

ptv vision

VISUM – State-of-the-Art Travel Demand Modeling



VISUM – Travel Demand Modeling

VISUM is a comprehensive, flexible software system for transportation planning, travel demand modelling and network data management. VISUM is used on all continents for metropolitan, regional, state wide and national planning applications. Designed for multimodal analysis, VISUM integrates all relevant modes of transportation (i.e., car, car passenger, goods vehicles, bus, train, motorcycles, bicycles and pedestrians) into one consistent network model. VISUM provides a variety of assignment procedures and 4-stage modelling components which include trip-end based as well as activity based approaches.

VISUM is a PC-based programme using MS Windows and offers data and image exchange in the Windows environment via clipboard or interfaces to industry standard formats. In addition, VISUM has an open object-oriented concept that enables users to programme their own applications using Visual Basic or the programming language of their choice. PTV Vision® is more than just traditional demand modelling. Our software integrates demand modelling with microscopic traffic and pedestrian simulation (VISSIM), providing transportation professionals with the most complete suite of analysis tools. To round out the software package, VISUM includes embedded components from other leading software packages such as ArcGISTM from our business partner ESRI for better GIS integration.

VISUM is used to build conventional four-step models for regional and state-wide planning while also serving as a powerful analysis and data management tool for traffic engineers and transportation planners. A unique strength is detailed public transportation service planning, with a data model for routes and schedules that goes far beyond traditional demand models. Furthermore we do support operating systems with 64bit and so it is possible to edit bigger networks and models even more efficiently through the enlarged memory.



VISUM Features – A Close Up View

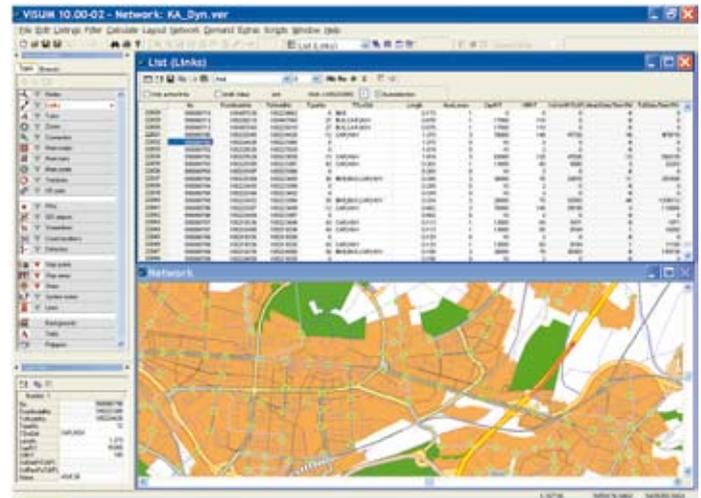
Interactive Use of VISUM:

VISUM is an extremely flexible visualisation environment. The VISUM Graphical User Interface (GUI) is easy to learn and to use. Selection and editing of network objects in the Geographical Information Systems (GIS) style is highly intuitive. With the junction editor for example all relevant details of an intersection can be modelled. This reaches from the node and turn attributes all the way through the whole junction model. Also the network object toolbar lets you toggle the visibility of layers and filter settings. Using the spatial selection users can select any collection of network objects they want to edit.

VISUM speeds up your transportation planning analysis workflows. Just one example for this is Multi-Threading, which helps to split each task into multiple parts which run concurrently. Through this parallelisation the computationally intense procedures can be speeded up. Furthermore the Network object toolbar and context menus give you fast access to functionalities such as graphic parameters, visibility of layers, listings and/or filters.

The listings for each network object work like a spreadsheet programme, which allows for fast and efficient editing of model data. Network editor and listings are synchronised. Different synchronisation modes make it possible to work parallel in the listings and network editor.

VISUM includes integrated “Undo” and “Redo” commands that restore network integrity after a complex series of user interactions and network modifications. Even data for very large models can be easily accessed and modified via VISUM’s GUI. All model steps, such as assignments



User interface with synchronized map and list

can be interactively started from the menu. With the print preview mode, users can access a “what-you-see-is-what-you-get” view.

A Quick View window allows the users to view and edit attributes of the currently marked objects without opening any dialogs. This speeds up the network editing process significantly. For creating different map views, the graphics parameter selector can be used for changing between graphical settings with just one mouse click.

GIS Integration

One of the most exciting features of VISUM is its ability to merge GIS-data and transportation data into a common database with several layers including: Traffic Analysis Zones and jurisdiction boundaries; transportation network with connectivity, street centrelines, intersection turns and public transport routes; user defined attributes and user defined object classes; and background maps. In addition the linkage to the personal geo database of ESRI or shape files can be used to populate additional geography layers in VISUM which then can

be intersected and buffered with the transportation network of VISUM. This GIS integration enables networks to be coded in a geographically accurate way.

VISUM alone is sufficient to design powerful maps including flexible legends, no other GIS software is needed for post-processing and presentations. Only a few steps are necessary to make use of the many visual options. To enrich the graphical capabilities all standard vector formats as well as image and bitmap formats can be imported. This includes aerial imagery file formats such as MrSID and ECW.

Script Based Use of VISUM

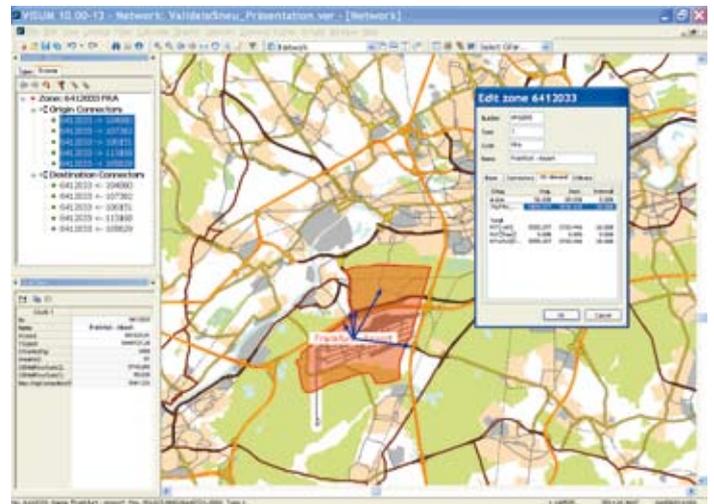
VISUM provides a COM interface based on MS Windows technology and can be integrated with other COM-compliant Windows products like MS Office and ArcGIS. Users can programme applications using Python, Visual Basic, C, C++ and others. Based on this concept, VISUM is an open system that enables users to create and run customised pre-processing and post-processing utilities and to control advanced multi-stage model runs.

Network Data Management

The network model of VISUM is composed of layers of different object classes commonly used for transportation demand modelling:

- ▶ Transportation network links and nodes
- ▶ Zones
- ▶ Centroid connectors
- ▶ Public Transport (transit) routes
- ▶ Multi-layered public transport stops
- ▶ Intersection movements
- ▶ Territory objects for aggregated evaluation
- ▶ User defined object layers

All of these objects contain standard attributes and user definable attributes. VISUM has a powerful editor for all of these objects. You can change the shape, as well as the attribute data of every single object interactively. Creating a public transport route is just a matter of a few mouse clicks. In addition to the single change, you can change multiple objects at a time. This feature is extremely useful when it is combined with the powerful selection tools. As a result it is easy and efficient to exchange with MS Access, MS Excel, ArcGIS, MapInfo and other software products with relational databases.



Interactive network editing

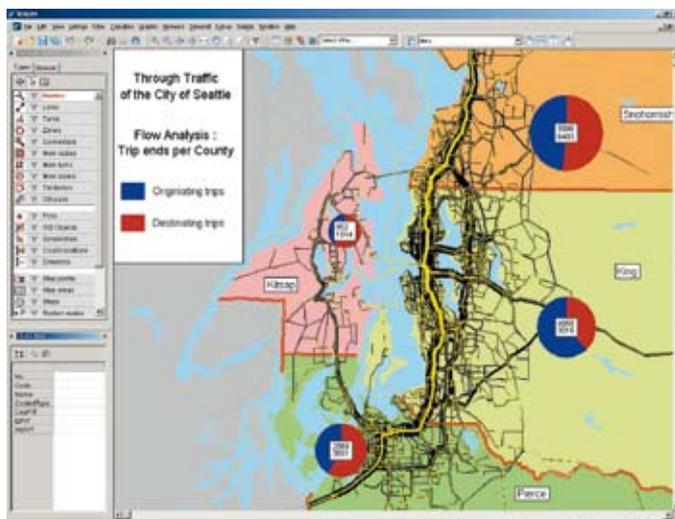
Network Consistency

A unique feature of the interactive network editor is the automated network consistency check. These checks are performed in the background after each operation. For example, splitting a link or renumbering a node that is used by a public transport route will automatically update the public transport route data as well. This means that the network is always ready for routing and assignment. During the process of network editing, VISUM also offers "undo" and "redo".

Assignment Procedures

VISUM offers users both advanced highway and public transport assignment procedures. The highway assignment simultaneously loads multiple modes (i.e. car, taxi, good vehicles) and offers the following procedures:

- ▶ Linear User Cost Equilibrium (LUCE): Origin-based Assignment which achieves perfect proportionality of path volumes within one origin; Loads richer path set (in congested networks); Implicit path representation as bushes instead of explicit paths
- ▶ Incremental loading
- ▶ User-optimal equilibrium, fulfilling the strict Wardrop criterion
- ▶ A general user-optimal equilibrium ("learning method")
- ▶ Dynamic User Equilibrium (DUE): dynamic algorithm including blocking back, time-dependent capacities and departure time choice model
- ▶ Bi-criterion stochastic user-equilibrium ("TRIBUT") – for road pricing studies
- ▶ Stochastic equilibrium
- ▶ Dynamic stochastic equilibrium with departure time choice



Highway assignment and flow analysis for large metropolitan models

Highway and public transport assignment

In addition to a pre-defined selection of formulas for volume-delay functions (VDF) used in an assignment, it is possible to define your own custom VDF. VISUM allows weights on zone connectors providing better levels of calibration for side streets and intersection volumes.

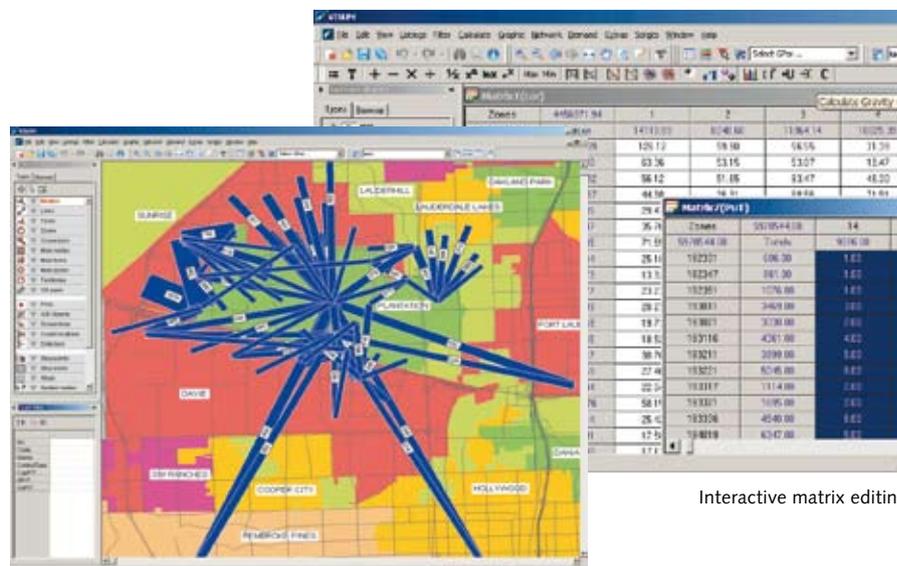
For public transport assignment VISUM offers two different families of procedures:

- ▶ Headway based and
- ▶ Timetable based assignment.

All methods create multiple path alternatives for every OD pair. All public transport paths can be multi-modal (e.g. P&R-bus-train-walk). All assignments are time dynamic, reflecting varying service and path choice and demand variations during the day. Passenger survey data can be easily integrated, automatically tested for plausibility and then converted into a direct assignment.

Four Stage Models and Convergence

VISUM covers the entire model chain from generation to destination and mode choice to assignment. The user can define flexible destination and mode choice models.



Display of urban desire lines

Interactive matrix editing

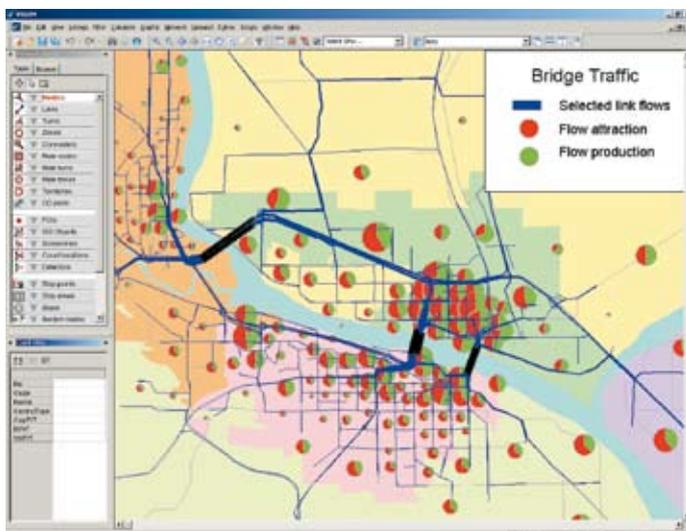
VISUM provides menu-driven (i.e. without scripting) calibration and execution of 4-stage models. Users can also add their own programme code into the model loop using any COM-compatible programming language. Combined iterations of assignment, destination and mode choice are recommended and will reach high level of convergence thanks to the sophisticated assignment procedures in VISUM.

For experienced users there is also an advanced activity-based approach. It builds trip chains (or journeys) from activity programmes, allows the use of demand stratifications and takes into account mode choice constraints along a trip chain. VISUM also features an interactive matrix editor that easily manages large trip tables and performs all basic matrix operations with one or multiple matrices.

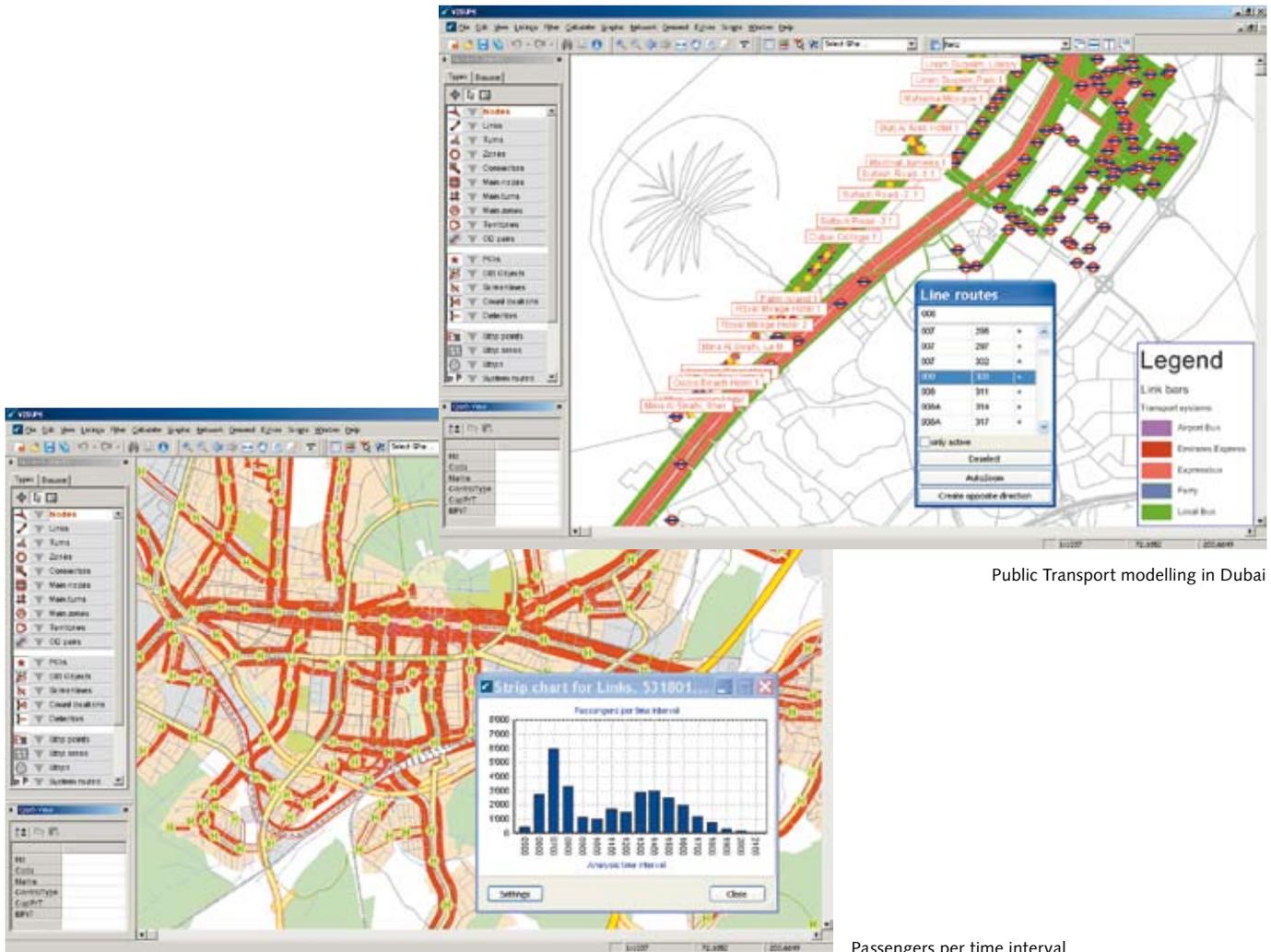
Post Assignment Analysis in VISUM

VISUM is the only demand-modelling package that stores all paths after assignment and makes them available in several analysis functions:

- ▶ Volume displays of links and nodes
- ▶ Difference and multiple volumes
- ▶ Select link analysis
- ▶ Select node analysis
- ▶ Select zone analysis
- ▶ Area flow analysis
- ▶ Screen line
- ▶ Aggregated statistics for evaluation territories (e.g. counties)
- ▶ Isochrones
- ▶ Sub-area models



Quick assignment flow analysis



Public Transport modelling in Dubai

Passengers per time interval

Public Transportation Model

VISUM is equipped with an interactive editor for public transport routes. The public transport routes are consistently integrated with the rest of the transportation network. The network model differentiates between the abstract stop in the schedule and multiple physical stop locations in the network. The description of service can be as detailed as in a scheduling system, including route variations, time profiles, schedules and varying service frequencies. VISUM can also estimate public transport system capacity based on vehicle types and perform a sophisticated estimation of operational cost and revenue.

The cost-revenue model consists of the following components:

- ▶ Fare model
- ▶ Line blocking (vehicle rotation) including inter-route vehicle transfers
- ▶ User-definable vehicle types and train compositions
- ▶ Operational cost model

Also available is a schedule optimisation feature which minimises transfer time and fleet size.

Time Dynamics

To support the use of time-dynamic approaches, VISUM automatically adds a time stamp to all data, including a 24-hour clock and if the user wishes even different weekdays or a calendar. Thus network attributes, travel demand and all assignment results are stored as time-dependent variables.

Time-dynamic assignment procedures are available for both public transport and highway. The dynamic assignment algorithm handles multiple OD-matrices layered in time slices as well as time-dependent demand profiles. If travel paths are time-dynamic, VISUM considers the effects of capacity constraints that occur only at certain times of day and computes downstream metering and upstream spill-back.

Intergrating Microsimulation

Intersection Models and Level of Service (LOS) Analysis

During highway assignment, delays can be computed for nodes (intersections) in addition to links. There are several approaches for node delay. One planning oriented approach defines capacity constraints for intersections as a function of node type, link class ranking, relation to major flow, and movement type (left, right, through, U-turn).

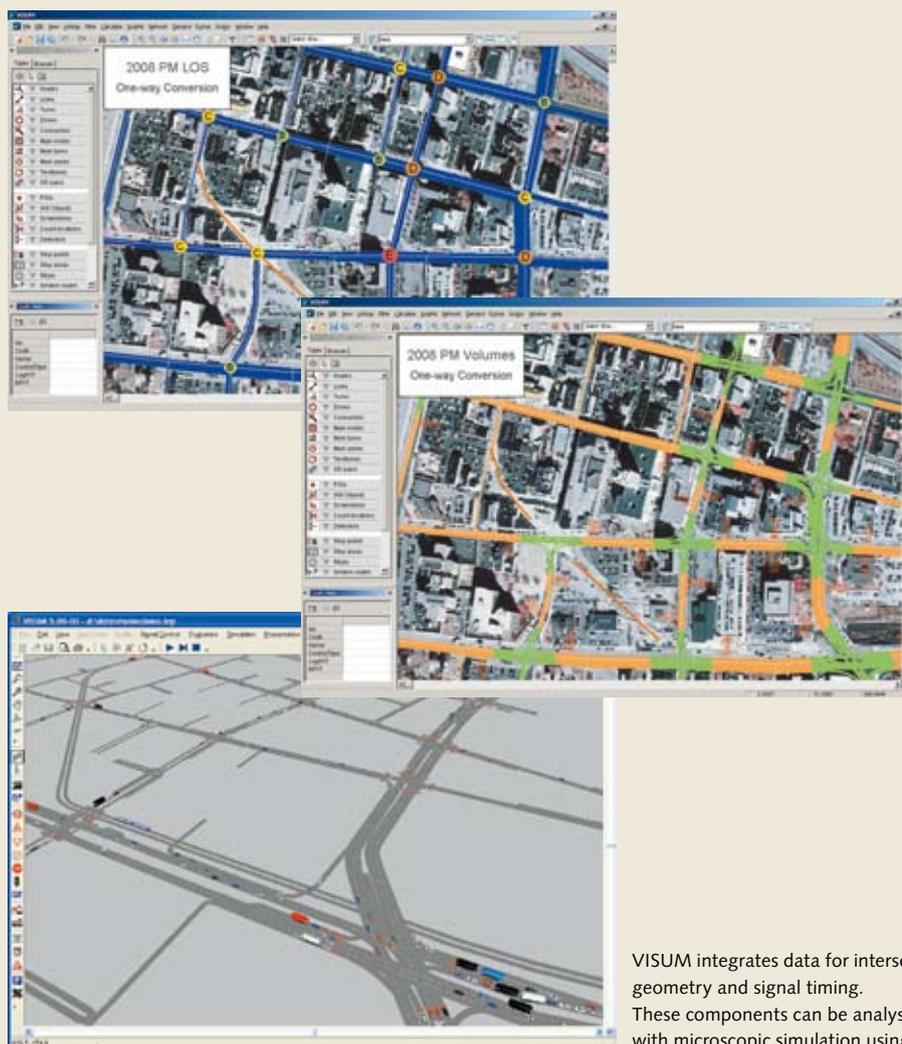
Another approach is inherited from the TMODEL software, deriving delays from a node capacity that is applied to some or to all turns.

The third approach uses additional intersection data such as signal timing and intersection geometry. Intersection Capacity Analysis (ICA) computes intersection delays and level of service (LOS) conforming to the Highway Capacity Manual (HCM) 2000 and other LOS standards.

Intersection delay and LOS can either be used during the assignment process, or simply be generated as post-assignment statistics. This capability in combination with the integrated NCHRP 255 turn flow post-processing procedure makes VISUM a very efficient analysis tool for infrastructure planning projects such as Major Investment Studies (MIS) and Corridor Studies.

Integrating Microsimulation

The PTV Vision suite integrates macroscopic analysis in VISUM with microscopic traffic simulation in VISSIM. Both programmes work together seamlessly, saving valuable time and reducing error. Travel demand volumes can be determined in VISUM and then exported into microscopic simulation. VISUM can also export consistent microscopic networks for VISSIM. Together, the two programmes help to analyse the effectiveness of transportation scenarios including mode shift, regional route choice and operational impacts. VISUM users can incorporate the microscopic detail of VISSIM to obtain a better understanding of critical and congested parts of the network. Or, they can use VISSIM only as a graphical post-processor to produce 3D visualisations of their results. The PTV Vision suite is unique in its integration of macroscopic planning and microscopic traffic analysis. It opens exciting new opportunities to planners as well as to traffic engineers to combine the strength of the two different approaches in order to produce the most accurate analysis.

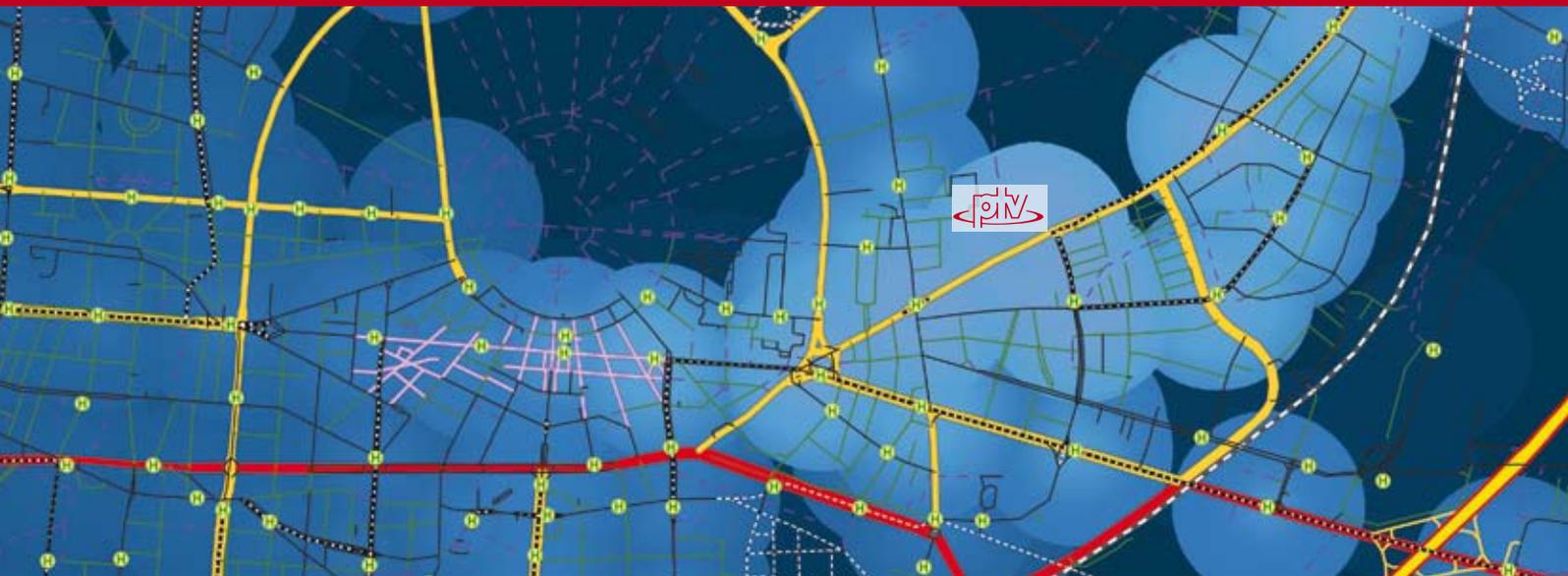


VISUM integrates data for intersection geometry and signal timing. These components can be analysed with microscopic simulation using VISSIM.

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VISUM – State-of-the-Art Travel Demand Modelling

Your benefits of VISUM at a glance:

- ▶ Display of all relevant traffic data in one model
- ▶ Detailed analysis and planning possibilities
- ▶ High data quality through consistent network models
- ▶ GIS-orientated and detailed
- ▶ Individual and customised through open system concepts
- ▶ Numerous efficient calculation procedures
- ▶ User-defined level of detail
- ▶ Close linkage to VISSIM for traffic simulation and to ITS

VISUM sets a new benchmark

With VISUM at the core of PTV Vision, transportation planners and engineers can calculate traffic flows, operational measures of effectiveness as well as noise and air quality impacts. VISUM by far surpasses the present level of detail in a network model for both private and public transport. Prominent features are time dynamics and the extension of public transport modelling.

PTV's Focus on the Users

For more than 15 years, the PTV Vision development team has been setting new standards that our clients value and our competitors aspire to. Today, PTV Vision is helping increase the productivity of transportation professionals and the value they provide to their countries in more than 90 countries. We view our clients as a pivotal resource for ideas. Our industry leading products combined with our desire and motivation to continue setting new standards guarantees a sound investment for years to come.