Indices of Walkability to Identify Environmental Barriers to Walking in Urban and Rural Communities

North Pearl St., Albany

Akiko S. Hosler, Ph.D.[1,2]

Xiangmei Gu, M.S.[1]

1. University at Albany School of Public Health Department of Epidemiology and Biostatistics

2. University at Albany Prevention Research Center

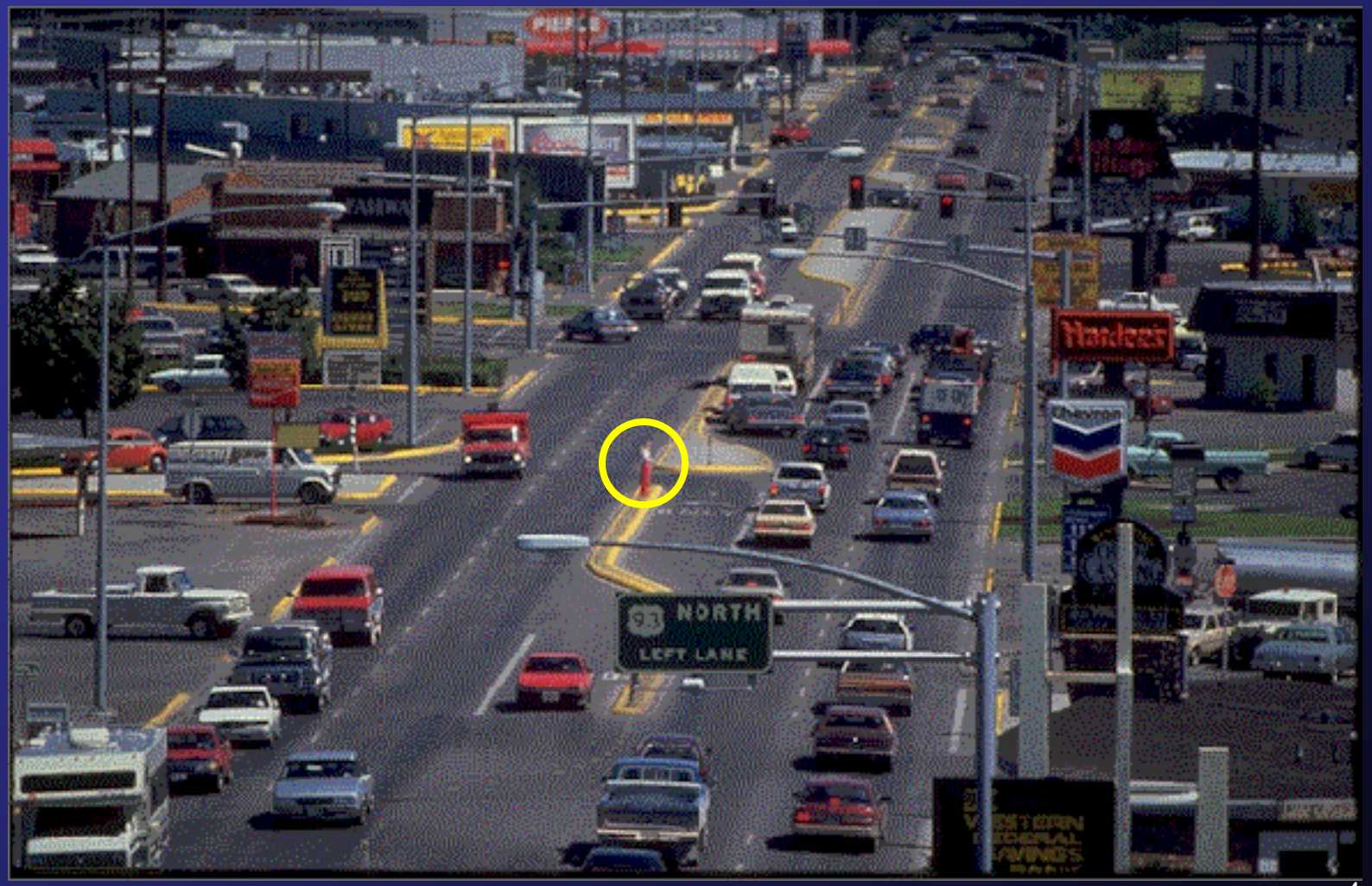
Importance of Walking

- Walking is an excellent mode of exercise, especially people at risk for chronic disease
- 3-4 hours (180-240 minutes) /week of walking can reduce
  - Diabetes risk by 48-66%
  - Heart disease risk by 30-50%
  - Risk of hip fracture by 18-24%
  - Reduce risk of dementia

Walking in the Community

- Walking is the most frequent leisure time physical activity among adults
- Sidewalks/streets are the most popular site/facility for leisure time walking
- Walking on sidewalks/streets has community benefits too
  - Increases retail profit, reduces air pollution, etc.
- But around 40% of adults report environmental barriers to walking

Walk *there*?

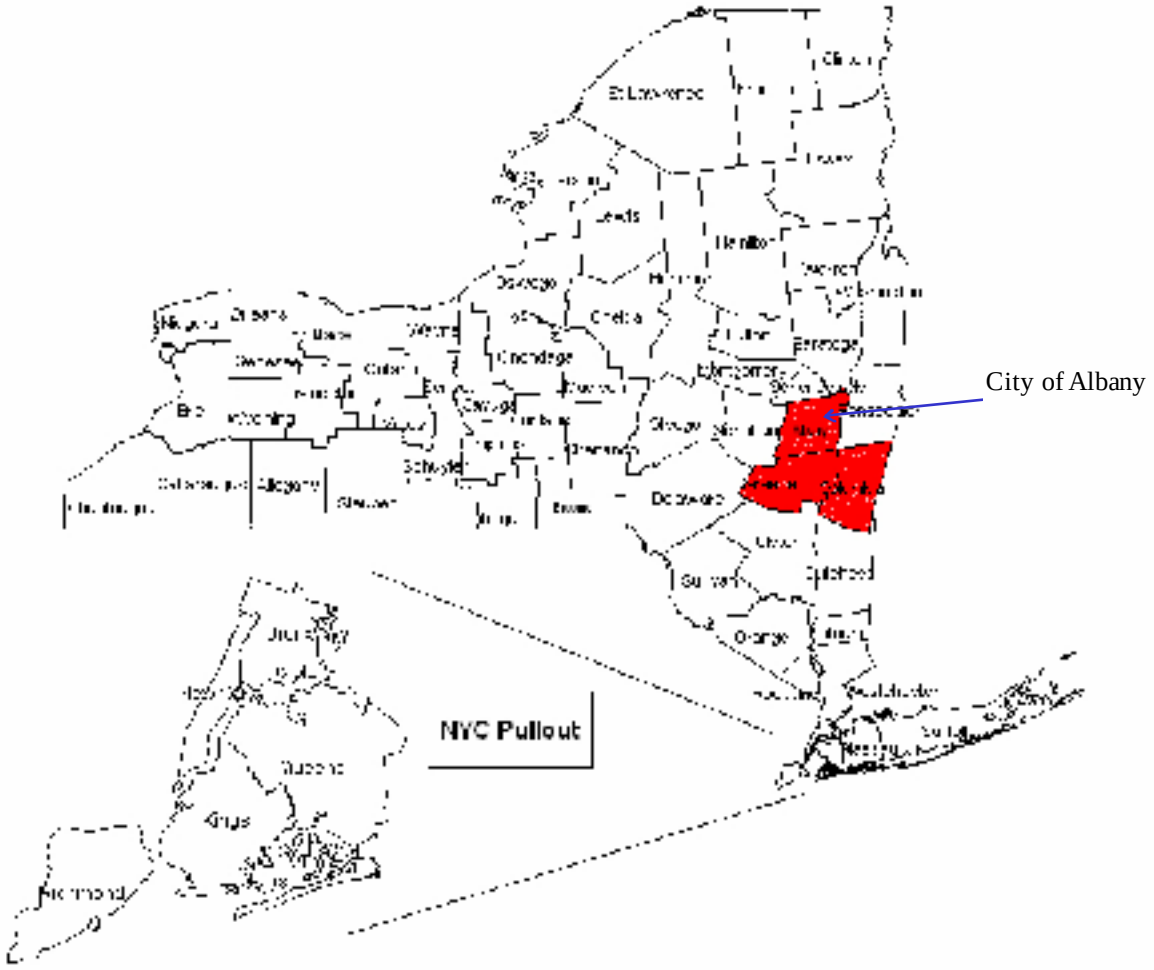


Purpose of the Study

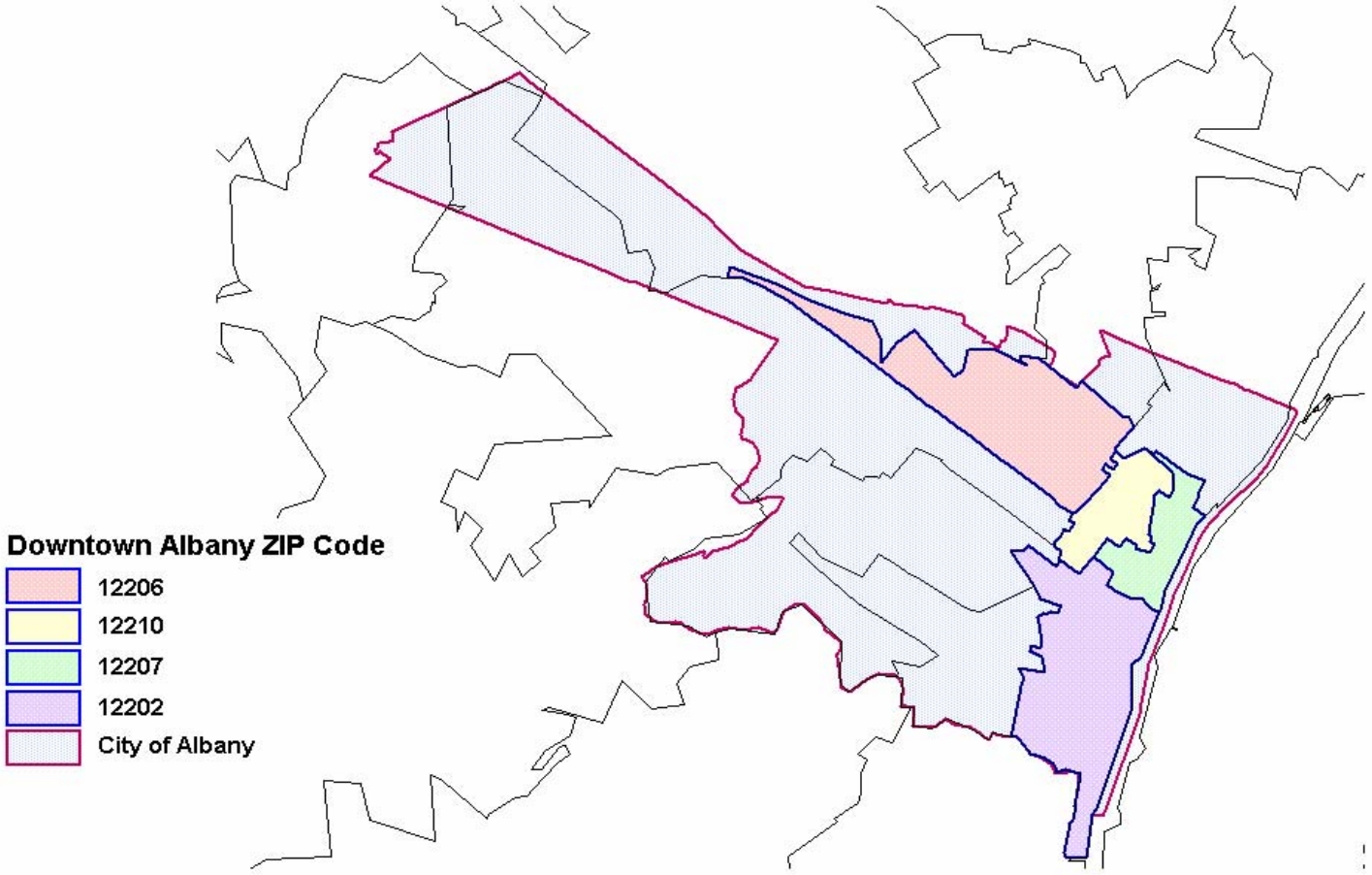
- To assess "Walkability" of the study communities by measuring multiple indicators of sidewalks, streets, and other built environment
- To develop standardized survey tools and methodology that can be used in both urban and rural communities
- To link walkability measures to neighborhood demographic information from the census

Study Communities

- The same three communities previously identified by the Albany Prevention Research Center core project team
- Downtown Albany (zip codes 12202, 12206, 12207, and 12210) representing urban underserved community
- Entire Columbia and Greene Counties representing rural communities



City of Albany and Downtown Area



Sampling Methodology

- The unit of analysis is “street” – one residential block length or equivalent
- The study communities were divided into Census Block Groups (CBGs) (N=146).
- The CBGs were stratified into 3 groups by the degree of urbanization, then different rates of sampling were applied

  Urban CBGs (n=60): 100% sampling

  Suburban CBGs (n=22): 100% sampling

  Rural CBGs (n=64): 33% sampling

Sampling Methodology (continued)

- From the selected CGBs (N=104), one street per CGB was randomly selected
- The total number of streets assessed was 110 (5 Albany CBGs where over-sampled due to large land area)
- Sampling weights (the reverse of selection probabilities) were assigned to all streets - The weighted total number of streets equals the total number of CBGs for each community

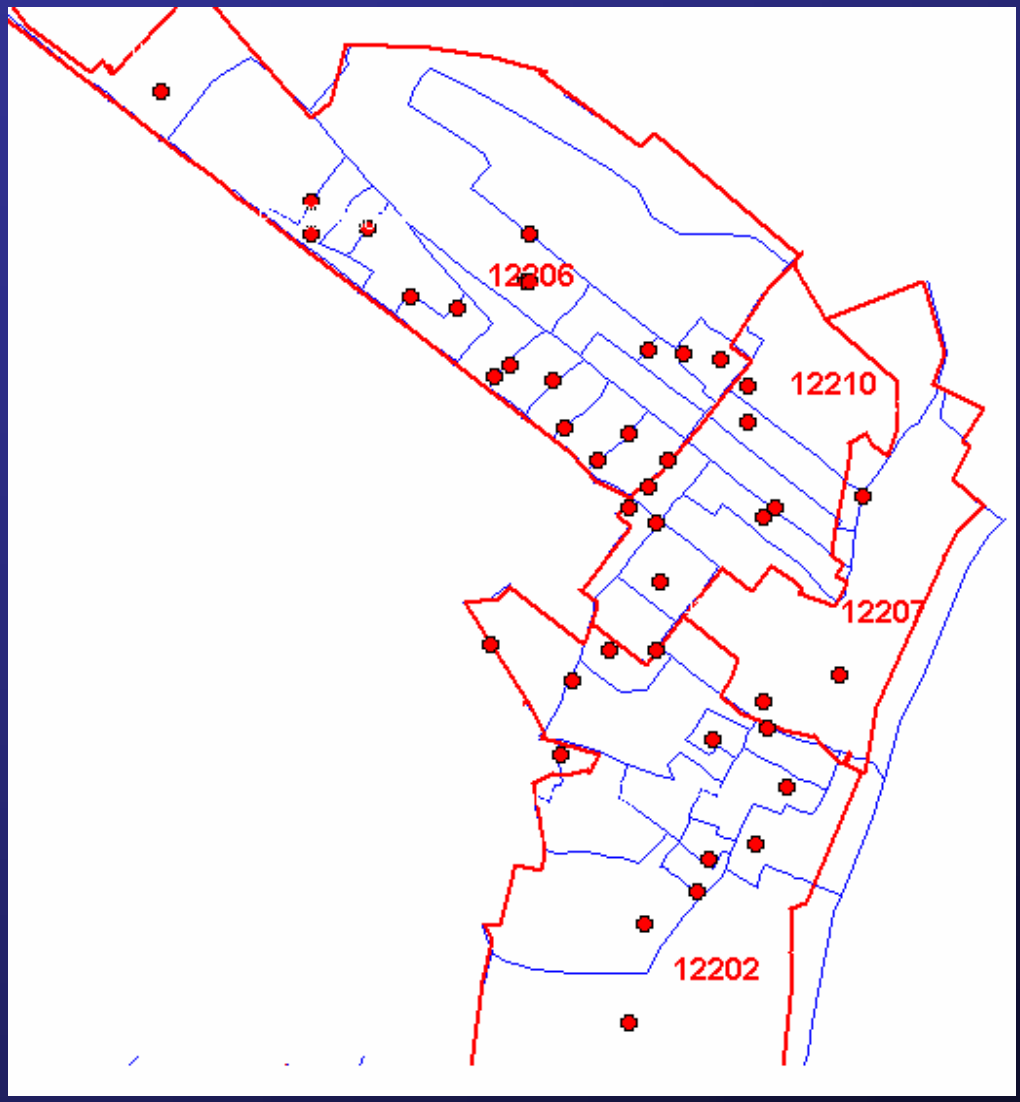
Sampling Summary

	Albany	Columbia			Greene		
	Urban	Urban	Suburbs	Rural	Urban	Suburbs	Rural
Total CBGs	38	13	13	38	9	9	26
Sampling rate	100%	100%	100%	37%	100%	100%	31%
Sampled CBG / street	38/44*	13/13	13/13	14/14	9/9	9/9	8/8
Sampling weights	0.33, 0.50, 1.00**	1.00	1.00	2.71	1.00	1.00	3.25

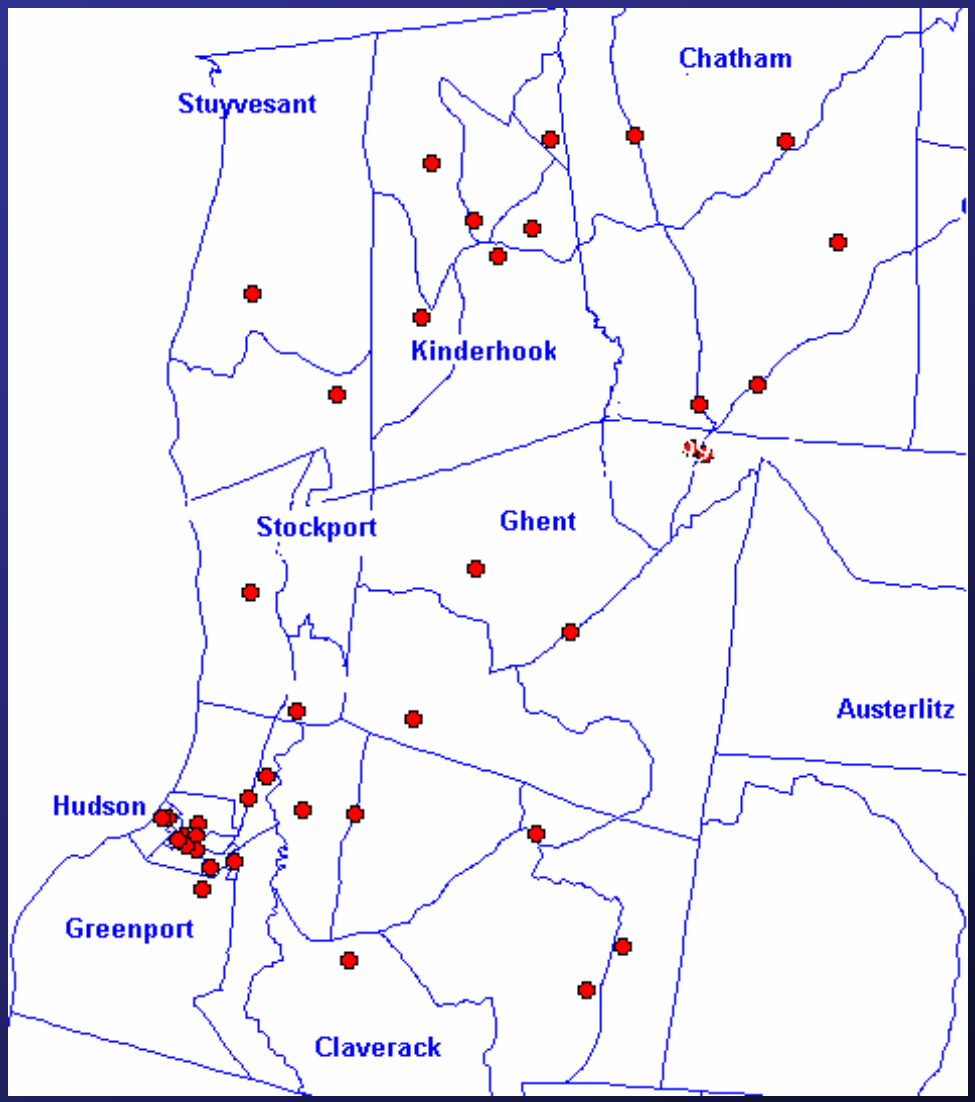
* Due to over-sampling of 5 CBGs

** Weights less than 1.00 were applied to streets that were over-sampled

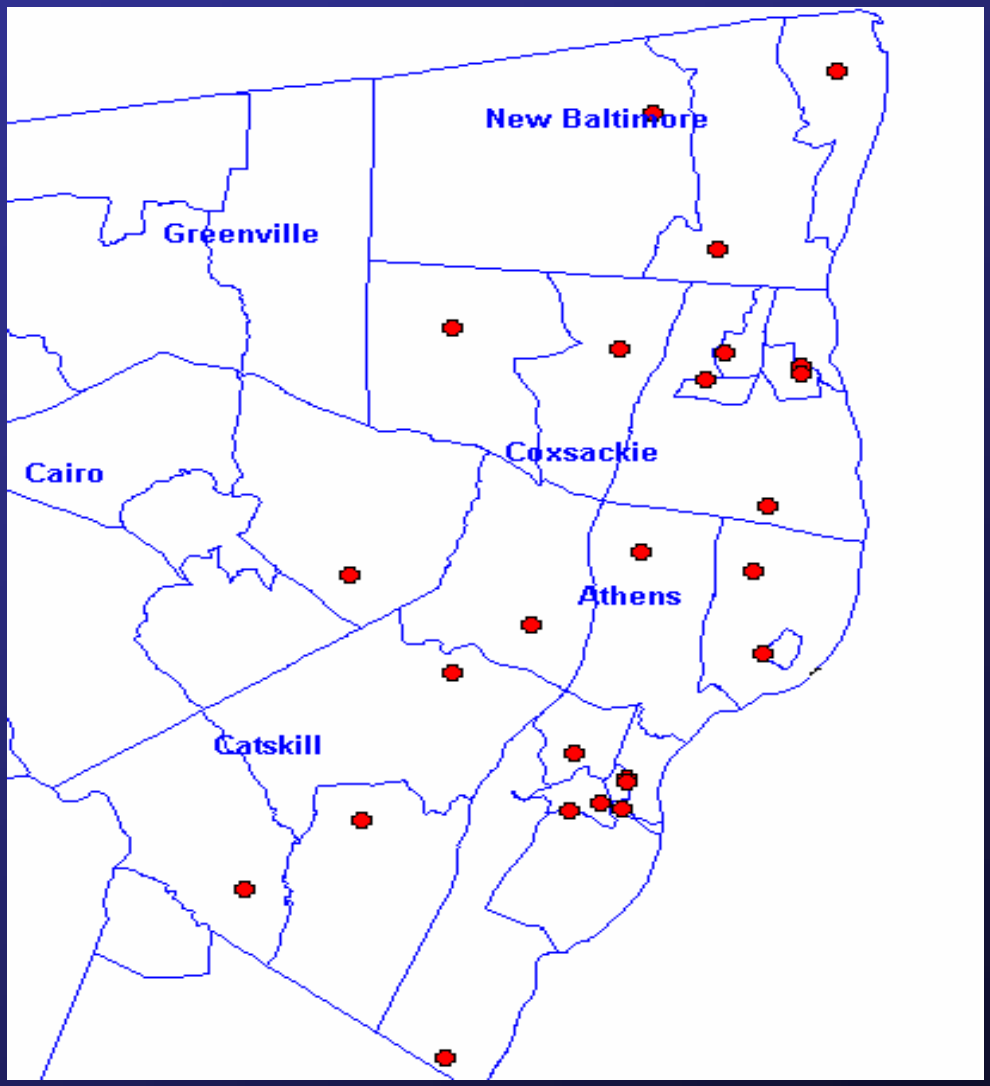
Streets Assessed in Albany



Streets Assessed in Columbia County



Streets Assessed in Greene County



Survey Tool

- A one-page survey tool for field data collection and its manual were developed
- Some of the items were adopted from
  - The "Street Observation Response Sheet" developed by the NYS DOH Health's Healthy Heart Program
  - "Sidewalk Assessment Tool" by the South Carolina Prevention Research Center
  - The sidewalk assessment manual developed by the U.S. Department of Transportation
  - "Sidewalk Installation & Design" for pedestrian circulation plan by the City of Placerville, CA

University at Albany Prevention Research Center Diabetes Core Project No _____

[GENERAL INFO] **Date & Time:** _____ **Survey taker:** _____

Block group ID: _____ **Street:** _____ **Between** _____ **&** _____

City _____ **Zip** _____

[START POINT] **House #** _____ **Latitude** _____ **Longitude** _____

Crosswalk: 1.Yes 2. No **Sidewalk curb ramp:** 1. Yes, functional 2, Yes, with a gap 3. No 9. N/A

Signals: 1. Traffic signal w/ pedestrian signal 2. Traffic signal only 3. No signals at all

[COUNT] **Occupied bldg.** _____ **Vacant bldg.** _____ **Vacant lot** _____ **Alley** _____ **Driveway** _____

Land use: 1. Residential ___ % 2. Commercial ___ % 3. Industrial ___ % 4. Public ___% 5. Agricultural ___%

[SIDEWALK] **Sidewalk present?** 1. Yes, continuous 2. Yes, partial _____ % 3. No

Sidewalk material: 1. Concrete 2. Asphalt 3. Other _____ **Sidewalk width** _____ inches

Buffer present? 1. Yes, continuous 2. Yes, partial _____ % 3. No

Buffer material: 1. Brick 2. Grass 3. Asphalt 4. Concrete 5. Other _____ **Buffer width:** _____ inches

Curbs:? 1. Yes, continuous 2. Yes, partial _____ % 3. No **Height of curbs:** _____ inches

Levelness: 1. Excellent 2. Good 3. Fair 4. Poor **Maintenance:** 1. Excellent 2. Good 3. Fair 4. Poor

Other surface issues 1. None 2. Any _____

[STREET] **Garbage, debris, animal droppings :** 1. Excellent 2. Good 3. Fair 4. Poor

***Shoulder present?** 1. Yes, continuous 2. Yes, partial _____ % 3. No ***Shoulder width** _____ inches

Personal safety concerns: 1. None 2. Any _____

Speed limit: _____mph **Street type:** 1. One-way 2. two-way, single lane 3. two-way, double lane

Car traffic: 1. Little or no 2. Moderate 3. Heavy **Pedestrian traffic:** 1. Little or no 2. Moderate 3. Heavy

Street parking: 1. Few or no 2. Some 3. Full **Gradient (Hilly):** 1. Flat 2. Moderate 3. Severe

Street lamps: 1. All along 2. Some 3.None **Shady trees:** 1. All along 2. Some 3. None

(* For streets without sidewalks only)

[END POINT] **House #** _____ **Latitude** _____ **Longitude** _____

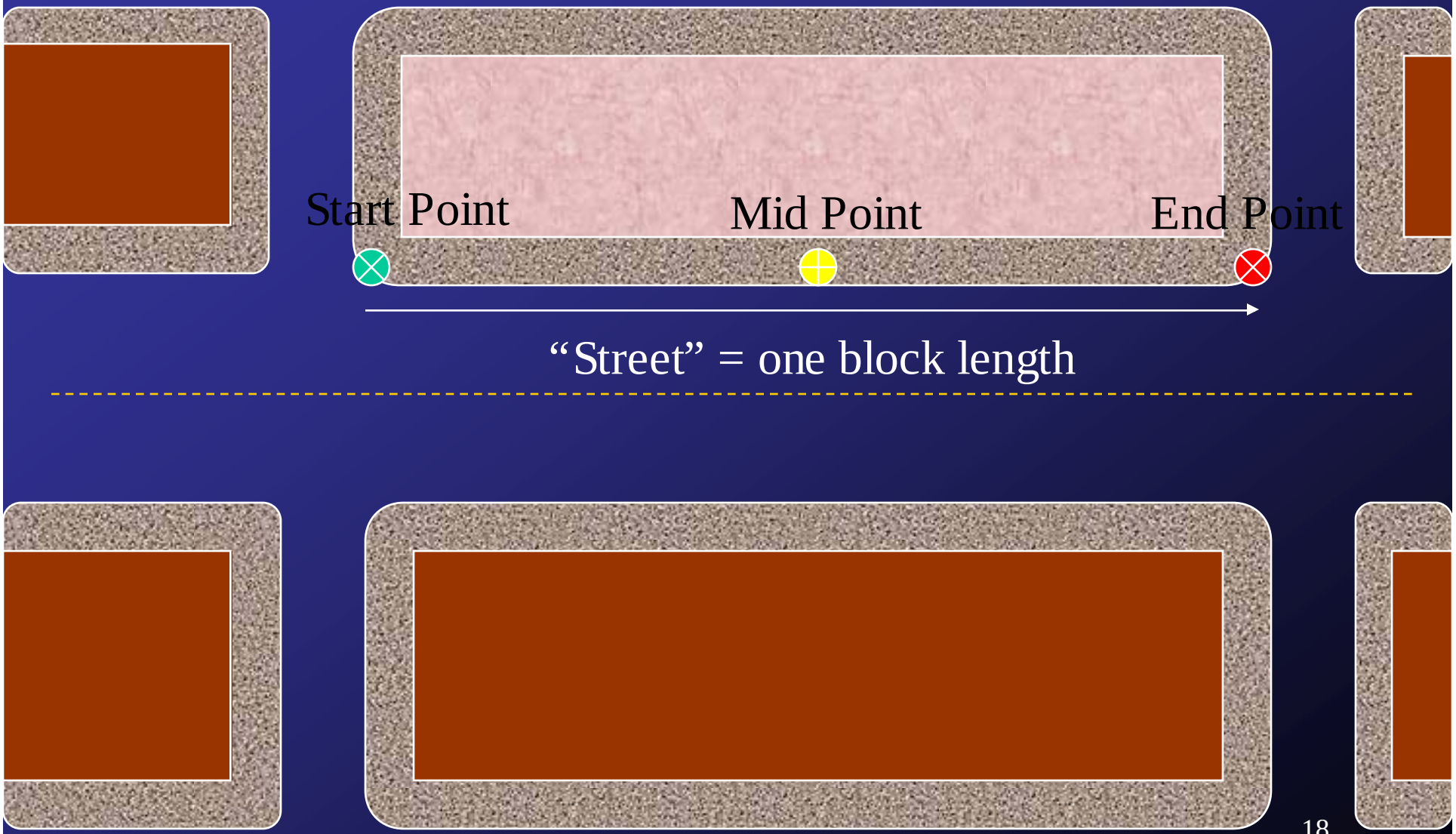
Crosswalk: 1.Yes 2. No **Sidewalk curb ramp:** 1. Yes, functional 2, Yes, with a gap 3. No 9. N/A

Signals: 1. Traffic signal w/ pedestrian signal 2. Traffic signal only 3. No signals at all

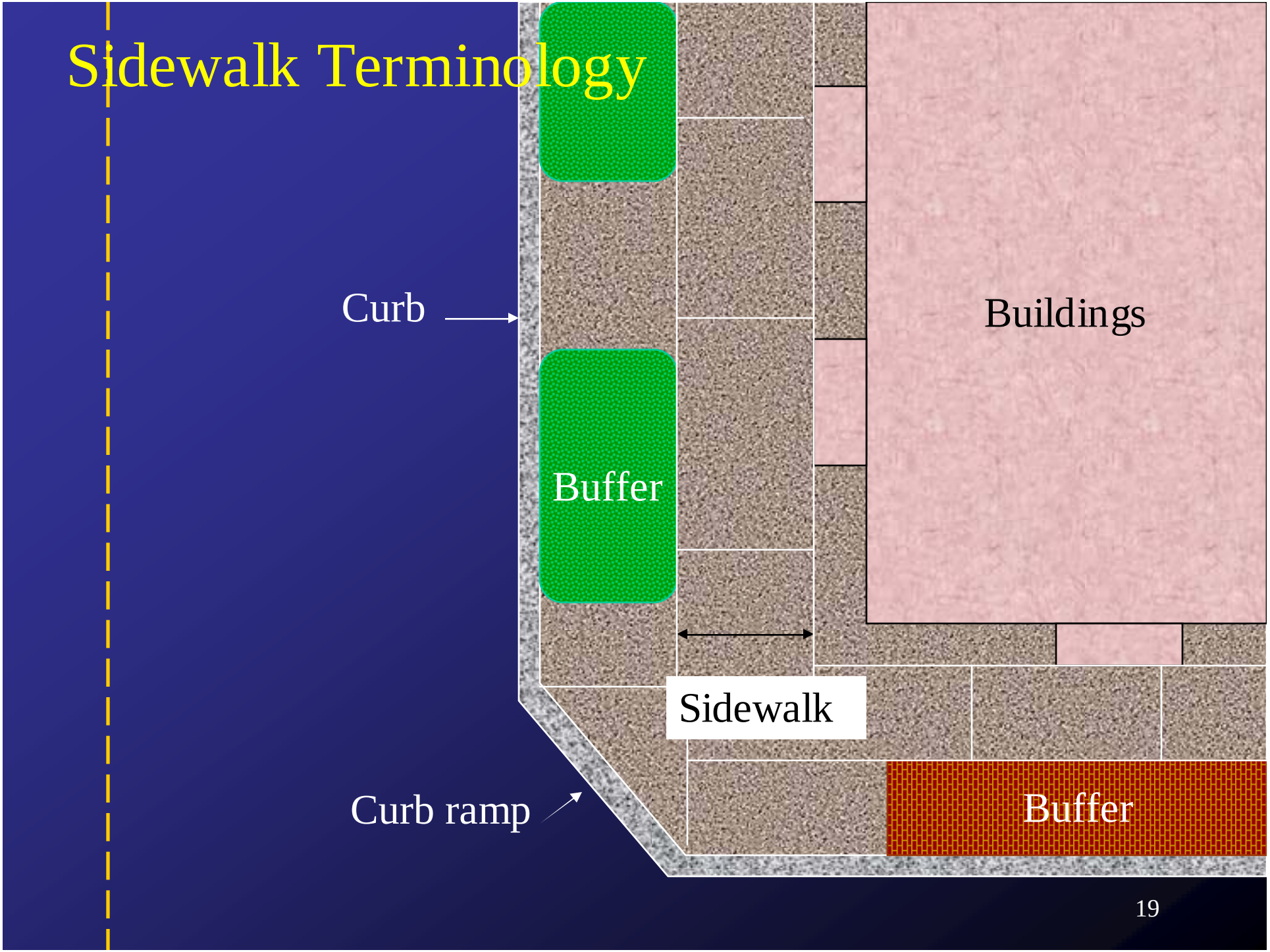
Data Collection Technique

- Point-based assessment
  - Start and end points (intersections)
    - GPI coordinates, cross walks, signals, curb ramps
  - Mid point
    - Most physical measurements (width of sidewalk, height of curb)
- Street-length assessment (as you walk)
    - Land use, house & drive way counting, car & pedestrian traffic, narrow spots, obstacles and other maintenance problems
- "Turn around and evaluate"
    - Gradient, cleanliness, safety concerns,
- On average, a two-person team can finish entire assessment in about 10 minutes per street!

Assessment Protocol



Sidewalk Terminology



Key dimensions of Assessment

- **Sidewalk basic features** – presence & coverage of sidewalk, buffer and curb; material and width of sidewalk and buffer, height of curb and narrow points (11 items)
- **Sidewalk maintenance** - levelness, garbage, removable & permanent obstacles (6 items)
- **Personal safety** —land use, housing vacancy, loitering (5 items)
- **Traffic safety**— speed limit, lane type, crosswalk, signals and numbers of driveways (10 items)
- **Gradient** (steepness) (1 item)

"Points" System for Indices

- What are the "desirable" sidewalk & street features?
- 4 (Excellent) to 1 (poor) points
- 0 point if there is no such thing!

Example: Sidewalk width

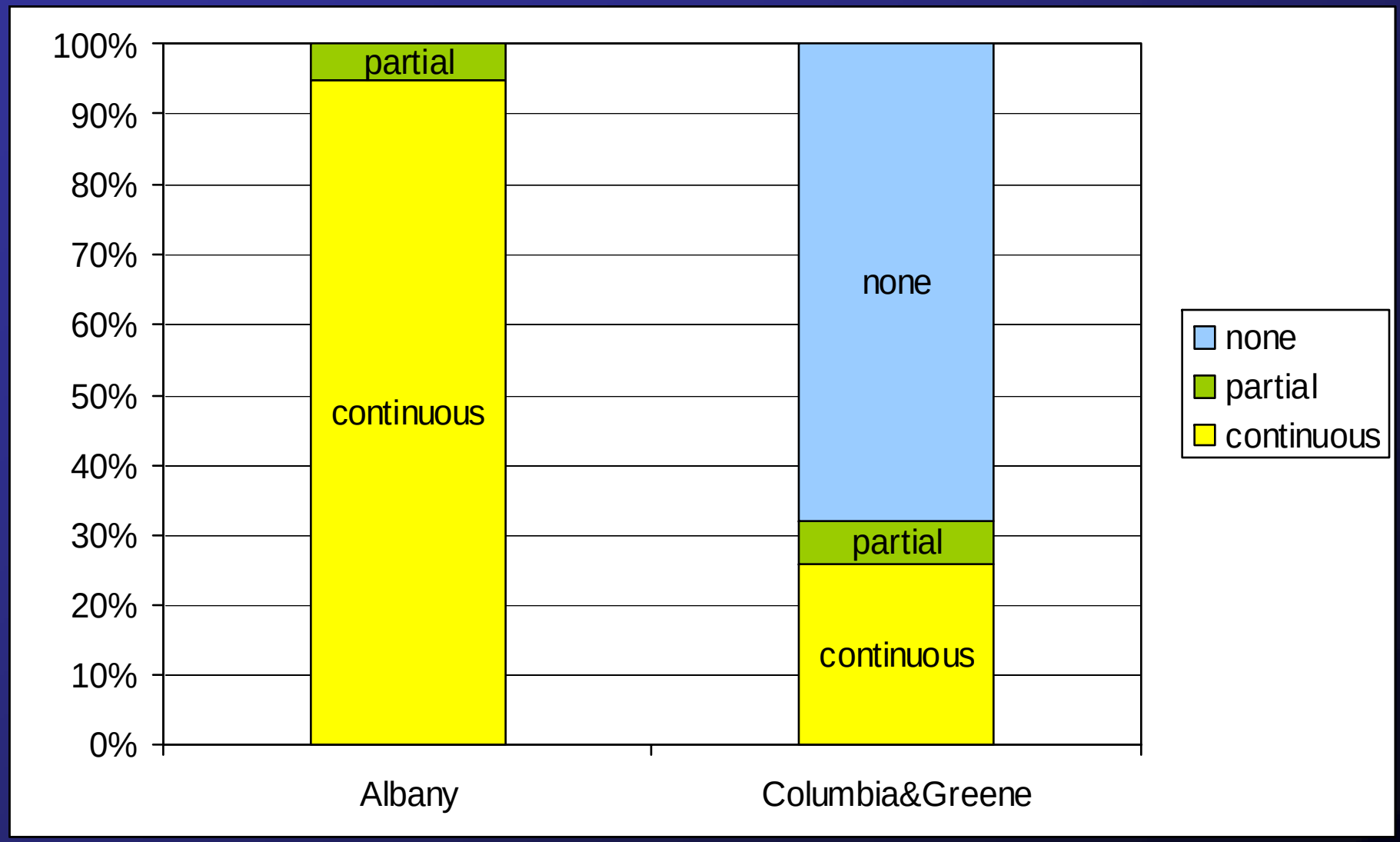
72 inches or more : 4 points

60-71 inches: 3 points

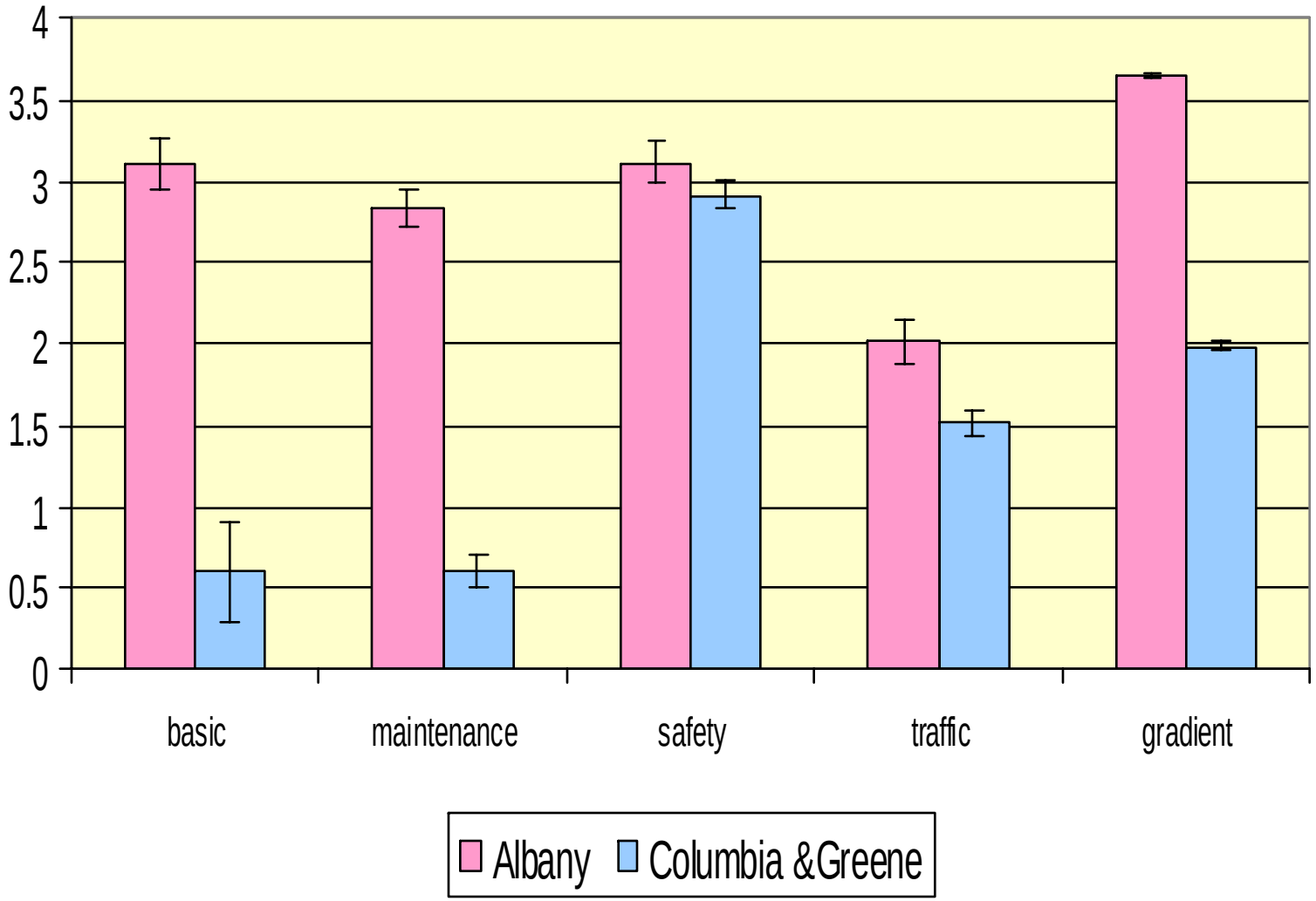
48-59 inches: 2 points

Less than 48 inches: 1 point

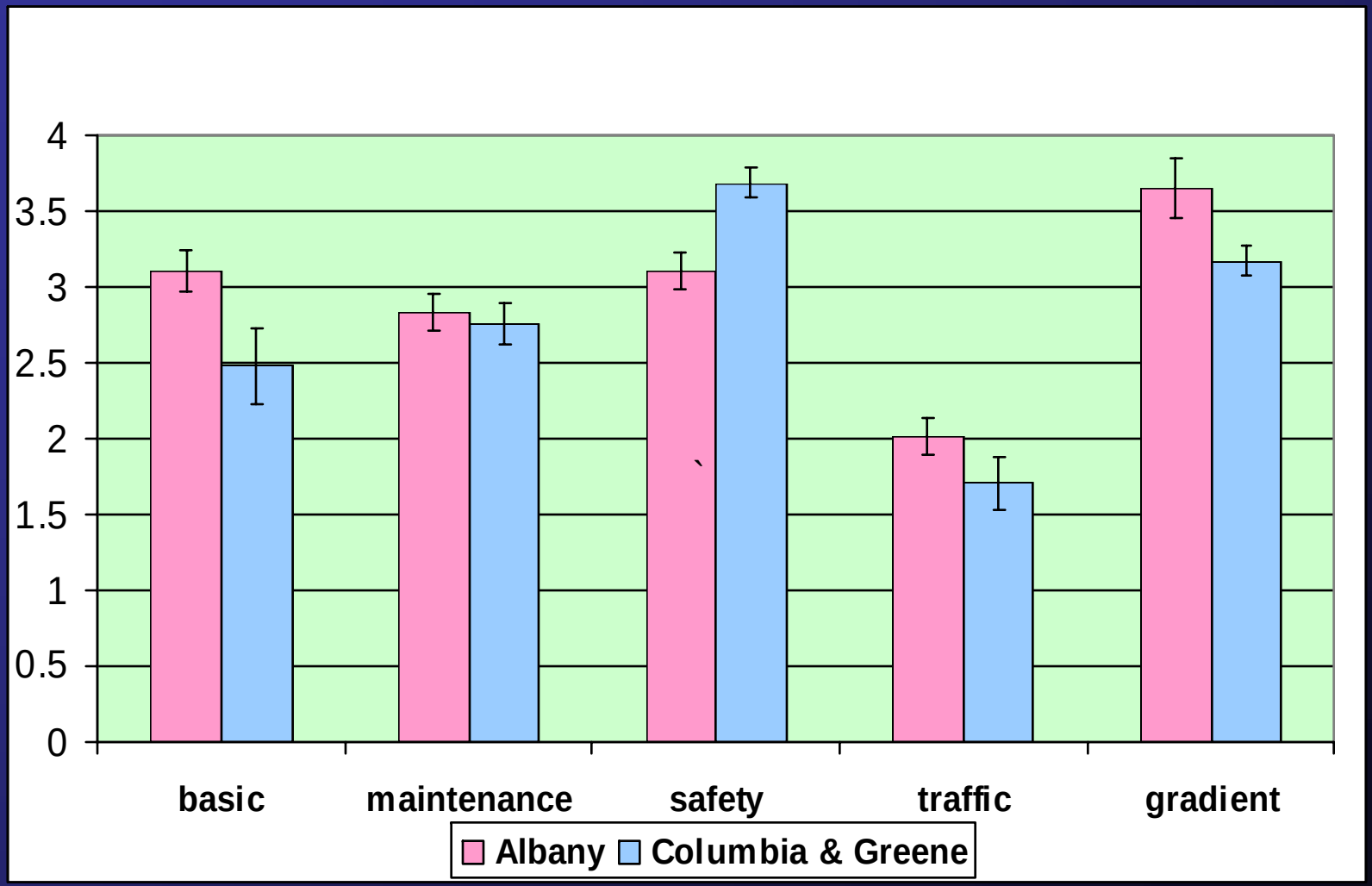
Sidewalk Coverage by Community



Street Condition Summary



Sidewalk Condition Summary
(streets with sidewalks only)



Findings from Descriptive Analysis

- All walkabilty Indices of streets in Downtown Albany are better than those in Columbia & Greene counties (all are statistically significant except the personal safety)
- For the streets with sidewalks, Albany was also significantly better in basic features and gradient, but Columbia & Greene were better in personal safety

Subjective Assessment of Walkability from Previous Studies in the Same Communities

	Statewide[1] (n=3,134)	Downtown Albany[2] (n=104)	Columbia/ Greene[2] (n=104)
Used sidewalks and/or streets for walking	56.6	**92.3***	69.2
Have community/neighborhood reason(s) for not being more active	37.0	47.1	38.4
Community/neighborhood reason(s)			
Heavy traffic	**7.6**	**1.9**	**7.7**
Sidewalk - too few or in bad condition	**5.8**	**5.8**	**12.5***
High crime	**5.0**	**23.1***	**1.9**
Rural environment, remote area	**2.2**	**0.0**	**7.7***
Too many hills	**0.8**	**3.8***	**9.6***
Not enough recreational facilities	4.2	2.9	6.7
Bad weather	3.6	3.8	7.7
Not enough physical activity programs	1.0	**4.8***	**4.8***
All other reasons	15.8	7.6	4.8

* Significantly ($p<0.01$) higher than the statewide 1. BRFSS data 2003 2. PRC Diabetes Patient Survey 2003

Personal Safety Issue

- Overall, Columbia & Greene had similar personal safety scores as Albany, largely because many rural streets were in very remote, desolate, and wooded areas
- But when streets with sidewalks were compared, Albany's scores were significantly lower, because there were many vacant buildings and unused lots, and frequent street loitering

Area	Index Crime	Total population	Crime rate (per 10,000 person)
Albany city	6434	93919	685.1
Columbia/Greene	1614	113304	142.5

From "Index Crimes Reported:2000-2005" by Division of Criminal Justice Services of New York State

Multivariate Regression Analysis
Walkability Index & Socio-demographics

- Walkability Index: basic feature, maintenance, personal safety, traffic safety
- Socio-demographic variables: percent of minority, percent of poverty, percent of renter and percent of urban (for Columbia &Greene County only) . (Source: 2000 census data)
- Unit of analysis: Census block group

Beta Coefficients for Ordinary Least Square Regression Models for Each Dimensions of the walkability index: Albany and Columbia/Greene

	Urban: Downtown Albany[1]		Rural: Columbia/Greene			
	Sidewalk Maintenance	**Personal Safety**	**Basic Features**	**Sidewalk Maintenance**	**Personal Safety**	**Traffic safety**
Percent minority	**-0.347 ***	**-0.556 ***	**---**	**---**	**---**	**0.349 ***
Percent below poverty	**---**	**---**	**---**	**-0.261 ***	**-0.374 ****	**---**
Percent renter	**---**	**---**	**0.297 ****	**0.455 ****	**0.581 *****	**---**
Percent urban	**---**	**---**	**0.288 ****	**0.233 ***	**0.237 ***	**---**
R square	**0.121**	**0.309**	**0.263**	**0.218**	**0.288**	**0.121**

1 Models for basic features and traffic safety dimensions in Downtown Albany could not produce significant (at least p<.05) coefficients

* p<.05, ** p<.01, *** p<.001

Findings from Regression Analysis

- In Albany, higher the minority population percentage, the lower the scores for sidewalk maintenance and personal safety indices
- In Columbia & Greene, it was little more complex
  - Basic feature was positively associated with renter and urbanity
  - Both sidewalk maintenance and personal safety were positively associated with renters and urbanity, but negatively associated with poverty
  - Traffic safety was positively associated with minority
    - Urban features had generally positive effects!

Conclusions

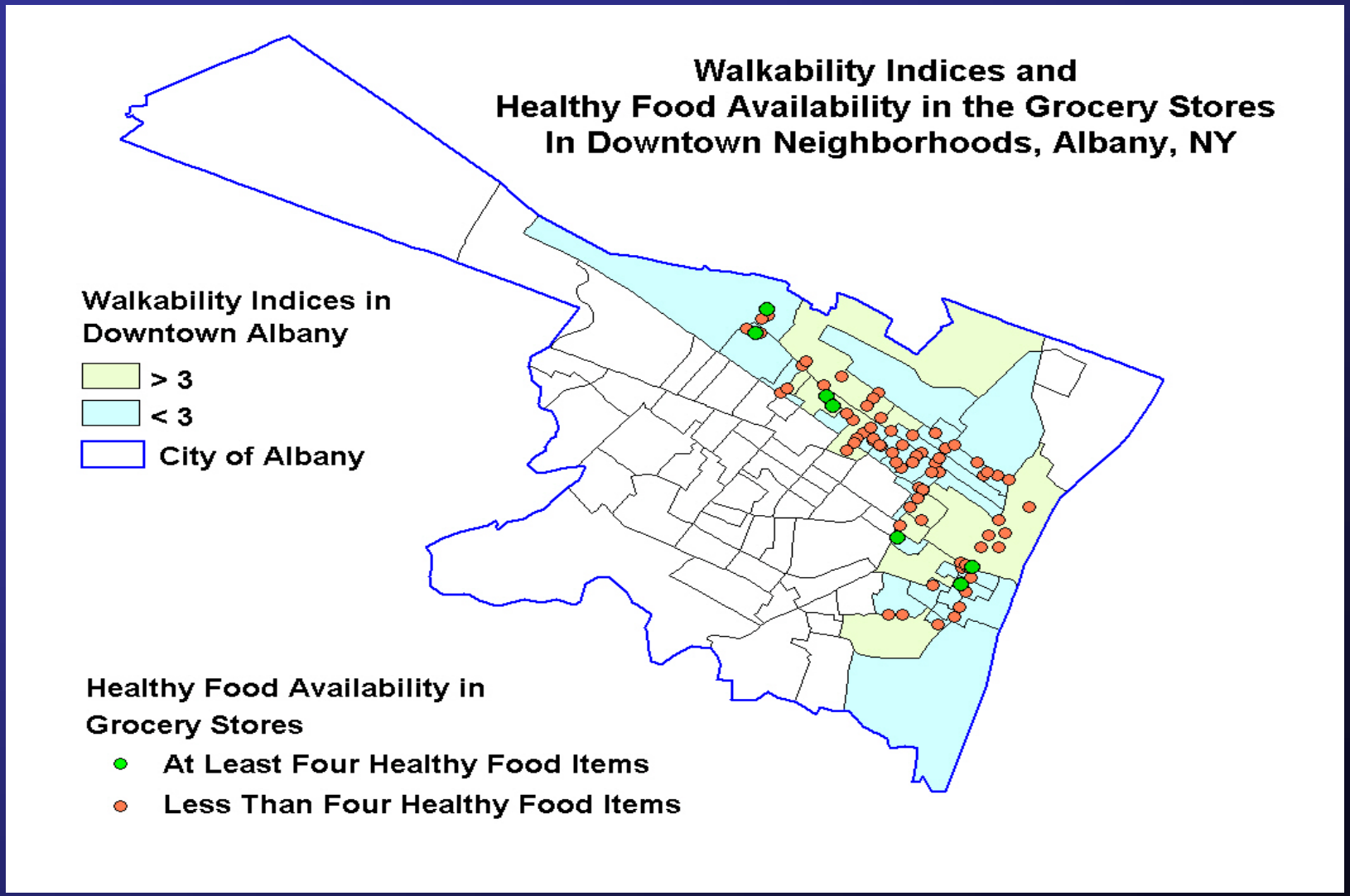
- Overall. downtown Albany has much better infrastructure for walking than rural Columbia & Greene – higher environmental barriers to walking in rural communities were confirmed
- Sidewalk maintenance and personal safety issues in minority neighborhoods in Albany should be addressed
- Pedestrian traffic safety features (cross walks, pedestrian signals, shoulders) need improvement in both communities

Population of the Census Block Groups (CBGs) with Walkability Index That Were at or Above 3.0 (75th percentile)

	Urban: Downtown Albany			Rural: Columbia/Greene		
	CBGs	Population	%	CBGs	Population	%
Total of the area	38	41,014		108	111,289	
Have a sidewalk	38	41,014	100.0*	26	24,414	21.9
Have a sidewalk with the basic features index ≥ 3.0	27	30,433	74.2*	7	7,529	6.8
Have a sidewalk with basic features and maintenance index ≥ 3.0	16	20,792	50.7*	6	6.308	5.7
Personal safety index ≥ 3.0	24	27,249	66.4*	57	56,911	51.1
Traffic safety index ≥ 3.0	2	2,112	5.1	0	0	0
Gradient measure ≥ 3.0	33	36,434	88.8*	36	33,697	30.3
Grand total of indices ≥ 3.0	10	15,257	37.2*	1	763	0.7

* Significantly (P<0.01) higher than Columbia/Green

Next Step: Linking Other Environmental Measures with Walkbility



Acknowledgements

- This study was supported by the Centers for Disease Control and Prevention through the Albany Research Center Cooperative Agreement #U48/DP000028
- Additional funding for graduate student intern support by the New York State Department of Health Maternal and Child Health Block Grant
- We thank Deepa Rajulu for her assistance in data collection, data entry and mapping, and Tatiana Ledneva for her assistance in mapping

Thank You Very Much

Contact Information:

Akiko S. Hosler, Ph.D.
Assistant Professor
Department of Epidemiology and Biostatistics
University at Albany School of Public Health
One University Place, Rensselaer, NY 12144-3456
ash05@health.state.ny.us
Phone: 518-402-1561