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École Mines-Télécom

Georgia Institute of Technology

IPIC 2024

Demand estimation adapted to hyperconnected transport systems in regional areas

May 31st, 2024

Liz Araceli Cristaldo - Eva Petitdemange - Matthieu Lauras - Benoit Montreuil

AGENDA

1. RESEARCH CONTEXT
2. RESEARCH PROJECT
3. LIMITATIONS AND FUTURE WORK

Global trade expansion → Logistics infrastructure

Freight: Same day delivery, JIT procurement → Smaller and more frequent shipments

Passenger: Offers lack of flexibility and customization → Alternative solutions

Regional areas

Passenger transport: Not accessible to everyone.

Freight transport: Scarce demand, Limited infrastructure

Ambra, T., Caris, A., & Macharis, C. (2019).
Bucchiarone, A., Battisti, S., Marconi, A., Maldacea, R., &Ponce, D. C. (2021).

Physical Internet (PI) concept → Novel framework to address logistics and transportation challenges

Open and Connected System

- Consolidated logistic flows
- Shared assets

Urban and freight - centric transport

Regional areas transport systems

↓

Scientific challenges !

Understand in detail, the regional transport demand characteristics.	Align supply capabilities with the expectations of regional transport demand.

Montreuil, B. (2011).

Novel methodology

Quantitative and Qualitative aspects of regional transport demand

freight

passengers

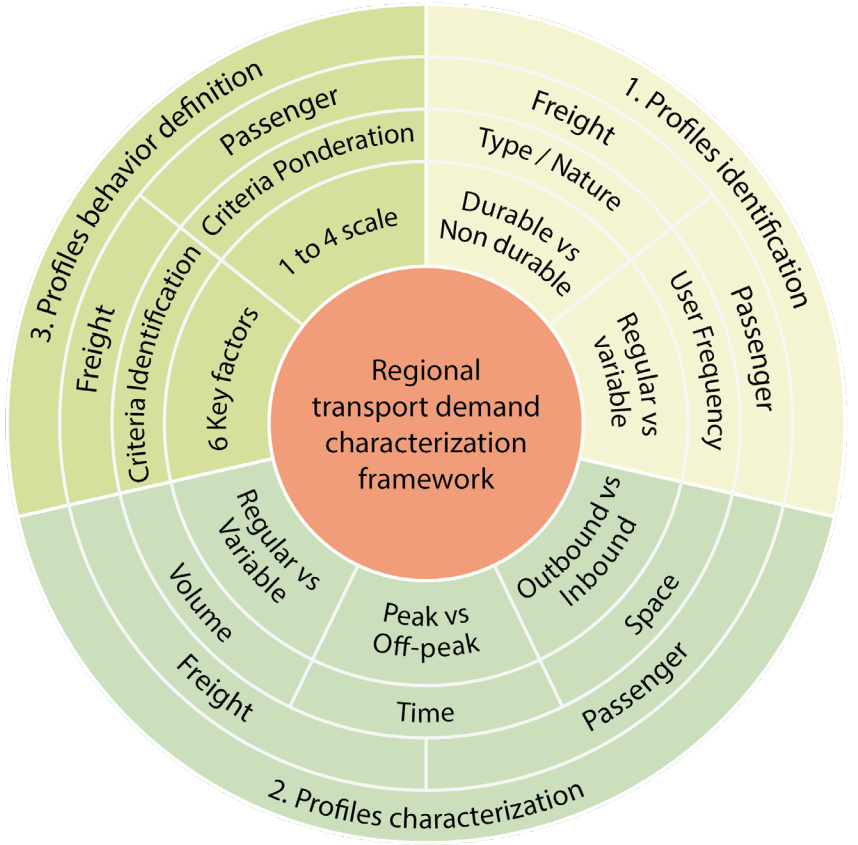
Single customer base with common transportation needs

Practical application

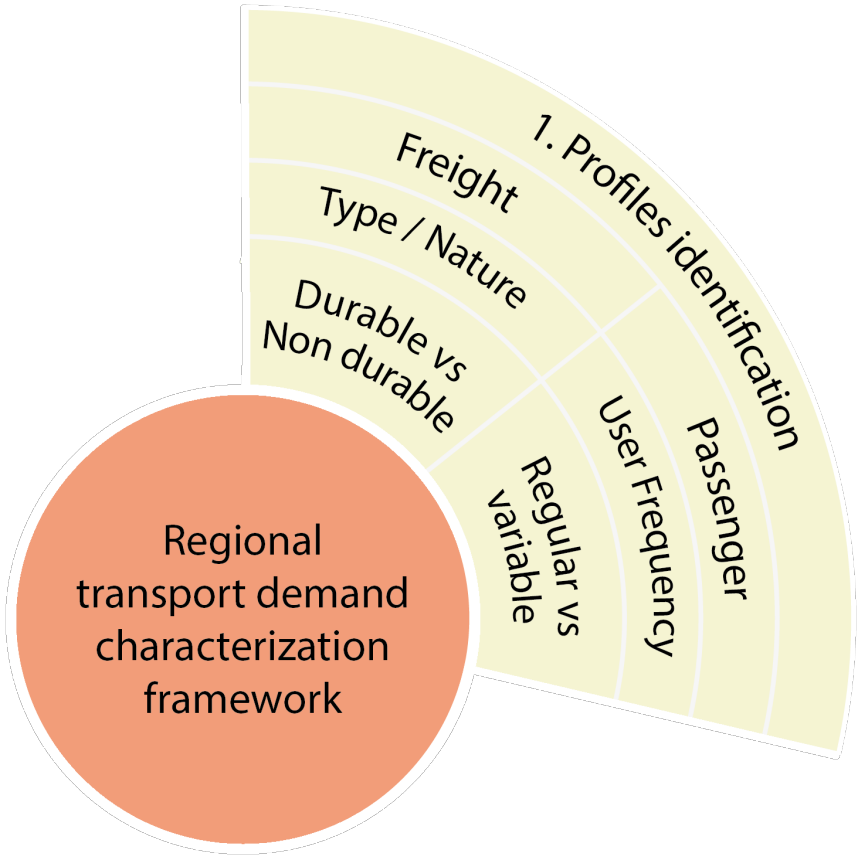
Case study

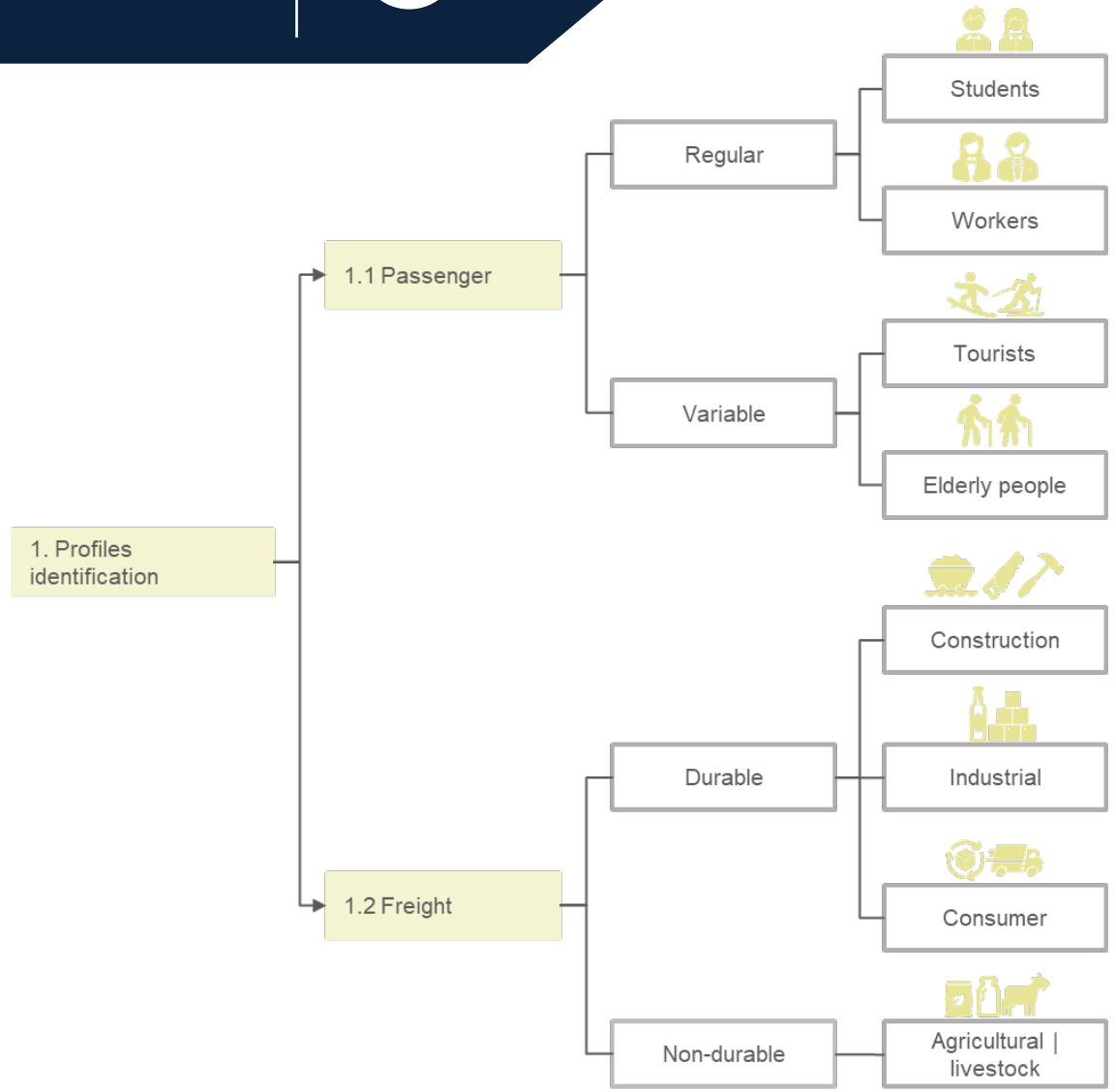
Integrate autonomous rail shuttles within the existing transport network.

https://www.imt-mines-albi.fr/actus/ecotrain



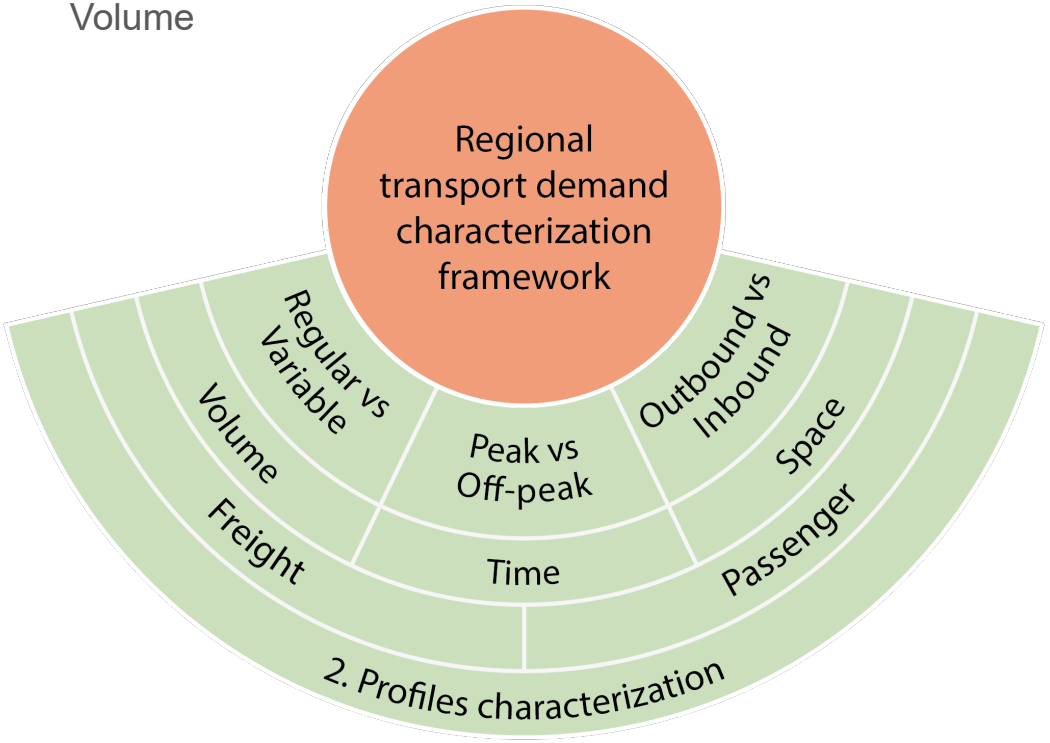
Proposed methodology for regional transport demand characterization.

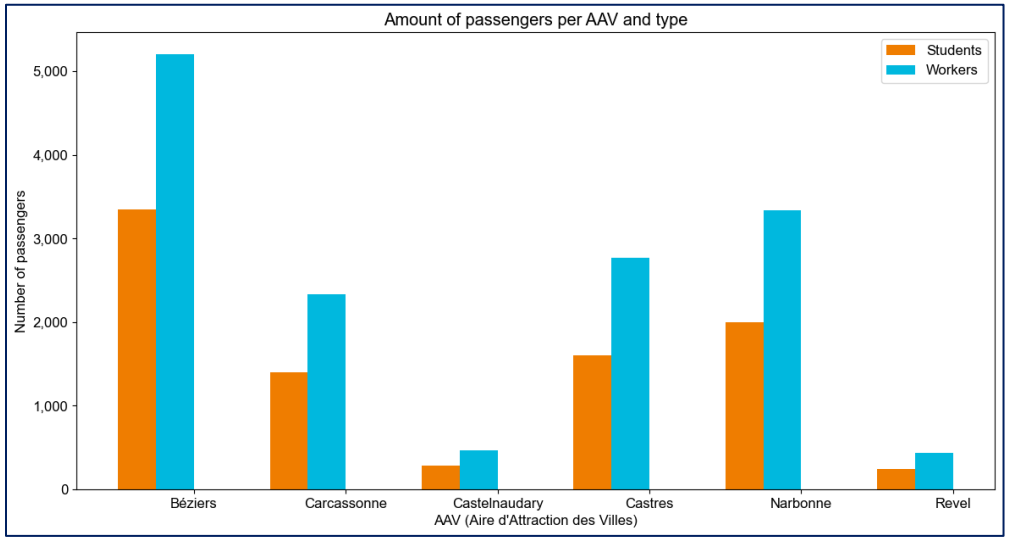


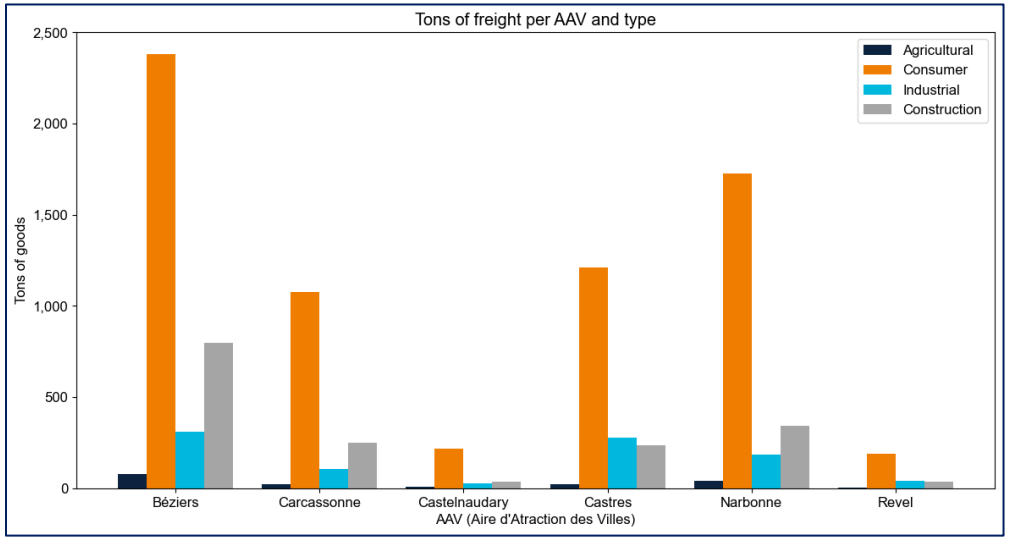


INSEE - French National Institute of Statistics and Economic Studies
ASCM Supply Chain Dictionary. (Pittman & Atwater, 2022)

Volume







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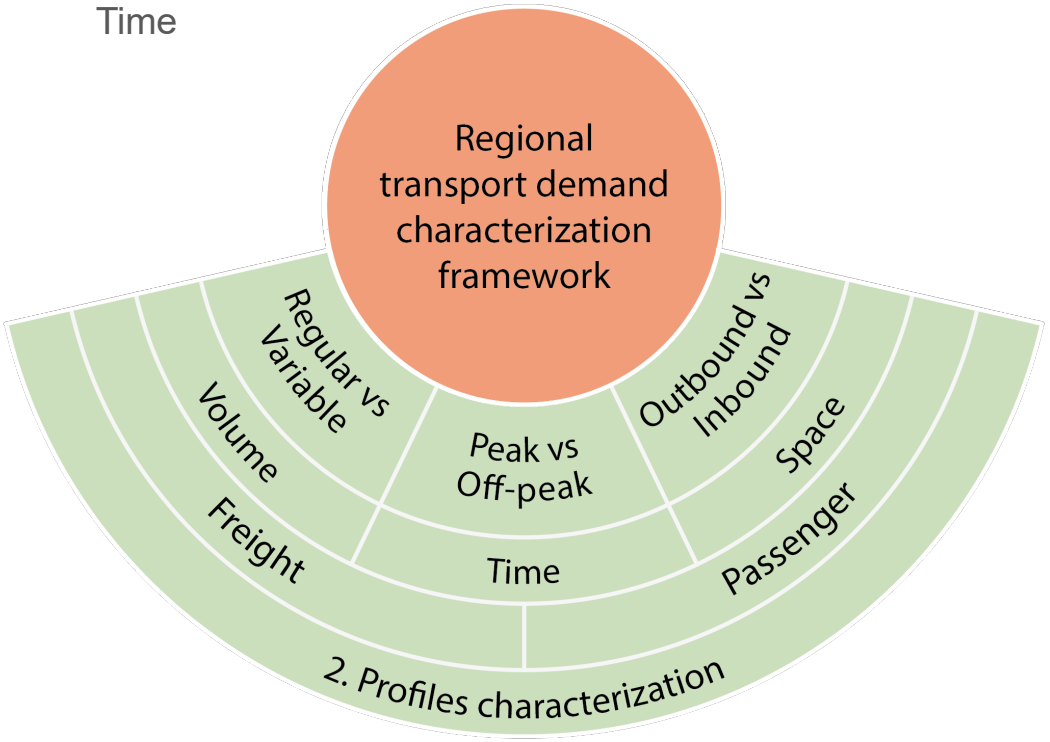
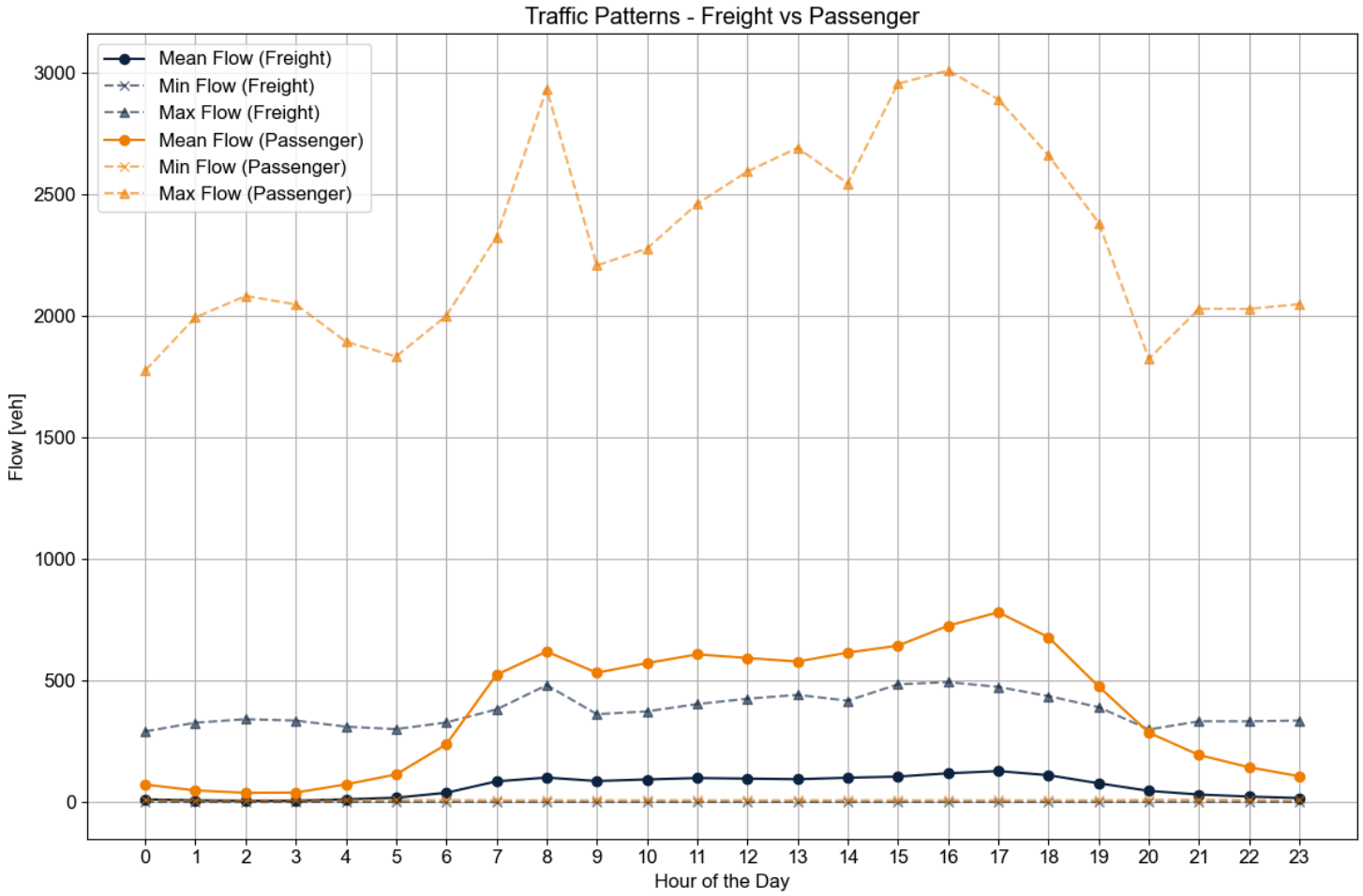
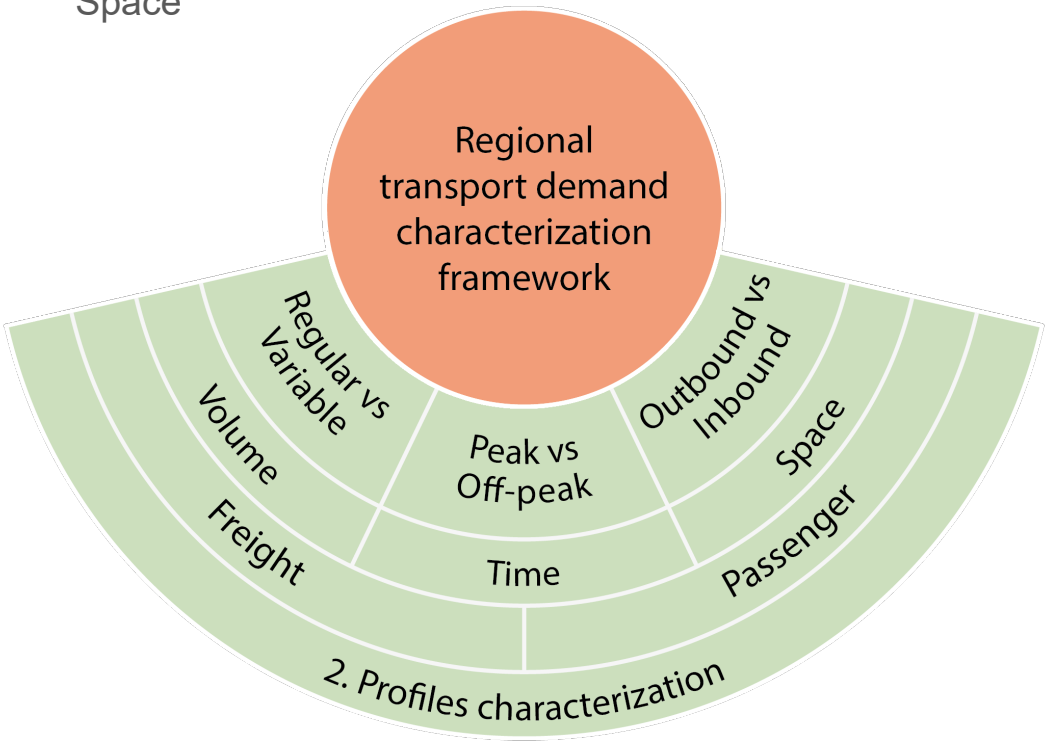
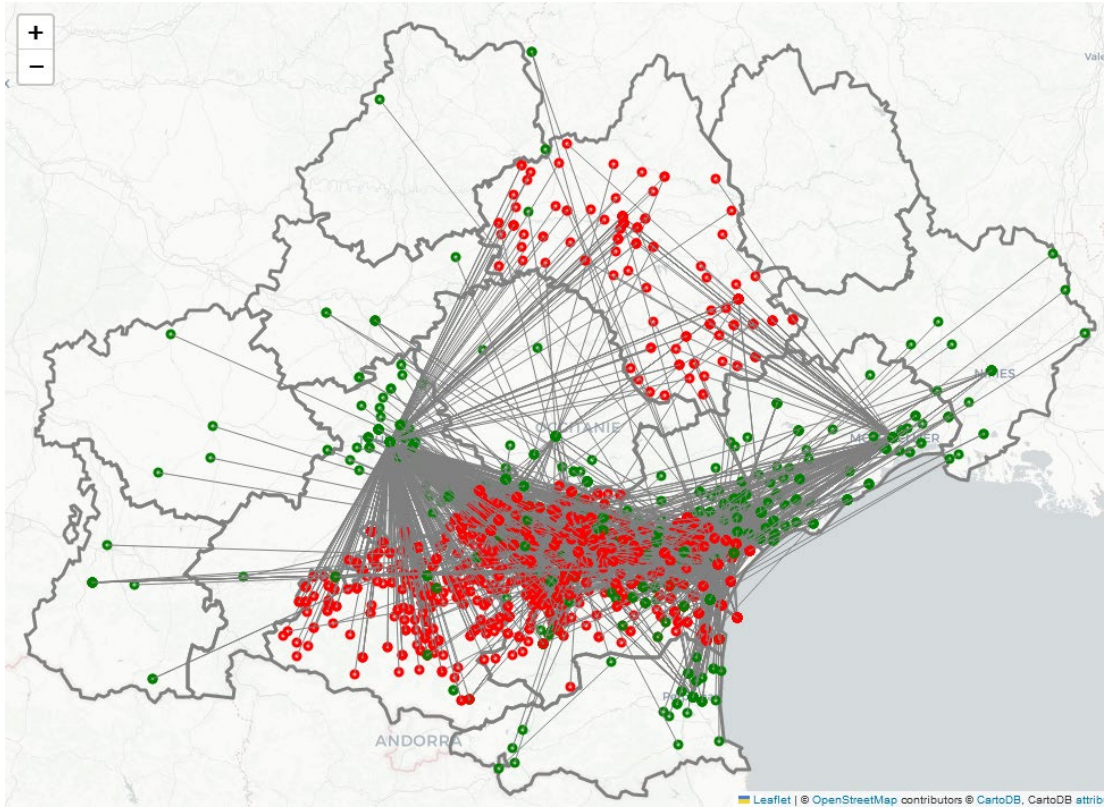
Time


Regional transport demand characterization framework
Regular vs Variable
Peak vs Off-peak
Outbound vs Inbound
Volume
Space
Freight
Time
Passenger
2. Profiles characterization


Traffic Patterns - Freight vs Passenger
Mean Flow (Freight)
Min Flow (Freight)
Max Flow (Freight)
Mean Flow (Passenger)
Min Flow (Passenger)
Max Flow (Passenger)
Flow [veh]
Hour of the Day

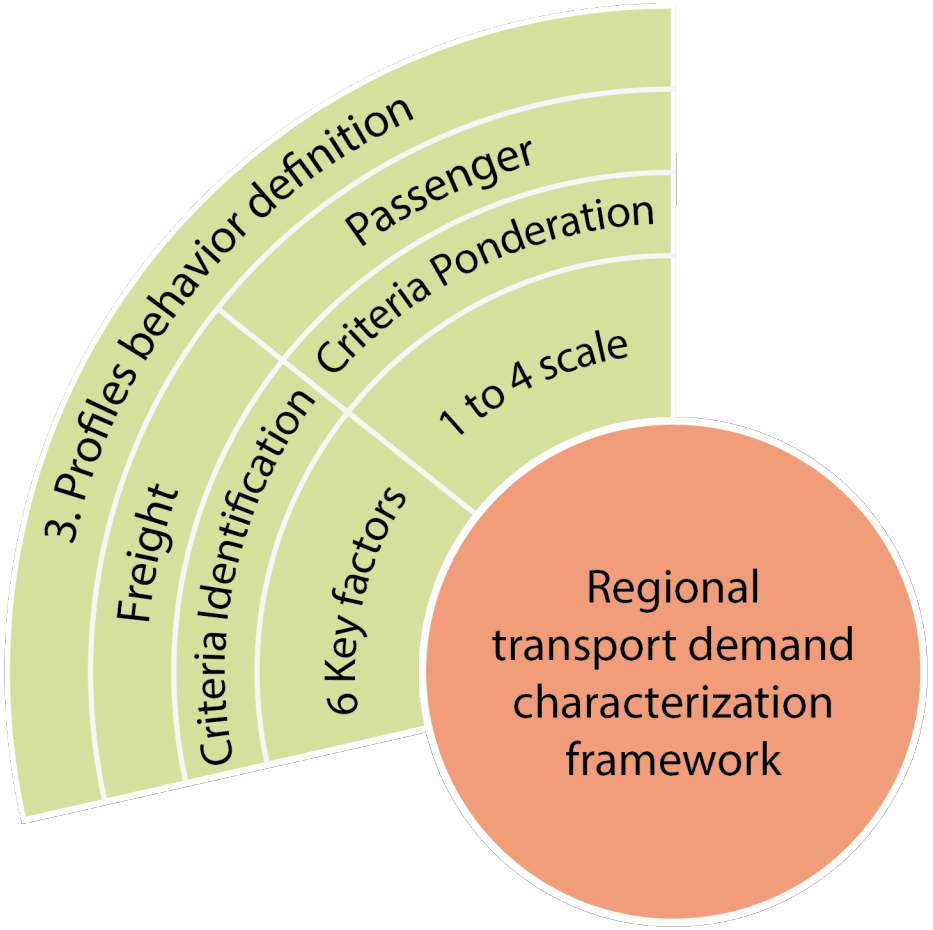
Space





Workers mobility – Occitanie, France

Data source : https://www.insee.fr/fr/statistiques/6456052?sommaire=6456104


3. Profiles behavior definition
Freight
Passenger
Criteria Identification
Criteria Ponderation
6 Key factors
1 to 4 scale
Regional transport demand characterization framework

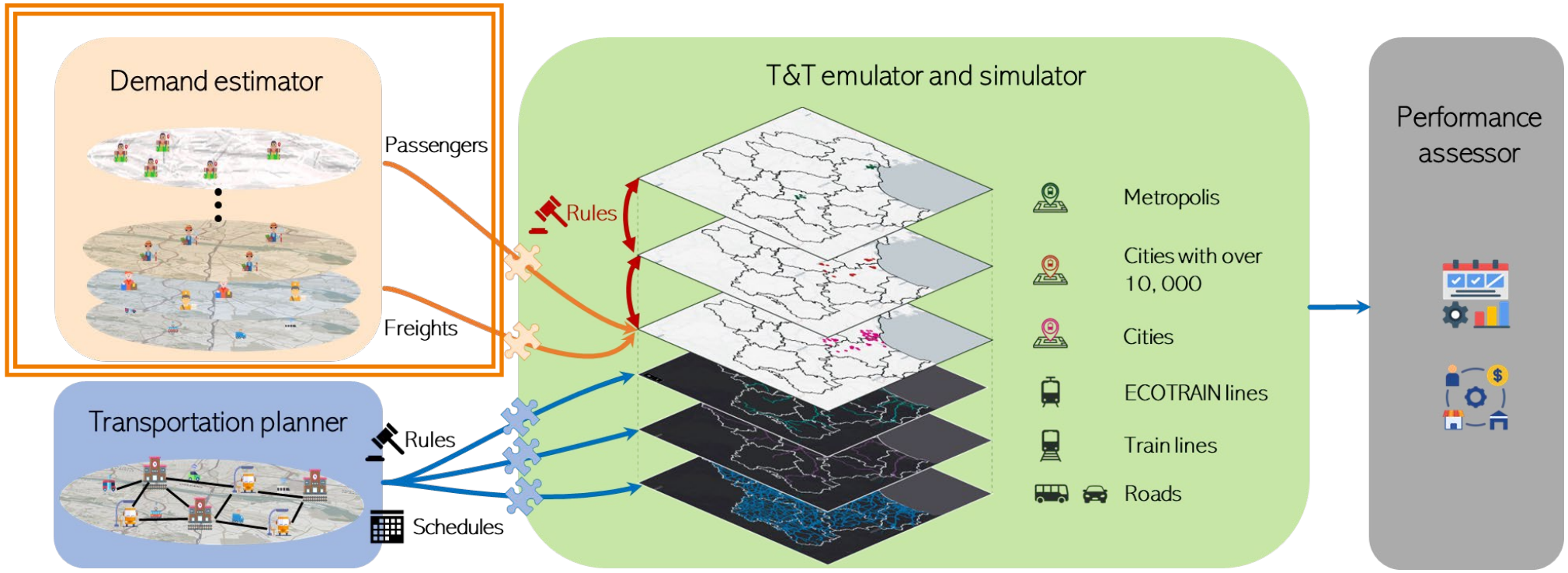

Price
Time
Environmental impact
Timetable compliance (reliability)
Comfort | Materials handling
Safety
Influencing factors
Measurement scale.
4 (most important)
1 (least important)

Limitations

- Add guidelines to scale and adapt the methodology to different regional characteristics (technological development and/or data access availability).
- A deeper dive into the roles of different stakeholders.

Future work

- Select a forecasting model that reflects actual demand patterns in regional contexts.
- Use the collected data to develop a simulation-based demand generator.


Demand estimator
Passengers
Freights
Transportation planner
Rules
Schedules
T&T emulator and simulator
Rules
Metropolis
Cities with over 10, 000
Cities
ECOTRAIN lines
Train lines
Roads
Performance assessor

Thank you

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liz.cristaldo_jimenez@mines-albi.fr

Animations inspired by Robin Batard and Frédérick Benaben

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