

The Impact of Land Use on Commute Behavior Changes: An Empirical Investigation from Northern California

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Outline

- Introduction – Questions of Interest
- Sampling and survey
- Baseline characteristics
- Descriptive statistics of commute changes
- Modeling permanent and temporary commute changes
- Conclusions

Questions of

Interest



Over a 6-month period, compared to normal commute patterns, how many people made changes that were

- Permanent?
- Temporary?
- Environmentally beneficial?
- Environmentally problematic?



What factors are involved in the individual's choice to make those changes?

- Socio-demographic data and work-related information?
- Neighborhood types and baseline commute patterns?
- Attitudes e.g. time- and price-sensitivity, environmental beliefs, and stated preference for various modes of travel?

Changes of Interest

 Increases and Decreases in Drive Alone Commuting



Study Region and Context

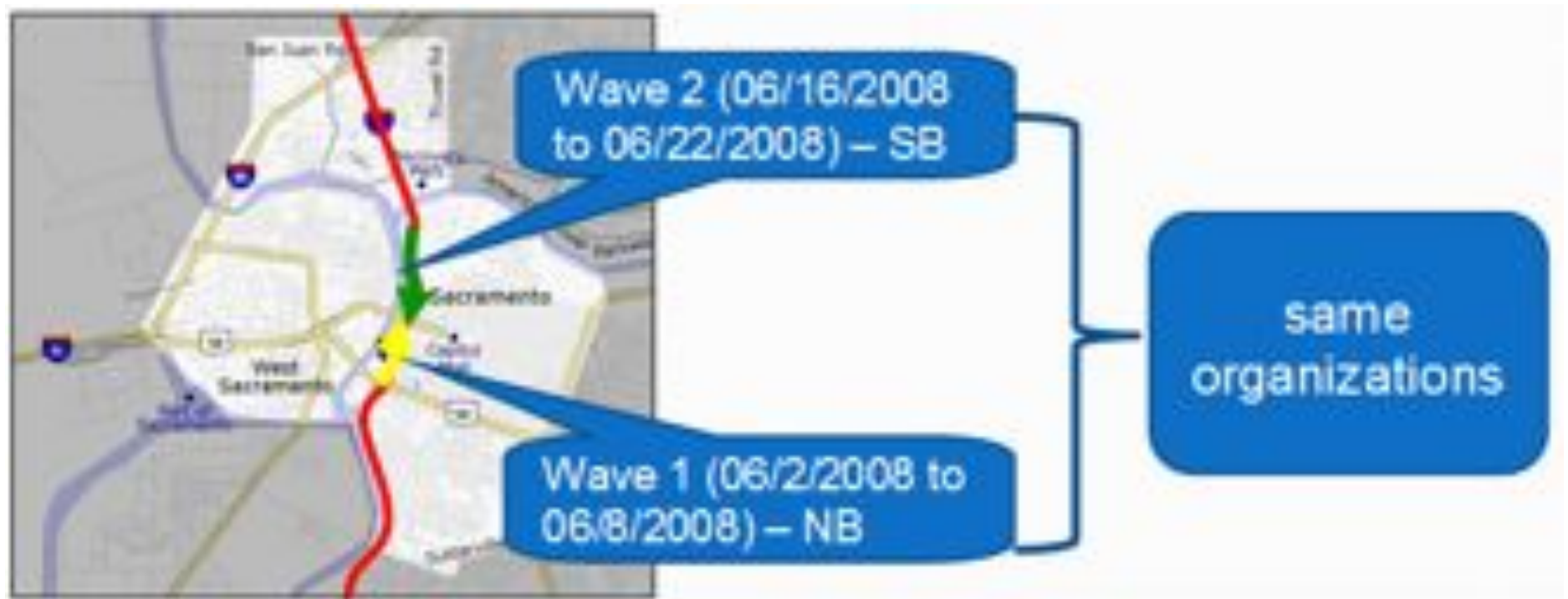


Sacramento area, during and following the closure and (re)construction of Interstate 5



Panel Survey

 Two waves of data collection during the construction
– overlapping sample



Sampling Methodology

- Population of Interest:
 - Workers living somewhere in the region, for whom it was reasonable to expect that they could have been affected by the closure.
- Obtained respondents via email invitations to organizations:
 - Numerous State agencies
 - The Fix I-5 listserv (6K subscribers)
 - Transportation Management Agencies (TMAs)
 - The Commuter Club of the Sacramento TMA (25K subscribers)

Wave 3: six months later

- In January/February 2009, re-surveyed Wave 1 & 2 respondents who had given us permission to do so
- Obtained ~2000 usable responses
- Individuals in the final sample completed the wave 1 or wave 2 survey or both (with preference given to wave 2 in this study), **and** completed the wave 3 survey





Wave 1 and 2 Survey

- Four parts in each survey (Wave 1 and Wave 2 nearly identical):
 - Part A: “normal” (pre-Fix) work and commute patterns
 - Part B: travel changes made during the target week
 - Part C: commute-related programs, possible facilitators/barriers to changing commuting habits, and sources of information on Fix I-5
 - Part D: socio-demographic characteristics

Wave 3 Survey

- Six sections in the Wave 3 Survey:
 - Part A: attitudes, lifestyle, values/beliefs
 - Part B: current baseline work and commute patterns
 - Part C: permanent changes made to work/commute patterns since spring 2008
 - Part D: temporary changes made to work/commute patterns during summer 2008
 - Part E: desirability of sustainable commute actions, and barriers to them
 - Part F: socio-demographic characteristics

Key Assumptions

-  Individuals' attitudes in wave 3 represent attitudes over the study period
-  When individuals responded to both waves 1 and 2, changes made during wave 2 were considered
-  Individuals who are already performing certain behaviors can not switch *to* that behavior
-  Drive alone commuting is most problematic in terms of greenhouse gas emissions

Commute Patterns





In all waves of the survey, we asked the current frequency with which respondents:



- Worked at home without commuting (home-based business or telecommuting)
- Physically commuted, and;
- Rode a bus for any portion of the commute
- Rode light rail for any portion of the commute
- Rode Amtrak for any portion of the commute
- Rode a bicycle for any portion of the commute
- Car/vanpooled for most of the commute
- Drove alone for most of the commute
- Walked for the entire commute

Identifying Changes

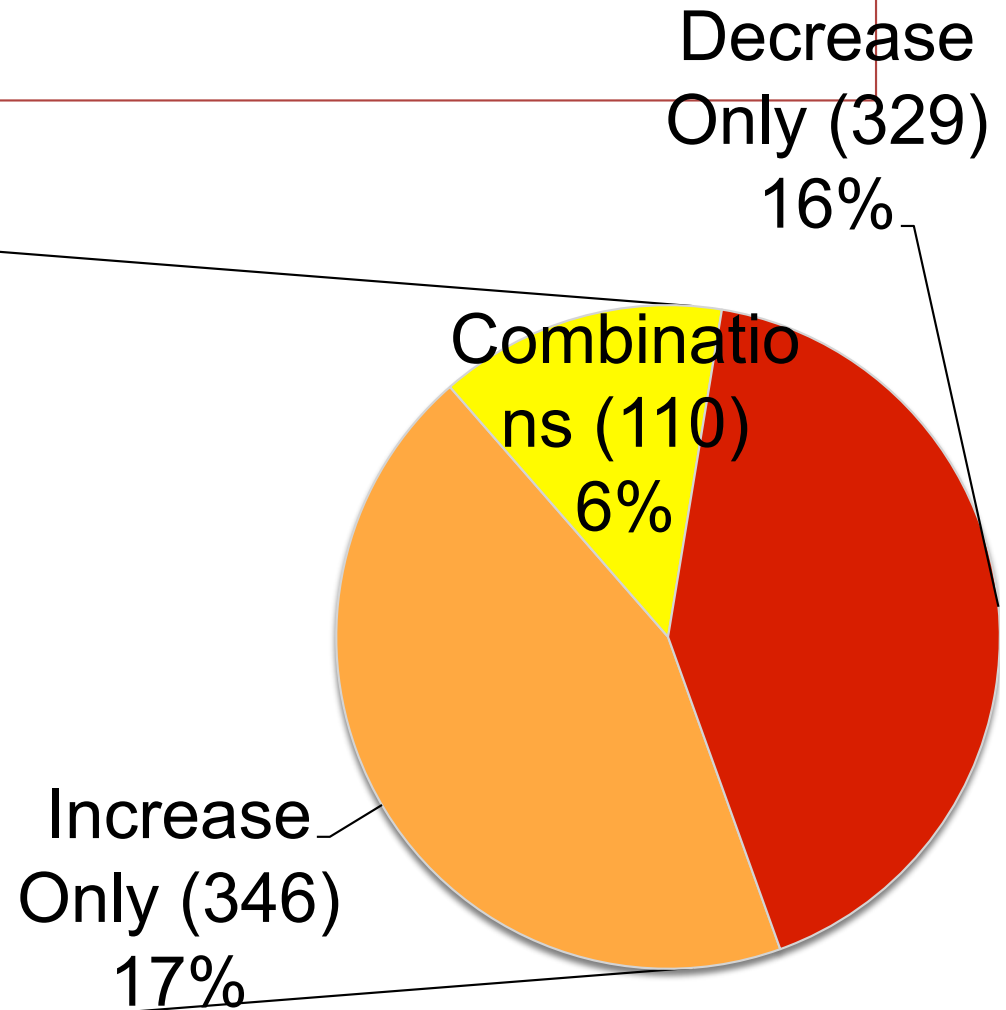
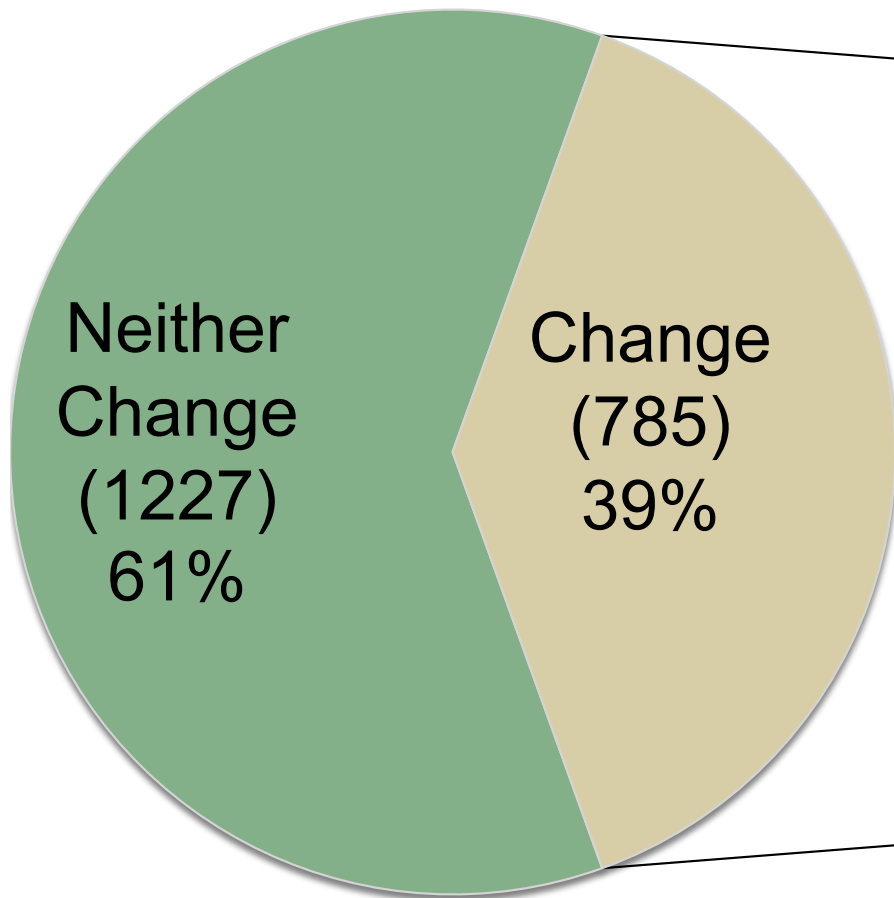
Permanent Changes

-  Compare frequencies of drive alone commuting between waves 1-2 and wave 3
-  Identify self-reported permanent changes in driving alone, reported in wave 3

Temporary Changes

-  Identify contemporaneous changes reported in waves 1 and 2
-  Identify retrospective changes reported in wave 3

Frequencies of Changes



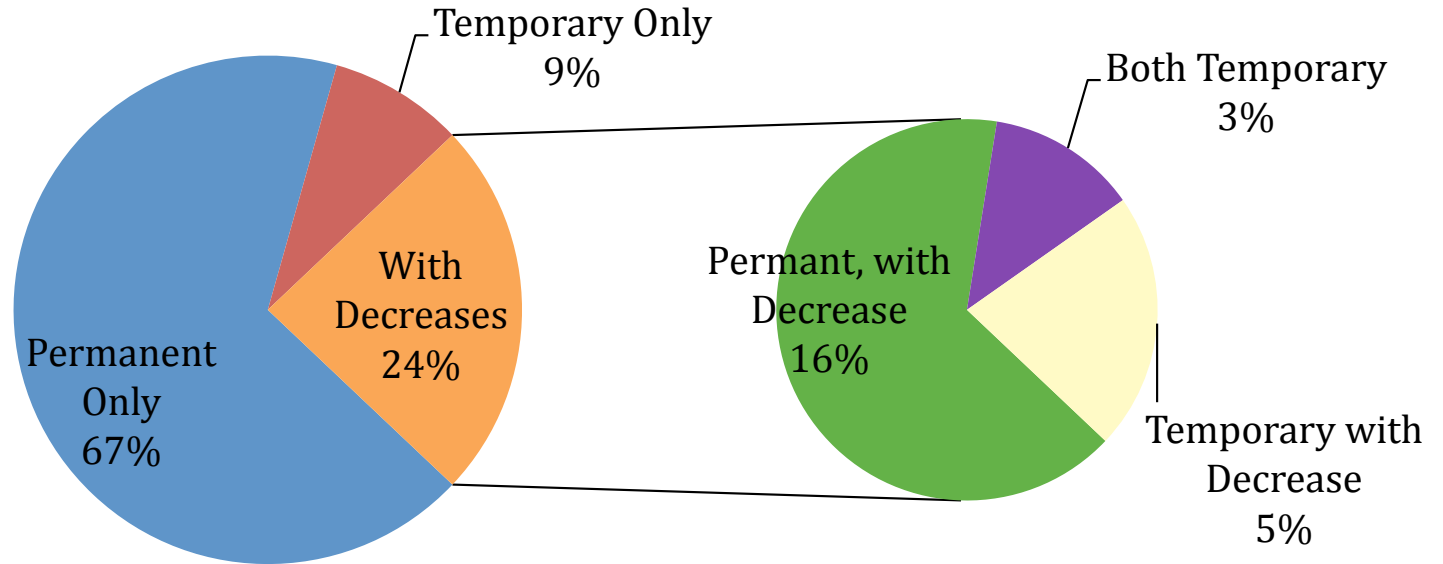
Total Sample =
2012

Frequencies of Changes

Increases (N = 456)

Total Permanent
Increases = 379

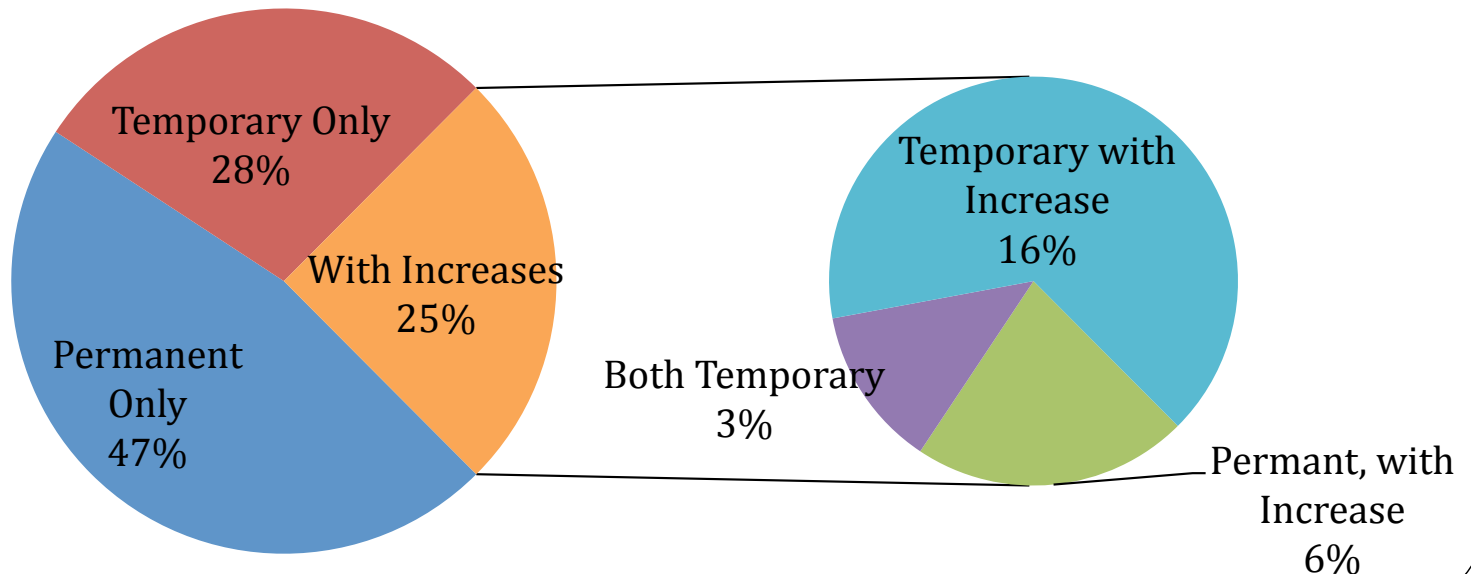
Total Temporary
Increases = 77



Decreases (N = 439)

Total Permanent
Decreases = 229

Total Temporary
Decreases = 210



Modeling Changes



What factors (demographics, commute patterns and attitudes) influence individuals to make increases and decreases in driving alone?



Are the same factors important for permanent and temporary changes?













Did Fix I-5 play a role in the propensity to make these changes?



Are land use characteristics important factors in whether or not individuals made changes?

Demographics

-  64% of the sample is female, 36% male
-  65% has completed 4-year degree or higher level of education
-  80% has annual income of \geq \$60,000
-  Average household:
 -  Size is 2.7 persons
 -  Number of motorized vehicles is 2.2
 -  Is within a 10-minute walk of transit (58.7% of sample)
 -  Has approximately 0.5 children
 -  Has approximately 2.10 licensed drivers
 -  Has 1.9 workers (full and part time)

Commute

Characteristics

Characteristic ^{1, 2}	Total Sample	Permanent Increase (N=379)	Temporary Increase (N=77)	Permanent Decrease (N=229)	Temporary Decrease (N=210)
Commute Minutes (1965)	33.98	30.5	32.01	33.71	33.17
Commute Distance (1957)	18.05	17.3	15.65	16.31**	19.60**
Household Vehicles (1913)	2.21	2.10	2.3	2.44*	2.28*

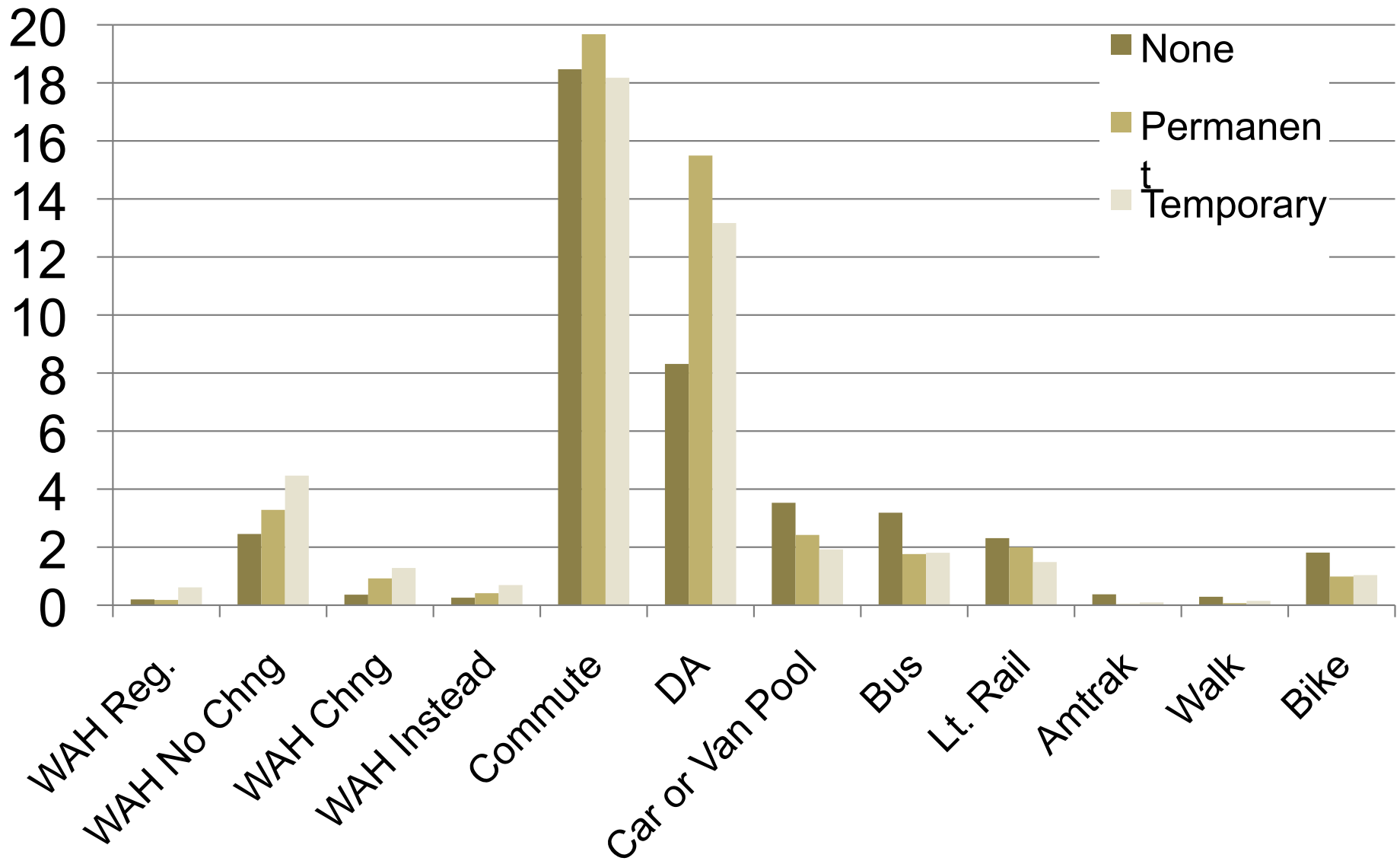
1. p-values are shown for chi-square tests for significant differences among categories for permanent, temporary and no change within the same type of change. 2. * and ** represent mean values which are significantly different to the 0.1, and .05 level between the permanent and temporary changes only; **not compared to those who did not change**

p = (.077)

(p=.001)

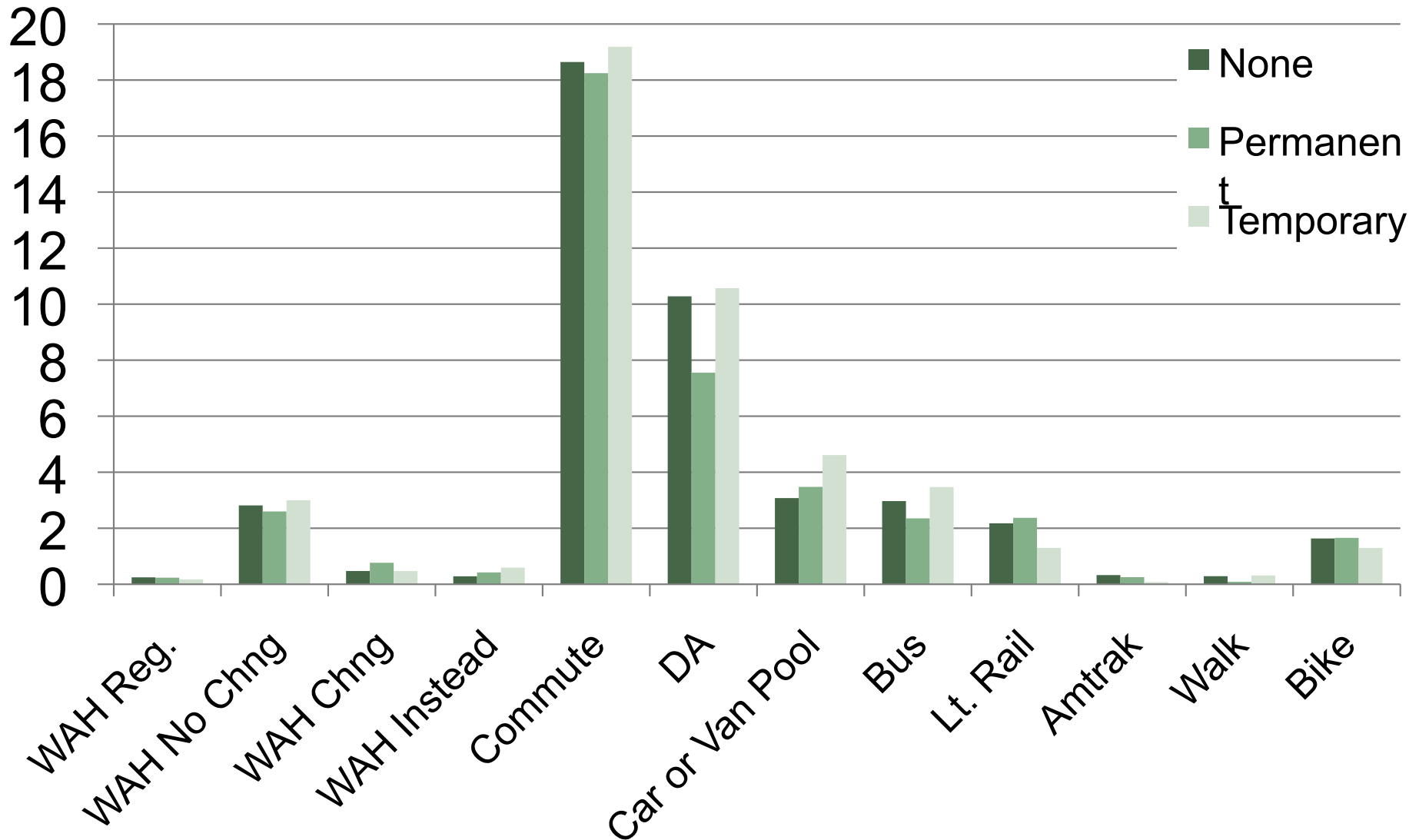
Mode Use by

Decrease



Mode Use by

Increase



Land Use

Characteristics

	Characteristic (Self-reported)	Total Sample	Permane nt Increase (N=379)	Temporar y Increase (N=77)	Permane nt Decrease (N=229)	Temporar y Decrease (N=210)
Type (1939)	Lot of Retail/Commercial	201 (10.4%)	32 (8.7%)	7 (9.7%)	24 (10.9%)	12 (5.8%)
	Some Retail/Commercial	644 (33.2%)	117 (32.0%)	25 (34.7%)	70 (31.7%)	67 (32.5%)
	Mostly Residential	964 (49.7%)	194 (53.0%)	38 (52.8%)	117 (52.9%)	114 (55.3%)
	Few Other Buildings	89 (4.6%)	15 (4.1%)	2 (2.8%)	6 (2.7%)	10 (4.9%)
	Other	41 (2.1%)	8 (2.2%)	0	4 (1.8%)	3 (1.5%)
Transit (1936)	Less than 5minute walk					
	5-10 minute walk	622 (32.1%)	106 (29.0%)	30 (41.7%)	78 (35.3%)	59 (28.6%)
	10-20 minute walk	526 (27.2%)	125 (34.2%)	18 (25.0%)	48 (21.7%)	65 (31.6%)
	More than 20 minute walk	307 (15.9%)	39 (10.7%)	12 (16.7%)	41 (18.6%)	35 (17.0%)
	Don't know	403 (20.8%)	78 (21.3%)	9 (12.5%)	43 (19.5%)	39 (18.9%)
Home (1936)	Single-Family Detached	1611 (83.2%)	308 (84.4%)	56 (78.9%)	182 (82.4%)	179 (87.3%)
	Duplex/Town Home	108 (5.6%)	21 (5.8%)	3 (4.2%)	13 (5.9%)	8 (3.9%)
	Apartment/Condo	183 (9.5%)	28 (7.7%)	11 (15.5%)	24 (10.9%)	14 (6.8%)
	Other	34 (1.8%)	8 (2.2%)	1 (1.4%)	2 (0.9%)	4 (2.0%)

Factor Analysis in wave

3

- 22 **attitudinal** statements



7 factors:

- Pro-transit
- Pro-bike/walk
- Pro-driving
- Pro-high-density
- Utilitarian travel
- Travel minimizer
- Commute benefit
- 14 **lifestyle** statements



5 factors:

- Driving commitment

- Price sensitivity

- Time sensitivity

- Pro-exercise

- Variety-seeking

- 16 **values/belief** statements



5 factors:

- Congestion is a problem

- Air quality is a problem

- Energy dependence is bad

- Personal responsibility

- No worries

Multinomial Logit Model Base Alternative: Permanent Decrease	No Decrease	Temporary Decrease
Household Vehicles	-.22874**	-.51558***
Some Retail in Neighborhood	-.37744*	-.53302**
Occupation Type: Manager	---	.64983***
Occupation Type: Professional	-.61687***	---
Days Driving Alone	-.11439***	-.08366***
Days Carpooling	-.10589***	-.13257***
Days Working at Home (Changing Location)	-.06810***	---
Members of Household ages 16 to 18	-.34369*	---
Income	---	.23409**
Pro-transit attitude	-.17527**	---
Travel Minimizing Attitude	.22716***	.24547***
Commute Benefit	-.25106***	-.37418***
Anti-Driving	-.58563***	-.44067***
Price Sensitivity	---	.25669***
Constant	4.25597***	.88284

Note: ***, **, *: Significance at 1%, 5%, 10% level.

Multinomial Logit Model Base Alternative: Permanent Increase	No Increase	Temporary Increase
Some Retail in Neighborhood	---	.46489*
Transit within 5 minutes	---	.48810*
Age	---	-.03401***
Days Driving Alone	.10258***	.13669***
Days Carpooling	.06951***	.13370***
Days Taking Bus	.06476***	.09381***
Days Taking Light Rail	.03806***	---
Days Taking Amtrak	.06035**	---
Days Biking	.05037***	---
Days Walking for Entire Trip	.15655***	.19308**
Commute Distance	---	-.02120*
Pro Transit Attitude	.22447***	.45093***
Price Sensitivity	-.21605***	---
Time Unpressured Lifestyle	---	-.29589**
Pro Exercise	---	.23067**
Number of Children less than Six yrs. old	.35671**	---
Part-Time Schedule	---	1.57587***
Variable Schedule	---	.93887***
Normal Schedule	-.33663***	---
Constant	-.10783	-2.63605***

Note: ***, **, *: Significance at 1%, 5%, 10% level.

Conclusions



Mode use in the baseline *may* be important to potential changes in driving alone.



Attitudes are fairly good predictors of changes; particularly those related to transit and driving.



Access to transit important for both increases and decreases in driving alone – in environmentally desirable direction.



Land use type also important for both – again in environmentally desirable direction.



Similar factors important for temporary and permanent changes, with more similarities between decreases in driving alone.

Future Research



Land-use variables; home and work locations are geo-coded for finer grained analyses



Changes in other variables; socio-demographic, employment type, self-reported land use characteristics



What role did Fix I-5 play in changes to driving alone?



Particular information sources relevant for increases and decreases in driving alone?



What factors contribute to increasing and decreasing the use other modes?

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