VISSIM 4.10
User Manual

PTV Planung Transport Verkehr AG
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Important Notice to Users of Previous VISSIM Versions

Versions Previous to 4.10

Lists displayed in some new input windows now provide a context menu (right mouse-button). This functionality replaces some buttons provided in previous versions. Example: Delete/New Signal control.

In the toolbar, the Simulation control buttons are displayed by default. The general run control buttons provided for Simulation, Test or Animation (as in previous versions) can still be activated by the user, if necessary.

The Network evaluation now also includes vehicles not having left the network yet at the end of the interval.

Versions Previous to 4.00

With version 4.00, VISSIM introduces a new quality of application user interaction. Among the new features are

► Customizable menus, toolbars and shortcuts
► Resizable dialog windows
► Free placement of toolbars and sub-menus

The main menu has been completely restructured to provide a more intuitive approach and placement of commands. Although for most of our customers this might involve some inconvenience at first, we trust that after a short adaptation period you will truly like the new structure and features that come along with it.

VISSIM 4.0 also offers a COM interface (optional module) with a certain set of commands. The command set will be further enhanced in future versions.

Other new features include multiple background image formats (also vector graphics) and the option to move most network elements not only within the same link/connector but also to any other link/connector.

Versions Previous to 3.70

The 3D model and color assignment for a vehicle type is done through distributions (see sections 5.2.4 and 5.2.5 for details). Thus definition of vehicle model appearance is to be done in the distribution rather than in the Vehicle Type window.
Important Notice to Users of Previous VISSIM Versions

New two column toolbar: All toolbar options are now shown at all times (no more secondary toolbars).

The three network editor modes “Create links”, “Edit links” and “Connectors” are combined into one mode “Links and Connectors”. Thus some link and connector handling commands have slightly changed (see sections 6.3.1 and 6.3.2 for details).

Partial routes now affect transit routes (lines) as well. A rerouting of transit vehicles can be avoided by restricting the vehicle classes of the routing decision (see section 6.4.1 for details).

More hotkeys: The range of keyboard shortcuts (hotkeys) has been greatly expanded (see section 3.2.2 for details).

As the car following and lane change models have been improved (especially for merging areas) the simulation results may be different when comparing with an earlier version.

Due to new program features a network file saved with version 3.70 cannot be read in any older version of VISSIM.

**Dynamic Assignment**: Parking lots cannot be assigned to more than one zone any more. A parking lot from an old VISSIM network file that is assigned to more than one zone is converted to several parking lots assigned to one zone each.

**North American licenses**: Optional module “NEMA” available which includes an interface to the standard NEMA controller type (see section 6.7.3.3). Optional TEAPAC and SYNCHRO import module available (see section 6.2.1.2).

**Versions Previous to 3.60**

For users of Dynamic Assignment: The file format and interpretation of the time in matrix files (*.FMA) has changed in order to make it fully compatible with VISUM:

- A time value of 1.50 is now interpreted as 1 hour 50 mins rather than 1 hour 30 mins (1.5 hrs).
- The time stated in the matrix is now the **absolute** time of day (not relative to the simulation start). For more information please refer to chapter 11.4.
- The matrix scaling factor is now used in VISSIM.

With the introduction of link types, network files from versions prior to VISSIM 3.60 will be transformed to replicate the existing driving behavior and link features using link types. On rare occasions where a single vehicles mix contains cycles and pedestrians the link type might not be identified correctly by VISSIM. Thus traffic on those links might appear different as from versions prior to 3.60.
Important Notice to Users of Previous VISSIM Versions

Versions Previous to 3.50

VISSIM from version 3.5 incorporates a single model to handle vehicle data for both 2D and 3D representation. As 3D elements have a static length the use of length distributions is impossible and thus is not supported any more. If network files of older VISSIM versions are to be loaded in the current version, each vehicle type will be assigned a length that is computed as the average of the previous length distribution that has been assigned to it. In order to reflect the behavior of length distributions a vehicle model distribution may be used.

Furthermore the format of the 3D vehicle models has been improved in order to minimize loading times. Thus the V3D format is now used for all 3D objects. There is a selection of vehicles in V3D format that is included with the installation of VISSIM - at least one for each standard vehicle type. Any existing 3DS files can be converted and adapted using the optional module “V3DM” (VISSIM 3D Modeler) which is available from PTV AG.

In order to make VISSIM use any 3D vehicles during a simulation run when using a network file of an older version, a vehicle model distribution needs to be selected for each vehicle type. The new 3D models are not assigned to existing vehicle types automatically as it would automatically overrule the dimensions of any 2D models and thus would result in great differences compared to version 3.0. Instead, vehicle “blocks” that use exactly the dimensions of the 2D-model will be created and shown during a 3D visualization.

If a 3D model is assigned to a vehicle type, the dimensions (e.g. length) of the vehicle type will be adapted according to the 3D model and thus changes the 2D representation also.

As the file format for animation files (*.ANI) has changed, animation files generated with earlier versions of VISSIM can not be loaded in VISSIM version 3.50 or higher.
VISSIM Quick Start Checklist

For those users who are constructing their first network this is a checklist intended to assist in building the network in the most efficient order.

1. Open VISSIM and create a new file
2. Create/edit speed profiles (see section 5.2.1)
3. Check/edit vehicle type characteristics (see section 5.3.1)
4. Create traffic compositions (see section 5.4)
5. Create BMP format background image (see section 4.4)
6. Open, scale and save a scaled background image. Note: scaling the background map accurately is extremely important (see section 4.4.3)
7. Draw links and connectors for roadways tracks and crosswalks (see section 6.3.1)
8. Enter traffic volumes at network endpoints and pedestrian volumes on crosswalks (see section 6.4.2)
9. Enter routing decision points and associated routes (see section 6.4.1)
10. Enter speed changes (see sections 6.3.3.1 and 6.3.3.2)
11. Enter priority rules for non-signalized intersections (see section 6.6.1)
12. Enter stop signs for non-signalized intersections (see section 6.6.2)
13. Create Signal Controls with signal groups, enter timing for fixed time or choose a different controller for vehicle actuated signals (e.g. VAP or NEMA, see section 6.7)
14. Enter signal heads in network (see section 6.7.1)
15. Enter detectors for intersections controlled by traffic actuated signal control (see section 6.7.2)
16. Enter stop signs for right turns on red (see section 6.6.2)
17. Enter priority rules for permissive lefts, right turns on red, pedestrian crosswalks (see section 6.6.1)
18. Create dwell time distributions and place transit stops in network (see sections 5.2.6 and 6.5.1)
19. Create transit lines (see section 6.5.2)
20. Setup for output files, e.g. travel time segments, delay segments, queue counters, data collection points (see chapter 10)
1 Introduction
1.1 What is VISSIM?

VISSIM is a microscopic, time step and behavior based simulation model developed to model urban traffic and public transit operations. The program can analyze traffic and transit operations under constraints such as lane configuration, traffic composition, traffic signals, transit stops, etc., thus making it a useful tool for the evaluation of various alternatives based on transportation engineering and planning measures of effectiveness.

VISSIM can be applied as a useful tool in a variety of transportation problem settings. The following list gives a selective overview of previous applications of VISSIM:

► Development, evaluation and fine-tuning of transit signal priority logic.

► VISSIM can use various types of signal control logic. In addition to the built-in fixed-time functionality there are several vehicle actuated signal controls identical to signal control software packages installed in the field. In VISSIM some of them are built-in, some can be docked using add-ons and others can be simulated through the external signal state generator (VAP) that allows the design of user-defined signal control logic. Thus virtually every signal control (incl. SCATS, SCOOT) can be modeled and simulated within VISSIM if either the controller details are available or there is a direct VISSIM interface available (e.g. VS-PLUS, TEAPAC).

► VISSIM is used to evaluate and optimize (interface to Signal97/TEAPAC) traffic operations in a combined network of coordinated and actuated traffic signals.

► VISSIM is used to evaluate the feasibility and impact of integrating light rail into urban street networks.

► VISSIM is applied to the analysis of slow speed weaving and merging areas.

► VISSIM allows for an easy comparison of design alternatives including signalized and stop sign controlled intersections, roundabouts and grade separated interchanges.

► Capacity and operations analyses of complex station layouts for light rail and bus systems have been analyzed with VISSIM.

► Preferential treatment solutions for buses (e.g. queue jumps, curb extensions, bus-only lanes) have been evaluated with VISSIM.

► With its built-in Dynamic Assignment model, VISSIM can answer route choice dependent questions such as the impacts of variable message signs or the potential for traffic diversion into neighborhoods for networks up to the size of medium sized cities.
1.2 Traffic Simulation Model

The simulation package VISSIM consists internally of two different programs, exchanging detector calls and signal status through an interface. The simulation generates an online visualization of traffic operations and offline the generation of output files gathering statistical data such as travel times and queue lengths.

The traffic simulator is a microscopic traffic flow simulation model including car following and lane change logic. The signal state generator is a signal control software polling detector information from the traffic simulator on a discrete time step basis (as small as one tenth of a second). It then determines the signal status for the following second and returns this information to the traffic simulator.

![Communication between traffic simulator and signal state generator](Communication between traffic simulator and signal state generator)
Essential to the accuracy of a traffic simulation model is the quality of the actual modeling of vehicles; e.g. the methodology of moving vehicles through the network. In contrast to less complex models using constant speeds and deterministic car following logic, VISSIM uses the psycho-physical driver behavior model developed by WIEDEMANN (1974). The basic concept of this model is that the driver of a faster moving vehicle starts to decelerate as he reaches his individual perception threshold to a slower moving vehicle. Since he cannot exactly determine the speed of that vehicle, his speed will fall below that vehicle’s speed until he starts to slightly accelerate again after reaching another perception threshold. This results in an iterative process of acceleration and deceleration.

Stochastic distributions of speed and spacing thresholds replicate individual driver behavior characteristics. The model has been calibrated through multiple field measurements at the Technical University of Karlsruhe, Germany. Periodical field measurements and their resulting updates of model parameters ensure that changes in driver behavior and vehicle improvements are accounted for.

VISSIM’s traffic simulator not only allows drivers on multiple lane roadways to yield for two preceding vehicles, but also two neighboring vehicles on the adjacent travel lanes. Furthermore, approaching a traffic signal results in a higher alertness for drivers at a distance of 100 meters in front of the stop line.

VISSIM simulates traffic flow by moving “driver-vehicle-units” through a network. Every driver with his specific behavior characteristics is assigned to a specific vehicle. As a consequence, the driver behavior corresponds to the
technical capabilities of his vehicle. Attributes characterizing each driver-vehicle-unit can be discriminated into three categories:

- **Technical specifications of the vehicle**
  - Length
  - Maximum speed
  - Potential acceleration
  - Actual position within the network
  - Actual speed and acceleration

- **Behavior of driver-vehicle-unit**
  - Psycho-physical sensitivity thresholds of the driver (ability to estimate, aggressiveness)
  - Memory of driver
  - Acceleration based on current speed and driver’s desired speed

- **Interdependence of driver-vehicle-units**
  - Reference to leading and following vehicles on own and adjacent travel lanes
  - Reference to current link and next intersection
  - Reference to next traffic signal
2.1 System Requirements

As a 32-bit application VISSIM runs under Windows 98 SE, Windows ME and Windows NT 4.0/2000/XP. The performance of a VISSIM simulation is mainly dependent on the number of vehicles simultaneously contained in the network and on the number and type of signal controlled junctions included. Thus using identical VISSIM input files, a faster computer will always lead to a faster simulation. For very large applications (like a network of at least half a city with more than 50 signal controlled junctions at least 1 GB of RAM is recommended).

To provide an optimal desktop layout when multiple windows are displayed simultaneously it is beneficial to use the highest resolution supported by the hardware configuration. At a minimum, a resolution of 1024x768 pixel should be used. However, we recommend a resolution of 1280x1024 (or 1280x960) pixel on a 17” and 1600x1200 pixel on a 21” monitor for convenience. In 3D mode, simulation speed may be significantly lower by using higher screen resolutions. In order to increase 3D visualization speed it may be useful to reduce the screen resolution temporarily.

For 3D visualization of a simulation, VISSIM uses Open-GL™ routines. Thus a graphics adapter with Open-GL™-support takes a lot of the workload and significantly increases visualization speed. We recommend graphics adapters with Nvidia chipset.

We strongly recommend that the latest driver update of your graphics adapter is used since simply updating the driver can solve most problems that occur with the 3D visualization. For most graphics adapters a driver update can be obtained via download from the Internet.

In case of 3D graphics problems, please ensure that you’ve installed the latest graphics driver on your computer before contacting the VISSIM hotline.
2.2 Installation with Windows 98, ME, NT, 2000 and XP

In order for the installation to be successful please ensure that the **Microsoft .NET Framework**, Version 1.1 (or higher) is installed on your PC.

To install VISSIM, insert the CD in your CD-ROM drive. If the installation procedure does not start automatically, use **START - RUN...** (or the Windows explorer) to start the installation program **SETUP.EXE**. Then follow the instructions on the screen.

If you are installing VISSIM with Windows NT, 2000 or XP you must be logged in with administrator rights.
2.3 Distributable VISSIM viewer

Contained on the VISSIM installation CD there is also a restricted VISSIM version (= VISSIM Demo version without demo examples) that may be handed out to your clients along with VISSIM project data. The main restrictions of this version are:

► Network files cannot be saved
► No evaluation files can be generated
► Simulation runs are possible only for the first 900s. This period cannot be extended in order to show longer simulation runs. If it is necessary to show vehicle visualization beyond the first 900s, animation files (*.ANI) can be used. For animation files there is no time limit.
► The COM interface cannot be used

For instructions on how to create a CD that contains the distributable VISSIM version along with project data please refer to the file README.TXT that is contained in the directory DEMO directly on the VISSIM installation CD.
3 Program Handling
3.1 VISSIM Desktop

The desktop of VISSIM is divided into the following areas:

- **Header**: Shows program title, version and input file name
- **Menu**: Access by mouse click or keyboard shortcut
  - Indicates a pull-out menu
  - Indicates that a window opens
  
The last four network files accessed by VISSIM are listed in the File menu ("most recently used files"). Selecting any one of these files opens it.
- **Toolbars**: Control network editor and simulation functions (see dedicated section below)
- **Status bar**: Shows editing instructions and simulation status (see dedicated section below)
- **Scrollbars**: Horizontal and vertical scrolling of network viewing area
- **Logo**: Depending on the location of the sale of the software license a logo will appear in the upper right hand corner of the VISSIM network.
  
  You may insert a custom logo in the lower right corner of VISSIM by naming it CUSTOM.BMP and placing it in the same directory as VISSIM.EXE.
3.1.1 Customizing Menus

Menu items can be re-arranged, inserted or removed. Also all menu commands are available to be placed inside any of the toolbars.

If you customize VISSIM menus it might be difficult for you to locate menu commands that are referenced in the manual or by the hotline.

To tear away a copy of a sub menu from their original location, drag the menu at the “grip” section (between the title and the commands) and pull it to the desired location.

The sub menu is shown as a floating toolbar.

Now you can also dock this menu to any one of the borders of the main VISSIM menu.

To edit the menu content:

1. Right click inside the menu area. A context menu appears.
2. Choose CUSTOMIZE...
3. While in Customize mode you may
   - **Add** a menu command from the Commands list:
     In the [COMMANDS] tab, choose the desired command and drag it with the mouse to the desired position inside an existing menu
   - **Move** a menu command by dragging it with the mouse to the desired position
   - **Remove** a command from a menu by dragging it outside any menu
   - **Reset** a menu to its VISSIM default:
     Right-click on that menu and choose RESET from the context menu.
   - **Reset** the entire menu structure to its VISSIM default: In the [TOOLBARS] tab, press RESET... and confirm with Ok.

3.1.2 Toolbars

VISSIM offers toolbars that can be docked to any position along the four borders of the main VISSIM window. Toolbars can also be taken out of the toolbar area and placed as a floating window. To hide or show a certain toolbar, right click inside the toolbar area and choose the desired toolbar from the context menu.
Depending on the current edit and graphics mode, not all of the buttons might be available. Buttons that are disabled are shown colorless.

### 3.1.2.1 Customizing Toolbars

Buttons of toolbars can be re-arranged, inserted or removed. New toolbars can be created. Also menu commands are available to be placed inside any of the toolbars.

If you customize VISSIM toolbars it might be difficult for you to locate buttons that are referenced in the manual or by the hotline.

To edit the toolbar content:

1. Right click inside the toolbar area. A context menu appears.
2. Choose **CUSTOMIZE**...
3. In the [TOOLBARS] tab you may
   - **Enable/Disable** a toolbar by toggling the checkbox in the list of **Toolbars**
   - **Create** a new toolbar by pressing **NEW**... Choose the desired name and position of the new toolbar and confirm with **Ok**
   - **Rename/Delete** a custom toolbar by pressing the corresponding buttons (the standard VISSIM toolbars cannot be removed or deleted)
   - **Reset** your changes to VISSIM defaults by pressing **RESET**... and confirming with **Ok**
4. In the [COMMANDS] tab you may
   - **Add** a menu command to a toolbar: Choose the desired command and drag it with the mouse to the desired position inside an existing toolbar
   - **Move** a button/command from one toolbar to another by dragging it to the desired position
   - **Remove** a button/command from a toolbar by dragging it outside any toolbar.

### 3.1.2.2 Default Toolbars

**FILE**

- **Create new VISSIM network**
- **Open existing VISSIM network**
### Selection

Defines edit mode in combination with the selected network element

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard selection mode</td>
<td></td>
</tr>
<tr>
<td>Multi-select mode</td>
<td>(see description in the section below)</td>
</tr>
<tr>
<td>Label position mode</td>
<td>Any labels of network elements (e.g., signal head names) can be relocated if at the same time the edit mode of that network element is active.</td>
</tr>
<tr>
<td>If several links/connectors are located at the mouse click position this button can be used to browse through all these links/connectors.</td>
<td>Tab</td>
</tr>
</tbody>
</table>

### Run Control

For all the run modes (Simulation, Animation, Test) there is a dedicated toolbar available. In addition to those, there is one toolbar which controls the most recently used run mode.

By default, all dedicated toolbars are hidden and only the general run mode toolbar is visible. In the section left to the buttons the current run mode is stated: To change to a different mode, the respective command needs to be selected in the main menu

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
<th>Shortcut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous simulation, animation or test</td>
<td>F5</td>
<td></td>
</tr>
<tr>
<td>Single step simulation, animation or test</td>
<td>F6</td>
<td></td>
</tr>
<tr>
<td>Stop simulation, animation or test</td>
<td>Esc</td>
<td></td>
</tr>
<tr>
<td>Continuous backwards (animation only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single step backwards (animation only)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Navigation

Commands for changing the observer position within the network

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
<th>Shortcut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Show entire network</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic zoom (left click), Previous view (right click)</td>
<td></td>
<td>Page Up, Page Down</td>
</tr>
</tbody>
</table>
### 3 Program Handling

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Zoom" /></td>
<td>Zoom by factor</td>
</tr>
<tr>
<td><img src="image" alt="Move" /></td>
<td>Move network (3D only, shortcuts also in 2D)</td>
</tr>
<tr>
<td><img src="image" alt="Rotate" /></td>
<td>Rotate network (3D only)</td>
</tr>
<tr>
<td><img src="image" alt="Fly" /></td>
<td>Fly through network (3D only)</td>
</tr>
</tbody>
</table>

While one of the following buttons is pressed, a new elements of the corresponding type can be created or existing items edited. For details on each element please refer to chapter 6 if not stated otherwise.

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Links" /></td>
<td>Links and connectors</td>
</tr>
<tr>
<td><img src="image" alt="Pavement" /></td>
<td>Pavement Markers (Graphics only)</td>
</tr>
<tr>
<td><img src="image" alt="Vehicle" /></td>
<td>Vehicle inputs</td>
</tr>
<tr>
<td><img src="image" alt="Static routes" /></td>
<td>Static routes (to direct traffic within the network)</td>
</tr>
<tr>
<td><img src="image" alt="Desired speed" /></td>
<td>Desired speed decisions (permanent change of vehicle speed)</td>
</tr>
<tr>
<td><img src="image" alt="Reduced speed" /></td>
<td>Reduced speed areas (temporary change of vehicle speed)</td>
</tr>
<tr>
<td><img src="image" alt="Priority rules" /></td>
<td>Priority rules (e.g. for non-signalized intersections)</td>
</tr>
<tr>
<td><img src="image" alt="Stop" /></td>
<td>Stop signs</td>
</tr>
<tr>
<td><img src="image" alt="Signal heads" /></td>
<td>Signal heads</td>
</tr>
<tr>
<td><img src="image" alt="Signal detectors" /></td>
<td>Signal detectors</td>
</tr>
<tr>
<td><img src="image" alt="Public transport stops" /></td>
<td>Public transport stops</td>
</tr>
<tr>
<td><img src="image" alt="Public transport lines" /></td>
<td>Public transport lines</td>
</tr>
<tr>
<td><img src="image" alt="Cross section" /></td>
<td>Cross section measurements (see chapter 10)</td>
</tr>
<tr>
<td><img src="image" alt="Travel time" /></td>
<td>Travel time and delay measurements (see chapter 10)</td>
</tr>
<tr>
<td><img src="image" alt="Queue counters" /></td>
<td>Queue counters (see chapter 10)</td>
</tr>
<tr>
<td><img src="image" alt="Parking lots" /></td>
<td>Parking lots / zone connectors (see chapter 11)</td>
</tr>
<tr>
<td><img src="image" alt="Nodes" /></td>
<td>Nodes (some VISSIM licenses also allow for node evaluation)</td>
</tr>
</tbody>
</table>
3.1.3 Status bar

The status bar is divided into three sections. Depending on the current program mode each section displays different data:

**Section 1**  
2D Graphics:
- Current cursor position (x, y coordinates in meters, “world coordinates”)

3D Graphics:
- All modes except flight mode (only if not in any run mode):
  - Current position (x, y, z coordinates in meters) of that part of the network, that is displayed at the center of the VISSIM window at ground level.
- Flight mode: Current position (x, y, z coordinates in meters) of camera.

**Section 2**  
Network editing:
- Number of selected link/connector
- Position within selected link/connector (if mouse is inside selected link)

Simulation:
- Current simulation time and local cycle time

3D Graphics (Flight mode, not during simulation):
- Focal point position (the point the ‘plane’ is aiming for; x, y, z coordinates in meters)

**Section 3**  
Network editing:
- Editing instructions

Network editing (3D-Zoom, Rotate, Pan):
- Current observer position (d, A, C):
  - d = distance (in meters) above level 0.0 m
  - A: angle between XZ-plane and observer
  - C: angle between XY-plane and observer

Simulation:
- Number of vehicles currently in the network
- Speed factor (actual simulation speed compared to real time)
- In brackets: Number of vehicles that could be simulated at real time (displayed only if simulation speed is set to *maximum*)
3.2 Keyboard and Mouse Operation

3.2.1 General behavior

The following information applies to the general philosophy that is widely used for the VISSIM network editor (as far as it is not overruled by standard Windows behavior).

**Mouse click right**

- **Outside** the network: Open a list of all defined elements of the current edit mode.
- **On** a link: Insert a new element.

**Mouse click left**

- **Single click**: Select an existing element.
- **Double click**: Open the associated properties window.

**RETURN**

Corresponds to a mouse click on the highlighted button (usually the Ok button).

**ESC**

Corresponds to a mouse click on the CANCEL button.

**DEL**

Deletes a selected network element

3.2.2 Shortcuts (Hotkeys)

VISSIM offers a selection of default keyboard shortcuts (hotkeys). It is also possible to create your own shortcut for any of the VISSIM menu commands and/or to change the existing shortcut. In order for a shortcut to be executed, the main VISSIM window needs to be active.

If you customize VISSIM shortcuts it might be difficult for you to locate shortcuts that are referenced in the manual or by the hotline.
3.2.2.1 Customizing Shortcuts

1. Right click on the toolbar area.
2. Select CUSTOMIZE... from the context menu. The Customize window opens.
3. Press KEYBOARD... The Customize Keyboard window opens.
4. Out of the list to the left, select a command category. On the right, select the command for which you would like to add a shortcut.
5. Choose the desired shortcut out of the selection list. If the selected shortcut is already assigned to another command, that command is shown below the selection list.
6. Press ASSIGN to confirm your selection. In case the shortcut was already assigned to another command, this assignment is deleted.
7. Close both windows by pressing CLOSE.

3.2.2.2 Default Shortcuts

<p>| CTRL+A   | Toggles between Center Line and Normal link display mode. If display mode Invisible is active, CTRL+A toggles between Center Line and Invisible display mode. |</p>
<table>
<thead>
<tr>
<th>Key Combination</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CTRL+B</strong></td>
<td>Toggles the display of a loaded background graphics</td>
</tr>
<tr>
<td><strong>CTRL+D</strong></td>
<td>Toggles between 2D edit mode and 3D display mode</td>
</tr>
<tr>
<td><strong>CTRL+N</strong></td>
<td>Toggles the display of network elements/labels</td>
</tr>
<tr>
<td><strong>CTRL+Q</strong></td>
<td>Controls the visualization mode (3 states: normal vehicle visualization, alternative link display (if defined), no visualization)</td>
</tr>
<tr>
<td><strong>CTRL+T</strong></td>
<td>Toggles link color (either link type specific or global)</td>
</tr>
<tr>
<td><strong>CTRL+U</strong></td>
<td>Toggles the type of display of the simulation time within the status bar (either seconds or time of day)</td>
</tr>
<tr>
<td><strong>CTRL+V</strong></td>
<td>Toggles the extended vehicle display (see section 4.2.2)</td>
</tr>
<tr>
<td><strong>CTRL+Z</strong></td>
<td>Dynamic Assignment only (while in “Parking Lot” mode): Shows the centroids of all parking lots that belong to the same zone. See section 11.7.2 for details</td>
</tr>
<tr>
<td><strong>TAB</strong></td>
<td>Moves to next link or connector layer (when clicking at a position with at least two links/connectors)</td>
</tr>
<tr>
<td><strong>F5</strong></td>
<td>Simulation <strong>Continuous</strong>: Starts/continues continuous simulation</td>
</tr>
<tr>
<td><strong>F6</strong></td>
<td>Simulation <strong>Step</strong>: Executes next simulation time step</td>
</tr>
<tr>
<td><strong>Esc</strong></td>
<td>Simulation <strong>Stop</strong>: Ends the simulation</td>
</tr>
<tr>
<td><strong>ENTER</strong></td>
<td>(during a simulation run only:) Switch to <strong>continuous</strong> simulation</td>
</tr>
<tr>
<td><strong>SPACE</strong></td>
<td>(during a simulation run only:) Executes next simulation time <strong>step</strong></td>
</tr>
<tr>
<td><strong>+</strong></td>
<td><strong>Increase</strong> simulation speed (depending on computer performance)</td>
</tr>
<tr>
<td><strong>-</strong></td>
<td>Decrease simulation speed</td>
</tr>
<tr>
<td>*<strong>”</strong></td>
<td><strong>Maximum</strong> simulation speed (depending on computer performance)</td>
</tr>
<tr>
<td><strong>/”</strong></td>
<td>(if maximum speed is active:) Back to <strong>last</strong> speed value</td>
</tr>
<tr>
<td><strong>1</strong></td>
<td>Simulation speed <strong>real time</strong> (1.0s)</td>
</tr>
<tr>
<td><strong>HOME</strong></td>
<td>Display entire network</td>
</tr>
<tr>
<td><strong>PAGE UP</strong></td>
<td>Zoom in</td>
</tr>
<tr>
<td><strong>PAGE DOWN</strong></td>
<td>Zoom out</td>
</tr>
<tr>
<td><strong>BACKSPACE</strong></td>
<td>Back to previous view</td>
</tr>
<tr>
<td><strong>↑,↓,←,→</strong></td>
<td>Scrolls the screen size by 1/20 in the selected direction. Holding down <strong>&lt;SHIFT&gt;</strong> increases the scroll portion to ½ of the screen size.</td>
</tr>
</tbody>
</table>
3.3 Selection Modes

The selection mode defines the way and what portion of network elements can be selected for editing.

- In 2D mode, all three selection modes are available.
- In 3D mode, only the standard selection mode is available. This is due to the fact, that all network elements except static 3D objects can only be edited in 2D mode.

3.3.1 Standard- (Single-)select Mode

To select a network element and access its data the corresponding edit mode needs to be active. Except for links and nodes all network elements need to be placed on a link or connector.

To place such an element

- select the desired element edit mode (by clicking on the corresponding toolbar button)
- select the desired link or connector by single left click
- follow the instructions to create a new element of that type

While an element edit mode is active, a single element can also be selected by its number. This is done by selecting the desired element out of the list of all network elements of that type. To open this list

- right click outside the VISSIM network (not clicking on a link or connector)
- or select EDIT – SELECTION LIST...

The element type is displayed in the window title (the example shows a list of all Links & Connectors).

From that list the properties of each network element are available (DATA...) and also the location can be found (ZOOM). In a large network it might be helpful to use the ZOOM FACTOR command after pressing the ZOOM button to see the surrounding area of the selected network element.

3.3.2 Multi-select Mode (2D only)

Currently multi-select mode is available for

- editing certain properties of links and connectors,
- moving active links, connectors and those nodes that are completely located within the selection box,
Program Handling

- deleting active links, connectors and nodes,
- defining active nodes nor node evaluations.

Selection of network elements in Multi-select Mode (defining active network elements):

- Links, connectors and nodes can be added to or removed from the selection (toggled) either
  - by spanning a rectangle around them (using left mouse button) or
  - by clicking on a link/connector (left mouse button)
- Links/connectors can be added to the selection (independent of their previous state) by pressing \textit{SHIFT} while drawing the selection box.
- Links/connectors can be removed from the selection (independent of their previous state) by pressing \textit{CTRL} while drawing the selection box.

Only those links/connectors/nodes that are \textbf{entirely} located within the selection rectangle are affected by the selection. \textbf{Exception:} When moving a multi-selection, all connectors between links that are contained in the multi-selection are moved as well.

- The entire selection can be \textbf{cancelled} by clicking outside the selection while pressing \textit{CTRL}.
- All links/connectors in the selection can be \textbf{moved} by clicking inside the selection.
  - Connectors that connect two selected links are moved together with the corresponding links - even if they are not included in the selection.
  - If \textbf{intermediate points} of a connector should not be moved (along with the start and end points) such a connector needs to be deselected and \textit{CTRL} must be pressed while moving the selection.
- Nodes defined by link segments (exported from VISUM) are not affected by moving links - only the position of labels may change.

**Properties & Options**

The properties of all selected links/connectors can be accessed by right mouse click (for link evaluations, cf. chapter 10.11). The following attributes can be changed (for details please refer to the sections "links" and "connectors" in chapter 6.3):

- link \textit{Type}
- \textit{Gradient}
- \textit{Segment evaluation}
- \textit{Segment length}
- \textit{COST}
- \textit{LANE CLOSURE}
- \textit{CONNECTORS} (see below)
- \textit{Visualisation} (of vehicles)
- \textit{Label}
- **Emergency stop position**
- **Lane Change** position
- Vehicle class closure (for Dynamic Assignment only)
- **Direction:**
  If two or more connectors within the selection have different Direction values then the default is set to “keep value” (i.e. all connectors remain unchanged). To change all connectors to the same value, select the desired Direction.

Drop-down list boxes have an additional entry "Keep Values" if the original values are not identical. If this entry is selected, the old values are kept for all links.

### 3.3.3 Label Mode (2D only)

If any of the labels of network elements are visible (see chapter 4.2.1), these labels can be moved in label mode.

To move a label, the corresponding network element mode needs to be active. E.g., to move the visible label of a signal head, the signal head mode must be active. The position of each label is stored in the VISSIM network file *.INP.
3.4 Command Line Operation

VISSIM can also be controlled from the command line prompt. In order to get results from an input file run in batch mode, the desired evaluations must be specified in the vissim.ini file used by the VISSIM executable. The VISSIM executable uses the VISSIM.INI file in the directory where it is called from. Therefore the VISSIM.INI file you use must reside in the same directory as the batch file.

The following table shows the optional parameters and their functionality:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;input-filename&gt;</code></td>
<td>Loads the input file</td>
</tr>
<tr>
<td><code>-b&lt;ini-filename&gt;</code></td>
<td>Loads a background bitmap and zooms in according to the information contained in the *.INI file (only works in conjunction with an input filename). An *.INI file can be saved using View – Save Settings... in the main menu. Example: VISSIM.EXE LUX567.INP -BLUX567.INI opens VISSIM with the network file LUX567.INP and the options file LUX567.INI.</td>
</tr>
<tr>
<td><code>-s&lt;n&gt;</code></td>
<td>Starts and runs the simulation &lt;n&gt; times. Any non-critical runtime errors will not display a message box. See section 7.1.1 for another method of running multiple simulation runs with VISSIM.</td>
</tr>
<tr>
<td><code>-v&lt;%volume&gt;</code></td>
<td>The volume flag is only used with Dynamic Assignment (optional module) and the number following is the percentage of the total volume that should be added to the percentage specified in the Dynamic Assignment window as Reduced Volume [%]. If VISSIM is run in batch mode the volume will increase by this percentage every run until it reaches 100%.</td>
</tr>
</tbody>
</table>

Sample line from a batch file:
C:\VISSIM410\EXE\VISSIM.EXE C:\VISSIM410\EXAMPLE\KING.INP -S1
3.5 COM Interface (Optional Module)

VISSIM offers an additional module which provides COM (component object model) functionality for use with external programming environments (e.g. VBA in Microsoft™ Excel™). This way it is possible to automate certain tasks in VISSIM by executing COM commands from an external program.

A list of all available functions and commands in VISSIM-COM is included in the documentation VISSIM_COM.PDF which is contained in the folder <VISSIM-INSTALLATION>\DOC.

Please note that the COM interface is not available in VISSIM demo versions.
3.6 Printing

The internal print function of VISSIM will be redesigned and enhanced in order to become more versatile. Thus in the current version there is no internal print function available.

Output text files can be viewed and printed with standard Windows applications such as Notepad™. Furthermore, most output files are created in CSV format (comma/semicolon separated values) for easy import into spreadsheet applications (e.g. Microsoft™ Excel™).

Dynamic signal timing windows and any other real time displays can be imported into graphic applications (e.g. Paintbrush™, PaintShopPro™, Corel PhotoPaint™) or word processors (e.g. Microsoft™ Word™) using the Windows print screen function **ALT + PRT SCREEN** and the clipboard. The best results will be achieved with the highest available monitor resolution.
4 View Settings

VISSIM offers the display of vehicle visualization both in 2D and 3D mode. Except for placing static 3D models, the 3D graphics mode is intended solely for presentation purposes. All network editing is to be done in 2D graphics mode.

In addition to that there is a 2D graphics mode that displays aggregated values by colored link segments instead of displaying each vehicle separately.
4.1 Display Options

This section deals with the some global display parameters. Most of them are contained in the Display Options window provided via View – Options.

4.1.1 Network

View - Options... - [Network] contains options for displaying the link network. The following options are available:

- **Normal**: Shows links in their full width.
- **Center Line**: Displays only the link centerlines using these colors:
  - **Blue**: normal links
  - **Green**: links without visualization (e.g. tunnel or underpass)
  - **Pink**: connectors
  - **Red**: transit stops

- **Invisible**: Links are not displayed at all but will be highlighted if selected. This option can be used to animate the simulation on a background map.
- **Lane marking (width)**: Defines the pixel width used to display the lane markings on multiple lane links (0 = no display).
- **Minimum lane width**: Defines the minimum width that a lane will be displayed at. (Effective only during simulation using the Aggregated values display mode and during route or transit line editing.)

The default shortcut **CTRL+A** toggles between the last selected display (of either normal or invisible mode) and center line display.

In 3D mode when displaying a background during the simulation, VISSIM automatically refreshes the background every time the vehicles move. This allows the user to switch off the link display (option **invisible**) and show the vehicles traveling on the actual roads on the background map.
4.1.2 Traffic

View - Options... - [Traffic] contains options for the visualization of traffic inside the link network. The following options are available:

- **Individual vehicles**: Each vehicle is animated separately. Vehicles are represented as colored, rounded boxes (2D) or by the 3D model distribution assigned in the vehicle type (3D).

Multiple options are available for the vehicle color:

- **Standard coloring**: The vehicle color is determined by vehicle type, class or transit route, cf. section 4.2.2.1.
- **Automatic dynamic colors**: Vehicle colors are determined by certain states of the vehicles, e.g. lane change, gridlock resolution etc. For details please refer to section 0.
- **User defined dynamic colors**: Vehicle colors are determined by a value selection and class boundaries referring to that value. For details please refer to section 4.2.2.3.

The **Interval** defines that every \(<n>\)th frame of the visualization will be updated. The default value is 1 and corresponds to a frame update at every simulation time step.

- **Aggregated values**: Vehicles will not be displayed at all. Instead, colored boxes representing some data value for each segment of a link (or lane) will be displayed. All configuration is done through the Configuration button. The segment length can be set for each link and connector separately. For details, please refer to section 4.2.2.3.
- **No visualization**: Neither vehicles nor aggregated values are displayed during the simulation. Use this option to maximize simulation speed.
- ![Total Redraw](https://example.com/td.png) **Total Redraw**: VISSIM completely redraws the entire screen at every visualization interval. This is helpful when displaying a background graphic in a 2D-simulation using single-step mode since otherwise moving vehicles would visually erase parts of the background graphic.

The vehicle visualization of traffic requires a substantial amount of computing time. Turning off the visualization increases the simulation speed. Another option to increase the simulation speed is to increase the interval of frame updates for the visualization (Interval).
4.1.3 Colors

VIEW - OPTIONS... - [COLORS] contains color options for scene and network. Vehicle colors are determined differently (see 4.1.2).

The following options are available:

- When any of the three colored buttons next to Sky, Land or Links is pressed, a Color selection window appears and a color for that area of the model can be selected.

- **Use Link Type Color**: The links are colored according to their link types (except in 2D mode during a simulation run). Otherwise all links are painted with the same general link color.

- **DEFAULT COLORS** resets the colors to the program default.

- **Bitmap Display**: Changes the appearance of a background bitmap image in 2D display. The options are More Black (emphasis on black pixels), More White (emphasis on white pixels) or Best for colors (calculating average colors).

The color chosen for Links is always used for simulation and animation in 2D graphics. Additionally, it is used for all other display modes, if Use Link Type Color is not checked.

The Sky color is visible only in 3D graphics mode.

4.1.4 Language & Units

VIEW - OPTIONS... - [LANGUAGE & UNITS].

The following options are available:

- **Language**: Sets the current language to be used in VISSIM (e.g. in menus and windows). The available languages depend on your VISSIM license.

- **Units**: The units selected here will be used in most windows in VISSIM as well as in the output files.
4.1.5 Status Bar

Select the status bar representation of the time during a simulation either as

- Simulation second (VIEW - STATUS BAR - SIMULATION SECOND) or as

- Time of day using the format hh:mm:ss. (VIEW - STATUS BAR - TIME). The initial time (= time at simulation second 0) can be set in the simulation parameters.

The default shortcut to toggle the time display is CTRL+U.
4.2 2D Graphics Mode

The VISSIM network along with the vehicles can be view in the network editor either in 2D or 3D graphics. 2D Graphics mode is the standard. All network editing (except static 3D objects) must be done using the 2D graphics mode.

4.2.1 Network Elements

The display of Network Elements allows for display of more than one network element at a time (independently of the current edit mode) and for showing any labels of network elements (e.g. detector no.).

The menu command SHOW NETWORK ELEMENTS (default shortcut CTRL+N) toggles the display of the selected network elements. This is convenient when a large number of elements is displayed simultaneously.

View - Network Elements... opens the Display of Network Elements window:

- Checking an Element turns on the display of that element.
- Color determines the color that the (active) element will be displayed in.
- Checking the fill option creates a solid display as opposed to the default outline (only if corresponding edit mode is not active).
- The Label list box contains the options for text displays associated with that element. A label may be switched on independently of the element display.
2D Graphics Mode

- The Color option following the Label list box determines the text color of the label and the Size option determines the text size of the label.

The label is initially placed at the center of the associated element. It can be moved (using the mouse) if the edit mode of that network element and the label selection mode are active.

4.2.2 Vehicle Visualization

Depending on the traffic display options (see section 4.1.2) VISSIM displays either vehicles or aggregated data in the 2D visualization mode. The visualization can also be switched off completely. In addition to vehicles, the current state of signal heads is displayed as a colored bar at the location of the signal head. If the display of any other network elements is activated, then these are displayed also.

4.2.2.1 Standard coloring

The vehicle color is determined by vehicle type, class or transit route. This is the case if neither the automatic nor the user defined dynamic color mode is active.

<table>
<thead>
<tr>
<th>Defined in Vehicle Type</th>
<th>Defined in Vehicle Class</th>
<th>Defined in Bus/Tram Line</th>
<th>Displayed Color Determined by</th>
</tr>
</thead>
<tbody>
<tr>
<td>color distribution</td>
<td>-</td>
<td>-</td>
<td>Type</td>
</tr>
<tr>
<td>color distribution</td>
<td>color</td>
<td>-</td>
<td>Class</td>
</tr>
<tr>
<td>color distribution</td>
<td>-</td>
<td>color</td>
<td>Line</td>
</tr>
<tr>
<td>color distribution</td>
<td>color</td>
<td>color</td>
<td>Class</td>
</tr>
</tbody>
</table>

For display of vehicles of a vehicle type belonging to several vehicle classes (which not necessarily have to be mapped with colors) the color set for the first one with color specification of those classes will be used.

4.2.2.2 Automatic Dynamic Color Mode

The extended vehicle display mode

- provides additional information on vehicle movements that can be identified by the vehicle color,
- can be toggled using CTRL+V whenever the VISSIM network window is active,
- works also in 3D display mode, as long as no 3D vehicle models with fixed color settings are used,
- uses the following colors:
### 4.2.2.3 User Definable Dynamic Colors

The vehicle colors are determined by the selected parameter.

For display of user defined dynamic colors the automatic dynamic color mode has to be switched off.
The configuration is done via **VIEW - OPTIONS - [TRAFFIC] - CONFIGURATION**:

- **Parameter**: The desired parameter to be displayed using a color code. Choosing ‘none’ switches off the user definable dynamic colors.
- **Classes**: For each range of values of the selected parameter a color may be defined. The **Color** may be selected by clicking the colored box adjacent to the value field. Up to 10 classes are available. The lower and upper boundary is included in the respective class. If a class value is deleted, the following values will be shifted to fill the gap.

Pressing **DEFAULT CLASSES** resets all values and colors to its defaults.

### 4.2.3 Display of Aggregated Values

As an alternative to vehicle display, VISSIM can also display certain parameters as aggregated values using a color code. This is extremely helpful when trying to locate hot spots in a big network. The color code is used to color each link (or lane, if applicable) segment of the VISSIM network according to the online data of the selected parameter. The segment length can either be set for each link and connector individually or for a range of links and connectors using the multi select mode (see section 3.3.2).

**Parameters**

The display of aggregated values can be activated on the [TRAFFIC] tab of the **Graphical Display window** (**VIEW – OPTIONS**). Clicking on the **Configuration** button opens the window **Aggregated Values - Configuration** where all display options can be set:
Parameter describes the evaluation parameter to be displayed. If no selection is available, press LINK EVALUATION... to select the desired value.

☑ Cumulative: If checked, data being collected during the current interval is added to the previous value and the result is shown.

LINK EVALUATION... displays the link evaluation configuration window (see 10.11.) to select evaluation parameters. The selected values will be displayed within the Value list box after the window is closed.

Classes: Defines the range of the value to be displayed evaluation parameter and the associated colors. Each range of values is represented by the color shown to its right. Class boundaries are included in the respective class. Clicking on DEFAULT CLASSES restores the default settings.
Example

A typical visualization using the above color code would look like this:
4.3 3D Graphics Mode

Checking the option ☑ 3D-Mode in the View menu (default shortcut CTRL+D) the VISSIM model will be shown in three dimensions. Each of the vehicles will have depth and height and the viewing position within the network can be freely chosen.

Except for placing static 3D models, the 3D graphics mode is intended solely for presentation purposes. All network editing is to be done in 2D graphics mode.

If a background image is active, when changing into 3D mode for the first time (with that bitmap visible) it may take a moment for VISSIM to convert the bitmap into 3D.

4.3.1 Navigation

This section describes the options how to move the observer position in 3D mode.

4.3.1.1 Navigation modes

In 3D mode additional toolbar buttons become active. The following commands are available in the Navigation toolbar:

- “Show Entire Network”: Displays the entire network.

- “Dynamic Zoom”: In contrast to the ZOOM command in 2D which uses a window to select the new viewing area DYNAMIC ZOOM in 3D moves the network closer dynamically by dragging the mouse from left to right and moves the network further away by dragging the mouse from right to left. A right click restores the previous view.

- “Zoom by Factor”: Zooms by a specified zoom factor: Values less than 1.0 zoom in.

- “Move network” allows the user to drag the 3D network in any direction without changing the height of the observer. This command will move the network always within the network plain. Thus if the camera position is very low, only a small movement of the mouse will result in a large movement of the network.
“Rotate network” changes the location from which the VISSIM network is viewed (“camera position”). When 3D is initially switched on, the network is viewed from directly overhead, similar to the standard 2D view. When ROTATE NETWORK is selected and the mouse is dragged on the screen, the camera position changes:

- dragging up and down changes the vertical angle at which the scene is observed (changing the height and angle of the observer)
- dragging left and right rotates the point of view around the network.

“Fly through the network”: In this mode the observer is moved continuously forward through the network while the left mouse button is pressed (right button: backwards movement).

- Movement of the mouse changes the direction of the flight.
- The speed of the flight can be increased using the left SHIFT key and decreased using the left CTRL key.
- If ALT is pressed during the flight, the mouse pointer is not fixed to the click location any more but stays where it is moved, indicating the direction and strength of a continuous rotation.
- The camera can be rotated without movement using the right SHIFT key.

The 3D viewing modes “Rotate network”, “Move network” and “Fly through the network” remain active as long as no other mode is selected. To end one of these modes, either another viewing mode or the single select mode may be selected.

4.3.1.2 Hardware to assist 3D Navigation

VISSIM is also capable of interfacing with a 3D display manipulation device (e.g. SpaceMouse or Cyberpuck). A SpaceMouse is capable of moving within all three dimensions at the same time and thus allows navigation within the VISSIM network with one touch. The standard mouse is still available for selecting vehicles or changing display options. For information on how to get such a device please contact your VISSIM distributor.

4.3.1.3 Sitting in the Driver’s Seat

Another 3D viewing option is to “sit in the drivers seat”. This can be done in single step mode by double-clicking with the left mouse button on the 2D projection of the vehicle. To do so it might be helpful to switch temporarily back to 2D graphics, double-click on the vehicle there, and switch back to 3D graphics. To leave the vehicle, close the corresponding vehicle information window. The view from of the drivers seat is also possible to be used as a camera position for a keyframe (in order to record an AVI file).
4.3.1.4 Changing the Viewing Angle (Focal Length)

You can adjust the viewing angle that is used to look at a 3D scene. This is similar to changing the focal length of a camera. The standard viewing angle in VISSIM is set to 45°, which is a focal length equivalent of about 53mm (for a 35mm camera system). To change the viewing angle:

► press `CTRL+SHIFT+F3` to decrease the viewing angle by 1 degree (i.e. moving a zoom lens towards the telephoto end)

► press `CTRL+SHIFT+F4` to increase the viewing angle by 1 degree (i.e. moving a zoom lens towards the wide-angle end)

The current viewing angle is displayed in the second section of the status bar while the viewing angle is changed.

VISSIM does not store any changes in the viewing angle. As soon as VISSIM is closed and reopened, the standard value applies.

Changing the viewing angle applies to all 3D navigation modes as well as all the keyframes.

The following table show the focal length equivalents of various viewing angles:

<table>
<thead>
<tr>
<th>View. angle</th>
<th>F. length (35mm)</th>
<th>View. angle</th>
<th>F. length (35mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.9°</td>
<td>500mm</td>
<td>45°</td>
<td>53mm</td>
</tr>
<tr>
<td>8.2°</td>
<td>300mm</td>
<td>47°</td>
<td>50mm</td>
</tr>
<tr>
<td>12°</td>
<td>200mm</td>
<td>51°</td>
<td>45mm</td>
</tr>
<tr>
<td>14°</td>
<td>180mm</td>
<td>63°</td>
<td>35mm</td>
</tr>
<tr>
<td>18°</td>
<td>135mm</td>
<td>75°</td>
<td>28mm</td>
</tr>
<tr>
<td>24°</td>
<td>100mm</td>
<td>82°</td>
<td>25mm</td>
</tr>
<tr>
<td>29°</td>
<td>85mm</td>
<td>92°</td>
<td>21mm</td>
</tr>
<tr>
<td>34°</td>
<td>70mm</td>
<td>100°</td>
<td>18mm</td>
</tr>
</tbody>
</table>

4.3.2 Vehicle Visualization

3D vehicles in VISSIM can be assigned for each vehicle type using model and color distributions (see sections 5.2.4 and 5.2.5 for details).
4.3.3 Static objects

In 3D mode, static objects like trees, buildings or any other user defined 3D objects can be placed at any position within the VISSIM network and edited using the following mouse operations:

<table>
<thead>
<tr>
<th>Mouse click</th>
<th>Add. key</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>/./</td>
<td>Inserts a 3D object by opening the 3D Vehicle Model window in order to select a 3D file in order to be placed as static object. The procedure is similar to selecting a 3D vehicle file (see section 5.2.5).</td>
</tr>
<tr>
<td>Left</td>
<td>/./</td>
<td>Deletes the 3D object</td>
</tr>
<tr>
<td>Left</td>
<td>SHIFT</td>
<td>Moves the 3D object within network plane</td>
</tr>
<tr>
<td>Left</td>
<td>CTRL</td>
<td>Rotates the 3D object</td>
</tr>
<tr>
<td>Left</td>
<td>CTRL + SHIFT</td>
<td>Scales the 3D object (smaller: mouse move left, larger: mouse move right)</td>
</tr>
</tbody>
</table>

If complex 3D objects are used then switching into 3D mode may take a moment for VISSIM to initialize.

To select a static 3D model, the mouse click position needs to be unambiguous. I.e., the 3D model must not overlap at the click position.

Static 3D objects (such as buildings etc.) can be converted from 3D-StudioMax file format *.3DS into the VISSIM 3D file format *.V3D using the optional module V3DM (VISSIM 3D Modeler).

Furthermore, simple 3D models can be modeled directly in V3DM and textures used to give them a realistic appearance.

4.3.4 Fog/Haze

Fog can be added to any 3D scene in VISSIM. The fog is visible only on 3D objects, not on the surrounding area that is referred to as ‘sky’. In order to get a fog effect on the sky also, you need to place a static 3D object ‘wall’ with a sky texture on it. As an easy alternative you can also color the sky with a grey color similar to the fog.

The following hotkeys control the fog appearance:

<table>
<thead>
<tr>
<th>Hotkey</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTRL+F9</td>
<td>Toggle fog display on/off</td>
</tr>
<tr>
<td>Hotkey</td>
<td>Action</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td>CTRL+F3</td>
<td>Moving the fog front towards the observer</td>
</tr>
<tr>
<td>CTRL+F4</td>
<td>Moving the fog front away from the observer</td>
</tr>
<tr>
<td>CTRL+F5</td>
<td>Moving the 0-visibility front towards the observer</td>
</tr>
<tr>
<td>CTRL+F6</td>
<td>Moving the 0-visibility front away from the observer</td>
</tr>
</tbody>
</table>

From the observers point to the fog front, there is always 100% visibility. The fog increases between the fog front and the 0-visibility front. Behind the 0-visibility front there is 0% visibility. Consequently, the fog density decreases as the distance between the fog front and the 0-visibility front increases. The 0-visibility front cannot be moved in front of the fog front. Neither can the fog front be moved behind the 0-visibility front.

VISSIM does not store any changes regarding fog/haze. As soon as VISSIM is closed and reopened, haze/fog is disabled.

Adding fog/haze applies to all 3D navigation modes as well as all the keyframes.

See the following illustrations for the effects of the fog parameters:

For this example, V3DM (optional module) was used to place a sky picture on a vertical plain. This plain was included in VISSIM as a static 3D object. Otherwise, the fog would not be visible above the horizon.

Scene 0: no fog at all

Scene 1: Fog front and 0-visibility front are set to the same value: The fog appears as a solid wall.

Scene 2: Coming from scene 1, the **0-visibility front** is moved further away from the observer (default. shortcut **CTRL+F6**).
Scene 3:
Coming from scene 1, the fog front is moved further towards the observer (default shortcut \texttt{CTRL+F3}).

Scene 4:
Both settings from scene 2 and scene 3 are combined here.
4.4 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.

4.4.1 Supported Formats

VISSIM can display various image file formats, both bitmaps and vectors. Among the supported formats are:

<table>
<thead>
<tr>
<th>Supported bitmap formats</th>
<th>Supported vector formats</th>
</tr>
</thead>
<tbody>
<tr>
<td>*.BMP</td>
<td>*.DWG ¹)</td>
</tr>
<tr>
<td>*.JPG</td>
<td>*.DXF ¹)</td>
</tr>
<tr>
<td>*.PNG</td>
<td>*.EMF</td>
</tr>
<tr>
<td>*.TGA</td>
<td>*.WMF</td>
</tr>
<tr>
<td>*.TIF (uncompressed &amp; packbits)</td>
<td>*.SHP (shape files)</td>
</tr>
<tr>
<td>*.SID (Mr. SID)</td>
<td></td>
</tr>
</tbody>
</table>

¹) Note: DWG and DXF formats are updated with each version of Autodesk AutoCAD™. VISSIM supports the formats of versions 13 and 14. If you experience trouble loading a DWG file, please convert it to a DXF file and try to load it again. It may also help to save a DWG or DXF file to an earlier AutoCAD™ version format in order to load it in VISSIM.

4.4.2 Background Creation Workflow

The following steps explain how to convert image files to VISSIM background maps. We recommend to start with a map which shows the entire network area:

1. Go to VIEW - BACKGROUND - EDIT..., press LOAD... and select the name of the desired graphics file in order to import it into VISSIM. This process may take a few moments for large image files.

Although it is possible to select many different file types, VISSIM does not necessarily support all the selectable file types. If a file type is not supported, VISSIM shows a message box.

2. Close the Background selection window and select SHOW ENTIRE NETWORK from the Navigation toolbar to display the entire map.
Be aware that the map is not displayed to scale, even if the image file has an intrinsic scale. Precise scaling is necessary for an accurate network model, therefore we strongly recommend to use large scale distances (> 100 m / > 300 ft). To fit the map to VISSIM units, zoom in to an object or distance between two objects where you know the original distance precisely. For example, this could be a map scale or the distance between two building edges or geographic points.

3. Open again the Background selection window (VIEW - BACKGROUND - EDIT...), select the file to be scaled and press SCALE. The mouse pointer turns into a ruler with the upper left corner as the “hot spot”.

4. Click and hold the left mouse button and drag the mouse along the scale distance.

5. After releasing the left mouse button, enter the real distance of the scale line and confirm with Ok.

The scale of a VISSIM network cannot be changed later on. Therefore we strongly recommend to use great precision in the scaling process to avoid inconsistencies.

6. While the Background Selection window is still open, press ORIGIN in order to move the background image to the desired position. The mouse pointer turns into a hand with its thumbnail acting as the “hot spot”. Keep the left mouse button pressed to drag the background map to its new location. Typically, moving the background is not necessary for the first bitmap as long as it does not have to fit an existing VISSIM network.

7. Go to VIEW - BACKGROUND - PARAMETERS... and press SAVE in order to permanently store the scaling and origin information of the background image. This command creates a parameter file named <GRAPHICS-FILE>.HGR. Whenever you reload that background, make sure that the corresponding *.HGR file is located in the same directory as the background file.

The size of an image file depends on

- data format and compression (especially JPG)
- screen resolution and color depth
- working storage and graphics card memory (especially for 3D mode)

Thus the max. permissible file size depends on the particular system. In case of incorrect image display (e.g. black or white polygon instead) the permissible file size is exceeded supposingly. Please reduce file size then, either cut out a smaller section or reduce the solution.

After the “overview” background map has been established, other maps (showing smaller areas in high detail) can be loaded and scaled in the same way and then be moved to their correct position. In order to place them correctly (in relation to the other background images) it is recommended to create a coarse VISSIM network first, where strategic links are placed on the main “overview” background. Place links at positions where this background
overlaps with the background to be moved into the right place. To accomplish this it could be helpful to place some VISSIM links temporarily on building edges.

More than one image can be loaded simultaneously.

Once one or more background images are loaded, their visibility can be toggled using View - Show Background or the default shortcut Ctrl+B.

The image files do not have to be stored in the same directory as the network file (*.INP).

4.4.3 Scanning Images

The following steps outline the recommended procedure for scanning maps and plans for use with VISSIM:

1. Maps and plans to be scanned should include a north arrow and a scale. It is recommended to create one overview map that shows all intersections to be modeled and individual signal plans for each intersection showing stop lines and detector locations (if applicable).
2. Ensure that the scanned plans show a strong contrast.
3. Maps and plans should be oriented to North direction. In the case of modeling a North-South corridor, another orientation could be useful.
4. Use a copy machine to reduce plans in case they do not fit the available scanner.
5. An A4 sized map should be scanned with 300 dpi. Depending on the speed of the computer also higher resolutions can be useful. Generally speaking, the higher the resolution the bigger the bitmap file size and the longer it takes VISSIM to load the bitmap and to refresh the network.
6. Save the scanned file to one of the supported bitmap formats (e.g. BMP, JPG, uncompressed TIF).
4.5  Save/Load Settings

Several graphics and other VISSIM options can be saved to a settings file (*.INI). Among the stored settings are

► Main window size and position
► Zoom factor
► Display options
► Evaluation settings for online or offline output

To save a settings file, go to View - Save Settings..., enter a filename and confirm with Ok.

To load a settings file, go to View - Load Settings..., choose a filename and confirm with Ok.

The size and position of all VISSIM dialog windows is stored separately (not in the settings file).
5 Base Data For Simulation

The stochastic nature of traffic implies the necessity to provide this kind of variability in VISSIM models also. The heart of VISSIM, the car following model of Wiedemann (see chapter 1.2), deals with this fact by incorporating several parameters that use stochastic distributions. This chapter deals with the base information for the traffic simulation by explaining the different type of distributions and functions, and also the way vehicles are modeled. If you would only like to use the VISSIM test functionality then you do not need to read this chapter.
5.1 Vehicle Acceleration and Deceleration Functions

VISSIM does not use a single acceleration and deceleration value but uses functions to represent the differences in a driver’s behavior. For each vehicle type there are two acceleration and two deceleration functions, represented as graphs:

- Maximum acceleration
- Desired acceleration
- Maximum deceleration
- Desired deceleration.

These are predefined for each of the default vehicle types in VISSIM. They can be edited or new graphs can be created by BASE DATA – FUNCTIONS...

When one of the four types is selected, an edit window will open to allow for editing the existing acceleration graphs.

To reflect the stochastic distribution of acceleration and deceleration values, each graph consists of three different curves showing the minimum, mean and maximum values. Each curve can be edited individually.

The vertical axis depicts the acceleration value and the horizontal axis depicts the corresponding speed. The visible range of both axes can be set using the corresponding fields. Pressing the button BEST FIT will use the
current graph to determine the minimum and maximum values to be shown on both axes.

Within one graph each curve can be edited separately by dragging one of its intermediate points. When dragging points of the median curve (red dots) both the values of the border lines are adjusted as well.
5.2 Distributions

A range of parameters in VISSIM is defined as a distribution rather than a fixed value. Thus the stochastic nature of traffic situations is reflected realistically. Most of the distributions are handled similarly and it is possible to use any kind of empirical or stochastic data for definition. All distributions can be accessed by BASE DATA - DISTRIBUTIONS.

5.2.1 Desired Speed Distribution

For any vehicle type the speed distribution is an important parameter that has a significant influence on roadway capacity and achievable travel speeds. If not hindered by other vehicles, a driver will travel at his desired speed (with a small stochastic variation called oscillation). The more vehicles differ in their desired speed, the more platoons are created. If overtaking is possible, any vehicle with a higher desired speed than its current travel speed is checking for the opportunity to pass without endangering other vehicles, of course.

Stochastic distributions of desired speeds are defined for each vehicle type within each traffic composition. The window Desired Speed Distribution can be accessed via BASE DATA – DISTRIBUTIONS - DESIRED SPEED.... A desired speed distribution can then be selected (single mouse click), edited (single mouse click and EDIT or double click) or created (NEW). Creating or editing a desired speed distribution opens the window shown above.

The minimum and maximum values for the desired speed distribution are to be entered into the two fields above the graph (the left number must always be smaller than the right number). Intermediate points are displayed as red dots. They can be created with a single right button mouse click and moved by dragging with the left mouse button. Merging two intermediate points deletes the first one of them.

The horizontal axis depicts the desired speed while the vertical axis depicts the cumulative percentage from 0.0 and 1.0. Two intermediate points are generally adequate to define an s-shaped distribution which is concentrated around the median value.
5.2.2 Weight Distribution

The weight of vehicles categorized as HGV can be defined as a weight distribution. Along with a power distribution it affects the driving behavior on slopes.

A Weight Distribution can be defined/edited by BASE DATA - DISTRIBUTIONS – WEIGHT... in the same way as a speed distribution (see 5.2.1 for details).

Each vehicle type is assigned to one vehicle category. For each vehicle of a type that is defined as HGV category, VISSIM computes the power-to-weight-ratio as kW/t - using its weight and power values. The range of the power-to-weight-ratio is from 7 to 30 kW/t. According to this value, one curve out of each acceleration/deceleration function is selected for this vehicle proportionally.

Example: If the power-to-weight-ratio is computed as 7 kW/t, the resulting max. acceleration curve is the lower border of the range of curves (see section 5.1). If it is 30 kW/t, the resulting curve is the upper border.

5.2.3 Power Distribution

The power of vehicles categorized as HGV can be defined as a power distribution. Along with a weight distribution it affects the driving behavior on slopes.

A Power Distribution can be defined/edited by BASE DATA - DISTRIBUTIONS – POWER... in the same way as a speed distribution (see 5.2.1 for details).

Please refer to the weight distribution for details on how the power distribution comes into action.

5.2.4 Color Distribution

This distribution is only necessary for graphics - it has no effect on simulation results. A Color Distribution can be defined/edited by BASE DATA - DISTRIBUTIONS - COLOR...
The color distribution is used instead of a single color for a vehicle type. Even when only one color should be used for a vehicle type still a distribution needs to be defined (with one color only).

Up to ten colors are possible for each distribution and each one needs to have a relative percentage (Share). The absolute percentage is automatically computed by VISSIM as the proportion of an individual Share compared to the sum of all Shares.

### 5.2.5 Vehicle Model Distribution

This distribution defines the variety of vehicle dimensions within a vehicle type. It is necessary for graphics and has an effect on simulation results (e.g. due to vehicle length and width).

A Model Distribution can be defined/ edited by BASE DATA - DISTRIBUTIONS - VEHICLE MODEL...

The vehicle model distribution is used instead of a single vehicle model for a vehicle type.

Even when a type should only be represented by one model still a distribution needs to be defined (with one model only).

Up to ten vehicle models are possible for each distribution and each one needs to have a relative percentage (Share).

The absolute percentage is computed automatically: The proportion of an individual Share compared to the sum of all Shares.

Each model can be defined via separately for 2D Model or 3D Model data.

### 2D Vehicle Model

**Vehicle Model Distribution 2D Model** opens the Vehicle Elements 2D window:
It contains the number of elements the vehicle consists of. Each element can be defined individually. All defined elements are listed on the left and can be selected and edited by single left click. The unit of each parameter depends on the global settings of units – see section 4.1.4.

Below follows an illustration of all the parameters to be defined.
## Zugfahrzeug

*Lorry*

(Element 1)

- Deichsellänge: 0
- Kupplung hinten: 0
- Achse vorn: Front axle
- Achse hinten: Rear axle

## Anhänger

*Trailer*

(Element 2)

- Kupplung hinten: 0
- Deichsellänge: Shaft length
- Achse vorn: Front axle
- Achse hinten: Rear axle

## Bahn, Tram

*Train, Tram*

1. **Wagen**

*1st Car*

(Element 1)

- Deichsellänge: 0
- Kupplung hinten: 0
- Achse vorn: Front axle
- Achse hinten: Rear axle

2. **Wagen**

*2nd Car*

(Element 2)

- Kupplung hinten: 0
- Deichsellänge: Shaft length
- Achse vorn: Front axle
- Achse hinten: Rear axle
3D Vehicle Model

Vehicle Model Distribution 3D Model opens the 3D Model window:

![3D Model window](image)

Here the 3D representation of the vehicle model is selected. All available 3D files can be previewed and selected.

- The **ADD** button adds the current file selection to the *Selected Model Elements* section.
- Vehicles that consist of more than one element (e.g., trams) can be composed using the **ADD** button multiple times to add the desired vehicle elements.
- Using the **MULTIPLE** button the same selected element will be added multiple times.
- In the *Selected Model Elements* section a selected element can be moved using the **<<** and **>>** buttons, and deleted using the **DELETE** button (or **DELETE ALL** for all contained elements).

As soon as the 3D Vehicle Elements window is closed, the length of the vehicle is computed as the sum of the 3D elements. The length is shown in the Vehicle Type window (see section 5.3.1).

Changes within the 3D Model window will modify the parameters of the Vehicle Elements 2D...
Every modification within the Vehicle Elements 2D window will delete the link to the selected 3D model.

If the link to the 3D model is lost or if no 3D model is assigned at all, in 3D mode the vehicle will be displayed as a colored box with the dimensions as defined for the Vehicle Elements 2D.

Due to the fact that 3D vehicle elements have a static length, a length distribution can be defined by choosing different vehicle models with different lengths into the same distribution.

The color as chosen in the distribution, or for a class or transit line will be used to fill all “designated surfaces” within the 3D vehicle model. These surfaces may be specified in the optional VISSIM module “V3DM” (VISSIM 3D Modeler).

During the simulation VISSIM uses a vehicle path algorithm to determine the location of subsequent elements within the network (trajectories). Thus the turning behavior of segmented vehicles will look more natural the higher the number of time steps per simulation second is set.

New VISSIM files have a default model distribution for each vehicle type defined. The distribution for cars contains six different car models with different percentages. These models are assigned to predefined 3D vehicle models named CAR1.V3D ... CAR6.V3D. To change one of these default vehicle models, rename the desired V3D vehicle file to one of these file names.

Caution: If you change the default vehicle models you will get different simulation results in all simulations that refer to these standard models. This is due to the fact, that the vehicle length will be different.

5.2.6 Dwell Time Distribution

The dwell time distribution is used by VISSIM for dwell times at

- parking lots which have to be defined per time interval for route decisions of the parking lot type, see section 6.4.4,
- stop signs and e.g. toll counters,
- transit stops. For transit vehicles (e.g. buses, trams) the amount of time they stop at a passenger pick up area has to be defined for each transit stop or train station if the time required for boarding and alighting is not calculated by one of the methods provided..

A Dwell Time Distribution can be defined/edited by Base Data - Distributions - Dwell Time... There is a choice of two types:
Distributions

- **Normal distribution**: A normal distribution is defined by the mean value and standard deviation (in seconds). Defining the standard deviation as 0s creates a constant dwell time. If a negative dwell time results from the normal distribution it is automatically cut to 0s.

- **Empirical distribution**: An empirical distribution is defined by providing a minimum and a maximum value and any number of intermediate points to build a graph of various shapes (similar to the definition of speed distributions - see 5.2.1). Thus any type of distribution can be defined.

For the application of time distributions see chapter 6.5.1.

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### 5.2.7 Model Year Distribution (emissions module only)

The model year of vehicles can be defined as a model year distribution. Along with other distributions it effects the emission results when using the optional internal emissions module.

A *Model Year Distribution* can be defined/edited by **BASE DATA – DISTRIBUTIONS – MODEL YEAR...** in the same way as a speed distribution (see 5.2.1 for details).

---

### 5.2.8 Mileage Distribution (emissions module only)

The mileage of vehicles can be defined as a mileage distribution. Along with other distributions it effects the emission results when using the optional internal emissions module.

A *Mileage Distribution* can be defined/edited by **BASE DATA – DISTRIBUTIONS – MILAGE...** in the same way as a speed distribution (see 5.2.1 for details).

---

### 5.2.9 Temperature Distribution (cold emissions module only)

The temperature of the coolant and of a catalytic converter of vehicles can be defined as a temperature distribution. Along with other distributions it effects the emission results when using the optional internal cold engine emissions module.
A *Temperature Distribution* can be defined/edited by **BASE DATA – DISTRIBUTIONS – TEMPERATURE**... in the same way as a speed distribution (see 5.2.1 for details).
5.3 Vehicle Type, Class and Category

VISSIM uses a hierarchical concept to define and provide vehicle information at different levels throughout the application. This table shows the individual levels:

- **Vehicle type**: Group of vehicles with similar technical characteristics and physical driving behavior. Typically the following are vehicle types: car, LGV, HGV (truck), bus, articulated Bus, Tram, Bike, Pedestrian.

- **Vehicle class**: One or more vehicle types are combined in one vehicle class. Speeds, evaluations, route choice behavior and certain other network elements refer to vehicle classes. By default one vehicle class refers to one vehicle type with the same name. More than one vehicle type is to be included in a vehicle class if they incorporate a similar general driving behavior but have different vehicle characteristics (e.g. acceleration values). If only the shape and length of a vehicle is different they can be placed in the same type using the vehicle model and color distributions.

  Example 1: The models “Car1” to “Car6” refer to different models with different vehicle length yet similar driving behavior. Therefore they can be placed into one vehicle type using a model distribution with the six different models.

  Example 2: Standard and articulated busses only differ in length, thus they can be placed into one type with a distribution of two models. Exception: When these two bus types need to be used in different transit routes then they need to be defined as two separate vehicle types.

- **Vehicle category**: Preset, static categories of vehicles that incorporate similar vehicle interaction. E.g. the vehicle category “tram” does not allow for lane changes on multi-lane links and does not oscillate around its desired speed.

  Every vehicle type is to be assigned to a vehicle category.

5.3.1 Vehicle Types

In addition to the default vehicle types (Car, HGV, Bus, Tram, Bike and Pedestrian), new vehicle types can be created or existing types modified. For vehicles of the same category having different e.g. acceleration or speed properties, the appropriate number of vehicle types need to be defined. The data associated with vehicle types is accessed by BASE DATA – VEHICLE TYPES...

As one of the buttons EDIT, NEW or COPY is pressed, the Vehicle Type window opens. The following parameters are available:

- **No.**: Unique vehicle type identification
- **Name**: Any name or comment
5 Base Data For Simulation

[Static]
- **Category**: Defines the vehicle category
- **Vehicle Model**: Defines the shape and length (distribution) of the vehicle type by selection of one of the defined model distributions. New models cannot be defined directly within the vehicle type data but in the vehicle model distribution (see 5.2.5).

[Functions & Distributions]
- **Width**: Defines the displayed width of a 2D vehicle in VISSIM. This parameter is relevant also if overtaking within the same lane is possible (see "lateral behavior" in the driving behavior parameter set).
- **Occupancy**: Defines the number of persons (including the driver) contained in a vehicle.
- **Color**: Determines the color distribution that the current vehicle type will have. When displaying the vehicle in 3D, all VISSIM specific objects of that model (to be defined in the optional add-on “VISSIM 3D Modeler”) will be filled with that color. For color distributions, see section 5.2.4.
  The color information may be overruled by the color of the vehicle class where this vehicle type is assigned to or the route color of a transit vehicle.
- **Acceleration** and **Deceleration curves**: Define the acceleration and deceleration behavior of that vehicle type. For more information see section 5.1.
- **The Weight and Power distributions** are active only for vehicle types of **Category HGV**, and also, if an external model is selected. For further details see sections 5.2.2 and 5.2.3.
Dynamic Assignment

- **Cost Coefficients**: Opens the Cost Coefficients window. For further details please refer to section 11.5.

- **Equipment**: Defines if the vehicle has any route guidance system or similar equipment installed. This setting is relevant for en-route re-routing within a Dynamic Assignment.

- **Parking Lot Selection**: The data in the Parking Lot Search window is used when a vehicle is routed using Dynamic Assignment. The parameters are used to determine the desired destination in the Decision Situation described in the list box at the top.

All parameters are weights added to the values attributed to parking lots in the situation. For example, if the Parking Cost variable is weighted heavily, then cheaper parking lots will have an advantage over closer parking lots.

Other

- **PT Parameters (only applicable for public transport vehicles)**: Opens the Vehicle Type window: PT parameters to define the parameters for dwell time calculation (see 6.5.2, option B).

- The Emission Calculation settings will only be effective if an emission model (optional VISSIM module) is activated. For details please refer to separate documentation.

- **External Emission Model** (not available in all VISSIM licenses): Indicates that this vehicle type is subject to an external emission model.

- **External Driver Model** (not available in all VISSIM licenses): Indicates that this vehicle type is not subject to the VISSIM driving behavior but ruled by an external driver model.
5.3.2 Vehicle Classes

A vehicle class represents a logical container for one or more previously defined vehicle types. A vehicle type can also be part of several vehicle classes, thus “overlapping” classes are possible.

Vehicle classes can be accessed by BASE DATA – VEHICLE CLASSES...

The Vehicle Classes window contains a list of all classes defined. Using the control buttons to the right, the list can be edited.

To define a Vehicle Class, all of the vehicle types that are to be included must be highlighted in the list of Vehicle Types. A multi-selection is done by pressing CTRL while clicking on the desired vehicle type(s). Furthermore, the following parameters may be defined:

- **No.**: Unique identification of the class
- **Name**: Label of the class
- **COLOR** (only active, if the option "Use vehicle type color" is unchecked):
  - Defines the vehicle color for all vehicle types contained in that class. This overrides all color information of the vehicle types and can be used to identify vehicles of a certain class by color.
- **Use vehicle type color**: If checked, the vehicle color is determined by each vehicle type (or transit route respectively).

A new class can be used to collect data specifically for certain vehicle types or to distinguish those vehicles by color during a simulation.
5.4 Driving Behavior

Both the car following and lane change models in VISSIM use an extensive range of parameters. Some of these may be adapted by the experienced user to change basic driving behavior.

As these parameters directly affect the vehicle interaction and thus can cause substantial differences in simulation results, only experienced users should eventually modify any of the parameters described in this section.

The driving behavior is linked to each link by its link type. For each vehicle class, a different driving behavior parameter set may be defined - even within the same link (for details see chapter 5.5). The parameter sets can be edited in the Driving Behavior Parameter Sets windows which is accessible by BASE DATA – DRIVING BEHAVIOR. By default, 5 different parameter sets are predefined.

Add parameter set

Right-click in the list to call the context menu, then left-click NEW (or COPY after selection of a set):

- Enter parameters in the tags.
- No. and Name may be edited in the main window.

Delete parameter set

- Select the parameter set in the list, then left-click DELETE in the context menu.

5.4.1 The “Wiedemann” Approach

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 Wiedemann $^{1,2}$.

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 1.2):

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

- **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 he reaches his desired safety distance.

- **Following**: The driver follows the preceding car without any conscious acceleration or deceleration. He keeps the safety distance more or less constant, but again due to imperfect throttle control and imperfect estimation the speed difference oscillates around zero.

- **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.

For each mode, the acceleration is described as a result of speed, speed difference, distance and the individual characteristics of driver and vehicle. The driver switches from one mode to another as soon as he reaches a certain threshold that can be expressed as a combination of speed difference and distance. For example, a small speed difference can only be realized in small distances, whereas large speed differences force approaching drivers to react much earlier. The ability to perceive speed differences and to estimate distances varies among the driver population, as well as the desired speeds and safety distances. Because of the combination of psychological aspects and physiological restrictions of the driver’s perception, the model is called a psycho-physical car-following model.

The following sections describe the various behavior parameters in VISSIM.

---


5.4.2 Vehicle Following Behavior

These parameters are available:

- The **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**.
  - The **max.** value is the maximum distance allowed for looking ahead. It needs to be extended only in rare occasions (e.g. for modeling railways if signals and stations are to be recognized in time)
  - The **min.** value 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 20-30m (60-100 ft).

Without increasing the **min. look ahead distance** while modeling lateral behavior it may happen that vehicles will not stop for red lights or for each other. The Number of **Observed Vehicles** should not be changed to compensate for this behavior as it might easily result in unrealistic behavior elsewhere.

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

- **Temporary lack of attention** ("sleep" parameter): Vehicles will not react to a preceding vehicle (except for emergency braking) for a certain amount of time.
  - **Duration** defines, how long this lack of attention occurs
  - **Probability** defines how often this lack of attention occurs
The higher both of these parameters are, the lower the capacity on the corresponding links will be.

- **Car following model** selects the basic model for the vehicle following behavior. Depending on the selected model the **Model parameters** change.
  - *Wiedemann 74*: Model mainly suitable for urban traffic
  - *Wiedemann 99*: Model mainly suitable for interurban (motorway) traffic
  - *No Interaction*: Vehicles do not recognize any other vehicles (can be used for a simplified pedestrian behavior).

- **Model parameters**: Depending on the selected *Car following model* a different number of *Model parameters* is available. See sections 5.4.2.1 and 5.4.2.2 for details.

### 5.4.2.1 Wiedemann 74 Model Parameters

This model is an improved version of Wiedemann’s 1974 car following model. The following parameters are available:

- **Average standstill distance** (*ax*) defines the average desired distance between stopped cars. It has a fixed variation of ± 1m.

- **Additive part of desired safety distance** (*bx_add*) and **Multiplic. part of desired safety distance** (*bx_mult*) affect the computation of the safety distance. The distance *d* between two vehicles is computed using this formula:

\[
d = ax + bx
\]

where *ax* is the standstill distance

\[
bx = (bx_{add} + bx_{mult} * z) * \sqrt{v}
\]

* is the vehicle speed [m/s]

* is a value of range [0,1] which is normal distributed around 0.5 with a standard deviation of 0.15.

These are the main parameters to affect the capacity flow. For an example, see section 5.4.6.

### 5.4.2.2 Wiedemann 99 Model Parameters

This model is based on Wiedemann’s 1999 car following model. The following parameters are available:

- **CC0 (Standstill distance)** defines the desired distance between stopped cars. It has no variation.

- **CC1 (Headway time)** is the time (in s) that a driver wants to keep. The higher the value, the more cautious the driver is. Thus, at a given speed *v* [m/s], the safety distance *dx_safe* is computed to:

\[
dx_{safe} = CC0 + CC1 * v.
\]
Driving Behavior

- The safety distance is defined in the model as the minimum distance a driver will keep while following another car. In case of high volumes this distance becomes the value with the strongest influence on capacity.
- **CC2 (‘Following’ variation)** 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 e.g. 10m, 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 (Threshold for entering ‘Following’)** controls the start of the deceleration process, i.e. 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 (‘Following’ thresholds)** 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. CC4 is used for negative and CC5 for positive speed differences. The default values result in a fairly tight restriction of the following process.
- **CC6 (Speed dependency of oscillation)**: 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 (Oscillation acceleration)**: Actual acceleration during the oscillation process.
- **CC8 (Standstill acceleration)**: Desired acceleration when starting from standstill (limited by maximum acceleration defined within the acceleration curves)
- **CC9 (Acceleration at 80 km/h)**: Desired acceleration at 80 km/h (limited by maximum acceleration defined within the acceleration curves).

### 5.4.3 Lane Change

There are basically two kinds of lane changes in VISSIM:

- **Necessary lane change**
  (in order to reach the next connector of a route)
- **Free lane change**
  (because of more room / higher speed)

In case of a necessary lane change, the driving behavior parameters contain the maximum acceptable deceleration for the vehicle and the trailing vehicle on the new lane, depending on the distance to the emergency stop position of the next connector of the route.

In case of a free lane change, VISSIM checks for the desired safety distance of the trailing vehicle on the new lane. This safety distance depends on its
speed and the speed of the vehicle that wants to change to that lane. There is currently no way for the user to change the "aggressiveness" for these lane changes. However, changing the parameters for the desired safety distance (which are used for the vehicle following behavior) will effect the free lane changes as well.

In both cases, when a driver tries to change lanes, the first step is to find a suitable gap (time headway) in the destination flow. The gap size is dependent on the speed both of the lane changer and the vehicle that "comes from behind" (on that lane where the lane changer changes to). In case of a necessary lane change it is also dependent on the deceleration values of the “aggressiveness”.

### Lane Change Parameters

- **General Behavior**: Defines the way of overtaking:
  - **Free Lane Selection**: Vehicles are allowed to overtake in any lane
  - **Right Side Rule** resp. **Left Side Rule**: Allows overtaking in the fast lane only if speed in the fast lane is above 60 km/h. For slower speeds, vehicles in the slow lane are allowed to “undertake” with a max. speed difference of 20 km/h.

### Necessary Lane Change (Route)

For lane changes that result from routes, the aggressiveness of lane change can be defined. This is done by defining deceleration thresholds both for the lane changer (Own) and the vehicle that he is moving ahead 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/s²) is used to reduce the **Maximum Deceleration** with increasing distance off the emergency stop position.

Example: The following parameters result in the graph shown below
### Driving Behavior

<table>
<thead>
<tr>
<th>Necessary lane change (route)</th>
<th>Own</th>
<th>Trailing vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum deceleration:</td>
<td>-3.5 m/s²</td>
<td>-3.0 m/s²</td>
</tr>
<tr>
<td>-1 m/s² per distance:</td>
<td>300 m</td>
<td>200 m</td>
</tr>
<tr>
<td>Accepted deceleration:</td>
<td>-1 m/s²</td>
<td>-0.25 m/s²</td>
</tr>
</tbody>
</table>

**Other Parameters**

- **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 message will be written to the error file denoting the time and location of the removal.

- **Min. Headway (front/rear)** defines the minimum distance to the vehicle in front that must be available for a lane change in standstill condition.

- The value for **To slower lane if collision time** is used only if **Lane Change Behavior** is set to **Right Side Rule resp. Left Side 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.
5.4.4 Lateral Behavior

By default, in VISSIM one vehicle occupies the entire width of one lane. The lateral behavior parameters enables vehicles to travel at different lateral positions and also overtake other vehicles within the same lane if it is wide enough.

These parameters are available:

- **Desired position at free flow**: defines the desired lateral position of a vehicle within the lane while it is in free flow. The options are: Middle of Lane, Any or Right resp. Left.

- **Observe vehicles on next lane(s)**: Vehicles also consider the lateral position of other vehicles that are traveling on adjacent lanes.

- **Diamond shaped queuing**: Allow for staggered queues (e.g. for cyclists) according to the realistic shape of vehicles.

- **Overtake on same lane**: Select all vehicles classes that are allowed to be overtaken within the same lane by any vehicle of that class for which this parameter set is assigned. You can define also on which side they are to be overtaken (on left, on right or on both sides within the same lane).

- **Min. Lateral Distance**: Minimum distances for vehicles passing each other within the same lane are defined for each vehicle class to be passed. The distance is defined for standstill (at 0 km/h) as well as for 50 km/h. For those vehicle classes where no values are defined, the default definition applies.

**Example**

Bikes and cars travel on the same one-lane-link. Bikes are to drive on the right hand-side. Cars are allowed to overtake bikes on the left; bikes are
allowed to overtake cars on the right, and other bikes on the left. This behavior is accomplished in VISSIM as follows:

1. Create a new parameter set “Urban lateral” as a copy based on “Urban” behavior.

2. Edit parameters:
   - [FOLLOWING] min. look ahead distance: from 0 to 30m
   - [LATERAL] Overtake on same lane: Add new line and select vehicle class “Bike” to be overtaken on left.

3. Create a new parameter set “Urban cycle” as a copy based on “Cycle-Track” behavior.

4. Edit parameters in [LATERAL] Overtake on same lane:
   - uncheck “All” vehicle classes
   - add new line and select vehicle class “Car” to be overtaken on right
   - add new line and select vehicle class “Bike” to be overtaken on left.

5. Create a new link type “Urban lateral cycle”. Assign the “Urban lateral” behavior as default, and additionally assign the “Urban cycle” behavior to vehicle class “Bike”.

6. Assign the new link type “Urban lateral cycle” to the desired link(s).

5.4.5 Reaction to Amber Signal

These parameters define the vehicle behavior in front of a signal control showing amber.
5. **Base Data For Simulation**

- **Decision model:**
  - *Continuous Check*: Vehicles assume that the amber light stays amber for 2 seconds and continuously decides whether to proceed at each time step thereafter until passing the signal head.
  - *One Decision*: Three parameters (Alpha, Beta 1 and Beta 2) are used to calculate the probability of the driver stopping at amber light. The formula is:

\[
p = \frac{1}{1 + e^{-\alpha - \beta_1 v - \beta_2 dx}}
\]

A decision is kept until the vehicle has passed the stop line.

The option *One Decision* will produce the most accurate results if the number of *Observed vehicles* is increased accordingly (see [FOLLOWING BEHAVIOR]). This is due to the fact that a signal head internally is modeled as a vehicle and only recognized if there are no more other vehicles and network elements in front of the signal head than the number of *Observed vehicles* minus 1.

### 5.4.6 Changing the Saturation Flow Rate

In VISSIM the saturation flow is a result of a combination of parameters that are relevant for the simulation. Thus the saturation flow cannot be explicitly defined but experienced users may want to change the relevant driving behavior parameters in order to get a different saturation flow rate. The saturation flow rate defines the number of vehicles that can free flow on a VISSIM link during a period of one hour.
Driving Behavior

**Wiedemann 74 Car Following Model**

There are two parameters which have major influence on the safety distance and thus affect the saturation flow rate. These parameters are:

- **Additive part of desired safety distance** \((bx_{\text{add}})\)
- **Multiplicative part of desired safety distance** \((bx_{\text{mult}})\)

(see section 5.4.2.1 for details)

Apart from that the saturation flow rate is also dependent on many other parameters, such as vehicle speed, truck percentage, no. of lanes etc.

The results shown in the graph below provide the resulting saturation flows for some specific VISSIM examples only. The results will be different for networks that do not conform with the properties of these examples.

The graph is based on the following assumptions:

- single lane link
- speed distribution 48-58 km/h
- standard driving parameters except the values for both \(bx_{\text{add}}\) and \(bx_{\text{mult}}\) which are shown on the x-axis (in this example \(bx_{\text{add}}\) equals \(bx_{\text{mult}} - 1\))
- one time step per simulation second

**Wiedemann 99 Car Following Model**

CC1 is the parameter which has a major influence on the safety distance and thus affects the saturation flow rate. Apart from that the saturation flow rate is
also dependent on many other parameters, such as vehicle speed, truck percentage, no. of lanes etc.

All the following scenarios are based on

- Wiedemann 99 car following model with default parameters, except for the parameter CC1 which is shown on the x-axis in the graphs below.
- one time step per simulation second

The main properties of each scenario shown in the following graphs are

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Right-side-rule</th>
<th>Lanes</th>
<th>Speed cars*</th>
<th>Speed HGV*</th>
<th>% HGV</th>
</tr>
</thead>
<tbody>
<tr>
<td>99-1</td>
<td>no</td>
<td>2</td>
<td>80</td>
<td>n.a.</td>
<td>0%</td>
</tr>
<tr>
<td>99-2</td>
<td>no</td>
<td>2</td>
<td>80</td>
<td>85</td>
<td>15%</td>
</tr>
<tr>
<td>99-3</td>
<td>yes</td>
<td>2</td>
<td>80</td>
<td>n.a.</td>
<td>0%</td>
</tr>
<tr>
<td>99-4</td>
<td>yes</td>
<td>2</td>
<td>80</td>
<td>85</td>
<td>15%</td>
</tr>
<tr>
<td>99-5</td>
<td>yes</td>
<td>2**</td>
<td>120</td>
<td>n.a.</td>
<td>0%</td>
</tr>
<tr>
<td>99-6</td>
<td>yes</td>
<td>2</td>
<td>120</td>
<td>85</td>
<td>15%</td>
</tr>
<tr>
<td>99-7</td>
<td>yes</td>
<td>3***</td>
<td>120</td>
<td>n.a.</td>
<td>0%</td>
</tr>
<tr>
<td>99-8</td>
<td>yes</td>
<td>3</td>
<td>120</td>
<td>85</td>
<td>15%</td>
</tr>
</tbody>
</table>

* speed distribution no. as defined in the VISSIM defaults
** lane 2 closed to all HGV
*** lane 3 closed to all HGV

The results shown in the graphs below provide the resulting saturation flows for some specific VISSIM examples only. The results will be different for networks that do not conform with the properties of these examples.
Driving Behavior

Saturation Flow

Saturation Flow

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5.5 **Link Types**

VISSIM supports an abstract level of addressing more than one link in terms of driving behavior and color. These attributes are contained in a link’s type. Connectors implicitly have the same link type as the link where they originate from. Within one type different vehicle classes can have different driving behaviors.

Several predefined link types are available.

These can be edited and new ones can be defined via **BASE DATA - LINK TYPES...**

The list of all default link types can be edited using the buttons to the right.

Once one link type is selected for editing, these parameters are available:

- **No.**: Unique identification of the link type
- **Name**: Label of the link type
- **Vehicle class - Driving Behavior Parameter Set**: The assignment of driving behavior to a vehicle class. Different classes can have different driving behavior parameters assigned.

Driving behaviors are defined in **BASE DATA – DRIVING BEHAVIOR...** (see section 5.4).

- The **Link type color** is displayed only during 2D edit mode and 3D mode and if **Use link type colors** is active in the global display options (**VIEW - OPTIONS [COLORS])**.

- If **Invisible** is active, a link will not be drawn during the simulation or animation but vehicles traveling on that link will still be visible.

Currently the drawing sequence of links cannot be changed by the user.

Certain small VISSIM licenses (e.g. U.S. level 1) are restricted to the maximum of two link types per network file.
In this chapter, modelling a VISSIM network - creating and editing network elements - is described.
6.1 Overview

The basic element of a VISSIM traffic/transit network is a link representing a single or multiple lane roadway segment that has a specified direction of flow. A network can be built by connecting links with connectors. Only connected links allow for continuing traffic. Links that simply overlap (without a connector) have no interaction with each other.

Network elements can be defined at any location within the traffic and transit network.

Selection of network elements

For creating, editing or deleting a network object, the button of the respective network object type has to be active in the symbol bar.

Single-select mode

- By default, a network object is selected by **left-clicking directly** on the network object in the VISSIM network display on screen. Double-click calls the respective **Edit attributes** window.
- Alternatively, a selection list showing all network objects currently defined in the VISSIM network for the respective network object type can be called via
  - **EDIT - SELECTION LIST** or
  - right-click outside of the network.

Further steps:
- Select network object in the list and click **DATA** or **DELETE**.
- Instead of clicking **DATA**, the **Edit attributes** window can be called immediately by double-clicking the selected network object.
- It might be helpful to click **ZOOM** additionally for visualization of the selected network object within the VISSIM network.

Multi-select mode

For definition of active nodes or links/connectors, a polygon has to be drawn by several right-clicks in the network display on screen, see section 3.3.2.

Active network objects

- can be
  - deleted or
  - moved;
- have to be defined for two options provided under **EVALUATION - FILES**:
  - **Link evaluation** and
  - **Nodes**.

For **Link evaluation**, relevant attributes of active links/connectors can be edited.

Further selection options which might be provided for a network element are described in the respective section of this chapter.
The VISSIM network consists of
► static data remaining unchanged during the simulation and
► dynamic data containing all information about the simulated traffic.

**Static data**

Static data represents the roadway infrastructure. This data is required for both simulation and testing of a traffic actuated signal control logic. Static data includes:
► Links with start and end points as well as optional intermediate points; links are directional roadway segments with a specified number of lanes
► Connectors between links, e.g. to model turnings, lane drops and lane gains
► Location and length of transit stops
► Position of signal heads/stop lines including a reference to the associated signal group
► Position and length of detectors
► Location of transit call points

**Dynamic data**

Dynamic data is only to be specified for traffic simulation applications (not for applications using only the test functionality). It includes the following information:
► Traffic volumes including vehicle mix (e.g. truck percentage) for all links entering the network
► Location of route decision points with routes (link sequences to be followed), differentiated by time and vehicle classification
► Priority rules (right-of-way) to model unsignalized intersections, permissive turns at signalized junctions and yellow boxes (keep-clear-areas).
► Location of stop signs
► Public transport routing, departure times and dwell times

**Measures of Effectiveness (MOE)**

For measures of effectiveness the following elements (among others) can be coded:
► Data collection points (local measurements, user-definable, e.g. traffic volume, acceleration and speed discriminated by vehicle classes)
► Travel time measurement sections and delay data collection
► Queue counters for queue length statistics
Example

Simple network in normal display
The roadwork is displayed in dark gray showing an intersection with three legs and two pedestrian crossings.

Simple network in center line display:
The same roadwork is displayed as the center lines of the links (blue) and connectors (purple).

The junction in the example above is signal controlled with signal heads and detectors. Additionally some movements are secured by priority rules. (the colors of the network elements depend on user-defined settings.)
6.2 Import/Export

6.2.1 Network Import

For a productive workflow it is possible to import part or all of VISSIM network data from other applications.
In VISSIM 4.1, the Export functionality has been extended.

6.2.1.1 Read Network Additionally

VISSIM can read any other VISSIM network in addition to the current network. Any numbering conflicts of network elements or other data blocks are resolved. Furthermore the user can select to read certain network elements only.

To read a VISSIM network file additionally:
1. Go to File - Read Additionally... (available only if the current network was already saved).
2. Select the filename of the file to be read additionally.
3. Choose the Network Elements and Insert Position options and confirm with Ok. (For illustration and details see section below. The default settings read the entire network additionally.)
4. If the network is floating, defloat it at the desired location by clicking the left mouse button.
Insert Position
- **Select position with left mouse button:** Inserts the additional network as floating selection which can be moved with the mouse prior to its definite placement. Left click defloats the additional network.
- **Keep original world coordinates:** The additional network is placed exactly at the same location ("world coordinates") as in the original file. This method is recommended e.g. to combine several partial networks that were created based on a global coordinate system.

In both options the additionally read network portion remains multi-selected.

Network Elements
Each network element type can be activated or deactivated for the import. However, if a network element type is selected, all network element types that it refers to are selected automatically as well. If a network element type is deselected, all network element types referring to it are deselected automatically.

For each network element type of the imported network the numbering scheme can be specified:
- **New Numbers:** Each element will get a new number that is higher than the highest previously existing number of such a network element (in both networks), by adding a sufficiently high round
number to the old number of the imported network element. (If this procedure would cause numbers higher than 2,147,483,648, the read process is canceled with an error message.)

- If **New Numbers** is **not** checked, each imported network element keeps its number if this one doesn't yet exist in the old network, in which case it is changed as above.

- **Keep duplicates:** For each network element without a geometrical position (e.g. distributions) the user can select if exact duplicates of existing network elements are to be kept (with new numbers) or not.

**Example:** If the vehicle types 1..6 are defined identically in both networks then **Keep duplicates** changes the numbers of the vehicle types of the imported network to 11..16 (usually this is not desirable). If **Keep duplicates** is **not** checked, the corresponding network elements of both the existing and the imported files are compared by all their properties except for numbers. If two network elements are identical (no matter what number they have) then all references from the imported network are changed to that network element of the existing file.

### 6.2.1.2 TEAPAC and SYNCHRO Import (optional module)

Entire VISSIM networks including signals and signal timing can be imported from the signal optimization software packages TEAPAC and SYNCHRO if this module is part of your VISSIM license.

To use this feature go to **FILE – IMPORT… - TEAPAC resp. SYNCHRO.** The **TEAPAC Import resp. SYNCHRO Import** window opens.

Both of these windows receive the information necessary for converting the existing networks into the VISSIM format.

Networks created through this process will not match an existing background map or aerial photo in the same way as a network built by hand does. But they are as accurate as the input data provided and require a minimum of adjustment.
6.2.2 Network Export

Menu FILE - EXPORT - VISUM provides two options to export the VISSIM network in VISUM *.NET format.

Furthermore, VISSIM network data can be saved as VISUM *.NET file additionally to the *.STR output file during a simulation run, if option Link evaluation is active under EVALUATION - FILES.

Any export file is saved to the folder where the currently used *.INP file is stored. Directory changes are not permitted.

VISSIM data exported in VISUM network file format will not code a complete VISUM network. In VISUM, VISSIM data in VISUM data format may be used for visualization only, this network file cannot be used for assignments.

The “Export to VISSIM” functionality provided in VISUM cannot be applied to exported VISSIM networks. The VISSIM network originally exported from VISSIM to VISUM cannot be restored in VISSIM this way.

FILE - EXPORT - VISUM - NODES/EDGES...

(only provided for networks being subject to Dynamic assignment in VISSIM)

► The abstract network graph of VISSIM (nodes and edges) is written to a VISUM network file (*.NET).

► Additionally the paths and volumes (from the last simulation run where a path file (*.WEG) was written) are exported to several VISUM route files * RIM (one for each Dynamic Assignment evaluation interval). These files can be imported in VISUM, e.g. to create a volume diagram or to calculate a matrix correction with TFlowFuzzy.
FILE - EXPORT - VISUM - LINKS/CONNECTORS...

- The exported VISUM network file (*.NET)
  - contains the user-defined VISUM link attributes listed below for each exported VISSIM link or VISSIM connector,
  - can be read from file in both versions, VISUM 8 and VISUM 9.
- In VISUM, various graphical analyses can be performed, e.g.
  - use the link filter to set those links to the active state which show outstanding e.g. emergency stop positions or cost values, or
  - highlight all links being closed to selected vehicle classes.

<table>
<thead>
<tr>
<th>User-defined VISUM attribute</th>
<th>Link</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Surcharge 1</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Surcharge 2</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Emergency stop position</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Lane change position</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Closed to vehicle class (0=no, 1=yes)</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

EVALUATIONS – FILE – LINK EVALUATION

- A so-called base network file containing the network objects links and link polygons is created and saved as <VISSIM-INPUT-FIILENAME>.NET, and
- for each time interval, an additional network file containing the evaluation data gained during the particular time interval coded as user-defined VISUM attributes is created and saved as <VISSIM-INPUT-FIILENAME>_<INTERVALEND>.NET.

For data export during link evaluation:
- active links have to be defined in the Multi-select mode and
- option Link evaluation has to be checked in the Link attributes (Multi-select) window.

Via menu EVALUATION – FILE the Evaluations (File) window is called.

Here, the followings settings are required:
- Check option Link evaluation and
- Click CONFIGURATION button and set parameters:
- Check option **VISUM Export (Network + link attributes)**,
- Set intervals (take simulation time interval into consideration) and
- Set format option:
  - If option **VISUM 9 format** is **unchecked**, network data is saved in VISUM 8 data format.
  - Data in VISUM 8 *.NET format is required for reading network additionally in VISUM 8.
  - Data in VISUM 9 *.NET format is required for reading network additionally in VISUM 9.

For VISUM export, option **by lane** must be unchecked. Attribute **LaneNo.** is not exported.

- The **Base network file** contains VISUM nodes and links with
  - link evaluation attributes with constant values during simulation, and
  - the user-defined link attribute **LinkEvaluation {yes/no}**.
- Any **Interval network file** contains only the data coding user-defined link attributes and their respective values gained in the particular time interval.

Generating VISUM network objects from VISSIM network elements:
- A VISSIM link **without** segment evaluation is modeled as a VISUM link.
- A VISSIM link **with** segment evaluation is modeled as a set of VISUM links: from each VISSIM link segment a separate VISUM link is generated.

Generated VISUM nodes are numbered in adjacent order, starting from 1.
In both versions, VISUM 8 and VISUM 9,
► the exported base network file has to be opened first,
► then all further export files *.<INTERVALENDE>.NET have to be read using option ☑ Read network additionally.
6.3 Network Coding

The level of detail required for replicating the modeled roadway infrastructure depends on the purpose of a VISSIM application. While a rough outline of the analyzed intersection is sufficient for testing a traffic actuated signal logic, a more detailed model is required for simulation analyses. With VISSIM it is possible to model virtually any kind of intersection (or sequence/network of intersections) with a precision down to one millimeter!

In the event of using VISSIM to test traffic actuated controls through interactive, manual detector activation, it is recommended to create a rough model of the analyzed intersection including all approaches. However, it is not necessary to place the stop lines and detector loops at the exact positions.

For the purpose of simulating traffic and transit operations, it is necessary to replicate the modeled infrastructure network to scale. This is done either by using

- a scaled network import from VISUM, CROSSIG (or other applications that provide VISSIM network files), or
- a scaled import from one of the signal control optimization software packages TEAPAC and SYNCHRO (additional module, see chapter 6.2 for details), or
- base maps or drawings as a background so that the VISSIM network can be traced exactly according to a scaled map (see chapter 4.4 for details).

Network elements can be moved not only within the same link/connector but also to any other link/connector. Also the start and end of connectors can be moved to a different link. Input flows and the start of transit routes cannot be moved.

6.3.1 Links

If you are starting with an empty network in contrast to an imported one, you need to ensure that the scaling is right before you start to code the VISSIM network. This is done using at least one scaled background graphic. For details on how to load, move and scale a background graphic, please refer to chapter 4.4.

The first step in coding a VISSIM network is to trace links. Therefore look for all of the approaches to an intersection and determine the number of lanes both on the approach and within the intersection. Each approach and section will be represented by one link. Start with the major roads.

A link cannot have multiple sections with a different number of lanes. Thus multiple links need to be created for each section. If for any reason the number of lanes needs to be changed once a link is created, the split command can be used (EDIT - SPLIT LINK, default shortcut F8).
Modeling techniques:
- Create a link for one direction first, model its curvature and then use *Generate Opposite Direction* to create a similar shaped link in the opposite direction.
- Connectors (rather than links) should be used to model turning movements.
- Links should not turn corners at an intersection but should be extended to almost the center of the junction (if different number of lanes do not allow for a “through link”).

### 6.3.1.1 Graphical Editing

For all subsequent link actions, mode *Links and Connectors* needs to be active.

#### Create

1. With the right mouse button click at the desired start position of the link, drag the mouse in the direction of flow to the destination position and release the mouse button.
2. Edit the link data (for details see below)

#### Select

Left click on the link.

If multiple links/connectors overlap each other at the click position, the button 🕯️ (default shortcut TAB) may be used to browse through all links and connectors at the mouse click position in order to select the desired one.

#### Move

1. Select link.
2. While holding down SHIFT, left click on the link and drag it to the desired location.

#### Split

1. Select link.
2. Choose *EDIT* - *SPLIT LINK* (or default shortcut F8)
3. Left click on the split position.
4. Specify data:
   - Choose whether a connector should be created automatically or not.
   - Optionally the exact split position and the number of the new link can be specified.
5. Confirm with OK.
**Edit link data**

**Single-select Mode:** Double click on the link.

**Multi-select Mode:** Define active links (specify polygon) and right-click outside of the network.

**Edit curvature**

Select link. Choose the desired action for intermediate points:

- **Create:** Right click on the desired location within the link.

  **Create spline:** While holding down **ALT**, click left in the section (between two points) were you would like to start the spline, drag the mouse to the destination section of the spline and release the button there.

  In the upcoming window, select the number of intermediate points (including the start and end point of each section) and choose, if the existing points should be kept.

  The spline is drawn according to the direction of the first and the last section of the link portion.

- **Move:** Select and drag it to the desired location. The link length is automatically adjusted and displayed in the middle section of the status bar.

- **Delete:** Move it onto another intermediate point. To delete a section of points drag the last one of that section to the first one. All points between the two will be deleted.

- Define different **height** value: While holding down **ALT**, double click on the point to enter the height.

**Delete**

**Single-select Mode:**

Select link

- either in the network and click
  - **DEL** or
  - **EDIT - DELETE**.

- or in the selection list;

  Then click **DELETE**.

**Multi-select Mode:**

- Define network section (active elements)

  then click
  - **DEL** or
  - **EDIT - DELETE**.

  finally
  - check option(s) and
  - confirm OK in the “**Multiselection Delete**” window.
### 6.3.1.2 Properties & Options

The following attributes can be defined for a link:

- **No:** Unique identifier of the link (can only be edited on link creation)
- **Name:** Any label or comment
- **No. of Lanes**
- **Type** selects the link type that controls characteristics such as color and driving behavior (see section 5.4 for details).
- **Link length** shows the length as graphically drawn with the mouse. This value cannot be edited.

#### [LANES]

All parameters related to lanes:

- **Lane width:** Defines the width of each lane of the link.
- **VARIOUS LANE WIDTHS...:** Allows to define a different lane width for each lane separately.

The lane width is relevant only for graphics and to determine, if a vehicle can pass another vehicle within the same lane (if driving behavior parameters allow for it). It does not automatically influence vehicle free flow speeds.

- **With LANE CLOSURE...** one or more lanes of the link can be closed to any vehicle class. A LANE CLOSURE affects the vehicle behavior as follows:
  - Vehicles of classes to which the lane is closed will never move onto that lane (even if they have to! – e.g. according to a routing decision)
  - Will not enter that lane (from a vehicle input) except when all lanes are closed to that class

If **all** lanes of a link are closed to a vehicle class, vehicles of that class will still travel on that link but will not change lanes.

To delete a selection within the list of vehicle classes, press **CTRL** while clicking with the left mouse button.
To prevent vehicles from changing lanes on a multi-lane link/connector (e.g. when using a two-lane link with staggered stop lines) all lanes should be closed to all vehicle classes.

**Caution:** This modeling trick can lead to a deadlock: Allow enough time and space for vehicles that must change lanes according to a route.

Parameters that change the appearance of the link (no influence on driving behavior):

- **Height (3D):** Defines the z-coordinate of the start (Begin) and the End point of the link to be visible in 3D graphics mode. The Height has no effect on any driving behavior (it is independent of the gradient).

- **☑ Recalculate Spline Point Height** causes the intermediate (spline) points of the link to always reflect a straight “height line” between the two end points. See 6.3.1.1 “Edit curvature” on how to change the height of an individual spline point.

- ☐ **Visualization:** When turned off, no vehicles are shown on that link during the simulation. This option can be used e.g. to model tunnels and underpasses in 2D graphics. In 3D graphics it’s better to use the Height fields instead to show a realistic picture.

- ☐ **Label:** When showing link labels (to be switched on in VIEW - NETWORK ELEMENTS...) this option allows to individually switch off the label of that link.
Various other parameters:

- The **Gradient** changes acceleration and deceleration capabilities of all vehicles: For each percent of **positive** gradient (= road incline) the acceleration decreases by -0.1 m/s² and for every **negative** gradient it increases by 0.1 m/s². A gradient has no visual effect in 3D graphics mode (use the **Height (3D)** property to model different heights in 3D).

- ☑ **Generate opposite direction** creates a new link with the same curvature and the specified **No. of Lanes**, as the existing link. This new link points in the opposite direction of flow is placed next to the original link. If activated, the opposite direction link is generated as soon as the window is closed by pressing Ok. Any **Opposite Direction** link is not linked with the original link.

- **CHANGE DIRECTION** inverts the direction of traffic flow on that link.

- **EVALUATION**... (relevant for **Traffic Display**, option **Aggregated values**, and for **Link Evaluation**): Enables/disables **Segment Evaluation** of that link and defines the **Segment Length**. These properties can also be set for several links simultaneously by using the multi-select option (see section 3.3.2).

- **COST**... (relevant for Dynamic Assignment only): Opens a window where the cost and surcharges of the link can be set. These numbers are used by the Dynamic Assignment to evaluate the link cost of vehicles traveling on that link.

Free lane change only occurs on multiple lane roadway sections, but not between adjacent links; thus multiple lane links have to be used whenever vehicles should be able to pass each other.

With certain driving behavior settings it is possible that vehicles can overtake other vehicles within the same lane if it is wide enough (e.g. vehicles can overtake bikes on a single lane link). See “Lateral Behavior” in section 5.4 for more information on the required driving parameters.
6.3.2 Connectors

In order to create a road network, links need to be connected to other links. It is **not** sufficient to place one link on top of another link in order for vehicles to continue on the other link. Instead, a connector needs to be created to connect the two links. Furthermore connectors are used to model turnings of junctions.

Wherever possible the overlapping parts of a link and connector should be minimized in order to avoid modeling errors.

Connectors implicitly do have the same link type as the link where they originate from.

6.3.2.1 Graphical Editing

For all subsequent connector actions, mode **Links and Connectors** needs to be active.

**Create**

1. With the right mouse button click at the desired start position **inside** a link, drag the mouse in the direction of flow to the position **inside** the destination link and release the mouse button.
2. Edit the connector data (for details see below).

**Select**

Left click on the connector.

If multiple links/connectors overlap each other at the click position, the button (default shortcut **TAB**) may be used to browse through all links and connectors at the mouse click position in order to select the desired one.

**Move**

► In total, a connector can only be moved along with its start and destination link while in Multi-Select-Mode (see section 3.3.2 for details).
► To change the **connector position** within the start or destination link:
   1. Select the connector
   2. Click on the desired start/end point and drag it with the mouse to the desired location within the link.
► To change the **start/end** link of the connector:
   1. Select the connector
   2. Click on the desired start/end point and drag it with the mouse to the desired location within the new link.

Moving the start/end points of connectors or moving entire connectors from one link to another may break public and private transport routes.

**Split**

Not possible for connectors.
Network Coding

**Edit data**

- **Single-select Mode**: Double click on the connector.
- **Multi-select Mode**: Define active connectors (specify polygon) and right-click outside of the network.

**Edit curvature**

Select connector. Choose the desired action for intermediate points:

- **Create**: Right click on the desired location within the link.
- **Create automatic full spline**: Double click on the connector and activate the Spline option. All intermediate points are automatically relocated to form a Bezier curve.
- **Create automatic partial spline**:
  1. While holding ALT, press the left mouse button in the section (between two points) were you would like to start the spline and keep the button pressed
  2. Drag the mouse to the destination section of the spline and release the button there. The window Convert section to spline opens.
  3. Select the number of intermediate points (including the start and end point of each section) and choose, if the existing points should be kept.
  4. The spline is drawn according to the direction of the first and the last section of the connector portion.
- **Move**: Select and drag it to the desired location. The connector length is automatically adjusted and displayed in the middle section of the status bar.
- **Delete**: Move it onto another intermediate point. To delete a section of points drag the last one of that section to the first one. All points between the two will be deleted.
- **Define height value**: While pressing ALT, double click on the point to enter the height.

**Delete**

- **Single-select Mode**: Select connector
  - either in the network and click
    - **DEL** or
    - **EDIT** - **DELETE**.
  - or in the selection list;
  - Then click **DELETE**.
- **Multi-select Mode**:
  - **Define network section (active elements)**
    - then click
      - **DEL** or
      - **EDIT** - **DELETE**.
    - finally
      - check option(s) and
6 Traffic/Transit Network

- confirm OK
in the "Multiselection
Delete" window.

6.3.2.2 Properties & Options

The following attributes can be defined for a connector:

- **Name**: Any label or comment
- **from Link / to Link**: Defines the assignment of lane(s) of the connector with the lanes of both the start and the destination link. Lane 1 represents the rightmost lane. Multiple lanes can be selected by pressing **SHIFT**.

Note: The number of lanes selected from both lists must be the same. The assignment can still be edited once the connector has been created.

- **Spline**: Checking the Spline option will result in VISSIM drawing an automatic arc (Bezier curve) between the start and the end point of the connector with the specified number of Points. This can be done repeatedly in order to reflect changes in the placement of an adjacent link.

The number of intermediate points of a connector determines the accuracy of the arc: 2 points are sufficient for a straight connection, 5 to 15 intermediate points are recommended for curves (depending on the length and shape of the connector)

- **With LANE CLOSURE...** one or more lanes of the connector can be closed to any vehicle class. A lane closure affects the vehicle behavior as follows:
  - Vehicles of classes to which the lane is closed will never move onto that lane (even if they have to! – e.g. according to a routing decision).
  - If all lanes of a connector are closed to a vehicle class, vehicles of that class will still travel on that connector but will not change lanes.
- The *Emergency Stop* and *Lane change* parameters are used to model the lane change behavior for cars following their route.
  - *Lane change* defines the distance at which vehicles will begin to attempt to change lanes (e.g. distance of signpost prior to a junction).
  - *Emergency Stop* defines the last possible position for a vehicle to change lanes. Example: If a vehicle could not change lanes due to high traffic flows but needs to change in order to stay on its route, it will stop at this position to wait for an opportunity to change lanes.

- The *Direction* attribute is of no effect when vehicles are traveling on routes. Only when using Direction Decisions (not recommended) it needs to be set to a value different than *All*. Vehicles without any routing and direction information will always follow those connectors which are assigned to direction *All*. If no such connector exists, those vehicles will leave the network without warning.

**[Dynamic Assignment]**

**(optional module)**

- *Connector closed to:* Allows for modeling multi-modal networks for the use with Dynamic Assignment. By selecting one or more vehicle classes in the list, the connector is not available for route choice of the selected classes. Pressing **CTRL** while clicking with the left mouse button adds or removes an item from the current selection.

- *Cost...:* Opens a window where the cost and surcharges of the connector can be specified. These numbers are used by the Dynamic Assignment to evaluate the cost of vehicles traveling on that connector.

**[Other]**

- The *Gradient* changes acceleration and deceleration capabilities of all vehicles:
  - For each percent of positive gradient (road incline) the acceleration decreases by 
    $-0.1 \text{ m/s}^2$
  - For every negative gradient it increases by $0.1 \text{ m/s}^2$.

A gradient has no visual effect in 3D graphics mode (use the *Height (3D)* property to model different heights in 3D).
6.3.3 Desired Speed Changes

Whenever there is a change of free flow speed in the VISSIM network, a speed distribution change is to be defined. There are two ways of defining speed distribution changes:

- Temporary speed changes (e.g. for bends or turns) using Reduced Speed Areas
- Permanent speed changes using Desired Speed Decisions

Speed changes are required for modelling
- curves and turning lanes at intersections,
- any speed limits and
- bottlenecks.

The main difference between the two is, that with reduced speed areas a vehicle automatically decelerates prior to the start of the reduced speed area to get the speed defined for that reduced speed area right at the start of it. After the reduced speed area ends the vehicle automatically accelerates to the desired speed that its previously was assigned to it. A desired speed decision in contrast only affects the vehicle when it passes the decision cross section.

Each vehicle gets a fixed fractile value for speed distributions assigned when entering the network. For example, if the fractile is 40%, the vehicle will always get the 40% percentile of the desired speed distribution at desired
speed changes. If the fractile is 100%, the vehicle will always get the maximum speed value of the distribution.

Reduced speed areas and desired speed decisions can be labeled with the numbers of the assigned speed distributions also. If there is only one distribution, the lower and upper limit of the distribution is displayed as well. The label can be activated in VIEW - NETWORK ELEMENTS...

6.3.3.1 Reduced Speed Areas

When modeling short sections of slow speed characteristics (e.g. curves or bends), the use of reduced speed areas is advantageous over the use of desired speed decisions. Upon arriving at a reduced speed area, each vehicle is assigned a new desired speed from within the speed distribution assigned. After leaving the reduced speed area, the vehicle automatically gets its previous desired speed again.

When approaching a reduced speed area, a vehicle reduces its speed in order to reach its new (slower) speed at the beginning of the reduced speed area. The deceleration process is initiated according to the deceleration value defined. The acceleration at the end of the reduced speed area is determined by the characteristics of the driver-vehicle-unit as well as the original desired speed.

Definition

Prior to the definition of a reduced speed area at least one desired speed distribution needs to be defined (see section 5.2.1).

1. Select mode Reduced speed areas.
2. 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. Create the reduced speed area by right clicking at its start position (inside the link/connector) and dragging the mouse along the link/connector while the right button is held down. Thus the length of the reduced speed area is defined.
4. Release the mouse button. The Create reduced speed area window appears.
5. For each vehicle class passing that link/connector define the appropriate speed and acceleration value (see below).
6. 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.

Properties & Options

The properties of a reduced speed area can be accessed by
selecting the corresponding link/connector and
double-clicking with the left mouse button on the reduced speed area.

- **No.**: Unique identification of the reduced speed area.
- **Name**: Label or comment
- **Length**: Length of reduced speed area.
- **Lane**: Lane position within the link.
- **At**: Start position (link/connector coordinate)
- **Time (from/until)**: Defines the time interval for which the reduced speed area is active.

- **Label**: When showing labels (names) of all reduced speed areas (see VIEW - NETWORK ELEMENTS...), this option allows to individually switch off the label of that reduced speed area.
- **Vehicle Class - Desired Speed - acceleration** combination: For each relevant vehicle class one data line needs to be defined. It includes the desired speed distribution to be used by vehicles of that class while they travel in the reduced speed area and a deceleration value that defines the maximum deceleration used to slow down prior to the reduced speed area. The lower the value, the further away a vehicle starts to slow down. Use the buttons **NEW, EDIT and DELETE** to edit, create or delete a data line.

Reduced speed areas are typically used for curves (e.g. turning movements). Thus they are normally placed on connectors rather than links. If two reduced speed areas with the same properties are placed close to each other then the vehicles affected by them will continue with the reduced speed even between the two areas.

In order for a reduced speed area to become effective vehicles need to pass its start position.

A reduced speed area should not overlap with a stop line (of a signal head, priority rule or stop sign) but should start after a stop line. Otherwise it might happen that the stop line is not recognized by all vehicles.

A reduced speed area cannot reach across multiple links. However, multiple areas (one for each link) can be created and placed sequentially.
The combination of vehicle classes, speed distribution and acceleration value of the last reduced speed area that was edited is used as a default when placing a new reduced speed area.

Reduced speed areas can only be used for speed reductions, not to increase vehicle speeds.

### 6.3.3.2 Desired Speed Decisions

A desired speed decision is to be placed at a location where a permanent speed change should become effective (i.e. change of desired speed). Each vehicle gets a new speed from the relevant speed distribution as it crosses over the desired speed decision. Only then it reacts to the new speed - either by acceleration or deceleration according to its desired acceleration/deceleration function.

The typical application is the location of a speed sign in reality. Other applications include entries or exits of urban areas or narrow lane widths (average speed drops).

**Definition**

Prior to the definition of a desired speed decision at least one desired speed distribution needs to be defined (see section 5.2.1).

1. Select mode "Desired speed decisions".
2. Select the link/connector where the desired speed decision should occur.
3. Right click at the location of the speed decision on the selected link (decision point). The *Create desired speed decision* window opens.
4. For each vehicle class passing that link/connector define the appropriate speed distribution (see below).
5. Confirm with Ok. For multi-lane links desired speed decisions need to be defined for each lane separately. Thus different characteristics can be defined for each lane.

**Properties & Options**

The properties of a desired speed decision can be accessed by

- selecting the corresponding link/connector and
- double-clicking with the left mouse button on the desired speed decision.
• **No.**: Unique identification of the desired speed decision.
• **Name**: Label or comment
• **Lane**: Lane position within the link.
• **At**: Link/connector coordinate.
• **Time (From/Until)**: Defines the time interval for which the desired speed decision is active.

☑ **Label**: When showing labels (names) of all desired speed decisions (see **VIEW - NETWORK ELEMENTS...**) this option allows to individually switch off the label of that desired speed decision.

• **Vehicle Class - Desired Speed Distribution** combination: For each relevant vehicle class one data line needs to be defined. It includes the desired speed distribution to be assigned to vehicles of that class as they cross over the desired speed decision. Use the buttons **EDIT, NEW and DELETE** to edit, create or delete a data line.

Vehicles of classes that are not part of the data lines of a desired speed decision remain unaffected.

The desired speed decision defines where vehicles **start to change** the desired speed (not where they reached it already). Thus acceleration or deceleration occurs after the vehicle has passed this decision point. Depending on the current speed, the vehicle reaches its new desired speed at some point downstream.

If the desired speed decision is defined to model only a short stretch of a low speed area (e.g. bend or curve), a second desired speed decision has to be defined at the end to change the desired speed back to its original value. In that case it is more appropriate to use reduced speed areas △ as explained above.

Desired speed decisions are effective for all vehicles of a selected category; a selection only effective for turning vehicles is not possible but can be modeled by placing a Reduced Speed Area in the turning connector only.

The combination of vehicle classes and speed distribution of the last desired speed decision that was edited is used as a default when placing a new desired speed decision.
6.3.4 Rotate and Translate Network

In the VISSIM workspace it is possible to move and rotate the entire network. If only part of the network should be moved, then the move option of the multi-select-mode can be used (see 3.3.2).

A background image will not be affected by rotating or translating the network.

**Rotate Network**

**EDIT – ROTATE NETWORK...** rotates the network counterclockwise by the specified *Angle*.

**Translate Network**

**EDIT – TRANSLATE NETWORK...** moves the network by the specified *X* and *Y Distance*.

6.3.5 Pavement Markers

The edit mode Pavement Markers allows for placing markers on lanes showing the turning movements or direction of that lane or a high occupancy vehicle diamond.

**Definition**

1. To insert a marker in “Pavement Marker” mode, select a link or connector.
2. Right click on the start position of the marker. The *Create pavement marker* window opens.

3. Define the type of the marker, the exact position and the *Direction*. It is possible to choose any combination of *Directions*.

The visibility of all pavement markers is controlled in *View – Network Elements*.

**Properties & Options**

Doble-clicking a pavement marker calls the *Edit pavement marker* window.

- **Type**: Defines the displayed shape.
- **Directions** (relevant only for Arrow markers): Any combination is possible.
- **Position**: Enter position on link.

Pavement markers do not affect the driving behavior. They do not provide a means to model turning movements. Use routes to model turning movements.
6.4 Automobile Traffic

In VISSIM there are basically two methods to model automobile routing information:

- Static routes using routing or direction decisions
- Dynamic Assignment of routes using OD-matrices (available only with optional VISSIM module “Dynamic Assignment”)

With static routes the path of vehicles traveling through the VISSIM network can be statically determined either by routing decisions (section 6.4.4) or direction decisions (section 6.4.5). However, it is strongly recommended to use routing decisions since they are much easier to handle and the vehicle flows can be defined more precisely. In addition, vehicle input flows need to be defined in order for vehicles to enter the VISSIM network.

The use of Dynamic Assignment is explained in detail in chapter 11. When Dynamic Assignment is used, no static routes or input flows need to be defined.

6.4.1 Traffic Composition

A traffic composition defines the vehicle mix of each input flow to be defined for the VISSIM network. Please note that vehicles of transit routes must not be included here but will be defined separately (see chapter 6.5).

A traffic composition is part of any vehicle input in VISSIM and thus needs to be defined prior to the actual vehicle input flow. Also pedestrian flows are to be defined as a traffic composition. It consists of a list of one or more vehicle types with each one having a flow percentage and speed distribution assigned.

**Definition**

Traffic compositions can be defined at TRAFFIC - COMPOSITIONS...

The list can be edited using the buttons NEW, EDIT and DELETE.

Additional parameters such as Catalytic converter temperature distribution and cooling water temperature distribution are available only in conjunction with the optional VISSIM emission module.

![Traffic Composition Window](Image)
Properties & Options

For each data line the following parameters are to be defined:

- **Vehicle type**: Defines for which vehicle type the following data is defined.
- **Relative flow**: The relative percentage (proportion) of this vehicle type. After a composition is completed, VISSIM internally adds up all Relative flow values and calculates the absolute percentages to be used for each vehicle type of this composition. Therefore it is not necessary to enter values strictly between 0.0 and 1.0 but it is also possible to enter vehicle flows instead of percentages.
- **Desired speed**: The speed distribution to be used for the specified vehicle type when entering the VISSIM network.

6.4.2 External vehicle course files

This option allows for graphical representation of external vehicle course information thus not using any driving behavior of VISSIM. External vehicle course files need to be selected in the External Vehicle Course Files window which is accessed by TRAFFIC - EXTERNAL VEHICLE COURSE FILES...

Every file defines the journey of one vehicle using the following ASCII-text format:

- **1st row contains 5 values, separated by one or more blanks:**
  - vehicle type number
  - no. of starting link
  - no. of starting lane
  - coordinate within starting link [m]
  - starting time [s]

- **Every further row contains one value:**
  - Speed [m/s] at the end of simulation time step

Every time step of the simulation the next speed information for each vehicle will be read out of the file and assigned to that vehicle. As soon as the end of the file is reached, the vehicle will be taken out of the network.

6.4.3 Vehicle Inputs (Traffic Volume)

You can define time variable traffic volumes to enter the network. Traffic volumes are entered for a specific link and time period in **vehicles per hour** even if the time period is different from one hour. Within this time period 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 the defined time interval, a message is written to a log file (same name as input file with extension *.ERR) and the user is notified at the end of the simulation.

Input flows do not need to be defined when Dynamic Assignment is used as then the flow information is contained in the OD-matrices.

**Definition**

Prior to the definition of vehicle inputs at least one traffic composition needs to be defined (see section 6.4.1). Follow the steps below to define a vehicle input:

1. Select mode **Vehicle Inputs**.
2. Select the link where a vehicle input should be defined.
3. Double-click the left mouse button on that link to open the **Vehicle Inputs** window. Any existing inputs on that link will be shown.
4. Press **New** to create a new vehicle input, **Edit** to edit an existing one. The **Edit vehicle input** window appears.
5. Define the input properties (as shown in the next section) and confirm with **Ok**.
6. If applicable, define additional flows at other time intervals in the same way

**Properties & Options**

The vehicle input properties can be accessed by left double-click anywhere on the corresponding link. These parameters are available:

- **No.**: Unique identification of the vehicle input
- **Name**: Label or comment
- **Label**: When showing vehicle input labels (see **VIEW - NETWORK ELEMENTS...**) this option allows to individually switch off the label of that vehicle input.
- **Composition**: Vehicle mix to be selected from the previously defined set of traffic compositions.
• *Volume*: Traffic volume, always as vehicles per hour (no matter what time interval will be defined). **Caution**: This is usually a different value than pcu (passenger car unit)!

• *from/until*: The time interval (in simulation seconds) when this input is to be active. Time intervals may overlap when defining more than one time interval for the same entry link.

• ☑️ *Generate exact number of vehicles*: Creates exactly the edited number of vehicles to enter the network as opposed to a distribution.

### 6.4.4 Routes and Routing Decisions

A route is a fixed sequence of links and connectors

► from the routing decision point (red cross section)

► to a destination point (green cross section).

Each routing decision point can have multiple destinations resembling a tree with multiple branches.

A route can have any length - from a turning movement at a single junction to a route that stretches throughout the entire VISSIM network.

A routing decision affects only vehicles of a class that is contained in the routing decision and not having any routing information. If a vehicle already has a route assigned to it then it first has to pass its destination point (green bar) prior to be able to receive new routing information. Exceptions of this rule: Partial routes and Parking lot routes (see below).

#### Definition

Route definition (except routes of type *Parking lot*) is a four step process. To initialize the process, click on the Routing Decision 🔴 mode button. The next required action is shown in the status bar. To get back one step, left click outside the VISSIM network. Please see section 6.4.4.3 for details on where to place the decision and destination points.

1. Select the link/connector for the start of the route.
2. Right click on the location for the routing decision point (red bar) on the selected link. The *Create Routing Decision* window appears. Define the routing decision properties (as shown below) and confirm with Ok.
3. Select the link/connector for the route destination.
4. According to route type:
   - *Parking lot*: Select parking lot(s) by left-click; selected parking lots are highlighted in blue.
   - *Dynamic*: cf. section 11.7.5
   - *Else*:
     Right click on the location for the route destination point (green bar). If there is a valid connection between the red bar and the click position the link sequence is shown as a yellow band and the *Route
window appears. Define the route properties (as shown below) and confirm with Ok.
If there is no consecutive sequence of links and connectors possible, VISSIM cannot suggest a route and thus neither the yellow band nor the Route window appears. In that case, either the destination link or destination location must be changed or any missing connectors be created.

To define
► more destinations (multiple routes) from the same routing decision point (red bar), click twice outside the VISSIM network to go back two steps and continue with steps 3 and 4 for each additional route.
► a new routing decision, click on the Routing Decision mode button and repeat steps 1 to 4.

6.4.4.1 Routing Decisions

Upon selection of the Routing Decision mode all defined
► routing decisions are shown in dark red and additionally the
► destination cross sections of all routing decisions are shown in dark green.

A selected routing decision is displayed in light red, and only the corresponding destination cross sections remain visible (light green).

Properties & Options

The properties of a routing decision can be accessed by the following sequence:
1. Click on the “Routing Decision” mode button (to make sure to be in step 1 so that no routing decision is shown in bright red).
2. Select the corresponding link/connector.
3. Double-click with the left mouse button on the routing decision (the routing decision must be shown in highlighted red).

• No.: Unique identification of the routing decision
• Name: Label or comment
[LOCATION & TYPE]

- **At:** Link/connector coordinate.
- **Label:** When showing labels (names) of all routing decisions (see **VIEW - NETWORK ELEMENTS...**) this option allows to individually switch off the label of that routing decision.
- **Vehicle Classes:** Define the vehicle classes to be affected by this routing decision (transit routes are defined separately in the Bus/Tram Lines mode - see chapter 6.5).
- **Type (Static, Partial Route, Parking lot, Dynamic, Closure):**
  - **Static routes:** Routes vehicles from a start point (red) to any of the defined destinations (green) using a static percentage for each destination.
  - **Partial Route:** Defines a section of one or more static routes where vehicles should be re-distributed according to the routes and percentages defined by the partial routes. After leaving the partial route vehicles continue to travel on their original route.
    **Example:** Partial routes can be used to model route diversion caused by variable message signs (VMS) without the need to change each individual route that passes the section where the VMS is active. Instead simply one partial routing decision with two routes (if there are two alternative routes possible) and the desired proportions of traffic assigned to these partial routes needs to be defined.

Partial routes also affect transit lines. In order to prevent transit lines to be rerouted restrict the **Vehicle Classes** accordingly.

- **Parking lot:** (only for parking lots of type **Real parking spaces**): Defines a decision point that automatically generates routes leading to each of the selected destination parking lots and routes leading from those parking lots back into the link network. Select parking lot(s) of the appropriate type instead of destination point(s), cf. section 11.3.1.
- **Dynamic** (relevant for Dynamic Assignment only): Defines a decision point where traffic is re-routed according to a user-definable condition and strategy. For more information please refer to chapter 11.7.5.
- **Closure** (relevant for Dynamic Assignment only): Defines a route as a link sequence to be excluded from the set of edges available for Dynamic Assignment. For more information please refer to chapter 11.8.4.
Define the time intervals for which the routing decision should be active. VISSIM allows for different route proportions for each time interval. The time intervals must not overlap. Use the EDIT, NEW and DELETE functions to modify time intervals.

When multiple routes are defined for a routing decision all Relative Flows for each time interval are listed in the Time Interval window and can be edited here as well.

For the last time interval it is recommended to leave the default value of 99999s.

In case of temporal deviations of the flow shares using the routes of a routing decision, various non-overlapping time intervals have to be defined.

For routing decisions of the Parking lot type not only the Time interval(s) need to be defined, but also the Rate of parking vehicles (in %) has to be entered and the Time distribution has to be selected per time interval. Cf. section 5.2.6

This tab page is relevant only for routing decisions of the Parking lot type. Please refer to chapter 11.7.5 for details.

No vehicles will be taken out of or added to the network automatically in order to match the relative flows of a route with the absolute flows (e.g. counted turning proportions of subsequent junctions in most cases do not match). The user is responsible for consistent flow data in order to replicate the real condition.
Relative Flows: Instead of absolute vehicle flows VISSIM uses relative flows to determine the proportions among all route destinations of one routing decision. This characteristic allows that either real flow volumes or percentages can be entered. Internally VISSIM adds up all these relative flows and computes the absolute percentage for each flow automatically.

6.4.4.2 Routes

Select a route for editing route alignment or route data:

► In the List of all Routes:
  - to be called by right-click outside the VISSIM network:
  - choose the desired route and
  - press DATA. (recommended option)

A - sign in the Volume column indicates a route of the Parking lot or Closure type which cannot be edited.

► In the network display on screen:
  - select the dark-red routing decision (active= bright red)
  - select the link/connector where the desired route destination (green bar) is located and
  - double-click with the left mouse button (active = bright green).

Properties & Options

- **Route**: Unique identification of the route.
- **At**: Link/connector coordinate of the destination (green bar).
- **Time: rel. flow**: A list that contains all time intervals defined for that route and the corresponding flow value.
- **REL. FLOW...** (or double-click on the time interval in the list): Edit the relative flow value for that route and time interval.

For more information about relative flows see info box above.
Modifying the route alignment

A yellow band represents the current route alignment (link/connector sequence). It can be changed by using intermediate points to drag part of the route on a different link/connector. In contrast to intermediate points of links and connectors, for routes these are temporary only.

A single right mouse button click on the yellow band creates a temporary intermediate point. This point can then be dragged onto another link using the left mouse button. VISSIM then calculates a new link sequence via the new intermediate point and any existing intermediate points. Intermediate points can be removed by dragging them onto another point. This also causes VISSIM to recalculate the link sequence.

A single left click outside the yellow band accepts the currently shown link sequence, thus completing the modification of the route alignment.

Deleting Routes

► To delete one route either
- open the list of all Routes (right-click outside the VISSIM network), selecting the route to be deleted and press DELETE or
- drag the route destination point (green bar) out of its link.

► To delete all routes of a routing decision
- click on the Routing Decision mode button (to make sure that no routing decision is shown in highlighted red),
- select the link/connector of the routing decision and
- drag the routing decision point (red bar) out of its link/connector.

6.4.4.3 How Routing Decisions come into Action

During the simulation each vehicle that passes a routing decision point is assigned a specific route unless it already has a route assigned to it. The stochastic distribution onto multiple routes at a single routing decision point is based on a Monte Carlo methodology; in other words the percentage of vehicles on each route corresponds directly to the routes’ designated relative flow volume. A vehicle that is assigned to a specific route chooses its travel lane on multiple lane roadways independently so that it can reach the next connector along its route. As soon as it reaches a certain range defined as Lane change parameter of the next downstream connector that is included in its route, it tries to change to a lane that leads to this connector. From this point the vehicle will not change to a lane not leading to the connector for the purpose of passing a slower vehicle except when it approaches a transit vehicle that stops.

A lane change is indicated in 2D graphics with a short red bar at the front of the vehicle (indicator) or as a flashing indicator in the 3D model (if it is defined in the 3D model). With urban driving behavior, vehicles on the destination travel lane of the indicating vehicle will then cooperate in allowing the vehicle to change lanes.
When using routes on multi-lane links, a routing decision needs to be placed **well in advance** of the point where the routes divide into different directions. This is to avoid unrealistic queues due to the fact that at a routing decision **all** vehicles will get routing information and thus more weaving might appear in the simulation than in reality. As a rule-of-thumb, the routing decision should be placed further upstream than the longest queue expected on that link.

**Recommended placement**

When a series of routing decisions are used (e.g. modeling turning movements for each junction separately) it is important to remember that a vehicle will disregard any routing decisions while it still travels on a previous one. For a vehicle to successfully move from one route to another, the start of the second route must be placed downstream of the previous one.

An easy way to accomplish this is to place all green sections of a route on the first connector (or similar position on a link) after the last decision point for that route. By placing all red sections (routing decisions) always on a link after the junction (after all connectors ended) it is ensured that all previous routes ended prior to the start of the next one (see illustration below).

As with any decision point the routing decision affects a vehicle only the time step **after** it has crossed the decision point. Therefore, the distance between a routing decision point and the first connector should be, at a minimum, equal to the distance a vehicle travels with the highest desired speed within one time step.
6.4.5 **Parking lots**

Basically, the network element “Parking lot” is used for two completely different purposes:

1. If static routes are used: Modelling parking and halting events at the road side.
2. For Dynamic assignment: Modelling origins and destinations of trips.

This section explains option 1, whereas usage of parking lots for Dynamic assignment is described in section 11.3.1.

**Parking at the road side**

For modeling intermediate stops of a certain duration, parking lots of the type *Real parking spaces* and route decisions of the type *Parking lot* are combined. These route decisions work similar to partial routes. To a route decision of the type *Parking lot*, no routes are assigned, but any number of parking lots. For this kind of route decision, the user also has to specify the percentage of vehicles to which a parking space provided by the selected parking lots is to be assigned. For assignment of parking lots or parking spaces the following criteria are taken into account:

- Open hours
- Maximum parking time
- Attractiveness

A vehicle, to which a parking space is assigned by a route decision of the *Parking lot* type, will follow an automatically generated route to drive there. Then it will park there as long as preset by the dwell time distribution specified by time interval for the route decision of the *Parking lot* type. Once the dwell time is over, the vehicle will leave from the parking lot, again following an automatically generated route. An automatically generated route serves for routing the vehicle as fast as possible to a position behind the recent route decision on its initial route.

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3 The default value of 60 seconds can be changed in the driving behavior parameter set (see section 5.4)
Thus a vehicle may
► either cover a part of its route twice
► or skip a part of its initial route.

When generating the vehicle’s route for returning into the road network, VISSIM regards both, the total initial route of the vehicle and the current position of the vehicle in the parking lot it intends to leave.

If all spaces of a parking lot are occupied, then no vehicle will be routed to this parking lot until at least one vehicle will have left thus making parking space available.

Definition

A parking lot is defined as follows:
1. Select the “Parking lot” edit mode.
2. Select the desired link/connector.
3. Mark the range to be covered by the parking lot by clicking the right-hand mouse-button at the desired “entrance gate position” on the link and keeping it pressed while dragging the pointer according to the intended length in with-flow direction.

Once the properties and options have been specified in the Create parking lot window, confirm OK.

Properties & Options

Double-clicking a parking lot calls the Edit parking lot window.

- **No.**: Unique identification of the parking lot.
- **Name**: Optional label or comment
- **At**: Link/connector coordinate of the destination (green bar).
- **Length**: Total length of the parking lot in [m]
- **Type**:
  - Zone connector
  - Abstract parking lot
Both types refer to Dynamic assignment, cf. section 11.3.1
- **Real parking spaces**: Modeled parking capacity with user-definable length of the car-parking
spaces on a lane in with-flow direction.

Combining parking lots of the type Real parking spaces and routes of the type Parking lot allows for realistic modeling of parking and halting events at the road side.

- **Label:** When showing labels (names) of all parking lots (see View - Network Elements...) this option allows to individually switch off the label of that parking lot.

These properties are regarded by Dynamic assignment.

[Dynamic Assignment]

[Parking spaces]

Only relevant to parking lots of the Real parking spaces type:

- **Lane:** Reference lane number for the Location property.

- **Location** (only provided when creating a parking lot, no subject to changes):
  - on existing lane: The parking lot is created on the selected existing lane.
  - on new lane added to the right/left: A new lane is created on the appropriate side of the link/lane and the parking lot is placed on it.

- **Length of each space:** in [m].

  If the length total differs from the length resulting from the number of parking spaces (which is automatically calculated) multiplied by the Length of each space, then the remaining length difference will be placed at the end of the parking lot in with-flow direction. This section will not be used by parking vehicles.
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[SELECTED PARAMETERS]

- **Open hours**: Time interval of availability of the parking capacity; vehicles will use this parking lot only during opening hours and will not drive there before or after.

- **Maximum parking time**:
  - Type *Real parking spaces*: vehicles having a longer dwell time will not use this parking lot.
  - Types *Zone connector / Abstract parking lot* (only relevant if a trip chain file is used): Time span, a vehicle may use this parking lot. The parking lot is not used by a vehicle, if minimum dwell time exceeds max. parking time.

- **Attraction**: The higher the value the more attractive is the parking space. Thus any parking lot feature can be modeled which is not explicitly provided as a property in VISSIM.
  For *Real parking spaces* a *First* and a *Last* value have to be entered. In case of identical values, all spaces provided by this parking lot are of the same level of attractiveness. In case of different values, the attractiveness of the spaces located in a row will increase/decrease accordingly (linear function). To model a parking lot with the most attractive spaces located either in the middle of the parking lot or - also in a symmetric manner - to the right and to the left of e.g. the elevator, two parking lots of the *Real parking spaces* type have to be created with inverse *Attraction* values for *First* and *Last*.

- **Parking fee** (only relevant for *Zone connector / Abstract parking lot*):
  - *Flat*: charged for parking not regarding the dwell time.
  - *Per hour*: charged per parking hour, thus the vehicle’s dwell time is taken into regard. If trip chains are used, the minimum dwell time will be regarded. Otherwise parking is supposed to last one hour.

6.4.6 🚶‍♂️ Direction Decisions

Direction decisions should not be used as their handling is more difficult to routes. Direction decisions remain from VISSIM when routing decisions did not exist.

**Definition**

To define a direction decision, take the following steps:

1. Select the 🚶‍♂️ Direction Decision mode. If it is not in the network elements toolbar, you can add it to the toolbar using the CUSTOMIZE function.
2. Select a link with a single left button mouse click.
3. Select the desired location for the direction decision point on the selected link with a single right button mouse click. The Create Direction Decision window appears.

Properties & Options

4. Select the desired direction of this decision point (Desired Direction).
5. Select the class(es) of vehicles to be affected by the direction decision (Vehicle Classes).
6. Define the percentage of vehicles to be affected by the direction decision (Rate).

Example: An input of 1.000 results in all vehicles of the selected type being affected by the direction decision, while an input of 0.100 only affects 10% of the vehicles.

7. In addition, a time period can be specified for which the direction decision is to be effective.

8. Having completed the parameter settings, click on Ok. The location of the direction decision point will be indicated on the link. The appearance of the direction decision will be one of the following:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue arrow</td>
<td>Direction decision to the right or left (effective at the next connector specified as 'right' or 'left')</td>
</tr>
<tr>
<td>Blue line</td>
<td>Annihilation of all effective direction decisions</td>
</tr>
<tr>
<td>Green arrow</td>
<td>Direction decision to change lanes</td>
</tr>
<tr>
<td>Green line</td>
<td>Direction decision to stay in the current lane</td>
</tr>
</tbody>
</table>

Example

DIRECTION DECISION LEFT AT 600 M RATE 30 %;
DIRECTION DECISION RIGHT AT 601 M RATE 20 %.

As a result of these two direction decisions, 20% of the vehicles will turn right at the next intersection, 24% will turn left and 56% will continue through the intersection. This is because 30% have been originally assigned with a left turn decision, then 20% of all vehicles (including those which have already a
routing decision!) are affected by the second direction decision and thus the percentage of left-turn vehicles will be reduced by 20%.

A direction decision becomes effective the time step after the vehicle has passed the decision point; thus the distance between decision point and the next following connector should be sufficient. The minimum distance depends on the speed of the fastest vehicles. If the fastest vehicle is traveling with a speed of 20 meters per second, the minimum distance between direction decision point and connector is 20 meters if the model is running at one time step per simulation second.

On a multiple lane section vehicles with an assigned direction decision ‘left’ will use the leftmost lane while vehicles with an assigned direction decision ‘right’ will move to the far right lane.

A direction decision can affect all vehicles that have not been assigned to a route. If a vehicle with an assigned direction decision passes another direction decision point and gets a new direction decision assigned to, then the new decision overwrites the previous one (see example above).

A vehicle’s direction decision is only reset when passing a connector with the appropriate direction setting. Otherwise it keeps the direction decision until it leaves the network, gets a new direction assignment or passes a direction decision with the ‘none’ criteria.

Setting the desired direction to “none” resets the direction decision for vehicles affected by that decision point.

### 6.4.7 Routing Decisions versus Direction Decisions

Routes do have several advantages compared to direction decisions. Thus it is recommended always to use routing decisions.

- While direction decisions only affect a single lane, routes capture traffic on all lanes, thus reducing coding effort.
- Routes do not require the cumbersome calculation of turning percentages when the traffic flow is distributed between more than two directions.
- Modeling traffic flow with routing decisions guaranties an accurate replication of merge situations. In contrast to turning decisions, routing decisions force vehicles to follow predefined link sequences, even if that means waiting at a connector for a gap to merge. Vehicles that have been assigned a direction decision would just continue if they cannot find a gap to merge, requiring the use of special “tricks” for realistic modeling.
- Routes allow for accurate modeling of traffic flow through multiple intersections and turning decisions. This is in contrast to modeling with
turning decisions where the origin of vehicles is forgotten after each turning movement. As a consequence, modeling with routing decisions is required, for example, when simulating a double-diamond freeway interchange where weaving between multiple traffic streams occurs between the two signalized intersections.

► The modeling of roundabouts also requires routing decisions. With direction decisions there always would be some vehicles circulating within the roundabout.
6.5 Transit (Public Transport)

Transit vehicles can operate in mixed traffic as well as on dedicated roads or tracks. They are defined separately from all other traffic.

Data input for transit occurs in two steps:

Step 1: Definition of transit stops.

Step 2: Definition of routes including served transit stops and schedules.

6.5.1 Transit Stops

Transit stops can be created on or adjacent to an existing link. There are two types of stops:

► On Street stop (curbside stop): A transit vehicle stops on a user defined travel lane of the selected link

► Bus Lay-by (turnout): A transit vehicle stops on a special link next to the slow lane of the selected link.

Vehicles approaching a transit vehicle that stops for passenger interchange will attempt to pass it on a multiple lane link, but will wait behind the transit vehicle on a single-lane link. By default, a bus leaving a lay-by will have the right-of-way (appropriate priority rules forcing following vehicles to yield for the transit vehicle are coded automatically). Deleting the priority rule for the bus priority changes this behavior.

Definition

Prior to the definition of a transit stop, at least one dwell time distribution needs to be defined (see section 5.2.6) except when dwell time calculation is used (see section 6.5.2 for details).

1. Select edit mode Bus/tram stops.

2. Select the link/connector on (or adjacent to) which the transit stop should be placed (a lay-by stop can only be placed on a link, not a connector).

3. Create the stop by right clicking at its start position (inside the link/connector) and dragging the mouse along the link/connector while the right button is held down. Thus the length of the stop is defined (it is displayed in the middle section of the status bar).

4. Release the mouse button. The Create bus/tram stop window appears.

5. Define the stop properties (as shown in the next section) and confirm with Ok.

Properties & Options

The transit stop properties can be accessed by selecting the corresponding link/connector and double-clicking with the left mouse button on the stop.
- **No.**: Unique identification of the stop.
- **Name**: Label or comment
- **Length**: Length of transit stop
- **Lane**: Lane position of transit stop
- **At**: Start position (link/connector coordinate)
- **Label**: When showing labels (names) of all transit stops (see **VIEW - NETWORK ELEMENTS**) this option allows to individually switch off the label of that stop.
- **Type**: Defines the placement of the stop:
  - **Street** (= curbside stop): Directly on the selected link and lane
  - **Lay-by** (= bus turnout): Adjacent to the slow lane of the selected link. For this purpose a new link with two connectors is created automatically and the stop is placed on the new link. Furthermore two pairs of priority rules are created in order to model the right-of-way for the transit vehicle to turn back on the main road.

- **PASSENGERS**...(only for use with dwell time calculation): Opens the **Boarding Passengers** window which allows for definition of a passenger flow profile to wait for transit vehicles (see 0 for details). Use the buttons **EDIT, NEW and DELETE** to modify the profile.

For a passenger profile the following information is needed:
- **Volume**: Passenger flow as persons per hour (independent of the time interval defined)
- **from/until**: Time interval for which passengers are generated
- **Used Bus/Tram Lines**: Select all lines which passengers of this profile can use.

Multiple lines can be selected by pressing **CTRL** while clicking.

**Moving and Deleting**

A street transit stop can be moved as follows:
1. Select the link with the left mouse button.
2. Select the transit stop with the left mouse button and keep the button pressed.

3. Drag the transit stop to its new location within the same link.

   Bus lay-bys cannot be moved graphically.
   
   To delete a
   ► bus lay-by, mark it in the links mode and press **DEL**. All connectors and priority rules are removed at the same time.
   ► street transit stop, drag it off the link on which it is placed.

   It is possible to create a stop where more than one transit vehicle can have passenger interchange at the same time. In order to do so, the stop must be long enough to accommodate the total length of all vehicles plus sufficient headway ahead of, between and behind each vehicle.

   On a multi-lane link it is possible for transit vehicles to turn out behind another stopping vehicle or to turn into a stop ahead of another vehicle if there is enough space left to accommodate it completely.

   If the stop is placed on a single lane link (e.g. a lay-by), a following vehicle cannot leave before the preceding vehicle.

### 6.5.2 Transit Lines (Bus/Tram lines)

A transit line consists of buses or light rail vehicles/trams serving a fixed sequence of transit stops according to a time table. The stop times are determined by dwell time distributions or calculations of passenger service times. If a real-world transit line should operate on different routes, it has to be coded as separate routes in the VISSIM network.

Transit lines are coded similarly as static routes except that transit lines do not distribute arriving vehicles but generate vehicles.

Transit vehicles follow the transit line route and remain in the VISSIM network even after the route finishes. Thus it is important to model transit lines as such as they end on an exiting link. Otherwise transit vehicles remain in the network and travel on undefined routes.

### Definition

Before coding a transit line, all bus/tram stop should be created.

It is recommended to start every transit line on a separate link that is dedicated to that line. Thus a "dummy stop" can be created to model a variation of arrival times (see 0) and the sequence of vehicle arrivals of different transit lines can be modeled.
Transit line definition is a five step process. To initialize the process, activate mode Transit Lines. The next required action is shown in the status bar.

1. Select the link for the start of the transit line.
2. Right click anywhere inside the selected link to create the line start (a bar in highlighted red appears at the start of that link).
3. Select the link/connector for the transit line destination.
4. Right click on the location for the route destination point (green bar).
   - If there is a valid connection between the red bar and the click position the link sequence is shown as a yellow band and the Bus/tram line window appears. Define the transit line data and confirm with OK. If the yellow band shows a route different from the desired one it can be modified later.
   - If there is no consecutive sequence of links and connectors possible, VISSIM cannot suggest a route and thus neither the yellow band nor the Bus/tram line window appears. In that case either the destination link or destination location must be changed or any missing connectors be created.
5. Include/exclude stops in the transit route as required and define their properties.

To define another transit line, select mode Transit Lines again and repeat steps 1 to 5.

Properties & Options

Accessing the transit line properties:
- Open the Bus/Tram Lines list (right-click outside the VISSIM network)
- Select the desired line
- Click on DATA
- No.: Unique identification of the transit line
- Name: Label or comment
- Vehicle type: Vehicle type to be used for transit vehicle
- Desired Speed Distribution: Initial speed of the transit vehicle
- Time Offset: The time offset defines the amount of time transit vehicles enter the VISSIM network before their scheduled departure time at the first transit stop. In other words, the network entry time is defined as departure time at the first stop minus time offset. If the START TIMES... are defined as the departure times of the first stop in the VISSIM network, the time offset should cover the travel time to the first
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stop as well as the vehicle’s dwell time there. Then the transit vehicle can leave the first stop according to schedule.

- **Slack Time Fraction**: The waiting time after passenger service as a fraction of the remaining time until scheduled departure (only relevant for those stop which have a departure time assigned).

- **Color**: Color of the transit vehicle

- **START TIMES**... Opens the **Starting times** window. The list can be edited using the buttons **SERVICE RATE**, **NEW**, **EDIT** and **DELETE**. Start times can be entered as individual runs (**NEW**) as well as a **SERVICE RATE**... Both options can be mixed also. Using a service rate VISSIM creates multiple individual runs automatically.

For more information on how to define a service rate see section below.

Besides each starting time in the list the corresponding course number and occupancy is displayed.

- **PT TELEGR** (relevant only for use of transit signal calling points): Opens the **PT Telegram** window for definition of data to be transmitted to traffic signal controllers at transit signal calling points.

The telegrams are sent only if the option **Sending PT Telegrams** is checked. Every time a PT calling point is actuated, a telegram is sent using the data as defined within the window (**Line, Route, Priority, Tram Length, Manual Direction**).

**SERVICE RATE**

To define multiple start times at one go, select **SERVICE RATE** in the **Starting Times** window of a transit line.

- **Starting Time**: A service rate creates multiple starting times for the time interval **Begin – End**. The frequency is defined by **Rate**.

- **Course**: Optionally, course information may be defined. A course identifies each starting time with a unique number and can be used e.g. for PT telegrams.
To create course numbers define the *First course number* and the *Step value* by which the course number for each starting time should be increased.

- **Occupancy**: Number of passengers that are in the transit vehicle when entering the VISSIM network.

The course numbers and the *Occupancy* are displayed in the list of all *Starting Times*.

**Transit Line Route Alignment**

The route alignment of a transit line can be visualized by opening the list of all *Bus/Tram Lines* (right-click outside the VISSIM network), selecting the desired line, clicking on *Zoom* and closing the list.

VISSIM initially activates all transit on-street stops that are included within the highlighted route (displayed in bright red). Bus lay-bys are not automatically part of a new transit line. To include it in a transit route, while the yellow band is shown create an intermediate point by right clicking on the yellow band and drag that point onto the bus lay-by. In the same way other route modifications can be done.

In order to not modify accidentally a previously adapted alignment it is necessary to use two more intermediate points as “pins” which enclose the area to be modified. Thus when dragging an intermediate point only that part of the route which is enclosed by the “pins” will be recalculated.

Any stop of either type that is added after a line has been created will be inactive on all lines that pass it (the stop is shown in green).

If a transit line should not service a specific stop it can be deactivated for that line (see Line specific stop data).

**Line-specific stop data**

The line specific stop data (*Bus/tram Stop Data*) can be accessed by double-clicking the left mouse button on a stop while the yellow band of a transit line is shown.
• **Departure**: Determines when a transit vehicle is scheduled to depart from this transit stop (as time offset after departing from the first transit stop). If such a schedule-based operation is not desired, the *Departure* time should be set to 0.

• **Dwell Time**: If
  - *Distribution* is active, the selected dwell time distribution is used to determine the stop time.
  
  Note: In order to select this option, at least one dwell time distribution must be defined (see 5.2.6).
  - *Calculation* is selected the stop time is determined using the number of boarding and deboarding passengers (according to the calculation method).
  - *Deboarding Probability* defines the percentage of passengers that alight at that stop.

• ✔️ **Skipping possible**: If active, a transit stop is skipped if there are no passengers wanting to board or deboard as the vehicle is within a distance of 50m in front of the stop (when using dwell time calculation) or if the random dwell time results in a value of less than 0.1 sec (when using dwell time distributions).

  A lay-by is skipped completely only if it is composed of a single link which connects directly back to the link from which it originated. In case the network topology is more complex or the transit vehicle has already reached the lay-by link when passing the 50m threshold, it passes the stop without stopping.

  Skipped stops are logged in the vehicle protocol file with ID and dwell time 0.

• ✔️ **PT stop active**: Allows to activate or deactivate a transit stop (for the current line only). A deactivated (= not served) transit stop is displayed as green.

**Transit Vehicle Dwell Times**

As mentioned in the Line-specific stop data there are two methods to model transit vehicle dwell times in VISSIM:

► Option A: Dwell time distributions

► Option B: Dwell time calculation using advanced passenger model

Option A is quicker to define than option B but option B provides a means to model more accurate stopping behavior, e.g. possible clustering of vehicles of the same line due to lateness.
Option A: Dwell Time Distributions
To use option A all dwell time distributions that can occur in the VISSIM network need to be defined beforehand (see 5.2.6). Then for each stop (specific to each transit line) one of these dwell time distributions is to be assigned.

Option B: Dwell Time Calculation (Advanced Passenger Model)
To use the calculation of dwell times according to the advanced passenger model, the following data needs to be defined in the PT PARAMETERS... window by transit vehicle type (BASE DATA - VEHICLE TYPES... - [SPECIAL]):

- **Deboarding time**: The average time it takes for one passenger to get off that vehicle (considering the number of doors, i.e. if one passenger needs 6s to deboard and there are 3 doors, the deboarding time to be entered is 2s.)
- **Boarding time**: The time it takes for one passenger to board (considering the number of doors - see above).
- The **Total Dwell Time** may be calculated by using either the **Additive** or **Maximum** method.

If there are exclusive (one-directional) doors then only the maximum out of the total passenger boarding and deboarding time should be used, otherwise the sum of both.

- **Clearance time**: The time needed for the vehicle to stop and to open/close the doors.
- **Capacity**: The number of passengers the bus or tram can hold. If capacity is reached no more passengers can get on the vehicle.

- Initial occupancy of the transit vehicles (see Start Times in Bus/Tram Line window)
- Passenger flows for each transit stop (see section 6.5.1)
- **Deboarding** percentage and **Skipping possible** option in Bus/Tram Stop Data.

Once all this data is provided, VISSIM calculates the dwell time of a transit vehicle at a stop as follows:

1. Determine the number of deboarding passengers (defined by the percentage of passengers on board that are getting off).
2. Determine the number of boarding passengers (all waiting passengers whose list of acceptable lines include the line of this transit vehicle and taking into account its maximum capacity).
3. Determine the time required for deboarding (computed as the number of passengers deboarding multiplied by the average deboarding time).
4. Determine the time required for boarding (computed as the number of passengers boarding multiplied by average boarding time).
5. Determine the total passenger service time (computed as the sum of clearance time plus deboarding time plus boarding time).

6. If a departure time is defined for that stop, the transit vehicle remains at the stop (after completion of passenger service) for that portion of the remaining time until scheduled departure, which is defined by the slack time fraction.

**Variation of Arrival Times**

In reality, transit vehicles do not enter the simulated network section exactly according to schedule. Their network entry is randomly distributed around their scheduled time (e.g. ±1 min). In order to model this random arrival in VISSIM, follow the instructions below:

1. Create a dummy transit stop at the beginning of the transit route (typically on the dedicated link). Make sure the end of the stop is far enough away (50-100m depending on the speed) from the start of the link so that the transit vehicle can securely stop.

2. Include the dummy stop in the transit line.

3. Assign a dwell time distribution to the dummy stop. For example, a mean value of 60 seconds and a standard deviation of 20 seconds could be chosen. The actual departure time at the dummy stop would then be normally distributed between 0 and 2 minutes (99% value).

4. Consider the dwell delay at the dummy transit stop (average dwell time of 60 sec) for all other scheduled departure times.
6.6 Non-Signalized Intersections

In VISSIM, non-signalized intersections as well as separating or joining links can be modeled by appropriate modeling techniques. In this chapter, these methods are described in detail.

6.6.1 Priority Rules (Right-of-way Designation)

VISSIM designates the right-of-way for conflicting movements with the use of priority rules. A priority rule consists of

► one stop line and
► one or more conflict markers that are associated with the stop line.

Depending on the current conditions at the conflict marker(s) the stop line allows vehicles to cross or not.

The two main conditions to check at the conflict marker(s) are

► minimum headway (distance) and
► minimum gap time.

As a rule of thumb, for free flow traffic on the main road the min. gap time is the relevant condition. For slow moving or queuing traffic on the main road the min. headway becomes the most relevant condition.

The minimum headway is typically defined as the length of the conflict area. During the simulation the current headway is determined by the distance between the conflict marker (green bar) and the first vehicle approaching it. If any part of a vehicle is located on the green bar the resulting headway is 0m. Whenever the current headway is less than the minimum headway, the corresponding stop line (red bar) stops any approaching vehicle (similar as a red signal).

The current gap time (during simulation) is determined every time step by the time an approaching vehicle will require to reach the conflict marker (green bar) - provided that it continues traveling at its current speed. A vehicle located on the green bar is not considered by the current gap time. If the current gap time is less than the minimum gap time (defined for the conflict marker) the corresponding stop line (red bar) stops any approaching vehicle (similar as a red signal).
Example

The blue vehicle traveling on the main road at 50km/h (i.e. \(~14\, m/s\)) is 49m upstream of the conflict marker. The current gap time is 49m / 14m/s = 3.5s. Thus the yellow vehicle (on the minor road) can still pass, because the min. gap time is set to 3.0s.

The blue vehicle is now only 28m away from the conflict marker. The current gap time is 28m / 14m/s = 2s. Because the min. gap time is set to 3.0s the yellow vehicle must stop.

The blue vehicle has just passed the conflict marker. The current gap time is 0s because the vehicle front has already passed the conflict marker. But because the min. headway is set to 10m the yellow vehicle still needs to wait until the conflict area is cleared completely.

In order for a vehicle not to stop at the stop line, the conditions of all corresponding conflict markers need to be fulfilled (logical “AND” condition).

VISSIM supports multiple conflict markers (green bars) for each stop line (red bar). Thus multiple rules can be applied to the same stop line.

Both the stop line and the conflict marker(s) can be defined for certain vehicle classes only. In addition, a maximum speed can be defined for vehicles on the major road: Then only vehicles that approach the conflict marker at a speed below the max. speed will be considered by the headway of the priority rule.

Conflict markers and stop lines can be defined by lane or by link. Thus modeling can be simplified. However, for lane-specific parameters or different stop line positions, lane-specific stop lines and the appropriate number of markers need to be defined.
Depending on the scenario to be modeled either the gap time or the headway can be of higher importance. Vehicles waiting for the chance to enter or cross a flow of higher priority usually regard the gap time. On the other hand, the headway is used to find out, if a vehicle of higher priority has already reached a certain position.

Additionally the relevance depends on the flow on the link where the conflict marker is located.

In case of normal traffic flows, the gap time is the relevant parameter, whereas the headway is decisive in case of bumper-to-bumper traffic and congestions.

For a selected priority rule, min. headway > 0 is displayed by a green triangle indicating the direction of traffic at the given position on the link.

The conflict marker recognizes vehicles on all connectors that enter the link before the position where the conflict marker is located. This behavior causes problems if the waiting vehicle is also recognized by the conflict marker, for example, if the waiting vehicle is within the headway range of the conflict marker. To avoid this problem, a conflict marker on a link should always be placed at a position prior to the position where any relevant connectors enter that link.

If vehicles appear to be ignoring priority rules this could be the reason:

If at a set of priority rules one or more vehicles wait for themselves or one another (gridlock situation) then VISSIM recognizes the gridlock and resolves it: Then the vehicle with the longest waiting time comes first.

**Definition**

A priority rule always consists at least of a pair of cross sections:
- the stop line (red bar) and
- one or more conflict markers (green bars).

Thus the definition process is somewhat similar to static routes.

The definition of a priority rule is a four step process.

To initialize the process, select mode “Priority Rules”. The next action to be done is shown in the status bar. To go back one step, left click outside the VISSIM network.

1. Select the link/connector where the stop line should be placed on.
2. Right click on the location for the stop line on the selected link.
3. Select the link/connector where the conflict marker should be placed on.
4. Right click on the location for the conflict marker. Typically it is located within the last two meters of the conflict area. The *Priority rules* window appears. Define the properties (as shown below) and confirm with Ok.

To define more conflict markers that belong to the same stop line, click twice outside the VISSIM network to go back two steps and continue with steps 3 and 4 for each additional conflict marker.

To define a new priority rule, select mode ▼ “Priority Rules” and repeat steps 1 to 4.

**Selection**

The properties of a priority rule can be accessed by the following sequence:

1. Select mode ▼ “Priority Rules” (to make sure that no previous priority rule is selected).

2. Select one of the corresponding links/ connectors.

3. Double-click with the left mouse button on the stop line or conflict marker (the corresponding pair of conflict marker and stop line is shown in highlighted colors). When selecting the stop line, only the corresponding conflict markers will be shown (in dark green).

Alternatively, the properties can be accessed by opening the list of all *Priority Rules* (right-click outside the VISSIM network), selecting the desired priority rule and pressing the DATA button.
Properties & Options

- **No.**: Unique identification of the priority rule.
- **Name**: Label or comment
- **Label**: If showing labels (names) of all priority rules (see VIEW - NETWORK ELEMENTS), this option allows to individually switch off the label of that priority rule.

The following properties are available for both markers (stop line and conflict marker) separately:

- **Lane**: Defines the lane number where the marker is placed.
- **At**: Link/connector coordinate of the marker.
- **All Lanes**: Defines the marker to stretch over all lanes of that link (in contrast to be placed on a single lane).
- **Vehicle Classes**: Define the vehicle classes to be affected by the marker. A multi-selection is done using <CTRL> while clicking the left mouse button.

The following properties affect the **stop line**:

- **Condition...**: Opens the PR - Condition window to link the priority rule with the current state of a signal group. This option is useful when vehicles should not yield to vehicles queuing behind red signals.
  - **Stop only if**: Activates the condition so that the stop line is only active when the following condition is true.
  - If the selected **Signal Group** of the selected **SC** (Signal controller) has the selected **Signal State** then the stop line is active and checks the other conditions as well (min. headway, min. gap time etc.).

The following properties affect each **conflict marker**:

- **Min. Gap Time**: Minimum gap time (in s) between the conflict marker and the next approaching vehicle.
• **Min. Headway**: Minimum headway (distance) between conflict marker and next vehicle upstream.

• **Max. Speed**: Any vehicle approaching the conflict marker will only be taken into account for the headway condition if its speed is the same or lower as the *Maximum Speed*.

### Deleting

To delete:

► one conflict marker, either

- open the list of all *Priority Rules* (right-click outside the VISSIM network), selecting the priority rule to be deleted and press the **DELETE** button or

- drag the conflict marker (green bar) out of any link.

► a priority rule completely

- click on the “*Priority Rules*” mode button (to make sure that no priority rule is selected), select the link/connector of the stop line of the priority rule to be deleted and drag the stop line out of any link/connector.

### Examples

The following examples illustrate the use of priority rules.

**Example 1: Driveway Exit**

Modeling a driveway exit (or similar situation) is very simple:

1. Place the stop line (red bar) at the position where yielding vehicles need to stop.

2. Place the conflict marker (green bar) on the major road link (not on the connector that leads onto that link) about 1m before the end of the conflict area (before the connector enters the link of the major road).

3. Accept the standard parameters (headway = 5m, gap time = 3s).

The green bar is placed before (upstream of) the location where the minor road connector enters the major road so that vehicles of the minor road will not yield to themselves.
Example 2: Modeling “Keep Clear areas” and “Yellow Boxes”

1. Place the stop line on the stop position before the intersection.

2. Place the associated conflict marker on the same (or consecutive) link using the length of at least one vehicle as the distance away from the intersection. If there is a vehicle mix of HGV and cars, the distance could be 20m for example. However, this distance should be chosen considering the driver’s behavior in real life for that situation.

3. To prevent the intersection from being blocked during congested traffic conditions, the maximum speed option is used. Depending on the level of driver’s acceptance of the “keep clear area” the maximum speed is typically between 10 and 20 km/h. The gap time is set to 0 sec. and the vehicle headway to slightly less than the distance between the two sections.

Both, the location of the conflict marker (and thus the headway) and the speed can be used to calibrate the acceptance of the “keep clear area”.

Example 3: Dual-lane roundabout with dual-lane entry

To model an entry of a roundabout several priority rules are necessary, each of them serving different tasks. According to their difference in acceleration capability and vehicle length cars and HGV/trucks/busses are dealt with differently.

The following four illustrations visualize all the priority rules according to their task. For easy reference the rules are numbered. The numbers refer to small boxes within the illustration where the corresponding parameters can be found. The values used for min. gap time, min. headway and max. speed have been determined through research. Thus for most applications these serve as a realistic base.

Place priority rules according to the following criteria (cf. illustrations):

► Stop lines represent the typical waiting position. If more than one green bar refers to the same stop line it is important to model them as multiple green bars to the same red bar (not as separate priority rule pairs) as long as the conditions for the red bar are the same. E.g. it is not possible to combine two red bars into one if they have different vehicle classes assigned.

► Conflict markers used for headways are to be placed shortly before the position where the connector enters the roundabout link (if they would be placed after the entry of the connector it could result in a situation where a vehicle would wait for itself and thus drastically reduce capacity of the roundabout).

► A green bar used for min. gap time only should be placed around the same distance away from the conflict area as the associated stop line.
At first, priority rules for vehicles entering the roundabout from lane 1 will be defined.

There are different positions, each for time gap and headway to model a more realistic vehicle flow. Thus a vehicle within the roundabout driving faster than 14 km/h will not be detected by the headway but only by the time gap condition. Therefore a vehicle wanting to enter the roundabout can start to enter even if the one within the roundabout has not left the conflict area completely. Priority rules 1 and 2 model this behavior - these are valid for all vehicle classes: No. 1 secures the conflict area during slow moving traffic and congestion within the roundabout; No. 2 contains the conditions for normal traffic conditions (time gap).

Because traffic from the inner lane of the roundabout also affects entering vehicles of lane 1 an additional priority rule is required (No. 3). This one only needs a small gap time condition, which again is valid for all vehicle classes.
The previously entered priority rules (Nos.1-3) are valid for all vehicle classes. In the case where a long vehicle within the roundabout passes the conflict area, the minimum speed condition (No. 1) is not sufficient. It could happen that vehicles entering the roundabout crash into an HGV/truck. To avoid this, another priority rule needs to be added (No.4). It needs to be placed at the same position as No.1 and is valid only for long vehicles approaching the green bar (in this case HGVs and Buses).

To finish off the priority rules related to lane 1 another one is needed to consider entering vehicles having a lower acceleration capability than cars. For this purpose priority rule No.5 is used. It is placed exactly as No.2 but needs different parameter settings: As vehicle classes of the conflict marker only HGV and Bus needs to be selected and the gap time set to 3.6s.
Now the priority rules for lane 2 of the entering traffic will be defined:
As with lane 1 the first few priority rules deal with all vehicle classes and in principal work the same way. The difference for traffic from lane 2 is that both of the roundabout lanes need to be taken into account. Thus 4 priority rules are needed (instead of 3 for lane 1): Nos. 6 and 7 for the outer and Nos. 8 and 9 for the inner roundabout lane.

Please note that because of the greater distance to the conflict area the minimum time gap for the inner roundabout lane (No. 9) is slightly higher than for the outer one.
Finally the priority rules for lane 2 dealing with specific vehicle classes need to be entered. Same as with lane 1, long vehicles need to be secured (No. 10) and entering HGVs and buses to be provided with higher gap times (Nos. 11 and 12). Same as with lane 1 there is a slightly higher value for the time gap of the inner roundabout lane.

### 6.6.2 Stop Sign Control

Intersection approaches controlled by SSTOP signs TOP signs are modeled in VISSIM as a combination of priority rule and STOP sign. A STOP sign forces vehicles to stop for at least one time step regardless of the presence of conflicting traffic while the priority rule deals with conflicting traffic, looking for minimum gap time and headway etc. Dispatch counters (e.g. customs clearance) represent a variant of STOP signs with a dwell time distribution assigned additionally.

STOP signs can be used to model the following:

► Regular STOP signs: Additionally to the STOP sign a priority rule has to be defined to make sure, that traffic flows are regarded accordingly. The STOP sign and the stop line (red) should be placed at the same position.
► Right turn on red: Option *Only on Red* has to be checked. Then, the STOP sign becomes active only while the allocated signal group shows red.

► Dispatch counters (e.g. customs, road toll etc.): Option *Use time distribution* has to be checked. Then, vehicles will stop as long as preset by the assigned time distribution (to be defined via *BASE DATA – DISTRIBUTIONS – DWELL TIME*...).

**Definition**

STOP signs are coded as outlined below:

1. Select mode “Stop Signs”.
2. Select the link on which vehicles will have to stop.
3. With a right click, define the location on the selected link where vehicles should stop (stop line).
4. Edit the stop sign properties (see section below).
5. Confirm with Ok.

**Properties & Options**

The properties of a stop sign can be accessed by selecting the corresponding link/connector and double-clicking on the stop sign marker.

- **No.:** Unique identification of the stop sign
- **Name:** Label or comment
- **Lane:** Defines the lane number where the marker is placed.
- **At:** Link/connector coordinate of the marker.
- **Label:** When showing labels (names) of all stop signs (see *VIEW – NETWORK ELEMENTS*...) this option allows to individually switch off the label of that stop sign.
Non-Signalized Intersections

[RTOR]  
(= right turn on red)

- **Only on Red**: The stop sign is only active if the selected SG (signal group) of the selected SC (signal controller) shows “red” (see section below for details).

[TIME DISTRIBUTION]  
- **Use time distribution**: For each vehicle class, a time distribution (see section 5.2.6) may be assigned in the list below. The list is edited by the NEW, EDIT and DELETE buttons. All vehicles of a class for which a time distribution is defined will stop for a certain time out of the corresponding distribution.

If no time distribution is selected, the dwell time will be one time step.

Right Turn On Red

Stop signs are also used to model right-turn-on-red movements using the option **Only on Red**. In that case, the stop sign is active only if the associated signal controller phase displays red. There are two scenarios where right turn on red can be modeled:

- An exclusive right turn lane:
  A stop sign (with **Only on Red**) needs to be placed on that lane. It might be advisable to additionally place a signal head in this lane and select a vehicle type like Tram or Pedestrian so that the vehicles on the lane will not be affected by it but the state of the signal will be visible.

- A combination of through and right turn lane:
  A stop sign (with **Only on Red**) needs to be placed on the right-turn connector only. That way turning vehicles only will see the stop sign. The signal head is placed in the same location but on the link rather than the connector. The signal head will control the through movements.
The illustration shows both scenarios. The South approach is a combination turn lane and the West approach is an exclusive turn lane. The lighter bars are signal heads and the darker are stop signs.

### 6.6.3 Merging and Weaving Sections

In order to get the best vehicle behavior it is important to implement merging and weaving sections in VISSIM properly. Here are the important things to remember:

- The merge section (weaving section) should be one link with the number of lanes equal to the number of lanes on the main freeway plus the number of lanes merging onto the freeway.

- There should be only one connector after the merge link (weaving section) to the main freeway. For graphical reasons an additional dummy link (not a connector) can be added at the end of the merging lane(s) to smoothen the lane reduction.

- The through movement needs to follow a route in order to prevent it from using the acceleration lane(s). This route must end no sooner than on the main link after the merge link. Additionally the Lane Change distance for the connector downstream from the merge link (weaving section) must be larger than the length of the merge link itself. If this is not the case, a vehicle from a through lane may change to the acceleration lane (merging lane) and then needs to get back to the main link thus producing unrealistic lane changes.

- The routes of the merging traffic must also extend past the merge link (weaving section). If not, vehicles on the merge link will not know that they need to change lanes in order to get on to the main link prior to the end of the merging lane(s).

See below for an illustration of a one-lane merge into a three-lane freeway:
Merging section in Normal display

Merging section in center line display.
6.7 Signalized Intersections

Signalized intersections can be modeled in VISSIM either using the built-in fixed-time control or an optional external signal state generator (e.g. optional module VAP, see Appendix A for a user manual). The standard VISSIM license does not contain any traffic actuated signal controllers.

VISSIM is also available with other signal control logic add-ons such as VS-PLUS, TRENDS, VOS and Type 2070 VS-PLUS controller software. VISSIM can also be controlled externally through a serial interface to a NEMA TS/2 controller.

Note: Modeling right turn on red is discussed in section 6.6.2.

6.7.1 Signal Groups and Signal Heads (Indicators)

In VISSIM every signal controller (SC) is represented by its individual SC number and signal groups (also referred to as signal phase) as its smallest control unit. Depending on the selected control logic, VISSIM can simulate up to 125 signal groups per signal controller. VISSIM also discriminates between signal groups and signal heads.

A signal head is the actual device showing the picture of the associated signal group. Signal heads are coded in VISSIM for each travel lane individually at the location of the signal stop line. Vehicles wait approximately 0.5m behind a signal head/stop line that displays red. Vehicles approaching an amber signal will proceed through the intersection if they cannot come to a safe stop in front of the stop line. Optionally an advanced calculation method can be used for VISSIM to calculate a probability for whether the vehicle should continue through amber or not using three values of the Driving Behavior Parameters (see section 5.4).

Signal indications are typically updated at the end of each simulation second. If the controller module for VISSIM is equipped for switch times down to 0.1s, VISSIM is able to reflect this behavior. However, this is dependent on the controller type.

Signal head coding allows for the exact modeling of any kind of situation. This includes the ability to model different signal groups for different vehicle types on the same travel lane. For example, modeling a bus traveling in mixed traffic but yielding to its own separate signal phase is possible with VISSIM by selecting the appropriate vehicle classes for each signal head.

With any SC, all conflicting movements that can run at the same time need to be secured using priority rules (see section 6.6.1)

Definition

For coding Signal heads, a Signal controller has to be defined and Signal groups, cf. section 6.7.3:
1. Select mode "Signal heads".
2. Select the link on which it is to be placed.
3. With a right click, define the position of the signal head on the selected link.
4. Edit the signal head properties (see section below).
5. Confirm with Ok.

Properties & Options

- **No.**: Unique identifier of the signal head
- **Name**: Optional label or comment
- **SC**: Selected signal controller.
- **Signal group**: Selected signal group.
- **Label**: When showing labels of all signal heads (see VIEW - NETWORK ELEMENTS...) this option allows to individually switch off the label of that one.
- **Or Sig. Gr.**: If this option is active, overlaps can be modeled by defining a primary signal group as well as a secondary signal group and combining them. The signal head will then turn green if either the first or the second signal group is green. If the first signal group shows red, the signal head displays the signal of the **Or Sig. Gr.** (even if it is amber or red/amber). If one of the two signal groups shows amber and the other one red/amber, the signal head displays green. To display the signal status of each signal group separately, create a short dummy link next to the intersection with a signal head for each signal group.
- **Vehicle Classes**: Selected vehicle class(es) the signal head refers to. Thus e.g. bus signals can be defined which are to be ignored by private traffic.

### 6.7.2 [ ] Detectors

Real life vehicle/pedestrian detection is achieved using various methodologies including induction loops, video cameras, push buttons, track circuits etc. VISSIM models each detector type in the same way: a network element of user-definable length. A message impulse is transmitted to the signal controller as soon as a vehicle reaches this element with its front and
another one when it leaves it with its tail. This information is then interpreted by the signal control logic.

**Definition**

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

1. Select mode "Detectors".
2. Select the link the detector is to be placed on.
3. Click with the right mouse button on the location within the link where the detector should start. The new detector will be shown with a default length of 5 m and the Detector window appears.
4. Set the detector properties (see section below).
5. Confirm with Ok.

**Properties & Options**

To access the detector properties,

- select the link/connector and then
- double-click on the detector.

- **No.**: The physical channel number that the signal control program uses. Multiple detectors of the same controller can have the same channel number, causing the controller to treat them as one detector. This allows VISSIM to model detectors reaching over multiple lanes by defining one detector per lane coded with the same number.

- **Name**: Label or comment.

- **Length**: defines the length of the detector. A value of 0 is permitted (e.g. for push buttons). The detector is then displayed as a thin line.

- **SC (signal controller)**: Associates the detector to the controller. For PT calling points there is no association to any controller.

- **PT Calling Pt.**: defines the detector as a public transport calling point. That is, it only detects transit vehicles that send out PT telegrams (see “Transit Routes” for details).
At contains the detector’s link coordinate.

Lane: Defines the lane number where the detector is placed.

Before stop: The detector’s distance to the next signal stop line (available only if the stop line is located on the same link).

Vehicle Classes: The detector will recognize only vehicles that are contained in at least one of the selected classes.

PT Lines: The detector will recognize only vehicles of those PT lines that are selected here. A multi-selection is possible using Ctrl and mouse click.

Departure Signal: The detector will detect a vehicle only if
- the vehicle stops in the selected PT stop and the dwell time will be finished after the given time (x seconds before departure) or the total dwell time is shorter than the given time
- the vehicle has already decided to skip that PT stop (in which case the detector call is sent to the controller as soon as the vehicle reaches the detector)

Smoothing factors define the exponential smoothing of detector occupancy rates used by certain signal control programs.
- Increase defines the weight of a new occupancy rate in the new exponentially smoothed average if the new rate is higher than the previous average
- Decrease defines the weight of a new rate smaller than the previous average.

Visible (Screen): The detector will never be displayed if this option is turned off.
- **Label:** When showing labels (names) of all detectors (see **VIEW NETWORK ELEMENTS...**) this option allows to individually switch off the label of that detector.
- **Sound:** A wave file (*.WAV) can be assigned to a detector. If a sound card and driver is installed it is played every time a vehicle is detected. The wave file needs to be located in the same directory as the network data file (*.INP).

### Exponential smoothing

Exponential smoothing is a way of leveling out the occupancy rate of a detector. This is necessary because detectors are either occupied or not and because of that they do not provide enough information to make signal control decisions. Exponential smoothing allows for calculation of an occupancy rate using the last t seconds. This equation is used:

\[ s(t) = \alpha \cdot x + (1 - \alpha) \cdot s(t-1) \]

where

- \( s(t) \) is the new exponentially smoothed value
- \( s(t-1) \) is the old exponentially smoothed value (1 time step before)
- \( x \) is the new detected value
- \( \alpha \) is the smoothing factor \([0..1]\)

The new exponentially smoothed value is a weighted average of the new (detected) value and the exponentially smoothed value after the last simulation second. The new detected occupancy rate has a weight of \( \alpha \) and the old smoothed value a weight of \((1-\alpha)\). In VISSIM the user can enter two different values for \( \alpha \), one for increasing \( x \) values (used if \( x \) is greater than \( s(t-1) \)) and one for decreasing \( x \) values (used if \( x \) is smaller than \( s(t-1) \)).

This means that the exponentially smoothed occupancy rate is a kind of a floating average of the detected values from all time steps before, with the most current ones having the highest weight. A general rule is that with a smoothing factor of \( 1/n \) most of the result originates from the last \( 2^n \) values, e.g. with \( \alpha = 0.25 \) the last 8 detected values account for most of the smoothed value. If you do not want your values to be smoothed you can set \( \alpha \) to 1 and the equation will give you only the newly detected value \( x \).

### Moving & Deleting

By dragging while keeping the left mouse-button pressed, a detector may be

- moved within its link/connector, into another link/connector or
- deleted (moving outside any link/connector).
6.7.3 Signal Controllers

The Signal control window contains the list of all signal controllers defined in the current network. This list can be edited:

- by editing the header data in the upper section of the window for the SC selected in the list
- via context menu to be called by right-clicking in the list. The context menu provides the following functions: Via
  - NEW (or COPY, if a signal controller is selected) another SC can be defined,
  - IMPORT data provided in an external file can be loaded (see section below: external control strategies);
  - DELETE the selected entry can be removed from the list.

Definition

In order to define a new signal controller, access the Signal control window by SIGNAL CONTROL – EDIT CONTROLLERS...

Select

- NEW or
- COPY, if a signal controller is selected, and edit header data.

Properties & Options

For each Signal Controller the following header data are available:
- **Number**: Unique ID of the signal controller
- **Name**: Label or comment
- **Cycle Time**: Fixed cycle length in seconds or ☑ Variable cycle length
- **Offset**: A value that delays the first (and therefore all subsequent) cycle by <value> seconds.
- **Type**: Defines the controller type and control strategy. Other options are enabled or disabled according to this setting.

For the selected control strategy, the tags contain special data on file names etc. (see below: control strategies)

[**[SIGTmTBL.**](#) [**Cfg]**] Here, the settings for the *Signal timing plan* display window (during simulation run) can be edited, cf. section 10.8.

[**[SC/DET.**](#) [**REC]**] For SC using an external control strategy, the *SC/Detector Record* settings can be edited, cf. section 10.9.

### 6.7.3.1 Fixed Time Signal Control

VISSIM starts a signal cycle at second 1 and ends with second *Cycle time*.

In the tag, the following data can be edited:

- ▶ List of signal groups (see context menu)
- ▶ Data of selected Signal group:
  - *Type* has to be selected from the list
  - Numerical data can be overwritten. Read-only data are shaded.

Example: Edited signal group data of a *fixed-time* SC.
Signalized Intersections

For fixed time signal controls only Red end and Green end times need to be defined along with timings for Amber and Red/Amber.

Both, Amber as well as Red/Amber times can be set to 0 in order to switch them off.

Also with fixed time control signal groups can be switched to green twice during one cycle. This is done simply by entering a second pair of switch times in the Red End 2 and Green End 2 fields.

Type provides Permanent Green, Permanent Red and Cycle for selection.

### 6.7.3.2 VAP - Vehicle Actuated Signal Control (optional module)

VISSIM can model actuated signal control in conjunction with an external signal state generator if the optional VAP module is installed. This signal state generator allows users to define their own signal control logic including any type of special features (e.g. transit priority, railroad preemption, emergency vehicle preemption, variable message signs on motorways etc.). The use of the external signal state generator and its VAP programming language is explained in Appendix A. VisVAP (the optional graphical desktop to model flow chart logics) is explained in Appendix B.

For VAP signal controllers using an Offset, values within VAP need to be adapted by this offset, too, in order to prevent malfunction of the time conditions.
6.7.3.3 NEMA Standard SC Emulator (optional module)

This controller is available in North American releases of VISSIM and emulates common signal controllers used there. With this controller VISSIM can simulate fully actuated signal control as well as coordinated and semi-actuated coordinated signal control. The interface to the controller is accessed through VISSIM but saves its settings to an external data file with the extension (*.NSE). To use the NEMA standard emulator, select NEMA in the Type box of the SC window. See appendix C for information on settings.

6.7.4 Switch of Signal Control Type

The type of signal control can be switched from fixed time to actuated control or vice versa after the initial setup. However, some of the required input parameters such as Red End, Green End etc. may be missing depending on the new and previous control type. These parameters can be defined in the Signal Groups window. Parameters that are no longer used with the new control type are lost and need to be re-entered in case the control is switched back.

6.7.5 Signal Control Communication

Any two Signal Controllers that support communication with other controllers can be linked (similar as a wire link between two controllers).

Go to SIGNAL CONTROL - CONTROLLER COMMUNICATION....

Using the buttons to the right, connections can be created, edited and deleted. See below on how to establish a new connection.

Each connection is directed from an output channel number of one SC to an input channel number of another SC. Data written by the control program to an output channel is transmitted in the simulation second to the connected input channel and can be read from its control program.
Example (using controller type VAP)

Define a SC communication from SC 1, channel 7 to SC 3, channel 5. In the control logic the following commands can be used to send and receive data:

► Within the control logic of SC 1 the command

```
Marker_Put( 7, 1 )
```

sets the output value of channel 7 to 1.

► One simulation second later, the control logic of SC 3 can read this value using the command

```
Value := Marker_Get( 5 )
```

to read this value through channel 5. The user-defined variable “Value” will then be set to 1 and can be used for subsequent program commands.

6.7.6 Railroad Block Signals

Railroad block signals can be edited only directly in the VISSIM network file (*.INP). A signal head that is defined as a block signal (“Blocksicherung”) does not belong to a signal group or signal controller but is switched according to the state of the next two signal groups downstream.

Every block signal determines once per time step the status of the next two adjacent blocks downstream (a block is defined as the area between two block signals). The signal will display

► **Red** in case of a vehicle occupying the next immediate block downstream

► **Amber** in case of the next block is unoccupied and the following block occupied by a vehicle

► **Green** if both downstream blocks are empty

All vehicles passing a block signal displaying amber receive the associated maximum speed until they approach a block signal displaying green.

Railroad block signals count normal signal heads as block delimiters but do not influence the states of those signals.

The definition of a railroad block signal will look like the line below:

```
SIGNAL_HEAD 912 NAME "" LABEL 0.00 0.00 BLOCK_SIGNAL DESIRED_SPEED 25.00
POSITION LINK 1 LANE 1 AT 558.020 VEHICLE_CLASSES ALL
```

The speed 25.00 (km/h) refers to the maximum speed at an amber signal; the position 558.020 (meters) refers to the position along link 1 where the signal head is located. The link and signal head numbers refer to the link and signal head defined in the model.
7 Simulation and Test

7.1 Simulation

A simulation run is started using the menu command **Simulation – Continuous** or **Simulation – Single Step**.

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
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<tbody>
<tr>
<td><img src="icon" alt="Start button" /></td>
<td>Starts the continuous simulation. F5</td>
</tr>
<tr>
<td><img src="icon" alt="Step button" /></td>
<td>Calls the next simulation step in the Single step simulation mode; Allows also toggling from Continuous to Single Step simulation mode during the simulation run. F6</td>
</tr>
<tr>
<td><img src="icon" alt="Stop button" /></td>
<td>Terminates the current simulation run. Esc</td>
</tr>
</tbody>
</table>

7.1.1 Simulation Parameters

Parameters for the next Simulation or Test run can be set in the Simulation Parameters window that is accessible by **Simulation – Parameters...**

- **Comment**: Text to identify the simulation run. The comment line is stored in the input file and included both in printouts of the network and in output files.

- **Traffic regulations**: Specifies the standard driving side (e.g. Britain and Hong Kong use *Left-side-Traffic*). It affects the driving behavior on motorways (overtaking in the fast lane), the placement of the opposite direction of a link and the placement of bus lay-bys.

- **Period**: The period of time to be simulated. Any warm-up times to fill up the network must be included here as well.

- **Start Time**: The time shown on the clock at the beginning of the simulation. In order for it to be displayed, the **Time** option needs to be selected (see **View – Status Bar**). For Dynamic Assignment applications, the **Start Time** is used to generate the traffic demand of the OD-matrices at the right time. The time needs to match the settings in the matrix files.

- **Simulation Resolution**: The number of times the vehicle’s position will be calculated within one simulated second (range 1 to 10). The input of 1 will result in the vehicles moving once per simulation second. An input of 10 results in the vehicles’ position being calculated 10 times per simulation.
second thus making vehicles move more smoothly. The change of simulation speed is inversely proportional to the number of time steps.

The interaction between vehicles is subject to changes when changing the time steps value and thus the simulation results can be different. Thus we strongly recommend not to change this parameter during a simulation run or even during a running project.

The simulation resolution does also control the playback speed of AVI files recorded with VISSIM. Please take note of this dependency when choosing the simulation resolution for a new project.

- **Controller Frequency**: This parameter indicates the number of passes per simulation second and thus controls the switching frequency of signal controllers during simulation. Restraints to be kept:
  - Value range: 1 - 10
  - Value **Simulation resolution** has to be = n x value **Controller Frequency** with n = integer value.
  
When a VISSIM network file *.INP is read, the **Controller Frequency** is reset to zero first the default value is concerned.
- saved, the special data line is only saved with the file if the value differs from the default value. Furthermore, the parameter has to be editable.

```
--- VISSIM 4.10-00*
RANDOM_SEED 10101
SIMULATION_DURATION 1000.0
SIMULATION_STARTTIME "00:00:00"
SIMULATION_SPEED_MAX 10.0
TIME_STEP 8
SCJ_FREQUENCY 4
```

**Controller Frequency** can only be edited

- in networks with only fixed-time signal controllers defined and
- as long as no simulation is running.

- **Random Seed**: This parameter initializes the random number generator. Simulation runs with identical input files and random seeds generate identical results. Using a different random seed changes the profile of the traffic arriving (stochastic variation of input flow arrival times) and therefore results may change also.

When using multiple simulation runs with different random seeds, the option **Generate exact number of vehicles** is to be switched on for all input flows in the network.

- **Simulation Speed**: The number of simulation seconds to a real time second. If **maximum** is selected, the simulation will run as fast as
Simulation and Test

possible. The change of the *Simulation Speed* does not affect the results of the simulation and can therefore be done at any time during the simulation.

Note: The actual achieved simulation speed depends on the size of network to be simulated and the computer hardware used.

- **Break at:** After reaching the time entered here, VISSIM automatically switches into the Single Step mode. This option can be used to view traffic conditions at a certain time during the simulation without having to watch the simulation all the time before.

### 7.1.2 Save simulation state (*.SNP)

A so-called snapshot file can be saved via **Simulation – Save Snapshot**… at any time while the simulation is running preferably in Single step mode.

The *.SNP file contains the simulation state reached at the moment when the snapshot file is saved, i.e.

- the vehicles located on links and in parking lots with their particular state of movement or interaction, public transport vehicles included,
- the signalization states of all fixed-time SC and VAP-SC,
- the states of priority rules and
- the passengers in public transit vehicles and at stops.

Thus, any state-of-the-art of a simulation run can be saved to file via **Simulation – Save Snapshot** and reloaded via **Simulation – Load Snapshot** for networks having SCs of the types mentioned above and either static routes or routes read from path and cost file.

After reading the *.SNP file, the simulation will be continued in Single step mode as if it had not been interrupted.

Evaluations which had

- started before the snapshot file was saved will not be continued.
- not been performed yet when the snapshot file was generated will be performed at the given simulation second after loading the *.SNP file.

The *.SNP file does not contain the following information

- network data,
- settings of display options,
- state of external control strategies (except VAP)
- state of guiding systems.

Therefore, neither running dynamic assignments nor simulations in networks with traffic-actuated SC (except VAP) can be continued.
7.2 Test of Signal Control without Traffic Simulation

VISSIM offers the Test function to analyze a signal control logic’s behavior with various detector call scenarios without actually modeling traffic flows. Detector calls are generated through
- interactive mouse clicks or
- pre-recorded macros.

The Test function is helpful when debugging a newly developed control logic especially if it contains only sporadically used functions such as railroad preemption, transit signal priority or queue “flush-out”. VISSIM discriminates between the following detector actuactions:

<table>
<thead>
<tr>
<th>Single Actuation</th>
<th>Increasing impulse (vehicle front) and decreasing impulse (vehicle end) within one second</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeated Actuation</td>
<td>Increasing and decreasing impulse during every second; equivalent to a single actuation each second</td>
</tr>
<tr>
<td>Continuous Actuation</td>
<td>Single impulse increase; impulse decrease only after explicit termination of actuation</td>
</tr>
</tbody>
</table>

7.2.1 Interactive Placement of Detector Calls

To place detector calls (actuations) follow the steps outlined below:

1. In VIEW - OPTIONS - [TRAFFIC], activate Individual Vehicles.
2. In VIEW - NETWORK ELEMENTS activate the display of Detectors.
3. If you would like the creation of a Signal/Detector-Protocol (see section 10.9), toggle the appropriate options in EVALUATIONS – FILES and/or – WINDOWS.
4. If the sequence of detector actuations is to be stored for later testing of other control strategies, activate the macro function using TEST – RECORDING.
5. Start the test function with TEST – CONTINUOUS or TEST – SINGLE STEP.

- Starts the continuous Test run. | F5
- Calls the next step in the Single step mode; Allows also toggling from Continuous to Single Step mode during the Test run. | F6

6. Activate individual detector calls by clicking:
   - **Left** mouse button: In Single Step mode, switch between no actuation (black) to single actuation (blue) to repeated actuation (cyan) and back to no actuation.
   - **Right** mouse button: Place (as well as terminate) a continuous actuation (purple)
7.2.2 Using Macros for Test Runs

Instead of interactively placing every single detector call in every test run, a macro file can be used that contains all desired detector calls. The use of macro files is recommended if:

- a test run with a fixed set of detector calls is to be evaluated under different control strategies or
- different, but similar test runs are to be evaluated.

A macro for a test run can be created by:

- interactive placement of detector calls with the option RECORDING activated or
- using the macro editor.

In case of creating a macro file for a fixed test run for multiple control scenarios follow the steps outlined below:

1. Select TEST - RECORDING (when reopening the TEST menu, a check mark appears at RECORDING)
2. Interactively place the desired detector actuations with TEST – CONTINUOUS or TEST – SINGLE STEP.
3. Terminate the test run with STOP. Because of the activated recording function, a macro file with the extension *.M_I will be created.
4. Modify the parameters of the control logic and repeat the same set of detector calls with TEST – MACRO – RUN...

To evaluate a control logic with different, but similar test runs, use the macro editor as described below:

1. Create a macro data file through interactive placement of detector calls as outlined above.
2. Create similar test macros using the macro editor (TEST – MACRO – EDIT). The Macro Editor window appears.
3. Delete existing actuations (Highlight the appropriate line and press DELETE).
4. Insert an additional actuation:
   Select a signal controller (SC), detector number (Det.), time interval (from, until resp. in) and type (Single, Continuous, Repeating) of the actuation. Since single actuations only last one second, only one time is...
to be defined. Pressing INSERT: inserts the new actuation before the currently highlighted detector call. VISSIM will not automatically sort the detector call listing.

5. For editing previously defined actuations (e.g. change time interval), delete the existing actuation and create a new actuation.

6. The test macro can be saved with a different name using the SAVE AS command.

7. If public transit call points are supported by the selected control strategy, call telegrams can also be included in the macro as special actuations for detector type PT Tel..

The files generated during test runs are not named automatically according to test number or similar. Be careful when specifying file names.

When testing VS-PLUS control strategies, usually a SC/Detector protocol is generated. It is recommended to name this *.LDP file and the macro test file (*.M_I) accordingly.

7.2.3 Using Batch Mode Operation for Test Runs

In addition to manually defined detector actuations, VISSIM can also analyze a series of special test cases. This feature is especially helpful to answer questions like:

► How does the tested logic react to exceptional situations such as repeated demand for all signal phases with a transit preemption event at a certain time?

► What happens if the preemption event occurs one second later or two seconds earlier, etc.?

The batch mode operation discriminates between signal groups (phases) with specific detector actuations (test phases) and signal groups (phases) with constant demand or recall operation (recall phases).

VISSIM logs all signal changes that occurred during the test run in an output file (*.SLO). It uses this output file to prepare the following analyses:

<table>
<thead>
<tr>
<th>Red Time Distribution</th>
<th>Green Time Statistics</th>
<th>Time-Time-Diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waiting times for test phase vehicles depending on the cycle second in which the preemption call occurred</td>
<td>Green time average and distribution for all signal groups (phases) depending on preemption time point, required green time and volume to capacity ratio</td>
<td>Diagram showing green time of up to four signal groups (phases) against the time of preemption</td>
</tr>
</tbody>
</table>

VISSIM requires a configuration file (*.SLF) as input. This file has to be created with a text editor outside of VISSIM according to the example shown below. Note that VISSIM ignores the comments (text preceded by two
dashes ‘--’). The presence and sequence of the key commands at the beginning of each line is important.

Example

The following example analyzes the impact of a light rail preemption event between simulation second 1 and 10 on the signal operation. Light rail trains place their preemption call via detector #901 and checkout via detector #902. The average queue length at the stop line defines the number of vehicles usually queued at the beginning of the green interval. It is assumed that the transit vehicle is in the middle of the queue and gets an additional delay of 2 seconds per vehicle in front of it. Detector actuations for the recall phases can be set to repeated (ALF/LFD) or continuous (AST/STE). Multiple detectors including call sequence and time gap can be defined for call and checkout using the following syntax:

call:  ANF <#> {NACH <sec.> DET <#>}*
checkout: ABM <#> {NACH <sec.> DET <#>}*

-- Configuration File for VISSIM/Test/Loop
-- 18598s4.SLF
LSA   1 -- controller number
VLZ  120 -- startup time (before preemption event)
NLZ  240 -- recover time (after preemption event)
BUM   5 -- number of analyzed cycles (if applicable - otherwise delete this line)
ASL   1 -- number of nested loops
ALF   7 -- total number of detectors with repeated demand (recall)
LFD   1 2 3 4 5 6 8 -- detector numbers with repeated demand (recall)
--
SLF   1 -- Loop 1:
VON   1 -- start of analysis time window
BIS  10 -- end of analysis time window
ANF  901 -- preemption call detector (actuated)
ABM  902 -- checkout detector
SGP  204 -- preemption (actuated) signal phase
FZ1  53 -- travel time from call detector to stop line
FZ2  3 -- travel time from stop line to checkout detector
MRL   0 -- average queue length at stop line in vehicles

Nesting of analysis loops is an option to analyze multiple combinations of events. However, this type of analysis requires a substantial amount of computing time.

Overview of the Syntax

Please note, that German and English commands can be used in the same file.

<table>
<thead>
<tr>
<th>German</th>
<th>Definition</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSA</td>
<td>Controller No. 1</td>
<td>SCJ</td>
</tr>
<tr>
<td>SGP</td>
<td>Actuated signal phase No. (preemption)</td>
<td>SGP</td>
</tr>
</tbody>
</table>
### 7.2.3.1 Red Time Distribution

The red time distribution is a graphical representation of the waiting time for each signal group (phase).

To get a red time distribution follow the steps outlined below:

1. Create a loop output file (*.SLO) via LOOP – RUN.
2. Create the red time distribution file via LOOP – ANALYZE – WAITING TIMES DISTRIBUTION....

VISSIM creates a file with the extension *.AWZ and the following content:

```
1 1 *
2 1 *
3 1 *
```
The first column contains the time of preemption call and the second column shows the resulting waiting time for test phase vehicles. The number of stars to the right represents the waiting time graphically. The average waiting time is shown at the bottom. This example shows that preemting light rail vehicles experience one second of delay for every analyzed preemption time.

### 7.2.3.2 Green Time Statistics

VISSIM generates a green time distribution with and without preemption event for all signal groups (phases) specified in the demand file (*.BEL). VISSIM also calculates green time requirement and volume to capacity ratio for all signal groups (phases) according to the specified volume demand.

To get the green time statistics follow the steps outlined below:

1. Use an external text editor (e.g. Notepad) to create a demand file according to the example shown below:

   ```
   -- Intersection Demand File for VISSIM/Test/Loop
   -- 185p98s4.BEL
   LSA          1 -- controller #
   ASL          1 -- # of nested loops
   BELASTUNG   12 -- preemting vehicles per hour
   -- signal phase #/ demand [veh/h] / base green time [sec]:
   SGP  1 BELASTUNG  100  SAETTIGUNG 1770  BASISGRUEN  8
   SGP  2 BELASTUNG 1390  SAETTIGUNG 3725  BASISGRUEN 55
   SGP  3 BELASTUNG  185  SAETTIGUNG 1770  BASISGRUEN 15
   SGP  4 BELASTUNG  915  SAETTIGUNG 5471  BASISGRUEN 25
   SGP  5 BELASTUNG 1125  SAETTIGUNG 1770  BASISGRUEN 16
   SGP  6 BELASTUNG  845  SAETTIGUNG 3686  BASISGRUEN 49
   SGP  8 BELASTUNG  845  SAETTIGUNG 3686  BASISGRUEN 42
   ```

2. Generate the green time statistics file with the extension *.AGZ via LOOP – ANALYZE – GREEN TIME STATISTICS. Use the previously generated loop output file (*.SLO). It will have the following content:

   Signal group 1:
   Average green time:
   - without modification = 8.0 s (100.0%)
   - modified by public transport = 14.5 s (181.2%)
   - weighted average = 10.6 s (132.5%)
   Capacity:
   - saturation flow = 1770 veh/h
   - public transport modifications = 12 veh/h
   - flow = 100 veh/h
   - capacity = 156 veh/h
   - degree of saturation = 0.64
   Required green time = 6.8 s
7.2.3.3  **Time-Time Diagram**

The time-time diagram shows green time against the time of preemption call for up to 4 signal groups (phases). VISSIM creates a separate diagram for each nested loop in relationship to the call time point of the first loop.

To get a time-time diagram follow the steps outlined below:

1. Use an external text editor to create a demand configuration file (*.ZZD) that contains up to 4 signal groups (phases) using the following syntax:

   ```
   -- Configuration File for Time-Time Diagram for VISSIM/Test/Loop
   -- 185p98s4.ZZD
   LSA 1 -- controller #
   -- analyzed signal groups (phases):
   SGP 2 5 204
   ```

2. Generate the time-time diagram file with the extension .AZZ via LOOP – ANALYZE – TIME-TIME-DIAGRAM.... Use the previously generated loop output file (*.SLO). It will have the following content:

   ```
   A = 2
   B = 5
   C = 2 + 5
   D = 204
   E = 2 + 204
   F = 5 + 204
   G = 2 + 5 + 204
   ```

<table>
<thead>
<tr>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>HHHHHHHHHHBB          DDEEAAAAAAAAAA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>HHHHHHHHHHBB          DDEEAAAAAAAAAA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>HHHHHHHHHHBBCCC       DDEEAAAAAAAAAA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>HHHHHHHHHHBBCCC       DDEEAAAAAAAAAA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>HHHHHHHHHHBBCCCA      DDEEAAAAAAAAAA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>HHHHHHHHHHBBCCCA      DDEEAAAAAAAAAA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>HHHHHHHHHHBBCCCAA     DDEEAAAAAAAAAA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>HHHHHHHHHHBBCCCAA     DDEEAAAAAAAAAA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>HHHHHHHHHHBBCCCAA     DDEEAAAAAAAAAA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>HHHHHHHHHHBBCCCAA     DDEEAAAAAAAAAA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   The first column shows the time of preemption call of the test phase, the heading line depicts the cycle time of the resulting timing plan as illustrated to the right of each time of preemption using a letter coding scheme. Each letter represents a combination of one or more signal groups (phases) that show green. The legend at the top of the file shows the relation of letters and signal groups (phases).
8.1 Animation

For the purpose of reviewing simulation runs and ease of presenting those runs, VISSIM offers the option of recording simulation sessions and saving them as animation files (*.ANI). These files can be recorded at any time interval during the simulation and played back from any point within the VISSIM network and at any speed supported by your hardware. Unlike simulations, animation files can be run in forward and reverse allowing presenters and analysts to replay a selected sequence easily. Animation files do not support the runtime analysis tools that can be used during and after a simulation. These are separate files generated during the simulation.

Animation files do support the recording of the Alternative Link Display. To get Alternative Link Display output during an animation VISSIM must show alternative display graphics during the simulation already (see section 4.4). The best way to verify that you will get Alternative Link Display output in the Animation file is to make sure that you can view it during the simulation.

Since an animation file only replays the graphics the animation runs are much faster than the actual simulation.

8.1.1 Record Animation Files

To record an animation, follow the steps outlined below:

1. Select PRESENTATION - ANIMATION PARAMETERS... The Animation Parameters window appears.

2. Press NEW... next to the Time Intervals list and define an interval to be recorded. There may be multiple intervals to be recorded during a single simulation run but they may not overlap.

3. Press NEW... next to the Areas list. The main VISSIM window then becomes active. Draw one or more areas by moving the mouse while holding down the left mouse button. Only vehicles simulated within at least one of these boxes will be included in the animation file.

4. If only aggregated data in contrast to single vehicles should be recorded, uncheck the option □ Save Vehicle Positions. Then the animation file will not save vehicle display information and thus will be much smaller.
If **Save Vehicle Positions** is active during the recording of aggregated data, vehicle positions will be saved additionally. Thus vehicle movements can be shown alternatively during the animation run.

5. Before starting the simulation, **PRESENTATION - ANI RECORDING** must be activated. Then the selected interval(s) and area(s) will be written to the animation file during the next simulation run. After the simulation run, the **RECORDING** option will be deactivated automatically.

### 8.1.2 Replay Animation File

1. Go to **PRESENTATION - ANIMATION PARAMETERS...** and open the desired **Animation File**.
2. Choose the **Animation Start** second and press Ok.
3. Go to **PRESENTATION - CONTINUOUS** to start the animation run. You can control the animation run from the ‘Run Control’ buttons in the toolbar.
4. Alternatively you can activate the ‘Animation’ toolbar: Right-click in the toolbar area and tick **ANIMATION** from the context menu.

<table>
<thead>
<tr>
<th>Action</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starts the continuous animation.</td>
<td>F5</td>
</tr>
<tr>
<td>Calls the next animation step in the <strong>Single step</strong> mode; Allows also toggling from <strong>Continuous</strong> to <strong>Single Step</strong> animation mode during the animation run.</td>
<td>F6</td>
</tr>
<tr>
<td>Terminated the current animation run.</td>
<td>Esc</td>
</tr>
<tr>
<td>Continuously in reverse direction.</td>
<td></td>
</tr>
<tr>
<td>Single-step mode in reverse direction.</td>
<td></td>
</tr>
</tbody>
</table>
8.2  Recording 3D Video files

VISSIM can record a video of a 3D simulation run using the AVI format. To set up VISSIM to record an AVI file follow the steps outlined below.

8.2.1  Recording Options

VISSIM records AVI files that will be played at a constant rate of 20 frames (pictures) per second. As each simulation time step results in one picture, the actual playback speed of the AVI file depends on the simulation resolution (time steps per simulation second) during the recording: When 10 time steps are chosen (recommended value), the playback speed is twice as fast as real time. When using only 1 time step, then the resulting playback speed will be 20 times faster as real time.

Be aware that changing the simulation resolution has an impact on the driving behavior and thus might lead to different simulation results.

There are two optional features that are associated with AVI-file recording:

►  **PRESENTATION - 3D-VIDEO - ANTI-ALIASING**: Special algorithm to reduce “jaggies” (i.e. pixel edges caused by the screen resolution). When this option is enabled, AVI recording is much slower but produces a video file of higher quality.

►  **PRESENTATION - 3D-VIDEO - STEREO (2 AVIS)**: Produces two AVI files, the second one with a slightly different camera location. This feature allows for production of a stereoscopic movie (special equipment needed for viewing).

8.2.2  Keyframes

In order to use different viewing locations within an AVI file, a predefined set of camera locations may be used. These locations are called keyframes. In order to use them for recording an AVI file, the keyframes need to be defined prior to the recording.

Keyframes are saved in the VISSIM network file (*.INP).

**Definition**

In order to define keyframes, the 3D graphics mode needs to be active.

1. Set the observer position in 3D as desired for the keyframe.
2. Go to **PRESENTATION - 3D-VIDEO - KEYFRAMES**... The **Keyframe** window appears containing a list of all keyframes currently defined (see below for keyframe list functions).
3. Press New... to create a new keyframe entry in the list. Define the keyframe properties (see below) and confirm with Ok.

4. The 3D view may be changed even while the Keyframe window remains open. Doing so allows to create a series of keyframes. Simply repeat steps 1 and 3 for every keyframe to be added.

5. After all keyframes have been created, close the list of keyframes with Ok.

The settings provided for Create keyframe and Edit keyframe only differ in option Delay later keyframes: If a keyframe is to be added between 2 existing keyframes, then subsequent keyframes can be delayed accordingly by the number of dwell time simulation seconds of the current keyframe.

Properties & Options

The properties of a keyframe can be accessed by selecting Presentation - 3D-Video - Keyframes..., selecting the desired item from the list and pressing Edit.

- **Name**: Label or comment
- **Starting time**: Start time of this keyframe (in simulation seconds). The start time is relative to the simulation time, where the recording is started. Therefore the first keyframe should start at 0s.
- **Dwell Time**: The time the simulation will be viewed from the position defined by this keyframe (in simulation seconds). Using the Start and Dwell Time, VISSIM performs a check if the current keyframe fits into the existing keyframe sequence. If it does not fit, the changed data cannot be applied.
- **Movement** defines the type of movement between the camera positions of this and the next keyframe:
  - A linear movement results in a change of position at constant speed.
  - A sinusoidal movement uses slower speeds closer to the keyframe positions and accelerates between them thus making the movement smoother.
  - A linear-sinus movement starts with a constant speed and slows down towards the next keyframe.
  - A sinus-linear movement starts with an increasing speed and continues with a constant speed towards the next keyframe.

The latter two options can be used to define intermediate keyframe positions with no dwell time to specify the path from one keyframe to another while retaining a smooth movement.
Example: If keyframe 2 is an intermediate keyframe with 0s dwell time, then the movements could be defined as:

Keyframe 1: sinus-linear
Keyframe 2: linear
Keyframe 3: linear-sinus

- **Delay later keyframes**: When inserting a new keyframe between two existing ones this option shifts the starting times of all subsequent keyframes by the dwell time defined in the inserted keyframe. Dwell times and movement times of subsequent keyframes remain unchanged. The calculated movement time of the edited keyframe is also kept.

If the new starting time shifts the edited keyframe to another position in the list of keyframes, i.e. the temporal order is changed due to the edited starting time, then the time gap appearing in the original position of the edited keyframe is closed automatically: The starting times of all subsequent keyframes are adjusted accordingly.

This might also concern the new starting time of the edited keyframe (only, if starting time was shifted to a later time). Dwell time and calculated movement time of adjusted keyframes remain unchanged. The dwell time of the initial predecessor keyframe is recalculated.

### Keyframe List Functions

The keyframe list can be accessed by selecting **PRESENTATION - 3D-VIDEO - KEYFRAMES**... While the list is visible, only a selection of all VISSIM functions, commands and hotkeys is available. Among them are the view and simulation commands so that the viewing position can be changed and the simulation started while the keyframe list is visible. A click on a keyframe in the list changes the camera position in the 3D network window.

- **NEW**: Creates a new keyframe with the current 3D view.
- **EDIT**: Access of the properties of an existing keyframe.
- **UPDATE POSITION**: Changes the camera position associated with the selected keyframe to the current 3D view.
- **DELETE**: Deletes the selected keyframe(s).
- **Preview**: Clicking **START** calls the display of the camera movement through the selected keyframes in the list (or all keyframes, if less than
two are selected). This simulates the movement during recording of an *.AVI file in the selected speed. The preview can be canceled with Esc.

The Movement time between two keyframes is computed automatically by taking into account the start and dwell time of the current keyframe and the start time of the following one. It is not possible to insert a keyframe into the list that overlaps with an existing one.

The type of movement is shown right behind the movement time, indicating the starting letter(s) of the corresponding type.

All changes made in the list of keyframes are only permanent if the Keyframe window is closed with the Ok button. Thus any changes to the list can be undone by leaving the window with CANCEL.

### How Keyframes Come Into Action

Basically there are two applications for keyframes:

- “Storybook” for the recording of AVI files
- Library of predefined perspectives for 3D mode

#### Keyframes as “Storybook” for the recording of AVI files

During the recording of an AVI file the keyframes will be run through in the order in which they are listed (sorted by start time), starting from that time when PRESENTATION - AVI-RECORDING is activated. Then the 3D view will change to the first keyframe. If no keyframes are present, VISSIM will record the current view of the 3D model. If the users changes the view during the simulation that change will be recorded.

#### Using keyframes without recording an AVI file

The list of keyframes is available also during a simulation run in order to provide a means to view the 3D simulation from predefined perspectives. As a keyframe is selected in the list, the view changes to its camera position. Note: While the Keyframe window is visible, not all VISSIM functions, commands and hotkeys are available.

### 8.2.3 Starting the Recording

1. If not enabled already, switch to 3D graphics mode.
2. To start the recording from the beginning, select PRESENTATION - AVI-RECORDING and start the simulation. If you would like to start the recording at a later time during the simulation run, go to single step mode as soon as the desired start time is reached and then activate AVI-RECORDING. The enabled option is confirmed with a check mark.
3. As the recording is started, you will be prompted for a filename of the associated AVI file. Select the filename and confirm with Ok.
The AVI file needs to be saved to the same directory as the VISSIM network file (*.INP).

4. The Video Compression window open to receive the desired video compression mode. It is highly recommended to use video compression as AVI files become very large without compression. The compression modes available depend on your Windows installation. Some compression modes offer additional configuration.

5. Confirm with Ok in order for the AVI file to be recorded. The AVI file is now recorded while the simulation is active.

Recording an AVI file can take substantially longer than a normal 3D simulation, especially if the Anti-Aliasing option is activated.

The video compression used for the AVI recording must be installed also on every computer where the AVI file is to be shown. As video compression codecs depend on the Windows installation, it is recommended to use a codec that is widely used in standard installations, e.g. “Microsoft MPEG-4 Video Codec”
9 Results

VISSIM offers a wide range of evaluations that result in data displayed during a simulation/test run and/or in data stored in text files. The definition and configuration process along with sample results is described in chapter 10 according to each evaluation type. This chapter provides information about enabling evaluations and possible runtime errors. A complete list of all file types that are associated with VISSIM is contained in chapter 12.
9.1 Enabling Evaluations

Apart from definition and configuration (which is described in chapter 10), evaluations need to be enabled in order to produce output files or display evaluation data online during a simulation/test run.

9.1.1 Windows Output

Window output is enabled through EVALUATION - WINDOWS. The following options are available:

► VEHICLE INFORMATION... Configuration of the vehicle information data that will be displayed when double-clicking on a vehicle during a simulation run.

For details on vehicle information see section 10.6.

► SIGNAL TIMES TABLE controls the display of the Signal Times Table window for each controller individually. Inside these windows both Detectors and Signal Groups can either be labeled with their Name or Number.

For further information on Signal Times Tables see section 10.8.

► SC/DET.RECORD... controls the display of the Signal Control Detector Record window for each controller individually. Inside these windows both Detectors and Signal Groups can either be labeled with their Name or Number.

For further information on SC/Detector Records see section 10.9.

► SIGNAL CHANGES: Displays a chronological list of all phase changes of all signal controllers. For further information see section 10.10.

► TRAVEL TIMES: Displays the exponentially smoothed travel times for each defined Travel Time Measurement. For further information see section 10.1.
9.1.2 File Output

File output is enabled through the Offline Analysis (File) window which can be accessed by Evaluations – Files...

For every evaluation type that is activated (by ticking the box adjacent to it), output files are generated during a simulation run according to the definition and configuration specific to each evaluation type (for more information please refer to chapter 10).

The filename of the corresponding output file is composed by the name of the input file and the evaluation type specific extension.

See section 12.1 for a complete list of all output files.

Existing output files of previous simulation runs of the same input file will be overwritten without warning. In order to save the existing files it is recommended to move them into another directory immediately after the end of the simulation run.

9.1.3 Database Output

VISSIM also allows to output some data in a database format. Currently database output is possible for

- Vehicle record
- Link evaluation
- Paths (Dynamic Assignment)
9.1.3.1 System Requirements

In order to enable the database output functionality the “Microsoft Data Access Components” (MDAC) need to be installed on the computer. We recommend to use the latest version of MDAC (at least version 2.7). If you’re not sure if these components are installed on your computer, the latest version can be downloaded from the internet from the Microsoft™ homepage (http://www.microsoft.com). Simply search for “MDAC” and follow the instructions on the download page.

For a successful installation the user must be logged in with administrator rights.

The VISSIM database output has been tested for Microsoft™ Access™ and Oracle™ database systems.

9.1.3.2 Database Connection

The database connection is configured in the Evaluations (Database) window which is accessed by EVALUATION – DATABASE… These properties are saved to the VISSIM network file (*.INP).

- Create New Access Database (necessary only when using a new Microsoft™ Access™ database file): Provides a shortcut to create a new Microsoft™ Access™ database file (*.MDB). It is also possible to select an existing database file. This file will then be overwritten in order to be used for VISSIM.

  Depending on the installed version of Microsoft™ Access™, either the button ACCESS 97 or ACCESS 2000/XP is to be used.

  The ACCESS 2000/XP button is available only if the “Jet 4.0 OLE DB Provider” is present on the computer.

  For ACCESS 97 at least the “Jet 3.51 OLE DB Provider” must be present on the computer.

- Database connection: Using the DATA LINK PROPERTIES... (see below for details), a database “connection string” is generated that will be used to create a database connection prior to the start of the simulation. A connection can only be established to an existing database. For Oracle™ systems also a user ID needs to be provided.

- Confirm Overwrite Table: If active, VISSIM prompts the user to confirm overwriting an existing database.
Properties & Options

The Data Link Properties can be accessed by pressing the button DATA LINK PROPERTIES in the Evaluations (Database) window.

[PROVIDER] List of all database providers on the computer. Select the desired provider ("Jet" or "Oracle" providers have been tested with VISSIM).

[CONNECTION] The connection properties depend on the provider selected. Only selected properties are listed below:

- Access (Jet provider):
  - Database name: Name of the database file (*.MDB) for the VISSIM output.
  - User name: Unless a specific user name is needed use the default value.

- Oracle:
  - Server Name: Provides the connection to the Oracle server.
  - User name: An existing user name must be entered.
  - Password. Note: The password provided here will be saved in the VISSIM network file as plain text (not encrypted).
  - ☐ Allow Saving Password needs to be active.

[ADVANCED] & [ALL] Further properties dependent on the provider selected. Typically these properties can be left at their default values.

9.1.3.3 Database Output Data

The database output (what information is to be stored in the database) is configured directly in the configuration window of each evaluation type. By default, all evaluations are stored in an ASCII text file, not in a database. For data configuration and activation of the database output please refer to the following sections:

- Vehicle record: see section 10.7.
- Link evaluation: see section 10.11.
- Paths (Dynamic Assignment only): see section 10.21.
9 Results

9.2 Runtime Errors

This section explains how to deal with errors that may occur during a simulation run.

9.2.1 Assertion Error Messages

Any error message that contains the text “Assertion failed...” reports an unexpected program state. The information of these messages are very important for PTV in order to fix the problem. In case you encounter an assertion error please send an e-mail to the VISSIM hotline. Please use the form provided via http://www.english.ptv.de/cgi-bin/kontakt/vissim_form.pl and state the following information:

► Your exact VISSIM version (incl Service pack no.)
► Your operating system
► The complete text of the error message including the file name, line number and possible expression (e.g. screenshot)
► The immediate action that has lead to the error
► Information about the reproduction possibility of the error, i.e. if you were able to reproduce the same error again.
► Depending on the error it might be helpful to send the VISSIM data also.

For some assertion messages VISSIM offers one of the options IGNORE or CONTINUE. Selecting either of these options may results in undefined program behavior or later data loss, especially if the assertion message occurred during a file write operation. Any file saving after an error occurred should be done using a different file name than the original file as the file might be corrupted.

We strongly recommend to close the application after an error occurred and restart VISSIM before continuing your work.

9.2.2 Program Warnings (*.ERR file)

If any non fatal errors or warnings occur during a VISSIM simulation run, the corresponding messages are written to a file with the same name as the network file but with the extension *.ERR.
After the simulation run, a message box appears, notifying the user of the newly created error file.

For some errors, a message box also appears prior to the start of the simulation. By pressing CONTINUE, any subsequent error messages will be shown. By pressing NO MESSAGE, all subsequent messages of the same kind will be suppressed. But still all errors will be logged to the error file.

These are some of the problems/errors that VISSIM reports:

► A routing decision that is placed too close to the start of a connector
► A desired speed decision that might be placed too close to the start of a connector. This message does not necessarily point to a problem as a simplified method of computing the minimum distance is used.
► An entry link that did not generate all vehicles as defined by the coded input flow because of capacity problems resulting in a queue outside the network at the end of the defined time interval.
► A vehicle that has been removed from the network because it had reached the maximum lane change waiting time (default = 60 seconds).
► A distance too short between the beginning of a routing decision and the first connector causing a vehicle to leave its route because it has not enough time to stop beforehand.
► The passage of more than 5 connectors at the same time by a single vehicle resulting in a virtual shortening of the vehicle in the visualization.
► For signal controllers that use information on intergreen and minimum green times: Each violation of one of the times defined in VISSIM will be reported if it occurs during a simulation run.
This chapter provides all information on how to define and configure the individual evaluation types and what the results look like. In order to generate output data, the corresponding option needs to be enabled (see section 9.1).

Some evaluations may result in an
- online window representation (e.g. signal times table),
- a text file can be written, or
- a database table can be saved.

Some evaluation types support two or even all options. As the text files use semicolons as delimiters they can easily be imported in spreadsheet applications (like Microsoft™ Excel™) in order to use them for further calculations or graphical representation.
10 Evaluation Types

10.1 Travel Times

VISSIM can evaluate average travel times if travel time sections have been defined in the network. Each section consists of a start and a destination cross section. The average travel time (including waiting or dwell times) is determined as the time a vehicle crosses the first cross section to crossing the second cross section.

**Definition**

To define a travel time section follow the steps outlined below:

1. Select the mode “Travel Time Measurements”.
2. With a single left mouse click select the link for the travel time section to start.
3. Select the desired location for the travel time section start on the selected link by clicking the right mouse button. The start cross section will be shown as a red bar with link number and coordinate being displayed in the status bar.
4. If necessary, modify the screen view using the zoom commands or scroll bars in order to place the destination cross section.
5. With a single left mouse click select the link for the destination cross section.
6. Select the desired location for the destination of the travel time section within the selected link by clicking the right mouse button. The destination cross section will be displayed as a green bar and the Create Travel Time Measurement window appears.
7. Set the properties of that section (see below) and confirm with Ok.
Properties & Options

- **No.**: A unique number to reference this travel time section. It is recommended to use a numbering scheme that is implemented to the whole VISSIM network in order to easily reference the evaluations.

- **Name**: Label or comment of the travel time segment.

- **From Section/To Section**: Exact location of the travel time segment.

- **Vehicle Classes**: Only vehicles of the selected class(es) will be measured.

- **Distance**: between the start and end cross section as determined by the shortest route. If this field is blank, VISSIM could not determine a continuous link sequence between both cross sections. The cause may be that a connector is missing or that one of the cross sections was placed on the wrong link (e.g. opposite direction).

If Dynamic Assignment (optional module) is activated, the shortest distance (in contrast to the distance with the minimum no. of links) will be used as the distance. However, it can only be computed if both travel time cross sections are located either between two nodes or within a node.

- **Visible (Screen)**: If active, the travel time cross sections are visible during the simulation (if travel times have been enabled in the global display settings).

- **Label**: If active, the label of the travel time section (as enabled in the global display settings) is shown.

- **Write (to File)**: If active, the travel time values for this section will appear in the output file.

- **Smooth. Factor** (applies only to the window representation of the travel times, not to the file): Exponential factor as how a new travel time will be weighted before added to the existing average travel time.

Configuration

In order to get the desired output format additional information is needed. This is to be provided within the **Travel Time Measurement Configuration** window which can be accessed by pressing the **CONFIGURATION** button in **EVALUATION – FILES**… once the option **Travel Time** is ticked. The following configuration data can be defined:
- **Active Travel Times**: Only data for the selected travel time sections will be collected.

- **Time**: The starting and finishing time and the time interval of the evaluation (defined as simulation seconds).

- **Aggregation method**: Select here whether a vehicle should be counted to the evaluation interval where it crossed the *start section* or the *destination section*.

- **Output** defines the output format of the text file:
  - *Compiled Data* generates a file (*.RSZ) according to the times, vehicle classes etc. as defined in this window.
  - *Raw Data* generates a file (*.RSR) where simply every completed travel time measurement event will be logged in chronological order.

---

**Results**

Travel times can be output to

- a window (see 9.1.1) and/or to
- a file (see 9.1.2).

A compiled output text file (*.RSZ) contains:

- File title
- Simulation comment
- List of all travel time sections that have been evaluated, including the distance for the shortest route for that section
- Table with 2 columns:
  - travel times (in seconds) and
  - no. of vehicles
  measured for each section and time interval.

---

**Example (*.RSZ file)**

Table of Travel Times

SimulationComment

No. 11: from link 1 at 47.5 m to link 37 at 132.7 m, Distance 1583.3 m
No. 12: from link 2 at 57.0 m to link 2 at 1642.7 m, Distance 1585.7 m
No. 21: from link 22 at 45.2 m to link 37 at 133.3 m, Distance 1584.7 m
No. 22: from link 2 at 57.4 m to link 2 at 1643.0 m, Distance 1585.6 m
<table>
<thead>
<tr>
<th>Time:</th>
<th>VehC:</th>
<th>Trav:#Veh:</th>
<th>All:</th>
<th>Trav:#Veh:</th>
<th>All:</th>
<th>Trav:#Veh:</th>
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<th>All:</th>
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<tbody>
<tr>
<td>900</td>
<td>11:</td>
<td>49:</td>
<td>132.6</td>
<td>49:</td>
<td>142.0</td>
<td>219:</td>
<td>0.0:</td>
<td>219.8:</td>
<td>2:</td>
</tr>
<tr>
<td>1800</td>
<td>11:</td>
<td>61:</td>
<td>134.6</td>
<td>61:</td>
<td>140.4</td>
<td>249:</td>
<td>297.5</td>
<td>1:</td>
<td>229.9</td>
</tr>
<tr>
<td>2700</td>
<td>12:</td>
<td>53:</td>
<td>141.6</td>
<td>53:</td>
<td>143.3</td>
<td>275:</td>
<td>0.0:</td>
<td>282.1:</td>
<td>1:</td>
</tr>
<tr>
<td>3600</td>
<td>22:</td>
<td>53:</td>
<td>146.0</td>
<td>53:</td>
<td>148.8</td>
<td>272:</td>
<td>312.9</td>
<td>1:</td>
<td>286.9</td>
</tr>
</tbody>
</table>
10.2 Delay Times

Based on travel time sections VISSIM can generate delay data for networks. A delay segment is based on one or more travel time sections. All vehicles that pass these travel time sections are captured by the delay segment, independently of the vehicle classes selected in these travel time sections.

If a vehicle is detected by more than one of these travel time sections then it will be counted multiple times in the delay segment.

Definition

A delay time measurement is defined as a combination of a single or several travel time measurements; regardless of the selected vehicle classes, all vehicles concerned by these travel time measurements are also regarded for delay time measurement. As delay segments are based on travel times no additional definitions need to be done. For definition of travel time measurements please refer to section 10.1.

A delay time measurement determines - compared to the ideal travel time (no other vehicles, no signal control) - the mean time delay calculated from all vehicles observed on a single or several link sections.

Configuration

In order to get the desired output format additional information is needed. This is to be provided within the Delay Segments window which can be accessed by pressing the CONFIGURATION button in EVALUATIONS – FILES... once the option Delay is ticked. The following configuration data can be defined:

- **No. (Travel Times):** Shows all defined delay segments. Each delay segment is to be based on one or more travel time measurements (shown in brackets). The list can be edited by using the NEW, EDIT and DELETE buttons.

  While editing a measurement, use CTRL to select multiple travel time sections into this measurement.

- **Time:** The starting and finishing time and the time interval of the evaluation (defined as simulation seconds).

- **Output** defines the output format of the text file:
- **Compiled Data** generates a file (*.VLZ) according to the times and numbers as defined in this window
- **Raw Data** generates a file (*.VLR) where every completed delay measurement event will be logged in chronological order.

### Results

This is the format of a compiled output text file (*.VLZ):

- File title
- Simulation comment
- List of all delay segments that have been evaluated
- Table with the delay data measured for each section and time interval. It contains the following information:
  - **Delay**: Average total delay per vehicle (in seconds). The total delay is computed for every vehicle completing the travel time section by subtracting the theoretical (ideal) travel time from the real travel time. The theoretical travel time is the time that would be reached if there were no other vehicles and no signal controls or other stops in the network (reduced speed areas are taken into account). The delay time does not include passenger stop times at transit stops. However, the loss time caused by acceleration or deceleration because of such a stop remains part of the delay time.
  - **Stopd**: Average standstill time per vehicle (in seconds), not including passenger stop times at transit stops.
  - **Stops**: Average number of stops per vehicle, not including passenger stop times at transit stops.
  - **#Veh**: Vehicle throughput
  - **Pers**: Average total delay per person (in seconds), not including passenger stop times at transit stops.
  - **#Pers**: Person throughput

### Example (*.VLZ file)

<table>
<thead>
<tr>
<th>No.:</th>
<th>Time; Delay; Stopd; Stops; #Veh; Pers.; #Pers; VehC; All;</th>
<th>; ; ; ;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>900; 102.6; 49.9; 1.10; 268; 102.6; 268; 1800; 114.2; 41.0; 1.33; 310; 114.2; 310; 2700; 121.3; 42.0; 0.72; 328; 121.3; 328; 3600; 126.0; 43.7; 0.60; 335; 126.0; 335;</td>
<td></td>
</tr>
</tbody>
</table>
10 Evaluation Types

10.3 Data Collection

Data collection offers the collection of data on single cross sections rather than a section or segment.

Definition

To define data collection points follow the steps outlined below:
1. Select the mode “Data collection points”.
2. With a single left mouse click select the link for the data collection to be placed.
3. Define the data collection point with the right mouse button.
4. Enter a number in the appearing window and choose Ok.

Configuration

In order to get the desired output data and format additional information is needed. This is to be provided within the Data Collection window which can be accessed by pressing the CONFIGURATION button in EVALUATIONS – FILES… once the option Data Collection is ticked. The following data can be defined:

- **Measurem.# (Pts.):** Shows all defined data collection measurements and the collection points they are composed of.
  
The list can be edited by using the NEW, EDIT and DELETE buttons.
  
While editing a measurement, use **CTRL** to select multiple travel time sections into this measurement.

Alternatively one of the buttons **AUTO (ALL)** or **AUTO (GROUP)** may be used to define data collection measurements:

- **AUTO (ALL)** generates one measurement for each individual data collection point (even if it is included in another data collection measurement already).

- **AUTO (GROUP)** automatically combines data collection points which are situated within 3m on the same link/connector into one data collection measurement. This option is useful when data on multi-lane links should be collected for the complete link and not for individual lanes.

If there are no multi-lane links contained in the network, the result is identical to that of **AUTO (ALL)**.
Data Collection

- **Time**: The starting and finishing time and the time interval of the evaluation (defined as simulation seconds).

- **Output** defines the output format of the text file: **Compiled Data** generates a file (*.MES) according to the times and numbers as defined in this window, **Raw Data** generates a file (*.MER) where simply every data collection event will be logged in chronological order.

- **Configuration...** opens the **Data Collection - Configuration** window that allows to select the data and output format of the data collection measurements.

  - The selected data is displayed within the list box to the left (**Layout of columns**). Using the **Up** and **Down** buttons allow to change the sequence of the selected data as it will appear within the compiled output file. The contents of the list box can be changed using the << and >> buttons.
  
  - Depending on the **Parameter**, the **Function** and **Class Bounds** fields may offer additional specification for the chosen parameter.
  
  - The data collection can also be restricted to certain **Vehicle Classes**.

  The configuration will be saved to an external file (*.QMK).

**Results**

This is the format of a compiled output text file (*.MES):

- File title
- Simulation comment (as set in the global parameters)
- List of all cross section measurements that have been evaluated
- Brief description of the evaluated data
- Table with the measured data.

The output format is determined by the settings of the **Data Collection - Configuration** window.
### Example: Compiled data file (*.MES)

**Data Collection (Compiled Data)**

Luxembourg with SC 5, 6, 7 for VISSIM size B

- Measurement 413: Data Collection Point(s) 4131
- Measurement 431: Data Collection Point(s) 4311
- Measurement 519: Data Collection Point(s) 5191, 5192

**Measurement**: Data Collection Number
- **from**: Start time of the Aggregation interval
- **to**: End time of the Aggregation interval
- **Number Veh**: Number of Vehicles
- **Speed**: Speed [km/h]

<table>
<thead>
<tr>
<th>Measurement</th>
<th>from</th>
<th>to</th>
<th>Number Veh</th>
<th>Number Veh</th>
<th>Number Veh</th>
<th>Number Veh</th>
<th>Speed</th>
<th>Speed</th>
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</thead>
<tbody>
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<td>0;</td>
<td>5;</td>
<td>186;</td>
<td>191;</td>
<td>48.1;</td>
</tr>
<tr>
<td>431;</td>
<td>3600;</td>
<td>4500;</td>
<td>0;</td>
<td>3;</td>
<td>0;</td>
<td>33;</td>
<td>36;</td>
<td>0.0;</td>
</tr>
<tr>
<td>519;</td>
<td>3600;</td>
<td>4500;</td>
<td>0;</td>
<td>0;</td>
<td>5;</td>
<td>323;</td>
<td>328;</td>
<td>47.9;</td>
</tr>
<tr>
<td>413;</td>
<td>3600;</td>
<td>4500;</td>
<td>0;</td>
<td>0;</td>
<td>5;</td>
<td>323;</td>
<td>328;</td>
<td>47.9;</td>
</tr>
</tbody>
</table>

### Example: Raw data file (*.MER)

**Data Collection (Raw Data)**

Luxembourg, SC 3-10

**Data Collection Point**
- 7211: Link 10064 Lane 1 at 3.096 m, Length 0.000 m.
- 6411: Link 10064 Lane 2 at 3.187 m, Length 0.000 m.
- 6321: Link 45 Lane 1 at 150.642 m, Length 0.000 m.

**Data C.P. t(enter) t(leave) VehNo Type Line v[m/s] a[m/s²] Occ Pers tQueue VLength[m] CatTemp[°C] CWTemp[°C] DistX[m]**

<table>
<thead>
<tr>
<th>C.P.</th>
<th>t(enter)</th>
<th>t(leave)</th>
<th>VehNo</th>
<th>Type</th>
<th>Line</th>
<th>v[m/s]</th>
<th>a[m/s²]</th>
<th>Occ</th>
<th>Pers</th>
<th>tQueue</th>
<th>VLength[m]</th>
<th>CatTemp[°C]</th>
<th>CWTemp[°C]</th>
<th>DistX[m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>7211</td>
<td>900.00</td>
<td>100.00</td>
<td>938</td>
<td>100</td>
<td>0</td>
<td>11.0</td>
<td>-1.02</td>
<td>0</td>
<td>0.36</td>
<td>1</td>
<td>0.00</td>
<td>4.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20.00</td>
<td>67.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6411</td>
<td>900.29</td>
<td>900.76</td>
<td>932</td>
<td>100</td>
<td>0</td>
<td>10.3</td>
<td>-2.00</td>
<td>0</td>
<td>0.47</td>
<td>1</td>
<td>0.00</td>
<td>4.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20.00</td>
<td>178.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6321</td>
<td>900.15</td>
<td>900.53</td>
<td>926</td>
<td>100</td>
<td>0</td>
<td>12.9</td>
<td>-0.01</td>
<td>0</td>
<td>0.38</td>
<td>1</td>
<td>0.00</td>
<td>4.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20.00</td>
<td>242.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Column</td>
<td>Description</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>----------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t(enter)</td>
<td>Time when the vehicle’s front has passed the cross-section. Entry -1 indicates, that this happened before the current time step</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t(leave)</td>
<td>Time when the vehicle’s end has passed the cross-section. Entry -1 indicates, that this has not happened yet.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VehNo</td>
<td>Internal number of the vehicle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Vehicle type (e.g. 100 = car)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line</td>
<td>Public transit line</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>v</td>
<td>Speed (in m/s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>Acceleration (in m/s²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Occ</td>
<td>Occupancy: Time (in s) the vehicle has spent on the decision point in this simulation second</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Pers</td>
<td>Number of persons in the vehicle</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tQueue</td>
<td>Total time (in s) the vehicle has spent in congestion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VLength</td>
<td>Vehicle length</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CatTemp</td>
<td>Emission module only: Catalyst temperature (in °C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CWTemp</td>
<td>Emission module only: Cooling water temperature (in °C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DistX</td>
<td>Total distance (in m) the vehicle has travelled in network.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
10.4 Queue Counters

The queue counter feature in VISSIM provides as output the
► average queue length,
► maximum queue length and
► number of vehicle stops within the queue.

Queues are counted from the location of the queue counter on the link or
connector upstream to the final vehicle that is in queue condition. If the
queue backs up onto multiple different approaches the queue counter will
record information for all of them and report the longest as the maximum
queue length.

The back of the queue is monitored until there is not a single vehicle left over
on the approach that still meets the queue condition, though other vehicles
between the initial start and the current end of the queue do no longer meet
the queue condition (having a speed > End speed).

Queue length is output in units of length not in number of cars.

The queue is still monitored as long as there is a “queue remainder” - even
if the first vehicles directly upstream of the queue counter are not in queue
condition any more. Thus the results of queue evaluations may be different
compared to version 3.50 or earlier versions of VISSIM.

The maximum queue length reaches to the next queue counter located at
an upstream position. Queue counters created automatically for node
evaluations are not regarded.

Definition

Queue counters can be placed at any position within a link/connector. The
most suitable position is at the stop lines of a signalized intersection.

To define queue counters follow the steps outlined below:

1. Select mode △ “Queue Counters”.
2. With a single left mouse click select on the link the location of the queue
counter.
3. Define the location of the queue counter within the link by clicking the
right mouse button at the desired location. Queues will be measured
upstream from this location.
4. Enter a number in the appearing window and choose Ok.

Configuration

In order to get the desired output data additional information is needed. This
is to be provided within the Queue Measurement - Configuration window (see
below) which is accessible by pressing the CONFIGURATION button in
EVALUATIONS – FILES… once the option Queue Length is active.
The following data can be defined:

- **Queue Definition** defines the queue condition: A vehicle is in queue condition if its speed
  - drops below the *Begin* speed and
  - has not exceeded the *End* speed yet.

- **Max. Headway** defines the maximum distance between two vehicles so that the queue is not disrupted.

- **Max. Length** defines the max. length of the queue - even if the actual queue is longer. This parameter is helpful if longer queues are detected in a network of subsequent junctions but the queues are to be evaluated for each junction separately.

- **Time**: The starting and finishing time and the time *Interval* of the evaluation (defined as simulation seconds).

The simulation performance depends on the value set for **Max. Length**. If there is a big queue building up in the network, and the **Max. Length** parameter is set to a large value (e.g. 4 km), the simulation speed decreases.

### Results

This is the format of an output text file (*.STZ):

- File title
- Simulation comment
- List of all queue counters that have been evaluated
- Table with the queue data measured for each counter and time interval. It contains the following information for each queue counter (3 columns) and each time interval (one line):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Column</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average queue length</td>
<td>Calculation method: The current queue length is measured upstream (in m) every time step. From these values the arithmetical average is computed for every time interval</td>
<td>Avg</td>
</tr>
<tr>
<td>Maximum queue length</td>
<td>Calculation method: The current queue length is measured upstream (in m) every time step. From these values the maximum is computed for every time interval</td>
<td>Max</td>
</tr>
</tbody>
</table>
## Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Column</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of stops</td>
<td>Number of stops within queue: Total number of events when a vehicle enters the queue condition</td>
<td>Stop</td>
</tr>
</tbody>
</table>

### Example (*.STZ file)

Queue Length Record

Luxembourg with SC 5,6,7 for VISSIM size B

<table>
<thead>
<tr>
<th>Queue Counter</th>
<th>520: Link 247 At</th>
<th>66.200 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queue Counter</td>
<td>531: Link 241 At</td>
<td>18.600 m</td>
</tr>
<tr>
<td>Queue Counter</td>
<td>532: Link 243 At</td>
<td>18.795 m</td>
</tr>
<tr>
<td>Queue Counter</td>
<td>534: Link 242 At</td>
<td>46.900 m</td>
</tr>
</tbody>
</table>

Avg.: average queue length [m] within time interval
Max.: maximum queue length [m] within time interval
Stop: number of stops within queue

| Time; Avg.; Max.; Stop; Avg.; Max.; Stop; Avg.; Max.; Stop; Avg.; Max.; Stop; No. | 520; 520; 520; 531; 531; 531; 532; 532; 532; 534; 534; 534; 600; 12; 32; 15; 10; 73; 72; 12; 73; 51; 2; 13; 6; 1200; 12; 52; 19; 5; 37; 58; 7; 49; 34; 2; 20; 7; 1800; 17; 45; 12; 4; 36; 43; 7; 73; 36; 1; 7; 2 |
10.5 Green Time Distribution

VISSIM records the cumulative number of green and red durations as well as the mean and average green and red time for each signal group (phase), if option *Distribution of green times* is checked via *Evaluation – Files*. This information is useful for evaluations of vehicle actuated signal controls.

**Definition**

No additional definition required.

**Configuration**

No additional configuration required.

**Results**

This is the format of an output text file (*.LZV):

► File title
► Simulation comment
► Duration of the evaluation
► For every signal control a block for the average green times
► For every signal control a block for the green and red times. The - columns represent the individual signal groups (phases) \( j \), - rows represent the green and red time durations (up to 120 s) \( i \).

Every table entry \( ij \) indicates how often the signal group (phase) \( j \) had a green (red) time of \( i \) seconds.

► For every signal control and every signal group (phase): Separate data blocks for the distribution of the green and the red times with their frequency and mean value and a simple graphical visualization.

For graphical display of green time distributions the import of the *.LZV file in a spreadsheet program (e.g. Microsoft Excel) is recommended, especially the tabular green times data block.

**Example (*.LZV file)**

*Distribution of Signal Times*

*Luxembourg with SC 5,6,7 for VISSIM size B*

*Duration of Simulation: 3600*

*SC 1, Average Green Times:*

<table>
<thead>
<tr>
<th>Signal group;</th>
<th>( t );</th>
</tr>
</thead>
<tbody>
<tr>
<td>1;</td>
<td>13.7;</td>
</tr>
<tr>
<td>2;</td>
<td>48.4;</td>
</tr>
<tr>
<td>3;</td>
<td>14.2;</td>
</tr>
<tr>
<td>4;</td>
<td>21.5;</td>
</tr>
</tbody>
</table>
### Evaluation Types

<table>
<thead>
<tr>
<th></th>
<th>5</th>
<th>12.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>48.1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>40.0</td>
<td></td>
</tr>
</tbody>
</table>

#### SC 1, Green Times:

<table>
<thead>
<tr>
<th>t</th>
<th>SG</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>19</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

#### SC 1, Red Times:

<table>
<thead>
<tr>
<th>t</th>
<th>SG</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>0</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

#### SC 1, Signal group 1, Green Times:  (Mean: 13.7)

| 7 | 3 | *** |
| 8 | 20 | ******************** |
| 27 | 10 | ************ |

#### SC 1, Signal group 1, Red Times:  (Mean: 88.8)

| 21 | 1 | * |
| 28 | 1 | * |
| 37 | 1 | * |
| 38 | 1 | * |
| 45 | 1 | * |
| 48 | 5 | ***** |
| 52 | 1 | * |
| 86 | 1 | * |
| 89 | 1 | * |
| 90 | 1 | * |
| 91 | 1 | * |
| 106 | 1 | * |
| 108 | 11 | ************ |

...
10.6 Vehicle Information

During a simulation run vehicle information is available in a vehicle window by double-clicking on any vehicle. The information shown can be configured by the user.

Vehicle information can also be saved to an output file using the Vehicle Record (see section 10.7).

Definition

No additional definition required.

Configuration

In order to display the desired vehicle information additional configuration is needed. This is to be provided within the Vehicle Information Configuration window (see below) which is accessible by pressing the VEHICLE INFO... button in EVALUATION – WINDOWS…

The Selected parameters are displayed within the list box to the left. Use the UP and DOWN buttons to change the sequence of the selected data. Additional parameters can be inserted and removed by clicking on the corresponding buttons [ ] and [ ].

The configuration will be saved to an external file (*.FZI).

Results

When double-clicking on a vehicle during a simulation run,

► the vehicle contains a red bar confirming that it is selected and
► the vehicle information window is displayed.

Additionally, if display mode is set to 3D, the viewing position will be changed as from the drivers position.
10.7 Vehicle Record

Similar to the display of vehicle information in a window any combination of vehicle parameters can be saved to an output file.

Definition

No additional definition required.

Configuration

In order to get the desired output data additional information is needed. This is to be provided within the Vehicle Record - Configuration and Vehicle Record Filter windows. These can be accessed by pressing the Configuration or Filter buttons in Evaluations – Files... once the option Vehicle Record is active. The Configuration window allows for definition of any combination of the vehicle parameters. If Database output is not active, each layout line results in a column within the output file (*.FZP).

The configuration settings will be saved to an external file (*.FZK).

- The Selected parameters are displayed in the list box to the left. Use the Up and Down buttons to change the sequence of the selected data. Additional parameters can be inserted and removed by clicking the corresponding buttons << and >>.

For the list of parameters provided for selection and a brief description, please see below.

Schedules stops at public transit stops are not regarded.

Please note that some parameters will only report correct results if the corresponding optional module (such as Dynamic Assignment, Emission etc.) is installed.
• **Including Parked Vehicles** (Dynamic Assignment only): Includes vehicles that are contained in a parking lot in the evaluation output as well.

• **Database**: When active, evaluation output is directed to a database to the specified *Table Name* (rather than to an ASCII text file). The table name must not be used for any other VISSIM database evaluations. In order to use the database output the database connection needs to be configured (see section 9.1.3).

## Filter

Once the vehicle record parameters are selected, a filter may be applied to capture specific vehicles within the simulation. This can be done in the *Vehicle Record Filter* window.

In addition to the selection of vehicle classes, also a time interval for the evaluation can be defined. If the evaluation should only be done for individual vehicles, their numbers can be directly edited using the option *Individual Vehicle*.

The filter information is stored in a filter configuration file (*.FIL).

To calculate the total values for evaluations like Delay and Travel Time for the network it is possible to collect data for all vehicles and filter it to get the maximum values before the vehicle leaves the network. It is also necessary to collect the values from the vehicles remaining in the network at the end of the simulation.

There is one evaluation called Total Time that returns the total time the vehicle spent in the network. This value is saved to file only at the last second before the vehicle leaves the network. This is also the time step that the delay time for that vehicle should be collected.

For the vehicles still in the network at the end of the simulation their total time in the network must be calculated using their start times.

## Results

The vehicle protocol (*.FZP) consist of

- File title
- Simulation comment
- Brief description of output parameters
Data block

The vehicle record file can contain any of the parameters listed below. The table also includes the abbreviations that will be used within the vehicle record file. Please note that some parameters will only report correct results if the corresponding optional module (such as Dynamic Assignment, Emission etc.) is installed.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Column Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration</td>
<td>Acceleration [m/s²] during the simulation step</td>
<td>A</td>
</tr>
<tr>
<td>Cat. converter Temperature</td>
<td>Current catalytic converter temperature</td>
<td>CatTemp</td>
</tr>
<tr>
<td>Cooling water temperature</td>
<td>Current cooling water temperature</td>
<td>CWTemp</td>
</tr>
<tr>
<td>Delay time</td>
<td>Difference from optimal driving time (in s)</td>
<td>TQDelay</td>
</tr>
<tr>
<td>Desired headway</td>
<td>Desired headway [m] during the simulation step</td>
<td>abx</td>
</tr>
<tr>
<td>Desired Lane</td>
<td>Desired Lane (by Direction decision)</td>
<td>DesLn</td>
</tr>
<tr>
<td>Desired Speed [km/h]</td>
<td>Desired Speed [km/h]</td>
<td>VdesKmh</td>
</tr>
<tr>
<td>Desired Speed [m/s]</td>
<td>Desired Speed [m/s]</td>
<td>Vdes</td>
</tr>
<tr>
<td>Destination Lane</td>
<td>Destination lane number of current lane change</td>
<td>DLn</td>
</tr>
<tr>
<td>Destination Parking Lot</td>
<td>Number of the Destination Parking Lot</td>
<td>DPL</td>
</tr>
<tr>
<td>Dwell Time</td>
<td>Dwell Time [s] (For Stop Sign or Transit Stop)</td>
<td>DwlTm</td>
</tr>
<tr>
<td>Emissions (Evaporation) HC</td>
<td>Hydrocarbon in the current simulation step</td>
<td>HC_evap</td>
</tr>
<tr>
<td>Emissions Benzene</td>
<td>Benzene emissions in the current simulation step</td>
<td>Bnzn</td>
</tr>
<tr>
<td>Emissions CO</td>
<td>Carbon Monoxide emissions in current simulation step</td>
<td>CO</td>
</tr>
<tr>
<td>Emissions CO2</td>
<td>Carbon Dioxide emissions in the current simulation step</td>
<td>CO2</td>
</tr>
<tr>
<td>Emissions HC</td>
<td>Hydrocarbon emissions in current simulation step</td>
<td>HC</td>
</tr>
<tr>
<td>Parameter</td>
<td>Definition</td>
<td>Column Header</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Emissions NMHC</td>
<td>Non-methane Hydrocarbon Emissions in the current simulation step</td>
<td>NMHC</td>
</tr>
<tr>
<td>Emissions NMOG</td>
<td>Non-methane organic gas emissions in the current simulation step</td>
<td>NMOG</td>
</tr>
<tr>
<td>Emissions NOx</td>
<td>Nitrogen Oxide emissions in current simulation step</td>
<td>NOx</td>
</tr>
<tr>
<td>Emissions Particulate</td>
<td>Particulate Emissions in current simulation step</td>
<td>Particulate</td>
</tr>
<tr>
<td>Emissions SO2</td>
<td>Sulfur Dioxide Emissions in the current simulation step</td>
<td>SO2</td>
</tr>
<tr>
<td>Emissions Soot</td>
<td>Soot emissions in current simulation step</td>
<td>Soot</td>
</tr>
<tr>
<td>Following Distance</td>
<td>Following distance to the next car [m] for the simulation step</td>
<td>Dx</td>
</tr>
<tr>
<td>Fuel Consumption</td>
<td>Fuel consumption [mg/s] in the current simulation step</td>
<td>Fuel</td>
</tr>
<tr>
<td>Fuel Consumption [l/100km]</td>
<td>Fuel consumption [l/100 km] in the current simulation step</td>
<td>Fuel</td>
</tr>
<tr>
<td>Gear</td>
<td>Current Gear</td>
<td>Gear</td>
</tr>
<tr>
<td>Interaction State</td>
<td>Description/Number of the interaction procedure</td>
<td>IntacP</td>
</tr>
<tr>
<td>Lane Change</td>
<td>Direction of current lane change</td>
<td>LCh</td>
</tr>
<tr>
<td>Lane Number</td>
<td>Number of the Active Lane</td>
<td>Ln</td>
</tr>
<tr>
<td>Lateral Position</td>
<td>Lateral position relative to middle of lane (0.5) at the end of the simulation time step</td>
<td>Y</td>
</tr>
<tr>
<td>Length</td>
<td>Length [m]</td>
<td>Length</td>
</tr>
<tr>
<td>Link Coordinate</td>
<td>Link Coordinate [m] at the end of the simulation step</td>
<td>X</td>
</tr>
<tr>
<td>Link Cost</td>
<td>Cumulated Cost</td>
<td>Cost</td>
</tr>
<tr>
<td>Link Number</td>
<td>Number of the Active Link</td>
<td>Lk</td>
</tr>
<tr>
<td>Mileage</td>
<td>Mileage [km]</td>
<td>Mileage</td>
</tr>
<tr>
<td>Model Year</td>
<td>Model</td>
<td>Model</td>
</tr>
<tr>
<td>Number of Stops</td>
<td>Total Number of Stops</td>
<td>Stops</td>
</tr>
<tr>
<td>Parameter</td>
<td>Definition</td>
<td>Column Header</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Occupancy</td>
<td>Number of persons/passengers in the vehicle</td>
<td></td>
</tr>
<tr>
<td>Origin Parking Lot</td>
<td>Number of the Origin Parking Lot</td>
<td>OPL</td>
</tr>
<tr>
<td>Power</td>
<td>Power [kW]</td>
<td>Power</td>
</tr>
<tr>
<td>Preceding Vehicle</td>
<td>Number of the relevant preceding vehicle</td>
<td>LVeh</td>
</tr>
<tr>
<td>PT: Alighting Passenger</td>
<td>Number of passengers alighting at current stop</td>
<td>StpAlt</td>
</tr>
<tr>
<td>PT: Average Wait Time</td>
<td>Average Wait Time [s] for a boarder at the current stop</td>
<td>StpWaT</td>
</tr>
<tr>
<td>PT: Boarding Passenger</td>
<td>Number of boarding passengers at current stop</td>
<td>StpBd</td>
</tr>
<tr>
<td>PT: Course Number</td>
<td>Number of the course</td>
<td>Course</td>
</tr>
<tr>
<td>PT: Current Dwell Time</td>
<td>Dwell Time [s] at current stop (incl. slack time)</td>
<td>StpDwl</td>
</tr>
<tr>
<td>PT: Lateness</td>
<td>Lateness [s] at the exit from the current stop (&gt;0 = late)</td>
<td>StpLtns</td>
</tr>
<tr>
<td>PT: Line Number</td>
<td>Number of the line</td>
<td>Line</td>
</tr>
<tr>
<td>PT: Passenger Service Time</td>
<td>Passenger Service Time [s] at current stop</td>
<td>StpSvcT</td>
</tr>
<tr>
<td>PT: Total Dwell Time</td>
<td>The sum of all the transit stops dwell times [s]</td>
<td>SSStpsDwlT</td>
</tr>
<tr>
<td>PT: Transit stop number</td>
<td>Number of the current transit stop</td>
<td>Stp</td>
</tr>
<tr>
<td>PT: Waiting Passengers</td>
<td>Number of passengers waiting at current stop</td>
<td>StpWP</td>
</tr>
<tr>
<td>Queue Encounters</td>
<td>Total number of Queue Encounters</td>
<td>QEnc</td>
</tr>
<tr>
<td>Queue Time</td>
<td>Total Queue Time Thus Far [s]</td>
<td>SVZ</td>
</tr>
<tr>
<td>Queueflag</td>
<td>Flag: is Vehicle in Queue? + = yes, - = no</td>
<td>Queue</td>
</tr>
<tr>
<td>Required Power</td>
<td>Current Required Power [kW]</td>
<td>ReqPow</td>
</tr>
<tr>
<td>Revolutions</td>
<td>Current revolution speed (rpm)</td>
<td>Revolutions</td>
</tr>
<tr>
<td>Simulation Time</td>
<td>Simulation Time [s]</td>
<td>t</td>
</tr>
<tr>
<td>Slope</td>
<td>Slope [%] of the current link</td>
<td>Slope</td>
</tr>
<tr>
<td>Parameter</td>
<td>Definition</td>
<td>Column Header</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Speed [km/h]</td>
<td>Speed [km/h] at the end of the simulation step</td>
<td>VKmh</td>
</tr>
<tr>
<td>Speed [m/s]</td>
<td>Speed [m/s] at the end of the simulation step</td>
<td>V</td>
</tr>
<tr>
<td>Speed Difference [km/h]</td>
<td>Speed relative to the proceeding car [km/h] for the simulation step (&gt;0 = faster)</td>
<td>DvKmh</td>
</tr>
<tr>
<td>Speed Difference [m/s]</td>
<td>Speed relative to the proceeding car [m/s] for the simulation step (&gt;0 = faster)</td>
<td>Dv</td>
</tr>
<tr>
<td>Start Time</td>
<td>Start Time [Simulation Second]</td>
<td>STim</td>
</tr>
<tr>
<td>Target Link</td>
<td>Target Link (Next Link on the Route)</td>
<td>T Ln k</td>
</tr>
<tr>
<td>Theoretical Speed [km/h]</td>
<td>Theoretical Speed [km/h] Without Obstructions</td>
<td>v Theo Kmh</td>
</tr>
<tr>
<td>Theoretical Speed [m/s]</td>
<td>Theoretical Speed [m/s] Without Obstructions</td>
<td>v Theo</td>
</tr>
<tr>
<td>Total Path Distance</td>
<td>Total Elapsed Distance on the Route[m]</td>
<td>DistX</td>
</tr>
<tr>
<td>Total Time in Network</td>
<td>Total Time in Network [s]</td>
<td>T Tot</td>
</tr>
<tr>
<td>Vehicle Number</td>
<td>Number of Vehicle</td>
<td>VehNr</td>
</tr>
<tr>
<td>Vehicle Type</td>
<td>Number of Vehicle Type</td>
<td>Type</td>
</tr>
<tr>
<td>Vehicle Type Name</td>
<td>Name of the Vehicle Type</td>
<td>Veh Type Name</td>
</tr>
<tr>
<td>Weight</td>
<td>Weight [mt]</td>
<td>Weight</td>
</tr>
<tr>
<td>World Coordinate X</td>
<td>World Coordinate x (Vehicle leading edge at the end of the simulation step)</td>
<td>WorldX</td>
</tr>
<tr>
<td>World Coordinate Y</td>
<td>World Coordinate y (Vehicle leading edge at the end of the simulation step)</td>
<td>WorldY</td>
</tr>
<tr>
<td>World Coordinate Z</td>
<td>World Coordinate z (Vehicle leading edge at the end of the simulation step)</td>
<td>WorldZ</td>
</tr>
</tbody>
</table>
Example (*.FZP file)

The following extract shows the vehicle record of one specific vehicle:

Evaluation table

Luxembourg with SC 5,6,7 for VISSIM size B

t: Simulation Time [s]
a: Acceleration [m/s²] during the simulation step
abx: Desired headway [m] during the simulation step
vDesKmh: Desired Speed [km/h]
vKmh: Speed [km/h] at the end of the simulation step

<table>
<thead>
<tr>
<th>t</th>
<th>a</th>
<th>abx</th>
<th>vDesKmh</th>
<th>vKmh</th>
</tr>
</thead>
<tbody>
<tr>
<td>34.4</td>
<td>-3.09</td>
<td>2.8</td>
<td>48.88</td>
<td>11.43</td>
</tr>
<tr>
<td>34.6</td>
<td>-3.09</td>
<td>2.8</td>
<td>48.88</td>
<td>9.20</td>
</tr>
<tr>
<td>34.8</td>
<td>-3.10</td>
<td>2.8</td>
<td>48.88</td>
<td>6.97</td>
</tr>
<tr>
<td>35.0</td>
<td>-2.61</td>
<td>2.8</td>
<td>48.88</td>
<td>5.09</td>
</tr>
<tr>
<td>35.2</td>
<td>-1.96</td>
<td>2.8</td>
<td>48.88</td>
<td>3.67</td>
</tr>
<tr>
<td>35.4</td>
<td>-1.39</td>
<td>2.8</td>
<td>48.88</td>
<td>2.67</td>
</tr>
<tr>
<td>35.6</td>
<td>-1.13</td>
<td>2.8</td>
<td>48.88</td>
<td>1.86</td>
</tr>
<tr>
<td>35.8</td>
<td>-0.62</td>
<td>2.8</td>
<td>48.88</td>
<td>1.42</td>
</tr>
<tr>
<td>36.0</td>
<td>-0.60</td>
<td>2.8</td>
<td>48.88</td>
<td>0.98</td>
</tr>
<tr>
<td>36.2</td>
<td>0.63</td>
<td>2.3</td>
<td>48.88</td>
<td>1.44</td>
</tr>
<tr>
<td>36.4</td>
<td>1.36</td>
<td>2.3</td>
<td>48.88</td>
<td>2.42</td>
</tr>
<tr>
<td>36.6</td>
<td>1.79</td>
<td>2.3</td>
<td>48.88</td>
<td>3.70</td>
</tr>
<tr>
<td>36.8</td>
<td>2.02</td>
<td>2.3</td>
<td>48.88</td>
<td>5.16</td>
</tr>
<tr>
<td>37.0</td>
<td>2.13</td>
<td>2.3</td>
<td>48.88</td>
<td>6.69</td>
</tr>
<tr>
<td>37.2</td>
<td>2.18</td>
<td>2.3</td>
<td>48.88</td>
<td>8.26</td>
</tr>
<tr>
<td>37.4</td>
<td>2.06</td>
<td>2.3</td>
<td>48.88</td>
<td>9.74</td>
</tr>
<tr>
<td>37.6</td>
<td>1.82</td>
<td>2.3</td>
<td>48.88</td>
<td>11.06</td>
</tr>
<tr>
<td>37.8</td>
<td>1.53</td>
<td>2.3</td>
<td>48.88</td>
<td>12.16</td>
</tr>
<tr>
<td>38.0</td>
<td>1.24</td>
<td>2.3</td>
<td>48.88</td>
<td>13.05</td>
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<tr>
<td>38.2</td>
<td>0.74</td>
<td>2.3</td>
<td>48.88</td>
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<tr>
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<td>13.91</td>
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<tr>
<td>38.6</td>
<td>0.39</td>
<td>2.3</td>
<td>15.02</td>
<td>14.19</td>
</tr>
<tr>
<td>38.8</td>
<td>0.33</td>
<td>2.3</td>
<td>15.02</td>
<td>14.42</td>
</tr>
<tr>
<td>39.0</td>
<td>0.26</td>
<td>2.3</td>
<td>15.02</td>
<td>14.61</td>
</tr>
<tr>
<td>39.2</td>
<td>0.20</td>
<td>2.3</td>
<td>15.02</td>
<td>14.76</td>
</tr>
<tr>
<td>39.4</td>
<td>0.15</td>
<td>2.3</td>
<td>15.02</td>
<td>14.87</td>
</tr>
</tbody>
</table>
10.8 Dynamic Signal Timing Plan

The Dynamic signal timing plan (signal times table) offers a graphical display of the actual signal setting and detector occupancy. It displays green, amber and red times graphically with a horizontal time axis.

Definition

No additional definition required.

Configuration

To create or edit a signal times table configuration, follow the steps outlined below:

1. Select SIGNAL CONTROL - EDIT CONTROLLERS...
2. Select the controller to be edited from the list of all coded signal controllers.
3. In the [SigTimTbLCfg] tag, data can be edited.
10 Evaluation Types

Add line

To add a new line to the current Layout of lines table, a new entry has to be defined as follows:

► Left-click the selected value type in the Type (Category) list.
► Specific data (e.g. SG No.) have to be selected from the neighbouring list, if applicable.
► Add this combination to the current Layout of lines on top of the currently marked entry via
  - clicking the \( \approx \) button or
  - clicking one of the selected Type (Category) entries twice.

Delete line

To remove a line from the current Layout of lines table:

Select line and

► press DEL or
► right-click (calls the context menu) and press DELETE then, or
► left-click the \( \Rightarrow \) button.

Save layout

The configuration file (*.SZP) contains the currently specified Layout of lines. When the Signal control window is closed via OK, the layout file is saved automatically (with the specified file name) to the folder, where the currently used VISSIM network file (*.INP) is stored. It can then be reused for other signal controls or different projects.

To create a new configuration file, a new file name has to be entered for configuration file. The VISSIM network file (*.INP) always refers to the recently saved configuration file which is automatically opened by default if both, the *.INP file and the *.SZP file are stored in the same folder.

Read layout

To use an existing configuration file, press \( \\cdot \\) and select an existing file. When prompted, choose YES, in order for the configuration file to be read. Caution: The previous configuration will be overwritten with the new layout configuration.

With external signal control programs, the dynamic signal timing plan can also be used to display other information such as the status of stages etc. Please refer to the documentation of the individual control program for details on the display of this additional data.
Results

The signal times are shown in one separate window for each signal control. These windows can be activated during a simulation run.

The colors indicate the current state of the signal control. The current simulation time step is on the right.

If detectors are shown in the signal times table, the following colors indicate the detector occupancy conditions:

► Change from empty (black line) to light blue: A vehicle passes the detector within one time step resulting in an impulse increase and decrease within one simulation second.

► Change from dark blue to light blue: A vehicle leaves the detector and a new vehicle is detected within the same time step resulting in an impulse decrease and increase within the same simulation second.

► Multiple seconds of light blue: multiple events similar to the color change black to light blue.

► Dark blue: A vehicle is detected at the end of the time step. Therefore, a change from empty (black) to dark blue represents an arriving vehicle that does not leave the detector within the same simulation second; a longer dark blue bar represents a vehicle waiting on top of the detector. This corresponds to the ' | ' symbol in the Signal/Detector record.

Measurement of Time Spans: VISSIM provides a ruler to measure the span between two times (e.g. the time between a particular detector call and the start of the corresponding green phase). While in single step mode, click with the left mouse button in the window, keep the button pressed and move the mouse. VISSIM then displays the time span between the current mouse position and position where the left button was pressed.
10.9 Signal Control Detector Record

The signal control detector record is user-definable record of signal status, detector actuations and internal parameters and variables for every signal controller with external control logic. This record can be generated for simulation as well as test runs and provides a platform to contain all important parameter and variable values. The Signal/Detector record can be displayed in a window on the desktop and/or stored in an output data file (*.LDP).

Definition

No additional definition required.

Configuration

To create or edit a configuration of the SC/Detector Record follow the steps outlined below:
1. Select SIGNAL CONTROL - EDIT CONTROLLERS...
2. Select the controller to be edited from the list of all coded SC.
3. In the [LDP CONFIG] tag, data can be edited.

Title per column

In the Layout of columns list, a user-definable Title can be specified for the selected entry, which will be used instead of the preset VISSIM column header in the record file.

☑ Short title: Tick this option to save space within the header (especially for window output). Then for default headers abbreviated column headers are used.
Add column
To add a new column to the current Layout of columns table, a new entry has to be defined as follows:
► Left-click the selected value type in the Type (Category) list.
► Specific data (e.g. SG No.) have to be selected from the neighbouring list, if applicable.
► Add this combination to the current Layout of columns on top of the currently marked entry via
  - clicking the << button or
  - clicking one of the selected Type (Category) entries twice.

Delete column
To remove an entry from the current Layout of columns table:
Select line and
► press DEL or
► right-click (calls the context menu) and press DELETE then, or
► left-click the button.

Save layout
The configuration file (*.KFG) contains the currently specified Layout of columns. When the Signal control window is closed via OK, the layout file is saved automatically (with the specified file name) to the folder, where the currently used VISSIM network file (*.INP) is stored. It can then be reused for other signal controls or different projects.
To create a new configuration file, a new file name has to be entered for configuration file. The VISSIM network file (*.INP) always refers to the recently saved configuration file which is automatically opened by default if both, the *.INP file and the *.KFG file are stored in the same folder.

Read layout
To use an existing configuration file, press and select an existing file. When prompted, choose Yes, in order for the configuration file to be read. Caution: The previous configuration will be overwritten with the new layout configuration.

Recording file
If option SC/Det. record is checked via Evaluation - Files..., the signal/detector protocol file is saved to the specified file.
Results

The SC/Detector Record may be
► viewed in a window during a simulation/test run and/or
► written to an output file (*.LDP)
(see sections 9.1.1 and 9.1.2 respectively).

The data types that can be logged in the SC/Detector record depend on the signal controller used and is documented in its user manual.

The SC/Detector record has a tabular layout with
► a row for each simulation second and
► a column for each traced parameter or variable.

Example (*.LDP file)

SC/Detector record  [02/12/07 16:09:02]

SC 1; Program file: vap214.exe; Import files: 185p498s.vap, 185th-2.pua; Program No. 1; Simulation run

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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</table>

SC 5 SC/Detector Record

<p>| | | | | | | |</p>
<table>
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<tr>
<th></th>
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</tr>
</tbody>
</table>

Example (*.LDP file)
8 |../......I.I.|....
9 |../......I.I.|....
10 |../......I.I.|....
11 |../......I.I.|....
12 |.........I.I.|....
10 Evaluation Types

10.10 Signal Changes

This evaluation provides a chronological list of all signal group (phase) changes of all selected signal controllers.

Definition

No additional definition required.

Configuration

No additional configuration required.

In order to display the desired signal control information select EVALUATION – WINDOWS… and activate the option Signal Changes.

In order to save the signal changes data to an output file (*.LSA) select EVALUATION – FILES… and activate the option Signal Changes.

Results

This is the format of an output file (*.LSA):

► File title
► Simulation comment
► List of all signal groups
► Data section containing one line for each signal change event of each signal group.

Example (*.LSA file)

Signal Changes Protocol

Luxembourg with SC 5,6,7 for VISSIM size B

SCJ 5 SGroup 1 Link 247 Lane 1 At 66.0
SCJ 5 SGroup 2 Link 243 Lane 1 At 18.3
SCJ 5 SGroup 3 Link 241 Lane 2 At 18.4
SCJ 5 SGroup 3 Link 241 Lane 1 At 18.3
SCJ 5 SGroup 4 Link 242 Lane 1 At 46.8
SCJ 5 SGroup 5 Link 231 Lane 1 At 29.2
SCJ 5 SGroup 21 Link 288 Lane 1 At 15.1
SCJ 5 SGroup 21 Link 289 Lane 1 At 1.8
SCJ 5 SGroup 22 Link 294 Lane 1 At 2.2
SCJ 5 SGroup 22 Link 295 Lane 1 At 1.5
SCJ 5 SGroup 23 Link 292 Lane 1 At 2.6
SCJ 5 SGroup 23 Link 293 Lane 1 At 1.8
SCJ 5 SGroup 24 Link 290 Lane 1 At 5.5
SCJ 5 SGroup 24 Link 291 Lane 1 At 1.7
SCJ 5 SGroup 25 Link 289 Lane 1 At 10.7
SCJ 5 SGroup 25 Link 288 Lane 1 At 5.8
SCJ 5 SGroup 51 Link 106 Lane 1 At 84.0
SCJ 5 SGroup 52 Link 110 Lane 1 At 352.1

...
<table>
<thead>
<tr>
<th>Time (s)</th>
<th>Distance (m)</th>
<th>Queue</th>
<th>Signal</th>
<th>Duration (s)</th>
<th>Color</th>
<th>VAP</th>
<th>Phase</th>
</tr>
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<tbody>
<tr>
<td>34.0</td>
<td>34.0</td>
<td>5</td>
<td>amber</td>
<td>3</td>
<td>33.0</td>
<td>VAP</td>
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<td>0</td>
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<tr>
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<td>35.0</td>
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<td>red</td>
<td>6</td>
<td>3.0</td>
<td>VAP</td>
<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>36.0</td>
<td>36.0</td>
<td>5</td>
<td>red/amber</td>
<td>52</td>
<td>36.0</td>
<td>VAP</td>
<td>0</td>
</tr>
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<td>36.0</td>
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<td>51</td>
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<tr>
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<td>52</td>
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<td>VAP</td>
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</tr>
<tr>
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<td>37.0</td>
<td>5</td>
<td>green</td>
<td>51</td>
<td>1.0</td>
<td>VAP</td>
<td>0</td>
</tr>
<tr>
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<td>37.0</td>
<td>5</td>
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<td>0</td>
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<td>37.0</td>
<td>5</td>
<td>red</td>
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<td>3.0</td>
<td>VAP</td>
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</tr>
<tr>
<td>37.0</td>
<td>37.0</td>
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<td>1</td>
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<tr>
<td>37.0</td>
<td>37.0</td>
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<td>39.0</td>
<td>6</td>
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<td>VAP</td>
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<tr>
<td>39.0</td>
<td>39.0</td>
<td>6</td>
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<td>23</td>
<td>39.0</td>
<td>VAP</td>
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<tr>
<td>40.0</td>
<td>40.0</td>
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<td>1</td>
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<td>5.0</td>
<td>VAP</td>
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</tr>
<tr>
<td>44.0</td>
<td>44.0</td>
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<td>red</td>
<td>23</td>
<td>5.0</td>
<td>VAP</td>
<td>0</td>
</tr>
<tr>
<td>44.0</td>
<td>44.0</td>
<td>6</td>
<td>amber</td>
<td>4</td>
<td>7.0</td>
<td>VAP</td>
<td>0</td>
</tr>
<tr>
<td>46.0</td>
<td>46.0</td>
<td>6</td>
<td>amber</td>
<td>1</td>
<td>29.0</td>
<td>VAP</td>
<td>0</td>
</tr>
<tr>
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<td>47.0</td>
<td>5</td>
<td>amber</td>
<td>52</td>
<td>10.0</td>
<td>VAP</td>
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</tr>
<tr>
<td>47.0</td>
<td>47.0</td>
<td>5</td>
<td>amber</td>
<td>51</td>
<td>10.0</td>
<td>VAP</td>
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<td>red</td>
<td>23</td>
<td>8.0</td>
<td>VAP</td>
<td>0</td>
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<tr>
<td>47.0</td>
<td>47.0</td>
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<td>2</td>
<td>39.0</td>
<td>VAP</td>
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<tr>
<td>47.0</td>
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<td>red</td>
<td>4</td>
<td>3.0</td>
<td>VAP</td>
<td>0</td>
</tr>
</tbody>
</table>

...
10.11 Link Evaluation

The link evaluation feature allows the user to gather simulation results based on an area of an active link rather than based on individual vehicles. Data is collected about vehicles that pass over that lane segment for a user-defined time interval. The segment length can be specified separately for each active link or connector or in Multiselect mode for all active links/connectors.

The Link Evaluation window also allows for VISUM Export of VISSIM network data, cf. section 6.2.2.

Definition

For all links and connectors to be included in the link evaluation,
► the property Link Evaluation needs to be active and
► the segment length defined (see sections 6.3.1 and 6.3.2 for details).

In order to set these properties for multiple links/connectors at the same time the multi-select mode can be used (see section 3.3.2 for details).

Configuration

In order to get the desired output data additional information is needed. This is to be provided within the Link Evaluation Configuration window that is accessible by pressing the CONFIGURATION button in EVALUATIONS – FILES… once the option Link Evaluations is ticked. The window allows for definition of any combination of parameters.

If Database output is not active each layout line results in a column within the output file *.STR.

The configuration settings will be saved to an external file (*.SAK).
The selected parameters (and vehicle classes) are displayed within the list box to the left (*Layout of columns*).

Additional parameters can be inserted and removed by using the buttons << and >> - considering the choice of *Vehicle Class* for certain parameters. For a list of all parameters available see below.

A time period for the evaluation and the aggregation interval needs to be defined.

- **Per Lane**: If active, data will be evaluated individually for every lane of multi-lane links. Otherwise the data will be aggregated for all lanes.
- **Database**: If active, evaluation output is directed to a database to the specified *Table Name* (rather than to an ASCII text file). The table name must not be used for any other VISSIM database evaluations. In order to use the database output the database connection needs to be configured (see section 9.1.3).

### Results

A link evaluation file (*.STR) contains:

- File title
- Simulation comment
- List of selected parameters with brief description
- Data block with a column for each selected parameter: See list below.

The list below contains the set of parameters available, including the column headers that will be used in the link evaluation output file.

Some parameters will only report correct results if the corresponding optional module (such as Dynamic Assignment, Emission etc.) is installed.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Column Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>Vehicle density [veh/km]</td>
<td>Density</td>
</tr>
<tr>
<td>Emissions (Evaporation) HC</td>
<td>Emissions (Evaporation) Hydrocarbon in the current interval</td>
<td>HC_evap</td>
</tr>
<tr>
<td>Emissions Benzene</td>
<td>Emissions Benzene during current interval</td>
<td>Bnzn</td>
</tr>
<tr>
<td>Emissions CO</td>
<td>Emissions CO during current interval</td>
<td>CO</td>
</tr>
<tr>
<td>Emissions CO2</td>
<td>Emissions Carbondioxid during current interval</td>
<td>CO2</td>
</tr>
<tr>
<td>Emissions HC</td>
<td>Emissions HC during current interval</td>
<td>HC</td>
</tr>
<tr>
<td>Emissions NMHC</td>
<td>Emissions HC without Methane during current interval</td>
<td>NMHC</td>
</tr>
<tr>
<td>Emissions NMOG</td>
<td>Emissions Nonmethan Organic Gasses during current interval</td>
<td>NMOG</td>
</tr>
<tr>
<td>Emissions NOx</td>
<td>Emissions NOx during current interval</td>
<td>Nox</td>
</tr>
<tr>
<td>Emissions Particulates</td>
<td>Emissions Particulates during current interval</td>
<td>Part</td>
</tr>
<tr>
<td>Emissions SO2</td>
<td>Emissions Sulfurdioxide during current interval</td>
<td>SO2</td>
</tr>
<tr>
<td>Emissions Soot</td>
<td>Emissions Soot during current interval</td>
<td>Soot</td>
</tr>
<tr>
<td>Fuel consumption</td>
<td>Fuel consumption during current interval</td>
<td>Gas</td>
</tr>
<tr>
<td>Lane number</td>
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<td>Lane</td>
</tr>
<tr>
<td>Link number</td>
<td>Link number</td>
<td>Link</td>
</tr>
<tr>
<td>Lost time</td>
<td>Delay portion of a vehicle’s total travel time on the segment</td>
<td>LostT</td>
</tr>
<tr>
<td>Segment start coordinate</td>
<td>Segment start link coordinate [m]</td>
<td>SegStC</td>
</tr>
<tr>
<td>Segment end coordinate</td>
<td>Segment end link coordinate [m]</td>
<td>SegEndC</td>
</tr>
<tr>
<td>Segment end x</td>
<td>Segment end (cartesian coordinate x)</td>
<td>SegEndX</td>
</tr>
<tr>
<td>Segment end y</td>
<td>Segment end (cartesian coordinate y)</td>
<td>SegEndY</td>
</tr>
<tr>
<td>Parameter</td>
<td>Definition</td>
<td>Column Header</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Segment start x</td>
<td>Segment start (cartesian coordinate x)</td>
<td>SegStX</td>
</tr>
<tr>
<td>Segment start y</td>
<td>Segment start (cartesian coordinate y)</td>
<td>SegStY</td>
</tr>
<tr>
<td>Segment length</td>
<td>Segment length [m]/[ft]</td>
<td>SegLen</td>
</tr>
<tr>
<td>Simulation time</td>
<td>Simulation time [sec]</td>
<td>T</td>
</tr>
<tr>
<td>Speed</td>
<td>Average speed [km/h]</td>
<td>V</td>
</tr>
<tr>
<td>Volume</td>
<td>Volume [veh/h]</td>
<td>Volume</td>
</tr>
</tbody>
</table>

**Example (*.STR file)**

Evaluation table

Luxembourg with SC 5,6,7 for VISSIM size B

Vehicle Class: 0 = All Vehicle Types  
Vehicle Class: 1 = Car  
Vehicle Class: 2 = HGV  
Vehicle Class: 3 = Bus  
Vehicle Class: 4 = Tram  
Vehicle Class: 5 = Pedestrian  
Vehicle Class: 6 = Bike

Lane: Lane number  
Link: Link number  
Density: Vehicle density [veh/km] (Vehicle Class 0)

Lane; Link; Density(0);  
1; 10413; 3.40;  
1; 10413; 1.02;  
1; 10412; 0.64;  
1; 10412; 0.63;  
1; 10287; 8.44;  
1; 10286; 0.00;  
1; 10285; 16.37;  
1; 10284; 8.70;  
2; 10284; 8.09;  
1; 10283; 30.02;  
1; 10283; 29.84;  
1; 10283; 19.13;  
1; 10283; 17.95;
10.12 Node Evaluation

Node Evaluation is a way of collecting data for a user defined area within a VISSIM network. The evaluations are automatically collected using the node boundaries as the evaluation segment definitions. The Node Evaluation is designed especially for gathering intersection specific data without the need to manually define all the data collection cross-sections.

**Definition**

For each junction to be evaluated, a node polygon needs to be drawn. See the chapter 0 for more information on defining nodes.

**Configuration**

The *Node Evaluation – Configuration* window defines which data is to be evaluated by a node evaluation.

It contains the following lists:

- **Selected Parameters** (use buttons << and >> to add/remove a selected parameter)
- available parameters (*Parameter Selection*) and
- **Vehicle Class** (enabled only for some parameters).

Use the buttons Up and Down to arrange the entries (columns in data file). The selected parameters will be saved to a node evaluation configuration file (*.KNK).*
Node Evaluation

Filter

The evaluation can be switched on/off

► separately for each node within the node attributes or

► using the list of Active Nodes in the Node Evaluation – Filter window.

Furthermore, the

► upstream Start position for delay measurements is to be defined along with the

► time period (From - Until) and the

► time Interval of the evaluation.

Results

The results from a Node Evaluation are grouped by turning movements and saved to a file with the extension *.KNA. Each turning relation is named using the approximate compass directions (N / NE / E / SE / S / SW / W / NW) of its first and last link (at the node boundary) with “North” direction facing to the top of the VISSIM network. Example: "NE-S" is a movement entering from the North-East and leaving to the South.

The two link numbers can be written to the evaluation file as well to avoid ambiguity (two "parallel" turning relations with identical first and last links do look identical). All results are aggregated over a user defined time period for time intervals with a user defined length.

The node evaluation file *.KNA contains

► File title

► Simulation comment

► List of selected parameters with brief description

► Data block with a column for each selected parameter. The data section contains for every time interval

- one row per turning relation of each active node and

- an additional row for the node total (turning relation "All").

- here is one additional line per time interval with node number 0 containing the system total.

The volume, average delay and standing time values as well as the number of stops are determined by a delay segment created automatically as a combination of new travel time measurements from all possible upstream starting points (distance user defined, but not extending across an upstream
node boundary) to the node exit point of the respective turning relation. Also available is the number of passengers and person delay by vehicle class.

The queue length values are collected by a queue counter created automatically and placed at the first signal head or priority rule stop line on the link sequence of the turning relation. If there is no such cross section, the queue counter is placed at the node entry point. The node evaluation places a queue counter on every edge (movement) found inside the node. It is placed at the position of the signal head or priority rule stop line that is the closest one upstream to the node boundary on the respective edge.

Scheduled stops at transit stops are not counted as stops. Passenger transfer times and dwell times at STOP signs are not counted as delays (though time losses due to deceleration/acceleration before/behind public transit stops do count for delay calculation).

If there is more than one edge with the same from link and to link then only one queue length is recorded.

The automatically created network elements (travel time sections, delay segments, queue counters) are not available for user modifications because they exist only during the simulation run. The time periods and interval lengths for delay segments and queue counters are set to the values defined for the node evaluation (overwriting all others) as soon as the user leaves the Evaluation Files... window with the node evaluation activated (a warning message appears if the respective evaluation was also activated).

Example (*.KNA file)

Evaluation table

Luxembourg, SC 3-10

Node: Node Number
Movement: Movement (Bearing from-to)
Veh(All): Number of Vehicles, All Vehicle Types
Delay(All): Average delay per vehicle [s], All Vehicle Types
maxQueue: Maximum Queue Length [m]

Node;Movement;Veh(All);Delay(All);maxQueue;
1; W-N; 5; 15.9; 62.0;
1; N-W; 3; 8.7; 59.2;
1; S-N; 5; 56.3; 28.0;
1; S-W; 3; 141.7; 28.0;
1; NO-W; 167; 9.6; 73.5;
1; NO-S; 0; 0.0; 12.6;
1; NO-S; 12; 15.9; 12.6;
1; NO-N; 64; 14.2; 73.2;
1; N-W; 2; 125.0; 33.4;
1; N-S; 11; 61.2; 33.4;
1; All; 272; 16.3; 73.5;
0; All; 272; 16.3; 73.5;
...
10.13 Network Performance Evaluation

Network Performance Evaluation evaluates several parameters that are aggregated for the whole simulation run and the whole network to an *.NPE file.

Definition

No additional definition required.

Configuration

The Network Performance Evaluation – Configuration window defines which data is to be evaluated by a network performance evaluation.

It contains the following lists:

► **Selected Parameters** (use buttons << and >> to add/remove a selected parameter)

► available parameters (**Parameter Selection**) and

► **Vehicle Class** (enabled only for some parameters).

Use the buttons UP and DOWN to arrange the entries (columns in data file). The selected parameters will be saved to a network performance evaluation configuration file (*.NPC).

Filter

Set a filter with regard to time:

• *from - till* simulation second.
Results

A network performance evaluation file (*.NPE) contains:

► File title
► Simulation comment
► Date and time of evaluation
► Analyzed simulation time
► List of selected parameters with brief description
► Data block with a line for each selected parameter.

The evaluation takes into account

► vehicles that have left the network or reached their destination parking lot and also
► vehicles still being in the network at the end of the analysis interval:

Example (*.NPE file)

Evaluation table

Luxembourg, SC 3-10

Network Performance

Wed Mar 16 14:54:01 2005

Simulation time from 0.0 to 180.0.

*****************************************
Number of vehicles in the network, all vehicle types            :        131
Number of vehicles in the network, Vehicle Class Bus            :          3
Number of vehicles that have left the network, all vehicle types:        193
Total Path Distance, all vehicle types                          :        130.954 km
Total travel time, all vehicle types                            :          5.112 h
Average speed, all vehicle types                                :         25.616 km/h
Total delay time, all vehicle types                             :          2.292 h
*****************************************

---

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10.14 Observer

The observer evaluation creates a binary file (*.BEO) to contain all vehicle information for every vehicle and every time step. Thus this evaluation creates extremely large files within a short simulation period. This evaluation remains in VISSIM only for historic reasons. We recommend to use the Vehicle record evaluation instead as it is much more flexible.
10 Evaluation Types

10.15 Lane Changes

This evaluation provides data according to when and where lane changes of vehicles happened.

**Definition**

No additional definition required.

**Configuration**

In order to get the desired output data additional information is needed. This is to be provided within the *Vehicle Record Filter* window which is accessible by pressing the *FILTER* button in *EVALUATIONS – FILES*... once the option *Lane Change* is ticked. For further information on the filter definition see section 10.7.

**Results**

For every vehicle captured by the filter definitions, every lane change event will be logged into a lane change file (*.SPW). The data that will be logged includes:

- Simulation second
- Vehicle number
- Speed [m/s]

and for both the old and new preceding vehicle:

- Vehicle number (0 if not existing)
- Speed [m/s]
- Speed Difference [m/s]
- Distance [m]
10.16 Bus/Tram Waiting Time

This evaluation provides a log file (*.OVW) of all events when a public transport vehicle stopped (excluding passenger interchange stops and stops at stop signs).

Definition

No additional definition required.

Configuration

No additional definition required.

Results

This is the file format of an output file (*.OVW):

► File title
► Simulation comment
► Data block:
  - one column for each parameter, and
  - one data line for each event when a public transport vehicle stopped for any other reason than a passenger interchange.

Example (*.OVW file)

Table of bus/tram waiting times

Luxembourg with SC 5,6,7 for VISSIM size B

<table>
<thead>
<tr>
<th>Time</th>
<th>VehNo</th>
<th>Line</th>
<th>Link</th>
<th>At</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>122</td>
<td>1</td>
<td>218</td>
<td>106</td>
<td>81.72</td>
<td>25</td>
</tr>
<tr>
<td>160</td>
<td>54</td>
<td>206</td>
<td>106</td>
<td>81.67</td>
<td>5</td>
</tr>
<tr>
<td>227</td>
<td>55</td>
<td>1114</td>
<td>247</td>
<td>57.95</td>
<td>117</td>
</tr>
</tbody>
</table>
10.17 Vehicle Input

This evaluation provides a log file (*.FHZ) of all vehicle input events (i.e. when a vehicle enters the VISSIM network).

**Definition**

No additional definition required.

**Configuration**

No additional definition required.

**Results**

This is the file format of an output file (*.FHZ):

- File title
- Simulation comment
- Data block:
  - one column per parameter,
  - one data line for each event when a vehicle entered the VISSIM network.

**Example (*.FHZ file)**

Table of vehicles entered

<table>
<thead>
<tr>
<th>Time</th>
<th>Link</th>
<th>Lane</th>
<th>VehNo</th>
<th>TypeNo</th>
<th>Line</th>
<th>DesSpeed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>2008</td>
<td>1</td>
<td>1</td>
<td>41</td>
<td>218</td>
<td>48.9</td>
</tr>
<tr>
<td>0.2</td>
<td>1001</td>
<td>1</td>
<td>2</td>
<td>41</td>
<td>101</td>
<td>48.9</td>
</tr>
<tr>
<td>1.2</td>
<td>279</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>46.1</td>
</tr>
<tr>
<td>2.6</td>
<td>273</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>45.3</td>
</tr>
<tr>
<td>3.6</td>
<td>279</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>48.1</td>
</tr>
<tr>
<td>7.1</td>
<td>274</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>50.7</td>
</tr>
<tr>
<td>9.2</td>
<td>275</td>
<td>1</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>48.0</td>
</tr>
<tr>
<td>9.7</td>
<td>279</td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>0</td>
<td>52.8</td>
</tr>
<tr>
<td>10.0</td>
<td>272</td>
<td>1</td>
<td>10</td>
<td>1</td>
<td>0</td>
<td>52.6</td>
</tr>
<tr>
<td>10.4</td>
<td>365</td>
<td>1</td>
<td>11</td>
<td>1</td>
<td>0</td>
<td>54.6</td>
</tr>
</tbody>
</table>
10.18 Emission Statistics

The emissions statistics are based on a simple emission estimation according to U.S. guidelines (this is not the optional VISSIM Emissions module). As a result global emission values for the whole VISSIM network will be evaluated.

The results of the emission statistics do not relate to any of the emission parameters that are based on the optional emissions module (e.g. parameters of Vehicle Record or Link Evaluations).

In order to get an emissions statistics output file (*.EMI) there must be an entry in the input file and a data file must be created. The data file must contain emissions data for the vehicles running in the simulation. The file EMISS.DAT is an example of the data file needed to get emissions statistics. Shown below is the addition that must be made to the input file in order to get an emissions statistics output file.

Auswertung Typ Emissionen Datei "emiss.dat" dt 900.0
  Zeit von 0.0 bis 3600.0

The name in quotes ("emiss.dat") is the file name of the data file that will be referenced by VISSIM.

The number following dt is the cycle time for the data collection.

The last two numbers are the total time the data will be collected during the simulation.

In order to get an *.EMI file, the option SPECIAL EVALUATIONS in EVALUATIONS – FILES… must be checked.

The data required for the vehicle data file can be obtained through the freeware program Mobile 5A. However, in order to make it usable for VISSIM it needs to be parsed beforehand.
10.19 Export

The menu item Evaluation - Files accesses the Export Configuration window. It allows to enable the output of dedicated output files for external visualization packages.

The GAIA file format is an export from VISSIM to be displayed in another visualization tool.
Special Evaluations (Discharge rate evaluation)

10.20 Special Evaluations (Discharge rate evaluation)

The option Special Evaluations contained in the Offline Analysis (File) window (EVALUATION – FILES…) enables any evaluations that have to be entered within the input file directly. In this section the evaluation of the discharge rate (which is the reciprocal of the saturation flow) is explained.

For definitions of other special evaluations please refer to the external document SYNTAX.DOC.

A discharge in most cases will be measured at a stop line of a signal control. In order to get reasonable values for the discharge rate the flows that are measured need to be saturated (i.e. at least as many vehicles queuing as can pass at green time).

Definition

For every discharge rate evaluation, a signal head and a data collection point at the position of the signal head needs to be defined.

The discharge rate evaluation is then defined directly in the *.INP file (using a text editor) like this:

```
EVALUATION TYPE DISCHARGE SCJ 1 SIGNAL_GROUP 2 COLLECTION_POINT 1
     TIME FROM 0.0 UNTIL 99999.0
```

In this example, the evaluation refers to the green times of signal group 2 of SC 1, and the times are measured at data collection point 1 which needs to be located at the corresponding stop line. The time interval is usually set to a value at least as large as the simulation period.

Configuration

No additional configuration required.

Results

The result for each discharge rate evaluation will be written to a separate file (with ascending extensions starting with *.A00 then *.A01, *.A02, etc.) using the following format:

- Each line refers to one green time (one cycle).
- The 1st first column contains the simulation time of the start of the green time.
- The 2nd column is the elapsed time between the start of the green time and the arrival of the first vehicle at the data collection point.
- The 3rd column is the time gap between both the front ends of vehicle #1 (vehicle at 1st position in the queue) and vehicle #2. Thus it is the time vehicle #2 needs to clear its queue position which is the Discharge Rate of vehicle #2.
► The following columns contain all subsequent Discharge Rates according to the vehicle positions.

► Numbers in parenthesis show the number of vehicles passed during that green time and their average Discharge Rate (both not including the Discharge Rate of vehicle #1 because that time depends on the location of the data collection point).

► Values after parenthesis are the Discharge Rates of vehicles crossing the stop line after the green time (during amber or even red).

► The 4th line from the bottom contains the index of the vehicle’s position in the queue for each signal cycle.

► The 3rd line from the bottom contains the average Discharge Rates for the corresponding vehicle position.

► The 2nd line from the bottom contains the number of all vehicles measured for that position (higher indices might have smaller numbers if the flow is not saturated at all times).

► The bottom line shows the total number of vehicles and total Discharge Rate for the whole evaluation period.

Example (*.A00 file)

Evaluation table

```
Discharge at SCJ 1, signal group 2 (measurement 1)

31  0.85  2.58  1.61  1.61  1.59  ...  1.48 (16: 1.77)  1.57  1.54
91  0.97  2.42  2.21  1.92  1.71  ...  1.31 (16: 1.73)  2.01  1.64
...
1651 1.02  2.33  1.86  1.87  1.71  ... 
----- 1    2    3    4    5  ...  17   18   19   20   21
----- 0.95  2.43  2.02  1.85  1.73  ...  1.64  1.80  1.65  1.87  1.04
----- 28   28   28   28   28  ...  27   25   16    6    2
[496: 1.74]
```
10.21 Paths

The Paths Evaluation file (*.WGA) can be used with the Dynamic Assignment module only. It is intended to produce results for a Dynamic Assignment procedure in a user-definable format.

Definition

No additional definition required.

Configuration

For configuration, call the Path Evaluation Configuration window can be accessed, if option Paths (Dynamic Ass.) is ticked in the Offline Analysis (File) window (EVALUATION – FILES...).

Path evaluation can be output

► to file (*.WGA) or
► to a Database table, see Table name, if option Database is checked.

Selected parameters are displayed within the list box to the left.

The current selection can be edited by pressing the << and >> buttons.

The configuration will be saved to an external file (*.WGK).

- Database: If active, evaluation output is directed to a database to the specified Table Name (rather than to an ASCII text file). The table name must not be used for any other VISSIM database evaluations. In order to use the database output the database connection needs to be configured (see section 9.1.3).

Filter

Additionally, the filter information needs to be configured. This is done in the Path Evaluation - Filter window which is accessed by selecting Paths (Dynamic Ass.) in the Offline Analysis (File) window (EVALUATION – FILES...).
The filter allows for evaluation
► of selected paths only and
► for a user defined time interval (from ... until).

It can be used either with Parking Lots or Zones.

Whenever one of the two options is selected the settings of the non-selected option are irrelevant.

Path evaluation is done only for the selected relations.

The filter configuration is saved to a file with extension *.WGF.

**Example (*.WGA file)**

As the output format is user-definable, there are no default results. One possible output format is shown below:

**Evaluation table**

| TimeFrom; TimeTo; OrigZ; DestZ; PathNo; Dist;TravTimeDiff; TotCost(1); Volume(1) |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| 0.0; 600.0; 1; 2; 1; 339.24; -0.65; 22.00; 79; |
| 600.0; 1200.0; 1; 2; 1; 339.24; 0.27; 21.58; 85; |
| 1200.0; 1800.0; 1; 2; 1; 339.24; 0.52; 21.53; 97; |
| 1800.0; 2400.0; 1; 2; 1; 339.24; 0.19; 21.44; 75; |
| 2400.0; 3000.0; 1; 2; 1; 339.24; -0.06; 21.68; 88; |
| 3000.0; 3600.0; 1; 2; 1; 339.24; 0.40; 21.51; 76; |
10.22 Convergence Evaluation

The Convergence Evaluation file (*.CVA) can be used with the Dynamic Assignment module only. It contains for every time interval the distribution of change in volume and travel times of all edges and paths. Therefore volume changes are divided into 9 volume classes and travel time changes into 12 travel time classes. For every class the number of paths/edges are shown that have changed in terms of volume and travel time. This data can be used to determine whether or not the Dynamic Assignment process has converged. For more information please refer to “Dynamic Assignment” in chapter 11.

If a sequence of simulation runs is executed in batch mode (command line parameter -s<n>) the simulation run number (1..n) will be included in the *.CVA file name.

Definition

No additional definition required.

Configuration

This is to be provided within the Convergence Configuration window which is accessed by pressing the Configuration button in Evaluations – Files… once the option Convergence is active.

Here the minimum edge length (in meters) for edges to be considered for the calculation of travel time differences can be defined.

Shorter edges won't be included in the convergence evaluation and convergence detection

Results

The results from the Convergence Evaluation are displayed in a text table that compares the volumes and travel times on all of the edges and paths (longer than defined in the configuration) for each iteration.

The table is divided into two blocks:

► Volume difference
► Travel time difference

Each data line of these evaluation blocks refers to one time interval (e.g. 300.0; 600.0; means: from simulation second 300 to 600) and shows for each column the number of edges resp. paths that are contained in the corresponding class. The class boundaries are found in the header of each block (Class from, Class to), inclusive of the value of (Class to).
E.g. (Class from) 2 to 5 for volume difference on edges means: All edges that changed volume by more than 2 up to 5% are contained here (in the example below the value is 7 for time interval 0 to 300).

**Example (*.CVA file)**

This is a sample output file of a convergence evaluation (*.CVA):

```plaintext
TimeFrom; TimeTo; Volume Difference;
(Class from)          0;   2;   5;  10;  25;  50; 100; 250; 500;
(Class to)             2;   5;  10;  25;  50; 100; 250; 500;   ~;
Edges:
   0.0;   300.0;  12;   7;   4;   0;   0;   0;   0;   0;   0;   0;   0;
   300.0;   600.0;  0;   0;   7;  14;   2;   0;   0;   0;   0;   0;
Paths:
   0.0;   300.0;  12;   0;   0;   0;   0;   0;   0;   0;   0;   0;
   300.0;   600.0;  7;   2;   1;   2;   0;   0;   0;   0;   0;

TimeFrom; TimeTo; Travel Time Difference
(Class from)          0%; 10%; 20%; 30%; 40%; 50%; 60%; 70%; 80%; 90%;100%;200%;
(Class to)            10%; 20%; 30%; 40%; 50%; 60%; 70%; 80%; 90%;100%;200%;   ~;
Edges:
   0.0;   300.0;  20;   2;   1;   0;   0;   0;   0;   0;   0;   0;   0;
   300.0;   600.0;  21;   2;   0;   0;   0;   0;   0;   0;   0;   0;   0;
Paths:
   0.0;   300.0;  12;   0;   0;   0;   0;   0;   0;   0;   0;   0;
   300.0;   600.0;  12;   0;   0;   0;   0;   0;   0;   0;   0;   0;
```
Without the Dynamic Assignment, routes for the simulated vehicles are supplied manually using the network editor. The optional Dynamic Assignment module however is designed to model the route choice behavior of drivers, thus allowing to model networks without static routes and instead using the specification of origin-destination matrices as flow input. In VISSIM the assignment is done dynamically over time by an iterated application of the microscopic traffic flow simulation.

The following terminology is used when referred to Dynamic Assignment in this Chapter:

- **path** and **route** are used as synonyms.
- **cost** in its exact meaning denotes financial cost, i.e. the component of the general cost that is not travel time and not distance. But cost is often used instead of general cost if the context allows for it.
- **general cost** is the weighted sum of travel time, distance and cost. The general cost is what is used in the route choice model as the utility of the routes to choose from.
- **travel time** of a route or an edge is the average time the vehicles need to travel from the beginning to the end of the route resp. edge in the current simulation.
- **smoothed travel time** is computed by exponential smoothing of the travel times measured in the course of iterations. The smoothed travel time is the one that is used in the general cost function.
- **expected travel time** is used if we want to express the difference between the travel time that is used in the route choice model at trip begin (that is the expected travel time) and the travel time that actually can be measured after the trip is completed.
11 Dynamic Assignment

11.1 Introduction

In the preceding chapters, the simulated vehicles followed routes through the network that were manually defined by the user, i.e. the drivers in the simulation had no choice which way to go from their origin to their destination. For a lot of applications that is a feasible way of modeling road traffic.

However, if the road network to be simulated becomes larger it will normally provide several options to go from one point in the network to another and the vehicles must be distributed among these alternative routes. This problem of computing the distribution of the traffic in the road network for a given demand of trips from origins to destinations is called traffic assignment and is one of the basic steps in the transport planning process.

Traffic assignment is essentially a model of the route choice of the drivers or transport users in general. For such a model it is necessary first to find a set of possible routes to choose from, then to assess the alternatives in some way and finally to describe how drivers decide based on that assessment. The modeling of this decision is a special case of what is called discreet choice modeling, and a lot of theory behind traffic assignment models originates from the discrete choice theory.

The standard procedure in transportation planning is the so called Static Assignment. Static here means that the travel demand (how many vehicles want to make trips in the network) as well as the road network itself is constant in time. However, in reality travel demand changes significantly during the day, and even the road network may have time dependent characteristics, e.g. signal control may vary during the day. To consider these time dependencies, Dynamic Assignment procedures are required.

The motivation to include route choice in a simulation model like VISSIM is twofold:

► With growing network size it becomes more and more impossible to supply the routes from all origins to all destinations manually, even if no alternatives are considered.
► On the other hand the simulation of the actual route choice behavior is of interest because the impact of control measures or changes in the road network on route choice are to be assessed.

The small example DETOUR.INP which can be used as an introduction to Dynamic Assignment is enclosed with the VISSIM installation and located in the directory <VISSIM_Dir>\Example\Training\DynamicAssignment\Detour\.
11.2 Principle

The Dynamic Assignment procedure in VISSIM is based on the idea of iterated simulation. That means a modeled network is simulated not only once but repetitively and the drivers choose their routes through the network based on the travel cost they have experienced during the preceding simulations. To model that kind of “learning process”, several tasks are to be addressed:

► Routes from origins to destinations must be found. VISSIM assumes that not everybody uses the best route but that less attractive routes are used as well, although by a minor part of the drivers. That means not only the best routes must be known for each origin-destination relation but a set of routes. Ideally we would have the set of the $k$ best routes but there are no efficient methods to compute this set of routes directly - at least not in a way that makes sense for traffic assignment. The solution adopted in VISSIM is to compute best paths in each repetition of the simulation and thus to find more than one route because traffic conditions change during the iteration. During the iterated simulations VISSIM builds a growing archive of routes from which the drivers choose. See section 11.6 for a detailed description of how routes are computed.

► The routes must have some kind of assessment on which the drivers base their choice. In VISSIM for all routes the so called generalized costs are computed, i.e. a combination of distance, travel time and “other” costs (e.g. tolls). Distance and costs are defined directly in the network model but travel time is a result of the simulation. Therefore VISSIM measures travel times on all edges in the network during one simulation so that the route choice decision model in the next simulation can use these values.

► The choice of one route out of a set of possible routes is a special case of the more general problem called “discrete choice modeling”. Given a set of routes and their generalized costs, the percentages of the drivers that choose each route is computed. By far the most frequently used mathematical function to model that kind of choice among alternatives is the Logit-model. VISSIM uses a variant of the Logit model to handle route choice. See section 11.6.2 for a detailed description.

The VISSIM road network model is very detailed in order to allow an exact reproduction of the traffic flow in a high resolution in time and space. All of the three tasks above do not require such a detailed model of the network, e.g. the choice which route to take from one side of the city to the other does not consider how the intersections actually look like or on which lane the vehicles travel.

Assignment related problems always refer to a more abstract idea of the road network where the intersections are the nodes and the roads between the intersections are the edges of an abstract graph. The assignment procedures can operate much more efficiently on this type of graph and this level of abstraction is more appropriate even for the human understanding of the problem.
Example: If we describe to our neighbor the way from its home to a restaurant, we tell him a series of intersections, and whether he must turn left or right there, but no more details.

In VISSIM an abstract network representation is built for Dynamic Assignment and the user defines the parts of the network model that are to be considered as nodes. Normally the user will define as nodes what corresponds to the real-world intersections. The process of building the abstract network and working with it is described in section 11.3.

The iteration of the simulation runs is continued until a stable situation is reached. Stable here means that the volumes and travel times on the edges of the network do not change significantly from one iteration to the next. In VISSIM this situation is called convergence and the criteria for convergence can be defined by the user.

The following flow chart illustrates the principle of the Dynamic Assignment as explained above.
Principle of Dynamic Assignment

**Input**
- Load trip matrix for all OD
- Build node-edge-graph
- Convergence criterion
- Max number of iterations N

\[ n = 0 \]
For all edges: set expected travel time = distance

\[ n = n + 1 \]

**Route Search**
For all OD: Search route with minimum cost
Add new route to the set of routes

**Route Choice**
For all OD: Split demand onto all routes

**Simulation & Travel Times**
For all OD and all vehicles (simultaneously):
Perform microscopic simulation
For all edges: Calculate travel time and cost

**Query**
\[ n \geq N \quad \text{OR} \quad \text{Convergence criterion fulfilled} \]

\[ \text{YES} \]
End of assignment

\[ \text{NO} \]
11.3 Building an Abstract Network

11.3.1 Parking Lots and Zones

When using Dynamic Assignment travel demand is not specified by using vehicle inputs on selected links with a given volume but in the form of an origin-destination matrix. To define travel demand using a origin-destination matrix, the area to be simulated is divided in sub-areas called zones and the matrix contains the number of trips that are made from all zones to all zones for a given time interval. Thus the dimension of the matrix is: (number of zones) x (number of zones).

To model the points where the vehicles actually appear or leave the road network, a network element „parking lot“ is used. A parking lot belongs to a certain planning zone, i.e. trips originating from this zone or ending in this zone can start or end at this parking lot. A zone can have more than one parking lot. In that case the coming or going traffic can use any of the parking lots belonging to a certain zone. The total originating traffic of a zone is distributed to its parking lots according to user defined relative flows. One parking lot can belong to one zone only.

The distribution of destination traffic to the parking lots is computed by a choice model explained in section 11.7.2.

Traffic starting at a parking lot is similar to traffic generated by vehicle inputs, but the composition of the traffic is not explicitly specified for the parking lot. Instead the traffic composition is defined with the OD-Matrix that generates the vehicles entering at the parking lot. However, the desired speed for the vehicles leaving the parking lot is not taken from the distribution defined in the traffic composition with the matrix, but it is taken from desired speed distributions defined locally at the parking lot. It is possible to define desired speed distributions for different vehicle classes at the parking lot, and there is always a default distribution that covers all vehicles that are not included in one of these classes. The reason for the local definition of desired speeds at the parking lot in contrast to define it globally for the matrix is to provide a way to model the correct speed limit on each road where traffic is originating from.

Three types of parking lots are offered. Two of them can be used for Dynamic assignment, resulting in different driving behavior of the vehicles entering the parking lot:

► Zone Connector: On approach of a parking lot vehicles slow down until they come to a stop in the middle of the parking lot. Then the vehicle is removed from the network (parked) and the next one can enter the parking lot. This type of parking lot should be used if the road network model is detailed enough to represent actual parking lots. The implicit entry capacity can cope with up to 700 vehicles per hour and per lane due to detailed modeling of the stopping process.
Abstract Parking Lot: Entering vehicles do not slow down and are just removed from the network (parked) as they reach the middle of the parking lot. Thus the entry capacity is not restricted. This type should be used to model origin and destination points where traffic enters or exits the network without using real parking. Typically this is the situation at the borders of the modeled network.

Definition

To define a parking lot follow the steps outlined below:

1. Select mode "Parking lots".
2. Select a link.
3. Mark the parking lot by dragging the mouse within the selected link while holding down the right mouse button.

The Create Parking Lot window opens for data input. Set the properties and confirm with Ok.

Properties & Options

For editing, this window can be accessed with a left button double-click on an existing parking lot on a selected link. This section deals only with the attributes relevant to Dynamic assignment. For any other attribute or option please refer to section 6.4.5.

- Zone: Allocated zone no. from OD matrix. To a zone, several parking lots can be allocated.
- Capacity (only for Abstract parking lots): see above.
- Rel. flow: Only relevant, if a zone has multiple parking lots: Percentage of the zone’s total demand, e.g. value 0 = no demand, (e.g. if a parking lot is located on a link having no successor). The the values of several parking lots per zone are summed up and the total is set = 100%, then the appropriate share per parking lot is calculated.
- Speeds: DesiredSpeed distributions allocated to vehicle classes. Default: just a single vDes-distribution for all classes.
Label: When showing labels of all parking lots (see View - Network Elements...) this option allows to individually switch off the label of that one.

When modeling parking lots at the borders of a network, a single node on the border can be used for correctly placing both the origin and the destination parking lot (see illustration).

Parking lots must be placed on an edge between two nodes. They may also be placed within an internal node (a node that is not situated at the border of the network).

No more than one parking lot must be placed between any two nodes or within a node.

A parking lot blocks the road in terms of path search: There are no paths that include a link that leads through a parking lot (i.e. where the parking lot would be ignored).

If a parking lot (for destination traffic only) is placed on an outgoing link of the network, i.e. a link from which no other parking lots can be reached, then the relative flow of the parking lot must be set to zero. Make sure that there is at least one node on both sides of the parking lot.

The cost for each edge where a parking lot is placed on, is determined as the average cost of all vehicles traveling into and out of the parking lot.

Potential traps

If you get an error message similar to "The destination parking lot 10 is part of several different edges", typically at least one node is missing or placed incorrectly. That results in multiple paths being found between the two nodes where the parking lot is placed, and for each path a separate cost is evaluated. On rare occasions, this could result in multiple different link costs for the same stretch of physical road and thus would lead to a wrong distribution of vehicles.

To solve this problem, locate that parking lot in the VISSIM network and ensure, that

► the path diverge/merge points before and after the parking lot (in direction of driving) are both included in a node
► both the nodes, where the parking lot is placed in between, are modeled correctly in terms of including the path diverge/merging point

Right clicking outside the VISSIM network in parking lot mode opens a window with a list of all parking lots in the network. Then the data of the parking lot can be accessed via the Edit button. Pressing the zoom button moves the view position to show the selected parking lot in the network.
11.3.2 **Nodes**

The road network model in VISSIM is very detailed with respect to geometry. For route choice decisions this level of detail is not required since it does not matter to a driver what a certain junction looks like as long as he is allowed to perform the turning movements needed to follow his desired route. In order to reduce the complexity of the network and thus to reduce computing time and storage for paths it is sensible to define some parts of the VISSIM network as nodes, i.e. those parts of a network where paths could diverge. In general these nodes will be equivalent to what is normally described in the real world as a “junction”. Nodes also need to be defined at the ends of the links at the border of the network.

**Definition**

1. Select mode “Nodes”.
2. Start to draw a polygon around the area to be defined as a node by dragging the mouse while holding down the right mouse button. Subsequent points to shape a node can be created by clicking the right mouse button. Double-clicking finishes the polygon.

The *Node* window opens for data input. Set the properties and confirm with OK.

**Properties & Options**

- **No.**: Node number
- **Name**: Optional name or comment
- **Node evaluation**: If option *Node* is checked via **EVALUATION – FILES**, then the node is regarded for evaluation if this option is active. (May also be ticked in the Multiselect mode.)
- **Label**: When showing labels of all nodes (see **VIEW - NETWORK ELEMENTS...**) this option allows to individually switch off the label of that one.

**Move**

Single-select Mode: Left-click anywhere within the node, then keep mouse-button pressed while dragging the node to the desired position.

**Copy**

Hold down **CTRL**, left click within the node and move the mouse to the desired location.
11 Dynamic Assignment

Delete

Single-select Mode:
Select node
► either in the network and click
- DEL or
- EDIT - DELETE.
► or in the selection list;
Then click DELETE.

Multi-select Mode:
► Define network section (active elements)
► then click
- DEL or
- EDIT - DELETE.
► finally
- check option(s) and
- confirm OK
in the “Multiselection Delete” window.

Overlapping nodes are not permitted. If an input file containing overlapping nodes is opened an error message appears and the numbers of the overlapping nodes are listed in the error file.

11.3.3 Edges

From the information given by the user’s definition of nodes, VISSIM builds an abstract network graph as soon as the Dynamic Assignment is started. The graph consists of what we will call “edges” to distinguish them from the “links” the basic VISSIM network is built from.

There are two types of edges:
► edges inside nodes (intra-node edges)
► edges between nodes

The semantics of the graph that is built from the nodes is slightly different to conventional travel model network graphs (e.g. in software products like VISUM or EMME2):
► There can be more than one edge between two nodes
► The intra-node edges represent the turning movements but they have a real length in VISSIM

The edges are the basic building blocks of the routes in route search, i.e. a route is a sequence of edges. For all the edges travel times and costs are computed from the simulation providing the information needed for the route choice model.
The edges automatically constructed by VISSIM can be visualized in the following way:

1. Select **EDIT – EDGE SELECTION...** if the network contains at least 2 nodes and while the ✒ **Node** edit mode is active. The **Edge Selection** window appears.

2. In the window, choose a pair of nodes by selecting the numbers from the **From Node** and **To Node** lists.

3. Then in the list at the top of the window all available edges are listed along with their number, **Vehicle Type** specific cost and the total(!) flow for the selected **Time Interval**.

4. From the top list, choose an edge to show its graphical representation in the VISSIM network (shown as a yellow or red band).

Via
- **Option Edge closed** (for the selected edge)
- **Buttons OPEN/CLOSE ALL EDGES** edge closures can be defined or discarded.

In the list, an edge can be selected for graphical display in the VISSIM network.

Automatically created VISSIM edges are highlighted as follows in the network display:
- **Yellow** = not closed or
- **Red** = closed during Dynamic assignment.

The paths shown in the window result from the last iteration where the path file was updated. The costs shown are taken from the last cost file that was written.

Thus the **Edge Selection** window only then shows the results of the last iteration, if both the cost and path files where written during that iteration.
An edge can be completely banned from being used with Dynamic Assignment by selecting the option *Edge Closed* while the respective edge is selected. The edge is then shown in red.
11.4 Traffic Demand

In Dynamic Assignment traffic demand is typically modeled using origin-destination matrices (OD-matrices). Beyond that it is also possible to define the demand in a trip chain file. It is also possible to mix both options. Furthermore both options can be combined with traffic defined by vehicle inputs and static routes (e.g. for pedestrian flows). However, this kind of traffic is not affected by the Dynamic Assignment.

11.4.1 Origin-Destination Matrices (OD-matrices)

The volume of traffic to be simulated in the network is specified as origin-destination matrices. Such an OD-matrix contains the number of trips for every pair of planning zones for a given time interval. For a simulation using Dynamic Assignment, a number of matrices can be defined, each containing demand information for a certain traffic composition for a certain time interval. Time intervals of different matrices may overlap arbitrarily; the generated traffic for every moment comprises the vehicles from all the matrices that include that moment in their time interval.

OD-matrices are specified in the Dynamic Assignment window that can be accessed by selecting TRAFFIC - DYNAMIC ASSIGNMENT...

By checking the option Matrices, the associated list box becomes active. Use the EDIT, NEW and DELETE buttons to define or edit entries of the list box.

A matrix is linked to a given traffic composition, i.e. the trips of that matrix are performed by vehicles randomly generated from the associated traffic composition. As explained in the section “parking lots” the desired speed distribution for the generated vehicles is not taken from the composition defined with the matrix but is overruled by the desired speed distribution defined with the parking lot where the vehicle starts its trip.

The matrices cannot be edited directly using the VISSIM user interface but are stored in text files and can be edited with standard text editors. The format of the matrices is one of the formats used by the transport-planning tool VISUM so matrices can be exchanged easily between VISSIM and VISUM. However, these files can also be created manually or converted from other transport planning systems.
Matrix file format (*.FMA)

Below follows the description of the format of OD-matrix files (*.FMA).
► All lines starting with an asterisk (*) are treated as a comment and are not mentioned here.
► Time interval (hh.mm) for which the matrix is valid.

Examples:
1.3 reads as 1 hour 3 minutes (and not as 1 hour 30 minutes)
1.30 reads as 1 hour 30 minutes
1.50 reads as 1 hour 50 minutes (and not as 1 hour 30 minutes)

The time information in the matrix is the absolute time of day (not a relative time related to the simulation start as it was in VISSIM prior to version 3.60). Therefore in the VISSIM Simulation Parameters the start time needs to match the start time used in the desired matrix.

► Scaling factor. This factor can be used to scale the matrix globally
► Number of zones
► Zone numbers of all zones that are used in the matrix
► Flow data. The data is interpreted as total number of vehicles per time interval defined in the header (not necessarily no. of vehicles per hour).

The first line contains all trips from the first zone to all other zones in the order given with the definition of the zone numbers. The next line contains all the trips from the second zone to all others and so on.

Example of an OD-matrix

Example reading: From zone 20 to zone 30 190 trips are defined for the period of 1½ hours (from 0:00 to 1:30).

* time interval in hours
  0.00  1.30
* scaling factor
  1.0
* number of zones:
  8
* zones:
  10  20  30  40  50  60  70  80
* number of trips between zones
  0  180  200  170  60  120  150  200
  170   0  190  140  110  160  120  180
  190  250   0  90  130  170  130  100
  200  200  180   0  140  110  110  150
  150  100  120  130   0  30  190  160
  20  180  260  100  10   0  140  170
  140  190  120  100  180  130   0  120
  190  170  90  140  150  160  110  0
11.4.2 Trip Chain Files

With Dynamic Assignment it is also possible to supply traffic demand of a simulation with trip chains. In contrast to OD-matrices a trip chain file allows to supply the simulation with more detailed travel plans for individual vehicles; however, the coding effort is much higher.

VISSIM internally works with trip chains only. If OD-matrices are used, a preprocessing algorithm generates trip chains from these matrices. Thus it is possible to mix traffic demand by OD-matrices and trip chains in the same simulation.

To provide traffic demand with trip chains, in the Dynamic Assignment window check the option associated with the button TRIP CHAIN FILE. Then press TRIP CHAIN FILE and select a single file with the extension *.FKT.

A trip chain file contains a set of individual-vehicle travel definitions (trip chain), each one composed of one or more trips.

A trip chain is associated with a vehicle and identified by three numbers:
- Vehicle number
- Vehicle type
- Origin zone number

After this “header” one or more trips follow. A trip is defined by a group of four numbers:
- Departure time
- Destination zone number
- Activity number
- Minimum stay time

The departure time of the next trip depends on the arrival time in that zone and on the minimum stay period for this activity. The specified departure time for the next trip will be taken in account only if the minimum stay time is guaranteed: If a vehicle arrives too late the departure time is corrected to the sum of the actual arrival time plus the minimum stay time.

Trip chain file format (*.FKT)

The trip chain file (*.FKT) is line oriented, i.e. each line specifies a trip chain (a sequence of trips for an individual vehicle). The actual trips of a trip chain are formatted as groups of columns separated by semicolon:
- The first three columns specify the vehicle number and type and its origin zone.
Each subsequent group of four columns defines one trip within the trip chain.

The format description follows in BNF (Backus-Naur-Form):

```plaintext
<trip chain file> ::= <version> {<trip chain>}
.VERSION ::= <real> <nl>
<trip chain> ::= <vehicle> <vehicle type> <origin> {<trip>} <nl>
<trip> ::= <departure> <destination> <activity> <minimal stay time>

<vehicle> ::= <cardinal> <semicolon>
<vehicle type> ::= <cardinal> <semicolon>
<origin> ::= <cardinal> <semicolon>
<departure> ::= <cardinal> <semicolon>
<destination> ::= <cardinal> <semicolon>
<activity> ::= <cardinal> <semicolon>
<minimal stay time> ::= <cardinal> <semicolon>

<nl> ::= new line
<semicolon> ::= semicolon (;)
<cardinal> ::= positive integer (for example: 23)
<real> ::= floating point number (for example: 3.14)
```

**Example**

This example file (*.FKT) contains 11 trip chains.

```
1,1
1; 1; 10; 1; 20; 101; 117; 211; 20; 101; 169; 732; 20; 101; 171;
2; 1; 10; 4; 20; 101; 255; 334; 20; 101; 147; 815; 20; 101; 124;
3; 1; 10; 8; 20; 101; 202; 395; 30; 101; 178; 832; 20; 101; 175;
4; 1; 10; 12; 20; 101; 216; 703; 30; 101; 162; 533; 20; 101; 208;
5; 1; 10; 16; 20; 101; 164; 601; 30; 101; 251; 1134; 20; 101; 159;
6; 1; 10; 20; 20; 101; 295; 529; 30; 101; 133; 846; 20; 101; 114;
7; 1; 10; 25; 20; 101; 248; 262; 30; 101; 256; 987; 20; 101; 117;
8; 1; 10; 29; 20; 101; 169; 322; 30; 101; 164; 463; 20; 101; 141;
9; 1; 10; 31; 20; 101; 138; 543; 30; 101; 212; 405; 20; 101; 252;
10; 1; 10; 35; 20; 101; 296; 205; 30; 101; 160; 802; 20; 101; 221;
11; 1; 10; 40; 20; 101; 270; 622; 30; 101; 244; 604; 20; 101; 175;
```
11.5 Simulated Travel Time and General Cost

11.5.1 Simulation Period and Evaluation Interval

The microscopic simulation of the traffic flow is used during the Dynamic Assignment to determine travel times in the network. This travel time measurement is performed per edge and per evaluation interval.

In Dynamic Assignment, as opposed to static assignment, travel demand and network infrastructure are not assumed to be constant in time. Therefore the traffic situation and as a result the travel times will change during the assignment time period. To cover these changes the total simulation period is divided in smaller evaluation intervals in which travel times are observed separately. The appropriate size of the evaluation interval depends on the dynamics of the travel demand. The evaluation interval should be smaller than the interval in which the demand changes.

Example: If you have OD-matrices intervals of an hour, the evaluation interval should not be longer than half an hour.

As a rule of thumb, evaluation should have at least the double temporal resolution of the demand changes.

On the other side, an evaluation interval below five minutes does not make sense because the fluctuation of the values will increase with smaller intervals. Especially when signal controls are used the evaluation interval must be significantly larger than the cycle times used.

In most cases, evaluation intervals ranging from 5 to 30 minutes will be appropriate.

11.5.2 Simulated Travel Times

During a simulation, travel times are measured for each edge in the network. All vehicles that leave the edge report the time they have spent on the edge. All travel times during one evaluation interval are averaged and thus form the resulting travel time for that edge. There is a special treatment of vehicles that spend more than one evaluation period on an edge, e.g. during congestion. They report their dwell time as well although they have not left the edge. That is necessary to get information about heavily congested links even if there is - because of congestion - no vehicle able to leave.

The travel time measured in the current iteration \( n \) is actually not used directly for route search and route choice in the same iteration. Instead it influences next iterations. This behavior is sensible since we normally do not want the travel times during 8 a.m. and 9 a.m. on Tuesday to influence route choice for the time from 9 a.m. to 10 a.m. the same day but rather to influence the same period, i.e. 8 to 9 on the next day.
To model a growing experience of travel times the times not only from the immediately preceding iteration should be considered but from all preceding iterations. However, we want the more recent measurements to have more influence, and the appropriate mathematical method for that is exponential smoothing.

**Exponential Smoothing**

If we get a new set of measured values, we compute the smoothed travel time as the weighted sum of the old smoothed value and the newly measured value. That smoothed value represents the travel time that we expect in the next iteration. Formally:

\[
T_a^{n,k} = (1 - \alpha) \cdot T_a^{n-1,k} + \alpha \cdot TO_a^{n,k}
\]

where

- \( K \) = index of the evaluation interval within the simulation period
- \( n \) = index of the assignment iteration
- \( a \) = index of the edge
- \( TO_a^{n,k} \) = measured travel time on edge \( a \) for period \( k \) in iteration \( n \)
- \( T_a^{n,k} \) = expected travel time on edge \( a \) for period \( k \) in iteration \( n \)
- \( \alpha \) = smoothing factor

Please note that this kind of smoothed average of travel times includes the information of all preceding iterations but the “older” an iteration is, the less it influences the measurements of the current iteration. In VISSIM we use a smoothing factor of 0.5 which means that the last iteration \( n \) has a weight of 50%, iteration \( (n-1) \) 25%, iteration \( (n-2) \) 12.5% and so on.

After an iteration of the simulation the expected travel times for the next iteration are stored in the VISSIM cost file (extension *.BEW) in order to provide a base for the route choice in the next iteration.

### 11.5.3 General Cost

Travel Time is not the only factor to influence route choice. There are at least two other major influences: travel distance and financial cost (e.g. tolls). In contrast to travel times these factors are not depending on the traffic situation and thus have not to be determined by simulation. To cover all three major influences on route choice, for all edges in the network the so called general cost is computed as a weighted sum:

\[
\text{general cost} = \alpha \cdot \text{travel time} + \beta \cdot \text{travel distance} + \gamma \cdot \text{financial cost} + \Sigma \text{supplement2}
\]
The coefficients $\alpha$, $\beta$ and $\gamma$ can be defined by the user. In VISSIM the weights are specific to vehicle types and allow the modeling of driver groups with different route choice behavior.

The travel distances are determined by the geometry of the links. The financial cost of an edge is the sum of the costs of all links that are contained in that edge. The individual cost of a link is computed by multiplying the traveled distance on that link by the cost specified as a link attribute plus adding the supplements.
11.6 Route Search and Route Choice

11.6.1 Routes and their Cost

A route is a sequence of edges that describes a path through the network. Routes in VISSIM’s Dynamic Assignment start and end at parking lots. Since normally more than one route exists between an origin and a destination parking lot in the network VISSIM has to model the driver’s decision which route to take. For the beginning let’s assume that the set of available routes is known for a certain origin-destination pair.

As stated in the introduction the route choice is a special case of the discrete choice problem. For a given set of discrete alternatives the probabilities for the alternatives to be chosen must be determined. For traffic assignment we need to define a utility function to assess each route in the set and a decision function based on this assessment.

As discussed in the previous section we know for all edges their general costs which are computed from expected travel times, travel distances and financial costs. The general cost for a route is then simply defined as the sum of the general costs of all its edges:

\[ C_R = \sum_{a \in R} C_a \]

where

- \( C \) = general cost
- \( R \) = route
- \( a \) = an edge belonging to \( R \)

11.6.2 Route Choice

In Dynamic Assignment the drivers have to choose a route when they start their trip at the origin parking lot. In this section let’s assume that the destination parking lot is known and a set of possible routes is already known. The problem of how to find routes and choosing the destination parking lot is covered in separate sections.

One basic assumption in VISSIM’s route choice model is that not all drivers use the best route but all routes available can be used. Of course more traffic should be assigned to “better” routes than to “worse” routes. To assess how “good” a route is, we use the general cost of the route as explained in the section above. The general cost is obviously the inverse of what is called a utility value in discrete choice modeling. So we use as an utility function the reciprocal of the general cost:
\[ U_j = \frac{1}{C_j} \]

where

\( U_j \) = utility of route \( j \)
\( C_j \) = general cost of route \( j \)

The most widely used and thus theoretically best analyzed function to model discrete choice behavior is the Logit function:

\[ p(R_j) = \frac{e^{\mu U_j}}{\sum_i e^{\mu U_i}} \]

where

\( U_j \) = utility of route \( j \)
\( p(R_j) \) = probability of route \( j \) to be chosen
\( \mu \) = sensitivity factor of the model (>0)

The sensitivity factor determines how much the distribution reacts to differences in the utilities. A very low factor would lead to a rather equal distribution with nearly no regard of utility, and a very high factor would force all drivers to choose the best route.

If we use the Logit function with an utility function defined as above, we end up with the situation that the model considers the difference between 5 and 10 minutes of travel time to be the same as the difference between 105 and 110 minutes of travel time, since the Logit function is invariant against translation and considers only the absolute difference of the utilities. Obviously that is not appropriate for deciding route choice, since in the real world two routes having travel times of 105 and 110 minutes would be considered nearly the same, whereas 5 and 10 minutes are much of a difference. The solution adopted in VISSIM is to use the so called Kirchhoff distribution formula:

\[ p(R_j) = \frac{U_j^k}{\sum_i U_i^k} \]

where

\( U_j \) = utility of route \( j \)
\( p(R_j) \) = probability of route \( j \) to be chosen
\( k \) = sensitivity of the model
Again the sensitivity $k$ in the exponent determines how much influence the differences in utility have. In this formula, the relative difference in utility determines the distribution, so that we will see only a small difference between the 105 and 110 minute routes, whereas the 5 minute route will receive much more volume than the 10 minute route.

Actually the Kirchhoff distribution formula can be expressed as a Logit function, if the utility function is transformed to be logarithmic:

$$p(R_j) = \frac{U_j^k}{\sum_i U_i^k} = \frac{e^{k \cdot \log U_j}}{\sum_i e^{k \cdot \log U_i}} = \frac{e^{-k \cdot \log C_j}}{\sum_i e^{-k \cdot \log C_i}}$$

where $C_j$ is the general cost of route $j$.

### 11.6.3 Route Search

In VISSIM we assume that the drivers do not use only the best routes from one parking lot to another, but that the traffic volume is distributed among a set of available routes. Obviously, one would like to know the set of the $n$ best routes for each origin-destination-pair. Unfortunately there is no efficient algorithm to simply compute the $n$ best routes but there are algorithms to find the single best one. To solve this problem we search for the best route for each O-D-pair in each iteration of the Dynamic Assignment. Since the traffic situation and thus travel times change from iteration to iteration (as long as convergence is not reached) we will find different “best” routes in the iterations. All routes found (i.e. all routes that have qualified at least once as a best route) are collected in an archive of routes and are known in all later iterations. These routes are all stored in the path file (extension *.WEG).

The criterion for the “best” route is the general cost. That implies that for different vehicle types different best routes can be found, because the parameters of the general cost function are type-specific. Route search is done at the beginning of each evaluation interval and is based on the expected general cost for this interval computed from the preceding iterations.

Since in the very first iteration no travel time information from preceding simulation runs is available the cost is evaluated by replacing the travel time with the distance (in m). Thus for the initial route search also link/connector costs are taken into account. For every subsequent iteration the edges in the network that have not been traveled by any vehicle have a default travel time of only 0.1 second. This way it attracts the route search to build routes including unused edges. This method might result in some useless routes being found initially but by encouraging vehicles to try new paths the process of finding new routes is speeded up. You might want to control the courage of the vehicles to discover new routes by adding some weight to the distance in the general cost function so that they do not try obvious detours. However, it
is generally good to find as many routes as possible. If a route proves bad during the following iterations it may be discarded (depending on the Extended path settings) and thus does not harm.

11.6.4 Route Visualization

The routes found during the iterations of the Dynamic Assignment can be visualized in the network editor by EDIT – AUTO ROUTING SELECTION (while mode "Parking Lot" is active).

In the Paths window, all known routes for the selected origin-destination-pair are listed with their general Cost value and length (Distance). Furthermore it displays the number of vehicles (Volume) that have used a path in the last simulation run where a path file (*.WEG) was written.

Since costs are type specific and time dependent a vehicle type and an evaluation interval needs to be selected. If a route is selected in the list box, it is highlighted in the network display as a yellow band.

If automatic detour detection is used, the list of paths is separated in the sets of "normal" Paths and Detours. The corresponding buttons select which set is listed.

If convergence parameters are set, the option Show Non Converging Paths displays all paths that have not met the convergence criteria.
The paths shown in the *Paths* window result from the last iteration where the path file was updated. The costs shown are taken from the last cost file that was written. Thus the *Path* window only then shows the results of the last iteration, if both the cost and path files where written during that iteration.
11.7 Optional Enhancements of the Model

11.7.1 Multi-class Assignment

Multi-class assignment is the simultaneous assignment of different interacting road user classes on the same network. The road user classes in general have different route choice behavior and they can access different subsets of the road network. Examples of user classes are commuters, business travelers, local drivers, foreign drivers etc.

To model different route choice behavior the parameters $\alpha$, $\beta$ and $\gamma$ of the general cost function can be defined separately for each vehicle type. Thus it is possible to model e.g. drivers that are willing to pay tolls to gain time, and other drivers that do not want to pay and accept longer distances or travel times. The parameters can be set in the Cost Coefficients window that can be reached from the vehicle type window by pressing the button COST COEFFICIENTS. When defining the coefficients it is important to take into account the units of cost components to get the right scale of the result: Travel time is in seconds and distance is in meters, Link Cost has no implicit unit. So if e.g. link cost is given in Dollar per kilometer and shall have a significant influence, the coefficient must be large enough to bring the whole term to the same order of magnitude as the travel times in seconds.

The second aspect of multi-class assignment is the selective accessibility of the road network, that means that not all different vehicle types are allowed in all parts of the network. This feature could be used e.g. to model local drivers with full knowledge of the network and foreign drivers who know only the major roads. In VISSIM access to parts of the network is controlled by the connectors. A connector can be closed for selected vehicle classes. The route search will then build no routes containing that connector while building routes for that vehicle type. See section 6.3.2 for an explanation how to use connectors.

11.7.2 Parking Lot Choice

The travel demand given in the OD-matrix refers to zones for destinations. Zones are represented in the VISSIM network by one or more parking lots. If a zone is represented by more than one parking lot, the driver has to choose one of them before he chooses the route.

Parking lot choice is another example of a discrete choice problem, so we have to define the set of alternatives, the utility function and the decision
function. To support the choice model, parking lots have a number of attributes, see section 6.4.5.

**Relevant Situations**

Parking lot choice can take place in the following situations:

- When a vehicle starts a trip at its origin parking lot
- When a vehicle is forced to review its decision by a dynamic routing decision
- When a vehicle is forced to review its decision by the route guidance system

In all of these situations, the set of valid alternatives and the parameters of the utility function may be different. The set of available parking lots for a choice decision at departure is simply the set of all parking lots that belong to the destination zone and are open at the time of departure. For parking lot decisions made because of route guidance or dynamic routing decisions, the set of valid parking lots depends on the strategy chosen. See the description of these features in their separate sections.

The utility function of a parking lot is defined as:

\[
U_{k,s} = \alpha_{k,s} \cdot C_{parking} + \beta_{k,s} \cdot attraction + \gamma_{k,s} \cdot D_{dest} + \delta_{k,s} \cdot D_{veh} + \epsilon_{k,s} \cdot fs
\]

where

- \(C_{park} = \) parking cost
- \(D_{dest} = \) distance to destination zone
- \(D_{veh} = \) distance from vehicle position
- \(fs = \) availability of free spaces
- \(k = \) index of the vehicle type
- \(s = \) index of the decision situation (departure, routing decision...)

The availability of free places is computed as the ratio of the free places in the parking lot in question to the maximum number of free places in all parking lots in the choice set.

The value “distance to the destination zone” might look strange at the first glance, since parking lots belong to a zone and zones are not explicitly defined as network elements. How can they then have a position? The answer to the first question is that in some situations parking lots in other zones than the destination zone are considered, e.g. if all parking lots there...
Optional Enhancements of the Model

are full. Then of course drivers are looking for near other parking lots. The position of a zone is computed from the positions of all parking lots as the average of the coordinates. (You can see the computed zone centroids in the network editor by using default shortcut $\text{CTRL+Z}$ while in mode “Parking Lot”).

The coefficients of the utility function can be defined for each vehicle type in the Parking Lot Selection window. The window is reached by pressing the button PARKING LOT SELECTION in the Vehicle Type window.

Once the utility for all valid parking lots in the choice set is determined, the choice probabilities are computed by a Logit function. The sensitivity factor of the parking lot Logit model can be set in the Dynamic Assignment window in the field labeled Logit Scaling Factor. There is also a field labeled Logit Lower Limit, where a threshold can be defined, so that parking lots with a lower utility than the threshold are not chosen at all.

### 11.7.3 Detour Detection

As described above in the section about route search, the vehicles are encouraged to find new routes by trying links that are not yet traveled. This may lead to useless routes in the route collection. A route is considered useless if it is an obvious detour, and we define an obvious detour as a route that can be generated out of an other known route by replacing a sequence of links by a much longer sequence (in terms of distance). How much longer the replacing link sequence must be to qualify as a detour can be defined by the user in the Dynamic Assignment window. E.g. if there is a detour factor of 2 defined then all routes are checked whether they are just copies of other routes with a subroute replaced by another partial route that is at least double as long.

If detour detection is active you can choose in the path visualization window whether you want to see the detected detours or the non-detour routes.

### 11.7.4 Correction of Overlapping Paths

For every OD-pair the whole demand will be distributed on all available routes. The distribution considers the general cost values as defined by the decision parameters of the route choice model. A route is assembled by a
sequence of edges. Two routes are different if their sequence of edges is not exactly the same. Therefore two routes may be considered different if they differ only by a small section. In this case both routes have about the same weight within the distribution, but the overall distribution is biased. This is a general problem of dynamic assignment and know as the blue/red bus paradox. The following graphics illustrate the problem:

**Case 1**

Two routes with identical cost. The trips are split 50:50, no problem.

**Case 2**

Three routes with identical costs. Each route receives one third of the demand from A to B, still no problem.

**Case 3**

Problem: Actually there are only two distinct routes, but because of the slight variations at the end, the route search finds 3 routes.

Result: Distribution on 3 routes, but the overlapping part of the two similar paths contains too much traffic.

**Case 4**

Opposite problem of case 3: Actually there are 3 routes but two have a short part in common.

As in case 3 all three routes will get about one third of the demand, which is much more realistic than in case 3.

**Solution in VISSIM**

VISSIM offers an optional extension of the route choice model to correct the biased distribution in case of overlapping routes. It is based on the idea of the computation of a so called commonality factor of the routes. The commonality factor expresses how much of a route is shared with other routes. A high commonality factor indicates that a route has many edges in common with other routes, and a low commonality factor indicates that a route is quite independent of others. The commonality factor is then taken
into account in the route choice model in way that a high commonality factor reduces the probability of the route to be chosen. However, the use of the overlapping correction tends to assign more traffic to longer routes in certain network situations. Although in general path overlapping correction will improve the assignment quality, we recommend to use the feature only in combination with restricting the differences in cost of the allowed routes.

11.7.5 Dynamic Routing Decisions

When Dynamic Assignment is used, the vehicles in the network from origin-destination matrices are on their assigned routes and will ignore any standard routing decisions they come across. Dynamic routing decisions are used to direct those vehicles that for some reason must be rerouted. The idea behind is that a vehicle coming across a dynamic routing decision checks whether a certain condition is fulfilled at that moment, e.g. its destination parking lot is full. If the condition is true for the vehicle a new parking lot choice or a new route choice is computed according to a certain strategy. The strategy chosen defines which parking lots are in the choice set.

In the Routing decision window, the condition and strategy as well as the additional parameters for the conditions can be set.

Routing is based on the same general costs of the edges as the route choice of the Dynamic Assignment in the current evaluation interval. Much like the Dynamic Assignment paths, the dynamic routing paths can be viewed in the Paths window. The only difference between this window and the Dynamic Assignment window is that From Zone is replaced by From Routing Dec. To view this window, select the route definition mode and choose Edit – Auto Routing Selection.
The only difference is the following:
Instead of the origin parking lot, a route
decision has to be selected.
Call the Autorouting selection window
via menu EDIT – AUTO ROUTING
SELECTION while the Routes edit mode
is active.

11.7.6 Route Guidance

With Dynamic Assignment the vehicles choose their routes to their
destinations at departure time based on the general cost information
collected in the preceding iterations of the simulation. However, VISSIM
offers additionally the possibility to re-route vehicles during their trips based
on the current traffic situation in the current simulation iteration. This method
can be used to model vehicle route guidance systems.

Other than dynamic routing decisions the rerouting caused by the route
guidance system is not restricted to fixed positions in the road network.
Instead, the equipped vehicles are rerouted in fixed time intervals. At the
current state of the implementation, the action triggered by the system is
always to search the best route from the current vehicle position to the
destination parking lot. The criteria for the route search is general cost with
travel times measured in the current simulation. The travel times taken into
account for the re-routing are not necessarily the most recent travel times but
travel times measured some time ago (offset). This offset is introduced to
model the processing time of typical route guidance systems, i.e. the time
from measurement on the road until the data is available to the route
guidance equipment in the vehicles.
Two independent route guidance systems are offered for simulation with identical functionality.

Whether a vehicle type is equipped with one or both route guidance systems can be selected in the vehicle type window. The parameters for the route guidance system are defined in the Route Guidance window.

It can be accessed by the button ROUTE GUIDANCE in the Dynamic Assignment window.
11.8 Assignment Control

11.8.1 Path Evaluation File

To analyze the results of the Dynamic Assignment, the most important information is to know the paths found, their cost and how it is computed, and how much of the traffic volume was assigned to them. This kind of information is offered for output in the path evaluation file. See section 10.21 for a detailed description of the file format and how to configure the evaluation.

11.8.2 Iteration Control

The Dynamic Assignment is computed by running the simulation for the same model repetitively. During the iterations, information about routes in the network and about travel times on the edges of the road network is collected. This information is stored in two files, the cost file (*.BEW) and the path file (*.WEG). These files represent the current state of the assignment. The names of these files are not generated automatically like most of the evaluation files but can be set by the user in the Dynamic Assignment window. That way different sets of assignment states can be stored.

Writing of the cost and path files during simulation can be disabled in the Dynamic Assignment window by deactivating the options Store Costs and Calculate and Store Paths. This is appropriate for example if the assignment has converged and the route choice shall not be changed during the following simulations. To prevent accidental overwriting, VISSIM automatically deactivates these two options whenever a network file is opened which is linked to existing cost and path files. If VISSIM is run from the command line in batch mode with a number of runs specified, VISSIM will create and/or overwrite these files automatically.

The number of routes available increases during the iterations. In the first iterations, only few routes are known for each origin-destination-pair. This may lead to unrealistic congestion on these routes because the volume cannot be distributed on enough different roads. This congestion will disappear in later iterations when more routes are found but convergence is slowed down because of the exponential smoothing of the measured travel times. To avoid these start-up congestions it is recommended to load the network with less than the full travel demand during the first iterations (e.g. 10-20%). To continue from there, there are two options:

1. Delete the cost file and run the next iteration with full demand load. Because of the previous iterations, now most of the paths for every OD-pair are available and thus traffic demand will be distributed over these paths.
2. Increase the demand gradually over the next iterations until the full demand is reached. In order to conveniently control this process it is possible to scale all OD-matrices globally with a factor for the current simulation. That factor can be set with the option Reduced Volume [%] in the Dynamic Assignment window.

Using VISSIM Batch Mode to Run Multiple Iterations

Since Dynamic Assignment normally requires many simulation iterations it is possible to start VISSIM in batch mode and compute several subsequent iterations without stopping. Therefore VISSIM can be called from the command line with the 

\[ \text{VISSIM.EXE TEST.INP --s<n>} \]

would compute 20 iterations of the network file TEST.INP. This feature can be combined with the congestion-avoiding scaling of travel demand by using the command line option 

\[ \text{VISSIM.EXE TEST.INP --s<n> --V<p>} \]

would compute 20 iterations of the network file TEST.INP and increase the traffic demand by 5% each iteration. E.g. if in TEST.INP a reduced volume factor of 20% is defined then in the first iteration the travel demand would be scaled down to 20%, in the second iteration increased by 5% from there (so there will be 25% of the full traffic demand), then 30% and so on, and from the 16th iteration onwards the total travel demand would be assigned.

11.8.3 Convergence Control

The process of iterated simulation runs to compute the result of the Dynamic Assignment can be stopped if eventually a stable traffic situation is reached. This is the case when travel times and volumes do not change significantly from one iteration to the next. The stability of travel times and volumes must be reached for all evaluation intervals from one iteration to the next, not necessarily within one simulation period where traffic conditions may change from one evaluation interval to the next.

VISSIM offers an automated test for convergence. The Convergence window for the configuration of the convergence test can be accessed by the Convergence button in the Dynamic Assignment window.
Three different criteria for convergence can be selected and the respective tolerance values set:

- **☑ Travel Time on Paths** computes the change of the travel time on every path compared to its travel time in the previous run. If this change for all paths is lower than the user-defined factor, convergence for this criterion is detected.

- For **☑ Travel Time on Edges** the old and new travel times on edges are compared in the same way as described for paths above.

- For the option **☑ Volume on Edges** the absolute difference of old and new volume on every edge is determined and compared with the user-defined number of vehicles.

This test for convergence is done at the end of each evaluation interval. If all selected convergence conditions are fulfilled for all evaluation intervals a message box shows up at the end of the simulation run. In the case of a batch run a different message box shows up offering the option to terminate the batch run.

Another way to observe and control convergence during the iteration process is offered by the convergence evaluation output file. VISSIM writes to this file a statistic evaluation of the differences in travel times and volumes for all edges and paths from the preceding to the current iteration. See section 10.22 for a description of the file format.

The non converging paths in the last iteration can be displayed within the *Paths* window (*Edit* - *Auto Routing Selection*...). A path doesn't converge in a time interval if the travel time percentage difference between the previous and the last iteration is bigger than the percentage defined in the convergence window. The *Paths* window displays the previous and the last travel time for each time interval where a path is not converging.

### 11.8.4 Route Search Control and Local Calibration

The Dynamic Assignment process can be controlled by the user in several ways. Control becomes necessary if the assignment result differs from real world observation although the road network and infrastructure are modeled correctly. That may happen because for obvious reasons the decision model in VISSIM cannot cover the complete range of factors to influence of the real drivers decision behavior.

Thus VISSIM offers several means to control the use of certain parts of the network during Dynamic Assignment route choice.
### Surcharges

One method to model the behavior that some parts of the road network attract more or less traffic than expected, the cost of VISSIM links and connectors can be increased or decreased using surcharges. Surcharges are added to the total cost once per visit of a link/connector (i.e. **not** per km).

The surcharge can be defined in the link or connector properties window by pressing the COST button in [OTHER] resp. [DYN. ASSIGNMENT].

There are two kinds of surcharges:

- Surcharge 1 is sensitive to the weight for financial cost in the vehicle type cost coefficients.
- Surcharge 2 is simply added to the general cost and is independent of the cost coefficients of the vehicle type.

### Edge Closure

A more rigid method of avoiding traffic on certain road sections, is to ban certain edges for the use in the Dynamic Assignment routing.

Edges can be closed in the Edge Selection window by selecting an edge and activating the option **Edge Closed**.
All closed edges will be shown in red color rather than yellow.

Restricting the Number of Routes

The number of routes found during the iterations in principle is not restricted. Therefore, as long as no special action is done, all routes that have been found are stored in the route archive and are used for traffic distribution. As a result, to some rather expensive routes some vehicles will still be assigned even if in later iterations much better routes are found. To avoid this effect, the number of routes that is used for each OD-pair can be restricted. There are two ways of restricting the number of routes:

► Defining an upper limit for the number of routes
► Defining a maximum of cost difference between the best and the worst route

Defining an upper limit may not be appropriate in networks where for some OD-relations many alternative routes exist (and shall be used) and for other relations only few routes exist. Then the maximum of cost difference between the cheapest and the most expensive route may be defined. This method is intended to discard unwanted expensive routes that once have been the cheapest because some or all edges had no real cost evaluations yet (i.e. they were initialized with cost value 0.1). The low initialization values encourage the route choice model to assign traffic to routes where no vehicles have been traveled yet. Those routes which are found to be much more expensive (compared to existing routes) after some vehicles have traveled on them for the first time can be discarded from the route archive using this method.

The following action is performed every time the data from a path file is loaded (generally speaking at every start of a new iteration):

For each OD-relation separately, out of the set of all available routes VISSIM finds the cheapest and the most expensive route. Then every route is discarded for which the excess cost (compared with the cheapest route) divided by the cost of the cheapest route is higher than the defined threshold factor for all evaluation intervals.
Both the threshold factor and the upper limit can be defined in the Path Search window. It is reached by pressing the button EXTENDED in the Dynamic Assignment window.

- **Search paths for O-D pairs with zero volume**: If this option is selected, new paths for "empty parking lot relations" are also searched. A parking lot relation is empty, if no volume is required in any of the involved O-D matrices for the zone pair.

It is recommended to leave this option unselected (default), saving considerable amounts of memory in case of sparse traffic demand matrices.

**Route closure**

Another method to influence the routing in Dynamic Assignment is to manually close subroutes (a sequence of links and connectors) in the network. A route closure does not guarantee that all routes are blocked which include the edge sequence of the route closure. There are two main possibilities where a route closure is ignored:

1. If the route closure is part of the only possible route between two parking lots
2. As long as no other route with less cost was found (in the first iteration least cost is determined by shortest distance)

A route closure should only be used as the last option to restrict a specific movement. The better option is to use correct cost parameters and speeds, and if necessary, closure of a turning movement (edge inside a node). Before using a route closure please make sure that there is no other way to model the situation differently. In most cases, a turning movement (edge) closure will do the job if the node boundaries are placed differently.
The subroute to be closed is defined in the same way as a static route is defined, i.e. they have a starting point and an destination point.

Route closures can be created and edited using the Routing Decisions mode by selecting Closure in the Create routing decision window. For more information on Routing Decisions please refer to section 6.4.4.

11.8.5 Generation of Static Routing

VISSIM offers the possibility to convert the current state of the Dynamic Assignment (the routes found and their volumes) into a VISSIM model with static routes. It is then possible to use the simulation without the Dynamic Assignment module; in other words: the assignment is frozen.

Vehicle inputs and routing decisions are created from the current data of the Dynamic Assignment files (*.WEG, *.BEW, *.FMA). At least one vehicle input per time interval is created for each origin parking lot (parking lot with relative flow > 0) with the volume determined from the total zone volume from *.FMA and/or *.FKT files and the stochastic distribution of these vehicles among the origin parking lots (according to their relative flows).

One static routing decision is created for each origin parking lot per vehicle type group (set of vehicle types with identical cost coefficients, connector closures, destination parking lot selection parameters and constant ratios in traffic compositions used for matrices). The relative flow of each route to a destination parking lot is determined from the total zone volume (as above), the stochastic distribution of these vehicles among the origin parking lots, the destination parking lot selection parameters of the vehicle type group and the path costs read from the cost file *.BEW.

► The identifier of any vehicle input automatically created is 1000 times the parking lot number plus the index of the time interval.
► The identifier of any routing decision automatically created is 1000 times the parking lot number plus the index of the vehicle type group.
• If these numbers exceed the valid range or if a vehicle input or routing decision with the same number already exists, the creation of static routing is terminated and an error message displayed.
The conversion to static routes is done using the button **CREATE STATIC ROUTING** in the *Dynamic Assignment* window.

The number of generated static routes can be reduced.

Enable option

☑ *Limit number of routes*

and set parameters accordingly.

Then confirm OK.

---

Option *Limit number of routes* has the following effect:

First off, all paths are converted into routes with static volumes. Then, the number of generated static routes is reduced by comparing both, the absolute and the relative minimum volume of each decision cross-section with the given threshold and also the number of routes per destination cross-section.

All routes which do not fulfill all of these three criteria and also their volumes will be removed. Decision cross-sections will not be removed, even if all routes starting from a decision cross-section have been deleted.

Parameters provided in the *Generate static routes* dialog (these settings are only stored during a VISSIM session, they are not saved to file):

- **rel. min. volume**: 2 decimal places, value range \([0.0..1.0]\), default = 0.05. To each route applies: A static route is deleted, if – in each time interval - its relative volume < current **rel. min. volume**. If zero is entered as **rel. min. volume**, then none of the generated static routes will be discarded for this criterion. The relative volume per time interval = absolute volume per time interval: total volume summed up from all volumes per time interval.
- **abs. min. volume**: integer, value range \([0..999999999]\), default = 2. To each route applies: A static route is deleted, if its absolute volume < current **abs. min. volume**. If zero is entered as **abs. min. volume**, then none of the generated static routes will be discarded for this criterion.
- **max. number of routes (per destination cross-section)**: integer, value range \([0..999999999]\), default = 10. All routes from a decision cross-section to a destination cross-section are taken into consideration. For each decision cross-section the number of routes leading to a destination cross-section is determined. If several destination cross-sections specified for just one decision cross-section are located closed to each other on the same link (tolerance ± 1m) these destination cross-sections are regarded as if they were a single destination cross-section. If the number of routes per destination cross-section > current **max. number of routes**, then the routes with lowest volume totals calculated from all volumes per time interval will be removed. If an unlikely value is entered, e.g. 999999, then none of the generated static routes will be discarded for this criterion.
11.8.6 Summary of the Dynamic Assignment Parameters

The Dynamic Assignment window is accessed by TRAFFIC – DYNAMIC ASSIGNMENT. In this section only a short summary of the available options is shown. A more detailed description of most of the parameters is contained in the relevant sections above.

- **Trip Chain File**: Links to a trip chain file (e.g. exported from VISEM)
- **Matrices**: Contains a link to one or more matrix files each related to a vehicle composition
- **Cost File**: The file that contains the estimated travel times for the edges of the abstract network graph.
- **Path File**: The file that contains the route archive of the network
- **Check Edges**: When active, VISSIM checks the consistency of the cost resp. path file in terms of network changes. It is strongly recommended to leave this option enabled since otherwise results of the Dynamic Assignment may be inconsistent. For large networks the Check Edges process may take some time. In this case it may be switched off if it is assured that no changes have been done to the network structure.

- **Evaluation Interval** is the interval at which the cost is calculated and new routes are searched
- **Store Costs**: If checked, VISSIM writes a new cost file.
- **Extended**: Access to the smoothing factor for cost calculation
- **Calculate and Store Paths**: If checked VISSIM calculates new shortest paths through the network and stores them in the paths file.

If VISSIM is run in batch mode with a specified number of runs VISSIM creates or overwrites the cost and path files automatically.

- **Extended**: Further options to limit the number of routes being found
- **The Kirchhoff Exponent**: Sensitivity parameter of the Kirchhoff distribution function used for route choice
- **Logit Scaling Factor**: Sensitivity factor for the Logit model used in parking lot choice
- **Logit Lower Limit**: Defines the cutoff proportion for the parking lot choice algorithm. If the benefit proportion of a parking lot is below the limit, no vehicles will be assigned to it.
- **Reduced Volume [%]**: This checkbox allows for reduction of the volume from all OD-matrices used for the next Dynamic Assignment run down to the given percentage.
- **Correction of overlapping paths**: Corrects the proportions of vehicles being assigned if routes share common edges
- **Avoid Long Detours**: Paths with long detours (segments that could be replaced by shorter distance alternatives from different paths) will not be used for vehicle distribution. The factor for deciding when a segment is a detour can be defined in the adjacent field.
- **VISSIM’s Virtual Memory** allows the user to conserve some of the memory (RAM) used while running a simulation with Dynamic Assignment. If checked, a file is created that holds a reference to the vehicles that will eventually enter the network instead of those vehicles being generated at the beginning of the simulation and being stored in the computers memory until they leave the network. Using the Virtual Memory option slows down the simulation but will not tie up as much of the systems memory resources.
- **CONVERGENCE**: Provides three threshold values to detect convergence of the Dynamic Assignment process
- **ROUTE GUIDANCE**: Allows for definition of up to two control strategies to be used by vehicles with route guidance (e.g. navigation system)
- **CREATE STATIC ROUTING**: Starts the conversion of the current Dynamic Assignment results into static routes
12 Glossary of Files associated with VISSIM
## 12.1 Simulation Output Files

<table>
<thead>
<tr>
<th>Extension</th>
<th>Name</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>*.A00 : *.A99</td>
<td>Used by various evaluations</td>
<td>Output files for various specifically defined evaluations.</td>
</tr>
<tr>
<td>*.ANI</td>
<td>Animation</td>
<td>Contains recorded simulation for playback.</td>
</tr>
<tr>
<td>*.BEO</td>
<td>Observation</td>
<td>Binary file that includes vehicles position, speed and acceleration for each vehicle for each simulation second. Used as base for time-space, speed-distance and other diagrams.</td>
</tr>
<tr>
<td>*.EMI</td>
<td>Emission output</td>
<td>Contains total emissions in grams for CO and NO\textsubscript{X}. This is not the output of the optional warm/cold emissions module.</td>
</tr>
<tr>
<td>*.ERR</td>
<td>Run time warnings</td>
<td>Contains warnings of non-fatal problems that occurred during the simulation.</td>
</tr>
<tr>
<td>*.FHZ</td>
<td>Vehicle Inputs</td>
<td>List of all vehicles including time, location and speed at their point of entry into the VISSIM network.</td>
</tr>
<tr>
<td>*.FZP</td>
<td>Vehicle Record Output</td>
<td>Contains vehicle information specified for collection by the user in the *.FZK file in the Vehicle Record Configuration window.</td>
</tr>
<tr>
<td>*.KNA</td>
<td>Node Evaluation Output</td>
<td>Contains the output from the node evaluation.</td>
</tr>
<tr>
<td>*.LDP</td>
<td>Signal/detector record</td>
<td>Contains log of signal display changes and detector actuations (to be configured using a *.KFG file).</td>
</tr>
<tr>
<td>*.LOG</td>
<td>Simulation Log file</td>
<td>File is created automatically and contains real time information about the current simulation run. Example: The number of paths found when using Dynamic Assignment.</td>
</tr>
<tr>
<td>*.LSA</td>
<td>Signal changes</td>
<td>Contains all signal changes occurring during a simulation run in chronological order.</td>
</tr>
<tr>
<td>*.LZV</td>
<td>Signal timing log</td>
<td>Contains green and red times for all signal groups (phases) of all controllers.</td>
</tr>
<tr>
<td>*.MER</td>
<td>Data collection (raw)</td>
<td>Contains raw data collected at previously defined data collection points.</td>
</tr>
<tr>
<td>Extension</td>
<td>Name</td>
<td>Content</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>*.MES</td>
<td>Data collection</td>
<td>Contains compiled data collected at previously defined data collection points.</td>
</tr>
<tr>
<td>*.NPE</td>
<td>Network Performance Evaluation</td>
<td>Contains the number of vehicles, total distance traveled, total travel time, average network speed and total network delay.</td>
</tr>
<tr>
<td>*.OVW</td>
<td>Transit delay</td>
<td>Transit stop times (excluding times for passenger interchange).</td>
</tr>
<tr>
<td>*.ROU</td>
<td>Routes</td>
<td>Protocol of route choices for all vehicles (generated automatically with observer file).</td>
</tr>
<tr>
<td>*.RSZ</td>
<td>Travel times</td>
<td>Average travel times during a simulation for previously defined travel time sections.</td>
</tr>
<tr>
<td>*.SPW</td>
<td>Lane change data</td>
<td>This file contains information about specific vehicles lane changes.</td>
</tr>
<tr>
<td>*.STR</td>
<td>Segment data</td>
<td>Output from the link segment evaluation feature.</td>
</tr>
<tr>
<td>*.STZ</td>
<td>Queues</td>
<td>Average and maximum queue lengths at previously defined queue counters.</td>
</tr>
<tr>
<td>*.TRC</td>
<td>Trace</td>
<td>Contains trace information as programmed in a VAP logic (with optional module VAP).</td>
</tr>
<tr>
<td>*.VLR</td>
<td>Delay data</td>
<td>Evaluation of delay data (raw data)</td>
</tr>
<tr>
<td>*.VLZ</td>
<td>Delay data</td>
<td>Evaluation of delay data (compiled data)</td>
</tr>
</tbody>
</table>
### 12.2 Test Mode Files

<table>
<thead>
<tr>
<th>Extension</th>
<th>Name</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>*.AGZ</td>
<td>Green time statistics</td>
<td>Output green time statistics</td>
</tr>
<tr>
<td>*.AWZ</td>
<td>Red time distribution</td>
<td>Output red time distribution</td>
</tr>
<tr>
<td>*.AZZ</td>
<td>Time-time diagram</td>
<td>Output time-time diagram: Green time as a function of preemption call event during signal cycle</td>
</tr>
<tr>
<td>*.BEL</td>
<td>Demand file</td>
<td>Traffic demand for green time statistics preparation</td>
</tr>
<tr>
<td>*.M_I</td>
<td>Macro-Input</td>
<td>Manually placed or edited detector calls; input file for macro test runs</td>
</tr>
<tr>
<td>*.M_O</td>
<td>Macro-Output</td>
<td>Manually placed detector calls created during test run, to be renamed to *.M_I</td>
</tr>
<tr>
<td>*.SLF</td>
<td>Loop file</td>
<td>Configuration file to evaluate the impact of transit priority/preemption calls</td>
</tr>
<tr>
<td>*.SLO</td>
<td>Loop output file</td>
<td>Temporary file created during a loop test run, used for creation of green time statistics file, red time distribution, etc.</td>
</tr>
<tr>
<td>*.ZZD</td>
<td>Configuration file</td>
<td>Configuration file containing signal groups (phases) to be evaluated in a time-time diagram</td>
</tr>
</tbody>
</table>
## 12.3 Dynamic Assignment Files

<table>
<thead>
<tr>
<th>Extension</th>
<th>Name</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>*.BEW</td>
<td>Cost file</td>
<td>Contains the current list of costs for the paths through the network</td>
</tr>
<tr>
<td>*.CVA</td>
<td>Convergence evaluation</td>
<td>Contains volume and travel time values for the current run and previous runs</td>
</tr>
<tr>
<td>*.FMA</td>
<td>O-D matrix file</td>
<td>Contains the origin destination matrix for Dynamic Assignment</td>
</tr>
<tr>
<td>*.WEG</td>
<td>Path file</td>
<td>Contains the current list of discovered paths through the network</td>
</tr>
<tr>
<td>*.FKT</td>
<td>Trip Chain File</td>
<td>Alternative vehicle input format for Dynamic Assignment</td>
</tr>
<tr>
<td>*.PCS</td>
<td>Export file</td>
<td>VS-pCoq Spy export file</td>
</tr>
<tr>
<td>*.SCH</td>
<td>Raw Emission Data</td>
<td>Input file for optional emission module</td>
</tr>
<tr>
<td>*.WGA</td>
<td>Path Evaluation Output</td>
<td>Contains data collected on Dynamic Assignment paths</td>
</tr>
<tr>
<td>*.WGF</td>
<td>Path Evaluation Filter</td>
<td>Contains a list of from and to nodes or parking lots data should be collected for</td>
</tr>
<tr>
<td>*.WGK</td>
<td>Path Evaluation Configuration</td>
<td>Contains a list of evaluations that will be collected for each path</td>
</tr>
</tbody>
</table>
## 12.4 Other Data Files

<table>
<thead>
<tr>
<th>Extension</th>
<th>Name</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>*.BMP</td>
<td>Bitmap</td>
<td>Background graphic (e.g. aerial photo, signal plan)</td>
</tr>
<tr>
<td>*.FIL</td>
<td>Filter file</td>
<td>Contains the list of vehicle classes referenced by the *.FZK file</td>
</tr>
<tr>
<td>*.FZI</td>
<td>Vehicle Window Parameters</td>
<td>The configuration of the vehicle information window is saved in this file.</td>
</tr>
<tr>
<td>*.FZK</td>
<td>Vehicle Record Parameters</td>
<td>Contains the parameters that the user has specified to be output in the *.FZP file.</td>
</tr>
<tr>
<td>*.GAIA</td>
<td>Vehicle position export file</td>
<td>The GAIA file contains vehicle data to be exported to another visualization tool</td>
</tr>
<tr>
<td>*.HGR</td>
<td>Background parameter</td>
<td>Contains parameters for background image (origin and scale)</td>
</tr>
<tr>
<td>*.INI</td>
<td>Initialization</td>
<td>Contains position and size of the individual output windows, selected display options as well as output file configurations.</td>
</tr>
<tr>
<td>*.INP</td>
<td>Network (Input)</td>
<td>Contains all input data for VISSIM's traffic and transit network</td>
</tr>
<tr>
<td>*.IN0</td>
<td>Backup</td>
<td>Automatically created backup of *.INP file</td>
</tr>
<tr>
<td>*.KFG</td>
<td>Configuration</td>
<td>Configuration of columns for signal/detector record</td>
</tr>
<tr>
<td>*.PUA</td>
<td>VAP start-up stages and interstages</td>
<td>Contains definitions of stages, start-up stages and (if applicable) interstages for signal controllers with VAP logic (optional module)</td>
</tr>
<tr>
<td>*.QMK</td>
<td>Data collection parameters</td>
<td>The data collection file configuration is saved in this file.</td>
</tr>
<tr>
<td>*.SAK</td>
<td>Segment data configuration</td>
<td>Listing of the evaluations and vehicle classes collected on the segments.</td>
</tr>
<tr>
<td>*.SZP</td>
<td>Configuration of dynamic signal timing plan</td>
<td>Configuration of the sequence of signal groups (phases) and detectors for dynamic signal timing plan</td>
</tr>
<tr>
<td>Extension</td>
<td>Name</td>
<td>Content</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>*.V3D</td>
<td>VISSIM 3D file</td>
<td>The format for VISSIM 3D objects and the VISSIM 3D modeler.</td>
</tr>
<tr>
<td>*.VAP</td>
<td>VAP logic</td>
<td>Description of a user-defined traffic responsive signal control logic (available only with optional VAP module)</td>
</tr>
<tr>
<td>*.WTT</td>
<td>Signal control interface</td>
<td>(Internal) interface definition of parameters exchanged between VISSIM and external signal control program</td>
</tr>
</tbody>
</table>
13 Service & Support

Website
PTV operates an English internet site at http://www.english.ptv.de. Here you'll find additional product information, sample AVI files for download and the FAQ and service pack download areas (see below).

Our colleagues in the U.S. operate another website at http://www.ptvamerica.com with some additional features like a user forum and a download area for VISSIM 3D models.

Sales
For any questions regarding VISSIM license fees, please contact our international sales manager at sales.vissim@ptv.de.

Training
PTV offers training classes both for new and advanced users. Classes can be arranged as training-on-the-job at whatever location you prefer, or you may join one of our set training sessions. Details are available on our website at http://www.english.ptv.de/cgi-bin/traffic/traf_schulungen.pl.

If you are interested in a training-on-the-job and would like to receive an offer, please contact either your local distributor or PTV directly at sales.vissim@ptv.de.

Software Maintenance
In order to stay up-to-date with your VISSIM software and to benefit from extended services, PTV and some of our distributors offer software maintenance contracts. Benefits include

► Free updates whenever a new VISSIM version is available
► Download of service packs of the latest VISSIM version
► E-mail hotline support not only in the case of program errors but also for modeling and other problems (for trained users)
► Access to the extended FAQ section in the internet

For more information on software maintenance contracts, please contact your local distributor. Alternatively, you may contact PTV directly at traffic.customerservice@ptv.de (information and delivery procedures) or at sales.vissim@ptv.de (offers).

FAQ
At http://www.english.ptv.de/cgi-bin/traffic/traf_faq.pl you can find a wide selection of FAQ (frequently asked questions) on VISSIM.

For all clients with a software maintenance contract, an extended range of FAQ is available after entering the password supplied with the program license (see letter of delivery).
For all clients with a software maintenance contract, service packs of the latest VISSIM version are available for download at http://www.english.ptv.de/cgi-bin/traffic/vissim_download.pl. Please note that service packs can be used with the latest VISSIM version only.

In the download area on our website you can also register for an automatic e-mail notification whenever a new VISSIM service pack is available.

PTV operates a technical hotline e-mail service for VISSIM that is available for:

► **Program errors of the most recent version.** As our software is continually being improved, we regret that we cannot provide hotline support for older versions of VISSIM.

► Application and modeling assistance for trained users of our clients who signed a software maintenance contract.

Please understand that our hotline cannot provide the skills of a VISSIM training course. Neither is it possible that the hotline provides engineering skills outside the VISSIM functionality (such as demand modeling or signal control design) or project related tasks. If you are interested in one of these topics, we are happy to offer you consulting or a dedicated training course on that subject at competitive rates.

In case you got a maintenance contract with one of our local distributors, please contact them for hotline support. All other clients, please use hotline@ptvamerica.com (for North America) or hotline.vissim@ptv.de (if your maintenance contract is with PTV).

Please help us providing a fast and effective hotline service by complying to the following guidelines:

Before posting a VISSIM question or problem to our hotline, please check out the FAQ section as the solution for a number of problems is already included there. This way you get an answer instantly and minimize delays of hotline response.

When posting a mail to the VISSIM hotline, please include the following information:

► Version number of VISSIM incl. service pack no. (e.g. 4.00-05). The exact version number can be found in File - Info...

► Operating system incl. possible service pack no.

► In case of a problem: Detailed description of the problem, actions that have been taken beforehand (so that we can reproduce the error) and a screenshot (jpg) if necessary.

► All data files necessary to reproduce the error or problem.

Thank you for your cooperation.