



The proposed multilevel decision support tool is a scientific and technical procedure, aiming to explore the available urban mobility solutions for each examined area, depending on the characteristics. The aim of Level 2 is to develop an analysis of the planning and evaluation of emerging mobility systems. Through the procedure's steps, information from various sources will be used.

The planning process 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 like the mean walking distance for a passenger to reach a stop, the maximum waiting time, or the maximum/average trip duration. 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. More information about the theoretical approach on how each scenario of Level 2 was designed and implemented, can be found in the Deliverable of Task 5.2 "Interactive Decision Support Tool".

The document with the guidelines of the Level 2 of the Decision Support Toolset presented below, was developed in order to assist users of the tool to understand all the details of the produced tool. Should you require any more information about the Decision Support Tool, please contact **Josep Maria Salanova Grau** (jose@certh.gr), **Evrpidis Magkos** (emagkos@certh.gr) and **Zisis Maleas** (zismaleas@certh.gr)

First section – Available Services

In the first section of Level 2, user need to specify the service, they want to investigate. Users can choose between available categories of services:

- Vehicle sharing: This option refers to investigation of bike sharing, scooter sharing and car-sharing systems
- On demand : This option refers to investigation of DRT systems

Second section – Input Data

In the second section of Level 2, the user need to upload the input data to the online DST interface. In each input data categories, user can find a template of how input data should be imported. Below, the available input data are described:

- 1) Floating car data file: refer to floating car input transportation data – json format. From the whole trajectory only the origin-and destination coordinates and timestamp needed.
- 2) OD matrices: refers to the Origin Destination matrix in hourly basis for the selected area - json format
- 3) Polygons files: refers to a file which describes the areas in which the examined service will be tested. This input is **necessary** if the input demand is in OD matrices form. - geojson files
- 4) Bike lanes network data file: refers to a file which describes the bicycle network in which the examined service will be tested - shp files
- 5) Public transport data file: refers to a file which describes the public transport network in which the examined service will be tested - shp files
- 6) Road network File: refers to a file which describes the road network in which the examined service will be tested - shp files

Input data with the asterisk (*), are mandatory fields that need to be uploaded for Level 2. There are two combinations that can be minimum accepted for the tool:

- ✓ Floating Car data or
- ✓ OD matrix & Polygons file

Input data (Bike lanes network data file, Public transport data file and Road Network file) are optional parameters for the tool. They can be imported in the tool in order to add a specific constrain that the user want to add in the investigation.

Input files

<input type="checkbox"/>	* Floating Car Data File	<input type="text" value="Choose File"/> No file chosen	Download Template	Download Sample	Download Repository
<input type="checkbox"/>	* OD matrix	<input type="text" value="Choose File"/> No file chosen	Download Template	Download Sample	Download Repository
<input type="checkbox"/>	* Polygons file	<input type="text" value="Choose File"/> No file chosen	Download Template	Download Sample	Download Repository
<input type="checkbox"/>	Bike Lanes Network Data File	<input type="text" value="Choose File"/> No file chosen	Download Template	Download Sample	Download Repository
<input type="checkbox"/>	Public Transport Data File	<input type="text" value="Choose File"/> No file chosen	Download Template	Download Sample	Download Repository
<input type="checkbox"/>	Road Network File	<input type="text" value="Choose File"/> No file chosen	Download Template	Download Sample	Download Repository

The next step of the input data is user to define the estimated daily demand for the service in the examined area. Demand must be added in trips per day.

Estimated daily demand trips/day

[Submit Input](#)

Third section (step 1b) – Visualization of input data

Once input data are imported in the tool, user need to press the button “submit Input”. Then a window with the visualization of the input data can be seen in the areas where those are located. In this step, user can choose a subset of the total area by selecting the polygons accordingly.

Area filtering
Click on the map to select the areas that you would like to be examined. If none is selected, the system will take into account all the areas.

Polygon visualization map

Fourth section (step 2a) – Stop candidates input

This module creates a set of candidate locations. These locations are determined based on the spatial distribution of demand. The parameters user should define are:

- **Maximum walking distance:** the distance each service user must walk to reach the nearest stop.
- **The range of stops:** The range in which the algorithm searches for the optimal value.
- **The step size:** the search step of the stops (e.g. the value 5 means search range 60,65,70, 75,..).

STEP 2a: Stop Candidates Input

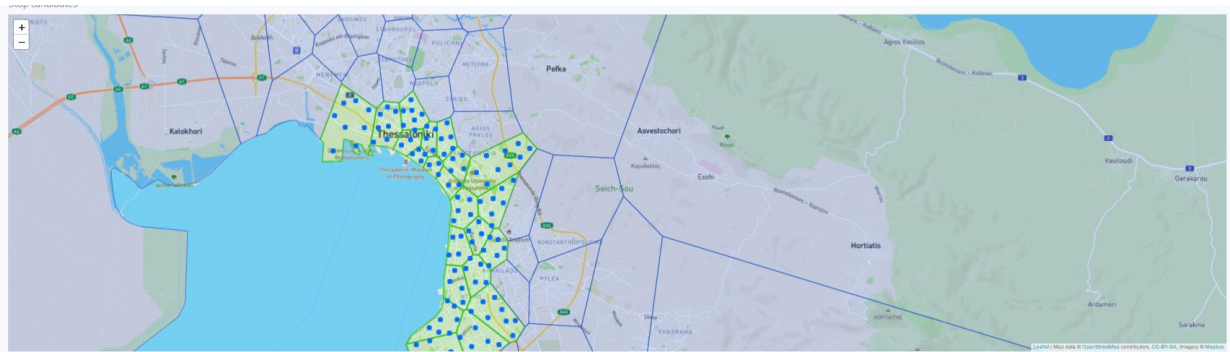
Maximum walking distance meters

Number of stops

Search step stops

[Find stop candidates](#)

The output is the station candidates for the service.



Fifth section (step 3) - Facility Location

In this step the user defines the facility location problem parameters. There are two blocks of parameters. The first one includes parameters that work as penalty and the according values (range from 0 to 1)

- Distance from bike lane: The penalty factor for stops that are far from bike lanes.
- Distance from bus stop: The penalty factor for stops that are far from bus stops.
- Number of stations: The penalty factor for regularization of the increased number of stops.
- Size of stations: The penalty factor that regularize number of docks in each stop.

The second one contains parameters that work as hard constraints, and the according values should take values based on the according unit system.

- Capacity calculation
 - Stations upper bound: The maximum number of docks in each station
 - Stations lower bound: The minimum number of docks in each station

- Min docks: The minimum number of docks in the hole system
- Max docks: The maximum number of docks in the hole system
- Density Constraint: The minimum distance each station i should have to be assigned to station j .
- Number of stops: The maximum number of stops allowed

STEP 3: Facility Location

⊗ Penalty configuration

Inner distance

Distance from bike lane

Distance from bus stop

Number of stations

Size of stations

⚙ Parameter configuration

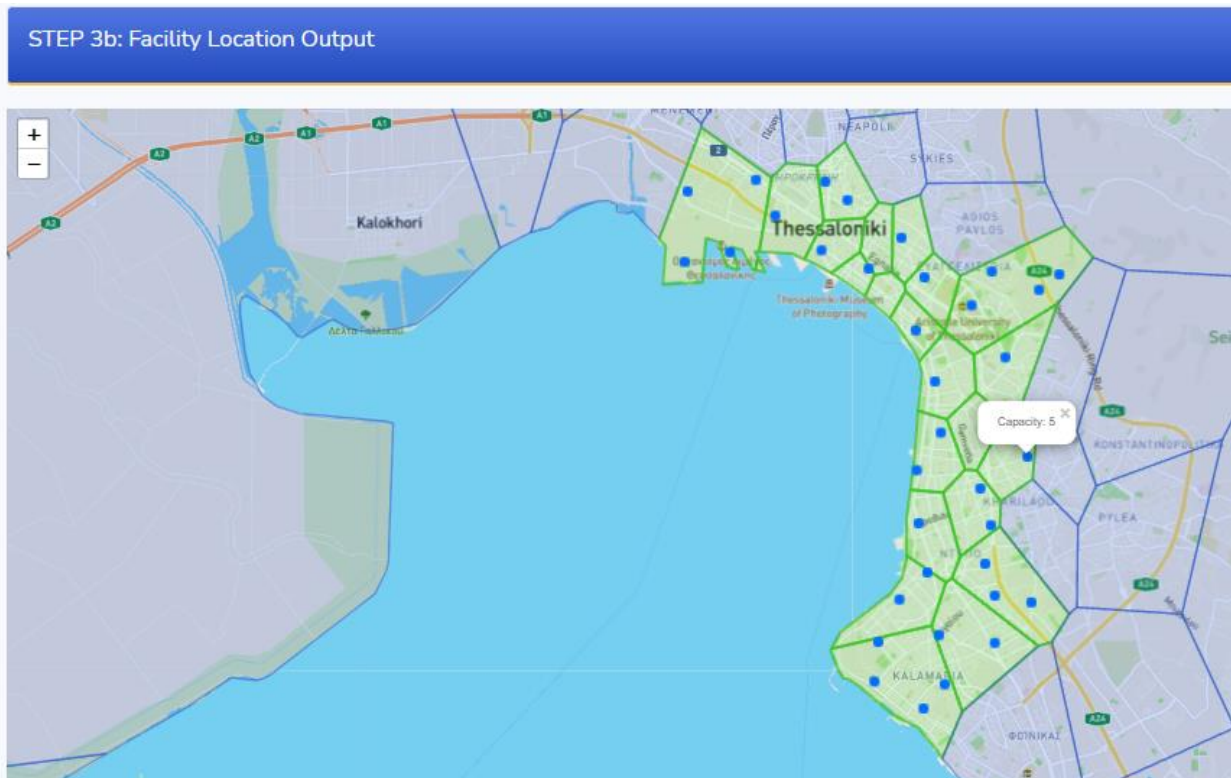
Capacity calculation Stations upper bound Stations lower bound Min docks Max docks

Density Constraint Kms

Number of stops stops

[Submit >](#)

The output is the set of the final location of the stations.



Sixth section (Step 4) - Fleet Size

To define the fleet size, user should specify the maximum duration each trip needs, the range of vehicles the service can use, and the mean speed of each vehicle.

STEP 4: Fleet Size

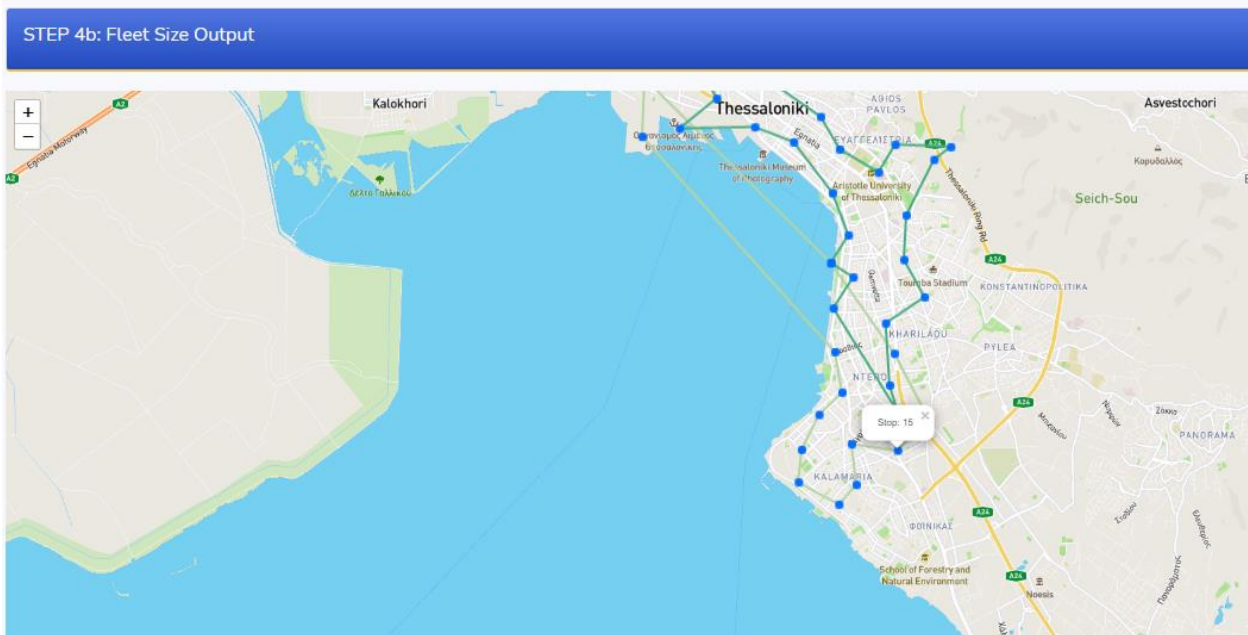
Maximum rebalancing duration minutes

Number of vehicles

Mean speed Km/h

[Fleet Size >](#)

The output of that step is the number of vehicles required to serve the demand together with the assignment of stops for each vehicle.



Seventh section – Results

Finally, in the last section, system characteristics are summarized in order to give to the user a more comprehensive insight of the produced results.

Route stop information

<input checked="" type="checkbox"/>	Route 1 1 > 20 > 65 > 12 > 47 > 43 > 118 > 24 > 3 > 34 > 97 > 17 > 7 > 84 > 56 > 8 > 42 > 89 > 40 > 57 > 55 > 112 > 107 > 92 > 19 > 111 > 76 > 88 > 94 > 73
<input checked="" type="checkbox"/>	Route 2 1 > 14 > 58 > 66 > 27 > 15 > 90 > 59 > 102 > 51 > 46 > 106 > 108 > 54 > 53 > 68 > 28 > 33 > 85 > 120 > 44 > 71 > 99 > 81 > 36
<input checked="" type="checkbox"/>	Route 3 1 > 70 > 98 > 91 > 119 > 103 > 13 > 30 > 11 > 79 > 6 > 62 > 83 > 39 > 74 > 109 > 25 > 48 > 63 > 115 > 78 > 32 > 121 > 75 > 49 > 96
<input checked="" type="checkbox"/>	Route 4 1 > 38 > 117 > 86 > 31 > 60 > 69 > 41 > 5 > 22 > 82 > 110 > 67 > 104 > 29 > 100 > 52 > 114 > 2 > 9 > 105 > 64 > 16 > 101 > 26 > 77 > 23 > 95 > 18 > 10 > 37 > 21 > 80 > 35 > 45 > 113 > 61 > 72 > 116 > 87 > 4 > 50 > 93

Metrics

MEAN WALKING DISTANCE 1.1	MEAN NETWORK DENSITY 3.9	NUMBER OF VEHICLES 4
NUMBER OF STOPS 120	NUMBER OF STOPS PER ROUTE 31	SYSTEM CAPACITY 600
INTERARRIVAL TIME 6.34	DISTANCE PER ROUTE 188.2	