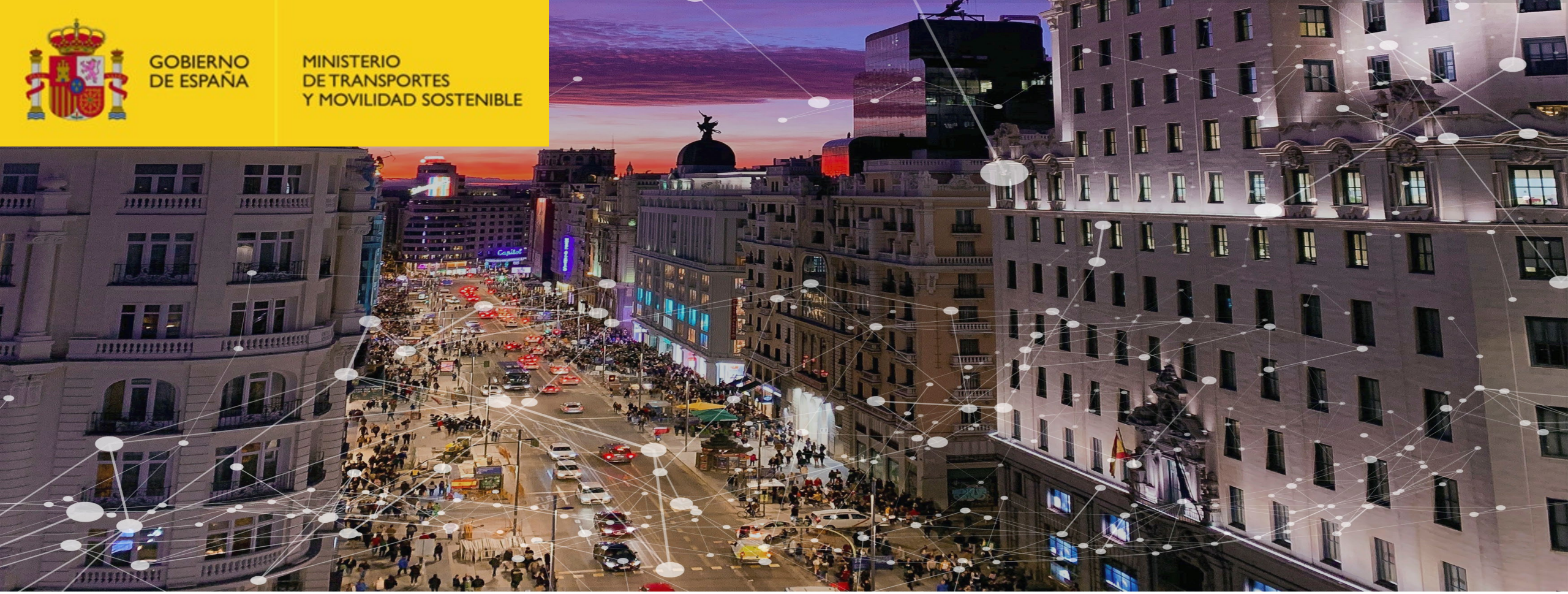
GOBIERNO DE ESPAÑA

MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE



BIG DATA AND AI TO ANALYZE MOBILITY IN SPAIN

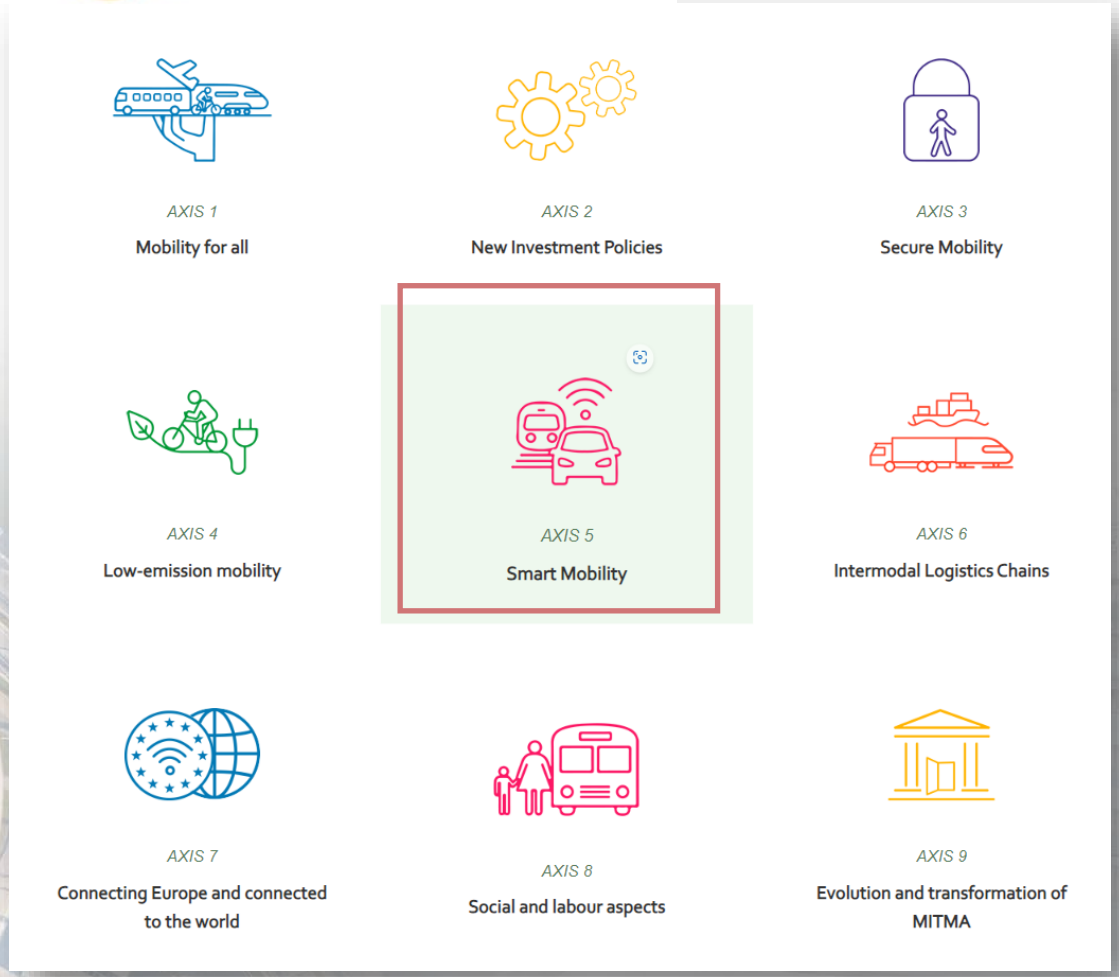
Tania Gullón Muñoz-Repiso

1. Introduction and Overall framework
2. Methodology
3. Studies and results
4. Conclusions

GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE

es.movilidad

2030 Safe, Sustainable and Connected Mobility Strategy



5.1.2. Analysis of mobility flows at the national level and creation of the national transport model

GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE

es.movilidad

2030 Safe, Sustainable and Connected Mobility Strategy

AXIS 5
Smart Mobility

TRANSPORT INFRASTRUCTURES

TRANSPORTATION SERVICES

NAP
Transporte Multimodal

MOBILITY

Introduction

GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE

Advantages of using bigdata for measuring mobility

SURVEYS

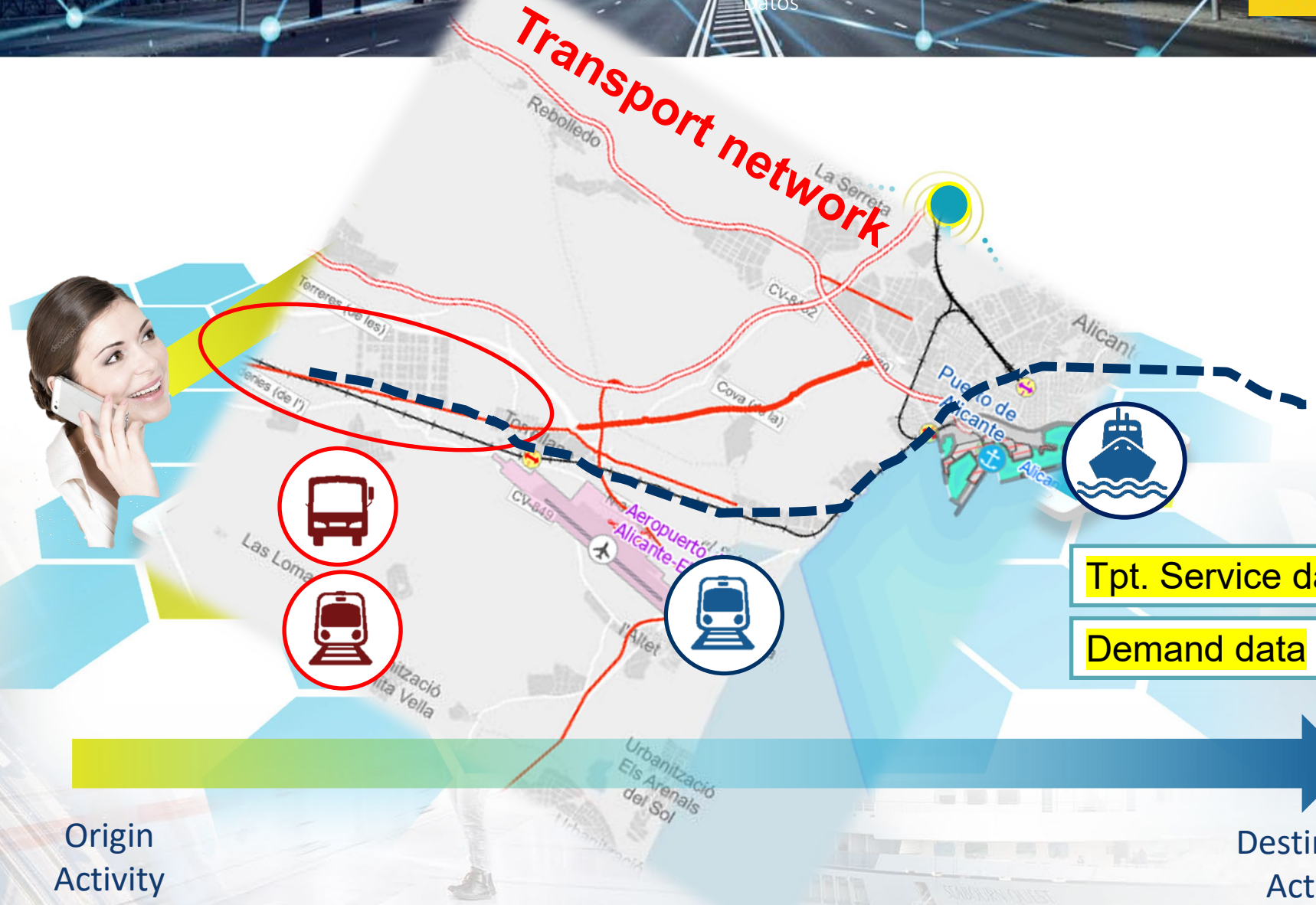
- High investment
- Small Sample
- Not seamless
- Subjective info

BIGDATA

- Low investment
- Large sample
- Seamless
- Comparable

30% Spanish population

METHODOLOGY



Tpt. Service data: schedules, stops

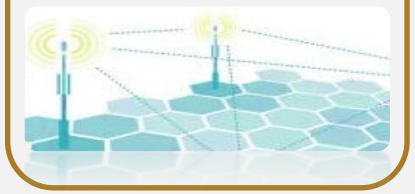
Demand data

❖ Workflow (1/2)

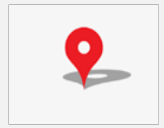
GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES, MOVILIDAD Y AGENDA URBANA

Mobile Devices

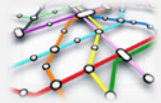
Cell map-Network topology



Land Use and POIS

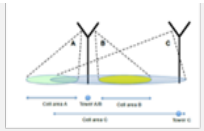


Transport Network and transport services supply and demand data

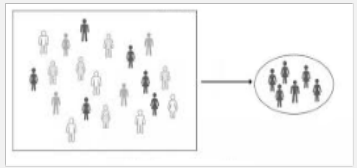


Sociodemographic statistics

Pre-processing and data cleansing



Sample selection



Activity and travel detection algorithms

Sample expansion

Transport and mobility indicators generation

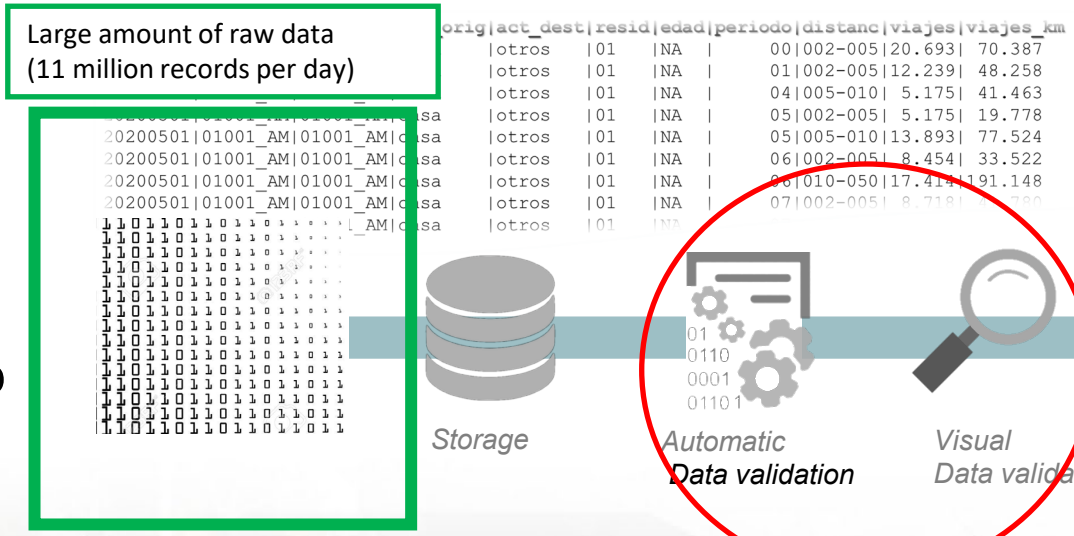
O/D Travel Matrix

Data validation

❖ Workflow (2/2)

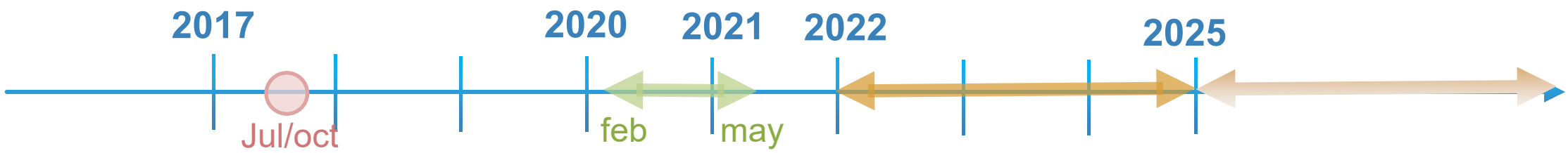
We get this..

Large amount of raw data
(11 million records per day)

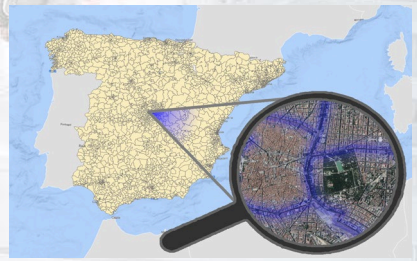


STUDIES AND RESULTS

BIGDATA Studies :



2017	2020	2021
2 weeks	Every day	Every day
Modal split		Modal split
Regions 60 areas + abroad	Municipalities 2600 areas	Districts 3800 areas+ abroad



+ accurate

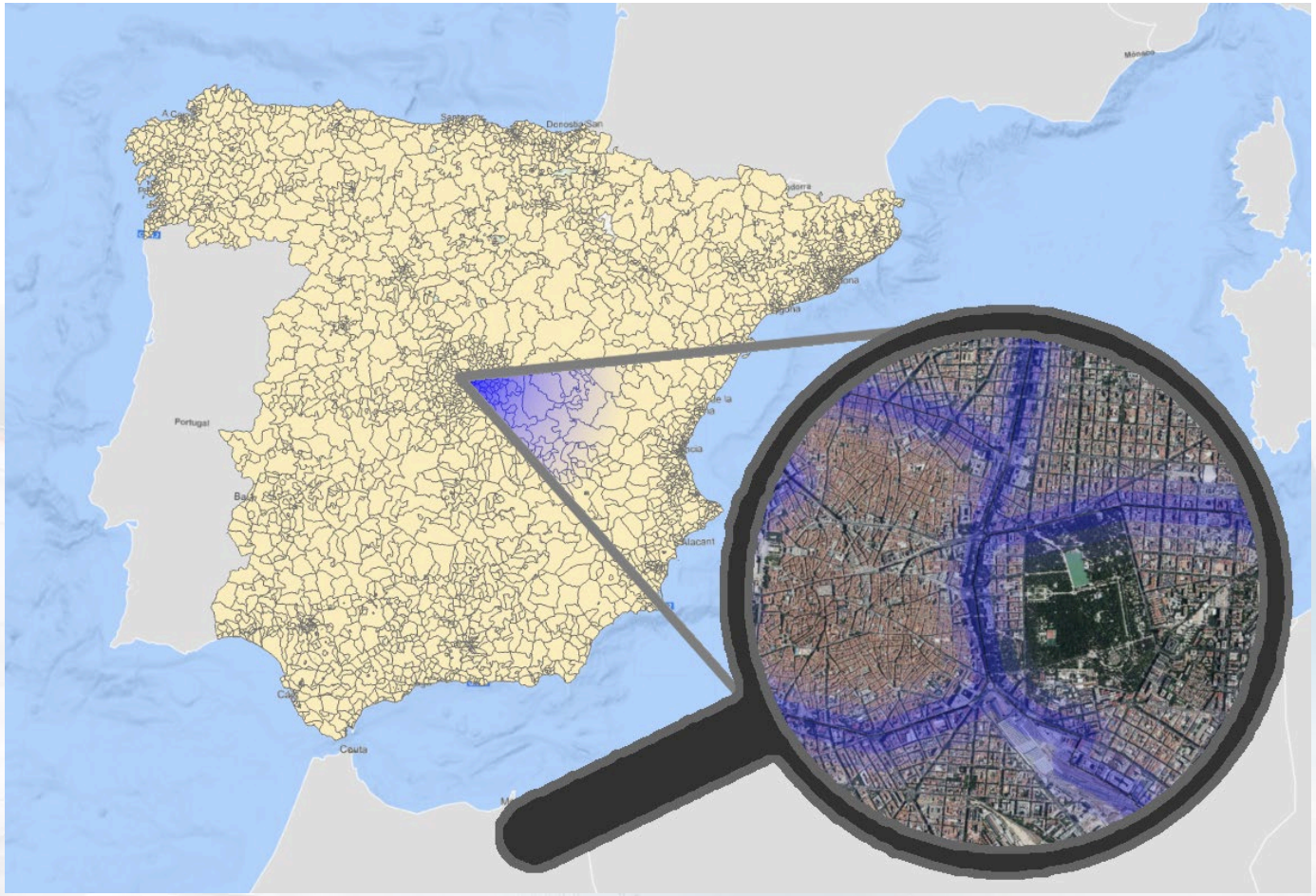
+ ambicious

District level

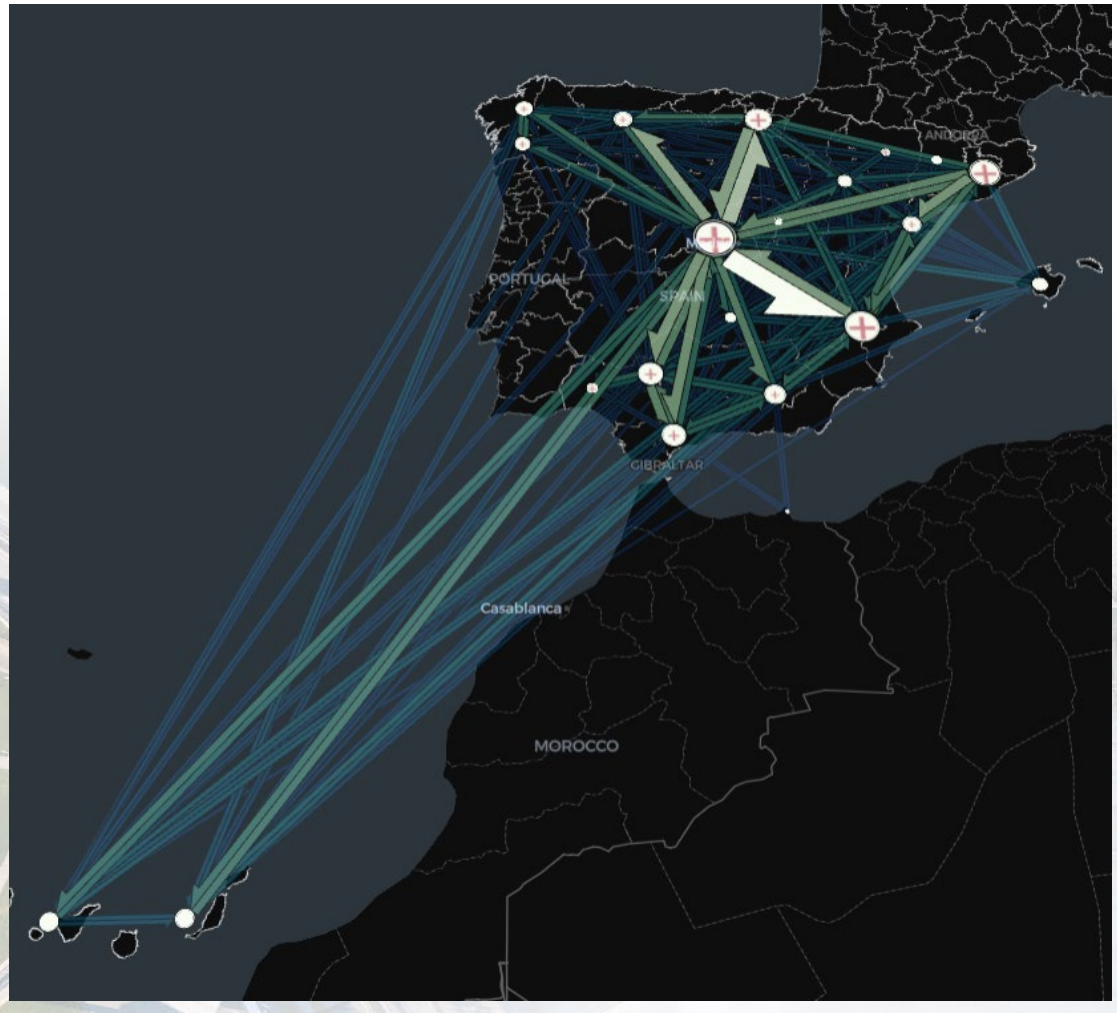
3.743 study areas + foreign countries

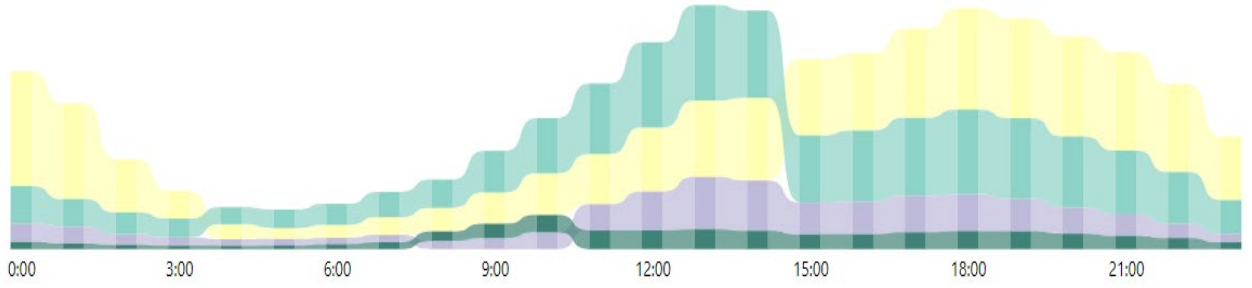
Personal Data Protection Regulation

Study Area population>2500



Monitor Real time Mobility - O/D trips per hour





- By Origin Destination
- By hour
- By distance
- By sociodemographic profile
- By activity (home/work/frequent/not frequent)
- By residence
- **Overnight stays**
- **N º trips per person**

❖ 2022-2024 Study

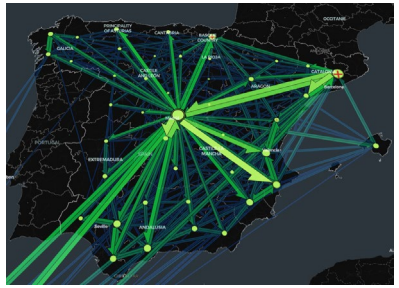
GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE

1) General Mobility:

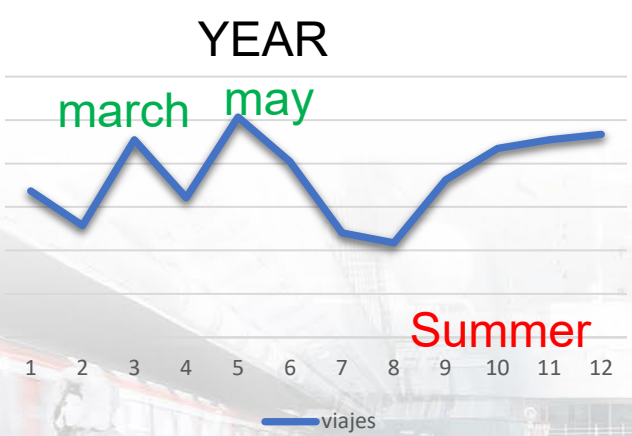
2) Modal split

3) Road Routes

- **Main flows** between regions

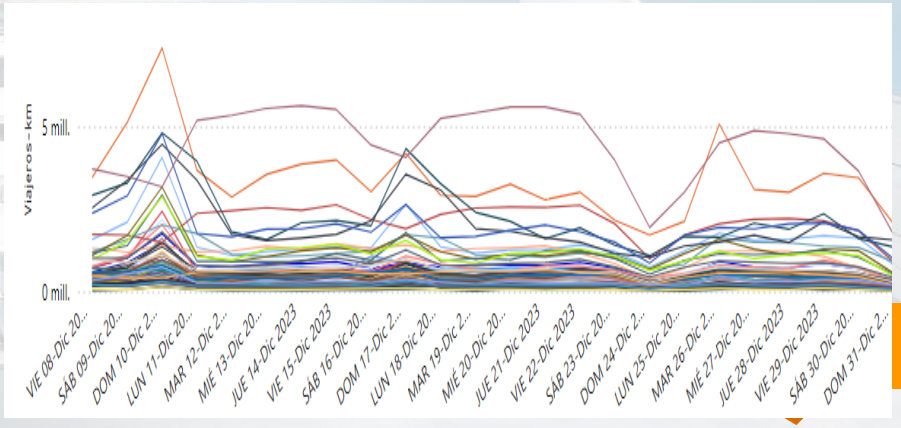


- **Mobility patterns**:

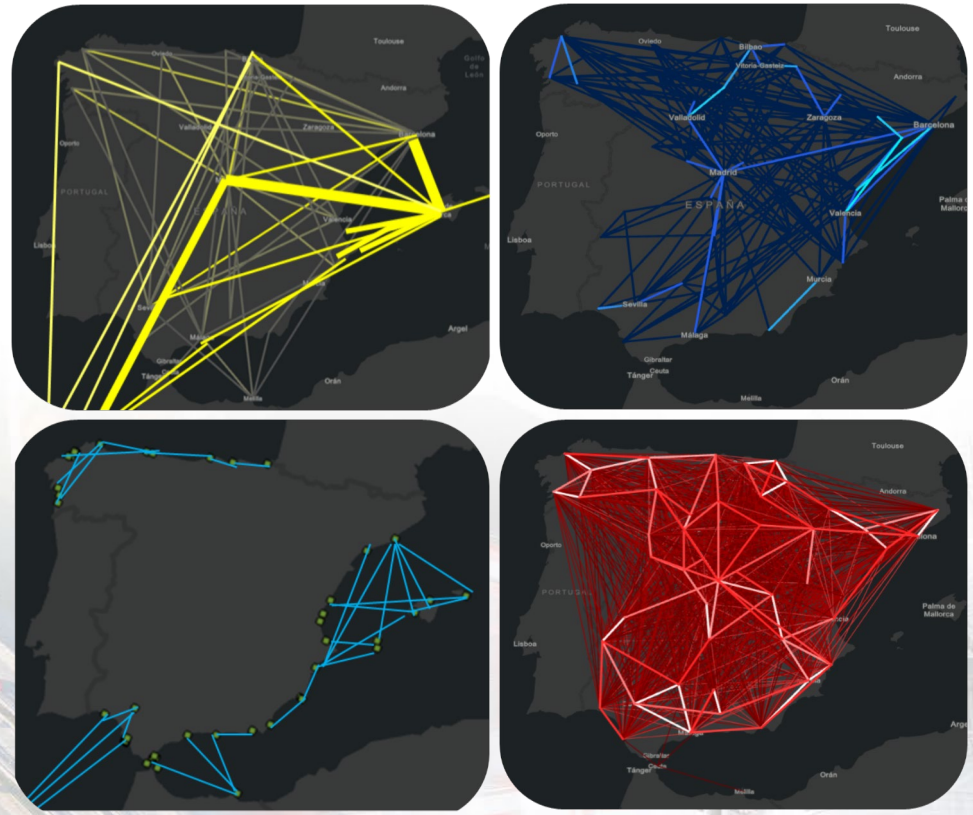


- **Compare** different regions /different dates

- **Analyze** mobility by activity/ distance/ age/ gender/ income..



Trips > 5km



- Smartphones+ external sources
- Trips+Stages matrixes
- 15 days per month

Trips >0 km
Urban modes

*Pilot for 2 cities
+ surveys

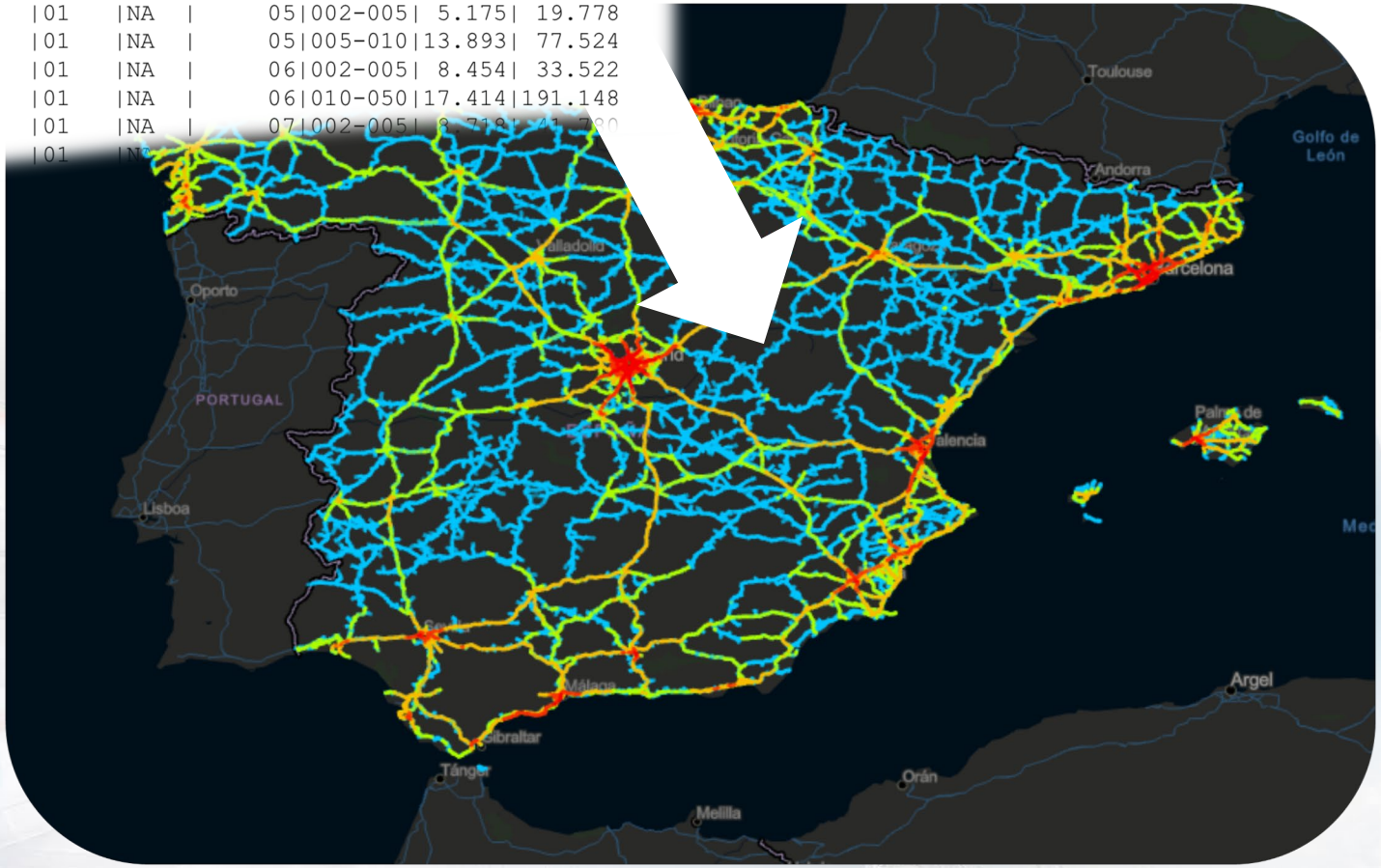
Monthly Trip rate

PT Terminals
study

Cross-border
study

GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE

fecha	origen	destino	act_orig	act_dest	resid	edad	periodo	distanc	viajes	viajes_km
20200501	01001_AM	01001_AM	casa	otros	01	NA	00	002-005	20.693	70.387
20200501	01001_AM	01001_AM	casa	otros	01	NA	01	002-005	12.239	48.258
20200501	01001_AM	01001_AM	casa	otros	01	NA	04	005-010	5.175	41.463
20200501	01001_AM	01001_AM	casa	otros	01	NA	05	002-005	5.175	19.778
20200501	01001_AM	01001_AM	casa	otros	01	NA	05	005-010	13.893	77.524
20200501	01001_AM	01001_AM	casa	otros	01	NA	06	002-005	8.454	33.522
20200501	01001_AM	01001_AM	casa	otros	01	NA	06	010-050	17.414	191.148
20200501	01001_AM	01001_AM	casa	otros	01	NA	07	002-005	[illegible]	
20200501	01001_AM	01001_AM	casa	otros	01	[illegible]				



a) **Routes** for each O/D

For each Route:
- #trips
- Average travel time
- Distance

b) For each **road section**

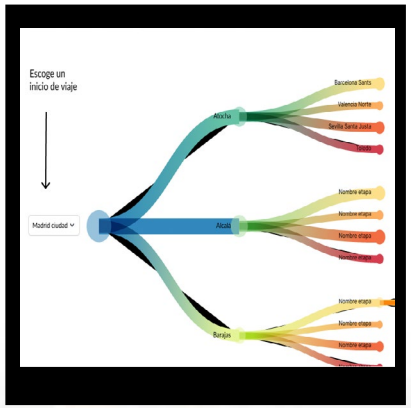
For each section:
- #trips
- ODs
- Distribution of distances

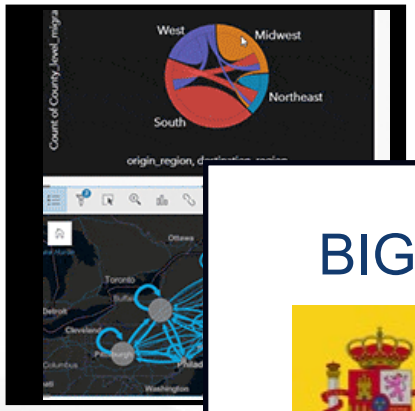
❖ Results:

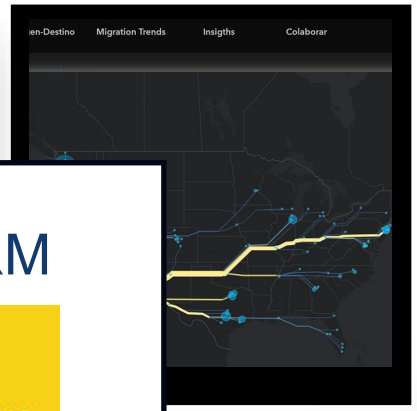
obility

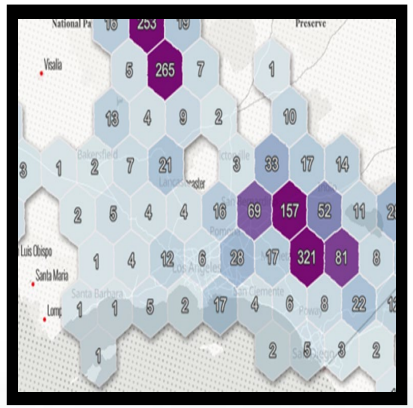
❖ Work in progress..

GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE



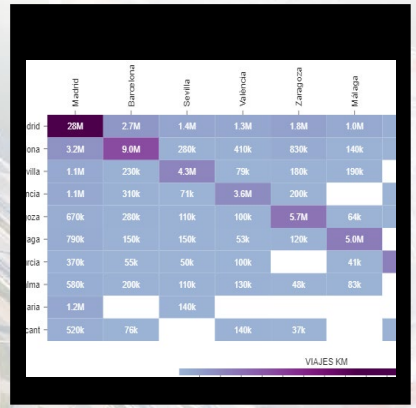


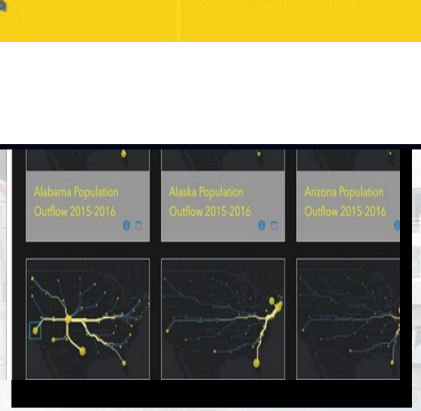




BIGDATA PLATAFORM

GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE





❖ Usage

GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE

Transport planning in A Coruña

Mobility planning and monitoring in Vitoria-Gasteiz

Urban mobility studies

Studies on the evolution of the pandemic and its impact on mobility

Mobility reports for other government bodies

R&D projects at the AEI

Public transport analysis at the Murcia Region

New infrastructure planning

Mobility analysis in the Murcia metropolitan area

Transport Carbon footprint

Digital twins

Mobility Studies in the island of Tenerife

Studies on demand of Multimodal transport

Correlation Analysis between Real Estate price and origin and destination of commutes

Multimodality studies for high-speed train stations

National Transport Model (NTM)

Sustainable Urban Mobility Plans

PMUS

Analysis of traffic flows into Madrid

National and International Research projects

Sustainable and inclusive strategies for the optimization of transport in rural areas

Reports and public communications on mobility in Andalucia

Transport planning in the Balearic Islands

Analysis of high traffic areas

AMB bigdata platform

Flu outbreak models based on mobility patterns

CONCLUSIONS

GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE

- Bigdata applied to telephone records is **very useful and has a lot of potential** but:
  - Limited by the Data Protection regulation - Rural mobility
  - Has biases (children, elderly)
  - **For interregional mobility:** Demand data fusion required for modal inference (and data is not easy to get)
    - Incomplete or non existing data (bus, boat)
    - Not shared data (railways)
  - **For urban mobility:** Surveys data fusion (+demand data) required for urban modes inference
  - **Investment required for** Data validation **and** Data processing
  - The evolution in quality is linked to evolution in technology and data sharing - MOBILITY DATA SPACES

GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE

Sustainable

Innovation

Collaboration

Mobility Data Spaces

GOBIERNO DE ESPAÑA

MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE

THANK YOU VERY MUCH

Tania Gullón Muñoz-Repiso

❖ Challenges

Solutions

- **Intercity** modes discrimination:

  Calibration required: demand data

  Bicycle: ???

- **Urban** modes discrimination:

  Surveys required

  Public modes: Transport Smart Cards

  Active modes: ???

- **Rural** mobility: Area coverage and data protection
- Mobility by **age and gender**: data protection

- **Skewedness:** Children, elderly people…
- **Surveys Vs**: reasons for choice of modality…

- Agreements/Legislation
- Bus and boat: Digitization and improvement of counting techniques
- Bicycle R&D&I: ML GPS, Strava..

Cities:

-Surveys **designed for big data**

-**Collaboration** municipalities, consortiums

-**R&D&I** (GPS, cam metering, ML GPS)

Ad-hoc products

Collaboration with the Data Protection Agency

Technological evolution: 5G

-Surveys **designed for big data**

-R&D&I

-Mobility Data Space