Analyses of Travel Demand Variation Considering Users' Choice Behaviors on Urban Expressway Using ETC Data

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Key words: Drivers' behavior, ETC, Expressway

Background

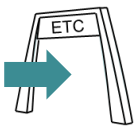
➢Travel demand and traffic management (TDM) aim to ensure the efficient use of existing roadway system.

The better knowledge of travel demand enhance the efficient implementations of TDM/ITS strategies.

Limitations of conventional methods:

➢Collecting travel information is difficult.

➢Usually, based on stated preference (SP) data and small sample size.



On Metropolitan Expressway (MEX)

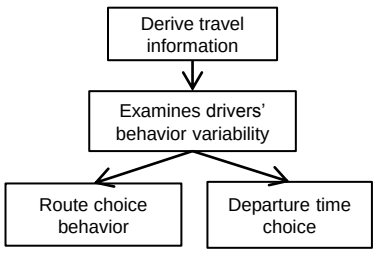
➢More than 90% of expressway users use ETC system.

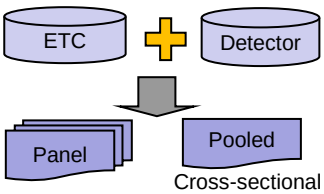
Purpose

➢To obtain better knowledge of travel demand variation using travel information derived from ETC and available data sources.

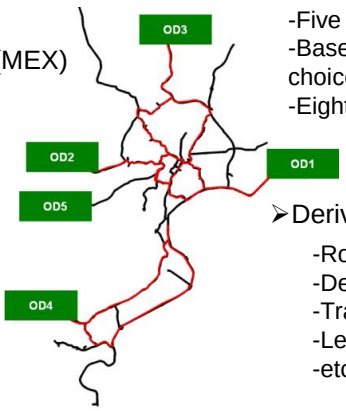
Study Sites

➢Tokyo metropolitan expressway (MEX)





Cross-sectional data



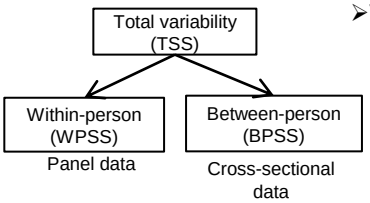
-Five study areas are selected
-Based on two major route choices
-Eight months travel data

➢Derived travel data

-Route choice
-Departure time
-Travel characteristics
-Level of service information
-etc.

Empirical Results

Daily variability characteristics of trip making behavior



Panel data

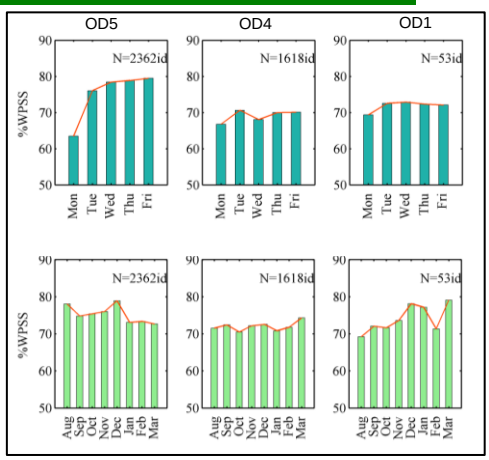
Cross-sectional data

➢Variability is measured by sum-of-square (SS)

$$TSS = WPSS + BPSS$$

$$\sum\sum\left(t_{i,k}-\bar{\bar{t}}\right)^2 = \sum\sum\left(t_{i,k}-\bar{t}_i\right)^2 + k\sum\left(\bar{t}_i-\bar{\bar{t}}\right)^2$$

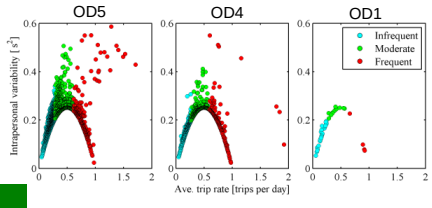
where $t_{i,k}$: number of trip by vehicle i on day k



➢Individual variability

$$s_i^2 = \frac{1}{J-1}\sum_{j=1}^{J}\left(t_{ij}-\bar{t}_i\right)^2$$

where
S_i^2: intrapersonal variability by vehicle i
J : Total observation days



Route choice behavior

➢Preference of using Route1 or Route2

➢Define drivers' main route.
➢Preference of switching to alternative route.

Departure time choice behavior

Conclusion

➢A knowledge of travel demand variation is examined in both spatial (route choice) and temporal (departure time) dimension using revealed preference (RP) travel information from ETC and detector data.

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