PTV Visum 2022
New Features At A Glance

Contents

1   Procedures

1.1   Static private transport assignments

An absolute highlight of this year's release is the almost unbelievable acceleration of the classic equilibrium assignment. The procedure has been completely modernized, resulting in a dramatic reduction in runtime. Our tests showed runtime reductions of up to 95%. For example, the Germany model Validate with over 20,000 traffic analysis zones and more than five million links achieves a gap of 10^{-3} in less than an hour[1].

The following Figure 1 shows the runtime of some sample models over the course of the last five Visum releases. The runtimes have been normalized with respect to Visum 17 (Visum 17 = 100%). The solid grey line represents the average over the models tested. The solid red line represents the course for the Germany-wide model Validate (right scale).
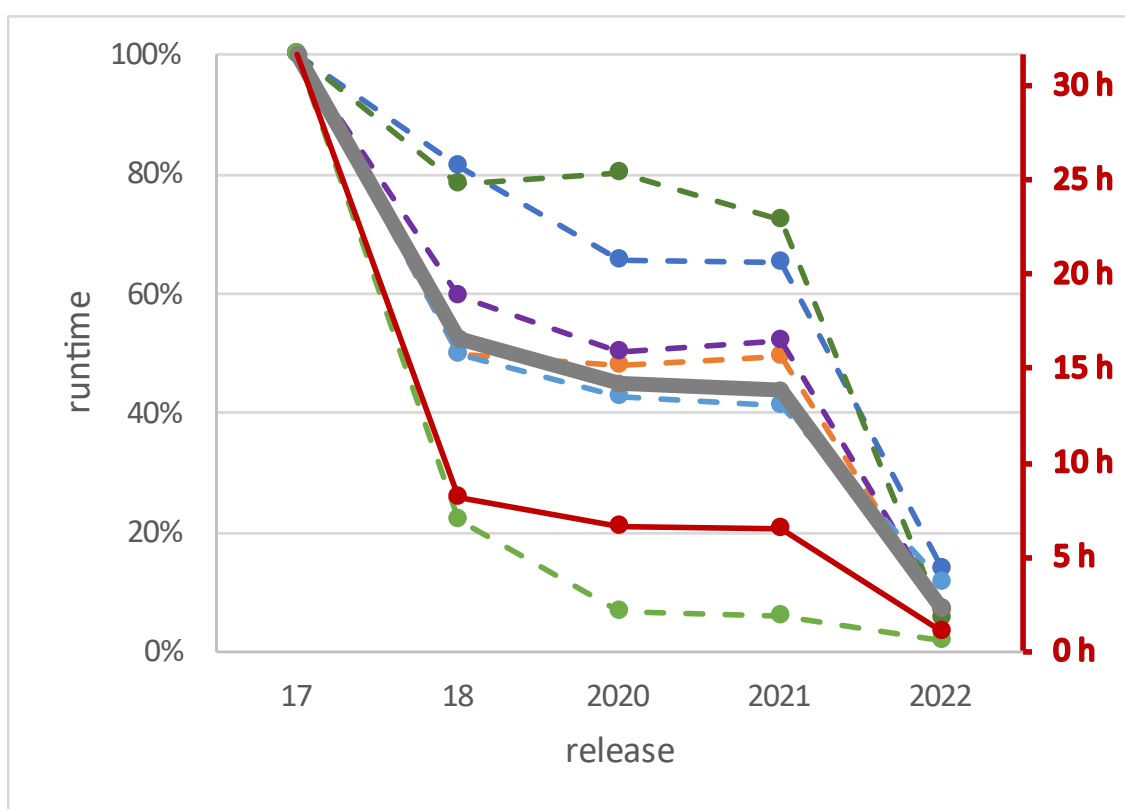
Figure 1: Development of runtimes of some sample models for the classical equilibrium assignment

Another focus of the current release is on the static highway assignment bi-conjugate Frank-Wolfe (BFW). It was introduced in PTV Visum 17 and has been improved in two respects. On the one hand, the high memory consumption observed especially in large models has been reduced and, on the other hand, the procedure has been functionally extended.

During its execution, BFW produces a lot of paths, especially in case of smaller gaps ($\leq 10^{-4}$). The corresponding high load on the RAM has now been reduced considerably. In our tests, the memory consumption goes down by up to 70%. Secondly, the method has

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[1] The computer used for the tests is equipped with an Intel(R) Xeon(R) W-2155 CPU @ 3.30GHz with 10 physical cores.

been extended in such a way that it achieves complete proportionality. Proportionality means a realistic well-balanced distribution of demand among all paths. Without proportionality, the assignment may result in counter-intuitive path choices. If we assume a paired alternative segment, then one OD relation may use exclusively its upper part, while another relation uses exclusively its lower part, see the Figure 2 left. If proportionality is given, the paths of both relations are distributed over both segments (see Figure 2 right). This improvement of the assignment quality requires a longer runtime for some models.
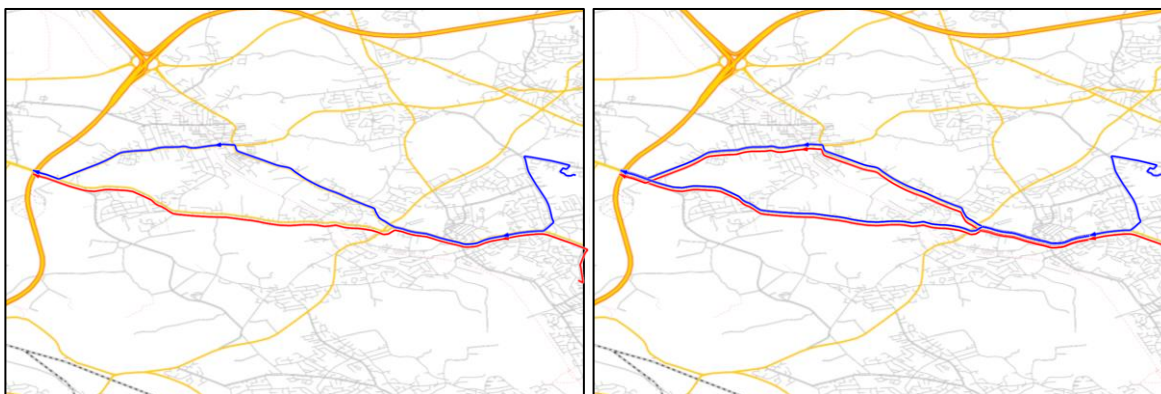
Figure 2: Assignment result without (left) and with (right) proportionality

1.2   Public transport assignments for combined supply

With PTV Visum 2022, the timetable-based assignment has been extended. It can take services into account for which headways but no timetables are specified. There are various use cases in which this combination is more suitable than using the existing methods with timetable or headways only.

A typical use case are regional models, where the public transport supply differs considerably. On the one hand, there are services that operate at very short headways, e.g. metro lines in city centres. On the other hand, there are regional lines that operate according to a timetable. The availability of timetables is therefore less critical for services running with high frequencies than for regional supply that operates only every two hours, for example, but must ensure connections to other services in the region.

Other use cases involve situations where only limited information is available. For example, timetables of lines for some operators are available, but you also want to include services in the model for which this information is not available.

The extension allows lines with and without timetables to be combined in a single assignment. The transfer relations take into account information about coordinated lines or specific transfer times. If this information is not provided, half of the headway is used.

The calculation of the PuT operational indicators has been extended to also include headway-based services. For the corresponding lines temporary representatives of the vehicle journeys are automatically generated in the procedure. They serve as the basis for the calculation of the operational and transport performance. Thus, a cost-benefit analysis is also possible for a purely headway-based specification as well as for a combined supply.

1.3 ABM 2.0: Quantum leap in demand modeling

Activity-based models (ABM), in contrast to macroscopic models, represent the mobility of individuals. This allows a detailed calculation of transport demand. Since Visum 2020, Visum provides a framework for the creation of such models. The framework includes the necessary data structures, the corresponding COM interfaces, and numerous graphical analysis tools. The impact models, such as destination and mode choice, can be programmed by modelers in the form of scripts according to their own ideas.

As an alternative to programming, this release includes a complete, widely disaggregated model. The model can be used as a template for own models. For this purpose, only the data must be exchanged, and the specifications of the choice models must be adapted. It is not necessary to adapt the included scripts.

The ABM developed by PTV is characterized by four disaggregation levels:

➡ The spatial resolution corresponds to locations and not, as is usual in aggregated models, to zones. Consequently, mode choice is based on exact node-to-node paths rather than on average zone relations.

➡ The temporal resolution of several time-of-day periods makes it possible that destination and mode choice consider temporally differentiated public transport supply quality as well as different PrT saturation levels.

➡ The population is represented by individual persons. Thus, segmentations can be designed very flexibly, or characteristics of persons can even be directly incorporated into choice models.

➡ Destination and mode choice take place within a concrete tour and are modeled in a fully consistent way. For example, the mode choice is also based on the traffic situation at the time of the return journey, and the choice models of intermediate destinations, as well as sub-tours, consider the main activity (through so-called rubber-banding) and the tour mode.

The newly developed model thus represents a quantum leap, especially for mode choice:

➡ In the case of motorized PrT, travel times for specific time periods are considered; for instance, they can be used to model a peak hour toll.

➡ The time-dependent public transport skims reflect the changing supply quality throughout the day. In particular off-peak times are correctly taken into account in the mode choice.

➡ Travel times between neighboring locations are based on shortest paths and no longer represent average travel times between zones. This leads to significantly improved mode choices especially for walking and cycling modes, which are increasingly becoming the focus of transport planning.

➡ The length of walk access to public transport is a decisive factor for its use. While this parameter is included in macroscopic models by means of a zone-wide average value, it is considered individually for each pair of locations in the ABM.

The framework has been rounded off with some new functionalities that enable the fast processing of very large amounts of data. This also includes parallelization, which allows a high-performance calculation of the demand for several million people.

1.4 Bicycle assignment

The increasing use of bicycles is a trend that has been observed for a long time and has been given further momentum by the pandemic. As a result, more attention is being given to modeling bicycle traffic. This not only refers to the forecasting ability on the demand side but includes the assignment of bicycle demand. In contrast to motorized private transport, the route choice of cyclists is rarely volume-dependent or aims exclusively at minimizing travel time, as in the case of an equilibrium assignment. Criteria such as distance, the attractiveness of a route, but also safety and comfort play a role. Dedicated bicycle routes are often more attractive than sections where cyclists share space with cars or pedestrians. In addition, preferences among cyclists differ and thus different routes are chosen between two zones. To better account for these aspects, a dedicated bicycle assignment has been introduced in Visum 2022.

1.5 Extensions to the modeling of ride-sharing systems

A key question in the modeling of ride-sharing systems is the evaluation of their sustainability. On the one hand, their intrinsic characteristics can lead to an improvement in accessibility in combination with traditional public transport. However, they can also lead to a massive increase in network-wide vehicle kilometers traveled (VMT) due to detours and empty trips. By introducing the parameter "ideal travel distance", the system efficiency of a ride-sharing offer can now be evaluated. The "ideal travel distance" reflects the transport service that the passenger asks for. The ratio of booked passenger kilometers to the total vehicle kilometers of a service is the measure of system efficiency.

The functionalities of the dispatcher, which links the generated trip requests with the available vehicle fleet, have been extended:

▶ Passengers who submit a trip request are assigned to a pick-up and drop-off point by the dispatcher. This is no longer automatically the next access node of the ride-sharing system. The choice is made by evaluating between fewer detours for the operator and shorter access time for passengers. This allows a trade-off between service level and optimized operation.
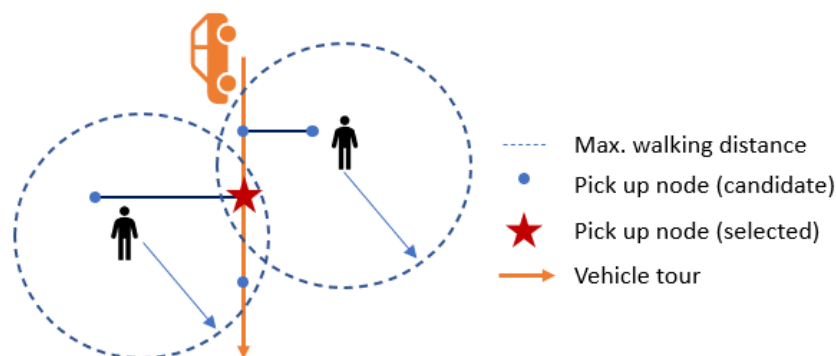
Figure 3: Determination of the optimal pick-up point for passengers with a trip request

▶ Vehicles that have dropped off their last passenger idle for a defined time. If no new trip request is received that can be served, the vehicle returns to a holding area. In PTV Visum 2022, a smarter choice of the holding area is applied. Whereas previously the

vehicle simply returned to the nearest holding area, now the area where the vehicle is most needed is selected.
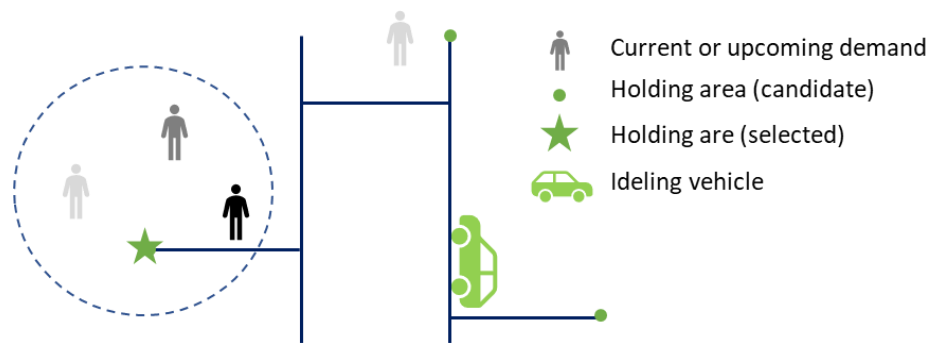
Figure 4: Determination of the optimal holding area for waiting vehicles

1.6   Discontinuation of the Lohse assignment

Over the last few years, we have invested significantly in new assignment methods and improvements to existing methods. In particular, with the introduction of the bi-conjugate Frank-Wolfe (BFW) equilibrium method, a procedure similar to the equilibrium Lohse method has been incorporated. With the introduction of proportionality in BFW, the remaining gap was closed, making this procedure superior to the equilibrium Lohse procedure. We have therefore decided to discontinue the equilibrium Lohse method. This has the following consequences:

➡ No more bug fixes related to this method will be made.

➡ The procedure will be removed in two years' time, i.e. from the release in the year 2023, the procedure will no longer be available in PTV Visum.

➡ Releases that are distributed up to the year 2022 are not affected by the removal.

➡ The discontinuation does not affect the assignment method Tribut equilibrium Lohse.

2 Modeling of private transport

2.1 Junction editor: improved geometry view

Historically, the network model in Visum is an abstract node-edge model of the traffic supply, where details such as the actual geometry of an intersection did not play a role. For the classical strategic models and their use cases, this is sufficient. However, this is not so true for the increasingly important mesoscopic models, and even less true when, for example, a subarea is extracted for microscopic simulation in PTV Vissim. In these cases, the positions of the stop lines, the lengths of pocket lanes, and many other details are of great importance, but so far hardly supported by the visual feedback in the junction editor.

For Visum 2022, the geometry view of the junction editor has been completely revised and shows not only a single node, but the entire road network, making it clear for example, whether the number of lanes changes in the vicinity of a node. This helps to detect errors and inconsistencies. Navigation through the model is direct and easy in the junction editor with the classical options of zooming and panning, and thus much more comfortable.

The displayed geometry is also much closer to the representation in Vissim, reducing "surprises" and correction effort when models are transferred from Visum to Vissim. The representation follows more and more the idea "What you see (in Visum) is what you get (in Vissim)".
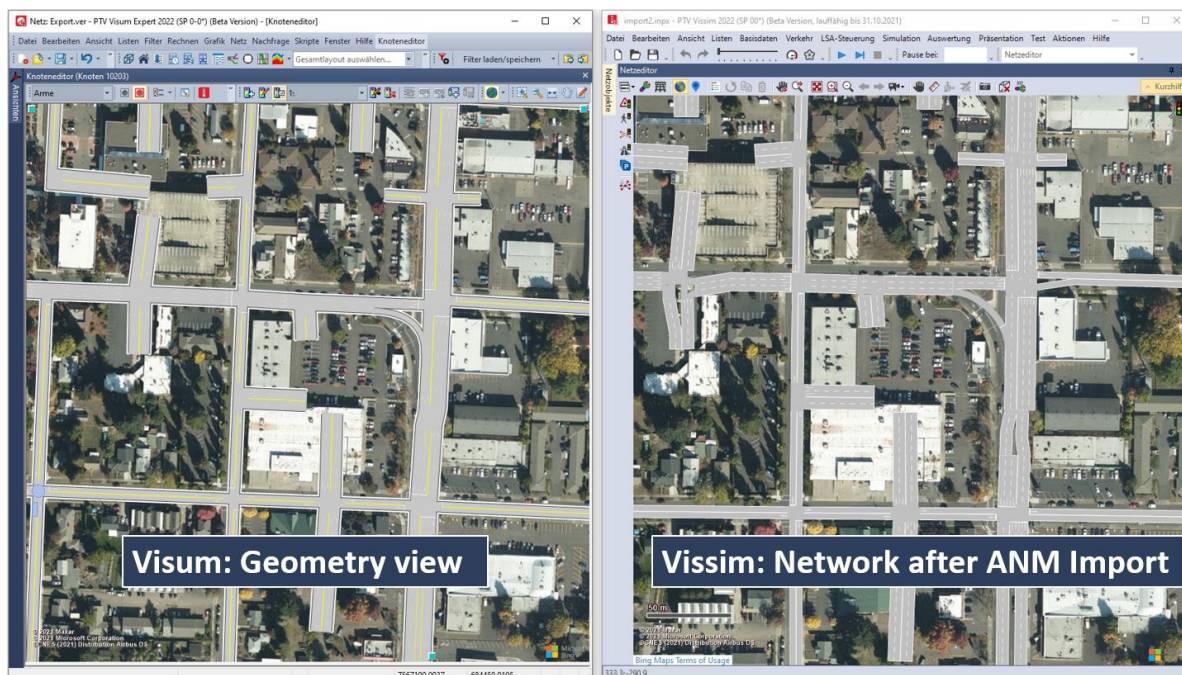
Figure 5: Network in the geometry view in Visum and in the network editor in Vissim

In addition, the foundation for interactive and thus faster editing of geometry in the junction editor has been laid. Nodes can be positioned with the mouse and the course of links can be edited. Discrepancies can be quickly corrected based on the background map that is displayed. Further editing options are planned in a further stage. The changes of the junction editor are completed by an adaptation of the toolbars and context menus.
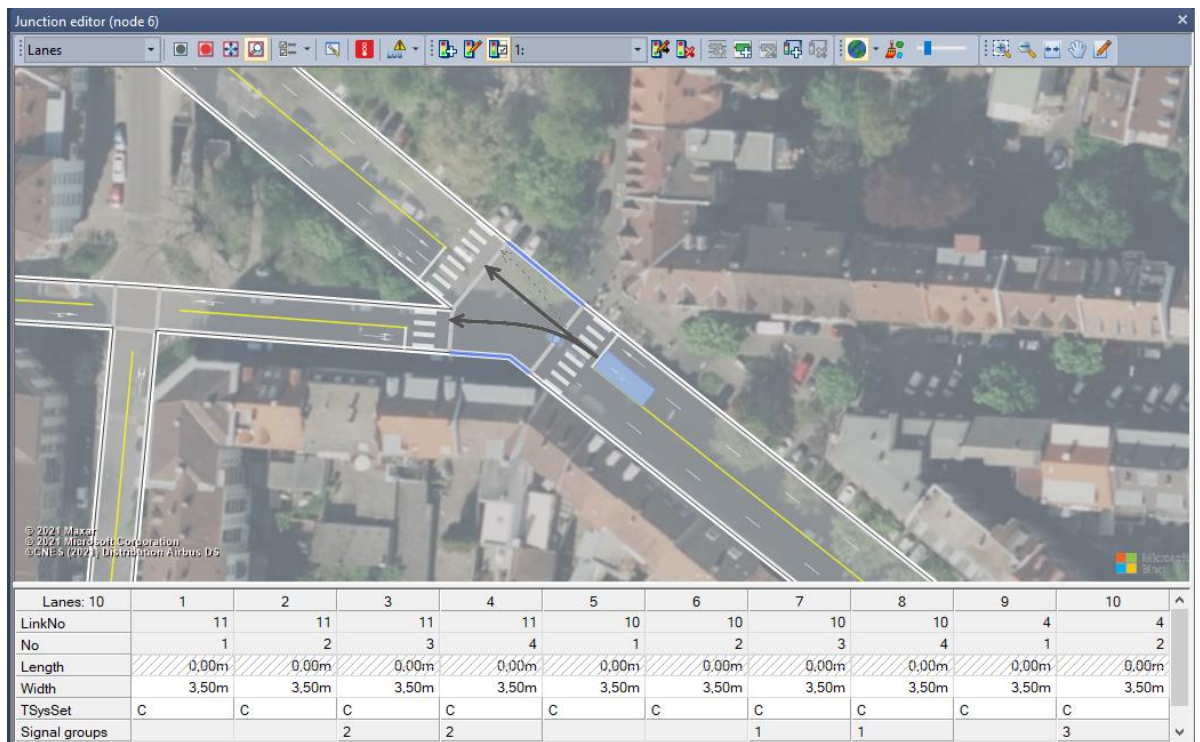
Figure 6: Geometry view with transparent network for adjustment to the background

2.2　Modeling of restricted traffic areas

Many cities are looking for solutions to tackle congestion and the increasing environmental impacts associated with it. With the objective to establish sustainable changes, various measures are being introduced or are to be tested as part of traffic studies.

These include driving bans, forbidden through traffic or charging policies depending on pollutant emissions. In contrast to driving bans, forbidden through traffic allows access for origin and destination traffic. Also, the environmental zones introduced or planned in many cities fall into this category of measures. In Germany, environmental zones are often defined as areas in which only vehicles that meet certain standards for exhaust emission are allowed. In the context of restricted traffic areas, they represent areas with driving bans. In other countries such as London (UK), vehicles that do not meet corresponding standards must pay a fee if they want to access the so-called ultra low emission zone (ULEZ). This, therefore, corresponds to a system with an area toll.
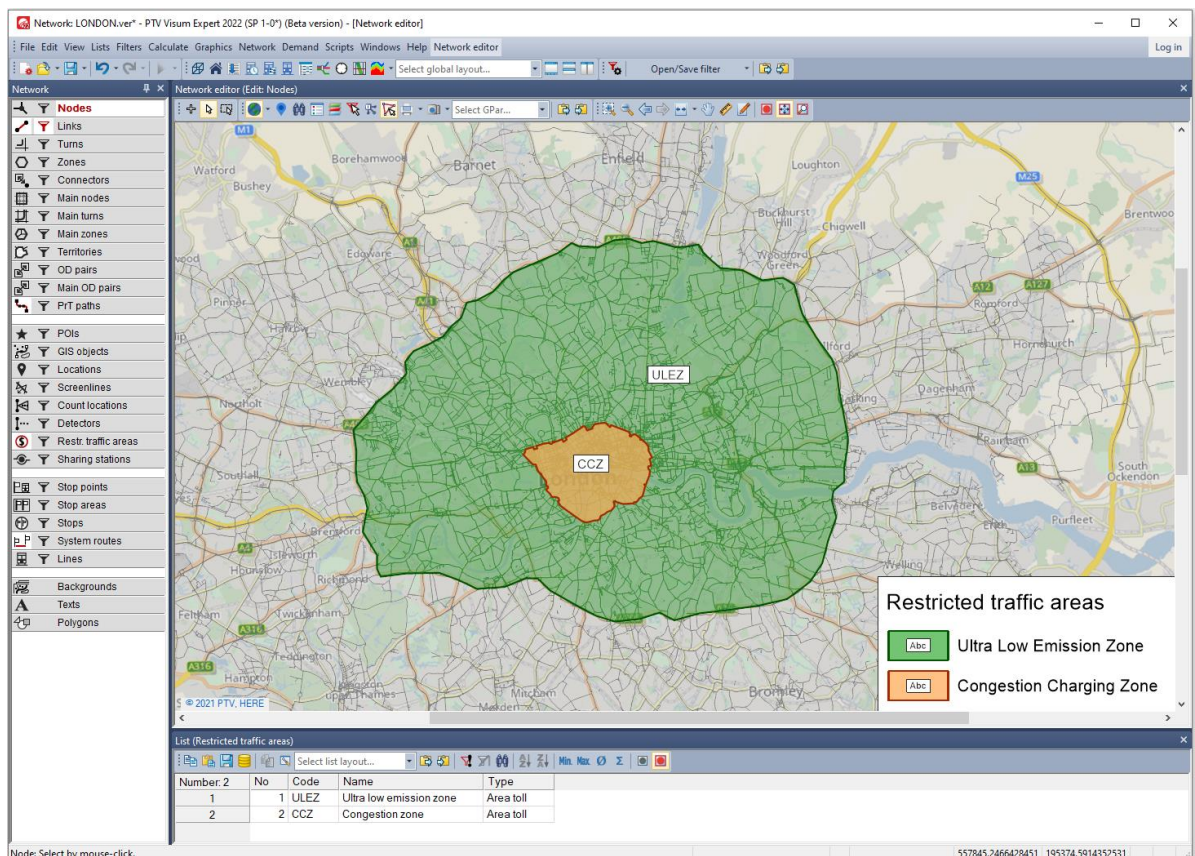
Figure 7: Network of London with restricted traffic areas

With PTV Visum 2022, measures of this type can be modeled more easily and compared in scenarios. These measures can be used individually or in combination. In addition, the effects can be calculated in static assignments as well as within the simulation-based assignment (SBA).

The network object 'Toll systems' has been renamed to 'Restricted traffic areas'. Like toll systems before, restricted traffic areas can be defined by polygons, i.e. they are either areas or sequences of links within the polygon. A distinction is made between four types of restricted traffic areas:

- No through traffic
- No traffic
- Area toll
- Matrix toll

Depending on the type of restriction, blocked transport systems (no through traffic, no traffic) or the amount of toll for each transport system (area toll) must be defined.

Restricted traffic areas of the type no traffic, no through traffic, and area toll can be considered in all static non-Tribut assignments. The only exception to this is LUCE. With this method, forbidden through traffic cannot be considered. For assignment with ICA, limitations are imposed by the choice of method for the subordinate assignment.

In the simulation-based assignment (SBA), restricted traffic areas of the type no traffic, no through traffic as well as area tolls can be taken into account. Area tolls can also be defined as a temporary attribute to model changes of tolls during the day.

For the consideration of restricted traffic areas in non-Tribut assignments, the impedance definition in the General procedure settings has been extended to include restricted traffic areas. Optionally, there is also the possibility to restrict the calculation to active restricted traffic areas.

For the Tribut assignment methods this means that area or matrix tolls are no longer defined as toll systems but as restricted traffic areas. As before, areas of the type 'matrix toll' can only be considered within the Tribut Equilibrium-Lohse assignment. Note that in contrast to the previous behavior, link tolls are considered within the Tribut Equilibrium Lohse when restricted traffic areas of the type area toll are used. To avoid this, toll-related impedance components must be removed or multiplied with a coefficient of zero in the General procedure settings.

2.3 Improvements in the simulation-based assignment (SBA)

In the simulation-based assignment (SBA), various improvements affecting the behavior of the vehicles were made. In detail, this concerns:

▶ the lane selection on approaches to complex intersections,

▶ the look-ahead distance for lane selection,

▶ the possibility to calibrate the capacity loss downstream of merges.

The changes are presented in detail below

In SBA, a simplified lane selection model is used. Vehicles choose their lanes at nodes before entering a link so that they can follow their allocated routes. However, additional internal nodes (e.g. nodes 1 and 2 in Figure 8) that are created when additional pocket lanes or channelized turns are defined could result in unrealistic lane changes on the approach to a node. The behavior has now been changed so that vehicles select lanes already considering the turning direction at the end of the link, i.e. additional lane changes at internal nodes are avoided.
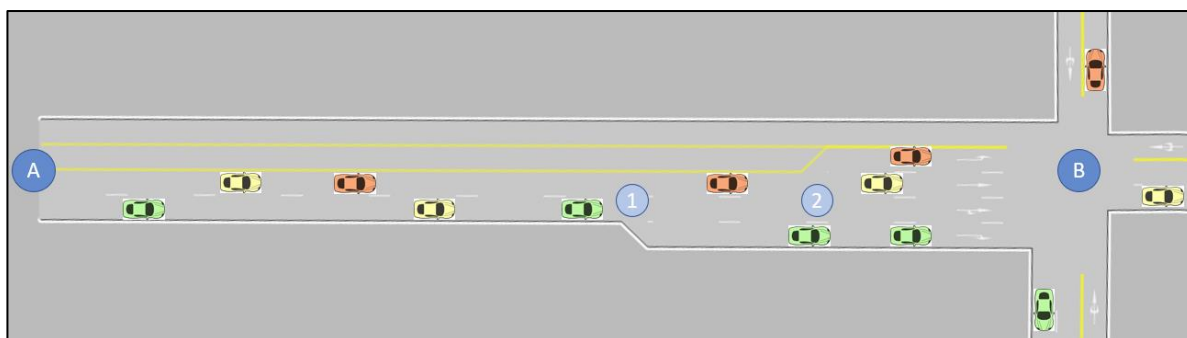
Figure 8: Lane selection on the approach to a node with two pocket lanes

The lane selection can also be influenced by a look-ahead distance. The look-ahead distance defines the distance that a vehicle can "see" beyond the end of the link. Any necessary lane changes within the look-ahead distance are already taken into account. The following Figure 9 shows an example for vehicles driving from A to D. The top image of Figure 9 shows the behavior without the look-ahead distance. In this case, vehicles can choose both lanes when entering link A-B. If a look-ahead distance is defined for link A-B that is longer than the link B-C, vehicles at A select only the right lane.
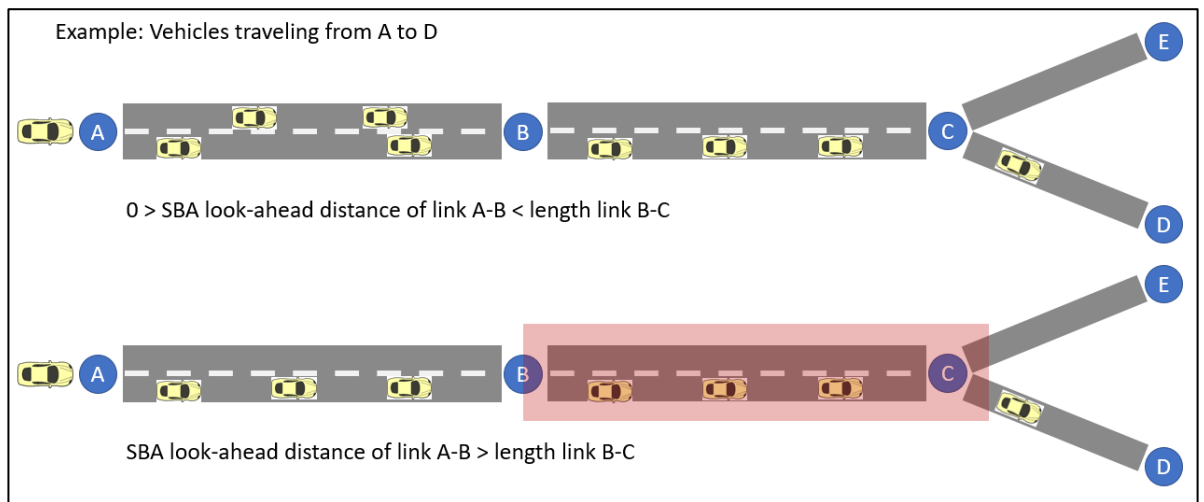
Figure 9: Lane selection at node A considering the turning direction at node B

The definition of look-ahead distances is useful when modeling signalized roundabouts as a sequence of single nodes. Vehicles typically select their lanes considering their exits further downstream.

By introducing the node attribute ' SBA penalty for merging vehicles', observed capacity drops downstream of merges can be calibrated. The value of the attribute defines the temporal headway in addition to the SBA reaction time that vehicles must maintain when entering the same destination lane but coming from different incoming lanes. It does not matter whether the incoming lanes are from different links or the same link. Figure 10 below illustrates the effect. If vehicles enter the destination lane from different lanes, the minimum time headway on the subsequent link increases and thus results in a drop of capacity on this link.
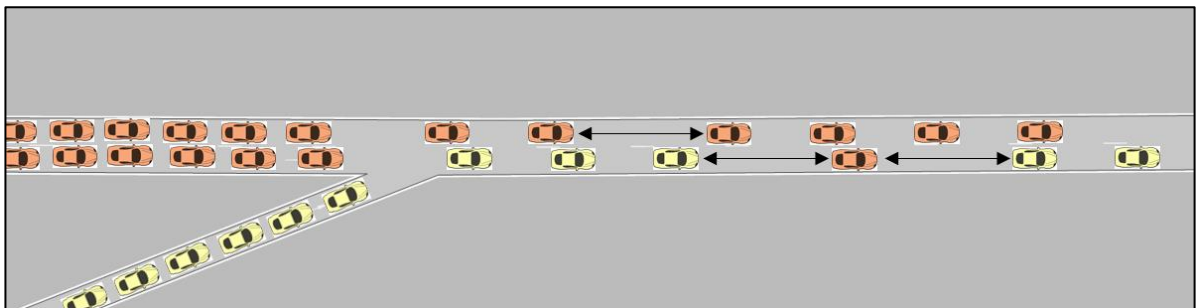
Figure 10: Vehicle headways downstream of a merge

2.4   Signal data redesign

In Visum, the data model of the signal data has been unified. With the exception of Ring Barrier Controllers (RBC), signal control in Visum is now defined based on the Vissig data model. This has advantages for some use cases, for example, signal control (SC) can be defined when creating a model without considering potential use cases at a later stage. The previously available internal signal control for signal group- and stage-based control, for example, could not easily be extended for the use of daily signal plans. The signal optimization procedures applicable to the respective signal controls were not the same and not available for all signal control types. In the course of the redesign, the challenge was to support the modeling of both simple and complex signal controls. Even though the

Vissig signal control previously served a wide range of requirements, a major drawback was that the data was stored in external .sig files.

After the redesign, external files are longer be required. The content of the .sig file is now stored in a new attribute 'Signal program data' of the SC. The attribute is of the type Base64Xml, i.e. it is base64 coded string. This attribute is also saved in network, attribute, and model transfer files. When reading these files, the data of the corresponding signal control is completely replaced. Furthermore, there is a new option to import or export .sig files. This can still be useful for the exchange with external systems.
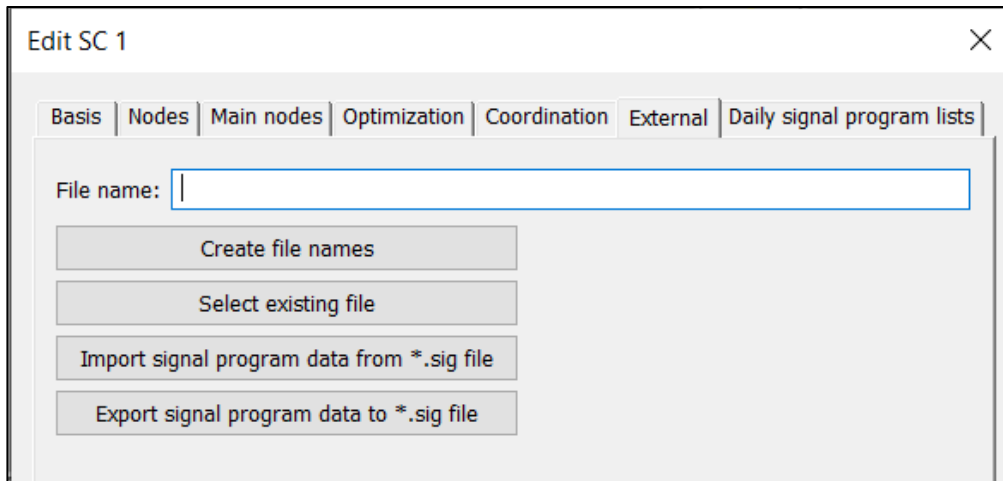
Figure 11: Export and import options in the Edit SC dialog

As part of the redesign, signal data can now be integrated into the calendar, i.e. it is now possible to allocate daily signal plans to calendar days. If valid days are defined, the allocation of daily plans to calendar days can be made on the basis of the valid days.
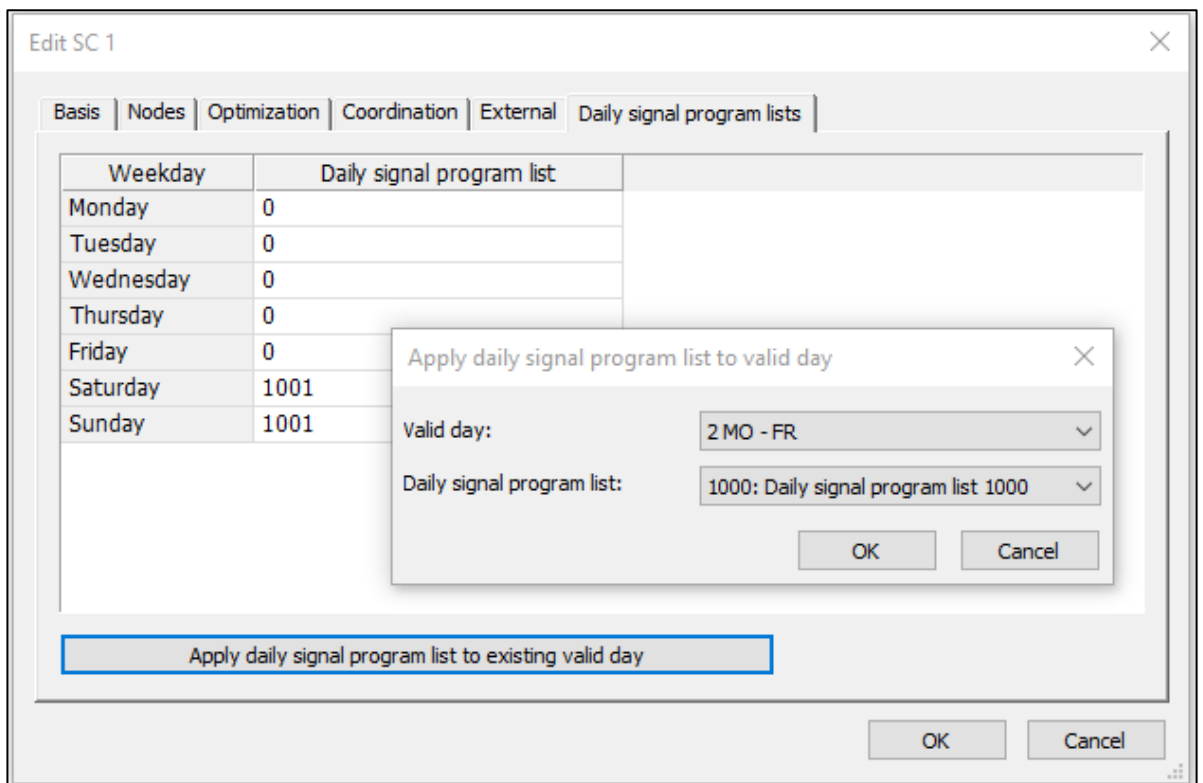
Figure 12: Allocation of daily signal programs to calendar days

Simple signal group- or stage-based controls can still be defined in the junction editor in Visum without having to use the GUI of the Vissig editor. The data is synchronized between Visum and Vissig and part of the data - especially attributes of signal groups and stages - is reflected in Visum. This enables editing them like other attributes on the UI, i.e. in the junction editor and in lists. Every change to the data of the signal control causes an update of the attribute 'Signal program data' of the SC.

Since the basis is the Vissig data model, a signal program is always generated even when defining a signal group-based control. When defining a stage-based control, interstages are generated in addition to the signal program. When creating a stage-based control, the number of stages can optionally be defined. Based on the cycle time and taking the duration of interstages into account, the stage length is initially distributed equally. Stage green times can be edited. However, due to the consideration of interstages, the green times of stages are no longer independent of each other, i.e. changing the green time start automatically changes of the green time end of the previous stage, for example. The duration of the interstage can be changed via the context menu in the signal timing view.

For more complex signal controls, the changes must be made in the Vissig GUI, which can be opened both from the junction editor and from the context menu of the SC list. Such changes include:

- the creation of additional signal programs

- the definition of daily signal program lists

- editing, creating, and assigning intergreen matrices

- editing of interstages in which signal groups are switched within the interstage

- the use of other default sequences for signal groups

The signal timing view in the junction editor has been changed. Now signal times of signal groups are always displayed and synchronized with the geometry view of the network. In the case of stage-based controls, interstages are displayed as well and they can be moved individually or together within the cycle time.
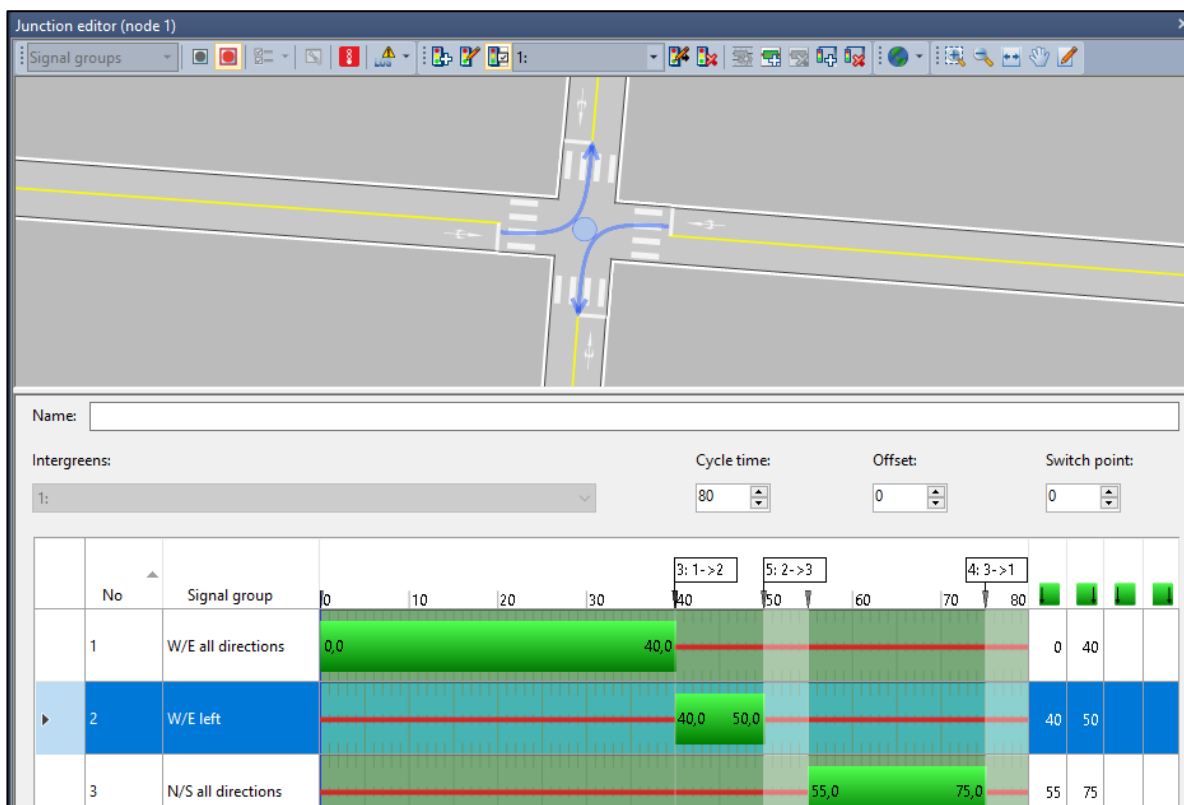
Figure 13: Signal timing view in the junction editor

The stage diagrams can be viewed in the Vissig GUI.

What are the consequences for existing models in Visum 2022?

When the version file is read, all signal data is converted. If external .sig files were previously used, they are no longer needed after saving the version in Visum 2022.

For signal time optimization, all optimization procedures are offered for Vissig controls. Green time optimization for stage-based Vissig controls is unchanged, but it differs from the green time optimization offered for stage-based internal controls in Visum 2021 and earlier. Green time optimization for Vissig signal group-based controls has been added. The procedure is similar to the procedure that has already been used for internal signal group-based controls.

For the ANM export, the attribute 'Signal program data' is also written as a Base64String in the ANM file. Since the attribute is also introduced in Vissim 2022 for Vissig fixed-time control signal data can be read using this attribute in the ANM import or when comparing ANM files for the adaptive ANM import. If there is a difference in the attribute when using the adaptive ANM import, the attribute is read in Vissim and the data of the signal control is replaced.

In scenario management, changes to the signal data are only considered for the signal control. More precisely, this means that if modifications are combined (e.g. one modification for the cycle time and another modification for the green time start of a signal group), the last modification read wins and this data is applied to the SC. Model transfer files saved with versions prior to Visum 2022 are not adjusted. Consequently, applying such model transfer files in Visum 2022 can lead to undesired changes.

3   Speed up

The **classical equilibrium assignment** has been extremely accelerated. The calculation speed increases by up to 2,000% (see also chapter 1.1).

Also, the **simulation-based assignment** (SBA) has been accelerated by up to 15%.

The calculation of **node impedances** is now much faster than before. All static assignments benefit from this acceleration by up to 60% of the runtime.

The matrix estimation procedure **TFlowFuzzy** calculates up to 20% faster.

The calculation of **flow bundles** is up to twice as fast as before.

The runtime of the **PrT skim calculation** has been reduced by up to 60%.

4 Handling

4.1 Live location search

The live location search allows you to navigate quickly in large networks. In the network editor, you will find a button that allows you to enter search terms. Potential matches are displayed below the text entry.
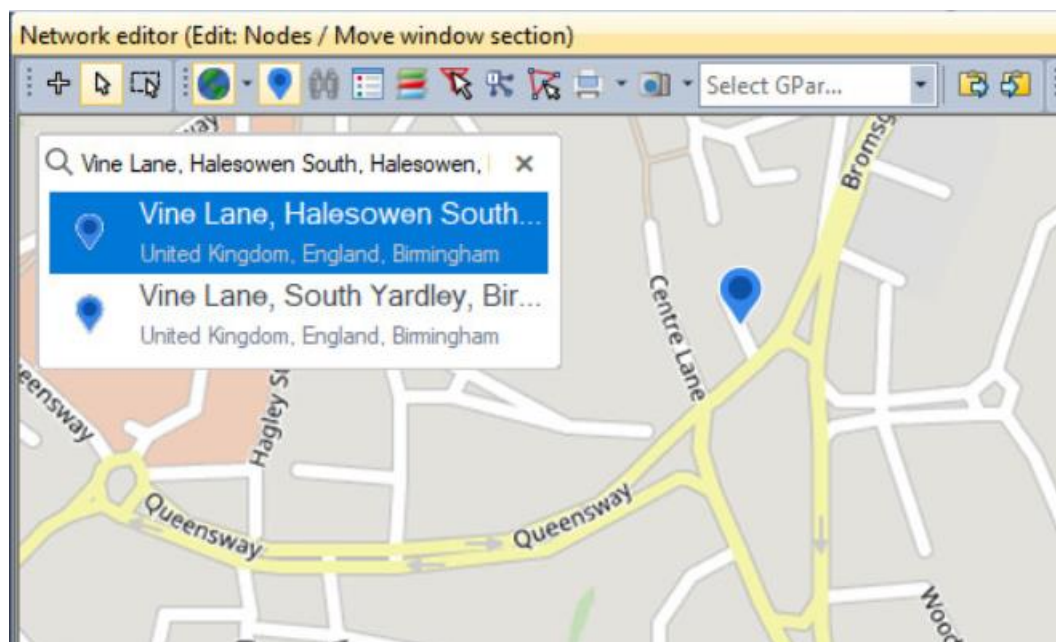
Figure 14: Live location search in the network editor

4.2 Extensions for working with matrices

Traffic demand is represented by matrices in PTV Visum. The dimension of the matrices is the number of zones in a model. On the one hand, the model areas are getting larger and larger, but also the level of detail is getting finer. Thus, the number of zones increases and better processing and overview of the matrix entries is necessary.

Filtering of OD pairs is a frequent step for editing matrix values. Via the button 🔻 passive pairs can be hidden in the matrix editor (see Figure 15 right). In the following Figure 15, you can see that changes - in this case an addition of 100 - only affect active matrix cells if you apply this change to a selected area of the matrix. The left side of the Figure 15 (without filters) is only used for illustration purposes.
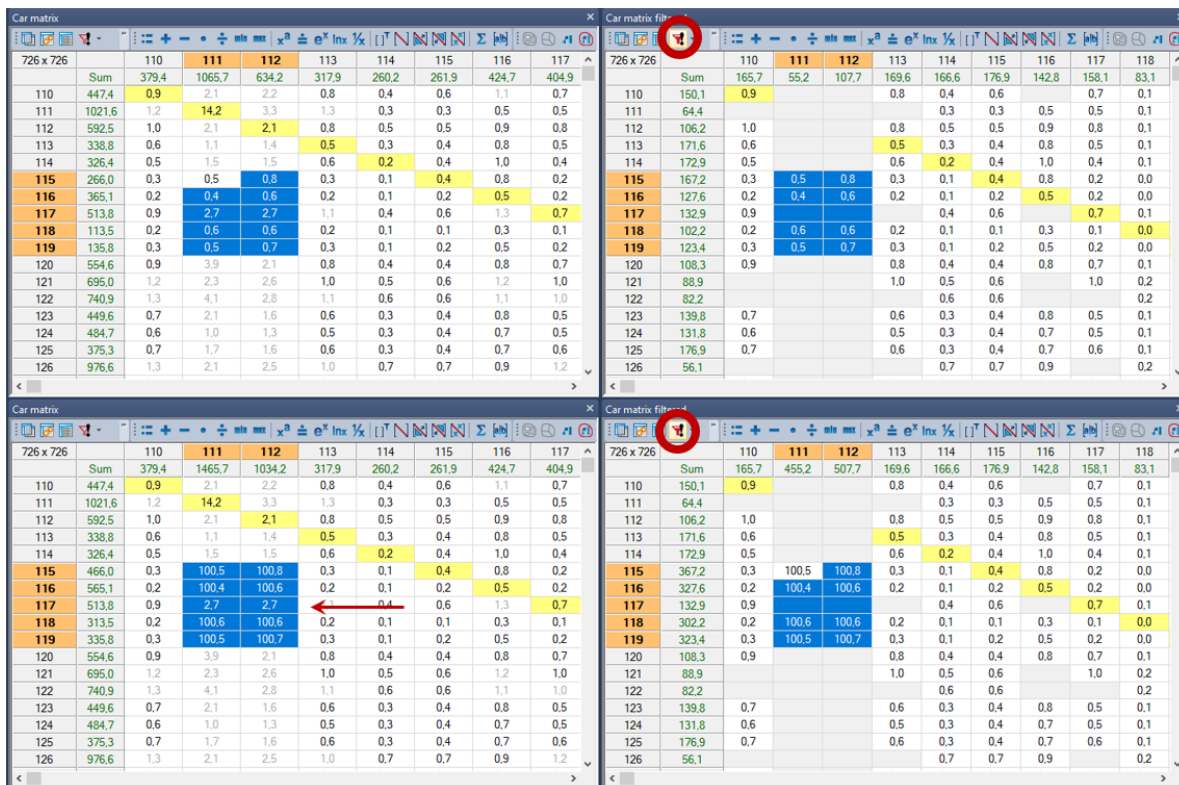
Figure 15: Matrix editor: above/below – before and after editing a rectangular area; left / right – without and with a filter applied

Active matrix cells are also considered in the matrix histogram and in the matrix comparison. This refers to both the graphical representation as well as the values in the grid and, in the case of the matrix comparison, the output of the statistics.
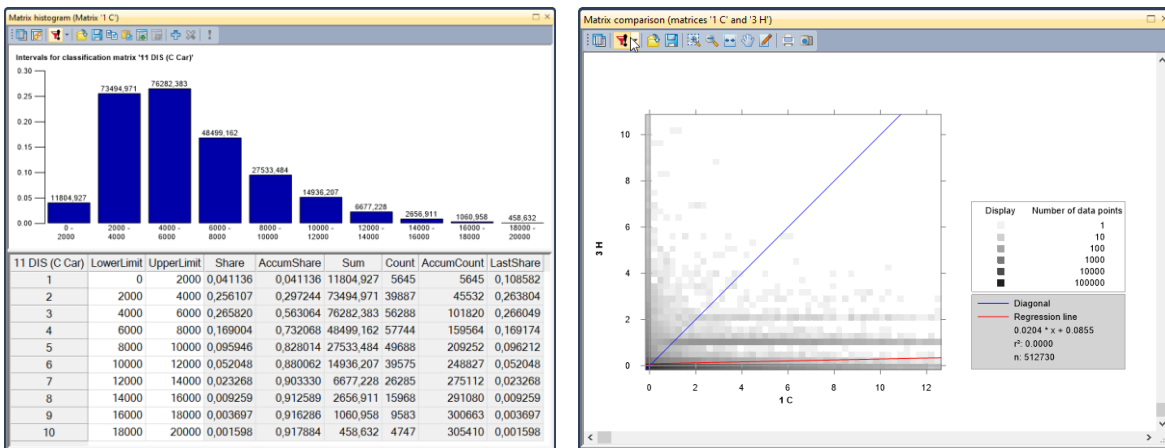
Figure 16: Matrix histogram and matrix comparison with an active filter for OD pairs

When using multiple matrix editors, matrix histograms, and matrix comparisons, it is helpful to rename the header via the view-specific menu. These are then not only visible in the title of the window but also in the tabs of open views.

5 Interfaces

5.1 Update of the Emme import

Converting data from other program systems as lossless as possible simplifies the creation of a model in PTV Visum. PTV Visum offers import functionality for all common modeling software. In the latest version, the interface to Inro's Emme has been updated and the workflow simplified.

▶ "Extra Attributes" that are similar to the user-defined attributes in PTV Visum can be imported.

▶ Intermediate points of links that exist in the 'shapes' file are taken into account.

▶ Modifications of transport systems for links coded in the 'm-lines' are read and converted.

The character set encoding, as well as the projection of the coordinates, can be set before the import. The same applies to the transport system-specific setting of the public transport routing of the delivered public transport information.

5.2 MapFan DB import

The company 'Increment P' offers detailed map data for Japan. In PTV Visum 2022, it is possible to import MapFan DB data directly. Both roads and railroads are transferred. You can limit the amount of data by setting the model boundaries before importing. All static data, such as identifiers, time-dependent closures, and speed limits are stored in user-defined tables. The interface enables a seamless transfer of data and thus quickly creates a solid foundation for Japanese models.

Figure 17: Imported data from Map Fan

5.3   Changes to the COM interface

The following changes to the COM interface may require adjustments to your scripts. For more details and a complete list, please refer to the release notes.

- The COM-Interface `ITollSystem`, `ITollSystems` and `ITollSystemList` have been renamed to `IRegulatedTrafficArea`, `IRegulatedTrafficAreas` and `IRegulatedTrafficAreaList`.
- The return value type of `GetFilteredSet` und `FilteredBy` was changed from ICollectionBase to the actual container type, i.e. the type on which `GetFilteredSet` or `FilteredBy` was called.
- Several methods for writing files based on an `ITableAttrSelection` object have been renamed.
- Lists for PrT-Path and user-defined paths have been separated. User-defined paths are now accessible via the `IPathList`, or `IPathItemList` interface.
- The attributes `PTripsUnlinked>2` and `PTripsUnlinked>2_DSeg` have been renamed to `PTripsUnlinkedGt2` und `PTripsUnlinkedGt2_DSeg`.
- `wxPython` had to be updated in PTV Visum 2022. Scripts or AddIns with a graphical user interface, which are based on wx, may have to be adjusted.

6 Miscellaneous

6.1 Reading of older version files

Reading version files saved with releases prior to Visum 11.03 is no longer supported in PTV Visum 2022. The same applies to other binary files, i.e. graphics parameters (.gpar), list layouts (.lla), and procedure parameters (.par). Network files that have a version number lower than 3 are also no longer readable in Visum 2022.

The reading of text files (.net, .dmd, .att) is not explicitly rejected, but a warning is shown when trying to read files with older version numbers.

6.2 Settings for language and add-ons

The settings for the languages and add-ons have been moved to the user preferences. You can select the primary and fallback language. Switching between these two options is enable using short cut Ctrl+L. It is also possible to turn on and off existing modules (add-ons). This reduces the user interface to the selected modules and their functionalities and can thus provide a clearer working environment.

7 Technical topics

7.1 Python environment

With Visum 2022, support for Python 2 has ended. The corresponding files have been removed from the setup. Scripts used must use Python 3 from now on.

The Python 3 .x environment has been updated to Python 3.9.5 (released on May 3, 2021). At the same time, the Python libraries included in the setup were updated. The following table contains an overview of the libraries supplied with Visum 2022.

Library	Version	Library	Version
certifi	2021.5.30	partd	1.2.0
chardet	4.0.0	patsy [1]	0.5.1
clodpickle	1.6.0	pillow	8.2.0
cycler [1]	0.10.0	pyparsing	2.4.7
dask	2021.6.2	python-dateutil	2.8.1
fsspec	2021.6.1	pytz	2021.1
GDAL	3.3.0	pyyaml	5.4.1
idna	2.10	requests	2.25.1
kiwisolver	1.3.1	scipy	1.6.3
locket	0.2.1	six	1.16.0
matplotlib	3.4.2	statsmodels	0.12.2
numexpr	2.7.3	tables	3.6.1
numpy	1.20.3	toolz	0.11.1
openmatrix [1]	0.3.5.0	urllib3	1.26.5
pandas	1.2.4	wxpython [1]	4.1.1

[1] unchanged compared to PTV Visum 2021

All add-ins installed with PTV Visum have been adapted accordingly. The update to Python 3.9 also requires an adjustment of your own add-ins. Specifically, the following block must be removed in the .vai file or Python 3.9 must be added:

```
<SupportedScriptingEnvironments>
<ScriptingEnvironment>Python 2.7</ScriptingEnvironment>
<ScriptingEnvironment>Python 3.7</ScriptingEnvironment>
</SupportedScriptingEnvironments>
```

7.2 Improved License management

License management has been improved, simplifying many operations and providing an easy overview of your licenses, such as:

- ▶ License updates are now possible without a license key.
- ▶ License borrowing is simpler and more robust.
- ▶ File-based offline activation is now integrated.

The complete functionality is described in the [user documentation](#). You can use the new license management in two ways:

- ▶ With the [PTV License Manager](#): As an added advantage, this stand-alone tool can be used independently of product installations, for example on a license server. It also works for previous product versions.
- ▶ Within PTV Visum 2021.1-08 or later.

PTV Visum will automatically notify you when a license update is available. You can install it with a single click.

7.3 CodeMeter Runtime

The CodeMeter Runtime environment has been updated to version 7.21a.

PTV VISUM

the mind of movement

PTV VISUM

the mind of movement

2022.01-00 [234355]

2021-09-24

⊕ New Features and Changes

Activity Profile

⊕ Detail view: The filtering of the elements in the detail view can now be canceled or can only be based on the selected time. **(21199)**

COM-API

⊕ Output of notes in case of rejected COM calls: If the Visum COM server is busy, it can generally happen that incoming COM calls are rejected (exception 'RPC_E_SERVERCALL_RETRYLATER' (0x8001010A)). In this case, a note on possible causes is now output to the log file to facilitate the search for possible causes. **(23085)**

⊕ Remove zigzags: Until now, zigzags in line routes could only be removed interactively. Now, with a new COM function, this possibility is also available via the COM API. **(22625)**

Data Model

⊕ New relations between point objects and surface objects: There are new multi-relations between nodes or POIs (point objects) and surface objects (territories, main nodes, POI surfaces, restricted traffic areas). This allows to identify the containing surface objects or contained nodes or POI point objects respectively. **(19406)**

⊕ Relation from link to allocated count locations: Access to the count locations allocated to a link has been accelerated. **(17236)**

⊕ Time series and time interval sets: Standard time series can be defined on the basis of time interval sets. Conversely, time interval sets with the corresponding time intervals can be generated from standard time series. **(19924)**

Demand Procedures

⊕ List for activity chains: There is a new list for activity chains. **(19465)**

Dialogs

⊕ Line breaks in column headers: In lists and embedded grids, column headings are automatically wrapped. The height of the heading line can be set separately for this purpose. **(11199)**

⊕ PuT Operating Indicators: After the functional enhancements by the stop point analysis, the procedure parameter dialog of the PT operational indicators was restructured and made clearer. **(22984)**

⊕ Time series and time interval sets: Standard time series can be defined on the basis of time interval sets. Conversely, time interval sets with the corresponding time intervals can be generated from standard time series. **(19924)**

⊕ Tour planning: After the functional enhancements of the route planning, the procedure parameter dialog was restructured and made clearer. **(22119)**

I/O Interfaces

⊕ Error messages when accessing PTV Visum Publisher: The error messages issued when accessing PTV Visum Publisher have been made more specific and are now also written to the log file to make them more transparent. **(23129)**

Installation

⊕ Power saving mode: The PTV Visum application now survives power saving mode, which is common especially on laptops, i.e. if the system is put into power saving mode while the Visum instance is running, the same instance can continue to be used after the system is restored. **(22940)**

Junction Editor

⊕ Attribute ID 'CIslandoffset': The attribute ID of the leg attribute 'CIslandoffset' has been changed to 'Lateraloffset'. **(23013)**

⊕ Change of default values: The default values of the following attributes have been changed: Length (Detector), Has separate right turn (Leg), and channelized turn (Leg). **(22668)**

⊕ Check of SCs: A check for transport consistency is provided for signal controls of the Vissig type. It finds transport conditions that do not make sense. In the Vissig window, these are highlighted in red. **(22461)**

⊕ Creating detectors: When creating detectors, the attribute 'TSys' is preset with the lane attribute of the same name. **(22924)**

⊕ Crosswalks: The geometry calculation for crosswalks has been adjusted so that crosswalks are correctly placed and displayed even in non-standard cases. **(22173)**

⊕ Display of lane turns: The geometry calculation for lane turns has been modified. **(22175)**

⊕ Display of the center island: The display of the center island has been improved. It is no longer displayed as paved. **(22551)**

⊕ Network section: The network section of the Junction editor is saved with the global layout. **(22936)**

⊕ Usability: Various improvements have been made to improve usability and support existing workflows while editing. **(22667)**

⊕ Vissim previewer updated: The Vissim version used for the node preview has been updated to PTV Vissim 2022.00-00. **(22746)**

Lists

⊕ Line breaks in column headers: In lists and embedded grids, column headings are automatically wrapped. The height of the heading line can be set separately for this purpose. **(11199)**

⊕ List for activity chains: There is a new list for activity chains. **(19465)**

Main Window

⊕ Login to PTV Cloud: The user's login to PTV Cloud is shown in the program. **(21188)**

Miscellaneous

⊕ Creating zones: The process of creating zones for large matrices has been accelerated. **(23074)**

⊕ Version comparison with command line parameters: Simple version comparison ('Compare current network with version file') is possible using command line parameters. For the comparison, Visum must be started with the parameters -h [VerFile1] -j [VerFile2]. **(22985)**

Network Editor

⊕ Check network for inaccessible stop points: The network check function 'Boarding and alighting at inaccessible stop points' now displays a special message in advance in case there are no connectors in the network instead of listing all stop events. **(23024)**

⊕ Multiple selection of network objects: By dragging a rectangle, a multi-selection of the selected network object type is made. The objects can be edited, but they are not filtered as in the spatial selection. **(21933)**

⊕ Network check for link orientations: A new network check function has been added. It checks whether the current orientations match those that would be set during a recalculation. A corresponding repair function is also provided. **(21965)**

Other Procedures

⊕ ABM tours: The procedure "Generate path sequences from tours" generates path sequences from ABM tours. Path sequences, in contrast to tours, can be displayed and analysed as paths of existing assignments. **(20249)**

⊕ Pseudo-dynamic volumes (PDV): There is a new procedure, the pseudo-dynamic volumes (PDV), which is used to generate dynamic volumes for links based on the paths of a static assignment and a demand time series. **(17218)**

⊕ SC split optimization: The option 'Retain intergreens' in the general procedure settings has been removed, i.e. the intergreen matrix for signal groups is always taken into account. If this is empty, the value of the SC attribute 'Standard intergreen' applies. **(22904)**

PrT Assignment

⊕ BPR type VD function: The special handling for integer exponents in the BPR function has been removed. **(21477** 🔴**)**

⊕ Classical equilibrium assignment: The procedure has been modernized and significantly accelerated. **(17641** 🔴**)**

- ⊕ Equilibrium_Lohse procedure: If a PrT assignment of the 'Equilibrium_Lohse procedure' variant exists when opening a version file in the procedure sequence, a warning is issued because this procedure has been discontinued, i.e. it will no longer be available from the release version in 2023. **(22892)**
- ⊕ Pseudo-dynamic volumes (PDV): There is a new procedure, the pseudo-dynamic volumes (PDV), which is used to generate dynamic volumes for links based on the paths of a static assignment and a demand time series. **(17218)**

PuT Assignment

- ⊕ Discomfort Skim Matrix: In the general procedure settings, the time unit can be set for the PT skim matrices. However, this did not work for the skim matrix discomfort due to overload, it was always calculated in seconds. This has now been changed, the discomfort skim matrix is now always calculated according to the general procedure settings. **(21962)**
- ⊕ Headway-based Assignment: The simultaneous headway-based assignment of many demand segments has been accelerated. **(22693)**
- ⊕ Hybrid PuT assignment (timetable-based and headway-based): In the timetable-based assignment, it is now possible to consider a part of the supply, for which either no timetable is known or for which the specific timetable is not relevant from the customer's point of view due to the very dense supply, as a headway-based supply. No vehicle journeys need to be defined on this part. PuT path legs on a headway-based supply have no reference to specific vehicle journeys. **(18487)**
- ⊕ Service frequency: The calculation of the service frequency considers coupled vehicle journeys. As a result, two coupled vehicle journeys are only counted as one trip opportunity in the service frequency. **(22370)**

PuT Line Blocking

- ⊕ It's possible to manually insert empty trips in a line block. **(22969)**

PuT Operating Indicators

- ⊕ Number of Section service trips: For the evaluation of double traction, the key figure number of section service trips can be evaluated differentiated by vehicle combination and territory. For this purpose, two new indicators have been introduced: 'Number of section service trips' at the Territory- PuT detail and 'Number of section service trips-vehicle combination' at the vehicle journey item. **(21769)**
- ⊕ Revenue for vehicle journey items: In addition to vehicle journeys, revenues are also reported for vehicle journey items. **(20807)**
- ⊕ Stop point analysis: The new stop point analysis summarizes the operational and traffic performance indicators from the perspective of the stop point and offers new indicators. A list of the indicators can be found in the manual. The 'Number of service trips' indicators are renamed 'Number of stops events' for stops and stop points. The indicator of the stop events at territories, Territory PuT detail and Territory PuT detail-vehicle journey item are prefixed with 'Number', so that the naming is consistent. **(21718)**
- ⊕ Transport supply: Indicators for the transport supply can now be calculated if only headway information is available for the service. Indicators on the aggregation below the time profile are not possible. **(13934)**
- ⊕ Vehicle Journey Items: The number of stop events are calculated at the vehicle journey items. Additionally they are derived on the basis of vehicle journey section, and without considering couplings. **(19578)**

Visum Files

- ⊕ Warning when overwriting version file in newer format: When overwriting an existing version file, a warning is now issued if a file in a format of an earlier program version is replaced by the current version in the process, so that the file can then no longer be opened in the older program version. The prerequisite is that you activate the general warning regarding the overwriting of existing files in the user settings. **(19363)**

✓ Fixed Bugs

Add-Ins

- ✓ Error when using weighted aggregation in 'Calculate Matrix': Using the weighted aggregation (function 'AVGW') in the 'Calculate Matrix' add-in resulted in an error message. This error has been fixed. **(23082)**

COM-API

- ✓ Effect of AddAllColumns at lists dependent on user setting: The effect of the 'AddAllColumns' method on list objects (I...List) was previously dependent on the user's settings for preselecting time intervals for attributes with subattributes AHP or AHPI or AZI. This error has been fixed in that this method now always creates columns for all subattribute values, analogous to the method of the same name at 'ITableAttrSelection'. **(22991)**

- ✅ Exporting transposed lists to array: No more crash when exporting a transposed list (e.g. list 'PuT assignment statistics' or list 'Emission statistics (HBEFA)') via the SaveToArray method. Transposed lists are also saved to the array in non-transposed form, i.e. the first dimension corresponds to the objects, the second to the attributes per object. **(22868)**

Data Model

- ✅ Attributes of structural properties inaccessible for Tour-based model: The attributes of the network object structural property were only accessible with the add-on module EVA, although they are also required in demand models of type Tour-based model. This error has been fixed. **(23055)**
- ✅ Restriction of the duration of the calendar period: For very long calendar periods, the number range is not sufficient to display points in time distinctively, with a wide variety of negative effects on the data model and procedures. The duration of the calendar period is therefore now limited to a maximum of 50 years. **(22961)**
- ✅ Shortest path search criterion for empty trips at the block version: The shortest path search criterion when creating empty trips was previously saved as an attribute ID at the block version, although it was actually an enumeration type. Therefore, the previous attribute 'Link attribute for shortest path' at the block version has been made obsolete and replaced by the new attribute 'Criterion for shortest path searches used for empty trips' of appropriate (enumeration) type. **(23004)**

Demand Procedures

- ✅ Sorting of activity locations: Activity locations are sorted in lists, among others, according to the associated activity codes. However, the sorting differed from the sorting in activity lists with regard to upper and lower case. This has been changed: The sorting with regard to activities is now identical in both lists. **(22959)**

Dialogs

- ✅ Crash after changes to signal programs: A crash no longer occurs when selecting a signal program in the SC dialog after signal programs of the signal control assigned to this SC have been removed. **(23066)**
- ✅ Crash in parameters dialog of 'Spatial PuT analysis': No more crash when deleting an attribute entry in the parameters dialog of the procedure 'Spatial PuT analysis' if it is the only attribute entry of this procedure. **(22926)**
- ✅ Crash on empty file name for matrix operand from file: A crash no longer occurs when exiting the 'Select the operand for ... ' dialog if loading a matrix from file is selected but no file name is indicated. **(22712)**

Filters

- ✅ Filter on empty multi-enumeration type (e.g. TSysSet) did not always work correctly: If the condition was set in the filter that an attribute of an enumeration type that allows multiple selections (typically sets of objects such as TSysSet, DSegSet, etc.) was not equal to the empty set or contained at least one element of the empty set, network objects whose attribute value was the empty selection fulfilled this filter condition. This bug has been fixed. **(22917)**

Formulas

- ✅ Crash when accessing demand segments whose volumes are stored at other demand segments: If it was indicated in the general procedure settings for a PuT demand segment that the volumes would be stored at another demand segment, Visum crashed until now, if either a demand matrix correction was executed for this demand segment or the assignment matrix was accessed via a formula. This error has been fixed. **(23104)**
- ✅ Error in MIRROR_LOWER function inside formula matrices: The MIRROR_LOWER function available in formula matrices returned incorrect results under certain conditions. This bug has been fixed. **(23070)**

Graphics 3D

- ✅ Warnings during SBA visualization: If trajectories of an SBA assignment were displayed in the 3D network editor, but were not recorded during the SBA assignment, warnings that occurred during the assignment possibly interrupted the recording of the trajectories. This error has been fixed. **(22864)**

I/O Interfaces

- ✅ Crash when exceeding size limit for Access export: A crash no longer occurs when exporting large amounts of data to MS Access when the size limit of 2GB is exceeded. An error message now indicates the limit. Since Access limits the file size itself, the actual problem can only be solved by using other databases, e.g. SQLite. **(22649)**
- ✅ Trajectory export to PTV Visum Publisher: When exporting trajectories to PTV Visum Publisher, incorrect data could occur. This error has been fixed. **(22911)**
- ✅ Warning for unlisted OCPs during railML import: If OperationControlPoints (OCPs) were used in trainPart elements while importing railML that are not listed in the infrastructure, this violation of the referential integrity of the railML file was previously accepted silently. Now such files can still be read in, but a warning lists all affected OCPs. **(23058)**

☑ Windows for login and Visum Publisher export sometimes in the background: On certain systems, it could happen that the window for login as well as the window for export to PTV Visum Publisher was not displayed as part of Visum but as a separate window in the Windows taskbar and could also be hidden by the main window of Visum. This error has been fixed. **(22998)**

Junction Editor

☑ Display of the Signal times view: The Signal times view was not displayed correctly in some cases. This error has been fixed. **(23049)**

☑ Display of the stop line: For nodes of the control type 'Two-way yield', the stop lines were drawn incorrectly on all lanes of links and not only on lanes of links that have to give way. This error has been fixed. **(23035)**

☑ Right-turns in opposite flow in ICA calculation: When calculating the node impedance according to ICA, for the opposite flow of a permitted left turn with the option 'ICA right turn will influence opposing left turn' switched on, the right turns of the opposite direction were only taken into account for this opposite direction in the case of shared straight/right lanes. This error has been fixed. **(23056)**

Lists

☑ Analysis rows in path lists when switching the demand segment: After switching the displayed demand segments of a path list, the analysis rows (Min, Max, Sum or Avg) continued to display values matching the previously displayed content of the list. This error has been fixed. **(23030)**

☑ Case-sensitive key attribute changes: For network object types whose key is a string (e.g. transport system or line), this key attribute could not be changed in a list if this change consisted only of case-sensitive key changes. This bug has been fixed. **(22221)**

☑ Marking when releasing the mouse outside the cells: If the mouse is released outside the display area of the cells when marking a whole block in a list or in the matrix editor, the marking displayed as a preview was not applied. This bug has been fixed. **(22775)**

Matrix Editor

☑ Marking when releasing the mouse outside the cells: If the mouse is released outside the display area of the cells when marking a whole block in a list or in the matrix editor, the marking displayed as a preview was not applied. This bug has been fixed. **(22775)**

Matrix Estimation

☑ Consideration of PT walk trips: The matrix correction procedure adjusts demand matrices in such a way that the resulting volumes correspond as closely as possible to count values. Previously, PT walk trips were also taken into account in the volumes, although they were presumably never counted in the count values. The procedure has now been changed: PT walk trips are no longer taken into account in the volumes. **(22879)**

☑ Crash when accessing demand segments whose volumes are stored at other demand segments: If it was indicated in the general procedure settings for a PuT demand segment that the volumes would be stored at another demand segment, Visum crashed until now, if either a demand matrix correction was executed for this demand segment or the assignment matrix was accessed via a formula. This error has been fixed. **(23104)**

Network Comparisons

☑ No display of differences between POIs and user-defined tables: When comparing the current network to a version file, the values of both networks are displayed. However, this did not work for the values of user-defined attributes at POI categories or user-defined tables. This bug has been fixed. **(23119)**

Network Editor

☑ Crash when removing trivial zigzag routings: Crashes no longer occur when repairing trivial zigzag routings if the coupling would have to be removed for a vehicle journey of the affected line route and the corresponding query was answered with 'No'. **(22925)**

☑ Network section incorrect when marking ABM objects without a location reference: When marking an ABM object without a location reference, e.g. a newly inserted trip, the network editor showed the area around the coordinate (0, 0) when the synchronization mode 'Move' or 'Autozoom' was switched on. This error has been fixed. **(23020)**

Other Procedures

☑ Message during 'Set travel times': When executing the special function 'Set travel times' for user-defined PrT paths, an error message occurred and the action could not be undone. This error has been fixed. **(23023)**

☑ Multimodal assignment conceals error messages: If error messages occurred during the execution of the procedure 'Multimodal assignment', the procedure was still considered to have been executed successfully, and as a result, subsequent procedure steps in the procedure sequence were executed. This error has been fixed. **(22982)**

- ✅ Negative buffer size possible in 'Intersect' dialog: In the parameter dialog of the 'Intersect' procedure, negative values could be entered for the buffer size of the source or target object, which were then treated as 0 during the actual calculation. This error has been fixed. **(23025)**

Passenger Surveys

- ✅ Change between vehicle journeys on the same time profile always implausible: If in multi-line survey data specific vehicle journeys were indicated by their number and a change from one vehicle journey to another vehicle journey on the same time profile was required within a path, this path was always marked as implausible. This error has been fixed. **(23038)**

PrT Assignment

- ✅ Calculation of vCur-PrTSys: The calculation of v0-PrTSys and vCur-PrTSys was not consistent, so that certain VD functions returned vCur values that were smaller than v0PrT. This error has been fixed. **(23005)**
- ✅ Incorrect network volumes in intermediate steps: In the Bi-conjugate Frank-Wolfe, Incremental assignment, and Equilibrium_Lohse methods, network volumes were not calculated correctly in the intermediate steps, which deteriorated the convergence. This error has been fixed. **(22906)**
- ✅ Rare crash in various assignments: A possible, but very rare cause for crashes in various PrT assignment procedures has been fixed. **(22913)**
- ✅ Right-turns in opposite flow in ICA calculation: When calculating the node impedance according to ICA, for the opposite flow of a permitted left turn with the option 'ICA right turn will influence opposing left turn' switched on, the right turns of the opposite direction were only taken into account for this opposite direction in the case of shared straight/right lanes. This error has been fixed. **(23056)**
- ✅ Warm start for PrT assignment with ICA: The calculation of the PrT assignment with ICA with warm start took unnecessarily long because the values were not saved in the version file. This error has been fixed. **(22511)**
- ✅ Warnings during SBA visualization: If trajectories of an SBA assignment were displayed in the 3D network editor, but were not recorded during the SBA assignment, warnings that occurred during the assignment possibly interrupted the recording of the trajectories. This error has been fixed. **(22864)**

PuT Assignment

- ✅ Connection file import and network changes: The program no longer crashes when carrying out a timetable-based assignment using percentage shares (MPA) and based on a connection file if, between writing this connection file and using it as the basis for the assignment, the network has been changed so that previously connected zones are no longer connected. In this case, the use of the connection file is now rejected. **(23064)**
- ✅ Wrong search impedance at transition from DRT to lines: When using Branch&Bound search in timetable-based assignment with DRT, the impedance was incorrectly calculated when transferring from a DRT path leg to a path leg covered with a PuT line transport system. This error has been fixed. **(23141)**

PuT Operating Indicators

- ✅ Crash on user cancelation: A crash no longer occurs when the user explicitly cancels the procedure 'PuT operating indicators'. **(22963)**
- ✅ Slight errors in line blocks lead to error messages in PuT operating indicators: If the calculation of costs and vehicle requirements in the PuT operating indicators was based on line blocks that contained slight errors (e.g. vehicle errors or layover time errors), this led to the output of an error message in the message window. In this situation, however, the calculation can still be performed, and the PuT operating indicators procedure is then considered to have been completed successfully. This error has been corrected by downgrading the message to a warning. **(22980)**
- ✅ Two errors occured when calculating indicators for the network object 'Territory PuT detail vehicle journey item': Firstly, the indicators 'Number of service trips' (with and without coupling) were not distributed to the individual vehicle combinations for evaluation levels with vehicle combination. Secondly, values could be output for territories in which the relevant vehicle journey item was not located, if the section for the subsequent vehicle journey item was located in this territory. Both errors have been fixed. **(22819)**

Ride Sharing

- ✅ Tours with stop event exceeding day change: The execution of the procedure 'Tour planning' or the import from PTV MaaS Modeller failed if a vehicle tour contained a stop event that started before the day change and ended afterwards. This error has been fixed. **(23065)**

Subnetwork Generator

- ✅ Attribute values at vehicles per block item type were lost: When generating a subnetwork, values of attributes at vehicle units and at vehicle combinations that had subattribute block item type (e.g. cost rate, range, etc.) were lost. This error has been fixed. **(23012)**

Visum Files

- ✅ Faulty files result from '&' in codes: In certain cases procedure parameter files and version files could be created that were not readable if the character '&' occurred in strings (e.g. in DSeg code 'P&R'). This error has been fixed. **(23019)**

- ✅ Non-deterministic behavior of the network reader when completing line routes: In certain special cases, non-deterministic behavior could occur when reading in line routes or system routes to complete the route course if inserted elements were located on link stop points and no path could be found during the shortest path search for completing the line course. This bug has been fixed. **(23069)**

- ✅ Switched off Vissig SCs are switched on: If a signal control (SC) of the type Vissig was switched off via the attribute but had a valid signal program, it was implicitly switched on when writing and later reading the version file. This error has been fixed. **(22983)**

❗ Breaking Changes

Filters

- ❗ Filter on empty multi-enumeration type (e.g. TSysSet) did not always work correctly: If the condition was set in the filter that an attribute of an enumeration type that allows multiple selections (typically sets of objects such as TSysSet, DSegSet, etc.) was not equal to the empty set or contained at least one element of the empty set, network objects whose attribute value was the empty selection fulfilled this filter condition. This bug has been fixed. Thus, procedures that are restricted to 'Active network objects only' deliver different results than before. **(22917)**

Junction Editor

- ❗ Right-turns in opposite flow in ICA calculation: When calculating the node impedance according to ICA, for the opposite flow of a permitted left turn with the option 'ICA right turn will influence opposing left turn' switched on, the right turns of the opposite direction were only taken into account for this opposite direction in the case of shared straight/right lanes. This error has been fixed. As a result, the results of the assignment with ICA change. **(23056)**

Matrix Estimation

- ❗ Consideration of PT walk trips: The matrix correction procedure adjusts demand matrices in such a way that the resulting volumes correspond as closely as possible to count values. Previously, PT walk trips were also taken into account in the volumes, although they were presumably never counted in the count values. The procedure has now been changed: PT walk trips are no longer taken into account in the volumes. This may change the results. **(22879)**

PrT Assignment

- ❗ BPR type VD function: The special handling for integer exponents in the BPR function has been removed. This can change the results of the BPR function slightly. **(21477 ⊕)**

- ❗ Calculation of vCur-PrTSys: The calculation of v0-PrTSys and vCur-PrTSys was not consistent, so that certain VD functions returned vCur values that were smaller than v0PrT. This error has been fixed. As a result, calculation results may change. **(23005)**

- ❗ Classical equilibrium assignment: The procedure has been modernized and significantly accelerated. This changes the results of the procedure. **(17641 ⊕)**

- ❗ Incorrect network volumes in intermediate steps: In the Bi-conjugate Frank-Wolfe, Incremental assignment, and Equilibrium_Lohse methods, network volumes were not calculated correctly in the intermediate steps, which deteriorated the convergence. This error has been fixed. This changes the results of the mentioned assignment methods. **(22906)**

- ❗ Warm start for PrT assignment with ICA: The calculation using the option 'Use current assignment result as initial solution' for PrT assignment with ICA took unnecessarily long because the values required for the warm start were not saved in the version file. This error has been fixed. As a result, the results of the assignment with ICA change when using the 'Use current assignment result as initial solution' option. **(22511)**

Visum Files

- ❗ Switched off Vissig SCs are switched on: If a signal control (SC) of the type Vissig was switched off via the attribute but had a valid signal program, it was implicitly switched on when writing and later reading the version file. This error has been fixed. As a result, after writing and reading the version file, the attribute value changes compared to the previous state and subsequently also the results of various procedures (e.g. ICA calculation, Assignment with ICA). **(22983)**

PrT Assignment

🛑 Right-turns in opposite flow in ICA calculation: When calculating the node impedance according to ICA, for the opposite flow of a permitted left turn with the option 'ICA right turn will influence opposing left turn' switched on, the right turns of the opposite direction were only taken into account for this opposite direction in the case of shared straight/right lanes. This error has been fixed. As a result, the results of the assignment with ICA change. **(23056)**

2022.00-00 [231683]

⊕ New Features and Changes

ANM

⊕ Signal data: During the ANM export the content of the SC attribute 'Signal program data' are written into the ANM file to transfer data of signal controllers. **(22523 🛑)**

Add-Ins

⊕ Adaptaton of add-ins to Python 3.9 environment: All add-ins delivered with PTV Visum have been updated to Python 3.9. **(22723)**

⊕ The wx-Python library has been updated to version 4.1.1. Add-Ins that are part of the Visum installation have been adapted. **(22157)**

COM-API

⊕ Access to currently loaded scenario: There is a new COM method at IProject that returns the currently loaded scenario as an IScenario object. **(16926)**

⊕ Changed return value of 'GetFilteredSet' and 'FilteredBy': The methods 'GetFilteredSet' and 'FilteredBy', available on network object container objects like 'ILinks', no more return an unspecific object of type 'ICollectionBase', but the specific network object container object of the same type as the method has been called on. Therefore, specific methods available for this type can be called directly. E.g. for an 'ILinks' object you may directly call 'SplitAtStopPointOnLink' on the result of the 'GetFilteredSet' or'FilteredBy' operator. **(20420)**

⊕ Check if an attribute exists: The new method AttrExists on the IAttributes object allows to query whether there is already an attribute with the specified attribute ID in the network. **(19430)**

⊕ End literals in the COM documentation: For enumeration types, the last literal of the enumeration type, which is not a permissible expression, was sometimes listed in the COM documentation. This error has been fixed. **(18739)**

⊕ Extensions for COM access of markings: COM access is now possible for markings of type StopSequenceItem, Storyboard, StoryboardAction, CameraPosition. **(16318)**

⊕ Fast access through new methods 'GetMultipleAttributesRaw' / 'SetMultipleAttributesRaw': Analogous to the accelerated access methods for matrices there are new accelerated access methods 'GetMultipleAttributesRaw' / 'SetMultipleAttributesRaw' designed for reading / writing attribute values. In the helper library VisumPy.helpers shipped together with Visum there is also a pair of methods with the same names. These check the integrity of the passed parameters and should be used when using these new accelerated access methods. **(18512)**

⊕ Import and Export of .sig files: At ISignalControl there are new COM methods for the import and export of .sig files. **(22214)**

⊕ ItemByKey method for access to a single attribute: The new ItemByKey method at the IAttributes object now allows direct access to a single attribute. Parameter is the attribute ID, returned is the corresponding IAttribute object. **(15504)**

⊕ More functions for adding and removing columns in lists: The COM objects for lists (I...List) now provide more functions to add or remove columns, similar to the ITableAttrSelection object. In particular, all columns of a category (e.g. 'PrT Input') can be added using 'AddColumnsForCategory'. **(20942)**

⊕ Multiple PrT shortest path searches via COM: A new COM function allows the calculation of many PrT shortest path searches with one function call. **(22158)**

⊕ Option in list of persons: The option 'Location as household' or 'Location as long-term choice' available in the list of persons is now also accessible through the COM method SetObjects of IPersonList. **(22006)**

⊕ Paste from clipboard via COM: The new method PasteFromClipboard() at Visum.Lists. has been introduced which allows to paste content from the clipboard via COM in lists. **(22030)**

⊕ Support for Python 2 ends: Python 2 is not supported anymore. Corresponding parts of the installation of PTV Visum have been removed. Scripts must be adapted to Python 3. **(22074)**

Data Model

⊕ Bicycle traffic: When a new network is created, it automatically includes a transport system, a mode, and a demand segment with the name Bike. **(22683)**

- ⊕ Converting POIs to locations: POIs can be converted into locations. The POIs are either subsequently deleted or for the location a reference to the originating POI is created to subsequently transfer further attributes from the POI to the location. **(20606)**
- ⊕ Copy and paste of definitions of user-defined attributes (UDA): The definitions of user-defind attributes (UDA) can be copied from one version file to an other via the clipboard. Corresponding functionality can be found in the context menu of the list of attributes. **(21740)**
- ⊕ Cost of line blocks / -elements: The total costs of line blocks and line block elements are shown. An additional attribute at the respective object shows the weighted costs according to the set cost function. **(20643)**
- ⊕ Cost rate per vehicle: The cost rate per vehicle always refers to the analysis period. In existing models, that use the analysis horizon as a reference period, the cost rate is divided by the projection factor of the valid day 'daily' and the reference period is set to analysis period. **(21985)**
- ⊕ Default for storage of PrT paths: The default for saving PrT paths in the general procedure parameters has been changed to 'Save as connections'. **(12808)**
- ⊕ Display of attributes with percentages: Attributes that typically represent proportions (e.g. vol/cap ratio) are displayed in the format 'Percent' by default, whereby the floating point number is multiplied with 100. **(21217 ⛔)**
- ⊕ Evaluation of elevation data of links: There are four new calculated attributes of links that evaluate elevation data from the link polygon including its intermediate points. **(22117)**
- ⊕ Generation of objects of the node geometry: For nodes and main nodes with a default geometry the objects of the node geometry (legs, lanes, lane turns) are always generated when reading version files. Consequently, the corresponding lists always show all objects and evaluations based on attributes of these objects are available immediately. **(21795)**
- ⊕ Integration of daily plans with the calendar: Daily signal plans can now also be allocated to calendar days. The attribute 'Daily signal program list number' has been abolished, instead the daily signal plans allocated to calendar days can be viewed via the SC attribute 'Daily signal program list number per day (CDay)'. In the procedure 'Set signal times', the active signal program is now set for the respective calendar day. **(22297 ⛔)**
- ⊕ New relation to effective signal groups: There is a new relation from stages to effective signal groups. The effective signal groups are the signal groups that are actually green during a stage. **(22496)**
- ⊕ New relations between stop points and territories: There are new relations between stop points and territories showing containing territories and contained stop points, respectively. **(22258)**
- ⊕ New relations of POIs: There are two new relations from POIs, namely to the nearest node and to the nearest active node. **(22003)**
- ⊕ New relations of locations: There are two new relations from locations, namely to the nearest node and to the nearest active node. **(22342)**
- ⊕ Path items: The vehicle tour items, which result from dispatching a ride sharing service, now contain information about charging time and dwell time at holding areas. **(22454)**
- ⊕ Regulated traffic areas: The network object 'Toll systems' has been renamed to 'Regulated Traffic Areas' and the functionality has been extended. In addition to the area toll, regulated traffic areas of type 'No through traffic' and 'No traffic' can now be defined and taken into account in static assignments as well as in the simulation-based assignment (SBA). Regulated traffic areas are taken into account in the impedance function. A restriction to active areas is possible for the calculation of the impedance. In particular, the renaming of the network object affects the COM interface, since corresponding COM objects and methods have been renamed as well. **(16841 ⛔)**
- ⊕ Relation from node to allocated location: Nodes have a relation to all locations for which they are the nearest (or nearest active) node. **(22665)**
- ⊕ Unification of the data model for signal control: With the exception of RBC control, signal controller are defined in Visum based on the Vissig data model. Previously defined internal signal controllers are converted to Vissig when read in Visum 2022. The signal data is stored into an attribute 'Signal program data' of the SC. The same applies when reading models with Vissig control, i.e. signal data is also read into this attribute and no longer stored in external .sig files. Some of the Vissig control data, especially attributes of signal groups and stages, are reflected in Visum and can be edited in the junction editor or in lists. More complex signal controllers are to be edited via the Vissig GUI. **(22209)**
- ⊕ Unique geometric or user-defined allocation of locations to zones: Locations now have an allocated zone, which can optionally be defined geographically. An attribute can be used to specify whether or not this is to be understood as a manually allocated zone or the zone in which the location is found. The relation from the location to the zone outputs the relevant zone. Conversely, a new relation at the zone outputs all locations allocated to this zone. **(22655)**
- ⊕ Unlimited number of demand segments: The number of demand segments within a network is no more limited (was max. 512 up to now). **(22584)**
- ⊕ Volume capacity ratio attributes: The naming of the volume capacity ratio attributes has been standardized. The average ratio in the line hierarchy is now consistently referred to as 'MeanVolSeatCapRatio' or 'MeanVolTotalCapRatio'. The ratio at the line route- and travel time- profiles were named 'VolSeatCapRatio' and 'VolTotalCapRatio', respectively. At the links, the utilization of public transport is now called 'VolSeatCapRatioPuT' and 'VolTotalSeatCapRatio'. **(22130 ⛔)**

Data Model, Graphics

- Adjusting graphic parameters: The adjustment of graphic parameters has been accelerated, so that in particular operations based on the data model of public transport (such as the aggregation of line routes) have shorter run times. **(21910)**

Demand Procedures

- Distribution functions Logit and Combined:
The distribution functions Logit and Combined were previously formulated with a parameter 'a'. In the subsequent calculations, this parameter appeared in both the numerator and the denominator, which is why it could not have any effect on the results and was therefore superfluous.
This parameter has now been removed and can no longer be entered by the user. However, the results may still change slightly due to minimal numerical inaccuracies. **(21385)**
- Message for trip distribution with Kirchhoff: The error message when calculating a trip distribution with negative Kirchhoff exponent and non-positive utility values has been improved. **(21585)**
- Trip generation with negative savings in the freight demand calculation: If the values of savings become negative, then the transformed savings are set to zero regardless of the function type used. This means that tours from A to B via C back to A are not used, if they are more expensive than the sum of tours A-B-A and A-C-A . **(21870 ⚠)**

Dialogs

- Encoding for text files: The options for encoding of text files in the user settings have been removed. The default UTF8 is now always used. **(22296 ⚠)**
- Extensions for the SC dialog: The dialog for signal control has been extended to import and export .sig files. **(22212)**
- Language and add-ons: The language settings can be found under the user preferences in the 'GUI / General' branch. The 'GUI / add-ons' branch shows additional modules. You can activate and deactivate these to limit the number of functionalities on the user interface. The license dialogue only shows the information about your license. **(20796)**
- PuT operating indicators: In the procedure parameter dialog for PuT operating indicators, the grid in the Tab 'User-defined attr.' has been replaced by a modern list grid. **(22885)**
- Saving matrices: When saving matrices in binary format there is an additional option for saving column and row names. **(21804)**
- Transform network coordinates: For a coordinate transformation, the user can choose between the center of the network and a free coordinate as the center. The center point of the transformation is the coordinate that will not change during scaling and rotation. **(22066)**

Filters

- Automatic activation of filters when editing: Filters are activated automatically when the filter is edited. **(21775)**
- Line and stop filter: The filter dialogs of the lines and the stops cover all associated hierarchy levels. Line routes, travel time profiles etc. as well as stop areas and stops are accessible in tabs. The selection of the displayed tab when opening the filters is now more intelligent. In general, the dialog opens with the tab that was open for the last time during the session. Access from special views or on specific hierarchy levels are considered and the selection of the initial register is adjusted. **(21580)**
- Use of active network objects for 1:1 relations: When filtering network objects that have a 1:1 relation to other network objects (e.g. connector to zone), the active network objects can be referred to by selecting the aggregation function 'CountActive' objects as an attribute and setting the value to 1 (true) or 0 (false). **(21000)**

Formulas

- Allocation of time series elements to matrices: When converting percentage time series to matrix time series the time series elements are references by matrix references using the code and time information of corresponding matrices. **(21094)**
- Line breaks in formulas: Line breaks in strings within formulas are allowed arbitrarily. **(22631)**

Graphics

- Column charts: Column charts are available for vehicle journeys, time profiles, and as a network-wide evaluation. **(21526)**
- Drawing of markings: Drawing of markings is done in the background without blocking the program. When selecting many objects the synchronization can be switched on via the context menu entry 'Synchronize marking'. **(19121)**
- Improvements for the SVG export: The SVG export parameters include an additional option for the transformation of coordinates. The new option corresponds to the default and adjusts the range of coordinates. **(22790)**
- SVG Export for the geometry view: For the geometry view of the junction editor there is now the possibility of the SVG export. **(22473)**

- Speed up of drawing of markings: Drawing of markings has been accelerated significantly. **(14294)**
- Visualising path sequences: When visualizing path sequences, paths from an existing assignment can optionally be used. Up to now, all existing paths were displayed. The improved functionality now only draws exactly one, randomly selected assignment path. **(19268)**

I/O Interfaces

- Consistent allocation of the code during VDV452 import: During the VDV452 import, stop areas now receive the same code as stop points assigned to them. **(21509)**
- DBF Import: Data from DBF files can be imported to PTV Visum. After specifying a name, a user-defined table is created with the contents of the DBF file. This function can also be called via COM. **(22517)**
- Data base format: The default data base format for both the export as well as the import has been changed to SQLite. **(22251)**
- Emme- Import: The interface for importing data from Emme (4 or smaller) has been updated. Additional 'extra attributes' are imported. Polypoints of links and m-lines for changes to the Link TSys have been considered. The dialogues have been modernized. **(22029)**
- Import MapFan DB: Increment P company provides detailed map data for Japan. Visum imports Map Fan DB data directly into an empty network. Both the roads and the railroads data are transferred. **(22065)**
- RailML Import: If the RailML files contain additional information for timetables, blocks, vehicles, or vehicle combinations that previously had no equivalent in Visum, these can now be assigned to attributes or created as user-defined attributes. **(19485)**
- railML-Import: Line blocks without the underlying journeys in railML files can be transferred to PTV Visum. The prerequisite is, that the required journeys already exist in the model. The block information is mapped to the existing journeys during import. **(22053)**
- railML-Import: Not only operation, control or stop points can be used to describe the route, but also link information. The attributes holding this information are now selectable not only on the destination but also on the origin side. **(21802)**
- railML-Import: Vehicle information will be read from railML data 'vehicles' and 'formations' and is assigned to vehicle units and vehicle combinations within PTV Visum. **(21673)**

Installation

- Support for Python 2 ends: Python 2 is not supported anymore. Corresponding parts of the installation of PTV Visum have been removed. Scripts must be adapted to Python 3. **(22074)**
- The wx-Python library has been updated to version 4.1.1. Add-Ins that are part of the Visum installation have been adapted. **(22157)**
- Update of Python 3.X: The Python 3 environment has been updated to version Python 3.9.5 (Release Date: May 3, 2021). At the same time, the supplied libraries have been updated to the latest version. **(21572)**

Junction Editor

- Background map: In the geometry view of the junction editor, a background map can optionally be displayed. **(22319)**
- Editing link geometry: The geometry of links can be edited interactively in the geometry view of the junction editor. **(22469)**
- Graphic parameters: For the geometry view there are graphic parameters that are saved in the version file and in the global layout. **(22320)**
- Junction editor layout: The global layout has been extended. It also includes the view of the junction editor. Via the menu Junction editor > Open junction editor layout it is possible to read global layouts partially, i.e. with the information saved for the junction editor only. **(22884)**
- New relation to effective signal groups: There is a new relation from stages to effective signal groups. The effective signal groups are the signal groups that are actually green during a stage. **(22496)**
- Selection of signal program: The combo box for selecting the signal program is also available for stages in the Junction editor under geometry. **(22507)**
- Signal timings - View: The signal timings view in the junction editor now always shows the geometry view in the upper part and the signal groups in the lower part. For stage-based SC, the interstages are also displayed. interstages can be freely moved within the cycle time. The duration of the interstages can also be changed via the context menu. **(22462)**

Lists

- Column filter: The selection of the filter category in column headers has been extended by the entries 'Empty' and 'Not empty'. This allows distinguishing between the entries '0' and 'Empty' for attributes that allow empty values. **(20654)**

- Copy and paste of definitions of user-defined attributes (UDA): The definitions of user-defind attributes (UDA) can be copied from one version file to an other via the clipboard. Corresponding functionality can be found in the context menu of the list of attributes. **(21740)**
- Paste from clipboard via COM: The new method PasteFromClipboard() at Visum.Lists. has been introduced which allows to paste content from the clipboard via COM in lists. **(22030)**
- SC list: The list of SC has been improved. SC can be created and deleted via the list. The context menu has been extended and enables access to the SC dialog, to the Vissig GUI or the allocation of nodes and main nodes to the SC. **(22445)**

Lists, COM-API

- The previously implicitly connected lists for PrT paths from assignments (i.e. with demand segments) on the one hand and user-defined paths (i.e. allocated to path sets) on the other hand have been separated at the user interface as well as in the COM interface. Therefore, in the 'Lists' menu under 'Paths' there are now separate entries to the lists 'PrT Paths' and 'PrT paths on link level' for the assignment paths and to the lists 'Path sets', 'Paths' and 'Path items' for the user-defined paths. Similarly, at the ILists object in COM via CreatePathList or CreatePathItemList the list for user-defined paths or their elements is opened. Switching the IPrTPathList by specifying a path set in the SetObjects method is no longer possible. **(18702 ⚠)**

Matrix Editor

- Editing filtered entries: filtered entries in the matrix editor are hidden by default. If a rectangle is drawn interactively over active and passive entries and a value is assigned to the entries, the changes are only applied to the active elements. **(18136)**
- Editing headers of views: The headers of the matrix editor, matrix histogram and matrix comparison can be changed under the menu of the corresponding view > Change header.... **(21277)**
- Matrix histogram, Matrix comparison: Both the matrix histogram and the matrix comparison optionally take into account the filters on zones, OD pairs, or matrix values. **(2651)**
- Matrix histogram: For long-running calculations in the matrix histogram, a progress bar and a remaining time are displayed. It is possible to cancel this calculation. **(21791)**
- Matrix histogram: The user guidance in the 'Matrix histogram' view has been improved. **(17634)**
- Rounding in the matrix editor: The method used for random round has been changed to bucket round. **(19408)**

Network Editor

- Aggregation of zones or territories: If zones or territories are aggregated by an attribute, the value of this attribute is taken over. **(22279)**
- Allocation of time series elements to matrices: When converting percentage time series to matrix time series the time series elements are references by matrix references using the code and time information of corresponding matrices. **(21094)**
- Calculation of z-coordinate when splitting a link: When splitting a link, the z-coordinate is calculated for the new node. This also considers the z-coordinates of the link polygon points. **(22661)**
- Drawing of markings: Drawing of markings is done in the background without blocking the program. When selecting many objects the synchronization can be switched on via the context menu entry 'Synchronize marking'. **(19121)**
- Location search: A location search allows you to navigate quickly in large networks. In the network editor, you will find a button that allows you to enter short search terms. Potential hits will be displayed. The location of the selected address is displayed in the network editor. **(15590)**
- MapTiler background maps: Maps provided by the provider MapTiler are now available as background map. **(22754)**
- Network Check: A new check finds stops that have no PuT-Walk connection to zones but at which time profiles allow boarding and alighting. The optional repair function prohibits boarding and alighting at such stops. **(21587)**
- Remove zigzags: The check for zigzag routing of line and system routes has been changed. Trivial zigzags are now also zigzags that have profile points only on one of the links that have been traversed multiple times. These are taken over during the repair. **(20950)**
- Remove zigzags: The check of zigzag routings of line and system routes has been extended to loops. A loop is created when the same route point is passed over several times. Within the loop, the same route points are traversed for the outward and return directions. Trivial loops have no further profile points within the loop. After checking for zigzags and loops, these are reported and optionally repaired. **(20982)**
- Speed up of drawing of markings: Drawing of markings has been accelerated significantly. **(14294)**

Network Editor, COM-API

- Split links: A function to split links at link stop points is available via the context menus of links and link stop points. The function can be called via COM on basis of a container of links and stop points as well as on single links and stop points. **(19321)**

Other Procedures

⊕ Integration of daily plans with the calendar: Daily signal plans can now also be allocated to calendar days. The attribute 'Daily signal program list number' has been abolished, instead the daily signal plans allocated to calendar days can be viewed via the SC attribute 'Daily signal program list number per day (CDay)'. In the procedure 'Set signal times', the active signal program is now set for the respective calendar day. **(22297 🔴)**

⊕ Signal optimization: Green time optimization for Vissig controllers with signal group-based programs is now also available. **(22385)**

⊕ Shortest path search: The shortest path search that is used outside the private transport assignment has been improved and accelerated. **(21818)**

PrT Assignment

⊕ Bicycle assignment: A new PrT assignment method for bicycle traffic was added, taking into account special aspects of cyclists' behavior. **(22052)**

⊕ Improvements for the method bi-conjugate Frank-Wolfe (BFW): The assignment method bi-conjugate Frank-Wolfe has been improved: Firstly, memory consumption has been reduced and secondly, the assignment fulfills the condition of proportionality across transport systems. **(20009 🔴)**

⊕ Look ahead distance for lane choice in SBA: For lane choice, a look-ahead distance can be taken into account beyond the end of the link that the vehicle enters. For this purpose, a new link attribute 'SBA look-ahead distance for lane choice' has been introduced, which defines the distance starting from the ToNode of the link. **(17847)**

⊕ Messages for calculations of PrT skim matrices: The output of messages when executing the PrT skim matrix calculations has been improved. **(21929)**

⊕ Messages when initializing PrT assignments: The output of messages when initializing PrT assignments has been improved. **(20968)**

⊕ Precise message on warm start of SBA with percentage connectors (MPA): If percentage connectors with distribution for individual relations (MPA) are used, the simulation-based dynamic assignment (SBA) cannot be based on an existing assignment result. However, when trying to do so, a non-specific error message appeared so far, which did not point out this cause. This message has been improved. **(19907)**

⊕ Regulated traffic areas: The network object 'Toll systems' has been renamed to 'Regulated Traffic Areas' and the functionality has been extended. In addition to the area toll, regulated traffic areas of type 'No through traffic' and 'No traffic' can now be defined and taken into account in static assignments as well as in the simulation-based assignment (SBA). Regulated traffic areas are taken into account in the impedance function. A restriction to active areas is possible for the calculation of the impedance. In particular, the renaming of the network object affects the COM interface, since corresponding COM objects and methods have been renamed as well. **(16841 🔴)**

⊕ SBA - calibration of capacity downstream of merges: For the simulation-based assignment (SBA) a new node attribute has been introduced that enables calibration of capacity downstream of merges. The node attribute 'SBA penalty for merging vehicles' increase the minimum time between vehicles if they are entering the same destination lane but come from different origin lanes. **(22231)**

⊕ SBA random number generator: The random number generator used in SBA has been replaced. **(22291 🔴)**

⊕ Setting for the design hourly volume at nodes: The option 'Volume PrT [PCU]' as the design hourly volume for the calculation of impedances at nodes has been removed. Instead the option 'Volume PrT with base volume [PCU]' is used and the settings for the base volume under PrT settings > Assignment is considered. **(21496 🔴)**

⊕ Usage of formula attributes in the PrT impedance function: When using formula attributes in the detailed impedance definition, they will be highlighted in yellow and a tooltip is being used to indicate restrictions when using volume-dependent attributes apart from tCur. **(18357)**

Procedure Sequence

⊕ Copy & paste for procedures: Procedures can be copied from one version file to another via the clipboard. New context menu entries are available for this purpose. Copying can be carried out either for one or more marked procedure steps or for one or more marked groups. **(19280)**

PuT Assignment

⊕ Headway-based assignment with a headway of zero: A headway of zero is not allowed in the headway-based assignment. The assignment will be aborted with an error message. **(22493 🔴)**

⊕ Messages for PuT assignment procedures: The output of messages when executing PuT assignments has been improved. **(21657)**

⊕ Skim 'Path leg attribute' now uses path leg attribute: Previously, the 'Path leg attribute' skim used a time profile attribute for definition, contrary to its designation. Now, a path leg attribute is actually used, so that, for example, the vol/cap ratio of the vehicle journey items used can be evaluated. Only those indirect attributes are available whose value results from the assignment. **(21961)**

⊕ Skim for adaptation time: The skim adaptation time is also available for analysis time intervals. **(21001)**

- Speed-up for constructing data structures for shortest path search: The construction of data structures containing shortest paths for PuTWalk and PuTAux has been accelerated. This has a particular effect when opening version files that contain public transport assignments. **(22104)**

Ride Sharing

- A vehicle that cannot serve new trip requests returns to a holding area. The selection of the area is no longer based on distance alone, but on a cost function. In addition to distance, this function includes the capacity, weight, and potential of the holding area. The current and future demand now influences the decision of which holding area is selected. **(22334)**
- Dispatching: A major extension of the dispatching algorithm now allows for more flexible service schemes: For each trip request, all pickup (resp. drop-off) locations within a certain walking time from the origin (resp. destination) can be considered for tour planning. This creates additional flexibility in vehicle dispatching and typically reduces the number of vehicles needed. The dispatcher will define the pickup and drop-off combination for a trip request.
  The choice of the best-fitting pickup and drop-off can be controlled through a combination of the level of service (= short walk access and egress) and efficient vehicle usage (= short extra travel time) in one generalized cost function. **(21861)**
- Ideal travel distance: The tour planning procedure determines the parameter Ideal travel distance. This is stored on the public transport path leg and indicates the shortest distance to serve a trip request. **(20787)**
- Loops in vehicle tours: It is possible to correctly map loops of vehicle tours in the PrT path. Such loops occur when a vehicle departs from a node and is ordered back to the same node before reaching the next stop. A clean separation between idle and travel time is now possible in such cases. **(19791)**
- Tour planning: Optionally, serving all trip requests without stopover can be enforced during trip planning, i.e. only trip requests with the same pickup and drop-off nodes combination can be served together (time pooling). This is particularly relevant for VTOLs (air cabs) **(22140)**

Safety

- APM (Accident Prediction Model) attributes for sections: All APM attributes (APM accident count, APM accident density, APM accident rate, APM accident cost, APM accident cost density, APM accident cost rate) are now also available for sections. **(19575)**

Scenario Management

- Access to currently loaded scenario: There is a new COM method at IProject that returns the currently loaded scenario as an IScenario object. **(16926)**
- Calculation state and global layout: The calculation state also depends on the global layout. If the global layout has been changed, the calculation state is set to 'Calculated (not up-to-date)'. **(20993)**
- Calculation times of scenarios: The Tab Scenarios contains three new attributes Calculation start time, Calculation end time, and Calculation duration. **(16622)**
- Log-Entry about used version file: When creating a project, a log entry is created with the directory and name of the base version used. **(20866)**
- Modifications and allocated scenarios: Under the tab Modification there are two new attribute 'Scenarios' and Scenarios (completed). The attribute 'Scenarios' lists the number of scenarios in which the modification is explicitly used the attribute 'Scenarios (completed)' displays the numbers of all scenarios including those in which a modification depends on another one. **(19459)**
- Name of base version: The name of the base version can be changed under Tab 'Basic settings' > 'Project settings...'. **(12453)**

Subnetwork Generator

- Unused stops: Stops that are located on active routes or nodes can now optionally be included in the subnet even if they are not served by active line routes. **(20302)**

Timetable Editor

- Naming of regular services: Vehicle journey attributes and their relations can be used as a prefix for naming regular services. **(20492)**

Visum Files

- Default encoding of text files: The default encoding of text files has been changed to UTF8. **(21242 ⚠)**
- Junction editor layout: The global layout has been extended. It also includes the view of the junction editor. Via the menu Junction editor > Open junction editor layout it is possible to read global layouts partially, i.e. with the information saved for the junction editor only. **(22884)**

- ⊕ Reading of older binary files: Reading binary files in the format before Visum 11.03 is no longer supported in Visum 2022. In addition to version files, this also applies to graphic parameter files, procedure parameter files, list layouts and filter files. **(22403)**
- ⊕ Reading of text files: UTF-32 encoded text files cannot be read anymore in PTV Visum. **(21901)**

🔴 Breaking Changes

ANM

- 🔴 Signal data: During the ANM export the content of the SC attribute 'Signal program data' are written into the ANM file to transfer data of signal controllers. From PTV Vissim 2022 the data of the attribute 'Signal program data' are imported for fixed time control. **(22523 ⊕)**

Add-Ins

- 🔴 Crash when expanding 'wx' in the Python console: No more crash when displaying the possible values within the autocompletion when entering 'wx' (after an import statement 'import wx') in the Python console. Due to incompatible changes in the newer version of wx it may be necessary to adapt the code of your own Python applications. **(20946)**

COM-API

- 🔴 Changed default regarding non-editable attributes for export methods: For the Visum.IO.SaveNet, Visum.IO.SaveDemandFile, Visum.IO.SaveAccessDatabase, Visum.IO.SaveToMsSqlServerDatabase and Visum.IO.SaveSQLiteDatabase methods, which all export data based on a specified layout file, the default of the 'editableOnly' parameter has been changed to 'false'. Thus, if the parameter is not set, all attributes specified in the layout file are actually exported, whereas previously the non-editable attributes were filtered out. With unchanged client code, the behavior changes accordingly if the parameter in question is not explicitly set in this code. **(22008)**
- 🔴 Spelling of Property IAttribute.Category corrected: The spelling of Property IAttribute.Category has been changed. It was previously written in lower case. Depending on the target language, client code must be adapted. **(22687)**

Data Model

- 🔴 Display of attributes with percentages: Attributes that typically represent proportions (e.g. vol/cap ratio) are displayed in the format 'Percent' by default, whereby the floating point number is multiplied with 100. This changes results of these attributes, because the multiplication with 100 is not done until the display is in the format 'Percent'. **(21217 ⊕)**
- 🔴 Integration of daily plans with the calendar: Daily signal plans can now also be allocated to calendar days. The attribute 'Daily signal program list number' has been abolished, instead the daily signal plans allocated to calendar days can be viewed via the SC attribute 'Daily signal program list number per day (CDay)'. In the procedure 'Set signal times', the active signal program is now set for the respective calendar day. This eliminates the need for the daily plan number. **(22297 ⊕)**
- 🔴 Regulated traffic areas: The network object 'Toll systems' has been renamed to 'Regulated Traffic Areas' and the functionality has been extended. In addition to the area toll, regulated traffic areas of type 'No through traffic' and 'No traffic' can now be defined and taken into account in static assignments as well as in the simulation-based assignment (SBA). Regulated traffic areas are taken into account in the impedance function. A restriction to active areas is possible for the calculation of the impedance. In particular, the renaming of the network object affects the COM interface, since corresponding COM objects and methods have been renamed as well. Scripts must be adapted accordingly. If toll systems of the type area toll are defined, these are automatically taken into account in static assignments or SBA if the impedance component Toll-PrTSys is included. **(16841 ⊕)**
- 🔴 Volume capacity ratio attributes: The naming of the volume capacity ratio attributes has been standardized. The average ratio in the line hierarchy is now consistently referred to as 'MeanVolSeatCapRatio' or 'MeanVolTotalCapRatio'. The ratio at the line route- and travel time- profiles were named 'VolSeatCapRatio' and 'VolTotalCapRatio', respectively. At the links, the utilization of public transport is now called 'VolSeatCapRatioPuT' and 'VolTotalSeatCapRatio'. **(22130 ⊕)**

Demand Procedures

- 🔴 Calculation of the diagonal in the procedure P+R lot choice: When calculating the utility in the procedure P+R lot choice, the values of the diagonal were not calculated or initially set to zero. This error has been fixed. The values of the diagonal are now set to -99999. This can change calculation results in demand models with P+R. **(22062)**
- 🔴 Trip generation with negative savings in the freight demand calculation: If the values of savings become negative, then the transformed savings are set to zero regardless of the function type used. This means that tours from A to B via C back to A are not used, if they are more expensive than the sum of tours A-B-A and A-C-A . This can change results of the trip generation in the freight demand model. **(21870 ⊕)**

Dialogs

⚠ Encoding for text files: The options for encoding of text files in the user settings have been removed. The default UTF8 is now always used. This may result in changes in output files. **(22296 ⊕)**

Lists, COM-API

⚠ The previously implicitly connected lists for PrT paths from assignments (i.e. with demand segments) the one hand and user-defined paths (i.e. allocated to path sets) on the other hand have been separated at the user interface as well as in the COM interface. Therefore, in the 'Lists' menu under 'Paths' there are now separate entries to the lists 'PrT Paths' and 'PrT paths on link level' for the assignment paths and to the lists 'Path sets', 'Paths' and 'Path items' for the user-defined paths. Similarly, at the ILists object in COM via CreatePathList or CreatePathItemList the list for user-defined paths or their elements is opened. Switching the IPrTPathList by specifying a path set in the SetObjects method is no longer possible. **(18702 ⊕)**

PrT Assignment

⚠ Improvements for the method bi-conjugate Frank-Wolfe (BFW): The assignment method bi-conjugate Frank-Wolfe has been improved: Firstly, memory consumption has been reduced and secondly, the assignment fulfills the condition of proportionality across transport systems. This changes the assignment results. **(20009 ⊕)**

⚠ SBA lane selection on links with several pockets or channelized turns at the ToNode: On links to nodes with multiple pockets and/or channelized turns, unrealistic lane changes could occur. This error has been fixed. When entering a link, vehicles now already select lanes that allow them to turn at the to node of the link according to their route. This behavior could be achieved in PTV Visum 2021 using the UDA 'SBAUseLaneChoiceLookaheadForPockets' (ID 21780). The UDA is now no longer required. This changes SBA assignment results. **(22308)**

⚠ SBA random number generator: The random number generator used in SBA has been replaced. This changes the results of SBA. **(22291 ⊕)**

⚠ Setting for the design hourly volume at nodes: The option 'Volume PrT [PCU]' as the design hourly volume for the calculation of impedances at nodes has been removed. Instead the option 'Volume PrT with base volume [PCU]' is used and the settings for the base volume under PrT settings > Assignment is considered. Calculation results can change if the settings for the design hourly volume at nodes was not in line with the settings for the base volume of (main) turns. **(21496 ⊕)**

PuT Assignment

⚠ Headway-based assignment with a headway of zero: A headway of zero is not allowed in the headway-based assignment. The assignment will be aborted with an error message. This changes assignment result or the assignment cannot be executed without adjusting the headway. **(22493 ⊕)**

Ride Sharing

⚠ Pre-booking time on the previous day: If demand exists early in the day, the creation time of the associated trip requests can be on the previous day. This case was previously not mapped correctly, resulting in distributions of the pre-booking time not being respected. This error has been fixed. In return, the maximum possible pre-booking time has been reduced from 48h to 23h 59m 59s. In previous Visum versions, the import from PTV MaaS Modeller can no longer be used to import tour planning results in which individual trip requests occur with an origin time before the day change. **(22510)**

Visum Files

⚠ Default encoding of text files: The default encoding of text files has been changed to UTF8. This can change output files, e.g. .net and .att files. **(21242 ⊕)**

Other Procedures

⚠ Integration of daily plans with the calendar: Daily signal plans can now also be allocated to calendar days. The attribute 'Daily signal program list number' has been abolished, instead the daily signal plans allocated to calendar days can be viewed via the SC attribute 'Daily signal program list number per day (CDay)'. In the procedure 'Set signal times', the active signal program is now set for the respective calendar day. This eliminates the need for the daily plan number. **(22297 ⊕)**

PrT Assignment

⚠ Regulated traffic areas: The network object 'Toll systems' has been renamed to 'Regulated Traffic Areas' and the functionality has been extended. In addition to the area toll, regulated traffic areas of type 'No through traffic' and 'No traffic' can now be defined and taken into account in static assignments as well as in the simulation-based assignment (SBA). Regulated traffic areas are taken into account in the impedance function. A restriction to active areas is possible for the calculation of the impedance. In particular, the renaming of the network object affects the COM interface, since corresponding COM objects and methods have been renamed as well. Scripts must be adapted accordingly. If toll systems of the type area toll are defined, these are automatically taken into account in static assignments or SBA if the impedance component Toll-PrTSys is included. **(16841 ⊕)**