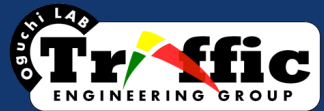


# Analyses on Travel Demand Variation Considering User's Choice Behavior on Urban Expressway Using ETC Data\*

ETCデータを用いた都市高速の交通需要変動分析



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\* This research was conducted under the collaborative study with Tokyo Metropolitan Expressway Co. Ltd.



## What is ETC data?

Electronic Toll Collection or ETC Data is obtained when a car passes through the ETC gate at the expressway. By analyzing this data, it is possible to observe and understand the behavior of each driver. This knowledge can be used by the expressway operator in making efficient strategies to manage travel demand.

- ID
- Entry time
- Vehicle type
- On-ramp code

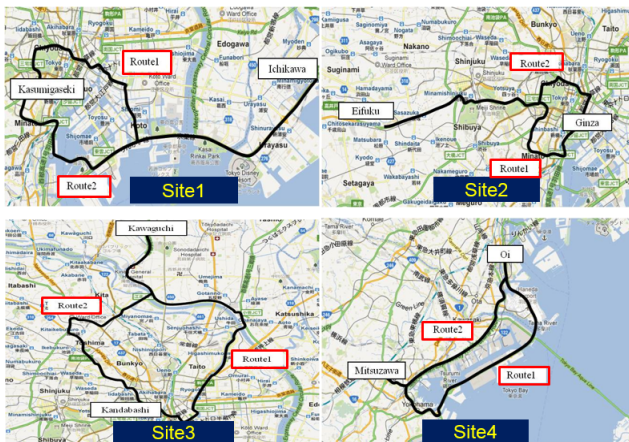


- ID
- Exit time
- Off-ramp code

【~90% of expressway users use ETC system!!】

## Study Area

Analysis of Data from Tokyo Metropolitan Expressway Data collected from August 2010 to March 2011 (8



## Pooled Data versus Panel Data

Two data types from ETC and detector data:

There are 5 data points and 5 different vehicles!

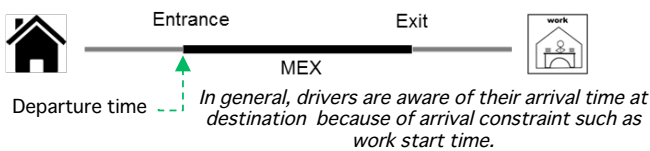


Pooled data is obtained by putting together all vehicle data over the observation period. If the same vehicle is observed again it will be treated as a different vehicle. Conventional methods use pooled data and assume that driver behavior is stable over time.

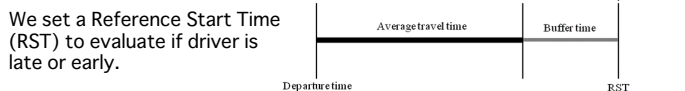
Panel data, on the other hand, recognizes the same vehicle on another observation. Thus, we can check if there is variation in driver behavior.



## Choice of Departure Time



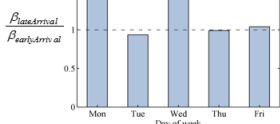
### Do drivers always depart early/late?



Buffer time = 95<sup>th</sup> Percentile travel time for a trip - Average travel time (Lomax, et. al. 2003)

$$V_i = \beta_{travelCost} TC_i + \beta_{earlyArrival} \max(0, (RST - AT_i)) + \beta_{lateArrival} \max(0, (AT_i - RST)) + \beta_{speedReq} SPD + \beta_{reqUser} FREQ \quad (\text{Small, 1982})$$

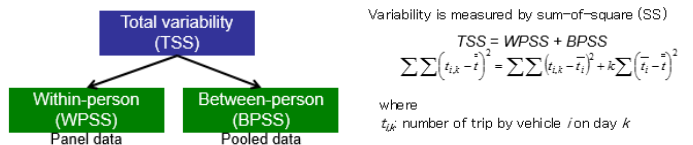
Where:  $V_i$  - deterministic utility function;  $AT_i$  - arrival time;  $TC$  - travel cost/time



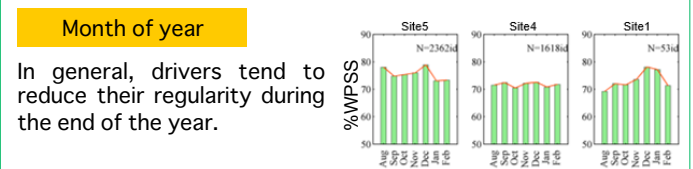
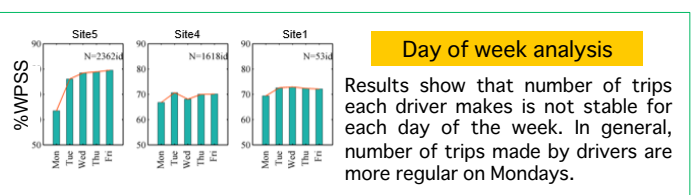
Drivers are aware of being late than being early on Mondays and Wednesdays. On Tuesday, Thursday and Friday, late and early penalty are slightly different.

## Daily variability in trip making behavior

Conventional traveler demand analysis methods assume that each driver behaves the same way on weekdays. We try to confirm this by analyzing panel data.



Lower level of %WPSS means driver makes more regular number of trips.



Behavior is not stable over time !