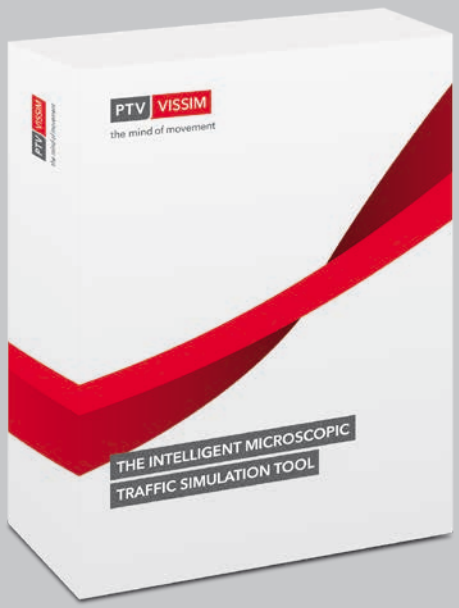
PTV VISSIM

the mind of movement

# WHAT KEEPS TRAFFIC FLOWING?



# A POWERFUL TOOL FOR MULTIMODAL TRAFFIC SIMULATION

Whether comparing junction geometries, analysing public transport priority schemes or considering the effects of certain signalling – PTV Vissim allows you to simulate traffic patterns exactly. Motorised private transport, goods transport, rail and road related public transport, pedestrians and cyclists – as the world's leading software for microscopic traffic simulation, PTV Vissim displays all road users and their interactions in one model. Scientifically sound motion models provide a realistic modelling of all road users.

The software offers flexibility in several respects: the concept of links and connectors allows users to model geometries with any level of complexity. Attributes for driver and vehicle characteristics enable individual parameterisation. Furthermore, a large number of interfaces provide seamless integration with other systems for signal controllers, traffic management or emissions models.

PTV Vissim is rounded off with comprehensive analysis options, creating a powerful tool for the evaluation and planning of urban and extra-urban transport infrastructure. For example, the simulation software may be used to create detailed computational results or impressive 3D animations for different scenarios. It is the perfect way to present convincing and comprehensible planned infrastructure measures to decision-makers and the public.

# 6 GOOD REASONS FOR PTV VISSIM

## BENEFITS

### MULTIMODALITY

Whether public authorities, consulting or research – worldwide, PTV Vissim is used by more than 12,000 users for microscopic traffic simulation. Join the community and model all modes of transport and their interactions, integrated into a single tool. Dedicated motion models for motorised traffic, bicycles and pedestrians make a valid assessment and a realistic representation of all traffic-related aspects possible.

### MAXIMUM ACCURACY TO DETAIL

Achieve the maximum accuracy to detail with PTV Vissim. With our links and connectors concept, you can map your network in detail and model different geometries – from a standard node to complex intersections. The inclusion of scientific behavioural models such as Prof. R. Wiedemann's car following model, or the Social Force Model for pedestrians, also ensure realistic behaviour of all road users within the existing and planned infrastructure.

### EASE-OF-USE AND PRODUCTIVITY

Build your model effectively in PTV Vissim: take advantage of the various interfaces (COM, DriverModel, DrivingSimulator, SignalControl, Emission, ANM) to import, for example, existing networks from PTV Visum or other strategic transport models and to connect external signal controllers (for example Siemens TL, Lisa+, VS-Plus, SCOOT, SCATS, RBC and others) or to transfer emissions data in order to conduct detailed analyses by means of simulation. The graphical user interface with flexibly dockable windows, 2D and 3D network windows, editors with many features for efficiently creating and editing network objects and their attributes, as well as numerous options for outputting results, all ensure ideal user-friendliness.

### FLEXIBILITY AND INTEGRATION CAPACITY

Opt for a planning tool that can be customised to suit your needs. The generic COM interface allows you to interact with external applications. Settings for driver and vehicle properties at different levels, for traffic demand and for public transport timetables help you to flexibly expand your microscopic planning tool into a stable test environment. As part of the PTV Vision Traffic Suite, you can seamlessly connect the simulation software to other PTV software solutions.

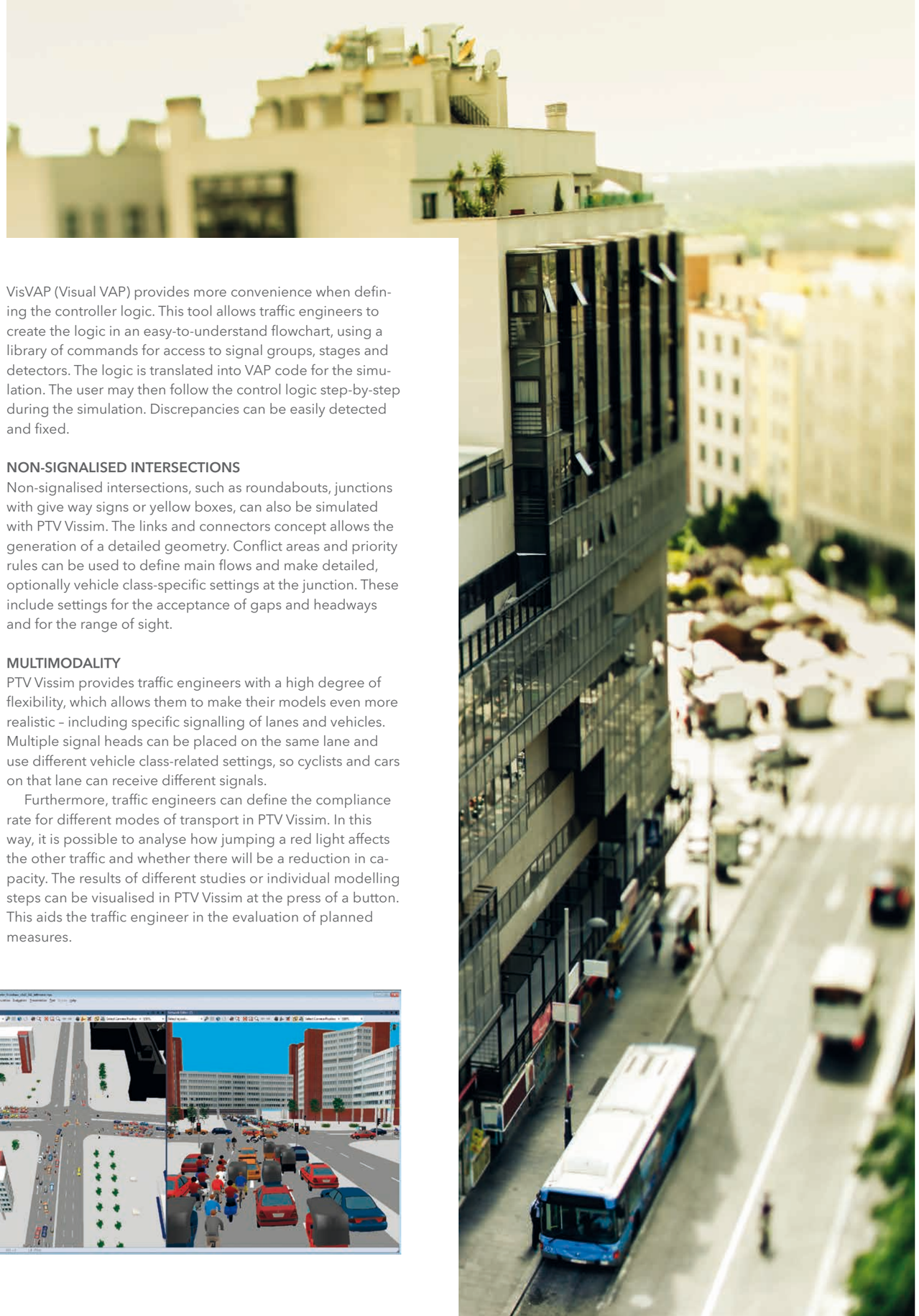
### SCIENTIFIC APPROACH

Rely on a software package that is based on decades of intensive research and close networking with customers and continuous development. You will have access to a stable simulation tool that always incorporates the latest findings from research and practice and that sets new standards.

### VISUALISATION IN 2D AND 3D

Switch perspective with a click of the mouse in PTV Vissim and impressively display your analysis results: assist in public decision-making processes with detailed reports, 2D animations and stunning 3D visualisations. Make complex traffic situations appealing and understandable to all.

# USE CASES AT A GLANCE



## JUNCTIONS

From simple junctions, to signal-controlled nodes and roundabouts with public transport priority and pedestrian interaction or "magic roundabouts" – with PTV Vissim it is possible to model and study any node geometry and any type of priority and signalling.

### SIGNAL CONTROL

Traffic signals affect the traffic flow dominantly, especially in urban areas. With PTV Vissim, traffic engineers can model and optimise all types of signal control – whether fixed time, traffic-actuated or public transport priority schemes. The software provides interfaces to all common controller types such as Sitraffic Office, SCOOT and SCATS, as well as to PTV Visum and PTV Vistro, in order to simulate and fine tune optimised controls.

### SIGNAL GROUPS AND PHASE-BASED FIXED TIME CONTROL

Externally created intergreen matrices and signal programs can be imported into PTV Vissim or entered and then optimised. In this way, traffic engineers can create fixed time signal control based on signal groups: thanks to the clear representation of the signal states in a graphical editor, any intergreen violations can be quickly detected and corrected.

In addition, stage-based fixed time signal control can be created with the add-on module Vissig. Stages and interstages can either be defined via a graphical editor or generated automatically.

### TRAFFIC-ACTUATED SIGNAL CONTROL

The add-on module VAP (Vehicle Actuated Programming) allows users to simulate adaptive signal control in PTV Vissim. During the simulation, VAP interprets the program instructions of the controller logic and generates appropriate switching commands for the traffic signals.

VisVAP (Visual VAP) provides more convenience when defining the controller logic. This tool allows traffic engineers to create the logic in an easy-to-understand flowchart, using a library of commands for access to signal groups, stages and detectors. The logic is translated into VAP code for the simulation. The user may then follow the control logic step-by-step during the simulation. Discrepancies can be easily detected and fixed.

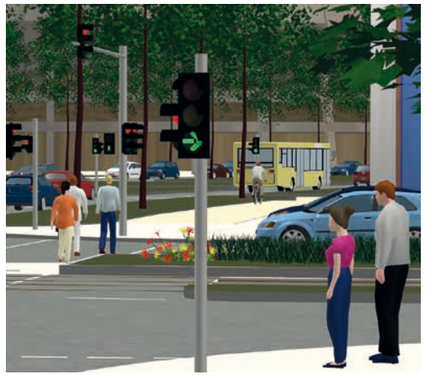
### NON-SIGNALISED INTERSECTIONS

Non-signalised intersections, such as roundabouts, junctions with give way signs or yellow boxes, can also be simulated with PTV Vissim. The links and connectors concept allows the generation of a detailed geometry. Conflict areas and priority rules can be used to define main flows and make detailed, optionally vehicle class-specific settings at the junction. These include settings for the acceptance of gaps and headways and for the range of sight.

### MULTIMODALITY

PTV Vissim provides traffic engineers with a high degree of flexibility, which allows them to make their models even more realistic – including specific signalling of lanes and vehicles. Multiple signal heads can be placed on the same lane and use different vehicle class-related settings, so cyclists and cars on that lane can receive different signals.

Furthermore, traffic engineers can define the compliance rate for different modes of transport in PTV Vissim. In this way, it is possible to analyse how jumping a red light affects the other traffic and whether there will be a reduction in capacity. The results of different studies or individual modelling steps can be visualised in PTV Vissim at the press of a button. This aids the traffic engineer in the evaluation of planned measures.





## MULTIMODAL SYSTEMS

PTV Vissim is the only microscopic simulation tool in the world that can be used to represent all modes of transport and simulate their interaction – whether motorised traffic such as cars, lorries and buses, rail-based transport such as trams and trains, or non-motorised traffic such as pedestrians and cyclists.

### BICYCLE TRAFFIC: NON-LANE BASED BEHAVIOUR

With PTV Vissim also bicycle traffic can be integrated into planning. This is made possible by the detailed consideration of mixed traffic. If motorists and cyclists have to share a road, they can drive side by side and overtake each other on the same lane. Regardless of the configuration of the lane marking, PTV Vissim can have vehicles with different widths interact with each other on a single lane and make their way through lateral movements wherever enough space for cutting in is available.

The simulation software models bicycle traffic with non-lane based behaviour. In PTV Vissim, cyclists always choose the lateral position that enables them to move as far as possible at their desired speed. Moving into gaps that favour forward movement and small distances to other nearby road users are taken into account and simulated.

### PUBLIC TRANSPORT

In order to represent public transport systems in detail, users can easily import their public transport models planned in PTV Visum into PTV Vissim or manually add them in the simulation software. Public transport lines, different public transport vehicle types, timetables, stops, stop types and dwell times can be specified and public transport priority signalisation can be modelled. The simulation then shows how well a planned timetable actually works, how many bus bays the bus station needs and whether the planned connecting times are feasible for the passengers.

### PEDESTRIANS

The consideration of pedestrian flows and their interaction with nearby traffic events is a key component of traffic and urban planning. The add-on module PTV Viswalk allows pedestrian behaviour to be studied step-by-step. Here the software considers the free choice of direction that is typical for pedestrians and that is based on individual decisions and allows the user to freely configure the different pedestrian types. Inter-modal connection relations and complex vehicle-pedestrian interactions can be developed in PTV Vissim. Event and evacuation scenarios help planners and decision-makers to select the correct evacuation strategy for buildings, tunnels or stadia.

### MODELLING FREIGHT TRAFFIC

In the case of freight traffic, weight is a factor because the driving behaviour of fully loaded vehicles is different from that of vehicles in an unloaded state. A wide range of freely definable settings in PTV Vissim means it is possible to specify the precise dimensions of any vehicle and to display loading states visually. The load weight can be modified by manual entry and finely adjusted by means of a COM script. As a result, driving processes can be authentically depicted in PTV Vissim and the acceleration force and braking processes can be visualised and analysed via the simulation.

## MOTORWAY TRAFFIC

The assessment of traffic quality on motorways is typically based on macroscopic variables such as travel times and queue lengths. PTV Vissim achieves realistic results at this aggregated level by means of detailed geometry and microscopic behaviour models.

### OPERATIONAL LEVEL: DRIVING BEHAVIOUR

Modelling individual driving behaviour forms the core of simulation. With an unlimited number of vehicle models, types, and classes, users can put together any fleet of vehicles required and adjust the driver and vehicle properties in detail. In addition to basic attributes such as the desired speed and acceleration and deceleration behaviour, at the operational level, traffic flow is determined by car following behaviour and lane changing behaviour.

Car following behaviour is simulated using Professor R. Wiedemann's psycho-physical car following model. In this model, the driver responds according to the distance and the difference in speed to the vehicle ahead by accelerating or decelerating.

A rule-based model is used for lane changing, which can also be configured. One example is aggressiveness when changing lanes: what gap size is required in the adjacent lane? And how much deceleration can be accepted for the trailing vehicle on the target lane?

### TACTICAL LEVEL: LANE SELECTION AND COOPERATIVE BEHAVIOUR

Lane selection is vitally important for the traffic flow and primarily depends on the route of the vehicle and the look ahead distance.

However, lane selection does not just depend on static network characteristics, but also on the surrounding vehicles: Lane selection, acceleration and deceleration allow vehicles to cooperate with other vehicles, e.g. to facilitate merging at a weaving at a ramp. This in turn has an influence on the capacity of the merging area and is strongly dependent on the situation. Therefore, properties such as the willingness to cooperate can be adjusted in PTV Vissim so that the behaviour in the region being studied can be mapped realistically. Finally, this flexibility also allows the evaluation of traffic management measures and Car2X systems that have an impact on individual behaviour and whose effects on the entire traffic flow should be evaluated.

## ACTIVE TRAFFIC MANAGEMENT

Active Traffic Management measures can be employed in both motorways and urban areas to increase the quality of traffic. Traffic engineers can intervene in traffic on a selective, section-based or network-wide level. The objective is to avoid or prevent traffic jams. Using PTV Vissim, it is possible to model all operational interventions and to assess their effect on the overall traffic flow.

### VARIABLE SPEED LIMITS AND HARD SHOULDER RELEASE

Different lane control systems can be represented in PTV Vissim and studied with respect to the effect on traffic. Examples include traffic-actuated speed limits, ban on passing for heavy goods vehicles or traffic jam warnings. The temporary release of hard shoulders can also be simulated.

### RAMP METERING

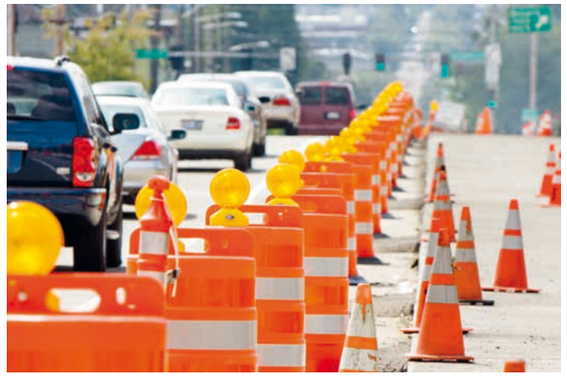
If congestion in the main lane becomes apparent at an on-ramp, managing the admission of traffic may be an appropriate strategy. With VAP, the add-on module VisVAP and COM, users can test different control algorithms and identify the best strategy and optimal switching threshold values.

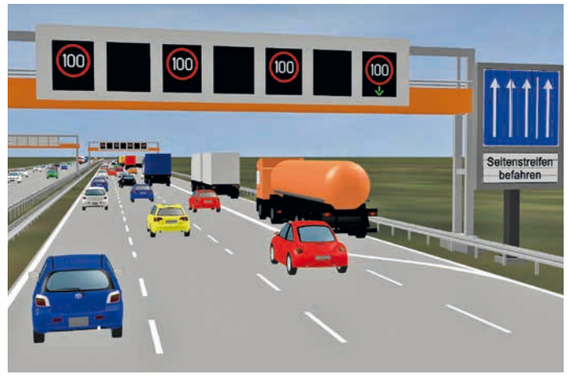
### STATIONARY ROUTING AND INDIVIDUAL ROUTE GUIDANCE

The effect of systems affecting route choice, such as variable message signs and navigation systems, can also be simulated. For example, both traffic-actuated and pretimed variable message signs with varying degrees of compliance can be simulated at motorway junctions. Individual vehicle types can be equipped with different guidance systems. In this case, intervals can be defined for which the routes to the destination are determined based on the current traffic situation.

### CAR2X APPLICATIONS

Car2X applications allow communication with other vehicles or with the infrastructure. Thanks to them, interventions in the vehicle movement should be possible in the future. Focusing on this new technology in the field is a costly endeavour: it is usually not possible to equip large enough vehicle fleets which would represent a relevant percentage of the overall traffic. Simulation with PTV Vissim offers a cost-effective alternative. Using COM, it is possible to model Car2X systems and evaluate any type of intervention and its influence on traffic.






## PUBLIC TRANSPORT

Sustainable traffic planning puts emphasis on the promotion of public transport. PTV Vissim aids traffic engineers in different sub-disciplines of public transport planning and offers them an extensive range of dedicated features and detailed modelling possibilities. Simulation of public transport is based on the flexible structure of public transport lines, both rail-based and road-based with different vehicle types, and the allocation of corresponding timetables and the line routes. Moreover, public transport networks created in PTV Visum can easily be imported via an interface and simulated in detail.

To determine the vehicle dwell times at stops, the software differentiates between three variable modelling types:

- Distribution-based dwell time
  In this method, the respective dwell time is based on a dwell time distribution. The user can define the wait time distribution as normal distribution or empirical distribution, based on compiled data.

- Calculated dwell time
  In this case the dwell time is calculated based on an average boarding and alighting time per passenger that can be defined by the user and the proportion of passengers boarding and alighting. The boarding and alighting process can be further specified by door-specific settings (boarding and alighting or boarding only or alighting only). The percentage distribution of boarding and alighting passengers per vehicle and stop, the demand-based time interval for the public transport line use and the allocation of passenger destinations, including their distribution over various public transport lines, can all be represented in PTV Vissim. Furthermore, PTV Vissim offers a wide selection of departure time options: to this end, public transport lines can depart according to a timetable, depending on their occupancy rate or in consideration of delays.

- Simulated dwell time
  The pedestrian module PTV Viswalk supports an even more detailed investigation. Both the capacity and the impact of the geometry of the stop design on passenger transfer times and on the overall traffic flow in private traffic and public transport can be assessed. The visual representation of pedestrians interacting with public transport lines within the stop geometry allows planners to quickly identify possible weak points in the processes of boarding and alighting and thus to derive planning-based improvements.

### PUBLIC TRANSPORT PARTIAL ROUTE DIVERSION

A COM script or the add-on module VisVAP can be used by traffic engineers to test various scenarios for assigning public transport partial routes. For example, buses can be assigned to free bus bays or the transfer processes of passengers to public transport lines that run to different stops can be simulated.

## EMISSIONS MODELLING

Emissions are becoming ever more important in traffic studies. In this case, both network-wide total volumes and local volumes (Hot Spot Analysis) are relevant. Using the add-on module EnViVer, which is based on the VERSIT+ exhaust emissions model from TNO, it is possible to determine pollutant emissions based on vehicle trajectories and other information from PTV Vissim.

It is primarily the validity of the speeds and accelerations of the separate vehicles that is crucial for good quality emissions modelling. With PTV Vissim, these can be exported as individual vehicle trajectories to vehicle record files which can be imported into EnViVer for further analysis. Vehicle types are used to assign additional properties such as fuel type or pollutant class to each vehicle in EnViVer.

In EnViVer, detailed calculations of $CO_2$, NOx and PM10 emissions in the area being studied are prepared in graphical or tabular format for an easy-to-understand result. Furthermore, users have the option of generating different views of the analyses – whether representation of the total sum or different types of emissions for the entire network or as heat maps, which indicate the spatial distribution of the emissions. On this basis, various traffic planning or management strategies can be studied in the simulation for their emissions-reducing factors and compared with each other.

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