

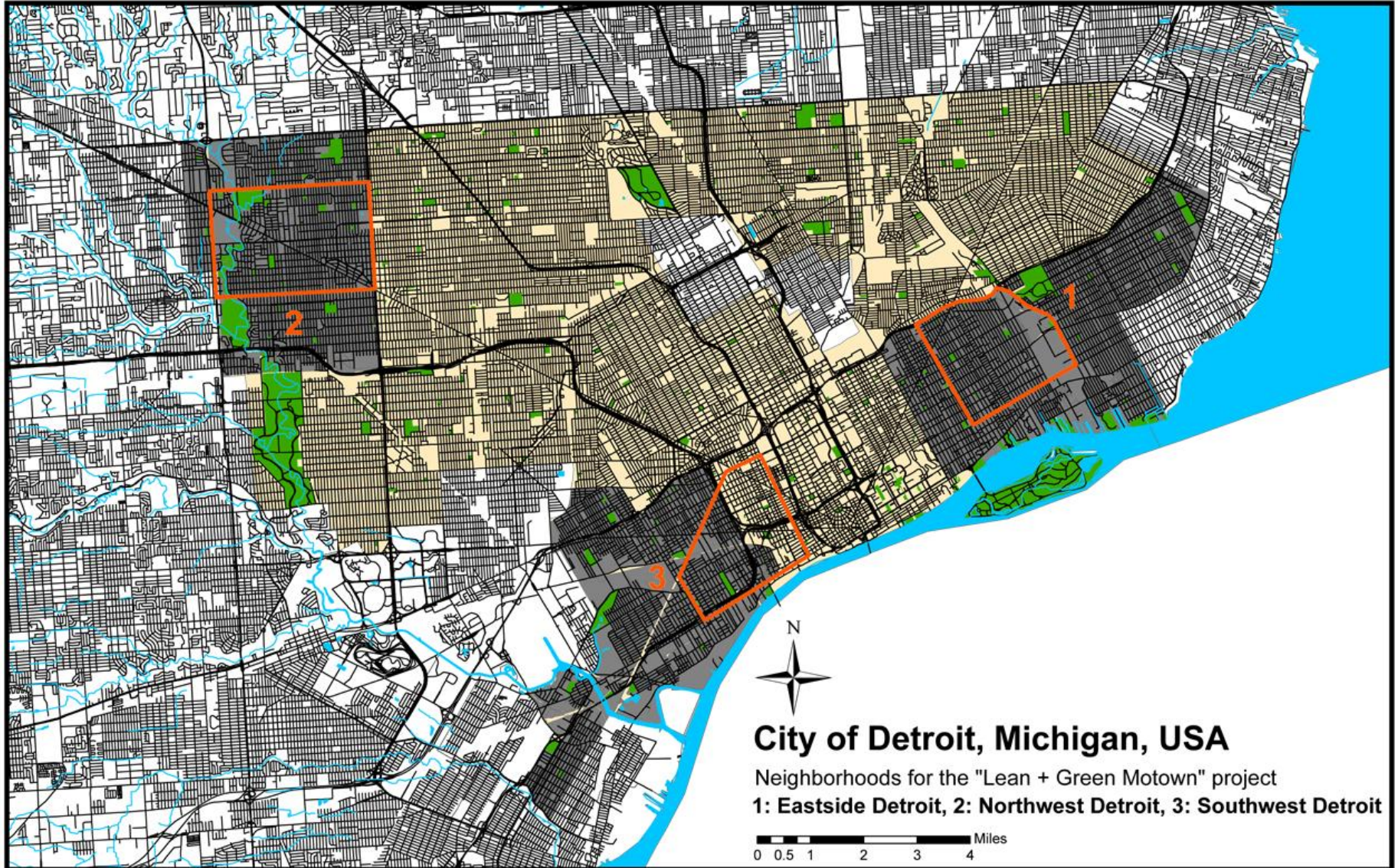
# Neighborhood Design and Health: Characteristics of the Built Environment and Health Related Outcomes for Residents of Detroit Neighborhoods



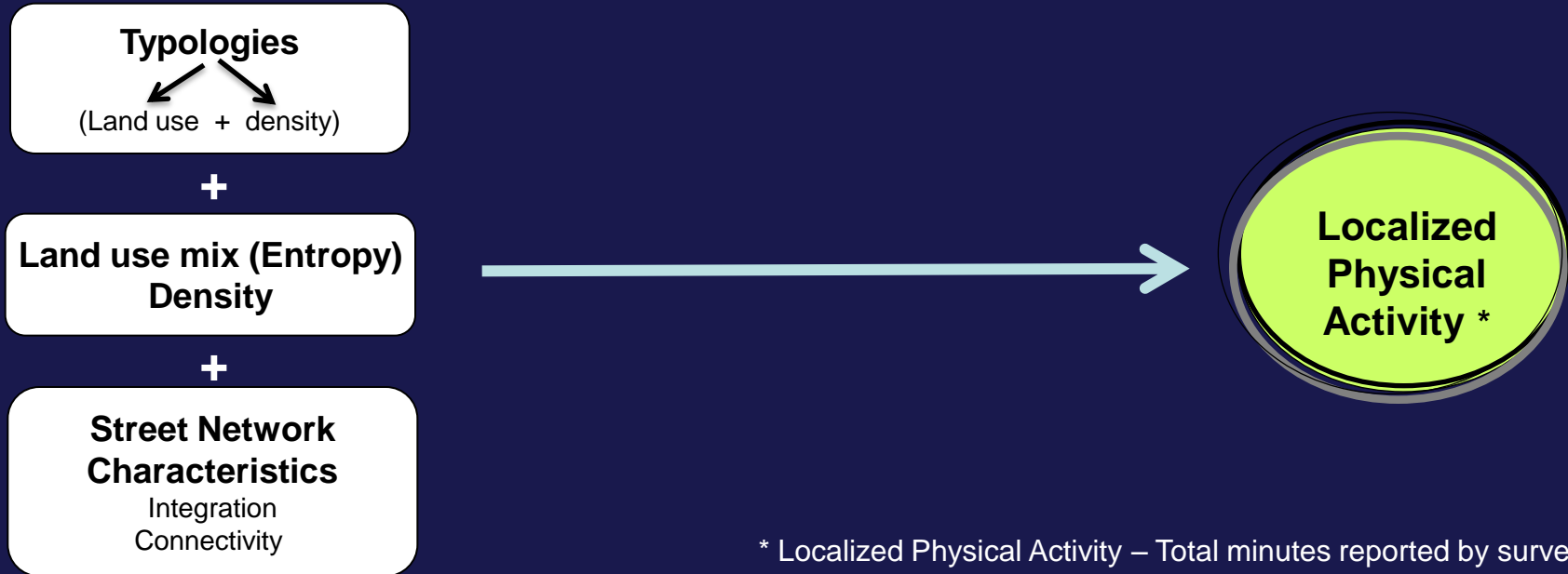
Wineman, Jean D. (University of Michigan), Marans, Robert W. (University of Michigan),  
Schulz, Amy J. (University of Michigan),  
van der Westhuizen, Diaan L. (University of the Free State),  
Max, Paul (Detroit Health Department + Wellness Promotion)



# Healthy Environments Partnership Study Areas



# Conceptual Model



\* Localized Physical Activity – Total minutes reported by survey respondents devoted to walking for recreation and walking to specific destinations (i.e. stores, church, etc.)



# Reported HEP Outcome Measures

## 2008 Physical activity scale

- In a usual week, do you do moderate/vigorous physical activity for at least 10 minutes at a time such as walking vacuuming, gardening, or anything that causes small increases in breathing or heart rate?
- How many days per week do you do moderate/vigorous physical activity?

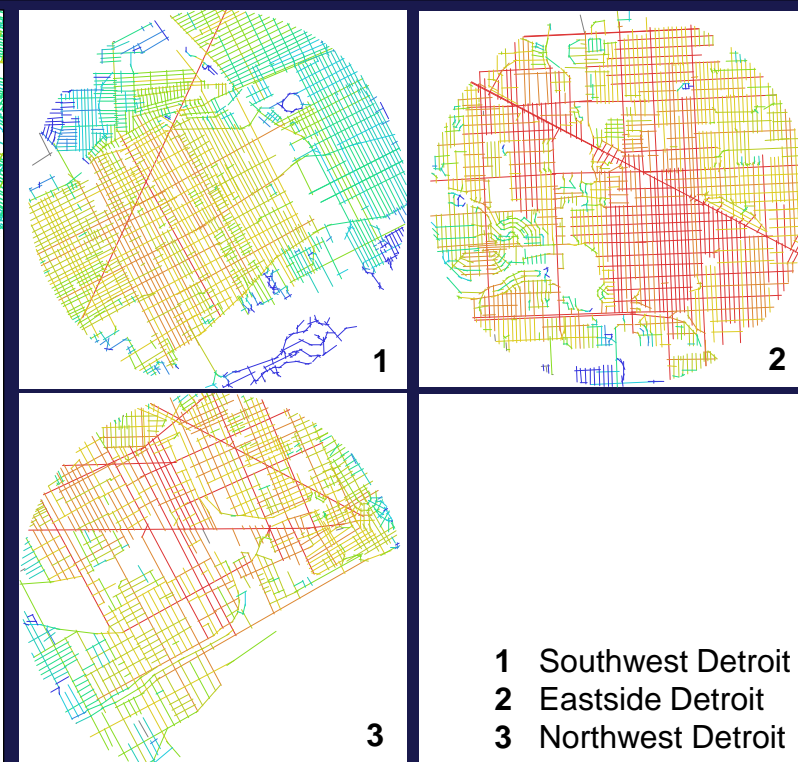
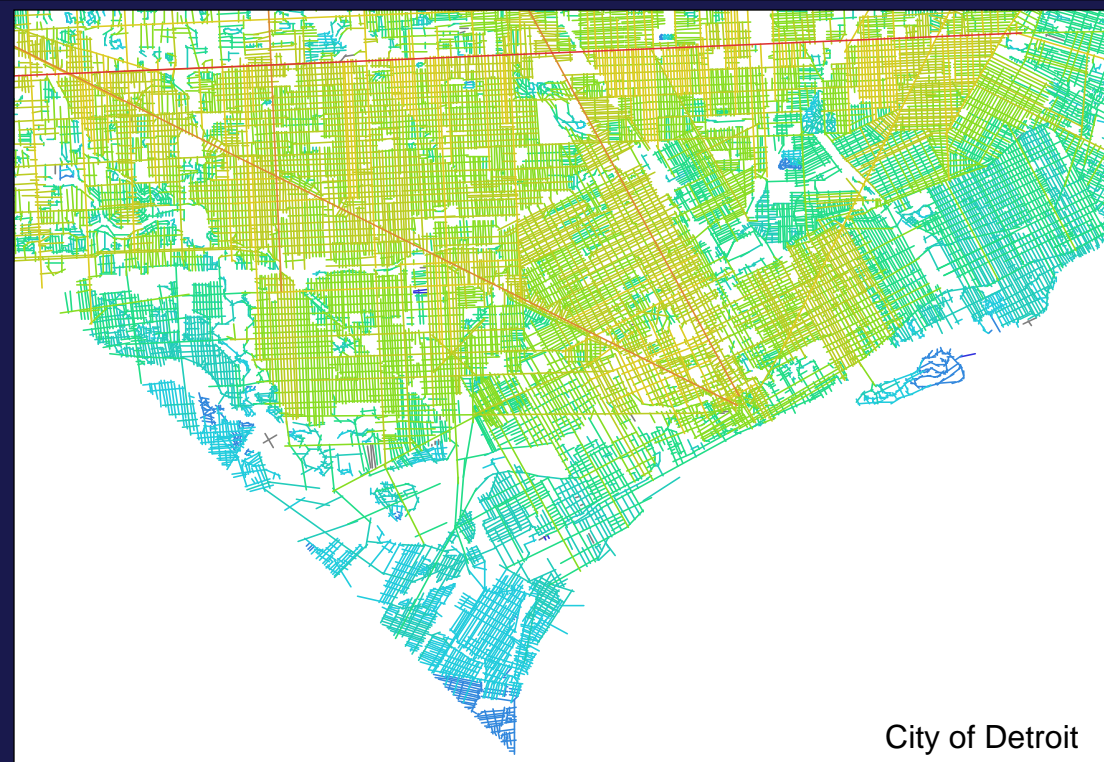
## 2008 Transportation walking

- How many days per week do you walk for at least 10 minutes from place to place?
- How much time do you spend walking from place to place?

## 2008 Leisure walking

- Not counting any walking already mentioned, how many days per week do you walk for at least 10 minutes in your leisure time?
- How much time do you spend walking for leisure?

# Objective Measures: Space Syntax Street Network Characteristics



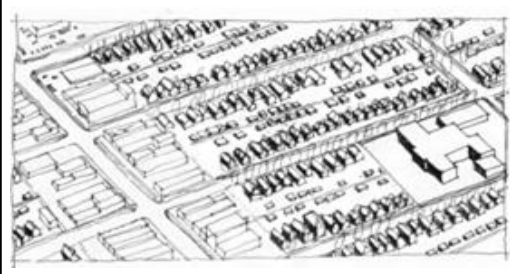
**City-wide Street Network Integration**

**Street Network Connectivity**

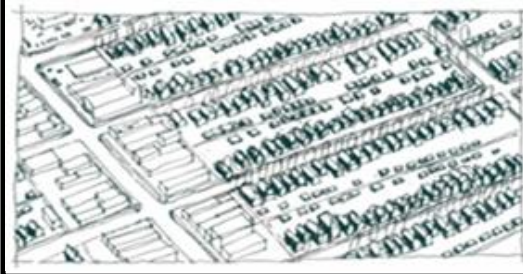


# Objective Measures: Planning Measures

High land use mix



Medium land use mix



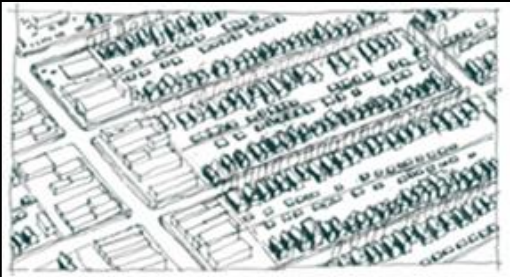
Homogeneous



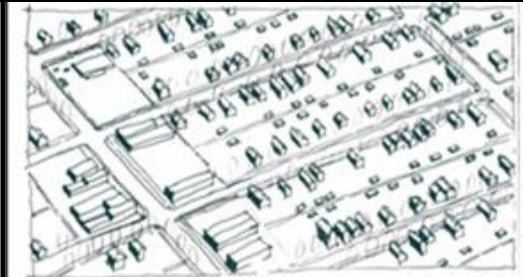
Commercial  
Institutional & Office  
Educational  
Parks  
Industrial

## Land use Mix

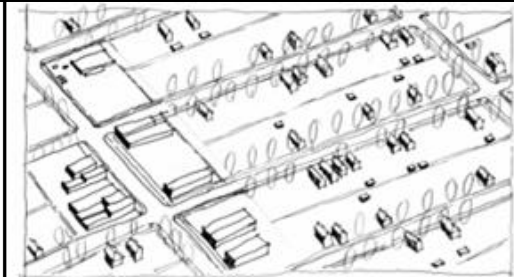
High density



Medium density



Low density



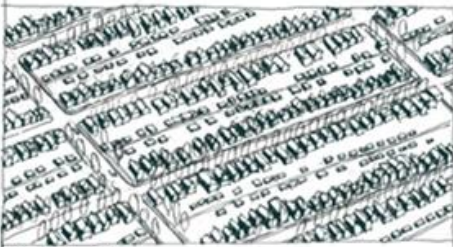
0 – <4  
housing units/acre  
4 – <6  
housing units/acre  
6+  
housing units/acre

## Residential Density



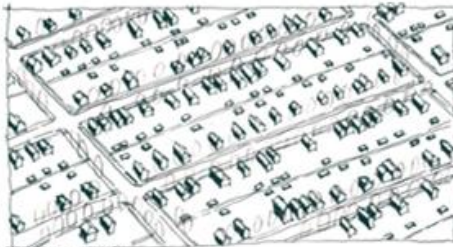
# Objective Measures: Neighborhood Typologies

**TYPE 1:** Homogeneous  
MIX=0  
High Density (6+)



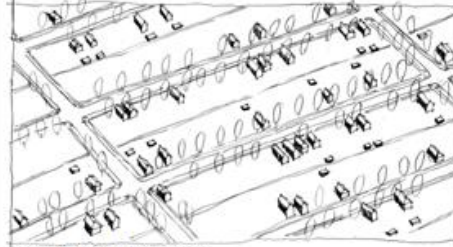
Single Family

**TYPE 2:** Homogeneous  
MIX=0  
Medium Density (4-<6)



Single Family

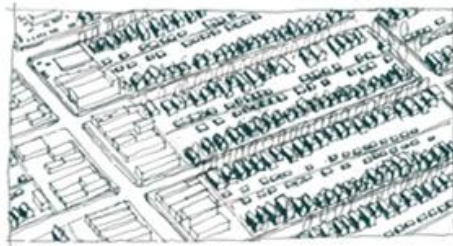
**TYPE 3:** Homogeneous  
MIX=0  
Low Density (0-<4)



Single Family; Vacancy

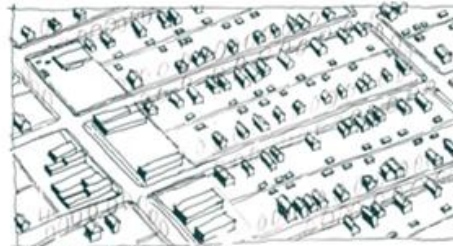


**TYPE 4:** Medium Mix  
MIX=1  
High Density (6+)



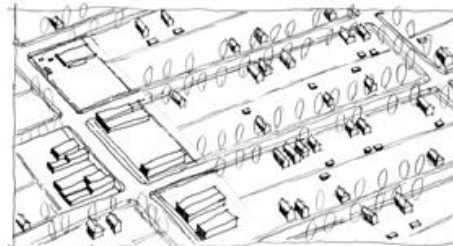
Single Family; Commercial

**TYPE 5:** Medium Mix  
MIX=1  
Medium Density (4-<6)



Single Family; Commercial

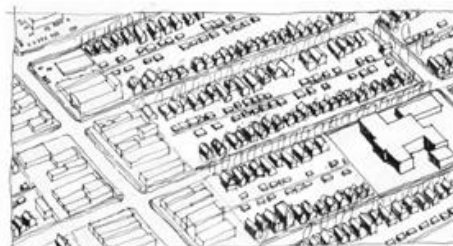
**TYPE 6:** Medium Mix  
MIX=1  
Low Density (0-<4)



Single Family; Commercial; Vacancy



**TYPE 7:** Medium Mix  
MIX= 2 or more  
High Density (6+)



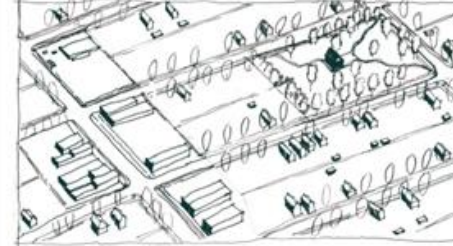
Single Family; Commercial; Educational

**TYPE 8:** Medium Mix  
MIX= 2 or more  
Medium Density (4-<6)



Single Family; Educational; Institutional

**TYPE 9:** Medium Mix  
MIX= 2 or more  
Low Density (0-<4)



Single Family; Commercial; Parks; Vacancy



# Findings for physical activity and walking\*

## Street Network Characteristics

Individuals in **more locally connected** neighborhoods report: *higher* overall and leisure physical activity

Individuals in **more globally integrated** neighborhoods report: *higher* overall, transportation, and leisure physical activity

	Localized Overall Physical Activity	Localized Transportation Physical Activity	Localized Leisure Physical Activity
<b>Street Network Characteristics</b>			
Street network connectivity	+ (p=.015)	not significant	+ (p=.017)
Street network integration	+ (p=.001)	+ (p=.008)	+ (p=.001)
<b>Urban Planning Measures</b>			
Density at the ¼ mile radius	- (p=.019)	- (p=.048)	- (p=.001)
Land use mix (Entropy) at the ½ mile radius	- (p=.012)	not significant	- (p=.011)
<b>Neighborhood Typologies</b>			
Density and land use mix at the ½ mile radius	+ (p=.099)	+ (p=.072)	not significant

\*All walking measures reported in MET minutes



# Findings for physical activity and walking\*

## Urban Planning Measures

Individuals in neighborhoods with **higher density** report:  
*lower* overall, transportation, and leisure physical activity

Individuals in neighborhoods with **higher land use mix** report:  
*lower* overall and leisure physical activity

	Localized Overall Physical Activity	Localized Transportation Physical Activity	Localized Leisure Physical Activity
<b>Street Network Characteristics</b>			
Street network connectivity	+ (p=.015)	not significant	+ (p=.017)
Street network integration	+ (p=.001)	+ (p=.008)	+ (p=.001)
<b>Urban Planning Measures</b>			
Density at the ¼ mile radius	- (p=.019)	- (p=.048)	- (p=.001)
Land use mix (Entropy) at the ½ mile radius	- (p=.012)	not significant	- (p=.011)
<b>Neighborhood Typologies</b>			
Density and land use mix at the ½ mile radius	+ (p=.099)	+ (p=.072)	not significant

\*All walking measures reported in MET minutes

# Findings for physical activity and walking\*

## Neighborhood Typologies

Individuals in **higher density/land use mix** neighborhoods report: *higher* overall and transportation physical activity

	Localized Overall Physical Activity	Localized Transportation Physical Activity	Localized Leisure Physical Activity
<b>Street Network Characteristics</b>			
Street network connectivity	+ (p=.015)	not significant	+ (p=.017)
Street network integration	+ (p=.001)	+ (p=.008)	+ (p=.001)
<b>Urban Planning Measures</b>			
Density at the ¼ mile radius	- (p=.019)	- (p=.048)	- (p=.001)
Land use mix (Entropy) at the ½ mile radius	- (p=.012)	not significant	- (p=.011)
<b>Neighborhood Typologies</b>			
Density and land use mix at the ½ mile radius	+ (p=.099)	+ (p=.072)	not significant

\*All walking measures reported in MET minutes



# Contributions

- Found significant association between objective environmental characteristics and physical activity.
- Urban neighborhoods that are well connected locally and within the larger urban area were associated with higher levels of physical activity.
- Neighborhoods that are higher in density with heterogeneous land-use mix were associated with higher levels of physical activity.

# Contributions

- Previous research, such as Frank et al. (2008), has shown the relative independent predictive strength of density, connectivity and land use mix in relationship to walking behavior.
- Our research suggests that as independent variables, density and land use mix have negative associations with localized physical activity for these neighborhoods.
- Past studies report that these less affluent neighborhoods may lack the amenities and environmental conditions that support walking



# Contributions

- Saelens and Handy found less consistent results for neighborhood connectivity, and Frank and his colleagues suggest that street connectivity is related to walking only in the highest density neighborhoods.
- Our research indicates a strong positive association between both local and global scale connectivity with walking.
- Global connectivity (integration) shows a relationship to leisure and transportation walking. Local connectivity is associated with leisure time walking.

# Contributions

- Our sample neighborhoods can be generally characterized by low density housing, much vacant land, and lower socioeconomic levels. This research provides a valuable understanding the effects of environmental planning/design on walking behavior in these communities.
- This research identifies critical ‘bundles’ of physical environmental characteristics that play a role in the creation of neighborhoods that support walking and other physical activity.