11TH WORLD CONGRESS OF HIGH-SPEED RAIL
Marrakech, 7-10 MARCH 2023

Mobile data analytics in Italian HSR stations

Lorenzo Vannacci, Mario Tartaglia and Luigi Galieni
FS Research Centre, Ferrovie dello Stato Italiane, Italy
6.3 Station / Capacity
ITALIAN HIGH SPEED NETWORK EVOLUTION

- **First** Pendolino (tilting) train for public service between Rome and Ancona in 1976,
- **First HSR section in Europe** (1977)
- Europe **first** competitor on open access services from 2012
- **European** Brand

**Key Dates**
- 1977 Firenze – Roma 1st section
- 1976 First Pendolino (tilting) train for public service between Rome and Ancona
- 2012 European first competitor on open access services from 2012

**Network Milestones**
- 1992 Firenze-Roma
- 2005 Dec Roma-Napoli
- 2006 Feb Torino-Novara
- 2007 Mar Padova-Mestre
- 2008 Dec Milano-Bologna
- 2008 Jun Napoli-Salerno
- 2009 Dec Bologna-Firenze
- 2009 Dec Torino-Milano
- 2009 Dec Roma-Napoli completion
- 2013 HS Stations: Torino, Reggio Emilia, Bologna
- 2016 Dec Milano-Brescia
DATA ANALYSIS & MOBILITY

RAILWAYS IS ALREADY THE GREENEST MODE OF TRANSPORT

“Continuos” Evaluation:

- Mobility demand mapping **ESSENTIAL**
- Commercial performance
- New services (smart working, business travels, holidays....)

INCREASE PASSENGER

Traditional
- Travel diary samples
- Ticketing data
- On site - Surveys
- Traveller count

Big Data
- Mobile phones data
- Social networks use
- Wi-fi data

MOBILE DATA ANALYTICS IN ITALIAN HSR STATIONS
MOBILE NETWORK DATA

Requirements

- Preliminary desk research on the state of the art (es: from CDR to MDN)
- Call for tender (national wide analysis area) for MNO
- Contract with Vodafone
- One year of calibration and investigation (mapping all Italy!)
- Focus on modal identification
- From 2022 “standard” tool for analysis and strategic decision

* Some limitation......

FIRST

- 4V compliant (big in volume, variety, velocity, veracity)
- IoT compliant, coming from connected devices
- Containing geo-referenced location data
- Focused on mobility kinematics

Lacking information about travelers’ characteristics
Lacking information about travel reason
Lacking information about socioeconomic and territorial context
Perfect for describing machine behaviour, but what about humans?

LIVE DATA

* 20 days delay
ITALIAN HSR MAIN STATIONS: OVERVIEW

- Focus on main station
- Dedicated mobile network
- Behaviour passenger and visitors
- POI identification
- Airport train
- Connections
- Waiting times

Station performance

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS services calling at this station</td>
<td>202</td>
<td>323</td>
</tr>
<tr>
<td>Number of cities reachable within 4h*</td>
<td>38</td>
<td>43</td>
</tr>
<tr>
<td>Population of station user base**</td>
<td>48,008</td>
<td>1,809,388</td>
</tr>
<tr>
<td>By 15' walk</td>
<td>2018</td>
<td>1,809,388</td>
</tr>
<tr>
<td>30' by collective transport</td>
<td>26,370</td>
<td>1,965,355</td>
</tr>
</tbody>
</table>

Malpensa
Linate & Bergamo airports

Fiumicino
Naples’ islands
PRESENCES IN THE 3 STATIONS

- **ROMA Termini**
  - 78% Passenger
  - 6.4 millions

- **NAPOLI C.le**
  - 91% Passenger
  - 4.0 millions

- **MILANO C.le**
  - 86% Passenger
  - 5.6 millions

**ITALIANS**

**TOURISTS**

Passenger and Visitors

**MOBILE DATA ANALYTICS IN ITALIAN HSR STATIONS**
DURATION OF STAY
Passenger & Visitors (April - November 2022)

- Inbound
- Outbound
- Transfer

PASSENGER

VISITORS
POI ANALYSIS

HSR passenger & POI visits

November 22

August 22

Naples’ islands

MOBILE DATA ANALYTICS IN ITALIAN HSR STATIONS
INTERACTIVE DASHBOARDS

FOCUS: Roma Termini

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total presence</td>
<td>60,140,849</td>
</tr>
<tr>
<td>Passengers</td>
<td>46,874,929</td>
</tr>
<tr>
<td>Visitors</td>
<td>13,265,920</td>
</tr>
</tbody>
</table>

BACINO DI UTENZA

- **Arrival**
  - Total arrivals: 2,108,523
  - Transfer by train: 1,682,841
  - Transfer by bus: 425,682
  - Transfer by other: 22,999

- **Departure**
  - Total departures: 3,104,220
  - Transfer by train: 1,373,845
  - Transfer by bus: 850,385
  - Transfer by other: 479,990

- **Stay time**
  - Average stay time: 60 minutes

- **Arrival time**
  - Monday: 21%
  - Tuesday: 22%
  - Wednesday: 23%
  - Thursday: 24%
  - Friday: 25%
  - Saturday: 26%
  - Sunday: 27%

- **Departure time**
  - Monday: 21%
  - Tuesday: 22%
  - Wednesday: 23%
  - Thursday: 24%
  - Friday: 25%
  - Saturday: 26%
  - Sunday: 27%
**MAIN CONCLUSIONS**

- **Unique experience** from research to corporate tool
- **Extensive know how**
- **Updated** data (quite live.....)
- **Less expensive** than traditional surveys
- **Customizable** (also after data availability)
- **Limitation** in urban environment
- **We are ready for Public Data dissemination**
NEXT STEPS

After 2 years of intensive use:

- Better **modal identification** for station access and egress links
- Increase **dedicated networks in stations** (better analysis)
- Detailed study on **urban areas**: FS is starting a research with several Universities to overcome this limitation
- **Guide lines** (partnership Italian Statistic Institute)
- Work on 5/10 minutes time slots analysis in order to allow a **timetable improvement** in stations (connections)
- Definitely replace surveys when it is possible
- Develop the ability to work and plan with **live data**
THANK YOU

Eng. Lorenzo Vannacci
FS Research Centre
l.vannacci@fsitaliane.it