Preferred citation style

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E-bike city: Verifying a vison

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IVT
ETH
Zürich

October 2023

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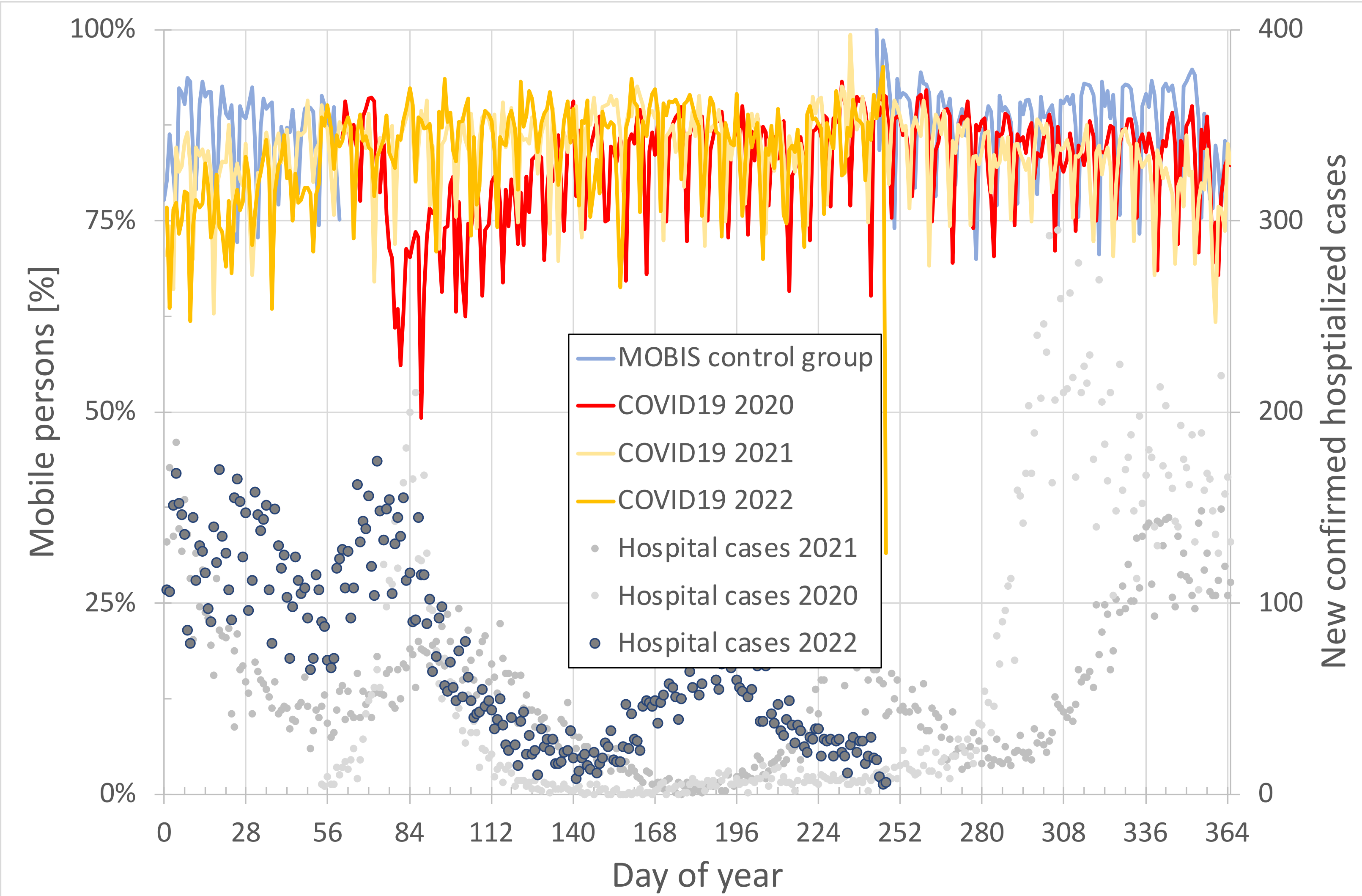
Prelude: Changeability of travel behaviour

Share of mobiles September 2019 – June 2022



Source: MOBIS/COVID19 GPS panel

Sydney 23/10

Dilemma of transport policy

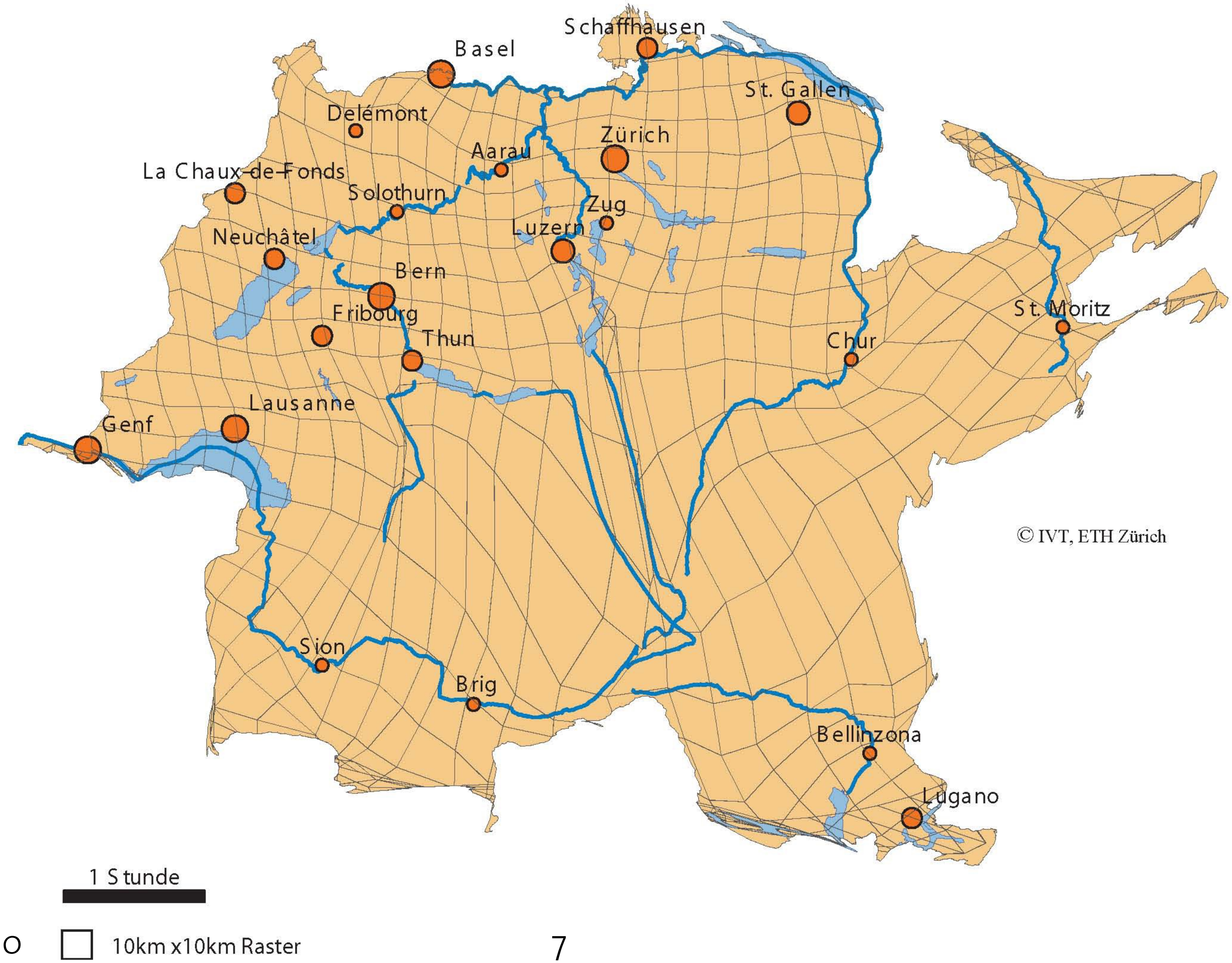
Transport

is a

Normal (private) good

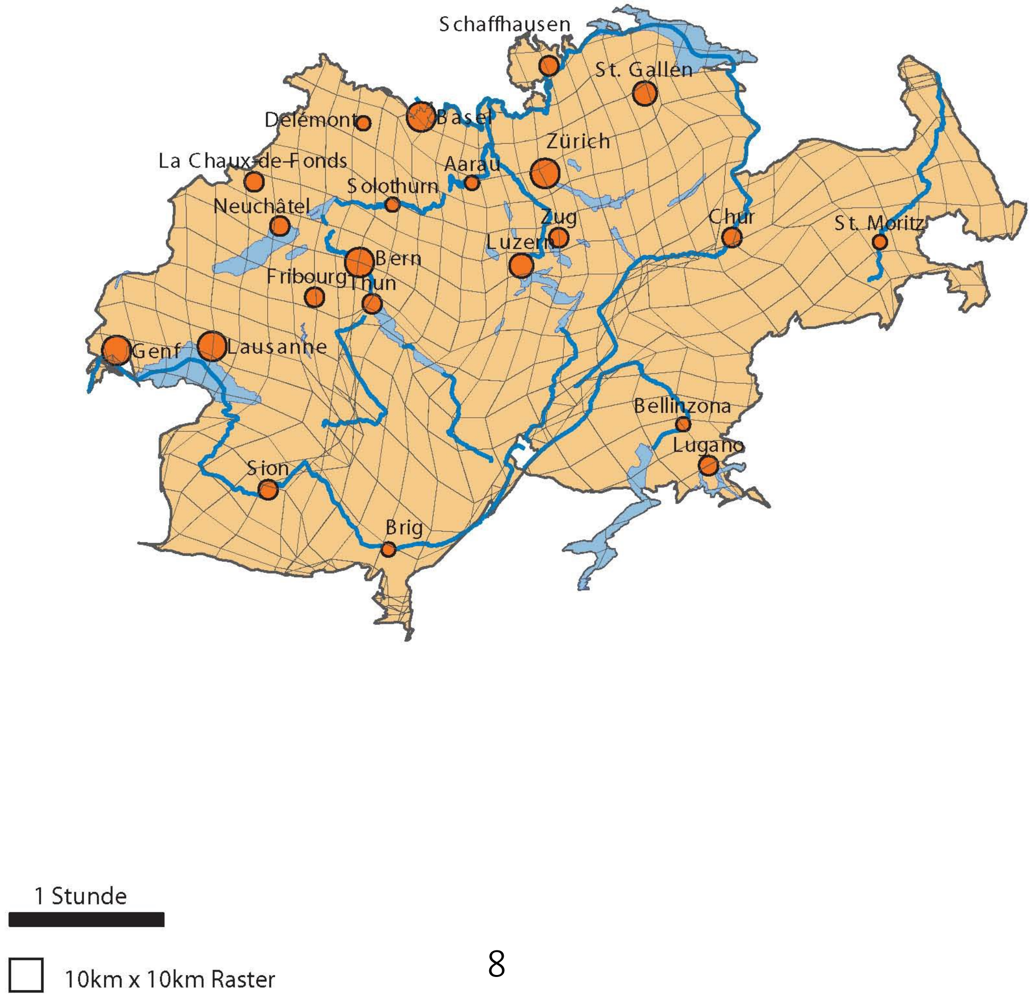
i.e.. it has a negative generalized cost elasticity

Shrinking "road" – Switzerland (1950)



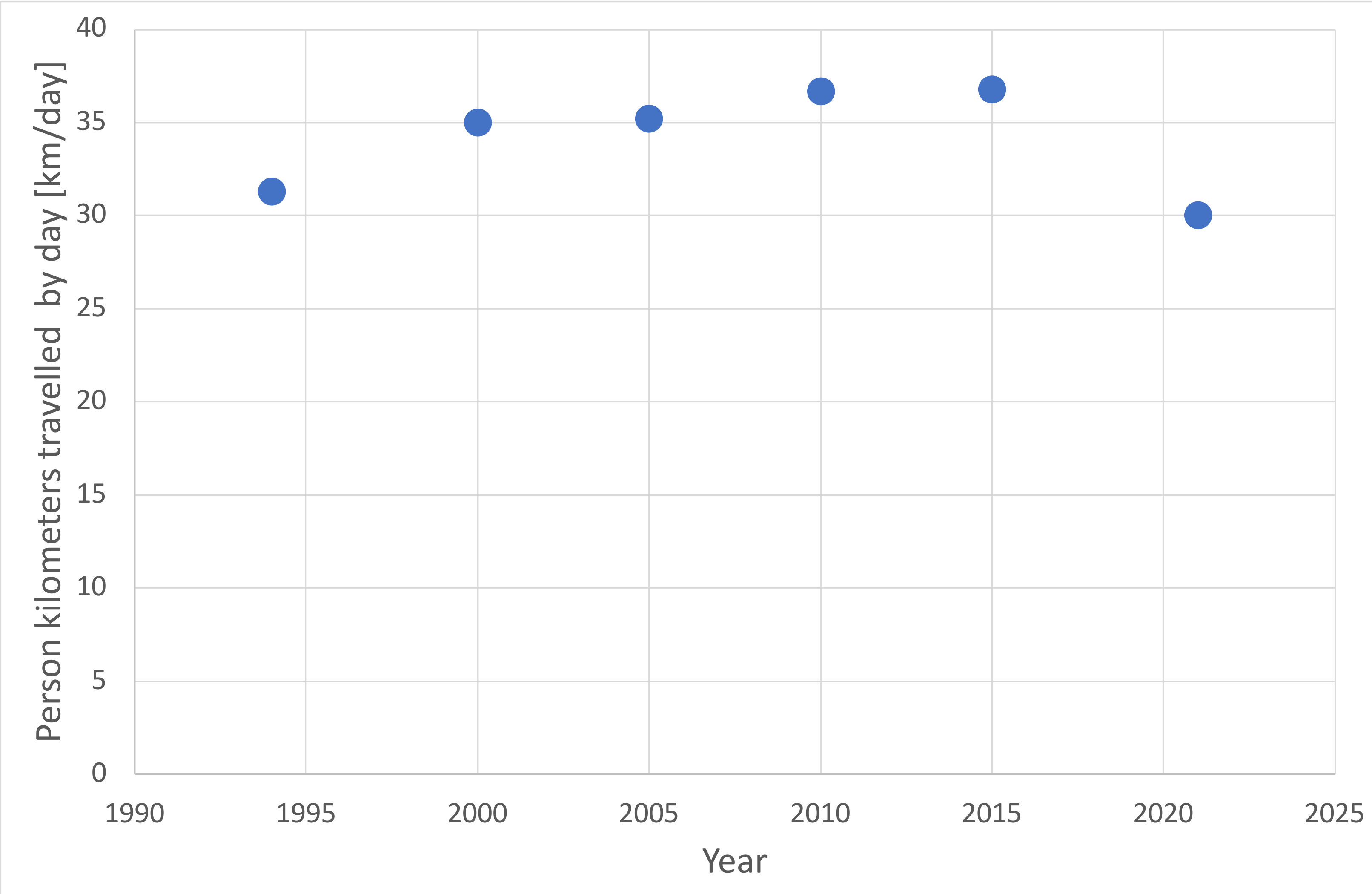
Scherer, 2004

Shrinking "road" – Switzerland (2000)



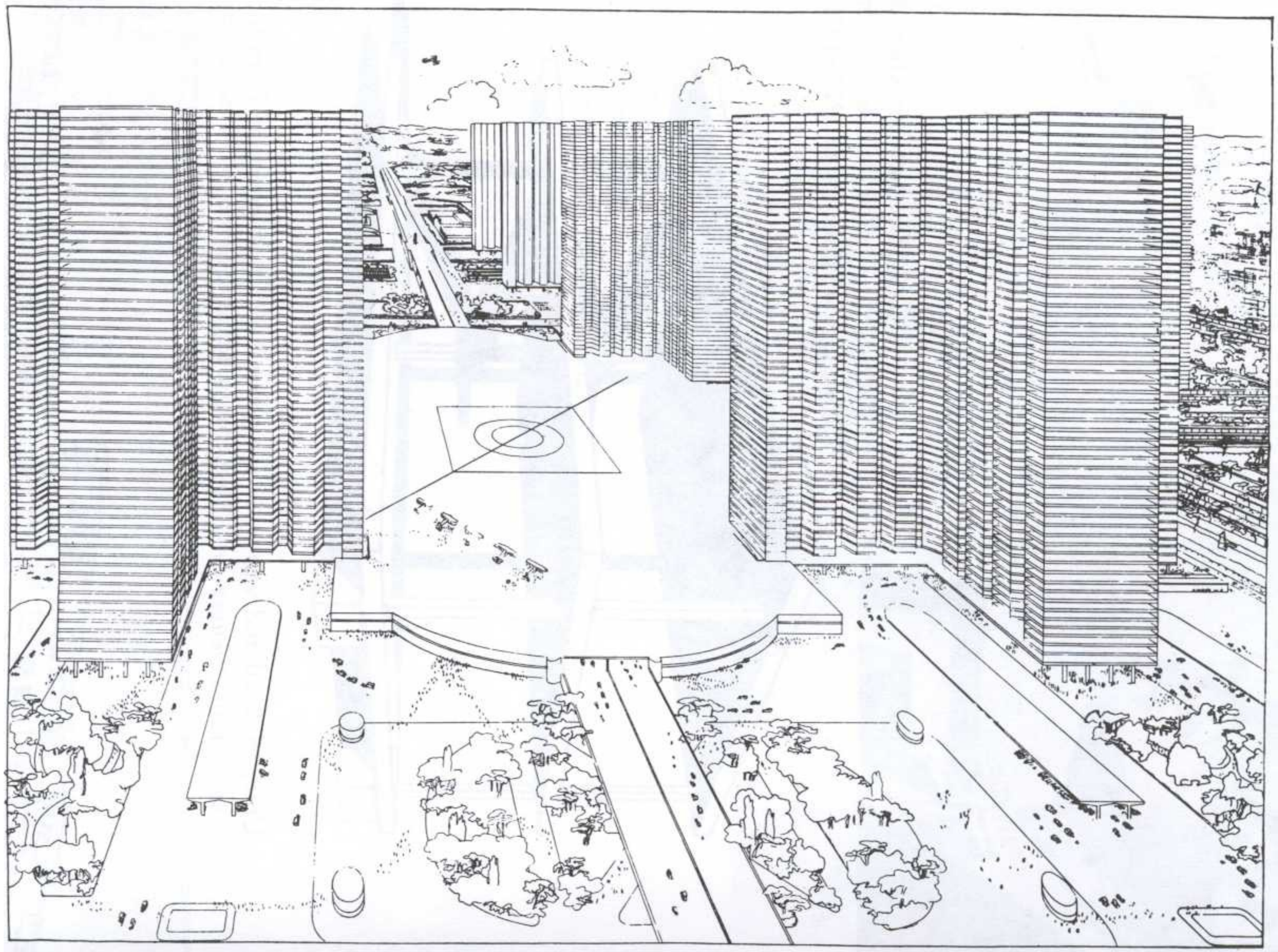
Scherer, 2004

Switzerland: Pkm change since the MZ 1994

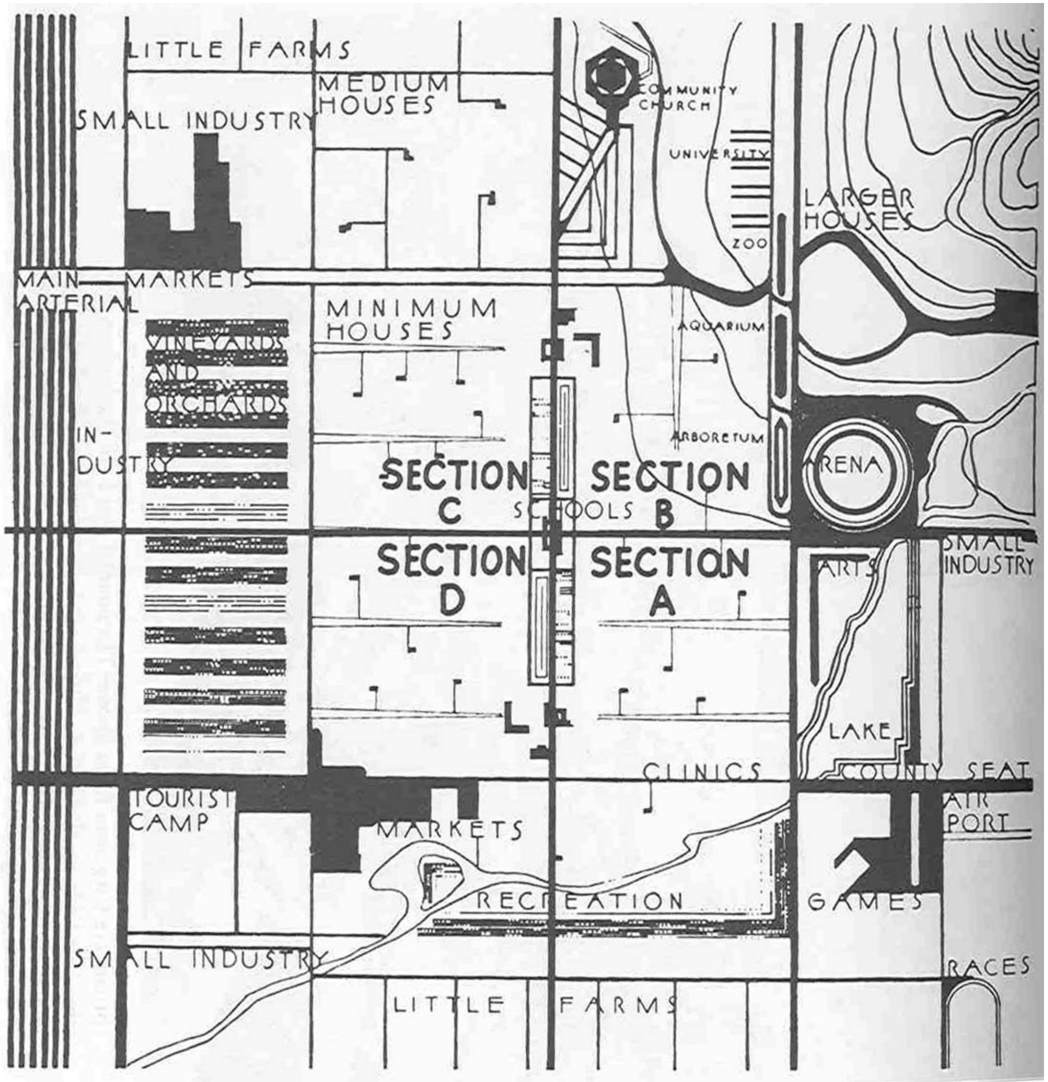


What were the past visions ?

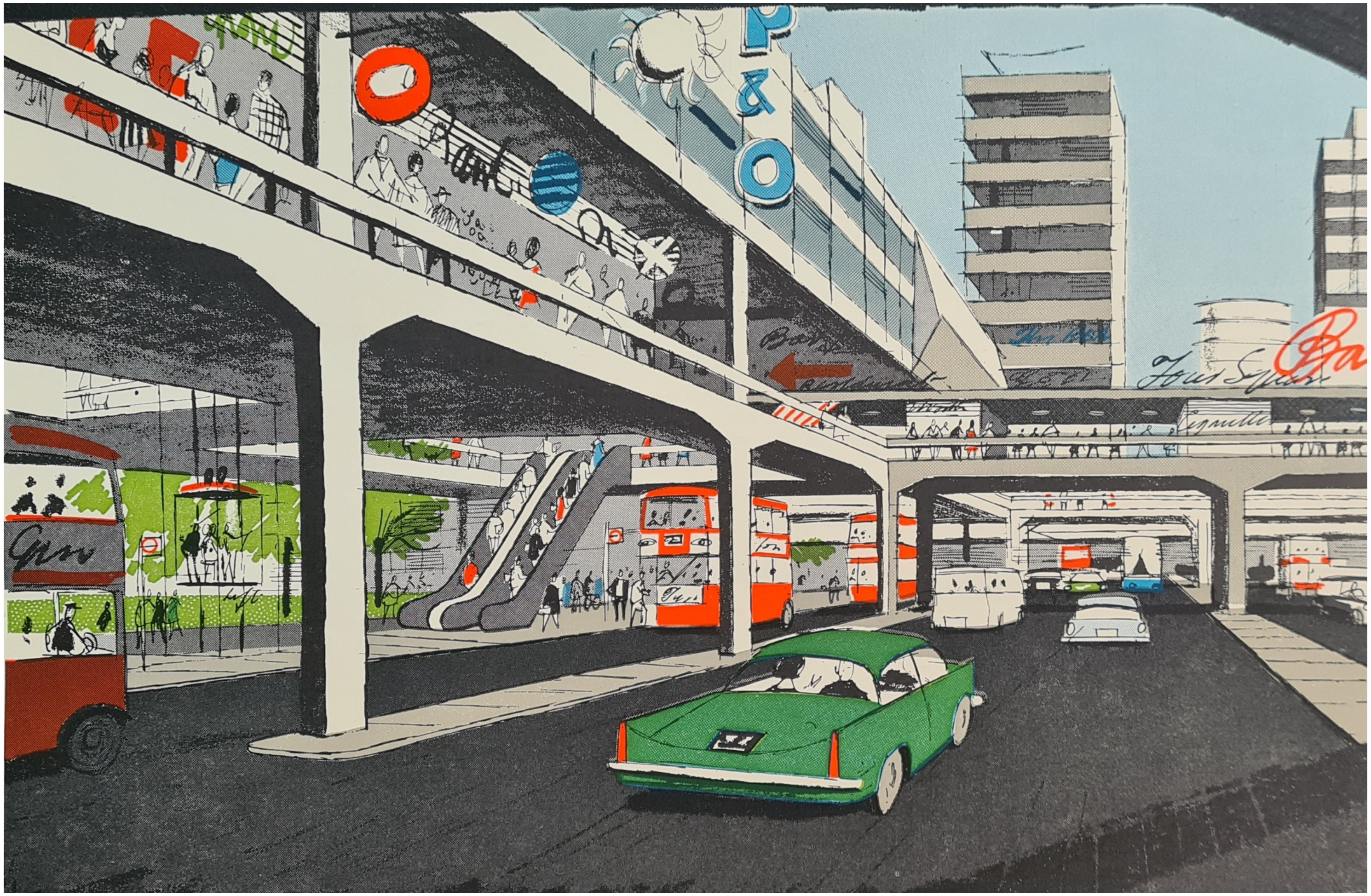
Past radical dreams: Le Corbusier's *Cite radieuse*



Past radical dreams: Lloyd Wright's Usonia

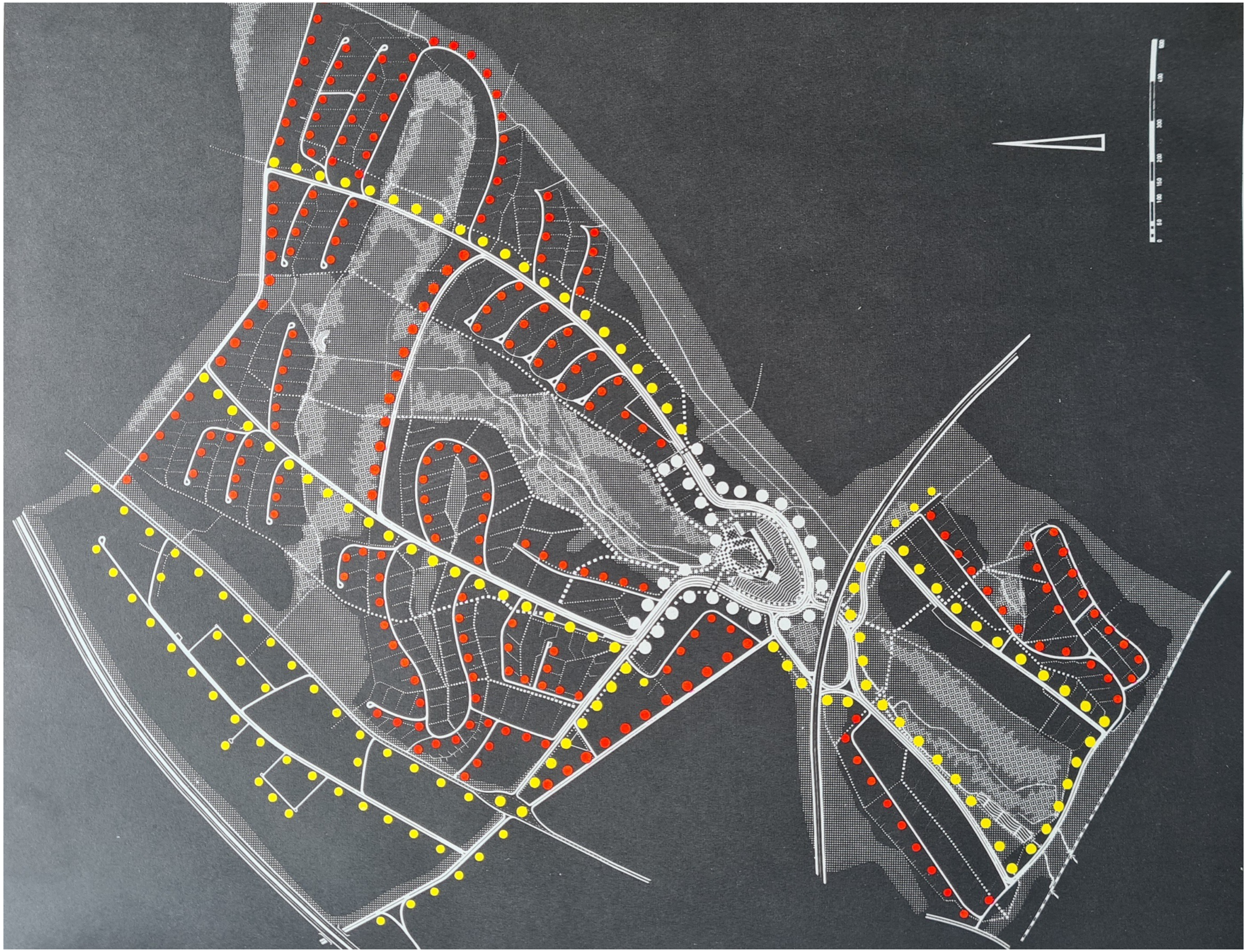


Past radical dreams: Buchanan's two-level central London



Source: Buchanan Report (1963)

Past radical dreams, realised: «Autogerechte Stadt»



Source: Reichow (1963), p. 24

Past radical dreams, realised: Motorways

What dilemma ?

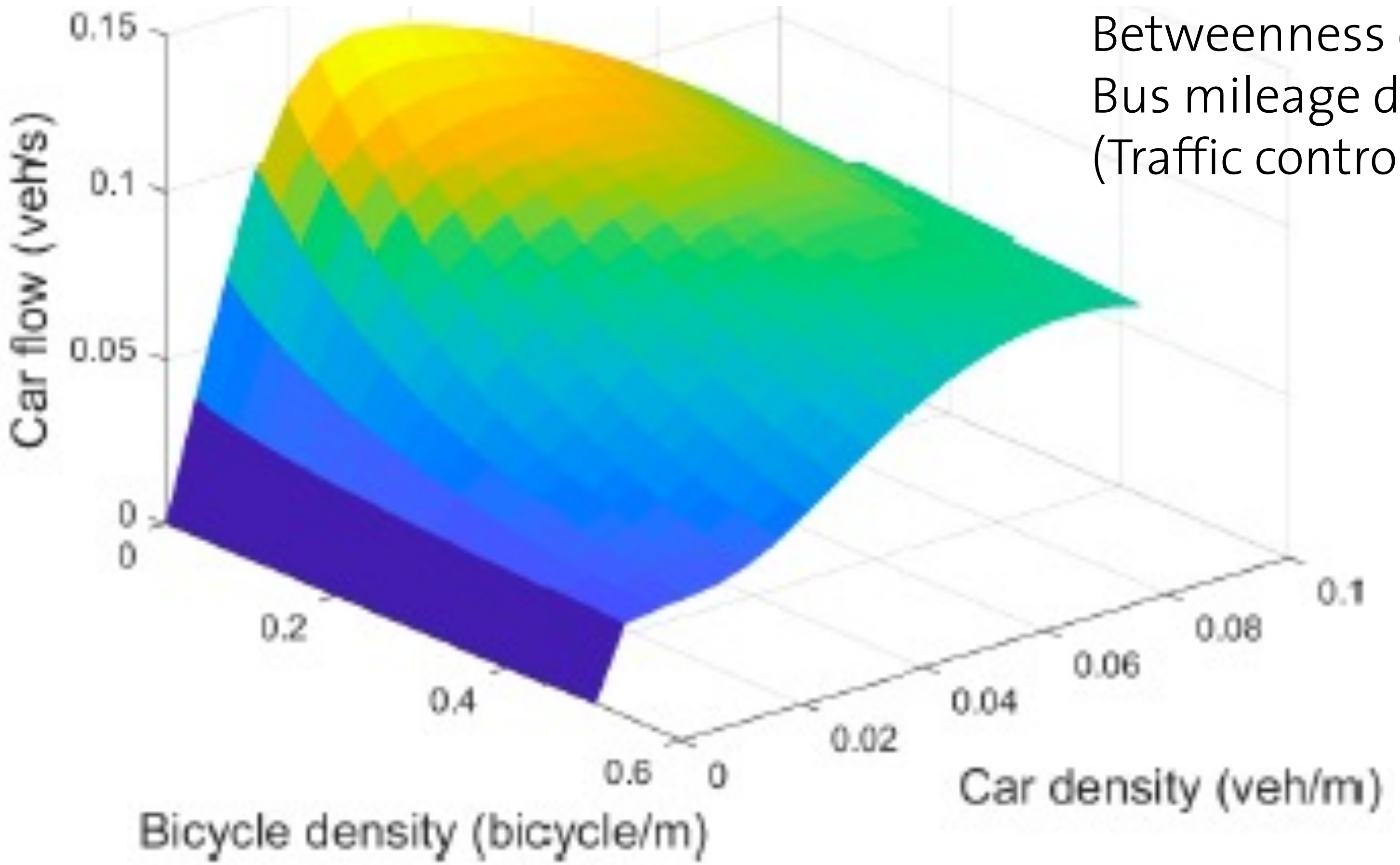
What dilemma ?

- Higher accessibility improves productivity and social capital

- Underused unpriced off-peak capacity due to (additional) capacity for population (growth) in the peak (roads, parking, transit) encourages overuse otherwise
- Induced demand due to the lower GC of electric and automated private and public transport
- Working from home making PT less relevant for many

- CO_2 reduction requirements
- Sprawl limitations
- VMT growth and congestion

Nearly fixed urban network capacity =



Junction density,
Lane miles density
Betweenness centrality,
Bus mileage density
(Traffic control)

See Locder *et al.*, 2019

Which future are we discussing?

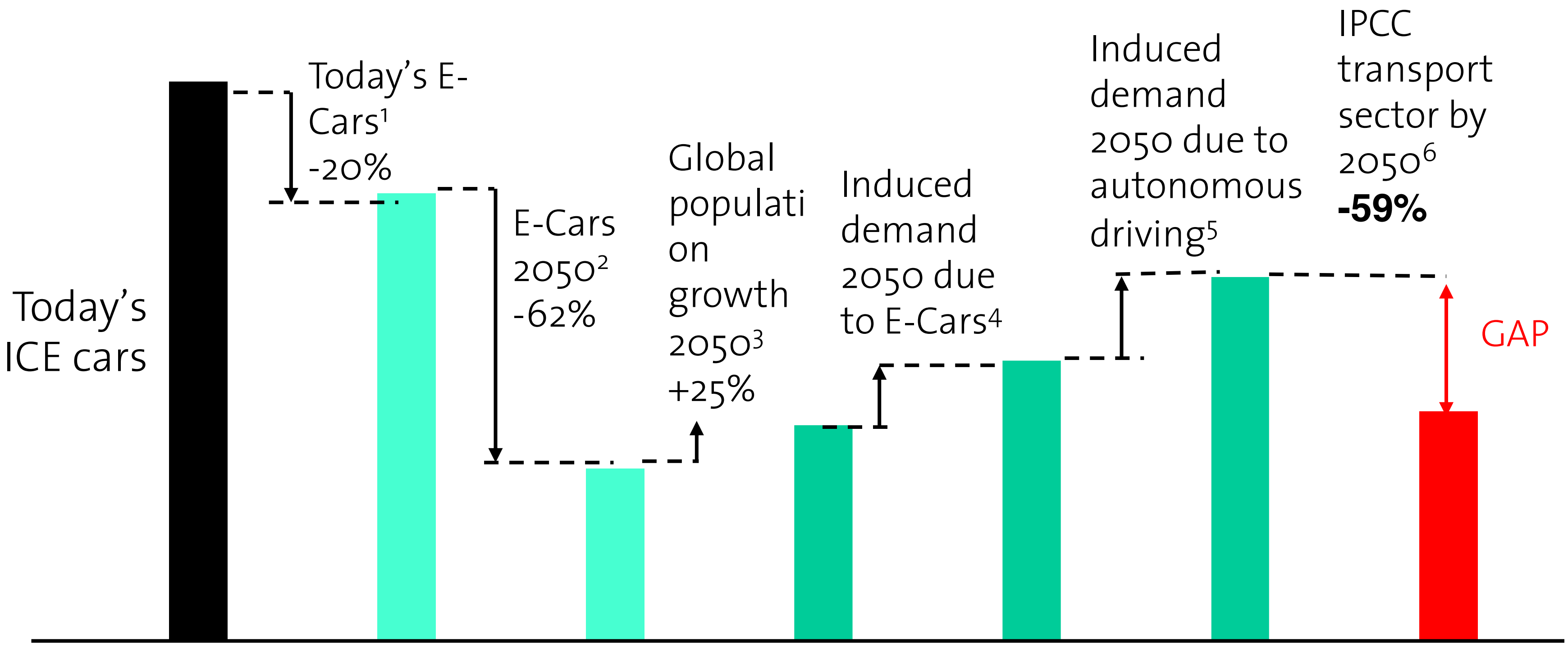
Which future are we discussing?

- Business as usual

- Electric cars
- AV
- *Mobility pricing*
  - Two-part tariffs for infrastructure
    - Option fee
    - Pay-as-you-go for usage
  - Congestion pricing
  - (Demand responsive) parking pricing
  - GHG (CO_2) pricing
  - Local emission pricing

- MaaS improved shared mobility, e.g. DRT

Limits of current approaches



Note: These are optimistic estimates of how many CO_2 emissions can be avoided through technology.

An e-bike city?

The idea of an e-bike city

- Thinking the city from the e-bike perspective

- 50% of road space for slow vehicles (e-bike, bike etc.)
- Maintaining of current accessibility levels (for all)
- Ensuring emergency and service access
- Integration with shared services for the larger demand variations

Zürich as an ebikecity (Draft L. Ballo, 2023)

Modelling an e-bike city?

Facets and actors (without land use changes)

- Persons
  - Time use
  - Movement
  - Expenditure (in-store, on-line)

- Goods
  - Distribution centres and policies
  - Delivery (at location, pick-up point)
  - Returns/waste

- Firms
  - Locations and sizes
  - Pricing policies
  - WFH policies

Scheduling possibilities (in stable MATSim)

Number and type of activities EBC?
Sequence of activities EBC?

- Start and duration of activity
- Composition of the group undertaking the activity DRT?
- Expenditure division
- Location of the activity

  - Movement between sequential locations

    - Location of access and egress from the mean of transport
      - Parking search and type EBC?
    - Vehicle/means of transport
    - Route/service EBC?
    - Group travelling together episim?
    - Expenditure division

Example MATSim implementation

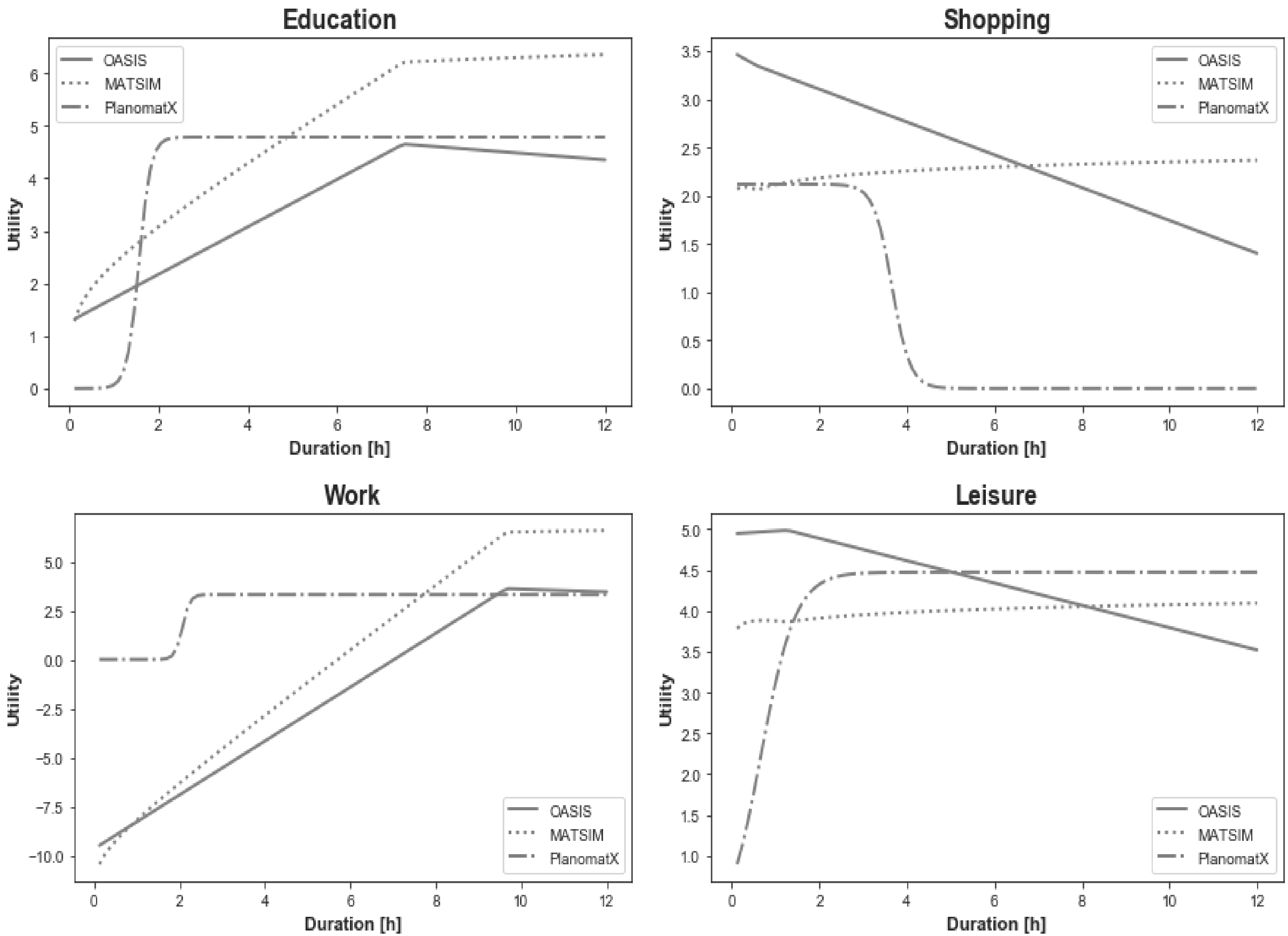
Source: Fourie, 2014

Modelling activity schedules

Modelling activity schedules: OASIS (Pougala, EPFL)

- Efficient generation of realistic non-chosen schedules
- Model estimation (e.g. small subsample Swiss Microzensus 2015)
  - OASIS (Pougala)
  - Planotmat-x (Feil based on Joh utility function)
  - MATSim (Charypar & Nagel)
- Simulations

Modelling activity schedules: Comparison of 3 formulations



Source: Pougala, Hillel and Bierlaire, 2023

Modelling activity schedules: Add a richer description

Activities

- Min/Max durations (Joh)
- Saturation over multiple days (JTAP: Märki, Janzen, Penazzi)

Destinations

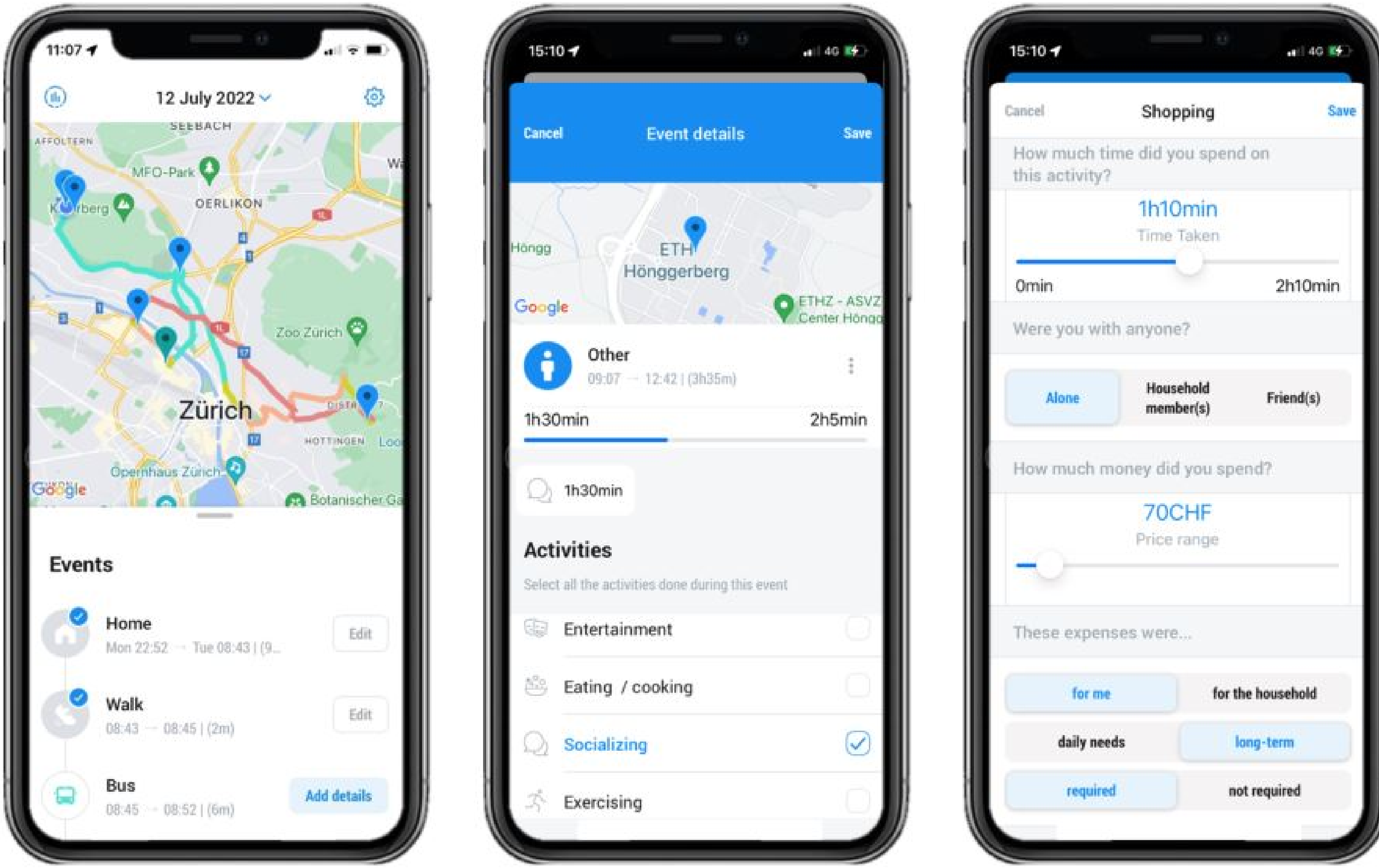
- Price levels (Gramsch)
- Parking prices (and search & walking times) (Tchervenkow)
- Social homophily (Gramsch)

Movement

- Transfer and transfer waits and walks
- Reliability
- Crowding

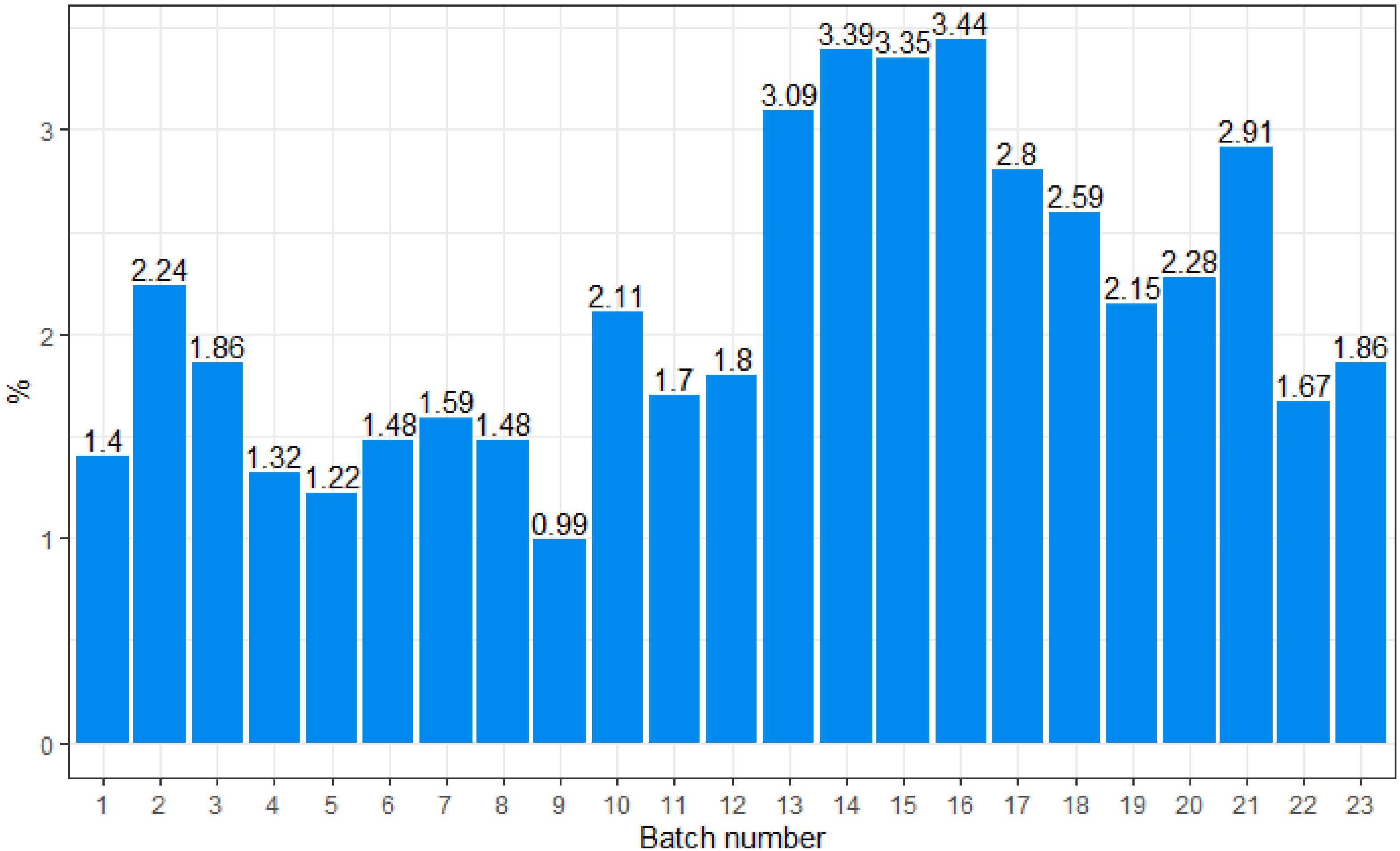
Detour: Time Use+ (Winkler, Meister, Axhausen)

Detour: Time Use+ - The App



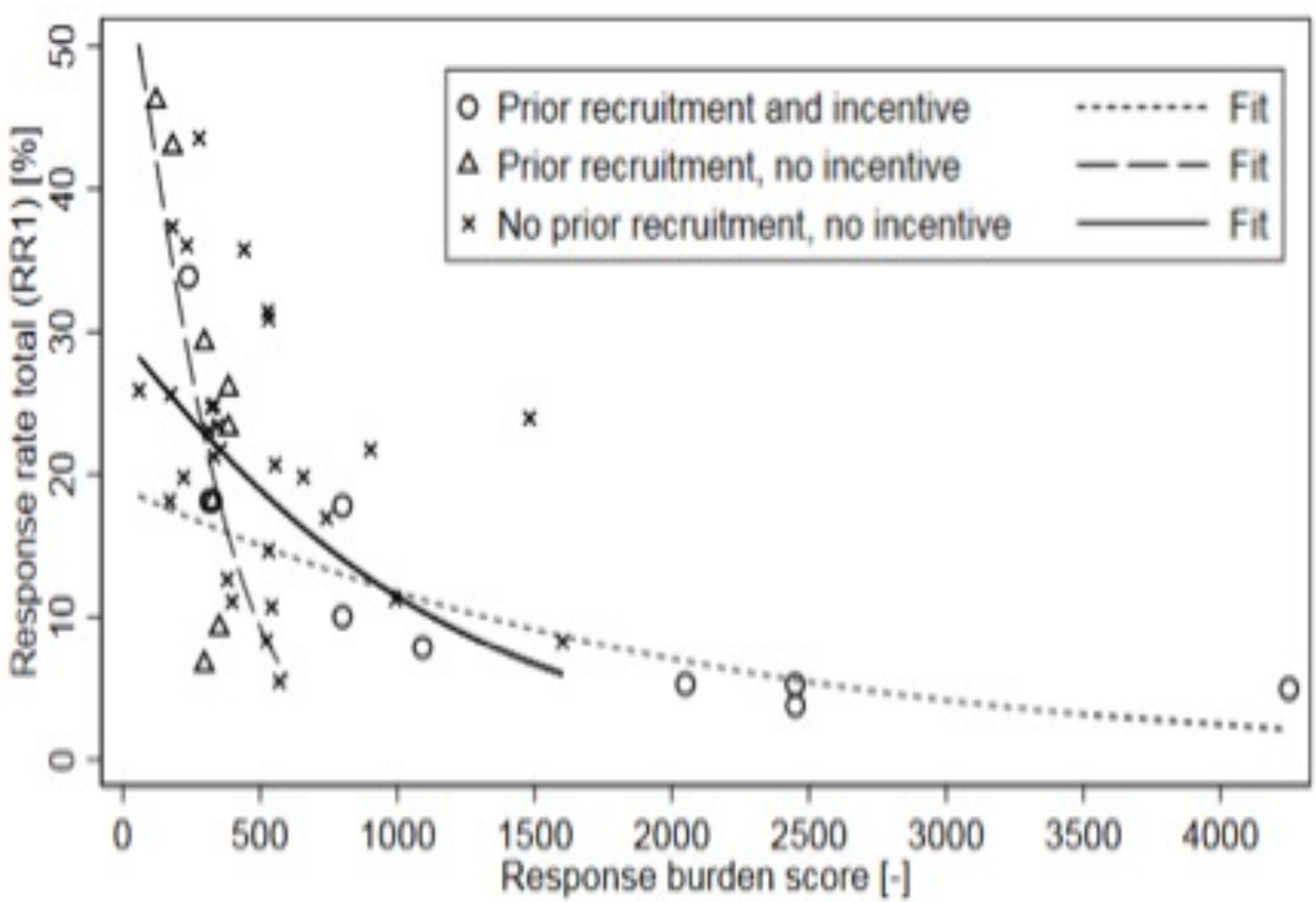
Source: Winkler et al., 2023

Detour: 1350 Time Use+ respondents by «batch» (wave)



Source: Winkler et al., 2023

Detour: Response = f(response burden) for IVT surveys

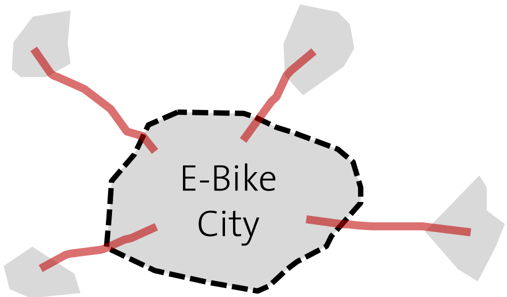


Source: Schmid and Axhausen, 2019

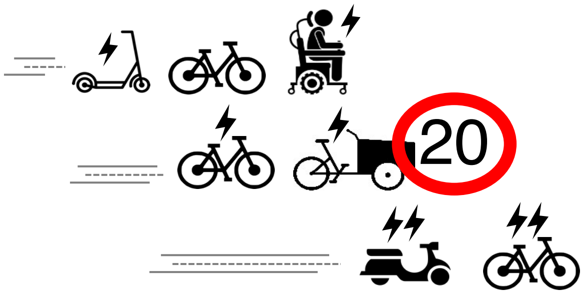
Modelling the e-bike city?

Which questions arise ?

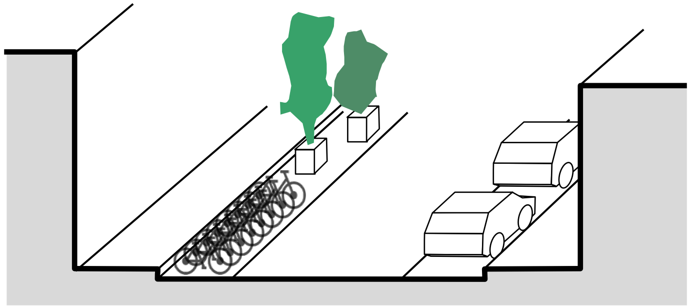
Special arrangements for emergency and utility vehicles



Intercommunal e-bike highways

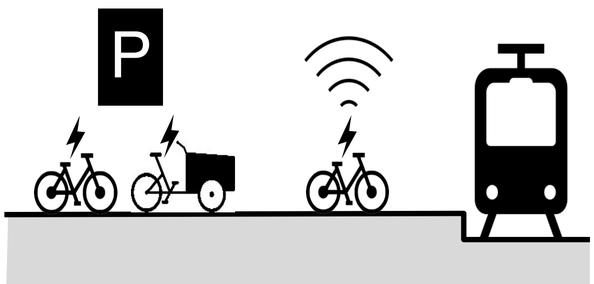


Infrastructure for heterogeneous micro-mobility vehicles and/or local speed limits

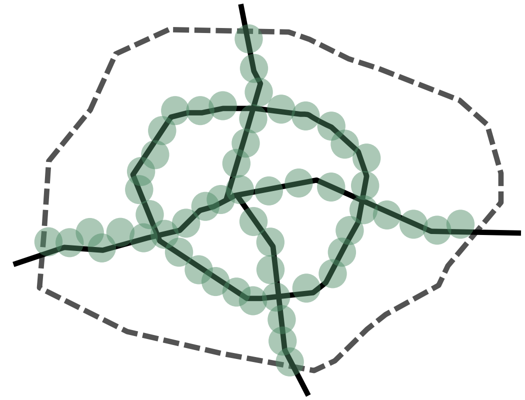


Converting a part of car parking into bicycle parking + parklets

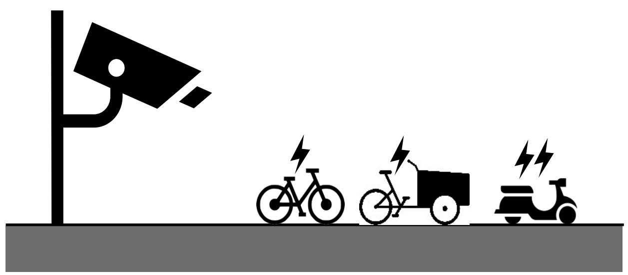
Which questions arise?



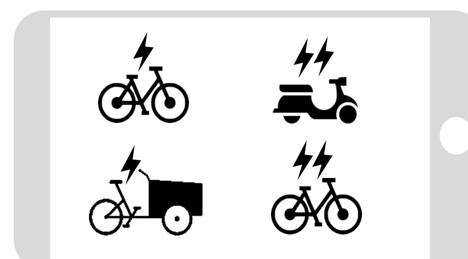
Integration with public transport for longer distances / bad weather



A basic cycling network with weather protection, e.g., by trees



Monitored parking for expensive e-bikes



Sharing schemes provide everybody an access to the right vehicle

Which further questions arise ?

- Optimal one-way street networks
- Cost of reconstruction
- Today's behaviour of e-bike users
  - Route choice models and non-chosen alternatives
- Future mode choice/demand
  - Convincing future scenarios in stated choice experiments
- Modelling the schedule adjustments
- CO_2 – impacts and LCA forecasts
- Future multi-modal accessibilities
- Equity impacts

- Freight and package delivery
- Road safety

What tools and resources are available?

- Models
  - MATSim Switzerland (Zürich) (IVT)
  - National VISUM-based SBB model (SBB with EPFL support)
  - National VISUM-based model (ARE & ASTRA)
  - MFD-based approaches (Leclercq / Loder)
- Data
  - MOBIS & MOBIS/COVID (about 750k tracked days)
  - EBIS (about 300k+ tracked days)
  - Time Use+ (about 36k tracked days and time budgets)

e-bike city team by subproject

E-Bike City PIs:

- K.W. Axhausen (C, H)
- M. Bierlaire (EPFL)
- F. Corman (B)
- A.Kouvelas (D)
- *M. Makridis* (D)
- M. Raubal (E)
- S. Hellweg (F)
- D. Kaufmann (G)
- B. Adey (I)

E-Bike City co-ordinator

- C.V. Livingston

E-Bike City researchers:

- L. Ballo (C, H)
- F. Fuchs (B)
- C.V. Livingston (C)
- M. Makridis (D)
- A.D. Marra (B)
- H. Martin (E)
- A.H.G. Meister (C)
- L. Meyer de Freitas (H)
- Y-C. Ni (D)
- J. Pougala (EPFL)
- S. Pfister (F)
- V. Schenker (F)
- J. Stephan (G)
- N. Wiedemann (E)
- M. Wiki (G)
- D. Zani (I)

Questions?

- www.ivt.ethz.ch
- ebikecity.baug.ethz.ch/
- ebis.ethz.ch/

References

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