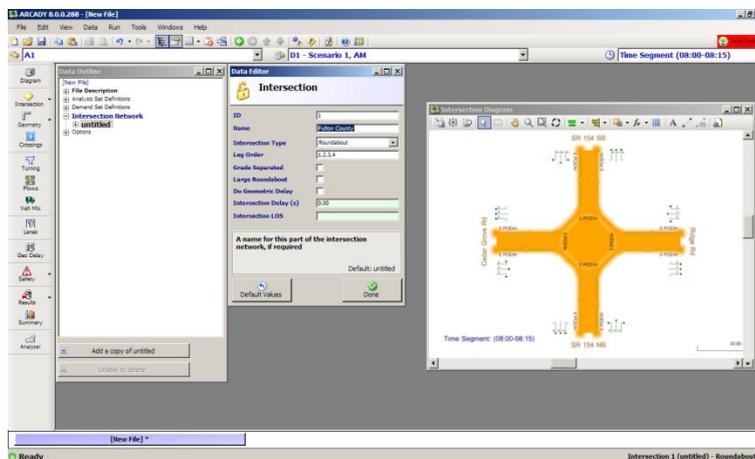
- Rather than refer to legs by their IDs (Arm 1 etc), it's sometimes easier to view their actual names. In ARCADY 8 there are various modes and options for data display, ordering, and so on.

Using the Data Outline, select *Data Outline>Options>Sorting and Display*. Double click to show the Data Editor. Click the *Show Arm Names* option. The diagram and Data Outline will now show 'untitled' for each item, and the next step will be to enter the real names.



- Referring to the roundabout picture at the start of these notes, enter the name of each leg by double clicking on each leg and entering it in the *Name* field.

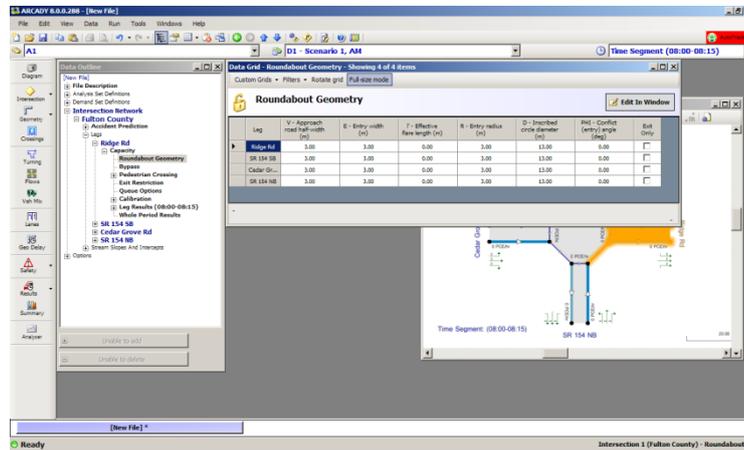
You can also enter a name for the roundabout itself (click on the **Intersection** button, or use the Data Outline to access the roundabout properties).



- The next step is to enter the geometries for each leg. There are several ways to do this.

Click on the **Geometry** button on the main vertical toolbar. Note that this expands the Data Outline to the currently selected leg, or you can navigate here manually if you prefer.

The Data Grid will show the familiar roundabout geometries each leg.

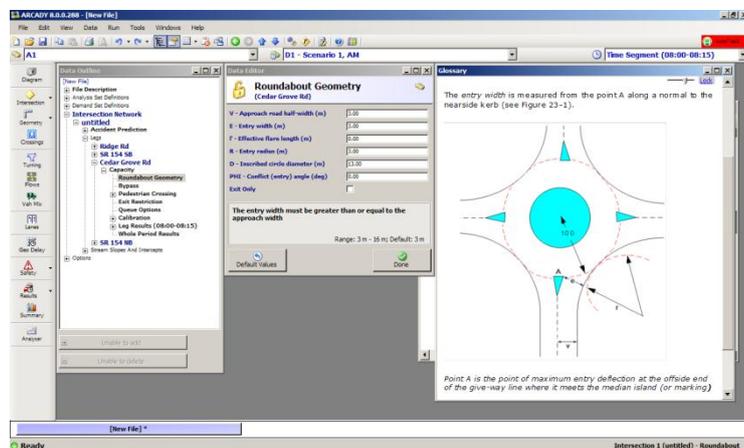


- Click on a different leg, and note that the Data Grid changes to show the leg name, etc, rather than the geometries. Press the **Geometry** button to show the geometries again.

Now click on the **Padlock** icon on the Data Grid. This will LOCK the Data Grid to show only data of the current type. Clicking on other legs will then highlight the geometry of those legs.

Note: You can move any window and re-position any screen without losing data to make working easier, or try using the *Windows Manager* tool for alternative layouts by clicking *Windows > Windows Layouts > Windows Manager*.

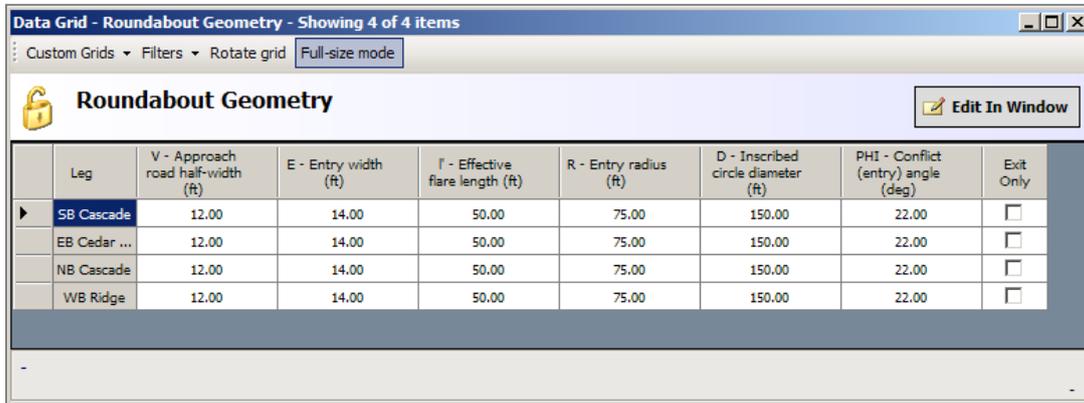
- To view specific information for a single Leg such as geometry in this case, go to the relevant leg in the *Data Outline* and double click on **Geometry**
- Double click any item and the glossary screen will appear. This will update to show information about the currently active item. E.g. clicking on *Entry Width* in the Data Editor will show information about entry width, and so on.



Click on different items in the Data Outline and note how both the Data Editor and data grids change.

Experiment with the *Rotate Grid* and *Full-size mode* options in the data grid; these are for your personal preference.

16. Make sure that the data grid is showing geometries, and enter the following data:



Leg	V - Approach road half-width (ft)	E - Entry width (ft)	l - Effective flare length (ft)	R - Entry radius (ft)	D - Inscribed circle diameter (ft)	PHI - Conflict (entry) angle (deg)	Exit Only
SB Cascade	12.00	14.00	50.00	75.00	150.00	22.00	<input type="checkbox"/>
EB Cedar ...	12.00	14.00	50.00	75.00	150.00	22.00	<input type="checkbox"/>
NB Cascade	12.00	14.00	50.00	75.00	150.00	22.00	<input type="checkbox"/>
WB Ridge	12.00	14.00	50.00	75.00	150.00	22.00	<input type="checkbox"/>

17. If you wish, press the **Run** button and observe that even though we haven't yet entered any flows, the results already show how the legs perform.

18. If you haven't done so already, save the file.

19. Optional: return to the *Roundabout* properties and change the **Intersection Type** to *Mini-roundabout* or *Crossroads*. Pressing the *Geometry* button will now show mini-roundabout or crossroad geometries rather than the standard roundabout geometries. Change the intersection type back to *Roundabout* and note that your data values are still there.

Unlike some early versions, ARCADY 8 lets you **change options at any time without loss of data**.

20. Optional: edit one of the legs so that its flare length is 100m. Press the **Task List** button on the main toolbar. The task list shows any errors or warnings, and in this case will warn you about the long flare length.

Press **Undo** to revert this change.



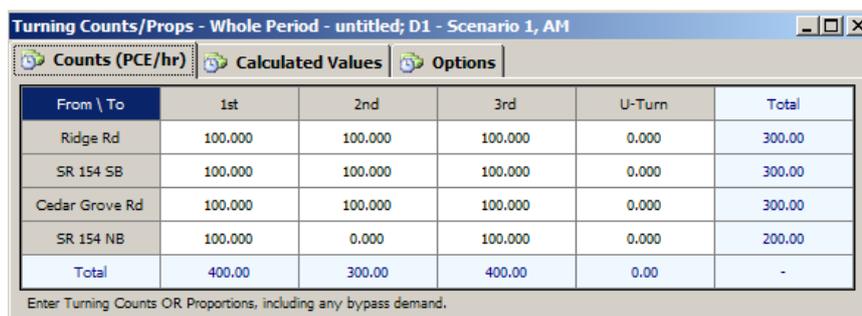
ID	Severity	Area	Item	Problem
1	Warning	Geometry	Ridge Rd -...	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.

Exercise 2.

Entering traffic flows

1. There are various ways of entering flows in ARCADY 8, but we'll assume that you have a set of turning counts for one hour.

Press the Turning button on the main vertical toolbar to show the turning counts screen. Then, in the **Options** select **By Exit** for **Data Matrix Style**.



From \ To	1st	2nd	3rd	U-Turn	Total
Ridge Rd	100.000	100.000	100.000	0.000	300.00
SR 154 SB	100.000	100.000	100.000	0.000	300.00
Cedar Grove Rd	100.000	100.000	100.000	0.000	300.00
SR 154 NB	100.000	0.000	100.000	0.000	200.00
Total	400.00	300.00	400.00	0.00	-

Note that, like most other screens, the units (in this case PCE/hour) are clearly displayed.

Briefly click on the *Proportions* tab and note that the proportions are calculated automatically and shown for reference (read-only).

(If you wish to enter proportions, enter them on the *Counts* tab.)

2. Briefly look back at the *Options* tab. This is where you can set up options similar to those in the Principal Options screen of ARCADY 6.

In particular, change the *Data Matrix Style* to **By Exit** and enter the data shown below (or if your course notes are electronic, paste them directly into ARCADY).

Turning Counts (PCE/hour)

From \ To	1st	2nd	3rd	U-Turn	Total
Main ST	10.000	385.000	135.000	0.000	530.00
Grove RD	90.000	55.000	15.000	0.000	160.00
High ST	20.000	770.000	0.000	0.000	790.00
Range RD	90.000	10.000	10.000	0.000	110.00
Total	210.00	1220.00	160.00	0.00	-

3. Although the turning counts have been entered in PCE/hr, ARCADY 8 still needs to know how many heavy vehicles are involved. (This is necessary for some internal calculations that work only in vehicles. In many cases, the heavy vehicle percentages will make little difference, but, you should always enter them.)

Press the **Veh Mix** button on the main vertical toolbar.

The quickest way for now is to go to the *Options* tab of the Vehicle Mix screen and click *Default Vehicle Mix*. The *HV Percentages* tab will then show 10% HV for every turning movement.

Vehicle Mix - Whole Period - untitled; D1 - Scenario 1, AM					
Truck Percentages		Average PCE per Veh			Options
From \ To	1st	2nd	3rd	U-Turn	Average
Ridge Rd	10.000	10.000	10.000	10.000	10.00
SR 154 SB	10.000	10.000	10.000	10.000	10.00
Cedar Grove Rd	10.000	10.000	10.000	10.000	10.00
SR 154 NB	10.000	10.000	10.000	10.000	10.00
Average	10.00	10.00	10.00	10.00	-

If you have Heavy Vehicle Percentages then enter them now.

4. All data entry is now complete (we'll return to pedestrian crossings later), so save the file again.

Remember, in ARCADY 8 you can enter data in any order; you don't have to stick to the order presented in these exercises.

Exercise 3.

Running files and checking results

In ARCADY 8, you are encouraged to run the model frequently, so that you develop a ‘feel’ for the roundabouts performance as you vary input items.

1. Load in the completed file from the previous exercise (or any other working file).
2. Press the **Run** button on the main program toolbar.
3. If there are any errors, the Task List will be highlighted in red and you won’t be able to run the file. If this happens, check with the course tutor.
4. If all is well, the **Summary Results** screen will appear. You can leave this screen visible all the time and should think of running the file as simply refreshing this screen and all other results.

The results shown here represent the ‘**worst**’ values for each leg over the whole modeled period. Click on *Columns* and select all options as below.

AM								
	Queue (PCE)	95% Queue (PCE)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS	Network Residual Capacity
A1 - Scenario 1								
Ridge Rd	0.89	1.10	5.50	0.45	A	8.86	A	22% [Cedar Grove Rd]
SR 154 SB	0.24	?	4.88	0.18	A			
Cedar Grove Rd	2.93	6.60	12.38	0.73	B			
SR 154 NB	0.19	?	5.58	0.15	A			

5. The results show that Grove Rd suffers from the longest queue and delay as well as the worst LOS.
6. The *Delay* column is based on *Average Delay per Arriving Vehicle* – i.e., takes into account the fact that vehicles arriving during this time segment may be delayed in other time segments if they join a long queue.
7. *LOS (Level of Service)* is based on the *Delay* value. LOS varies from A-F and is color coded, with F representing unacceptable delay. See the User Guide for full details.
8. As an experiment, show the geometries for Grove Rd and alter the entry width to a larger value. Run the file and see what happens to the summary results.
9. Press the **Auto-run** button on the main program toolbar (next to the Run button). Changing entry width or any other value will automatically re-run the file, so that you can immediately see the effect of changing any data.
10. Turn off Auto-run and set the entry width back to its original value (or use the Undo button)
11. More detailed results are available via the Data Outline or by clicking on the **Results** button on the main vertical toolbar. These can be viewed with the Data Editor and Data Grids, as with any other data type.

Data Grid - Leg Results - Showing 4 of 4 items

Custom Grids Filters Rotate grid Full-size mode

Leg Results Edit In Window

Leg	Leg Results	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
Ridge Rd	(08:00-0...	399.01	99.75	397.09	654.40	14.98	0.00	1306.70	1239.49	0.305	0.00	0.48	4.345	A
SR 154 SB	(08:00-0...	120.46	30.11	119.91	14.98	397.09	0.00	1092.53	595.69	0.110	0.00	0.14	4.070	A
Cedar Gr...	(08:00-0...	594.75	148.69	590.68	363.40	153.61	0.00	1229.00	992.07	0.484	0.00	1.02	6.164	A
SR 154 NB	(08:00-0...	82.81	20.70	82.41	157.32	586.97	0.00	986.11	741.84	0.084	0.00	0.10	4.380	A
Total	N/A	1197.04	299.26	N/A	N/A	N/A		N/A	N/A	0.48	N/A	N/A	5.22	A

For full details of the data available, try running a report.

The data covers multiple outputs. In particular, the entry, exit and circulating flows are explicitly shown, these are also displayed by default in the **Intersection Diagram**.

- This data is **per time segment**. At any time there is a current time segment, which you can view and change via the drop-down in the top-right of the main screen. Currently this will be set to 08:00-08:15, but you can change it to any other segment and see how the results change.

Generally the 'worst' results will be in the middle of the modeled period.

- The Data Outline shows that there are several sets of results. The **Results** button on the main toolbar is a shortcut to *Time Segment Results*, which you can expand to see more advanced results. You can also use the Data Outline to select *Whole Period Results*, which forms the basis of the Summary Results screen.

Data Outline

D:\...\Training Files\Georgia DOT Exercise 2.arc8

- File Description
 - Analysis Set Definitions
 - Demand Set Definitions
 - Intersection Network**
 - untitled
 - Accident Prediction
 - Legs
 - Ridge Rd**
 - Capacity
 - Roundabout Geometry
 - Bypass
 - Pedestrian Crossing
 - Exit Restriction
 - Queue Options
 - Calibration
 - Leg Results (08:00-08:15)
 - Whole Period Results**

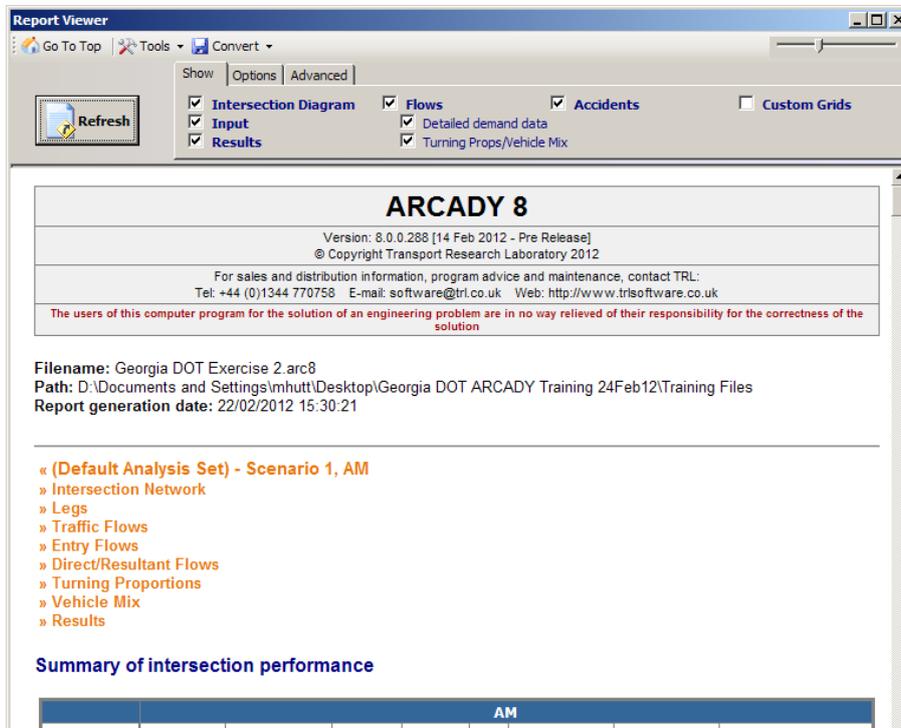
Optional: Show a data grid of results and then click on the **Copy** button on the main program toolbar. Launch Excel, or any other editor, and paste the clipboard contents. You should find that the relevant results appear as a table.

This is a convenient way to generate your own reports if you only want specific information.

- To generate a report that includes ALL data, click the **Generate Report** button on the main program toolbar as before.

This will generate a HTML report and show it in the built-in **Report Viewer**. The viewer contains various options at the top of the screen which control the contents of the report.

Experiment with the options here and use the **Refresh** button to re-generate the report.



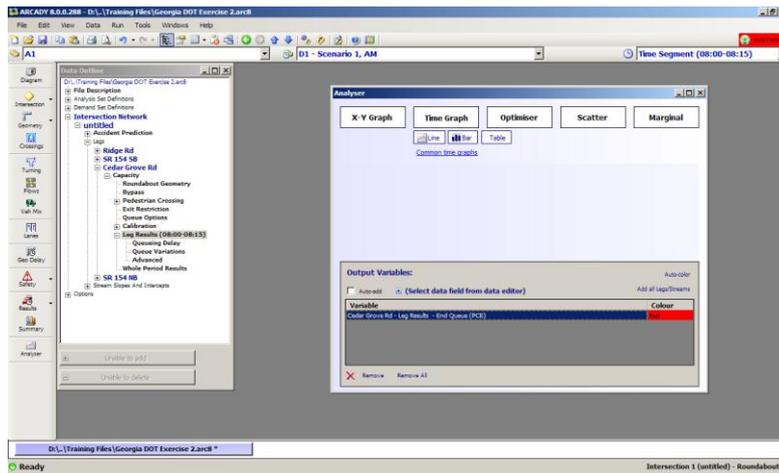
15. To save the current report as a PDF file, click *Convert>Save as PDF document*, or to convert to a Microsoft Word document click *Convert > Convert to Word Document*.
16. You can also create your own custom grids and save these for future use, by using the *Custom Grids* option in any Data Grid. See the User Guide or the course tutor for full details.
17. It's possible to visualize how a given output value – such as **LOS** for a leg – varies over time, as follows:

Click the **Analyzer** button on the main vertical toolbar.

Select **Time Graph** mode.

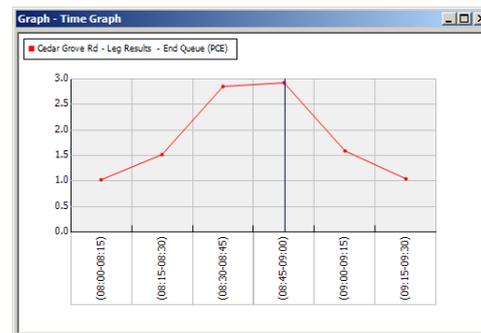
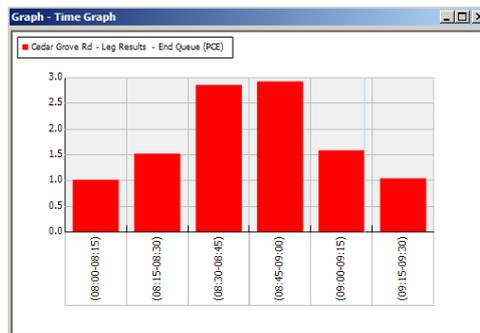
Use the Data Outline/Editor/Grid to navigate to an item of interest – for example, the End Queue for Grove Rd. Click on this item in the Data Editor/Grid.

The Analyzer Screen's *Output Variables* section will show an option above the grid to add this item as a 'variable of interest'. Clicking this option will add the data item to the grid.

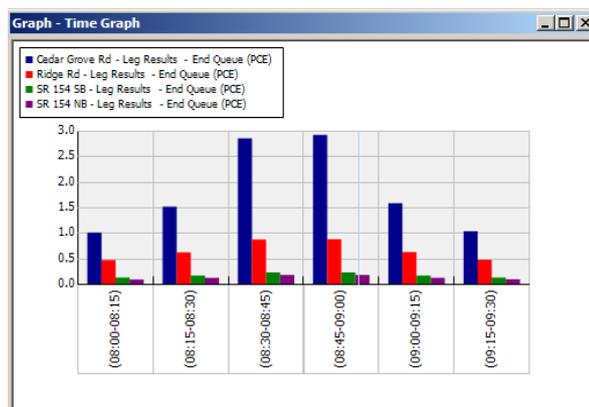


The same system applies to nearly ANY other data item.

Below the **Time Graph** button, press **Line**, **Bar** or **Table**. This will illustrate in various ways how the data item (End Queue) varies over time. (The resolution depends on *Demand Set Definition>Time Segment Length*).



In the Analyzer screen, above the lower grid, press the *Add all Legs* and then the *Auto-color* options. This is a convenient way to add in the same data item for all legs in the roundabout and assign a color to each, which leads to a graph like this:



This graph quickly shows how the queue builds up and then decays again, and how Grove Rd (the dark blue line) has a higher queue than the other legs.

*You can also try out one of the pre-loaded **Common X-Y Graphs** and it's also possible to visualize results through the **Intersection Diagram**, which we'll come onto later.*

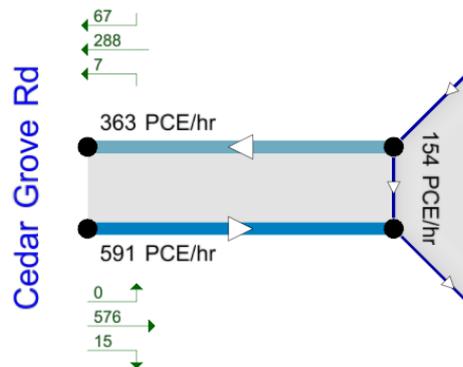
Exercise 4.

Intersection Diagram – more features

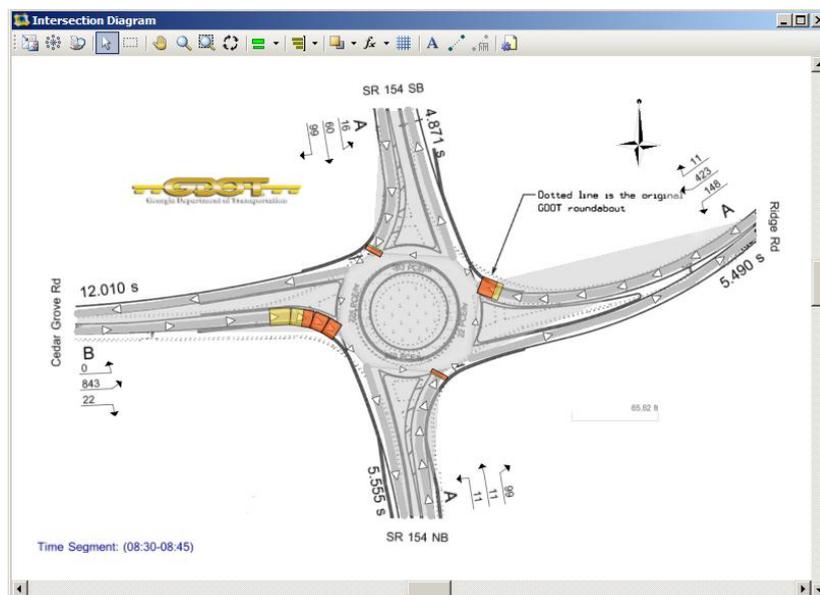
1. Continue with the file from the previous exercise or load a completed file. Show the Intersection Diagram.
2. By default, the diagram shows the flow in and out of each leg, along with the turning and circulating flows. These are ACTUAL calculated flows, i.e. what ARCADY 8 calculates when the file is run. Therefore they only exist once the file has been run, and they may or may not match the entered turning counts.

The values are shown for the **current time segment**.

Choose different time segments (drop-down menu at top-right of program) and see how the flows show in the diagram change.



Try out the options through the button in the **Intersection Diagram**, here's an example of a customized diagram (we will show you how to achieve this shortly):



3. Compare the entry flows shown as default in the diagram to the turning counts in the Turning Counts screen.

The numbers will not match exactly; this is due to the small amount of random queuing that can occur even when an entry is within capacity.

4. Increase some of the turning counts and run the file until one or more of the legs are over-capacity. The entry flows shown in the diagram should now represent the capacity of the legs – i.e., the maximum flows that the Intersection can cope with.
5. There are many options that you can customize in the diagram.

For example, you can show the entered turning counts on the diagram instead of the calculated entry flows, as follows:

Press the *Options* button in the Intersection Diagram toolbar.

Select *Text Overlays*

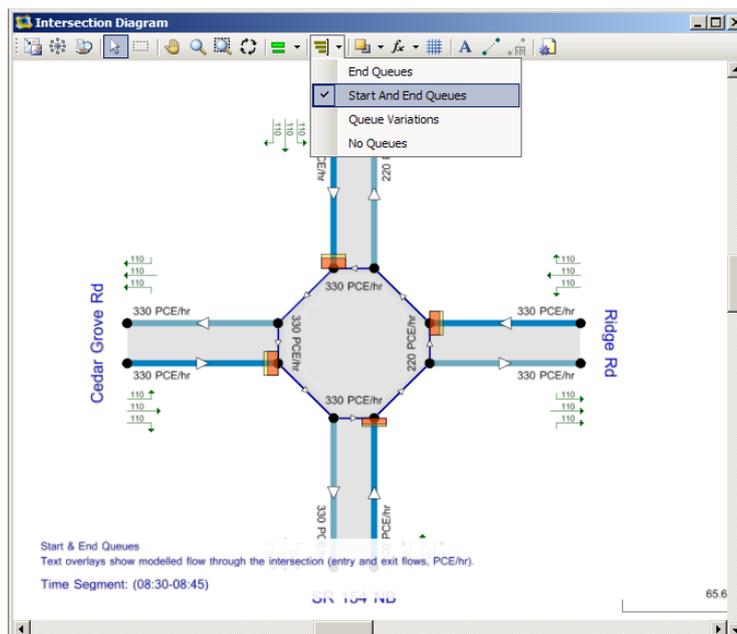
In the *Per Leg* screen, press *Select Field* for *Text A* and *B*. The diagram will change accordingly. Entering different values in the Turning Counts screen will now update the diagram immediately.

Note, you may have to change the *Numeric Overlay* setting in the **Intersection Diagram** to *Custom* .

In the options screen, switch to *Arms>Turn Boxes*, and repeat the process as above.

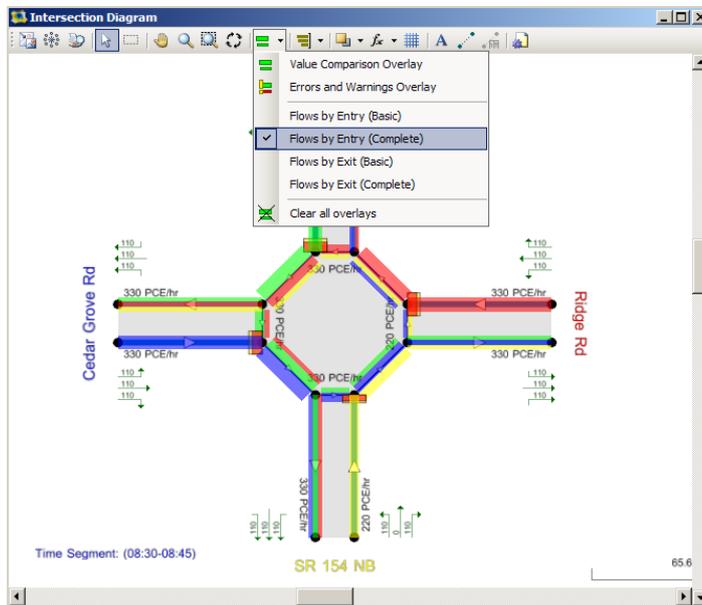
To restore defaults, use the *Defaults* button in both parts of the screen.

6. To visualize queues, use the menu as shown below and then choose different time segments.



- Use the menu as shown below to visualize the relative flows around the roundabout: (You can go to the Options screen and adjust Overlay Boxes>Overlay Box Width).

This should show that most traffic (the widest boxes) travel around the roundabout on Grove Rd.



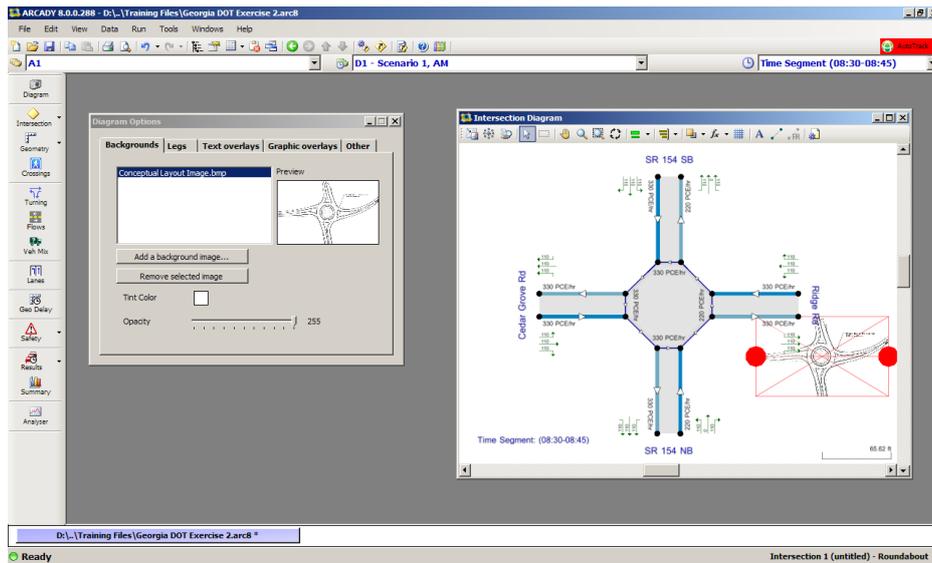
- Locate the **ruler** on the diagram and note that you can drag it with the mouse to help with measurements.

If the roundabout has an ICD of 150ft. Position the ruler so that it stretches across the inside of the roundabout, then right-click on it, select *Adjust Scale* and enter 150. If you now try to use the ruler to ‘measure’ other parts of the roundabout, they should be realistic, depending on how you’ve positioned the legs.

If, however, you have a background image, the ruler can be more useful, as we’ll see next.

- Show the Intersection Diagram **Options** screen and select the **Background** tab. Click *Add* and browse to the exercise files and find the **exercise background image.gif** file.

You can add any number of images and overlap them as needed.



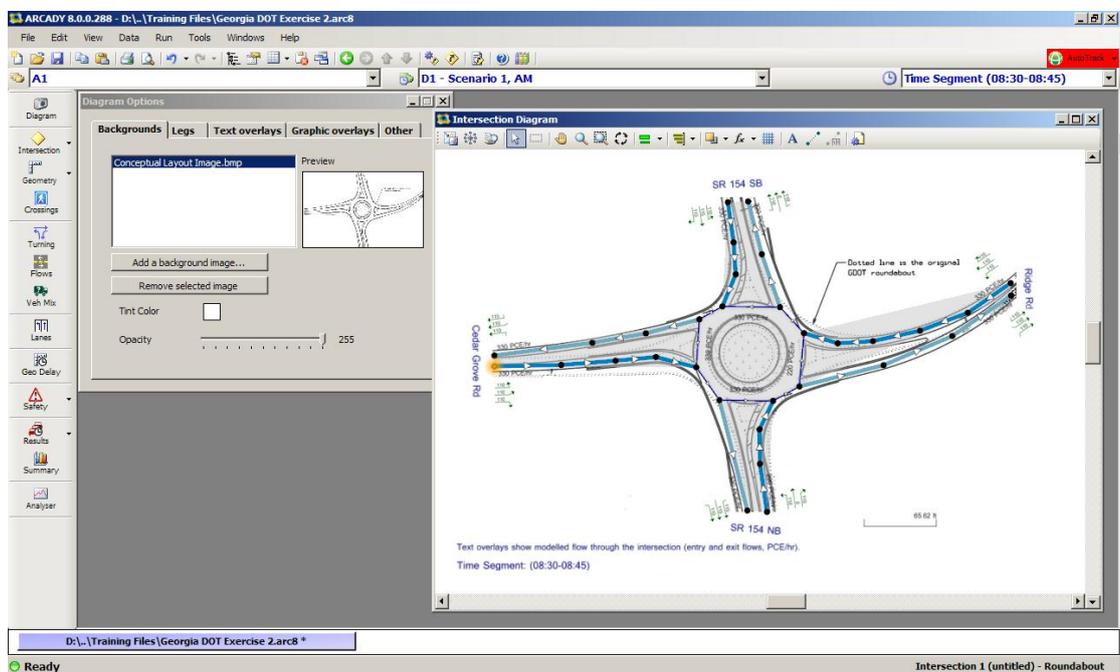
10. Make sure that the file is selected in the options screen, then use the red handles in the diagram to manipulate the size and position of the picture.

Use the *Opacity* slider to fade the picture relative to the rest of the diagram.

You can then try to move the legs so that they more closely match the real layout.

To add 'bends' to a leg, right-click on it and select *Add new Section*. This will add a new control point that you can drag.

You can also adjust the relative size of labels and text using the Options screen.



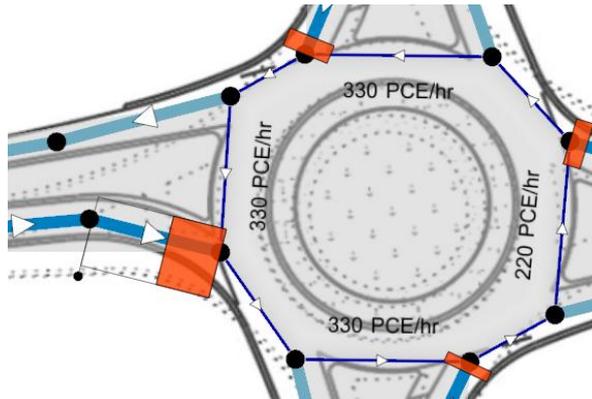
11. If you have calibrated the ruler, try turning on the queue display again. The size of the red queues should roughly match the real length of the queues in meters; based on an average, default PCE length of 5.75m (**this is adjustable: Data Outline > Options > Analysis Options**).

12. For any leg, use the Data Outline to show its *Capacity>Queue Options* properties. The *Flare Storage* and *Lanes on Approach* **only affect the diagram – they don't affect the model.**

If you set *Lanes on Approach* to 2, then the length of the queue in the diagram will halve, on the assumption that the queue is evenly spread across two lanes.

The *Flare Storage* option works in a similar way.

(See the User Guide for full details.)

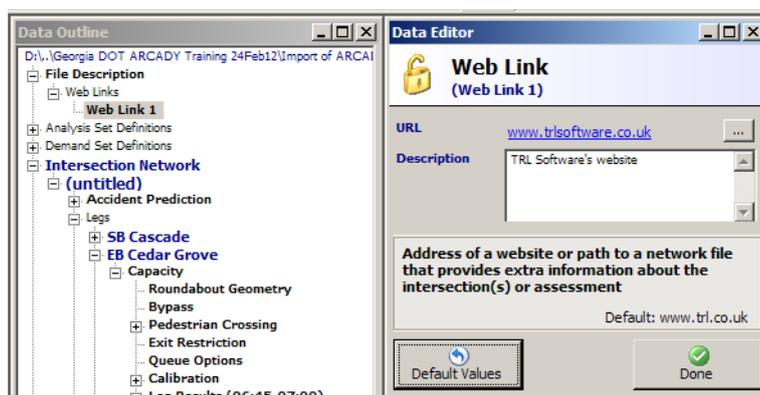


13. If you want to store a location to a map, web site, etc, you can do this as follows:

Use the Data Outline to select *File Description>Web Links*. Add a new Web Link and show the Data Editor. You can then edit the URL to any web address or local file address, and can add as many web links as needed.

Clicking the link will then open the link in your browser.

Generating a report will include the links as hyperlinks towards the top of the project report.



Web Links

URL	Description
www.trlsoftware.co.uk	TRL's website

Exercise 5.

Pedestrian Crossings

Let's say that the roundabout has pedestrian crossings on some of the legs.

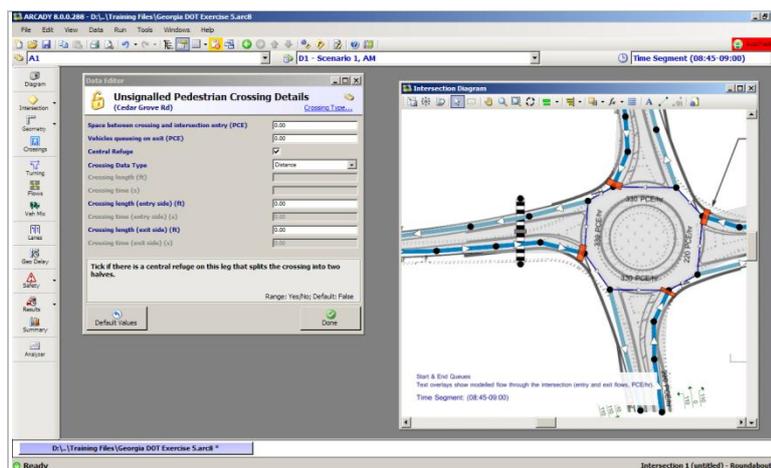
In ARCADY 8 if you add a crossing to a leg, it will be visualized in the diagram but its position and orientation do NOT affect the model. As with all other data, the only data that affects the model results is entered via the Data Outline and Editor.

1. Press the **Crossings** button on the main vertical toolbar. This will take you to the *Pedestrian Crossing* section of the currently selected leg.

To add a crossing, change the *Crossing Type* (default='None').

2. To edit details of each crossing, use the Data Outline to select the *Unsignalled Details* section.
3. Also, in ARCADY 8 you can enter the crossing length separately for the entry and exit side of the crossing and can choose to enter a crossing *time* instead of length.

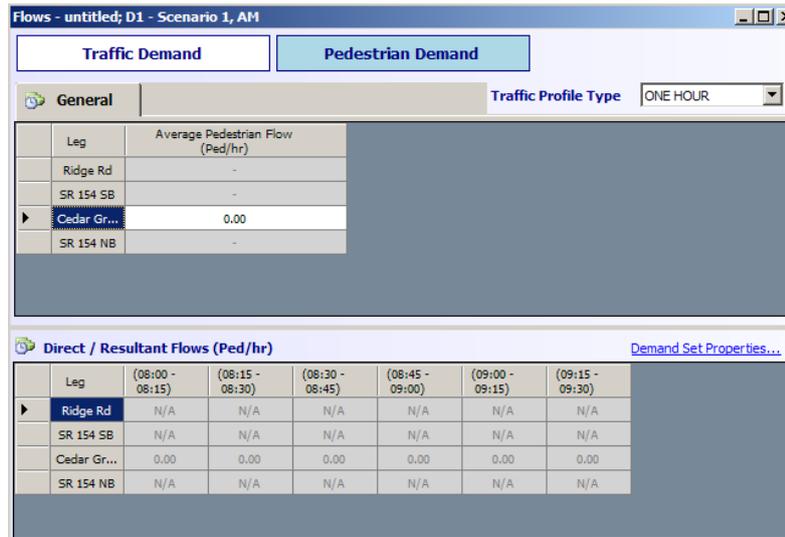
The data for the exercise file is shown below:



4. To enter pedestrian flows, use the main Flows screen on the vertical toolbar. If there are any crossings present, an additional **Pedestrian Flows** button will show.

In ARCADY 8, ped flows are entered in the same way as traffic flows, and most of the same options are available.

As an example, choose keep the ONE HOUR profile for the pedestrian flows. In this mode, a single number is entered for each crossing and this flow is then distributed to time segments in a similar way to the traffic profile (i.e. the central time segment is the busiest).



The screenshot shows the 'Flows' software interface with two tabs: 'Traffic Demand' and 'Pedestrian Demand'. The 'Pedestrian Demand' tab is active. Under the 'General' section, the 'Traffic Profile Type' is set to 'ONE HOUR'. Below this, there are two tables.

Average Pedestrian Flow (Ped/hr)

Leg	Average Pedestrian Flow (Ped/hr)
Ridge Rd	-
SR 154 SB	-
Cedar Gr...	0.00
SR 154 NB	-

Direct / Resultant Flows (Ped/hr)

Leg	(08:00 - 08:15)	(08:15 - 08:30)	(08:30 - 08:45)	(08:45 - 09:00)	(09:00 - 09:15)	(09:15 - 09:30)
Ridge Rd	N/A	N/A	N/A	N/A	N/A	N/A
SR 154 SB	N/A	N/A	N/A	N/A	N/A	N/A
Cedar Gr...	0.00	0.00	0.00	0.00	0.00	0.00
SR 154 NB	N/A	N/A	N/A	N/A	N/A	N/A

- Does the presence of the pedestrian crossing make much different to the overall results (*ensure that you have entered some pedestrian flow!!*)?

Click *File>Copy Into New File*. This will create a clone of the file which you can then switch between by using the blue file bars at the bottom of the screen.

You can load as many files as you like and switch between them in this way.

Run both files and experiment with increasing the pedestrian flows until you see an obvious difference in the Summary Results.

There are various other ways that results can be compared - see the next exercise.

- ARCADY 8 includes a **Signalled crossing** model. The data requirements are very similar to the existing Unsignalled crossing model.

Optional: Investigate the difference in performance between an unsignalled, signalled and adaptive signalled crossing (*Tip: The x-y graph generator may be useful here*).

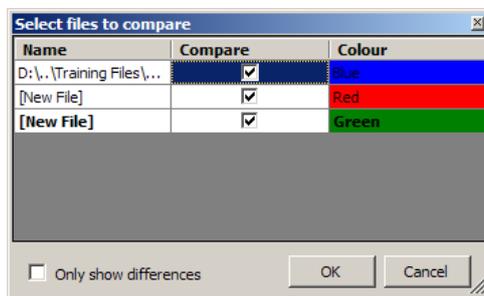
Exercise 6.

Comparing and analyzing results

1. Close all files, and then load in a working file and run it.
2. Click *File>Copy Into New File*. This will create a clone of the file which you can then switch between by using the blue file bars at the bottom of the screen.
3. Run both files and flick between them and confirm that the results are identical.
4. Now make an obvious change to one of the files. For example, change one of the geometries or flows by a large amount. A good one to try is one or more of the *Flow Scaling Factors* in the Flows screen.

Run the file; flicking between the files should show clearly the difference in the results.

5. Optionally, make a third copy (or as many as you like), with other changes.
6. Select **Tools>Compare Files** from the main menu. Make sure both files are ticked and choose a color for each file by double clicking the color.



7. When you press *OK*, a report will be generated using whatever options you have previously set up for reports.

The report will contain various colors corresponding to the files being compared.

Results

Results Summary for whole modelled period

Name	Max V/C Ratio	Max Delay (s)	Max Queue (PCE)	Max LOS	Average Demand (PCE/hr)	Total Intersection Arrivals (PCE)	Total Queuing Delay (PCE-min)	Average Queuing Delay (s)	Rate Of Queuing Delay (PCE-min/min)	Inclusive Total Queuing Delay (PCE-min)	Inclusive Average Queuing Delay (s)
Ridge Rd	0.49 0.45 0.54	6.00 5.50 6.60	1.08 0.89 1.27	A	534.97 498.34 583.60	802.46 729.51 875.41	70.17 59.66 82.30	5.25 4.91 5.64	0.78 0.66 0.91	70.18 59.66 82.31	5.25 4.91 5.64
SR 164 SB	0.22 0.19 0.25	5.76 5.28 6.35	0.31 0.26 0.37	A	181.50 148.82 176.18	242.25 220.23 264.27	20.40 17.34 23.94	5.05 4.73 5.44	0.23 0.19 0.27	20.40 17.34 23.95	5.05 4.73 5.44
Cedar Grove Rd	0.82 0.74 0.90	18.28 12.61 31.69	4.68 2.98 6.62	C B D	797.41 724.92 669.90	1196.11 1087.38 1304.85	229.58 183.09 354.90	11.52 9.00 16.32	2.55 1.81 3.94	229.60 163.12 354.96	11.52 9.00 16.32
SR 164 NB	0.17 0.15 0.20	6.10 5.58 6.71	0.22 0.19 0.27	A	111.03 100.94 121.13	166.55 151.41 181.69	14.78 12.54 17.36	5.32 4.97 5.73	0.16 0.14 0.19	14.78 12.54 17.36	5.32 4.97 5.73

8. Changing options in the report and pressing **Refresh** will update the report as usual and you can use all other features such as creating a PDF or converting to Word.

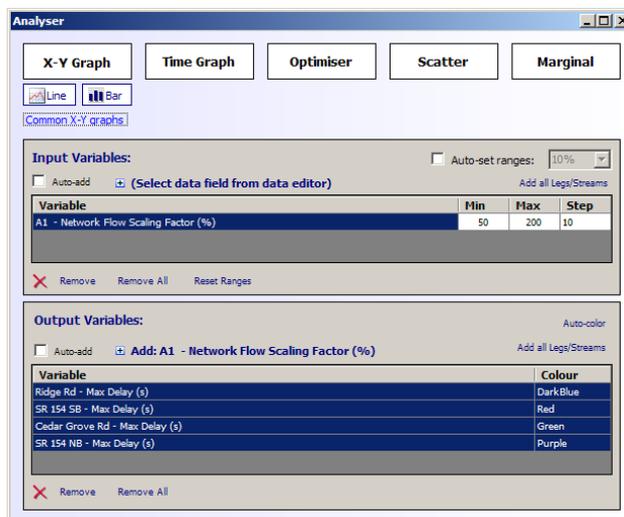
9. In some cases, a small difference in an input item has a cascading effect on more output items than you might expect. What is the effect of the change you made?
10. It's also possible to investigate within one file the effects on any output of any change to any input variable, leading to powerful sensitivity analysis.

As an example, consider a graph of showing how the RFC on Arm 1 varies as the flow scaling factor on Arm 1 is varied. To set this up, follow these steps:

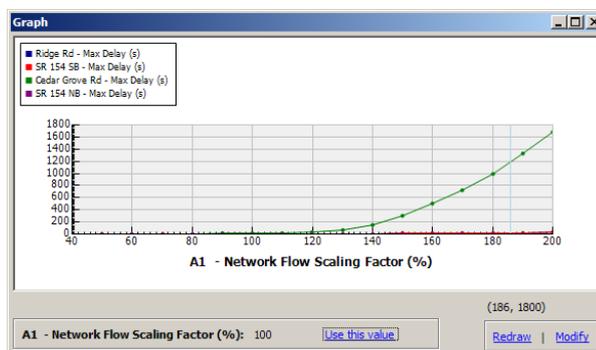
Close all files except one and make sure that it still runs without error.

11. Show the Analyzer Screen and select X-Y Graph mode, select *Common X-Y Graphs > Max Delay vs Flow Scaling Factor*.

The Analyzer screen should now look like the below:



12. Press either the *Line* or *Bar* button under the *X-Y Graph* mode button to generate the graph. This will perform a set of ARCADY 8 runs and plot the results. As might be expected, the Delay increases steadily as the flow scaling is increased and Grove Rd suffers the most.



13. In the Analyzer screen, try de-selecting the other Legs and generating a more detailed graph for Grove Rd.

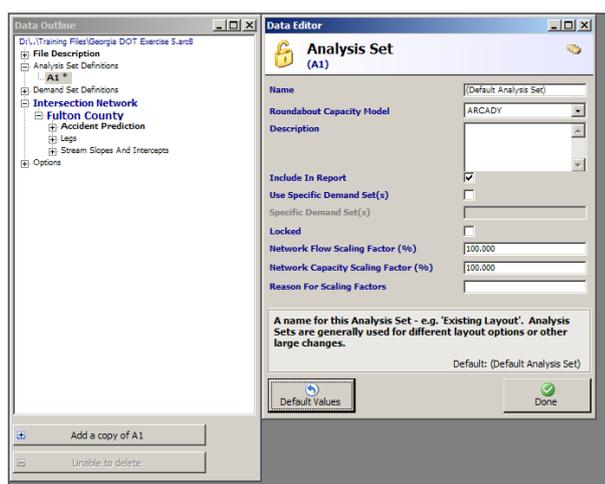
Exercise 7.

Analysis Sets and Demand Sets

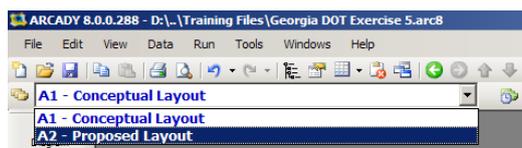
 **Analysis Sets (e.g. A1, A2...)** allow you to store multiple sets of geometric layout data within the same file (ie. *both proposed and conceptual layouts*), or to compare different options such as overall flow scaling or lighting/surface conditions

 **Demand Sets (e.g. D1, D2...)** allow you to store different sets of flow data, which can be combined together, within the same file. Each Demand Set is associated with a time of day (e.g. AM, PM, etc) and also a flow type, such as base or development flows. This allows you to model AM, PM, Saturday and Design Years in one single file.

1. Close any open files and re-open your project file (complete with geometries and turning counts).
2. By default, there is a single Analysis Set. Analysis Sets are set up via the Data Outline. Browse in the Data Outline to Analysis Sets>Analysis Set 1 and view its details in the Data Editor.



3. Enter the name for Analysis Set 1 as “Conceptual Layout”.
4. Use the Data Outline to add a new Analysis Set (Add a copy of Analysis Set...) and name it ‘Proposed Layout’. (If you wish, add some further analysis sets.)
5. To choose which Analysis Set is *in use*, select between them via the drop-down on the main toolbar.



6. Throughout ARCADY 8, certain items can be entered separately for each analysis set. These items are identified by a ‘card stack’ icon in the Data Editor screen and some other data editing screens.  This includes all geometric delays. If an entire group of items can be entered separately for each analysis set, the icon is shown at the top of the Data Editor.

7. Make sure that *Proposed Layout* is selected as the current analysis set, then make some changes to geometries and run the file and check in the Summary Results that the results differ.
8. Switch between *Conceptual Layout* and *Proposed Layout* and check that the values in the geometry screens vary as expected (as you are switching between two sets of data.)
9. You can continue to switch between the two sets and by default ARCADY will show all results together.

Show the Summary Results screen and select *Mode>Show All Sets* (notice the differences).

AM				
	Queue (PCE)	Delay (s)	V/C Ratio	LOS
Conceptual Layout - Scenario 1				
Ridge Rd	0.89	5.50	0.45	A
SR 154 SB	0.24	4.88	0.18	A
Cedar Grove Rd	2.93	12.38	0.73	B
SR 154 NB	0.19	5.58	0.15	A
Proposed Layout - Scenario 1				
Ridge Rd	0.89	5.50	0.45	A
SR 154 SB	0.24	4.88	0.18	A
Cedar Grove Rd	2.38	10.00	0.69	A
SR 154 NB	0.19	5.58	0.15	A

10. **Demand Sets** work in a similar way, but only affect flows. Use the Data Outline to access and add/delete Demand Sets. Each Demand Set has properties such as its start and end time, time segment length etc, similar to those in ARCADY 6.

In ARCADY 8, the Scenario Name is used for the year, or type of flows (e.g. base/development/etc), and the Time Period Name is used to indicate the time of day.

Edit Demand Set 1 so that **Scenario Name = "2012"** and **Time Period Name="AM"**.

This system is not compulsory but the Summary Results screens etc. are designed to use this naming convention.

11. Add a second demand set, and change its Time Period Name to "PM". (Optionally, add a third or more for low demand periods such as the middle of the day or weekends).
12. Go to the Flows or Turning Counts screen and notice the green demand set icon, which indicates that data can be entered for each Demand Set.
13. Select the active Demand Set from the drop-down at the top of the screen, as with Analysis Sets.

Enter different flows or turning counts for the AM and PM peak, and run the file. The Summary Results screen shows the main results for each time period for each layout option.

You can explore detailed results as usual, remembering to select the active Analysis and Demand Sets using the main drop-downs at the top of the screen.

		AM				PM			
	Queue (PCE)	Delay (s)	V/C Ratio	LOS	Queue (PCE)	Delay (s)	V/C Ratio	LOS	
Conceptual Layout - 2012									
Ridge Rd	0.89	5.50	0.45	A	0.94	5.65	0.46	A	
SR 154 SB	0.24	4.88	0.18	A	0.25	4.97	0.19	A	
Cedar Grove Rd	2.93	12.38	0.73	B	3.31	13.64	0.76	B	
SR 154 NB	0.19	5.58	0.15	A	0.20	5.72	0.15	A	
Proposed Layout - 2012									
Ridge Rd	0.89	5.50	0.45	A	0.94	5.65	0.46	A	
SR 154 SB	0.24	4.88	0.18	A	0.25	4.97	0.19	A	
Cedar Grove Rd	2.38	10.00	0.69	A	2.64	10.81	0.71	B	
SR 154 NB	0.19	5.58	0.15	A	0.20	5.73	0.15	A	

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.

'D1 - 2012, AM' model duration: 08:00 - 09:30
'D2 - 2012, PM' model duration: 08:00 - 09:30
Run using ARCADY 8.0.0.288 at 22/02/2012 17:10:49

14. If you generate a report at this point, you can use options in the Report Viewer (*Report Viewer>Time Segments>Show full details for all sets*) to generate a long report that shows full details for ALL analysis and demand sets.
15. Use the Analysis and Demand set system to add further sets for future years.
16. Explore the other options in the analysis and demand set definition screens. See the User Guide for details or ask the course tutor. Some more examples are shown below – see if you can replicate the Demand Sets and Analysis Sets below.

		AM				PM			
	Queue (PCE)	Delay (s)	V/C Ratio	LOS	Queue (PCE)	Delay (s)	V/C Ratio	LOS	
Conceptual Layout - 2012									
Ridge Rd	0.89	5.50	0.45	A	0.94	5.65	0.46	A	
SR 154 SB	0.24	4.88	0.18	A	0.25	4.97	0.19	A	
Cedar Grove Rd	2.93	12.38	0.73	B	3.31	13.64	0.76	B	
SR 154 NB	0.19	5.58	0.15	A	0.20	5.72	0.15	A	
Conceptual Layout - 2032									
Ridge Rd	0.99	5.79	0.48	A	1.06	6.00	0.49	A	
SR 154 SB	0.26	5.06	0.19	A	0.28	5.20	0.20	A	
Cedar Grove Rd	3.78	15.18	0.78	C	4.57	17.84	0.81	C	
SR 154 NB	0.21	5.88	0.16	A	0.22	6.10	0.17	A	
Proposed Layout - 2012									
Ridge Rd	0.89	5.50	0.45	A	0.94	5.65	0.46	A	
SR 154 SB	0.24	4.88	0.18	A	0.25	4.97	0.19	A	
Cedar Grove Rd	2.38	10.00	0.69	A	2.64	10.81	0.71	B	
SR 154 NB	0.19	5.58	0.15	A	0.20	5.73	0.15	A	
Proposed Layout - 2032									
Ridge Rd	0.99	5.79	0.48	A	1.06	6.00	0.49	A	
SR 154 SB	0.26	5.06	0.19	A	0.28	5.20	0.20	A	
Cedar Grove Rd	2.95	11.77	0.73	B	3.46	13.33	0.76	B	
SR 154 NB	0.21	5.88	0.16	A	0.22	6.10	0.17	A	

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.

Exercise 8.

Linked roundabouts

ARCADY 8 models systems of linked roundabout by feeding the exit flow from one roundabout as the entry flow of the next roundabout, and so on, and converging a solution for the system as a whole. This can be extended by using the concept of automatic exit restrictions.

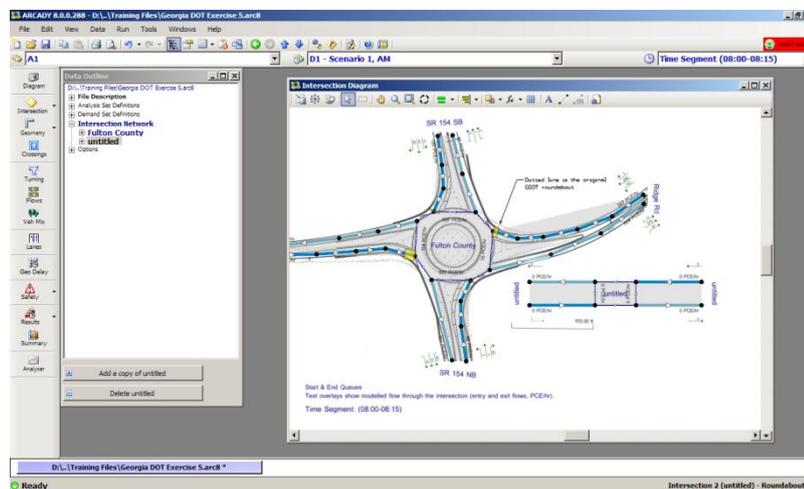
The system outlined above is a mathematical one only. You should apply caution when modeling very closed spaced roundabouts, **such as double mini-roundabouts in particular**. The interactions at such intersections are not well studied and are not explicitly modeled. If a separated turn lane is present, the loss of this traffic before the next roundabout should be taken into account.

1. Close all files and load the main exercise file and check that it runs.
2. Assume that there is three-leg roundabout to the south of the roundabout, which connects with Range Rd. This can be added to the file as a second roundabout, and can then be joined to the first roundabout.

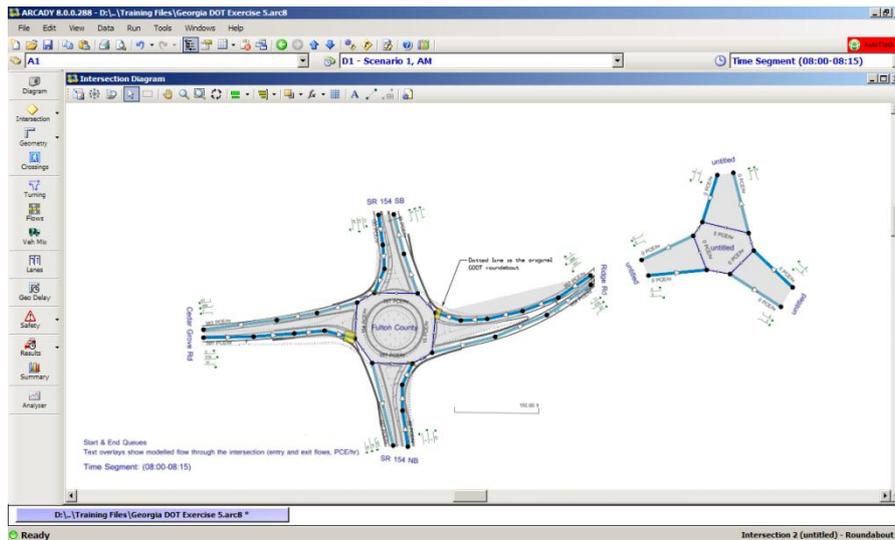
Note: You can add roundabouts at any time, but normally, it's easier to add the necessary roundabouts as the very first step when creating a file.

3. In the Data Outline, select *Intersection Network*, right-click and select *Add a new roundabout*. This will add a new roundabout, but by default it will only have two legs and will be located somewhere on top of the existing roundabout(s).

(You can also create a clone of the current roundabout although in this case it's easier to start with a new roundabout.)



4. Click on each leg of the new roundabout and drag them to the corner of the diagram, zooming out as necessary.
5. Click on either leg of the new roundabout, and use the Data Outline to add a third leg. Edit the name of each leg and position the legs as in the example below:



6. Confirm that the Data Outline now lists two roundabouts, each of which you can expand on work on independently. As well as a name, each roundabout has an ID, (Roundabout 1, Roundabout 2 etc) which you will need to know for some data entry. You can check the ID of each roundabout by clicking on a leg and then selecting the **Roundabout** icon from the main toolbar to show that roundabout's properties. For reference set the name of the new roundabout to *New* and the *Arm Names* to *West, East and North*.
7. Show a data grid of geometries: you should see the geometries for both roundabouts listed. For now, leave the geometries of *New* at their default values, but change the approach and entry width to, say, 17ft, to provide a reasonable capacity.
8. Open the Flows screen. This only shows data for one roundabout at a time, as confirmed at the top of the screen. To change to the other roundabout, click in the diagram on any leg.
9. Show the Turning Counts screen. Again, this shows the counts for one roundabout at a time. For the new roundabout, enter the following data:

Counts (PCE/hr)				
From \ To	1st	2nd	U-Turn	Total
West	500.000	250.000	0.000	750.00
East	400.000	400.000	0.000	800.00
North	150.000	100.000	0.000	250.00
Total	1050.00	750.00	0.00	-

Enter Turning Counts OR Proportions, including any bypass demand.

10. Run the file.

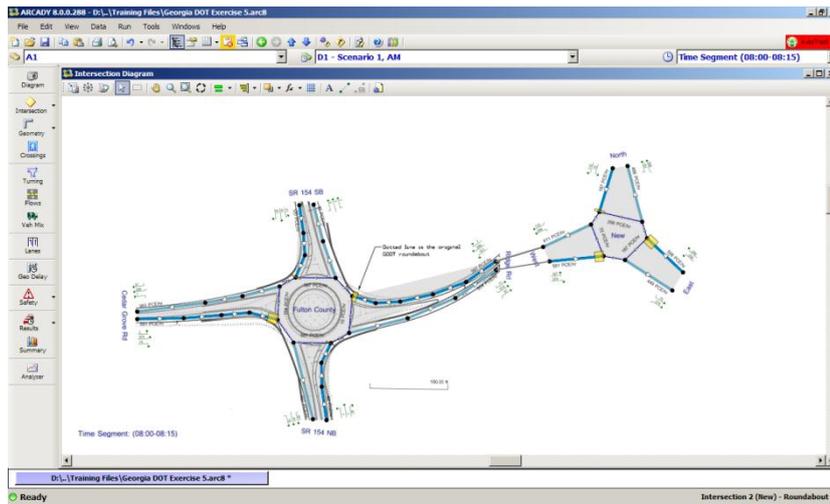
The summary results screen will show results for both roundabouts, and you can explore the individual results using data grids as usual. All other screens such as the Analyzer screen, reports, and visualizations in the Intersection Diagram and so on will work as usual.

You can add more roundabouts in exactly the same way or a **quick and easy way to create a copy of an existing intersection is to simply select a roundabout in the Data Outline and select *Add a copy of....***

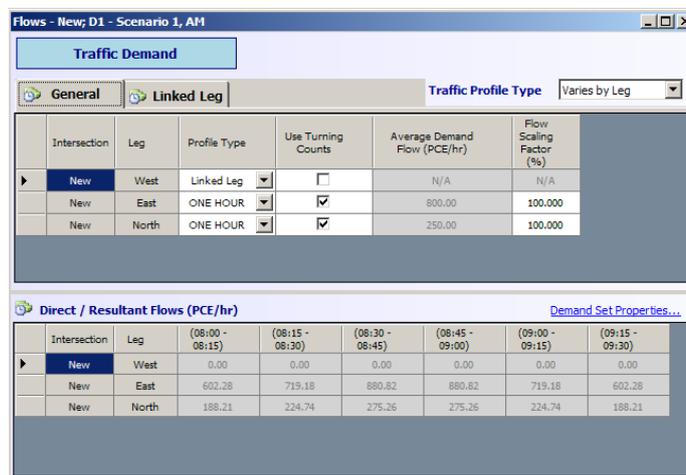
Currently however the roundabouts are **not linked** – they are completely separate. . Sometimes this can be useful because you can simply store several roundabouts in the same file, whether or not they are in reality linked.

The next step in this example, however, is to **link** the roundabouts.

11. In the Intersection Diagram click on the *Connect Items* Icon  and connect the two roundabouts from Range Rd to West or vice versa. The Intersection Diagram will display the connection



12. Now click on the flows screen and then the Linked Arm tab. It should show that the legs are now connected and the Profile Type should be set to *Linked Arm* as below.



13. Run the file.
14. In the Intersection Diagram, turn on the flow overlays. The colors are separate for each roundabout – i.e. the colors do NOT follow through between the roundabouts. However, by positioning the linked legs next to each other, you should be able to prove to yourself that the total width of the bars (i.e. the total flow) is the same.

15. Turn on the queue overlays and position the legs to confirm that, so far, there's no risk of the queues in the busiest time segment reaching as far as the other roundabout.
16. Increase all flows (using the flow scaling factor will be the quickest method) by 150% for example, to see what could happen in future years.
17. Run the file. Leaving aside the enormous queues that may occur elsewhere, look at the queues on *West*. Are they longer than the space between the roundabouts? (If not, keep increasing the flow scaling).

Note: depending on how you position linked legs in the diagram, it may be possible to visualize the queue explicitly between the two roundabouts.

18. The queue may be longer than the space between the roundabouts. This is similar to the 'vertical queues' used in TRANSYT and intuitively indicates that the roundabout system may have a problem.
19. It is also possible to model simple blocking back. This uses a special mode where the model is constrained such that the 'internal queue' can never be longer than the space between the roundabouts. Instead, upstream legs suffer a capacity reduction to represent blocking back.

To switch this on, return to the Flows screen. For BOTH roundabouts, in the *Linked Arm* tab, tick *Queue Limited* and enter the *Internal Storage Space* as, say, 10 PCE. See the example on the following page.



20. Run the file again. You should find that the queue between the roundabouts is no more than 10 PCE, but that the queues on other legs have increased.
21. Increase the flow scaling further and check what happens.
22. Use the x-y graph generator to check how the queues on various legs are affected by the increase in flows, and compare the situation with and without the automatic exit restriction mode.

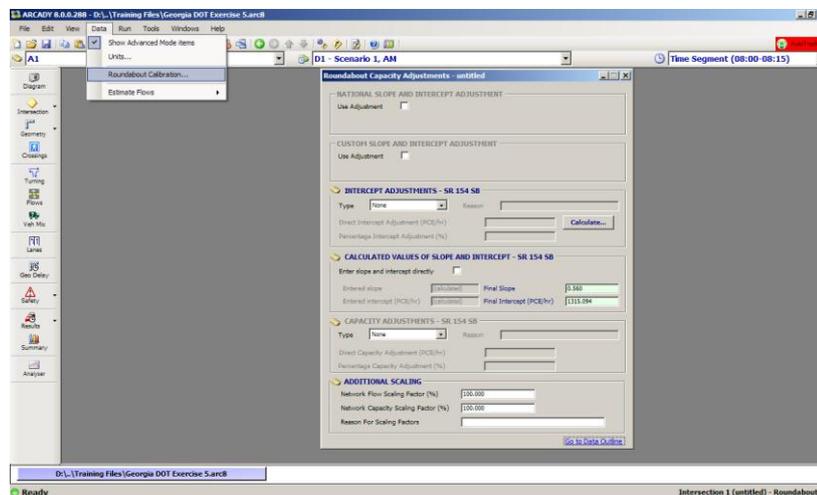
The exit restriction mode models blocking back, but you are limited to one exit restriction per roundabout. This is an easy way to check for blocking along a roundabout interchange or corridor.

Exercise 9.

Flow, Slope, Intercept and Capacity Adjustments

This section assumes that you are familiar with the concept of **slope** and **intercept**.

1. Close all files and load the main exercise file (WITHOUT the linked roundabout).
2. Run the file and use the Data Outline to browse to *Arm>Capacity>Slope/Intercept/Capacity Adjustments*. The slope and intercept are shown directly, and will update as soon as you change any geometry.
3. We've already seen that you can scale flows and capacities by setting scaling factors on Analysis Set properties and also for each leg within the Flows screen. Some of these factors, and others, are brought together in a special screen accessed via *Data>Slope/Intercept/Capacity Adjustments* from the main toolbar.



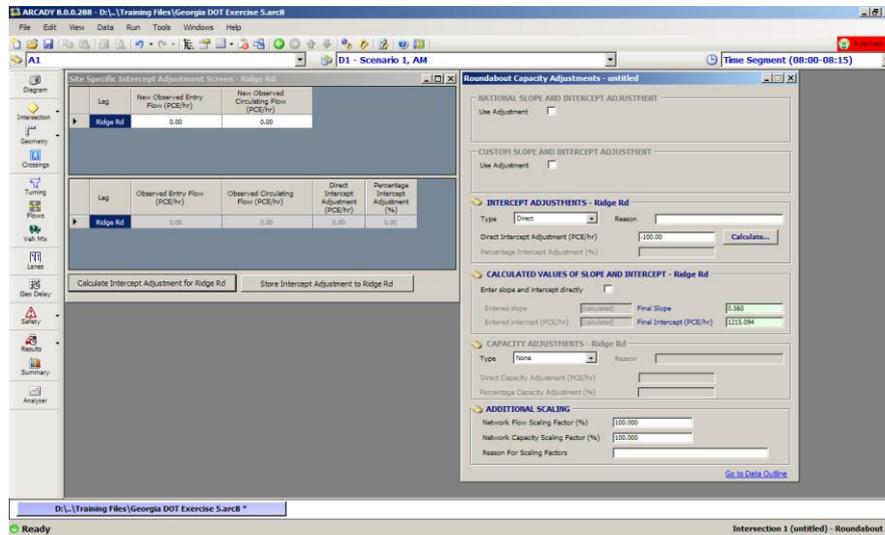
Some items on this screen apply to a single leg only. To show data for other legs, click on the leg in the Intersection Diagram or any other screen.

Enter values at the bottom of the screen for *Network Flow/Capacity Scaling*, and check that these do what you'd expect when you run the file.

4. Reset the scaling factors back to 100%.
5. The *National* and *Custom* slope/intercept adjustments are designed for use in North America.
6. If you happen to know the slope and intercept, and want to overwrite ARCADY's calculated values, you can enter them directly. Try doing this and see what happens to the summary results.

- You can enter *Intercept Adjustments* one at a time for each leg. (Click on an item in this screen and then click 'Go to data outline' to jump straight to the relevant section.)

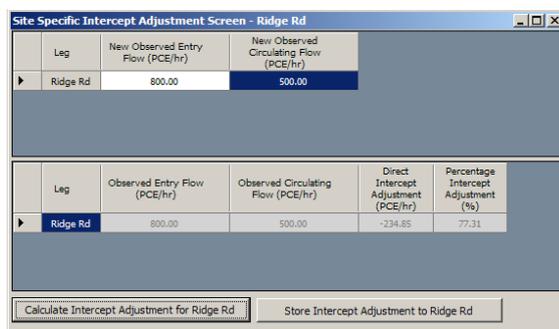
As an example, enter an intercept adjustment of -100 PCE/hr for Range Rd.



- Run the file. The intercept represents the maximum capacity for the leg, so reducing it by 100 PCE/hr will have a negative impact on the performance.
- Plot an x-y graph of capacity for a given time segment against intercept adjustment. This should show the capacity varying exactly in line with the adjustment.
- It may be that you don't know what the adjustment should be, but you've measured entry and circulating flows at the roundabout. The adjustment can be calculated from these. In the *Intercept Adjustments* section of the screen, press *Calculate*.
- The screen that appears works for each leg, one at a time. Change leg by selecting other legs via any screen.

For now, let's assume that for Range Rd, only, we measured on-site an entry flow of 800 PCE/hr and a circulating flow of 500 PCE/hr.

Enter this data in the top of this screen and then press *Calculate*.

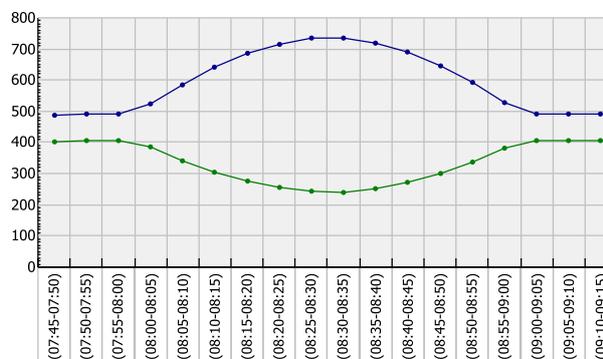
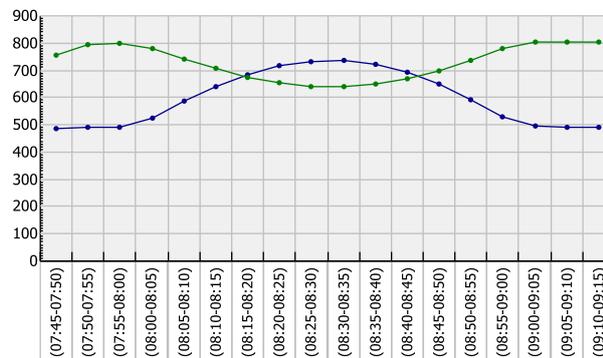
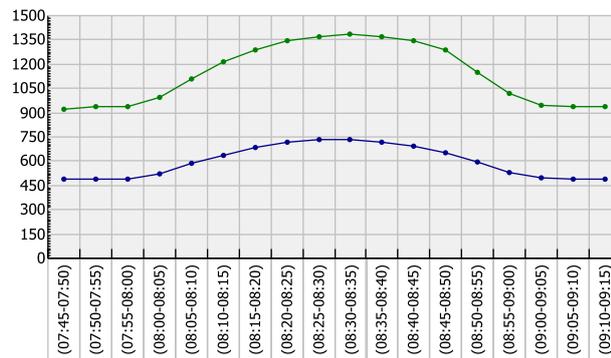


The program calculates that the observed performance is WORSE than that predicted by ARCADY, equivalent to an intercept adjustment of -234.85 PCE/hr.

Press Store to actually use the adjustment (otherwise it will be thrown away when you close the screen).

12. Run the file. As expected, the overall performance should be worse.
13. Look at the individual time segments and find one where the circulating flow happens to be close to 500 PCE/hr. For this time segment, the entry flow should be close to 800 PCE/hr.
14. *Optional:* Use a **Time Graph** to look at the entry and circulating flow for all time segments. The relationship will depend on the value of the intercept adjustment.

The graphs on the following page show increasingly negative intercept adjustments, which has the effect of pushing the entry flow lower and lower, and also affects the shape of the graph.





15. Turn off the intercept adjustments, or close and re-load the file.
16. In ARCADY 8 it's also possible to use **capacity adjustments**.

You can enter these directly as a direct or percentage value:

Altering the capacity of a single leg in this way allows you to check how sensitive the leg is to small changes in capacity.

Capacity adjustments are more generalized than intercept corrections, because they are applied towards the end of the modeling process rather than at the beginning.

Exercise 10.

Units and other options

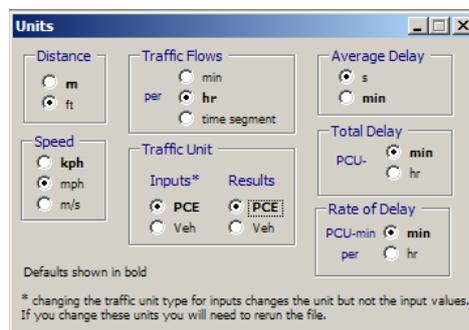
1. Close any open files and load the main example file.
2. Look at the flows screen, any results screen, and a generated report, and observe that, wherever possible, numerical values are always shown with an associate UNIT.

What is the default value of flow? Capacity? Queue? Distance? Speed?

3. PCE (Passenger Car Equivalent) is generally recommended, because it automatically takes into account vehicle composition. A queue quoted as 10 PCE, for example, is less ambiguous than 10 Veh.

In ARCADY 8, *spaces* are usually measured in PCE. E.g. the space between a crossing and a roundabout is expressed as a number of PCE.

4. Close all windows but show main geometries (entry width etc) and note that these are shown in feet.
5. Click *Data>Units*.

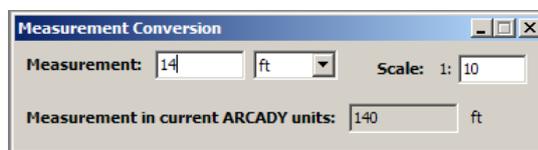


6. Change the Distance units to meters and note that the geometry screen automatically updates.
7. Enter geometry in meters and then switch the units back to feet and note that again the geometry screen automatically takes this into account.
8. Show the flows and turning counts screen, and use the Units screen to switch the traffic flow unit between *per hour*, *per minute* and *per time segment*. Note that the values automatically update. Because you can switch at any time, this allows you to quickly compare different items in different units.
9. The Summary Results screen will update to show different units, **but you will need to re-run the file for this to take effect.**
10. Choose different units and save the file. Close the file and re-open it. Are the units the same or have they reset to defaults?

ARCADY 8 saves the units *in the file*.

Therefore, when checking someone else's ARCADY 8 file, **pay attention to the choice of units.**

11. Show the Vehicle Mix screen and check that there are 10% Heavy Vehicles.
12. Use the Units screen to toggle the *Traffic Unit Results* between PCE and Veh. Look at time segment results: flows and queues in Vehicles will be higher than in PCE. Again, ARCADY 8 automatically allows for this.
13. Delays and other results can also be expressed in different units. For full details, see the User Guide.
14. Click *Tools>Measurement Converter*. This utility screen allows you to convert a quantity in one unit to the current file units, you can apply a scale conversion at the same time.



15. Experiment with the *Copy* and *Paste* buttons on the main toolbar and their application to various screens such as the Flows and Turning Counts screen. Try transferring data between ARCADY 8 and Excel or Word (or other ARCADY and TRANSYT files).

Add several demand sets, and use *Edit>Copy/Paste All Demand Sets*. Can you use Excel to manage the data for several demand sets, and then paste it into ARCADY 8 in one go?

16. The following options can all be changed easily at any time - can you locate them? (TIP: Try using *Help > Data Field Finder* or press *F3*)
 - drive-on-the-left/right
 - lighting conditions (mini-roundabout only)
 - road surface conditions (mini-roundabout only)
 - description of each analysis and demand set
 - demand set relationships
 - grade separated roundabout type
 - queue variations and queue markers (*this is not covered in the upgrade course but see the User Guide or ask the course tutor if you would like details*)
 - RFC/ LOS threshold
 - Vehicle length (used for queue length calculations)
 - Options to control the sorting and grouping of legs
 - Options to control the font size



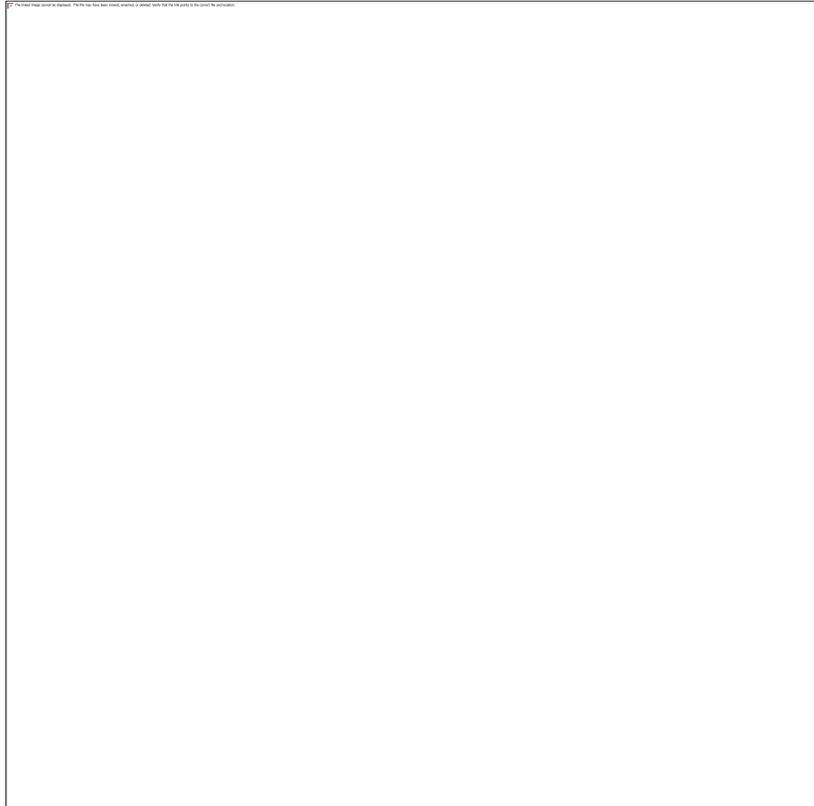
*Finally, if you haven't already done so, please notice the hyperlink shown at the very bottom of the screen. **This changes from time to time and is a link to latest news about the product.** If you notice that the headline has changed, please take the time to read the full story. We will use this system to alert you to new versions, upgrades, maintenance releases and any other useful information.*

Notes:

Geometric Measurement Reference

Approach Road Half-Width - V

The *approach road half-width*, v , is measured at a point in the approach upstream from any entry flare, from the median line to the nearside kerb.

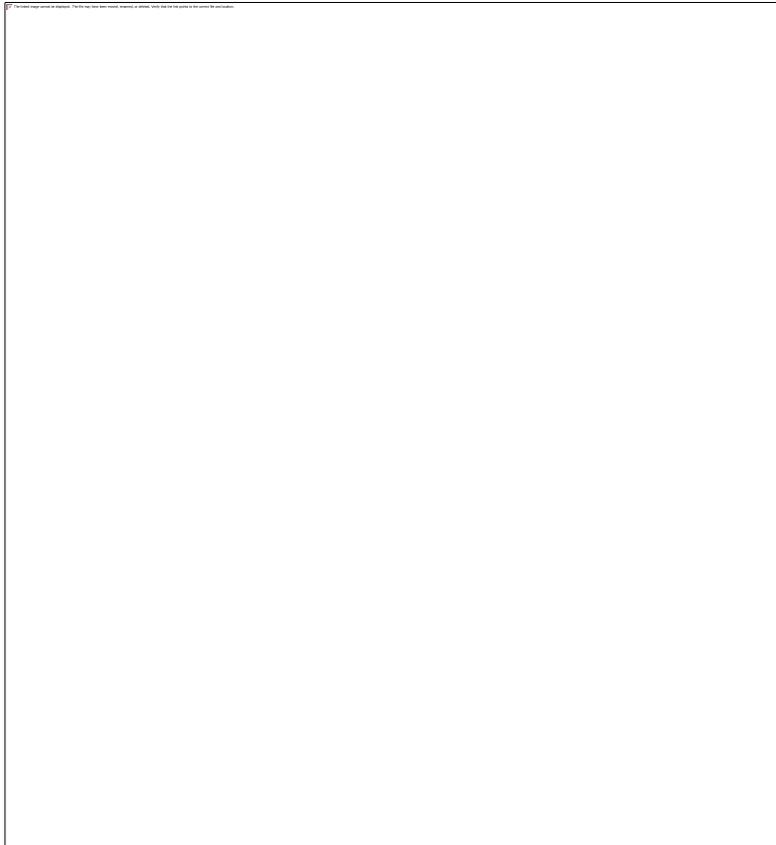


Point A is the point of maximum entry deflection at the offside end of the yield line where it meets the median island (or marking).

Range: 6.56168 ft - 39.37008 ft

Entry Width – E

The *entry width* is measured from the point A along a straight line at right angle to the nearside kerb.



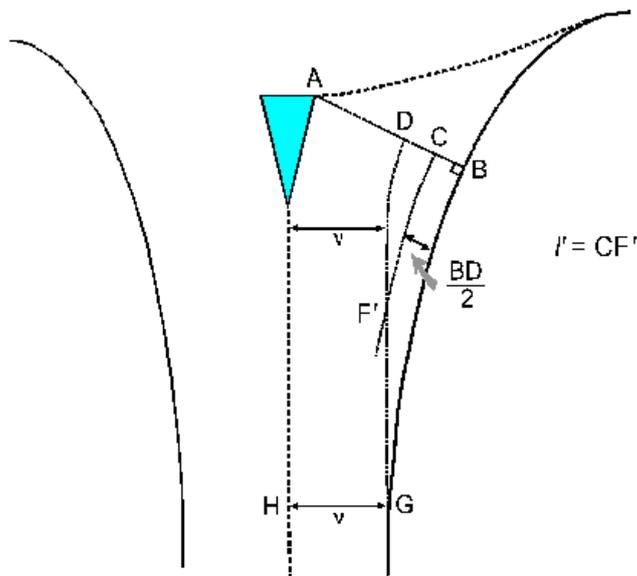
Point A is the point of maximum entry deflection at the offside end of the yield line where it meets the median island (or marking).

Range: 9.84252 ft - 52.49344 ft

Effective Flare Length – l'

The effective flare length is recorded as zero if there is no flare. Note that if a zero flare length is entered then ARCADY will check that $E = V$ and show an error otherwise. Conversely, if E is greater than or less than V a non-zero flare length **must** be entered.

The construction to be used to obtain the average effective length, over which the flare is developed, l' , is illustrated below.



Note: the shape of the line CF mirrors that of the nearside kerb line. Similarly, the shape of line DG mirrors that of the centre line or kerb of the central island if one exists.

$AB = E$ (the point A is as in Figure 23-1).

$GH = V$ (the point G is the best estimate of the start of the flare).

GD is parallel to AH and distance v from it.

CF' is parallel to BG and distance $\frac{1}{2} BD$ from it.

The simplest way to obtain the measurements is as follows:

1. If not already done so, draw the projection line AB as used to measure the entry width (see above).
2. Draw 'tram lines' parallel to the centre of the road, towards the yield line, from the point G at the start of the flare.
3. This line (GD) intersects the line AB, which is the line along which the entry width (e) is measured, at point D. The flare length (l') is measured from the point C, which bisects BD along a line parallel to the kerb and distance $\frac{1}{2} BD$ from it, to a point F' where it intersects line GD.

The effective flare length is then defined as $l' = CF'$ (The line over which l' is measured is often curved as it matches the curve of the nearside kerb).

Effective Flare Length Continued - I'

NOTE: The point G can often be chosen by identifying the first point upstream of the yield line where the nearside kerb and centre line of the road are parallel to each other.

Also note that on occasions when the line A-B is NOT perpendicular to the island kerb (or centre line) the line D-A is not always (v) wide.

TIP: Measurement of Median Line:

In order to measure some parameters, it is first necessary to define a line "midway" between the kerb line and centre line (or centre island) on the entry to the roundabout. It is sometimes also necessary to define a midway line on the roundabout exits.

Naturally, the midway line (or centre line, or median line) passes through all the centre points. Each centre point is defined as the centre of a line drawn from kerb to centre line (or island) at right angles to the kerb line.

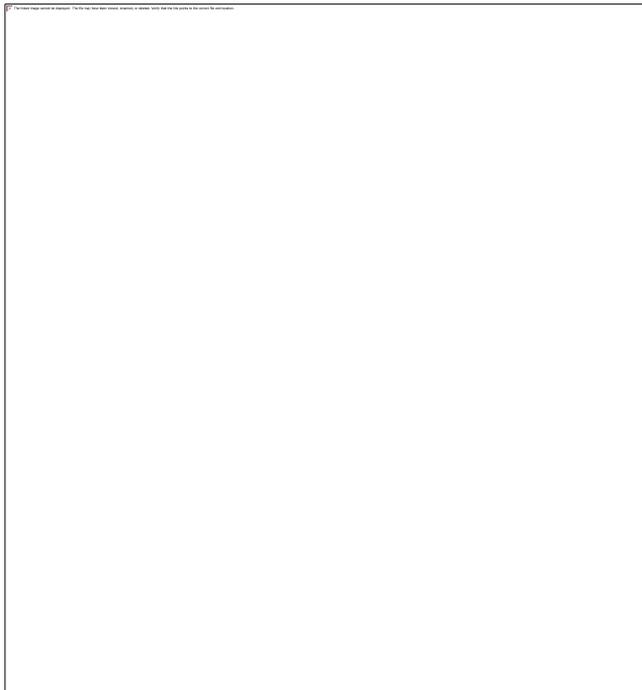
Range: 0 ft - 3277.55906 ft

Entry Radius - R

The *entry radius* is measured as the *minimum radius of curvature* of the nearside kerb line at entry. For some designs the arc of minimum radius may extend into the following exit, but this is not important provided that a half or more of the arc length is within the entry region.

When the radius of the kerb line is continuously changing (i.e. it is a transitional curve) TRL recommend measuring the entry radius as follows:

1. De-lineate a length of kerb line which extends from a point 25 metres upstream of the yield line to 10 metres downstream of the yield line (measured along the curved path of the nearside kerb line).
2. **Within** the length of kerb line defined above, choose a 20 metre length with the maximum average curvature (i.e. this 20 metre length has a greater average curvature than any other 20 metre length you could have chosen). This process will have to be done by eye and is therefore somewhat subjective. (If the length of kerb line in (1.) is less than 20 metres long, then use whatever length is available for defining (2.)).
3. Measure the **average** radius of the 20-metre length defined in (2.). **This measurement becomes “r”**.



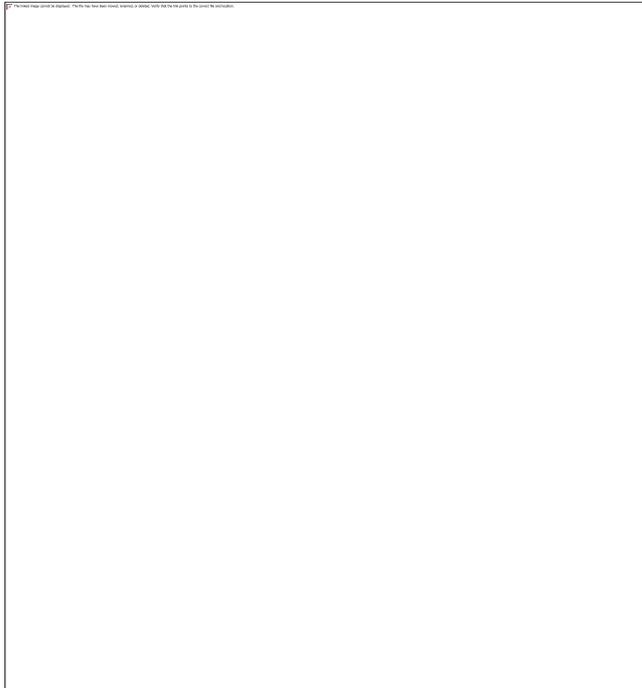
Point A is the point of maximum entry deflection at the offside end of the yield line where it meets the median island (or marking).

Range: 9.84252 ft - 3277.55906 ft

Inscribed Circle Diameter – ICD

The *inscribed circle diameter*, D , is the diameter of the largest circle that can be inscribed within the junction outline.

In cases where the roundabout is asymmetric, the local value in the region of the entry (Leg) being considered is used.

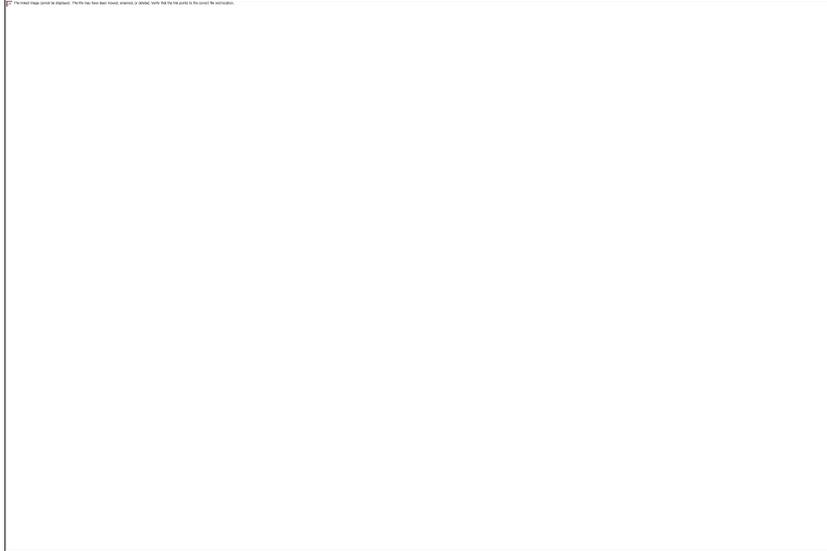


Point A is the point of maximum entry deflection at the offside end of the yield line where it meets the median island (or marking).

Conflict (Entry) Angle – PHI

The *conflict angle, or entry angle*, serves as a geometric proxy for the conflict angle between entering and circulating streams. Two constructions are used for the conflict angle: the first applies to well-defined conventional roundabouts, and the second to all other types.

For conventional roundabouts (i.e. those with identifiably parallel-sided weaving sections, where the arms are well separated), the angle measured is in effect that between the projected path of an entering vehicle and the path of a circulating vehicle.



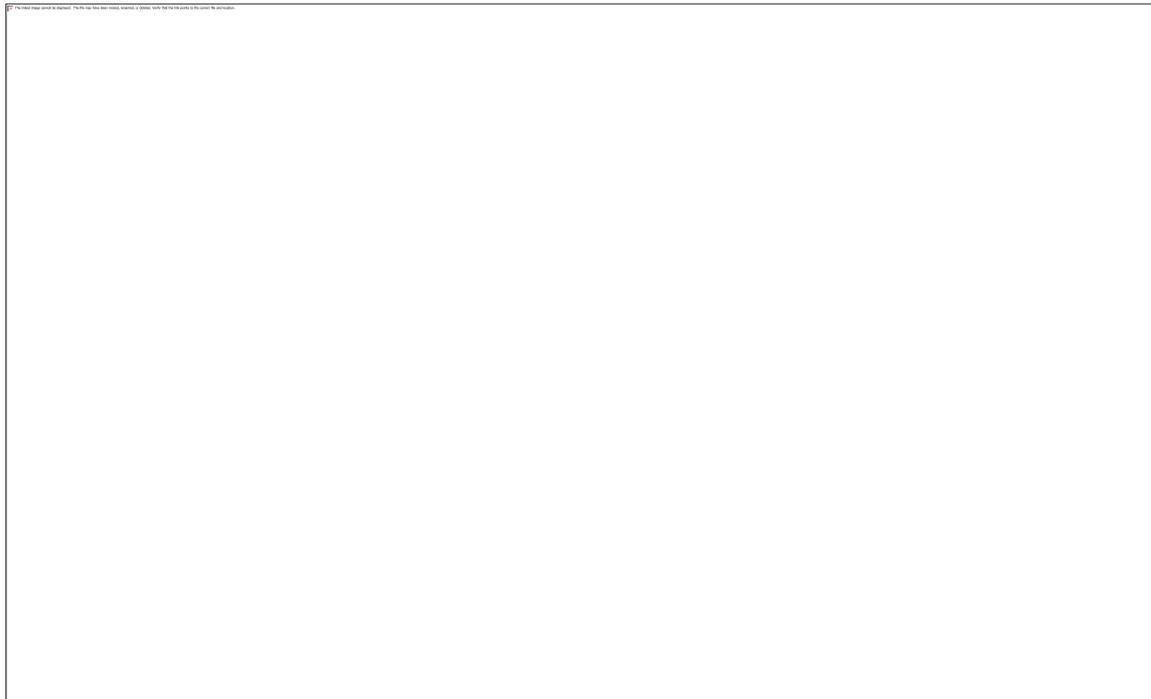
A'D' is a line parallel to the path taken by the circulating flow, along the centre of the circulating carriageway.

EF is a line midway (along its entire length) between the nearside kerb line and the median line or nearside edge of any median island.

BC is a tangent to EF at the point where EF intersects the yield line.

PHI is then measured as the angle between BC and the tangent to A'D' at the point of intersection of the two lines.

For other cases the construction is different as below. This construction is used when there is insufficient separation between entry and adjacent exit to be able to define the path of the circulating vehicle clearly. In this case, circulating traffic which leaves at the following exit will be influenced by the angle at which that arm joins the roundabout. The angle between the projected entry and exit paths is measured and then halved to find PHI, as on the following page.



EF is a line midway (along its entire length) between the nearside kerb line and the median line or nearside edge of any median island.

BC is a tangent to EF at the point where EF intersects the yield line.

JK is as EF but for the following exit.

GH is a tangent to JK at the point where JK intersects the boundary of the roundabout circulation.

PHI is then defined as **[angle HLB] / 2**.

Note that if angle GLB exceeds 180 degrees, then PHI is defined as zero.

If it is not clear which of the two methods should be used, the following should clarify the situation. All three vehicle paths (entry, exit and circulatory carriageway medians) should be constructed, and the entry and exit paths projected towards the roundabout centre. The choice of construction for PHI depends on where these projections meet: if the meeting point is closer to the centre of the roundabout than the arc of the circulatory carriageway median, then the first construction for conventional roundabouts should be used; if they meet outside that area, then the construction for small roundabouts be used. In the limiting case where all three medians intersect at a point, it is common for the circulatory carriageway median to bisect the angle between the other two medians, so that the two methods become equivalent.