Using Google Street View to measure the implementation of zoning and land use policies across communities

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UIC Illinois Prevention Research Center

PAPRN+ PHYSICAL ACTIVITY POLICY • RESEARCH • NETWORK • PLUS

Project Members

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- Paul Needham, Research Assistant
- Cheryl Kelly, PhD, Consultant

Rationale for the Study

- PAPRN+ Network focus is on walking
  - Will support the Surgeon General's Everybody Walk! Initiative
  - The walkability of communities nationwide varies greatly based on where people live by virtue of the land use and zoning policies and subsequent built environment infrastructure in their communities

Research Aims

1. **Evaluate the walkability-orientation of zoning codes** in 10 small and/or southern jurisdictions (Phase I, Year 1)
2. **Construct measures of community walkability** using GIS and Google Street View (GSV) for the 10 site (Phase 1 and Phase 2, Years 1 and 2);
3. **Qualitative interviews with zoning officials** in the communities to understand the policy development, adoption, and/or implementation processes (Phase 3, Year 3);
4. **(POSSIBLE EXPLORATORY resources permitting) Surveys of adults** living in the pilot communities to assess walking behaviors and their perceptions of the community walkability (Phase 4, Year 4); and,
5. **Develop a series of end products** targeted at a range of stakeholders including advocates, land use and planning officials, policy makers (Phase 5, Year 5).

Progress to Date

- **Community walkability audit tool** was developed to construct walkability indices using GIS methods and GSV technology by adapting methods employed by Kelly et al.
- **Two pilot communities identified for testing GSV** technology; both communities have "walkable" oriented zoning codes based on our analysis
  - **Large, urban community:** Tucson, AZ has 35,023 street segments (pop. 134,421)
  - **Small, rural community:** Mead township, CO has 257 street segments (pop. 3,405).
- Street segment samples were drawn and coded using our sampling protocol.
- 10 percent of street segments were coded for inter-rater reliability testing.

Pilot Sites and Audit Tool

Pilot Sites

Street View Images ©2016 Google

Tucson, AZ: Urban Pilot Site

Mead, CO: Rural Pilot Site

Google StreetView Audit Tool

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STREET SEGMENT OBSERVATION FORM • 2015

Address Range:

SEG ID:

Completion Code	
COMPLETED – *CODE MODE*	01
PARTIALLY COMPLETED – *CODE MODE, DISPOSITION*	02
NOT ELIGIBLE *CODE DISP*	96

Google Street View Timestamp(s):

Historic Street View Range Available?

SEGMENT SAMPLE ATTRIBUTES	NO	YES
Segment replaces a primary sample observation	0	1

DATE STAFF 1 STAFF 2

START TIME END TIME

A1. Scan both sides of the street for presence of:	NO	YES, ONE SIDE	YES, BOTH SIDES
a. Residential Land use (includes: Housing – Single family, Multifamily, Mobile Homes)	0	1	2
b. Commercial Land use (includes: office/professional, service, retail, and recreation / fitness).	0	1	2
c. Agricultural	0	1	2
d. Undeveloped	0	1	2
e. Public / Civic	0	1	2
f. Institutional	0	1	2
g. Industrial / Manufacturing	0	1	2
h. Public / Communal Space	0	1	2
i. Public Parking	0	1	2
j. Vacant Building or Lot	0	1	2
k. Other	0	1	2
1. Specify Other:			

A2. Parking Facilities	NO	YES
a. On-Street, angled or parallel	0	1
b. Small lot (30 or fewer spaces)	0	1
c. Medium to large Lot/Garage/Structure	0	1

A3. Physical Activity Venues	NO	YES
a. Park with exercise/sport facilities/equip	0	1
b. Park with sign, no equipment	0	1
c. Open/Green Space	0	1
d. Off-road Trail (incl. bike paths)	0	1

A4. Do any buildings have…?	NO	YES
a. Bars on Windows	0	1
b. Broken/Boarded Windows	0	1
c. Graffiti/Tagging	0	1
d. Yard Debris	0	1

B1. Traffic Features	NO	YES
a. Traffic Circle/Roundabout/Rotary	0	1
b. Speed Hump/Table	0	1
c. Median	0	1
d. Curb Extension/Bulb-out	0	1

B2. Designated Bike Lanes	NO	ONE SIDE	BOTH SIDES
a. Marked Lane*	0	1	2
b. Separated by physical barrier*	0	1	2

B3. Is /Are there any…?	NO	ONE SIDE	BOTH SIDES
a. Street Shoulder*	0	1	2
b. Street or Sidewalk Lighting	0	1	2
c. Sidewalk *(IF NO, SKIP B3c1-5)**	0	1	2
1. Street and Sidewalk Buffer*	0	1	2
2. Continuous Sidewalk within segment	0	1	2
3. Sidewalk continuous at both ends between segments	0	1	2
4. Missing Curb Cuts/Ramps at crossing points	0	1	2
5. Sidewalk Shade*	0	1	2

B4. Intersection and Crossing	NO	YES
a. Traffic Light	0	1
b. Pedestrian Signal at traffic light	0	1
c. Stop Sign	0	1
d. Marked Crosswalk	0	1

C1. Signage Present	NO	YES
a. Bicycle Crossing	0	1
b. Other Bicycle-related Signage	0	1
c. Pedestrian Crossing	0	1

D1. Amenities	NO	YES
a. Benches or Other Seating	0	1
b. Bicycle Parking	0	1

D2. Transit Facilities	NO	Yes
a. Bus Stop/Trolley	0	1
b. Bench or Covered Shelter at transit	0	1

Notes:

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GSV Street Segment Sampling Strategy

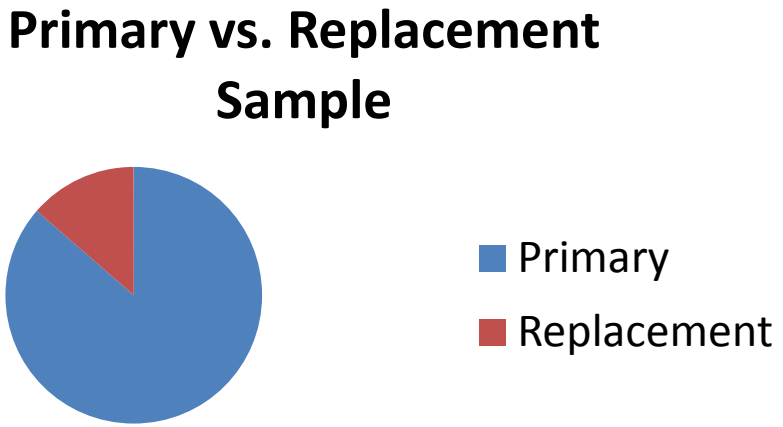
- Draw independent samples of residential and arterial street segments (95% confidence level, CI 0.15 width=maximum of 171 segments (smaller for rural areas) per street type) for each community.
- Stratify streets by high, medium and low income (based on National US Census income data).
- Determine the proportion of each income group represented by census of streets.
- Draw our sample based on the proportion of streets that fall into each income category.

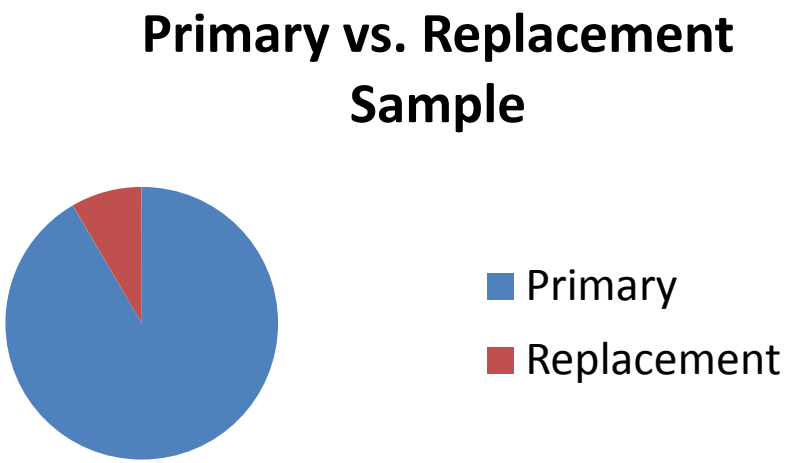
Street Segment Inter-Rater Reliability Results

- 90 segments were coded by two coders.
- Overall agreement was 90.36% agreement
- 8 street features had less than 80% agreement
  - 3 were land use types
  - 2 related to physical disorder
  - Marked bike lane
  - Sidewalk lighting
  - Sidewalk shade

GSV Pilot Results

Mead, CO →





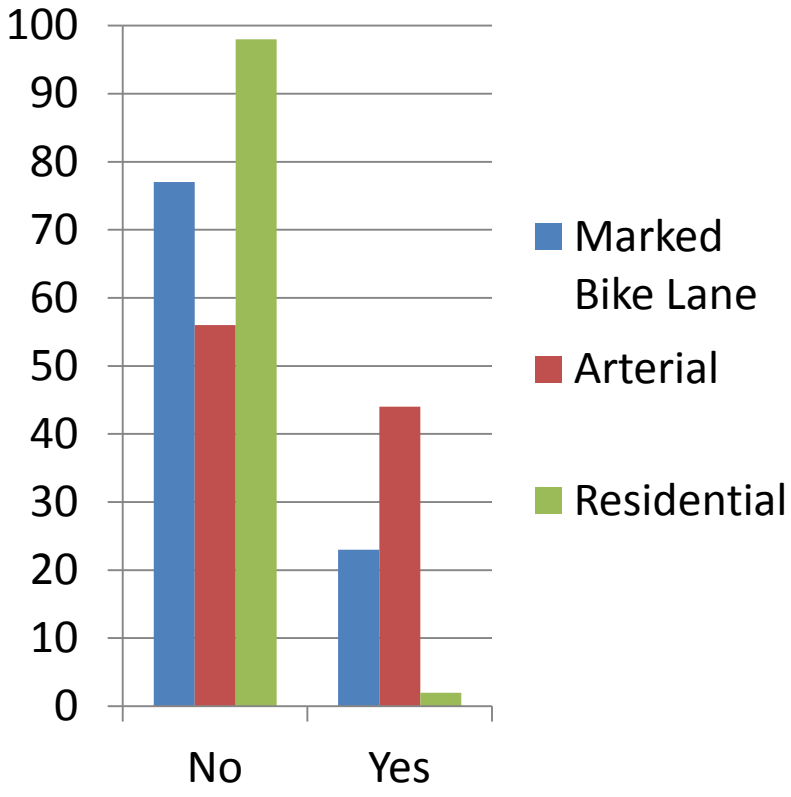
←Tucson, AZ

GSV Sample

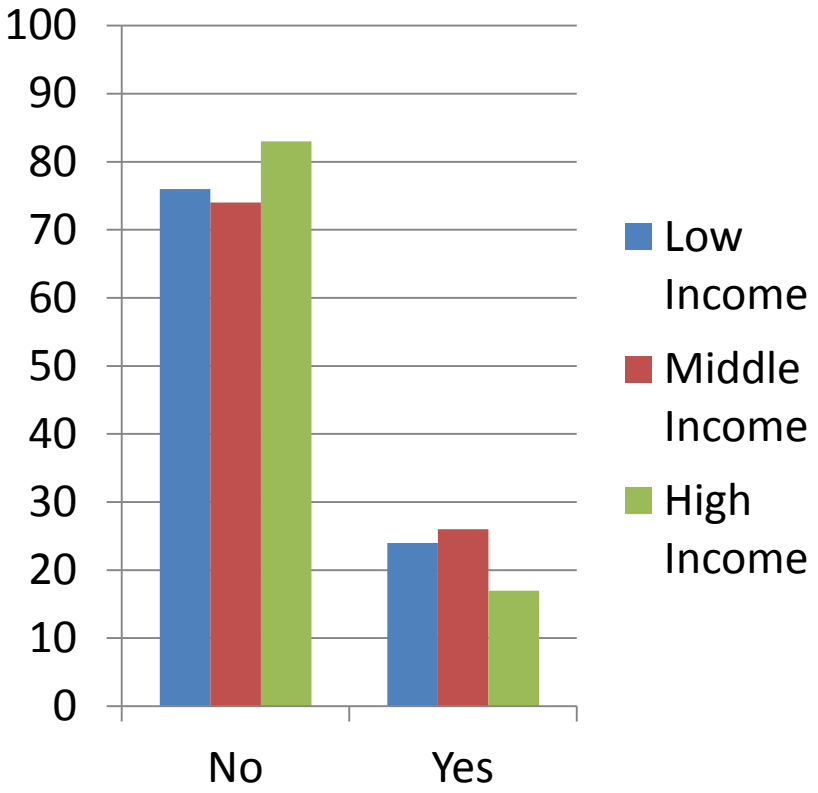
Mead, CO				
Target Street Samples	**N**	**Low Income**	**Middle Income**	**High Income**
Arterial	census	census	0	census
Residential	104	17	0	88
Coded Street Sample				
Arterial	37	9 (24%)	0	28 (76%)
Residential	110	17(15 %)	0	93 (85%)
Total	147	26 (18%)	0	121 (82%)
Tucson, AZ				
Target Street Samples	**N**	**Low Income**	**Middle Income**	**High Income**
Arterial	171	106	45	22
Residential	171	99	49	25
Coded Street Sample				
Arterial	173	106 (61%)	45 (26%)	22 (13%)
Residential	171	97 (57%)	48 (28%)	26 (15%)
Total	344	203 (59%)	93 (27%)	48 (14%)

Example of Future Results

Overall Presence of Bike Lanes, by Street Type



Presence of Bike Lanes by Neighborhood SES



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Implications for Practice and Policy

- Results of the study will:
  - identify what makes zoning codes more "walkability" and "bikeability" oriented
  - Provide insights as to the facilitators and barriers to implementation of more walkable zoning codes.
  - Useful for urban planners, land use developers, governments, and the PA community as to how zoning can be used as a tool to facilitate walking.

Acknowledgement

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