Mode choice in urban courier deliveries

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Some alternative titles and outlook

- Titles
  - "Mode choice in urban courier deliveries" → PASI title
  - "Potentials of electric cargo bikes for last-mile deliveries" → Project results
  - "Acceptance of urban freight innovations" → More project results
  - "..." → PhD thesis
- Outlook
  - Personal and institutional background
  - The courier market in Germany
  - Locations of demand for courier trips
  - Project background and empirical foundation
  - Results: ex-ante vs. ex-post
  - Discussion and further steps

Personal and institutional background

- Degree in human geography (LMU University Munich, Germany)
- Since 2011: research asisstant at DLR-Institute of Transport Research, Berlin
  - DLR: public research institution with 8000 employees and 16 sites, active in aeronautics, space, transport (~ 10% of employees) and energy business areas
  - Institute of Transport Research (led by Prof. Barbara Lenz): about 50 researchers of various disciplines
- Project manager of a research project analyzing the potentials of electric cargo bikes for urban courier logistics deliveries (funded by the Federal Ministry for the Environment)
- "Transition phase" towards dissertation

The courier market in Germany

- Courier is a segment of the CEP market: courier, express, parcel/postal
  - Deliveries – CEP: 2.45 billion → courier 0.24 billion (10%)
  - Turnover – CEP: 17.8 billion € → courier: 3.9 billion € (22%)
  - Employees – CEP: 254,000 → courier: 19,000 car, 5,000 bike messengers
- Some usual characteristics of courier companies:
  - Many regionally operating companies
  - Acting as intermediary between B2B customers and self-employed messengers
  - Dispatching of assignments via "open radio" or smartphone
  - Messengers use their own vehicles
  - Provision-based remuneration
  - Pricing depending on vehicle ordered and shipment distance

Berlin: example for pricing of courier shipments

Pricing = vehicle ordered	Goods' size (max. cm³)	Goods' weight (max. kg)	Fixed costs (incl 1st km)	Variable costs (per km)	Market share (t1)
Bicycle	50 x 30	5	5.50 €	0.95 €	54%
Cargo Bike	50 x 30 x 30	25	6.00 €	0.95 €	6%
Car	100 x 70 x 50	100	6.50 €	1.00 €	29%
Small van	150 x 100 x 100	250	10.00 €	1.00 €	7%
Large van	320 x 180 x 150	1000	15.00 €	1.10 €	4%

messenger

pricing model extracted from www.messenger.de

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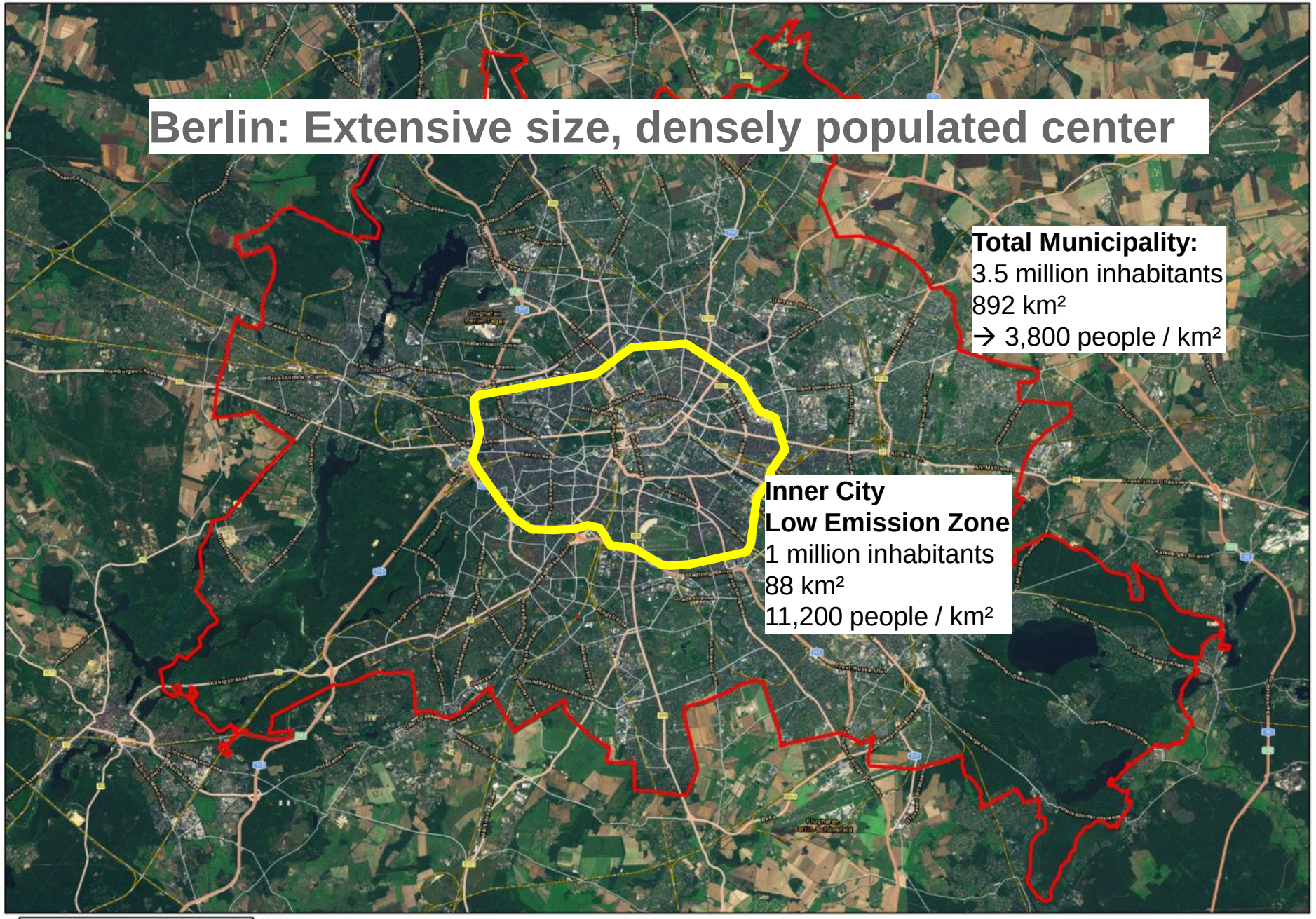
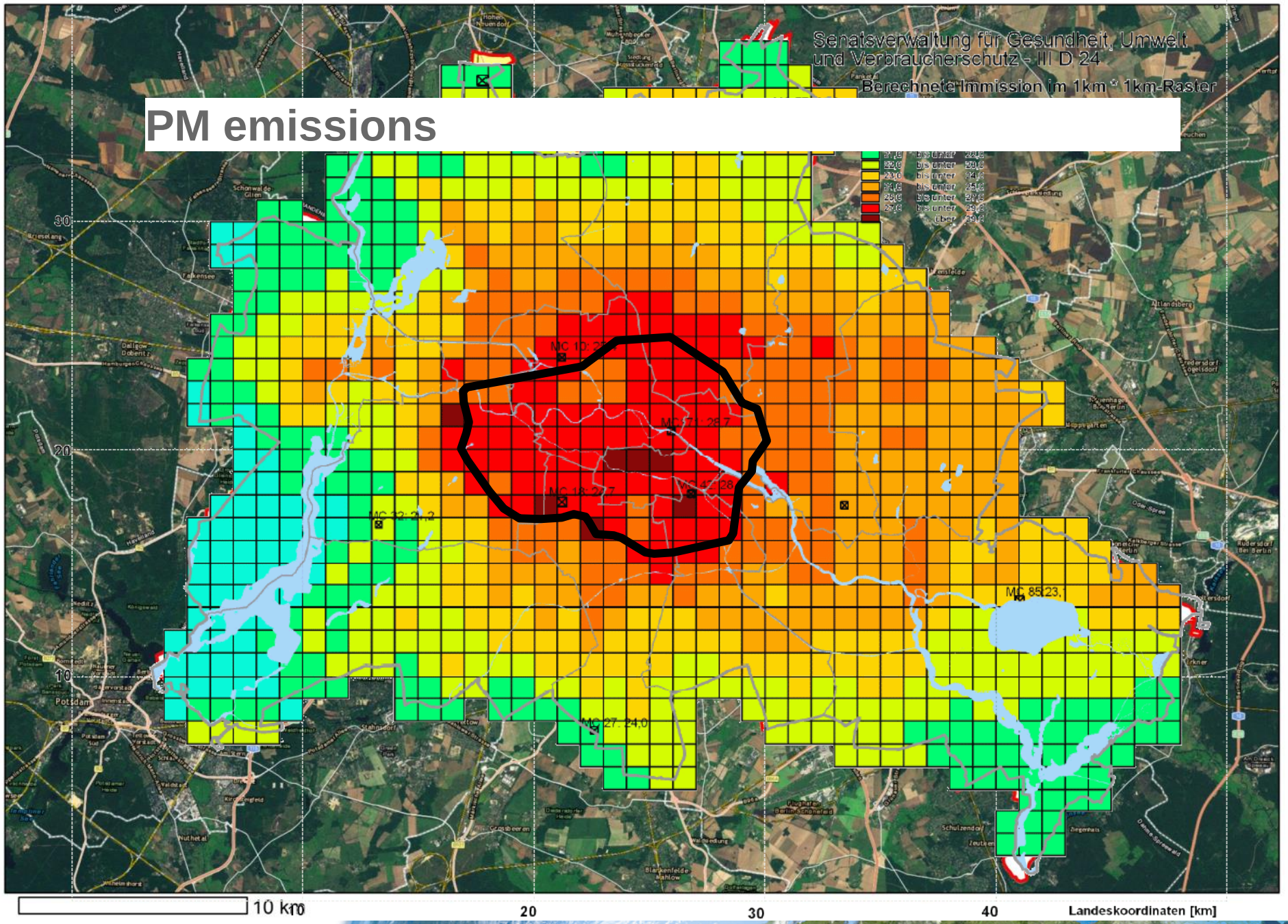
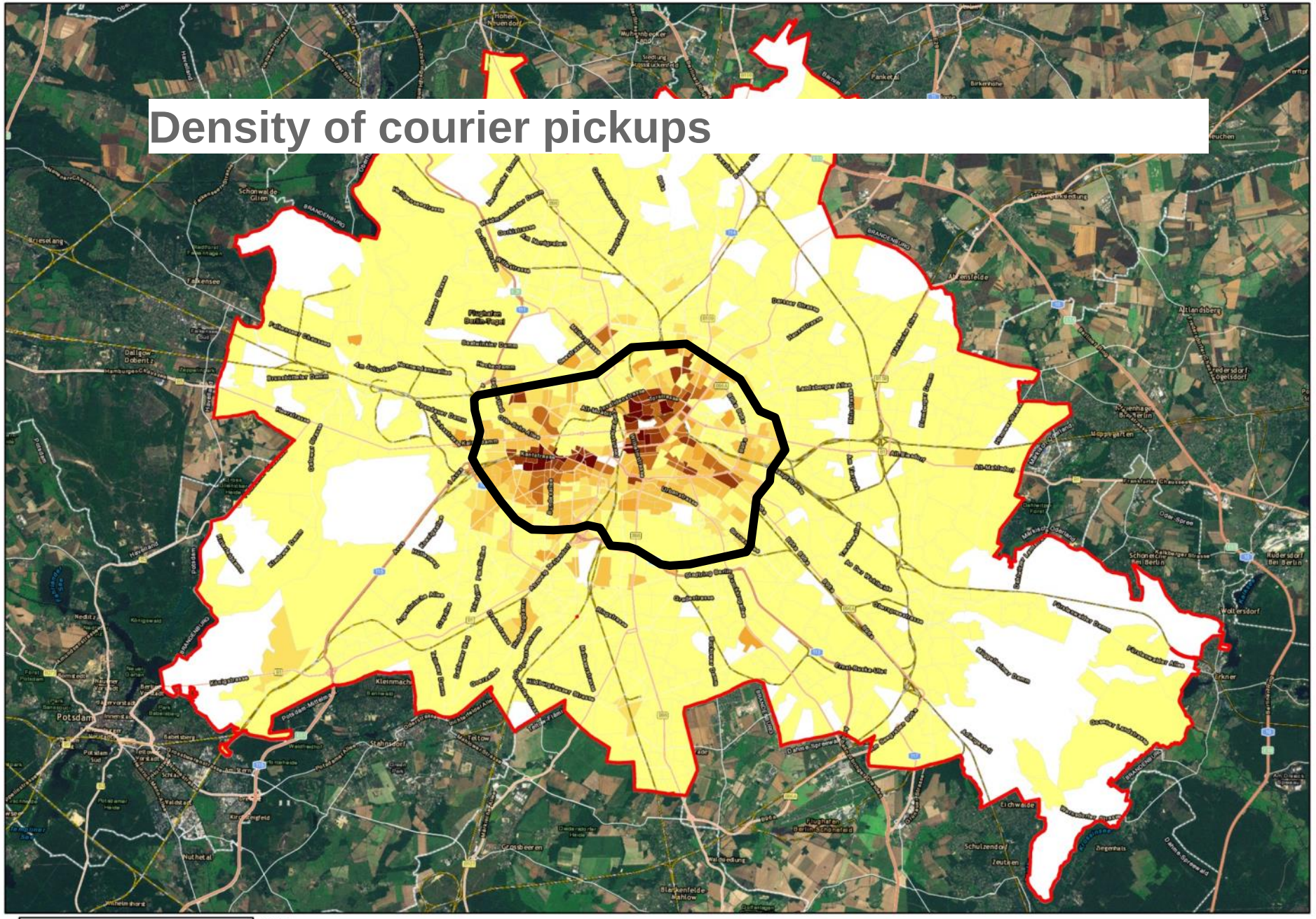
Berlin: Extensive size, densely populated center



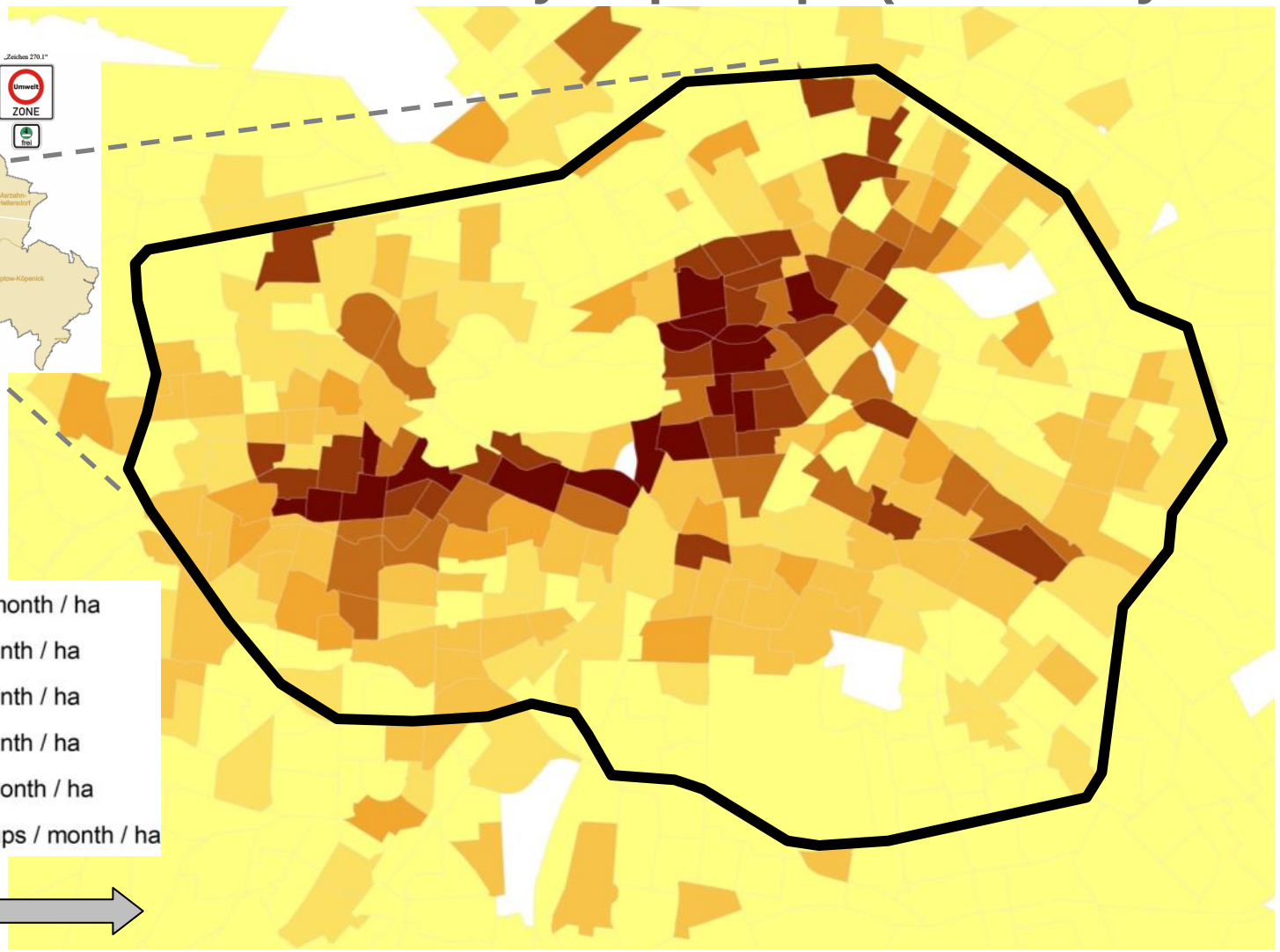


PM emissions

Density of courier pickups



The courier market – density of pickups (Berlin city center)



- 0.5 - 1 pickups / month / ha
- 1 - 2 pickups / month / ha
- 2 - 3 pickups / month / ha
- 3 - 5 pickups / month / ha
- 5 - 10 pickups / month / ha
- 10 and more pickups / month / ha

5 km

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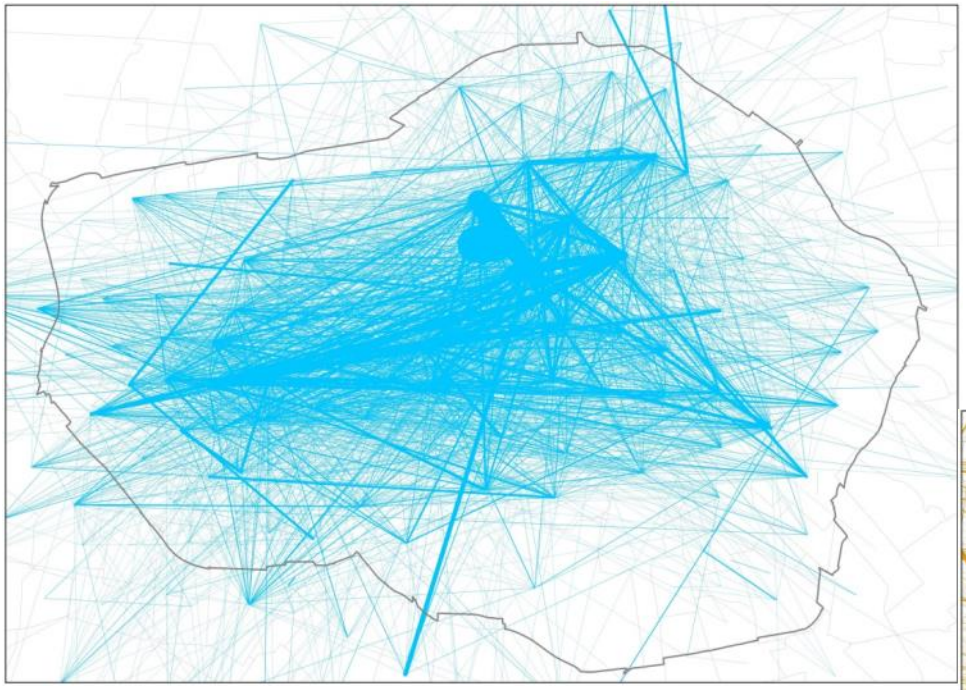
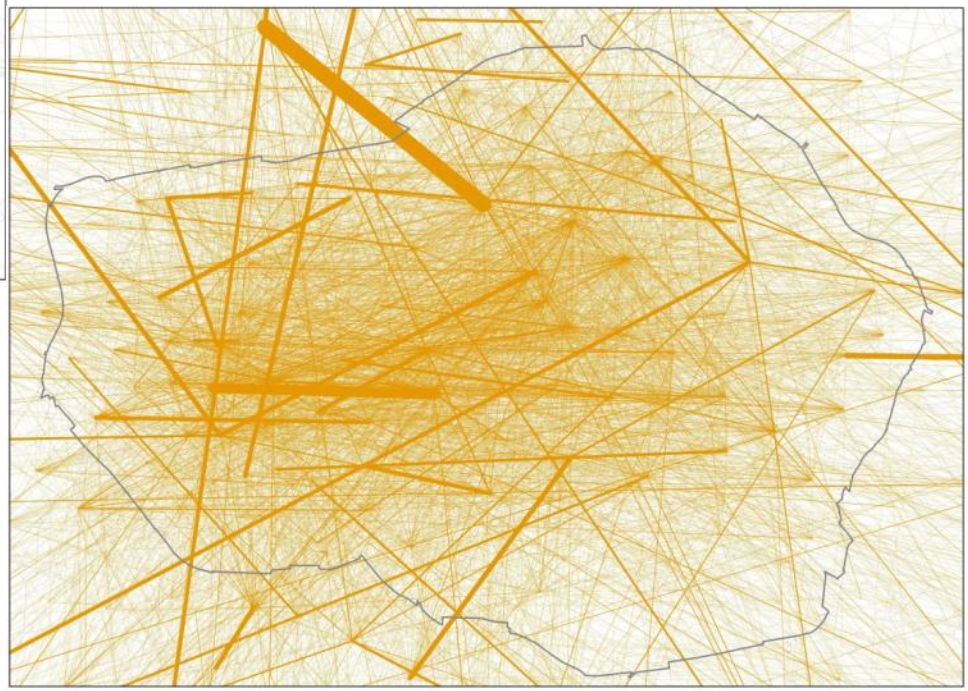
OD-relations of courier shipments (Berlin city center)



Bike messengers

Car messengers



Shipments per week:

1

10

1 km

Project "I substitute a car": How sustainable is implementing electric cargo bikes for courier deliveries?

- Used vehicle: *iBullitt Pedelec* (x40)

- 250 Watts engine
- Payload: ~ 100 kg
- Cargo box volume: ~ 200 l

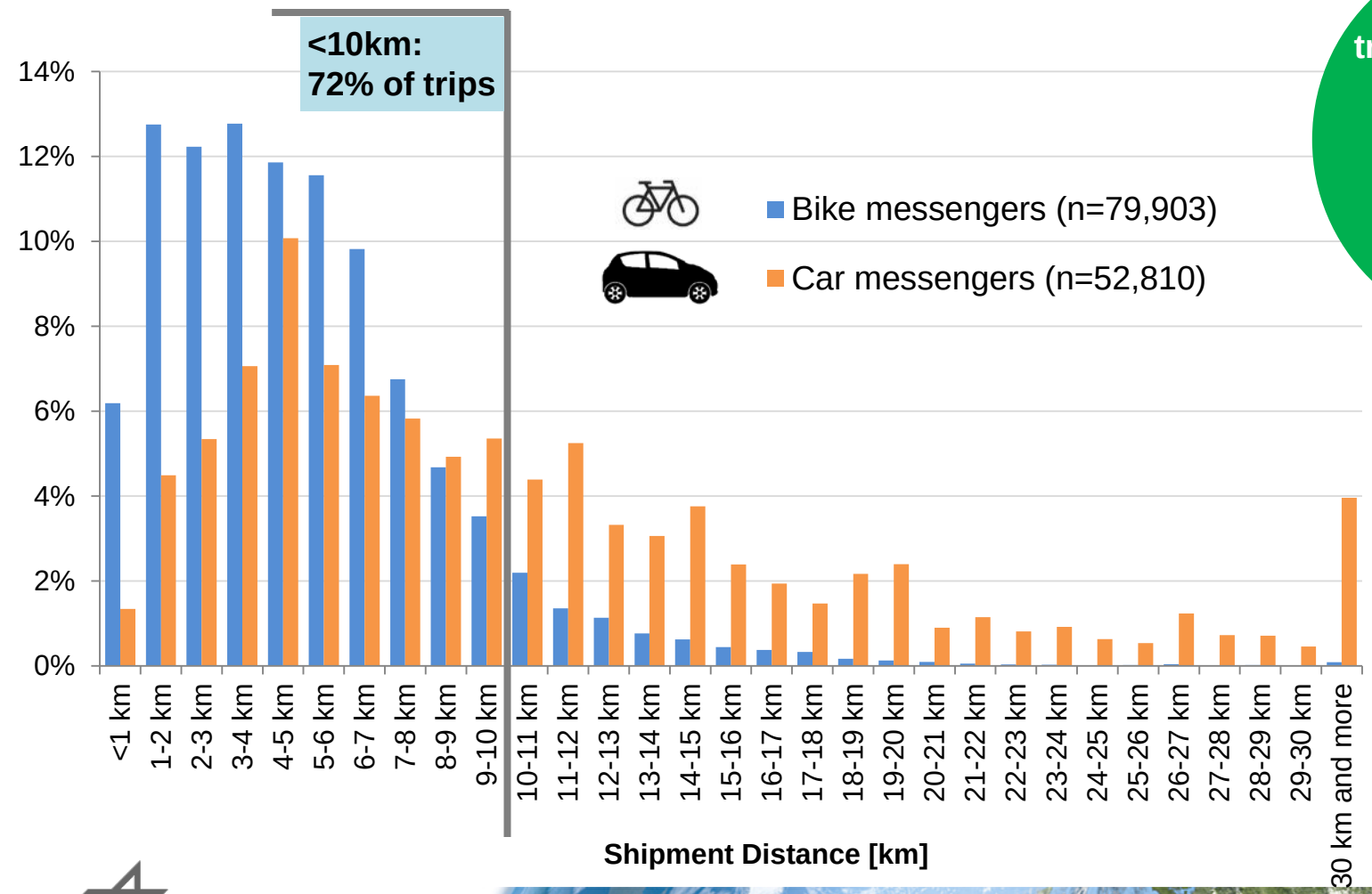
- Additional vehicle: *CargoCruiser* (x1)

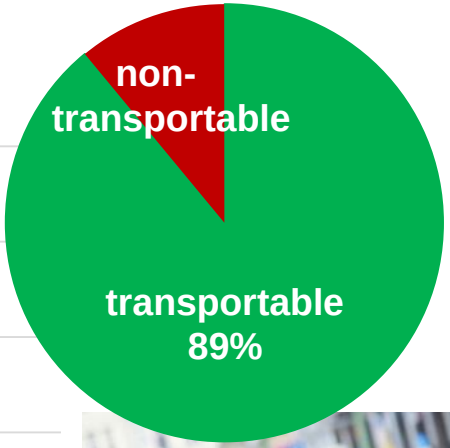
8 German cities,
8 courier companies

Empirical foundation

- Database: 3 million (=3 years) of courier shipment records of 8 courier companies:
  - Type of shipment: point-to-point vs. milk run
  - OD and shipment distance
  - Time stamps
  - Priced vehicle and used vehicle
  - Messenger ID
  - partly: type/size of good, customer's business sector, delivery windows
- Quantitative surveys targeting all ~600 messengers associated with these 8 courier companies:
  - t0-survey (2012), 191 responses, 2 groups: bicycle and car messengers
  - t1-survey (2014), 171 responses, 3 groups: bicycle, iBullitt and car messengers
  - panel data from 63 respondents
- Qualitative interviews with CEOs, dispatchers and messengers

Short trips and light goods: downshift in type of vehicle seems possible.

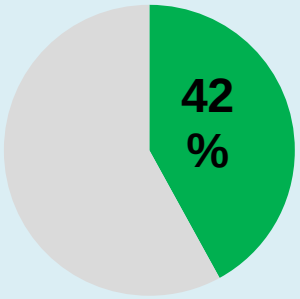




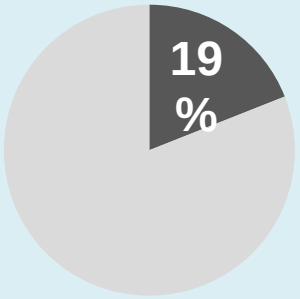
Car substitution potential

Share of trips below 10km & transportable goods

Substitutable deliveries



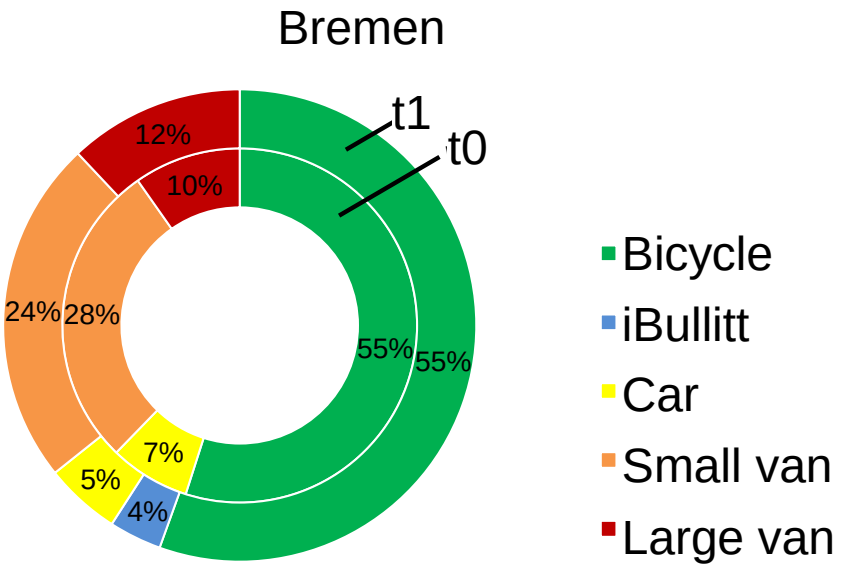
Substitutable mileage

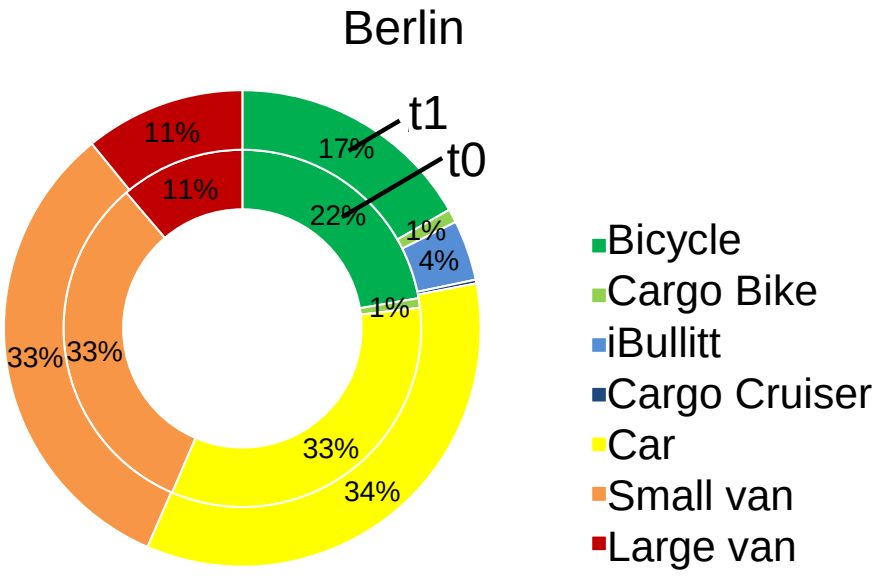


21 months of using the electric cargo bikes – It was successful ...

	# iBullitts 	Shipments by iBullitt	% of all shipments	iBullitt net traveled km	% of all net traveled km	Mean shipment length
TOTAL	**37**	**125.900**	**8%**	**485.000**	**4%**	**4,0**
Berlin	17	46.500	10%	202.000	4%	4,3
Hamburg	4	23.900	6%	75.000	2%	3,2
München	4	21.800	12%	83.000	7%	3,8
Düsseldorf	4	8.300	7%	31.000	7%	3,8
Bremen	3	12.600	9%	38.000	4%	3,0
Nürnberg	3	3.400	3%	13.000	2%	3,8
Leipzig	1	3.100	3%	14.000	1%	4,3
Potsdam	1	6.300	35%	29.000	8%	4,6

... but was it sustainable?
Change in modal split of net km traveled in 2 cities





t0 (before implementation): 5/2011 – 6/2012
t1 (after implementation): 7/2012 – 3/2014

Messengers' background, job organization, attitudes

		Type of vehicle		
		Bicycle	*iBullitt*	Car
	n (t1 survey 2014)	48	46	77
Demographics	Age Ø	39 years	39 years	50 years
	Gender: male	90%	93%	95%
	Education: high *(Abitur)*	74%	67%	33%
Income	Below 500 €	14%	20%	3%
	2500 € and more	2%	0%	19%
Job organization	Working as messenger only	75%	57%	74%
	Working hours per week Ø	30.1	27.2	47.0
	Using only one type of vehicle	83%	26%	79%

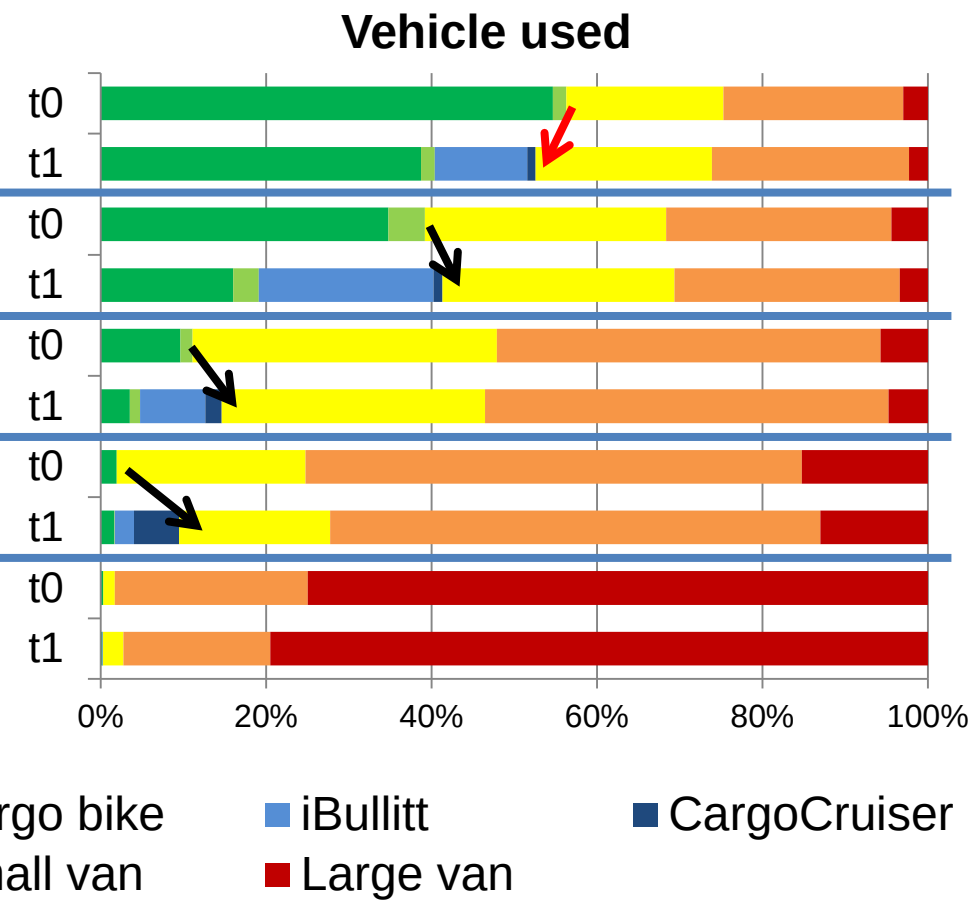
	Agreement t0	**Agreement t1**
"Using electric cargo bikes in my city makes sense."	84%	94%
"Electric cargo bikes will generally be successful in courier services."	48%	62%
"There is plenty of information available on electric cargo bikes and their use."	36%	42%

n=63

Berlin: vehicle ordered vs. vehicle used

Vehicle ordered	Market share (t1)	Change (t0 → t1)
Bicycle	54%	-1%
Cargo Bike	6%	+43%
Car	29%	+3%
Small van	7%	+45%
Large van	4%	+27%

total: + 5%



Project results

- Considerable demand for courier services in urban core areas
- Several modes are in direct competition
- Large potential for electric cargo bikes to substitute urban small-scale car trips
- Assessment of sustainability: mixed results
  - Economically successful for companies and majority of messengers
  - Environmentally: Substitution of bicycle trips in some cities (from macro-perspective) vs. positive effects in some areas
  - Socially: Almost only bicycle messengers were willing to change to electric cargo bikes
- Structures are shifting, yet gradually

Possible further steps

- Revealed preference analysis – with an "open radio" as assignment market, messengers have several options to choose from
- Possible spheres of influence for mode choice in urban courier deliveries:
  - trip characteristics
  - company's operations: order acceptance, pricing, dispatching
  - customer
  - degree of messenger competition
  - individual messenger's background and skills (e.g. bundling of shipments)
  - seasonality, weekday, time of day
  - weather conditions
  - congestion status
- Things to check:
  - Is this a relevant segment of urban freight?
  - Is the available data representative?
  - "So what"?

Thank you for your attention - and your questions!

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