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Partner meeting

Brno, 14th September 2021



OVERVIEW PRESENTATION ABOUT TRENDS IN PUBLIC TRANSPORT AND THE USE OF IT TOOLS



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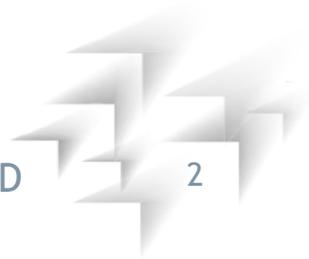
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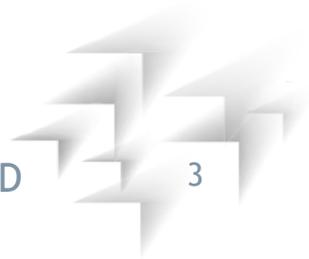


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The public transportation sector is a contemporary issue that has changed significantly with the Covid-19 pandemic. An important role in the decreasing of the demand for mobility has been played by the following factors:

- The digitization of economic, educational and commercial activities (with the growth of remote working, the diffusion of distance learning, and the explosion of e-commerce)
- Regulations that have reduced the capacity of transportation to respect social distancing
- The strong fear of sharing with other people the experience of travel



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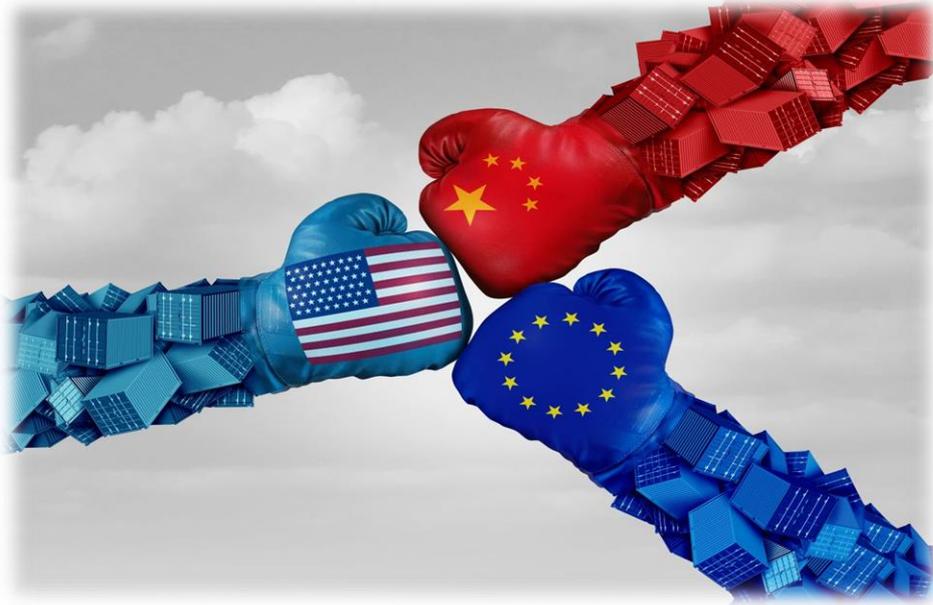
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HOW THE PT HAS CHANGED?

Today people are looking for forms of mobility that guarantee social distance, where the contact with other people is limited.

During the pandemic, in the whole world, there has been an increase in the use of private vehicles, electric scooters and bicycles.



To better understand the mobility changing, we take into consideration some different area and we study what happens in each area.

The areas that we consider are: Europe, United States of America and China.





Post-Covid19 mobility in Europe is characterized by an increase of bicycle use, including both electrical and traditional bicycles. In fact, most European Union countries have included cycling in their strategic plans for recovery from the Covid-19 pandemic.



Another significant increase has been observed in walking trips; overall, walking and bicycling trips increased from 21% to 59%.



UNITED STATES OF AMERICA

In the United States of America there has been an increase in the use of electric bikes and scooters to avoid public transport.



In New York, there has been a 50% increase in travel by electric bikes and electric scooters compared to same period of the previous year.

In Chicago, the increase is even more significant with an increase in bike trips of 100% compared to the previous year.





In China before the pandemic the public transport was used by 56% of the population, after Covid-19 the public transport is used only by 24% of the population.

This percentage variation is moving in the direction of private vehicle use, private car use in China increased from 34% to 66%.



The use of electric bicycles and scooters was not massive before Covid-19 and the same is happening now that the pandemic is ongoing.

Logically, this shift to private mobility means a disaster for polluting emissions, traffic and the overall cost of transportation.



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PUBLIC TRANSPORTATION, IT TOOLS AND BIG DATA

In most of our time, all we do is create, download, send and display data.



These data are the basis of what is known as Information Technology.

In fact, the term IT (Information Technology) refers to everything related to the transmission, processing, storage and use of data.

Nowadays, the volume, velocity, and variety of the data we deal with have increased to such a degree that it is necessary to introduce the concept of "Big Data"

This is also true for Public Transportation

Among the different definitions of big data, in this document we refer to the simplest one:

*“Any data that cannot fit into an Excel spreadsheet” **



- These encompass automatically and routinely generated different dynamic information coming from different sources (e.g., sensors, devices, third parties, web applications, and social media) at various speeds and frequencies.
- These data sources are thus also aligned with the definitions proposed by Laney**, where big data are defined with **3 Vs (volume, velocity, variety)**.



* Data source: Michael Batty, 2013

** Data source: Doug Laney, 2001

For what concerns the big data sources for Public Transport (PT), three key categories of data can be identified within this field:



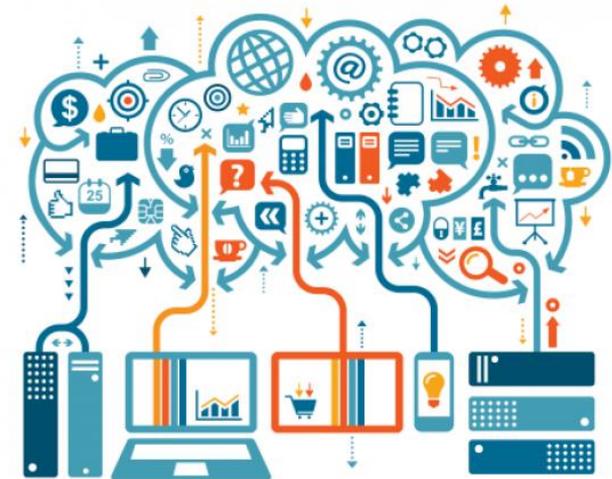
FCD (Floating Car data);



Mobile phone data;



AFC (Automated Fare Collection) data.





Floating Car Data (FCD), generally refers to data collected directly by the vehicle itself as it is in motion, typically covering its location and speed. It must be noted that FCD is not limited to car data only, as it also encompasses technologies such as Automated Vehicle Location (AVL).

FCD is emerging as a means of monitoring traffic with better performances than speed sensors.

Modern AVL systems, which are based on GPS or differential GPS often augmented by dead reckoning, are leveraged to collect data on vehicle location, speed, and other information. The GPS technology installed in the vehicle enables the collection of time, location, and service status of transport modes.



OD matrix construction

Site	Germany (study carried out by University of Wuppertal)
Data	The investigation was based on an FCD dataset for 2015, which included data from several navigation service providers containing both passenger and freight vehicles.
Results	The results of the experience with FCD show that the data source may have potential to either complement or even replace traditional mobility survey data in the future.

Traffic congestion prediction

Site	Guangzhou, China
Data	66.228 bus driving records from 50 buses for 66 working days
Results	The FCD data provided by the buses make it possible to predict when there will be congested traffic in some specific road sections





At present, most individuals carry their mobile phone almost everywhere, which makes mobile phone data the largest human mobility data source.

There are broadly two sources of mobile phone data:

- Network-based data that can be used in the contemporary PT studies: call data record (CDR) and global system for mobile communication (GSM) data
- Smartphone sensor-based data that can be collected by dedicated applications, for example Twitter, Facebook etc.



The data based on cellular network have a good temporal frequency (especially GSM data) whereas smartphone sensor-based data have a higher spatial resolution.

For public transport, cellular network based data have been mostly used so far, but in the future it is thought that data from smartphone sensors will be increasingly used.



MOBILE PHONE DATA - APPLICATIONS

Planning for bus lines and stops based on demand data

Site	Tokyo, Japan
Data	Mobile phone data in Tokyo
Results	It was observed that a demand-based dynamic bus line planning has the potential to reduce road traffic emissions by approximately 13%.

Identification of areas and time slots of interest for transportation planning

Site	Los Angeles, California
Data	Metro, an agency that runs buses in Los Angeles, used location data from 5 million cell phones . The data were processed so that researchers could connect geolocations (at a resolution of about 300 meters) to a device but could not link the device to a phone number or a number to a person.
Results	While confirming the traditional local peak times (7-9am and 3-6pm), a third peak was found in areas not traditionally served in transportation network planning.



ATC - AUTOMATED FARE COLLECTION



Automated Fare Collection (AFC) is a generic term for a ticketing system in public transport where the fare is paid via ticket vending machines, online services or other methods. In practice AFC is the default fare collection method in any modern PT system.

Among AFC systems, Smart Card Automated Fare Collection (SCAFC) is becoming increasingly popular among transit operators. Currently, many large-/medium-sized cities in the world such as London (Oyster card), New York (SmartLink), Boston (Charlie card), Beijing (Yikatong), and Hong Kong (Octopus card), have their own smart card system.



These cards are based on radio-frequency identification (RFID) technology and passengers are required to tap the cards during entry and/or exit. Depending on the type of smart card, it automatically and continuously collects different trip records while using PT.

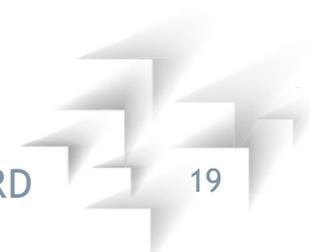


Early detection of abnormal passenger flows

Site	Guangzhou, China
Data	AFC from Guangzhou Metro
Results	<p>The solution proposed is a framework capable of establishing an early-warning mechanism through four major phases: data acquisition, pre-processing, off-line modelling, and on-line detection.</p> <p>The response time for detection stay below 5 min.</p>

Platform for public transport planning

Site	Gijón, Spain
Data	AFC, georeferenced data
Results	<p>The system was developed to reach the following main objectives: Mobility patterns, bus bunching, occupancy ration, speed and time, spatial analysis.</p>



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THANK YOU!



Francesco Edoardo Misso
T Bridge S.p.A.
YOUMOBIL



T BRIDGE
BV TECHGROUP



www.interreg-central.eu/youmobil



f.misso@tbridge.it



+39 10 5769111