Where the Sidewalk Ends: An Analysis of the Difference Between Sidewalk & Street Networks in a Connectivity Study

Elizabeth Clapp
Geography 592
June 11, 2009

Introduction

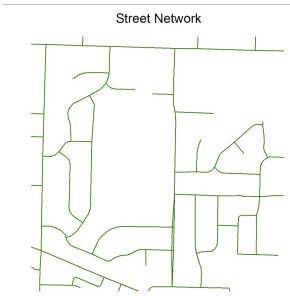
- Many people have trouble adhering to traditional fitness regimens
- "Daily life activities" may impact overall fitness
- Most researchers have used street networks for connectivity studies
- Chin et al. (2008) compared connectivity using street vs. pedestrian networks
- Results: connectivity increased up to 120% when pedestrian networks were factored into the analyses

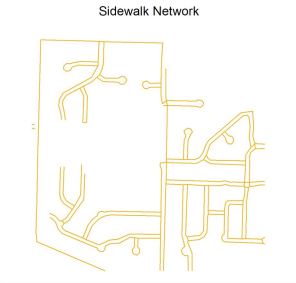
Research Questions

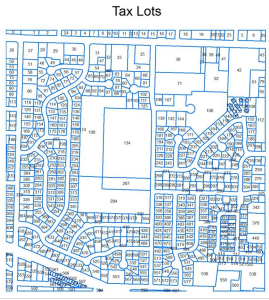
- Do connectivity measures differ between pedestrian and street networks in a suburban Portland Area neighborhood?
- How do the results of this study compare to those of Chin (2008) and Randall (2001)?

Data

- High resolution aerial photo (6-inch), June 2006, Metro
- Tax lots, 2006, RLIS
- Streets, 2006, RLIS
- Sidewalk network – digitized (EC)







Study Area – Gresham, OR

- Non-grid streets
- Central focal point
- High resolution image available
- Similar to neighborhood analyzed by Randall

Methods

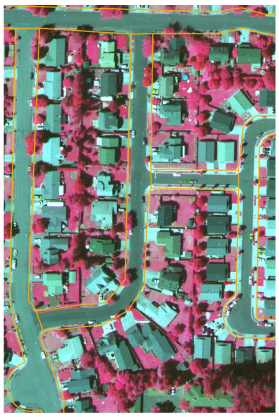
- Data Preparation, pre-processing
- Digitize sidewalk network
- Random selection of tax lots for route “origins”
- Create street & sidewalk networks in geodatabase
- Create routes in Network Analyst from tax lots to school (street, sidewalk) – distance impedance
- Calculate 2 measures of connectivity
- Determine possible retro-fit & test new network
- Compare results to Chin and Randall

Data Preparation

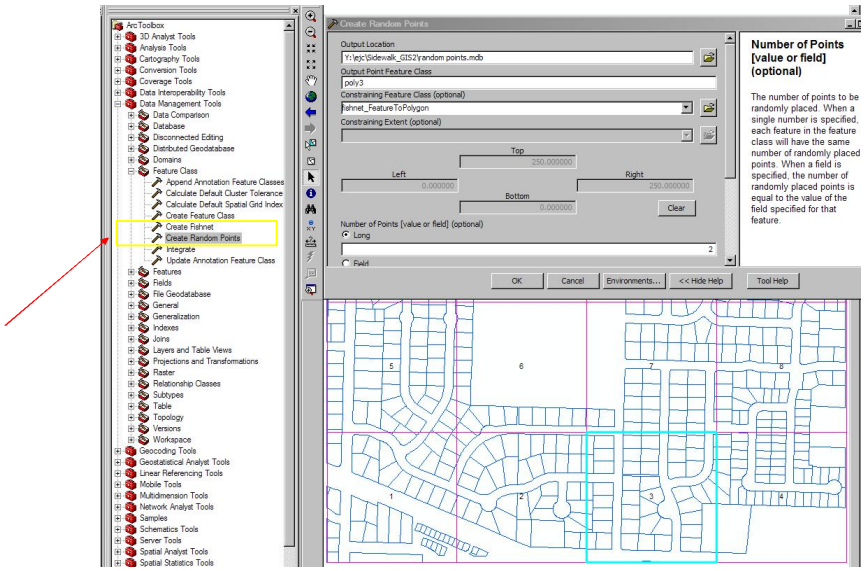
- Convert aerial photo from .jpeg to .img
- Re-project photo to projection of RLIS data
- Clip streets and tax lot to study area
- Created a Geodatabase in Arc Catalogue- updates distance as shapefiles modified

Digitizing Sidewalks

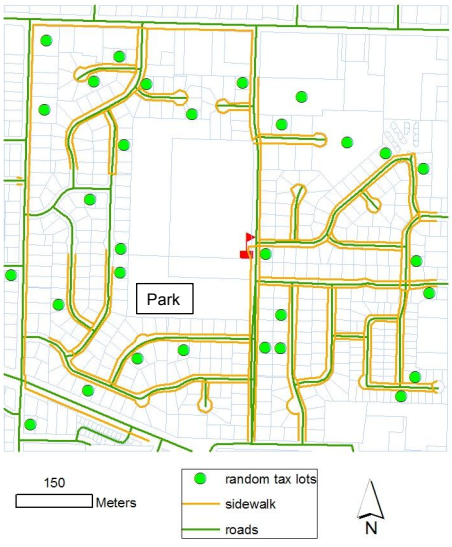
- Create geodatabase feature class (polyline)
- Use Editor to draw sidewalk lines using aerial photo and Google Maps Street level
- Created crossings/intersections between corners



Random Sampling: Create Fishnet & Generate Random Points



Used Network Analyst to Create Routes & Calculate Distance



Calculating Connectivity Measures

Used same 2 measures as Randall:

1. Route distance
2. Pedestrian Route Directness (route distance/geodetic distance)

Determining Geodetic distance:

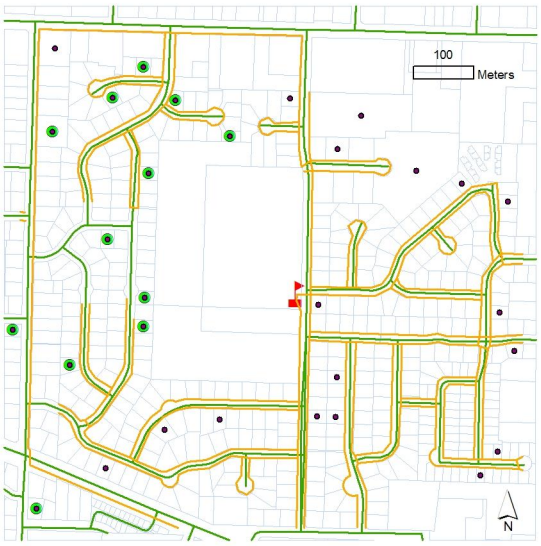
1. Convert tax lot polygon to point file (centroid)
2. Use Near tool

Results – Mean (St Dev)

Walkability Thresholds:
<400 meters
PRD=<1.5

	Route Distance (meters)	Geodetic Distance (meters)	Pedestrian Route Directness
Street Network	580 (295)	340 (116)	1.69 (.78)
Sidewalk Network	633 (361)	340 (116)	1.81 (.77)
Randall & Baetz (2001): Sidewalk Network	744		1.7

Results – Sidewalk Connectivity

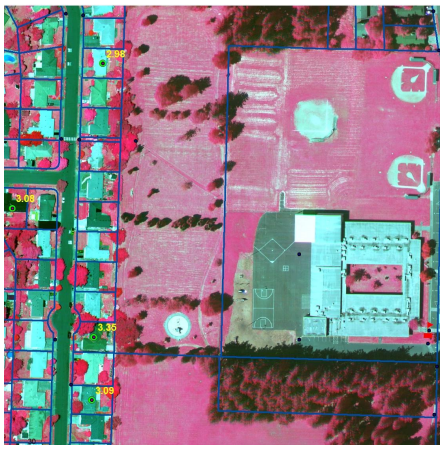


40% of random tax lots had unacceptable connectivity

unacceptable connectivity: PRD exceeds 1.5

Example – Poor Sidewalk Connectivity

Retro-fit Recommendation



Effect of Retro-fit on Connectivity

FID	Old Sidewalk PRD	New Sidewalk PRD
136	2.98	1.31
98	3.2	2.3
65	2.16	1.58
45	1.75	1.79
59	1.94	1.98
86	2.18	2.14

Limitations

- When calculating route distance, snaps from origin to nearest point on the network
- Conservative with sidewalk intersections
- Only used distance as impedance

Conclusions

- Results of the present study were contrary to Chin's – pedestrian network was less connected than street network
- Randall & Baetz had slightly longer av. route distance but lower PRD
- Overall, the average route distance & PRD were higher than standard walkability thresholds
- Small areas without sidewalks or safe crossings can greatly effect these measures

References

- Chin, G.K.W., Van Niel, K.P., Giles-Corti, B., & Knuiman, M. (2008). Accessibility and connectivity in physical activity studies: The impact of missing pedestrian data. Preventive Medicine, 46, 41-45.
- Randall, T.A. & Baetz, B.W. (2001). Evaluating pedestrian connectivity for suburban sustainability. Journal of Urban Planning and Development, 127, 1-15.
- Geoffrey Duh