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VISSIM – State-of-the-Art Multi-Modal Simulation

Traffic Mobility Logistics
VISSIM

Microscopic Simulation

VISSIM is a microscopic simulation model and a component of the PTV Vision® suite. It is the most powerful tool available for simulating multi-modal traffic flows, including cars, trucks, buses, heavy rail, trams, LRT, bicyclists and pedestrians. Its flexible network structure provides the user with the confidence to model any type of geometric configuration or unique operational/driver behavior encountered within the transportation system.

What are typical VISSIM applications?
VISSIM is used for a host of traffic and transit (public transport) simulation needs. Common applications include:
- Arterial/corridor studies
- Roundabout analysis
- Freeway operational and planning studies
- Evacuation planning
- Light rail/bus rapid transit studies
- Transit signal priority evaluations
- Transit center/bus mall designs
- Railroad grade crossing analyses
- Toll plaza evaluations
- Environmental impact studies
- Intelligent Transportation Systems (ITS) assessments
- Airport studies for landside and airside traffic
VISSIM Features – An Up Close View

What Makes VISSIM Special?

VISSIM is based on over two decades of intensive research at various academic institutions throughout the world. Core algorithms are well documented and many model parameters are accessible for calibration.

The link-connector topology allows the highest versatility and accuracy, combined with vehicle movements in a detailed 1/10s resolution. With over 15 years of commercial availability, VISSIM is setting the standard for simulation software. Intensive research and a large user community worldwide guarantee VISSIM to be the leading traffic and transit micro simulation software.

PTV Vision® suite was the first comprehensive transportation planning package integrating microscopic simulation with strategic transport planning/travel demand modeling.

Network

VISSIM has been used to analyze networks of all sizes ranging from individual intersections to entire metropolitan areas. Within these transportation networks, VISSIM is able to model all roadway functional classifications from freeways to parking lots and driveways. VISSIM’s network flexibility also allows for easy construction of multimodal facilities, such as transit, bicycle and pedestrian facilities. Constructing networks is made simple by importing from VISUM or SYNCHROTM.

Some examples include:

- Multi-lane freeways, interchanges, roadway grades
- HOV (High Occupancy Vehicles) and HOT (High Occupancy Toll) lanes
- Merging and weaving areas
- Signalized and unsignalized intersections
- Roundabouts
- U-turns and 2-way left turn lanes
- Bike lanes
- Multi-modal lane sharing and passing (e.g., bikes and cars)
- Angle and parallel parking
- Single point urban interchanges
- Continuous flow intersections, diverging diamonds
- Airport curbside drop-off areas
- Transit exclusive lanes, mixed-flow lanes, queue jumps, queue-bypass lanes
- Transit stops, terminals
- Center and side-running BRT/LRT alignments
- Pedestrian facilities
Traffic Demand

An unlimited number of vehicle types exist in VISSIM allowing the user to model a full range of multi-modal operations. These vehicle types include cars, trucks, buses, heavy rail and light rail vehicles, bicyclists, wheelchairs, pedestrians and even aircraft.

VISSIM also offers the unprecedented ability to assign these vehicles to the network using one or a combination of three methods. The basic method assumes that traffic is stochastically distributed over fixed routes from user-definable start to end points. For coding intersection turning movement counts, these start and end points cover a single intersection, but they can also continue through multiple intersections (e.g., freeway interchange) or even the entire study area. Dynamic routes allow traffic to be dynamically assigned to user-specified paths when specific events occur. One example of dynamic routes is the assignment of vehicles to a railroad underpass only when the railroad grade crossing is occupied on the more commonly traveled path.

Dynamic Traffic Assignment (DTA) allows VISSIM to assign traffic to the network using origin/destination matrices (time and vehicle class-dependent) and travel cost stochastic assignment techniques. Origin/destination matrices can be generated using the integrated demand model of VISUM with its advanced matrix estimation and calibration functionality (TFlowFuzzy).

Transit (Public Transport)

VISSIM has long been the software of choice for transit related studies including bus rapid transit, light rail transit and multimodal transit terminals. Besides being able to analyze the transit related network and signal control aspects listed in the previous sections, VISSIM models transit routes, various transit vehicle types, schedules, stops, stop types and dwell times.
Traffic Control

VISSIM can model intersections that control traffic using yield signs, stop signs (all-way, 2-way stop control), signals and any combination thereof. The flexibility in modeling all forms of signal control is what makes VISSIM the preferred tool for detailed operational studies. There are several ways to model signal control in VISSIM:

- Fixed-time/pre-timed signal plans
- Actuated (via a ring-barrier graphical user interface)
- User definable signal control logic through VISSIM’s VAP macro language logic
- Interfaces to signal controller firmware (virtual controllers) such as Econolite ASC/3 ™ SIL or D4
- Interfaces to adaptive algorithms such as Peek’s Spot/Utopia, SCATS and SCOOT
- Serial communication to external controllers
- Hardware-In-The-Loop connections to VISSIM via NEMA TS2 or TS1 standards, allowing users to connect signal controllers directly to VISSIM

The C-like traffic control macro language, VAP, is supplemented with a flow chart editor VisVAP for easy data entry, error checking and debugging. In addition, the RBC dialogs (standard controller) used to enter actuated signal timings in VISSIM also have custom menus to allow users to model bus and LRT priority, and railroad preemption.

Some examples of signal control and related ITS applications of VISSIM include:

- Ramp metering
- Adaptive signal control
- LRT and bus signal priority
- Railroad preemption
- Emergency vehicle preemption
- Dynamic speed control
- Lane control signals
- Dynamic lane assignment signals
- Changeable message signs

VISSIM allows great flexibility for the user to control yielding vehicles anywhere in the network, intersections, merge areas, railroad crossings, etc. VISSIM provides objects that define where and when a vehicle is expected to stop. To simplify the model building process, conflict areas automatically calculate the gap time that is required for the vehicle in the area.
Analysis

Numerous measures of effectiveness (MOEs) can be reported from VISSIM. Typical MOEs include delay, travel time, stops, queues, speeds, and density. VISSIM supports the decision making process by providing the flexibility to summarize and report the MOEs needed to answer the problem. When, where, and how data are reported from a VISSIM simulation is defined by the user. Data can be summarized for any time period and interval within that time period; at any point-location in the network, at an intersection, along any path, or for the entire network; and aggregated by any combination of mode, or individual vehicle class. Data can also be reported for an individual vehicle. Data is provided in ASCII or database formats, based on the user preference, and automatically formatted using common software such as Microsoft Access or Excel. Several MOEs can also be exported to the transportation planning software, VISUM, for detailed graphical representations. VISUM provides an extensive graphics library for effectively visualizing transportation modeling results.

Graphics

VISSIM supports 2D and 3D animation. This feature allows users to create realistic video clips in AVI format, an excellent tool for communicating a project’s vision. VISSIM also offers users background mapping capabilities with aerial photographs and CAD drawings. Building models can be imported from Google Sketchup®. For even more advanced virtual reality visualization, the simulated traffic can be exported to Autodesk® 3DS Max software.

Interfaces Increase Efficiency

One of VISSIM’s strengths is its ability to interface with a number of programs that are common to the transportation engineering and planning profession including:

- Signal optimization tools – SYNCHRO™
- Travel demand models – emme/2, TranPlan, CUBE, TransCAD.
- Geographic information systems (GIS) and navigation data - ArcGIS and NAVTEQ

PTV pioneered the integration of simulation and travel demand software. This effort has led to the first truly integrated simulation software, VISSIM, and travel demand software, VISUM, on the market as explained in further detail below. Simply put, the benefit to the transportation community is efficiency.
For the past quarter century, PTV has been developing software tools to address the spectrum of needs within the transportation profession from traffic analysis to real-time traffic management. Our vision has been to seamlessly integrate these tools into a transportation software suite.

This is a natural progression in the development of these tools since they share many of the same data elements (e.g., network geometry, volumes and traffic control devices). Our vision is a reality today! The transportation software suite, PTV Vision, integrates these tools to increase efficiency in work tasks and is scalable to grow with an organization’s needs.

VISSIM is a key component in PTV Vision, as shown in the data flow diagram to the side. It allows for a detailed analysis of multi-modal traffic operations. In some instances, however, this level of detail may not be appropriate to answer the transportation question at hand. PTV Vision allows users to expand their analysis to a more macroscopic view with VISUM, VISSIM’s complimentary travel demand model. Data sharing between VISSIM and VISUM is facilitated with the PTV Vision data model.

New for VISUM 10 and VISSIM 5.0 is the ability to maintain on-going connectivity between the macroscopic and microscopic model spheres. As an example of the tremendous productivity gain of that capability, the user can develop a highly detailed operational VISSIM model including features such as ramp metering, light rail signal priority, calibrated weaving areas, etc. At the same time, users can quickly generate input volume and vehicle routes based on time of day or forecast scenario using the linked VISUM model’s wealth of assignment options.

This data model provides access to numerous sources of data to expedite model building and thus answer transportation analysis questions more quickly. For example, PTV Vision provides the ability to:

- Share data elements between simulation and travel demand modeling to reduce manual data entry and the potential of errors.
- Incorporate real-time traffic data into the planning and analysis phases of a project.
- Monitor and manage the transportation system through PTV Vision. An abundant amount of data is collected by Traffic Management Centers as well as Transit AVL systems. PTV Vision allows this data to be presented easily so that decisions can more be made.
- Share data across the internet among various transportation organizations.
- Access GIS data from sources like ArcGIS, or NAVTEQ, to build and update/maintain model networks for a sub-area/corridor, metropolitan region, evacuation area or even an entire country.
- Perform intersection level of service analyses based on the Highway Capacity Manual or other commonly used capacity analysis methodologies.
- Share data with signal timing optimization programs and then import optimized timings back into PTV Vision. From there, the timings can be uploaded to the field and/or used to evaluate scenarios.
- Interface with the suite through COM where users can write their own scripts to automate workflow tasks.
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5 Reasons for VISSIM

▶ Flexible link/connector network topology
▶ Powerful 3D multi-modal modeling and recording
▶ Integrated with travel demand models and GIS via VISUM
▶ Flexible scripting through COM programming interface
▶ Numerous virtual signal controllers commercially available

Application Development Platform

VISSIM offers a COM interface allowing advanced users and researchers to program large applications using Visual Basic, Javascript, Python, Visual C++ or other applications’ macro languages (e.g., MS EXCEL). The COM interface provides access to the network topology, signal control, path flows, vehicle behavior and evaluation data. Typical applications of this powerful feature include automation of customized work flow processes, modification of simulation parameters during run time and customized display options (e.g., side-by-side simulation of different scenarios). COM notably allows full flexibility and thus empowers the user to use his or her own creativity to the fullest extent.

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 pursue to. Today, PTV Vision is helping increase the productivity of transportation professionals and the value they provide to their communities in more than 80 countries. This level of success will only expand in the future as we continue to focus on the needs of our clients. We draw on our experience as transportation planners, engineers and software developers to answer any and all questions users ask. Our development team of more than 50 transportation professionals draws on various resources for ideas to enhance PTV Vision. We view our clients as a pivotal resource for ideas. These resources also include knowledge gained through consulting projects; research conducted within PTV as well as inside and outside of our profession; and partnership with other software developers who share our values. Our industry leading products combined with our desire and motivation to continue setting new standards guarantee an investment for years to come.