Modelling approach for cargo bikes in rural areas as logistic carriers

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RADLÄR

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RESEARCH QUESTION

Are cargo bikes feasible for logistics in rural areas?

METHOD

→ In-depth analysis and simulation of three German model regions

- Literature analysis, traffic- and logistics-data analysis
- Expert interviews, participatory workshops (serious game), agent-based microsimulation

SIMULATION FRAMEWORK

- Calibration/ validation: traffic counts, timestamps from CEP data
- Logistic processes: *trips* via pre-defined *containers*, *container stops, capacities,* and customized v*ehicle definition*
- Analysis based on p*ersoninfo, tripinfo* outputs

MODEL REGIONS AND USE CASES

Region 1: short-distance transport B2B; delivery services for medications, groceries, and small goods for retail

Region 2: delivery services for medications, groceries, and small goods for retail; tourism, social, and other special applications

Region 3: CEP; market, event, and city center logistics; delivery services for medications, groceries, and small goods for retail

VEHICLE DEFINTION

vClass= bicycle;
maxSpeed= 6.9 m/s;
maxRange= 50 km

ContainerCapacity= 275 Parcels
(2,2 m^3, 291 kg)

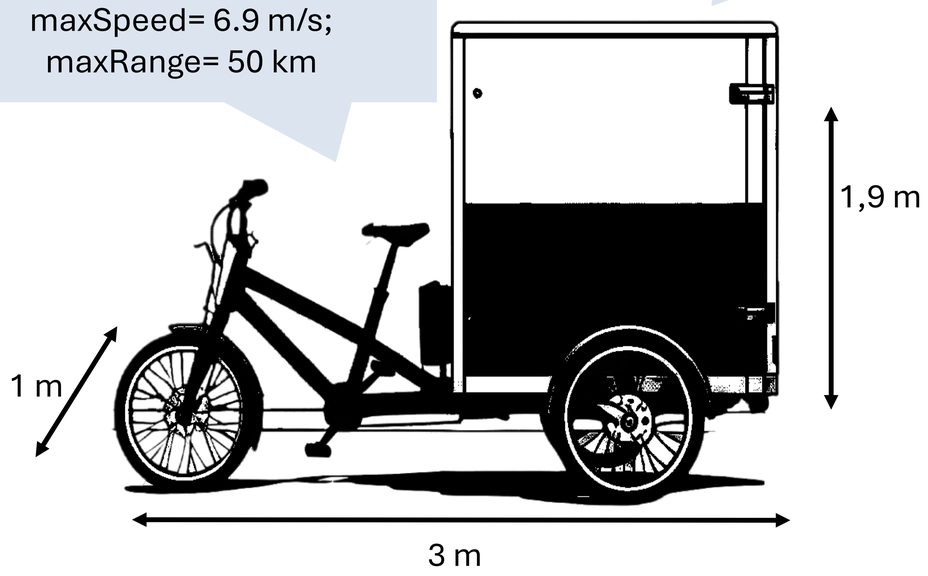

Figure 2: Vehicle definition, cargo bike model Antric (Modified, Regen Technology Co., 2025)

ContainerCapacity= 750 Parcels
(6 m^3, 1000 kg)

vClass= delivery;
maxSpeed= 47 m/s;
maxRange= 500 km

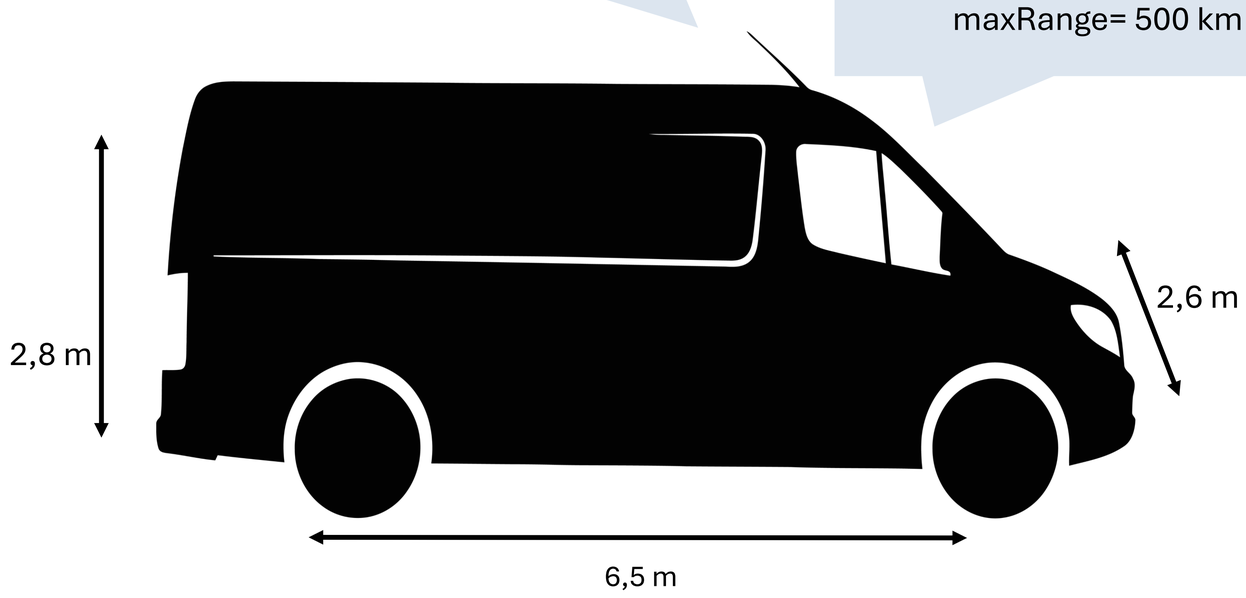

Figure 3: Vehicle definition, van model: Ford Transit (Adobe Stock 1956773424)

SIMULATION RESULTS

Tour	Vehicle	Time	Distance	Capacity	
Tour 1		106 min	20,2 km	41/275 Parcels, 0,328/2,2m^3	Volume of a parcel (CEP) = 0.008m^3, Storage space: Cargo bike = 2,2m^3, 275 Parcels Van = 6m^3, 750 Parcels
		81 min	20, 3 km	41/750 Parcels, 0,328/6m^3	
Tour 2		57 min	10,2 km	29/275 Parcels, 0,232/2,2m^3	
		53 min	10,6 km	29/750 Parcels, 0,232/6m^3	
Tour 3		13 min	2,9 km	7/275 Parcels, 0,056/2,2m^3	
		12 mim	2,9 km	7/750 Parcels, 0,056/6m^3	

Table 1: First simulation results from the comparison between van (Ford Transit) and cargo bike (Antric) within the use case *Courier, Express and Parcel Services (own table, 2026)*

Route optimization by bike only feasible for **longer routes**

Same capacity output

Short routes have **similar delivery times**

KEY FINDINGS

✔ Cargo bikes can **replace and complement** conventional logistics vehicles (e.g. vans and cars)

✔ Feasible are **repetitive, short, low-capacity routes in rural areas** → more space-efficient than vans in similar timeframe

! But: The use of a cargo bike is **not only a technical matter;** also **social, cultural,** and **political issues** must be taken into account

OUTLOOK

Develop and simulate the remaining **scenarios**

Analysis of **acceleration and deceleration**

Identification of **alternative routes and cost, emission benefits**

Transferring the results to other areas

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