

Research Trends and Results

Towards the Application of Population Flow Statistics Using Data Transmitted Through Mobile Phone Networks to the Field of Urban Transportation

SHINGAI Hiroyasu, Head
YOSHIDA Jundo, Senior Researcher,
 Urban Facilities Division, Urban Planning Department

SHIGETAKA Koichi, Head
TORIUMI Daisuke, Researcher
 Maintenance Information Technology Division, Research Center
 for Land and Construction Management

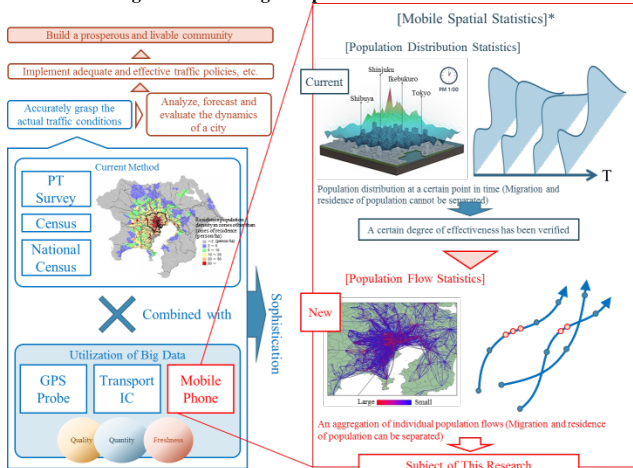
HASHIMOTO Hiroyoshi (Ph.D. in engineering), Senior Researcher
 Road Division, Road Traffic Department

(Keywords) Big data, mobile phone base station, population flow statistics, urban transportation, person trip survey

1. Background and Purpose of Research

In recent years, there has been rapid progress in the research on utilization of big data and the actual use thereof in the field of transportation. The purpose of this research, which focuses on data transmitted through mobile phone networks (see Figure 1), is to establish a methodology for generating statistical data and verify the effectiveness of such data, in order to facilitate a more sophisticated utilization of big data in the field of urban transportation and also to enable us to grasp the flow of population such as the migration and residence of population.

Figure 1. Positioning of Population Flow Statistics



Target for Comparison	Area		Sample Size	Attribute		Survey Frequency	Characteristics
	Depth	Wide Area		Agr. etc.	Purpose, etc.		
PT Survey	△	×	△	○	◎	×	The PT Survey, which is conducted every ten years, enables us to grasp trip data, purposes of trips, etc. in a comprehensive manner.
Population Flow Statistics	△	◎	◎	○	×	◎	The Population Flow Statistics are based on data on the migration of population that are estimated for 24 hours a day, 365 days annually from a large sample size.
GPS Probe Survey	○	○	×	△	△	◎	Although its sample size is small, the GPS Probe Survey enables us to grasp detailed migration routes at any time.
Traffic Volume Survey	◎	×	△	○	×	△	The Traffic Volume Survey enables us to grasp actual traffic numbers, such as actual traffic volume, for specific days and places.
National Census	△	×	◎	◎	×	×	The National Census, which is conducted every five years, is a detailed statistical survey targeted at the whole of the population.

Then, in order to better clarify the characteristics of population flow statistics, we checked the effectiveness of population flow statistics by analyzing their correlation with the results of metropolitan area person trip (PT) surveys, among other things. Specifically, we compared the results of the Shizuoka-Chubu Metropolitan Area PT survey and population flow statistics in terms of OD (origin-destination) amounts. As a result, we confirmed the high correlation between the two in city zones (see Figure 3).

Likewise, we compared the two in terms of the migration and residence of population. As a result, we found that they were broadly consistent with each other in all zones except for some urban zones, where there were some gaps in the data. It has become apparent that we need to further analyze the relationship between the footprint and base station density of mobile phone base stations and spatial resolution.

2. Main Content and Results of Research

Based on data available at mobile phone base stations, we clarified a methodology for developing population flow statistics (see Figure 2) and its specifications with which we can estimate the migration and residence of population. The characteristics of the population flow statistics are that it is possible to locate the places of transmission and receipt of data over wider areas across the nation and also to obtain data continuously without any interruption 24 hours a day and 365 days a year. A comparison of major characteristics between the current statistical surveys, etc., and the population flow statistics is summarized as follows:

Table. Comparison of Major Characteristics between Current Statistical Surveys and Population Flow Statistics

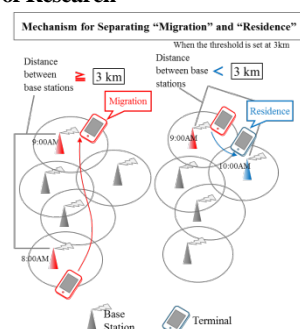


Figure 2. Judgment Criteria for Preparation of Population Flow Statistics

3. Next Steps

In order to ensure that population flow statistics will be utilized to enhance tourism and disaster prevention, among other things, which is the policy goal, we consider it necessary to conduct more practical research on population flow statistics going forward, including enhancing spatial and temporal resolutions, which would make it possible to more accurately grasp the migration of population, among other things.

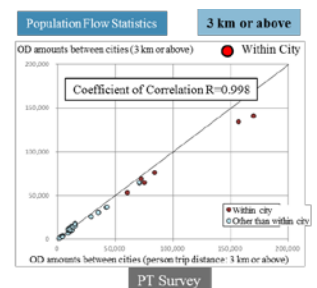


Figure 3. Comparison with PT Data (Distance between base stations: 3km or above)

1) "Research on the Application of Population Flow Statistics Using Data Transmitted Through Mobile Phone Networks to the Field of Urban Transportation", A Collection of Studies and Lectures on Civil Engineering Planning, Volume 52 by the Japan Society of Civil Engineers, November 2015