

NEW FEATURES AT A GLANCE

PTV Visum 2023



Copyright:

© 2022 PTV Planung Transport Verkehr GmbH

All rights reserved.

Imprint

PTV Planung Transport Verkehr GmbH

Address:

Haid-und-Neu-Str. 15

76131 Karlsruhe, Germany

Management Board:

Christian U. Haas (CEO), Johannes Klutz

Contact:

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

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

E-Mail: info@ptvgroup.com

www.ptvgroup.com

Entry in the Commercial Register:

Local court Mannheim HRB 743055

Sales tax ID:

Sales tax identification number according to §27 a Umsatzsteuergesetz: DE 812 666 053

Content

1	Procedures	4
1.1	Macro–meso hybrid simulation	4
1.2	Support of lane-based use cases in the simulation-based assignment (SBA)	5
1.3	Network-wide signal optimization	7
1.4	Changes to the Pseudo-dynamic Volumes (PDV)	8
1.5	Processing Check-In / Check-Out data and Ticket card data	9
1.6	Update to HBEFA 4.2 Integration	10
1.7	Integration with ActivitySim for ABM modeling	11
2	Speed up of select procedures	12
3	Handling	13
3.1	Nested groups in the procedure sequence	13
3.2	User-defined groups for user-defined attributes (UDA)	13
3.3	Assignment of demand matrices for public transport based on stop areas	14
3.4	Visualization of ABM trajectories	14
3.5	Integration of web map services (WMS)	14
3.6	Improvements on map legend	15
3.7	Rotate link bar labels	16
4	Interfaces	17
4.1	Extended Import of GTFS data	17
4.2	Import of PuT supply from PTV Visum	17
4.3	Transfer of bicycle information from OSM	17
5	COM interface and Python	19
5.1	Changes of the COM interface	19
5.2	Python installation	20

1 Procedures

1.1 Macro–meso hybrid simulation

Regional travel demand models often serve as the basis for project studies in selected parts of the model area. Often, these project studies consider measures which are beyond the scope of the regional model, e.g. the investigation of traffic management strategies. For this type of analysis, dynamic modelling approaches are applied, which more precisely reproduce time-dependent phenomena like the effects of signal control and the emergence and development of congestion. Adding the required level of detail to the network can produce significant efforts. Depending on the size of the study area to be investigated, either sub-networks were created and used for the study, i.e. detached from the original model, or the regional model was adapted to the requirements of the project.

A hybrid macro-meso solution was developed to enable a model-wide view while at the same time to drastically reduce modeling efforts. In the project study area, the simulation-based assignment (SBA) method is used, i.e., a dynamic method in which temporal changes of the supply as well as the waiting times resulting from junction control are considered. In the remaining part of model, vehicles are propagated through the network based on the macroscopically determined travel times, i.e. with static methods.

Since the simulation-based assignment considers detailed modeling down to the level of lanes (see 1.2), it is now possible to consider use cases that previously were only possible in microscopic simulation and thus involved considerable efforts in large models.

As an additional feature, an existing macroscopic assignment result can be used as a starting solution for both the hybrid simulation as well as for SBA, thus reducing the runtime further.

The use cases are similar to those of SBA, but detailed modeling is limited to the project study area simulated with SBA. Since the need to generate a subnetwork is eliminated, the model-wide effect of a measure on route choice can also be studied.

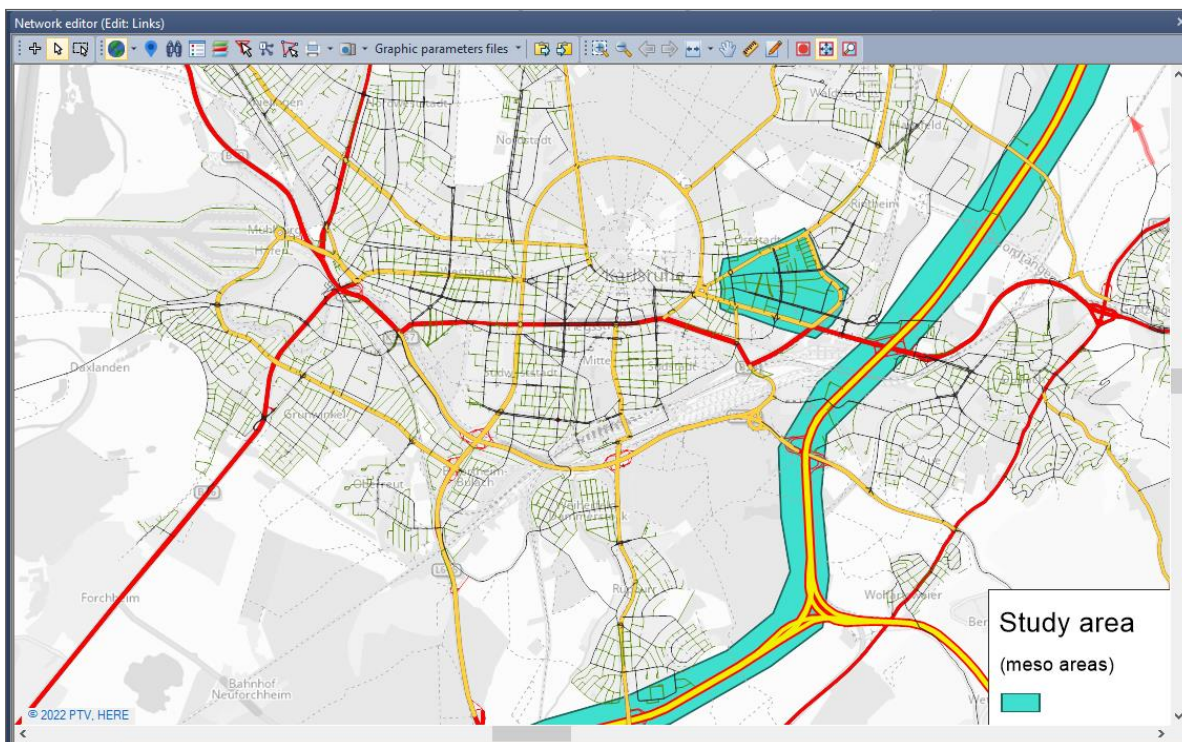


Figure 1: Model area with mesoscopically simulated parts

The macro-meso hybrid simulation is implemented as an extension of SBA. If this option is selected, links on which mesoscopic simulation is performed are to be indicated by a non-zero attribute value.

1.2 Support of lane-based use cases in the simulation-based assignment (SBA)

With Visum 2023, the simulation-based assignment (SBA) will consider lanewise settings for allowed transport systems – permanently as well as restricted to certain periods. The extension opens the stage for new applications of SBA, i.e. it is possible to investigate changes at the level of lanes. Examples are:

1. the introduction of special lanes, e.g.
 - for High Occupancy vehicles (HOV) on freeways
 - for electric, autonomous vehicles, taxis or busses
2. the usage of temporary lanes, e.g.
 - shoulder lanes on freeways
 - directional use of lanes depending on the main direction of travel

The following figure shows an application of both types, i.e.

- from 6:00 to 7:00 the inner lanes of the freeway are closed to all vehicles
- from 7:00 inner lanes can be used by HOV (displayed in yellow)

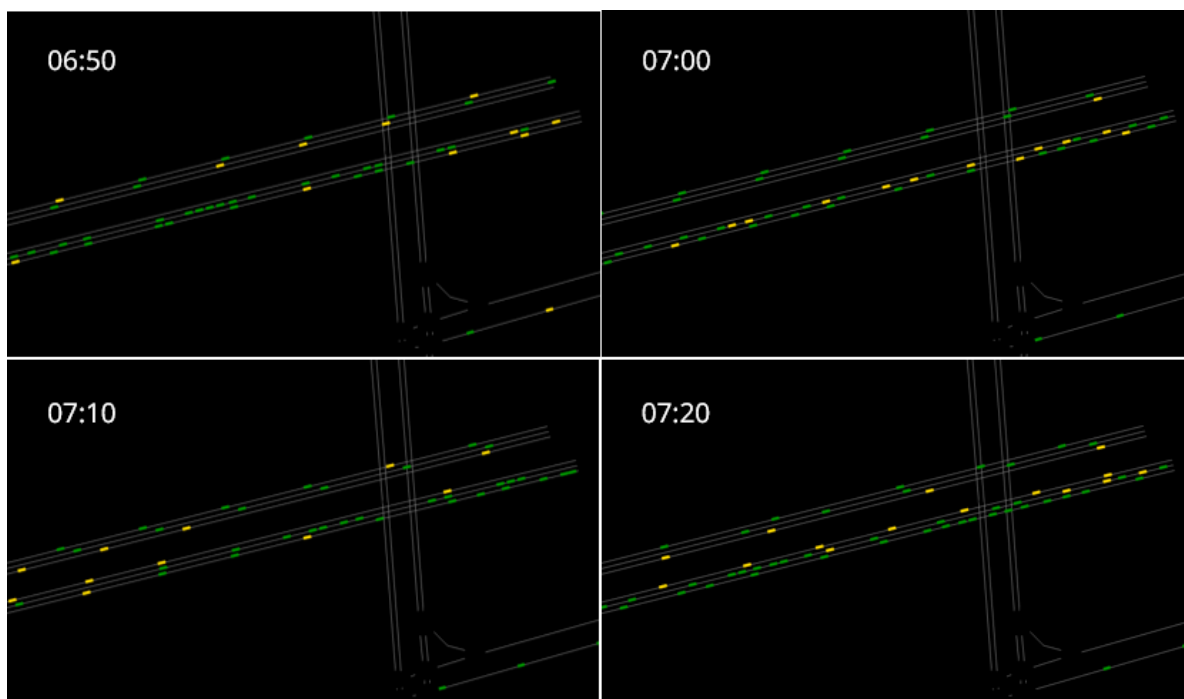


Figure 2: Freeway with temporary lane closure and dedicated HOV lanes

Previously, the permitted transport systems for lanes and lane turns were defined on the upper-level network object, i.e. on links and turns or main turns. This assumption implicitly meant that all lanes of a link have the same transport systems. This has changed in Visum 2023. The transport systems explicitly defined for lanes and lane turns are taken into account by default. This has an effect on the lane selection when a vehicle enters the link. During the simulation, a vehicle can only select a lane from which the next link of the route can be reached without the need to change lanes. If there is only one lane from which the vehicle can reach the desired turn direction at the end of a link it will choose this lane and the outgoing lane turn. In addition to these criteria already in place, a vehicle can only select lanes and lane turns on which its transport system is permitted. There is no change of lanes for vehicles while driving along a link.

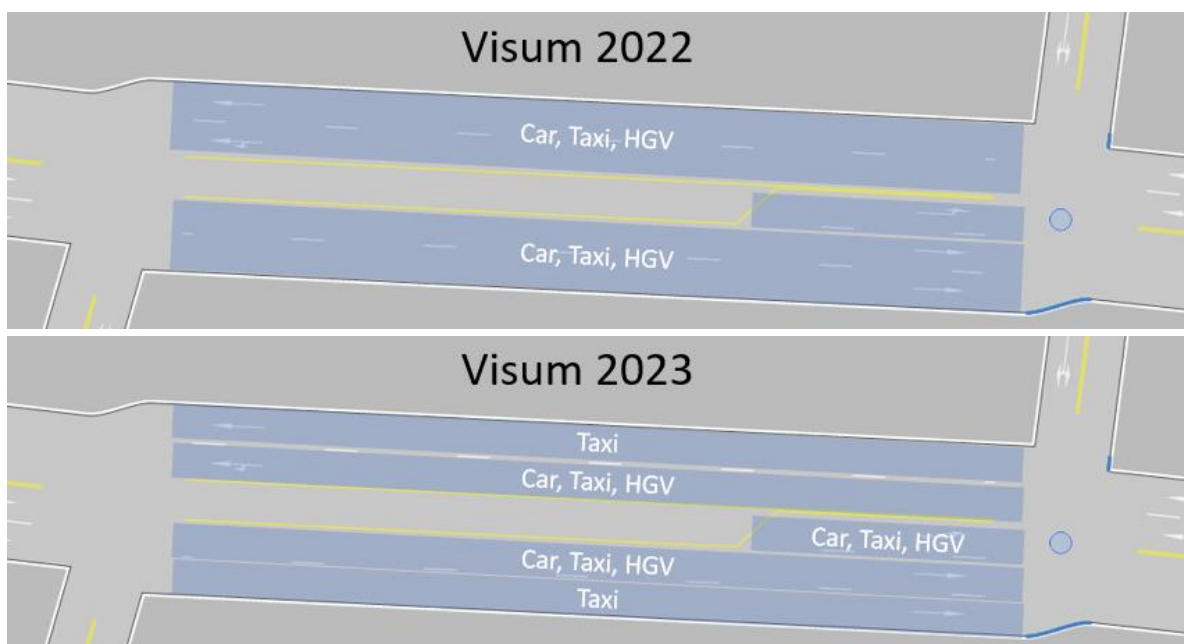


Figure 3: Difference compared to Visum 2022 – consideration of transport systems of lanes and lane turns

For reasons of consistency when modeling transport systems for lanes and lane turns the following three changes have been made:

- Any transport system used for lanes must be included in the transport system set of the link.
- The transport system set of a (through) lane must be the same at the FromNode and at the ToNode.
- Any transport system used for lane turns must be included in the transport system set of the corresponding turn or main turn.
- If the transport system set of a link (turn or main turn) is changed, the set of transport systems of lanes (lane turns) is adapted. Example: If a new transport system is added to the transport systems of a link (turn or main turn), it is automatically included in the transport system set of a lane (lane turn). Restrictions for individual lanes can be made in a second step.
- Transport systems of type PuTWalk are no longer permitted on lanes.

Automatic adjustments of inconsistent states are made when version files from older releases are read into Visum 2023. If the simulation-based assignment fails after reading a version in Visum 2023 we recommend to set the transport systems of lanes to those of links and the transport systems of lane turns to those of turns and main turns, respectively. The easiest way to do so is to use (grouped) lists of lanes and lane turns.

1.3 Network-wide signal optimization

Signal times can be optimized in two ways: There is the local optimization, which can be used to adjust the green and cycle times of individual signal controllers, and the offset time optimization, in which signals of a corridor are coordinated to reduce waiting time and the number of stops. Until Visum 2022, two separate procedures were available for this purpose: 'Signal cycle and split optimization' for local optimization and 'Signal offset optimization' for signal coordination.

The new procedure in Visum 2023, the network-wide signal optimization, combines both optimization methods in one procedure. It replaces the procedure 'Signal offset optimization', but at the same time offers the possibility to combine it with a local optimization in one step.

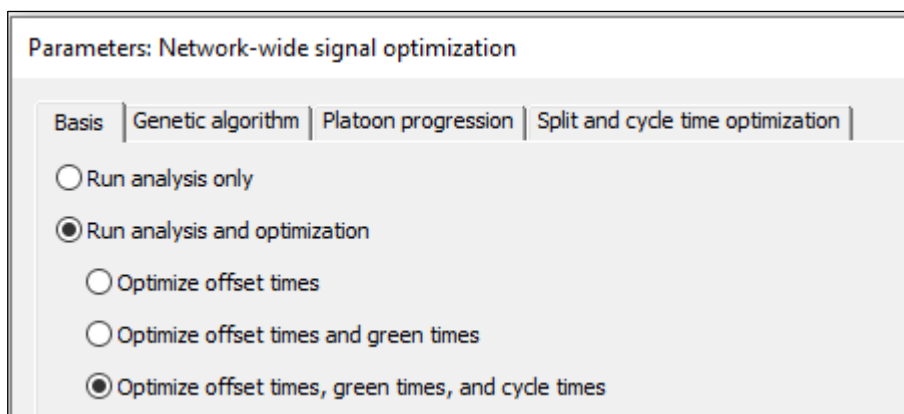


Figure 4: Dialog of the procedure Network-wide signal optimization

The integrated approach allows to use additional information in the local green time and cycle optimization. Travel times from the upstream signalized nodes and the arrival of platoons of vehicles can be derived from the paths and volumes used in the network-wide signal

optimization In contrast, the isolated ‘Signal cycle and split optimization’ considers local turn volumes, only.

For the network-wide signal optimization, you can define weights to stress the influencing factors of traffic flows in certain corridors. Typically, this is based on the main direction of traffic, so for example, in the morning peak traffic going into the city gets higher weights. To do so, user-defined paths are used with weights stored in a user-defined attribute. In the procedure, the corresponding path set can be selected.

The results of the procedure can be visualized in the signal time-space diagram for individual corridors or further evaluated using the link attributes of the Signal controller coordination output group.

The following figure shows a before/after display for a single corridor. The change in offset time can be seen in the continuous green bands after optimization. The right image also shows an increase of the green time duration for the second signal controller (lower part).

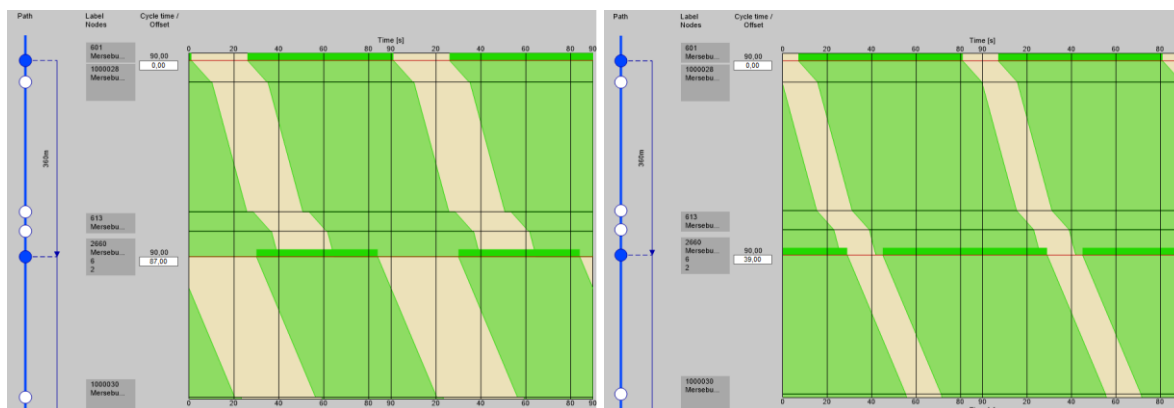


Figure 5: Display of green and offset times before (left) and after the optimization (right)

The following table gives an overview of signal programs for which network-wide optimization can be applied.

procedure	Vissig: Signal-group based	Vissig: stage-based	RBC
Signal cycle and split optimization	✓	✓	✗
Network-wide signal optimization			
• offset (mandatory)	✓	✓	✓
• offset and green times	✗	✓	✓
• offset, green and cycle times	✗	✓	✓

1.4 Changes to the Pseudo-dynamic Volumes (PDV)

Since Visum 2022 we offer the procedure Pseudo-dynamic volumes (PDV). With this method a static assignment result can be postprocessed to create volumes per analysis time interval. More precisely, volumes are propagated through the network using travel times in the loaded network and as a result volumes per analysis time intervals are obtained. Using this method, one can, for example, produce hourly volumes from average daily traffic volumes.

In Visum 2023 we have improved the data structures of results, which opens up additional options for using the results. The results can now be used in the following calculations:

- the dynamic matrix estimation
- the generation of subnetworks with demand time series
- the export of paths via ANM to PTV Vissim
- the dynamic flow bundle, i.e. with a temporal restriction

For the dynamic matrix estimation and the generation of subnetworks, the demand time series allocated to the demand segments must be of type matrix time series.

With the change of data structures for results, also the results of the procedure will change compared to Visum 2022.

The procedure can widely be used as shown in the following Figure 6, which is an application for studying passenger flows at stations. Alighting passengers of two trains are shown differentiated by destination alightings (blue) and transferring passengers (red).

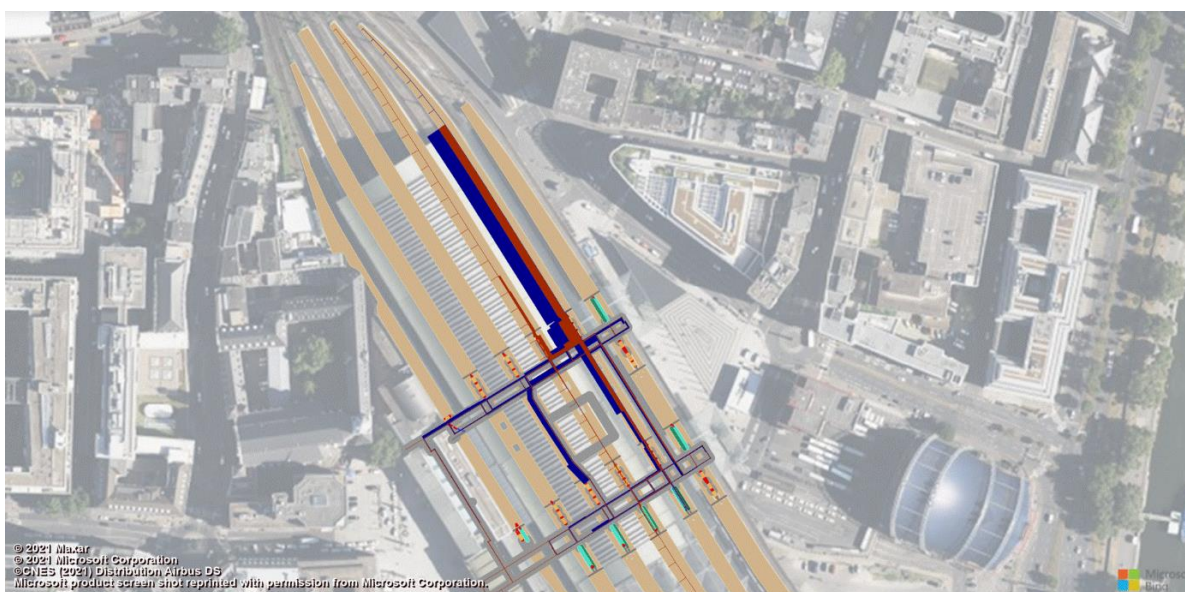


Figure 6: Modeling of passenger flows at stations

The video in Figure 6 is used with the kind permission of DB Analytics.

1.5 Processing Check-In / Check-Out data and Ticket card data

Analysis of the current situation is an essential part of the planning and improvement of Public Transport systems. This requires capturing and processing of data about passenger streams and their origins and destinations. Automatically collected data, e.g. from ticketing systems is increasingly used for that purpose in addition to classic passenger surveys.

Many electronic ticketing systems rely on entry and exit controls at stops or in vehicles (Check-In/Check-Out). Here, cross-sectional data is collected, i.e., at least the following information:

- the start stop
- the time of access
- the final stop

Thereby, information about origins and destinations is readily collected by those systems. Still lacking is the information about the actual services and connections used by the passengers. For years, PTV Visum features the 'Passenger survey' module to enrich partial data from passenger survey and construct full passenger journeys therefrom by matching it to the actual lines and timetable. This procedure has now been extended to make the best use of typical data collected by automated Check-In/Check-Out ticketing systems. The resulting outputs are paths assigned to the Public Transit network which can be analyzed using most of the tools and KPIs provided in Visum for public transport analysis.

In such ticketing datasets, the most reliable information about a passenger's journey is collected for the beginning or end of the path. A shortest path search is therefore often suitable for determining the most probable connection including all path legs. This approach differs significantly from using traditional longitudinal survey data. For this reason, the options for the plausibility check of survey data have been extended by two variants. In addition to the existing option, there are the following options for processing check-in/check-out data:

- Access control at the stop (location, time).
- Access control at the vehicle and at the stop (location, time, trip information)

While the first option gets along with the minimum information mentioned above, the second option processes additional data when accessing the vehicle, since this usually means that data on the selected trip is available.

By adding these options, it was possible to accelerate the plausibility check-in/check-out data considerably (by a factor of about 150). This is especially helpful regarding the high sample size (close to 100%) of such systems.

Access controls at platforms can deviate in time from the start of the journey. The maximum permissible difference of the departure in the timetable to the time stamp of the data record can now be specified separately for positive and negative offsets as an additional parameter in the plausibility check.

1.6 Update to HBEFA 4.2 Integration

Since February 2022 an update of the Handbook Emission Factors for Road Transport (HBEFA) has been available. This is a minor update, in which the most urgent adjustments according to the environmental agencies were made.

With Visum 2023 we support the calculation according to HBEFA 4.2 only. There are changes to the vehicle subsegments as well as to the emission factors. Accordingly, the lists of HBEFA fleet compositions and HBEFA vehicle subsegments change and a new data package with the emission factors will also be provided. There are no changes to the amount of traffic situations. Also, the countries and the years for which data are available are the same.

For you as a user that means that calculations are made based on the latest version of HBEFA. When reading older version files in Visum 2023, in which HBEFA 4.1 was used, vehicle subsegments are adjusted and allocated to those in HBEFA 4.2, and therefore also the fleet compositions are adjusted. It is recommended to check these adjustments, especially if you have created your own fleet compositions using weights based on the HBEFA data.

Note: The new data packages for the emission factors ([Visum-HBEFA-DataPackage](#))

Version 4.20) are not available from the beginning of the Beta-Test, but will be added on the [website of PTV Vision Setups](#) in the course of the test phase.

1.7 Integration with ActivitySim for ABM modeling

ActivitySim¹ is a popular open-source package for activity-based demand modeling in the U.S. and internationally. Based on skim matrices as well as a synthetic population, ActivitySim calculates disaggregated demand. Visum is an ideal partner for this: In Visum, network and structural data can be maintained, the necessary skim matrices can be calculated, and all data can be graphically displayed and analyzed.

The interaction of both programs has now been significantly simplified. Visum provides all the necessary connecting pieces for the workflow:

- an import for the synthetic population (from PopulationSim)
- an export of the skim matrices that ActivitySim needs for the demand calculations
- a procedure to run ActivitySim from Visum
- an import of the result data from ActivitySim

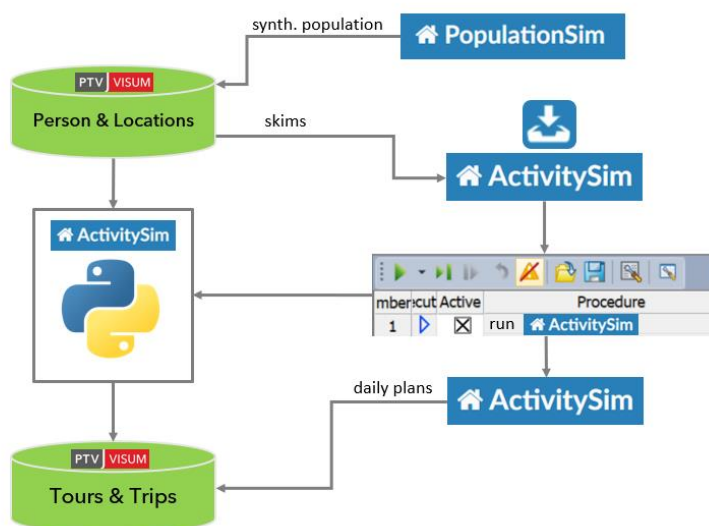


Figure 1: Schematic representation of the workflow between Visum and ActivitySim

In addition, the installation of ActivitySim has been greatly simplified: the ActivitySim consortium offers a free installer on its web pages.

The newly created functionalities allow a user-friendly integration of ActivitySim into a Visum model. In particular, model users with limited programming experience and knowledge of the mechanism can use ActivitySim as a demand model alongside their Visum network model.

¹ ActivitySim & PopulationSim are managed by a consortium of transportation planning organizations, see activitysim.github.io

2 Speed up of select procedures

Transport models continue to become larger and more complex. To keep the computing time as short as possible, we are continuously improving our procedures. For this year's release, we were able to achieve the following accelerations:

- PrT skim calculation: up to 50% time saving
- Incremental assignment: up to 70% time saving
- PT Filter: up to 70% time saving
- PT assignment: up to 10% time saving
- PT skim calculation: up to 10% time saving

3 Handling

3.1 Nested groups in the procedure sequence

Procedure sequences can sometimes be very long. To still keep the overview, procedures can be sorted into groups and subgroups with any nesting depth.

Groups can be moved or copied, individually or entire blocks in the procedure sequence simultaneously.

When a group is deactivated, the active statuses of the individual procedures are retained. If a procedure of a group is inactive, it remains inactive even after deactivation and reactivation of the group.

Procedure
▶ Preparation ...
▶ Skim Matrices ...
▼ Demand Model
▶ Generation ...
▼ Distribution
Tour-based model
Tour-based model
▶ Matrix-Aggregation
▶ Assignment ...

3.2 User-defined groups for user-defined attributes (UDA)

When you update and extend your model over many years, you usually have a lot of user-defined attributes (UDA). The longer these attributes exist in the model, the less clear it is whether they will continue to be used or what purpose they served. Using the new user-defined groups you can categorize UDAs, i.e. allocate them to a user-defined group. User-defined groups are network objects that have their own list. When you allocate UDAs to user-defined groups you can perform operations on the UDAs of a group. Several options are available for this purpose. In the attribute list you can select and group UDAs more easily, you can delete a user-defined group in the list and optionally also delete the UDAs belonging to this group. You also have the possibility in the attribute selection dialog to add UDAs of a group to the list view by selecting the group. The allocation of UDAs can either be done directly when creating a UDA or afterwards by adding the user-defined group in the list of attributes.

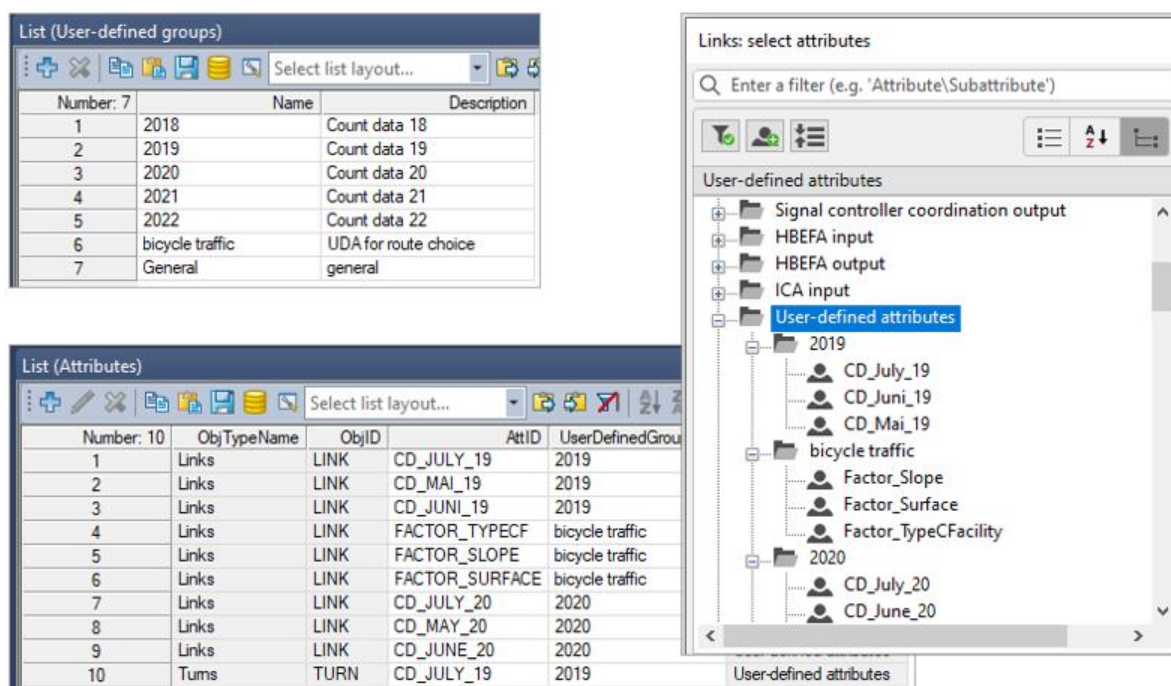


Figure 7: User-defined groups in different dialogs in Visum

3.3 Assignment of demand matrices for public transport based on stop areas

Demand matrices for public transport based on stop areas can be obtained from surveys, but also from procedures in Visum, namely the PuT relation-based analysis. In order to assign these matrices a number of manual steps were required. These included:

- the generation of zones
- the creation of their connectors
- the conversion of the stop area demand matrix into a matrix based on zones
- the assignment

A new special function for stop areas called 'Generate zones for stop areas' simplifies the workflow. More precisely, the first three steps are automated, i.e. the number of existing zones is increased by the stop areas. Zone matrices are adjusted and also the stop area matrix is converted to a zone matrix and can then be used for assignment.

3.4 Visualization of ABM trajectories

Trajectories from an ABM calculation can be exported to PTV Visum Publisher. This allows to visualize the trips of agents in an ABM model as dots moving in the network. It is also possible to display the number of activities executed at a given location over time.

3.5 Integration of web map services (WMS)

In addition to the provided default PTV map services, you can also insert custom Web Map or Web Tile Services (WMS, WTS) as a background map. The integration of these external map services as background maps in the network editor previously required knowledge of

the exact syntax structure of the service. A new interface now allows easier access to the configuration of map services. All you need is the base URL of the service.

The interface depicts the available layers and offers the possibility to select the available styles for display. The configuration of a custom background maps based on a WMS service is possible in just a few clicks.

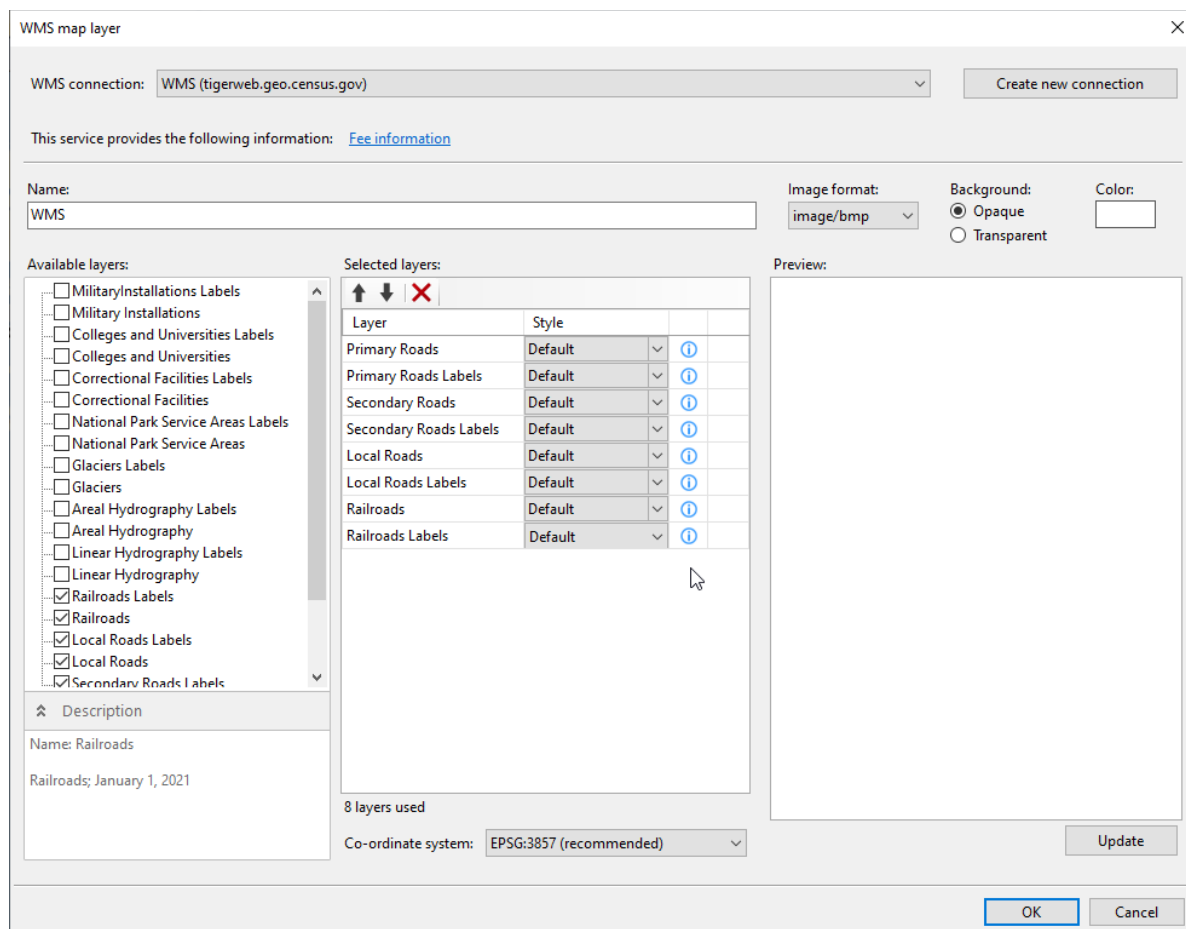
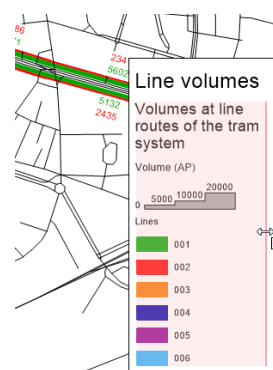


Figure 8: Settings for the integration of WMS in the user settings

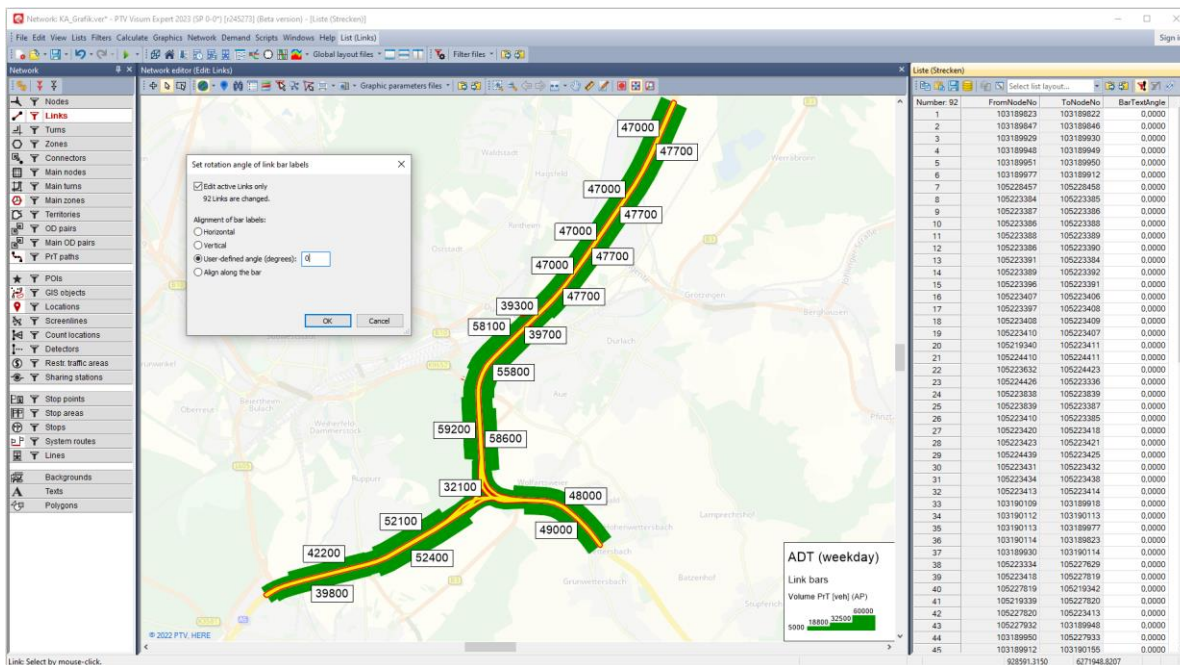
3.6 Improvements on map legend

A legend describes the data in an illustration. Its layout must meet many user-specific requirements. With Visum 2023, it is possible to assign each legend element its own width interactively and in tabular form. Texts are wrapped accordingly. This enables much more compact representations of the legend. The order of the objects can now also be controlled for the line route course via the graphic parameters.



3.7 Rotate link bar labels

In Visum 2023 you can display link bar labels horizontally. For individual link labels the angle can be changed interactively, but you also have the option of changing the angles of link labels for (active) links via the context menu of links in the tool window (Bar labels > Set rotation angle ...). You can also use the context menu to reset the rotation angles and thus reset to default state along bars.



4 Interfaces

4.1 Extended Import of GTFS data

The General Transit Feed Specification (GTFS) has become a globally used format for public transport services. To benefit from developments of the format, the import has been extended by additional components. The data of the file 'frequencies.txt' contains the information in which frequency individual services operate. During the import, copies of these vehicle journeys are now generated using the specified headway. The route course between two stops, which is stored in the file 'shapes.txt', is now imported as intermediate points of the link, instead of a sequence of nodes and straight links. This results in a speed up the import process.

4.2 Import of PuT supply from PTV Visum

The transfer of the public transport supply from one Visum model to another allows you to merge the public transport network of two PTV Visum models. This is especially useful after importing public transport data that is imported into an empty Visum network file (e.g. GTFS, HAFAS, ...). This import of the public transport service now also includes walking distances and times between stops, as provided for example in GTFS. The routing of the line routes in the target network now considers the intermediate points of links from the source network and thus leads to a more exact course.

4.3 Transfer of bicycle information from OSM

Cycling continues to receive more attention in transport planning. More often agencies require cycling to be represented in the transport model, including the ability of the model to quantify the effect of measures. Since Visum 2022, there is a dedicated bicycle assignment. The biggest difficulty to date is the generation of a network that is suitable for modeling bicycle traffic. In Visum 2023, a new configuration 'Detailed urban bicycle network' has been added to the import of data from OpenStreetMap (OSM). Using this configuration all links open for cycling are imported. In addition, characteristics relevant for modeling route choice are stored in user-defined attributes (UDA). These include, for example, the following information:

- road surface
- type of cycling facility
- designed cycling routes

Elevation data is also relevant, but since this does not only apply to modeling of cycling, elevation data is included for other configurations as well.

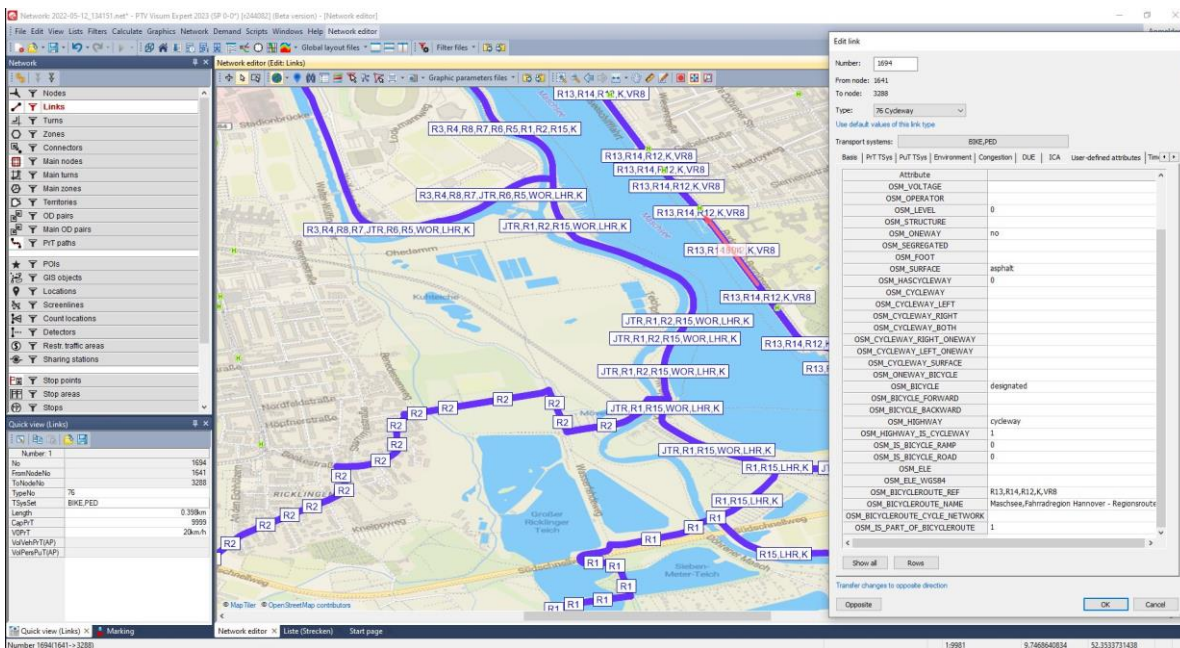


Figure 9: Result of an OSM import using the new configuration 'Detailed urban bicycle network'

5 COM interface and Python

5.1 Changes of the COM interface

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

- For attribute categories (e.g. PuT Input) the English notation is expected and returned. Examples are `ITableAttrSelection.AddColumnsForCategory` and `I...List.AddColumnsForCategory`.
- The object `IAttribute` has the properties `UserDefinedGroup` (readable and writable) and `IsUserDefined` (read only). At `IAttributes` there is access to all categories as well as to all user-defined categories.
- User-defined categories can be queried and created `INet`, i.e. `INet.UserDefinedGroups` and `INet.AddUserDefinedGroup`. The class of the container is `IUserDefinedGroups`.
- Releasing a COM list interface no longer causes the associated list to be closed if `Show()` was previously called. The `Detach()` method is thus unnecessary and has been removed. `Close()` can be called to explicitly close a list.
- The parameters of the equilibrium assignment were simplified. In particular, the two procedure parameter classes `IEquiInitialSolutionPara` and `IEquiStopCriteriaPara` including the function at `IPrTEquilibriumAssignmentPara` no longer exist. The elimination is a consequence of the changes to the equilibrium assignment in Visum 2022.
- As a result of the introduction of nested groups in the procedure sequence, the COM interface has been changed. In particular, when creating or removing a procedure, the absolute position within the whole sequence is no longer used as the key, but the parent group and the position within this group. The access from a group to its members is added as a new method. Please note the changes at `IOperations`. There are two new functions (`GetParent` and `GetRelPos`) for legacy applications that have to be adapted to the new semantics of `AddOperation` and `RemoveOperation`. Unlike before, in case the procedure to be deleted is a group, `RemoveOperation` no longer deletes only the group itself, but recursively all its members too. Since there is no correspondence of procedures based only on their position in the sequence `IOperations::OpenXmlWithOptions` no longer supports the read mode `„ReplaceByID“` in parameter `„roType“`. The underlying enumeration type has changed, also cleaning up the notations of the now only two instances (`ReadOperations_Insert` and `ReadOperations_ReadAll`).
- There are changes to the creation of flow bundle conditions. When inserting an Active network object condition using `CreateConditionActive...` or `CreateConditionSelected...` to `IFlowBundle`, a new OR group was always created until now. Consequently, such conditions could not be combined with other conditions using AND. This has been changed and results in a change of behavior when several conditions, among them an Active network object condition, are inserted one after the other using COM. To combine conditions with OR a new group calling `CreateNewGroup` must explicitly be added. Furthermore, the method

`ExecuteActiveTimeProfiles` has been removed. It can be replaced by separate calls for inserting the condition and the subsequent execution.

- To resolve naming conflicts, the 'Direction' enumeration type, which specifies the direction of connectors, has been renamed to `ConnectionDirection`, and the 'Direction' net object type has become 'PuTDirection'. The change of enumeration type also affects the COM interface. The COM object of the PT direction is still called `IDirection`.

5.2 Python installation

Changes to the Python installation with Visum 2023:

- Python 3.9 is installed under Visum. This installation supports the execution of the Add-ins, but also contains a number of other libraries that you can use in your scripts. Since this is a Python installation, unlike the previous releases, where packages were provided, you can also include and use this installation directly in your Python IDE (e.g. PyScripter).
- The Python installation outside Visum (previously installed under C:\Program files) has been removed from the Setup. If you need an external Python installation besides the installation under Visum, you can install any Python distribution (e.g. the standard distribution available under <https://www.python.org/downloads/>).
- You can use additional Python libraries. To install them, you need an external installation of Python and the Python pip module. These Python libraries can either be included in a virtual environment or alternatively installed in the user directory, where they are available globally, i.e. they can also be used in Visum.
- Virtual environments can be made available in Visum under the user settings. We recommend using the venv module to create such environments. Using a virtual environment is especially recommended if you also use Python for other projects outside of Visum and for which special requirements apply with regard to the modules and their versions.