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Important Notice to Users of Previous VISSIM Versions

This section includes information about changes and new functionality only in those cases where there are substantial changes in VISSIM compared to previous versions. A complete list of all changes and news is contained in the file RELEASE_NOTES_530_E.TXT which is included in the DOC directory of your VISSIM installation.

Versions Previous to 5.30

The destinations as well as the intermediate points of pedestrian routes can be placed on ramps now.

The path and cost files created with VISSIM 5.20 can no longer be used if they contain data generated with certain edge models.

Each VISSIM 5.30 installation without the pedestrians add-on provides the opportunity to model up to 30 pedestrians in the network.

In the 3D mode, just right-click to load a static 3D object file (*.SKP, *.DWF or *.3DS). The Select 3D Model window will open as for *.V3D files. Right-click and pressing CTRL simultaneously is no longer required to load a file of the file types mentioned above.

To delete a static 3D object, select the object by left-click and press DEL subsequently now. The left-click will no longer immediately remove the object from the network display.

With Windows 7 and Windows Vista, just one EXAMPLES folder is now installed per main version. Access to this folder is provided via the environment variable VISSIM530_EXAMPLES, cf. section 2.3.

Versions Previous to 5.20

For the desired position at free flow you may now also select option Right for left-side traffic and vice versa in driving behavior parameter sets.

In the default driving behavior parameter set “Urban“, the Look ahead distance has been set to 4 observed vehicles (instead of 2).

Now click CTRL+L (instead of just the L key) to toggle between different LOS views.

Keyframes can optionally be defined with Absolute start times. In case of changes to keyframe settings, the renamed option Shift subsequent keyframes leads to a different behavior now. The start times of later frames are now shifted by $\Delta t$:

$\Delta t = \text{new start time} - \text{old start time} + \text{new dwell time} - \text{old dwell time}$. 
Thus it is no longer possible to shift a keyframe to another position within the list and to retain the movement times and dwell times simultaneously. You may not enter a new start time which is before the end of the dwell time of the previous keyframe.

For Fixed time control, the Signal program Editor replaces the previous tabular data supply for SC of that type. All fixed time controllers are now handled as external (VISSIG) controllers. Hence the controller data is not stored in the *.INP file anymore but in a separate *.SIG file for each controller. Please keep that in mind if you transfer VISSIM project data to another location or client.

Versions Previous to 5.10

In addition to link-based vehicle traffic VISSIM now includes an area-based, multi-level pedestrian behavior model (optional module). Its main advantage is its capability to model walkable areas and ramps as well as obstacles rather than directional links/connectors. Thus pedestrians are able to move in all directions including counter-flow situations.

To automatically multi-select all links/connectors of any display type or behavior type, the new function MULTI-SELECT IN NETWORK is available in the context menu of the list of all display types and behavior types respectively.

The *.BEW and *.WEG files are no longer necessarily overwritten during a (Multirun) Simulation, since existing output files can be saved to archive now. VISSIM provides complete unicode support for filenames.

Versions Previous to 5.00

Link types are now split into link behavior types and link display types. This allows to handle the graphical display of a group of links independently of the driving behavior. Link display types have several new attributes for 3D display.
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. Set the simulation parameters (cf. section 8.1.1)
3. Create/edit speed profiles (cf. section 5.2.1)
4. Check/edit vehicle type characteristics (cf. section 5.3.1)
5. Create vehicle compositions (cf. section 6.4.1)
6. Open the master plan of your study area as a background image (cf. section 4.4)
7. Place and scale the background image and save background image file. Note: Scaling the background image accurately is extremely important (cf. section 4.4.3)
8. Draw links and connectors for roadways tracks and crosswalks (cf. section 6.3.1)
9. Enter vehicle volumes at network endpoints and pedestrian volumes on crosswalks (cf. section 6.4.3)
10. Enter routing decision points and associated routes (cf. section 6.4.4)
11. Enter speed changes (cf. sections 6.3.3.1 and 6.3.3.2)
12. Define conflict areas for non-signlized intersections (cf. section 6.6.2), for special cases you may enter priority rules, if applicable (cf. section 6.6.1)
13. Enter stop signs for non-signalized intersections (cf. section 6.6.3)
14. 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, cf. section 6.7)
15. Enter signal heads in network (cf. section 6.7.1)
16. Enter detectors for intersections controlled by traffic actuated signal control (cf. section 6.7.2)
17. Enter stop signs for right turns on red (cf. section 6.6.3)
18. Enter priority rules for permissive lefts, right turns on red, pedestrian crosswalks (cf. section 6.6.1)
19. Create dwell time distributions and place PT stops in network (cf. sections 5.2.6 and 6.5.1)
20. Create PT lines (cf. section 6.5.2)
21. Setup for output files, e.g. travel time segments, delay segments, queue counters, data collection points (cf. chapter 11).
22. Run the simulation (cf. section 8.1).
1 Introduction

VISSIM is a microscopic, time step and behavior-based simulation model developed to model urban traffic and public transport operations and flows of pedestrians.
1.1 What is VISSIM?

The program can analyze private and public transport operations under constraints such as lane configuration, vehicle composition, traffic signals, PT stops, etc., thus making it a useful tool for the evaluation of various alternatives based on transportation engineering and planning measures of effectiveness. Accordingly, also pedestrian flows can be modelled, either exclusively or combined with private traffic and/or public transport.

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

► Development, evaluation and fine-tuning of 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).

► Evaluation and optimization (interface to Signal97) of traffic operations in a combined network of coordinated and actuated traffic signals.

► Feasibility and traffic impact studies of integrating light rail into urban street networks.

► Analysis of slow speed weaving and merging areas.

► 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.

► Modeling and simulating flows of pedestrians - in streets and buildings - allow for a wide range of new applications. VISSIM can also simulate and visualize the interactions between road traffic and pedestrians.
1.2 The Traffic Simulation Model

The simulation package VISSIM consists internally of two different parts, 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 the 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 (down to 1/10 of a second). It then determines the signal status for the following time step and returns this information to the traffic simulator.

Communication between traffic simulator and signal state generator
Car following logic (Wiedemann 1974)

The accuracy of a traffic simulation model is mainly dependent on the quality of the vehicle modeling, 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 (since 2009 KIT – Karlsruher Institut für Technologie), 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 react to preceding vehicles (4 by default), but also neighboring vehicles on the adjacent travel lanes are taken into account. 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 the 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 driving behavior corresponds to
the technical capabilities of his vehicle. Attributes characterizing each driver-vehicle unit can be discriminated into three categories:

► Technical specification of the vehicle, for example:
  - Length
  - Maximum speed
  - Potential acceleration
  - Actual position in the network
  - Actual speed and acceleration

► Behavior of driver-vehicle units, for example:
  - 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, for example:
  - 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 Program Installation

VISSIM is designed to run on systems with Microsoft™ Windows 7 and XP and with Vista.

This chapter contains the following information:
► Technical requirements
► Reference to the VISSIM Installation Guide
► Access to the EXAMPLES folder
► The VISSIM Viewer
2.1 System Requirements

The performance of a VISSIM simulation mainly depends on the following:

► the number of vehicles simultaneously contained in the network
► the number of signal controlled junctions
► the type of signal controllers
► the number of processor cores being used

Using identical VISSIM input files, a faster computer will always lead to a faster simulation.

VISSIM is also provided in a 64 bit edition. This makes using more than 3 GB RAM possible.

For very large applications (like an urban network with more than 50 signal controlled junctions) at least 1 GB of RAM is recommended:

<table>
<thead>
<tr>
<th>VISSIM edition</th>
<th>Recommended memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>32 Bit</td>
<td>minimum 2 GB RAM</td>
</tr>
<tr>
<td>64 Bit</td>
<td>minimum 4 GB RAM</td>
</tr>
</tbody>
</table>

As a rule of thumb one VISSIM vehicle takes about 2 kB of RAM. So if a simulation contains 50,000 vehicles in the network, the vehicles alone take up about 100 MB of RAM. Quad-Core processor machines are recommended.

Hyperthreading allows for parallel calculation runs on those computers and the simulation speed is supported. Even while a simulation is running, working is more comfortable.

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 1280x800 pixel should be used. However, we recommend a resolution of 1920x1080 for convenience.

In 3D mode, simulation speed may be significantly lower by using higher screen resolutions. In order to increase the 3D visualization speed it may be useful to resize the main VISSIM window to a smaller size.

The 3D visualization of VISSIM may run significantly slower compared to the 2D visualization. This is due to the fact that the 3D visualization requires a lot more computer power. VISSIM uses Open-GL™ routines for the 3D visualization, therefore a graphics card with Open-GL™ support takes a lot of the workload and results in a faster visualization speed compared to other graphics cards. For up-to-date information on recommended graphics cards please check FAQ #6 on our website on www.ptvag.com/FAQ_VISSIM.

We strongly recommend to use the most recent driver for your graphics card since simply updating the driver solves most problems that occur with the 3D visualization. For most graphic cards the driver update can be downloaded from the Internet.
In case of problems with the VISSIM 3D visualization, please make sure that you have installed the latest graphics driver on your computer before contacting the VISSIM hotline.
2.2 Installation and Deinstallation of VISSIM

The file VISSIM_530_INSTALLMANUAL.PDF contains the guide for the installation and deinstallation procedures of the VISSIM version.

► The DVD (here, drive D:) stores this file in the folder D:\ONCD\DOCUMENTATION\ENG

► After the installation, you find the file on your PC in the folder C:\PROGRAM FILES\PTV_VISION\VISSIM530\DOC\ENG

There, you can open this file in the Explorer or via the button START > ALL PROGRAMS > PTV_VISION > VISSIM 5.30 > DOCUMENTATION > ENGLISH
2.3 Access to the EXAMPLES folder

For VISSIM installations with Windows 7 or Windows Vista, all VISSIM examples are stored in the following directory:

PROGRAMDATA\PTV_VISION\VISSIM530\EXAMPLES

Exceptions: instead of PTV_VISION, PTV_DEMO is used with demo versions and PTV_UNI for installations at academic institutions.

For access to the EXAMPLES\ folder, you can apply either option:

► Use the START button for direct access via the reference:
  Click START > PROGRAMME > PTV_VISION > VISSIM 5.30 > EXAMPLES

► Use the environment variable VISSIM530EXAMPLES, which is created with the installation:
  In the Windows Explorer, enter %VISSIM530EXAMPLES% in the address bar and confirm.

This directory structure and the environment variable apply to VISSIM installations with Windows 7 and Windows Vista.

For Sitraffic Office installations and installations running with Windows XP, the VISSIM examples are installed in the same directory as the VISSIM EXE directory.
2.4 The Distributable VISSIM Viewer

Amendatory to your VISSIM installation, there is also a restricted VISSIM version (= VISSIM Demo version without demo examples) that VISSIM users can hand out to the clients along with VISSIM project data.

These are the main restrictions of this version:
- Network files cannot be saved.
- Evaluation files cannot be generated.
- Simulation runs are possible only for the first 1800s. This period cannot be extended in order to show longer simulation runs. If it is necessary to show the visualization of vehicles and/or pedestrians beyond the first 1800s, animation files (*.ANI) can be used. For animation files there is no time limit.
- The COM interface cannot be used.

How to install the VISSIM-Viewer

Follow the steps outlined below for a download of the VISSIM Viewer setup package:

1. Click [www.ptv-vision.com/download](http://www.ptv-vision.com/download)
   The Traffic Customer Service Download area opens.

2. Enter guest and click the LOG-IN button.
   The list of available downloads appears.

3. Select the recent version of VIEWER_VISSIM_CD.ZIP and click the DOWNLOAD button.
   The authentication window appears.

4. Enter guest twice and confirm Ok.
   Save the *.ZIP file to your hard disk.

5. Extract the *.ZIP file and start a VISSIM Viewer session.

For instructions on how to create a CD for your clients that contains the distributable VISSIM version along with project data please refer to the file README.TXT which is contained in the downloaded *.ZIP file.
3 Program Handling

Similar to other software programs, the VISSIM main window is surrounded by a menu bar and several toolbars which can freely be placed on screen and can be customized by the user.
3.1 The VISSIM Desktop

The desktop of VISSIM is divided into the following areas:

**Header**
Shows program title, version and service pack no. and also the name of the network file; for demo versions, “Demo” is added to the version no.

**Menu bar**
Access is provided via mouse click or keyboard shortcut, cf. section 3.1.1.
Some of the menu commands point to a submenu or window:
- Indicates a pull-out menu.
- “…“ Indicates that a window will open.

The last eight network files accessed by VISSIM (“most recently used files”) are listed in the FILE menu. Click one of these files to open it.

**Tool bars**
Control network editor and simulation functions (cf. section 3.1.2).

**Status bar**
Shows editing instructions and simulation status (cf. section 3.1.3).

**Scroll bars**
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 corner of the VISSIM network.
In the lower right corner, you may display a custom logo by naming it CUSTOM.BMP and placing it in the same directory as VISSIM.EXE.
### 3.1.1 The VISSIM Menus

Menu items can be re-arranged, inserted or removed. Also all menu commands can be placed inside any of the toolbars, cf. section 3.1.1.2.

#### 3.1.1.1 Default Menus

#### FILE

General file management and printing commands:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>Initialize system (close network file without saving data, create new VISSIM network)</td>
</tr>
<tr>
<td>Open</td>
<td>Open network file</td>
</tr>
<tr>
<td>Read Additionally</td>
<td>Open network file in addition to the existing network</td>
</tr>
<tr>
<td>Save</td>
<td>Save network to current *.INP file</td>
</tr>
<tr>
<td>Save As ...</td>
<td>Save network to selected path &amp; file name</td>
</tr>
<tr>
<td></td>
<td>If a different path is chosen, the referenced files required by the network need to be copied manually to the new folder.</td>
</tr>
<tr>
<td>Import</td>
<td>Read SYNCHRO7 data from file or load Abstract Network Model data from VISUM, cf. section 6.2.1</td>
</tr>
<tr>
<td>Export</td>
<td>Start data export to VISUM or to 3DS MAX, cf. section 6.2.1.6</td>
</tr>
<tr>
<td>Page Setup</td>
<td>Set parameters for print output</td>
</tr>
<tr>
<td>Print Preview</td>
<td>Page preview on screen prior to printing</td>
</tr>
<tr>
<td>Print</td>
<td>Print output to file/device</td>
</tr>
<tr>
<td>Open Working</td>
<td>Opens the Windows Explorer in the current working directory (where the *.INP file is stored)</td>
</tr>
<tr>
<td>Directory</td>
<td></td>
</tr>
<tr>
<td>List of most</td>
<td>List of most recently used network files. The list is updated whenever an *.INP file is either opened or saved with a new file name. Update is</td>
</tr>
<tr>
<td>recently used</td>
<td>performed before the FILE menu is opened. That is why all parallel running instances of a single main version (5.20) share a single list.</td>
</tr>
<tr>
<td>files</td>
<td></td>
</tr>
<tr>
<td>Exit</td>
<td>Terminate session, close VISSIM</td>
</tr>
</tbody>
</table>

#### EDIT

Network editing commands:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undo</td>
<td><em>Undo</em> functionality for construction element</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Redo</td>
<td>Redo functionality for construction element editing (Pedestrians add-on): Redoes the previously undone action.</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete selected Links/Connectors and/or Nodes</td>
</tr>
<tr>
<td>Split Link</td>
<td>Splits the selected link</td>
</tr>
<tr>
<td>Combine Routes</td>
<td>Combines static routes</td>
</tr>
<tr>
<td>3D Signal Heads</td>
<td>Enables the 3D Signal Heads editing mode and displays 3D signal head locations in 2D</td>
</tr>
<tr>
<td>Selection Mode</td>
<td>Allows for selection of the Standard (Single-Select), Multiselect or Label mode for network editing</td>
</tr>
<tr>
<td>Selection List</td>
<td>Calls the list of network elements for the currently active network editing mode</td>
</tr>
<tr>
<td>Check Nodes/Edges</td>
<td>Only in the Nodes mode: Checks the nodes/edges structure for damages</td>
</tr>
<tr>
<td>Edge Selection</td>
<td>Active only in Nodes mode: Opens the list of all edges of a Dynamic Assignment</td>
</tr>
<tr>
<td>Auto Routing Selection</td>
<td>Active only in Routes mode or Parking Lots mode: Opens the list of all paths of a Dynamic Assignment</td>
</tr>
<tr>
<td>Rotate Network</td>
<td>Rotates the entire network around (0,0)</td>
</tr>
<tr>
<td>Translate Network</td>
<td>Moves the entire network in x, y and/or z direction</td>
</tr>
<tr>
<td>View</td>
<td>Commands and options for display on screen:</td>
</tr>
<tr>
<td>Options</td>
<td>Set general display options</td>
</tr>
<tr>
<td>Level Display</td>
<td>Define 3D display for pedestrians add-on</td>
</tr>
<tr>
<td>Center Line</td>
<td>Toggle center line display</td>
</tr>
<tr>
<td>3D Mode</td>
<td>Toggle 2D/3D display mode</td>
</tr>
<tr>
<td>Network Elements</td>
<td>Configuration of the multiple network elements display</td>
</tr>
<tr>
<td>Show Network Elements</td>
<td>Switch on/off display of network elements</td>
</tr>
<tr>
<td>Background</td>
<td>Load and configure background image file(s)</td>
</tr>
<tr>
<td>Show Background</td>
<td>Toggle background display</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>Status Bar</td>
<td>Select simulation time display format</td>
</tr>
<tr>
<td>Load Settings…</td>
<td>Open VISSIM settings file *.INI</td>
</tr>
<tr>
<td>Save Settings…</td>
<td>Save VISSIM settings file *.INI</td>
</tr>
</tbody>
</table>

**BASE DATA**  
User-editable base data for the simulation:

<table>
<thead>
<tr>
<th>Functions</th>
<th>Cf. section 5.1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Distributions</td>
<td>Cf. section 5.2</td>
<td></td>
</tr>
<tr>
<td>Emission</td>
<td>Parameters for Cold Emission module</td>
<td></td>
</tr>
<tr>
<td>Vehicle Types</td>
<td>Cf. section 5.3.1</td>
<td></td>
</tr>
<tr>
<td>Vehicle Classes</td>
<td>Cf. section 5.3.2</td>
<td></td>
</tr>
<tr>
<td>Driving Behavior</td>
<td>Cf. section 5.4</td>
<td></td>
</tr>
<tr>
<td>Link Behavior Types</td>
<td>Cf. section 5.5.1</td>
<td></td>
</tr>
<tr>
<td>Pedestrian Types</td>
<td>Cf. section 7.1.2</td>
<td></td>
</tr>
<tr>
<td>Pedestrian Classes</td>
<td>Cf. section 7.1.3</td>
<td></td>
</tr>
<tr>
<td>Walking Behavior</td>
<td>Cf. section 7.1.9.1</td>
<td></td>
</tr>
<tr>
<td>Area Behavior Types</td>
<td>Cf. section 7.1.9.2</td>
<td></td>
</tr>
<tr>
<td>Display Types</td>
<td>Display options for links and construction elements, cf. section 5.5.2</td>
<td></td>
</tr>
<tr>
<td>Level Properties</td>
<td>Definition for <em>Multiple Levels</em> Add-on (currently for pedestrians only)</td>
<td></td>
</tr>
</tbody>
</table>

**TRAFFIC**  
User-defined vehicle/pedestrian flow data:

<table>
<thead>
<tr>
<th>Vehicle Compositions</th>
<th>Traffic compositions for vehicular traffic, cf. section 6.4.1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian Compositions</td>
<td>Traffic compositions for pedestrian traffic, cf. section 7.1.6</td>
<td></td>
</tr>
<tr>
<td>External Vehicle Course Files</td>
<td>Display of externally created vehicle data, cf. section 6.4.2</td>
<td></td>
</tr>
<tr>
<td>Dynamic Assignment</td>
<td>Parameters for Dynamic Assignment, cf. section 12.8.6</td>
<td></td>
</tr>
<tr>
<td>Dynamic Assignment -</td>
<td>Starts the automatic VISUM assignment calculation</td>
<td></td>
</tr>
</tbody>
</table>
### 3 Program Handling

<table>
<thead>
<tr>
<th>VISUM Assignment</th>
<th>Toll Pricing Calculation Models</th>
<th>Managed Lanes Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment</td>
<td>Definition for managed lanes</td>
<td>Definition for managed lanes</td>
</tr>
</tbody>
</table>

### SIGNAL CONTROL

**Data input for Signal Control:**

<table>
<thead>
<tr>
<th>Edit Controllers</th>
<th>Create/Edit/Delete signal controllers, cf. section 6.7.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>Link/Unlink signal controllers, cf. section 6.7.6</td>
</tr>
<tr>
<td>Optimize All Fixed Time Signal Controllers</td>
<td>Starts the greentime optimization of all the stage-based fixed time controllers in the network, cf. section 6.7.3.11</td>
</tr>
</tbody>
</table>

### EVALUATION

**Select evaluation type(s) and set parameters:**

<table>
<thead>
<tr>
<th>Windows</th>
<th>Configuration of online evaluations, cf. chapter 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Files</td>
<td>Configuration of off-line evaluations, cf. chapter 11</td>
</tr>
<tr>
<td>Database</td>
<td>Database configuration for evaluations, cf. section 10.1.3</td>
</tr>
<tr>
<td>Analyzer Reports</td>
<td>Production of report-ready evaluations of simulation runs, cf. section 11.24</td>
</tr>
</tbody>
</table>

### SIMULATION

**Simulation parameters and run control:**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Set simulation parameters, cf. section 8.1.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous</td>
<td>Run simulation continuous</td>
</tr>
<tr>
<td>Single Step</td>
<td>Run simulation one step further</td>
</tr>
<tr>
<td>Stop</td>
<td>Stop the simulation run</td>
</tr>
<tr>
<td>Multirun</td>
<td>Set parameters and start Multirun simulation, cf. section 8.1.3</td>
</tr>
<tr>
<td>Load Snapshot</td>
<td>Load simulation snapshot file, cf. section 8.1.2</td>
</tr>
<tr>
<td>Save Snapshot</td>
<td>Save current simulation state as snapshot</td>
</tr>
</tbody>
</table>
Create and control a simulation presentation, cf. chapter 9:

<table>
<thead>
<tr>
<th>PRESENTATION</th>
<th>3D Video</th>
<th>3D Mode only: Set parameters for video recording, cf. section 9.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVI Recording</td>
<td>3D Mode only: Toggle *.AVI file recording, cf. section 9.2.3</td>
<td></td>
</tr>
<tr>
<td>Animation Parameters</td>
<td>Set parameters for recording an animation file, cf. section 9.1</td>
<td></td>
</tr>
<tr>
<td>ANI Recording</td>
<td>Toggle *.ANI file recording, cf. section 9.1.1</td>
<td></td>
</tr>
<tr>
<td>ANI.TXT Recording</td>
<td>Saves the trajectories of vehicles and pedestrians to a text file for import in Autodesk’s 3ds Max software</td>
<td></td>
</tr>
<tr>
<td>Continuous</td>
<td>Run continuous animation</td>
<td>F5</td>
</tr>
<tr>
<td>Single Step</td>
<td>Run animation one step further</td>
<td>F6</td>
</tr>
<tr>
<td>Stop</td>
<td>Stop the animation run</td>
<td>Esc</td>
</tr>
</tbody>
</table>

Test of signal control without traffic simulation, cf. section 8.2:

<table>
<thead>
<tr>
<th>TEST</th>
<th>Continuous</th>
<th>Run continuous test</th>
<th>F5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single Step</td>
<td>Run test one step further</td>
<td>F6</td>
</tr>
<tr>
<td></td>
<td>Stop</td>
<td>Stop test run</td>
<td>Esc</td>
</tr>
<tr>
<td></td>
<td>Macro</td>
<td>Define/Edit macros for test runs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loop</td>
<td>Batch mode operation for test runs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recording</td>
<td>Toggle macro recording for test run</td>
<td></td>
</tr>
</tbody>
</table>

Access to script files, cf. section 3.5.1:

| SCRIPTS | Run script file | Open and run script file (*.VBS, *.PYS, *.PY, *.JS) |

Information on current VISSIM version, Service and Contact, cf. chapter 15:

| HELP | Online Help | Opens the online help | F1 |
3.1.1.2 Customizing Menus

Menu commands can be re-arranged, new commands inserted or exiting ones removed. A copy of a submenu can be placed outside the menu area either as a toolbar or floating window. Menu commands can also be placed inside of any toolbar.

In case of customized 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 its original location**

1. Drag the menu at the “grip” section (between the title and the commands) and pull it to the desired location.

2. The sub menu is shown as a floating toolbar.

3. Now you can also dock this menu to any border of the main VISSIM menu.
To edit the menu content

1. Right click inside the menu area. A context menu appears.
2. Choose CUSTOMIZE... to call the Customize window.
3. While being in the Customize mode you may do the following:
   - **Add** a menu command:
     On 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:
     Drag the command with the mouse to the desired position.
   - **Remove** a command from a menu:
     Drag the command 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, click RESET... and confirm with Ok.

### 3.1.2 The VISSIM Toolbars

VISSIM offers toolbars that can be docked to any position along the four borders of the main VISSIM window. Toolbars can also be torn away from 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 Default Toolbars

**FILE** General file management and printing commands:

| ![Create new VISSIM network file] | Create new VISSIM network file |
| ![Open existing VISSIM network file] | Open existing VISSIM network file |
| ![Save VISSIM network file to given path / file name] | Save VISSIM network file to given path / file name |
| ![Print Preview] | Print Preview |
| ![Print] | Print |

CTRL+S

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### SELECTION

Defines the edit mode in combination with the selected network element:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-select mode (Standard)</td>
<td></td>
</tr>
<tr>
<td>Multi-select mode</td>
<td></td>
</tr>
<tr>
<td>Label position mode</td>
<td>Any labels of network elements (e.g. of signal heads) can be relocated while the edit mode of that network element is active.</td>
</tr>
<tr>
<td>TAB</td>
<td>If several links/connectors are located at the mouse click position click this button to browse through all these links/connectors.</td>
</tr>
</tbody>
</table>

### PEDESTRIAN MODE

*Pedestrian mode* add-on for modelling and simulation of pedestrian flows.

For the *Pedestrian elements* toolbar, please see below.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian mode</td>
<td>Toggles between vehicular and pedestrian traffic mode.</td>
</tr>
</tbody>
</table>

### SIMULATION

The toolbar for *Simulation* run control is visible by default.

There are additional toolbars for *Animation* or *Test* runs. Furthermore there is the *Run Control* toolbar which controls the most recently used run mode. All of these additional toolbars are not visible by default.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run simulation continuous</td>
<td>Use F5 to run simulation continuously.</td>
</tr>
<tr>
<td>Run simulation one step further</td>
<td>Use F6 to run simulation one step further.</td>
</tr>
<tr>
<td>Stop simulation</td>
<td>Use Esc to stop simulation.</td>
</tr>
</tbody>
</table>

### NAVIGATION

Commands for changing the observer position within the network.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Show entire network</td>
<td>Use PAGE UP, PAGE DOWN to show entire network.</td>
</tr>
<tr>
<td>Dynamic zoom (left click or mouse wheel), Previous view (right click)</td>
<td>Use PAGE UP, PAGE DOWN to zoom by factor.</td>
</tr>
<tr>
<td>Move network (3D only, shortcuts also in 2D)</td>
<td>Use ↑,↓,←,→ to move network (3D only).</td>
</tr>
<tr>
<td>Rotate network (3D only)</td>
<td></td>
</tr>
<tr>
<td>Fly through network (3D only)</td>
<td></td>
</tr>
</tbody>
</table>
In the vehicular traffic mode a new element of the corresponding type can be created or existing items of this type can be edited, while one of the following buttons is pressed. For details by element please refer to chapter 6 if not stated otherwise.

<table>
<thead>
<tr>
<th>Network Elements</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Links and connectors</td>
</tr>
<tr>
<td></td>
<td>Pavement Markers (Graphics only)</td>
</tr>
<tr>
<td></td>
<td>Vehicle inputs</td>
</tr>
<tr>
<td></td>
<td>Routing decisions and routes (to direct traffic within the network)</td>
</tr>
<tr>
<td></td>
<td>Desired speed decisions (permanent change of vehicle speed)</td>
</tr>
<tr>
<td></td>
<td>Reduced speed areas (temporary change of vehicle speed)</td>
</tr>
<tr>
<td></td>
<td>Priority rules (e.g. for non-signalized intersections)</td>
</tr>
<tr>
<td></td>
<td>Conflict areas</td>
</tr>
<tr>
<td></td>
<td>Stop signs</td>
</tr>
<tr>
<td></td>
<td>Signal heads</td>
</tr>
<tr>
<td></td>
<td>Signal detectors</td>
</tr>
<tr>
<td></td>
<td>Public transport stops</td>
</tr>
<tr>
<td></td>
<td>Public transport lines</td>
</tr>
<tr>
<td></td>
<td>Cross section measurements (cf. chapter 11)</td>
</tr>
<tr>
<td></td>
<td>Travel time and delay measurements (cf. chapter 11)</td>
</tr>
<tr>
<td></td>
<td>Queue counters (cf. chapter 11)</td>
</tr>
<tr>
<td></td>
<td>Parking lots / zone connectors (cf. chapter 12)</td>
</tr>
<tr>
<td></td>
<td>Nodes (some VISSIM licenses also allow for node evaluation independently of Dynamic Assignment; cf. chapter 12)</td>
</tr>
</tbody>
</table>
In the pedestrian traffic mode a new construction element of the corresponding type can be created or an existing item can be edited while one of the upper three buttons is pressed. The buttons underneath serve for definition of pedestrian inputs or routes and evaluations as well. For details please refer to chapter 7 if not stated otherwise.

### 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.

### Editing the toolbar content

1. Right click inside the toolbar area. The context menu appears.
2. Choose **Customize...** to open the **Customize** window.
3. In the [**TOOLBARS**] tab you may
   - **Enable/Disable** a toolbar:
     Toggle the **✓** checkbox in the list of **Toolbars**
   - **Create** a new toolbar:
     Press **NEW...** and choose the desired name and position of the new toolbar. Then confirm with **Ok**
   - **Rename/Delete** a custom toolbar:
     Press the corresponding buttons (the standard VISSIM toolbars cannot be removed or deleted)
   - **Reset** to VISSIM defaults: Press **RESET...** and confirm 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 to another toolbar:
     Drag the button to the desired position inside another toolbar
   - **Remove** a button/command from a toolbar:
     Drag the button outside any toolbar.

### 3.1.3 How to Reset Customized Menus, Toolbars and Windows

1. Close the VISSIM session.
2. In the Explorer, open the EXE folder of your VISSIM installation and double-click VDIAGGUI.EXE.
3. In the [ACTION] tab, left-click the appropriate button:
   - **RESET TOOLBAR AND MENU**
   or
   - **RESET WINDOW POSITIONS**
   This will take effect when the next program session starts.

For details on the support functionality of this diagnostics tool, please refer to section 10.2.2.2.
### 3.1.4 The VISSIM Status Bar: Data Output

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

<table>
<thead>
<tr>
<th>Section 1</th>
<th>2D Graphics:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Current cursor position (x, y coordinates in meters, “world coordinates”)</td>
</tr>
<tr>
<td>3D Graphics:</td>
<td>- 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.</td>
</tr>
<tr>
<td></td>
<td>- Flight mode: Current camera position (x, y, z coordinates in [m]).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section 2</th>
<th>Network editing:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Number of selected link/connector</td>
</tr>
<tr>
<td></td>
<td>- Position within selected link/connector (if mouse is inside selected link)</td>
</tr>
<tr>
<td>Simulation:</td>
<td>- Current simulation time and local cycle time</td>
</tr>
<tr>
<td></td>
<td>- Cf. section 4.1.6: The default shortcut <strong>CTRL-U</strong> toggles between the display types of the simulation time.</td>
</tr>
<tr>
<td>3D Graphics (Flight mode, not during simulation):</td>
<td>- Focal point position (the point the ‘plane’ is aiming for; x, y, z coordinates in meters)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section 3</th>
<th>Network editing:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Editing instructions</td>
</tr>
<tr>
<td>Network editing (3D-Zoom, Rotate, Pan):</td>
<td>- Current observer position (d, A, C):</td>
</tr>
<tr>
<td></td>
<td>- d = distance (in meters) above level 0.0 m</td>
</tr>
<tr>
<td></td>
<td>- A = angle between XZ-plane and observer</td>
</tr>
<tr>
<td></td>
<td>- C = angle between XY-plane and observer</td>
</tr>
<tr>
<td>Simulation:</td>
<td>- Number of vehicles currently in the network</td>
</tr>
<tr>
<td></td>
<td>- Speed factor (actual simulation speed compared to real time)</td>
</tr>
<tr>
<td></td>
<td>- In parentheses: Number of vehicles that could be simulated at real time (displayed only if simulation speed = maximum)</td>
</tr>
<tr>
<td></td>
<td>- When command line parameter -s&lt;n&gt; was used to start VISSIM: No. of current simulation run and (total number of runs).</td>
</tr>
</tbody>
</table>
3.2 Keyboard and Mouse Operation

The information provided in section 3.2.1 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).

3.2.1 General Behavior

<table>
<thead>
<tr>
<th>Right mouse key</th>
<th><strong>Click outside</strong> the network: Calls a list of all defined elements of the current edit mode. Here, the <strong>Zoom</strong> button can be used to focus on the network section where the network element is located. <strong>Click inside</strong> the network (e.g. on a link): Inserts a new element.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Left mouse key</strong></td>
<td><strong>Single-click</strong>: Select an existing element. <strong>Double-click</strong>: Open the associated properties window.</td>
</tr>
<tr>
<td><strong>Middle mouse key</strong></td>
<td>Panning the network display</td>
</tr>
<tr>
<td><strong>Mouse wheel</strong></td>
<td>Up = Zoom in / Down = Zoom out</td>
</tr>
<tr>
<td><strong>RETURN</strong></td>
<td>Corresponds to a mouse click on the highlighted button (usually the OK button).</td>
</tr>
<tr>
<td><strong>ESC</strong></td>
<td>Corresponds to a mouse click on the CANCEL button.</td>
</tr>
<tr>
<td><strong>DEL</strong></td>
<td>Deletes a selected network element.</td>
</tr>
</tbody>
</table>

3.2.2 The VISSIM 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 shortcuts, cf. section 3.2.2.2.

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 Default Shortcuts

<table>
<thead>
<tr>
<th>Shortcut</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CTRL+A</strong></td>
<td>Toggles between <em>Center Line</em> and the last active link display mode (either <em>Normal</em> or <em>Invisible</em>).</td>
</tr>
<tr>
<td><strong>CTRL+B</strong></td>
<td>Toggles the display of loaded background images.</td>
</tr>
<tr>
<td><strong>CTRL+C</strong></td>
<td>Copies the selected 3D signal, continue with <strong>CTRL+V</strong>.</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+H</strong></td>
<td>Toggles the display of 3D signals.</td>
</tr>
<tr>
<td><strong>CTRL+L</strong></td>
<td>Loops through all LOS definitions during the simulation of pedestrians in aggregate data display mode.</td>
</tr>
<tr>
<td><strong>CTRL+M</strong></td>
<td>Toggles the display of the compass.</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 visualization of individual vehicles/pedestrians / alternative display of aggregate values for vehicles on links or of pedestrians on construction elements / no visualization). While the pedestrian simulation is running in aggregate data display mode, the currently selected LOS type is displayed in the status bar when looping via <strong>CTRL+L</strong>.</td>
</tr>
<tr>
<td><strong>CTRL+T</strong></td>
<td>Toggles the color of links and walkable elements: either display type specific color or global color, cf. section 4.1.3</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, cf. section 4.2.2.</td>
</tr>
<tr>
<td><strong>CTRL+Z</strong></td>
<td>Dynamic Assignment only (while in <em>Parking Lots</em> mode): Shows the centroids of all parking lots that belong to the same zone. Cf. section 12.7.2 for details.</td>
</tr>
<tr>
<td><strong>CTRL+SHIFT+C</strong></td>
<td>Dynamic Assignment only: Sets the relative volumes of all parking lots to the volume totals of their paths in the current path file <em>.WEG</em>. Cf. section 12.7.2 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 <em>Continuous</em>: Starts/continues continuous simulation.</td>
</tr>
<tr>
<td><strong>F6</strong></td>
<td>Simulation <em>Step</em>: Executes next simulation time step.</td>
</tr>
<tr>
<td><strong>ESC</strong></td>
<td>Simulation <em>Stop</em>: Ends the simulation.</td>
</tr>
<tr>
<td><strong>ENTER</strong></td>
<td>(during a simulation run only:) Switch to <em>continuous</em> simulation.</td>
</tr>
<tr>
<td><strong>SPACE</strong></td>
<td>(during a simulation run only:) Executes next simulation time step.</td>
</tr>
<tr>
<td>Key</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>+</td>
<td><strong>Increase</strong> simulation speed (depending on computer performance)</td>
</tr>
<tr>
<td>-</td>
<td><strong>Decrease</strong> simulation speed</td>
</tr>
<tr>
<td>*</td>
<td><strong>Maximum</strong> simulation speed (depending on computer performance)</td>
</tr>
<tr>
<td>/</td>
<td>(if maximum speed is active:) Back to last speed value</td>
</tr>
<tr>
<td>1</td>
<td>Simulation speed <a href="1.0s">real time</a></td>
</tr>
<tr>
<td><strong>HOME</strong></td>
<td>Display entire network</td>
</tr>
<tr>
<td><strong>BACKSPACE</strong></td>
<td>Back to previous view</td>
</tr>
<tr>
<td><strong>PgUp, PgDn</strong></td>
<td>Zoom in/out (fast)</td>
</tr>
<tr>
<td>T, G</td>
<td>Zoom in/out (slow)</td>
</tr>
<tr>
<td>↑, ↓, ←, → or E, D, S, F</td>
<td>Scrolls the screen. To speed up moving, hold down <code>&lt;SHIFT&gt;</code> simultaneously.</td>
</tr>
<tr>
<td><strong>K, I</strong></td>
<td>3D mode only: Tilt the network plain up/down</td>
</tr>
<tr>
<td><strong>J, L</strong></td>
<td>3D mode only: Rotate the network around the z-axis</td>
</tr>
<tr>
<td><strong>Q, A</strong></td>
<td>3D mode only: Moves the current observer camera vertically (like an elevator). To speed up moving, hold down <code>&lt;SHIFT&gt;</code> simultaneously.</td>
</tr>
<tr>
<td><strong>CTRL+PgUp, CTRL+PgDn</strong></td>
<td>3D mode only: Increase/Decrease the focal length of the observer camera (telephoto/wide-angle).</td>
</tr>
</tbody>
</table>

### 3.2.2.2 Customizing Shortcuts

1. Right click in the toolbar area.
2. Select **CUSTOMIZE...** from the context menu. The Customize window opens.
4. Out of the **Categories** list, select a command category. On the right, select the command for which you would like to add a shortcut.
5. Choose the desired shortcut from the selection list. If the selected shortcut has been assigned to another command already, the 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.
3.3 Selection of Network Elements

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

- In 2D display mode, all three selection modes are available.
- In 3D display 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 follow the steps outlined below:

- Select the desired element edit mode
- Mark the desired link or connector by a single left click
- Follow the instructions how 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. There are two ways to open this list:

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

The element type is displayed in the window title along with the total number of instances of this type.

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 BY FACTOR command additionally after pressing the ZOOM button to see the surrounding area of the selected network element.
### Multi-Select Mode (2D only)

Currently the multi-select mode is available for processing of network elements being located completely within the selection:

- Editing certain properties of links and connectors
- Moving links, connectors and nodes
- Deleting links, connectors and nodes

#### Multiselection of Network Elements

- Keep left mouse-key pressed while spanning a rectangle. All elements being located completely inside are selected:
  - Links and connectors
  - Node polygons
- Links/connectors can be added to the selection (independent of their previous state) by pressing **SHIFT** while drawing the rectangular selection box.
- Links/connectors can be removed from the selection (independent of their previous state) by pressing **CTRL** while drawing the rectangular selection box.
- Toggle functionality: Left-click the a single link/connector or node to add the single element to the selection or to remove it from the selection.
- The entire selection can be cancelled by clicking outside the selection while pressing **CTRL**.
- All links/connectors in the selection can be moved by clicking inside the selection.
  
  Connectors that connect two selected links are moved together with the corresponding links - even if the connector itself is not included in the selection.

  If **intermediate points** of a connector should not be moved (along with the start and end points) such a connector needs to be deselected and **CTRL** must be pressed while moving the selection.

  The following applies to nodes defined by link segments (exported from VISUM)

  - Segment nodes in the polygon are not highlighted as if being selected.
  - Their status selected / not selected cannot be changed by mouse-click.
  - They are not affected by moving links - only the position of labels may change.
  - Even if being not selected, segment nodes inside the polygon are deleted like selected polygon nodes.
3.3.2.2 Properties & Options: Editing in Multiselect Mode

The properties of all selected links and connectors can be accessed by right mouse click (for link evaluations, cf. chapter 11.11). The following attributes can be changed (for details please refer to the sections Links and Connectors in section 6.2.2.4):

- **Behavior Type**: If the original values are not identical for all links, select the entry 0 Keep old values to retain these values for all links.
- **Display Type**: ditto
- **Gradient**
- **Thickness (3D)**
- **Link Evaluation**
- **Segment length of links**
- **Visualization** (of vehicles)
- **Label**
- **COST** calls the Link Cost window
- **LANE CLOSURE** calls the Lane Closure window
- **CONNECTORS** calls the Connectors (Multiselection) window.

Here the following connector attributes can be edited additionally:

- **Emergency Stop** position
- **Lane Change** position
- **Recalculate Spline**: If this option is active, you can either keep the number of points given by connector or you can enter the new number of points which is to be applied for curve calculation to all of the selected connectors.
- **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 Values (i.e. all connectors remain unchanged). To change all connectors to the same value, select the desired Direction.
3.3.3 **Label Mode (2D only)**

If any of the labels of network elements are visible (cf. section 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 heads** mode must be active. The position of each label is stored in the VISSIM network file *.INP.*
3.4 The VISSIM Command Line Operations

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 be stored 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>Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;INP-filename&gt;</td>
<td>Loads the input file.</td>
</tr>
<tr>
<td>-b&lt;INI-filename&gt;</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>-d&lt;n&gt;</td>
<td>Sets the number of decimal places for the evaluation files to &lt;n&gt;. The following evaluations are regarded: Analyzer output, Node evaluation, Link evaluation, Vehicle protocol, Pedestrian protocol</td>
</tr>
<tr>
<td>-nosearchpaths</td>
<td>Dyn. Assignment: Do not perform short path search.</td>
</tr>
<tr>
<td>-regserver</td>
<td>Register/unregister VISSIM as COM server. The main VISSIM window is briefly shown in case of successful registration, otherwise a message box appears.</td>
</tr>
<tr>
<td>-unregserver</td>
<td></td>
</tr>
<tr>
<td>-s&lt;n&gt;</td>
<td>Starts and runs the simulation &lt;n&gt; times. Any non-critical runtime errors will not display a message box. The status bar shows the number of the current run. Refer to section 8.1.3 for another method of running multiple simulation runs with VISSIM.</td>
</tr>
<tr>
<td>-threads&lt;n&gt;</td>
<td>[2 ≤ n ≤ 8] In the simulation kernel, VISSIM uses multithreading. Thus a simulation can run much faster on multi-processor or multicore PCs using this option.</td>
</tr>
<tr>
<td>-v&lt;%volume&gt;</td>
<td>The volume flag is only used with Dynamic Assignment (optional module) and the number following is the percentage that - during each simulation run - is added to the percentage specified in the Dynamic Assignment window as Scale Total Volume to [%]. The volume will</td>
</tr>
</tbody>
</table>
increase by this percentage every run until 100% is reached. Further runs will be performed with 100%.

Example

Example for running VISSIM from a batch file:
C:\VISSIM\EXE\VISSIM.EXE C:\VISSIM\EXAMPLE\KING.INP -S7 -V10
3.5 The 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 the COM interface is included in the documentation VISSIM_COM.PDF which is contained in the folder <VISSIM-INSTALLATION>\DOC.

Please note that neither the external COM interface nor the SCRIPTS menu is provided with VISSIM demo or viewer versions, cf. section 2.4.

3.5.1 Loading and Running Scripts in VISSIM

External scripts can be read from file interactively via menu SCRIPTS - RUN SCRIPT FILE.

The execution of the script will start automatically then.

Open script file

- Click menu SCRIPTS – RUN SCRIPT FILE.
- The window Open Script File appears.
- Select a file and click OPEN.

In VISSIM, script files have the extensions *.VBS, *.JS, *.PYS or *.PY.

Notes to users starting a script file interactively

The global variable Vissim can be used throughout the script without prior initialization. It always refers to the VISSIM instance from which the script is run.

This object Vissim on top of the script file has not been created with CreateObject, because VISSIM is already running (it is possible however, to do so if further Vissim instances are needed in the script). Scripts can use the entire command set of the Visual Basic Scripting Edition (VBS), e.g. loops, if-then-else, I/O functions and error handling. Scripts may not contain any global declarations.

Example

This script serves for dividing all input flow volumes by two:

```
Set all_flows = VISSIM.Net.VehicleInputs
For i = 1 To all_flows.Count
    all_flows(i).AttValue("VOLUME") = 0.5 * all_flows(i).AttValue("VOLUME")
Next
```
3.5.2 Python as Script Language

VISSIM additionally supports Python besides VBA/VBS. Python is characterized by its very comfortable functions, e.g. for chart creation as well as for the development of functions of user surfaces. Python provides for the setup of a user guidance tailored to a particular project.

Python and all additional libraries are open source programs without any confinements concerning their use.

As a precondition, the *Python interpreter* and the *PythonWin* supplement providing Python with a COM functionality have to be installed first.

PTV provides a library of scripts for a great variety of tasks. They can easily be used by the user and modified according to their own requirements. In the future, these scripts will be provided on the PTV website.

Example

*.PYS

As an example of the possibilities of the script language, the following example file serves for dynamic changes to the state of static 3D objects:
# Python Script sample for VISSIM
# Copyright (C) PTV AG. All rights reserved.
# SB, VR 2006-07-25
#
# This code demonstrates the use of the following interfaces for the simulation of a
# car park with access control and available free places information:
# - ISignalControllers and ISignalGroups
# - IDetectors: Use of the attributes PRESENCE and IMPULSE
# - IStaticObjects: Use of the attribute STATE to change 3D state during simulation time
#
import win32com.client

# constants
NAREAS = [0, 1, 2]
GREEN = 2 # signal group type # permanent green#
RED = 3 # signal group type # permanent red#
OPENEDTIME = 5 # opened barrier time
NPLACES = 11 # number of places

# initialize global variables
Sim = VISSIM.Simulation
SgCtrls = VISSIM.Net.SignalControllers
SgGrps = [SgCtrls.GetSignalControllerByNumber(i+1).SignalGroups.GetSignalGroupByNumber(1) for i in NAREAS]
[SgGrps[i].SetAttValue("TYPE", RED) for i in NAREAS]
St_objs = VISSIM.Net.StaticObjects
Barriers = [St_objs.GetStaticObjectByName('Barrier0' + str(i+1) + '.v3d') for i in NAREAS]
[Barriers[i].SetAttValue("STATE", 0) for i in NAREAS]
BarrierOpening = [False for i in NAREAS]
BarrierClosing = [False for i in NAREAS]
Dets = [SgCtrls.GetSignalControllerByNumber(i+1).Detectors for i in NAREAS]
DetsIn = [Dets[i].GetDetectorByNumber(11) for i in NAREAS]
DetsPass = [Dets[i].GetDetectorByNumber(12) for i in NAREAS]
DetsOut = [Dets[i].GetDetectorByNumber(91) for i in NAREAS]
VehEntering = [False for i in NAREAS]
VehParked = [0 for i in NAREAS]
CtrName = [['Counter_P0' + str(i+1) + j + '.v3d' for i in NAREAS] for j in ['a', 'b']]

# control detector for the entrance, pass and exit

def ControlEntrances() :
# Through all entrances for i in NAREAS :
    # if vehicle is on the entrance and no entrance is being processed
    # then start enter process
    if DetsIn[i].AttValue("PRESENCE") and not VehEntering[i] :
        VehEntering[i] = True # start entrance process
        BarrierOpening[i] = True # start open barrier process

    # did the entering vehicle enter?
    if VehEntering[i] and DetsPass[i].AttValue("PRESENCE") :
        SgGrps[i].SetAttValue("TYPE", RED) # don't allow to enter
        BarrierClosing[i] = True # start closing barrier

# open and close barriers appropriately
def ControlBarriers() :
    #through all barriers for i in NAREAS :
    if BarrierOpening[i] : #opening barrier
        if Barriers[i].AttValue('STATE') < Barriers[i].AttValue('NSTATES') - 2 :
            Barriers[i].SetAttValue('STATE', Barriers[i].AttValue('STATE') + 1) #opening

        if Barriers[i].AttValue('STATE') == Barriers[i].AttValue('NSTATES') - 2 : # opened
            BarrierOpening[i] = False
            SgGrps[i].SetAttValue('TYPE', GREEN) #allow vehicle to enter

    if BarrierClosing[i] : #closing barrier
        if Barriers[i].AttValue('STATE') > 0 :
            Barriers[i].SetAttValue('STATE', Barriers[i].AttValue('STATE') - 1) #closing

        if Barriers[i].AttValue('STATE') == 0 : #barrier closed
            BarrierClosing[i] = False
            VehEntering[i] = False

    #=======================================================
    #update occupied places counters
    #=======================================================
    def CountOccupiedSpaces() :
        ...
        ...

    #=======================================================
    #update digit counters
    #=======================================================
    def UpdateCounters() :
        ...
        ...

    #start simulating
    for SimStep in range(1, Sim.Period * Sim.Resolution) :
        Sim.RunSingleStep()

        ControlEntrances()
        ControlBarriers()
        CountOccupiedSpaces()

        #update counters every second
        if (SimStep % Sim.Resolution) == 0:
            UpdateCounters()

        VISSIM.DoEvents() #allow VISSIM to handle its events
        #=======================================================
3.6 **Print Output**

This section shows how to print the graphical network and other VISSIM outputs.

3.6.1 **Printing the Graphical Network**

The Graphical network (e.g. the current simulation state) can be printed or exported to a print file using the **FILE - PRINT** command. The print output of a VISSIM network consists of the following:

- the current screen display
- a legend containing program and user-defined data

Prior to printing, the design can be checked using the **FILE - PRINT PREVIEW** command.

**Prepare Printing**

Choose the network section to be printed.

- Size the VISSIM network window on screen and/or
- Zoom to the desired section
3 Program Handling

Page Setup Options

FILE - PAGE SETUP opens the Page Setup window. The following settings are available:

- **Fit to page**: If this option is active, the current network view will be extended to fill the available print space.
  - not active, the current network view will be aligned to the top and left margins.

- **Landscape Format**: Use landscape rather than portrait format.

- **Margins**: Print margins (always in mm - independent of current unit settings)

- **Text Fields**: Two rows for user-defined data (defaults: Project and Scenario).

- **PRINTER**: calls the Print window of the operating system.

Print Preview

FILE - PRINT PREVIEW opens the Print Preview window to check the print output on the screen prior to printing.
3.6.2 Other Printouts

In VISSIM there is no direct option to print the output data files or windows. Please find below ways to print this information externally.

► **Result 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™).

► **Result windows** (e.g. dynamic signal timing window) can be imported into image processing applications (e.g. PaintShopPro™) or word processors (e.g. Microsoft™ Word™) using the Windows print screen function **ALT + PRT SCREEN** and the clipboard. The best results are achieved with the highest available monitor resolution.

► **SC Editor** users please refer to section 6.7.4.10 for special output options. For consulting and testing purposes, the attached document _DESCRIPTION.* is provided as Word file and as PDF in the following subfolder of your VISSIM installation: ..\EXAMPLES\TRAINING\SIGNALCONTROL\MANUALEXAMPLE.VISSIG\ENG
3.7 Decimal Separator & Data Editing

This section describes the decimal separator default settings and how to handle the input of decimal numbers in VISSIM.

3.7.1 Default Settings

In VISSIM there is no direct option to choose either decimal point or comma as decimal symbol for numerical values with decimal places.

By default, the current Windows settings on your personal computer are regarded for data display in VISSIM windows.

Check (and adjust, if applicable) this selection via START > SETTINGS (only XP) > CONTROL PANEL > REGIONAL AND LANGUAGE OPTIONS > REGIONAL OPTIONS (XP, or FORMATS with VISTA) tab > CUSTOMIZE… button > [NUMBERS] tab > Decimal symbol selection list.

3.7.2 Data Editing

For data input of real numbers, both decimal point and comma could be used equally in previous VISSIM versions.

Resulting from the implementation of modern data grids, you should take the following changes into consideration for data input in the current VISSIM version:

<table>
<thead>
<tr>
<th>Elder edit boxes</th>
<th>Modern data grids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data display</td>
<td>Decimal point</td>
</tr>
<tr>
<td>Data input</td>
<td>Decimal point or comma</td>
</tr>
</tbody>
</table>

For data input of decimals, preferably use the decimal separator being currently set as default selection via the Control panel, cf. section 3.7.1.

A warning will be displayed, if the entered decimal separator does not meet the requirements.
4 View Settings

VISSIM offers the display of vehicles and/or pedestrians 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 the 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 describes the global display parameters. Most of them are contained in the Display Options window provided via VIEW – OPTIONS.

Display option settings can be stored in the *.INI file, cf. section 4.5.

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 with selected color.
- **Center Line** displays only the link centerlines using one of these colors:
  - **Blue**: Normal links
  - **Green**: Links without visualization (e.g. tunnel or underpass)
  - **Pink**: Connectors
  - **Red**: PT 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.
- **Total Redraw every time step**: VISSIM completely redraws the entire screen at every visualization interval.
- **Display Compass**: Displays a compass indicating the North direction. Double click inside the compass toggles the edit mode where the following actions can be done:
  - **Rotate**: Click and drag the mouse to change the North orientation.
  - **Translate**: Click and hold down **SHIFT** while dragging the mouse to move the compass to the desired location.

As long as this option is active, the user-defined North direction is regarded for any directions listed in Node Evaluation output files, cf. section 11.12. If the compass is not set by the user, "up" is still North, by default.
*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 for lane display. (This takes effect only during a simulation run using the Aggregated values display mode and during route or PT 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. When the link display is switched off (option *invisible*) the vehicle movements are shown directly on the background map.

### 4.1.2 Vehicles

The options provided for visualization of road users and for display of compiled data gained from vehicular or pedestrian traffic are almost alike for vehicles on links and pedestrians on areas and ramps or stairways.

For display of pedestrians, please refer to section 7.3.

This section describes the options for the visualization of vehicular traffic in the link network, which can be accessed via **VIEW - OPTIONS... - [VEHICLES]**.

The following options are available:

*Individual vehicles*: Each vehicle is animated separately. They are represented as colored, rounded boxes (2D) or by a 3D model from the
model distribution which has been assigned to the vehicle type (3D) via Base Data – Distributions – 2D/3D Model....

- **Configuration:** Select the parameter for colored vehicle display, enter the upper limit by class and set the color by class for display of vehicles, cf. section 4.2.2.

- **Interval** defines that only 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:** If this option is active, each link segment is colored instead of individual vehicles. For that the color code representation of the parameter selected via Configuration is used. Different segment lengths can be defined for links and connectors and the display can be checked or unchecked, cf. section 6.3.1.2 and 6.3.2.

- **Configuration:** Select the parameter for colored aggregate value visualization, enter the upper limit by class and set the color by class for colored display of compiled data, cf. section 4.2.3.1.

- **No visualization:** Neither individual vehicles nor aggregated values are displayed during the simulation. Use this option to maximize simulation speed.

Click **CTRL-Q** to activate the next of these three display options during a simulation (Individual vehicles / Aggregated values / No visualization).

The 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 as well as options for bitmap display.
The following options are available:

- Press the appropriate colored buttons next to Sky, Land, Links/Areas or Marking to call the Color selection window and select a specific color for this portion of the model display on screen.

- **Use display type colors:**
  - ☑ If this option has been checked, each link/connector and walkable construction element is colored according to its display type (except in 2D mode during a simulation run).
  - ☐ If this option has not been checked, all links, connectors, areas and ramps/stairways are painted with the color selected for Links/Areas.

  Press **CTRL+T** simultaneously to toggle between link/area coloring by display type and global coloring.

- **SET DEFAULT COLORS** resets the colors to the program defaults.

The color chosen for Links/Areas is always used for simulation and animation in 2D graphics.

Additionally, it is used for all other display modes if ☐ *Use display type color* is not checked. For obstacles, the Land color is used in this case.

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

Colors for vehicles or pedestrians are set in a different way, cf. section 4.2.2.

The colors of the nodes in the network are neither defined by the user nor set due to display type. The color of a node represents the node’s properties, cf. section 12.3.2.3.

- **Marking:** The link/connector colors differ according to the values of the selected attribute.
These attributes are available:
- None
- Lane closure (at least one closure to at least one vehicle class)
- Gradient (different from 0)
- Link evaluation (active)
- Cost/Surcharge (at least one value different from 0)
- Connector closure (to at least one vehicle class)

- **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)
  - Best for colors (calculating average colors)

- **3D Background Resolution**: User-selectable maximum resolution for background images in 3D (raster and vector graphics). The maximum resolution for correct display of background images in 3D depends on the graphics hardware in the computer and on the number of images loaded at the same time.
  Options:
  - Lowest (1024)
  - Low (2048)
  - Medium (4096)
  - High (8192)
  - Tiles: If this option has been selected, the image is loaded tile by tile. The width \( W \) and height \( H \) of the tiles have to be entered as Tile Size.

    This option is recommended for large networks, if also large background images are used. Opening these image files may take some time due to file size - especially in 3D graphics mode.

A background file being read from file in VISSIM appears as tiles on screen. While the tiles are being drawn in 3D mode, you may edit the current window section. As long as the image has not been loaded completely, the entire network is displayed on screen. Subsequently, the user-defined window section that was displayed before loading the image file will be displayed again.
4.1.4 3D

VIEW - OPTIONS... - [3D] provides options for display in 3D graphics mode.

![Display Options](image)

**Default Textures**

For sky, land and for links and connectors as well as areas and ramps/stairs, textures (image files) may be used instead of colors. For each option the textures are stored separately. Please note that when using textures the computer performance greatly depends on the available memory of your graphics card.

Click the button to call the **Texture Manager** for the corresponding option, cf. section 4.1.4.1.

- **Sky**: Projects the selected texture on a half sphere that is automatically placed around the VISSIM network.

The graphics card of the computer needs to be equipped with at least a 16 bit z-buffer, otherwise the skydome is not displayed because of the insufficient depth resolution.

- **Land**: Displays the selected texture on the land around the network. If it is not large enough to fill the entire land space the texture is tiled.

- **Links/Areas**: Displays the selected texture tiled on all links or connectors and areas and ramps.

The **Default Texture** selected for **Links/Areas** in this window can be overruled for any link/connector and area or ramp/stair by a different texture selected for its display type, cf. sections 5.5.2, 6.3.1 and 6.3.2.
Traffic Signals

- PROPERTY DEFAULTS opens the 3D Traffic Signal Defaults window (cf. 4.1.4.2).
- Display Style: Defines the way signals are displayed in 3D mode. These options are available:
  - Signals & Blocks
  - Signals & Stop Lines
  - Signals Only
  - Blocks Only
  - Stop Lines Only
  - None

Level Of Detail

User-defined LOD cutoff distances to provide simplified display of objects that are far away from the observer and thus speeding up 3D graphics display. There are several levels of simplification. Their threshold values (min. distance of activation) can be entered separately for each level of simplified display:

- Simplified vehicle geometry beyond: Simplified display of vehicles as boxes with lighting, the object surfaces are painted uniformly (no “shiny” surfaces).
- No lighting beyond: Simplified vehicle display as boxes without lighting.
- Draw vehicle blocks beyond: Simplified display of vehicles as cuboids.

These settings are saved with the *.INP file.

4.1.4.1 The Texture Manager

Click the appropriate button provided via VIEW - OPTIONS... - [3D] to open the Texture Manager for the option listed to the left. Here standard textures (image files) can be selected to be displayed on links/connectors, land or sky.

A preview of the selected texture is shown in the right part of the window.

While the corresponding option is enabled in VIEW - OPTIONS... - [3D], the selected texture is shown in the 3D mode.

For one or multiple links/connectors, a different texture can be selected, cf. section 6.3.1 and section 6.3.2. The same applies to walkable construction elements, cf. section 7.1.4.3 and section 7.1.4.5.

Almost every type of image files can be used to store a texture. Please note, that textures for links/areas and land need to have dimensions that are powers of 2 (e.g. 128x128, 256x128, 256x256 pixels etc.). Otherwise the tiling effect looks poor.
● **ADD**: Opens the file selection window to load a texture file.
● **REMOVE**: Removes the texture file from the selection list. The actual file remains intact.
● **Description**: User-defined name of the texture provided as graphics file.
● **Filename**: Path and name of the file.
● **Scale Factor**: Defines the scale of the texture.

When changing the selected texture, the result can be seen immediately in the main VISSIM window without closing the texture manager.

### 4.1.4.2 Traffic Signal Default Properties

**VIEW - OPTIONS... - [3D] - PROPERTY DEFAULTS** opens the *3D Traffic Signal Defaults* window where the default settings for 3D signal heads are set. The defaults are stored in the *.INP* file and will be applied to each newly created element.
Signal mast defaults:
- **Style**: Appearance of the mast.
- **Scale**: Percentage of normal size.
- **Height**: Mast height (max: 60m).
- **Diameter**: Mast diameter.
- **Light Style**: Defines if a street light is attached to the mast.
- **Boom length**: Length of the boom incl. the light (max: 20m).
- **Attached to mast at**: Mounting height of the light relative to lower end of the mast.

**[ARM]**
- **Style**: Appearance of the arm.
- **Scale**: Percentage of normal size.
- **Length**: Arm length (max: 60m).
- **Attached to mast at**: Mounting height of the arm relative to lower end of the mast.
- **Rotation Spacing**: When inserting another arm to the same mast it is inserted at this angle relative to the orientation of the previously inserted one (counter-clockwise).

For the arm position, the direction of traffic is regarded that is currently selected in the simulation parameters window.
- **Layout traffic:** Configuration of the signal heads for motorized vehicles. Various default models are provided (1-lens up to 6-lens signal heads).
- **Layout pedestrian/bike:** Configuration of the signal heads for pedestrians and bicyclists. Various default models are provided (1-lens up to 3-lens signal heads, some of them with a timer, cf. section 4.3.4.3).
- **Layout public transport:** Configuration of the signal head for public transport vehicles. Various default models are provided (1-lens up to 3-lens signal heads).
- **Red & amber with colored arrow:** If inactive a black arrow on red and amber light is displayed.
- **Scale:** Percentage of normal size.
- **Vertical/Horizontal:** Defines the orientation of the signal head.
- **Attached to mast at:** Mounting height of the bottom of the signal head relative to lower end of the mast.
- **Horizontal offset:** Defines the horizontal placement of the signal head front plate in relation to the mast center.
- **Rotation spacing (mast):** When inserting another signal head to the same mast it is inserted at this angle relative to the orientation of the previously inserted one (counterclockwise).
- **Vertical offset (arm):** Defines the vertical placement of the signal head center in relation to the arm center.
- **Horizontal spacing (arm):** Defines the horizontal offset of the first signal head to the mast, and of subsequent signal heads placed on the same arm. Negative values define an offset to the left.

The properties of 3D signal heads are described in section 4.3.4.3.
4.1.5 Language & Units

View - Options... - [Language & Units] allows for selection of the language and the units to be used.

- **Language**: Select the language from those provided with the VISSIM installation.
- **Units**: Select either a metric or an imperial unit for the following parameters:
  - **Distance (short)**
  - **Distance (long)**
  - **Speed**
  - **Acceleration**

The current language will be used in menus and windows. The available languages depend on your VISSIM license.

The units selected here are used in all VISSIM windows as well as in the output files (exception: For raw data output, almost always metric units are used).

4.1.6 Simulation Time Display in the Status Bar

Select the status bar representation of the simulation time during a simulation run. Two options are provided:

- Simulation second (View - Status Bar - Simulation Second)
- 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 type is `CTRL+U`. 
4.2 The 2D Graphics Mode

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

Display option settings can be stored in the *.INI file, cf. section 4.5.

4.2.1 Visualization of Network Elements

The Display of Network Elements window 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.).

► VIEW - 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.
Here for each network element the following settings can be changed:

- **Show Element**: Turns on the display of that element.
- **Color of Element** determines the color for display of the (active) element.
- **Fill**: Creates a solid display as opposed to the default outline (only if corresponding edit mode is not active).
- **Label**: Enables text displays associated with that element. A label may be switched on independently of the element display.
- **Color of Label** sets the label text color.
- **Size of Label** determines the label font size.

Initially, the label is placed in the center of the associated element. It can be moved (using the mouse) if both, the edit mode of that network element and the label mode are active.

### 4.2.2 2D Visualization of Vehicles and Pedestrians

Depending on the current display option settings (cf. sections 4.1.2 and 7.2.5) in the 2D display mode, VISSIM displays either individual vehicles or pedestrians respectively or aggregated data.

The visualization can also be switched off completely for the entire network or for certain links/connectors or construction elements only, cf. for example section 6.3.1.2 [DISPLAY] for vehicles.

Multiple options are available for the vehicle color:

- **Standard coloring**: The vehicle color is determined by either vehicle type, vehicle class or PT 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 4.2.2.2.
- **User-defined dynamic colors**: Vehicle colors are determined by a selected parameter and class boundaries referring to the parameter value. For details please refer to section 4.2.2.3.

In addition to vehicles, the current state of signal heads is displayed as a colored line at the location of the signal head, cf. section 5.3.

If display of other network elements has been activated, then these elements are also displayed.

### 4.2.2.1 Standard Coloring

The color of a vehicle or pedestrian is determined by its type, class or PT route. This is the case if neither the automatic nor the user-defined dynamic color mode is active.
### Defined by type

<table>
<thead>
<tr>
<th>Defined by type</th>
<th>Defined by class</th>
<th>Defined by PT 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>PT line</td>
</tr>
<tr>
<td>Color distribution</td>
<td>Color</td>
<td>Color</td>
<td>Class</td>
</tr>
</tbody>
</table>

For display of vehicles/pedestrians of a type belonging to several 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 following applies to the automatic dynamic color mode:
- It provides additional information on vehicle movements that can be identified by the vehicle color.
- It can be toggled using **CTRL+V** whenever the VISSIM network window is active.
- It works also in 3D display mode (as long as the color of the 3D vehicle models is determined by VISSIM).

The following color code is used for vehicles:

<table>
<thead>
<tr>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>Cooperative braking to allow other vehicle to change lanes</td>
</tr>
<tr>
<td>Orange</td>
<td>Lane change desired but not yet started</td>
</tr>
<tr>
<td>Dark red</td>
<td>Braking for own necessary lane change</td>
</tr>
<tr>
<td>Light blue</td>
<td>Waiting for necessary lane change at the emergency stop position for more than 6 simulation seconds</td>
</tr>
<tr>
<td>Light green</td>
<td>Currently lane changing</td>
</tr>
<tr>
<td>Dark green</td>
<td>Lane change finished during the last 6 simulation seconds</td>
</tr>
<tr>
<td>Bluish green</td>
<td>Ignoring priority rules (to solve the detected gridlock)</td>
</tr>
<tr>
<td>Black</td>
<td>Part of a priority rule gridlock situation</td>
</tr>
<tr>
<td>Dark yellow</td>
<td>During the last 3 simulation seconds, the vehicle decided to ignore a red signal or priority rule because its speed was too high to stop safely before the stop line</td>
</tr>
<tr>
<td>Purple</td>
<td>Light braking (between -1.0 to -3.0 m/s^2)</td>
</tr>
<tr>
<td>Pink</td>
<td>Heavy braking (below -3.0 m/s^2)</td>
</tr>
<tr>
<td>Red</td>
<td>Temporary lack of attention</td>
</tr>
<tr>
<td>White</td>
<td>Vehicle is in queue condition (only if there is at least one queue counter in the network)</td>
</tr>
<tr>
<td>Dark blue</td>
<td>All other situations (standard)</td>
</tr>
</tbody>
</table>
4.2.2.3 User-Definable Dynamic Colors

The colors of vehicles or pedestrians are determined by the selected parameter.

For display of user-defined dynamic colors the automatic dynamic color mode has to be switched off.

For vehicles, the configuration is done via VIEW - OPTIONS - [VEHICLES] - CONFIGURATION for Individual vehicles.

- **Parameter**: The desired parameter to be displayed with the color code. ‘None’ switches off the user definable dynamic colors. The currently active unit is displayed underneath.

- **Classes**: For each user-defined range of values of the selected parameter a Color is to be defined. The Color is selected by clicking the colored box adjacent to the value field. Up to 10 classes are available. The upper boundary is included in the respective class. If a class value is deleted, the following values will be shifted to fill the gap.

- **DEFAULT CLASSES** resets all values and colors to the defaults.

4.2.3 2D Display of Aggregated Values for Vehicles (LOS)

As an alternative to the display of individual vehicles or pedestrians, 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.

Basically, the options for visualization of aggregated values of the simulated traffic are the same for vehicles on links and pedestrians on areas, cf. section 7.3.3.

This section describes the display of aggregated values for vehicle traffic in the link network. Click VIEW - OPTIONS... - [VEHICLES] and set the options.
The color code is used to color each segment of a link (or lane, if applicable) in the VISSIM network according to the online data of the selected parameter, cf. section 4.1.2. Therefore, you can freely select the class limits by parameter and the color by class. According to the color code settings, each segment of a link or connector will be colored, even by lane, if applicable, cf. section 4.2.3.1

The segment length can be set and display can be enabled or disabled either for each link and connector individually in Standard mode or for multiple links and connectors simultaneously in Multi-select mode, cf. section 3.3.2.

4.2.3.1 Viewing Aggregated Values of Vehicle Traffic

Click VIEW – OPTIONS... to open the Display Options window. In the [VEHICLES] tab do the following:

1. Check option Aggregated Values
2. Click the CONFIGURATION button
3. Set the options

The color of a segment results from these settings.

- **Parameter**: The desired parameter to be displayed by color code. If no selection is available, press LINK EVALUATION... to select the desired parameter. The appropriate unit appears underneath.

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

- **LINK EVALUATION...** calls the link evaluation configuration window (cf. section 11.11.) for parameter selection and time interval definition. The selected parameters are displayed in the Parameter list box after the window is closed.

- **Classes**: Define the class limits (upper limit belongs to the interval) for the values of the selected parameter and click the associated color icon to the right to set the color by class.

- Click DEFAULT CLASSES to restore the default settings (limits/colors).
4.2.3.2 Examples: Aggregated Values of Vehicle Traffic

Example 1  Typical visualization using the above color code for Speed evaluation:

Example 2  Typical Density visualization:
4.3 The 3D Graphics Mode

In the View menu, click the 3D Mode command (default shortcut Control+D) to call the three-dimensional display of the VISSIM model. Furthermore, also static elements can be added to the network display at any network position. The network display can be viewed from any observer position.

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 image to a 3D texture.

Display option settings can be stored in the *.INI file, cf. section 4.5.

Static 3D objects are taken into consideration when the rectangular floor space is calculated. In this way, resulting gaps between the models and the floor area can be avoided and also view problems in case of very large models.

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. Alternatively the mouse wheel can be used to zoom in/out independently of the current navigation mode.

Zoom by Factor: Zooms by a user-defined factor: Values < 1.0 zoom in.
**Pan:** Pressing left-hand mouse-key allows for dragging the 3D network in any direction without changing the height of the observer. This command will move the network within the network plain. Thus if the camera position is very low, just 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 through the network.
- Double-click (left) starts/ends the movement; double-click (right) starts/ends backwards movement.
- Movement of the mouse changes the direction of the flight.
- The speed of the flight can be changed:
  - With the left `SHIFT` key the speed is increased.
  - With the left `CTRL` key the speed is decreased.

The 3D viewing modes are:
- Rotate network
- Pan network
- Fly through the network

The selected 3D viewing mode remains active until either the single-select mode is enabled or another 3D viewing mode is selected.

### 4.3.1.2 Sitting in the Driver’s Seat

Another 3D viewing option is to “sit in the driver’s seat”. This can be done in single step mode by double-clicking on the vehicle. To leave the vehicle, close the corresponding vehicle information window. The view from of the driver’s seat is also possible to be used as a camera position for a keyframe (in order to record an *.AVI* file).
4.3.1.3 Changing the Field of View (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 43mm (for a 35mm camera system).

To change the field of view, use one of the options below:

- Press **CTRL+PGUP** or **G** to decrease the viewing angle by 1 degree (i.e. moving a zoom lens towards the telephoto end).
- Press **CTRL+PGDN** or **T** 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 to 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 shows 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°</td>
<td>500mm</td>
<td>38°</td>
<td>53mm</td>
</tr>
<tr>
<td>7°</td>
<td>300mm</td>
<td>40°</td>
<td>50mm</td>
</tr>
<tr>
<td>10°</td>
<td>200mm</td>
<td>44°</td>
<td>45mm</td>
</tr>
<tr>
<td>11°</td>
<td>180mm</td>
<td>54°</td>
<td>35mm</td>
</tr>
<tr>
<td>15°</td>
<td>135mm</td>
<td>65°</td>
<td>28mm</td>
</tr>
<tr>
<td>20°</td>
<td>100mm</td>
<td>72°</td>
<td>25mm</td>
</tr>
<tr>
<td>24°</td>
<td>85mm</td>
<td>81°</td>
<td>21mm</td>
</tr>
<tr>
<td>29°</td>
<td>70mm</td>
<td>90°</td>
<td>18mm</td>
</tr>
</tbody>
</table>

4.3.2 3D Visualization of Vehicles and Pedestrians

3D models in VISSIM can be assigned to each type of vehicles or pedestrians respectively using model and color distributions (cf. sections 5.2.4 and 5.2.5 for details).
4.3.3 3D Animation of PT Vehicle Doors

Select the 3D Model of the PT vehicle via BASE DATA – DISTRIBUTIONS - 2D/3D MODEL... - 2D/3D Model Distributions, cf. section 5.2.5.2.

If the *.V3D model file stores also vehicle doors for the 3D model, the opening and closing of sliding doors (also double doors) is visualized in the 3D mode.

Here, the following applies:

► For animated display, the doors need to satisfy the following conditions:
  - Boarding and/or alighting must be permitted for the door and at the stop.
  - The door is located at a valid position at a platform edge. Without a platform edge, which is only required for pedestrians as passengers, the door needs to be in a valid position between start and end of the PT stop.

► Temporal restrictions:
  As soon as the vehicle does no longer move at the PT stop, the opening of the vehicle doors starts which lasts 1.5 seconds.

The closing of the doors depends:

- For calculated dwell times: The closing of the vehicle doors starts 3 seconds prior to the end of the vehicle’s dwell time at the stop.
- For “real” pedestrian flows: The doors start closing, if no passenger has tried to use one of the vehicle’s doors for boarding or alighting during the last 3 seconds.

Door closing always takes 2 seconds.

- During the first of these two seconds, the doors will open again if a passenger wants to board or alight.
- During the second of these two seconds, the passengers behave as if the doors were already closed.

When the doors are closed, the vehicle waits another seconds and will depart then.

The number of time steps depends of the simulation resolution.

► During the opening process, shifting the door polygons is performed as follows:
  - By 6 cm perpendicular to the vehicle for 0.3 s
  - By the width of the door in parallel to the vehicle element heading to the direction with the bigger distance to the next door (or end of the vehicle, if applicable).

Closing the doors means the reverse order and direction of these two polygon shifting steps.
4.3.4 3D Signals

There is a choice of signal head displays in 3D mode (cf. section 4.1.4 for all available displays). One option is to show real signals rather than the blocks used in versions prior to VISSIM 4.20. This section describes how to enable and configure real signal heads.

Creating a signal head requires the **2D graphics mode** and the **Signal heads edit mode**.

Editing signal heads can be done in 2D mode and in 3D mode.

- In the **2D graphics mode**, the **Signal heads edit mode** needs to be active.
- In the **3D graphics mode** they can only be edited within the dialog window (double click on the object in 3D mode to open the window), whereas in 2D, they can be moved and rotated outside of the dialog box, too.

4.3.4.1 Creating

Most properties of a new 3D signal are taken from the signal defaults (cf. section 4.1.4.2).

Follow the steps below to create a new 3D signal:

1. Open the **Signal Head** window for the signal head you want to create a new 3D signal for.

2. Press **NEW 3D SIGNAL** to open the **3D Traffic Signal** window.

3. Set the position of the new signal.
   
   Select one of the options:
5. Edit the signal data (cf. section 4.3.4.3) and confirm with OK.
6. Close the *Signal Head* window with OK.
7. Switch on the 2D representation of the 3D signals (default shortcut **CTRL+H**). The new signal can now be placed and edited (cf. below for details).

### 4.3.4.2 3D Signals in the Network Display

**EDIT - 3D Signal Heads** (default shortcut **CTRL+H**) shows the 3D signals as a 2D representation:

- Unselected 3D signal heads are displayed as a green square with a diamond and a red circle inside. A selected signal is painted in dark blue in 2D, light blue in 3D mode.
- The circle represents the *mast*.
- Any arm is displayed as a red line indicating the direction and length of that arm.
- Small blue arrows along the arm indicate the *signal heads*.
  - In 2D mode, signal heads which are directly attached to the mast are displayed as a blue circle.
  - While holding the left mouse-key down, you may drag a 3D signal head to a new position on the mast in 2D mode.

**Select**

Click on the green square. The selected square is painted blue.
**Move**

**Entire Signal**: Select the signal and drag it to the desired location.

**Arm only**: An arm can be sized or rotated around the mast: Click inside the red circle at the far end of the arm and drag it to the desired length and location.

Cf. section 4.3.4.4: Move, Tilt, Rotate, etc.

**Copy & Paste**

Select the signal to copy and press **CTRL+C**.

To paste a copied signal, press **CTRL+V** and drag the copied signal to the desired position while holding down left mouse-key.

**Edit data**

Double click on the green square to open the *Mast Properties* window.

**Delete**

Select the signal and press **DEL**.

---

**4.3.4.3 Properties & Options**

This section describes all parameters and options to be set for each signal individually.

The definition of the default properties for new 3D signals is described in section 4.1.4.2.

The default properties for a new 3D signal are defined in the view settings (cf. section 4.1.4.2).

A 3D signal may consist of up to 4 components:

- Mast
- Arm
- Signal Head
- Sign
Mast

Double click on the 2D representation of the signal opens the *Mast Properties* window:

- **ID** (in window title, read-only): Shows the mast identification no.
- **Style**: Appearance of the mast.
- **Height**: Mast height.
- **Arm length**: Length of the currently selected arm.
- **Diameter**: Mast diameter.
- **Z-Position**: Charted elevation of the mast position, (> 0 e.g. for masts on bridges).
- **ADD ARM**: Creates a new arm and opens the *Arm Properties* window.
- **ADD SIGNAL**: Creates a new signal head that is attached directly to the mast (not to an arm) and opens the *Signal Head Properties* window.
- **ADD SIGN**: Creates a new sign that is attached directly to the mast (not to an arm) and opens the *Sign Properties* window.
- **ADD LIGHT**: Creates a new arm with the style *Light*.
- **FLIP ALL**: Toggles the direction of the arm on the mast accordingly for right-hand traffic or left-hand traffic.

The following buttons are enabled only if either an arm, a signal head or a sign is selected:
The 3D Graphics Mode

- **EDIT ARM / EDIT SIGNAL / EDIT SIGN**: Opens the corresponding Properties window.
- **HIDE/SHOW**: Disables/Enables the visibility of the selected object(s). Hidden objects of first degree are shown in grey. Nested hidden objects are not shown.
- **DELETE**: Deletes the object.

**Arm**

In the *Mast Properties* window, click on the desired arm and press EDIT ARM. The *Arm Properties* window allows to edit the properties:

- **ID** (in window title, read-only): Shows the mast and arm identification no.
- **Style**: Appearance of the arm.
- **Length**: Arm length.
- **ADD SIGNAL**: Creates a new signal head and opens the *Signal Head Properties* window.
- **ADD SIGN**: Creates a new sign and opens the *Sign Properties* window.

The following buttons are enabled only if the particular component has been selected:

- **EDIT SIGNAL / EDIT SIGN**: Opens the corresponding Properties window.
- **HIDE/SHOW**: Disables/Enables the visibility of the selected object(s). Hidden objects are shown in grey.
- **DELETE**: Deletes the object.
Signal Head

On Mast
In the Mast Properties window, click on the desired signal head that is attached directly to the mast and press Edit Signal.

On Arm
In the Arm Properties window, click on the desired signal head and press Edit Signal.

The Signal Properties window allows to edit the signal head properties:

- **ID** (in window title, read-only): Shows the mast, arm (if applicable) and signal head identification no.
- **Type**: Due to the selected type (Pedestrian/Bike, Traffic or Public Transport), various layouts are provided for the signal head. With the Pedestrian/Bike type, also signals with timer can be chosen.
- **Orientation**: Choose Vertical or Horizontal orientation.
- **Associated controller data**: Link to VISSIM controller and signal group no. that should be displayed on this signal head. Depending on the Layout one or more of the direction lines Left, Through and Right are enabled, e.g. Left is enabled only if the Layout contains at least one bulb with a left arrow.
- **Layout**: Number of lenses and configuration of the signal head.
With a fixed time signal control, **countdown timers** show the currently remaining red and green times of a signal group during the cycle.

If required, they can also be used in combination with signals of any vehicle type if desired.

They are activated as soon as they are linked to a signal group (as with all other 3D signals).

These are the characteristics of the timers:

- The timer is colored “red” during signal group states “red” and “red/amber”.
- The timer is colored “green” during signal group state "green" (and not e.g. during "green flashing").
- For all other signal group states (e.g. “amber”, “red flashing”, “amber flashing” or “green flashing”) the timer remains off (dark).
- The displayed red and green timings (timer start values) are taken from the last red and the last green period of the signal group respectively (where red/amber belongs to red in this context). I.e., the timer always starts with the value of the last duration of the corresponding state. If that duration was 0 then no timer is displayed.
- Timers do not function properly if there are more than one red or green time period within the same cycle (because the counters will still show the timings of the last green or red period).

**Note that due to the “history” behaviour, timers may display no or incorrect values during the first and possibly second signal cycle after simulation start, and also during the first and possibly second signal cycle after any change of signal program.**

**Timers are intended for fixed time signals only.**

If they are used with vehicle-actuated signal controls, the timers will display incorrect timings due to the unpredictable red and green times.
**Sign**

**On Mast**
In the *Mast Properties* window, select the desired sign that is attached directly to the mast and press *Edit Sign*.

**On Arm**
In the *Arm Properties* window, select the desired sign and press *Edit Sign*.

The *Sign Properties* window allows for interactive changes to the sign dimensions as well as to edit other sign properties.

Each shape consists of two parts that can be scaled independently using the mouse:

- **Border**: Click on the edge of the border and drag the mouse to the desired dimension.
- **Internal area**: Click inside the internal area to select it. A dashed line indicates that the internal area is selected. Then click on its edge and drag the mouse to its desired dimension (inside the border area).

The current scale (*Width*, *Height*) can be checked in the lower part of the *Sign Properties* window.

- **ID** (in window title, read-only): Shows the mast, arm (if applicable) and sign identification no.
- **Shape**: Geometrical form of the sign.
- **Width**: Length of the largest horizontal extension of the shape.
- **Height**: Length of the largest vertical extension of the shape.
ASSIGN TEXTURE...: Opens the Texture Manager window (cf. 4.1.4.1) to assign a texture to the shape.

REMOVE TEXTURE: Removes the texture from the shape.

Border Color: Color used to paint the border of the shape. Press ... to select a different color.

Background Color: Color used to paint the internal area of the shape. Press ... to select a different color.

### 4.3.4.4 Editing

The upper part of the property window of each component includes a preview panel that shows the selected component along with other components attached to it (e.g. arm on mast in the Mast Properties window).

All these preview panels reflect the changes of all properties and allow interactively for the following actions:

<table>
<thead>
<tr>
<th>Action</th>
<th>Add. Key</th>
<th>Mouse Action</th>
<th>Shortcut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pan entire preview</td>
<td>J.</td>
<td>Click background &amp; drag</td>
<td>↑,↓,←,→</td>
</tr>
<tr>
<td>Rotate entire preview</td>
<td>CTRL</td>
<td>Click background &amp; drag</td>
<td>J.</td>
</tr>
<tr>
<td>Zoom entire preview</td>
<td>J.</td>
<td>Mousewheel with nothing selected</td>
<td>PgUP, PgDN</td>
</tr>
</tbody>
</table>

These actions are available only in the Mast Properties and Arm Properties windows:

<table>
<thead>
<tr>
<th>Action</th>
<th>Add. Key</th>
<th>Mouse Action</th>
<th>Shortcut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Move object up, down, left, right</td>
<td>J.</td>
<td>Click object &amp; drag</td>
<td>J.</td>
</tr>
<tr>
<td>Move object in &amp; out</td>
<td>SHIFT+ALT</td>
<td>Click object &amp; drag</td>
<td>J.</td>
</tr>
<tr>
<td>Rotate object (vertic.)</td>
<td>CTRL</td>
<td>Click object &amp; drag</td>
<td>J.</td>
</tr>
<tr>
<td>Tilt object (horizont.)</td>
<td>CTRL+ALT</td>
<td>Click object &amp; drag</td>
<td>J.</td>
</tr>
<tr>
<td>Scale object</td>
<td>J.</td>
<td>Select object, then Mousewheel</td>
<td>J.</td>
</tr>
</tbody>
</table>

Some of these actions are graphically supported by colored arrows indicating the particular plane and the possible directions of movement.
Move

Tilt
4.3.5 Static 3D 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 static 3D object from a <em>.V3D file at the click position by opening the Select 3D Model window for file selection. The procedure is similar to selecting a 3D vehicle file <em>.V3D (cf. section 5.2.5). Furthermore the following is possible: Direct import of Google SketchUp files (</em>.SKP) up to version 8, Autodesk files (</em>.DWF) and Autodesk 3DS files (*.3DS).</td>
</tr>
<tr>
<td>Left</td>
<td>./.</td>
<td>Selects a 3D object, which then appears within a bounding box. Press DEL to remove the marked object from the network.</td>
</tr>
<tr>
<td>Left</td>
<td>SHIFT</td>
<td>Horizontal movement of the 3D object within the network plane</td>
</tr>
<tr>
<td>Left</td>
<td>SHIFT+ALT</td>
<td>Vertical movement of the 3D object</td>
</tr>
</tbody>
</table>
### 4 View Settings

<table>
<thead>
<tr>
<th>Mouse click</th>
<th>Add. key</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
<td><strong>CTRL</strong></td>
<td>Rotates the 3D object</td>
</tr>
<tr>
<td>Left</td>
<td><strong>CTRL+SHIFT</strong></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 Autodesk 3DS-Max 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.

SketchUp files do not have to be converted into *.V3D files by means of V3DM.

### 4.3.6 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><strong>CTRL+F9</strong></td>
<td>Toggle fog display on/off</td>
</tr>
<tr>
<td><strong>CTRL+F3</strong></td>
<td>Move the fog front towards the observer</td>
</tr>
<tr>
<td><strong>CTRL+F4</strong></td>
<td>Move the fog front away from the observer</td>
</tr>
<tr>
<td><strong>CTRL+F5</strong></td>
<td>Move the 0-visibility front towards the observer</td>
</tr>
<tr>
<td><strong>CTRL+F6</strong></td>
<td>Move 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 and all the keyframes.

**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 \texttt{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.

In the VISSIM 64 bit edition, the selection of background image file formats is limited. Files with some vector formats (*.DWG, *.DXF) may not be displayed correctly. Work-around: Convert the file to a raster graphics format (e.g. *.BMP, *.JPG) with a graphics program.

Display option settings can be stored in the *.INI file, cf. section 4.5.

4.4.1 Supported Background Data 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>
<tr>
<td>(best resolution for display)</td>
<td></td>
</tr>
<tr>
<td>ECW (fixed resolution only)</td>
<td></td>
</tr>
</tbody>
</table>

¹) Note: Each new version of Autodesk AutoCAD™ will update DWG and DXF formats automatically. VISSIM can handle DWG versions 13 - 15 and DXF versions 9 - 14.

*.DWG and *.DXF files may contain multiple images. Currently only the first image of a file is shown in VISSIM.

4.4.2 Workflow: Creating a Background

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>.BGR. Whenever you reload that background, make sure that the corresponding *.BGR file is located in the same directory as the background file. In case the *.BGR file is missing, VISSIM will read data from the *.HGR file and save changes to the newly created *.BGR file.
The size of an image file depends on the following:
- data format and compression (especially *.JPG)
- screen resolution and color depth
- computer and graphics card memory (especially for 3D mode)

Thus the max. file size depends on the system configuration.

If the background file you would like to open exceeds the available main storage, a warning will be displayed. Optionally, this message provides further loading.

In case of incorrect image display (black or white box instead of the image) reduce the file size by either cropping a smaller section or reducing the resolution.

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. For detailed node modelling precise maps should be used.

Multiple images 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.

Image files may, but do not have to be stored in the same directory as the network file (*.INP).

In the *.INI file, background file paths are saved as meta filenames (especially #data# for current data directory). This allows to continue to use *.INI files that reference background files in the data directory (where *.INP resides) after the whole directory has been renamed, moved or copied to a different place.

Loaded background images are removed, if an *.INI file is read via menu VIEW – LOAD SETTINGS which refers to another background file itself.

### 4.4.3 Workflow: Scanning an Image

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. as *.BMP, *.JPG or uncompressed *.TIF file).
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

The size and position of all VISSIM dialog windows are stored separately (not in the settings file).

Save settings to file

1. Click VIEW - SAVE SETTINGS...
2. Enter the filename.
3. Confirm OK.

Read settings from file

1. Click VIEW - LOAD SETTINGS...
2. Select the filename.
3. Confirm OK.

Alternatively, you can drag the *.INI file from the Windows Explorer and drop it in the VISSIM window to read the settings from 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 (cf. section 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 or pedestrians are modeled. If you would only like to use the VISSIM test functionality then you do not need to read this chapter.
5.1 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. Acceleration and deceleration are functions of the current speed. Combustion engines reach their maximum acceleration at low speeds, whereas three-phase motors of e.g. trams or trains show a constant acceleration within a wide range of speeds.

For each vehicle type two acceleration functions and two deceleration functions (graphs) need to be assigned:

► Maximum acceleration: Max. technically feasible acceleration. Regarded only if an acceleration exceeding the desired acceleration is required to keep the speed on slopes.
► Desired acceleration: Used for any other situation.
► Maximum deceleration: Max. technically feasible deceleration. Adjusted on slopes by 0.1 m/s² for each percent of positive gradient and -0.1 m/s² for each percent of negative gradient.
► Desired deceleration: If it is lower than the max. deceleration, then the desired deceleration is used as the maximum for the deceleration
  - caused by a desired speed decision,
  - in case of Stop & Go traffic, when closing up to a preceding vehicle,
  - in case of insufficient lateral distance for overtaking within the lane,
  - towards an emergency stop position (route),
  - for co-operative braking: In this case, 50% of the vehicle’s own desired deceleration is used as the max. reasonable deceleration for the decision, whether an indicating vehicle may change from the neighbouring lane to the vehicle’s lane.

In any other case, the parameters of the car following model are relevant.

Predefined functions are provided with each of the default vehicle types in VISSIM. They can be edited or new graphs can be created through BASE DATA – FUNCTIONS... When one of the four types is selected, an edit window opens 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.

The default maximum acceleration/deceleration curves in VISSIM

The default maximum acceleration curves for cars are almost the original ones provided with the Wiedemann 74 model, cf. section 5.4.1.

► For cars, these measurements performed in Germany before 1974 have slightly been adapted for shorter time steps with jerk limitation and for the user-defineable spread (min-max).

Jerk is the rate of change of acceleration; that is, the derivative of acceleration with respect to time. With more than 2 time steps per second, it is limited by the share that corresponds with twice the time
step length. Example: With 10 time steps per second (time step = 0.1 s), the limit is 20% (0.2) of the intended change in acceleration. The accelerations from standstill have been validated against test vehicle data in the European research project RoTraNoMo (www.rotranomo.com) in 2004.

- For trucks, the acceleration/deceleration curves have been adapted to data from the European research project CHAUFFEUR 2 in 1999.
- For trams and buses, the acceleration/deceleration curves have been set according to information from the Karlsruhe public transport company (VBK), 1995.

All curves should be adapted to local conditions (especially the vehicle fleet) if these are substantially different from Western Europe.

**Speed calibration by adjusting the maximum acceleration/deceleration curves**

For all vehicles, the maximum acceleration is affected by the gradient:

- It is reduced by 0.1 m/s² per 1% upwards gradient.
- It is increased by 0.1 m/s² per 1% downwards gradient.

For trucks, the actual acceleration is limited by the desired acceleration function, too, so the surprisingly high maximum acceleration values for trucks are only relevant at very low speeds for steep gradients.

The maximum acceleration of a specific vehicle at a certain speed is somewhere between the maximum value and the minimum value (black lines without red dots in the maximum acceleration curve dialog).

The position in this range is determined by the following:

- By power and weight for vehicles of a vehicle type with category "HGV".
- By a random value for all other vehicles.

The random value is normal distributed (with average 0.5 and standard deviation 0.15 but limited to [0..1], so the distance between the average curve and the and min/max curve is 3.333 times the standard deviation (SD)).

This results in the following:

- About 70% of the vehicles are in the inner third (-1 SD .. + 1 SD) of the random values
- And 95% are inside the inner two thirds (-2 SD .. + 2 SD).

Linear interpolation in VISSIM:

- For random values below 0.5 VISSIM interpolates between the min (0.0) and the average curve (0.5),
- For random values above 0.5 VISSIM interpolates between the average and the max curve (1.0).
HGV vehicles do not use a random value but the power/weight ratio instead. With metric units, the minimum is 7 kW/ton and the maximum is 30 kW/ton, which means an average of 18.5 kW/ton.

Accordingly, the following applies:

► All HGV with a p/w ratio of 7 or less will use the minimum curve.
► All HGV with a p/w ratio of 30 or more will use the maximum curve.
► All HGV with a p/w ratio of 18.5 will use the average.
► For HGV with any other value, linear interpolation will be performed.

If your actual power/weight ratios are outside of this range, it is necessary to use separate maximum acceleration curves (and separate vehicle types) for specific power/weight ranges, with a very small spread.

After the interpolation, the maximum acceleration is modified by the gradient, as described above.
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 vehicle 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.

Each vehicle type is assigned to one vehicle category. For each vehicle of a type that is defined as HGV category, VISSIM randomly selects one value out of the weight distribution and another one out of the power distribution that is assigned to its vehicle type. The weight and power values do not automatically correspond to each other (i.e. it is possible that a vehicle gets a high power and low weight assigned). VISSIM therefore computes the power-to-weight-ratio of the vehicle as kW/t. In order to prevent extreme power/weight combinations the power-to-weight-ratio has a range of 7-30 kW/t. If the ratio is computed lower than 7 kW/t, the ratio is internally set to 7 kW/t; if the ratio is computed higher than 30 kW/t, it is set to 30 kW/t.

According to the power-to-weight-ratio, 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 (cf. section 5.1). If it is 30 kW/t, the resulting curve is the upper border.

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

### 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 (cf. 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 graphical display - it has no effect on simulation results. A Color Distribution can be defined and edited via BASE DATA - DISTRIBUTIONS - COLOR...

The color distribution is used instead of a single color for a type of vehicles or pedestrians. Even if only one color should be used for a type a distribution still needs to be defined (with one color only).

Up to 10 colors are possible for each distribution and each one needs to have a relative percentage > 0 (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 Model Distribution

This distribution defines the variety of the dimensions, colors and textures which is required for graphical display:

► vehicle properties within a vehicle type
► properties of pedestrians within a type of pedestrians

Especially the dimensions have an effect on simulation results (e.g. due to length and width of vehicles or pedestrians, as applicable).

A Model Distribution can be defined or edited via BASE DATA - DISTRIBUTIONS - 2D/3D MODEL... in the 2D/3D Model Distribution window.
The model distribution is used instead of a single model for a type of vehicles or pedestrians. Even if a type should only be represented by one model still a distribution needs to be defined (with one model only).

Up to ten models are possible for each distribution and each one needs to have a relative percentage \( \text{(Share)} > 0 \).

The absolute percentage is computed automatically: The proportion of an individual \( \text{Share} \) is compared to the sum of all \( \text{Shares} \).

Via \( \text{Geometry} \), each pedestrian/vehicle model can be defined by its \text{Geometry} or by the selection of a \text{3D-Model} file.

### 5.2.5.1 2D Model Definition (Geometry)

In the \text{2D/3D Model Distribution} window, the \text{Geometry} button opens the \text{Geometry} window.

This window contains the number of elements the particular vehicle or pedestrian model consists of. All defined elements are listed on the left and can be selected for editing in the tabs to the right.

The list can be edited as follows:

- Click \text{NEW} to add another element to the model.
- Click \text{DELETE} to discard the selected element.

In the \text{BASE} tab, each element can be defined in detail.

The \text{Length} entry is used as element ID.

The units of the parameters depend on the global unit selection, cf. section 0.

See the illustrations below for the parameters which are to be defined.
Zugfahrzeug

Lorry
(Element 1)

Deichsellänge = 0
Shaft length
Gelenk vorn = 0
Front joint
Gelenk hinten = 0
Rear joint

Anhänger

Trailer
(Element 2)

Gelenk hinten = 0
Rear joint

Deichsellänge
Shaft length
Gelenk vorn
Front joint

Bahn, Tram

Train, Tram

1. Wagen
1st Car
(Element 1)

Deichsellänge = 0
Shaft length
Gelenk vorn = 0
Front joint

2. Wagen
2nd Car
(Element 2)

Gelenk hinten
Rear joint

Gelenk vorn
Front joint

Deichsellänge
Shaft length

Länge
Length

Achse vorn
Front axle

Achse hinten
Rear axle

Länge
Length
This tab contains the door data for 2D models of PT vehicles.

For the selected element of the model, create a row per door and enter the following data:

- **Position**: Distance of the door from the front of the vehicle element
- **Width**: Width of the door
- **Z-Offset**: Height above the link level
- **Side**: Select *Both*, if the element has doors on both sides, or select the particular direction of traffic.
- **Usage**: Select whether the door is intended for either *Alighting* or *Boarding* only or *Both* for alighting and boarding as well. Furthermore, option *Closed* is provided.

For any length data, the unit currently selected via **View – Options – [Language & Units]** is regarded.
5.2.5.2 3D Model Definition

In the 2D/3D Model Distribution window, the 3D Model button opens the Select 3D Model window:

In this window, you can select the 3D models for static objects, vehicles and pedestrians.

Some of the V3DM settings can be made visible, though they are not subject to changes in VISSIM.

A 3D model still has to be defined with the help of V3DM or any other appropriate tool.
In the PANEL OPTIONS menu, you may check or uncheck the display of the V3DM attribute panels one by one or all at once:

- DIMENSIONS
- STATES
- DETAILS
- LODS (LEVELS OF DETAIL)
- TEXTURES

When UNCHECK ALL is clicked, the Preview window will appear next to the navigator tree, since the sections in the middle are faded out. Closing the window will reset the Select 3D Model window view to the default settings.

In the VIEW OPTIONS menu, you may check or uncheck the display of the auxiliary view components known from V3DM one by one or all at once:

- AXLE PLACEMENT
- JOINT PLACEMENT
- SHAFT LENGTH
- DISPLAY GROUND

Additionally, the LOCK LEVEL OF DETAIL command is provided.

Beneath the menu bar, the path of the currently selected model file is displayed.

The two buttons on top of the navigator tree allow for general path selection. Subsequently, select the appropriate *.V3D file in the list of files underneath.

- Click the CURRENT PROJECT button to open the project folder of the currently loaded *.INP file.
- Click the STANDARD 3D MODELS button to open the 3DMODELS folder which is provided in the EXE folder of your VISSIM installation. The 3D models provided with the VISSIM installation are stored in the following sub-folders:
  - STATIC
  - TEXTURES
  - VEHICLES

All *.V3D files provided via the selected path are listed in the window section underneath and can be displayed in the Preview section after selection from the list of files.
Element grouping

You may combine multiple elements to form a group representing a vehicle.

- **Show group elements**: If this option is active, the selected elements are displayed in the pane on the bottom of the window. These elements are grouped automatically. Use the buttons to arrange them accordingly prior to Preview (3D) display.

- **ADD TO GROUP**: This button is only provided if option **Show group elements** is active. Click this button to add the selected file to the Selected Model Elements section.

Vehicles that consist of more than one element (e.g. trams) can be composed using **ADD TO GROUP** with a factor > 1 to combine the desired vehicle elements.

The blinking cursor in the Selected Model Elements section indicates the current insert position for the next ADD TO GROUP action. You can move the cursor freely, even to the front position.

- The corresponding buttons underneath the Selected Model Elements section allow for the following:
  - Use ⇕ or → to move the selected element to the correct position.
  - DELETE removes the selected element.
  - CLEAR ALL removes all of the contained elements from the selection.
  - PREVIEW shows the grouped elements in the Preview (3D) section.

As soon as the Select 3D Model 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 (cf. section 5.3.1).

For models of pedestrians, only the first element of the model is regarded. Other model elements are ignored.

Preview (3D)

3D display of the selected model (or the model resulting from the grouped elements respectively).

- **Zoom**: Use the mouse wheel to zoom in or out. The distance value on top of the preview is adjusted accordingly.

  Alternatively, you may change the View distance on top and confirm ENTER. The unit of the View distance depends on the current settings via menu View – Options – [Language & Units].

- **Rotate**: Left-click and keep the mouse-key pressed while moving the model display in any direction.

Section Textures

For models which do not consist of grouped elements, the following details are displayed:

- File size of the *.V3D file (Texture only, if applicable).
- The original model view.

Section Dimensions

For each model the Height, Width and Length data is displayed. In case of grouped elements, the new values are calculated immediately.
**Section Details**

- **Base color**: For color preview purposes, click the Color icon to open the palette. Select the appropriate VISSIM color (for example, as set by a type or class of vehicles or pedestrians) for the display of the 3D model. This selection cannot be stored in this window. Color settings are defined by means of color distributions per vehicle class or type, cf. section 5.3 (for pedestrians, cf. section 7.1 respectively).

- **# Polys**: The variance of the number of polygons (high/low) is displayed.

**Section States**

Next to the ▶ button, the number of states being available for this model is displayed.

- **ANIMATE**: In case of various model states (as required for walking pedestrians, for example) all states are displayed automatically one by one.

  Alternatively, you may click the button indicating the particular direction to call the display of either the previous or the next state manually.

**Section Levels of Detail**

Additionally to the global Level of Detail settings defined via VIEW – OPTIONS – [3D], you may define different LOD display parameters for the same distances and graphical display settings for additional distances for the particular 3D model.

Click the ▶ or ◄ button to call the next LOD for this 3D model. The name of the currently displayed level is displayed.

- **Override global cutoffs**: Check this option to redefine the global LOD settings by 3D model:
  - Simple *(Simplified vehicle geometry beyond)*
  - No lighting *(No lighting beyond)*
  - Blocks *(Draw vehicle blocks beyond)*

- **Min dist/level**: Enter the new distance

- **# Polys (curr)**: Output of the number of polygons, the model consists of. The closer the distance, the more polygons are usually required for modeling.

For *Static* 3D models, also the *Elevation* value ±0 can be entered and the degrees can be specified for rotation in any direction *(YZ, XY, XZ)*.

*In 2D mode the vehicle is always displayed with the values (vehicle length, axle positions, …) entered / shown in the Geometry dialog. In 3D mode the 3D model from the selected file is used. The geometry values from the 3D model file are ignored in the simulation after any modification in the Geometry dialog. This can cause vehicles to overlap or keep too large gaps in 3D mode. After loading an *.INP file a warning message is displayed if the geometry data differs from the values in the 3D model file.*

Accordingly, the selection of a new 3D model will overwrite all Geometry data.*
If a type’s link from the 2D model to a 3D model is lost or if no 3D model is assigned at all, in 3D mode the vehicle/pedestrian will be displayed as a colored box with the dimensions as defined for 2D Geometry.

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

The color as chosen in the distribution or for a class or PT line will be used to fill all “designated surfaces” within the 3D model. Appropriate basic models provided, 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. 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: Changing a default vehicle model file causes different simulation results only if the changed geometry values are passed into the Geometry dialog by OK in the Select 3D Model dialog.

5.2.6 Dwell Time Distribution (PT Stops & Parking Lots)

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

► parking lots which have to be defined per time interval for routing decisions of the parking lot type, cf. section 6.4.4,

► stop signs and e.g. toll counters,

► PT stops. For PT vehicles (e.g. buses, trams) the amount of time they stop at a passenger pick up area has to be defined for each PT 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 or edited by BASE DATA - DISTRIBUTIONS - DWELL TIME... Two types are provided:
• **Normal distribution:** A normal distribution is defined by the mean value and the 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, cf. section 5.2.1). Thus any type of distribution can be defined.

For the allocation of dwell time distributions to stops, cf. section 6.5.2.5.

### 5.2.7 Location Distribution (PT Boarding/Alighting Pass.)

The allocation of alighting passengers to the doors of a PT vehicle can be defined through a **Location Distribution** via **BASE DATA - DISTRIBUTIONS - LOCATION**. It shows how the total number of boarding and alighting passengers is spread over the whole length of the vehicle. Each door of a vehicle dwelling inside the PT stop (which is used for boarding and alighting) calculates "its" part of the total vehicle length:

► half-way to the adjacent door(s) respectively
► full distance to the front/rear of the vehicle.

To each share of the total vehicle length, the increase in y direction over this part on the x axis of the location distribution is assigned as percentage of passengers to the respective door.

► The alighting location distribution can be selected per PT line stop: Double-click on a red PT stop in a selected PT line, cf. section 6.5.2.5. Default is **no distribution** which assigns the same percentage to each door (regardless of the position).

► The boarding location distribution can be selected for each pedestrian area with PT usage separately in the **Boarding location** selection list, cf. section 7.1.4.3. Default is **Nearest door** which assigns each boarding passenger to the door which is situated most closed to him and can be reached quickly.

VISSIM provides five predefined distributions:

• **Uniform:** linear over the whole length of the vehicle
• **Center:** more passengers alight near to the middle of the vehicle
• **Front:** more passengers near the front
5.2.8 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 or edited by Base Data – Distributions – Temperature... in the same way as a speed distribution (cf. 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 buses 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 PT routes then they need to be defined as two separate vehicle types.

- **Vehicle category**: Preset, static categories of vehicles that incorporate similar vehicle interaction. For instance, 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. Existing types can be 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...

Press one of the buttons EDIT, NEW or COPY or double-click the selected list entry to open the Vehicle Type window. The following parameters are available:
- **No.:** Unique vehicle type identification
- **Name:** Any name or comment
- **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 (cf. 5.2.5).
- **Length:** Shows the range of vehicle lengths (min. and max.) according to the selected model distribution (this value is read only).
- **Width:** Defines the displayed width of a 2D vehicle in VISSIM. This parameter is relevant also if overtaking within the same lane is possible (cf. “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, cf. section 5.2.4.

The color information may be overruled by the color of the vehicle class to which this vehicle type is assigned or by the route color of a PT vehicle.
• **Acceleration and Deceleration curves:** Define the acceleration and deceleration behavior of that vehicle type. For more information cf. 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 cf. sections 5.2.2 and section 5.2.3.

---

**Dynamic Assignment:**

• **Cost Coefficients:** Opens the Cost Coefficients window. For further details please refer to section 12.5.

• **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:** This data is used for vehicle routing in Dynamic Assignment. The parameters determine the desired destination in the **Decision Situation** described in the list box on 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.
Others:

- **PT PARAMETERS** (only applicable for public transport vehicles): Opens the *Vehicle Type* window: *PT parameters* to define the parameters for dwell time calculation (cf. section 6.5.2.6, 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.

- **☑ Use external driver model** (add-on): Indicates that this vehicle type is not subject to the VISSIM driving behavior parameters but ruled by an external driver model.

- **Path and filename of driver model DLL**: Enter or select filename.

- **Path and filename of parameter file**: Enter or select filename.

VISSIM sends the following data to the *.DLL even if 0 was returned by `DriverModelGetValue` (DRIVER_DATA_SETS_XY_COORDINATES, ...):

- DRIVER_DATA_VEH_REAR_X_COORDINATE and
- DRIVER_DATA_VEH_REAR_Y_COORDINATE

This means that vehicle rear world coordinates are available in an external driver model for vehicles on VISSIM links.

Two new type codes have been added to the files DRIVERMODEL.CPP and DRIVERMODEL.H in VISSIM version 5.20-10:

- DRIVER_DATA_STATUS
- DRIVER_DATA_STATUS_DETAILS

In the DRIVERMODEL.CPP, the command `DriverModelSetValue()` can handle the following two parameters without returning zero:

- DRIVER_DATA_VEH_ACTIVE_LANE_CHANGE
- DRIVER_DATA_VEH_REL_TARGET_LANE
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 defined and edited via BASE DATA – VEHICLE CLASSES. The Vehicle Classes window contains a list of all classes defined. Use the control buttons to the right to edit the list.

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 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, cf. section 4.2.2.1.
  - **□ Use vehicle type color:** If checked, the vehicle color is determined by each vehicle type (or PT 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 behavior type. For each vehicle class, a different driving behavior parameter set may be defined - even within the same link (cf. section 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, five different parameter sets are predefined.

Right-click in the list to call the context menu.

- Click NEW (or DUPLICATE after selection of a set).
- Enter No. and Name in the main window.
- Enter the parameters in the tab pages.

- Select the parameter set in the list.
- 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 (cf. 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 the complete list of interaction states which can be recorded during the simulation please refer to section 11.7.

For each time step, the vehicle’s state of interaction can be displayed in the vehicle information window or stored with the vehicle protocol file, cf. section 11.6 and section 11.7.

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 Car 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 *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).
  
  - 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).

Without increasing the *min. look ahead distance* while modeling lateral behavior it may happen that vehicles do not stop for red lights or for each other. The Number of *Observed Vehicles* (by default: 4 for *Urban* driving behavior, else 2) 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.

The *Look back distance* defines the distance that a vehicle can see backwards in order to react to other vehicles behind (within the same link).

- 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).
- The *max.* value is the maximum distance allowed for looking backward. In networks with many small meshes, e.g. with many connectors over a short distance, the simulation speed can be improved if the maximum look back distance is reduced from the default value.

*Temporary lack of attention* (“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 lasts.
- *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. Cf. sections 5.4.2.1 and 5.4.2.2 for details.

These are the main parameters to affect the saturation flow rate. For examples, cf. section 5.4.6.

### 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 variation between -1.0 m and +1.0 m
which is normal distributed around 0.0 m with a standard deviation of 0.3 m.

- **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

\[
bx = (bx\_add + bx\_mult * z) * \sqrt{v}
\]

\( v \) is the vehicle speed [m/s]

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

### 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:

\[
dx\_safe = CC0 + CC1 \cdot v.
\]

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 time gap (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 the lane changer changes to). In case of a necessary lane change it also depends on the deceleration values of the "aggressiveness".

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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 the speed in the fast lane is > 60 km/h. For slower speeds, vehicles in the slow lane are allowed to "undertake" with a max. speed difference of 20 km/h.

To improve the general lane change behavior with either option, you can add the parameters for cooperative lane changing to the *.INP file with a text editor:

If the keyword **COOPERATIVE** follows after the keyword **RIGHT_HAND_RULE** or **FREE_LANESEL** in the *.INP file, the lane change behavior of the respective driving behavior parameter set will be more cooperative. In this case, a vehicle A who sees that the leading vehicle B on the adjacent lane wants to change to the lane of the vehicle A tries to change lanes itself to the other side in order to make room. It behaves as if it had to change lanes for a connector far in the distance, accepting only the base values for necessary lane changes ("Accepted deceleration") for its own deceleration and for the trailing vehicle C on the new lane. Vehicle A does not change cooperatively to a lane which is less suited for its own route, and it does not change lanes cooperatively if vehicle B is more than 3 m/s faster or if the collision time would be more than 10 seconds with the speed of vehicle A increased by 3 m/s. These two parameters can be optionally changed, too, in the *.INP file, after the keyword COOPERATIVE:

**COOPERATIVE SPEED <real> COLLISION_TIME <real>**.
If they are not specified, the default values 3 m/s and 10 seconds are used.

**Example *.INP:**

```plaintext
...  -- Driving Behavior: --
-----------------------
DRIVING_BEHAVIOR 1 NAME "Urban (motorized)"
  LANE_CHANGE_BEHAVIOR FREE_LANESEL COOPERATIVE SPEED 3.0 COLLISION_TIME 10.0
    T_DISAPPEAR 60.00 MIN LC GAP 0.50 MIN FREEFLOW 0.00
    MIN ACCELERATION OWN MIN -3.00 DISTANCE 50.00 MAX -1.00
    TRAILING VEHICLE MIN -3.00 DISTANCE 50.00 MAX 0.00
  CAR_FOLLOW_MODEL WIEDEMANN74
  NUMB PRECED 2 OBS DISTANCE MIN 0.00 MAX 250.00 REAR OBS DISTANCE MIN 0.00 MAX 150.00
    AX AVERAGE 2.00 BX ADD 2.00 BX MULT 3.00
    CC0 1.50 CC1 0.90 CC2 4.00 CC3 -8.00 CC4 -0.35
    CCS 0.35 CC6 11.44 CC7 0.25 CC8 3.50 CC9 1.50
  LATURAL BEHAVIOR MIDDLE
    OVERTAKE RIGHT VEHICLE CLASSES
    OVERTAKE LEFT VEHICLE CLASSES
    LAT DISTANCE DEFAULT DX STAND 1.00 DY 50 KM/H 1.00
  TURN COLLISION TIME 2.00 SPEED 1.00
  AMBER_BEHAVIOR CONT CHECK
    AMBER ALPHA 1.59000000 AMBER BETA1 -0.26000000 AMBER BETA2 0.27000000
DRIVING_BEHAVIOR 2 NAME "Right-side rule (motorized)"
  LANE CHANGE BEHAVIOR RIGHT HAND RULE COOPERATIVE
    T_DISAPPEAR 60.00 MIN LC GAP 0.50 MIN FREEFLOW 11.00
    MIN ACCELERATION OWN MIN -3.00 DISTANCE 50.00 MAX -1.00
    TRAILING VEHICLE MIN -3.00 DISTANCE 50.00 MAX 0.00
  CAR FOLLOW MODEL WIEDEMANN99
...```

**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 Decelerations*. In addition, a reduction rate (as meters per 1 m/s²) is used to reduce the *Maximum Deceleration* with increasing distance from the emergency stop position.

**Example:** The following parameters result in the graph shown below:

<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.

- **Safety distance reduction factor**: During lane changes the reduction factor is regarded, which takes effect for:
  - the safety distance of the trailing vehicle in the new lane for the decision whether to change lanes or not,
  - the own safety distance during a lane change and
  - the distance to the leading (slower) lane changing vehicle.

During any lane change, the resulting shorter safety distance is calculated as follows: **original safety distance x reduction factor**. The default factor of 0.6 reduces the safety distance by 40%. After the lane change, the original safety distance is regarded again.
- **Maximum deceleration for cooperative braking**: Defines if a trailing vehicle will start cooperative braking allowing a leading vehicle to change from an adjacent lane into its lane. If the trailing vehicle determines that it would have to brake with a higher deceleration than this value if the leading vehicle started the lane change, it does not start or continue cooperative braking. A higher value will result in more braking and thus probability of lane changing. The leading vehicle will still initiate the lane change dependent upon the safety distance reduction factor for lane changing and car-following parameters. Maximum values suggested are 0.7-1.0 local acceleration due to gravity (9.81 m/s², 32.2 ft/s²).

Cooperative braking uses the following:

- up to 50% of the desired deceleration (cf. section 5.1) until the leading vehicle starts changing lanes,
- between 50% of the desired deceleration and this user-defined **Maximum deceleration**. Typically, deceleration during lane changes will be significantly lower than the **Maximum deceleration**, since a lane changing leading vehicle will not expect an extremely high deceleration of the trailing vehicle.

Note: Lane change behavior is similar to VISSIM version 4.10, if the
- **Safety distance reduction factor** is set to 0.0 - 0.1 and
- **Maximum deceleration for cooperative braking** is set to -9m/s².

- **Overtake reduced speed areas**: This option is off by default.
  - ☑ If this option is checked, you can model lane-dependent speed restrictions which are considered for lane changing.

- ☐ If this option is not checked, vehicles never change lanes directly upstream of a reduced speed area. Furthermore, they ignore reduced speed areas on the target lane.
5.4.4 Lateral Behavior

By default, one vehicle occupies the entire width of one lane in VISSIM. The lateral behavior parameters enable 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 vehicles that are traveling on adjacent lanes and keep the minimum lateral distance. For this purpose, they even adjust their own lateral position in their own lane by drawing aside. The simulation also regards the exact position of the rear ends of vehicles during or after lane change to adjacent lanes. If this option is not ticked, vehicles in adjacent lanes are ignored even if their widths exceed the width of their lanes (except in case of lane changing).

This option will reduce the simulation speed significantly.

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

- **Consider next turning direction**: For non lane based traffic, this option provides improved modeling of the lateral behavior upstream of turns.

If this option is checked, late overtaking of vehicles going through is avoided in the with-flow direction toward the direction of the turn.

The relevant connector is always the first one downstream in the vehicle’s route which has a desired direction value of "left" or "right". If
the vehicle is inside the lane change distance of this connector (ignoring the flag "lane change distance per lane") the vehicle moves laterally on its lane to the respective side and vehicles which do not want to turn at the same connector or earlier on the same side try not to overtake the vehicle on that side. (In previous versions, only the immediate next connector was checked, and the lane change distance was ignored.)

With the *.INP file, a data row consisting of the three driving behavior parameters for lateral behavior is stored on top of the AMBER_BEHAVIOR data row in this case.

Example:

```
... DRIVING_BEHAVIOR 1 NAME "Urban (motorized)"
   LANE_CHANGE_BEHAVIOR FREE LANESEL COOPERATIVE
      T_DISAPPEAR 60.00 MIN LC_GAP 0.50 MIN FREEFLOW 0.00
      MIN_ACCELERATION OWN MIN -3.00 DISTANCE 50.00 MAX -1.00
      TRAILING_VEHICLE_MIN -3.00 DISTANCE 50.00 MAX 0.00
   CAR_FOLLOW_MODEL WIEDEMANN74
      NUMB_PRECED 2 OBS_Distance MIN 0.00 MAX 250.00 REAR_OBS_Distance MIN 0.00 MAX 150.00
      AX_AVERAGE 2.00 BX_ADD 2.00 BX_MULT 3.00
      CC0 1.50 CC1 0.90 CC2 4.00 CC3 -8.00 CC4 -0.35
      CC5 0.35 CC6 11.44 CC7 0.25 CC8 3.50 CC9 1.50
   LATERNAL BEHAVIOR MIDDLE
      OVERTAKE RIGHT VEHICLE_CLASSES
      OVERTAKE LEFT VEHICLE_CLASSES
      LAT_DISTANCE DEFAULT DX_STAND 1.00 DX_50KMH 1.00
      TURN COLLISION_TIME 2.00 SPEED 1.00
   AMBER_BEHAVIOR CONT_CHECK
      AMBER_ALPHA 1.59000000 AMBER_BETA1 -0.26000000 AMBER_BETA2 0.27000000
...
```

Please note, that the default values of the latter two AMBER_BEHAVIOR parameters can only be modified manually in the *.INP file.

These parameters work as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
</table>
| TURN      | The direction (left / right / through (= "all") of the next turning movement (i.e. the next connector of the vehicle's route) is taken into consideration:  
- The vehicle does not change the lateral position in order to overtake a vehicle on the wrong side (since this would cause a collision at the next intersection)  
- The vehicle moves laterally on the lane to the side of the next turn if there is room. Option Consider next turning direction has precedence over option Desired position at free flow.  
Please note, that the lane change distance of the connector is ignored so far and only the |
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>next connector is considered.</td>
<td></td>
</tr>
<tr>
<td>COLLISION_TIME</td>
<td>Minimum collision time gain (calculated with the desired speed of the vehicle) which is required for a change of the lateral position. The default = 2 seconds can be set to a lower value if vehicles should move laterally for smaller advantages, too.</td>
</tr>
<tr>
<td>SPEED</td>
<td>Minimum longitudinal speed [m/s] allowing lateral movement. The default = 1 m/s can be set to a lower value if vehicles should move laterally even if they have almost come to a standstill already.</td>
</tr>
</tbody>
</table>

- **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 and for the lateral distance to vehicles in the adjacent 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 other speed values, the appropriate minimum distance value is gained by linear interpolation. 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 behavior 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 behavior type “Urban lateral cycle” to the desired link(s).

### 5.4.5 Signal Control

**Reaction to amber signal**

The decision model defines the vehicle behavior in front of a signal control showing amber.

- **Decision model**: Select the appropriate decision model.
  - **Continuous Check**: Vehicles assume that the amber light stays amber for 2 seconds and continuously decide whether to proceed at each time step thereafter until passing the signal head.

  The vehicle will not brake, if even the maximum deceleration would not allow for a stop at the stop line or if a value > 4.6 m/s² would be required for braking to the halt.
The vehicle brakes if it cannot pass the signal head within 2 seconds when continuing at its current speed rate.
In the range in-between, if both options applied, a normally distributed random variable decides whether the vehicle brakes.

- **One Decision**: The probability $p$ of the driver stopping at amber light is calculated using a logistic regression function with the current speed $v$ and the distance from the vehicle front to the stop line $dx$ as independent variables and three fitting parameters ($\alpha$, $\beta_1$, $\beta_2$):

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

The provided standard parameter values have been derived from empirical data.
Enter the appropriate probability factors.
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]). This is due to the fact that a signal head internally is modeled as a vehicle and will only be recognized if the number of vehicles and network elements in front of the signal head does not exceed the value resulting from number of *Observed vehicles* minus 1.

**Applied deceleration**

Once the driver has decided to stop according to the decision model, a constant deceleration rate will be calculated for the target braking to the stop line, cf. section 5.1.

The applied deceleration rate $b_{\text{applied}}$ depends on the distance to the stop line $dx$ and the current vehicle speed $v$ and is calculated as follows:

$$b_{\text{required}} = \frac{v^2}{2 \cdot dx}$$

$$b_{\text{applied}} = \min(b_{\text{required}}, b_{\text{max}})$$

Where $b_{\text{required}}$ is the required deceleration and $b_{\text{max}}$ is the maximum possible deceleration according to the defined deceleration function.
Behavior at red/amber signal

This parameter defines the vehicle behavior in front of a signal control showing red/amber.

For the driving behavior parameter set, you can select Go (same as green) or Stop (same as red) to adjust the behavior to different country/region specific habits or rules:

Reduced safety distance close to a stop line

These parameters define the vehicle behavior close to a stop line.

- **Reduction factor**: Within the given distance from Start to End, the user-defined reduction factor is applied to the vehicle’s desired safety distance, cf. section 5.4.3.
  
  For lane changes in front of a signal control, both the resulting values are compared to each other. VISSIM will use the shorter distance.

- **Start upstream of stop line**: Distance upstream of the signal head.
- **End downstream of stop line**: Distance downstream of the signal head.

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.

Depending on the selected *Car following model* different *Model parameters* are available, cf. section 5.4.2.1 and section 5.4.2.2 for details.

Wiedemann 74 Car Following Model

The model contains 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** \((bx\_add)\) and
- **Multiplicative part of desired safety distance** \((bx\_mult)\)

Apart from that the saturation flow rate is also dependent on many other parameters, such as vehicle speed, truck percentage, number 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 below is based on the following assumptions:

- single lane link,
speed distribution 48-58 km/h,
- standard driving parameters except the values for both \( bx_{add} \) and \( bx_{mult} \) which are shown on the x-axis (in this example \( bx_{add} \) equals \( bx_{mult} - 1 \)),
- 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>
</tbody>
</table>
### Scenario 99-7
- Right-side rule: yes
- Lanes: 3
- Speed cars*: 120
- Speed HGV*: n.a.
- % HGV: 0%

### Scenario 99-8
- Right-side rule: yes
- Lanes: 3
- Speed cars*: 120
- Speed HGV*: 85
- % HGV: 15%

* 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.
Saturation Flow

<table>
<thead>
<tr>
<th>CC1</th>
<th>0.5</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
<th>0.9</th>
<th>1.0</th>
<th>1.1</th>
<th>1.2</th>
<th>1.3</th>
<th>1.4</th>
<th>1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>veh / h / lane</td>
<td>0,5</td>
<td>0,6</td>
<td>0,7</td>
<td>0,8</td>
<td>0,9</td>
<td>1,0</td>
<td>1,1</td>
<td>1,2</td>
<td>1,3</td>
<td>1,4</td>
<td>1,5</td>
</tr>
</tbody>
</table>

- Scenario 99-2
- Scenario 99-4
- Scenario 99-6
- Scenario 99-8
5.5 Links: Behavior Type and Display Type

Before VISSIM 5.0, each link had a link type which defined both the driving behavior of vehicles on that link and the graphical display of that link. Connectors used the link type of their origin link.

Since version 5.0, each link and connector has a behavior type and a display type, allowing independent handling of these attributes. It is still possible to change the behavior or display of a group of links at once if all these have the same behavior type respectively display type.

For links, the following options are provided:
► Use the link behavior type to allocate a specific driving behavior parameter set to a selected vehicle class.
► Use the link display type to assign specific display parameters.

If an old network file is read (from VISSIM versions before 5.0), VISSIM automatically executes the following steps:
► Link types are split into link behavior types and link display types and assigned to the respective links.
► Connectors get the same link behavior type and display type as their origin links.

5.5.1 Link Behavior Type by Vehicle Class for Links

VISSIM provides several predefined link behavior types which can be edited via BASE DATA - LINK BEHAVIOR TYPES...

The list of predefined types and the list of driving behavior parameter sets assigned to vehicle classes can be edited via NEW or DELETE in the context menu.

When working with a link network, MULTI-SELECT IN NETWORK in the context menu serves as a link filter for further changes to the properties of all links of the selected type: VISSIM automatically switches into the multi-selection edit mode when OK is confirmed, cf. section 6.1.

The properties of the selected link behavior type can be edited:
• **No.**: Unique identification of the link behavior type.

• **Name**: Label of the link behavior type.

• **Allocation Vehicle class: Driving Behavior**: Assignment of a driving behavior parameter set to a vehicle class. To the various classes, different driving behavior parameter sets can be assigned. One parameter set needs to be assigned to the virtual class “default” which is used for all vehicles whose vehicle types do not belong to any of the mentioned vehicle classes.

Driving behavior parameter sets are defined in **BASE DATA – DRIVING BEHAVIOR...** (cf. section 5.4).

---

Certain small VISSIM licenses (e.g. U.S. level 1) are restricted to the maximum of two link behavior types per network file.

---

For pedestrian simulations, you can define **WALK BEHAVIOR PARAMETER SETS** and assign them to **AREA BEHAVIOR TYPES** by pedestrian class in the **BASE DATA** menu accordingly.

---

### 5.5.2 Display Type by Link/Connector or Construction Element

Display types can be defined via **BASE DATA – DISPLAY TYPES...** for links and connectors as well as for areas, ramps and obstacles (Pedestrians add-on, cf. section 7.3.1).

In the **Display Options** window, decide whether to use the display type colors for screen display, cf. section 4.1.3.

In the **Display Types** window, the list of display types can be edited via **NEW**, **DELETE** and **DUPLICATE** in the context menu.

When working with a link network, **MULTI-SELECT IN NETWORK** in the context menu serves as a link filter for further changes to the properties of all links of the selected display type: VISSIM automatically switches into the **multi-selection** edit mode when **MULTI-SELECT IN NETWORK** is confirmed, cf. section 6.1.
For 2D view, the general properties of the selected display type are displayed on top of the tabs and can be edited:

- **No.**: Unique identification of the display type.
- **Name**: Label of the display type.
- **Color**: Used for the display in the network (except during a simulation or animation run in 2D) if option ✓ *Use display type colors* is checked under **VIEW – OPTIONS – [COLORS]***.
- ✓ **Invisible**: If this option is active none of the links or construction elements of this display type will be drawn during a simulation or animation run (but the vehicles/persons moving on these links/elements will be displayed).

**[3D DISPLAY]**

The properties for 3D display are arranged in this tab:

- **Texture**: Graphics file to be used for link display in 3D mode. The cross means „no texture“, otherwise a preview of the texture is displayed. The graphics file can be selected through the texture manager (cf. section 4.1.4.1) which is opened by a click on the preview pane.
- ✓ **Curved**: If this option is selected the texture is oriented along the center line of the link, following its curvature (which is useful for text/numbers/markings on the pavement). If the option is not selected the textures for all links and connectors of this display type are oriented the same way so that no edges are visible where they overlap.
- ✓ **No Mipmapping**: If this option is selected the texture is drawn with maximum resolution even in greater distance from the viewer, which is good for markings on the pavement. If this option is not selected the texture is drawn blurred in the distance which looks better for pavement without markings.
Links with a thickness > zero have two additional options:

- **Shaded walls**: activates shading for the side walls of the link;
- **All sides same color/texture as top side**: causes the side walls to be drawn with the same color and texture as the top side.

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

- **Railroad tracks**: If this option is selected, railroad tracks are displayed on the link in 3D mode which can be configured via CONFIGURATION.
Optionally, you can select a different LOS scheme for the selected display type. Settings in this tab will overrule the global settings for area-based display of aggregated values via menu VIEW – OPTIONS – [PEDESTRIANS]. Type settings can be overruled by the current settings for a particular area or ramp or stairway. For more details, please refer to section 7.3.3.
5.6 Managed Lane Facilities & Toll Pricing Models

Prior to defining routing decisions of the Managed lanes type (cf. section 6.4.4) in the network and using them during simulation, please define the following in the TRAFFIC menu:

► MANAGED LANE FACILITIES
► TOLL PRICING CALCULATION MODELS

5.6.1 Managed Lane Facilities

In VISSIM, a managed lane facility does not have co-ordinates, but combines a toll pricing calculation model and a decision model.

Via menu TRAFFIC - MANAGED LANE FACILITIES the Managed Lanes Facilities window appears.

Right-click to call the context menu in the list of facilities:

Click NEW to create a new managed lane facility.

After selection of a managed lane facility you may click DUPLICATE or DELETE. Alternatively, you can edit the Number or Name property of a selected managed lane facility in the Details section of the window.
DUPLICATE creates a new managed lane facility with the properties of the selected managed lane facility, but a new number = 1 + maximum managed lane facility No. in current network.

DELETE removes the selected managed lane facility from the current network. If this facility had still been allocated to a routing decision, then the routing decision remains incomplete: It will not take effect during simulation, though it has not been deleted from the network.

5.6.1.1 The Pricing Model

The pricing model defines when the managed lane facility will calculate the road toll and also the way it will be calculated.

User classes and Pricing update interval(s)

The following occupancy rates have been predefined:

<table>
<thead>
<tr>
<th>1 person (SOV)</th>
<th>driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 persons (HOV2)</td>
<td>driver and co-driver</td>
</tr>
<tr>
<td>3 or more persons (HOV3+)</td>
<td>3 or more people in the vehicle</td>
</tr>
</tbody>
</table>

During the simulation, the user class of a vehicle is derived from the occupancy rate defined by vehicle type.

Since the vehicle occupancy rate is an integer value, it is calculated as outlined below, for example:
If the predefined occupancy rate is 1 for vehicle type A, then all vehicles of type A are assumed to have only the driver sitting in them.

If the predefined occupancy rate is 1.4 for vehicle type B, then 60% of the vehicles of type B are assumed to have only the driver sitting in them and 40% are assumed to have driver and co-driver sitting in them.

The *Pricing update interval* defines, how often the travel times (i.e. travel time savings and average speed values) and the particular road toll are re-calculated. Travel times and road toll are valid throughout the current *Pricing update interval* and will be re-calculated when a new *Pricing update interval* starts.

Optionally user-defined moments of time can be regarded additionally for toll pricing re-calculation: After re-calculation at a user-defined time the general *Pricing update interval* will be regarded again for the next re-calculation. For *Time interval definition* please refer to section 6.4.3.1.

**Road toll per occupancy rate and time interval**

Road toll is defined by time interval. You may apply it in two ways:

- Road toll is a constant value (fixed price)
- Road toll is derived from a user-defined calculation model:
  
  Click ▶️ to call the selection list and make your choice. There are two options:
  
  - Select one of the pricing models from the list predefined via menu **TRAFFIC - TOLL PRICING CALCULATION MODELS**
  
  - Select <Configure> to call the **Toll Pricing Calculation Models** window directly.

For fixed price = 0.0 no road toll is charged.

Also a user-defined calculation model may result in road toll = 0.0.

Road toll = 0.0 does not automatically mean that all vehicles would take the managed lane (cf. section 5.6.1.2).

Road toll is calculated according to the selected calculation model at each managed lane facility for each of the three user classes and remains valid until the next pricing update. In the network, the managed lane facilities’ moments of time when a pricing update has to be calculated can differ.
The decision model calculates the number of vehicles actually using the managed lane. For probability calculation, a Logit model is applied using the following equation:

\[ P(\text{Managed}) = 1 - \frac{e^{\alpha U_{\text{Managed}}}}{e^{\alpha U_{\text{Managed}}} + e^{\alpha U_{\text{Unmanaged}}}} = 1 - \frac{1}{1 + e^{\alpha \Delta U}} \]

Here, the utility difference results from the travel time difference (TT savings = unmanaged TT - managed TT in [min]) and from the cost difference (charges) between managed route and unmanaged route:

\[ \Delta \text{Utility} = \text{CostCoefficient} \times \Delta \text{Cost} + \text{TimeCoefficient} \times \Delta \text{Time} \]

Enter the following parameters:
- **Logit-Alpha** (Default = 0.05)
- **Utility-Coefficient Cost** (optionally by vehicle class)
- **Utility-Coefficient Time [min]** (optionally by vehicle class)

For vehicles of a type that does not belong to any of the given classes the default coefficients are used.
For vehicles of a type that belongs to several of the given classes the values specified for the vehicle class with the lowest number the vehicle type belongs to will be used.
Travel time on the managed route exceeding the travel time on the unmanaged route would cause negative time savings. In this case, travel time saving = 0 is used.

### 5.6.2 Toll Pricing Calculation Models

Via menu **TRAFFIC - TOLL PRICING CALCULATION MODELS** the **Toll Pricing Calculation Models** window appears.

Call the context menu via right-click in the list of models:
- Click **NEW** to create a new toll pricing calculation model. After selection of a toll pricing calculation model you may click **DUPLICATE** or **DELETE**.
- Edit the **Number** or **Name** property of a selected toll pricing calculation model in the **Details** section of the window.

**DUPLICATE** creates a new toll pricing calculation model with the properties of the selected toll pricing calculation model, but a new number = 1 + maximum toll pricing calculation model No. in current network.

**DELETE** removes the selected toll pricing calculation model from the current network. If a toll pricing calculation model is removed though it is still used by a managed lane facility then the managed lane facility will use road toll = 0.0 instead.

**Traffic Responsive Toll Pricing**

For toll price calculation, the following values are used:
- Travel time savings in [min] and
- Average speed on the managed lane in [km/h or mi/h] which was determined for those routing decisions using the managed lane facility.
*COM scripts* can also address Toll Pricing Calculation Models.
Instead of a COM script, users may also create and use a *.DLL file for
dpricing calculation. The required header data file (C++) is to be found in the
following sub-directory: API\TOLLPRICING_DLL\.
6 The Traffic Network

In this chapter, modeling a VISSIM network - creating and editing network elements - is described.
6.1 Overview

The basic element of a VISSIM traffic network is a link representing a single (or multiple) lane roadway segment with a specific direction of flow. A network can be built by connecting links via 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 network. They can be edited or deleted.

In the simple network example below, the junction is a signal-controlled intersection with signal heads ▀ and detectors ▣. Additionally some movements are secured by priority rules ▇ (the colors of the network elements depend on user-defined settings).

Example

Normal display:
The roadwork is displayed in dark gray showing an intersection with 3 legs and 2 pedestrian crossings.

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

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.

By default, network objects are selected as follows:

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 in the network display on screen, cf. 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.

Users of the Pedestrians add-on should refer to section 7.1.4, since the selection of a construction area, for example, differs from the regular procedure.

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 PT stops
- Position of signal heads/stop lines including a reference to the associated signal group
- Position and length of detectors
- Location of PT 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 routing 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 class),
► Travel time measurement sections and delay data collection,
► Queue counters for queue length statistics.

Users of the Pedestrians add-on should refer to section 7.2, since similar evaluations are provided for pedestrian flows.
6.2 Data Import/Export

VISSIM allows for data exchange between VISSIM and other software programs.

6.2.1 Data Import

For a productive workflow it is possible to import part or all of VISSIM network data from other applications.

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. Click FILE - READ ADDITIONALLY...

   This functionality is only available if a newly created network was already saved to file.

2. Select the filename of the *.INP file to be read additionally.

3. Set the options:
   - Select the Insert Position option
   - Choose the Network Elements

4. Confirm Ok.

   Use the default settings to read the entire network additionally.

   Use option Select position with left mouse button to fix the final position for the network which is read additionally.
• **Insert Position**
  - *Select position with left mouse button*: Inserts the additional network as floating selection which can be moved with the mouse pointer 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 cases, 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 automatically selected 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.)

- **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).

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

- **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 SYNCHRO 7 Import (add-on module)

VISSIM supports the import of entire networks, including signals and signal timing, from the software package SYNCHRO, version 7, if this module is part of your VISSIM license. The SYNCHRO network must be saved as a *.CSV combined data file prior to data import in VISSIM.

This functionality does not facilitate the import of data generated with an elder SYNCHRO version.

VISSIM will import all elements from the SYNCHRO 7 file, including network geometry, volumes, turning movements, vehicle compositions, intersection control, and signal timing. All signal timing will be imported to individual Ring Barrier Control (RBC) files for VISSIM.

To use this feature, click menu **FILE – IMPORT… - SYNCHRO 7**. The *SYNCHRO 7 Import* window opens.
Choose the specific SYNCHRO 7 file for input and choose the path for the created VISSIM files (which will include the *.INP file and the *.RBC files).

The name of the *.CSV file selected for import will be used as *.PANM und *.INP file names.

Similar to the ANM Import, a network generated via SYNCHRO7 import can be modified later and the modified data can be read adaptively then.

**Example workflow**

► Create the VISSIM network via menu FILE – IMPORT… - SYNCHRO7.
► Refine the VISSIM network, e.g. adjust VISSIM link polygons, add travel time sections etc.
► Run the simulation.
► As a result, you might notice that the signal control data needs to be adjusted or changed in SYNCHRO 7.
► Start SYNCHRO 7, make the desired changes to the SYNCHRO signalization data and save the new SYNCHRO data.
► In VISSIM, start menu FILE – IMPORT… - SYNCHRO 7 ADAPTIVELY and import the new, updated SYNCHRO data.
► VISSIM compares the originally imported (ANM) data with the new (ANM) data: if only signalization data differs, then only signalization data is re-created in VISSIM.
► In this case, all manually changed VISSIM links/connecters remain unchanged, the travel time sections are retained etc.

The adaptive import is only possible if the current network was originally created by SYNCHRO 7 Import. This button is disabled if no current network exists or if the current network was not created by SYNCHRO 7 Import.

This is similar to the ANM Adaptive Import, as described in section 6.2.1.5.

It should be noted that networks created through this process may not match an existing background map or aerial photo in the same way as a network built in VISSIM. The network will be as accurate as the input data provided and may require a minimum of adjustment.

**6.2.1.3 Adaptive SYNCHRO7 Import**

Menu FILE - IMPORT – SYNCHRO 7 ADAPTIVE starts another import run additionally to the initial import.
The adaptive SYNCHRO 7Import should be called only for a VISSIM network that was originally created by means of an initial SYNCHRO 7 Import and has been modified in SYNCHRO 7 in-between, cf. section 6.2.1.2.

6.2.1.4 ANM Import

*.ANM files contain an abstract network model in XML format. They can be exported since VISUM 10 or could be created by other traffic planning or engineering software as well.

ANM Import can be performed in two ways:
► Complete import (initial: creating a new VISSIM network)
► Adaptive import (only differences in the new *.ANM file compared with the *.ANM file imported earlier) in order to update only the affected data in the VISSIM network, cf. section 6.2.1.5.

The abstract network model is based on nodes and edges with optional node details (lanes, lane turns, pockets, pedestrian crosswalks, control type, signalization, detectors).

The geometry of the VISSIM links and connectors is created in VISSIM.

Volumes and routing data which are stored in *.ANMROUTES files can be imported in VISSIM for further use in Dynamic Assignment or as static routes.
► For dynamic assignment:
  - Matrix file(s) and path file and cost file are created.
  - The names of the generated *.FMA matrix files include demand totals and relevant time interval as well as the name of the input file to avoid overwriting any matrix files from previous exports by mistake.
Route volumes in a path file resulting from ANM Import do not necessarily be integers, since the assignment result may have floating point values in VISUM.

During the export, the DTA route volumes are stored as volumes per ANM time interval in the path file. During the import, the volume values are converted into volume data per evaluation interval of the Dynamic assignment.

For Dynamic Assignment, these values are rounded by random in VISSIM (according to the share to be rounded). Example: 0.3 is rounded up to 1 with 30% probability and down to 0 with 70% probability. Random rounding causes the total of the values in the matrix to remain approximately constant.

▶ For static routing:
- Inputs and routing decisions with static routes are created.
- Each routing decision for static routes is assigned a name containing the ANM origin zone number.
- The IDs of the ANM routes serve as route numbers of static routing decisions. This way, any route can be found in the ANMROUTES file and the respective OD pair can be determined.

Since VISSIM 5.00-05 also data files exported by SITRAFFIC OFFICE can be imported.

During ANM Import, warnings and messages are displayed in the protocol window, cf. section 10.2.1.

**Starting the (initial) ANM Import**

Call **File – Import… - ANM** to open the **ANM Import** window.
Specify the paths for input files and output files.

- **Import network data**: If this option is active, path and file name of the ANM file to be imported as abstract network model have to be entered.

- **Import routing**: If this option is active, do the following:
  - Chose whether routing data has to be imported as Static Routing or for further use in Dynamic Assignment.
  - For Dynamic Assignment: Enter the evaluation interval, if applicable.

If the option Static Routing is selected with the initial import of the network data, no parking lots (zone connectors) will be created. Thus, the adaptive routing import for dynamic assignment is not possible subsequently.

ANM Import creates a network file which includes the *.ANM file data. By this, your currently loaded network could be overwritten or deleted.

For future adaptive ANM Import a name for the output file *.INP is required. The files *.PANM and *.PANMROUTES are automatically copied to the folder which has been specified for the *.INP file.
● Show warnings during import: If this option is active, you have to confirm every warning on screen. Simultaneously, all messages and warnings are traced to a Log file and can be listed on screen after the import.
If this option is not active, no messages will be displayed during import, but the Log file will be created and the list of messages can be opened on screen as well subsequently.

● CLOSE closes the window and saves current settings.
● IMPORT starts the import procedure.
● CANCEL closes the window and ignores modified settings.

Instead of ANM Import you may also select the *.ANM file in the Explorer and open it in the VISSIM window via Drag´n´Drop.
► If no *.INP network file has been loaded, this *.ANM file is imported.
► If an *.INP network file has been loaded which initially was imported via ANM Import, you may pick to read this file adaptively or initially now.

How the VISSIM Network is built

The ANM Import creates the following VISSIM network elements from exported VISUM network objects:

<table>
<thead>
<tr>
<th>VISUM</th>
<th>VISSIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport system</td>
<td>Vehicle type and vehicle class</td>
</tr>
<tr>
<td>Node</td>
<td>Node (as segment node, cf. section 12.3.2)</td>
</tr>
</tbody>
</table>
| Link                   | Links (one per segment; e.g. the start of a pocket creates a new link with one additional lane); multi-lane links according to lane geometry, if applicable. You can create multiple connectors connecting the same two links and also connectors from or towards the same lane (those can be exported since VISUM 11.0).
The emergency stop distance for connectors representing turning movements in nodes is set to the pocket length minus 10 m.
The front time gap for a conflict of a left-turn and a parallel crosswalk is set to 2.0 seconds. (This way, opposite right-turns with a front time gap = 0.5 s may start prior to the left-turns as soon as their conflict area has been cleared normally.) |
<p>| Lane                   | Lanes (with lane-specific permission or closure by vehicle type) |
| Turn                   | Connector, with reduced speed area in case of sufficient curvature. |</p>
<table>
<thead>
<tr>
<th>VISUM</th>
<th>VISSIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right-turn on red movements are created with stop sign, signal head and conflict area. Multiple lane turns from a lane to several lanes on the same link are permitted.</td>
<td>Connector closures Note: In VISSIM, the lane closure for a specific Public Transport TSys is applied only if in VISUM a vehicle combination has been defined with this TSys assigned.</td>
</tr>
<tr>
<td>Blocked Turn for TSys</td>
<td></td>
</tr>
<tr>
<td>Connector closures</td>
<td></td>
</tr>
<tr>
<td>Note:</td>
<td></td>
</tr>
<tr>
<td>In VISSIM, the lane closure for a specific Public Transport TSys is applied only if in VISUM a vehicle combination has been defined with this TSys assigned.</td>
<td></td>
</tr>
<tr>
<td>Zone and Connector</td>
<td></td>
</tr>
<tr>
<td>► Parking lots (for dynamic assignment) or</td>
<td></td>
</tr>
<tr>
<td>► vehicle input and static routing decision (for static routing). For VISSIM zone connectors cf. below</td>
<td></td>
</tr>
<tr>
<td>On connectors from/to VISSIM links, that represent zone connectors in the ANM file exported from VISUM, conflict areas are created, so that the vehicles entering/leaving the network via these links do not interfere with “normal” traffic.</td>
<td></td>
</tr>
<tr>
<td>VISSIM links and connectors representing zone connectors in the ANM file from VISUM are created with option „Visualization“ unchecked by default. Thus vehicles driving on them are invisible.</td>
<td></td>
</tr>
<tr>
<td>Link attribute Type</td>
<td></td>
</tr>
<tr>
<td>A Link behavior type is created accordingly (No./Name) and one of the automatically created Link display types is allocated:</td>
<td></td>
</tr>
<tr>
<td>► ANM Default</td>
<td></td>
</tr>
<tr>
<td>► Pedestrian Crosswalk (1 m before stop line)</td>
<td></td>
</tr>
<tr>
<td>► Zone Connector (additional link)</td>
<td></td>
</tr>
<tr>
<td>For connectors between links, link behavior type and link display type of the FromLink are allocated.</td>
<td></td>
</tr>
<tr>
<td>Link attribute v0-PrT</td>
<td></td>
</tr>
<tr>
<td>Desired speed distribution assigned to a desired speed decision</td>
<td></td>
</tr>
<tr>
<td>Stop points</td>
<td></td>
</tr>
<tr>
<td>PT Stops whose length and type (Street/Lay-by) result from the parameters that had been set in VISUM for ANM Export of public transport stop points.</td>
<td></td>
</tr>
<tr>
<td>Public transport vehicle journeys (in the exported time period)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bus/Tram Lines</td>
</tr>
</tbody>
</table>
VISUM | VISSIM
--- | ---
Signal controller and signal groups | SCJ and signal groups
Signal group assignment to lanes in the junction editor | Signal group assignment to signal heads on lanes
Time interval | Evaluation period for dynamic assignment
From the node control type | Signal heads, stop signs, conflict areas
For NEMA signal controlled nodes | Detectors

**VISUM zone connectors**

- It is recommended to have VISUM zone connectors only from/to nodes that have only one (feeder) link to/from an adjacent node, and from that node only to/from a single zone. In this case the parking lots (or vehicle inputs and routing decisions) for these zone connectors can be placed on the existing feeder link.

- If the zone connector is connected to a node with more than one link or if more than one zone are connected to the same node each connector must be modeled by an additional link in the VISSIM network which is connected to the node’s links without any regard for the node geometry.

**Reduced speed areas on VISSIM connectors**

Reduced speed areas on VISSIM connectors are generated automatically if the curvature of the turn exceeds a threshold. Therefore, the coordinates of the adjacent links are regarded and the angle between points as well.

Normally, the automatically created reduced speed area is placed in the middle of the connector and has a length of 2 m. Thus the starting position $x = \text{connector length} : 2 - 1m$. In case of connector length $< 2$ m, the reduced speed area covers the entire connector.

Speed is assigned as follows automatically:
- Inner turns (left-turns in case of right-hand traffic): 25 km/h
- Outer turns (right-turns in case of right-hand traffic): 15 km/h

The value range of the automatically generated desired speed distributions is $\{-10\%...10\%\}$.

Since VISSIM 5.00-07, deceleration depends on the vehicle class. If the vehicle class includes a vehicle type of category HGV or Bus or Train, deceleration is set to $1.3\text{ms}^2$, otherwise deceleration is set to $2.0\text{ms}^2$ (as before).
6.2.1.5 Adaptive ANM Import

The adaptive ANM Import should be called only for a VISSIM network that has been originally created by means of an initial ANM Import.

In contrast to the initial ANM Import, the Adaptive ANM Import works as follows:

The initial ANM data which was saved by VISSIM during the initial ANM import is kept independently of manual refinements in the VISSIM network. During an adaptive ANM Import VISSIM compares the new ANM data with the saved initial ANM data and uses only the differences between the two data sets to adapt the VISSIM network accordingly. If a node has been changed in the ANM file only this node and the connected edges are created from scratch by the adaptive import, thus only manual geometry improvements in this (small) part of the network will get lost. All manual modifications of the VISSIM network in nodes (and edges) that are not affected by the changes in the ANM file remain intact, however, as do VISSIM network objects that have been added only in the VISSIM network editor.

Adaptive ANM Import allows for:

► Exporting changes to the original VISUM network into a previously exported VISSIM network which has been refined manually in the meantime without losing much of the work in the VISSIM network editor.

► Loading a different demand scenario (matrix and assignment result) from VISUM - in this case the VISSIM network remains completely unchanged (unless a necessary parking lot or route need to be added).

Routing data is imported adaptively only if the routes to be imported have been changed, i.e. if the *.ANMROUTES file has been changed.

If the routes have been changed manually in VISSIM and the original *.ANMROUTES files shall be imported again, initial ANM import has to be used: Select only routing for import. Then, the network will remain unchanged.

Starting the adaptive import also runs an additional check of the VISSIM nodes. If a VISSIM node matches with an ANM zone it will be checked whether the current edge structure complies with the internal ANM attributes (IDs of the ANM zone connector) of the node.

The node geometry cannot be restored if only node name or/and the link name and/or the link behavior type have changed.

In case of changes to name or type, the reconstruction of the node geometry is forced on purpose in case of two parallel links between two nodes.

Starting the Adaptive ANM Import

Call **FILE – IMPORT… - ANM ADAPTIVE** to open the **ANM Import Adaptive** window.
Adaptive ANM Import uses all of the parameters provided for initial ANM Import (cf. section 6.2.1.4) and additionally two more options:

- **Delete omitted objects**: During further network processing in VISUM network objects could have been removed from the initial VISUM network after VISUM export to *.ANM file and ANM Import in VISSIM. Thus, a new *.ANM file provided for Adaptive Import in VISSIM might contain only part of the network objects which originally had been imported into VISSIM. This way, missing objects could occur during Adaptive Import of an abstract network model.

  If this option is active, those objects missing in the new *.ANM file are also removed from the VISSIM network and so are VISSIM network elements which were automatically generated from these objects.

  If this option is not checked, this portion of the VISSIM network will remain unchanged.

- **Complete routes after Import**: If this option is active, VISSIM will automatically complete existing routes in the VISSIM network which were corrupted by adaptive ANM Import.

The filename you enter for the *.INP file will also be used for the *.PANM file and the *.PANMROUTES file.

### 6.2.1.6 Hermes XML Import

Via menu FILE – IMPORT – HERMES XML, you can start the import of network data in XML format. The data is converted into ANI data format and will be stored as *.ANI data file with the given filename in the same folder.
6.2.2 Data Export

Via menu File – Export you can export VISSIM data in various data formats.

Data export to VISUM

Menu File - Export - VISUM provides two options to export the VISSIM network in VISUM network file *.NET format, cf. section 6.2.2.1 and section 6.2.2.2.

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, cf. section 6.2.2.3.

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 do 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 in this way.

Data export to 3DS MAX

Via menu File – Export – 3DS MAX you can export VISSIM data to 3DS MAX, cf. section 6.2.2.4.

6.2.2.1 File - Export - VISUM - Nodes/Edges...

This option is provided only for networks after Dynamic Assignment.

You can export your VISSIM network and your VISSIM demand for import in VISUM to start an assignment in VISUM, cf. section 12.9. This section describes a static VISUM assignment, which can serve as initial solution for the Dynamic Assignment. After Dynamic assignment in VISSIM, you can export the calculated VISSIM paths for import in VISUM for subsequent graphical display and analysis of the paths and their volumes in VISUM.

1. Export for subsequent assignment in VISUM

   VISSIM exports the network and the demand for import in VISUM. Therefore, VISSIM creates a VISUM version file *.VER. Additionally, a VISUM network file *.NET and a VISUM matrix file *.MTX are created. The version file includes this data already.

2. Export of routes for visualization in VISUM

   VISSIM exports the network and the paths for import in VISUM. Therefore, VISSIM creates a VISUM version file *.VER. Additionally, a
VISUM network file *.NET and multiple VISUM route files *.RIM are created. The version file includes this data already.

**Export for subsequent assignment in VISUM**

Follow the steps outlined below:

1. Open the VISSIM network you would like to export.
2. Via menu **FILE - EXPORT - VISUM – NODES/EDGES…**, open the VISUM-Export window.

3. Check option *For assignment in VISUM (without VISSIM paths)*.
4. Use the button to select the folder and the filename for the VISUM version file *.VER.*
5. Click OK to start the data export.

Just for the VISUM version file *.VER* you can enter folder and filename. Additionally to the *.VER* file, the export creates a VISUM network file *.NET and a VISUM matrix file *.MTX with identical filenames. All files will be saved to the folder specified for the VISUM version file.

If the VISSIM network includes edges, that cannot be exported to VISUM, then these edges will be listed in the protocol window. Nevertheless you can execute the export, alternatively you may cancel. VISSIM provides support for the fixing of damaged nodes and edges, cf. section 12.3.4.

**VISSIM feature: Ambiguous zone connectors**
A warning will appear if the VISSIM network includes nodes with ambiguous zone connectors (parking lot zones).

VISSIM handling:
Create another node to create unambiguous zone connectors.

Export of routes for visualization in VISUM

Follow the steps outlined below:
1. Open the VISSIM network you would like to export.
2. Via menu FILE - EXPORT - VISUM – NODES/EDGES…, open the VISUM-Export window.
3. Check option For visualization in VISUM (with VISSIM paths).
4. Use the button to select the folder and the filename for the VISUM version file *.VER.
5. Click OK to start the data export.

For the VISUM version file *.VER you can enter folder and filename. Additionally to the *.VER file, the export routine will create a VISUM network file *.NET and multiple VISUM route files *.RIM.

From the total demand in VISSIM matrices, a VISUM matrix file *.MTX is generated for export. Only the demand in the export time interval (simulation start time + simulation period as defined by the user in the Simulation parameters window) is regarded for export. If a VISSIM matrix file is not completely in the export time interval, then only the portion in the export time interval will be exported. Please note: The demand is summed up, thus you will not receive separate matrices for different VISSIM vehicle types and/or vehicle classes.

Route import files are only exported if VISSIM cost and path files are available. Route import files contain the routes and volumes resulting from the Dynamic assignment: For each Dynamic assignment evaluation interval a separate *.RIM file is generated. If cost and path files do not exist, a warning will appear and only the network and matrix data will be exported.

Closures of edges or connectors are exported to VISUM and can be regarded during the assignment. Normally, VISUM does not use paths which are not possible in VISSIM.

The only exception to this rule are disjunctive parallel edges between two VISSIM nodes that either originate from different turns or lead to different turns. These are exported as a consolidated edge to VISUM. This might lead to paths determined in a VISUM assignment which cannot be applied in VISSIM.

For details on Route import in VISUM please refer to chapter “Program Interfaces” in the VISUM User Manual.

Further processing in VISUM

How to open a version file *.VER in VISUM
1. Click FILE – OPEN VERSION.
2. In the Open version file window, select the desired version file *.VER.

The VISUM version file created during export contains all required data. There is no need to open the additionally created VISUM files separately. If no version file was created during export, you may open the additionally created files instead one by one.

How to open a network file *.NET in VISUM
1. Click FILE - OPEN - Networks.
2. In the *Open network file* window, select the desired network file *.NET.*

**How to import the *.RIM files in VISUM**
Cf. chapter 4 and chapter 13 in the VISUM User Manual:
1. Call *CALCULATE - PROCEDURES - [OPERATIONS]*
2. Click *CREATE* to call the *Operation* window.
3. In the *Assignments* folder, select the entry *Route import*.
4. Confirm OK.
   A new row is added to the list.
5. Click *SELECTION DSEG* and select the demand segment.
6. Confirm OK.
7. Click *BROWSE* to call the *Open Route Import window*.
8. Select the *.RIM* file.
9. Click *OPEN*.
10. Click *EXECUTE* to start the import.

**How to open a matrix file *.MTX in VISUM**
Please refer to chapter 3 in the VISUM User Manual:
1. Add the matrix to the VISUM network model via VISUM menu *EDIT – MATRIX EDITOR - ADD EXTERNAL MATRIX TO THE NETWORK MODEL.*

**Building a VISUM network from a VISSIM network after Dynamic assignment**

<table>
<thead>
<tr>
<th>VISUM network object</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSys, Mode, DSeg</td>
<td>VISUM creates a single Private transport system, a single PrT mode and a single demand segment (C Car). VISSIM vehicle types and/or classes are not exported as various transport systems or modes or demand segments. The VISSIM route export creates an additional VISUM DSeg-PrT for each VISSIM Dynamic assignment evaluation interval.</td>
</tr>
<tr>
<td>Nodes</td>
<td>Are generated according to VISSIM nodes. VISUM node numbers correspond to VISSIM node numbers. Please note: The max. permitted node number in VISUM is 2147483647. VISSIM nodes with a number greater than this are renumbered, starting with the smallest free VISSIM node number.</td>
</tr>
<tr>
<td>VISUM network object</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>Node details (type, geometry, signalization, orientations etc.) are neither exported nor generated.</td>
</tr>
<tr>
<td>Links</td>
<td>Are generated according to VISSIM edges between the nodes. Parallel edges: in VISSIM it is possible to have several edges from one node to another node. In case of several edges between the same two nodes, only the shortest edge is exported. First, the suitability of the VISSIM network structure is checked. In case of unsuitable modeling (e.g. parallel edges) a warning appears. Details are listed in the Log Window.</td>
</tr>
<tr>
<td>Number</td>
<td>Starts with 1. Has no correlation to the VISSIM link number or any other VISSIM network element.</td>
</tr>
<tr>
<td>Type</td>
<td>Is set to 0 for all links. Has no correlation to the VISSIM link behavior type.</td>
</tr>
<tr>
<td>Length</td>
<td>Is calculated from the corresponding VISSIM edge.</td>
</tr>
<tr>
<td>Number of lanes</td>
<td>Is set the to minimum number of lanes of all VISSIM links/connectors corresponding to the edge.</td>
</tr>
<tr>
<td>Capacity PrT</td>
<td>NumberVehicles/hour = Number of lanes * 900 Capacity = NumVeh/h * (SimPeriod/3600) SimPeriod = simulation period, cf. Simulation parameters Correlates to “vehicles per simulation period”.</td>
</tr>
<tr>
<td>v0 PrT</td>
<td>Is calculated from the speed distributions of VISSIM origin parking lots and desired speed decisions on the edge. Speed for one distribution: 85th percentile. For parking lots, only the default speed distribution is considered. For speed decisions, the average of all given distributions is calculated (85th percentile of each distribution).</td>
</tr>
<tr>
<td>Turns</td>
<td>Are generated from the VISSIM edges inside the nodes. A VISUM turn is open if the corresponding VISSIM edge exists. Turn capacity is set to 99999 for all. U-turns get type 4, other turns get type 0.</td>
</tr>
<tr>
<td>Zones</td>
<td>Are generated according to VISSIM zones. The</td>
</tr>
</tbody>
</table>
6.2.2.2 **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.

The exported network can be read from file in VISUM 8 and higher.

► In VISUM, various graphical analyses can be performed, for example you may use the link filter for the following:

- Set those links to the active state which show outstanding attribute values (e.g. emergency stop positions or cost values).
- 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>

6.2.2.3 **EVALUATION – FILE – Link evaluation**

A so-called base network file containing the network objects links and link polygons is created and saved as `<INP-FILENAME>.NET`.

Furthermore, an additional network file containing the evaluation data gained by time interval is stored as `<INP-FILENAME>_<INTERVALEND>.NET` for each time interval. The data by time interval is coded as user-defined VISUM attributes.

For data export during link evaluation:

► Define active links in the Multi-select mode and

► Check option *Link evaluation* in the *Link attributes (Multiselect)* window.

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

Here, the followings settings are required:

► Check option ☒ *Link evaluation*.

► Click **CONFIGURATION** and set parameters:
Check option VISUM Export (Network + link attributes),
Set intervals (take simulation time interval into consideration)

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 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 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 VISUM, follow the steps outlined below:
- Open the exported base network file first.
- Then read all further export network files *_<INTERVALEND>_NET additionally. Use the option Read network additively.

The window Read network data additively includes the Conflict handling column: Select option Overwrite attributes for network object type LINK.
6.2.2.4 **FILE – EXPORT – 3DS MAX**

Enter the file name.

The exported *.TXT file stores merely the polygon data of links and walkable areas which is arranged in two data blocks.

Either data block may be empty.

- The coordinates in the first data line are required for the future calculation of the polygon point positions.
- Then, the link data block follows.
- Finally, the polygon data block is saved to file which contains the ramps/stairs and areas for pedestrians.

For each network element, the data record starts with the “network element number” and ends with a `g` flag, it consists of the list of coordinates per network element.

**Example:**

```
[870.10447,7438.97385,0.0]
```

Links

```
"10000", [49.36338,-17.03216,0.00000], [49.32021,-17.04763,0.00000], [52.51336, -15.69895,0.00000], [52.51911, -15.69774,0.00000], [53.83595, -18.11195,0.00000], [53.75370, -18.15874,0.00000], [50.40885, -19.84607,0.00000], [50.27076, -19.89165,0.00000]
```

```
g...
```

```
"24", [119.98432,109.21772,0.00000], [120.12069,109.33330,0.00000], [121.04083,110.20962,0.00000], [122.80267,108.44778,0.00000], [121.83278,107.50869,0.00000], [121.72320,107.39984,0.00000], [121.51023,107.15226,0.00000], [121.30799,106.87590,0.00000], [121.15323,106.63884,0.00000], [119.05983,108.00547,0.00000], [119.25107,108.29841,0.00000], [119.55083,108.70804,0.00000], [119.89186,109.10447,0.00000], [120.08228,109.29362,0.00000], [119.23839,108.47652,0.00000], [120.99823,106.71668,0.00000], [121.79237,107.47300,0.00000], [121.60074,107.31058,0.00000]
```

```
EndPedestrianAreas
```

For more details on the subsequent import in 3DS MAX please refer to the files stored in the sub-folders of the `...\API\3DSMAXEXPORT` folder of your VISSIM installation.
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 operations, it is necessary to replicate the modeled infrastructure network to scale. This can be done as follows:

► Import of a scaled network from VISUM, CROSSIG, P2 (or other applications that provide VISSIM network files)
► Import of a scaled network from the signal control optimization software package SYNCHRO (additional module, cf. section 6.2 for details)
► Import of base maps or drawings as a background so that the VISSIM network can be traced exactly according to a scaled map (cf. section 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 a connector can be moved to a different link. Input flows can be placed on another link in the Input flows window only. The start of PT 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 images, please refer to section 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.

To generate the opposite direction of a link, option Generate Opposite Direction has to be checked. The newly created link can have a different number of lanes. A link always should represent the real shape in the road network.
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 numbers of lanes do not allow for a “through link”).

This section deals with links carrying vehicular traffic.

Users of the Pedestrians add-on can define links as walkable areas for pedestrians that have been defined as vehicle type. For more details cf. section 7.1.5.

6.3.1.1 Creating

The Links & Connectors mode needs to be active.

1. Right-click at the desired start position of the link, keep the mouse-button pressed while dragging the mouse in the direction of flow to the destination position and release the mouse button.

2. Edit the link data (cf. section 6.3.1.2)
The following properties can be defined for a link:

- **No:** Unique identifier of the link (can only be edited when the link is created)
- **Name:** Any label or comment
- **No. of Lanes:** Number of lanes per link direction.
- **Link length:** Shows the length as graphically drawn with the mouse. This value is not subject to changes.
- **Behaviour Type:** Selects the link behavior type that controls driving behavior characteristics (cf. sections 5.5.1 and 5.4 for details).
- **Display Type:** Selects the link display type that controls color characteristics (cf. section 5.5.2 for details).
- **Change Direction:** Sets the selected link to the opposite direction of traffic as soon as the dialog box is closed by clicking OK.
- **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 and 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.
- **Use as pedestrian area:** Creates a walkable space for pedestrians from the link, cf. section 7.1.5 (Pedestrians add-on required).

**[LANES]**

All parameters refer 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 or on the adjacent 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 change lanes to that lane (even if they would need to according to a routing decision),
  - not enter that lane from a vehicle input on this link except when all lanes are closed to that class,
  - try to leave that lane as soon as possible if there is an adjacent lane that is not closed to the vehicle’s class.

  They will however move to the lane if coming from a connector.

  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 deselect a vehicle class in the list, press **CTRL** while clicking with the left mouse button.

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). Cf. section 5.4 for more information on the required driving parameters.
NO LANE CHANGE...:
Define by lane whether the vehicles of a vehicle class may change to the neighboring lane(s) located to the LEFT and to the RIGHT in with-flow direction.

Banned lane changes prevent any kind of lane change, even those due to routes. Therefore be careful, please: See that lane changes due to routes either can be finished before the no-lane-change section or can be performed behind the no-lane-change section.

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).
- **Thickness (3D)**: Thickness of the bar representing the link in 3D graphics mode.
- **Recalculate Spline Point Height** causes the intermediate (spline) points of the link to always reflect a straight “height line” between the two end points. Cf. section 6.3.1.3 for how to change the height of an individual spline point.
- **Visualization**: When turned off, no vehicles are shown on that link during the simulation. For example, this option can be used to model tunnels and underpasses in 2D graphics. In 3D graphics it is recommended 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.

**[OTHER] Various other parameters:**

- **Gradient**: The Gradient affects acceleration and deceleration capabilities of all vehicles on the link:
  The possible acceleration decreases by 0.1 m/s² per percent of **positive** gradient (road incline). If the gradient is **negative** it increases by 0.1 m/s² per percent. The possible deceleration changes the other way round.
  The gradient has no visual effect in 3D graphics mode (use the Height (3D) property to model different heights in 3D).

- **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 (cf. 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.
6.3.1.3 **Editing**

The 🚓 *Links & Connectors* mode needs to be active.

**Select**

**Single-select:**

There are two ways to select a single link or connector:

- Right-click outside of the VISSIM network calls the *Links/Connectors* selection list: Left-click to select a link or connector and click DELETE, ZOOM or DATA).

- Left-click on the link or connector within the VISSIM network.

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.

**Multi-select** *(Only for Edit attributes, Move, Delete)*:

There are three ways to define active links or connectors for further editing in the multi-select mode:

- Draw polygon (cf. section 6.1) or
- Use Display type filter (cf. section 5.5.2) or
- Use Link behavior type filter (cf. section 5.5.1).

**Move**

**Single-select:**

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

**Multi-select:**

1. Select links and connectors.
2. Left click on the active elements and drag them to the desired position while holding down left mouse-key.
**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 data**

**Single-select:** Double click on the link calls the *Link Data* window, cf. section 6.3.1.2.

**Multi-select:** Right-click outside of the VISSIM network calls the *Link Attributes (Multiselection)* window for editing data of active links and connectors, cf. section 6.3.1.2
Edit curvature

Select link and 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) where 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. Option **Keep current intermediate points** is only relevant in case of existing intermediate points.

   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 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 active links

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

► finally
  - check option(s) and
  - confirm **OK** in the **Multiselection - Delete** window.
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.

If data is read from an *.INP* file that has been created with a VISSIM version prior to 5.0 both the **display type** and the **behavior type** of its origin link are assigned to each connector.

### 6.3.2.1 Creating

The 🗿 *Links and Connectors* mode needs to be active.

1. With the right mouse button click at the connector’s desired start position **inside** a link, drag the mouse in the direction of flow to the position **inside** the destination link.
2. Release the mouse key.
   - The *Connector* window opens, cf. section 6.3.2.2.
3. Edit the connector data.
6.3.2.2 Properties & Options

The following attributes can be defined for a connector:

- **Name**: Any label or comment
- **Behaviour Type**: The link behavior type controls the driving behavior characteristics (cf. sections 5.5.1 and 5.4 for details).
- **Display Type**: The display type controls the color characteristics (cf. section 5.5.2 for details).
- **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**.

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

- **Recalculate Spline**: If this option is checked VISSIM draws an automatic arc (Bezier curve) with the specified number of **Points** between the start and the end point of the connector. 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 connector, 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 from an adjacent lane to 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 Routes.
  - *Emergency Stop* defines the last possible position for a vehicle to change lanes. It is measured upstream from the start of the connector. The min. emergency stop distance is 5m. If a vehicle needs to change more than one lane, an additional 5m is added for each additional lane. If the current lane has an odd no., an additional 2.5m is added to the total emergency stop distance. This is to avoid a conflict because of identical locations when two vehicles on adjacent lanes mutually want to change lanes.
    
    **Example:** A vehicle on lane 1 needs to change to lane 4 in order to continue on its route. The emergency stop distance in the subsequent connector is defined as 10m. Then the relevant emergency stop distance for lane 1 is: 10+5+5+2.5 = 22.5m. For lane 2 it would be 10+5=15m and for lane 3 10+2.5=12.5m.
    The emergency stop position (in contrast to the distance) is then computed as the difference of the link coordinate, where the connector starts, minus the emergency stop distance. From the result only the integer amount is taken (no decimals).
    
    **Example:** If the connector starts at coordinate 67.2 and the emergency stop distance is 12.5m, the emergency stop position results in 67.2-12.5=54.7 -> 54m.
  - *Lane change* defines the distance at which vehicles will begin to attempt to change lanes (e.g. distance of signpost prior to a junction).
  - **per lane:** If this option is active, the given *lane change* value will be multiplied by the number of lanes the vehicle has to change to reach the connector.
    
    **Example:** To reach a connector starting only from lane 1 with lane change distance 200 m per lane, a vehicle on lane 3 starts to look for a gap to change lanes from 400 m upstream of the start of the connector.

• **Desired Direction:** If vehicles are traveling on Routes, this option is of just a viewing effect during a simulation run:
Taking the currently selected option into consideration, matching intended lane changes or turning movements are visualized by direction-indicating blinking prior to changing to a connector due to the vehicle’s route.

When using Direction Decisions (not recommended) it needs to be set to a value different from 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.

- **Thickness (3D):** Thickness for display of connectors in 3D mode.
- **Recalculate Spline Point Height** (3D mode only): Causes the intermediate (spline) points of the connector to always reflect a straight “height line” between the two end points (cf. the “Graphical Editing - Edit curvature” section on how to change the height of an individual spline point).
- **Visualization:** When turned off, no vehicles are shown on that connector during the simulation. This option can be used e.g. to model tunnels and underpasses in 2D graphics. In 3D graphics rather use the Height fields of the surrounding links to show a realistic picture. Otherwise vehicles will just disappear instead of using different levels.
- **Label:** When showing connector labels (to be switched on in VIEW - NETWORK ELEMENTS...) this option allows to individually switch off the label of that connector.
The **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.

The **Gradient** affects acceleration and deceleration capabilities of all vehicles on the connector:
- The acceleration decreases by -0.1 m/s² per percent of positive gradient (road incline)
- If the gradient is negative it increases by 0.1 m/s² per percent.

The possible deceleration changes the opposite way.

The gradient has no visual effect in 3D graphics mode (use the **Height (3D)** property to model different heights in 3D).

**Evaluation...** (relevant for **Display options - [TRAFFIC]**, 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 (cf. section 3.3.2).

---

### 6.3.2.3 Editing

The **Links and Connectors** mode needs to be active.
Select

**Single-select:**

There are two ways to select a single link or connector:

► Right-click outside of the VISSIM network calls the *Links/Connectors* selection list: Left-click to select a link or connector and click DELETE, ZOOM or DATA).

► Left-click on the link or connector within the VISSIM network.

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.

**Multi-select** (Only for Edit attributes, Move, Delete):

► There are three ways to define active links or connectors for further editing in the multi-select mode:
  - Draw polygon (cf. section 6.1) or
  - Use Display type filter (cf. section 5.5.2) or
  - Use Link behavior type filter (cf. section 5.5.1).

► Right-click outside of the VISSIM network to call the *Link Attributes (Multiselection)* window for editing data of active links and connectors.

Move

**Single-select:**

A connector can only be moved along with its start and destination link while in Multi-Select-Mode (cf. 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.

**Multi-select:**

1. Select links and connectors.

2. Left-click in the area of active elements and drag them to the desired position while holding down the left mouse-key.

**Split**

Not possible for connectors.

Moving the start/end points of a connector or moving the entire connector from one link to another may break public and private transport routes.
**Single-select:** Double click on the connector calls the *Connector* window, cf. section 6.3.2.2.

**Multi-select:**
Right-click outside of the VISSIM network calls the *Link Attributes (Multiselect)* window for editing data of active links and connectors, cf. section 6.3.1.2.
Click CONNECTORS... to access the connector-specific attributes, cf. section 6.3.2.2.

The attributes *Behavior Type* and *Display Type* can be edited in the *Link Attributes (Multiselect)* window for all selected links and connectors simultaneously.
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.

**Single-select:**

Select either in the network and click

- **DEL** or
- **EDIT-DELETE**.

or in the selection list and click **DELETE**.

**Multi-select:**

Define active elements, then click

- **DEL** or
- **EDIT-DELETE**.

finally

- check option(s) and
- confirm **OK** in the "**Multiselection - Delete**" window.
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:

► Reduced Speed Areas (Temporary change)
► Desired Speed Decisions (Permanent change)

Speed changes are required for modeling the following:

► bends, curves and turning lanes at intersections,
► any speed limits,
► bottlenecks.

Both of them are modeled as network elements in VISSIM. The main difference between the two is, that with reduced speed areas a (faster) vehicle automatically decelerates prior to the start of the reduced speed area to get the speed defined for its vehicle class for that reduced speed area right at the start of it. After passing the reduced speed area the vehicle automatically accelerates to the desired speed that previously was assigned to it. In contrast, a desired speed decision does not affect the vehicle before, but when passing 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 also be labeled with the numbers of the assigned speed distributions. If there is only one distribution, the lower and upper limit of the distribution is displayed instead. Via VIEW - NETWORK ELEMENTS..., the label display can be switched on or off.

6.3.3.1 Reduced Speed Areas

When modeling short sections of different speed characteristics (e.g. curves or bends), the use of reduced speed areas is advantageous over the use of desired speed decisions.

Reduced speed areas are typically used for curves (e.g. turning movements). Thus they are normally placed on connectors rather than links.

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

A reduced speed area cannot reach across multiple links. However, multiple consecutive areas (one for each link) can be created and placed on consecutive 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 new speed even between the two areas.
Upon arriving at a reduced speed area, each vehicle is assigned a new desired speed from within the speed distribution assigned to its vehicle class. Basically, a reduced speed area is not meant to speed up a vehicle when reaching it, though this is also possible.

► When approaching a reduced speed area, a faster 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 user-defined deceleration value.

► A slower vehicle will not change its speed prior to reaching the start of the reduced speed area. For vehicles with a slower current desired speed, the start of a reduced speed area works like a desired speed decision with that higher desired speed.

A reduced speed area only takes effect for vehicles of the selected vehicle classes. The vehicle classes of vehicles that should keep their original (slow or fast) speed when passing the reduced speed area may not be selected for the list of vehicle classes which are to be regarded by the reduced speed area.

After leaving the reduced speed area, each vehicle automatically gets its previous desired speed again. 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. Exception: If two reduced speed areas with identical properties were defined next to each other in with-flow direction, the concerned vehicles will keep the new speed even in the section in-between.

**Definition**

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

1. Select the **Reduced speed areas** mode.

2. Select the link or connector where the reduced speed area should be placed on.

3. On the link or connector, mark the start of the reduced speed area by right click on its start position. Drag the mouse along the link/connector while keeping the right button pressed to define the length of the reduced speed.

4. Release the mouse button. The *Create reduced speed area* window appears.

5. For each selected vehicle class passing that link/connector define the appropriate speed and acceleration value.

6. Confirm with OK.

**Properties & Options**

You can define the following properties of a 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 (cf. 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 faster vehicle starts to slow down.

Use **NEW**, **EDIT** and **DELETE** to create, modify or remove a data line.

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.

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.
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**Editing**

The **Reduced speed areas** mode needs to be active.

**Select**

There are two ways to select a reduced speed area:

- Outside of the VISSIM network, right-click to call the Reduced speed areas selection list: Select the reduced speed area by left-click and click DELETE, ZOOM or DATA to continue.

- In the VISSIM network, left-click to select the link or connector. Select the reduced speed area by another left-click.

**Zoom**

In the Reduced speed areas list, click ZOOM for the selected reduced speed area.

**Edit data**

In the Reduced speed areas list, click DATA for the selected reduced speed area.

In the network display, double-click the reduced speed area.

**Delete**

In the Reduced speed areas list, click DELETE for the selected reduced speed area.

In the network display, select the reduced speed area and click DEL or drag it out of its link/connector while keeping the left mouse-key pressed.

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 the particular 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).

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

**Definition**

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

1. Select the **Desired speed decisions** mode.
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 select the appropriate new speed distribution.
5. Confirm OK.

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 to which the desired speed decision refers.

- **Label**: When showing labels (names) of all desired speed decisions (cf. 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 EDIT, NEW and DELETE to create, modify or remove a data line.

Vehicles of classes that have not been selected for a desired speed decision remain unaffected.

The combination of vehicle classes and speed distribution of the desired speed decision that was edited recently is used as a default when a new desired speed decision is added.

The desired speed decision defines the position where vehicles intend to change the desired speed (not where they reach it). Thus the phase of acceleration or deceleration takes place 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 a Reduced Speed Area, cf. section 6.3.3.1.

Desired speed decisions for turning vehicles can be modeled by placing a Reduced Speed Area on the turning connector.

6.3.4 Rotate and Translate Network

In the VISSIM workspace it is possible to translate and rotate the entire network, including static 3D objects, 3D signals and keyframe positions. In addition, when the network is translated, all background images that are currently open in VISSIM are translated as well.

To move only a section of the network (without 3D objects, background images or keyframes), the move functionality of the Multi-Select mode may be used (cf. section 3.3.2).

**Rotate Network**

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

Rotating the network does not affect background images.

**Translate Network**

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

Translating the network in z-direction does not affect background images.

6.3.5 Pavement Markers and Zebra Crossings

The Pavement Markers edit mode 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 (or center island for US roundabouts). For Zebra crossings, no direction has to be selected, but the length needs to be entered.

The visibility of all pavement markers is controlled in VIEW – NETWORK ELEMENTS.

Option Zebra Crossing is meant for marking links which are defined as a pedestrian link and will be used as pedestrian crosswalks. It provides visualization in full link width. Any traffic information is to be defined with the link, cf. section 7.1.5.

Properties & Options

Double-clicking a pavement marker calls the Edit pavement marker window.

- **Type**: Defines the displayed shape.
- **Directions** (for option Arrow marker only): Any combination is possible for the upper three options.
- **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 decisions (or direction decisions): 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 6.4.5.4). However, it is strongly recommended to use routing decisions since routes are much easier to handle and the vehicle inputs can be defined more precisely.

► Dynamic Assignment using OD matrices ("Dynamic Assignment" add-on required): The use of Dynamic Assignment is explained in detail in chapter 12. For Dynamic Assignments, neither static routes nor inputs need to be defined.

6.4.1 Vehicle Compositions

Vehicle compositions represent the mix of vehicle types and have to be defined prior to the input flow definition. Please note that vehicles of PT routes must not be included here but are to be defined separately (cf. section 6.5).

A vehicle composition consists of a list of one or more vehicle types. To each of these vehicle types, a flow percentage and a speed distribution are assigned. Both vehicle compositions and pedestrian flows can be defined as traffic compositions.

Also pedestrian flows can be defined as a vehicle composition, but should preferably be defined as a pedestrian composition. The pedestrians as vehicle compositions are bound to links and follow the Wiedemann model (cf. section 5.4.1).

6.4.1.1 Creating & Editing

Vehicle compositions can be defined via TRAFFIC - VEHICLE COMPOSITIONS...
The list can be edited via NEW, EDIT and DELETE.
For additional parameters such as Catalytic converter temperature distribution and cooling water temperature distribution the optional Emissions add-on is required.

6.4.1.2 Properties & Options

For each data line the following attributes 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:

- The 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]
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- starting time [s]

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

The difference from the speed at the end of the previous time step returns the constant acceleration (if positive) respectively deceleration (if negative) during the current 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.

The new coordinate is determined by the equation of motion:

\[
\text{new Coordinate} = \text{old Coordinate} + \text{old Speed} \cdot \text{time step length} + 0.5 \cdot \text{acceleration} \cdot \text{time step length}^2
\]

Example

If the parameter Simulation resolution is set to 10 Time steps per simulation second, VISSIM will read ten speed time steps per second from file.

This leads to a coordinate time step (time_step_length) = 0.1 seconds.

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 Volumes)

In VISSIM, time variable traffic volumes to enter the network can be defined. For vehicle input definition, at least one vehicle composition has to be defined, cf. section 6.4.1.

Traffic volumes are defined for each link and each time interval in vehicles per hour even if the time intervals are different from one hour. Within a time interval vehicles enter the link according to 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 traced to a log file (same name as input file with extension *.ERR) indicating also the time interval of the particular input. Furthermore, the user is notified in detail at the end of the simulation. Please note that if the vehicle input time interval exceeded the simulation period, no messages are stored in the *.ERR file in case there are stacked vehicles left. The maximum volume that can be reached depends on permitted speed and driving behavior parameters.

Input flows do not need to be defined when Dynamic Assignment is used as then the flow data is contained in the OD matrices.
6.4.3.1 Creating & Editing

For all subsequent actions the Vehicle Inputs mode needs to be active.

There are two ways to open the Vehicle Inputs window:

► For vehicle inputs of a certain link: Double-click that link.
► For all vehicle inputs in the network: Right-click outside of the VISSIM network.

As long as this modeless dialog window is open you may navigate or zoom in/out the network display.

The vehicle input data is arranged in two sections:

► Volumes/Compositions section
► Time intervals section

Time Intervals Section

(This section can be hidden by clicking on . To show it again, click on .)

Here the time interval boundaries are defined. At least one time interval is required, thus the first and the last line may not be deleted. By default, the simulation period is set for the time interval, cf. section 8.1.1.

Changes to the list of time interval thresholds will immediately change the column layout in the Volumes/Compositions section (see below).

1. Right click inside the section and choose New from the context menu.
   A new line is added at the end of the list.
2. Enter the value of the new time interval boundary. The value must be different from any other time but can also be smaller than the last value. In that case, an existing time interval is split at the time newly entered.
Edit time interval data

Any time entry can only be changed to a value that is in between the neighboring times (i.e. the time sequence cannot be changed; to do so, the given boundary has to be deleted and a new threshold has to be added).

1. Select the time to change.
2. Type in the new time and confirm with \texttt{\textbf{ENTER}}.

All flow values remain unchanged.

Delete interval(s)

1. Select the start time of the interval to be deleted.
   Press \texttt{\textbf{CTRL}} simultaneously to select several rows.
2. Right click and choose \texttt{DELETE} from the context menu.
3. Confirm the upcoming message.

If a time interval does not contain any input values, the time interval will be deleted when the \textit{Inputs} window is closed.

Volumes/Compositions Section

For each link, the vehicle inputs are arranged in columns, sorted by time interval. For each combination of link and time interval, a data pair consisting of a volume and a vehicle composition may be defined (empty pairs are allowed). It is \textbf{not} possible to define a volume without vehicle composition or vice versa.

It is possible to have multiple rows for the same link if there are volumes for different vehicle compositions defined within a time interval. When sorted by link no., these rows are identified by a combined display of the link no. and with the same input flow name (optional).

Define new vehicle input

Prior to the definition of vehicle inputs at least one vehicle composition needs to be defined (cf. section 6.4.1).

1. Double-click on the link where the new vehicle input is to be defined. The \textit{Vehicle Inputs} window opens with the corresponding link no.
2. If a vehicle input already exists, either change it or right click and choose \texttt{NEW} to create a new row for this link.
3. Define the input properties, cf. section 6.4.3.2.

Edit data

For \textbf{volume} changes:

1. Select the cell to change.
2. Type in the new volume and confirm with \texttt{\textbf{ENTER}}.

For \textbf{composition} changes:

1. Select the cell to change.
2. Press the button on the right to open the pull-down list.
3. Select the new composition from the list.

For further information and property changes please refer to section 6.4.3.2.
Scale Volume

Select the cells with volume values to be multiplied by the user-defined factor. Click Scale Volumes in the context menu and enter the factor for volume scaling.

Copy & Paste data

In the Volumes/Compositions section, the Copy & Paste commands (similar to the Microsoft Excel method) are available through context menu. Data exchange is permitted within the input window or from/to external data sources (e.g. *.XLS or *.DOC files).

- **COPY**: Select a source cell or rectangular source region using
  - Shift + cursor keys or
  - mouse move while holding down left mouse button.

- **PASTE**: Select a destination region being
  - congruent (identical dimensions) or
  - larger than the source region (e.g. source 2x3, destination 6x6 or 10x15; not ok: 3x6 or 6x10).

Please disable display of either volumes or compositions before selection, since only one data type can be copied/pasted.

Only values of visible columns are copied and pasted (not values that are contained in hidden columns).

Delete vehicle input(s)

1. Select the entire row to be deleted by clicking on the row no. (on the far left of the grid). Press **Ctrl** simultaneously to select several rows.
2. Right click and choose Delete from the context menu.
3. Confirm the upcoming message.
6.4.3.2 Properties & Options

Cf. section 6.4.3.1 on how to open the Vehicle Inputs window.

This section describes the properties and options for the Volumes/Compositions section.

- **Link Number & Link Name**: Refers to the link where the vehicle input is placed. Values can be selected from the list of all links either by no. or (optional) name of the link.

- **Input Name**: Optional name of the vehicle input. Refers to all data entered for the same link.

- **Show Label**: When showing vehicle input labels (cf. VIEW - NETWORK ELEMENTS...) this option allows to individually switch off the label of that vehicle input.

Each of the following columns (one for each time interval) contains the vehicle flow and vehicle composition data pair(s) per link.

- **Column Header**: Shows start and end time of the interval (in simulation seconds). The columns are created automatically from the list of time intervals in the Time Interval section (if more or other time intervals are needed, please refer to “Add new interval” in the “Time Intervals” section above).

- **Data pair**: For each row and time interval, a data pair may be defined:
  - Upper line: Vehicle input volume (veh/h)
  - Lower line: Vehicle composition

The text color indicates whether the data pair is valid for
- this interval only (black) or
- a period of combined intervals (Continued Input: light-grey). In that case, only the master cell (black) can be edited and affects automatically all subsequent continued cells.

The background color indicates whether the vehicle volume is
- stochastic (white) or
- exact (yellow).

When EXACT VOLUME is enabled VISSIM generates exactly the edited number of vehicles to enter the network as opposed to a distribution.

The configuration of the data section can be changed via the context menu. Select one or multiple cells and call:

- **EXACT VOLUME**: Volume values are regarded as exact volumes, if this option is checked. The cells are highlighted in yellow.
- **STOCHASTIC VOLUME**: Volume values are regarded as stochastic volumes, if this option is checked. The cells are not highlighted.
- **CONTINUED INPUT**: Select all cells to be combined (except the master cell) and check this option to define a combined flow: The master cell is the one previous to the selected cells; the master cell entry spans over the selected sequence of time intervals.
  - The master cell remains editable, indicated by black text entries. Changes to the master cell entry are copied to all subsequent cells.
  - Grey text entries indicate combined cells (Read-only).

Uncheck this option to separate selected combined cells.

- **VIEW VOLUMES**: Toggles display of the volume values (upper line per time interval) on and off.
- **VIEW COMPOSITION**: Toggles display of the selected vehicle compositions (lower line per time interval) on and off.
- **ZOOM**: The input’s position in the network is placed in the middle of the VISSIM window on screen.

### 6.4.4 Routing Decisions and Routes

A route is a fixed sequence of links and connectors:
- from the routing decision point (red cross-section)
- to at least one 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
Types of Routing Decisions and Routes

► **Static**: Routes vehicles from a start point (red) to any of the defined destinations (green) using a static percentage for each destination.

► **Partial**: 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. Partial routes also affect PT lines. In order to avoid rerouting of PT lines 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 6.4.5.

► **Managed lanes**: Creates two parallel routes from the decision to the destination. For a Managed Lanes Routing Decision, a user-defineable toll pricing model and a decision model have to be selected. Thus, vehicle occupancy (SOV, HOV2, HOV3+), simulation time and the current traffic situation (travel time savings, average speed) are regarded.

Relevant only for Dynamic Assignment:

► **Dynamic**: Defines a decision point where traffic is re-routed according to a user-definable condition and strategy. For more information please refer to section 12.3.1 and to section 12.7.5.

► **Closure**: 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 section 12.8.4.

6.4.4.1 Creating

Route definition (except routes of type Parking Lot) is a four step process. To initialize the process, activate the Routes mode. The next required action is shown in the status bar. To discard the recent step and return to the previous step, left click outside the VISSIM network. Please cf. section 6.4.4.6 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 basic routing decision properties (cf. section 6.4.4.4) and confirm with Ok.

3. Select the link/connector for the route destination.

4. According to route type:
   - **Static Routes, Partial Routes, Closures:**
     Right-click on the location for the route destination point (green).
     If there is a valid connection between the red bar and the click position the link sequence is shown as yellow band from the routing decision to any destination point defined for that routing decision. After definition of all destinations per routing decision, right-click outside of the link to call the Routes window.
     Define the route properties (cf. below) and confirm with Ok.
     If there is no consecutive sequence of links and connectors possible, VISSIM cannot suggest a route and thus no yellow band appears. The Routes window will not contain route data for this routing decision. In that case, either the destination link or destination location must be changed or any missing connectors be created.

   - **Parking Lot:** Select parking lot(s) by left-click; selected parking lots are highlighted in blue.

   - **Dynamic:** cf. section 12.7.5

   - **Managed Lanes:** As for static routes, right-click to define the location for the route destination point (green). The first route being generated for a routing decision of the Managed type is always a route of the Toll type which is highlighted green. To generate the second route, mark – for the same route start point – the second route destination point next to the first one on the same link. The second route which is created for a routing decision of the Managed lanes route type is always a route of the General purpose route type and is indicated by yellow color. A routing decision of the Managed lanes type has just two routes to which – similar to partial routes – the same destination point is allocated automatically.
A routing decision of the *Managed Lanes* type needs to be complete. Otherwise it is ignored in the simulation. Both a route of the *Managed* type and a route of the *General purpose* type are required. Furthermore, a managed lane facility with user-defined toll pricing calculation model and decision model needs to be allocated.

To define further destinations (multiple routes) from the same routing decision point (red bar), follow the steps outlined below:

► Select the next destination link immediately.
► Right-click the position of the next destination cross-section (or parking lot).
   This has to be done for each additional route starting from the currently active decision cross-section.

To define a new routing decision, deselect all links by double-clicking in the network and repeat steps 1 to 4.

In the *Routes* window, the following settings are required:

► Set the time intervals by routing decision type.
► Select appropriate *Vehicle class(es)* by routing decision.

### 6.4.4.2 The *Routes* Window Structure

As this is a mode-less dialog you may navigate or zoom in/out the network display though the window is open.
The data describing routing decisions and their routes is arranged in the following sections of the Routes window:

**Tabs (Types)**

For each type of routing decision, this section contains a specific tab. Since defined routing decisions are stored and edited by type, each tab contains the list of routing decisions of this type. Additionally the total numbers of routing decisions and routes of the particular type are listed underneath. Each tab page allows for the following steps:

► Select a single or multiple or all routing decision(s) of this type:
  - You can edit the list of routing decisions.
  - You can call the route list display in the Routes section and edit the list of routes.

► Copy/Paste/Edit the following data: *Name, At, Vehicle class(es)*.

► Delete the selected routing decision(s) of this type from the list.

► Zoom into the network with the selected decision(s) in the focus.

The content of the sections to the right depends on the particular routing decision type and on the selected decision(s).

**Decision**

This section can be hidden by clicking the icon. To show it again, click the icon.

If only a single routing decision is selected in a tab, this section allows for the following:

► Editing routing decision properties (except type and link number).

► Allocating the appropriate vehicle class(es).

**List of Routes**

The list contains in particular:

► all routes selected via routing decisions (and link filter, if applicable)

► all time intervals defined for that type of routing decisions (columns)

► the corresponding flow value per route and time interval (user entry)

This section allows for the following processing steps:

► Selecting a single or multiple or all route(s) starting from this decision.

► Editing route properties.

► Copy/Paste volume data for marked time interval(s).

► Checking the routes for inconsistencies.

► Deleting the selected route(s) from the list.

► Zooming into the network with the selected route(s) in the focus.
This section can be hidden by clicking ✅. To show it again, click ✅.

Here all boundaries of the time intervals for which the routing decisions of this type should be active are defined by routing decision type. 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.

VISSIM allows for different route proportions for each time interval. When multiple routes are defined for a routing decision all Relative Flows for each time interval are listed in the Routes section and can be edited there.

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.

At least one time interval is to be defined, thus the first and the last line may not be deleted. By default, the time interval 0-99999s is defined. Changes to the list will immediately change the column layout in the Routes section.

Create/Edit/Delete time interval(s): For details, please refer to 6.4.3.1.

For Sorting & Filter options provided in the list of routing decisions and in the list of routes, please cf. section 6.4.4.5.

### 6.4.4.3 Editing

For all subsequent actions the Routes mode needs to be active.

Upon selection of the Routes mode, the elements are highlighted:

- routing decisions are shown in dark red
- destination cross sections of all routing decisions are shown in dark green (whereas each parking lot is surrounded by a blue frame).

Selection of a routing decision (optional, cf. Info box below):

1. Left-click the link where the routing decision is located,
2. Left-click the routing decision:
   - The selected routing decision is displayed in light red and
   - only the corresponding destination cross sections (dark green) or parking lots (solid blue) remain visible.

Selection of a route starting from the selected routing decision:

1. Left-click the link where the destination cross section is located,
2. Left-click the destination cross section:
   - The selected destination cross section is displayed in light green,
   - the route is displayed as a yellow band.

Since VISSIM 4.30-03, a route of the type static, partial route or closure can be selected without selection of the routing decision cross-section: left-click the destination link first and the destination cross-section then.
Selection in the Routes window

To open the Routes window for display of
► all routes and routing decisions in the network: Right-click outside of the VISSIM network.
  If a routing decision is currently highlighted, the appropriate Routing decision type tab will open and its routes will be listed in the Route List.
► only the routes starting from a certain routing decision: Double-click on that routing decision.
  If a route is currently displayed as a yellow band, the appropriate Route decision type tab will open and the selected route will appear blue-shaded in the Route List.
  Alternatively, a route’s destination cross section can be double-clicked.

All routes of those routing decisions being selected in a Routing decisions tab are listed in the particular Route List.

All routes being selected in the Route List are automatically highlighted as yellow bands in the network display.
► To select a single route or routing decision in the list, click in the grey cell to the left of the particular line. The previously selected route or routing decision is automatically deselected.
► To (de)select multiple routes or routing decisions, press CTRL or SHIFT simultaneously.
► SELECT ALL via context menu.

Routing decisions and routes of the type static, partial route or closure: As soon as a decision is selected in the list, not only the particular routes are listed but the one on top of the list will be selected, too, and highlighted as a yellow band on screen.

For display of a Parking lot type route as a yellow band, the route has to be selected in the Route List, since clicking a destination parking lot (solid blue) will delete the route to this parking lot. Toggle functionality: Click the parking lot (blue frame) again to restore the route.

Delete

► In the Routes window, select one or several routing decisions or routes and continue as follows:
  - Either press DEL
  - Or click DELETE in the context menu.
► In the network, select a routing decision or route destination and continue as follows:
  - Either press DEL
  - Or drag the cross section bar out of its link/connector into the network while holding down left mouse-key.

With a routing decision, all of its routes are deleted.
Shift position

► In the Routes window, edit the At property of the decision or destination cross section. The particular link number is not subject to changes in the lists.

► In the network, drag the selected routing decision (or destination cross section) to another position on the same link or to any other link while holding down left mouse-key.

Edit 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.

Edit listed data

To each of the lists in the Routes window, the following applies:

► A context menu can be called by right-click. The following functionality is provided:
  - DELETE removes the selected row,
  - COPY/PASTE for data exchange, e.g. to/from *.XLS or *.DOC files.
  - ZOOM changes network display scale and section to show all network elements being currently selected in the list,
  - SELECT ALL selects all of the listed routes or routing decisions.

  Additionally the CHECK command can be clicked for selected routes. In case of errors, a detailed message appears.

► Editable properties can be edited directly in selected cells.
Combine static routes

For static routes ending on a link where another static routing decision is located, the combination of those routes can be triggered as follows:

1. Click on the routing decision
2. Click menu EDIT - COMBINE STATIC ROUTES

All routes starting from this decision are appended to all routes ending upstream of this routing decision on the same link. This includes the following steps:

► Deleting the selected routing decision and all destination cross-sections originally ending upstream of this decision.
► Forming the maximum number of new routes from each routing decision originally leading to the deleted decision cross-section to each destination cross-section of the deleted routing decision.
► Distributing the given total relative volumes to the resulting routes.

Only static routes and routing decisions with identical time intervals and identical vehicle class selection can be combined.

All routes that can be combined are highlighted in the network and a confirmation message box appears. In the Routes list, this max. number of routes can be reduced by the user (DELETE).

Example

Combining static routes will change data accordingly:

From the example settings in the Routes window the elements placed on link 180 can be seen:

► The common destination cross-section of 3 routing decisions (no. 22, 24, 26)
► The routing decision (no. 33) with 2 routes starting from it.
COMBINE ROUTES creates six new routes:

- They start from the original three decisions 22, 24, 26.
- They lead to the original destinations of the two routes that started from the deleted decision.
6.4.4.4 Properties & Options

For a new routing decision on the selected link, the following properties have to be set, cf. section 6.4.4.1:

- **No.**: Unique identification of the routing decision
- **Name**: Label or comment
- **At**: Position on the link/connector.
- **Type**: Select the appropriate option. *(Static, Partial, Parking, Dynamic, Closures; Managed Lanes)*
  The type is not subject to subsequent changes.
- **Show only routes over link**: If this option has been checked, you can select the link that serves as a route filter for route list display.

**Routes window**

For a static routing decision, define in the *Routes* window:

- **Vehicle Class(es)**: From a drop-down list, select the vehicle classes to be affected by this routing decision (PT routes are defined separately in the *PT Lines* mode, cf. section 6.5). For multi-selection, press CTRL while clicking the left mouse button.
- **Show Label**: When showing labels (names) of all routing decisions (cf. VIEW - NETWORK ELEMENTS...) this option allows to individually switch off the label of that routing decision.

**Editable properties of a static route:**

- **Route no.**: Unique identification of the route.
- **Dest. Link**: Unique identification of the destination link.
- **At**: Link/connector coordinate.
- The relative flow value by route and time interval.

**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.
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.

**[Partial]**

This tab page is relevant only for *Partial* routing decisions and routes.

For *Partial* routing decisions and routes the same properties have to be set as for static ones.

**[Parking]**

This tab page is relevant only for *Parking lot* type routing decisions and routes (only for parking lots of type *Real parking spaces*, cf. section 6.4.5).

► For routing decisions of the *Parking lot* type, the same properties have to be set as for static ones.

► For routes of the *Parking lot* type, the data is arranged in two tabs:
  - [Routing] with *Decision no.* and *Parking lot no.*
  - [Parking Rate & Duration], cf. section 6.4.5.2.
A vehicle to which a parking facility of the Parking type has been assigned by a routing decision uses an automatically generated route to reach this destination. It will stay there as long as preset by the dwell time distribution. This dwell time distribution is allocated by time in the routing decision. Once the dwell time has elapsed the vehicle again uses an automatically generated route to reach the position behind the routing decision in the original route as soon as possible.

This tab page is relevant only for routing decisions and routes of the Dynamic type for Dynamic Assignment (parking lots of the Abstract parking lot type or Zone connector type, cf. section 6.4.5).

- For routing decisions of the Dynamic type, the same properties have to be set as for static ones.
- For routes of the Dynamic type, cf. section 12.7.5 for details.

The dynamic routing decision should not be placed on an edge at which a parking lot is located that cannot be passed.
This tab page is relevant only for Closures in Dynamic Assignment, cf. section 12.8.4.

Except the Vehicle Class(es) property, the same properties have to be set for Closures as for static routing decisions.

For route Closures, neither time intervals nor flow values are required.

Additionally to the common properties of routing decisions, for a managed lane routing decision please select from the predefined selection list:

- Vehicle class(es): Only types of the selected class(es) will be regarded. Vehicles of other types will use neither the managed route nor the general purpose route.

- Managed Lane facility: Click EDIT for selection from the facilities predefined via menu TRAFFIC - MANAGES LANE FACILITIES. This way, a pricing model as well as a decision model is allocated to the routing decision, cf. section 5.6.1.

For routing decisions of the Managed lane type, time intervals can be defined with the pricing model.
For each route pair of a managed lane routing decision, define the following in the Routes list:

- Route Type: From a drop-down list, select either General Purpose Route or Managed Route.
- At: Position on the selected destination link.

### 6.4.4.5 Sorting & Filtering Data in Lists

**Sorting**

In the lists, the direction of the little triangle in the currently selected column header indicates either ascending or descending order of listed entries. Click in the column header to change the current order.

**Filter icons**

Use the Filter functionality to reduce the number of list entries.

In the following columns, the options All (no filter) and Custom (user-defined filter conditions) are provided; alternatively, one of the entries can be selected from the list:

- For **Route decisions**:
  - Decision no.
  - Decision name
  - Start link no.
  - Vehicle class(es), (does not apply to Closures).

- For **Routes** (Static, Partial and Closures):
  - Route no.
  - Route type
  - Destination link no.

For parking lots and dynamic routes, specific properties serve as filter criteria.
Click on the filter icon in the column header and select one of the entries from the selection list.

► The filter icon remains grey if All is selected.
► Active filters are indicated by a blue filter icon.

For user-defined filter settings, select option Custom via Filter icon. The window Enter filter criteria for <current column> appears:

This third-party module allows for column-specific definition of filter conditions connected by AND or OR:

- ADD CONDITION adds another line: Select Operator and Operand.
- DELETE CONDITION removes the selected line: Select the line by clicking on the button to the left of the entry line.
- AND conditions / OR conditions: The selected option regards all of the current filter settings.
Additionally, the Routes section provides option Show only routes over link:
► Check this option and
► Select one of the VISSIM network links from the list.

Then only those routes will be listed in the Routes section which traverse this link. Simultaneously, they will be highlighted in the network display.

### 6.4.4.6 How Routing Decisions Come Into Action

**Routes in general**

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 PT vehicle that stops.

In the 2D mode, a lane change is indicated by a short red bar at the front of the vehicle (indicator) and in the 3D model as a flashing indicator (if it is defined in the 3D model).

Vehicles on the destination travel lane of the indicating vehicle will co-operate in allowing the vehicle to change lanes according to their driving behavior parameters (cf. section 5.4.3).

A routing decision needs to be placed well in advance of the point where the routes divide into different directions. This is to allow the vehicle to react to its new destination. In addition, for multi-lane links it 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 (but - of course - downstream of the end of all previous routes).

**Partial Routes**

For 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 need to be defined.

**Recommended placement**

When a sequence of routing decisions is 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.

Vehicles assigned to a specific route and waiting for a gap to merge will be removed from the network after a waiting period of 60 seconds to avoid unrealistic backups. The assumption is that in reality those vehicles would have forced their way into the flow.

The default value of 60 seconds can be changed in the driving behavior parameter set (cf. section 5.4).

If VISSIM cannot find a connection between the routing decision point (red bar) and the destination point (green bar) usually a connector is missing. In this case double-check the desired link sequence using the Center line viewing mode (VIEW – CENTER LINE or default hotkey CTRL+A).
During the simulation start, VISSIM checks for partial routes and managed lane routes whether all destination cross sections starting from the same start cross section have the identical position on the identical destination link. If not so, the destination link number and the position (at [m]) of the route having the smallest route number will be used for any other partial route or managed lane route starting from this decision cross section.

Managed Lanes

During a simulation, routing decisions of the managed lanes type do only control the route choice of those vehicles which are already either on a static route or on one of the two routes starting from a routing decision of the managed lanes type. Vehicles on dynamic assignment paths are not regarded by those routing decisions.

The managed part of a highway we call a separate road built in parallel to the normal - unmanaged part of the - highway. Normally, the managed part of the highway is equipped with numerous feeders for access and egress of vehicles. Routing decisions of the managed lanes type serve for modeling the so-called “part-distance” use of managed and unmanaged sections of those roads built in parallel.
Placing a routing decision of the Managed lanes type

When defining a routing decision of the managed lanes type, follow the outlined steps. Place

► on the unmanaged part of the highway: a decision before each feeder from the unmanaged to the managed part of the highway which are in parallel. For each of these decisions, place the destination behind the nearest possible exit from the managed part towards the unmanaged part.

► on the managed part of the highway: a decision before each feeder from the managed part of the highway to the unmanaged part of the highway. The destinations for each of these decisions place behind the nearest possible exit from the managed to the unmanaged part on the unmanaged part of the highway.

When passing a routing decision of the type Managed lanes for the first time, a vehicle receives a random number indicating the probability for changing to the managed lane. The vehicle will use this random number for any other routing decision of the type Managed lanes. This way it can be guaranteed, that only in case of heavily changing traffic conditions the vehicle might change its initial decision.

Two routing decisions of the managed lanes type should use the same Managed Lane Facility only if the following applies:

► The courses of the unmanaged routes starting from these decisions are closed to identical.

► The courses of the managed routes starting from these decisions are closed to identical, too.

Graphical display of a routing decision of the Managed lanes type

Via menu VIEW - NETWORK ELEMENTS open the Display of Network Elements window and

► check option Routing decision and

► select Managed Lanes Data in the Label column.

Then, the network display on screen will show

► the number of the decision of the Managed lanes type,

► current travel time savings and speed on the managed lane and

► the current road toll charged for user group 1 Person (SOV).

Evaluations regarding routing decisions of the Managed lanes type

Via menu EVALUATION - FILES you can check the Managed Lanes option to generate the evaluation file *.MLE (Managed Lanes Evaluation) during the next simulation run.

6.4.5 Parking Lots

Basically, the network element Parking lot is used for two completely different purposes:
1. For the use of static routes: Modeling roadside parking and pick-up/drop-off lanes.

2. For Dynamic Assignment: Modeling origins and destinations of trips.

This section explains the functionality of roadside parking and the definition of parking lots in general. The usage in combination with Dynamic Assignment is described in section 12.3.1.

### 6.4.5.1 Roadside Parking Functionality

For modeling intermediate stops of a certain duration, parking lots of the type *Real parking spaces* and routing decisions of the type *Parking lot* are combined. These routing decisions work similar to partial routes. To a routing decision of the type *Parking lot*, no routes are assigned, but any number of parking lots. Also the dwell time distribution and the percentage of vehicles that should park in one of the associated parking lots needs to be defined.

#### Parking Lot Placement

A parking lot is placed on a lane. If that lane does not continue downstream of the parking lot, take care that the emergency stop position of the first downstream connector does not include any part of the parking lot (for details about the emergency stop position please refer to section 6.3.2.2).

The start of a parking lot needs to be placed well downstream of the corresponding routing decision so that any vehicle can slow down safely to reach the first parking space. Otherwise it might happen that no vehicle will be assigned to the first parking space(s) or that vehicles will miss their assigned space and block the traffic flow.

#### Parking Space Allocation

Parking space is allocated through a routing decision of the type *Parking Lot*. It affects all vehicles of the assigned vehicle classes, also public transport vehicles. The only exception are vehicles that already have a parking space assigned.

For assignment of parking lots or parking spaces the following criteria are relevant:

- Open hours
- Max. parking time
- Available space(s) (suitable for the vehicle length)
- Attractiveness

A parking space is only assigned, if the parking lot is open (Opening hours), the vehicle dwell time (assigned by the routing decision) is less than the Max. Parking Time and if a suitable space is available (see below). If any of these criteria is not met, the vehicle continues on its route without parking.

If all the above criteria are met, the vehicle is assigned to the best parking space available when crossing the corresponding routing decision. The best
space is determined by attraction value. If two or more spaces have the same attraction, the first space in direction of flow is assigned.

Finding a Suitable Space

A vehicle fits into one parking space if the space is more than 0.5m longer than the vehicle. If the vehicle is longer, VISSIM checks if two or more consecutive spaces are available to accommodate the vehicle. However, partially occupied spaces will not be assigned to other vehicles (i.e. a vehicle will always stop at the front of a parking space). If consecutive spaces are not available, the long vehicle will not park and continue on its route.

Parking Behavior on Multi-lane Parking Lot Links

A vehicle decides to use a parking space only if either condition is met:
► The parking space is not occupied by a parking vehicle.
► The neighbouring parking space on the driver’s side is not occupied either.

If the chosen parking space is still empty when crossing the decision cross section, but will be occupied right before the car arrives, then the car selects another parking space. Therefore, at least a single empty parking space is required (on the route of the parking lot decision) in with-flow direction.

Entering and Leaving the Parking Space

VISSIM automatically creates routes from the routing decision to each parking space of the associated parking lots. These routes cannot be edited by the user. As soon as a vehicle is assigned to a parking space, it follows on the corresponding route until standstill. The inside of the vehicle turns white once it has reached its final park position. After the dwell time is over, the vehicle leaves the parking space on an automatically created route that leads back to its original route.

VISSIM looks for the shortest path in terms of time to get to a position behind the parking lot routing decision. Both, the current position of the vehicle as well as its entire initial route are taken into consideration. Thus a vehicle may travel a portion of its route twice or skip a portion of its original route.

6.4.5.2 Creating

This section refers to both roadside parking and Dynamic Assignment.

A parking lot is defined as follows:
1. Select the Parking Lots mode.
2. Select the desired link/connector.
3. Define the parking lot: Right click at the start position and drag the mouse downstream to define the length.
6.4.5.3 Properties & Options

This section refers to both roadside parking and Dynamic Assignment. 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

- **Type**:
  - Zone connector:
  - Abstract parking lot:
    Both types refer to Dynamic Assignment, cf. section 12.3.1
  - 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 (cf. VIEW - NETWORK ELEMENTS...) this option allows to individually switch off the label of that parking lot.

These properties are regarded by Dynamic Assignment, cf. section 12.3.1.
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**: Length
  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 direction of flow. This section will not be used by parking vehicles.

**Selection 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.

### 6.4.5.4 Editing

For all subsequent actions the Parking Lots mode needs to be active.

Upon selection of the Parking Lots mode, the parking lots are highlighted by a dark-blue frame:

**Select**

You can select a parking lot either in the list or in the network display:

- Right-click outside of the VISSIM network calls the Parking lots selection list: Left-click to select the parking lot, then click DELETE or ZOOM or DATA.
- In the network display: Click parking lot (dark-blue): The polygon turns light-blue.

**Edit data**

- In the network display: Double-click to call the Edit parking lot window for the selected parking lot.
- In the selection list: Select the parking lot, then click DATA.

**Move**

- In the Edit parking lot window you can enter different At and Length values. Link number and world coordinates are not subject to changes.
- In the network display: Drag the selected parking lot to another position within the same link or into another link/connector while holding down left mouse-key. The polygon turns yellow.

**Delete**

- In the selection list: Select the parking lot and click DELETE.
- In the network display: Select the parking lot and click DEL. Alternatively, you can drag the selected parking lot out of its link or connector.

### 6.4.6 Direction Decisions

Direction decisions should not be used as their handling is more difficult than the handling of routes. Direction decisions remain from out-dated VISSIM versions without routing decisions.

**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 *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 guarantees 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 Public Transport

Public transport 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 public transport requires two steps:

- Step 1: Creating PT stops.
- Step 2: Creating a PT line including route, served stops, PT vehicle and schedules.

6.5.1 PT Stops

PT stops can be created on a link or next to it. There are two types of PT stops:

- On Street stop (curbside stop): A PT vehicle stops on a user-defined travel lane of the selected link.
- Bus Lay-by (turnout): A PT vehicle stops on a special link next to the slow lane of the selected link.

Vehicles approaching a PT vehicle that stops for passenger interchange will attempt to pass it on a multiple lane link, but will wait behind the PT 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 PT vehicle are coded automatically). Deleting the priority rule for the bus priority changes this behavior.

6.5.1.1 Creating

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

1. Select the PT stops mode.
2. Select the link/connector on (or adjacent to) which the PT stop should be placed (a lay-by stop can only be placed on a link, not on 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 PT Stop window appears.
5. Define the stop properties (as shown in the next section) and confirm with Ok.
It is possible to create a stop where more than one PT 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 PT 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.

### 6.5.1.2 Properties & Options

- **No.**: Unique identification of the stop.
- **Name**: Label or comment
- **Length**: Length of PT stop
- **Lane**: Lane position of PT stop
- **At**: Start position (link/connector coordinate)
- **Label**: When showing labels (names) of all PT stops (cf. 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 PT vehicle to turn back on the main road.
- **Generate platform edge**: Optionally, area(s) of the polygon type serving as a platform edge can be created additionally for either type of stop. An automatically created platform edge follows the user-defined link course. With a width of 2m it is placed directly next to the PT stop. Select the appropriate position(s) due to the direction of traffic. The options **left** and **right** can be checked simultaneously, if passengers may board/alight on both sides. Subsequent changes to the properties of the pedestrian area are not necessary, since all area attributes are set automatically. The area name contains stop number and side (**Platform edge PT stop No. (side)**) and will not automatically be adjusted if the platform edge area is allocated to another stop later on.
If a platform edge is created, the Volume [Pers/h] term in the Boarding Passengers windows will change to Relative volume. Any stop with an area defined for PT usage is used by passengers that have been generated as pedestrians. To the PT lines, these passengers are distributed as percentages.

Without the Pedestrians add-on and as well-known from previous VISSIM versions, passenger volumes are distributed exactly according to the given volume numbers per PT stop.

As a property of a pedestrian area, the usage as a platform edge or as a waiting area for one or more selected PT stops can be defined, cf. section 7.1.4. The shape of this platform edge is given by the pedestrian area polygon which is to be defined manually by the user.

A pedestrian area which is automatically created as a platform edge due to this option, always follows the course of the particular section of the link on which the PT stop has been placed. The width of an automatically created pedestrian area is 2 m by default.

- **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 PT vehicles. Use the buttons EDIT, NEW or DELETE to modify the profile.

A passenger profile contains the following information:

- **Volume**: Passenger flow as persons per hour (independent of the time interval defined)
- **from/until**: Time interval for which passengers are generated
- **Used PT Lines**: Select all lines which passengers of this profile can use.

Multiple lines can be selected by pressing **CTRL** while clicking.
Relative flow volume definition for pedestrians using PT stops with platform edge:

For passengers which have been defined as pedestrians of a pedestrian class, default data will be created in two cases:

- If a pedestrian area (either waiting area or platform edge) is assigned to a PT stop for which no passenger volumes have been defined.
- For each automatically created platform edge.

According to the default data, any pedestrian arriving at the waiting area within the time interval 0 – 99999 will board any vehicle of any PT line.

6.5.1.3 Editing

For all subsequent actions the PT stops mode needs to be active.

Upon selection of the PT stops mode, the PT stops are highlighted by a dark-red frame:

Select

You can select a PT stop either in the list or in the network display:

- Right-click outside of the VISSIM network calls the PT Stops selection list: Left-click to select the stop, then click DELETE or ZOOM or DATA.
- In the network display: Click stop (dark-red): The polygon turns light-red.

Edit data

- In the network display: Double-click to call the Edit PT stop window for the selected stop.
- In the selection list: Select the stop, then click DATA.

Move

- In the Edit PT stop window you can enter different At, Length and Lane values. Link number and Type are not subject to changes.
- In the network display:
  - A bus lay-by cannot be moved graphically
  - Drag the selected street stop to another position within the same link or into another link/connector while holding down left mouse-key. The polygon turns light-blue.
6 The Traffic Network

Delete

► In the selection list: Select the stop and click DELETE.
► In the network display:
  - Select the bus lay-by and press DEL. All connectors and priority rules are removed at the same time.
  - Select the street stop and click DEL. Alternatively, you can drag the selected stop out of its link or connector.

6.5.2 PT Lines (Bus/Tram lines)

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

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

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

6.5.2.1 Creating

Before coding a PT line, all PT stops should be created.

It is recommended to start every PT 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 and the sequence of vehicle arrivals of different PT lines can be modeled.

PT line definition is a five step process. To initialize the process, activate the PT Lines mode. The next required action is shown in the status bar. To get back one step, left click outside the VISSIM network.

1. Select the link for the start of the PT 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 PT 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 PT line window appears. Define the PT 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 PT 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 PT route as required and define their properties.

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

### 6.5.2.2 Properties & Options

- **No.**: Unique identification of the PT line.
- **Name**: Label or comment.
- **Vehicle type**: Vehicle type running the PT line.
- **Desired Speed Distribution**: Initial speed of the PT vehicle.

- **Time Offset**: The time offset defines the amount of time PT vehicles enter the VISSIM network **before** their scheduled departure time at the first PT stop (as defined with START TIMES...).
  The idea is that the departure times of a real timetable are entered as the start times of the VISSIM PT line. Then Time Offset is defined as the time the vehicle travels until the first stop in the network plus the average passenger interchange time at this stop - hence resulting in a departure at the time defined as PT line start time.
  The resulting network entry time will be set to 0 for all start times that are less than Time Offset.
  If Time Offset is set to 0 the PT line vehicles enter the VISSIM network exactly at their defined start time.

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

- **Color**: Color of the PT 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. 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 are displayed.

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

The telegrams are sent only if the option **Line sends PT telegrams** is checked. Every time a PT calling point is actuated, a telegram is sent using the data as defined within the window (PT 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 PT 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 PT vehicle when entering the VISSIM network.

*Course no.* and *Occupancy* data is displayed in the list of all Starting Times.
6.5.2.3 Editing

Accessing the PT line properties:
► Activate the PT Lines mode
► Open the PT Lines list (right-click outside of the VISSIM network)
► Select the desired line
► Click DATA

6.5.2.4 PT Line Route Alignment

How to visualize the route alignment of a PT line:
► Open the PT Lines list (right-click outside of the VISSIM network)
► Select the desired line
► Click ZOOM
► Close the list

VISSIM initially activates all PT on-street stops (displayed in bright red) that are included in the highlighted route. Bus lay-bys are not automatically part of a new PT line. To include a lay-by in a PT line 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 section 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 PT line should not service a specific stop it can be deactivated for that line (cf. section 6.5.2.5).

6.5.2.5 PT Line-specific Stop Data

The PT Line-specific stop data (PT Stop Data) can be accessed by double-clicking a stop while the yellow band of a PT line is shown.

The PT Stop Data window appears:
● **PT stop active**: Allows to activate or deactivate a PT stop (for the current line only). A deactivated (= not served) PT stop is displayed as green.

● **Departure time offset**: Option to define a schedule-based departure at this stop that will be used in addition to the passenger interchange time. The resulting departure time is calculated as follows:

\[
\text{arrival simulation second} + \text{dwell time} + \max(0, (\text{PT line Start time} + \text{Departure time offset}) - (\text{arrival simulation second} + \text{dwell time})) \times \text{PT line Slack time fraction}.
\]

In other words, if the scheduled departure time is later than the sum of arrival time + dwell time, then the PT vehicle will wait until the scheduled departure time is reached, if the slack time fraction is 1. In case of lower the slack time fraction values the vehicle departs proportionally before its scheduled departure time.

If either the Slack time fraction or the Departure time offset is 0, then this schedule-based operation is inactive and the dwell time is determined according to the current settings in the Dwell time section.

Section **Dwell Time**:

Decide how the dwell time of the PT line vehicle is to be determined by stop event.

As you can see from the image below, some of the PT stop parameters are regarded only by a micro-simulation.

For a micro-simulation, pedestrian areas with Public transport usage (type Waiting area or Platform edge) need to be allocated to the PT stops, cf. section 7.1.4.3.
Minimum:

- If this option is active, the selected dwell time distribution is used to determine the minimum dwell time for pedestrian areas with Public transport usage.

If this option is unchecked, the minimum dwell time = 0.

PT vehicles do not depart earlier. They might depart later, since they do not depart until all of the alighting passengers have left the PT vehicle. This also applies if the minimum dwell time = 0.

Additionally, you can check the option Late boarding possible for each PT line stop event.

Distribution: If this option is active, the selected dwell time distribution is used to determine the stop time or the minimum dwell time, if applicable.

Note: In order to select this option, at least one dwell time distribution must be defined, cf. section 5.2.6.

Calculation:

- If this option is active, the stop time is determined from the number of boarding and alighting passengers according to the selected method, cf. section 6.5.2.6.

For micro-simulations, the dwell time calculation regards the selected distribution and the number of boarding and alighting passengers, if the option Late boarding possible is checked.

- For passengers available as vehicle type, the volume is defined in persons/hour by stop and line.
- For passengers available as type of pedestrians, the volume is defined by relative flows.

- **Alighting percentage**: If option *Calculation* has been selected, enter the percentage of passengers that alight at that stop. This value serves for volume-based dwell time calculation.

No further calculation parameter settings required for pedestrians that have been defined as vehicle type.

For users of the *Pedestrian* add-on, two more options are provided additionally for calculation:

- **Alighting composition**: Select the appropriate composition of PT passengers from the list of compositions that were pre-defined via menu TRAFFIC – PEDESTRIAN COMPOSITIONS. Inside the PT vehicle, the pedestrian types are created according to selected composition and the user-defined percentage will be applied.

- **Alighting location**: Select the appropriate distribution of alighting PT passengers from the list of distributions that were pre-defined via menu BASE DATA – DISTRIBUTIONS – LOCATION. Inside the PT vehicle, the pedestrians who want to alight at this stop, are distributed accordingly to the doors of the vehicle.

- **Alighting possible**: Separately for *Alighting* and *Boarding* events, the option □ *possible* can be checked for either side (left/right) of the vehicle (due to door placement and use). An arrow in the PT vehicle footprint indicates the direction the PT line is heading to.

- **Late boarding possible**:

  □ If this option is active, the minimum stop time is definitely kept and furthermore the vehicle will not depart until all boarding passengers are on-board. The doors are closed after three seconds without boarding or alighting events.

  This option has to be checked, if neither option *Minimum* is active nor a timetable is used.

  □ If this option is not active, minimum stop time = maximum stop time applies.

  - If slack time fraction = 0 applies, the vehicle will depart as soon as the minimum dwell time is over.

  - If slack time fraction > 0 applies, the particular portion of the remaining time until the departure according to the timetable will be added to the stop dwell time, if the departure time has not yet come.

  To make sure, that the PT vehicle leaves precisely at the time of departure, if this option has not been checked, passengers can board the vehicle only until the doors start closing.

  Closing the doors takes three seconds. The doors also close if a passenger boarded the vehicle right before closing the doors has started.
- ** Skipping possible:** If this option is active, a PT stop is passed without stop event under certain circumstances:
  - If the dwell time is calculated: if there are no passengers who want to board or alight as the vehicle is within a distance of 50m in front of the stop.
  - If dwell time distributions are used: if the random dwell time results in a value less than 0.1 s.

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 PT 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.

- **Apply dwell time data to all lines on this stop:** If this option is active, the current dwell time settings for the given PT line at the given PT stop are applied to all PT lines which serve this stop.

### Example: Setting the parameters for micro-simulation

To reproduce the results gained in previous VISSIM versions, set the following parameters accordingly:

<table>
<thead>
<tr>
<th>Option</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum dwell time</td>
<td>Not active</td>
</tr>
<tr>
<td>Late boarding possible</td>
<td></td>
</tr>
<tr>
<td>Slack time fraction</td>
<td>As before</td>
</tr>
<tr>
<td>Departure time offset</td>
<td>As before</td>
</tr>
</tbody>
</table>

### 6.5.2.6 Methods for PT Vehicle Dwell Time Calculation

As mentioned in the Line-specific stop data section, there are several methods to model PT vehicle dwell times in VISSIM:

- **Option A:** Dwell time distributions
- **Option B:** Dwell time calculation using the advanced passenger model
- **Option C:** If the station is simulated microscopically, the dwell time can be calculated as travel time between two platform edges, cf. section 7.2.1 and section 7.7.

Option A is much faster 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 PT 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 (cf. section 5.2.6). Then for each
stop (specific to each PT 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 PT vehicle type (BASE DATA - VEHICLE TYPES... - EDIT - [SPECIAL]-PT PARAMETERS):

- **Alighting 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 alight and there are 3 doors, the alighting time to be entered is 2s.)

- **Boarding time:** The time it takes for one passenger to board (considering the number of doors as described above).

- The **Total Dwell Time** may be calculated by using either the **Additive** or the **Maximum** method.

  If there are exclusive (one-directional) doors then only the maximum out of the total passenger boarding and alighting 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.

Other input data:

- Initial occupancy of the PT vehicles (cf. Start Times in PT Line window)
- Passenger flows for each PT stop (cf. section 6.5.1)
- Alighting percentage and Skipping possible option in PT Stop Data window.

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

1. Determine the number of alighting passengers (defined by the percentage of passengers on board that are alighting).
2. Determine the number of boarding passengers (all waiting passengers whose list of acceptable lines include the line of this PT vehicle and taking into account its maximum capacity).
3. Determine the time required for alighting (computed as the number of passengers alighting multiplied by the average alighting 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 alighting time plus boarding time).
6. If a departure time is defined for that stop, the PT 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.

6.5.2.7 Variation of Arrival Times

In reality, PT 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 link at the beginning of the PT route (typically on the dedicated link) and use the PT line number as link number, if possible. Make sure that the length is sufficient (50-100m due to vehicle length and speed) so that the PT vehicle can enter the network on this link and safely stop. Connect the dummy link to the link network.

2. Create a dummy PT stop on the dummy link. It should start at 25 m or more and its length should exceed the PT vehicle length. For numbering, use the line number as stop number, too. This dummy stops makes it possible to model deviating times of arrival for PT lines which enter the VISSIM network.

3. Include the dummy stop in the line route and 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 PT 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 section, these methods are described in detail.

6.6.1 Priority Rules

The right-of-way for non-signal-protected conflicting movements is modeled with priority rules. This applies to all situations where vehicles on different links/connectors should recognize each other. Vehicles within the same link will implicitly see each other, even if the link has multiple lanes.

Actually, conflict areas are recommended for modeling. If these do not return the expected results, the experienced user can model priority rules.

If the Pedestrians add-on is included in your installation, then priority rules can also be defined for conflicting flows of pedestrians as well as for the interactions of pedestrians and vehicle flows, cf. section 7.1.5.

6.6.1.1 Principles

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 cor-
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 entry (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 50 km/h (i.e. \(~14 \text{ m/s}\)) is 49m upstream of the conflict marker. The current gap time is \(49 \text{m} / 14 \text{ m/s} = 3.5s\). 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 \(28 \text{m} / 14 \text{ m/s} = 2s\). 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 satisfied (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 upstream of 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.
6.6.1.2 Creating

As a priority rule always consists of at least one pair of cross sections, 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 the \( \nabla \) Priority Rules mode. 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 the \( \nabla \) Priority Rules mode and repeat the steps 1 to 4.
6.6.1.3 Properties & Options

See section 6.6.1.2 on how to access the properties of a priority rule.

- **No.**: Unique identification of the priority rule
- **Name**: Label or comment
- **Label**: If showing labels (names) of all priority rules (cf. **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. For multi-selection, press CTRL while clicking the left mouse button.

The vehicle class configuration of the stop line (red bar) affects all conflict markers that belong to that stop line. In order to define a stop line for a different set of vehicle classes, a new (separate) priority rule must be created and the stop line has to be placed at the same location.

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.
- **Look beyond red signals**: Also vehicles located upstream of red signals are "seen" by the conflict marker. If deactive, headway and gap time are only checked up to red signal heads.

### 6.6.1.4 Editing

#### Editing data

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

1. Select the **Priority Rules** mode (to make sure that no previous priority rule is selected).
2. Select one of the corresponding links/connectors.
3. With the left mouse button, double-click 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.

#### Deleting

- There are two options to delete a single conflict marker:
  - Open the list of all *Priority Rules* (right-click outside the VISSIM network), select the priority rule to be deleted and press the **DELETE** button.
- Alternatively, you may drag the conflict marker (green bar) out of any link.

► To delete a priority rule completely, follow the steps below:
- Click \( \triangledown \) **Priority Rules** mode (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.

### 6.6.1.5 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”

Modeling a Yellow Box causes vehicles to stop in front of an intersection if it cannot continue without blocking part or all of it. Thus different priority rules are needed for each vehicle "length" class, e.g. cars and HGVs/buses.

To model a Yellow box follow the steps below:
1. Place the stop line on the stop position before the yellow box/intersection.

2. Place the conflict marker at least one vehicle-length downstream of the conflict area (e.g. for cars 5-6m, for HGVs/buses 12-18m). This is the "storage area" for the first vehicle downstream of the gap.

You may want to include separate priority rule pairs for cars and HGVs as HGVs need more space on the far end of the junction.

3. The headway needs to cover almost the entire distance between the stop line and the conflict marker. This is to prevent vehicles from entering the "storage area" if another vehicle is still in it.

Make sure that the headway does not reach beyond the stop line. Otherwise vehicles will slow down even if they could drive through straight away.

4. Use the parameter Max. speed to set a limit as to when the priority rule should be active. For normal traffic flow, you do not want only one vehicle in the area between stop line and conflict marker (as this would reduce capacity enormously). Thus set Max. speed to a value between 13 and 20 km/h so that slow moving vehicles will recognize the gap whereas faster ones will not. The higher the speed, the higher is the acceptance of the keep clear area.
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/buses 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. All 3 priority rules mentioned here relate to the same stop line (i.e. one stop line with 3 conflict markers).

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 conflict marker needs to be added (No.4) to the same stop line as Nos.1-3 but 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. In contrast to all the existing priority rules, this one needs a new stop line because a different set of vehicle classes (HGV & Bus) is affected. It is placed at the same location as No.2 but with a higher gap time of 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 four 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. All four conflict markers relate to the same stop line.

Please note that because of the greater distance to the conflict area the minimum gap time for the inner roundabout lane (No.9) is slightly higher than for the outer one.
Example 3 - Step 4

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 - added to the same stop line as Nos. 6-9) and entering HGVs and buses to be provided with higher gap times (Nos. 11 and 12 - added to a new stop line). Same as with lane 1 there is a slightly higher value for the time gap of the inner roundabout lane.

6.6.2 Conflict Areas

Conflict areas are a new alternative to priority rules to define priority in intersections.

They are the recommended solution in most cases because they can be modelled more easily and the resulting vehicle behavior is more intelligent.

6.6.2.1 Principles

A conflict area can be defined wherever two links/connectors in the VISSIM network overlap. For each conflict area, the user can select which of the conflicting links has right of way (if any).
Drivers make a plan how to cross the conflict area. A yielding driver observes the approaching vehicles in the main stream and decides for which gap he wants to go. Then he plans an acceleration profile for the next seconds that will allow him to cross the area, taking into account the situation behind the conflict area: if he knows that he has to stop or to slow down there because of other vehicles, he will calculate more time to cross the conflict area or decide not to go at all.

Vehicles in the main stream react on the conflict area as well: if a crossing vehicle could not complete the crossing because the driver estimated the situation too optimistically, the vehicle in the main stream will brake or even stop. And if a queue builds up from a signal downstream the conflict area, the vehicles in the main stream try not to stop in the conflict area in order not to block the crossing stream. This is accomplished by having the drivers make a similar plan to cross the conflict area as the yielding vehicles do.

A conflict area can be created at any position where two links/connectors overlap.

Exceptions: In the following cases, this is not possible:

► If the overlapping sections differ in height (z coordinate) by more than 1.0 m
► If the overlapping section is shorter than 0.5 m
► If vehicles cannot use one or both of the overlapping link segments (since they cannot be reached from a parking lot or by an input)
► if vehicles leave from the network immediately after passing the overlapping section (since there is no connecting turn starting from that section)

A conflict area can be used to model the following conflict types:

► **Crossing** conflicts (one link crosses the other)
► **Merging** conflicts (two connectors lead to the same link or one connector leads to a link that has other traffic coming from upstream)
► **Branching** conflicts (two connectors come from the same link or one connector comes from a link that continues further downstream)

The driving behavior of vehicles approaching a conflict area provides the maximum possible flow-rate for the minor road without interfering with the traffic on the main road. (In case of merging areas vehicles entering from the minor road may interfere with the traffic on the main road, depending on the user-defined safety distance factor: The smaller the factor the stronger the interference.)

► A vehicle on the minor road approaching a conflict area (where it must yield) determines if there will be a sufficient gap in the major road movement when it arrives at the conflict area (with its current travel plan, i.e. if it ignored the conflict area). If there is no such a gap, the vehicle decelerates as if it had to stop in front of the conflict area. In the next time step the vehicle calculates again, so it can possibly cancel the braking and continue even with a certain acceleration, "aiming" at a later gap.

► A vehicle on the main road tries not to "crash" into vehicles on the minor road. If it determines that a vehicle on the minor road will still be inside the conflict area when it arrives there, it brakes to stop in front of the conflict area. (As this deceleration causes it to arrive later, it can possibly continue its journey without further braking in a later time step so that it passes just behind the vehicle on the minor road.)

A vehicle on a minor road will try not to enter a crossing conflict area if there is not sufficient space downstream of the conflict area to leave the conflict area immediately. This means that a vehicle enters the first conflict area of several adjacent conflict areas (without room for the whole length of the vehicle in between) only if it can pass all these conflict areas in one continuous movement.

With a conflict area of the **crossing** type, also a vehicle of the major flow intends to keep the conflict area clear as long as this vehicle belongs to the percentage that has been specified via the **Avoid Blocking** property, cf. section 6.6.2.3

Conflict areas of the **merging** or **branching** type are not kept clear of major flow vehicles. To keep conflict areas of the **merging** or **branching** type clear, a priority rule has to be defined, cf. section 6.6.1.5, example 2.

Vehicles on the minor road do not enter if they must assume that they cannot leave the conflict area before the next vehicle on the main road will arrive (plus safety gap, cf. section 6.6.2.3).
A vehicle on the minor road that has already entered a conflict area will always try to leave it, even if this means entering another conflict area where the gap condition is not met (anymore).

Conflict areas are created, deleted and edited in the Conflict Area mode.

### 6.6.2.2 Creating

**Define area** Left-click on a position where flows might conflict:

The two overlapping link segments are displayed in yellow with the links outlined in yellow, too. This is referred to as a passive conflict area.

**Define state** Right-click once or several times to define an active conflict area:

Select the appropriate right of way configuration, displayed in the status line and through link colors:

- **Green** = main road (right of way).
- **Red** = minor road (yield).
- **Both red** may be used for branching conflicts where vehicles need to "see" each other but there is no right of way because vehicles simply stay in their original sequence.
- **Both yellow** is passive.

### 6.6.2.3 Properties & Options

The attributes affect the calculation of the plan (acceleration profile) for each vehicle approaching the conflict area. The resulting situations (especially the resulting front and rear gaps between two vehicles) can be different from the defined attributes. This is caused by the fact that a vehicle may change its plan (and thus its current behavior) due to a change in the current traffic situation.

Some of the attributes are relevant only for some conflict situations.

- **Visibility**: Maximum distance from where an approaching vehicle can see vehicles on the other link. As long as a vehicle on the minor road is further away from the conflict area it plans to stop in front of the conflict area. Caution: Values below 1 m can cause a vehicle to stop forever because it may not come close enough to the conflict area due to the driving behavior settings.

![Diagram of a conflict area](image)

The blue vehicle reached the point from where it can fully see past the building. Therefore visibility for link 2 is \( d_{L2} \).
• **Front Gap** (only for crossing conflicts): Minimum gap in seconds between the rear end of a vehicle on the main road and the front end of a vehicle on the minor road, i.e. the proposed time elapsed since the vehicle with right of way has left the conflict area before the yielding vehicle enters it. For each vehicle class, a separate gap can be entered.

This illustration shows the current and the "planning ahead" situation ("ghost cars") when the car on main road just left the conflict area. Then the front gap is evaluated as the time needed for the vehicle on the minor road to reach the conflict area (here: 0.5s)

• **Rear Gap** (only for crossing conflicts): Minimum gap in seconds between the rear end of a vehicle on the minor road and the front end of a vehicle on the main road, i.e. the time that a yielding vehicle must provide after it has left the conflict area before a vehicle with right of way enters the conflict area. For each vehicle class, a separate gap can be entered.

This illustration shows the current and the "planning ahead" situation ("ghost cars") when the car on main road just reached the conflict area. Then the rear gap is evaluated as the time elapsed since the vehicle on the minor road left the conflict area (here: 0.7s)
- **Safety distance factor:** (only for merging conflicts) This value is multiplied with the normal desired safety distance of a vehicle on the main road to determine the minimum headway that a vehicle from the minor road must provide at the moment when it is completely inside the merging conflict area. For each vehicle class, a separate factor can be entered.

- **Additional stop distance** (only for the minor road): Distance that moves the (imaginary) stop line upstream of the conflict area. As a consequence, yielding vehicles stop further away from the conflict and thus also need to travel a longer distance until they pass the conflict area.

- **Observe adjacent lanes:** If this option is active, the incoming vehicles on the minor road pay attention to the vehicles on the prioritized link which are going to change to the conflicting lane. Please note: This option will reduce the simulation speed.

- **Anticipate routes:** Enter a real number in the interval [0, 1]. This factor describes the percentage of incoming vehicles on the minor road which consider the routes of those approaching vehicles on the main road that will turn at an upstream position and thus will not reach the conflict area.

- **Avoid blocking** (only for crossing conflicts): Enter a rate factor in the interval [0, 1], which describes the percentage of vehicles on the main road which will not enter the crossing conflict area as long as they cannot expect to clear it immediately. While these vehicles on the major road are waiting for more room downstream of the conflict area the vehicles on the minor road can cross the conflict area. A prioritized vehicle in the selected percentage checks the room downstream of the crossing conflict area. If this is less than the vehicle's length plus 0.5 m and if the blocking vehicle is slower than 5 m/s and slower than 75% of its desired speed (or if the obstacle is a red signal head), the prioritized vehicle will not enter the conflict area.

*Similar situations but different factors (top = 1.0, bottom = 0.5). Thus blue vehicle can still enter while red vehicle needs to stop*
6.6.2.4 Editing

Call the Conflict areas dialog by

► double-clicking a (passive or active) conflict area or
► right-click outside of the VISSIM network.

Define main or minor link

In the dialog window,

► Left-click the particular entry: A double click on a link number in the conflict area window makes this link the major road for this conflict area (data row), displayed on green background, and the other link the minor road (red).

► Alternatively, right click and select the appropriate option from the context menu. The following buttons are provided: PRIORITY, YIELD, and PASSIVE.

- The conflict area can be switched to all-red (e.g. for a branching area) through a right click on the green link and setting it to YIELD, too.

- Selecting PASSIVE in the context menu after a right-click disables this conflict area completely (white, respectively yellow while selected).

Set attribute values

Edit selected cell(s) by direct entry or Copy & Paste.

For editing data by vehicle class, please see below.

Node-based list display

- ✓ show all possible Conflict Areas in Node:
  - Check the option
  - Select the node number from the selection list or enter it.

Then, only the conflict areas inside the selected node will be listed including the passive ones. This is a good way to check if any conflicts inside a node are not yet provided with an active conflict area.

In the network, right-click the link until the appropriate status is displayed by color and in the status bar.

In the dialog window,
Set data by vehicle class

For the attributes *Front gap*, *Rear gap* and *Safety distance factor*, a specific value can be set for each vehicle class.

1. In the cell to be edited, place the pointer on the button.
2. Left click to open the selection list.
3. In the *Vehicle Class* column, right click to open the context menu:
   - Click NEW to add another row to the list.
   - Click DELETE to remove the selected row from the list.
4. In the *Value* column, you can edit the data by vehicle class.
5. To replace a listed vehicle class, click the button in the particular row of the *Vehicle Class* column.
6. In either column, the entries can be sorted: Left-click in the column header.
7. To close the selection list, left-click outside of the columns.

Disable a conflict area

Select the data row in the list, call the context menu and chose one of the options:
► Click DELETE to remove the data row from the grid.
► Select the PASSIVE state instead (can also be done graphically).

6.6.3 **Stop Sign Control**

Intersection approaches controlled by STOP 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.
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- 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...).

### 6.6.3.1 Creating

1. Select the ✅ Stop Signs mode.
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.
5. Confirm with Ok.

### 6.6.3.2 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 (cf. VIEW - NETWORK ELEMENTS...) this option allows to individually switch off the label of that stop sign.
### 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.

6.6.4 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 Signal Controllers

In VISSIM, signalized intersections can be modeled by means of the built-in fixed-time control including the VISSIG add-on, if applicable, cf. section 6.7.3.10.

Additionally, various external signal control logic add-ons are available:
- Econolite ASC/3, cf. section 6.7.3.8.
- LISA+OMTC, cf. section 6.7.3.6.
- SCATS, cf. section 6.7.3.4.
- SCOOT, cf. section 6.7.3.5.
- VAP, cf. section 6.7.3.3.
- Ring Barrier Controller (RBC), cf. section 6.7.3.7.
  The Ring Barrier Controller (RBC) is the default actuated signal controller for licenses distributed by subsidiary PTV America.
  The RBC User Manual can be accessed through the HELP menu in the RBC GUI, additionally it is stored in the DOC folder of your VISSIM installation.

Further custom external signal controller types support Siemens VA, TRENDS, VAS, and VS-PLUS.

Users of the 32 bit edition of VISSIM receive the 32 bit version of the specific *.DLL files. Accordingly, the 64 bit version of the specific *.DLL files is provided to users of the 64 bit edition of VISSIM.

Alternatively, you can also define an External controller using user-defined signal controller *.DLL and signal controller *GUI.DLL files (in C or C++ programming language), cf. section 6.7.3.9.

Users of the External add-on need to compile the SC DLL files in accordance with the used VISSIM edition (32 bit or 64 bit).

Click menu HELP - LICENSE to verify which signal controllers are provided with your license.

VISSIM provides access to external controller data only if the network has been saved to file. This guarantees, that the controller files and the *.INP file are stored in the same folder.

6.7.1 Signal Groups and Signal Heads

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 (cf. section 6.6.1).

### 6.7.1.1 Creating

For coding Signal heads, a Signal controller has to be defined and Signal groups are required, cf. section 6.7.3:

1. Select the \textit{Signal heads} mode.
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 (cf. section 6.7.1.2).
5. Confirm with Ok.
6.7.1.2 Properties & Options

- **No.**: Unique identifier of the signal head
- **Name**: Optional label or comment
- **SC**: Selected signal controller.
- **Signal group**: Selected signal group.
- **Type**: Defines the display of the signal head in the 2D animation during a simulation or test run. Options:
  - Circular
  - Left Arrow
  - Right Arrow
  - Invisible.
  If the normal signal group of an (arrow) signal head has red or off and if an "or signal group" is defined, the state of the or signal group is displayed instead, without arrow (even if the normal signal group has amber and the or signal group has red/amber or vice versa).
- **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.
- **Label**: When showing labels of all signal heads (see VIEW - NETWORK ELEMENTS...) this option allows to individually switch off the label of that one (cf. section 4.2.1).
- **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.
- **NEW 3D SIGNAL**: Create a 3D signal, cf. section 4.1.4.2 and section 4.3.4.1.

To model right-turn movements (right-turn-on-red), which are controlled by an own signal group before/after the actual stage and signalized by the **Circular** type in the actual stage in VISSIM, enter the signal group of the green arrow for the **Or Sig.gr.** option.
6.7.1.3 Editing

1. Select the Signal heads mode.
2. Right click in the network display to call the Signal heads list. For each signal head, the list contains the SC no., the name and no. of the signal group and the name and no. of the signal head.
3. Select the signal head you would like to edit.
4. Click the ZOOM button to zoom into the network display, if applicable.
5. Click the EDIT button to modify the signal head’s properties (cf. section 6.7.1.2).
6. Confirm with Ok.

Alternatively, you can click the DELETE button in step 5 to delete the selected signal head in the network.

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: as 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.

Detectors on pedestrian links

Prior to VISSIM 5.20-06, only the presence at the end of the controller time step was passed to the controller. Now, detectors on pedestrian links detect changes between occupied and free between subsequent time steps, and pass this data to the controllers as "front ends / rear ends".

Thus, the assigned sound file can be played, when a pedestrian arrives on an empty detector, too.

6.7.2.1 Creating

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

1. Select the Detectors mode.
2. Select the link the detector is to be placed on.
3. Right-click 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 6.7.2.2).
5. Confirm with Ok.
6.7.2.2 Properties & Options

- **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.

- **SC (signal controller)**: Associates the detector to the controller.

- **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.

- **Type**: Choose the appropriate detector type:
  - *Standard* detectors register PT vehicles like any detector.
  - *Pulse* detectors do not pass any presence/occupancy information to the signal controller.
  - *Presence* detectors do not pass any pulse information (vehicle front ends or rear ends) to the signal controller.
  - *Public transport calling points* only detect PT vehicles that send out PT telegrams, cf. section 6.5.2 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 in one of the following cases:
  - 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
  - if the vehicle has already decided to skip that PT stop (in this case the detector call is sent to the controller as soon as the vehicle reaches the detector)

If the detector is located on a link which is to be used as pedestrian area, and serves for push button modeling for pedestrians, please select **Pedestrian class(es)** and define the **Maximum speed**, cf. section 7.1.5.
6.7.2.3 Exponential Smoothing of the Occupancy Rate

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:

\[ s(t) = \alpha \cdot x + (1 - \alpha) \cdot s(t-1) \]

The following applies:

<table>
<thead>
<tr>
<th>Table 6.1</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>s(t)</strong></td>
<td>is the new exponentially smoothed value</td>
</tr>
<tr>
<td><strong>s(t-1)</strong></td>
<td>is the old exponentially smoothed value (recent time step)</td>
</tr>
<tr>
<td>x</td>
<td>is the new detected value</td>
</tr>
<tr>
<td>(\alpha)</td>
<td>is the smoothing factor [0..1]</td>
</tr>
</tbody>
</table>

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

- **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).
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 $x$.

### 6.7.2.4 Editing

To access the detector properties for data editing (cf. section 6.7.2.2), there are two ways:

- Select the link/connector in the network display and double-click on the detector.
- Alternatively, you may right-click outside of the network to call the list of detectors. For each detector, the list contains the SC no., the detector no. and the name of the detector. Select the detector in the list and click the DATA button.

By dragging the detector while keeping the left mouse-button pressed, you can do the following:

- Move the detector either within its link/connector or into another link or connector.
- Delete the detector by dragging it outside of any link/connector.

### 6.7.3 Signal Control Types

The *Signal control* window contains the list of all signal controllers defined in the current network. This list can be edited.

- For the SC selected in the list you can edit the header data in the upper section of the window.
- By right-click in the list you can call a context menu. The context menu provides the following functions:
  - **NEW** adds another SC to the list
  - **DUPLICATE** creates a new SC with the properties of the selected one but a new SC no. = maximum SC no. + 1
  - **DELETE** removes the selected entry from the list
Click menu HELP - LICENSE to check for the SC add-ons provided with your VISSIM installation.

6.7.3.1 Creating

In order to define a new signal controller, access the Signal control window by SIGNAL CONTROL – EDIT CONTROLLERS...

Click one of the commands below to create a new SC:

► NEW: Enter data.
► DUPLICATE after selection of a signal controller: Edit data.

6.7.3.2 Properties & Options

For each Signal Controller the following header data is available:

- **Number**: Unique ID of the signal controller
- **Name**: Label or comment
- **Cycle Time**: Fixed cycle length in seconds or **Variable** cycle length
- **Type**: Select the control strategy. Other options are enabled or disabled according to this setting.
Offset: A value that delays the first (and therefore all subsequent) cycle by <value> seconds.

For Fixed time control, significant changes have been performed and the functionality has been extended by various new features. One of them is the VISSIG add-on, for example. Please refer to section 6.7.3.10 for the comprehensive description.

For the selected control strategy, the tabs contain special data, e.g. input file names etc. (see below).

[SIGTIM_TBL.CFG] Here, the settings for the Signal timing plan display window (during simulation run) can be edited, cf. section 11.8.

[SC/DET.REC] For SC using an external control strategy, the SC/Detector Record settings can be edited, cf. section 11.9.

6.7.3.3 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. PT 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 file VAP.PDF in the DOCUMENTS folder of your VISSIM installation. VisVAP (the optional graphical desktop to model flow chart logics) is explained in file VISVAP.PDF in the DOCUMENTS folder of your VISSIM installation.

Users of the 32 bit edition of VISSIM receive the 32 bit version of the VAP DLL files. Accordingly, the 64 bit version of the VAP DLLs is provided for users of the 64 bit edition of VISSIM.

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.

6.7.3.4 SCATS (optional module)

SCATS requires
► the files SCATS.DLL and SCATS_GUI.DLL and
► the programs WinTraff and ScatSim (and SimHub if applicable).

These are provided by the Roads and Traffic Authority of New South Wales, Australia.
SCATS users receive the *.DLL files with the VISSIM edition. The *.DLL files are also provided as 64 bit versions.

### 6.7.3.5 SCOOT (optional module)

SCOOT requires

- the files SCOOT.Logic.DLL and SCOOT.Gui.DLL and
- the program PCScoot.

These are provided by Siemens (http://www.scoot-utc.com).

- **Write log information**: If this option is checked, the following data is stored in the log file: Debug information and log information on the communication with the UTC.

SCOOT users receive the *.DLL files with the VISSIM edition. The *.DLL files are also provided as 64 bit versions.

### 6.7.3.6 LISA+ OMTC (optional module)

Provided by SCHLOTHAUER & WAUER Ingenieurgesellschaft für Straßenverkehr, Berlin, Germany.

### 6.7.3.7 Ring Barrier Controller (optional module)

This controller is standard in North American releases of VISSIM. With this controller VISSIM can simulate fully actuated signal control as well as coordinated and semi-actuated coordinated signal control.
Some of the general controller features available with RBC are: 16 signal groups, 16 overlaps, 8 PT signal groups, 4 rings, multiple detectors per signal group and multiple signal groups per detector, 2 preempts, etc. PT signal priority and Preemption capabilities are available based on your VISSIM license level.

The interface to the controller is accessed through VISSIM but saves its settings to an external data file with the extension *.RBC. The RBC manual is provided as MANUAL_RBC.PDF in the DOC folder of your VISSIM installation. This controller type replaced the NEMA controller type in North America. For data conversion, please refer to the NEMA_TO_RBC.PDF in the same folder.

RBC users receive the *.DLL files with the VISSIM edition. They are also provided as 64 bit versions.

How to edit RBC settings

For a single controller, go on as follows:

► Click menu SIGNAL CONTROL – EDIT CONTROLLER

The Signal Control window opens.

► Select the controller in the list.

Its data is displayed in the window’s details section.

► Select Ring Barrier Controller in the Type selection list, if applicable.

The [RING BARRIER CONTROLLER] tab appears in the first position.

► Check – and replace, if necessary – the preset *.DLL and *.WTT files (loaded from the EXE folder of your VISSIM installation).

► Click the EDIT SIGNAL GROUPS button.
The Ring Barrier Controller window opens.

Continue according to the MANUAL_RBC.PDF in the DOC folder of your VISSIM installation.

6.7.3.8 Econolite ASC/3 (optional module)

This control type is used in North America. When creating an SC of the Econolite ASC/3 type, the *.WTT file is automatically set to ASC3.WTT.

The files ASC3GUI.DLL and ASC3.DLL are provided with your VISSIM edition (32 bit version or 64 bit version).

Since the new version of ASC/3 requires the ASC3GUI.DLL file, for older projects the former file name ASC3_GUI.DLL needs to be replaced by the new file name ASC3GUI.DLL.

6.7.3.9 External

External does not represent a certain method, but is a generic name.

You need to create user-defined DLL files in C or C++ programming language, which are required by VISSIM:

► An external program DLL (controller)
► A specific dialog DLL
Users of the External add-on need to compile the SC DLL files in accordance with the used VISSIM edition (32 bit or 64 bit).

Users with a license containing this feature can find the API source code modules and documentation in the API folder of the VISSIM installation.

In the [CONTROLLER (EXT.)] tab, the following parameters have to be set for a signal control of the External type:

- **Program file**: User-defined *.DLL
- **Dialog DLL file**: User-defined *.DLL
- **Data file 1**: Contains data for the control strategy.
- **Data file 2**: Contains data for the control strategy.

These data files (1/2) are only required if you do not want to include control strategy data into the program code of your own *.DLL file.

- **WTT files**: Value-Type tables contain the SC data types which are to be displayed in the SC/Detector protocol or in the signal timing plan window and their display properties.
- **Program no.**: Select the signal program for simulation. The number of the signal program can be entered even while the simulation is running.
- **Debug mode**: If this option has been checked, the signal states can be observed while the simulation is running.

External signal controls can provide filenames and paths for the program file, for the dialog *.DLL file and for the *.WTT files. Paths which include the current data folder (where the *.INP file is stored) or the program folder (where the VISSIM.EXE file is stored) are saved as relative path. This way
they will still work though the data folder might have been renamed or copied.

For a signal control of the *External* type, the number of the signal program can also be entered while the simulation is running. VISSIM automatically switches to the new signal program at the next switch point.

With external controller DLLs, the current cycle second (determined by VISSIM for fixed cycle times) is computed on the basis of the start of the first cycle at midnight. If 00:00:00 is set as start time, this will not make a difference.

### 6.7.3.10 Fixed time control

The external SC type *Fixed time control* is a fixed time control strategy. The Signal Control Editor replaces the original tabular data supply method for fixed time controls. The graphical signal program editor allows for changes to the signal timing plan. Due to the particular VISSIM license, the signal program editor’s add-on VISSIG provides additional functionality beyond the VISSIM standard version.

For *Fixed time control*, significant changes have been performed and the functionality has been extended by various new features, by the VISSIG add-on, for example. Please refer to section 6.7.4 for the comprehensive description.

For stage-based fixed time controllers, the greentime optimization can be performed, cf. section 6.7.3.11:

► For the selected fixed time controller via the button **START OPTIMIZATION** in the **Signal control** window – [**FIXED TIME**] tab.

► For all fixed time based controllers in the network via menu **SIGNAL CONTROL - OPTIMIZATION OF ALL FIXED TIME CONTROLLERS**.

**Definition**

Via **SIGNAL CONTROL – EDIT CONTROLLERS...** open the **Signal Control** window and create a signal control with fixed time control.

By right-click in the list you can call a context menu. The context menu provides the following functions:

► **NEW** adds another SC to the list

► **DUPLICATE** creates a new SC with the properties of the selected one but a new SC no.

► **DELETE** removes the selected entry from the list
Properties & Options
For each Signal Controller the following header data is available:

- **Number**: Unique ID of the signal controller
- **Name**: Optional label or comment
- **Type** (control strategy): Defines the controller type and control strategy. The number of provided control types depends on the current VISSIM license.

In this window, the *Cycle Time* and *Offset* settings for fixed time control are not subject to changes. Via the Signal program Editor’s navigator entry *Signal programs* you can define *Cycle Time*, *Offset* and *Switch point*, cf. section 6.7.4.6.

**[Fixed time]** Here, the following parameters have to be set:

- **Program file**: File name (VISSIG_CONTROLLER.DLL) of the control strategy. (This file is preset automatically and cannot be edited.)
- **Dialog DLL file**: File name (VISSIG_GUI.DLL) of the data supply interface. (This file is preset automatically and cannot be edited.)
- **Data file 1**: Contains the configuration file VISSIG.CONFIG. (This file is preset automatically and cannot be edited.)
  These three files are loaded automatically if they are stored in the EXE folder of your VISSIM installation.
- **Data file 2**: Contains the signal control file *.SIG in XML data format. (This file is preset automatically and cannot be edited.)
When an elder VISSIM network file is read from file, the *.SIG files are created automatically.
The *.SIG files and the VISSIM network file *.INP need to be stored in the same directory.

*.WTT files are automatically loaded. They are not subject to changes.

- **Program no.**: Select the signal program for the simulation. The signal program can also be a Daily Signal Program List, cf. section 6.7.4.8. In the single-step mode, the program can be switched during simulation. If the new signal program number is confirmed via OK, the program will be switched in the next simulation second.

- **Edit Signal Control**: Via this button, the Signal Control Editor is called, cf. section 6.7.4. The signal groups need to be defined and can be deleted in the SC Editor. Changes to the channel number of existing signal groups are recognized in VISSIM and will be adjusted in the appropriate signal heads.

Since VISSIM 5.20, the Controller Frequency is read from the external control data.
Internally, the controller frequency is the least common multiple of all SC. The value may not exceed 10, since VISSIM permits ten simulation steps per second at most.

- **Start Optimization**: Click this button to start the greentime optimization of the current stage-based fixed-time control, cf. section 6.7.3.11.

### 6.7.3.11 Greentime Optimization of Stage-based Fixed-time Control

This functionality requires the VISSIG add-on.

This functionality “automatically” improves the goodness of a signal plan for a single VISSIG signal control.

For that purpose, VISSIM runs repeated simulations of the whole network with all controllers switched off except a single one. Thus, upstream signals have no effect. The simulations continue as long as changes of the stage green times increase the flow (total volume) or reduce the average vehicle delay. Alternatively, the user can stop the iteration. The stage timings with the best result (highest flow / lowest average vehicle delay) are saved in the *.SIG file at the end of the optimization.

You can run the optimization either for the selected SC or automatically for all all fixed time SCs:

- For a single SC, click the button **Start Optimization** in the Signal control dialog.
Start the automatical run for all fixed time SCs, one by one, through the menu item SIGNAL CONTROL – OPTIMIZE ALL FIXED TIME CONTROLLERS.

**Prerequisites and Conditions for Application**

The following needs to be defined:

- In VISSIG: signal groups, an intergreen matrix, stages and a stage-based signal program.
- In VISSIM: signal heads, a surrounding node and adjacent nodes.

Furthermore, the following applies:

- The minimum green times and the relevant intergreens should be included in the interstages because the optimization can reduce the stage length to zero. The signal program still needs to be consistent even if all stages show a length of zero.
- The stage-based signal program has a user-defined cycle time but it can have arbitrary stage lengths. It is easiest to use the stage lengths that were the default values upon program creation.
- Select the program number in the Signal Control window in VISSIM.
- Traffic demand and routing must exist in the VISSIM network, too, i.e. vehicle inputs and routing decisions or parking lots and matrices (or a trip chain file) and a path file. The routing does not need to be defined as static turning movements. Dynamic assignment or static routes passing multiple nodes can also be used, since it only is relevant that the vehicles traverse the node of the signal controller.
- Other signal controllers are not regarded.

**Calculation method in VISSIM**

The optimization works in the following way:

- Using an automatically generated node evaluation, VISSIM determines for each signal group and for the complete simulation run the mean delay of all vehicles which have passed the node in the particular lanes of the signal group, i.e. on their particular turning relations.
- For the optimization, the signal group at which the vehicles returned the greatest mean delay is determined for each stage.
- Subsequently, the stage with the lowest maximum mean delay is selected for the best stage, whereas the stage with the greatest maximum mean delay is selected for the worst stage. From the best stage, one greentime second is removed, to the worst stage, one second is added. If no second is left over to be removed from the best stage, the second-best stage will be used. If even this stage cannot be reduced anymore, iteratively the next worst one will be used. If no stage is left over for further reduction, the optimization is completed.
- A signal program is always better than another one if the flow (total number of vehicles passing the node while the simulation is running) either increased significantly (at least by 25 vehicles or by 10%, if this is less) or if the flow did not shrink significantly (by 25 vehicles or 10%) and
The mean delay of all vehicles decreased. If a signal program is rated higher than the previous one, the former best signal program is replaced by the preferred one and the optimization will continue with another step.

Optimization terminates if either the signal program has not improved within 10 simulations or if the flow has decreased by more than 25% compared to the best signal program hitherto or if the mean delay has increased by more than 25%.

6.7.4 The SC Editor

The SC Editor has a separate user interface which consists of the following window sections:

- **Title bar**: Program name, number of the selected SC and name of the currently loaded controller data file *.SIG.

- **Menu bar**: By means of the mouse or using shortcuts the program can be operated. Menu commands contain graphical elements indicating a sub-menu or window:
  - ‣ indicates a sub-ordinated menu.
  - "..." indicates a sub-ordinated dialog window.

- **Toolbar**: Operating devices for control and editing.

- **Scroll bars**: Shift the current window display horizontally or vertically on screen.
### The Menus

**FILE**

General data file management:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>Import of a configuration file *.SIG</td>
</tr>
<tr>
<td>Export</td>
<td>Output to Excel workbook or as file *.PUA (Interstage programs in text format for VAP)</td>
</tr>
<tr>
<td>Save</td>
<td>Save the VISSIG configuration file *.SIG with identical path and file name</td>
</tr>
<tr>
<td>Save As…</td>
<td>Save the VISSIG configuration file *.SIG with new path and file name</td>
</tr>
<tr>
<td>Exit</td>
<td>Terminate the VISSIG program session</td>
</tr>
</tbody>
</table>

**EDIT**

Processing commands:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undo</td>
<td>Discards the previously performed action(s). Each step can be dismissed.</td>
</tr>
<tr>
<td>Redo</td>
<td>Redoes the previously discarded action(s). Each step can be renewed.</td>
</tr>
<tr>
<td>Options…</td>
<td>General settings (Common, Optimizations, View and Export)</td>
</tr>
</tbody>
</table>

### Options

This section describes the parameters which need to be set globally.

Open the *Options* window via menu **EDIT - OPTIONS**...

**[COMMON]**

You may select a *Language* of the languages which are included in the license. By default, the language being currently active in VISSIM is used.

**[OPTIMIZATIONS]**

This tab is only provided for users of the VISSIG add-on.

Refers to *Interstage programs*, cf. section 6.7.4.7.

- ✔ *Add minimum times in interstage*: The target signal states of the individual signal groups show at least the minimum duration that has been set in the signal groups.
- ✔ *Use optimal length in front*: If this option has not been checked, the green in the beginning of the interstage is terminated when switching from green to red.
- ✔ *Use optimal length in back*: If this option has not been checked, the green is only started at the end of the interstage (or at the end of the interstage minus minimum duration, respectively) when switching from green to red.
This tab is only provided for users of the VISSIG add-on. It contains the Common export parameters.

- **Render mode**: You may select one of the view modes:
  - **Fixed width**
  - **Fixed scale (Pixel per second)**

- **Signal group height**: Here you can globally redefine the height of signal groups (in Pixel) for any graphics export actions.
Export parameter settings for Signal programs
- **Picture width**: Enter the width of the image to be exported (in Pixel).
- **Pixel per second**: Enter the number of pixels representing a second in the export image.

Export parameter settings for Interstages
- **Picture width**: Enter the width of the image to be exported (in Pixel).
- **Pixel per second**: Enter the number of pixels representing a second in the export image.

Export parameter settings for Stage sequence
- **Stage width**: Enter the width of the image to be exported (in Pixel).

The Symbol bar
Due to the navigator entry and the selected editing view, the following buttons can be accessed:

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Signal Control window" /></td>
<td>Return to the Signal Control window in VISSIM</td>
</tr>
<tr>
<td><img src="image" alt="Save" /></td>
<td>Save</td>
</tr>
<tr>
<td><img src="image" alt="Undo" /></td>
<td>Undo</td>
</tr>
<tr>
<td><img src="image" alt="Redo" /></td>
<td>Redo</td>
</tr>
<tr>
<td><img src="image" alt="Go to previous view" /></td>
<td>Go to previous view</td>
</tr>
<tr>
<td><img src="image" alt="Go to next view" /></td>
<td>Go to next view</td>
</tr>
<tr>
<td><img src="image" alt="New" /></td>
<td>New</td>
</tr>
<tr>
<td><img src="image" alt="Duplicate" /></td>
<td>Duplicate</td>
</tr>
<tr>
<td><img src="image" alt="Edit" /></td>
<td>Edit</td>
</tr>
<tr>
<td><img src="image" alt="Delete" /></td>
<td>Delete</td>
</tr>
</tbody>
</table>

**Signal states and Signal state sequences**
At present, the following signals are available:

<table>
<thead>
<tr>
<th>Signal states</th>
<th>Graphical display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td><img src="image" alt="Red" /></td>
</tr>
<tr>
<td>Red/Amber</td>
<td><img src="image" alt="Red/Amber" /></td>
</tr>
<tr>
<td>Green</td>
<td><img src="image" alt="Green" /></td>
</tr>
</tbody>
</table>
For each signal state being displayed, the signal state sequence defines whether it is a green state or a red state. Furthermore it defines, whether the signal state is of the variable type and contains the value of the duration (or the minimum duration respectively) of the signal state in the default sequence. For each signal group, the preset minimum duration can be edited.

<table>
<thead>
<tr>
<th>Signal state sequence</th>
<th>State</th>
<th>Green</th>
<th>Fixed duration</th>
<th>Minimum duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent red</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permanent green</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red-Red/Amber-Green-Amber</td>
<td></td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Red-Green</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red-Red/Amber-Green-Flashing Green-Amber</td>
<td></td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Red-Green-Flashing Green</td>
<td></td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
### 6.7.4.1 Editing Signal Groups

In the navigator, click *Signal groups* to call the list of signal groups.

Right-click in the list calls the context menu. It provides the following functionality:

- **NEW** adds another SG with the first free channel number to the list and places it accordingly in the list.
- **DUPLICATE** creates a new SG with the properties of the selected one but a new SG no.
- **EDIT** allows for modifying the data of the selected SG.
- **DELETE** removes the selected entry from the list.
To the new signal groups, the signal state sequence *Red-Red / Amber-Green-Amber* is assigned. To ease data input the following is recommended: Create a signal group for each of the required signal group types, supply their standard signal sequence and duplicate this template finally as often as necessary.

Furthermore, you may edit the list as follows:

- **No.**: Double-click in the column and edit the number of the signal group.
- **Name**: Double-click in the column and edit the name of the signal group.
- **Notes**: Double-click in the column to call the editing view. You may enter a comment describing the signal group.

**The editing view**

Here you may change the parameters of the particular signal group as follows:

- **Name**: Short “speaking” name of the signal group.
- **Default sequence**: Except for permanent signal sequences, any signal state sequence mentioned in section *can* be selected:
  - *Red – Red / Amber – Green - Amber*
  - *Red - Green*
  - *Red – Red / Amber – Green - Flashing Green - Amber*
  - *Red – Green - Flashing Green*
  - *Red – Green - Amber*

  If option "Add minimum times in interstage" has been checked via menu **VIEW - Options - [OPTIMIZATIONS]**, increasing the duration of either the minimum green or increasing the duration of a fixed state may force the recalculation of particular interstages. Prior to storing the new data it is checked which of the interstages have to be recalculated. The appropriate query appears, if applicable.

  Also changes to current optimization settings or to stages may lead to recalculations which are not caused by the changes themselves.

- **Default durations**: Graphical display of the signal state sequence. The particular value of the signal state is shown. Double-click for value modification.
- **Notes**: Enter a comment describing the intended usage of the signal group.
In the editing view of a signal group the signal state sequence can be edited and also the *Default durations* of this signal state sequence. For signal states with a variable duration in the signal state sequence, the entered value is regarded as minimum duration. Otherwise it is regarded as duration.

In this way you can supply for instance 2 seconds Red-Amber, 5 seconds Amber for 70 km/h permitted speed (in Germany) or 15 seconds Minimum Green for a heavily loaded straight flow. The editing view can be accessed from the navigator, via the context menu or by double-click in one of the non-editable columns of the particular row in the list.

### 6.7.4.2 Editing Intergreen Matrices

Intergreen is the time that is required to elapse between the Green End of a clearing flow and the Green Start of an entering flow. Keeping the intergreen guarantees that the clearing flow will not come into conflict with the entering flow.

Conflicting flows and intergreens cannot be calculated. During intergreen data input no checks are performed, especially the symmetry of intergreen matrices is not checked.
Right-click in the list calls the context menu. It provides the following functionality:

- **NEW** adds another intergreen matrix to the list
- **DUPLICATE** creates a new intergreen matrix with the properties of the selected one but a new no.
- **EDIT** allows for modifying the data of the selected intergreen matrix
- **DELETE** removes the selected entry from the list

Furthermore, you may edit the list as follows:

- **No.**: Double-click in the column and edit the number of the intergreen matrix.
- **Name**: Double-click in the column and edit the name of the intergreen matrix.
- **Default**: The default intergreen matrix selected via Stage assignments is marked by x. Double-click in the column to call the particular editing view.

To each signal group-based signal program a separate intergreen matrix can be assigned. One of the intergreen matrices can be marked as default via Stage assignments in the navigator, cf. section 6.7.4.4. This way it will be taken into consideration when stages, interstages and stage-based signal programs are created.

**The editing view**

You may edit the properties of the selected intergreen matrix as follows:

- **Name**: Short “speaking” name of the intergreen matrix.

To edit an intergreen value, mark a cell or double-click. Gray-shaded cells do not contain data.
Marking a cell in the table will also highlight the corresponding cell in the opposite triangle of the matrix.

**Importing intergreens from Excel**

Interstage data can be imported from Microsoft™ Excel™. For example, if you have already exported an Excel workbook (cf. section 6.7.4.10), you can use Copy & Paste to use the intergreen matrix data in an existing or a new matrix.

Follow the steps outlined below to copy the Excel data to a new matrix which does not contain data yet:

1. In the navigator, click *intergreen matrices*.
2. In the context menu, select *NEW* to create a new intergreen matrix.
   An empty matrix is created with the name *intergreen matrix*.
3. Edit name or number of the intergreen matrix, if applicable.
4. Skip to your Excel file.
5. In the intergreen matrix, open a work sheet that contains the data which you would like to use.
6. Hold down the left mouse key while marking the rows and columns that contain data.
7. Press **STRG+C** to copy the marked data.
8. Skip to the editing view of the new intergreen matrix.

9. Click the top left cell of the matrix. The entire matrix is highlighted in blue.

10. Press **CTRL+V**. The values are entered in the new matrix.

You may also copy particular sections from the Excel table to the intergreen matrix. In this case make sure, that source section and target section (rows/columns) are identical.

The cells in the matrix diagonal (gray-shaded) may not contain data. Pasting will be cancelled if data is copied to the diagonal.

### 6.7.4.3 Editing Stages (VISSIG add-on)

Click *Stages* in the navigator to call the list of stages.

Right-click in the list of stages calls the context menu. It provides the following functionality:

- **NEW** adds another stage to the list to which the first free number is assigned. The stage is placed accordingly in the list.
- **DUPLICATE** creates a new stage with the properties of the selected one but a new number.
- **DELETE** removes the selected entry from the list.

Furthermore, you may edit the list as follows:

- **No.**: Double-click in the column and edit the *Stage* number.
- **Name**: Double-click in the column and edit the *Stage* name.
• **Pseudo stage**: The duration of a stage which has been marked as pseudo stage is always 0 seconds in any stage-based signal program, cf. section 6.7.4.5.

Only for stages without any allocated interstage the pseudo stage option can be checked.

Nevertheless, this option can be unchecked at any time.

• **Stage diagram**: Graphical stage display.

For display of direction indicating arrows, nodes are required in VISSIM. One for the analyzed node and one for each neighbouring node. These nodes have to be selected for Node evaluation.

### 6.7.4.4 Editing Stage Assignments (VISSIG add-on)

Via *Stage assignments* in the navigator, you can either permit or block each of the signal groups or mark their status as *not relevant*.

In the *Intergreen matrices* table, the selected matrix is marked as Default. This matrix has to be selected in the *Intergreens* selection list via *Stage assignments* in the navigator.

Double-click in a cell or click an arrow in the graphical display to change the state of the stage’s signal group. The cycle includes the following states:

- ✔️ Signal group is permitted in this stage
- ✗ Signal group is blocked in this stage
- ⌬ The state of the signal group is not relevant in this stage (in case of partial junction control, for example)

After selection of a default intergreen matrix, the generated stages are checked for conflicting flows. Permitted conflicting signal groups within a stage are highlighted red in this table.
Display options

Click and move the separator between tabular and graphical display to change the width of the two window sections. The display is adjusted immediately.

Via the graphics context menu you may toggle between the list of all stages and the enlarged display of the selected stage.

Via the context menu or via menu EDIT - OPTIONS - [VIEW] tab, you may enable or disable the display of direction-indicating arrows (without or without signal group numbers), cf. section ●.

These view settings are also regarded for the list of stages and the stage sequence editing window as well as for the graphical export of stage sequences.
6.7.4.5 Editing Stage Sequences (VISSIG add-on)

Via Stage sequence editing in the navigator, you can create signal programs and interstages.

The window consists of two sections.

The upper section serves for display of defined stages as well as for interstage calculation and stage sequence definition.

1. For calculation of an interstage, click the From-Stage first and then left-click while pressing **CTRL** simultaneously to select the To-Stage. The stages are marked by 1 and 2. In the context menu, select the CREATE AN INTERSTAGE command. The created interstage will be displayed in the lower section of the window.

Between two stages, multiple interstages can be defined (e.g. with/without minimum duration).

In VISSIG, a signal group can be switched only once per interstage, i.e. the signal group can change from permitted to blocked or vice versa.

To model an interstage which allows for switching a signal group twice, a pseudostage has to be defined in VISSIG and two interstages have to be added (one directly before the pseudostage and the other one following the pseudostage), cf. section 6.7.4.3.
2. Furthermore, you can define a stage sequence for signal program calculation in the upper window:

   - Click while pressing **CTRL** simultaneously to select the desired stage sequence. Click CREATE SEQUENCE in the context menu to create the stage sequence which will be displayed in the lower section.

   - To add another stage to the defined stage sequence, mark a single stage and select ADD TO SEQUENCE in the context menu or double-click the stage to be added.

In the lower section of the window, the currently selected stage sequence is displayed.
Double-click a stage or click Remove stage in the context menu to remove the selected stage from the sequence.

CLEAR SEQUENCE in the context menu will delete the stage sequence completely.

The context menu command EXPORT… allows for stage sequence export as an image file. Set the format options for the image file via menu EDIT - OPTIONS in the [EXPORT] tab, cf. section 6.7.4.10.

To create a signal program with fixed cycle times from the stage sequences, the following options are provided:

- **Cycle time tu:** Enter the duration in seconds.

- **CREATE STAGE BASED SIGNAL PROGRAM:** Click this button to calculate a stage-based signal program for a predefined cycle time. The *Signal programs* editing view appears and allows for further signal program editing, cf. section 6.7.4.6.

- **CREATE SIGNAL GROUP BASED SIGNAL PROGRAM:** Click this button to calculate a signal group-based signal program for a predefined cycle time. The *Signal programs* editing view appears and allows for further signal program editing, cf. section 6.7.4.6.

You may manually define the interstages to be used for signal program calculation. Right-click the dark-gray space between the two desired stages and click INTERSTAGES - CREATE… in the context menu or select an existing interstage.

These steps are performed if the interstages were not manually selected:

For each stage changeover in the sequence of stages it is checked whether there is already an appropriate interstage. If so, the first matching interstage is used for the calculation, otherwise a new interstage will be created. The new interstage will be stored for stage-based signal programs, whereas it will be deleted after signal program calculation in case of signal group-based signal programs.
Double-click an interstage to call the Interstage editing view for it. Click \( \text{\textarrow{left}} \) to return to Stage sequence editing.

Click and move the separator between the two window sections to change the size of the two sections.

### 6.7.4.6 Editing Signal Programs

Signal programs have a name and a number and also a cycle time, an offset for synchronization (e.g. for progressive signal systems) and a switch point that allows for changing to another signal program at a certain instant, in a daily signal program list, for example.

If an intergreen matrix has been assigned to a signal program, the compliance with the intergreens can be observed and retained during signal program editing. Intergreen violations will be highlighted automatically.
The list called via the navigator entry *Signal programs* can contain signal group-based signal programs and stage-based (VISSIG required) signal programs as well. In italic letters, the particular type is displayed by signal program in the navigator tree view.

Stage-based signal programs can only be created from stage sequences. Signal group-based signal programs can also be created in the list.

Right-click in the list calls the context menu. It provides the following functionality:

- **NEW** adds another signal program to the list
- **DUPLICATE** creates a new signal program with the properties of the selected one but a new signal program no.
- **EDIT** allows for editing the data of the selected signal program
- **DELETE** removes the selected entry from the list
- **EXPORT** allows for image file export of the selected signal program

You may edit the list as follows:

- **No.**: Double-click in the column and edit the *Signal program* number.
- **Name**: Double-click in the column and edit the *Signal program* name.
- **Intergreens**: The used intergreen matrix is displayed. Double-click calls the editing view for further changes.
- **Cycle time tu**: Duration of a cycle in seconds. Double-click calls the editing view for further changes.
- **Offset**: For synchronization (e.g. for progressive signal systems). Double-click calls the editing view for further changes.
- **Switch point**: Allows for switching between two signal programs. It is required, that all signal groups of both signal programs show the same
signal state at that time. Double-click calls the editing view for further changes.

The editing view

Signal group-based signal programs allow for modification of the individual signal groups and/or signal times. For graphical editing, the mouse can be used, alternatively, listed data can be edited. The display modes of list columns and signal states can be edited with the help of the context menu.

Right-click calls the context menu which provides the following commands:

- **EXPORT (VISSIG add-on required):** Graphical output of the signal program, cf. section 6.7.4.10.
- **APPEARANCE:** For signal program display, the following options are provided:
  - CLASSICAL
  - 3D TUBES
  - 3D BOXES
- **RESIZE AUTOMATICALLY:** In case of changes to the window size the data row size is adjusted automatically.
- **SHOW ENTIRE SIGNAL PROGRAM:** Redraws the signal program and adjusts the data row size to the window size.
- **EDIT SIGNAL STATES:** Select a row and hold left mouse-key down while moving the first or the last point of a signal state of variable duration. This editing mode you can also select in the symbol bar.
- **STRETCH/COMPRESS:** Select a row and hold left mouse-key down in the time axis label section to stretch (move pointer to the left) or compress (move pointer to the right) the signal state display. This editing mode you can also select in the symbol bar.
- **EXTRACT INTERSTAGE (VISSIG add-on required, provided only for signal group-based signal programs):** In the graphical display, you can cut out any interstage. If EXTRACT INTERSTAGE is selected, the cursor will appear as a cross in the \( tu \) column headers section. Hold left mouse-key down and mark the section you would like to extract. The selected interstage appears in the editing view, cf. section 6.7.4.7. This editing mode you can also select in the symbol bar.
- **SECOND GREEN TIME (provided only for signal group-based signal programs):** You can add another green time.
A second green time can only be defined via context menu.

- **EDIT COLUMNS...** (provided only for signal group-based signal programs): The *Select time columns to be displayed* window appears.

  - *Not selected* columns are listed on the left.
  - *Selected* columns are listed on the right.
  - Use the buttons [►►] and [◄◄] to add further columns to the selection or to remove selected columns from it.

You can change the height of rows:
1. Click in the desired row.
2. In the first gray column, move the pointer over the margin until it appears as a bi-directional arrow.
3. Hold left mouse-key down while dragging the margin of the row up or down.

Use the multiselect functionality (press **CTRL** while marking the rows) to change the height of multiple rows simultaneously.

In the symbol bar of the editing view, the editing functionality can be selected via the following icons:

<table>
<thead>
<tr>
<th>Icon</th>
<th>Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Signal group-based editing" /></td>
<td>Signal group-based editing</td>
</tr>
<tr>
<td><img src="image" alt="Stretch/Compress" /></td>
<td>Stretch/Compress</td>
</tr>
<tr>
<td><img src="image" alt="Extract interstage program" /></td>
<td>Extract interstage program (VISSIG add-on required)</td>
</tr>
</tbody>
</table>
Signal state editing

You can define the format of the graphical display with the help of the context menu and via menu EDIT - OPTIONS - [View] tab, cf. section ●.

Follow the steps outlined below to edit the cycle times of a signal group graphically:

1. Click the EDIT SIGNAL STATES icon. This functionality you may also select in the context menu.
2. Click the desired row.
3. As long as the pointer is moved over the displayed cycle times, you may select one of the options which are indicated by the particular pointer:

<table>
<thead>
<tr>
<th>View</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![65]</td>
<td>Hold the left mouse-key down while dragging the entire signal state with variable duration to the desired position.</td>
</tr>
<tr>
<td>![+35]</td>
<td>Hold the left mouse-key down while dragging the begin or the end of a signal state with variable duration to the desired point in time.</td>
</tr>
<tr>
<td>![8]</td>
<td>Signal states with fixed duration cannot be shifted directly.</td>
</tr>
<tr>
<td>![20 30]</td>
<td>As long as a state is shifted, reserve times are indicated by a green background and intergreen violations are indicated by an orange background.</td>
</tr>
<tr>
<td>![20 30]</td>
<td>With the pointer in the time axis labels section, you may shift the entire signal program (or the zero point of the signal program).</td>
</tr>
</tbody>
</table>
While shifting, the pointer may not be removed from the particular section. Otherwise shifting is cancelled.

The duration of each amber state can be edited separately in the table of the currently edited signal program if the duration differs from the user-defined default value of this signal group (e.g. adverse weather settings). For display of special programs, you may also edit the stage sequence.

**Stretch or compress a signal program**

Follow the steps outlined below to stretch (or compress) a signal program:

1. Click the **STRETCH/COMPRESS** icon. This functionality you may also select in the context menu.
2. As long as the pointer is moved in the time axis labels section, you may select one of the options:

<table>
<thead>
<tr>
<th>View</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Compress" /></td>
<td>Compressing a signal program: Within the time axis label section, move the pointer to the left while holding the left mouse-key down. The section highlighted in red will be cut out.</td>
</tr>
<tr>
<td><img src="image2.png" alt="Stretch" /></td>
<td>Stretching a signal program: Within the time axis label section, move the pointer to the right while holding the left mouse-key down. The duration of the section highlighted in green will be added in front of the section marked in green.</td>
</tr>
<tr>
<td><img src="image3.png" alt="Invalid" /></td>
<td>If this operation cannot be performed (e.g. for minimum duration violation) the marked section is displayed with a gray background.</td>
</tr>
</tbody>
</table>

To cancel a **STRETCH/COMPRESS** operation, release the mouse-key outside of the time axis label section.

**Extract and save interstage**

Follow the steps outlined below to cut a signal program:

1. Click the **EXTRACT INTERSTAGE** icon. This functionality you may also select in the context menu.
2. In the time axis labels section, move the pointer to the right while holding down the left mouse-key:

<table>
<thead>
<tr>
<th>View</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4.png" alt="Valid" /></td>
<td>Valid interstage: Indicated by a green background. Release the mouse-key while the pointer is in the time axis label section to skip to the interstage editing view automatically. The interstage is stored.</td>
</tr>
</tbody>
</table>
### View | Description
--- | ---
|  | For the extracted interstage, the From-Stage and the To-Stage are created if these are missing. These can be edited immediately or in future, cf. section 6.7.4.7.
| ![Interstage Example] | Irrelevant interstage: Indicated by a gray background (for example if the amber state was not marked completely). The interstage cannot be stored.
| ![Interstage Example] | Just a single signal stage change per signal group: If a second green state has been marked additionally, the background appears gray. The interstage cannot be stored.

To cancel an **Extract Interstage** operation, release the mouse-key outside of the time axis label section.

**Special case: Editing stage-based signal programs**

For editing a stage-based signal program the VISSIG add-on is required.

In stage-based signal programs, signal times cannot be edited individually.

- **Edit Signal States** allows for shifting the temporal position of stages within the signal program. Follow the steps outlined below:

| View | Description |
--- | ---
| ![Interstage Example] | Shift the begin or end mark in the time axis label section. |
| ![Interstage Example] | Shift the name of the interstage in the time axis label section. |
| ![Interstage Example] | Shift the interstage within the signal program (only possible, if the interstage’s duration exceeds 0 seconds). |

For interstages, the duration of a state is predefined by the particular default value in the signal group definition.

- **Stretch/Compress** can be applied to each stage separately.
- **Extract Interstage** cannot be applied to stage-based signal programs.
Zoom in the signal program display

For more precise changes to individual signal times you may zoom into a user-defined section of the displayed signal program (for example in case of controller frequency = 10 with possible switch points every 1/10 seconds).

Follow the steps outlined below:

1. Mark a row in the table.
2. Click the graphical display area of the selected row.
   The pointer appears as hand.
3. Click the scroll wheel in the graphical display area of the selected row to extend the time axis display next to the click position.
4. Click the scroll wheel again to reset the zoom.
   Toggle between the two states.

6.7.4.7 Editing Interstages (VISSIG add-on)

Interstages can only be created via entry Stage sequence editing in the navigator (cf. section 6.7.4.5). Via entry Interstages in the navigator, they can be duplicated, edited, exported and deleted.

Right-click in the list calls the context menu. It provides the following functionality:

▸ DUPLICATE creates a new interstage with the properties of the selected one but a new no.
▸ EDIT allows for editing the data of the selected interstage
▸ DELETE removes the selected entry from the list
▸ EXPORT allows for image file export of the selected interstage
You may edit the list as follows:

- **No.**: Double-click in the column and edit the *Interstage number*.
- **Name**: Double-click in the column and edit the *Interstage name*.
- **From stage**: The previous stage of the interstage. Double-click calls the associated editing view of the interstage.
- **To stage**: The target stage of the interstage. Double-click calls the associated editing view of the interstage.

Editing the signal times of interstages is similar to editing the signal times of signal group-based signal programs. Please refer to section 6.7.4.6.

**The editing view**

Right click to call the context menu which provides the following functionality:

- **EXPORT**: Graphical output of the signal program, cf. section 6.7.4.10.

Via menu **FILE - EXPORT - PUA** you can export interstages in PUA format which is required for a VAP control strategy, for example.

- **APPEARANCE**: For signal program display, the following options are provided:
- CLASSICAL
- 3D TUBES
- 3D BOXES

- **RESIZE AUTOMATICALLY**: In case of changes to the window height the data row height is adjusted automatically.
- **SHOW ENTIRE SIGNAL PROGRAM**: Redraws the interstage and adjusts the data row height to the window height.

The properties of the selected interstage can be edited:

- **Name**: The name is taken from the stage sequence selected via *Stage sequence editing* in the navigator, cf. section 6.7.4.5. This name is subject to changes.
- **From stage**: In the list, another origin stage can be selected. Selecting a new stage automatically starts the recalculation of the interstage.
- **To stage**: In the list, another target stage can be selected. Selecting a new stage automatically starts the recalculation of the interstage.

Appropriate origin or target stages are indicated by the following colors in the selection list:
6.7.4.8 **Editing Daily Signal Program Lists (VISSIG add-on)**

Via *Daily Signal Program lists* in the navigator, you can create multiple variants of a temporal sequence of existing signal programs for user-defined time intervals and store these variants as daily signal program lists.

---

**Blue background:** Indicates the selected stage.

**Magenta background:** Mouse-over on an interstage, which does not match the stage. The selection leads to an automatic recalculation of the interstage.

**White background:** The selection does not lead to an automatic recalculation of the interstage.

**Red background:** The selection leads to an automatic recalculation of the interstage.

**White background:** The selection does not lead to an automatic recalculation of the interstage yet.

**Black line:** The stage is not relevant.

Via double-click in the stage area of a signal group the state of this signal group can be switched in the stage. The interstage is recalculated automatically.

- **Duration:** In the selection list, you may edit the duration of the interstage. In each case, the difference between original and new value is added or subtracted at the end of the interstage. You may reduce the duration, but you may not undercut the longest duration of a fixed signal state (amber / red-amber state).

If the stage of a signal group is not relevant in either source stage or target stage when calculating an interstage, then the signal will not be changed for this signal group. Within the interstage, the same signal state will be displayed as for the relevant stage. If the state of a signal group is not relevant in either source stage or target stage, then also within the interstage the signal state will be displayed as being not relevant.
By means of daily signal program lists, you can switch to other signal programs while the simulation is running. For that purpose, not a signal group number has to be entered for program number, but the number of a daily signal program list.

In the context menu, click **NEW** to create a new daily signal program list. Alternatively, you can select an existing list and click **DUPLICATE**, **EDIT** or **DELETE**, as applicable.

Please note, that signal programs and daily signal program lists share the same numbering scheme.

When a daily signal program list is created, numbering starts from the first free number. This default can be replaced by a number that is not yet in use for a signal program.

### The editing view

Click in a row of the displayed table of daily signal program lists to call the editing view for this daily signal program list.
Via the context menu, create a NEW time interval, or DELETE the marked time interval.

Create or edit a daily signal program list:

- **Name**: Name of the daily signal program list (optional).
- **Time**: Select the instant (in **hh:mm:ss** format), when the time interval starts during which the allocated signal program is valid:
  - Mark either **hh** or **mm** or **ss** and use the arrow keys **UP** (along the time axis) or **DOWN** (reverse direction).

If the daily signal program list does not cover the whole day, then add the final instant to the end of the list and allocate **No Signal Program** for the rest of the day. For the interval from midnight until the first time entry, VISSIM automatically assumes **No Signal Program**.

- **Signal Program**: In the selection list, pick the signal program which is to be regarded during the particular time interval. Signal programs of either type (stage-based or signal group-based) can be selected for daily signal program lists.
- **Notes**: Comment on the daily signal program list (optional).

If the change from one signal program to the next is marked by a red dot, the switch point between the two has to be adjusted. Edit one of the signal programs or both, if applicable, so that the states of the two signal programs are coordinated for the change.
6.7.4.9 Detecting Inconsistent Planning Scenarios

Caused by the interdependencies between the individual data objects, changes to the properties of an object may lead to inconsistencies in objects that depend on the modified object. Those inconsistencies are explicitly permitted to prevent the operator from any restrictions. To support the operator’s efforts for consistent planning, the following checks and mechanisms have been implemented though:

► Changes to intergreens may cause intergreen violations in the associated signal programs and/or interstages. Those violations are highlighted graphically in the object data display.

► Adding further conflicts may result in invalid stages. Cells with conflicting green are highlighted red in the table that can be called via Stage assignments in the navigator.

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N R S (1)</td>
<td>✔️</td>
<td>-</td>
<td>✗</td>
</tr>
<tr>
<td>N L (2)</td>
<td>✔️</td>
<td>✔️</td>
<td>✗</td>
</tr>
<tr>
<td>E R S L (3)</td>
<td>✗</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>S R S (4)</td>
<td>✔️</td>
<td>-</td>
<td>✗</td>
</tr>
<tr>
<td>S L (5)</td>
<td>✔️</td>
<td>✔️</td>
<td>✗</td>
</tr>
<tr>
<td>W R S L (6)</td>
<td>✗</td>
<td>✗</td>
<td>✔️</td>
</tr>
<tr>
<td>N P (11)</td>
<td>✗</td>
<td>✗</td>
<td>✔️</td>
</tr>
<tr>
<td>E P (12)</td>
<td>✔️</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>S P (13)</td>
<td>✗</td>
<td>✗</td>
<td>✔️</td>
</tr>
<tr>
<td>W P (14)</td>
<td>✔️</td>
<td>✗</td>
<td>✗</td>
</tr>
</tbody>
</table>

► Changes to stages may lead to invalid interstages due to the new initial state (or target state) of a signal group. The following two cases have to be distinguished:

1. The associated interstages will remain consistent, if the state of a signal group is changed from either green or red to not relevant. Since the interstage is still consistent, another selection of the edited stage will not start a recalculation of the interstage. To force recalculation, select any other stage first and select the edited stage then in this case.
In stage 2, the state was changed from blocked to not relevant for N RS and S RS.

2. Associated interstages usually become inconsistent, if the state of a signal group is changed to either green or red. Inconsistent interstages are indicated by red bars in the navigator tree view.

In stage 2 the state of S RS has been changed from blocked to permitted.

- In the editing view of an inconsistent interstage, the schematic display of the stage that caused the inconsistencies is highlighted in red. Also the
diverging stages are marked by red color in the rows. Select the red stage explicitly to start the recalculation of the interstage to reach consistency with the modified stage.

- Changes to interstages may lead to inconsistencies in the associated stage-based signal programs. These inconsistencies are indicated by red signal program names in the navigator tree.

- Rows with inconsistent stage sequences caused by changes to the interstages are indicated by an exclamation mark in the editing view. The inconsistent section is marked in red.

The earlier change of stage 2 (described above) leads to a recalculation of interstage 2 when explicitly selecting stage 2 once again.

### 6.7.4.10 Export Functions

#### Export as graphics file

Stage sequences, signal programs and interstages can be exported as image files.

The following file types are supported:

- *.BMP
- *.GIF
- *.JPG
Exporting a stage sequence

Follow the steps outlined below for export of the displayed stage sequence:

1. Create a stage sequence, cf. section 6.7.4.5.
2. Right-click to call the context menu.
3. Click the EXPORT command in the context menu.
   The Save as window opens.
4. Select the folder for the image file.
5. Enter the file name.
6. Select the file type.
7. Click SAVE.

Exporting signal programs

Follow the steps outlined below for export of displayed signal programs:

1. Select Signal programs in the navigator and select a program in the list.
2. Right-click to call the context menu.
3. Click the EXPORT command in the context menu. The Save as window opens.
4. Select the folder for the image file.
5. Enter the file name.
6. Select the file type.
7. Click SAVE.

Exporting interstages
Follow the steps outlined below for the export of the displayed interstages:
1. Select Interstages in the navigator and select an interstage in the list.
2. Right-click to call the context menu.
3. Click the **EXPORT** command in the context menu.
   The **Save as** window opens.
4. Select the folder for the image file.
5. Enter the **file name**.
6. Select the **file type**.
7. Click **SAVE**.

**Export as *.PUA file (VISSIG add-on required)**

The *.PUA file is a VISSIG output file which serves as input file for a VAP control strategy. Interstages can be exported in the PUA format.

Follow the steps outlined below to export interstages as a *.PUA file:

1. Select menu **FILE - EXPORT - PUA**.
   The **VISSIG PUA Export** window appears.

2. In the **VISSIG PUA Export** window click the button next to **Save as**.
   The **Save as** window appears.
3. Select the output folder.
4. Enter the filename.
5. Click **SAVE**.
6. Select the start stages in the **VISSIG PUA Export** window.
7. Click **EXPORT**.

The file *.PUA is created with the given filename and will be stored in the chosen directory.

**Export to Microsoft™ Excel™ (VISSIG add-on required)**

You can save any fixed time control data as an Excel workbook.

Export the workbook as follows:

1. Select menu **FILE - EXPORT - EXCEL WORKBOOK**.
   The **Save as** window appears.
2. Select the appropriate folder.
3. Enter the **filename**.
4. Click **SAVE**.
The Excel file is saved with the extension *.XLSX (Format: Microsoft™ Excel™ 2007). Subsequently, you can use Microsoft™ Excel™ 2003 to open this file after conversion into an elder data format. Therefore you have to install the Microsoft Office Compatibility Pack which can be downloaded via Microsoft™ Download Center (www.microsoft.com).

The *.XLSX file can also be opened in Calc (OpenOffice.org). Prior to data editing in Calc, you should save the file with a new filename in Calc format.

Creating a Microsoft™ Word™ document

In the folder <VISSIM>\EXAMPLES\TRAINING\SIGNALCONTROL\MANUAL\EXAMPLE.VISSIG\ENG you can find an example and a brief instruction on how to include the exported image files and the data from the Excel™ file in a traffic engineering paper.

6.7.5 Changing the 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.

6.7.6 Signal Control Communication

Any two Signal Controllers that support communication with other controllers can be linked (similar as a wire link between two controllers).

Click Signal Control - 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 the 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 below will set the output value of channel 7 to 1:

```
Marker.Put( 7, 1 )
```

► One simulation second later, the control logic of SC 3 can read this value through channel 5 using the following command:

```
Value := Marker.Get( 5 )
```

The user-defined variable “Value” will then be set to 1 and can be used for subsequent program commands.

### 6.7.7 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 appears as follows:

► **Red** in case of a vehicle occupying the next immediate block downstream

► **Amber** if the next block is unoccupied and the following block is 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 of Pedestrians

In VISSIM, the movement of pedestrians is based on the Social Force Model (Helbing and Molnár, 1995). The basic idea is to model the elementary impetus for motion with forces analogously to Newtonian mechanics. From the social, psychological, and physical forces a total force results, which then sums up to the entirely physical parameter acceleration. The forces which influence a pedestrian’s motion are caused by his intention to reach his destination as well as by other pedestrians and obstacles.

Prof. Dr. Dirk Helbing from ETH Zurich acts as scientific advisor for PTV AG. For the use in VISSIM the Social Force Model was specially expanded by him.

This simulation model was validated in a threefold way: firstly, macroscopic parameters were calculated and compared to empirical data, secondly it was assured that microscopic effects like lane formation in counterflow situations and stripe formation in crossing flow situations are reproduced, and thirdly a realistic impression of resulting animations was in the focus.
For pragmatic reasons, the behaviour of pedestrians is often classified hierarchically into three levels (Hoogendoorn et al. 2002):

- On the strategic level (minutes to hours), a pedestrian plans his route. He generates a list of destinations.
- On the tactical level (seconds to minutes), the pedestrian decides on the route between the destinations, making a rough routing decision.
- On the operational level (milliseconds to seconds), the actual movement is performed. This includes evading opposing persons, moving through a dense crowd, or simply continuing the movement toward the destination.

Here, the Social Force Model controls the operational level and parts of the tactical level, whereas the strategic level is defined by the user input.

**Literature**


7.1 The Pedestrians Editor (Add-on)

VISSIM can be used in two modes:
- Vehicle traffic mode
- Pedestrian traffic mode

In the toolbar, the Pedestrian Edit Mode button serves for toggling between these two modes.

When the Pedestrian traffic mode is activated, the Pedestrian Elements toolbar for the Pedestrian traffic mode appears:
- The Network Elements toolbar for the Vehicle traffic mode is faded out.
- Only common toolbars (Navigation, Selection, File) remain visible in both modes.

The basic objects for modeling a network for simulation of pedestrian flows can be accessed in either mode.
- In the BASE DATA menu you may define the following:
  - Pedestrian types and Pedestrian classes
  - Walking behavior parameter sets
  - Area behavior types
  - Display types (of areas)
  - Level properties for multi-storey models
- In the TRAFFIC menu you may define Pedestrian compositions.

7.1.1 The Pedestrian Mode

As long as the Pedestrian Edit mode is active, the objects in the Pedestrian traffic mode toolbar are available.

- Areas
- Obstacles
- Ramps (or stairs)
- Pedestrian Inputs
- Pedestrian Routes
- Measurement Areas for Area evaluations (similar to Data collections for vehicular traffic, cf. section 11.3 and section 7.2.2)
- Pedestrian Travel Times for Travel time evaluations (similar to Travel time measurements for vehicular traffic, cf. section 11.1 and section 7.2.1)
If the VISSIM installation includes the *Pedestrians* component, a set of default data will be generated when the program session is started. This set includes the following:

- Types of pedestrians (“men”, “women”)
- Classes of pedestrians (“people”)
- Compositions of flows of pedestrians (“pedestrians”).

Even if the VISSIM installation does not include *Pedestrians*, network data can be read from any *.INP file. In this case, pedestrian traffic mode data will be ignored.

### 7.1.2 Types of Pedestrians

Types of pedestrians can be defined and edited similar to vehicle types, cf. section 5.3.1.

#### 7.1.2.1 Creating

Click **BASE DATA – PEDESTRIAN TYPES**... to call the *Pedestrian Types* window:

The grid to the left contains the list of defined types of pedestrians. Right-click to open the context menu which offers the following commands:

- **NEW** creates a new type of pedestrians.
- **DUPLICATE** creates a new type with the properties of the selected type, but a new number = 1 + maximum pedestrian type number in the current network.
- **DELETE** removes the currently selected type.
To the right, the displayed properties of the selected type of pedestrians can be edited.

Closing the dialog:

- **CANCEL** or ☐ in the top right corner of the window will discard any changes.
- **OK** saves all modifications.

### 7.1.2.2 Properties & Options

- **No.:** Unique identification of the type of pedestrians
- **Name:** Any name or comment
- **Behaviour parameter file:** Enter or select path and name of the pedestrian behavior parameter file *.XML, cf. section 7.1.9.1. For global parameters, the values specified in the behavior parameter file for the pedestrian type having the smallest type no. are used, cf. section 7.6.2.
- **Maximum acceleration:** Function for computation of the maximum acceleration (not dependent of the speed). For more information cf. section 5.1. This information is not used in the Social Force Model, i.e. it does not have an effect currently.
- **Weight:** This distribution determines the mass of newly created pedestrians of this type and can be edited. For further details cf. section 5.2.2.
- **Model distribution:** Defines the shape and the parameters length, width and height of the type of pedestrians by selection of one of the defined model distributions. New models cannot be defined directly within the type data but in the 3D model distribution via BASE DATA - DISTRIBUTIONS – 2D/3D MODEL.
- **Model length from - to:** Data from 3D model parameters (empty=0). Distribution of pedestrian object dimensions in direction of traffic. Identical height is not required for the first point and last point to be considered for an object dimension.
- **Dimension variance:** Scaling ranges for object dimensions (refers to the 3D model).
  - **Length +/-:** Scaling range for object length (refers to the 3D model width, e.g. from the tip of the toe of the front foot to the heel of the back foot).
  - **Width +/-:** Scaling range for object width (refers to the 3D model width, e.g. shoulder width).
  - **Height +/-:** Scaling range for object height (refers to the 3D model height, e.g. adults only or children and adults).
- **Color:** These distributions determine the colors for 3D display of the four main components of a pedestrian of the selected type for all objects of the current type of pedestrians. Prerequisite: Via menu BASE DATA - PEDESTRIAN CLASSES, option **Color determined by Pedestrian type** has to be checked. This way, colors defined via add-on "VISSIM
3D Modeler™ will partially be overruled. For color distributions, cf. section 5.2.4.

What the colors mean:
- Color 1: Shirt
- Color 2: Hair
- Color 3: Trousers
- Color 4: Shoes.

If option **Color determined by Pedestrian class** is active in the **Pedestrian classes** window, the color distribution selected for **Color 1** (Shirt) will be used for class-specific display of a type of pedestrians.

The distributions provided for selection have to be defined via **Base Data - Distributions**, cf. section 5.2.

### 7.1.3 Classes of Pedestrians

Types of pedestrians can be grouped to form classes of pedestrians similar to vehicle classes, cf. section 5.3.2. Classes just ease setting up a scenario. These classes are neither necessarily disjunctive nor mandatory: A type of pedestrians can belong to either several classes of pedestrians or to none of the classes as well.

#### 7.1.3.1 Creating

Clicking **Base Data – Pedestrian Classes...** calls the dialog:

The grid to the left contains the list of defined classes of pedestrians. Right-click to open the context menu the commands **NEW**, **DUPLICATE** and **DELETE**.

- **NEW** creates a new class.
- **DUPLICATE** creates a new class of pedestrians with the properties of the selected class, but a new number = 1 + maximum pedestrian class No. in current network.
- **DELETE** removes the currently selected class.
To the right, the details of the selected class of pedestrians are displayed and can be edited.

7.1.3.2 Properties & Options

- **No.**: Unique identification of the class of pedestrians
- **Name**: Any name or comment
- **Color determined by**: In 3D display mode, all objects of that model (to be defined in the optional add-on “VISSIM 3D Modeler”) will be filled with a color of this distribution. For color distributions, cf. section 5.2.4.
  - If option *Pedestrian type* is active, VISSIM will ignore the color distribution selected for the particular class of pedestrians and use the distributions selected by pedestrian type instead.
  - If option *Pedestrian class* is active, VISSIM will use the color distribution selected for the particular class of pedestrians for display of the shirt (cf. type color 1) for all pedestrians of a type belonging to the selected class. For a type belonging to two classes, VISSIM uses the color distribution currently being allocated to the class with the greater number.
- **Pedestrian types**: The types of pedestrians belonging to the selected class of pedestrians are highlighted in the list below. To edit this allocation, please left-click the one you would like to allocate to this class and thus automatically deselect all others. This way, you may mark multiple entries:
  - To multiselect several type entries, hold down **CTRL** simultaneously.
  - To select a range of types, hold down **SHIFT** simultaneously.

7.1.4 Construction Elements: Areas, Ramps, Obstacles

Pedestrians walk on dedicated pedestrian areas or on ramps. Ramps connect areas on different levels. Areas and ramps as well as obstacles represent a particular type in VISSIM: Construction Elements.

A construction element is basically a geometric shape (either a rectangle or a polygon). It can be either a walkable space (area/ramp) or an obstacle.

- **Obstacles** are no walkable space; on an obstacle, no pedestrians can walk.
- **Walkable spaces** are either areas or ramps; on a walkable space, pedestrians can walk where no obstacle is. Where walkable spaces overlap, pedestrians can pass from one space to the other. Areas can carry further optional information for pedestrian objects like e.g. pedestrian inputs or routing decisions. For public transport stops, areas can serve as waiting area or platform edge.
Areas have no direction and for pedestrians there is nothing corresponding to a connector which is known from the vehicle traffic network. Construction elements are connected if they touch directly or overlap.

Obstacles have the same effect on the walking dynamics as if one had modeled a hole in the walkable space.

Before the information on walkable areas is sent to the pedestrian model, touching and overlapping areas are combined to one walkable polygon as big as possible. In this case, the original area edges do not have the effect of an obstacle.

Thus splitting up areas during editing does not have any influence on the simulation of movements of pedestrians.

Defining an area of a difficult shape can be performed in several steps by specifying multiple overlapping polygons.

Areas of pedestrians created in the Pedestrian traffic mode serve as origin and/or destination of the pedestrian flow, whereas a link created in the Vehicular traffic mode with option Use as pedestrian area serves as walkable space where signal heads, detectors or conflict areas can be placed for interaction with vehicular traffic. For more details, cf. section 7.1.5.

For definition of a construction element and editing in the Pedestrian traffic mode, the Undo and Redo functionality is provided. You may either click the appropriate icon in the horizontal symbol bar or use the commands in the Edit menu.

### 7.1.4.1 Creating

To create a construction element, follow the steps outlined below:

1. Click the Pedestrian Edit Mode button in the symbol bar to activate the Pedestrian traffic mode.
2. Click the particular icon to activate the desired type of the construction element:
   - Area
   - Obstacle
   - Ramp
3. Click the appropriate Shape mode icon:
   - Rectangle
   - Polygon
For *Ramp/Stairway* definition, no shape mode has to be selected. It is always inserted as a rectangle. Prior to the definition, at least two levels have to be defined.

Not regarding the particular type of the construction element, all construction elements are numbered in ascending order.

**Rectangle**

Right clicking the mouse and dragging the pointer while holding down the mouse-key starts creating a new rectangular pedestrian area.

In this mode, the rectangle is inserted in two steps:

► Your first right-click will fix the coordinates of a corner-point of the rectangle. Drag the mouse pointer. By releasing the right mouse key, the end of the length edge of the rectangular shape is fixed. The arrow indicates the direction of drawing. Pedestrians may walk in both directions.

Holding down the **SHIFT** key while dragging the mouse in step one limits the number of possible directions; you may draw the pointer to just the multiples of 45°.

► After releasing the mouse key you can determine the width of the shape only towards one side (and thus not symmetrically): Move the mouse sideward and right-click again finally.

If the **CTRL** key is pressed simultaneously in step two the width of the shape is drawn symmetrically along the first edge which serves as a center axis in this case.

**Polygon**

Right-click to insert the first polyline point and keep mouse-key pressed while dragging the pointer: Successive right-clicks will add more points to the polyline.

Double-click (left) to finish the polygon without adding another point. Alternatively, double-click (right) to insert a last point.

The polyline is always closed automatically: The first point is automatically connected to the last point.

For the definition of a new polygon, these are the steps in detail:

► Keep right mouse-key pressed while dragging the pointer to insert the first vertex.

► Insert successive vertices by right-clicking for each of them. Press **SHIFT** simultaneously to draw a line in 45° or 90° until the next vertex is marked.

► To finish the polyline, double-click either right or left mouse-key.
  - Click right to finish with a final vertex at the click position.
  - Click left to finish without inserting a final vertex at the click position.

After inserting a new construction element or double-clicking an existing one, the properties window of the particular type appears, cf. section 7.1.4.7 et seq.
The properties of the three types are almost alike, slight differences are described with the particular type.

### 7.1.4.2 The Window Structure by Construction element type

#### List of elements

The list contains all construction elements of the particular element type. The numbering must not be continuously ascending, since numbering of construction elements of different types does not count separately. The list allows for the following processing steps:

- Selecting one or more elements of the particular type for further processing.
- Zoom into the network.
- Deleting selected element(s) from the list.

#### Properties

In this section, you may edit the properties of the selected element(s).

### 7.1.4.3 Properties & Options of Pedestrian Areas

- **No.:** Unique identification of the area.
- **Name:** Any name or comment
- **Level:** For an area, select one of the levels defined via View - Level Display, cf. section 7.1.4.6.
- **Z-Offset top:** Offset (positive or negative value) along z-axis to the particular edge for 3D display of the area. For areas, \( z = 0 \) is the ground pedestrians walk on, cf. A in figure below.
  - With **Thickness > z-Offset**, the walkable space rises from below zero
- With Thickness < z-Offset, the walkable space seems to hover in 3D
- Thickness (3D): Thickness of the area in 3D display (cf. B in figure below). Not regarded for simulation.

Thickness > 0 for an area or a ramp will reduce the headroom underneath the construction element which is displayed in the 3D mode, since the thickness of the ceiling (or ramp, respectively) is not regarded for the headroom-based calculation of the length of the ceiling opening (or solid ramp foot, respectively).

- Display Type: Color, texture etc. for the display of the area. Select one of the display types defined via BASE DATA - DISPLAY TYPES, cf. section 5.5.2.

Scheme: A = Z-Offset top, B = Thickness; Obstacle (red): C = Z-Offset bottom, D = Height

- Visualization: In this section, only the relevant option is regarded during a simulation, the other one will be ignored. This depends on the current selection via menu VIEW – OPTIONS – [PEDESTRIANS], cf. section 7.2.5. For example, these options can be used to model tunnels and underpasses in 2D graphics.
  - Individual pedestrians: This option is regarded, if the global display option Individual pedestrians is active, cf. section 7.3.2.
    - When turned off, no pedestrians are shown on that area during the simulation.
  - Aggregated values: If the global display option Aggregated values is active, the currently active LOS scheme can be overruled for this area in case of area-based LOS display, cf. section 7.3.3.
    - If this option is active, you can select either a LOS scheme which is different from the globally selected one or Display type from the list of schemes for display of this area during simulation.
    - When turned off, no aggregate values are shown on that area during the simulation.
- **Behavior type**: Optional property of areas, serves for modelling occasional changes to speed or other parameters. Select a type from the list of area behavior types defined via BASE DATA - AREA BEHAVIOR TYPES, cf. section 7.1.9.2.

- **Dwell time distribution**: Optional property of areas. Select a dwell time distribution from the list defined via BASE DATA - DISTRIBUTIONS - DWELL TIMES, cf. section 5.2.6. This dwell time distribution will be applied to pedestrians that pass this area due to their strategic route. Dwell time distributions at input areas have no effect on pedestrians that are inserted there.

For pedestrian areas with **PT usage** of either **waiting area** or **platform edge** type, you can define a minimum dwell time by allocating a dwell time distribution. PT vehicles do not depart until the minimum dwell time is over or (even with minimum dwell time = 0) will depart later, when all alighters will have deboarded. Optionally, you can check the option **Late boarding possible** by PT line stop event, cf. section 6.5.2.5.

- **Queuing**: Waiting type attribute of rectangular pedestrian areas with intermediate routing point or route destination point. If this option has been checked, waiting pedestrians will queue for the duration of their dwell time, or just for some seconds if no dwell time distribution has been allocated. The queuing follows the direction vector that has been defined during the creation of the area. The vector is displayed in center line mode. This option does not work with pedestrian areas for public transport usage.

- **Public transport usage**: Select the appropriate PT usage type.
  - **None**: The area is not used by PT
  - **Waiting area**: Location where pedestrians wait for the PT line they want to board at the allocated stop. If at least one public transport stop is selected, the pedestrians will choose a random point on the waiting area and wait there for the next public transport vehicle. It is currently not possible to model ordered waiting as a queue. If the PT vehicle which the passenger intends to board has arrived already the passenger does not follow his route to the randomly determined position in the waiting area. Instead, he directly walks towards the vehicle after reaching the waiting area as long as the vehicle’s dwell time will last at least two more seconds.
  - **Platform edge**: Location where pedestrians go to when alighting from a PT line at the allocated stop. Alighting passengers will always use the nearest platform edge. Then they follow the routing decision placed on that area. If no routing decision has been set here, they are removed from the network. For a platform edge, width = 2m is required for minimum. An area (polygon type) serving as platform edge can automatically be generated with a door, cf. section 6.5.1. A platform edge can be allocated to multiple stops.

- **For PT stop(s)**: Allocate one or several public transport stops to an area of the **Waiting area** or **Platform edge** type.
● **Boarding location**: By default, the door that is located most close to the passenger is used as boarding location on pedestrian areas with public transport usage. Alternatively, you can select one of the location distributions for the door choice of boarding passengers. When boarding a PT vehicle, the waiting passengers will select their doors accordingly, cf. section 5.2.7.

If at a stop at least one pedestrian area is defined as waiting area or platform edge, VISSIM assumes that alighting and boarding at that stop are to be simulated microscopically and that the dwell time is not only to be calculated numerically from the given numbers of alighting and boarding passengers.

The difference becomes visible in the *PT Line-specific Stop Data* window, since the content of this dialog changes when at least one pedestrian area is defined as *Waiting area* or *Platform edge*, cf. section 6.5.2.5.

### 7.1.4.4 Properties & Options of Obstacles

- **No.**: Unique identification of the obstacle.
- **Name**: Any name or comment
- **Level**: For an obstacle, select one of the levels defined via VIEW - LEVEL PROPERTIES, cf. section 7.1.4.6.
- **Z-Offset bottom**: Offset (positive or negative value) along z-axis to the particular edge for 3D display of the obstacle (cf. C in scheme).
- **Height**: Height of the obstacle in 3D display (cf. D in scheme).
- **Display Type**: Color, texture etc. for display of the obstacle. Select one of the display types defined via BASE DATA - DISPLAY TYPES, cf. section 5.5.2.
The general properties of ramps/stairs (upper portion of the properties window) are similar to the properties of areas and obstacles.

- **No.:** Unique identification of the Ramp/Stairs.
- **Name:** Any name or comment
- **Levels:** For a ramp/stairs, two levels have to be selected from those defined via `VIEW - LEVEL DISPLAY`, cf. section 7.1.4.6.
  - **Level 1** is the level where drawing the ramp started
  - **Level 2** is the level where drawing the ramp finished
- **Z-Offset** (for ramps by level): Offset (positive or negative value) along z-axis to the particular edge for 3D display of the ramp/stairs (= ground pedestrians walk on, cf. A in scheme).
  - With **Thickness > z-Offset**, the walkable space rises from below zero.
  - With **Thickness < z-Offset**, the walkable space seems to hover in 3D.
- **Thickness (3D):** Thickness of the ramp in 3D display (cf. B in scheme). Not regarded for simulation.
- **Display Type**: Color, texture etc. for display of the ramp/stairs. Select one of the display types defined via `BASE DATA - DISPLAY TYPES`, cf. section 5.5.2.

- **Visualization**: In this section, only the relevant option is regarded during a simulation, the other one will be ignored. This depends on the current selection via menu `VIEW - OPTIONS - [PEDESTRIANS]`, cf. section 7.2.5. For example, these options can be used to model tunnels and underpasses in 2D graphics.
  - **Individual pedestrians**: This option is regarded, if the global display option `Individual pedestrians` is active, cf. section 7.3.2.
    - When turned off, no pedestrians are shown on that ramp or stairway during the simulation.
  - **Aggregated values**: If the global display option `Aggregated values` is active, the currently active LOS scheme can be overruled for this stairway in case of area-based LOS display, cf. section 7.3.3.
    - If this option is active, you can select either a LOS scheme which is different from the globally selected one or `Display type` from the list of schemes for display of this stairway during simulation.
    - When turned off, no aggregate values are shown on that stairway during the simulation.

- **Behavior type**: Optional property of ramps and areas, serves for modelling occasional changes to speed or other parameters. Select a type from the list of area behavior types defined via `BASE DATA - AREA BEHAVIOR TYPES`, cf. section 7.1.9.2.

- **Element type**: Walkable space connecting two storeys can be either a `Ramp` or a `Stairway`. Select the appropriate option and set the specific parameters by element type.

Prior to *Ramp/Stairway* definition, at least two levels have to be defined.

**Specific properties of ramps and stairways**

![Diagram of Ramp/Stairway properties](image)
These parameters apply to ramps and stairways:

- **Ceiling opening**: Select the decisive parameter for the definition of the size and enter the appropriate value:
  - *headroom* (vertical magenta line)
  - *length* (horizontal green line)

- **Solid ramp foot**: Select the decisive parameter for the definition of the size and enter the appropriate value:
  - *headroom* (vertical yellow line)
  - *length* (horizontal black line)

- ☑ *Show solid obstacle (3D)*: The barrier effect of the solid ramp foot is visualized. If this option is unchecked, the obstacle still serves as a barrier, though it is displayed as empty space.

The data visualized by colored lines in the scheme do not take effect on pedestrian flows using the stairway or ramp. However, this data is regarded for the space being provided on the two neighboring storeys, since for the upper level, the size of the cut-out section depends on the ceiling opening properties and for the lower level, the blocked section depends on the dimensions of the obstacle. Make sure, that the footer’s headroom is sufficient, otherwise the pedestrians’ heads seem to go through the ramp.

Thickness $> 0$ for an area or a ramp will reduce the headroom underneath the construction element which is displayed in the 3D mode, since the thickness of the ceiling (or ramp, respectively) is not regarded for the headroom-based calculation of the length of the ceiling opening (or solid ramp foot, respectively).

Additionally, these parameters apply to stairs:

For *Stairway* definition, select the decisive parameter and enter the appropriate value:

- *Total steps*: number of steps
- *Rise*: height of the rise
- *Going*: step length to next step

### 7.1.4.6 Multiple Levels (Add-on)

At present, the *Multiple Levels* add-on can be used for pedestrians only.
Definition
For multi-storey modeling, you may define different levels via BASE DATA - LEVEL PROPERTIES:
Right-click to call the context menu:
● NEW or CTRL+N adds a new level.
● DELETE removes the selected level.
Select a level property and edit the settings:
● Name
● Height

Settings
Set options via VIEW - DISPLAY LEVEL.
Enable or disable graphical display and/or access for editing to a defined level or for All levels:

► Left-click the eye icon to toggle between visible (open/colored) and invisible (shut/gray) display.
► Left-click the padlock icon to toggle between editable (unlocked) and not editable (locked) state.
► Left-click the figure icon to toggle between visible (black) and invisible (gray) state of pedestrians.

7.1.4.7 Editing Construction Elements
Activate the appropriate construction element type: Obstacle or Area or Ramp.

For editing, the currently active shape mode is not regarded.
The level of the element must be in the unlocked state, cf. section 7.1.4.6.
Select

**Selection of one or several elements in the network display**

- Activate the appropriate construction element type. (The current shape mode is not regarded.)

- Single-Select:
  - Left-click the construction element in the network display. The selected element is highlighted on screen.
  - Double-click the construction element to call the properties window.

- Multi-Select:
  - Left-click and keep left mouse-key pressed while drawing a polygon around the elements you would like to select for further editing. Multi-selection regards all construction elements which are fully covered by the multi-selection polygon.
  - Double-click in the polygon to call the properties window.

Single-select: If multiple construction elements of the selected type overlap at the click position, the button \(\text{\textcircled{U}}\) (default shortcut TAB) may be used to browse through all elements of this type being located at the mouse click position in order to select the desired area or ramp or obstacle.

**Except Edit Shape**, any editing functionality can be applied to both, a single element or multiple selected elements.

**Selection of one or several elements in the list**

- Activate the appropriate construction element type.

- Right-click to call the list of all elements of this type. The list contains all construction elements of the particular element type. The numbering must not be continuously ascending, since numbering of construction elements of different types does not count separately.

  - Left-click to select a single element. The selected element is highlighted on screen.
  - Left-click as many elements as necessary while pressing CTRL simultaneously to select multiple elements one by one.
  - Left-click the first entry you would like to select and left-click the last entry of a continuous block of entries while pressing SHIFT simultaneously.

- Right-click to call the context menu.

Since the property window remains open during graphical editing, selection via the particular properties window provides quick access to data editing and shape or position editing simultaneously.

Prior to DELETE, the properties window needs to be closed after selection.
Appearance of a highlighted element

The handles of the highlighted element allow for the following:
- Use the cross in the middle to move the polygon.
- Use one of the four corner points to resize the polygon.
- Use the dot on top to rotate the polygon.
- Right-click on a polygon edge to add an intermediate point.

In each case, the appearance of the cursor will change accordingly.

**Zoom**
Press **CTRL+SHIFT+Z** simultaneously to place the selected element(s) in the center of the VISSIM window. The display is scaled accordingly.

**Edit data**
Given attribute data can be overruled in the properties section. Edit the desired cell(s) by a direct entry or a new selection.

► **Single element:** The number is not subject to changes.

► **Multiple elements:** The property cells indicate the following in case of different attribute values:
  - Grayed-out cells indicate, that identical values are not permitted (e.g. name).
  - Empty cells indicate, that the attribute values of the marked elements are different. These different values will be replaced by the new entry.

Confirm changes to data by clicking **APPLY** instead of **CLOSE** in the **Construction element** window for selection of other construction elements and further changes to their properties.

**Delete**
Select the construction element(s) and press **DEL**.

**Move**
► Place the cursor on the cross in the middle of the polygon.
  The pointer appears as a cross with arrow heads.

► Left-click inside the polygon and keep the mouse-key pressed while dragging the polygon to the desired position.

**Copy**
► Place the cursor on the cross in the middle of the polygon.
  The pointer appears as a cross with arrow heads.

► Press **CTRL**.
  Next to the pointer a plus sign appears.

► Shift the copy of the selected construction element(s) to the desired position.
In order to restrict the mouse movement while generating or moving or copying a construction element, hold down the **SHIFT** key: Now you can move an element (or its corner/edge) along the horizontal, vertical or 45-degree-diagonal axis. This also works in combination with the **CTRL** key. In this way, you can align precisely any copies of construction elements.

### Rotate

- Place the cursor on the dot on top of the polygon.
  
The pointer appears as a rotating arrow.
- Left-click the dot on top and keep the mouse-key pressed while dragging the pointer (clockwise or anti-clockwise) to the desired position. The footprint of the rotating polygon is displayed by a rubber-band. The position of the cross marking the middle of the original polygon is kept. As soon as the mouse-key is released, the frame will be adjusted.

### Edit shape

To edit the shape of a user-defined polygon, you can either remove an intermediate point from a polygon edge or add an intermediate point to an edge or shift a point to a new position.

- Place the cursor.
  
The pointer appears as a cross-hair.
- **Add vertex**: Place the pointer precisely on the position in the polygon edge where you want to add another polygon point. As soon as the pointer is indicated by a cross-hair, you can add the new point by right-click.
- **Move vertex**: Place the pointer on the polygon point to be shifted and keep left mouse-key pressed while dragging the point to the desired position. The shape of the polygon is adjusted immediately.
- **Delete vertex**: Place the pointer on the polygon point to be removed and keep the left mouse-key pressed while dragging this point to one of the neighbouring points. As soon as the mouse-key is released the dragged point is removed from the polygon. The shape of the polygon is adjusted immediately.

### 7.1.5 Links as Areas of Pedestrians

This section deals with links carrying pedestrian flows for modelling the interactions of vehicular traffic and pedestrians.

Users of the *Pedestrians* add-on module can define construction elements (areas, ramps, obstacles) for pedestrian traffic and additionally links as walkable space for pedestrians.
In contrast to links carrying vehicular traffic, pedestrian links
► are not defined by direction,
► can neither be split nor contain intermediate geometric points and
► may neither contain inputs nor connector start or end.
For basic link data and editing details, please refer to section 6.3.1.

In contrast to walkable construction elements, pedestrian links
► have to be defined and edited in the vehicular traffic mode,
► may neither be a ramp nor an area, and
► cannot be the start or end or an intermediate point of pedestrian routes.
An obstacle may not be placed on a walkable ramp, but on a pedestrian link.
Accordingly, a pedestrian area can be defined on a pedestrian link, which means, start or end or intermediate points of pedestrian routes can also be placed there.

The basic idea of pedestrian links is to use the same mechanism as for vehicles: At a junction where vehicles and pedestrians shall cross, a VISSIM link serves as the basis for an automatically created pedestrian area.
In contrast to walkable pedestrian areas, pedestrian links allow for flow control by link-related VISSIM objects.

On pedestrian links, other VISSIM network elements can be placed:
► conflict areas, cf. section 6.6.2,
► signal control, cf. section 6.7.1,
► detectors, cf. section 6.7.1.3, and
► priority rules, cf. section 6.6.1.

General

Interactions between vehicles and pedestrians can be handled by the means of
● signal control,
● conflict areas,
● detectors and
● priority rules.
Signal-Controlled Junctions

After creating a pedestrian link (B), the user can (in Signal head mode, defined signal group required) define signal heads (1+2) on corresponding links as for vehicles:

► left-click to select link,
► right-click to create signal head.

A pedestrian signal head is always directed:

► From one side it can always be passed by pedestrians.
► From the other side it can be either open or closed (depending on the dynamic state of the corresponding signal group: red & amber = closed, all other states = open).

The dynamic state (red, green) of the signal head is linked to the dynamic state of the signal group that the signal head belongs to.

A pedestrian will consider the signal head if and only if his pedestrian type is element of one of the selected pedestrian classes in the dialog.

Define separate signal heads on both opposing links to handle pedestrians from both directions (upstream and downstream).

The direction of the signal head corresponds to the direction of the link.

Instead of the vehicle classes’ listbox a pedestrians classes’ listbox will appear for a signal head located on a pedestrian link.

A pedestrian will consider the signal head if and only if his pedestrian type is element of one of the selected pedestrian classes in the dialog.

Conflict Areas

After creating a pedestrian link (B), the user can (in Conflict area mode) define a conflict area where pedestrian link and vehicle link intersect:

► left-click on the conflict position to create a passive conflict area (yellow: 1+2+3+4),
► right-click on the conflict area to toggle the right of way as for vehicles.

The conflict area dialog for so-called mixed conflict areas is the same as for conflicts between vehicle flows.

The conflict areas will be created on both opposing directions of pedestrian links. They always have the same right of way (pedestrians either have the
right of way or have to yield). Depending on the current right of way settings and based on their desired speeds and their current speeds the pedestrians and vehicles decide when to cross the conflict area.

A conflict area has also a user-definable stop line distance (red: 1+2+3+4). It describes the upstream position on the link where pedestrians or vehicles have to wait if they yield. Otherwise, the stop line position is right before the upstream start of the conflict area. The user can define the stop line in upstream direction of the conflict area’s regular stop line (x_min).

If the two links intersect with an acute angle, the distance which is to be covered to cross the road will increase and so will the time required for crossing. At present, no geometrical analysis is performed for evaluation of the relative position of the two links which are connected by the conflict area. Thus it might happen in this case, that a pedestrian is still crossing the road when the next vehicle enters it.

**Case 1: Pedestrians yield to vehicles**

Pedestrians who want to enter the conflicted area (yellow: 1+2) and cross the vehicle link (A1), have to consider the minimum speed, which is calculated at the stop lines (red: 1+2).

At the stop lines minimum speeds are dynamically computed: Pedestrians walking with that or higher speed can pass the stop line, others have to wait in front of it.

Pedestrians will enter the conflict area crossing a traveled road only if they can cross the entire link (lane by lane) without ever being located on a lane on which a vehicle is just passing the conflict area. Here, the desired speed of the pedestrian and the current speed of the vehicle are regarded. Neither vehicles which have not yet entered the network nor vehicles in a distance greater than 75 m multiplied by the number of link lanes are taken into account. After entering the conflict area, this condition can no longer be satisfied, if a vehicle accelerates, for example, or if a new vehicle enters the network nearby. In this case, the pedestrian will wait in front of that lane of the link, which he presumably cannot cross completely before the vehicle arrives.
Case 2: Vehicles yield to pedestrians

On the pedestrian link, the area from 3 m upstream to the begin of the conflict area serves as “detection area” for pedestrians approaching the conflict area (cf. Detectors below).

Pedestrians inside the conflict area are always taken into account.

The time gaps between (groups of) pedestrians when the conflict area is expected to be completely free of pedestrians are passed to approaching vehicles so they can react accordingly.

Detectors

Detector areas are used to model push buttons for pedestrian signals.

The Detector object is also used as SCJ detectors for pedestrians. It has to be placed on the pedestrian link where the signal head is located.

For definition of detectors for pedestrians and subsequent changes to their properties please refer to the detectors for signal-controlled vehicular traffic, cf. section 6.7.1.3.

Detector window

[ACTIVATION] tab:

The parameters in this tab regard whether the link has been defined for pedestrian traffic or for vehicles. For a pedestrian link please select:

- **Maximum speed**: Enter max. speed value. Slower pedestrians will be recognized as demanders by the detector.
- **Pedestrian classes**: A pedestrian is only detected if his type belongs to the selected class.

Priority rules

You can define priority rules not only for vehicular traffic, but also for conflicting pedestrian flows and also for the interactions between vehicles and pedestrians.

For pedestrians, a priority rule needs to be placed on a link that is permitted for pedestrians. Pedestrians can be the yielding flow as well as the flow having the right of way.
For definition of priority rules for pedestrians and subsequent changes to their properties please refer to the priority rules for signal-controlled vehicular traffic, cf. section 6.6.1.

Actually, conflict areas are recommended for modeling. If these do not return the expected results, the experienced user can model priority rules.

If the stop line (or one of the conflict markers) is located on a link which is used as pedestrian link, pedestrian classes are provided for selection instead of vehicle classes.

For a priority rule that has already been defined, follow the steps outlined below to configure either combination pedestrians x vehicles, vehicles x pedestrians or pedestrians x pedestrians:

► Select the link where the cross section to be edited is located.
► Open the Link attributes window, cf. section 6.3.1.2
► Click option Use as pedestrian link:
  - If this option is checked, pedestrian classes will be provided for selection at this cross section.
  - If this option is unchecked, vehicle classes will be provided for selection at this cross section.
7.1.5.1 Creating

To define a pedestrian link for later use of e.g. signal heads, detectors or conflict areas for pedestrian flows,

- Activate the Vehicle traffic mode and
- Define a pedestrian link (cf. section 6.3.1)
  - as a new link or
  - by editing an existing link:

- In both cases: check option “Use as pedestrian area” in the Link Data window.
- Select Level of Area, cf. section 7.1.4.

The height of a pedestrian link and its area is determined by the height of the chosen Level of Area and the user-defined Offset ([DISPLAY] tab).

The resulting height is displayed, however, it is not subject to changes, cf. section 7.1.5.2.

Create

From the above settings, VISSIM creates

- link no. 1 as pedestrian link (drawn by pointer) and
- link no. 2 as pedestrian link in opposite direction.

Edit

The edited vehicle link is stored as pedestrian link and an opposing pedestrian link is created with the coordinates of the original link, i.e. both links are located on top of each other.

7.1.5.2 Properties & Options

This section deals with those properties which are essential for links that are used as pedestrian areas:

[LANES]
- Use as pedestrian area: Activate this option to create a walkable pedestrian link which
  - serves as a walking ground for pedestrians (in both directions) and
- will not be traversed by vehicles.

As soon as this option is active, the Level of Area list box is provided.

- **Level of Area**: Select the appropriate level from the user-defined selection list, cf. section 7.1.4.

Select **Display Type** and **Behavior Type** as for links, cf. section 5.5.

![Link Data](image)

Enter **Offset top** and **Thickness (3D)** as for construction elements, cf. section 7.1.4.

### 7.1.5.3 Editing

**Edit data**

Editing a pedestrian link is similar to editing a link carrying vehicular traffic, cf. section 6.3.1:

► Activate the **Vehicle traffic** mode and

► Select the link

- from the list of links/connectors and click ZOOM, DATA or DELETE;
- in the network display and move or shorten/lengthen it or hit DEL.

Double-click allows for data editing.

**Delete**

Prior to deleting the selected pedestrian link please confirm, that also the corresponding link in the opposite direction will be deleted.
7.6 Pedestrian Compositions

Compositions of pedestrians can be defined, edited and used similar to vehicle compositions, cf. section 6.4.1.

Compositions of types of pedestrians are assigned to pedestrian inputs.

7.6.1 Creating

Clicking TRAFFIC – PEDESTRIAN COMPOSITIONS... calls the dialog:

![Pedestrian Compositions dialog]

The grid to the left contains the list of defined compositions of pedestrians. Right-click to open the context menu which offers the following operations:

- **NEW** adds a new composition to the list.
- **DUPLICATE** creates a new composition with the properties of the selected composition, but a new number (= 1 + maximum pedestrian composition No. in current network).
- **DELETE** removes the currently selected composition from the list. A warning will be displayed if the selected composition is still assigned to an input of pedestrians.

To the right, the properties of the selected composition of pedestrians have to be defined and can be edited.

- In the upper section, name and number of the selected pedestrian composition are subject to changes.
- In the grid, data rows can be added or deleted via the context menu.
- For changes to a data row, place the mouse pointer in the cell to be edited:
  - Select a pre-defined Pedestrian type or Desired speed distribution.
  - Enter the appropriate Ratio value.

7.6.2 Properties & Options

- **No.**: Unique identification of the composition of pedestrians
- **Name**: Any name or comment

The list contains a user-defined ratio for each combination of type of
pedestrians and desired speed distribution:

- **Pedestrian Type**: Select a type from the list defined via **BASE DATA - PEDESTRIAN TYPES**, cf. section 7.1.2.
- **Desired Speed**: Select a distribution from the list defined via **BASE DATA - DISTRIBUTIONS - DESIRED SPEED**, cf. section 5.2.1.
- **Ratio**: The ratio determines how many pedestrians of the type and with the given speed distribution will be created in relation to pedestrians of other types also included in the distribution.

### 7.1.7 Pedestrian Inputs

For a selected walkable space or pedestrian link, inputs of pedestrians can be defined and edited similar to vehicle inputs, cf. section 6.4.3.

For these inputs of pedestrians, VISSIM will - at random points in time - create pedestrians according to pedestrian compositions and input volumes.

#### 7.1.7.1 Creating & Editing

- Activate the **Pedestrian Edit Mode** and the **Pedestrian Inputs** mode.
- Select the pedestrian area on which you want to place the new input.
- Right-click inside the area at the position where you want to place the input. The new input is represented by a red dot inside of the area. The dot is merely a graphical representation – the pedestrians from this input will be created at random locations within the corresponding pedestrian area.

To open the **Pedestrian Inputs** window for

- **inputs of pedestrians per area**: Double-click on that area.
- **all inputs of pedestrians in the network**: Right-click outside of the VISSIM network.

![Pedestrian Inputs Window](image)

Similar to the vehicle input dialog, the input of pedestrians data is arranged in two sections (cf. section 6.4.3.1):
7 Simulation of Pedestrians

- Volumes/Compositions section,
- Time intervals section.

**Time Intervals Section**

(This section can be hidden by clicking [-]. To show it again, click [+].)

Here the time interval boundaries are defined. At least one time interval is required, thus the first and the last line may not be deleted.

Changes to the list of time interval thresholds will immediately change the column layout in the Volumes/Compositions section.

**Define new time interval**

1. Right click inside the section and choose New from the context menu. A new line is added at the end of the list.
2. Enter the value of the new time interval boundary. The value must be different from any other time but can also be smaller than the last value. In that case, an existing time interval is split at the time newly entered.

**Edit time interval data**

Any time entry can only be changed to a value that is in between the neighboring times (i.e. the time sequence cannot be changed; to do so, the given boundary has to be deleted and a new threshold has to be added).

1. Select the time to change.
2. Type in the new time and confirm with **ENTER**.
   All flow values remain unchanged.

**Delete interval(s)**

1. Select the start time of the interval to be deleted.
   Press **CTRL** simultaneously to select several rows.
2. Right click and choose DELETE from the context menu.
3. Confirm the upcoming message.

If a time interval does not contain any input values, the time interval will be deleted when the Inputs window is closed.

**Volumes/Compositions Section**

For each area, the inputs of passengers are arranged in columns, sorted by time interval. For each combination of area and time interval, a data pair consisting of a volume and a composition may be defined (empty pairs are allowed). It is **not** possible to define a volume without composition or vice versa.

It is possible to have multiple rows for the same area if there are volumes for different compositions defined within a time interval.
Define new input of pedestrians  
Prior to the definition of pedestrian inputs at least one pedestrian composition needs to be defined (similar to vehicle inputs, cf. section 7.1.6.1).

1. Double-click on the area where the new input of pedestrians is to be defined. The Pedestrian Inputs window opens with the corresponding link no.
2. If an input of pedestrians already exists, either change it or right click and choose NEW to create a new row for this area.
3. Define the input properties, cf. section 7.1.7.2.

Edit data  
For volume changes:
1. Select the cell to change.
2. Type in the new volume and confirm with ENTER.
For composition changes:
1. Select the cell to change.
2. Press the button on the right to open the pull-down list.
3. Select the new composition from the list.
For further information and property changes please refer to section 7.1.7.2.

Copy & Paste data  
In the Volumes/Compositions section, the COPY & PASTE commands (similar to the Microsoft Excel method) are available through context menu. Data exchange is permitted within the input window or from/to external data sources (e.g. *.XLS or *.DOC files).

► COPY: Select a source cell or rectangular source region using
- SHIFT + cursor keys or
- mouse move while holding down left mouse button.

► PASTE: Select a destination region being
- congruent (identical dimensions) or
- larger than the source region (e.g. source 2x3, destination 6x6 or 10x15; not ok: 3x6 or 6x10).

Please disable display of either volumes or compositions before selection, since only one data type can be copied/pasted.

Only values of visible columns are copied and pasted (not values that are contained in hidden columns).

Scale Volume  
Select the cells with volume values to be multiplied by the user-defined factor. Click SCALE VOLUMES in the context menu and enter the factor for volume scaling.

Delete input of pedestrians  
1. Select the entire row(s) to be deleted by clicking on the row no. (on the far left of the grid). Press CTRL simultaneously to select several rows.
2. Right click and choose DELETE from the context menu.
3. Confirm the upcoming message.
All changes in the **Vehicle Inputs** window can be undone by pressing **CANCEL** instead of **OK** to close the window.

### 7.1.7.2 Properties & Options

Cf. section 7.1.7.1 on how to open the **Pedestrian Inputs** window and how to edit the **Time** section.

This section describes the properties and options for the **Volumes/Compositions** section.

- **Area Number & Area Name**: Refers to the area where the input of pedestrians is placed. Values can be selected from the list of all areas either by no. or (optional) name of the area.

- **Input Name**: Optional name of the input of pedestrians. Refers to all data entered for the same area.

- **Show Label**: Not used.

Each of the following columns (one per time interval) contains - per area/input - the pair(s) consisting of flow of pedestrians data and composition of pedestrians data.

- **Column Header**: Shows start time and end time of the interval (in simulation seconds). The columns are created automatically from the list of time intervals in the **Time Interval** section (for more or different time intervals, please refer to “Add new interval” in the “Time Intervals” section above).
● Data pair: For each row and time interval, a data pair may be defined (several compositions can be allocated to a walkable space):
  - Upper line: Input volume (pedestrians/h)
  - Lower line: Composition of pedestrians
The text color indicates the validity of the data pair:
  - Black: For this interval only
  - Gray: For a period of combined intervals (Continued Input). In that case, only the master cell (black) can be edited and affects automatically all subsequent continued cells.

The background color indicates the type of the flow volume:
  - White: stochastic values or
  - Yellow: exact values.

When EXACT VOLUME is enabled VISSIM generates exactly the edited number of pedestrians to enter the network as opposed to a distribution.

The configuration of the data section can be changed via the context menu. Select one or multiple cells and call:
● EXACT VOLUME: Volume values are regarded as exact volumes, if this option is checked. The cells are highlighted in yellow.
● STOCHASTIC VOLUME: Volume values are regarded as stochastic volumes, if this option is checked. The cells are not highlighted.
● CONTINUED INPUT: Select all cells to be combined (except the master cell) and check this option to define a combined flow: The master cell is the one previous to the selected cells; the master cell entry spans over the selected sequence of time intervals.
  - The master cell remains editable, indicated by black text entries. Changes to the master cell entry are copied to all subsequent cells.
  - Grey text entries indicate combined cells (Read-only).

Uncheck this option to separate selected combined cells.
● VIEW VOLUMES: Toggles display of the volume values (upper line per time interval) on and off.
● VIEW COMPOSITIONS: Toggles display of the selected compositions (lower line per time interval) on and off.
● ZOOM: The input’s position in the network is placed in the middle of the VISSIM window on screen.

### 7.1.8 Routing Decisions and Routes

Routing decisions and the routes or partial routes for pedestrians can be defined and edited similar to routes and routing decisions for vehicles, cf. section 6.4.4.
Pedestrian routes belong to pedestrian routing decisions that are located on pedestrian areas.

A pedestrian route is a fixed sequence of areas and ramps:

- It starts at the routing decision area (red dot)
- It ends at a destination area or ramp (green dot).

Each routing decision point can have multiple destinations resembling a tree with multiple branches. The length of routes and partial routes is not limited.

The start, intermediate stops and the end of a pedestrian route cannot be placed on a link that has been defined as a pedestrian area.

Note: If required, you can create a construction element of the Area type on this link. Then place the routing decision or an intermediate point or the destination of a pedestrian route on that area.

Just the construction element Area can carry the routing decision point information.

Intermediate points and the destination of a static route or a partial route for pedestrians can be placed on an Area or a Ramp.

Consideration of routing decisions by pedestrians

A routing decision affects only pedestrians of a class that is contained in the routing decision and which do not have any routing information at the moment. If a pedestrian is already walking along his a route then he first has to reach the route’s destination (green dot) prior to be able to receive new routing information. Note that this is different for the routing decisions of partial routes. Details are explained below.

7.1.8.1 Types of Routing Decisions and Routes for Pedestrians

Pedestrians can be assigned Static routes or Partial routes. Routes always start from a routing decision which is of either type.

- **Static Route**: Routes the pedestrians from a start area (red dot) to one of the defined destinations (green dot) using a static percentage for each destination (similar to static vehicle routes between start and destination cross section, cf. section 6.4.4).

- **Partial Route**: Defines a section of one or more routes where pedestrians are re-distributed according to the routes and percentages defined for the partial routes. After having completed the partial routes the pedestrians continue to follow their original route.

All pedestrians who satisfy the following conditions are assigned a new route from the partial route’s decision area to the partial route’s destination area.

- The pedestrian enters an area, on which a partial routing decision is located whose destination is on an area where also an intermediate point or the destination of the pedestrian’s original route is located.
- The pedestrian belongs to a class that is contained in the partial routing decision.

After having completed the partial route, the pedestrians continue to follow their original routes from the partial route's destination area. It is not necessary, however, that the area of the partial route decision includes an intermediate point of the main route. Intermediate points of the original route are ignored until the destination area of the partial routing decision is reached. Multiple partial routes can overlap - the complete current route (extending all the way to the destination of the original route) is checked for the destination area of the partial routing decision.

Partial routing decisions bear a *Replacing Impact* – in contrast to the *Adding Impact* of a normal routing decision (main routes) which can only take effect in two cases: Either the pedestrian is just entering the network or the pedestrian has reached the destination of his former route on an area which is carrying another routing decision.

### 7.1.8.2 Partial Routes for Pedestrians

A partial route for pedestrians can be either *Static* or *Dynamic*.

Only those pedestrians are regarded by a partial routing decision, whose current route has either an intermediate point or the destination on exactly the destination area of the partial routes starting from this partial routing decision.

For partial routes it is sufficient if the pedestrian geometrically walks on the area carrying the partial routing decision. In this case, the area does not have to represent an intermediate point.

Please do not confuse *static partial routes* with *static routes*. Of the various partial routes the static partial routes work as static routes, except that they are partial routes. Therefore the naming similarity. To avoid confusion in certain circumstances static routes are also called main routes.

- **Static Partial Routes**: Select *Static* as *Route choice method* and enter the relative flow value for each user-defined time interval.
- **Dynamic Partial Routes**: Select a *Route choice method* other than *Static* and set the appropriate parameters.

All partial routes starting from a partial routing decision lead to the same destination area.

Overview of the *Route choice methods* for partial routes of pedestrians:
### Method | Short description
--- | ---
Static | Fixed choice ratios set by the user
Travel Time | Dependence of choice ratios on the travel time of preceding pedestrians who have already finished the partial route
Next free counter | For approaching a set of parallel organized queues (respectively desks or counters)

---

**The dynamic route choice criterion Travel time**

The following steps are performed:

- Initially the pedestrians are distributed equally on all routes of the decision, until each route has been concluded by at least one pedestrian.
- VISSIM evaluates the travel times of the latest user-defined number of pedestrians who have concluded a route. (The default value of the user-definable route choice method parameter is 10.)
- Travel time of route $i = Ti$ is the average of travel times of this user-defined number of pedestrians (respectively the pedestrians who have arrived at the route destination so far).

The following route choice parameters are provided:

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Best Route</strong></td>
<td>The user-defined percentage of pedestrians uses the best route, i.e. the route with the minimum travel time. In case of two best routes, either route is charged equally. All other pedestrians are split randomly among all other routes.</td>
</tr>
<tr>
<td><strong>Kirchhoff</strong></td>
<td>The probability of a route is calculated as the inverse of the travel time to the power of the user-defined exponent $a$ divided by the sum of these powers for all routes: $\frac{(1/T_{\text{TravTime}<em>i})^a}{\sum</em>{\text{All Routes}} (1/T_{\text{TravTime}_i})^a}$</td>
</tr>
<tr>
<td><strong>Logit</strong></td>
<td>The probability of a route is calculated as $\exp$ to the power of (the negative travel time divided by the user-defined denominator) divided by the sum of these powers for all routes: $\frac{\exp(-T_{\text{TravTime}<em>i}/\text{denominator})}{\sum</em>{\text{All Routes}} \exp(-T_{\text{TravTime}_i}/\text{denominator})}$</td>
</tr>
<tr>
<td><strong>Inverse Logit</strong></td>
<td>The probability of a route is calculated as $\exp$ to the power of (the user-defined numerator divided by the travel time) divided by the sum of these powers for all routes: $\frac{\exp(\text{numerator}/T_{\text{TravTime}<em>i})}{\sum</em>{\text{All Routes}} \exp(\text{numerator}/T_{\text{TravTime}_i})}$</td>
</tr>
</tbody>
</table>
Overview of the properties of the route choice parameters (data type: double):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Decimal places</th>
<th>Default value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best Route - Percentage</td>
<td>1</td>
<td>90.0</td>
<td>%</td>
</tr>
<tr>
<td>Kirchhoff - Exponent</td>
<td>1</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Logit - Denominator</td>
<td>0</td>
<td>10</td>
<td>s</td>
</tr>
<tr>
<td>Inverse Logit - Numerator</td>
<td>0</td>
<td>10</td>
<td>s</td>
</tr>
</tbody>
</table>

### 7.1.8.3 Static partial routes of pedestrians: Use cases

Basically, there are two different ways to make use of static partial routes.

► Use case 1 is to easily distribute pedestrians with long routes on rather narrow spaces without making them forget their main route.

► Use case 2 makes use of the “catch all” ability of static partial routing decisions: it helps to spatially distribute pedestrians in a better way, if their current position already suggests a certain further routing variant: In this case, typically only one route is attached to a routing decision.

In the following cases, a partial routing decision can apply to a pedestrian:

► If the pedestrian enters an area carrying a partial routing decision.

► If the pedestrian starts to follow a new main route.

This means, there are cases in which a partial routing decision is ignored, though following a partial routing decision could be expected under certain circumstances:

► Two areas called A and B carry a partial routing decision each (a and b). Area B is located completely within area A. Thus, a pedestrian will always step on area A first and might then step on area B, if applicable. The main route and the partial routes are defined in the following way: Partial routing decision b applies to the pedestrian, but partial routing decision a does not. However, partial routing decision a would become valid, if partial route b had been added to the main route. Nevertheless, partial routing decision a is not used – neither right after partial routing decision b nor when the pedestrian merely stands on area A after leaving from area B.

► During the simulation, a pedestrian enters the network and receives a main route. At his position, there are two more partial routing decisions called a and b. Partial route a leads to an area that also carries an intermediate destination of the pedestrian’s main route, but partial route b does not. Partial route b leads to an area that also carries an intermediate destination of partial route a. Nevertheless, only partial routing decision a is regarded, whereas partial routing decision b is not, since it is required for the check for existing partial routing decisions that a normal routing decision must have been performed. However, if partial routing decision b is not located directly at the position where the
pedestrian has been generated but on an area the pedestrian entered in the next time step, then it will be performed, of course.

Due to these restrictions endless loops which might arise in a single time step can be avoided.

**Use case 1**

Imagine pedestrians coming from different rather remote sources on routes with quite a few intermediate destinations, passing one common area with alternative routing options independent of the pedestrians’ source or destination and walking (with source-dependent ratios) to different remote destinations and again quite a number of intermediate destinations on their paths to come. In this case it is very helpful to model the route choice on the common area with special partial routes that pose only local changes to the routes and not to the path to come. As an example see the following figures, where the long up- and downstream route legs have been omitted. (Normal routes are depicted yellow, partial routes appear orange.)
To make the static partial route choice apply, the destinations of all partial routes need also to include an (intermediate) routing point of the main route. Without static partial routes, the long main routes would have to be defined as a whole as many times, as there are local alternatives on the area in common.

Use case 2

A problem with ticket gates is that simulated pedestrians mostly prefer to walk on the shortest path. They do not automatically detour to save time, even if the detour is as short as in the case of ticket gates. Therefore – if the pedestrians do not approach orthogonally to the line of ticket gates – they may cram unrealistically into one or two ticket gates, ignoring any other. Static partial routes do not solve the problem (for this purpose, dynamic partial routes should be applied, which will be provided soon) but help to build a workaround.

As the coordinate of a pedestrian being a few meters ahead of the ticket gates determines to some extent, which ticket gate he would use in reality, one can use the “catch all” ability of static partial routing decisions to guide him through that particular ticket gate, as to be seen from the figures below.
In fact the routing decision is not a routing decision here, as there is only one route attached to each decision. This underlines that it is the “replacing” ability that generates the benefit here.
Similar situations of “shortest vs. quickest route” issues can alternatively be addressed using the functionality of the dynamic potential (cf. section 7.1.8.8 et sqq.). This functionality suits especially for alternative routes which are less distinct as in the case of ticket gates, or which are not at all discrete as for example, when a large crowd has to do a 90 degree or a u-turn around a corner.

### 7.1.8.4 Creating

The definition of static or partial routes is a six step process. The next required action is shown in the status bar. To discard the recent step and return to the previous step, click outside the VISSIM network.

1. Activate the Pedestrian traffic mode and the Pedestrian Routes mode
2. Select the pedestrian area on which the decision shall be located.
3. Right-click inside the area at the desired position to place the new routing decision at the cursor position.

A red dot appears representing the new routing decision. The dot is merely a graphical representation – routes will be available to all pedestrians (when affected due to type/class) entering the corresponding area of pedestrians.

The Create routing decision window appears.

![Create Routing Decision Window](image)

Select the Type of the routing decision and confirm OK.

For the attributes and attribute editing please refer to section 7.1.8.6.

4. Select the walkable construction element (area/ramp) which is the destination.
5. Right-click to define the position of the destination (green dot). The bee-line will be highlighted yellow and the Pedestrian routes window will appear. Enter the properties and confirm Ok.

If there is no continuous connection, no route will be suggested and the window will not open. In this case, either select a different destination or check the VISSIM network.
6. Further steps depend on the type of the routing decision:

**Static routes:** To define more destinations, i.e. several routes starting from this decision (red dot), continue as follows:
- Select another destination area.
- Right-click to mark the position of the destination.
Repeat these steps for any further destination to be reached from this decision.

**Partial routes:** To define more routes, i.e. several routes starting from this decision (red dot) and leading to the same destination, continue as follows:
- Select the same destination area.
- Right-click to mark the position of the destination.
- Edit the course of the new partial route currently being highlighted by a yellow line, if applicable:
  Click the yellow handle in the middle of the line and keep the mouse-key pressed while dragging the handle to the new position, which is either a ramp or an area. In this way, you can place an intermediate point in the course of the route. If required, you may shift the newly created yellow handles to define further intermediate points in the partial route for the benefit of realistic modeling. User-defined intermediate points in the course of a partial route appear blue.

Within the same walkable area, immediate consequent intermediate points are not permitted along one static or partial route.

Repeat these steps to create more partial routes starting from the currently selected routing decision.
To define another routing decision, double-click in the network to deselect all areas and repeat the steps 1 - 6.

In the *Pedestrian Routes* window, the following settings are required:
► Select appropriate *Pedestrian class(es)* by routing decision.
► Set the time intervals for all routing decisions of the *Static* type.
► Set separate time intervals for all routing decisions of the *Partial* type with route choice method *Static*.
► Select the route choice method by routing decision of the *Partial* type and set the parameters.

### 7.1.8.5 The *Pedestrian Routes* Window Structure

Below, find example settings which illustrate the properties of routing decisions and routes described in this section.
7 Simulation of Pedestrians

Static routing decisions

Partial routing decisions with route choice method

Static

Partial routing decisions with route choice method

Travel Time
The data describing routing decisions for pedestrians and their routes is arranged in the following sections of the Pedestrian Routes window:

For each type of routing decision, this section contains a specific tab. Since defined routing decisions are stored and edited by type, each tab contains the list of routing decisions of this type. Each tab page allows for the following steps:

- Select a single or multiple or all routing decision(s) of this type:
  - You can edit the list of routing decisions.
  - You can call the route list display in the Routes section and edit the list of routes.

- Delete the selected routing decision(s) of this type from the list.
- For a single decision, you can edit the following data: Name of the decision, Start area; Destination area, Ped. class(es), Route choice method.

The content of the sections to the right depends on the particular routing decision type and on the selected decision(s).

The list of pedestrian routing decisions in the left-hand section of the window allows for the following:

- Selection of a pedestrian routing decision for data editing,
- Deletion of a selected pedestrian routing decision from the list,
- Selection of multiple pedestrian routing decisions for route list display and editing in the Pedestrian Routes section.

The content of the sections to the right depends on the currently selected routing decision(s).

Via and you can open or close this section.

If only a single routing decision is selected in the list, this section allows for input data editing, e.g. allocation of the appropriate pedestrian class(es).
The list contains:
- all (partial) routes starting from decisions which are currently selected in the list of pedestrian routing decisions.

Due to the particular routing decision type it contains also the following details, if applicable:
- all time intervals (columns) resulting from time settings, and
- the user-defined amount of pedestrians as share of 100% per route and time interval.

This section allows for the following:
- Editing the properties of the selected routes or partial routes,
- Deleting the selected (partial) routes from the list.

For Sorting & Filter options provided in the list of routing decisions and in the list of routes, please cf. section 6.4.4.5.

### 7.1.8.6 Properties & Options

For the definition of a new routing decision for pedestrians the following properties have to be set:

- **Decision No.:** Unique identification of the routing decision
- **Decision Name:** Label or comment
- **Location:** Number of the start area and name, if applicable
- **Type:** At present, either *Static* or *Partial* can be selected

In the *Pedestrian Routes* window, the following properties can be set:

- **Start Area:** Location of the routing decision
- **Destination Area (only for partial routes):** Number of the destination area selected for the partial routing decision.
- **Pedestrian Classes:** From a drop-down list, select the pedestrian classes to be affected by this routing decision. For multi-selection, press CTRL while clicking the left mouse button.
- **Route choice method (only for partial routes):** From a drop-down list, select the route choice method to be used by this routing decision. Set the appropriate route choice parameters.

The following methods are provided:

- **Static**
- **Travel time,** cf. section 7.1.8.8
- **Service point selection,** cf. section 7.1.8.13

Properties of a route or partial route of pedestrians:

- **Route No.:** Unique identification of the route or partial route.
- **Destination Area:** Number of the destination area of the route or partial route.
- **Value per time interval (only for static routes and static partial routes):**

From the ratio values of the routes, the relative flows are calculated.
automatically by routing decision. If the sum of shares is not 1 (100%), VISSIM automatically norms the shares. Example: If a ratio of 1, 1, and 2 is specified for three routes belonging to a single routing decision, the upper two routes will receive 25% each and the last one will receive 50% of the flow.

- **Maximum number of queuing pedestrians** (only for partial routes with route choice method Service point selection)
- **Route choice parameters** and **Number of the pedestrians to be regarded for travel time calculation** (only for partial routes with route choice method Travel time)

### 7.1.8.7 Editing

For all subsequent actions the *Pedestrian traffic* mode and the *Pedestrian Routes* mode need to be active.

Display in the *Pedestrian Routes* mode:

- all defined routing decisions for pedestrians are shown as dark red dots
- all defined destinations are shown as dark green dots

**Graphical selection**

Selection of a pedestrian routing decision:

1. Optionally left-click the area where the routing decision is located,
2. Left-click the routing decision:
   - The selected routing decision is displayed as light red dot.
   - The corresponding destinations are displayed as dark green dots. Destinations belonging to other routing decisions are hidden.

Selection of a route starting from the selected routing decision:

1. Optionally left-click the area where the destination is located,
2. Left-click the destination:
   - The selected destination is displayed as a light green dot,
   - the route is displayed as a yellow band with intermediate point(s).
   - Open the *Pedestrian Routes* window and select the appropriate tab for display of all pedestrian routes and routing decisions of this type in the network:

**Selection in the Pedestrian Routes window**

- **Right-click** outside of the VISSIM network calls the complete list of routing decisions.
  If a pedestrian routing decision is currently highlighted, the appropriate routes will be listed in the Route List.
- **Double-click** on a routing decision.
  If a route is currently displayed as a yellow band, the selected route will appear color-shaded in the Route List.
  Alternatively, a route’s destination can be double-clicked.
All routes of those routing decisions being selected in the list of routing decisions are listed in the particular Route List.

All routes being selected in the Route List are automatically highlighted as yellow bands in the network display.

► To select a single route or routing decision in the list, click in the grey cell to the left of the particular line. The previously selected route or routing decision is automatically deselected.

► To (de)select multiple routes or routing decisions, press \texttt{CTRL} or \texttt{SHIFT} simultaneously.

**Delete**

In the Pedestrian Routes window:

► Select one or several routing decisions or routes

► Press \texttt{DEL} or click DELETE in the context menu

With a routing decision, all of its routes are deleted.

**Edit route alignment**

A pedestrian route is graphically represented by a yellow line spanning between either two successive strategic points of the route. The center point of each yellow line is marked by a smaller yellow dot. The dot does not represent an intermediate stop but serves for editing the course of the route:

► Left-click and drag the yellow handle onto another area while keeping the mouse-key pressed. The currently selected area is highlighted on screen.

► Release the mouse-key if the correct area is marked.

► In case of several overlapping areas hit \texttt{TAB} as often as necessary to select the desired area.

On the chosen area, a new strategic intermediate point will be placed that is marked by a blue dot.

**Tip**

The start can neither be placed on a stair or ramp nor on links that have been defined as areas. Just areas can carry this information.

Intermediates stops and the ends of pedestrian routes can be placed on areas and ramps/stairs.

**Edit listed data**

In each of the lists in the Pedestrian Routes window,

► right-click calls a context menu providing DELETE to remove the selected row(s) from the list,

► editable properties can be edited directly in selected cells.
7.1.8.8 Dynamic Potential: Overview

The dynamic potential is a route-related method to control operational wayfinding. The basic intention is to make pedestrians walk not on the shortest but more on the quickest path.

Additionally to this overview, the following information on the dynamic potential of pedestrian wayfinding is provided below:

► For use case descriptions, cf. section 7.1.8.9
► For the editing workflow, cf. section 7.1.8.10
► For the properties & options, cf. section 7.1.8.11
► For the method in detail, cf. 7.1.8.12

One way to look at the dynamic potential is to see it as a continuous complement to travel time based dynamic partial routes. For both the basic idea is that minimizing travel time is a determinant of walking behavior. However, while travel time based partial routes offer a way to make pedestrians discretely choose between distinct routes at one point in time. With the dynamic potential activated for a destination or intermediate destination (in the remainder of the section intermediate destinations are always included, when destinations are mentioned) pedestrians are seeking to walk what they currently estimate to be the quickest path. In slightly more technical terms: they desire to walk into that direction in which by estimation of some heuristic mathematical method their remaining walking time to the next destination is minimized.

Already in this rough description of the method of the dynamic potential the continuous character is exhibited: there is not one single time of decision, but – as far as the time step of the simulation allows – a continuous optimization behavior of the pedestrians with regard to travel time; the pedestrians do not try to walk on one (the one with the smallest travel time) out of a finite
number of user-defined routes, but with the dynamic potential, they implicitly select their route out of a continuous, infinite and uncountable set of potential trajectories.

### 7.1.8.9 Dynamic Potential: Use Cases

Compares with travel time based partial routes and partial routes in general, there are many use cases, which in principle could be addressed either with the dynamic potential or using partial routes, and the difference in the degree of how these are suited also can be large or small, i.e. in one case – after some experience with both – it is obvious that partial routes are the method of choice, in another only the dynamic potential can lead to the expected behavior, in a third group success might come with either method and a fourth group contains those cases to which neither the partial routes nor the dynamic potentials can so far successfully be applied.

There is a rule of thumb which method probably would be the better one to be used. As partial routes are discrete and the dynamic potential is continuous in many aspects, one at first think of partial routes to model situations of discrete choice and the dynamic potential to model continuous choices. The simplest examples are probably the flow of a large group of pedestrians around a 90° or 180° corner to be modelled with the dynamic potential but to use partial routes, when in the corner there is an array of ticket gates which discretizes the choice set. “In the corner” here implies that the path length from origin to destination is different for each ticket gate.

Nevertheless, as the editing effort for the dynamic potential usually is much smaller than for partial routes, one might sometimes try to model situations with the dynamic potential which appear to be better suited for partial routes. For that reason it is intended to offer a refined dynamic potential method in future VISSIM versions, which extends its scope of application into what currently is the realm of partial routes.

### 7.1.8.10 Dynamic Potential: Editing

Follow the steps outlined below to define the dynamic potential:

- Activate a route such that it is shown with all red, blue and green dots and the yellow line.
- Press the **ALT** key while double-clicking on a destination point (green or blue).

  The **Routing Point** window appears, cf. section 7.1.8.11.

- Activate the option **Use Dynamic Potential**.
- Set the **Impact** which describes the strength of influence.

  - If the value is 1% the method is activated and calculation time for it is consumed (as much as for any other parameter choice), but it almost has no effect and the pedestrians continue to desire to walk on the shortest path.
- The higher the value, the more sensible is the reaction of the pedestrians to the movement of pedestrians in front of them. At values near 100% this can cause unrealistic behavior.

- Set the length of the *Calculation time interval* for the update of the potential. The method of the dynamic potential takes quite some time to be calculated, increasing this value may help on slower PCs or with many dynamic potentials activated that the simulation speed will stay reasonable. However, so far the experience is that the smaller the value, the better the results are.

- Close the dialog. The blue or green dot of the route now changes to be a square, which visually marks those destinations for which the dynamic potential has been activated.

### 7.1.8.11 Dynamic Potential: Properties & Options

How to select a route for changes to the current dynamic potential settings is described in section 7.1.8.10.

- **Use Dynamic Potential**: Activate this option to use the dynamic potential for way-finding.
- **Impact**: Enter the impact as percentage for correct modeling of the strength of influence of the dynamic potential on the behavior of the pedestrians.
- **Calculation time interval**: Enter the length of the interval between two updates of the potential in simulation seconds.

### 7.1.8.12 Dynamic Potential: Description of the Method

To understand the essentials of the dynamic potential method one first has to ask, how in general pedestrians in the simulation find their next destination area. This is accomplished by having the *driving force* of the social force model point into the direction of the next destination as long as the pedestrian does not already walk into that direction:

\[
\vec{F}_\alpha^0(\vec{v}_\alpha, v^0_\alpha \vec{e}_\alpha) := \frac{1}{\tau_\alpha} (v^0_\alpha \vec{e}_\alpha - \vec{v}_\alpha)
\]
In this equation, $v_{\text{alpha}}$ is the current velocity of the pedestrian, $v^0_{\text{alpha}}$ is his desired speed taken from a distribution defined by the user. The crucial value is the unit vector $\mathbf{e}_{\text{alpha}}$ which multiplied with the desired speed gives the current desired velocity.

Up to now $\mathbf{e}_{\text{alpha}}$ in VISSIM always has been pointing into the direction of the shortest path. With the dynamic potential the idea is that it points into a direction which is a current estimation for the direction of the quickest path. It can never be analytically the “true” and correct direction of the quickest path as such a solution could only in principle be the result of an iterated simulation. Yet, up to now no such method exists for pedestrians, not even for small systems unless they are trivially small (e.g. just one pedestrian). As real pedestrians also err a lot about what at a current point in time is the direction that will take them in quickest time to their destination, it is not a principle problem that the true direction of the quickest path can not be calculated exactly. Therefore assuming hypothetically that the direction of the quickest path would be available in the simulation and thus the behavior of all pedestrians would be individually optimal, it would probably not be realistic.

The meaning of the parameter $\text{impact}$ is that an $\mathbf{e}_{\text{alpha}}^s$ for the direction of the shortest path and an $\mathbf{e}_{\text{alpha}}^q$ for the direction of the quickest path are calculated and then a resulting $\mathbf{e}_{\text{alpha}}$ is calculated in which $\mathbf{e}_{\text{alpha}}^s$ and $\mathbf{e}_{\text{alpha}}^q$ have weights according to the value of the parameter $\text{Impact}$.

No matter if $\mathbf{e}_{\text{alpha}}$ points into the direction of the shortest path (dynamic potential deactivated) or the estimated quickest path (dynamic potential activated 100%) it is always calculated by at first calculating values for the points of a grid which give either the distance or the estimated remaining travel time from that particular point to the corresponding destination area. This grid is what is called potential, another name would be “look-up table”. As the distance to the destination does not change in the course of a simulation run, the potential holding the distance values is called static potential. As, on the contrary, the estimated remaining travel time to the destination – under consideration of the presence of all other pedestrians – changes continuously this potential is called dynamic potential. One can imagine the values of a potential as elevation values and $\mathbf{e}_{\text{alpha}}$ then points into the direction of steepest descent, mathematically it is the (negative) gradient.

The potentials are calculated by driving a front outward from the boundaries of the destination area. This can be imagined as tipping some object onto a water surface and following the out-most wave front, for each point of the surface noting, at which time after the tipping it was reached. For the calculation of the static potential the speed of the wave front is everywhere the same, for the dynamic potential it is slower, if a spot is occupied by a pedestrian (in fact the relative walking orientation of the pedestrian also has an impact on the speed of the wave front). Mathematically this is the numerical solution of the Eikonal equation using a method similar to the Fast Marching Method.
Once \texttt{e\_alpha} has been calculated – be it based on the static or the dynamic potential – it is set into the driving force term and the sum of the driving force and the social forces makes up for the acceleration of the pedestrian in that particular time step.

7.1.8.13 The Service Point Selection Method

The dynamic routing of pedestrians can be performed by means of the service point selection method.

The route choice method Service Point Selection is intended for these scenarios:

1. **Central queue:**
   To model a “first come - first served“ principle if there are multiple service points that are all fed by a single queue. In reality this principle is often used at post offices, airports or railway stations.

2. **Immediate service point allocation:**
   As a (simple) decision model if there are multiple service points that all have individual queues and a person needs to decide which queue to join. Usually he tries to find the queue where he reaches the service point as fast as possible, but this is not easily predictable especially if there is a large number of queues and/or queuing people. This situation can often be found at supermarket checkouts or ticket gates.

3. **Survey/interview:**
   Single pedestrians walking by are asked to stop for a short time (e.g. to answer a few questions of a questionnaire) before they continue their path.

Pedestrians that are affected by this partial routing decision are directed to either

- the central queue (on the queuing area with an optional dwell time where the partial routing decision is located) or
- directly to one of the service points if at least one queue at a service point is not longer than the value defined in the routing decision parameters. If all queues are “filled”, the partial routing decision is ignored (i.e. the pedestrian ignores the service points).

The service point is the first queuing area in the route sequence that contains an intermediate point of the partial route. Each queuing area may have an optional dwell time distribution assigned.

**Modeling suggestions for the situations mentioned above**

Direction of flow for all illustrations is from left to right.

Notes on the images below:
### Scenario 1: Central Queue

Typical queuingThreshold *Proceed to service point if no more than __ people are queuing there* = 0. This factor ensures that there is no queue at a service point.

### Scenario 2: Immediate service point allocation

Typical queuingThreshold *Proceed to service point if no more than __ people are queuing there* = 99. This factor guarantees that all pedestrians join a queue.
Scenario 3: Survey/interview

Typical queuingThreshold Proceed to service point if no more than __ people are queuing there = 0. This factor ensures that there is no queue at a service point.

Prerequisites and Conditions for Application

► There is one main difference between partial routing decisions with the method Service point selection and other partial routing decisions: In order for the partial route to be “seen” by a pedestrian, an intermediate point of the original route of the pedestrian must be located on the area where the partial routing decision is defined (decision area). Pedestrians following a route that has no intermediate point on the decision area are not affected by the partial routing decision (and they do not proceed to a service point, of course).

► Each of the partial routes needs to include at least one intermediate point on a queuing area (with an optional dwell time).

► For a central queue, the routing decision must be placed on a queuing area (with an optional dwell time)

► For an immediate service point allocation, the routing decision must not be placed on a queuing area.

Calculation Methods

\( n \) is the route choice method parameter (queuingThreshold) that can be edited by the user which defines the maximum number of pedestrians queuing at one service point that still allows selection of that queue.

► If the decision area is a queuing area, the first pedestrian in the queue
  1. waits until his waiting time at the decision area is over (if a waiting time distribution is defined there),
  2. continues to the best queue only if at least one service point has no more than \( n \) pedestrians queuing. If all queues are “full”, the pedestrian waits until a space in one of the service point queues becomes available.
The partial routing decision may be defined for specific pedestrian classes. If the decision area is a queuing area with an additional dwell time distribution defined, then all pedestrians of other classes than the specified ones will be affected by the queue as well, if they are currently on a route which has an intermediate point on the “Service point selection” decision area. Then they will wait in the same queue but will not continue to any service point. Instead, they will then continue on their original route.

If the decision area is a queuing area without a dwell time distribution, then all such pedestrians will queue in the queue only until they reach the decision area and then continue immediately on their original route. Pedestrians who are not affected by the partial routing decision because their route does not have an intermediate point on the destination area of the partial routes are treated the same way, i.e., they can still be part of the queue if there is a dwell time distribution assigned to the decision area or if the queue extends outside of the decision area.

Summary: All pedestrians on a route with an intermediate point on the decision area are affected by the queue outside of the area. Inside, they are only affected if there is a dwell time assigned or if they will select one of the service points (i.e., if they belong to one of the specified pedestrian classes and their original route has an intermediate point on the destination area of the partial routes.

► If the decision area is no queuing area, each pedestrian (of the specified class) entering the decision area
  1. waits until his waiting time at the decision area is over (if a waiting time distribution is defined there),
  2. continues to the best queue if at least one service point has no more than \( n \) pedestrians queuing. If all queues are full, it continues with its original route (ignoring all service points).

► The best queue is calculated as follows:
  - Select from all queues where no more than \( n \) pedestrians are queuing.
  - If more than one such queue exists, choose the one with the smallest number of pedestrians (= shortest queue).
  - If there is more than one shortest queue, choose from these the queue end nearest to the routing decision (bee line).

Pedestrians who are on their way to a service point or the corresponding queue are considered to be in the queue already.

Note that only the first queuing area on each route after the routing decision is considered (and not any further queuing areas that follow downstream within the partial route).
7.1.9 Area-based Walking Behavior

Walking behavior is composed from a desired speed, which is allocated to the pedestrian composition, and the parameters of the pedestrian dynamics model, which are allocated to the pedestrian type. Additionally there is the possibility to assign area-based walking behaviors to areas and ramps.

An Area-based Walking Behavior is composed of the following:
► One or more Walking Behavior Parameter Sets
► A class of pedestrians to which it applies for each Walking Behavior Parameter Set.

A Walking Behavior Parameter Set comprises of the following:
► A time interval structure
► For each time interval: a desired walking speed distribution
► For each time interval: a parameter file

7.1.9.1 Walking Behavior Parameter Sets

Similar to a driving behavior parameter set for a vehicle class (cf. section 5.4), a walking behavior parameter set is applied to pedestrians belonging to a certain class of pedestrians.

The walking behavior is linked to each walkable element by the area behavior type. For each class of pedestrians, a different walking behavior parameter set may be defined - even within the same walkable element (for details cf. section 5.5).

The parameter sets can be edited in the Walking Behavior Parameter Sets window which is accessible by BASE DATA – WALKING BEHAVIOR.

By default, several parameter sets are provided in XML data file format in the sub-folder EXE\PEDESTRIANMODELDATA of your VISSIM installation.

For the parameters in detail, please refer to section 7.6.

For time interval definition and editing, please refer to section 6.4.3.1.
7. Simulation of Pedestrians

Add parameter set
In the list of walking parameter sets:
► Right-click to call the context menu.
► Left-click NEW to add a new line to the list.
  - In the Details section, edit No. and Name, if applicable.
  - In the Time section, edit time interval(s), if applicable.
  - In the list of time intervals, select a Desired speed distribution for each time interval.

Duplicate parameter set
In the list of walking parameter sets:
► Select a parameter set.
► Right-click to call the context menu.
► Left-click DUPLICATE to copy the selected line in the list.
  A new parameter set is created with the properties of the selected one but a new number.
► Edit the settings in the tab page.

Delete parameter set
► Select the parameter set in the list.
► Right-click to call the context menu.
► Left-click DELETE in the context menu.

Edit parameter set
► Select the parameter set in the list.
► Edit the settings in the tab page.

7.1.9.2 Area Behavior Types of Construction Elements

The sets of area behavior types can be edited in the Area Behavior Types window which is accessible via BASE DATA – AREA BEHAVIOR TYPES.
Add type  Right-click in the list of area behaviour types (or column header) to call the context menu, then left-click NEW (or DUPLICATE after selection of a set):
  ● In the upper section of the window, you may edit No. and Name.
  ● In the list in the lower section, call NEW in the context menu to allocate the pedestrian class(es) to a walking behavior parameter set.

Delete type  ● Select the type in the list of area behaviour types.
  ● Choose DELETE from the context menu.

Edit type  ● Select the type in the list of area behaviour types.
  ● In the data section to the right, edit Name or Number in the upper section or edit the allocation of Pedestrian Class and Behavior Parameter Set in the list below.
7.2 Evaluation Types for Simulations of Pedestrians

This section describes the options for the evaluation of pedestrian traffic.

Similar to the vehicle information (cf. section 11.6), the online data of selected pedestrians can be displayed in separate windows, cf. section 7.2.5.

Other evaluations can be stored in files or databases: Via menu EVALUATION – FILES the window Evaluations (File) can be called. The [PEDESTRIANS] tab allows for the configuration of pedestrian traffic evaluations, cf. section 10.1.

7.2.1 Pedestrian Travel Time Measurements

A travel time measurement for pedestrians consists of a "directed" pair of pedestrian areas (using existing normal areas): One of these is the starting area – pedestrians entering it get tracked by the device until they enter the corresponding destination area. When this happens, the following observables are recorded and written to an ASCII file associated with the travel time measuring device:

- Arrival time at end of the measurement
- Measurement number
- Pedestrian number
- Pedestrian type
- Total distance walked between start and end of the measurement
- Total time needed to walk from start to end of the measurement
- Sum of “time lost” while walking between start and end of the measurement. This is the sum of “wasted times” in every time step computed from the difference between actual walking speed and desired walking speed (if walking slower than intended). Attention: Delays caused by walking along non-optimal paths etc are not regarded.
- Sum of “time gained” while walking between start and end of the measurement. This is analog to the value above but summed up when actually walking faster than desired.
- Deviation between the pedestrians’ current speeds and the desired speeds during walk from start to end.

Contents and format of evaluation files are shown below.
The evaluation files are named automatically: The file name is the name of the input file and the file extension is either *.RSRP for raw data or *.RSZP for compiled data. Those files will be stored in the path where the input file is.

Inserting a new travel time measurement is done by selecting an existing pedestrian area and inserting the start point of the device by right-click. The start point will be marked with a red dot. Then select another pedestrian area and insert the end point of the device by right-click again. The end point of the device will be marked with a green dot.

After inserting a new travel time measurement device or double-clicking an existing one, the details dialog comes up:

In contrast to properties dialogs of other network elements, all travel time measurements have one dialog window in common: They are always shown in tabular form.

You can edit the no. and name of the measurement and the start/end locations.

In the Output column, you can set up the preselection for the Active travel times list in the Configuration window.

**Definition**

Define a pedestrian travel time measurement as follows:

► Click the Pedestrian Traffic mode icon.

► Click the Travel Time Sections icon.

Follow the steps outlined in the status bar for pedestrian travel time measurement definition. Generally, it can be compared to travel time measurement for vehicles, cf. section 11.1.

**Configuration**

Click menu Evaluation - Files - [Pedestrians] tab, check option Travel times and click the Configuration button to call the Configuration window: Set time data and select defined travel time evaluations as well as the desired output data format.
### Results

Structure of the output data file:
- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- List of all cross section measurements that have been evaluated
- Brief description of the evaluated data
- Table with the measured data

As for Travel times of vehicular traffic, you can create two types of output files for pedestrians.

#### Example: Compiled data file *.RSZP

Pedestrian travel time measurement (compiled data)

<table>
<thead>
<tr>
<th>Time;</th>
<th>Trav;</th>
<th>#ped;</th>
<th>Trav;</th>
<th>#ped;</th>
<th>No;</th>
</tr>
</thead>
<tbody>
<tr>
<td>30;</td>
<td>0.00;</td>
<td>0;</td>
<td>0.00;</td>
<td>0;</td>
<td>1;</td>
</tr>
<tr>
<td>60;</td>
<td>0.00;</td>
<td>0;</td>
<td>0.00;</td>
<td>0;</td>
<td>1;</td>
</tr>
<tr>
<td>120;</td>
<td>0.00;</td>
<td>0;</td>
<td>0.00;</td>
<td>0;</td>
<td>2;</td>
</tr>
</tbody>
</table>

#### Example: Raw data file *.RSRP

Pedestrian travel time measurement (raw data)

<table>
<thead>
<tr>
<th>Time;</th>
<th>Trav;</th>
<th>#ped;</th>
<th>Trav;</th>
<th>#ped;</th>
<th>No;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Raw data output:

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
<td>Time pedestrian entered destination area of travel time measurement [simulation second]</td>
</tr>
<tr>
<td>No.</td>
<td>Travel time measurement number</td>
</tr>
<tr>
<td>PedNo</td>
<td>Pedestrian number</td>
</tr>
<tr>
<td>PedType</td>
<td>Pedestrian type</td>
</tr>
<tr>
<td>TravDist</td>
<td>Distance traveled from start to destination area [m]</td>
</tr>
<tr>
<td>TravTime</td>
<td>Time traveled from start to destination area [s]</td>
</tr>
<tr>
<td>TimeDelay</td>
<td>Time delay [s] while traveling from start to destination area</td>
</tr>
<tr>
<td>TimeGain</td>
<td>Time gain [s] while traveling from start to destination area</td>
</tr>
<tr>
<td>DevSpeed</td>
<td>Differences [km/h] between actual speed and v_des</td>
</tr>
</tbody>
</table>

| t; No.; PedNo; PedType; TravDist; TravTime; TimeDelay; TimeGain; DevSpeed |
|-----------------------------|---------------------|-----------------------------|-----------------------------|-----------------------------|
| 32.2; 15; 409; 200; 83.2; 31.2; 13.7; 0.0; 0.7; |
| 34.7; 14; 47; 100; 87.8; 34.5; 16.2; 0.0; 0.6; |
| 35.7; 14; 185; 200; 87.9; 35.2; 13.8; 0.0; 0.5; |

7.2.2 Pedestrian Area Evaluations

Area-based evaluations provide the collection of data gained from user-defined sections on walkable elements.

Generally, it can be compared to data collection for vehicular traffic, cf. section 11.3.

**Definition**

Define a pedestrian measurement as follows:

1. Click the *Pedestrian Mode* icon.
2. Click the Measurement Areas icon.

Follow the steps outlined in the status bar for measurement area definition.

Right-click in the network calls the list of defined measurement areas:

Measurement areas are only displayed, if the Measurement Areas mode is active.

As 3D display has no modes, there is currently no way to see measurement areas in 3D display.

To gain correct output data, please check the assigned level by measurement area and adjust it accordingly in this grid.

A visual check for correct placement on the levels can be done in 2D display using the level display option, cf. section 7.1.4.6.

**Configuration**

Call the Area Evaluations window as follows:

1. Click menu EVALUATION – FILES and select the [PEDESTRIANS] tab
2. Check option Area evaluation
3. Click the CONFIGURATION button

Additional settings are required for the desired data output and data format:

- EvaluationNo. (Areas): List of defined area evaluations (with the area numbers in parentheses).
- Click NEW to define a new evaluation.
- Click EDIT for changes to an existing one.
Click **CTRL** simultaneously to select multiple areas for an area evaluation.

Alternatively, you can use the button **GENERATE 1:1** for area evaluation definition.

- **GENERATE 1:1**: For each single measurement area, a separate area evaluation is created (even if the area has already been selected for another area evaluation).
- **Time**: Define the evaluation period and the length of aggregation intervals.
- **Output**: Select the desired data format.
  - **Raw data**: Stores all pedestrians traversing the measurement area in chronological order in an *.MERP file (Area evaluation raw data)
  - **Compiled Data**: Stores the selected parameters (using the selected aggregate function (mean, min, max, if applicable) in an *.MESP file.
- **CONFIGURATION**: In the **Area evaluation – Configuration** window, the user can select the desired parameters and arrange them in the desired order. These settings are only regarded for **Compiled data** output.

The selected parameters are listed in the **Layout of columns** section.

- Use the buttons **MOVE UP** and **MOVE DOWN** for the final arrangement of columns in the output file (1st row = 1st column).
- Use the buttons **<<** to add the selected parameter to the layout section (and **>>** to remove it from the layout section).
For some of the parameters, one of the aggregate functions has to be selected: Minimum, Maximum or Mean.

The Configuration settings file is saved as *.MESPK file.

**Results**

Pedestrian area evaluations are output only if at least one pedestrian input has been defined.

Structure of the output data file:
- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- List of all areas that have been evaluated
- Brief description of the evaluated data
- Table with the measured data

As for Data collections of vehicular traffic, you can create two types of output files for pedestrians.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Column Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation number</td>
<td>Area evaluation number</td>
<td>EvalNo</td>
</tr>
<tr>
<td>Time</td>
<td>End of aggregation time interval [simulation second]</td>
<td>t</td>
</tr>
<tr>
<td>Number of pedestrians</td>
<td>Number of pedestrians on measurement area(s)</td>
<td>NumPeds</td>
</tr>
<tr>
<td>Density</td>
<td>Density of pedestrians on measurement area(s) in [ped/m²] or [ped/ft²], as applicable</td>
<td>Density</td>
</tr>
<tr>
<td>Desired speed</td>
<td>Desired speed</td>
<td>vDes</td>
</tr>
<tr>
<td>Speed</td>
<td>Speed</td>
<td>v</td>
</tr>
<tr>
<td>DevSpeed</td>
<td>Deviation between actual speed and desired speed of pedestrians</td>
<td>DevSpeed</td>
</tr>
<tr>
<td>Source volume</td>
<td>Number of pedestrians who left the measurement area(s)</td>
<td>SourceVol</td>
</tr>
<tr>
<td>AvgXOrientation</td>
<td>Average of x values of orientation vector</td>
<td>AvgXOri</td>
</tr>
<tr>
<td>AvgYOrientation</td>
<td>Average of y values of orientation vector</td>
<td>AvgYOri</td>
</tr>
<tr>
<td>World coordinate</td>
<td>World coordinate z</td>
<td>WorldZ</td>
</tr>
</tbody>
</table>
### Evaluation Types for Simulations of Pedestrians

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Column Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>z</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total delay time</td>
<td>Total time delay [s] on measurement area(s) (of pedestrians who left measurement area(s) during aggr. interval)</td>
<td>TimeDelay</td>
</tr>
<tr>
<td>Total distance</td>
<td>Total distance traveled on measurement area(s) (of pedestrians who left measurement area(s) during aggr. interval)</td>
<td>TotalDist</td>
</tr>
<tr>
<td>Total dwell time</td>
<td>Total time [s] spent on measurement area(s) (of pedestrians who left measurement area(s) during aggr. interval)</td>
<td>TotalDwell</td>
</tr>
<tr>
<td>Total gained time</td>
<td>Total time gain [s] on measurement area(s) (of pedestrians who left measurement area(s) during aggr. interval)</td>
<td>TotalGain</td>
</tr>
</tbody>
</table>

**Example: Compiled data file *.MESP**

Underneath the file header, the evaluated areas are listed.

The second line contains just the number of the particular area evaluation (Note: not the number of the defined measurement area(s)) underneath the particular block of columns.

Another line is added for each aggregation time interval. Each of those additional lines contains the data gained by area evaluation during this interval.

Area evaluation (compiled data)

File: D:\Programme\PTV_Vision\VISSIM530\Examples\Training\Pedestrians\HotelRimea.inp

Comment: 
Date: Friday, October 23, 2009, 1:41:30 pm
VISSIM: 5.20-04* [20767]

Area evaluation 1 : Measurement area(s) 1
Area evaluation 2 : Measurement area(s) 2
Area evaluation 3 : Measurement area(s) 3

AvgXOri : Average of x values of orientation vectors
AvgYOri : Average of y values of orientation vectors
Density : Density of pedestrians on measurement area(s) [ped/m²]
vDes : Desired speed [km/h]
EvalNo : Area evaluation number
NumPeds : Number of pedestrians on measurement area(s)
SourceVol : Number of pedestrians who left the measurement area(s)
Example: Raw data file *.MERP

In the data block underneath the file header, the set of column headers is listed.

Area evaluation (raw data)

File: D:\Programmes\PTV_Vision\VISSIM-520\Examples\Training\Pedestrians\Hotel.inp
Comment:
Date:  Friday, July 10, 2009 2:58:58 PM
VISSIM:  5.20-00* [19452]

Area evaluation 1 : Measurement area(s) 1
Area evaluation 2 : Measurement area(s) 2

EvalNo     : Area evaluation number
tEnter     : Time pedestrian entered measurement area(s) [simulation second]
tLeave     : Time pedestrian left measurement area(s) [simulation second]
PedNo      : Pedestrian number
PedType    : Pedestrian type
Dwelltime  : Total time [s] pedestrian spent on measurement area(s)
vDes       : Desired speed [km/h]
v          : Speed [km/h]
DevSpeed   : Deviation of pedestrian speed [km/h]
Density    : Density of pedestrians on measurement area(s) [ped/m²]
AvgXOri    : Average of x values of orientation vector
AvgYOri    : Average of y values of orientation vector
WorldZ     : World coordinate z
TimeDelay  : Time delay [s]
TimeGain   : Time gain [s]
Dist       : Distance [m] pedestrian traveled on measurement area(s)
DistNetwork: Distance [m] pedestrian traveled in network so far
<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EvalNo</td>
<td>Area evaluation number</td>
</tr>
<tr>
<td>tEnter</td>
<td>Time pedestrian entered measurement area(s) [simulation second]</td>
</tr>
<tr>
<td>tLeave</td>
<td>Time pedestrian left measurement area(s) [simulation second]</td>
</tr>
<tr>
<td>PedNo</td>
<td>Pedestrian number</td>
</tr>
<tr>
<td>PedType</td>
<td>Pedestrian type</td>
</tr>
<tr>
<td>Dwelltime</td>
<td>Total time [s] pedestrian spent on measurement area(s)</td>
</tr>
<tr>
<td>vDes</td>
<td>Desired speed (in the current unit for speed)</td>
</tr>
<tr>
<td>v</td>
<td>Speed (in the current unit for speed)</td>
</tr>
<tr>
<td>DevSpeed</td>
<td>Deviation of pedestrian speed (in the currently selected speed unit)</td>
</tr>
<tr>
<td>Density</td>
<td>Density of pedestrians on measurement area(s) [ped/m² or ped/ft² according to the current unit for short distances]</td>
</tr>
<tr>
<td>AvgXOri</td>
<td>Average of x values of orientation vector</td>
</tr>
<tr>
<td>AvgYOri</td>
<td>Average of y values of orientation vector</td>
</tr>
<tr>
<td>WorldZ</td>
<td>World coordinate z</td>
</tr>
<tr>
<td>TimeDelay</td>
<td>Time delay [s]</td>
</tr>
<tr>
<td>TimeGain</td>
<td>Time gain [s]</td>
</tr>
</tbody>
</table>
7.2.3 Pedestrian Record

For each pedestrian, the pedestrian protocol *.PP records a data line per time step. The evaluation can be limited to a user-defined time interval as well as to selected classes of pedestrians.

Generally, it can be compared to the vehicle protocol, cf. section 11.7.

Furthermore, many of the pedestrian record output parameters can be viewed as pedestrian information in a separate window for each of the selected pedestrians while the simulation is running, cf. section 7.2.5.

**Definition**

No additional definition required.

**Configuration**

In order to get the desired output data additional information is needed. This can be provided within the Pedestrian Record - Configuration window which can be accessed by pressing the Configuration button via Evaluation - Files in the [Pedestrians] tab once the option Pedestrian Record is active. The Configuration window allows for definition of any combination of the parameters of pedestrians. If Database output is not active, each layout line results in a column within the output file *.PP.

The configuration settings will be saved to an external *.PDK file.

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dist</td>
<td>Distance (in the current unit for short distances) that the pedestrian traveled on measurement area(s)</td>
</tr>
<tr>
<td>DistNetwork</td>
<td>Distance [m] pedestrian traveled in network so far</td>
</tr>
</tbody>
</table>
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 [Left] and [Right].

For the list of parameters provided for selection and a brief description, please see below.

- **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, cf. section 10.1.3.

**Filter**

Once the pedestrian record parameters have been selected, a filter may be applied to capture specific pedestrian classes during the simulation. This can be accessed via **EVALUATION – FILES – [PEDESTRIANS] tab** by pressing the **FILTER** button once the option **Pedestrian Record** is active.

By default, all pedestrian classes are recorded within the simulation period.

In addition to the selection of pedestrian classes, a time interval for the evaluation as well as the resolution of recording are to be defined. If an integer > 1 is entered for **Resolution**, only one time step will be logged for the user-defined number of time steps.
The filter information is stored in a filter configuration file *.PIL.

**Results**

The pedestrian protocol (*.PP) consists of the following:

- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- Brief description of output parameters
- Data block

The pedestrian record file can contain any of the parameters listed below. The table also includes the abbreviations that will be used within the pedestrian record file.

Generally, current unit settings for (short/long) distance/speed/acceleration under View - Options - [Language & Units] are regarded for evaluation data output.

Please note: The units of those parameters with the particular unit mentioned in the column header abbreviation will not change, for example V_mps.

In contrast, the output of the speed in the v column, for example, regards whether the metric or the imperial unit has been selected.

Parameters (such as TotalDist) which can be output with long length and with short length simultaneously, always have the particular length in the column header.

For parameters which are returned according to the current Units settings (either metric or imperial) the current selection is added to the name of the parameter in the Pedestrian protocol - Configuration window and will be displayed in the Information line after mouse-click.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Column Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Element</td>
<td>Number of construction element</td>
<td>ConstrElem</td>
</tr>
<tr>
<td>Current destination</td>
<td>Number of current destination (construction element)</td>
<td>CurrentDest</td>
</tr>
<tr>
<td>Desired speed [km/h]</td>
<td>Desired speed [km/h]</td>
<td>vDes</td>
</tr>
<tr>
<td>Desired speed [m/s]</td>
<td>Desired speed [m/s]</td>
<td>vDes_mps</td>
</tr>
<tr>
<td>Height</td>
<td>Pedestrian height [m]</td>
<td>Height</td>
</tr>
<tr>
<td>Length</td>
<td>Pedestrian length [m]</td>
<td>Length</td>
</tr>
<tr>
<td>Parameter</td>
<td>Definition</td>
<td>Column Header</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Level</td>
<td>Level number</td>
<td>Level</td>
</tr>
<tr>
<td>On ramp</td>
<td>Pedestrian on ramp? 0 = no, 1 = yes</td>
<td>OnRamp</td>
</tr>
<tr>
<td>Orientation x value</td>
<td>X value of orientation vector (direction of latest movement)</td>
<td>XOri</td>
</tr>
<tr>
<td>Orientation y value</td>
<td>Y value of orientation vector (direction of latest movement)</td>
<td>YOri</td>
</tr>
<tr>
<td>Partial route</td>
<td>Partial route number</td>
<td>PartRoute</td>
</tr>
<tr>
<td>Partial routing decision</td>
<td>Partial routing decision number</td>
<td>PartRoutDec</td>
</tr>
<tr>
<td>Pedestrian number</td>
<td>Pedestrian number (in the Pedestrian Info window header)</td>
<td>PedNo</td>
</tr>
<tr>
<td>Pedestrian type</td>
<td>Pedestrian type number</td>
<td>PedType</td>
</tr>
<tr>
<td>Pedestrian type name</td>
<td>Pedestrian type name</td>
<td>PedTypeName</td>
</tr>
<tr>
<td>Previous destination</td>
<td>Number of previous destination (construction element)</td>
<td>PrevDest</td>
</tr>
<tr>
<td>PT alighting</td>
<td>Pedestrian alighting from a PT vehicle? 0 = no, 1 = yes</td>
<td>PTAlighting</td>
</tr>
<tr>
<td>PT approaching</td>
<td>Pedestrian approaching a PT vehicle? 0 = no, 1 = yes</td>
<td>PTApproaching</td>
</tr>
<tr>
<td>PT waiting</td>
<td>Pedestrian waiting for PT? 0 = no, 1 = yes</td>
<td>PTWaiting</td>
</tr>
<tr>
<td>Queuing area</td>
<td>Current queuing area number (0 = pedestrian not in a queue)</td>
<td>QueueArea</td>
</tr>
<tr>
<td>Queuing distance</td>
<td>Direct distance (short length) to begin of current queue</td>
<td>QueueDist</td>
</tr>
<tr>
<td>Queuing time</td>
<td>Time spent in last queue [s] (in the time step when the pedestrian leaves the queue)</td>
<td>QueueTime</td>
</tr>
<tr>
<td>Queuing total time</td>
<td>Total time spent in queues [s]</td>
<td>QueueTotalTime</td>
</tr>
<tr>
<td>Remaining Distance</td>
<td>Remaining distance (short length) to the next internal destination. If the next (intermediate) destination is located on the same level as the pedestrian, this is the distance to this (intermediate) destination. If the next (intermediate)</td>
<td>RemDistance</td>
</tr>
<tr>
<td>Parameter</td>
<td>Definition</td>
<td>Column Header</td>
</tr>
<tr>
<td>----------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Simulation time</td>
<td>Simulation time [s] (not in the Pedestrian Info window, but in the status bar of the VISSIM window)</td>
<td>t</td>
</tr>
<tr>
<td>Simulation time of day</td>
<td>Simulation time as time of day [hh:mm:ss] (not in the Pedestrian Info window)</td>
<td>TimeOfDay</td>
</tr>
<tr>
<td>Speed [km/h]</td>
<td>Speed [km/h] at end of time step</td>
<td>v</td>
</tr>
<tr>
<td>Speed [m/s]</td>
<td>Speed [m/s] at end of time step</td>
<td>v_mps</td>
</tr>
<tr>
<td>Start time</td>
<td>Start time [simulation second]</td>
<td>StartT</td>
</tr>
<tr>
<td>Start time of day</td>
<td>Start time as time of day [hh:mm:ss] (not in the Pedestrian Info window)</td>
<td>StartTimeOfDay</td>
</tr>
<tr>
<td>Static route</td>
<td>Static route number</td>
<td>StatRoute</td>
</tr>
<tr>
<td>Static routing decision</td>
<td>Static routing decision number</td>
<td>StatRoutDec</td>
</tr>
<tr>
<td>Time delays</td>
<td>Accumulated time delays [s]</td>
<td>TotalDelay</td>
</tr>
<tr>
<td>Time gains</td>
<td>Accumulated time gains [s]</td>
<td>TotalGain</td>
</tr>
<tr>
<td>Total distance [km]</td>
<td>Total distance traveled in network [long length]</td>
<td>TotalDist_km</td>
</tr>
<tr>
<td>Total distance [m]</td>
<td>Total distance traveled in network [short length]</td>
<td>TotalDist_m</td>
</tr>
<tr>
<td>Total time</td>
<td>Total time in network [s]</td>
<td>TotalTime</td>
</tr>
<tr>
<td>Width</td>
<td>Pedestrian width [m]</td>
<td>Width</td>
</tr>
<tr>
<td>World coordinate x</td>
<td>World coordinate x (Pedestrian position)</td>
<td>Worldx</td>
</tr>
<tr>
<td>World coordinate y</td>
<td>World coordinate y (Pedestrian position)</td>
<td>Worldy</td>
</tr>
<tr>
<td>World coordinate z</td>
<td>World coordinate z (Pedestrian position)</td>
<td>Worldz</td>
</tr>
</tbody>
</table>

**Example: Pedestrian Record file *.PP**

The following extract represents the Pedestrian Record:

Pedestrian Record
7.2.4 Pedestrian Queue Evaluations

Click EVALUATION – FILES and call the [PEDESTRIANS] tab. Activate the ☑ Queues option to create a *.PQE file which contains – by time interval and selected area – the following compiled values:

► the number of pedestrians in the queue
► the length per queue (bee-line)

Definition

Only those areas are provided for selection that have checked the option ☑ Queuing, cf. section 7.1.4.3.

If orderly queuing of pedestrians in single file is required, a Dwell time distribution has to be allocated to the area, cf. section 5.2.6.

In the Pedestrian Area window, check – and edit, if applicable – these properties of one or several selected pedestrian areas.

The behavior of pedestrians in queues is described in section 5.2.6.

For each area, the number of queueing pedestrians and the queue’s spatial extent are logged.

In case of areas without orderly queuing (i.e. not single file but only stopped at a bottleneck), the following applies:
If a queuing area which is selected for queue evaluation has no dwell time distribution selected, all pedestrians who fulfill the three criteria listed below are considered to be part of that queue for the queue evaluation until they leave this area.

► The pedestrians have this area as next routing destination (or have already arrived on that area).
► The pedestrians are slower than 0.4 m/s.
► The pedestrians are either closer than 2 m to the area edge that the queue arrow points to or closer than 2 m to another pedestrian who belongs to that queue.

Pedestrians are displayed as red ovals in 2D mode while they are inside such a queue.

Configuration

No configuration settings required.

Filter

In the Queue Evaluation - Filter window, the following settings have to be made:

► Set the time filter
► Define active areas

- **Time section:**
  - Define the length of the evaluation intervals.
  - Shift the start of the protocol, if applicable.
  - Reduce the length of the protocol, if applicable.
Recording can be shorter than the simulation period, cf. Simulation - Parameters.

- **Queuing Area Selection section:**
  The Passive Areas list contains all areas of the Queuing type.
  - To shift a single area to the Active Areas list, mark it and use the button or double-click the area.
- To shift all passive areas to the Active Areas list, use the << INSERT ALL button.

Under Active Areas the areas which are to be regarded for the evaluation are listed.

- To remove a single area from the Active Areas list, use the button or double-click the area.
- To remove all areas from the Active Areas list, use the REMOVE ALL >> button.

Results

A Pedestrian queue file (*.PQE) consists of the following:

- File title
- Path and name of the network file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- Brief description of output parameters
- Data block with one column for each parameter

Example: Pedestrian Queue file *.PQE

Pedestrian Queue Evaluation

File: C:\programfiles\PTV_Vision\VISSIM520\Examples\Training\Pedestrians\HR.inp
Comment: Manual Example
Date: Wednesday, October 28, 2009, 5:31:39 pm
VISSIM: 5.20-04 [20852]

<table>
<thead>
<tr>
<th>t</th>
<th>AreaNo</th>
<th>PedCount</th>
<th>Extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>500; 4;</td>
<td>23.8; 0;</td>
<td>46; 20.5; 0; 42.9;</td>
<td></td>
</tr>
<tr>
<td>500; 5;</td>
<td>7.7; 0;</td>
<td>25; 5.8; 0; 22.5;</td>
<td></td>
</tr>
<tr>
<td>1000; 4;</td>
<td>35.8; 24;</td>
<td>47; 31.5; 19.3; 43.2;</td>
<td></td>
</tr>
<tr>
<td>1000; 5;</td>
<td>13.9; 1;</td>
<td>27; 10.9; 0; 24.2;</td>
<td></td>
</tr>
<tr>
<td>1500; 4;</td>
<td>13.9; 3;</td>
<td>25; 10.6; 1.4; 21.2;</td>
<td></td>
</tr>
<tr>
<td>1500; 5;</td>
<td>0.0; 0;</td>
<td>1; 0.0; 0.0; 0.0;</td>
<td></td>
</tr>
<tr>
<td>2000; 4;</td>
<td>57.7; 2;</td>
<td>114; 43.8; 0.5; 67.2;</td>
<td></td>
</tr>
<tr>
<td>2000; 5;</td>
<td>55.6; 0;</td>
<td>111; 41.9; 0.0; 66.3;</td>
<td></td>
</tr>
</tbody>
</table>
### 7.2.5 Pedestrian Information

During a simulation run pedestrian information is available in a *Pedestrian Information* window after double-click on any pedestrian. The information shown can be configured by the user.

Additionally, pedestrian information can be saved to an output file using the Pedestrian Record output parameters, cf. section 7.2.3.

**Definition**

No additional definition required.

**Configuration**

Via *Evaluation – Windows... – Pedestrian Information* you can call the *Pedestrian Information Configuration* window:

The *Selected parameters* are displayed within the list box to the left.

Use UP and DOWN to change the sequence of the selected data.

Additional parameters can be inserted and others can be removed by clicking on the corresponding buttons and [ ].

The configuration is saved to an external file (*.PDI)*.

**Result**

While the simulation is running, switch to the single-step mode and double-click on a pedestrian for the following:

- A red dot marks the selected pedestrian.
- The pedestrian information window appears.

Additionally, if the display mode is set to 3D, the viewing position will be changed as from the pedestrian’s position, cf. section 7.4.
7.3 2D Visualization of Pedestrian Traffic

Basically, the three options provided for visualization of road users and for display of compiled data gained from vehicular or pedestrian traffic are the same for vehicles on links and pedestrians on areas and ramps or stairways.

Also the display types can be allocated to links in the road network and to construction elements for pedestrians as well.

This section describes the options for the visualization of pedestrian flows using walkable construction elements.

For pedestrians, multiple Level of Service schemes allow for various evaluations with regard to space or speed rating, cf. section 7.3.3.

7.3.1 Display Types of Construction Elements

As for vehicle traffic, display types for construction elements can be defined via BASE DATA – DISPLAY TYPES, cf. section 5.5.2

Via VIEW – OPTIONS – [COLORS] you can enable or disable the usage of the display types for screen display of obstacles, areas, ramps and stairways, cf. section 4.1.3.

If option □ Use display type color is not checked in this window, the color chosen for Links/Areas will be used for areas and ramps and stairways instead. For obstacles, the Land color will be used in this case.

7.3.2 Display Options for Pedestrians

Via VIEW - OPTIONS... - [PEDESTRIANS] various options are provided for the visualization of pedestrians traversing areas and ramps or stairways.
The following options are available:

- **Individual Pedestrians**: Each pedestrian is animated separately.
  - In 2D mode, pedestrians are displayed as colored, rounded boxes.
  - In 3D mode, they are represented by a 3D model from the model distribution assigned to the pedestrian type.
  - **Configuration**: If option *Individual Pedestrians* has been checked, select the parameter to be displayed, enter the upper class limits to set up the classes and assign a color to each class for display of *Speed* or *Acceleration* of pedestrians in 2D display mode, cf. section 4.2.2.

- **Interval** defines that only 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**: If this option is active, each polygon (area, ramp, stairway or grid cell respectively) is colored instead of display of individual pedestrians. For that the configuration settings are used.
  - **Configuration**: Select the LOS scheme (or the parameter, respectively) and define the appropriate color code. Alternatively, you can select a parameter (*Speed* or *Density*) and set up user-defined classes. For details, please refer to section 7.3.3.
  - **Update interval**: Enter start and end of the interval for data updates. The display changes every \(<Update interval>\) seconds, then shows the result of the last (completed) interval and stays the same for \(<Update interval>\) seconds (until the new result is displayed). The update interval is also regarded for cumulative data display.
  - **Area-based**: If this option is active, the walkable construction elements (areas and ramps/stairs) are used for data collection and graphical value display by color.
  - **Grid-based**: If this option is active, a user-defined grid is created for data collection and graphical value display by color that covers the walkable elements. Enter the length of the edge of such a mesh to define the cell size.

- **No visualization**: Neither individual pedestrians nor aggregated values are displayed during the simulation. Use this option to maximize the simulation speed.

Click **CTRL+Q** to activate the next of these three display options during a simulation (*Individual vehicles / Aggregated values / No visualization*).

If option *Aggregated values* is selected in the [PEDESTRIANS] tab, press **CTRL+L** to toggle between multiple LOS definitions. The LOS scheme being currently used for data visualization is mentioned in the status bar.
The 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).

### 7.3.3 2D Display of Aggregated Values for Pedestrians (LOS)

As an alternative to the display of individual pedestrians, VISSIM can also use well-known LOS schemes for display of aggregated values using a color code.

This section describes the display of aggregated values for pedestrian traffic on areas, ramps and stairways.

The color code is used to color each traversed polygon - which is either a walkable construction element or a cell of a user-defined grid - according to the value computed for this polygon. This value results from the online data of the selected parameter. Alternatively to visualization of data gained by update interval, also cumulative data display can be selected.

### Selection: The LOS Schemes Provided for Aggregate Value Display

The two tables below list the LOS schemes and parameters provided in the *Aggregated Values - Configuration* window. You can freely select a color for each class.

- For the schemes, the upper interval limits of the classes are predefined by scheme. The colors can freely be allocated to the value classes. For each scheme, find a short description attached.
- For the parameters, you can freely select the upper interval limits to set up the classes and assign a color to each class.

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Walkways</th>
<th>Stairways</th>
<th>Queuing</th>
<th>User-defined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruin</td>
<td>☑️</td>
<td>☑️</td>
<td>☑️</td>
<td></td>
</tr>
</tbody>
</table>

Fruin states as introduction that "the breakpoints that determine the various levels-of-service have been determined on the basis of the walking speed, pedestrian spacing, and the probabilities of conflict at various traffic concentrations". Numerically the breakpoints are given as density and (alternatively) flow. By defining both, density and flow limits, Fruin provides the planner with the right strategy, as the level of service concept is meant to assess walking quality up to capacity, where above capacity is tried to be avoided in any case.

| Weidmann  | ☑️       |           |          |              |

Weidmann follows Pushkarev and Zupan and the HCM in stating eight criteria to assess pedestrian walkway quality. He refers to eight more references to use these criteria to verbalize level limits given as densities.
Weidmann does not give the way to translate verbalized in numerical limits.

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Walkways</th>
<th>Stairways</th>
<th>Queuing</th>
<th>User-defined</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBS</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| These level limits are very similar to those of HCM; like rounded values, when HCM is given in the metric system. The importance of considering effective width (or area) is pointed out. Additionally a factor is given to calculate an effective density for counterflow situations. VISSIM calculates the LOS using the geometric area and does not check for counterflow situations.

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Walkways</th>
<th>Stairways</th>
<th>Queuing</th>
<th>User-defined</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCM</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| HCM refers to Fruin as originator of the LOS concept, but the breakpoints between the levels are set at clearly smaller values.

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Walkways</th>
<th>Stairways</th>
<th>Queuing</th>
<th>User-defined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pushkarev-Zupan</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Pushkarev and Zupan along with Fruin are credited in the HCM as having done the base work.

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Walkways</th>
<th>Stairways</th>
<th>Queuing</th>
<th>User-defined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polus</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Walkways</th>
<th>Stairways</th>
<th>Queuing</th>
<th>User-defined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanaboriboon-Guyana</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| The breakpoint values for this six-level scheme have been derived from measurements in Bangkok. So, if there is an Asian scheme, it is this one. This is the only LOS scheme with breakpoint values constantly higher than the ones of the walkway LOS of Fruin.

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Walkways</th>
<th>Stairways</th>
<th>Queuing</th>
<th>User-defined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teknomo</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| In contrast to density-based LOS, this speed-based LOS definition uses the opposite sequence (starting with the worst LOS) because with increasing speed the LOS becomes better.

### Selection: The Parameters Provided for Aggregate Value Display

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Walkways</th>
<th>Stairways</th>
<th>Queuing</th>
<th>User-defined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Speed</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
</tbody>
</table>
How the Settings for LOS Visualization are Regarded

**Global Settings**

If option *Area-based* has been checked for display of aggregated values: The LOS scheme selected in the global settings can be overruled by the LOS scheme selected for the display type of construction elements. Both settings can be overruled by the LOS scheme selected for a particular area or ramp or stairway, if applicable.

If option *Grid-based* has been checked for display of aggregated values, the global settings cannot be overruled by different settings for a selected display type or for selected elements. In this case, different LOS schemes selected by display type and/or construction element will be ignored.

**By Display Type**
If option *Area-based* has been checked for display of aggregated values, you can select a different LOS scheme for a certain display type of areas and ramps or stairways via menu BASE DATA – DISPLAY TYPES – [PEDESTRIANS], cf. section 5.5.2.

Alternatively, you can select *None* to exclude all construction elements of this display type from the LOS visualization. Their static color/texture will be used for display instead.

The LOS scheme selected for the display type of construction elements is overruled by the LOS scheme selected for a particular area or ramp or stairway, if applicable.

**By Construction Element**
If option *Area-based* has been checked for display of aggregated values, you can set a different LOS scheme for a single or multiple construction element(s) in the *Pedestrian Area* properties window, cf. section 7.1.4.3., or in the *Ramp/Stairway* properties window, cf. section 7.1.4.5:

In the *Visualization* section, select either *Display type* or a different LOS scheme for *Aggregated values* display. To exclude a single or multiple construction element(s) from LOS visualization, uncheck the option *Aggregated values*. The static color/texture will be used for display instead.

**7.3.3.1 Display Options for LOS of Pedestrian Traffic**
Click VIEW – OPTIONS... to open the *Display Options* window.

In the [PEDESTRIANS] tab do the following, cf. section 7.3.2:

1. Check option *Aggregated Values*
2. Enter the *Update interval* in seconds
3. Select the spatial basis for the visualization:
   - *Area-based*: If this option is checked, data is evaluated and LOS is visualized by area or ramp or stairway. The global LOS scheme, which is to be selected in the associated *Configuration* window, can
be overruled by display type LOS scheme and/or by the LOS scheme
selected for particular areas, ramps or stairways.

- **Grid-based**: If this option is checked, a user-defined grid will cover
the network area. The parameter values are computed by grid cell
and will be indicated by the cell’s color.

Enter the length of the cell edges as **Cell size value** (short length
unit).

The global LOS scheme, which is to be selected in the associated
`Configuration` window, cannot be overruled by any other settings.

4. Click the `Configuration` button
5. Set the options

The color of a cell or area results from these settings:

- **Scheme**: In the list, select the desired scheme with pre-
defined classes for evaluation and with a user-definable color
 code for display, cf. section 7.3.3.

Alternatively, parameter **Speed** or parameter **Density** can be
selected, for which the classes have to be defined accordingly.

The appropriate unit is displayed underneath.

- **Display**: Decide, how to visualize the aggregated values
resulting from the selected scheme.

These three options are provided for each of the
schemes and both parameters and take the user-defined time
interval into consideration. Thus, visualization is
performed as long as the current simulation second is
within the range `from – until`.

The display of the data is still updated every **Update interval**, starting with
simulation second `<from>`, then `<from> + <Update interval>` and so on.
When the current simulation second is outside the range `from - until`,
each area or cell is colored as if **Aggregated values** was **not** selected.

- **Average (Interval)**: If this option has been checked, the average
value of the current interval is visualized and the data will be reset at
the end of the interval.
- **Average (Cumulative):** If this option has been checked, the parameter data is not reset every Update interval but continuously collected as long as the current simulation second is within the range from - until. The current average value is added to the total of the previous average values. The resulting sum is visualized.

- **Worst of interval averages:** If this option has been checked, the averages of all intervals are compared to each other and the worst average value is visualized (minimum speed or maximum density).

- **Classes:** A class combines a value range and the Color for its representation on screen.
  - For provided LOS schemes, the value range by class has been predefined.
  - For the parameters *Speed* and *Density*, the classes can be defined by the user.
  
  The upper class limit is always included in the interval.
  
  To allocate a color to each of the classes, click the colored cell next to the particular upper interval limit.

- **DEFAULT CLASSES:** Click this button to restore the default settings (limits/colors) of the current scheme.

---

### 7.3.3.2 Examples: Aggregated Values of Pedestrian Traffic

**Example 1**
Example 2
7.4 3D Visualization of Pedestrian Traffic

Similar to the 3D viewing option “Sitting in the driver’s seat”, the user can watch the pedestrian traffic with the eyes of a selected pedestrian.

This can be done in the single step mode (2D) by double-clicking on the pedestrian. In this way, the pedestrian information window is called, cf. section 7.2.5. The 3D view from the pedestrian's position remains active as long as the pedestrian information window is open.

To remain in the 3D mode but watch the pedestrian flows from a different position, select another pedestrian’s information window.
7.5 Simulation of Pedestrians: Preconditions & How to

This section describes the preconditions which are required for a pedestrian simulation and also the internal process of the simulation.

7.5.1 Preconditions for Simulating Pedestrian Flows

1. Every external pedestrian movement *.DLL file that is referenced by a type of pedestrians must exist at the referenced location.
2. The *.DLL files must be installed correctly and their dependencies to third party *.DLL files must be fulfilled. The latter can be checked using the tool „Dependency Walker“ (http://www.dependencywalker.com/).
3. All pedestrian types must reference an existing and valid external pedestrian movement *.DLL file.
4. The folder PEDESTRIANMODELDATA must exist in VISSIM’s executable path even if no pedestrian model *.DLL file uses it.
5. At least one pedestrian type must be defined including a valid reference to an external movement *.DLL (cf. section 7.1.2).
6. At least one pedestrian composition must be defined.
7. At least one pedestrian input must be defined and yield pedestrians.
8. On every pedestrian input, there must be at least one pedestrian routing decision.
9. At every pedestrian routing decision on pedestrian inputs there must be at least one route for every pedestrian type that belongs to a pedestrian composition on that input.
10. All sequences of pedestrian areas referenced by any pedestrian route must be valid – every (intermediate or final) stop of the route must be reachable on walking ground from its predecessor.
11. Be careful in case of obstacles being located closed to each other: Depending on the external movement *.DLL pedestrians might get stuck in the alleyway and there might be no walkable trajectory along some strategic path.

7.5.2 How the Simulation Internally Works

Inserting pedestrians at pedestrian inputs

On pedestrian areas where pedestrian inputs are defined it is mandatory to define routing decisions for pedestrians as well. There must be at least one route for every pedestrian type that belongs to the input. Pedestrians without a strategic route are not defined and simulation will stop with an error in that case.
After creation of a new pedestrian, a strategic route is fetched from the routing decision according to the type (class respectively) of the pedestrian. If there is more than one route, one route is chosen randomly according to the ratios of the route distribution.

The strategic route consists of a sequence of numbers of pedestrian areas and ramps. These are copied to the pedestrian’s data structures. From which routing decision the route was taken is stored here as well to avoid fetching several routes again and again on one and the same routing decision.

How a pedestrian walks along the strategic route

A pedestrian always walks towards his nextmost strategic routing point. Whether he aims at the exact coordinates of the point or only at the area where the strategic point is located in, depends on the external movement DLL that is used.

Once reaching it (i.e. entering the area that contains the point or reaching the point itself) the external movement DLL makes the pedestrian wait according to the dwell time distribution defined at the area. What the pedestrian “does” during this time is determined by the DLL.

If this was not the end of the pedestrian’s strategic route, he moves on towards the next strategic point. If this was the end point of the strategic route and if the area, where the pedestrian’s current position is located in, contains a routing decision defining routes for this pedestrian (more precisely: for the class, the pedestrian belongs to), the pedestrian will get a new strategic route and will start moving on along that route. If there is no strategic route, the pedestrian will be removed from the scene.

Between two subsequent strategic routing points there may be several possibilities to walk “tactically” (pass-by obstacles left or right, use one of several ramps to change to another level, etc).

Currently, VISSIM computes an internal routing graph consisting of the user-supplied strategic points and of the bottoms and tops of all ramps.

Each vertex A of this graph is connected to each other vertex B as long as they are located on the same “walking partition” – i.e. pedestrians can walk from A to B without changing level and without “loosing walkable ground” inbetween.

Based on this graph, the shortest path between either two strategic points of a pedestrian’s strategic route is determined and used for the tactic movement of the pedestrian.

How routing decisions are applied

If a pedestrian without route (immediately after creation or at the end of his route) enters a walkable area for which a routing decision has been defined including routes for the type of the pedestrian and if the pedestrian does not already have his current strategic route from this decision, a new strategic route will be chosen from the routes defined for the type of the pedestrian.
As for the initial routes, the number of the decision is stored at the pedestrian’s data structure to avoid fetching several routes from one and the same decision again and again.
7.6 Parameters of the Social Force Model in VISSIM

The parameters of the model can be categorized into three groups:

1. Parameters of the original model (by pedestrian type).
2. Parameters of the model extensions for VISSIM (by pedestrian type).
3. Implementation-specific global parameters include all discretization parameters: E.g. for models formulated using a continuous time. As analytical approaches to solve the differential equations are only possible in scenarios of limited size in any respect, time needs to be discretized in some way to make a simulation on a computer possible.

Literature

The original model was published in the following works. Entry [6] gives an overview:


7.6.1 Model Parameters by Pedestrian Type

For each type of pedestrians, parameters derived from the original model can be set. Furthermore additional VISSIM-specific parameters can be set by pedestrian type.
► **tau (τ)**

Tau is the relaxation time, which one can relate to a reaction time or inertia, as it couples the difference between the desired speed and direction \( v_0 \) and the current speed and direction \( v \) to the acceleration \( a \):

\[
a = (v_0 - v) / \tau.
\]

In the folder `..\EXAMPLES\TRAINING\PEDESTRIANS\PARAMETER DEMONSTRATION` you can find training example models specifically demonstrating the effect of this parameter.

► **lambda_mean (\( \lambda_{\text{mean}} \))**

Lambda governs the amount of anisotropy of the forces from the fact that events and phenomena in the back of a pedestrian do not influence him (psychologically and socially) as much as if they were in his sight. From lambda and the angle \( \phi \) between the current direction of an agent and the source of a force a factor \( w \) for all social (i.e. non-physical) forces is calculated that suppresses the force, if \( \phi \neq 0 \) and \( \lambda < 1 \):

\[
w(\lambda) = \left( \lambda + (1 - \lambda) \left( 1 + \cos(\phi) \right) / 2 \right).
\]

So, if \( \phi = 0 \) one has \( w = 1 \) and if \( \phi = \pi \) one has \( w(\lambda) = \lambda \).

In the folder `..\EXAMPLES\TRAINING\PEDESTRIANS\PARAMETER DEMONSTRATION` you can find training example models specifically demonstrating the effect of this parameter.

► **A_soc_isotropic and B_soc_isotropic**

These two parameters together with \( \lambda \) govern one of two forces between pedestrians:

\[
F = A_{\text{soc isotropic}} w(\lambda) \exp(-d/B_{\text{soc isotropic}}) n,
\]

with \( d \) as distance between the pedestrians (body surface to body surface) and \( n \) as unit vector pointing from one to the other.

► **A_soc_mean, B_soc_mean, and VD**

These parameters determine strength (\( A \)) and range (\( B \)) of the social force between two pedestrians. The social force between two pedestrians is calculated as

\[
F = w(\lambda) A \exp(-d/B) n,
\]

if the influencing is in front (180°) of the influenced pedestrian, else it is zero. Here \( w(\lambda) \) is the factor calculated from \( \lambda \), which is explained above, \( d \) is the distance (body surface to body surface) between two pedestrians and \( n \) is the unity vector pointing from the influencing to the influenced pedestrian.

Note that if the parameter \( VD \) is greater than zero the relative velocities of the pedestrians are considered in addition.

In this case the distance \( d \) is generalized to and thus replaced by

\[
d \rightarrow 0.5 \sqrt{d^2 + (d - (v_1 - v_0) VD)^2 - ((v_1 - v_0) VD)^2}
\]

with \( VD \) given in [seconds]. Here \( v_0 \) is the velocity of the influenced and \( v_1 \) the velocity of the influencing pedestrian and \( d \) points from the influencing to the influenced pedestrian with \( |d| = d \). (The “influenced pedestrian” is the one for whom the force is calculated.)

In the folder `..\EXAMPLES\TRAINING\PEDESTRIANS\PARAMETER DEMONSTRATION` you can find training example models specifically demonstrating the effect of parameter \( VD \).
noise
The greater this parameter value, the stronger is the random force that is added to the systematically calculated forces if a pedestrian remains below his desired speed for a certain time. Check this effect like this: Let a group of pedestrians pass a bottleneck of about 70 cm. With noise=0, so-called "arches" will form and stay stable. If the noise value is in the range of [0.8..1.4] then one pedestrian will step back after a while and another other one will pass.

react_to_n
Only the influences of the \( n \) closest pedestrians are considered when the total force is calculated for a pedestrian.

In the folder ..\EXAMPLES\TRAINING\PEDESTRIANS\PARAMETER DEMONSTRATION you can find training example models specifically demonstrating the effect of this parameter.

queue_order and queue_straightness
These two parameters control the shapes of queues. Use values between 0.0 and 1.0. Generally speaking, the greater the parameter values the more orderly the queue will be.

side_preference
This parameter determines whether opposing flows of pedestrians prefer either the right side or the left side for passing each other. Enter -1 for right-side preference or 1 for left-side preference. For uncontrolled behavior as hitherto, enter 0.

In the folder ..\EXAMPLES\TRAINING\PEDESTRIANS\PARAMETER DEMONSTRATION you can find training example models specifically demonstrating the effect of this parameter.

7.6.2 Implementation-specific Global Parameters

grid_size
By this parameter one defines how far at largest pedestrians influence each other.

The pedestrians are stored in a grid with cells of size \( grid_size \times grid_size \) square meters. Each pedestrian only interacts with the pedestrians in the same or adjacent (including over corner) grid cells.
In the folder ..\EXAMPLES\TRAINING\PEDESTRIANS\PARAMETER DEMONSTRATION you can find training example models specifically demonstrating the effect of this parameter.

► **routing_large_grid**
This parameter defines the topological grid-size; *routing_large_grid x routing_large_grid* cells become one cell in the superordinate grid.

The required memory depends on this parameter, but the precision of the calculation of distances to destination areas does not. There is no global value that fits best in any case. For small-sized scenarios (in a building, for example) with numerous small obstacles and numerous walkable areas a low value (< 10) is recommended. For large areas and big obstacles (e.g. simulation of a district not regarding the details) even 100 or more can be set. Since we expect the 64 bit edition of VISSIM to be used mainly for large-scale projects, the default value is 7 for the 32 bit edition and 20 for the 64 bit edition. As long as no memory problems occur in a project this parameter value can be kept. Problems that might occur can be solved by changes to this parameter without subsequent disadvantages.

► **routing_step**
This is one parameter that governs the calculation of the potential. If it is large, the potential is more precise, but its calculation needs more time. Reasonable values are 2, 3, 4 or 5.

► **routing_accuracy**
This is the second parameter that governs the calculation of the potential. It can take values in \([0.0 .. 1.0]\) and results in more precise potentials, the greater it is.

► **routing_obstacle_dist**
During the calculation of the static potential (aka “distance potential field”, “distance look-up table”), grid cells which are close to walls receive a sort of “extra distance” atop of their true distance. By this, one can achieve that more pedestrians decide to choose a wide corridor instead of a narrow one, if there are two corridors from one and the same source to one and the same destination with identical walking distance. Generally, the pedestrians keep some distance toward walls. With this parameter the distance is set to which nearby walls influence the potential field. This parameter only has an effect on the calculation of the static potential. It is not yet considered in the calculation of the dynamic potential.

In the folder ..\EXAMPLES\TRAINING\PEDESTRIANS\PARAMETER DEMONSTRATION you can find training example models specifically demonstrating the effect of this parameter.

► **routing_cell_size**
This parameter defines the distances of fixed data points to be set for the calculation of distances to a destination area. The default value is 0.15 [m]. This default should only be edited if the model included passageways with a width of 50 cm or less since pedestrians will not pass these channels during the simulation. Instead, they will stand still.
apparently not oriented into a particular direction as soon as an area behind the channel is their next (intermediate) destination area. In this case, the value of the parameter can be reduced to 0.1 m. This change increases the memory requirements and further reductions might cause further problems. Therefore, each project should use the default value until reductions are required for troubleshooting purposes.

► **Use_cache**

The pedestrians calculate their desired direction (the direction of the desired velocity) as the gradient of a look-up table (physicists also call it "potential") of distances toward the destination area. Since obstacles are considered in the calculation of this look-up table this calculation is very complex and usually takes some time. To reduce the required time, the look-up table can be saved to disc by setting use_cache=1; thus, if you re-run the simulation without changes to the geometry, the look-up table will be read from disc instead of being calculated anew.

Known bug: From time to time it might happen that VISSIM does not realize that the geometry has changed. In this case, a wrong potential will be read from disc and pedestrians might walk strangely. To solve this problem, set use_cache=0, run the simulation once, and set it back to use_cache=1, if applicable.
7.7 Fields of Application & Requirements

Over the years, the possibilities of simulating public transport passengers or pedestrians have significantly been extended in VISSIM. Since the Pedestrians add-on has been implemented you have – for each project – the choice whether to apply the Wiedemann model which is included in the standard installation or to prefer the detailed Helbing model instead which is provided as Pedestrians add-on.

The various scenarios which can be dealt with require different model data as you can see from the tables below.

Finally you can find a brief introduction to the modelling workflow for the microscopic simulation of public transport passengers as pedestrians in the network.

Main differences between the Wiedemann and the Helbing approach

Obviously, when pedestrians are modeled as a vehicle type (Wiedemann approach) and when by this they are bound to move along user-defined links, the spatial character of their trajectories is fixed in advance by the user, it is an input to the model, not a result (except for the time at which a pedestrian crosses which point of the link). If pedestrians can move freely in two spatial dimensions (Helbing approach), their trajectories are not fixed in advance, but calculated by the model. Therefore this approach is much more flexible, detailed and realistic. However, there are situations, in which the essential elements of the dynamics are produced by the Wiedemann model. An example are projects, where pedestrians have no other role than to impose interruptions to vehicular traffic at signalized intersections.

<table>
<thead>
<tr>
<th>Level of Interaction: Wiedemann Model</th>
<th>Pedestrians add-on</th>
<th>Elements in the VISSIM network</th>
</tr>
</thead>
</table>
| Pedestrians using cross-walks in the road network | Not required | ▶ Links  
▶ Pedestrians as vehicle type |
| PT passengers | Not required | ▶ PT stops  
▶ PT lines as vehicle type  
▶ Stop dwell time distribution or number of boarding passengers |
<table>
<thead>
<tr>
<th>Level of Interaction: Helbing Model</th>
<th>Usable elements that are provided by the Pedestrians add-on</th>
<th>Usable elements that are provided by the VISSIM network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure pedestrian flows, e.g.</td>
<td>Walkable construction elements (ramps/stairs and areas, platform edges and waiting areas included)</td>
<td>None</td>
</tr>
<tr>
<td>☐ Evacuation in case of emergency</td>
<td>Multi-storey, if applicable</td>
<td></td>
</tr>
<tr>
<td>☐ Airport, Hotel etc.</td>
<td>Pedestrians as type/class of pedestrians</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compositions of pedestrians</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Area behavior types, if applicable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Walking behavior parameter sets, if applicable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Location distributions, if applicable</td>
<td></td>
</tr>
<tr>
<td>Pedestrians using crosswalks in the road network</td>
<td>Pedestrians as type/class of pedestrians</td>
<td>Links as walkable space</td>
</tr>
<tr>
<td></td>
<td>Compositions of pedestrians</td>
<td>Signalization</td>
</tr>
<tr>
<td></td>
<td>Area behavior types, if applicable</td>
<td>Conflict areas</td>
</tr>
<tr>
<td></td>
<td>Walking behavior parameter sets, if applicable</td>
<td>Detectors</td>
</tr>
<tr>
<td>Pedestrians as PT passengers in the network</td>
<td>Construction elements (areas as platform edges or waiting areas included)</td>
<td>PT stops</td>
</tr>
<tr>
<td></td>
<td>Multi-storey, if applicable</td>
<td>PT lines as vehicle type with doors</td>
</tr>
<tr>
<td></td>
<td>Pedestrians as type/class of pedestrians</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compositions of pedestrians</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Area behavior types, if applicable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Walking behavior parameter sets, if applicable</td>
<td></td>
</tr>
</tbody>
</table>
7.7.1 Overview: Pedestrians as PT Passengers

The simulation of pedestrians and the simulation of public transport are connected by special modeling elements. Pedestrians can walk to a platform, wait until the public transport vehicle arrives and will board the vehicle after the alighting people have left the train. Alighters will follow the routes which are given to them as soon as they have left a train or bus.

The scenario can easily be modeled using waiting areas, platform edges and the number of boarding and alighting people.

PT stops, PT vehicles and their belonging public transport lines are modeled as before.

► Waiting areas of a stop are the places where pedestrians wait until the arrival of a vehicle of the line they want to board. To define waiting areas for a stop, the user has to create a pedestrian area and select Waiting area for the Public Transport usage option. A waiting area has to be allocated to one or more stops.

► A platform edge is a pedestrian area that belongs to one or more stops. Platform edge has to be selected for the Public Transport usage option.

Alighting pedestrians walk to the nearest platform edge they can reach from their position in the vehicle. If a routing decision has been defined at the platform edge, the pedestrians continue their way. Otherwise, they are removed from the network.

It is possible to create a platform edge along a stop automatically. Therefore, you have to check the Generate platform edge option in the Edit PT stop window. The two options left and right determine the position of the platform edge related to the stop. The area attributes are set automatically, thus changes in the Pedestrian Area window are not required necessarily.

Default data is created if a pedestrian area is assigned to a PT stop either as waiting area or as platform edge and no boarding passenger volumes have been defined for this PT stop.

Those default data is also created for an automatically generated platform edge.

Due to the default data, each pedestrian arriving at the waiting area in the time interval 0 – 99999 will board any vehicle of any PT line.

Alighting pedestrians are created according to the data in the PT Stop Data window.

For each line and each stop event you need to define the percentage of alighting passengers.

Additionally, you have to select a pedestrian composition for the alighting passengers in the PT Stop Data window. This composition determines the types of pedestrians that will be created inside the vehicle.

Moreover, the user can define for each stop on which side the pedestrians are allowed to board or to alight respectively. You may select either side or
both sides. The default behavior has no restrictions: all doors on both sides can be used for boarding and alighting.

Boarding pedestrians wait on a waiting area of a particular stop. In order that a waiting area can be reached by pedestrians, it has to be defined as a route destination.

Based on the boarding data of a stop, it is determined which lines the boarding pedestrians want to travel with. If a vehicle of one of these lines arrives at the stop, the boarding pedestrians walk straight to the nearest door. Once, all alighting pedestrians have left the vehicle, the boarding pedestrians board.

A vehicle departs from a stop as soon as the departure time is reached and nobody has boarded during the last 3 sec. The departure time results either from the timetable or from the preset dwell time. For the timetable-based departure time the line’s Slack time fraction is considered.

For boarding passengers as well as for alighting passengers you can define the distribution of the passengers to the doors. For boarding pedestrians, select the distribution in the Pedestrian areas window, for alighting pedestrians set the distribution in the PT stop data window. Use the option Late boarding possible to configure how a PT vehicle having a timetable-based departure time or a predefined dwell time for departure time calculation will handle a never-ending flow of boarding pedestrians.

If a pedestrian was not able to board the vehicle, e.g. for capacity reasons, the pedestrian moves back to a waiting area.

Default data for boarding pedestrians is also generated for a platform edge or waiting area which has been allocated to a PT stop for which no boarding passenger share has been entered yet. According to the default data each pedestrian who arrives at one of the waiting areas of this PT stop, will board the next vehicle of any line serving this stop.

Another improvement is the possibility to define doors for 2D vehicle models. A door is defined by its position (relative to the leading edge), its width and one of the vehicle sides.

For each door you can specify whether it can be used for boarding only or for alighting only or for boarding and alighting as well.

These settings are stored in the Geometry window.

The properties of doors are derived automatically from the 3D model (if any). The user can add or delete doors by using the context menu and modify the data directly in the table in the [DOORS] tab.

If changed values do not match the 3D model a warning appears. Nevertheless, you can confirm the new values. The data set in this window is used for simulation only, whereas the 3D model values are used for the visualization of opening/closing doors in 3D mode.

If not even a single door has been defined for a vehicle, a temporary door will be created at the middle of the vehicle length. This way it is ensured, that pedestrians can alight from the vehicle and board the vehicle. To provide this information, a warning is logged to the trace file.
7.7.2 Step-by-Step Instruction: Pedestrians as PT Passengers

This section describes step by step how to create a public transport interface for pedestrians (i.e. a public transport station). All construction elements are explained in detail in the manual. You will find links here on occurance.

1. First create a Link, cf. section 6.3.1.1

2. Create a Public Transport Stop, cf. section 6.5.1.1
   If you tick one or both of the Generate platform edge boxes, a Pedestrian Area is created on the corresponding side of the link that has the property Public Transport Usage: Platform Edge. When there is more than one Level, VISSIM tries to guess the correct level depending on the height of the link.
If at a stop a Public Transport Usage area is attached, VISSIM calculates the occupancy of a train leaving the station not from the numbers that are specified as Boarding Passengers, but from the number of passengers that have actually boarded the train in the microscopic simulation.
3. Create a *Public Transport Line*, cf. section 6.5.2.1

![Image of VISSIM interface](image)

4. Edit the *Line Stop Data*, cf. section 6.5.2.5.
   - Activate the stop
   - *Alighting percentage*: Set the ratio alighting passengers / total occupancy
   - *Alighting location*: Distribute the alighting pedestrians to the doors available for alighting
   - Choose which side of the vehicles of the line should be available for alighting and boarding
   - Set the timetable-based departure time (fix value) and/or the minimum dwell time (dwell time distribution), if applicable. Taking the slack time fraction into account, these three values determine how long the stop event will last at least. From the timetable-based departure time and the slack time fraction the real departure time is calculated. The PT vehicle will depart at the later moment in time after comparison of this instant and the moment in time that is calculated from the minimum dwell time.
   - If the option *Late boarding possible* is checked the PT vehicle will not depart at this instant but stay at the PT stop as long as still pedestrians flow in who intend to board the vehicle. Except for a break in this flow, only the capacity of the PT vehicle defines the upper limit of the PT vehicle’s dwell time (please refer to menu BASE DATA – VEHICLE TYPES… - EDIT… - SPECIAL – PT PARAMETERS).
5. Choose an appropriate 3D Model, cf. section 5.2.5.2.
6. Edit the doors of the train or bus
   - Number
   - Position
   - Width
   - Z offset
   - Side
   - Usage
7. Create some more station geometry
8. Create a *Pedestrian Route Decision* on the Platform Edge Area and at least one *Pedestrian Route* leading somewhere the alighting passengers are meant to walk to, cf. section 7.1.8.
9. Create an area, where boarding passengers shall wait for the train or bus.
10. Create a Pedestrian Input as source of boarding pedestrians, cf. section 7.1.7.
11. Create a Route from this input to the Waiting area

12. Set the capacity of the tram or bus.
8 Simulation and Test

The parameters apply to the simulation of both vehicles and pedestrians. For additional parameters for the simulation of pedestrians please refer to section 7.5 et seqq.
8.1 Simulation of Vehicles and Pedestrians

Use the menu command SIMULATION – CONTINUOUS or SIMULATION – SINGLE STEP to start a simulation run.

- Starts the continuous simulation. **F5**
- 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**
- Terminates the current simulation run. **Esc**

Via SIMULATION - MULTIRUN, the parameters for a multirun simulation can be set and the run can be started.

In order to get a good impression of the possible stochastic spread of results it is recommended to run multiple simulation runs with different random seeds.

In case of extensive networks with numerous vehicles, the VISSIM 64 bit edition may provide simulation results which differ from those calculated by the 32 bit edition due to small differences in internal rounding.

8.1.1 Simulation Parameters

Parameters for the next simulation or test run can be set in the *Simulation Parameters* window that is accessible via SIMULATION – PARAMETERS...
- **Comment**: Text to identify the simulation run. The comment line is stored in the input file and included in both printouts of the network and in output files.

- **Traffic regulations**: Specifies the standard driving side (e.g. Great 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.

- **Start Date**: Can be used to specify a date for signal controllers that have a date-dependent logic. This date is passed to the controller DLL.

- **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. We recommend 3 or more time steps per simulation second. The change of simulation speed is inversely proportional to the number of time steps.

On a fundamental level the simulation is a numerical integration of the system of coupled differential equations. The intended solution would be a continuous integration.

This means that the numerical solution (the simulation) in time steps is only an approximate solution of the equation system, which gets worse when the length of time steps in the integration process is increased.

This fundamental level of the simulation on the operational level receives "orders" from a supervising level within VISSIM.

An example for such an order is: "Destination area 1 is reached, the next destination area is area 2".
The larger the time intervals between the communications between the operational and the supervising level the more the simulation on the operational level can develop into a wrong direction.

For the simulation of vehicles one can typically allow for a bit larger time steps than for the simulation of pedestrians as for pedestrians in their two spatial dimensions there are more possibilities (degrees of freedom) to run astray. The possibility to choose 1 simulation step per second therefore can be fine for a vehicles-only simulation. It can also be fine during the building process of a model including pedestrians, but once problems occur and for the evaluation and measurement 5 or 10 simulation steps per second should be set if pedestrians are included in the model.

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 also controls the playback speed of *.AVI files recorded with VISSIM. Please take note of this dependency when choosing the simulation resolution for a new project.

If pedestrians are included in the simulation, the Simulation Resolution value is not subject to changes during the simulation run.

- **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 and therefore results may also change. In this way, the stochastic variation of input flow arrival times can be simulated. For meaningful results it is recommended to determine the arithmetic mean based on the results of multiple simulation runs with different random seed settings.

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.

Instead of running multiple simulation runs with different random seeds, a multirun simulation can be started via Simulation - Multirun, cf. section 8.1.3.

- **Simulation Speed:** The number of simulation seconds to a real time second. If maximum is selected, the simulation will run as fast as 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 achieved actual simulation speed depends on the size of the 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.

• **Number of cores:** Select the number of processor cores to be used during simulation. The maximum number depends on the hardware of the computer where VISSIM is run. The selected value is kept for the next simulation start. The default value is 1. The number of cores is stored in the *.INP file. During a simulation, this parameter is not subject to changes.

The simulation of pedestrians will always use all of the cores specified here, even if models with only a single level are simulated.

### 8.1.2 Saving the Simulation State (*.SNP)

A snapshot file (*.SNP) is used to save and restore the current simulation state. Thus it is possible to run a certain portion of the simulation (e.g. warm-up period), save the simulation state and restore it, e.g. in order to look at different signalization options from there.

The snapshot file contains the following data at the current simulation time:

- all vehicles located on links/connectors and in parking lots including their current interaction state (public transport vehicles included)
- all passengers in PT vehicles and at PT stops
- the states of priority rules
- the state of all fixed-time and VAP controllers

It does **not** store the following:

- the state of any other external signal controllers
- cost and path information from Dynamic assignment
- the state of route guidance systems
- any network data
- display settings
- evaluation data

It is **not** possible to use the snapshot functionality in the following cases:

- with external signal controllers other than VAP
- during a Dynamic Assignment (when the cost and/or path file is updated)
- where evaluation files started before the snapshot file begins

A snapshot file can only be loaded with the VISSIM version that was used to save the *.SNP file.
If the VISSIM network was changed between saving and loading the snapshot file, the behavior of VISSIM is undefined (it might even crash).

The snapshot file does not yet include simulation of pedestrians data.

**Definition**

To create a snapshot file follow the steps outlined below:

1. Run the simulation.
2. Select Single step mode at the time when a snapshot file should be created.
3. Go to SIMULATION – SAVE SNAPSHOT and enter the desired file name.

To continue a simulation from a snapshot file follow the steps outlined below:

1. Ensure that the corresponding network file (*.INP) has been loaded and no simulation is active.
2. Go to SIMULATION – LOAD SNAPSHOT and choose the desired file name.
3. Continue the simulation.

The simulation then continues as if it was not interrupted. Any evaluations that should begin after the start time of the snapshot file will be evaluated as usual.

### 8.1.3 Multirun Simulation

Use the multirun simulation feature to automatically run multiple simulation runs.

Typical applications are:

- Variation of random seed
- Dynamic Assignment iterations
- Successive increase of traffic demand with Dynamic Assignment

In contrast to single simulation runs the particular case-specific parameter (e.g. random seed) is changed for every simulation run of a multirun simulation.

For other settings please refer to:

- Simulation parameters (cf. section 8.1.1) and
- Dynamic Assignment settings (cf. section 12.8.6).

For output of the desired evaluation files, these need to be selected and configured via EVALUATION - FILES prior to the multirun start.

For Dynamic Assignment all settings need to be done in TRAFFIC - DYNAMIC ASSIGNMENT prior to the multirun start.
Properties & Options

SIMULATION – MULTIRUN... opens the Multirun window where all additional settings for the multirun simulation are done.

- **Starting random seed**: cf. section 8.1.1 Random seed.
- **Random seed increment**: Offset that will be added to the random seed for every subsequent run. The stochastic variation is independent of the size of the number. When using Dynamic Assignment this parameter should be set to 0.

For a multirun simulation with different Starting random seed numbers, the Random seed increment is decisive. In this case, the particular starting random seed value which serves as index of the simulation run is attached to the evaluation file *.LDP.

- **Number of runs**: Amount of automatic simulation runs to be done. Depending on the application 5 to 20 runs are recommended. When using Dynamic Assignment more runs might be necessary.
- **Dynamic Assignment Volume Increment** (refers only to Dyn. Assignment): When using Dynamic Assignment the total demand can be increased successively (similar to command line parameter -v). The start value is taken from the parameter "Scale total volume to" from the Dynamic Assignment (cf. section 12.8.6). For every iteration the demand is increased by this value until 100% is reached.
  
  Please note, that the start value should not exceed 100% demand.
- **Evaluation files directory**: Directory where the evaluation and error files are saved. Press ... to select a different directory. The flag being added to the name of the output file by iteration run indicates the actual random seed value automatically calculated from the start random seed plus the particular difference resulting from the random seed increment by run. Since existing files with identical filename are overwritten without warning, careful selection of the output folder is recommended. As usual, *.BEW and *.WEG files are saved to the project directory containing the *.INP file.
- **Create archived cost and path files**: If this option is active, existing output files *.BEW and *.WEG stored in the same folder as the *.INP file will be renamed. Numbers will be added to the filenames prior to creating new output files. Thus the data file archive allows for subsequent analyses of changes during Dynamic Assignment. You even might start...
calculation from an elder assignment state. If this option is active, existing output files *.BEW and *.WEG are replaced.

- **CLOSE**: Closes the window and stores the current settings internally until the VISSIM session is terminated.
- **START**: Closes the window, stores the current settings internally and starts the multirun. The status bar shows the number of the current run and the total number of runs (in parentheses). The evaluation files are saved to the directory set in the parameters.

The settings are saved with the *.INP file.

If the selected evaluation directory is a sub-folder of the current data directory (or the data folder itself), a relative path is saved. Thus, copying the *.INP file to a different folder will cause subsequent evaluations to be written to a subdirectory of the new folder or to the new folder itself.

It is not recommended to use the variation of random seeds in combination with Dynamic Assignment as ping pong effects may occur.

To get statistically sound results all vehicle inputs need to have the *exact volume* property enabled (in contrast to *stochastic volume*).
8.2 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, PT signal priority or queue “flush-out”. VISSIM discriminates between the following detector actuations:

<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>

8.2.1 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 to create a Signal/Detector protocol (cf. section 11.9), 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 functionality using Test – Recording.
5. Start the test function with Test – Continuous or Test – Single Step.

<table>
<thead>
<tr>
<th>Starts the continuous Test run.</th>
<th>F5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calls the next step in the Single step mode; Allows also toggling from Continuous to Single Step mode during the Test run.</td>
<td>F6</td>
</tr>
</tbody>
</table>

6. Activate individual detector calls by clicking:

- **Left** mouse button: In Single Step mode, switch from no actuation (black) to single actuation (blue) and to repeated actuation (cyan) and back to no actuation.
- **Right** mouse button: Place (as well as terminate) a continuous actuation (purple).
### 8.2.2 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 in each the following cases:

- A test run with a fixed set of detector calls is to be evaluated under different control strategies.
- Different, but similar test runs are to be evaluated.

A macro for a test run can be created in two ways:

1. Use one of the options to place the detector calls interactively:
   - option RECORDING
   - the macro editor

**Recording**

To create 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**, cf. section 8.2.1.
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**.

**Editing**

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 list.

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 PT 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.

**Application**

For each test run, please follow the steps outlined below:

1. Macro file recording (and editing, if applicable).
2. Adjust control logic parameters to the particular test scenario.
3. Enable evaluation(s), if applicable.
4. Start test run via TEST – MACRO – RUN...
5. Save evaluations, if applicable.

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 an SC/Detector protocol is generated for each test scenario. It is recommended to name each *.LDP file like the particular macro test file (*.M_I) that was used for generating the *.LDP file.

### 8.2.3 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 PT 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).

In an output file *.SLO, VISSIM logs all signal changes that occurred during the test run. This output file is used to prepare the following analyses:

<table>
<thead>
<tr>
<th>Red Time Distribution</th>
<th>Waiting times for test phase vehicles depending on the cycle second in which the preemption call occurred</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Time Statistics</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>
</tr>
<tr>
<td>Time-Time-Diagram</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 comments (text following 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 PT 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
-- 185p98s4.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>VLZ</td>
<td>Startup time (before preemption event)</td>
<td>LDT</td>
</tr>
<tr>
<td>NLZ</td>
<td>(Optional) recover time (after preemption event): 120 s</td>
<td>CTI</td>
</tr>
<tr>
<td>BUM</td>
<td>Total number of analyzed cycles, (if applicable, otherwise delete this line)</td>
<td>NCY</td>
</tr>
<tr>
<td>ASL</td>
<td>Total number of nested loops</td>
<td>NLO</td>
</tr>
<tr>
<td>AST</td>
<td>Total number of detectors with continuous demand, followed by STE</td>
<td>NCA</td>
</tr>
<tr>
<td>STE</td>
<td>Numbers of the detectors with continuous demand, only following AST</td>
<td>CAC</td>
</tr>
<tr>
<td>ALF</td>
<td>Total number of detectors with repeated demand (recall), followed by LFD</td>
<td>NRA</td>
</tr>
</tbody>
</table>
8.2.3.1 Red Time Distribution (*.AWZ)

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. Via TEST - LOOP – RUN, load an *.SLF file and create a loop output file *.SLO.

2. Create the red time distribution file via TEST - LOOP – ANALYZE – WAITING TIMES DISTRIBUTION.... from the *.SLO file.

VISSIM creates a file with the extension *.AWZ and the following content:

```
1  1 *
2  1 *
3  1 *
4  1 *
5  1 *
6  1 *
7  1 *
8  1 *
9  1 *
10 1 *
1.0
```

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.
8.2.3.2 Green Time Statistics (*AGZ)

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 (*BEL, see example below) and set parameters accordingly. A demand file is required for comparing actual and necessary green times and has the following structure:

   -- Intersection Demand File for VISSIM/Test/Loop
   -- 185p98s4.BEL
   LSA          1 -- controller #
   ASL          1 -- # of nested loops
   BELASTUNG   12 -- preempting 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  170  SAETTIGUNG 1770  BASISGRUEN  6
   SGP  6  BELASTUNG 1125  SAETTIGUNG 3725  BASISGRUEN 49
   SGP  8  BELASTUNG  845  SAETTIGUNG 3686  BASISGRUEN 42

2. Generate the green time statistics file with the extension *.AGZ via TEST-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

   Distribution of green times:
   13  1 *
   14  7 ******
   15  0
   16  0
   17  2 **
8.2.3.3 Time-Time Diagram (*.AZZ)

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

   10        20        30        40        50        60

   1  BBBBBBBBBBBBBB   DDDDEEEEEEEEE
   2  BBBBBBBBBBBBBB   DDDDEEEEEEE
   3  BBBBBBBBBBBBBCC   DDDDEEEEEE
   4  BBBBBBBBBBBBBCC   DDDDEEEE
   5  BBBBBBBBBBBBBCCCA  DDDDEEEE
   6  BBBBBBBBBBBBBCCCA  DDDDEE
   7  BBBBBBBBBBBBBCCCAA  DDDDE
   8  BBBBBBBBBBBBBCCCAAAA  DDD
   9  BBBBBBBBBBBBBCCCAAAAA  DDD
   10 BBBBBBBBBBBBBCCCAAAAAA  DDD

   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).
9 Presentation

For presentations, you can use two types of record files. This chapter describes the recording work flows:
► Animation files, cf. section 9.1
► 3D Video files, cf. section 9.2
9.1 Animation

For the purpose of reviewing simulation runs and ease of presenting those runs, VISSIM offers the option of recording simulation sessions - even simulations of pedestrians - 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 direction thus 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 can also be recording with Alternative Link Display for vehicular traffic or LOS display for pedestrians. On behalf of that, the aggregate parameters display needs to be active during recording (cf. section 4.1.1 for vehicles and section 7.3.3 for pedestrians).

3D signals are not included in the animation file and thus will not show while running an animation in 3D mode. In this case recording an *.AVI file is recommended.

Since an animation only replays the graphics the animation runs are much faster than the actual simulation.

9.1.1 Record Animation File

To record an animation, follow the steps outlined below:

1. Select PRESENTATION - ANIMATION PARAMETERS... to open the Animation Parameters window.

2. Press NEW... next to the Time Intervals list and define an interval to be recorded. There may be multiple intervals for a single simulation run but they may not overlap.

3. Press NEW... next to the Areas list to activate the main VISSIM window. Draw one or more areas by moving the mouse while holding down the left mouse button. Only vehicles/pedestrians simulated within at least one of these boxes will be included in the animation file.

4. Uncheck the option □ Save vehicle/pedestrian positions to record only aggregated data instead of individual vehicles/pedestrians. Then the animation file will not save display information and thus will be much smaller.
If option ☑ Save vehicle/pedestrian positions is active during the recording of aggregated data, the positions will be saved additionally. Thus movements can be shown alternatively during the animation run.

The wording of this option regards the active modules, i.e. without pedestrians add-on, only vehicles are mentioned.

5. Before starting the simulation, PRESENTATION - ANI RECORDING must be activated. Then the parameters described above will be saved to the animation file during the next simulation run. After the simulation run, the RECORDING option will be deactivated automatically.

When the *.ANI file is recorded, also the colors of those segments are saved to file for color-coded display of aggregated values, which are not completely located within the user-defined network sections.

9.1.2 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></th>
<th>Starts the continuous animation.</th>
<th>F5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Calls the next animation step in the Single step mode; Allows also for toggling from Continuous to Single Step animation mode during the animation run.</td>
<td>F6</td>
</tr>
<tr>
<td></td>
<td>Terminates the current animation run.</td>
<td>Esc</td>
</tr>
<tr>
<td></td>
<td>Continuous in reverse direction.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Single-step mode in reverse direction.</td>
<td></td>
</tr>
</tbody>
</table>

9.1.3 Record ANI.TXT File (optional module)

Via PRESENTATION - ANI.TXT RECORDING, network data and trajectories of cars and pedestrians and also the states of the signal controllers and of the detectors are saved to a text file for the import in Autodesk’s 3DS MAX software.

For this add-on, the folder ..\API\3DSMAXEXPORT of your VISSIM installation has various subfolders which store a script in Autodesk’s macro
language for import of the generated data files in 3DS MAX as well as some example vehicle models (3D) and instructions and more information.
9.2 Recording 3D Video files

VISSIM can record a video of a 3D simulation run using the *.AVI data file format. To set up VISSIM to record an *.AVI file follow the steps outlined below.

9.2.1 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: If 10 time steps are chosen (recommended value), the playback speed will be twice as fast as real time. When using only 1 time step, then the resulting playback speed will be 20 times faster than 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 options provided additionally to *.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 used, *.AVI file 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).

9.2.2 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).

9.2.2.1 Creating

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. Click **PRESENTATION - 3D-VIDEO - KEYFRAMES**... to call the **Keyframe** window. It contains a list of all defined keyframes.
3. Press NEW... to create a new keyframe entry in the list. Define the keyframe properties 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, click OK to close the list of keyframes.

### 9.2.2.2 Properties & Options

For access to the properties of a keyframe, click PRESENTATION - 3D-VIDEO - KEYFRAMES.... For list or data editing, cf. section 9.2.2.3.

- **Name**: Label or comment
- **Starting time**: Start time of this keyframe:
  - If option *Absolute start times* is checked in the keyframe list the time entry refers to the start of the simulation. The keyframe starts as soon as the simulation second equals the entered starting time.
  - If option *Absolute start times* is not checked in the keyframe list the start time is interpreted as the time relative to the moment when the AVI RECORDING command was activated.

Changing the *Starting time* also allows for changing the sequence position of the keyframe.

- **Dwell Time**: The time the simulation will be viewed without movement from the position defined by this keyframe.

Using the *Starting time* and *Dwell time*, VISSIM performs a check whether the current keyframe fits into the existing keyframe sequence: Neither for the start time nor for the dwell time of a keyframe a value can be set that intersects with the dwell time of another keyframe. However, all subsequent keyframes may be shifted to accommodate for the new starting time and/or dwell time by activating the option *Shift subsequent Keyframes* (see below).

- **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

- Shift subsequent Keyframes: Moves the start times of all subsequent keyframes according to the current settings for the selected (new or edited) keyframe:
  - When inserting a new keyframe (KF) between two keyframes in the existing keyframe sequence, VISSIM checks that the start time of the new keyframe is later than the dwell time end of the previous one. If so, then VISSIM changes the start times of all subsequent keyframes by $\Delta t = \text{start time new KF} + \text{dwell time new KF} + \text{movement time previous KF} - \text{start time next KF}$. By adapting the next KF’s start time accordingly, VISSIM ensures that the (calculated) movement time to the keyframe following the new keyframe is retained. Thus it remains the same as it was before the new keyframe was inserted.
  - When editing an existing keyframe, all subsequent keyframes are moved to accommodate for the new start and dwell times. I.e., the start times of all subsequent keyframes are moved by $\Delta t = \text{new start time} - \text{old start time} + \text{new dwell time} - \text{old dwell time}$.

As long as option Shift subsequent Keyframes is checked, an existing keyframe cannot be moved before any previous keyframe.

9.2.2.3 Editing

The list of keyframes 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 can be 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**: Provides access to the properties of the selected 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 the START button calls the display of the camera movement through the selected keyframes in the list. This simulates the movement during recording of an *.AVI file in the selected speed. The preview can be canceled with Esc.
- **Columns**:
  - The *Movement* time between two keyframes is computed automatically as the difference between start and dwell times 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, it is indicated by the starting letter(s) of the corresponding type.
  - The *Focal Length (Field of View)* column contains current settings by keyframe, cf. section 4.3.1.3
- **Absolute Start Times**: If this option has been checked, the *Start times* are regarded as absolute simulation times.

If this option has not been checked, start time data counts from the moment in time when the AVI RECORDING command is activated in the PRESENTATION menu. Thus the process does no longer automatically start from the moment when the AVI RECORDING command is clicked. Via menu PRESENTATION – 3D-VIDEO – KEYFRAMES, the start can be delayed with a start time entry > 0 s for the first keyframe. Thus you can enter *Start time* = 0 for the first keyframe to start the run immediately by clicking the AVI RECORDING command as usually.
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.

9.2.2.4 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 display

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 the first 
starting time which not necessarily needs to be the start time of the 
simulation. 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 of the VISSIM functions, 
commands and hotkeys are available.

9.2.3 Starting the AVI 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, set the start time of 
the first keyframe accordingly. 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 opens to receive the desired video compression codec. It is highly recommended to use video compression since *.AVI files become very large without compression. The compression modes available depend on the system configuration. Some compression modes offer additional configuration to be set in this window.

Be aware that some compression codecs might not be compatible for use with *.AVI recording (in contrast to playback). As the behaviour depends on the system configuration, the easiest way to check this beforehand is to record a short sample *.AVI and try to run it after completion. If the newly generated *.AVI file does not run, try a different video codec.

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.

5. Confirm with OK in order for the *.AVI file to be recorded. The *.AVI file is now recorded while the simulation is active.

The selection dialogs for the name of the *.AVI file and for the video codec are displayed prior to the simulation initialization which takes more time the more pedestrian areas are in the network.

Recording an *.AVI file can take substantially longer than a normal 3D simulation, especially if the Anti-Aliasing option is activated.
10 Output of 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 and/or in a database.

Due to improvements and enhancements of the driving behavior in newer versions the output results may differ from older VISSIM versions.

The definition and configuration process along with sample results is described in chapter 11 by evaluation type.

For the Pedestrians add-on, the evaluations are described in section 7.2.

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 13.
10.1 **Enabling Evaluations**

Apart from definition and configuration, evaluations need to be enabled in order to produce the desired output.

files and/or databases or display evaluation data online during a simulation/test run.

The table provides an overview of the various evaluations:

- **Window** column: Online display in a window during a simulation/test run (cf. section 10.1.1)
- **Raw data** column and **Comp. data** column: Output of raw data and/or compiled data to file (cf. section 10.1.2)
- **MDB** column: Output of raw data and/or compiled data to a database (cf. section 10.1.3).
- **Config.** column and **Filter** column: For numerous evaluation, customized configuration or filter settings can be saved to file for later use.

<table>
<thead>
<tr>
<th>Evaluation type</th>
<th>Raw data</th>
<th>Comp. data</th>
<th>Config.</th>
<th>Filter</th>
<th>MDB</th>
<th>Window</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observer</td>
<td>*.BEO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Export</td>
<td><em>.</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Veh. Record</td>
<td>*.FZP</td>
<td>*.FZK</td>
<td>*.FIL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Veh. Information</td>
<td></td>
<td>*.FZI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nodes</td>
<td>*.KNR</td>
<td>*.KNA</td>
<td>*.KNK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data collection</td>
<td>*.MER</td>
<td>*.MES</td>
<td>*.QMK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Performance</td>
<td>*.NPE</td>
<td>*.NPC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PT Wait time</td>
<td>*.OVW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel times</td>
<td>*.RSR</td>
<td>*.RSZ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lane change</td>
<td>*.SPW</td>
<td></td>
<td>*.LCF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Queue length</td>
<td>*.STZ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Link evaluation</td>
<td>*.STR</td>
<td>*.SAK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delay</td>
<td>*.VLR</td>
<td>*.VLZ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle inputs</td>
<td>*.FHZ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluation type</td>
<td>Raw data</td>
<td>Comp. data</td>
<td>Config.</td>
<td>Filter</td>
<td>MDB</td>
<td>Window</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------</td>
<td>------------</td>
<td>---------</td>
<td>--------</td>
<td>-----</td>
<td>--------</td>
</tr>
<tr>
<td>Analyzer database</td>
<td>*.MDB</td>
<td>*.XLS</td>
<td>*.XML</td>
<td>*.PDF</td>
<td></td>
<td>☑</td>
</tr>
<tr>
<td>Special evaluations</td>
<td><em>.A</em>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paths (Dyn. Assignment.)</td>
<td>*.WGA</td>
<td></td>
<td>*.WGK</td>
<td>*.WGF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convergence</td>
<td>*. CVA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managed lanes</td>
<td>*.MLE</td>
<td></td>
<td>*.MLC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal times table</td>
<td></td>
<td></td>
<td>*.SZP **</td>
<td></td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Distribut. of green times</td>
<td>*.LZV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SC/Detector record</td>
<td>*.LDP</td>
<td></td>
<td>*.KFG</td>
<td></td>
<td></td>
<td>☑</td>
</tr>
<tr>
<td>Signal changes</td>
<td>*.LSA</td>
<td></td>
<td></td>
<td></td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Pedestrian Information</td>
<td></td>
<td></td>
<td>*.PDI</td>
<td></td>
<td></td>
<td>☑</td>
</tr>
<tr>
<td>Ped: Area evaluation</td>
<td>*.MERP</td>
<td>*.MESP</td>
<td>*.MESPK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pedestrian record</td>
<td>*.PP</td>
<td></td>
<td>*.PDK</td>
<td>*.PIL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ped: Travel times</td>
<td>*.RSRP</td>
<td>*.RSZP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ped: Queues</td>
<td></td>
<td></td>
<td>*.PQE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** For the Signal times table window, the output has to be configured via menu SIGNAL CONTROL – EDIT CONTROLLER in the [SigTimTblConfig] tab and can be saved to file there as well.
10.1.1 Output to Window

Click menu Evaluation - Windows to enable the appropriate Window output.

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 more details cf. section 11.6.

► **Pedestrian Information...**: Configuration of the pedestrian information data that will be displayed when double-clicking on a pedestrian during a simulation run.

For more details cf. section 7.2.5.

► **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 more details cf. section 11.8.

► **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 more details cf. section 11.9.
**10.1.2 Output to File**

File output is enabled through the *Evaluations (File)* window which can be accessed by **EVALUATION – FILES...**

Three tabs are provided:
Output of Results

**[VEHICLES]**

- Evaluations of vehicle traffic, cf. chapter 11

**[SIGNAL CONTROL]**

- Evaluations of signal control, cf. chapter 11

**[PEDESTRIANS]**

- Evaluations of pedestrians, cf. section 7.2

For data output during the simulation run, tick the box adjacent to the evaluation option. If applicable, check the configuration and filter settings by evaluation type.
The filenames of the corresponding output files are generated as follows:

<table>
<thead>
<tr>
<th>Output file</th>
<th>Name of the input file + evaluation type specific output file extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration file</td>
<td>Name of the input file by default + evaluation type specific configuration file extension</td>
</tr>
<tr>
<td>Filter parameter file</td>
<td>Name of the input file by default + evaluation type specific filter file extension</td>
</tr>
</tbody>
</table>

Default names can be replaced by the user. To filenames, the Windows filename conventions apply. A filename may contain blanks or specific characters such as _+-$.# and the German äÖüß or the French Ç œ, for example.

For the complete list of VISSIM output files, please refer to section 14.1.

For output of compiled data, the user can set up a specific configuration. Raw data output always includes all of the provided parameters.

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 simulation run.

### 10.1.3 Output to Database

VISSIM also allows to output some data in a database format. Currently database output is possible for the following evaluations:

- Vehicle records
- Link evaluations
- Paths (Dynamic Assignment)
- Travel Times (raw data)
- Delays (raw data)
- Signal changes
- Queue lengths
- Node evaluations (raw/compiled data)
- Pedestrian records

For each activated evaluation type with option *Database output* checked, a special table is created in the database file.
Furthermore, the database contains the table `EvalInfo`, which stores the list of evaluations selected for database output with the user-defined table name assigned to each evaluation.

Additionally, the VISSIM Analyzer allows for saving a user-defined report to a database.

### 10.1.3.1 System Requirements

All SQL:1999-compatible databases are supported. Database connections via SQL fit for the 32 bit edition and the 64 bit edition of VISSIM and have proved successfully. We recommend to use the gratis MS SQL Server 2008 Express Edition. Download the latest version from [http://www.microsoft.com](http://www.microsoft.com). There, browse for “SQL Server 2008 Express” and follow the instructions.

For a successful installation the user must be logged in with administrator rights. Database output tests have been performed with Microsoft™ Access™ and Oracle™.

### 10.1.3.2 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™, one of the buttons ACCESS 97, ACCESS 2007, or ACCESS 2000/XP is to be used.
MS Access can only be applied to the 32 bit edition of VISSIM.

For Access 97 at least the Jet 3.51 OLE DB Provider must be installed on the computer.

For Access 2000/XP at least the Jet 4.0 OLE DB Provider must be installed on the computer.

Option Access 2007 is only provided, if Office 12.0 Access Database Engine OLE DB Provider has been installed on the PC.

- Evaluations Database: 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 checked, VISSIM prompts the user to confirm overwriting an existing database.

**Data Link Properties**

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” and “Oracle” providers have been tested with VISSIM).
The connection properties depend on the provider. Only selected properties are listed below:

- **Access 2003** (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.

- **Access 2007** (Access Database Engine OLE DB Provider)
  - **Data source**: Name of the database source file (*.ACCDB).
  - **Storage location**: Name of the storage location.

- **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.

Further properties depend on the selected provider. Typically these properties can be left at their default values.

### 10.1.3.3 Database Output Data

The database output (what information is to be stored as *.MDB) 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 records: cf. section 11.7
- Link evaluations: cf. section 11.11
- Paths (Dynamic Assignment only): cf. section 11.21
Enabling Evaluations

► Travel Times (raw data): cf. section 11.1
► Delays (raw data): cf. section 11.2
► Signal changes: cf. section 11.10
► Queue lengths: cf. section 11.4
► Node evaluations: cf. section 11.12
► Pedestrian records: cf. section 7.2.3

Section 11.24 describes the VISSIM Analyzer.

Direct data output to a database may reduce the simulation speed. During the simulation you can save the output data as text file (ASCII) and import this file into a database once the simulation is finished.

**Import example**

Import the *.FZP file in MS Access:

1. Use a text editor to open the *.FZP file.
2. In the file, delete all data above the data block.
3. Save the file, replace the original extension by *.TXT.
4. In Access, use **FILE - NEW** to create an empty database.
5. Click **FILE – EXTERNAL DATA - IMPORT** to import the text file.

Make sure, that file type **Text files** has been selected in the **Import** window.

6. Click **IMPORT**.
   
   The **Text import assistant** appears.

7. Check option **With separator** and click **NEXT**.

8. Check option **Semicolon** and **First row contains names** and click **NEXT**.

9. Check option **New table** and click **NEXT**.

10. For each column, select the appropriate **data type** (Double, Integer or Text) from the list and click **NEXT**.

11. Check option **No primary keys** and click **NEXT**.

12. Click **FINISH**.
10.2 Runtime Messages

During a VISSIM session, messages and warnings are displayed on screen to ease user interactions.

10.2.1 Protocol Window

In the protocol window, messages, error messages and warnings are listed. There are two ways to call the protocol window:

► Click menu HELP – PROTOCOL WINDOW.
► Click CTRL+SHIFT+F10.

- **Bring always to front**: As soon as a new warning appears, the window is displayed on top.
- **CLEAR** removes all entries from the list. To delete a single entry, mark the row and press DEL.
- **OPEN LOG FILE** opens the protocol file VISSIM_MSGS.TXT in a text editor on screen.
- **Time**: The moment in time when the message was generated.
- **Type**: Type of the network object (e.g. Node)
- **ID**: The ID of the network object
- **Description**: The message in detail.

If the Type and ID of a network object (e.g. nodes and links) are allocated to a message, then you can zoom into this network section.

The consistency check which is automatically run prior to the start of a simulation of pedestrian flows returns warnings and error messages in the protocol window. Click one of the warnings which are listed in the protocol window: VISSIM will switch to the appropriate editing mode and select the particular element while zooming to the network position. This does not work as long as the simulation is running.

The log file VISSIM_MSGS.TXT

During each VISSIM session, messages are logged to VISSIM_MSGS.TXT. This log file is stored in automatically in \DOCUMENTSANDSETTINGS\<USER>\LOCALSETTINGS\TEMP\VISSIM\VISSIM_MSGS.TXT.

It contains system messages which are generated when the VISSIM program session is started, and - as a second data block - the individual
steps performed during this session as well as detailed messages and warnings, which were displayed during e.g. ANM import (and building the VISSIM network).

<table>
<thead>
<tr>
<th>Time</th>
<th>Type</th>
<th>Id</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-04-16 14:30:41</td>
<td>System</td>
<td></td>
<td>[ANM] Import started.</td>
</tr>
<tr>
<td>2008-04-16 14:30:41</td>
<td>Warning</td>
<td></td>
<td>SPEED: This attribute is 0 and is set to the default value. ANM link 4A:</td>
</tr>
<tr>
<td>2008-04-16 14:30:47</td>
<td>Warning</td>
<td></td>
<td>SPEED: This attribute is 0 and is set to the default value. ANM link 4B:</td>
</tr>
<tr>
<td>2008-04-16 14:30:48</td>
<td>Warning</td>
<td></td>
<td>Multi-leg node has zone connectors attached. Dummy link stubs which ignore node geometry are generated. ANM node 10:</td>
</tr>
<tr>
<td>2008-04-16 14:30:49</td>
<td>Warning</td>
<td></td>
<td>Multi-leg node has zone connectors attached. Dummy link stubs which ignore node geometry are generated. ANM node 40:</td>
</tr>
<tr>
<td>2008-04-16 14:30:50</td>
<td>Warning</td>
<td></td>
<td>This node contains lanes that do not have any movements defined to or from. ANM node 20:</td>
</tr>
<tr>
<td>2008-04-16 14:30:51</td>
<td>Warning</td>
<td></td>
<td>This node contains lanes that do not have any movements defined to or from. ANM node 40:</td>
</tr>
<tr>
<td>2008-04-16 14:30:53</td>
<td>Warning</td>
<td></td>
<td>Position of PT stop was adjusted. ANM PT stop 100B:</td>
</tr>
<tr>
<td>2008-04-16 14:30:58</td>
<td>Warning</td>
<td></td>
<td>Position of PT stop was adjusted. ANM PT stop 200B:</td>
</tr>
<tr>
<td>2008-04-16 14:30:59</td>
<td>Warning</td>
<td></td>
<td>Position of PT stop was adjusted. ANM PT stop 400A:</td>
</tr>
<tr>
<td>2008-04-16 14:31:00</td>
<td>Warning</td>
<td></td>
<td>Position of PT stop was adjusted. ANM PT stop 400A:</td>
</tr>
</tbody>
</table>

**10.2.2 Error Messages**

This section explains how to deal with errors that may occur, e.g. during a simulation run.

**10.2.2.1 Fatal Error**

Fatal errors result from an unexpected program state.

In case you encounter such an error, please follow the recommendations mentioned in the message to avoid data loss.
It is not safe to continue your work with VISSIM unless you close it completely and restart VISSIM. If you save your network file (*.INP), do choose a different filename as the file might get corrupt or incomplete. Check whether the saved file is complete (e.g. by comparing it with a backup copy). If it is not complete, use a backup copy of your network file (by renaming the backup file *.IN0 to *.INP) once you restarted VISSIM.

We are constantly improving VISSIM in order to avoid these errors. In order to do that we rely on your information once you encountered this error.

Please contact the VISSIM hotline via the REPORT ERROR button which provides direct access to the VISSIM Technical Hotline form.

Different from the hotline contact via menu HELP - INFO... or directly via http://www.ptv-vision.com/hotline_vissim (cf. section 15.3.2), access via the REPORT ERROR button automatically copies the required data including the error report into the form.

10.2.2.2 Troubleshooting via VDiagGUI.exe

If you encounter problems with VISSIM the hotline team may ask you to execute the program VDiagGUI.EXE in the EXE\ directory of your VISSIM installation.

Follow the steps outlined below:

► Start the Windows Explorer.
► Open the directory EXE\ of your VISSIM installation.
► Start VDiagGUI.EXE through a double click on the file name: The window VDiagProGUI opens.
► Follow the instructions of the support team and open the desired tab page.
[ACTIONS]

- **START VISSIM DIAGNOSTICS**: Start VISSIM in the diagnostics mode only on hotline team request: Left-click the button.

The **RESET** functionality is described in section 3.1.3.
In this tab, you can select the required files for the VISSIM support team. Forward the packed file to PTV AG.

- **Custom files:** Select the required project data files.
  - Click **ADD FILES** to add another file.
  - Click **REMOVE** to remove a selected file from the list.
- **Diagnostics files:** Activate the appropriate options. For detailed information on the content stored with each option call the tooltip by option via mouse move over the option text.
- **Save path:** Enter the file name and select the appropriate format.
- **CREATE:** Click this button to create the file which can be forwarded to the VISSIM support team.
In certain cases you might be asked to check the list for a certain file.
In certain cases you might be asked to create a log file: Press the SAVE LOG button.

### 10.2.2.3 Program Warnings (*.ERR file)

By default, the error files *.ERR are stored in the folder where the network file *.INP has been stored.

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.

In rare cases, the file VISSIM.ERR is stored in the folder of the *.INP file. This may have either reason:

- You have created and edited a new file, but you have not saved it yet.
- An error occurred when an *.INP file was read.

After the simulation run, a message box appears, notifying the user of the newly created error file.

SHOW calls the content of the *.ERR file.
For some errors, a message box also appears prior to the start of the simulation.

Without option Do not show this message, any subsequent error messages will be shown. If this option is active, 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.
► Pedestrians add-on: On pedestrian areas, the number of pedestrians per simulation second exceeds the limit.
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 10.1).

The output can be produced in the following form:

► online window representation (e.g. signal time table)
► a text file can be written
► 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.

Generally, current length/speed/acceleration units settings (VIEW - OPTIONS - [LANGUAGE & UNITS]) are regarded for evaluation data output.

Only parameters having the unit explicitly in the name do not regard these settings.

Some of the evaluations allow for output of both, raw data and compiled data.

For raw data output, usually only metric units are used.

The user-defined configuration is not regarded for raw data output.

Evaluations of the simulation of pedestrian flows (Travel Times, Pedestrian Record, Area Evaluations and Queues) are described in section 7.2.
11.1  Travel Times

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 required by a vehicle between crossing the first (start) and crossing the second (destination) cross sections.

During a simulation run, VISSIM can evaluate average travel times (smoothed) if travel time measurement sections have been defined in the network. Via EVALUATION – WINDOWS, the travel time records can be displayed in a window on the desktop. They can also be stored as an output file if option Travel times is ticked via EVALUATION – FILES.

Definition

To define a travel time measurement section follow the steps outlined below:

1. Select the Travel Time Sections mode.
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 start section 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 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.

Please make sure, that the resulting distance is sufficient when placing the travel time measurement cross-sections. Please note: Vehicles traversing both, start and end cross-section within a single time step, are not regarded for travel time measurements.

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**: Select compiled or raw data (ASCII format or database):
  - ✓ *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.
  - ✓ *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 may not be used for any other VISSIM database evaluation. In order to use the database output the database connection needs to be configured (cf. section 10.1.3).

Results

Travel times can be output to
- a window (cf. section 10.1.1) and/or to
- a file (cf. section 10.1.2).

A compiled output text file (*.RSZ) contains:
- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- List of all travel time sections that have been evaluated, including the distance for the shortest route for that section
Table with two columns:
- travel times (in seconds) by section and time interval
- no. of vehicles by section and time interval

Example (*.RSZ file)

Table of Travel Times

File: E:\Programme\PTV_Vision\ISSIM520\Examples\Demo\LRT-Priority.LU\lux3_10.inp
Comment: Luxembourg, SC 3-10
Date: Wednesday, May 13, 2009 12:26:34 PM
VISSIM: 5.20-00 [18711M]

No. 4071: from link 10049 at 0.6 m to link 10049 at 19.0 m, Distance 18.4 m
No. 4072: from link 102 at 298.4 m to link 10050 at 33.8 m, Distance 106.8 m

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>Trav C. Veh</th>
<th>Trav #Veh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.: 4071; 4072</td>
<td>60; 132.6; 49; 142.0; 219;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120; 134.6; 61; 140.4; 249;</td>
</tr>
</tbody>
</table>
11.2 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 11.1.

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 Evaluation – Files… once the option Delay is ticked. The following configuration data can be defined:

- **No. [active] (Travel Times):** List of all defined delay segments with the active state flag x [in brackets]. Inactive delay measurements are not regarded for evaluation. Selected travel time measurements are shown in parentheses.
• **Time**: Enter the start time and end time and the time interval of the evaluation (in simulation seconds).

• **NEW** creates a new delay time measurement,

• **EDIT** allows for editing existing delay time measurements.
  - Each delay segment is to be based on one or more travel time measurements; use **CTRL** to select multiple travel time sections for this measurement.
  - For the selected delay segment, option **active** has to be (un)checked.

• **DELETE** removes the selected delay time measurement from the list. Belonging travel time sections are not deleted.

• **Output** defines the data output format:
  - **Compiled Data** generates a text file (*.VLZ) according to the times and numbers as defined in this window.
  - **Raw Data** generates a text file (*.VLR) where every completed delay measurement event will be logged in chronological order.
  - **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 (cf. section 10.1.3).

### Results

This is the format of a compiled output text file (*.VLZ):

- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- 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 real travel time does not include passenger stop times at PT stops or the time vehicles spent in real parking lots. However, the loss time caused by acceleration or deceleration before/after a PT stop remains part of the delay time.

- **Stopd**: Average standstill time per vehicle (in seconds), not including passenger stop times at PT stops or in parking lots.
- **Stops**: Average number of stops per vehicle, not including stops at PT stops or in parking lots.
- **#Veh**: Vehicle throughput
- **Pers**: Average total delay per person (in seconds), not including passenger stop times at PT stops.
- **#Pers**: Person throughput

**Example: Compiled data file *.VLZ**

Table of Delay

File: E:\Programme\PTV_Vision\VISSIM520\Examples\Demo\LRT-Priority.LU\lux3_10.inp
Comment: Luxembourg, SC 3-10
Date: Wednesday, May 13, 2009 1:03:31 PM
VISSIM: 5.20-00 [18711M]

No. 4082: Travel time section(s) 4082

| Time; Delay; Stopd; Stops; #Veh; Pers.; #Pers; VehC; Train; |
|---|---|---|---|---|---|---|---|
| 61; 0.1 | 0.0 | 0.00 | 3; 0.1 | 70; |
| Total; 0.1 | 0.0 | 0.00 | 3; 0.1 | 70; |

**Example: Raw data file *.VLR**

Table of Delay

File: E:\Programme\PTV_Vision\VISSIM520\Examples\Demo\LRT-Priority.LU\lux3_10.inp
Comment: Luxembourg, SC 3-10
Date: Wednesday, May 13, 2009 1:03:31 PM
VISSIM: 5.20-00* [18711M]

Time; No.; Veh; VehTy; Delay;
118.8; 4092; 2; 402; 6.1;
11.3 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 Data collection points mode.
2. With a single left mouse click select the link for the data collection point to be placed.
3. Define the data collection point with the right mouse button.
4. Enter a number in the appearing window and set further properties, if applicable.
   Click OK to confirm.

For subsequent changes to data collection points, activate the Data collection point mode and right-click outside of the VISSIM network to call the selection list containing all data collection points with their numbers and names that have been defined in the network so far: Select the desired data collection point and click either the ZOOM button or DATA or DELETE to continue.

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 Evaluation – 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. Click NEW to create a new data collection and use EDIT for changes to existing ones.

While editing a measurement, use CTRL to select multiple travel time sections for this measurement.

Alternatively, either AUTO (ALL) or AUTO (GROUPS) 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 (GROUPS)** 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).

- **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 and to the CONFIGURATION parameter settings,
  - **Raw Data** generates a file (*.MER) where simply every data collection event will be logged in chronological order (all parameters).

  The file header of this output file also contains the start time of the simulation, if the start date has been set in the simulation parameters.

- **CONFIGURATION...** opens the Data Collection - Configuration window that allows to select the data and output format of the data collection measurements. These settings are only regarded for compiled data.
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*, both the *Function* and *Vehicle Class* 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
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- 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 in the *Data Collection - Configuration* window.

**Example: Compiled data file *.MES**

Data Collection (Compiled Data)

File: C:\Program Files\PTV_Vision\VISSIM530\Examples\Demo\LRT.LU\lux3_10.inp
Comment: Luxembourg, SC 3-10
Date: Dienstag, 12. April 2011 13:18:39
VISSIM: 5.30-05* [28342]
### Measurement 1031: Data Collection Point(s) 10311, 10312
- Start: 0
- End: 60
- Number Veh: 3
- Acceleration: 1.3 m/s²
- Distance: 284.0 m
- Speed: 53.9 km/h
- Length: 4.5 m
- Persons: 1
- Queue Del. Tm.: 55.6 s

### Measurement 1032: Data Collection Point(s) 10321
- Start: 0
- End: 60
- Number Veh: 0
- Acceleration: 0.0 m/s²
- Distance: 0.0 m
- Speed: 0.0 km/h
- Length: 0.0 m
- Persons: 0
- Queue Del. Tm.: 0.0 s

### Measurement 1042: Data Collection Point(s) 10421, 10422
- Start: 0
- End: 60
- Number Veh: 7
- Acceleration: 2.7 m/s²
- Distance: 138.7 m
- Speed: 44.7 km/h
- Length: 4.5 m
- Persons: 1
- Queue Del. Tm.: 48.6 s

### Measurement 91032: Data Collection Point(s) 910321
- Start: 0
- End: 60
- Number Veh: 0
- Acceleration: 0.0 m/s²
- Distance: 0.0 m
- Speed: 0.0 km/h
- Length: 0.0 m
- Persons: 0
- Queue Del. Tm.: 0.0 s

---

**Example: Raw data file *.MER**

**Data Collection (Raw Data)**

File: `C:\Program Files\PTV_Vision\VISSIM530\Examples\Demo\LRT.LU\lux3_10.inp`

Comment: Luxembourg, SC 3-10

Date: Dienstag, 12. April 2011 13:18:39

VISSIM: 5.30-05* [28342]

**Data Collection Point**
- 3131: Link 46 Lane 1 at 179.168 m, Length 0.000 m.
- 3151: Link 10065 Lane 1 at 2.568 m, Length 0.000 m.
- 3211: Link 42 Lane 1 at 197.590 m, Length 0.000 m.
- 3231: Link 49 Lane 1 at 197.617 m, Length 0.000 m.
- 3311: Link 10063 Lane 1 at 6.208 m, Length 0.000 m.

**Data C.P. t(enter) t(leave) VehNo Type Line v[m/s] a[m/s²] Occ Pers tQueue VehLength[m]**

|       |        |         |   |  |       |        |         |   |  |       |        |         |   |  |        |        |         |   |  |       |        |         |   |  |       |        |         |   |  |       |        |         |   |  |       |        |         |   |  |       |        |         |   |  |       |        |         |
| 6311  | 16.95  | -1.00   | 10| 17|       | 7.9    | -2.83   | 0.05| 1  | 0.0    | 4.55   | 179.168 | 0.000  |    |
| 6311  | -1.00  | 17.60   | 10| 17|       | 6.0    | -2.83   | 0.00| 1  | 0.0    | 4.55   | 179.590 | 0.000  |    |
| 6312  | 19.90  | -1.00   | 15| 11|       | 5.3    | -2.68   | 0.10| 1  | 0.0    | 4.11   | 179.617 | 0.000  |    |
| 6321  | 20.03  | -1.00   | 14| 14|       | 13.5   | -0.99   | 0.07| 1  | 0.0    | 4.11   | 179.625 | 0.000  |    |
| 6321  | -1.00  | 20.34   | 14| 14|       | 13.2   | -0.99   | 0.04| 1  | 0.0    | 4.11   | 179.639 | 0.000  |    |
### Raw data output:

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<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>
</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>
</tr>
<tr>
<td>VehNo</td>
<td>Internal number of the vehicle</td>
</tr>
<tr>
<td>Type</td>
<td>Vehicle type (e.g. 100 = car)</td>
</tr>
<tr>
<td>Line</td>
<td>PT line</td>
</tr>
<tr>
<td>v</td>
<td>Speed (in m/s)</td>
</tr>
<tr>
<td>a</td>
<td>Acceleration (in [m/s²])</td>
</tr>
<tr>
<td>Occ</td>
<td>Occupancy: Time (in s) the vehicle has spent on the decision point in this simulation second</td>
</tr>
<tr>
<td>Pers</td>
<td>Number of persons in the vehicle</td>
</tr>
<tr>
<td>tQueue</td>
<td>Total time (in s) the vehicle has spent in congestion</td>
</tr>
<tr>
<td>VehLength</td>
<td>Vehicle length (in [m])</td>
</tr>
</tbody>
</table>
Queue Counters and Vehicle Stops

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.

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 the **Queue Counters** mode.
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 **EVALUATION – 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
  - is less than 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). Definition of the aggregation **interval** (in s): If value 600 is entered, the *.STZ file will contain data blocks of 600s each, starting from the value entered for **from**.

- **Analyzer Sample Interval**: Enter the number of simulation seconds (e.g. 0 or 10) for evaluations via Analyzer Report, cf. section 11.24.

- **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 10.1.3).

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 greater value (e.g. 4 km), the simulation speed will decrease.

**Results**

This is the format of an output text file (*.STZ):

- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- 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 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 every time step. From these values the maximum is computed for every time interval.</td>
<td>max</td>
</tr>
<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

File:  e:\programfiles\PTV_Vision\VISSIM520\Examples\example.inp
Comment: Manual Example
Date:  Wednesday, May 2, 2009, 5:31:39 pm
VISSIM:  5.20-00 [19895]

<table>
<thead>
<tr>
<th>Queue Counter</th>
<th>Link</th>
<th>At</th>
<th>ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>520</td>
<td>Link</td>
<td>247</td>
<td>66.200</td>
</tr>
<tr>
<td>531</td>
<td>Link</td>
<td>241</td>
<td>18.600</td>
</tr>
<tr>
<td>532</td>
<td>Link</td>
<td>243</td>
<td>18.795</td>
</tr>
<tr>
<td>534</td>
<td>Link</td>
<td>242</td>
<td>46.900</td>
</tr>
</tbody>
</table>

Avg.: average queue length [ft] within time interval
Max.: maximum queue length [ft] within time interval
Stop: number of stops within queue

| Time; Avg.; max.;Stop; Avg.; max.;Stop; Avg.; max.;Stop; Avg.; max.;Stop; Avg.; max.;Stop| No.:; 600; 520; 520; 531; 531; 531; 532; 532; 532; 534; 534; 534; 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 |
11.5 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.

Filter

Based on the Period in [Simulation seconds] specified via SIMULATION - PARAMETERS, the start of the protocol can be shifted and the duration can be reduced for recording.

Results

This is the format of an output text file (*.LZV):

- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- Duration of the evaluation based on filter & simulation parameters (Time)
- 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 (phas): 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

File: e:\programfiles\vissim520\example\projekt_1\example.inp
Comment: Manual Example
Date: Wednesday, May 2, 2009, 5:31:39 pm
VISSIM: 5.20-00 [19895]

Time: 0.0 - 300.0

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>
<tr>
<td>5;</td>
<td>12.9;</td>
</tr>
<tr>
<td>6;</td>
<td>48.1;</td>
</tr>
<tr>
<td>8;</td>
<td>40.0;</td>
</tr>
</tbody>
</table>

SC 1, Green Times:

t|SG;   1; 2; 3; 4; 5; 6; 8; ...
---|---|---|---|---|---|---|---|
11; 0; 0; 0; 0; 1; 0; 0;
12; 0; 0; 1; 0; 2; 0; 0;
13; 0; 0; 4; 0; 3; 0; 0;
14; 0; 0; 1; 0; 19; 0; 0;
...

SC 1, Red Times:

t|SG;   1; 2; 3; 4; 5; 6; 8; ...
---|---|---|---|---|---|---|---|
61; 0; 17; 0; 0; 0; 1;
62; 0; 1; 0; 0; 1; 0;
63; 0; 1; 0; 0; 1; 0;
64; 0; 0; 0; 0; 0; 1;
...

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  **********
...
11.6 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 (cf. section 11.7 for Parameters).

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 which is accessible by pressing the VEHICLE INFORMATION... button in EVALUATION – WINDOWS…

The Selected parameters are displayed within the list box to the left. Use UP and DOWN to change the sequence of the selected data. Additional parameters can be inserted and others can be removed by clicking on the corresponding buttons "" and "".

The configuration will be saved to an external file (*.FZI).

Results

Double-clicking on a vehicle during a simulation run causes the following:
► the selected vehicle is indicated by a red bar
► the vehicle information window appears

Additionally, if the display mode is set to 3D, the viewing position will be changed as from the driver’s position.
11.7 Vehicle Record

Similar to the display of vehicle information in a window any combination of vehicle parameters can be saved to an output file. The evaluation can be limited to a user-defined time interval as well as to selected vehicles.

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 window which can be accessed by pressing the Configuration button in Evaluation – 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 Up and Down.

For the list of parameters provided for selection and a brief description, please see below.

Neither scheduled stops at public transport stops nor stops in parking lots are regarded for Number of Stops or Delay times.

Please note that some parameters will only report correct results if the corresponding optional module (such as Dynamic Assignment, Cold Emission etc.) is installed.
11 Evaluation Types for Simulations of Vehicles

- **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 10.1.3).

**Filter**

Once the vehicle record parameters are selected, a filter may be applied to capture specific vehicles within the simulation. This can be accessed by pressing the FILTER button in EVALUATION – FILES... once the option *Vehicle Record* is active.

In addition to the selection of vehicle classes, also a time interval for the evaluation as well as the resolution of recording are to be defined. If an integer > 1 is entered for *Resolution*, only one time step will be logged for the user-defined number of time steps.

If the evaluation should only be done for individual vehicles, their numbers are to be added or removed via the buttons, if option *Individual Vehicle* is active.

By default, all vehicle classes are recorded within the simulation period. 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 file *.FZP consists of the following:

- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- 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.

Generally, current (short/long)distance/speed/acceleration units set via View - Options - [Language &Units] are regarded for evaluation data output. This does not apply to world co-ordinates which are always recorded in [m].

Please note: The units of those parameters with the particular unit mentioned in the column header abbreviation will not change.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Column Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration</td>
<td>Acceleration during the simulation step</td>
<td>a</td>
</tr>
<tr>
<td>Delay Time</td>
<td>Difference from optimal (ideal (theoretical)) drive time (in s)</td>
<td>TQDelay</td>
</tr>
<tr>
<td>Desired Direction</td>
<td>Vehicle Info only: Desired Direction / Next Link / Route End Coordinate</td>
<td></td>
</tr>
<tr>
<td>Desired Lane</td>
<td>Vehicle Record only: Desired Lane (by Direction decision)</td>
<td>DesLn</td>
</tr>
<tr>
<td>Parameter</td>
<td>Definition</td>
<td>Column Header</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Desired Speed</td>
<td>Desired Speed</td>
<td>vDes</td>
</tr>
<tr>
<td>Desired Speed [m/s]</td>
<td>Desired Speed [m/s]</td>
<td>vDesMS</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 signs)</td>
<td>DwITm</td>
</tr>
<tr>
<td>Emissions (Evaporation) HC</td>
<td>Only with Emissions add-on: Emissions (Evaporation) Hydrocarbon in the current simulation step</td>
<td>HC_evap</td>
</tr>
<tr>
<td>Emissions Benzene</td>
<td>Only with Emissions add-on: Benzene emissions in the current simulation step</td>
<td>Bnzn</td>
</tr>
<tr>
<td>Emissions CO</td>
<td>Only with Emissions add-on: Carbon Monoxide emissions in current simulation step</td>
<td>CO</td>
</tr>
<tr>
<td>Emissions CO2</td>
<td>Only with Emissions add-on: Carbon Dioxide emissions in the current simulation step</td>
<td>CO2</td>
</tr>
<tr>
<td>Emissions HC</td>
<td>Only with Emissions add-on: Hydrocarbon emissions in current simulation step</td>
<td>HC</td>
</tr>
<tr>
<td>Emissions NMHC</td>
<td>Only with Emissions add-on: Non-methane Hydrocarbon Emissions in the current simulation step</td>
<td>NMHC</td>
</tr>
<tr>
<td>Emissions NMOG</td>
<td>Only with Emissions add-on: Non-methane organic gas emissions in the current simulation step</td>
<td>NMOG</td>
</tr>
<tr>
<td>Emissions NOx</td>
<td>Only with Emissions add-on: Nitrogen Oxide emissions in current simulation step</td>
<td>NOx</td>
</tr>
<tr>
<td>Emissions Particulates</td>
<td>Only with Emissions add-on: Particulate Emissions in current simulation step</td>
<td>Particulate</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 SO2</td>
<td>Only with Emissions add-on: Sulfur Dioxide Emissions [mg/s] in the current simulation step</td>
<td>SO2</td>
</tr>
<tr>
<td>Emissions Soot</td>
<td>Only with Emissions add-on: Soot emissions in current simulation step</td>
<td>Soot</td>
</tr>
<tr>
<td>Following Distance</td>
<td>Following distance to the relevant leading vehicle before 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>Fuel100km</td>
</tr>
<tr>
<td>Gradient [%]</td>
<td>Gradient [%] of the current link</td>
<td>Grad</td>
</tr>
<tr>
<td>Headway</td>
<td>Distance to the next (not necessarily relevant) vehicle downstream</td>
<td>Head</td>
</tr>
<tr>
<td>Interaction State</td>
<td>Short description of the state in the interaction procedure which caused the acceleration/deceleration of the vehicle in the recent time step; cf. also section 5.4.1. For a complete list of possible states, please see below.</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>Lane</td>
</tr>
<tr>
<td>Lateral Position</td>
<td>Lateral position relative to middle of lane (0.5) at the end of the simulation step</td>
<td>y</td>
</tr>
<tr>
<td>Leading Vehicle</td>
<td>Number of the relevant leading vehicle that determines the following behavior</td>
<td>IVeh</td>
</tr>
<tr>
<td>Length</td>
<td>Length</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>Link</td>
</tr>
<tr>
<td>Number of Stops</td>
<td>Total number of all occasions where the vehicle reaches stand-</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>still (speed = 0) except PT dwell stops and stops in parking lots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupancy</td>
<td>Number of persons/passengers in the vehicle</td>
<td>#Pers</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 next (not necessarily relevant) vehicle downstream</td>
<td>LVeh</td>
</tr>
<tr>
<td>PT: Alighting Passengers</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 Passengers</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 PT stops dwell times [s]</td>
<td>SSStpsDwlT</td>
</tr>
<tr>
<td>PT: PT stop number</td>
<td>Number of the current PT 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 Flag</td>
<td>Flag: is vehicle in queue? + = yes, - = no</td>
<td>Queue</td>
</tr>
<tr>
<td>Queue Time</td>
<td>Total Queue Time Thus Far [s]</td>
<td>QTm</td>
</tr>
<tr>
<td>Route</td>
<td>Vehicle Record only: Route number</td>
<td>Route</td>
</tr>
<tr>
<td>Routing decision</td>
<td>Vehicle Record only: Routing</td>
<td>RoutDec</td>
</tr>
<tr>
<td>Parameter</td>
<td>Definition</td>
<td>Column Header</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>decision number</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Routing decision &amp; Route</td>
<td>Vehicle Info only: Routing decision number &amp; Route number</td>
<td></td>
</tr>
<tr>
<td>Routing Sequence</td>
<td>Vehicle Info only: Links, Connectors, possibly Parking Lots and PT Stops</td>
<td></td>
</tr>
<tr>
<td>Safety Distance</td>
<td>Desired safety distance during the simulation step</td>
<td>abx</td>
</tr>
<tr>
<td>Simulation Time</td>
<td>Vehicle Record only: Simulation Time [s]</td>
<td>t</td>
</tr>
<tr>
<td>Simulation Time of Day</td>
<td>Vehicle Record only: Simulation Time as Time of Day [hh:mm:ss]</td>
<td>ToD</td>
</tr>
<tr>
<td>Speed</td>
<td>Speed at the end of the simulation step</td>
<td>v</td>
</tr>
<tr>
<td>Speed [m/s]</td>
<td>Speed [m/s] at the end of the simulation step</td>
<td>vMS</td>
</tr>
<tr>
<td>Speed Difference</td>
<td>Speed relative to the relevant leading vehicle before the simulation step (&gt;0 = faster)</td>
<td>Dv</td>
</tr>
<tr>
<td>Speed Difference [m/s]</td>
<td>Speed relative to the relevant leading vehicle [m/s] before the simulation step (&gt;0 = faster)</td>
<td>DvMS</td>
</tr>
<tr>
<td>Start Time</td>
<td>Start Time [Simulation Second]</td>
<td>STim</td>
</tr>
<tr>
<td>Target Link</td>
<td>Vehicle Record only: Target Link (Next Link on the Route)</td>
<td>TLnk</td>
</tr>
<tr>
<td>Theoretical Speed</td>
<td>Theoretical Speed Without Obstructions</td>
<td>vTheo</td>
</tr>
<tr>
<td>Theoretical Speed [m/s]</td>
<td>Theoretical Speed [m/s] Without Obstructions</td>
<td>vTheoMS</td>
</tr>
<tr>
<td>Total Distance Traveled</td>
<td>Total Distance Traveled in the Network in [m]</td>
<td>DistX</td>
</tr>
<tr>
<td>Total Time in Network</td>
<td>Total Time in Network [s]</td>
<td>TTot</td>
</tr>
<tr>
<td>Trip Chain: Activity</td>
<td>Vehicle Info only: Number of Activity</td>
<td></td>
</tr>
<tr>
<td>Trip Chain: Departure Time</td>
<td>Vehicle Info only: Departure Time [simulation second] from Parking Lot</td>
<td></td>
</tr>
</tbody>
</table>
### Parameter | Definition | Column Header
--- | --- | ---
Trip Chain: Destination Zone | Vehicle Info only: Number of the Destination Zone | 
Trip Chain: Minimum Duration | Vehicle Info only: Minimum Duration of the Activity | 
Trip Chain: Parking Lot Number | Vehicle Info only: Number of the Parking Lot | 
Vehicle Number | Vehicle Record only: Number of Vehicle | VehNr |
Vehicle Type | Number of the Vehicle Type | Type |
Vehicle Type Name | Name of the Vehicle Type | VehTypeName |
Weight | Weight [mt] (metric tons) | Weight |
World Coordinate Front X | Vehicle Record only: World Coordinate x (Vehicle front end at the end of the simulation step) | WorldX |
World Coordinate Front Y | Vehicle Record only: World Coordinate y (Vehicle front end at the end of the simulation step) | WorldY |
World Coordinate Front Z | Vehicle Record only: World Coordinate z (Vehicle front end at the end of the simulation step) | WorldZ |
World coordinate Rear X | Vehicle Record only: World coordinate x (Vehicle rear end at the end of the time step) | RWorldX |
World coordinate Rear Y | Vehicle Record only: World coordinate y (Vehicle rear end at the end of the time step) | RWorldY |
World coordinate Rear Z | Vehicle Record only: World coordinate z (Vehicle rear end at the end of the time step) | RWorldZ |
## List of interaction states

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
</table>
| FREE    | The vehicle is not affected by any relevant preceding vehicle; it tries to stick to the desired speed  
         | Cf. section 5.4.1: "Free driving"                                             |
| FOLLOW  | The vehicle tries to follow the preceding vehicle at the preceding vehicle’s speed  
         | Cf. section 5.4.1: "Following"                                                |
| BRAKEBX | Braking for the desired safety distance (before reaching the safety distance range)  
         | Cf. section 5.4.1: "Approaching"                                              |
| BRAKEAX | Braking for the desired safety distance (from within the safety distance)      
         | Cf. section 5.4.1: "Braking"                                                  |
| CLOSEUP | Closing up to a standing preceding vehicle or an obstacle (signal head, stop sign, priority rule, conflict area...) |
| BRAKEZX | Target deceleration aiming at an emergency stop position (for a lane change) or at the start of a reduced speed area |
| BRAKELC | Slight deceleration for a lane change when waiting for a gap in the upstream flow on the adjacent lane |
| BRAKECOOP | Cooperative braking in favor of another vehicle that intends to change to another lane (set via parameter  
            | Maximum deceleration for cooperative braking)                                |
| PELOPS  | Acceleration/deceleration according to an external DriverModel DLL           |
| SLEEP   | Parameter Temporary lack of attention is just active at that moment, neither acceleration nor deceleration is recorded (except for emergency braking) |
| PASS    | Acceleration/deceleration to reach the permitted speed (due to the lateral distance) for overtaking another vehicle which is either on the same lane or on the adjacent lane |
### Example *.FZP file

The following extract shows the vehicle record of vehicles of a selected type:

**Vehicle Record**

- **File:** `e:\programfiles\vissim520\example\projekt_1\example.inp`
- **Comment:** Manual Example
- **Date:** Wednesday, May 2, 2009, 5:31:39 pm
- **VISSIM:** 5.20-00 [19895]

<table>
<thead>
<tr>
<th>t</th>
<th>VehNr</th>
<th>v</th>
<th>a</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.3</td>
<td>3</td>
<td>25.72</td>
<td>1.19</td>
</tr>
<tr>
<td>1.4</td>
<td>3</td>
<td>25.87</td>
<td>2.14</td>
</tr>
<tr>
<td>1.5</td>
<td>3</td>
<td>26.06</td>
<td>2.90</td>
</tr>
<tr>
<td>1.6</td>
<td>3</td>
<td>26.30</td>
<td>3.55</td>
</tr>
<tr>
<td>1.7</td>
<td>3</td>
<td>26.59</td>
<td>4.21</td>
</tr>
<tr>
<td>1.8</td>
<td>3</td>
<td>26.92</td>
<td>4.86</td>
</tr>
<tr>
<td>1.9</td>
<td>3</td>
<td>27.28</td>
<td>5.23</td>
</tr>
<tr>
<td>2.0</td>
<td>3</td>
<td>27.60</td>
<td>4.70</td>
</tr>
<tr>
<td>2.1</td>
<td>3</td>
<td>27.89</td>
<td>4.23</td>
</tr>
<tr>
<td>2.2</td>
<td>3</td>
<td>28.15</td>
<td>3.81</td>
</tr>
<tr>
<td>2.3</td>
<td>3</td>
<td>28.38</td>
<td>3.43</td>
</tr>
<tr>
<td>2.4</td>
<td>3</td>
<td>28.59</td>
<td>3.09</td>
</tr>
<tr>
<td>2.5</td>
<td>3</td>
<td>28.78</td>
<td>2.78</td>
</tr>
<tr>
<td>2.6</td>
<td>4</td>
<td>18.59</td>
<td>4.44</td>
</tr>
<tr>
<td>2.6</td>
<td>3</td>
<td>28.95</td>
<td>2.50</td>
</tr>
<tr>
<td>2.7</td>
<td>4</td>
<td>18.77</td>
<td>2.58</td>
</tr>
<tr>
<td>2.7</td>
<td>3</td>
<td>29.11</td>
<td>2.25</td>
</tr>
<tr>
<td>2.8</td>
<td>4</td>
<td>19.00</td>
<td>3.49</td>
</tr>
<tr>
<td>2.8</td>
<td>3</td>
<td>29.24</td>
<td>2.02</td>
</tr>
<tr>
<td>2.9</td>
<td>4</td>
<td>19.29</td>
<td>4.22</td>
</tr>
<tr>
<td>2.9</td>
<td>3</td>
<td>29.37</td>
<td>1.82</td>
</tr>
<tr>
<td>3.0</td>
<td>4</td>
<td>19.62</td>
<td>4.87</td>
</tr>
<tr>
<td>3.0</td>
<td>3</td>
<td>29.48</td>
<td>1.64</td>
</tr>
<tr>
<td>3.1</td>
<td>4</td>
<td>20.00</td>
<td>5.53</td>
</tr>
<tr>
<td>3.1</td>
<td>3</td>
<td>29.58</td>
<td>1.48</td>
</tr>
<tr>
<td>3.2</td>
<td>4</td>
<td>20.42</td>
<td>6.19</td>
</tr>
<tr>
<td>3.2</td>
<td>3</td>
<td>29.67</td>
<td>1.33</td>
</tr>
<tr>
<td>3.3</td>
<td>4</td>
<td>20.89</td>
<td>6.84</td>
</tr>
<tr>
<td>3.3</td>
<td>3</td>
<td>29.75</td>
<td>1.20</td>
</tr>
<tr>
<td>3.4</td>
<td>4</td>
<td>21.36</td>
<td>6.88</td>
</tr>
</tbody>
</table>

...
11.8 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] tab page, the data can be edited.

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 << 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 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 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.

The width of an SC time step is 4 pixel in case of one SC time step per simulation second. In case of two SC time steps per simulation second, the width is reduced to just 2 pixel. In case of three or more time steps it will be just one pixel. The cycle second is viewed every 10 simulation seconds, even if the SC runs with more than one time steps per second. Scaling bars are viewed every 5 seconds. If the control *.DLL (or *.EXE) contains the same simulation second multiple times, only the first one is used for axis labelling. Instead of only 500 time steps at most as known from previous versions, now up to 5,000 control time steps are viewed.
11.9 Signal Control / Detector Record

The SC/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 for test runs and provides a platform to contain all important parameters and variable values. The SC/Detector record can be displayed in a window on the desktop and/or stored in an output data file (*.LDP).

For output to file, please click menu EVALUATION – FILES - [SIGNAL CONTROL] tab and check option Signal Control / Detector Record.

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] tab page, 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) (cf. sections 10.1.1 and 10.1.2 respectively).

The data types that can be logged in the SC/Detector record depend on the signal controller used and can be found 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.

The SC/Detector Record can display up to 1000 parameters with a maximum of 3000 characters per row.
Example (*.LDP file)

- File title with date and time of the evaluation
- Simulation comment
- SC No., SC files, Program No., Simulation or Test run
- Data block

The current values are saved after the the control logics has finished:


Manual Example

SC 7;  Program file: vap215.dll;  Import files: l07_d_m0.vap, l07_d.pua;  Program No. 1;  Simulation run

SSSSSSSSS
iiiiiiiii
999999999
........
DDDDDDDDDD SS
S CiiiiiiiiiiSSSSStttt
i ysssssssssttstttttaaaa
m cccccccccccaaaaatttt
u lllllllllllttttteeeee
l eaaaaaaaaaeeeee
. yyyyyyyyyy DDDD
s s DDDDDDDDDDDD
e eSSSSSSSSSSSSTTTTTTTT
C oGGGGGGGGGGTTTTTT"
11.10 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 further configuration required for data output in a window.

Signal changes data can be output to:

- an output file (*.LSA), cf. section 10.1.2,
- a database, cf. section 10.1.3.

Select Evaluation – Files… - [Signal Control] tab, activate option Signal Changes and click Configuration to open the Signal Changes - Configuration window:

- **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 10.1.3).

Results

The output file (*.LSA) contains:

- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- List of all signal groups
- Data section containing one line for each signal change event of each signal group. The columns contain the following data (from left to right):
  - Simulation time [s]
  - Cycle time [s]
  - SCJ no.
  - Signal group no.
Signal Changes

- **New signal state**
- **Time since last signal change** (= length of previous signal display)
- **SCJ type**
- **Due to SG** (supported only by certain vehicle-actuated controller types): Signal group that caused the current signal switch.

**Example (*.LSA file)**

Signal Changes Protocol

File: e:\programfiles\vissim520\example\projekt_1\example.inp
Comment: Manual Example
Date: Wednesday, May 2, 2009, 5:31:39 pm
VISSIM: 5.20-00 [19895]

```
SC 5 SGroup 1 Link 247 Lane 1 At 66.0
SC 5 SGroup 2 Link 243 Lane 1 At 18.3
SC 5 SGroup 3 Link 241 Lane 2 At 18.4
SC 5 SGroup 3 Link 241 Lane 1 At 18.3
SC 5 SGroup 4 Link 242 Lane 1 At 46.8
SC 5 SGroup 5 Link 231 Lane 1 At 29.2
SC 5 SGroup 21 Link 288 Lane 1 At 15.1
SC 5 SGroup 21 Link 289 Lane 1 At 1.8
SC 5 SGroup 22 Link 294 Lane 1 At 2.2
SC 5 SGroup 22 Link 295 Lane 1 At 1.5
SC 5 SGroup 23 Link 292 Lane 1 At 2.6
SC 5 SGroup 23 Link 293 Lane 1 At 1.8
SC 5 SGroup 24 Link 290 Lane 1 At 5.5
SC 5 SGroup 24 Link 291 Lane 1 At 1.7
SC 5 SGroup 25 Link 289 Lane 1 At 10.7

...  
1.0; 1.0; 6; 11; green ; 1.0; VAP ; 0;
1.0; 1.0; 6; 1; green ; 1.0; VAP ; 0;
1.0; 1.0; 10; 32; green ; 1.0; VAP ; 0;
1.0; 1.0; 10; 31; green ; 1.0; VAP ; 0;
1.0; 1.0; 10; 25; green ; 1.0; VAP ; 0;
1.0; 1.0; 10; 3; green ; 1.0; VAP ; 0;
1.0; 1.0; 10; 2; green ; 1.0; VAP ; 0;
1.0; 1.0; 10; 1; green ; 1.0; VAP ; 0;
1.0; 1.0; 9; 53; red/amber ; 1.0; VAP ; 0;
1.0; 1.0; 9; 52; red/amber ; 1.0; VAP ; 0;
1.0; 1.0; 9; 51; red/amber ; 1.0; VAP ; 0;
1.0; 1.0; 9; 25; green ; 1.0; VAP ; 0;
1.0; 1.0; 9; 22; green ; 1.0; VAP ; 0;
1.0; 1.0; 9; 11; green ; 1.0; VAP ; 0;
1.0; 1.0; 9; 10; green ; 1.0; VAP ; 0;
1.0; 1.0; 9; 1; green ; 1.0; VAP ; 0;
1.0; 1.0; 8; 52; red/amber ; 1.0; VAP ; 0;
1.0; 1.0; 8; 51; red/amber ; 1.0; VAP ; 0;
1.0; 1.0; 8; 30; green ; 1.0; VAP ; 0;
1.0; 1.0; 8; 29; green ; 1.0; VAP ; 0;
1.0; 1.0; 8; 24; green ; 1.0; VAP ; 0;
...```
11.11 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 6.2.2.2.

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 needs to be defined (cf. sections 6.3.1 and 6.3.2).

In order to set these properties for multiple links/connectors at the same time the Multiselect mode can be used (cf. 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 Evaluation – Files… - [VEHICLES], 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*).

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.

*from/until*, *Interval*: 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 (cf. section 10.1.3).

### Results

A link evaluation file (*.STR) contains:

- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- List of all evaluated vehicle classes
- 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.

Generally, current \textit{(short/long)distance/speed/acceleration units} set via \texttt{VIEW - OPTIONS - [LANGUAGE & UNITS]} are regarded for evaluation data output. Emissions are always output in \textit{mg/m/s}.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Column Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>Vehicle density</td>
<td>Density</td>
</tr>
<tr>
<td>Emissions (Evaporation) HC</td>
<td>Only with Emissions add-on: Emissions (Evaporation) Hydrocarbon in the current interval</td>
<td>HC\textsubscript{evap}</td>
</tr>
<tr>
<td>Emissions Benzene</td>
<td>Only with Emissions add-on: Emissions Benzene during current interval</td>
<td>Bnzn</td>
</tr>
<tr>
<td>Emissions CO</td>
<td>Only with Emissions add-on: Emissions CO during current interval</td>
<td>CO</td>
</tr>
<tr>
<td>Emissions CO2</td>
<td>Only with Emissions add-on: Emissions Carbon dioxide during current interval</td>
<td>CO2</td>
</tr>
<tr>
<td>Emissions HC</td>
<td>Only with Emissions add-on: Emissions HC during current interval</td>
<td>HC</td>
</tr>
<tr>
<td>Emissions NMHC</td>
<td>Only with Emissions add-on: Emissions HC without Methane during current interval</td>
<td>NMHC</td>
</tr>
<tr>
<td>Emissions NMOG</td>
<td>Only with Emissions add-on: Emissions Nonmethane Organic Gasses during current interval</td>
<td>NMOG</td>
</tr>
<tr>
<td>Emissions NOx</td>
<td>Only with Emissions add-on: Emissions NOx during current interval</td>
<td>NOx</td>
</tr>
<tr>
<td>Emissions Particulates</td>
<td>Only with Emissions add-on: Emissions Particulates during current interval</td>
<td>Particulate</td>
</tr>
<tr>
<td>Emissions SO2</td>
<td>Only with Emissions add-on: Emissions Sulfurdioxide during current interval</td>
<td>SO2</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 Soot</td>
<td>Only with Emissions add-on: Emissions Soot during current interval</td>
<td>Soot</td>
</tr>
<tr>
<td>Fuel consumption</td>
<td>Fuel consumption during current interval [mg/m/s]</td>
<td>Fuel</td>
</tr>
<tr>
<td>Lane number</td>
<td>Lane number</td>
<td>Lane</td>
</tr>
<tr>
<td>Link number</td>
<td>Link</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 end coordinate</td>
<td>Segment end link coordinate</td>
<td>SegEndC</td>
</tr>
<tr>
<td>Segment start coordinate</td>
<td>Segment start link coordinate</td>
<td>SegStC</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>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</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</td>
<td>v</td>
</tr>
<tr>
<td>Volume</td>
<td>Volume [veh/h]</td>
<td>Volume</td>
</tr>
</tbody>
</table>

**Example (*.STR file)**

Link Evaluation

File: e:\programfiles\vissim520\example\projekt_1\example.inp
Comment: Manual Example
Date: Wednesday, May 2, 2009, 5:31:39 pm
VISSIM: 5.20-00 [19022]

Vehicle Class: 0 = All Vehicle Types
Vehicle Class: 10 = Car
Vehicle Class: 20 = HGV
Vehicle Class: 30 = Bus
Vehicle Class: 40 = Train
Vehicle Class: 50 = Pedestrians
### Evaluation Types for Simulations of Vehicles

Vehicle Class: 60 = Bike

- **t**: Simulation Time [s]
- **Link**: Link Number
- **v**: Average speed [mph] (Vehicle Class 0)
- **Volume**: Volume [veh/h] (Vehicle Class 0)
- **Density**: Vehicle density [veh/mi] (Vehicle Class 0)
- **Fuel**: Fuel consumption [mg/m/s] (Vehicle Class 10)

<table>
<thead>
<tr>
<th>t</th>
<th>Link</th>
<th>v(0)</th>
<th>Volume(0)</th>
<th>Density(0)</th>
<th>Fuel(10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60.0</td>
<td>233</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>-</td>
</tr>
<tr>
<td>60.0</td>
<td>233</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>-</td>
</tr>
<tr>
<td>60.0</td>
<td>233</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>-</td>
</tr>
<tr>
<td>60.0</td>
<td>233</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>-</td>
</tr>
<tr>
<td>120.0</td>
<td>233</td>
<td>17.60</td>
<td>151.07</td>
<td>8.58</td>
<td>-</td>
</tr>
<tr>
<td>120.0</td>
<td>233</td>
<td>22.54</td>
<td>157.16</td>
<td>6.97</td>
<td>-</td>
</tr>
<tr>
<td>120.0</td>
<td>233</td>
<td>27.04</td>
<td>116.04</td>
<td>4.29</td>
<td>-</td>
</tr>
<tr>
<td>120.0</td>
<td>233</td>
<td>28.44</td>
<td>119.52</td>
<td>4.20</td>
<td>-</td>
</tr>
<tr>
<td>180.0</td>
<td>233</td>
<td>28.41</td>
<td>114.29</td>
<td>4.02</td>
<td>-</td>
</tr>
<tr>
<td>180.0</td>
<td>233</td>
<td>28.18</td>
<td>143.61</td>
<td>5.10</td>
<td>-</td>
</tr>
<tr>
<td>180.0</td>
<td>233</td>
<td>28.12</td>
<td>181.00</td>
<td>6.44</td>
<td>-</td>
</tr>
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<td>180.0</td>
<td>233</td>
<td>29.16</td>
<td>167.11</td>
<td>5.73</td>
<td>-</td>
</tr>
<tr>
<td>240.0</td>
<td>233</td>
<td>18.97</td>
<td>101.75</td>
<td>5.36</td>
<td>-</td>
</tr>
<tr>
<td>240.0</td>
<td>233</td>
<td>24.70</td>
<td>119.26</td>
<td>4.83</td>
<td>-</td>
</tr>
<tr>
<td>240.0</td>
<td>233</td>
<td>28.63</td>
<td>115.18</td>
<td>4.02</td>
<td>-</td>
</tr>
<tr>
<td>240.0</td>
<td>233</td>
<td>30.49</td>
<td>116.47</td>
<td>3.82</td>
<td>-</td>
</tr>
<tr>
<td>300.0</td>
<td>233</td>
<td>24.63</td>
<td>277.47</td>
<td>11.27</td>
<td>-</td>
</tr>
<tr>
<td>300.0</td>
<td>233</td>
<td>27.81</td>
<td>298.34</td>
<td>10.73</td>
<td>-</td>
</tr>
<tr>
<td>300.0</td>
<td>233</td>
<td>29.89</td>
<td>296.68</td>
<td>9.92</td>
<td>-</td>
</tr>
<tr>
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<td>233</td>
<td>30.91</td>
<td>295.23</td>
<td>9.55</td>
<td>-</td>
</tr>
</tbody>
</table>

...
11.12 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. Cf. chapter 12.3.2 for more information on defining nodes.

For all nodes to be included in the node evaluation, the property Node Evaluation needs to be active.

Configuration

In order to get the desired output data additional information is needed. This is to be provided within the Node Evaluation Configuration window that is accessible by pressing the CONFIGURATION button via EVALUATION – FILES… - [VEHICLES], once the option Node is ticked. The window allows for definition of data to be evaluated by a node evaluation.

It contains the following lists:
11 Evaluation Types for Simulations of Vehicles

- **Selected Parameters** (use << and >> to add or remove a selected parameter)
- **Available parameters (Parameter Selection)**
- **Vehicle Class** (enabled only for some parameters)

Use the buttons UP and DOWN to arrange the entries (columns in *.KNA data file).

- **Output**: Select data type, e.g. as database table, if applicable:
  - **Compiled data**: Creates an ASCII file *.KNA according to the current settings in the window (parameters, vehicle classes etc.). If VISSIM is started with command line parameter -s<n> or if the simulation run is started via COM with RunIndex set to a value >0, the index of the simulation run will be added to the name of the output file (*.KNA).
  - **Raw data**: Creates an ASCII file *.KNR, does not regard user-defined parameter settings.
  - **Database**: If active, evaluation output of compiled and/or raw data is directed to a database with the specified Table Name (rather than to an ASCII text file *.KNA and/or *.KNR). 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 (cf. section 10.1.3).

The selected parameters and other settings are saved to a node evaluation configuration file (*.KNK) when the window is closed via OK.

**Filter**

The evaluation can be switched on/off

- separately for each node via the node attributes or
- via the list of **Active nodes** in the Node Evaluation – Filter window.

Furthermore, define the following parameters for delay measurements:

- the upstream **Start of delay segment** position,
- time period (**From** - **Until**) and
- length of the time **Interval** of the evaluation.
Results

The results of 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. If a compass with a user-defined North direction is active, any output direction data will refer to these settings, cf. section 4.1.1. 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 the following data:

- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- 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")
- an additional row 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 (with user-defined distance, but not extending across an upstream node boundary – unless there are more than four branches to side roads between the two nodes) to the node exit point of the respective turning relation. Also available is the number of passengers and the 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.

Neither scheduled stops at PT stops nor stops in parking lots are counted as stops. Neither passenger transfer times nor dwell times at STOP signs or the time spent in parking lots are counted as delays (though time losses due to
deceleration/acceleration before/behind PT stops do count for delay calculation).

Edges between nodes are ignored if they contain more than three forks, which are defined as a connector starting from a link with another connector starting downstream from the same link. This can speed up the calculation of the network graph dramatically.

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).

For Movement data output, all directions refer to the user-defined North direction of the compass, if applicable. If the compass is not displayed, Up is taken for the North direction.

Current (short/long)distance/speed/acceleration units set via View - Options - [Language & Units] are regarded for evaluation data output.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Column Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Queue Length</td>
<td>Average Queue Length</td>
<td>aveQueue</td>
</tr>
<tr>
<td>Delay time</td>
<td>Average delay per vehicle [s]</td>
<td>Delay</td>
</tr>
<tr>
<td>Emissions CO</td>
<td>Emissions CO [g]</td>
<td>EmissCO</td>
</tr>
<tr>
<td>Emissions NOx</td>
<td>Emissions NOx [g]</td>
<td>EmissNOx</td>
</tr>
<tr>
<td>Emissions VOC</td>
<td>Emissions VOC [g]</td>
<td>EmissVOC</td>
</tr>
<tr>
<td>From Link</td>
<td>Number of the link entering node</td>
<td>FromLink</td>
</tr>
<tr>
<td>From Node</td>
<td>Number of the previous node</td>
<td>FromNode</td>
</tr>
<tr>
<td></td>
<td>Node number 0 is recorded if a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>movement has no FromNode.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Only one of the node numbers is</td>
<td></td>
</tr>
<tr>
<td></td>
<td>recorded for movements with more</td>
<td></td>
</tr>
<tr>
<td></td>
<td>than one FromNode.</td>
<td></td>
</tr>
<tr>
<td>Fuel Consumption</td>
<td>Fuel Consumption [gal]</td>
<td>FuelCons</td>
</tr>
<tr>
<td>Maximum Queue Length</td>
<td>Maximum Queue Length</td>
<td>maxQueue</td>
</tr>
</tbody>
</table>
### Node Evaluation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Column Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>Movement</td>
<td>Movement (Bearing from-to; the North direction depends on the current compass settings)</td>
<td>Movement</td>
</tr>
<tr>
<td>Node</td>
<td>Node Number</td>
<td>Node</td>
</tr>
<tr>
<td>Number Veh</td>
<td>Number of Vehicles</td>
<td>Veh</td>
</tr>
<tr>
<td>Person Delay</td>
<td>Average delay per person [s]</td>
<td>PersDelay</td>
</tr>
<tr>
<td>Persons</td>
<td>Number of People</td>
<td>#Pers</td>
</tr>
<tr>
<td>Stopped Delay</td>
<td>Average stopped delay per vehicle [s]</td>
<td>tStopd</td>
</tr>
<tr>
<td>Stops</td>
<td>Average number of stops per vehicle</td>
<td>Stops</td>
</tr>
<tr>
<td>Time from</td>
<td>Start time of the Aggregation interval</td>
<td>tStart</td>
</tr>
<tr>
<td>Time to</td>
<td>End time of the Aggregation interval</td>
<td>tEnd</td>
</tr>
<tr>
<td>To Link</td>
<td>Number of the link leaving node</td>
<td>ToLink</td>
</tr>
<tr>
<td>To Node</td>
<td>Number of the next node Node number 0 is recorded if a movement has no ToNode. Only one of the node numbers is recorded for movements with more than one ToNode.</td>
<td>ToNode</td>
</tr>
</tbody>
</table>

**Example: Compiled data file (*.KNA)**

Node evaluation

File: e:\programfiles\vissim520\example\projekt_1\example.inp
Comment: Manual Example
Date: Wednesday, May 2, 2009, 5:31:39 pm
VISSIM: 5.20-00 [19022]

Node: Node Number

tStart: Start time of the Aggregation interval
tEnd: End time of the Aggregation interval
FromLink: Number of the link entering node
ToLink: Number of the link leaving node
Movement: Movement (Bearing from-to)
Delay: Average delay per vehicle [s], Vehicle Class Car
tStopd: Average stopped delay per vehicle [s], Vehicle Class Car
MaxQueue: Maximum Queue Length [ft]
### Example: Raw data file *.KNR

Node Evaluation (Raw data)

- **File:** e:\programfiles\vissim520\example\projekt_1\example.inp
- **Comment:** Manual Example
- **Date:** Wednesday, May 2, 2009, 5:31:39 pm
- **VISSIM:** 5.20-00 [19895]

```plaintext
VehNo; VehType; TStart; TEnd; StartLink; StartLane; StartPos; NodeNo; Movement; FromLink; ToLink; ToLane; ToPos; Delay; TStopd; Stops; No_Pers;
11; 100; 10; 18; 365; 1; 0; 2; SE-SW; 365; 10151; 3; 10; 2; 0; 0; 1;
16; 100; 15; 20; 358; 1; 0; 3; W-S; 358; 10420; 1; 0; -1; 0; 0; 1;
20; 100; 17; 25; 365; 1; 0; 2; SE-SW; 365; 10151; 3; 10; 2; 0; 0; 1;
6; 150; 18; 28; 274; 1; 0; 3; W-S; 358; 10420; 1; 0; -1; 0; 0; 1;
27; 100; 20; 30; 365; 1; 0; 2; SE-SW; 365; 10151; 3; 10; 2; 0; 0; 1;
33; 100; 25; 31; 358; 1; 0; 3; W-S; 358; 10420; 1; 0; -1; 0; 0; 1;
29; 100; 23; 34; 235; 1; 2; 3; N-S; 234; 234; 2; 59; 1; 0; 0; 1;
36; 100; 27; 38; 235; 1; 2; 3; N-S; 234; 234; 2; 59; 1; 0; 0; 1;
14; 100; 24; 38; 274; 1; 152; 2; SE-SW; 249; 249; 2; 44; 4; 0; 0; 1;
13; 100; 24; 38; 274; 1; 152; 2; SE-SW; 249; 249; 2; 44; 4; 0; 0; 1;
```

### Raw data output:

<table>
<thead>
<tr>
<th>Column Header</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>VehNo</td>
<td>Vehicle number</td>
</tr>
<tr>
<td>VehType</td>
<td>Vehicle type number</td>
</tr>
<tr>
<td>TStart</td>
<td>Simulation time when the vehicle crossed the start of the travel time section</td>
</tr>
<tr>
<td>TEnd</td>
<td>Simulation time when the vehicle crossed the end of travel time section (i.e. the node exit)</td>
</tr>
<tr>
<td>StartLink</td>
<td>Number of the link at the start of travel time section</td>
</tr>
<tr>
<td>StartLane</td>
<td>Number of the lane at the start of travel time section</td>
</tr>
<tr>
<td>StartPos</td>
<td>Link coordinate/Position of the travel time section on StartLink</td>
</tr>
<tr>
<td>NodeNo</td>
<td>Node number</td>
</tr>
<tr>
<td>Movement</td>
<td>Bearing from-to (compass settings)</td>
</tr>
<tr>
<td>FromLink</td>
<td>Number of the link entering the node (Note: link where the shortest path from the start of the travel time section enters the node, this is not necessarily the link where the vehicle entered the node.)</td>
</tr>
<tr>
<td>ToLink</td>
<td>Number of the link leaving node. (The vehicle really did leave the node on this link.)</td>
</tr>
<tr>
<td>ToLane</td>
<td>Number of the lane leaving node. (The vehicle really did leave the node on this lane.)</td>
</tr>
<tr>
<td>ToPos</td>
<td>Link coordinate/Position of the node exit on ToLink, i.e. where the link leaves the node</td>
</tr>
<tr>
<td>Delay</td>
<td>Delay in seconds (since travel time start section was passed)</td>
</tr>
<tr>
<td>TStopd</td>
<td>Stopped delay in seconds (since travel time start section was passed)</td>
</tr>
<tr>
<td>Stops</td>
<td>Number of stops (since travel time start section was passed)</td>
</tr>
<tr>
<td>No_Pers</td>
<td>Number of passengers</td>
</tr>
</tbody>
</table>
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

In order to get the desired output data additional information is needed. This is to be provided within the Network Evaluation - Configuration window that is accessible by pressing the CONFIGURATION button in EVALUATION – FILES... - [VEHICLES], once the option Network Performance is ticked. The window allows for definition of data 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 network performance evaluation configuration file (*.NPC).

Scheduled stops at PT stops and stops in parking lots are counted as stops. Passenger transfer times and dwell times at STOP signs and the times spent parking are counted as delays.
Filter

Set a filter with regard to time:

- *from* - *till* simulation second.

Results

A network performance evaluation file (*.NPE) contains:

- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- Evaluated simulation time (Simulation Time)
- Data block with a line for each selected parameter.

The evaluation takes the following 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.

For output of emission data, the Emissions add-on is required.

<table>
<thead>
<tr>
<th>Parameter name in the list box</th>
<th>Parameter legend in the dialog and notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of active vehicles</td>
<td>Number of vehicles in the network</td>
</tr>
<tr>
<td></td>
<td>Total number of vehicles in the network at the end of the simulation. Does not include the already arrived vehicles or the latent demand (see below).</td>
</tr>
<tr>
<td>Number of arrived vehicles</td>
<td>Number of vehicles that have left the network</td>
</tr>
<tr>
<td></td>
<td>Total number of vehicles which have already reached their destination and left the network during the simulation.</td>
</tr>
<tr>
<td>Latent demand</td>
<td>Number of vehicles which could not enter the network (from vehicle inputs and</td>
</tr>
</tbody>
</table>
### Table of Evaluation Parameters

<table>
<thead>
<tr>
<th>Parameter name in the list box</th>
<th>Parameter legend in the dialog and notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>parking lots)</td>
<td>Number of vehicles at the end of the simulation waiting to enter the network (in a parking lot or input). These are not counted as active vehicles.</td>
</tr>
<tr>
<td>Latent delay time</td>
<td>Total waiting time of vehicles which could not enter the network (immediately) [h] Summed up waiting time in vehicle inputs and parking lots of all vehicles which could not enter the network at their original start time. This can include waiting time of vehicles which have entered the network before the end of the simulation.</td>
</tr>
</tbody>
</table>

The sum of (latent demand + active vehicles + arrived vehicles) equals the total demand from vehicle inputs and matrices during the simulation period.

<table>
<thead>
<tr>
<th>Parameter name in the list box</th>
<th>Parameter legend in the dialog and notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>Total Distance Traveled [km] / [mi] Total distance traveled by active and arrived vehicles.</td>
</tr>
<tr>
<td>Travel Time</td>
<td>Total travel time [h] Total travel time of all active and arrived vehicles.</td>
</tr>
<tr>
<td>Average speed</td>
<td>Average speed Total Distance / total Travel Time (see above)</td>
</tr>
<tr>
<td>Delay Time</td>
<td>Total delay time [h] Total delay time of all active and arrived vehicles. The delay time of a vehicle in one time</td>
</tr>
<tr>
<td>Parameter name in the list box</td>
<td>Parameter legend in the dialog and notes</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>step is the part of the time step which is spent because the actual speed is lower than the desired speed. It is calculated by subtracting the quotient of the actual distance traveled in this time step and the desired speed from the length of the time step.</td>
</tr>
<tr>
<td></td>
<td>Note: Dwell times of bus/trams stopping at a PT stop are not included. Parking in any type of parking lot is not included.</td>
</tr>
<tr>
<td></td>
<td>Note: Delay time includes stopped delay (see below).</td>
</tr>
<tr>
<td>Average delay time</td>
<td>Average delay per vehicle [s]</td>
</tr>
<tr>
<td></td>
<td>Total delay time / (active + arrived vehicles)</td>
</tr>
<tr>
<td>Stopped Delay</td>
<td>Total stopped delay [h]</td>
</tr>
<tr>
<td></td>
<td>Total stopped time of all active and arrived vehicles.</td>
</tr>
<tr>
<td></td>
<td>Stopped delay = time when vehicle is standing (speed is zero).</td>
</tr>
<tr>
<td></td>
<td>Note: Dwell times of bus/trams stopping at a PT stop are not included. Parking in any type of parking lot is not included.</td>
</tr>
<tr>
<td>Average stopped delay</td>
<td>Average stopped delay per vehicle [s]</td>
</tr>
<tr>
<td></td>
<td>Total stopped delay / (active + arrived vehicles)</td>
</tr>
<tr>
<td>Number of Stops</td>
<td>Total number of stops</td>
</tr>
<tr>
<td></td>
<td>Total number of stops of all active and arrived vehicles.</td>
</tr>
<tr>
<td></td>
<td>A stop is counted if the speed of the vehicle was greater than zero at the end of the previous time step and is zero at the end of the current time step.</td>
</tr>
</tbody>
</table>
## 11 Evaluation Types for Simulations of Vehicles

<table>
<thead>
<tr>
<th>Parameter name in the list box</th>
<th>Parameter legend in the dialog and notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average number of stops</td>
<td>Average number of stops per vehicle</td>
</tr>
<tr>
<td></td>
<td>Total number of stops / (active + arrived vehicles)</td>
</tr>
<tr>
<td>Fuel Consumption Emissions</td>
<td>Fuel Consumption / Emission [kg]</td>
</tr>
<tr>
<td></td>
<td>Only available if the Emissions module is included in the VISSIM license. Please refer to section 11.18.</td>
</tr>
</tbody>
</table>

### Example (*.NPE file)

Network Performance

File:  e:\programfiles\ PTV_Vision\Vissim530\example\manual.inp
Comment:  Manual example
Date:  Friday, August 13, 2010, 15:43:02
VISSIM:  5.30-00* [24926]

Simulation time from 0.0 to 180.0.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average delay time per vehicle [s], All Vehicle Types</td>
<td>27.221</td>
</tr>
<tr>
<td>Average number of stops per vehicles, All Vehicle Types</td>
<td>0.836</td>
</tr>
<tr>
<td>Average speed [km/h], All Vehicle Types</td>
<td>24.883</td>
</tr>
<tr>
<td>Average stopped delay per vehicle [s], All Vehicle Types</td>
<td>18.564</td>
</tr>
<tr>
<td>Total delay time [h], All Vehicle Types</td>
<td>2.450</td>
</tr>
<tr>
<td>Total Distance Traveled [km], All Vehicle Types</td>
<td>130.606</td>
</tr>
<tr>
<td>Evaporation [kg], All Vehicle Types</td>
<td>-</td>
</tr>
<tr>
<td>Emissions Benzene [kg], All Vehicle Types</td>
<td>-</td>
</tr>
<tr>
<td>Emissions CO [kg], All Vehicle Types</td>
<td>-</td>
</tr>
<tr>
<td>Emissions CO2 [kg], All Vehicle Types</td>
<td>-</td>
</tr>
<tr>
<td>Emissions HC [kg], All Vehicle Types</td>
<td>-</td>
</tr>
<tr>
<td>Emissions NMHC [kg], All Vehicle Types</td>
<td>-</td>
</tr>
<tr>
<td>Emissions NMOG [kg], All Vehicle Types</td>
<td>-</td>
</tr>
<tr>
<td>Emissions NOx [kg], All Vehicle Types</td>
<td>-</td>
</tr>
<tr>
<td>Emissions Particulates [kg], All Vehicle Types</td>
<td>-</td>
</tr>
<tr>
<td>Emissions Soot [kg], All Vehicle Types</td>
<td>-</td>
</tr>
<tr>
<td>Fuel Consumption [kg], All Vehicle Types</td>
<td>-</td>
</tr>
<tr>
<td>Latent delay time [h], All Vehicle Types</td>
<td>0.000</td>
</tr>
<tr>
<td>Latent demand, All Vehicle Types</td>
<td>0.000</td>
</tr>
<tr>
<td>Number of Stops, All Vehicle Types</td>
<td>271.00</td>
</tr>
<tr>
<td>Number of vehicles in the network, All Vehicle Types</td>
<td>127.00</td>
</tr>
<tr>
<td>Number of vehicles that have left the network, All Vehicle Types</td>
<td>197.00</td>
</tr>
<tr>
<td>Total stopped delay [h], All Vehicle Types</td>
<td>1.671</td>
</tr>
<tr>
<td>Total travel time [h], All Vehicle Types</td>
<td>5.249</td>
</tr>
</tbody>
</table>
11.14 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.
11.15 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 accessible by pressing the Filter button in Evaluation – Files… - [VEHICLES], once the option Lane Change is ticked.

Filter

The Lane Change Evaluation Filter window is similar to the Vehicle Record Filter window. For further information on the filter definition cf. section 11.7. Filter parameters are saved to *.LCF file.

Results

For every vehicle captured by the filter definitions, every lane change event will be logged into a lane change file (*.SPW).

- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- Data block with
  - Time when the lane change starts
  - Vehicle number
  - Speed [m/s]
  - Link number
  - Number of the old lane
  - Number of the new lane
  and for both the old and new vehicles in front (VF) and the old/new vehicles in the back (VB):
  - Vehicle number (0 if not existing)
  - Speed [m/s]
  - Speed Difference [m/s]

The end of the time step in which the lane change starts is output. If the simulation is run with only one time step per simulation second, the lane change has started about one second ago at this point in time.
Distance [m] between the rear bumper of the preceding vehicle (VF) and the front bumper of the trailing vehicle (VB)

For lane change data output, metric units are used.

**Example (*.SPW file)**

Lane Change Record

<table>
<thead>
<tr>
<th>t</th>
<th>VehNr</th>
<th>Link No.</th>
<th>Lane</th>
<th>New Lane</th>
<th>VF (m/s)</th>
<th>dv VF (m/s)</th>
<th>vb VF (m/s)</th>
<th>dx VF (m)</th>
<th>VB (m/s)</th>
<th>dv VB (m/s)</th>
<th>vb new VB (m/s)</th>
<th>dx new VB (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.40</td>
<td>22</td>
<td>15.19</td>
<td>1; 1</td>
<td>2; 7</td>
<td>14.55</td>
<td>0.63</td>
<td>137.42</td>
<td>0</td>
<td>-1.00</td>
<td>-1.00</td>
<td>-1.00</td>
<td>14</td>
</tr>
<tr>
<td>22.50</td>
<td>16</td>
<td>14.36</td>
<td>28; 2</td>
<td>1</td>
<td>0</td>
<td>-1.00</td>
<td>-1.00</td>
<td>-1.00</td>
<td>0</td>
<td>-1.00</td>
<td>-1.00</td>
<td>-1.00</td>
</tr>
<tr>
<td>24.00</td>
<td>17</td>
<td>14.16</td>
<td>28; 2</td>
<td>1</td>
<td>0</td>
<td>-1.00</td>
<td>-1.00</td>
<td>-1.00</td>
<td>0</td>
<td>-1.00</td>
<td>-1.00</td>
<td>-1.00</td>
</tr>
</tbody>
</table>
11.16 PT 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 configuration required.

Results

This is the file format of an output file (*.OVW):

- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)

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.

For PT waiting time data output, metric units are used.

Example (*.OVW file)

Table of PT waiting times

<table>
<thead>
<tr>
<th>Time</th>
<th>VehNo</th>
<th>Line</th>
<th>Link</th>
<th>At</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>123</td>
<td>1</td>
<td>218</td>
<td>106</td>
<td>82.97</td>
<td>5</td>
</tr>
<tr>
<td>137</td>
<td>44</td>
<td>2114</td>
<td>272</td>
<td>152.46</td>
<td>45</td>
</tr>
<tr>
<td>159</td>
<td>55</td>
<td>206</td>
<td>106</td>
<td>83.08</td>
<td>12</td>
</tr>
<tr>
<td>233</td>
<td>54</td>
<td>1114</td>
<td>247</td>
<td>58.50</td>
<td>135</td>
</tr>
<tr>
<td>323</td>
<td>242</td>
<td>2114</td>
<td>272</td>
<td>145.77</td>
<td>43</td>
</tr>
<tr>
<td>324</td>
<td>249</td>
<td>202</td>
<td>106</td>
<td>82.97</td>
<td>2</td>
</tr>
<tr>
<td>482</td>
<td>386</td>
<td>218</td>
<td>106</td>
<td>82.86</td>
<td>6</td>
</tr>
<tr>
<td>482</td>
<td>416</td>
<td>107</td>
<td>110</td>
<td>351.65</td>
<td>5</td>
</tr>
<tr>
<td>497</td>
<td>420</td>
<td>2114</td>
<td>272</td>
<td>152.33</td>
<td>31</td>
</tr>
<tr>
<td>518</td>
<td>429</td>
<td>1114</td>
<td>247</td>
<td>58.45</td>
<td>46</td>
</tr>
<tr>
<td>573</td>
<td>501</td>
<td>206</td>
<td>106</td>
<td>82.86</td>
<td>3</td>
</tr>
</tbody>
</table>
11.17 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 configuration required.

Results

This is the file format of an output file (*.FHZ):

- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no (VISSIM)
- Data block:
  - one data line for each vehicle entering the VISSIM network, and
  - one column per parameter.

If a dynamic assignment vehicle starts from a parking lot, the number of the parking lot is written to the column “Link” (not the link number) and zero to the column “Lane”.

Example (*.FHZ file)

Table of vehicles entered

File: e:\programfiles\vissim520\example\manual.inp
Comment: Manual example
Date: Wednesday, May 2, 2009, 15:43:02
VISSIM: 5.20-00 [19022]

<table>
<thead>
<tr>
<th>Time</th>
<th>Link</th>
<th>Lane</th>
<th>VehNr</th>
<th>VehType</th>
<th>Line</th>
<th>DesSpeed</th>
<th>CatTemp</th>
<th>CWTemp</th>
<th>DestPLot</th>
<th>Start Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>2008</td>
<td>1</td>
<td>1</td>
<td>401</td>
<td>218</td>
<td>48.9</td>
<td>20.0</td>
<td>20.0</td>
<td>0</td>
<td>0.1</td>
</tr>
<tr>
<td>0.1</td>
<td>1001</td>
<td>1</td>
<td>2</td>
<td>402</td>
<td>101</td>
<td>48.9</td>
<td>20.0</td>
<td>20.0</td>
<td>0</td>
<td>0.1</td>
</tr>
<tr>
<td>1.2</td>
<td>279</td>
<td>1</td>
<td>3</td>
<td>100</td>
<td>0</td>
<td>49.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
<td>1.3</td>
</tr>
<tr>
<td>2.6</td>
<td>273</td>
<td>1</td>
<td>4</td>
<td>100</td>
<td>0</td>
<td>48.3</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
<td>2.6</td>
</tr>
<tr>
<td>3.6</td>
<td>279</td>
<td>1</td>
<td>5</td>
<td>100</td>
<td>0</td>
<td>51.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
<td>3.7</td>
</tr>
<tr>
<td>7.1</td>
<td>274</td>
<td>1</td>
<td>6</td>
<td>150</td>
<td>0</td>
<td>53.7</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
<td>7.1</td>
</tr>
<tr>
<td>9.2</td>
<td>275</td>
<td>1</td>
<td>7</td>
<td>100</td>
<td>0</td>
<td>51.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
<td>9.2</td>
</tr>
<tr>
<td>9.7</td>
<td>279</td>
<td>1</td>
<td>8</td>
<td>150</td>
<td>0</td>
<td>55.8</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
<td>9.8</td>
</tr>
</tbody>
</table>

...
11.18 Emission Statistics

Additionally to the VISSIM interface to various external emission calculation modules, PTV AG offers the Emissions add-on to VISSIM. For further information please contact PTV AG.

Without this add-on, emission data can be output via Node evaluation.
11.19 Export

Once option Export is checked via EVALUATION – FILES… - [VEHICLES], the Export Configuration window can be accessed via CONFIGURATION.

The Export Configuration window allows for output of dedicated output files for later use in external visualization packages:

- GAIA,
- VS-pCoq Spy,
- MISKAM
- SSAM Trajectory.
11 Evaluation Types for Simulations of Vehicles

11.20 Special Evaluations (Discharge rate evaluation)

The option Special Evaluations contained in the Offline Analysis (File) window (EVALUATION – FILES... - [VEHICLES]) 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.

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.). A Discharge rate evaluation file (*.A**) contains the following information:

- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- Details, e.g. Discharge at SC 10, signal group 4 (data collection point 10422)
- Data block:
  - 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)**

Discharge Rate Evaluation

File: e:\programfiles\vissim520\example\manual.inp
Comment: Manual example
Date: T Wednesday, May 2, 2009, 15:43:02
VISSIM: 5.20-00 [19061]

Discharge at SC 10, signal group 4 (data collection point 10422)
## Evaluation Types for Simulations of Vehicles

<table>
<thead>
<tr>
<th></th>
<th>2.07</th>
<th>2.52</th>
<th>(1: 2.52)</th>
<th>2.14</th>
</tr>
</thead>
<tbody>
<tr>
<td>901</td>
<td>2.10</td>
<td>2.73</td>
<td>1.73</td>
<td>2.19</td>
</tr>
<tr>
<td>989</td>
<td>2.08</td>
<td>2.61</td>
<td>2.27</td>
<td>2.12</td>
</tr>
<tr>
<td>1081</td>
<td>1.91</td>
<td>2.65</td>
<td>1.90</td>
<td>2.10</td>
</tr>
<tr>
<td>1169</td>
<td>1.95</td>
<td>2.86</td>
<td>2.02</td>
<td>1.80</td>
</tr>
<tr>
<td>1261</td>
<td>2.07</td>
<td>2.65</td>
<td>1.78</td>
<td>1.85</td>
</tr>
<tr>
<td>1351</td>
<td>1.92</td>
<td>2.60</td>
<td>1.97</td>
<td>1.88</td>
</tr>
<tr>
<td>1442</td>
<td>2.06</td>
<td>2.34</td>
<td>2.04</td>
<td>2.00</td>
</tr>
<tr>
<td>1529</td>
<td>2.03</td>
<td>2.86</td>
<td>1.84</td>
<td>2.41</td>
</tr>
<tr>
<td>1619</td>
<td>2.00</td>
<td>2.75</td>
<td>2.09</td>
<td>1.38</td>
</tr>
<tr>
<td>1709</td>
<td>2.06</td>
<td>2.61</td>
<td>1.90</td>
<td>1.93</td>
</tr>
<tr>
<td>1797</td>
<td>2.11</td>
<td>2.44</td>
<td>2.01</td>
<td>1.62</td>
</tr>
<tr>
<td>1889</td>
<td>1.90</td>
<td>2.58</td>
<td>1.86</td>
<td>1.56</td>
</tr>
<tr>
<td>1981</td>
<td>2.03</td>
<td>2.54</td>
<td>2.09</td>
<td>1.71</td>
</tr>
<tr>
<td>2070</td>
<td>1.95</td>
<td>2.64</td>
<td>2.14</td>
<td>1.80</td>
</tr>
<tr>
<td>2158</td>
<td>2.13</td>
<td>2.42</td>
<td>1.87</td>
<td>1.71</td>
</tr>
<tr>
<td>2249</td>
<td>1.93</td>
<td>2.63</td>
<td>1.80</td>
<td>2.11</td>
</tr>
<tr>
<td>2341</td>
<td>1.95</td>
<td>2.64</td>
<td>2.14</td>
<td>1.80</td>
</tr>
<tr>
<td>2429</td>
<td>1.93</td>
<td>2.63</td>
<td>1.80</td>
<td>2.11</td>
</tr>
<tr>
<td>2521</td>
<td>2.02</td>
<td>2.48</td>
<td>1.75</td>
<td>2.37</td>
</tr>
<tr>
<td>2609</td>
<td>2.03</td>
<td>2.57</td>
<td>1.98</td>
<td>1.92</td>
</tr>
<tr>
<td>2701</td>
<td>1.87</td>
<td>2.72</td>
<td>1.99</td>
<td>1.92</td>
</tr>
<tr>
<td>2798</td>
<td>2.22</td>
<td>2.48</td>
<td>1.92</td>
<td>1.49</td>
</tr>
<tr>
<td>2881</td>
<td>2.00</td>
<td>3.10</td>
<td>1.91</td>
<td>1.73</td>
</tr>
<tr>
<td>2972</td>
<td>2.09</td>
<td>3.00</td>
<td>2.67</td>
<td>1.71</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
<td>24</td>
<td>22</td>
</tr>
</tbody>
</table>

[173: 1.92]
11.21 Paths Evaluation

The Paths Evaluation file (*.WGA) can only be used with the Dynamic Assignment add-on. It is intended to produce results in a user-definable format for a Dynamic Assignment run.

Definition

No additional definition required.

Configuration

For configuration, the Path Evaluation Configuration window can be accessed, if option Paths (Dynamic Ass.) is ticked in the Offline Analysis (File) window (EVALUATION – FILES… - [VEHICLES])

Path evaluation can be output to file (*.WGA) and 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 (cf. section 10.1.3).

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.

**Results**

A Path evaluation file (*.WGA) contains the following information:

- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- List of selected parameters with brief description
- Data block with output data per path

**Travel time edge:** Sum of travel times of edges of the path between two parking lots. The travel time of an edge sums up from the travel times of all vehicles traversing this edge except input vehicles or public transport vehicles. Thus vehicles passing an edge can also be those with different origin or destination parking lots. Vehicles which have not yet finished their ride through the network are regarded for only those edges they already have traversed.

**Travel time path:** Travel time for relations from–to parking lots. The measurement can only include vehicles which have reached their destination parking lot.

For output of travel times, three variants are provided for either type:

- **Expected:** Travel time before simulation run.
- **Determined:** Travel time of last run.
- **Smoothed:** Travel time after averaging according to the settings in the Edge Cost Values window. Access to this window is provided via menu TRAFFIC - DYNAMIC ASSIGNMENT which calls the Dynamic Assignment window. Here, click the EXTENDED button next to option Store costs.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Column Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>Distance (selected short length unit)</td>
<td>Dist</td>
</tr>
<tr>
<td>Link Cost</td>
<td>Total of all link cost on the path</td>
<td>LinkCost</td>
</tr>
<tr>
<td>Parking Lot Destination</td>
<td>Destination parking lot number</td>
<td>DestP</td>
</tr>
<tr>
<td>Parking Lot Origin</td>
<td>Origin parking lot number</td>
<td>OrigP</td>
</tr>
<tr>
<td>Path number</td>
<td>Path number (see legend)</td>
<td>PathNo</td>
</tr>
<tr>
<td>Relative Volume</td>
<td>Share of the number of vehicles started on all paths for this OD pair (Veh. Type)</td>
<td>RelVol</td>
</tr>
<tr>
<td>Time from</td>
<td>Time interval start</td>
<td>TimeFrom</td>
</tr>
<tr>
<td>Time to</td>
<td>Time interval end</td>
<td>TimeTo</td>
</tr>
<tr>
<td>Total Cost</td>
<td>Total Cost (using the vehicle type's coefficients)</td>
<td>TotCost</td>
</tr>
<tr>
<td>Travel time diff.</td>
<td>Percentage difference to travel time from previous iteration</td>
<td>TravTimeDiff</td>
</tr>
<tr>
<td>Travel time edges (determined)</td>
<td>Determined average total of edges’ travel times [s]</td>
<td>DetEdgeTT</td>
</tr>
<tr>
<td>Travel time edges (estimated)</td>
<td>Expected average total of edges’ travel times [s]</td>
<td>ExpTravT</td>
</tr>
<tr>
<td>Travel time edges (smoothed)</td>
<td>Smoothed average total of edges’ travel times [s]</td>
<td>SmEdgeTT</td>
</tr>
<tr>
<td>Travel time path (determined)</td>
<td>Determined average path travel time [s]</td>
<td>DetPathTT</td>
</tr>
<tr>
<td>Travel time path (estimated)</td>
<td>Expected average travel time for the path [s]</td>
<td>ExpPathTT</td>
</tr>
<tr>
<td>Travel time path (smoothed)</td>
<td>Smoothed average path travel time [s]</td>
<td>SmPathTT</td>
</tr>
<tr>
<td>Volume</td>
<td>Number of vehicles started on the path (Veh. Type)</td>
<td>Volume</td>
</tr>
<tr>
<td>Zone Destination</td>
<td>Destination zone number</td>
<td>DestZ</td>
</tr>
<tr>
<td>Zone Origin</td>
<td>Origin zone number</td>
<td>OrigZ</td>
</tr>
</tbody>
</table>
Example (*.WGA file)

Path Evaluation

File: D:\Programme\PTV_Vision\VISSIM520\Examples\Training\DynamicAssignment\Detour\Detour.inp
Comment: Dynamic Assignment routing example
Date: Thursday, Oct. 22, 4:27:10 pm
VISSIM: 5.20-00* [20623]

TimeFrom: Time interval start
TimeTo: Time interval end
OrigP: Origin parking lot number
OrigZ: Origin zone number
DestP: Destination parking lot number
DestZ: Destination zone number
PathNo: Path number (see legend)
Dist: Distance [ft]
LinkCost: Total of all link cost on the path
TotCost: Total Cost (using the vehicle type's coefficients) (Vehicle Type 1)
TravTimeDiff: Percentage difference to travel time from previous iteration
DetEdgeTT: Determined average total of edges’ travel times [s]
ExpEdgeTT: Expected average total of edges’ travel times [s]
SmEdgeTT: Smoothed average total of edges’ travel times [s]
DetPathTT: Determined average path travel time [s]
ExpPathTT: Expected average travel time for the path [s]
SmPathTT: Smoothed average path travel time [s]
Volume: Number of vehicles started on the path (All Vehicle Types)
RelVol: Share of the number of vehicles started on all paths for this OD relation (All Vehicle Types)

Path 1, from parking lot 1, to parking lot 3, through node(s): 1 2 3 4
Path 2, from parking lot 1, to parking lot 3, through node(s): 1 2 9 10 3 4
Path 3, from parking lot 1, to parking lot 3, through node(s): 1 2 9 10 3 4
Path 1, from parking lot 1, to parking lot 4, through node(s): 1 2 3 4
Path 2, from parking lot 1, to parking lot 4, through node(s): 1 2 9 10 3 4
Path 3, from parking lot 1, to parking lot 4, through node(s): 1 2 9 10 3 4
Path 1, from parking lot 2, to parking lot 3, through node(s): 1 2 3 4
Path 2, from parking lot 2, to parking lot 3, through node(s): 1 2 9 10 3 4

...
11.22 Convergence Evaluation

The Convergence Evaluation file (CVA) can be used with the Dynamic Assignment module only. For every time interval it contains the distribution of changes 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 chapter 12.

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 Evaluation – Files… - [VEHICLES], once the option Convergence is active.

Here the minimum edge length can be defined for edges to be considered for the calculation of travel time differences.

Shorter edges will not be included in convergence detection and evaluation.

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.

A convergence evaluation file (*.CVA) contains the following information:
► File title
► Path and name of the input file (File)
► Simulation comment (Comment)
► Date and time of the evaluation (Date)
► Version no. with Service pack no. and Build no. (VISSIM)
► Data table:
  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), value (Class to) belongs to the class. Thus class from 2 to 5 for volume difference on edges means: All edges that changed volume by more than 2 up to 5 vehicles are contained here (in the example below the value is 7 for time interval 0 to 300).

Example (*.CVA file)

Convergence Evaluation

File: e:\programfiles\vissim520\example\manual.inp
Comment: Manual example
Date: Friday, June 20, 2009, 15:43:02
VISSIM: 5.20-00 [19895]

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;
          300.0; 600.0; 0; 0; 7; 14; 2; 0; 0; 0; 0;
Paths:
          0.0; 300.0; 12; 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; 0;
          300.0; 600.0; 12; 0; 0; 0; 0; 0; 0; 0; 0; 0; 0;
11.23 Managed Lanes

Managed lane parameters for the whole network gained during the complete simulation run can be output as *.MLE file.

Definition

Managed lanes and toll pricing models have to be defined, cf. section 5.6.

Configuration

EVALUATION – FILES… - [VEHICLES] – Managed lanes - Configuration calls the Managed lanes evaluation - Configuration window which allows for the selection of the evaluation parameters.

The window contains the following lists:

- **Parameter selection**
- **Selected parameters:** Shows the currently set format of the output file.
- **Vehicle class** (applies only to some of the parameters).

This configuration is saved as configuration file *.MLC.

Result

The manages lanes evaluation file (*.MLE) contains the following data:

- File title
- Path and name of the input file (File)
- Simulation comment (Comment)
- Date and time of the evaluation (Date)
- Version no. with Service pack no. and Build no. (VISSIM)
- Number and name of the managed lane
- Number and name of the managed lane routing decision
11 Evaluation Types for Simulations of Vehicles

- **Brief description of the parameters**
- **Data block with one column per parameter**

**Example (*.MLE file)**

Managed Lanes Evaluation

File: `e:\programfiles\vissim520\example\projekt_1\example.inp`
Comment: Base Model
Date: Friday, June 20, 2009, 15:43:02
VISSIM: 5.20-00 [19061]

Managed lanes facility 1: Main Road
Managed lanes decision 2: MLD Main

<table>
<thead>
<tr>
<th><strong>AvsGP</strong></th>
<th><strong>AvsML</strong></th>
<th><strong>FacilityNo</strong></th>
<th><strong>Time</strong></th>
<th><strong>HOV2</strong></th>
<th><strong>HOV3+</strong></th>
<th><strong>SOV</strong></th>
<th><strong>Revenue</strong></th>
<th><strong>TTS</strong></th>
<th><strong>VehGP(All)</strong></th>
<th><strong>VehML(All)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>60.00</td>
<td>60.00</td>
<td>1</td>
<td>0.0</td>
<td>2.00</td>
<td>3.00</td>
<td>2.50</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>60.00</td>
<td>60.00</td>
<td>1</td>
<td>200.0</td>
<td>-1.00</td>
<td>-1.00</td>
<td>-1.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.00</td>
<td>0.00</td>
<td>1</td>
<td>Total</td>
<td>2.00</td>
<td>3.00</td>
<td>2.50</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
11.24 Analyzer Report

The VISSIM Analyzer is a tool for generating easy to read, filtered reports. The Analyzer is to provide a simple way for users to do the following:

► configure what data they want
► store the data in a central location and
► provide report files

Additionally to the Standard report format, there are also some basic ways to extend and enhance these reports.

11.24.1 Quick Start

Creating an Analyzer database

To create an Analyzer database, you must do the following:

► load a network *.INP
► set your nodes to the intersections that you are interested in
► open the EVALUATION menu from the menu bar and select FILES….
► tick option ANALYZER DATABASE
► click the CONFIGURATION button
  - enter the name of the database you want to save the data to
  - click OK to store your filename
► click OK to confirm and to exit the dialog
► run your simulation (for multiple simulation runs, cf. section 8.1.3).

How to run the Analyzer

In this example, a full report will be generated.

To use the Analyzer, open the EVALUATION menu from the menu bar and select ANALYZER REPORTS....

Enter the filename or browse for your database using 

The database does not have to belong to your current project.
11 Evaluation Types for Simulations of Vehicles

► Select your Access version.
► Select the Access database or create a new *.MDB.

In the Analyzer Database window, you may click DATABASE CONNECTIONS to select another database, cf. section 10.1.3.2.

► Check the connection.
► Confirm Ok.

Analyzer allows for selection of the reports to be generated. By default, all of the reports are checked, however, you can deselect a report by right click on the report title and selecting “DeSelect Report” from the pop up-menu. To tick a report that has not yet been selected, right click and select “Select Report” from the pop up menu. To generate the reports click GENERATE REPORTS on the Analyzer Reports dialog window:

During report generation, Analyzer will inform you of the report that it is generating and its progress in generating the report in the Status Bar of the dialog.

Once the reports are finished, Microsoft Excel™ will open, displaying your reports.

An Options dialog will also open, allowing you to save the reports to file (*.XML or *.PDF) or add a header or footer to the reports.
All the reports are visible as tabs at the bottom of the Excel window as well as a blank sheet for editing.

11.24.2 User Interface In Depth

In this example, a customized report will be generated.
When first opened, the left window displays options for the user to click on:

**Network Information**
- Information about the network that created the Analyzer Database, including the Database name, the network name and location, comments and the number of links, nodes, and simulation runs.

**Global**
- Allows you to select filters and apply them to all reports. (Global Filter: Location does not apply to the Travel Times report, as Travel Time Sections are handled differently than...
Reports | Network performance, Delay, Movement Group Delay, Travel Times, Travel Time Delay, Queue Lengths, Volumes (cf. section 11.24.4)

Filters are criteria that allow you to trim your selections from all the data collected for Analyzer from the entire network to just the information you are interested in. This is done by adding clauses to the database query when Analyzer starts processing the reports. These filters include:

| Nodes | The nodes (Intersections) or Travel Time Segments that are contained in the network. |
| Vehicle Types | The types of vehicles in the network that generate data. (Note: If a vehicle is not listed in the filter, it generated no data which is usable by Analyzer reports.) |
| Random Seed | The Random seed values associated with individual simulation runs. |
| Time Period | Allows user to select a time period in the simulation that they are interested in seeing data for. The Time Period filter works two ways:  
► If the data is recorded at a particular time, the Time Period filter will select only the data that falls within the period you selected, or  
► if the data occurs within a range of time, the Time Period filter will only select the data whose start and end time fall within the period you selected. |
| Measures | Travel time measures defined in the network. (Selection refers only to the Travel Times Report, since nodes are evaluated in a different manner.) |
| Movement Group Delay | You can select groups of turn volumes and groups of vehicle types. The report logs the delays for each combination. (Selection refers only to the Movement Group Delay Report) |

By default, Analyzer automatically selects all the objects in the filter. This is indicated above the filter selection window by a checkbox. To select individual objects in the filter, uncheck the checkbox and make your selections.

In each filter you can select multiple adjacent items using **SHIFT + CLICK** or click & drag. You can also select non-adjacent items by using **CTRL + CLICK**.
Selecting filters in *Global* Filter will allow you to set or reset all of the other filters of that type at once (with the exception of Travel Time’s Location filter). Each report will then contain the selections made in *Global* Filter. Changes to the report filters will not affect *Global* Filters.

**Time filters**

Via *Global* you can set a single time interval which will be regarded for all of the reports: Check the option *Set values or All*.

For time interval definition, you need to uncheck the option *Set values or All* in the *Global* filter first. Then you need to check it again to use the time interval settings for any other report.

If you click on the Time Period filter, a dialog appears and allows you to manually enter the time period that you are interested in.

This dialog displays the times (in simulation seconds) of the first and the last data recorded in your network.
New Interval
1. Make sure, that the option Set values or All: has been unchecked. Otherwise you cannot define a time interval by report but just the Global one.
2. In the desired report, select the Time entry.
3. In the window to the right, right-click to call the context menu: Select NEW.
4. Enter the time span for network data output.
5. Confirm OK.
The new interval appears in the window to the right.

Delete Interval
1. Mark the desired interval.
2. In the context menu, select DELETE.

Edit Interval
1. Mark the desired interval.
2. In the context menu, select EDIT.

Vehicle group filters
In the Movement Group Delay filter you can define a Vehicle group filter for this report.

For vehicle group definition, you need to uncheck the option Set values or All. ✔ in the Movement Group Delay filter first.

New vehicle group
1. Make sure, that the option Set values or All: has been unchecked. Otherwise you cannot define a new vehicle group.
2. In the Movement Group Delay filter, select the Vehicle group entry.
3. In the window in the middle, right-click to call the context menu: Select NEW.
4. In the Enter group name window, enter the name.
5. Confirm OK.
6. In the window to the right, left-click while holding CTRL down to select the desired vehicle types.
The marked vehicle types in the window to the right already represent your selection.

1. In the window in the middle, mark the desired vehicle group.
2. Click **DEL** or select **DELETE** in the context menu.

### Loading and Saving Settings

**SETTINGS** allows you to save filter selections you’ve made for this database as well as saving headers and footers for the generated report (For information about setting headers and footers, see below: Adding a Header and Footer). To save your settings, make your filter selections and press **SETTINGS**. When the *Analyzer Configuration* dialog displays, press **SAVE**, select the location and filename you would like to save to and press **OK**. This will also save the header and footer if you apply them to the reports through the Analyzer *Add Header / Footer* dialog.

You can also load previously saved settings through this window. To load settings, press **LOAD** and browse to your file location, select it and click **OPEN**. When the file is loaded, pick the Settings you want to load.
The **Preview Settings** will be displayed in the preview window on the right. Select the settings you would like to load and press OK.

- If you loaded any of the report settings, they will be selected when you return to the main Analyzer window.
- If you loaded the header or footer settings, they will be applied when the reports are generated.

If you load report filter selections for a different database than was used to save the settings, Analyzer will select any matches it finds in your current database.

Analyzer uses an *.ANC (Analyzer Configuration) file to store your settings. This file can be opened and modified with any text editor. The basic format is as follows:

```
[Database]
Database0=C:\Projects\analyzer.mdb

[Header]
Header.Left=PTV America
Header.LeftPicture=
Header.Center=
Header.CenterPicture=
Header.Right=Page &P of &N

[Footer]
Footer.Left=&D &T
Footer.LeftPicture=
Footer.Center=
Footer.CenterPicture=
Footer.Right=Page &P of &N
```
Viewing the Database

If you have Microsoft Access™ 2003 or later installed, you can view your database by clicking on View Database in the main Analyzer window. Database table descriptions can be found in the Section: Database Tables.

Finished Report Options Bar

After the reports have been generated, a small dialog will display with some options for your report. In addition to generating the reports in XLS Format, if your Excel™ Version is 2003 or above you can also export your report to an XML format.

Header and Footer information cannot be exported to XML.

If you have PDF Creator installed, you can export to PDF format.

You cannot export or add headers and footers while in Print Preview mode.

From this dialog, you can also add a header or footer by pressing ADD HEADER / FOOTER. Pressing it will give you the following dialog.
If you have loaded settings from the main window, this will already be populated with the contents you loaded. If you chose to save your settings, when you press OK, it will write the contents of this dialog to the ANC file.

Analyzer Header & Footer uses the same symbols Excel™ does to save and apply formating:

- &P : Page Number
- &N : Number of Pages in Document
- &D : Current Date
- &T : Current Time
- &G : Graphic

### 11.24.3 The Analyser Report Format

The Analyzer can create multiple main reports and one summary report with information about the network file, the database file and selections the user has made. The main reports are:

- Network Performance
- Delay
- Movement Group Delay
- Travel Times
- Travel Time Delay
- Queue Lengths
- Volumes

#### Network Performance

- **Vehicle class**: Name and number.
- **Number of vehicles**: List of vehicles inserted during the simulation.
- **Travel time**: Total travel time over a travel time measurement for all vehicles crossing this measurement.
11 Evaluation Types for Simulations of Vehicles

- **Distance**: Total distance for all vehicle types and for all defined simulation runs.
- **Delay**: Total delay for all vehicle types and for all defined simulation runs.
- **Avg speed**: Average speed of vehicles passing the travel time measurement, based on shortest path and average speed.
- **Avg delay**: Average delay per vehicle (in seconds), cf. definition in section 11.12.
- **Avg number of stops**: Average number of stops per vehicle (in seconds).
- **Avg stop delay**: Average standstill time per vehicle (in seconds).

For a network evaluation you may not chose a special selection. This report always regards the entire network.

### Delay

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Approach</th>
<th>Movement</th>
<th>Run</th>
<th>LOS</th>
<th>Average(s)</th>
<th>Standard Deviation(s)</th>
<th>Min(s)</th>
<th>Max(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Intersection**: Node number or name.
- **Approach**: The direction of the approach of vehicles to the intersection as defined by node evaluation.
- **Movement**: The turning movement within the intersection.
- **Delay**: The average delay of all vehicles as defined in section 11.12
- **Volume**: The number of vehicles recorded through the node as defined in 11.12
- **LOS**: Level of Service of the intersection based on the Highway Capacity Manual (HCM) LOS categorization for signalized intersections (Chapter 16). The level of service is based on the signalized intersection definition regardless of the type of intersection. Note that VISSIM provides total delay as specified by the user for each node evaluation, while the HCM LOS designations are based on control delay estimated on 15 minute intervals. Refer to Section 10.2 and FHWA Publication No. FHWA-HRT-04-040 for more discussion on the comparison of simulation delay results to the HCM methodology. The table below lists the average delay per vehicle in seconds:

|  | A | ≤ 10 |
|  | B | > 10 - 20 |
|  | C | > 20 - 35 |
|  | D | > 35 - 55 |
|  | E | > 55 - 80 |
You can select movement groups and vehicle type groups. The report contains the delay by combination.

- **Movement Group Delay**
  - **Intersection Name**: Node names.
  - **Intersection number**: Node numbers.

- **Travel Times**
  - **Name**: User-defined name of the travel time section
  - **Travel Time Section**: Section number used to uniquely identify the travel time section
  - **Distance**: Shortest path from beginning of travel time section to end
  - **Travel Time**: Average travel time across a travel time section for all vehicles that complete the travel time section
  - **Volume**: Number of vehicles that complete the travel time section
  - **Average**: Volume-weighted average of travel time
  - **Field Estimate(s)**: Can freely be filled.
  - **Standard Deviation**: Standard deviation of travel time based on raw data in the database
  - **Min**: Minimum time taken for any vehicle to complete the travel time section
  - **Max**: Maximum time taken for any vehicle to complete the travel time section
  - **Average Speed**: Average speed of the vehicles that complete the travel time section based on shortest path and average speed.
  - **85th Percentile**: 85th Percentile of speed.

- **Travel Time Delay**
  - **Name**: User-defined name of the travel time measurement.
  - **Travel time section**: Unique number of the travel time measurement.
  - **Delay**: Delay for all defined simulation runs.
  - **Volume**: Number of vehicles passing the travel time section.
  - **Average**: Avg travel time weighted by volume.
  - **Standard deviation**: Standard deviation of the travel time, based on raw data stored in the database.
  - **Min**: Minimum time measured for a vehicle passing the travel time section.
11 Evaluation Types for Simulations of Vehicles

Queue Lengths

- **Max**: Maximum time measured for a vehicle passing the travel time section.

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Approach</th>
<th>Movement</th>
<th>95% Queues per Run</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1  2  3 Max 95% Median Average Standard Deviation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>72  77  82</td>
</tr>
</tbody>
</table>

- **Intersection**: Node number or name.
- **Approach**: The direction of the approach of vehicles to the intersection as defined by node evaluation.
- **Movement**: The turning movement within the intersection.
- **Max**: Maximum movement queue observed at the indicated intersection and approach.
- **95% Queues**: The 95th % highest observed maximum queue.
- **Median (50% Queues)**: The 50th % highest observed maximum queue.
- **Average**: Arithmetically determined distribution of the maximum queue lengths.
- **Standard Deviation**: Standard deviation of observed queue length based on raw data in the database.

Volumes

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Approach</th>
<th>Movement</th>
<th>Run</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1   2  3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>72   77  82</td>
</tr>
</tbody>
</table>

- **Intersection**: Node number or name.
- **Approach**: The direction of the approach of vehicles to the intersection as defined by node evaluation.
- **Movement**: The turning movement within the intersection.
- **Run**: The number of vehicles at the intersection as defined in section 11.12.
- **Standard Deviation**: Standard deviation of observed queue length based on raw data in the database.

Omitted Nodes

At the bottom of the report, you may see some nodes that have been omitted due to lack of data. These nodes did not produce any data usable by Analyzer.

11.24.4 Database Tables

There are many tables produced in the Analyzer database by VISSIM, and Analyzer creates temporary tables that are removed upon completion of report creation. For this reason Analyzer requires that you have both read and write access to the database file.

Listed below are the Analyzer tables:
## VEHICLE_DATA

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iteration</td>
<td>Iteration Number</td>
</tr>
<tr>
<td>VehNo</td>
<td>Vehicle number</td>
</tr>
<tr>
<td>VehType</td>
<td>Vehicle type number</td>
</tr>
<tr>
<td>TStart</td>
<td>Time vehicle crosses start of travel time section in simulation seconds</td>
</tr>
<tr>
<td>TEnd</td>
<td>Time vehicle crosses end of travel time section in simulation seconds</td>
</tr>
<tr>
<td>StartLink</td>
<td>Number of the link at start of travel time section</td>
</tr>
<tr>
<td>StartLane</td>
<td>Number of the lane at start of travel time section</td>
</tr>
<tr>
<td>StartTime</td>
<td>Link coordinate/Position of the travel time section on StartLink (meter/feet according to current Units)</td>
</tr>
<tr>
<td>NodeNo</td>
<td>Node number</td>
</tr>
<tr>
<td>Movement</td>
<td>(Bearing from-to) - use compass settings</td>
</tr>
<tr>
<td>FromLink</td>
<td>Number of the link entering node</td>
</tr>
<tr>
<td>ToLink</td>
<td>Number of the link leaving node</td>
</tr>
<tr>
<td>ToLane</td>
<td>Number of the lane leaving node</td>
</tr>
<tr>
<td>ToPos</td>
<td>Link coordinate/Position on the ToLink, link leaving node (meter/feet according to current Units)</td>
</tr>
<tr>
<td>Delay</td>
<td>Delay in seconds</td>
</tr>
<tr>
<td>TStopd</td>
<td>Stop Delay in seconds</td>
</tr>
<tr>
<td>Stops</td>
<td>Number of stops</td>
</tr>
<tr>
<td>No_Pers</td>
<td>Number of People</td>
</tr>
<tr>
<td>PersDelay</td>
<td>Average Delay per person in seconds</td>
</tr>
</tbody>
</table>
### QUEUE_DATA

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iteration</td>
<td>Iteration Number</td>
</tr>
<tr>
<td>SimSec</td>
<td>Simulation time (according to the user-defined Analyzer Sample Interval, cf. section 11.4)</td>
</tr>
<tr>
<td>NodeNo</td>
<td>Node number</td>
</tr>
<tr>
<td>Movement</td>
<td>(Bearing from-to) - use compass settings</td>
</tr>
<tr>
<td>FromLink</td>
<td>Link entering node</td>
</tr>
<tr>
<td>FromLinkPos</td>
<td>Link coordinate on the FromLink, link entering node (meter/feet according to current Units)</td>
</tr>
<tr>
<td>QueueLength</td>
<td>Queue length in time step (m/ft according to current Units)</td>
</tr>
</tbody>
</table>

### TRAVELTIME_DATA

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iteration</td>
<td>Iteration Number</td>
</tr>
<tr>
<td>Time</td>
<td>Simulation time</td>
</tr>
<tr>
<td>TravelTimeSection</td>
<td>Travel time section number</td>
</tr>
<tr>
<td>VehNo</td>
<td>Vehicle number</td>
</tr>
<tr>
<td>VehType</td>
<td>Vehicle type number</td>
</tr>
<tr>
<td>TravelTime</td>
<td>Travel time (in seconds)</td>
</tr>
<tr>
<td>Delay</td>
<td>Time delay (in seconds)</td>
</tr>
</tbody>
</table>

### SIMULATION

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comment</td>
<td>Simulation Parameters - Comment</td>
</tr>
<tr>
<td>Period</td>
<td>Simulation Parameters – Period</td>
</tr>
<tr>
<td>StartTime</td>
<td>Simulation Parameters – Start Time in format [hh:mm:ss]</td>
</tr>
<tr>
<td>Speed</td>
<td>Simulation Parameters – Simulation Speed [Sim.sec. / s]</td>
</tr>
<tr>
<td>Resolution</td>
<td>Simulation Parameters – Simulation Resolution</td>
</tr>
<tr>
<td>RandomSeed</td>
<td>Simulation Parameters – Random Seed; If MultiRun is active, this is calculated according to MultiRun parameters (Starting random seed, Random seed increment)</td>
</tr>
<tr>
<td>BreakAt</td>
<td>Simulation Parameters – Break at</td>
</tr>
<tr>
<td>LeftSideTraffic</td>
<td>Simulation Parameters - Traffic regulations</td>
</tr>
</tbody>
</table>
### RunIndex
- **Description**: If MultiRun active: run index starting with 1, else if not: 0

### SearchPaths
- **Description**: Traffic – Dynamic Assignment - Search new paths
  - 0= option not active/checked ([ ]), 1= option is active ([x])

### VISSIM

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version</td>
<td>VISSIM version as displayed in the VISSIM main window</td>
</tr>
<tr>
<td>Unitdistance1</td>
<td>View – Options – Language&amp;Units (analogous to input file): 0 = m, 1 = ft</td>
</tr>
<tr>
<td>Unitdistance2</td>
<td>View – Options – Language&amp;Units (analogous to input file): 0 = km, 1 = mi</td>
</tr>
<tr>
<td>Unitspeed</td>
<td>View – Options – Language&amp;Units (analogous to input file): 0 = km/h, 1 = mph</td>
</tr>
<tr>
<td>Unitaccel</td>
<td>View – Options – Language&amp;Units (analogous to input file): 0 = m/s², 1 = ft/s²</td>
</tr>
<tr>
<td>Date</td>
<td>Current system date/time</td>
</tr>
<tr>
<td>NetworkFile</td>
<td>Input filename with complete path</td>
</tr>
</tbody>
</table>

### NETPERFORMANCE

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iteration</td>
<td>Iteration number</td>
</tr>
</tbody>
</table>
| VehClass        | 0: Default; is used in case of missing vehicle class
                  > 0: Vehicle class number                                                  |
| NumVehicles     | Number of vehicles in network                                               |
| NumArrived      | Number of vehicles that have left the network                               |
| TravelTime      | Total travel time                                                           |
| Distance        | Total distance                                                              |
| Delay           | Total delay                                                                 |
| StoppedDelay    | Total standstill time                                                       |
| NumStops        | Total number of stops                                                       |
| AvgSpeed        | Average speed                                                               |
| AvgDelay        | Average delay per vehicle                                                   |
| AvgStoppedDelay | Average standstill time per vehicle                                         |
| AvgNumStops     | Average number of stops per vehicle                                         |
### NODES

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>Node number</td>
</tr>
<tr>
<td>Name</td>
<td>Node name</td>
</tr>
<tr>
<td>ControlType</td>
<td>Control type</td>
</tr>
<tr>
<td>Active</td>
<td>Is the node active? Yes = 1, No = 0.</td>
</tr>
</tbody>
</table>

### NODELINKS

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node</td>
<td>Node number</td>
</tr>
<tr>
<td>Link</td>
<td>Link number</td>
</tr>
</tbody>
</table>

### PARKINGLOTS

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>Parking lot number</td>
</tr>
<tr>
<td>Name</td>
<td>Parking lot name</td>
</tr>
<tr>
<td>Link</td>
<td>Number of the link where parking lot is located</td>
</tr>
</tbody>
</table>

### LINKS

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>Link number</td>
</tr>
<tr>
<td>Name</td>
<td>Link name</td>
</tr>
<tr>
<td>Cost</td>
<td>Cost</td>
</tr>
<tr>
<td>Gradient</td>
<td>Gradient</td>
</tr>
<tr>
<td>Lanewidth</td>
<td>Average lane width (meter/feet according to current Units)</td>
</tr>
<tr>
<td>Length</td>
<td>Link length (meter/feet according to current Units)</td>
</tr>
<tr>
<td>NumLanes</td>
<td>Number of lanes</td>
</tr>
<tr>
<td>Surcharge1</td>
<td>Surcharge1</td>
</tr>
<tr>
<td>Surcharge2</td>
<td>Surcharge2</td>
</tr>
<tr>
<td>Type</td>
<td>Number of the link type</td>
</tr>
</tbody>
</table>

### LINKTYPES

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
</table>
### Link Type Information

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>Link type number</td>
</tr>
<tr>
<td>Name</td>
<td>Link type name</td>
</tr>
<tr>
<td>VehClass</td>
<td>0: default, apply if no vehicle class data available</td>
</tr>
<tr>
<td></td>
<td>&gt; 0: Vehicle class number</td>
</tr>
<tr>
<td>Behavior</td>
<td>Driving behavior parameter set number</td>
</tr>
</tbody>
</table>

### VEHICLETYPES

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>Vehicle type number</td>
</tr>
<tr>
<td>Name</td>
<td>Vehicle type name</td>
</tr>
<tr>
<td>Category</td>
<td>Category (analogous to input file)</td>
</tr>
<tr>
<td>Model</td>
<td>Vehicle Model distribution number</td>
</tr>
<tr>
<td>MinLength</td>
<td>Length from (meter/feet according to current Units)</td>
</tr>
<tr>
<td>MaxLength</td>
<td>Length to (meter/feet according to current Units)</td>
</tr>
<tr>
<td>Width</td>
<td>Width (meter/feet according to current Units)</td>
</tr>
<tr>
<td>Occupancy</td>
<td>Occupancy</td>
</tr>
<tr>
<td>MaxAccel</td>
<td>Number of Max Acceleration distribution</td>
</tr>
<tr>
<td>DesAccel</td>
<td>Number of Desired Acceleration distribution</td>
</tr>
<tr>
<td>MaxDecel</td>
<td>Number of Max Deceleration distribution</td>
</tr>
<tr>
<td>DesDecel</td>
<td>Number of Desired Deceleration distribution</td>
</tr>
<tr>
<td>Weight</td>
<td>Number of Weight distribution</td>
</tr>
<tr>
<td>Power</td>
<td>Number of Power distribution</td>
</tr>
</tbody>
</table>

### VEHICLECLASSES

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>Vehicle class number</td>
</tr>
<tr>
<td>Name</td>
<td>Vehicle class name</td>
</tr>
<tr>
<td>VehType</td>
<td>Vehicle type number</td>
</tr>
</tbody>
</table>
11 Evaluation Types for Simulations of Vehicles

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>Travel time section number</td>
</tr>
<tr>
<td>Name</td>
<td>User-defined name</td>
</tr>
<tr>
<td>FromLink</td>
<td>From link</td>
</tr>
<tr>
<td>ToLink</td>
<td>To link</td>
</tr>
<tr>
<td>Distance</td>
<td>Calculated the same way as in dialog. Set to –1.0 if not possible to calculate distance. (meter/feet according to current Units)</td>
</tr>
</tbody>
</table>

#### 11.24.5 Extras: Export to VISUM network file *.NET

If the corresponding VISSIM network is open when you run Analyzer, Analyzer will try to export your *.INP file to a VISUM *.NET file with two extra user-defined node attributes: `AnalyzerAvgDelay` and `AnalyzerLOS`. This export, along with the LOS.GPA file that came with your VISSIM installation will allow you to graphically view the Level of Service of your selected nodes (see the example 'Analyzer' for an example graphics parameter file for use with VISUM).

After creating the VISUM input file, open the network *.NET file in VISUM and open the graphics parameters (LOS.GPA) file then.
The network and LOS ratings are based on signalized intersections.

(Reference chart 1-a)

11.24.6 Troubleshooting Tips

Error Messages

To make sure Analyzer requires little or no supervision during report generation, any errors that occur after the “Analyze” button is clicked will be written to an error log. If you have loaded an *.INP file, the error log will be written to that directory, otherwise it will appear in your EXE directory.

Below is a list of Analyzer errors and what they mean:

► **Analyzer: You Must have Microsoft Excel 2002 or later installed**
  Microsoft® Excel® is either not installed on your computer or is not version 10 (2002) or higher.

► **Analyzer: Database is corrupted or not of type mdb, Please check file**
  The file that you tried to load is not an Access® database, or has been corrupted.

► **Analyzer: Database is incomplete, Please run simulation again**
  The database is missing information or information has been modified outside of VISSIM.

► **Analyzer: Excel 2002 or later must be open, Please restart Analyzer**
  Microsoft® Excel® has been closed or encountered an error during report generation. Analyzer cannot display the reports and must be restarted.

► **Analyzer: An error has occurred generating one of the reports. See AnalyzerErrorLog.txt for details**
  You will see this error if a report has encountered a problem.

► **Analyzer: The selected file was not a valid Analyzer Configuration File**
  The file was not an .anc file or the contents have been modified and are no longer valid as Analyzer Configuration settings.

► **Analyzer: Cannot generate XML while Excel is in print preview**
  Excel® is in print preview mode or Excel® 2003 or later is not installed.

► **Analyzer: Please make sure PDF Creator is installed and Excel is not in print preview**
  This error can mean that Excel® is in print preview and cannot generate a pdf, pdf creator is not installed, or pdf creator is installed but the printer name has been changed.

► **Analyzer: Excel Is not open, Analyzer cannot apply a header or footer**
  Excel® is not open, there is no sheets open to add a header or footer to.

► **Analyzer: Cannot apply header or footer while in print preview.**
  Excel® is in print preview mode and is blocking Analyzer from applying a header or footer.

► **Analyzer: There is no report open to add header or footer to.**
Excel® is not open and no picture can be applied to the header or footer.

The following errors may appear in the error log:

► _Analyzer: A Fatal Error has occurred and Analyzer cannot finish your reports._

This error generally occurs if there is a problem communicating with excel. Since all reports rely on communication with excel, no further report will be generated.

► _[Report Name]: Corrupt Data, Analyzer Cannot Continue Processing the [Report Name] Report_

The data in the database is not the data expected by Analyzer. This generally occurs when data is modified outside of Vissim.

► _[Report Name]: The Current Database is Read-Only. Please check your permissions._

This error generally occurs when the database has read-only permissions, is moved or deleted during Analyzer processing or has been locked by another program.

**Performance Tips**

► Close all unnecessary applications.

► Try reducing the number of selections in your filters. Large numbers of selections may cause Analyzer to have to search more of the database.

► Having a local copy of the database you are trying to access will increase the speed that Analyzer can communicate with the database.
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.
12 Dynamic Assignment

12.1 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 public 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 discrete 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 ..\EXAMPLES\TRAINING\DYNAMICASSIGNMENT\DETOUR\.
12.2 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 12.6 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 12.6.2 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 12.3.

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**
\[ n \geq N \text{ OR Convergence criterion fulfilled} \]

**End of assignment**
12.3 Building an Abstract Network

12.3.1 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 an 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 12.7.2.

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 vehicle 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 vehicle 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, which can be used for Dynamic Assignment. The three types show different driving behavior of the vehicles entering the parking lot:

► **Zone Connector**: 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.

► **Abstract Parking Lot**: 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.

► *Real parking spaces*: For parking lots of this type, a parking space
decision which is located 50 m before the entrance to the parking lot is
created automatically prior to the simulation start. Numbering of parking
space decisions starts from 10000. Activate the label display via **VIEW –
NETWORK ELEMENTS – Routing Decision**. Select one of the options:

- *Number*: Number of the parking space decision (> 10000).
- *Name*: Number of the allocated parking lot or group.
- *Parking lot numbers*: Numbers of all allocated parking spaces.

Parking lots of the *Real parking spaces* type can be grouped freely. The
automatically created parking space decisions are automatically
combined for the parking lots belonging to the same group if they are
located no more than 50 m apart. If a vehicle’s destination is one of the
parking lots belonging to a group, the vehicle can select any of the
parking lots belonging to this group.

Accordingly, the *Condition* that has been selected for a routing decision
of the *Dynamic* type, regards all parking lots belonging to the parking
lot’s group.

Example: *Parking lot full* = The whole parking lot group is full.

Parking space decisions are created automatically at the simulation start.
They can neither be listed nor edited interactively.

Groups can freely be defined for parking lots of the *Real parking spaces*
type; they are stored as parking lot property.

### Definition

To define a parking lot follow the steps outlined below:

1. Select the *Parking Lots* mode.
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.
[Dynamic Assignment]

- **Zone:** Allocated zone no. from OD matrix. To a zone, several parking lots can be allocated.

- **Group (only for Real parking spaces):** Freely selectable number for parking lot grouping. Without a number, the parking lot does not belong to a group.

- **Capacity (only for Abstract parking lots):** cf. above. For Real parking spaces, the value results from the parking lot Length and the Length of each space, the displayed capacity is not subject to changes.

- **Initial occupancy (only for Abstract parking lots and Real parking spaces):** The value indicates the parking lot occupancy at simulation start which is regarded for destination parking lot choice (also for dynamic routing decisions) calculation. Furthermore, it is used to determine if a parking lot is full. The initial occupancy should not include vehicles that arrive at the parking lot within the simulation period and might leave from there later (could be contained in matrices). For Real parking spaces, the composition of the initial occupancy is listed.

- **Composition (only for Real parking spaces):** For the initial occupancy, select the appropriate vehicle composition, cf. section 6.4.1.

- **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 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.

- **Desired Speeds:** Desired speed 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. Options for parking lot labels: Number, Name, Zone no., Group no., Occupancy and Parking Availability.
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 inside of 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.

CTRL+SHIFT+C sets the relative volumes of all parking lots to the volume totals of their paths as contained in the current path file (*.WEG). This can be helpful, if a new volume scenario (new matrix and path file) is to be applied to a network which was originally exported from VISUM, since relative volumes of origin parking lots might fit significantly better this way.

**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

- both, the path diverge point before the parking lot as well as the path merge point after the parking lot (in direction of driving) are included in a node and

- 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.

### 12.3.2 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.

VISSIM provides two types of node definition:
- as polygon node or
- as link segments.

To define a node you may
- manually create a polygon or
- import an ANM file from VISUM with segment nodes.

A polygon node can be converted into a segment node and vice versa.

Node definition as link segments allows for detailed graphical changes to the node or its segments, respectively, cf. section 12.3.2.4.

Nodes may not overlap.

When opening a network file *.INP that contains overlapping nodes and also if an overlapping node is created, an error message appears. In the protocol window (which provides also zoom functionality) the numbers of the overlapping nodes are listed, cf. section 10.2.1.

Identical attributes and options are provided for polygon nodes and segment nodes. Also the colors of polygon nodes and segment nodes indicate the same state.

Dynamic Assignment regards polygon nodes and segment nodes in the same way.
In the network file, node data is stored as follows:

-- Nodes: --
---------------

NODE 3 NAME "Polygon" LABEL 0.00 0.00
EVALUATION NO
  NETWORK_AREA 4 -513.486 955.289 -496.780 926.808 -433.519 952.277 -448.033 989.795

NODE 4 NAME "Segments" LABEL 0.00 0.00
EVALUATION NO
  NETWORK_AREA
  LINK 3 FROM 0.000 UNTIL 21.500
  LINK 7 FROM 164.858 UNTIL 173.726
  LINK 8 FROM 165.746 UNTIL 190.539
  LINK 9 FROM 24.911 UNTIL 34.422
  LINK 22 FROM 0.000 UNTIL 17.899
  LINK 26
  LINK 39
  LINK 58
  LINK 66 FROM 0.000 UNTIL 8.572
  LINK 101 FROM 261.912 UNTIL 302.411
  LINK 102 FROM 69.609 UNTIL 110.371
  LINK 344
  LINK 345
  LINK 10003
  LINK 10004
  LINK 10005
  LINK 10006
  LINK 10007
  LINK 10022
  LINK 10106
  LINK 10107
  LINK 10421
  LINK 10484

12.3.2.1 Creating

1. Select the Nodes mode.

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.

Definition of overlapping nodes is not permitted.

Alternatively, nodes can be imported via ANM Import, cf. section 6.2.1.4. ANM Import always creates segment nodes.
You may convert the current node definition (polygon or segments) into the respective other node definition, cf. section 12.3.2.5.

Any conversion is always followed by automatic adjustment of the new node definition which can be edited by the user subsequently.

## 12.3.2.2 Properties & Options

![Node properties window](image)

- **No.:** Node number
- **Name:** Optional name or comment
- **Label:** When showing labels of all nodes (see VIEW - NETWORK ELEMENTS...) this option allows to individually switch off the label of that one.
- **Node evaluation:** If option Node is checked via EVALUATION – FILES, then the node is regarded for evaluation if this option is active.
- **Dyn. Assignment:** If this option is active, the node is regarded for the network graph during Dynamic Assignment.
  - If this option is not active, the node is ignored for the network graph during Dynamic Assignment. Nevertheless it can be used for node evaluation, as long as the particular option has been set.
  
  In the Edge selection window only those nodes are displayed for which option **Dyn.Assignment** has been checked, cf. section 12.3.3.

- **User-defined orientations:** Check this option to overwrite the orientation that is automatically determined from the intersection coordinates of the node polygon and the edge leading to the neighboring node if this VISSIM orientation does not match reality.

  In the Orientations table, the Neighbor column contains the list of the selected node’s neighboring nodes in the network. Select one of the table rows and select the appropriate orientation from the drop-down list.
of orientations provided in the Orientation column: N, NE, E, SE, S, SW, W, NW.

This functionality is especially helpful in case of multiple edges leading to the same neighboring node since VISSIM might have determined an unrealistic orientation. By default, VISSIM uses the most frequently appearing orientation in case of numerous edges. In case of just two edges to the same node VISSIM uses the one that occurs first in the clock-wise list of orientations (see list above).

The evaluation graph for the computation of the orientations regards only the nodes which meet the following two requirements:

► For each pair of neighboring nodes, option ☑ Node evaluation has to be checked. If this is not the case for all nodes in the network, the resulting graph will be incomplete.
► The distance between neighboring nodes may not exceed 500 m. In case of a longer distance between neighboring nodes we recommend to create an additional node in between.

The evaluation graph for the computation of the orientations is based on the current North direction in the network. For your network, you can set the North direction via View – Options - [Network] option Display Compass, cf. section 4.1.1.

### 12.3.2.3 What the Colors Mean

#### Standard Selection

In the unselected state, the color code applies to node polygons as well as to segment nodes in the network.

The particular color of a node in the network display indicates certain properties of this node.

<table>
<thead>
<tr>
<th>Color</th>
<th>Meaning in the unselected state</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>Neither option Node evaluation nor option Dyn. assignment has been checked.</td>
</tr>
<tr>
<td>Red</td>
<td>Option ☑ Dyn. assignment has been checked, whereas option Node evaluation has not.</td>
</tr>
<tr>
<td>Green</td>
<td>Option ☑ Node evaluation has been checked, whereas option Dyn. assignment has not.</td>
</tr>
<tr>
<td>Black</td>
<td>Both options ☑ Node evaluation / ☑ Dyn. assignment have been checked.</td>
</tr>
</tbody>
</table>

In the selected state, polygon nodes and segment nodes show a different behavior.

<table>
<thead>
<tr>
<th>Nodes</th>
<th>Display in the selected state</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segment node</td>
<td>The segments always appear yellow, regardless of the</td>
</tr>
</tbody>
</table>
### Nodes Display in the selected state

<table>
<thead>
<tr>
<th>Nodes</th>
<th>Display in the selected state</th>
</tr>
</thead>
<tbody>
<tr>
<td>segment node’s color in the unselected state.</td>
<td></td>
</tr>
<tr>
<td>Polygon node</td>
<td>The vertices of the polygon appear in the appropriate color. The node color does not change.</td>
</tr>
</tbody>
</table>

### Multi Selection

Polygon nodes and segment nodes are always displayed in black color, in the selected state as well as in the unselected state.

### 12.3.2.4 Editing

Select the **Nodes** mode.

- For data editing, the single-select mode is required.
- For deleting, also the multi-select mode can be applied.

The selection list always contains all nodes of any node definition (polygon nodes and segment nodes).

**Overlapping nodes may not result from editing a segment node or a polygon node.**

Node processing functions provided for either polygon nodes or segment nodes only are indicated accordingly.

#### Select

**Single selection**

A node you may pick from the selection list or in the network display:

- **Network display:** Left-click at any position within the node
  - Polygon node: inside polygon
  - Segment node: on any segment or inside the invisible rectangular box surrounding the node segments
- **List display:** Left-click the desired row.

The selected node is highlighted accordingly, cf. section 12.3.2.3.

For some of the processing functions, the mouse pointer will change appropriately which is described with the particular editing function.

#### Multi-selection

Activate the Multiselect mode, span a rectangle to select the nodes roughly and (de-)select individual nodes, if necessary, cf. section 3.3.2.1

#### Move polygon

Select a polygon node, the hand symbol will appear while the pointer is moved over the node:

Keep left mouse-button pressed while dragging the node to the desired position. Link courses remain unchanged.

#### Copy polygon

Select a polygon node, the hand symbol will appear while the pointer is moved over the node:

Hold down **CTRL** and keep left mouse-button pressed while dragging the copied node to the desired position. Link courses remain unchanged.
Select a polygon node:

- **Add polygon point**: On the polygon-defining line, place the pointer exactly where you want to add another polygon point. As soon as the pointer is no longer shown as a hand, but as a reticle, you may define the new point by right-click.

- **Shift polygon point**: Place the pointer on the point you want to shift to another position. As soon as the pointer is no longer shown as a hand, but as a reticle with arrowheads, you may drag the point to the desired position while holding the left mouse-key down. The course of the polygon is aligned accordingly.

- **Remove polygon point**: Place the pointer on the point you want to delete from the polygon. As soon as the pointer is no longer shown as a hand, but as a reticle with arrowheads, you may drag the point to a neighbouring polygon point while holding the left mouse-key down. A new line is formed from the former neighbouring polygon lines. The course of the polygon is aligned accordingly.

Select a segment node:

- **Select link**:  **CTRL** - Left-click selects the link, where
  - you want to add a segment or
  - the segment you want to edit is located.
  The start cross section is marked dark red and the end cross-section is marked dark green in with-flow direction of the link.
  Connectors appear more narrow compared to links.

- **Add segment**: Right-click in the selected link to create another node segment by adding the selected link completely to the segment node. If the link already contains a segment of the node, the length of the segment will be set to link length.
  In both cases, the segment length can be edited subsequently.

- **Select segment**: Left-click on a cross-section of the segment. The start cross section will be highlighted light red (end cross-section: light green).

- **Remove segment**: Drag the selected cross-section away from the link while holding left mouse-key down. As soon as the mouse-key is released while the pointer is placed anywhere in the network display (but not on the link) the segment is removed from the segment node definition.
  To delete a segment with segment length = link length, right-click in the selected link.

- **Edit segment length**: Drag the selected cross-section to the desired position on the link while holding left mouse-key down.

- **Stretch segment to start/end of link**: Right-clicking the selected cross-section automatically places the selected cross-section on the link’s start or end.

- **Set segment length = link length**: After right-clicking the selected link the length of the link segment will automatically cover the link length completely.
Be aware of keeping the consistency of internal relations when editing the segments of a node. If a link contains two segments belonging to different nodes, these segments may not overlap.

**Edit data**
- Select node in
  - Network display: Double-click calls the *Node* window.
  - List display: Clicking *DATA* calls the *Node* window.
- Any input properties (attributes and options) are subject to changes, cf. section 12.3.2.2.

**Convert**
- Select node in network display,
- Right-click within node,
- Confirm CONVERT, cf. section 12.3.2.5.

**Delete**

**Single-selection:**
- Select node
  - either in the network and click
    - **DEL** or
    - **EDIT - DELETE**.
  - or in the selection list; then click **DELETE**.

**Multi-selection:**
- Define network section (active elements)
- then click
  - **DEL** or
  - **EDIT - DELETE**,
- finally
  - check option(s) and
  - confirm OK in the "Multiselection - Delete" window.
12.3.2.5 Converting a Node

Select polygon

Follow the outlined steps:
► Select the node, its polygon points will be highlighted.
► Place the pointer inside the polygon.
The pointer has to be a hand symbol.

Convert
► Right-click to call the query and
► confirm CONVERT.

The converted polygon is now displayed as segments on links covering the original dimensions of the original node polygon.
For further processing you may
► select a link via CTRL - Left-click or
► re-convert via right-click.

Converting
► a polygon node into a segment node creates exactly the segments being located in the former polygon;
► a segment node into a polygon node enlarges the size of the polygon.

Select and convert a segment node
► Select the node: its segments are highlighted in red.
► Call the query via right-click and
► confirm CONVERT.
The node polygon is created.
Position and size of the polygon are determined by position and size of the segments: A horizontally-based quadratic polygon with 4 corners is calculated. Thus the polygon fully covers all of the segments totally. The horizontal bottom line is drawn directly underneath the undermost point of all segments and the vertical line to the right is drawn directly to the right from the segment point which is located outermost right. The segments inside of the polygon do not necessarily match the initial segments.

Manual adjustment

From node conversion, overlapping nodes might result. In this case, a warning will appear.

► For manual adjustment of a polygon definition cf. Edit polygon in section ●.
► For manual adjustment of a segment definition cf. Edit segments in section ●.

Example

Converting a node multiple times will cause the following:

► The size of the node polygon will increase.
► Further segments are added to the segment definition or the size of the segments is stretched, respectively.

### 12.3.3 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. In the Nodes edit mode you can call the Edge Selection window via EDIT – EDGE SELECTION... if the network contains at least one node with active option for Dyn. Assignment.

If a node is currently selected in the network when the Edge selection window is called, this node will also be selected in the window’s selection lists.

The lists in the Edge selection window contain only those nodes for which option for Dyn. Assignment has been checked.

2. In the window, choose a pair of nodes by selecting the numbers from the From Node and To Node lists.

3. From the top list of all available edges between the selected nodes, choose an edge to show its graphical representation in the VISSIM network (as a yellow or red band).
Edge attributes:
• generated No.,
• vehicle type specific cost Value,
• Length
• Volume of the total flow for the selected Time Interval
• Current closures and the selected vehicle type(s) are indicated.

Edge closures can be defined or discarded via
• Edge closed (for the selected edge)
• OPEN/CLOSE ALL EDGES buttons.

In the list, an edge can be selected for graphical display in the VISSIM network.

Automatically created VISSIM edges are highlighted in the network display:
► Yellow = not closed or
► Red = closed for 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 were written during that iteration.

In the Edge selection window, the results of the recent iteration can only be displayed if cost and path data was saved to *.BEW and *.WEG file during this iteration.
An edge can be banned completely 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.

An edge between nodes is ignored in the Dynamic Assignment if it contains more than three connections (possibly across several connectors) from a link back to the same link. Cost and path files from VISSIM 5.20 which contain such edges cannot be used anymore.

An edge is ignored in the Dynamic Assignment if it contains more than one parking lot extending over all lanes (i.e. zone connectors and abstract parking lots on any link and real parking spaces on one-lane links only, cf. section 12.3.1). Cost and path files from VISSIM 5.20 which contain such edges cannot be used anymore.

### 12.3.4 Check Nodes/Edges

The node/edge structure is checked for errors, such as overlapping nodes. For this step, the **Nodes** editing mode needs to be active.

Nodes and edges are checked as follows:

1. Click the **Nodes** editing mode.
2. Click menu **EDIT – CHECK NODES / EDGES**

   The node/edge structure is checked.

### 12.3.4.1 Correction of Overlapping Nodes

Nodes may not overlap.

VISSIM will show an error message if a network file *.INP containing overlapping nodes is opened or if a node is defined that overlaps the polygon of a neighbouring node.

**Solution in VISSIM**

The error message and the numbers of the overlapping nodes are listed in the log window.
1. To open the log window, click menu HELP – LOG WINDOW or CTRL+SHIFT+F10.
2. Click the particular record to place the overlapping nodes automatically in the middle of the screen.

3. Move the polygon points in a way that they no longer will overlap.
4. Click menu EDIT – CHECK NODES/EDGES to perform another check. A message will confirm the successful build of the node/edge structure.

12.3.4.2 Correction of Multiple Edges Between Two Nodes

In VISSIM, multiple edges connecting two nodes are permitted for Dynamic assignment.

For export to VISUM, only the shortest edge is regarded.

VISSIM warnings can be ignored in case of two nodes which are connected by multiple links of almost the same length and link sequence.

Solution in VISSIM

In the log window, the error message and the numbers of the involved nodes are listed.
If you do not want to resign those edges, you can do the following:

1. Click the **Node** mode.
2. On the longer edge, right-click to define a new node.
   This way you have created two new links and their nodes are not identical.
3. Start the export to VISUM again.

**12.3.4.3 Correction of Unexpected Start/End of Nodes**

Nodes can be created from link segments, cf. section 12.3.2. When building a node/edge structure via **CHECK NODES/EDGES**, an error message is displayed if the end or the start of a node cannot be used for the building process. VISSIM offers to fix damaged link segments.

**Solution in VISSIM**

Click OK to confirm the error messages. The **VISSIM** window suggests how to rebuild the nodes.

There are two options provided:

1. Form a node polygon from link segments.
2. Edit link segments.
The buttons serve for node repair:

► **YES**: Confirm the suggestion for the particular node.
► **YES TO ALL**: Confirm the suggestion for all damaged nodes.

Changes performed via the **YES TO ALL** button should be verified in the log window subsequently. Each repair action executed by VISSIM is logged to the protocol.

► **NO**: You do not agree. The node remains damaged.
► **NO TO ALL**: This option is not provided. Click **CANCEL** to terminate the repair action.
► **CANCEL**: You terminate though not all of the damaged nodes have been repaired yet. Repaired nodes are retained, these changes will not be discarded.

Once all nodes have been repaired a message confirms the successful build of the node/edge structure.

In rare cases, not all of the nodes are rebuilt automatically. In this case, you need to fix those nodes manually.
12.4 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.

12.4.1 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 vehicle 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...

Check the option Matrices to activate the associated list box. Use EDIT, NEW and DELETE to define or edit an entry in the list box or to remove it from the list.

A matrix is linked to a given vehicle composition, i.e. the trips of that matrix are performed by vehicles randomly generated from the associated vehicle 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 matrices can be exchanged easily between VISSIM and VISUM via VISUM export from VISSIM and ANM export from 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)
  (This format was chosen for reasons of compatibility to other systems.)

The time information in the matrix is the absolute time of day. 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 the number 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 [hh.mm]
  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
```
12.4.2 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 pre-processing 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 numbers – four numbers in data format 1.1 or five numbers in data format 2.1:
► Departure time
► Destination zone number
► World coordinates of the destination (format version 2.1 only)
► 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.
With data format version 1.1, each subsequent group of four columns defines one trip within the trip chain.

With data format version 2.1, each subsequent group of five columns defines one trip within the trip chain. Between the destination zone number and the activity number it contains the destination world coordinates.

- These coordinates in parentheses are used instead of the center of the destination zone for the component "Distance from desired zone" in the parking lot selection.
- If the coordinates of the center of a zone should be regarded with data format version 2.1, enter [] instead of the world coordinates.

In the first line of the trip chain file, the data format version number has to be set.

The format description follows in BNF (Backus-Naur-Form).
Specific version 2.1 entries are gray-shaded:

```plaintext
<trip chain file> ::= <version> {<trip chain>}
<version> ::= <real> <nl>
<trip chain> ::= <vehicle> <vehicle type> <origin> {<trip>} <nl>
<trip> ::= <departure> <destination> <coordinates> <activity> <minimal stay time>
<vehicle> ::= <cardinal> <semicolon>
<vehicle type> ::= <cardinal> <semicolon>
<origin> ::= <cardinal> <semicolon>
<departure> ::= <cardinal> <semicolon>
<destination> ::= <cardinal> <semicolon>
<coordinates> ::= <opening parenthesis> <x coordinate> <comma> <y coordinate> <closing parenthesis> <semicolon>
                  | <opening bracket> <closing bracket> <semicolon>
<x coordinate> = <real>
<y coordinate> = <real>
<comma> = ","
<opening parenthesis> = "(" 
<closing parenthesis> = ")"
<opening bracket> = "["
<closing bracket> = "]"
<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 of *.FKT file in version 1.1 data format

This example file (*.FKT) contains 11 trip chains.

```
1.1
1; 1; 10; 1; 20; 101; 117; 211; 30; 101; 169; 732; 20; 101; 171;
2; 1; 10; 4; 20; 101; 255; 334; 30; 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;
```

Example of *.FKT file in version 2.1 data format

This example file (*.FKT) contains 11 trip chains, with destination world coordinates specified for zone 20 only.

```
2.1
1; 1; 10; 1; 20; (113.0,157.0); 101; 117; 211; 30; []; 101; 169; 732; 20;
(105.0,159.0); 101; 171;
2; 1; 10; 4; 20; (102.0,160.0); 101; 255; 334; 30; []; 101; 147; 815; 20;
(128.0,153.0); 101; 124;
3; 1; 10; 8; 20; (126.0,163.0); 101; 202; 395; 30; []; 101; 178; 832; 20;
(117.0,182.0); 101; 175;
4; 1; 10; 12; 20; (128.0,153.0); 101; 216; 703; 30; []; 101; 162; 533; 20;
(103.0,155.0); 101; 208;
5; 1; 10; 16; 20; (114.0,174.0); 101; 164; 601; 30; []; 101; 251; 1134; 20;
(113.0,157.0); 101; 159;
6; 1; 10; 20; 20; (105.0,159.0); 101; 295; 529; 30; []; 101; 133; 846; 20;
(120.0,172.0); 101; 114;
7; 1; 10; 25; 20; (117.0,182.0); 101; 248; 262; 30; []; 101; 256; 987; 20;
(102.0,160.0); 101; 117;
8; 1; 10; 29; 20; (119.0,157.0); 101; 169; 322; 30; []; 101; 164; 463; 20;
(121.0,160.0); 101; 141;
9; 1; 10; 31; 20; (121.0,160.0); 101; 138; 543; 30; []; 101; 212; 405; 20;
(119.0,157.0); 101; 252;
10; 1; 10; 35; 20; (120.0,172.0); 101; 296; 205; 30; []; 101; 160; 802; 20;
(126.0,163.0); 101; 221;
11; 1; 10; 40; 20; (103.0,155.0); 101; 270; 622; 30; []; 101; 244; 604; 20;
(114.0,174.0); 101; 175;
```
12.5 Simulated Travel Time and General Cost

12.5.1 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 with intervals of 1 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 longer than the cycle times used.

In most cases, evaluation intervals ranging from 5 to 30 minutes will be appropriate.

12.5.2 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, if you want the older measurements to have less influence, the appropriate mathematical method for that is exponential smoothing. The user-defined smoothing factor indicates the relative weight of the respective recent iteration.

► Alternatively, MSA (Method of Successive Averages) can be applied which assigns as much weight to any recent iteration as to the current one by forming the arithmetic mean from all iterations. This way, the influence of any further iteration is reduced. As long as no *.BEW file is available, the parameter value is set automatically in VISSIM (not user-defined), if this option is active. In case of an existing *.BEW file the user has to enter the number of iterations calculated for this file. Here, also a value below the actual number of current iterations can be entered to increase the influence of the next iterations. This is recommended, if the path evaluation states that the measured travel times deviate heavily from expected travel times, cf. section 11.21.

The appropriate method can be selected and the parameters can be set via TRAFFIC - DYNAMIC ASSIGNMENT via EXTENDED in the Dynamic Assignment window, if option Store costs is active.

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 (from previous iterations) and
► the newly measured value (from current iteration).

That smoothed value represents the travel time that we expect in the next iteration.

Formally:

\[ T_i^{n,K} = (1 - \alpha) \cdot T_i^{n-1,K} + \alpha \cdot TO_i^{n,K} \]

where

\[ K \] = index of the evaluation interval within the simulation period

\[ n \] = index of the assignment iteration

\[ i \] = index of the edge
$TO_{i}^{n,K}$ = measured ("observed") travel time on edge $i$ for period $k$ in iteration $n$

$T_{i}^{n,K}$ = expected travel time on edge $i$ for period $k$ in iteration $n$

$\alpha$ = constant smoothing factor (user-defined).

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. If a smoothing factor of 0.5 is used, the last iteration $n$ has a weight of 50%, iteration $(n-1)$ has a weight of 25%, iteration $(n-2)$ has a weight of 12.5% and so on.

**MSA**

With a new set of measured values, the smoothed travel time is computed as the weighted sum of

- the old smoothed value (from previous iterations) and
- the newly measured value (from current iteration).

That smoothed value represents the travel time that we expect in the next iteration.

Formally:

$$T_{i}^{n,K} = (1 - \frac{1}{N+n}) \cdot T_{i}^{n-1,K} + \frac{1}{N+n} \cdot TO_{i}^{n,K}$$

where

- $N$ = user-defined value
- $K$ = index of the evaluation interval within the simulation period
- $n$ = index of the assignment iteration
- $i$ = index of the edge

$TO_{i}^{n,K}$ = measured ("observed") travel time on edge $i$ for period $k$ in iteration $n$

$T_{i}^{n,K}$ = expected travel time on edge $i$ for period $k$ in iteration $n$

$$\frac{1}{N+n}$$ = variable smoothing factor resulting from parameter $N$ and the index of the iteration

### 12.5.3 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 each of the edges in the network the so called general cost is computed as a weighted sum:

$$ \text{general cost} = \alpha \cdot \text{travel time} + \beta \cdot \text{travel distance} + \gamma \cdot \text{financial cost} + \sum \text{supplement2} $$

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 supplement1. Supplement2 is an additional cost value per link that is not weighted by the factor $\gamma$ but just added to the general cost of the edge.
12.6 Route Search and Route Choice

12.6.1 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 us 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

\[C = \text{general cost} \]
\[R = \text{a route} \]
\[a = \text{an edge belonging to } R\]

12.6.2 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 us 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:
The most widely used and thus theoretically best analyzed function to model discrete choice behavior is the Logit function:

$$p(R_j) = \frac{\mu U_j}{\sum_i e^{\mu U_i}}$$

where

- $U_j = \text{utility of route } j$
- $p(R_j) = \text{probability of route } j \text{ to be chosen}$
- $\mu = \text{sensitivity factor of the model (>0)}$

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

- $U_j = \text{utility of route } j$
- $p(R_j) = \text{probability of route } j \text{ to be chosen}$
- $k = \text{sensitivity of the model}$
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:

$$p(R_j) = \frac{U_j^k}{\sum_i U_i^k} = \frac{e^{-k \log C_j}}{\sum_i e^{-k \log C_i}}$$

where $C_j$ is the general cost of route $j$.

### 12.6.3 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 OD-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 \textit{Extended} path settings) and thus does not harm.

**Search for alternative paths**

Optionally, an additional search for alternative paths can be performed using stochastic modification of edge evaluations: Multiple runs of the shortest path algorithm with (slightly) modified edge evaluation parameters will increase the chance to find more alternative routes, which should be used though having higher total cost.

This option can be activated in two ways: Activate

- \textbf{ALTERNATIVE PATH SEARCH...} separately for each OD pair of zones via \textsc{EDIT} – \textsc{AUTO ROUTING SELECTION} in the \textit{Paths} window, cf. section 12.6.4; or

- \textit{option Stochastic edge penalization for Alternative path search} via \textsc{EXTENDED} for option \textit{Search new paths} in the \textit{Dynamic Assignment} window (via \textsc{TRAFFIC} – \textsc{DYNAMIC ASSIGNMENT}), cf. section 12.8.4.

**12.6.4 Route Visualization**

The routes found during the iterations of the Dynamic Assignment can be visualized in the network editor by \textsc{EDIT} – \textsc{AUTO ROUTING SELECTION} (while the \textbf{P Parking Lots} mode is active).
In the *Paths* window, all known routes are listed with their general *Cost* value and length (*Distance*) for the selected OD pair. Furthermore, it displays the number of vehicles (*Volume*) that have used a path in the last simulation run when a path file (*.WEG) was written.

Since costs are type specific and time dependent, a vehicle type and an evaluation interval need to be selected. If a route is selected in the list box, it is highlighted in the network display as a yellow band.

The corresponding buttons select which set is listed.

- For automatic detour detection, the list of paths is separated in sets of
  - “normal” *Paths* and
  - *Detours*.
- If convergence parameters are set, all paths that have not met the convergence criteria can be displayed via option
  - *Show Non Converging Paths*.

Closed paths (because of edge and connector closures) are listed as well in the *Path* selection window:

- The closed edges respectively edges containing closed links are highlighted in red when the path is displayed.
- The path’s parameters (length, cost, volume) are shown in brackets.

The path volume is always shown as the sum of all vehicle types. Thus selecting a different vehicle type will not change this value. Furthermore, there might still be vehicles listed for paths where a connector is closed for a certain (and not all) vehicle class only.

**Alternative Path Search...**

If *Penalization of the shortest path* is checked, VISSIM will continue after the normal shortest path search; further searches with changed edge evaluations will be run, until either a new path without route closures is found or the maximum number of passes is reached.
For changes to the evaluations, the evaluations of all edges of the currently best path are multiplied by the user-defined factor prior to each further pass.

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 shows the results of the last iteration only, if both the cost and path files were written during that iteration.
12.7 Optional Enhancements of the Model

12.7.1 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.

12.7.2 Parking Lot Selection

The travel demand given in the OD matrix refers to zones for destinations. In the VISSIM network, zones are represented 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 parameters regarded for selection which are stored in the [SEL. PARAMETERS] tab, cf. 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:

\[
U_{k,s} = \alpha_{k,s} \cdot C_{parking} + \beta_{k,s} \cdot attraction + \gamma_{k,s} \cdot D_{dest} + \delta_{k,s} \cdot D_{veh} + \epsilon_{k,s} \cdot f_s
\]

where

- \(C_{parking}\) = parking cost
- \(D_{dest}\) = direct distance between parking lot and the destination zone’s center of gravity
- \(D_{veh}\) = general cost of best route from current vehicle position
- \(f_s\) = availability of free parking 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 from 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 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 **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 [SPECIAL] tab page of 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 utility less than the threshold are not chosen at all.

### 12.7.3 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.

### 12.7.4 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.

### 12.7.5 Dynamic Routing Decisions

When Dynamic Assignment is used, the vehicles in the network 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 *Create routing decision* window, *No.* and *Type* have to be set.

In the *Routes* window, the condition and strategy as well as additional parameters (e.g. option *Exclude full parking lots*) can be set for *Routing decisions* of the *Dynamic* type, cf. section 6.4.4.
**Optional Enhancements of the Model**

### Condition selection list:

![Condition selection list](image1)

### Strategy selection list:

![Strategy selection list](image2)

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 is that From Routing Dec. has to be selected instead of From Parking Lot.

Call the Paths window via menu EDIT – AUTO ROUTING SELECTION while the Routes edit mode is active.

### 12.7.6 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 via ROUTE GUIDANCE in the Dynamic Assignment window.
12.8 Assignment Control

12.8.1 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. Cf. section 11.21 for a detailed description of the file format and how to configure the evaluation.

12.8.2 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 the 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 –s<n> parameter. The number n denotes the number of iterations to be computed.

Example: VISSIM.EXE TEST.INP –S20

This entry 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 –v<p>. The number p denotes the percentage points by which the scaling factor in the input file is increased in each iteration until 100% is reached.

Example: VISSIM.EXE TEST.INP –S20 –V5

This entry would compute 20 iterations of the network file TEST.INP and increase the traffic demand by 5% in 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 17th iteration onwards the total travel demand would be assigned. Increased volumes will not exceed 100%. If 100% is reached, further runs will also be performed with 100%.

Alternatively to option -s<n> -v<p>, the MULTIRUN functionality is provided in the SIMULATION menu, cf. section 8.1.3.

12.8.3 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.

It is recommended to use only one out of the three possible convergence criteria, preferably the **Travel Time on Paths** option. Make sure that you set the convergence criteria not too tight (e.g. by using all three criteria at the same time). Otherwise convergence is never reached. Especially the **Volume on Edges** option might be too tight as it looks for absolute values which on heavily loaded links differ more than on low-flow links even though the difference in percentage is the same.

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 11.22 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 does not 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.

### 12.8.4 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 section (i.e. not per km). A section is delimited by node boundaries. Thus, the surcharge is added to the link’s general cost as often as the vehicle enters an edge on that link. E.g. in case of a link intersecting with 2 nodes, the surcharge is added 3 times, if the vehicle traverses the entire link.

Define surcharges in the *Link Data* window by pressing COST in [OTHER].

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.*
- clicking the appropriate button for all edges.
Closed edges are 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 pairs 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 pair 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.

In the *Path Search* window

- the threshold factor and
- the upper limit

can be defined, if the particular option is active. It is reached by pressing the button EXTENDED for option [Search new paths](#) in the *Dynamic Assignment* window.

Furthermore, the following options are provided:
Dynamic Assignment

- **Search paths for OD 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 OD 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.

- **Stochastic edge penalization for alternative paths search**: If this option is active, the specified number of stochastic passes will be run after each regular shortest path search (at the beginning of each evaluation interval during Dynamic Assignment). Prior to each pass, the evaluation of each edge in the network is multiplied by a random factor between \((1-x)\) and \((1+x)\), where \(x\) is the user-defined maximum Spread share for each OD pair of zones. Alternatively, the search for alternative paths can be performed with modified edge evaluations for each OD pair, cf. section 12.6.4.

### 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 a 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.

### 12.8.5 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).

Make sure, that the simulation period is a multiple of the evaluation interval for Dynamic assignment, since path file and cost file save the data by interval and would otherwise be incomplete.

Vehicle inputs and routing decisions are directly generated from the route volumes being stored in the path file:

- At least one vehicle input per time interval is created for each origin parking lot (parking lot with relative flow > 0). Its volume is summed up from all volumes of paths listed in the *.WEG file which start from this parking lot.

- One static routing decision is created for each origin parking lot per vehicle type group which is a set of vehicle types with identical route choice behavior in the Dynamic assignment (identical cost coefficients, identical connector closures, identical destination parking lot selection parameters etc.). The relative flow of each route to a destination parking lot equals the path volume listed in the path file.

- The identifier of any vehicle input automatically created is 1,000 times the parking lot number plus the index of the time interval.
- The identifier of any routing decision automatically created is 100,000 times the parking lot number plus the index of the vehicle type group. Thus, none of the given parking lot numbers may exceed 42949. 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 will be terminated and an error message will appear.

► The vehicle compositions are derived from the matrix files.

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 the option

☑ Limit number of routes

Set the 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 fulfil 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 window (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.

12.8.6 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 presented. 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.
• **Archive files:** If this option is active, existing output files *.BEW and *.WEG which are stored in the same folder as the *.INP file will be renamed. Numbers will be added to the filenames prior to creating new output files.

Archiving of cost and path files saves the existing initial files, too. These additional initial archive files (with number zero) are created for the path and cost files if the following applies:
- option **Archive files** is checked and
- path and/or cost files exist (when starting the simulation) and
- there are not any existing archive files in the directory.

This is done for both a normal continuous simulation and for the first run of a multirun series.

If there are already archive files in the directory then these initial archive files are not created because it is assumed that the last archive files correspond to the current start path/cost files.

Thus the data file archive allows for subsequent analyses of changes during Dynamic Assignment. You even might start calculation from an elder assignment state.

If this option is not active, existing output files *.BEW and *.WEG are replaced.

• **Store Costs:** If checked, VISSIM writes a new cost file.

• **EXTENDED:** Access to
  - the smoothing factor for cost calculation with regard to former edge evaluations or
  - MSA (Method of successive averages), cf. section 12.5.2.

• **Search new paths:** If checked VISSIM calculates new shortest paths through the network.

• **EXTENDED:** Further options to limit the number of routes being found, cf. section 12.8.4.

• **Store paths (and volumes):** If checked VISSIM stores new paths and their volumes in the path file.

If VISSIM is run in batch mode with a specified number of runs VISSIM creates or overwrites cost and path files automatically.

• 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.

• **Scale Total volume to [%]:** This checkbox allows for modification of the volume from all OD matrices used for the next Dynamic Assignment run
either up or down to the given percentage. Values > 100% permitted (e.g. for future demand scenarios).

- **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.
- **Use 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, cf. section 12.8.5.
12 Dynamic Assignment

12.9 Initial Solution from VISUM

As an initial solution for the Dynamic Assignment in VISSIM, the result of a static VISUM assignment can be used. This aims on the reduction of the number of iterations which are required in VISSIM until convergence is reached. The VISUM assignment does not represent the final result but an initial solution.

You can start the VISUM assignment in VISSIM. VISSIM provides two possibilities:
- Automatic VISUM assignment calculation
- Manual VISUM assignment calculation

12.9.1 Automatic VISUM Assignment Calculation

In VISSIM, click menu TRAFFIC - DYNAMIC ASSIGNMENT - VISUM ASSIGNMENT to start the automatic VISUM assignment calculation.

The VISUM assignment is calculated by means of the VISUM Converter which is included in your VISSIM installation. Later the routes calculated in VISUM will be stored in the automatically created VISSIM path file *.WEG. The filename is derived from the PATH FILE entry in the Dynamic Assignment window. From an existing path file with the same filename, a backup copy *.BAK is generated prior to overriding.

Please note that your data files *.WEG and *.BAK are be replaced automatically in case of multiple assignment calculations.

A static VISUM assignment in VISSIM requires significantly less time compared to a microscopic VISSIM traffic simulation, which is caused by the individual vehicles.

Once the VISUM assignment has been finished, the simulation (even a multi-run simulation) can be started immediately in VISSIM without any other work steps. The first iteration uses the paths which were calculated in VISUM. After the first iteration, the path file and the cost file created in VISSIM are used. Their file names are retained.

No assignment can be calculated, if the VISSIM network contains nodes with a number that exceeds the maximum permitted node number in VISUM. For assignment calculation in VISUM, the VISSIM node numbers need to be edited in a way that they no longer exceed the maximum permitted VISUM node number.
During the automatic VISUM assignment calculation, warnings, notes and process messages are recorded in the protocol file. Call the protocol file window via menu HELP – LOG WINDOW.

12.9.2 Manual VISUM Assignment Calculation

The steps of the automatic VISUM assignment calculation can be performed manually one by one. This approach allows for additional VISUM network editing prior to the calculation.

Workflow of the manual calculation

Prior to the Export step it is recommended to run a simulation in VISSIM. In this way it can be guaranteed, that the VISSIM network contains paths for all OD pairs with demand > 0.


2. In VISUM: Open the VISUM version file *.VER that has been created during VISSIM export to VISUM.

3. In VISUM: Perform the desired changes to the network.

In VISUM, the network topology is not subject to changes, since otherwise the import of VISUM routes might fail in VISSIM.

The network topology is not affected by the following modifications:
- Editing link attributes (type, length, PrT capacity, v0 PrT)
- Editing the link polygon course
- Editing node attributes (type, PrT capacity, t0 PrT, control type)
- Editing the node geometry/orientations
- Editing the node coordinates
- Signal control definition (via Junction Editor).

The following modifications in VISUM could cause the route import in VISSIM to fail:
- Create/Delete nodes
- Edit node number
- Create/Delete links
- Create/Delete connectors
- Open blocked links (Changes to the TSys settings of links)
- Open blocked turns (Changes to the TSys settings of turns)
- Open blocked connectors (Changes to the TSys settings of connectors)
- Create/Delete TSys/Modes/DSeg

4. In VISUM: Calculate the assignment.
For more details please refer to the VISUM User Manual.

5. In VISUM: Start the export of the routes resulting from assignment.

For more details on **VISSIM Export (ANM Export)** from VISUM please refer to chapter 13 „Using interfaces to exchange data“ in the VISUM User Manual.

Please make sure that only routes (*.ANMROUTES) are exported. Network data (*.ANM) and matrix data is not required.

In VISUM, set the time interval in the **ANM - Export parameters** window according to the **Export time interval** specified for the VISUM export in VISSIM:

- **Export time interval** in VISSIM:
6. In VISSIM: Import the routes for the Dynamic Assignment.
   Follow the steps outlined below:
   1. Click menu File - Import… - ANM.
   2. In the ANM Import window, uncheck option Import network data.
3. Select option *Dynamic Assignment*.

4. Check option *Import routing* and select the *.ANMROUTES file that was exported from VISUM.*

5. Click **Import**.

6. Confirm **OK**.

   This message indicates that no errors occurred during import.

**VISSIM** creates a path file *.WEG that stores the routes calculated in VISUM. The filename is derived from the **PATH FILE** entry in the *Dynamic Assignment* window. From an existing path file with the same filename, a backup copy *.BAK is generated prior to overriding. The route import does not change VISSIM network data.

The distribution of the zone’s origin flow to the zone’s parking lots in VISSIM regards only the relative flows entered in VISSIM. It does not depend on the distribution to the origin zone connectors during the VISUM assignment. The result of the VISUM assignment is only used for the distribution of vehicles from VISSIM parking lots to the routes that were found in VISUM that lead to the particular destination parking lot.
13 VISSIM Programming Interfaces (API)

VISSIM provides different Application Programming Interfaces (API) as add-on modules for the users to automate their workflow and customize their VISSIM models with their own applications. These add-on modules are not automatically part of every VISSIM license. The particular documentation provided by interface is stored in the appropriate sub-folder of the main folder (named <VISSIM> below) of your VISSIM installation. If you are interested in any add-on, please contact PTV AG.
13.1 COM Interface

Occasionally projects will require extensive pre- or post-processing, numerous scenarios to be investigated or the application of customized control algorithms.

For these cases VISSIM can be run from within other applications serving as a toolbox for transportation planning algorithms. Access to model data and simulations is provided through a COM interface, which allows VISSIM to work as an Automation Server and to export the objects, methods and properties.

The VISSIM COM interface supports Microsoft Automation, so you can use any of the RAD (Rapid Application Development) tools ranging from scripting languages like Visual Basic Script or Java Script to programming environments like Visual C++ or Visual J++, cf. section 3.5.

Scripts can also be started from within VISSIM (internal scripting, cf. section 3.5.1).

Documentation:
► <VISSIM>\DOC\ENG\VISSIM_COM.PDF

Examples:
► <EXAMPLES>\TRAINING\COM\
13.2 **External Driver Model - DriverModel.DLL**

The External Driver Model DLL Interface of VISSIM provides the option to replace the internal driving behavior by a fully user-defined behavior for some or all vehicles in a simulation run.

The user-defined algorithm must be implemented in a DLL written in C/C++ which contains specific functions.

During a simulation run, VISSIM calls the DLL code for each affected vehicle in each simulation time step to determine the behavior of the vehicle. VISSIM passes the current state of the vehicle and its surroundings to the DLL and the DLL computes the acceleration / deceleration of the vehicle and the lateral behavior (mainly for lane changes) and passes the updated state of the vehicle back to VISSIM.

The external driver model can be activated for each vehicle type separately in the dialog box *Vehicle Type* by checking the checkbox *Use external driver model* on the tab page *External Driver Model* and selecting a driver model DLL file and optionally a parameter file to be used, cf. section 5.3.1.

Documentation:

- `<VISSIM>\API\DRIVERMODEL_DLL\INTERFACE_DESCRIPTION.PDF`

Example file:

- `<VISSIM>\API\DRIVERMODEL_DLL\DRIVERMODEL.CPP`
13.3 3dsMaxExport

The 3dsMaxExport Module allows to export simulation results from VISSIM into the format ANI.TXT, cf. section 9.3.1. It is to be imported into the modeling, animation and rendering package 3ds Max from Autodesk Inc. In 3ds Max, the results can be tuned to high end 3D presentations.

Documentation:
- `<VISSIM>\API\3DSMAXEXPORT\HOWTO\USERGUIDE.PDF`
- `<VISSIM>\API\3DSMAXEXPORT\HOWTO\HOWTO3DS.PDF`
13.4 Car2X Module

The Car2X Module allows the implementation and testing of applications that use Vehicle-to-Vehicle and/or Vehicle-to-Infrastructure communication. The algorithms for the Car2X applications can be written as Python script or C++ program. It can access data of the vehicles which have the respective equipment flag set in the vehicle type and defines when vehicles send messages to nearby vehicles and how vehicles react on messages received from other vehicles. The wireless communication is modeled in a separate *.DLL, which is part of the Car2X module.

Documentation:
► <VISSIM>\API\C2X\VISSIM_C2X.PDF

Examples:
► <VISSIM>\API\C2X\EXAMPLES\
13.5 External Signal Control – SignalControl.DLLs

Users can also define external signal controllers using the signal controller *.DLL and signal controller *GUI.DLL (in C or C++ programming language).

External signal control can be activated in the Signal Control dialog on the tab page Controller (ext.), cf. section 6.7.

For the defined controllers, in each controller time step VISSIM contacts all controller *.DLLs at the end of the current simulation time step. First, the current signalization states and detector data of all SCs are passed to the respective *.DLLs. Second, the *.DLLs are asked to calculate new desired signal states which are subsequently passed back to VISSIM. Depending on parameters set by the controller logic, either these signal states are applied immediately, or transition states (e.g. amber when switching from green to red) are inserted automatically, as defined in the signal group parameters in VISSIM. In the next simulation time step the vehicles in VISSIM will cope with the new signalization.

Documentation:
► <VISSIM>\API\SIGNALCONTROL_DLLS\SIGNALCONTROL_DLL\SC_DLL_INTERFACE.DOC

Examples:
► <VISSIM>\API\SIGNALCONTROL_DLLS\EXAMPLES\
13.6 Emission Calculation – EmissionModel.DLL

This interface allows to connect an external emission calculation module to VISSIM.

The external emission model is selectable for each vehicle type separately in the Vehicle Type dialog by checking the respective checkbox (at the bottom of the [SPEZIAL] tab page).

If this option is checked, VISSIM will call the functions in the EMISSIONMODEL.DLL for calculation of emission values used in the vehicle record and link evaluation / alternative link display.

Documentation:

►  <VISSIM>\API\EMISSIONMODEL_DLL\EMISSIONMODEL.TXT

Files:

►  <VISSIM>\API\EMISSIONMODEL_DLL\
13.7 Tolling – TollPricing.DLL

In VISSIM, user defined Toll Pricing Calculation Models can be implemented as COM scripts or specific *.DLL files.

Such a file *.DLL can be selected in the TollPricing Calculation Models dialog if the option COM-Script is activated, cf. section 5.6.2.

The *.DLL must contain the functions declared in TOLLPRICING.H: Init() and Exit() are called from VISSIM at the start respectively end of a simulation run and can be used to initialize the *.DLL respectively clean up. CalculateToll() is called whenever a new toll price needs to be calculated, i.e. at the start of each calculation interval of each managed lane facility, once per user class (SOV, HOV2, HOV3+).

VISSIM passes the number of the managed lane facility, the user class, the current simulation time, the travel time savings (in minutes) on the managed lane and the average speed on the managed lane (both since the start of the last interval) and it expects the new toll price to be stored with the reference variable <toll>.

Documentation:
► <VISSIM>\API\TOLLPRICING_DLL\TOLLPRICING.TXT

Files:
► <VISSIM>\API\TOLLPRICING_DLL\
14 Glossary of Files associated with VISSIM
### 14.1 Simulation Output Files

<table>
<thead>
<tr>
<th>Extension</th>
<th>Name</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>*.A00 :</td>
<td>Used by various evaluations</td>
<td>Output files for various specifically defined evaluations.</td>
</tr>
<tr>
<td>*.A99</td>
<td></td>
<td></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.</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 compiled data output from the node evaluation</td>
</tr>
<tr>
<td>*.KNR</td>
<td>Node Evaluation Raw data</td>
<td>Contains the raw data 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>*.MDB</td>
<td>Database output</td>
<td>Analyzer Reports and other output data</td>
</tr>
<tr>
<td>Extension</td>
<td>Name</td>
<td>Content</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------</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>*.MERP</td>
<td>Data collection (raw)</td>
<td>Area-based output data from simulation of pedestrians</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>*.MESP</td>
<td>Data collection</td>
<td>Compiled area-based output data from simulation of pedestrians</td>
</tr>
<tr>
<td>*.MLE</td>
<td>Managed Lanes Evaluation</td>
<td>Vehicles on routes with/without road toll, includes also compiled data.</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>PT delay</td>
<td>PT stop times (excluding times for passenger interchange).</td>
</tr>
<tr>
<td>*.PP</td>
<td>Pedestrian Protocol</td>
<td>Evaluation output file from simulation of pedestrians</td>
</tr>
<tr>
<td>*.PQE</td>
<td>Pedestrian Queue Evaluation</td>
<td>Evaluation of the number of pedestrians in queues and the extension of the queues.</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>*.RSR</td>
<td>Travel times (raw data)</td>
<td>Protocol of completed travel time measures in chronological order.</td>
</tr>
<tr>
<td>*.RSRP</td>
<td>Pedestrian travel time (raw)</td>
<td>Raw data from simulation of pedestrians</td>
</tr>
<tr>
<td>*.RSZ</td>
<td>Travel times (compiled)</td>
<td>Average travel times during a simulation for previously defined travel time sections.</td>
</tr>
<tr>
<td>*.RSZP</td>
<td>Pedestrian travel time (compiled)</td>
<td>Compiled data from simulation of pedestrians</td>
</tr>
<tr>
<td>*.SNP</td>
<td>Snapshot file</td>
<td>Simulation state.</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>Extension</td>
<td>Name</td>
<td>Content</td>
</tr>
<tr>
<td>-----------</td>
<td>----------</td>
<td>-------------------------------------------------------------------------</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>*.TXT</td>
<td>ANI.TXT file</td>
<td>Text file with Network data and vehicle trajectories for import in Autodesk’s 3ds Max software with the help of a script in Autodesk’s macro language.</td>
</tr>
<tr>
<td>*.VLR</td>
<td>Delay data (raw)</td>
<td>Protocol of completed delay time measures in chronological order.</td>
</tr>
<tr>
<td>*.VLZ</td>
<td>Delay data</td>
<td>Evaluation of delay data (compiled data)</td>
</tr>
<tr>
<td>*.XLS</td>
<td>Excel sheet</td>
<td>Analyzer output file according to filter settings</td>
</tr>
</tbody>
</table>
### 14.2 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 PT 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>
### 14.3 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>OD 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>Vehicle input format (demand) 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 are collected for each path</td>
</tr>
</tbody>
</table>
## 14.4 ANM Import Files

<table>
<thead>
<tr>
<th>Extension</th>
<th>Name</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>*ANM</td>
<td>Abstract network model</td>
<td>Input data file in *XML format; Network export from VISUM</td>
</tr>
<tr>
<td>*ANMROUTES</td>
<td>Route file</td>
<td>Input data file in *XML format; Export of routes and route volumes from VISUM</td>
</tr>
<tr>
<td>*.PANM</td>
<td></td>
<td>Backup copy of the imported *.ANM file</td>
</tr>
<tr>
<td>*.PANMROUTES</td>
<td></td>
<td>Backup copy of the imported *.ANMROUTES file</td>
</tr>
<tr>
<td>*.INP</td>
<td>Cf. section 14.5</td>
<td>Output file of the ANM Import</td>
</tr>
<tr>
<td>*.FMA</td>
<td>Cf. section 14.3</td>
<td>Output file of the ANM Import for Dynamic Assignment</td>
</tr>
<tr>
<td>*.WEG</td>
<td>Cf. section 14.3</td>
<td>Output file of the ANM Import for Dynamic Assignment</td>
</tr>
</tbody>
</table>
## 14.5 Other Data Files

<table>
<thead>
<tr>
<th>Extension</th>
<th>Name</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>*.ANC</td>
<td>Analyzer configuration file</td>
<td>Name and path of the output file *.MDB.</td>
</tr>
<tr>
<td>*.BGR</td>
<td>Background scaling file</td>
<td>Scale/Position parameters for the background of the VISSIM network.</td>
</tr>
<tr>
<td>*.BMP</td>
<td>Bitmap</td>
<td>Background graphic (e.g. aerial photo, signal plan) or texture (several formats are supported)</td>
</tr>
<tr>
<td>*.FIL</td>
<td>Filter settings</td>
<td>Filter settings for Vehicle protocol</td>
</tr>
<tr>
<td>*.FZI</td>
<td>Window configuration</td>
<td>Settings for Vehicle information display</td>
</tr>
<tr>
<td>*.FZK</td>
<td>File configuration</td>
<td>Settings for Vehicle protocol</td>
</tr>
<tr>
<td>*.GAIA</td>
<td>Vehicle position</td>
<td>The GAIA file contains vehicle data to be exported to another visualization tool</td>
</tr>
<tr>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*.HGR</td>
<td>Background parameter</td>
<td>Outdated data format: Parameters for background image (origin and scale)</td>
</tr>
<tr>
<td>(outdated format)</td>
<td></td>
<td></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 traffic network input data (also Public transport and Pedestrians add-on data)</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>*.KNK</td>
<td>Node Evaluation</td>
<td>Contains the parameters for the Node Evaluation output file</td>
</tr>
<tr>
<td>Parameters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*.LCF</td>
<td>Filter settings</td>
<td>Filter settings for Lane change evaluations</td>
</tr>
<tr>
<td>Extension</td>
<td>Name</td>
<td>Content</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>*.MLC</td>
<td>Configuration</td>
<td>Settings for Managed lanes evaluation</td>
</tr>
<tr>
<td>*.MESPK</td>
<td>Configuration</td>
<td>Settings for Compiled area-based evaluation during simulation of pedestrians.</td>
</tr>
<tr>
<td>*.NPC</td>
<td>Configuration</td>
<td>Settings for Network evaluation</td>
</tr>
<tr>
<td>*.PDK</td>
<td>Configuration</td>
<td>Settings for Pedestrian protocol</td>
</tr>
<tr>
<td>*.PIL</td>
<td>Filter settings</td>
<td>Filter settings for Pedestrian protocol</td>
</tr>
<tr>
<td>*.PUA</td>
<td>VAP start-up stages and interstages</td>
<td>VISSIG/CROSSIG/P2 output file: Contains definitions of stages, start-up stages and (if applicable) interstages for signal controllers with VAP logic (optional module)</td>
</tr>
<tr>
<td>*.PW1</td>
<td>Parameter file</td>
<td>VS PLUS parameter settings</td>
</tr>
<tr>
<td>*.QMK</td>
<td>Configuration</td>
<td>Settings for Data collection</td>
</tr>
<tr>
<td>*.SAK</td>
<td>Configuration</td>
<td>Settings for Link evaluation</td>
</tr>
<tr>
<td>*.SIG</td>
<td>Fixed time SC data output file</td>
<td>Signal control data file in XML data format that is automatically created for each fixed time control when an *.INP file provided in previous data format is opened. Only required until the *.INP file is saved with the new data format</td>
</tr>
<tr>
<td>*.STG</td>
<td>TRENDS control</td>
<td>ASCII supply file for TRENDS</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 plans</td>
</tr>
<tr>
<td>*.TZM</td>
<td>Export files from IVA and SiVIP</td>
<td>Fix time programs can be exported from IVA and SiVIP in the *.TRADAT format (ASCII) for import in VISSIM</td>
</tr>
<tr>
<td>*.DAT</td>
<td>Export files from IVA and SiVIP</td>
<td>Fix time programs can be exported from IVA and SiVIP in the *.TRADAT format (ASCII) for import in VISSIM</td>
</tr>
<tr>
<td>*.V3D</td>
<td>VISSIM 3D model file</td>
<td>VISSIM 3D modeler output file</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>*.VCE</td>
<td>VS-PLUS in C format</td>
<td>VS PLUS parameter settings in C format</td>
</tr>
<tr>
<td>*.VXB</td>
<td>TRENDS data supply</td>
<td>Binary supply data file for TRENDS control</td>
</tr>
<tr>
<td>Extension</td>
<td>Name</td>
<td>Content</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>*.WTT</td>
<td>Signal control</td>
<td>(Internal) interface definition of parameters for data exchange between VISSIM and an external signal control program</td>
</tr>
</tbody>
</table>
The VISSIM Online Help consists of the VISSIM User Manual. Use one of the following options to call the Online Help during your program session:

- Menu HELP - ONLINE HELP
- ALT+H - H
- F1

15.1.1 Find topic

Search in table of contents

- Select and open one of the listed chapters by double-click first.
- Select one of the listed sections then.
Search in list of index entries
► Enter keyword first.
► Select the entry from listed index items (by double-click or via DISPLAY) then.
Full-text search

- Enter word(s).
- Check and modify Search options, if applicable.
- LIST TOPICS: Calls the list of relevant topics.
- Select item from the displayed list and call display (by double-click or via DISPLAY).

Search options

- **Show previous results**: The next search run will only stick to the list of items found in the previous search when a new keyword is entered for another search run.
- **Match similar words**: The search run will not only find identical words, but also words with similar spelling.
- **Search titles only**: The search will only regard the headlines of the manual chapters and their sections.
15.1.2 Show topic

Use the buttons to skip to the next or to the previous section. Within a chapter, the hyperlinks listed under More can be used. Use the scroll icons to navigate in the online help.

Display options

► Check/Uncheck the display of tabs:
  - via HIDE/SHOW buttons or
  - via OPTIONS – HIDE TABS / SHOW TABS.

► Navigate in the Online Help:
  - via BACK/FORWARD buttons or
  - via OPTIONS – BACK/FORWARD.

► Within a chapter, you may click
  - a hyperlink highlighted in the text or
- one of the hyperlinks listed under More to skip to another topic.

► **SEARCH HIGHLIGHT ON:** The search keyword found in the manual text will be highlighted by a colored bar. Unchecked via **SEARCH HIGHLIGHT OFF.**

► **Start print output:**
  - via PRINT button or
  - via OPTIONS – PRINT...

The items to be printed can be selected in the *Print items* window.

► **OPTIONS menu:** The commands
  - **HOME,**
  - **STOP,**
  - **REFRESH,**
  - **INTERNET OPTIONS...**

refer to the functionality of Internet Browsers (e.g. Internet Explorer).
15.2 License Info

For details on your current VISSIM installation you can call the License window via menu HELP - LICENSE.

This window displays the following:

- the Maximum
  - number of signal controllers permitted,
  - size of the network,
  - number of link types,
  - duration of a simulation,
  - number of pedestrians permitted;
- a list of available/installed add-on Modules,
- a list of available/installed Signal Controllers,
- customer-specific data on the installed VISSIM Version and
- the path of the VISSIM installation.

You can model up to 30 pedestrians and run a pedestrian simulation even if your VISSIM license does not include the Pedestrians add-on.
15.3 Contact Info

In case of problems or requests, please use one of the numerous options for instant and direct contact.

During your VISSIM session, click INFO... in the HELP menu for immediate access to

► the internet presence of PTV Vision,
► the list of FAQs,
► the contact form provided for VISSIM Hotline requests or
► the download page for VISSIM service packs.

15.3.1 Sales & Distribution

For more information on software maintenance contracts or contract updates and any questions regarding VISSIM license fees, please contact your local distributor.

Alternatively, you may contact PTV AG directly via Info.Vision@ptv.de (information and delivery procedures).
15.3.2 Technical Hotline

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 have 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).

Prior to contacting the VISSIM hotline, please do the following:

- Refer to your manual, since mostly the required information can be found therein.
- Refer to the FAQ list provided via Internet. It includes numerous helpful hints and describes various modeling problems and how to solve them.

If your maintenance contract is with PTV AG, please help us providing a fast and effective hotline service by using the hotline contact form provided via http://www.ptv-vision.com/hotline_vissim and complying to the following guidelines:

When posting a mail to the VISSIM hotline, please include the following information:

- Detailed description of the problem and of the actions that have been taken beforehand (so that we can reproduce the error) and a screenshot (*.JPG) if necessary.
- All data files which are required to reproduce the error or the problem.

The following details are automatically stored in the hotline contact form:

- **VISSIM version no. and service pack no.** (e.g. 5.30-04), cf. also VISSIM window title,
- Program edition (32 bit / 64 bit)
- Operating system and service pack no.
- PTV customer no.
- Dongle no.

Thank you for your cooperation.
15.4 Services

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.

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 websites at http://www.english.ptv.de/software/transportation-planning-traffic-engineering/trainingevents/ and http://ptvamerica.com/trainingevents.html.

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 Info.Vision@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 Info.Vision@ptv.de (offers and delivery procedures).

Service Packs
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.

FAQ
At http://www.ptv-vision.com/faq_vissim 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).

Technical Hotline
PTV operates a technical hotline e-mail service for VISSIM, cf. section 15.3.2.