



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



2030 Safe, Sustainable and Connected Mobility Strategy



AXIS 1
Mobility for all



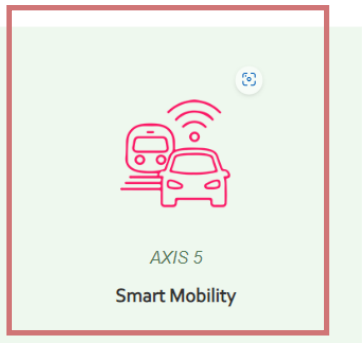
AXIS 2
New Investment Policies



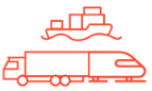
AXIS 3
Secure Mobility



AXIS 4
Low-emission mobility



AXIS 5
Smart Mobility



AXIS 6
Intermodal Logistics Chains



AXIS 7
Connecting Europe and connected to the world



AXIS 8
Social and labour aspects



AXIS 9
Evolution and transformation of MITMA

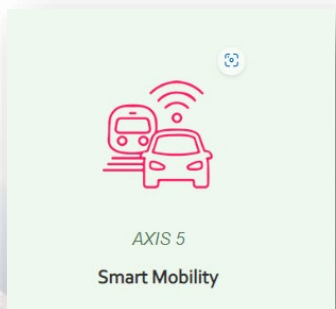
5.1.2. Analysis of mobility flows at the national level and creation of the national transport model



es.movilidad

2030 Safe, Sustainable and Connected Mobility Strategy

TRANSPORT INFRASTRUCTURES



TRANSPORTATION SERVICES



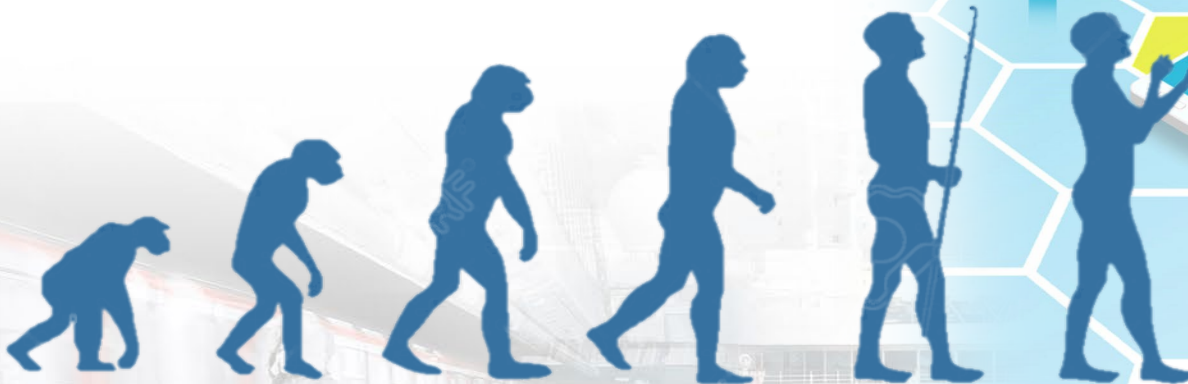
MOBILITY



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



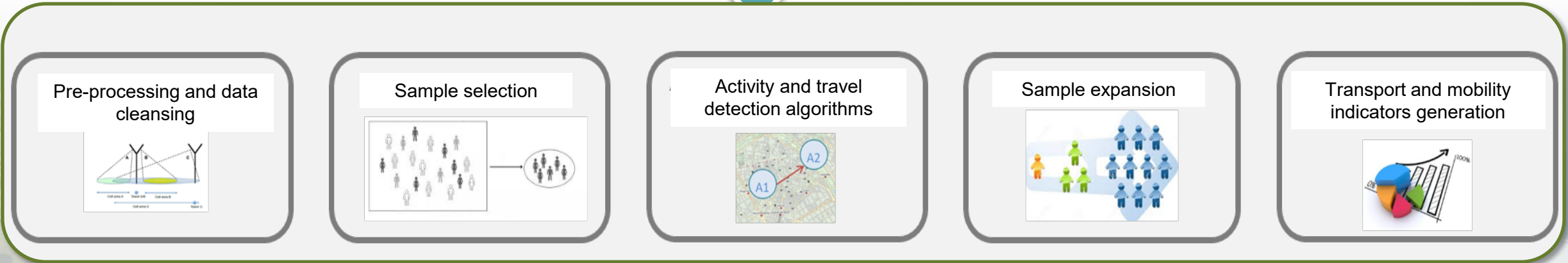
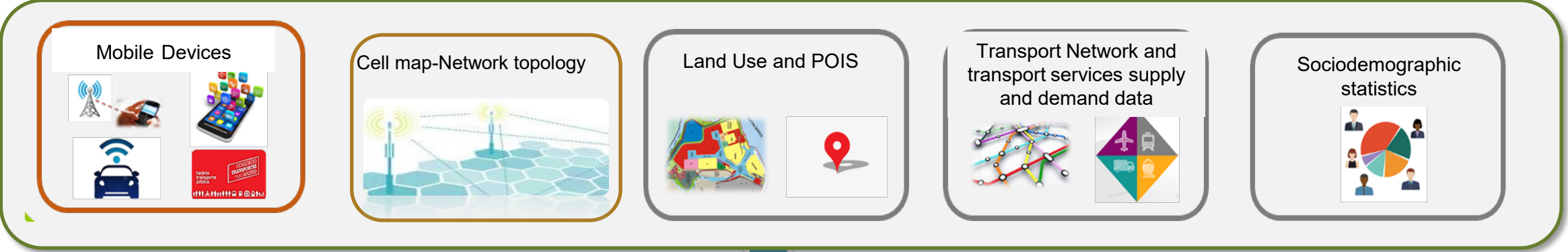
Origin Activity

Destination Activity

Tpt. Service data: schedules, stops

Demand data

❖ Workflow (1/2)





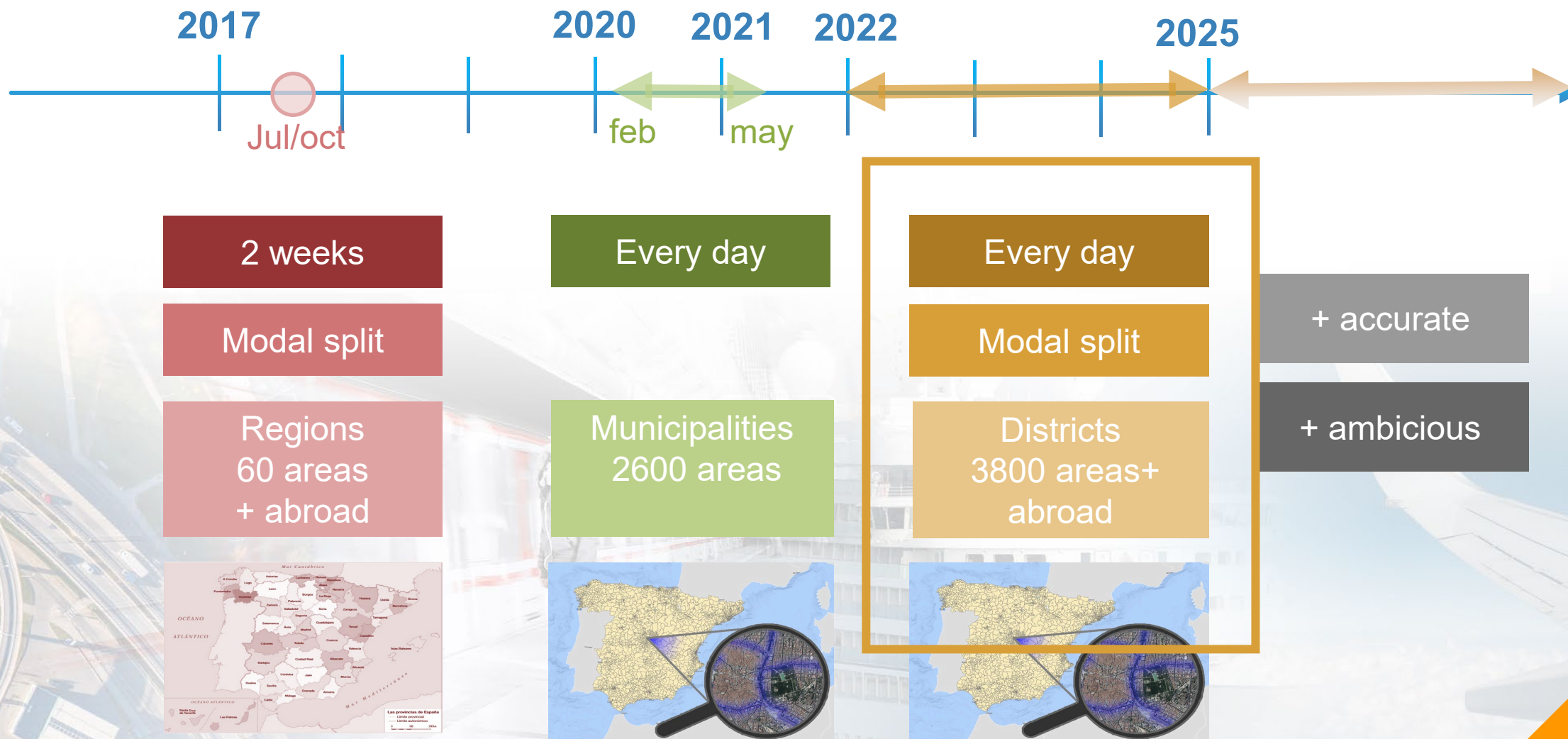
STUDIES AND RESULTS

BIGDATA Studies :



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❖ 2022-2024 Study



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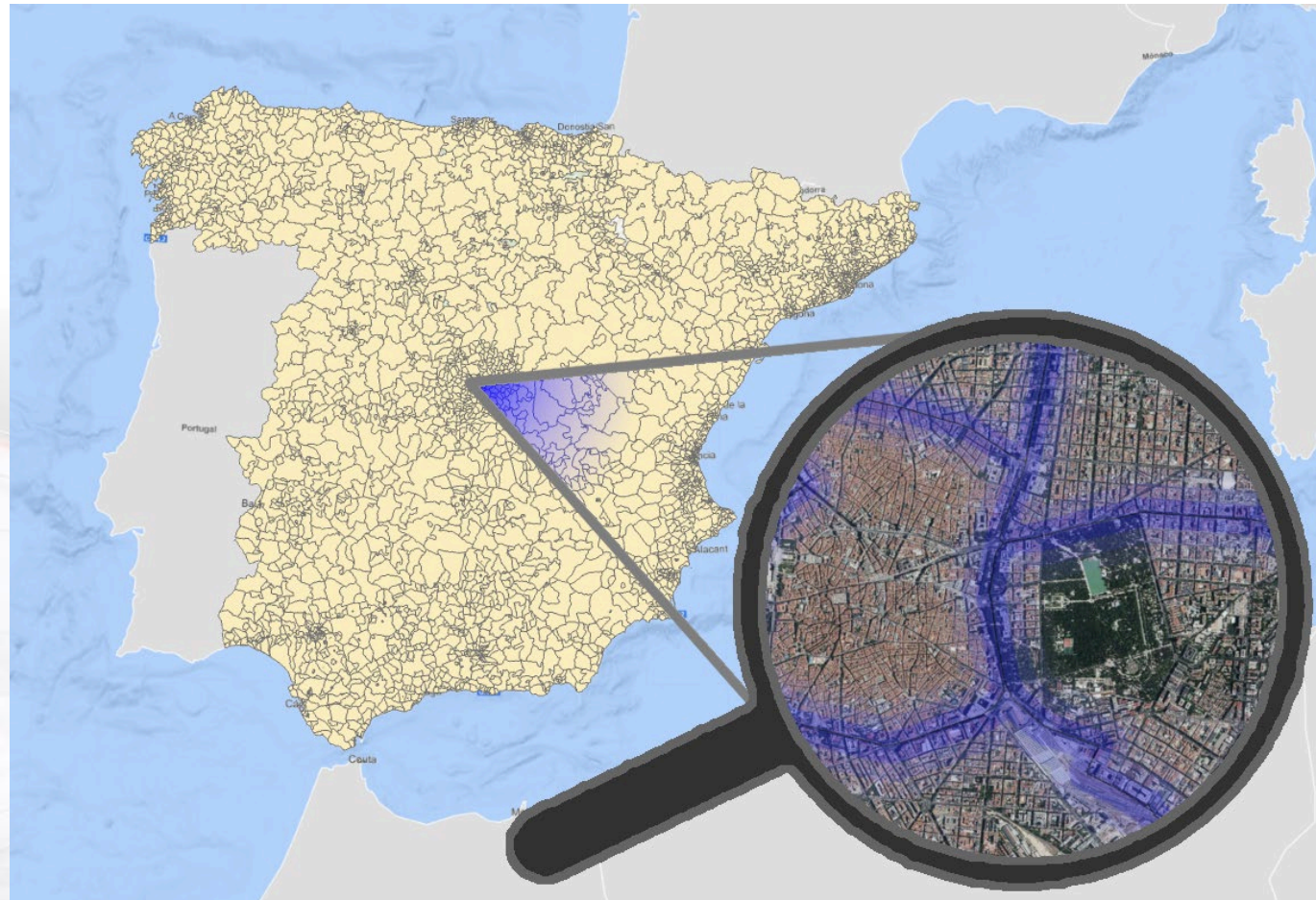
1) General Mobility

2) Modal split

3) Road Routes

District level

3.743 study areas + foreign countries



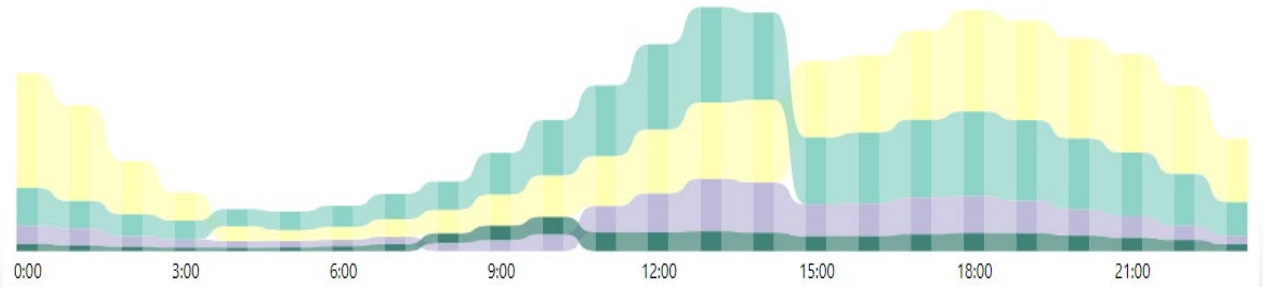
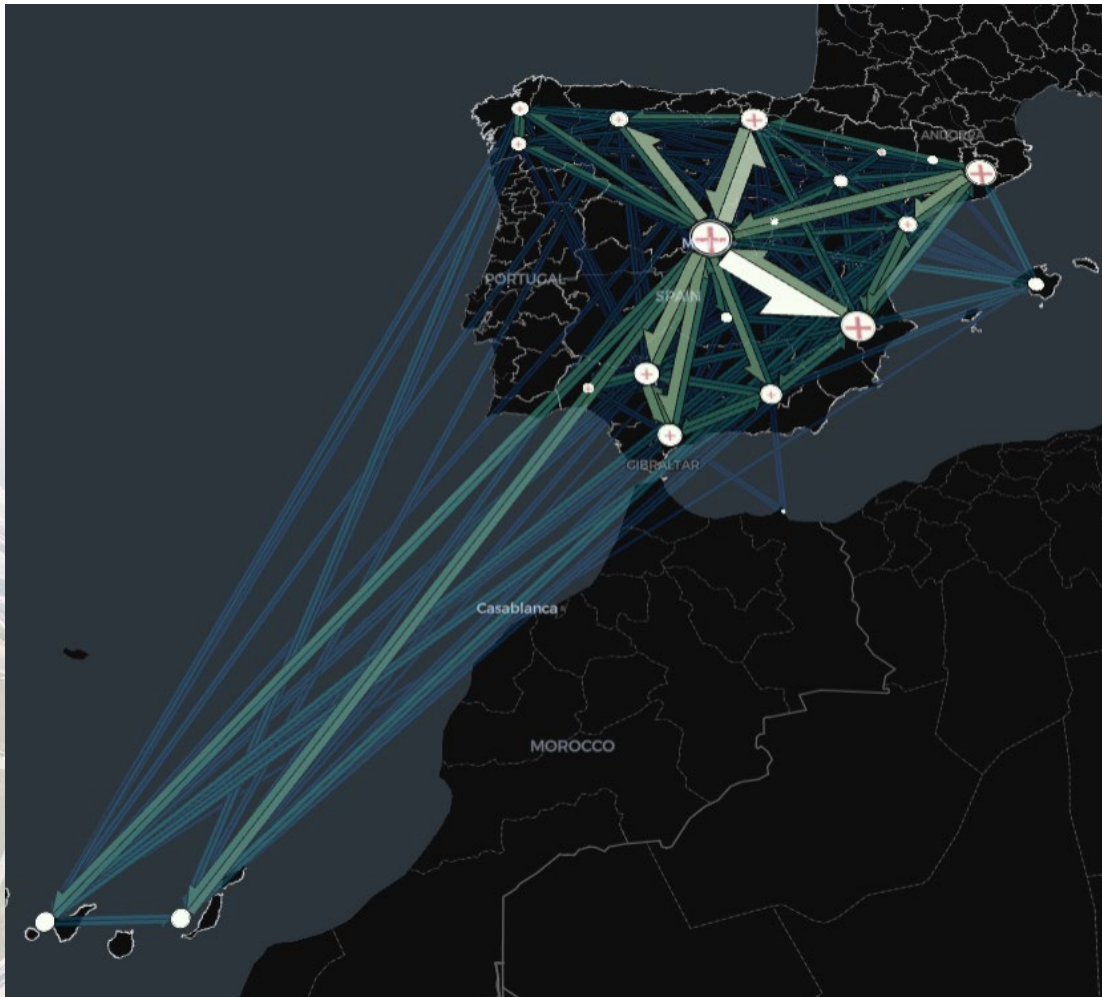
Personal Data Protection
Regulation
Study Area
population > 2500

1) General Mobility:

2) Modal split

3) Road Routes

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 ° trips per person**

❖ 2022-2024 Study



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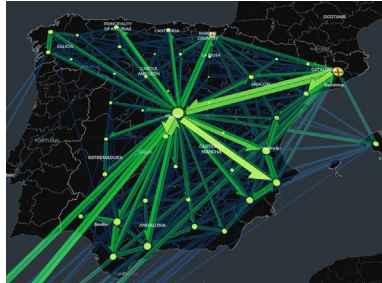
MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE

1) General Mobility:

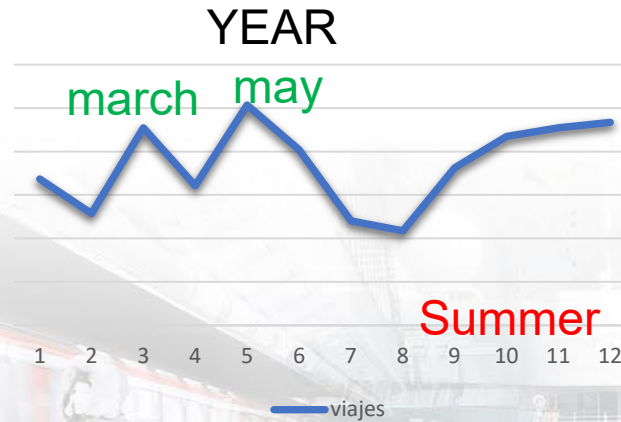
2) Modal split

3) Road Routes

- Main flows between regions



- Mobility patterns:



WEEK

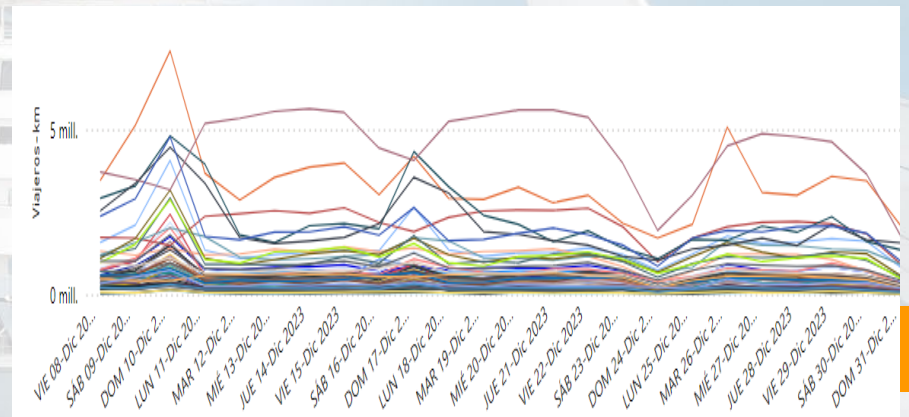


DAY



- Compare different regions /different dates

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



1) General Mobility

2) Modal split

3) Road Routes

Trips > 5km



Trips > 0 km
Urban modes

*Pilot for 2 cities
+ surveys



Monthly Trip rate



PT Terminals study



Cross-border study



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

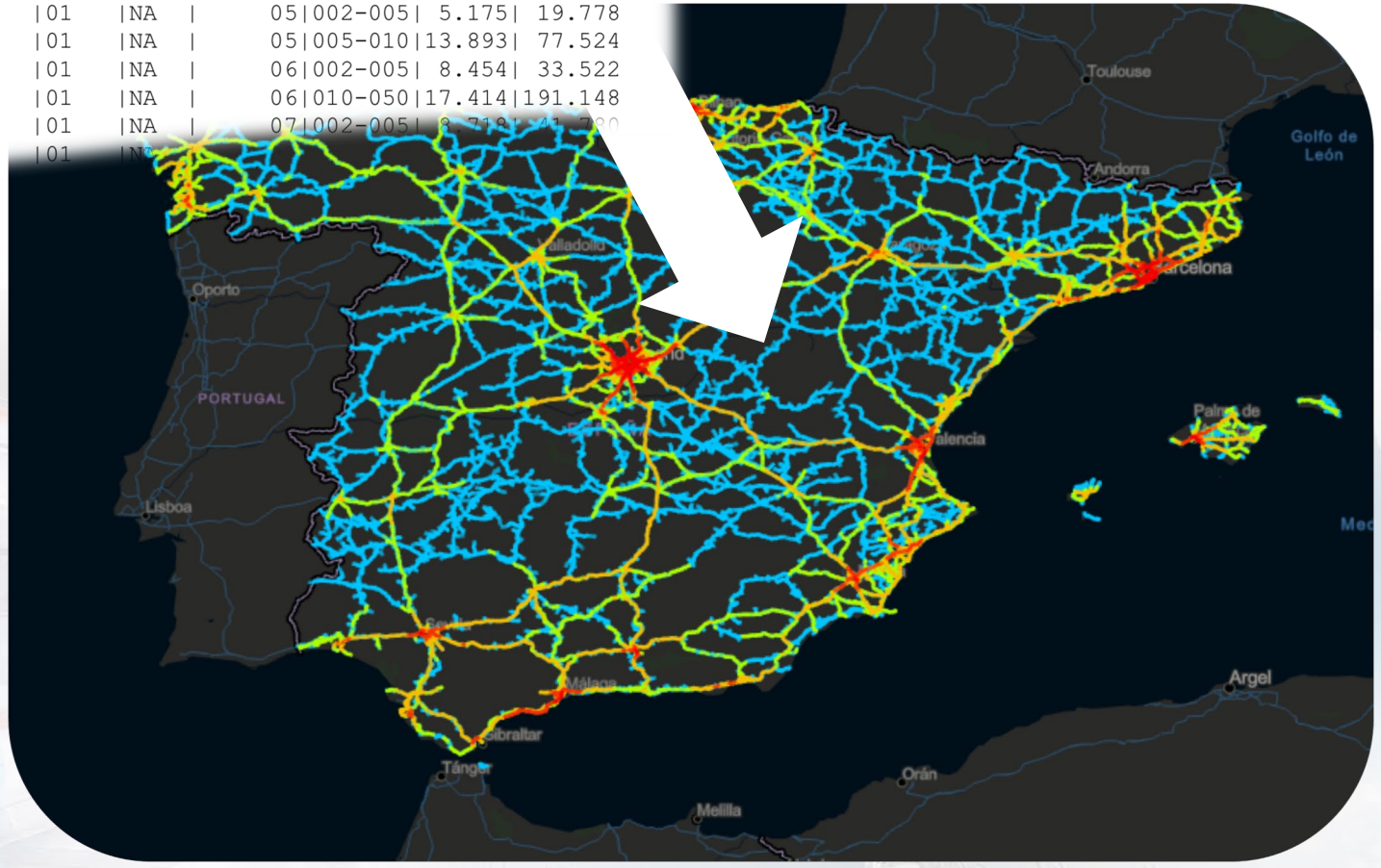
❖ 2022-2024 Study

1) General Mobility

2) Modal split

3) Road routes

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	8.718	34.500	
20200501	01001_AM	01001_AM	casa	otros	01	NA	07 010-050	17.414	191.148	



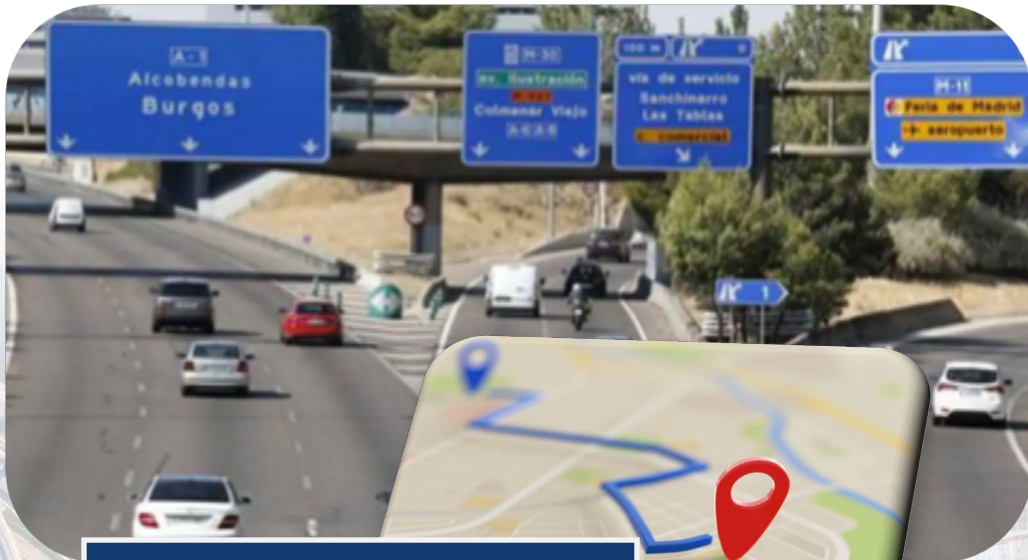
1) General Mobility

2) Modal split

3) Road routes

a) Routes for each O/D

b) For each road section



For each Route:

- #trips
- Average travel time
- Distance



For each section:

- #trips
- ODs
- Distribution of distances

Results:

mobility

PANEL INTERACTIVO - MOVILIDAD DIARIA

Fecha: 23/05/2023 | Comunidad: Todas

Movilidad total
137.845.965 Viajes
↓ -3,43 % respecto a la semana anterior

Cada Ciudadano ha realizado
2,91 viajes al día | 25 Km. al día

14:00 Hora punta | 03:00 Hora valle
*período de inicio de viaje con mayor número de viajes

320,99 mil Viajes internacionales
3,96 mil Viajes intraprovinciales
133,57 mil Viajes intraprovinciales

% Viajes por CC.AA. (Origen) respecto del total

% Viajes por Provincias (Origen) respecto del total

Principales flujos mayores a 50km

MOBILIDAD AUTONÓMICA Residencia

23/12/2022 | 18/01/2023

Comunidad de origen: Aragón

Comunidad de destino: Selección múltiple

Viajes diarios

Viajes por hora de salida

Viajeros-km por residencia

Open Data Mobility

Mobility data in Spain for the period from January 2022 onwards is available in this shared space. The Ministry of Transport is committed to open data with the aim of promoting transparency, efficiency, citizen participation and economic development, since data can be consulted, enriched with new data, applications and services and generate new business.

- The positioning of mobile phones has been used as the main source of data, with compliance with Organic Law 3/2018, of 5 December, on the Protection of Personal Data and guarantee of digital rights being an essential condition.
- The content is structured in folders according to the type of study and in subfolders by zoning (municipal, districts and GAUS). For each zoning there is a folder for each type of product and another for metadata related to data quality. There is also another folder with the zoning used and its associated information.

The project is divided into 3 types of studies:

Basic Studies, where the mobility of residents in Spain is analysed on a daily basis at the census district level. As a result, the matrices of trips, overnight stays and people are available. The data are published on a monthly basis, around the 15th of the following month.

Complete studies, which analyses, for one week a month and singular days, the mobility of the population present in Spain (residents and foreign visitors) differentiating by mode of transport and other indicators of interest. These studies will begin to be published from January 2024.

Road Routes, which analyses, for two time periods of the year, the routes followed in road journeys. Results will be available in early 2024.

The Ministry's Open Data License can be consulted at this link.

To consult data from 2020 and 2021, access this link.

Explorador: mitma-movilidad-v2

Archivo	Fecha	Tamaño
estudios_basicos		
estudios_completos		
zonificacion		
LICENCIA de datos abiertos del MITMA 20201203.pdf	2022-12-10 14:32:07	156 KB
README - formato ficheros movilidad MITMA 20201228.pdf	2022-12-21 15:59:12	170 KB

Viewing Results

- Mobility Overview
- Regional mobility
- Provincial mobility
- Municipal mobility

❖ Usage



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Transport planning in A Coruña

R&D projects at the AEI

Public transport analysis at the Murcia Region

Digital twins

Multimodality studies for high-speed train stations

National Transport Model (NTM)

Analysis of traffic flows into Madrid

Transport planning in the Balearic Islands

Analysis of high traffic areas

AMB bigdata platform

National and International Research projects

Mobility planning and monitoring in Vitoria-Gasteiz

New infrastructure planning

Urban mobility studies

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

Mobility reports for other government bodies

Mobility analysis in the Murcia metropolitan area

Transport Carbon footprint

Studies on demand of Multimodal transport

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

Sustainable Urban Mobility Plans

PMUS

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

Reports and public communications on mobility in Andalusia

Flu outbreak models based on mobility patterns



- 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**



Innovation

Sustainable

Collaboration

Mobility Data Spaces



THANK YOU VERY MUCH

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❖ Challenges

Solutions



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• Intercity modes discrimination:

 **Calibration** required: demand data

 Bicycle: ???

• Urban modes discrimination:

Surveys required

 Public modes: Transport Smart Cards

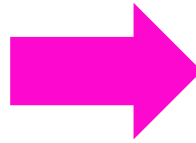
 Active modes: ???

• 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**