ITF's work on shared mobility, policy implications from four cities

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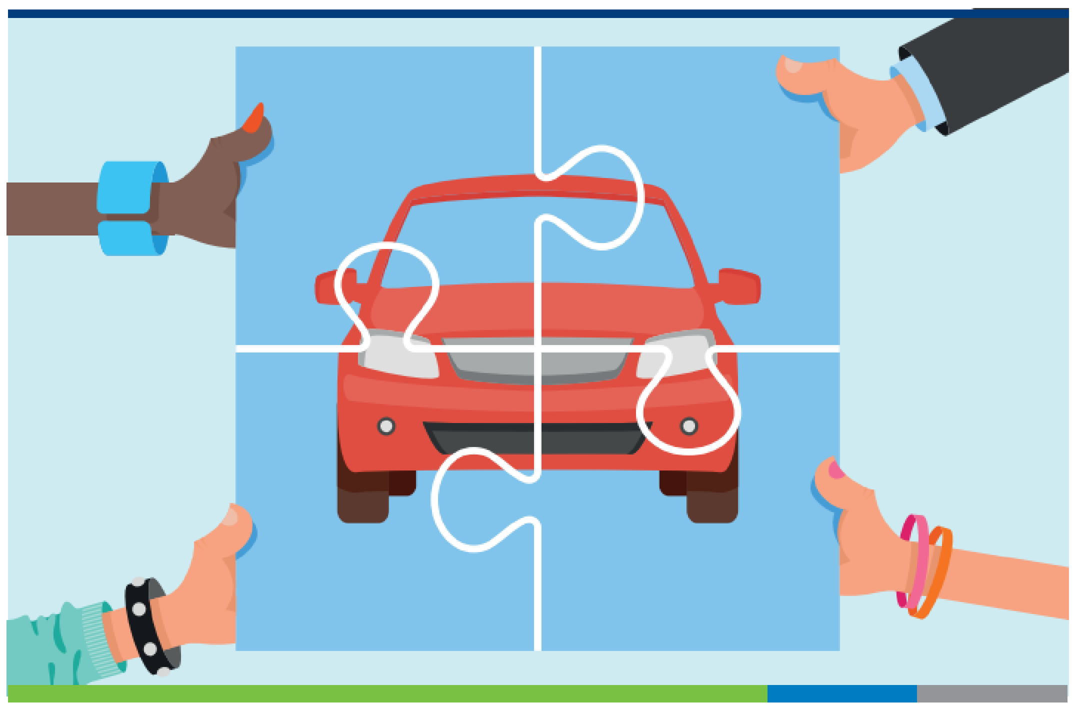

How can shared mobility help addressing the current challenges of urban mobility, exploring recent emerging technologies, governance and societal trends?

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Shared modes specification

Mode	Booking	Access time	Max. waiting time (depending on distance)	Max. total time loss (depending on distance)	Vehicle type
Shared Taxi	Real time	Door-to-door	5 minutes (≤ 3 km), up to 10 minutes (≥ 12 km)	Detour time + waiting time, from 7 minutes (≤3 km), up to 15 minutes (≥12 km)	Minivan of 8 seats rearranged for 6 seats, with easy entry/exit
Taxi-Bus	30 minutes in advance	Boarding and alighting up to 400 m away from door, at points designated in real time	Tolerance of 10 minutes from preferred boarding time	Minimum linear speed from origin to destination (15 km/h)	Minibuses with 8 and 16 seats. No standing places

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Qualitative comparison of transport modes

Service type	Service quality					
	Access	On-board time	Waiting	Transfers	Comfort	Price
Private Car 	★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★
Public transport 	★★	★	★	★★	★★	★★★★★
Shared Taxi 	★★★★★	★★★★	★★★★	★★★★★	★★★★	★★
Taxi-Bus 	★★★	★★★	★★★	★★★★★	★★★★	★★★
Feeder service to rail, ferry or BRT 	★★★	★★★★	★★	★★★★	★★★	★★★★

Assessing the range of quality of specification designed for shared mobility services

New services may emerge in this spectrum

(e.g. peer to peer ridesharing)

Legend:

Comparative modes performance rating

★	Very low performance
★★	Low performance
★★★	Average performance
★★★★	High performance
★★★★★	Very high performance

How to assess it?

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Modelling Framework

Characterisation of the study area

Transport infrastructure and services
- Road network
- PT GTFS model

Spatial definition and resolution
- Study area boundaries
- Grid system definition

Mobility seed and transport mode preferences
- Travel survey
- Mode choice model

Transport performance by OD pair and mode
- Travel times by mode

Probability of trip production / attraction
Land use data (Grid)
- Population
- Employment
- Ameneties (POIs)
- Building footprint

Focus group and stated preference analysis
- Willingness to shift to SM

SM mode selection
Shared-Taxi, Taxi-Bus
Feeder service to rail, ferry or BRT

Synthetic mobility dataset
Household characterisation
(Residential location, family profile)

Individual data
(age, education level)

Mobility data
(trip sequence, each trip (origin, destination, schedule, purpose, transport mode))

Transport demand & supply scenarios
Demand (Scenario specification)
Private car trips,
(% modal shift to SM),
Bus trips (% modal shift to SM)

Supply (Scenario specification)
Private car (allowed: Yes/No)
Bus (preserved: Yes/No)
BRT (preserved: Yes/No)
Walking & biking (preserved: Yes)
Rail and Ferry (preserved: Yes)
Low Emission Zone (active: Yes/No)

Simulation (Outputs)
Service quality
- Waiting time
- Detour time

Operational Performance
- Average vehicle occupancy
- Fleet requirements
- Costs

Society (Sustainability)
- Emissions
- Congestion
- Accessibility indicators
- Parking requirements

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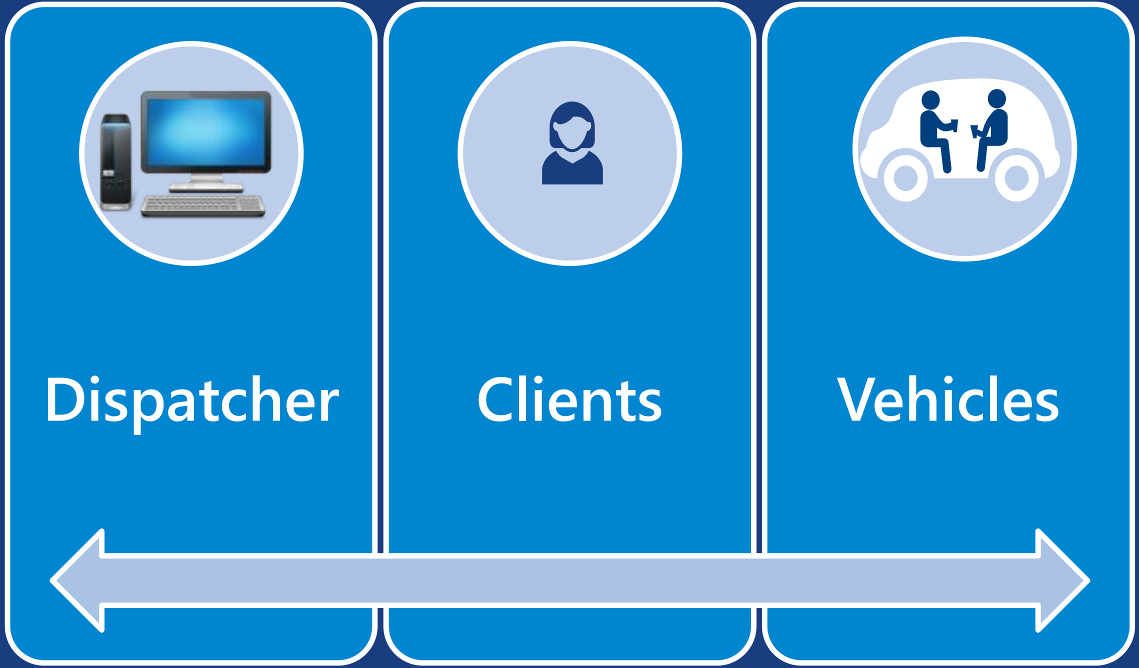
Agent-based Simulation framework



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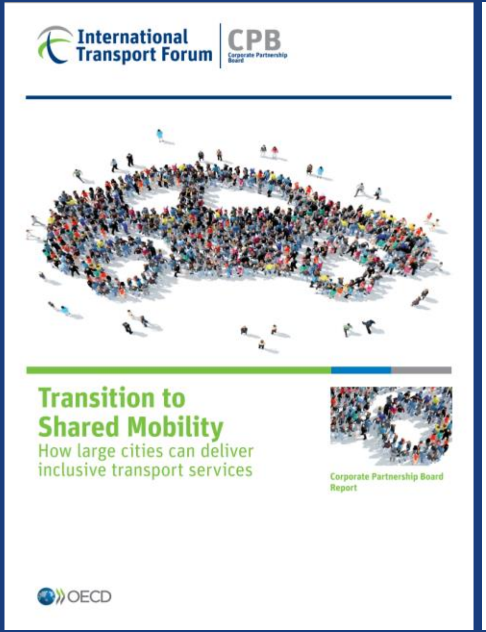

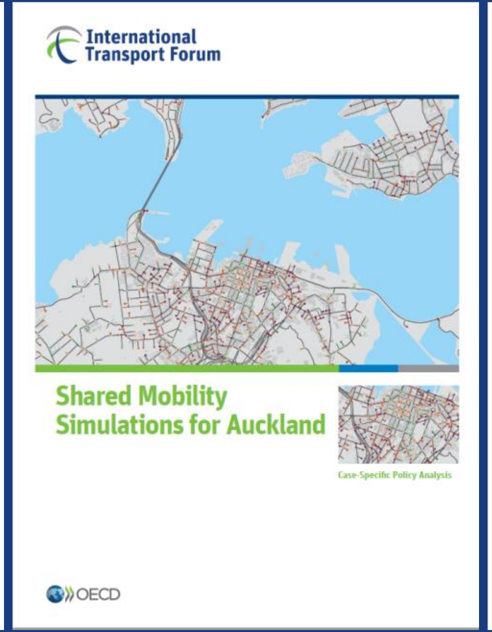

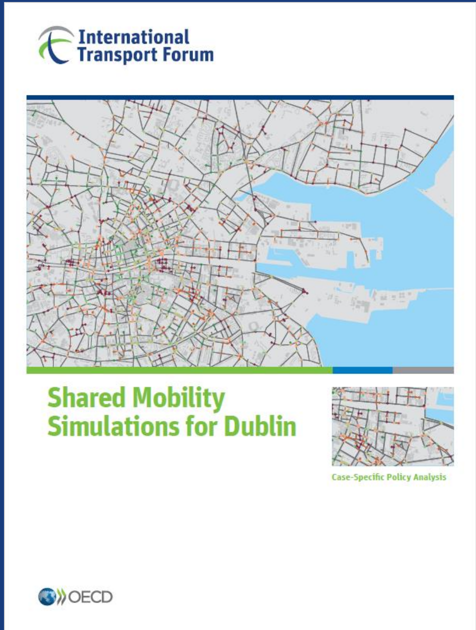

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Current mobility

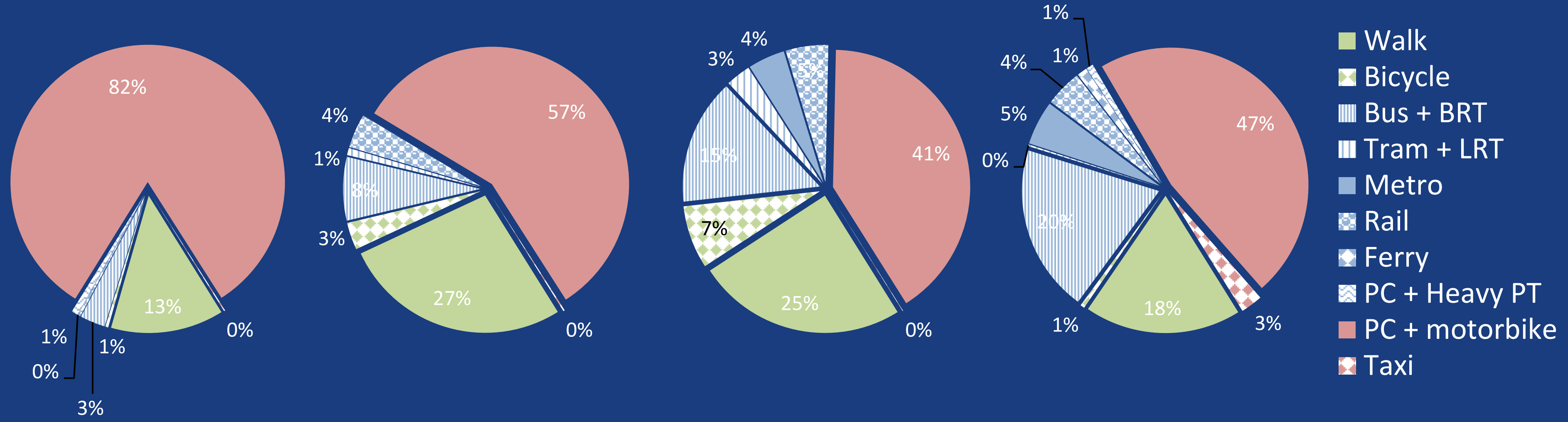
Modes shares

Transport supply characterisation

Land use patterns

CO_2 intensity per inhabitant

Mode shares



(Auckland) (Dublin) (Helsinki) (Lisbon)

Transport supply characterisation

	(Auckland)	(Dublin)	(Helsinki)	(Lisboa)
Heavy PT infrastructure (km per 1 000 inhabitants)	0.10	0.07	0.21	0.14
Service provision (seat-km heavy PT per 1 million inhabitants)	3.7	4.9	16.2	6.7
Connectivity PT (avg. linear speed > 1 km with 10 min penalty in transfer)	8.0	6.7	16.1	7.9
PT/PC travel time ratio (avg., travel time ratio trips > 1km)	2.8	2.7	1.0	3.1

Land use patterns

Study area size (total / active surface sqkm)	2 233 / 986	6 988 / 1 047	770 / 639	3 015 / 999
Population density (inhabitants per sqkm – total/active surface)	582 / 1 318	258 / 1 720	1 414 / 1 703	929 / 2 802
Land use mixture (Average Land use Entropy Index)	0.32	0.36	0.29	0.53
CBD influence radius (Distance to reach 3 x inhabitants as CBD employees)	17.5	16.8*	20.6	8.9
	(Auckland)	(Dublin)	(Helsinki)	(Lisboa)

* Proxy data

CO2 intensity per inhabitant

6.0	3.1	2.5	3.5
(Auckland)	(Dublin)	(Helsinki)	(Lisboa)

kg of CO_2 per inhabitant, day

Urban policy testing

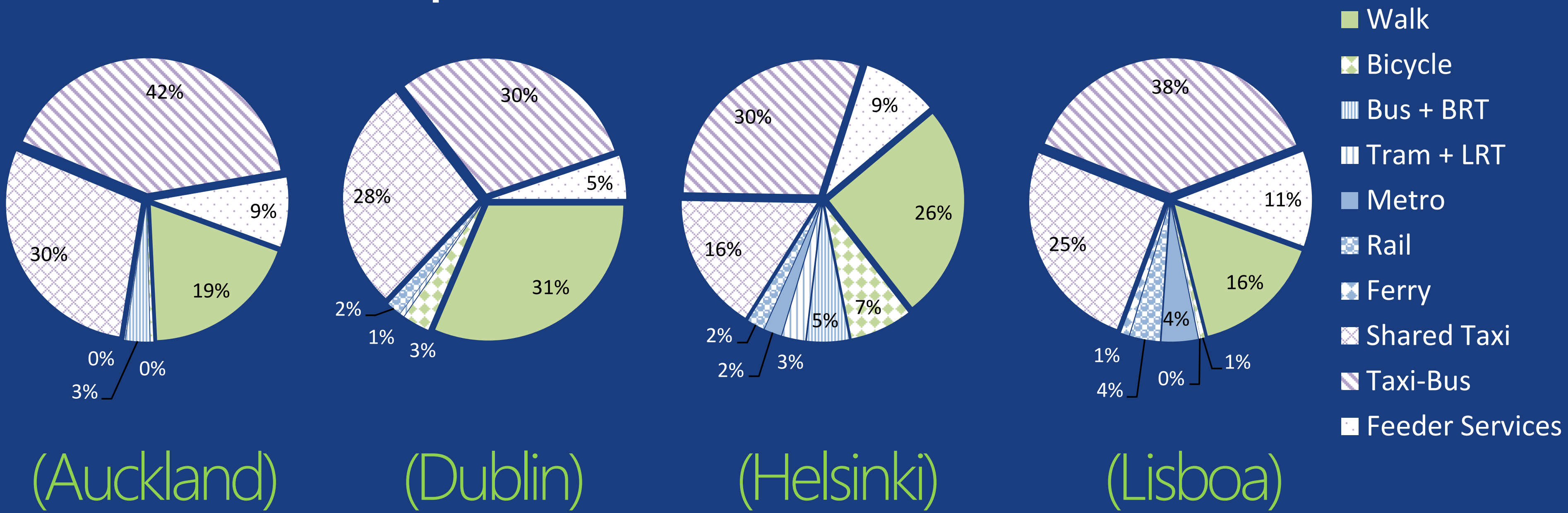
Impacts Full adoption scenario

Factors affecting outcome

Testing targeted policies

Transition

Impacts (Full adoption scenario)



Mode shares

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Impacts (Full adoption scenario)

-54% -31% -34% -62%

(Auckland) (Dublin) (Helsinki) (Lisboa)

CO_2 emissions

24hrs.

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Impacts (Full adoption scenario)

-93%	-97%	-96%	-96%
(Auckland)	(Dublin)	(Helsinki)	(Lisboa)

Motorised Fleet size

24hrs.

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eliminate
all street parking

Impacts (Full adoption scenario)

+681%	+54%	+30%	+47%
(Auckland)	(Dublin)	(Helsinki)	(Lisboa)

Heavy PT ridership

24hrs.

Impacts (Full adoption scenario)

+254%	+183%	+111%	+589%
(Auckland)	(Dublin)	(Helsinki)	(Lisboa)

PT + SM accessibility

24hrs.

Impacts (Full adoption scenario)

-36% (-12%)	-10% (+69%)	-15% (+43%)	-9% (+37%)
(Auckland)	(Dublin)	(Helsinki)	(Lisboa)

Avg. mobility costs (retaining the car)

24hrs.

Impacts (Full adoption scenario)

2.7	2.1	1.8	1.6
(Auckland)	(Dublin)	(Helsinki)	(Lisboa)

CO2 /inhabitant

kg of CO_2 per inhabitant, day

24hrs.

Factors affecting outcome

Current modal share
Public transport quality
Density of the area
Trip patterns

Testing targeted policies

Car users adoption rates

- In all cities the different car adoption rates were tested: 20%, 50% and 100%

(Auckland)

- Strong decrease of CO_2 from early adoption rates giving the strong car usage and low occupancy rate
- Congestion reduction elasticity around 0.85, showing a great potential congestion reduction

(Dublin)

- Huge efficiency of the measure for CO_2 reduction up to 20%, not being that effective between 20% and 50%
- Congestion reduction elasticity around 0.92, showing a great potential congestion reduction

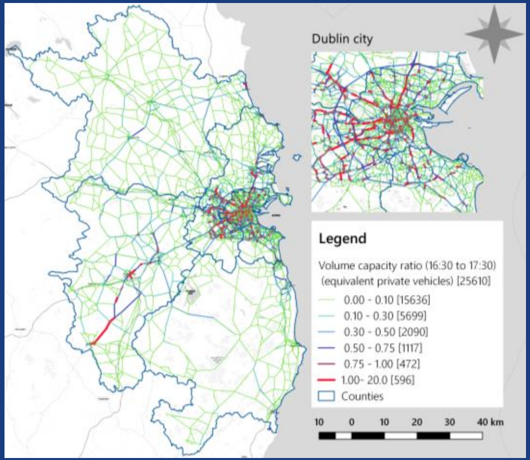
(Helsinki)

- More limited impacts for lower levels of adoption. Saving start being more significant close to 50% adoption
- Congestion reduction elasticity around 0.45, showing a medium potential congestion reduction

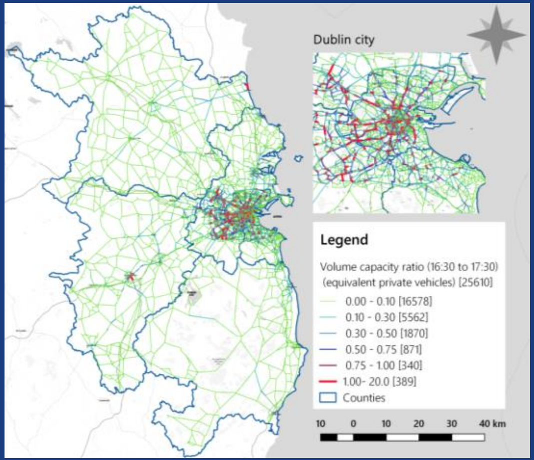
Testing targeted policies

Car users adoption rates (Dublin example)

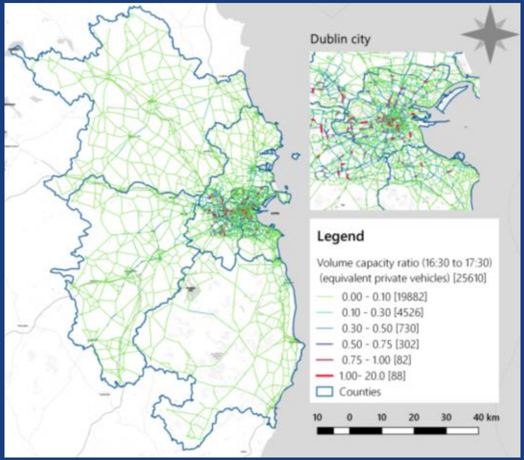
(Baseline)



(20%)



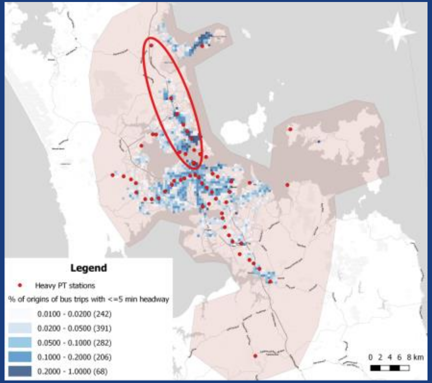
(100%)

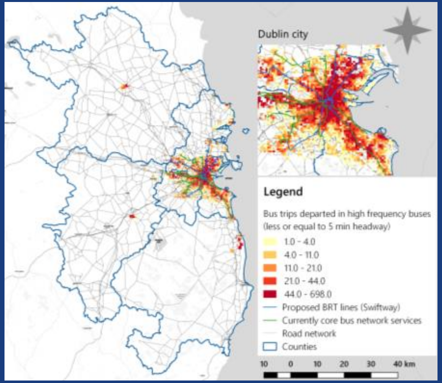


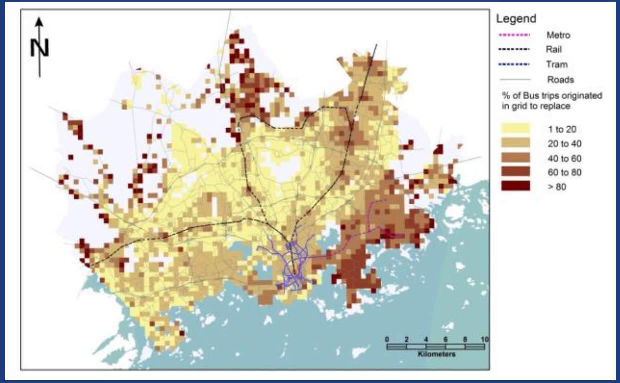
Testing targeted policies

Interaction with current bus operation

(Auckland) **(Dublin)** **(Helsinki)**







Testing targeted policies

Interaction with current bus operation

(Auckland)

- BRT corridors preservation demonstrated better performance
- Low frequency services showed worse performance than SM
- Services should be adapted and flexibilising
- Cost provision reduction and greater connectivity and access

(Dublin)

- Core bus network and new BRT corridors seem to be well fitted to current demand (recent design) and perform better than flexible low capacity SM services
- SM outperforms other bus services specially regional services in the wider GDA
- Cost provision reduction and greater connectivity and access

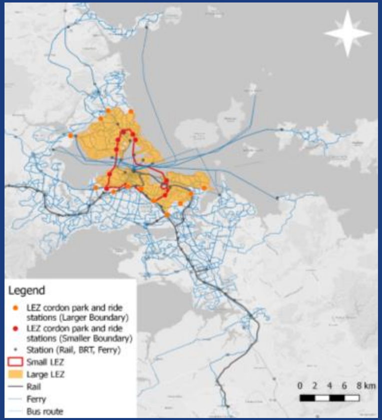
(Helsinki)

- Tested replacement of bus feeder services to Heavy PT or low frequency services
- Both approached of update these services provided now by SM give very positive outcomes, specially replacing feeder services
- Keep the other services or adapt
- Cost provision reduction and greater connectivity and access

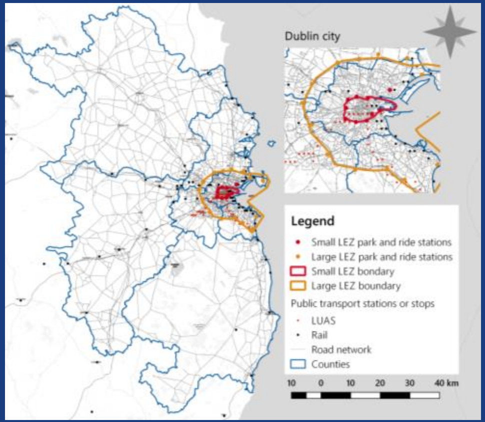
Testing targeted policies

Car use restrictions (Low Emission Zones)

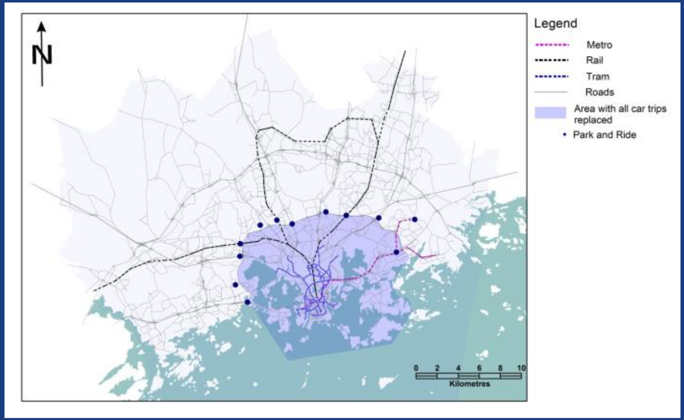
(Auckland)



(Dublin)



(Helsinki)



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Testing targeted policies

Car use restrictions (Low Emission Zones)

(Auckland)

- Spatially narrow LEZ with small interaction with Heavy PT may led to greater congestion near the LEZ parking lots
- Peak period focus can almost achieve similar CO2 performance as the whole day restrictions
- Feeding SM services outside Limited cost efficiency

(Dublin)

- Both tested LEZ systems where successful, yet again the narrow configuration has local congestion effects
- Traffic inside the LEZ is strongly reduced
- Services outside key in reducing the congestion at transfer points between car and SM / PT

(Helsinki)

- Significant reduction in congestion in tested scenario, showing comparable results with higher degrees of SM adoption in the whole study area
- Good integration with PT system allows reducing the local congestion effects
- Very efficient SM system (mainly Taxi-Buses)

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Testing targeted policies

Electrification

(Auckland)

- Reduce significantly costs
  1. The increase in fleet due to requirements of range and charging time are largely compensated by reduction on energy costs
  2. These savings became negligible if small market size and may even increase costs

(Dublin)

- Small reduction in costs
  1. The nature of a regional shared mobility services with greater distances leads to cars range be very frequently activated as a constraint, requirement significantly larger fleets for operation
  2. This problem intensifies for small adoption rates

(Helsinki)

- Reduce significantly costs
  1. Large potential due to small required fleet increases with rare range constraint activation
  2. These savings became less significant in smaller fleets to recoup the additional investment costs

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Testing targeted policies

Self-driving technology

- The model estimates for self-driving operation result in reductions of approximately 50% on the prices for Shared Taxi and Taxi-Buses per kilometre. This reduction would lead to Shared Taxis being cheaper than current public transport in some cases

- The estimated values are aligned with recent studies that assessed the cost of shared self-driving vehicles

- Stephens, T. S., J. Gonder, Y. Chen, Z. Lin, C. Liu and D. Gohlke (2016), Estimated Bounds and Important Factors for Fuel Use and Consumer Costs of Connected and Automated Vehicles, National Renewable Energy Laboratory, NREL/TP-5400-67216

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Testing targeted policies

Market structure of SM provision

- 15 %

CO_2 savings with several dispatchers and non integrated operators

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Transition

Land use policies

Economic instruments

Infrastructure/service measures

Regulatory policies

Recommendations

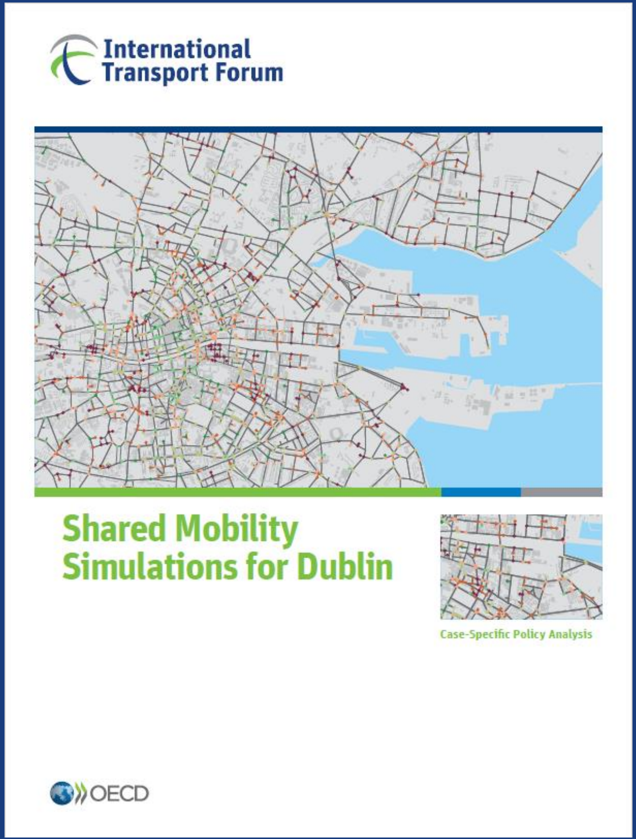
Enable shared mobility as part of policy package

Introduce at a sufficient scale

Feed to mass transit

Target potential early adopters particularly car users

Ensure line and station capacity



Next reports

1. Shared Mobility Simulations for Dublin
2. Shared Mobility Simulations for Lyon
3. Shared Mobility Simulations Methodology

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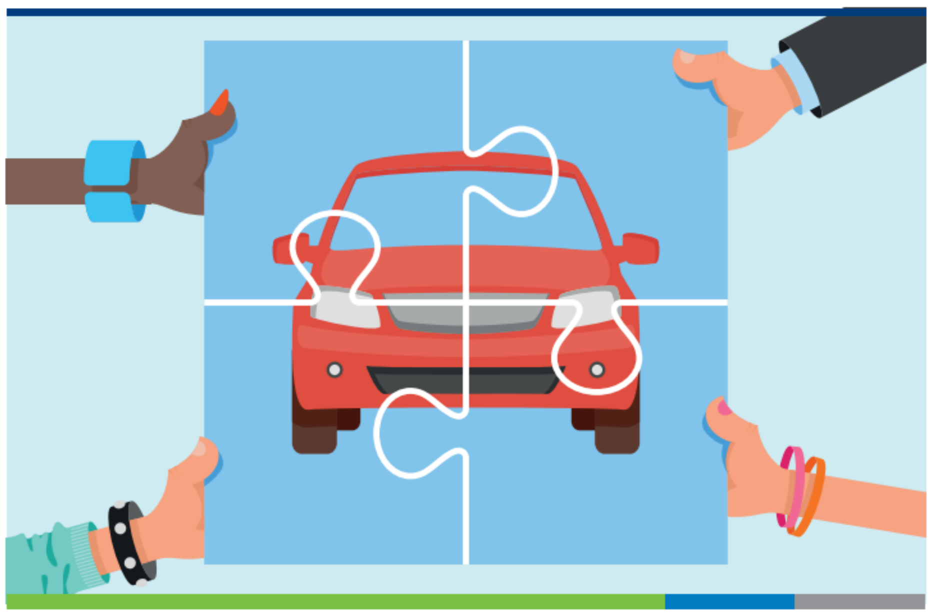

Thank you!

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Latest reports available at
https://www.itf-oecd.org/itf-work-shared-mobility

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