Urban Planning & Active Living Research
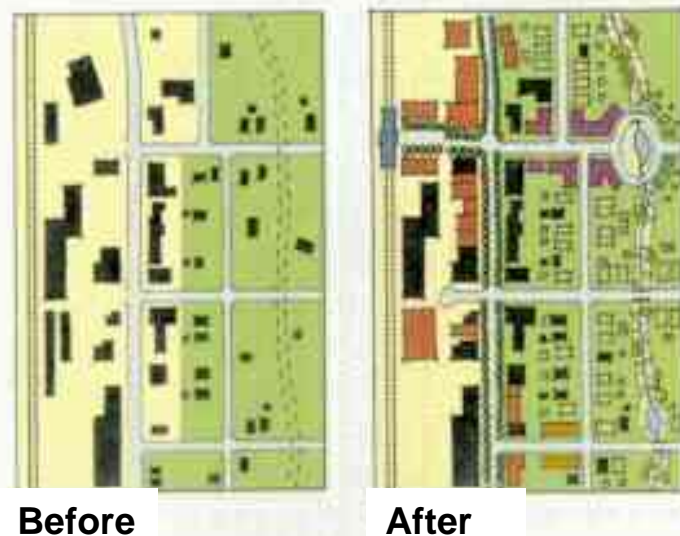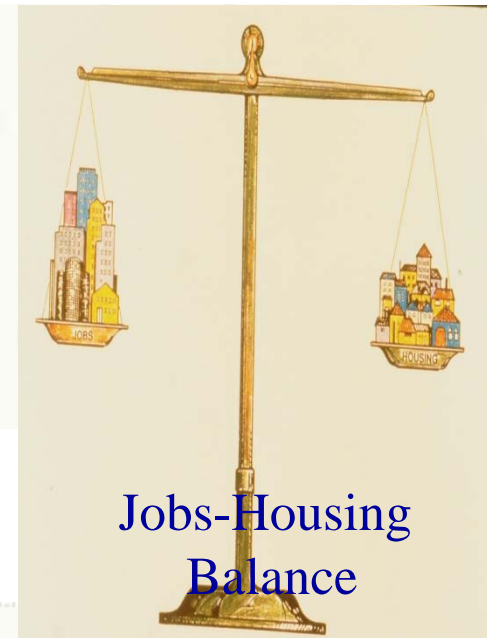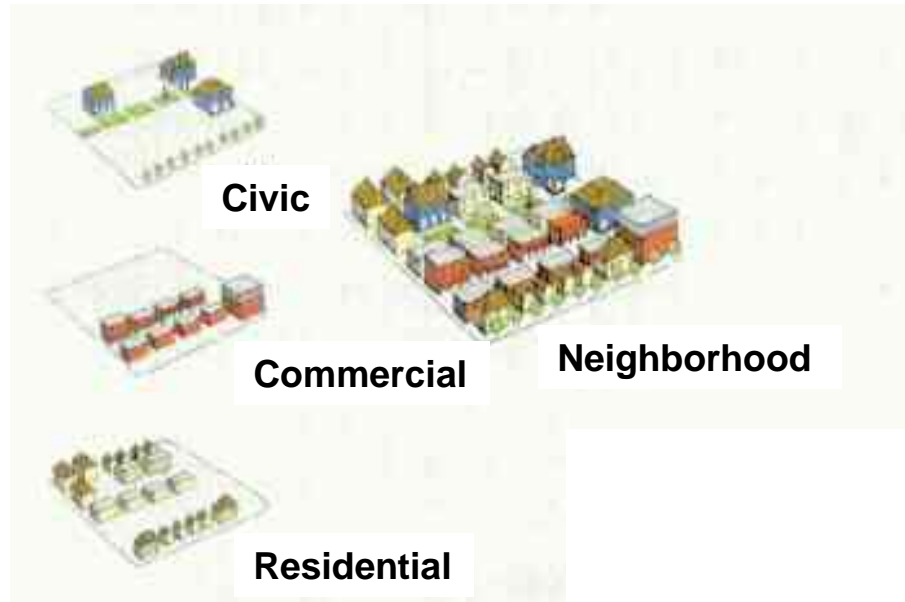
➢ Urban planning: long rooted in health concerns…
- Density & crowding
- Non-compatible uses & exclusionary zoning
- Sanitation
- Building codes & public safety
- Clean air mandates

➢ Increasingly inclusionary & trans-disciplinary
- Bringing key stakeholders together – developers, citizens, employers, environmental advocates, public health officials
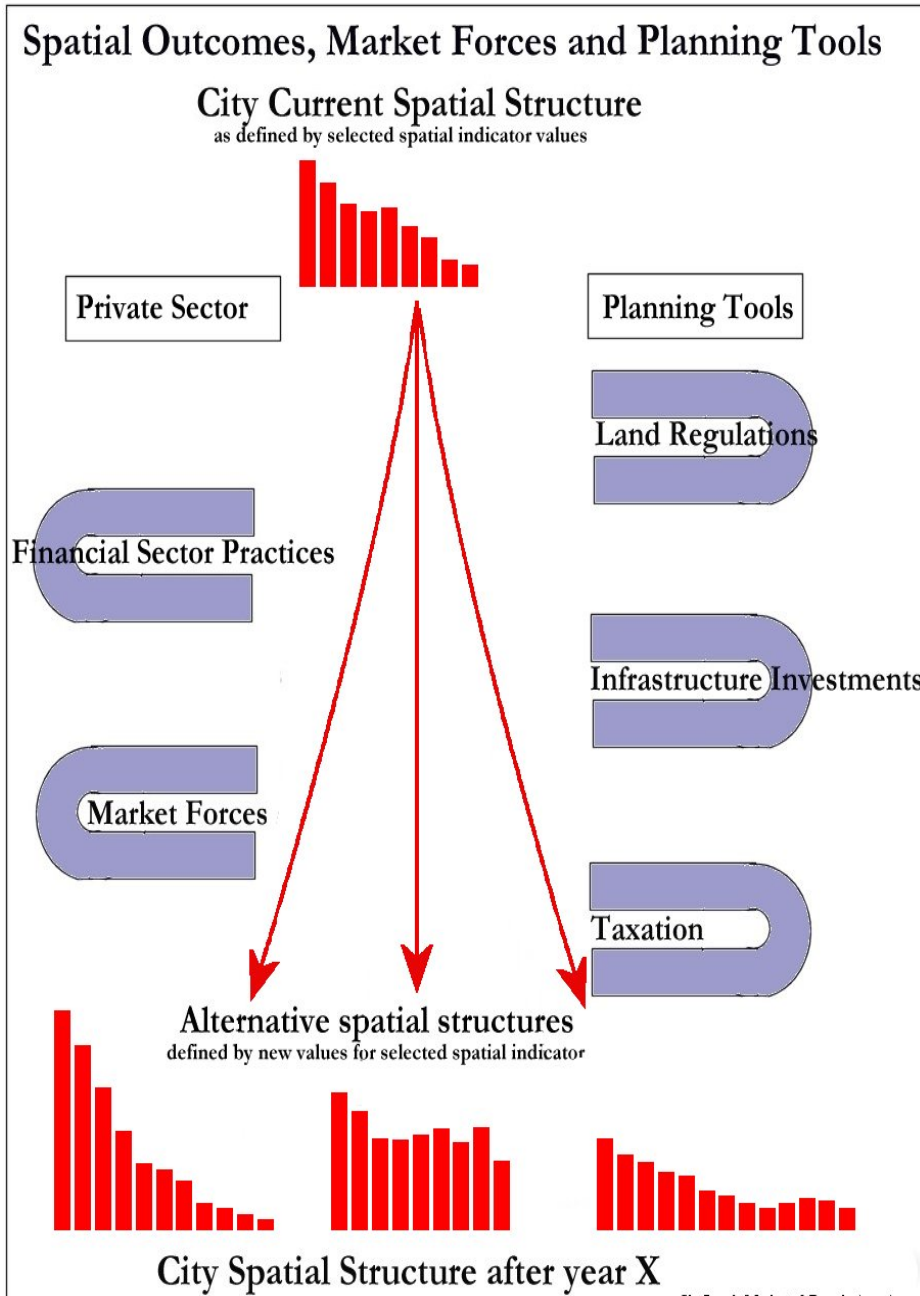
Diversity & Inclusion

Civic

Commercial

Neighborhood

Residential

Jobs-Housing Balance

Before

After

Re-Use & Selective Infill

Urban Planning Implementation Tools

Spatial Outcomes, Market Forces and Planning Tools

City Current Spatial Structure
as defined by selected spatial indicator values

Private Sector

Planning Tools

Land Regulations

Financial Sector Practices

Infrastructure Investments

Market Forces

Taxation

Alternative spatial structures
defined by new values for selected spatial indicator

City Spatial Structure after year X

file:Land, Markets&Regulations.jpg

- General Plans/Neighborhood Plans
- Zoning, Subdivision Regulations, Building Codes
- Design Guidelines
- Impact & Environmental Review (NEPA/EIS)
- Land Banking/UGB
- Targeted Infrastructure Investment
- Tax Increment Financing
- Enterprise Zones
- Tax Abatement

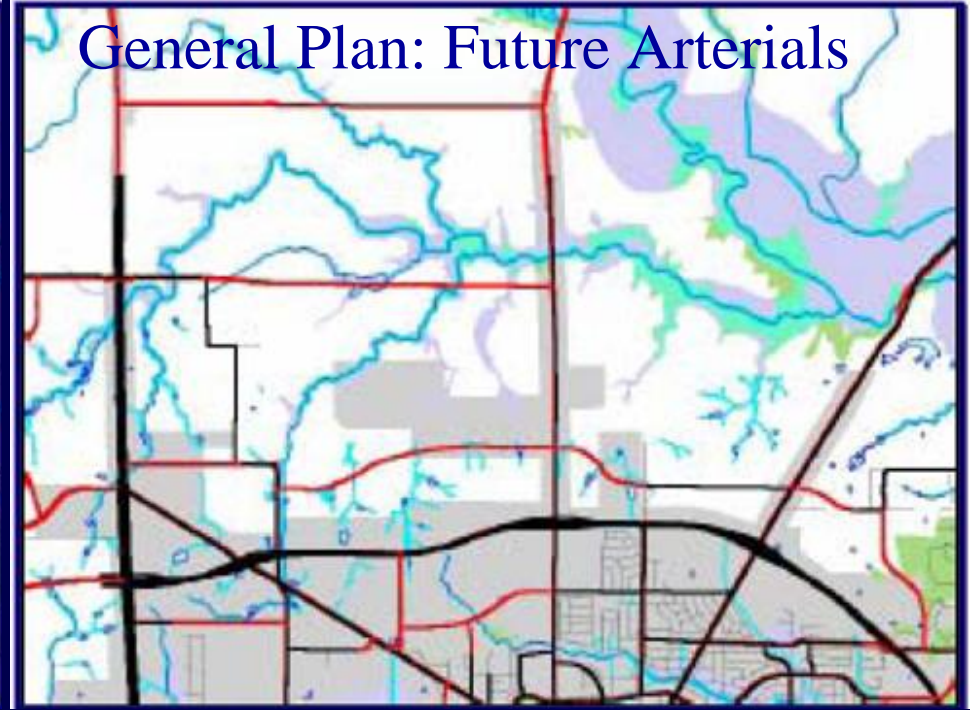# Urban Planning: Temporal & Spatial Contexts

➤ **Planners Work at Multiple Scales**

Region   District   Neighborhood
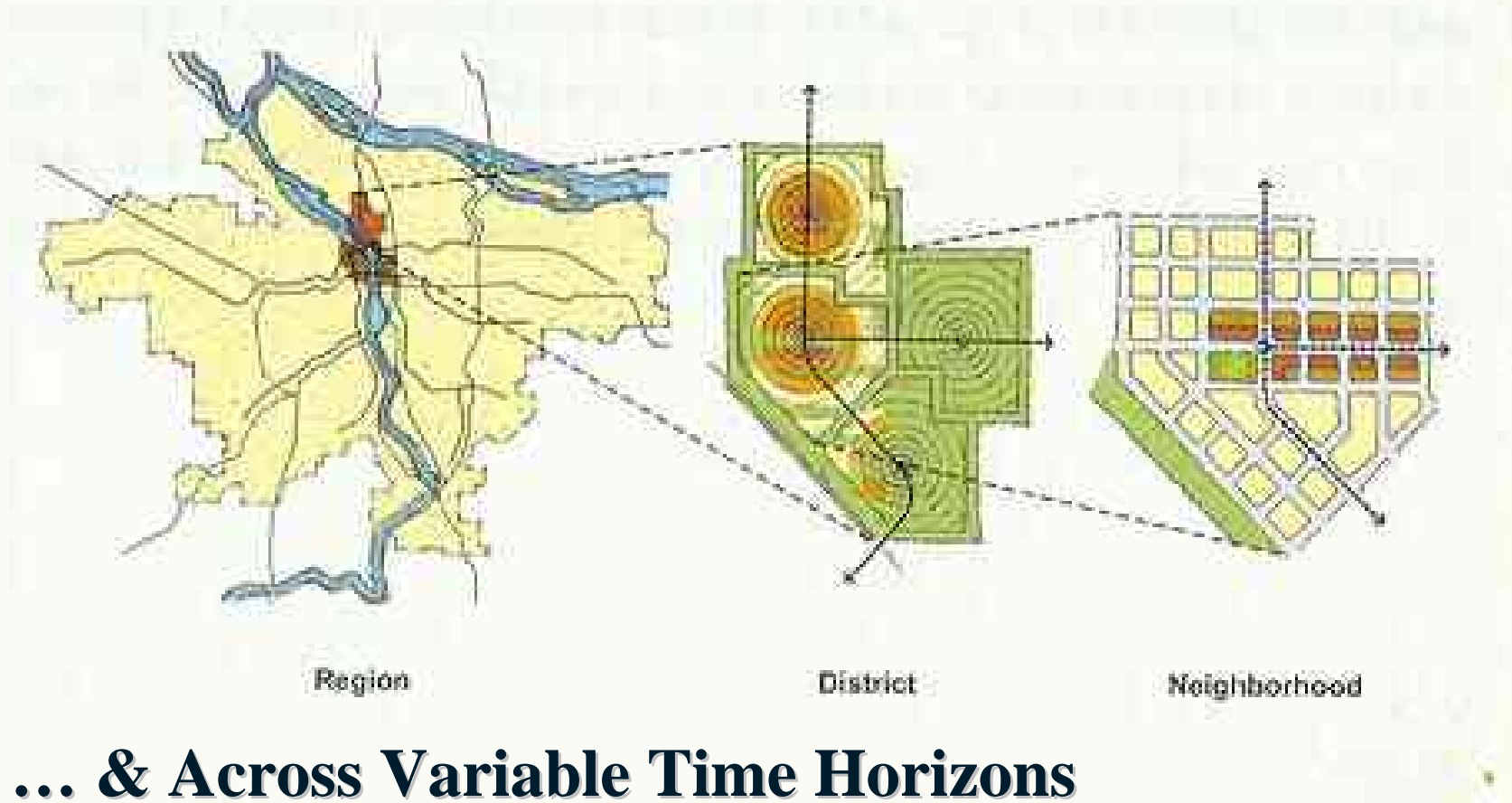
➤ **… & Across Variable Time Horizons**
- Managing & regulating existing growth
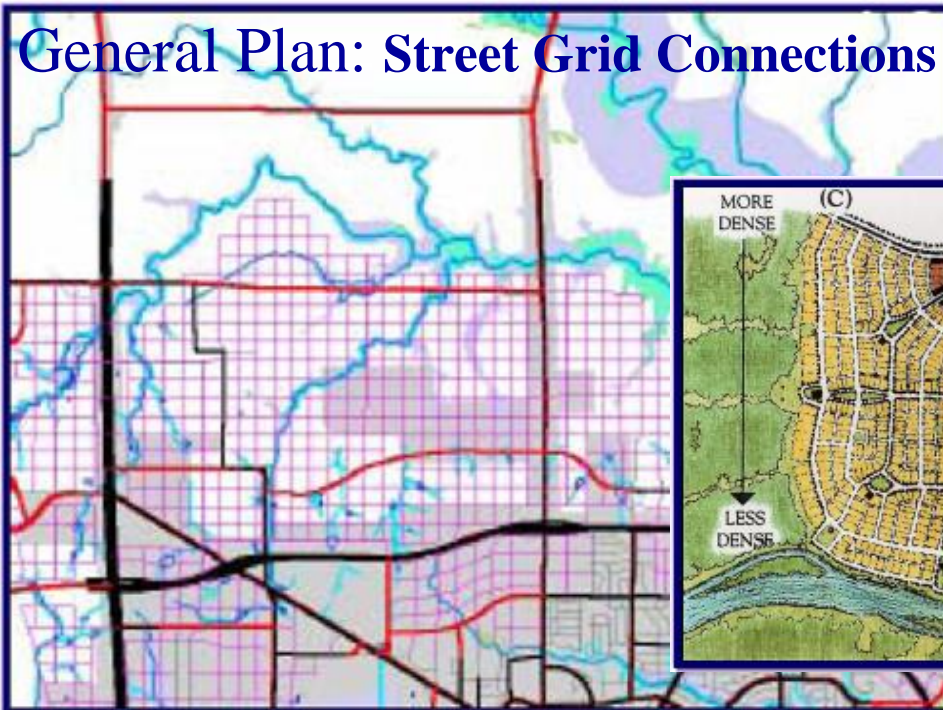- Forward-looking: anticipating & guiding future growth
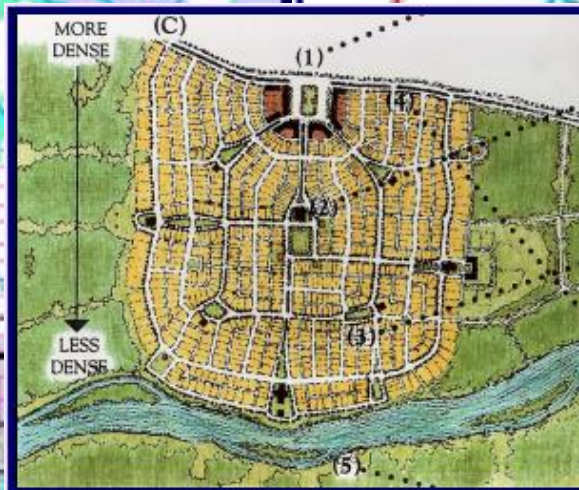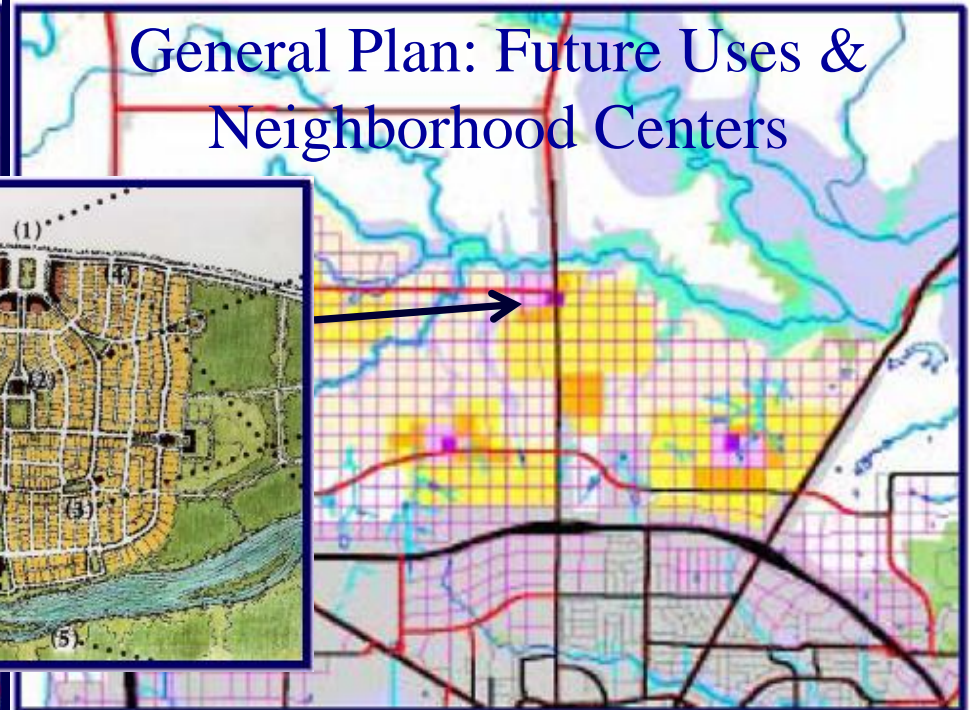
General Plan: Existing Conditions

General Plan: Future Arterials

General Plan: **Street Grid Connections**

General Plan: Future Uses & Neighborhood Centers

MORE DENSE

LESS DENSE

(C)

(1)

(4)

(2)

(3)

(5)

Neighborhood Grocery Store Access

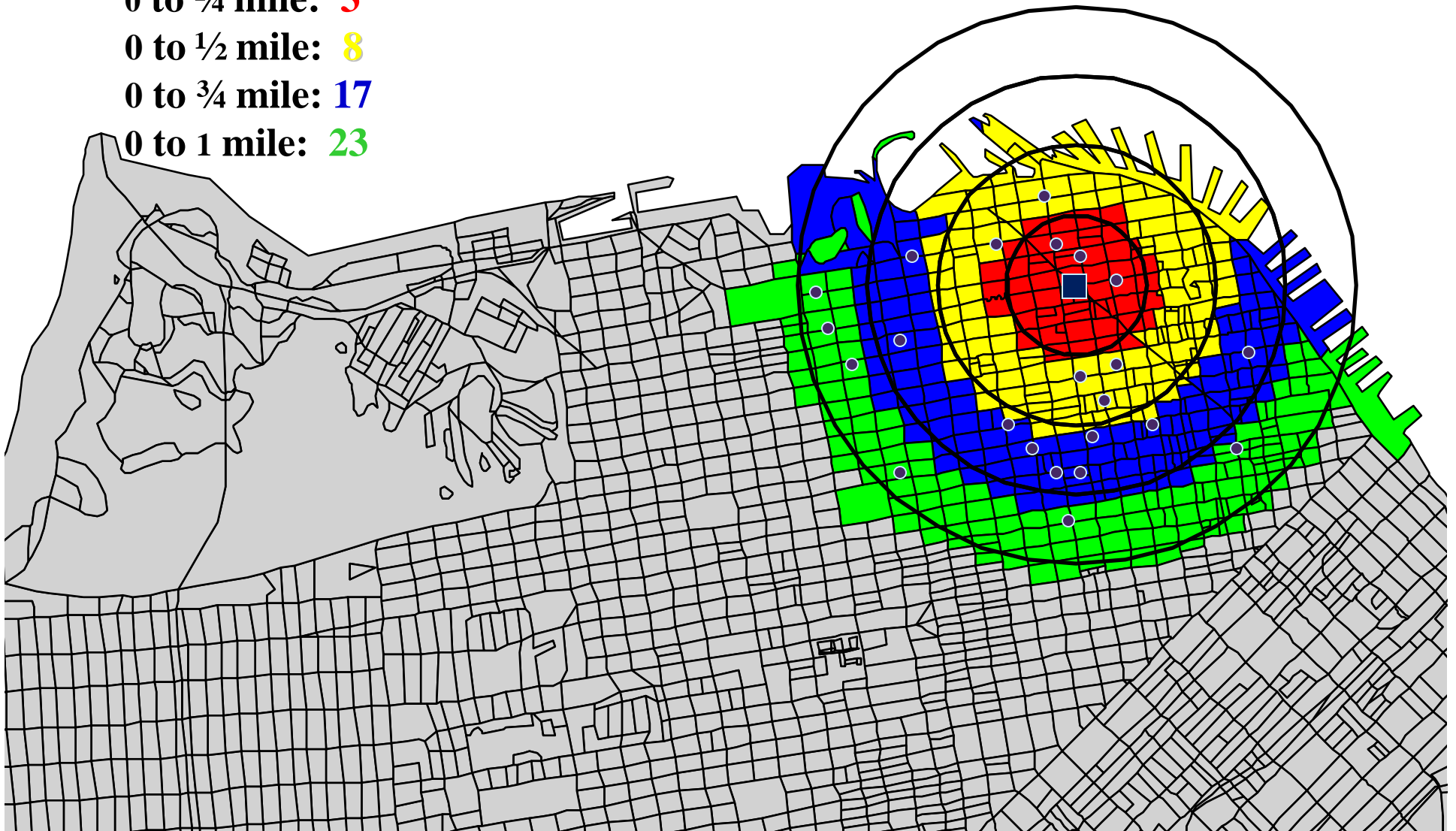## ¼ Mile Isochrones, Imputed from City Block Data

No. of Convenience Retail Stores (< 5000 ft.^{2}) within Isochrone

0 to ¼ mile: 3

0 to ½ mile: 8

0 to ¾ mile: 17

0 to 1 mile: 23

BUILDING A NETWORK

Bike lanes encourage bike commuting:

Portland, Oregon 1990

Black lines:
1990
bikeway
network…

Colors areas:
1990 mode splits

(by census tract)

Bike Commute
Mode Split

- 0 - 2%
- 2 - 3%
- 3 - 5%
- 5 - 8%
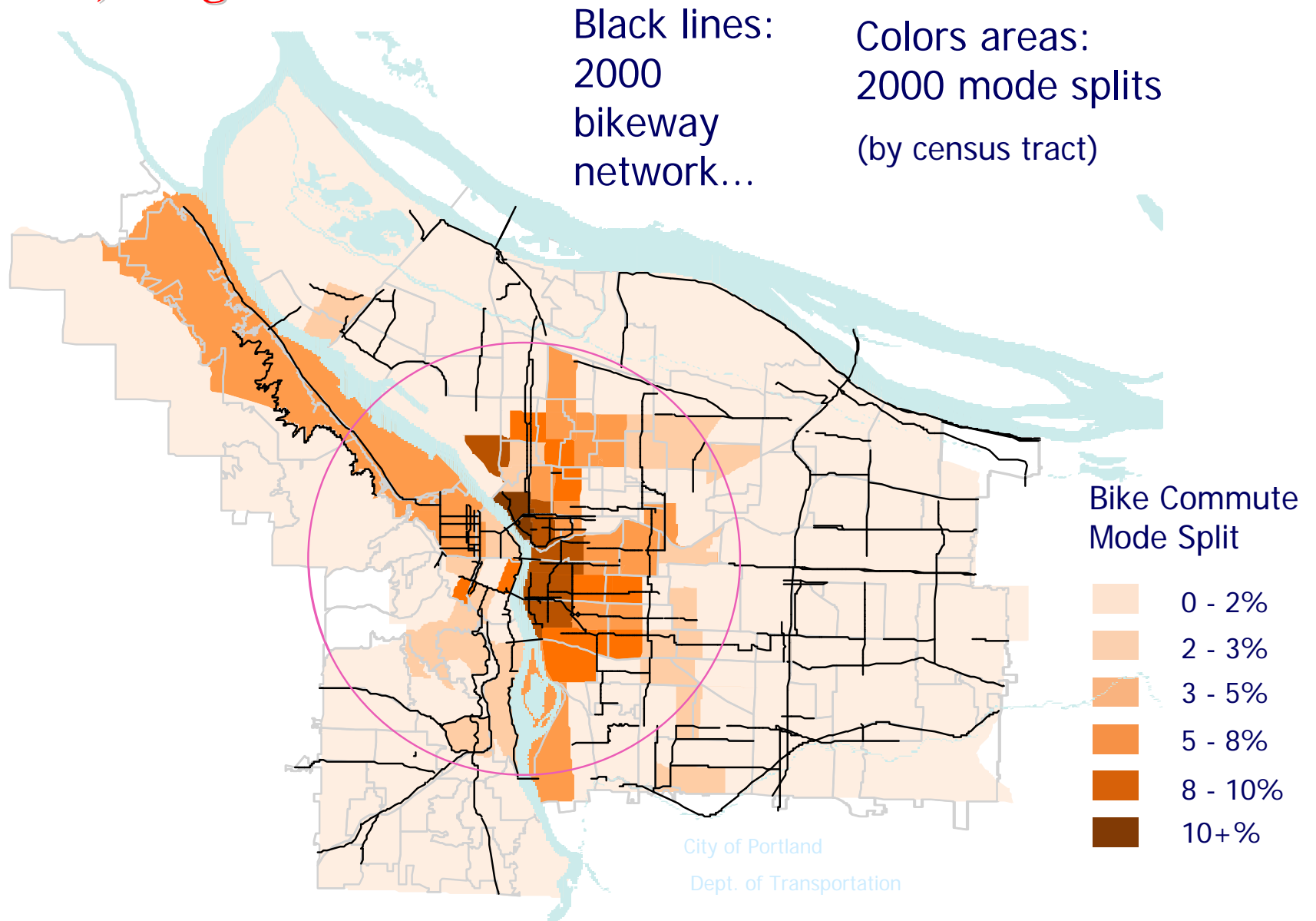- 8 - 10%
- 10+%

City of Portland

Dept. of Transportation
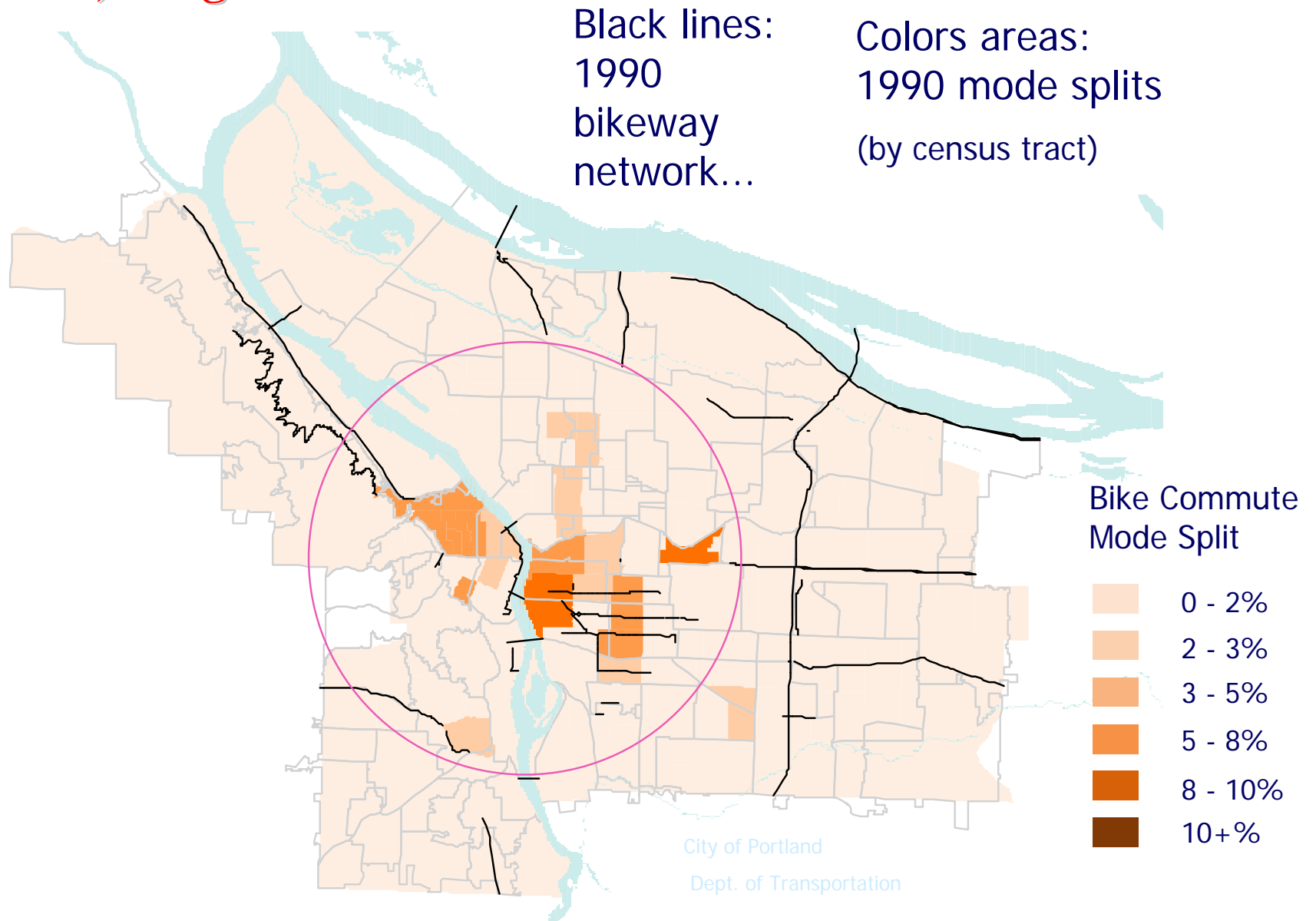
BUILDING A NETWORK
Bike lanes encourage bike commuting:
Portland, Oregon 2000

Build It &
They Will Come

Black lines: 2000 bikeway network…

Colors areas: 2000 mode splits

(by census tract)

Bike Commute Mode Split

0 - 2%
2 - 3%
3 - 5%
5 - 8%
8 - 10%
10+ %

City of Portland
Dept. of Transportation
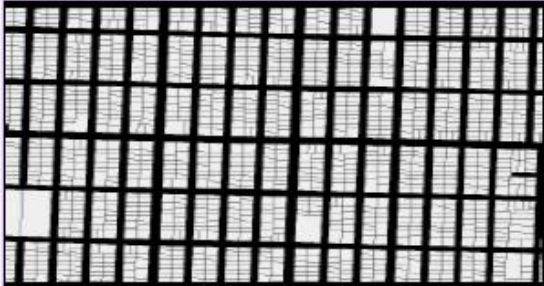
Gridiron
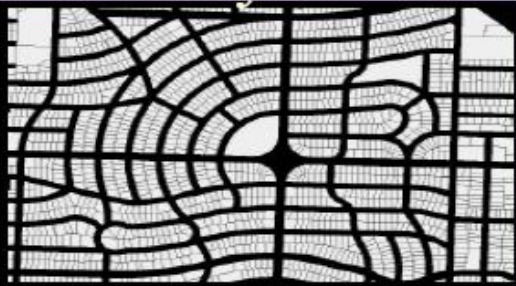
Curvilinear

Radial

Organic

93 NORTH
LEFT LANE

10' WALK/TREE LAWN | 4' BIKE | 11' TRAVEL LANES | 11' | 8' MEDIAN 80' | 11' TRAVEL LANES | 11' | 4' BIKE | 10' WALK/TREE GRATE
R.O.W.
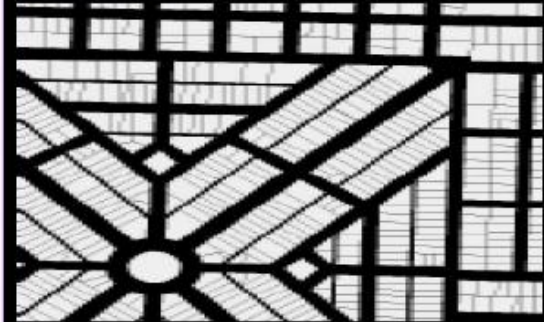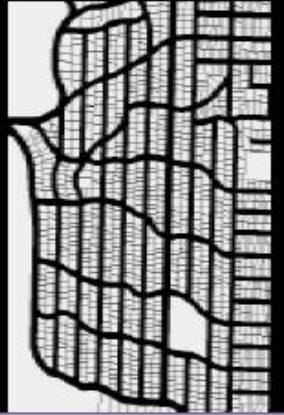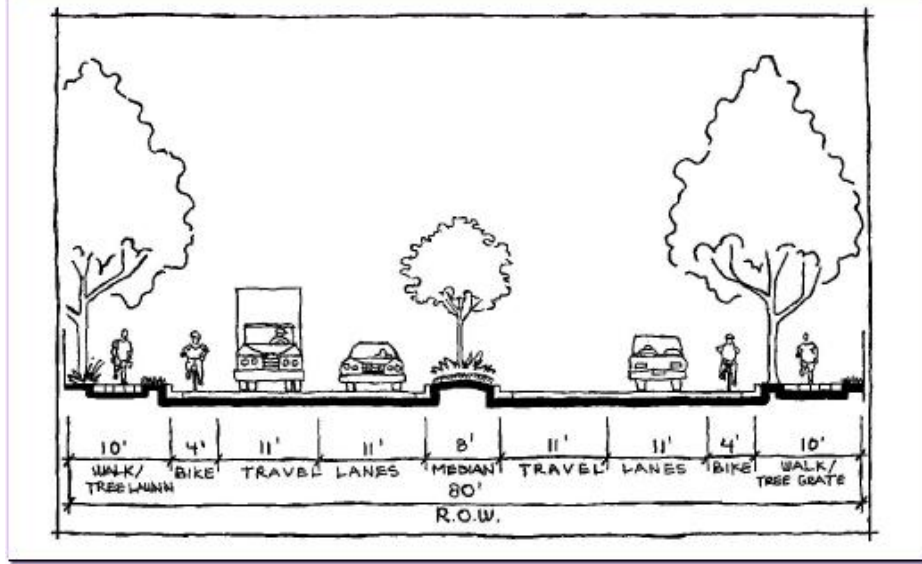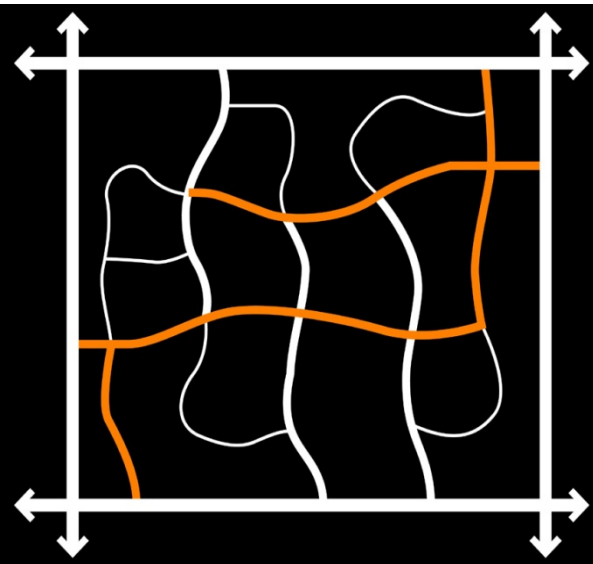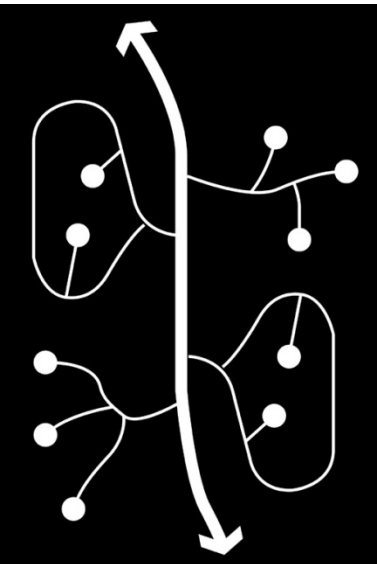
Measuring Connectivity

Grid
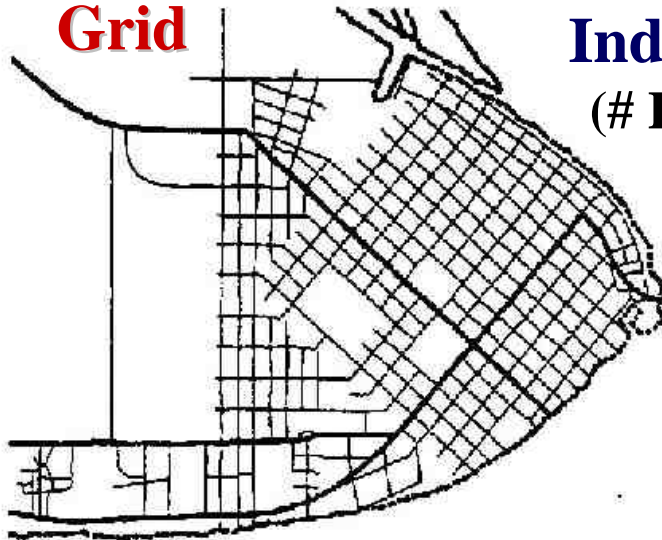
Connectivity Index =

(# Roadway Links) / (# Nodes) = **1.7**

Curvilinear: Loops & Lollipops
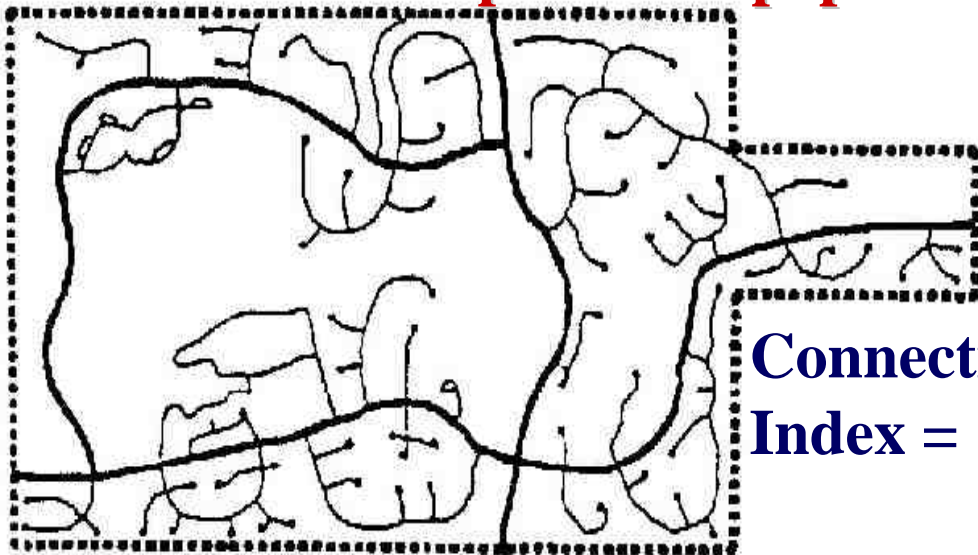
Connectivity Index = 1.2

	ELMWOOD (1905)	KENTLANDS (1989)	LAGUNA WEST (1990s)
Street Patterns			
Intersections			
Lineal Feet of Streets	18,000	24,000 (alleys 7, 000)	19,000
Number of Blocks	23	24 (w.o. alleys 14)	16
Number of Intersections	20	41 (with alleys)	20
Number of Access Points	17	22	14
Number of Loops & Cul-de-sacs	1	10	15

Smart Growth Street Design

Smart Growth Street Design
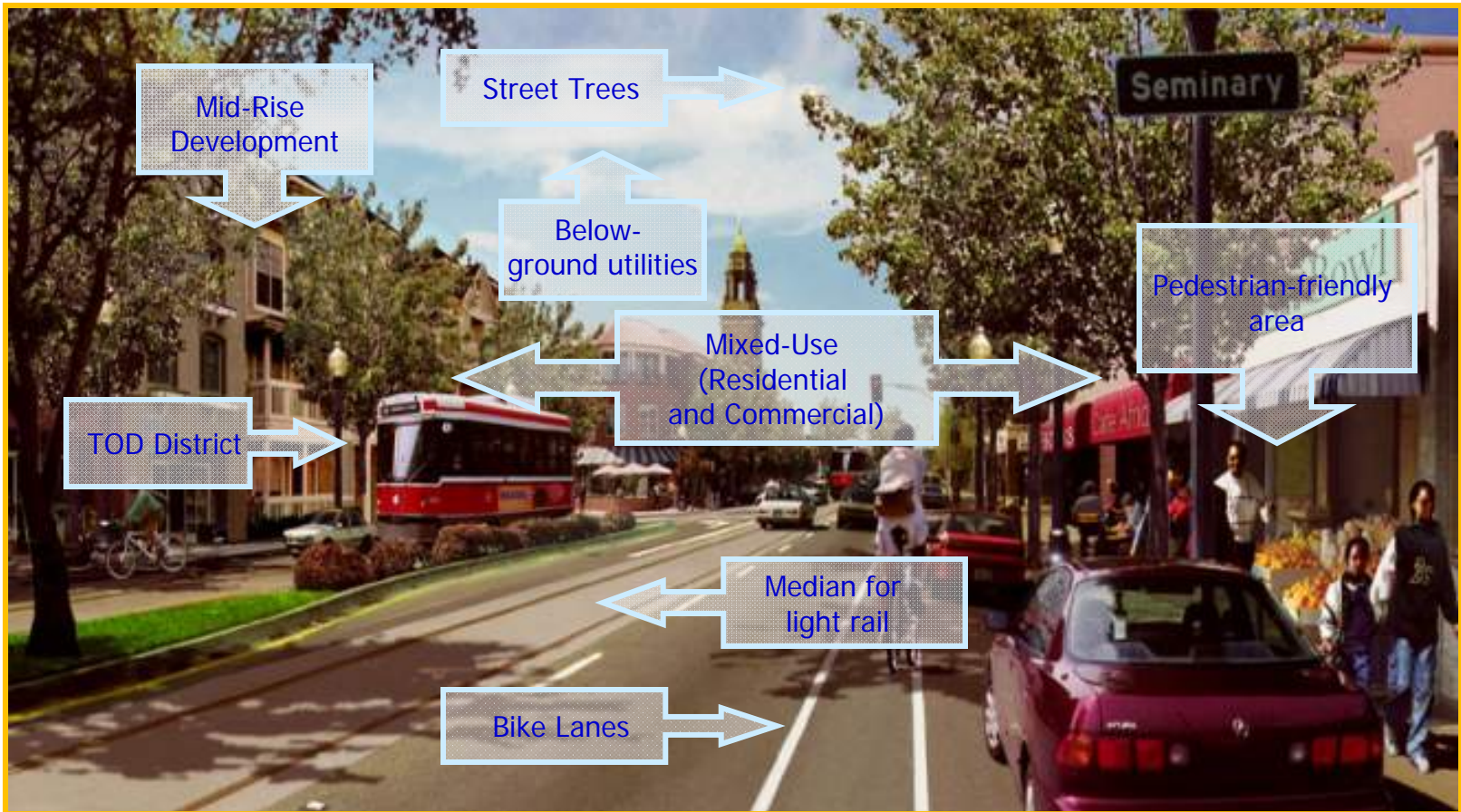
Urban Planner's Role in Transdisciplinary Research

Influences of Built Environments on Walking and Cycling: Lessons from Bogotá

Robert Cervero, Ph.D., University of California, Berkeley

Olga L. Sarmiento, M.D., Los Andes University, Bogotá

Enrique Jacoby, M.D., PanAmerican Health Organization, Washington

Luis Fernando Gomez, M.D., Foundacion Social, Bogotá

IUHPE www.iuhpe.org
International Union for Health Promotion and Education

CDC GENTE·SEGURA·SALUDABLE™

FUNDACION FES social

Organización Panamericana de la Salud
Oficina Regional de la Organización Mundial de la Salud
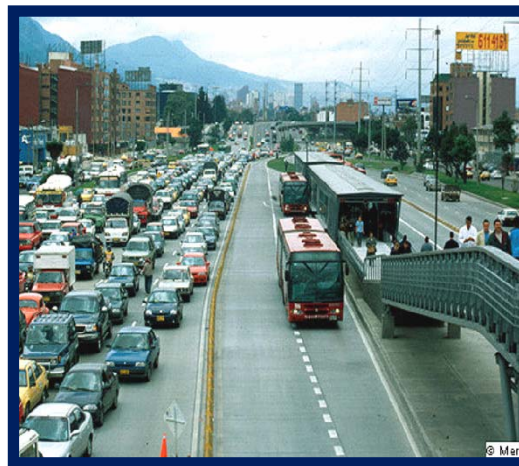
Research Design

1. **Physical Activity & Travel Data:** weekly diaries compiled from International Physical Activity Survey (IPAQ) of 1335 HHs; validated by accelerometers

2. **Built Environment Data:** 5 D's compiled using cadastral data & GIS

3. **Modeling:**
   Ecological Approach –
   * **Socio-economic factors**
   * **Attitudinal factors**
   * **Policy variables**
   * **Environmental factors**
     -- **Built Environment**
     -- **Natural Environment**

3 D's of the Built Environment

Density

Diversity   Design

5 D's of the Built Environment

Density

Diversity   Design

Distance (to transit)   Destination Accessibility
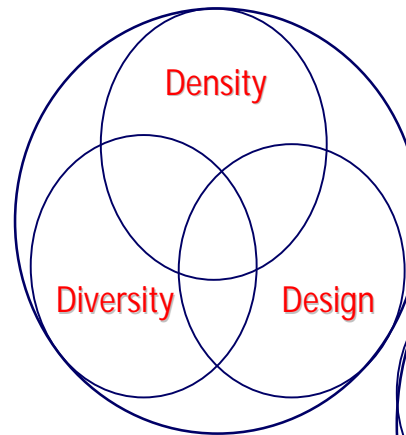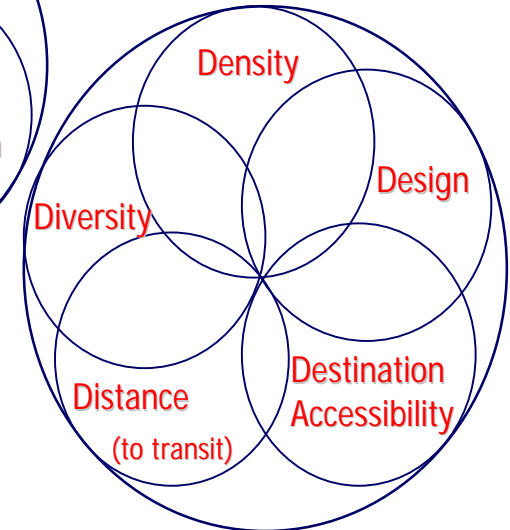
Used Multi-Level Modeling: People nested within Neighborhoods

Defining Environments

Physical Environment

Natural Environment
- Topography
- Climate/Weather
- Water Features

Built Environment
- Land Uses (Diversity)
- Density
- Design (Walkability/ Bikability)
- Destination Accessibility
- Distance to Transit

Non-Physical Environment

Social Environment
- Security/Safety
- Social Cohesion

Cultural Environment
- Norms
- Ethnic Backgrounds

Political Environment
- Financial Support
- Legal Context

| Dimension	Candidate Variables
(1) DENSITY	Persons per hectare; dwelling units per hectare; % of land area occupied by buildings; average building floor height; plot ratio (building m^2/land m^2)
(2) DIVERSITY	Entropy index of land-use mix (0-1 scale); proportion of buildings vertically mixed; proportion of total floorspace in buildings with 2+ uses
(3) DESIGN *Amenities*	Public park area as % of total land area; average park size (hectares); % of road links with median strips; traffic light density (traffic lights/street length); tree density (trees/street length);
(3) DESIGN *Site & Street Design*	Average lot size (m^2); quadrilateral lots as % of total; percent of blocks with contained housing and access control; street density (street area/land area); proportion of intersections with: 1 point (cul de sac), 3 points, 4 points, 5+ points; bike lane density (lineal m of bikelane/lineal m of streets); route directness (0-1 scale measuring shortest street distance/straightline distance between neighborhood centroid and 8 compass points); connectivity index (intersection nodes/street links); number of bridges; ciclovia twoway length (lineal m)
(3) DESIGN *Safety*	Number of pedestrian bridges; pedestrian accidents per year; average automobile speeds on main streets; deaths (all types) in traffic accidents per year; number of reported crimes per year
(4) DESTINATION ACCESSIBILITY	Number of: public schools; hospitals; public libraries; shopping centers (> 500m^2); churches; banks
(5) DISTANCE TO TRANSIT	Number of TransMilenio (BRT) stations; shortest network distance to closest TransMilenio station; number of feeder TransMilenio stations.

Scales of Analysis for Built Environment Variables

BLOCK
500 meter buffer around the block centroid
(immediate neighborhood environment)
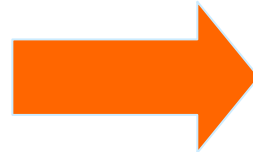
DISTRICT
1000 meter buffer from the neighborhood boundaries
(expanded neighborhood environment)

Measure: DESIGN
Walking/Biking Quality

- **Network Connectivity Indicator** = (# links)/(# nodes)

- **Sidewalk completeness** = Length of sidewalks/Length of public street (centerline distances)

- **Bikelane completeness** = Length of bikelanes/Length of public streets (centerline distances)

- **Route directness** = avg. straight-line distance to neighborhood center/avg. shortest road distance to neighborhood center

- **Proportion of blocks (or block faces) with**:
  - sidewalks; street trees; overhead street lights; quadrilateral shape; bicycle lanes; mid-block crossings

"Route Directness"
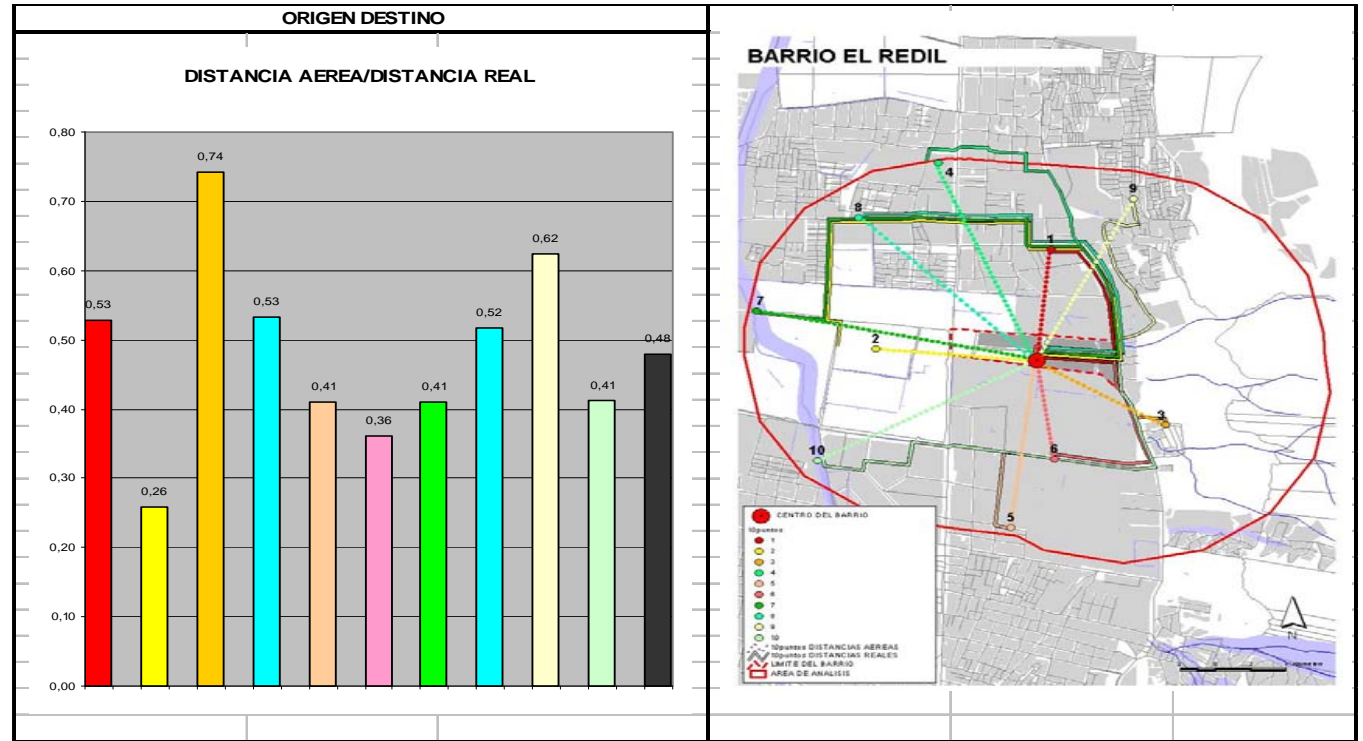
INDICADOR	ESCALA	VARIABLES	UNIDADES	VALORES	VALOR DEL INDICADOR
PROMEDIO DE LA DISTANCIA AEREA AL CENTRO DEL BARRIO(PARA 10 PUNTOS)/PROMEDIO DE LA DISTANCIA DE LAS CALLES POR LA RUTA MAS DIRECTA AL CENTRO DEL BARRIO	AREA DE ANALISIS	P1 DISTANCIA AEREA	METROS LINEALES	668,991	
		P1 DISTANCIA REAL	METROS LINEALES	1265,644	0,53
		P2 DISTANCIA AEREA	METROS LINEALES	796,363	
		P2 DISTANCIA REAL	METROS LINEALES	3081,329	0,26
		P3 DISTANCIA AEREA	METROS LINEALES	727,582	
		P3 DISTANCIA REAL	METROS LINEALES	980,705	0,74
		P4 DISTANCIA AEREA	METROS LINEALES	1257,5	
		P4 DISTANCIA REAL	METROS LINEALES	2362,936	0,53
		P5 DISTANCIA AEREA	METROS LINEALES	970,905	
		P5 DISTANCIA REAL	METROS LINEALES	2361,627	0,41
		P6 DISTANCIA AEREA	METROS LINEALES	580,142	
		P6 DISTANCIA REAL	METROS LINEALES	1603,521	0,36
		P7 DISTANCIA AEREA	METROS LINEALES	1401,952	
		P7 DISTANCIA REAL	METROS LINEALES	3411,191	0,41
		P8 DISTANCIA AEREA	METROS LINEALES	1211,729	
		P8 DISTANCIA REAL	METROS LINEALES	2348,756	0,52
		P9 DISTANCIA AEREA	METROS LINEALES	1066,25	
		P9DISTANCIA REAL	METROS LINEALES	1710,535	0,62
		P10 DISTANCIA AEREA	METROS LINEALES	1204,694	
		P10 DISTANCIA REAL	METROS LINEALES	2927,269	0,41
		PROMEDIO CONSOLIDADO			0,48
ACCESIBILIDAD	MANZANA	ISOCRONAS POR USOS?			

Measure: DESIGN Walking Quality

- **Lighting**: # street lights/road length (centerline)
- **Trees**: # street trends/road length
- **Furniture:** # benches/road length
- **Prop. of signals with**:
  - Ped phase
  - Marked crosswalks
- **Ped Signal Lengths:** average of:
  (Duration of Ped. Lights / Total Signal Cycle Length)
- **Average block length**
- **Average street width**
- **Prop. of road links with median strips**
- **Bike-lane density**: bikelane distance
  (centerline) / km^2 of land
- **Distance between overhead lights**
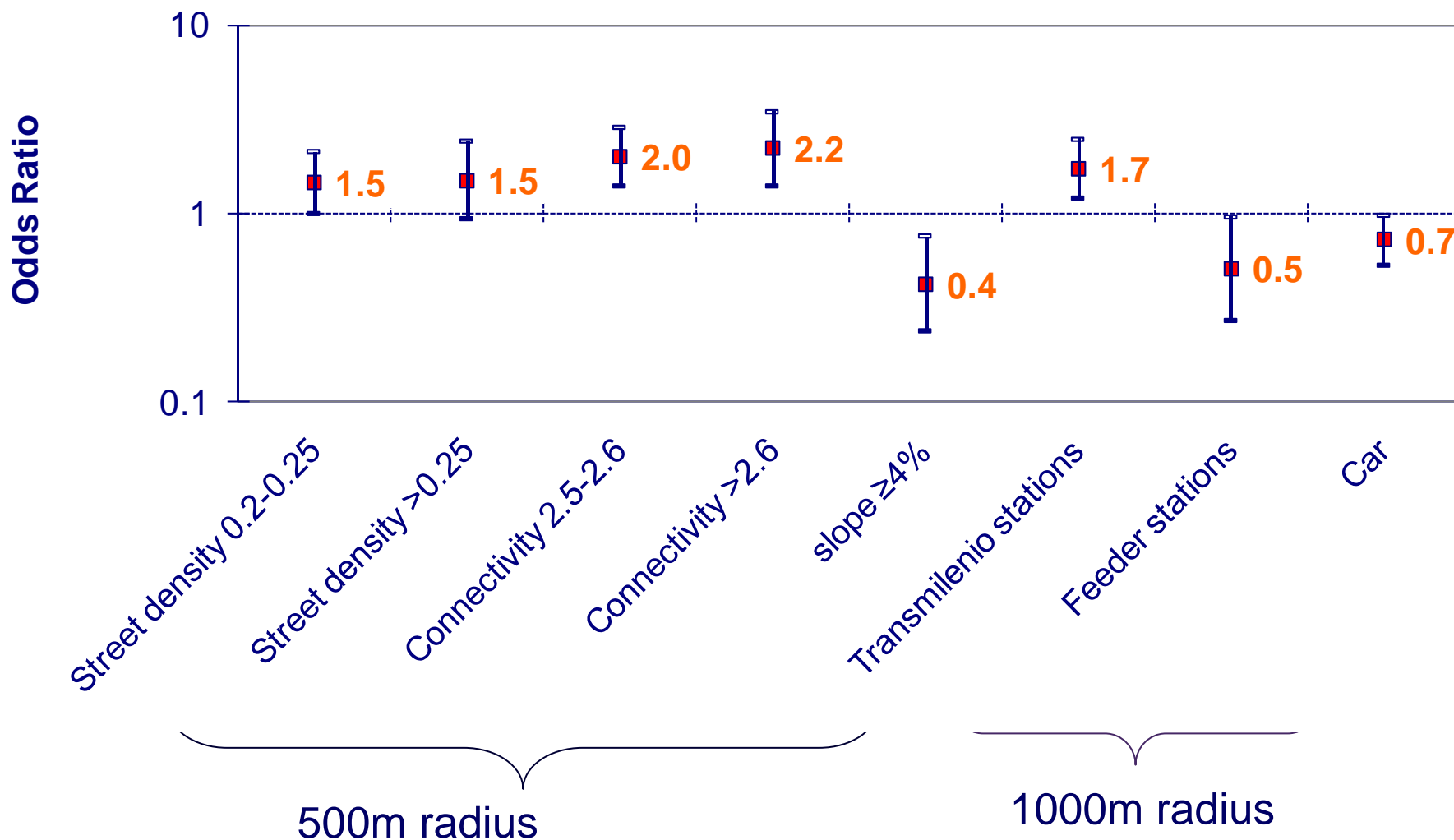- **Ped. Accident rates**
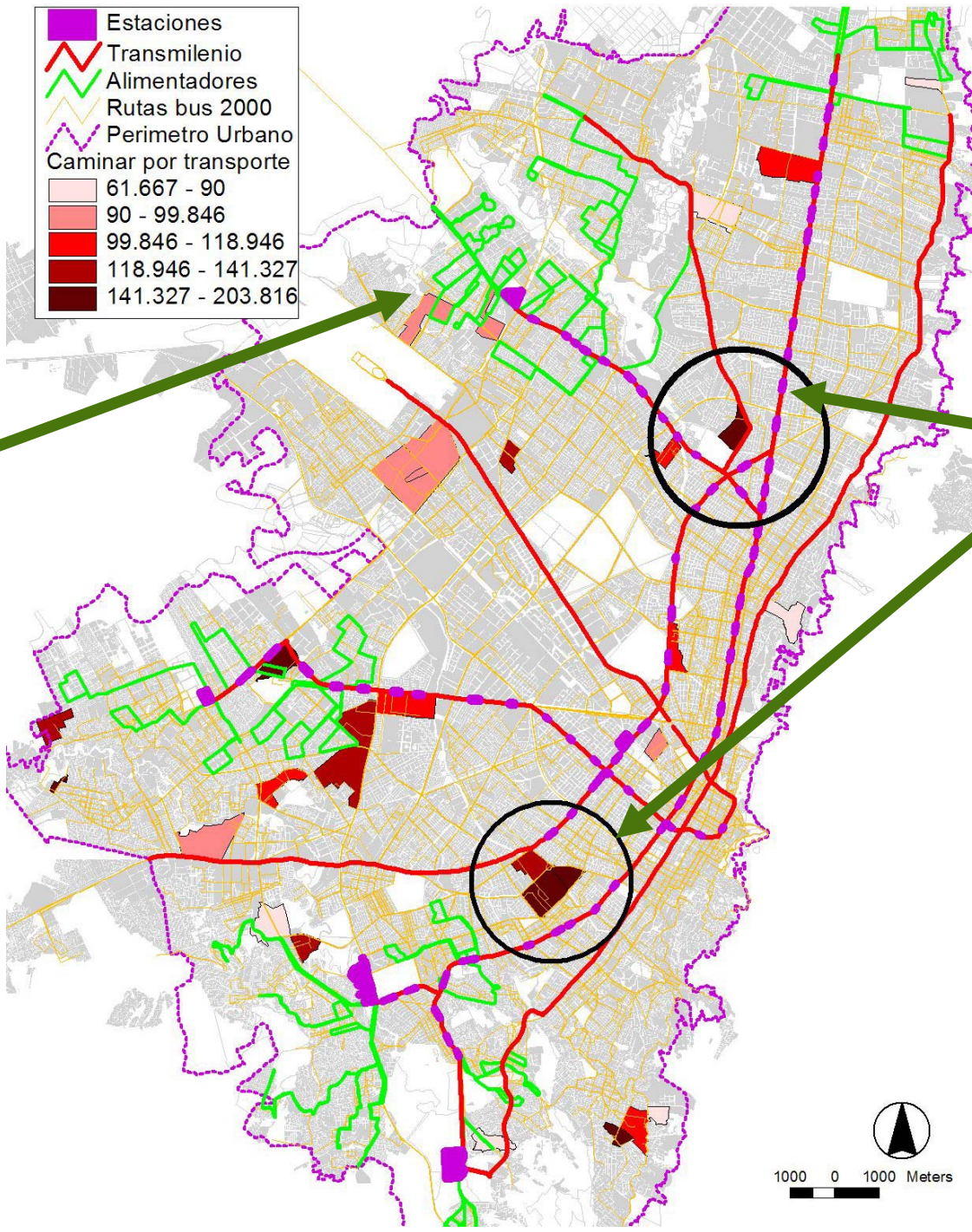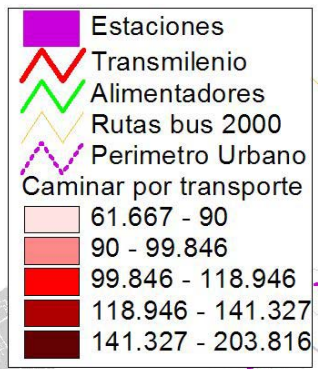- **Average auto speeds**

Diverse Streetscapes

Distance to Transit and Destination accessibility

Odds Ratios & 95% Conf. Intervals for MLM on
Walking ≥ 30 Minutes per Weekday
*for Utilitarian Purposes*

Odds Ratio

10

1

0.1

1.5 1.5 2.0 2.2 0.4 1.7 0.5 0.7

Street density 0.2-0.25
Street density >0.25
Connectivity 2.5-2.6
Connectivity >2.6
slope ≥4%
Transmilenio stations
Feeder stations
Car

500m radius

1000m radius

Low walking incidence & Bus Feeders

High walking incidence & Transmilenio Stations

Legend:
- Estaciones
- Transmilenio
- Alimentadores
- Rutas bus 2000
- Perimetro Urbano

Caminar por transporte
- 61.667 - 90
- 90 - 99.846
- 99.846 - 118.946
- 118.946 - 141.327
- 141.327 - 203.816

1000 0 1000 Meters

TransMilenio Offers Physical Activity Opportunities
Multi-Modal Planning & Design

TransMilenio
station/Bikeways
& Parks

< 3km

Feeders

>3km

800
m
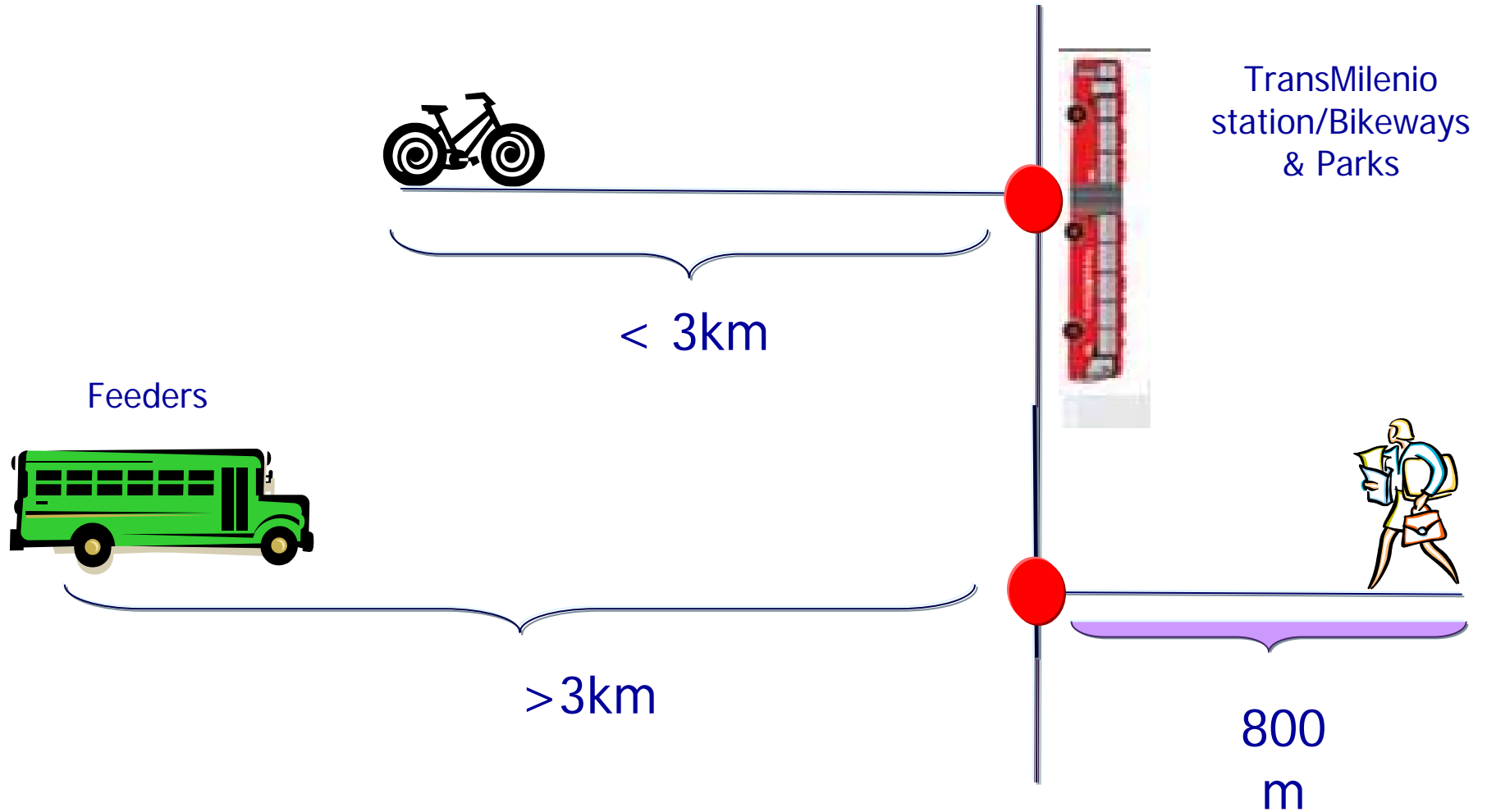
Policy Choices:
Invest in Feeder Buses or "Green Connectors"?