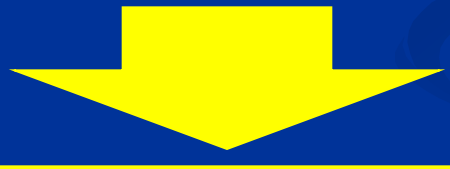
Mode Choice Analysis with Imprecise Location Info.

Toshiyuki Yamamoto & Ryosuke Komori
Nagoya University

NU TREND
Nagoya University
TRansport and ENvironment Dynamics

Background

- Public transit such as LRT and Flexible bus is regarded one of the alternatives for EST projects, which improves the access and egress conditions to public transit.
- Centroid of TAZ is used as the origin and destination in conventional mode choice models



Location information of trip is not precise enough

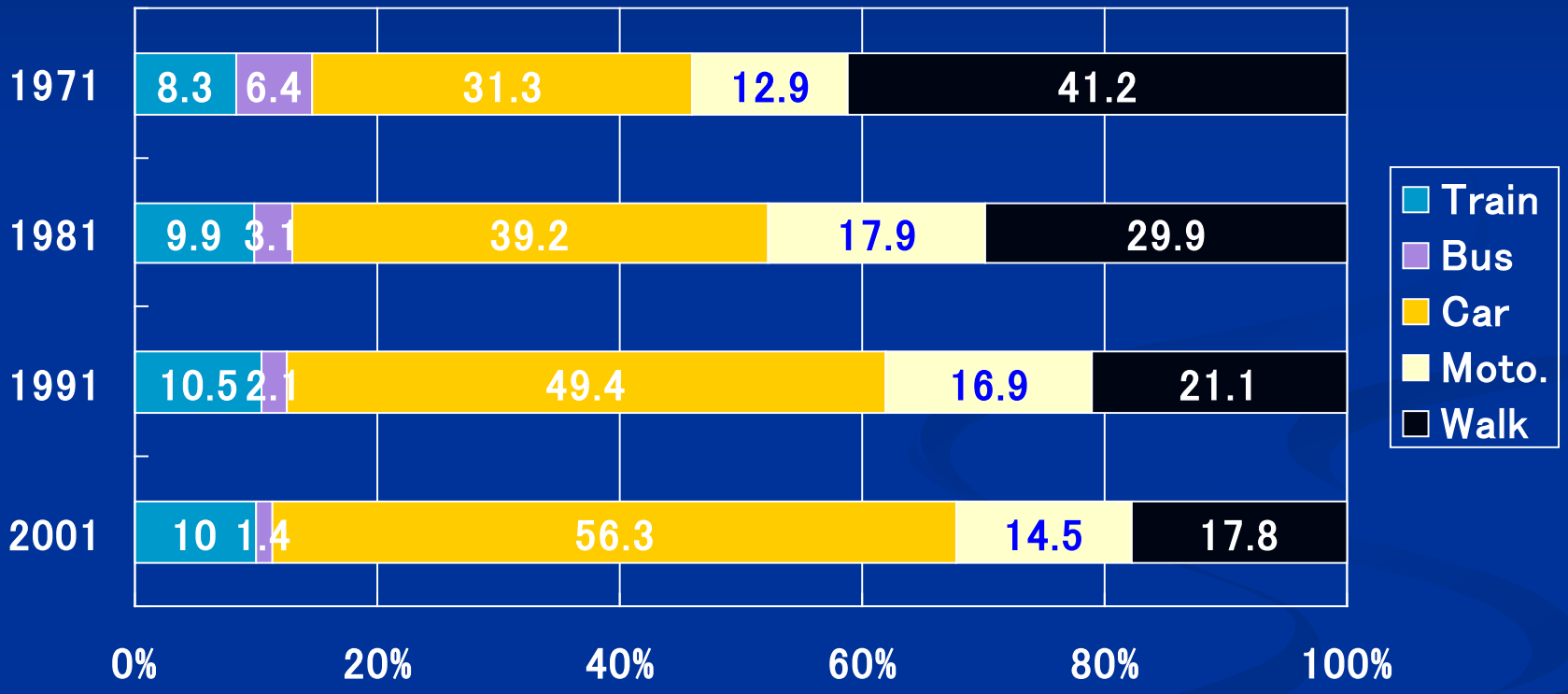
Objective

Effective use of large-scale person trip data to investigate the effects of access condition to the station and bus stop

by

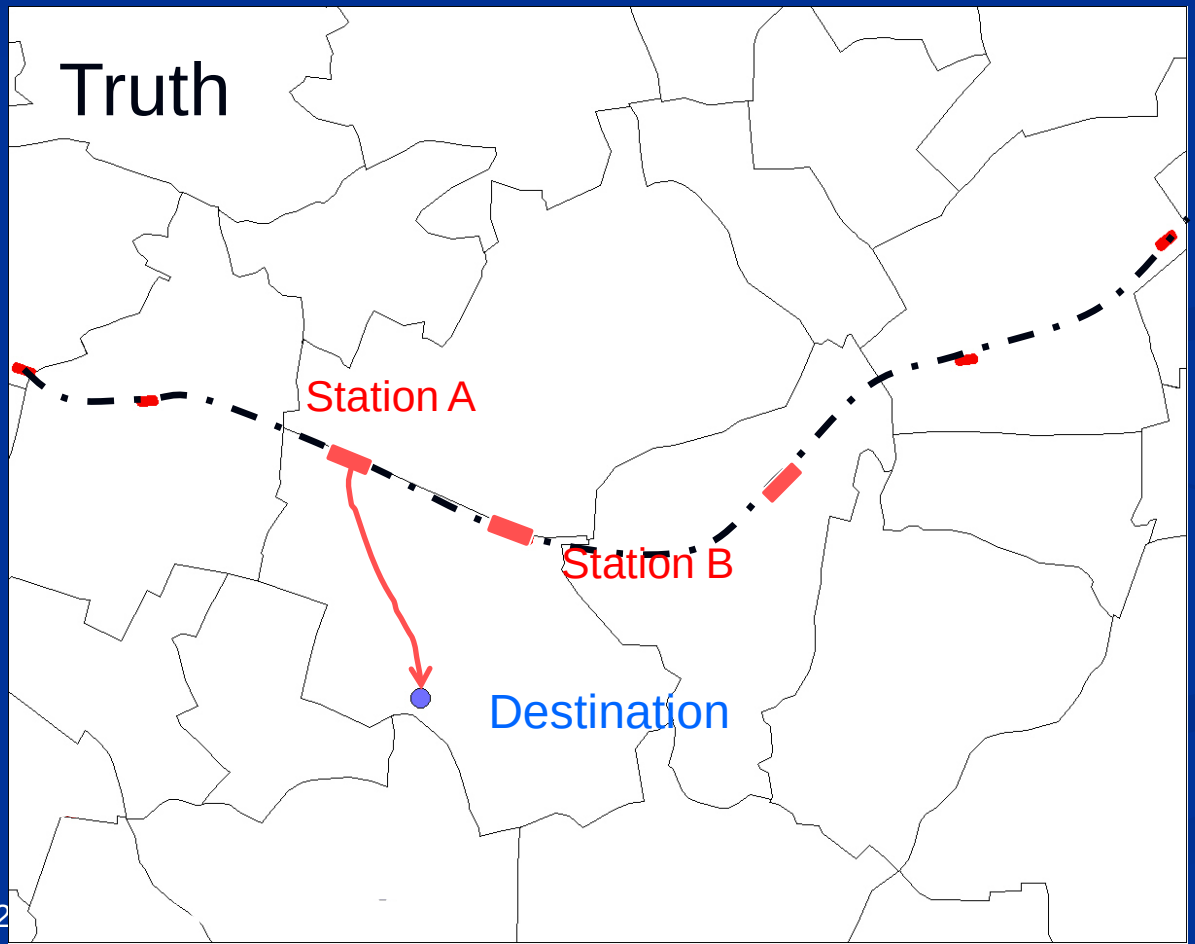
- Combine information to get precise location information
- Develop a model to overcome the impreciseness

Chukyo Metro. Person trip data



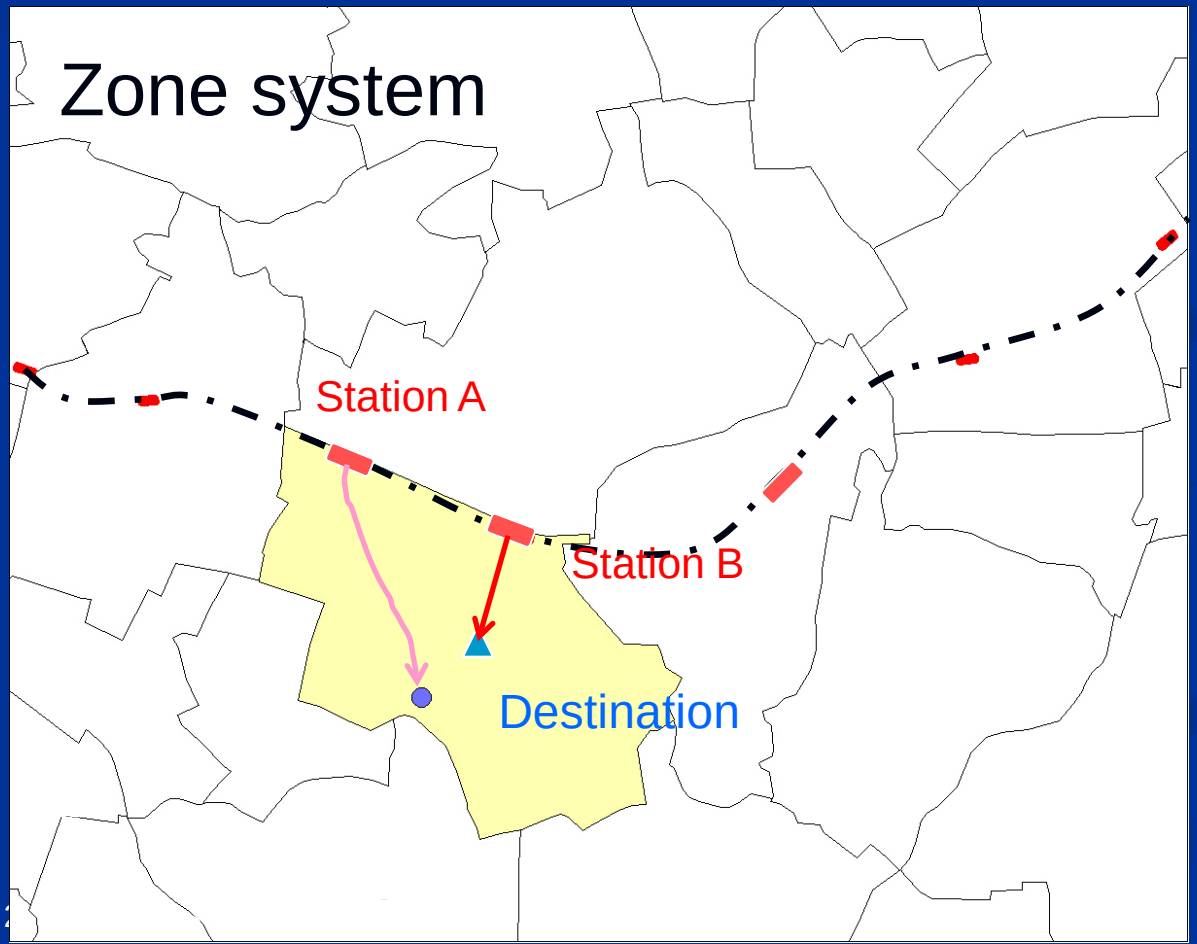
Zone system

- True access = 730 m



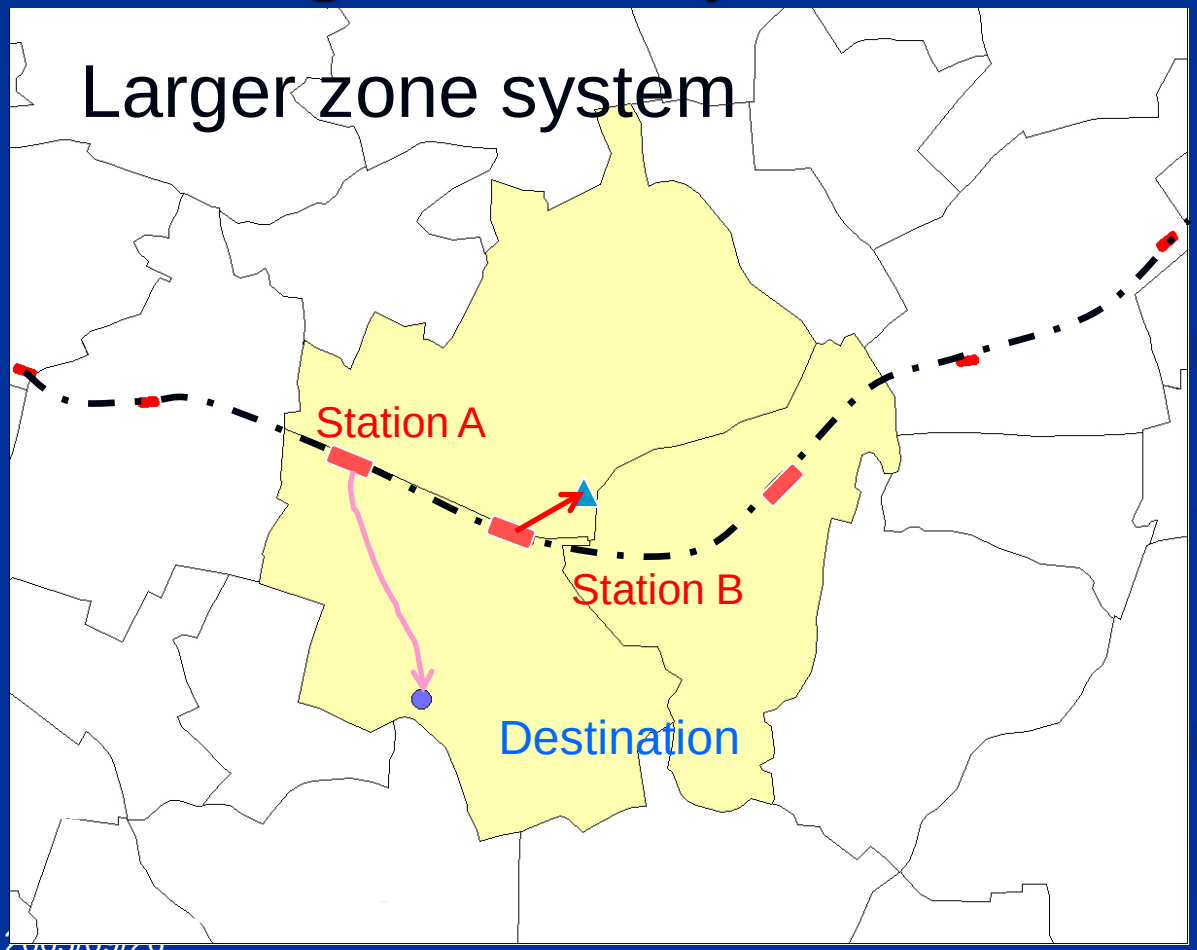
Zone system

- True access = 730 m
- Access to zonal centroid = 490 m



Zone system

- True access = 730 m
- Access to zonal centroid = 490 m
- If larger zone system is used = 330 m

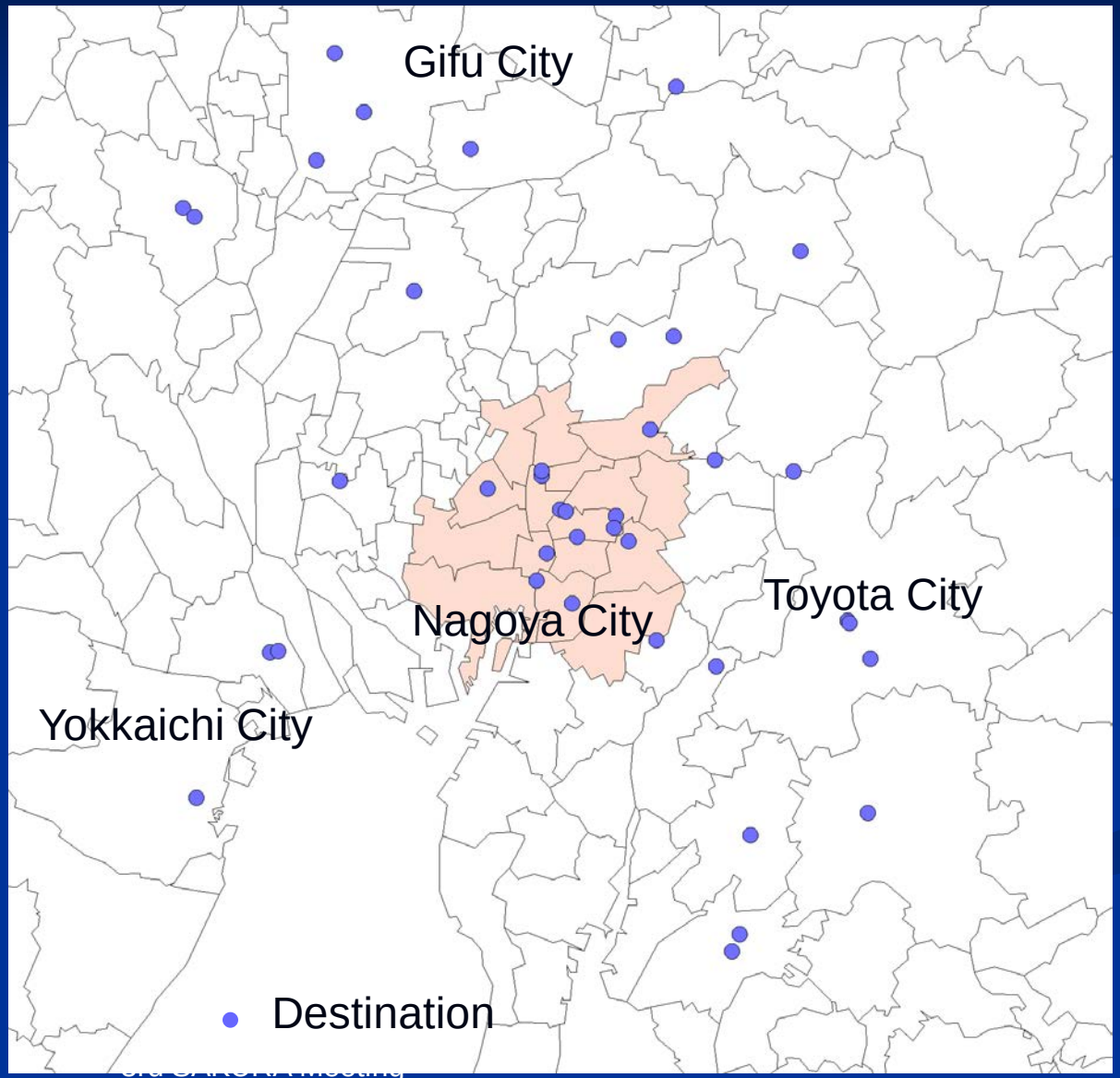


Our approach: egress

- Trip to governmental office, hospital and school can be identified by information on destination type
- Multiple governmental offices are not located together, and usually, one zone contain at most one governmental office
- The same thing applies hospital and school
  - Note: trips to small clinics might be included as noise
- Precise location and access to station and bus stop is calculated by using GIS data

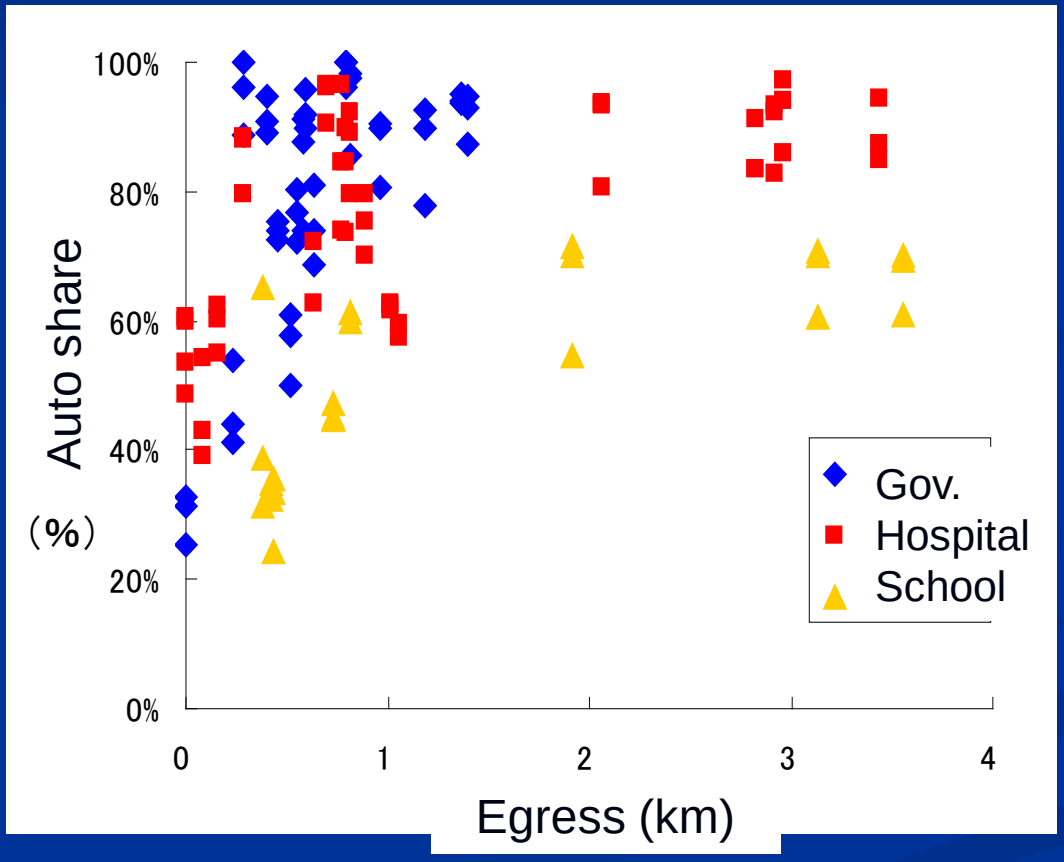
Destinations

20 zones with largest number of trip destinations for each type of destination are used

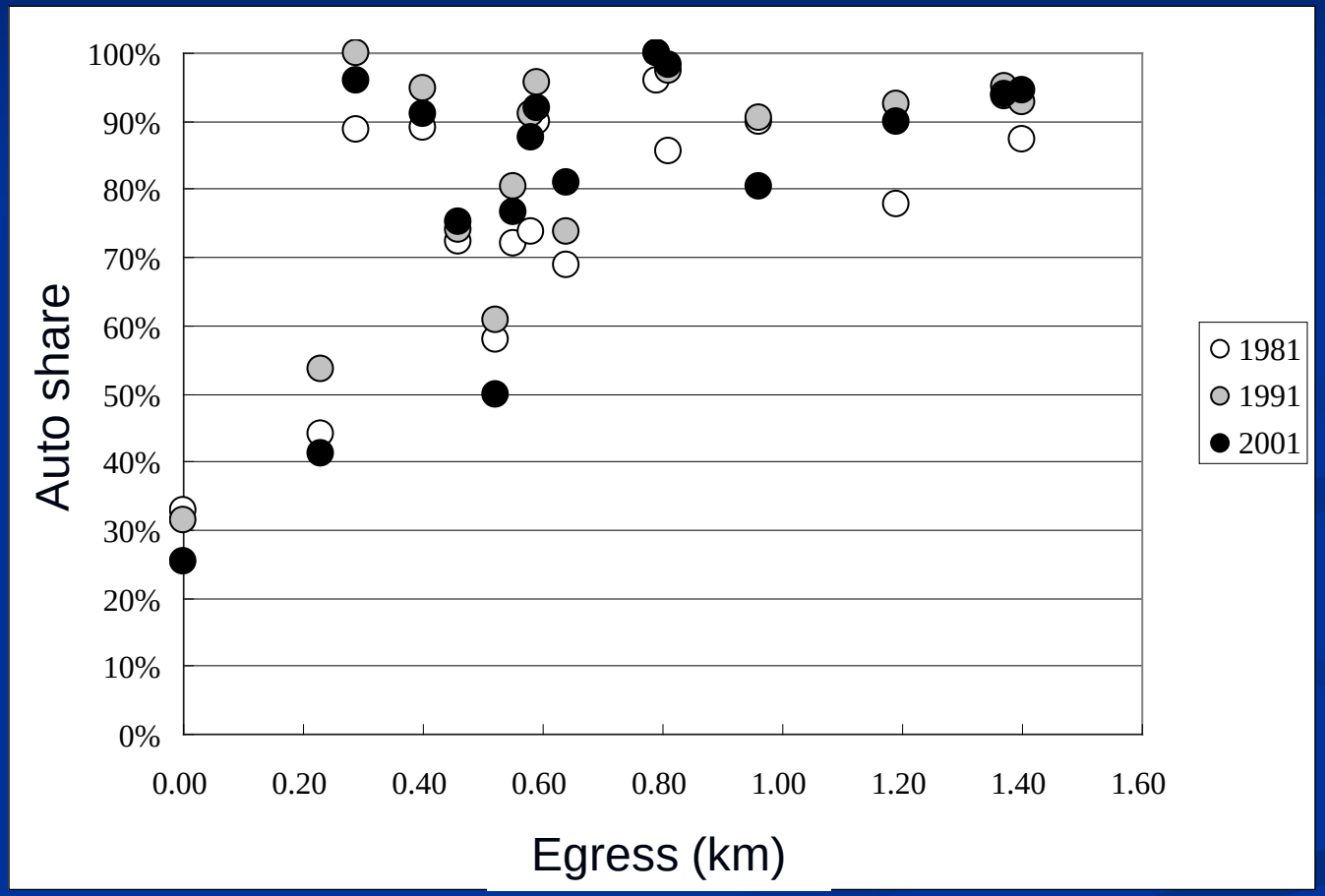


Descriptive analysis

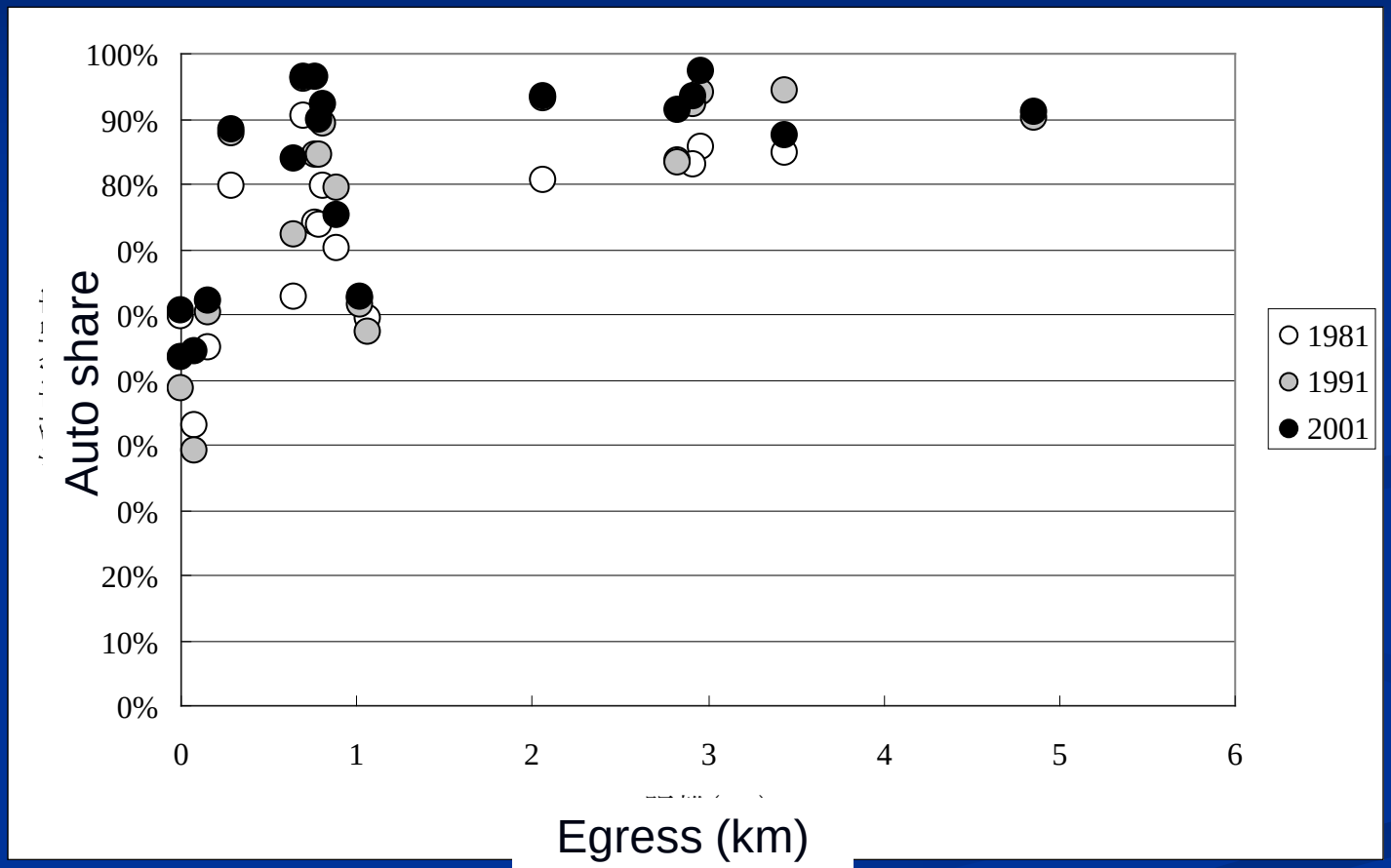
Relationship between egress and auto share



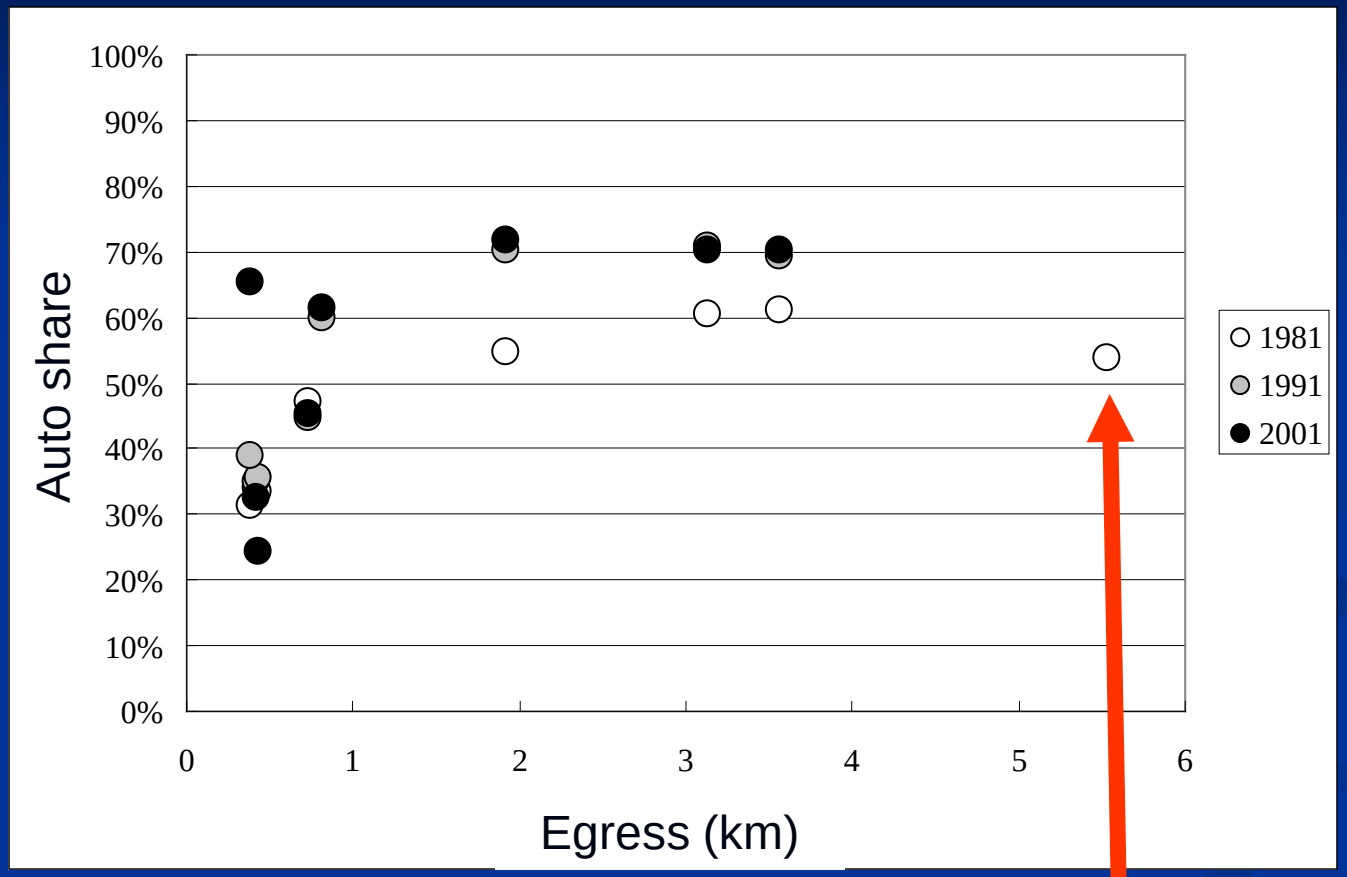
Gov. office: 1981 to 2001



Hospital: 1981 to 2001



School: 1981 to 2001



This university operated school bus from station

Location choice in motorization

Hospitals which located after 1970

	Year	Length (km)	Our o16
Hospital A	1984	**4.9**	1st
Hospital B	1974	**2.9**	4th
Hospital C	1972	**2.8**	5th

Buildings which moved after 1970

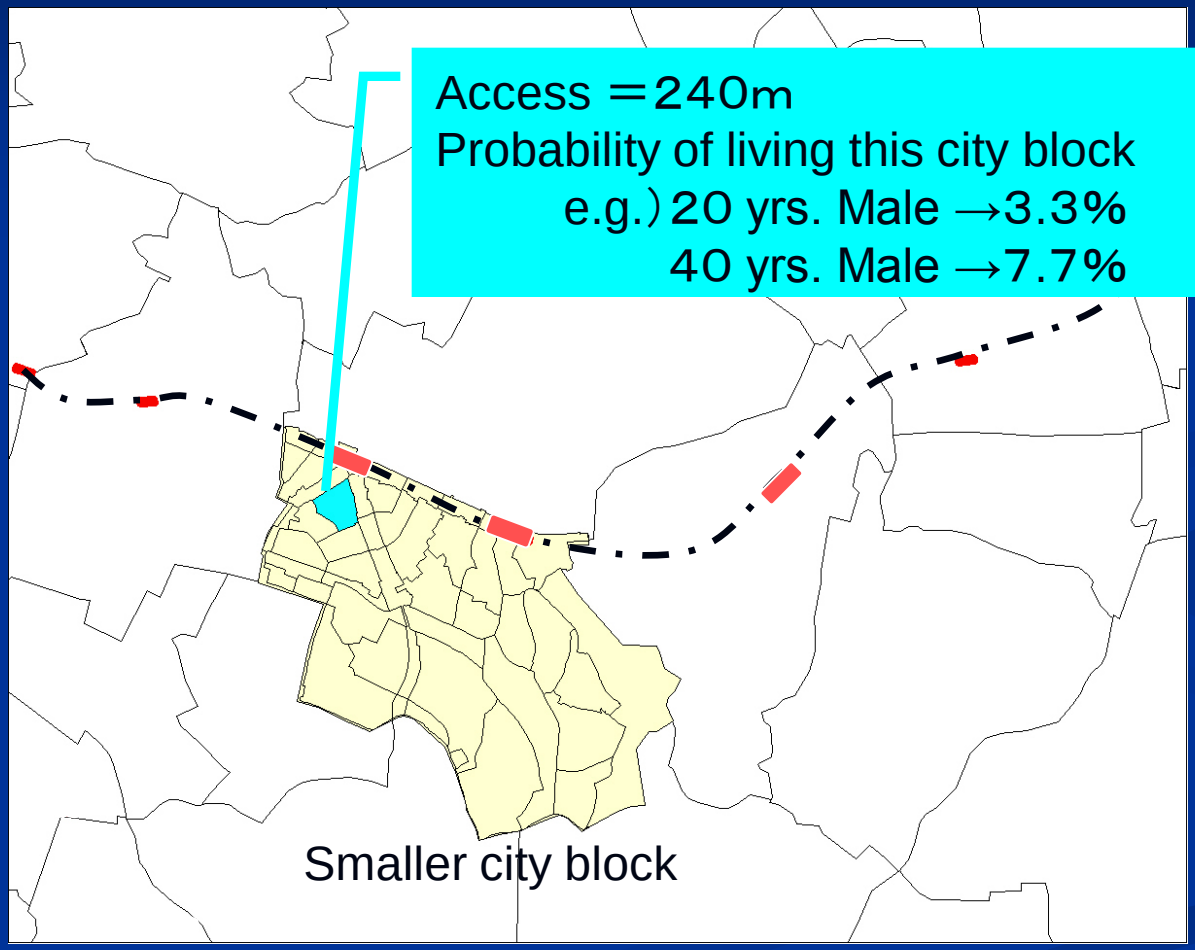
		Length（km）	
	Year	Before	After
Municipality Hall D	1966	**1.1**	**1.4**
City Hall E	1976	**0.2**	**1.0**
Hospital F	1974	**0.4**	**0.8**
Hospital G	1978	**0.6**	**0.6**

Our approach: access

- About home-based trip, it is impossible to identify the house, origin of the trip
- Census data provide distribution of residents of specific age/sex within survey zone

- Access length is treated as probabilistic variable in estimating the mode choice model

Calculation of choice probability



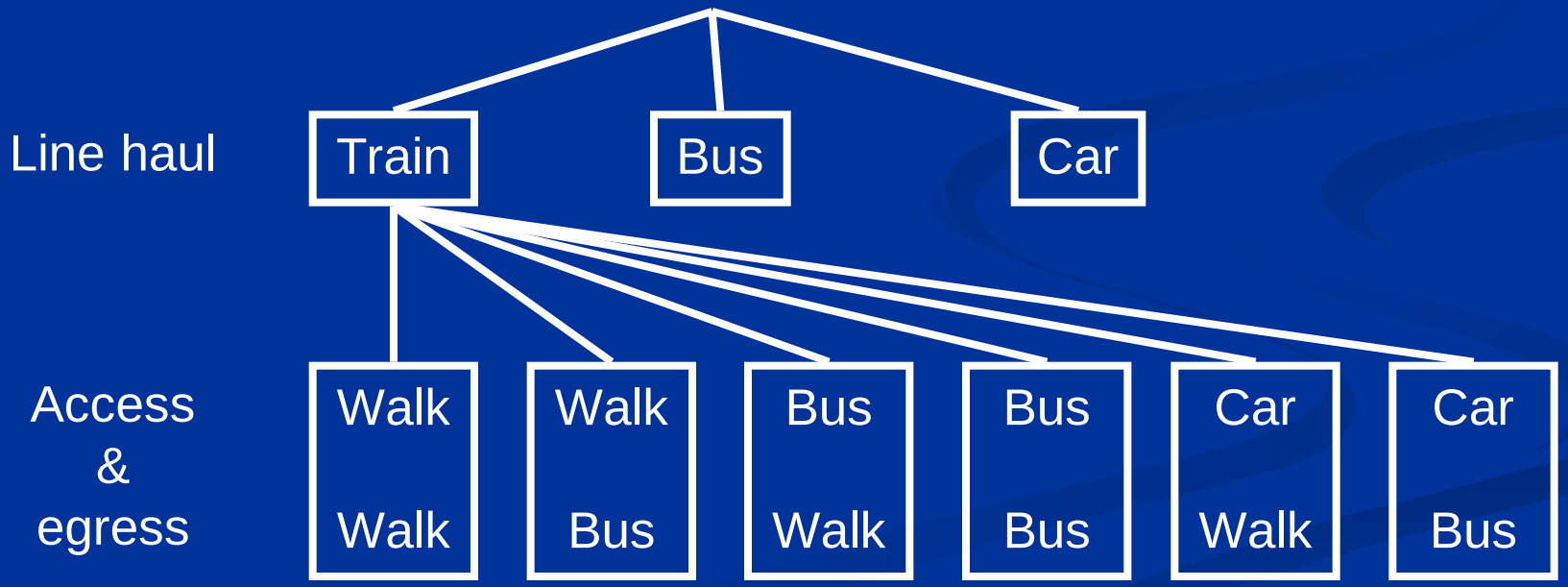
Calculation of choice probability

- Q(j): Probability of living in city block j
  - Calculated by census and treated as known
- P(i| j): Probability of choosing mode i given that he lives in city block j
  - Precise access information is used as explanatory variable
- P(i): Marginal probability of choosing mode i is calculated by $\sum_{j} P(i|\, j)Q(j)$

Choice structure

Nested logit model with

- Line haul mode in upper level
- Access and egress modes for train in lower level



Effects of preciseness of egress info. （zone system is used for access）

Coefficient estimate and t-stat. in parenthesis

	GIS based	Zone system
Upper level		
Bus egress	-2.0 (-3.4)	-1.7 (-4.2)
Lower level		
Sta. egress	-2.8 (-18.9)	-1.8 (-17.8)
Log-likelihood	-2944	-3063

GIS based egress has

- Better log-likelihood
- Larger coefficient estimates in absolute value

Effects of preciseness of access (GIS base is used for egress)

Coefficient estimate and t-stat. in parenthesis

	Proposed model	Zone system	Larger zone
Upper level			
Bus access	-9.2 (-5.6)	-2.5 (-8.8)	-2.5 (-9.3)
Lower level			
Bus access	-1.4 (-4.0)	-1.2 (-4.6)	-1.1 (-4.7)
Sta. access	-1.4 (-11.9)	-0.8 (-11.8)	-0.7 (-11.0)
Log-likelihood	-2900	-2944	-2944

Proposed model has

- Better log-likelihood
- Larger coefficient estimates in absolute value

Comparison between access & egress

Access: proposed method Egress: GIS based		
Upper level	Coef.	t-stat.
Bus access	-9.2	(-5.6)
Bus egress	-1.8	(-3.2)
Lower level		
Sta. access	-1.4	(-11.8)
Sta. egress	-2.9	(-18.7)

- Use of bus: access to bus stop from home is dominant
- Terminal mode for train: egress has larger effect than access

Conclusion

- Efficient use of conventional person trip data is proposed, and confirmed by empirical analysis
- Rail ridership can be increased by locating closer to station, but move from 3 km to 2 km doesn't mean anything
- Egress from station is more important than access to station