

A Review of the Survey Method of the Korean National Household Travel Survey: Focusing on the Comparison of International Cases*

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Abstract

The increasing use of various types of data to capture travel behavior relatively discredits the utility of traditional national-scale household travel surveys. However, the surveys are still arguably meaningful in their clarification of purposes and means of travel. Accordingly, this study reviews travel survey cases and related literature, to identify the status of the Korean National Household Travel Survey (KNHTS). It discusses improving the KNHTS's survey method, focusing on its long investigation cycle, short survey period, reduction in sample size, and questionnaire format biased toward mandatory travel. To address these issues, this study suggests reducing the survey cycle, conducting a year-round survey, combining weekday and weekend surveys, and specifying items on nonmandatory travel. These practical suggestions duly consider the validity and reliability of the KNHTS within budget constraints and its applicability to related fields, such as tourism, public health, and sociology.

Keywords : Korean National Household Travel Survey, Survey Method, Literature Review, Case Study

1. Introduction

Starting in 1996, Korea has conducted a national household travel survey (NHTS) every five years, to collect basic data required for establishing transportation infrastructure and mid- or long-

range transportation plans and policies. The first Korea NHTS (hereafter, KNHTS) and the next in 2001 had exploratory purposes and were geographically limited to the Capital Region. In 2006, KNHTS expanded to its neighboring provinces, North and South Chungcheong and Gangwon. Finally,

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in 2010, it became a nationwide survey. Throughout the five surveys that had occurred by 2016, measurement validity and reliability underwent continuous revision (The most recent KNHTS occurred in October 2021, with a substantially smaller sample size due to COVID-19 and related practical barriers. This year, the central government still discusses how to disclose its information.).

KNHTS can be a phone, hand-delivered, or in-person interview survey. Regardless of the questionnaire distribution method, the response generally arrives through a self-report method. Such a traditional type of survey allows calculating the sampling error, through a confirmed method in the existing survey-method literature, and reveals and categorizes travel purposes and modes (TMIP, 2013). Meanwhile, in the upcoming era of the Fourth Industrial Revolution, transportation data reflect affluence in type and amount, which may supplement the KNHTS data, the size of which is relatively small, in estimating origin/destination (O/D) traffic (Chen et al., 2016). Indeed, this includes not only those data directly reflecting travel (e.g., transportation card data) but also attempts to use different types of mobility data (e.g., social media data, mobile phone GPS data). Accordingly, the great potential of big data could make KNHTS useless in its current traditional survey form (Caceres et al., 2007; Tolouei et al., 2017).

Nonetheless, the irreplaceable strengths of KNHTS are that it clearly captures the purposes and modes of travel, and it can secure high-quality data for estimating population characteristics through representative sampling, even from

children and seniors without mobile phones or substantial mobility. Thus, updating KNHTS by overcoming its inherent weaknesses as a sample survey and enabling it to benefit from the strengths of big data is a better approach.

From this perspective, this study aims to review previous studies on Korean domestic and international travel surveys, to identify issues with KNHTS and relevant alternatives. Specifically, while few original journal articles at the international level exist to review travel surveys critically, this study is meaningful in its development of a methodological discussion by presenting international reference cases and examining issues that previous empirical studies report, in which survey outcomes were used for empirical analyses. To this end, this study begins with a discussion of the KNHTS purposes and survey methods, identifying its conceptual issues through a literature review. In addition, the study detects practical issues with KNHTS through pilot interviews with transportation experts on survey methods and travel surveys (subsequent alternatives are reviewed for securing their content validity). Subsequently, it compares KNHTS with other cases of domestic and international travel surveys. Last, a summary will support drawing conclusions and providing suggestions.

2. KNHTS Characteristics and Related Issues

2.1 Characteristics of Each KNHTS Round

Five rounds of the KNHTS occurred from 1996 to the most recent one in 2016, among those

Table 1. Characteristics of Each Round of KNHTS

Survey year	1996	2002	2006	2010	2016 onward
Spatial coverage	Capital Region (Seoul, Incheon, and Gyeonggi)	Capital Region	Capital Region and its neighboring provinces (Chungnam, Chungbuk, and Gangwon)	Entire country (except small islands)	Entire country
Survey period	11/27 (W), but otherwise, any one day between 11/26 (Tu) and 11/29 (F)	4/17 (W), but otherwise, any one day between 4/16 (Tu) and 4/18 (Th)	One weekday 11/1(W) and two weekend days 10/28 (Sa)-29 (S)	One weekday 10/14 (Th) and two weekend days 10/16 (Sa)-17 (S)	One weekday (Th) and two weekend days (Sa and S) in the survey period of May-June
Sampling rate	One-day questionnaire survey (about 3% of the population) and diary-keeping panel survey (about 3% of the sample for the one-day survey)*	About 2.5% of the population	About 3% of the total households for the main weekday survey and about 5% households of the main survey sample for the weekday survey	About 2.5% of the total households for the main weekday survey and about 5.4% of the effective main survey sample for the weekday survey	1.15% for the main weekday survey and 0.06% for the supplementary weekend survey
Sampling method	Cluster sampling	Cluster sampling	Cluster sampling (the weekday and weekend samples were the same)	Cluster sampling (the weekday and weekend samples were different)	Cluster sampling (the weekday and weekend samples were different)
Distribution and retrieval	Voluntary participation through school media, commercials, and financial rewards; distributed by public agencies; personal (home and workplace) visit and phone survey	Home visit; distributed by public agencies	Distributed by community-level admin bodies and neighborhood heads	Distributed by census-takers, community-level admin bodies, and women's associations	Home visit; distributed by community-level admin bodies and hired fieldworkers
Response rate	83.22%	84.10%	Weekday 88%, weekends 81%	Weekday 88%, weekends 86%	Weekday 84%, weekends 93%

* The diary-keeping panel survey had the sampling rate of 3% of the questionnaire survey sample. The panel has been contacted beforehand and the quality control (monitoring during the survey process and phone calls and personal visits) was made.

Sources: Seoul Metropolitan Government (1997, 2003), Metropolitan Transportation Authority (2007), and Korea Transport Institute (2011, 2016)

registered in the semidecadal Korean Census, and every five years (actually, four to six years), a questionnaire survey was quickly done with a large number of them. Until 2010, KNHTS collected travel data on one particular day, but for the 2016 survey, it did so on Thursdays for a predefined period. A weekend travel survey began in 2006 as a supplement to the main weekday survey, to measure travel on the weekends preceding and following the main survey date. Table 1 presents the sampling frames, survey methods, response rates, and other traits of the five KNHTSs.

2.2 Theoretical and Practical KNHTS Issues

KNHTS categorizes trips according to their purposes and modes. Most trips are for commuting, so, unintentionally, transportation systems and infrastructure, as well as transportation policies and plans, tend to focus on commuting (Forsyth et al., 2007). This makes KNHTS inherently defective in explaining the expansion of nonregular trips, such as those for leisure, and substantial changes in the population structure and transportation environment (Handy, 2005).

The current KNHTS occurs every five years, for which a large number of fieldworkers collect responses for a short time. This survey method exposes three issues concerning the survey cycle and period. First, a relatively long cycle between surveys limits an understanding of longitudinal dynamics. One of the primary purposes of KNHTS is estimating the current population values of regional O/D traffic, to predict future traffic. Various socioeconomic indicators contribute to the prediction. However, semidecadal data cannot duly

reflect the effects of rapidly changing social and economic phenomena (Nam et al., 2013). Second, a lack of fieldworker expertise can be an issue. The main survey takes two months to complete the recruiting and training of fieldworkers, the implementation of the survey, and the monitoring and quality control of responses. Thus, the fieldworkers cannot secure sufficient expertise, necessarily increasing nonsampling error. Indeed, according to the report of the National Passenger O/D Traffic Survey (Korea Transport Institute, 2016), despite various data examinations for error control by fieldworkers, managers, and coders, a large number of survey errors occurred. Accordingly, the survey had to be reconducted in the Capital Region and elsewhere, increasing time and cost burdens. Last, the sensitivity of particular travel purposes to seasons and weather conditions—for example, leisure travel—means the short survey period cannot duly consider their effect. South Korea has differing weather conditions throughout the four seasons, so leisure, recreational, and other long-distance trips reflect different patterns by season. Thus, without due consideration of the conditions, the short-length survey must admit to a limitation on population estimation, particularly relating to discretionary or nonmandatory trips. In addition, while those trips are more common on weekends, Nam et al. (2013) argue that the weekend survey of KNHTS samples only 5% of the main weekday survey population, so it can claim considerably less sample representativeness.

Essentially, data has suggested redefining the concept of “trip.” Unlike commuter and business-related trips, shopping and leisure trips involve

less utilitarian purposes (Gim, 2018). That is, arriving at the destination on time is not the primary aim. Instead, these travelers seek a variety of “utilitarian” activities that may include conversation, reading, rest, and idle observation (Mokhtarian and Salomon, 2001). The current KNHTS does not collect data on these “on-the-way” auxiliary activities; it only focuses on planned activities at the trip destination.

Meanwhile, in compact, smart, and declining cities in the era of the Fourth Industrial Revolution, internal trips via nonmotorized modes (and personal transporters) would replace external trips (Ewing and Cervero, 2010). Indeed, studies in Seoul, Korea, found that internalized trips align with the compact urban form (Gim, 2018). However, the current KNHTS intentionally ignores short-length trips—usually internalized—by asking respondents to exclude “those cases in which (they) walk to stores and other places near home.”

Last, the researcher conducted expert group interviews on February 13, 2019, to confirm the KNHTS issues that the literature indicates and to detect practical issues present during the real-world field survey. The transportation experts were only those with experience designing and/or conducting KNHTS, and the IRB (Institutional Review Board) of Seoul National University approved the interviews (IRB No. 1908/002-022). Among the additions were, first, the current type of survey cannot accurately measure long-length leisure trips that occasionally happen during vacations. Next, as Table 1 shows, the effective sampling rate is in a declining trend, which may considerably harm the reliability of the population estimates.

In particular, the weekend survey samples only 5% of the weekday sample, so its level of reliability is even lower. In general, the budget per household is downsizing, arguably limiting the quality of the survey data.

3. Analysis of International Cases

3.1 Survey Cycle and Period

As shown in Table 2, international NHTSs enable dichotomizing the survey cycle. The first type involves conducting a survey regularly, once in a couple of years: This type includes the KNHTS, U.S. National Household Travel Survey (NHTS), German Mobility in Germany (MiD), and Japanese Nationwide Person Trip Survey (NPTS). The survey uses a large sample size, which contributes to internal validity. However, a long interval between surveys makes it difficult to identify time-series changes, as do the effects of social and economic events on travel (Nam et al., 2013). However, socioeconomic indicators and transportation statistics by mode support annual updates of O/D data. An alternative is to conduct a survey each year and compile and announce accumulated data for several years. Representative cases include the U.K. National Travel Survey (NTS), Australian Household Travel Surveys (HTS), and New Zealand Household Travel Survey (NZHTS).

Regarding survey periods, most NHTSs collect data all year, thus, reflecting seasonal variations in travel in the data. However, the distribution of KNHTS questionnaires (as of 2016, the most recent survey year) occurs in May (first- and second-round surveys) and October through December

Table 2. Survey Cycle and Period of National Travel Surveys

Title	Survey cycle	Survey time/period
Korea National Household Travel Survey (KNHTS)	About 5 years (4-6 years)	3 times a year (in 2016, first round on 5/8-18, second round on 5/20-25, and supplementary survey on 10/4-12/18)
U.S. National Household Travel Survey (NHTS)	5 years (5-8 years)	Year-round
U.K. National Travel Survey (NTS)	Conducted annually, but compiled/announced every three years	Year-round
German Mobility in Germany (MiD)	Non-regular (5-8 years)	Year-round (for the 2017 survey, June 2016-September 2017)
Australian Household Travel Survey (HTS)	Conducted annually, but compiled/announced every three years	Year-round in Sydney, Melbourne, Perth, and Hobart, 9 months of the year in Adelaide, 10 weeks of normal academic semesters in Brisbane (only weekdays), 3 months in Canberra (except for weekends, school holidays, and public holidays), and one week in Darwin (1/7 of the sample was assigned to each week)
New Zealand Household Travel Survey (NZHTS)	Conducted annually, but compiled/announced every three years	Year-round
Japanese Nationwide Person Trip Survey (NPTS)	5 years	For the 2015 survey, one day (between Tuesday and Thursday) in September-November and one Sunday

Sources: German Federal Ministry of Transport (2022), New Zealand Ministry of Transport (2022), U.K. Department for Transport (2022), U.S. Bureau of Transportation Statistics (2022), and Stopher et al. (2011)

(supplementary survey, due to a low response rate), thus failing to duly capture the seasonal variations. Notably, Korea has harsh weather conditions in summer and winter, as well as frequent vacation trips during these seasons. Despite suppositions that summer and winter trips differ, they are currently underrepresented and possibly misestimated (particularly leisure trips).

To address these issues with the survey cycle and period, a panel survey method has been suggested not only for NHTSs in general (Handy, 2005) but also particularly for KNHTS (Han, 2015).

Regarding this alternative, the expert focus group interviewed for this study acknowledged the validity of the panel survey as a small-sample supplementary survey of the entire KNHTS. Nonetheless, entirely changing the survey method is virtually impossible, due to the difficulty of keeping the original panel and financial constraints (Gim, 2016). An example of the small-sample supplementary survey appears in San Francisco, where a supplementary survey of about 800 people occurred from 2013 to 2017 and identified meaningful determinants of traffic variations (SFMTA, 2017).

3.2 Sample Size

The effective sampling rate of KNHTS relative to the population was about 3% in 1996. The rate continued to decrease, to 2.5% in 2010 and 1.15% in 2016 (the weekend survey was even lower at 0.06%). This raised considerable concern over the reliability of population traffic estimates from the O/D data of a much-reduced sample.

In fact, as Table 3 shows, KNHTS—especially its weekday survey—does not have a worse sampling rate than other NHTSs. Nonetheless, group interviews with Korean transportation experts found that considering rapid land-use changes in Korea, even the effective sampling rate of 2.5% was not enough to accurately measure all survey items.

Different from its weekday survey, the effective sampling rate of the KNHTS weekend survey of 0.06% (as of 2016) is considerably lower than that of international NHTSs. Its rate is smaller

than the rates of those large surveys that occur on a regular basis, surveys similar to KNHTS, such as the German MiD (0.33%) and Japanese NPTS (0.09%). Also, the KNHTS weekend sample is even smaller than the samples for those small-sample, year-round surveys—for instance, the New Zealand NZHTS (0.27%) and the Australian HTS (0.08). The effective sampling rate of the U.K. NTS is only 0.03%, but as it occurs every year, the sampling rate for the KNHTS weekend survey (0.06%) is deemed substantially lower. From this perspective, previous studies highlight the limitation of KNHTS as its lower sampling rate for the weekend survey than the weekday-survey sample (Nam et al., 2013).

The weekday-weekend separation survey method explains the low sampling rate of the KNHTS weekend survey. KNHTS measures one-weekday trips using a weekday survey and two-weekend-day trips with a separate weekend survey. By

Table 3. Comparing the Sample Size, Effective Sampling Rate, and Weekday-weekend Separation

Surveys (reference years)	Sample sizes (households)	Sampling rate (%)	Weekday-weekend separation
Korea KNHTS (2016)	202,316	1.15	Weekday and weekend surveys separated
U.S. NHTS (2017)	12,221	0.06	Weekend survey individually conducted
U.K. NTS (2017)	129,696	0.01*	Unseparated
German MiD (2017)	6,135	0.03 [†]	Unseparated
Australian HTS	135,000	0.33 [‡]	Unseparated
New Zealand NZHTS (10/2015-7/2018)	3,000-3,500	0.07 [¶]	Mixed (out of eight megaregions, unseparated in six and only weekday survey conducted in the other two)
Japanese NPTS (2015)	4,144	0.27 [§]	Unseparated

* Calculated based on the population of 22,694,600 households in 2017

† Calculated based on the population of 41,305,000 households in 2017

‡ Calculated based on the population of 4,551,000 households in 2012-2013 (assuming 3,250 for the effective sample)

¶ Calculated based on the population of 1,549,890 households in 2013

§ Calculated based on the population of 53,448,685 households in 2015

Sources: German Federal Ministry of Transport (2022), U.K. Department for Transport (2022), U.S. Bureau of Transportation Statistics (2022), and Stopher et al. (2011)

comparison, most of the international NHTSs do not separate weekends from weekdays; instead, they continuously measure trips throughout one whole week or so.

As with KNHTS, several international surveys do separate weekday and weekend trips, including the Japanese NPTS, U.S. NHTS, and Australian HTS. However, unlike KNHTS, they do not entirely separate the weekday and weekend surveys. In Japan, the survey is done for one weekday and one weekend day, but the weekday and weekend samples do not differ, that is, the same travelers respond regarding the two travel days. For the sample assigned to add-on agency partners, the U.S. NHTS allows separating 6/7 of the sample for measuring weekday trips and 1/7 for weekend trips. However, the official sample assigned to public administration is equally separated (i.e., 1/7) over the seven days of the week. The Australian HTS compiles data collected independently by megaregion, and except for two that only conduct weekday surveys, the other six do not separate the weekday and weekend surveys.

3.3 Survey Items and Response Options

KNHTS categorizes travel purposes into 12 types. Among them, the category for discretionary/nonmandatory purposes includes five response items—"to buy stuff (shopping)," "eating out," and "visiting relatives" are independent items, whereas "leisure/sports/tourism/recreation" and "others (religious activities, personal affairs, etc.*)" combine several purposes. Mixed purposes may create difficulties in accounting for trip characteristics (Kim, 2015), calling for a refined classi-

fication system to duly reflect discretionary/nonmandatory travel purposes.

Compared to KNHTS, the U.S. NHTS, U.K. NTS, and Japanese NPTS categorize discretionary travel purposes in greater detail. For shopping [i.e., "to buy stuff (shopping)"], U.S. NHTS separately asks about (1) goods purchase (food and groceries, clothes, appliances, gas, etc.) and (2) services purchase (laundry, banking, car repair, pet care, etc.). Also, for leisure [i.e., "leisure/sports/tourism/recreation"], NHTS has two response items: (1) recreational activities (park, movie, bar, museum, etc.) and (2) sports activities (jog, stroll, dog walk, gym, etc.). Lastly, the KNHTS item for "others (religious activities, personal affairs, etc.*)" subdivides into three: (1) other general chores (post office, library, etc.), (2) religious or other community activities, and (3) others.

The "to buy stuff (shopping)" option in the KNHTS includes in the U.K. NTS (1) food and grocery shopping and (2) other types of shopping. Even the "eating out" option in the U.K. survey has categories for (1) eating out (alone or at work) and (2) eating out (on other occasions). Also, "leisure/sports/tourism/recreation" offers three response options: (1) recreation/public social activities, (2) participating in sports activities, and (3) daily trip/strolling. By and large, the Japanese NPTS and the KNHTS have similar classification systems for travel purposes, but for the "to buy stuff (shopping)" option, the Japanese survey uses the concept of the daily-living sphere and offers the following two options: (1) meal/social/recreation (within the daily-living sphere) and (2) tourism/outing/leisure (outside the daily-living sphere).

KNHTS classifies travel modes into 21 types. Most international NHTSs have similar classification systems. Notably, however, the U.S. NHTS proactively reflects mobility innovations, such as bike-sharing services (Bikeshare, Zagster, and CycleHop), smartphone-based car-sharing services (Uber, Lyft, and Sidecar), and general car-sharing services (Zipcar and Car2GO).

Aside from travel purposes and modes, other survey items ask respondents to identify the characteristics of each trip, and KNHTS can refine the item on companions, namely, “number of passengers and the driver together (selective question for private car/taxi/truck users).” This may underestimate the number of companion travelers for walking and public transit. In contrast, the National Tourism Survey, which the Korean Ministry of Culture, Sports and Tourism administers, to understand the characteristics of domestic tourists, measures the number of companions for each and every tour. Among international cases, the U.S. NHTS asks respondents to list household members among companions, and the U.K. NTS separately measures the number of companions (adults and underaged) and passengers. The Japanese NPTS separately measures the numbers of drivers and passengers and, particularly for passengers, differentiates household members.

Lastly, KNHTS does not count travel costs; it had asked about whether the parking fee was paid, but its data were not made public, and the questionnaire no longer includes that question.). By contrast, the National Tourism Survey measures spending on leisure travel, and, internationally, NHTSs include similar questions, e.g., tolls in the

U.S., parking fees in the U.K., and use of toll roads in Japan.

3.4 Survey Method

The KNHTS operates through personal visits by fieldworkers, who provide respondents with assistance in answering the self-report survey. Following up to collect missing responses occurs through a supplementary phone survey. In addition, for one-person households, double-income households, and other cases in which no stay-home persons are present and interviews with the fieldworkers are not feasible, an Internet-based survey is also an option, and related instructions enable respondents to freely participate without temporal and spatial constraints.

By comparison, the U.S. NHTS and German MiD employ the hand-delivered survey, Internet survey, and phone interview methods together. The Australian HTS survey method slightly differs among its eight regions, but it generally centers on hand-delivered and phone surveys that fieldworker-interviewers support. New Zealand’s NZHTS respondents keep a travel diary for two days with a fieldworker’s assistance and guidance. In principle, the Japanese NPTS is a mail survey, but the respondent can conveniently complete the survey on a website.

4. Discussion

In the context of how to improve KNHTS, this study focuses on the survey cycle and period, sample size, survey items/response options, and questionnaire distribution/retrieval (see Table 4).

Table 4. Selective Issues and Alternatives for KNHTS

Types	Issues	Alternatives
Survey cycle	Five-year cycle is too lengthy to capture longitudinal travel variations.	To reduce the survey cycle
Survey period	Survey is conducted at a particular time, and seasonal travel variations non-regular travel are difficult to catch.	To conduct a year-round survey to account for travel variations by season and weather condition
Sample size	The size of the weekend survey sample is too small to duly represent the entire population.	To conduct the weekday and weekend surveys together, to determine the size of the weekend sample in line with the weekday-weekend traffic ratio, and to initiate a supplementary survey for long-standing small-sample measurement
Survey items: (1) trip purpose	Weekend travel is made for a variety of purposes and its patterns are hard to capture.	To categorize travel purposes in greater detail according to activities (and to define the subgroups of the purposes by distance)
Survey items: (2) travel mode	New travel modes are not readily reflected.	To include more response options and rapidly reflect new travel modes
Survey items: (3) others	Travel purpose categories are biased to weekend travel, focusing on compulsory/mandatory travel, particularly commuting.	To add survey items such as number of companions and travel-unrelated costs (e.g., for leisure purposes)
Survey method	Interview survey through personal visits would face physical barriers.	To conduct self-report survey, phone survey, web-based survey, etc. simultaneously

One of the study's contributions is that comparing international cases identifies a priority of methodological issues to address and proposes practical alternatives. Regarding each prioritized issue, theoretically, the study posits (1) determining the survey interval, considering the stability of the survey population and the costs, and (2) either shortening the survey period, to achieve a homogeneous sampling that makes the sample more representative of the narrowly defined population, or lengthening it, so variable ranges become wide enough to be statistically controlled. Also, (3) the design of the weekend survey and specifying travel purposes should allow for different compulsory or mandatory trip levels (e.g., dis-

cretionary leisure travel, as opposed to compulsory commuting). Last, (4) the sample size has continued to shrink, and the recent 2021 survey occurred using a much smaller sample than ever before. Thus, planners must develop a breakthrough to estimate the population parameter accurately. The sample-size issue relates to (2) and (3) with respect to overall reliance on big data and limited applicability of travel survey data (Mokhtarian, 2018; Wilhelm and McGuckin, 2018).

First, regarding the survey cycle, a short interval can sensitively capture travel-pattern changes. For the KNHTS population, the Korean Census was updated, from the traditional semi-decadal field survey to its 2015 register-based census

(i.e., population, household, and housing statistics, based on administrative data from public systems, e.g., the resident registration system and the building register, instead of the traditional mail survey or personal visits to all households across the country). As census data are updated annually, shortening the KNHTS cycle can occur accordingly. While major international NHTSs maintain the five-year cycle, KNHTS is advised to shorten it, noting that U.K., Australia, and New Zealand can thus consider rapid land use and social changes.

Regarding survey periods, year-round measurement is desirable, to explain seasonal changes in travel patterns and reflect nonregular discretionary travel purposes (e.g., leisure). A year-round survey is common in cases internationally. For more efficient control of the budget, spending, and response quality, conducting the survey more than four times a year, by evenly dividing the predefined sample, offers an alternative.

Another recommendation is enlarging the weekend sample size. Three alternatives are possible. First, the weekday and weekend surveys can occur simultaneously, without changing the current KNHTS practice of separating weekday and weekend trips, just as the Japanese NPTS asks the same respondents about their weekday and weekend trips. Second, weekday and weekend surveys can access the entire sample through the proportional sampling technique—that is, according to weekday and weekend traffic ratios. For example, in the results of the 2010 KNHTS, 83% and 67% of the weekday and weekend surveys, respectively, made trips. This means that weekend travelers equal about 80% of weekday travelers. Thus, in

the next KNHTS round, the target sample size for the weekend survey could be 80% of the weekday survey sample. The third alternative is to format the weekend survey differently from the main weekday survey. Leisure trips, most of which occur on weekends, are sensitive to weather and seasonal conditions. As such, the current way of evaluating weekend trips in a two-day period cannot duly evaluate weekend travel patterns. Rather, extending the survey period by adjusting the sample size could support a better understanding of weekend trips.

Regarding the travel-purpose classification system, response options are biased toward compulsory/mandatory purposes, making discretionary/nonmandatory trips hard to examine in detail. One alternative is to detail travel purposes according to activities, as the U.S. NHTS and U.K. NTS do. Notably, however, excessively classifying response options could result in unclear differences between them; thus, assuming their mutual exclusivity is less certain. Moreover, the complexity would tire respondents more easily and could lead them to give hasty and unconsidered answers. Considering that trip length varies according to leisure purposes (Jang, 2015), KNHTS could separate short and long leisure trips, as the Japanese NPTS does. For example, the “leisure/sports/tourism/recreation” item could become “leisure/sports” and “tourism/recreation”.

Also, reflecting new technological and policy developments could improve the travel-mode response options. When people drive a shared car, they are not sure if they should check “sedan/van (driving)” or “others.” Also, using a Tada service,

the mode could be either “taxi” or “others.”¹⁾ To prevent this ambiguity and subsequent nonsystematic error, referring to U.S. NHTS could help KNHTS update travel-mode options.

Next, replacing the question on “number of passengers and driver together” with the number of companions and/or the number of household members among the companions could emulate what the U.S., U.K., and Japan do. Also, a survey item on expenditures during each trip would provide transportation planners with additional insights.

Finally, adding survey rounds or allowing a year-round survey could support alternative questionnaire distribution and response retrieval methods, in addition to the current personal-visit method. To increase survey cost-efficiency and enable it even during harsh weather conditions. Phone and Internet-based surveys are viable alternatives, as the surveys by the U.S., Germany, and Japan confirm.

5. Summary

As transportation data increasingly abound in type and amount, a concern arises regarding traditional KNHTS measurement. However, by proposing collecting data on travel purposes and modes instead of entirely abolishing the survey, this study explores quality improvement by reviewing the transportation literature and referring to major international NHTSs.

Among its major methodological limitations, KNHTS undertakes surveying large numbers for a short period, with a lengthy survey cycle of five years. This makes a longitudinal analysis difficult, and the short time hinders detecting travel variations due to seasonal and meteorological changes. Second, the effective sampling rate continued to decrease, and the issue of sample representativeness especially arises in relation to the smaller-size weekend survey. Third, the response options for travel purposes are biased toward compulsory or mandatory purposes, such as commuting to school and work, and relatively discretionary or nonmandatory travel, such as recreation and tourism, could be underrepresented.

As an alternative to each of these three issues, attempting the smaller-size year-round survey could also ultimately reduce the survey cycle. Second, sample representativeness could improve if the weekday and weekend surveys occurred simultaneously, consistently using the same sample or considering the ratio of the traffic volume and proportionally enlarging the weekend sample. Third, adding response options for discretionary travel could occur by specifying shopping and leisure travel in greater detail or classifying it by trip length. Third, the travel-mode options could better reflect transportation innovations by adding more options. As a minor suggestion, survey items on the number of companions and costs on the way to the destination are desirable.

Notably, this study’s suggestions are practical and

1) Tada is a rental van-hailing service running in Korea (<https://tadatada.com>). World-famous Uber is banned in Korea, and instead, through Tada, customers can rent a van and a driver together (renting a sedan instead of a van forces them to drive the car on their own).

strategic choices to minimize additional resources. Other alternatives are possible if expanding human, time, and monetary resources could occur. Also, this study considered the applicability of KNHTS data to other fields, such as tourism, public health, and sociology. Nonetheless, a limitation exists, in that the validity and feasibility of the suggestions were not tested/confirmed through a real survey. Thus, in a follow-up study, we plan to revise the KNHTS according to the suggestions and pretest the revision.

Another limitation is that, as with the existing literature dedicated to the critical review of national travel surveys (e.g., Litman, 2011; Mokhtarian, 2018; Wilhelm and McGuckin, 2018), this study relied only on qualitative analysis. Accordingly, further studies equipped with quantitative approaches are recommended.

Although alternatives this study proposes are strategic options to minimize additional resources, they are not comprehensive and complete. Thus, future research must explore other options to make a household travel survey irreplaceable or complementary to transportation big data.

References

1. Caceres, N., J.P. Wideberg and F.G. Benitez (2007), "Deriving Origin-Destination Data from a Mobile Phone Network", *IET Intelligent Transport Systems*, 1(1): 15~26.
2. Chen, C., J. Ma, Y. Susilo, Y. Liu and M. Wang (2016), "The Promises of Big Data and Small Data for Travel Behavior (Aka Human Mobility) Analysis", *Transportation Research Part C*, 68: 285~299.
3. Ewing, R. and R. Cervero (2010), "Travel and the Built Environment: A Meta-Analysis", *Journal of the American Planning Association*, 76(3): 265~294.
4. Forsyth, A., J.M. Oakes, K.H. Schmitz and M. Hearst (2007), "Does Residential Density Increase Walking and Other Physical Activity?", *Urban Studies*, 44(4): 679~697.
5. Gim, T.-H.T. (2016), "Testing the Reciprocal Relationship between Attitudes and Land Use in Relation to Trip Frequencies: A Nonrecursive Model", *International Regional Science Review*, 39(2): 203~227.
6. Gim, T.-H.T. (2018), "Land Use, Travel Utility, and Travel Behavior: An Analysis from the Perspective of the Positive Utility of Travel", *Papers in Regional Science*, 97: S169~S192.
7. Han, S. (2015), *Transport Monthly 2015-5*, Sejong, Korea: Korea Transport Institute.
8. Handy, S.L. (2005), "Does the Built Environment Influence Physical Activity? Examining the Evidence: Critical Assessment of the Literature on the Relationships among Transportation, Land Use, and Physical Activity", *TRB Special Report*, 282.
9. Jang, Y.J. (2015), "An Analysis of the Behavioral Characteristics of Leisure Mobility on Household Life Cycles: A Focus on the Choice of Leisure Destination at Residences", *International Journal of Tourism and Hospitality Research*, 29(8): 111~123.
10. Kim, S. (2015), *Revising Statistical Indicators of the Traffic Survey for Pedestrian Policy Design*, Seoul, Korea: Seoul Institute.
11. Korea Transport Institute (2011), *2010 National Passenger O/D Survey*, Goyang, Korea: Korea Transport Institute.
12. Korea Transport Institute (2016), *2016 National Passenger O/D Survey*, Sejong, Korea: Korea Transport Institute.
13. Litman, T. (2011), *Short and Sweet: Analysis of Shorter Trips Using National Personal Travel Survey Data*, Victoria, Canada: Victoria Transport Policy Institute.
14. Metropolitan Transportation Authority (2007), *Report of the 2006 Capital Region Household Travel Survey*, Seoul, Korea: Metropolitan Transportation Authority.

15. Mokhtarian, P. (2018), "Why Travel Surveys Matter in the Age of Big Data?", *Transportation Research Circular*, E-C238: 2~4.
16. Mokhtarian, P.L. and I. Salomon (2001), "How Derived Is the Demand for Travel? Some Conceptual and Measurement Considerations", *Transportation Research Part A*, 35(8): 695~719.
17. Nam, K., T. Heo and G. Park (2013), *Final Report of a Research Project on National Travel Surveys 2013 Regular Statistics Quality Monitoring*, Daejeon, Korea: Statistics Korea.
18. San Francisco Municipal Transportation Agency (2017), *2013-2017 Travel Decision Survey Data Analysis and Comparison Report*, San Francisco, CA: San Francisco Municipal Transportation Agency.
19. Seoul Metropolitan Government (1997), *Seoul Transportation Census and Database Construction (National Household Travel Survey)*, Seoul, Korea: Seoul Metropolitan Government.
20. Seoul Metropolitan Government (2003), *2002 Seoul Household Travel Survey: Household Travel Survey and OD Construction*, Seoul, Korea: Seoul Metropolitan Government.
21. Stopher, P., Y. Zhang, J. Armoogum and J.L. Madre (2011), "National Household Travel Surveys: The Case for Australia", 34th Australasian Transport Research Forum.
22. Tolouei, R., S. Psarras and R. Prince (2017), "Origin-Destination Trip Matrix Development: Conventional Methods Versus Mobile Phone Data", *Transportation Research Procedia*, 26: 39~52.
23. Travel Model Improvement Program (2013), *Household Surveys at a Glance*, Washington, DC: Federal Highway Administration.
24. Federal Ministry of Transport, "Mobility in Germany (MiD)", Accessed February 20, 2022. <https://www.infas.eu/projects/infas-project/mobility-in-germany-mid/>
25. New Zealand Ministry of Transport, "New Zealand Household Travel Survey", Accessed February 20, 2022. <https://www.transport.govt.nz/>
26. U.K. Department for Transport, "National Travel Survey 2017 Report", Accessed February 20, 2022. <https://www.gov.uk/government/collections/national-travel-survey-statistics>
27. U.S. Bureau of Transportation Statistics, "National Travel Survey 2017 Report", Accessed February 20, 2022. <https://www.bts.gov/>
28. Wilhelm, J. and N. McGuckin (2018), "Rethinking the Survey Part of the NHTS", *Transportation Research Circular*, E-C238: 70~71.

요 약

통행을 포착할 수 있는 자료가 양적으로 방대해지며 가구통행실태조사와 같은 전통적 교통조사에 대한 무용론이 제기되고 있다. 그러나 통행의 목적과 수단을 파악할 수 있는 등 가구통행실태조사는 그 중요성이 여전하다. 이에 본 연구는 국내외 교통조사 사례 및 관련 문헌을 검토하여 가구통행실태조사의 현황을 파악하고 개선방안을 논의한다. 본 연구는 가구통행실태조사가 직면한 한계점 중 긴 조사주기, 짧은 조사기간, 유효표출률의 감소, 의무통행 중심의 문항 구성에 대해 다룬다. 이에 대한 개선방안으로 조사주기 단축, 연중조사 시행, 주중조사와 주말조사의 병행 시행, 주말통행 관련 항목 세분화 등을 제안한다. 본 연구는 교통분야 외에 관광, 보건, 사회 등의 분야에서도 응용할 수 있도록 확장성을 감안하며, 제약된 예산 하에서 현실적인 개선방안을 고려한다는 데에 의의가 있다.

주제어 : 가구통행실태조사, 조사방법, 문헌검토, 사례조사
