PTV VISUM – BIG DATA IN TRANSPORT MODELLING

OCTOBER 2016

Data Hungry Models
Getting Started Faster
Big Data Use Case: Abu Dhabi
Demand Data
Real-time
OUR VISION

WE PLAN AND OPTIMISE EVERYTHING WORLDWIDE WHICH MOVES PEOPLE AND GOODS.
OVER 2,000 CLIENTS LOCATED IN 105 COUNTRIES

Key Clients
- Public Authorities (TfL, DfT, HE, West Midlands etc)
- Consultants (Aecom, Atkins, Arup, Jacobs, PBA, etc)
- Universities (Imperial, UCL, Napier, Newcastle)
- Public transport operators
- Road operators
- Airport operators
- Vehicle manufacturers
- Architects & Developers
- Research institutions
# PTV VISION SOFTWARE SUITE

<table>
<thead>
<tr>
<th>PTV VISUM</th>
<th>Network modelling – large scale, national, regional and local transport network developments and demand modelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTV VISSIM</td>
<td>Detailed microscopic modelling of individual vehicles covering all modes of transport – multi-modal micro-simulation</td>
</tr>
<tr>
<td>PTV VISWALK</td>
<td>Advanced microscopic pedestrian simulation, both inside and outside buildings</td>
</tr>
<tr>
<td>PTV VISTRO</td>
<td>A solution for all traffic analysis needs</td>
</tr>
<tr>
<td>PTV OPTIMA</td>
<td>Real-time traffic simulation model, based on offline strategic model (PTV Visum), fused with real-time data</td>
</tr>
<tr>
<td>PTV BALANCE</td>
<td>Online traffic signal adaptive network control – model-based</td>
</tr>
<tr>
<td>PTV SAFETY</td>
<td>Management tool for accident analysis prevention</td>
</tr>
</tbody>
</table>

## Interconnected

The suite offers interconnected solutions for various traffic analysis needs.
MODELS ARE DATA HUNGRY

- Junction info (e.g. type, signal data)
- Road info (e.g. speed limits, lanes)
- Map data (links / nodes)
- Behavioural surveys
- Land use data
- Growth projections
- OD demand & surveys
- Traffic/passenger counts
- Parking data
- Journey times
- Stop locations
- Timetables
- Interchanges
- Fare systems

Road network
Demand model
Transit network

Delay-functions
GETTING STARTED FASTER

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Fare systems
PTV can supply map data in Visum format from a variety of sources:
- OSM (free, self-import)
- TomTom
- HERE
- Shapefile import
PTV Visum can interface with a variety of transit data specifications and scheduling software:
- General Transit Feed Specification
- UK ATCO CIF
- RailML
- VDV 452
- Hafas
- Cube/TransCAD/EMME etc.
GETTING STARTED FASTER - TRANSIT

https://www.theguardian.com/cities/2014/feb/19/cities-motion-how-we-mapped-matatus-Nairobi
PTV Visum can automatically import GPS trajectories (GPX format) and snap to the underlying network.

Information can then be used to create new network attributes such as speeds or elevation.
PTV can supply historical speed profiles with map data in Visum format from a variety of sources (GPS and Cell):
- TomTom
- INRIX
- HERE
BIG DATA USE CASE – ABU DHABI OPERATIONS MODEL

- Studying road/junction improvements
- Event management
- Current / opening year scenarios
- Bus lane/operations
- Optima first steps
- (Big) data hub
- Multi-resolution modelling
- Quick assessment of LOS, queues and delays

Operations Model

Junction modelling
Constant refresh
Shorter runtimes
Greater accuracy
Export to microsimulation
BIG DATA USE CASE – ABU DHABI OPERATIONS MODEL

Extract data from Strategic Model

- Network
- Zoning system
- Present-year forecast (2015) demand
- Demand segmentation

Fuse data sources and increase model granularity

- Merge with HERE maps to get ‘best of both’
- Process observed data: radar/video/taxi GPS
- Code junction geometries from satellite photography
- Process signals from controller data
- Import public transport supply

Build automation tools

- Network matcher
- Signal plan converter
- Count extractor
- TFF-engine*

Calibrate

- Harmonise data from different sources
- TFF-engine*
- Vissim export
Stage 1: Matrix estimation to adjust demand to better match observed counts, without junction modelling and therefore based on ‘demand’ flows.

- Faster
- Good approx. before starting calibration with junction modelling

Stage 2: As above, now with junction modelling incorporated in to the assignment.

- Added complexity of queueing and flow metering, i.e. can increase flow downstream by unlocking congestion
- Intelligent chopping examines conflicts and ‘self heals’
- Completely automated process
BIG DATA USE CASE – ABU DHABI OPERATIONS MODEL

STANDARD FUNCTIONS AVAILABLE THROUGH GUI

WRITE PYTHON / VB SCRIPT DIRECTLY WITHIN VISUM

RUN PYTHON / VB SCRIPT FROM EXTERNAL FILES

CONTROL VISUM USING VBA
GETTING STARTED FASTER

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DEMAND DATA

HIGHWAY
- Intercept surveys
- GPS data

TRANSIT
- On-board surveys
- (e-)ticketing data
- Stop-surveys

Demand models
- Household interviews
- Mobile phone data
- Census data
Demand for activities?

Which mode?
- By foot?
- By bike?
- By car?
- By PuT?

Which destination?
- café 1
- café 2
- café 3

Which route?
- 1
- 2
PTV Visum can automatically import raw data survey or e-ticketing data, each record describing one passenger trip from entry station to exit station.

- Reconstructs the trip in detail within the network (so-called direct assignment).
DEMAND DATA – TRANSIT TRAJECTORIES
DEMAND DATA – TRANSIT TRAJECTORIES

- Project to mine smartcard database for:
  - Deriving bus network
  - Identifying bus bunching/scheduling issues
  - Understanding passenger behaviour
  - Analysing bus capacity utilisation
DEMAND DATA – GPS TRAJECTORIES
DEMAND DATA – GPS TRAJECTORIES

http://www.prism-wm.com/
DEMAND DATA – MOBILE PHONE TRAJECTORIES

Analyzing cell phone location data for urban travel: current methods, limitations and opportunities. Çolak, Alexander, Alvim, Mehndiretta, González, 2014
DEMAND DATA – MOBILE PHONE TRAJECTORIES

PASSIVE (standby)

Generating Trajectories from Mobile Phone Data. Schlaich, Otterstätter, Friedrich, 2009
DEMAND DATA – MOBILE PHONE USE CASE

PROCESSED BY MNOs

- Identification of Trips
- Identification of Home and Work
- Exclusion of Non Highway Modes
- Expansion Process
- Stochastic Rounding Process
- Interim Mobile Phone Matrices

PROCESSED IN VISUM

- National Vehicle Type Split Data
- Journey Purpose Segmentation
- Vehicle Class Segmentation
- NTEM/NTS Data
- VISUM Zone Conversion
- VISUM Trip Retiming
- Relevant Trip Identification
- Matrix Verification in VISUM
- Prior Matrices V1
- Prior Matrices V2
- Prior Matrices V3

- Verification in VISUM
- Further Matrix Refinement
- Fix TLD
- Final Prior OD Matrices

Matrix Calibration (Matrix Estimation using Screenlines/Counts as per WebTAG Criteria) and Model Validation
PROS
- Incredibly rich
- Multi-modal

CONS
- Lack of population segmentation
- Lack of short-distance trips

CONCLUSION
- Greatly improves OD matrices for many modes, as with GPS
- Demand models still required, at least for now, but RSIs could become obsolete
- Network operator involvement required to process raw data into usable OD matrices
- Modeller needs to understand and accept the assumptions made
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PTV can supply real time data from a variety of sources:
- TomTom
- INRIX
- HERE
- Coyote
REAL-TIME FORECAST

DATA AMPLIFIER

PTV OPTIMA

PTV VISUM

DATA HUB

DECISION SUPPORT
360° SMARTPHONE APPS

Offline planning

Live data: mobile phone, GPS, detectors
City intervention: diversions, special events
Continuous & real-time

PTV OPTIMA

PTV VISUM

Your City App
Real-time, multimodal travel planning
Citizen/tourist advice and alerts
Influence mobility behaviour
Shared mobility

GPX Importer
Smartcard Importer
Mobility Surveys
CYCLING – LONDON CYCLE SUPERHIGHWAYS

https://www.youtube.com/watch?v=Thyy2-J-BFw
USEFUL LINKS

- **PTV Vision Website**
  http://vision-traffic.ptvgroup.com/en-uk/products/

- **PTV Vision Youtube Site**
  https://www.youtube.com/user/ptvvision

- **PTV Vision Webinars and Tutorials**
  http://vision-traffic.ptvgroup.com/en-uk/community/webinars/

- **Trial licences can be downloaded directly from:**
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