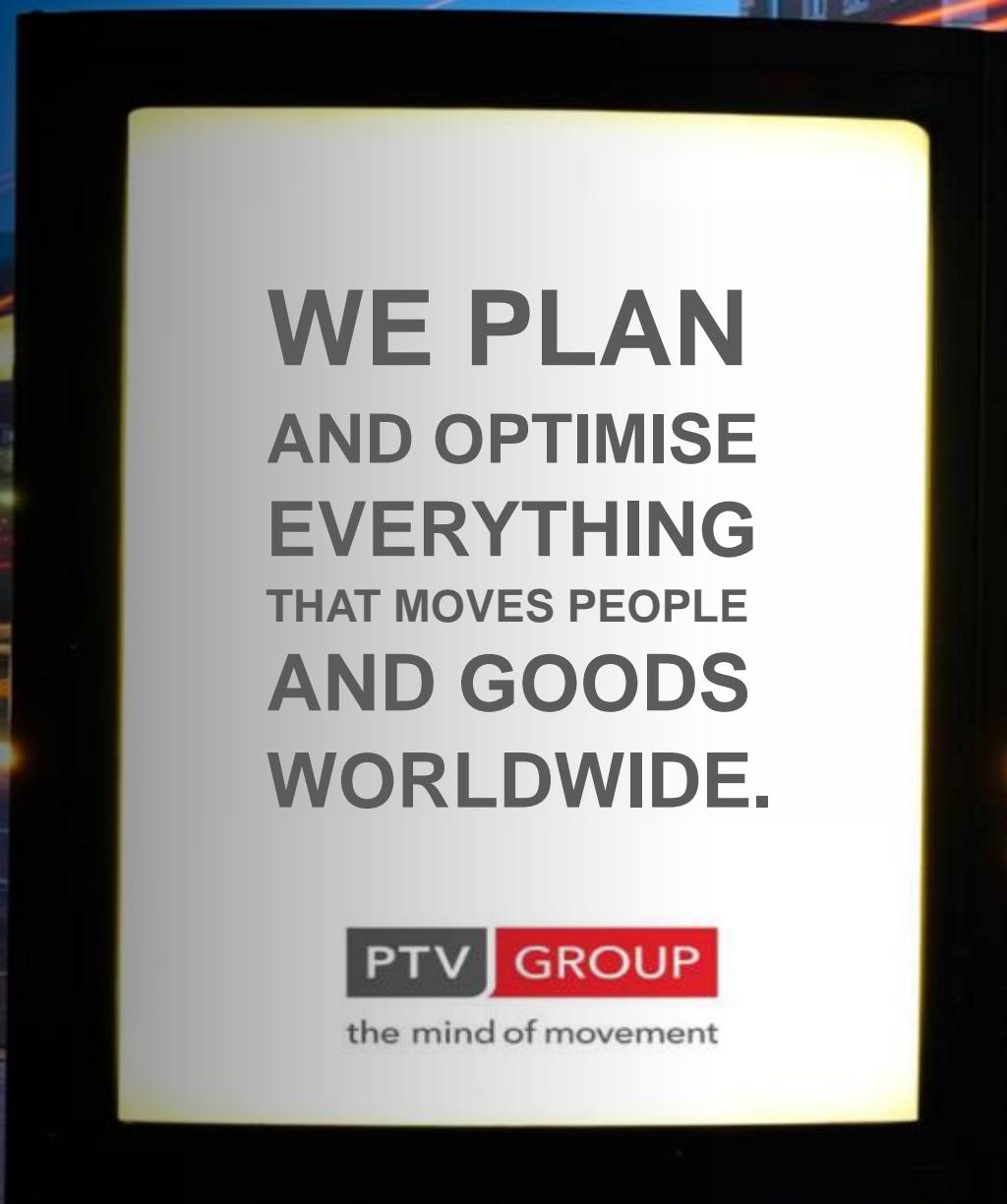


TRANSPORT MODELLING AND SIMULATION WITH PTV VISION SOFTWARE

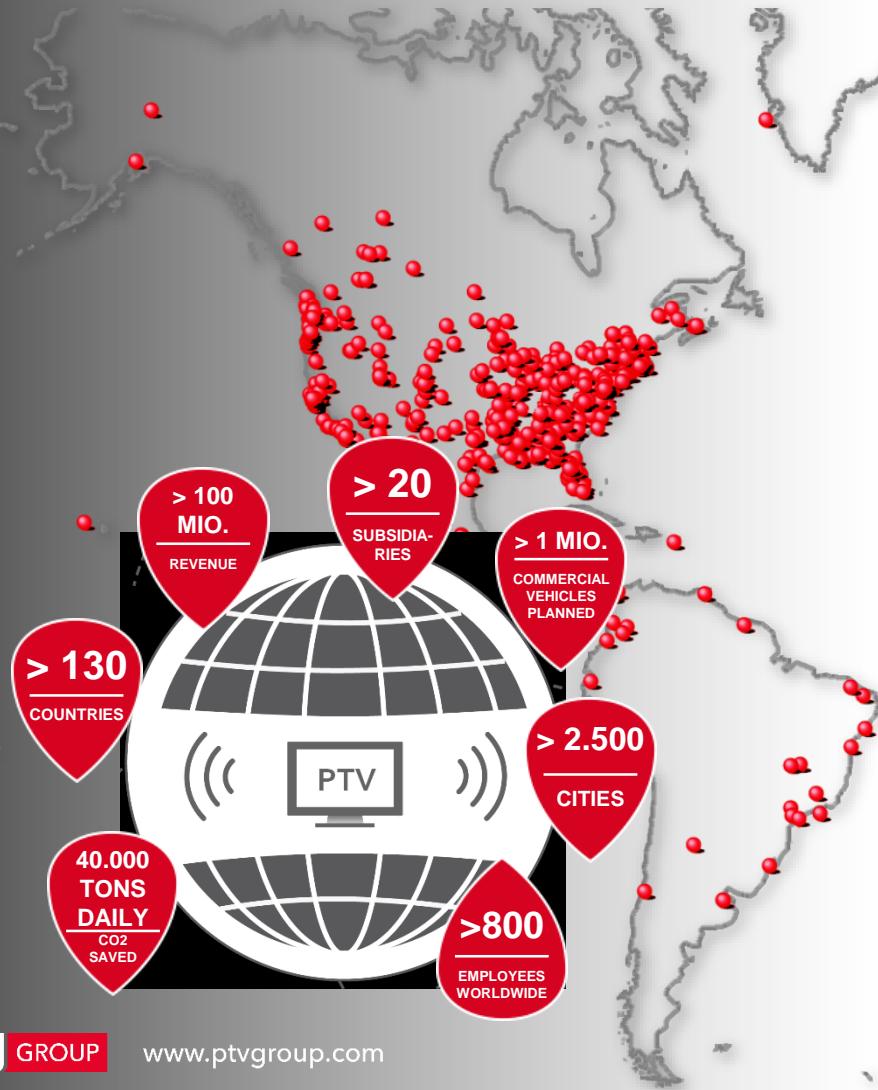


**WE PLAN
AND OPTIMISE
EVERYTHING
THAT MOVES PEOPLE
AND GOODS
WORLDWIDE.**

PTV GROUP

the mind of movement

PTV Group - Global Reach



- Headquartered in Germany
- Total of 800+ staff
- Parent company Porsche SE

PTV UK Ltd - Logistics



- ▶ Based in Birmingham
- ▶ Total of 35 staff

Plan and Optimise transport routes – anytime, anywhere. Even smaller vehicle fleets can save 7-15% of their costs with software-assisted planning. Our professional truck navigation solution gets drivers to their destination quickly and safely as the route is calculated specifically for their respective vehicle type.

What's more, you can use our notification service to actively stay informed of the estimated time of arrival (ETA) of your transport in real-time. You can also share this information with every link in the transport chain. We offer you the right solutions for efficient, advanced and environmentally-friendly transport logistics.

PTV UK Ltd - Traffic



- ▶ Offices in Birmingham & London
- ▶ Total of 10 staff
- ▶ All from transport consultancy background

Look after our Vision suite of software:

PTV Vissim
PTV Visum
PTV Viswalk
PTV Vistro
PTV Optima
PTV Balance and
PTV Vistad

Vision Software - Offline

PTV VISUM

Network modelling - large scale, national, regional and local transport network developments and demand modelling



PTV VISSIM

Detailed microscopic modelling of individual vehicles covering all modes of transport - multi-modal micro-simulation



PTV VISWALK

Advanced microscopic pedestrian simulation, both inside and outside buildings



PTV VISTRO

Traffic impact analysis and signal timing optimisation



Vision Software - Realtime

PTV OPTIMA

Real-time traffic simulation model, based on offline strategic model (PTV Visum), fused with real-time data



PTV BALANCE

Online traffic signal adaptive network control - model-based



PTV VISTAD

Qualitative collection and validation of accident data



Vision Software - Clients



JACOBS® ARUP



AECOM

WSP

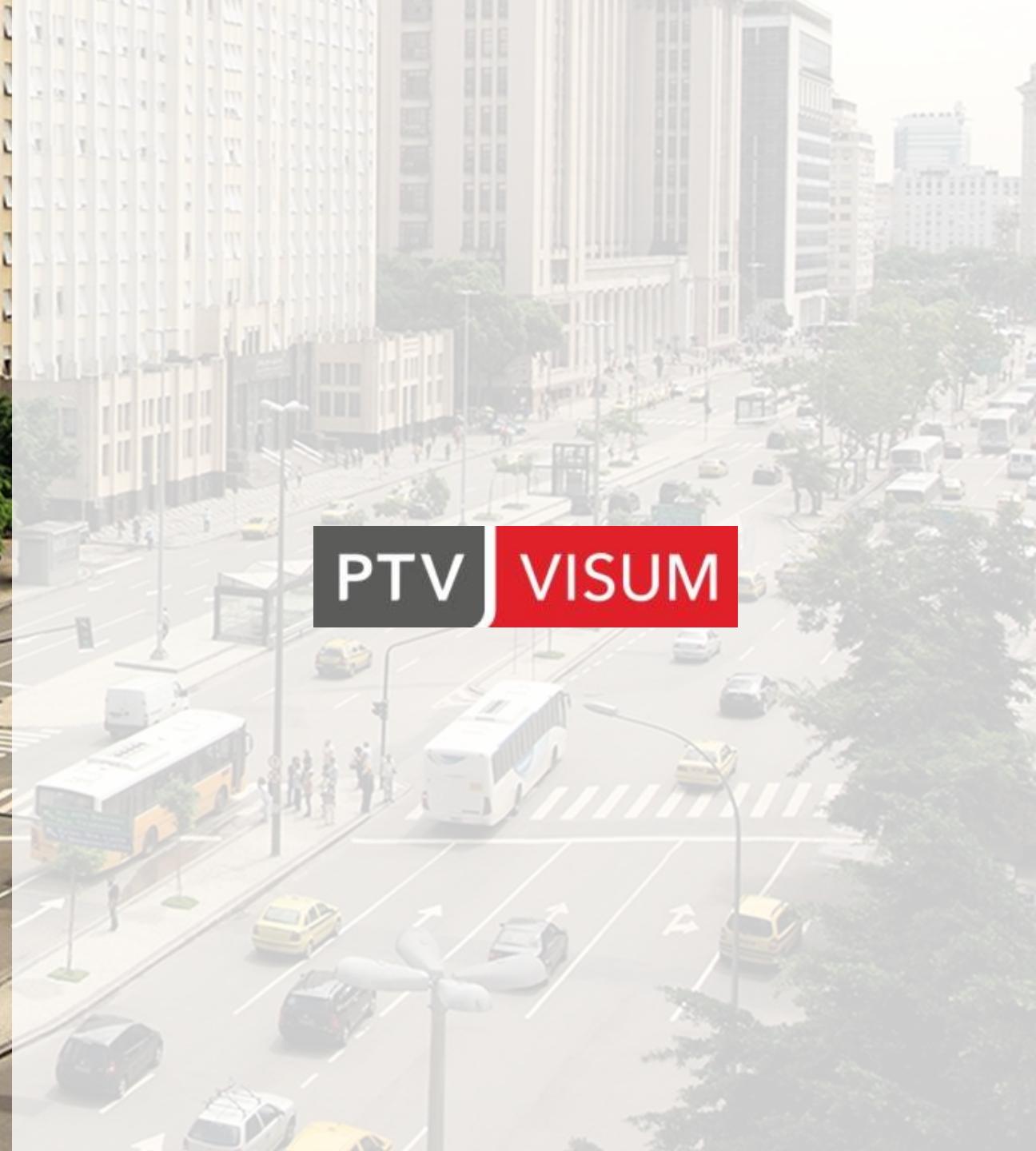
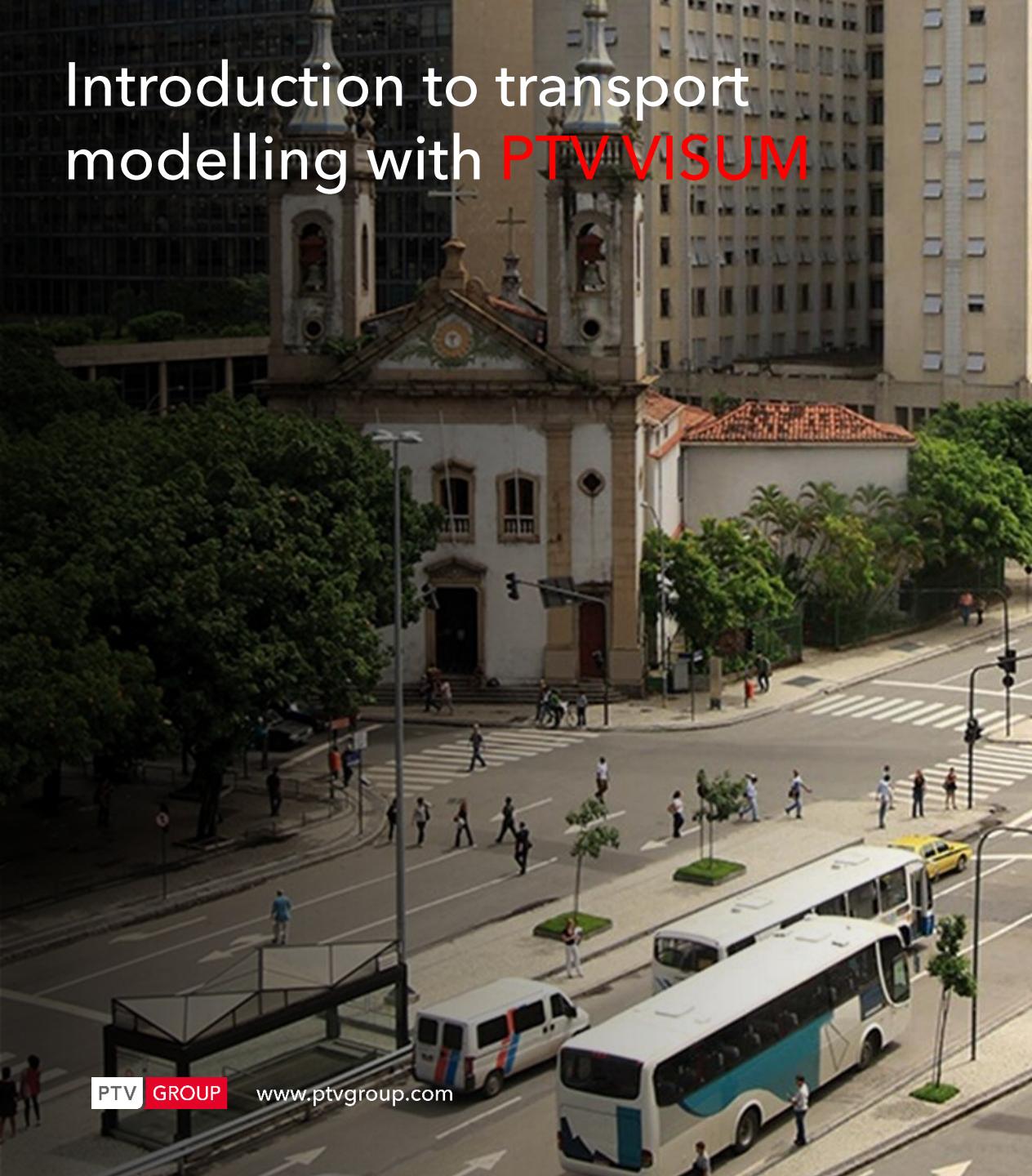


UNIVERSITY OF LEEDS
Institute for Transport Studies

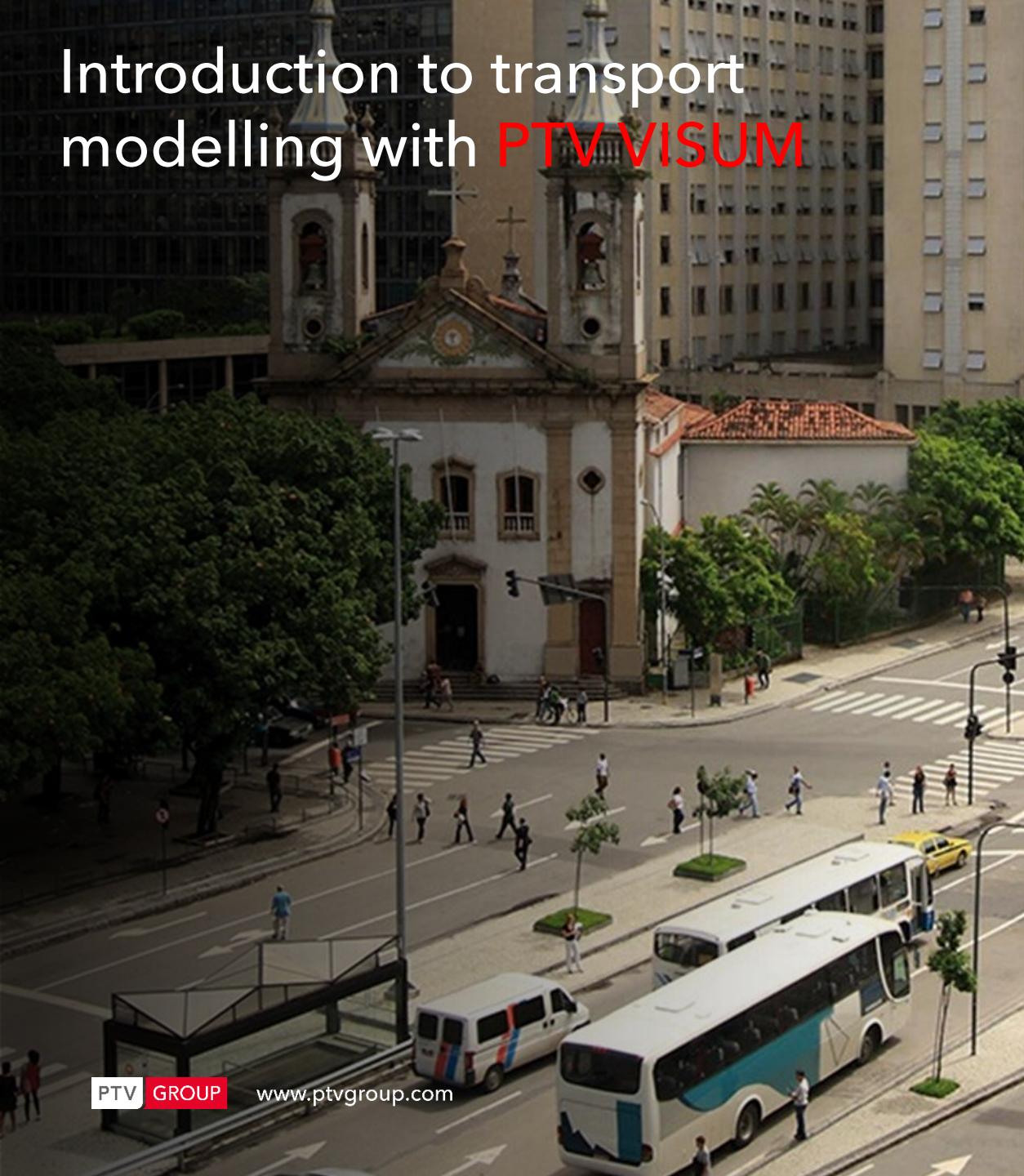
**Imperial College
London**

- ▶ Public Authorities (TfL, DfT, HE, West Midlands etc)
- ▶ Automotive Manufacturers, OEM's
- ▶ Engineering Consultants (Aecom, Atkins, Arup, Jacobs, etc)
- ▶ Universities and students (Imperial, UCL, Newcastle)
- ▶ Research Institutions and NGOs (Catapult)
- ▶ Developers and Architects
- ▶ Government Authorities (TfL, DfT, GA, Transport Scotland and Boroughs)
- ▶ Public transport operators
- ▶ Road and motorway operators
- ▶ Airport operators
- ▶ Research organisations

Introduction to transport modelling with PTV VISUM



Introduction to transport modelling with PTV VISUM

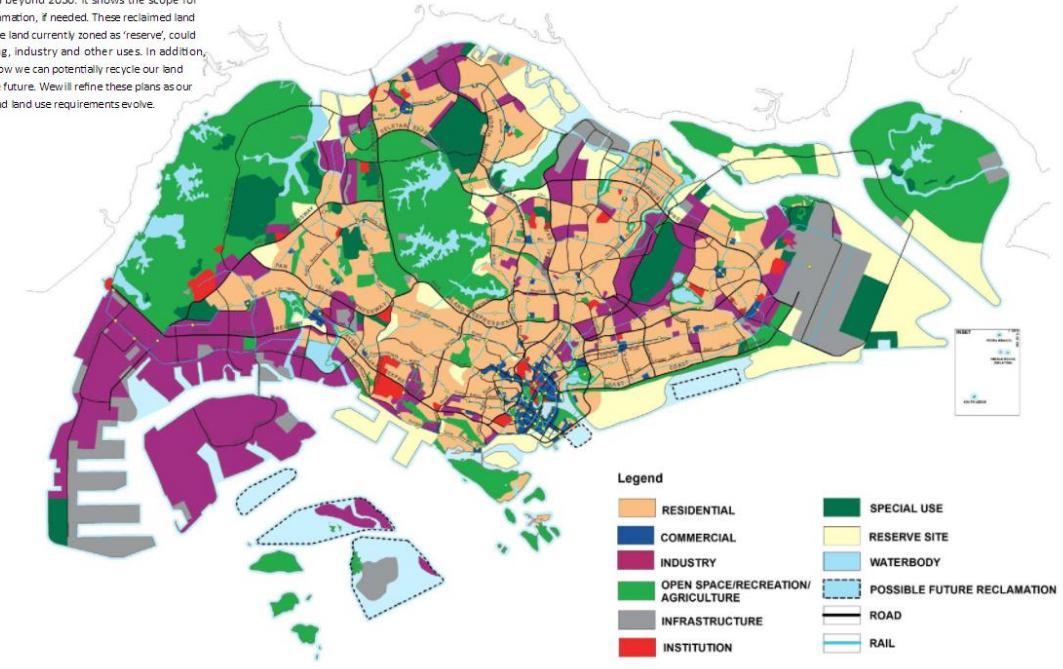


PTV VISUM

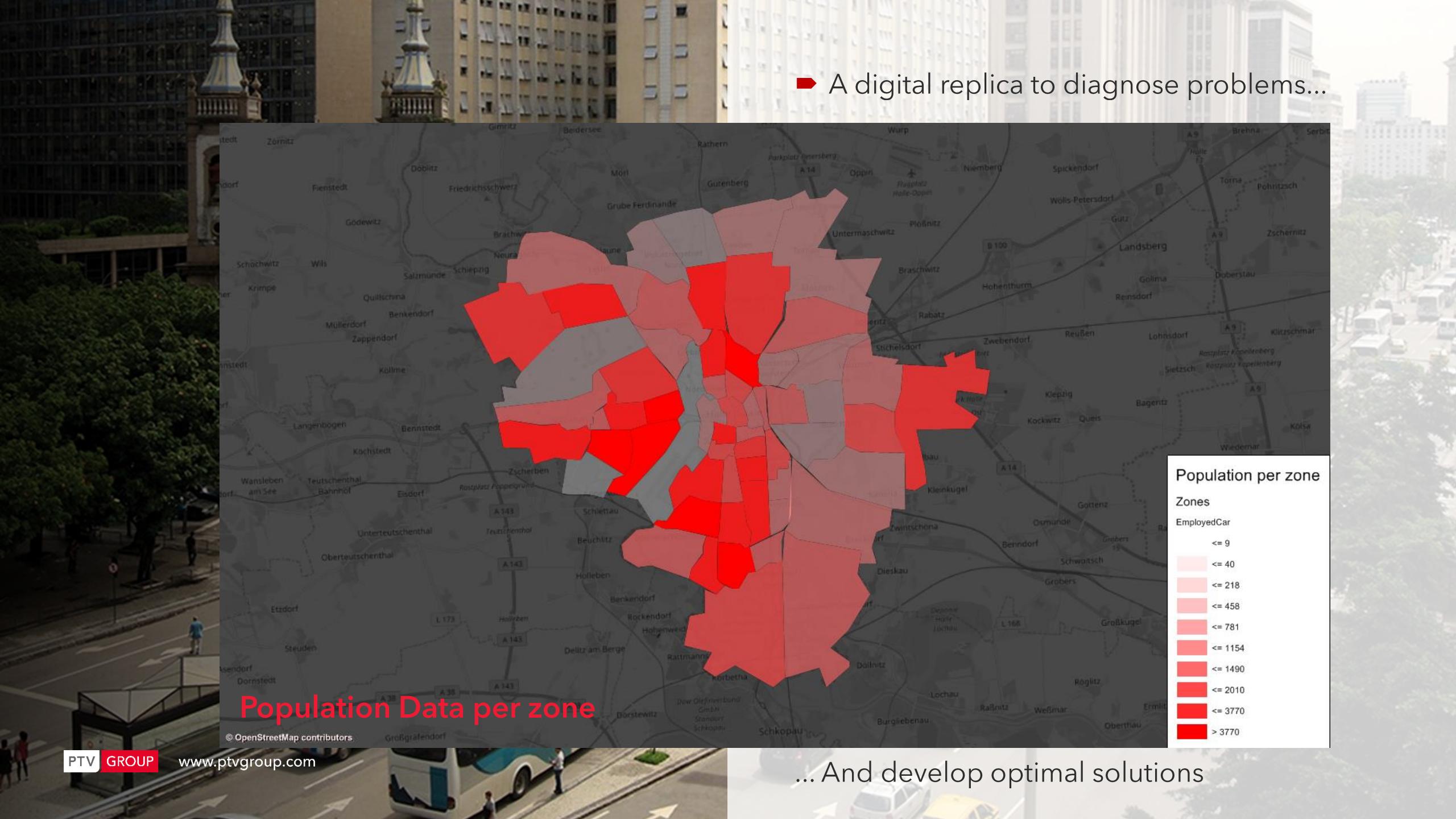
- ▶ Some problems are too complex for a spreadsheet...

Land Use Beyond 2030

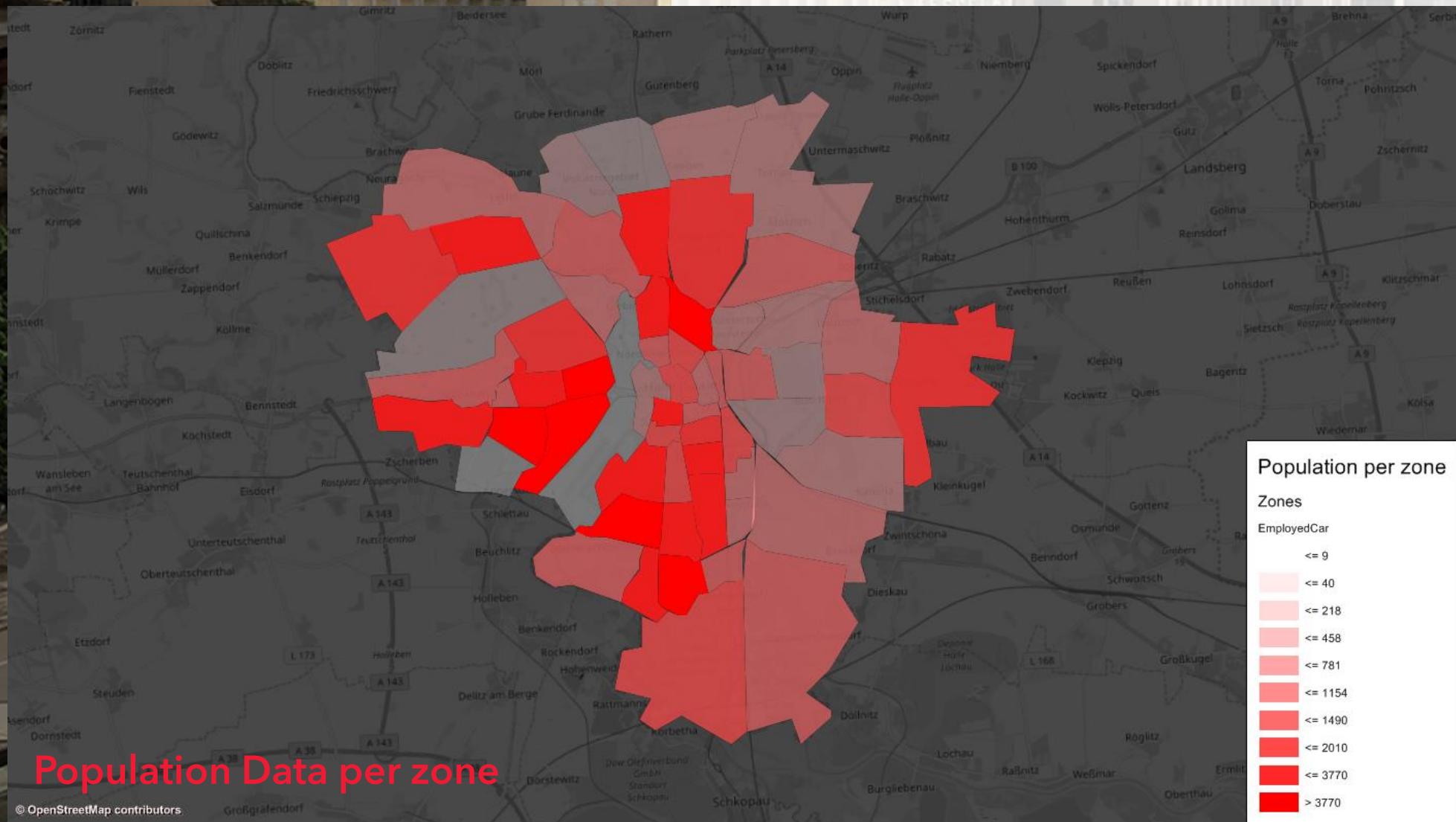
This map illustrates the likely profile of Singapore and possible land use allocation beyond 2030. It shows the scope for additional land reclamation, if needed. These reclaimed land parcels, including the land currently zoned as 'reserve', could be used for housing, industry and other uses. In addition, the map indicates how we can potentially recycle our land for other uses in the future. We will refine these plans as our population needs and land use requirements evolve.



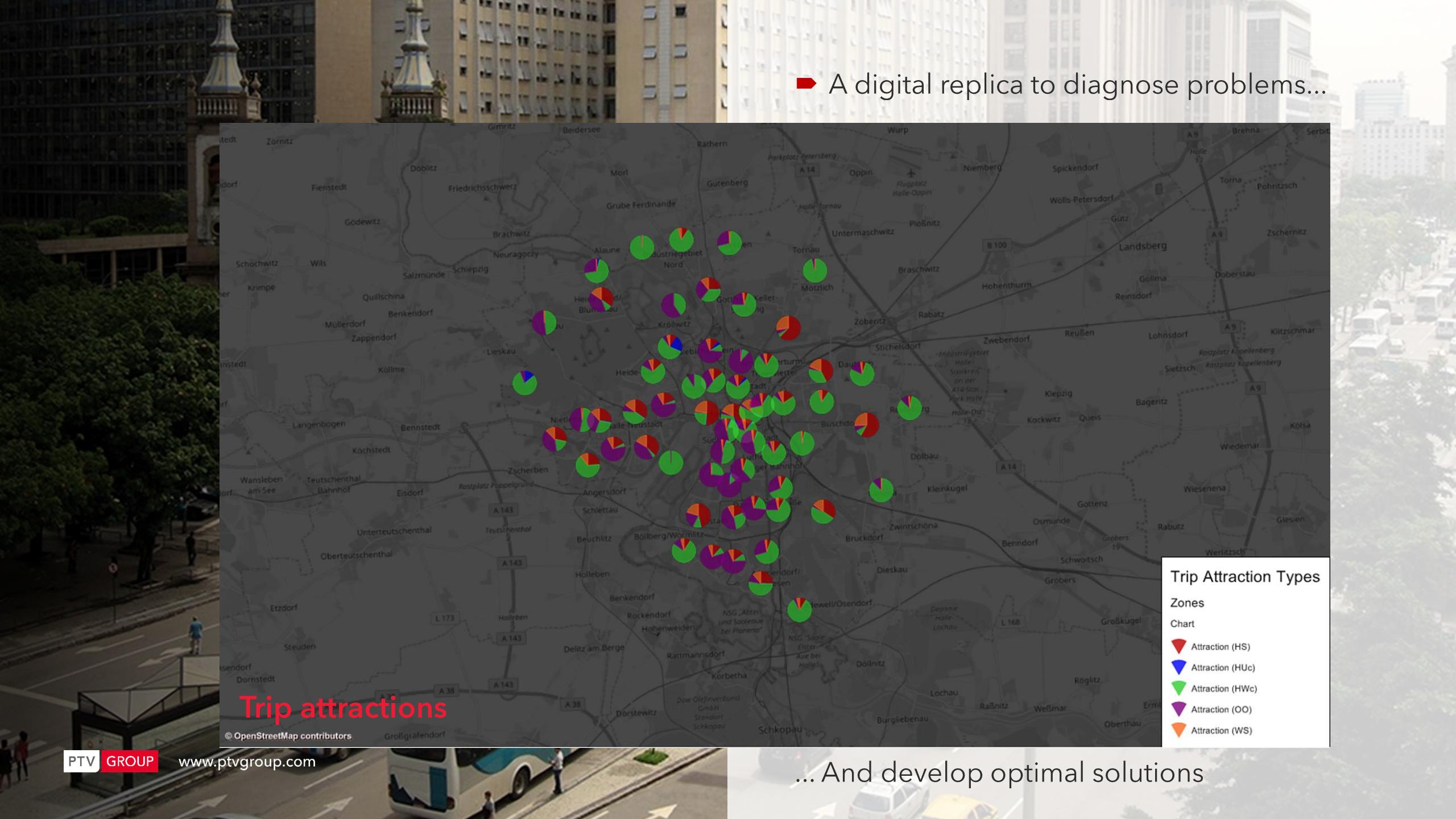
... And too important to leave for chance



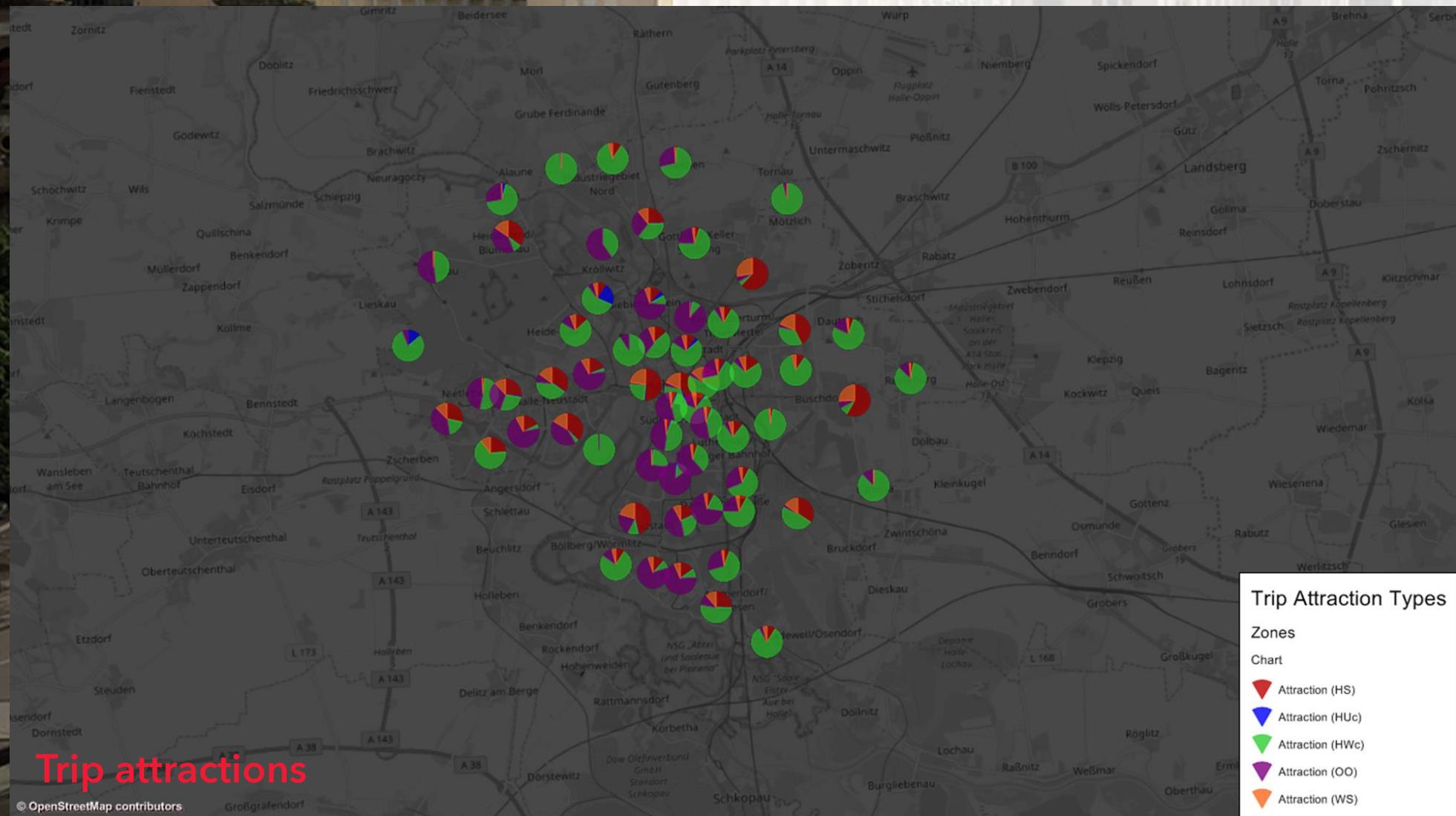
► A digital replica to diagnose problems...



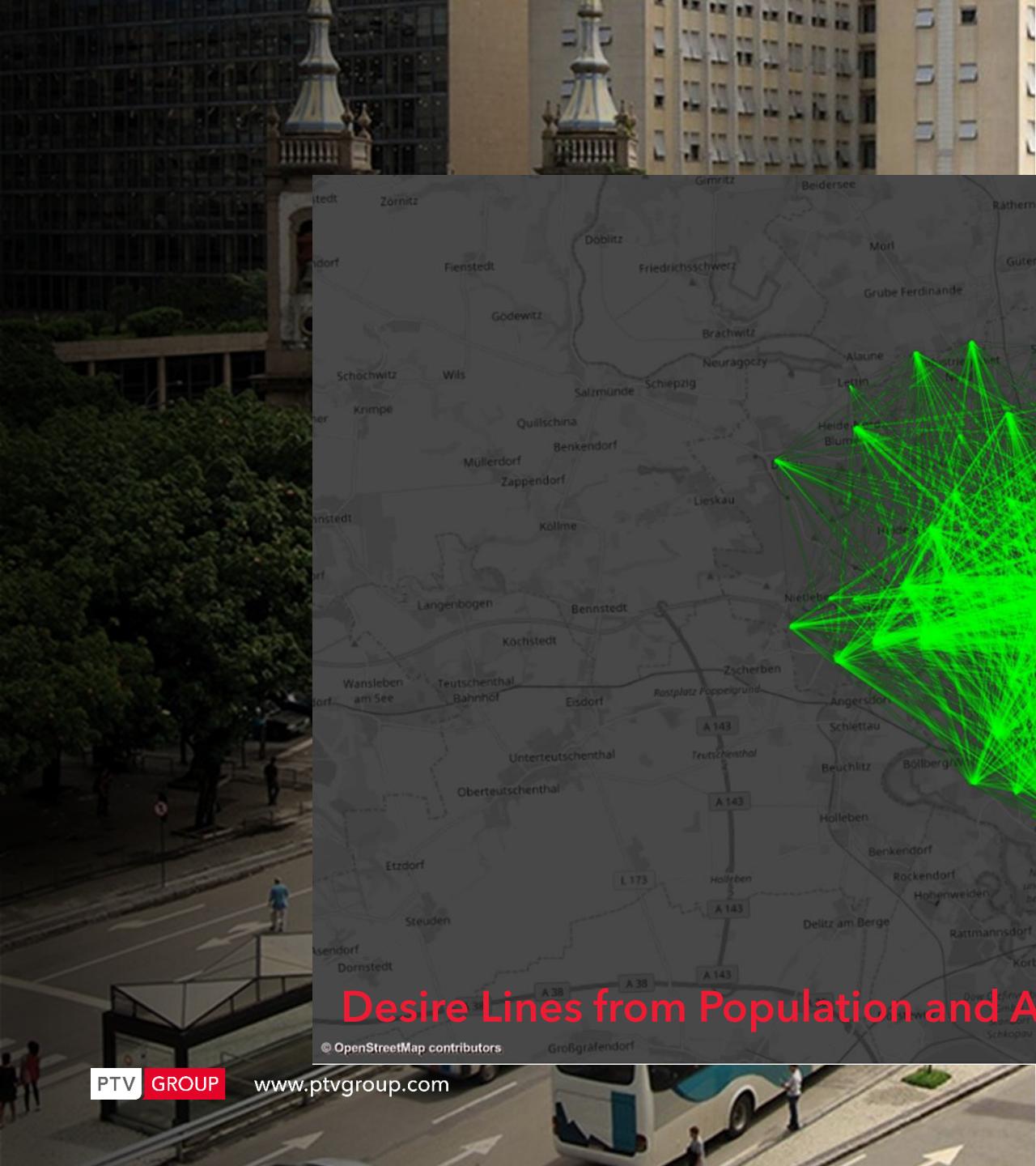
... And develop optimal solutions



► A digital replica to diagnose problems...



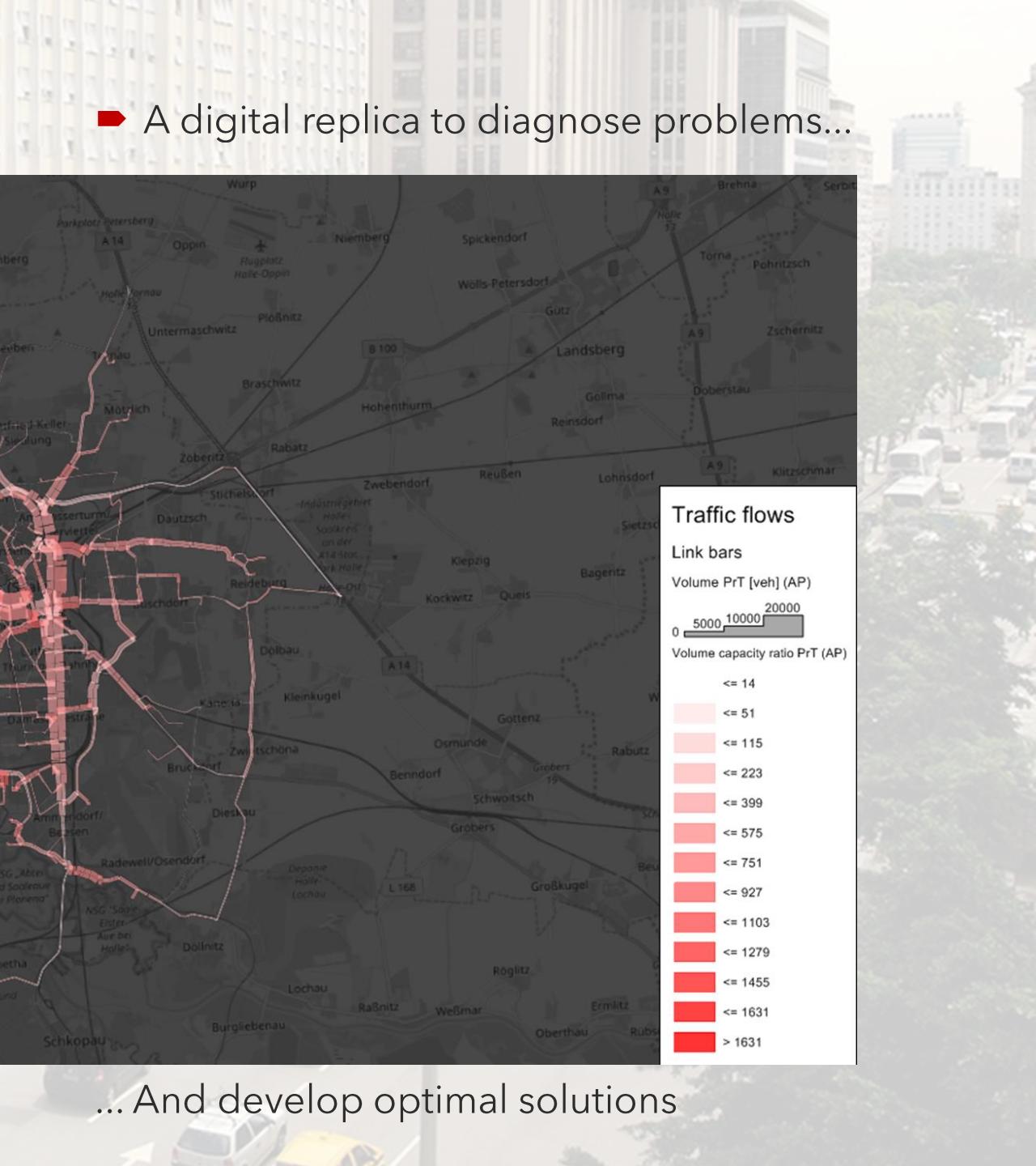
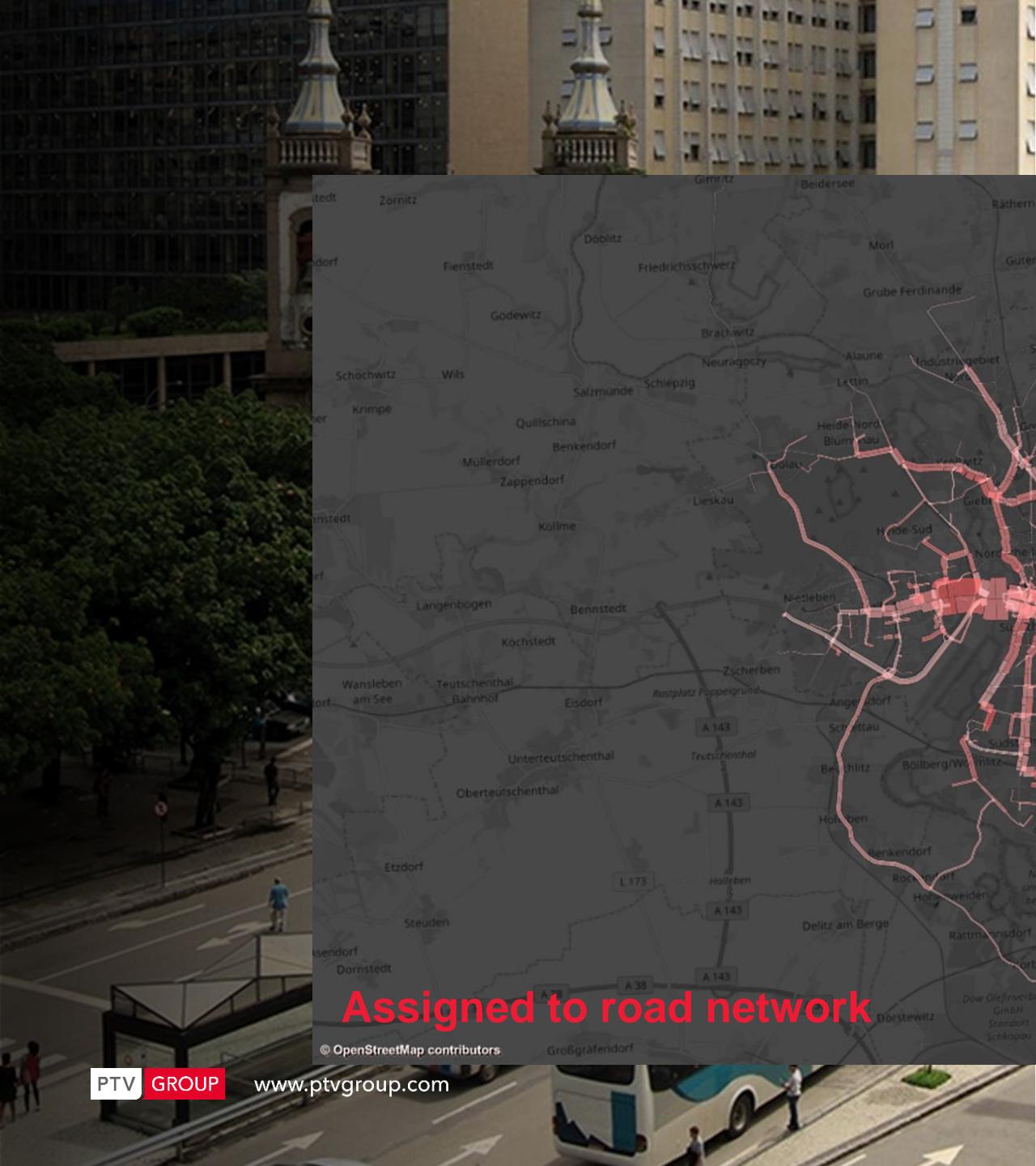
... And develop optimal solutions



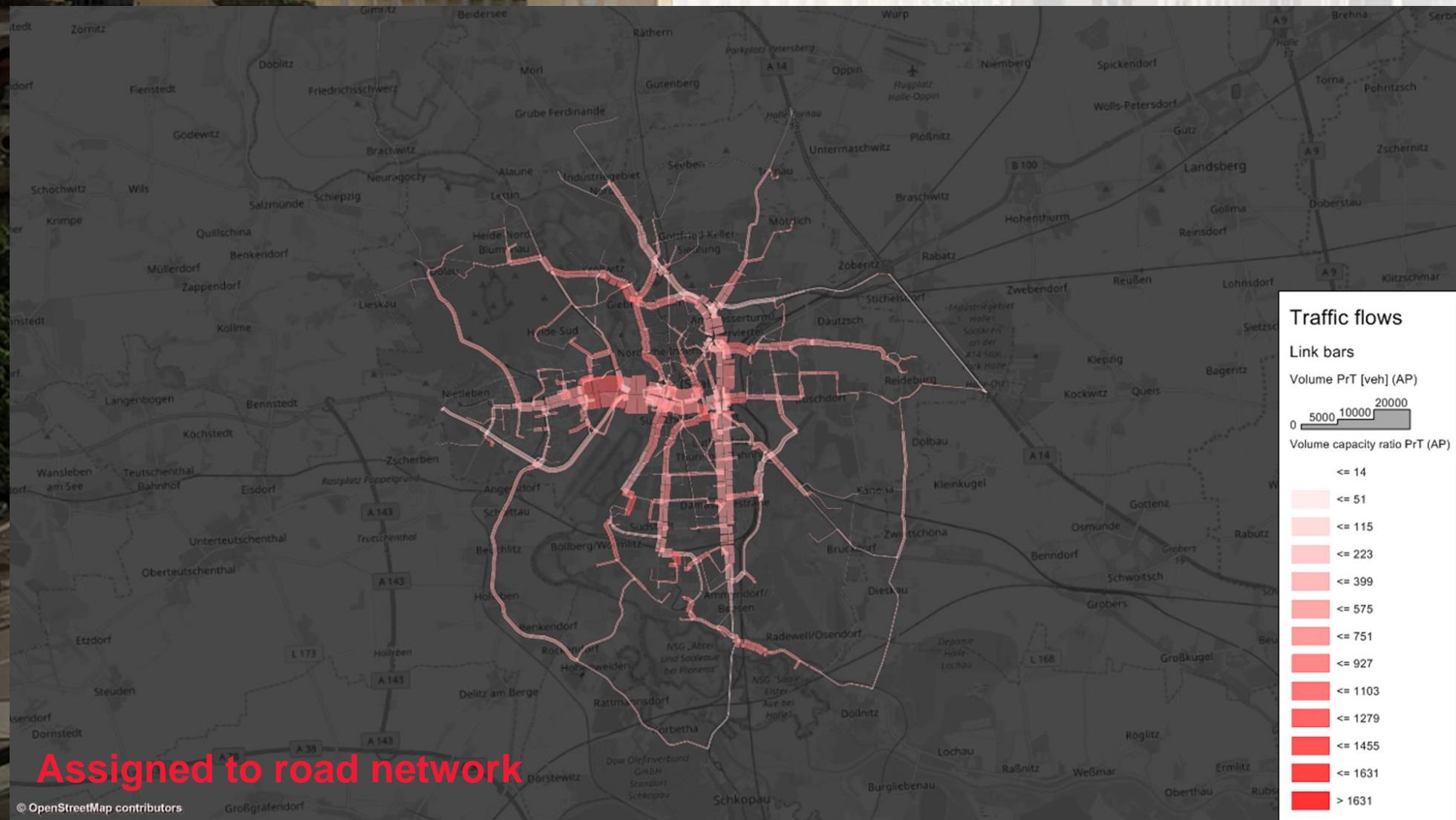
► A digital replica to diagnose problems...



... And develop optimal solutions

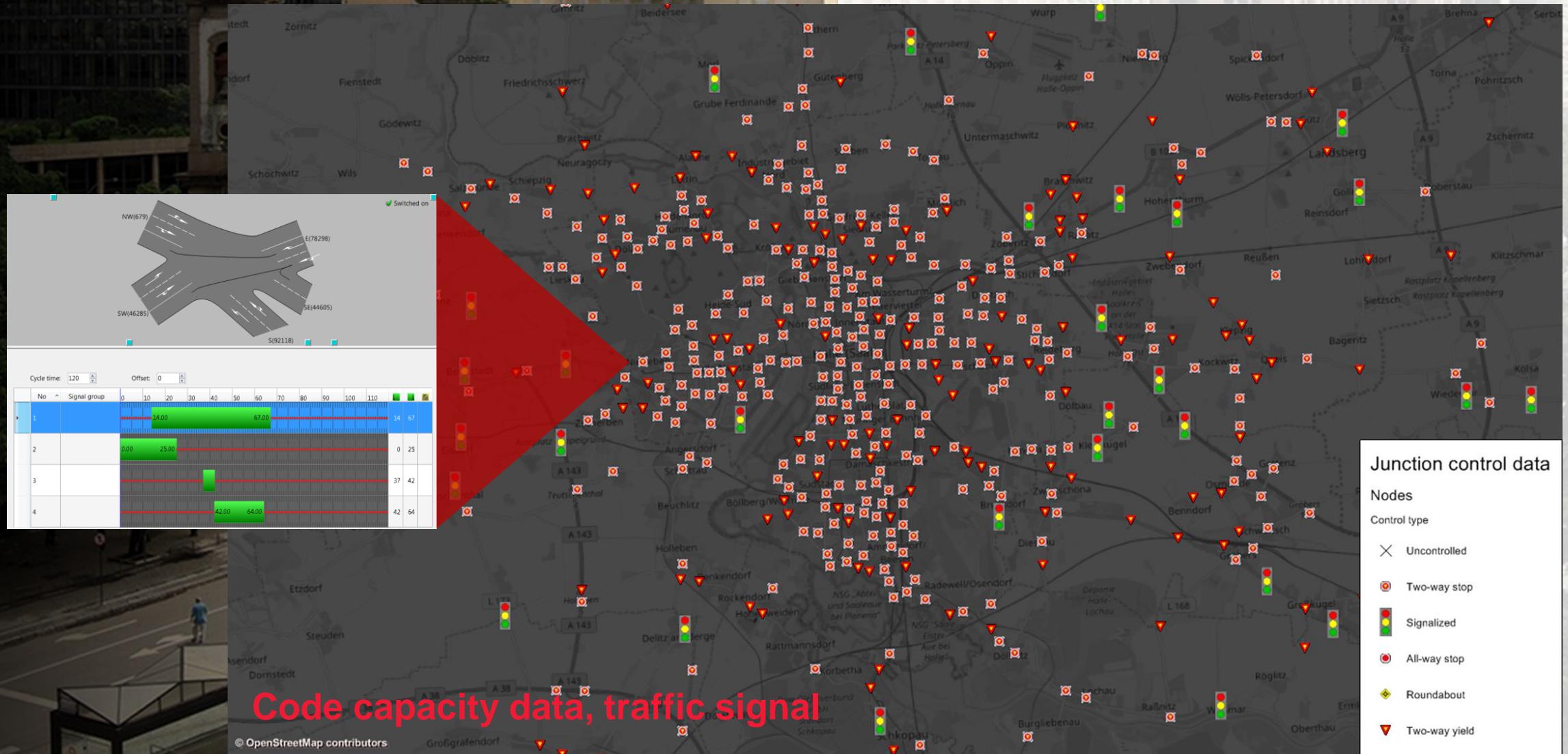


► A digital replica to diagnose problems...



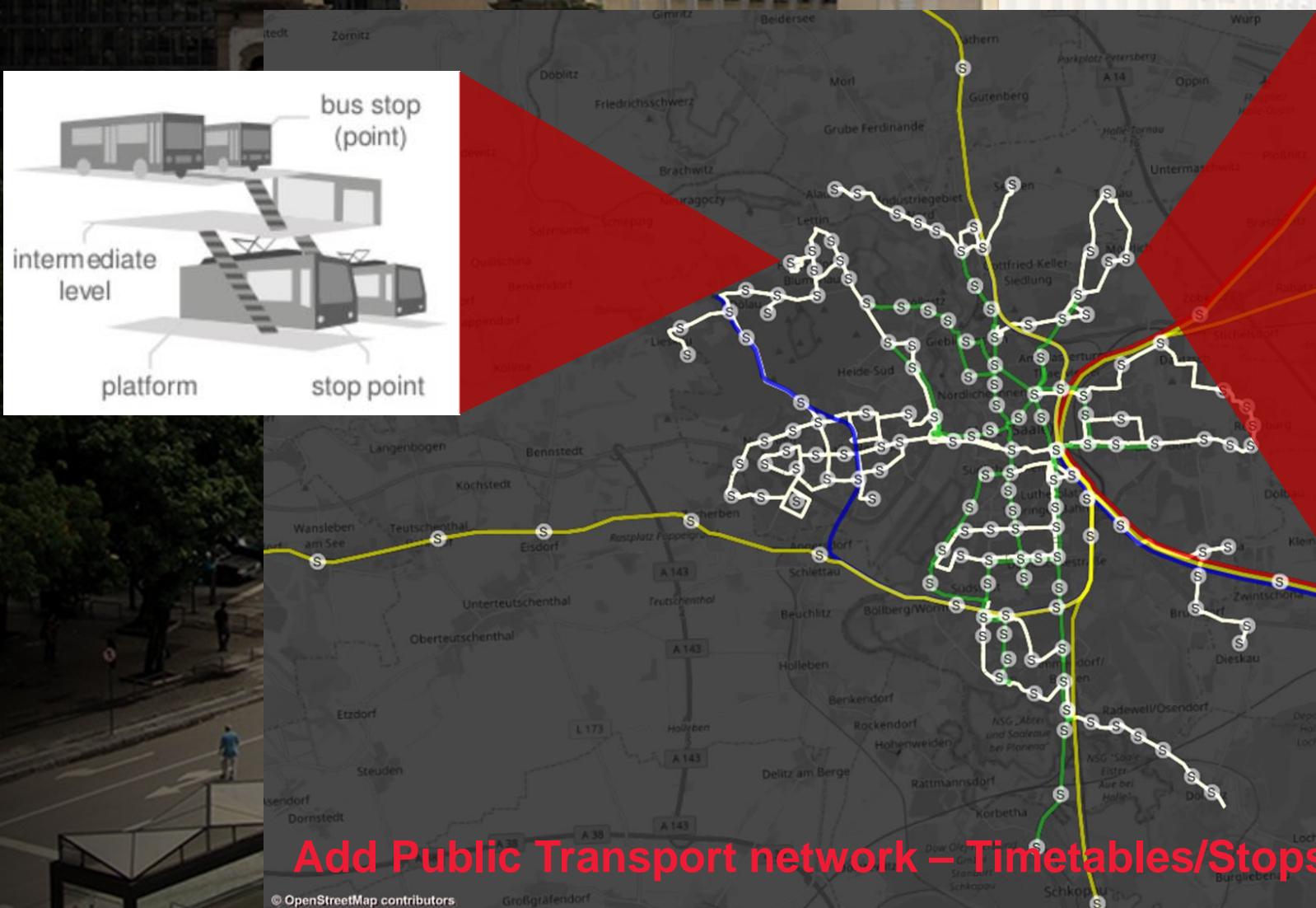
... And develop optimal solutions

► A digital replica to diagnose problems...



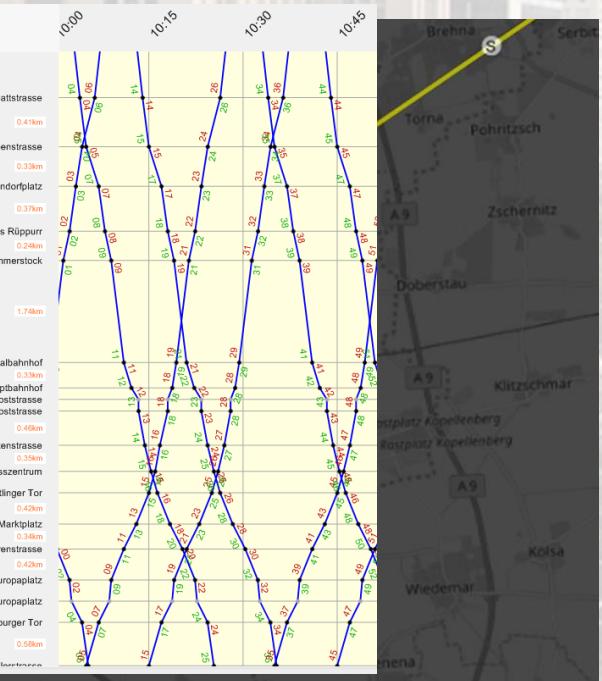
Code capacity data, traffic signal

► A digital replica to diagnose problems...



Add Public Transport network – Timetables/Stops

© OpenStreetMap contributors



Public transport systems

Route courses

Transport systems

Bus

InterCity Rail

Light Rail Transit

Regional Rail

Tram

Stops

S

... And develop optimal solutions

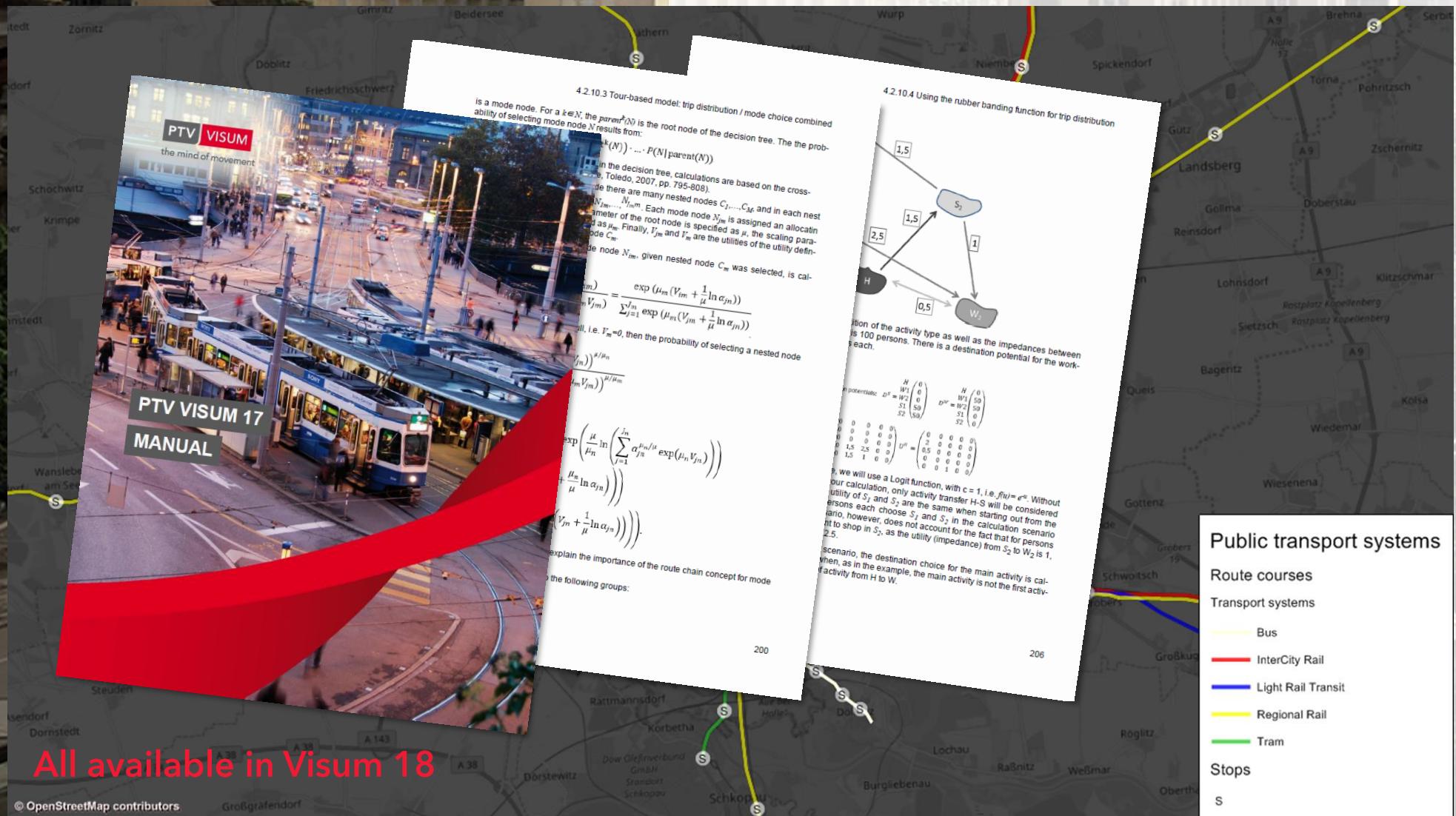


► A digital replica to diagnose problems...



... And develop optimal solutions

► A digital replica to diagnose problems...



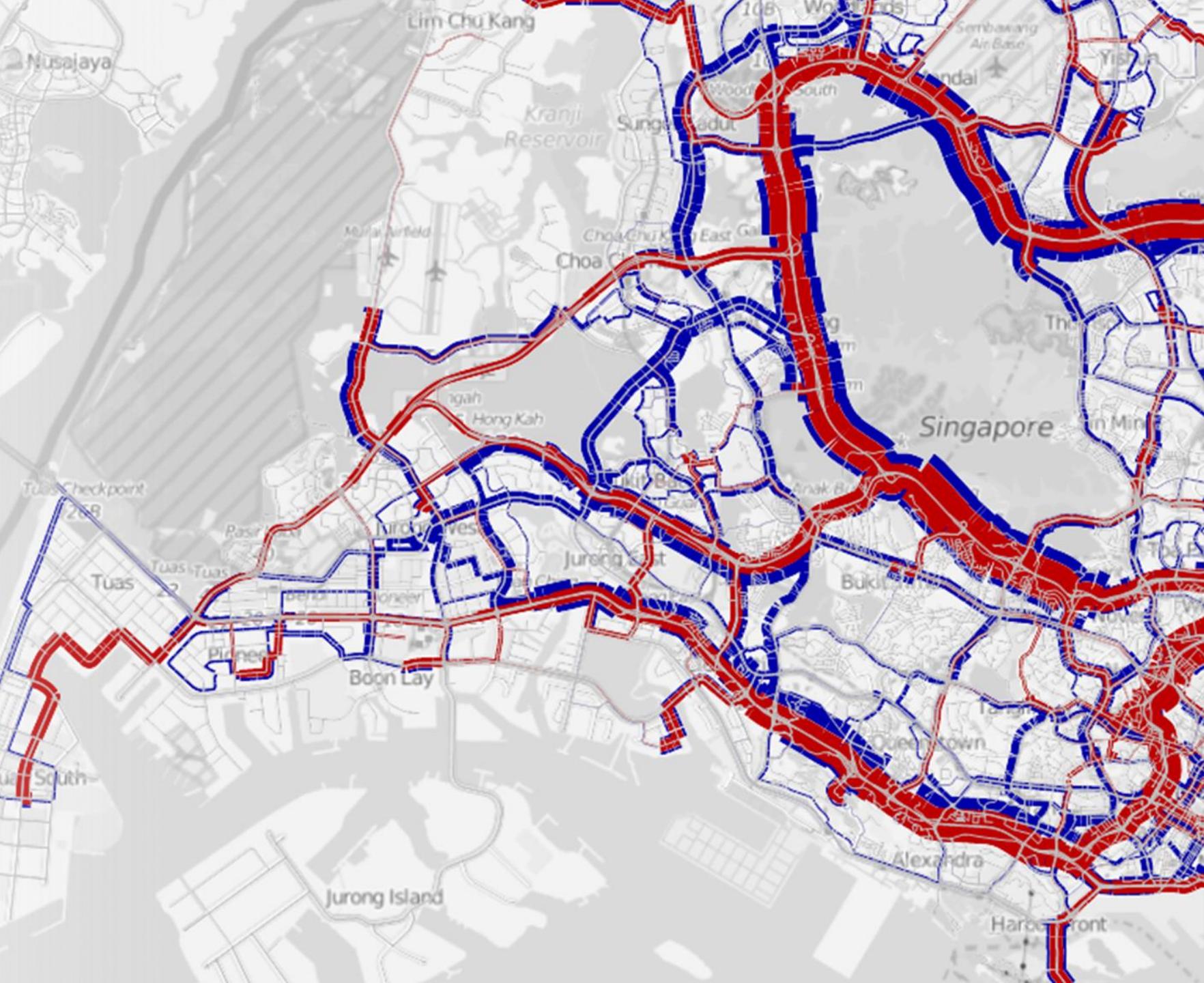
PTV Visum is a hub for city data, analytics and decision support



PTV Visum is a hub for city data, analytics and decision support



Transport model of Singapore in 60 minutes



Data Source - Openstreetmap (geofabrik)

download.geofabrik.de

Download OpenStreetMap data for this region:

Asia

[\[one level up\]](#)

Commonly Used Formats

- [asia-latest.osm.pbf](#), suitable for Osmium, Osmosis, imposm, osm2pgsql, mkgmap, and others. This file was last modified 1 day ago and contains all OSM data up to 2015-11-20T22:22:02Z. File size: 3.8 GB; MD5 sum: 2294ah1ae89cfcb751b9e538703cbe2.
- [asia-latest.shp.zip](#) is not available for this region; try one of the sub-regions.

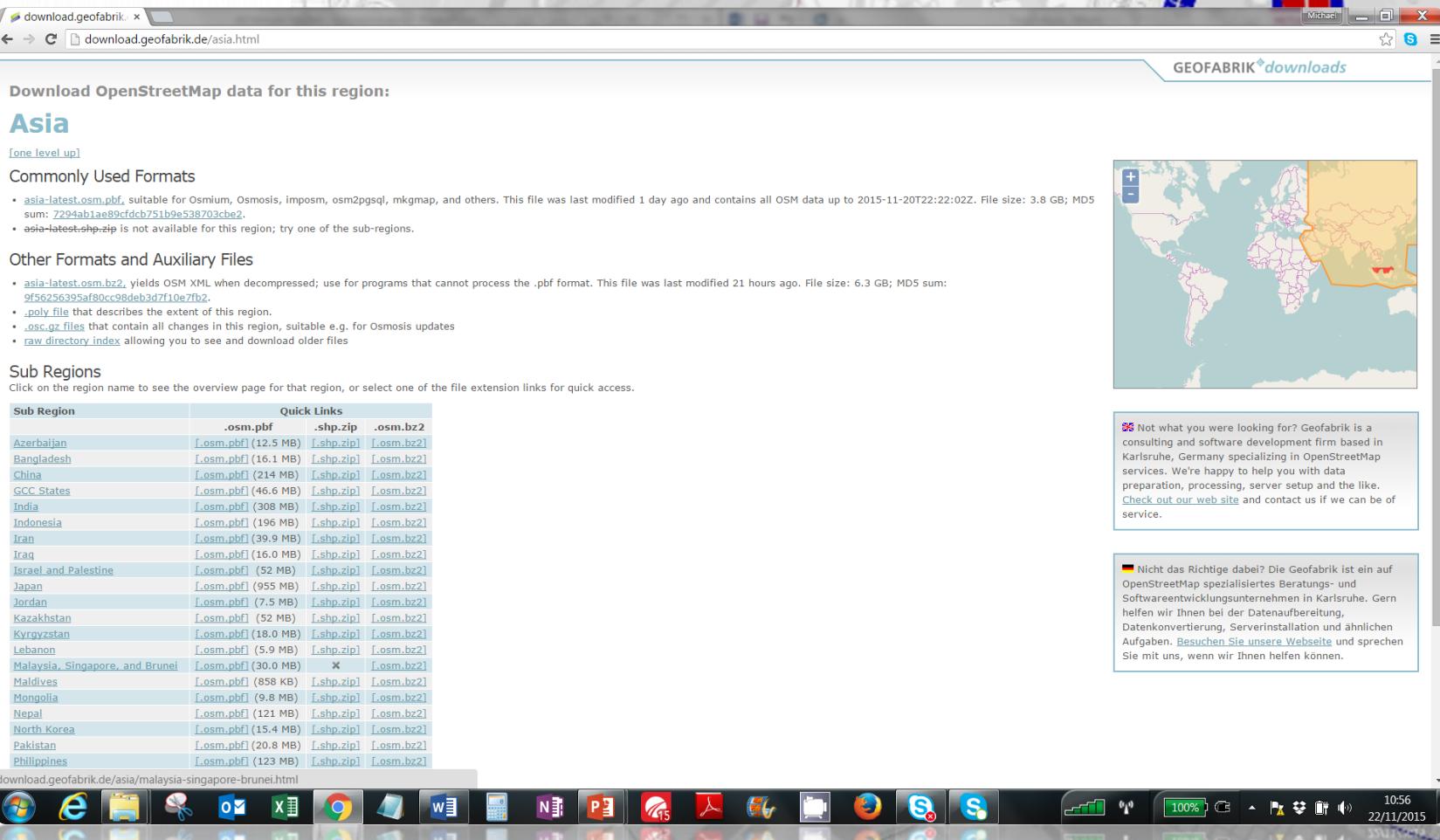
Other Formats and Auxiliary Files

- [asia-latest.osm.bz2](#), yields OSM XML when decompressed; use for programs that cannot process the .pbf format. This file was last modified 21 hours ago. File size: 6.3 GB; MD5 sum: 9f56256395af80cc984eb3d7f10e7fb2.
- [.poly file](#) that describes the extent of this region.
- [.osc.gz files](#) that contain all changes in this region, suitable e.g. for Osmosis updates
- [raw directory index](#) allowing you to see and download older files

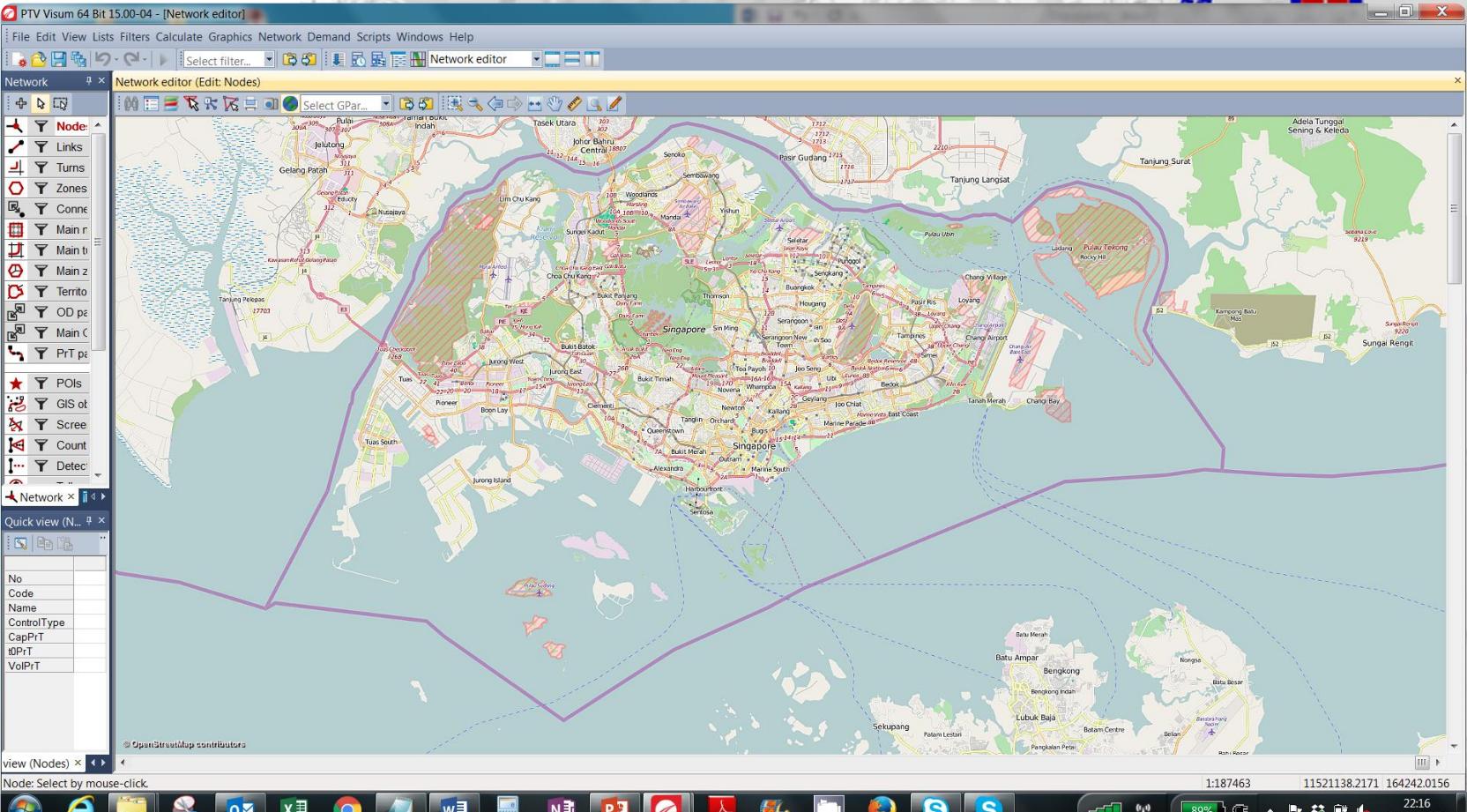
Sub Regions
Click on the region name to see the overview page for that region, or select one of the file extension links for quick access.

Sub Region	Quick Links
	.osm.pbf .shp.zip .osm.bz2
Azerbaijan	.osm.pbf (12.5 MB) .shp.zip .osm.bz2
Bangladesh	.osm.pbf (16.1 MB) .shp.zip .osm.bz2
China	.osm.pbf (214 MB) .shp.zip .osm.bz2
GCC States	.osm.pbf (46.6 MB) .shp.zip .osm.bz2
India	.osm.pbf (308 MB) .shp.zip .osm.bz2
Indonesia	.osm.pbf (196 MB) .shp.zip .osm.bz2
Iran	.osm.pbf (39.9 MB) .shp.zip .osm.bz2
Iraq	.osm.pbf (16.0 MB) .shp.zip .osm.bz2
Israel and Palestine	.osm.pbf (52 MB) .shp.zip .osm.bz2
Japan	.osm.pbf (955 MB) .shp.zip .osm.bz2
Jordan	.osm.pbf (7.5 MB) .shp.zip .osm.bz2
Kazakhstan	.osm.pbf (52 MB) .shp.zip .osm.bz2
Kyrgyzstan	.osm.pbf (18.0 MB) .shp.zip .osm.bz2
Lebanon	.osm.pbf (5.9 MB) .shp.zip .osm.bz2
Malaysia, Singapore, and Brunei	.osm.pbf (30.0 MB) .shp.zip .osm.bz2
Maldives	.osm.pbf (858 KB) .shp.zip .osm.bz2
Mongolia	.osm.pbf (9.8 MB) .shp.zip .osm.bz2
Nepal	.osm.pbf (121 MB) .shp.zip .osm.bz2
North Korea	.osm.pbf (15.4 MB) .shp.zip .osm.bz2
Pakistan	.osm.pbf (20.8 MB) .shp.zip .osm.bz2
Philippines	.osm.pbf (123 MB) .shp.zip .osm.bz2

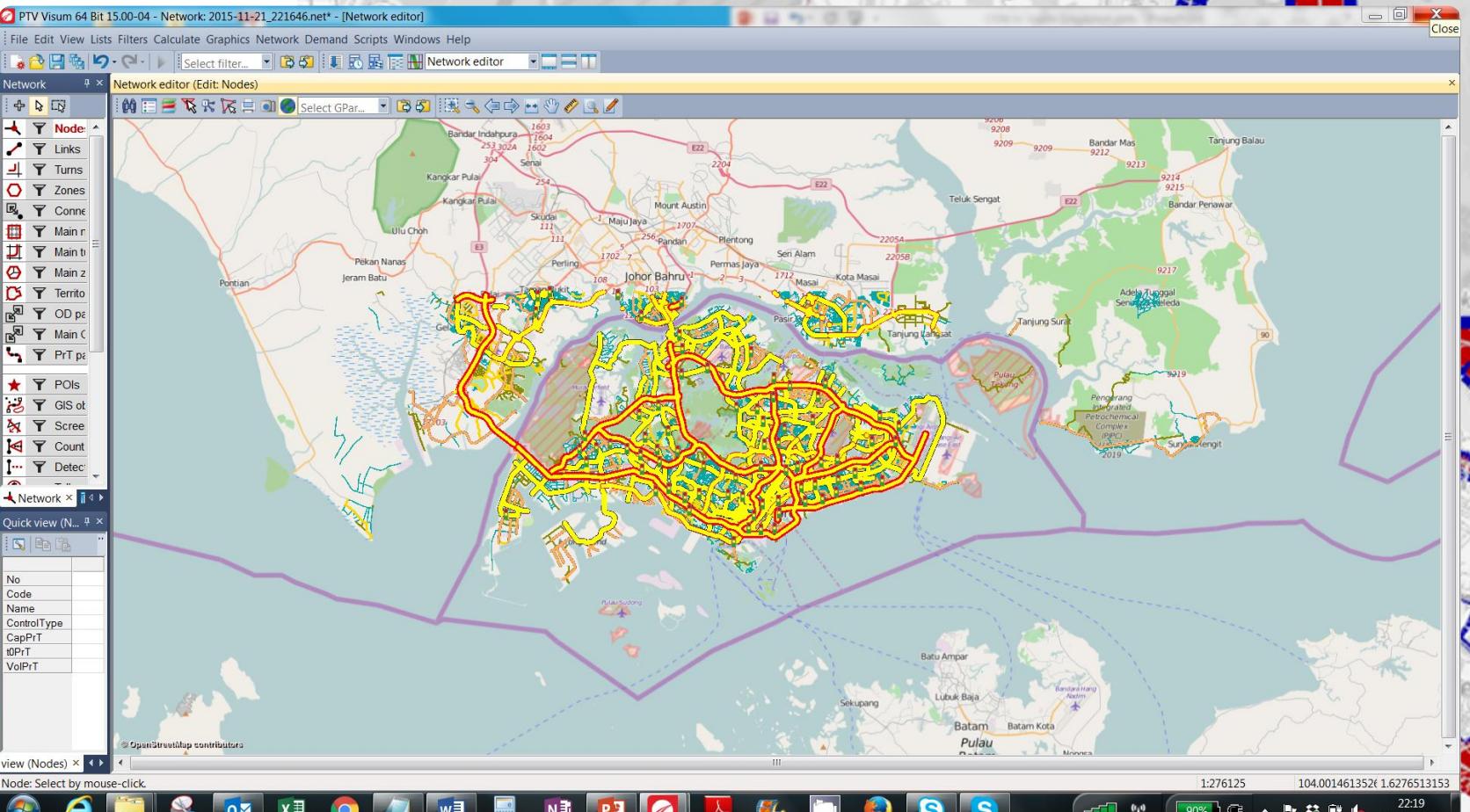
download.geofabrik.de/asia/malaysia-singapore-brunei.html



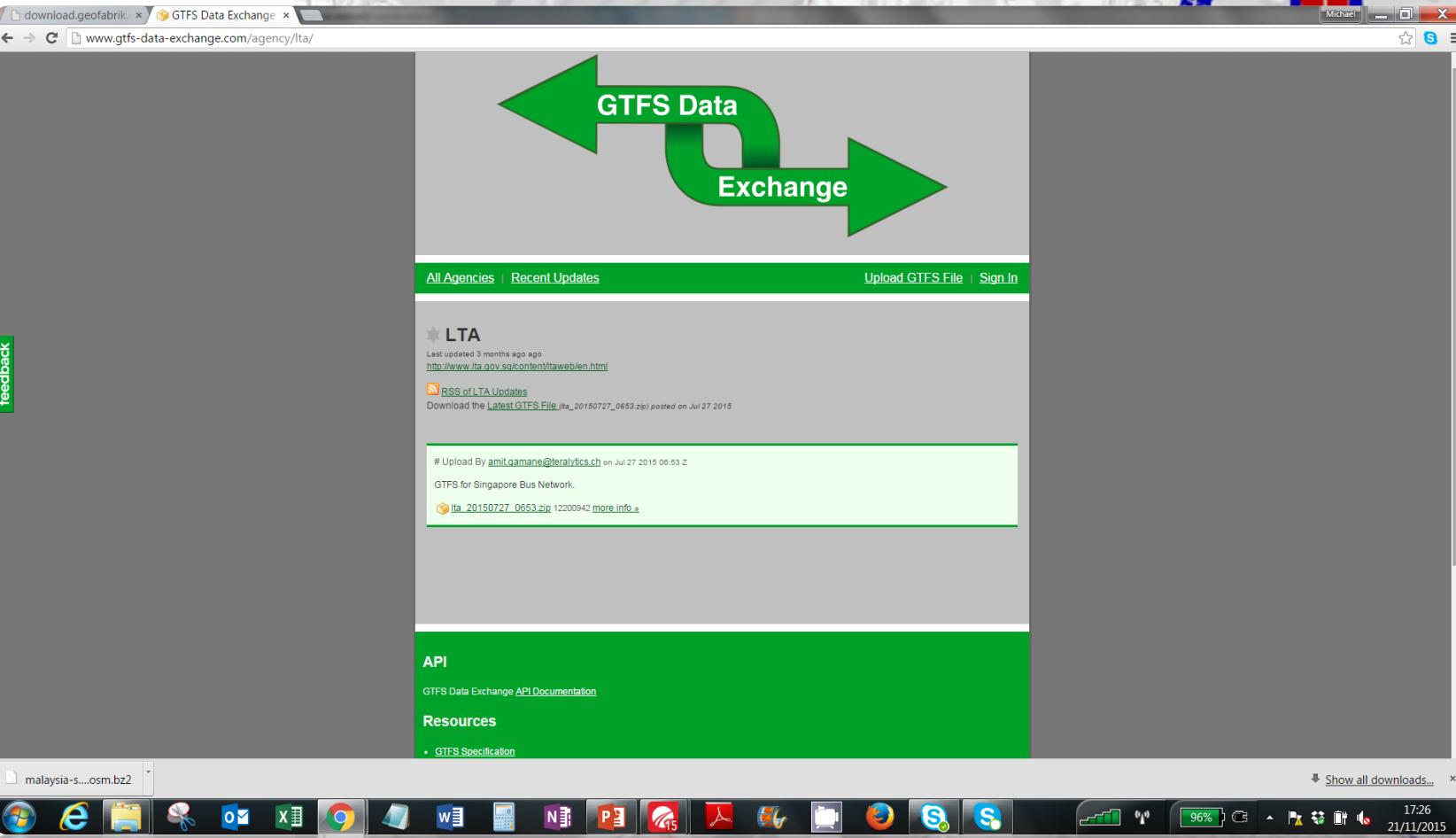
Data Source: - PTV Visum background map



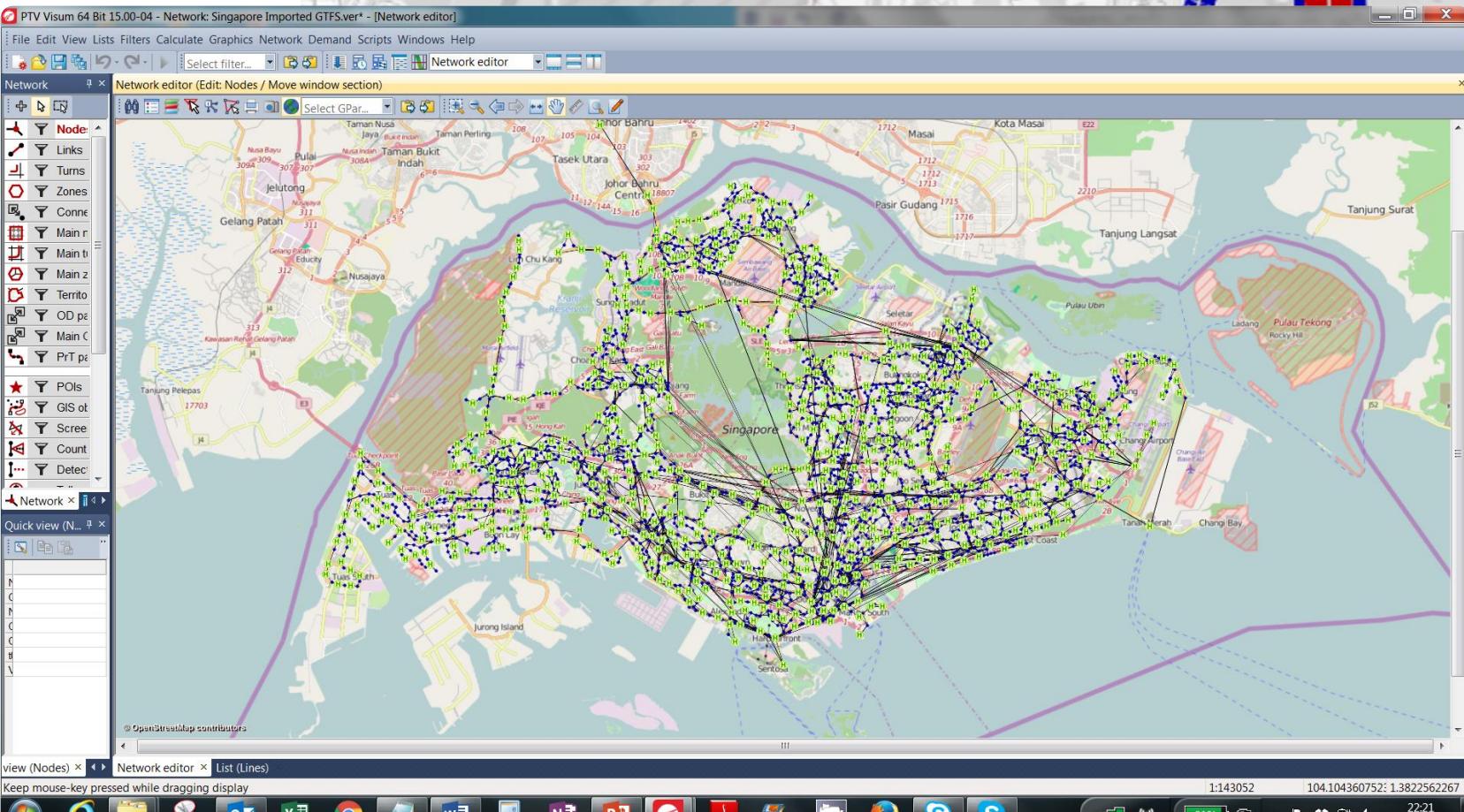
Process: - import Openstreetmap area



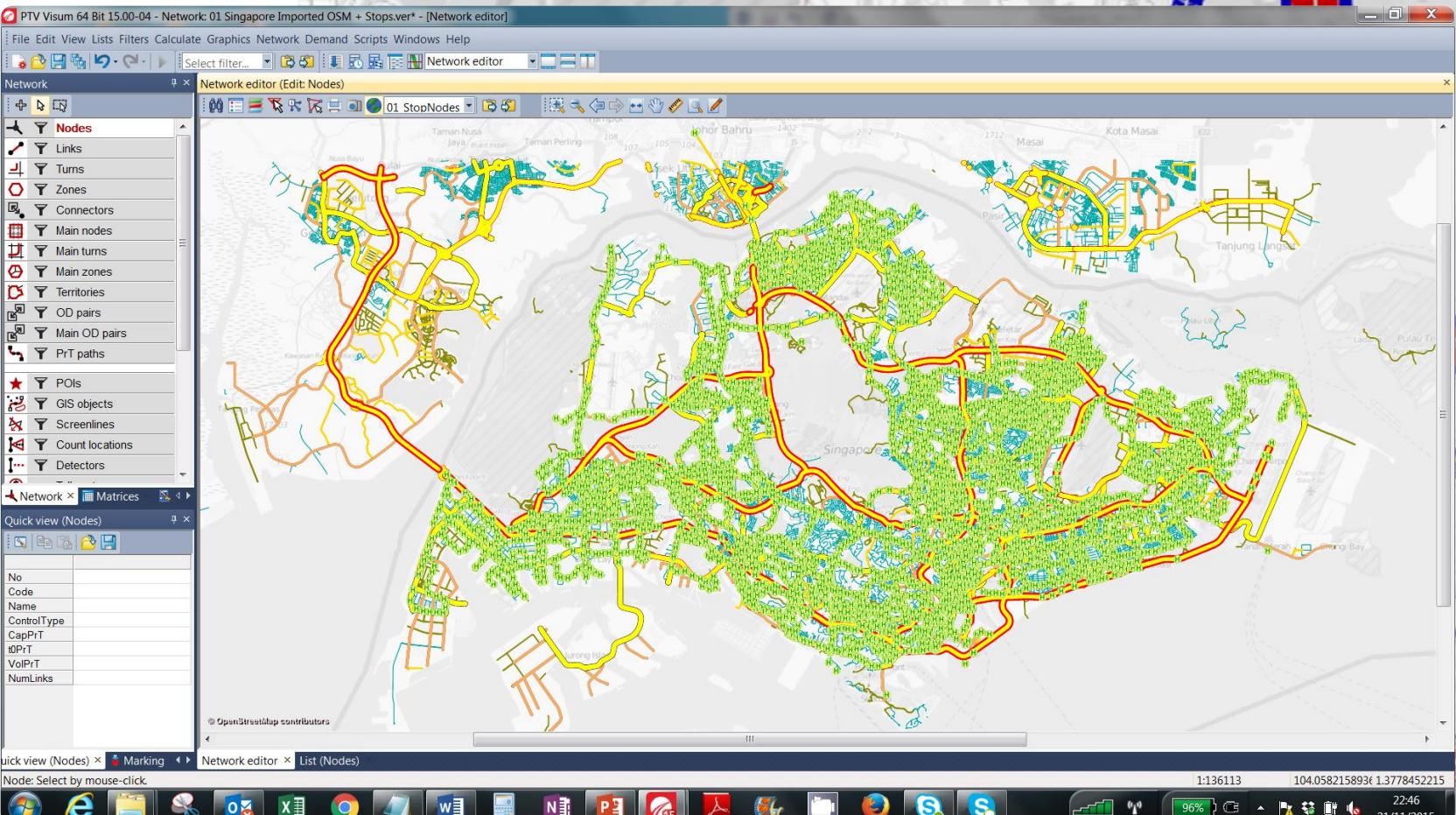
Data Source: - GTFS (Data exchange)



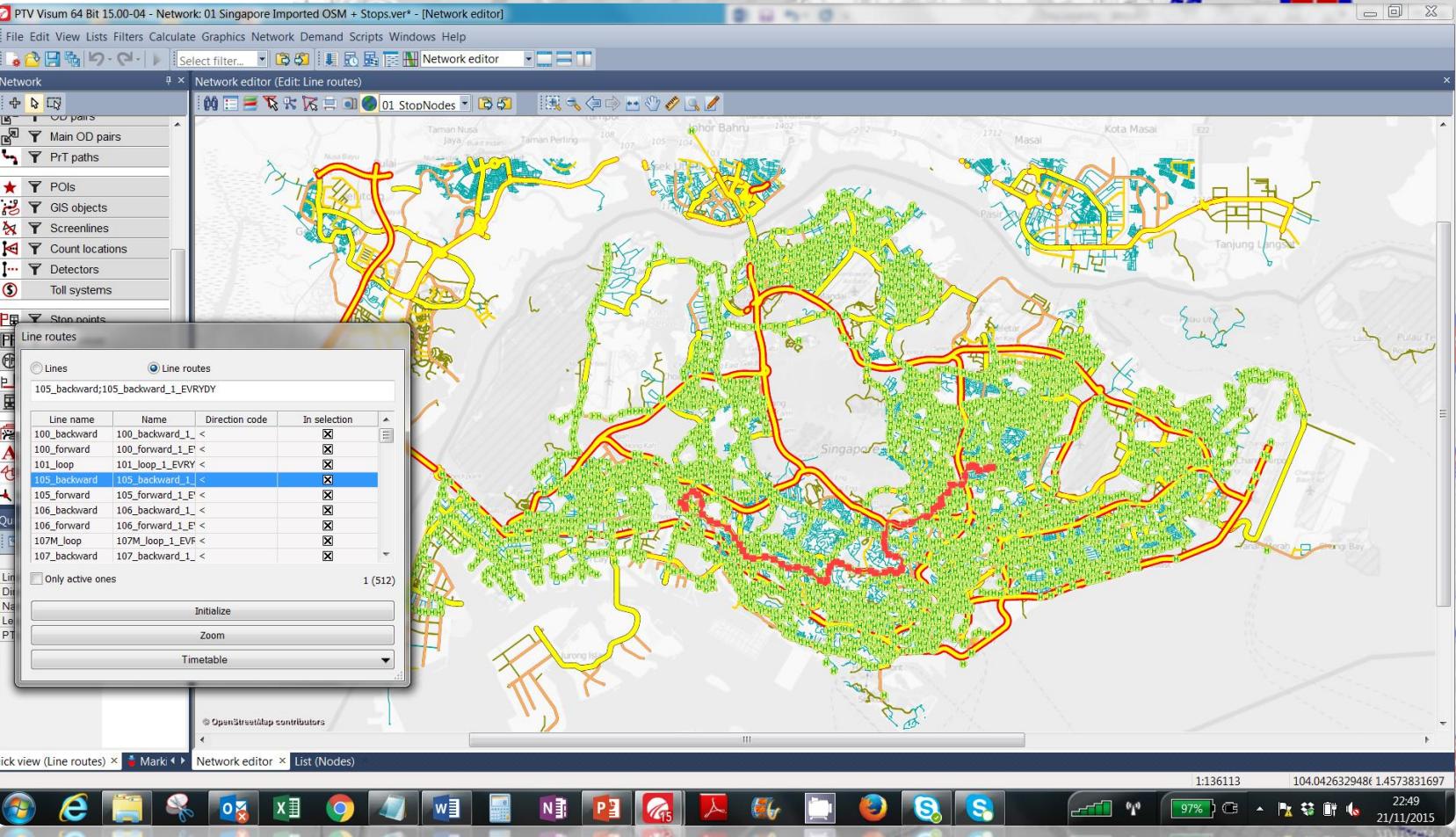
Process: - Import GTFS



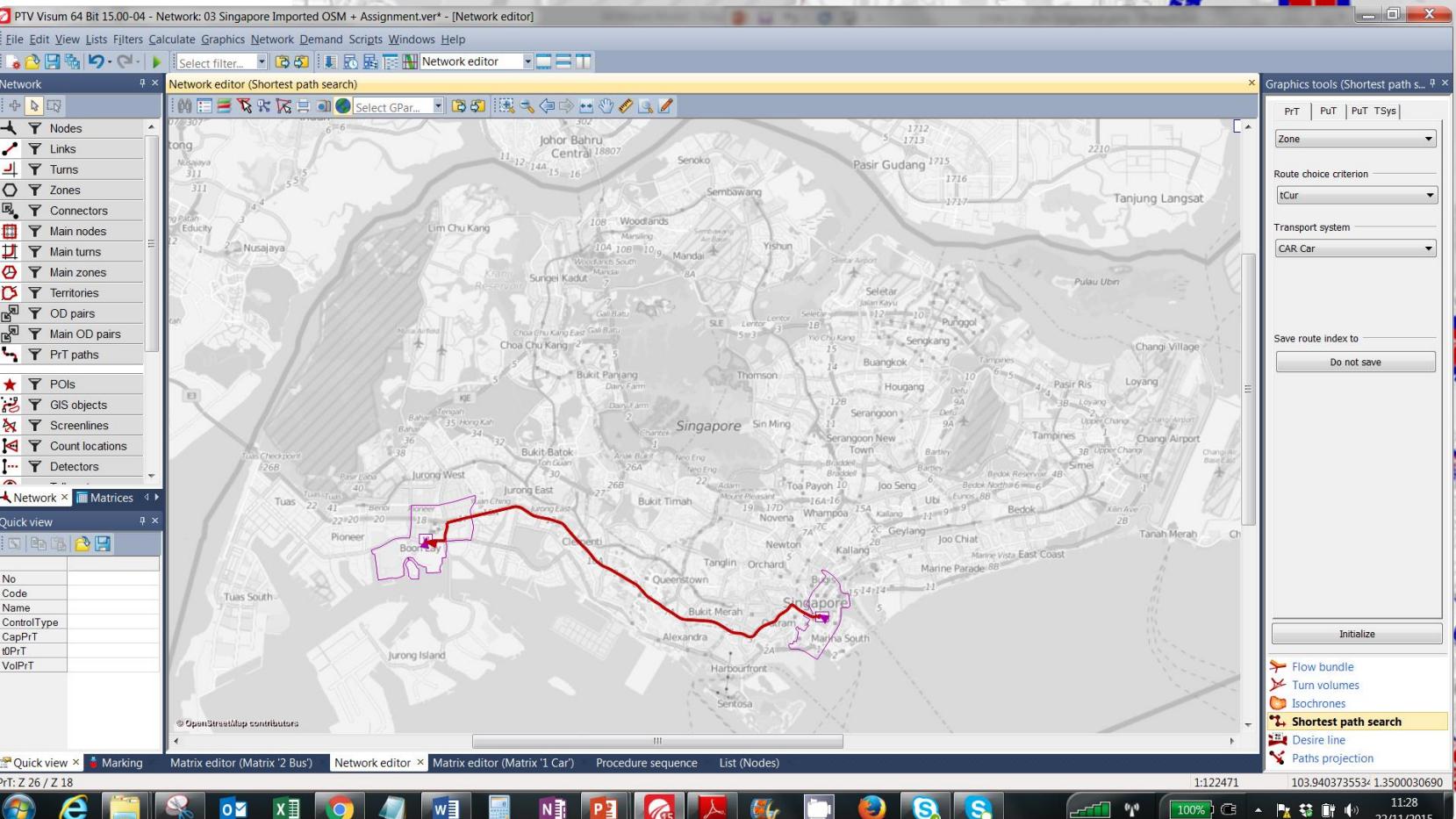
Fusion: - GTFS stops with Openstreetmap



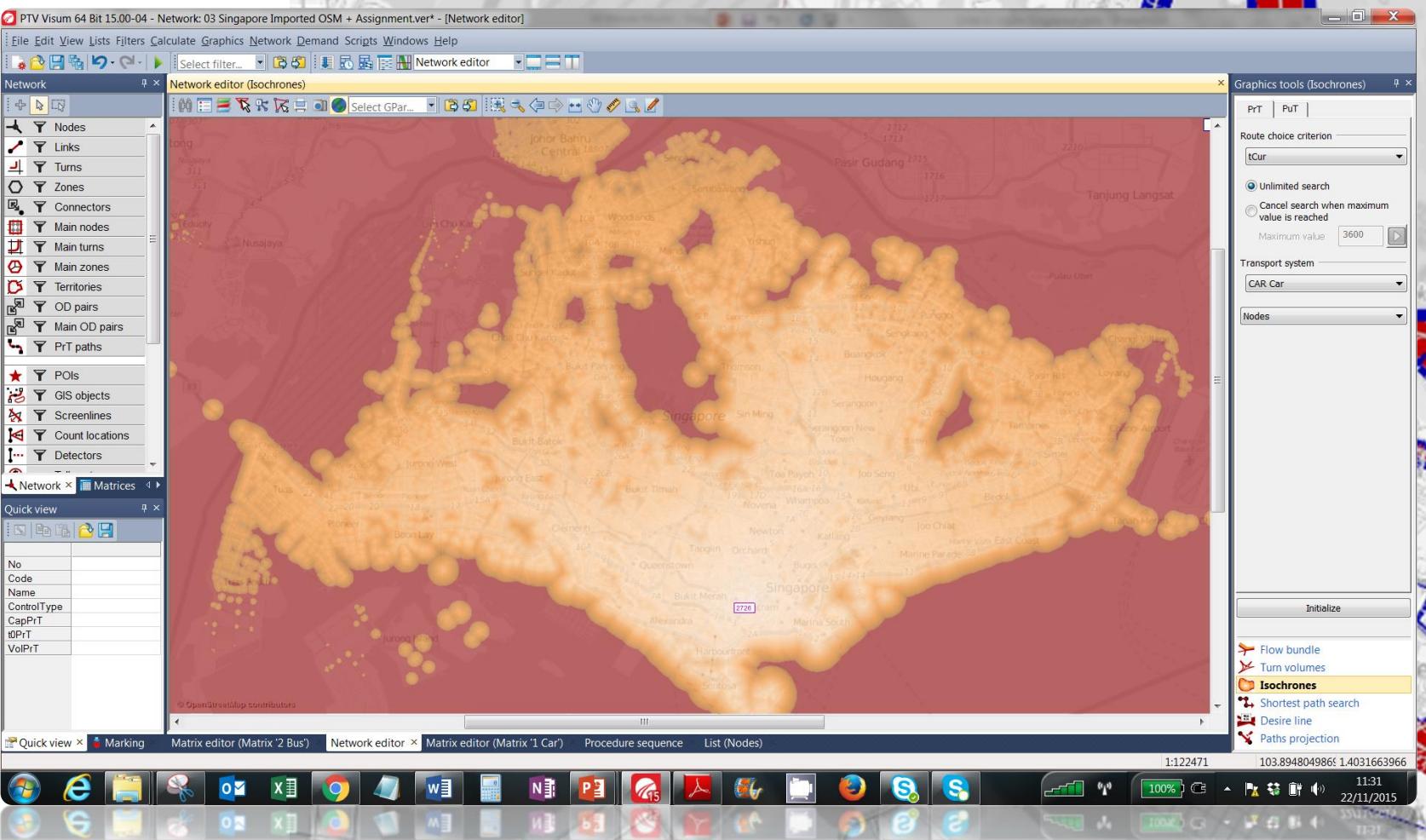
Fusion: - GTFS lines with Openstreetmap & stops



Analysis: - Shortest path



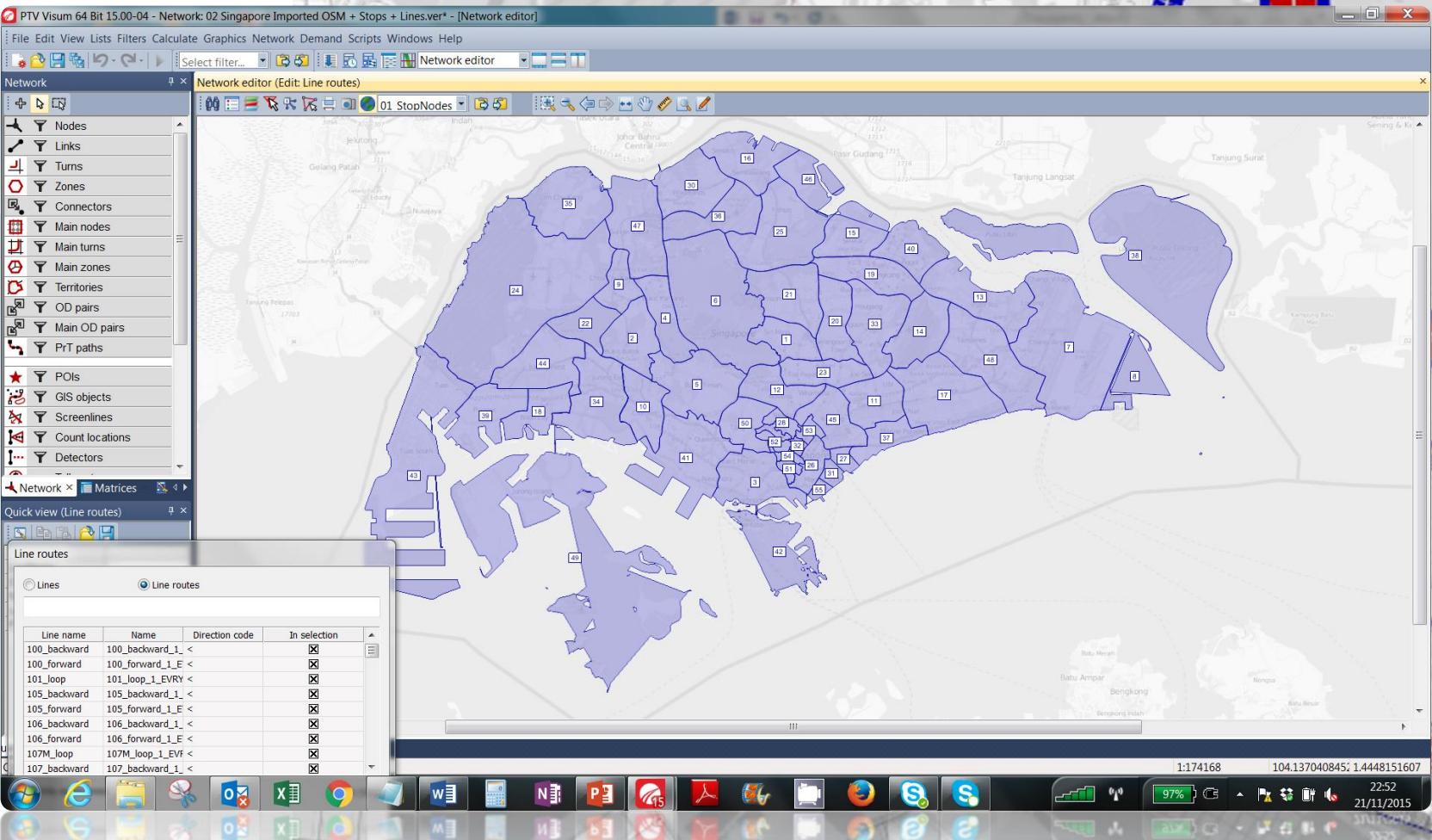
Analysis: - Isochrones (accessibility analysis)



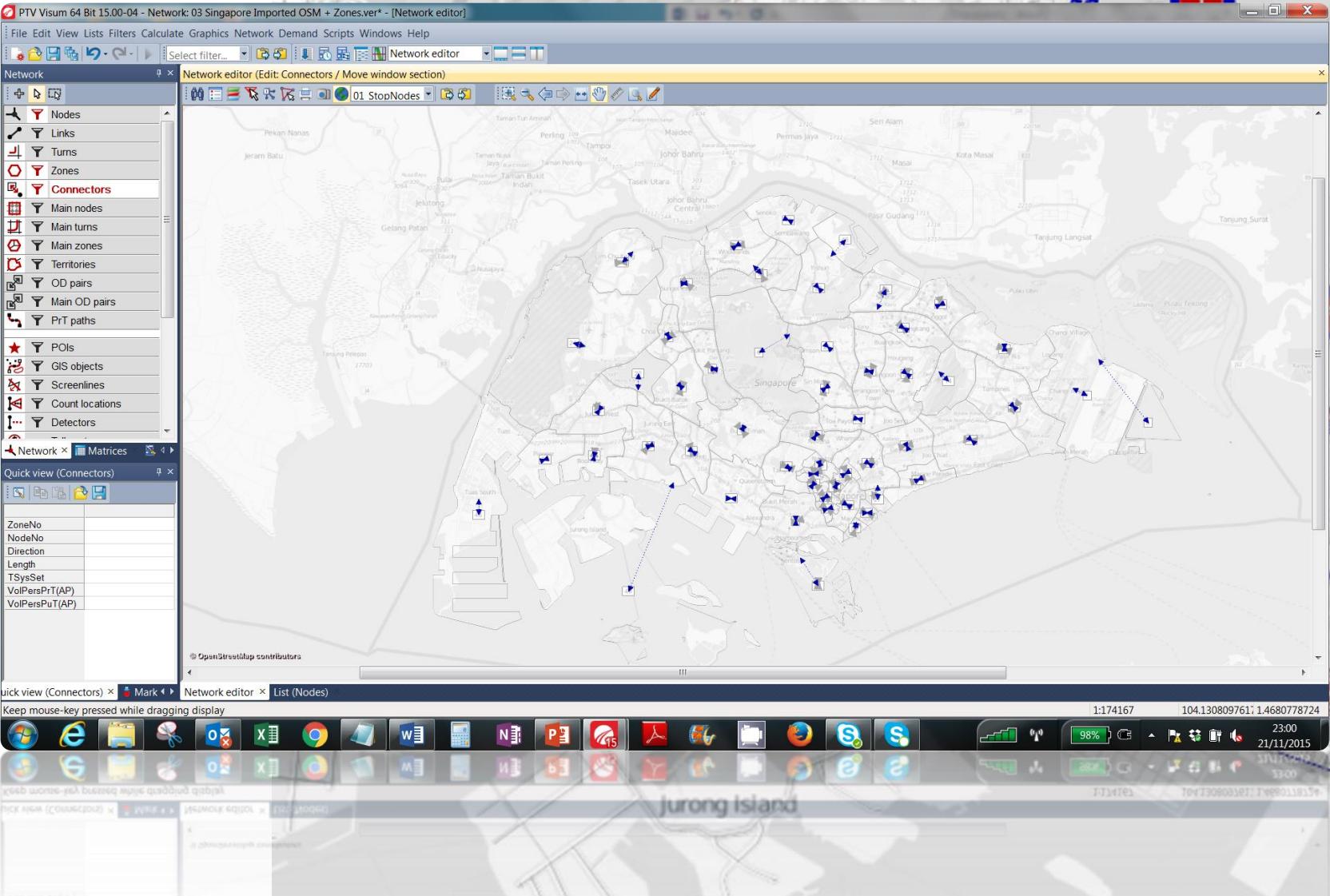
Data source: Official LTA website (planning zones)

The screenshot shows a web browser window displaying the data.gov.sg website. The main content is a map of Singapore and surrounding areas, specifically highlighting the 'Master Plan 2014 Planning Area Boundary'. The map is color-coded, with red areas representing the planning zones. The title of the page is 'Master Plan 2014 Planning Area Boundary' by 'Urban Redevelopment Authority'. Below the map, there is a section titled 'Data and Resources' which includes a download link for the 'Master Plan 2014 Planning Area Boundary' in KML format. There is also a 'Metadata' section showing the last update date as October 20, 2015, at 06:23. A 'Tags' section lists 'MP14', 'MP2014', 'Master Plan 2014 Pl...', and 'Planning Area'. At the bottom of the browser window, the taskbar shows several open files including 'mygeodata.zip', 'ogr2gui_0.7x64.zip', 'Master-Plan-20...zip', 'PlanningAreaC...kml', and 'SGP_adm.zip'. The system tray shows the date and time as 21/11/2015 17:00.

Process: Import shapefile as zones



Fusion: Generate connectors



Travel demand (for this demo...)

PTV Visum 64 Bit 15.00-04 - Network: 03 Singapore Imported OSM + Assignment.ver - [Matrix editor (Matrix '2 Bus')]

File Edit View Lists Filters Calculate Graphics Network Demand Scripts Windows Help Matrix editor

Matrices

Matrix editor (Matrix '1 Car')

Matrix editor (Matrix '2 Bus')

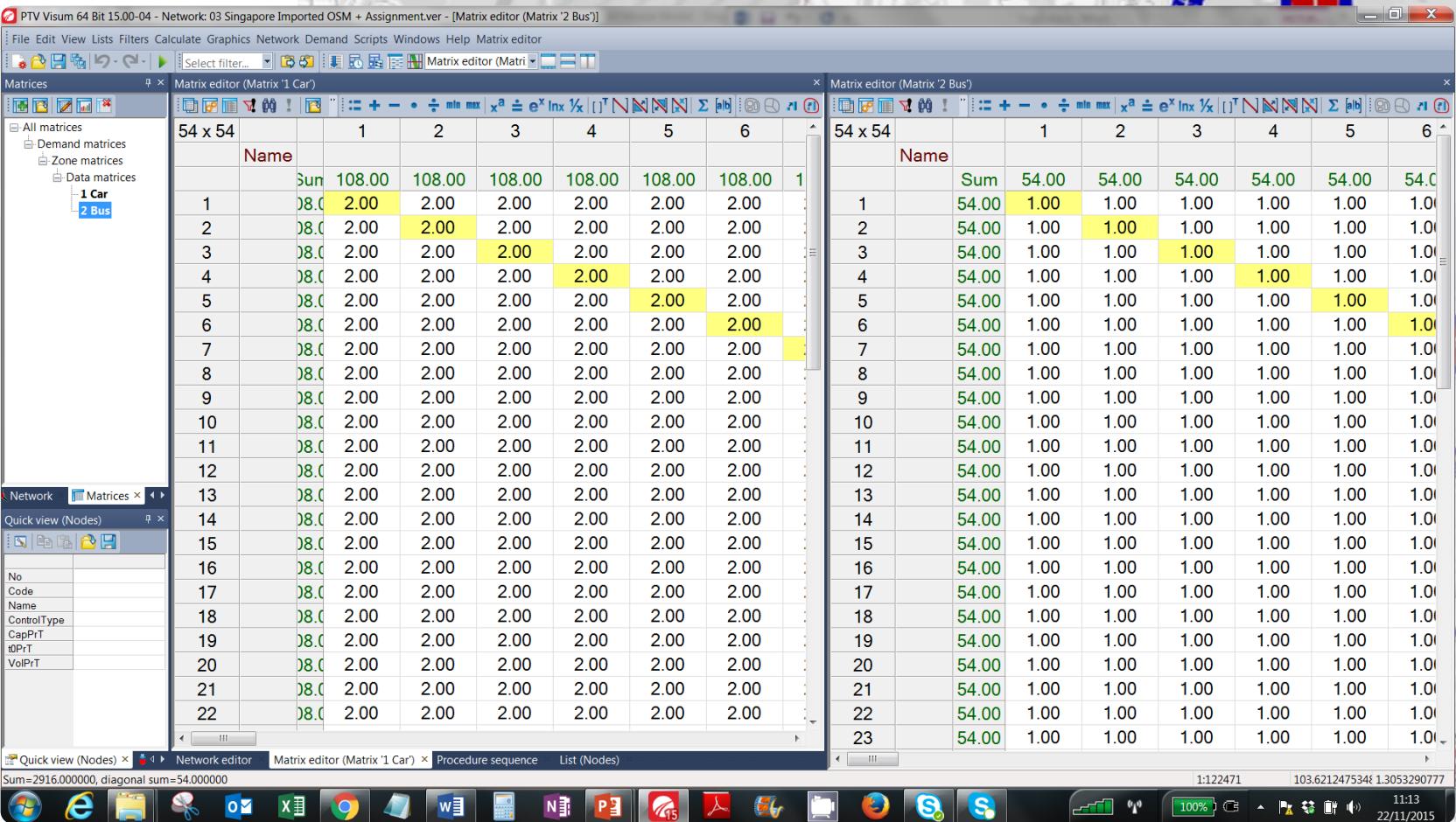
54 x 54

	1	2	3	4	5	6	
Name	Sum	108.00	108.00	108.00	108.00	108.00	108.00
1	08.0	2.00	2.00	2.00	2.00	2.00	2.00
2	08.0	2.00	2.00	2.00	2.00	2.00	2.00
3	08.0	2.00	2.00	2.00	2.00	2.00	2.00
4	08.0	2.00	2.00	2.00	2.00	2.00	2.00
5	08.0	2.00	2.00	2.00	2.00	2.00	2.00
6	08.0	2.00	2.00	2.00	2.00	2.00	2.00
7	08.0	2.00	2.00	2.00	2.00	2.00	2.00
8	08.0	2.00	2.00	2.00	2.00	2.00	2.00
9	08.0	2.00	2.00	2.00	2.00	2.00	2.00
10	08.0	2.00	2.00	2.00	2.00	2.00	2.00
11	08.0	2.00	2.00	2.00	2.00	2.00	2.00
12	08.0	2.00	2.00	2.00	2.00	2.00	2.00
13	08.0	2.00	2.00	2.00	2.00	2.00	2.00
14	08.0	2.00	2.00	2.00	2.00	2.00	2.00
15	08.0	2.00	2.00	2.00	2.00	2.00	2.00
16	08.0	2.00	2.00	2.00	2.00	2.00	2.00
17	08.0	2.00	2.00	2.00	2.00	2.00	2.00
18	08.0	2.00	2.00	2.00	2.00	2.00	2.00
19	08.0	2.00	2.00	2.00	2.00	2.00	2.00
20	08.0	2.00	2.00	2.00	2.00	2.00	2.00
21	08.0	2.00	2.00	2.00	2.00	2.00	2.00
22	08.0	2.00	2.00	2.00	2.00	2.00	2.00
23	54.00	1.00	1.00	1.00	1.00	1.00	1.00

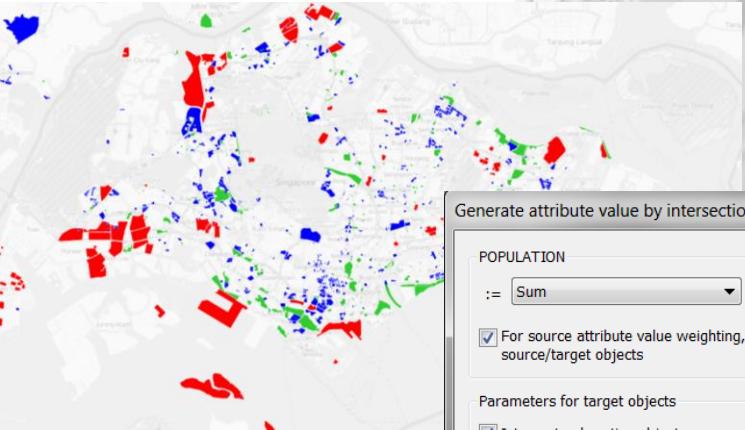
Quick view (Nodes) x Network editor Matrix editor (Matrix '1 Car') x Procedure sequence List (Nodes) x

Sum=2916.000000, diagonal sum=54.000000

1:122471 103.6212475348 1.3053290777 11:13 22/11/2015



Travel Demand (alternatively...)



Generate attribute value by intersection with source attribute

POPULATION
:= Sum of all source attribute values

For source attribute value weighting, use the source object's share in the overlapping area of source/target objects

Parameters for target objects
 Intersect only active objects
Network object: Zones
Attribute: POPULATION
Buffer size: 0.00m
 Add value Truncate Round

Parameters for source objects
 Intersect only active objects
Network object: POIs: All POI categories
Attribute: POPULATION
Buffer size: 0.00m

OK Cancel

Procedure sequence



Count:	Execution	Active	Procedure	Reference object(s)
1	▶	<input checked="" type="checkbox"/>	Trip generation	AP01_G01
2		<input checked="" type="checkbox"/>	Trip distribution	AP01_G01

SINGAPORE

Population: 5.1 million

Land area: 712 km²

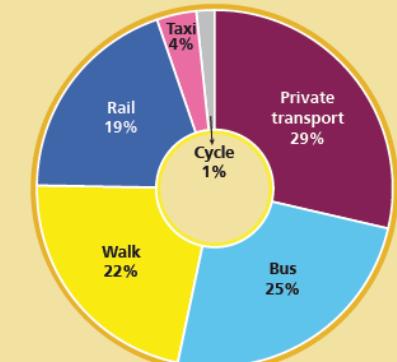
Mode share

Based on the number of journeys by main mode of transport. It includes all modes for all purposes. Mass transit constitutes 44% of all journeys.

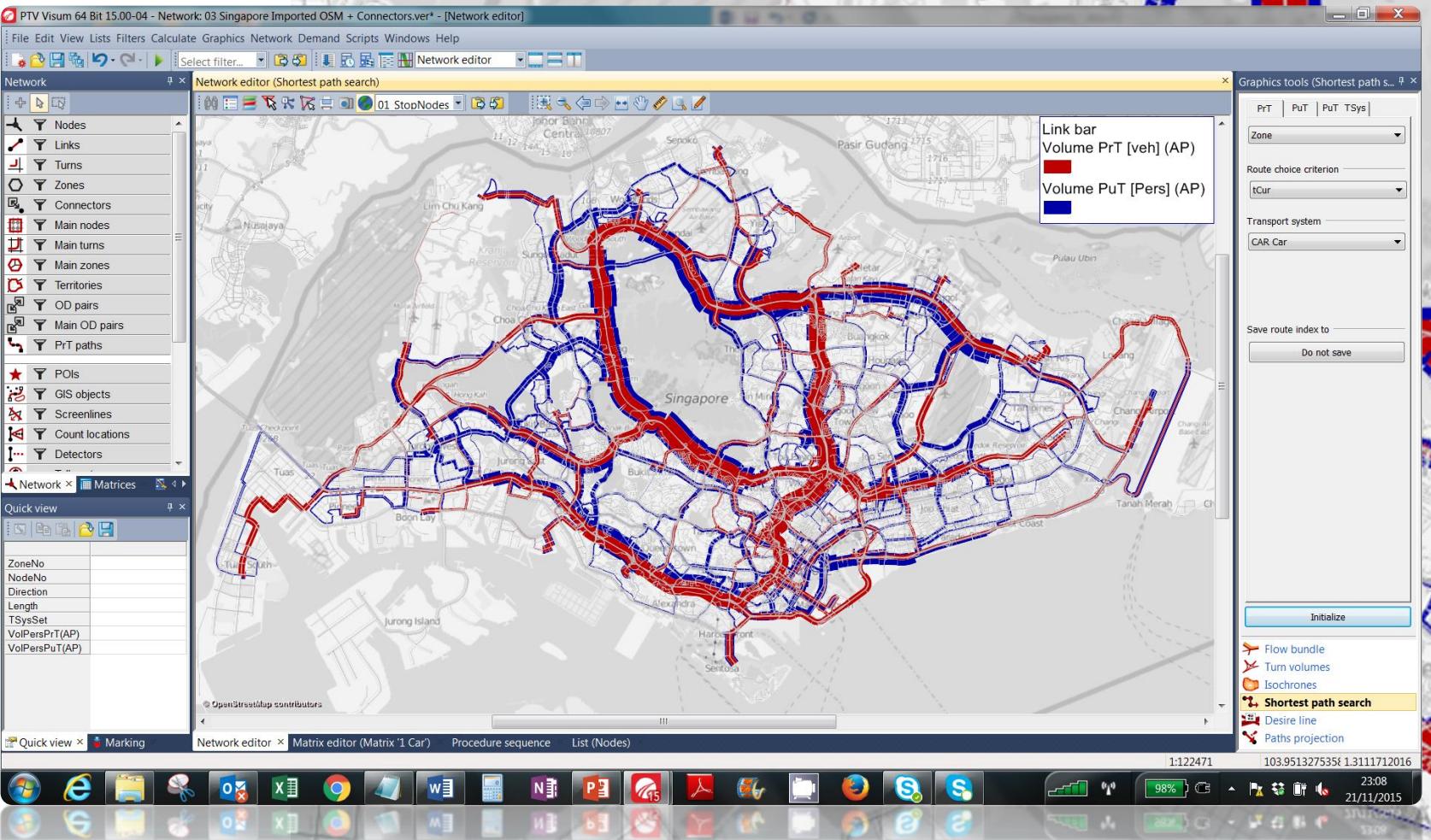
Data Sources:

Singapore in Figures 2011
Travel Survey 2011, Land Transport Authority, Singapore

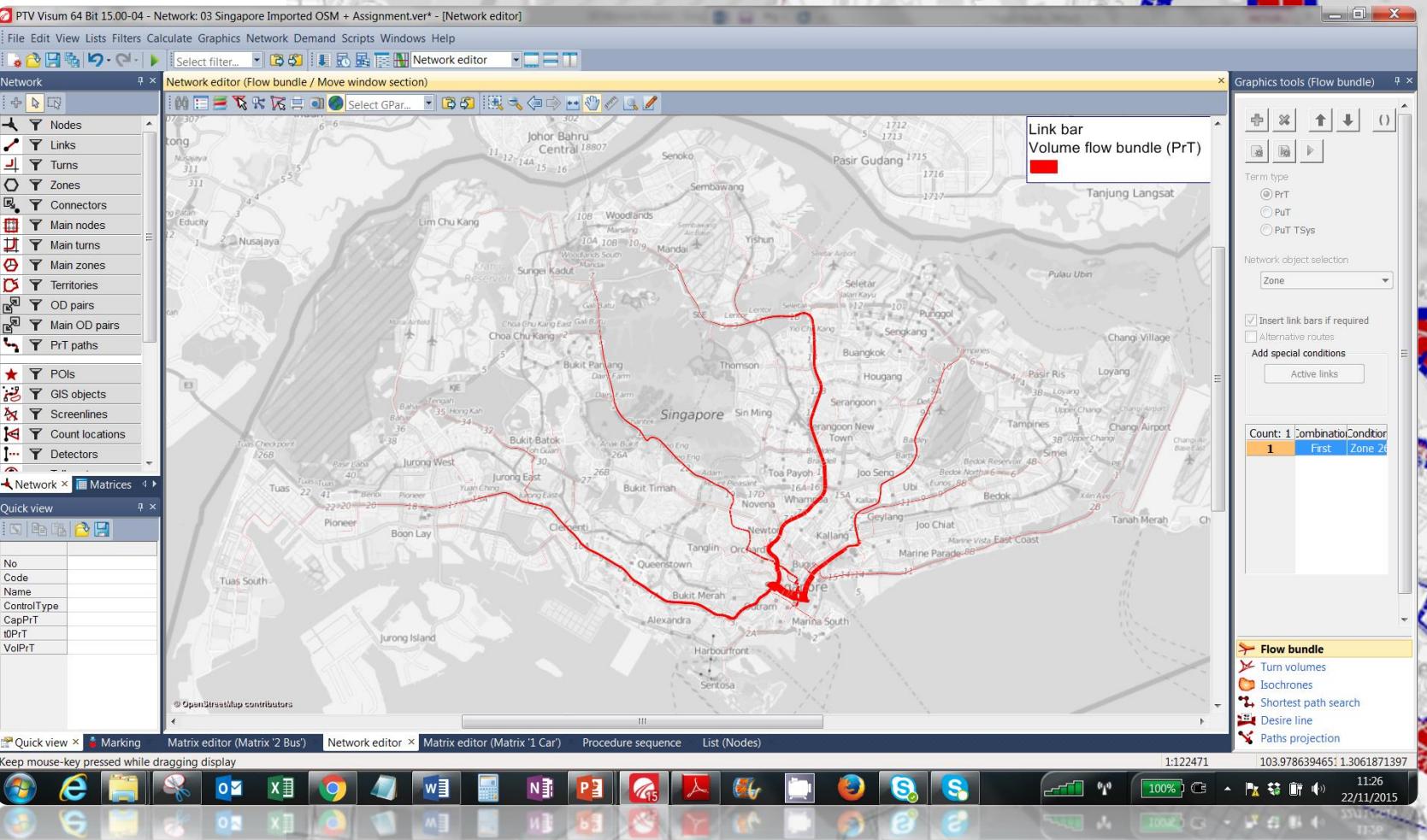
Figure 23: Mode share in Singapore



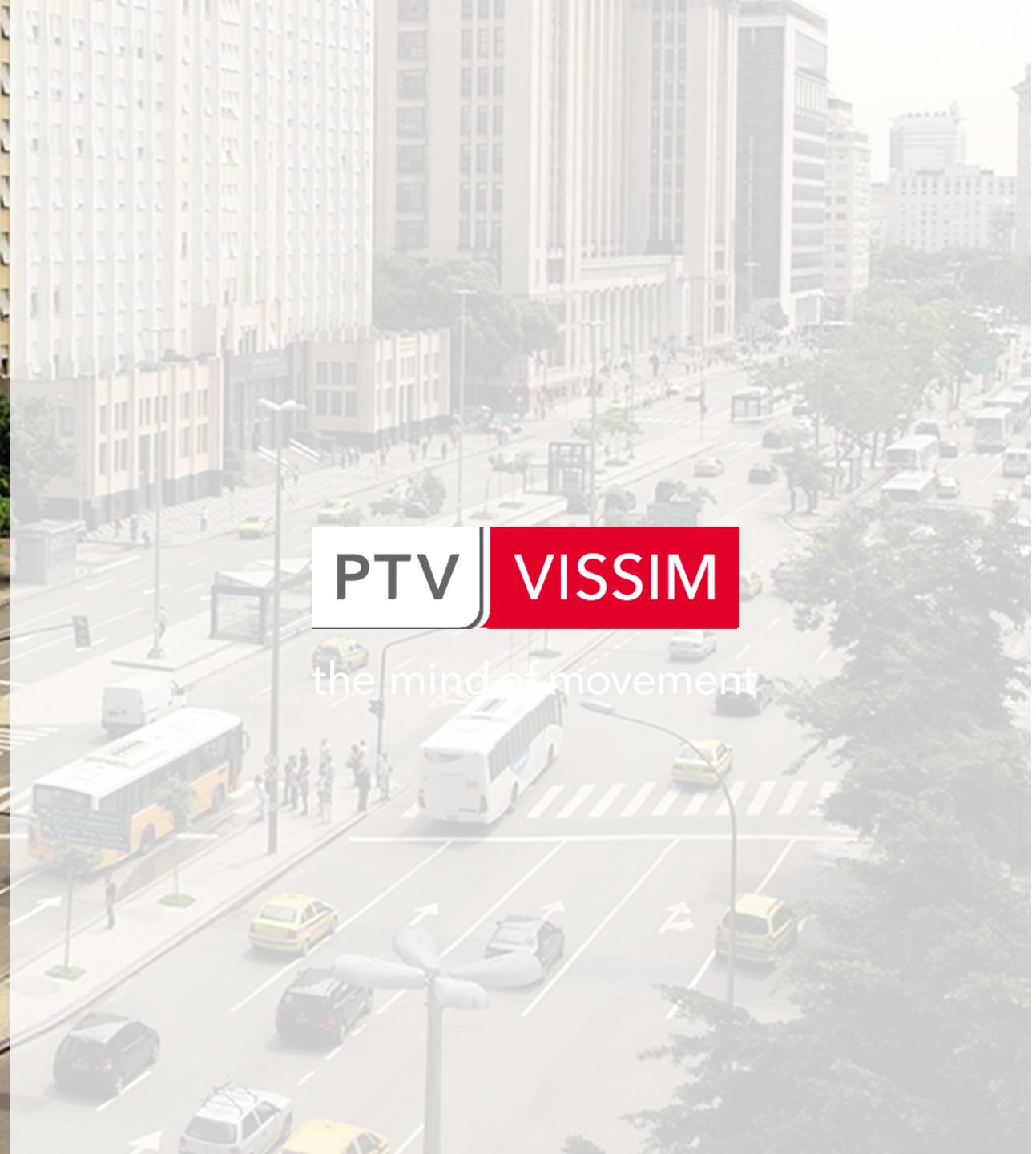
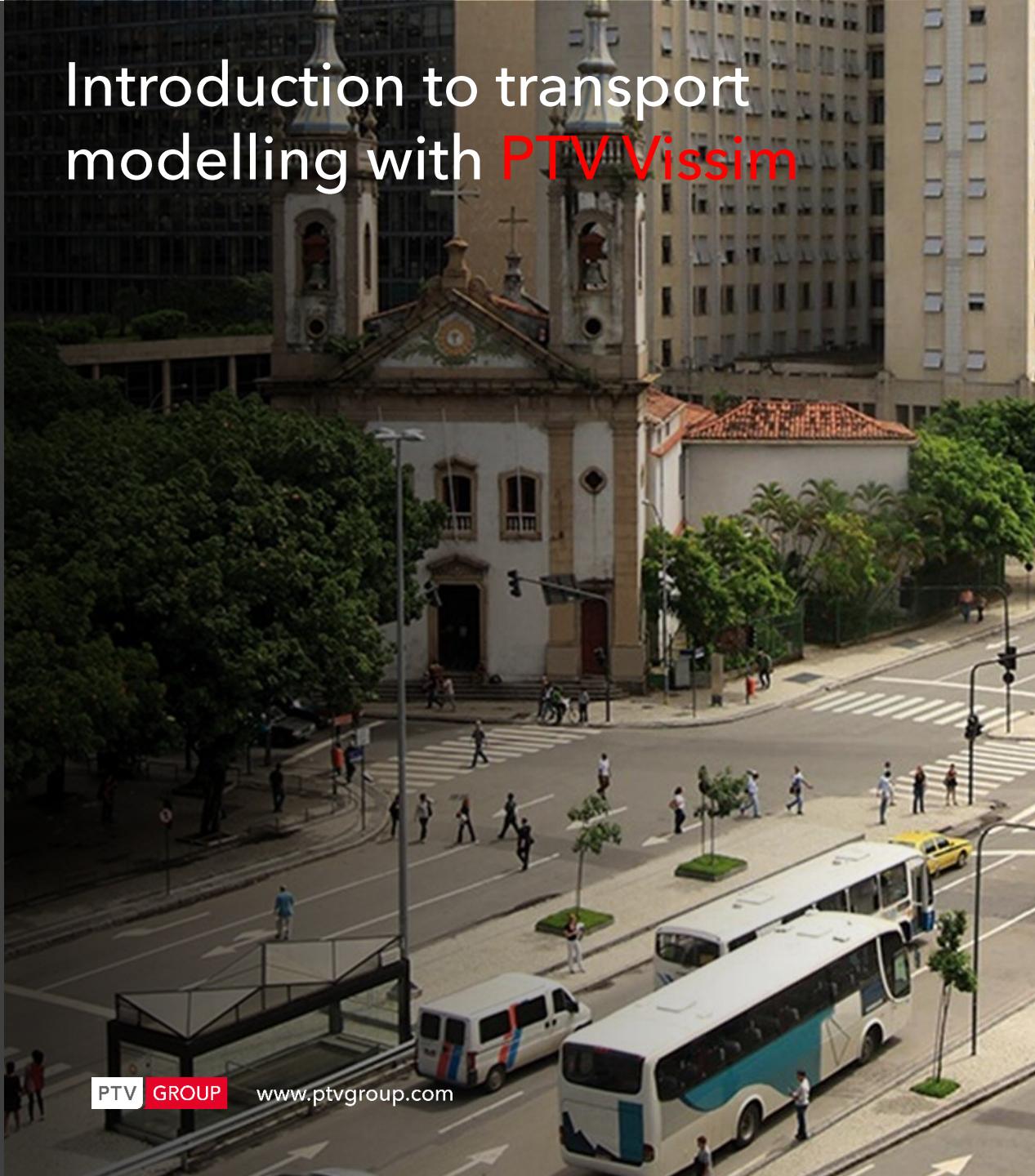
Assignment : Private and Public transport



Analysis: Flow bundle (all travel to/from location)



Introduction to transport modelling with PTV Vissim



Traffic Simulation

Multimodal traffic simulation

- ▶ Simulation of all modes of transport in a single piece of software.
- ▶ Modelling of public transport.
- ▶ Detailed representation of all network objects.
- ▶ Online visualization in 2D and 3D for decision support.
- ▶ Simulation of advanced traffic control measures.
- ▶ Emissions modelling

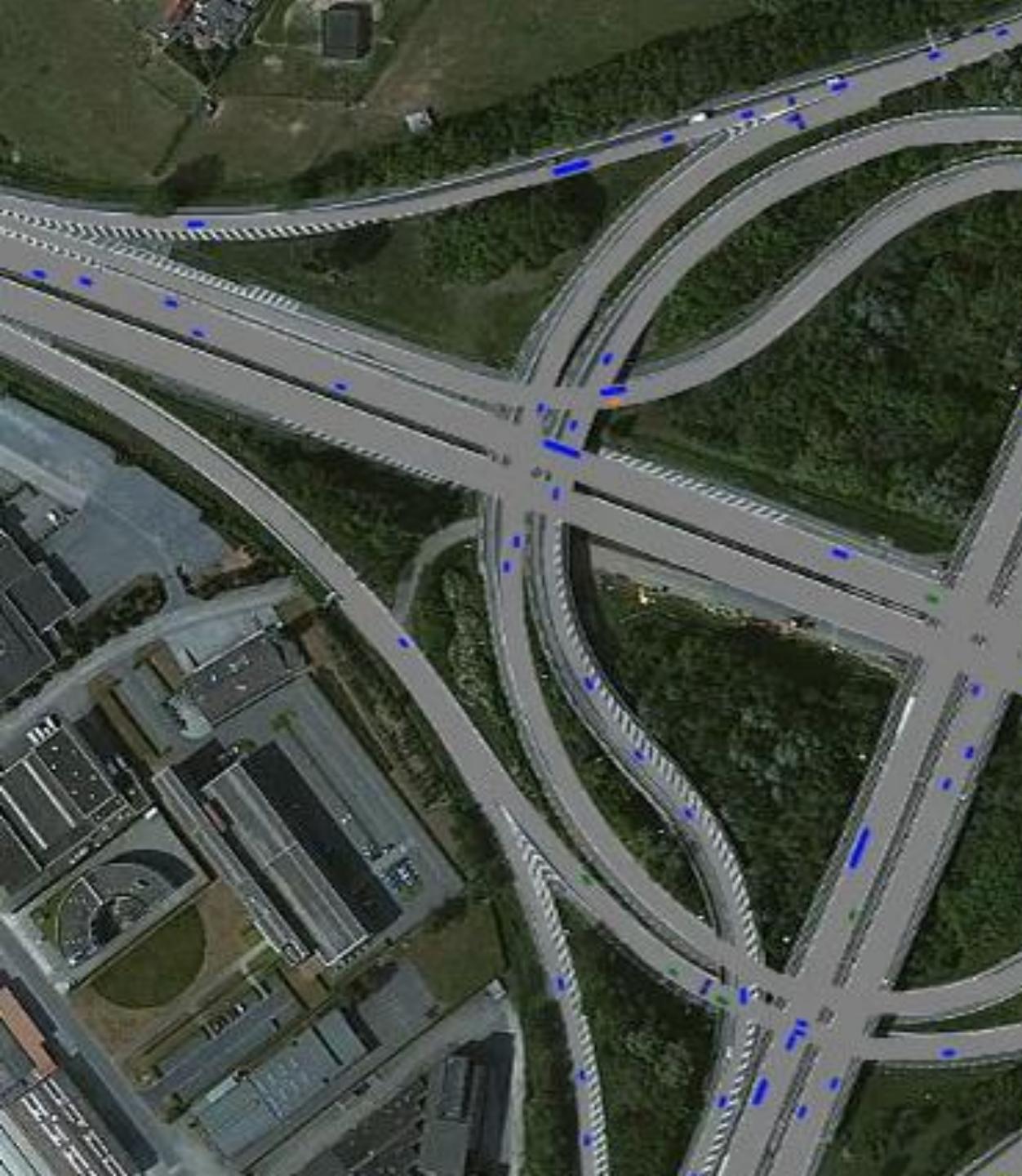


Video: Courtesy of Stuart Gibb, Jacobs

Traffic Simulation

Highway network modelling

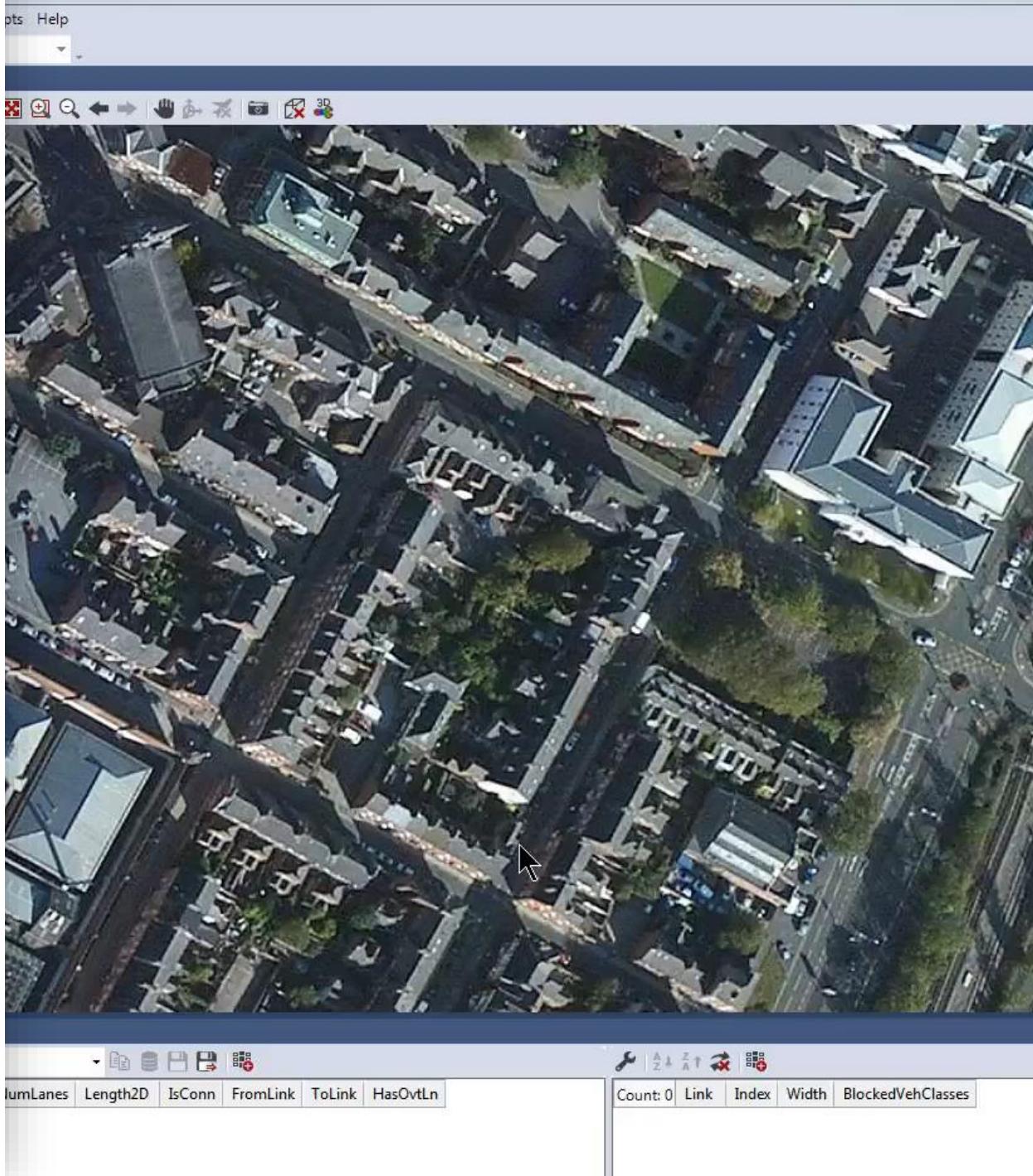
- ▶ Realistic junction and highway geometry.
- ▶ Integrated mesoscopic/ microscopic/ hybrid simulation.
- ▶ Scientifically proven car-following model.
- ▶ Quantitative evaluation data output:
 - ▶ Journey times, queues, delay, speed etc
 - ▶ Trajectory data
- ▶ Used in wide range of traffic engineering, transport assessment projects.



Traffic Simulation

Easy to use Graphical User Interface

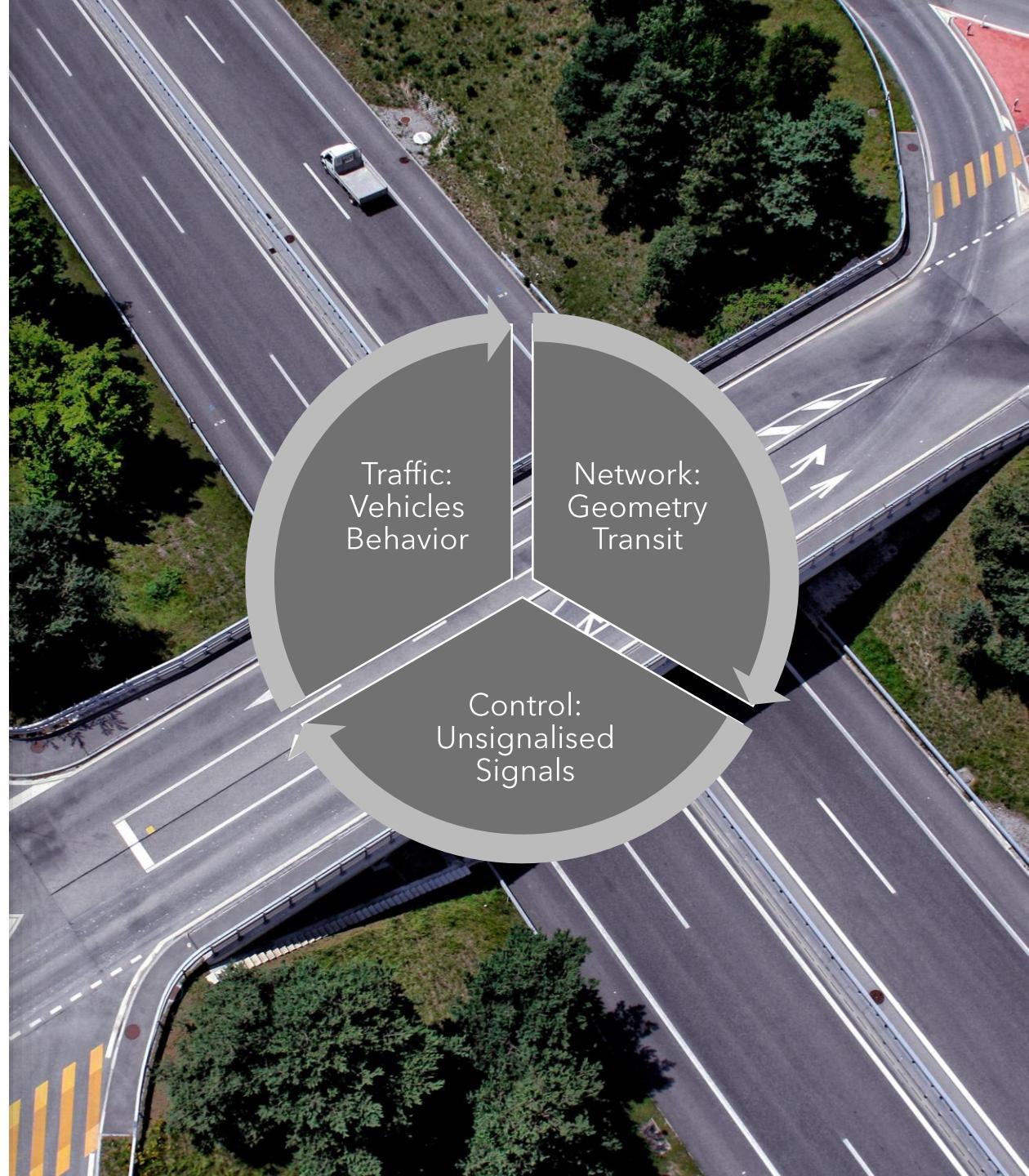
- ▶ User friendly interface (including copy/paste).
- ▶ Scenario Management.
- ▶ Integration with PTV Visum for multi-resolution modelling.
- ▶ Modelling of traffic demand, network supply and vehicle behavior.
- ▶ Integrated mesoscopic/ microscopic/ hybrid simulation.



Traffic Simulation

Core Building Blocks

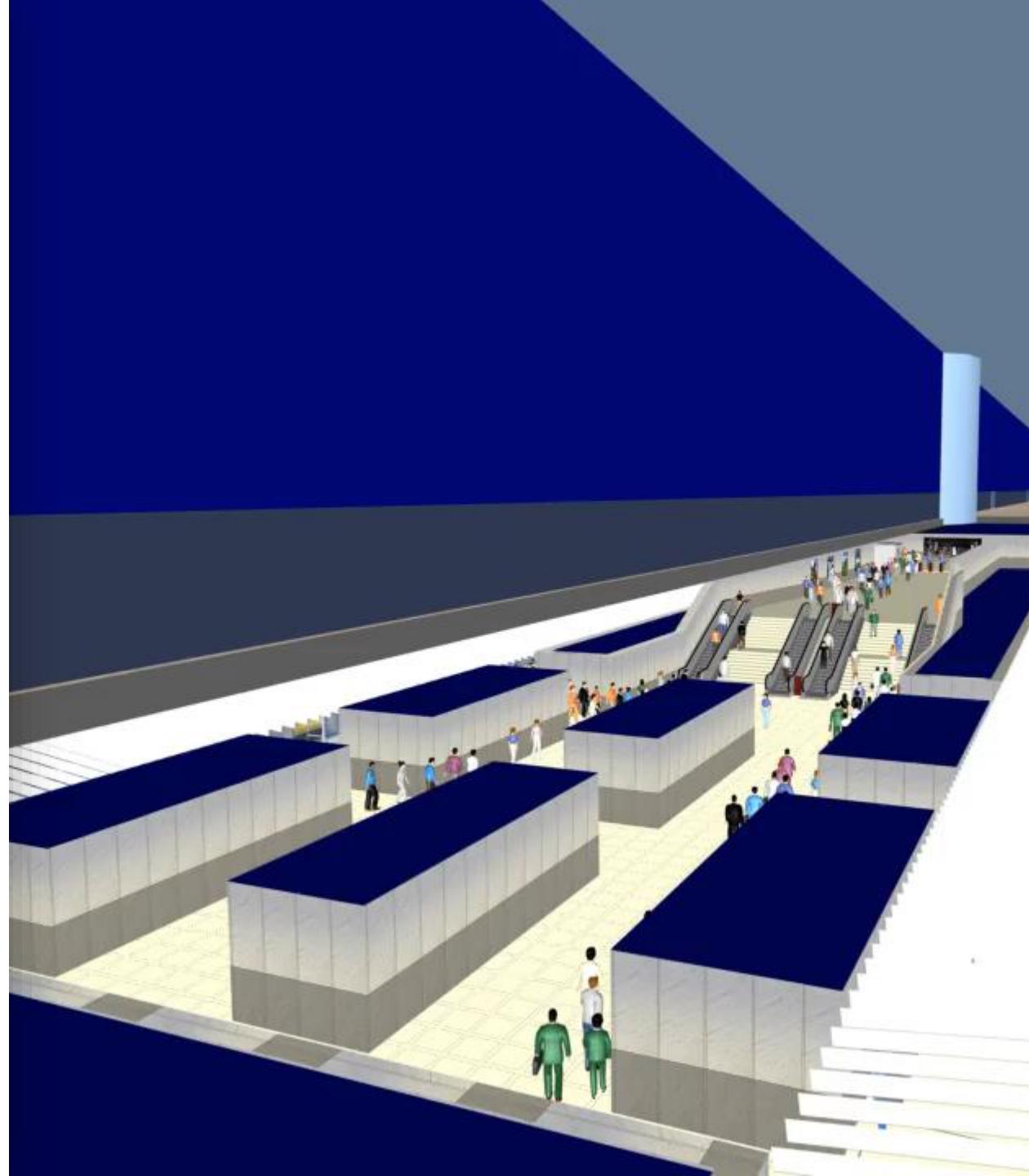
- ▶ **Network:** the physical infrastructure for roadway and tracks
- ▶ **Traffic:** the vehicular movements on the network
- ▶ **Control:** how traffic behaves in case of conflicting movements



Pedestrian Simulation

Simulation of people walking every step

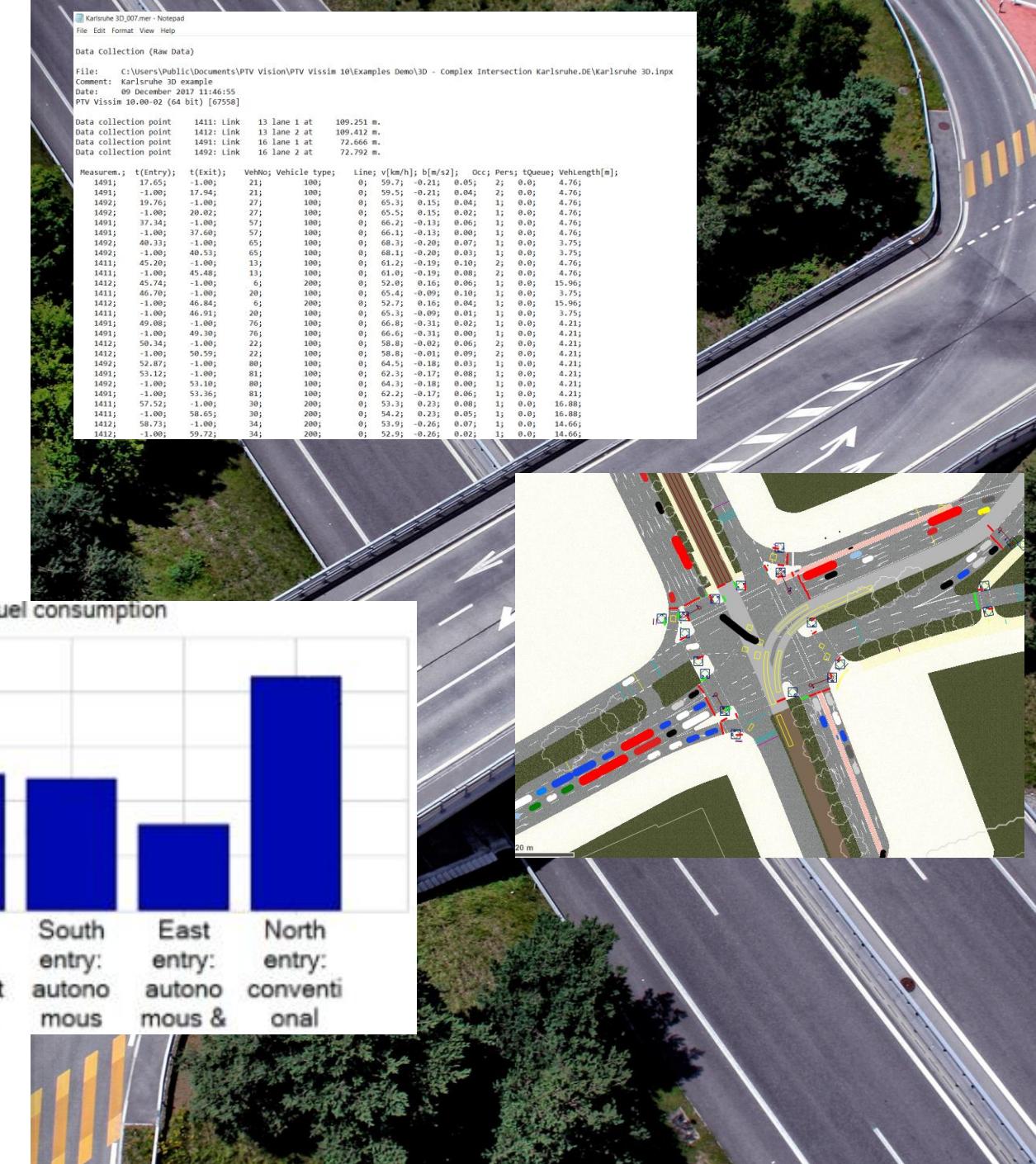
- ▶ Simulation of the interaction of pedestrians with
 - ▶ Each other
 - ▶ In crowds
 - ▶ Built environment
 - ▶ Public transport
 - ▶ Vehicles
- ▶ Can be used for:
 - ▶ Pedestrian Infrastructure Engineering
 - ▶ Crowd Flow Management
 - ▶ Transport Infrastructure Design
 - ▶ Building and Space Design



Rich Data Outputs

Numerous available parameters

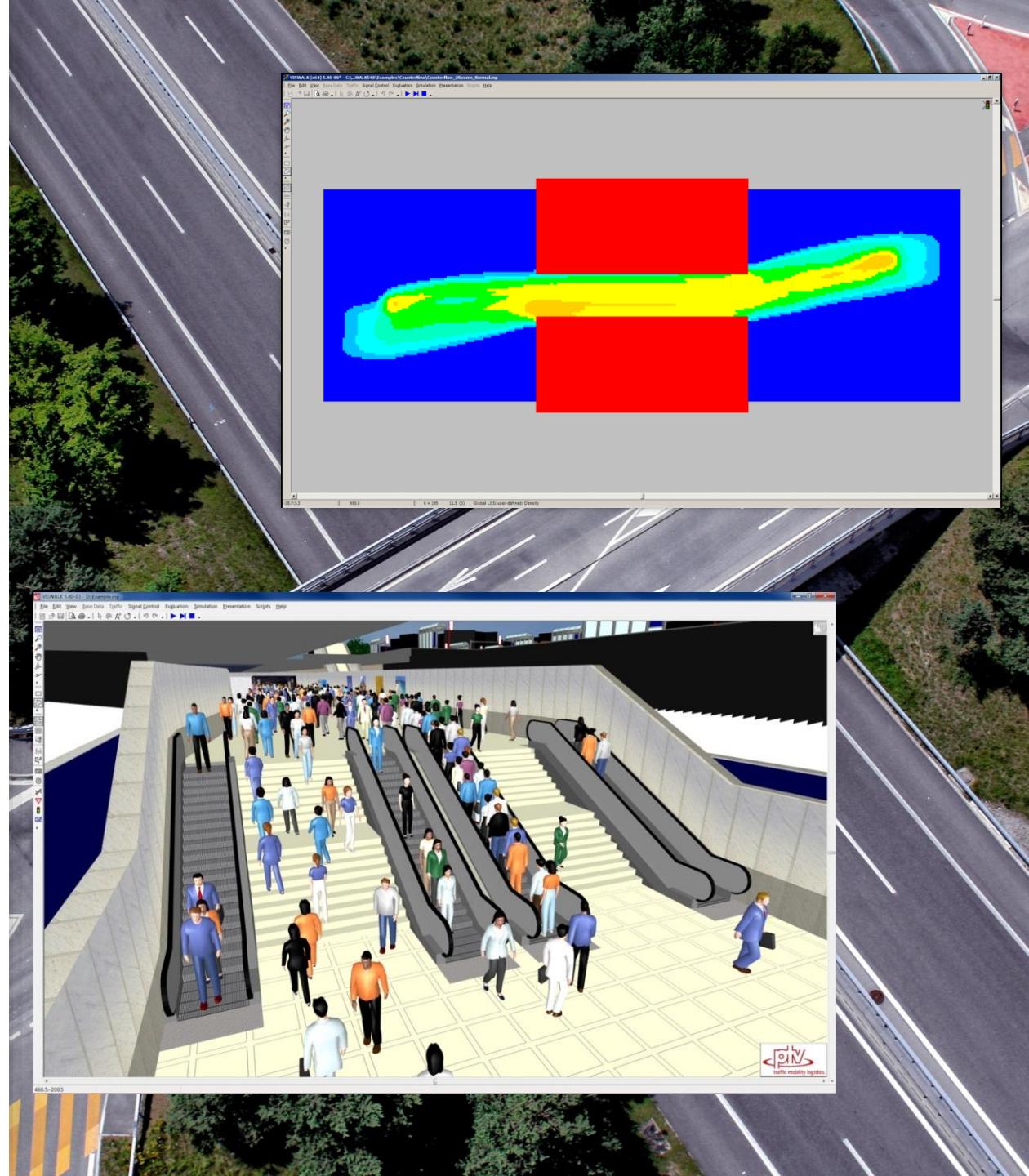
- ▶ Journey times, queues, delays, stops
- ▶ Detailed trajectory data
- ▶ Emissions
- ▶ Individual vehicle data
- ▶ 2D / 3D-animation



Rich Data Outputs (Pedestrians)

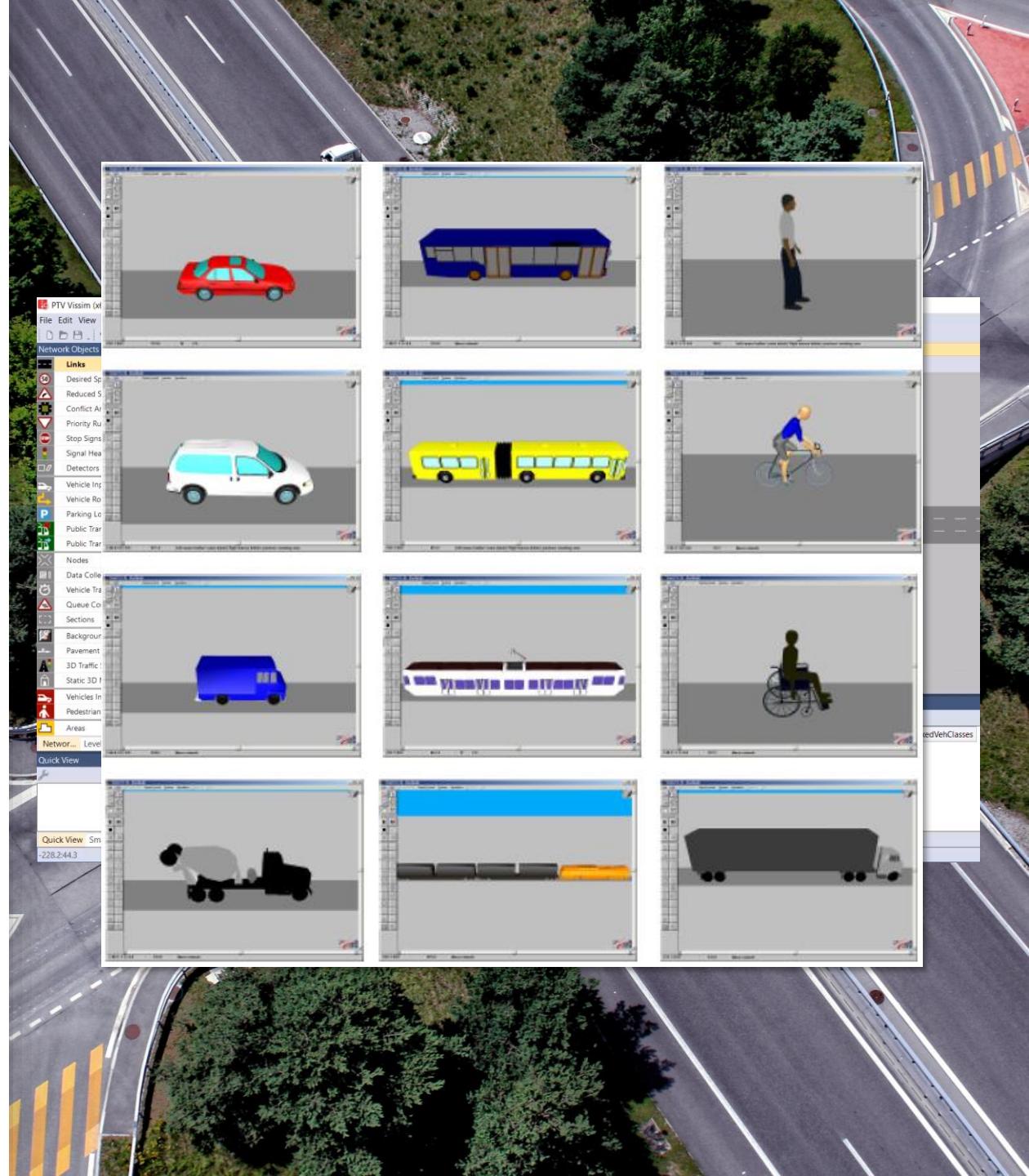
Numerous available parameters

- ▶ Density, speed, dwell times, and other properties one can measure for an area
- ▶ Record file (in effect detailed trajectory data)
- ▶ Level of Service (LOS) in various variants
- ▶ Individual on-simulation data
- ▶ Queuing / transaction times
- ▶ 2D / 3D-animation
- ▶ Journey times



PTV Vissim Advantages

- ▶ Detailed geometry, driving behavior & traffic control.
- ▶ Access to lists and intuitive interface.
- ▶ Ease of use and configuration to local conditions.
- ▶ Unlimited vehicle types and number.
- ▶ Scenario Management & comparison for multiple designs.
- ▶ Link to external interfaces for signals, design, visualisations, simulators etc
- ▶ Assignment options for traffic input.



Traffic Simulation

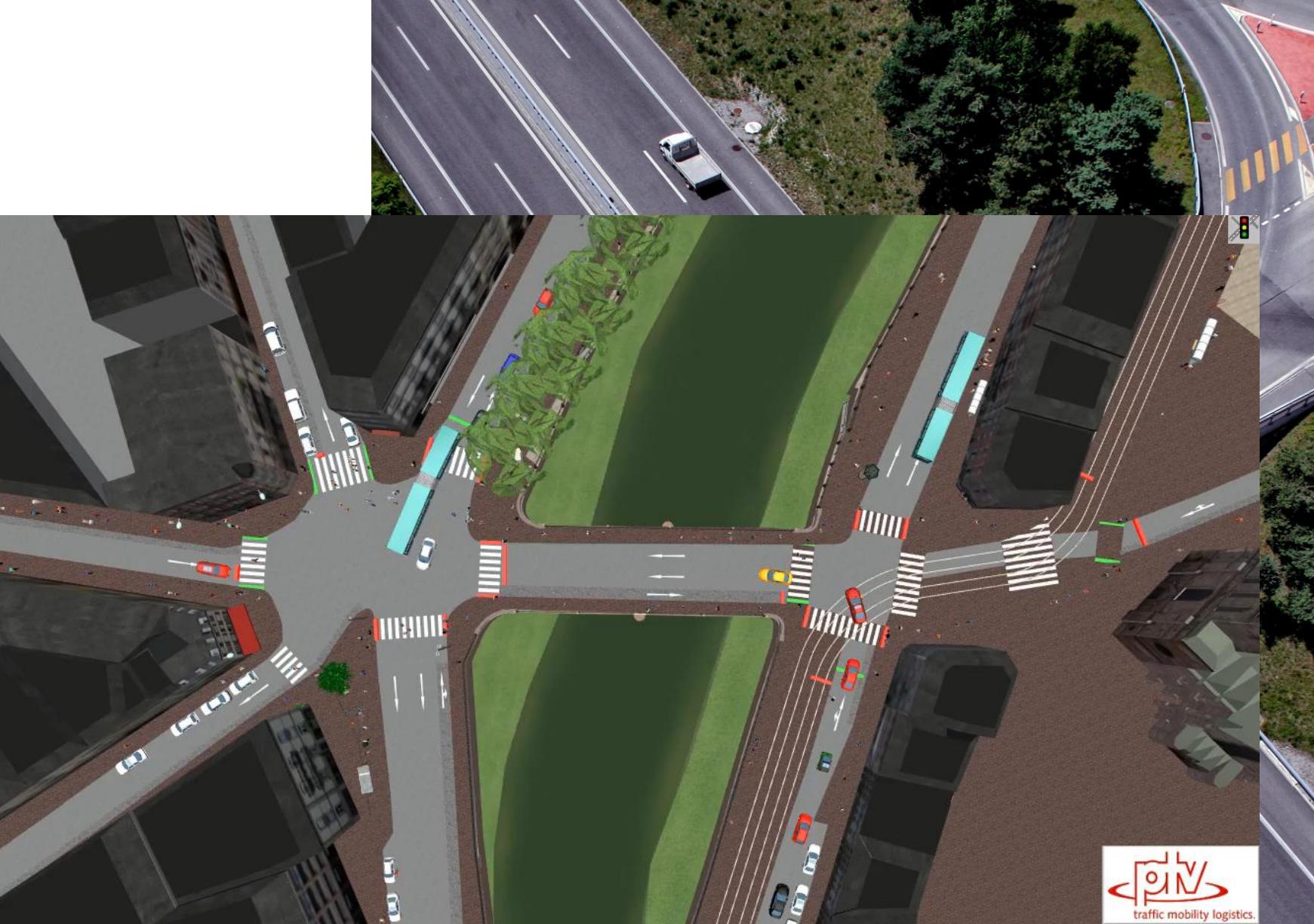
Public Realm



Traffic Simulation

Public Realm

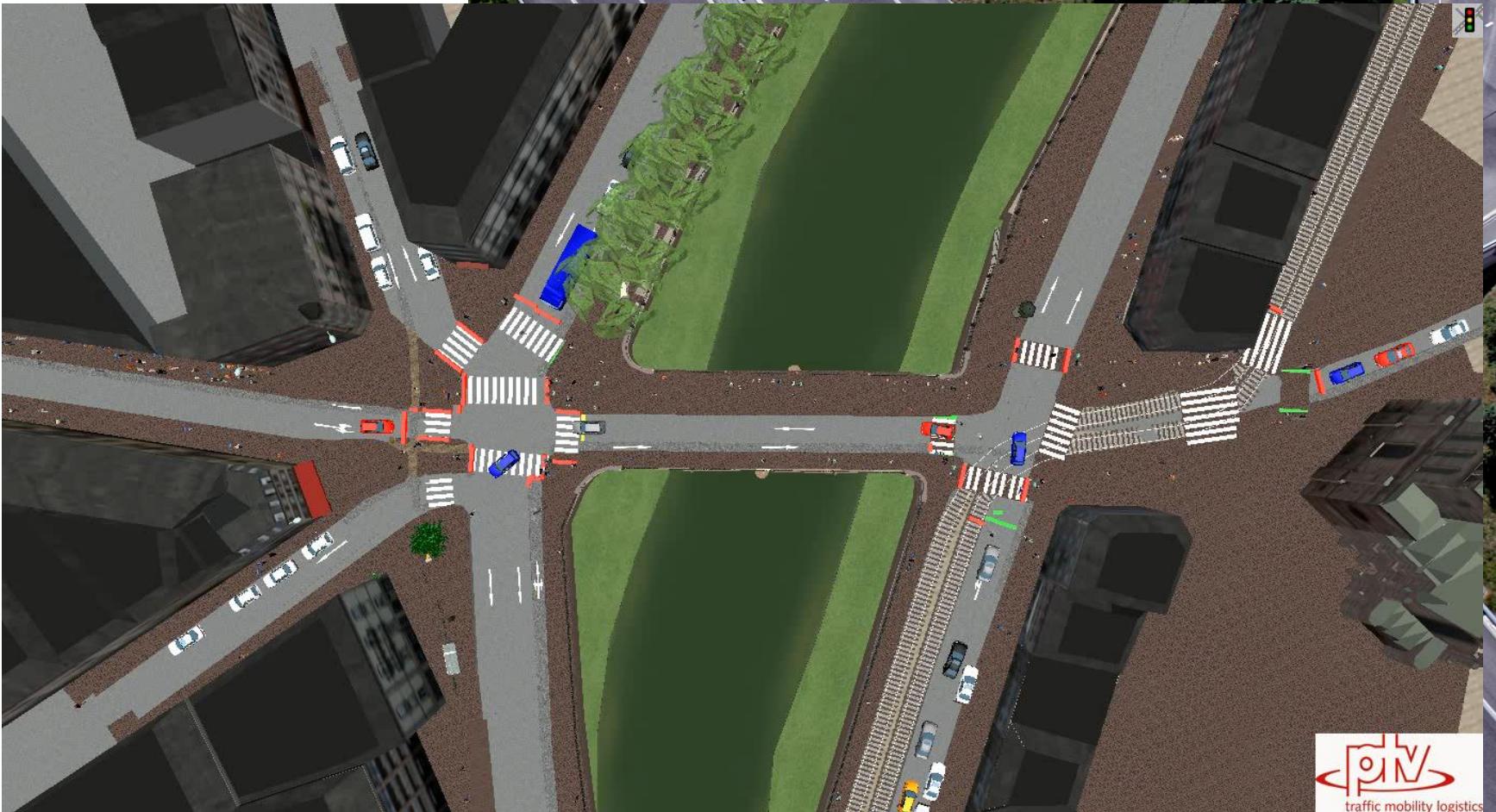
Pedestrian improvements



Traffic Simulation

Public Realm

Pedestrian improvements (ii)



Traffic Simulation

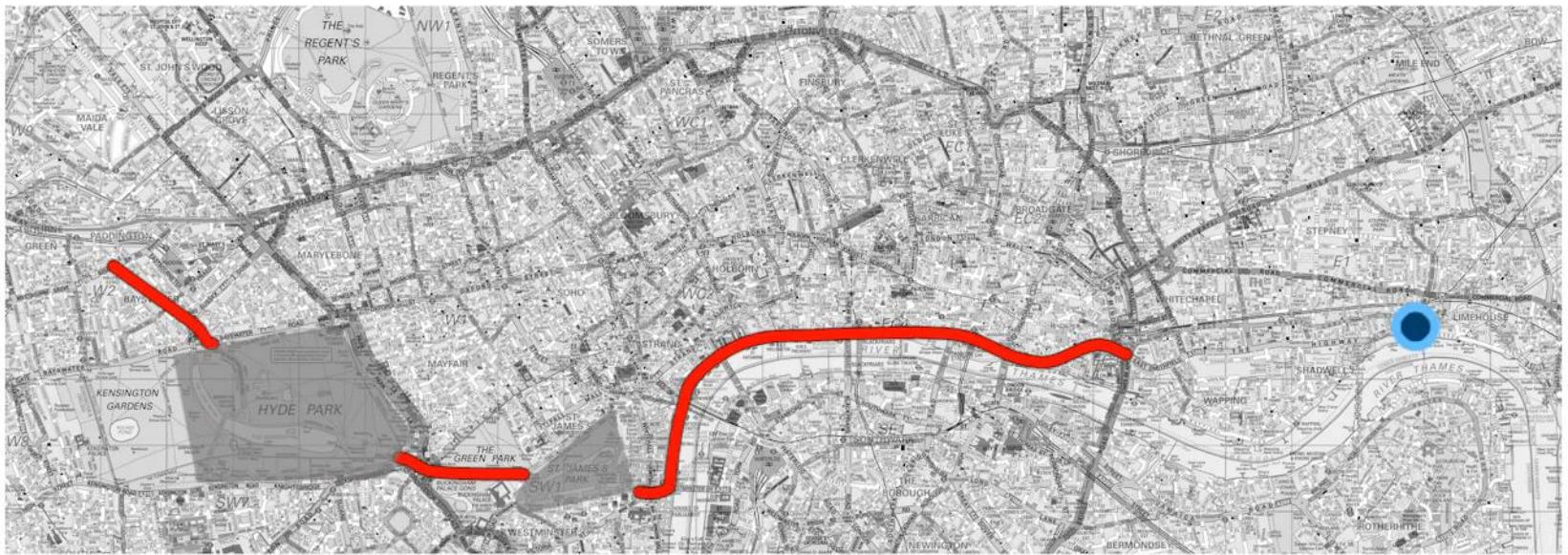
Public Realm

Pedestrian improvements

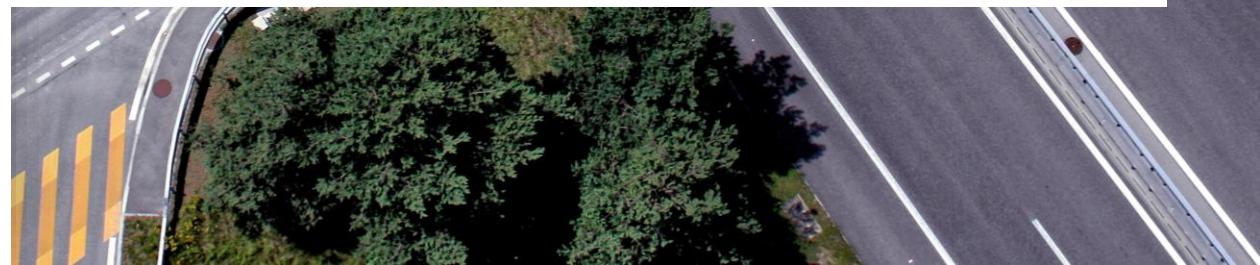
Cycle Schemes



East-West Cycle Superhighway Post-consultation Designs



The Highway



Simulation of Connected Autonomous Vehicles with PTV Vissim

PTV Vissim is quickly establishing itself as the go to software for simulating CAV's in a wide range of applications and industries.

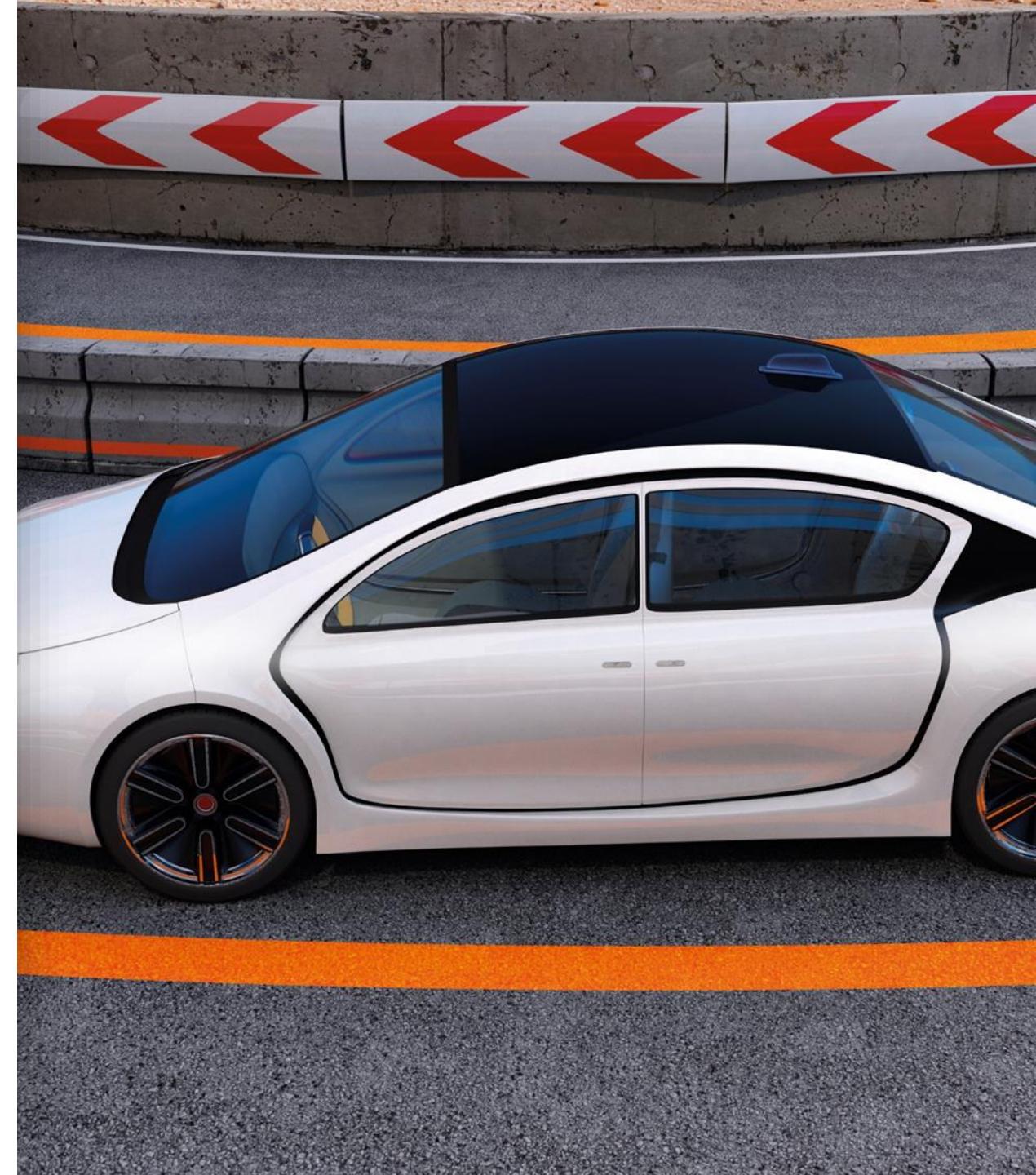
Can support traffic analysis with top down assumptions and bottom up technology led hardware in the loop applications.

Different levels of detail ranging from adapting driving behaviour to utilising external interfaces.

PTV Group engaged in a number of research and development projects to support software development.

Example files developed to demonstrate functionality in PTV Vissim for CAV modelling.

Development in ride hail & mobility as a service applications.



How to model CAV's with PTV Vissim

Using INTERNAL capabilities by adapting default parameters:

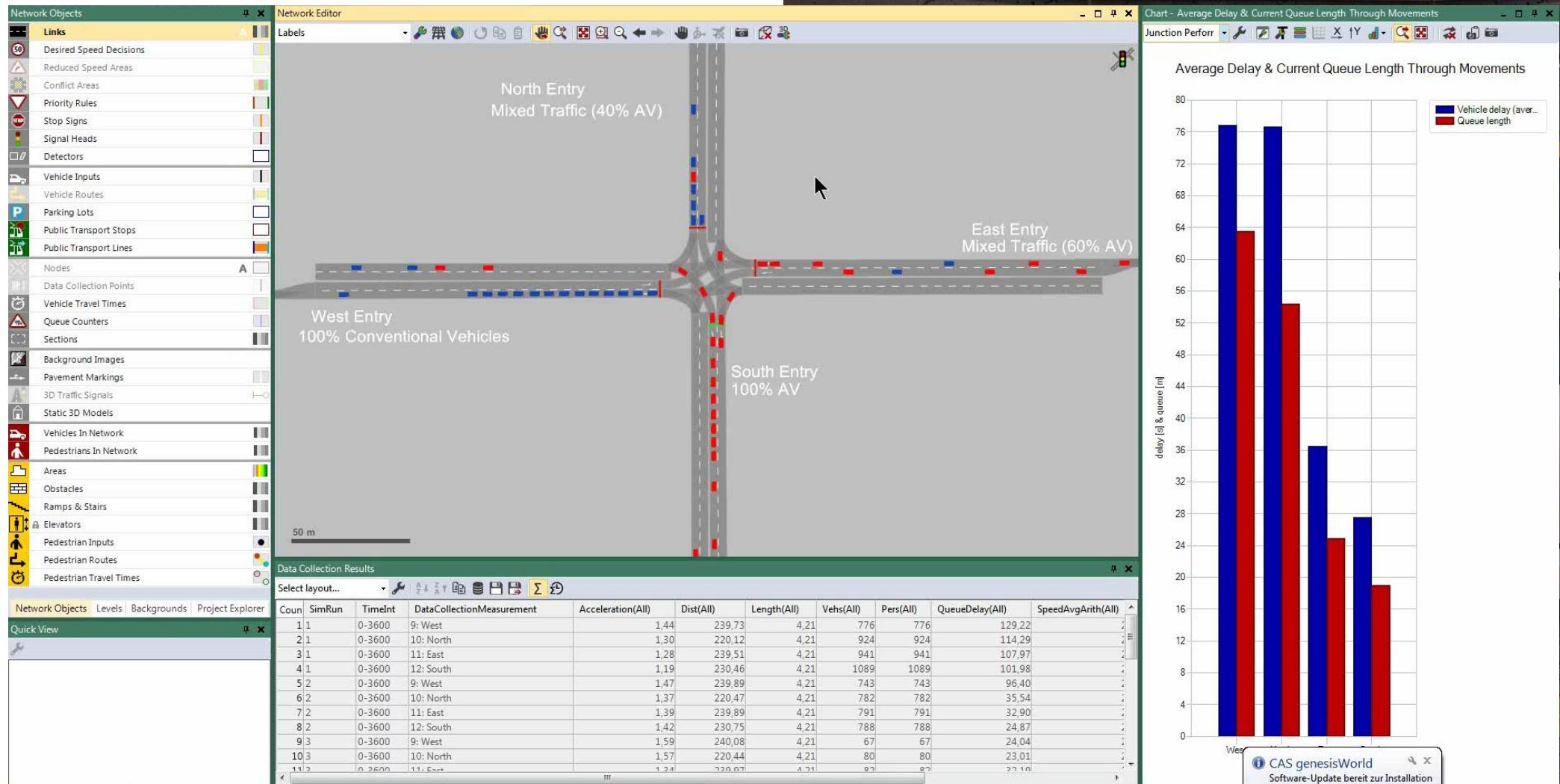
Driver Behaviour

Lane Change Behaviour

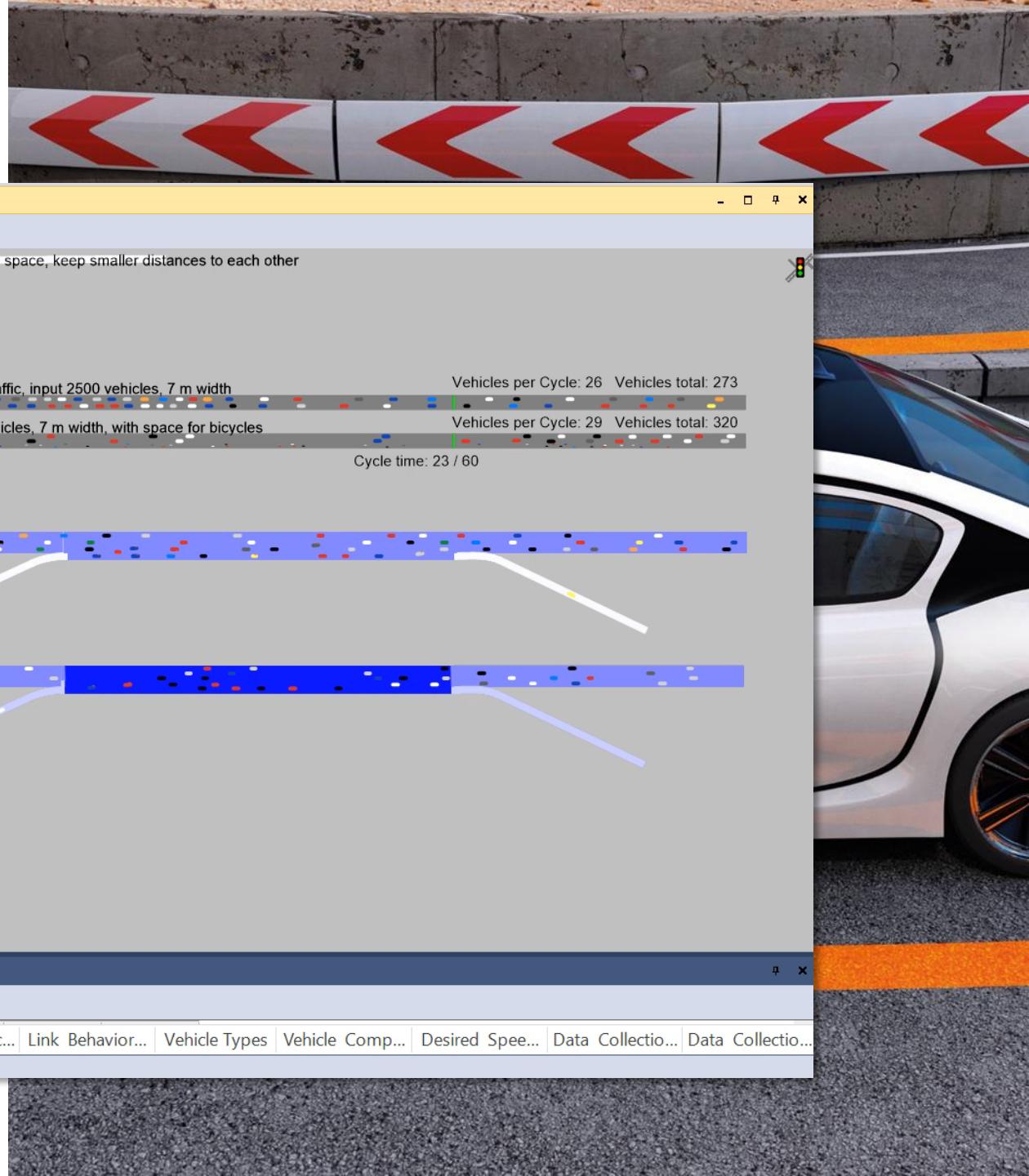
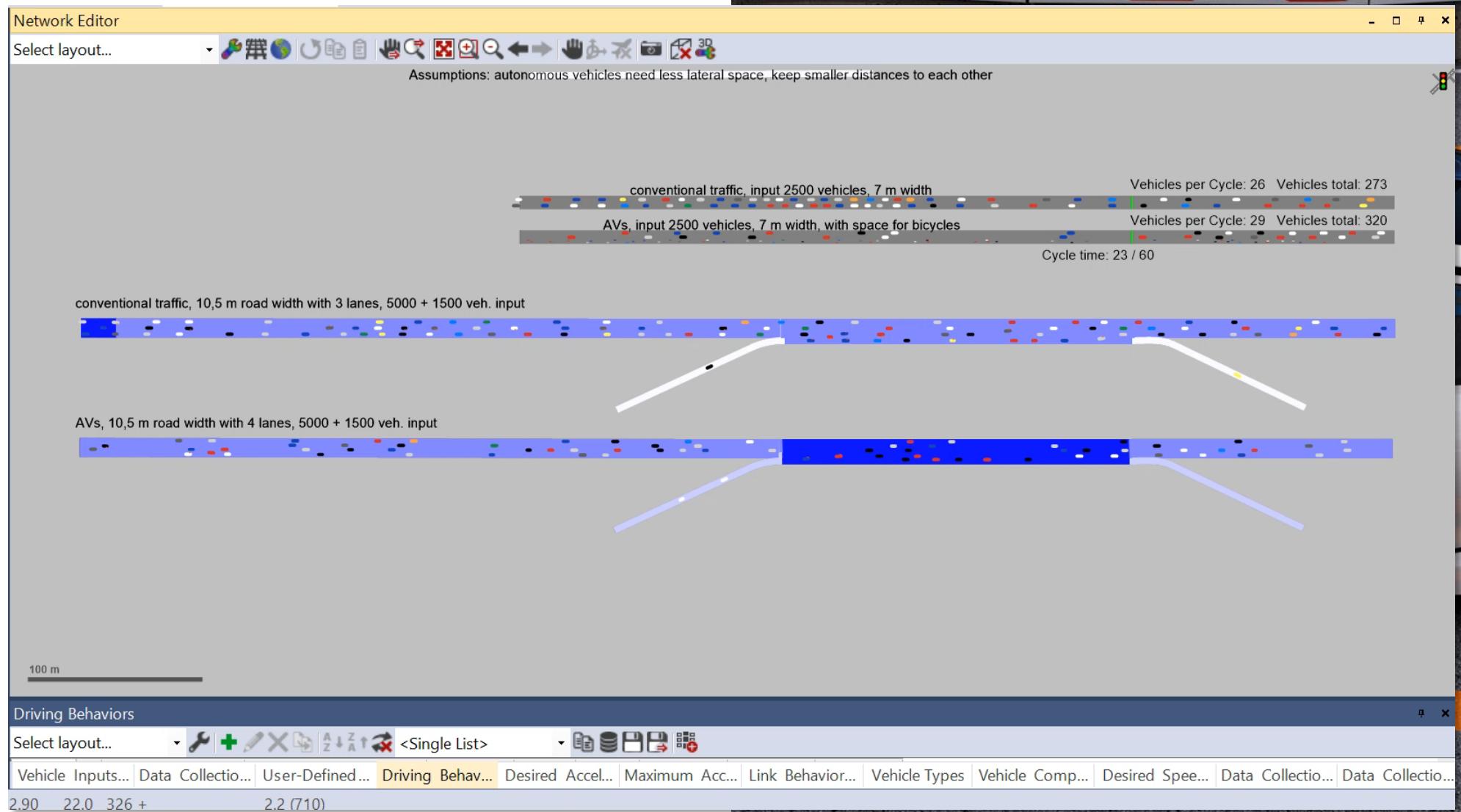
Speeds



C2X via COM Interface



Lane and Lateral Behaviour



How to model CAV's with PTV Vissim

Using EXTERNAL capabilities by PTV Interfaces

COM Interface

Driver Model DLL

Driving Simulator DLL



Platooning via the COM Interface

The screenshot shows the PTV Vissim software interface. On the left, the "Network Editor" window displays a road network with a 100 m scale bar. Below it, the "Scripts" window shows a table of simulation scripts:

Count:	No.	Name	RunType	FromTi	ToTim	Peric	Scope	ScriptFile	FuncName	LinkNo	LaneN
1	1	Initialization	Before simulation	0.00	MAX	100	Simulation	Generate Platoons	Initialization	1.000	
2	2	GeneratePlat	At time step start	5.00	MAX	100	Simulation	Generate Platoons	GeneratePlato	1.000	
3	3	GeneratePlat	At time step start	0.00	MAX	100	Simulation	Generate Platoons	GeneratePlato	1.000	
4	4	CloseUp	At time step end	0.00	MAX	5	Simulation	Generate Platoons	CloseUp	1.000	
5	5	AddToPlatoon	At time step end	0.00	MAX	5	Simulation	Generate Platoons	AddToPlatoon	1.000	
6	6	UpdatePlato	At time step end	0.00	MAX	5	Simulation	Generate Platoons	UpdatePlato	1.000	

At the bottom, status bars show "59,10", "72 + 0", and "2 (142)". To the right, a 3D rendering of the road network and a close-up view of a white car's side mirror are visible.

C2X via the COM Interface

PTV Vissim (x64) 9.00-08 - Network: C:\AVs Webinar\AV5 C2X Speed\AV5 C2X adjust speed at signal.inpx

File Edit View Lists Base Data Traffic Signal Control Simulation Evaluation Presentation Test Scripts Help

Network Objects Network Editor

Entry

North entry: autonomous vehicles (AVs)

Cycle time: 53 / 60

East entry: mixed flow (AVs & CAVs)

Cycle time: 53 / 60

West entry: conventional cars only

Cycle time: 53 / 60

Cycle time: 53 / 60

South entry: connected autonomous vehicles (CAVs)

100 m

Vehicle Types

Select layout... <Single List>

Count	No	Name	Category	Model2D3DDistr	ColorDistr1	OccupDistr	ReceiveSignalInformation
1	100	Car	Car	10: Car	103: BLACK	2: Single Occupancy	<input type="checkbox"/>
2	101	Car-AV	Car	300: Av	105: YELLOW	2: Single Occupancy	<input type="checkbox"/>
3	102	Car-CAV	Car	300: Av	102: RED	2: Single Occupancy	<input checked="" type="checkbox"/>

Quick View Smart Map

153.8:16.3 1072,80 52,0 56 + 0 6,8 (356)

Chart - Fuel Consumption

Fuel Consumption

Route	Fuel Consumption
S-N (CAVs)	~0.55
E-W (AVs + CAVs)	~0.65
N-S (AVs)	~0.65
W-E (cars)	~1.0

Chart - Number of Stops

Number of Stops

Route	Number of Stops
S-N (CAVs)	~0.05
E-W (AVs + CAVs)	~0.55
N-S (AVs)	~0.80
W-E (cars)	~1.10

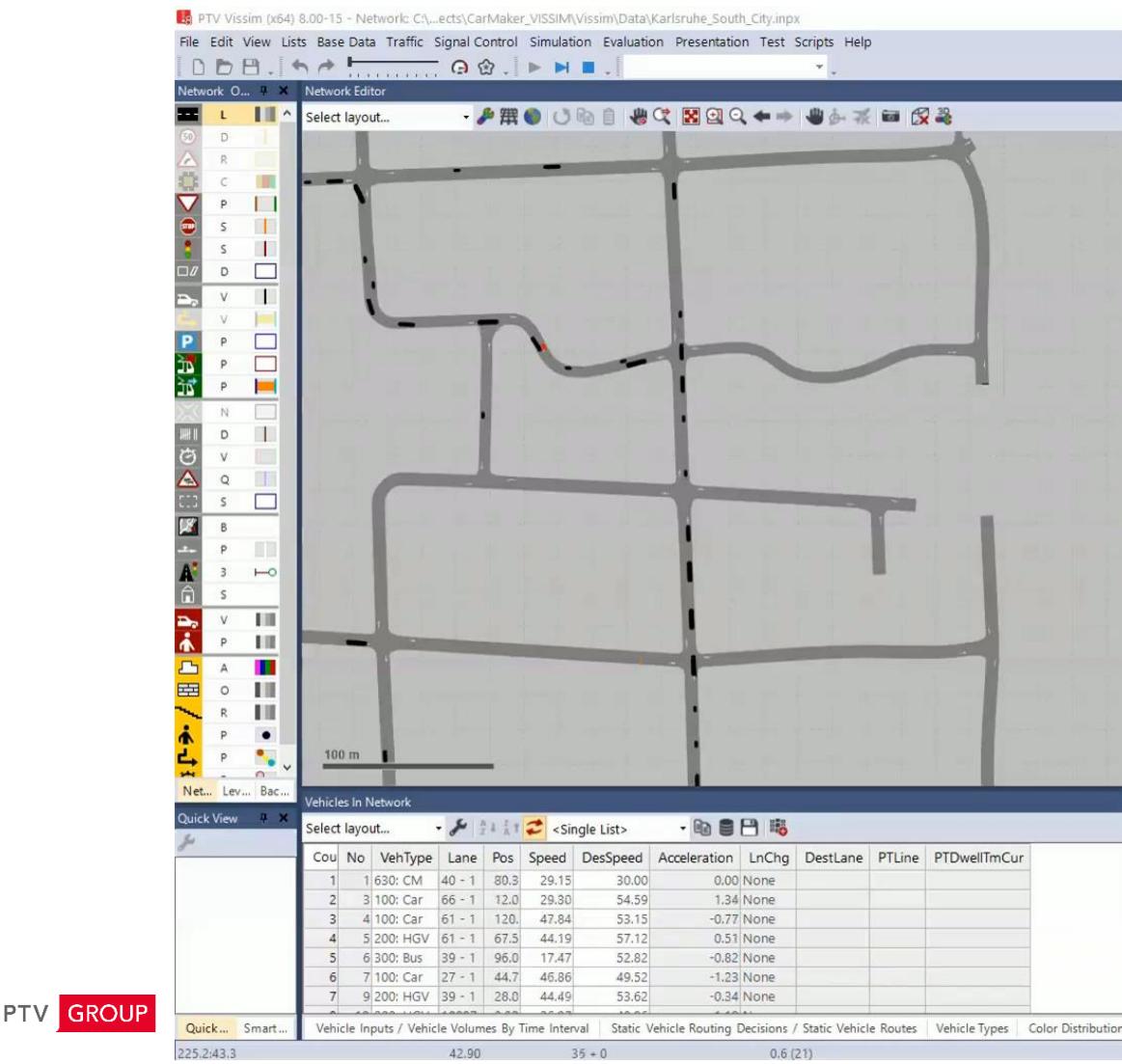
Signal Controllers / Signal Groups

Select layout...

Count	No	Name	CycTm	CycSec	TimeUntilNextGreen	TimeUntilNextRed	SigState
1	1	East en	60	53,0	9,00 s	18,00 s	Red
2	6	South			24,00 s	33,00 s	Red
3	9	West e			39,00 s	48,00 s	Red
4	12	North			54,00 s	3,00 s	Green



Driving Simulator Interface with PTV Vissim



Driving Simulator Interface with PTV Vissim



Vissim + PreScan



the mind of movement

PTV GROUP

tass international

Driving Simulator Interface with PTV Vissim



Questions

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