Understanding Land Use and Walk Behavior in Utah

15th TRB National Transportation Planning Applications Conference
Callie New | GIS Analyst + Planner
11 statistical areas (2010 census)

55,000 square miles federal land; 65% of total land area:

5 National Parks
6 National Monuments
3 National Historic Trails
STUDY AREA

TRB 2015 | examining non-motorized travel behavior
Wasatch Front Regional Council Planning Area:

- 6 counties
- 4 statistical areas
- multi-modal planning
- + growth management

STUDY AREA

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QUICK FACTS: URBANIZED AREA
Population: 1.7 million
Median household income: ~$60,000
Median age: 30.5
Educational attainment | HS diploma: 89%
Unemployment rate: ~3.4%

Major industries:
- Aerospace + defense
- IT+ software
- Finance
- Life Sciences
- Natural resources + energy
- Outdoor recreation

STUDY AREA
PLANNING CHALLENGES

Regional Population Growth

Air Quality

Supporting Active Transportation

Land Use and Transportation Nexus
PLANNING CHALLENGES
Utah population to double by 2050
PLANNING CHALLENGES
Regional focus on improving air quality.
PLANNING CHALLENGES
Growing enthusiasm for walk and bike travel in region.
PLANNING CHALLENGES
Growing enthusiasm for walk and bike travel in region.

200 West Protected Intersection at 300 South
Source: CITYLAB, “Why Salt Lake City Chose to Build the First Protected Intersection for Bicycling in the U.S.”
PLANNING CHALLENGES
Current travel patterns highly auto-centric.

Travel behavior in Wasatch Front

<table>
<thead>
<tr>
<th>Mode</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bike</td>
<td>1.4%</td>
</tr>
<tr>
<td>Walk</td>
<td>6.8%</td>
</tr>
<tr>
<td>Transit</td>
<td>1.8%</td>
</tr>
<tr>
<td>Auto</td>
<td>90%</td>
</tr>
</tbody>
</table>

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2012 Household Travel Survey, WFRC
PLANNING CHALLENGES
...there are pockets of high walkability.

Travel behavior downtown SLC

- Bike: 5.5%
- Walk: 48%
- Transit: 6%
- Auto: 40%

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2012 Household Travel Survey, WFRC
PLANNING CHALLENGES
WFRC aims to focus growth in centers; provide multi-modal infrastructure planning.
RESEARCH QUESTIONS

• What factors influence non-motorized trip making decisions?
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- What factors influence non-motorized trip making decisions?
- What factors influence the length of non-motorized trips?
RESEARCH QUESTIONS

• What factors influence non-motorized trip making decisions?
• What factors influence the length of non-motorized trips?
• What factors influence the frequency of non-motorized trips?
VARIABLES

1. BUILT ENVIRONMENT
2. NATURAL FEATURES
3. HOUSEHOLD CHARACTERISTICS
4. PERCEPTIONS AND ATTITUDES
1 BUILT ENVIRONMENT
VARIABLES

1 BUILT ENVIRONMENT: 3 D’S

DESIGN

DIVERSITY

DENSITY
VARIABLES

1. BUILT ENVIRONMENT: 3 D’S
   street connectivity and block size
   side walk and bike lane infrastructure

TRB 2015 | examining non-motorized travel behavior
Ewing & Cervero, 2010; Dill & Voros, 2006
BUILT ENVIRONMENT: 3 D’S
- multi-modal access to opportunities
- land use mix
- jobs/household mix
1. BUILT ENVIRONMENT: 3 D’S
   population and employment density

Kockelman, 1991; Dill & Voros, 2006
2  NATURAL ENVIRONMENT
2 NATURAL ENVIRONMENT

topography (slope)
weather patterns (number of rainy/snowy days)
climate (extended hot and/or humid summers)
HOUSEHOLD CHARACTERISTICS

- race/ethnicity
- number of non-working adults
- number of school-aged children
- income
- age
- immigration status
- sex
- vehicle / bike ownership

Dill & Voros, 2006; Ewing & Cervero, 2014
VARIABLES

4 PERCEPTIONS AND ATTITUDES

- rating or perception of the bicycling environment; safety
- exercise valuation
- cost
- convenience
- time valuation

Dill & Voros, 2006; Boarnet, et al., 2015
METHODOLOGY

Data collection

Unit of analysis

Regression analysis

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DATA COLLECTION

2012 Utah Travel Survey

Utah Statewide Travel Study - Survey Approach

- Household Survey
  - Trip Diary Questions
  - Debrief Questions
- Stated Preference
  - Add-On Survey
- Household Diary (100%)
  - Minimum 8,300 HHs
- Long Distance (33%)
  - Attitudinal/Opinion (33%)
  - Customized by geography
- Walk/Bike (33%)
- Stated Preference Residential Choice
  - All HH diary participants asked willingness and then invited to SP. Those taking SP are provided an additional incentive.
- College Student Travel Diary Survey
  - Based upon HH Diary Survey questions and data elements
- Extended Walk/Bike Survey
  - Based upon Walk/Bike questions from HH Diary, but will be expanded to include additional questions
UNIT OF ANALYSIS

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REGRESSION MODEL

ordinary least squares model

zero inflation model
What factors influence non-motorized trip making decisions? zero-inflation model

RESULTS

- Household Size
- Life cycle 1
- Vehicle Ownership
- Bike Ownership
- Jobs/Housing Balance (2 mile radius)
- Intersection density

TRB 2015 | examining non-motorized travel behavior
What factors influence non-motorized trip making decisions?

- Household Size
- Working adults, no children
- Vehicle Ownership
- Bike Ownership

Jobs/Housing Balance (2 mile radius)
Intersection density

TRB 2015 | examining non-motorized travel behavior
What factors influence the frequency of non-motorized trips? zero-inflation model

WALK TRIPS

- Household Size
- Working adults, with children
- Number of workers in household
- Vehicle Ownership
- Manufacturing job density (5 minute auto trip)
- Retail job density (TAZ)
- Restaurant job density (TAZ)
- Government job density (TAZ)
What factors influence the frequency of non-motorized trips?

- Household Size
- Life Cycle 2
- Number of workers in household
- Vehicle Ownership

Managers job density (5 minute auto trip)
Retail job density (TAZ)
Restaurant job density (TAZ)
Government job density (TAZ)
What factors influence the frequency of non-motorized trips?

The expected change is a decrease in daily walk trips for one unit increase in retail (employment) density.
What factors influence the length of non-motorized trips? Ordinary least squares model

![Bar chart showing factors influencing walk distance](chart.png)

- Jobs/housing balance (TAZ)
- Population density (1 mile radius)
- Land Use Mix
- Number of government/education jobs (1 mile radius)
- Number of healthcare jobs (1 mile radius)
NEXT STEPS

1. Incorporate results into travel model.

2. Increase sample size of bicycle trips.

3. Examine areas of high and low accessibility for planning strategies.
THANK YOU!
callie@wfrc.org


Survey and observations; measured changes in behavior associated with traffic improvement projects.

Survey; chi-squared test; spatial analysis (GIS) of distance between proximity to attractive biking locations and varying levels of self-identified utilitarian cyclist categories.

Meta-analysis using summary statistics from previous studies as new observations; elasticities computed.

Simple ordinary least-squares model; binary dependent variables; logit model; step-wise variable deletion and addition.

Review and guidebook for planners / policy-makers.
What factors influence non-motorized trip making decisions? (zero-inflation model)

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<thead>
<tr>
<th>VARIABLES</th>
<th>ESTIMATE</th>
<th>Z VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household size</td>
<td>-0.10968</td>
<td>-3.1861</td>
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<tr>
<td>Family life cycle 1: households without children and no retirees</td>
<td>-0.37327</td>
<td>-4.01</td>
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<tr>
<td>Vehicle ownership</td>
<td>0.18838</td>
<td>4.081</td>
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<tr>
<td>Bike ownership</td>
<td>-0.14179</td>
<td>-5.126</td>
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<tr>
<td>Number of jobs accessible within 5 minute auto travel distance</td>
<td>-0.23348</td>
<td>-6.532</td>
</tr>
<tr>
<td>Jobs/Household per 2 mile radius</td>
<td>-0.23348</td>
<td>-6.532</td>
</tr>
<tr>
<td>Intersection density (street connectivity)</td>
<td>-2.077</td>
<td>-3.892</td>
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</table>

examine non-motorized travel behavior | Wasatch Front Regional Council
What factors influence the length of non-motorized trips? (ordinary least squares model)

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<th>VARIABLES</th>
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<th>F VALUE</th>
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<tbody>
<tr>
<td>Jobs / Household per TAZ</td>
<td>-.00009</td>
<td>8.34</td>
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<tr>
<td>Population within 1 mile radius</td>
<td>-.00003598</td>
<td>3.21</td>
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<td>Population within 2 mile radius</td>
<td>.00000764</td>
<td>2.38</td>
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<tr>
<td>Land Use Mix</td>
<td>-.17201</td>
<td>7.39</td>
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<tr>
<td>Number of retail jobs per TAZ</td>
<td>-.00039317</td>
<td>4.01</td>
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<td>Number of government / educational jobs per 1 mile radius</td>
<td>.0000444</td>
<td>6.1</td>
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<tr>
<td>Number of healthcare jobs per 1 mile radius</td>
<td>.0001781</td>
<td>19.44</td>
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What factors influence the frequency of non-motorized trips? (zero-inflated model)

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<tbody>
<tr>
<td>Household size</td>
<td>.172</td>
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<tr>
<td>Life cycle 2: Households with children,</td>
<td>.3354</td>
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<tr>
<td>no retirees</td>
<td></td>
<td></td>
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<tr>
<td>Number of workers per household</td>
<td>-.0723</td>
<td>-2.08</td>
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<tr>
<td>Vehicle ownership</td>
<td>-.08</td>
<td>-2.375</td>
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<tr>
<td>Number of manufacturing jobs per 5</td>
<td>-.0006</td>
<td>-3.11</td>
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<tr>
<td>minute auto travel distance</td>
<td></td>
<td></td>
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<tr>
<td>Number of retail jobs per TAZ</td>
<td>.0004</td>
<td>-3.4</td>
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<tr>
<td>Number of food jobs per TAZ</td>
<td>.00022</td>
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<tr>
<td>Number of healthcare jobs per TAZ</td>
<td>.0001</td>
<td>2.16</td>
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