



# Development of the Kyoto MATSim model and planned applications

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# Outline

- Kyoto MATSim model
  - Progress
  - Challenges
- Planned Applications and Ongoing Research
  - Micro-mobility
  - Tourism
  - Truck routes
- Discussions...

# Kyoto Model

## Network

- Six prefectures in Kinki region with the focus on Kyoto
- Area: 27,338.01km<sup>2</sup>; Population: 20,207,545

## Trip data

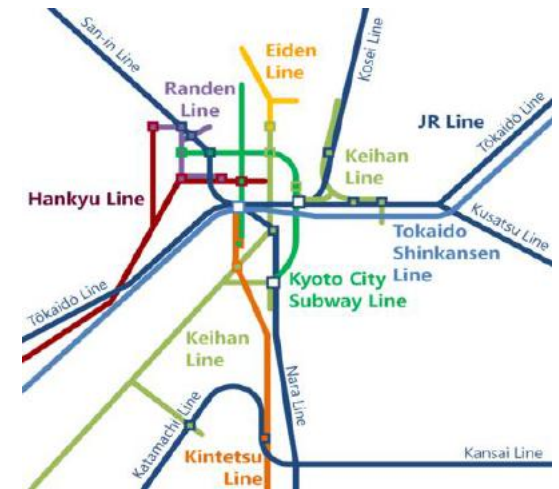
- Personal trip survey data of year 2010 or 2021
- Gender, age, daily travel activities
- Others: occupation, car ownership, disability level...

## Public transport

- (Inter-)urban railway; city subway, tram, bus
- Operated by various individual carriers

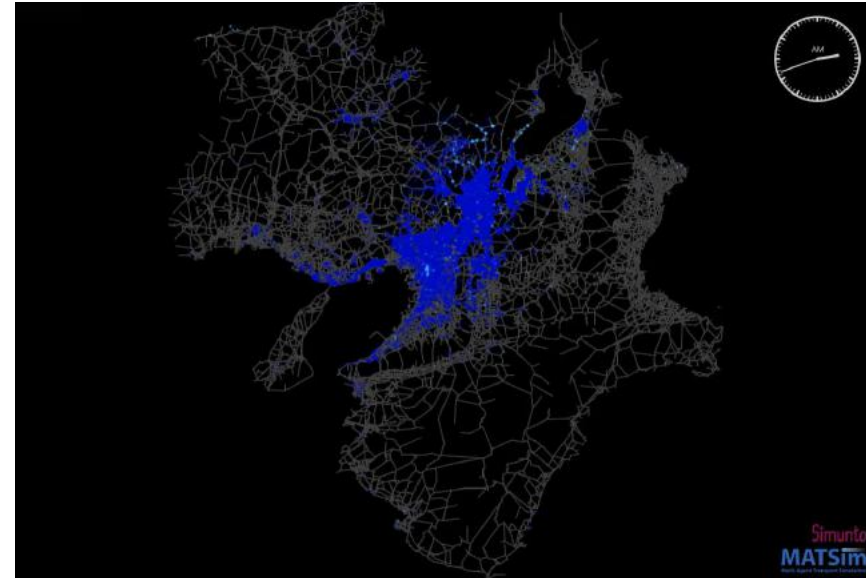


Railway lines in Kyoto city



# Model Set-up

- Scenario
  - 10pct sample of Kyoto and its surrounding area
  - network from OSM
- Initial population
  - Personal trip (PT) survey data (2010) and census data (2020)
  - Include agent activities and mode choice
- First test run --- dashboard: <https://vsp.berlin/simwrapper/>
  - Scope: All Kinki agents having activities in Kyoto (167,501 agents)
  - Network mode: car; Teleported mode: PT, bike, walk
  - No mode choice
- The scenario will be calibrated taking into consideration the traffic counts, modal split and mode-specific trip distance distributions.



# Public transport in the model (1)

To create public transport as network mode

- Railway, city tram: No GTFS
- Yahoo app data
  - Temporal and spatial data of each *run*
  - Need to extract trains in Kinki region and group *runs* into *transitLine* or *transitRoute* and extract information (e.g, travel time, boarding and alighting time, stops, train type)

1064 rows x 12 columns												Go to column	
# Index	Train Type	Start	Start Sect...	Start ...	# Start Distance	# Start...	End Station...	End Sect...	End De...	# End ...	# End Ave...		
		Min: 0 (0%) Max: 1064 (100%)	Min: 0 (0%) Max: 1064 (100%)	Min: 0 (0%) Max: 1064 (100%)	Min: 0 (0%) Max: 613 (58%)	Min: 0 (0%) Max: 1064 (100%)	Min: 0 (0%) Max: 637 (60%)	Min: 0 (0%) Max: 637 (60%)	Min: 0 (0%) Max: 637 (60%)	Min: 0 (0%) Max: 637 (60%)	Min: 0 (0%) Max: 135 (13%)		
		1064 Distinct values	1064 Distinct values	613 Distinct values			637 Distinct values						
0	10041	たにがわ12号	21312	2 R 上道新幹線	06:2200	40743.67	166.05	22828	2 R 上道新幹線	07:2425	3693.49	44.32	
1	10042	たにがわ19号	21313	2 R 上道新幹線	06:1600	18634.01	147.26	22828	2 R 上道新幹線	07:1205	3693.49	44.32	
2	10043	たにがわ24号	21313	2 R 上道新幹線	06:5300	18634.01	130.89	22828	2 R 上道新幹線	07:5205	3693.49	44.32	
3	10044	たにがわ29号	21313	2 R 上道新幹線	07:2200	18634.01	147.26	22828	2 R 上道新幹線	08:1805	3693.49	44.32	
4	10045	たにがわ36号	23938	2 R 上道新幹線	06:1600	32155.35	160.78	22828	2 R 上道新幹線	07:3655	3693.49	44.32	
5	10046	たにがわ40号	23938	2 R 上道新幹線	07:1500	32155.35	175.4	22828	2 R 上道新幹線	08:4155	3693.49	44.32	
6	10047	たにがわ44号	23938	2 R 上道新幹線	07:4800	32155.35	160.78	22828	2 R 上道新幹線	09:1655	3693.49	44.32	
7	10048	たにがわ50号	23938	2 R 上道新幹線	08:2700	32155.35	160.78	22828	2 R 上道新幹線	11:0055	3693.49	44.32	
8	10049	たにがわ58号	23938	2 R 上道新幹線	10:3100	32155.35	160.78	22828	2 R 上道新幹線	12:0055	3693.49	44.32	
9	10050	たにがわ60号	23938	2 R 上道新幹線	11:3300	32155.35	160.78	22828	2 R 上道新幹線	13:0055	3693.49	44.32	
10	10051	たにがわ62号	23938	2 R 上道新幹線	14:0300	32155.35	160.78	22828	2 R 上道新幹線	17:2655	3693.49	44.32	
11	10052	たにがわ64号	23938	2 R 上道新幹線	19:1500	32155.35	160.78	22828	2 R 上道新幹線	20:4055	3693.49	44.32	
12	10054	とく110号	24031	2 R 上道新幹線	06:1500	20920.32	241.27	22828	2 R 上道新幹線	10:4455	21211.39	17.08	





## Public transport in the model (2)

To create public transport as network mode

- Bus (Some with GTFS)  
Three ways based on data availability
  - some with GTFS data
  - “hand-extracted” information (frequency, distance...) for the bus lines in Kyoto
  - shapefile of bus routes and assumed frequency
- Fare: estimated, e.g., linear relation of distance

more  
accurate  
↑



<https://www.gtfs.jp/>

330 457 1845  
登録事業者数 登録ファイル数 登録ファイル数

GTFS データ リポジトリ

<https://gtfs-data.jp/>



<https://www.ptd-hs.jp/>

バス時刻検索

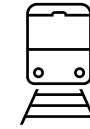
[バス時刻検索](#) > [GTFSオープンデータ利用状況](#) > [全国GTFSオープンデータ一覧](#)

[全国の公共交通GTFSオープンデータ一覧](#)

[https://bustime.jp/GtfsAgency/gtfs\\_list/](https://bustime.jp/GtfsAgency/gtfs_list/)

# Challenges

- Lack of good public transport data
- Estimate proper income for each agent
  - No income data in the trip survey
  - To link to each agent, only the data in the survey is useful
  - Occupation, car ownership
- OpenSource?  
Need to obtain permission for “randomized household survey data”



# Planned Applications and Ongoing Research

Micromobility    Tourism    Trucks





# Planned Applications and Ongoing Research

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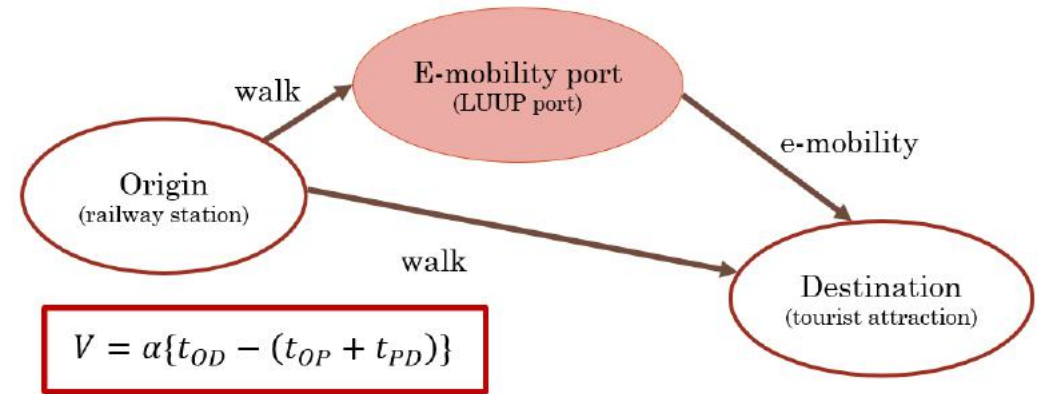


# A study about shared e-mobility

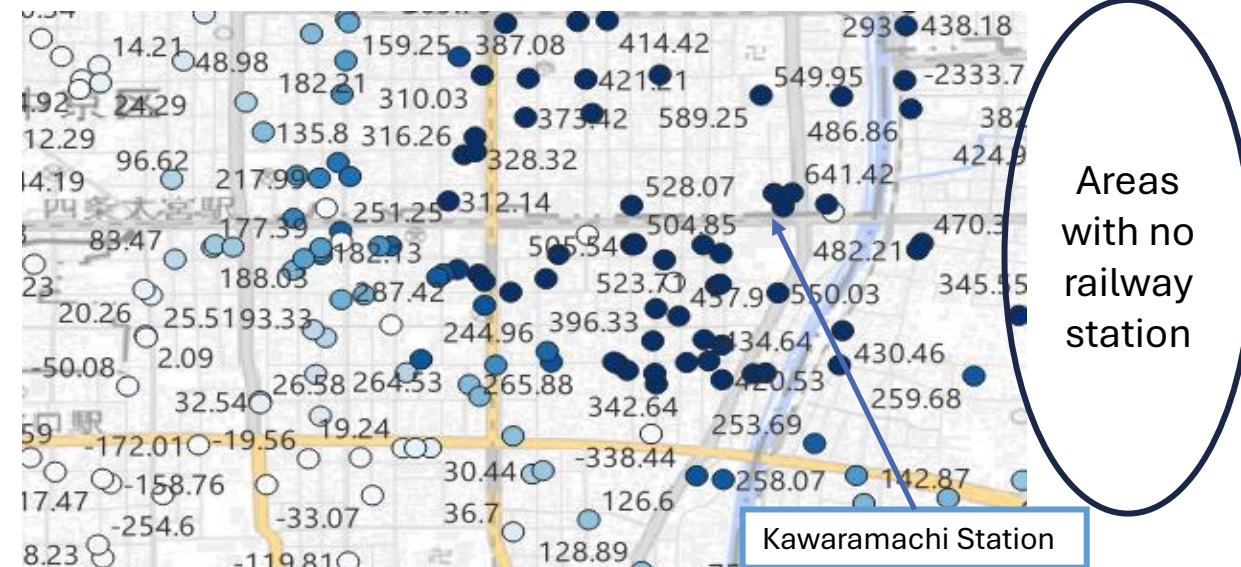
- Explores the factors that influence the intention to use shared e-mobility, focusing on the location of the port and the means of transportation used on a daily basis.
- How much more are passengers **willing to pay (WTP)** if the walking to access e-kickboard stations is reduced?
- WTP is likely highly **locally** influenced



# Value of port locations



- WTP of ports around Kawaramachi Station is higher due to the lack of a station on the east side
- On the west side, WTP is lower due to the high accessibility to tourist attractions by train.



➤ We plan to extend the survey and use the results in conjunction with MATSim

# MATSim for Micro-mobility

## (Collaborative project with TU Berlin&M2G Campus)

Assessing the impacts of shared micro neo mobility on zero carbon transportation in urban areas  
A comparative study between Germany and Japan

- How could the distribution of new and shared micro mobility vehicles impact private and public transport.

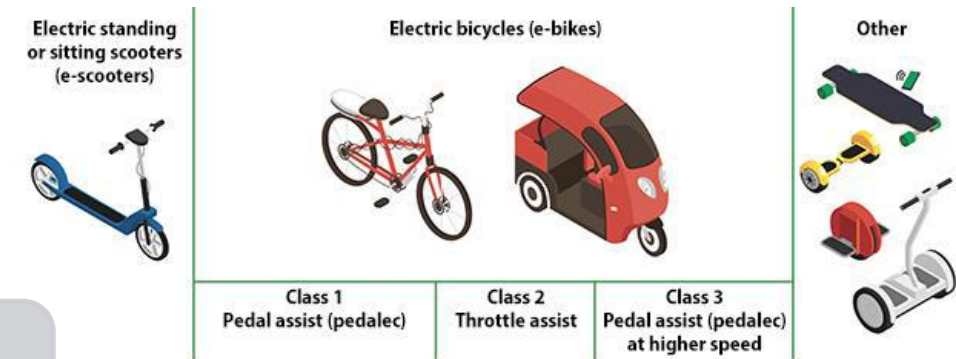
SP-RP questionnaire

- To capture passengers' willingness of using micro mobility from hypothetical scenarios
- To understand individuals' preferences and decision-making processes

MATSim simulation

- To simulate agent's travel behaviors
- To evaluate the impact of micro mobility on the whole transport system

Micro mobility vehicles:  
(e)-scooter, (e)-bike, cargo bike...



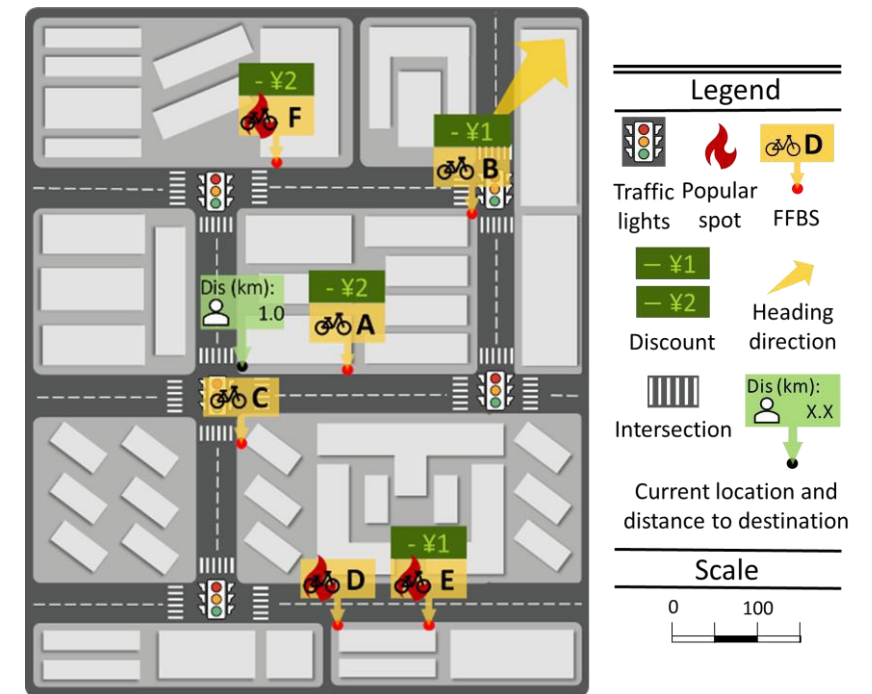
© Laura Sandt, PBIC.

Source: <https://highways.dot.gov/public-roads/spring-2021/02>

# Is MATSim detailed enough to estimate micro-mobility share and “hub network design”?

- Current MATSim model creates activities in zones and “releases” agents to a transport node.
- However, previous survey found very local factors influencing choice to take micromobility
  - distance to bicycle
  - direction (distance to dest.)
  - price of bicycle
- Micro-level?

Detailed locational aspects and relation to activity spots matter if one wants to predict which vehicles are going to be used.



# Planned Applications and Ongoing Research

Micromobility Tourism Truck

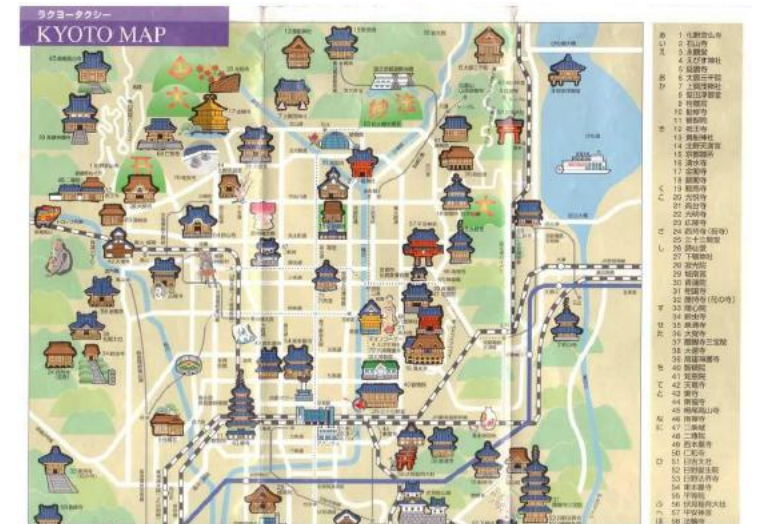




# Tourist demand management

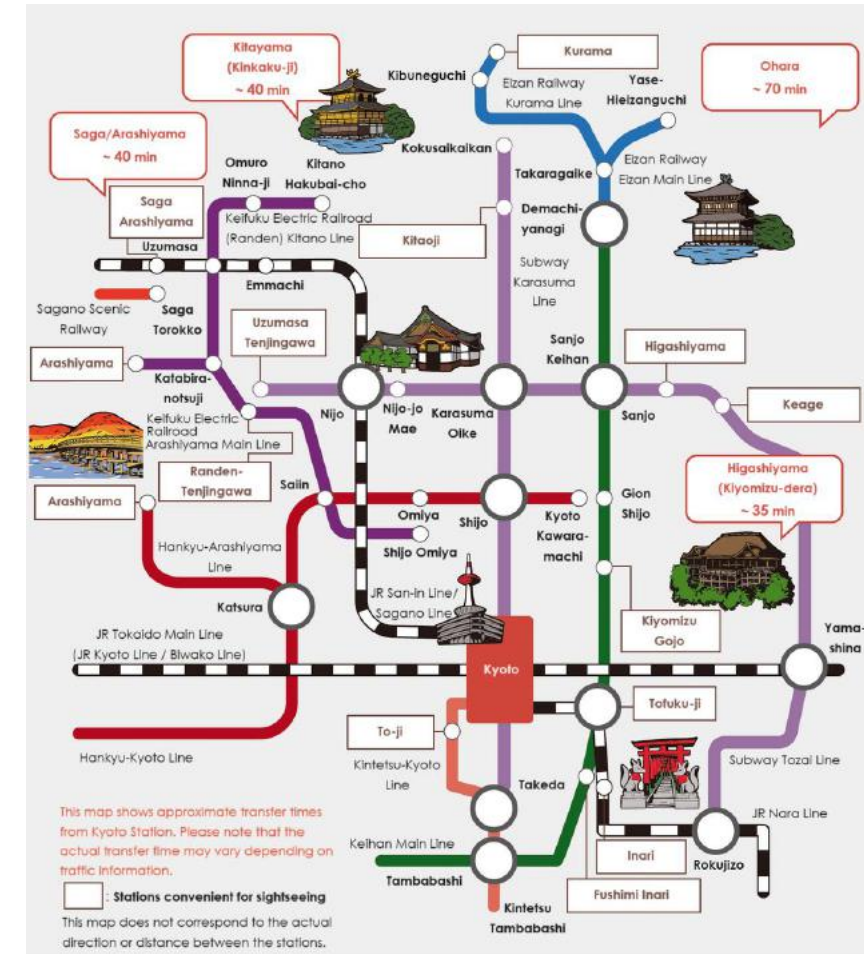
- Overcrowded in Kyoto, especially in tourism season
  - Sights are distributed, not a single “old town”
- Hence: Need to travel by PT

Picture taken near Heijan Jingu



# MATSim Challenges for Tourist Modelling

- Modelling tourist agents
- Strong diversity in preferences
- Link as well as node congestion will effect plans - for some
- “en-route” flexibility to add/drop an activity
- “multidimensional utility function”
- Longer-term flexibility (multi-day plans)



[https://kyoto.travel/en/see-and-do/preparing\\_for\\_sightseeing\\_in\\_kyoto\\_p1.html](https://kyoto.travel/en/see-and-do/preparing_for_sightseeing_in_kyoto_p1.html)

# Current funding application



# Planned Applications and Ongoing Research

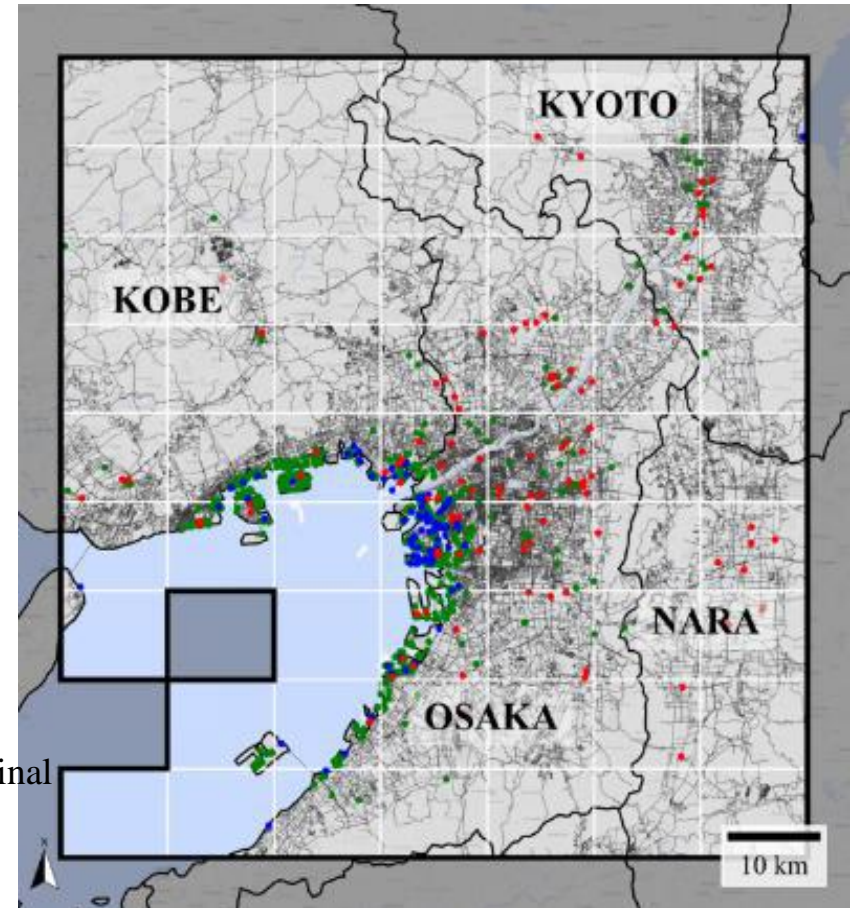
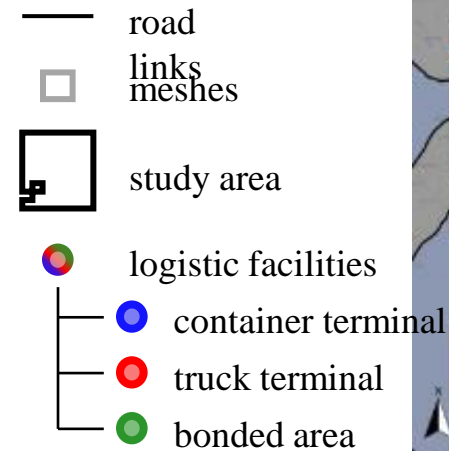
Micromobility    Tourism    Truck





# Ongoing research: Route Choice Characteristics of Large Trucks

- Explain the route choice of trucks considering the road information from Digital Road Map (DRM).
- Recursive logit models estimated with DRM variables as explanatory variables.

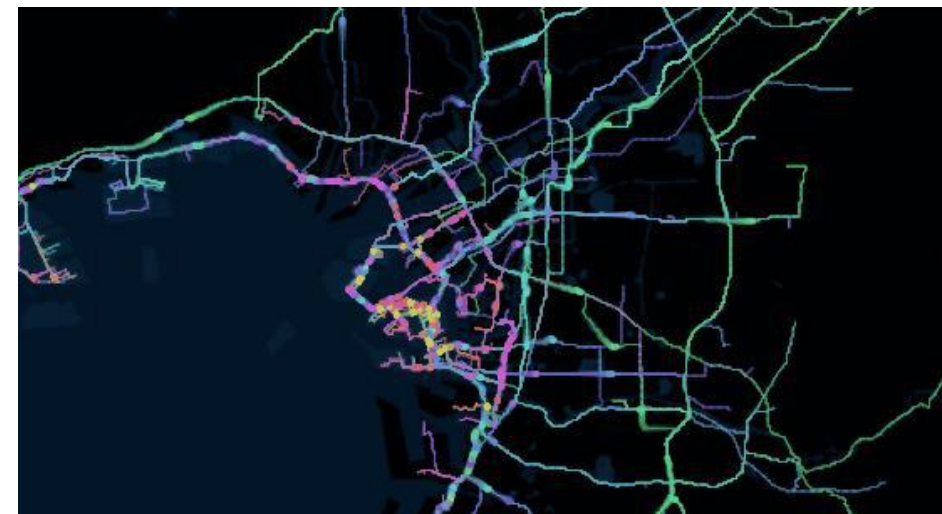


Area (Central Kansai Urban Area) and road network

# Truck trajectory data from ETC 2.0

Example of a link-based truck trip

Link seq.	Link ID	In time	Out time	Travel time (s)	Travel speed (km/h)	Link length (m)	Road type	Adminis- trator	Main/side road	Number of lanes	Median barrier width (m)
1	5235361 1311275	12:16:06	12:18:18	132.5	69.5	2562	1	1	1	4	20
2	5235361 1201131	12:18:18	12:18:21	3.1	71.9	63	1	1	1	4	45
...	...	...	...	...	...	...	...	...	...	...	...
99	5235020 1570162	13:12:13	13:13:22	68.7	11.9	227	3	4	1	6	46
100	5235020 1621175	13:13:22	13:13:49	26.9	14.7	109	7	6	0	2	0



Map matched trips



# Potential MATSim application

- Route choice impacts of changed network design
- E-truck charging scenarios with limited public charging stations: Truck flow and charging points

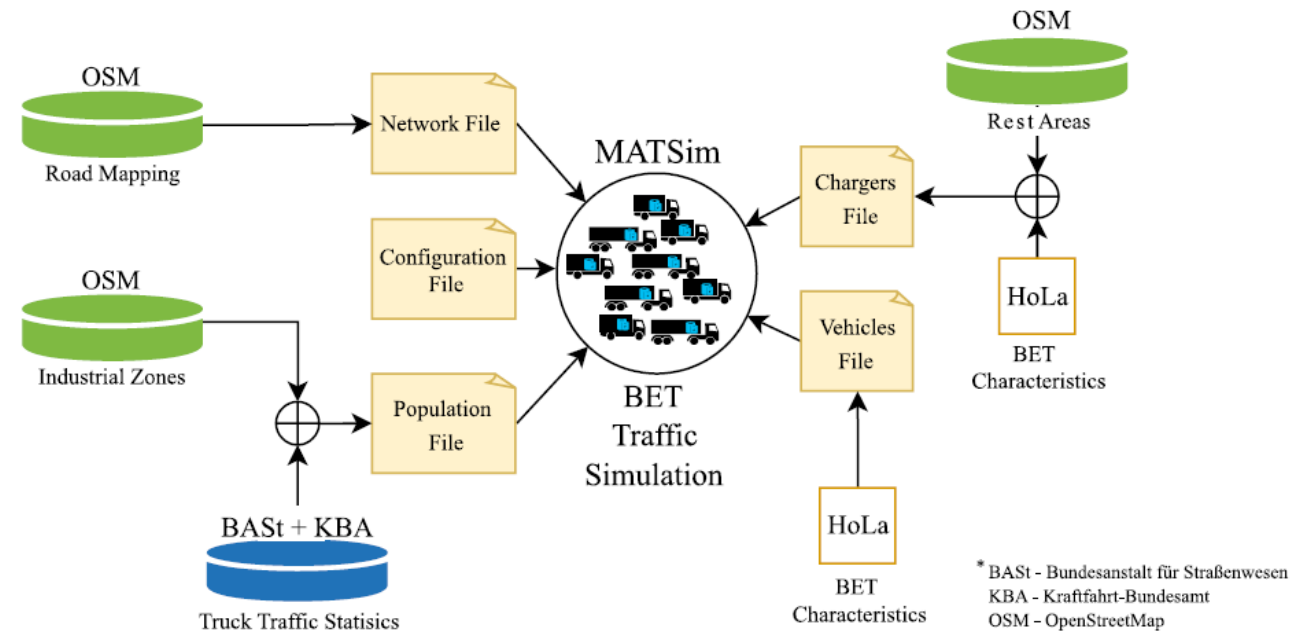
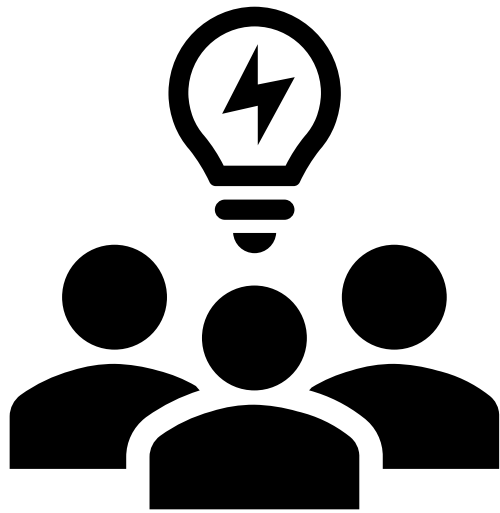


Figure taken from Tietz et al (2024): Electric Long-Haul Trucks and High-Power Charging - Modelling and Analysis of the Required Infrastructure in Germany



# Thank you! & any feedback?

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