Urban mobility patterns using big data

Viviana Muñoz - vmunoz@mtt.gob.cl
Big Data in Transportation Area

Intelligent Transportation Systems
Ministerio de Transportes y Telecomunicaciones de Chile
January 2021

Agenda

1.- Context

2.- The line of work in urban mobility patterns

3.- Main projects

● Digital Capture of Mobility (HTS Remote)

● OD trips estimation trough MNO data

4.- The new model for Household Travel Surveys → "Digital HTS"

1.- Context

- Urban mobility patterns based on HTS (Household Travel Survey)

- Data gathering applied in 26 cities / Every 10 years

- CAPI Methodology (face to face)

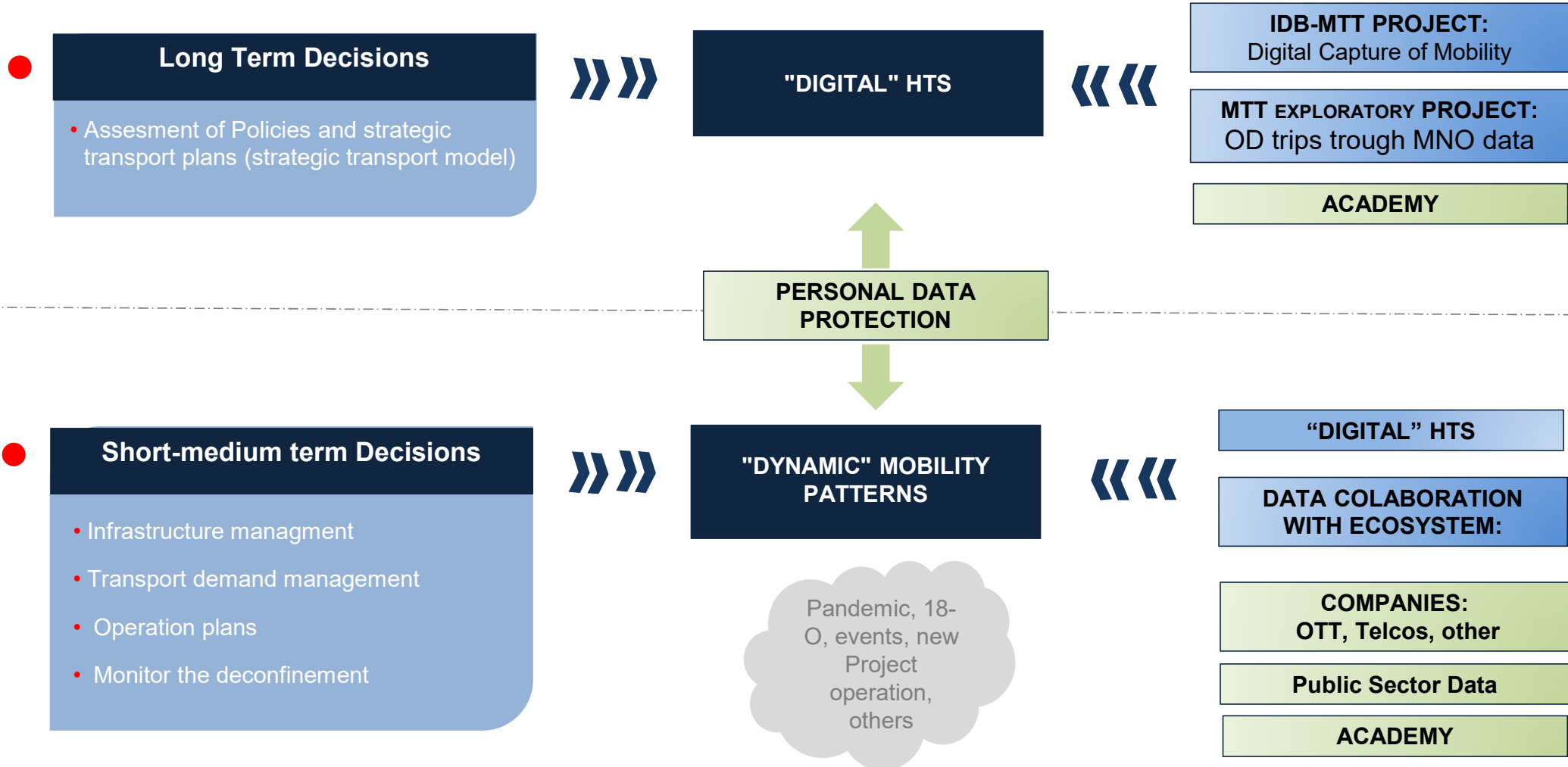- Data gathering: increasingly complex, more time consuming, and more expensive.
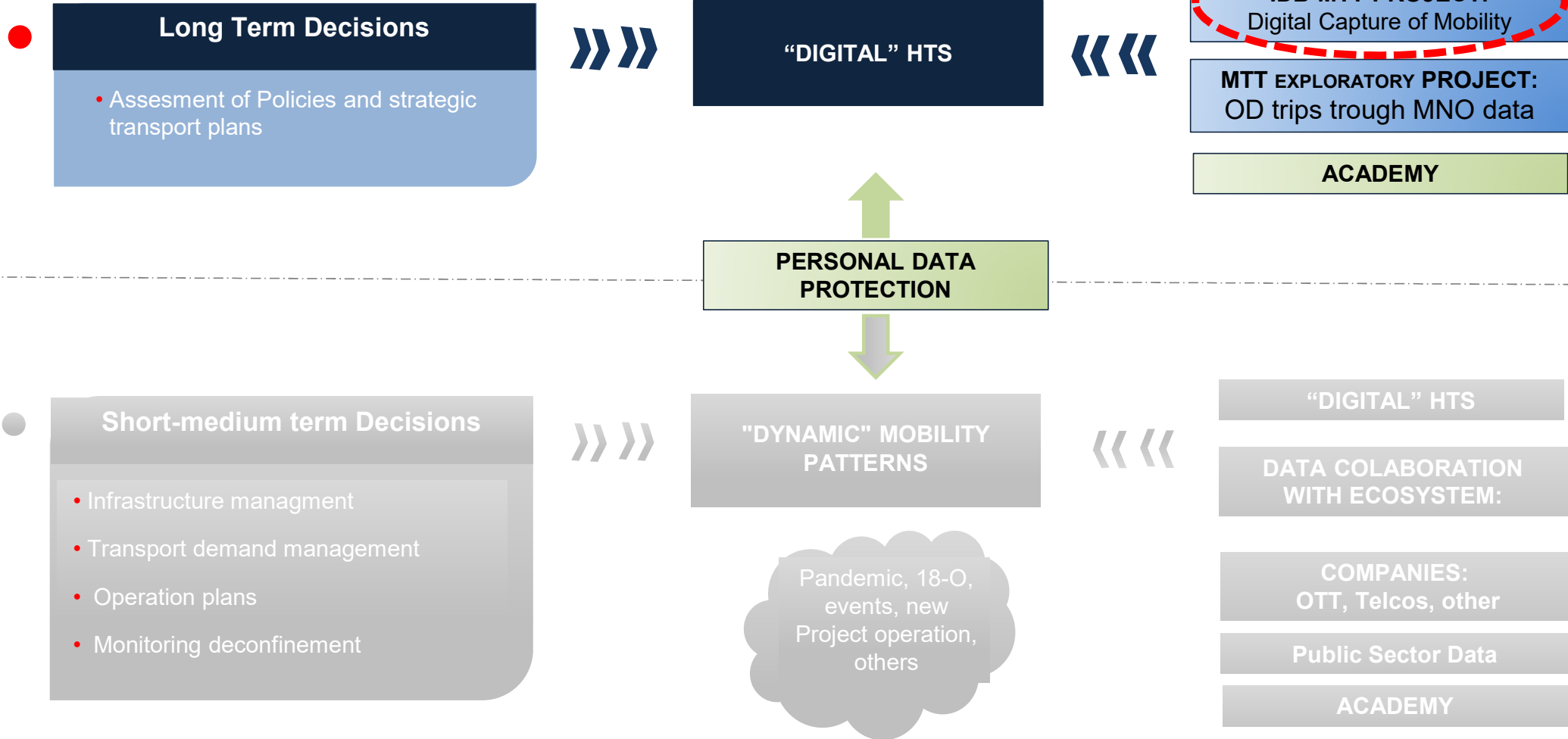
⬇

| Modernize the currently HTS methodology |

⬇

| Line of work in urban mobility patterns using big data |

Long Term Decisions

• Assesment of Policies and strategic transport plans (strategic transport model)

"DIGITAL" HTS

IDB-MTT PROJECT:
Digital Capture of Mobility

MTT EXPLORATORY PROJECT:
OD trips trough MNO data

ACADEMY

PERSONAL DATA PROTECTION

Short-medium term Decisions

• Infrastructure managment

• Transport demand management

• Operation plans

• Monitor the deconfinement

"DYNAMIC" MOBILITY PATTERNS

Pandemic, 18-O, events, new Project operation, others

"DIGITAL" HTS

DATA COLABORATION WITH ECOSYSTEM:

COMPANIES:
OTT, Telcos, other

Public Sector Data

ACADEMY

Long Term Decisions

• Assesment of Policies and strategic transport plans

≫ ≫

"DIGITAL" HTS

≪ ≪

IDB-MTT PROJECT:
Digital Capture of Mobility

MTT EXPLORATORY PROJECT:
OD trips trough MNO data

ACADEMY

PERSONAL DATA PROTECTION

Short-medium term Decisions

• Infrastructure managment

• Transport demand management

• Operation plans

• Monitoring deconfinement

≫ ≫

"DYNAMIC" MOBILITY PATTERNS

Pandemic, 18-O, events, new Project operation, others

≪ ≪

"DIGITAL" HTS

DATA COLABORATION WITH ECOSYSTEM:

COMPANIES:
OTT, Telcos, other

Public Sector Data

ACADEMY

Principal Aim

- HTS Modernization through collecting households travel data **remotly,** trough technological devices.
- Reducing time and cost of their application
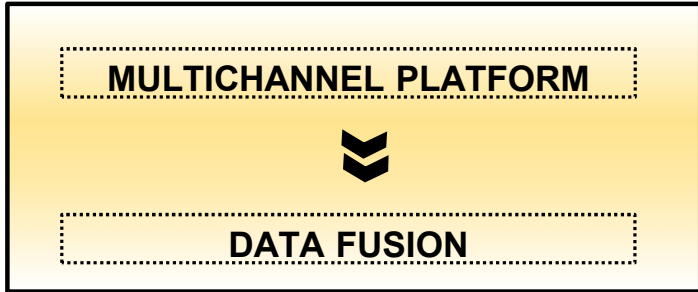- Making the households reporting easier.

RESTRICTIONS

Subject to:

- Current modeling approach *(household based)*
- Representative sample of households *(random selection)*
- One face-to-face visit (Set household members, *telephone N°, consent)*

So far….

Remote Tools

CHALLENGES

- Data fusion (biases)
- Incentives
- Local adaptation

OD-App

Mobile app
(principal tool)

MULTICHANNEL PLATFORM

DATA FUSION

CAWI
(Computer-Assisted Web Interview)

Web page

PRODUCTS

- New HTS Methodology
- **Scale up** in Rancagua City

CATI
(Computer-Assisted Telephones Interview)

Voice call

Complementary tools

New Methodology for HTS

Remote Tools

CHALLENGES

- Data fusion (biases)
- Incentives
- Local adaptation

MULTICHANNEL PLATFORM

⌄⌄

DATA FUSION

PHASE I

OD-App

Mobile app

CAWI
(Computer-Assisted Web Interview)

Web page

PRODUCTS

- New HTS Methodology
- **Scale up** in Rancagua City

CATI
(Computer-Assisted Telephones Interview)

Voice call

New Methodology for HTS

Remote Tools

CHALLENGES

- Data fusion (biases)
- Incentives
- Local adaptation

MULTICHANNEL PLATFORM

⌄⌄

DATA FUSION

PHASE II

OD-App

Mobile app
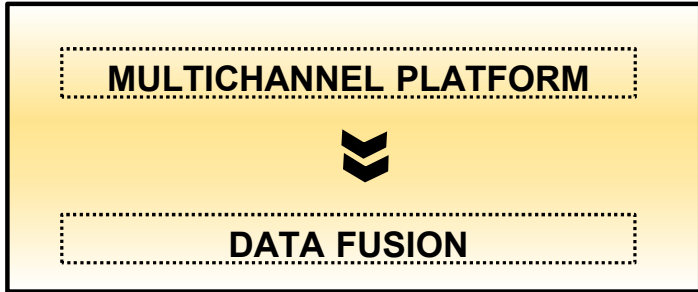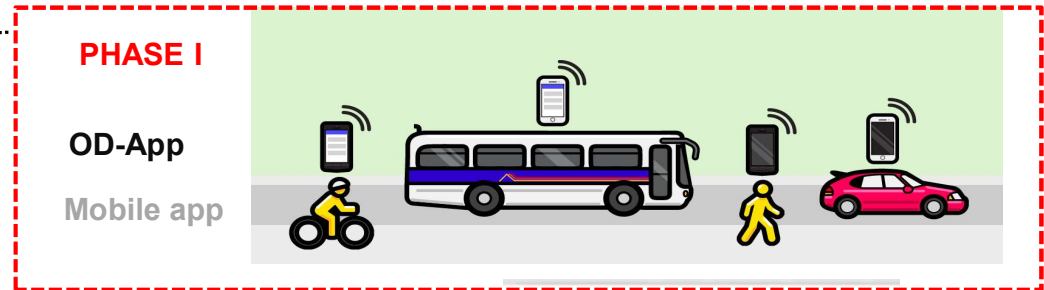
CAWI
(Computer-Assisted Web Interview)

Web page

CATI
(Computer-Assisted Telephones Interview)

Voice call
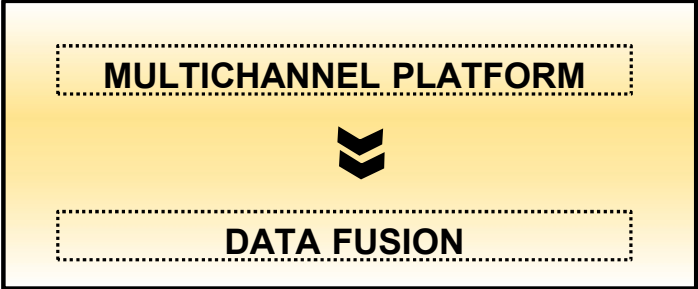
PRODUCTS

- New HTS Methodology
- Scale up in **Rancagua City**
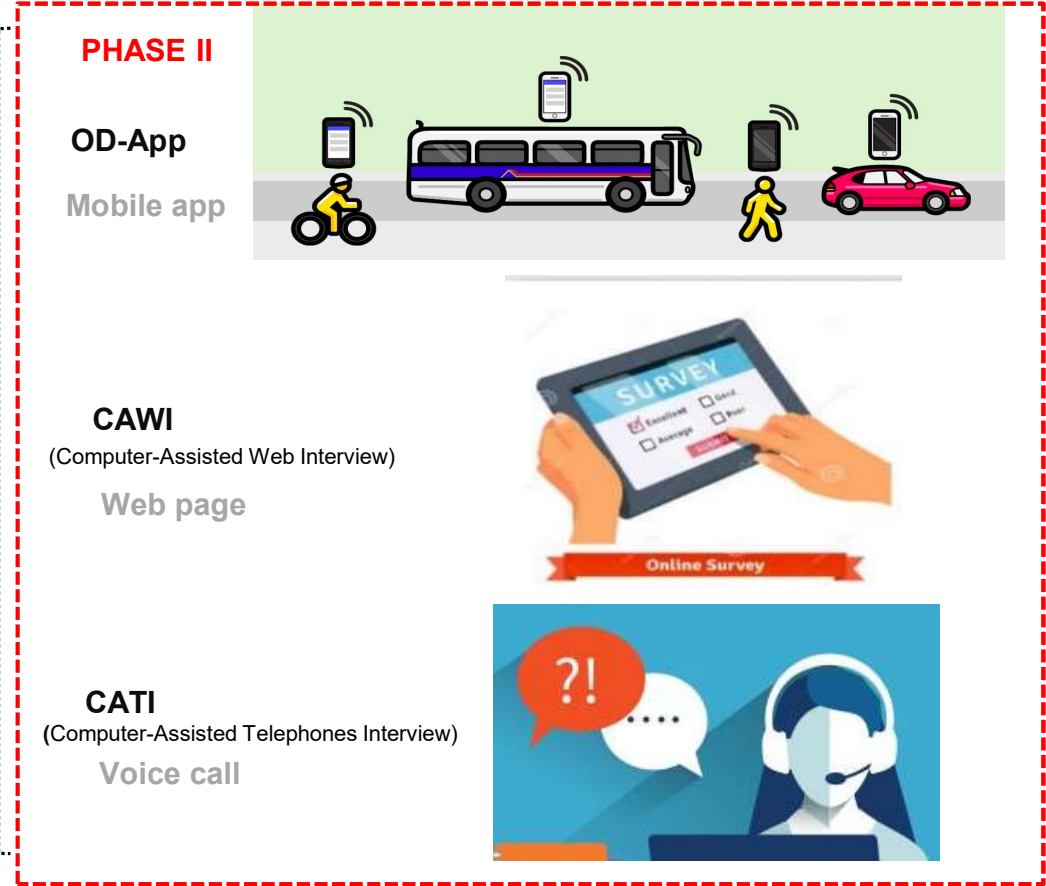
New Methodology for HTS

- Phase 1 / Pilot 1: X-ING App / 200 participants / Not random, leaders of households.

Diary of trips/activities:

- Line of time with paths of trips and activities

- Features inferred by the App.

- Validation/correction: ex-post by the participant

But….we see some challenges so far:

- Inferred but not validated data? (low rate)

- Learning curve (complexity)

- Practical issues (battery, notifications)

- Incentives to download and validate
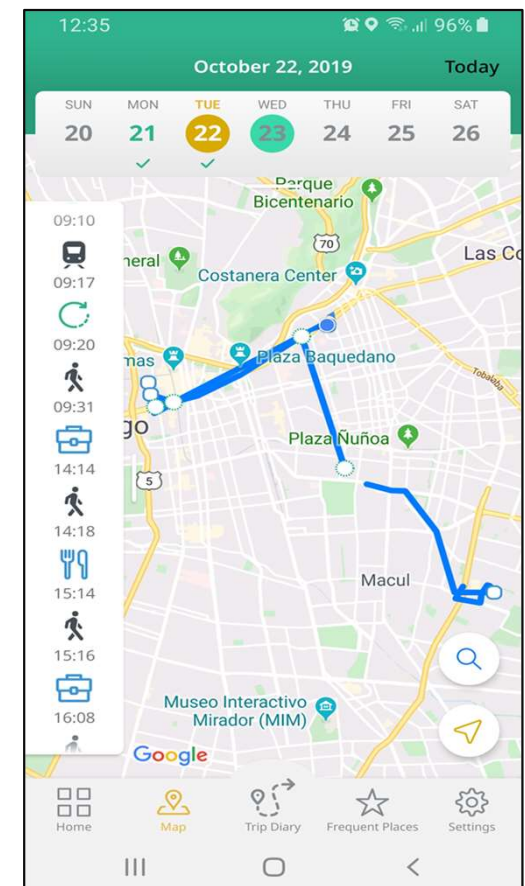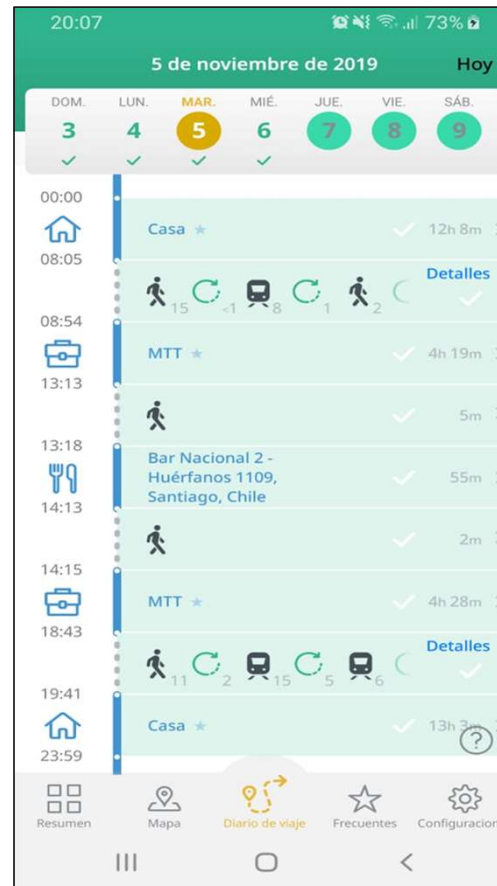
Fuente: Aplicación X-ING , Report N°1 Study «Digital Capture of Mobility – Fase I»

1.- The Line of work in urban mobility patterns

Long Term Decisions

- Assesment of Policies and strategic transport plans

"DIGITAL" HTS

IDB-MTT PROJECT:
Digital Capture of Mobility

MTT EXPLORATORY PROJECT:
OD trips trough MNO data

ACADEMY

PERSONAL DATA PROTECTION

Short-medium term Decisions

- Infrastructure managment
- Transport demand management
- Operation plans
- Monitoring deconfinement

"DYNAMIC" MOBILITY PATTERNS

Pandemic, 18-O, events, new Project operation, others

"DIGITAL" HTS

COLABORATION WITH THE ECOSYSTEM:

COMPANIES:
OTT, Telcos, other

Public Sector Data

ACADEMY

The real potencial of MNO data for estimating urban trips (Rancagua City)

MNO: Mobile Network Operator

WHAT?	HOW?

Anonimized data → Control Plane
DB 37 days / 2019

- **EDA:**
  Temporal / spatial distribution of hits
  Phantom trips, others

Testing Algorithm → Identify critical issues
(any algorithm)

- Zoning system Redundancy signals/Antenna Features
- Homezone Criteria (Resident/NR definition, impact on size of the resident sample)
- Dwell definition (its impact on trips)

Field Test 0 → 5 deanonymized mobiles

- Compare Raw antenna det. vs. GPS / Journey, Dwell
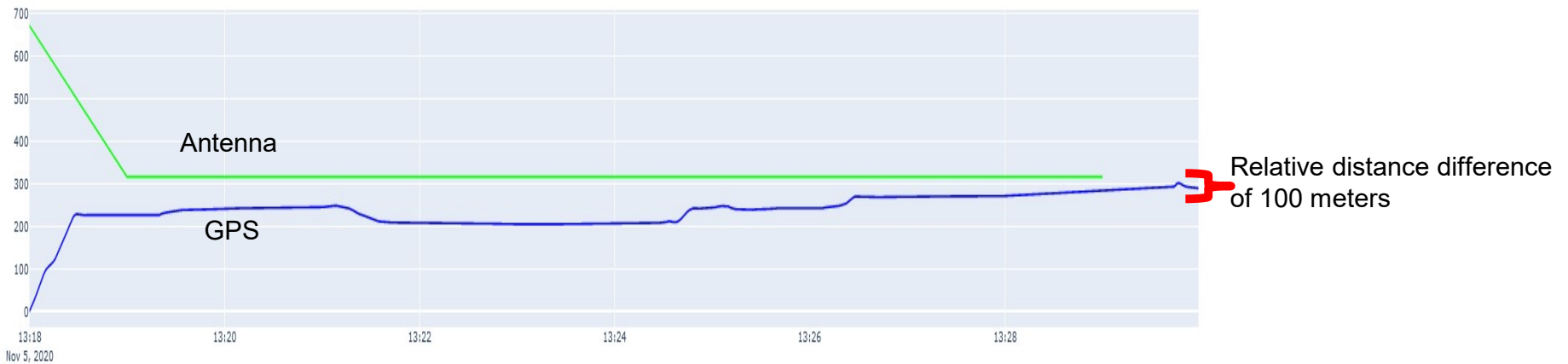- Algorithm estimation vs. GPS / Journey, Dwell

- Example of Dwell: GPS vs. Antenna detection (raw data)
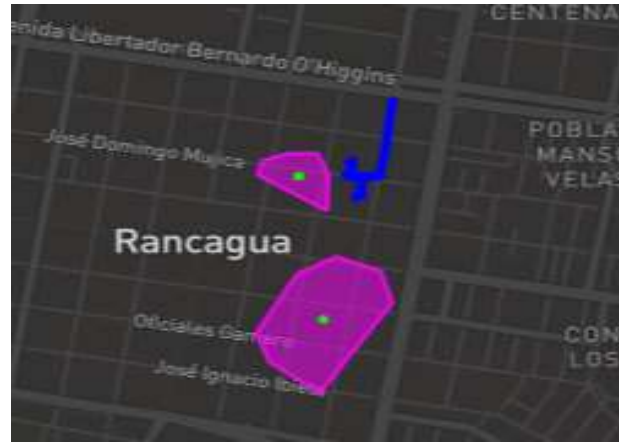
GPS

Antenna

BLUE: Hit GPS
GREEN: Antenna projection (raw)
Purple: Zoning system (MNO)

Antenna

GPS

Relative distance difference of 100 meters

13:18
Nov 5, 2020
13:20   13:22   13:24   13:26   13:28

- **Example of Dwell: GPS vs. Antenna detection (pre-algorithm)**

GPS

Antenna

BLUE: Hit GPS
GREEN: Antenna projection (raw)
Purple: Zoning system (MNO)

Antenna

Velocity <= 60 [km/hr]

GPS
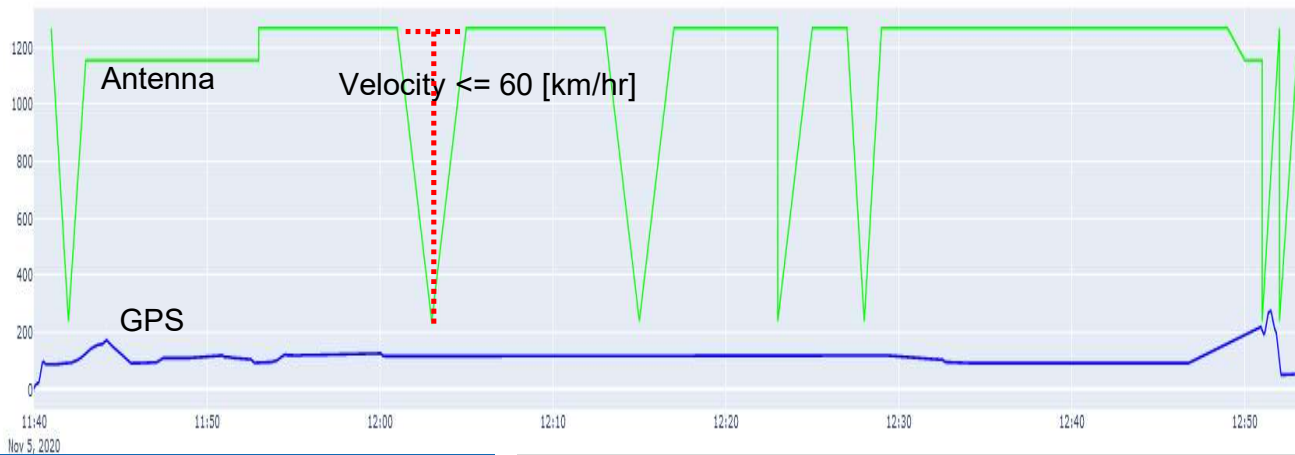
Relative distance difference of 1km with real location in dwell time

Nov 5, 2020

- Trip estimation in field test 0 - Post algorithm:

Number of trips estimated by the algorithm, depending on the dwell

Dwell	Trips detection			
	5 min	10 min	15 min	30 min
Antennas	89	64	39	9
GPS	72	54	38	17
variation	24%	19%	3%	-47%

Work in progress…

Long Term Decisions

• Assesment of Policies and strategic transport plans

»» »

"DIGITAL" HTS

«« ««

IDB-MTT PROJECT:
Digital Capture of Mobility

MTT EXPLORATORY PROJECT:
OD trips trough MNO data

ACADEMY

PERSONAL DATA PROTECTION

Short-medium term Decisions

• Infrastructure managment

• Transport demand management

• Operation plans

• Monitoring deconfinement

»» ««

"DYNAMIC" MOBILITY PATTERNS

«« ««

Pandemic, 18-O, events, new Project operation, others

"DIGITAL" HTS

DATA COLABORATION WITH ECOSYSTEM:

COMPANIES:
OTT, Telcos, other

Public Sector Data

ACADEMY

FIELD WORK

Back Office/Face to Face Contact

- **Sample selection (smaller?)**
- **Consent**
- **Phone N°**
        (One visit)

COMP. DATA

- **Smartcard data**
- **Vehicule counters**
- **Others**

MULTICHANNEL PLATFORM

HOUSEHOLD / MEMBERS / TRIPS

App + CAWI + CATI

Every 5 years,

or less

MNO DATA

OD Trips

- **Depuration**
- **Correction / Expansion**
- **Trips "compatible" with Multichannel platform**

DATA FUSION / VISUALIZATION

DIGITAL HTS

Thanks!

Viviana Muñoz - vmunoz@mtt.gob.cl

Ministerio de Transportes y Telecomunicaciones
Gobierno de Chile