

## Planning & Simulation Modeling with PTV Vision



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### Agenda

- Introduction
- Who is PTV ?
- VISUM Overview
- VISSIM Overview
- Questions

## Introduction - PTV AG

### Founded

1979

### Locations

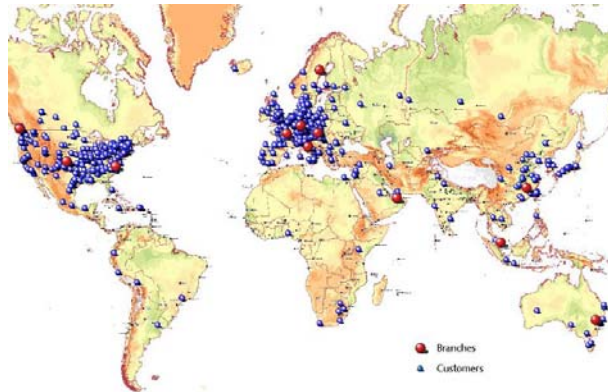
Karlsruhe, Germany  
+ 7 other in Germany

### Subsidiaries

19 worldwide

### Staff

700 +



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## Introduction - PTV America, Inc.

### Founded

1997 (Innovative Transportation  
Concepts)

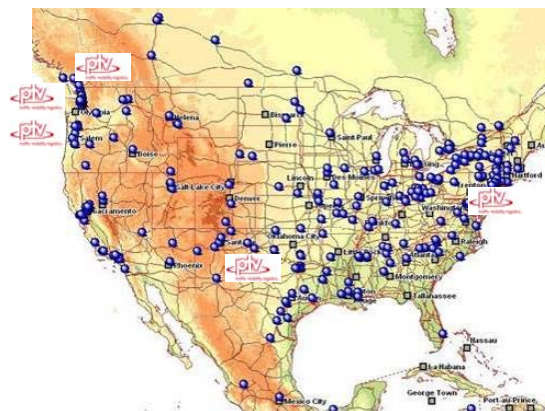
1982 (TModel Corporation)

### Locations

Portland, OR  
Tacoma, WA  
Vancouver, BC  
Austin, TX  
Wilmington, DE

### Staff

35+



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## Introduction - NuStats

### Founded

1984

### US Market Leader for

Travel Surveys & Travel Behavioral Research

### Recent Surveys for

Washington / Oregon

NYMTC

Chicago Area Transportation Study

Washington DC Metro Area

Indianapolis

### Staff

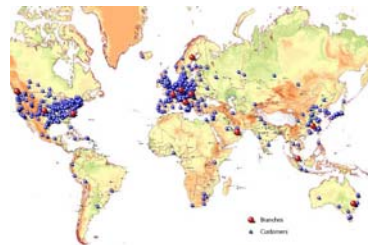
100+



## Introduction - User Community

### 1450+ user organizations worldwide

- 525 in North America
- 650 in Europe
- 275 in Asia, South America and Africa
- 80 Countries / 6 Continents



**300 VISUM** user organizations in North America

**500 VISSIM** user organizations in North America

## What is PTV Vision?

### VISUM

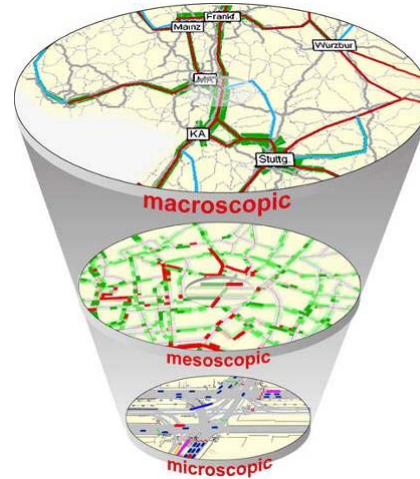
- > Strategic Planning Platform

### VISSIM

- > Microscopic Traffic & Transit Simulator

**PTV Vision is a fully integrated suite of transportation planning/travel demand modeling and traffic simulation for all modes of transportation.**

**PTV Vision incorporates macro, meso, and microscopic levels analyses dynamically over time.**



## VISUM Overview

### Network

- > Network Parameters
- > Highway (integrated intersection modeling)
- > Transit
- > Consistency

### Demand

### Procedures (Assignment & Skims)

### Data Management

**Compatibility across other platforms: COM API**

## **Skimming and Assignment**

User defined delay and generalized cost functions.

Assignment of buses with all other vehicles on roadways i.e. pre-loading.

Linkage to a Dynamic Traffic Assignment (DTA)

Select link/node/zone for all vehicle classes without re-running assignments.

Correct allocation of auto trip to intermediate stop at parking space, when walking remaining distance to destination.

Parallel processing to improve run times.

Simultaneous skimming for multiple link attributes.

## **Highway Skimming and Assignment**

Stochastic and user equilibrium highway assignment methodologies.

Representation of different characteristics for different vehicle classes i.e. setting different auto and truck operating speeds as part of the generalized cost assignment.

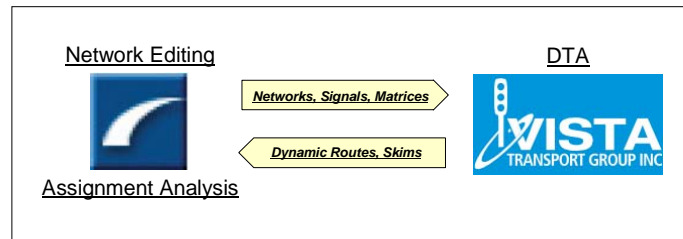
Linkage to a traffic micro-simulation process

Representation of intersection delay for regional applications.

## Linkage to a DTA

### Dynamic Routing Interface Makes Possible...

- Dynamic User Equilibrium (DUE) within VISUM
- Interface to VISTA Transport Group DTA
- DynusT (next generation DYNASMART) – PTV Vision Interface
- VISSIM DTA
- and more to come....



## Transit Skimming and Assignment I

Conversion of bus routes to bus vehicle link loadings that can be used in highway assignments.

Optimized multi-path transit assignment.

Bike access to transit.

Linkage to a transit micro-simulation process.

Station to station summaries of transit assignments

All-or-nothing transit assignment option.

Transit mode specific assignment feature.

## Transit Skimming and Assignment II

Multiple fares by transit mode or service type feature.

Transit fares by route.

Auto access to transit capability.

Description of how auto access transit assignment is handled on the auto side of the trip and the transit side.

Point to point transit path identifier to identify the routes taken from origin to destination.

## Compatibility with other software

Interface with ArcGIS networks and geodatabase, Synchro, SQL databases

Compatibility with the Python scripting language and other COM compliant scripting languages.

Interface with Urbansim.

*VisumPy is the easiest to use among several travel model interfaces I worked with. Thank you for the great work.*

*- Liming Wang, University of Washington, OPUS*

## What is VISSIM?

### Microscopic transit/traffic simulation consisting of

- > Traffic flow model which moves and tracks each vehicle
- > Signal control model

### User-friendly graphical interface (GUI)

- > Graphical network editor for data input of road network, transit lines, routes, volumes, detectors, signals, etc.
- > Definition of user-specific vehicle types (passenger cars, HOV-cars, trucks, buses, articulated buses, trams, LRT-vehicles, bicyclists, pedestrians etc.)
- > Definition of user specific driving behavior to override default values

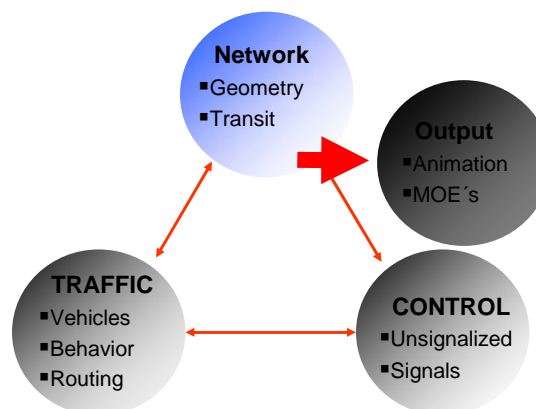
### Decision support system

- > On-line visualization of traffic operation in 2D and 3D
- > Measures of effectiveness like delay, queue length, travel times, mean speed, emissions etc

## Core Building Blocks of VISSIM

### Four core building blocks in VISSIM

- > **Network** representing the physical infrastructure for roadway and tracks
- > **Traffic** representing the vehicular movements on the network
- > **Control** representing how traffic behaves in case of conflicting movements
- > **Output** generating results from simulation runs





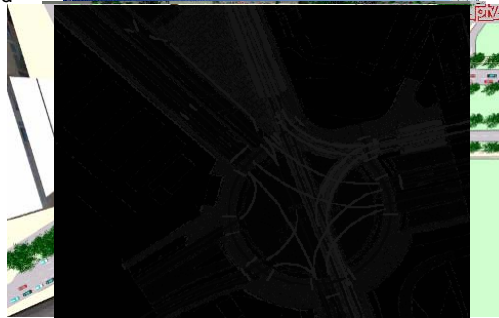
## Geometry Details

### Network topology

- > Not link/node model; Links and connectors
- > Flexible geometry
- > Traffic modeled within intersections

### 3D

- > Networks
- > Vehicles
- > Objects



## Geometry

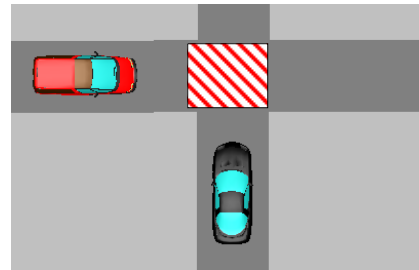
- > All functional classifications
- > ITS infrastructure
- > Toll plazas
- > Merging and weaving areas
- > HOV lanes
- > U-turns
- > Roundabouts
- > All-way stops
- > 2-way left turn lanes
- > Bike lanes and crosswalks



## Vehicle/Vehicle Interaction



Car following  
(model based on  
Wiedemann)



Conflict areas:  
priority rules

## Vehicle Routing

### Static O/D Routes

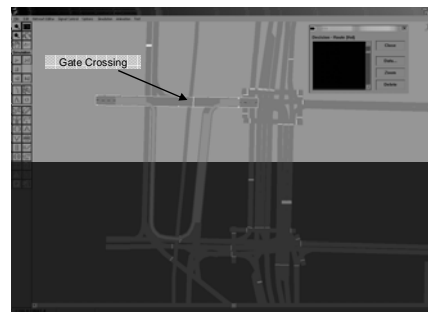
- > Turning Movements
- > Per Time Period, Per Vehicle Class
- > Relative Flow Of All Routes Per Decision Point

### Dynamic Routes

- > Dynamic Relative Flow
- > Based on Traffic Condition

### Dynamic Traffic Assignment

- > TAZ's and O/D tables
- > Automatic route search based on minimum cost
- > Multiple iterations



## VISSIM Performance Measures

### System

- > Network Delay, Network Travel Time, VMT

### Intersection

- > Delay - stopped, control, or person
- > Queue lengths
- > Number of stops

### Link

- > Density, Volume, Speed

### Transit

- > Travel time, Standard Dev., Pass. Wait Time

### Emissions

- > Mobile 6, Engine Curves

### Signal control

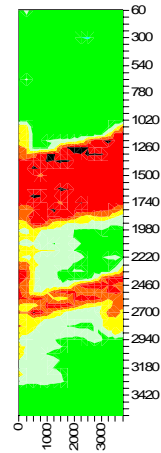
- > Average Cycle Length, Average Green Time

### Routes

- > Travel time, speed, delay

### Point Data Collection

- > # vehicles, speed



## VISUM ↔ VISSIM Interfaces

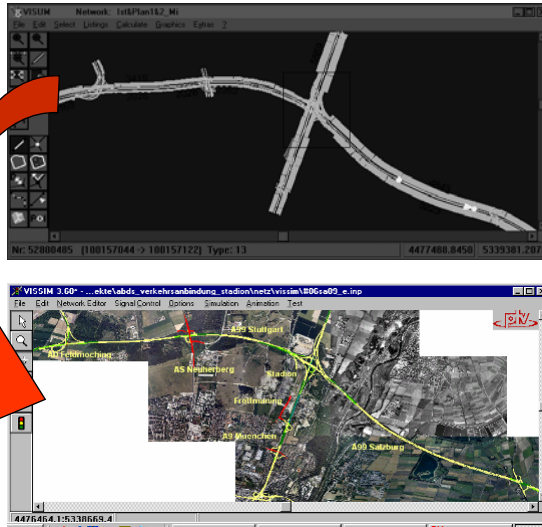
### Export from VISUM to VISSIM

- > With static routes from VISUM assignment
- > As starting solution for dynamic assignment
- > Standard VISUM network data complimented for export with additional junction/node information

### Export from VISSIM to VISUM

- > Abstract assignment-ready network with routes
- > Fully exploded VISSIM network
- > Link segments from link evaluation including results by evaluation time period

## From Planning Model to Microsimulation



### In VISUM:

- Cut sub-area network
- Export of:
  - > Network topology
  - > Node geometry
  - > Signal control
  - > O/D matrices
  - > Paths from assignment results

### to VISSIM as:

- Static routes
- Dynamic assignment

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## Additional VISSIM Features

### Model Interfaces and APIs

- > External Driver Model:
- > External Signal Control and Programming Language VAP
- > COM Programming Interface:

### Interface to VISUM

### Interface to GIS

### Interface to Synchro

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## PTV Vision Suite Emissions Output Alternatives

### **VISUM (Macro) Node Evaluation**

- > Same model as Transyt 7F, Synchro
- > Based on speed, VMT, total stops, total delay
- > Output: Fuel Consumption, CO, NOx, VOC

### **VISSIM (Micro) Evaluation**

- > Primary Emissions Indicators
  - # of stops
  - Vehicle trajectories (acceleration, deceleration, idle time)
  - Total time in network
  - Vehicle miles traveled
- > Based on each individual vehicle capabilities (library + user-defined)
- > Customize output to compare indicators for scenarios
- > Customize output to feed into offline analysis/external emissions model (MOVES, MOBILE6)

## PTV Vision Suite Emissions Output Alternatives

### **Emission Maps in VISSIM (Micro)**

- > Fuel Consumption, Emissions Dependent on:
  - Dynamic status (speed, acceleration)
  - Vehicle class/type (passenger car, motorcycle, HGV)
  - Emission class (cold, warm)
- > Uses look-up matrix
- > Extensive components
- > Output: Link Evaluation for each component

## Additional Emissions Output Alternatives

- **VISSIM Emission API (Micro)**
  - > User-defined model with C++ DLL interface
  - > Input: same attributes as standard emission module
  - > Output: Link Evaluation for user-defined components
- **VISUM COM (Macro)**
  - > MOBILE6 model
  - > Inputs of speed, traffic composition, local variables
  - > Output: Emissions statistics, VISUM graphics parameters

PTV. The Transportation Experts.

