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Using mobile location data to support urban transport planning

Customer Success Story



International Development Center of Japan

ABOUT IDCJ

Website: www.idcj.jp

Industry: Research Services

Headquarters: Minato-ku, Tokyo

The International Development Center of Japan, IDCJ, is a non profit organization specializing in international development and cooperation. Established in 1971, IDCJ has extensive experience in research, training, and consulting across international development initiatives.

IDCJ supports the formation, implementation, and evaluation of policies and projects related to Official Development Assistance, with expertise spanning public finance, regional development, social development, agriculture, industry, transportation, and evaluation. Its work extends across Asia, Africa, and Latin America.

Research Name: Evaluating Mobile Device GPS Data for Urban Transport Planning in Developing Countries: Case Studies from Lao PDR

Authors: Kiminari Takahashi, Executive Officer, International Development Center of Japan
Dr. Prosper S. Nyaki, Dean, Faculty of Logistics and Business Studies, National Institute of Transport

IN THIS CASE STUDY YOU'LL LEARN

- Role of mobile location data in OD analysis
- Trip purpose patterns identified within a country
- Business & personal travel patterns
- Mobile data correlation with traffic volumes
- Key limitations of mobile location data
- Future applications for transport planning

OVERVIEW

Rapid urban growth, emerging traffic problems, and the impact of natural disasters and other shocks are creating increasingly complex challenges for urban transport planning in developing countries. At the same time, conventional transport surveys can be costly to conduct and difficult to update, making it challenging for planners to maintain reliable and current data.

To address these challenges, the International Development Center of Japan (IDCJ), in collaboration with the National Institute of Transport (NIT), conducted a research study using urban transport infrastructure planning in Laos as an example. The study explored how new sources of big data could be applied to infrastructure planning, development, operation, and management, and how corresponding models could be developed to support better transport planning.

As part of the research, the team used mobile location data from Quadrant to analyze transport patterns, estimate origin and destination movements, identify travel purposes, and examine relationships with road traffic volumes. The findings demonstrated the potential of mobile location data to provide useful insights for urban transport planning in Laos and highlighted how scalable big data sources can complement conventional transport surveys.

CHALLENGES

As urban areas in developing countries grow, transport planners face increasing traffic challenges and the need to regularly update infrastructure plans. Natural disasters and other shocks can also have significant impacts on socioeconomic activity, while existing master plans can become outdated and forecasting can become difficult.

Traditional transport planning relies on sample surveys, including household visits and traffic volume surveys. However, the high cost of conventional field surveys can make regular updates difficult using domestic funding alone.

IDCJ evaluated multiple commercially available mobile location data sources as a potential alternative. The challenge was finding data that could provide the required coverage and quality for transport analysis while remaining commercially viable.



Area of the study: Laos

SOLUTION & RESEARCH METHODS

IDCJ and NIT used mobile location data from Quadrant as an additional data source for transport analysis in Laos. The data provided a scalable view of movement patterns that could complement conventional transport surveys and support the development of models for urban transport planning.

Quadrant offered the best fit for the study, combining the required data quality and geographic coverage with a competitive price point.

The research focused on four key questions:

- How can mobile location data support urban transport planning?
- How accurately can mobile location data represent trip generation and attraction?
- Can mobile location data help identify trip purposes and travel patterns?
- How closely does mobile location data correlate with conventional traffic volume surveys?

The study combined mobile location data from Quadrant with existing transport and geographic datasets, including **JICA Person Trip and traffic volume surveys and OpenStreetMap building data**. The research then applied these datasets across key transport planning use cases, including travel pattern and origin destination analysis, trip purpose identification, and comparison with road traffic volumes.

1. ANALYZING TRAVEL PATTERNS WITH MOBILE LOCATION DATA

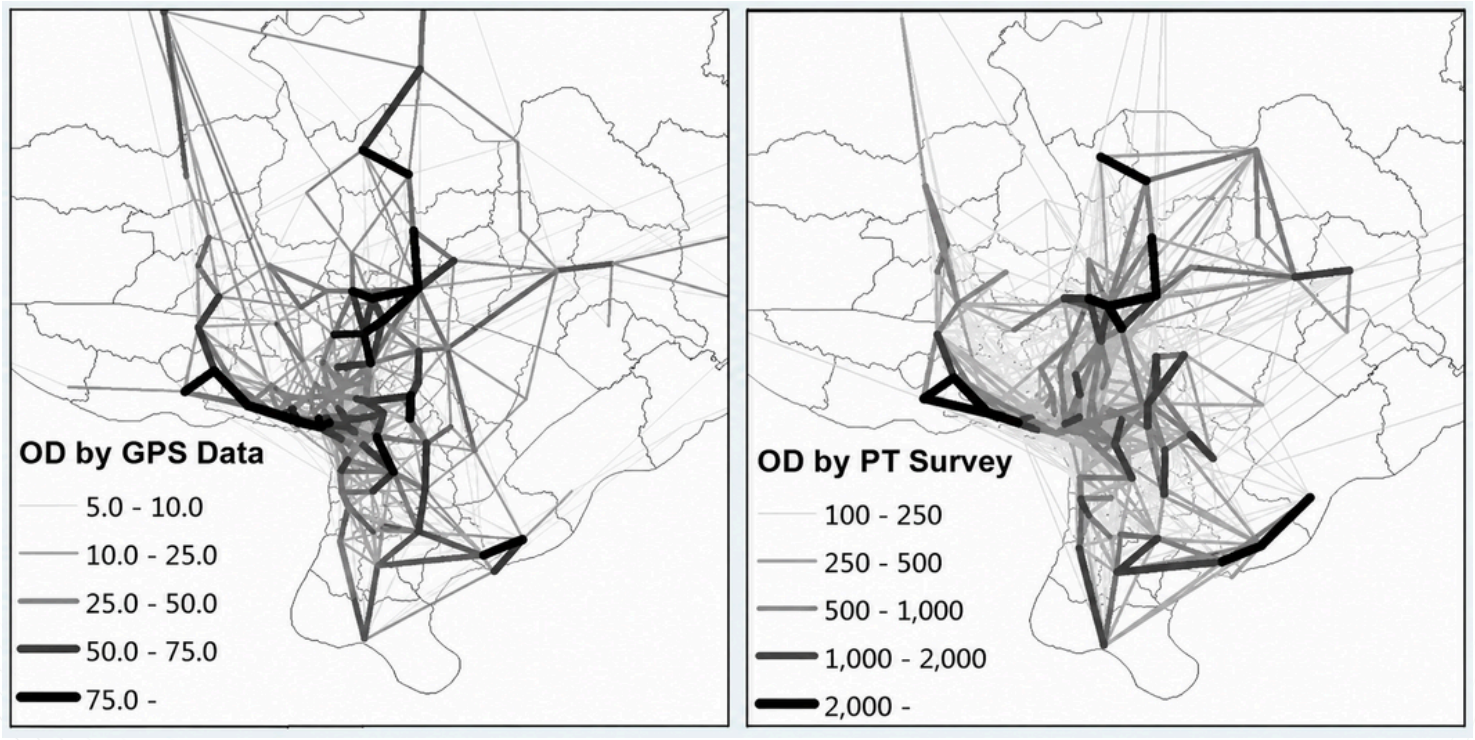
Measuring Origin and Destination Accuracy: The study compared randomly sampled device IDs from the mobile location data with zone level trip generation and attraction volumes from JICA's PT survey. The analysis found a correlation of $R > 0.65$, indicating a strong relationship between the two datasets.

Correlation stabilized once the sample exceeded 10,000 device IDs, representing approximately 2% of the urban mobile owning population.

The analysis also identified sampling variability, with uneven population distribution across zones affecting the accuracy of the results.

Trip Purpose Analysis: The study linked trip ends to OpenStreetMap building data and combined dwell time and time of day patterns to identify trip purposes such as home, work, and school. Mobile location data showed a similar overall pattern to the PT survey (JICA Person Trip survey), including strong shares of return home and commuting or school trips. However, limited OpenStreetMap building data in Laos made it difficult to identify the purpose of some trips.

Business and Personal Travel: The analysis revealed a notable difference in commercial areas in the city center, where mobile location data showed higher trip generation and origin destination volumes than the PT survey estimates. This suggests that mobile location data may capture non home based business and personal trips that conventional PT surveys may miss.



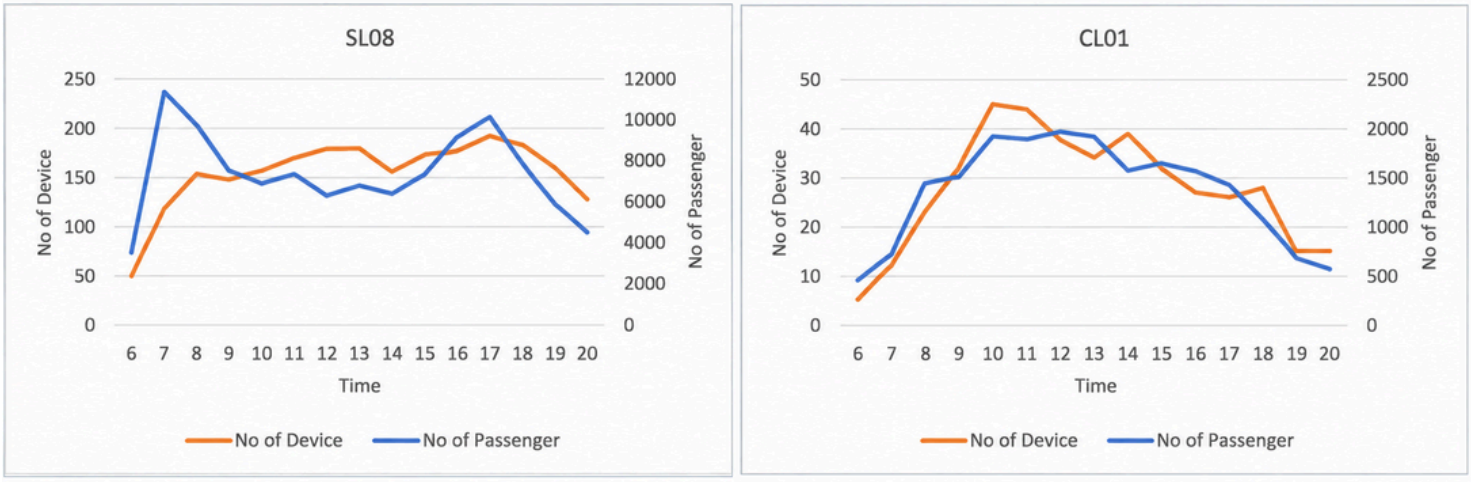
Origin and destination patterns from mobile location data compared with the Person Trip survey. The study found higher trip generation and origin destination volumes in commercial areas of the city center in the mobile location data.

2. COMPARING MOBILE LOCATION DATA WITH TRAFFIC VOLUMES

The study compared mobile device counts with passenger volumes recorded through JICA's cordon line and screen line traffic surveys to examine whether mobile location data could reflect observed traffic patterns across different locations.

The analysis found a correlation of approximately R ≈ 0.8 between mobile device counts and observed passenger volumes. Regression analysis against 15 hour traffic volumes also showed that mobile location data had a certain level of explanatory power for observed traffic volumes.

The results indicate that mobile location data can provide a useful additional signal for understanding traffic patterns across the transport network. However, several locations showed significant differences from the overall relationship, and the study could not identify the cause of these outliers.



Representative comparison of mobile device counts by time period with screen line survey passenger counts.

RESULTS AND BENEFITS

The research demonstrated the potential of mobile location data to support urban transport planning in Laos.
By comparing Quadrant's mobile location data with established transport survey data, the research demonstrated its potential for zonal OD analysis, trip purpose analysis, desire line comparison, and traffic volume analysis.
Key outcomes included:

- Zonal OD analysis with correlation stabilizing once device IDs exceeded 10,000
- Trip purpose analysis showing similar trends between mobile devices and the PT survey
- Business and personal travel insights that can be difficult to capture through conventional PT surveys
- Traffic volume analysis showing a correlation of approximately 0.8 with 15 hour traffic volume
- A scalable big data source for supporting urban transport planning

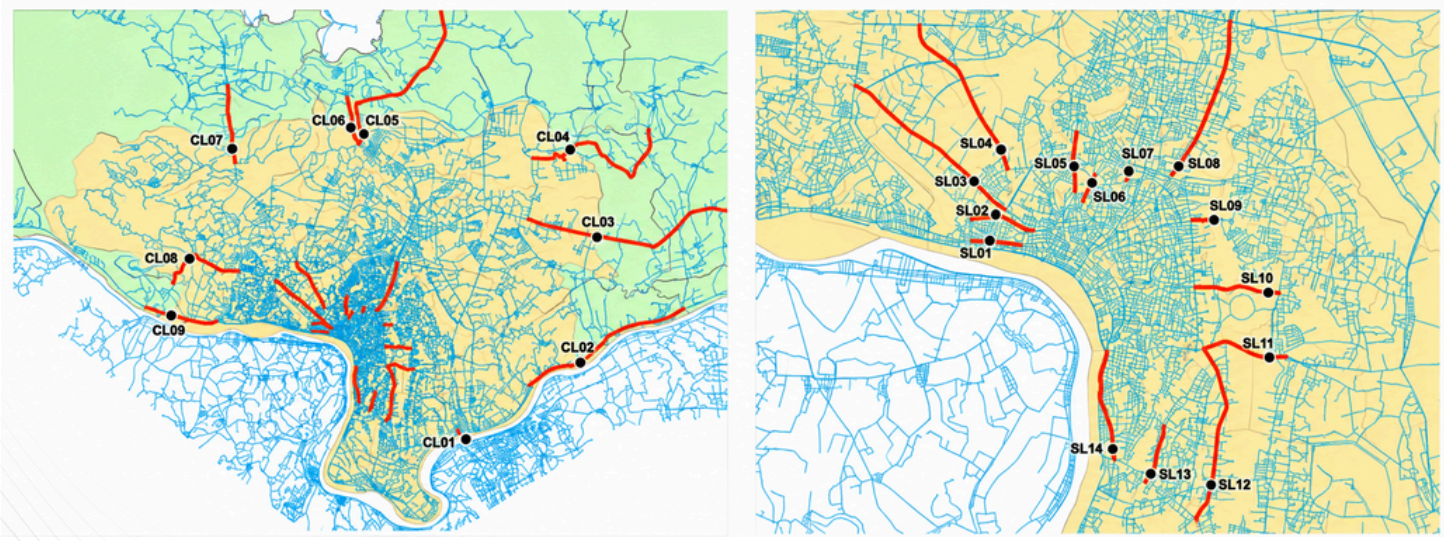
The study also identified limitations, including uneven spatial distribution of samples, difficulty detecting short duration stays, and challenges in correcting positioning errors.

LOOKING AHEAD

A key next step is to develop models that can move from observed on road location data toward OD reverse estimation, helping planners estimate origin and destination movements from observed mobility patterns. This could support more frequent monitoring of travel demand and provide additional evidence between conventional transport survey cycles.

The research also highlights the potential of AI and machine learning to automatically identify behavioral clusters and trip purposes. By combining location patterns with factors such as dwell time, time of day, day of week, and points of interest, future models could improve the identification of activities such as commuting, business travel, shopping, and other trip purposes.

The research points to several opportunities for expanding the use of mobile location data in urban transport planning through a complementary data model, where continuously collected mobile location data supports ongoing monitoring and analysis, while conventional PT surveys remain important for detailed travel attributes and periodic validation. This approach could help transport agencies respond more effectively to changing urban conditions and evolving travel demand.



The above image shows the cordon line and screen line locations used in the traffic volume analysis across the study area. These locations were used to compare mobile device activity with observed passenger volumes from JICA's traffic surveys. The red sections highlight locations identified as outliers, where the relationship between mobile device counts and observed traffic volumes differed from the overall pattern.

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> *Quadrant's reliable and scalable dataset provided us with valuable insights into mobility patterns that conventional surveys often miss. Their support was instrumental in demonstrating how big data can complement traditional planning methods to build more resilient transport systems.*
>
> *~ Kiminari TAKAHASHI Executive Officer, International Development Center of Japan (IDCJ)*

Quadrant, an Appen company, is a global provider of privacy first mobile location data and Point-of-Interest (POI) data. With coverage across 200+ countries, Quadrant delivers trusted, high quality geospatial datasets that help organizations build location powered products, applications, and solutions.

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