NEW FEATURES AT A GLANCE

PTV Visum 2024

Imprint

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Content

1 Procedures

1.1 Integrated demand calculation for ABM

ABM Nested Demand is a procedure to calculate disaggregated demand. It can be described as a spatially and temporally disaggregated 4-step, tour-based or Nested Demand model. It includes the destination and mode choice steps and is based on the same nested logit model as aggregate models. Most model parameters, as well as population and structural data, can be transferred from aggregate models to an ABM. The same is true for the static PrT assignments as well as the dynamic public transport assignments. With ABM Nested Demand, that is fully integrated in Visum, the effort to build an ABM is comparable to that of an aggregated model.

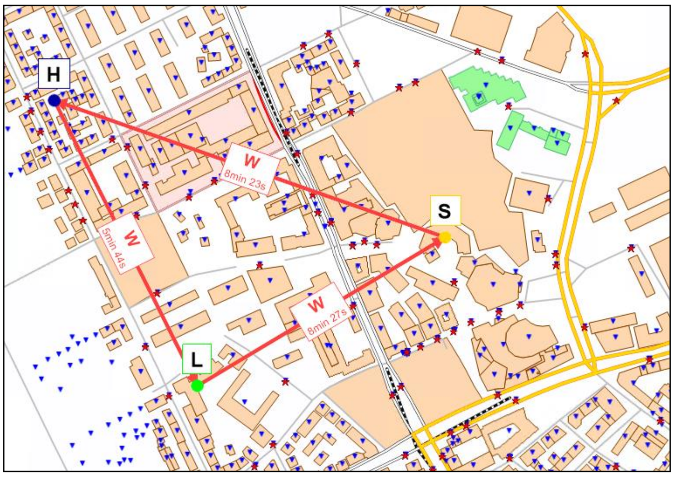

Figure 1: Representation of an ABM tour Home - Leisure - Shopping - Home with the walk mode.

Disaggregation allows destination and mode choices to be made on a very accurate basis. The temporal disaggregation enables the consideration of opposing supply qualities in PrT and public transport. This enables scenarios to be analyzed on various current questions, such as a morning toll, a denser frequency at peak times, or parking management.

The spatial disaggregation leads to a more precise modeling of the non-motorized traffic. Since the demand calculation does not require the existence of public transport connectors, scenarios concerning public transport accessibility in particular can be analyzed very precisely. Another function is long-term choices such as the workplace choice. The workplaces can then be left unchanged, especially in short-time scenarios.

In contrast to the trip-based view, the tour-based view enables analyses of phenomena such as home office, e-mobility or COVID-19.

An absolute novelty is the stability of the calculations. While probably every other ABM is based on so-called Monte Carlo simulations and thus generates random choices at the level of a single agent, the ABM Nested Demand is stable and consistent. This means, for example, that in two successive iterations of the demand calculation, if utility remains unchanged, all choices are also unchanged; and that changing utility leads exclusively to consistent new choices. Thus, since there is no more so-called white noise, the consequences of very small-scale scenarios can also be analyzed.

1.2 Fast shortest path search for public transport assignment

There are two options available for the search of the timetable-based public transport assignment, namely the branch & bound search and the shortest path search. Over the last few years, the Branch & bound search has become the standard, because it was much faster in urban networks. In Visum 2024, the shortest path search has been modernized. It is now based on a so-called Connection Scan Algorithm (CSA). This change has massively accelerated the new shortest path search. It is 4 to 100 times faster than before and also faster compared to the Branch & bound search by a factor of up to 20. These figures are based on tests with different models. In specific cases, the comparison results may differ.

Both options available in Visum have their strengths and weaknesses, which are briefly explained here. The shortest path search finds the best connection for each origin-destination pair and departure time, but only takes two criteria into account, namely journey time and the number of transfers. Due to the temporal independence of the individual connections, the connection set is robust to changes, e.g., the introduction of express connections. The stable connection set and speed up make the new shortest path search attractive for projects where public transport skims are calculated and in which the consideration of journey time and number of transfers in the impedance of the search is sufficient. The Branch & bound search is suitable in applications where multiple criteria are to be considered in the search and where other attractive connections are to be included in the connection set in addition to the best path. The Branch & bound search has proven itself in applications in which passenger flows are analyzed or in which public transport indicators are calculated.

It should be noted that the new shortest path search calculates connections for a destination zone from all origin zones, while the Branch & Bound search calculates connections from a origin zone to all destination zones. For this reason, the parameter dialog of the timetable-based assignment (Tab ‘Basis’) has been adapted for restricting origin-destination relations. You can restrict the range of zone numbers of origin and destination zone. The option to restrict relations using a filter still exists.

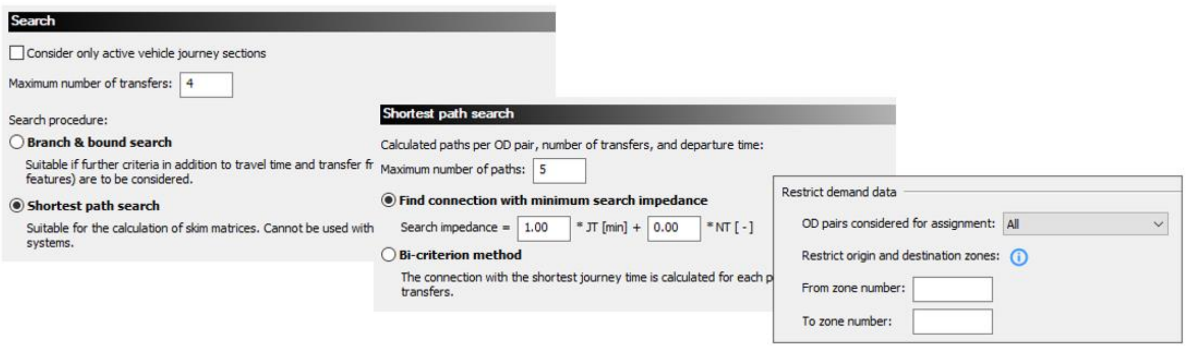

Figure 2: Settings for the shortest path search and for the restriction of demand data in the timetable-based assignment

1.3 Smaller changes in procedures

1.3.1 Differentiation for walk times in the public transport assignment

A passenger's trip on public transport starts and ends with a walk leg that takes him or her from the origin zone to the first stop and from the last stop to the destination zone, respectively. In addition, passengers experience some walk times when transferring from one vehicle journey to another. These two types of walk times are now distinguished in the general procedure settings:

- Maximum walk time for access and egress
- Maximum walk time for transfers

The maximum walk time for access and egress excludes walk times on the connectors. The maximum walk time for transfers excludes walk times for transfers within a stop. In other words, transfers within a stop are always possible regardless of the restriction imposed by the parameter.

The differentiation of walking times allows for a better parameterization of the public transport assignment. Thus, it is possible to keep the time restriction for transfers significantly smaller than for access and egress. This change is also motivated by the new shortest path search in the timetable-based assignment, because to take full advantage of the runtime savings of the new shortest route search, transfer times that are captured by the parameter 'Maximum walk time for transfers' must be minimized.

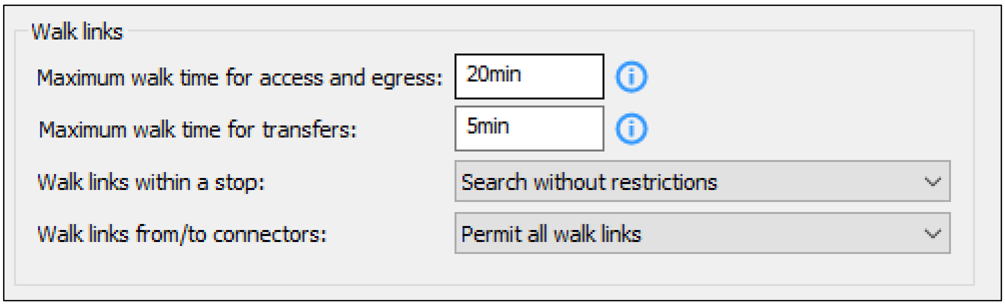

Figure 3: General procedure settings for walk times in public transport assignments

When reading version files saved with Visum 2023 or older, both parameters of the maximum walking times are set to the value of the maximum walk time.

1.3.2 Matrix estimation: new default weight in least squares

Visum offers various options for adjusting a matrix to count values. With the least squares variant, so-called weights must be defined for the counts. Since these weights are difficult to interpret, the constant value 1.0 is often used for all count values. This is not an optimal choice: large count values dominate the matrix estimation, small count values hardly play a role.

Therefore, the method now offers the possibility to use default weights. These weights automatically lead to a reasonable balance between large and small count values.

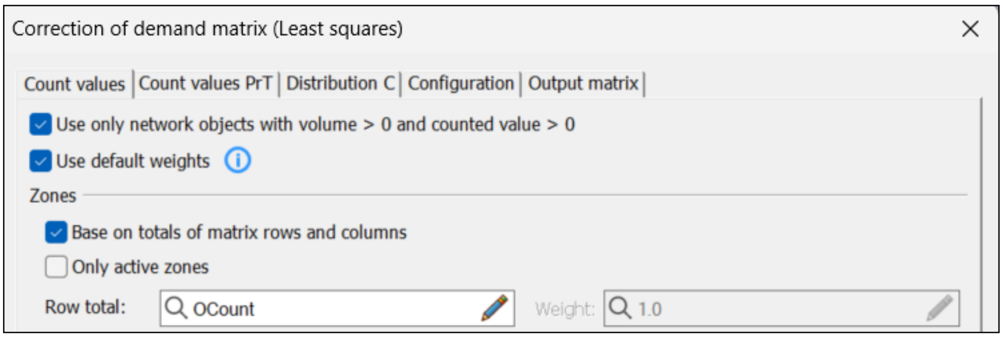

Figure 4: New option Use default weights

1.3.3 A new procedure for the calculation of split factors

The new procedure allows the integration of demand matrices based on a zone system other than the current one.

A typical use case is demand at the district level that is to be integrated into an existing model. In some places the existing traffic analysis zone system has a higher resolution, in others it is coarser than the district layer. The boundaries of the two systems do not always match and overlap in some places. The split of district demand should be based on a residential building layer on the origin side and a building layer with job counts on the destination side.

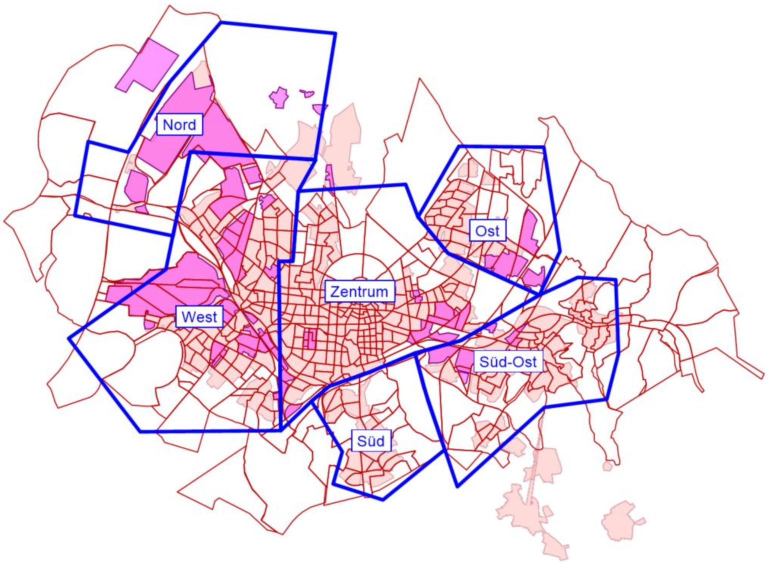

Figure 5: District-level demand (blue boundaries) is to be integrated into the existing zone system (red boundaries). On the origin side, a residential building layer (light pink areas) is to be considered, and on the destination side, a building layer with job counts (dark pink areas).

By intersecting the layers, the feature generates so-called split factors, which can be used to convert external demand matrices into internal matrices based on the zone system of the existing model.

1.3.4 EVA – trip generation with sub space balancing

The procedure EVA trip generation has been extended. The procedure calculates the target values for production and attraction. By default, the sum of values for the production targets equals the sum of values of attraction targets for all active zones. In Visum 2024 the values can be equal for subspaces. A subspace contains all zones for which the value of a selected zone attribute is identical. In models, subspaces are typically defined using administrative areas such as municipalities, districts, counties etc.

In the example shown below, main zones were used to define subspaces. The activated option ‘Use subspace balancing’ means that values for production target and attraction target are equal for main zones.

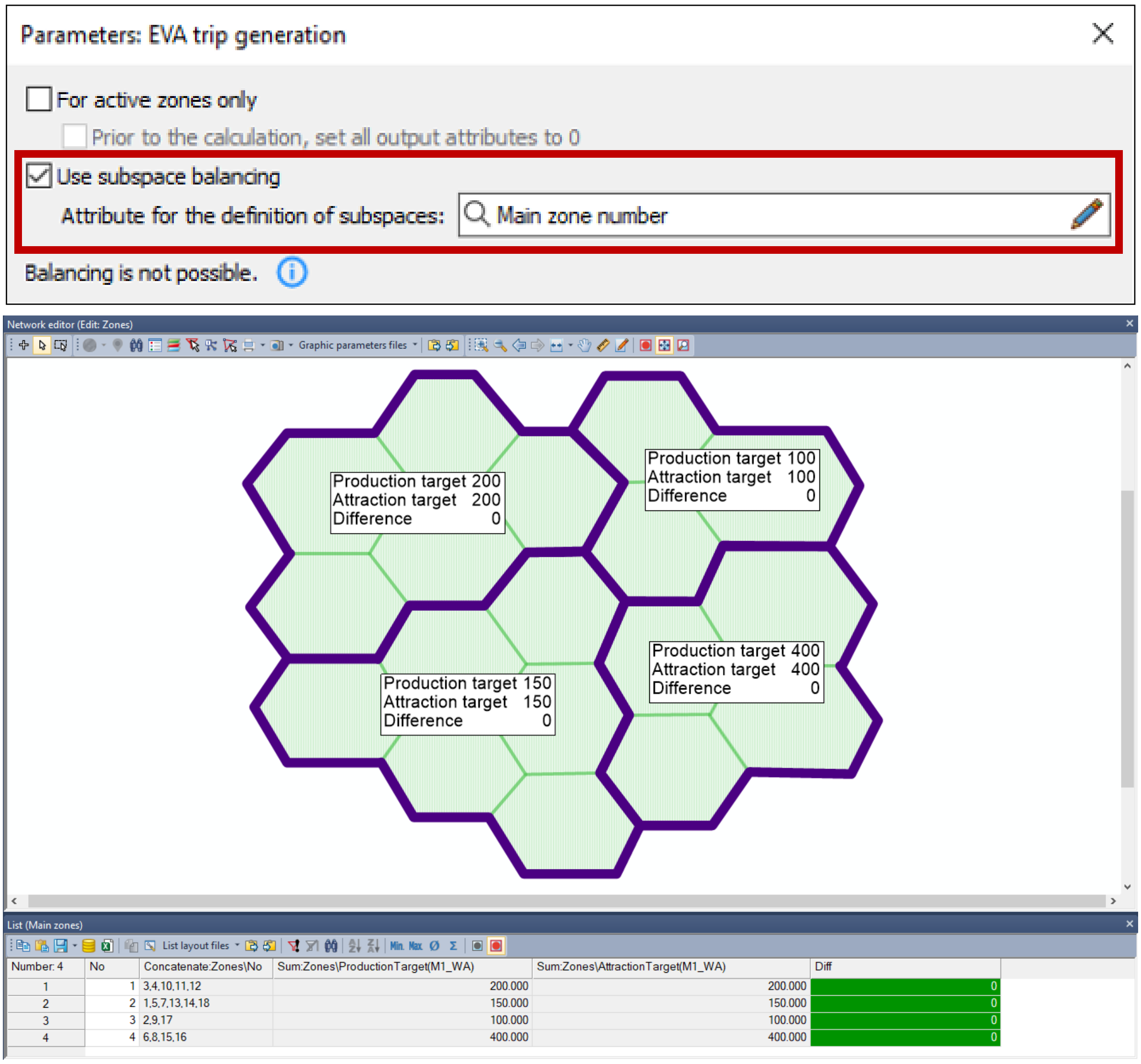

Figure 6: Calculation of EVA trip generation with subspace balancing

Depending on the OD type balancing is done on the side of an activity pair that does not correspond to the home activity.

1.3.5 Line blocking with the consideration of the duration of services

Line blocking establishes a connection between the vehicle journeys of the timetable and the service plan of the vehicles. The results contain the required number of vehicles and the operating performance as well as costs for current and planned timetable variants.

The procedure determines the cost-optimal solution from a large set of possible solutions. In Visum 2024 it is possible to take the minimal and maximal operation time of the vehicles into account when selecting the optimal solution. Operating times, i.e. times between depot stops, that are below or above these limits will be evaluated negatively. This prevents planning of line blocks that involve only a few trips or are last longer than the drivers' shift times. This additional component results in a realistic depiction of the line blocks and therefore of the operating costs.

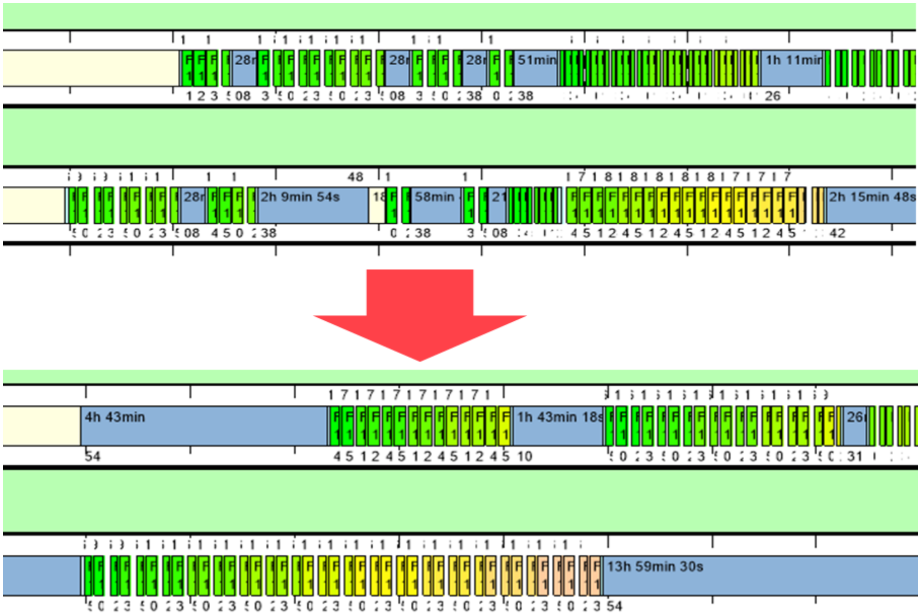

Figure 7: Line Blocking result with (below) and without (above) considering the duration of operation

2 Interfaces

2.1 Import of elevation data

Elevation data are of particular interest for modeling of active modes as well as for E-mobility. Both forms are in the focus of the planning process and become more important for decisions. Last year, we added elevation data in the OSM import. As an alternative to such punctual information elevation data are often available in the form of digital terrain models (DTM). These models are created from remote sensing data from satellites or aerial surveys. The elevation information is contained as area-wide grid cells of uniform edge length (e.g. 30m). A common data format is GeoTiff, a graphic file format in which the elevation data are encoded as grayscale values in a georeferenced raster image. With Visum 2024, the extraction of elevation data from this format is supported. By intersecting and interpolating the raster data with the network data during import, z-coordinates are allocated to nodes and intermediate points of links. The following link attributes are then calculated automatically using these z-coordinates:

- Maximum positive slope and maximum negative slope
- Accumulated positive and accumulated negative height
- Average slope

These attributes can subsequently be used both for the definition of impedances of active modes as well as in the consumption function for calculating the ranges of E-vehicles. The input attribute 'gradient' can also be optionally set when importing elevation data.

The z-coordinate of the intermediate points of the links can be displayed and interactively edited via the context menu of links if the 'Permit interactive editing of geometries' option of the network editor is active.

A source for elevation data with worldwide coverage with a resolution of 30m can be found on the internet by the Shuttle Radar Topography Mission of NASA.

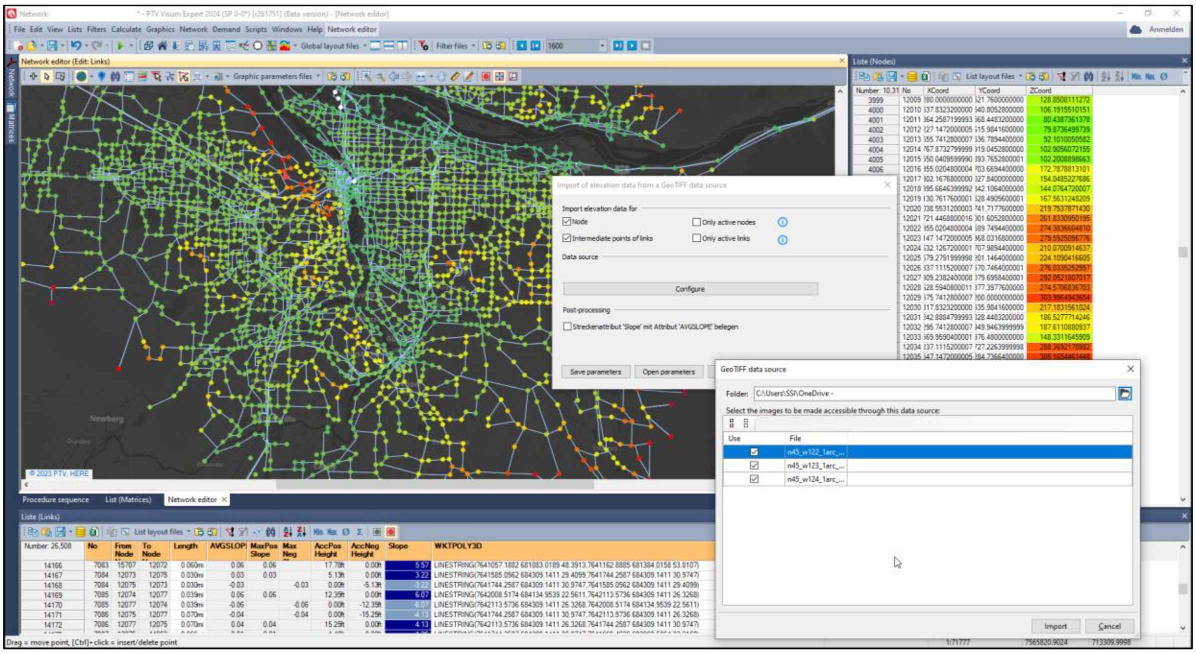

Figure 8: Dialogs for the import of elevation data

2.2 Merging of link data from different transport networks

In Visum 2024, link data can be transferred from one transport network to another using geographic information. The allocation and integration of such data is for example designed for the following use cases:

- Exchange of link data between a transport model and road data bases in both directions, i.e.
  - To enrich transport models with information from road databases such as locations of road works, blockages, conditions of road surfaces, road conditions, accidents
  - To transfer results such as volumes (or other attributes) from a transport model into road data bases to use and display them in other systems
- Transfer cycle routes or other cycle-related information into an existing transport model
- Update link data with more recent information

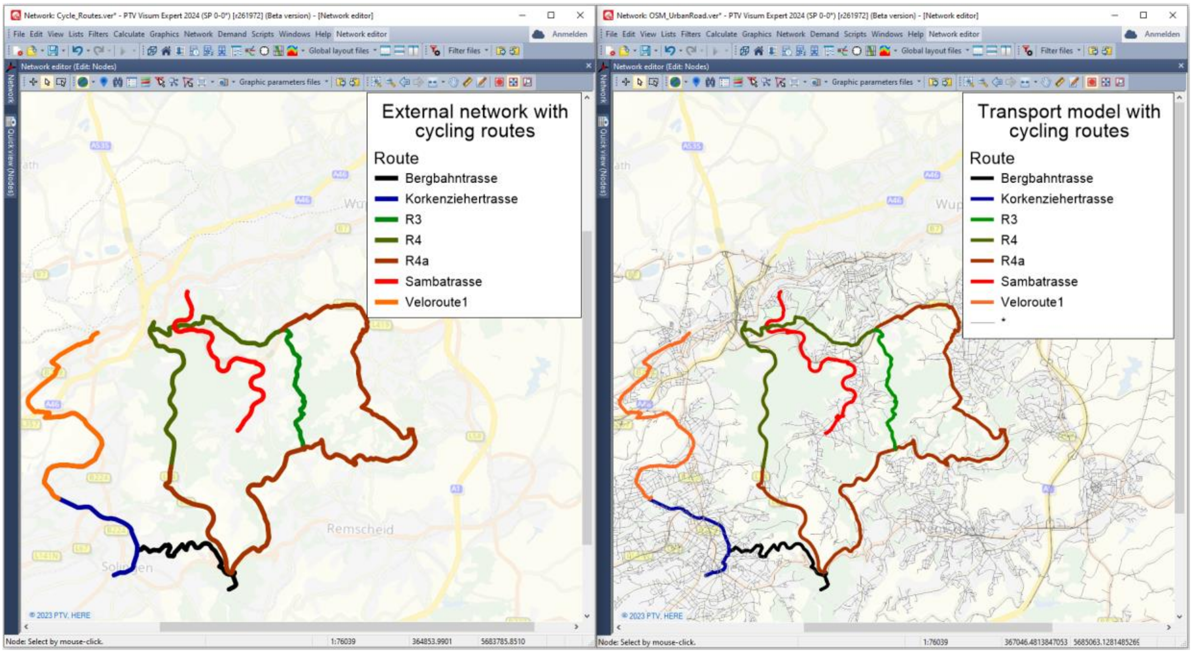

Figure 9: Import of cycling routes from external sources into a transport model

For the import two Visum version files are used. Routable networks are of advantage but not necessarily required. In most cases, the transport model is opened in Visum and a second network with the external information is opened in the background during the import.

There are different options to transfer link data between these two versions:

- Transfer of link data and their attributes from the external network to the currently opened version whereby the version file can be changed, i.e. creating new nodes and links is allowed as well as splitting links
- Transfer of link attributes from the external network to the currently opened version file without changing network objects
- Transfer of link attributes from the currently opened version to the external network (network objects in the external network cannot be changed)

The import is divided into three main steps:

- Generating link sequences in the external network

- Matching of these link sequences to links in the currently opened version file
- Transfer of link data and their attributes

The link sequences are generated based on the permitted transport system along successive links as well as from the similarity of links with regards to selected attributes such as the road name (e.g. M25 or Interstate 880) or name of a cycle route (e.g. Main Cycleway). The link sequences are matched to links of the currently opened network using the map matching algorithm and a shortest path search. As a result of this step link sequences and links are allocated to links in the currently opened version including shares and relative positions. Attributes values can be transferred in both directions. If link attributes are transferred from the external network to the opened version there are options to allow network changes (creating links and nodes, open links and turns for the transport system or split links). Attribute values are transferred in the same way as for the intersect operation using the allocation of links in the target network to links in the source network and their overlapping length. The aggregation function is determined by the type of the attribute. For example, numerical attributes can be transferred weighted with length using the aggregation function ‘Maximum’ or ‘Mean’, for string-valued attributes the aggregation function ‘Maximum share’ can be used.

Optionally, the link sequences generated in the external network can be stored in POIs of a selected POI category. Together with the model transfer file and the allocation of links to POIs the result of the import can be validated.

2.3 Transfer of intersection data using update data from Vistro

Besides importing Vistro files (*.vistro), in Visum 2024 Vistro update data (*.vistroupdate) can also be imported into Visum. This data can be created using the export from Vistro (via menu File > Export > Update Data). In contrast to *.vistro files, update data contains only the data of the selected scenario or the base scenario without mitigations.

The import of Vistro update data is primarily used to transfer and update intersection data, more precisely geometry and control of nodes in the Visum model. This can save modeling efforts in Visum that traffic engineers have already spent in creating and maintaining Vistro models. In addition to the junction data, links and optimization routes of the Vistro network are transferred. The transfer of turn volumes is, however, optional.

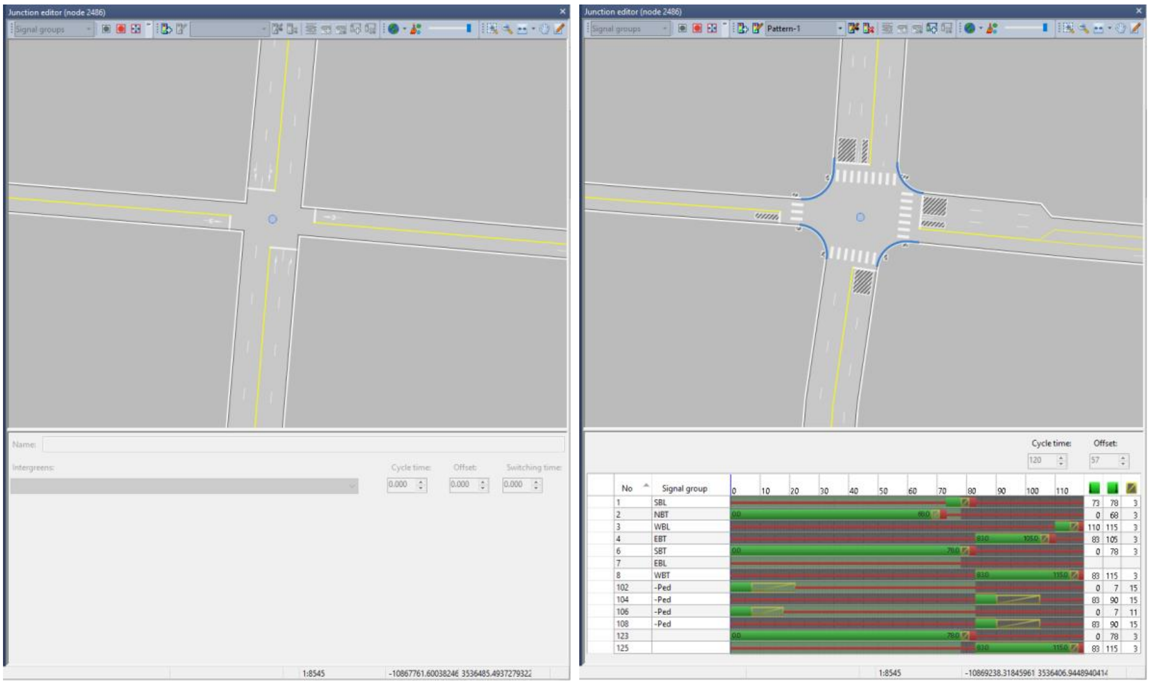

Figure 10: Display of a node in the junction editor before (left) and after (right) the import of a Vistro-Update

By default, the allocation of nodes from the Vistro network to the Visum model is based on coordinates but can be changed to attribute IDs by the import parameters. For example, when importing the file for the first time the Vistro node numbers are stored in user-defined attributes (UDA) of the corresponding Visum nodes. If the import of a Vistro update is repeated at regular time periods, the allocation can then be based on these UDA for subsequent imports.

Nodes and links, that only exist in the Vistro network are added to the Visum model. For links, their courses, the number of lanes and the permitted private transportation systems are adjusted. Capacities and free flow speeds of links in the Visum model are not changed and these attributes are not defined for links created during the import.

For the import, a spatial filter using corresponding objects (e.g. territories, zone, POIs) with surfaces can be used to restrict the import. This means that only nodes and routes within this spatial object will be imported.

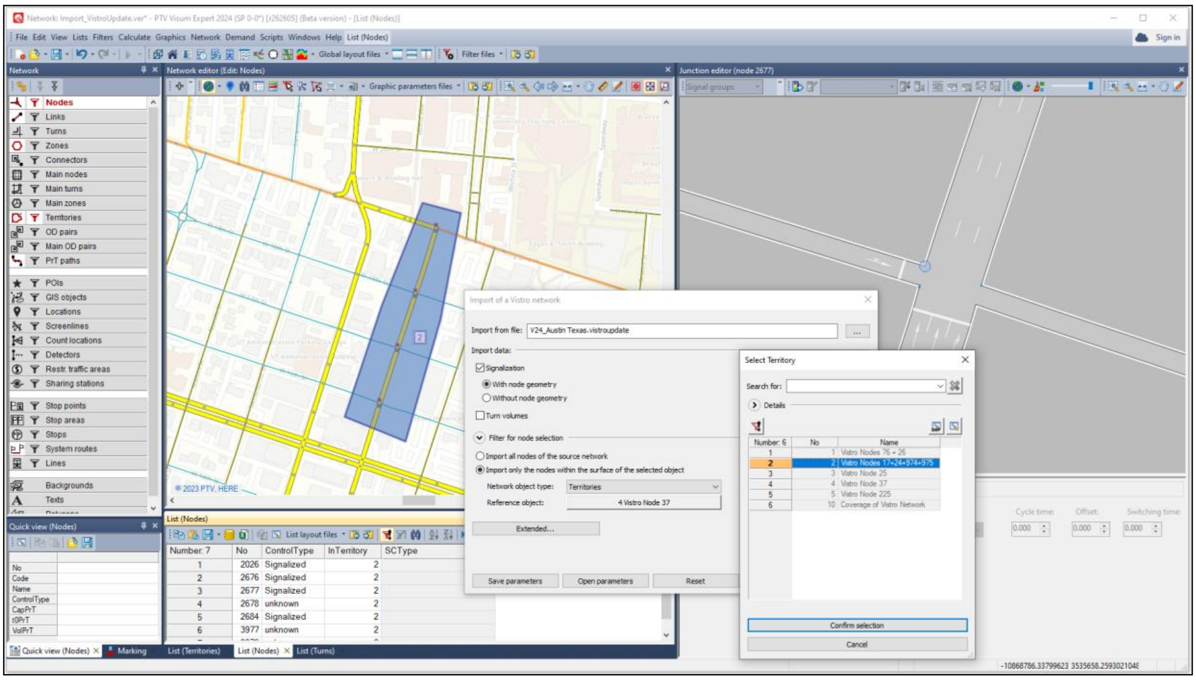

Figure 11: Dialog for importing Vistro update data plus spatial selection using a territory

Each import creates a model transfer file that gives an overview of changes of Visum model. This file can be saved to check and document the changes.

3 Handling & user interface

3.1 Excel export and CSV export from lists

A new export to MS Excel from lists has been implemented. The export follows the idea "What you see is what you get" (WYSIWYG). The export does not require any additional settings and the result corresponds to the display of the list. That means the following settings of the list are considered:

- Column headers
- Aliases
- Settings for formating
- Color scheme
- Filters
- Aggregation rows
- Groupings

In addition, comments are added in Excel. The first column contains information about the number of filtered objects or display of data. Comments of columns with attributes contain attribute descriptions or in cases of user-defined attributes (UDA) the information stored in the comment field in Visum.

The export is done in the language set for the user interface.

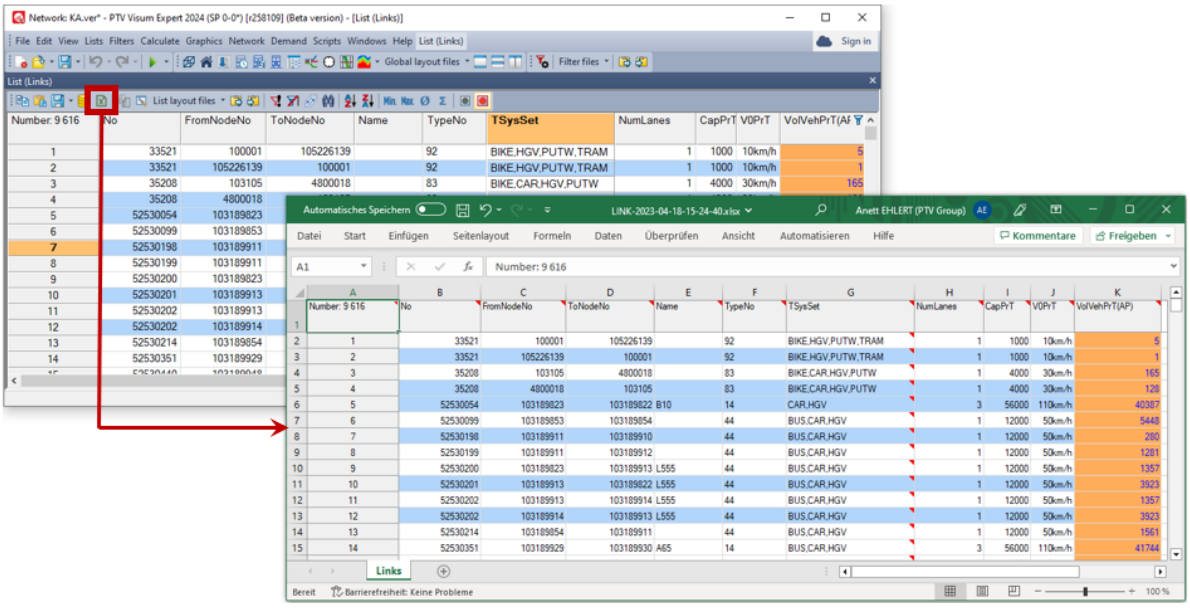

Figure 12: "WYSIWYG" – Export to MS Excel

The second export, the *.csv export, supports a completely different use case. The result of this export is mainly used for automatic postprocessing of the data, e.g. in scripts. There are fixed conventions for this export, among those:

- Human-readable text format
- Precise data without specifying the number of decimal places
- English attribute IDs
- ISO-8601 for dates and times
- Dot as decimal separator

- No thousands separator

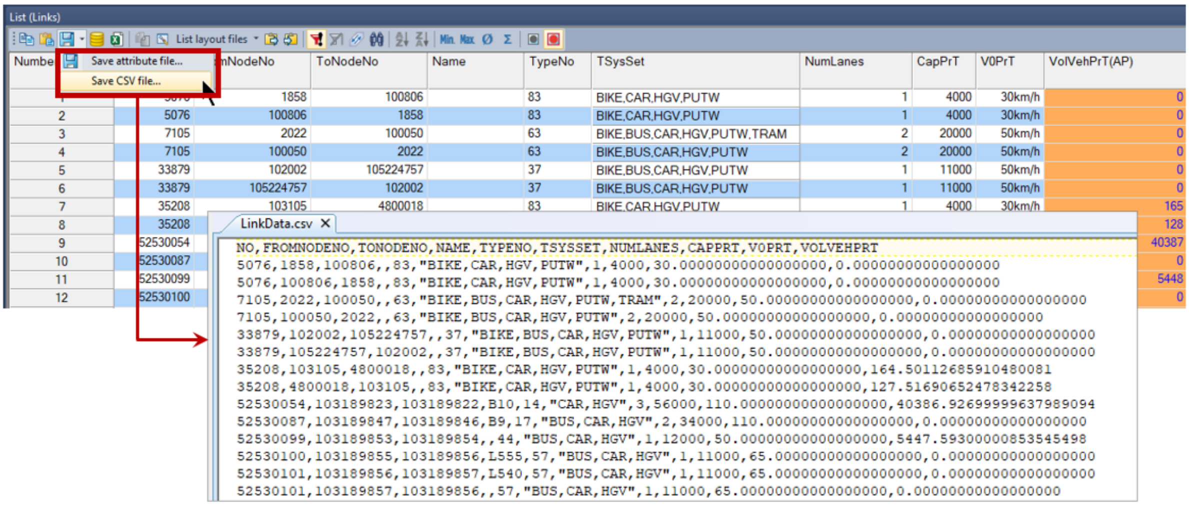

Figure 13: CSV – export of attribute file

Both exports need one click only without further dialogs. Saving an attribute file is still supported, but in English only. Reading attribute file in languages different than English is still supported but will be discontinued in the foreseeable future (see 4.1).

3.2 New GIS functionalities

3.2.1 Split territories

One or more territories can be split interactively by means of a dividing line. This functionality is accessible via the context menu 'Split geometrically'. The dividing line can be defined by a series of points. When digitizing, points of territories, links as well as nodes are snapped and additionally the dividing line automatically snaps to the shortest path between the two points when the CTRL - key is pressed.

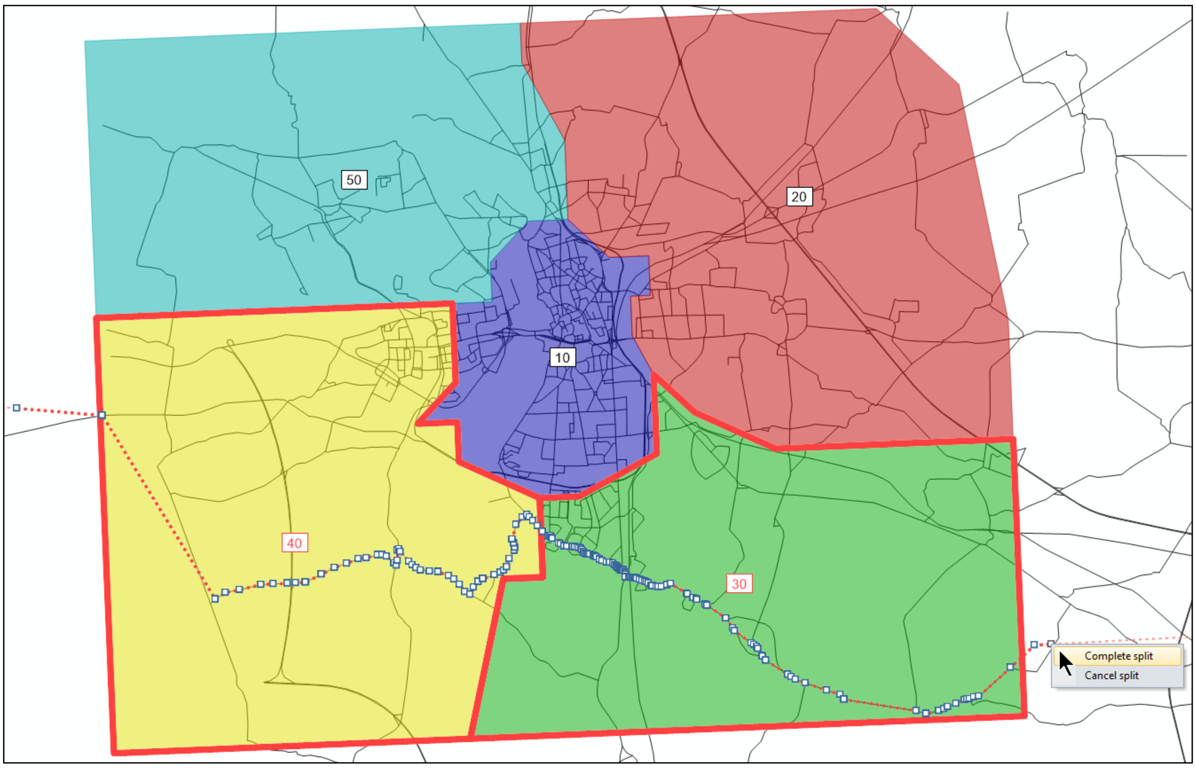

Figure 14: Definition of dividing line to split territories

The new territories are created with the next free number. Some attributes like code, name, type number are preserved. Calculation results like PuT operating indicators or territory indicators are deleted.

3.2.2 Intersect objects with surfaces as point objects

When intersecting objects with surfaces, there is an additional option in the intersect operation to intersect them as point objects. Using this option it is for example possible, to intersect different type of objects with surfaces with each other, taking into account the position of the centroid only.

The following Figure 15 serves as an example. It shows an intersect operation of zones with territories. In this procedure, the number of the territory is allocated to a zone attribute based on the location of the zone centroid.

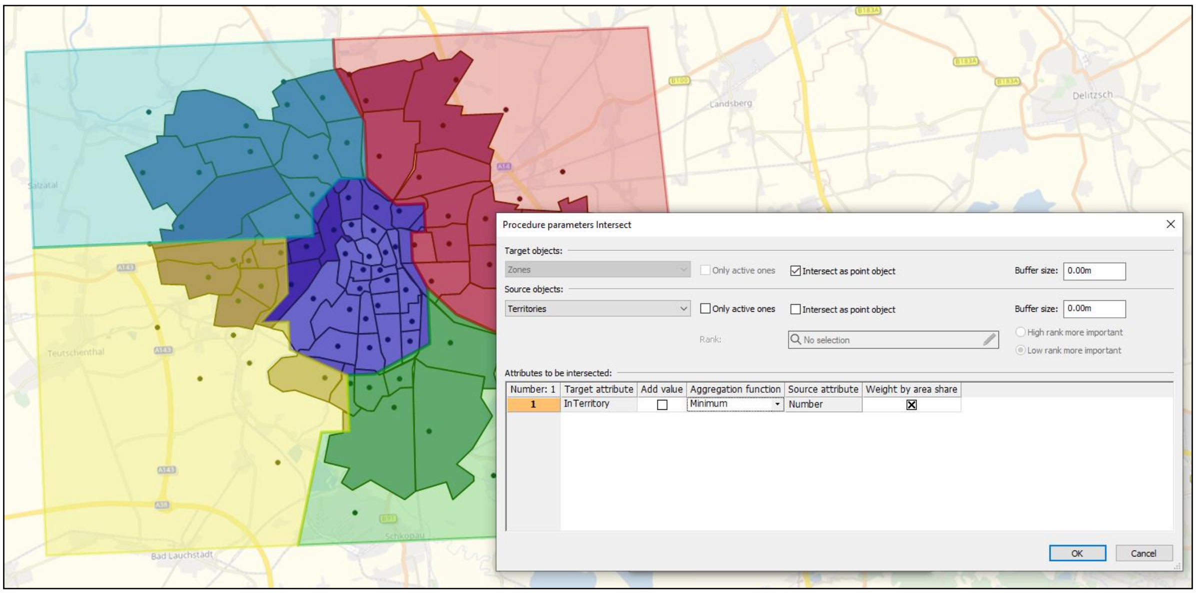

Figure 15: Intersect of zones as point objects with territories

3.3 Improved display of roundabouts in the junction editor

So far, roundabouts in the junction editor were displayed using a schematic representation, in which only a few input attributes were considered. The improved display in Visum 2024 takes additional input attributes into account and results in a more realistic display. Additional input attributes considered are:

- Roundabout inscribed circle diameter
- Roundabout entry radius
- Roundabout exit radius
- Number of conflicting lanes
- Roundabout circulating lane width (node attribute)

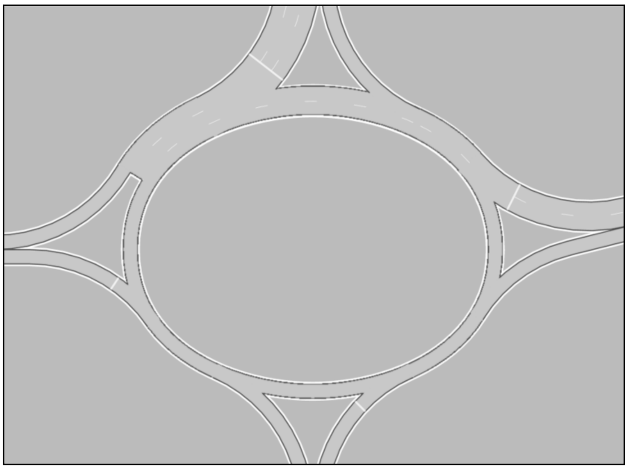

Figure 16: Oval roundabout with changing number of lanes in the roundabout

The improved display makes it easier to detect erroneous inputs. An easily overlooked cause of error was the number of lanes within the roundabout. The leg attribute ‘Number of conflicting lanes’ defines the number of lanes for the section between an exit and entry of the same leg (displayed in blue). The effect of this input attribute is now visible. The number of lanes between an entry and exit of successive legs (shown in red) is calculated using the number of lanes of incoming links.

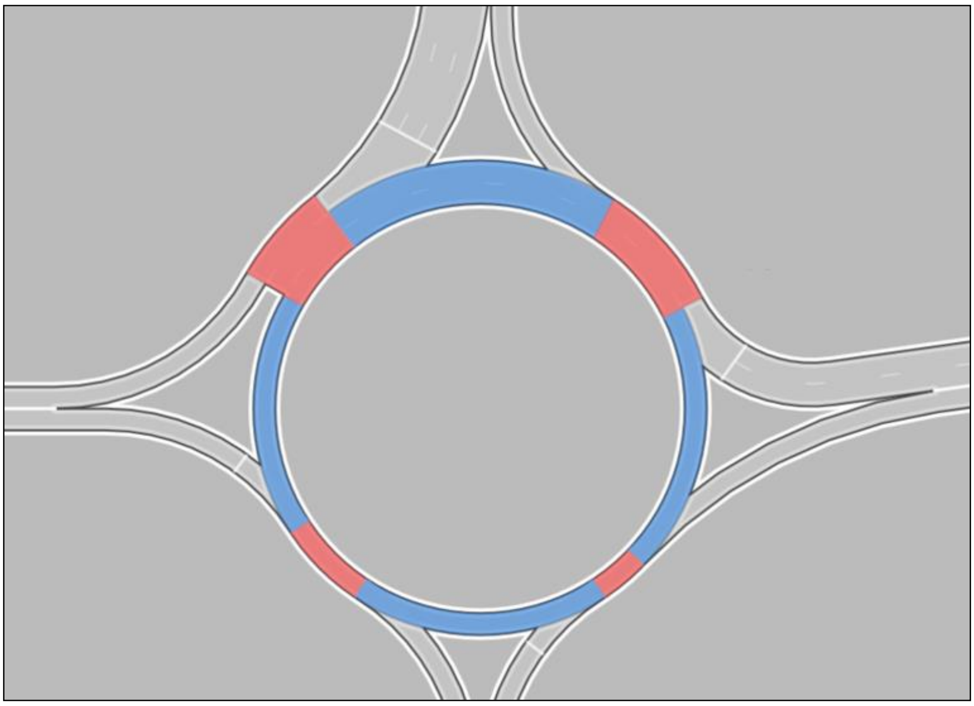

Figure 17: Effect of input attribute ‘Number of conflicting lanes’ (shown in blue)

3.4 Improvements in scenario management

There are some smaller improvements for the scenario management:

- Because of many requests the COM interface has been extended to also include access to comparison patterns.
- The load order of modifications can be adjusted more easily. You can mark multiple modifications and move them together using the arrow keys. Alternatively, the number of the load order can be edited directly. By doing so, the load order of both the modification with the number entered as well as the numbers of the following modifications will be adjusted accordingly.
- Opening scenarios with many model transfer files has been accelerated. This has a particularly positive effect if the individual model transfer files are small.
- The attribute identifiers for network comparisons have been improved. When applying a comparison pattern, the codes of the scenarios are used by default to describe calculated attributes of the comparison. Figure 11 below compares volumes from calculated scenarios 3 (as the leading scenario) and 1. The codes are defined as 'Code Sz3' and 'Code Sz1', respectively.

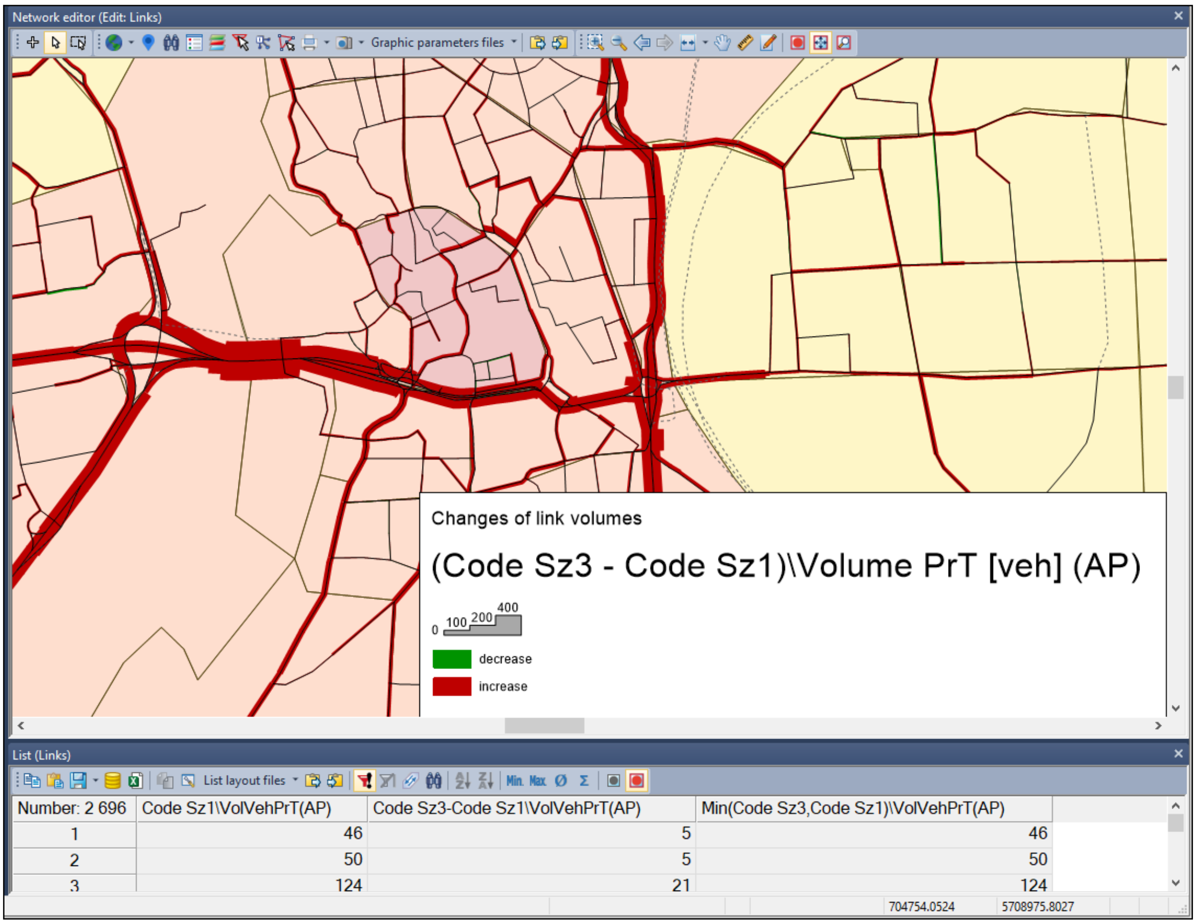

Figure 18: Attribute identifier when applying comparison patterns

The logic of creating these attribute identifiers is also used outside of scenario management, e.g. for version comparisons.

3.5 More flexibility for copying of attributes

Given the large number of attributes in Visum a simple and flexible handling of attributes is necessary. For this purpose, attributes can easily be copied to the clipboard in the attribute selection dialogs. The functionality can be accessed using the default keyboard shortcuts or via the context menu. Attributes can be pasted in the same way to the side of selected attributes in the attribute selection dialog or into search fields of other dialogs.

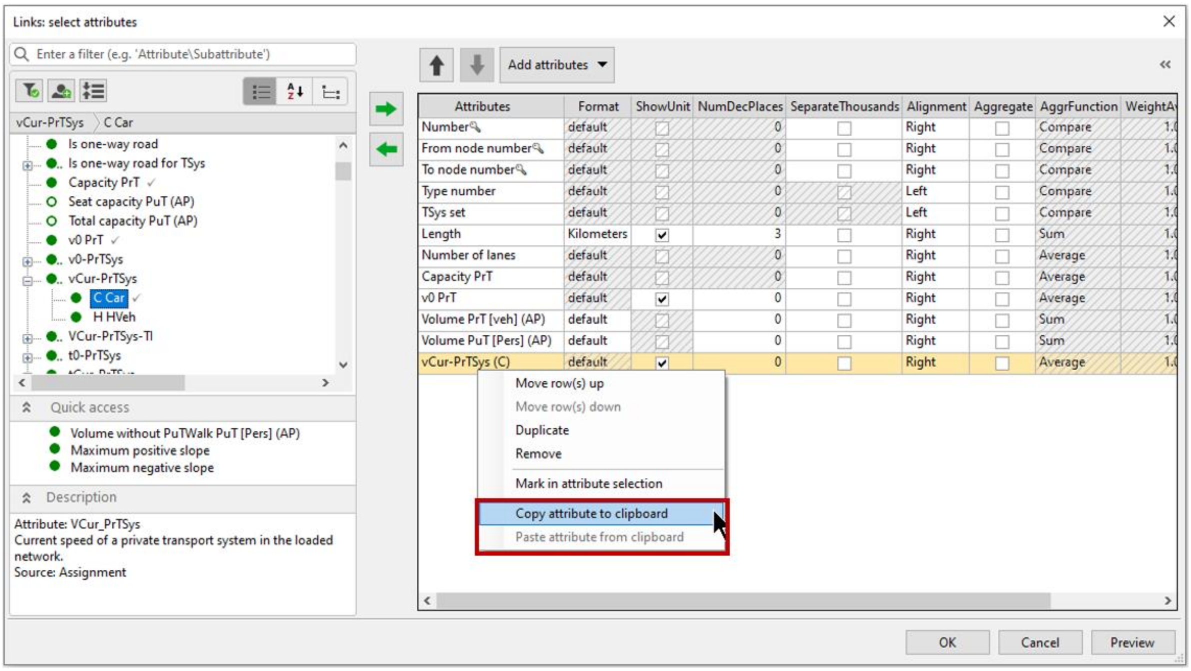

Figure 19: Copy & paste of attributes via the clipboard

3.6 Schematic line diagram: display of intermediate stops

The schematic line diagram provides a quick overview of all essential elements of service planning. Connecting nodes, arrival and departure times, headways as well as the type of service and operator can be displayed in a network context. To facilitate even better orientation and to adequately represent the quality of the service, intermediate stops can be displayed. These are stops that have not been included in the display as connecting nodes.

Intermediate stops are displayed in a simplified way as individual elements on the edges of lines. An option allows to display these stops also aggregated as a single object on the edge and to label them with the number of represented stops.

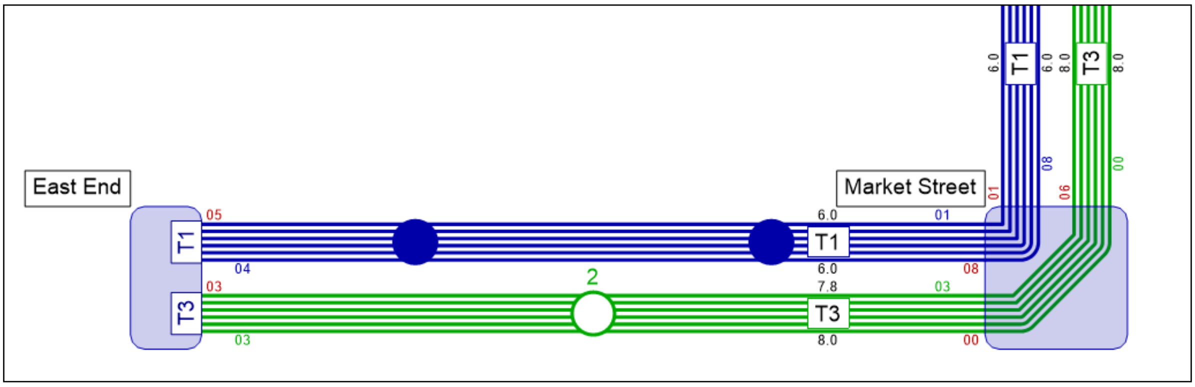

Figure 20: Display of intermediate stops in schematic line diagram

4 Technical changes and Python

4.1 Language settings for the export of text files

With the release of Visum 2024, a number of text files are always saved in English, i.e. the tables and attribute names listed in these files. The previously available user preference to switch to a language different from English has been removed. This affects the following file types:

- Network files (.net)
- Demand files (.dmd)
- Attribute files (.att)
- Model transfer files (.tra)
- Interval files (.att)
- Multi-row survey files

For a limited time, reading of these files in a language different from English will continue to be supported. In a later software version, reading of these file types will require files saved in English. If older files in other languages are still to be read, they must be "translated" to English by reading and saving them again in an earlier software version.

4.2 Python installation

The private Python installation under Visum has been updated to version 3.11. At the same time several libraries have been updated to newer versions. The Add-ins shipped with Visum have been adjusted accordingly.

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