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Transportation planners and Traffic Engineers to align Traffic, Transit and New Mobility Services

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"In 1980, McKinsey & Company was commissioned by AT&T (whose Bell Labs had invented cellular telephony) to forecast cell phone penetration in the U.S. by 2000.

The consultant's prediction, 900,000 subscribers, was less than 1% of the actual figure, 109 Million.

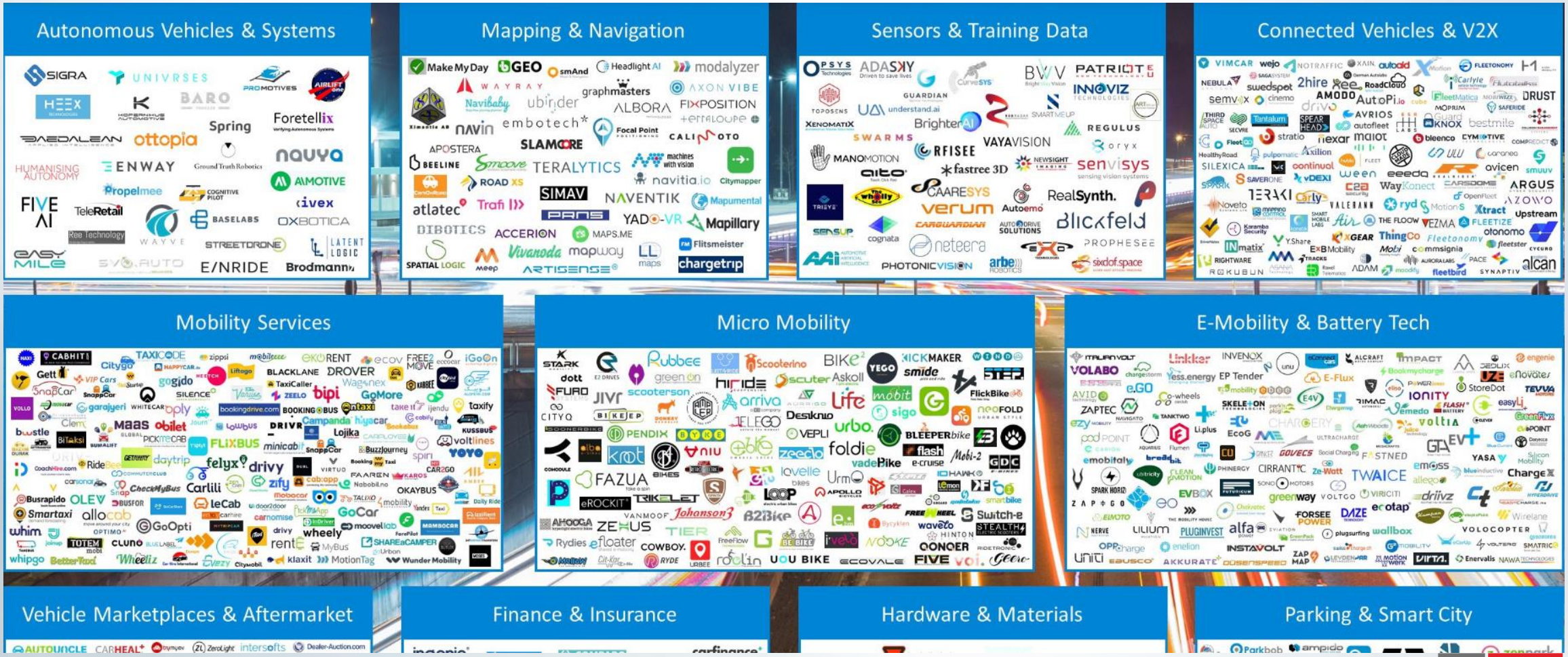
Based on this legendary mistake, AT&T decided there was not much future to these toys.

A decade later, to rejoin the cellular market, AT&T had to acquire McCaw Cellular for $12.6 Billion.

By 2011, the number of subscribers worldwide had surpassed 5 Billion and cellular communication had become an unprecedented technological revolution."

https://medium.com/uvc-partners-news/the-european-mobility-startup-landscape-e4cc239fde99

Simply Wow



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Forecasting the future of transport
It's become tricky

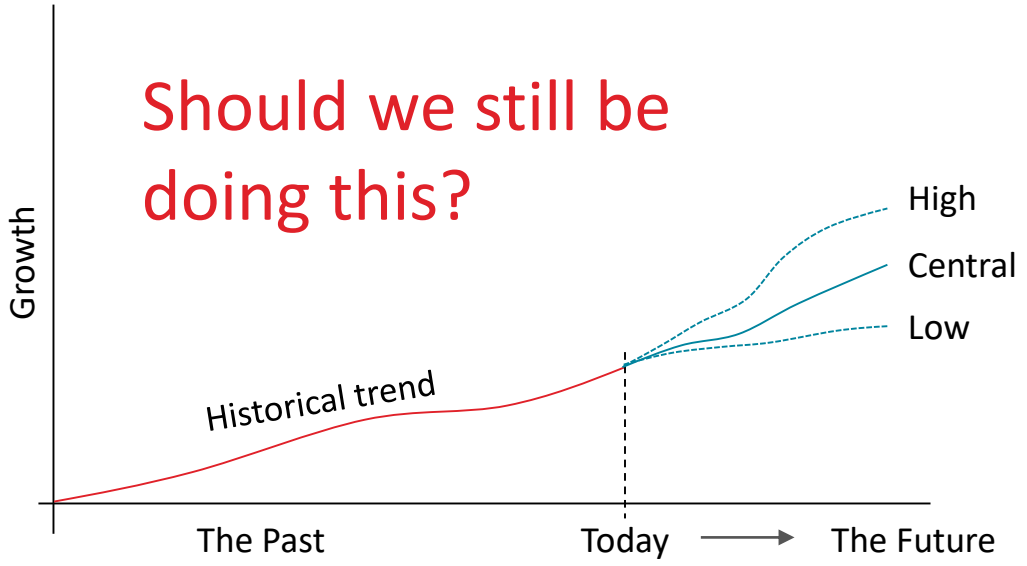
Traditionally….. We project forward based on historical trends. And then only a handful of futures

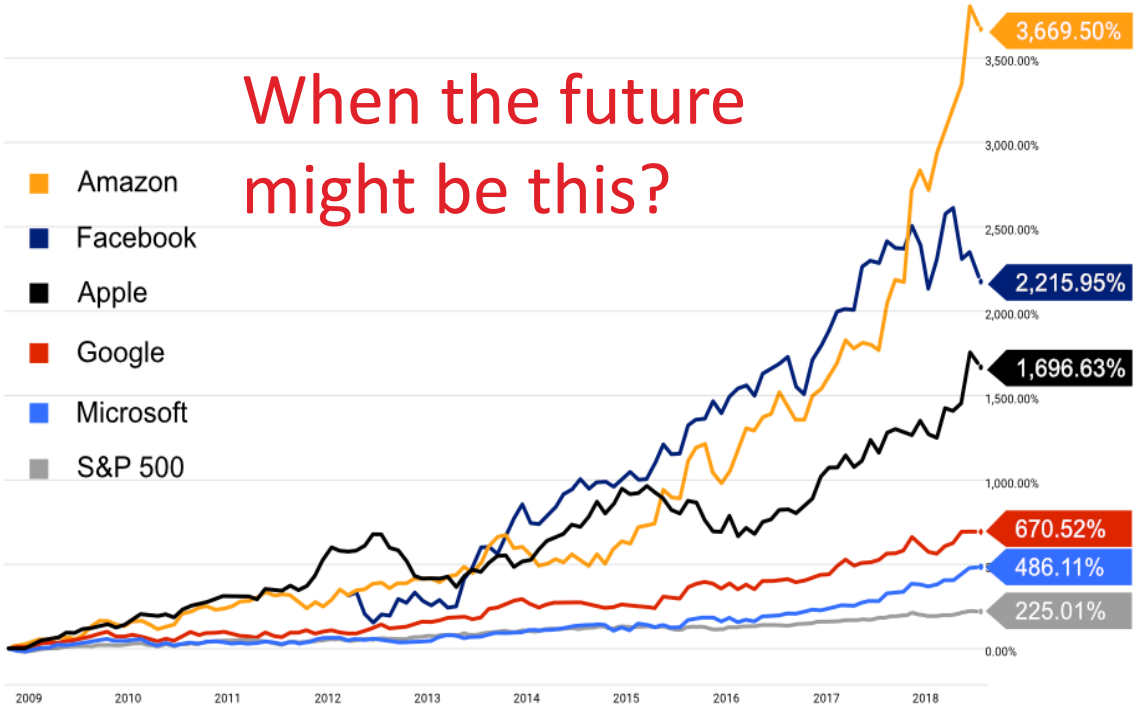
Traditionally….. We freeze…

- Trip Rates – our propensity to travel
- Value of Time (usually a disbenefit, but could this become a positive with AVs?)
- Car Availability levels (declining amongst younger people?)

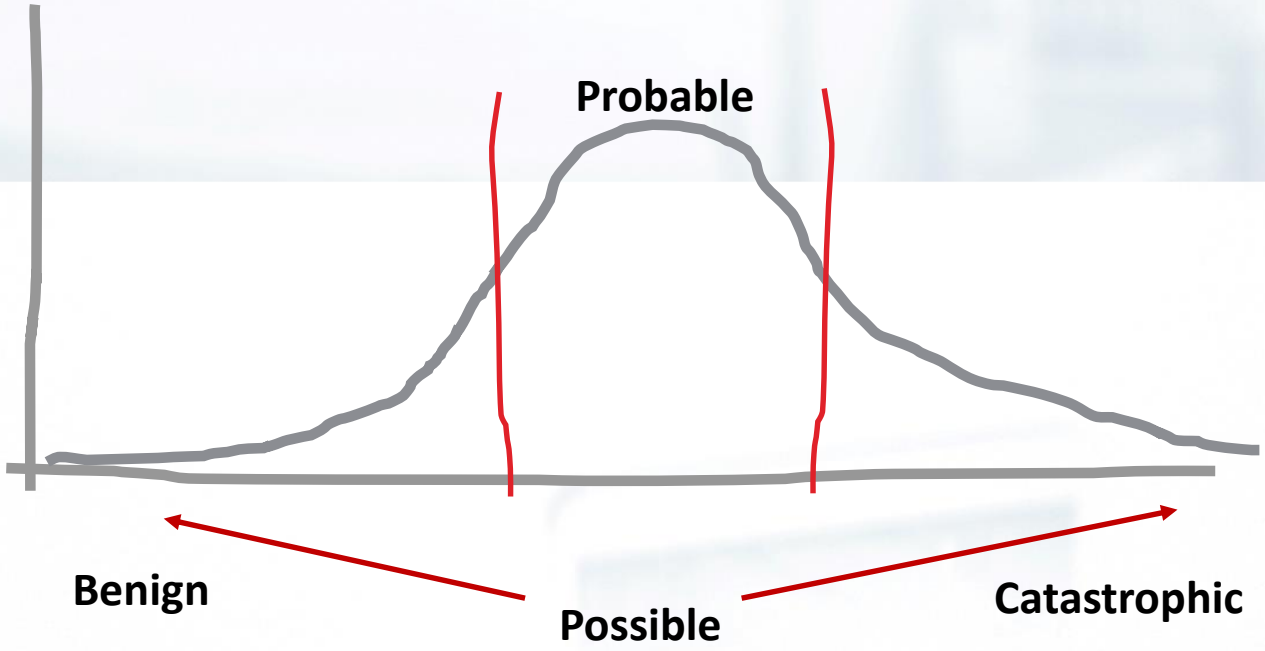
But are we witnessing new Megatrends with MaaS?

- Increased adoption in alternate modes (a change in consumer mindset)
- Reduced private car ownership ?
- Increase in choices, e.g. E-Mobility
- Increased inclusivity (propensity to travel)





By providing insight in the possible vs. the probable



The MPO as key player in a multimodal integrated future

The data hub for multi-modal mobility

- Transportation Network Data
- Movement data of people and goods
- Data standards

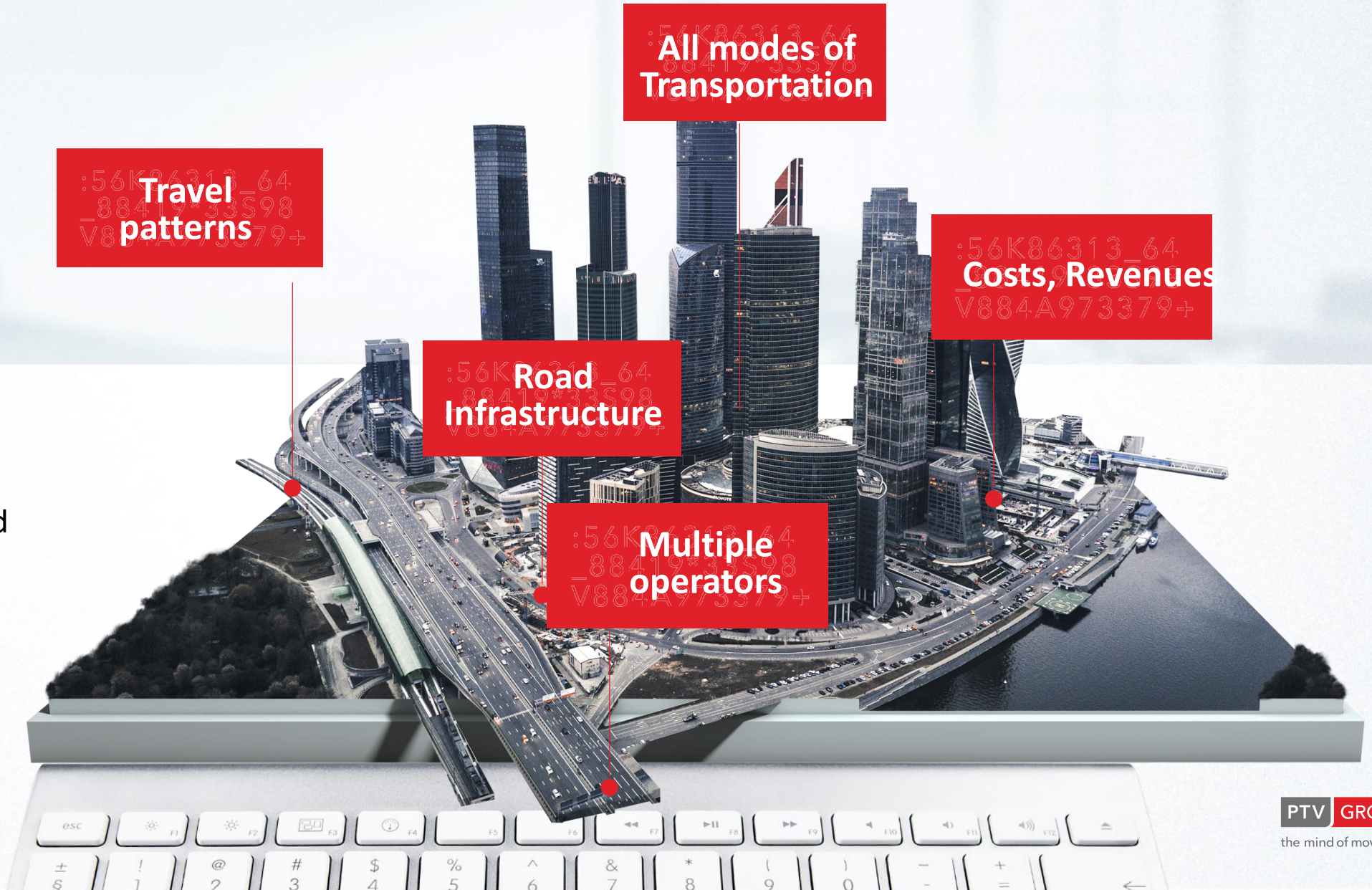
The Scenario Manager for the region

- New business models, roles and responsibilities
- Impact of New Technology

Providing insights in the “possible” and “probable”

- Performance metrics, visualization of the impact
- Investments, costs and revenues
- Policy guidance to the public and politicians

With a digital replica of Urban Mobility



- Levers can be pulled
- Use the ‘now’ to try and understand the ‘future’

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The Oslo Study

in conjunction with COWI

for Ruter#

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What is shared mobility?

- Ride sharing system
- Potential passenger sends a trip request
- Dispatcher assigns vehicles to passengers
- If an occupied vehicle is close to the new passenger, it can pick her up
- System is described by
  - fleet size
  - pick-up / drop-off points
  - vehicle size
  - min. guaranteed performance
  - ...

Oslo's PT provider: Ruter

Replacing private cars & PT with Shared Mobility

- Data as the basis
- Digital Twin
- **Scenario Management**
- **Results**

					Car Share	Ride Share	Ride Share	Δ VMT
1A								**+26%**
1B						TAXI		**-14%**
2A		✗	✗	✗				**+97%**
2B		✗	✗	✗		TAXI		**+31%**
3A		✗	✗	✗			TAXIBUS	**+67%**
3B		✗	✗	✗		TAXI	TAXIBUS	**+27%**

Study Area

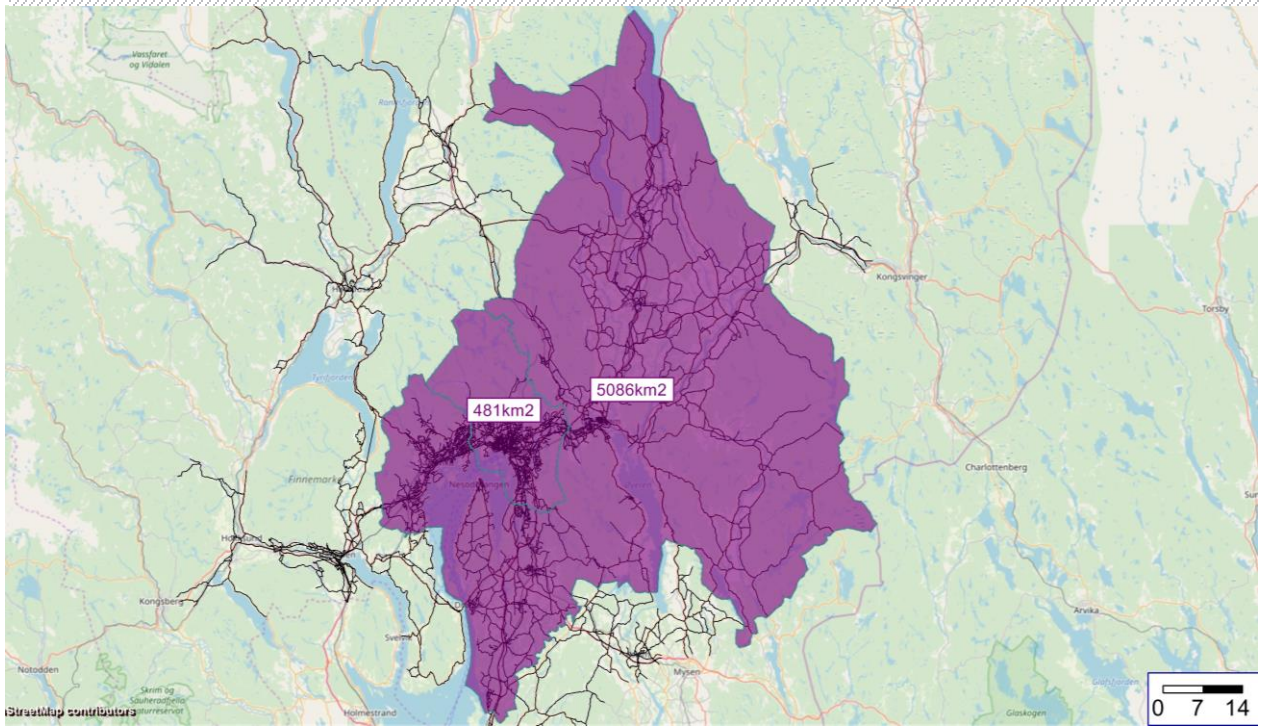
Covers Oslo & Akershus

AM peak 06:00-10:00 simulated.

The busiest Scenario includes existing car drivers, their passengers and public transport riders on tram and bus.

Simulating 600,000 individual trip makers moving to shared mobility.

- 540,000 trip requests
- 56,000 vehicles
- 37,000,000 journey legs



Simulating the solution

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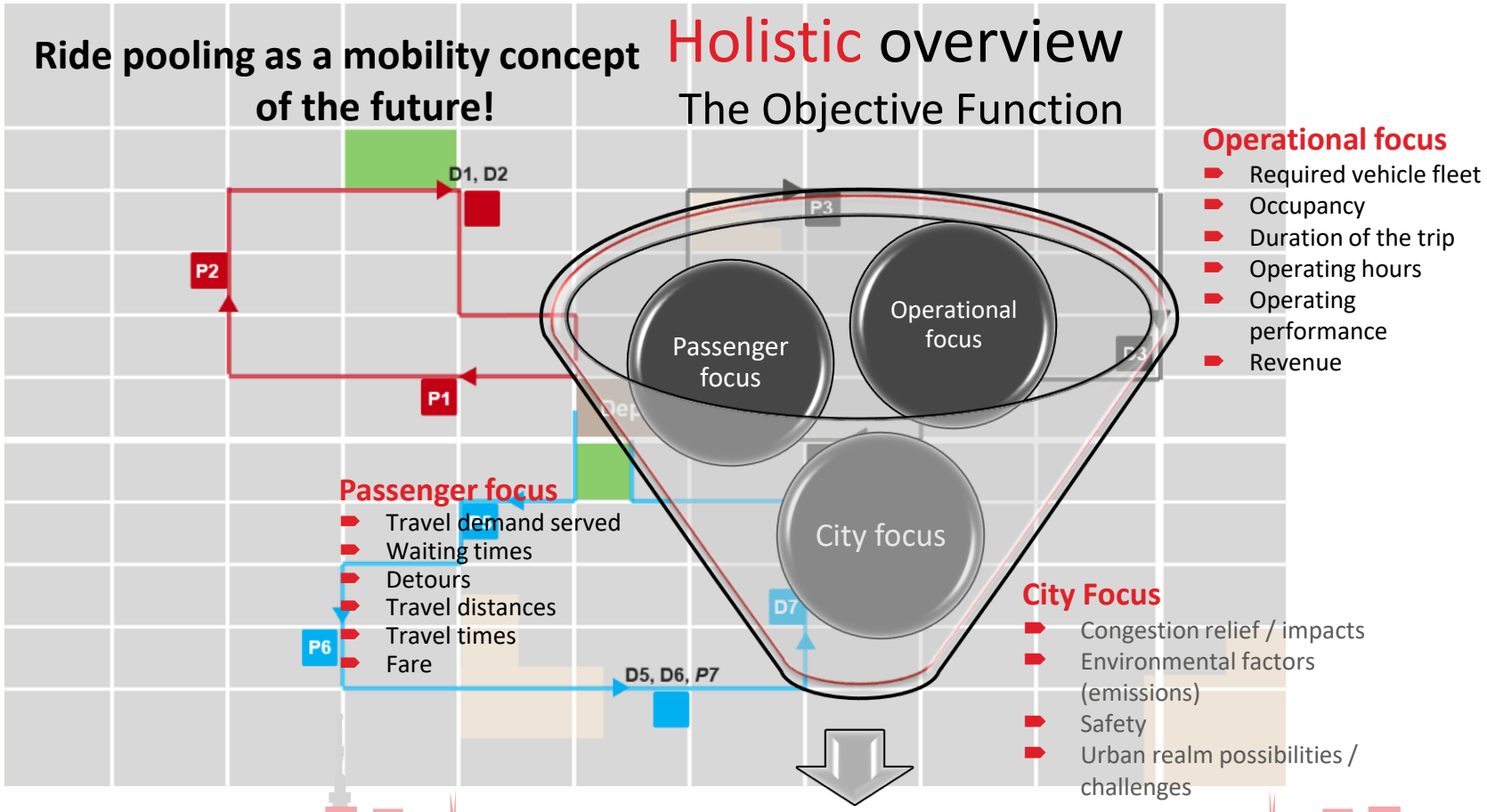
Simulating Shared Mobility

The shared mobility algorithm addresses three core conditions:

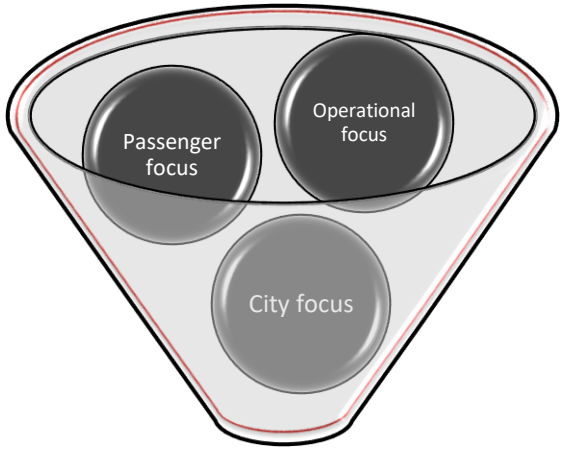
- Minimise unserved trip requests
- Minimise the fleet size required
- Minimise the objective function



Simulating Mobility as a Service

The shared mobility algorithm addresses three core conditions:

- Minimize unserved trip requests
- Minimize the fleet size required
- Minimize the objective function (cost)

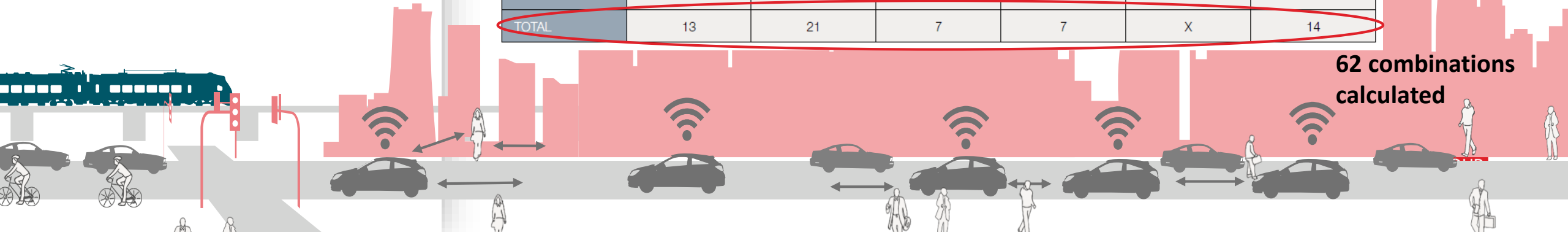


Sustainable decisions

TABLE 5-2 MaaS Simulations by scenario

	SCENARIO 1A	SCENARIO 1B	SCENARIO 2A	SCENARIO 2B	SCENARIO 3A	SCENARIO 3B
CAR	CAR SHARE	RIDE SHARE	CAR SHARE	RIDE SHARE	CAR SHARE (AS 1A)	RIDE SHARE (AS 1B)
PT (BUS & TRAM)			CAR SHARE	RIDE SHARE	RIDE SHARE (AS 3)	RIDE SHARE (AS 3)
FLEET SIZE	9	9	7	7	X	7
WAIT TIME	4	4			X	
DETOUR	X	8	X		X	7
TOTAL	13	21	7	7	X	14

62 combinations calculated



Best and worst case

Fleet size reduction does not correlate to reduced vehicle miles travelled.

	BASE	1A	1B	2A	2B	3A	3B
	PRIVATE CARS 2020	FROM PRIVATE CAR TO CAR SHARING	FROM PRIVATE CAR TO SHARED TAXI	FROM PRIVATE CAR, BUS AND TRAM TO CAR SHARING	FROM PRIVATE CAR, BUS AND TRAM TO SHARED TAXI	FROM BUS AND TRAM TO TAXIBUS	
						FROM PRIVATE CAR TO CAR SHARING	FROM PRIVATE CAR TO SHARED TAXI
PERSON TRIPS	401,000	401,000	401,000	611,000	611,000	611,000	611,000
FLEET SIZE	352,000	33,000	26,000	55,000	40,000	49,000	42,000
FLEET SIZE COMPARED TO BASE (PCT. OF BASE)	-	9%	7%	16%	11%	14%	12%
VEHICLE KM (MILLION)	4.4	5.5	3.7	8.6	5.7	7.3	5.5
PCT. CHANGES IN VEHICLE KM COMPARED TO BASE	-	+26%	-14%	+97%	+31%	+67%	+27%

Fleet size reduction - 91%

Vehicle VMT reduction -14%

Best case

Worst case

Vehicle VMT increase +97%

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Empty vehicles

Caused by vehicle re-positioning.

Has the effect of adding to congestion levels.

Reduces the benefits of ride pooling.

Car sharing increases empty miles by 50% compared to ride-pooling

	BASE	1A	1B	2A	2B	3A	3B
						FROM BUS AND TRAM TO TAXIBUS	
	PRIVATE CARS 2020	FROM PRIVATE CAR TO CAR SHARING	FROM PRIVATE CAR TO SHARED TAXI	FROM PRIVATE CAR, BUS AND TRAM TO CAR SHARING	FROM PRIVATE CAR, BUS AND TRAM TO SHARED TAXI	FROM PRIVATE CAR TO CAR SHARING	FROM PRIVATE CAR TO SHARED TAXI
VEHICLE KILOMETERS – IN SERVICE (MILLION)	4.4	4.0	3.1	6.1	4.6	5.5	4.7
VEHICLE KILOMETERS – EMPTY VEHICLE (MILLION)	0	1.5	0.6	2.4	1.1	1.7	0.9
VEHICLE KM (MILLION)	4.4	5.5	3.7	8.6	5.7	7.3	5.5
VEHICLE KILOMETERS SHARE – IN SERVICE	100%	73%	83%	72%	81%	76%	84%
VEHICLE KILOMETERS SHARE – EMPTY VEHICLE	0%	27%	17%	28%	19%	24%	16%

28% of VMT are "empty" vehicles

Fleet utilisation

Mean occupancy "in service" includes empty vehicle status

	BASE	1A	1B	2A	2B	3A	3B
						FROM BUS AND TRAM TO TAXIBUS	
	PRIVATE CARS 2020	FROM PRIVATE CAR TO CAR SHARING	FROM PRIVATE CAR TO SHARED TAXI	FROM PRIVATE CAR, BUS AND TRAM TO CAR SHARING	FROM PRIVATE CAR, BUS AND TRAM TO SHARED TAXI	FROM PRIVATE CAR TO CAR SHARING	FROM PRIVATE CAR TO SHARED TAXI
MEAN OCCUPANCY – IN SERVICE	1.14	0.79	1.62	0.80	1.62	1.10	1.62
MEAN OCCUPANCY – IN OPERATION	1.14	1.14	1.86	1.14	1.89	1.40	1.89
MEAN OPERATION DISTANCE [KM]	12	166	144	153	143	148	133
MEAN OPERATION TIME [H]	0.2	3.2	3.0	2.9	3.0	2.9	2.8

Vehicle operation distance increase from 12 kilometers to ~150 kilometres (in 4 hours)

Vehicle operation time increase from 12 minutes to ~3 hours (in a 4-hour period)

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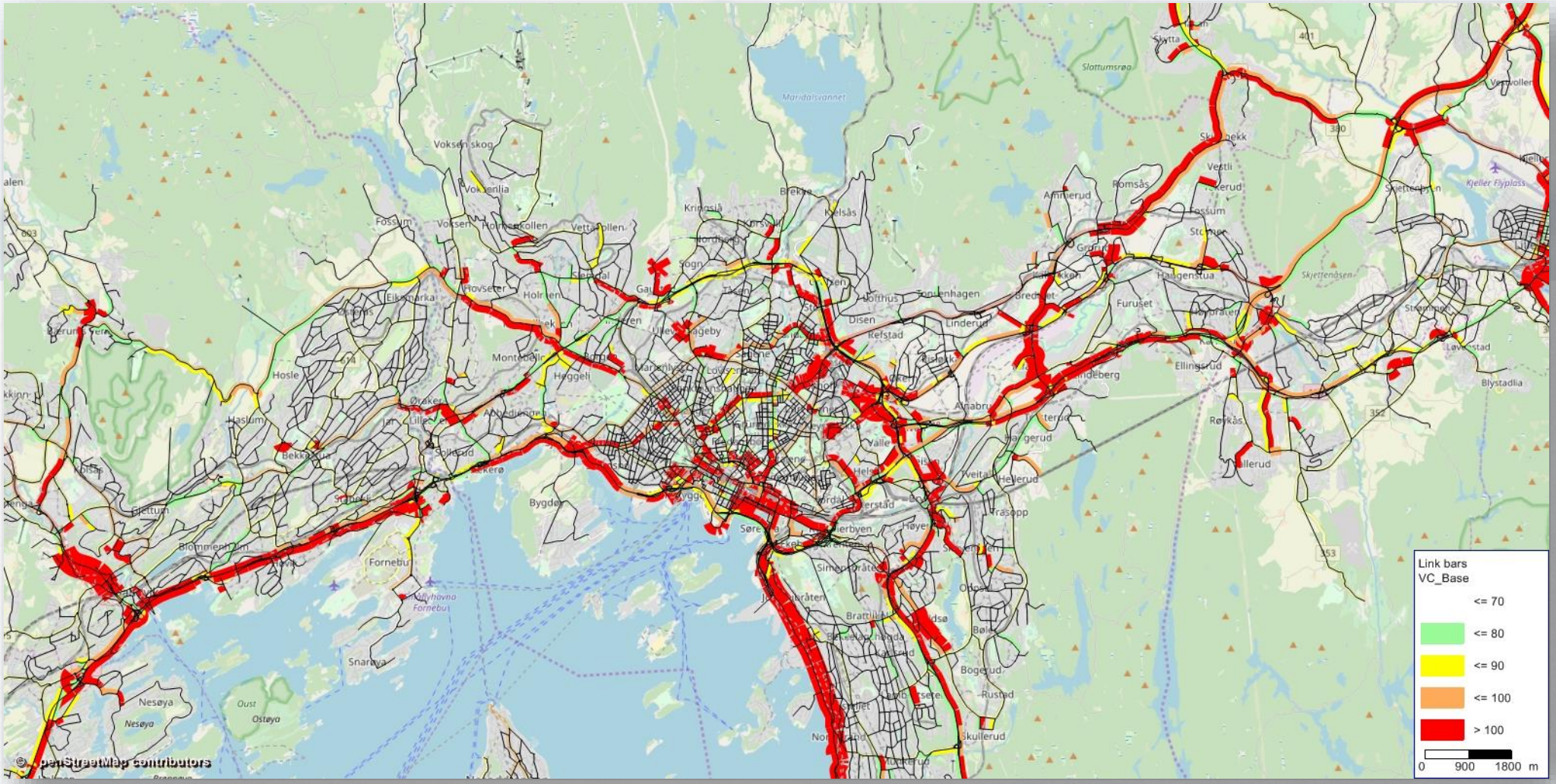
Demonstrating actionable Outcomes and Results

BASE CASE – EXISTING V/C

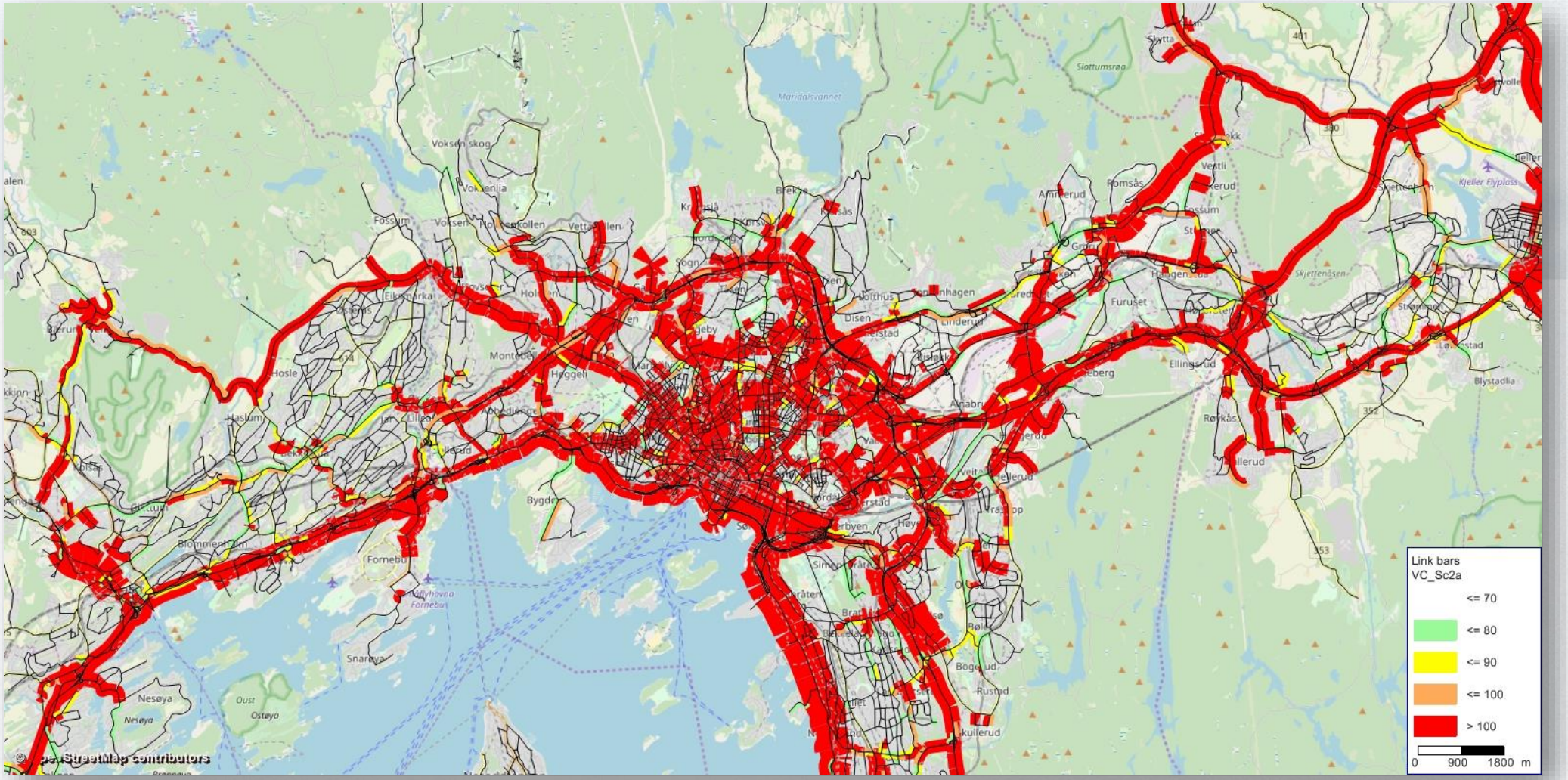
- Data as the basis
- Digital Twin
- Scenario Management
- **Results**



Demonstrating actionable Outcomes and Results

SCENARIO 2a – Worst Case V/C

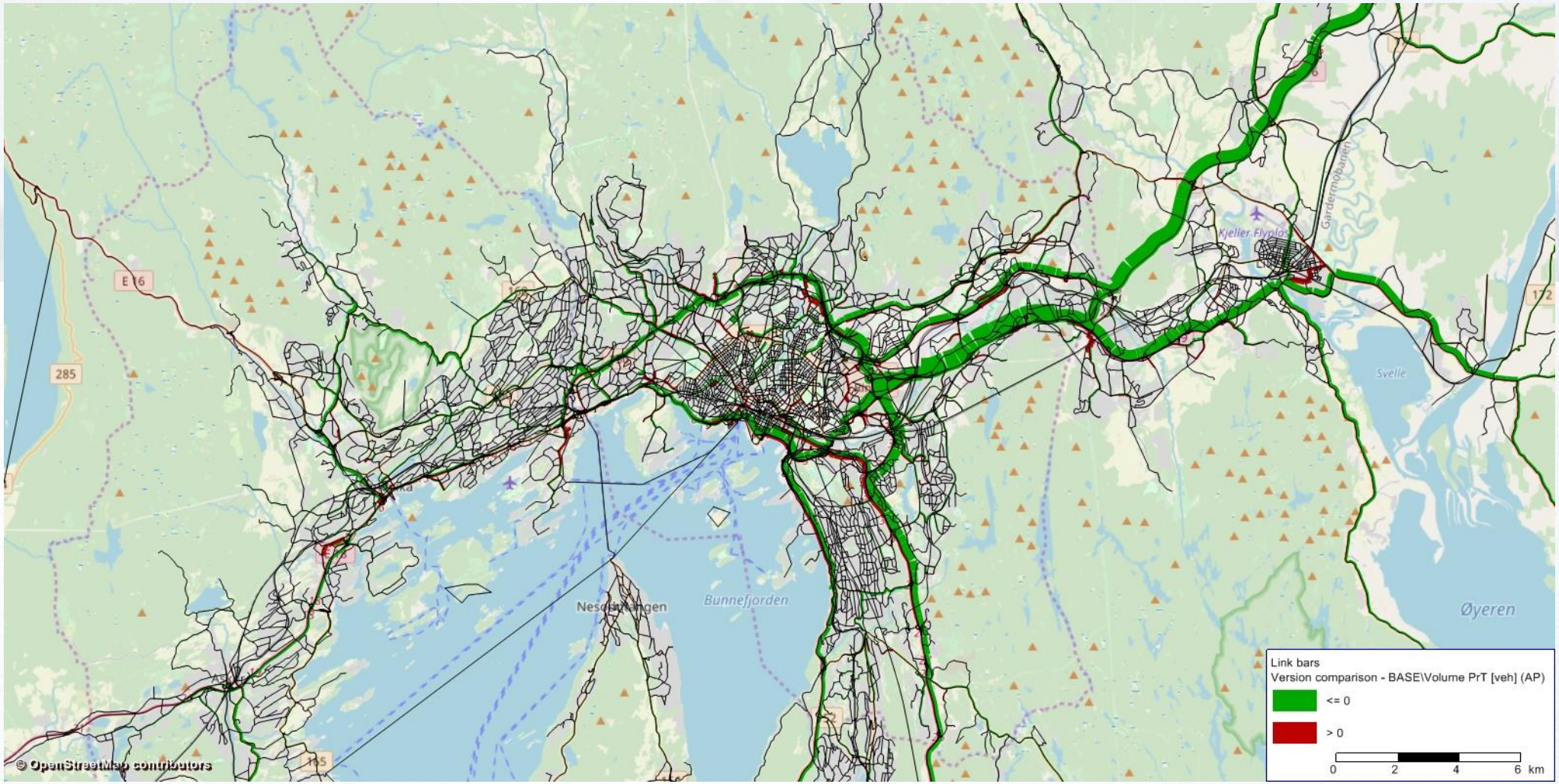
- Data as the basis
- Digital Twin
- Scenario Management
- **Results**



Demonstrating actionable Outcomes and Results

SCENARIO 1b – TRAFFIC FLOW REDUCTION

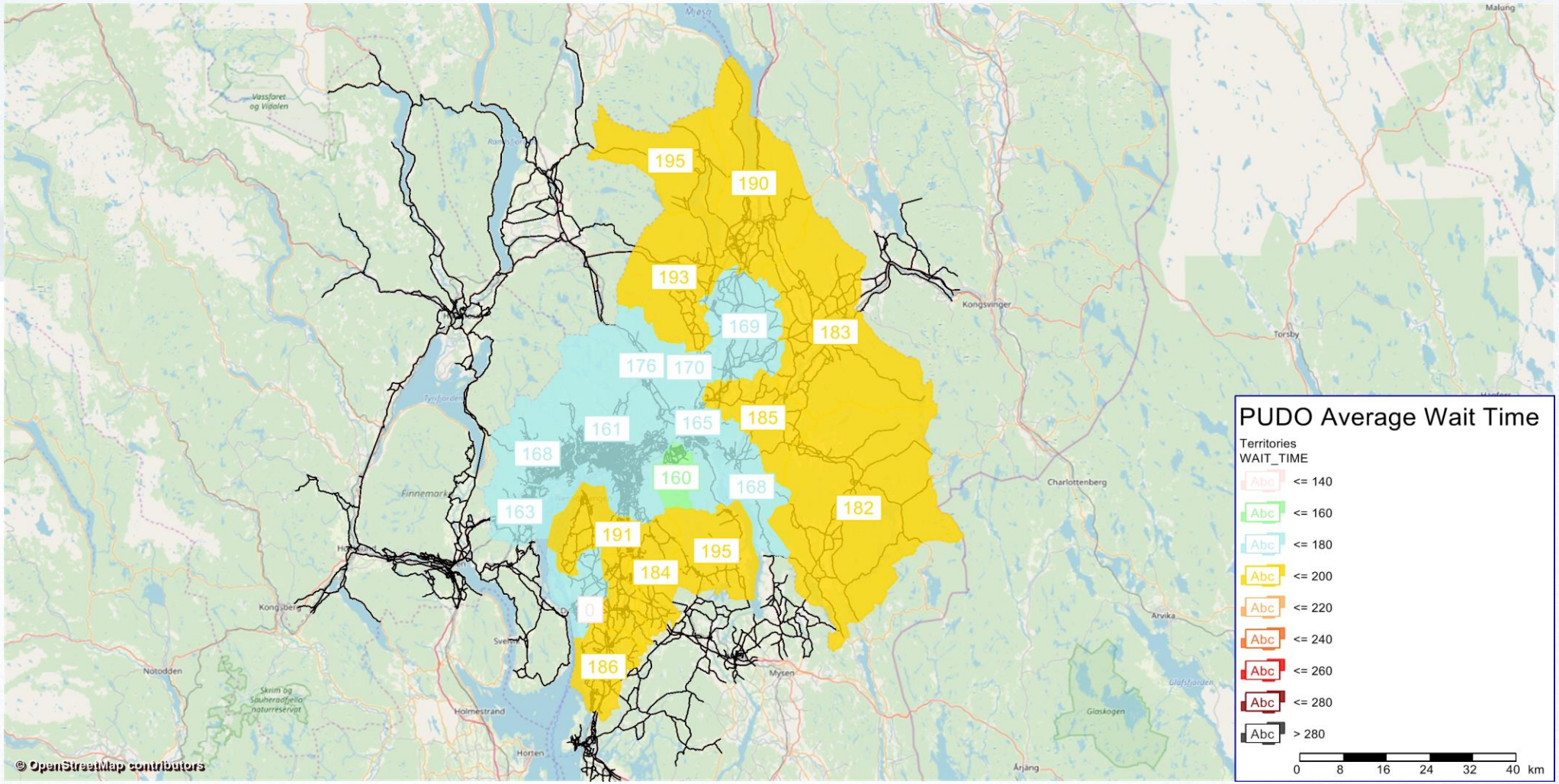
- Data as the basis
- Digital Twin
- Scenario Management
- **Results**



Demonstrating actionable **Outcomes and Results**

SCENARIO 1b – Average wait time

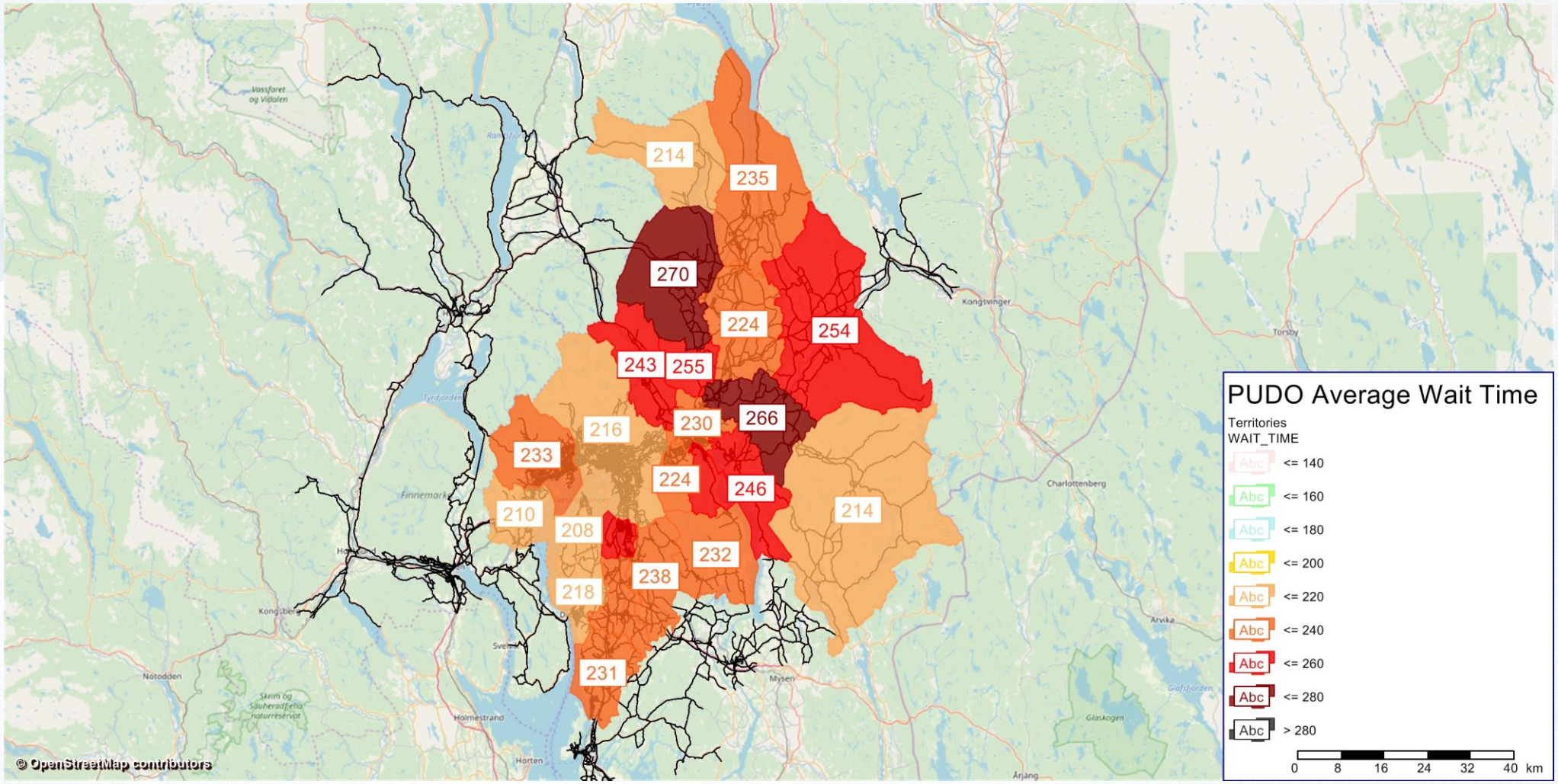
- Data as the basis
- Digital Twin
- Scenario Management
- **Results**



Demonstrating actionable **Outcomes and Results**

SCENARIO 1a – Average wait time

- Data as the basis
- Digital Twin
- Scenario Management
- **Results**



Passengers Level of service

	BASIS	1A	1B	2A	2B	3A	3B	3	BASIS
	PRIVATE CARS 2020	FROM PRIVATE CAR TO CAR SHARING	FROM PRIVATE CAR TO SHARED TAXI	FROM PRIVATE CAR, BUS AND TRAM TO CAR SHARING	FROM PRIVATE CAR, BUS AND TRAM TO SHARED TAXI	FROM BUS AND TRAM TO TAXIBUS		FROM TRAM AND BUS TO TAXIBUS	PUBLIC PASSEN-GERS IN BUS/TRAM 2020
						FROM PRIVATE CAR TO CAR SHARING	FROM PRIVATE CAR TO SHARED TAXI		
AVERAGE TRIP DISTANCE [KM]	11.7	11.4	12.6	11.4	12.6	11.9	12.7	12.9	13.3
AVARAGE TRIP TIME – TOTAL	12.3	18.3	20.5	18.3	20.7	19.2	20.7	21.0	31.6
AVERAGE WAITTIME [MIN]	0.0	4.1	2.9	4.0	2.8	3.6	2.8	2.6	5.7
AVERAGE TRIP DURATION [MIN]*	12.3	14.1	17.7	14.3	17.9	15.6	17.9	18.3	25.9
AVERAGE DETOUR TIME (RIDE) [MIN]	-	2.0	5.5	2.0	5.6	3.3	5.6	5.7	-

Without ride sharing, Car users' travel time extends by ~6 minutes

With ride sharing, Car users' travel time extends by ~8 minutes

Public transport passengers in bus/tram save 10-11 minutes

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Sensitivity analysis

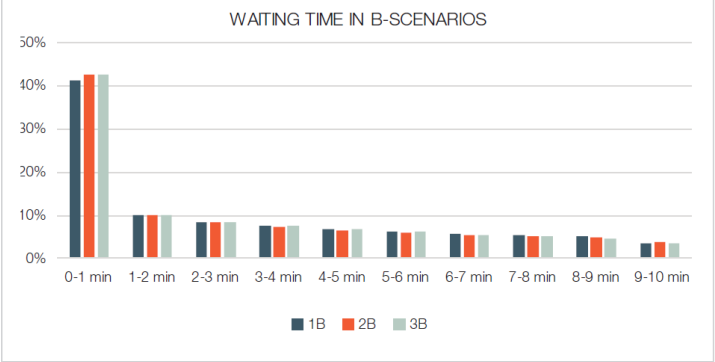
Level of service

- Detour factor and waiting time

	BASIS	1B	1B	1B
DIRECTION	PRIVATE CARS 2020	"FROM PRIVATE CAR TO SHARED TAXI	FROM PRIVATE CAR TO SHARED TAXI	FROM PRIVATE CAR TO CAR SHARING
ASSUMPTIONS				
DETOUR FACTOR	-	1.5	2.0	1.5
WAITING TIME MAXIMUM	-	10 MIN	10 MIN	20 MIN
RESULTS				
FLEET SIZE	352,000	26,000	20,000	26,000
FLEET SIZE PROPORTION OF BASIS		7%	6%	7%
VEHICLE KM (MILLION)	4.4	3.7	3.0	3.8
VEHICLE KM CHANGE COMPARED TO BASIS		-14%	-31%	-13%
MEAN OCCUPANCY – IN OPERATION	1.14	1.62	2.48	1.61
AVERAGE TRIP DISTANCE [KM]	11.7	12.6	14.8	12.6
AVARAGE TRIP TIME – TOTAL	12.3	20.5	25.8	20.6
AVERAGE WAITTIME [MIN]	0.0	2.9	3.5	3.0
AVERAGE TRIP DURATION [MIN]*	12.3	17.7	22.2	17.6
AVERAGE DETOUR TIME (RIDE) [MIN]	-	5.5	10.1	5.5

Larger reduction in VMT and fleet size can be achieved, but…

….it costs at the service level.



10 or 20 minutes of accepted waiting time makes no difference

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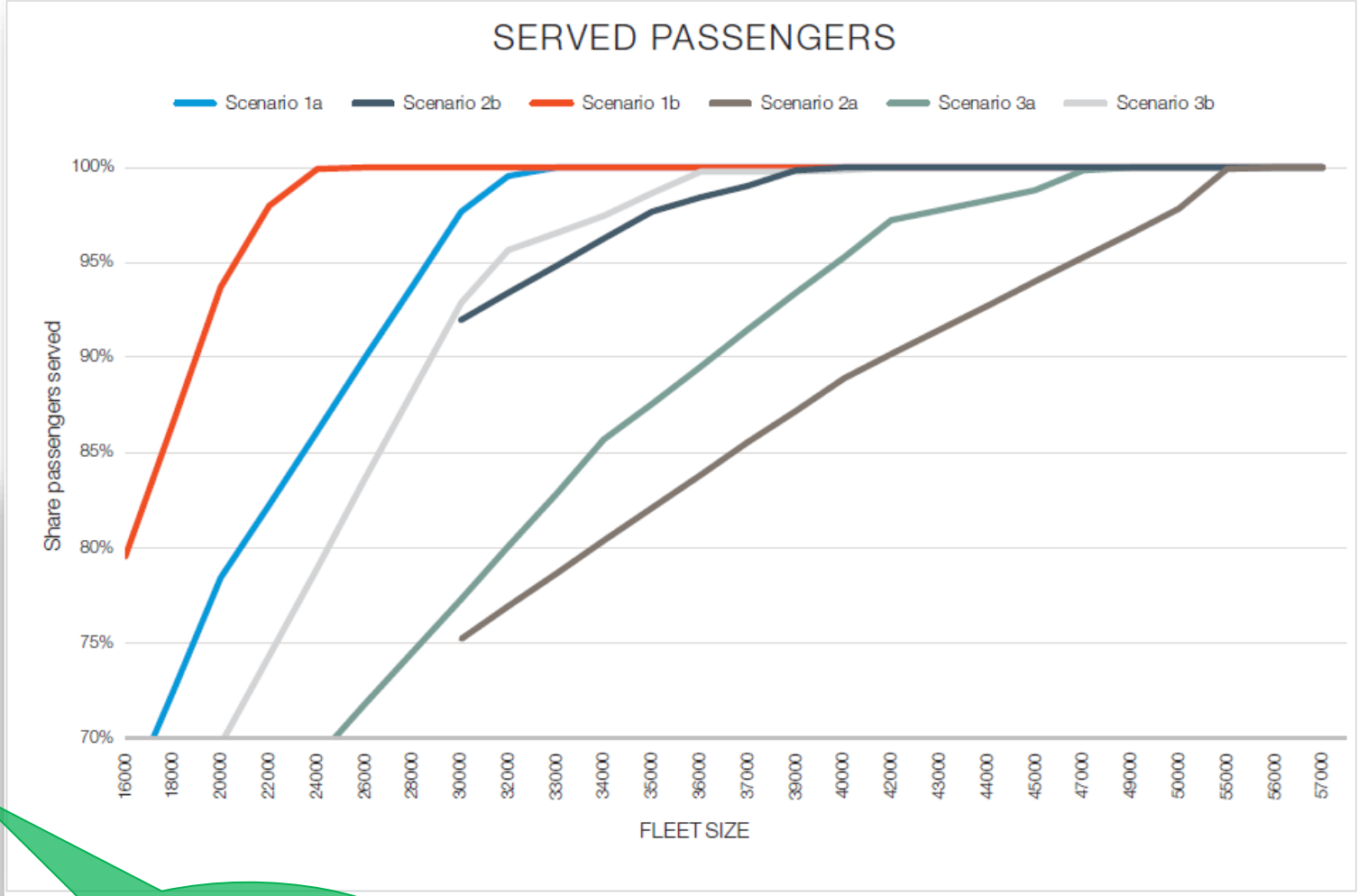
Sensitivity analysis

Level of service

- Served passengers

	1b	1b	1b
	From private car to shared taxi	From private car to shared taxi	From private car to shared taxi
Person trips	401,000	401,000	401,000
Share served passengers	100 %	98 %	94 %
Fleet size	26,000	22,000	20,000
Fleet size proportion of basis	7 %	6 %	6 %
Vehicle km (million)	3.7	3.7	3.5
Vehicle km change compared to basis	-14 %	-16 %	-20 %



Fleet size can be reduced considerably

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Take-aways & where next

Policy Insights

- Availability of technology
- Consumer preference
- Business Models
- Public investment plans

What's next for ? Ruter#

- Feeder Services
- Expanding transport hub catchment areas?
- Prioritize corridors?
- Equitability?
- <u>ON STREET PILOT</u>

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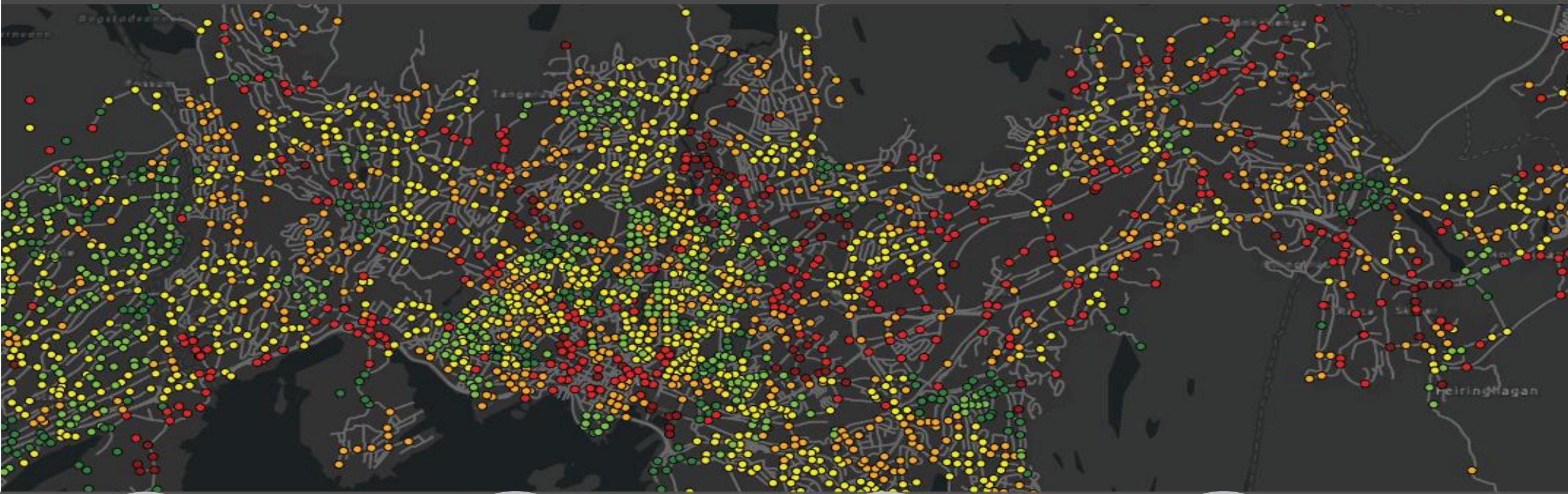
Conclusions

Aligning Traffic, Transit and New Mobility Services



Multi Modal/ Multi Agency

Focus on increased co-ordination

Transit, traffic, goods

Data Hub

Network data

Movement data

Scenario Manager

Data sharing & optimizing the optimized

Decision Support

Insights to public, politicians, and DOT's

Cost, revenue, travel time, access, equitability

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“Thank you!”

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More detailed report at: link

A PTV Talk webinar: https://ptvtraffic.us/resources/ptv-talks-the-oslo-study-measuring-the-impacts-of-shared-mobility/