spare

Cost and demand prognostication tool

for demand responsive transportation

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Spare Labs

SEI Project
(Coordination)

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Spare
(Model and Report)

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Agenda

Part 1

1. Intro to Spare Labs
2. Project Overview
3. Spare Realize
4. Intro to DRT Model
5. Model Training

Break (5 mins)

Part 2

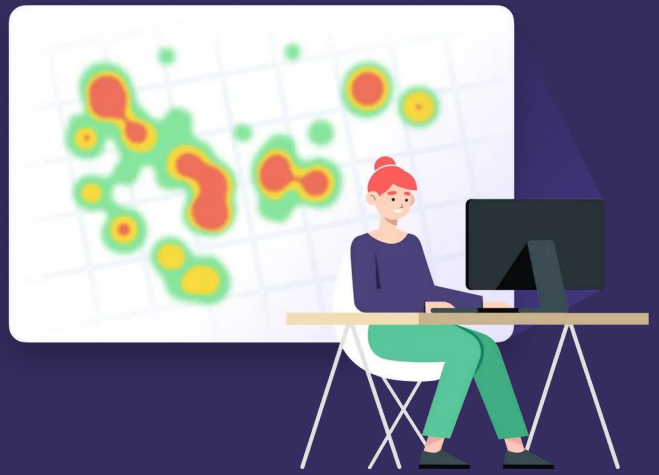
1. Model Case Studies
2. Considerations for DRT
3. Conclusions
4. Q&A

Project Overview

Intro to Spare Labs
Spare Realize
Intro to DRT Model
Model Training

- Break -

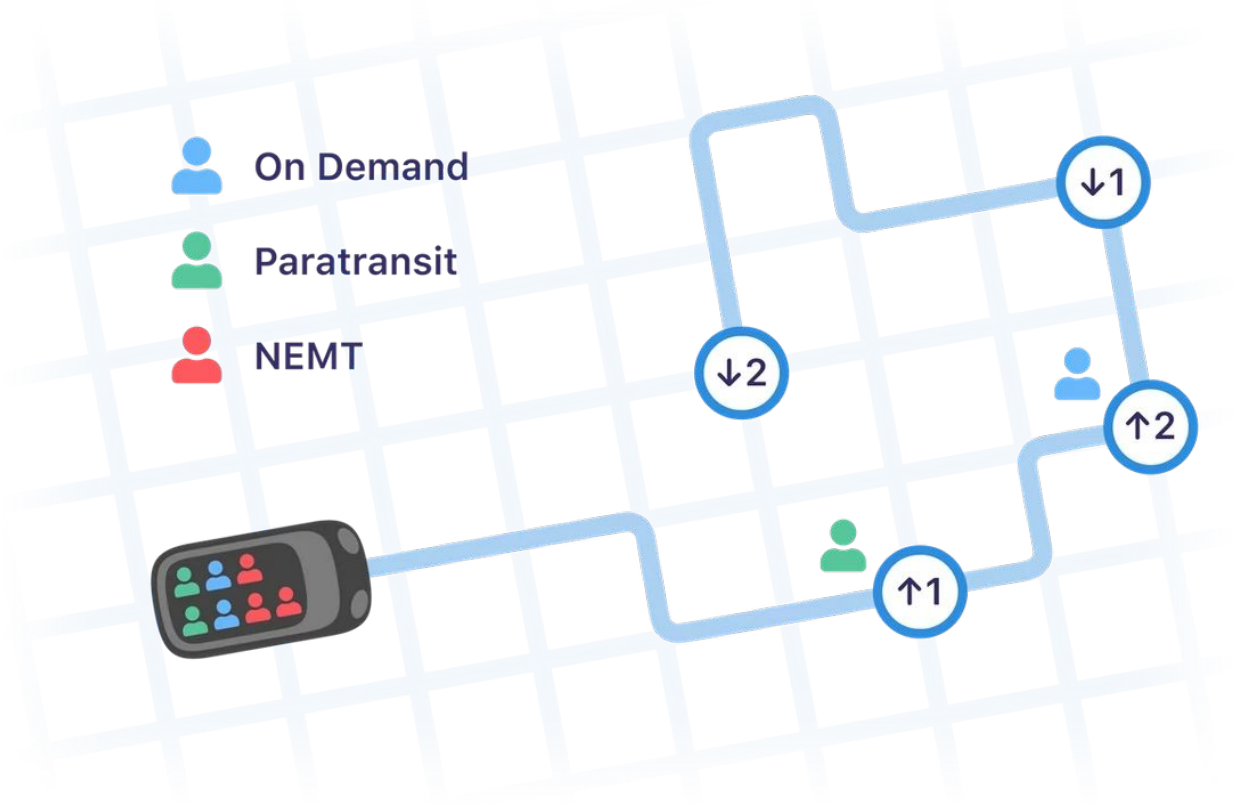
Model Case Studies
Considerations for DRT
Conclusions
Q&A



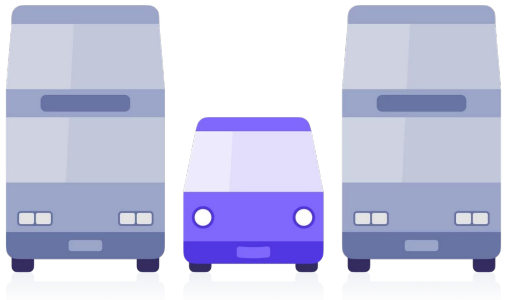
Response

Interreg
Baltic Sea Region

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND


On Demand
Paratransit
NEMT
↓1
↓2
↑2
↑1

Demand-responsive transit (DRT)...



fills
transit gaps

generates
useful data

enables
multimodality

Project aim

Develop a DRT cost and demand prognostication model for public use, including:

- **Building** the model
- **Preparing** instruction material for the model + **training** participants
- **Writing** a summary report

Project objectives

1. **Introduce a new way of simulating DRT services to stakeholders** who plan and operate transportation in the Baltic Sea region.

2. **Build a planning model** for forecasting the cost and demand of DRT, allowing users to estimate demand and costs involved.

3. **Help formulate policy** in sparsely populated areas of the Baltic Sea region, by applying the planning model to selected case studies.

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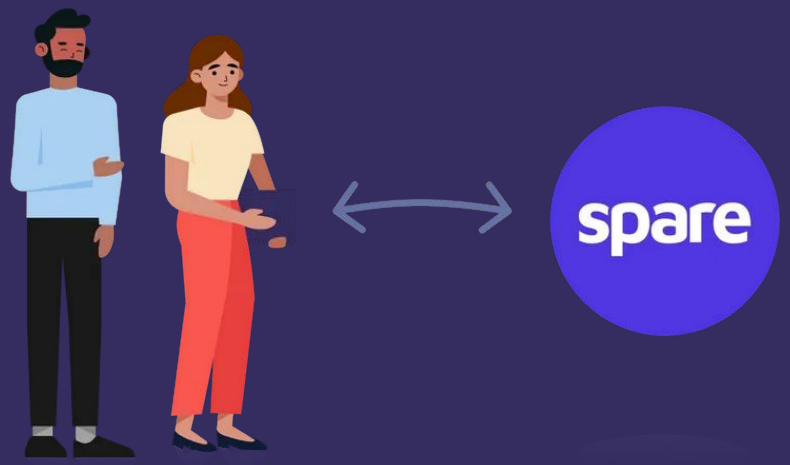
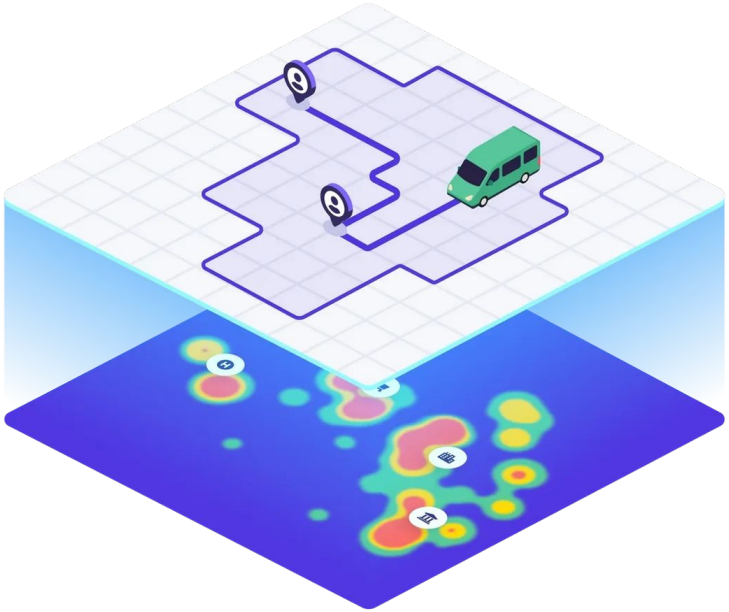


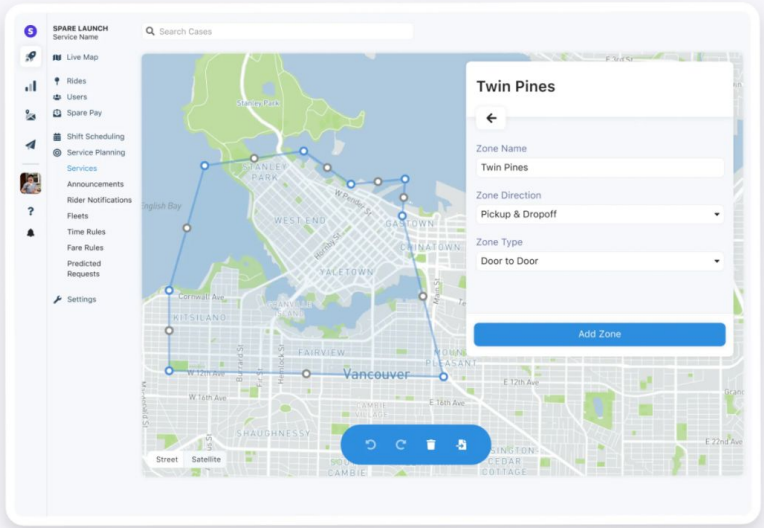
Spare Labs

Spare helps you build more efficient mobility services

A complete and flexible operating platform that allows you to easily launch and manage your microtransit, paratransit and ridehailing services.



Spare Platform



Mobility management. All in one place

Learn about our products →

Simulations

Unlock your potential with transit planning

Configuration & Operations

Run an efficient mobility service

Monitoring & Scaling

Grow your operation through data

Eligibility Management

Streamline customer relationships

Mobile Apps

Give riders and drivers the tools they need

Where we work

SPARE MOVES 2021

Let’s create the future of mobility together!

Dec. 2, 2021—9 am PST / 12 pm ET - Come explore where the industry is heading, connect with a community of like-minded on-demand transit and mobility providers and learn from experts in the field.

Register for free

spare

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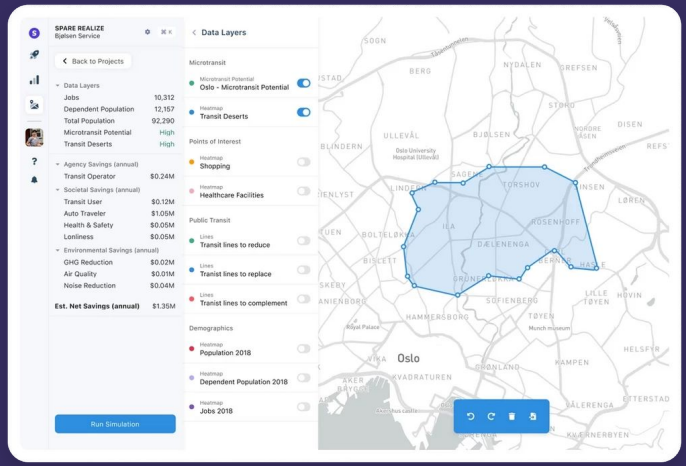
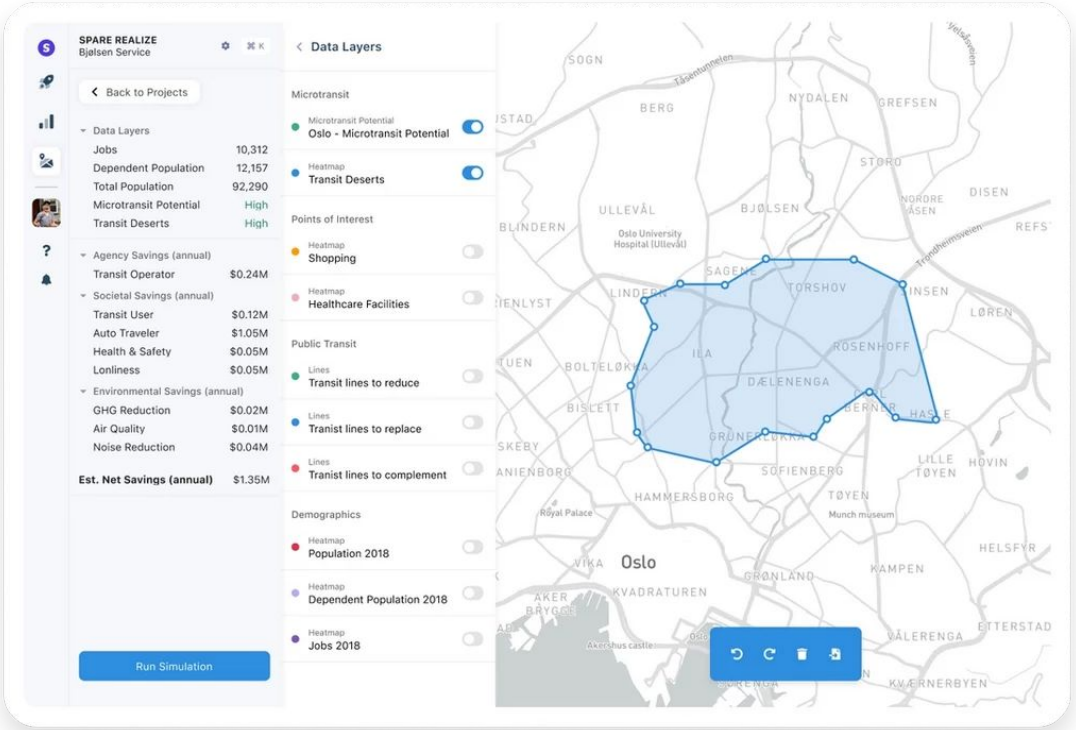


Spare Realize: Simulation and planning tool



PRODUCT TOUR

Microtransit Planning with Spare Realize

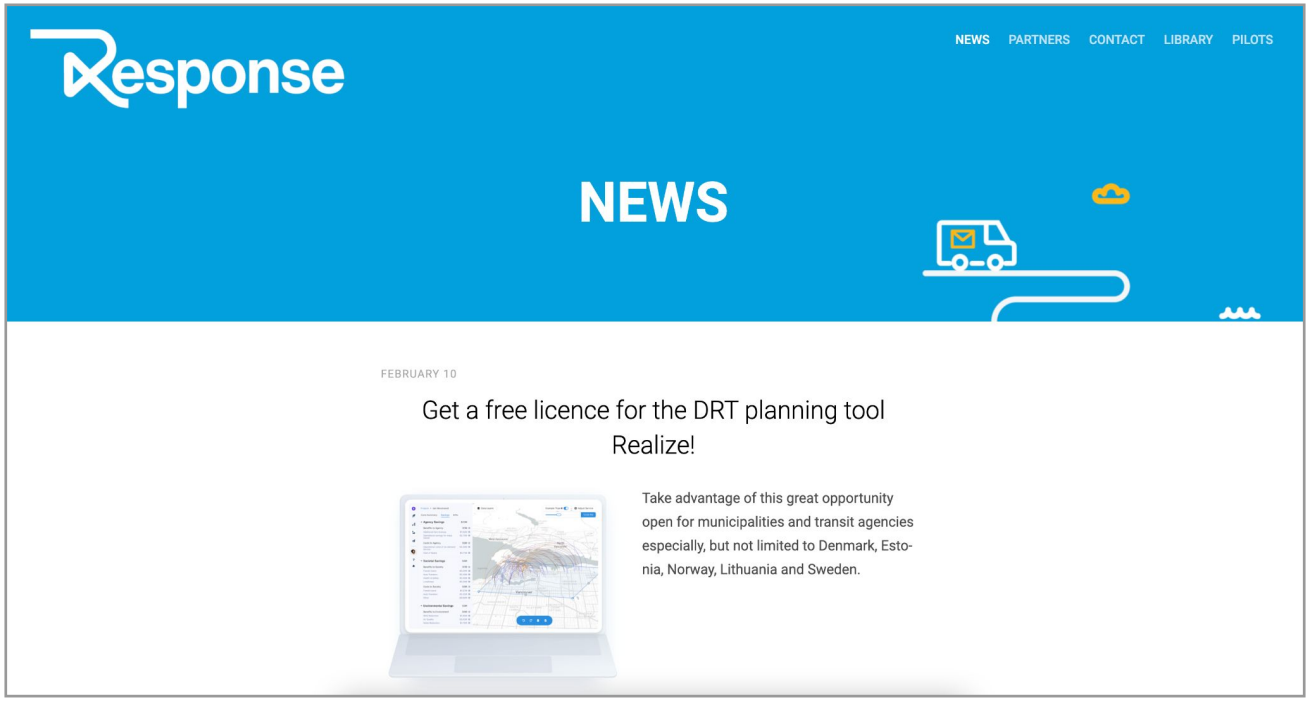
Realize Workshops

1. **Free Realize licenses** for up to 25 municipalities/transit agencies
   a. Use for a period of up to 12 months
   b. Two training workshops for participants

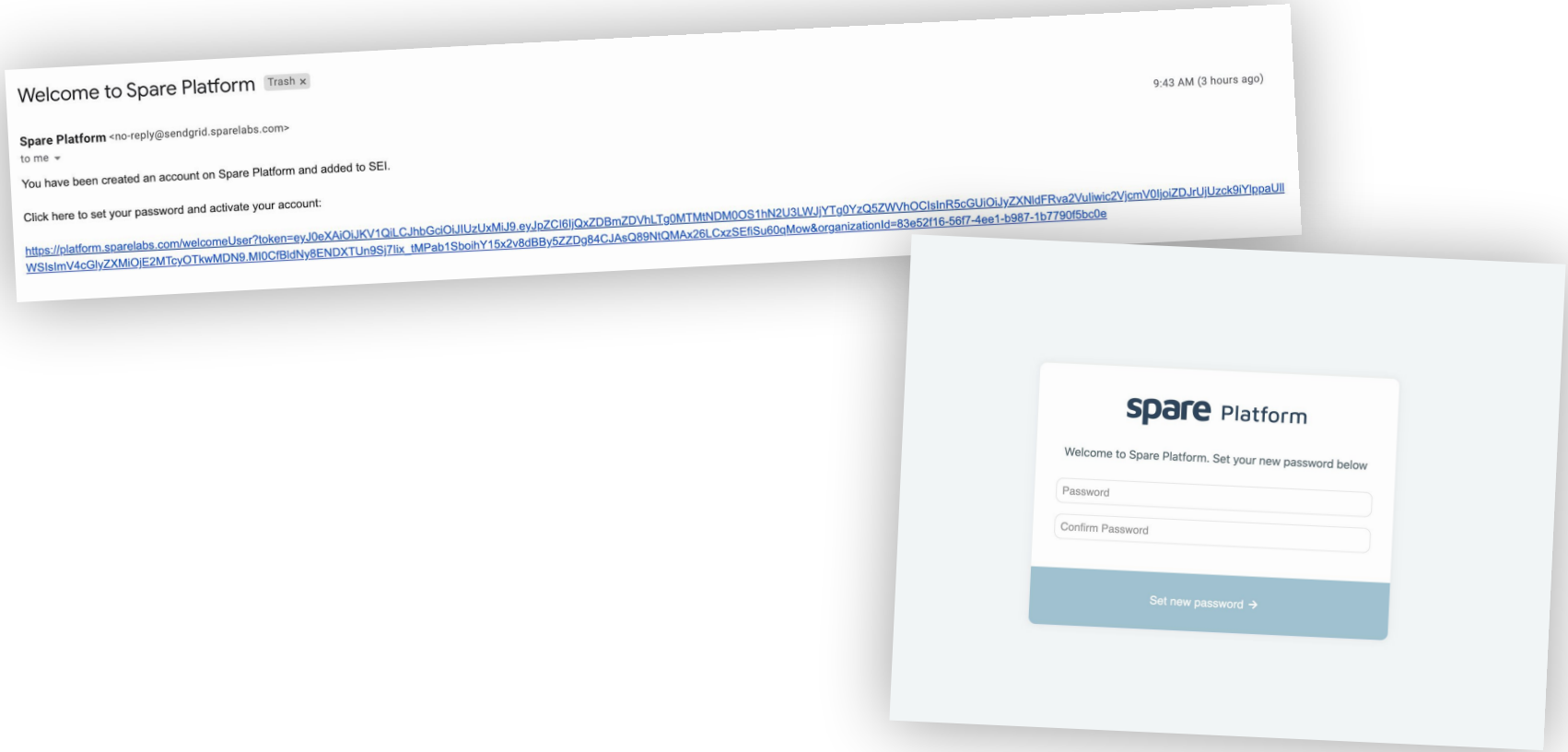
2. **Feedback on Realize**
   a. Workshop participants provided feedback on Realize tool

3. **User needs for SEI model**
   a. Follow-up discussions with engaged participants
   b. Understand their needs for an Excel-based model

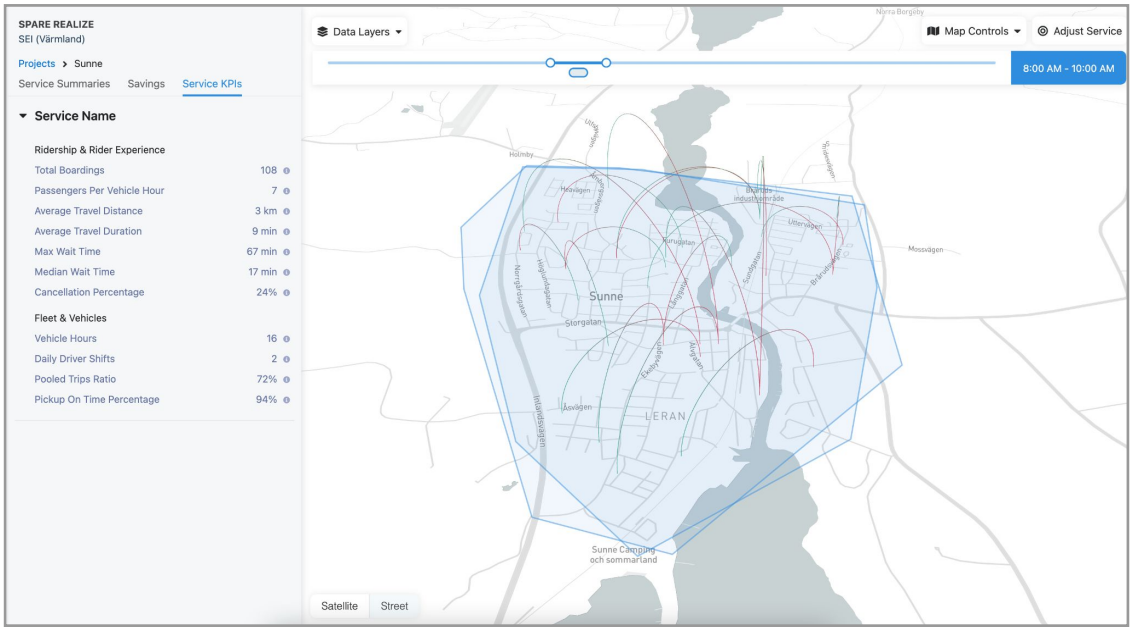
Realize Workshops



Access to Spare Realize

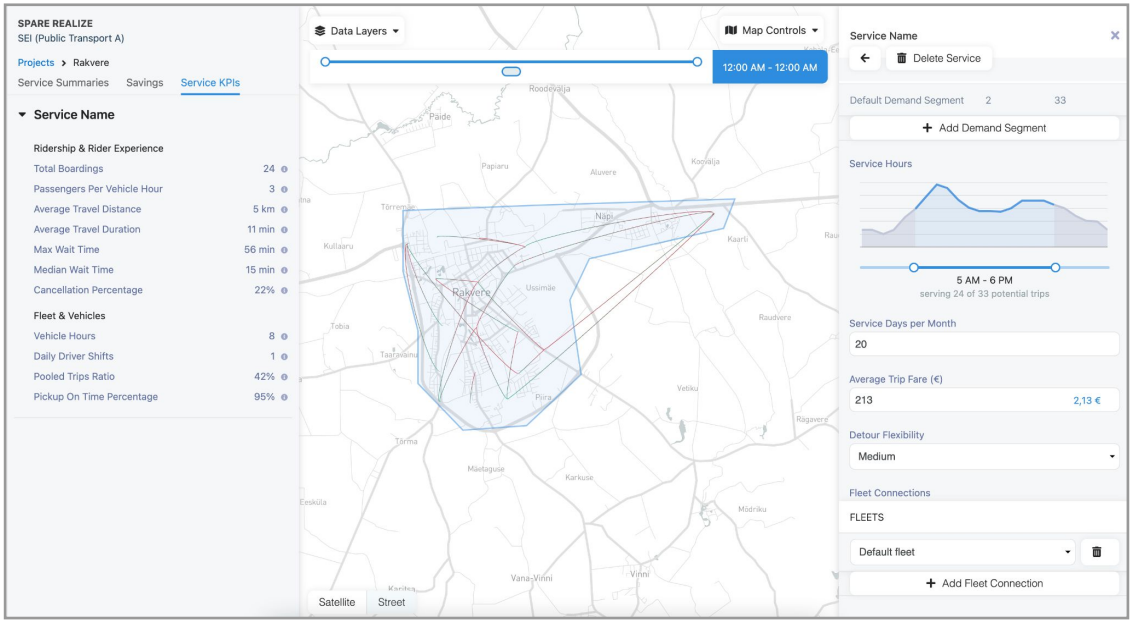


Spare Realize: Sunne, Sweden



Population: 10,000
DRT Demand: ~ 100 trips/day
Driver Shifts: 2/day
Efficiency: 7 PPVH
Avg. Wait Time: 17 mins

Spare Realize: Rakvere, Estonia



Population: 15,000
DRT Demand: ~ 25 trips/day
Driver Shifts: 1/day
Efficiency: 3 PPVH
Avg. Wait Time: 15 mins

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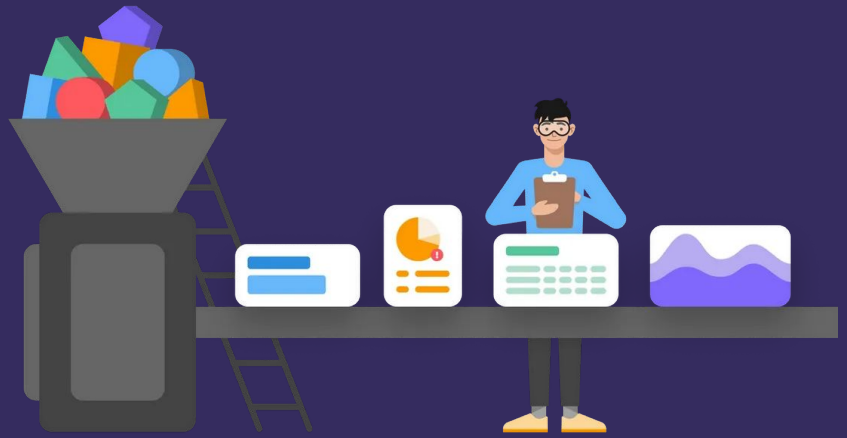
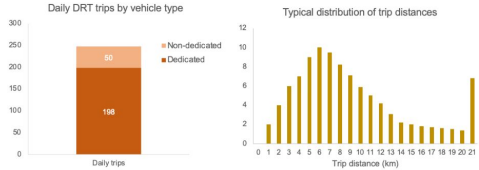


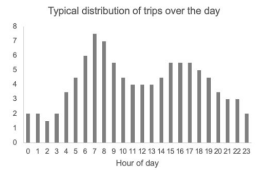
Excel Model: Functionality

Core functionality split into 3 key themes:

1. Estimates **demand for DRT** in study region
    a. Based on basic demographic information

DRT service summary (daily)		Detail
Daily DRT trips (dedicated and non-dedicated)	248	Total number of on-demand trips taken on all types of vehicles in the service.
Daily DRT trips (dedicated only)	198	Total number of on-demand trips taken on dedicated vehicles only.
Daily DRT trips (non-dedicated only)	50	Total number of on-demand trips taken on non-dedicated vehicles only (e.g. taxis).
Daily vehicle hours (dedicated vehicles)	20	Total number of vehicle hours supplied to the service by dedicated vehicles.





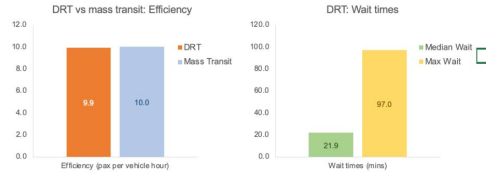
Excel Model: Functionality

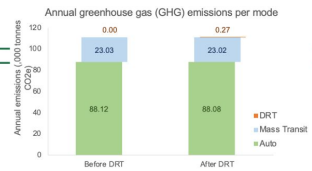
Core functionality split into 3 key themes:

1. Estimates **demand for DRT** in study region
   a. Based on basic demographic information

2. Calculates **key performance indicators** (KPIs)
   a. Efficiency, wait time, etc.

Key Performance Indicators (KPIs) (daily)		Detail
DRT service efficiency (PPVH) (#)	9.9	Average efficiency (or 'productivity') of the service, measured in passengers per dedicated vehicle hour (PPVH).
Median wait time (mins)	21.9	The median time a passenger must wait to be picked up once they have booked a trip.
Max wait time (mins)	97.0	The maximum time a passenger must wait to be picked up once they have booked a trip.
Pooled trips ratio (%)	100.0	Percentage of trips where a passenger shared their trip with another passenger.
Mass transit service efficiency (PPVH) (#)	10.0	Average efficiency (or 'productivity') of mass transit, measured in passengers per dedicated vehicle hour (PPVH).





Excel Model: Functionality

Core functionality split into 3 key themes:

1. Estimates **demand for DRT** in study region
   a. Based on basic demographic information

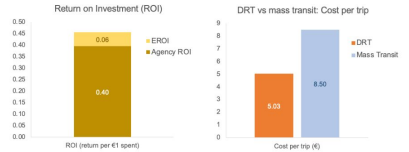
2. Calculates **key performance indicators** (KPIs)
   a. Efficiency, wait time, etc.

3. Estimates **financial and environmental ROI**

Cost / Benefit Analysis (annual)		Detail
Fare revenue (€)	120,437	Total revenue from increased fares collected in the on-demand service.
Fixed-route transportation cost savings (€)	50,022	Changes in operational costs of fixed-route mass transportation, following the introduction of on-demand service.
Agency benefits (€)	170,459	Total of transit cost savings and revenue from fares. Negative values represent a loss.
Agency costs (€)	-430,524	Annual operational costs and amortized capital costs of running the on-demand service. Negative values represent a loss.
Agency net savings (€)	**-260,065**	Total benefits minus total costs per year. Negative values represent a loss.
Net annual savings for environment (GHGs) (€)	26,254	Total benefits from GHG savings. Negative values represent a loss.

ROI / Costs Per Trip		Detail
Return on Investment for agency (ROI)	0.40	Total benefits to the agency, divided by the cost of investment annually. For every €1 , what is the return?
Return on Investment for environment (EROI)	0.06	Total benefits to the environment, divided by the cost of investment annually. For every €1, what is the return?
Cost per DRT trip (€)	5.03	Total costs, minus fare revenue, divided by total trips.
Cost per mass transit trip (€)	8.50	Total costs, minus fare revenue, divided by total trips.

vings for agency (annual)



Excel Model: Functionality

Compares costs and quality of DRT with **public transport alternative.**

vs

Photo source: SEI, Saaremaa DRT pilot

Excel Model: Versions

Two model versions provided to SEI:

1. A **complete non-public version** of the model
    a. All editable tabs shown
    b. Includes model formulae and default values and cells

2. A **simplified public-facing version** of the model
    a. Majority of the ‘backend’ is hidden from view
    b. Input/output tabs available

Excel Model: Model tabs

Sheet name	Status	Description
Introduction	Public	Overview of the model and instructions for how to use it.
Inputs	Public	Main inputs for the model, which affect calculations and the results displayed in the Dashboard.
Dashboard	Public	At-a-glance demand estimations, KPIs and ROI results.
Model_TripData	Hidden	Calculates key trip-based parameters to estimate demand.
Model_CostBenefits	Hidden	Calculates the costs/benefits of the DRT service to the transportation authority and environment.
Model_TripDistanceDistributions	Hidden	Calculates cumulative distributions of trip distances by zone type.
Model_TripTimeDistributions	Hidden	Calculates cumulative distributions of trip times over a typical day.
Model_KPIcoefficients	Hidden	Coefficients for the regression model predicting KPIs, trained on real data acquired by Spare.

Excel Model: Model tabs

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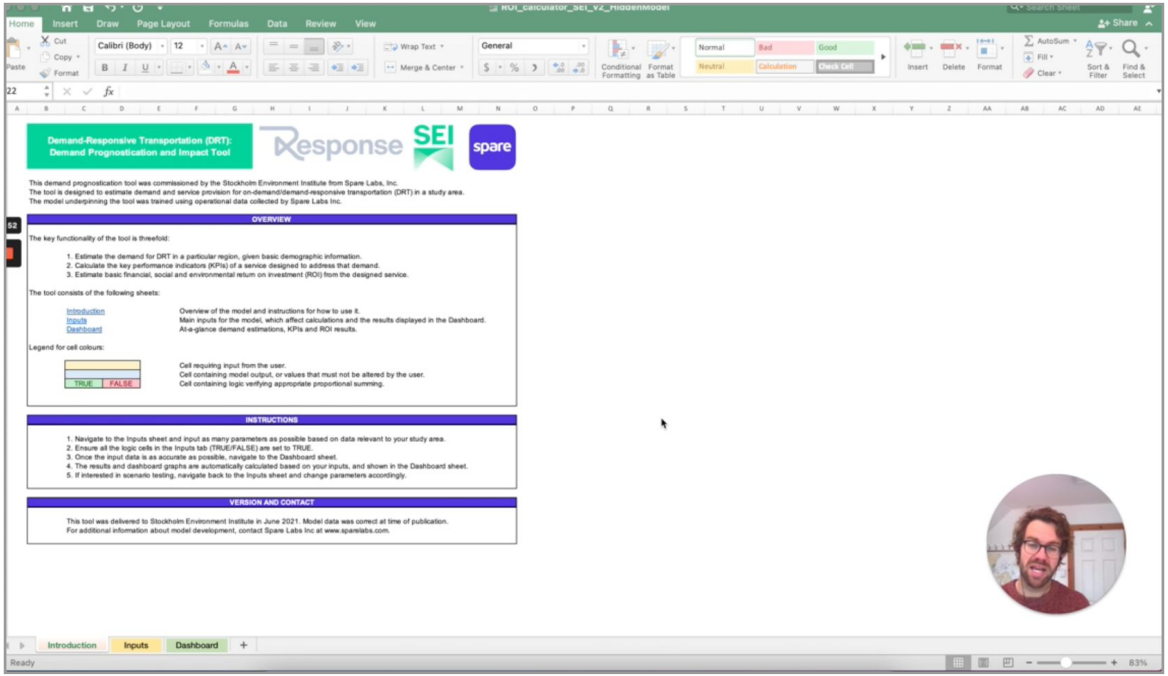
Hidden in public version of model

Training video



Public link: https://www.loom.com/share/9e30d703fae541198b97522936cf23e3

Training time!

Project Overview
Intro to Spare Labs
Spare Realize
Intro to DRT Model
Model Training

- Break -

Model Case Studies
Considerations for DRT
Conclusions
Q&A

Back in

5

minutes

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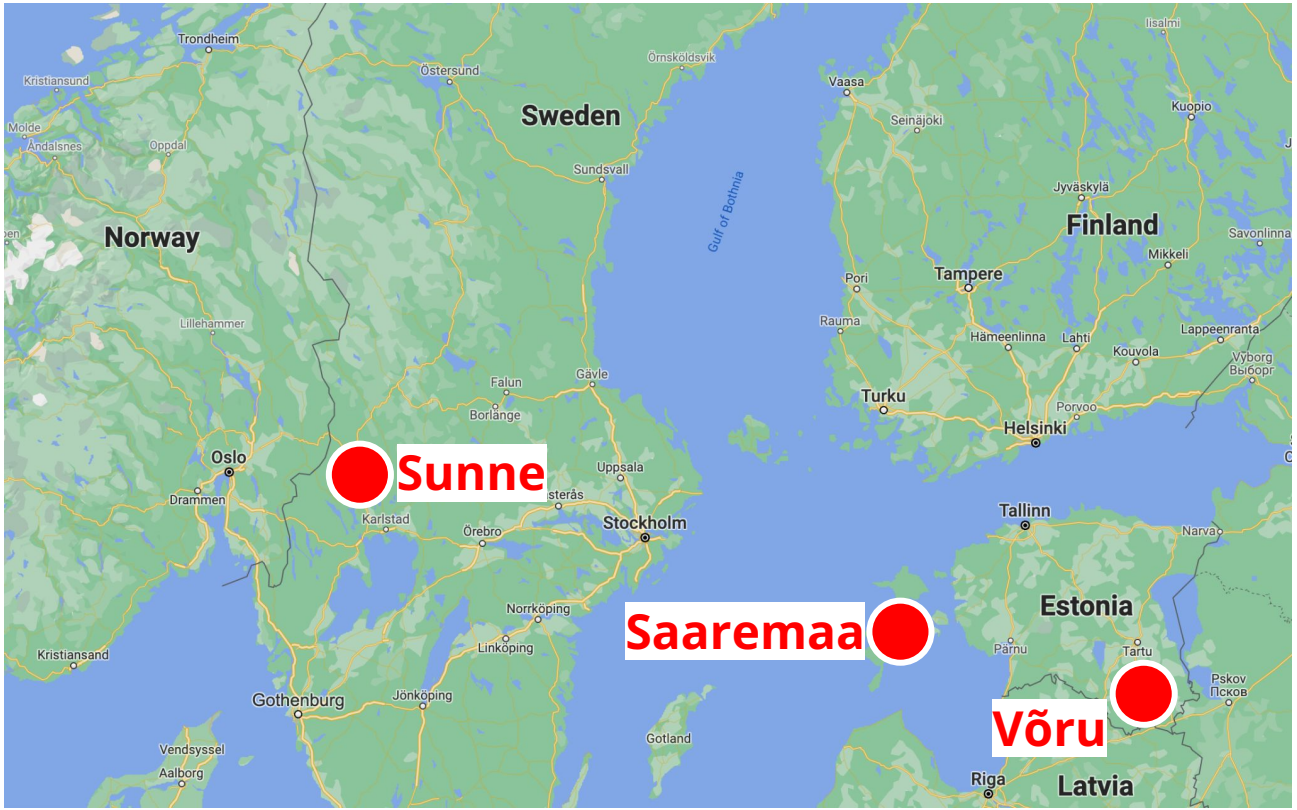
Case studies: Locations



Case studies: Scenarios

Small-scale DRT

Only a small part of the existing public transport infrastructure will be replaced by DRT.

(e.g. replacing fixed routes that only visit some areas once or twice a day, or fixed routes that receive low passenger numbers).

Medium-scale DRT

Most of the existing fixed route bus infrastructure will be replaced by DRT.

(e.g. only high-demand, high-capacity fixed route bus lines remain).

Large-scale DRT

All existing public transport on Saaremaa will be replaced by DRT.

(This is an extreme option that is rarely deployed in many systems around the world.)

Case studies: Parameter assumptions

Services

- Service days: weekdays (5 days a week)
- Service hours: 5am – 8pm
- Target average wait times: 20–30 minutes
- Average trip fare: €3 per trip

Vehicles

- 100% of DRT trips serviced using dedicated vehicles
- Driver shift length: 10 hours
- Opex: €50 per shift hour
- Capex: €30,000 to purchase each vehicle

Case studies: Parameter assumptions

Alternative mass transit:

- Proportion of mass transit: 10% of all trips (before introduction of DRT)
- Mass transit efficiency: 8 passengers per vehicle hour

Case studies: Results overview

		Daily trips	No. of vehicles	Vehicle hours	Efficiency (PPVH)	Median wait time (mins)	Max wait time (mins)	Annual costs (,000 €)	Annual benefits (,000 €)	Cost per trip (€)	Agency ROI	Annual GHG emissions (tonnes CO2e)
Saaremaa	Small scale	213	4	40	5.3	20.8	91	500	180	7.84	0.36	230
	Medium scale	711	18	180	4	33.6	181	2,200	670	11	0.3	770
	Large scale	3557	70	700	5.1	-	-	8,820	3,330	8.33	0.38	3,840
Võru	Small scale	28	1	15	1.7	13.4	41.5	186	17	28.27	0.09	20
	Medium scale	85	2	24	3.6	15.7	56.7	300	59	12.65	0.2	60
	Large scale	427	10	110	3.9	25.4	124.2	1,380	370	11.47	0.27	320
Sunne	Small scale	11	1	10	1.1	13.1	39.3	126	7	46.84	0.06	10
	Medium scale	36	1	15	2.4	13.9	45	186	25	19.65	0.13	30
	Large scale	179	4	40	4.5	19	79.4	504	160	9.73	0.32	140

Case studies: Results overview

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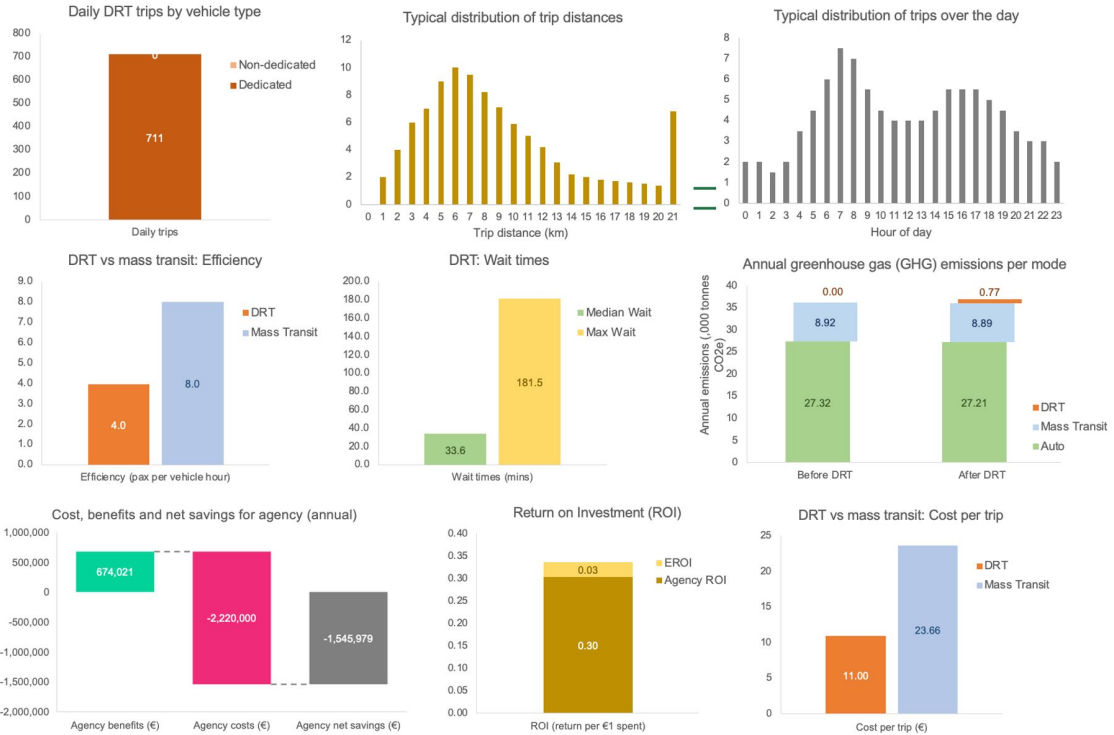
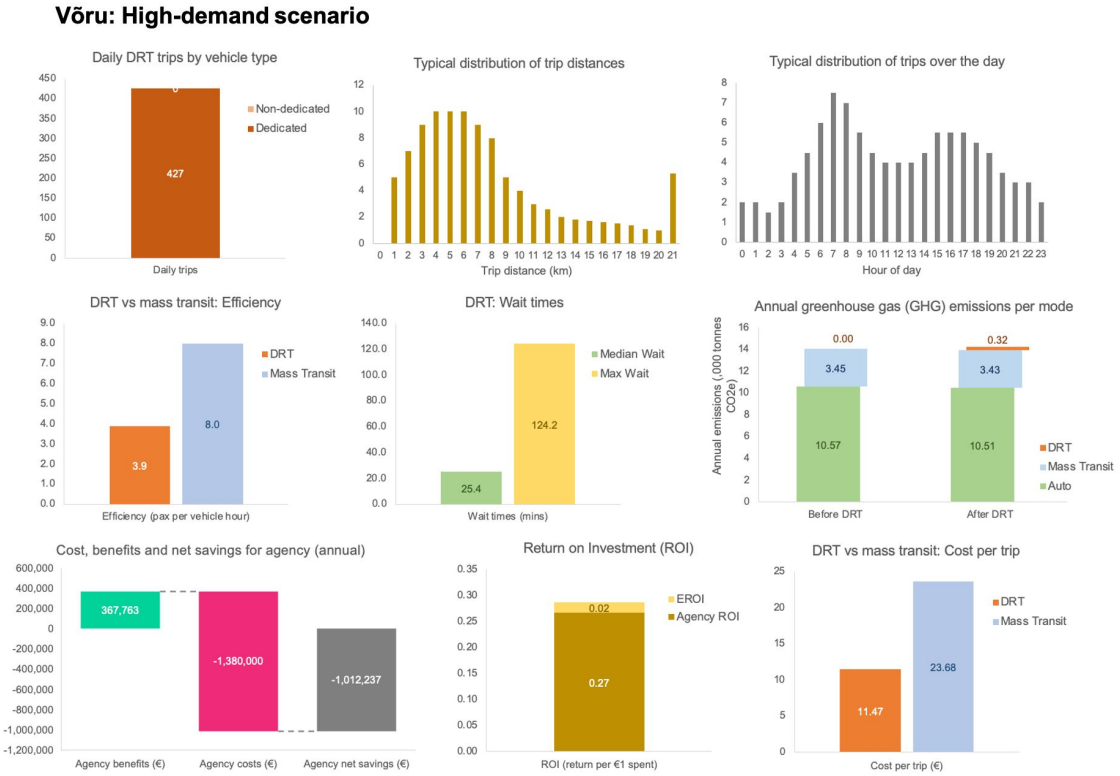
Scenarios with good potential

Case studies: Saaremaa, Estonia

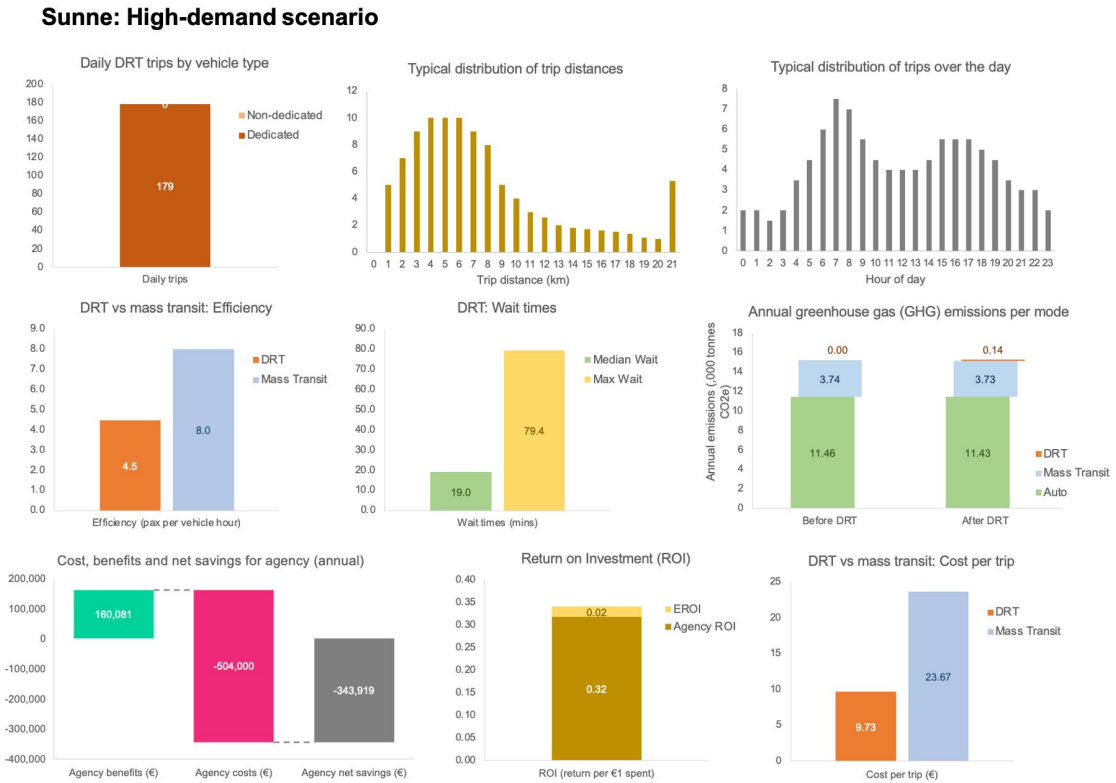
Saaremaa: Medium-demand scenario



Case studies: Võru, Estonia



Case studies: Sunne, Sweden



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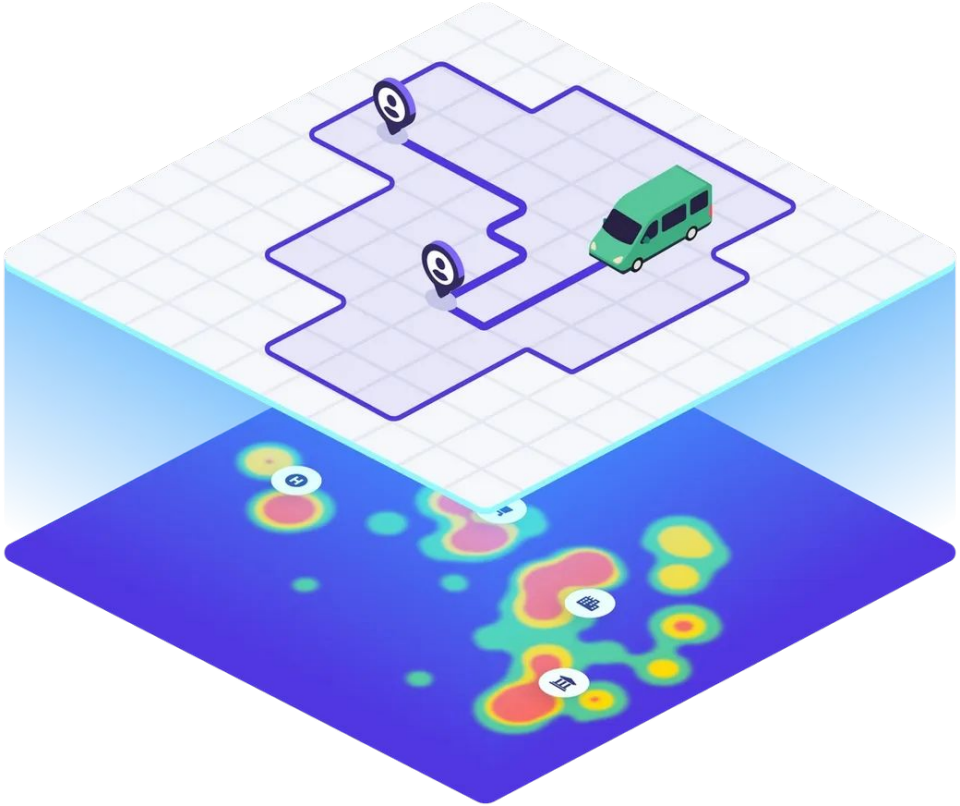
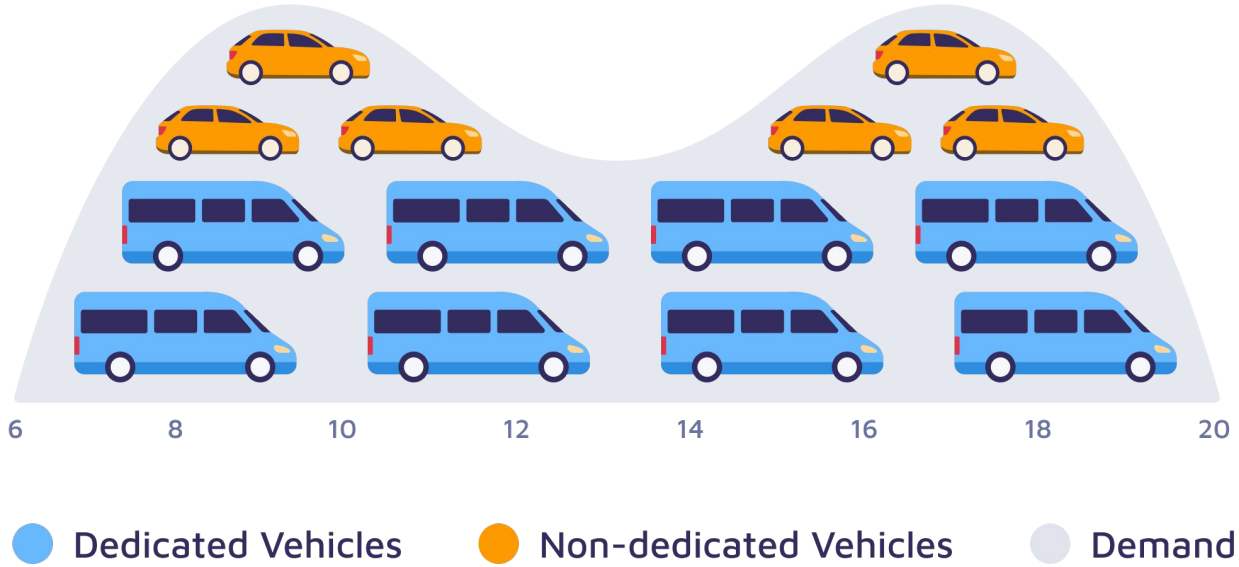
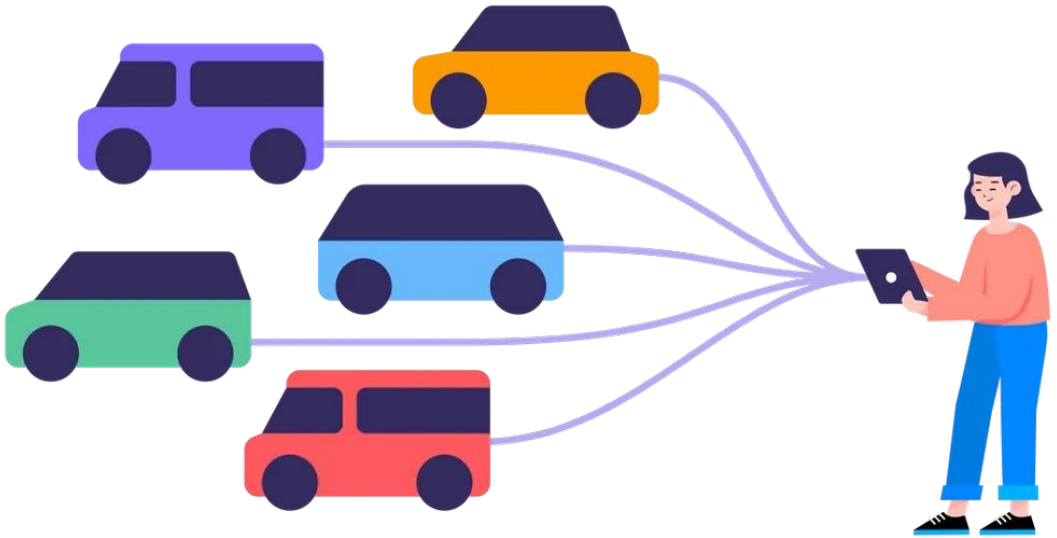
The power of mobility data



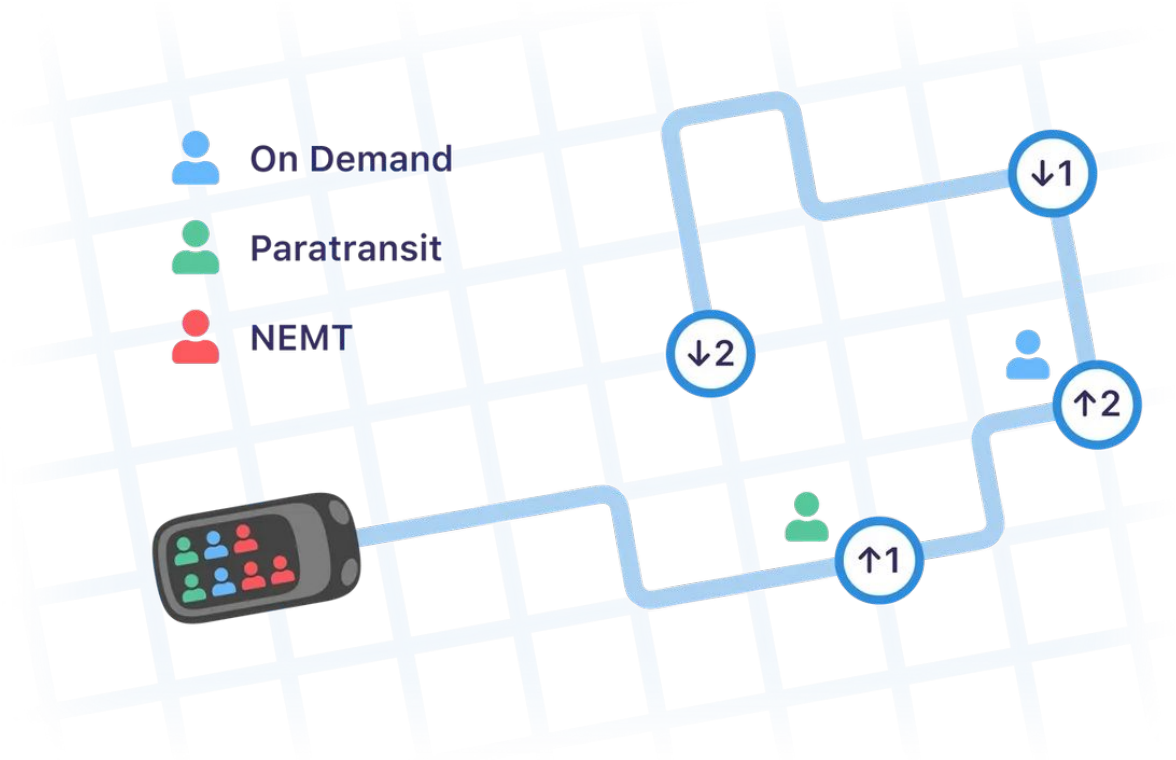
Non-dedicated trip brokering



Vehicle right-sizing



Commingling different services together



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Conclusions

- SEI has a new, bespoke demand prognostication model - and report!
- Model empowers users to assess:
  - Potential demand for DRT
  - Service performance (KPIs)
  - Costs and ROI for agencies and environment
- Model will be publicly available and free of charge.
- Model applied to 3 case studies in Baltic Sea Region
- Key considerations for DRT:
  - Power of mobility data
  - Non-dedicated trip brokering
  - Vehicle right-sizing
  - Commingling

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Q&A

jerome@sparelabs.com

www.sparelabs.com