Integrated Modelling Tool to Evaluate the Transport, Energy and Environmental-related Performance of Low-Carbon Mobility Actions

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Challenges of REMEDIO

The way (road) we were

The every day traffic jam

The vision we have
In the general approach of REMEDIO, IMT plays a fundamental role in the decision support system.
Integrated Modelling Tool

✓ Customized modelling tool to evaluate at local street level the environmental-related performance of low-carbon mobility actions.

✓ IMT integrates the following modules for the estimation of traffic related impacts:

- Pollutant emissions
- Carbon footprint
- Atmospheric dispersion
- Energy consumption
- Noise
- Health events and related Costs.

Access through the link http://130.206.115.232:3001/
IMT Modules

- Traffic Simulation ✓
- Pollutant Emissions Module ✓
- Carbon Footprint Module ✓
- Energy Consumption Module ✓
- Air Dispersion Module ✓
- Traffic Noise Module ✓

SUMO – Simulation of Urban MObility

VADIS Model

- Wind Flow Module (FLOW)
- Dispersion Module (DISPER)

Pollutants Concentrations

CNOSSOS-EU Methodology

- Health / Cost Module (Statistical Modelling)
Conceptual Modelling Approach

**Step 1: Zone Definition**
- Traffic data requirements
  - Vehicle technologies (fleet)
  - Traffic flow characterization
  - Vehicle loading
- Road data requirements
  - Road Definition
  - Number of trams
  - Especial lanes
  - Gradient
  - Curvature
  - Building/spaces identification

**Step 2: Traffic Definition**
- For each tram

**Step 3: Model Simulation**
- Model in "C"
- Calling SUMO+PHEMlight
- Energy model
- Noise model CNOSSOS-EU

**Step 4: Analysis of Results**
- Total fleet fuel consumption
- Consumption by vehicle type
- Consumption in public transport
- Total CO2 emissions traffic
- Houses exposed to Lden>65db
- Sensible sites exposed to Lden>65 db.

**Step 5: Modifications**
- Include one traffic light in the position X
- Increase the bus frequency
- Change tram to pedestrian
- Include bicycle lane

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**Steps 1 and 2:**
- Road description, Traffic data, Buildings dimensions, Meteorology, Air quality data

**Steps 3 and 4:**
- Application of modules
- Raw data, Graphs, Maps
- Data analysis

**Step 5:**
- Traffic scenarios building
IMT Application Exercise

Aim of the First Part of the Hands-on Exercise:

Get acquainted with:

➢ the **User Interface**
➢ the **Data Input Process**.

Aim of the Second Part of the Hands-on Exercise:

➢ Understand better the **Application of Modules**
➢ Understand better the **Output Results**
➢ Consider the **IMT Capitalization Perspectives**.
Let’s Start!
Did you Run IMT Modules?

Excellent!
IMT Modules Results:

Exercise Summary
- Fuel Consumption per vehicle type for the whole road axis

- Total Fuel Consumption per edge (i.e. road segment)
**Noise Module**

- **Total Noise emissions (absolute and normalized*) per edge**
  - ROAD TRAFFIC NOISE
  - NORMALIZED TRAFFIC NOISE

- **Vehicle-type Noise emissions per edge**

*Normalized emissions referred to noise values per 100 meters of road length*
Emissions Module (including Carbon Footprint)

- **Plots ➔ Graphs and Maps** for:
  
  - **Pollutants**: CO, NOx, HC, PM$_x$ and carbon footprint (CO$_2$)
  
  - **Vehicle Type**: Car, Moto, Trailer, Truck, Bus, Delivery (LCV), Coach or all vehicle types (i.e. Total)
  
  - **Type of Data**: Absolute or Normalized (per km) emissions
  
  - **Temporal Analysis**: Hourly or Daily
  
  - **Spatial Analysis**: Per edge or the whole road axis.
CO₂ emissions from Passenger Cars

Spatially Distributed Emissions

Total CO₂ emissions
(all vehicle types)
Emissions per Vehicle Type and Category

CO₂ emissions per vehicle type in the whole road axis

CO₂ emissions per vehicle category (EURO standards, fuel) in the whole road axis
IMT Additional Results:

Dispersion Module
- Air pollutant concentrations (CO, NOx, HC, PM$_x$)
- CO$_2$ concentrations
IMT Soft Actions:

Mobility Scenarios Building
8 Different Soft Actions to be Selected

- Action 1: Add a bus lane
- Action 2: Add one or more bus lines
- Action 3: Add a bike lane
- Action 4: Changes about traffic light
- Action 5: Remove/add a road lane
- Action 6: Change vehicle type distribution
- Action 7: Change a traffic pattern
- Action 8: Freight Module
Example: Add a Road Lane (Action 5)

- In the first step no changes are needed (as in the Base Case)
Example: Add a Road Lane (Action 5)

- In the second step, increase the number of car lanes to 4
Example: Add a Road Lane (Action 5)

- Step 3 : Insert the same traffic data as for the Base Case
Example: Add a Road Lane (Action 5)

Results for the Emissions Module

BEFORE: Base Case

AFTER: Increased Road Lanes (from 3 to 4)
Questions?

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