Application of Mobile Phone Data in Transport and Commuting

Task Team of the UN Committee of Experts on Big Data and Data Science for Official Statistics
Mobile Phone Data Task Team

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On behalf of the Transport and Commuting Subgroup

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Upcoming Handbook on MPD in Transport

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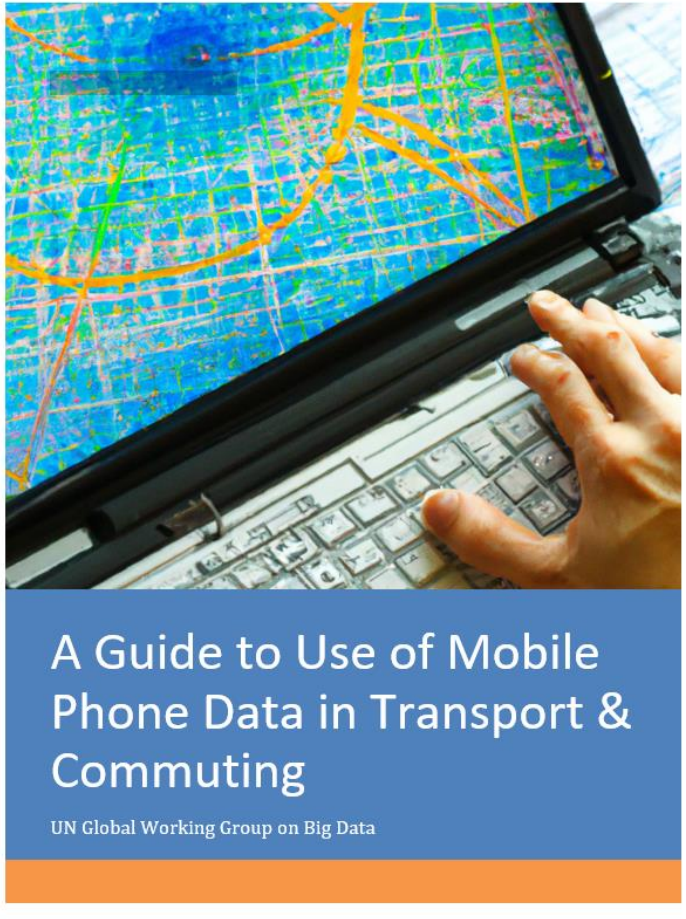
Transport and Commuting Subgroup

- Status: **Final Draft Review** by the Subteam
- Contents:
  - General Info on MPD Use in Transport
  - MPD Landscape in Transport
  - Applications in Transport and Commuting
  - Case Studies from Around the World



Some Transport Applications of MPD

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Statistics and Reporting	Reactive Decision Making	Realtime Decision Making	Predictive Applications
▪ Easier applications since historic or archived datasets are used. ▪ Data is easier to obtain and only aggregated data is used. ▪ Population density & people movement data used. ▪ Examples such as census, transport statistics, traffic statistics etc.	▪ Only historic, but periodically updated MPD data used. ▪ Aggregated, but segmented data used. ▪ Most applications rely on population density and people movement data. ▪ Typical examples include short & long-range planning & transport network enhancements.	▪ Near-realtime datasets used in decision-making. ▪ Aggregated, but segmented data used. ▪ Applications are event management, traffic management, incident management etc.	▪ Transport-related predictive applications, still in nascent stage. ▪ Require high-resolution historic, and realtime data sets. ▪ Applications are event management, incident detection and prediction, traffic prediction etc.

Some Transport Applications of MPD

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Transport Statistics

These statistics describe the mobility of people and goods across various modes of transport (e.g., cars, trains, planes, etc.).

Mobile phone data can provide information such as
- Origins and destinations of trips
- Modes of transport
- Population density
- Total Personal Miles Traveled (PMT)

Traffic Statistics

Traffic Statistics: Traffic statistics focus on road usage, specifically the movements of vehicles.

By monitoring location data from mobile phones, it's possible to
- Estimate the volume of traffic
- Identify congested areas
- Assess the average speeds
- Vehicle Miles Traveled (VMT)

Transport and Urban Planning

Mobile phone data can contribute to understanding the patterns of movement within a city or region.

This data can be used to
- Identify commuting patterns
- Popular routes
- Origin-Destination Matrix including Modal Split
- Travel Time Index

Transit & Public Transport Planning

Mobile phone data can be used to determine how, when, and where people are using public transportation.

This includes identifying
- Busy stations,
- Peak usage times,
- Popular routes
- Planning Transit and Public Transport

Traffic Analysis

Mobile phone data can be used to conduct detailed analyses of traffic conditions.

This can include
- Identifying patterns of congestion
- Studying the impact of road works accidents
- Analyzing the effects of weather on traffic

Operational Decision Support

In transport operations, mobile phone data can help predict demand and optimize schedules and routes.

For example, it can support decisions on
- Where to deploy additional buses during peak times
- How to reroute traffic in response to an incident

Events and Crisis Management

During events or crises, mobile phone data can provide real-time insights into population movements.

This could be useful for
- Managing crowds at a major event
- Understanding evacuation patterns during a crisis

Traffic & Transit Demand Prediction

With advanced analytics, mobile phone data can be used to predict future traffic and transit demand.

This could involve
- Forecasting daily traffic volumes
- Predicting the impact of a new transport service
- Modeling the effects of population growth on transport demand

Handbook highlights nine diverse case studies

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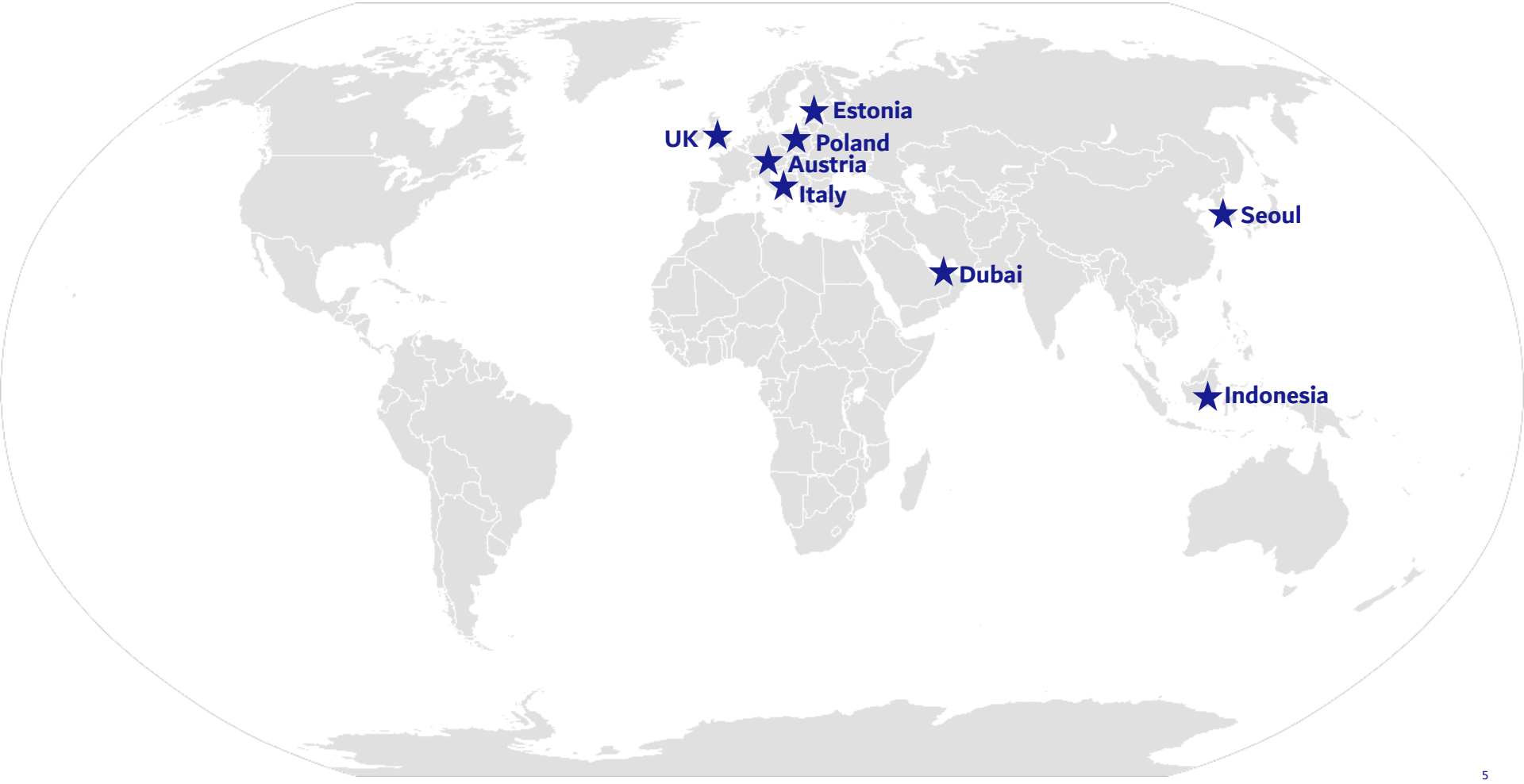

Some case studies...

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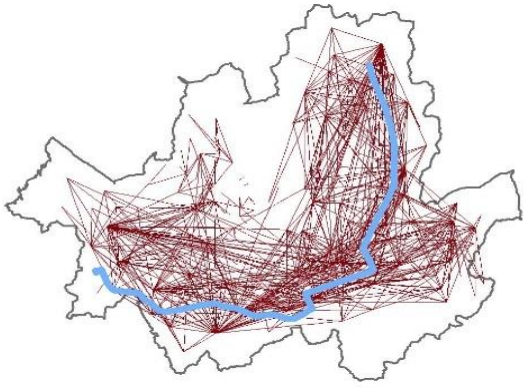
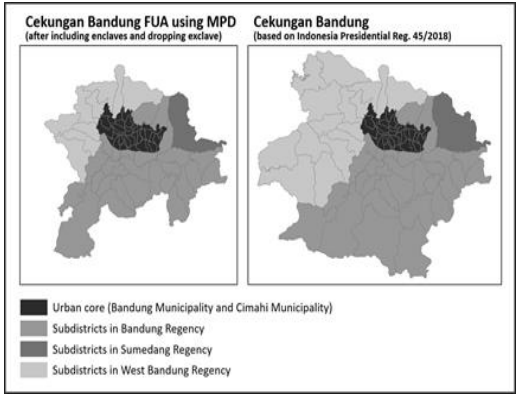
Seoul's Use of MPD in Planning Night Bus Service



The Data and Statistics division of Seoul's metropolitan government analyzed late night call records provided by the Korean telecom company to plan bus routes in a more inclusive manner.

Replacing Indonesia's Household Travel Surveys



In 2019, BPS-Statistics Indonesia worked with the Indonesian Ministry of National Development Planning to conduct a pilot project which explored the use of MPD to delineate metropolitan areas.

Optimizing Dubai's Bus Laybys based on First & Last Mile

Dubai RTA and Locatium used mobile phone data to optimize bus station layout based on passenger usage patterns

Case Study: Seoul's Use of MPD in Planning Night Bus Service

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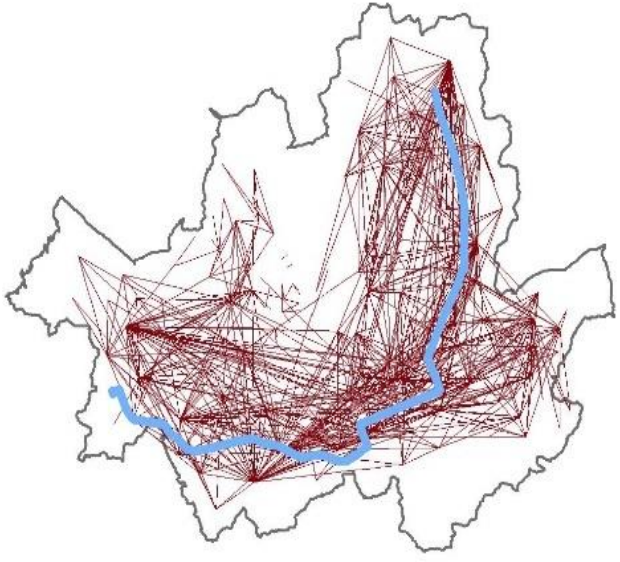

Figure showing travel patterns traced in Seoul for owl bus service

Case Study

The **Data and Statistics division of Seoul's metropolitan government** analyzed late night call records provided by the Korean telecom KT Company to plan bus routes in a more inclusive manner.

Objective

Designing routes for the night bus service proved difficult. Daytime traffic data could be misleading since commuter behavior might be different at night. **Relying on the intuition and guesswork of experts, which was the convention for route design**, would fall short of providing optimal routes and service frequency.

Methodology

The Seoul government reached out to a major telecommunications provider to gain access to a huge set of anonymous mobile communication data and the location of mobile users was used as a proxy for the movement pattern of commuters. **Over 3 billion mobile call logs were gathered** over a period of 1 month to map the distribution of late-night travelers across the city. **Journey data from over 5 million taxi rides**, collected through the T-Money card system, were also used. Seoul was then divided into 1,250 cell units of 1-kilometer radius each. The geographic information system-enabled Night Bus Route Design Support System then **overlaid the data onto the cells to produce a visualized pattern of the late-night floating population**

Impact

The result was **the creation of the "owl bus," which operates late into the night until five o'clock in the morning**. Since 2012, Seoul's "Owl Bus" service has saved the city's lower-income groups approximately $1.2 million by providing more affordable transportation using cell phone data to plan late night bus routes.

Case Study: Replacing Indonesia's Household Travel Surveys

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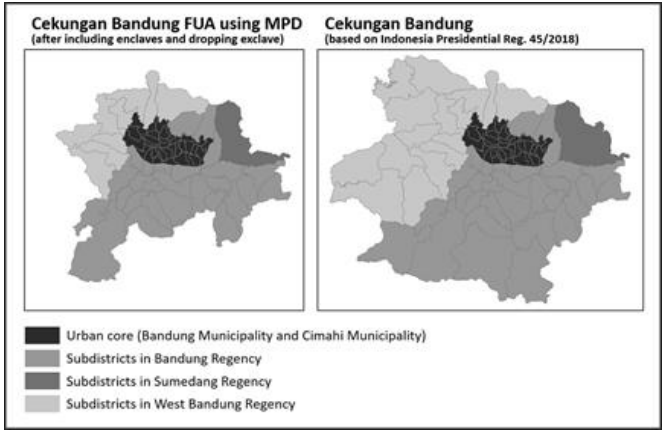

Figure above shows the visualization of MPD delineation and Indonesian Government delineation comparison on Cekungan Bandung metropolitan area

Case Study

In 2019, **BPS-Statistics Indonesia** worked with the Indonesian **Ministry of National Development Planning (BAPPENAS)** to conduct a pilot project which explored the use of MPD to delineate metropolitan areas.

Objective

Cekungan Bandung one of the metropolitan areas that have been delineated using commuting survey. The objective of this case study was **to use MPD to delineate the same metropolitan area** Cekungan Bandung and then compare with the last result

Methodology

The data itself was obtained from Telkomsel, one of the largest MNO in Indonesia, which is a state-owned private enterprise. **There were 50,907 Telkomsel subscribers** used as the sample within November 2019. To analyze commuter patterns using MPD, BPS-Statistics Indonesia **developed algorithms to identify commuters and estimate commuting flows at sub-district level** (the third level of local area unit in Indonesia). The **commuting flows were used to measure the integration** between the urban core and surrounding hinterlands in Cekungan Bandung

Impact

The delineation from **MPD results were then compared to the delineation** already determined by the Government of Indonesia, to identify which sub-districts were included in the metropolitan area by law but have a low rate of commuting flow. The **results was a recommendation for the Government** of Indonesia to help **determine a more appropriate delineation** by using MPD, especially in Cekungan Bandung

Case Study: Optimizing Dubai's Bus Laybys based on First & Last Mile

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Figure shows the GPS pings of users of buses to Dubai's Al Ghubaiba station, along with their final destination.

Case Study

In 2021, **Dubai RTA** and **Locatium** conducted studies using Mobile Phone Data to understand how passengers use bus stations prior and after to their public transport trip to optimize bus station layout.

Objective

Public Transport Agencies have a good understanding of their users travel pattern within their system via smart ticketing data. However, Dubai wanted to understand how this pattern continued before and after the PT system usage with the aim of optimizing bus laybys. Al Ghubaiba station forms a major transit center with all modes of transport converging in, including metro, taxi, marine and bus.

Methodology

For this pilot, Locatium collected anonymized smartphone-based GPS pings from a set of users. For the users whose journeys end or start at the Dubai's Al Ghubaiba Station, the dwell-time data was utilized to understand the origin or final destination of the trips. Based on rigorous analysis, it was found that a simple reconfiguration of laybys can help the users reach their next mode of transport with little walk from the station.

Impact

Without MPD data, such an analysis wouldn't have been possible. Use of MPD data supported in raising the customer satisfaction levels at the station by 7%. The station, now, consistently ranks very high in Google Reviews as well.

Thank you!