PHOEBE Project

Overview, Use cases & methodology

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Together with:
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This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101076963

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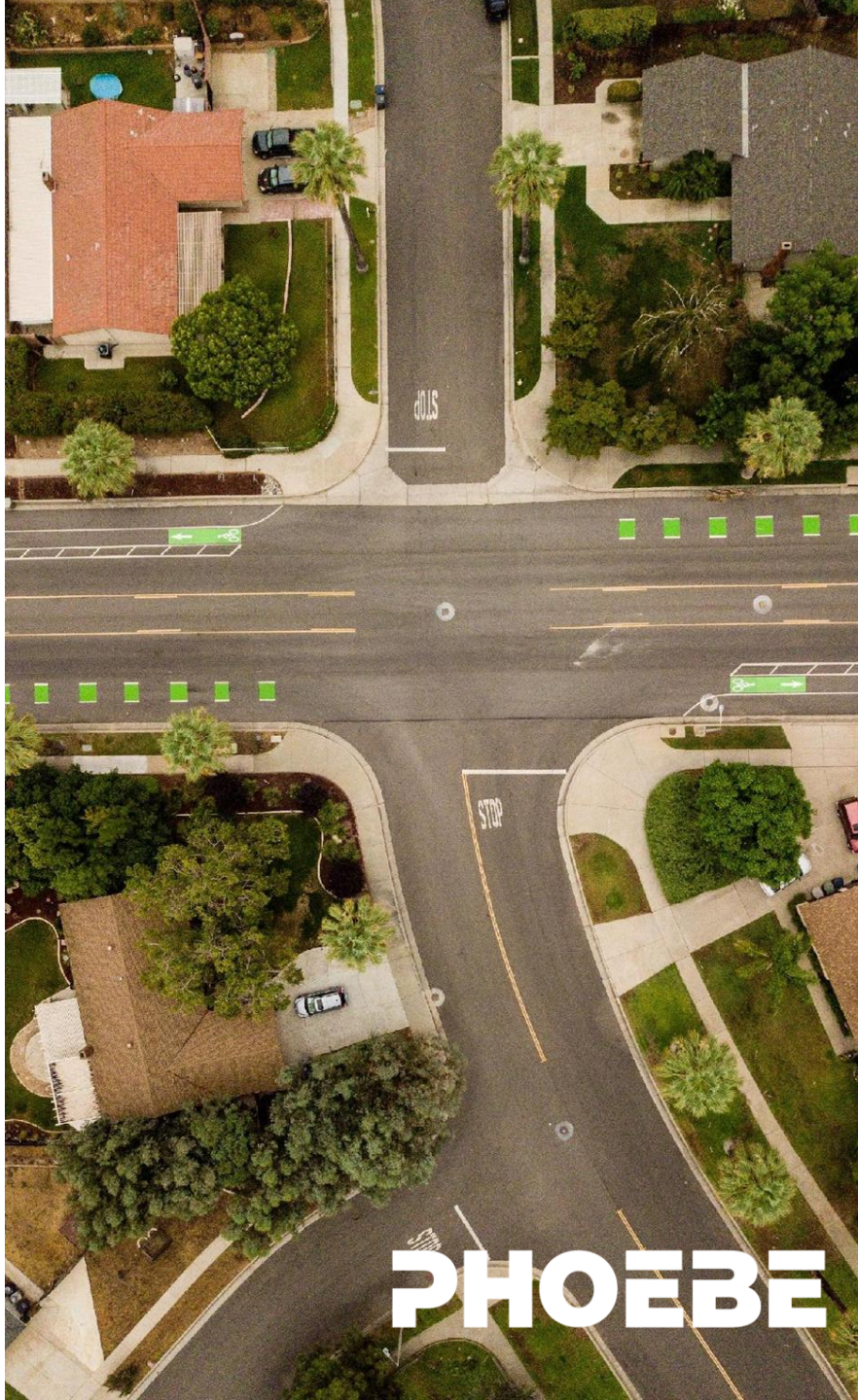
The need

Urban traffic systems are experiencing an increasing array of dynamic factors

Models strongly focused on vehicular traffic

Lack of integration with systems and tools used to manage and develop road networks



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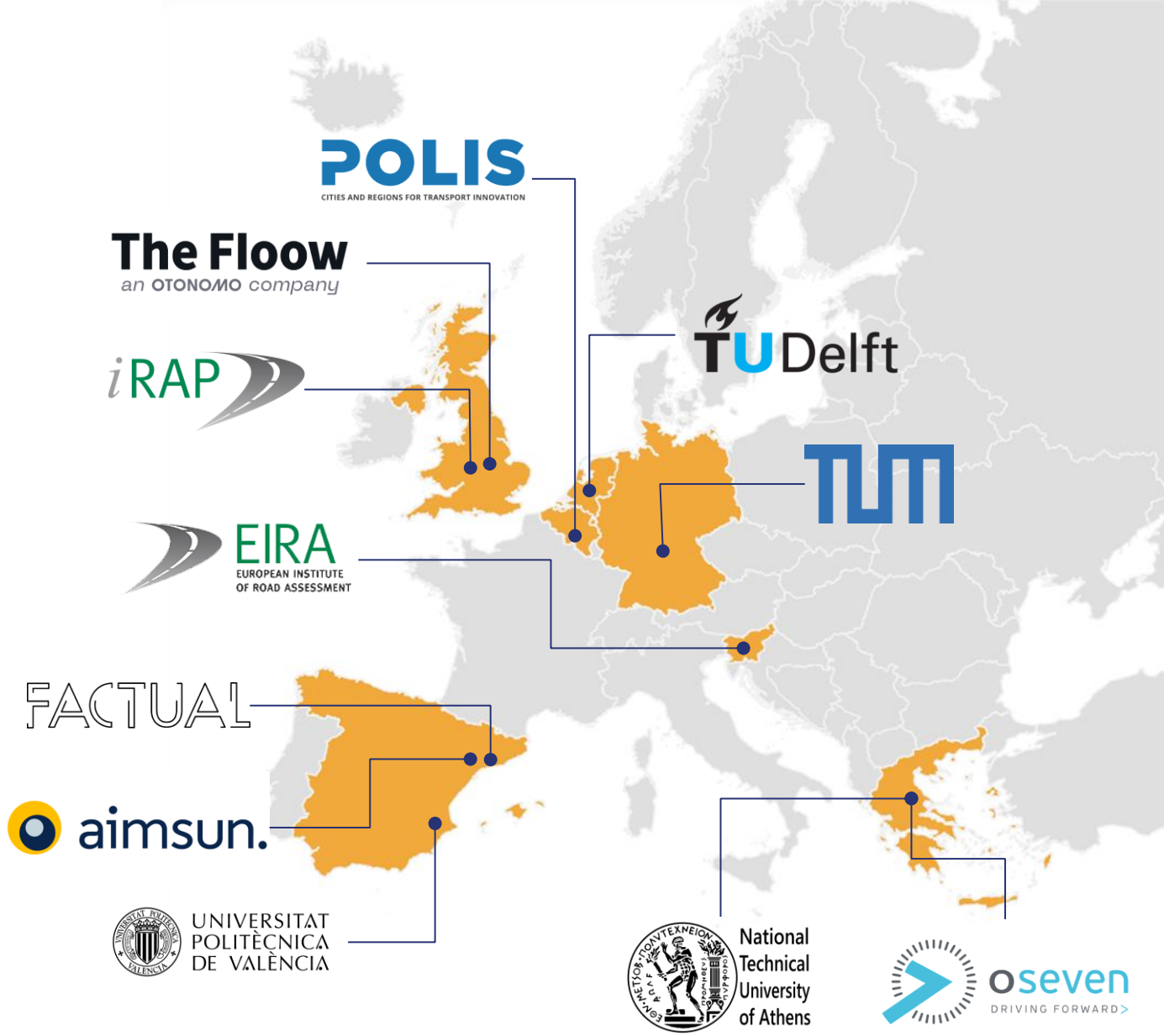
The team

seven COUNTRIES

eleven PARTNERS



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PHOEBE

The ambition (1)

network-wide (macro) level

Individual (micro) level

SAFETY & SOCIOECONOMIC OUTCOMES

- New forms of transport
- New technologies
- Regulatory and behavioural changes

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focused on both vulnerable road users and vehicle occupants

significant game-changer for urban stakeholders

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The ambition (2)

PHOEBE's methodological framework will be a **"blue-print"** for how cities can establish and apply the predictive safety assessment framework in an efficient and cost-effective way, providing a theoretical guide on how it works, and how to implement it.

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Project Objectives

1. To develop a new, replicable methodology for **dynamic safety prediction and socio-economic evaluation**
2. To **harmonise safety definitions** in traffic simulation models
3. To develop **enhanced and integrated urban risk assessment models and tools**
4. To **embody social components into risk assessments** to take into account changes in human behaviour, and mode and trip choices
5. To **exploit big data and telematics** through AI and ML data analysis techniques that are innovative and efficient
6. To apply the proposed methodological framework and enhanced and integrated predictive modelling tools in an **experimental multi-use-case**

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PHOEBE

The Methodology

Locations would be selected for simulation to understand how the changes the city is planning will work in the context of other trends.

The results are then extrapolated to the network-wide level to estimate the overall impact of the forecast changes and impacts are calculated.

Data gathered to establish baseline conditions and then simulate the expected changes to the road environment

The outputs would then be evaluated to produce dynamic safety scores. The results can be used to rerun and refine simulated scenarios and validate the results

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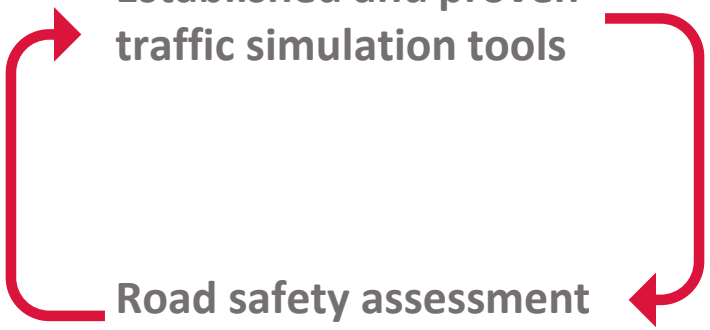
PHOEBE

The PHOEBE framework (1)



NEW

Dedicated road safety module in the traffic simulation tools

- (i) infrastructure safety, speed, modal shift, and induced demand models and performance metrics
- (ii) human behaviour models
- (iii) application of new and traditional data sources and analytics using artificial intelligence (AI) and machine learning (ML) techniques.

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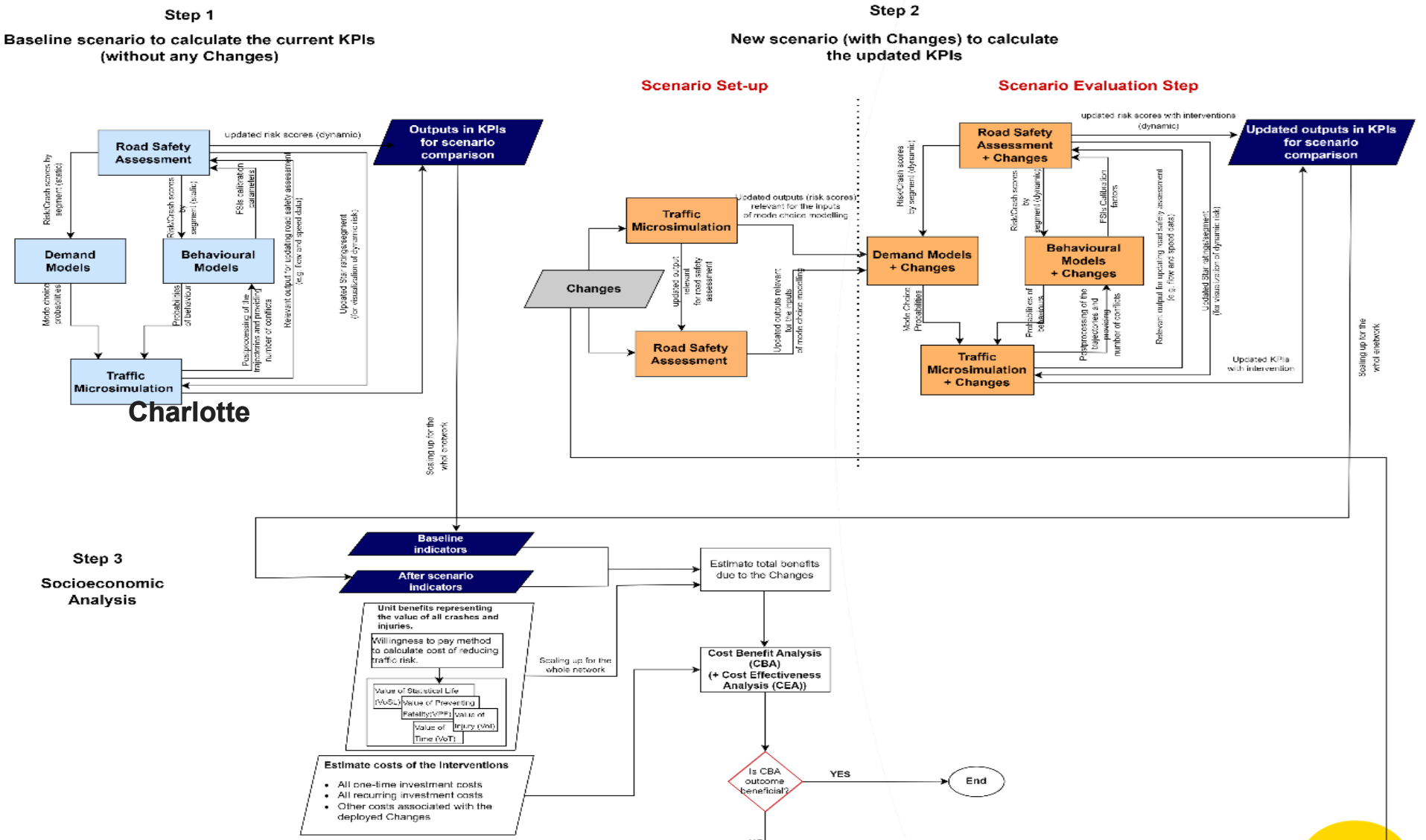
PHOEBE

The Phoebe Framework (2)



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Demand Modelling and Socio-Economic Impact Assessment

Main Role

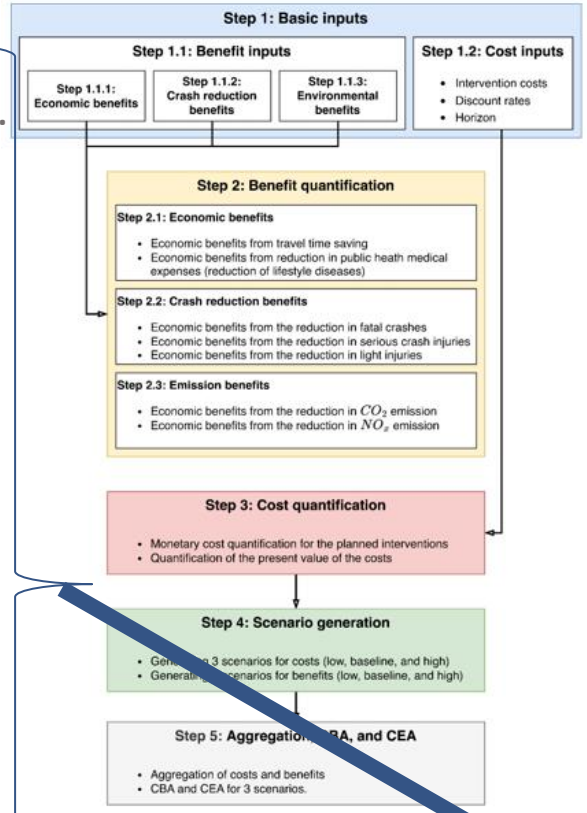
- Development of **mode choice and induced demand models**.
- Evaluation of **behavioural and modal shift** effects.
- Assessment of **socio-economic impacts** of urban mobility interventions.

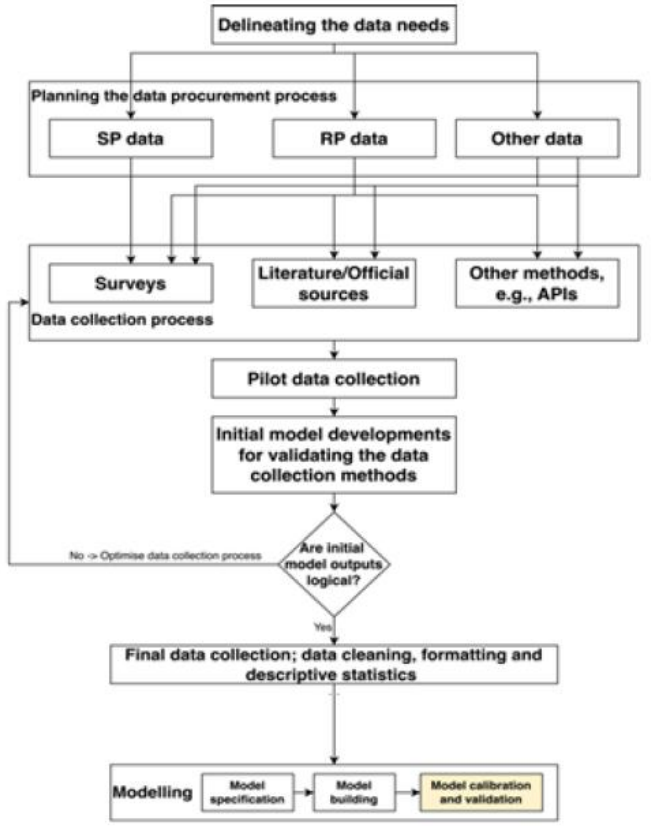
Integration with Simulation

- **Demand** models generate **future travel demand** and modal shift scenarios.
- Outputs are **integrated into the Aimsun simulation** environment.
- Simulated traffic conditions are subsequently used to **estimate safety, mobility and economic impacts**.

Key Contributions

- Cost-Benefit Analysis (**CBA**)
- Cost-Effectiveness Analysis (**CEA**)
- **Estimation** of safety, health **benefits**, travel time and environmental **impacts**.
- **Network-level extrapolation** of intervention impacts.





From behavioural changes to societal & economic impacts

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Human Behaviour Modelling & Safety-Oriented Simulation

Main Role

- Development of **predictive human behaviour models**.
- Analysis of **behavioural responses** to infrastructure and policy changes.
- **Modelling of Vulnerable Road User (VRU)** interactions and non-compliant behaviours.

Integration with Simulation

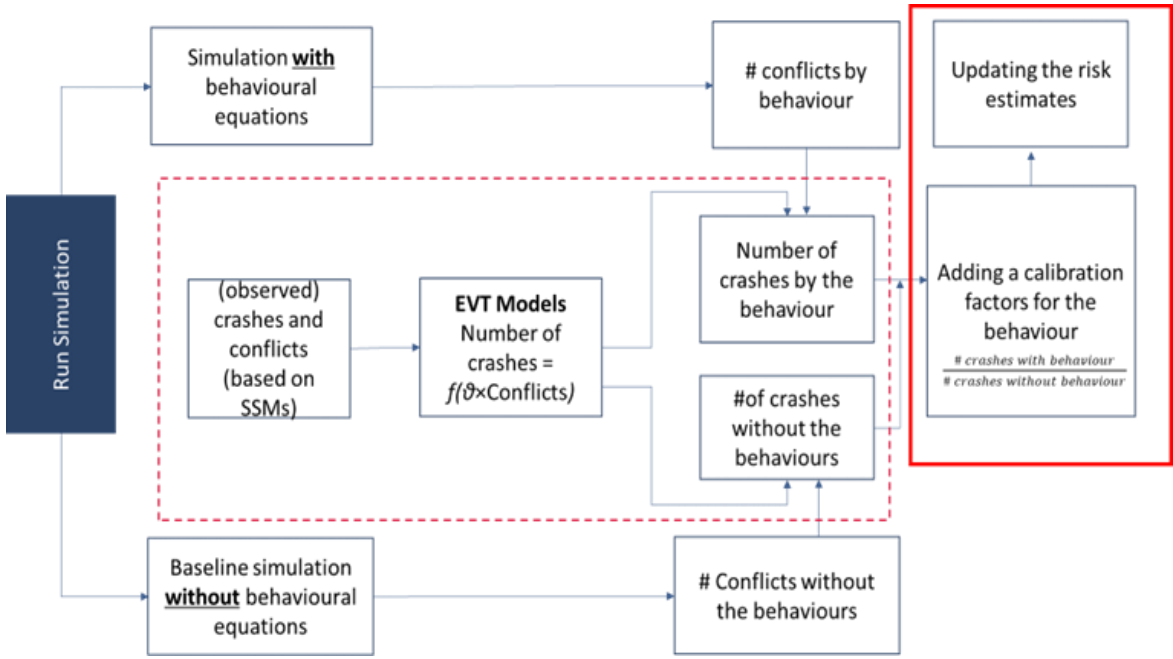
- **Behavioural models are embedded** into Aimsun simulations.
- **Behavioural outputs influence traffic dynamics**, conflicts and safety outcomes.

Key Contributions

- Speeding behaviour modelling
- Red-light violation modelling
- Crossing outside designated areas (jaywalking)
- Transferability assessment across cities

Data needed

- Video analytics
- Telematics
- Survey Data
- Traffic Observations



From human behaviour insights to safer mobility interventions

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Dynamic Safety Assessment & Simulation Integration

AIMSUN

- **Simulation** of future mobility scenarios.
- Estimation of traffic flows, speeds and interactions.
- **Evaluation of infrastructure** and policy interventions

Integration with Simulation

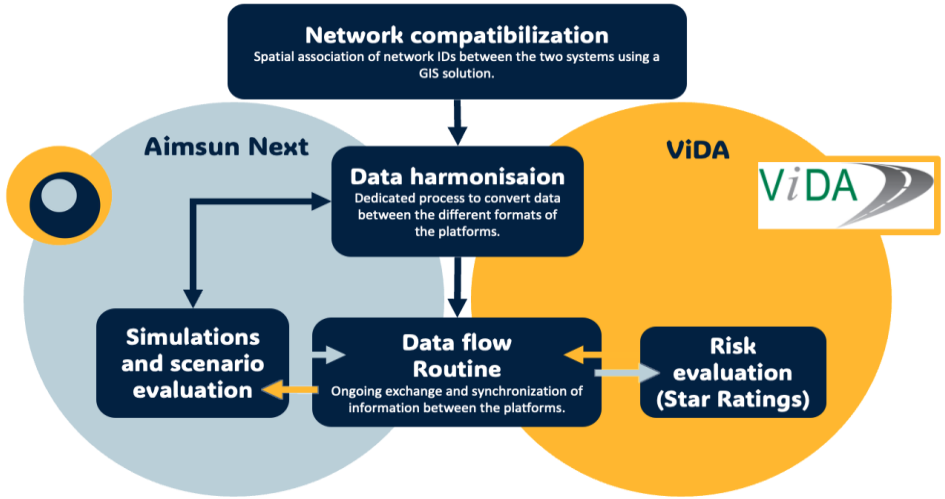
- **Star Rating Scores (SRS).**
- Fatal and Serious Injury (FSI) estimation.
- **Dynamic** road safety assessment and **safety prediction tools**.

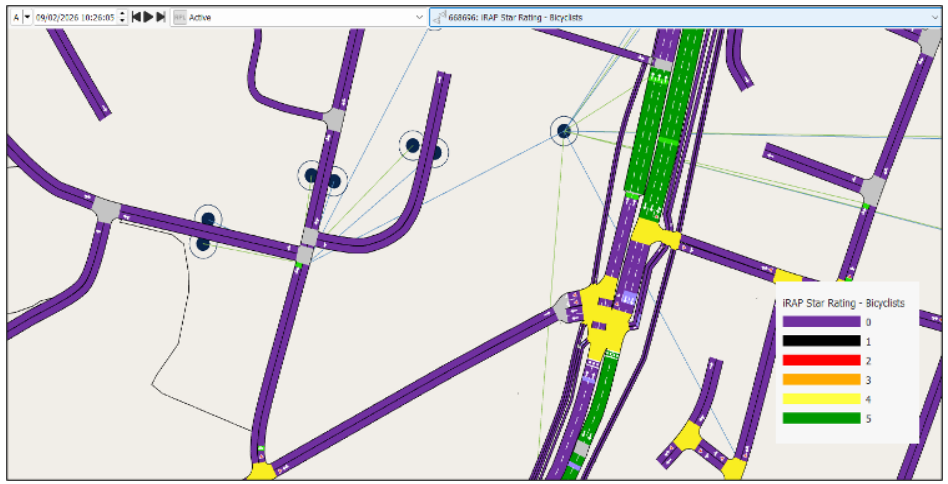
Risk Assessment

- Infrastructure-based safety evaluation
- **Dynamic risk estimation** under different traffic conditions
- Vulnerable Road User (VRU) risk assessment
- **Network-wide safety performance analysis**
- Identification of **high-risk locations and intervention** priorities

Key Contributions

- **Direct integration between Aimsun Next and iRAP ViDA**.
- Automated exchange of simulation and safety data.
- Evaluation of interventions before implementation.





From simulated scenarios to dynamic safety predictions

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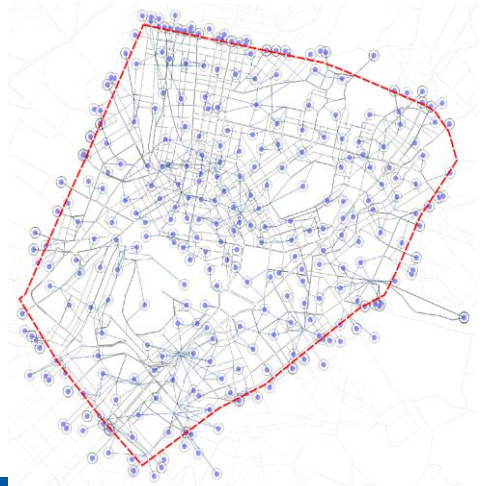
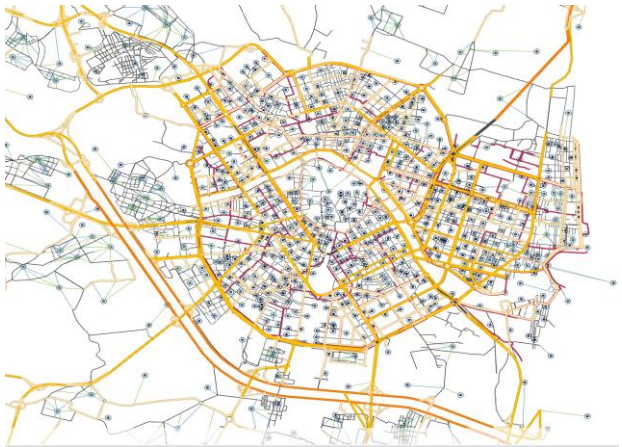
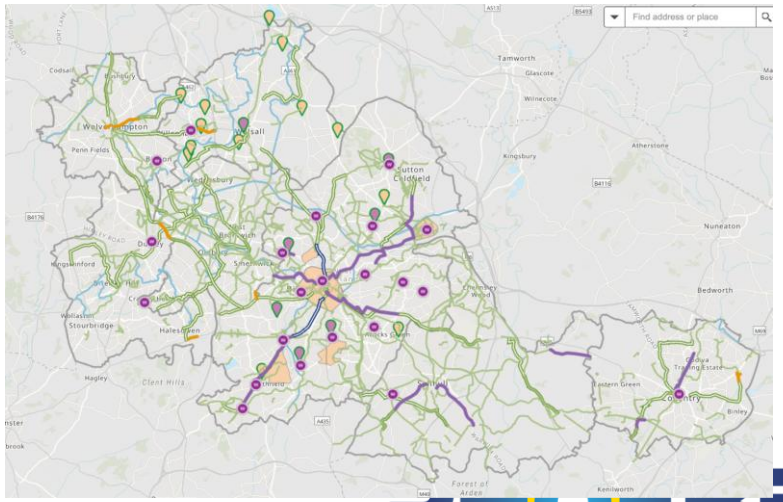
Use cases







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Use Case Common Points

- Regular **monitoring and evaluation** will be conducted to assess the effectiveness of the interventions and behavior analysis insights.
- The **evaluation process** of successful and less successful **areas** will ensure that ongoing adaptations can be made to enhance the overall effectiveness of the interventions.
- These improvements will aim to **enhance the safety** of the cycling infrastructure and address any behavioral challenges that contribute to the risk of accidents.
- **Methodological improvements** in the existing models are critically required, especially for incorporating VRUs and introducing new modes of transport such as micro-mobility options into each component of the Framework.

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