PTV | **GROUP**

NEW FEATURES AT A GLANCE

PTV Visum 2024

Imprint

PTV Planung Transport Verkehr GmbH

Address:

Haid-und-Neu-Str. 15

76131 Karlsruhe, Germany

Management Board:

Christian U. Haas (CEO), Dr. Karsten Kölsch (CFO)

Contact:

Phone: +49 (0) 721-9651-0

Fax: +49 (0) 721-9651-699

E-Mail: info@ptvgroup.com

www.ptvgroup.com

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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 private transport assignments as well as the dynamic public transport assignments. With ABM Nested Demand, which is fully integrated in Visum, the effort to build an ABM is comparable to that of an aggregated model.
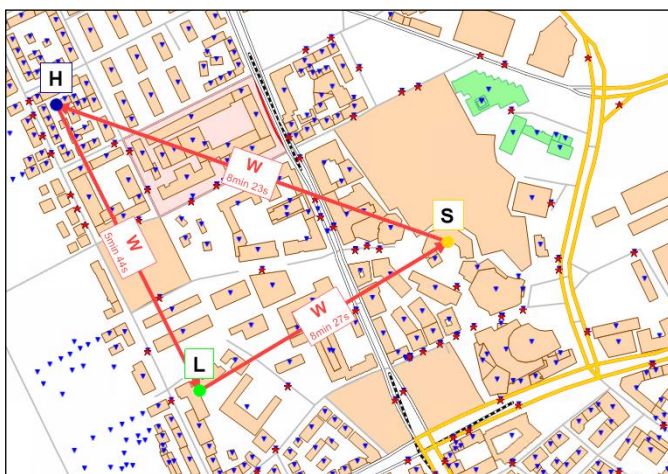

Figure 1: Representation of an ABM tour Home - Leisure - Shopping - Home with the walk mode.

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 private and public transport. It can be used to analyze scenarios for various current issues, such as morning tolls, higher peak frequency, 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 functionality 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 the 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 an 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 public transport assignment

A passenger's public transport trip 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. In addition, passengers face some walk time 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.

By differentiating the walk times, better settings can be made for public transport assignment. It is thus possible to keep the time restriction for transfers significantly lower 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 path 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 walk 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 and 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.
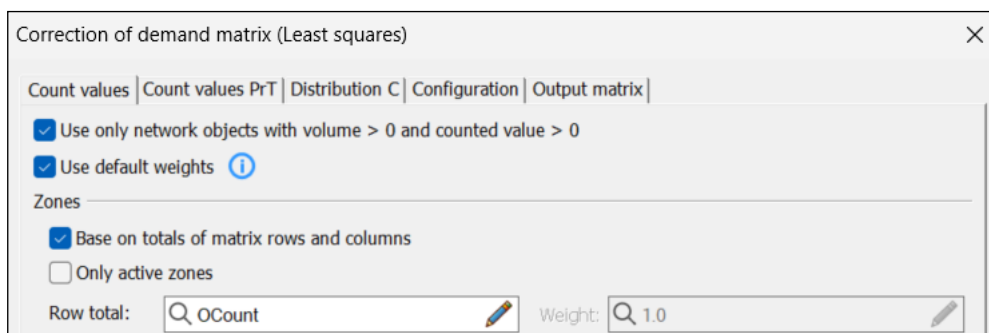
Figure 4: New option Use default weights

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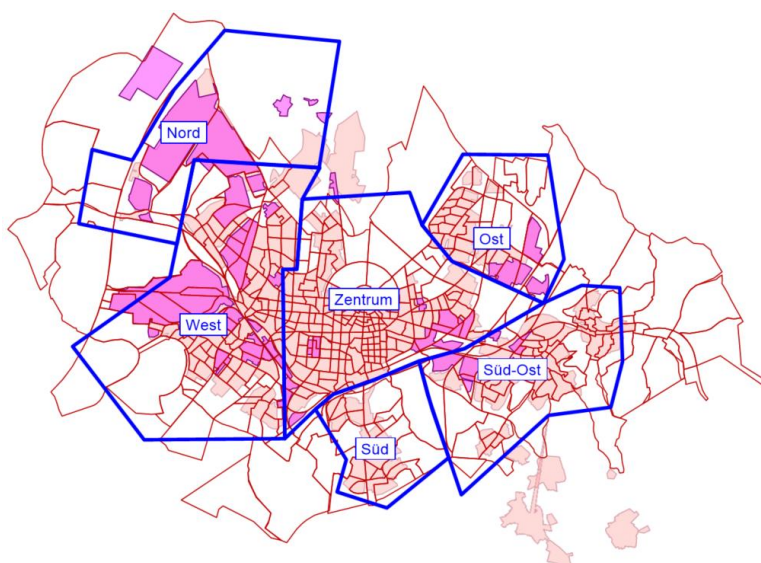
Figure 5: District-level demand (blue boundaries) is to be integrated into the existing zone system (red boundaries). On the origin side, a residential building layer (light pink areas) is to be considered, and on the destination side, a building layer with job counts (dark pink areas).

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 subspace 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 the production target and attraction target are equal for main zones.
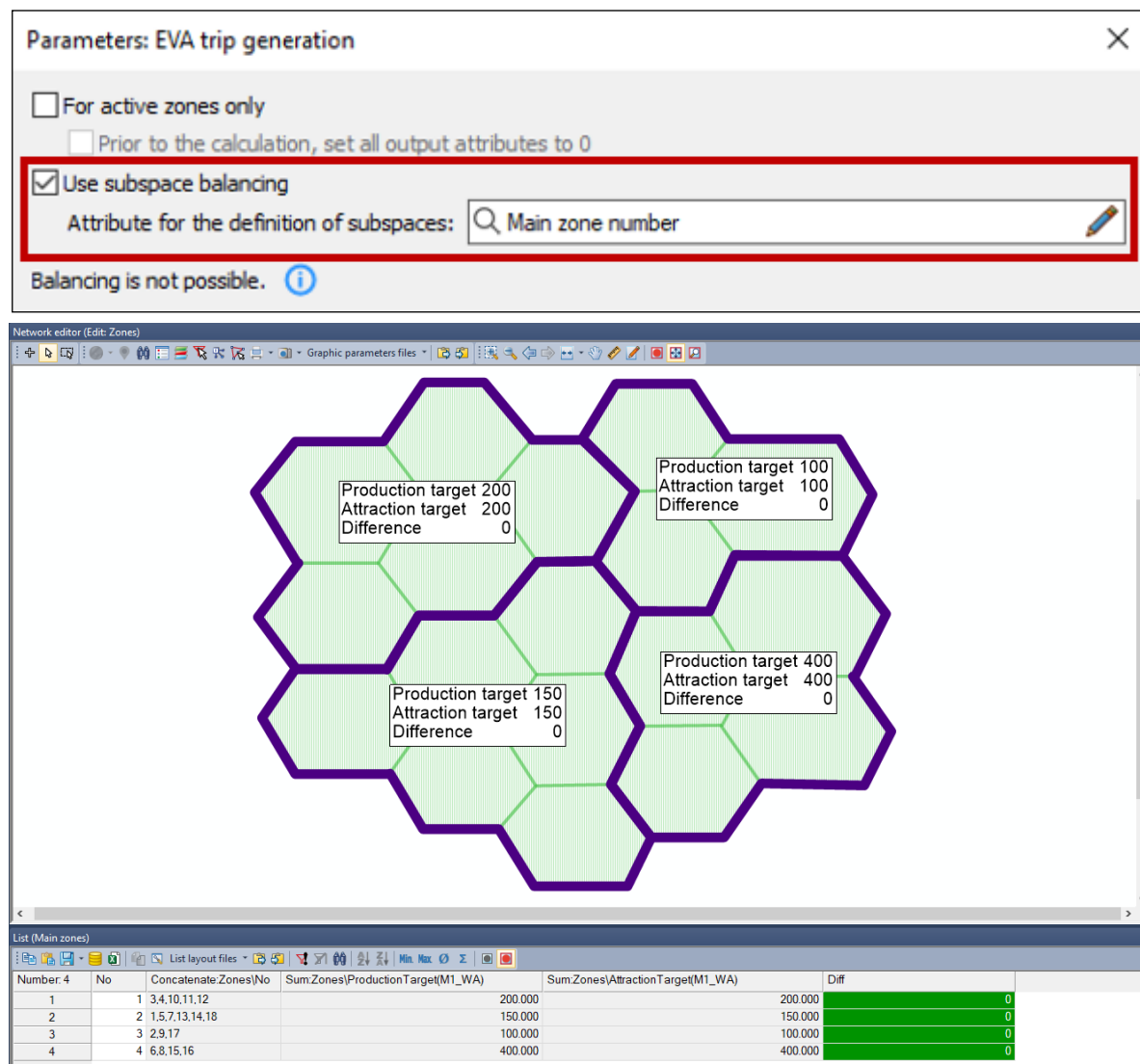
Figure 6: Calculation of EVA trip generation with subspace balancing

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 the planning of line blocks that involve only a few trips or 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.
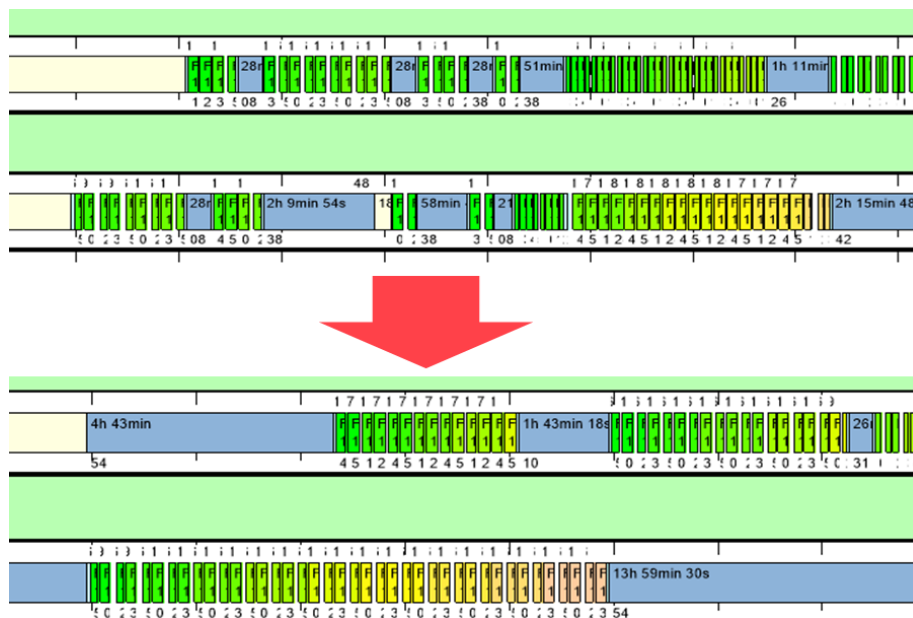
Figure 7: Line Blocking result with (below) and without (above) considering the duration of operation

2 Interfaces

2.1 Import of elevation data

Elevation data are of particular interest for modeling active modes as well as for E-mobility. Both forms are 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.
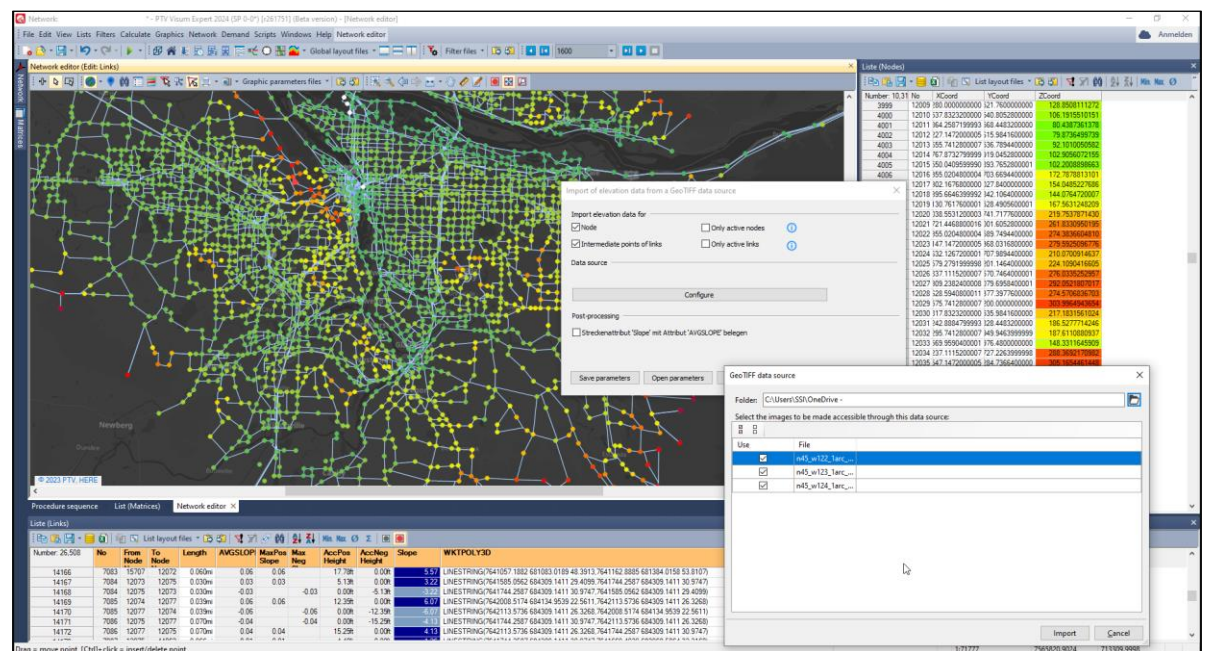
Figure 8: Dialogs for the import of elevation data

i Hint: When importing models from previous versions into PTV Visum 2024, the link attribute **"slope"** is reduced by a factor of 100. This value is now displayed correctly in percentage format in the list. This format is now also the default there. All calculations, such as the emission and noise calculations or the calculation according to ICA, which use the slope, have been adjusted. The adjustment does not change any calculation results. However, if you use the attribute "slope" in your impedance functions (e.g., for bicycle modeling) or as a component for consumption in the line blocking for e-buses, you must adapt your formulas accordingly.

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 databases 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 databases 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
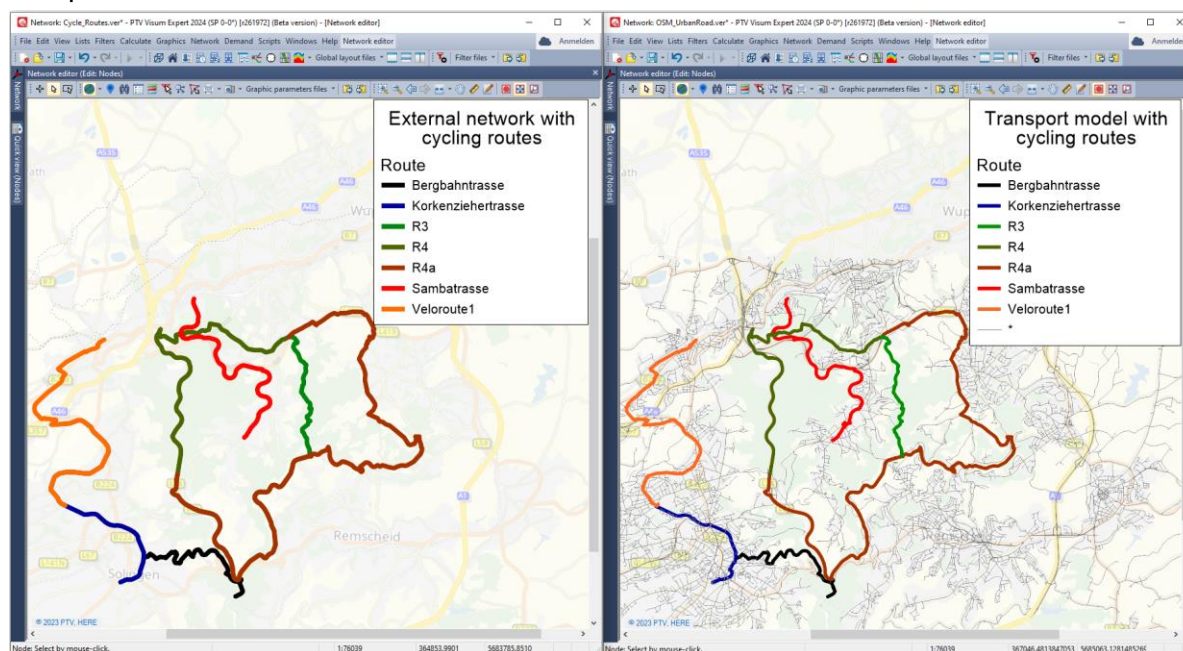- Transfer of link attributes from the external network to the currently opened version file without changing network objects
- Transfer of link attributes from the currently opened version to the external network (network objects in the external network cannot be changed)

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 the 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, opening links and turns for the transport system, or splitting 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 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), Visum 2024 can also import Vistro update data (*.vistroupdate) 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 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.
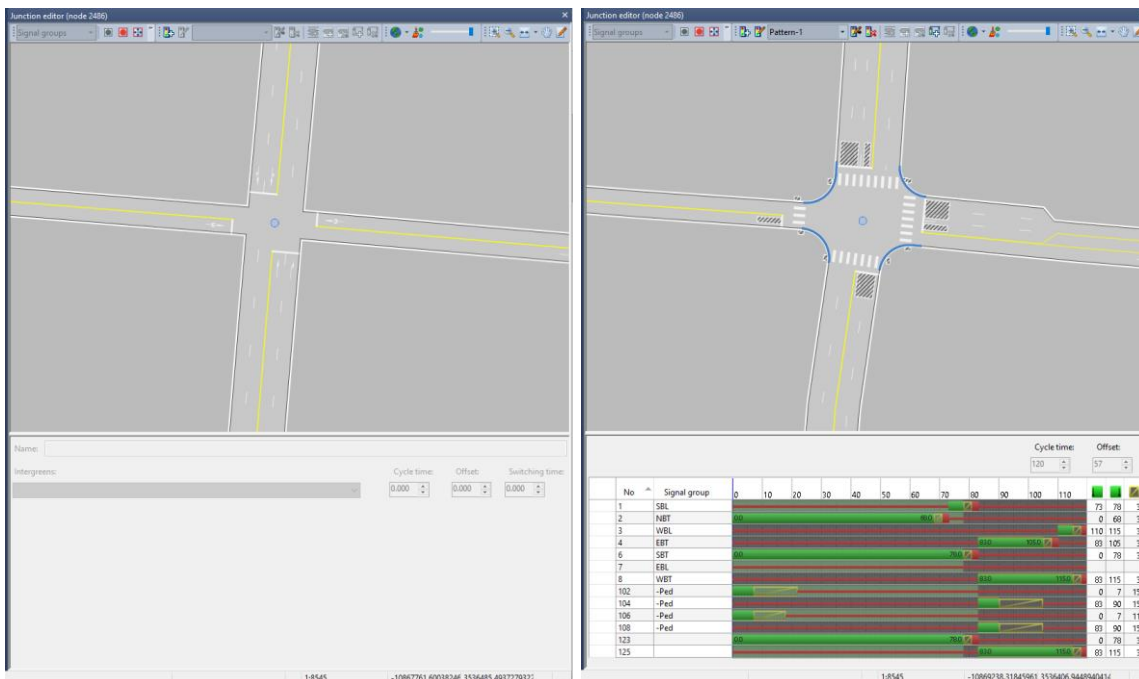
Figure 10: Display of a node in the junction editor before (left) and after (right) the import of a Vistroupdate

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 intervals, the allocation can 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 transport 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.

When importing, a spatial filter using corresponding objects (e.g. territories, zones, POIs) with surfaces can be used to restrict the import. This means that only nodes and routes within this spatial object will be imported.
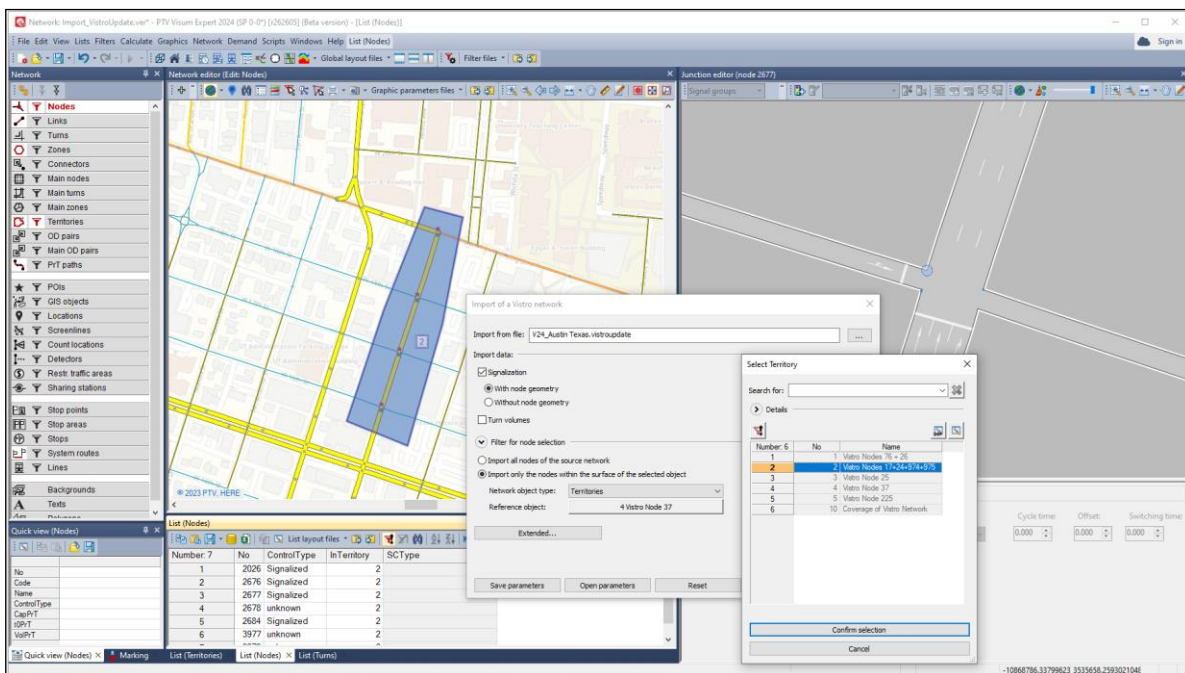
Figure 11: Dialog for importing Vistro update data plus spatial selection using a territory

Each import creates a model transfer file that gives an overview of changes in the 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 of lists to MS Excel 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.
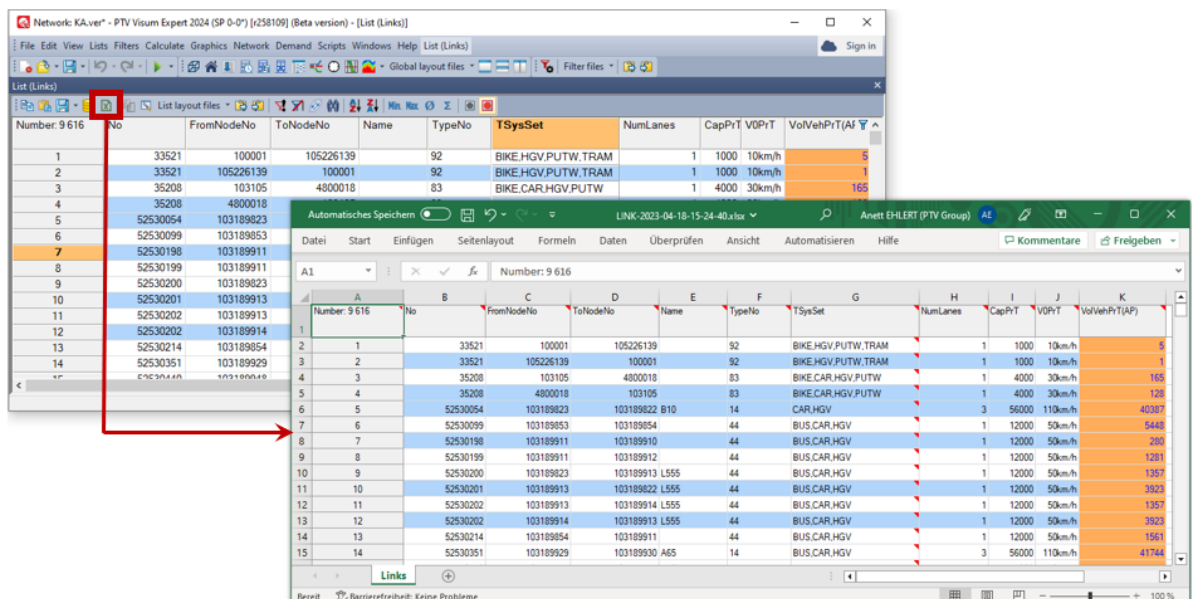
Figure 12: "WYSIWYG" – Export to MS Excel

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
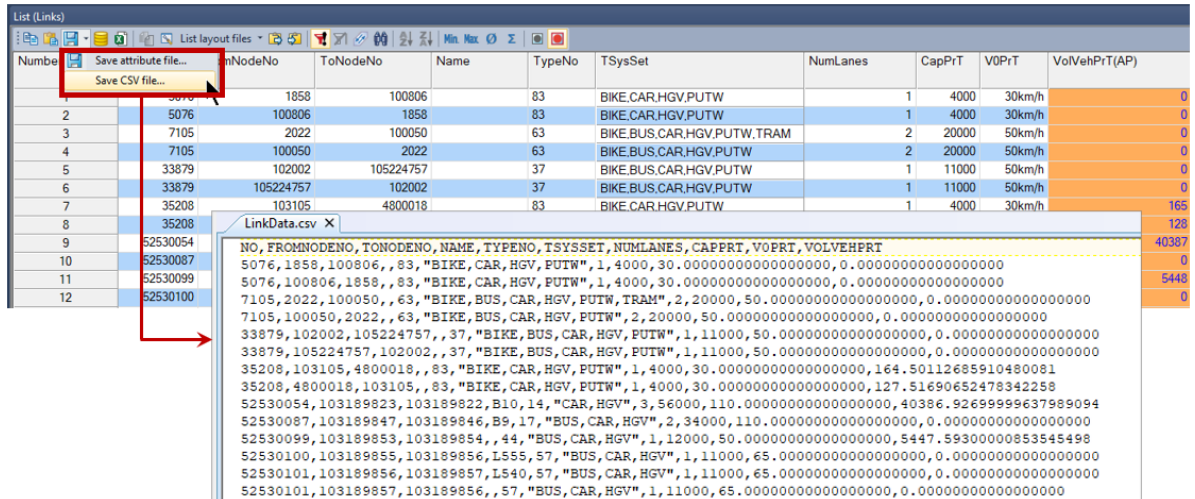
Figure 13: CSV – export of attribute file

Both exports need one click only without further dialogs. Saving an attribute file is still supported, but in English only. Reading attribute files 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 entry '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.
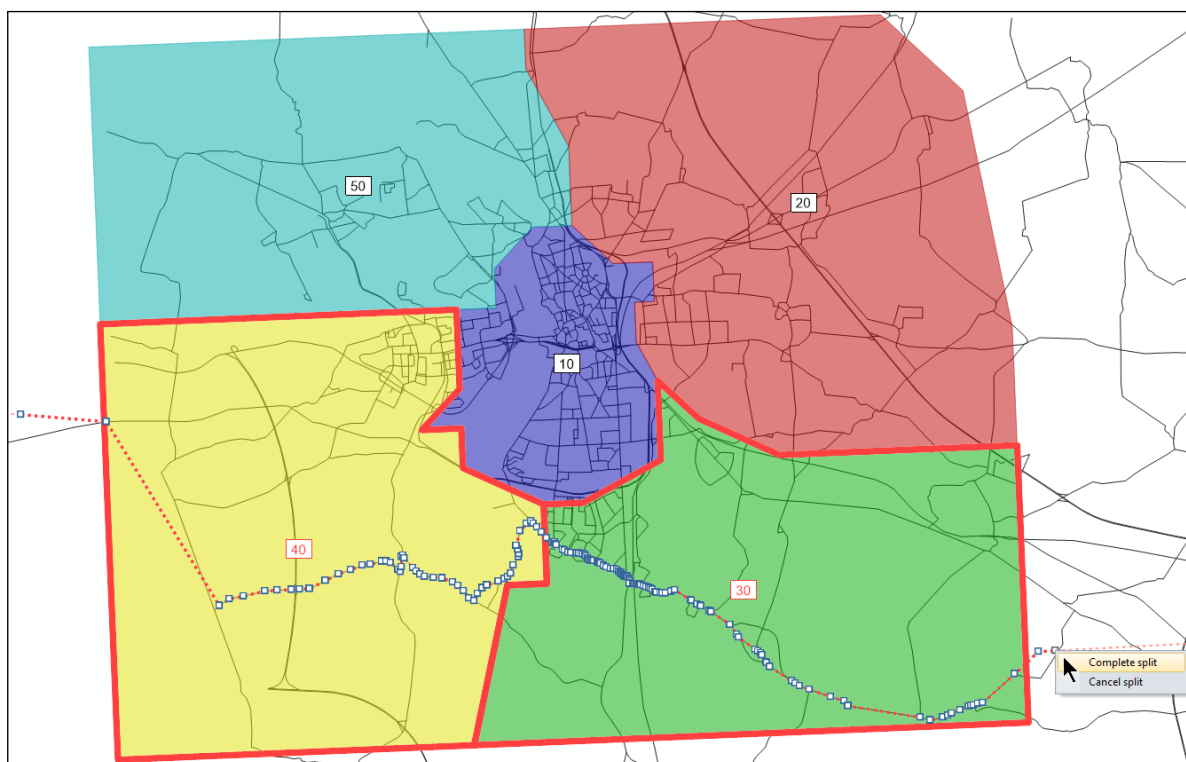
Figure 14: Definition of dividing line to split territories

The new territories are created with the next free number. Some attributes like code, name, and 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. With this option it is possible, for example, to intersect different types 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.
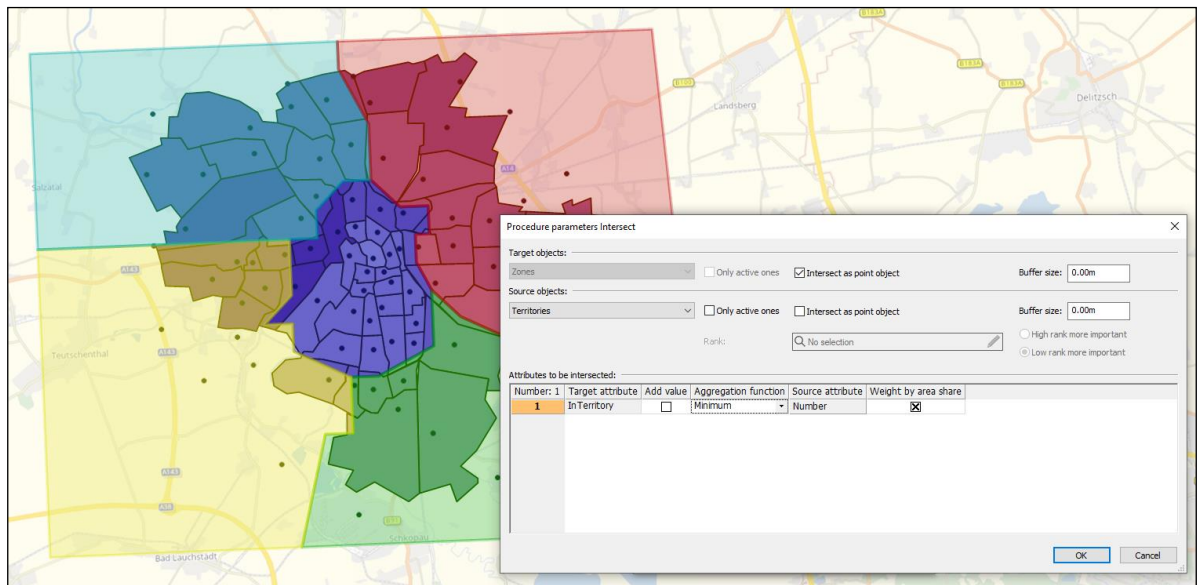
Figure 15: Intersect of zones as point objects with territories

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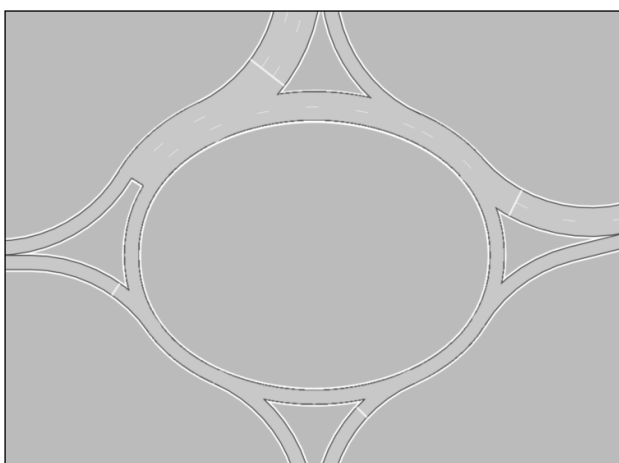
Figure 16: Oval roundabout with changing number of lanes in the roundabout

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.
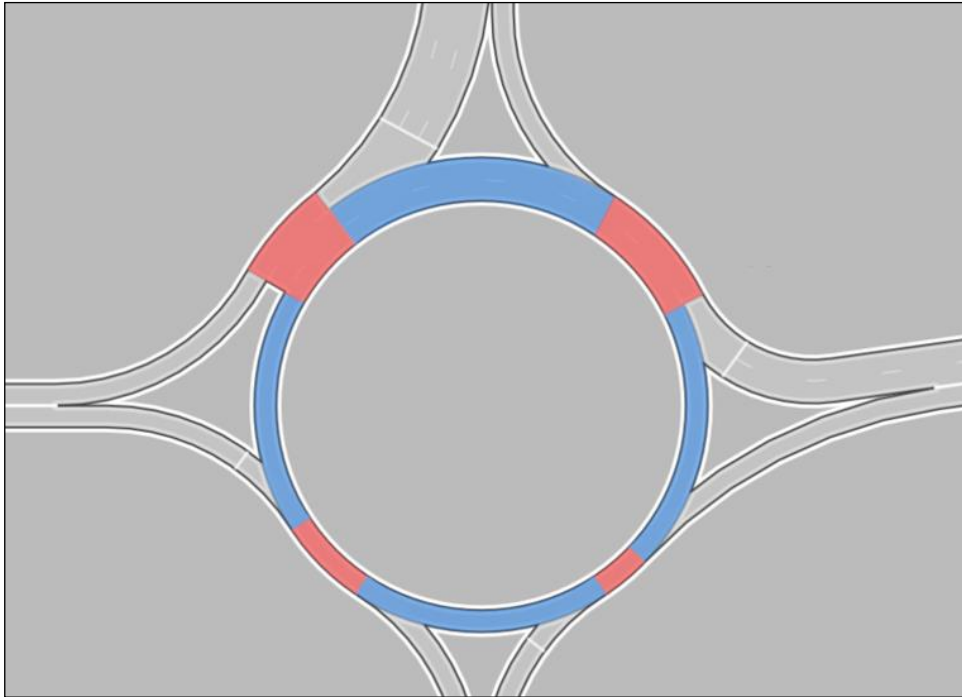
Figure 17: Effect of input attribute 'Number of conflicting lanes' (shown in blue)

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 the 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.
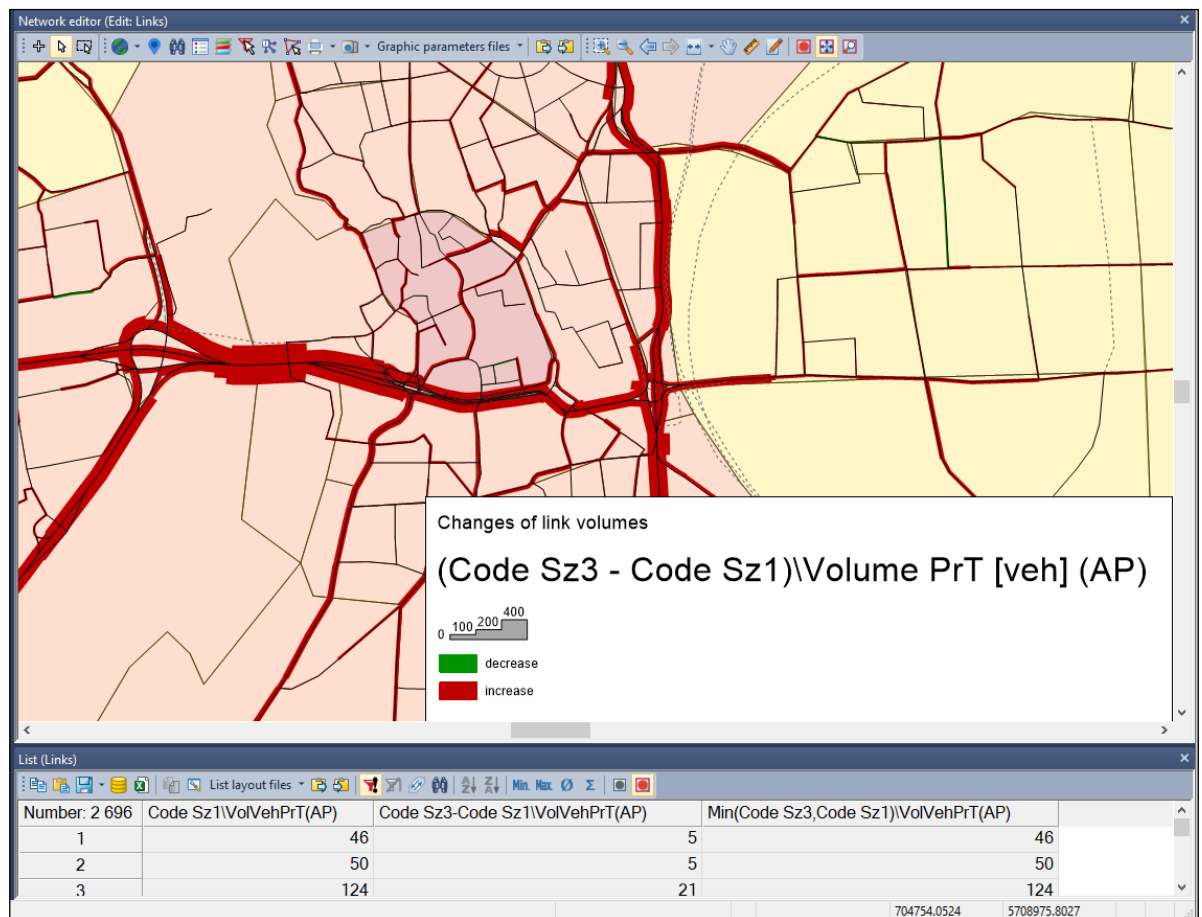
Figure 18: Attribute identifier when applying comparison patterns

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 selected attributes section of the attribute selection dialog or into search fields of other dialogs.
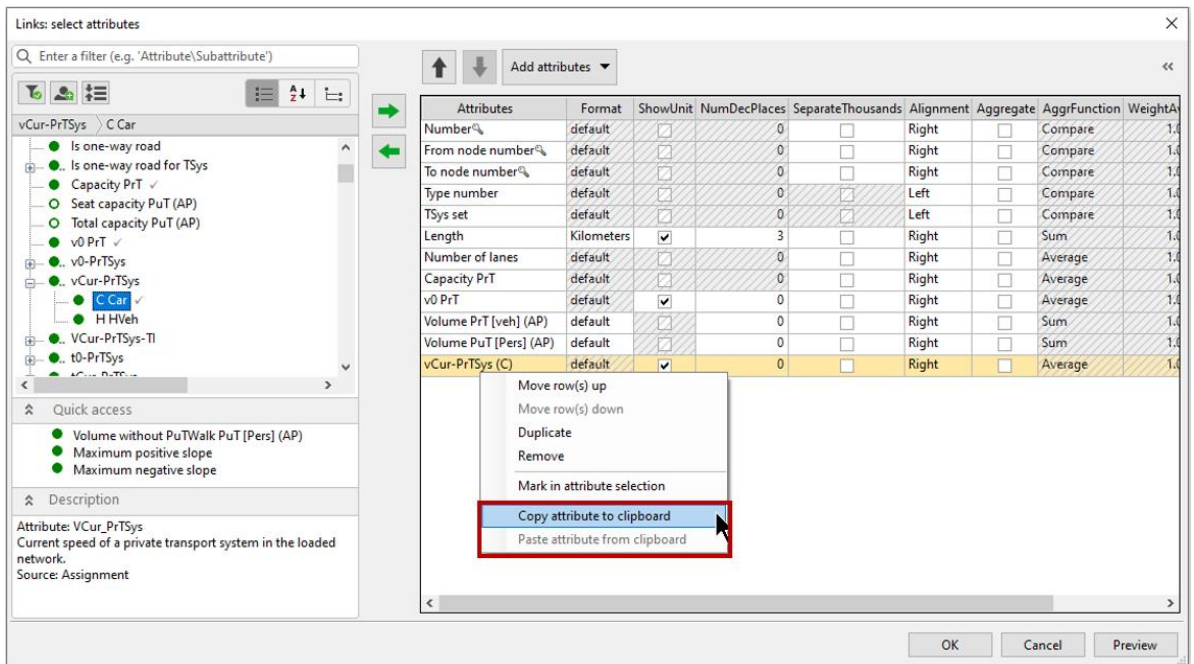
Figure 19: Copy & paste of attributes via the clipboard

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.
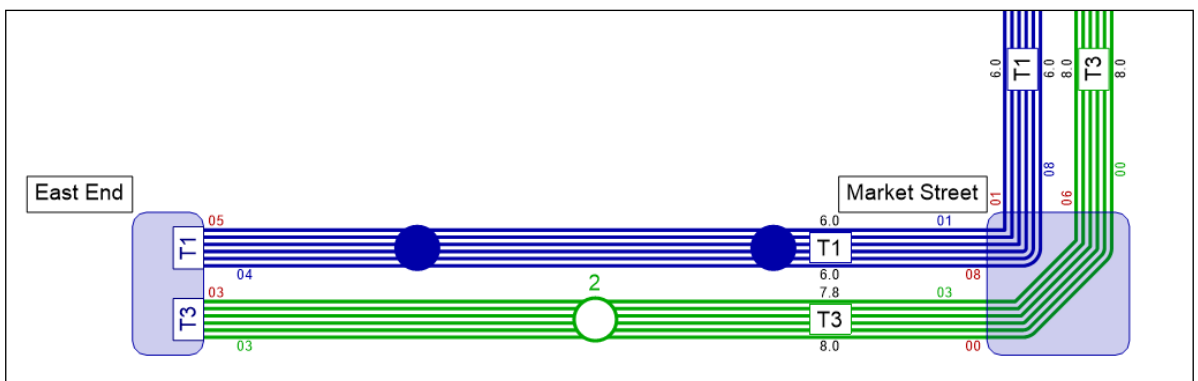
Figure 20: Display of intermediate stops in schematic line diagram

4 Technical changes, changes to COM and Python

4.1 Language settings for the export of text files

With the release of Visum 2024, several 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, the import of these files in a language different from English will continue to be supported. In a later software version, the import of these file types will require files saved in English. If older files in other languages are still to be imported, they must be "translated" to English by importing and saving them again in an earlier software version.

4.2 Changes to the COM interface

The changes of the COM interface listed below require changes in your scripts. For more details and a complete list of changes, see the release notes:

• Renaming of matrix attributes in 'MatrixRef'
  Attributes with 'Matrix' as part of the name (or extensions thereof, such as 'Distribution Matrix') whose type is a matrix reference have been renamed to 'MatrixRef' (or corresponding extensions). This concerns the network objects' demand description and time series items as well as the following procedure parameters:
  ActivitySimExportPara, DemandMatrixCorrectionResultPara, DemandMatrixCorrectionSkimDistributionPara, EstimateGravitationParametersOutputPara, EVAModeDStratModeChoicePara, JumpBackPara, LinCombParaItem, MatrixProjectionOperationPara, ModeChoiceDStratModePara, ModeChoiceDStratPara, ModeChoiceLinCombItem, ModeChoiceModeDStratPara, NestedDemandDemandMatrixPara, NestedDemandDemandStratumPara, ParkAndRideLotChoiceDStratPara, ParkAndRideLegSplitPathSeqSetPara, TBFreightDistributionDStratPara, TBFreightTourGenerationDStratPara, TBFreightTourGenerationOutputItem, TripDistributionDStratPara, TripDistributionLinCombPara, VisemDGroupActivityDistributionPara, VisemDGroupActivityTreeNodeNestedModeChoicePara, VisemOutputItem. The COM access under the previous names is still possible, but these names will be removed in future versions.
• Shortening of attribute identifiers of the timetable-based assignment
  The substring 'EquivalentConnections' in the four attributes BbSearchAllowDominanceForEquivalentConnections,

    BbSearchPrioForEquivalentConnectionsStopAreaAttr,
    BbSearchPrioForEquivalentConnectionsPlannedConnectingJourneyAttr and
    BbSearchUseLastStopForEquivalentConnections has been shortened to
    'EquivalentConns'.

- Removal of the procedure Lohse assignment
  The corresponding COM parameter classes IPrTEquilibriumLohseAssignmentPara and
  subordinate classes have been removed.
- Unique identifiers in the COM Interface Definition Language (IDL)
  The identifiers of the arguments in function calls have been unified in their notation so
  that the same identifier that occurs as an argument in different methods in the IDL has
  the same upper/lower case. If a script uses keyword arguments, the spelling in the
  script must be adapted to the changed spelling in the IDL. Position arguments are not
  affected.
- Resetting the Python import path (sys.path) before script execution
  The Python import path is now set to the following order of paths before each script
  execution: the user-defined path (if any), the add-in path, and the paths specified by
  Python.
- Relevant general procedure settings of the public transport isochrone directly accessible
  in the parameter object
  The parameter object 'IPuTIsochroneBasePara' has its own explicit parameters for walk
  links, i.e. for maximum walk times and for searching walk links within stops as well as
  from connector to connector. When the method
  'IIsochrones.ExecutePuTWithParameterObjects()' is called, these parameters are used
  instead of the general procedure parameters. The method 'IIsochrones.ExecutePuT()'
  on the other hand is unchanged and makes use of general procedure parameters.
- Renaming NodeLegLane in Lane
  The COM object of the list for lanes has been renamed from INodeLegLaneList to
  ILaneList. The same applies to the function CreateLaneList.
- Removal of deprecated COM methods
  The following COM methods and objects – deprecated for at least two major versions –
  have been removed: IVisum.Lists (replaced by IVisum.Workbench.Lists),
  IVisum.LoadNet (replaced by IVisum.IO.LoadNet), IVisum.SaveNet (replaced by
  IVisum.IO.SaveNet), IProcedures.OpenXml (…), IProcedures.SaveXml (…),
  ITimeProfile.VehJourneys (…), INet.VehJourneySections (…),
  IODPairFilter.FilterNetworkVolumes (…), IODPairFilter.FilterNetworkVolumes (…),
  IModalSplitB1InputPara, IModalSplitB2InputPara, IModalSplitOutputMatrix,
  IModalSplitOutputPara, IModalSplitProcedureB1Para, IModalSplitProcedureB2Para,
  IModalSplitProtocolPara, IModalSplitStandardizedAssessmentPara,
  IMapMatcher.GetScoreTotal (…)

4.3   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.

2024.01-00   [267602]

⊕ New Features and Changes

COM-API

⊕ Access to comparison patterns: Comparison patterns are now available through the COM interface as part of scenario management. **(162331 | 14842)**

Data Model

⊕ Volume seat capacity ratio and volume total capacity ratio at vehicle journey items: The two indicators 'Volume seat capacity' and 'Volume total capacity ratio' are now also provided as attributes at vehicle journey items. **(163806 | 21955)**

Data Model, Filters

⊕ Type of transport system specification of a PuT path leg: The data type of the specification of the transport system at a PuT path leg has been changed from string to transport system. As a result, the usual operators and input help for transport systems can be used in the dialog of the PuT path filter. **(181681 🔴)**

Demand Procedures

⊕ Microscopic demand (ABM): The procedure 'Calculate demand matrices from trips' aggregates the demand from trips into suitable demand matrices with appropriate time reference. **(164249 | 23681)**

⊕ Activity-based models: The new procedure '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. The result of a demand calculation is a detailed individual daily schedule per person. **(181669)**

⊕ Activity-based models: The new procedure 'ABM long-term location choices' is part of the ABM model type fully integrated in Visum for the calculation of disaggregated demand. It determines individual destinations for recurring mandatory activities such as work or school in analogy to the procedure 'ABM Nested Demand'. **(167550)**

Formulas

⊕ A new function 'Color(a, r, g, b)' has been introduced to determine the color value from separate values for alpha, red, green, and blue. The separate values are expected to be integers in the range from 0 to 255. **(168018)**

⊕ Exception values changed: Several exception values have been changed in matrix formulas. These are values that, by definition, are considered the result of a calculation that cannot be performed mathematically correctly. In particular, 0/0 = 1 now applies, positive number / 0 results in a very large positive value, negative number / 0 results in a very large negative value, and ln(0) also results in a very large negative value. **(164728 | 24893 🔴)**

Lists

⊕ New list for direct connections: A new list (under PuT Supply > Lines) shows all direct connections between selected stop areas. Connections on coupled vehicle journeys are identified, and passenger trip chains and circle line transitions lead to direct connections that extend beyond the stops on a vehicle journey. **(164470 | 24367)**

Matrix Editor

⊕ Exception values changed: Several exception values have been changed in matrix formulas. These are values that, by definition, are considered the result of a calculation that cannot be performed mathematically correctly. In particular, 0/0 = 1 now applies, positive number / 0 results in a very large positive value, negative number / 0 results in a very large negative value, and ln(0) also results in a very large negative value. **(164728 | 24893 🔴)**

Other Procedures

- ⊕ Calculate split factors for splitting matrices: The new procedure Calculate split factors allows the transformation of demand matrices based on a zone system other than the current one. Optionally, building layers can be used for weighting. **(164271 | 23738)**
- ⊕ Splitting matrices: The matrix operation 'Split' allows to read split factors from a user defined table. The result can optionally be written to a new external matrix as well as to an existing internal matrix. **(164794 | 24964)**

Procedure Sequence

- ⊕ Warning for unauthorized Go To operations: Go To operations are not allowed from or into groups that themselves contain a condition. A message now draws attention to such constellations. **(183143)**

PuT Assignment

- ⊕ Search impedance of PuT paths: The search impedance can optionally be stored for each path when using the branch & bound procedure in the timetable-based assignment. **(164241 | 23651)**

Safety

- ⊕ Replacement of database: Visum Safety now uses a SQLite database instead of a MS SQL Compact Edition database for saving data. **(170249)**

Visum Files

- ⊕ Reading and writing of user-defined attributes accelerated: Reading and writing the values of user-defined attributes has been accelerated. **(163097 | 18696)**

✅ Fixed Bugs

Add-Ins

- ✅ Demand Calibration did not calibrate: If the code of the calibration level (person groups or activities) contained several underscores, nothing was calibrated. This bug has been fixed. **(193296)**
- ✅ Demand Calibration did not calibrate: When executing the add-in 'Demand Calibration' with mode choice as the procedure to be calibrated, 'Modal Split' as the calibration object, and demand stratum as calibration level, nothing was calibrated. This error has been fixed. **(190948)**
- ✅ Error in case of key attributes in PuT in TransCAD import: If a shapefile selected in the add-in 'Import TransCAD Network' for PuT objects contained the key attributes as 32-bit integers, the import failed with an error message (see also ID 189219 for links and connectors). This error has been fixed. **(192365)**
- ✅ Error with key attributes in TransCAD import: If a shapefile selected in the 'Import TransCAD Network' add-in for links and connectors contained the attributes selected there for link number, from-node number or to-node number as 32-bit integers, the import failed with an error message. This error has been fixed. **(189219)**

Data Model

- ✅ Incorrect check for key violation: If in a list for a network object type with a numeric key (e.g. node, stop, etc.) the display of thousands separators was enabled for this key attribute, the check whether this number was already occupied was incorrectly executed when changes were made to the key attribute in this list. This could result in unjustified messages that the key was already taken, but key conflicts could also go unnoticed. In the second case, the data model could become inconsistent, so that saving it as a version file was no longer possible. This error has been fixed. **(192748)**

Dialogs

- ✅ Display of weights for connectors incorrect: After switching between different connectors via the buttons in the connector dialog, the values of the connector weights were sometimes displayed incorrectly. This has been fixed. **(164604 | 24655)**
- ✅ Headway-based supply in timetable-based assignment: In the parameter dialog of the timetable-based assignment, the setting 'Consider only active time profiles' for the headway-based supply could be lost in case of certain operation sequences. This error has been fixed. **(164602 | 24652)**
- ✅ Preselection in attribute selection incorrect: When entering the attribute selection dialog from list-like tables, the first attribute was always selected instead of the preselected attribute when sorting systematically. This bug has been fixed. **(179502)**

Filters

○ Cross-section values in lists in combination with
directed filter: If the display of cross-section values was activated in a
list, the object of the direction 'Up' with the cross-section values was
previously displayed for each pair. If a filter was set at the same time, which
inactivated the object of the direction 'Up', but activated the one of the
direction 'Down', there was no representative for this pair in the list
anymore. Now, in this particular case, the object of the direction 'Down' is
displayed with the cross-section values. For all attributes with cross-section
logic it doesn't matter, but the key attributes (e.g., for links
From-node-number and To-node-number) are then swapped. Note: The filter is
still effective on the individual network object themselves, not on pairs and
their cross-section values! **(174816)**

Graphical Procedures

○ Temporal restriction of flow bundle did not work for sharing paths: For pure sharing paths, i.e. PuT paths that contain only path legs of type Sharing or PuT Walk, temporal restrictions of the flow bundle did not work, i.e. paths were contained in the flow bundle that crossed the flow bundle object outside the set time window. This bug has been fixed. **(191693)**

Graphics

○ Background color of the network editor not completely white: If a pure white (RGB 255 / 255 / 255) was set as the background color for the network editor, the color was changed to a slightly bluish shade after saving a version or graphic parameters file and then re-loading this file. This error has been fixed. **(163948 | 22699)**

○ WMS service did not work: In certain combinations of WMS service and network projection, no background map could be displayed. This bug has been fixed. **(158760)**

I/O Interfaces

○ Duplicated block items while importing from railML 'only line blocks': During import 'only line blocks' from railML files, duplicated block items occurred if a vehicle journey section was split into several parts during the previously performed railML export and these parts were scheduled consecutively in one line block. This error has been fixed. **(175078)**

○ Invalid line routes after GTFS import: During the GTFS import, line routes occurred that consisted of only a single stop point that was both the start and end point, as well as vehicle journey sections where boarding or departing was prohibited at the start or end stop point. These cases are now rejected with a message. **(188662)**

○ One-way streets in OSM import: When importing one-way streets from OpenStreetMap (OSM), opposite directions that were closed but open to pedestrians were allocated the same number of lanes as the open main direction. This error has been fixed by now allocating 0 lanes to these links. **(191917)**

Installation

○ Crash during program start due to user-defined VD functions: No more crash at program start if there are invalid DLLs in the directory for user-defined VD functions. **(189761)**

○ No procedure sequences in older Windows versions: In Windows versions from release 1903 (i.e., older versions of Windows 10, Windows Server 2019, and earlier), no procedure parameter files could be imported. When a version file was loaded, the procedure sequence it contained was not imported. This error has been fixed. **(188582)**

Lists

○ Crash when activating column filters in PuT path leg list: A crash no longer occurs when selecting a column filter in the PuT path leg list. **(179606)**

○ Cross-section values in lists in combination with
directed filter: If the display of cross-section values was activated in a
list, the object of the direction 'Up' with the cross-section values was
previously displayed for each pair. If a filter was set at the same time, which
inactivated the object of the direction 'Up', but activated the one of the
direction 'Down', there was no representative for this pair in the list
anymore. Now, in this particular case, the object of the direction 'Down' is
displayed with the cross-section values. For all attributes with cross-section
logic it doesn't matter, but the key attributes (e.g., for links
From-node-number and To-node-number) are then swapped. Note: The filter is
still effective on the individual network object themselves, not on pairs and
their cross-section values! **(174816)**

- ✅ Incorrect check for key violation: If in a list for a network object type with a numeric key (e.g. node, stop, etc.) the display of thousands separators was enabled for this key attribute, the check whether this number was already occupied was incorrectly executed when changes were made to the key attribute in this list. This could result in unjustified messages that the key was already taken, but key conflicts could also go unnoticed. In the second case, the data model could become inconsistent, so that saving it as a version file was no longer possible. This error has been fixed. **(192748)**
- ✅ PuT path filter did not work on PuT OD pairs: In the list PuT OD pairs, when the 'Filter for OD pairs' and the filter 'Flow bundle routes' were set, only the filter for OD pairs (and additionally the flow bundle condition) worked, but not the PuT path filter belonging to the filter for OD pairs. This bug has been fixed. **(190593)**
- ✅ Shortcut menu entries for RBC signal controllers: The shortcut menu entries in the Signal controllers list for the various editing functions are now the same for Vissig and RBC controls. **(164676 | 24820)**

Matrix Editor

- ✅ Crash in the dialogs for splitting and aggregating: The program no longer crashes when trying to edit the only table entry in the parameter dialog for splitting or aggregating external matrices. **(194047)**

Network Editor

- ✅ Z-coordinates not interpolated for the desired links: If the network editor special function for interpolating z-coordinates was executed for active links, the coordinates of all links were interpolated. However, if it was run for all links, not just the active ones, and there was no active link, no link was interpolated at all. Both bugs have been fixed. **(190464)**

PrT Assignment

- ✅ Factors for vehicle lengths and reaction times at roundabouts swapped: The factors for vehicle lengths and reaction times in the simulation-based dynamic assignment (SBA) were swapped at roundabouts. This error has been fixed. **(189335)**
- ✅ Incorrect gap acceptance: Within the simulation-based dynamic assignment (SBA), conflicts at two-way nodes were incorrectly resolved in certain cases when the vehicles involved had different reaction times. This error has been fixed. **(189517)**

PuT Assignment

- ✅ Crash when exporting connections with sharing paths: Crashes no longer occur when executing the timetable-based assignment if a connection file with fares is exported and sharing transport systems are taken into account. **(191599)**
- ✅ PuT path filter did not work on PuT OD pairs: In the list PuT OD pairs, when the 'Filter for OD pairs' and the filter 'Flow bundle routes' were set, only the filter for OD pairs (and additionally the flow bundle condition) worked, but not the PuT path filter belonging to the filter for OD pairs. This bug has been fixed. **(190593)**
- ✅ Wrong values of skim 'Path leg attribute': The skim 'path leg attribute' provides access to any attribute of a path leg, but walk legs have been omitted, and the attribute 'path leg index' did not return correct values. Both errors have been fixed. **(185332)**

Subnetwork Generator

- ✅ Termination in case of POI category with user-defined attributes: The subnetwork generator will no longer be terminated if there is at least one POI category with at least one user-defined attribute in the network. **(187674)**
- ✅ Termination in certain constellations: In certain constellations, where both stops at the edge of the subnetwork and PrT assignment results were transferred to the subnetwork, the subnetwork generation would abort. This bug has been fixed. **(189696)**

Visum Files

- ✅ Crash while restoring the window configuration: In rare cases, a crash can occur when importing a version file with restoration of the tool window configuration (user setting). This error has been fixed. **(180132)**

❗ Breaking Changes

Data Model, Filters

- ❗ Type of transport system specification of a PuT path leg: The data type of the specification of the transport system at a PuT path leg has been changed from string to transport system. As a result, the usual operators and input help for transport systems can be used in the dialog of the PuT path filter. Existing filter files will be adapted as far as possible during import, but should be checked if they contain a PuT path filter. **(181681 ⊕)**

Formulas

- ⚠ Exception values changed: Several exception values have been changed in matrix formulas. These are values that, by definition, are considered the result of a calculation that cannot be performed mathematically correctly. In particular, 0/0 = 1 now applies, positive number / 0 results in a very large positive value, negative number / 0 results in a very large negative value, and ln(0) also results in a very large negative value. This changes calculation results in formulas as well as in various procedures, especially demand procedures. **(164728 | 24893 ⊕)**

Matrix Editor

- ⚠ Exception values changed: Several exception values have been changed in matrix formulas. These are values that, by definition, are considered the result of a calculation that cannot be performed mathematically correctly. In particular, 0/0 = 1 now applies, positive number / 0 results in a very large positive value, negative number / 0 results in a very large negative value, and ln(0) also results in a very large negative value. This changes calculation results in formulas as well as in various procedures, especially demand procedures. **(164728 | 24893 ⊕)**

PrT Assignment

- ⚠ Incorrect gap acceptance: Within the simulation-based dynamic assignment (SBA), conflicts at two-way nodes were incorrectly resolved in certain cases if the vehicles involved had different reaction times. This error has been fixed. As a result, the assignment results of simulation-based dynamic assignment change in almost all networks. **(189517)**

2024.00-00 [264230]	2023-08-01

⊕ New Features and Changes

COM-API

- ⊕ MapMatcher optionally considers main nodes: MapMatcher now optionally considers also main nodes, i.e. with the shortest path search between the candidate positions in the target network, the inner nodes and links of a main node are not considered. They are replaced by the main turn connecting the cordon links. It should be noted that the inner nodes and links are also not considered in the candidate search, so in principle input points that fall within the area of a main node cannot be placed well. **(174715)**
- ⊕ PuT isochrones with own parameters for the search of walk links: The parameter object 'IPuTIsochroneBasePara' has its own explicit parameters for describing the allowed walk links, i.e. for maximum walk times and for searching walk links within stops as well as from connector to connector. When calling the method 'IIsochrones.ExecutePuTWithParameterObjects()' these act instead of the general procedure parameters used so far. The parameter-free method 'IIsochrones.ExecutePuT()', on the other hand, uses the set general procedure parameters of the network as before. **(165566 | 24261 ⚠)**
- ⊕ Remove deprecated methods: Methods and objects that have been deprecated for at least two years have been removed. This includes IVisum.Lists (replace by IVisum.Workbench.Lists), IVisum.LoadNet (replace by IVisum.IO.LoadNet) and IVisum.SaveNet (replace by IVisum.IO.SaveNet). **(164531 | 24528)**
- ⊕ Reset Python import path (sys.path) before script execution: The Python import path is now set to the following paths before each script execution: the paths defined by the user (if any), the Add-in paths, the paths specified by Python. **(164956 | 25103 ⚠)**
- ⊕ Uniform spelling of argument identifiers: The spelling of argument identifiers in function calls has been unified so that the same identifier that appears as an argument in different methods in the IDL has the same upper/lower case. This prevents errors from occurring during execution, because otherwise arguments with the same name occur in a Python script in different notations. If a script uses keyword arguments, the spelling in the script must be adapted to the changed spelling in the IDL. Position arguments are not affected. **(164592 | 24628 ⚠)**

Data Model

- ⊕ Connector types: The restriction to typ numbers 1 to 10 for connector types has been removed. All non-negativ integers are allowed. **(155162 | 24372)**
- ⊕ Link attribute 'Slope': The link attribute 'Slope' has been reduced by a factor of 100. As a result, it is displayed correctly in percentage format in the list. This format is now also the default. Calculations that use the slope or the special function to set this attribute have been adjusted accordingly. Calculated results will not be modified because of these changes. **(164584 | 24617 ⚠)**
- ⊕ Relations from network: The following 1:n relations from network have been added: holidays, information signs, time series, and demand time series. **(155328 | 24683)**
- ⊕ Relations in fare model: Relations between ticket types and fare supplements-, from-to-zone fare, and short fare items, as well as other relations, have been added. **(164640 | 24736)**

- Renaming of 'Matrix' attributes: Attributes named 'Matrix' (or extensions thereof, such as 'Distribution matrix') whose type is a matrix reference have been renamed to 'MatrixRef' (or corresponding extension). This affects the network objects demand description and time series item as well as the following procedure parameters: ActivitySimExportPara, DemandMatrixCorrectionResultPara, DemandMatrixCorrectionSkimDistributionPara, EstimateGravityParametersOutputPara, EVAModeDStratModeChoicePara, JumpBackPara, LinCombParaItem, MatrixProjectionOperationPara, ModeChoiceDStratModePara, ModeChoiceDStratPara, ModeChoiceLinCombItem, ModeChoiceModeDStratPara, NestedDemandDemandMatrixPara, NestedDemandDemandStratumPara, ParkAndRideLotChoiceDStratPara, ParkAndRideLegSplitPathSeqSetPara, TBFreightDistributionDStratPara, TBFreightTourGenerationDStratPara, TBFreightTourGenerationOutputItem, TripDistributionDStratPara, TripDistributionLinCombPara, VisemDGroupActivityDistributionPara, VisemDGroupActivityTreeNodeNestedModeChoicePara, VisemOutputItem. COM access using the previous name is still guaranteed for a certain time. **(154414 | 23226 ⊘)**

Demand Procedures

- ABM and import of synthetic populations including their schedules: The previous importer for PopulationSim has been extended and renamed accordingly to Synthetic Population Data. Now, in addition to a synthetic population generated by PopulationSim, associated surveyed schedules can also be imported. For this, the daily plans only have to be available in the form of a simple trip diary. **(164687 | 24838)**
- ABM: The new fully integrated procedure ABM Nested Demand is a procedure to calculate disaggregated demand. It can be described as a spatially and temporally disaggregated 4-step, Visem or Nested Demand model. It includes the destination and mode choice steps and is based on the same nested logit model as aggregate models. **(167545)**
- EVA-Trip generation with subspace balancing: In the procedure EVA trip generation an optional balancing of production and attraction target values can be performed on the basis of the definition of subspaces. The normalization of production and attraction, respectively, is done for sides of an activity pair which is not Home activity. It is also done if the constraint for balancing is defined as 'hard'. **(161639 | 9796)**
- Standardized assessment: The specific mode choice procedure for an outdated version of the Standardized assessment has been removed from the program. The function set for the current standardized evaluation remains unaffected. **(164533 | 24530)**
- Tour-based freight trip generation: The progress display of the procedure Tour-based freight trip generation has been improved. **(155341 | 24706)**

Dialogs

- Centroids of surfaces: The function 'Recalculate centroids' for objects with surfaces has been renamed into 'Move coordinates to geometric centroids'. **(164724 | 24888)**
- Copy & paste of attributes: In the attribute selection dialogs there is a possibility to copy attributes to the clipboard via the context menu. The attributes can be pasted via the context menu, e.g. in the attribute selection dialog on the side of selected attributes or in the search field for attributes in dialogs. **(164486 | 24412)**
- Marking of key attributes: In the attribute selection dialog key attributes are marked by a trailing symbol of a key. **(164484 | 24410)**
- Network check: The network check 'Multiple straight turns and main turns has been moved from the section 'General' to 'PrT'. **(164903 | 25060)**
- New control: A new control for managing list layouts has been added. This control makes it easier to add new files, delete or rename existing files. **(164464 | 24357)**

Formulas

- Behavior of arithmetic operations: The settings for the behavior of arithmetic operations in the user preferences have been removed. The default values have been implemented. **(164447 | 24298 ⊘)**
- New function for matrix formula: There is a new matrix formula called 'DIRECTDISTANCE()' that calculates the direct distances between origins and destinations of a matrix. **(163779 | 21805)**
- Syntax change of some functions: The syntax of the following functions was renamed to improve readability of formulas: 'IDIV' to 'DIV', 'STRTONUM' to 'TEXTTONUM' and 'NUMTOSTR' to 'NUMTOTEXT'. For backwards compatibility, all existing formulas stay valid and will automatically be redirected to the renamed functions when the formula is evaluated. **(155373 | 24787)**

Graphics

- Layers in Inkscape-optimized SVG export: The Inkscape-optimized SVG export of a graphical view adds meta information so that various network objects are represented by Inkscape as named layers. **(163769 | 21742)**
- Updated library for coordinate transformations: The library used for coordinate transformations has been updated. **(185280)**

I/O Interfaces

- ⊕ .csv export from lists: A new export option has been implemented that writes files in .csv format. The export follows fixed conventions without any options for settings. **(163211 | 19159)**
- ⊕ Changed shapefile export to UTF-8: The shapefile export, which was previously exported as ANSI depending on the code page currently selected in the system, is now exported as UTF-8. **(155241 | 24487)**
- ⊕ Error messages during GTFS import: The GTFS import procedure now provides error messages with hints to the concrete reason for failure. **(180485)**
- ⊕ Excel-Export: The content of lists can be exported to a spreadsheet program. **(163857 | 22196)**
- ⊕ Import of Vistro update data: A new interface for the import of Vistro update data has been implemented. The import is based on geographic information. It is mainly intended to update junction data (geometry and control) in Visum models. **(164654 | 24780)**
- ⊕ Import of elevation data: Visum imports elevation data from locally stored GeoTIFF files. The z-coordinate of the (active) nodes and intermediate link points are set and all link attributes based on them are recalculated. **(164120 | 23292)**
- ⊕ Only vehicle code as identifier during railML import: During railML import, the comparison between imported vehicle combinations and vehicle units already existing in the network can now optionally be restricted to the attribute Code, i.e. if there is already a vehicle unit or a vehicle combination in the target network with the same code as specified in the railML file, it will be used instead of creating a new object. **(171016)**

Installation

- ⊕ Update of Python and python libraries: The private Python of the Software has been updated to version 3.11. At the same time several libraries have been updated too. **(172205)**

Junction Editor

- ⊕ Geometry improvements: The geometry of displayed roundabouts has been further improved, especially regarding to crosswalks and bypasses. **(164593 | 24634)**
- ⊕ Improved display of roundabouts: The display of roundabouts in the junction editor has been further improved. **(164598 | 24641)**

Line Blocking

- ⊕ Minor improvements: Line blocking with vehicle interchange as well as that with obligatory recurring actions has been improved and slightly accelerated. **(164785 | 24955 ❗)**

Lists

- ⊕ Excel-Export: The content of lists can be exported to a spreadsheet program. **(163857 | 22196)**
- ⊕ New control: A new control for managing list layouts has been added. This control makes it easier to add new files, delete or rename existing files. **(164464 | 24357)**

Matrix Estimation

- ⊕ Least squares as default Variant: When adding a procedure Demand matrix correction by default Least squares is selected as variant. **(180472 ❗)**
- ⊕ default weight for the Least Squares variant: In addition to the count values, the user previously had to define associated weights. This is no longer necessary: the user can select the default weight, which leads to a balance between count values of different magnitudes. **(164046 | 23084)**

Miscellaneous

- ⊕ Update of MKL: The MKL (Math Kernel Library) has been updated from Version 2020 to Version 2023.1. This supports newer processors and optimizes performance. **(180352)**

Network Comparisons

- ⊕ Short and long names of attributes for comparisons of scenarios: The readability of attributes when applying comparison patterns under Scenario Management has been improved. For corresponding comparison attributes, by default the codes of the scenarios are now used as part of the attribute name.
  For comparisons of networks as well as version comparisons, 'This network' is used for the currently loaded version and the code or version name for the comparison network. **(164415 | 24221)**

Network Editor

- ⊕ Interactive setting of the elevation of intermediate link points is possible. **(163979 | 22824)**
- ⊕ Split territories geometrically: For territories, a new network editor function 'Split geometrically' has been added which splits existing territories by an interactively defined line. **(164459 | 24341)**

Other Procedures

⊕ EWS: The outdated procedure of the economic efficiency analysis according to EWS-97 has been removed. **(164320 | 23902)**

⊕ Intersect objects with surfaces as point objects: The operation 'Intersect' has an additional option that allows to intersect objects with surfaces (e.g. zones) as point objects (e.g. considering the zone centroids) **(162661 | 16787)**

⊕ Intersect using a negative buffer size: The Intersect procedure allows for objects with surfaces negative values for the buffer size. The intersect procedure is then executed with the polygon reduced by te buffer size if the size still has a positive value. **(164030 | 23026)**

⊕ Intersect: The memory consumption of the intersect operation, especially with complexe objects with surfaces, has been reduced. **(163945 | 22690)**

⊕ Parameters for the signal cycle and split optimization: The parameters 'Use cycle times of coordination groups' and 'Precision of computation' in the General procedure settings have been removed. For signal controllers that are allocated to a coordination group the cycle times of the coordination groups are used, otherwise the signal controller attributes 'ICA minimum cycle time for optimization' and 'ICA maximum cycle time for optimization' are taken into account. Regarding precision of computation, for Vissig the controller frequency determines precision, and for RBC 1s is used. **(164995 | 24786)**

⊕ Procedure parameters intersect: The parameters 'Round', 'Separator' and 'Max. text length' in the procedure Intersect have been removed. Instead of optional rounding, rounding is always used. For the 'Separator' and 'Max. text length' the values defined in the network settings are used. **(164734 | 24901)**

PrT Assignment

⊕ Blocking back (fair) faster: The calculation of the blocking back model in the fair variant has been accelerated. **(164024 | 23008)**

⊕ List PrT assignment quality data: In these lists attributes of impedances are shown without units. **(167193)**

⊕ Logging of non-converged objects: The option 'Protocol of non-converged objects' in the General procedure settings has been removed and therefore also the listing of these objects in the file 'Protocol.txt'. **(164991 | 22999)**

⊕ Removal of the Equilibrium Lohse method: The PrT assignment method Equilibrium Lohse has been removed including its COM objects and methods. When reading version files, in which this method is used in the procedure sequence, it will be replaced by the method Equilibrium assignment Bi-conjugate Frank-Wolfe. **(163863 | 22223)**

⊕ Speed up of the stochastic assignment: The stochastic assignment has been accelerated significantly. **(164788 | 24958)**

Procedure Sequence

⊕ Conditional execution of procedures: The execution of procedures and groups of procedures, respectively, can be linked to a condition which is defined as formula in the column 'Condition'. The current value of the condition is shown in an additional column of the procedure sequence. **(162429 | 15506)**

Prt Assignment

⊕ ICA calculation in PrT assignments: The ICA calculations can only be executed in combination with the following PrT assignment methods: Assignment with ICA, equilibrium assignment Bi-conjugate Frank-Wolfe (BFW) if the option 'Impedances at ICA nodes' is activ, and in the macroscopically modeled part in the meso-macro simulation within the simulation-based assignment (SBA). **(164087 | 23224)**

PuT Assignment

⊕ Limitation of maximum walking times: The limitation of maximum walking times is now differentiated according to path legs during access and egress as well as path legs during transfers between two stops. **(164217 | 23575)**

⊕ Restriction of demand data in the timetable-based assignment: The previous option to restrict demand data in the timetable-based assignment to a range of origin zone numbers has been changed. The selected range of zone numbers now applies to origin and destination zones. **(164808 | 24982 ⛔)**

⊕ Shortest path search: The shortest-path search within the timetable-based assignment has been massively accelerated. It now offers a fast alternative to the Branch & Bound search, especially for the calculation of skims. **(164603 | 24654 ⛔)**

Scenario Management

⊕ Reading many modifications: Reading of many small modifications has been accelerated. **(164498 | 24451)**

Scenario Managment

⊕ Short and long names of attributes for comparisons of scenarios: The readability of attributes when applying comparison patterns under Scenario Management has been improved. For corresponding comparison attributes, by default the codes of the scenarios are now used as part of the attribute name.
For comparisons of networks as well as version comparisons, 'This network' is used for the currently loaded version and the code or version name for the comparison network. **(164415 | 24221)**

Schematic Line Diagram

⊕ Intermediate Stops: Stops between transfer nodes can now be displayed in a simplified way in the schematic line diagram. Here you can choose between the standard display, which aggregates the intermediate stops and depicts the number, or displays all intermediate. **(164421 | 24243)**

Timetable Editor

⊕ Chained-up vehicle journey sections: The tabular timetable now displays classifiable symbols for incoming and outgoing ends of chained-up vehicle journey sections. **(164516 | 24501)**

Visum Files

⊕ Format of timestamp: The format of the timestamp logged in the files 'Protocol.txt' and 'Messages.txt' has been unified to ISO 8601 format (i.e. yyyy-mm-dd hh:mm:ss.MMM). **(164834 | 25010 ⚠)**
⊕ Logging of non-converged objects: The option 'Protocol of non-converged objects' in the General procedure settings has been removed and therefore also the listing of these objects in the file 'Protocol.txt'. **(164991 | 22999)**
⊕ Text-based file exports in English: Text-based Visum files (i.e. network files, attribute files, demand files, model transfer files, interval files and multi-line survey data) can be saved in English only. The user setting to switch to localized exports has been removed as well as the COM access for this setting. **(164774 | 24944 ⚠)**

⚠ Breaking Changes

Data Model

⚠ Link attribute 'Slope': The link attribute 'Slope' has been reduced by a factor of 100. As a result, it is displayed correctly in percentage format in the list. This format is now also the default.
Calculations that use the slope or the special function to set this attribute have been adjusted accordingly. Calculated results will not be modified because of these changes.
Users, who have already used an elevation definition that is smaller by a factor of 100 in the 'Slope' attribute due to the display problem must adjust their data. If they have used the slope data in their own impedance or consumption definitions, calculation results based on this will change with PTV Visum 24. **(164584 | 24617 ⊕)**
⚠ RBC controller with coordination 'Free running: The Lead / Lag flag was wrongly taken into account on free running RBC controllers. This error has been fixed. Therefore, the resulting sequences change for free running controllers. **(164737 | 24906)**

Matrix Estimation

⚠ Least squares as default Variant: When adding a procedure Demand matrix correction by default Least squares is selected as variant. This changes the behavior of scripts that only create a new procedure demand matrix correction. **(180472 ⊕)**

PuT Assignment

⚠ Restriction of demand data in the timetable-based assignment: The previous option to restrict demand data in the timetable-based assignment to a range of origin zone numbers has been changed. The selected range of zone numbers now applies to origin and destination zones. If this option was used in Visum 2023 or older release versions the option 'OD pairs considered for assignment' in combination with a corresponding filter must be used instead. **(164808 | 24982 ⊕)**
⚠ Shortest path search: The shortest-path search within the timetable-based assignment has been massively accelerated. It now offers a fast alternative to the Branch & Bound search, especially for the calculation of skims. It's now based on a connection scan algorithm. Thus, the search is different and the assignment results obtained change accordingly. **(164603 | 24654 ⊕)**

Visum Files

- ⚠ Format of timestamp: The format of the timestamp logged in the files 'Protocol.txt' and 'Messages.txt' has been unified to ISO 8601 format (i.e. yyyy-mm-dd hh:mm:ss.MMM). Scripts using this information must be adjusted. **(164834 | 25010 ⊕)**
- ⚠ Text-based file exports in English: Text-based Visum files (i.e. network files, attribute files, demand files, model transfer files, interval files and multi-line survey data) can be saved in English only. The user setting to switch to localized exports has been removed as well as the COM access for this setting. Scripts must be adopted accordingly. **(164774 | 24944 ⊕)**

COM-API

- ⚠ GTFS Import/Export: The GTFS import/export has been adapted to the specification for GTFS (https://gtfs.org/), in particular a .zip file must be specified as the source for the import and a file name of a .zip archive must be specified when exporting. Other requirements listed in the specification are checked and reported accordingly. Older parameter files (*.puti) must be adjusted or lead to corresponding error messages. **(164679 | 24824)**
- ⚠ PuT isochrones with own parameters for the search of walk links: The parameter object 'IPuTIsochroneBasePara' has its own explicit parameters for describing the allowed walk links, i.e. for maximum walk times and for searching walk links within stops as well as from connector to connector. When calling the method 'IIsochrones.ExecutePuTWithParameterObjects()' these act instead of the general procedure parameters used so far. The parameter-free method 'IIsochrones.ExecutePuT()', on the other hand, uses the set general procedure parameters of the network as before. **(165566 | 24261 ⊕)**
- ⚠ Reset Python import path (sys.path) before script execution: The Python import path is now set to the following paths before each script execution: the paths defined by the user (if any), the Add-in paths, the paths specified by Python. Because resetting the Python import path was not done consistently so far, the behavior may change in models where the Python import path has been manipulated. **(164956 | 25103 ⊕)**
- ⚠ Uniform spelling of argument identifiers: The spelling of argument identifiers in function calls has been unified so that the same identifier that appears as an argument in different methods in the IDL has the same upper/lower case. This prevents errors from occurring during execution, because otherwise arguments with the same name occur in a Python script in different notations. If a script uses keyword arguments, the spelling in the script must be adapted to the changed spelling in the IDL. Position arguments are not affected. **(164592 | 24628 ⊕)**

Data Model

- ⚠ Renaming of 'Matrix' attributes: Attributes named 'Matrix' (or extensions thereof, such as 'Distribution matrix') whose type is a matrix reference have been renamed to 'MatrixRef' (or corresponding extension). This affects the network objects demand description and time series item as well as the following procedure parameters: ActivitySimExportPara, DemandMatrixCorrectionResultPara, DemandMatrixCorrectionSkimDistributionPara, EstimateGravityParametersOutputPara, EVAModeDStratModeChoicePara, JumpBackPara, LinCombParaItem, MatrixProjectionOperationPara, ModeChoiceDStratModePara, ModeChoiceDStratPara, ModeChoiceLinCombItem, ModeChoiceModeDStratPara, NestedDemandDemandMatrixPara, NestedDemandDemandStratumPara, ParkAndRideLotChoiceDStratPara, ParkAndRideLegSplitPathSeqSetPara, TBFreightDistributionDStratPara, TBFreightTourGenerationDStratPara, TBFreightTourGenerationOutputItem, TripDistributionDStratPara, TripDistributionLinCombPara, VisemDGroupActivityDistributionPara, VisemDGroupActivityTreeNodeNestedModeChoicePara, VisemOutputItem. COM access using the previous name is still guaranteed for a certain time. **(154414 | 23226 ⊕)**

Formulas

- ⚠ Behavior of arithmetic operations: The settings for the behavior of arithmetic operations in the user preferences have been removed. The default values have been implemented. In cases in which other values have been uses the calculation results change. **(164447 | 24298 ⊕)**

Line Blocking

- ⚠ Minor improvements: Line blocking with vehicle interchange as well as that with obligatory recurring actions has been improved and slightly accelerated. This also changes the results of these two procedure variants. **(164785 | 24955 ⊕)**

Visum Files

- ⚠ GTFS Import/Export: The GTFS import/export has been adapted to the specification for GTFS (https://gtfs.org/), in particular a .zip file must be specified as the source for the import and a file name of a .zip archive must be specified when exporting. Other requirements listed in the specification are checked and reported accordingly. Older parameter files (*.puti) must be adjusted or lead to corresponding error messages. **(164679 | 24824)**