

# Advance data-driven assessment and management of shared micromobility: System performances and digital tools for planning

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# Data

- **Data source 1:** General Bikeshare Feed Specification data from over 100 EU cities for two years
- ❖ Collection methods: extracted from operators API every few seconds
- **Data source 2:** Fleet battery swapping histories and charging log event files
- ❖ Collection methods: operator sharing and modular charging in Standab
- **Data source 3:** Open access OpenStreetMap and General Transit Feed Specification data

- ✓ **User information free**
- ✓ **Standardized GBFS following GDPR**

File Name	Defines
gbfs.json	Auto-discovery file;
gbfs_versions.json	GBFS documentation versions.
system_information.json	System operator, location, year implemented, URL, contact info, time zone.
vehicle_types.json (added in v2.1)	Describes vehicle types;
station_information.json	List of stations, capacities, and locations;
station_status.json	Available vehicles and docks at each station
vehicle_status.json (as of v3.0)	<b>Active availability, state-of-charge, location coordinates</b>
vehicle_availability.json (added in v3.1-RC2)	Future availability of vehicles (e.g., reservations)
system_hours.json	opening_hours instead.
system_calendar.json	opening_hours for operating dates. <b>Time stamps</b>
system_regions.json	Defines system regions.
system_pricing_plans.json	Defines pricing structure.
system_alerts.json	Provides current system alerts.
geofencing_zones.json (added in v2.1)	Defines geofencing zones and associated rules/attributes.



# Utilization

## Data-driven system performance assessment and monitoring of shared micromobility:

- Spatiotemporal Usage patterns: demand, utilization rate, trip characteristics (speed, duration, distance)
- Modal substitution and integration with other transport modes
- System-level emission reduction
- System-level user benefit (reduction in travel time and costs) and accessibility
- Impacts of implemented regulation and policies (e.g., parking regulations in Sweden 2022)
- Identifying underutilized vehicles and illegal parking

## Digital tools for system monitoring and planning:

- Digital tools based on continuous data streams for above purposes
- Digital tool for digital virtual parking (Geofencing) planning and optimization
- Digital tool for charging and rebalancing

Planning

Operation monitoring  
and management

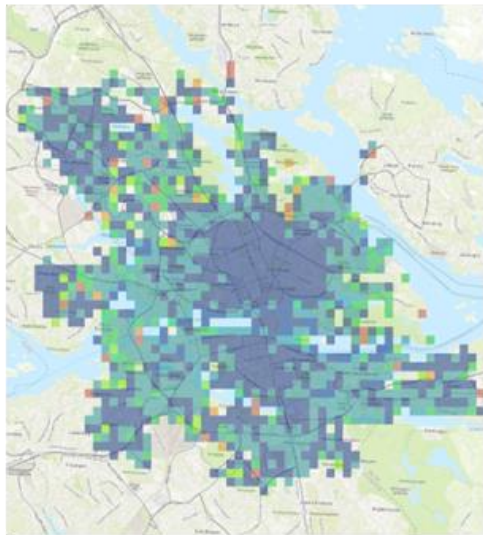
Decision making  
(CBA)

.....  
EDEN

# Usage example 1

Big data assessment of GHG emission reduction and user benefit of reducing travel time for CBA

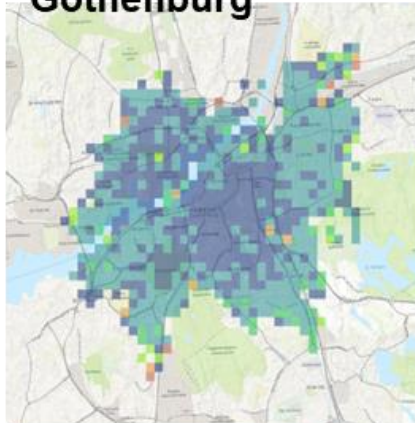
Reduce 6.1 min per trip  
Stockholm



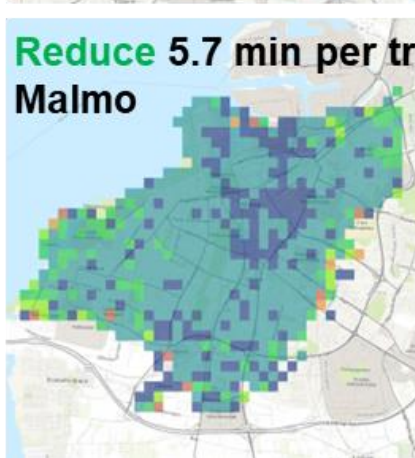
Average reduced travel time per trip

All zones positive impact

Reduce 6 min per trip  
Gothenburg



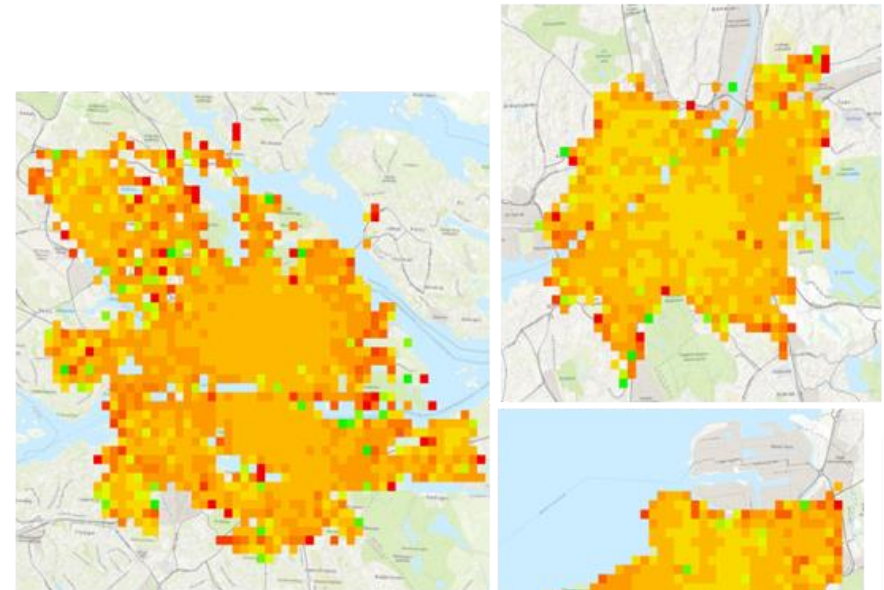
Reduce 5.7 min per trip  
Malmo



Reduced TT (minutes)



8.3%, 7.5% and 2.0% positive impact



Average GHG reduction per trip

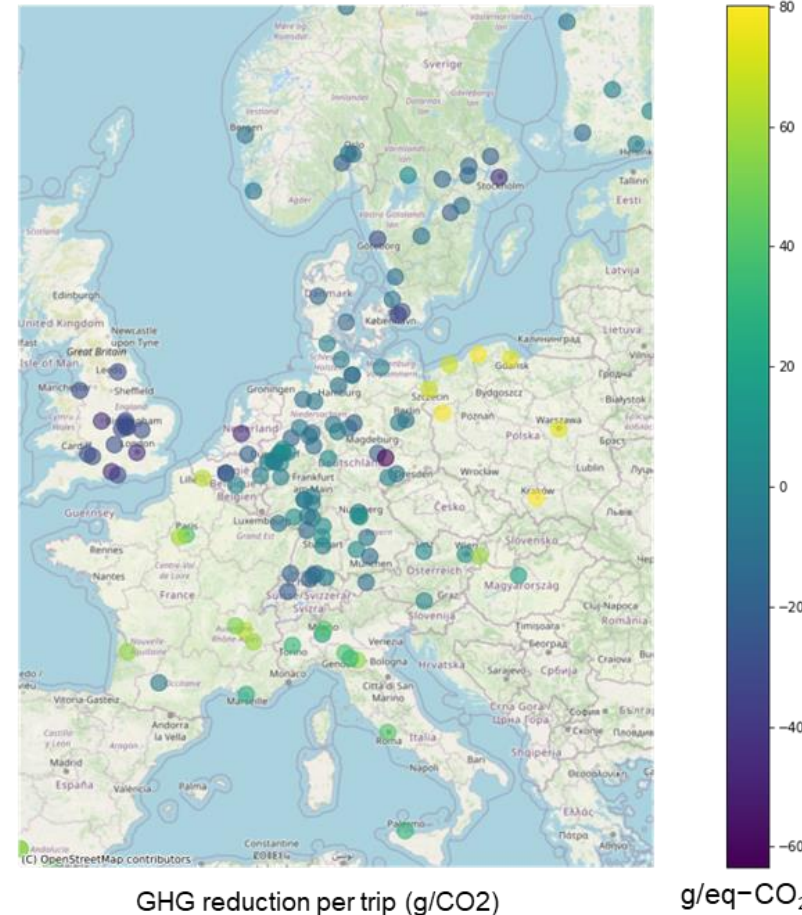
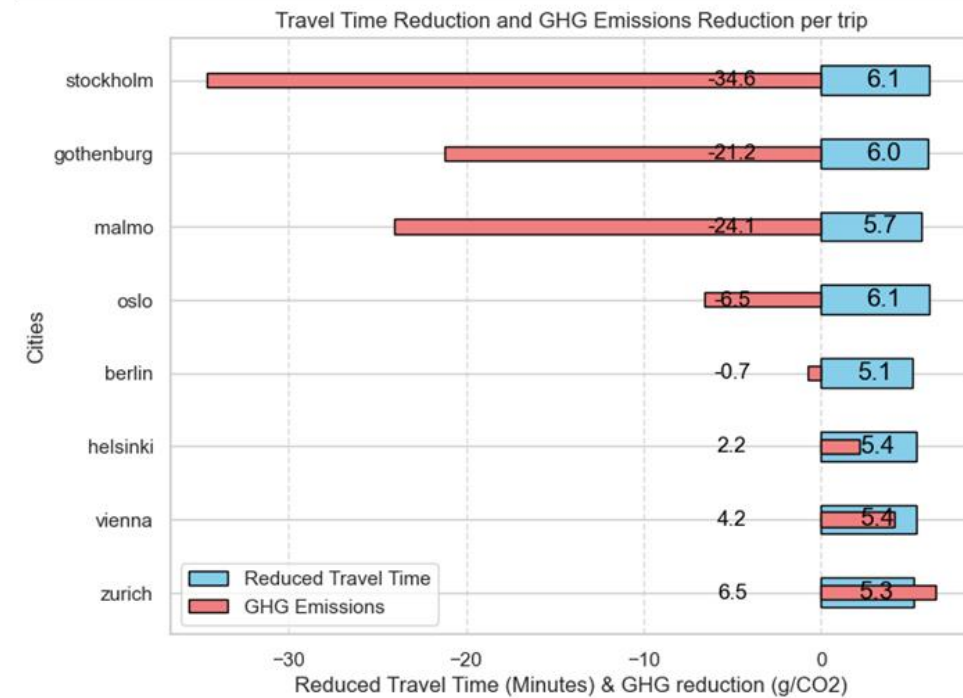
GHG reduction (gCO2)



# Usage example 1

Big data assessment of GHG emission reduction and user benefit of reducing travel time for CBA

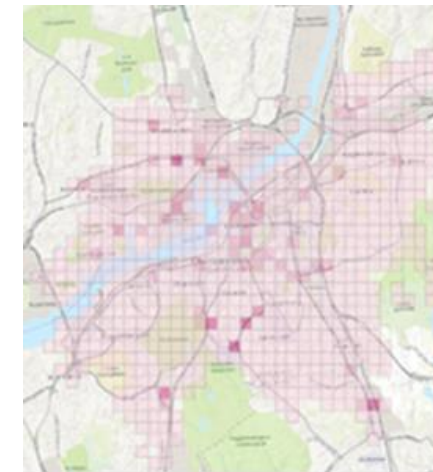
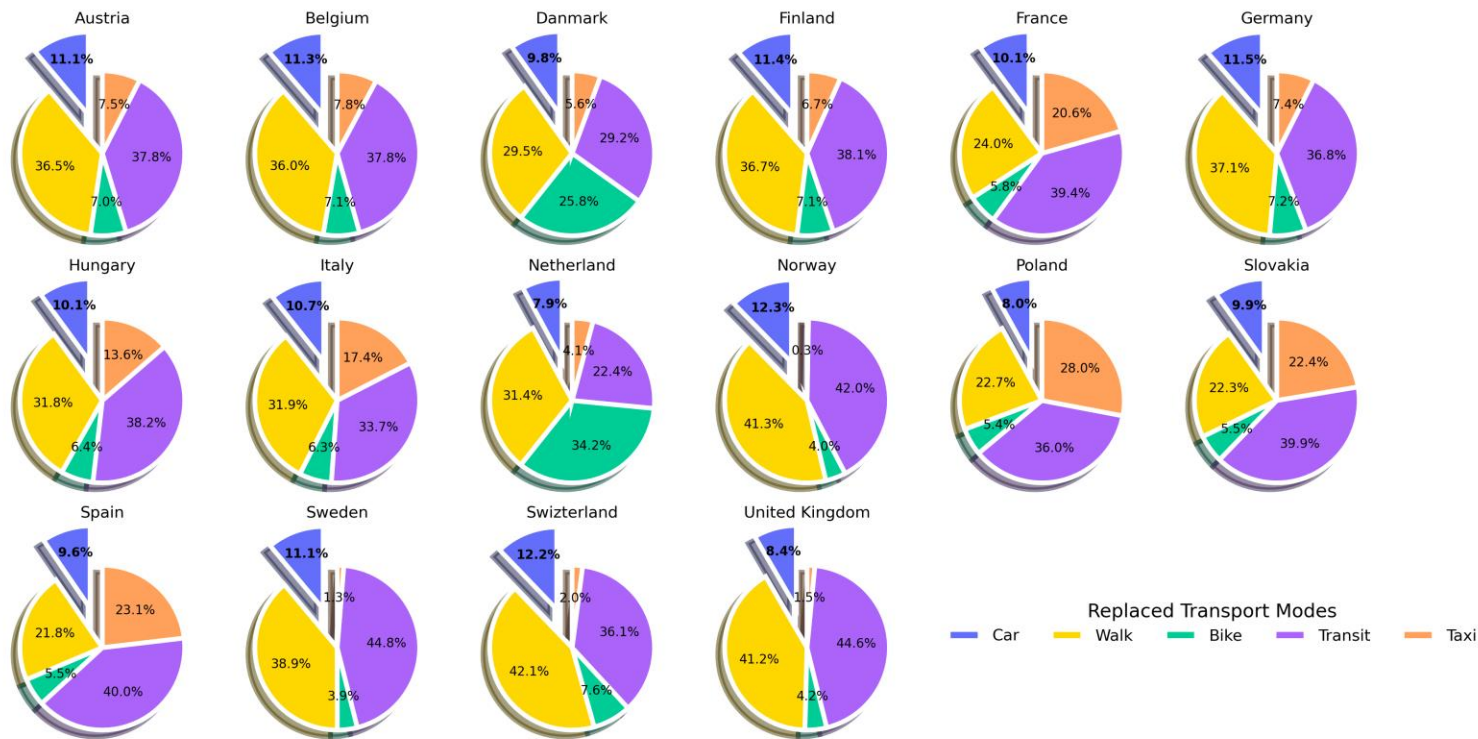
Reduced travel time **vs** Increased GHG emissions



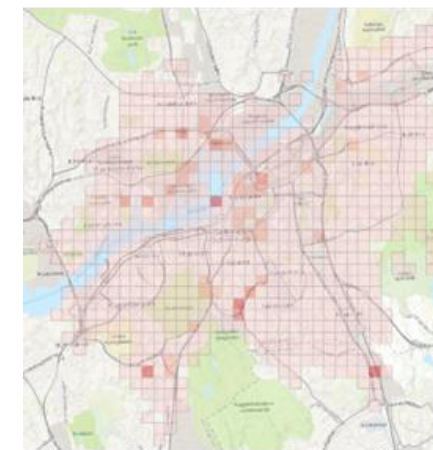
# Usage example 2

## Substitution and integration with other transport modes

Country Level Comparison on Probability of Replacing Car



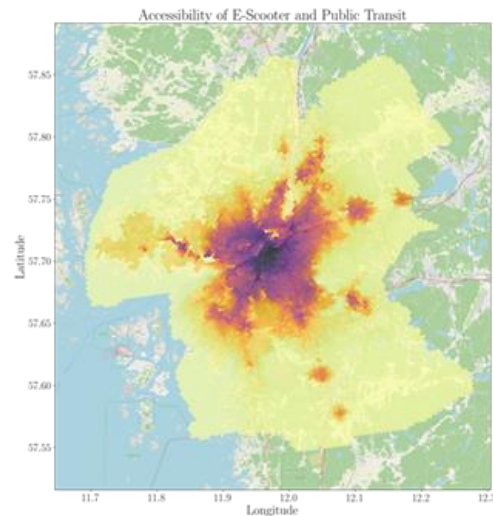
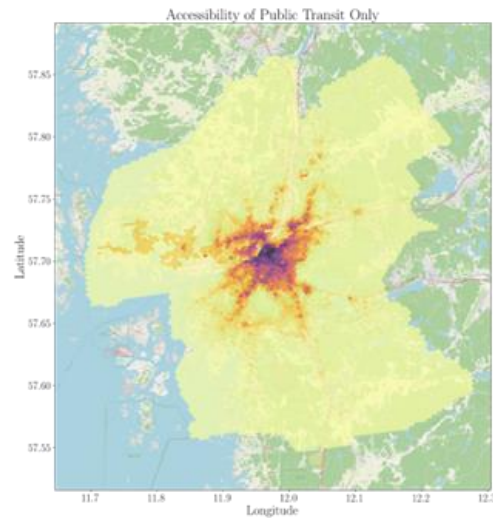
Last-mile integration with public transit



First-mile integration with public transit

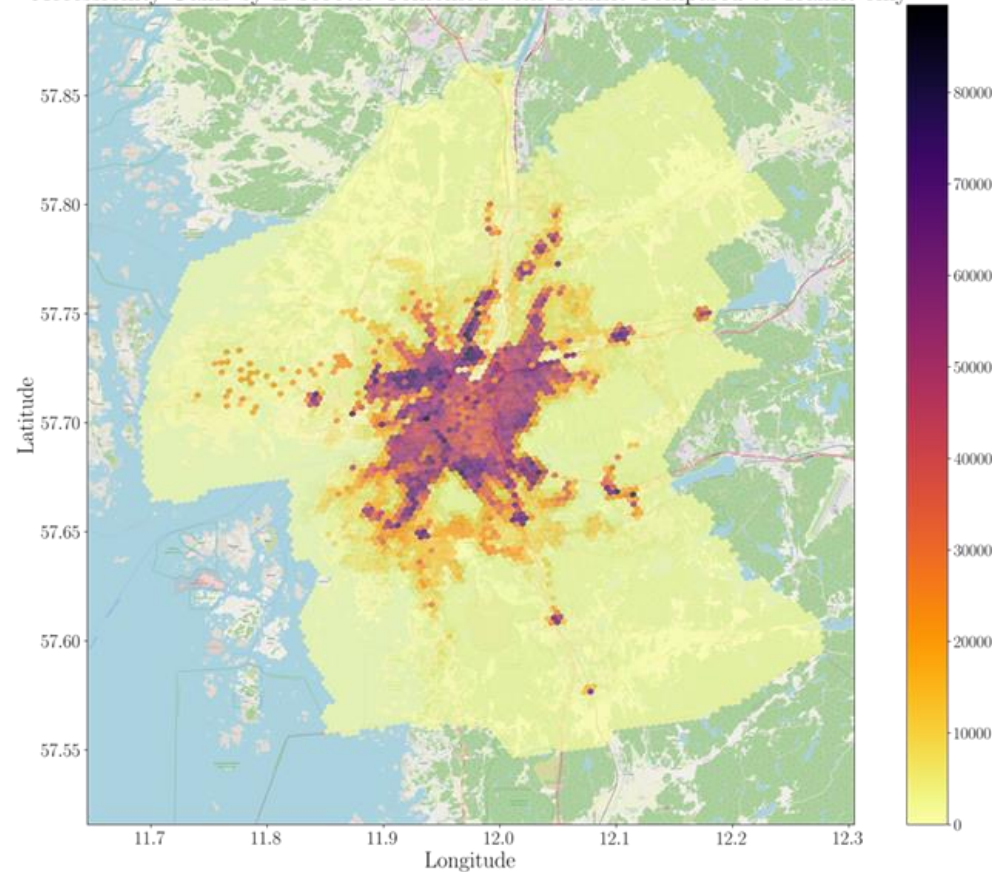
# Usage example 2

## Substitution and integration with other transport modes



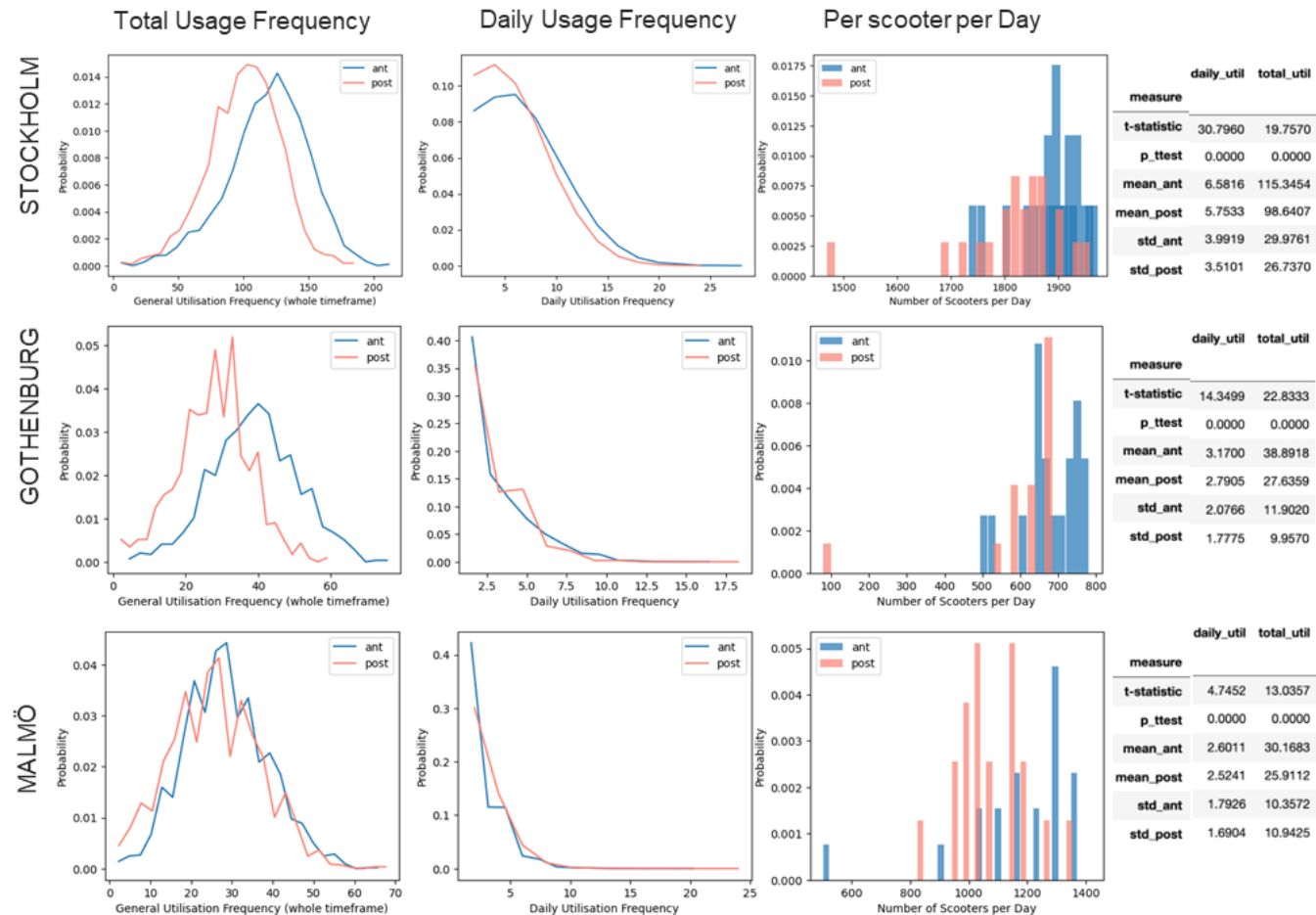
## Accessibility improvement to jobs Public transit **VS** Public transit+shared e-scooters

Accessibility Gains by E-Scooter Combined with Transit Compared to Transit-only



# Usage example 3

## Regulation and policy evaluation (impacts of parking regulations in Sweden of 2022)



Total Usage Frequency:  
decrease in all cities

- Daily Usage Frequency: decrease in all cities
- Average daily number of scooters:
  - STH: 3.5% decrease
  - GBG: 9.6% decrease
  - MÖ: 14.4% decrease

# Usage example 4

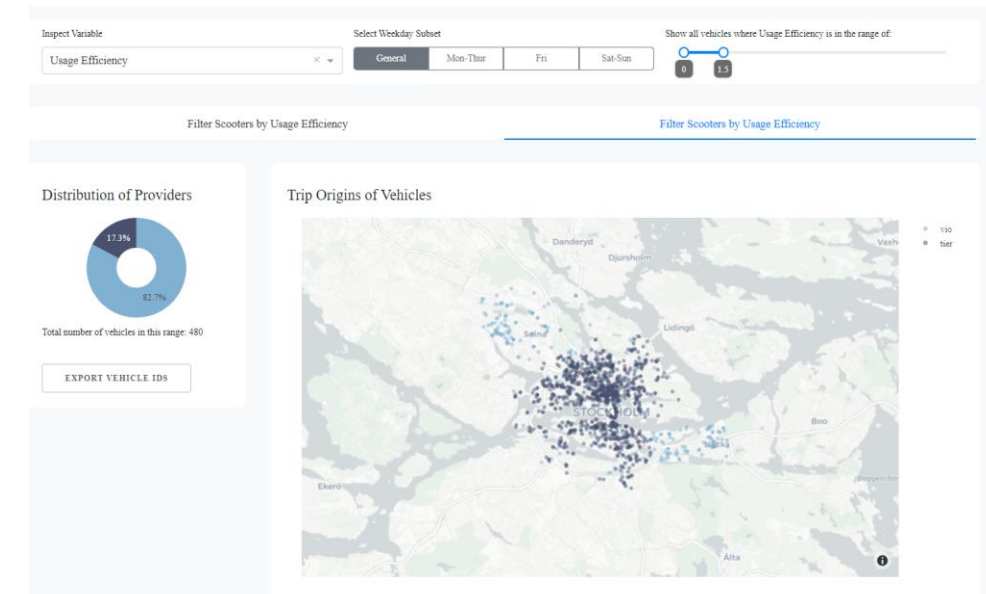
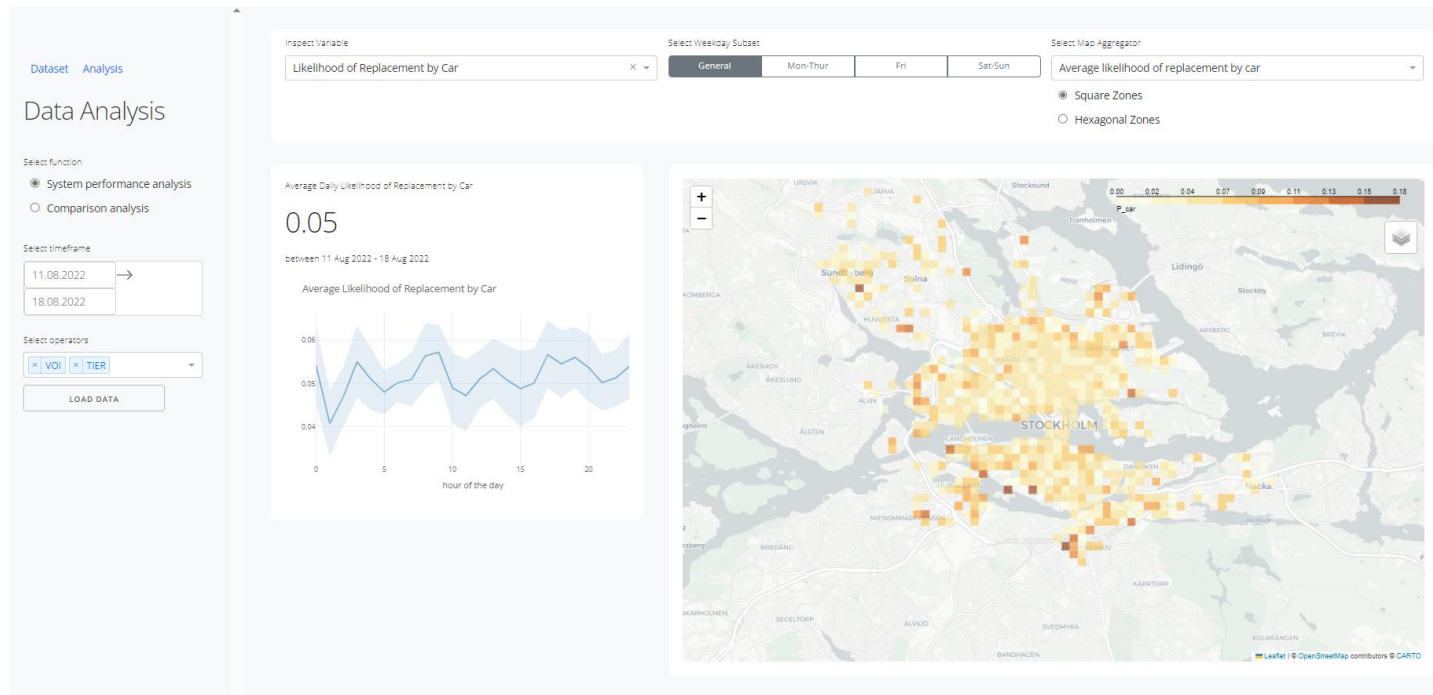
System performances of modular charging-parking solutions for less battery swapping and more ordered parking



# Usage example 5

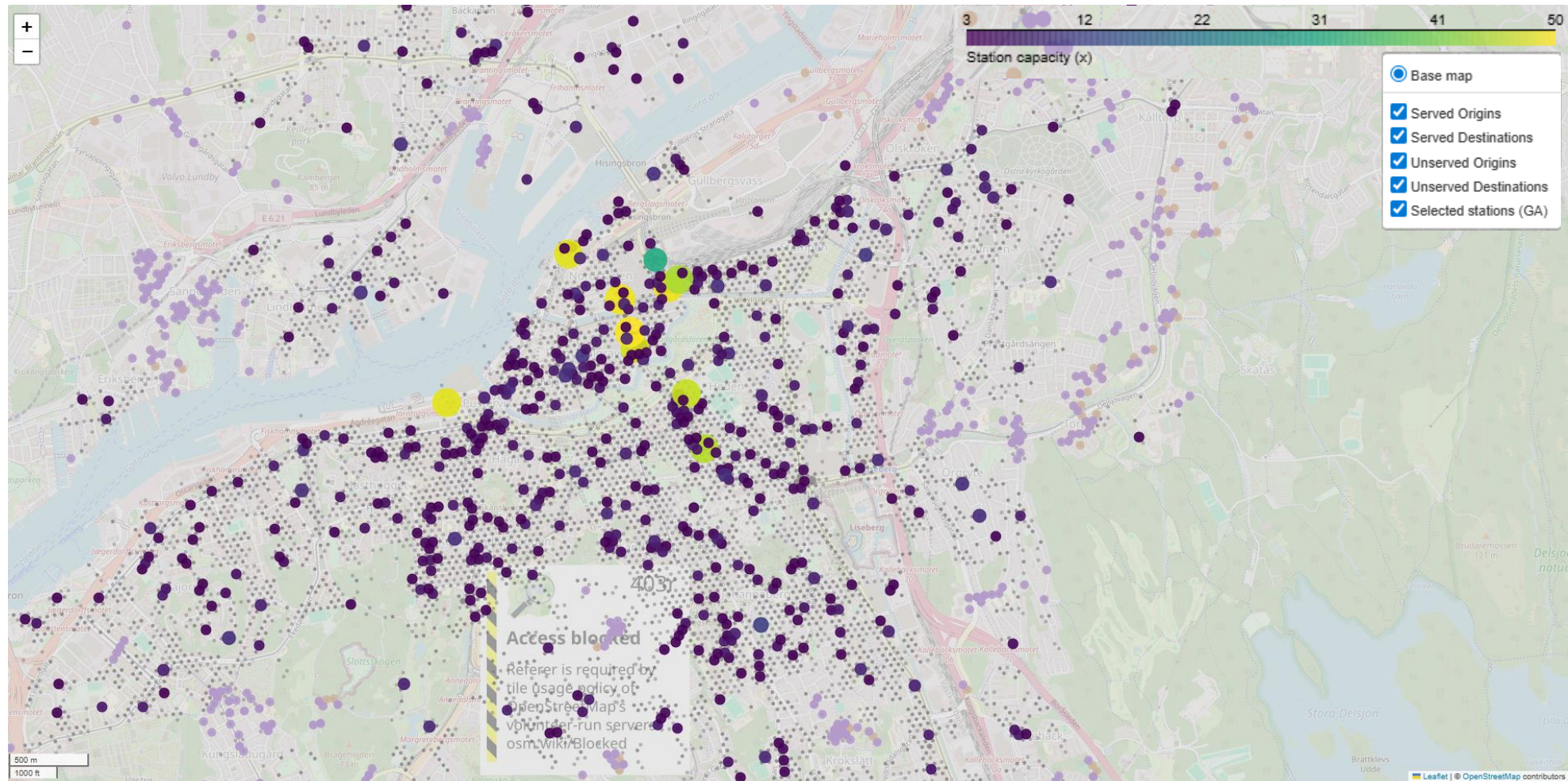
**Digital tools** for abovementioned functions for analyst, planner and manager based on big data

- Spatiotemporal Usage patterns
- Modal substitution and integration with other transport modes
- System-level emission reduction
- System-level user benefit (reduction in travel time and costs) and accessibility
- Impacts of implemented regulation and policies
- Identifying underutilized vehicles and illegal parking



# Usage example 6

Digital and interactive tools for virtual digital parking geofence based on big data for less illegal parking and less rebalancing costs



# Utilization

## What can the data or method be used for:

- Better system assessment and monitoring
- Better cost-benefit analysis and decision making
- Better infrastructure planning and system management

## Visions:

- The mentioned (even other more) data are there, generating every second
- Operators being more open and standardized to make the data sharing for utilization
- Stakeholders (cities/planners) being open to give a trial for new techniques of utilizing big data

THANK YOU FOR YOUR ATTENTION!

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