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Breaking new ground in how we manage large transport networks: data analytics, AI and real-time simulation prediction

Mohammad Saifuzzaman

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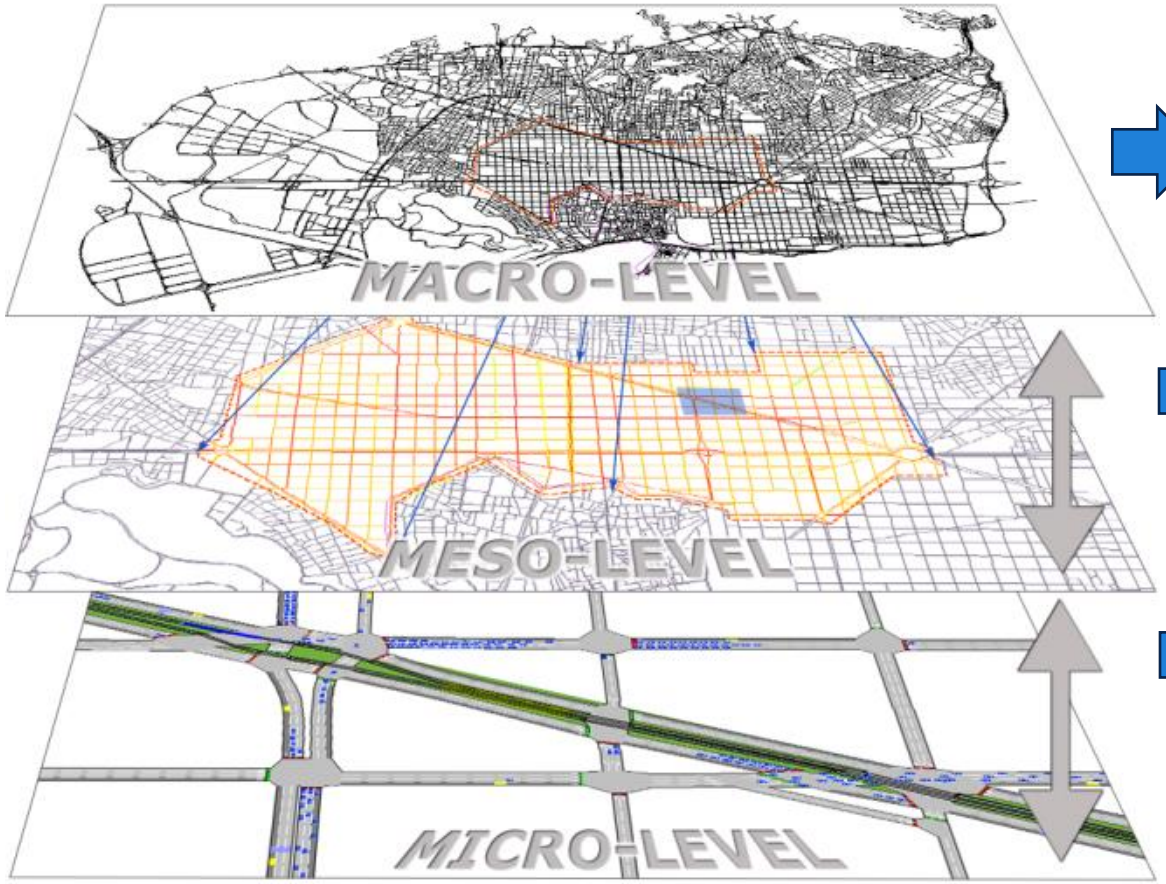
Multi-resolution modelling



Static models
Long term planning
Demand modelling
State/Region-wide models

Dynamic models
City-wide models (meso)
Medium-long term planning

Driver behaviour model (micro)
Short term planning
Operation analysis
Unexpected events
Environmental analysis
Congestion charging
ITS, AV, CAV

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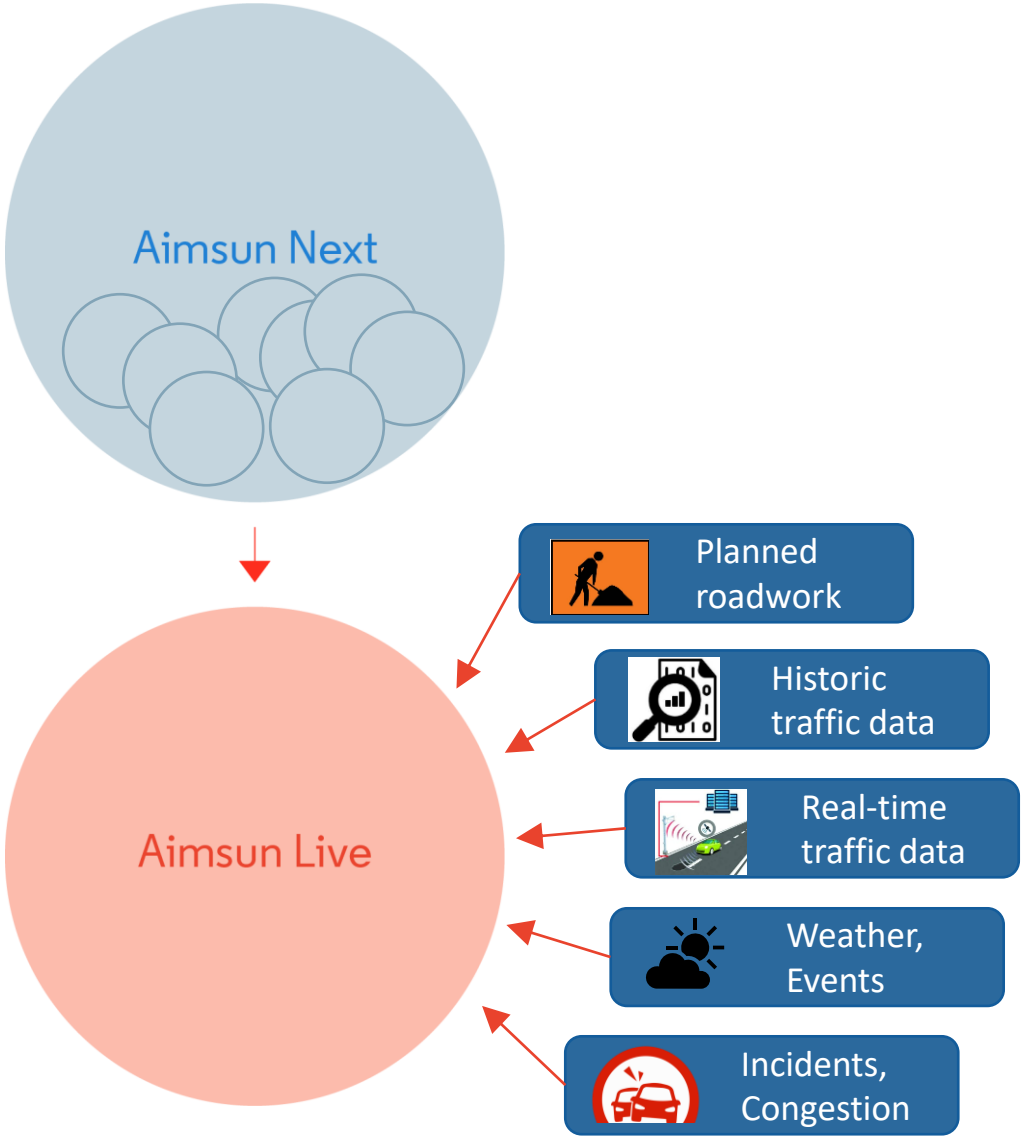
From Aimsun Next to Aimsun Live

Offline

- Micro-meso-macro integration
- Large-scale static and dynamic models
- Faster than real time
- Planning/operational model

Real-time

- Monitoring
- Prediction for next 60-120min
- Decision support



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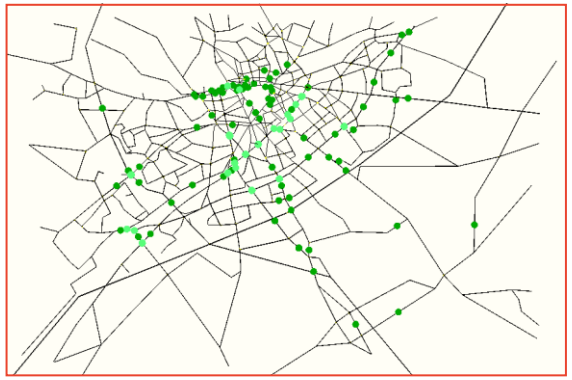
Monitoring

- From a limited set of detectors to a full network coverage

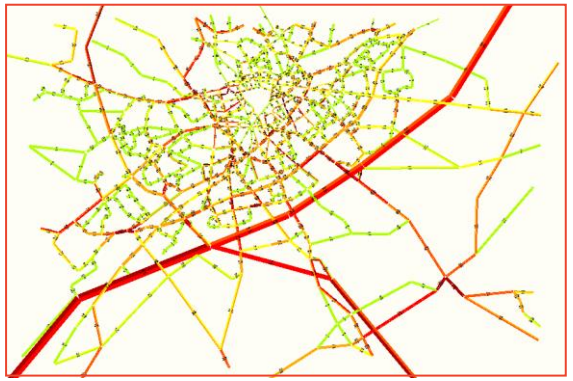
Traffic Monitoring in Real Time

Quality indicators
Daily reports
Monthly reports

Sensors



Real Time Monitoring t = 8:00:00



Prediction

- Analytical and simulation-based

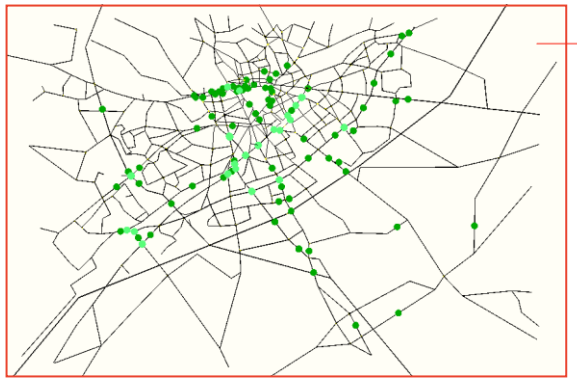
Traffic Monitoring in Real Time

Short term simulated forecasts (for all sections of the model)

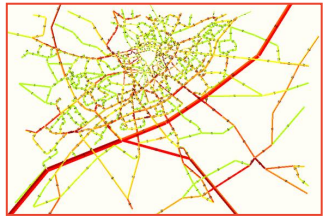
Short term analytical forecasts (for all detectors of the model)

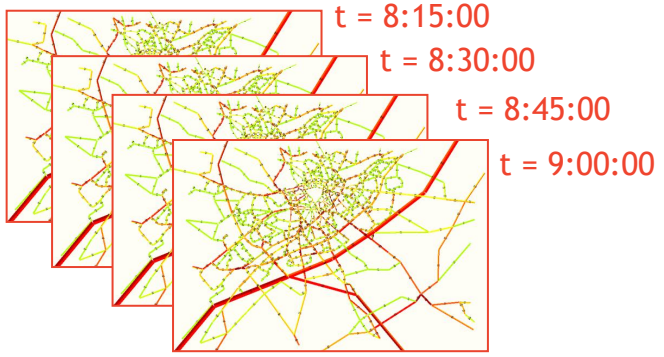
Quality indicators
Daily reports
Monthly reports

Sensors



Monitoring t = 8:00:00





t = 8:15:00
t = 8:30:00
t = 8:45:00
t = 9:00:00

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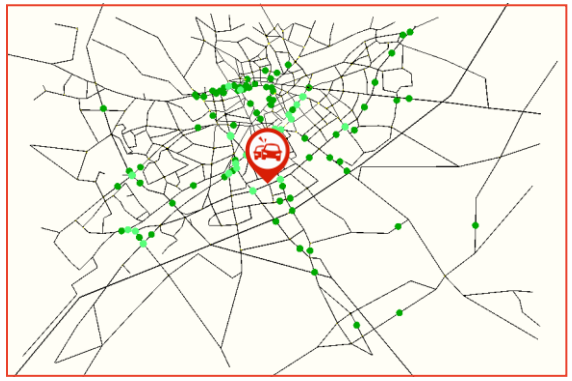
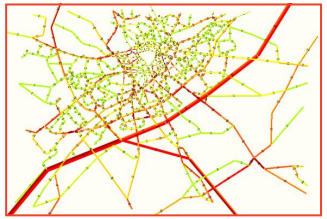
Decision support

Indicators and choice of the best strategy



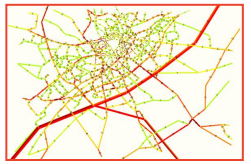
Assessment of different response plans

«Do-nothing» scenario

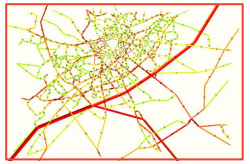


Scenario A
Score = 23

Scenario B
Score = 30



Scenario C
Score = 15



Proactive traffic management

Old	Detect	Verify	Respond
New	Predict	Act	Prevent

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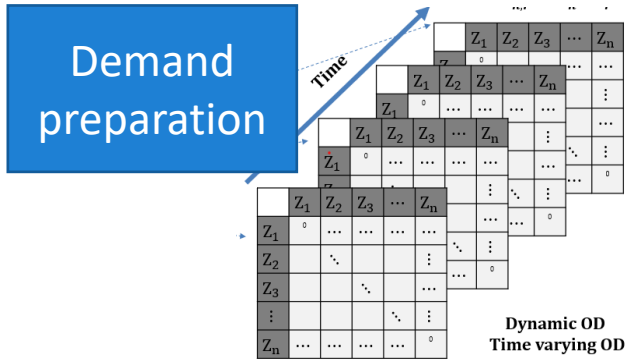
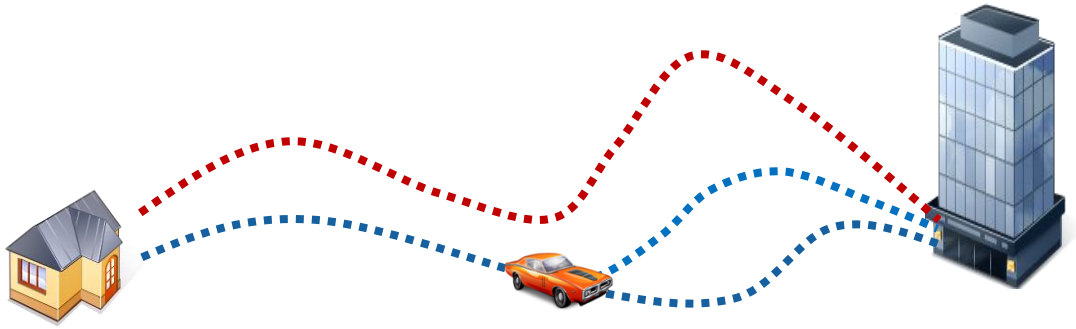
Research to improve Aimsun Live processes

Aimsun Live launches one simulation every 5min

- What demand to go with that simulation
- What routes will the vehicle choose
- What are the optimum network parameters





Research objectives

Partially automatize model calibration tasks

Improve model performance

Faster processes

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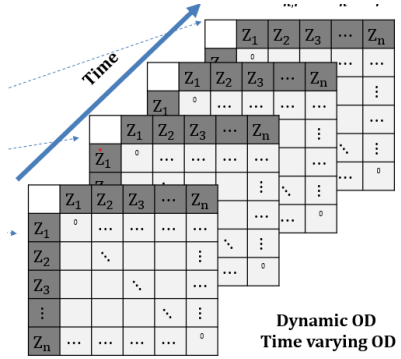
1-027: Advanced data analytics for real-time demand calibration and prediction in large scale networks

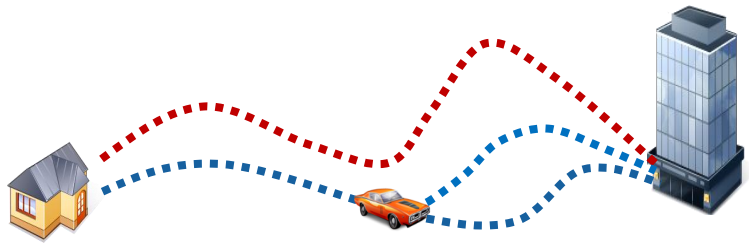
Activity 1: Develop a systematic framework to establish a library of traffic states and OD matrices from real traffic data

Activity 2: Develop short term traffic demand matching model for real time traffic simulation of urban networks

Activity 3: Enrich simulation model by offline calibration of route choice models using real traffic observations

Activity 4: Integration, testing, and further refinement of the developed modules on TMR node





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1-025: Advanced data analytics for real-time demand calibration and prediction in large scale networks

Activity 1: Develop proxy Aimsun Live model for offline development

Activity 2: Develop the AI-assisted calibration module based on data-driven machine learning techniques for analysing disparities between Aimsun Live's model results and observed data

Activity 3: Develop the pattern refinement module that maps traffic patterns with associated optimal parameter set for Aimsun Live

Activity 4: Develop the prediction confidence module

Activity 5: Integration, testing and further refinement of the developed modules

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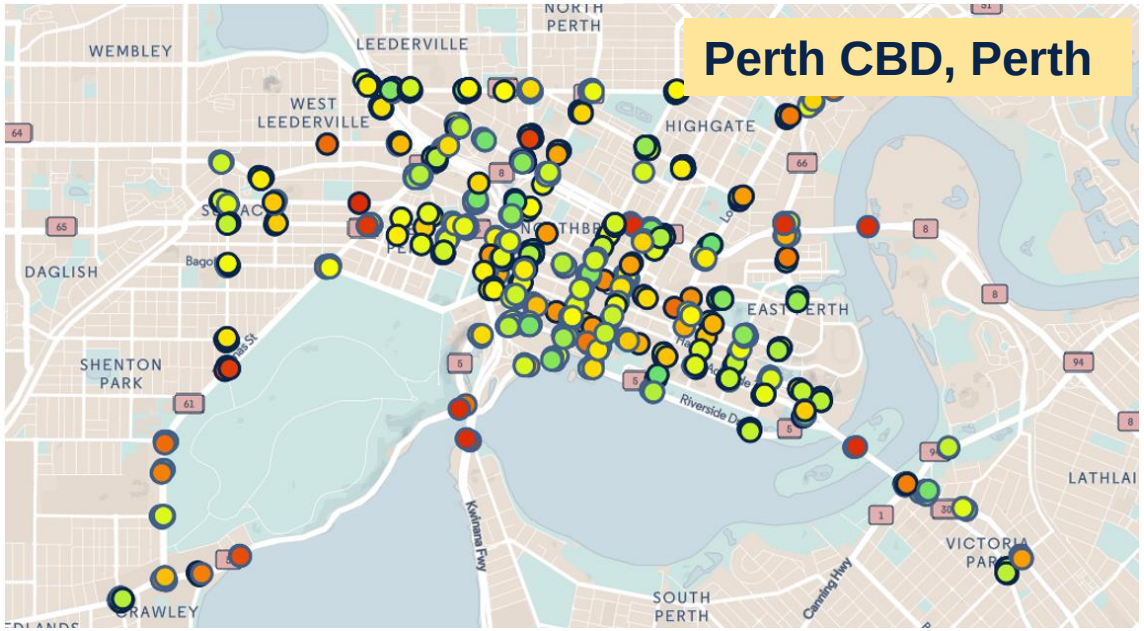
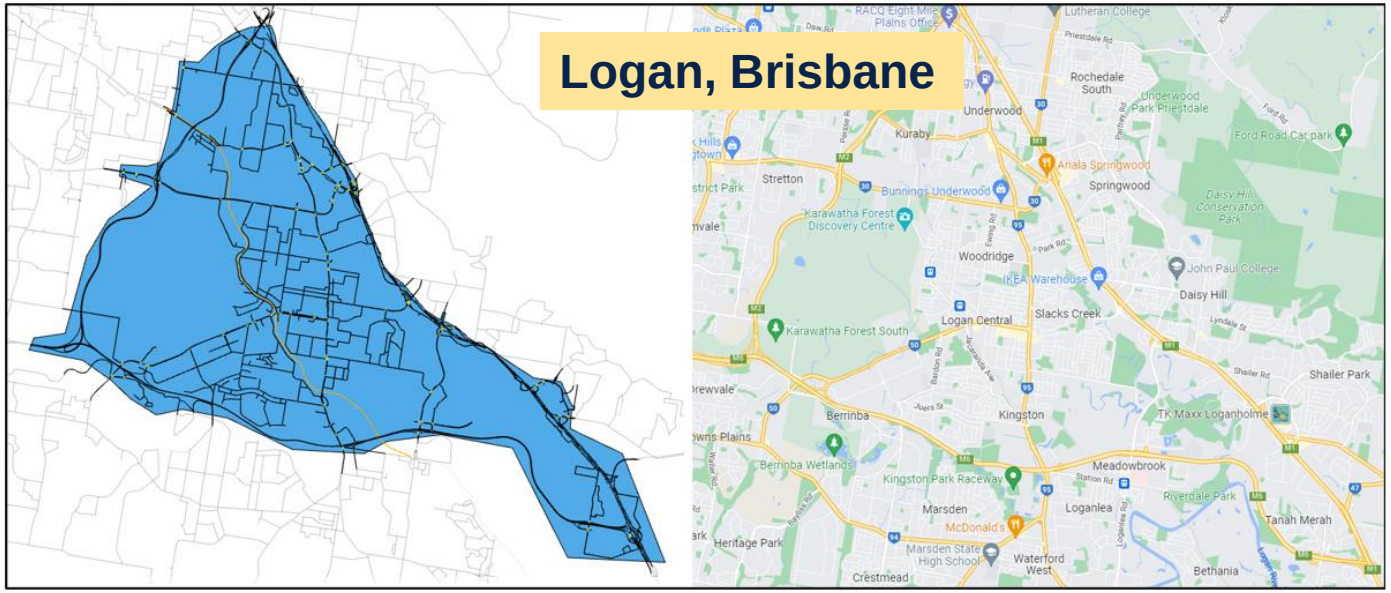
Test bed for the research

- Aimsun has developed two Aimsun Live test-beds
- Analysed/cleaned the historical data
- Calibrated the base models
- Deployed Aimsun Live pilot for the clients
- Transferred all the historical data, model and related information to the respective universities





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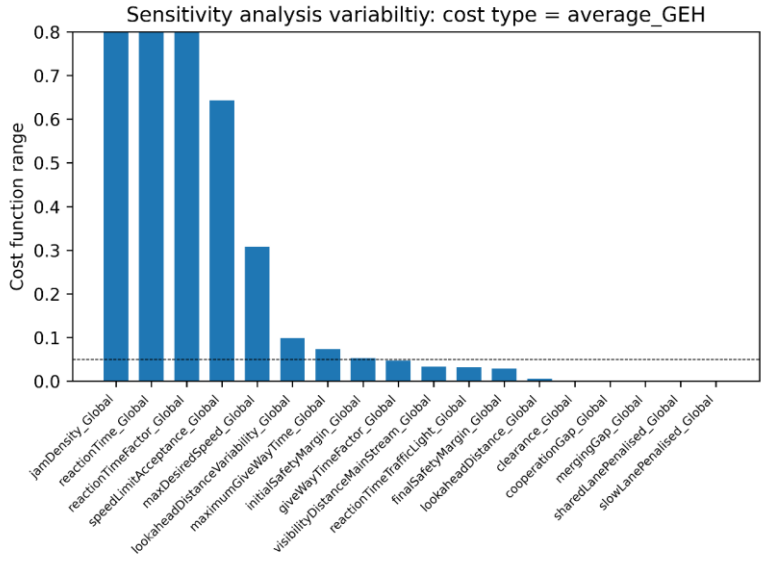
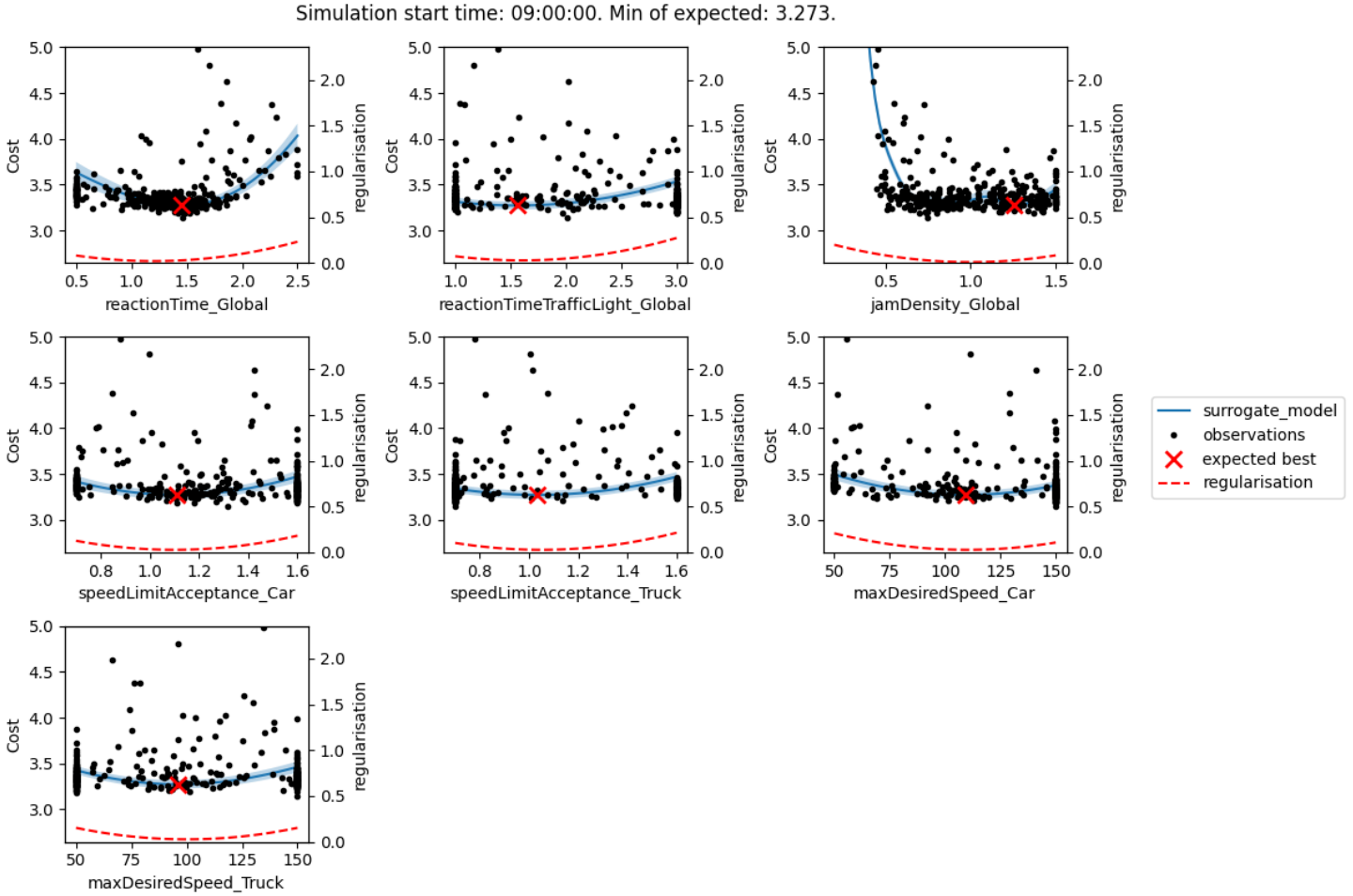
1-025 Activity 2: Develop the AI-assisted calibration module





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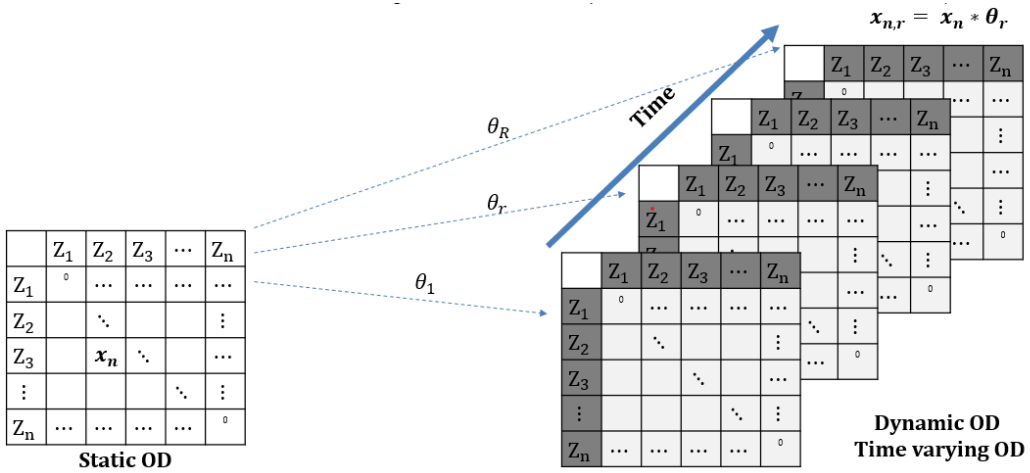
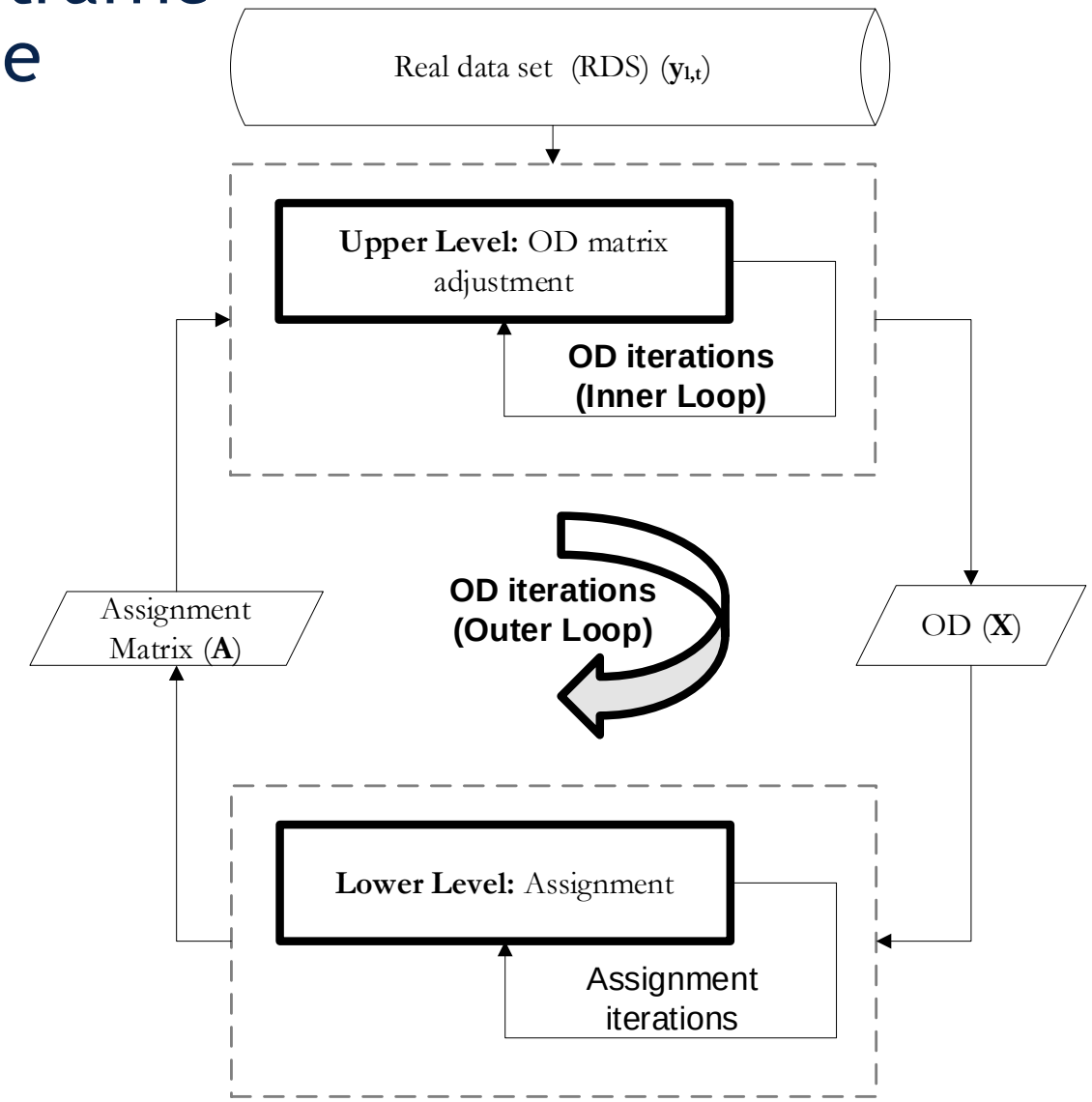
1-027 Activity 2: Develop short term traffic demand matching model for real time traffic simulation





Conclusion

- The research methodologies will be implemented in the Aimsun software/processes
- This should reduce manual model calibration effort
- The model performance for both offline and live models should improve
- These projects shows how we can combine AI, Data analytics and Simulations together to get the best outcome for short term traffic predictions

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Thank you!

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