

PTV VISUM

the mind of movement



VISION TRAFFIC SUITE – TUTORIAL

PTV VISUM 16 QUICK START

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About this Tutorial

This module is part of the tutorial on the Vision Traffic Suite product family by PTV AG. It is designed to assist users of these products by explaining step by step typical workflows and important features within VISUM. In the framework of this Quickstart tutorial these steps are explained in detail.

The tutorial unfolds its full usefulness together with your version-specific manual. In the tutorial you learn which decisions to make and which steps to take. The user manual provides you with information how to take the steps with the program version available.

The text is accompanied by an example referred to at specially indicated points. At the end of the main text you will find a list of all included data with reference to the text.

The tutorial including all files is copied automatically to folder “Documents” during the installation. The folder can also be opened from Visum (menu “Help”). First set the project directories on the enclosed folders entitled VISUM_NETWORKS for version files and ADDITIONAL_DATA for all other file types. To do so choose FILE + OPEN + PROJECT DIRECTORIES... from the menu bar and open the file PATHSETTINGS.PFD, which is in folder ADDITIONAL_DATA. The version files can be opened with Visum version 15, even if the network size exceeds your license. In this case you are able to open the version files and follow the examples, but saving of changed data will not be possible. For following the exercises of this tutorial you may need to refer to the subsequent version file.

The editorial staff of the PTV Visum tutorials hopes that you enjoy an interesting and instructive read!



The example network for this quickstart tutorial exceeds the possible number of objects for the **trial version for students**. It is recommended to users of this version to download the 30 day free trial version and use it in oversize mode.

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1 Structure of the tutorial PTV Visum Quickstart

The purpose of this Quickstart tutorial is to make the first steps in Visum easier. It will give you a first insight into essential functionality and workflows. All the steps which are necessary for the described modeling and analysis are described in detail. One just needs to work through the instructions step by step. If you are only interested in parts of the tutorial, you can begin working in every sub chapter. The necessary files with intermediate results are mentioned at the beginning of every sub chapter and can be found in the folder Visum_Networks.

The model area used in this tutorial is the fictitious town of Oppidum. In this tutorial you will extend a given transport network and perform traffic related analysis. The tutorial consists of two parts:

1. Private Transport (PrT): Analyse the traffic impacts of the construction of a bypass.
2. Public Transport (PuT): Analyse an urban bus network. With the help of Visum's analysis capabilities you will examine the given network and derive actions for improving it.

Overall this tutorial aims at introducing basic workflows to new Visum users. For more detailed background information on modeling principles and analysis capabilities we recommend to study the examples of the installation under C:\USERS\PUBLIC\DOCUMENTS\PTV VISION\PTV VISUM 16\EXAMPLES..

2 Private Transport (PrT): Impacts of a new bypass

The following section introduces you to Visum's PrT capabilities through the help of a typical PrT project. You will analyze the impact of a bypass on the traffic situation in Oppidum. The goal is for you to understand the Visum way of modeling transport and its analysis functionality step by step.

In chapter 2.1 you start with expanding the network. This section gets you familiar with creating network objects and modifying their visualization (graphic parameter) settings.

Afterwards, in section 2.2, you will include the travel demand between zones and automatically generate connectors to establish a connection between demand and supply (network).

In the following chapter, chapter 2.3, you will assign the demand to the transport network. At the same time, you will calculate skim matrices containing traffic related indicators such as transportation time between zones. The results of the traffic assignment in the form of link volumes will be displayed.

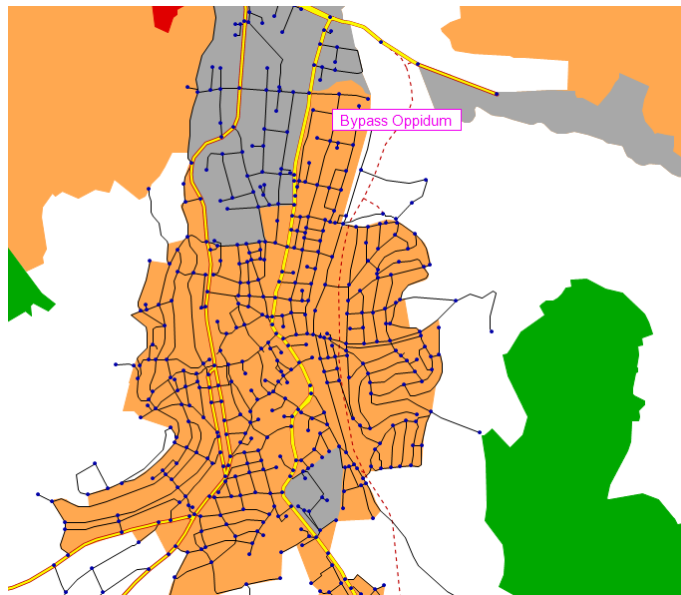
In chapter 2.4, you will explore the impacts of the bypass. For example, you will compare the link volumes in the actual state with the link volumes in the planned state. The calculated skim matrices will allow you to examine the changes of travel times between zones. In addition, you will calculate flow bundles (generalized select-link analyses) in order to identify which origin-destination-relations are affected by the new bypass. You will end your analysis by displaying the detailed turn volumes at an intersection.

2.1 Creation and attribution of network objects

Creating nodes and links

In this first step you have to insert the planned bypass into the network model. To make this easier for you, the road course is already displayed in the background with a red dashed line. Insert the needed nodes and links into the network via the following steps:

1. Choose **FILE + OPEN VERSION** from the menu bar and open the file **400_VISUMTUTORIAL.VER**. The transportation network of the town Oppidum will be displayed. The dashed red line is the proposed new bypass. The blue dots are nodes and the black links are existing links (roads) in the network.



2. Insert nodes of the bypass into the network:
 - Make sure that the window *Network* is displayed. If not choose **VIEW + NETWORK** from the menu bar to display it.
 - Select the object type **NODES** by left clicking on the **NODES** label. It will then be displayed with a white background:



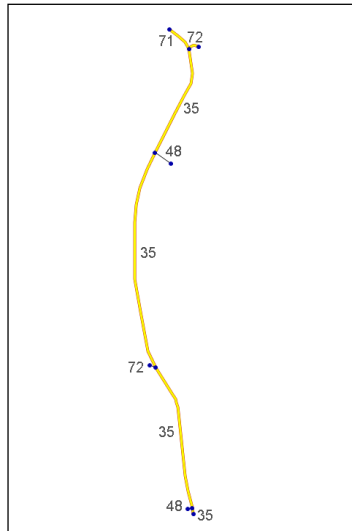
- Choose **EDIT + INSERT MODE** from the menu or click on the button .
- Zoom in to the Southern point of the proposed bypass and left click at the intersection of the red dashed lines. This will insert a new node for the bypass. In case the scale of your network is not suitable, you can zoom in and out by scrolling the mouse wheel or by pressing the button **SET WINDOW**  and defining a clipping with your mouse.

- The dialog *Create Node* is displayed. Keep the dialog's settings and click OK.
 - Iterate these steps for the remaining three nodes which are needed for the bypass. Note that the bypass extends the existing network, so there is no need for nodes at the intersection of the red dashed lines and the existing links.
3. Create links to connect the new nodes:
- Make sure that you reside in the window *Network* and select the object type LINKS by left clicking on the LINKS label:

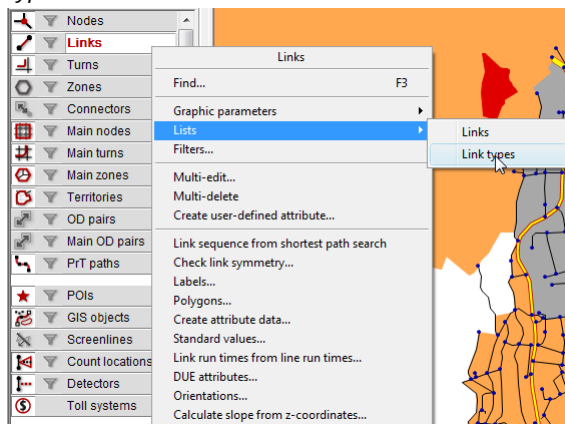


- Choose EDIT + INSERT MODE from the menu bar or click on the INSERT MODE button .
- Connect two nodes of the bypass by left clicking on the nodes one after another. The dialog *Create link* is displayed.

- Choose the link type from the combo box *Type* according to the following illustration. For example, the very Southern most link's link type is 35.

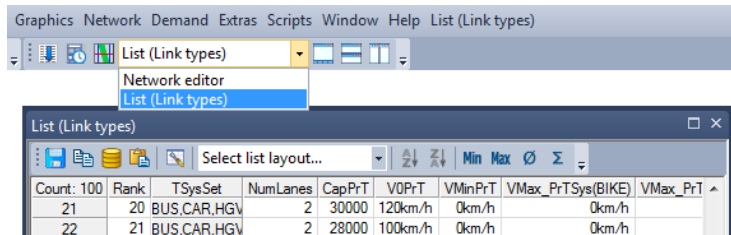


- Keep the other settings of the dialog and press OK.
 - Repeat these steps for the remaining eight links, which form the bypass.
4. By assigning a link type, various link attributes are automatically set based on the default value for that link type. The attributes are: permitted transport systems (**TsysSet**), capacity for private transport (**Capacity PrT**), the free flow speed (**v0 PrT**) and **the number of lanes**. Take a look at the link type default values:
- Choose **LISTS + NETWORK + LINK TYPES** from the menu bar or right click on the **LINKS** label in the window *Network* and choose *Lists – Link types* from the context menu.



- Take a look at the attribute settings for the different link types.

- Change back to the network editor view by selecting *Network editor* in the following combo box of the tool bar:

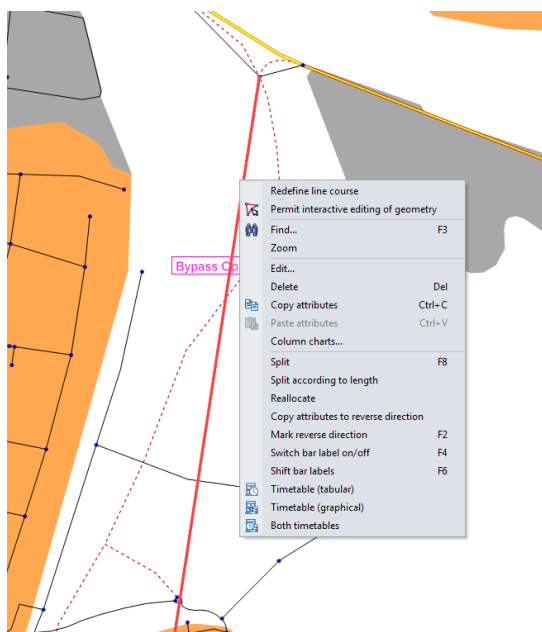


- Currently the links are straight lines. In order to define their spatial courses, you need to edit their shape:

- Make sure that you reside in the window *Network* and select the object type **LINKS** by left clicking on the **LINKS** label:



- Choose **EDIT + EDIT MODE** from the menu bar or click on the **EDIT MODE** button .
- Select one of the newly created links by left clicking on the link.
- By right clicking in the net editor window you get the context menu for the link. Choose the entry *Redefine line course*.



- Set several points along the given shape of the link. To do so, move the mouse pointer successively to the desired positions in the direction of the arrow and confirm each of the points by left clicking. After you set all the points, close the shape editing process by pressing **ENTER**.
 - If you are not satisfied with your link shape so far, you can change the shape by right clicking and choosing *Permit interactive editing of geometry* from the context menu. As an alternative you can activate the button  in the network editor. Then you can drag and drop the blue squared points.
 - Repeat these steps for all newly inserted links which form the bypass.
6. Since you have now edited the shape of the bypass, you can switch off the display of the red dashed line. The line was only displayed for assisting you in the shape editing process:
- Right click on the POIs caption in the window *Network* and select *Edit graphic parameters*.
 - Deactivate the check box for POI category No 15: Link .
 - Exit the dialog with OK.

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You can find this snapshot of the model in file 401_VISUMTUTORIAL.VER.

Adjusting graphic parameters for links

The attributes of the new links were assigned the default values of the assigned link type. For improving the links' graphical display, you have to make some further modifications:

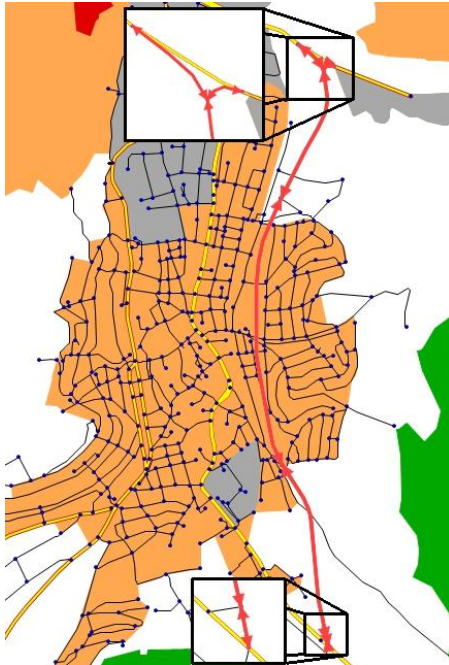
1. Start with adapting the link classification by the help of *multiple marking*. In the present network, the link classification is stored in a user-defined attribute (UDA).

- Use the mouse wheel to set the map view so you can see the whole course of the bypass in the net editor window. Alternatively you can also use the keys **PAGE-UP** and **PAGE-DOWN**.

- Press the EDIT MODE button  and select the object type LINKS by left clicking on the LINKS label:

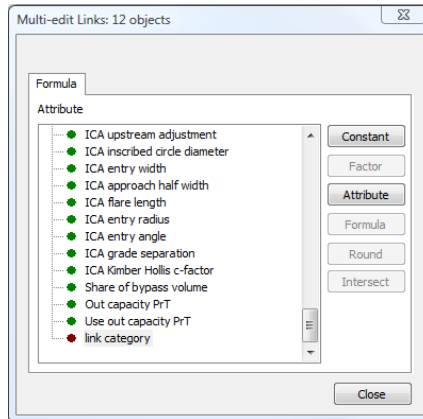


- Keep the **CTRL**-key pressed and mark the links of the bypass as shown in the illustration below. Make sure that you mark both directions of each link by clicking once on the left side and once on the right side of the link. These links are now displayed with a red line. If you now perform a *Multi-edit* operation these links' attributes will be changed as you will see in the next step.

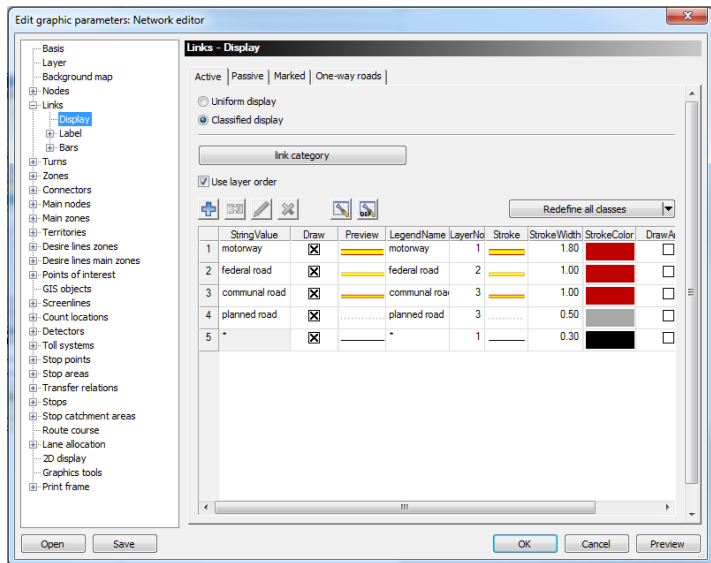


- Press **ENTER** to open the *Multi-Edit Links* dialog. The title bar of the window shows that twelve objects (here: links) are marked and thus the following changes will be applied to these twelve links.

- Choose the attribute **link category** from the list and press the **CONSTANT** button. By doing so you can assign a constant value to all marked links.



- Enter **federal road** into the input box and press OK.
 - *Note:* links have two directions and attributes such as the number of lanes or the capacity can be set to different values in both directions. That is why you had to mark both directions of each link.
 - Exit the *Multi-Edit Links* dialog by pressing the **CLOSE** button.
 - Press the **REFRESH** button  to display your changes.
2. As you can see, the graphics of the bypass have changed by assigning a different link category to its links. This shows how you can visualize network objects based on user-defined attributes. In order to see how the display of links is dependent on link categories, take a look at the graphic parameter settings:
- Right click on the **LINKS** label in the window *Network* and select *Graphic parameters – Display...* from the context menu. The *Edit graphic parameters* dialog is opened.
 - Make sure the tab **[ACTIVE]** is active. Here you can see that the active links are drawn differently dependent on the attribute **link category**.
 - Select the line containing class **federal road** by left clicking on the row.



- On the right you can see the graphic settings for links belonging to this class.
- Exit the dialog by pressing the CANCEL button.

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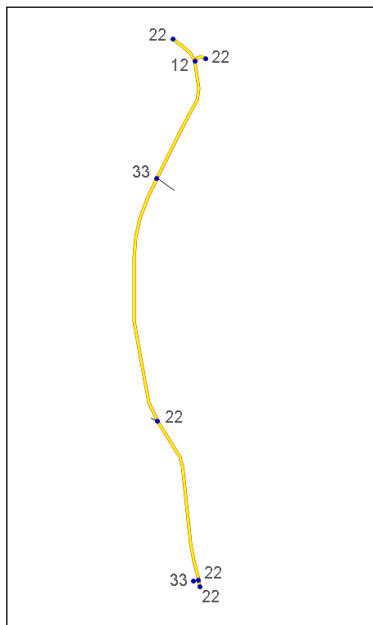
You can find this snapshot of the model in the file 402_VISUMTUTORIAL.VER.

Attribute settings for nodes

The assignment of values to node attributes is not mandatory. Nevertheless we recommend the use of node types which for example are used when defining turn standards. Turn standards are similar to link types since they contain default values for turn attributes **Capacity PrT** and **t0 PrT**, the turn-specific delays in the unloaded network. Turn standards depend on the flow hierarchy and the turn's via node **Type number**. The categorization of node types is not standardized and you can customize it to the needs of your project. In our example the following node types are used:

Type no.	Description
12	Motorway without transport systems PrT-Walk and Bicycle – connection of two ramps.
22	Crossing without traffic lights and without transport systems PrT-Walk and Bicycle. Right of way regulated by road signs.
33	Crossing with traffic lights and without transport systems PrT-Walk and Bicycle. Crossing coordinated.

Code the bypass nodes with the following node types:

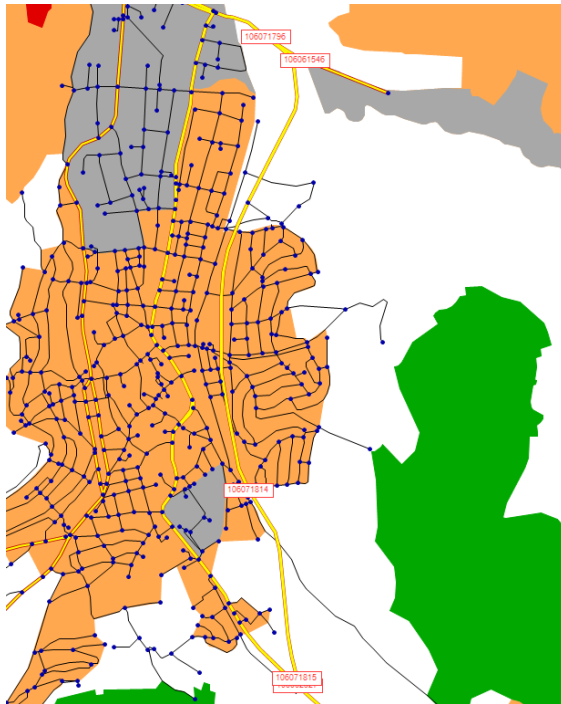


1. First select all the nodes of interest. These are nodes that will be coded with node type 22. This can be done again with *multiple markings*. The difference now is that you will set the node type in the *Quick View* window which offers a much faster and more efficient method for changing the attribute values of one or multiple network objects (*Note*: of course you could still do it via multi-edit as shown for the link classification, but in most cases the *Quick View* window is faster):

- Press the EDIT MODE button  and select the object type NODES by left clicking on the NODES label:

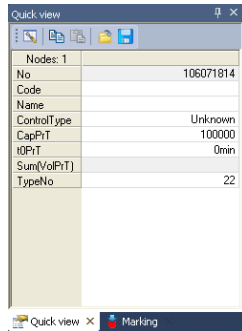


- Keep the **CTRL**-key pressed and select all nodes showing the node type 22 in the illustration above. The screen should then look like this:

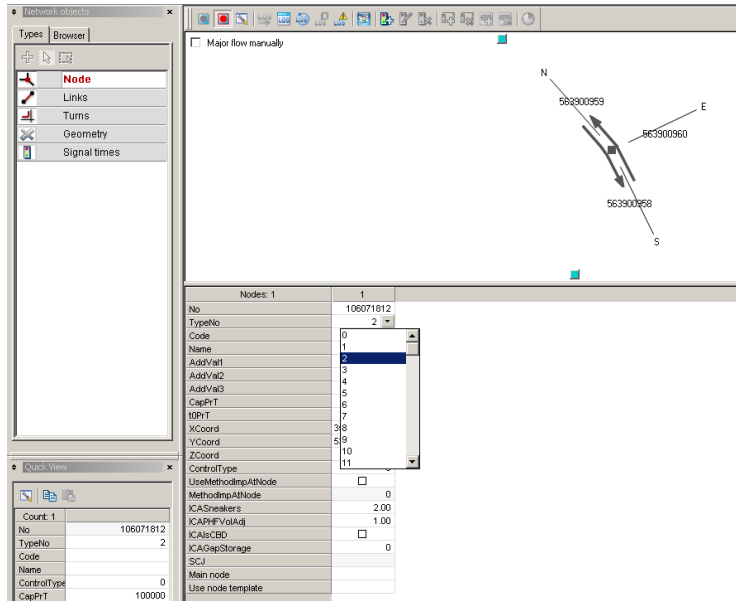


- Make sure that the *Quick View* window is visible on your screen. If not choose VIEW + QUICK VIEW from the menu bar to display it.
- The handling in this window is very similar to lists. Press the ATTRIBUTE SELECTION button  in the *Quick View* window. The dialog *Attribute selection (Nodes)* is displayed.
- Select the attribute **Type number** from the list and press the ADD button.
- Press OK to confirm your new attribute selection.

- Left click in the input field for **TypeNo** in the *Quick View* toolbar and enter **22**. For all the marked nodes this value is set.



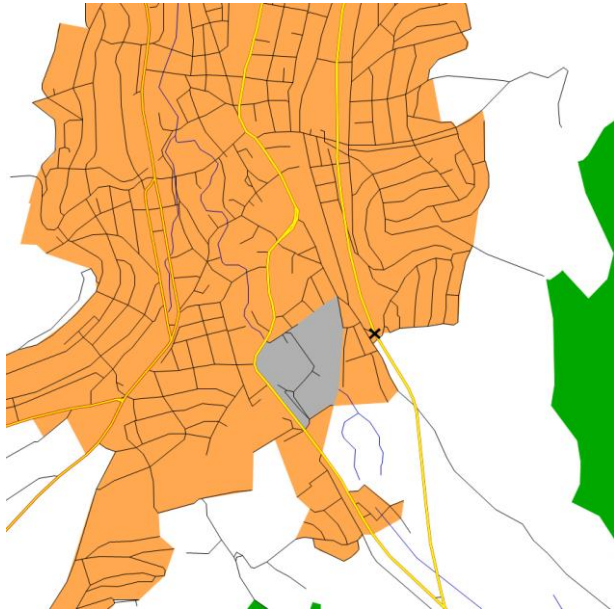
2. Repeat step 1 for all the node types where the node type has to be assigned to multiple nodes. (The attribute **TypeNo** remains in the *Quick View* window, i.e. must not be added again.)
3. In those cases, where the node type has to be assigned only to one node you do not have to keep the **CTRL**-key pressed when marking the node. Alternatively you can edit it in the *junction editor*:
 - Mark the desired node by double clicking left on it.
 - In the dropdown menu for **TypeNo** you can then select the desired type.
 - Exit the junction editor by pressing the CLOSE button .



Attribute settings for turns

When inserting a link, Visum automatically creates turns at the **From node number** and **To node number**. By default Visum creates all these turns to be open to the transport systems that are allows both on the incoming link and on the outgoing link of the turn. Consequently, we need to examine if the set of transport systems are correctly defined. Carry out the following steps for the turns belonging to the newly created nodes:

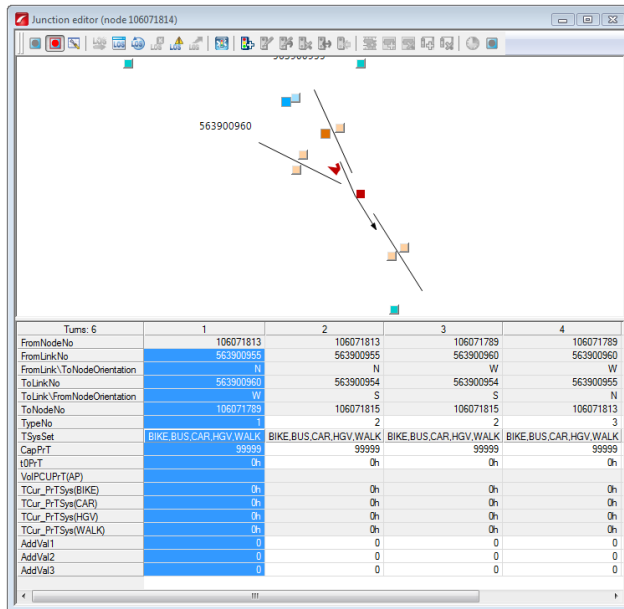
1. Open the junction editor for editing the turns belonging to a node:
 - Open the junction editor by double clicking left on the marked node.



- In the junction editor select the object type **Turns** by left clicking on the turns label:

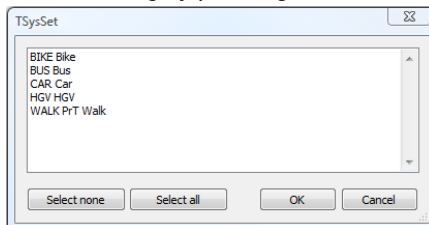


- Select a turn by clicking left on the column heading of the table view. In the schematic view of the node, the turn is drawn in dark red color. Now mark the turn shown in the following screenshot:



2. Block this turn for all transport systems:

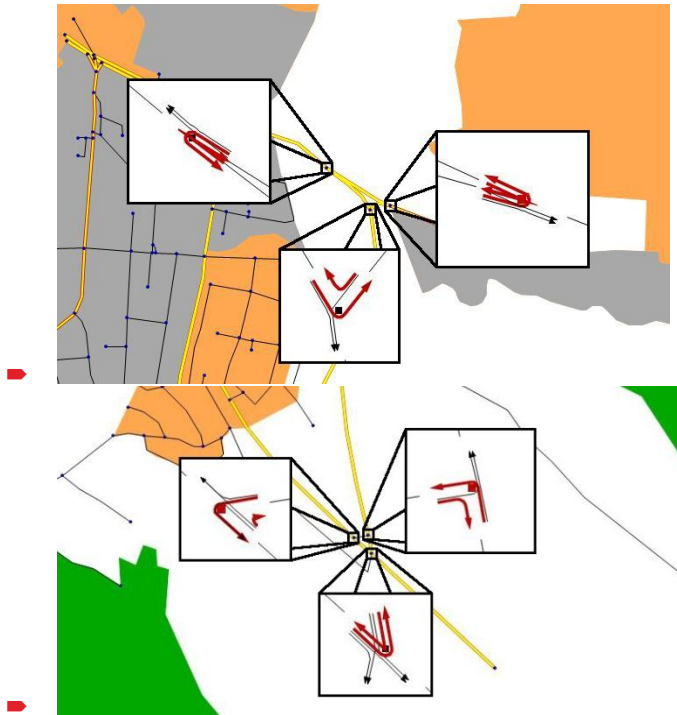
- Press the button for the **TSysSet**.
- Press the button **SELECT NONE**.
- Exit the dialog by pressing **OK**.



- Exit the junction editor by pressing the **CLOSE** button .

3. Close selected turns of nodes of the bypass by repeating steps 1 and 2:

- Close all U-Turns (**TypeNo 4**) of nodes of the bypass. Note that by default blocked turns are not shown in the junction editor, i.e. you only need to change the **TSysSet** if turns of type 4 are visible in the list. Generally, the display of turns can be adjusted via the context menu.
- Additionally close turns shown in the following illustrations of corresponding junctions. These junctions are located where the bypass is connected to the existing road network in the north and south, respectively.



The values of the turn attributes **Capacity PrT** and **t0 PrT** (turn-specific PrT delays in the unloaded network) are set from the default values of the turn standards.

1. Make sure that you still reside in EDIT MODE  and that the object type **Turns** is selected.
2. Ensure that all turns are active:

- Take a look if in the window *Network* there is a red point displayed behind the **Turns** label:



- If there is no red point, all turns are active and you can continue with step 3. If there is a red point, not all turns are active and you have to do the following:

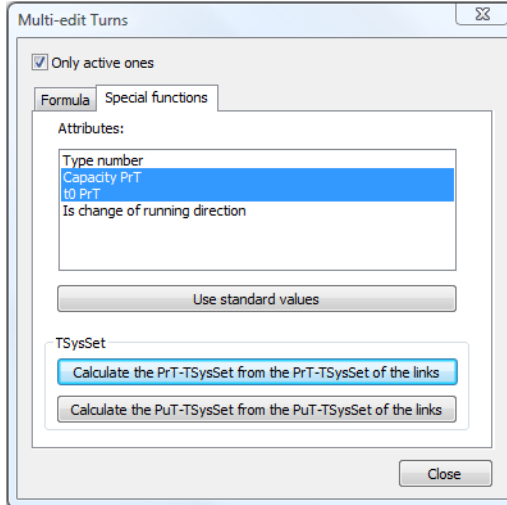
- To activate all turns change to the *Spatial selection mode* by pressing the button **SPATIAL SELECTION MODE** .
- Make sure that the check box behind the **Turns** label in the *Network* window is activated in order for the spatial selection actions to be applied to turns:



- Press the button **SELECT ALL OBJECTS** in the *Spatial selection* toolbar. All turns are active now.



3. Assign the standard values from the turn standards to the turns:
 - Right click on any place in the map and choose *Standard values...* from the context menu. The tab [SPECIAL FUNCTIONS] of the *Multi-edit Turns* dialog is displayed.
 - Keep the **CTRL**-key pressed and select the entries **Capacity PrT** and **t0 PrT**.



- Press the button **USE STANDARD VALUES**.
- Exit the dialog by pressing the **CLOSE** button.

You have now finished editing the network. The bypass links and turns are now properly attributed. In the next modeling step you will add travel demand to the model.

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You can find this snapshot of the model in the file 403_VISUMTutorial.ver.

2.2 Inserting travel demand

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Open the version file 403_VISUMTUTORIAL.VER to start working on the example in this chapter.

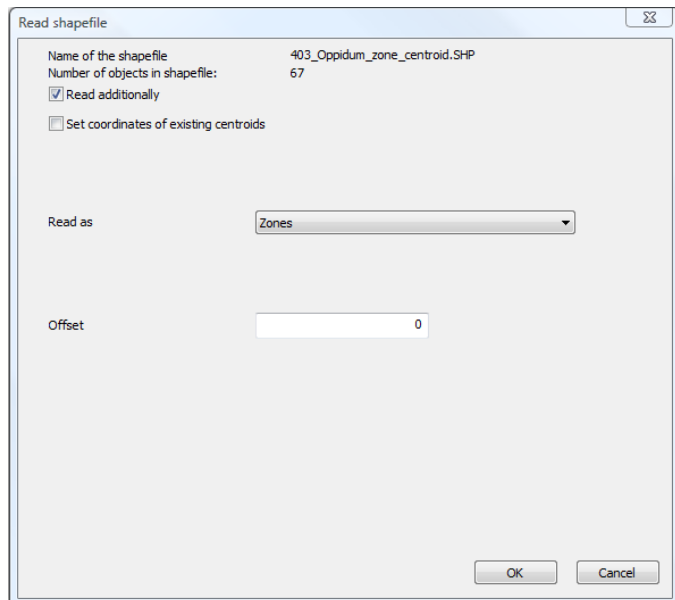
Import zones from shape files

For adding travel demand to the model, it is first necessary to create zones. Zones are origins and destinations of travel. For the present example, zone data is available in the form of shape files. Import these files into your Visum network:

1. Choose FILE + IMPORT + SHAPEFILE from the menu bar.
2. Select the file 403_OPPIDUM_ZONE_CENTROID.SHP and press OPEN.
3. The dialog *Read shapefile* is shown. Activate the option *Read additionally* and select *Zones* from the combo box *Read as*.

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The *Read Additionally* option when reading network files, databases, shape files, etc. is a very powerful feature. It allows one to add, remove and/or modify existing network objects already loaded.



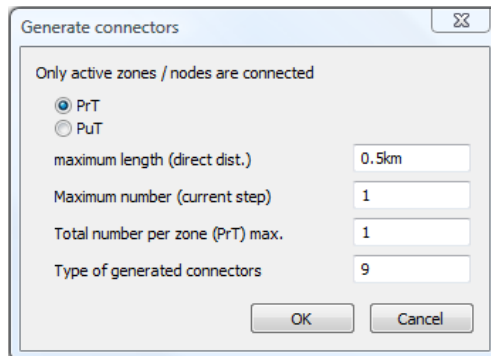
4. Keep the remaining settings and exit the dialog by pressing OK.
5. The dialog *Read Attributes* is displayed. Confirm by pressing OK.
6. Take a look at the imported zones in the list:
 - ➡ Choose LISTS + + NETWORK + ZONES from the menu bar.

- Take a look if in the window *Network* there is no red point displayed next to the NODES or ZONES labels.
- If there is no red point, all nodes and zones are active and you can continue with step 3. If there is a red point, some nodes / turns are passive and you have to do the following:
- Change to the *Spatial selection mode* by pressing the SPATIAL SELECTION MODE button .
- Make sure that the check boxes next to the NODES and ZONES captions in the window *Network* are ticked.
- Press the button SELECT ALL OBJECTS in the *Spatial selection* toolbar. All nodes and zones are active now.



3. Generate the connectors:

- Open the context menu by right clicking in the network editor and choose *Create....* Alternatively you can also choose EDIT + CREATE... from the menu bar.
- Activate the radio button *PrT*.
- Enter a maximum length of **0.5km**.
- Keep the remaining settings and confirm by pressing OK.



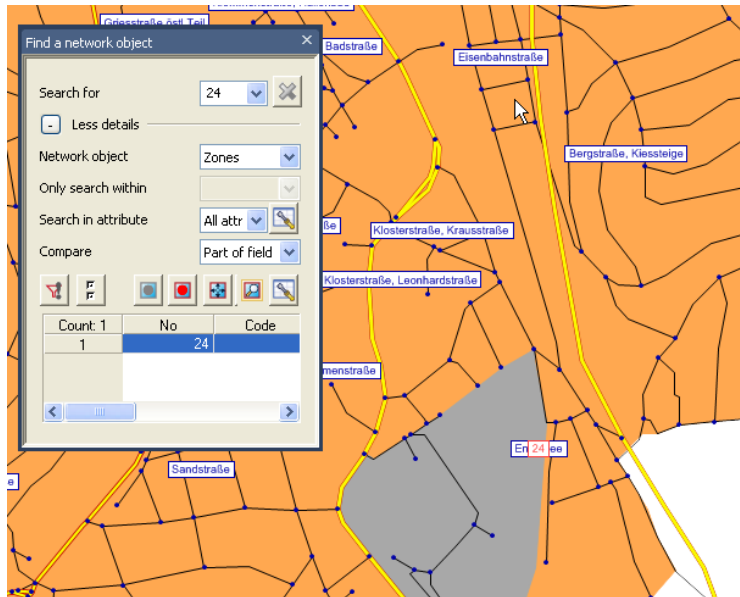
4. Take a look at one of the new connectors:

- Press the GRAPHIC LAYER button for CONNECTORS to display them:



- Move the mouse pointer over the *Network editor* and press **F3** to search for a zone or right click and select *Find* from the context menu.

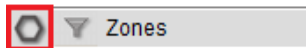
- Enter the zone number **24** in the input box (the zone named **Entensee**).
- Press the **AutoZoom** button. Zone number **24** is now displayed in the *Network editor*.
- The double-sided arrow between a node and a zone symbolizes a connector :



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You can find this snapshot of the model in the file 405_VISUMTUTORIAL.VER.

5. Hide the zones and connectors in the *Network editor*:
 - Close the *Find connector* dialog by pressing OK.
 - Press the **GRAPHIC LAYER** buttons for **ZONES** and **CONNECTORS** to deactivate the display:



Creating an OD matrix

Before you can add travel demand in the form of an OD matrix, you first have to insert a new demand segment.



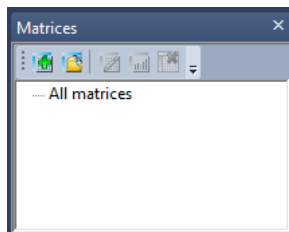
A demand segment is a partition of demand that represents a group of users with similar behavior in traffic.

The OD matrix will later be assigned to this demand segment:

1. Create the demand segment:

- Choose DEMAND + TSys/MODES/DSEGS from the menu bar.
- Change to tab [DEMAND SEGMENTS] and press the CREATE button.
- The dialog *Create demand segment* is displayed.
- Enter **C** as the Code and **Car_24h** as the Name for the new demand segment.
- Choose the mode **C Car** from the combo box.

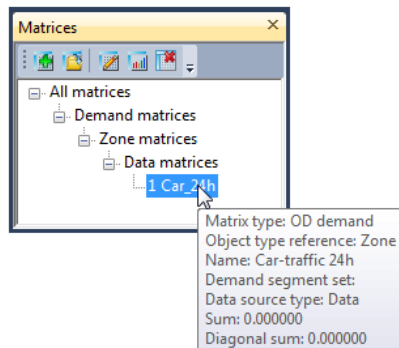
- Exit the dialog by pressing OK.
 - This brings you back to the dialog *TSys/Modes/DSEgs*. Again confirm by pressing OK.
2. Open the demand matrix containing the travel demand:
- Change to the window *Matrices*. The tree *All matrices* is initially empty as no matrices have been defined so far.



- Press the button CREATE MATRIX  or choose *Create matrix* from the context menu.

- The dialog *Create matrix* opens.
- Enter the Code **Car_24h** and the Name **Car-traffic 24h**.
- Leave matrix type as *Demand matrices* and Network object reference type as *Matrices with zone dimension*. Type of data source is Data matrix. Confirm with OK.

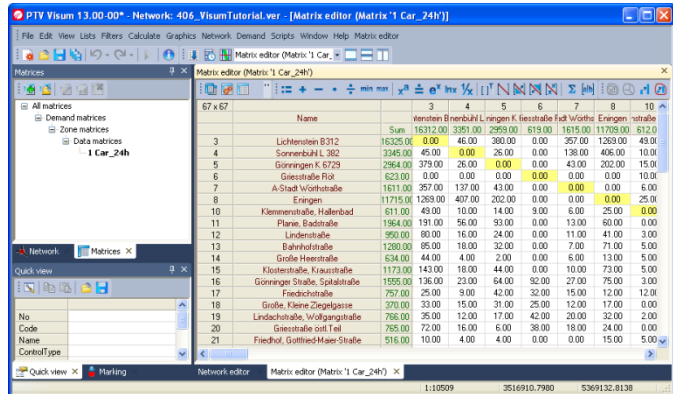
- The new matrix appears in the tree under *Demand matrices* -> *Zone matrices* -> *Data matrices*. The blue marking shows that the matrix is selected for the following actions. When moving the mouse over the entry in the tree more information is shown in the tooltip.



- Once the *Create Matrix* window is confirmed with Ok the matrix is opened in the matrix editor window if the option *Edit new matrices after creating* was checked.

3. Fill the matrix with values from a matrix file:

- Mark matrix No **1**, right click to access the context menu and select the corresponding entry *Open from file....* Select the matrix 405_CAR_24H.MTX and click OPEN. (Alternatively, use the button READ MATRIX CONTENT FROM FILE  in the *Matrix editor* window to assign the matrix values from the file 405_CAR_24H.MTX.)

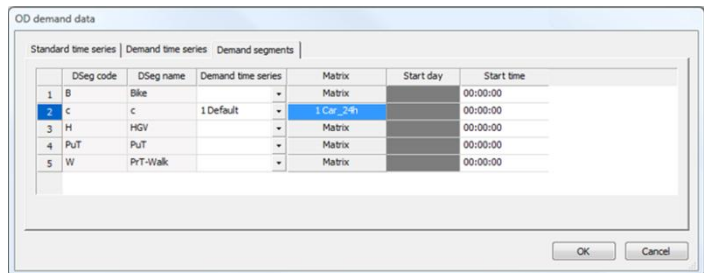


The screenshot shows the Matrix editor window for Matrix '1 Car_24h'. The window displays a 67x67 matrix with columns and rows labeled by zone numbers (3, 4, 5, 6, 7, 8, 10) and zone names (Lichtenstein B 312, Sonnenbühl L 382, Gönningen K 5729, Giesstraße R10, A-Stadt Wörthstraße, Enningen, Klemensstraße, Halenbad, Pflanz. Badstraße, Lindenstraße, Bahnhofstraße, Große Heerstraße, Klosterstraße, Krausstraße, Gönninger Straße, Spitalstraße, Friedrichstraße, Große Kleine Ziegelsäule, Lindachstraße, Wöllgangstraße, Giesstraße odt Teil, Friedhof, Gottfried-Mann-Straße). The matrix contains numerical values representing travel demand. The status bar at the bottom shows the matrix size 67x67 and the total sum 1.110509.

However, the matrix still needs to be linked to a demand segment so it can be assigned to the network.

4. Link the demand segment **Car** to the new demand matrix:

- Choose DEMAND + DEMAND DATA from the menu bar. The dialog *OD demand data* is opened.
- Change to the tab [DEMAND SEGMENTS].
- Select the row with the newly inserted demand segment **C**.
- Assign the opened matrix to the demand segment by choosing **Car_24h** from the column *Matrix*.



The screenshot shows the 'OD demand data' dialog with the 'Demand segments' tab selected. The table lists demand segments with columns for OSeg code, OSeg name, Demand time series, Matrix, Start day, and Start time. The segment 'C' (Bike) is selected, and its matrix is assigned to '1 Car_24h'.

OSeg code	OSeg name	Demand time series	Matrix	Start day	Start time
1 B	Bike	-	Matrix	-	00:00:00
2 C	c	1 Default	1 Car_24h	-	00:00:00
3 H	HGV	-	Matrix	-	00:00:00
4 PuT	PuT	-	Matrix	-	00:00:00
5 W	P+T-Walk	-	Matrix	-	00:00:00

- Exit the dialog by pressing OK.
- The travel demand for demand segment **Car** is now determined by matrix **1 Car-traffic 24h**.

E

You can find this snapshot of the model in the file 406_VISUMTUTORIAL.VER.

2.3 Assigning travel demand to the network

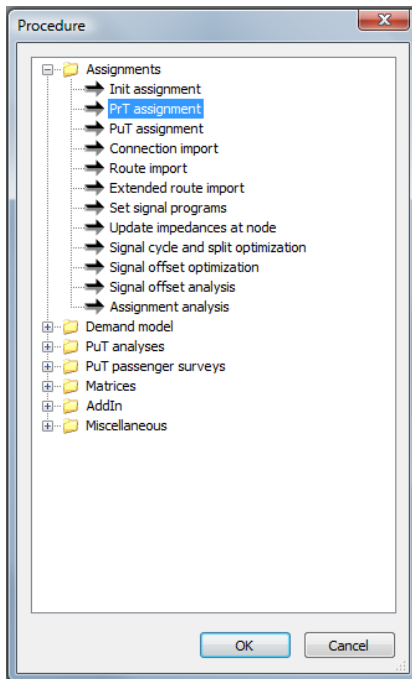
E

Open the version file 406_VISUMTUTORIAL.VER to start working on the example in this chapter.

Choosing the assignment method and parameters

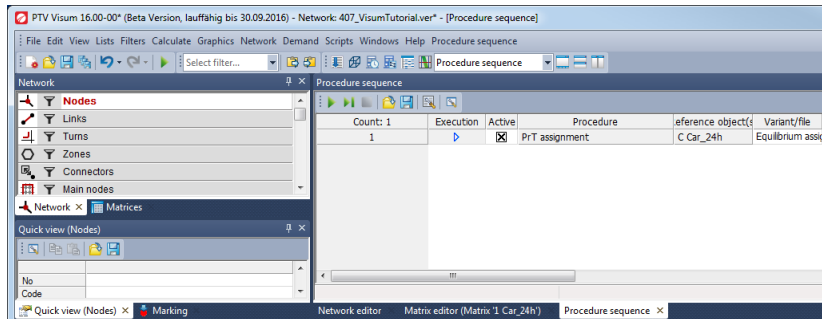
Now that the model has a travel demand matrix, this demand can be assigned to the network via the assignment procedure:

1. Choose CALCULATE + PROCEDURE SEQUENCE from the menu bar.
2. Press the CREATE button. The dialog *Operation* is opened.
3. Choose *Assignments – PrT assignment* and confirm by pressing OK.



4. A row for the new procedure appears in the table.
5. Press the button SELECTION OF DEMAND SEGMENT in the column *Reference object(s)*. A dashed line is shown as long as no selection is made.
6. Choose the demand segment **C Car_24h** and press OK.

7. Make sure that *Equilibrium assignment* is selected in the column *Variant/file*:



You can find more information about PrT assignment methods in the Visum manual, part Fundamentals, chapter User model PrT.

Setting up skim or indicator matrices

Visum allows you to calculate indicators such as travel times between zones.

1. Press the **CREATE** button in the *Procedure sequence* dialog. The dialog *Procedure* is displayed.
2. Choose *Matrices – Calculate PrT skim matrix* from the tree structure and press OK. Use the Down arrow () to move this procedure after the PrT assignment
3. Press the button **SELECTION DEMAND SEGMENT** in the column *Reference object(s)*.
4. Select the demand segment **C Car_24h** and confirm by pressing OK.
5. Mark the second row and click the **EDIT** button.
6. Select the indicator **tCur** (link travel time in the loaded/assigned network) from the table *Skims* (in the mid of the dialog) and make sure that you activate the check boxes *Calculate* and *Save to file*.
7. Enter the filename **PRT_SKIM** in the input box *File name*.



You save the matrix to file for later use when comparing the actual and planned networks. Note that you do not need to save skims to file when calculating skim matrices.

8. Keep the remaining settings from the dialog *Parameters PrT skim matrices* and confirm by pressing OK.

Parameters: PrT skim matrices

Analyzed OD pairs
☐ Calculate only OD pairs with demand > 0 All

Path choice
 Path search criterion Impedance
☒ Use paths from assignment
 Weighting of paths Mean over path volume

Sum up paths from
☒ Links ☒ Turns ☒ Origin connectors ☒ Destination connectors

Skims

	Calculate	Save to file	Open	Skim
1	☐	☐	☐	t0
2	☒	☒	☐	tCur
3	☐	☐	☐	v0
4	☐	☐	☐	vCur
5	☐	☐	☐	Impedance
6	☐	☐	☐	Trip distance
7	☐	☐	☐	Direct distance
8	☐	☐	☐	AddValue1
9	☐	☐	☐	AddValue2
10	☐	☐	☐	AddValue3
11	☐	☐	☐	AddValue-TSys
12	☐	☐	☐	Toll
13	☐	☐	☐	User-defined

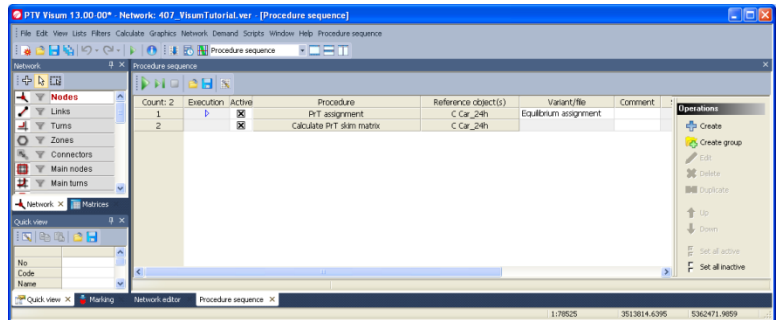
Output file
 File name PRT_SKIM
 Format Format V Means of transport no. (VISEM) ☒ 4
 Separator Blank Confirm overwriting ☒

OK Cancel

Executing the procedures

Execute the assignment and the skim matrix calculation:

1. Make sure that both operations are active in the *Procedure sequence* dialog:

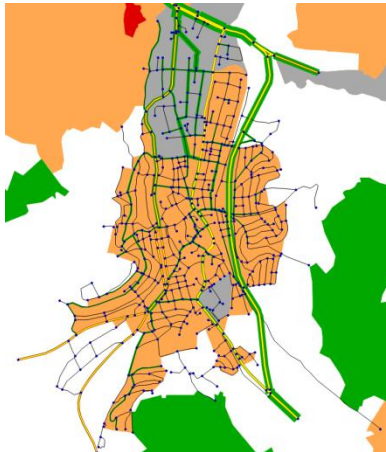


2. Press the button **START - EXECUTE ALL ACTIVE PROCEDURES** in the toolbar on the top.

i

To execute the procedures in single step mode you can use the corresponding button . Other alternatives to select and run procedures can be accessed via the context menu (right click).

3. Return to the network by selecting *Network editor* in the drop down menu of the toolbar. After the calculations are finished, the assigned volume (Attribute **Volume PrT [veh] (AP)**) is displayed as green link bars with widths relative to the volume.



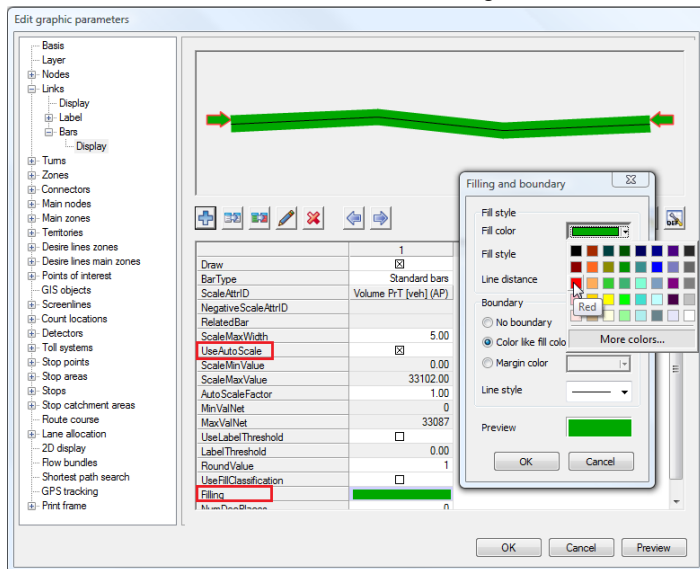
E

You can find this snapshot of the model in the file 407_VISUMTUTORIAL.VER.

Setting graphic parameters for links with link bars

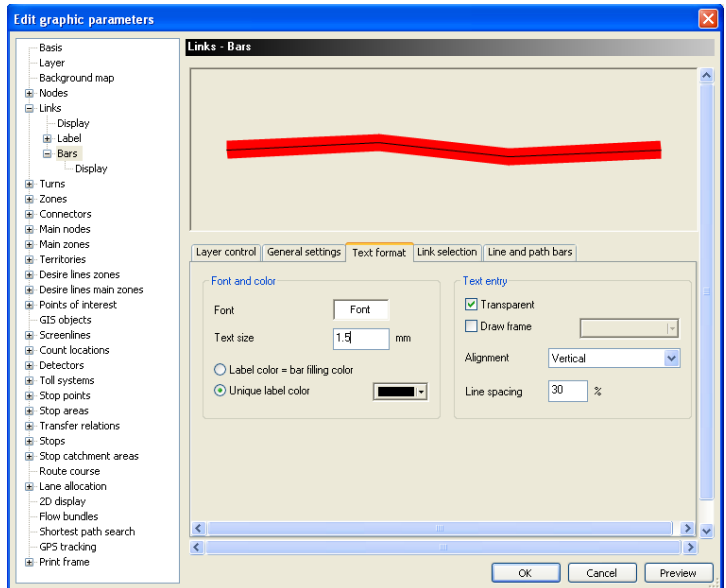
To display directional link information such as assigned volumes you must use link bars. To adjust the graphical display of the assignment results:

1. Change the display settings for link bars:
 - Move the mouse pointer over the **LINKS** label in the window *Network* and right click to open the context menu for *Links*.
 - Choose *Graphic parameters – Bars...* from the context menu. The *Edit graphic parameters* dialog is opened and shows the settings for the display of link bars.
 - Set the scaling of the bars to automatic, i.e. activate the check box *UseAutoScale*.
 - Set the color of the bar by clicking on the rectangle next to *Filling*. The dialog *Filling and boundary* is opened.
 - Choose a new color (e.g. Red) for the link bars by left clicking on the color field next to *Fill color*. Confirm the dialog with *Ok*.

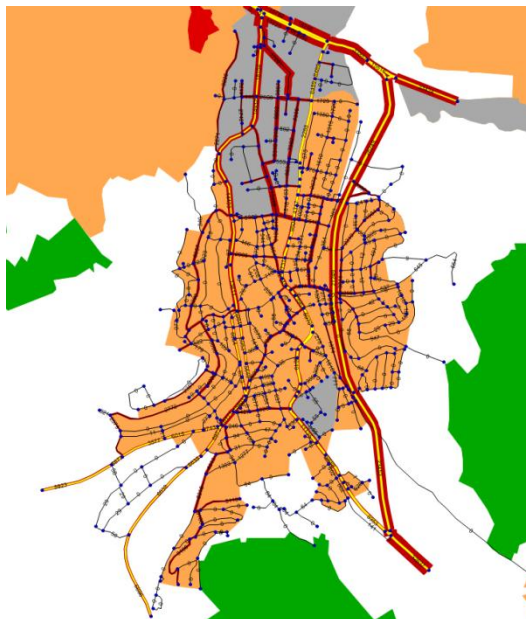


If you want to display more than one bar you can simply use one of the **DUPLICATE** buttons to copy the settings for another bar. This also works for bars with classified display.

2. Label the link bars with their assigned volume:
 - Select the sub-item *Bars* in the tree view and change to tab [Text format]
 - Enter a text *Size* of **1.5 mm**.



- Switch to the main item *Links* in the tree view and activate the check box *Draw bar label*.
- Confirm your changes by pressing the OK button.
- The link bar color changes and the bars are labelled with their volumes:



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You can find this snapshot of the model in the file 408_VISUMTUTORIAL.VER.

2.4 Analyzing the project network

After having edited the transport network, edited the travel demand, and run an assignment, you are now able to analyze the results.

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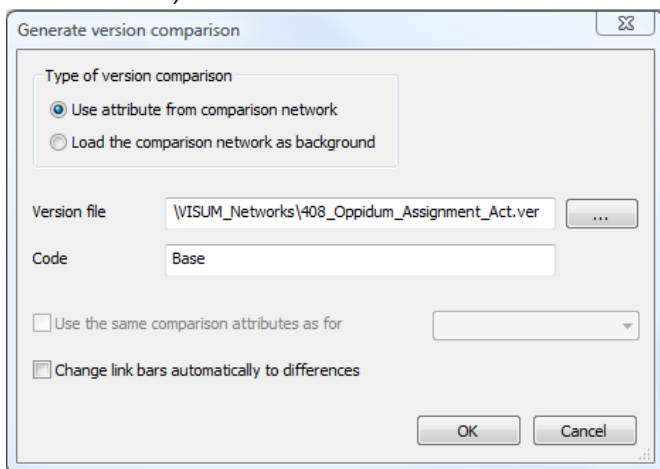
Open the version file 408_VISUMTUTORIAL.VER to start working on the example in this chapter.

Comparing assigned volumes using version comparisons

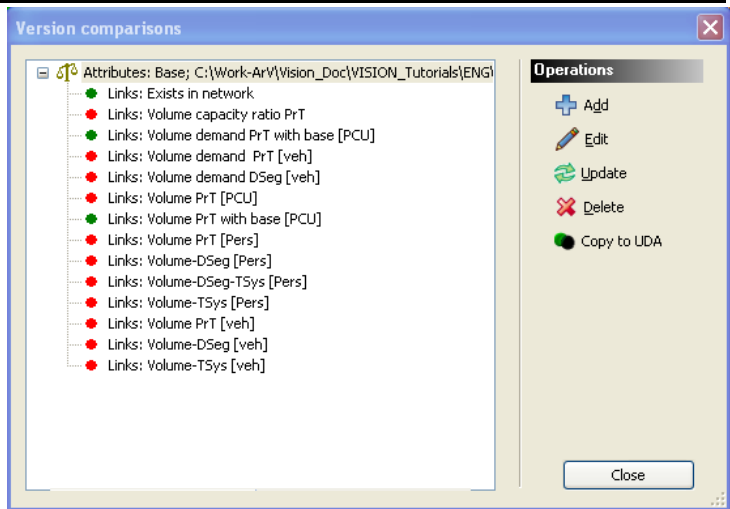
The assigned volumes of Oppidum's PrT-network should be compared in the state before and after constructing the bypass. Visum offers the possibility to compare selected attributes of two or more version files, i.e. the attribute values from one version file are copied across to another version file. The version file 408_OPPIDUM_ASSIGNMENT_ACT.VER contains the assignment result without the bypass.

1. To compare results via the version comparison:

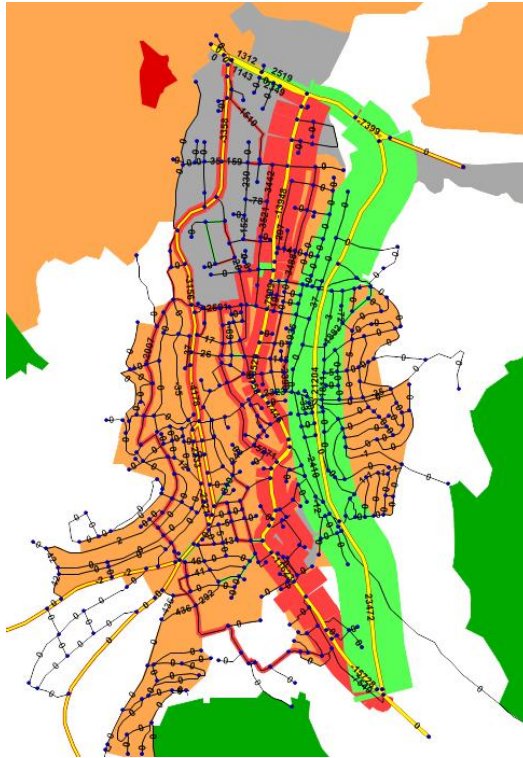
- Choose FILE + COMPARE AND TRANSFER NETWORKS + VERSION COMPARISONS from the menu bar.
- Click on ADD to generate a new comparison
- Select the file 408_Oppidum_Assignment_Act.ver
- Enter the code **Base** (attributes of the added version file can be found under this code)



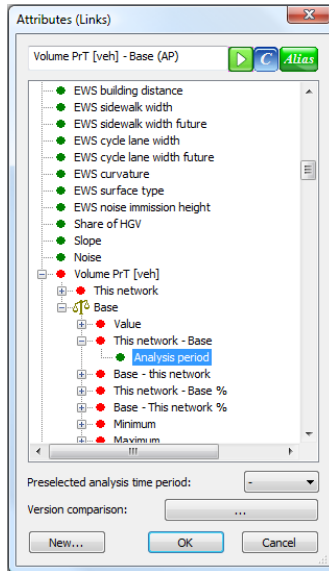
- Press the OK button.
- To restrict the version comparison to link attributes, you can activate the corresponding attributes in the next dialog *Create version comparison (User-defined)*, or alternatively open the layout file 408_LAYOUT_VERSIONCOMPARISON.NET.
- The dialog *Version comparisons* shows the attributes of the added version file if the tree is expanded by clicking on .



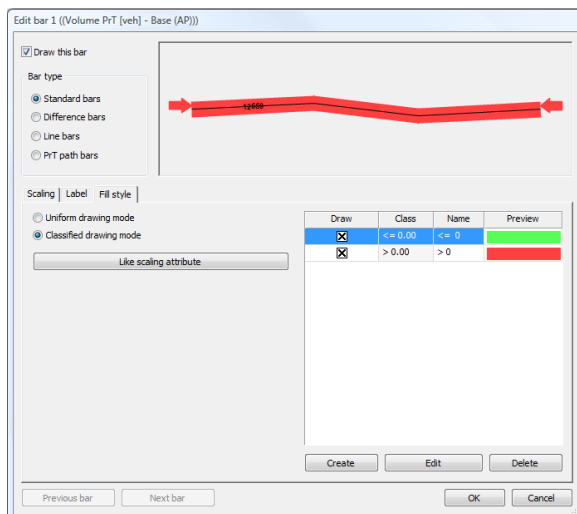
- Close the dialog.
2. Compare the changes of volumes graphically:
- Choose FILE + OPEN + GRAPHIC PARAMETERS..., and select the file 408_VERSIONCOMPARISON.GPA, (*Settings Read all graphic parameters active*), link bars display the volume differences between the two version files.



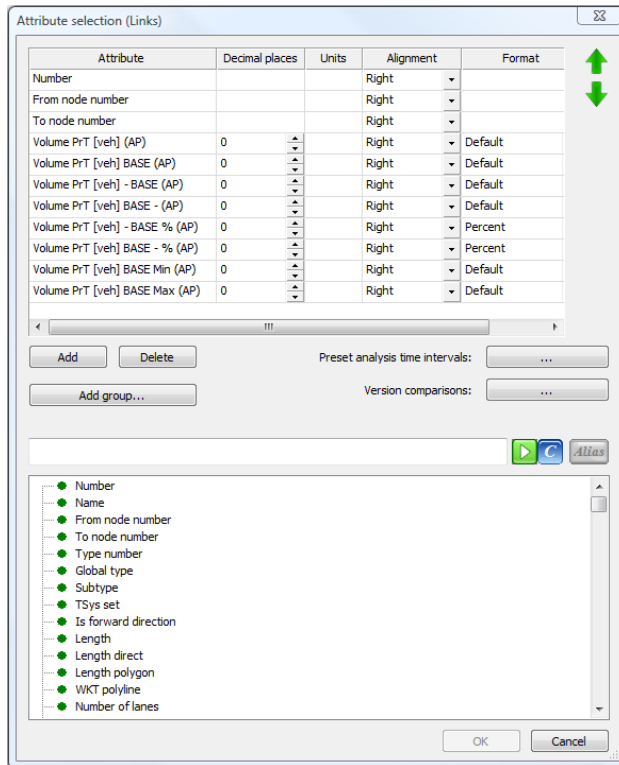
- Adjust the maximal width of the bars to improve the display
 - Change to the window *Network* and select network object **LINKS**
- Links
- Right click to open the context menu and choose **GRAPHIC PARAMETERS – BARS...**
 - Double click in the field next to **ScaleMaxWidth** and enter a value of 5.
 - The *ScaleAttrID* shows the attribute **Volume PrT [veh] – Base(AP)** which is calculated using the **Volume PrT [veh]** of the loaded version and the same attribute from the added version with code **Base**.



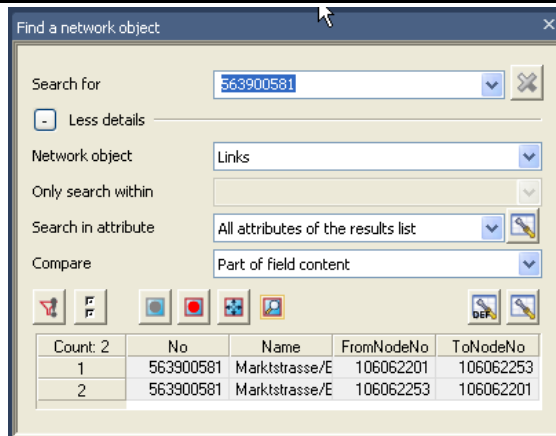
- The colors of link bars are not in line with the desired results because an increase in traffic should be shown in red whereas a decrease should be displayed in green. That means the colors of the classified display must be reversed.
- Click on the colors shown next to Filling. The dialog *Edit bar 1* ((Volume PrT[veh] – Base(AP))) opens. Ensure that for the classified drawing mode *Like scaling attribute* is selected. Reverse the colors by clicking in the column *Preview* on the right. Green applies for values smaller than or equal to zero, and red for values greater than zero



- % (AP), Volume PrT [veh] Base Min (AP), and Volume PrT [veh] Base Max (AP) by using the ADD button.



- ➡ Close the dialog using the button OK
- ➡ Search for link number **563900581** using button FIND  in the toolbar of the list



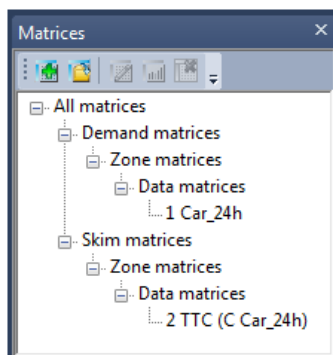
- It can be noted that traffic volume on this link of the through route decreases significantly. Corresponding absolute and relative values can be found in the attributes which have been added to the list.

Travel time changes between zones (skim matrix)

Furthermore, it is interesting how the travel times between zones change as a result of the bypass construction. A skim matrix was calculated along with the assignment in the version file containing the bypass. To obtain the difference in travel times the skim matrix saved from the version without the bypass is used. Carry out the following steps to see the calculated skim matrix:

1. Choose FILE + OPEN VERSION from the menu bar and open the file 408_VISUMTUTORIAL.VER.

- Choose window *Matrices*.



- Add a new matrix using the button CREATE MATRIX  or right click to choose CREATE MATRIX from the context menu.
- Enter Code **DiffTTC** and Name **Difference Travel time** in the dialog *Create matrix*

- Choose as Matrix type *Skim matrices* and Network object reference type as *Matrices with zone dimension*. Type of data source is *without formula*. Confirm with button OK.

Create matrices

Matrix attributes | Matrix quantity

If several matrices are created, the matrix number will continuously increase.

Number: 4

Code: DiffTTC

Name: Difference Travel time

Matrix type

☐ Demand matrices

☒ Skim matrices

Network object reference type

☒ Matrices with zone dimension

☐ Matrices with main zone dimension

☐ Matrices with stop area dimension

Type of data source

☒ Data matrix

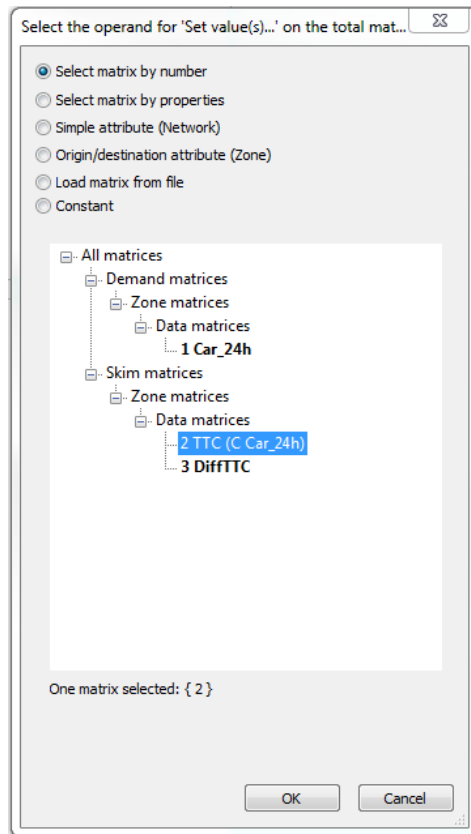
☐ Formula matrix

Edit formula

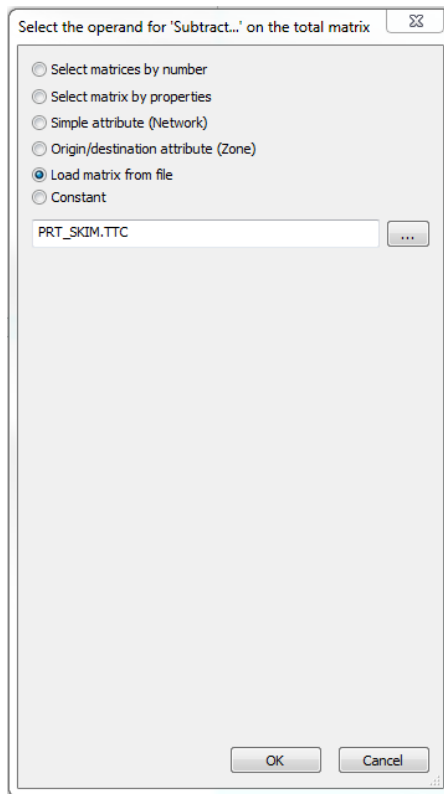
☒ Edit new matrices after creating

OK Cancel

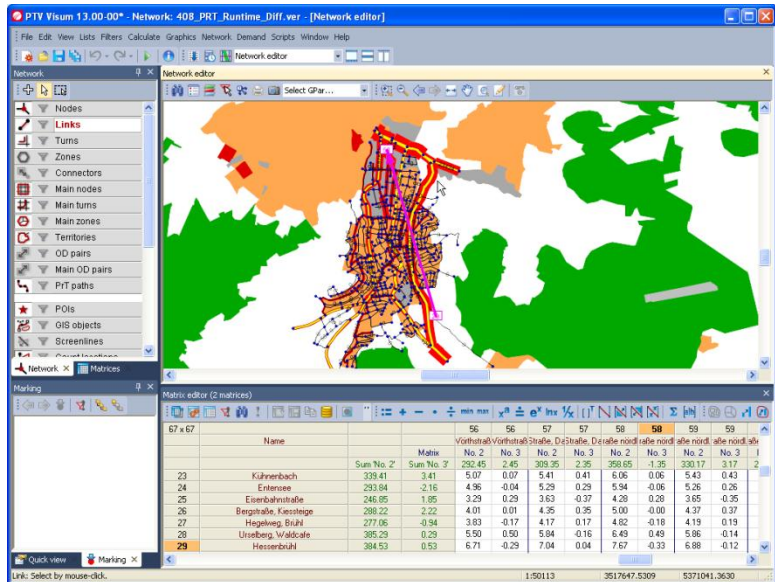
- The new matrix is initialized and opened
2. First the values from the skim matrix number 2 are copied
 - Click on the button SET VALUES 
 - Select matrix number 2 (**TTC**) and press OK



- Matrix number **3** contains the same values as the skim matrix No **2** (**TTC**)
- Click button SUBTRACT  and then choose the option *Load matrix from file*.
- Select the matrix PRT_SKIM.TTC and press OPEN and OK.



3. The new matrix number 3 contains the travel time changes between the two scenarios. Now analyze the changes:
 - Close matrix number **3**.
 - Mark matrices number **2** and **3** by keeping the STRG key pressed.
 - Choose **EDIT** from the context menu (right click) or the corresponding button  in the window *Matrices*. The values of the two matrices are shown next to each other in the matrix view.
 - Take a look at the entry in row 29 and column 58. You can see that the bypass reduces the travel time from zone **Hessenbrühl** to zone **Römerstraße nördlich** by more than 0.5 minutes to 7.6 minutes.



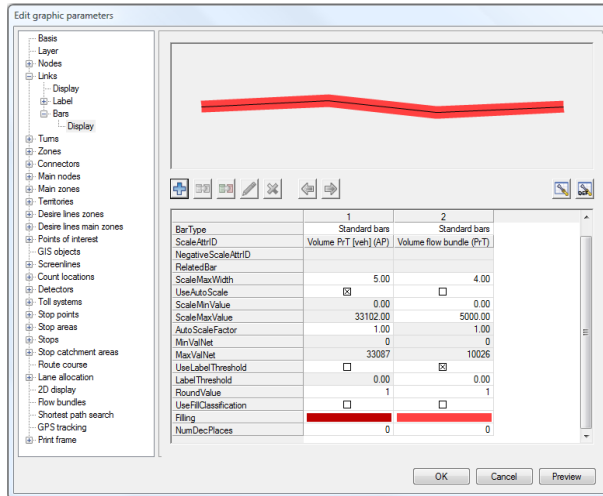
- E*

Analyzing the affected OD relations (flow bundles)

1. Switch off the link bars with the volumes from the assignment:

- PTV Visum – Tutorial

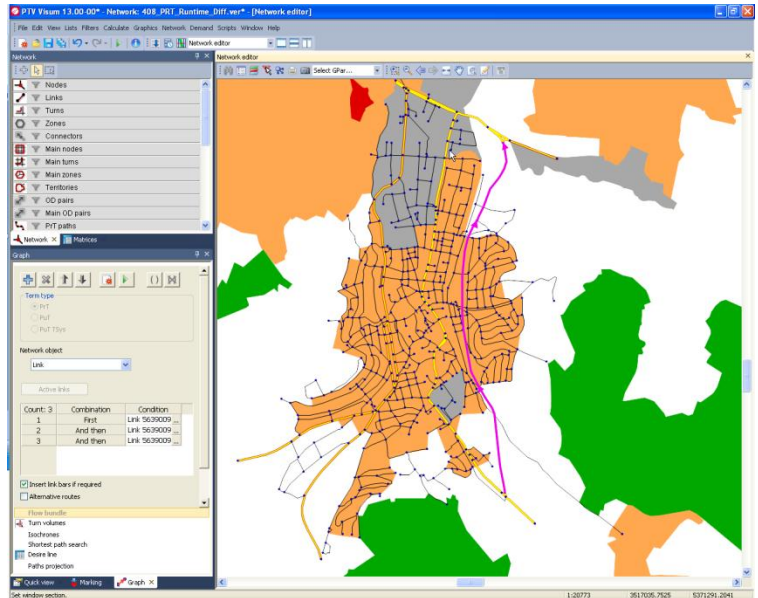
- Choose the entry for *Filling* to change the color of the link bar.



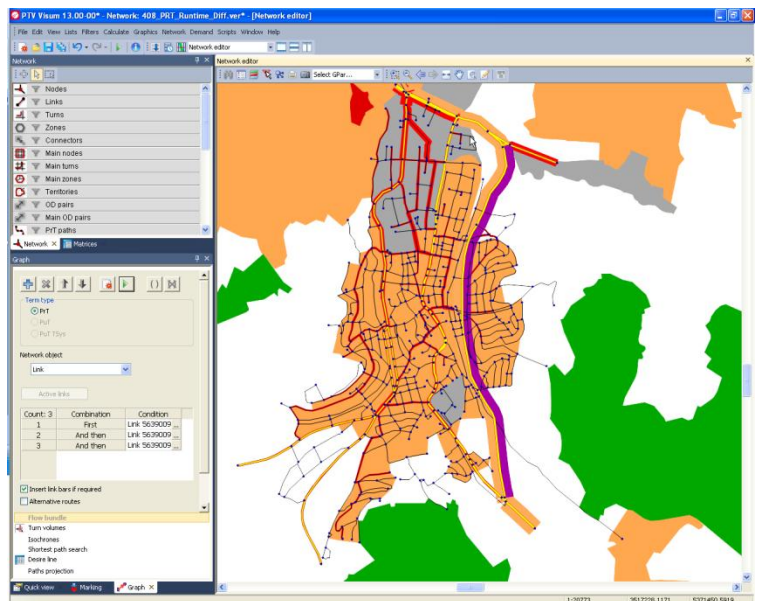
- Exit the dialogs by pressing OK.

- So far you do not see any change in the map. To display the flow bundle you must first calculate it:

- Choose GRAPHIC + FLOW BUNDLE from the menu bar.
- Make sure that the combo box entries are set to *PrT* and *Link*.
- Now select successively the links belonging to the bypass by left clicking them. Take care to choose the same link direction each time. The arrows from all selected links should point in the same direction. (You can change the link direction by left clicking on the left or the right side of the selected link. Click the side of the link in which traffic travels).



- Start the flow bundle calculation by pressing the EXECUTE button. You should get the following display:



- The result shows paths between origin and destination zones that traverse the bypass from South to North. The bars of selected links for the flow bundle analysis are shown in purple.
4. For further analysis of the flow bundle, change to the listings view:
- Choose **LISTS + PATHS + PrT PATHS ON LINK LEVEL** from the menu bar.
 - Choose the demand segment (DSeg) **C Car_24h** and the selection **Flow bundle routes** from the combo boxes.
 - Press the button **ATTRIBUTE SELECTION** .
 - Select the indirect attribute **PrTPath – Volume – Analysis period (PrT path\Volume (AP))** and add it to the list by pressing the **ADD** button.
 - The paths between origin- and destination zones belonging to the flow bundle are listed with all comprised links, i.e. you can see, how many motorists use the bypass in order to get from southern zones to the north.

Liste (IV-Wege streckenfein)

Select list layout...

DSeg / Path set: DSeg C Selection: Flow bundle routes

☐ Only active links Format: Standard

Count	70 rigZone	estZone	Path	Index	LinkNo	FromNodeNo	ToNodeNo	PrTPath\Vol(AP)
1		3	8	1				1269.000
2					1	563899619	106062397	
3					2	563900952	106062327	
4					3	563900954	106071815	
5					4	563900956	106071814	
6					5	563900958	106071813	
7					6	563900959	106071812	
8					7	53165892	106061546	
9		3	70	1				3769.052
10					1	563899619	106062397	
11					2	563900952	106062327	
12					3	563900954	106071815	
13					4	563900956	106071814	
14					5	563900958	106071813	
15					6	563900960	106071812	
16					7	563900938	106071796	
17					8	53165585	106061332	
18					9	53165563	106061313	
19					10	53169259	106061314	
20					11	563900039	106061187	
21					12	53165288	106061119	

E

You can find this snapshot of the model in the file 409_VISUMTUTORIAL.VER.

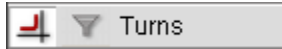
5. Exit the list view and initialize the flow bundle:
- Close the list by pressing the **CLOSE** button .
 - Press the button **INITIALIZE** in the dialog *Flow bundle*.
 - Close the flow bundle dialog by pressing the **CLOSE** button .

Turn volumes

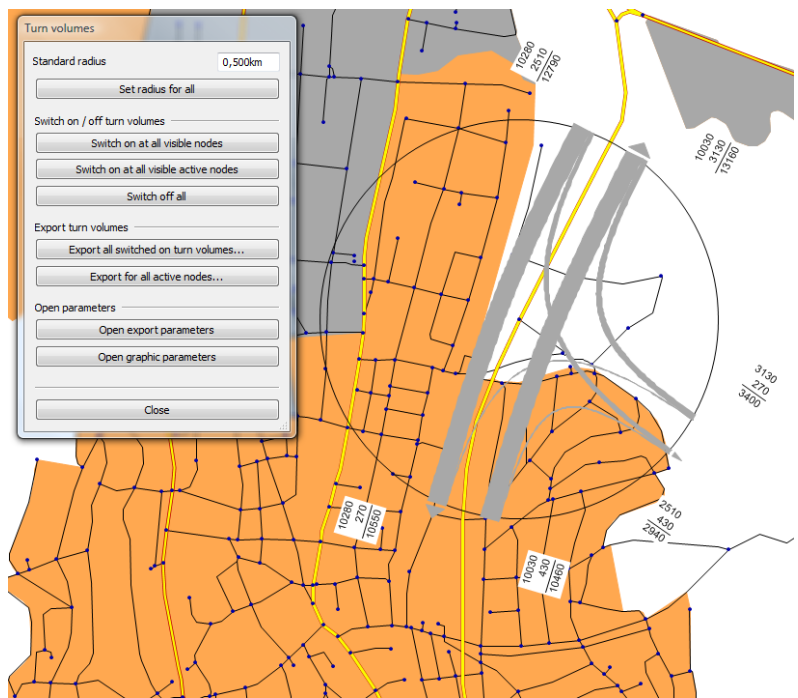
To complete the PrT project, you will now analyze the turn volumes at one of junctions of the bypass.

1. Configure the graphic parameters for turn volumes:

- Open the *Edit Graphic parameters* dialog by clicking right on the GRAPHICS LAYER symbol of the turns.



- Activate the check boxes *Draw turn volumes*, *Draw bars* and *Draw bar labels*.
- Switch to *Turns – Turn volumes – Display* in the tree view.
- Make sure that the scaling attribute (*ScaleAttID*) is **Volume PrT [veh] (AP)** and that the check box *Draw* is activated.
- Activate the check box for *automatic scaling (UseAutoScale)*.
- Change to the sub item *Turn volumes* in the tree view and tab [CIRCLE DISPLAY], activate the check boxes *Draw arrows* and *Draw circle*.
- Exit the dialog by pressing OK.
- Choose GRAPHIC + TURN VOLUMES from the menu bar.
- Enter a default radius of **0.500km**.
- Activate node number 106071813 of the bypass shown in the picture below by left click:
- The turn volumes of the turns at the intersection are displayed on the map. The volume bars of incoming and outgoing turns are displayed as well as their labels.



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You can find this snapshot of the model in the file 410_VISUMTUTORIAL.VER.

Conclusion

You have now successfully finished your first PrT-project in Visum. This gives you a first impression of typical workflows and important functionalities in the fields of private transport.

3 Public Transport (PuT): Optimizing a bus network

The following section introduces public transportation (PuT) modeling in Visum. You will examine the bus network of the town of Oppidum and derive suitable measures for improving PuT network supply with the help of Visum.

In chapter 3.1 you will start with analyzing Oppidum's line network in the actual state. For that you look at the existing stops and line routes and at the timetable stored in the model.

In chapter 3.2 you will add a PuT demand matrix to the model and visualize it in the form of *desire lines zones*.

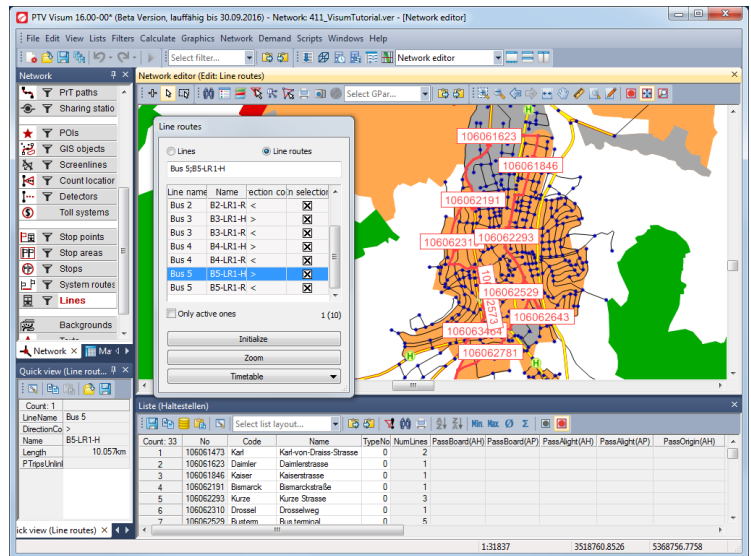
In chapter 3.3 you will assign the travel demand to the PuT network. At the same time you will calculate PuT operating indicators. In doing so you will also learn how to define user defined attributes for calculating individual indicators. To demonstrate Visum's analysis capabilities, you will then view the assignment results both graphically in the network editor and as a list.

After the calculation of assignment and indicators, you will examine the PuT network supply and its quality (chapter 3.4). You will analyze the accessibility of stops and examine the accessibility of network objects with the help of isochrones. In addition, you will analyze transfers and transfer waiting times between bus lines. This will be done with the Visum PuT flow bundles.

From the analysis of the actual state, some potential ideas for improving the PuT supply in Oppidum will arise. In chapter 3.5 you will consequently create new stops, change the course of a bus line and modify vehicle journeys. In doing so, you will also be introduced to the timetable editor.

To close the project, you will compare the planned bus network to the actual bus network (chapter 3.6). This will require to work with the matrix editor and to copy data to Excel.

- This also works in the opposite direction: mark a stop in the map and the respective stop will be selected in the list.
 - Close the list by pressing  and enlarge the network editor window by pressing .
3. View the existing line routes in the network editor:
- Move your mouse pointer over the **LINES** caption in the window *Network*. A tooltip is displayed which gives you information about the number of lines, line routes, etc. in the model and their actual status (active or passive).
 - Left click on the **LINES** caption. The dialog *Line routes* opens.
 - There are five lines each of them with the directions up (>) and down (<). In Visum this corresponds to ten line routes.
 - Select the existing line routes successively by left clicking on them. You can view their course in the network editor since they are displayed in red. Press the button **AUTOZOOM** to view their entire courses:

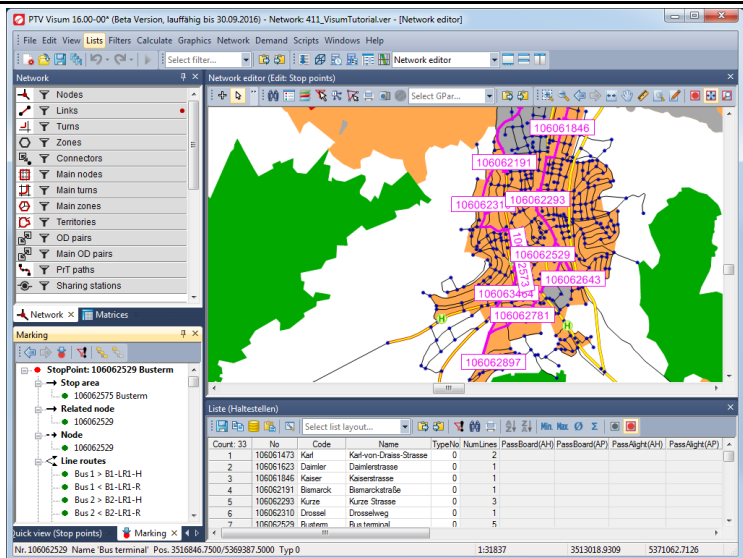


- As you can see there is a circle line within Oppidum and four lines going to the surrounding area.
4. You can also view the line routes as a list:
- Choose **LISTS + PUT SUPPLY + LINES + LINE ROUTES** from the menu bar.
 - Take a look at the lengths of the different line routes.
 - Close the list by pressing .
5. Use the functionality in the window *Marking* to examine which line routes stop at the bus terminal in the center of Oppidum:

- If the window *Marking* is not visible you can open it via the menu entry **VIEW + MARKING**
- Press the **EDIT MODE** button  and left click on the **STOP POINTS** label in the *Network objects* toolbar.



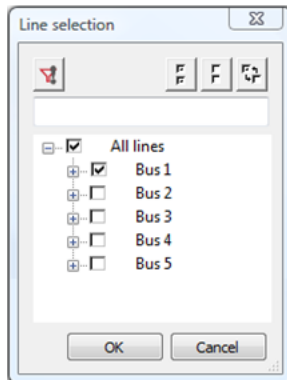
- Left click on the bus terminal (stop point number **106062529**) in the network editor.
- Switch to the window *Marking*. The browser in this window supports you in navigating between related network objects and provides you fast access to the related network objects of a selected network object.
- Left click on the line route **Bus 5 > B5-LR1-H**. The line route is now highlighted in the map.



- To edit some attributes of this line route, simply right click on the line route and choose *Edit..* from the context menu.
6. Take a look at the timetable stored for the bus lines:
- Left click on the **TIMETABLE EDITOR** button in the toolbar on the top or alternatively choose **EDIT + TIMETABLE (TABULAR)** from the menu bar:



- In the timetable editor press the button **BASIC LINE SELECTION** .
- The dialog *Line selection* appears. This is where you select the lines for display in the timetable editor.



- Activate the check box **Bus 1** and press OK.
- In the bottom half of the window is the departure and arrival times for the journeys at the stops belonging to bus line 1 (*Note: to see every single journey, make sure that the regular service mode  is not activated*):

Timetable (tabular)

Count 51

No	27	1	28	2	3	29	4	30	5	31	6
Name	Bus 1	Bus 1	Bus 1	Bus 1	Bus 1	Bus 1	Bus 1	Bus 1	Bus 1	Bus 1	Bus 1
LineName	Bus 1	Bus 1	Bus 1	Bus 1	Bus 1	Bus 1	Bus 1	Bus 1	Bus 1	Bus 1	Bus 1
DirectionCode	←	→	←	→	←	→	←	→	←	→	←
ConcatenateVehJourneySections	daily	daily	daily	daily	daily	daily	daily	daily	daily	daily	daily
FromStopPointCode	B-Town	Busterm	B-Town	Busterm	Busterm	B-Town	Busterm	B-Town	Busterm	B-Town	Busterm
Dep	04:55:00	05:05:00	05:55:00	06:05:00	06:35:00	06:55:00	07:05:00	07:25:00	07:35:00	07:55:00	08:05:00
Arr	05:52:29	06:02:29	06:52:29	07:02:29	07:32:29	07:52:29	08:02:29	08:22:29	08:32:29	08:52:29	09:02:29
ToStopPointCode	Busterm	B-Town	Busterm	B-Town	Busterm	B-Town	Busterm	B-Town	Busterm	B-Town	Busterm
OperatorNo	1	1	1	1	1	1	1	1	1	1	1
CountVehJourneySections	1	1	1	1	1	1	1	1	1	1	1
IsCoupled	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Vehicle journey sections

Base

Vehicle journeys Vehicle journey sections

ObjNo/ObjCode	ObjName	Arrivals	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr
062529	Busterm Bus terminal	Departures	Dep	Dep	Dep	Dep	Dep	Dep	Dep	Dep	Dep	Dep	Dep	Dep	Dep	Dep
062293	Kurze Kurze Strasse	Arrivals	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr
061473	Karl Kaufmann-Strasse	Arrivals	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr
071824	A-Town A-Town	Arrivals	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr
071825	L-Village L-Village	Arrivals	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr
071826	M-Village M-Village	Arrivals	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr
071827	B-Town B-Town	Arrivals	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr	Arr

Network editor Timetable (tabular)

- Close the timetable editor by pressing the CLOSE button .

3.2 Adding demand for PuT

So far there is no PuT travel demand in the model. We will add it to the model by importing a demand matrix.

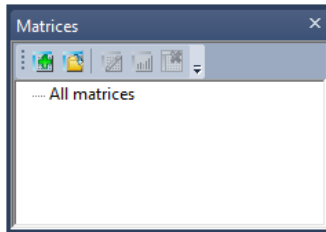
E

Open the version file 411_VISUMTUTORIAL.VER to start working on the example in this chapter.

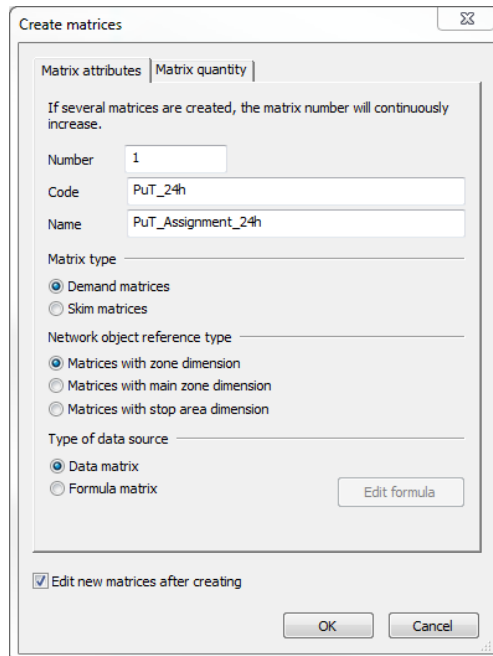
Embedding the demand matrix

1. Add a demand matrix for PuT and fill its values with data from file:

- Change to the window *Matrices*.



- Press the button CREATE MATRIX  for inserting a new matrix or choose CREATE MATRIX from the context menu (right click)..
- The dialog *Create matrix* opens. Change the *Code* to **PuT_24h** and the *Name* to **PuT_Assignment_24h**.
- Keep the settings for Matrix type as *Demand matrices* and Network object reference type as *Matrices with zone dimension*. Type of data source is Data matrix.



Create matrices

Matrix attributes | Matrix quantity

If several matrices are created, the matrix number will continuously increase.

Number: 1

Code: PuT_24h

Name: PuT_Assignment_24h

Matrix type

☒ Demand matrices
☐ Skim matrices

Network object reference type

☒ Matrices with zone dimension
☐ Matrices with main zone dimension
☐ Matrices with stop area dimension

Type of data source

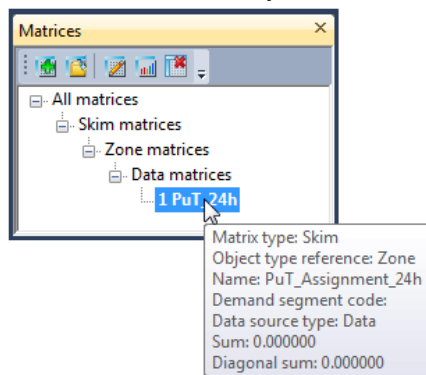
☒ Data matrix
☐ Formula matrix

[Edit formula](#)

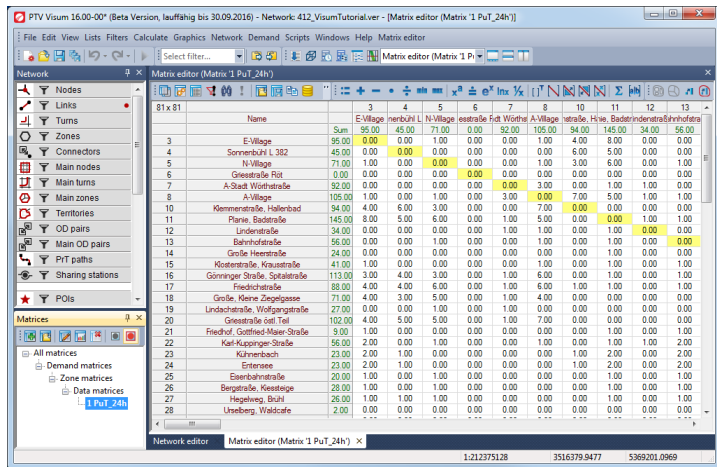
☒ Edit new matrices after creating

OK Cancel

- Confirm with OK. The matrix is initialized and opened if the check box for *Edit new matrices after creating* is activated.
- Further information about the matrix can be obtained when moving the mouse over the entry in the tree view of matrices



- Press the button **READ MATRIX CONTENT FROM FILE**  in the window of the open matrix or, alternatively, choose **OPEN FROM FILE** from the context menu after marking the new matrix and right click.



- Select file 411_PUT_24H.MTX and press OPEN.
 - Close the matrix editor.
2. Associate the demand matrix to the demand segment **PuT**:
- Choose DEMAND + DEMAND DATA from the menu bar. The dialog *OD demand data* is displayed.
 - Switch to the tab [DEMAND SEGMENTS].
 - Go to the *Matrix*-column and select **1 PuT_24h** in row 4 referring to *DSeg code PuT*.
 - Choose a demand time series in the column *Demand time series*. Use here the standard Visum demand time series **1 Default**
 - Keep **00:00:00** in the column *Start at* as a starting time. The *Start at* value allows you to define an offset from the start time specified in the demand time series. In our example, it is not necessary because the demand time series already refers to correct times of the day.

i The temporal distribution of travel demand within the analysis period is described by a **start time** and a **time series**. In Visum you can either assign separate demand matrices for each time interval of the time series or you can define time series as a percentage of one demand matrix. Time series are considered during PuT assignments and dynamic PrT assignments. They are not considered in static PrT assignments (for further information, please consult the user manual).

- Switch to the tab [STANDARD TIME SERIES] to take a look at the time series in this model. As you can see, here time series are defined as a percentage of one demand matrix, i.e. the matrix **PuT_Assignment_24h** is sliced according to the distribution curve defined here.
- Press the EDIT button to take a look at the distribution by percentages:

Edit time series

No.: 1
Name: Default

	From day	From time	To day	To time	Weight	Share	Percentages total
1	1	00:00:00	1	06:30:00	5.000	5%	5%
2	1	06:30:00	1	08:30:00	35.000	35%	40%
3	1	08:30:00	1	16:30:00	20.000	20%	60%
4	1	16:30:00	1	18:30:00	35.000	35%	95%
5	1	18:30:00	2	00:00:00	5.000	5%	100%

Create Multiple ... Delete OK Cancel

- Exit the dialog by pressing the CANCEL button and the dialog OD demand data by pressing the OK button.

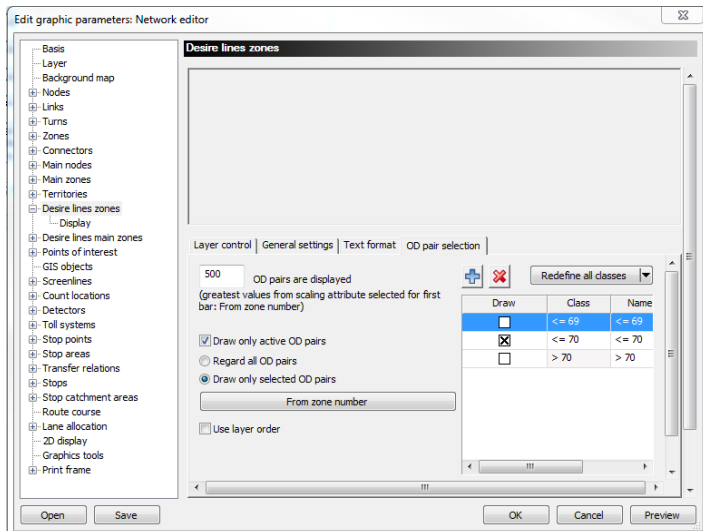
E

You can find this snapshot of the model in the file 412_VISUMTUTORIAL.VER.

Visualizing PuT-demand with Desire lines zones

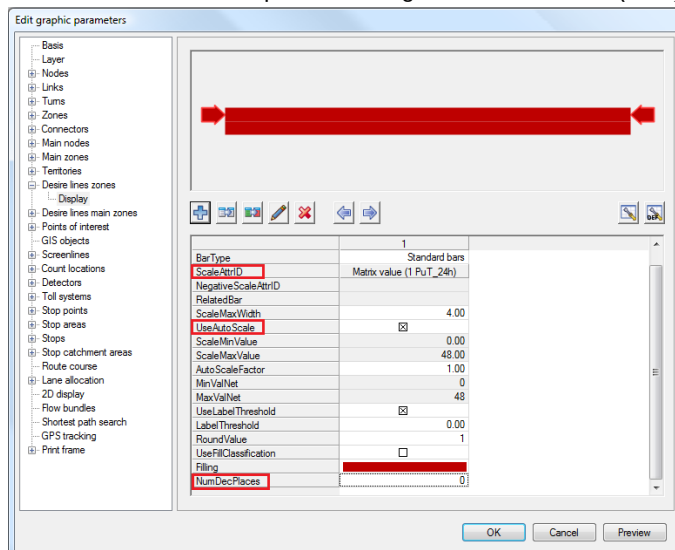
Now take a look at the PuT demand for zone 70 (A-Town):

- Configure the display of origin traffic from zone 70 with desire lines zones:
 - Choose GRAPHICS + EDIT GRAPHIC PARAMETERS from the menu bar.
 - Select *Desire lines zones* from the tree structure and activate the check box *Bar layer*.
 - Activate the check box *Layer desire lines zones*.
 - Activate the check boxes *Draw bars* and *Draw bar labels*.
 - Change to tab [OD PAIR SELECTION].and select the radio button for *Draw the bars only on selected OD pairs*. After this option is activated more input options are shown in the dialog.
 - Press the button under the radio button to select the attribute that should be displayed on the desire line bars.
 - Select the attribute **From zone number** and press OK.
 - Press the CREATE button twice for creating two new classes.
 - Enter the class **<= 69** in row one and the class **<= 70** in row 2.
 - Note: the class names are automatically taken over from the class limits. If you want, you can edit the column *Name* and give individual names to the classes. This is especially helpful when later on you want to create a legend showing these names.
 - Activate the check box for class **<= 70** in the column *Draw* and uncheck the other *Draw* check boxes.

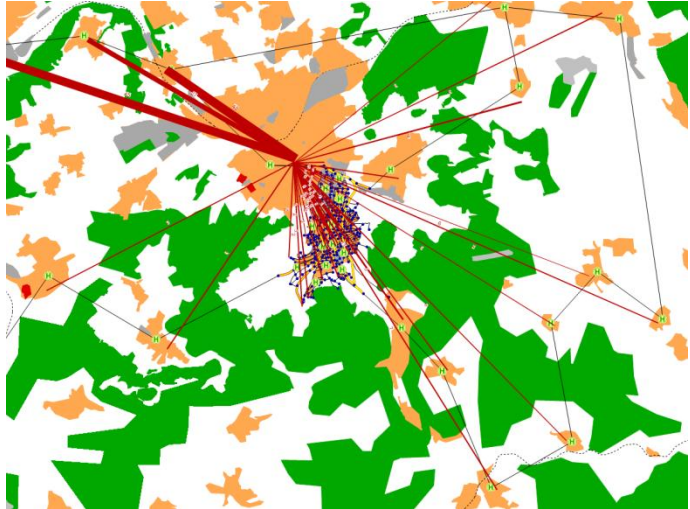


2. Change the settings for the display of the desire line bars:

- Change to *Desire line zones* – *Display* in the tree view.
- Activate the check box *Draw*.
- Ensure that *UseAutoScale* is active.
- Choose the sub attribute **Matrix Value (1 PuT_24h)** as **ScaleAttrID** and exit the dialog by pressing OK.
- Keep all the remaining settings in this dialog. If the attribute is not shown in the list, click on the button on the right and add the attribute to the selection in the top of the dialog *Attribute selection (Bars)*.



- Make sure that the check box *UseFillClassification* is not ticked.
 - Choose the color for the desire lines in row *Filling*.
3. Increase the font size for the bar labels:
- Choose *Desire lines zones* from the tree view and go to tab [TEXT FORMAT]
 - Set the *Text size* to **3mm**.
 - Press the OK button to let Visum draw the desire lines.
 - The desire lines are now displayed for zone 70. Their width is dependent on the demand between the zones:



4. After studying the desire lines, switch them off:
- Press the GRAPHICS LAYER button for OD pairs in the window *Network*:
-
- The desire lines are switched off.

E

You can find this snapshot of the model in the file 413_VISUMTUTORIAL.VER.

Viewing PuT-demand in the OD pair list

Visum also includes lists for OD pairs in which matrix values for all OD pairs can be viewed and edited. Take a look at the list for your PuT-demand:

1. Right click on the *OD pair* caption in the window *Network* and select *Lists – OD pairs* from the context menu.
2. In the list you can see a column showing the PuT demand between different zones.
3. Sort the list by the demand in column 3: Right click on the column head and choose *Sort in descending order* from the context menu.

List (OD pairs)

Select list layout...

OD pairs: 6561	FromZoneNo	ToZoneNo	MatValue(1	PuT	24h
1	3	3			
2		3	4		
3		3	5		
4		3	6		
5		3	7		
6		3	8		
7		3	10		
8		3	11		
9		3	12		
10		3	13		
11		3	14		
12		3	15		
13		3	16		
14		3	17	4.00	
15		3	18	4.00	
16		3	19	0.00	
17		3	20	4.00	

Sort ascending
Sort descending
Optimum width for all columns
Optimum width for column
Adjust column width to window size
Fix column
Remove column
Add column here...
Attribute selection...

4. As you can see the highest demand is between zones 70 and 88: Between those zones in each direction 48 passengers are using PuT within 24 hours.

3.3 Assignment and indicator calculation

By adding the PuT-demand to the model, you satisfied the precondition for running an assignment on the transport network. In addition, Visum allows you to calculate indicators between zones such as the journey times or the transfer wait times. Furthermore we will calculate PuT operating indicators such as mileage (**ServiceKm**).

E

Open the version file 413_VISUMTUTORIAL.VER to start working on the example in this chapter.

Parametrizing the assignment and the calculation of PuT indicators

1. Set up the timetable-based assignment:
 - Choose CALCULATE + PROCEDURE SEQUENCE from the menu bar.
 - Press the CREATE button, choose *Assignments – PuT assignment* from the tree and press OK.
 - Press the button SELECTION DEMAND SEGMENT under Reference object(s) and select the demand segment **PuT PuT**.
 - Confirm by pressing the OK button.
 - The assignment is based on the timetable stored in the model. Make sure *Timetable-based* is selected under Variant/file.
 - Press the EDIT button to define parameters.
 - Activate the check boxes *Calculate assignment* and *Calculate skim matrices* in the tab [BASIS].

Parameters: Assignment procedure: Timetable-based

☒ Calculate assignment
 ☐ Use connector shares
☒ Calculate skim matrices
 ☐ Save detailed log files
☐ Connection export
☐ Use capacity restriction

Origin zones: To
 Analyzed OD pairs:

Assignment time interval
 From:
 To:
 Extension:

Calculate paths from
☒ Connection search
☐ Stored connections for DSeg
☐ File
☐ Import fares

Time-varying impedance calculation
☐ Refine time series intervals
 Maximum interval length:

2. Make additional settings for the skim matrix calculation:

- Switch to the tab [SKIM MATRICES] in the *Parameters* dialog.
- In the mid part of the dialog, choose which indicators should be calculated. Select the check boxes in the columns *Calculate* for the indicators **Journey time**, **PuT Aux time**, **Transfer wait time adopted**, **Number of Transfers** and **Access distance**.
- Select the check box **Save to file** for the indicator **Transfer wait time adopted**.

i

We save **Transfer wait time adopted** to file because later we need this file of the matrix to compare the actual and planned state of the network.

- Enter PUT_SKIM_ACT as a filename.

Parameters: Assignment procedure: Timetable-based

Choice Capacity restriction Vol/Cap ratio-dependent impedance Skim matrices Connection export

Aggregation
Function: Avg value
Weighted by volumes ☒
IMP quantile: 50 %

Analyzed OD pairs
All

Skims

	Calculate	Save to file	Open	Skim
1	☒	☐	☐	Journey time
2	☐	☐	☐	Journey time adapted
3	☐	☐	☐	Ride time
4	☐	☐	☐	Ride time adapted
5	☐	☐	☐	In-vehicle time
6	☒	☐	☐	PuT Aux time
7	☐	☐	☐	Origin wait time adapted
8	☐	☐	☐	Transfer wait time
9	☒	☒	☐	Transfer wait time adapted
10	☐	☐	☐	Extended transfer wait time
11	☐	☐	☐	Walk time
12	☐	☐	☐	Access time

Settings for journey time equivalent

Output file
File name: PUT_SKIM_ACT
Example: PUT_SKIM_ACT.TWTA
Format: Format V
Means of transport no. (VISEM) ☒ 3
Separator: Blank
Confirm overwriting ☒

OK Cancel

- Press the OK button to return to the *Procedure sequence* dialog.



It is important that you activate the option *Calculate*. Otherwise the indicators are not available within the Visum version for additional analysis (such as desire lines zones).

- Finally add the calculation of PuT operating indicators to the procedures:
 - Press the CREATE button in the *Procedure sequence* dialog and choose the operation *PuT analyses – PuT operating indicators*.
 - Use the *Up* and *Down* arrows if you need to change the order of procedures



For more information about PuT assignment methods please consult the Visum manual, part Fundamentals, chapter User model PuT.

User-defined indicator for line evaluation

The calculation of user-defined indicators can be carried in different ways. You can set up a procedure within the procedure sequence or define user-defined attributes with a formula. The latter are automatically updated if any of the inputs change. Therefore, it is not appropriate for our purpose of comparing the outcome of varying PuT supply definitions. Because we will later on modify

the line courses, we need an indicator which tells us something about the efficiency of lines. This new efficiency indicator in the existing network will be called **LineEvaluation_Act** and will be the ratio of **Passengerkilometer** ($\text{PassBoard} \times \text{in-vehicle distance from board till alight}$) to **Servicekilometer** ($\text{Departures} \times \text{Journey Length}$). An increase in this indicator means the line is more efficient, since proportionately more passenger kilometers per service kilometer are covered.

Because the passenger kilometers and service kilometers are serving as an input, it is necessary that the PuT operating indicators are calculated in the procedures. In the previous chapter you already included this procedure in the procedure sequence. In the following you will create the user-defined attribute and take a look at the results for the line evaluation in the existing network.

1. Create the user-defined attribute **LineEvaluation_Act**:

- Choose NETWORK + USER-DEFINED ATTRIBUTES from the menu bar.
- Choose the network object *Line routes* from the combo box and press the CREATE button.
- The dialog *Create user-defined attribute (Line routes)* is shown. Make the settings as they are shown in the picture below:

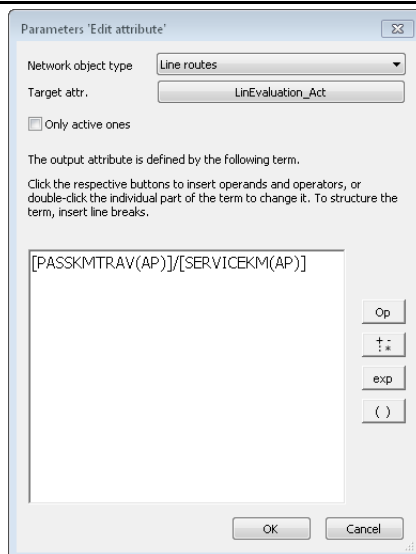
The screenshot shows a dialog box titled "Edit user-defined attribute (Line routes)". It contains the following fields and settings:

- Attribute ID: LINEVAACT
- Code: LinEvaAct
- Name: LineEvaluation_Act
- Comment: (empty)
- Type: Number with decimal places (selected as Data attribute)
- Decimal places: 1
- Default value: 0.0 (selected)
- Blank: (radio button)
- Minimum: (radio button)
- Unlimited: (radio button, selected)
- Maximum: (radio button)
- Unlimited: (radio button, selected)

At the bottom right, there are OK and Cancel buttons.

- Confirm by pressing the OK button and also press OK in the dialog *User-defined attributes*.

2. Insert the calculation of the user-defined attribute as a step in the *Procedures* dialog and assign the formula $PassengerKm / ServiceKm$ to the new attribute:
 - In the dialog *Procedure Sequence* press the **CREATE** button, choose the procedure *Miscellaneous – Edit attribute* and press **OK**.
 - In case the new procedure is not the last operation, left click to mark the row of the new procedure and position it as the last step in the sequence of procedures by using the button .
 - Press the **EDIT** button. The dialog *Parameters: Edit attribute* is displayed.
 - Choose *Line routes* from the combo box *Network object type*.
 - Press the button for attribute selection and choose **LineEvaluation_Act** as *Target attribute*.
 - Then configure the formula for the calculation of the attribute **LineEvaluation_Act** as shown in the screenshot below. You can access the attributes **Passenger kilometers (AP)** and **Service kilometers (AP)** by pressing the button in the columns *Attribute*.



Parameters 'Edit attribute'

Network object type: Line routes

Target attr.: LineEvaluation_Act

☐ Only active ones

The output attribute is defined by the following term.

Click the respective buttons to insert operands and operators, or double-click the individual part of the term to change it. To structure the term, insert line breaks.

[PASSKMTRAV(AP)]/[SERVICEKM(AP)]

Op

+ - * /

exp

()

OK Cancel

- Exit the dialog by pressing **OK**.

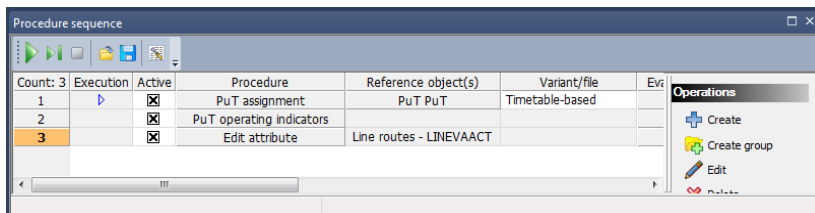
Executing the assignment and indicator calculation

In the previous two chapters you set the parameters for the timetable-based assignment and told Visum to calculate the indicators **Journey time**, **PuT Aux time**, **Transfer wait time adopted**, **Number of Transfers** and **Access distance**. Furthermore, you activated the calculation of PuT operating indicators. This provided you several information about the assignment and

PuT supply, including mileage (Servicekilometers). In turn, this indicator serves as an input to the newly defined indicator **LineEvaluation_Act**.

Execute these three procedures:

1. If necessary, change to the *Procedure sequence* dialog.



2. Make sure the check boxes for the timetable-based assignment, the calculation of PuT operating indicators and the attribute editing are activated.
3. Press the Start button . The arrow in the column *Execution* indicates which procedure is currently calculated. After the calculation has finished close the procedure sequence dialog .

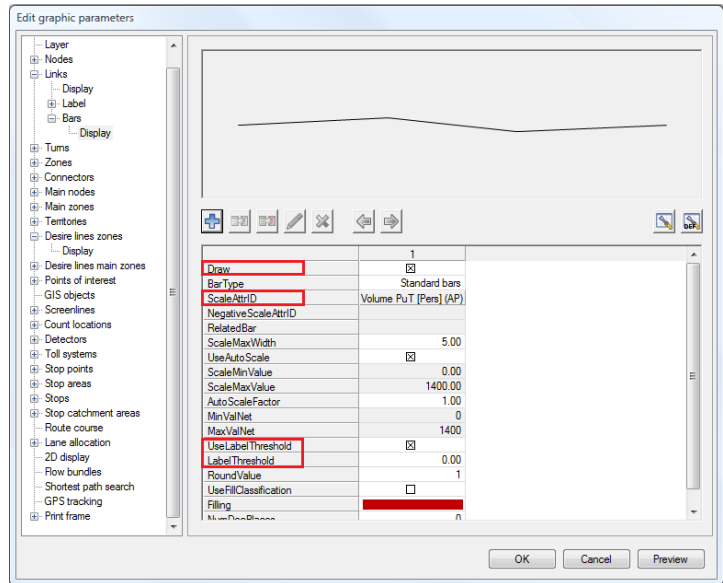
E

You can find this snapshot of the model in the file 414_VISUMTUTORIAL.VER.

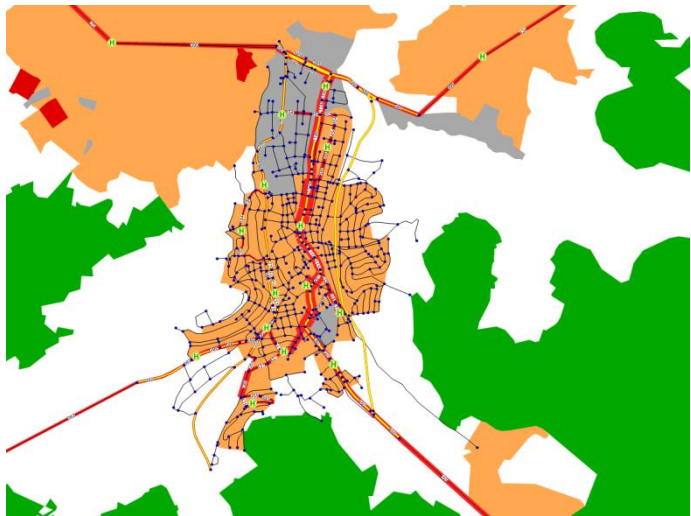
Viewing the assignment results in the network editor

To view the assignment results as link bars in the network editor you have to configure the graphic parameters:

1. Right click on the **LINKS** label in the window **Network** and choose **GRAPHIC PARAMETERS – BARS...** from the context menu. You directly get to the graphic parameter settings for the display of link bars.
2. Select the scaling attribute (*ScaleAttrID*).
3. Select the attribute **Volume PuT [Pers] (AP)**.
4. Ensure that the check box *Draw* is activated.
5. Activate the check box *UseLabelThreshold* and make sure the value *LabelThreshold* is zero



6. Select the main item *Links* from the tree view and activate the check boxes *Draw bar* and *Draw bar labels*.
7. Press OK to confirm. The result is the following display in the network editor:



E

You can find this snapshot of the model in the file 415_VISUMTUTORIAL.VER.

8. Now switch to the link bars off:

- Choose GRAPHIC + EDIT GRAPHIC PARAMETERS from the menu bar.
- Select *Links* from the tree view on the left.
- Deactivate the check boxes *Draw bar* and *Draw bar label*.
- Exit the dialog by pressing OK.

Examining the assignment results in the lists

The paths between zones and their link sequences are all stored after an assignment. Take a look at the *PuT path legs* list.

1. Open the list PuT paths legs by right clicking on the OD PAIRS label in the window *Network* and selecting LISTS – PATHS – PuT PATH LEGS:

Count	300	OrigZoneNo	DestZoneNo	PathIndex	PathLegIndex	ODTrips	FromStopPointNo	ToStopPointNo	TimeProfileKeyString	Time	WaitTime	Dist
1		3	5	1	1	1,000	106071816	106071816	Origin connector	4min 39s	6min	11.84km
2					2		106071816	106062529	Bus 3 B3-LR1-R < 1	11min	0h	3.750km
3					3		106062529	106062529	Transfer	0h	6min	0.000km
4					4		106062529	106071828	Bus 4 B4-LR1-H > 1	21min	0h	7.322km
5					5		106071828	106071828	Destination connector	6min 56s	0h	0.462km
6		3	8	1	1	1,000	106071816	106071812	Origin connector	43min 15s	6min	9.260km
7					2		106071816	106062529	Bus 3 B3-LR1-R < 1	11min	0h	3.750km
8					3		106062529	106062529	Transfer	0h	6min	0.000km
9					4		106062529	106071812	Bus 2 B2-LR1-H > 1	9min	0h	4.360km
10					5		106071812	106071812	Destination connector	12min 36s	0h	0.840km

2. View the path legs from origin zone (**OrigZoneNo**) 3 to destination zone (**DestZoneNo**) 5:
 - One path was found between the zones. This path consists of five path legs (see column **PathLegIndex**). As you can see in the column **ODTrips**, just one trip uses this path.
 - Zone 3 accesses the PuT network via stop point 106071816. In the column **TimeProfileKeyString** you find the entry **OriginConnector**, which refers to the origin connector from the zone into the network.
 - The access time from the origin zone to the stop point is 4 min 39 s, the access distance is 310 m.
 - The remaining rows describe the legs of the path: after 11 minutes on bus 3, a transition time of 6 minutes follows. After that the passenger transfers to bus 4 and then travels for another 21 minutes.
 - The egress from the PuT network is made via stop point 106071828. It can be seen by the entry **DestinationConnector**. The egress time is 6 min 56 s, the egress distance is 462 m.
3. Leave the list by pressing the CANCEL button .

Results of the user-defined line evaluation attribute

1. Take a look at the newly calculated indicator for line evaluation in the list view:
 - Choose LISTS - LINES - LINE ROUTES from the menu bar.

- Press the button ATTRIBUTE SELECTION .
- Remove all attributes for the Analysis horizon, i.e. with **AH**, using the button DELETE.
- The list is displayed as follows:

List (Line routes)

Select list layout...

Count	LineName	Name	DirectionCode	Length	LinkRunTime	NumServiceTrips	Uncoupled(AP)	ServiceKm(AP)	PassKmTrav(AP)	P.TripsUnlinked(AP)	LinEvaAct
1	Bus 1	B1-LR1-H	>	16.294km	57min 27s	25	423.644km	5604.039km	735	13.4	
2	Bus 1	B1-LR1-R	<	16.284km	57min 27s	25	407.100km	5603.529km	703	13.8	
3	Bus 2	B2-LR1-H	>	15.828km	54min 42s	18	284.904km	3111.855km	345	10.9	
4	Bus 2	B2-LR1-R	<	15.828km	54min 42s	17	269.079km	3217.333km	401	12.0	
5	Bus 3	B3-LR1-H	>	21.721km	1h 22min 5s	22	477.862km	4741.431km	421	9.9	
6	Bus 3	B3-LR1-R	<	21.721km	1h 22min 5s	21	456.141km	4741.431km	421	10.4	
7	Bus 4	B4-LR1-H	>	17.553km	1h 3min 11s	19	333.507km	2895.289km	324	8.4	
8	Bus 4	B4-LR1-R	<	17.553km	1h 3min 11s	19	333.507km	2796.529km	327	8.4	
9	Bus 5	B5-LR1-H	>	10.057km	14min 55s	12	120.684km	2027.018km	758	16.8	
10	Bus 5	B5-LR1-R	<	9.997km	14min 49s	12	119.964km	2034.295km	807	17.0	

- Leave the list by pressing the CANCEL button .

3.4 Analyzing PuT-supply quality

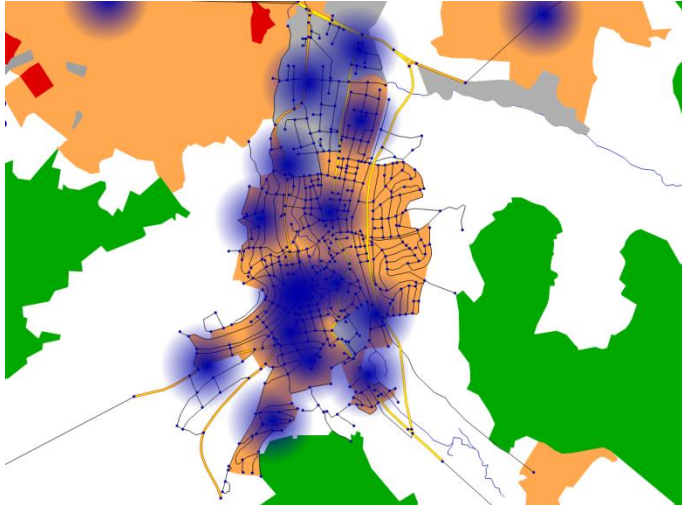
E

Open the version file 415_VISUMTUTORIAL.VER to start working on the example in this chapter.

Stop catchment areas for analyzing accessibility

Visum offers the ability to visualize stop catchment areas graphically. This gives you a first impression about the general accessibility of stops:

1. Configure the graphic parameter settings for stop catchment areas:
 - Right click on the **STOPS** label in the window *Network* and choose *Graphic parameters – Stop catchment areas...* from the context menu.
 - Activate the check box *Draw* and the radio button *Constant* under *Display* on the right side.
 - Enter a Radius of **400m** for the catchment areas.
 - Activate the radio button *Smooth color transition* and choose a *center color*.
 - Switch to the main item *Stop catchment areas* in the tree view.
 - Activate the check box *Layer Stop catchment areas* and deactivate the check box *Avoid overlapping when drawing*.
 - Exit the dialog by pressing the OK button.



2. View the stop catchment areas: The circles are 400m buffers around the PuT stops. It can be noted that the east part of Oppidum is insufficiently connected to the bus network.

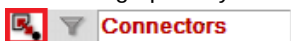
You can find this snapshot of the model in the file 416_VISUMTUTORIAL.VER.

3. Switch off the catchment areas again:
 - Choose GRAPHIC + EDIT GRAPHIC PARAMETERS from the menu bar and select *Stop catchment areas* from the tree view.
 - Deactivate the check box *Layer Stop catchment areas* and exit the dialog by pressing OK.

Viewing connectors for analyzing stop accessibility

A further method to examine stop accessibility is to display the connectors. In addition, we want to limit the analysis to zones with origin traffic for PuT greater than 25 passengers and mean access time greater than 5 minutes. To limit the selection, we will use a filter.

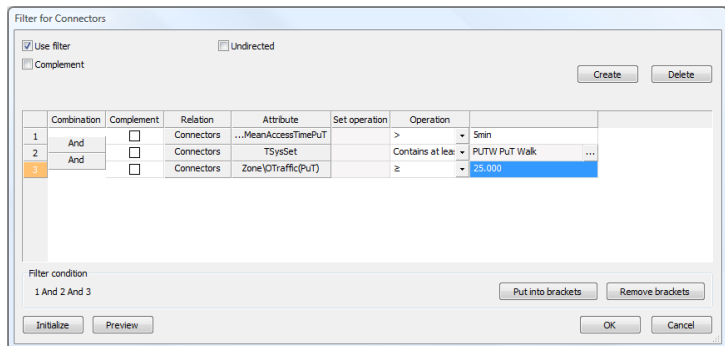
1. Display the connectors in the network editor window:
 - Press the graphic layer button for connectors in the window *Network*:



2. Set a filter for connectors:
 - Right click on the FILTER button next to the CONNECTORS caption in the window *Network*:



- The *Filter* dialog opens. Press the button for the new filter criterion in the column *Attribute* and select the indirect attribute under **Zone - Mean access time PuT** (Zone\Mean access time PuT).
- Choose *> Value* as *Operation* and enter a time of **5min**
- Add an additional filter criterion by pressing the **CREATE** button.
- Select the attribute **TSys set** by pressing the button in the column *Attribute*. Confirm by pressing the **OK** button.
- Keep the *Operation* as *Contains at least one*
- Press the button for selecting **PUTW PuT Walk** from available transport systems in the network and press **OK**.
- Insert another filter criterion by pressing the **CREATE** button.
- Select the attribute **Zone – Origin traffic-DSeg – PuT PuT**.
- Select *≥ Value* as *Operation*
- Enter **25 (persons)** as value.
- Ensure that all three filter criteria are connected by **AND**. You can change between **AND** and **OR** by pressing on those buttons directly as they then toggle between AND and OR



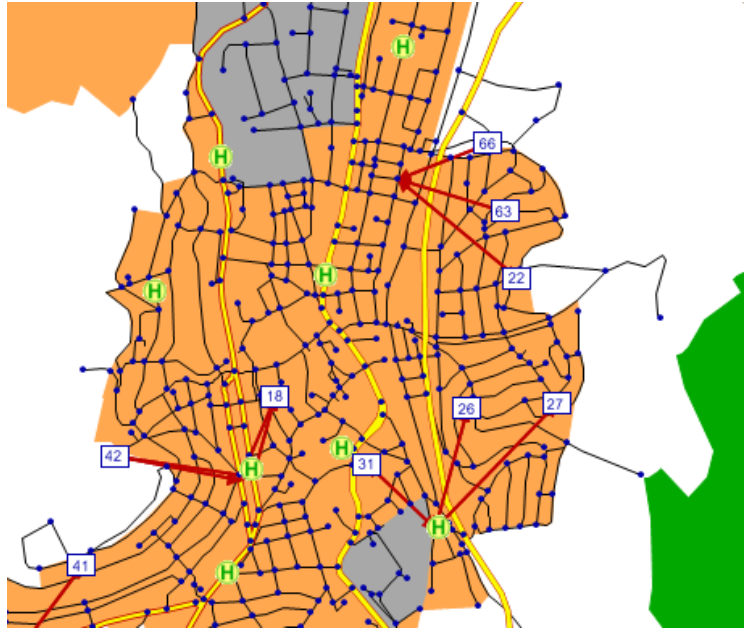
- Activate the check box *Use filter* and exit the dialog by pressing OK.
 - Now only those connectors which correspond to the defined filter criteria (that is the mean access time for PuT is at least 5 minutes, the transport system is PuT-Walk and the origin traffic for PuT is at least 25 persons) are displayed.
3. To see the zones which also satisfy the filter criteria for connectors, i.e. have at least one active origin connector, do the following steps:

- Left click on the graphic layer button for ZONES in the window *Network* to switch on the layer:



- All zones are displayed with their **Number**.
- Now open the filter for zones by clicking on the filter icon or choose FILTERS.. from the context menu (right click while moving the mouse over the ZONES caption)
- The *Filter* dialog opens. Press the button for the new filter criterion in the column *Attribute* and select the indirect attribute under **Origin connectors – CountActive**
- Choose $\geq$ *Value* as *Operation* and a value of 1
- Make sure that the box *Use filter* is active and press OK
- Note that this filter depends on the filter for connectors because the latter determines the number of active and passive connectors.
- To deactivate the display of passive zones right click on the graphic layer button for ZONES in the window *Network* to access the graphic parameters for zones
- Change to tab [PASSIVE], untick the box for *Draw*.
- Repeat the steps to deactivate passive network objects for connectors by changing to *Display* under *Connectors* in the tree view, select tab [PASSIVE] and untick the check box *Draw*.
- Press OK to confirm the changes

4. With the help of this illustration you can see that some of the zones in the east of Oppidum have insufficient PuT access, even though there is a significant amount of origin traffic for PuT (zones 22, 26, 27, 63 and 66):



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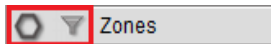
You can find this snapshot of the model in the file 417_VISUMTUTORIAL.VER.

5. After viewing the connector bars, revert the graphic parameter and filter settings:

- Press the buttons for the CONNECTOR graphic layer and for the CONNECTOR FILTER in the window *Network*:



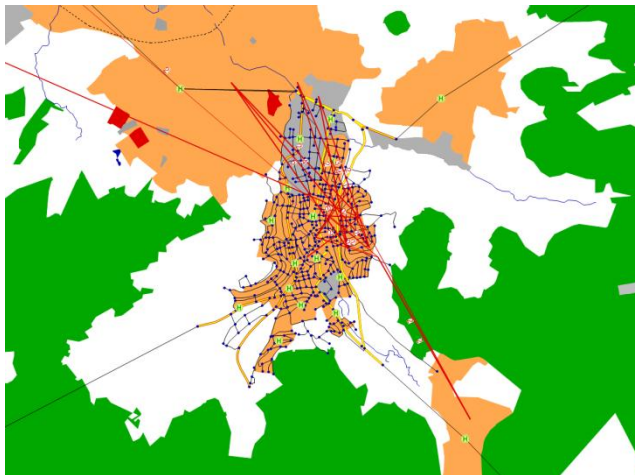
- Press the button for the ZONES GRAPHIC LAYER and for the ZONES FILTER in the window *Network* to switch off the display of zones and deactivate the filter:



PuT demand in Oppidum East

In the previous analysis you saw that the PuT network in east Oppidum is inadequate. However, there are zones in this area of Oppidum that have a significant amount of demand. With this information, you can derive suitable measures for improving PuT supply. This can, for example, include redirecting one of the bus lines through the eastside of Oppidum.

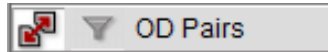
1. Open the graphic parameters file 417_DESIRELINES_PUT.GPA. This contains the settings for viewing the desire lines zones and for illustrating PuT demand in the zones in the east of Oppidum (zones 21 to 23, 26 to 28 and 63 to 66):
 - Choose FILE + OPEN + GRAPHIC PARAMETERS....
 - Open the file 417_DESIRELINES_PUT.GPA. This prompts the dialog *Reading Graphic Parameters: Select*.
 - Activate the radio button *Read selected parameters*.
 - Deactivate all graphic parameter settings by pressing the button UNCHECK ALL.
 - Activate the check boxes for *Layer* and *Desire lines zones* in the column *Read*
 - Press OK
 - Left click on the OD PAIRS graphic layer to switch on graphic parameters for desire lines zones
 - The desire line bars are displayed for the defined zones in Oppidum east. You can see that part of the PuT demand in this area is directed towards zone A-Town (zone number 70).



You can find this snapshot of the model in the file 418_VISUMTUTORIAL.VER.

2. After looking at the desire line bars, switch them off:

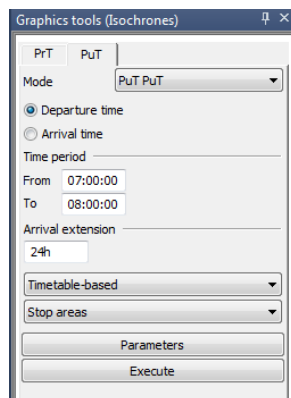
- Press the GRAPHICS LAYER button for OD PAIRS in the window *Network*:



Further accessibility analysis with PuT isochrones

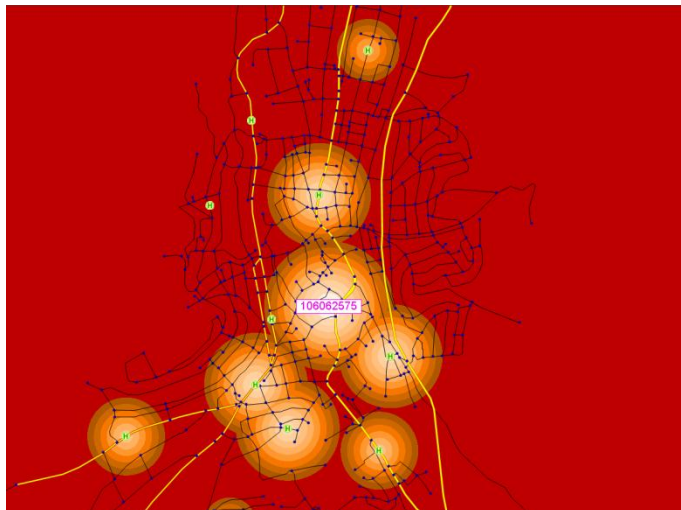
Isochrones can be used to examine the accessibility of network objects. In the following we want to analyze which places can be reached from the bus terminal within 5 minutes.

1. Configure the graphic parameter settings for isochrones:
 - Choose GRAPHICS + EDIT GRAPHIC PARAMETERS... from the menu bar.
 - Select *2D-Display* in the tree view.
 - Activate the check box Draw.
 - Select *Stop areas* from the combo box under *Attribute selection*.
 - Press the button below the combo box- and select the attribute **Isochrones time PuT**.
 - As an upper bound for the classification a value of **5 minutes** is already set. Keep this setting and the remaining class limits.
 - Exit the dialog by pressing OK. The network editor background is now colored in red.
2. Select network objects for isochrones:
 - Choose GRAPHICS + ISOCHRONES from the menu bar.
 - Configure the *Isochrones* dialog as follows:



- Select the bus terminal (stop area **106062575**) using a left click or via the *Find* option (right click in the network).

- Press the EXECUTE button in the *Isochrones* dialog. The resulting graphics look like shown below:



- As you can see in the time interval between 07:00 and 08:00 a.m. the stop Karl-von-Draiss-Strasse (number **106062607**) can be reached from the bus terminal within five minutes. The basis for this calculation is the timetable stored in the model. The circles around the stops show all those places which can then be reached on foot within the given time frame of five minutes. The calculation is based on direct air distance and the speed *V-access* as given under *2D display* in the graphic parameter dialog.

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You can find this snapshot of the model in the file 419_VISUMTUTORIAL.VER.

3. After viewing the isochrones, switch them off again:

- Press the INITIALIZE button in the *Isochrones* dialog.
- Exit the *Isochrones* dialog by pressing the CLOSE button.
- Choose GRAPHICS + EDIT GRAPHIC PARAMETERS from the menu bar.
- Select *2D-Display* from the tree view.
- Deactivate the check box *Draw* and exit the dialog by pressing OK.

Analyzing passenger transfers

It is often useful to display those stops with notable passenger transfers. The number of transferring passengers around each stop can be displayed using *stop catchment areas*.

1. Set the graphic parameter settings for stop catchment areas:

- Right click on the **STOPS** label in the window *Network* and choose **GRAPHIC PARAMETERS – STOP CATCHMENT AREAS** from the context menu.
 - Activate the radio button *Uniform display*.
 - Activate the check box *Draw*.
 - Activate the radio button *Determine from attribute*.
 - Press the button for attribute selection and choose the attribute **Passengers transferring total (AP)**.
 - Enter **0.3** in the attribute weight input box.
 - Select the radio button *Simple filling*.
 - Switch to *Stop catchment areas* in the tree view and activate the check box *Draw layer Stop catchment areas*.
 - Press the **PREVIEW** button. The radius of the circles depends on the number of transfers at the stop.
2. In addition, we want to label the circles with the number of transferring passengers and the stop name:
- Select *Stops* from the tree view and activate the check box *Layer: Stops*.
 - Switch to the *Display* under *Stops* and activate the check box *Draw table*.
 - Switch to *Table* under *Stops* and activate the check box *Draw table*.
 - Choose the attribute **Name** by clicking the button in the first row of *Column 1* and *Column 2* (press the button to select the attribute). Choose the attribute **Passengers transferring total (AP)** for both buttons in the second row.
 - Furthermore, make sure the rest of the settings are as follows:

☒ Draw table

Distance 1 mm of table

Text size 2 mm

Distance 30 % of text size

Font ☐ Transparent

Alignment Top center

☐ Same color for all

☒ Draw frame

Column 1

Text alignment Left

	Display	Attribute / Decimal places
1 ☒	Title	Name
2 ☒	Title	igers transferring tot
3 ☐	Title	Number
4 ☐	Title	Number
5 ☐	Title	Number

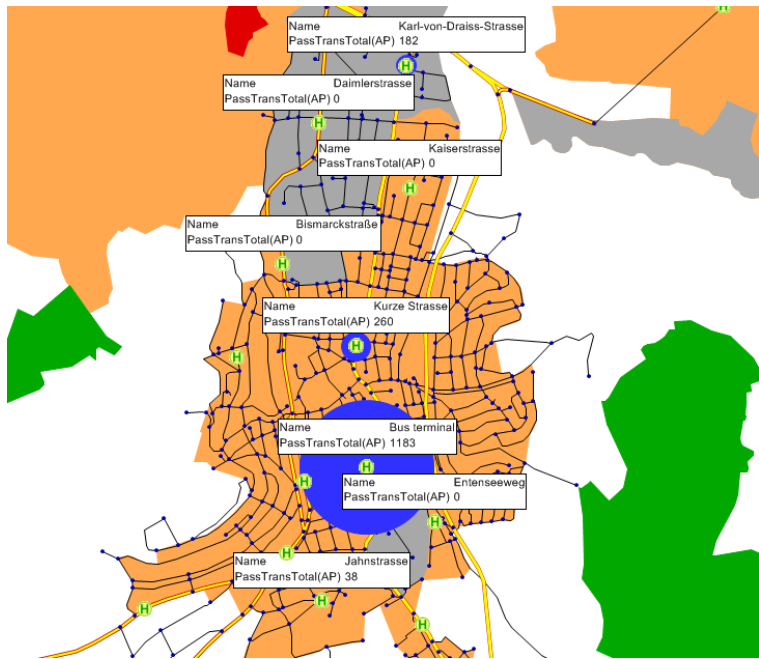
Column 2

Text alignment Left

	Display	Attribute / Decimal places
1 ☒	Value	Name
2 ☐	Value	igers transferring tot
3 ☐	Value	Number
4 ☐	Value	Number
5 ☐	Value	Number

- Press the PREVIEW button.
- 3. The layer *Stop catchment areas* is drawn on top of the *Stops* layer that contains the stop labels. Thus the order of layers in the *Edit graphic parameters* dialog needs to be modified:
 - Switch to *Layer* in the tree view.
 - Left click to select the row *Stop catchment areas* in the right part of the dialog.
 - Use the arrow-buttons  and  for moving the Layer *Stop catchment areas* below the Layer *Stops*.
 - Confirm the settings by clicking OK in the *Edit graphic parameters* dialog

As you can see, there are significant passenger transfers at the **bus terminal** (1183 passengers), at **Karl-von-Draiss-Strasse** (182 passengers) and at the stop **Kurze Strasse** (260 persons).



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You can find this snapshot of the model in the file 420_VISUMTUTORIAL.VER.

4. Switch this illustration off again:

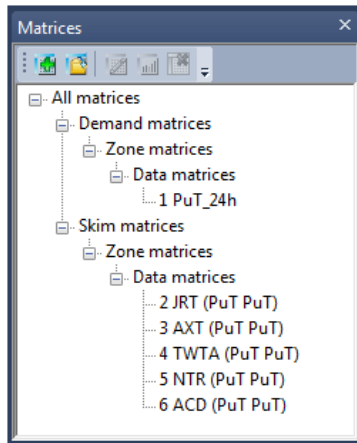
- Choose GRAPHICS + EDIT GRAPHIC PARAMETERS... from the menu bar.
- Select *Stops* from the tree view and deactivate the check box *Draw table* in *Table* under *Stops*.
- Select *Stop catchment areas* in the tree view and deactivate the check box *Layer Stop catchment areas*.
- Exit the dialog by pressing the OK button.

Analysis of transfer wait times

We want to examine the transfer wait times for trips between several zones. To do so we use the skim matrices which were calculated together with the assignment.

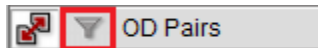
1. Look at the calculated skim matrix for transfer wait times:

- Choose window *Matrices*.
- Select the matrix number 4 containing the *transfer wait times adopted* and press the EDIT button.

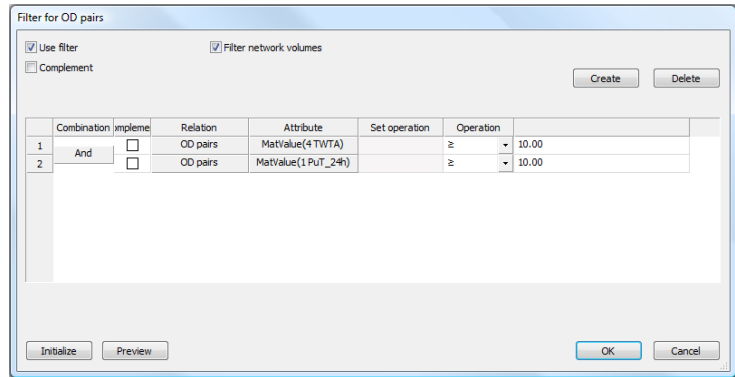


- This opens the matrix in the matrix editor. The values in the matrix are the mean transfer wait times of journeys between zones.
 - Close the skim matrix by pressing the button
2. Filter OD relations with high PuT demand and long transfer wait times by using the OD pair filter:

- Right click on the FILTER button next to the OD PAIR caption in the window *Network*:

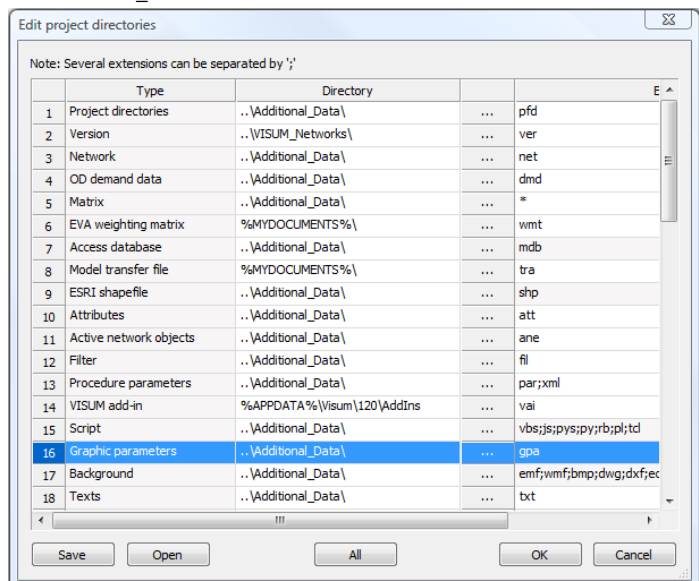


- Press the button in the column *Attribute* and select the attribute **Matrix value – Transfer wait time adopted**.
- Select $\geq$ *Value* as *Operation*
- Enter **10** as value which is in minutes as skim matrices have been saved in minutes.
- Press the CREATE button to insert a new filter condition.
- Choose the attribute **Matrix value – PuT_Assignment_24h**.
- Select $\geq$ *Value* as *Operation*
- Enter **10** (persons) as value.
- Activate the check box *Use filter* and exit the dialog by pressing OK.

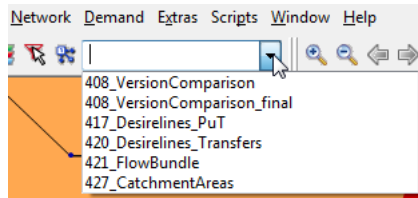


- We will now display the filtered OD pairs as desire line bars in the network editor. Load a GPA file to change the graphic settings by using the *Gpar selector*:

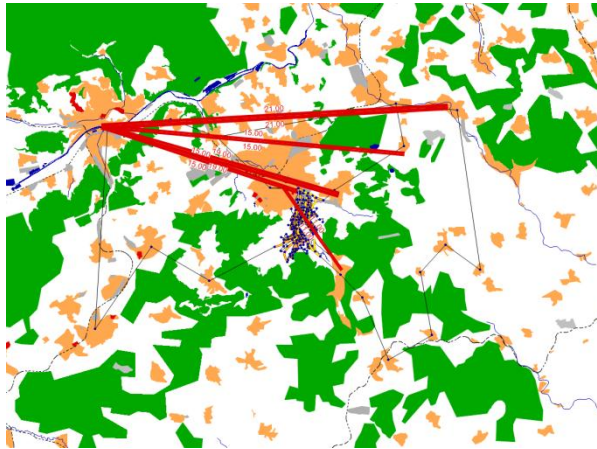
- Choose FILE + PROJECT DIRECTORIES + EDIT PROJECT DIRECTORIES from the menu bar.
- Make sure the project directory setting for GPA-files is set to the ADDITIONAL_DATA\ folder:



- Now find the *GPA selector* (see picture below) in the toolbar of the *Network editor* and click the drop down button: here you can see all the GPA-files stored in the project directory for graphic parameters.
- Select the GPA-file 420_DESIRELINES_TRANSFER.GPA.

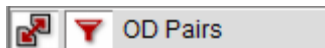


- Adjust the section displayed of the network by pressing the button ZOOM OUT , possibly several times.
- Desire line bars are displayed for all relations with a mean transfer wait time higher than 10 minutes and a demand higher than 10 passengers per day. The bar width is determined by the PuT demand between the zones. You should see that the relations between A-Village, B-Village and D-Village to B-Town show high transfer wait times but also high PuT demand.



You can find this snapshot of the model in the file 421_VISUMTUTORIAL.VER.

4. After viewing the desire lines, switch them off again and also deactivate the OD pair filter:
 - Press the GRAPHIC LAYER and FILTER button for OD PAIRS in the window *Network*:

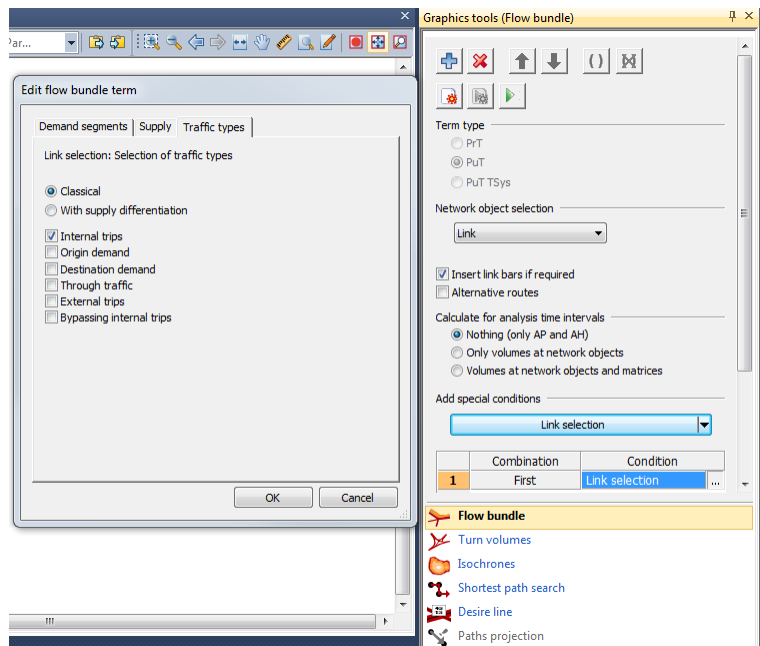


Analysis of stop utilization (PuT flow bundles)

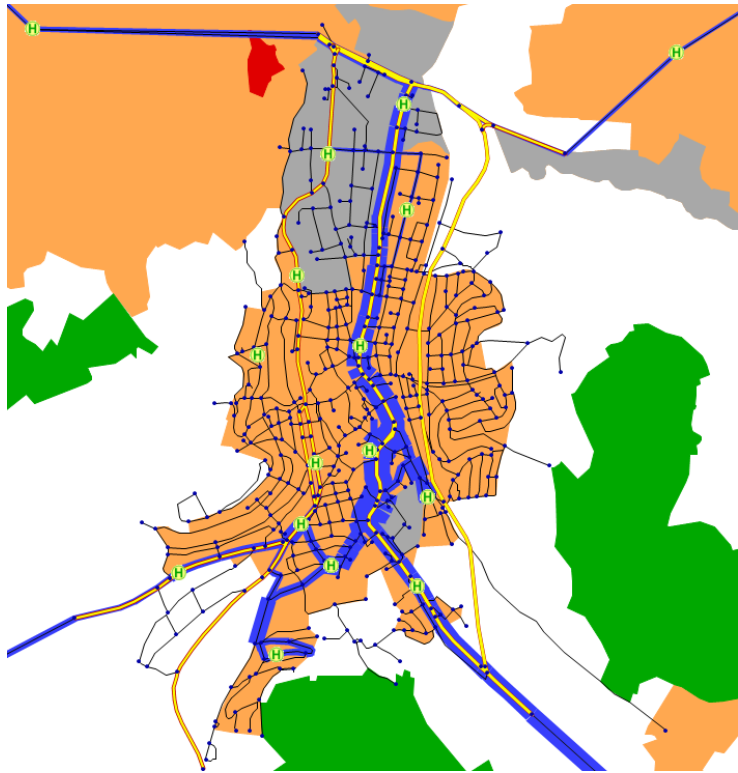
In a model with a calculated assignment a PuT flow bundle can be used to extract and display only those assignment paths which match certain criteria. Thus, you can display for example only those paths which use a selection of network objects such as stops, links or zones. In the following you will use this

feature to determine which type of passengers use the bus terminal in Oppidum the most: passengers who board, transfer or alight at this stop.

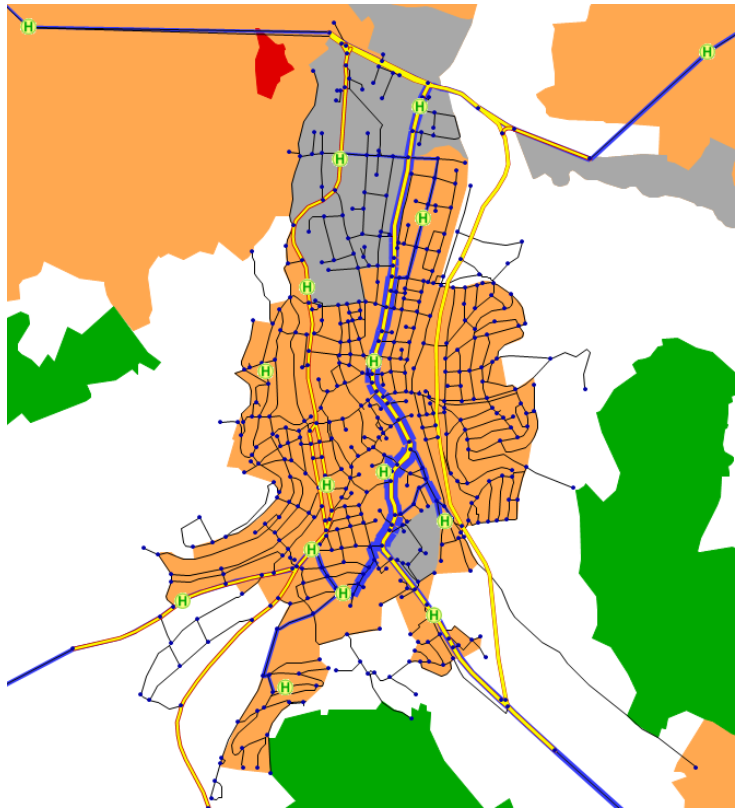
1. Open a graphic parameter file containing settings for the flow bundle:
 - Choose FILE + OPEN GRAPHIC PARAMETERS from the menu bar.
 - Open the file 421_FLOWBUNDLE.GPA.
 - Choose *Read all graphics parameters* and confirm with OK.
2. Check the parameters for the flow bundle:
 - Choose GRAPHICS + FLOW BUNDLE from the menu bar.
 - One criterion for **PuT** and **Stop** (bus terminal with stop number **106062529**) is defined.
 - Click under *condition* the button  next to Stop 106062529. The dialog *Edit flow bundle term* is displayed. Here, additional settings for *Traffic types* can be made.



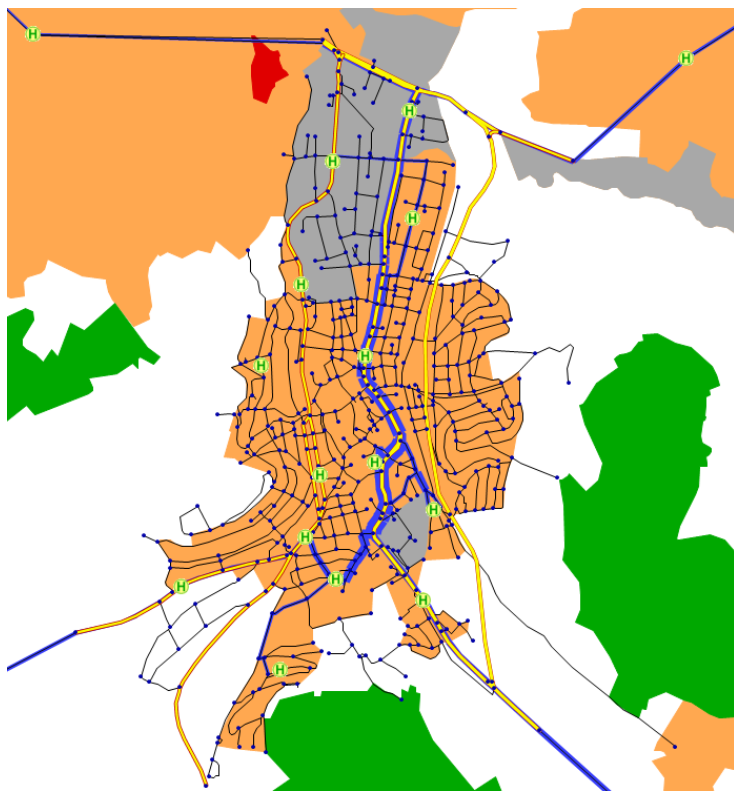
- Leave the *Flow bundle* dialog with the CLOSE button.



- In the network editor the blue flow bundle shows the paths found in the assignment that satisfy the criteria of transferring at the bus terminal.
3. Perform the same analysis for boarding passengers at the bus terminal:
- Choose **GRAPHICS + FLOW BUNDLE** from the menu bar.
 - Press the **INITIALIZE** button in the *Flow bundle* dialog.
 - Choose **PuT** and **Stop** from the two combo boxes on the left top of the dialog.
 - Select Stop **Bus terminal (No 106062529)** in the network editor
 - Choose **Origin boardings** from the dialog *Flow bundle of stop*.
 - Press the **EXECUTE** button to perform the calculation.
 - As you can see, more passengers use the bus terminal for transferring between two bus lines than for boarding a bus line.



4. Carry out the same examination for the alighting passengers:
 - Press the INITIALIZE button.
 - Repeat the steps, but choose **Destination alightings** from the dialog *Flow bundle of stop*.
 - Again you can see that more passengers use the bus terminal for transferring than for alighting.



You can find this snapshot of the model in the file 422_VISUMTUTORIAL.VER.

5. You can save the flow bundle settings to a GPA file for later use. To do so simply type a new name in the *GPA Selector*:
 - Type FLOWBUNDLEALIGHT into the *GPA Selector* and press **ENTER**.
 - This saves the file in the GPA folder.
 - Select a different GPA file from the selector to change the view and then select your new file to return to your flow bundle.
6. It is also possible to display this analysis as a list:
 - Choose LISTS + PATHS + PuT PATH LEGS from the menu bar.
 - Select **Flow bundle routes** from the combo box *Selection*.
 - Only those routes which satisfy the filter criteria are shown in the list.
 - Exit the list by pressing the Close-button .
7. Initialize the flow bundle:
 - Choose GRAPHICS + FLOW BUNDLE from the menu bar and press the INITIALIZE button.
 - Exit the dialog by pressing the CLOSE button.

Conclusion

This analysis of the PuT network supply found insufficient accessibility of the stops in the east of Oppidum and long transfer wait times on some of the relations. This is especially troublesome since some of the relations have high PuT demand. Thus there appears to be some potential for improvements. In the following chapter you will test some of these potential improvements.

3.5 Improving PuT quality

E

Open the version file 423_VISUMTUTORIAL.VER to start working on the example in this chapter.

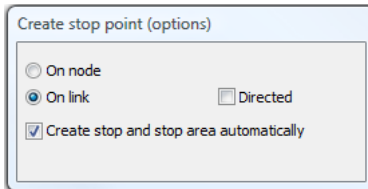
Creating new stops

To improve PuT accessibility in the east part of Oppidum, start by establishing some new stops. Create the stops via the following steps:

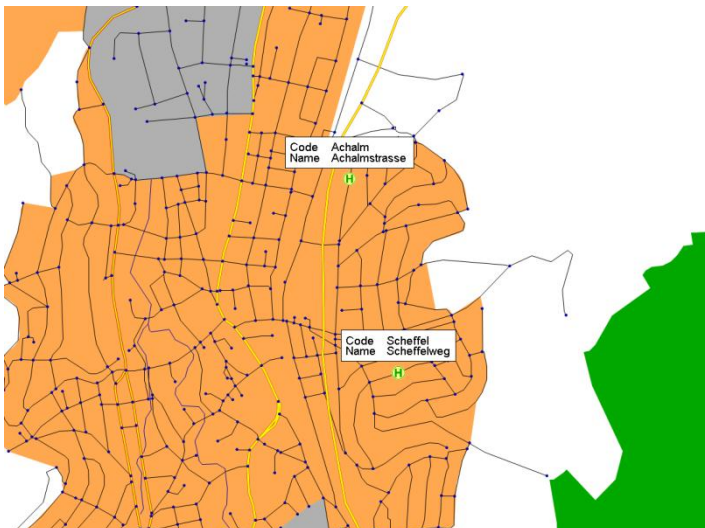
1. Press the button INSERT MODE  and left click on the STOP POINTS label in the window *Network*.



2. The dialog *Create stop point* is displayed. The stop points will be inserted on the links (link-based stop points). Take the settings as shown in this screenshot:



3. Create two new stop points at the places shown in the illustration below. Left click at the places shown on the map to create the stop points. The new stop point Achalmstrasse is situated between the nodes **106062148** and **106062280**. The new stop point Scheffelweg is situated between the nodes **106062455** and **106062426**.



4. Answer YES to the question about deleting the assignment results. This is required since the assignment paths are dependent on the stops in the model.
5. The dialog *Create stop point* will be shown. Use the **Code** and **Name** for the two stop points from the illustration above. Keep all the remaining settings and confirm by clicking OK.

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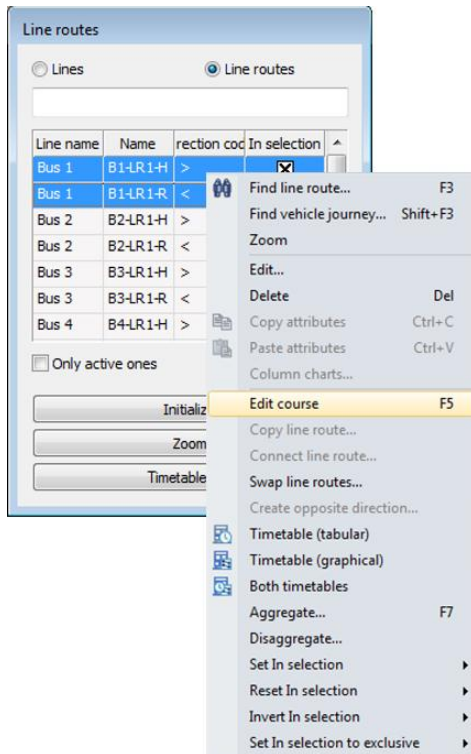
You can find this snapshot of the model in the file 424_VISUMTUTORIAL.VER.

Modifying the spatial course of lines

The new stop points have to be included in the spatial course of the bus line. For this we will redirect the course of an already existing bus line. Demand for a bus connection is especially strong in the zones of east Oppidum and especially in the direction of A-City (see chapter 3.4). Thus it is reasonable to redirect bus number 1, which operates in this direction, through these stops.

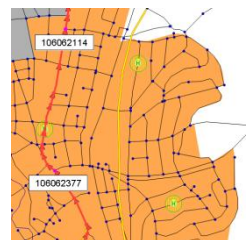
1. Redirect the course of the line route (edit shape):
 - Press the buttons EDIT MODE  and left click on the LINES label in the window *Network*:

 - The dialog *Line routes* appears. Select both direction *up* and direction *down* for bus number 1 (**B1-LR1-H** and **B1-LR1-R**).
 - Open the context menu by right clicking in the network editor window and choose *Edit shape*.

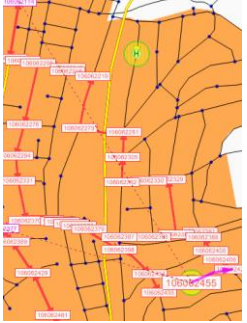
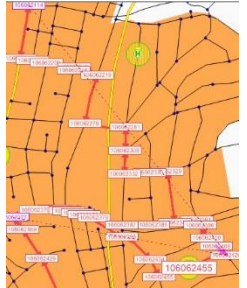


➡ Edit the shape of the line route as follows:

Select the two nodes highlighted in the illustration (number **106062114** and **106062377**) by left clicking them. These will serve as the fixed points. The spatial course of the line will only be modified between these points.



Select a point on the line route between the two fixed points and drag it to the node shown in the illustration on the right (number **106062455**). This should re-route the line route through this new point.

	
Select the node highlighted in the left of the illustration (number 106062276), keep the left mouse button pressed, and drag it to the node shown in the illustration on the right (number 106062426).	
Select the node highlighted in the illustration (number 106062219), keep the left mouse button pressed and drag it to the node shown in the illustration on the right (number 106062148).	



- After finishing the shape editing, press OK in the dialog *Edit shape of line route* to confirm the new course.
- Since the course of the line route has changed, the existing assignment and line costing result is no longer valid. Answer YES when prompted to delete the results.



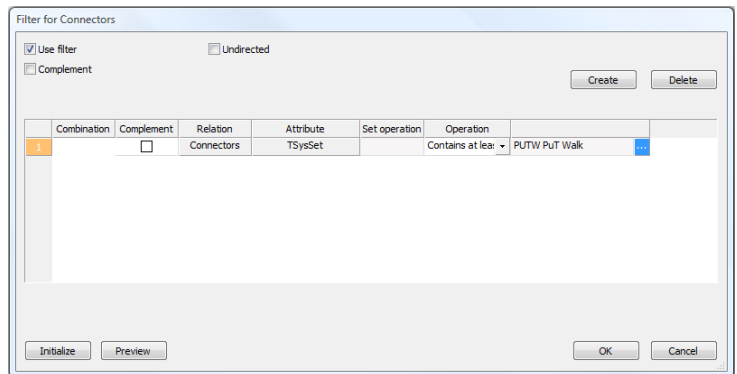
Visum automatically calculates the run times between the stops when the line course is changed.

2. Next, create PuT-connectors to allow passengers in the model to use the new stops. First set a connector filter, which filters only connectors that are open for PuT-Walk:

- Right click on the FILTER button for CONNECTORS in the window *Network*:



- The *Filter for Connectors* dialog is displayed. You only need one filter criterion, so delete the two already existing criteria by selecting the rows and pressing the DELETE button.
- For the remaining filter criterion press the button for attribute selection and select the attribute **TSysSet**.
- Choose *Contains at least one as Operation*
- Press the button for selecting the transport system  and choose **PUTW PuT Walk**.
- Confirm by pressing the OK button.
- Make sure that the check box *Use Filter* is activated and exit the dialog by pressing OK.

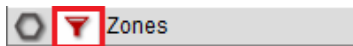


3. Delete the existing PuT connectors and create new ones:

- Left click on the CONNECTORS label in the window *Network*.



- Right click on CONNECTORS in the window *Network* and choose MULTI-DELETE from the context menu.
- Answer YES on the question if you want to delete active connectors.
- Make sure that all zones are active, i.e. click on the filter symbol next to zones to deactivate the filter.



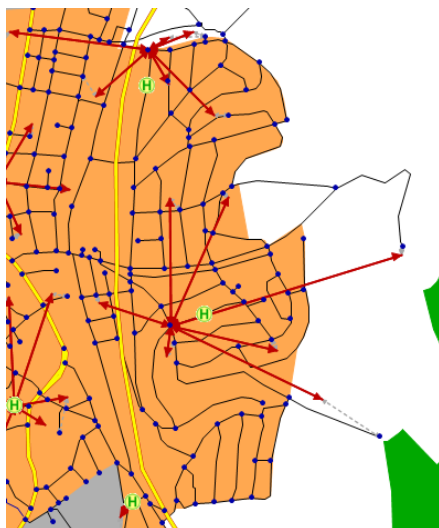
- Again open the context menu by right clicking on CONNECTORS in the window *Network* and choose CREATE from the context menu.
- Activate the radio button *PuT* in the dialog *Generate connectors*, and keep the remaining settings and press OK.

4. View the newly generated connectors in the network editor:

- Press the GRAPHIC LAYER button for CONNECTORS in the window *Network*.



- As you can see there are new connectors between the zone centroids and the nodes which are closest to the new stops.



5. Revert the graphic parameter settings:

- Again press the **LAYER** button for **CONNECTORS** in the window *Network*. The color of the button changes to grey.



6. Deactivate the connector filter:

- Press the **CONNECTOR FILTER** button in the window *Network*..



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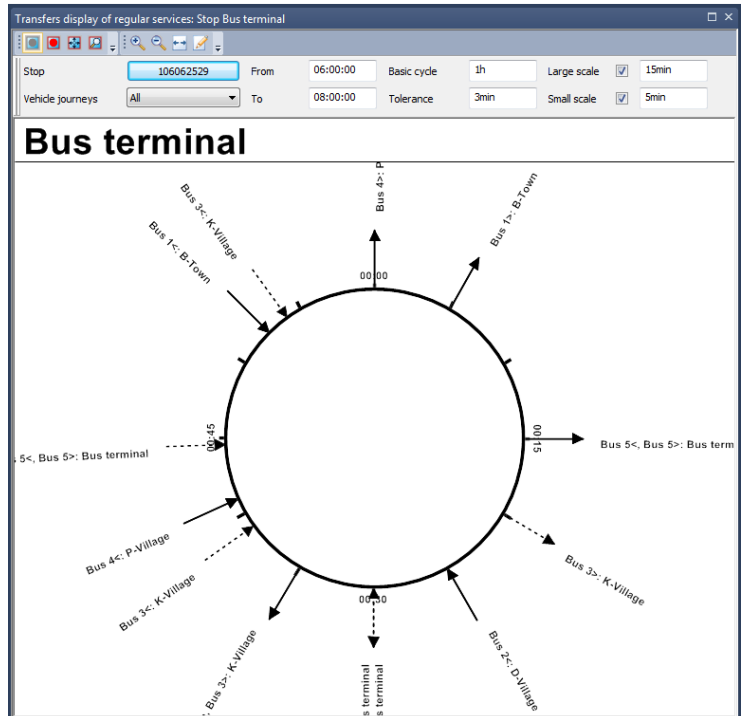
You can find this snapshot of the model in the file 425_VISUMTUTORIAL.VER.

Analyzing and modifying vehicle journeys

To optimize the transfers for passengers at the **Bus terminal**, we examine the transfer connections between arriving and departing services. As a result of the analysis we will implement some measures to better coordinate the services at this stop. To do so, we will use a specifically designed display for transfers between regular services. The *Transfer display of regular services* is particularly useful for an evaluation because it shows the services with their respective passenger volumes as well as passenger transfers including transfer times at the stop. We then shift some of the services temporally using the *Timetable editor* so that transfer times are reduced. The effects of a better coordination will be examined.

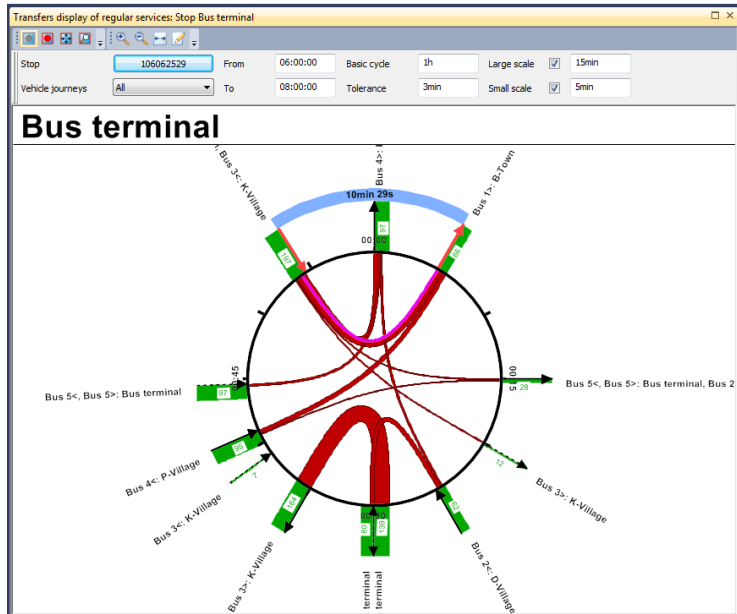
1. Look at the schedule of vehicle journeys and their temporal position relative to each other in the *Transfers display between regular services*:

- Choose menu EDIT + TRANSFER DISPLAY OF REGULAR SERVICES to open the window.
- Press the button next to *Stop* to select the **Bus terminal**. Reduce the time window to *From* **06:00:00** *To* **08:00:00**. Leave all other settings unchanged.



- To visualise passenger volumes of vehicle journeys and transfers in this view the corresponding information must be saved in the assignment result. Open the menu CALCULATE + GENERAL PROCEDURE SETTINGS. In the tree view on the left side choose *Assignment* under *PuT settings*. Change the settings for *Save transfers* to *Between vehicle journeys*. Confirm the changes with OK.
- To reassign the PuT demand, open the *Procedure sequence* via the menu CALCULATE + PROCEDURE SEQUENCE. Mark the row with the PuT assignment.
- To modify the settings and parameters for the assignment press the button EDIT.
- Deactivate the check box for *Calculate skim matrices* in tab [BASIS] so we do not overwrite previous results. Close the parameter dialog with OK.
- Mark the first procedure again and right click to access the context menu. Select *Execute marked procedures* to assign PuT demand. The demand for PuT is assigned to the network.

- Return to the *Transfers display of regular services*.
- Open the graphic parameter file for this view, i.e. choose menu TRANSFER DISPLAY OF REGULAR SERVICES + OPEN GRAPHIC PARAMETERS..., select the file 426_TRANSFERDISPLAY_BUS-TERMINAL.GPTA. You can now see the passenger volumes of vehicle journeys at the outer edge of the circle while in the inner part transfer flows are shown.
- To display transfer times click on the arrow for an arriving service (arrow towards the circle) and then on an arrow for a departing service (arrow points outwards). Keep the **CTRL** key pressed when selecting the arrows. The transfer time is shown in light blue.



- Keep the **CTRL** key also pressed to unmark the arrows.
 - The bars of transfer flows show that for some major connections waiting times are acceptable, i.e. transfer times are within 10min. In contrast, passengers arriving at minute 41 and 44 have long transfer times (24min and 15min, respectively).
- Shift some of the vehicle journeys using the Timetable editor to reduce transfer times for the passengers:
 - Open the Timetable editor via menu EDIT + TIMETABLE (TABULAR).
 - Click the button BASIC LINE SELECTION  and select line **Bus 4**, close the dialog.
 - You can expand the line hierarchy using the button EXPAND TREE. Select all levels of the direction **down**.
 - Make sure the option REGULAR SERVICE MODE ON/OFF is set to off, meaning that you see single vehicle journeys in the *Tabular timetable*.

Count: 19

No	149	150	151	152	153	154
Name						
LineName	Bus 4	Bus 4	Bus 4	Bus 4	Bus 4	Bus 4
DirectionCode	<	<	<	<	<	<
ConcatenateVehJourneySections	daily	daily	daily	daily	daily	daily
FromStopPoint/Code	P-Village	P-Village	P-Village	P-Village	P-Village	P-Village
Dep	05:50:00	06:50:00	07:40:00	08:40:00	09:40:00	10:40:00
Arr	06:51:00	07:51:00	08:41:00	09:41:00	10:41:00	11:41:00
ToStopPoint/Code	Busterm	Busterm	Busterm	Busterm	Busterm	Busterm
OperatorNo	1	1	1	1	1	1
CountVehJourneySections	1	1	1	1	1	1
IsCoupled	☐	☐	☐	☐	☐	☐

Fahrplanfahrabschnitte

ObjNo	ObjCode	ObjName	Arrivals	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep
106062529	Busterm	Bus termin	Dep	06:51:00	07:51:00	08:41:00	09:41:00	10:41:00	11:41:00				
106062791	Jahn	Jahnstrasse	Dep	06:50:00	07:50:00	08:40:00	09:40:00	10:40:00	11:40:00				
106063464	Sand	Sandstrasse	Dep	06:50:00	07:50:00	08:40:00	09:40:00	10:40:00	11:40:00				
106062800	Talacker	Talackerstr	Dep	06:49:00	07:49:00	08:39:00	09:39:00	10:39:00	11:39:00				
106071828	N-Village	N-Village	Dep	06:30:00	07:30:00	08:20:00	09:20:00	10:20:00	11:20:00				
106071829	O-Village	O-Village	Dep	06:14:00	07:14:00	08:04:00	09:04:00	10:04:00	11:04:00				
106071830	P-Village	P-Village	Dep	05:50:00	06:50:00	07:40:00	08:40:00	09:40:00	10:40:00				

- Mark the first two vehicle journeys (No **149** and **150**), which arrive at 6:41 and 7:41, respectively, at the **Bus terminal**, i.e. keep the **CTRL** key pressed while clicking on the column headers.
- Open with right-click on header the context menu and chose Select the option **MOVE VEHICLE JOURNEYS TO DIFFERENT TIME**, enter **10min** and choose *later*. Confirm with Ok.
- A message is displayed indicating that the assignment result is deleted. Choose **YES FOR ALL** to continue.
- Repeat the steps to shift vehicle journeys of **Bus 5**: Change the selection of lines in the *Line selection* dialog. Expand the tree under *Lines* and activate the entire hierarchy by clicking the button **SELECT ALL**.
- **Bus 5** is a circle line which starts and ends at the **Bus terminal**. The vehicle journeys for **down** and **up** run in opposite directions. Mark the columns of vehicle journeys no **169** and **181** in the *Tabular timetable*. Shift these two vehicle journeys by 10min, i.e. open the dialog *Shift vehicle journey(s)* using the button **SHIFT MARKED VEHICLE JOURNEYS**, select *Later* and enter **10min**.
- The two vehicle journeys now start 7:40:00 and end at 7:54:35.

The screenshot shows the 'Timetable (tabular)' window. The main table displays bus routes for 'Count 24' with columns for 'No', 'Name', 'LineName', 'DirectionCode', 'Concatenate Veh.Journey/Section', 'FromStopPoint/Code', 'Dep', 'Arr', 'ToStopPoint/Code', 'OperatorNo', 'Count Veh.Journey/Sections', and 'IsCoupled'. Below this, the 'Vehicle journey sections' section is expanded, showing a table with columns for 'ObjNo', 'ObjCode', 'ObjName', 'Arrivals', and 'Departures'. The 'Arrivals' column has sub-columns for 'Dep' and 'Arr' for each of the six bus lines (168, 180, 169, 181, 170, 182). The 'Departures' column has a 'Dep' sub-column. The table lists various stops and their corresponding arrival and departure times, with some entries marked with red and green icons.

- Close the Timetable editor by clicking the CLOSE button .
- To observe the changes in transfer times we re-assign demand. Change to the *Procedure sequence* and mark the first procedure. Right click to access the context menu and choose *Execute marked procedures*. The assignment is calculated.
- Change to the *Transfers display of regular services*. After the assignment we can see the expected result. In the *Transfers display of regular services* we observe that transfer times are reduced for passengers of shifted services (Bus 4 and 5) while for passengers of other services the conditions are unchanged.
- Exit both the *Transfers display of regular services* and the *Procedure sequence* by clicking the CLOSE button .

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You can find this snapshot of the model in the file 426_VISUMTUTORIAL.VER.

3.6 Comparing the existing and planned bus network

In the last chapter you improved the PuT network. Now you will compare the planned with the existing bus network in Oppidum.

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Open the version file 426_VISUMTUTORIAL.VER to start working on the example in this chapter.

Calculated procedures for the planning state

For comparing both the planned and existing bus network, you first have to calculate the assignment, the indicators and the user-defined attribute for the planned network. The line evaluation attribute for the planned state will be stored in the user-defined attribute **LineEvaluation_Plan**.

1. Create the user-defined attribute:

- Choose NETWORK + USER-DEFINED ATTRIBUTES from the menu bar.
- Select the network object LINE ROUTES from the combo box and press the CREATE button.
- The dialog *Create user-defined attribute (Line routes)* is shown. Make the following settings:

The screenshot shows a dialog box titled "Edit user-defined attribute (Line routes)". It contains the following fields and settings:

- Attribute ID: LINEVACT
- Code: LinEvaAct
- Name: LineEvaluation_Act
- Comment: (empty)
- Type: Number with decimal places (dropdown menu)
- Decimal places: 1
- Default value: 0.0 (radio button selected)
- Minimum: (empty) (radio button selected)
- Maximum: (empty) (radio button selected)
- Data attribute (radio button selected)
- Formula attribute (radio button unselected)
- Blank (radio button unselected)
- Unlimited (radio button selected for both Minimum and Maximum)

At the bottom right, there are "OK" and "Cancel" buttons.

- Confirm by pressing OK twice. You return to the network editor.

2. Adjust the procedure settings and execute them:

- Choose CALCULATE + PROCEDURE SEQUENCE... from the menu bar to open the *Procedure sequence* dialog.
- Select the row with the procedure *PuT assignment* and press the EDIT button to define parameters.
- In the dialog *Parameters: Assignment procedure: Timetable-based* under tab [BASIS] activate the check box for the *Calculation of skim matrices*.
- Change to the tab [SKIM MATRICES].
- Enter the filename PUT_SKIM_PLAN and confirm by pressing OK.
- Back in the procedure sequence dialog, select the row with the operation *Edit attribute* and press the EDIT button.
- Choose **LineEvaluation_Plan** as the *Target attribute* and keep the formula for calculating the attribute.
- Confirm by pressing the OK button.
- Make sure that all three procedures are active.
- Press the START button to calculate the procedures.
- Close the procedure sequence by pressing the CLOSE-button .

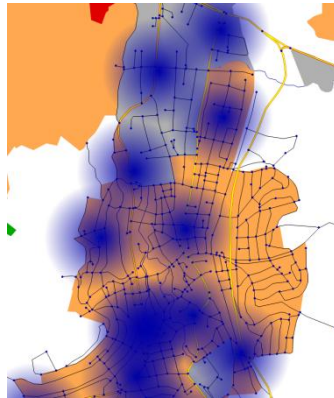
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You can find this snapshot of the model in the file 427_VISUMTUTORIAL.VER.

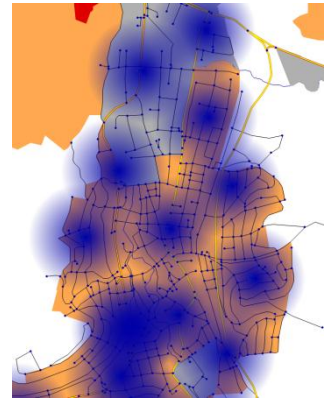
Stop accessibility in the planned network

Explore improving stop accessibility by creating new bus stops:

1. Open the graphic parameter file 427_CATCHMENTAREAS.GPA for viewing the stop catchment areas:
 - Choose FILE + OPEN + GRAPHIC PARAMETERS from the menu bar.
 - Open the file 427_CATCHMENTAREAS.GPA.
 - Activate the radio button *Read selected parameters* in the dialog *Read graphic parameters: Select*.
 - Deactivate the selection by pressing the button UNCHECK ALL.
 - Activate the check boxes *Stop catchment areas* and *Layer* in the column *Read*.
 - Press the OK button to confirm.



Catchment areas existing network



Catchment areas planned network

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You can find this snapshot of the model in the file 428_VISUMTUTORIAL.VER.

2. Deactivate the display of stop catchment areas:

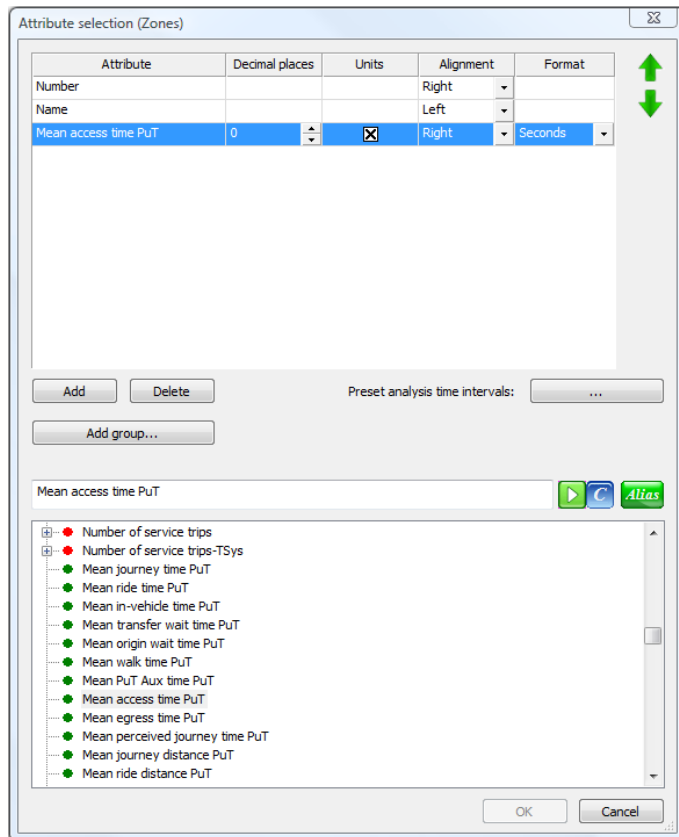
- Choose GRAPHICS + EDIT GRAPHIC PARAMETERS... from the menu bar.
- Select *Stop catchment areas* in the tree view.
- Deactivate the check box *Layer Stop catchment areas* and exit the dialog by pressing OK.

Viewing stop accessibility for the existing and planned network using lists

Next you will view the accessibility of stops in the planned network as a list and compare it to the existing network in the spreadsheet program Microsoft Excel.

1. Open the zone list and configure the list layout (view):

- Right click on the ZONES label in the windows *Network* and select LIST from the context menu.
- Press the button SHOW ONLY ACTIVE .
- Press the button SELECT ATTRIBUTES... .
- Keep the **CTRL**-key pressed, select all attributes in the top list except **Number** and **Name** and press the DELETE button.
- Select the attribute **Mean access time PuT** in the bottom list and press the ADD button.
- Change the *Format*-setting for this attribute to *Seconds* and confirm by pressing the OK button.



2. Load a filter file which filters the zones to only include Oppidum east:
 - Choose FILTERS + OPEN FILTER FILE... from the menu bar.
 - Open the file 428_FILTER_ZONES.FIL and press OK.
3. Copy the filtered list to the clipboard and insert it in a spreadsheet program such as Microsoft Excel:
 - Press the button COPY LIST TO CLIPBOARD .
 - In the dialog *Save attributes (Zones)* press OK to confirm.
 - Open your spreadsheet program (such as Microsoft Excel) and open the file 428_MATPUT_TEMPLATE.XLS.
 - Select the cell A1 and PASTE the data from the list.
 - Since the spreadsheet calculations (formulas) are already stored in the table, you do not have to make any further settings. In column "I" is the difference of the access times.
 - As you can see the accessibility of stops in the east of Oppidum improved significantly (*Note: The zones which had an access time of 0s in the actual state were not connected to PuT at all, since they were more than 1km away from the next stop*):

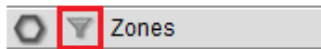
	A	B	C	D	E	F	G	H	I
1	VISION								
2	SVERSION\FILETYPE		LANGUAGE UNIT						
3	08.08.18		ENG KM						
4									
5	SZONE\NO	NAME	MEANACC ESTIMPE UT						
6	21	Friedhof, Gotthied-Maier-Straße	345s						
7	22	Karl-Kuppinger-Straße	382s						
8	23	Kühnenbach	458s						
9	26	Bergstraße, Kesssteige	82s						
10	27	Hegelweg, Brühl	296s						
11	28	Urselberg, Waldcafe	656s						
12	63	Hägenstraße, Beethovenstraße	251s						
13	64	Eninger weg, Achalmstraße	107s						
14	65	Gewerbegebiet Spielbach	64s						
15	66	Gewerbegebiet Galgenrain	129s						

Zone no.	Zone name	Mean access time PuT (Plan) [s]	Mean access time PuT (Act) [s]	Difference MAT PuT [s]
21	Friedhof, Gotthied-Maier-Straße	345	0	-345
22	Karl-Kuppinger-Straße	382	515	133
23	Kühnenbach	458	595	137
26	Bergstraße, Kesssteige	82	410	328
27	Hegelweg, Brühl	296	576	280
28	Urselberg, Waldcafe	656	0	-656
63	Hägenstraße, Beethovenstraße	251	372	121
64	Eninger weg, Achalmstraße	107	234	127
65	Gewerbegebiet Spielbach	64	257	193
66	Gewerbegebiet Galgenrain	129	323	194

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You can find this snapshot of the model in the files 429_VISUMTUTORIAL.VER and 429_MATPUT_PLAN-ACT.XLS

- Exit the list by pressing the CLOSE button .
- Press the ZONE FILTER button in the window *Network* to deactivate the filter.



Comparison of the transfer wait times

To analyze the changes in transfer wait times of journeys between the zones, we use the matrix editor to subtract the matrix of the existing network from the matrix in the planned network.

- Change to the window *Matrices*.
- Select the skim matrix number 4 for **transfer wait time adopted** and press the EDIT button  to open the matrix in the matrix editor. Alternatively, you can double left click on the matrix.
- The values in the matrix show the mean transfer wait times of journeys between the zones.
- Press the SUBTRACTION button  in the matrix editor toolbar on the top of the window.



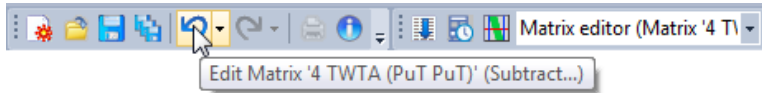
- Activate the radio button *Load matrix from file* and press the button for file selection .
- Open the matrix file 429_TRANSFERWAITTIME_ACT.MTX. This matrix contains the transfer wait times in the existing network.
- Press the OK button to subtract the matrix.
- Load the graphics parameters for the matrix editor via the menu MATRIX EDITOR + OPEN GRAPHICS PARAMETERS.... Select the file 429_TRANSFERWAITTIME_DIFF.GPM. The background of the matrix cells are colored depending on the classification defined for the matrix values.
- The matrix shows for which OD relations the transfer wait times improve for the planned network (negative values – green background) and for which OD pairs they get worse (positive values – orange background). OD pairs without change are displayed with white background. In grey are

matrix cells of relations for which in the existing case public transport was not available.

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You can find the difference of the transfer wait times in the matrix file 429_TRANSFERWAITTIME_DIFF.MTX.

10. Press the UNDO button to restore the transfer wait times of the planned network.



11. Exit the matrix editor by pressing the CLOSE button

Comparison of line evaluations

The final comparison is the line evaluation attribute created to measure efficiency. In the previous chapters you created the user-defined attributes **LineEvaluation_Act** and **LineEvaluation_Plan**. Now you can compare these attributes for bus line 1, which you modified in the planned network.

1. Open the list for line routes by choosing LISTS + PuT SUPPLY + LINES + LINE ROUTES from the menu bar.
 - Choose the button SELECT ATTRIBUTES...
 - Keep the STRG key pressed and mark all attributes under **Link run time** except the user-defined attributes **LinkEvaluation_Act** and **LinkEvaluation_Plan**.
 - Use the DELETE button to remove attributes from the selection.
 - Confirm with OK to return to the list
2. Compare the line evaluation changes between the existing and the planned network for line 1. You will see that the values of the user-defined attribute for line evaluation do not only increase for direction up and down for line 1, but also for all the other lines. This means that the ratio of **passenger kilometers** to **service kilometers** increased. Hence more passenger kilometers per service kilometer are travelled. Thus, the efficiency of the bus network would benefit from the measures in the planned network.

Count: 10	LineName	Name	DirectionCode	Length	LinkRunTime	LinEvaAct	LinEvaPlan
1	Bus 1	B1-LR1-H	>	17.877km	59min 13s	13.4	15.6
2	Bus 1	B1-LR1-R	<	17.867km	59min 13s	13.8	15.1
3	Bus 2	B2-LR1-H	>	15.828km	54min 42s	10.9	12.1
4	Bus 2	B2-LR1-R	<	15.828km	54min 42s	12.0	13.6
5	Bus 3	B3-LR1-H	>	21.721km	1h 22min 5s	9.9	11.1
6	Bus 3	B3-LR1-R	<	21.721km	1h 22min 5s	10.4	11.6
7	Bus 4	B4-LR1-H	>	17.553km	1h 3min 11s	8.4	9.4
8	Bus 4	B4-LR1-R	<	17.553km	1h 3min 11s	8.4	9.3
9	Bus 5	B5-LR1-H	>	10.057km	14min 55s	16.8	24.3
10	Bus 5	B5-LR1-R	<	9.997km	14min 49s	17.0	16.3

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You can find this snapshot of the model in the file 430_VISUMTUTORIAL.VER.

Conclusion

You have now successfully finished your first small PuT project and gained an overview of typical workflows and important features that Visum offers.

Index of example data

VISUM version files of the example network:

File name	Description	Ref.
400_VISUMTUTORIAL.VER	PrT-input network for editing the PrT project. This network does not contain the planned bypass or the zones.	2.1
401_VISUMTUTORIAL.VER	PrT-network including shape-edited bypass.	2.1
402_VISUMTUTORIAL.VER	PrT-network, in which the bypass is displayed dependent on the link category stored in a user-defined attribute.	2.1
403_VISUMTUTORIAL.VER	PrT-network with typified nodes and turns with default values from the turn standards.	2.1
404_VISUMTUTORIAL.VER	PrT-network with zones.	2.2
405_VISUMTUTORIAL.VER	PrT-network with connectors.	2.2
406_VISUMTUTORIAL.VER	PrT-network with OD matrix.	2.2
407_VISUMTUTORIAL.VER	PrT-network with calculated assignment and indicators.	2.3
408_VISUMTUTORIAL.VER	PrT-network with link bars showing the link volumes from the assignment.	2.3
409_VISUMTUTORIAL.VER	PrT-network with flow bundle.	2.4
410_VISUMTUTORIAL.VER	PrT-network with display of turn volumes.	2.4
411_VISUMTUTORIAL.VER	PuT-input network for editing the PuT project.	3.1
412_VISUMTUTORIAL.VER	PuT-network with demand matrix.	3.2
413_VISUMTUTORIAL.VER	PuT-network with desire line bars showing the PuT demand.	3.2
414_VISUMTUTORIAL.VER	PuT-network with calculated timetable-based assignment and indicators.	3.3
415_VISUMTUTORIAL.VER	PuT-network with link bars showing the volumes from the timetable-based assignment.	3.3
416_VISUMTUTORIAL.VER	PuT-network displaying stop catchment areas in the existing network.	3.4

417_VISUMTUTORIAL.VER	PuT-network showing connector bars in the existing network.	3.4
418_VISUMTUTORIAL.VER	PuT-network with desire line bars for PuT-demand in Oppidum east in the existing network.	3.4
419_VISUMTUTORIAL.VER	PuT-network showing PuT-isochrones in the existing network.	3.4
420_VISUMTUTORIAL.VER	PuT-network with desire line bars showing the transfers in the existing network.	3.4
421_VISUMTUTORIAL.VER	PuT-network with desire line bars showing the transfer waiting times in the existing network.	3.4
422_VISUMTUTORIAL.VER	PuT-network with flow bundles showing the transfers at the bus terminal.	3.4
423_VISUMTUTORIAL.VER	PuT-network in existing network.	3.5
424_VISUMTUTORIAL.VER	PuT-network with new stops in the planned network.	3.5
425_VISUMTUTORIAL.VER	PuT-network with new line courses in the planned network.	3.5
426_VISUMTUTORIAL.VER	PuT-network with shifted vehicle journeys in the planned network.	3.5
427_VISUMTUTORIAL.VER	PuT-network with calculated assignment and indicators in the planned network.	3.6
428_VISUMTUTORIAL.VER	PuT-network showing the stop catchment areas in the planned network.	3.6
429_VISUMTUTORIAL.VER	PuT-network with filtered zones in the planned network.	3.6
430_VISUMTUTORIAL.VER	PuT-network with comparison of line evaluations.	3.6

Other data:

File name	Type	Description	Ref.
403_OPPIDUM_ZONE_CE NTROID.SHP	Shapefile	Shapefile with zones.	2.2
403_OPPIDUM_ZONE_CE NTROID.SHX	Shapefile	Associated binary file.	2.2
403_OPPIDUM_ZONE_CE NTROID.CTF	Shapefile	Associated attribute name file.	2.2
403_OPPIDUM_ZONE_CE NTROID.DBF	Shapefile	Associated attribute value file.	2.2
405_CAR_24H.MTX	Visum matrix file	Demand matrix for PrT.	2.2
408_LAYOUT_VERSIONC OMPARISON.NET	Visum network layout file	Layout file for version comparison	2.4
408_VERSIONSCOMPARI SON.GPA	Visum graphic parameter file	Graphic parameter settings for version comparison	2.4
408_VERSIONSCOMPARI SON_FINAL.GPA	Visum graphic parameter file	Graphic parameter settings for version comparison	2.4
408_LISTLAYOUT_VERSI ONSCOMPARISON.LLA	Visum list layout file	List layout for version comparison	2.4
408_PRT_RUNTIME_DIFF .MTX	Visum matrix file	Travel time differences between planned and actual state.	2.4
PRT_SKIM.TTC	Visum matrix file	Skim matrix calculation of travel times between zones in the actual state.	2.4
408_OPPIDUM_ASSIGNM ENT_ACT.VER	Visum version file	Network with assignment in the actual state (without bypass).	2.4
411_PUT_24H.MTX	Visum matrix file	Demand matrix for PuT.	3.2
417_DESIRELINES_PUT. GPA	Visum graphic parameter file	Graphic parameters for displaying the desire line bars for PuT-demand in Oppidum east.	3.4
420_DESIRELINES_TRAN SFERS.GPA	Visum graphic parameter file	Graphic parameters for displaying the desire line bars for transferring passengers.	3.4
421_FLOWBUNDLE.GPA	Visum graphic parameter file	Graphic parameters for displaying the PuT flow bundles.	3.5

424_BUSNET_PLAN.NET	Visum network file	Network file including new stops and line courses.	3.5
426_TRANSFERDISPLAY-BUSTERMINAL.GPTA	Visum graphic parameter file	Graphic parameters for Transfers display of regular services.	3.5
427_CATCHMENTAREAS.GPA	Visum graphic parameter file	Graphic parameters for displaying stop catchment areas.	3.6
428_FILTER_ZONES.FIL	Visum filter file	Filter settings for activating the zones in Oppidum east.	3.6
429_MATPUT_PLAN-ACT.XLS	Excel file	Completed comparison of stop accessibilities in the planned and actual state.	3.6
428_MATPUT_TEMPLATE.XLS	Excel file	Template for comparison of stop accessibilities in the planned and actual state.	3.6
429_TRANSFERWAITTIME_DIFF.MTX	Visum matrix file	Matrix containing the difference between transfer waiting times in the planned state and the actual state.	3.6
429_TRANSFERWAITTIME_ACT.MTX	Visum matrix file	Matrix containing the transfer waiting times in the actual state.	3.6
429_TRANSFERWAITTIME_DIFF.GPM	Visum graphics parameters file	Graphics parameter for display of cells in the matrix editor	3.6
PUT_SKIM_ACT.TWTA	Visum matrix file	Matrix containing the mean transfer times in the actual state.	3.3
PUT_SKIM_PLAN.TWTA	Visum matrix file	Matrix containing the mean transfer times in the planned state.	3.6
PATHSETTINGS.PFD	Visum project directories	Settings regarding the Visum project directories.	3.6



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