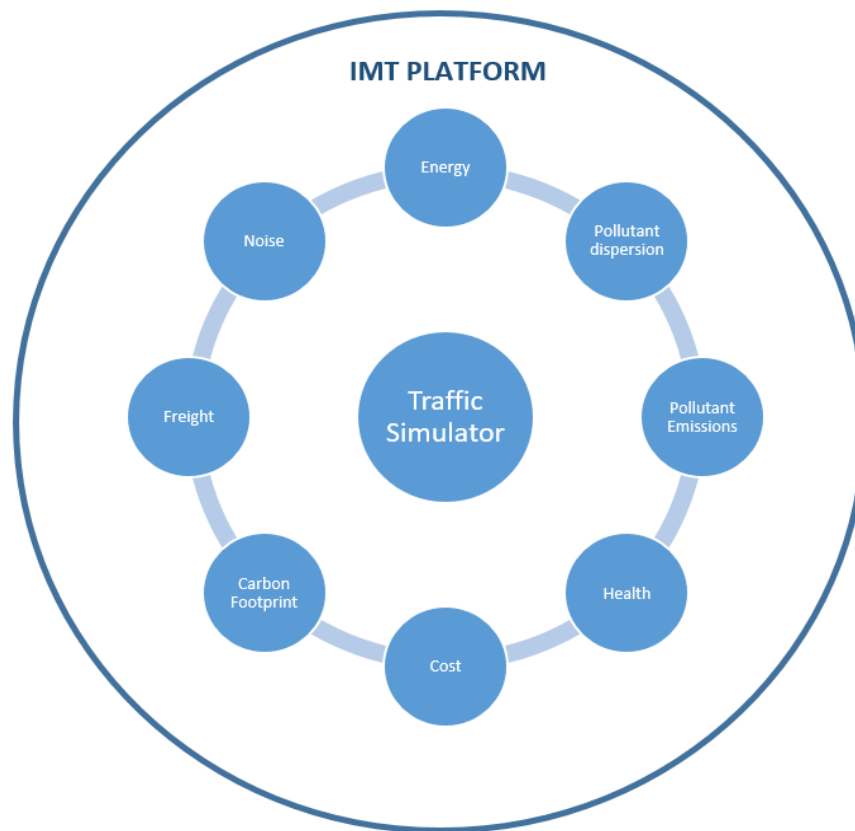


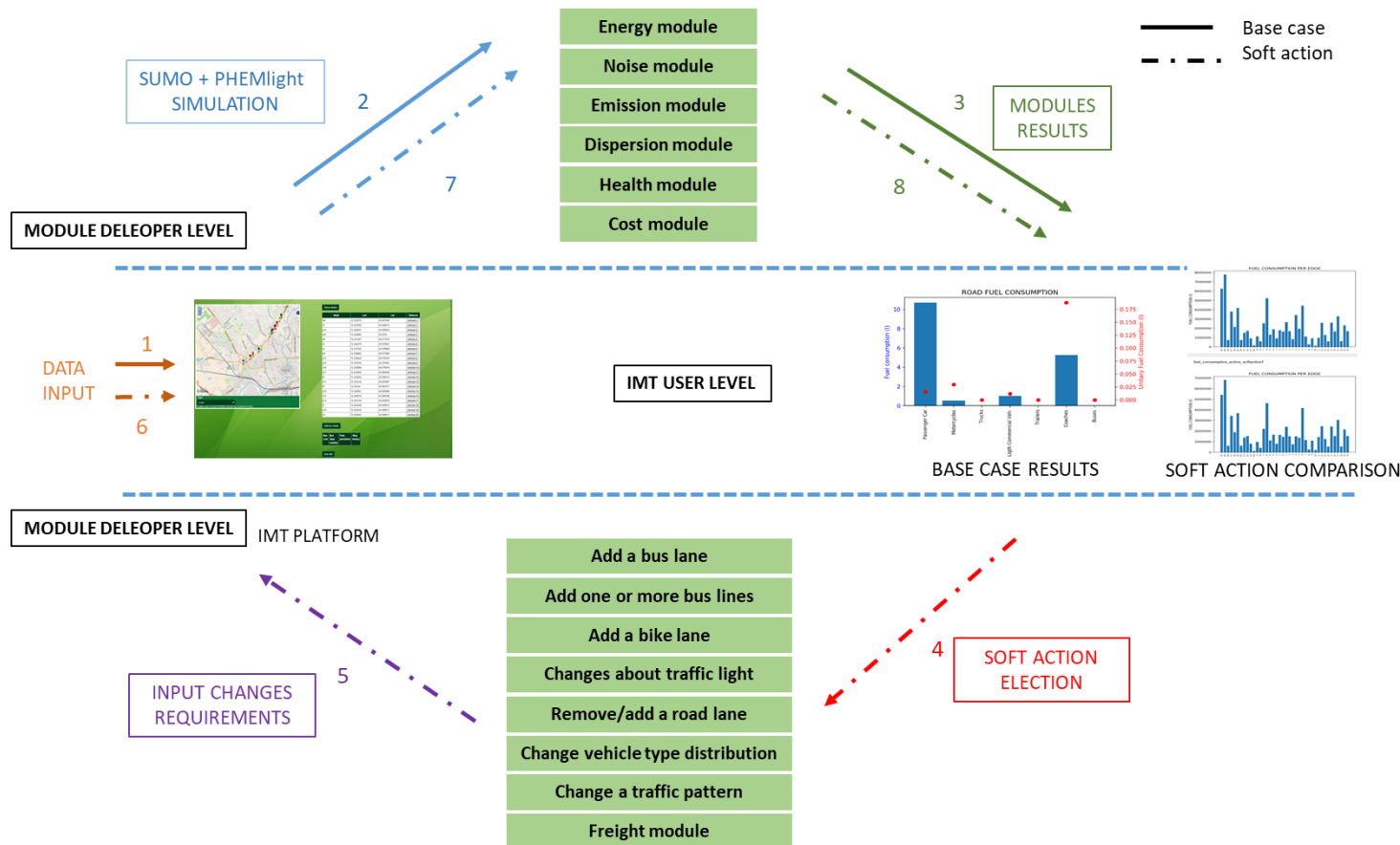
REMEDIO Integrated Modeling Tool and Mobility Solutions Assessment Results

**An online novel Integrated Modelling
 Tool (IMT) has been developed as a tool
 for mobility decision making.**



The IMT provides to users (i.e. technicians responsible for traffic management) the possibility of analyze the **main effects of traffic over congested roads/streets in the current situation, as well as analyzing the effects of potential soft-actions** to mitigate the road-congestion problems.

IMT conceptual process flow



"Simulation of **Urban MObility**" (Eclipse SUMO) is an open source, highly portable, microscopic and continuous road traffic simulation package designed to handle large road networks. SUMO is [licensed](#) under the [Eclipse Public License V2](#). "Eclipse SUMO" is a trademark of the Eclipse Foundation.

IMT platform

Two alternative ways to run the simulations within the IMT

OPTION 1: **Interactive** mode
Step-by-step process

ease of performing the simulation

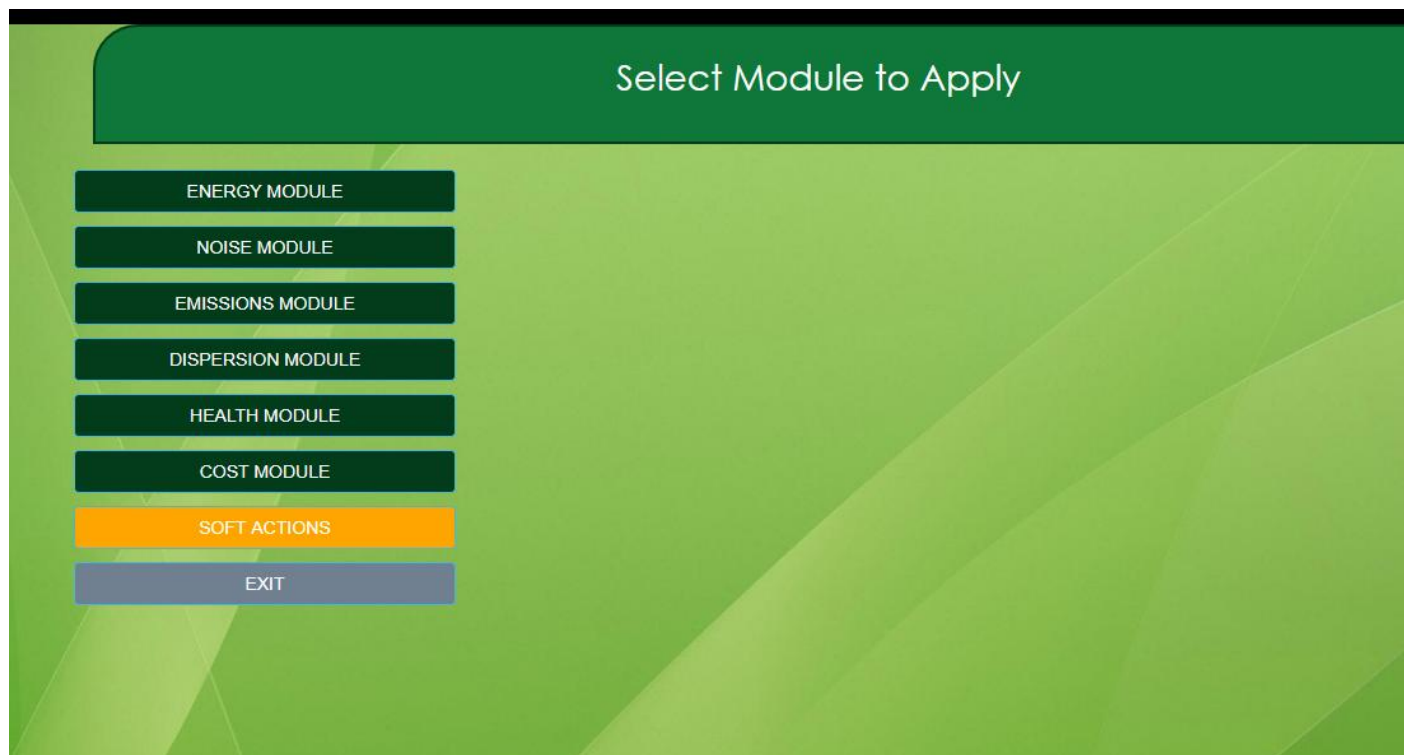


OPTION 2: **Batch** mode
Uploading text files (.xml)

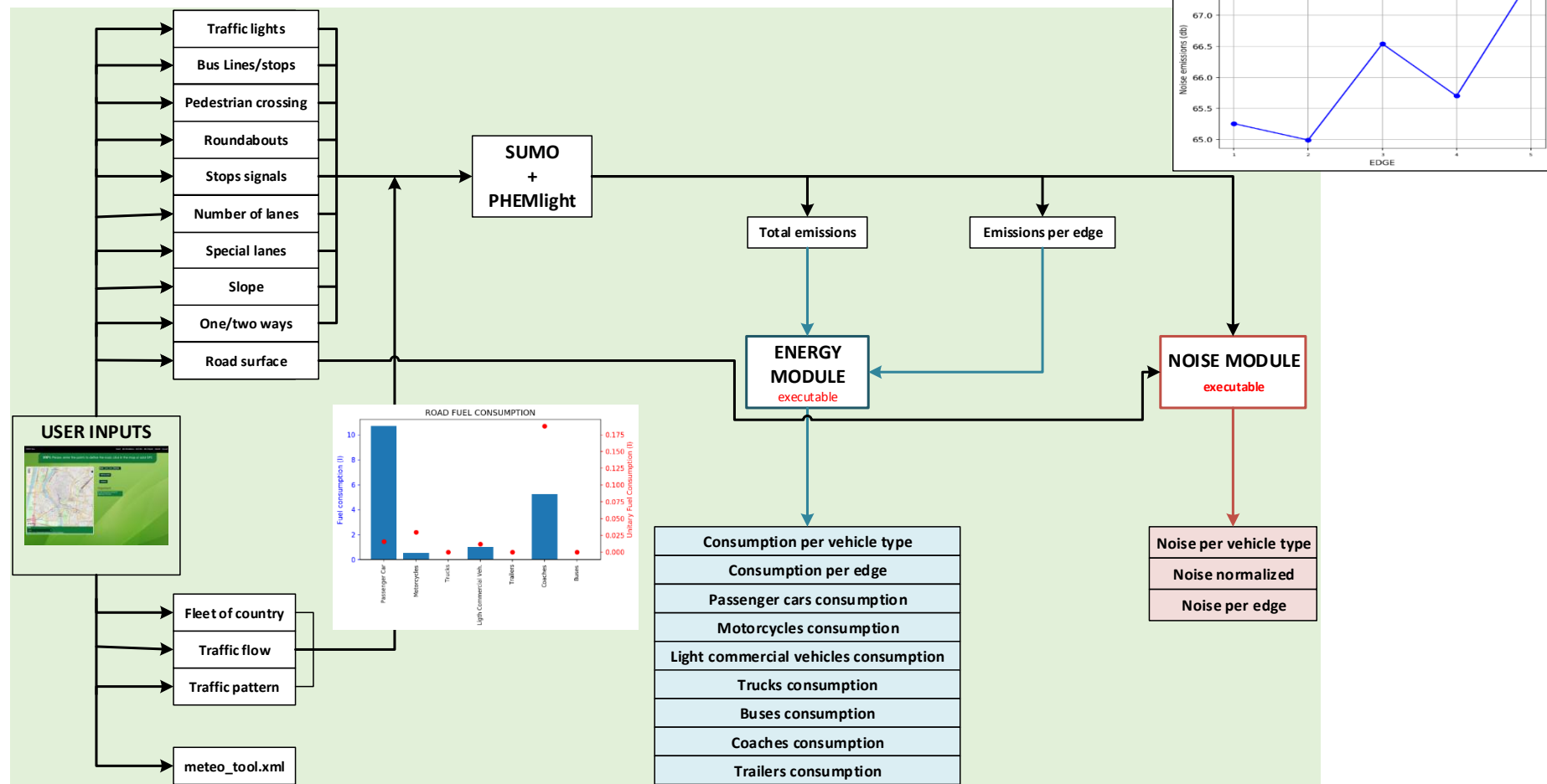
Fully flexible process

```
<?xml version='1.0'?>
<additional>
  <busStop id='b7' lane='1_0'/>
  <busStop id='b8' lane='1_0'/>
  <busStop id='-b7' lane='-1_0'/>
  <busStop id='-b8' lane='-1_0'/>
</additional>
```

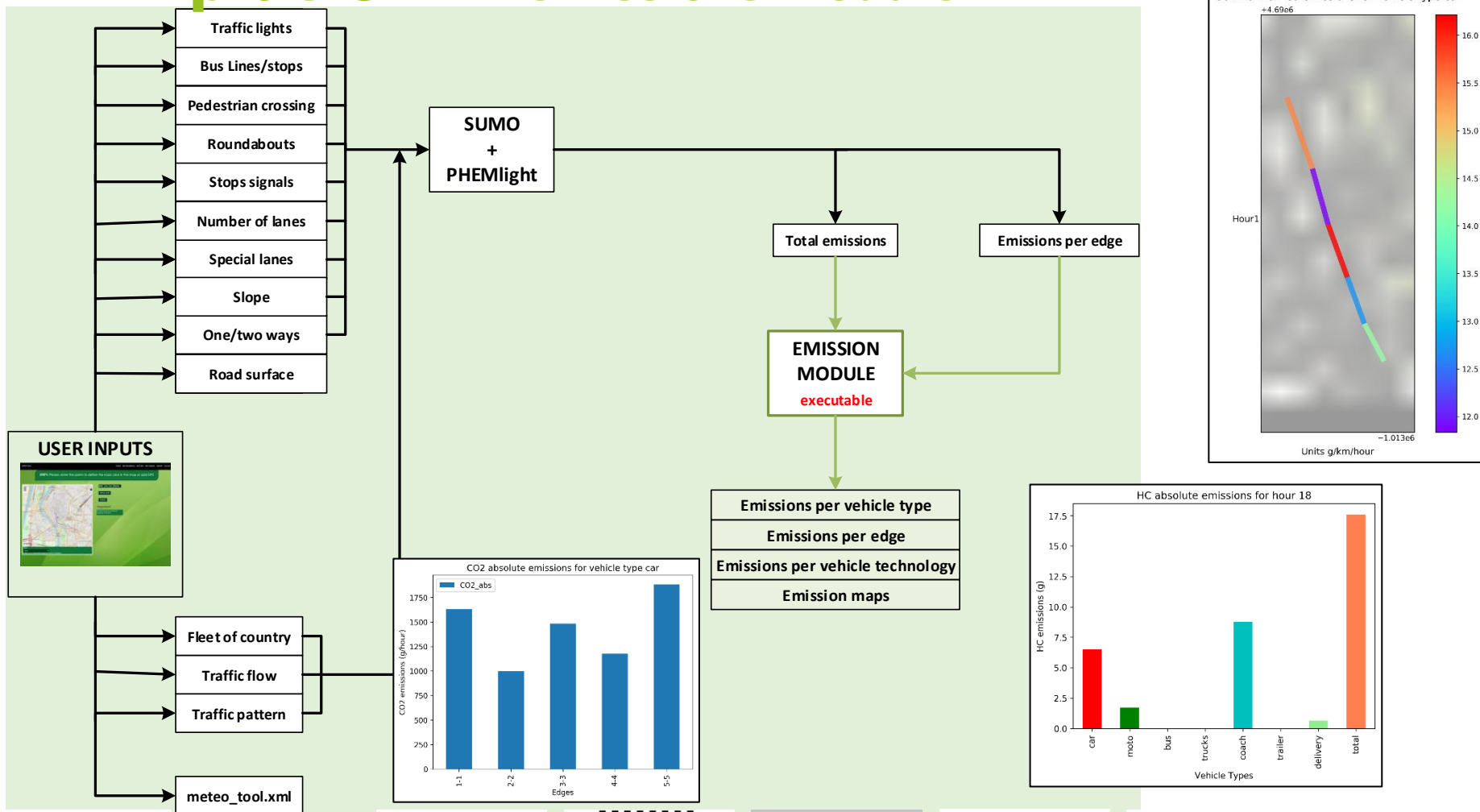
IMT platform: modules



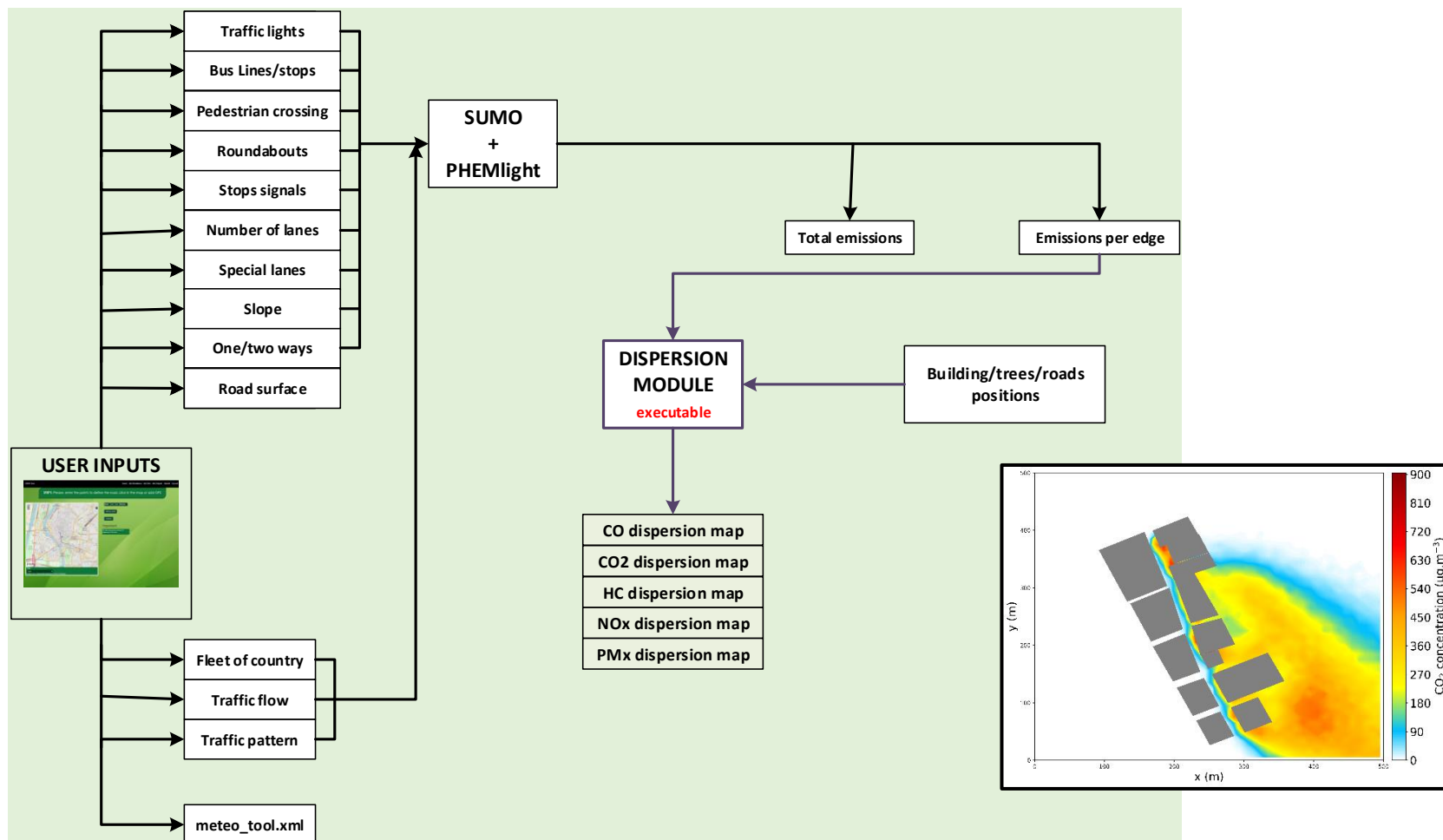
IMT platform: energy and noise module



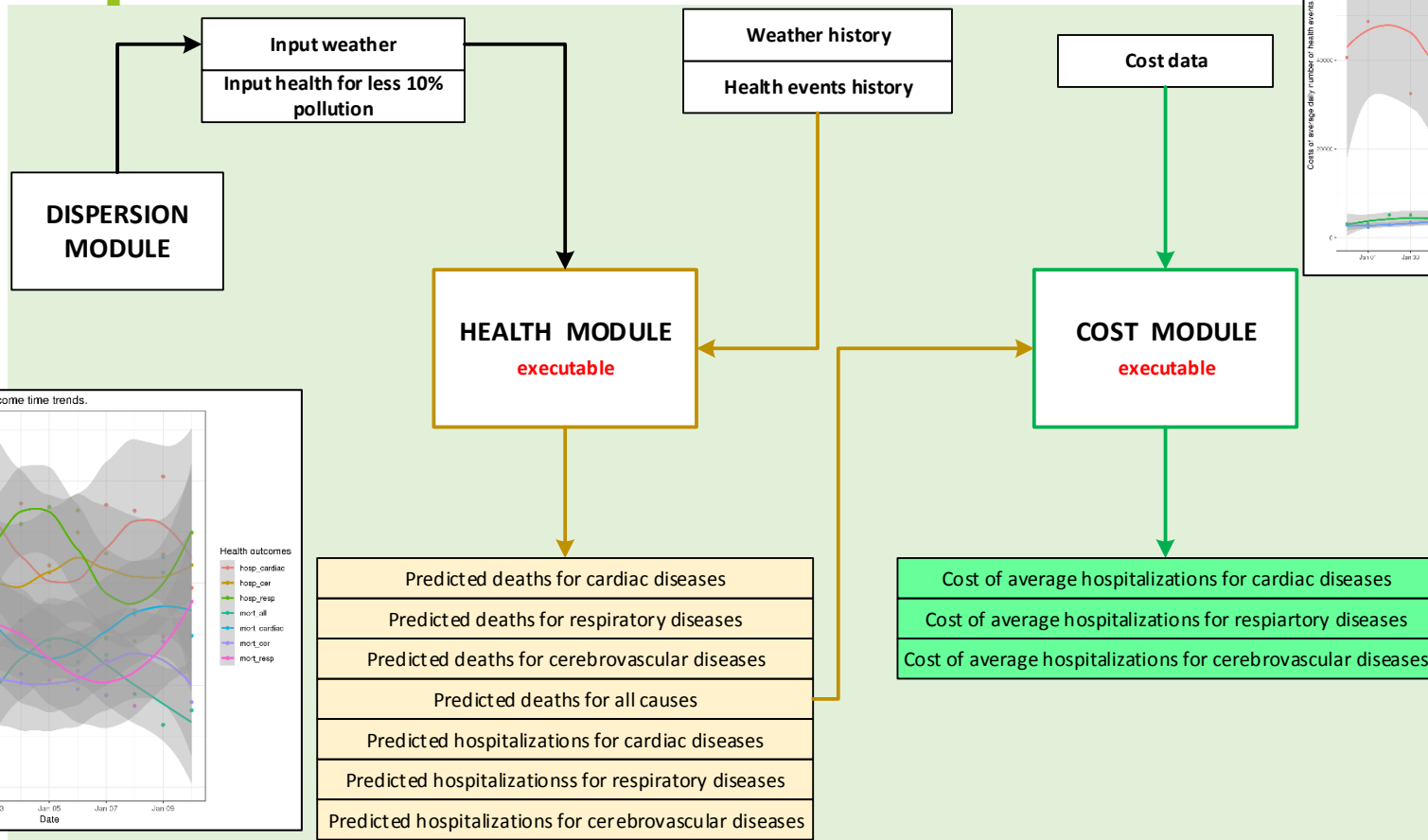
IMT platform: emissions module



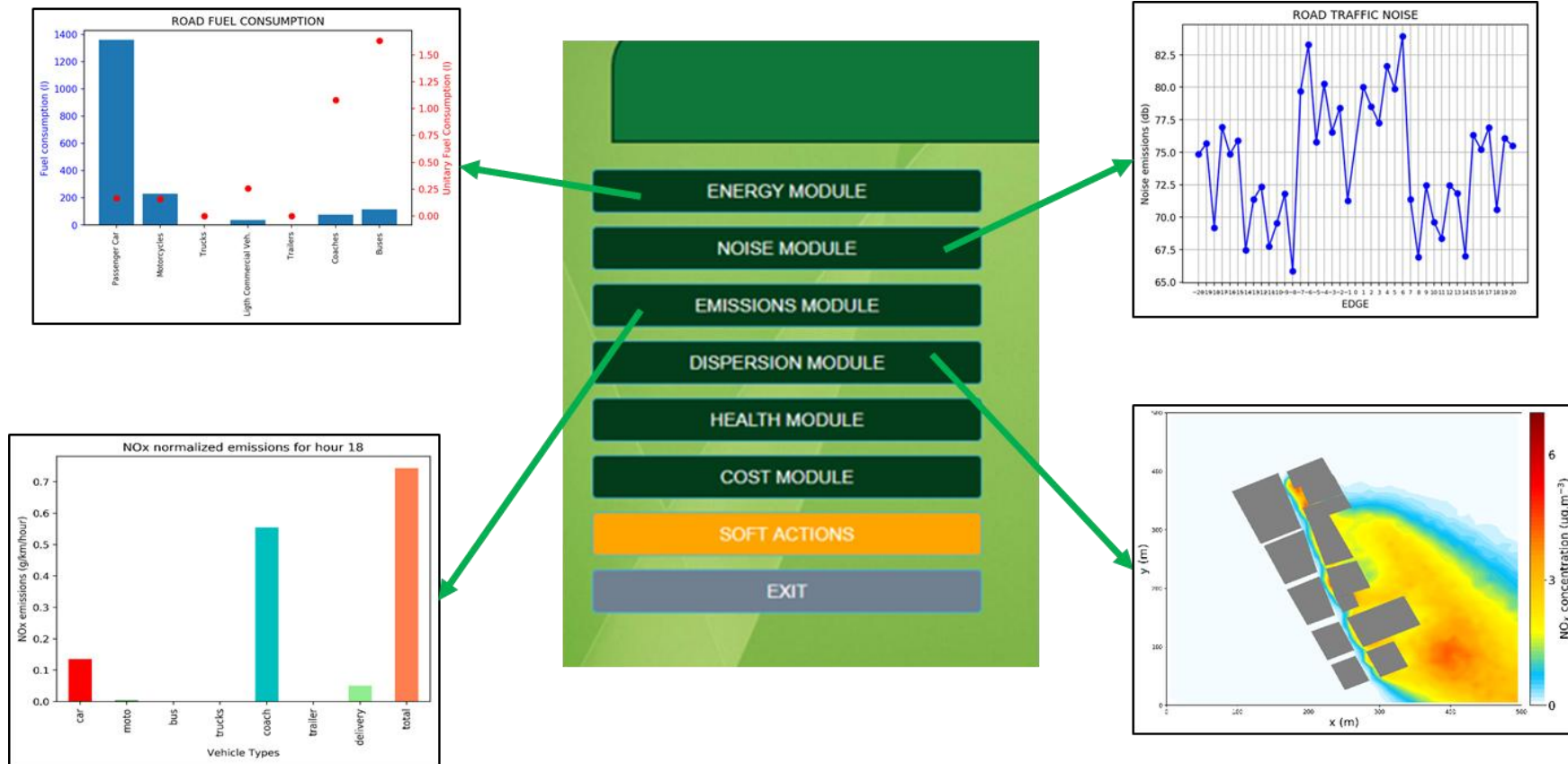
IMT platform: dispersion module



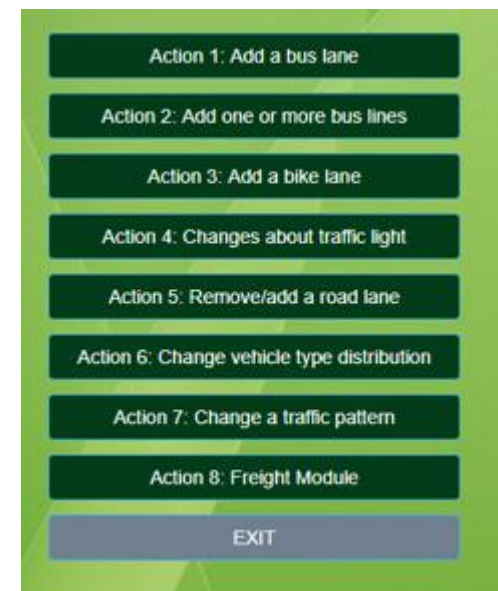
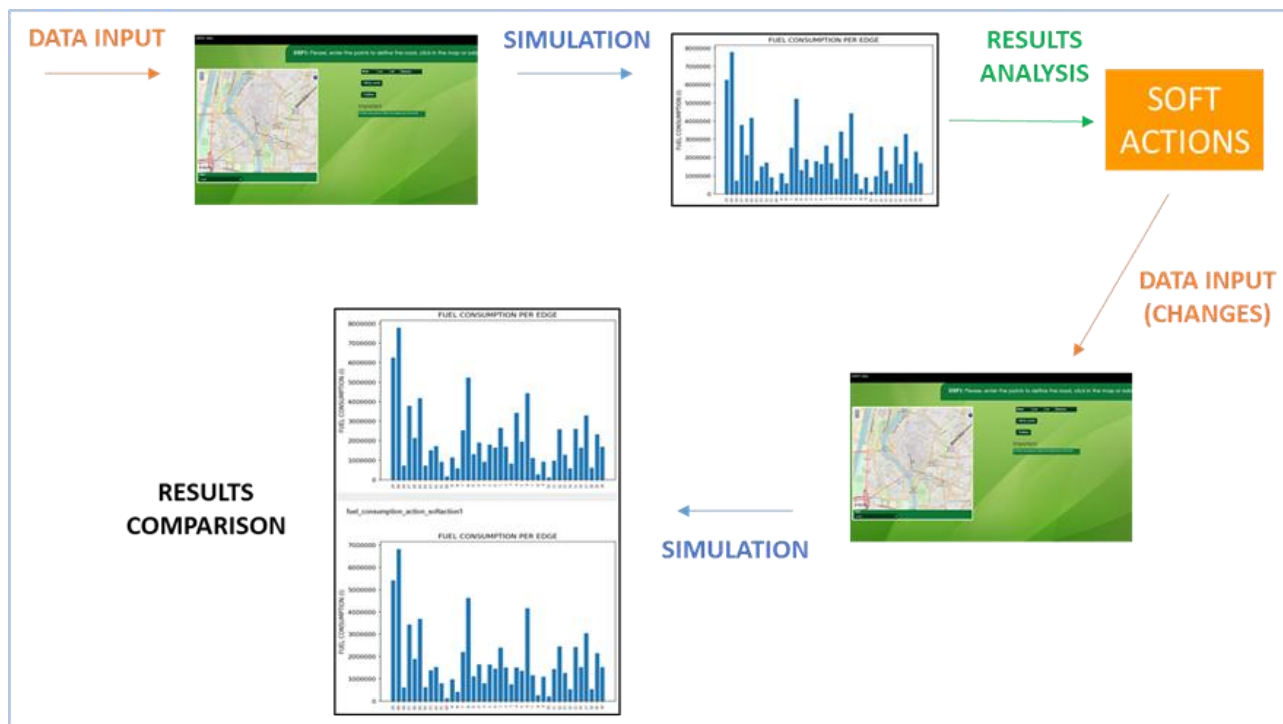
IMT platform: health and cost modules



IMT platform: outputs



IMT platform: soft actions



Treviso: pilot zone

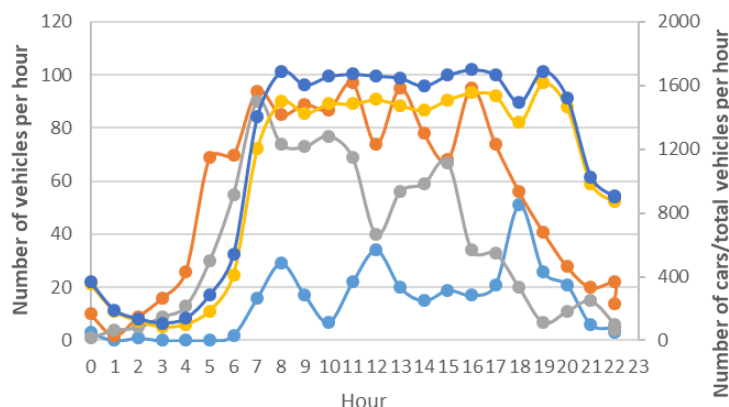


Municipality of Treviso:

- 85752 (30-04-2019) inhabitants
- 55.58 Km² with a population density of 1.542,86 persons per square meter

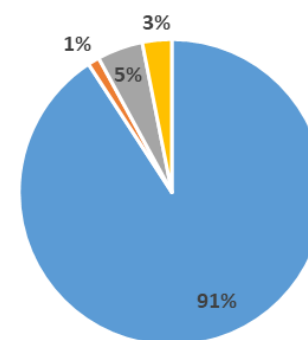
Main features of the pilot zone:

- two-ways road of 5,5 Km length
- 2 bus lines with 8 bus stops
- 6 traffic lights
- 1 roundabout



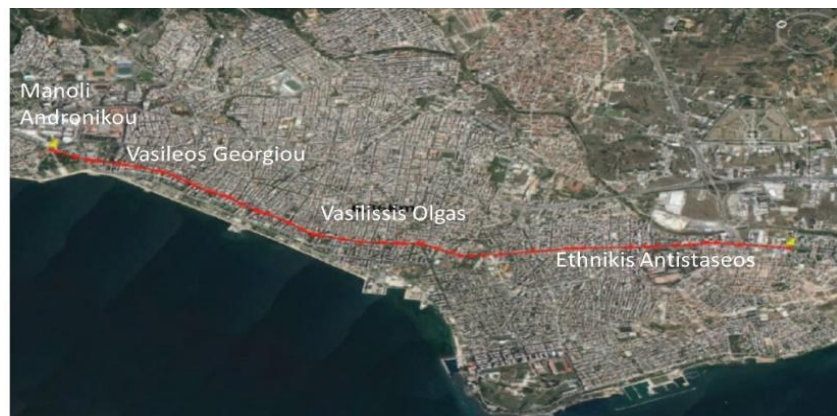
Motorcycle Delivery Truck Car Total

Daily vehicle type distribution



Passenger cars Motor cycles Delivery trucks

Thessaloniki: pilot zone



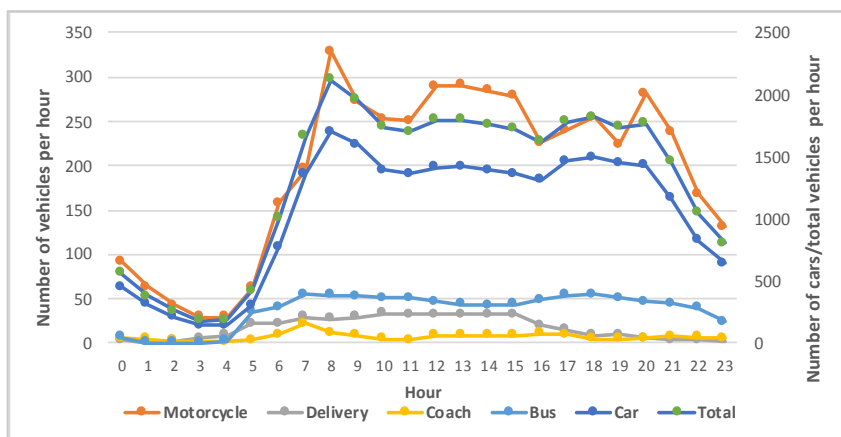
Total number of vehicles in the city exceeds 777.544 including private cars, heavy vehicles and motorcycles

Almost 2.2 million passenger's daily trips

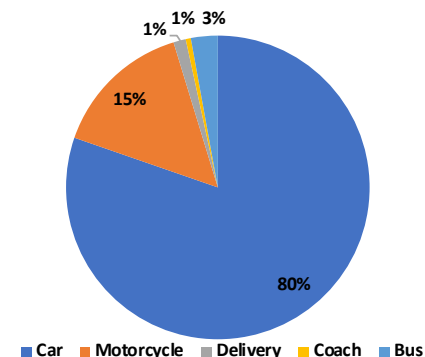
Public Transport share 27% approx.

Main features of the pilot zone:

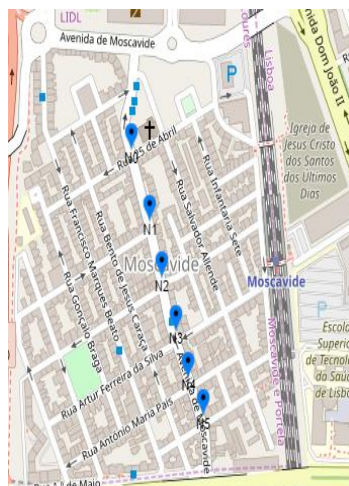
- Ethnikis Antistaseos, Vasilissis Olgas, Vasileos Georgiou and Manoli Andronikou streets
- 31 traffic lights
- 18 bus stops
- 9 bus lines



Daily Vehicle Type Distribution



Loures: pilot zone



Moscavide, submunicipality of Loures

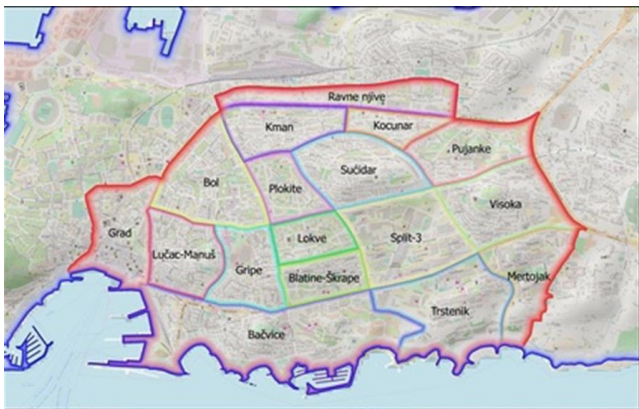
- Total area of 7.75 km²
- Population density of 12.969 persons per square meter

Main features of the pilot zone:

- One way road, 430 m length
- Traffic flow (18:00-19:00):

Edge	Passenger	Motorcycle	LCV	Coach
1	510	14	69	7
2	340	9	33	26
3	455	10	44	29
4	340	8	29	28
5	450	11	35	28

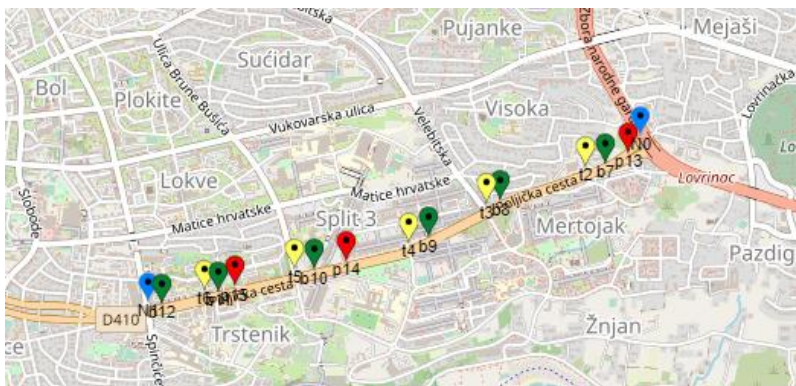
Split: pilot zone



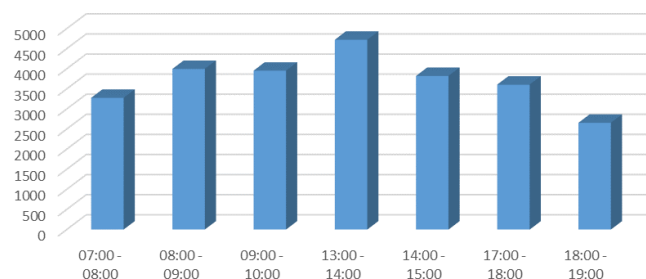
- 122,624 inhabitants in the surroundings of pilot zone, almost 69% of the total population in the municipality of Split
- 453 vehicles /1000 inhabitants

Main features of the pilot zone:

- Poljička Road
- Two-ways road of 2,3 km length
- 3 lanes
- 7 bus lines with 6 bus stops
- 5 traffic lights



Poljička average number of vehicles per hour



REMEDIO Mobility Solutions Assessment Results

Loures (PT): Moscavide Street

Before



After



✓ A structural intervention, with emphasis on promoting soft and sustainable mobility solutions:

- **Two Road lanes transformed in just one**
- Increasing of the **Public sidewalk**
- Inclusion of **Street furniture, Small gardens and Equipment.**

✓ Reduction by 15% of the daily total of the traffic flow.

	Passenger Car Unit		
Period	Before	After	Reduction
7h30 - 9h30	432	352	19%
13h15 - 15h15	422	372	12%
17h30 - 19h30	554	472	15%
Daily total	469	399	15%

Loures (PT): Measured Impacts on Air Quality

	PM _{2.5} (µg.m ⁻³)		
	Before	After	Reduction
Mean	13.5 ± 9.7	12.5 ± 5.6	7.5 %

	PM ₁₀ (µg.m ⁻³)		
	Before	After	Reduction
Mean	29.1 ± 13.2	27.0 ± 9.5	7.3 %

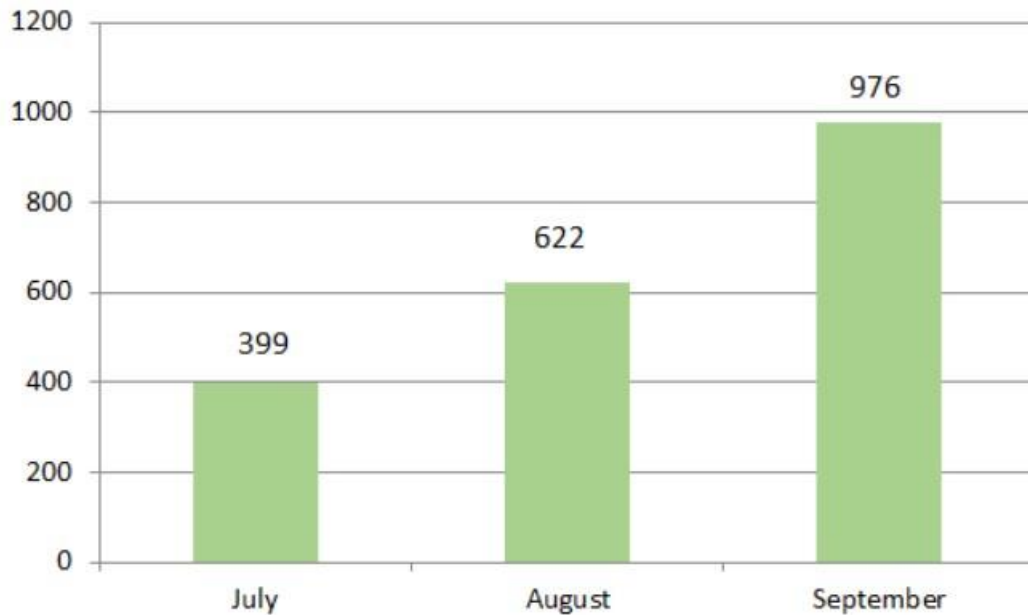
✓ Reduction by about 7 - 8 % regarding PM_x.

Split (HR): New Public Bike Sharing System



- ✓ 20 e-bikes
- ✓ 30 classic bikes
- ✓ 8 bike sharing stations

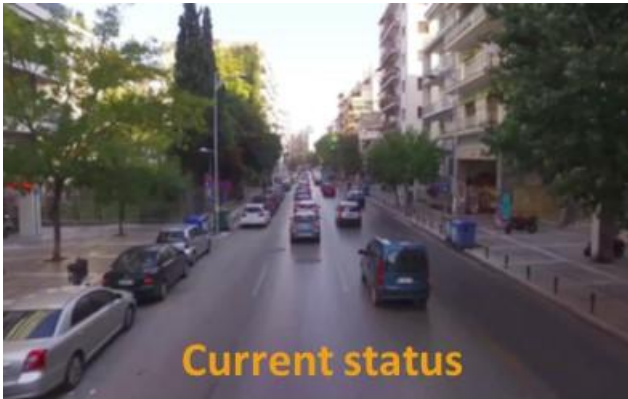
Split (HR): Number of Public Bike Rentals



Reference period: 10 July – 18 September 2019

- ✓ Total number of bike rentals – **1.997**
- ✓ Total number of registered users – **1.146**

Thessaloniki (GR): Eastern Horizontal Road Axis



1st Traffic Scenario (SCN10)

- ✓ **10% Reduction** of passenger cars and motorcycles traffic load.

2nd Traffic Scenario (SCN20)

- ✓ **20% Reduction** of passenger cars and motorcycles traffic load.
- ✓ **Increase by 2** of public buses circulation frequency.



Thessaloniki (GR): Environmental Impacts

- ✓ **Differences (%)** in values between the future traffic scenarios (SN10, SCN20) and the current traffic conditions (Base Case).

Fuel Consumption

SCN10 → **-18%**

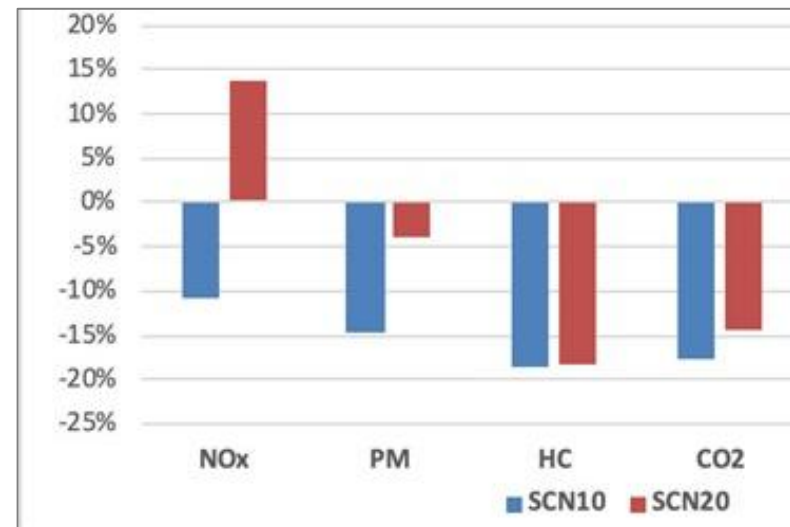
SCN20 → **-16%**

Traffic Noise

SCN10 → **-0.5%**
(max -2.8%)

SCN20 → **-1%**
(max -3.4%)

Pollutant Emissions – Carbon Footprint

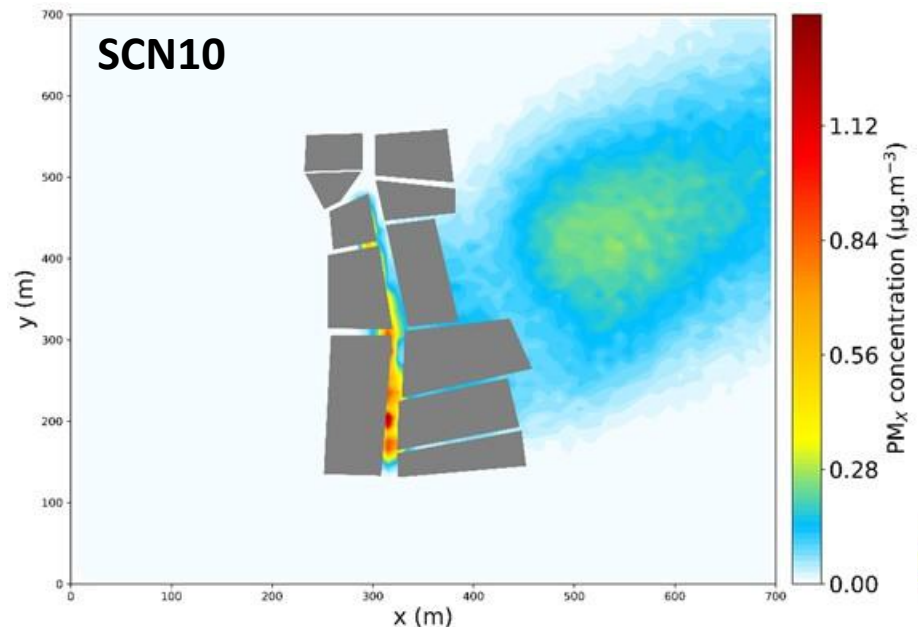


Thessaloniki (GR): Impacts on Air Quality

Pollutant	Max Concentration * Difference	
	SCN10	SCN20
PM _x	-12%	+9%
NO _x	-9%	+23%

**spatially unpaired*

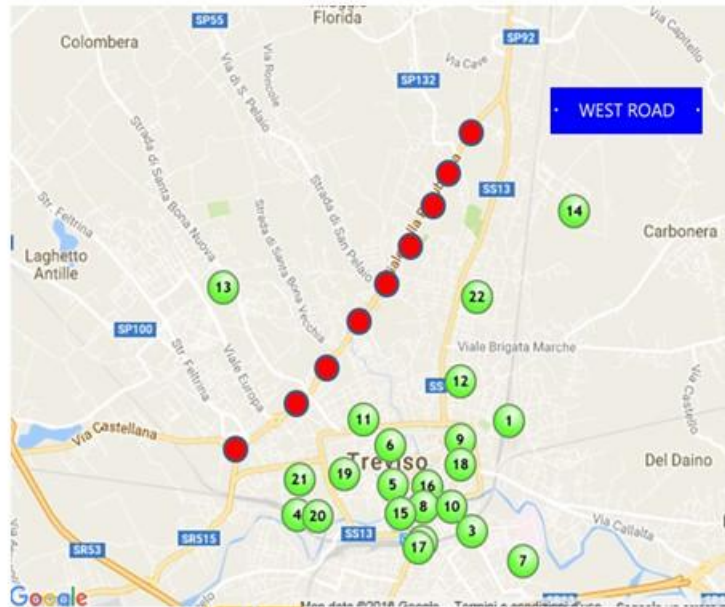
PM_x concentrations



Treviso (IT): Expanding the Bike Sharing System

Bike sharing – West Road
9 new station - 50 bikes

22 existing stations - 120 bikes



125 bikes used
(in 2 months)



125 journeys by car saved
253 km mileage saved

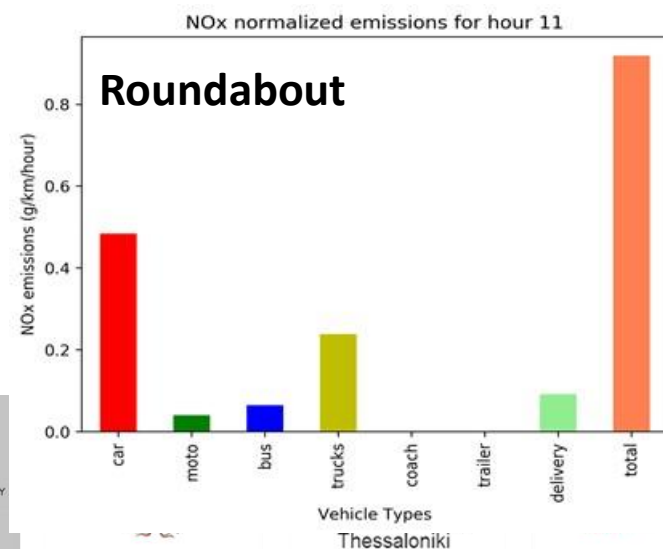
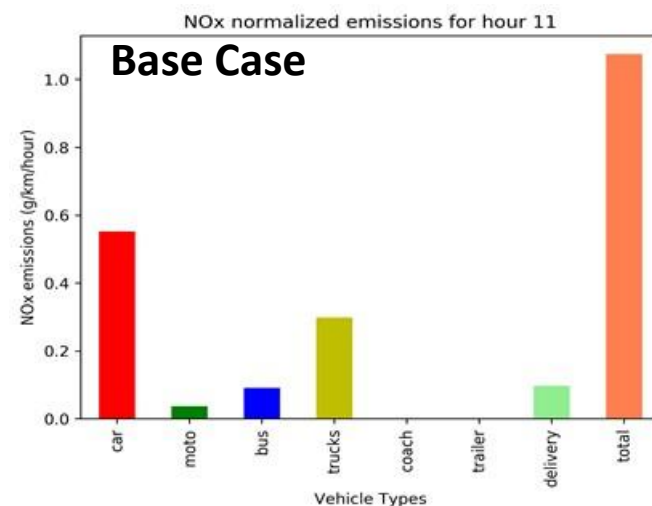
Mobility Office – Treviso Municipality

The ‘Roundabout’ Mobility Scenario:

- Replacement of **6 traffic lights** with roundabouts.

Treviso (IT): Impacts on Energy and Emissions

Environmental Variable	Total Value Reduction
Fuel Consumption	5%
CO Emissions	10%
CO ₂ Emissions	
PM _x Emissions	
NO _x Emissions	20%
HC Emissions	30%

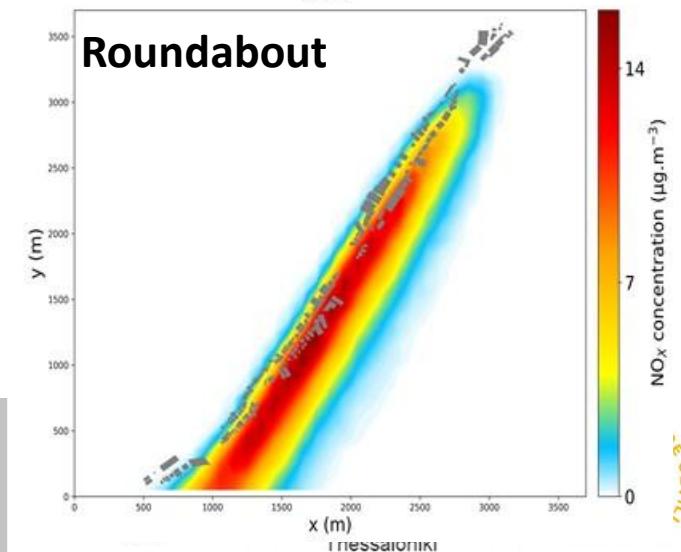
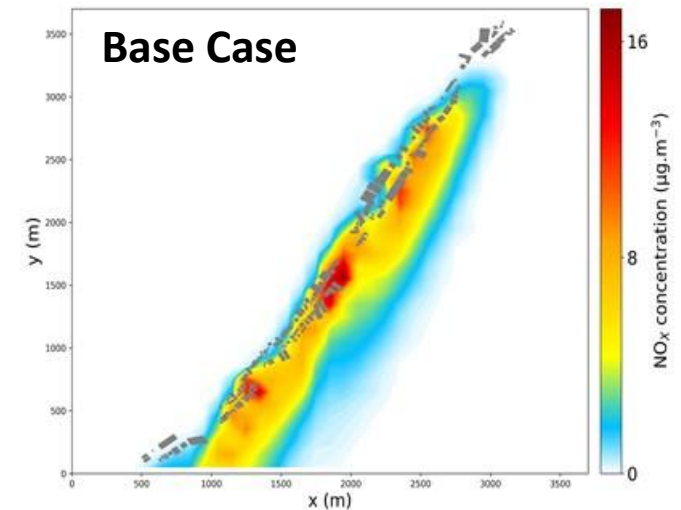


Treviso (IT): Impacts on Air Quality

Pollutant	Max Concentration * Reduction
CO	33%
PM _x	17%
NO _x	8%
HC	57%

*spatially unpaired

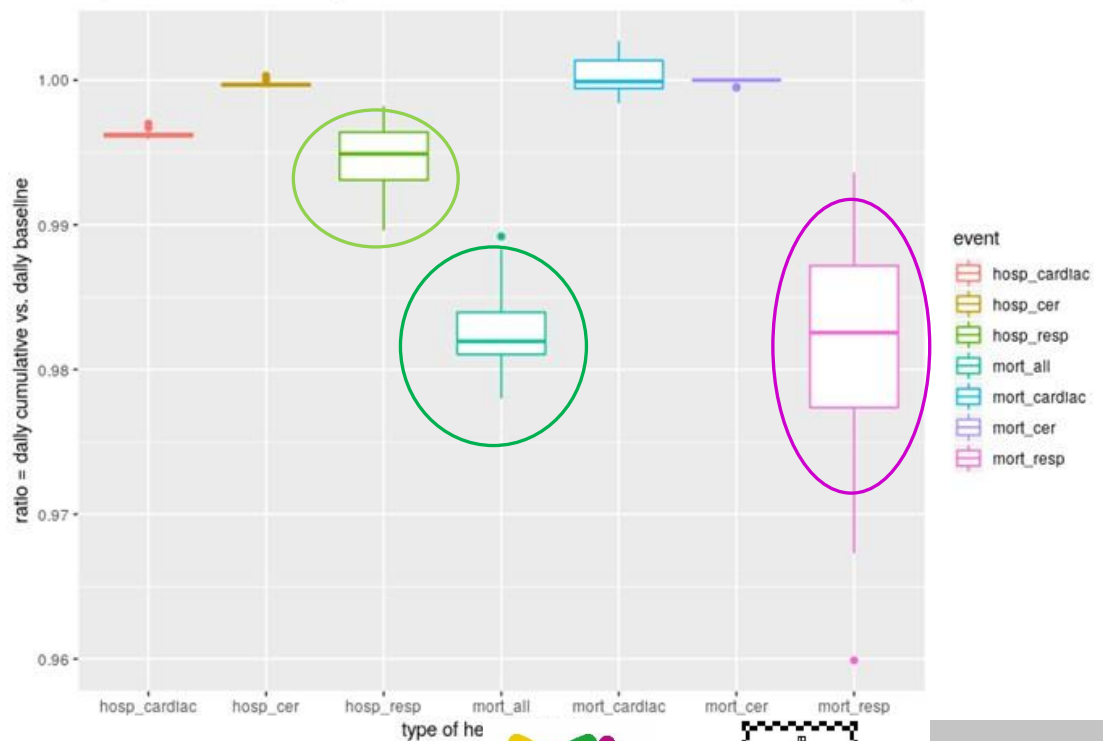
NO_x concentrations



Treviso (IT): Health and Cost Impacts (1)

? WHAT IF daily concentrations of NO_2 , PM_{10} , $\text{PM}_{2.5}$ were reduced by 10% due to the implementation of the mitigation measure? (Study period of 4 weeks: Oct-Nov 2017)

Boxplot of Hospitalizations and Deaths by Cause

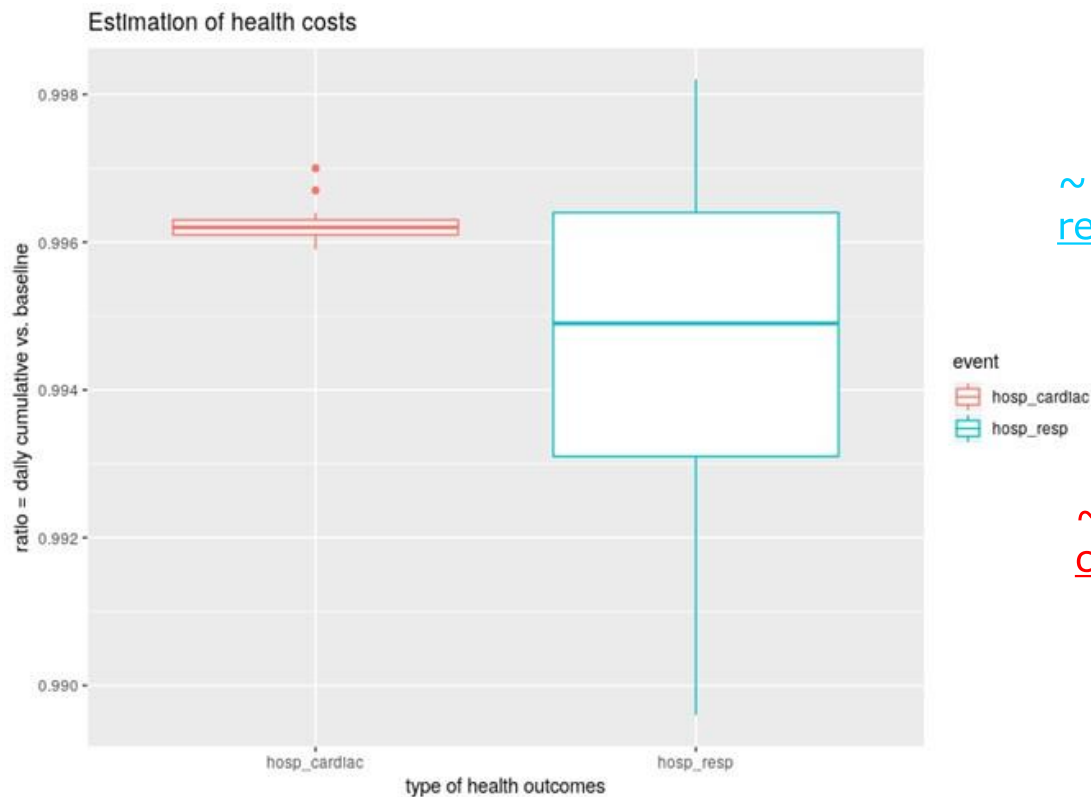


~ **0.5% reduction** of the median of hospitalization for respiratory causes.

~ **1.7% reduction** of the median of mortality from all causes.

~ **1.7% reduction** of the median of mortality from respiratory causes.

Treviso (IT): Health and Cost Impacts (2)



~ **0.5% reduction** of the median for
respiratory hospitalizations costs.

~ **0.4% reduction** of the median for
cardiac hospitalizations costs.

Conclusions

- ✓ **REMEDIO IMT: Sound, Customizable, Transferable Tool** to evaluate the environmental-related performance of low-carbon mobility actions.
- ✓ Sustainable mobility in pilot areas induce **Environmental Improvements and Health/Costs Reduced Impacts** as a result of:
 - **Soft mobility infrastructure**
 - **Improved traffic conditions**
 - **Private cars use reduction**
 - **Clear technology vehicles used for public transportation.**
- ✓ **Technical Developments** can be more useful when **Scientific Knowledge** is associated with **Participatory Governance**:
 - Citizens, Users
 - Experts
 - Stakeholders
 - Organizations, Local authorities, Policy Makers.

Collective Intelligence



Thanks for your attention!

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