

Grand Lyon, France

A Real Time Simulation Model for Urban Traffic
Control and Network Optimisation



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Region Director – Asia, Australia, New Zealand

2017 World Road Meeting

Delhi

Context: European OptiCities



- European Research Project
- 7th Framework Programme
- November 2013 – October 2016
- Operation ongoing
- Aimsun Subcontract to SPIE



Partners

[Home](#) > [Consortium](#) > [Partners](#)

The European dimension of the project is ensured by a consortium of 28 partners from 8 EU member states. The consortium includes 8 city authorities, major ITS actors (research institutes, information service providers, car industry) and the most important networks of European cities and international public transport operators.

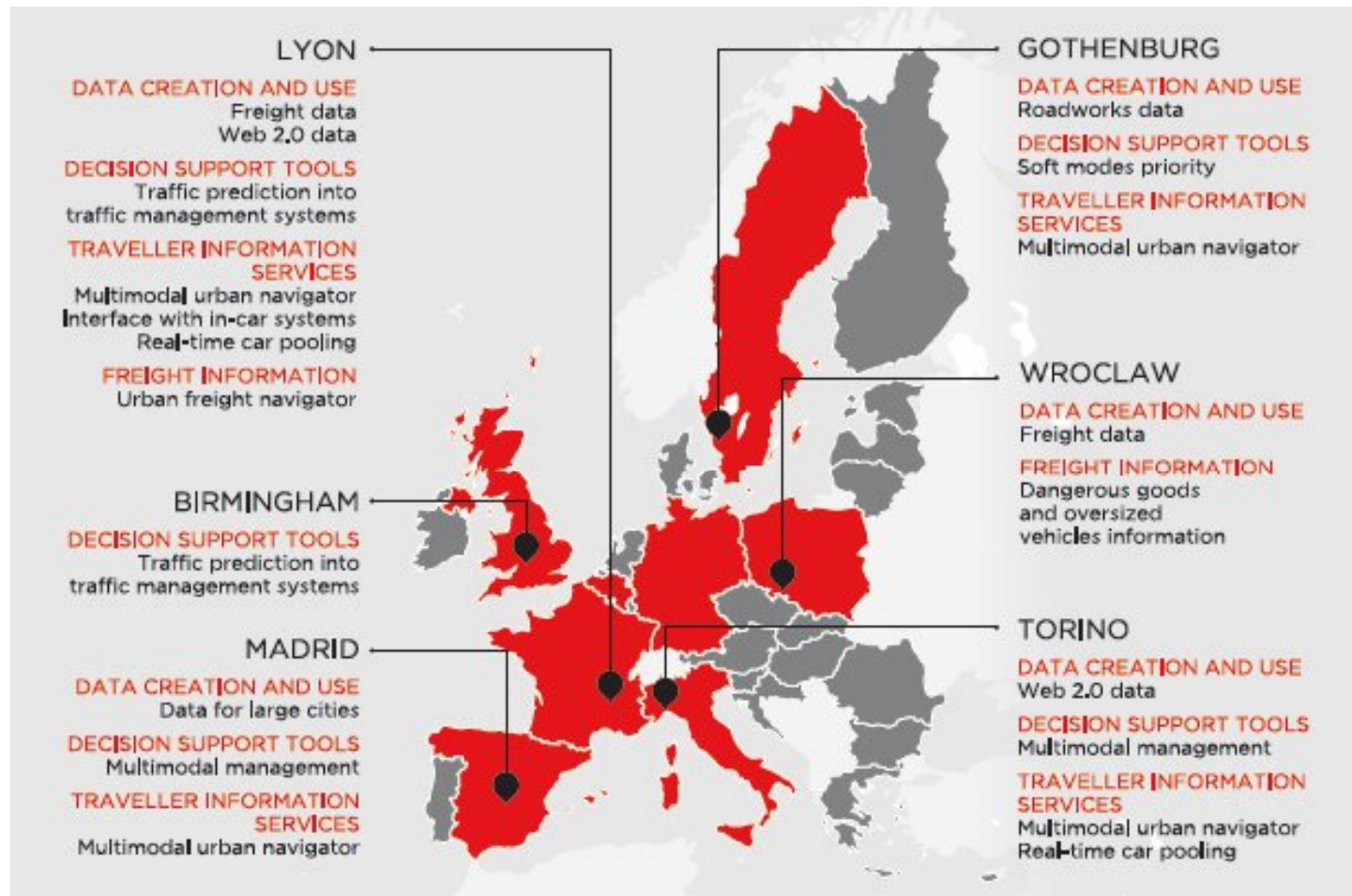
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A Real Time Traffic Simulation & Management Project

- Merging the current Traffic Management System, developed by SPIE, with a real time predictive traffic simulation system, powered by Aimsun Live for the Inner City of Lyon.
- Decision Support System to evaluate and propose an optimal scenario, based from the actual traffic conditions, through control and optimisation of the traffic signal systems.



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A Real Time Traffic Simulation & Management Project

- **Traffic Management System:** “CRITER” (by SPIE)
 - Counts and control in real time
 - Fixed control plans
 - Existing system - Changes plans (manually by TMC user) with time of day
- **Mesoscopic aimsun.live simulations**
- **Input:** 500 traffic counts online (from CRITER)
- **aimsun.live outputs:** Changes in traffic control plans
- **Graphical User Interface:** Via CRITER

The Software Engines: aimsun.next – True Model Integration

A Historical Approach



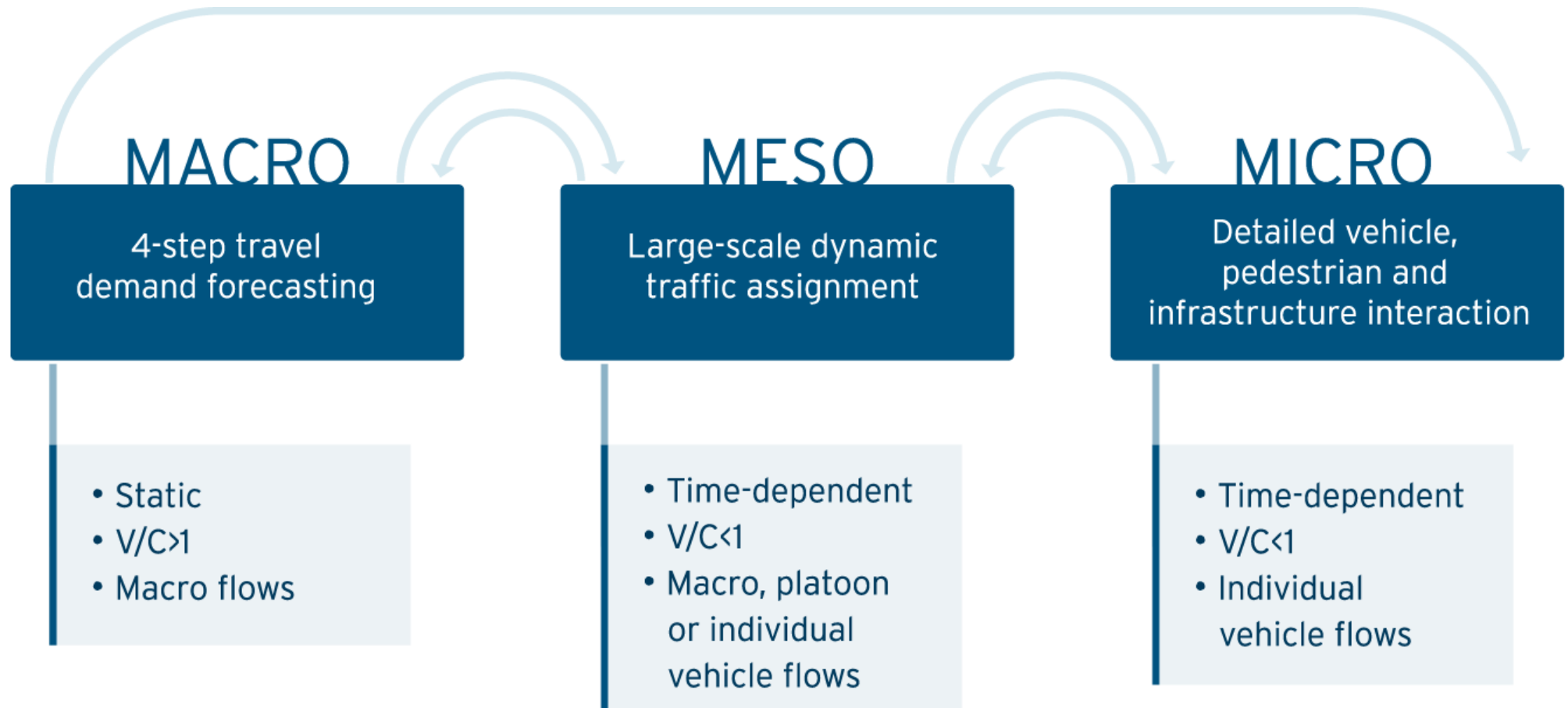
The Aimsun Next Approach



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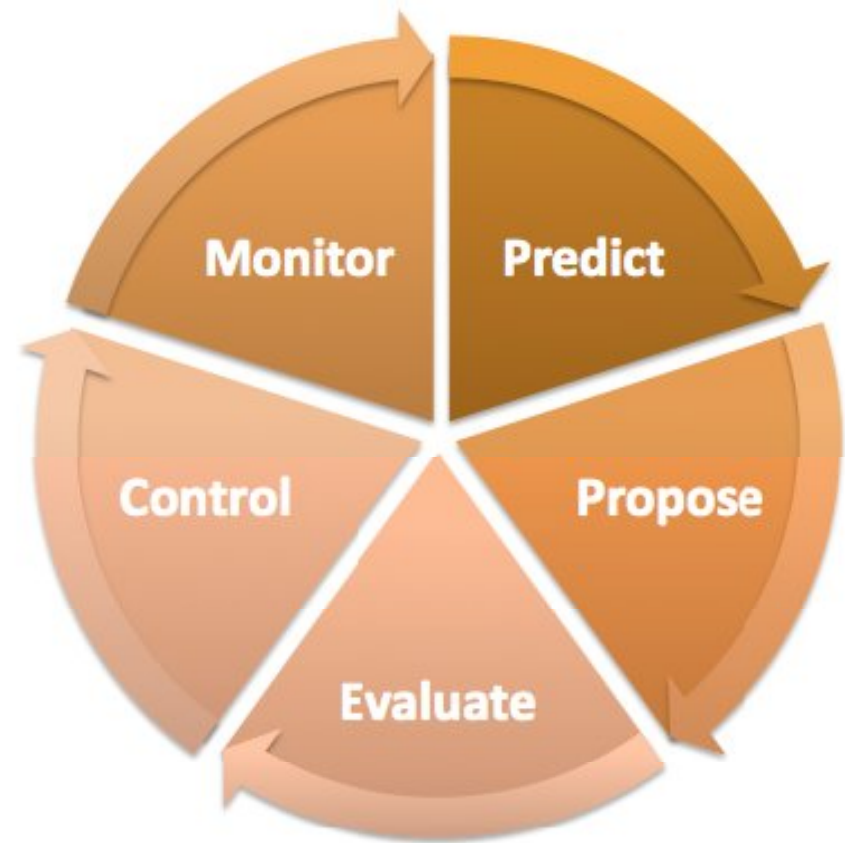
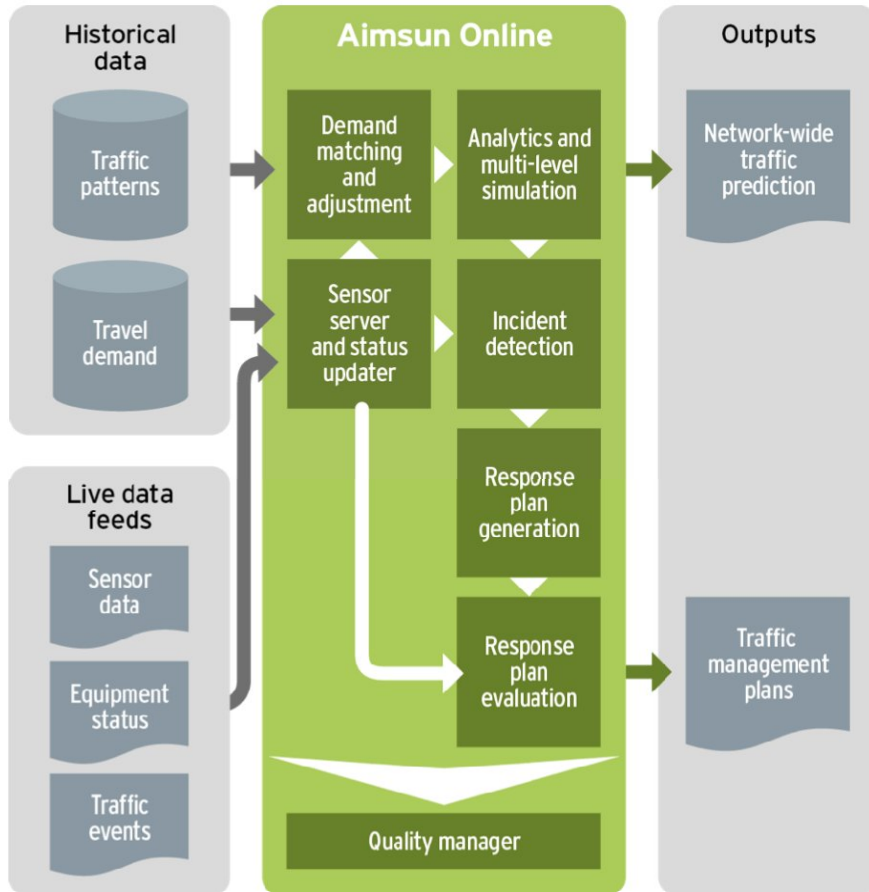
The Software Engines: [aimsun.next](https://www.aimsun.com) – True Model Integration



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The Software Engines: aimsun.live – Real Time Dynamic Simulation

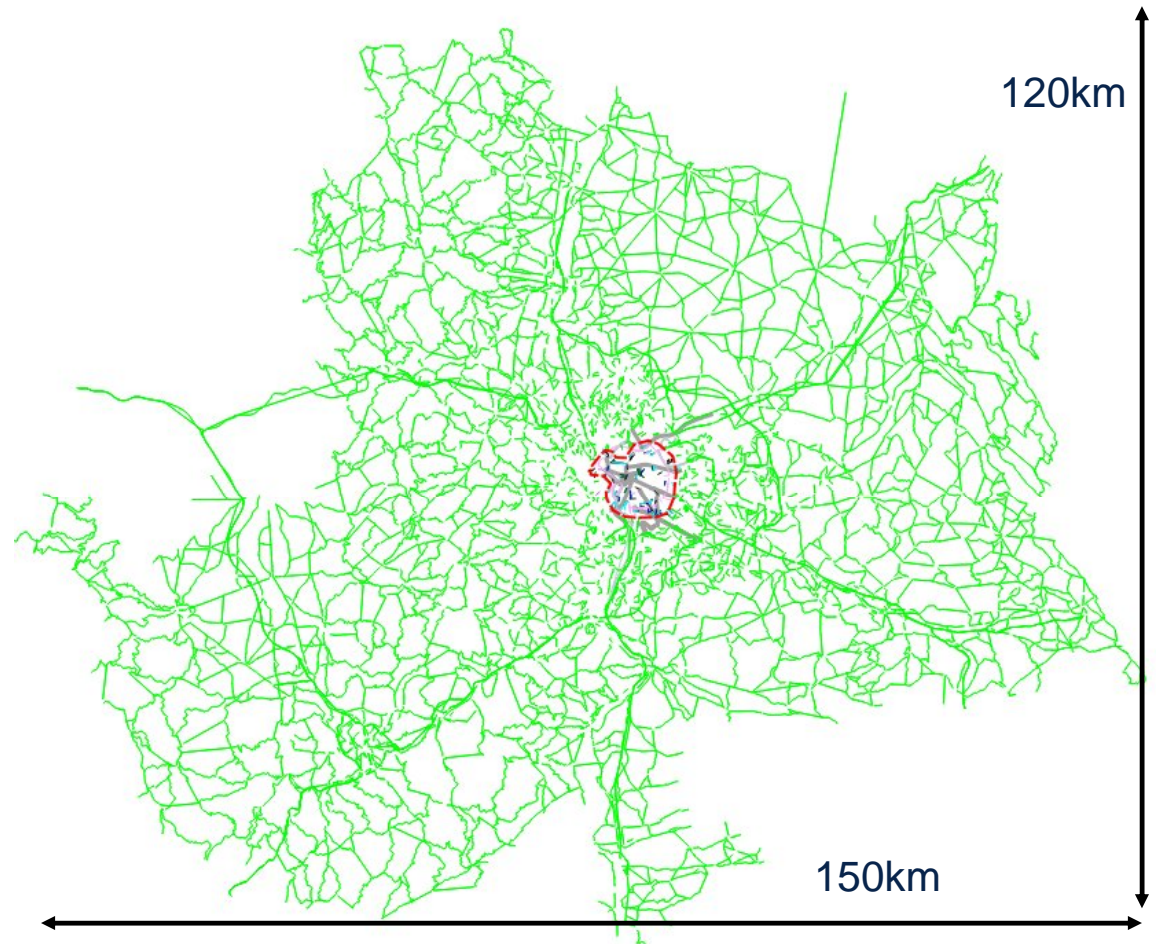


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The Network – Initiated from a pre-existing strategic level model

- **Section length:** 26,000 km
- **Sections:** 127,000
- **Nodes:** 49,000
- **Centroids:** 900
- **Number of trips (peak hour):** 620,000 vehs/hr
- **Cars and Trucks**

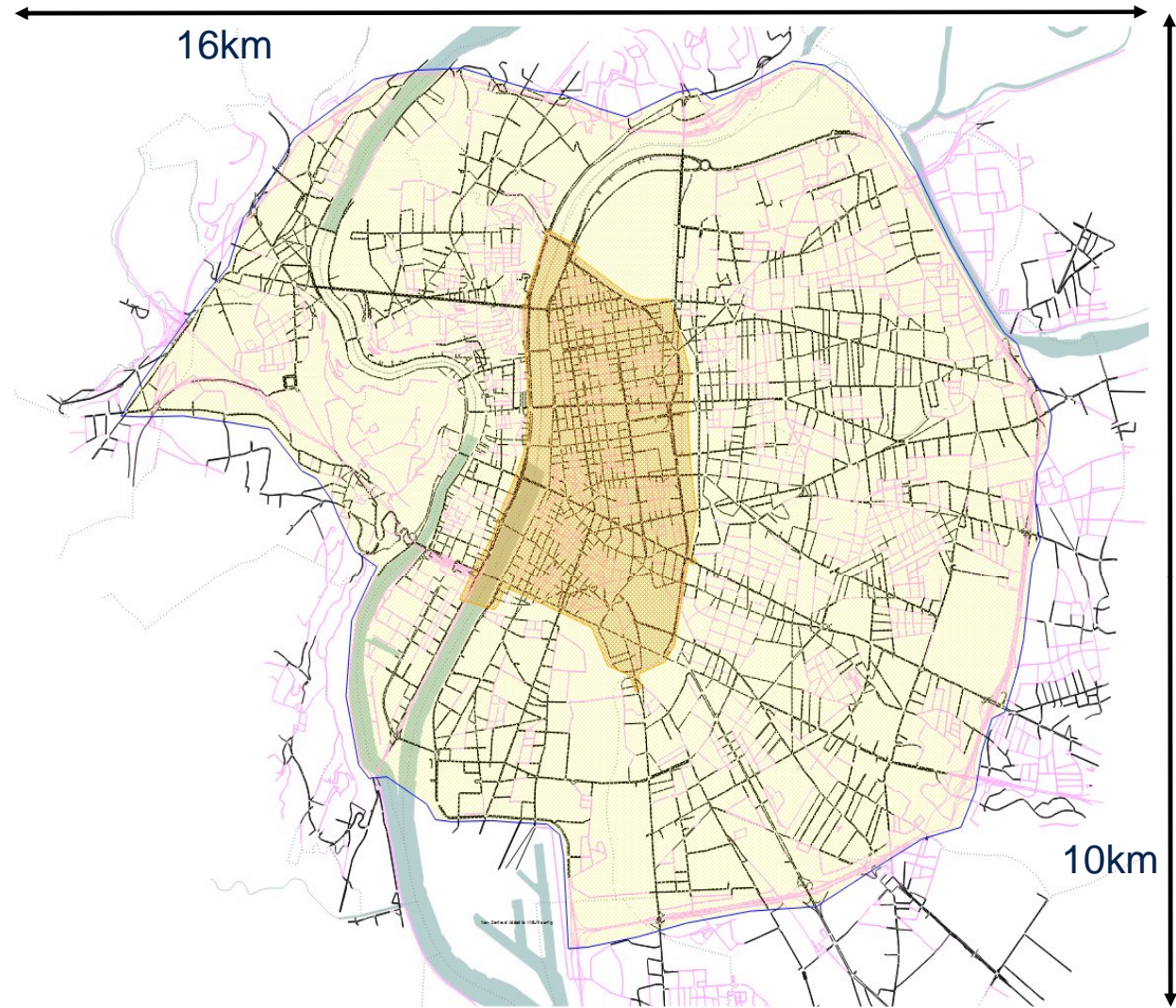


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Simulation Network:

- Compiled in [aimsun.next](#)
- Operating in [aimsun.live](#)
- **Section length:** 1,360 km
- **Lane length:** 1,730 km
- **Sections:** 16,000
- **Nodes:** 7,300
- **Centroids:** 700
- **Number of trips (peak hour):**
172,000veh/h
- **Cars, Trucks and PT**



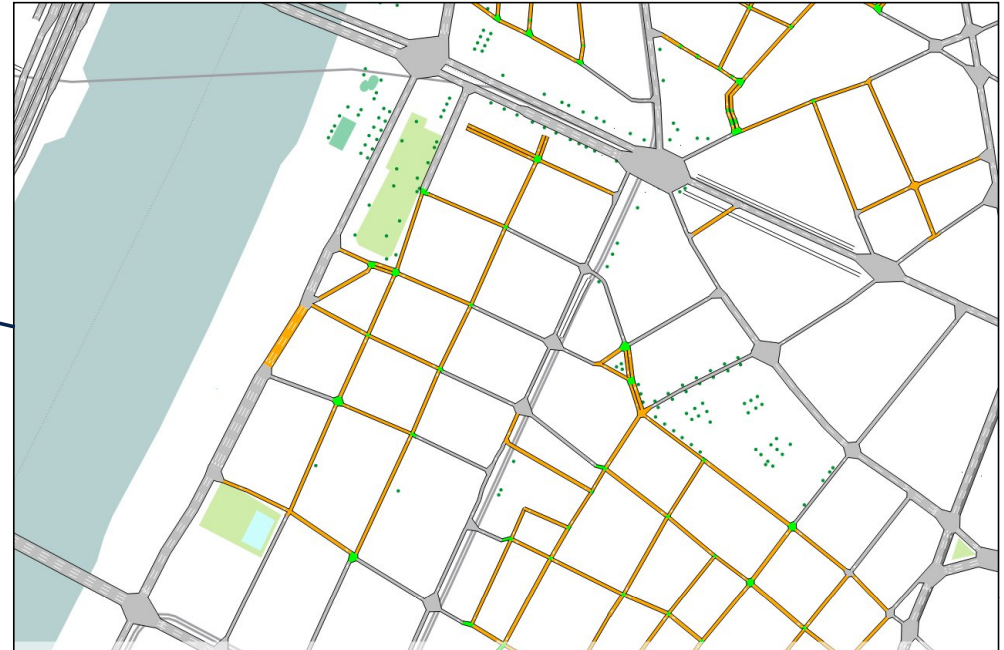
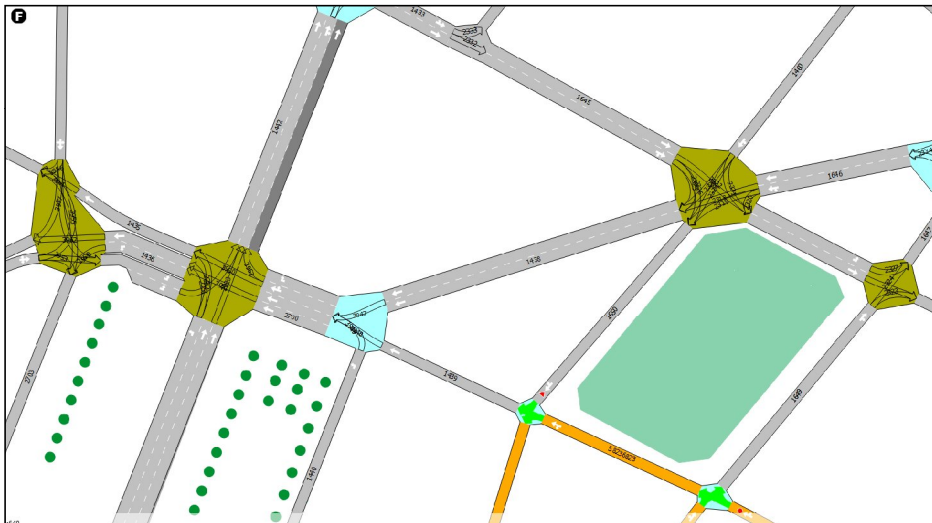
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Network Details

- A combination of:

CRITER database:
Communication with
controls, detectors...



- **Strategic model network:** Providing missing parts/detail of the CRITER network to compile an Aimsun model for all roads in the city.

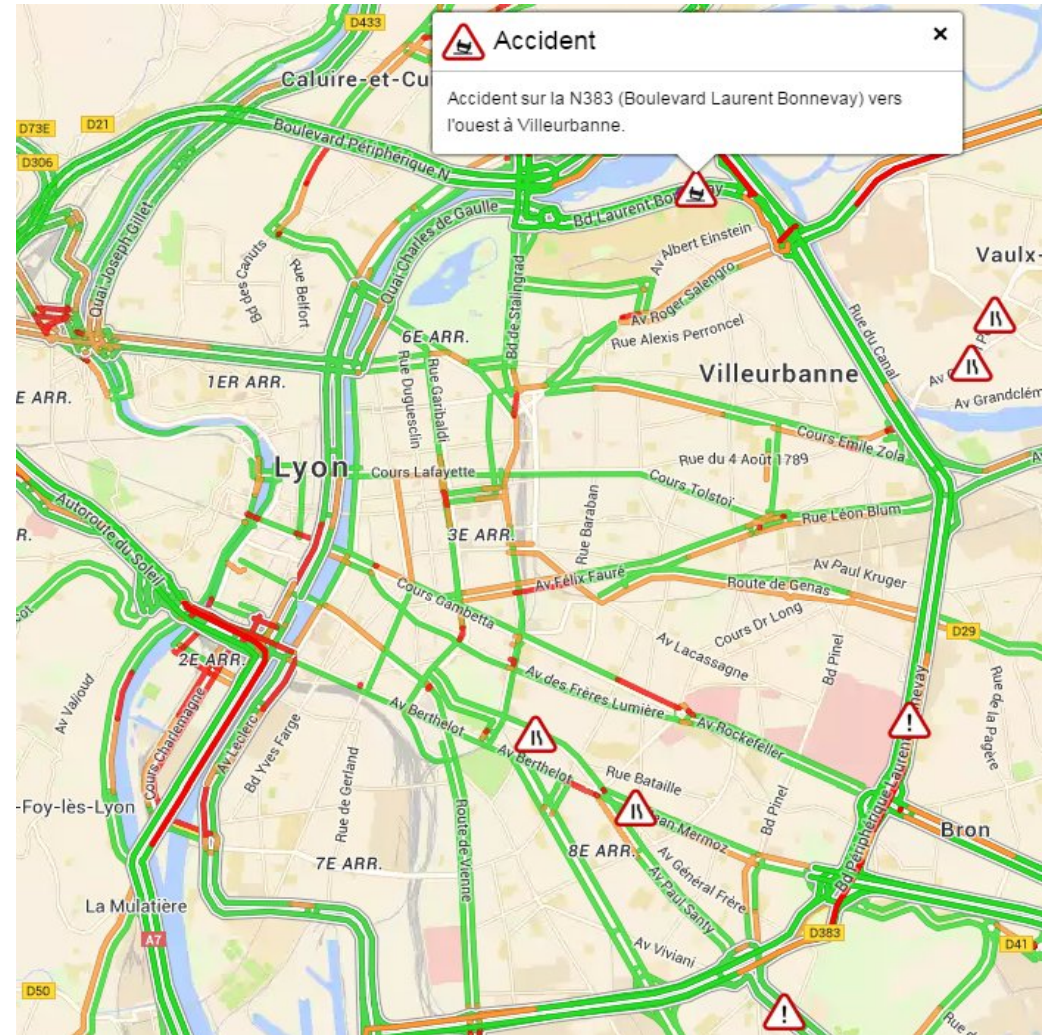
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Traffic and Events:

- Real time “Business as Usual” dynamic traffic simulation
- Running 24/7
- Untypical events - Two types:
 - Planned (Roadwork, modifications of the geometry.... Can be tested in advance)
 - Unplanned (Incidents, accidents....)

Received from the traffic center - To include in parallel scenario simulations (Runtime of 5 minutes, Up to 5 parallel simulations)



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Online Traffic Detection Sites:

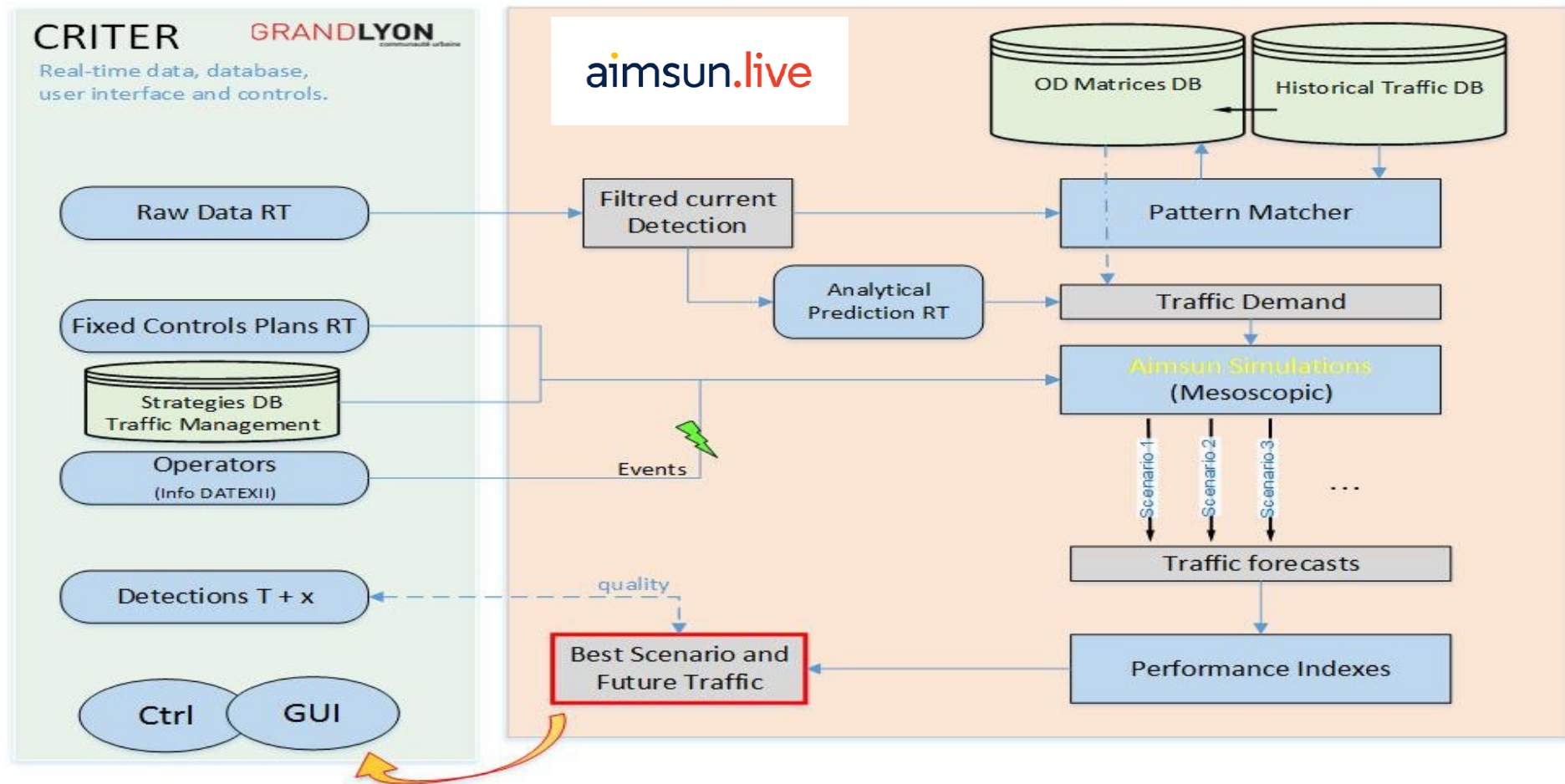


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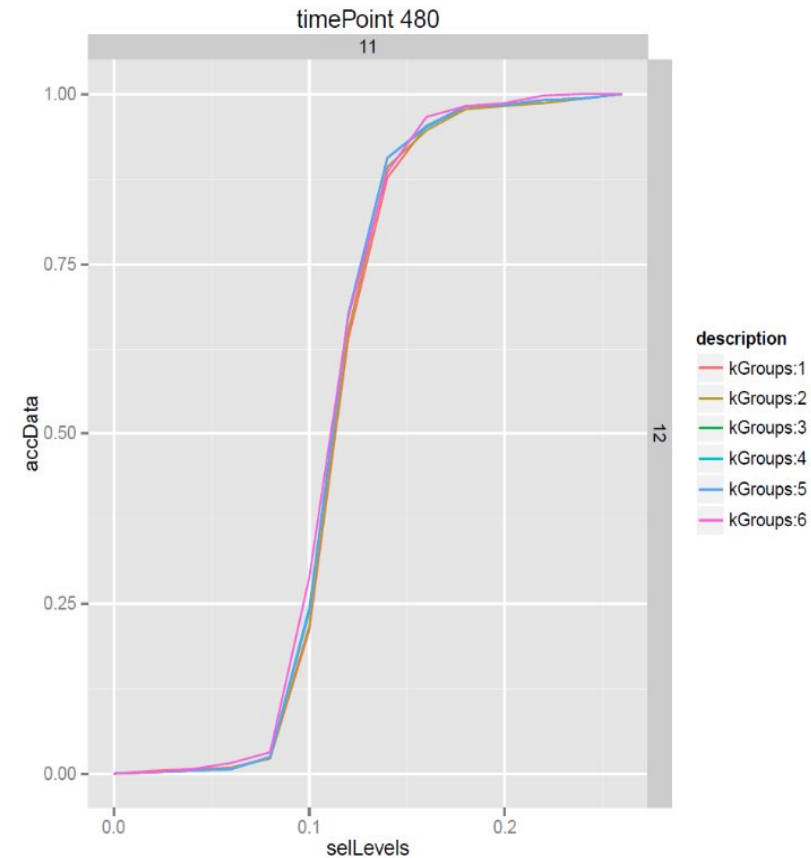
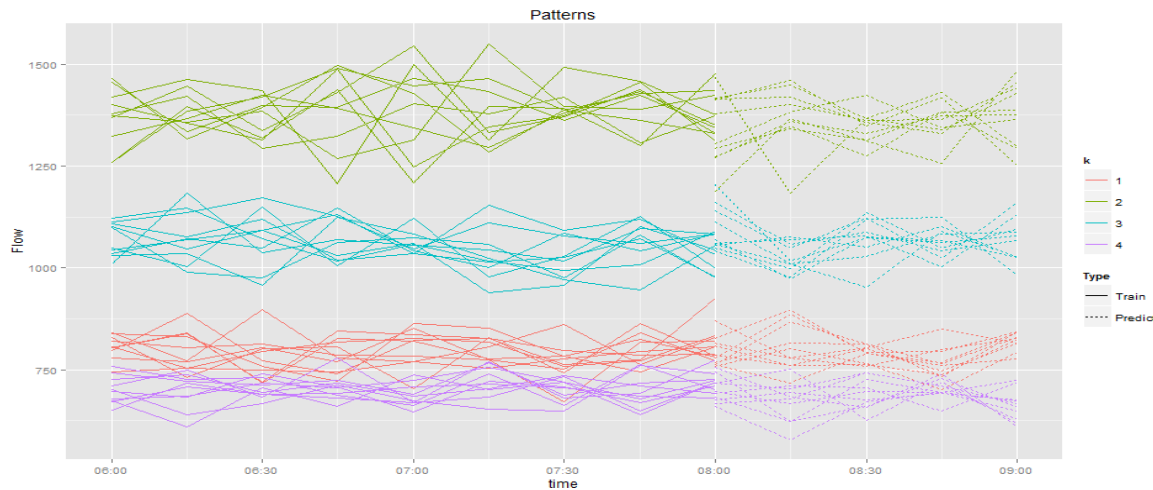


The Detailed Architecture - aimsun.live



Traffic Patterns, Simulation Demands

- Patterns derived from data itself (E.g. Not by 'day of the week' for instance)
- Range of different traffic patterns identified
- Method for patterns discrete clustering: K-means
- 18 minutes aggregation
- 24 hour demand



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Online Management Platform (aimsun.live GUI)

The screenshot displays the 'Dashboard' page of the aimsun.live GUI. The top navigation bar includes 'Dashboard', 'Tasks', 'Logs', and 'Executors', with the user logged in as 'anonymous'. On the left, there are three panels: 'USER ACTIONS' with links for Licenses, Help, and Quit; 'COMPUTER INFO' for SRVOPTICITIES1 (Address: 10.1.130.1, OS: Windows, Version: 8.1, Server 2012 R2, Bits: 64, Cores: 24, RAM: 64GB); and 'EXECUTORS' listing IP addresses 10.1.130.2 and 10.1.130.3. Below these is a line graph showing a fluctuating blue line over time. The main area contains seven server status cards, each with a green 'Kill' button and a status indicator (green square):

- Controller**: No running tasks, No queuing tasks. Uptime: 04:28:46.
- Sensor Server**: Patterns: 5. Real Time: Mon Sep 05 2016 17:09:00 GMT+0200 (Romance Standard Time). Detectors Received: 1079, Data Reliability (18 min): 66.368. Forecasted: Mon Sep 05 2016 18:00:00 GMT+0200 (Romance Standard Time). Uptime: 04:28:46. [More Info](#)
- Map Server**: Model UID: {5a886161-61c5-471d-b730-0b2161d79ba8}. Model Name: PROJET. Model Location: //10.1.130.1/AOData/SIM/Lyon_239_81_24_03.ang. Model DB: QPSQL://postgres@10.1.130.1:5432/lyon. Uptime: 04:28:42. [View Map](#)
- Pattern Matcher**: Current Pattern: 1. Uptime: 04:28:46.
- APM Server**: Running an Analytical + Simulation + Adjustment process for Mon Sep 05 2016 17:06:00 GMT+0200 (Romance Standard Time). Uptime: 04:28:46. [More Info](#)
- Quality Server**: Prediction vs Real: Mon Sep 05 2016 17:06:00 GMT+0200 (Romance Standard Time) QM: 73.16%. Simulation vs Real: Mon Sep 05 2016 17:06:00 GMT+0200 (Romance Standard Time) QM: 66.97%. Uptime: 04:28:46. [More Info](#)
- Model Updater Server**: Model still not updated. Next Model Update: Uptime: 04:28:46.

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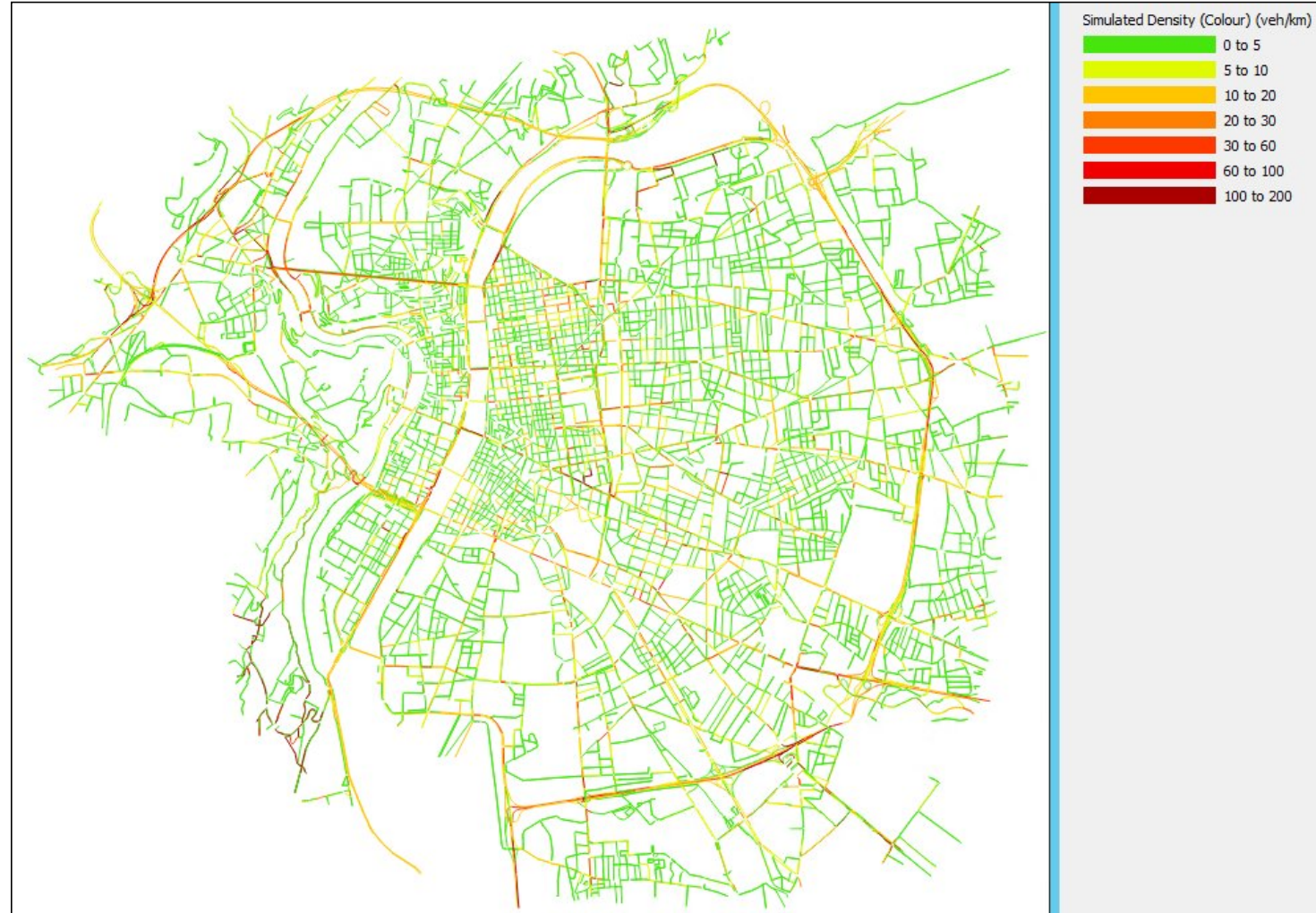
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Mesoscopic Simulation:

aimsun.next

aimsun.live



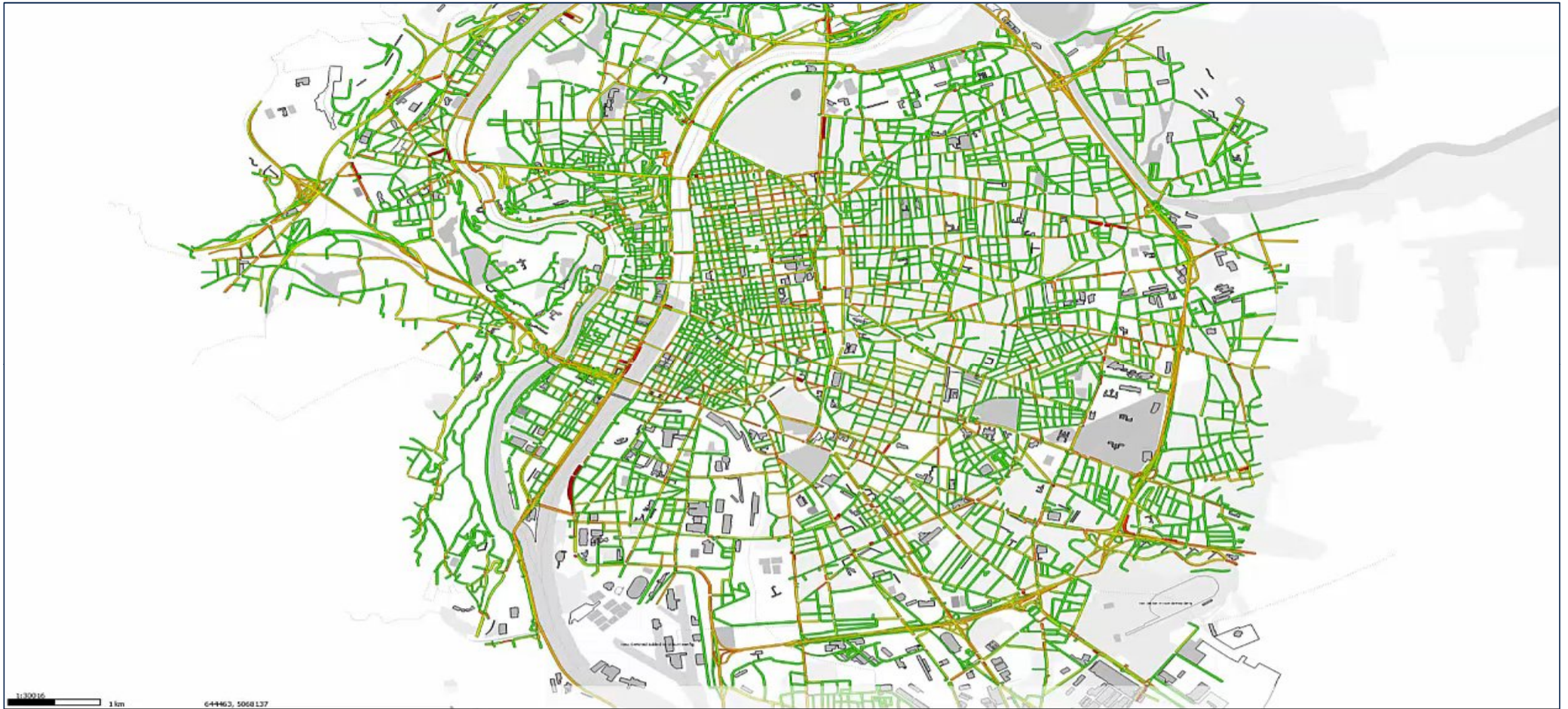
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aimsun.


City of Lyon: Mesoscopic Simulation



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Simulation Quality Management: Module Outputs

Prediction vs Real Simulated vs Real RTSS vs Real  Prediction vs Real Simulated vs Real RTSS vs Real Logged in as anonymous

10 records per page

Prediction Time	Global QM	QM 18 minutes
2016-04-11T14:06:00.000Z to 2016-04-11T15:00:00.000Z	95.55	97.41
2016-04-11T13:48:00.000Z to 2016-04-11T14:42:00.000Z	92.36	91.76
2016-04-11T13:30:00.000Z to 2016-04-11T14:24:00.000Z	79.45	77.9
2016-04-11T13:12:00.000Z to 2016-04-11T14:06:00.000Z	88.31	96.05
2016-04-11T12:54:00.000Z to 2016-04-11T13:48:00.000Z	92.04	91.84
2016-04-11T12:36:00.000Z to 2016-04-11T13:30:00.000Z	92.33	95.39
2016-04-11T12:18:00.000Z to 2016-04-11T13:12:00.000Z	91.01	94.24

USER ACTIONS
[Licenses](#)
[Help](#)

10 records per page Search:

Prediction Time	Global QM	QM 18 minutes	QM 36 minutes	QM 54 minutes
2016-09-06T05:06:00.000Z to 2016-09-06T06:00:00.000Z	77.66	85.39	77.69	69.89
2016-09-06T04:48:00.000Z to 2016-09-06T05:42:00.000Z	85.05	90.32	87.66	77.16
2016-09-06T04:30:00.000Z to 2016-09-06T05:24:00.000Z	93.3	95.96	94.08	89.87

Prediction vs Real Simulated vs Real RTSS vs Real Logged in as anonymous

10 records per page Search:

Simulation Time	Global QM	QM 18 minutes	QM 36 minutes	QM 54 minutes	R2 18 minutes	R2 36 minutes	R2 54 minutes	Slope 18 minutes	Slope 36 minutes	Slope 54 minutes
2016-09-06T05:06:00.000Z to 2016-09-06T06:00:00.000Z	93.35	81.66	100	98.39	0.65	0.76	0.8	0.54	0.67	0.83
2016-09-06T04:48:00.000Z to 2016-09-06T05:42:00.000Z	89.72	88.82	80.34	100	0.73	0.66	0.77	0.85	0.6	0.74
2016-09-06T04:30:00.000Z to 2016-09-06T05:24:00.000Z	88.1	92.77	89.22	82.33	0.5	0.75	0.65	0.62	0.92	0.63
2016-09-06T04:12:00.000Z to 2016-09-06T05:06:00.000Z	93.25	97.09	95.22	87.44	0.63	0.55	0.73	0.69	0.64	0.94
2016-09-06T03:54:00.000Z to 2016-09-06T04:48:00.000Z	95.98	98.75	96.6	92.61	0.52	0.59	0.56	0.66	0.68	0.74
2016-09-06T03:36:00.000Z to 2016-09-06T04:30:00.000Z	97.19	96.85	97.93	96.79	0.22	0.47	0.61	0.5	0.63	0.74
2016-09-06T03:18:00.000Z to 2016-09-06T04:12:00.000Z	93.33	84.4	97.73	97.84	0.42	0.24	0.49	1.59	0.52	0.65
2016-09-06T03:00:00.000Z to 2016-09-06T03:54:00.000Z	92.29	95.8	84.24	96.84	0.45	0.38	0.25	0.69	1.59	0.56
2016-09-06T02:42:00.000Z to 2016-09-06T03:36:00.000Z	86.84	83.7	95.35	81.46	0.4	0.47	0.37	1.39	0.74	1.82

Real Simulated vs Real RTSS vs Real

10 records per page

Simulation Time	Global QM	QM 18 minutes	QM 36 minutes	QM 54 minutes
2016-04-11T13:12:00.000Z	89.07	91.08	87.13	88.99
2016-04-11T12:00:00.000Z	85.68	88.78	82.46	85.8
2016-04-11T11:42:00.000Z	89.65	90.28	89.97	88.7
2016-04-11T11:24:00.000Z	88.94	91.78	89.03	86.01
2016-04-11T11:06:00.000Z	88.14	87.42	88.97	88.02
2016-04-11T09:00:00.000Z	76.88	63.13	80.96	86.54
2016-04-11T07:30:00.000Z	87.45	87.15	88.11	87.1
2016-04-11T07:12:00.000Z	88.49	89.8	88.09	87.57
2016-04-11T06:36:00.000Z	77.97	53.81	93.02	87.08
2016-04-11T05:42:00.000Z	86.1	87.97	83.26	87.08

Showing 1 to 10 of 204 entries

ation Systems

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Key Performance Indicators (KPI's)

- **Overall fluidity**
 - Difference between the journey time in free condition and the one simulated.
- **Dynamic Congestion**
 - Congestion level in the network. It penalizes congestions which remains at the end of simulation (not absorbed).
- **Respect of the network hierarchy "preserve quite area"**
 - Coefficient of determination of traffic values on major roads.
- **Pedestrians comfort "multimodal indicator"**
 - Number of pedestrian signals with delay > 20s.
- **Number of activated alerts**
- **Active alerts that could be triggered by the simulation**

Thanks for listening!

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