

PHOEBE Project

Overview, Methodology and Results

42nd IRTAD Meeting - International Transport Forum (OECD)

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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 Phoebe Project

CURRENT PRACTICE

- Ex-post evaluation, once **crashes have occurred**
- Small, volatile crash counts **at street level**
- Safety, mobility and environment assessed **separately**

PHOEBE APPROACH

- Ex-ante estimation, **before implementation**
- **Network-level** risk from infrastructure, traffic and behaviour
- Safety, mobility, environment and cost in a **single assessment**

3 pilot cities: Athens, Valencia, West Midlands

11 partners from 7 countries: universities, industry, cities

48 KPIs per scenario: 19 safety, 24 travel demand, 3 network operations, 2 environment

Phoebe Project Link: <https://phoebe-project.eu>



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FACTUAL



UNIVERSITAT
POLITÈCNICA
DE VALÈNCIA



The Floop
an OTONOMO company



TU Delft

TUM

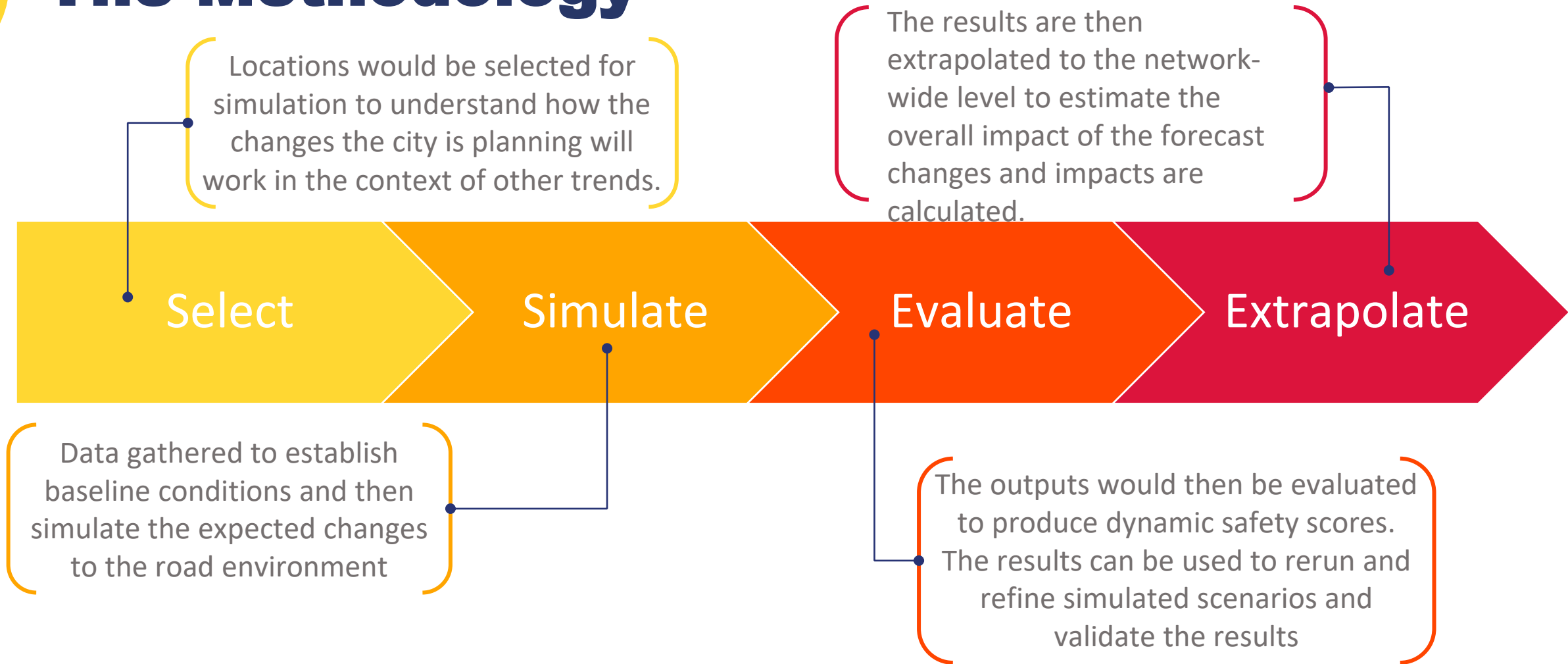


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PHOEBE

The Methodology



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Data ecosystem with 4 data families

Infrastructure

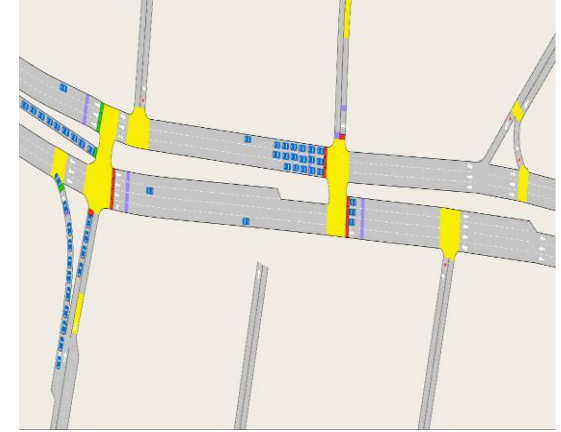
- 80+ attributes per road section
- geometry, speed limits, crossings, facilities
- matched to simulation network links



Road-user behaviour

surveys and video

- 500+ survey respondents per city
 - stated-preference experiments
- computer-vision trajectories (YOLO, DeepSORT)



Telematics

- speed profiles and driving behaviour
- mobile-phone distraction
- iRAP-accredited derived features



Traffic

detectors and travel times

- loop-detector counts
- travel-time validation
- Athens calibration: $R^2 = 0.98-0.99$



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Missing Data Protocols & Quality Grading

We promote the attitude that **there's no such thing as 'bad' data** - users just need to understand the limitations and caveats of what they have to hand.

1

Highly Unsuitable

Data does not fit the information need

e.g. Fixed-point study
< 1 year, ad hoc
collection or
inconsistent method

2

Poor Fit

Significant
weaknesses limit
usability

e.g. Incomplete record
of fatalities

3

Adequate

Acceptable with
notable caveats

e.g. Partial (> 50%)
serious-injury record,
or complete fatalities
for 1-2 years

4

Good Fit

Minor limitations,
broadly suitable

e.g. ≥ 3 years of all
crashes record
incomplete

5

Ideal Fit

Fully appropriate for
the information need

e.g. ≥ 3 years of all
crashes along the route



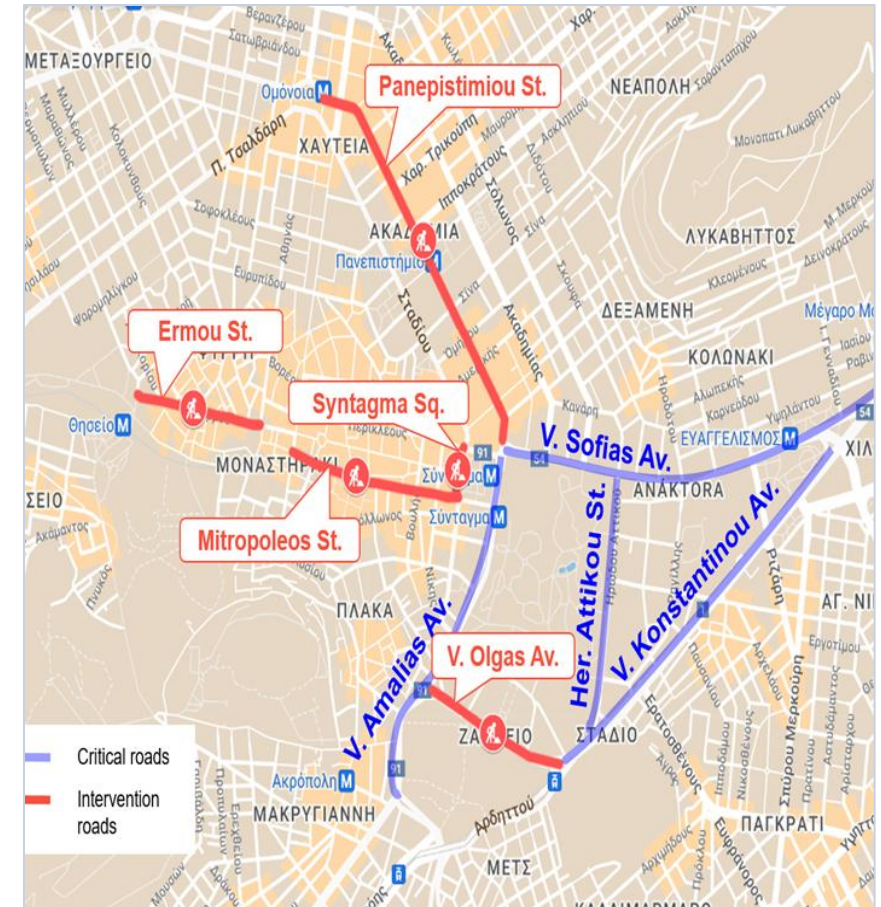
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Pillar A: Video data collection in central Athens

Location	Speeding	Red-light crossing	Jaywalking
Vas. Konstantinou (1)	●	●	
Vas.Amalias / Syntagma (2-3)	●	●	○
Vas. Sofias (4-5)	●	●	●
Panepistimiou (6-8)	○	●	●



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Automated detection of pedestrian red-light crossing

8

locations on the
intervention corridors

64 h

of video: peak and off-
peak, 2 weekdays, 2
weeks

3

behaviours:
red-light crossing,
jaywalking, speeding

Processing pipeline

Detect

pedestrians and
vehicles
(YOLOv8)

Track

Kalman filter,
re-identification

Projection

image →
ground plane
(homography)

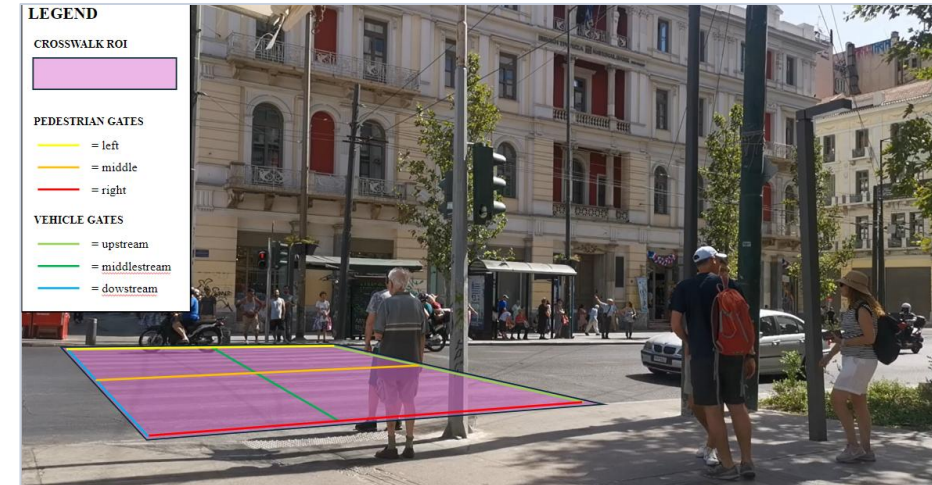
Classify

signal state &
crosswalk
zones

Measure

speed, TTC,
PET

Output: legal / illegal crossings, speeds and conflict indicators per location and time period, used to calibrate the behavioural models.

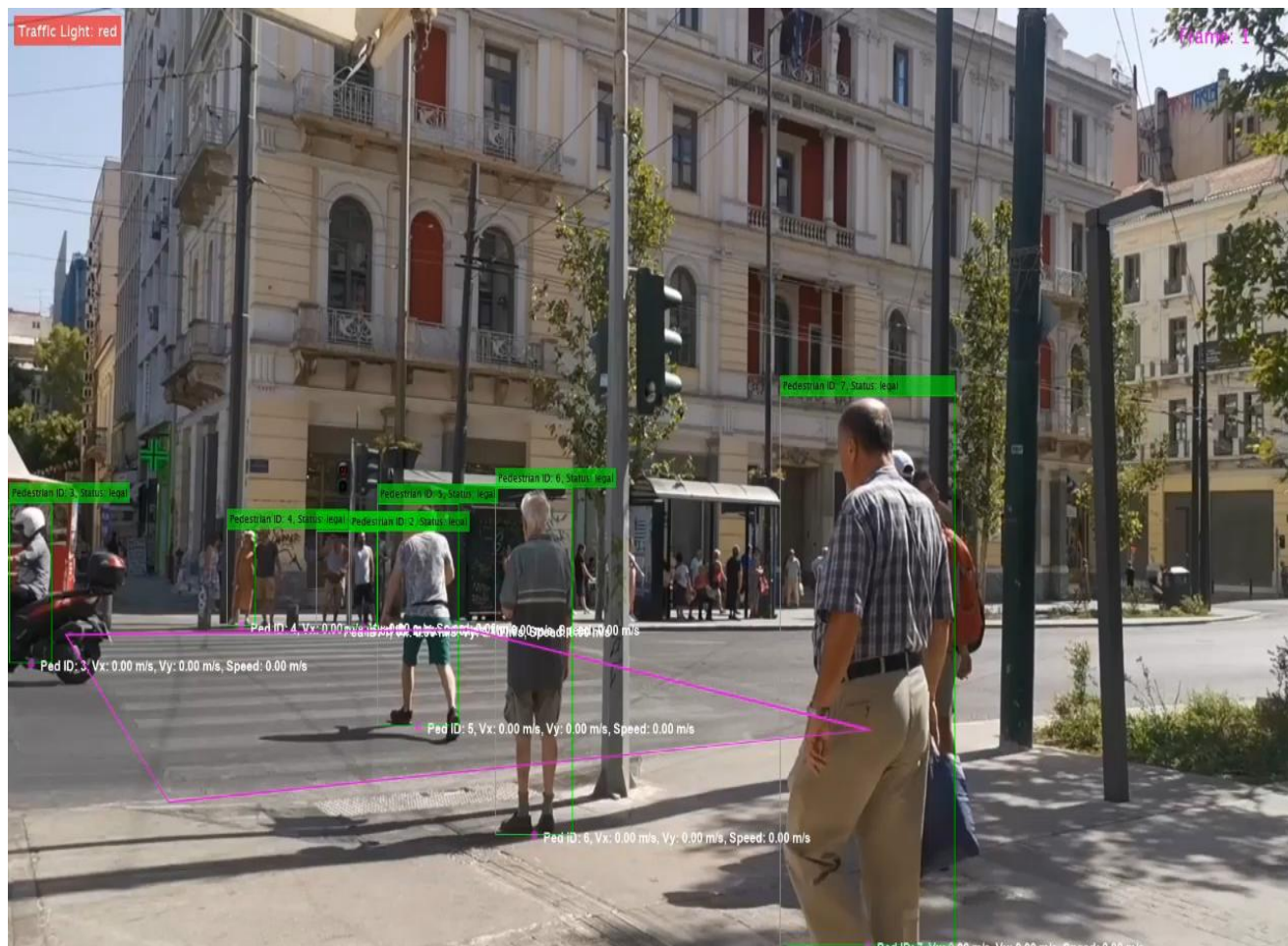


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Results- Legal and Illegal Behavior Detection



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Pillar B: Pedestrian Integration

- Pedestrian measurements were conducted manually by analyzing **videos from cameras**.
- A total of **6,912 pedestrians** were counted during the simulated period.
- Entrances and exits for pedestrians were established on each side of the crossings, and a corresponding **OD matrix** was developed.



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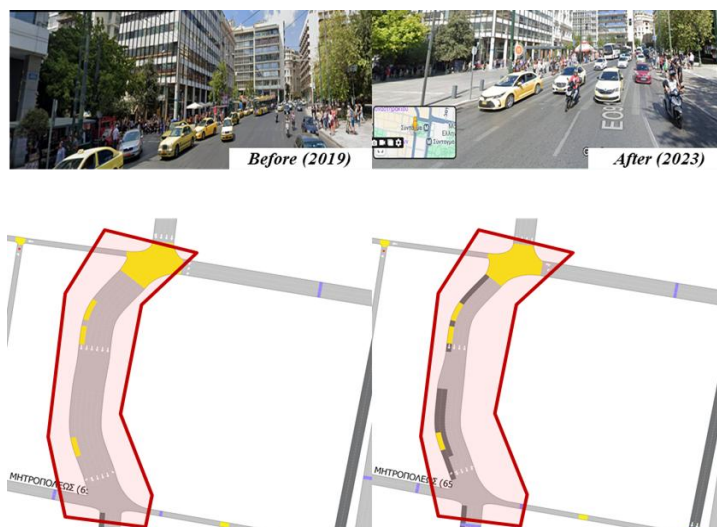
Interventions Integration

- The implemented interventions were incorporated into the simulation network by modifying **road geometry, lane allocation and traffic regulations**.

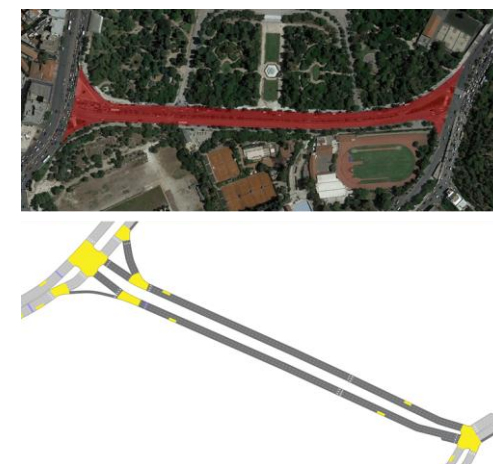
Panepistimiou Street



Syntagma Square



Vasilissis Olgas Avenue



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Non-Compliant Behaviour Modelling - Speeding API

SPEEDING

- **Driving above** the road/street **speed limit**.
- Integrated through the **Aimsun Next API** by modifying the speed acceptance parameter.
- Network transitions **trigger activation or deactivation of speeding** behaviour.
- Behaviour is activated based on **behavioural probability** and a random draw.

Behavioural
Probability



Random
Draw



Speeding
Activated



Athens model: speeding behaviour
visualisation



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Non-Compliant Behaviour Modelling - Pedestrian RLV API

PEDESTRIAN RED-LIGHT VIOLATION

- Implemented in **Aimsun Next** for the Athens use case.
- Violation assessed only when the pedestrian **signal is not green**.
- Behaviour activated when the **calculated probability exceeds the threshold**.
- **Threshold-based triggering** creates realistic non-compliant pedestrian actions.

Probability
Calculation



Threshold
Check (>0.5)



Violation
Triggered



Athens model: pedestrian red-light violation visualisation



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PHOEBE Decision Support Tool

A light and agile DST (built on Power BI)



PHOEBE Framework

Replication Protocols

Decision Support Tool

Interventions Explorer

Intervention

Road Space Reallocation

Use Case

Athens

Indicators Group

Mode Shift

Indicator

Female - Age 35-44

Road User Group

Walk

Road Characteristics

All

Impact Modification Factor

1,211

Baseline Value:

0,02324

Scenario Value:

0,02815

T-test

3,822

p-value

0,00013

1 Select

city, indicator, road type, road-user group

2 Compare

baseline vs. one or more scenarios

3 Use

IMF, confidence interval, significance

Target users

- City planners
- road safety specialists
- policy makers

Phoebe Project Dashboard: <https://phoebe-project.eu/phoebe-dashboard/>



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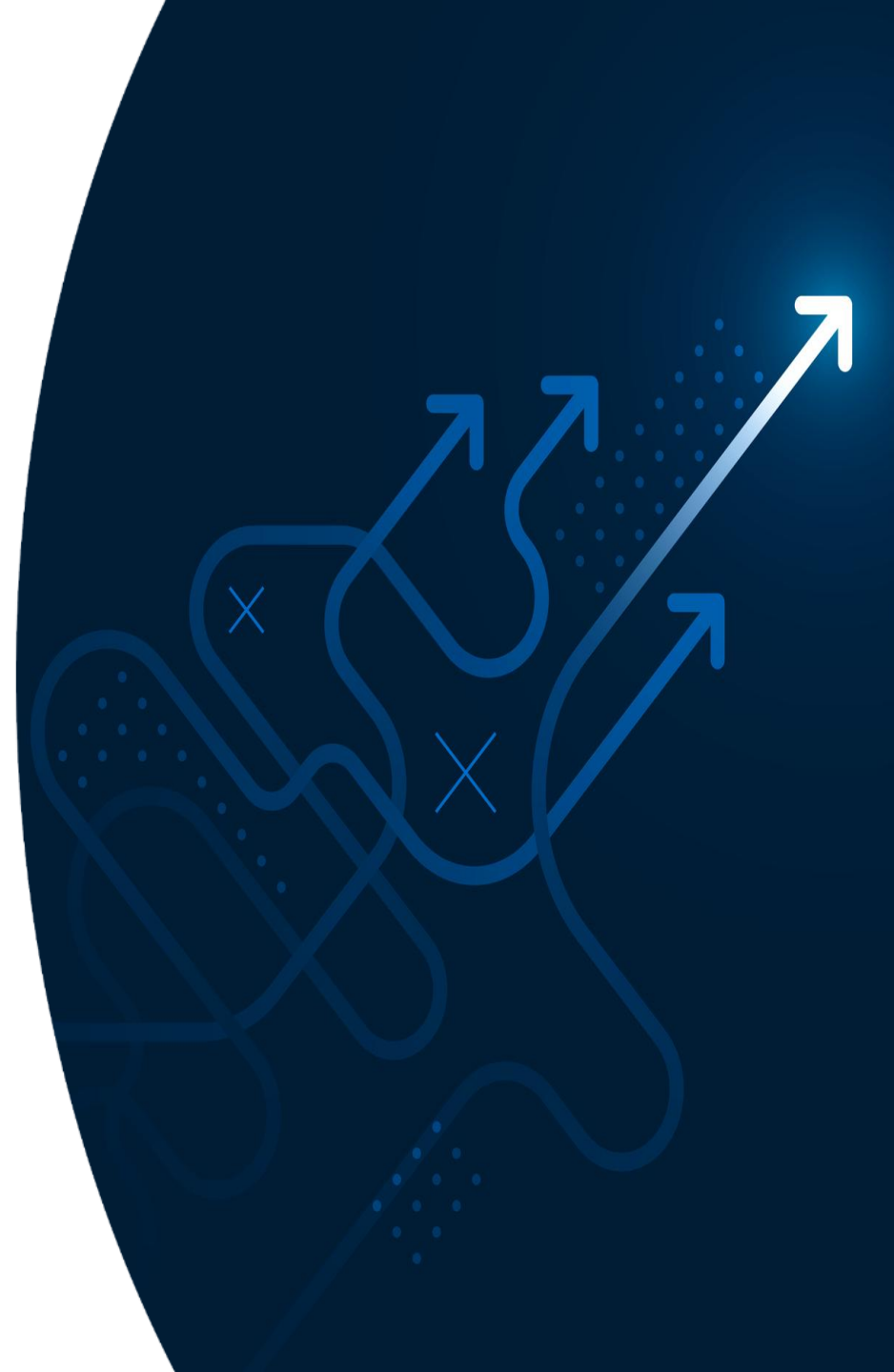
Conclusions

- By linking travel demand, road-user behaviour, traffic microsimulation and iRAP risk models, **cities can estimate the safety, mobility and environmental impact of an intervention before it is built.**
- **All model inputs are measured data**; a five-level quality grading lets imperfect data be used transparently.
- Non-compliant behaviours such as **speeding and pedestrian red-light crossing can be detected automatically from video** and built into the simulation making risk estimates more realistic.
- The **Decision Support Tool** turns complex model outputs into simple, comparable indicators for planners and policy makers.



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