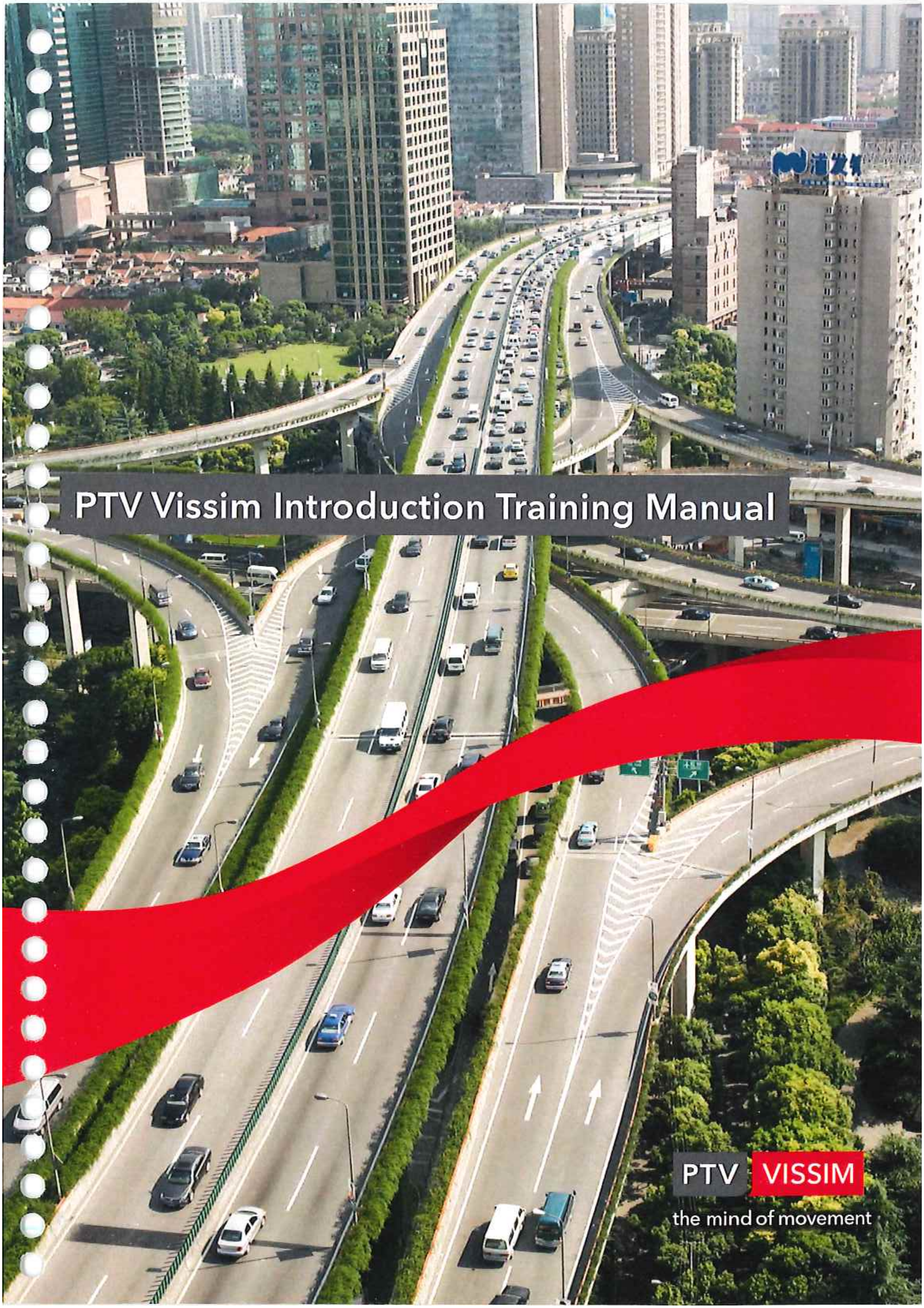
PTV Vissim Introduction Training Manual



PTV VISSIM

the mind of movement

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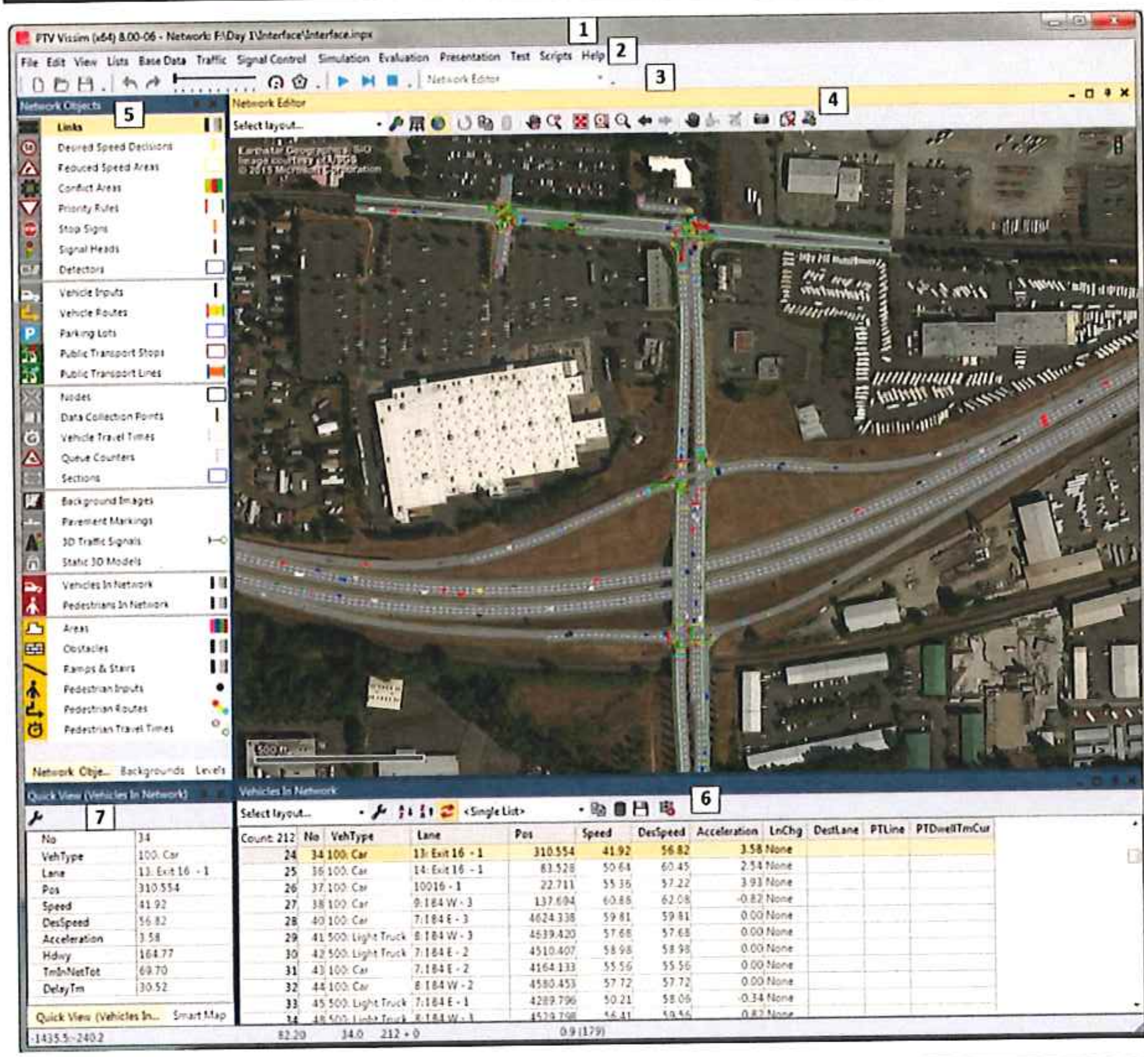
1 Vissim Introduction

This chapter is meant to familiarize a user with the Vissim interface. There are tool bars, windows, and lists that can be customized and repositioned to suit the user's needs.

1.1 Interface Overview



No	Name	Description	
1	Title Bar	• Program Name • Version-Service Pack • Project Directory	• Keep consistency. Using different versions and service packs may affect calibration.
2	Menu Bar	Call program functions. Edit/adjust internal configurations	

		and assumptions.	
3	Tool Bar	Quick access to specific functions	
4	Network Editor Windows	• The visual interface between the user and the network • Can be in 2D or 3D • Multiple can be open	• Incorporates internet background maps (2D only) • Window can be separated from the interface
5	Network Object Window(s)	• List of object layers • Has buttons for turning layers on/off, locking layers, and showing labels	• Generally working top down produces efficient coding • Window can be separated from the interface
6	List Windows	• Every object has a list • Lists show all objects of a specific type	• Lists display attributes • Are synchronized with the network editor windows
7	Quick View Window	• Shows attributes of the selected object	• Quickly edit a selected object

1.1.1 Title Bar

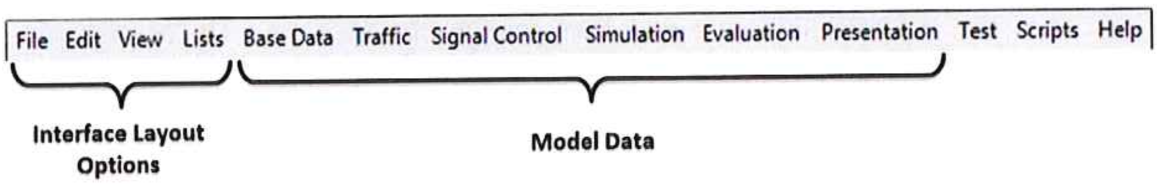
The title bar displays what version of Vissim is being run and what service pack is being used; in this image it is Vissim 8 and service pack 6.

Versions are major releases generally released annually where new functions, modules and add-ons are implemented.

Service Packs are released more frequently and provide updates and bug fixes to the software.

New features, modules, or bug fixes may alter internal assumptions or methods and thus change the calibrated model results. For this reason it is important to maintain consistency with the version and service pack on a particular model after calibration.

1.1.2 Menu Bar



File & Edit

- Save/Open Network Files (*.inpx)
- Save/Open Layout Files (*.layx)
- Import/Export
- Set global parameters

View & Lists menus open various windows within the Interface.

Base Data provides access to background inputs and assumptions.

Traffic provides access to demand inputs and configurations.

Signal Control provides access to the signal controllers' logic.

> Signal Optimization
>
> The optimization is designed for the Stage-Based Fixed Time Controllers primarily used in Europe.

Simulation allows for configuring the details of a simulation; duration, resolution, speed, etc.

Evaluation is where the user defines what data is collected and how to report it.

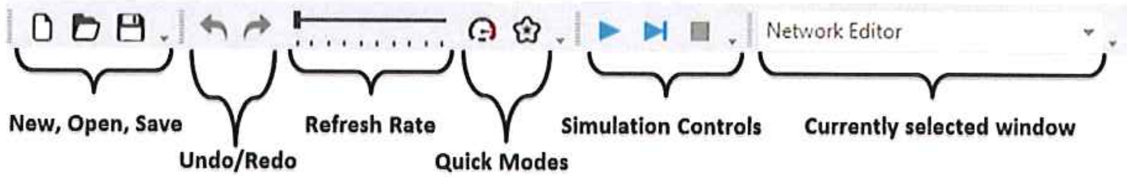
Presentation provides visualization tools in either 2D (*.ani) or 3D (*.avi).

Test allows you to observe signal controller functionality and detector settings without the computational overhead of a full simulation.

Scripts allows you to attach externally created subroutines to bypass Vissim's internal functionality

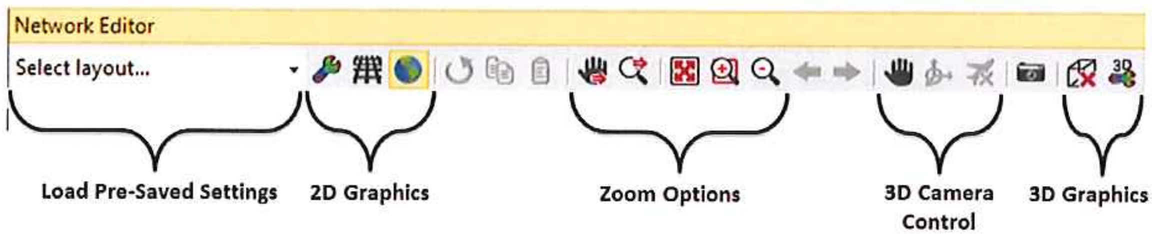
Help is where resources can be found to aid in building or running a network such as example file, manuals, or links to online content.

1.1.3 Tool Bar



The tool bar provides access to shortcut buttons for accomplishing certain function quickly such as saving, running a simulation or changing how often your display updates during a simulation.

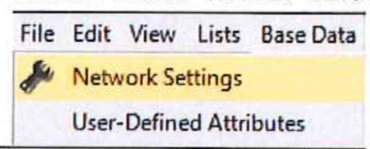
1.1.4 Network Editor Tool Bar

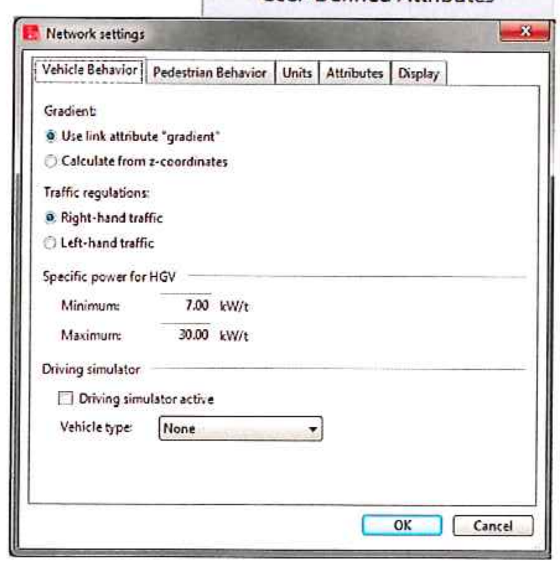


The network editor tool bar gives you the ability to manipulate the views and graphic parameters within the network editor.

1.1.5 Network Settings (Global Parameters)

To open the network settings window open the ***Base Data*** menu and select ***Network Settings***. Network settings change global assumptions within the model such as how gradients are calculated or what units are used in the model.



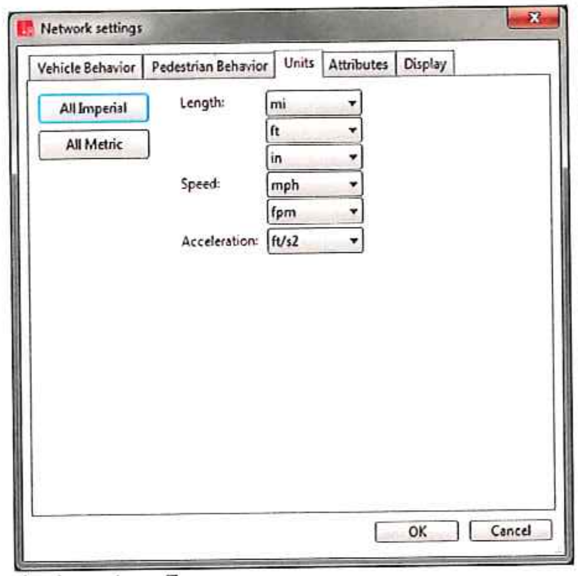


Vissim is unique in-that these settings can be changed at any time. The two most commonly used tabs are Vehicle Behaviors and Units.

Vehicle Behavior Tab

This tab defines which side of the road vehicles can drive on, how grades are calculated (from geometry or from user-defined values), and power assumptions for heavy trucks (impacts their performance on steep grades).

Units Tab



This tab defines what units are to be displayed for each value (length, speed and acceleration). Units can be changed to all Imperial (ft, in, miles, etc) or all Metric (m, km, etc) by clicking the respective buttons.

Alternatively the individual values may be changed using the drop-down menus. For example length can be in miles, feet and inches but speeds can be in km/h.

To learn more about the other tabs please consult the Vissim user manual chapter 5.

1.1.6 Windows

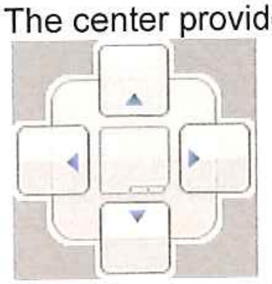
Vissim's interface is laid out with a series of different windows; Network objects, Network Editor, Quick View, etc. These windows can be detached from their default positions and rearranged to meet the specific modeler's needs.

To detach a window follow these steps:

1. Left-click and Hold the blue bar at the top of the window
2. Drag the window to the desired location
3. Release left-click

The windows can float independently of the program or they can be docked into specific locations. If a window is detached from Vissim and dragged either to the center of another window or to the edge of another window, an indicator will appear providing some options;

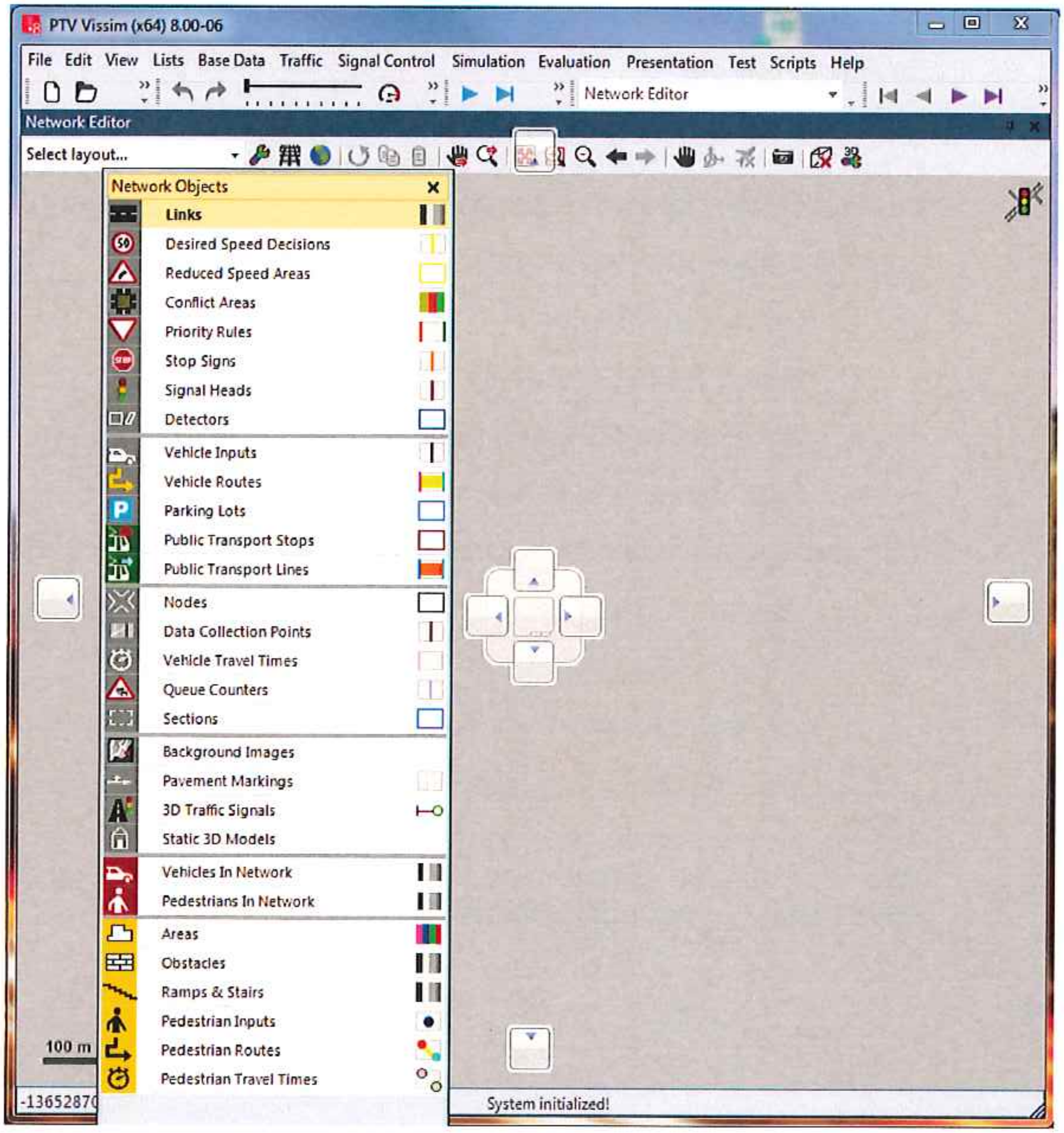
The center provides these options



1.  Dock the selected window over the top of this window in a tabular format.

2.  Dock the selected window to the right of this window (or left, top, or bottom).

The arrows on the edges are similar to option 2 above however they allow the selected window to be docked on the side, top or bottom of the entire interface adjusting all other windows appropriately.



1.1.7 Layouts

Once the interface is configured as desired these settings may be saved as a layout. Layouts offer the ability to view the model in different ways without the overhead of manually reconfiguring the network each time.

Keep in mind using different layouts will not affect results data or calibration in any way.

Perhaps there is one layout for network building, another for calibration and a third for evaluation runs. Each layout can be loaded when appropriate to quickly reconfigure the interface thus saving time manually reconfiguring and improving workflow efficiency and consistency.

Saving a Layout

The current configuration of windows can be saved as a layout file (*.layx) in the file menu. The *layx file is saved in the project directory (same file location on the hard drive or server where the model is saved).

To save a layout file follow these steps;

1. Open the ***File*** menu
2. Select ***Save Layout As...***
3. Windows explorer will open. Name the layout file.
4. Click ***Save*** to save the file.

To open a pre-existing layout file follow these steps;

1. Open the ***File*** menu
2. Select ***Open Layout...***
3. Windows explorer will open. Select the layout file.
4. Click ***Open*** to open the file.

The every time the model is opened in a fresh instance of Vissim it will open the default layout. The default can be changed by selecting the option ***Save Layout as Default***.

1.1.8 Activity Lesson 1-1 "Working with Vissim"

Objective:

To become familiar with the network interface. In particular moving and docking windows as well as saving and loading layout files.

Objects Used:

- Windows Docking Icons
- File menu
- Layout files (*.layx)

Procedure:

1. Open the file "1-1.inpx"
2. Save as a new file
3. Complete the task within the model

Task:

1. Run a Simulation.
    a. Press  to start a simulation.
    b. Press  to stop a simulation.
2. Open the Network Objects window.
    a. Open the View menu.
    b. Select Network Objects.
3. Adjust the size of the windows.
    a. Hover the cursor over the blue edge.
    b. Left-Click and Drag the edge to shift it.
4. Open a new Layout file.
    a. Open the File menu.
    b. Select Open Layout...
    c. Select the file 1-1_Alternate.layx
    d. Run a simulation and observe what has changed.

1.2 Background Images

Building an accurate Vissim model from scratch requires at least one scaled map that shows the real network. The image file of a digitized map can be displayed, moved and scaled in the Vissim network window and is used to trace the Vissim links and connectors. Vissim can import several image formats, both raster and vector, for display. The file formats that are supported include:

Supported raster formats	**Supported vector formats**
*.BMP	*.DWG
*.JPG	*.DXF
*.PNG	*.EMF
*.TGA	*.WMF
*.TIF (uncompressed & packbits)	*.SHP (shape files)
*.SID (Mr. SID, full res. only)	
*.ECW (fixed resolution only)	

The following steps illustrate how to configure background images:

Loading image file as background image

1. On the Network objects toolbar, click > ***Background Images***.
2. Hold down the ***CTRL key*** and in the *Network Editor*, ***right-click*** on the desired position.

   *The window **Select Bitmap File** opens.*
3. Select the graphic file which should be imported.
4. Click the ***Open*** button.
5. In the *Network Editor*, click on the icon ***Show entire network*** on the toolbar. Then, the digital map is show in its entirety and the name and a miniature view of the digital map is shown in the background images toolbar.

Positioning background image

You can position a background image in a Network Editor.

1. On the Network objects toolbar, click > **Background Images**.
2. In the Network Editor, click on the background image of your choice. A background image is marked.

3. ***Left-click*** and ***hold down*** and ***drag*** the background image to the position of your choice.

Scaling the background image

A loaded background image is not represented according to scale even when the file has a scale. For the precise modeling of a network, you must scale the map precisely. Use a large distance, for example > 300 feet. For the adjustment of the background image and the Vissim units, zoom in on an object or a link with original measurements known to you. For example, this can be the scale of the map or the edge between two corners of a building or geo-graphical points. The distance between two common reference points can often be accurately determined by using the distance measuring tool in internet based map service.

1. On the Network objects toolbar, click > **Background Images**.
2. In the Network Editor, ***left-click*** on the background image of your choice.
3. ***Right-click*** on the Network Editor.
4. From the context menu, select the entry **Set Scale**. The mouse pointer shows a cross. The reference point is the upper left corner.
5. ***Left-click*** on the desired starting point of the edge and ***hold*** and ***drag*** it to the desired end point of the edge.
6. Release the mouse button to open the **Scale** window.
7. Enter the original length of the edge.
8. Confirm with **OK**.

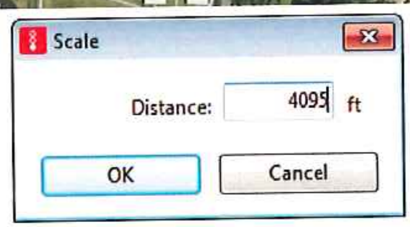
i The scale of a Vissim network cannot be changed later. Enter the scale carefully in order to prevent inconsistencies.

1.2.1 Activity Lesson 1-2 "Adding Background Images"

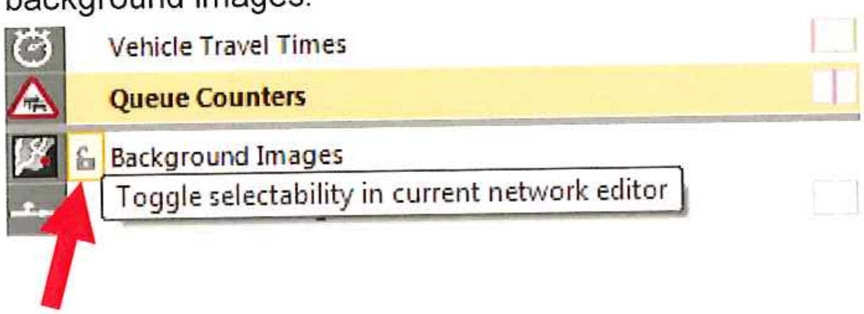
1. Open the file: *\Vissim Intro\Example Files\Ex_2-2_Background\NorthAmericaDefault.inpx*

   This file includes units set to Imperial and a North American vehicle fleet distribution

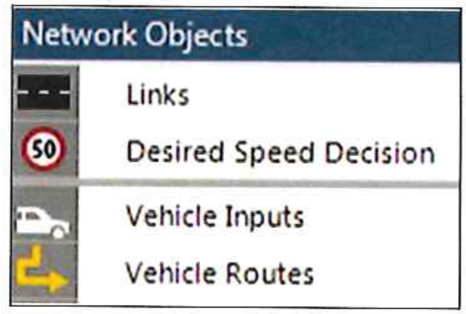
2. Confirm the unit settings by going to **Base Data > Network Settings > Units** tab.
3. Open the background image named *Aerial-West.tif* by selecting the Background Images in the network object toolbar.
4. Zoom in to the red line on the background image. ***Right-click*** and select **Set Scale**, then trace the 4,095 feet (1,248 m) red scaling line on the background image.



5. To move the image ***left-click*** and ***hold*** and ***drag*** the image to the desired location. This may be necessary when tiling multiple images together.
6. Once all background images are properly loaded, scaled, and positioned, lock the background image object in the network objects toolbar to prevent accidentally moving the images. You will need to select other than Background Images menu before you can lock the background images.



2 Basic Geometry



This chapter is an introduction to building a basic network in Vissim.

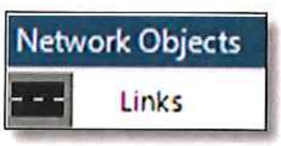
Objective

The purpose of this chapter is primarily to introduce how to create and manipulate the four basic objects in Vissim; Links, Desired Speed Decisions, Inputs and Routes.

The secondary goal is to demonstrate how to properly construct a freeway merge area. The model will encompass a multilane segment with both merging and diverging sections.

We will use default values for many parameters in order to highlight the mechanics of building the network. Topics such as following or lane change behaviors, speed distributions and vehicle types or classes will be covered in greater detail in later chapters. It is important to focus on the basic mechanics of Vissim in order to build a strong foundation of skill from which we can apply more complex methods.

2.1 Links



Links are the back bone of a Vissim network and should be among the first objects created within the network. Links are used to represent the geometry of the roadway; curvature, cross-section, etc.

This section will work through these aspects of building a link:

- Creating a link
- Creating a connector
- Adding shape to a link via spline points
- Splitting a link
- Adding lanes to a link

2.1.1 Activity Lesson 2-1 "Drawing Links"

Objective:

To become familiar with the process of creating a link by constructing the geometry of the roadway. Tasks 1-4 focus on creating and shaping links. Tasks 5-8 focus on drawing connectors. Tasks 9-13 focus on splitting links and adding additional lanes.

IMPORTANT The keystrokes of creating a link are similar for most objects and thus complete understanding is vital to successfully completing other tasks in Vissim. Therefore this activity lesson should be repeated until we are comfortable with the process before moving on to Activity 2-2.

By the end of this task you should know the proper keystrokes and mechanics of constructing/editing links and connectors; how to create new links, create connectors, split links, and add spline points

Objects Used:

- Links
- Layout Files

Procedure:

1. Open Activity Lesson 2-1.inpx.
2. Save as a new file.

Tasks

- Zoom into the "Creating Links" section and complete Tasks 1-4.
- Zoom into the "Creating Connectors" section and complete Tasks 5-8.
- Zoom into the "Adding Lanes and Splitting Links" section and complete tasks 9-13.

2.1.2 Activity Lesson 2-2 "Building an On-Ramp"

Objective:

To take the concepts learned in Activity lesson 2-1 and applying them to a real-world scenario. Task 1 is adding a leg to an existing intersection. Task 2 is creating a merge section on the freeway.

By the end of this activity you should be able to place links and connectors into your network. You should also know the proper method for creating a merging section of freeway.

Objects Used:

- Links

Procedure:

1. Open Activity Lesson 2-1.inpx.
2. Save as a new file.

Task 1: Adding a leg to the intersection

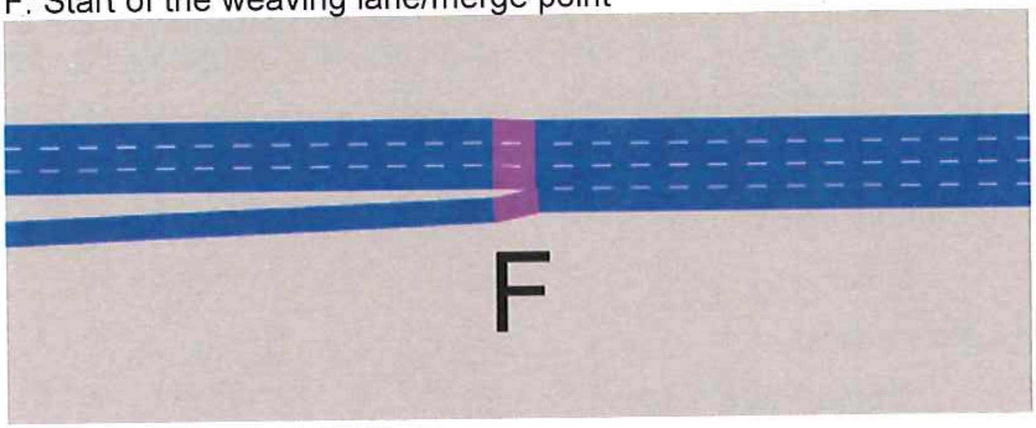
1. Draw an on-ramp link from position b to f.
2. Create the SB left turn movement:
    a. Add a lane to the left of the SB link at position a.
    b. Draw a connector from position a to b.
3. Create the EB through movement:
    a. Draw a connector from position e to b.
4. Create the NB right movement:
    a. Split the NB link at position d.
    b. Add a lane to the right of the NB link at position d.
    c. Draw a connector from position d to c.

(Task 2 on next page)

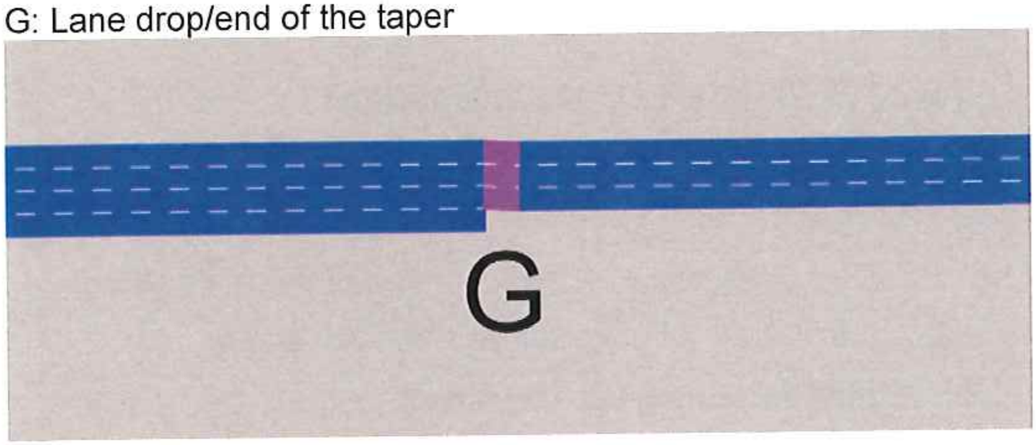
Task 2: Adding a freeway merging area

1. Split the freeway link at points f and g.
2. Add a lane to the right on the freeway section between f and g.
3. Draw a connector from the ramp to the new lane at position f.

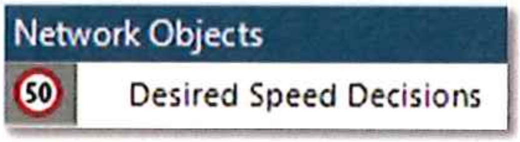
F: Start of the weaving lane/merge point



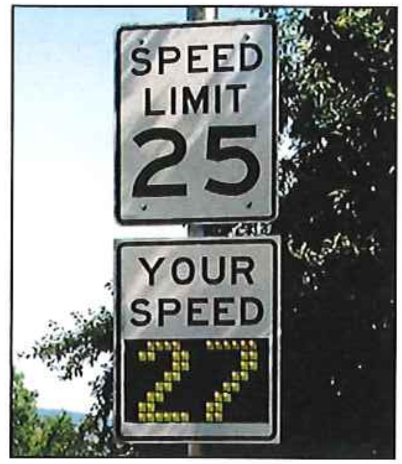
G: Lane drop/end of the taper



2.2 Desired Speed Decisions



Desired Speed in Vissim is the speed at which the vehicles wish to travel. If there are no obstacles ahead a vehicle will proceed at its assigned desired speed.



Vehicles are generated with a pre-determined Desired Speed (please see the next section on vehicle inputs for further information). Desired speed decisions permanently change the driver's desired speed.

Conceptually they act like posted speed limit signs. When a vehicle passes a desired speed decision their desired speed changes to whatever was posted on the desired speed decision point.

However each vehicle is not assigned the same desired speed. Individual vehicles are assigned a speed within a speed distribution. A distribution of speeds is used to ensure not every vehicle is traveling at exactly the same rate.

Using a distribution helps randomize the vehicle population, form platoons, and encourage realistic behaviors such as passing. If a vehicle is traveling below its desired speed it will make attempts to accelerate until it reaches its desired speed again. If there is a slower vehicle ahead it will look for an opportunity to pass.

2.2.1 Demo 2-3 "School Zone"

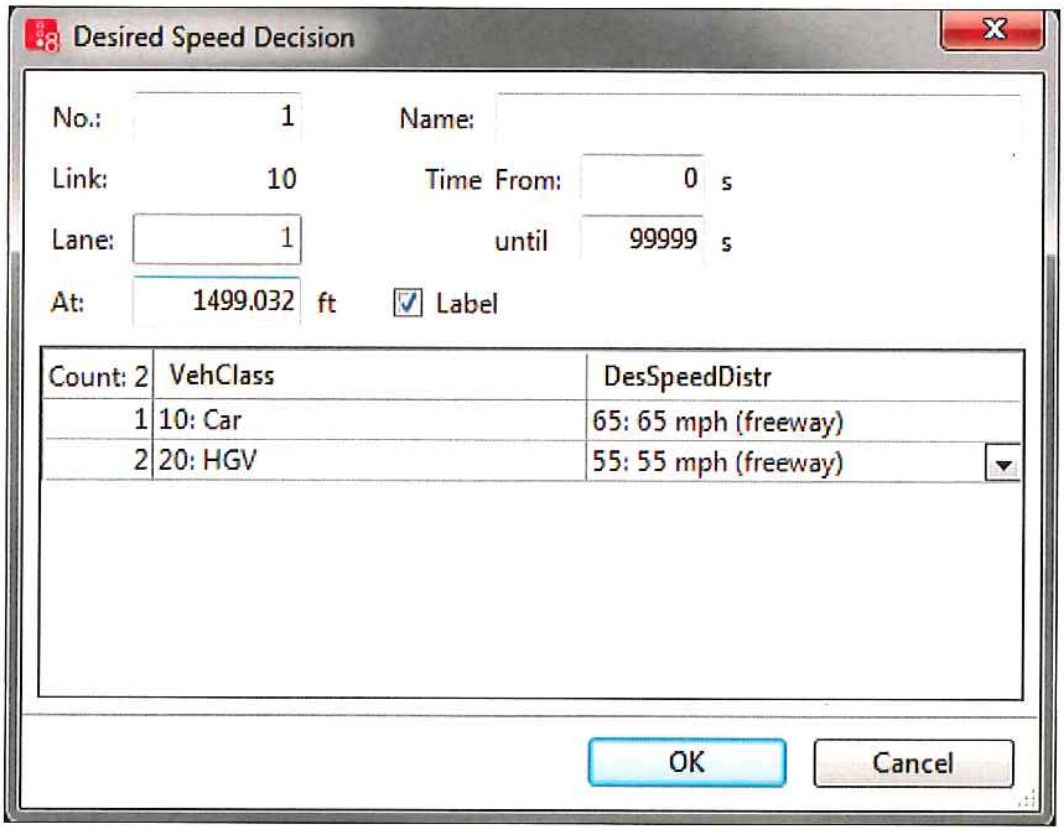
In this demo we see vehicles driving from left to right. Initially their speed will be distributed around 30 mph. They will drive into a school zone where the posted speed limit is 20 mph. The vehicles will begin decelerating after they cross the Desired Speed Decision. Once they have traversed the school zone they cross another desired speed decision causing them to return to their original speed of 30 mph.

Procedure:

1. Open "Demo 2-3.inpx"
2. Press the blue play button to start the simulation.
3. Observe when the vehicles' desired speeds and actual speed
   - Wait for a vehicle to enter the network
   - Pause the simulation using the spacebar
   - Select a vehicle in the network
   - In the Quick View window observe the values for "Speed" and "DesSpeed"
4. Advance the simulation slowly by holding the spacebar down.
5. Observe what happens when the vehicle crosses the desired speed decision.

2.2.2 Creating Desired Speed Decisions

1. ***Left-click*** to select the Desired Speed Decisions object.
2. ***Left-click*** to select the link or connector on which the desired speed decision will be placed.
3. Create the desired speed decision by ***holding*** the ***Ctrl*** key and ***right-clicking*** at the location where the vehicles are expected to begin accelerating or decelerating to the new desired speed.
4. The desired speed can now be assigned by vehicle class in the dialog ort in the desired speed decision list.
   NOTE the dialog can be opened by ***double left-clicking*** on a selected desired speed decision.
5. ***Right-click*** to add a vehicle class and define the appropriate speed.
6. Click Ok to save the settings.



2.2.3 Activity Lesson 2-4 "Speed Control"

Objective:

To become familiar with placing and configuring a network's speed settings through the use of Desired Speed Decisions. In this example desired speed decisions are used both as the posted speed limits as well as the suggested on/off-ramp speeds.

By the end of this activity you should be able to create a desired speed decision as well as know where they should be placed.

Objects Used:

- Desired Speed Decisions
- Layout Files

Procedure:

1. Open the file "2-4.inpx."
2. Save as a new file
3. Complete the tasks below.

Task:

1. Open the layout file "Theoretical Speed.layx".
   This will color vehicles based on their assigned Desired Speeds.
2. Run a simulation and observe the colors of vehicles that travel from the freeway onto the arterial.
3. After Discussion stop the simulation.
4. Place Desired Speed Decisions where the posted speed changes in the network. Set the distributions so they match the posted speed for both cars and HGV (trucks).
5. Open the layout file "Actual Speed.layx"
   This will color vehicles based on their current actual speed.
6. Run a simulation and observe when vehicles are accelerating/ decelerating in relation to the desired speed decisions.

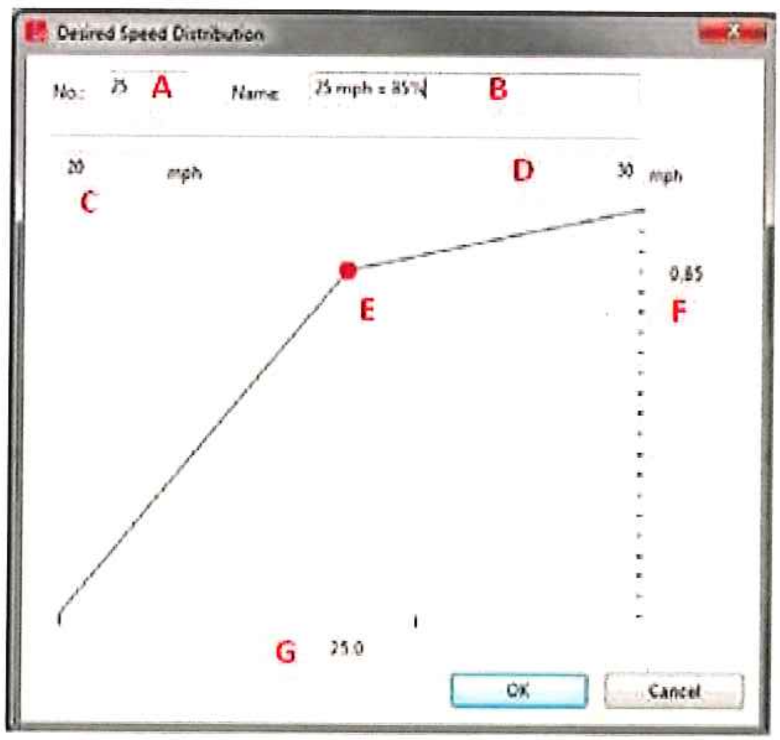
2.2.4 Creating a Basic Speed Distribution

In this section we will learn how to create a basic 85th percentile speed distribution in Vissim. In chapter 8 we will discuss creating a seed profile in greater detail.

To create a basic speed distribution, follow these steps:

1. Open the Base Data Menu
2. Hover over Distributions to expand the menu
3. Select Desired Speed. This will open the Desired Speed Distributions list.
4. Press the + button to create a new distribution.
5. Define the minimum and maximum speeds.
6. Add intermediate points to define percentiles.
   a. Right-Click on the graph to add a point.
   b. Left-Click and drag the point to the appropriate position.

A) Define an ID number for this distribution. It is common to give the ID number the value of the target speed of the distribution.
B) Naming the distribution will help identify it later.
C) Define a minimum value for the distribution.
D) Define a maximum value for the distribution.
E) The intermediate points represent percentile speeds.
F) The vertical axis represents the percentile (1.0=100%)
G) The horizontal axis represents the speed.



2.2.5 Activity Lesson 2-5 "Creating a Simple 35 mph Speed Distribution"

Objective:

By the end of this activity you will know how to create a basic speed distribution using the distribution editor as well as creating 85th percentile speeds.

Objects Used:

- Base Data Menu
- Desired Speed Distribution List
- Desired Speed Distribution Editor

Procedure:

1. Open the file "2-5.inpx".
2. Save as a new file
3. Complete the task below.

Task:

Create a new basic 35 mph speed distribution

1 Open the Desired Speed Distribution list.

   a. Open the Base Data menu.

   b. Select Distributions -> Desired Speed.

2 Open the existing 35 mph speed distribution and discuss how the speeds are distributed.

3 Create a new 35 mph speed distribution.

   a. Press the "+" to add a new distribution.

   b. Name the new distribution "35 mph = 85%"

4 Add an intermediate point to the curve.

5 Set the point to 35 mph and 0.85.

6 Apply the new distribution to the existing arterial speed decisions.

2.2.6 Activity Lesson 2-6 "Lists"

Objective:

To be introduced to working with a list to edit parameters. We will apply a different speed distribution to HGV traffic using the Desired Speed Decision List.

Objects Used:

- Desired Speed Decision
- Desired Speed Decision List
- Synchronization buttons

Procedure:

Open the file "2-6.inpx".

Save as a new file

Complete the task below.

Task:

1 Open the Desired Speed Decisions list.

   a. Right-Click on the Network Object title.

   b. Select the "Show List" option.

2 Activate synchronization between the list and the network editor view. Whenever an object is selected in the list, Vissim will center the network editor view on that object.

   a. Select the button  in the list. It will change to  when active.

   b. Select the button  in the network editor. It will change to  when active.

3 Change the freeway speed for HGV's (trucks) to 55 mph.

   a. In the column "DesSpeedDistr(20)" change the speed to 55 mph for decisions 1 and 7.

4 Run a simulation and observe truck speeds in the quick view window.

2.3 Vehicle Inputs

Traffic volumes entered a specific link at a stochastic rate. The volumes are always input as vehicles per hour even if the input time period is longer or shorter than one hour. Within this time vehicles enter the link based on a Poisson distribution. If the defined traffic volume exceeds the link capacity, the vehicles are 'stacked' outside the network until space is available again. If any 'stacked' vehicles cannot enter the network within that simulation a message is written to a log file and we are notified at the end of the simulation.

We can define time variable traffic volumes by creating custom time intervals for vehicle inputs. This process however will be described in greater detail in a later chapter.

2.3.1 Creating Vehicle Input Points

1. ***Left-click*** to select the Vehicle Inputs Object.
2. ***Left-click*** to select the link where a vehicle input should be defined.
3. To add a new vehicle input, hold the ***Ctrl*** key and ***right-click***. A new vehicle input will display in the vehicle input list.
4. Open the Vehicle Inputs list. ***Right-click*** on the Vehicle Inputs Network Object and select "*Show List*".
5. Define the input volume (always in vehicles per hour) in the "*Volume(0)*" column.
6. Define the vehicle composition in the "*VehComp(0)*" column.

Vehicle Inputs / Vehicle Volumes By Time Interval

Select layout... | Vehicle volumes by tir

Count: 4	No	Name	Link	Volume(0)	VehComp(0)
1	1		1: I-84 EB	3538	1: freeway (8% HGV)
2	2		3: Fairview Parkway SB	388	4: urban (5% HGV)
3	3		2: I-84 WB	2764	1: freeway (8% HGV)
4	4		4: Fairview Parkway NB	956	4: urban (5% HGV)

NOTE The "(0)" means this volume/composition will begin to apply at simulation second 0.

2.3.2 Activity Lesson 2-7 "Adding Vehicular Inputs"

Objective:
To place and configure Vehicle Inputs on the edges of the network.

Objects Used:
- Vehicle Inputs
- Vehicle Inputs List

Procedure:
1. Open the file "2-6.inpx".
2. Save as a new file
3. Complete the task below.

Task:

1 Add the SB vehicle input to link #3.
   a. Volume: 388
   b. Composition: Urban (2% HGV)

2 Add the NB vehicle input to link #4.
   a. Volume: 956
   b. Composition: Urban (2% HGV)

3 Add the EB vehicle input to link #1
   a. Volume: 3538
   b. Composition: Freeway (8% HGV)

4 Add the WB vehicle input to link # 2
   a. Volume: 2764
   b. Composition: Freeway (8% HGV)

5 Run a simulation and observe the arrival patterns of each input.

2.4 Static Routing

Static routes provide fixed paths and fixed volumes along those paths despite some potentially undesirable conditions. The static vehicle routing decisions in Vissim can be used for modeling intersection turning volumes or as O-D paths depending on what data the modeler has at their disposal.

Vissim uses a few different methods to route vehicles through the network; the two most common methods are Static Routes and Dynamic Routes. Dynamic routes may change the paths a vehicle will travel along during a simulation based on levels of congestion, the financial cost of a particular route, etc.

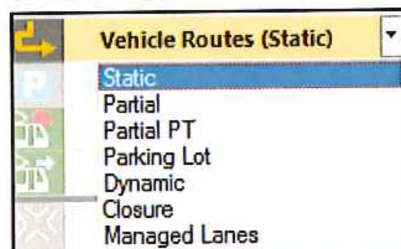
Please note that the Vissim Introduction course exclusively uses static routing methods.

Static routes use a concept called ***Relative Flow*** to determine the proportion of vehicles that use each path.

$$Probability\ of\ taking\ path\ A = \frac{Relative\ flow\ of\ A}{\sum Relative\ Flow\ of\ all\ paths}$$

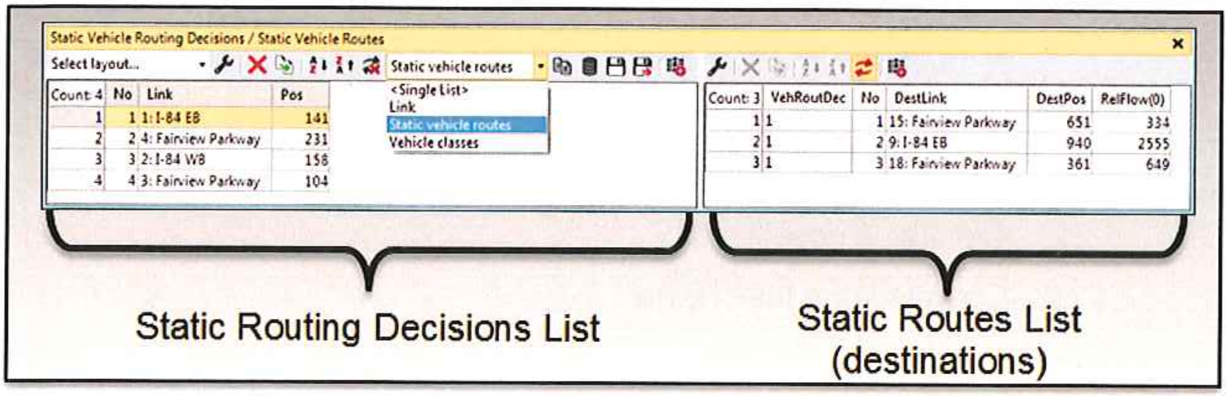
It is because of this property that Static routes can be used whether we have turn counts or percentages and hourly or daily counts are automatically scaled to fit within the simulation window.

2.4.1 Creating Static Routes



1. ***Left-click*** to select the link/connector for the start of the route.
2. On the Routing Decision object drop-down menu select the desired routing decision type (static).
3. Hold the ***Ctrl*** key and ***right-click*** on the location for the routing decision point on the selected link. A pink bar will show for the routing decision placement.
4. ***Left-click*** on the link/connector for the route destination. The end of the route is shown with a light blue bar and the route from the decision bar to the destination bar will highlight yellow along the links and connectors that make up the shortest path.

5. Vissim will be ready to add another route for the current routing decision. Select a different link to place another destination
6. Repeat for all destinations.
7. Click off of the network in grey space ("X" cursor will display) to end adding routes to the active routing decision.
8. Once all routing decisions and routes are defined open the vehicle routing decision list.
9. Set the coupled list to Static Vehicle Routes by selecting it from the drop-down menu in the static routes list



10. Select the desired route and enter the relative flow for each movement.

2.4.2 Activity Lesson 2-8
"Adding Static Routing Decisions"

Objective:

To draw static routes from origin to destination and configure the turning volume in a scenario where vehicles only make one routing decision in the network.

Objects Used:

- Static Vehicle Routes
- Static Vehicle Routes List

Procedure:

1. Open the file "2-8.inpx"
2. Save as a new file
3. Complete the task below.

Task:

1. Create a decision point at position A.
   a. Place destinations at positions F, G, and H.
   b. Assign relative flows F=22, G=84, H=282.
2. Create a decision point at position B.
   a. Place destinations at positions G, H, and E.
   b. Assign relative flows G=108, H=2656, E=54.
3. Create a decision point at position C.
   a. Place destinations at positions H, E, and F.
   b. Assign relative flows H=547, E=956, F=66.
4. Create a decision point at position D.
   a. Place destinations at positions E, F, and G.
   b. Assign relative flows E=334, F=2555, G=649.

3 Intersection Control

This chapter is an introduction to junction modeling; two-way stop, actuated signals and fixed-time signals.

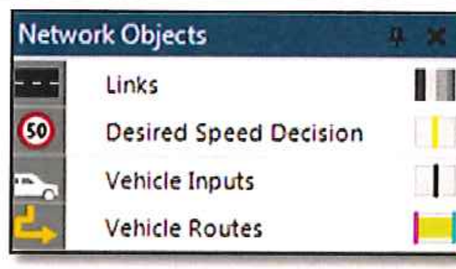
Objective:

The purpose of this chapter is primarily to introduce how to create and manipulate conflict avoidance objects in Vissim; Reduced Speed Areas, Conflict Areas, Priority Rules, Stop Signs, Signals and Detectors through the lens of building an arterial segment.

The model will encompass a two-way stop and a signalized intersection. The model will use default values for many parameters in order to highlight the mechanics of building the network. Topics such as following or lane change behaviors, speed distributions and vehicle types or classes will be covered in greater detail in other chapters.

3.1 Review Chapter 2

While we have already looked at Links, Desired Speed Decisions, Vehicle Inputs and Static Routes it is important to see and use these object within a different context.



3.1.1 Activity Lesson 3-1
"Geometry and Demand on Arterials"

Objective:

To practice building the basic geometry of an intersection; Left turn bays, right turn connectors, routes, and desired speed decisions.

Objects Used:

- Links
- Desired Speed Decisions
- Static Routes

Procedure:

1. Open the file "3-1.inpx"
2. Save as a new file
3. Complete the task within the model.

Task:

1. Zoom in to the intersection at 102nd Ave. and Glisan St.
2. Draw left turn bay connectors:
    a. SB from A to F.
    b. WB from B to G.
    c. NB from C to H.
    d. EB from D to E.
3. Draw right turn connectors:
    a. SB to H.
    b. WB to E.
    c. NB to F.
    d. EB to G.
4. Switch to Wireframe mode (Ctrl+A) 
5. Place Desired Speed Decisions the outbound legs, just downstream of all connectors.
    a. Assign 25 mph distributions at E and G.
    b. Assign 35 mph distributions at F and H.
6. Vehicle inputs have already been placed.
7. Create a static route for each approach:
    a. Place the decision points at A, B, C, and D.
    b. Create left, thru, and right-turn routes.
    c. Assign relative flows on all approaches as follows:
        i. Left = 35%
        ii. Thru = 50%
        iii. Right = 15%
8. Run a simulation and observe the behavior of the vehicles.

3.2 Reduced Speed Areas

Reduced Speed Areas serve as temporary speed reduction zones. They should be placed where it is expected that a vehicle slowdown in anticipation of some maneuver ahead be-it a sharp curve, a turn or even a crosswalk where drivers are cautious enough to apply the brake.

It is important to remember that Vissim vehicles have no internal knowledge of "sharp curves" or turns. Therefore they will not slow down based on the geometry of the link. It is at places like this where the primary use of Reduced Speed Areas occurs.

Common places to use Reduced Speed Areas include:

- Right turn connectors
- Left turn connectors
- Sharp curves
- In road delineation locations where it is expected for drivers to slow (roundabout approaches).

Reduce speed areas assign a new desired speed to the vehicles that enter the space and then automatically change it back when they leave the space.

Reduced speed areas also cause the vehicle to decelerate PRIOR to reaching the start of the reduced speed area. This is designed so that vehicles are at their new desired speed by the time they enter the space.

3.2.1 Example 3-2 "Speed Bump-Temporary Speed Reduction"

This example demonstrates how a reduce speed area causes a vehicle to slow down and then recover after traversing the space.

1. Open the file "3-2.inpx"
2. Run the Simulation
3. Pause the simulation when a vehicle appears on the link.
4. Select the vehicle and observe the vehicle's actual and desired speed.
5. Slowly advance the simulation by holding the spacebar.
6. Observe the vehicle's actual and desired speed as it traverses the reduced speed area.

3.2.2 Creating a Reduced Speed Area

1. Left-Click to select the "Reduced Speed Areas" object.
2. Left-Click to select the link or connector where the reduced speed area should be placed on. A reduced speed area cannot span over more than one link/connector.
3. Hold Ctrl and right-click at its start position (inside the link/connector) and drag the mouse along the link/connector while the right button is held down.
4. Release the mouse button when at the appropriate length.
5. The desired speed distribution can now be assigned by vehicle class in the reduced speed area list, or in the reduced speed area dialog opened by double left clicking on a selected reduced speed area.
6. Right-click to add a vehicle class and define the appropriate speed distribution and deceleration value.
7. Confirm with Ok.

For multi-lane links reduced speed areas need to be defined for each lane separately. Thus different characteristics can be defined for each lane.

3.2.3 Activity Lesson 3-3 "Placing Reduced Speed Areas"

Objective:

To practice creating reduced speed areas at one of the most common locations within a Vissim network; an urban intersection.

Objects Used:

- Reduced Speed Areas

Procedure:

1. Open the file "3-3.inpx"
2. Save as a new file
3. Complete the task below.

Task:

1 Zoom into the intersection at 102nd Ave. & Glisan St.

2 Create 10 mph Reduced Speed Areas on the right-turn connectors;

   a. Place them at the apex of the curve

   b. Make them about 10 ft. long

3 Create 15 mph Reduced Speed Areas on the left turn connectors;

   a. Place them at the apex of the curve after downstream of the left-turn bay

   b. Make them about 10 ft. long

4 Press Play on the simulation and observe the vehicle behavior.

3.3 Conflicting Movements

Within Vissim, vehicles that are on the same link follow one another, work to make lane changes or even pass each other. However vehicles traveling on different links do not interact in the same way. In fact, vehicles on different links do not interact at all unless they are told who has the right-of-way.

In traffic there are generally three types of conflicts; merging, diverging and crossing. Vissim has two different objects for controlling these hazardous zones, conflict areas and priority rules.

The two object do no, and in the vast majority of cases, should not be used at the same time. It is up to the modeler to decide which object is most appropriate.

3.3.1 Conflict Areas

Conflict areas are automatically generated any time two or more links occupy the same space. A conflict area has four states;

1. Passive (displayed yellow-yellow)
2. 1 waits for 2 (link 1 is displayed red and link 2 is displayed green)
3. 2 waits for 1 (link 2 is displayed red and link 1 is displayed green)
4. Undetermined (both links are displayed red and it is first-come-first-served)

As vehicles on the minor street (displayed as red by the conflict area) approach the conflict area they determine whether there is a sufficient gap for them to pass through the conflict without disturbing the major movement traffic. If need be a vehicle will change speed or come to a complete stop to avoid a "crash".

Vehicles on the minor street will attempt to minimize their delay so if they do not need to stop they will merely slow their approach to time a crossing just right.

Conflict areas use a few parameters to calculate acceptable gap including "front gap" "rear gap" and "safety distance factor" however these will be discussed in more detail in chapter 8.

3.3.2 Demo 3-4 "Conflict Area States"

In this example we see what the four conflict area types do to intersecting traffic.

1. Run the simulation
2. Observe vehicle behavior

3.3.3 Configuring a Conflict Area

As previously stated, all overlapping sections of links will create a conflict area automatically. Therefore all that is needed is to determine where conflicts actually exist and which movements have the right-of-way. For example an overpass or flyover link might produce conflicts that aren't supposed to exist; therefore they are left as passive.

1. Select the Conflict Areas network object
2. Right-click on a conflict area in the network editor
3. From the context menu choose one of these options;
    a. Passive
    b. 1 waits for 2
    c. 2 waits for 1
    d. Undetermined

OR

2. Hold Ctrl
3. Right click on a conflict area to cycle through the different states

Remember:

- Green = main flow (right of way)
- Red = minor flow (yield)
- Both Red = first-come-first-served (if two vehicles arrive at the exact same time the vehicle to the right, counter clockwise, should go first.
- Both Yellow = Ignore each other

3.3.4 Activity Lesson 3-5 "Configuring Conflict Areas in the Network"

Objective:

To code conflict areas in a way that gives appropriate yielding behavior.

Objects Used:

- Conflict Areas

Procedure:

1. Open the file "3-5.inpx"
2. Save as a new file.
3. Complete the task below.

Task:

1 Configure the right turning movements to yield to the target lane traffic.

   a. Left-Click to select a conflict area

      (If multiple are stacked on top of each other left-click on one then press Tab to cycle through conflict areas).

   b. Hold Ctrl.

   c. Right-Click on the conflict area to cycle through the states until the through is green and the right turn is red.

2 Configure left turning traffic to yield to oncoming traffic.

   a. Left-Click to select a conflict area

      (If multiple are stacked on top of each other left-click on one then press Tab to cycle through conflict areas).

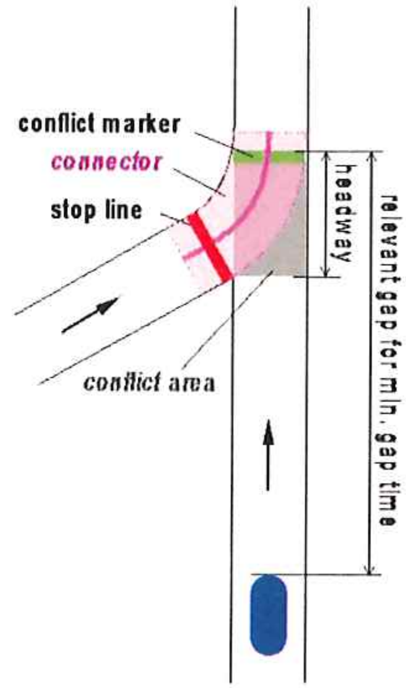
   b. Hold Ctrl.

   c. Right-Click on the conflict area to cycle through the states until the oncoming movement is green and the left turn is red.

3 Run a simulation and confirm proper yielding behavior.

3.3.5 Priority Rules

The other object that controls yielding behavior is the Priority Rule. Unlike the conflict area the priority rule is not automatically generated when links overlap. Furthermore priority rules are much more flexible about where they are placed and how they are used. Internally their concept of "gap" differs from a conflict area as well.



The drawback to priority rules is that they take longer to code and conflicts can be easily overlooked or forgotten.

A priority rule consists of one stop line (orange bar) and one or more conflict markers (green bars) that are associated with a specific stop line. Depending on the current conditions at the conflict marker(s), the stop line allows vehicles to cross or forces them to stop. The two main conditions to check at the conflict marker(s) are;

Minimum Gap Time (sec) for free flow traffic on the main road or,

Minimum Headway (ft/m) for slow moving or queuing traffic on the main road.

If the current gap time is less than the minimum gap time or if the current headway is less than the minimum headway, any vehicle approaching the stop bar will stop at the stop line.

> Current Gap Time (sec)
>
> Determined by the amount of time a major movement vehicle will require to reach the conflict marker (green bar) from its current position assuming that it continues traveling at its current speed. A vehicle located on the green bar is not considered by the current gap time.

> Current Headway (feet/meters)
> Determined by the physical distance between the conflict marker (green bar) and the front bumper of the first major movement vehicle approaching it. If any part of a vehicle is located on the green bar the resulting headway is 0ft.

3.3.6 Placing and Configuring Priority Rules

1. Select the Priority Rule network object.
2. Left-Click to select the link/connector on which the stop line (yield point) should be placed.
3. Hold Ctrl
4. Right-click at the location of the stop line (yield point).
5. Left-Click to select the link/connector on which the conflict marker should be placed.
6. Right-click at the location of the conflict marker (green bar). Typically it is located within the last two meters of the area of conflict.
7. The priority rule parameters can now be defined in the dialog.
8. Repeat steps 6 and 7 for subsequent conflict markers
9. Left-click off of the network to complete the task.

The context menu can be used to add additional conflict markers to an existing priority rule.

3.3.7 Activity Lesson 3-6 "Creating Priority Rules"

Objective:

To become familiar with placing priority rules as well as determining where priority rules should be placed.

Objects Used:

- Priority Rules

Procedure:

1. Open the file "3-6.inpx"
2. Save as a new file
3. Complete the task below.

Task:

At each of the eight sample movements place the necessary priority rules:

1 Place the yielding movement's stop bar at the red arrow labeled "1" and "2" (some movements require the yielding vehicle to stop more than once).

   a. Hold Ctrl

   b. Right-Click at the yield point to place a stop bar.

2 Place the priority movement's conflict markers at the green arrows labeled "a" and "b" (some conflicts require more than one conflict marker).

   a. Right-Click at the downstream position where the conflict ends.

   b. Configure the Min Gap to be 3.0 sec

   c. Configure the min headway to be as wide as the conflicting lane ~12ft

3 When all conflict markers are placed and configured. Left-Click off the network twice to complete the priority rule.

3.4 Stop Signs

In Vissim a stop sign is a bar placed in the lane at which a vehicle will be forced to decelerate to 0 mph for at least one time-step.

Stop signs must be used in conjunction with either a priority rule or a conflict area to assign proper yielding behavior and gap acceptance.

Rolling Stops
Some studies on stop controlled intersections report high flow rates due to "rolling stops". A reduced speed area with a low desired speed distribution may be used to model a rolling stop, instead of a stop sign.

3.4.1 Placing a Stop Sign

1. Select the stop sign network object.
2. Left-Click to select the link on which vehicles will have to stop.
3. Right-click on the link at the location where vehicles should stop.

3.4.2 Activity Lesson 3-7 "Two-Way Stop"

Objective:

To become familiar with placing a stop sign in a Vissim network as well as where it should be placed within the lane.

Objects Used:

- Stop Sign

Procedure:

1. Open the file "3-7.inpx"
2. Save as a new file
3. Complete the task below.

Task:

1 Place stop signs on the minor street approaches at 104^{th} and Glisan.

2 Run a simulation and observe where vehicles stop and where they wait for gaps.

3.5 Signalized Intersections

In the field we observe three primary components at most signalized intersections; some form of detection, some machine or computer controlling logic and signal display objects.

Within Vissim these three components are modeled quite similarly to in the field. Vissim uses detectors to collect necessary data, signal controllers to process the data into signal timing and signal heads to relay the signal timing to vehicles.

3.5.1 Ring-Barrier Controllers

Signal controllers in North America vary from city to city and even intersection to intersection depending on the needs and requirements in each situation. While Vissim does not provide an exact interface to every brand of signal controller, it does offer a variety of types of controllers.

The primary controller used by the majority of agencies is the Ring-Barrier controller (RBC). Therefore this will be the controller used in this course.

The RBC interface provides users with a seamless way of modeling complex real-world traffic signal timing such as actuated control, railroad preemption, and transit signal priority. During a simulation, Vissim passes the status of detectors and signal heads to the ring barrier controller and the controller returns the state of the signal heads for the next time step.

3.5.2 Generating RBC's

Vissim offers the ability to code a signal controller from scratch. However this task demands substantial amounts of time and a deeper look into signal controller operation. Therefore PTV offers and advanced Vissim course in signal timing and operations.

Signal Controller Types:

<u>Ring Barrier Controller</u>
-Primary controller type in North America
-Fixed time control mode
-Actuated control mode
-Time of Day patterns
-Coordinated timing
-Free Running Operation
-Transit Signal Priority
-Preemption

<u>Fixed Time Controller</u>
-European Stage Based Controller type

<u>Software-In-the-Loop Controllers</u>
-ASC/3
-McCain 2033
-SCATS
-SCOOT

<u>Script-Based Controllers</u>
-User Defined Logic
-VAP

If you are interested in dates and prices of the "Vissim-Advance RBC" course please speak with your instructor or contact PTV Group at info.us@ptvgroup.com.

Ring-Barrier Controllers generate *.rbc file extensions.

In many cases a Vissim modeler already has access to signal timing within other software. Controller logic files can be created, calibrated and coordinated in planning level programs like PTV Visum or HCM/ICA programs like PTV Vistro with ease. Therefore importing signal logic becomes a major time-saver.

Furthermore, already existing Vissim controllers can be copied from other files further saving the modeler time and energy.

NOTE It is recommended that controllers created in Vissim are also saved to a company-wide library so they can be applied and adapted to other models.

Once we have generated or selected from a library the appropriate controller logic, we will connect it to Vissim in the following way:

1. Open the ***Signal Control*** menu
2. Select the ***Signal Controllers*** option to open the signal controllers list
3. Press the green add button, ✚ , to create a new controller
4. A signal controller dialog will open
    a. Enter the controller number
    b. Enter the controller name (usually the two street names such as "1st Ave. and Main St.)
    c. Select the ***RBC*** controller type
5. Press the ***Edit Signal Groups*** button
6. The RBC interface will open
7. Open the ***File*** menu
8. Select ***Import***
9. Select the appropriate *.rbc file
10. Press ***Open***
11. The logic will import, check for correct timing and configuration.
12. Click ***OK*** to save the logic
13. In the Signal Controller dialog click ***OK*** to save the controller.

Once the controller is saved it can be referenced by other Vissim objects like signal head, detectors and evaluations.

3.5.3 Activity Lesson 3-8 "Adding a phase to a Ring-Barrier Controller"

Objective:

In this activity we will see how to import a RBC file as well as how to create signal phases.

Objects Used:

- Ring-Barrier Signal Controllers
- *.rbc files
- Signal Groups

Procedure:

1. Open the file "3-8.inpx"
2. Save as a new file
3. Complete the task below:

Task:

Create a Signal Controller

1. Open the Signal Control menu.
2. Select Signal Controllers to open the signal controllers list.
3. Press the "+" button to create a new signal controller.
4. Select the RBC controller type.
5. Press the "Edit Signal Groups" button to open the RBC editor.
    a. Open the File menu in the RBC Editor
    b. Select Import
    c. Open the file "3-8.rbc"
    d. View the signal timing
    e. Click Ok to save the controller.

Create a New Phase.

1. Open the RBC editor.
2. Open the Basic View
    a. Open the View menu
    b. Select Basic View
3. Add the following phase information for phase 1 and change the timing for phase 2:

Basic

SG Number	1	2	Phase Number
Min Green	5s	10s	Minimum Green Duration
Veh Extension	3s	3s	Green Extension/Gap Out Condition
Max 1	20s	40s	Maximum Green Duration
Yellow	4s	4s	Yellow Clearance
Red	0s	1s	All-Red Duration
Max Recall	√	√	Times Max Green Every Cycle

NOTE Activating Max Recall on all phases sets the controller to fixed time.

Pattern 1

Splits	24s	45s	Max 1 + Yellow + Red

Sequence

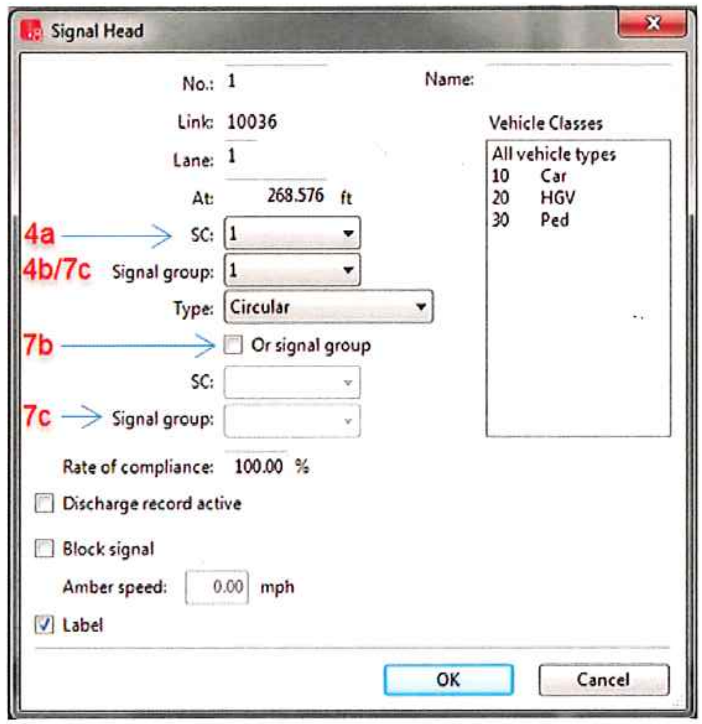
Ring 1	1	2	‖	3	4
Ring 2	5	6	‖	7	8

3.5.4 Signal Heads

Signal heads, like stop signs are placed in a particular lane and force a vehicle to decelerate to 0 mph. However unlike a stop sign a signal head, while showing red, will not allow vehicles to cross. Once the signal head shows green vehicles may accelerate back to their desired speed.

3.5.5 Placing Signal Heads

1. Select the ***Signal Heads*** network object.

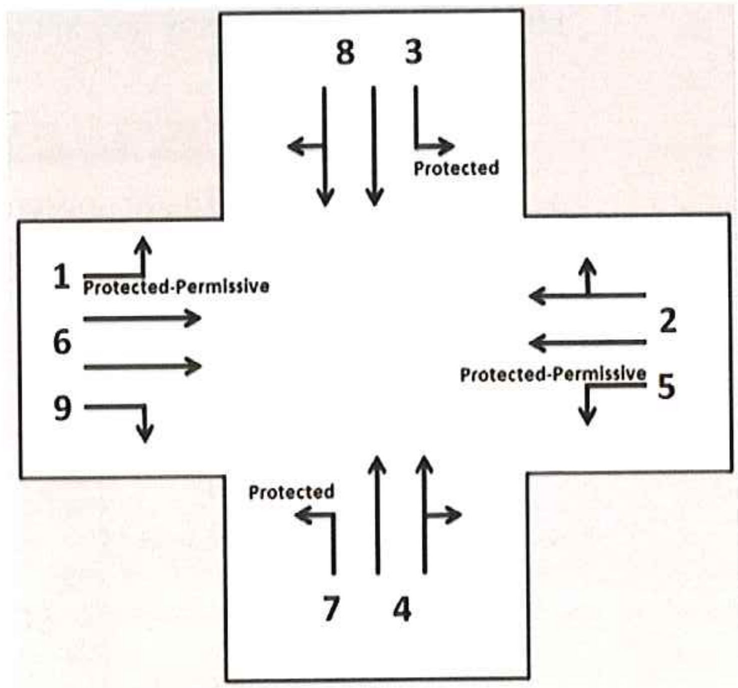


2. ***Left-Click*** to select the link on which vehicles will have to stop.
3. ***Right-Click*** on the link at the location where vehicles should stop.
4. Configure the signal head;
    a. Select the signal controller number
    b. Select the signal group
5. For ***protected left turns*** code the Signal group as the left turn phase
6. For ***permissive left turns*** select the though phase for the signal group
7. For ***protected-permissive left turns***;
    a. Code the Signal group as the left turn phase
    b. Check the "or signal group" box
    c. Select the associated through phase for the signal group.
8. Click ***OK*** to save settings

3.5.6 Activity lesson 3-9 "Placing Signal Heads"

Objective:

To become familiar with placing signal heads and connecting them to signal controllers



Objects Used:

- Signal Heads

Procedure:

1. Open the file "3-9.inpx"
2. Save as a new file
3. Complete the task below.

Task:

1. Add Signal Heads to each lane of the intersection at 102nd and Glisan.
   Hold Ctrl
   Right-Click at the desire stop position in the lane
2. Configure the signal head
   Select the Signal Controller
   Select the Signal Group
   - For protected left turn lanes:
     - SG: Select the left turn phase number.
     - Or Sig Group: leave **UNCHECKED**
   - For permissive left turns:
     - SG: Select the opposing through phase number.
     - OR Sig Group: leave **UNCHECKED**
   - For protected-permissive left turns:
     - SG: Select the exclusive left turn phase number
     - OR Sig Group: Select the opposing through phase number
   - For overlap right turns:
     - SG: Select the overlap phase number
3. Configure the phases according to the diagram above.

3.5.7 Detectors

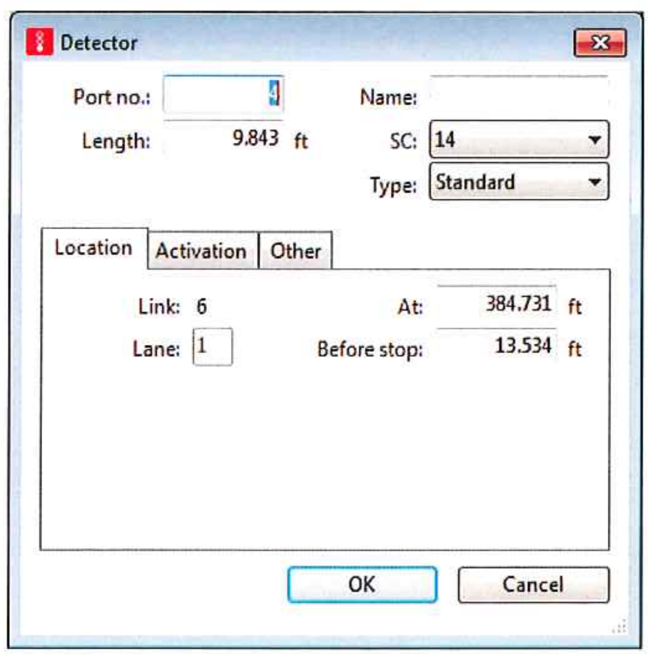
Vissim detectors work much the same way as detectors work in the field. As soon as the front of a vehicle crosses the detector a detection signal is sent to the controller. As soon as the rear of that vehicle leaves the detector the signal changes to no detection. This information is then interpreted by the signal control logic to determine what to do next.

Detection in the field is achieved using various methodologies including induction loops, video cameras, push buttons, track circuits, etc. Vissim models each detector type in the same way; wherever the calibrated detection zone is, is where a detector should be placed:

- Induction loops-place the detector in the same location on the link
- Video cameras-place the detector on the link within the same zone a camera will read a vehicle as detected
- Push button- place a detector on the ground where a pedestrian would stand to press the button

To define a new detector on a link follow the steps outlined below:

1. Select the ***Detectors*** network object.
2. ***Left-Click*** to select the link the detector will be placed on.
3. ***Right-Click*** on the location within the link where the detector should start (upstream location).
4. In the context menu select ***Add new detector***. The new detector will be created with a default length of 9.84 feet (3m).
5. ***Double Left-Click*** on the detector to open the detector editor window
6. Define the ***port number*** to be the phase number this detector calls
7. Assign the appropriate controller number
8. Click ***OK*** to save settings



3.5.8 Activity Lesson 3-10 "Adding Controller Detection"

Objective:

To become familiar with placing detectors in the proper locations as well as assigning them to the appropriate signal phase

Objects Used:

- Detectors

Procedure:

1. Open the file "3-10.inpx"
2. Save as a new file
3. Complete the task below.

Task:

Add detection to the controller.

1. Open the RBC editor
2. Open the Basic View, View→Basic View.
3. In the basic menu uncheck "Max Recall" for all phases.
4. In the detector section configure the detector ports.

Detector Number	1	2	3	4	5	6	7	8
Call	1	2	3	4	5	6	7	8
Extend SGs	1	2	3	4	5	6	7	8

> **NOTE** It is good practice to assign the phase number as the detector number This will help avoid confusion in later steps.

5. Click Ok to save settings.

Add detectors to the network.

1. Draw the detectors in lane.
   a. Hold Ctrl
   b. Right-Click and Drag the cursor to draw a detector
2. Configure the detector.
   Port No.: Set the port number equal to the RBC Detector number.
   SC: Assign the associated signal controller
   Type: Standard
   Length: Usually between 10 and 20ft
   Before Stop: distance upstream of the signal head

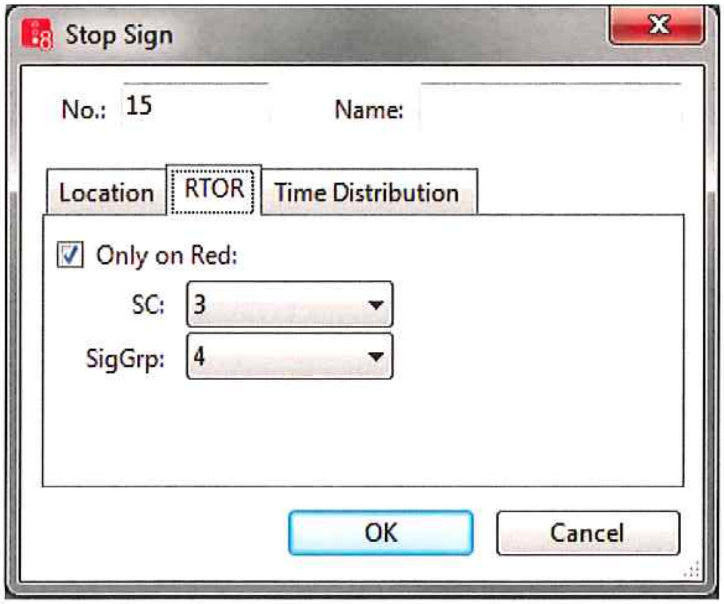
> Example: A stop bar detector's "Before Stop" ≅ "Length" + 2ft

3. Run a simulation and observe the signal operation.

3.5.9 Right Turn On Red (RTOR)

When a vehicle is allowed to make a right turn during a red light, the driver is supposed to treat the signal as they would a stop sign; come to a complete stop, then check for conflicting traffic.

In Vissim an approach is configured for RTOR using a stop sign. Stop signs can be configured to work in conjunction with a specific signal group.



By setting that stop sign as shown above, vehicles will stop at the stop sign when the parent signal group is displaying red, otherwise they will ignore the stop sign all together.

3.5.9.1 Exclusive Right with RTOR

For an exclusive right turn lane the stop sign may be used instead of a signal head. For example, if the EB right turn is controlled by overlap phase 9. Code the overlap phase into the controller and then place a stop sign in the lane configured to reference signal group 9.

> **NOTE** Many users still prefer to see a signal head in the lane. In this case we can code a signal head referenced to phase 9 but deselect all vehicle classes. This will make it so that all vehicles ignore the signal head. Then place a stop sign at the same position configured for RTOR and referencing phase 9.

3.5.9.2 Shared Through-Right with RTOT

For a shared through-right lane the placement of connectors, signal heads, and stop signs becomes very important.

Through Movement

The through moving traffic must still pay attention to the signal head so we can leave it at the desired stopping point on the through link.

Right Turning Movement

The right turning traffic needs to ignore the signal head. Therefore we need to extend the right turn connector so that it starts upstream of the signal head. We then place the stop sign, configured for RTOR, on the connector at the same position as the signal head.

This will accomplish two goals; firstly the right turning traffic will ignore the signal head completely and only pay attention to the stop sign. Secondly the through moving traffic will only pay attention to the signal head and ignore the stop sign (we don't want through vehicles proceeding through the intersection during red phases).

3.5.10 Activity Lesson 3-11 "Configuring a Signal for Right Turn on Red"

Objective:

To become familiar with placing detectors in the proper locations as well as assigning them to the appropriate signal phase

Objects Used:

- Stop Signs

Procedure:

1. Open the file "3-11.inpx"
2. Save as a new file
3. Complete the task below.

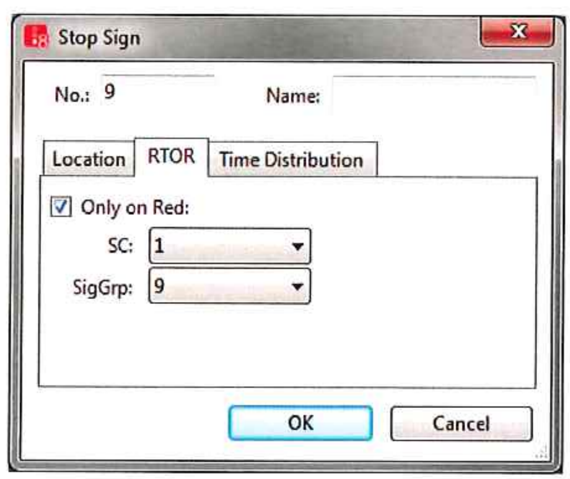
Task:

The Northbound, Westbound, and Southbound approaches have shared through-right turn lanes. Configure those to be RTOR

1. Extend the NBR, WBR, and SBR connectors just upstream of the signal heads in their shared lanes.
2. Place stop signs on the NBR, WBR, and SBR connectors so that the right turning vehicles will stop at the same point as through moving traffic.
3. Configure the stop signs for RTOR with their associated through phase.

The Eastbound approach has an exclusive right turn lane controlled by overlap phase 9.

4. Edit the existing signal head to not apply to any vehicle classes.
    a. Double Left-Click on the signal head
    b. In the signal head editor under the vehicle classes box hold Ctrl and Left-Click on All Vehicle Types.
5. Place a stop sign at the same point on the link
6. Configure the stop sign for RTOR.



4 Scenario Management and Importing ANM

4.1 Scenario Manager

Vissim's Scenario manager allows users to model and compare Vissim networks that depict a single study area under varying conditions; be-it time of day traffic flow (AM versus PM), future demand modeling, new constructions, or alternative build designs.

Scenario manager can also be used as a tool to notate and communicate with other users who may be working on the same file. Even if a Vissim model only has one scenario it can be beneficial to use Scenario manager to keep track of changes that are made to the network.

At its core Vissim's Scenario Manager has three main components; the Base Network, Scenario Networks, and modification files. Vissim's internal structure behaves as follows:

1. The base network is built.
2. Scenarios are created identical to the base network.
3. Modifications are created that alter the base scenario in some way.
4. Modifications are applied to specific scenarios.

Each unique scenario is the base scenario with a collection of modifications applied to it.

4.1.1 Placing a model under Scenario Management

To place a model under scenario management follow these steps:

1. Open the *.inpx file in Vissim.
2. Open the File menu→Scenario Management
3. Select Place Under Scenario Management.
4. Select a project name and name the first scenario.

   It is common practice to have Scenario 1 be an exact copy of the base network and therefore named "Base".

This will convert the existing Vissim model into the base network and automatically generate scenario one from the base network with no modifications.

4.1.2 Base Network

The base network is the starting point and foundation of the Vissim model. It consists of the basic geometry and calibration of the study area. The base network serves as the blueprint for every scenario in-that each scenario is created from the base network.

Changes made in the base scenario carry over to all scenarios and are applied before modifications take effect. Generally the base network should be built and calibrated before creating multiple scenarios.

Simulations and evaluations cannot be performed in the base network. It is common practice to have scenario 1 be identical to the base network (no modifications applied to scenario 1) for testing and calibration purposes.

4.1.3 Scenarios

Scenarios allow users to perform simulations and evaluations on the base network with specific modifications active. Each scenario, at its core, is the base network with a set of modifications applied to it.

4.1.4 Modifications

Editing a scenario will override any conflicting geometry or settings in the base network only for that specific scenario. Vissim tracks these edits in the form of Modification files.

By default, a modification applies to only the scenario the user currently has open. However this modification may be applied to multiple scenarios at the same time.

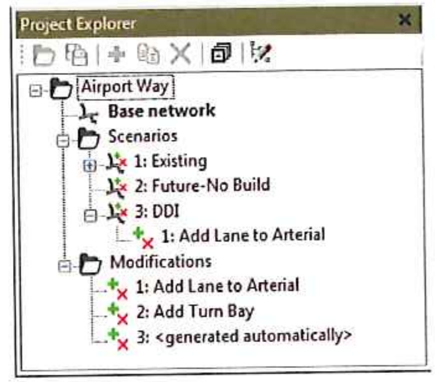
Modifications can be retroactively edited or disassociated with particular scenarios.

Any changes that need to be made globally (to all scenarios) can either be made in the base network or as a modification that is associated with all scenarios.

It is important to note that **modifications do not apply to the base network.**

4.1.5 Project Explorer

The project explorer is a tool used to navigate between the base network, scenarios, and modifications. It displays the names of each scenario as well as a map of which modifications apply to each scenario.



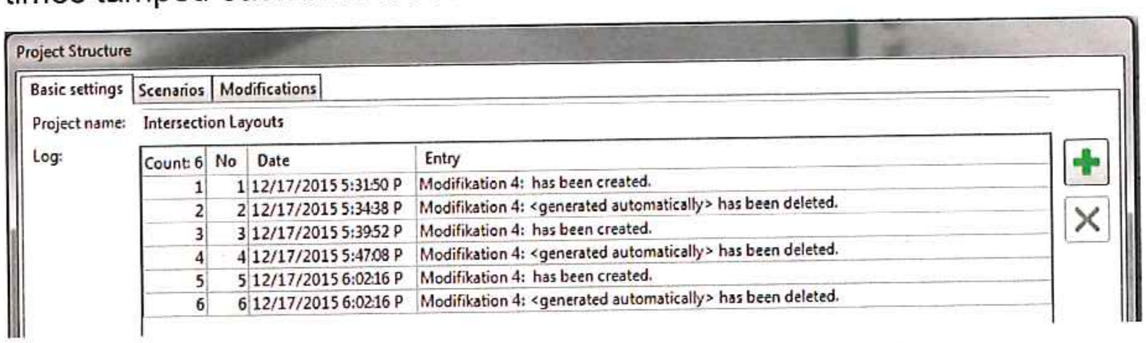
The base network, scenarios, or even specific modifications may be accessed by double-clicking on the title in the project explorer. It is in the project explorer view where users create, duplicate, or delete scenarios or modifications.

4.1.6 Project Structure Interface

The project structure interface can be accessed in the project explorer by clicking the  button.

4.1.6.1 Basic Settings Tab

In the Project Structure interface users can find a log of changes made to the entire Vissim project. Some log entries are automatically kept and times tamped each time a scenario or modification is created.



Project Structure

Basic settings | Scenarios | Modifications

Project name: Intersection Layouts

Log:

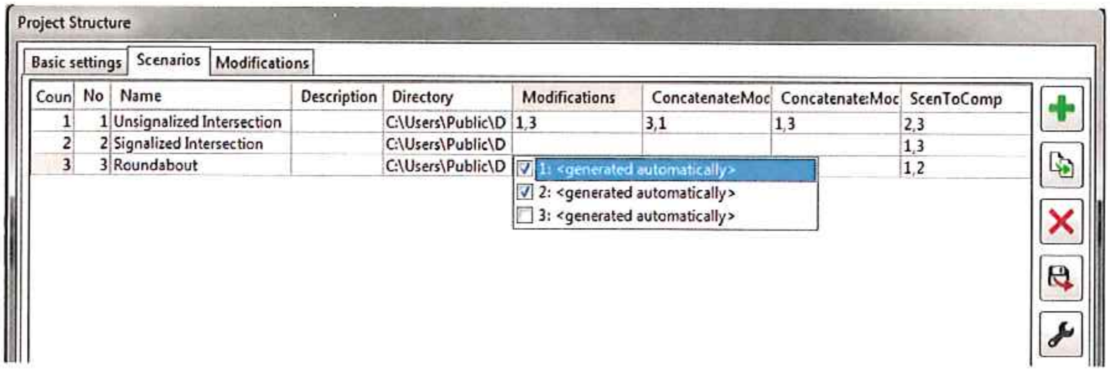
Count: 6	No	Date	Entry
1	1	12/17/2015 5:31:50 P	Modifikation 4: has been created.
2	2	12/17/2015 5:34:38 P	Modifikation 4: <generated automatically> has been deleted.
3	3	12/17/2015 5:39:52 P	Modifikation 4: has been created.
4	4	12/17/2015 5:47:08 P	Modifikation 4: <generated automatically> has been deleted.
5	5	12/17/2015 6:02:16 P	Modifikation 4: has been created.
6	6	12/17/2015 6:02:16 P	Modifikation 4: <generated automatically> has been deleted.

Log entries can also be manually entered using the + button. Users working in teams or in conjunction with modeling subcontractors can use this log to communicate and track changes made to the project file.

Even if the Vissim model only has one scenario, users can use this feature in the Scenario manager to track key model milestones.

4.1.6.2 Scenarios Tab

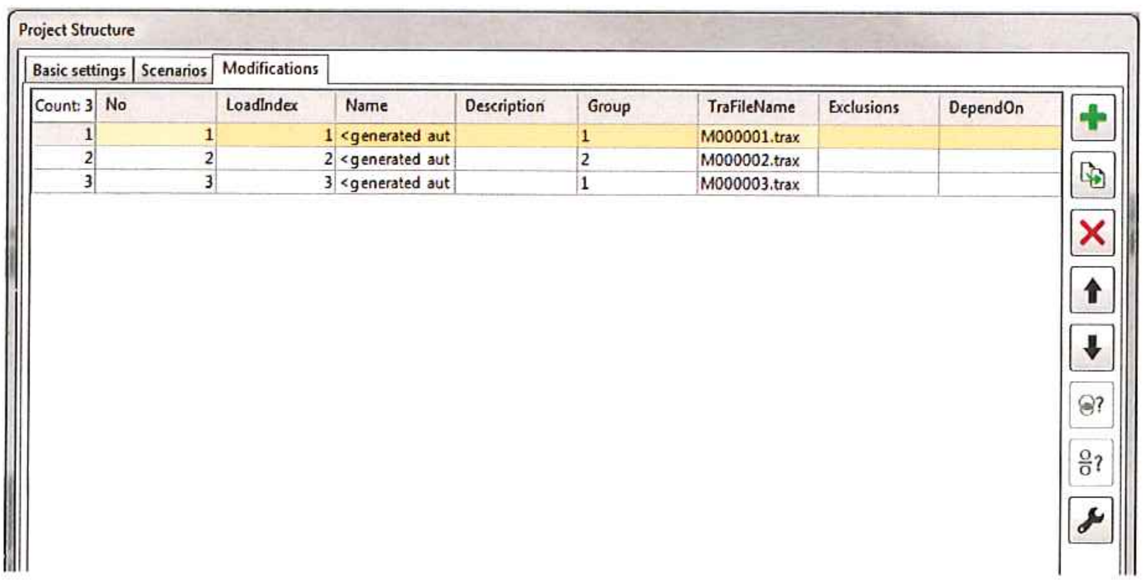
The scenarios tab keeps a list of all scenarios in the model. There are spaces for descriptions of each scenario as well as a field to assign modifications to each scenario.



From this list scenarios can also be created, duplicated, or deleted.

4.1.6.3 Modifications Tab

The modifications tab keeps a list of all modifications in the model. A modification can be created and not used. Each scenario may also have numerous modifications applied to it; therefore this list may be quite extensive in a mature model. Users can create, duplicate or delete modifications in this window. This tab also allows users to notate and check modification compatibility.

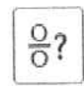


Some modifications are inherently incompatible or should not be used together. This tab allows users to check whether two modifications can be used together before being applied to a scenario.

These restrictions can be checked using the  button and tracked in the Exclusions field.

> For example:
>
> If in modification #2 a vehicle input is placed on link #5 but link #5 is was deleted in modification #1, then modification #2 can only be applied to scenarios that are not associated with modification #1.
>
> Therefore in the exclusions field for modification #2, modification #1 will be selected

Conversely, some modifications are not mutually exclusive and must be applied either together or not at all.

These dependencies can be checked using the  button and tracked in the DependOn field.

> For example:
>
> If in modification #2 a vehicle input is placed on link #5 but link #5 is was created in modification #1, then modification #2 can only be applied to scenarios that are associated with modification #1.
>
> Therefore in the DependOn field for modification #2, modification #1 will be selected.

NOTE It is good practice to heavily notate your scenarios and modifications. It can be easy to lose track of what each specific modification does and why a user created it or used it.

Recommendation:
At the very least use the log in the Basic Settings tab every time a user opens or closes the model. This can help colleagues, managers, and reviewers follow how each scenario differs and what changes were made.

4.1.7 Activity Lesson 4-1 "Scenario Management Basics"

Objective:
This activity will introduce how to place a file under scenario management.

Objects Used:

- File menu
- ANM import Dialog

*.anm files

Procedure:

1. Open the file "4-1.inpx"
2. Complete the task below.

Task 1:

1. Place the file under scenario management
   a. Go to File -> Scenario Management -> Place Under Scenario Management...
   b. Name the project "Activity 4-1"Name the first scenario "Base Simulation and Results"
2. Add an AM and PM scenario
   a. Open the Project Structure Window
   b. Select the Scenarios Tab
   c. Press the + button
   d. Name it "Activity 4-1 AM"
   e. Press the + button
   f. Name it "Activity 4-1 PM"
3. Notate your actions in the Basic Settings tab by adding your name to the log entry (for example, "Scenario 2: has been created *by* ____"
4. Close the Project structure interface
5. Edit Scenario 2 (AM)
   a. In the Project explorer menu double left-click on Scenario 2 (AM) to open it (your window headers will turn green when editing a scenario).
   b. In the Vehicle Inputs list copy the data from the column AM_Volume_Data into the Volume(0) column. The AM_Volume_Data is an user defined attribute containing the AM Volume.
   c. Edit the relative flows in the Static Vehicle Routing Decisions list

i. Select all Routing Decisions (all rows in the left side list)
ii. copy the data from the AM_TurnCount_Data column into the RelFlow(0) column
d. Save the scenario by pressing the save button or going to File→Save Scenario
6. Edit Scenario 3 (PM)
a. n the Project explorer menu double left-click on Scenario 3 (PM) to open it (your window headers will turn green when editing a scenario).
b. In the Vehicle Inputs list copy the data from the column PM_Volume_Data into the Volume(0) column
c. Edit the relative flows in the Static Vehicle Routing Decisions list
i. Select all Routing Decisions (all rows in the left side list)
ii. copy the data from the PM_TurnCount_Data column into the RelFlow(0) column
d. Save the scenario by pressing the save button or going to File→Save Scenario
7. Notice there are now two modifications generated automatically. We should note which one is which for later reference.
a. Open the project structure interface
b. Open the modifications tab
c. Rename Modification 1 to "AM Volumes and Relative Flow"
d. Rename Modification 2 to "PM Volumes and Relative Flow"

Task 2 (optional):

1. Create an arbitrary modification not associated with any scenarios.
a. In the project structure window, under the modifications tab, press the + button to add a new empty modification.
b. Name this modification "arbitrary link"
c. Close the window
d. In the project explorer you will see the new modification in the list. Double left-click on it to edit the modification (your window headers will turn red when you are editing a modification).
e. Draw an arbitrary link across the network that is easily noticed at a glance.
f. Save the modification by pressing the save button or going to File→Save Modification.
2. Add modification 3 to both scenario 2 (AM) and scenario 3 (PM)
a. Open the project structure window
b. Open the Scenarios tab

c. Under the Modifications column add modification 3 to scenarios 2 and 3
    i. Select the box in the modification column and row 2
    ii. Using the drop down also check modification 3 (keep modification 1 checked)
    iii. Repeat the process for scenario 3
d. Close the window

3. Open Scenario 2 (AM) and check whether the new link is present.
4. Open Scenario 3 (PM) and check whether the new link is present.

Task 3 (optional):

1. Edit the Base Network
    a. Double left-click on the base network in the project explorer (the window headers will turn gold when editing the base network)
    b. Draw an arbitrary link that is easily noticeable
    c. Save the base network by clicking the save button or going to File→Save Base Network
2. Open Scenario 2 (AM) and check whether the new link is present.

4.2 Importing ANM files

> **NOTE** It is recommended that models built in third-party software (not PTV Visum or PTV Vistro) be run through either Vistro or Visum first as the conversion form deterministic models to microsimulation can be complex if not in the correct format. Leading to discrepancies in network geometry

Up to this point we have created network geometry, configured the demand and placed control devices to mitigate conflicts manually. However if there is an existing model of the study area why go through the trouble of building it from scratch?

Perhaps there is a regional strategic planning or traffic demand model built in a platform like Visum where origin-destination assignment is already calibrated or trip-based assignment has been applied.

Or perhaps there is a capacity or traffic impact analysis model built in a platform like Vistro where the signals have been coordinated and optimized as well as HCM data has been generated.

The good news is all of these types of models can be brought into Vissim fairly painlessly (assuming the models were exported correctly from the other software).

The files exported from Visum or Vistro are *.anm files. These are the cleanest and most direct imports into Vissim from planning or deterministic models.

ANM files bring in network geometry objects (Links through Public Transit) as well as background data such as speed distributions, vehicle compositions and signal timing.

To import ANM files follow these steps:

1. Open the ***File*** menu
2. Hover over the ***Imports*** option to expand the list
3. Select ***ANM*** an import dialog will open
    a. Static Network Data-
        i. Press the "***...***" button and navigate to the appropriate *.anm file
        ii. Press ***Open***
    b. Dynamic Traffic Data- This section is for dynamic routes which are covered in the Vissim Advanced course DTA.

c. Save As- This section defines where the final import will be saved.

4. Press ***Import.***

4.2.1 Activity Lesson 4-2

Objective:

To become Familiar with importing ANM files and to see how much of the network coding can be skipped using the import options.

Objects Used:

- File menu
- ANM import Dialog

*.anm files

Procedure:

3. Open the file "4-2_blank.inpx"
4. Complete the task below.

Task:

1. Import the 4-1.anm file
    a. Open the File menu
    b. Select Import→ANM
    c. Check Import Network Data
    d. Select the file 4-1.anm
    e. Select Static Routing
    f. Deselect Import Routing
    g. Save the Vissim Input File
    h. Deselect Show Warnings During Import.
    i. Click Import.
2. Adjust any abnormal link geometry
3. Run a simulation

5 Vehicle Types and Classes

Vissim uses two methods of identifying vehicles; vehicle types and vehicle classes. Each is used in different ways within Vissim and it is up to the user to determine how specific or how generalized these classifications are.

The U.S. Department of Transportation's Federal Highways Administration provides a guide for vehicle classification. The FHWA uses thirteen classifications of vehicles defined by the number of axles and trailers. Vissim by default uses six rather general classes; car, hgv, bus, tram, pedestrian, and bike as well as seven general vehicle types; car, hgv, bus, tram, man, woman and bike.

5.1 Vehicle Types

Vissim defines a vehicle type as a group of vehicles that share similar characteristics.

Physical Characteristics

The basis for each Vehicle type is a collection of 3D models, called a 2D/3D model distribution[1], that determine the physical space each vehicle of that type will occupy; the vehicles' lengths, widths, heights, number of axels and silhouettes are all based on the 3D model distribution. A distribution is used to provide some variation from one vehicle to the next.

A vehicle's color is also based on a color distribution[2].

Performance Characteristics

Vehicles of the same type share common maximum acceleration and deceleration functions as well as common desired acceleration and deceleration functions[3]. These distributions determine how fast vehicles accelerate or brake in comfortable (desired) and emergency (maximum) situations. For example a car might accelerate more quickly than a large truck (significantly more) so cars and large trucks must not defined as the same vehicle type.

[1] Model Distributions can be created in the *Base Data Menu* under *Distributions-2D/3D Models*

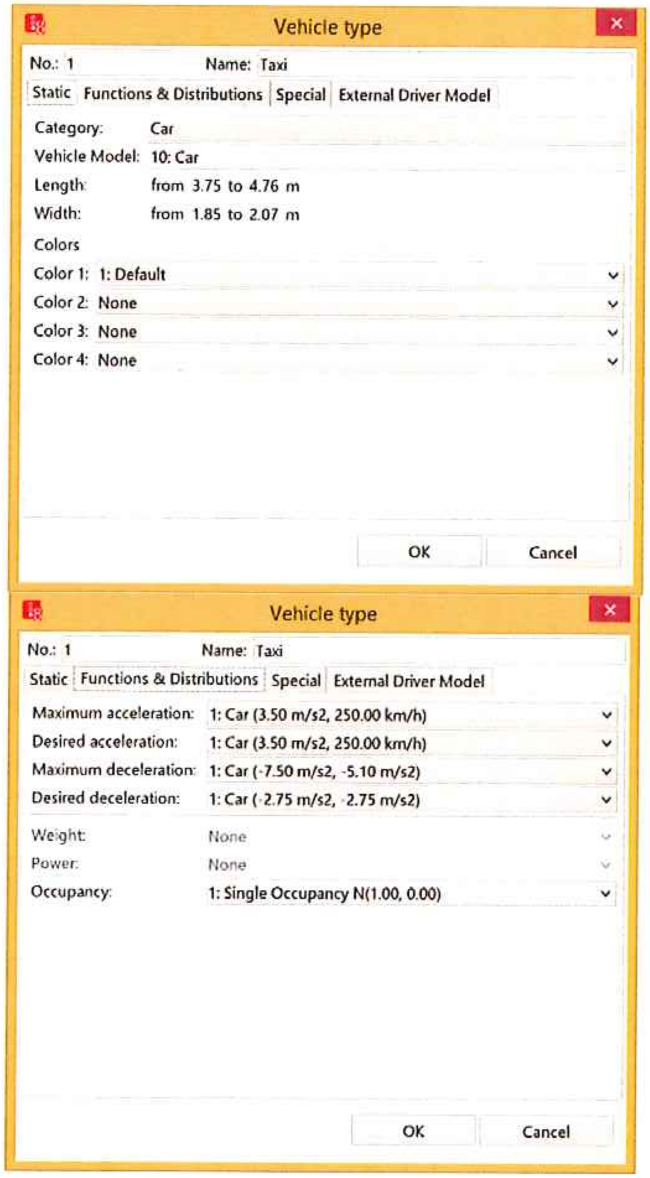
[2] Color Distributions can be created in the *Base Data Menu* under *Distributions-Colors.* However the color distribution can be overwritten by the use of a "Color Scheme"

[3] Acceleration functions can be defined in the *Base Data Menu* under *Functions.*

5.1.1 Creating Vehicle Types

To create a vehicle type follow these steps;

1. Open the ***Base Data*** menu
2. Select ***Vehicle Types*** to open the vehicle types list
3. Press the **+** button to create a new entry.
4. The Vehicle type editor will open automatically.
   a. ***Category***: this entry defines certain global parameter (i.e. does a grade affect acceleration?).
   b. ***Vehicle Model***: this entry is where the 2D/3D model distributions are selected for this type.
   c. ***Maximum Acceleration***: select the function that will define how fast this vehicle can accelerate.



   d. ***Desired Acceleration***: select the function that defines how fast the vehicle type wants to accelerate.
5. Click ***OK*** to save the settings.

5.2 Vehicle Compositions

Vehicle compositions are used by vehicle input points to determine what types of vehicles come into the network and in what proportions. The vehicle composition can be changed after creating an input but there must be at least one composition created prior to placing an input.

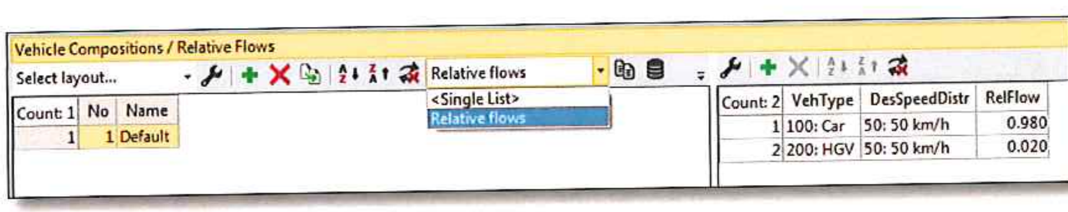
PEDESTRIANS

Please note that within Vissim, pedestrians are to be treated like vehicles in all circumstances (3D models, distributions, vehicle types, vehicle classes and vehicle compositions) while there are options for Pedestrian Types, Pedestrian Classes and Pedestrian Compositions, these objects are used within the Viswalk software and are not to be confused with Vissim pedestrians which can be found in vehicle types classes and compositions.

5.2.1 Creating a Vehicle Composition

To create a composition (cross-section) of vehicle types follow these steps;

1. Open the ***Traffic*** menu
2. Select ***Vehicle Compositions*** to open the vehicle compositions list
3. Within the list press the + button to create a new vehicle composition.
4. Open the ***Relative Flows*** child-list
5. Within the child list press the + button to add a new vehicle type to the composition
6. Define the relative flow for each vehicle type
7. Define the initial speed for each vehicle type



5.2.2 Vehicle Classes

Vehicle Classes are collections of vehicles that share similar driving behaviors, routes, seed distributions and many other driving characteristics. Within Vissim many objects reference vehicle classes; static routes, Desired Speed Decisions, Driving Behaviors, Signal Heads, etc.

5.2.3 Example 5-1 "Vehicle Classes"

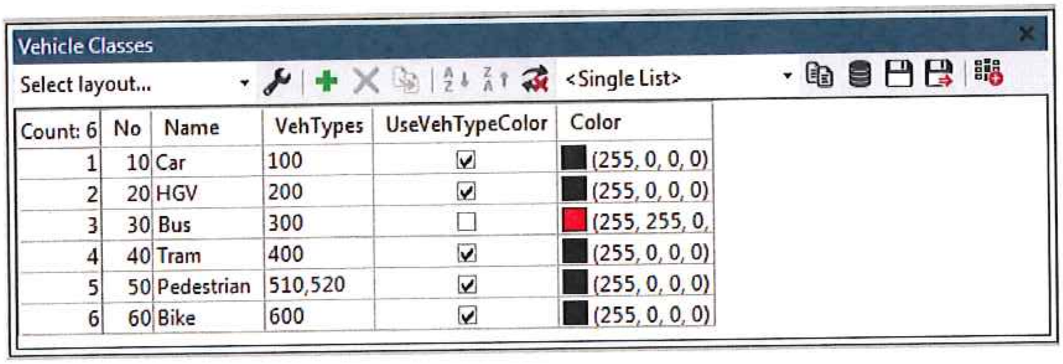
Vehicle classes and types can easily be confused and often are by many new users. If the FHWA defines thirteen types of vehicles, a Vissim modeler might define vehicle classes in the following way:

1. ***Private transportation***- Vehicle types that model drivers commuting, running errands, on vacation, non-commercial traffic. General traffic with a variety of driving styles (wide distributions)
    a. Motorcycles
    b. Passenger cars
    c. Light trucks
    d. Recreational vehicles
2. ***Public transportation***- Mass transit road-based vehicles. Schedule based routes. Familiar with the region. More aggressive driving styles.
    a. Busses
    b. Shuttles
    c. Taxis
3. ***Commercial vehicles***- Vehicles on delivery routes (Frequent stops). Construction equipment (can use special detours or lanes)
    a. Tow trucks
    b. Delivery Vans
    c. Construction equipment
4. ***Heavy Goods Vehicles (HGV)*** - Commercial freight trucks (tractor-trailers). Multiple axles, multiple trailers, heavy (restricted routes over bridges)

5.2.4 Creating a Vehicle Class

To create a vehicle class follow these steps;

1. Open the ***Base Data*** menu
2. Select ***Vehicle Class*** to open the vehicle classes list
3. Press the + button to create a new entry.
4. Define the vehicle class specifics
   a. ***VehTypes***: this entry defines the specific vehicle types that are included within this class
   b. ***Use Vehicle Type Color***: when this box is checked the vehicle types' color distribution is used
   c. ***Color:*** when the Use Vehicle Type Color box is left unchecked Vissim will display the selected color for all vehicles of this class



Count: 6	No	Name	VehTypes	UseVehTypeColor	Color
1	10	Car	100	☑	(255, 0, 0, 0)
2	20	HGV	200	☑	(255, 0, 0, 0)
3	30	Bus	300	☐	(255, 255, 0,
4	40	Tram	400	☑	(255, 0, 0, 0)
5	50	Pedestrian	510,520	☑	(255, 0, 0, 0)
6	60	Bike	600	☑	(255, 0, 0, 0)

5.2.5 Activity Lesson 5-3 "Vehicle Types, Classes, and Compositions"

Objectives:

To become familiar with defining common vehicle types to be used in a simulation of a freeway segment.
To become familiar with creating compositions of vehicle types within a freeway model.
To become familiar with creating vehicle classes for use in a freeway model.

Objects Used:

- Vehicle Types
- Vehicle Compositions
- Vehicle Classes

Procedure:

1. Open the file "5-3.inpx"
2. Save as a new file
3. Complete the task below

Task:

1. Create or Adjust the following vehicle types:
    a. SOV- Select Car and rename it SOV
    b. HOV-
        i. Duplicate SOV and rename the duplicate HOV
        ii. Assign the HOV Occupancy Distribution to HOV
    c. Bus- Assign the Bus Occupancy Distribution to Bus

2. Create the following vehicle classes:

	SOV	HOV	HGV	Bus
1: All	x	x		x
2: Commercial			x	
3: Public				x
4: Private	x	x		
5: Single Occupancy	x			
6: High Occupancy		x		

3. Create the following vehicle compositions:

	Vehicle Type	Speed	Relative Flow
Arterial	SOV	35mph	60
	HOV	35mph	30
	HGV	35mph	2
	Bus	35mph	8
Freeway	SOV	65mph	60
	HOV	65mph	30
	HGV	55mph	8
	Bus	55mph	2
Residential	SOV	25mph	55
	HOV	25mph	40
	Bus	25mph	5

4. Add the Vehicle Compositions to the Vehicle Inputs

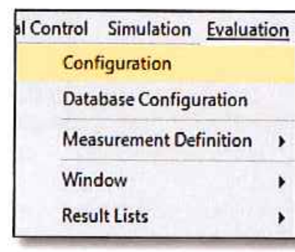
Input	Composition	Input	Composition
1	Arterial	7	Arterial
2	Residential	8	Arterial
3	Arterial	9	Freeway
4	Freeway	10	Freeway
5	Freeway	11	Residential
6	Arterial	12	Residential

6 Evaluations

Vissim is used to simulate real-world conditions and also is able to collect real world data from those simulations; traffic counts, speed data, delay, travel time or queue length among many others.

However being simulation, Vissim also has access to more specific data that would be more difficult to collect in the field such as acceleration, number of stops, distance traveled, dwell times, etc.

Given the breadth of data Vissim can keep track of, it is up to the modeler to decide what data is collected and how it is collected. Vissim can report second-by-second information for each specific vehicle, signal head, detector, lane, or intersection to be processed in a database, with a script, or in a spreadsheet. Or Vissim can automatically aggregate that information into time intervals (such as 15 minutes or 60 minutes) or across groups of vehicle classifications (i.e. SOV versus HOV)



In order to collect any sort of data from the simulation, the evaluation tools must be activated. By default none are activated to save processing power while building the network.

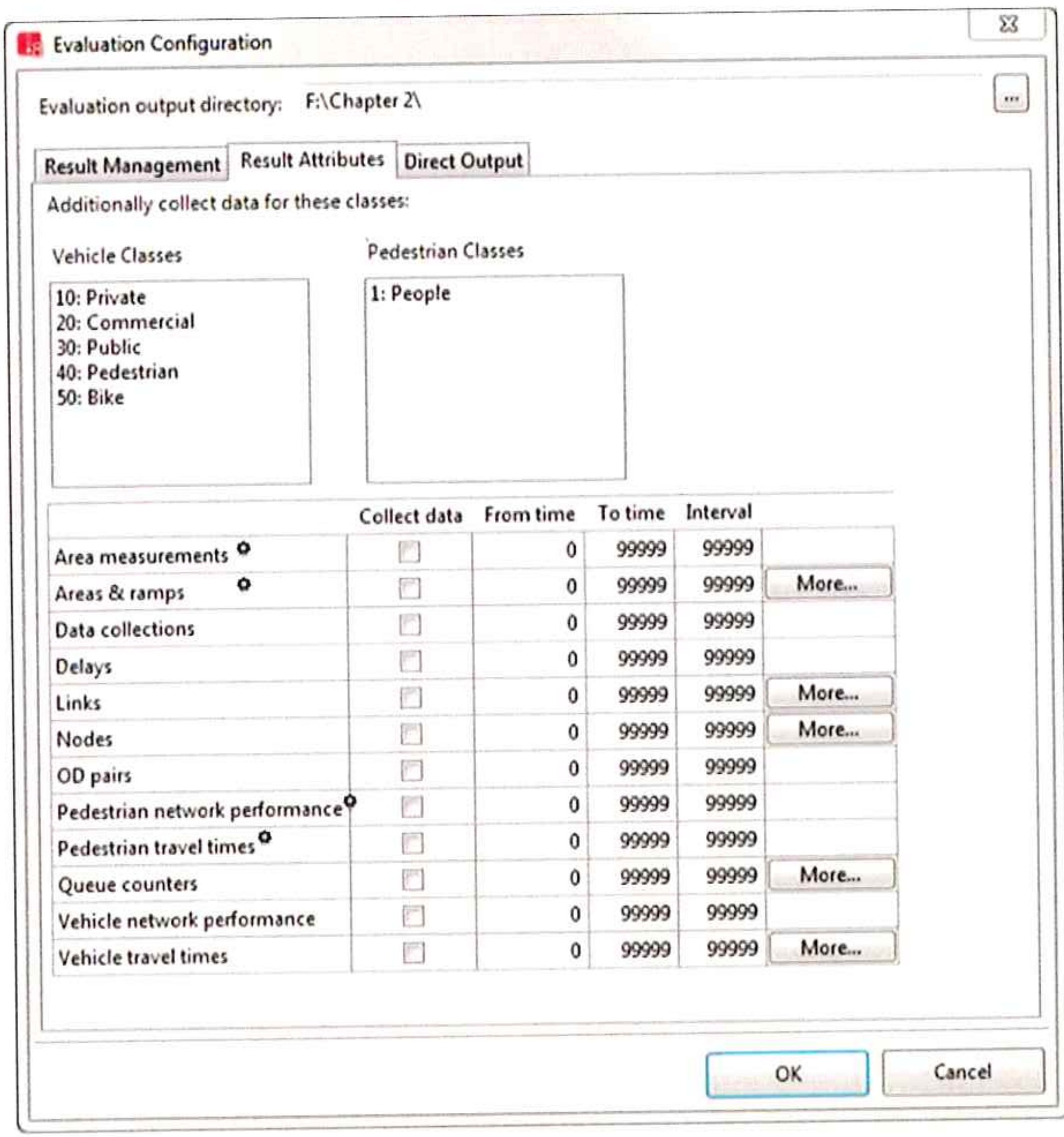
To activate the evaluation tools open the Evaluation menu and select Configuration.

Within the configuration window there are three tabs; Result Management, Result Attributes and Direct Output.

6.1 Result Attributes (Aggregated Data)

This window determines the data that will be collected and reported within the Vissim interface. Each row represents a different source of data and each respective source has an associated Result List where the data can be read.

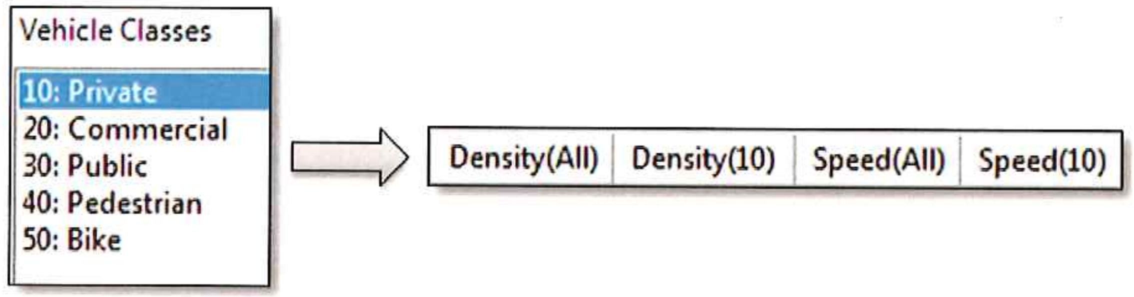
Data from the Result Attributes tab will report aggregated data from time interval to time interval as well as from simulation to simulation in the case of a multi-run (maximum, minimum, average and standard deviation).



° Viswalk Specific Outputs

Vehicle Classes

By default data is collected on all vehicles and will appear in the results as (All). If specific vehicle classes are selected from the list, Vissim will report data collected from all vehicles as well as data collected from just the selected classes. Data collected from a specific class is shown with the class number in parentheses. By default no classes are selected.



Collect Data

By checking this box the collection of data from that specific source is activated. By default the box is not checked; if this box is left unchecked, while running the simulation, the result list will remain blank.

From Time

This is the time when Vissim will begin collecting data from this source. The time is entered as simulation seconds (start of simulation = 0). If there is a seeding time or a warm-up period when data may be inaccurate or only the data from a specific time is relevant this value should be changed.

To Time

This is the time when Vissim will cease collecting data from this source. The time is entered as simulation seconds (start of simulation = 0). Data collection will continue until either the designated To Time has been reached or until the simulation stops; whichever happens first. By default the To Time is set to 99999s to automatically encompass the entire simulation.

Interval

Vissim will aggregate Result Attributes output data into intervals within the simulation. Each row of data within a Result List will be a different interval in the simulation. By default the interval is set to 99999s to encompass the entire simulation (1 interval/simulation). Interval values can range from 1 to 99999 seconds.

6.1.1 Results Lists

The evaluations configured within the results attributes tab each have an associated list that displays the specific data Vissim is collecting. These lists update in real time during a simulation run giving us the opportunity to look at the data without having to wait for the simulation to finish.

To open a result list

1. Open the ***Evaluation*** menu
2. Hover over the ***Result Lists*** option to expand the menu
3. Select the specific result list to be opened

Multiple lists can me open at any one time.

6.1.2 Activity Lesson 6-1 "Collecting Node and Link Data"

Objective:
To become familiar with configuring aggregate data collection as well as to become comfortable with opening and reviewing data during a simulation.

Objects Used:
- Evaluation Menu
- Evaluation Configuration Window
- Node Results List
- Link Results List

Procedure:
1. Open the file "6-1.inpx"
2. Save as a new file
3. Complete the task below

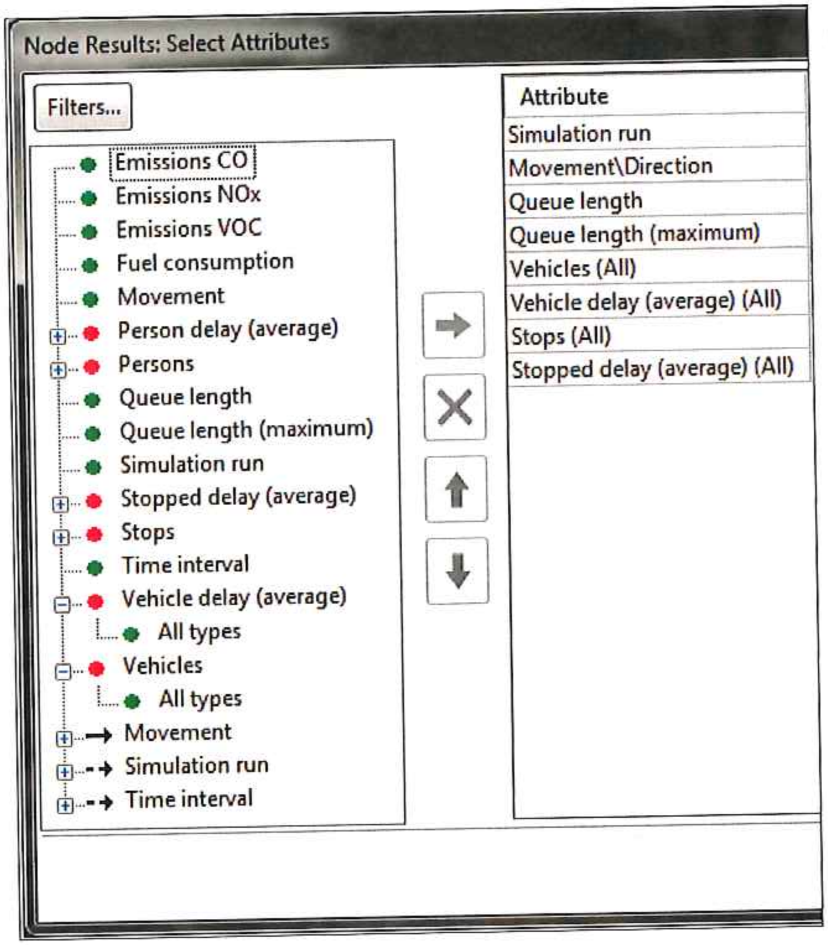
Task:
1. Activate Node and link evaluation for 10 minutes of simulation with a 5-minute warm-up period.
   a. Open the Evaluation menu
   b. Select Configuration
   c. Set the following:

	Collect Data	From	To	Interval
Node	x	300	900	600
Link	x	300	900	300

2. Open the Node and Link evaluation results lists
   a. Open the Evaluation menu
   b. Select Results Lists→Node Results
   c. Select Results Lists→Link Segment Results
3. Set Vissim to run two consecutive simulations.
   a. Open the Simulation menu
   b. Select Parameters
   c. Set the number of runs to 2.
4. Start running the first simulation
5. Press Ctrl+Q to place Vissim in quick mode.

6.1.3 Attribute Selection

Within each data source type (links, nodes, data collection, Queue Counters, Vehicle Travel Times, etc.) there are a number of specific outputs that Vissim records. The specific data that is shown in the list can be customized using the select attributes  button.



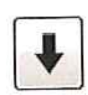
When the select attributes button is selected it opens the Attribute Selection window (shown right).

On the left side of the window Vissim lists all of the data types related to that evaluation source.

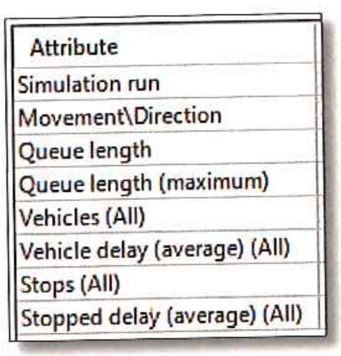
The right side of the window shows which data types are currently shown in the list.

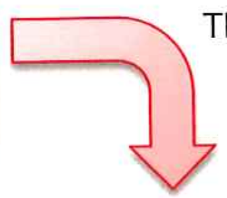
Data types can be moved from the left to the right using the green button. 

Data types can be moved from the right to the left using the red button. 

Data types can be positioned in the list using the black buttons.  

The set of data types on the right reflects the columns of data within the list.





SimRun	Movement\Direction	QLen	QLenMax	Vehs(All)	VehDelay(All)	Stops(All)	StopDelay(All)

6.1.4 Activity Lesson 6-2 "Collecting data on specific Vehicle Classes"

Objective:

To become familiar with adding attributes to a list through the lens of evaluation results.

Objects Used:

- Node Results List
- Attribute Selection Window

Procedure:

1. Open the file "6-2.inpx"
2. Save as a new file
3. Complete the task below

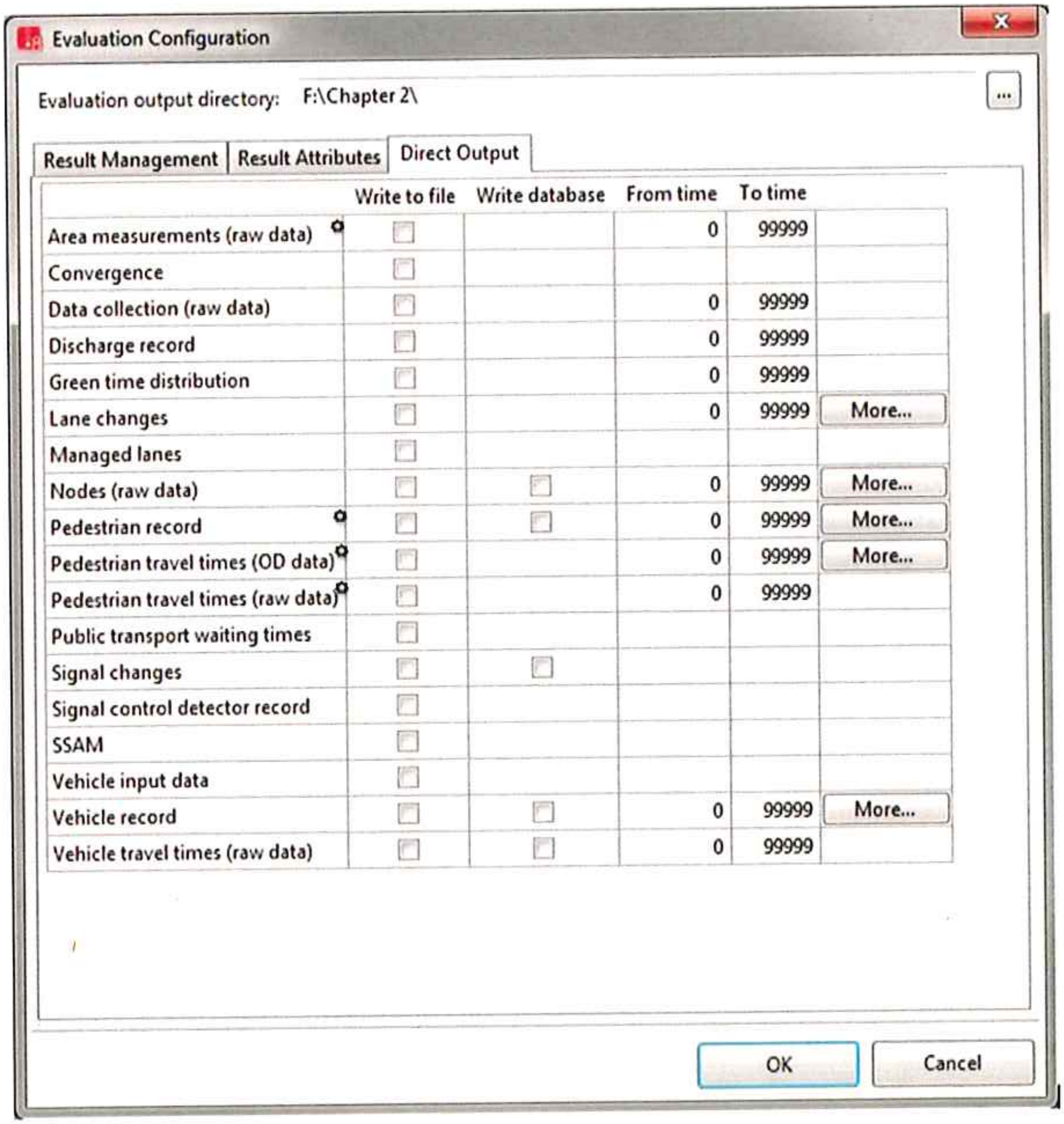
Task:

Configure the Node results list to show the delay for all vehicle classes as well as for the private vehicle class (10: Private)

1. In the Node Results list press to edit the list attributes. 
2. Remove all attributes except for Vehicle Delay
    a. Select the attribute on the right.
    b. Press the remove attribute button. 
3. Add Vehicle Delay for Private Vehicles
    a. Press the + next to Vehicle Delay to expand the options
    b. Select the attribute 10:Private
    c. Press the add attribute button. 
4. Click OK to save the settings
5. Run a simulation and observe the differences between All (All) and Private (10) vehicle delays.

6.2 Direct Outputs (Raw Data)

This window determines the data that will be collected and reported externally of Vissim; either in a text file or a database. Each row represents a different data type and has an associated file extension.



⚙ Viswalk Specific Outputs

Data from the Direct Output tab will report raw data (non-aggregated) with a new line of data for every time step; as a result these files can often become very large. Text files can be imported into other data processing software to be post-processed.

Write to File / Write to Database

At least one of these boxes must be checked in order for Vissim to output data of the desired type.

From Time

This is the time when Vissim will begin collecting data from this source. The time is entered as simulation seconds (start of simulation = 0). If there is a seeding time or a warm-up period when data may be inaccurate or only the data from a specific time is relevant this value should be changed.

To Time

This is the time when Vissim will cease collecting data from this source. The time is entered as simulation seconds (start of simulation = 0). Data collection will continue until either the designated To Time has been reached or until the simulation stops; whichever happens first. By default the To Time is set to 99999s to automatically encompass the entire simulation.

6.2.1 Direct Output Files

If write to file is checked data will be saved in a text file with a unique extension. The name of the text file is the same as the Vissim file with the addition of the simulation run number. The following is a list of some of the more common file extensions (more are found on page 926 of the Vissim user manual)

Data Collection (Raw Data) .... *.mer

Vehicle Record .... *.fzp

Node Evaluation (Raw Data) .... *.knr

Signal Detector Record .... *.ldp

Travel Times (Raw Data) .... *.rsr

Lane Changes .... *.spw

These files are saved in the same directory as the Vissim model file (*.inpx) and the signal controller files (*.rbc).

This data is not aggregated and often requires post processing or extra analysis.

6.2.2 Activity Lesson 6-3 "Direct Outputs and Raw Data Files"

Objective:

To become familiar with configuring direct outputs and working with direct output files.

Objects Used:

- Direct output configuration
- Vehicle record direct outputs

Procedure:

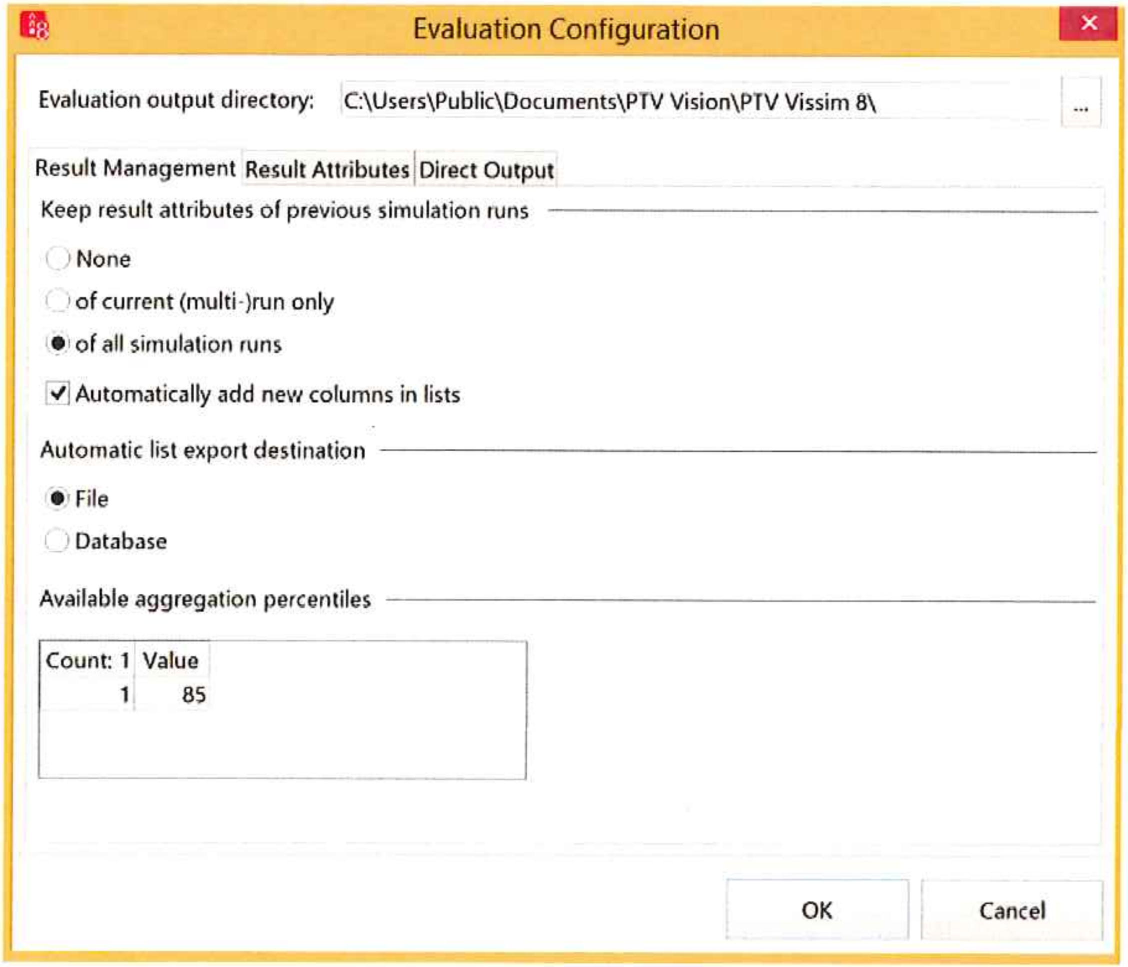
1. Open the file "6-3.inpx"
2. Save as a new file
3. Complete the task below.

Task:

1. Open the Evaluation menu
2. Select Configuration
3. Open the Direct Output tab
4. Configure the vehicle records evaluation
   a. Select Collect Data
   b. From 300s
   c. To 600s
5. Run a simulation
6. Open the output file and view the raw data.

6.3 Result Management

The result management tab contains some settings that control how data is aggregated.



Output Directory

The output directory is by default the same as the model file (*inpx). However depending on how the data is processed the directory could be changed to a new location, say a central server, removable drive, etc.

Keep Previous Runs

The three options within this section are designed for different phases of model creation and calibration.

1. **None**: this option makes it so every new simulation that is run erases the data collected on the previous run. This option is useful for model creation while making minor adjustments to select attributes; set an attribute, run a simulation, check the data, if it does not look right change the setting and re run the simulation.

2. **Current Run (Multi-run) Only**: this option keeps data of the current multi-run and automatically deletes the previous multi-run. This option is useful for final simulation runs after calibration is complete. It purifies the data ensuring only data sets from the fully calibrated runs are included. If this is not selected and previous (pre-calibration) data sets are still within memory, then the aggregated data will be inaccurate.

3. **All Simulation Runs**: this option does not automatically delete any data sets. This option is useful for the calibration phase of model building; set an attribute, collect data, change the attribute, rerun a simulation and compare the results. This is the default selection.

Aggregation Percentiles

Data collected from the result attributes tab is not raw data in that the data is collected over a time interval and then aggregated values are reported. Most results are reported as average values over the time interval. Some results are reported as maximums.

For example, Queue lengths (header: Qlen) are reported as average queue lengths over the time interval but another output in "Queue Length (Maximum)" with a header "Qlen(max)".

The aggregation percentiles section allows the modeler to define specific percentiles within data sets. For example, in the image above the 85th percentile has been defined meaning for any output within the result attributes tab there will be an option to also output the 85th percentile value; Qlen, Qlen(max) and Qlen(85th).

To define percentiles follow these steps:

1. Right-Click within the available aggregation percentiles box
2. Select "Add"
3. Define the percentile value as an integer number (i.e. 85% = 85 not 0.85)

> **NOTE** Percentile values can be defined either before a simulation or after a simulation.

6.3.1 Activity Lesson 6-4 "Configuring Aggregated Data"

Objective:

To become familiar with managing the results of a simulation; controlling data sets as well as defining result percentiles.

Objects Used:

- Result Management Tab
- Vehicle Record Result List
- Result List Attribute Selection Window

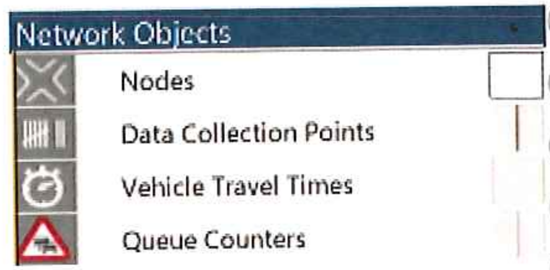
Procedure:

1. Open the file "6-4.inpx"
2. Save as a new file
3. Complete the task below:

Task:

1. Open the Link Evaluations List
   a. Open the Evaluations menu
   b. Select Results Lists→Link Segment Results
2. Observe the aggregated results from the previous multi-run
3. Configure Vissim to replace old multi-run data with new multi-run data.
   a. Open the Evaluation menu
   b. Select Configuration
   c. Open the Results Management tab.
   d. Select the option keep current multi-run only.
4. Add an 80^{th} percentile output.
   a. Right-Click in the percentile box
   b. Select Add
   c. Define the percentile to be 80.
5. Run a Multi-Run in quick mode and observe the results.

6.4 Data Collection Objects



Many evaluations are able to collect data without any configuration however there are some that require physical objects to be defined within the network. Without these data collection objects no data will be collected.

The four objects that can be found within the Network Objects window are Nodes, Data Collection Points, Vehicle Travel Times, and Queue Counters.

6.4.1 Nodes

Nodes have three general purposes;

- Generating intersection-based output data
- Serving as routing points for Dynamic Traffic Assignment (DTA)
- Mesoscopic Simulation (Meso)

This course only covers nodes for evaluation. DTA and Meso nodes are covered in more detail in the Vissim user's manual or in the Vissim Advanced DTA/Meso training course.

Vissim internally does not have a concept of what an intersection is. To Vissim the network is just a collection of links, routes, signal heads, and vehicles. The Node object is a way to tell Vissim which objects make up a particular intersection. It also helps Vissim determine which links belong to which legs.

6.4.2 Defining a Node

After the physical network is created; links, inputs, routes, signals, etc. a node can be defined around an intersection to tell the software what is an intersection. A node is defined by drawing a boarder around a space. The shape is defined by a series of vertexes and edges. Vissim can differentiate between different turning movements based on the orientation of the edges of the node.

To define a node follow these steps:

1. Select the ***Nodes*** network object

2. Hold ***Ctrl***
3. ***Right-Click*** a single time to define the first vertex
4. ***Left-Click*** a single time to define the next vertex. An edge will be created between the two vertexes
5. ***Left-Click*** again to define anther vertex
6. Continue placing vertices and edges until there is a single edge crossing each leg of the intersection.
7. Left-Click on the original vertex to complete the node
8. A Node editor window will open. Double check that the "***Use for evaluation***" box is checked.
9. Click ***OK*** to save settings

Keep in mind node evaluations (delay, queue length etc.) are not collected from the edge of the node in most cases. Rather the start of the queue is defined by the signal head or stop sign. Therefore the placement of the node does not need to be exact; as long as it encompasses all control devices at the intersection it will collect data just fine. The exception to this rule is on uncontrolled legs of an intersection (2-way stop or roundabouts).

6.4.3 Data Collection Points

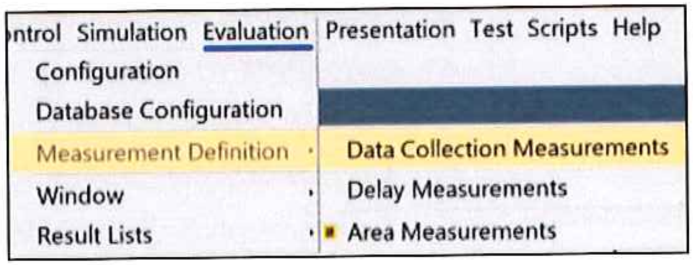
Data Collection Points are data collectors that act very similarly to pneumatic tubes used in the field. Data Collection points are objects that are placed in a lane and collect data about vehicles that cross over them. Data is collected about a vehicle the first time step in which the front of the vehicle passes over the bar in the lane. For multi lane links, if data is to be collected for the entire link, a data collection point will need to be defined in each lane.

6.4.4 Placing a Data Collection Point

To place a data collection point follow these steps:

1. Select the ***Data Collection Points*** network object
2. ***Left-Click*** to select the link
3. Hold ***Ctrl***
4. ***Right-Click*** a single time on the link to place a Data Collection Point.

6.4.5 Data Collection Measurements



Since Data Collection Points are lane-specific Vissim needs to know if data would like to be collected lane-by-lane or link-by-link. A Data Collection Measurement is essentially a bundle of data collection points. Once all of the data collection points have been placed Data Collection Measurements will need to be defined.

To define a data collection measurement follow these steps:

1. Place all Data Collection Points
2. Open the ***Evaluation*** menu
3. Hover over the ***Measurement Definition*** option to expand the list
4. Select ***Data Collection Measurements***
5. A data collection measurements list will open. Within the list press the **+** button to add a new measurement.
6. In the DataCollectionPoints box select all of the data collection points that are to have their collected data aggregated together.

   OR

7. Right-Click within the list to open the context menu
   a. **Add** will add a single blank measurement
   b. **Generate All (Grouped)** will generate a measurement for each link that has a data collection point with all of the data collection points on that link bundled together.
   c. **Generate All (1:1)** will generate one measurement per data collection point

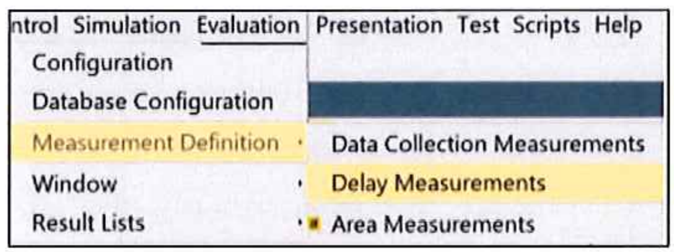
6.4.6 Vehicle Travel Times

Vehicle Records, Link Evaluations and Node evaluations all report travel time or delay results. However Vehicle Travel Times allow us to collect travel time and delay data between two specific points in the model.

To define a vehicle travel time follow these steps:

1. Select the ***Vehicle Travel Times*** network object
2. ***Left-Click*** to select the desired starting link
3. Hold ***Ctrl***
4. ***Right-Click*** a single time on the location where the travel time collections will start
5. ***Left-Click*** a single time at the location where the travel time collections will end
6. A ***Travel Time Measurement*** window will open.
7. Here we can define more precisely the positions of the start and end points as well as the distance between them.
8. Click ***OK*** to save these settings

6.4.7 Delay Measurements



Delay results can be collected based on the defined Vehicle Travel Time measurements. Similar to data collection points, Vissim doesn't know what travel times we want to include so we must define a Delay Measurement.

To collect delay data a delay measurement must be define; follow these steps:

1. Place all travel time objects
2. Open the ***Evaluation*** menu
3. Hover over ***Measurement Definition*** to expand the list
4. Select ***Delay Measurements***
5. A delay measurement list will open. Within the list press the **+** button to add a new measurement.
6. In the VehTravTmMeas box select all of the travel time objects that are to have their collected data aggregated together.

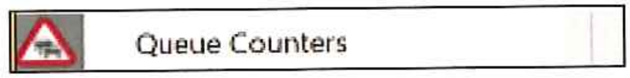
OR

7. ***Right-Click*** within the list to open the context menu

a. **Add** will add a single blank measurement

b. **Generate All (1:1)** will generate one delay measurement per travel time object

6.4.8 Queue Counters



Queuing data is collected in Node evaluation. However Node evaluations do not report queues that extend through upstream intersections. Queue counters offer more flexibility on where queue data is collected. In addition queue data collected with queue counters is not impacted by nodes upstream. Therefore we can collect true queue data that includes spillback distances through upstream intersections.

Queue counters report data from the entire link (not lane specific) and therefore do not require the additional step of defining a measurement like data collections or delays.

To define a queue counter follow these steps:

1. Select the ***Queue Counters*** network object
2. ***Left-Click*** to select the link where it will be placed
3. ***Hold Ctrl***
4. ***Right-Click*** at the location where the start of the queue data collection will start.

6.4.9 Activity Lesson 6-5 "Placing Evaluation Objects"

Objective:

To become familiar with placing and configuring the data collection objects Nodes, Data Collection Points, Vehicle Travel Times and Queue Counters as well as Data Collection Measurements and Delay Measurements.

Objects Used:

- Nodes
- Data Collection Points
- Data Collection Measurements
- Vehicle Travel Times
- Delay Measurements
- Queue Counters

Procedure:

1. Open the file "6-5.inpx"
2. Complete the task Below:

Task:

1. Collect intersection data at each intersection of the interchange
    a. Place a Node around the north interchange intersection.
    b. Place a Node around the south interchange intersection.
2. Collect volume data for each freeway direction
    a. Place a Data Collection Point in each lane of the freeway in both directions at points E and F.
    b. Create two Data Collection measurements, one for each freeway direction
        i. Open the Evaluation menu
        ii. Select Measurement Definition→Data Collection
        iii. Right-Click in the list and select
            Generate All (Grouped)
3. Collect travel time data for each freeway direction

   a. Place a travel time measurement from point A to C
   b. Place a travel time measurement from point D to B
4. Collect delay data for each freeway direction
   a. Open the Evaluation menu
   b. Select Measurement Definition→Delay
   c. Right-Click in the list and select Generate All (1:1)
5. Collect queue spill-back data at the interchange intersections
   a. Place a queue counter at point G
   b. Place a queue counter at point H
6. Run a simulation and observe the results.

6.1 Visualizing Results in Vissim

Vissim offers the ability to color network objects, such as links and vehicles, using a color scheme based on the value of a specific attribute.

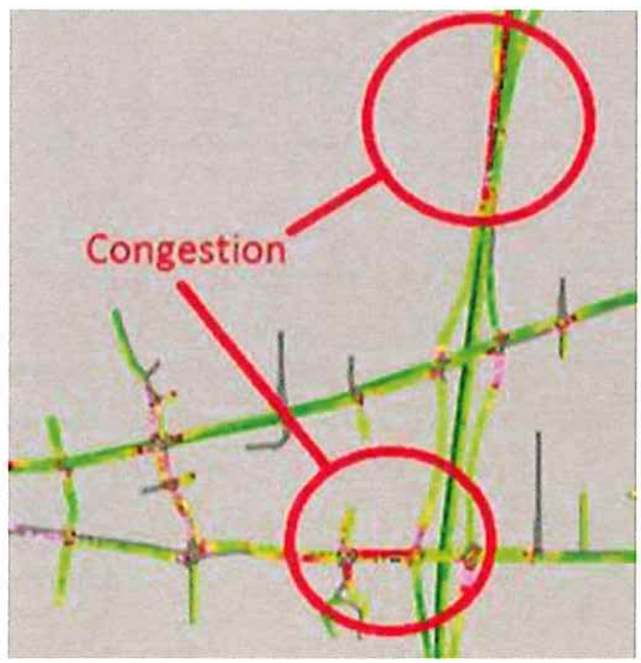
For example, depending on the speed of a vehicle, the delay on a section of a link or the density of a lane, Vissim will assign a different color based on user defined thresholds.

In this way we can use Vissim's color schemes to review a model for quality assurance/quality control, help calibrate congestion by generating heat maps, and Create visual representations of our data to better conceptualize our results.

6.1.1 Link Heat Maps

Using a color scheme to generate a heat map is a quick way to evaluate links and the network conditions in Vissim. This feature can be used to distinguish bottlenecks and any irregularity in the model. Congested areas may be expected as part of the simulation of the model; however there are cases that having a bottleneck on the roadway does not make sense. Digging through thousands of lines of raw outputs or determining if a certain result is reasonable can be very difficult. Using a heat map allows us to quickly identify congested areas or locations of underperformance.

The figure depicts a sample speed heat map. We can easily distinguish the congestion on the south bound freeway section before the off ramp as well as the congestion on the arterial to the south.

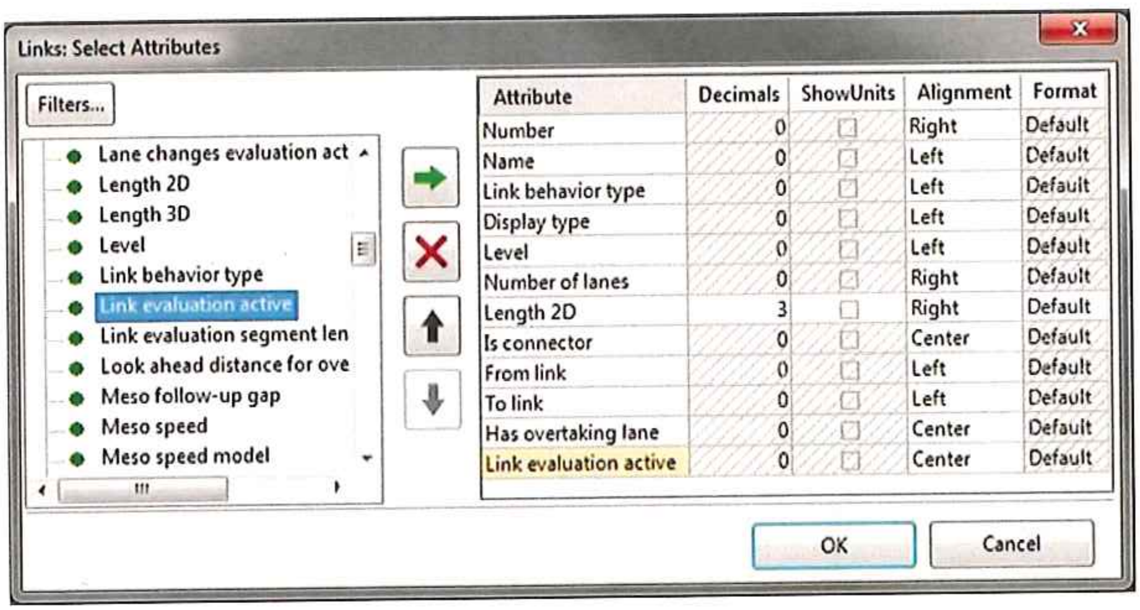


The existence of congestion and bottlenecks is not necessarily a result of poor modeling. If the field data shows that there is congestion in the field, the model should reflect the same pattern.

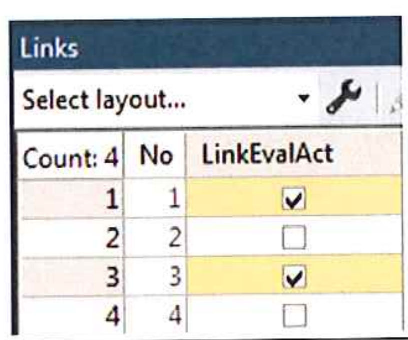
6.1.2 Creating a Heat Map on Links

To configure the links to display a heat map based on a specific attribute, in this case speed, follow these steps:

1. Activate Link Evaluation on the desired links
    a. Open the Links list.
        i. Right-Click on the Links network object
        ii. Select "Show List"
    b. Add the attribute "Link Evaluation Active" to the list.
        i. In the links list press the attribute selection button 
        ii. Select and move the "Link Evaluation Active" from the right to the left.
        iii. Click "OK"



    c. In the Links list check the box in the "LinkEvalAct" column for the desired links



2. Open the Links color scheme configuration window

    a. Right-Click on the Links network object

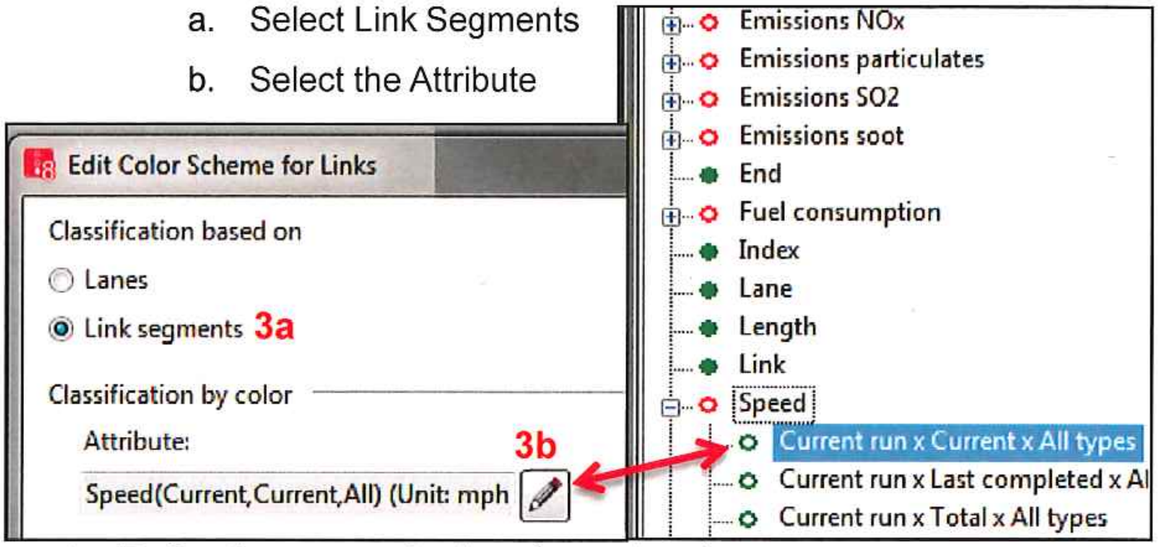
    b. Select Edit Graphic Parameters

    c. In the "Drawing Mode" field use the dropdown menu to select "Use Color Scheme"

3. Select the attribute we want to base the color scheme on

    a. Select Link Segments

    b. Select the Attribute



4. Define the range of values for each color.

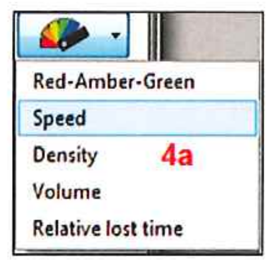
    a. We can choose pre-defined color schemes using the pull-down menu

    b. Or we can define our own

        i. Right-Click in the white box

        ii. Select Add

        iii. Define the color and the value range



Class bounds and colors: 4

Count: 11	LowerBound	UpperBound	Color
1	MIN	3.728	(255, 255, 128, 255)
2	3.728	7.456	(255, 255, 0, 0)
3	7.456	11.185	(255, 255, 128, 0)
4	11.185	14.913	(255, 255, 198, 0)
5	14.913	18.641	(255, 255, 255, 0)
6	18.641	22.369	(255, 198, 255, 0)
7	22.369	29.826	(255, 128, 255, 0)
8	29.826	37.282	(255, 0, 255, 0)
9	37.282	44.739	(255, 0, 187, 0)
10	44.739	74.565	(255, 0, 128, 0)
11	74.565	MAX	(255, 255, 255, 255)

5. Click "Ok".
6. We need to then activate Link evaluation.
    a. Open the Evaluation menu
    b. Select Configuration
    c. Activate Link evaluation
    d. Determine the interval length. This will dictate the refresh rate of the heat map. For example if we want a new heat map for every 15 minutes set the interval to 900s.
    e. Click "OK".
7. Run a simulation to update the colors.

> **NOTE** The described process will change all link lanes to the same colors. If you want lane-specific heat maps you will need to change the link evaluation from "Link Segments" to" Lane Segments"

6.1.3 Activity Lesson 6-6
"Creating a Heat Map on Links"

Objective:

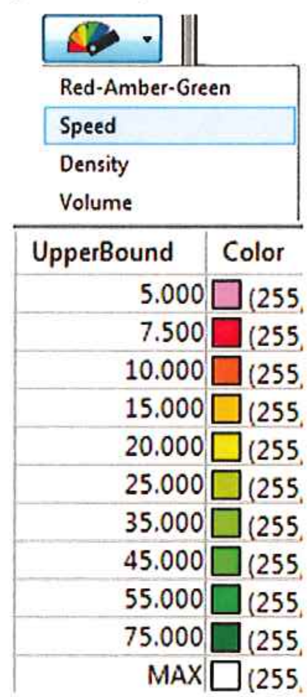
To generate a heat map based on the average speed on a link segment over 15 minutes of simulation. By the end of this activity we should be able to select an attribute to use for a color scheme, define the ranges of values for each color, define the heat map refresh rate, and identify congested areas in the network.

Objects Used:

- Link Lists
- Link Graphic Parameters Editor
- Evaluation Configuration Menu
- Help Menu
- Demo Files

Procedure:

1. Open the help menu and navigate to Example Files > Demo directory
2. Open the file "Roundabout Billings.inpx" by dragging the *.inpx file into the network editor window.
3. Save as a new file.
4. Open the Links list and activate Link evaluation on ALL links
5. Open the link graphic parameters and create a speed based color scheme using the following:
   a. Use the pre-defined speed color scheme
   b. Modify the ranges of each color
6. Open the evaluation configuration and activate link evaluation
7. Using the "More" button select "Lane Segment" to convert the color scheme to lane- by lane colorization.
8. Define the interval to be 900s
9. Run a simulation and determine where the hot spots are in the network



10. Discuss whether these are a result of speed control or congestion.

6.1.4 Color Vehicles by State

In the same way that we colored links in the previous section, we can also use color schemes on Vehicles in the network based on specific attributes of the vehicles such as speed, acceleration, occupancy, etc.

We can also use Vissim to display a vehicle's color based on each vehicle's driving state. Unlike using a color scheme, when coloring a vehicle by its state, we cannot edit the colors or what attribute the color is based on. Here is a table showing what each color represents:

Color		Description
White		In the queue mode. At least one queue counter should be specified.
Light Blue		Waiting for lane change after 6s in the emergency stop position.
Orange		Wants to change lane due to vehicle route
Light Green		In the process of changing lanes.
Dark Green		After lane change: lane change was performed in the last 6s.
Dark Red		Brakes to change lane: vehicle brakes, as it needs to change lanes.
Amber		Cooperative braking.
Red		Sleep: vehicle which is not paying attention to the driving.
Dark Yellow		Vehicle is ignoring signals
Pink		Heavy breaking
Purple		Moderate breaking from $-3.0\ m/s^2$ to $-1.0\ m/s^2$
Navy Blue		Default view.

Using the color vehicles by state functionality is an efficient way to perform QA/QC on the network, troubleshoot some unexpected behavior, or just to get a sense of what vehicles are doing in certain areas of the network.

6.1.5 Activity Lesson 6-7 "Color Vehicles by Driving State"

Objective:

By the end of this activity we should be able to color vehicles in a simulation by their driving state as well as hot to use this feature to determine how vehicles are reacting to reduced speed areas and conflict areas.

Objects Used:

- Vehicles in Network Graphic Parameters
- Quick View Window
- Demo files

Procedure:

1. Open the help menu and navigate to **Example Files > Demo directory**
2. Open the file "Roundabout Billings.inpx" by dragging the *.inpx file into the network editor window.
3. Save as a new file.
4. Configure the "Vehicles In Network" network object to display by vehicle state:
    a. Right-Click on the "Vehicles in Network" network object
    b. Select Edit Graphic Parameters
    c. In the "Drawing Mode" field use the dropdown menu to select "Color by Driving State"
5. Run a simulation and observe when vehicles are changing colors
6. Discuss where the different states occur most often.

7 Driver Behaviors

In this chapter we will explore some of the underlying processes that control how vehicles interact within the lane and during lane changes.

Vissim is not a black-box platform in that all of the driving behaviors are viewable and editable. In this way a model can be customized to match the driving styles of the region the model is emulating.

Car following model is the heart of the microsimulation model. It affects multiple important performance measures such as speed, volume, and density. Vissim provides two different following models; one for urban following and one for freeway following.

The following behaviors of vehicles in freeway segments drastically impact the performance of a Vissim model and in fact provide the highest level of impact to the calibration. In urban areas, the effects of objects like signal heads, conflict areas, reduced speed areas and acceleration functions have a much larger impact on the performance of the model. It is for these reasons that the freeway following model is more complex and why we will be looking into it in greater detail in this section.

The objective of this section is to highlight some of the most important parameters in the freeway following model. We will explore the impact they have on our models. However many of these should be left as defaults and only be adapted by an experienced user.

It is within the driving behaviors where we define parameters such as how far vehicles can see ahead or behind, how many vehicles they can react to at any one time, where they drive within a lane an how to assess acceptable gaps for lane changes; among many others more advanced parameters.

7.1 Creating a Driving Behavior

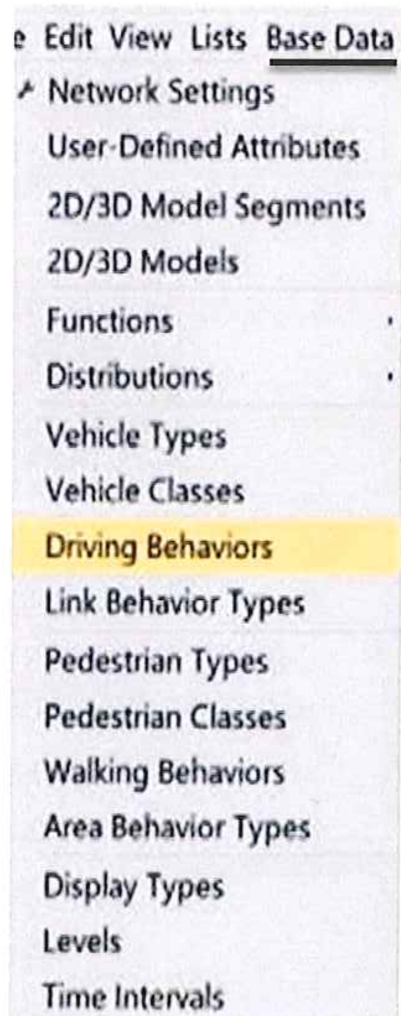
Driving behaviors can be found in the Base Data menu. Vissim contains five default driving behaviors. The two most popularly used behaviors are discussed within this chapter; ***Urban (motorized) and Freeway (free lane selection)***. However, in this section we will be focusing on the mechanics of how to make a new driving behavior by adapting one of the defaults.
We will be looking into editing the specific parameters in greater detail in the next section.

7.1.1 Customizing Driving Behaviors

Driving behaviors can be customized from the defaults provided by Vissim. Behaviors can be adapted and applied to different vehicles classes to increase the accuracy of the model. For example a commuter might drive differently (more aggressively) than a tourist. Changing the cross-section of driving behaviors can greatly impact the results of the model.

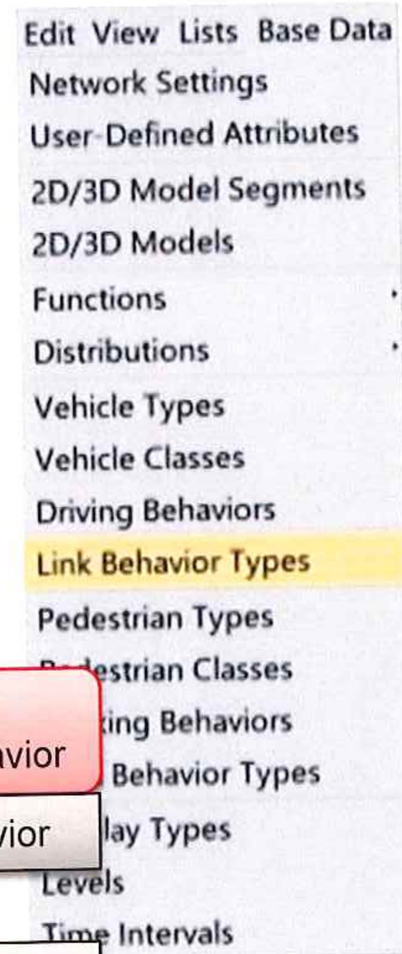
To duplicate and edit a driving behavior follow these steps:

1. Open the Base Data menu
2. Select Driving Behaviors to open the list of driving behaviors
3. Right-Click a behavior in the list to open the context menu
4. Select "Duplicate"
5. Right-Click the behavior in the list to open the context menu
6. Select "Edit"
7. Configure the parameters within the driving behavior editor
8. Click OK to save the settings.



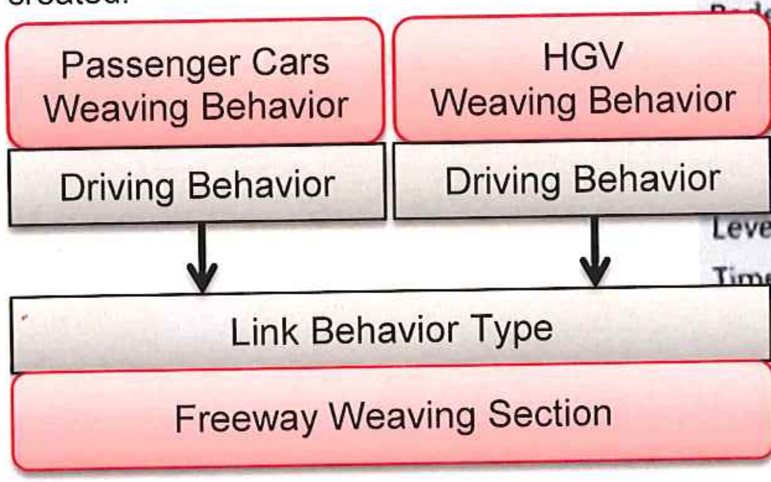
NOTE It is highly recommended to duplicate the default driving behaviors and edit a duplicate rather than just changing the defaults.
Once a default is changed it can be hard to revert it back. It can be easy to over-calibrate a behavior and having a default to compare to will help.

7.1.2 Link Behavior Types



Vissim does not know if a specific driving behavior is supposed to apply to all vehicles on a specific link or to a specific vehicle class(es). Therefore there is an intermediate step called a Link Behavior Type. A Link Behavior Type is a bundle of driving behaviors that will be applied to a link.

For example, in a weaving section a passenger car might behave differently from a heavy truck. Therefore each will have a unique driving behavior for this section of the network. However they are both applied to the same link so a Weaving section link behavior type will have to be created.



To define a Link Behavior Type, follow these steps:

1. Open the Base Data menu
2. Select Link Behavior Types to open the link behavior types list
3. Press the "+" button to add a new link behavior type
4. Use the pulldown to associate a driving behavior with the link behavior type.

7.1.3 Activity Lesson 7-1 "Creating and Applying Driving Behaviors"

Objective:

To become familiar with finding and identifying Freeway and Urban driving behaviors as well as creating Link Behavior Types.

Objects Used:

- Driving Behaviors
- Link Behavior Types
- Link Editor Window

Procedure:

1. Open the file "7-1.inpx"
2. Save as a new file
3. Complete the task below

Task:

Create a weaving section driving behavior.

1. Open the Base Data menu
2. Select Driving Behaviors
3. Duplicate the existing Freeway Driving behavior
    a. Right-Click on the Freeway behavior
    b. Select Duplicate

Create a weaving section link behavior type

1. Open the Base Data menu
2. Select Link Behavior Types
3. Press the + button to create a new link behavior type
4. Connect the newly created driving behavior to it.

Configure all links that will be using this new behavior.

1. Double Left-Click on link #5 and #9
2. Select the newly created link behavior type.

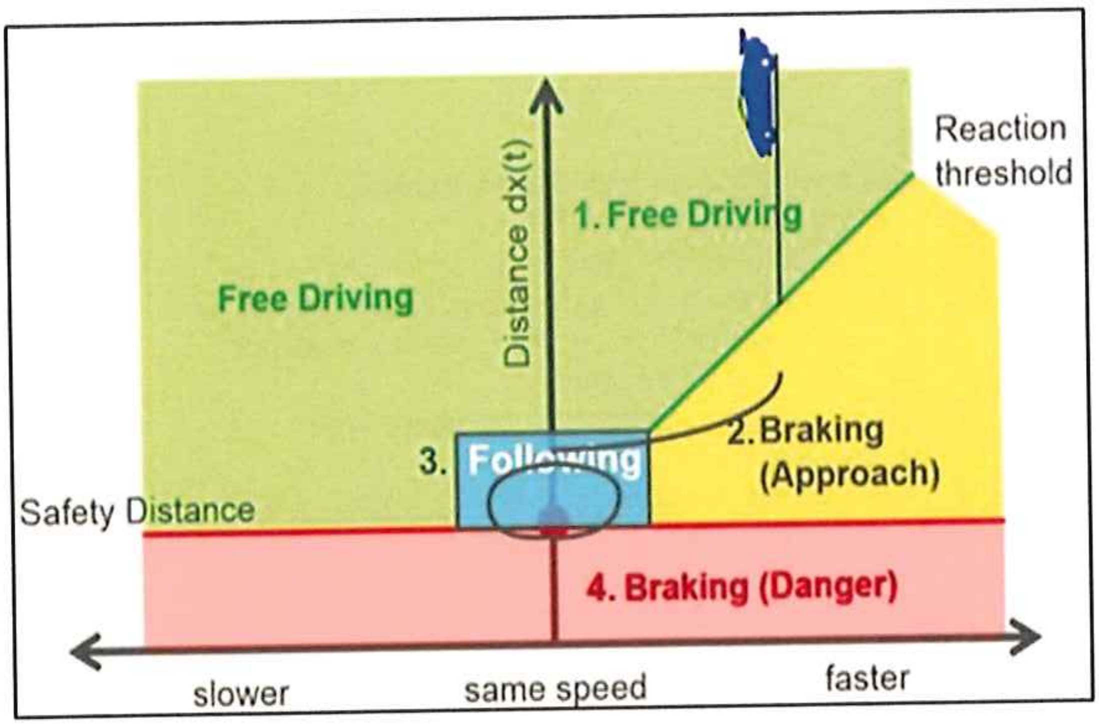
7.2 Car Following Parameters

In this section we will be looking more deeply into how Vissim simulated vehicles interact with one another specifically when they are following one another. Other driving behaviors, such as lane change parameters, will be covered in later sections.

7.2.1 Wiedemann's General Car-Following Model

The traffic flow model in Vissim is a discrete, stochastic, time step based microscopic model with driver-vehicle-units as single entities. The model contains a psycho-physical car following model for longitudinal vehicle movement and a rule-based algorithm for lateral movements. The model is based on the continued work of Rainer Wiedemann.

The basic idea of the Wiedemann model is the assumption that a driver can be in one of four driving modes (see also illustration in section:



1. **Free Driving**: No influence of preceding vehicles observable. In this mode the driver seeks to reach and maintain a certain speed, (in Vissim the desired speed). In reality, the speed in free driving cannot be kept constant, but oscillates around the desired speed due to imperfect throttle control.

2. **Approaching**: The process of adapting the driver's own speed to the lower speed of a preceding vehicle. While approaching, a driver applies a deceleration so that the speed

difference of the two vehicles is zero in the moment the vehicle reaches the desired safety distance (minimum following distance).

3. **Following**: The driver follows the preceding car without any conscious acceleration or deceleration. The safety distance is kept more or less constant, but again due to imperfect throttle control and imperfect estimation the speed difference oscillates around zero.
4. **Braking**: The application of medium to high deceleration rates if the distance falls below the desired safety distance. This can happen if the preceding car changes speed abruptly, or if a third car changes lanes in front of the observed driver.

Car Following Model

The following model pull-down selects the basic model for the vehicle following behavior. Two following models are available as shown below:

- Wiedemann 74: Model suitable for urban traffic.
- Wiedemann 99: Model suitable for freeway/highway traffic.
- No Interaction: Vehicles do not recognize any other vehicles (can be used for a simplified pedestrian behavior).

7.2.2 "Wiedemann 74" Following Model

The 74 model is used for urban driving behaviors and is Wiedemann's 1974 car following model. The following parameters can be modified:

Average Standstill Distance:

Defines the average desired distance between stopped cars. It has a fixed variation of ± 1m.

Additive Part of Desired Safety Distance:

Controls the base headway time; it increases the following distance based on the speed of the vehicle.

Multiplicative Part of Desired Safety Distance:

Determines the degree of variation between individual vehicles' following distance.

7.2.3 "Wiedemann 99" Following Model

The 99 model is used for freeway (uninterrupted flow) driving behaviors and is based on Wiedemann's 1999 car following model. Here is a brief description of its parameters:

CC0
Defines the average desired distance between stopped cars. It has no variation. This parameter directly impacts jam density.

CC1
Is the headway time (seconds) that a driver wants to keep. At a given speed, the mean safety distance is computed as:

Safety Distance = CC0 + CC1 * speed

The safety distance is defined in the model as the minimal distance a driver will keep while following other cars. The higher the value, the more cautious the driver is. In case of high volumes this distance becomes the value with the strongest influence on capacity.

CC2
Restricts the longitudinal oscillation or how much more distance than the desired safety distance a driver allows before he intentionally moves closer to the car in front. If this value is set to 10m for example, the following process results in distances between dx_safe and dx_safe + 10m. The default value is 4.0m, which results in a quite stable following process.

CC3
Controls the start of the deceleration process, for example when a driver recognizes a preceding slower vehicle. In other words, it defines how many seconds before reaching the safety distance the driver starts to decelerate.

CC4 and CC5
Control the speed differences during the "following" state. Smaller values result in a more sensitive reaction of drivers to accelerations or decelerations of the preceding car, i.e. the vehicles are more tightly coupled. Both parameters should be of the same absolute value in normal situations (one is for negative and one for positive speed differences) and the default value of 0.35 is a fairly tight restriction of the following process.

CC6
Influence of distance on speed oscillation while in following process. If set to 0 the speed oscillation is independent of the

distance to the preceding vehicle. Larger values lead to a greater speed oscillation with increasing distance.

CC7
Actual acceleration during the oscillation process.

CC8
Desired acceleration when starting from standstill (limited by maximum acceleration defined within the acceleration curves)

CC9
Desired acceleration at 80 km/h (limited by maximum acceleration defined within the acceleration curves).

> **NOTE** It is recommended to use only CC0, CC1, and CC2 parameters for calibration purposes unless there is a robust field data collection and research study behind changing parameters.

7.2.1 General Following Tab Parameters

Look Ahead Distance
Defines the distance that a vehicle can see forward in order to react to other vehicles either in front or to the side of it (within the same link). This parameter is in addition to the Number of Observed Vehicles.

Max
Is the maximum distance allowed for looking ahead. It needs to be extended only in rare occasions (such as modeling railways).

Example:

If modeling cyclists that are allowed to overtake each within the same lane, the min. Look Ahead Distance should be set to a value greater than 0 in order to prevent vehicles passing through one another because there might be more than two cycles on the same link coordinate at the same time and thus the parameter Number of Observed Vehicles is not sufficient.

Number of Observed Vehicles

Affects how well vehicles in the network can predict other vehicles movements and react accordingly. As some of the network objects are internally modeled as vehicles it might be useful to increase this value if there are several cross sections of network objects within a short distance. However, the simulation will run slower with higher values.

Look Back Distance

Defines the distance that a vehicle can see backwards in order to react to other vehicles behind (within the same link).

Min.

Is important when modeling lateral vehicle behavior. Especially if several vehicles can queue next to each other (e.g. bikes) this value needs to be increased. The value depends on the approach speed. In urban areas it could be 60-100 ft. (20-30m).

Max.

Is the maximum distance allowed for looking backward. In networks with many small meshes, for example with many connectors over a short distance, the simulation speed can be improved if the maximum look back distance is reduced from the default value.

Temporary lack of attention

Affects a reaction time based on the duration and probability of the vehicle composition of observing the duration. This value should not be modified as an initial calibration technique.

Smooth close up behavior:

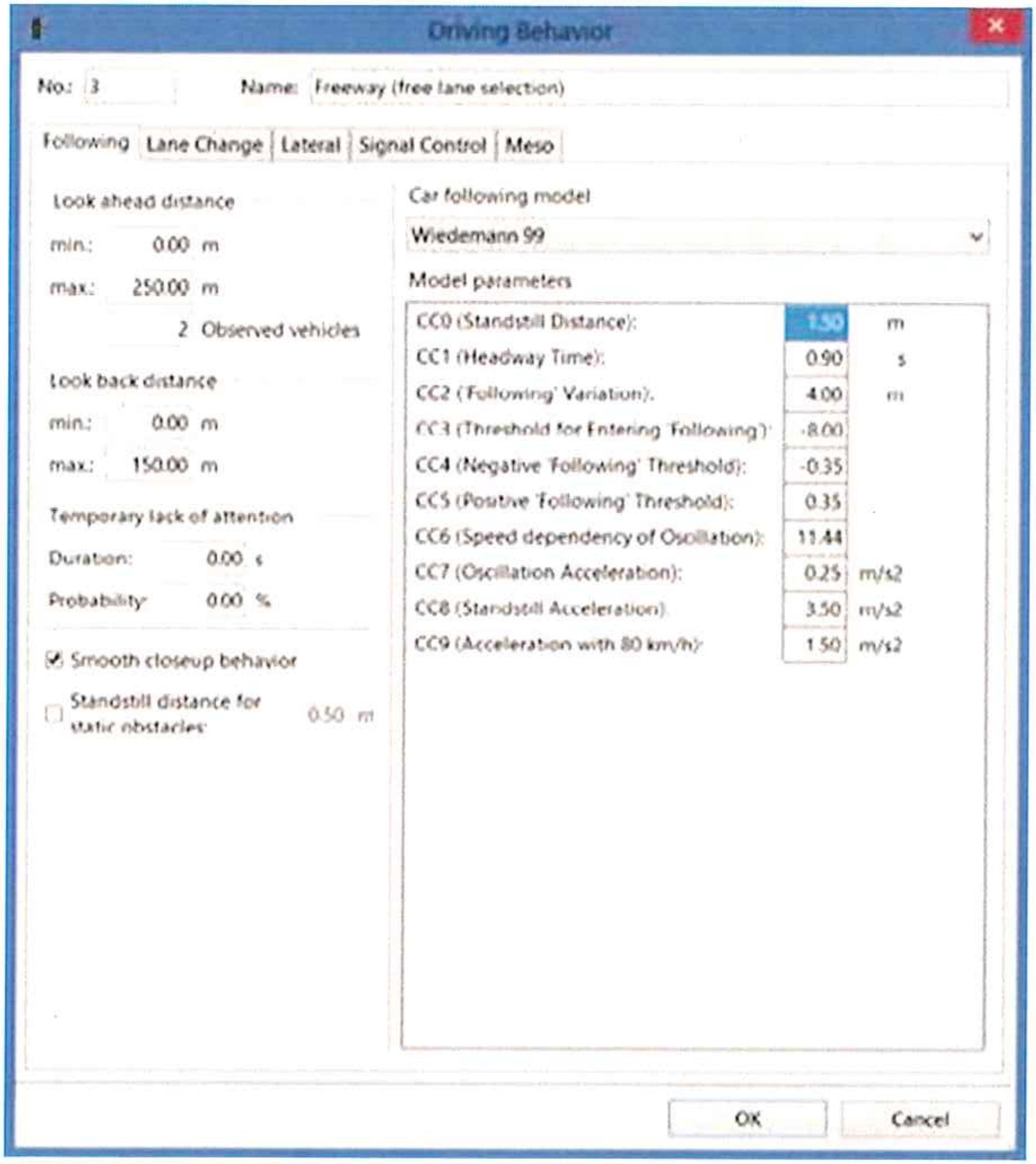
If this option is checked, vehicles slow down more evenly when approaching a standing obstacle. Starting at the maximum look ahead distance from the standing obstacle a trailing vehicle can plan to stop there behind a leading vehicle which will stop there as well.

If this option is not checked, the trailing vehicle will use the normal following behavior until the leading vehicle almost comes to a stand (speed < 1 m/s). Only then, the trailing vehicle determines the final approach behavior which can include a temporary acceleration.

Standstill distance for static obstacles:

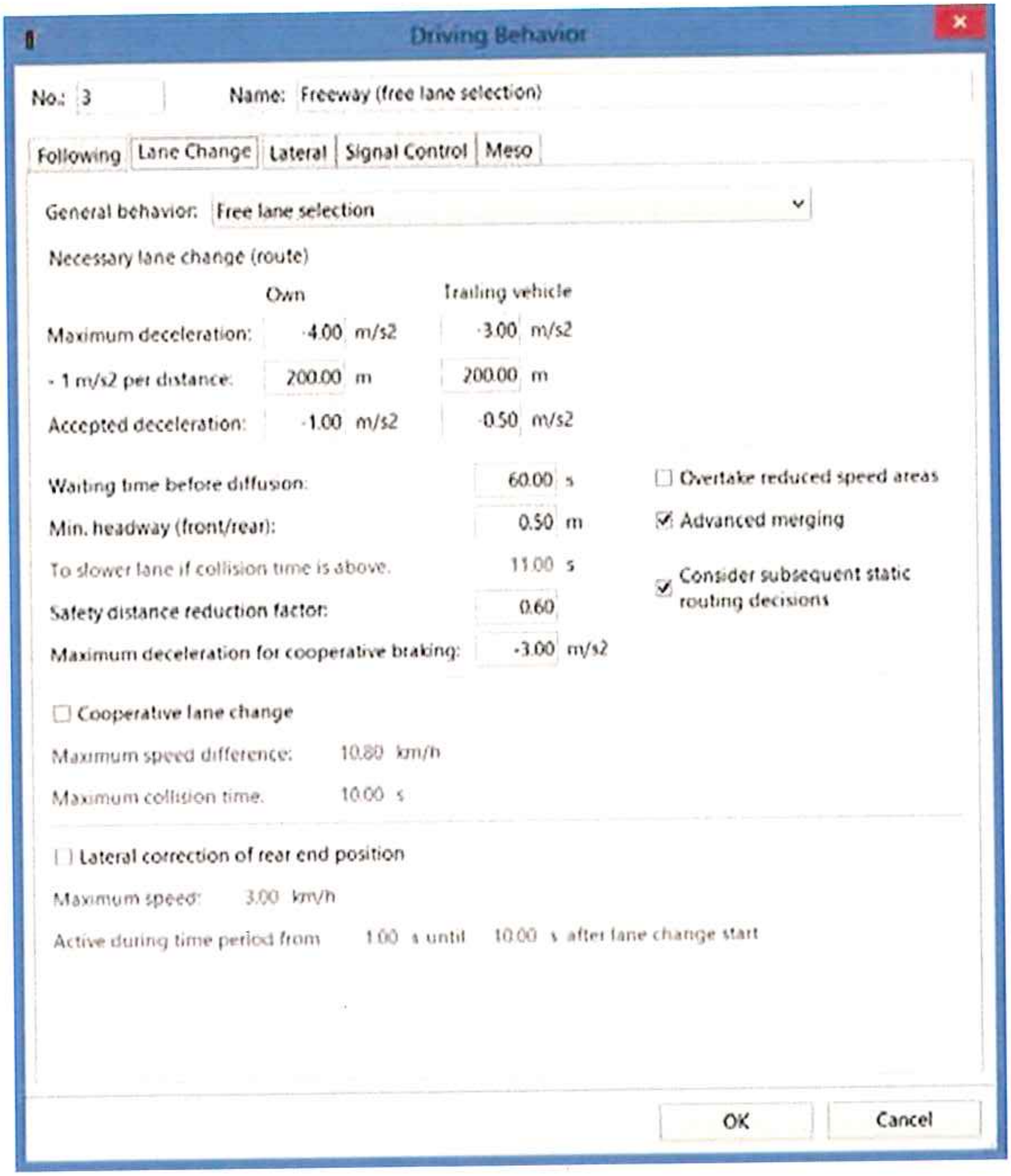
If this option is checked, the vehicles using this behavior will use the given value (default: 0.5 m) as standstill distance upstream of all static obstacles except parking space, stop signs (includes signal heads, stop signs, PT stops, priority rules, conflict areas) instead of a normal [0.5; 0.15] distributed random value. It is recommended to activate this option for PT vehicles at PT stops with screen doors and waiting queues at fixed positions on the platform.

If this option is not checked, the vehicles using this parameter set will use a normal [0.5; 0.15] distributed random value as standstill distance in meters upstream of all static obstacles.



7.3 Lane Change Parameters

The lane change tab of the driver behavior window includes parameters that can be set to calibrate the lane change model in Vissim.



General Behavior

Drop down menu is used to select way of overtaking (former link attribute "right side/left side rule").

Free Lane Selection Vehicles are allowed to overtake in any lane

Slow Lane Rule allows overtaking in the fast lane only.

Necessary lane change (route):

This section is for lane changes that are required to continue on the assigned route as opposed to merely passing a slower moving vehicle. The decelerations can be defined for the lane changing driver (Own) as well as for the vehicle the driver is pulling in front of (Trailing).

The range of these decelerations is defined by the Maximum and Accepted Deceleration. In addition a reduction rate (as meters per 1 m/s^2) is used to reduce the Maximum Deceleration with increasing distance to the emergency stop position.

Waiting time before diffusion

Defines the maximum amount of time a vehicle can wait at the emergency stop position waiting for a gap to change lanes in order to stay on its route. When this time is reached the vehicle is taken out of the network (diffusion) and a warning message will be written to the error file denoting the time and location of the removal.

Min. Headway (front/rear)

This Parameter defines the minimum distance to the vehicle in front that must be available for a lane change in standstill condition.

To slower lane if collision time

This parameter is used only if Lane Change Behavior is set to Slow Lane Rule. It describes the minimum time headway towards the next vehicle on the slow lane so that a vehicle on the fast lane changes to the slower lane.

Safety distance reduction factor:

During lane changes the reduction factor is regarded, which takes effect for the safety distance of the trailing vehicle in the new lane for the decision whether to change lanes or not, the own safety distance during a lane change, and the distance to the leading (slower) lane changing vehicle during any lane change, the resulting shorter safety distance is calculated as follows: original safety distance x reduction factor. The default factor of 0.6 reduces the safety distance by 40%. After the lane change, the original safety distance is regarded again.

Maximum deceleration for cooperative braking:

Defines the maximum deceleration the vehicle would use in case of cooperative braking thus allowing a lane changing vehicle to change into its own lane. Cooperative braking uses up to 50% of the desired deceleration until the leading vehicle starts changing lanes, Between 50% of the desired deceleration and this user-defined Maximum deceleration.

Typically, deceleration during lane changes will be significantly lower than the Maximum deceleration, since a lane changing leading vehicle will not expect an extremely high deceleration of the trailing vehicle.

Advanced merging:

This option is checked by default in the driving parameter sets in newly created networks, but not in existing versions of input files which have been created with previous Vissim versions. The current option setting affects any necessary lane change towards the next connector along the vehicle's route. If this option is checked, this will allow more vehicles to change lanes earlier; thus, the capacity will increase and the probability of standing vehicles waiting for a lane change will be reduced.

Cooperative lane change:

If vehicle A observes that a leading vehicle B on the adjacent lane wants to change to the (A) lane, then vehicle A will try to change lanes itself to lane (B) in order to make room for B.

Vehicle A behaves as if it had to change lanes for a connector far in the distance, accepting only the base values for necessary lane changes (Accepted deceleration) for its own deceleration and for the trailing vehicle C on the new lane.

Vehicle A does not change cooperatively to a lane which is less suited for its own route, and it does not change lanes cooperatively if vehicle B is more than 10.80 km/h (=3 m/s) faster or if the collision time would exceed 10 seconds with the speed of vehicle A increased by 10.80 km/h. Optionally, user-defined values can be regarded instead for these two parameters.

Maximum speed difference in [m/s]:

If option Cooperative lane change has been checked, the user-defined maximum speed difference value is taken into account.

Maximum collision time in [simulation seconds]:

If option Cooperative lane change has been checked, the user-defined maximum collision time value is taken into account.

Lateral correction of rear end position:

For a lane change that takes place at a lower speed than specified in the Maximum speed box, the vehicle's end moves laterally and the vehicle is parallel to the middle of the lane at the end of the lane change.

Maximum speed:

Speed up to which the correction of the rear end position should take place. Default value 3km/h.

Active during time period from:

Time after the start of the lane change at which the lateral movement of the rear end position should start, default value 1.0 s. Time after the start of the lane change at which the lateral movement of the rear end position should end. The value includes 3 s for the lane change of the front end, default value 10.0.

There are always questions about acceptable ranges of the car following and lane changing parameters. The objective of this training is not to suggest a prescriptive solution but to introduce some accredited references which suggest ranges for these values. Here are some of the references in this regard:

8 Model Calibration Tactics

After the model's geometry and demand have been created a certain amount of calibration might be required. This section will be diving a bit deeper into how a few of the parameters affect the simulation.

8.1 Weaving Sections

In this section we will look at modeling custom following and lane change behaviors for a freeway weaving section. In these areas drivers tend to change their behaviors; they often become more aggressive and more attentive.

To emulate weaving behaviors Vissim modelers will create a unique driving behavior and adjust some key parameters. This driving behavior will only be applied to the weaving sections of the network using Link Behavior Types.

8.1.1 Observed Vehicles (Following Tab)

The default setting in the freeway driving behavior is 2. This means at any particular point in time a Vissim vehicle is only tracking the two closest objects to it; typically the vehicle directly in front and then one other.

During weaving sections, with increased activity comes a need to track more vehicles at a given time. Therefore we will increase the number of observed vehicles so Vissim vehicles will track more activity.

8.1.2 Cooperative Lane Change (Lane Change Tab)

By default this is not active; meaning if a vehicle on the main line sees a merging vehicle, it will not attempt to provide space by changing lanes. Once this is checked we will see more vehicles moving over to allow merging vehicles to make lane changes.

This is a key calibration for controlling how congestion is spread laterally to the left most lanes in a weaving section:

> Higher values for Max speed difference means increased congestion in the left lanes.
>
> Lower values will see speeds i-n the left lanes closer to free-flow.

8.1.3 Safety Distance Reduction Factor (Lane Change)

Remember:

Safety Distance = CC0 + CC1 * speed

The reduction factor is a constant multiplier:

Safety Distance (during lane changes) = r * (CC0 + CC1 * speed)

This means that the safety distance reduction factor has a direct correlation to the aggressiveness of the vehicles during lane changes.

Values less than 1.0 make drivers more aggressive during lane changes.

Values greater than 1.0 will make drivers more conservative during lane changes.

A value of 1.0 means that drivers are neither more aggressive or more conservative.

8.1.4 Activity Lesson 8-1 "Driving Behavior and Link Capacity"

Objective:

This activity helps demonstrate how we might calibrate a weaving section's driving behavior and measure capacity in Vissim.

It is important to note that Capacity is an output in Vissim rather than an input.

Objects Used:

- Driving Behaviors
- Link Behavior Types
- Link Segment Results

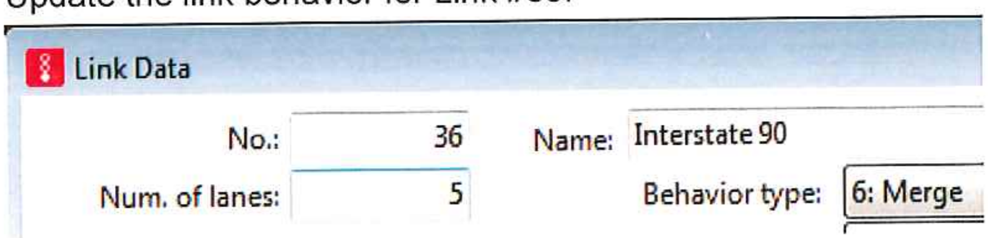
Procedure:

1. Open the file "8-1.inpx"
2. Save as a new file
3. Complete the task below

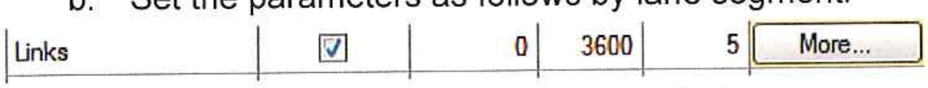
Task:

1. Run a simulation. Notice the merging behavior on link 36.
   The default driver behavior parameters are not allowing for aggressive enough merging behavior to accommodate the high merging volumes of this example.

2. Stop the Simulation.
3. Modify the Driver Behavior parameters
    a. Open **Base Data →Driving Behavior**
    b. Right-Click on #3 "Freeway".
    c. Via the context menu **duplicate** the parameter set and name the new set "**Merge**."
4. Make the following parameter changes to the Merge parameter set:
    - CC1 = 1.2 +/- 0.0
    - CC2 = 20
    - Trailing Vehicle -1 ft/s^2 per distance = 100 ft
    - Waiting time before diffusion = 99999
    - Safety distance reduction factor: 0.3
    - Check cooperate lane change
5. Create a new link behavior type
    a. Open **Base Data→Link Behavior types**
    b. Create a new link behavior type called Merge.
    c. Update the default driver behavior to the newly created driver behavior parameter set Merge.
6. Update the link behavior for Link #36.



7. Run the simulation and observe the changes in operation.
8. In the Other tab and activate the "Link Evaluation", make the segment length 600 ft.
9. Use Link Evaluation output to create a speed-flow curve for this segment to evaluate the saturation flow.
    a. Select Evaluation→Configuration
    b. Set the parameters as follows by lane segment.



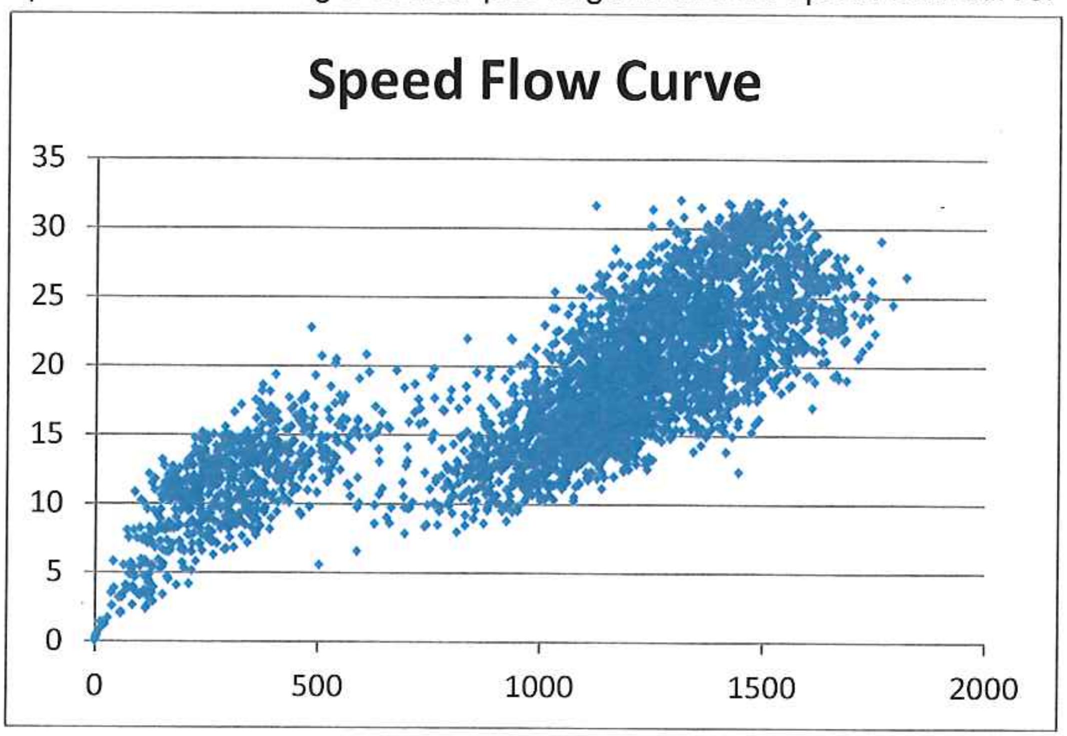
10. Run a simulation to generate the results attributes.
11. Review the results

a. Go to **Evaluation→Results Lists→Link Segments**. The list table is already configured to display the volume and speed result attributes.

b. Copy the data to the clipboard.

12. Open Excel, then paste the results list using the Paste→Use text Import Wizard:

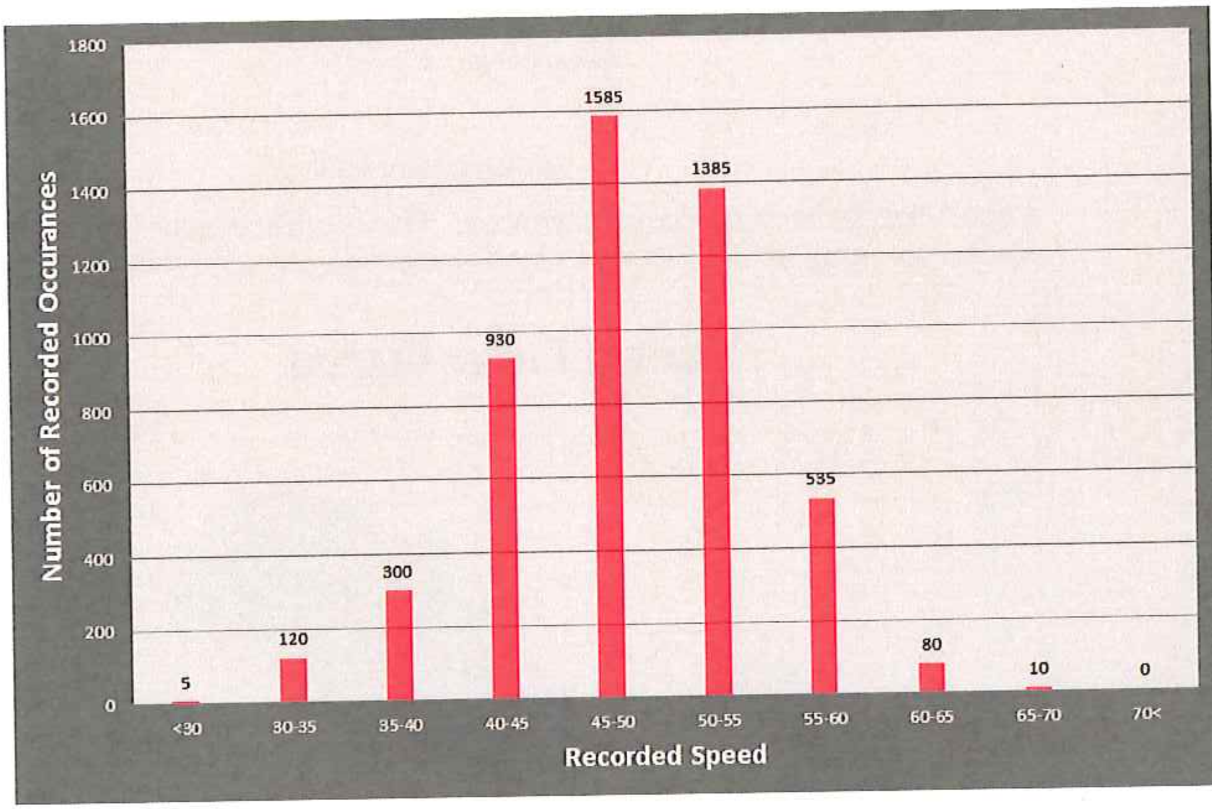
Import the table semi-colon delimited. Then in Excel plot the volume and speed columns using a scatter plot to generate the speed flow curve.



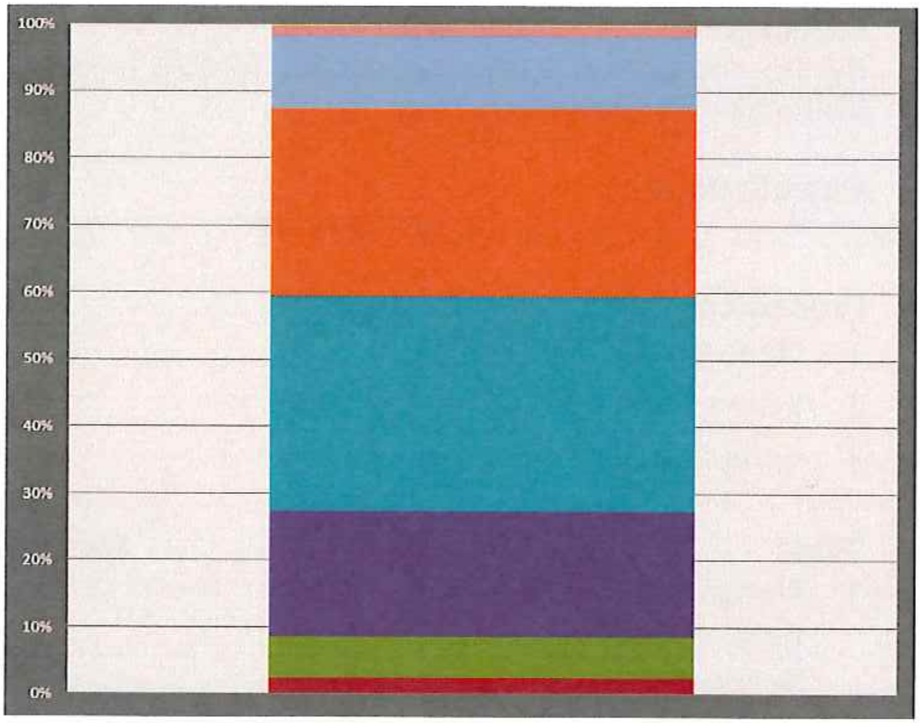
8.2 Speed Profiles

We have already discussed creating a basic speed distribution with an 85th percentile speed. This type of distribution will suffice for many model types. However, in freeway models especially, accurate speed representation plays an important role in the overall results. Therefore a more refined speed profile will be necessary.

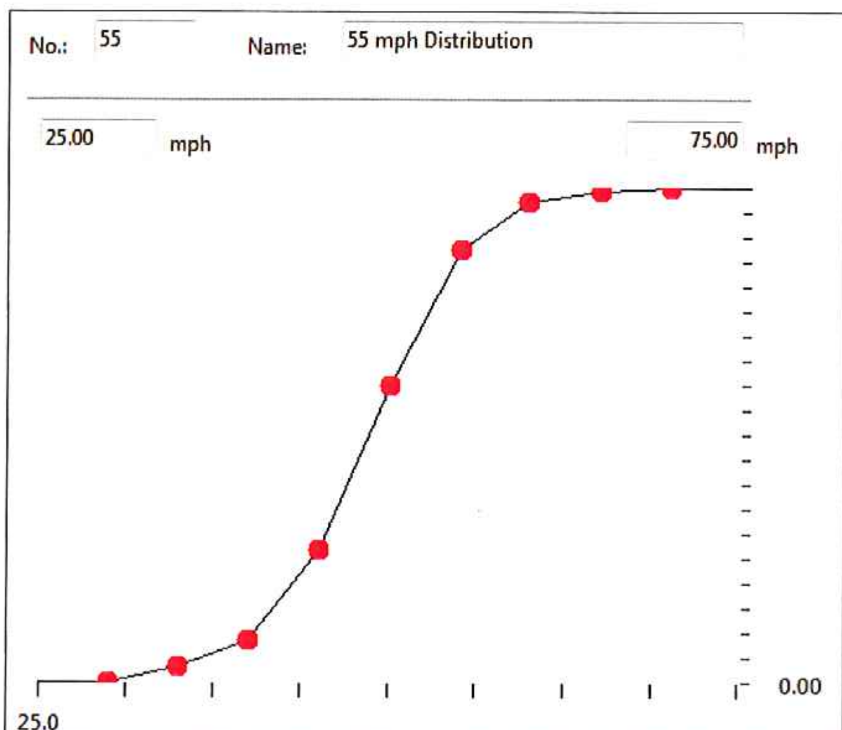
1. The first task will be to gather speed data. This can be done in a number of ways and will vary from study to study.
2. Once the data is collected and organized you will need to create a speed profile.



3. Once you have the speed profile, gather the profile data into a Cumulative Speed Distribution.



4. From the Cumulative Speed Distribution you can create the Desired Speed Distribution



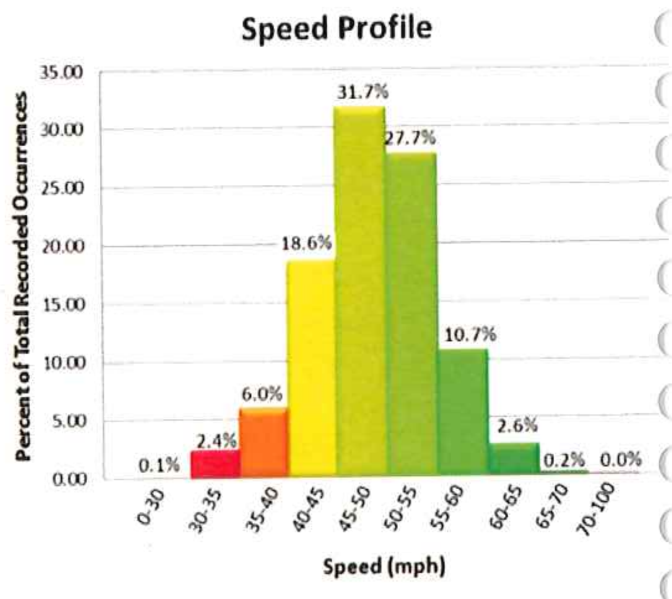
8.2.1 Activity Lesson 8-2 "Creating a Speed Profile"

Objective:
By the end of this activity we should be able to create a refined speed distribution from a speed profile.

Objects Used:
- Desired Speed Distributions

Procedure:
1. Open the file "8-2.inpx"
2. Save as a new file
3. Complete the task below

Task:



1. Using the Data shown here form a cumulative speed distribution
2. From the cumulative Speed Distribution create a desired speed distribution.
   a. Open the Base Data menu
   b. Select Distributions →Desired Speed
   c. Press the + button to create a new distribution
   d. Set the min to 30 mph
   e. Set the max to 70 mph
   f. Create intermediate points for each 5 mph threshold.
3. Assign the new speed distribution to the eastbound traffic.
4. Run a simulation and compare the average speeds of the eastbound traffic to those of the westbound traffic.

8.3 Conflict Area Gap Acceptance

Gap acceptance in Vissim can be obscure because many users are looking for a critical gap entry field. For conflict areas Vissim does not have "critical gap".

At a crossing conflict Vissim uses Front Gap and Rear Gap both with defaults of 0.5s.

The resulting "critical gap" at this conflict is the summation of the front and rear gaps in addition to the amount of time it takes to cross the intersection (dependent on the vehicle type's acceleration model).

For example:

Say it takes a passenger car 2.25 seconds to clear a conflict from a stopped position at a crossing conflict. The conflict area is configured to use the default front gap and rear gap. In this case:

Critical gap = front gap + travel time + rear gap

OR

Critical Gap = 0.5 + 2.25 + 0.5 = 3.25 seconds

We can adjust the critical gap acceptance by adjusting the front and rear gap; higher values directly increase the critical gap and lower values directly decrease the critical gap.

In other words, higher values create more conservative drivers at this conflict and lower values create more aggressive drivers at that conflict.

8.3.1 Activity Lesson 8-3 "Calibrating a Conflict Area"

Objective:

By the end of this activity we should be able to adjust the conflict area attributes to calibrate gap acceptance.

Objects Used:

- Conflict areas

Procedure:

1. Open the file "8-3.inpx"
2. Save as a new file
3. Complete the task below

Task:

1. Test the Default Values.
   a. Run a simulation with the default values
   b. Compare the results to the HCM curve.
2. Test a more aggressive Safety Distance Factor
   a. Adjust the Safety Distance Factor to 1.0
   b. Run a simulation.
   c. Compare the results to the HCM curve.
3. Test a more aggressive Front Gap
   a. Adjust the Front Gap to 0.25
   b. Run a simulation.
   c. Compare the results to the HCM curve.
4. Further adjust the Safety Distance Factor and Front Gap to calibrate the conflict area to the HCM trend line.

8.4 Volumes By Time Interval

Previously we learned how to create a vehicle input that generates constant demand. However demand is rarely constant. In this section we will learn how to take a demand curve and apply it to our vehicle inputs.

1. Gather our demand data.
2. Determine the resolution of the data; how often will the numbers change? Many modelers use either 60 or 15 minute intervals. Some go as far as to create 5 minute intervals. We can also use a combination (non-uniform intervals) where some are 15 minutes long and others are 20 or 10.
3. Create the time intervals in Vissim
    a. Open the Base Data Menu
    b. Select Time intervals to open the time intervals list
    c. In the list use the pull-down menu to select Vehicle Inputs
    d. Use the + button to add new intervals
    e. Define each interval, in simulation seconds
4. Open the Vehicle Inputs List
5. In the list open the attribute selection window
6. Add the volume and composition time intervals to the list
7. In the List define the Volumes (veh/hr) for each time interval. Vissim will automatically scale the input volumes.

For example we have a 15-minute interval and define a volume of 3000. That is 3000 veh/hr so Vissim will input roughly 750 vehicles in that time interval

8.4.1 Activity Lesson 8-4 "Input Volumes by Time Interval"

Objective:
By the end of this activity we should be able to create a refined demand profile based on 15-minute volume data

Objects Used:
- Time intervals
- Vehicle Inputs

Procedure:
1. Open the file "8-4.inpx"
2. Save as a new file
3. Complete the task below

Task:
1. Create volume time intervals for each 15-minute period.
    a. Open the Base Data menu
    b. Select Time Intervals
    c. Using the pull-down list select Vehicle Inputs
    d. Create four 900 second intervals
2. Adjust the volumes on the Vehicle inputs.
    a. Open the Vehicle Inputs List
    b. Make sure the list shows all time intervals
        i. Click the select attributes button (🔧)
        ii. In the list on the left select Volumes
        iii. Press the ➡ button to add the attributes to the list on the right
        iv. Click OK
    c. We may need to unlock the subsequent time intervals
        i. Using the pull-down menu select the Vehicle Inputs By Time Interval sub-list.
        ii. Select all inputs in the list on the left
        iii. Uncheck any row that has the box Continuous checked
    d. Copy the following table into the volume entries.

Input	0-15	15-30	30-45	45-60
WB On-Ramp	1000	1000	1000	1000
WB Main Line	3000	3000	3000	3000
EB On-Ramp	750	1000	1250	1000
EB Main Line	2250	3000	3750	3000

3. Run a simulation

PTV VISSIM

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