MOMENTUM

Modelling Emerging Transport Solutions for Urban Mobility

Introduction

The aim of this document is to describe the input and output data of level 1, level 2 and Level 3 of the online Decision Support Toolset, along with the scope of each level. The purpose of this document is to inform users who want to test the Decision Support Toolset, about the minimum number of available input data they need to have and the expected outputs (KPIS), based on the level examined.

In every level, user can find a manual document for each level with further details about each level. Should you require any more information, please do not hesitate to contact **Georgia Ayfantopoulou** (gea@certh.gr), **Josep Maria Salanova Grau** (jose@certh.gr) or **Evripidis Magkos** (emagkos@certh.gr)

MOMENTUM project

Decisions on transport policy measures have long-term impacts on society. Transport policy measures can lock up capital for decades and cause manifold external effects. Due to the growth in urban population, there has been an increase in demand for mobility and, consequently, an increase in the number of vehicles on the roads. The increased levels of traffic congestion indicate a strong and imminent need for cities to foster sustainable and eco-friendly solutions of urban mobility. In order to allow European policy-makers to evaluate transport polices, a decision support tool (DST) is required to evaluate economic, environmental and social impacts of the implementation of transport policies.

The overall goal of the MOMENTUM project is to develop a set of mobility data analysis and exploitation methods, transport models, planning and decision support tools, able to capture the impact of new transport options and ICT-driven behavioural changes on urban mobility environment. The multilevel Decision Support Toolset consists of three levels and its primary goal, is to develop a conceptual framework for assessing the impacts of new mobility options by collecting and analysing heterogeneous data sources and develop mobility patterns. The developed Decision support toolset integrates mobility data from different sources and modelling improvements in to one online platform, where cities can virtually test and asses the performance in order to support local authorities in the task of designing the right policy mix of emerging mobility solutions.

Decision Support Toolset

In order to tackle the needs of policy and decision makers, the development of an interactive Decision Support Toolset is the main outcome of the MOMENTUM project. The aim of the DST is to formulate policy objectives and assess the potential impact of emerging urban mobility services, across a range of KPIs
In the DST proposed, each level entails a different degree of complexity, both in the input and in the output data. The proposed three level DST is a scientific and technical procedure aiming to explore the available urban mobility solutions for each examined area, depending on the characteristics (socioeconomic, spatial, existing infrastructure etc.) of each case study. In each stage of the decision support tool, different level of detail is followed depending on the availability of input data.

Level 1

The main objective of level 1 of the DST is to identify the outlines of potential interventions in the urban mobility characteristics of a city. Key elements of this step are to define city's needs, perform economic and technical analysis for emerging urban mobility in the city. Level 1 is an automated procedure and requires a small amount of input data, such as geospatial socio-economic data about the population of the studied area and the available operating fleets of mobility services.

Level 2

The aim of this level is to analyse and evaluate the design of emerging mobility systems using data driven methods for input data. In line with the analysis of the initial level of the DST, Level 2 is an automated procedure that can be performed online. The nature and the level of analysis of input data in this Level, is more comprehensive and user need to perform data preparation to import transportation data on the applicable format.

Data Inputs, Outputs and scope

In this section is described the needs for input data, output data and the scope of the procedures followed in Level 1 and Level 2, of the online version of the DST, MOMENTUM project. This section includes all the necessary input data and the outcomes of different examined scenarios in the DST.

Level 1

Aim of Level 1 is to give an initial investigation of the implementation of emerging mobility services in the examined area. Below are described the Input and Output data of level 1, along with the scope of this level in the DST. In level 1, there are inputs **necessary** to import and **optional** ones.

Scope

Level 1 is an optimization process, so it will not provide the real values, but the optimum based on the mathematical formulations and the hypothesis, however, based on the results expected by the cities various mechanisms to "calibrate" the way the problem is optimized were included in order to allow the cities to ask for more "social" solutions and less economic. Features added to the tool, targeted to the expansion of possibilities to the city partners, to optimize the supply layout and evaluate the operational system of the services. Furthermore, the addition of the sensitivity analysis of demand option in Level 1, aimed to give user of the DST, the ability to receive a range of solutions, not only the optimal values of the tool, in order to define the most applicable set of interventions.

Inputs

- **Socioeconomic and Functional Variables –** value of time, mean demand, user waking speed
- **Geospatial –** Population, Square meters
- **System Data –** Cost of operation
- **Constrains –** Travel time activation, sensitivity mode for demand

Outputs

- Range of optimal solutions of:
  - fleet size
  - number of stations
  - number of docks
  - operational cost

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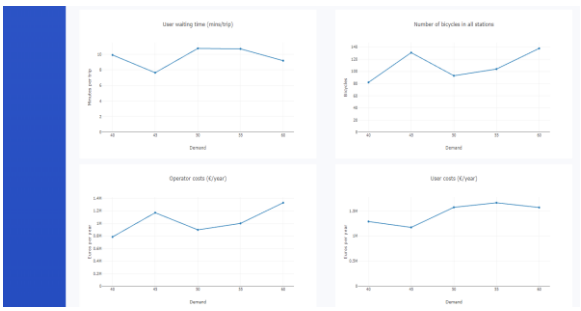
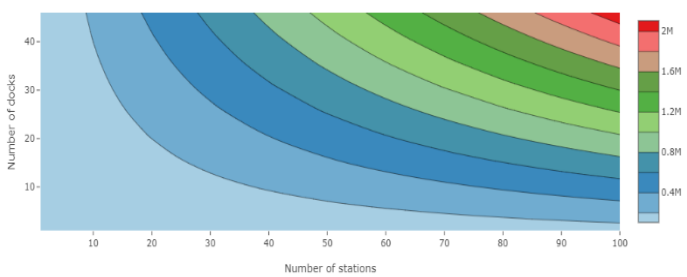
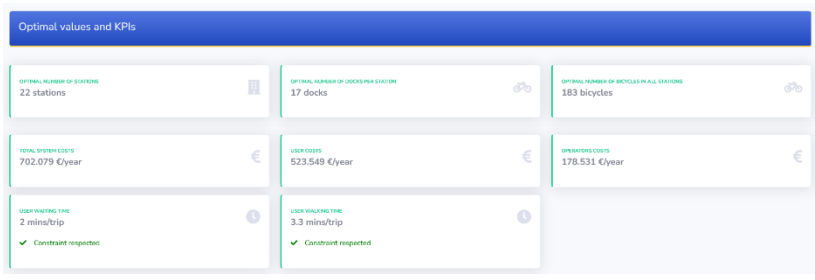
Operator costs in euros per year







Level 2

Aim of Level 2 is to analyse and evaluate the design of emerging mobility systems using data driven methods for input data in the examined area. Below are described the Input and Output data of level 1, along with the scope of this level in the DST. In level 1, there are inputs **necessary** to import and **optional** ones.

Scope

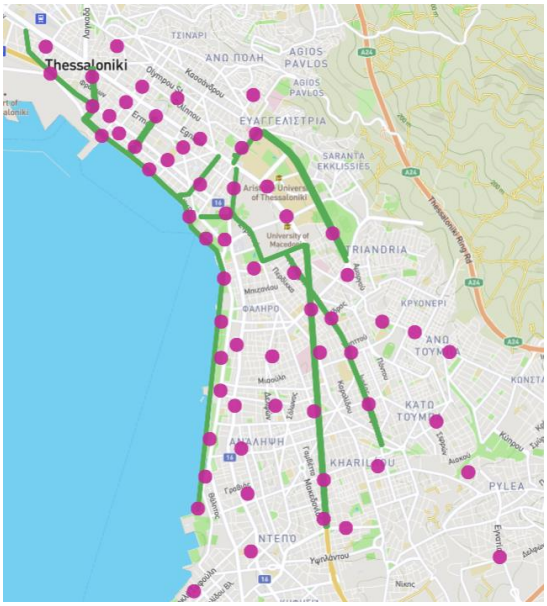
Level 2 aims to embody methods that utilize the spatially distributed data from trips or ODs to perform strategic decisions for the service. The user of the tool should define the desired characteristics of the service to let the algorithm decide the resources needed to fulfil the requirements. In that step the user should tune values of demand in the examined area, road network and constrains such as bicycle network and public transport stops. Based on those criteria the planning module can return the optimal number and location of stops/docks, the capacity of vehicles or stops and similar system parameters. The operational module helps to evaluate each strategic setup based on performance metrics. Those metrics also used in the optimization of planning parameters as they reveal possible surpluses or shortage of resources for the service

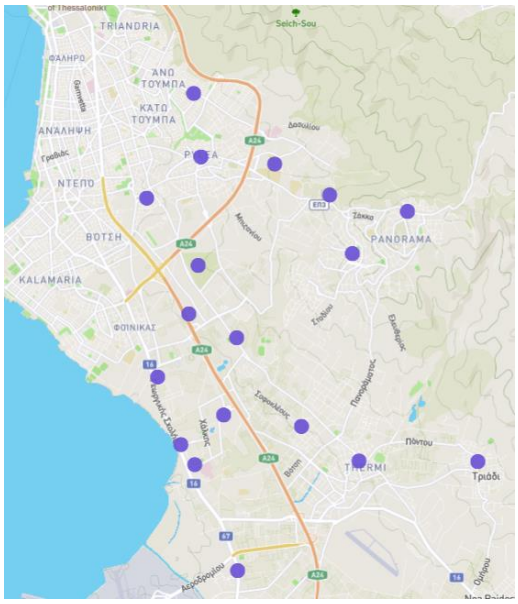
Inputs

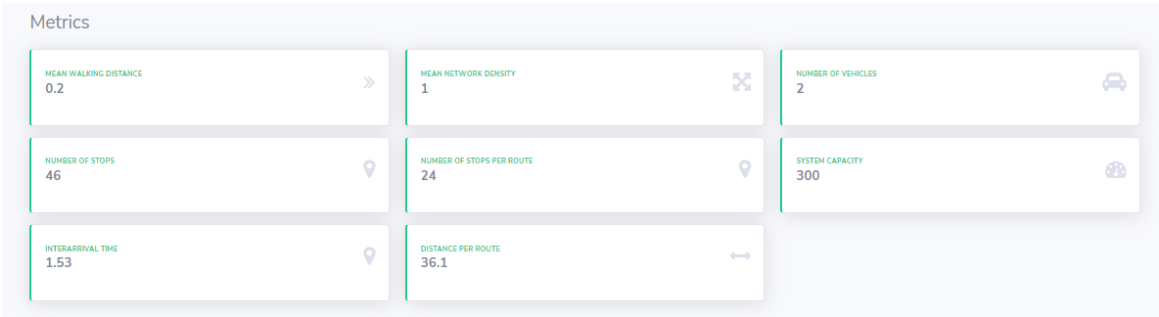
- **Transportation Data information** - Floating car data or OD matrices
- **Bike Lanes Network Data File –** shp file of bus lanes in the area
- **Public Transport Data File –** shp file of public transport in the area

Outputs

- optimal number of stations
- optimal location of the stations
- optimal number of stops
- optimal location of the stops
- number of docks
- number of units (bicycles, cars, DRT, scooters)







Level 3

Level 3 of the multilevel decision support tool involves a comprehensive analysis of the examined district by modelling the transport system of the selected city, including the demand, supply, fleet management and sustainability models. The nature of the methodological stream of Level 3 is based on the extension and investigation of city transport models in enabling the strategic planning and evaluation of shared mobility services. Hence the implementation of Level 3 needs to be offline and then, using the visualization and analytical tools of the online version to assess the produced KPIs.

Scope

The scope of Level 3, is to investigate the implementation of emerging mobility solutions in the context of the transportation model of the city. Level 3 is focused on expected demand, operating and future supply and the fleet management of the examined service.

The main objective of level 3, is to develop new modelling approaches that are able to assess the impact of emerging mobility concepts and solutions. This means that changes are required in order to incorporate emerging mobility solutions into strategic transportation models, both in terms of supply and demand. Models developed in level 3, are able to capture and mimic user interaction and behavior with emerging mobility services in the strategic transport models, both in terms of supply and demand. Level 3 integrates the models of the proposed intermediate modelling approach providing the opportunity for cities to efficiently integrate shared mobility systems into the city's traditional transportation models in order to evaluate and design long-term planning strategies. The Aimsun Next traffic simulation software is used as an example to demonstrate the enriched capabilities of state-of-the-art transport simulation software. Moreover, the simulation platform Aimsun Ride is designed for the deployment and evaluation of the shared-mobility services such as Demand Responsive Transport (DRT), car-sharing, bike-sharing and car-pooling). The platform was designed as a plug-in inside the commercial software Aimsun Next and has been improved and extended for the scope of the MOMENTUM project. Scenarios can be defined and evaluated in order to explore different aspects of the provision of a mobility service. The investigated aspects can be related to both the fleet operators as well as the users of the system.

Depending on the policy of intervention under study and the available data, each city can select a different subset of models to be run. Not all the developed modules are open source or developed with the same technologies, hence, an automatic integration of those modules is not feasible. The online DST visualizes work described in level 3, with results exported from the Aimsun Ride simulation platform for emerging mobility services.

Data availability and produced KPIs

Inputs

- Aggregate demand trips and sociodemographic information
- Disaggregate mode choice model for shared mobility services
- Individual requests for shared services
- City road network
- Network travel time information
- Fleet characteristics for shared mobility services
- Fleet operational solutions

Outputs

- Travel times for users and operators
- Travelled distances for users and operators
- Waiting times for service users
- Number of requests served
- Trip routes
- Fleet utilization
- Network performance and environmental indicators