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Shared Autonomous Vehicles and their contribution to improve rural public transport

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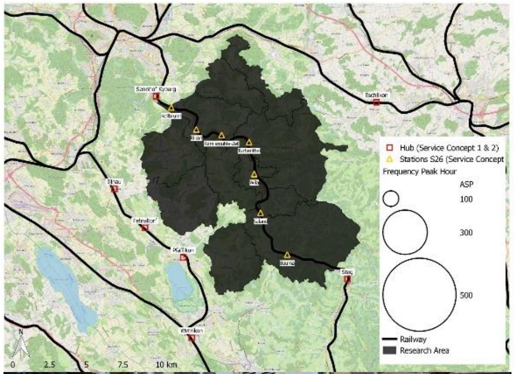


Research Inspiration

"Autonomous vehicles substantially change the accessibility landscape for Switzerland. … The strongest positive impact on accessibility is observed for well-connected exurban and rural municipalities." (Meyer et al. 2018)

- Public transport in urban areas will not loose its relevance upon market entry of shared autonomous vehicles (SAV) due to (space) efficiency (Buehler 2018)

- Public transport in rural areas is highly subsidized and under pressure to operate efficient

Research Questions

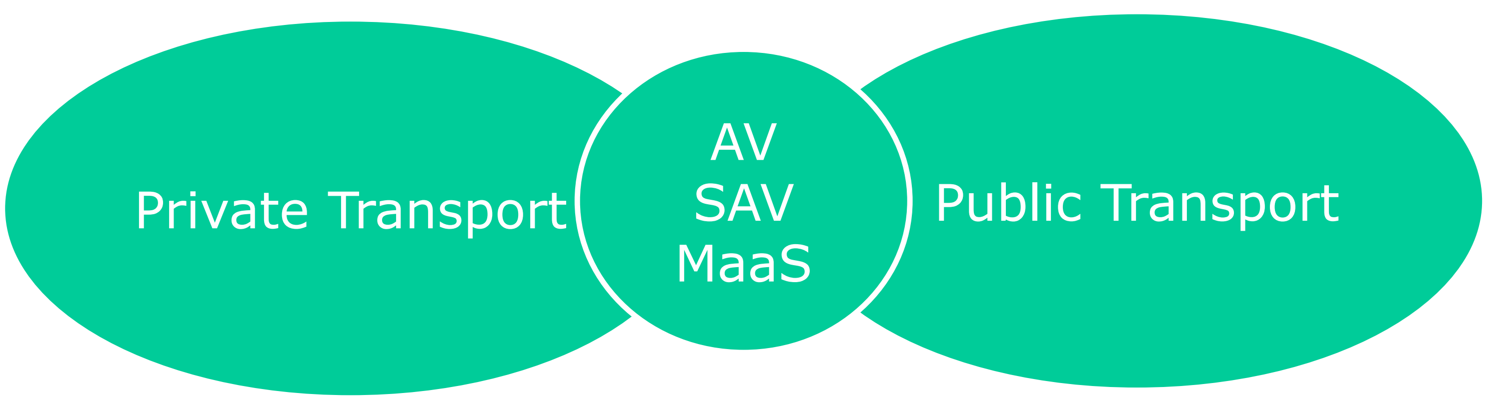
- What are economic and spatial consequences of SAVs on public rural transport?

- Is there still an eligibility for big, line bound public transport in times of SAVs in rural areas?

- How does a sustainable, successful SAV service concept have to be designed to improve rural transport networks?

Relevance of the research

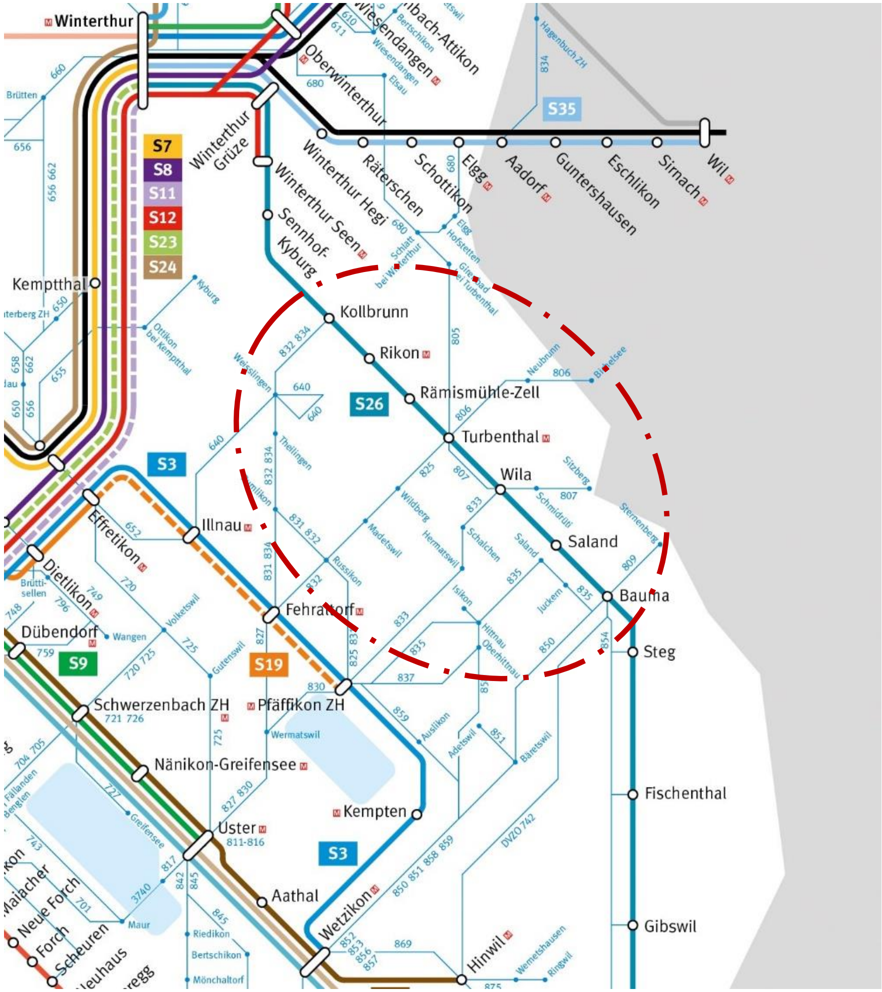
- Public transport as an important part of public service in Switzerland
- Swiss law ensures accessibility of settlements with more than 100 inhabitants by public transport
- Research on SAV service concepts concentrates on urban areas and on privately owned autonomous cars
  - Less concentration of complementing existing public transport
- Market entry of SAVs → change of balance public and private transport



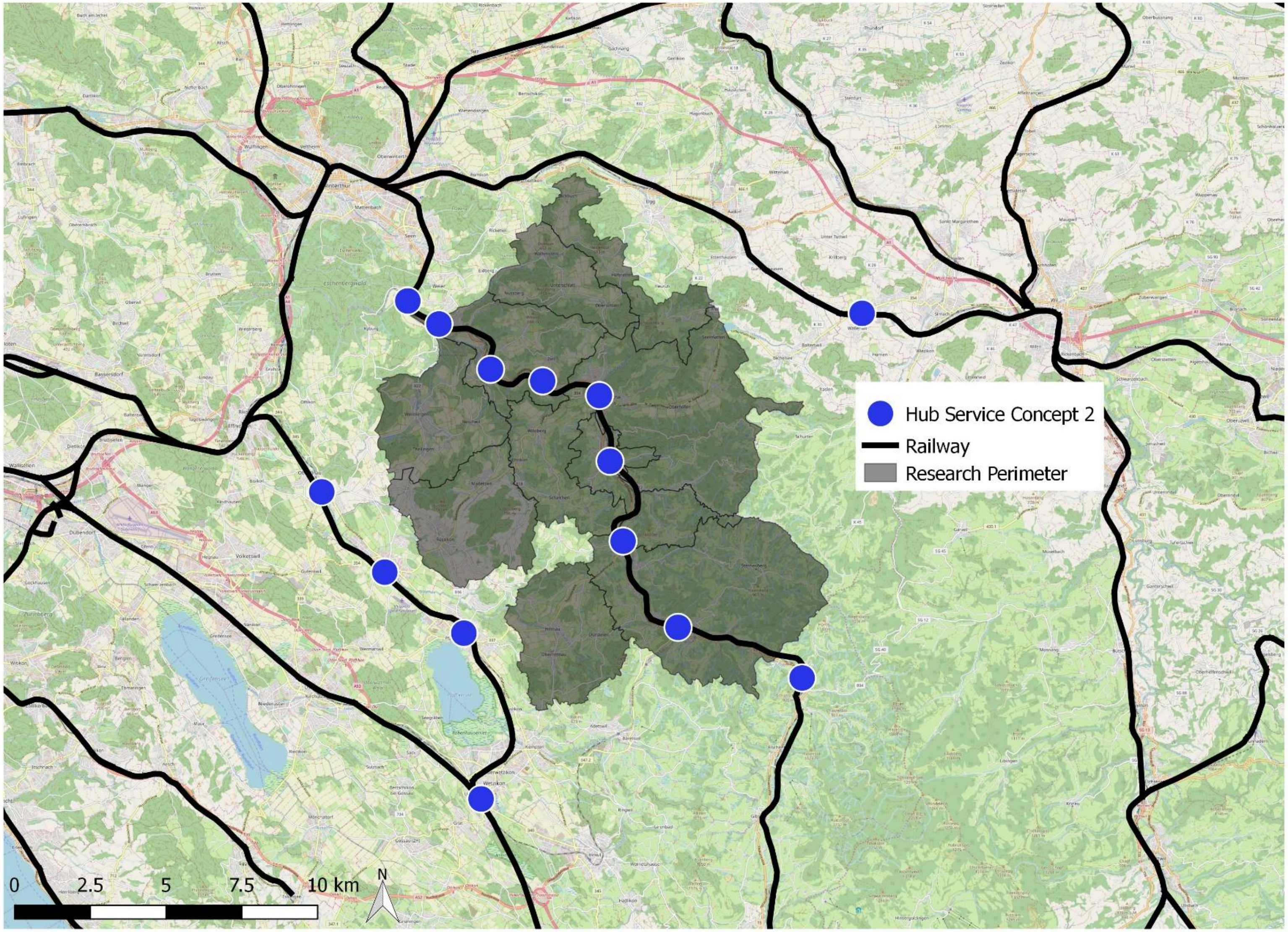
Methods

- Step 1: Development of two service concepts with matching hub concept

Case study approach: Service Concept 0



Case study approach: Service Concept 1 & 2



Methods

- Step 1: Development of two service concepts with matching hub concept

- Step 2: Assessment of demand, costs and revenues
  - Public transport demand (2013) for average weekday (average and peak-hour)
  - Apportionment of demand using origin-destination trips (overall traffic model)
  - Assignment of outbound trips to a hub (local traffic: direct SAV-trips)
  - Change of demand based on elasticities (frequency, travel time, changes)
  - Costs and revenues based on current economic situation
  - Costs for autonomous vehicles; degree of utilization of SAV: 2,5 persons per vehicle (Bösch et al. 2016; Bösch et al. 2018)
  - Assumption of stable prices for public transport

- Step 3: Consequences on commuter railway and long-distance traffic
- Step 4: SWOT analysis of the concepts

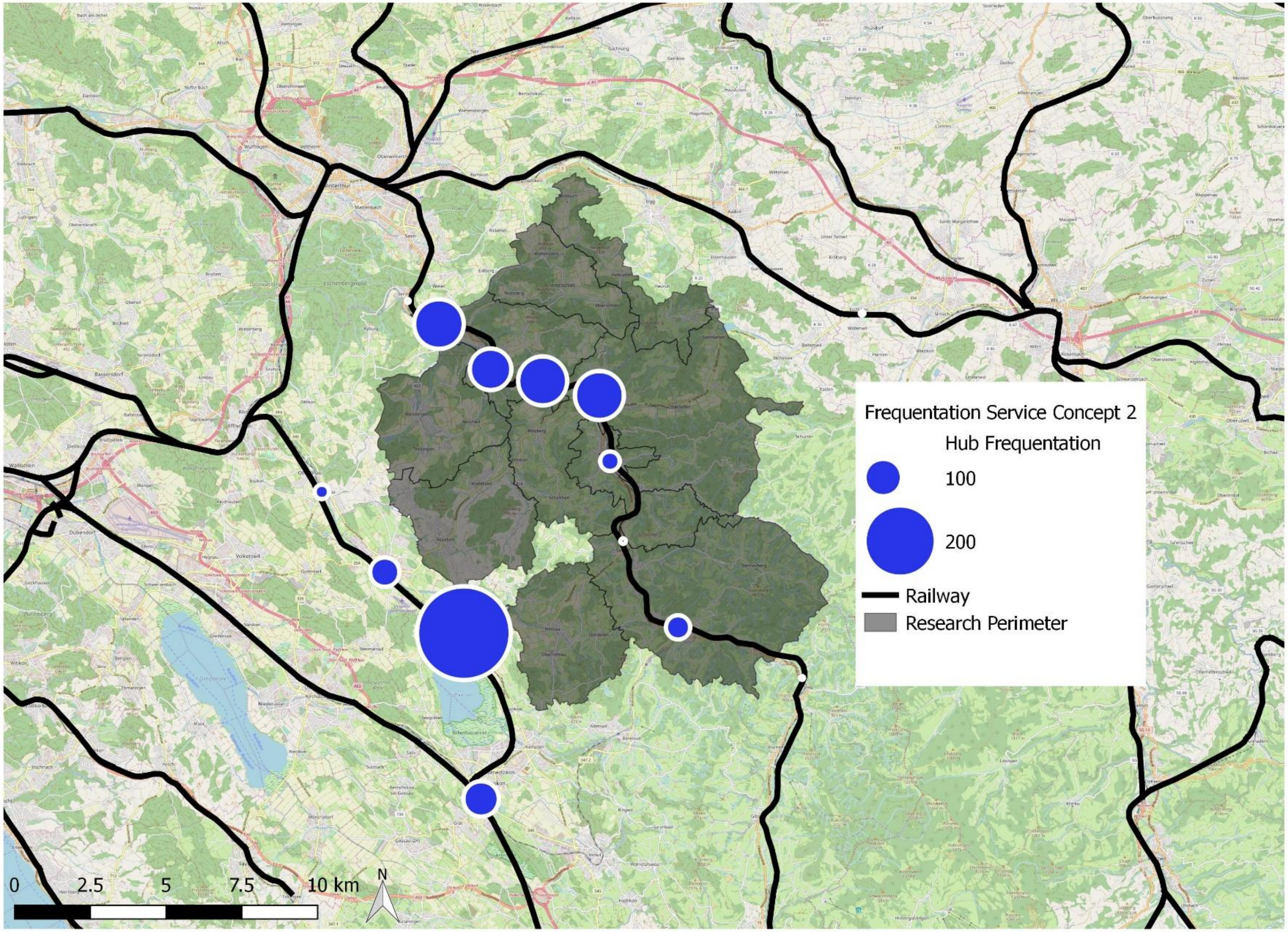
Cost reduction due to automatisation

- Commuter railway: 5-15% of operating costs (expert's opinion)
- Bus/Taxi (→SAV): 50% of operating costs (Spieser et al. 2014)

Findings: Selected KPIs

	Service Concept	0 Bus & railway	1 SAV	2 SAV & railway
Economic	Cost-efficiency	51%	111%	108%
	Daily demand public transp.	8’817	11’678 +32.46%	11’451 +29.89%
	Costs per trip	5.60 CHF	3.07 CHF	3.74 CHF

Case study approach: Service Concept 1 & 2



Discussion

- **Intelligent concept design** for improving rural public transport
  - On-demand services as in urban areas possible

- **Sustainable transport**: SAV & commuter railway
  - Lower initial investment necessary
  - Usage of existing infrastructure (S-train line): **strength of commuter railway** remains in context of services with SAVs

- **Regulative context** for sustainable compatibility
  - road pricing for privately owned SAVs
  - Expansion of service area to urban areas → desirable?
  - incentives to share vehicles

Open Questions

- Sustainable transport as theoretical background, integration of regional development theories?

- Spatial consequences only discussed on a basic level, further implications not predictable due to **uncertain development paths** of autonomous vehicles
  - Housing market? Working places? Disinvestment in transport infrastructure (service concept 1)?

- Regulation necessary, on which levels?
  - **private as well as public transport → possible?**

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