Sustainable Urbanism:
Urban Design with Nature

Council on Sustainable Urbanism and Architecture

Alexandria, VA

November 28, 2007

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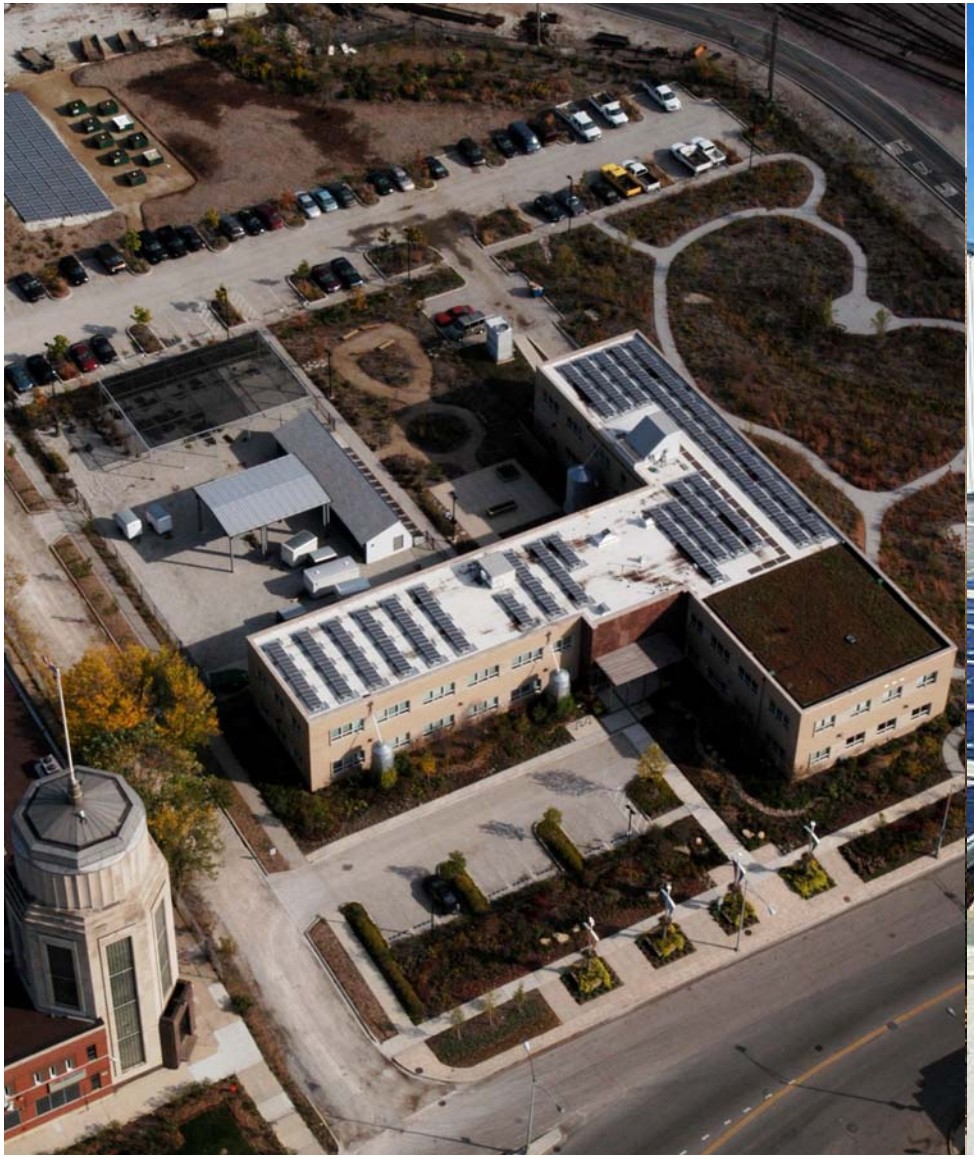

Chicago Center for Green Technology/CCGT

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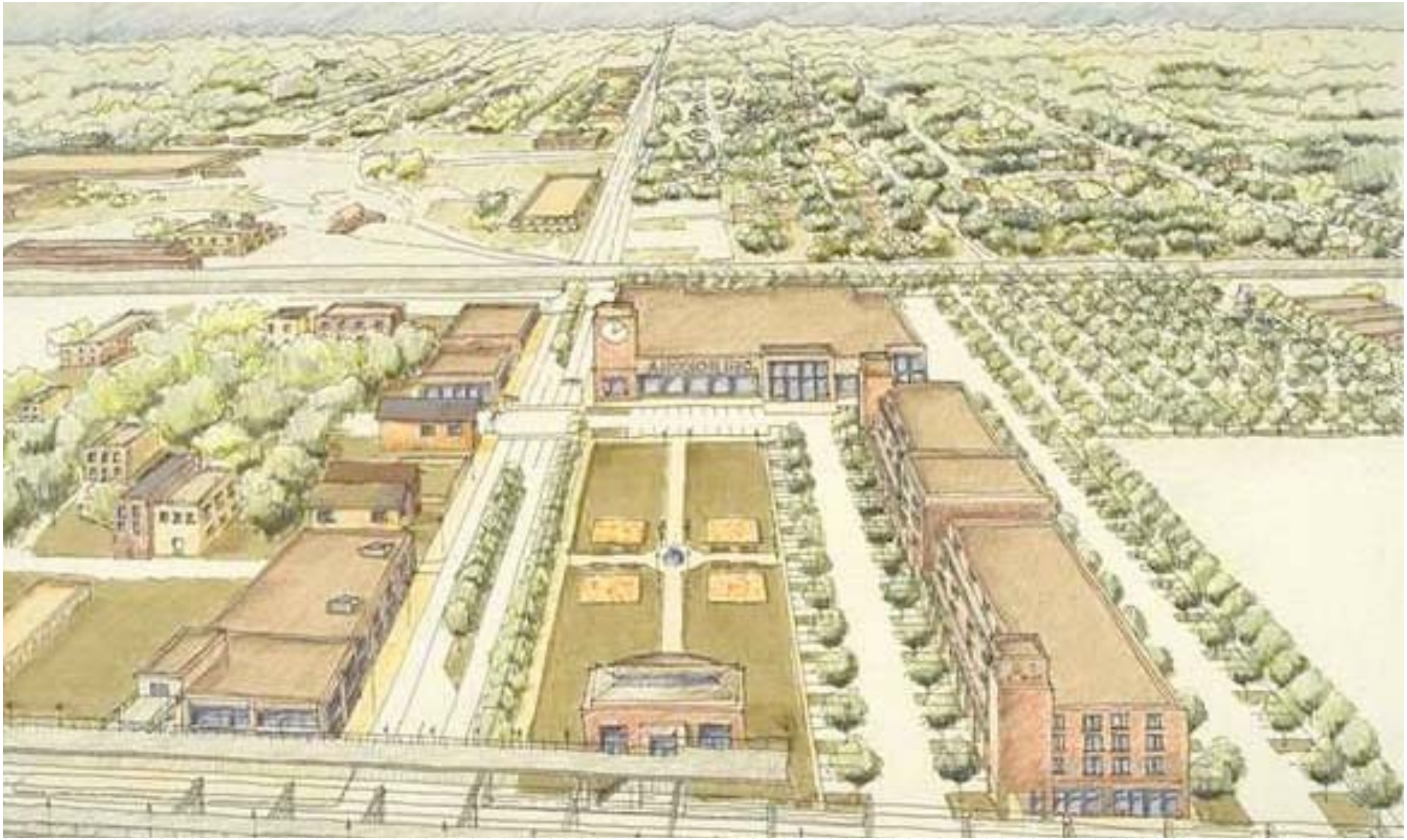

CTA Greenline/Lake-Pulaski TOD (1998)

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CTA Greenline/Lake-Pulaski TOD (1999)

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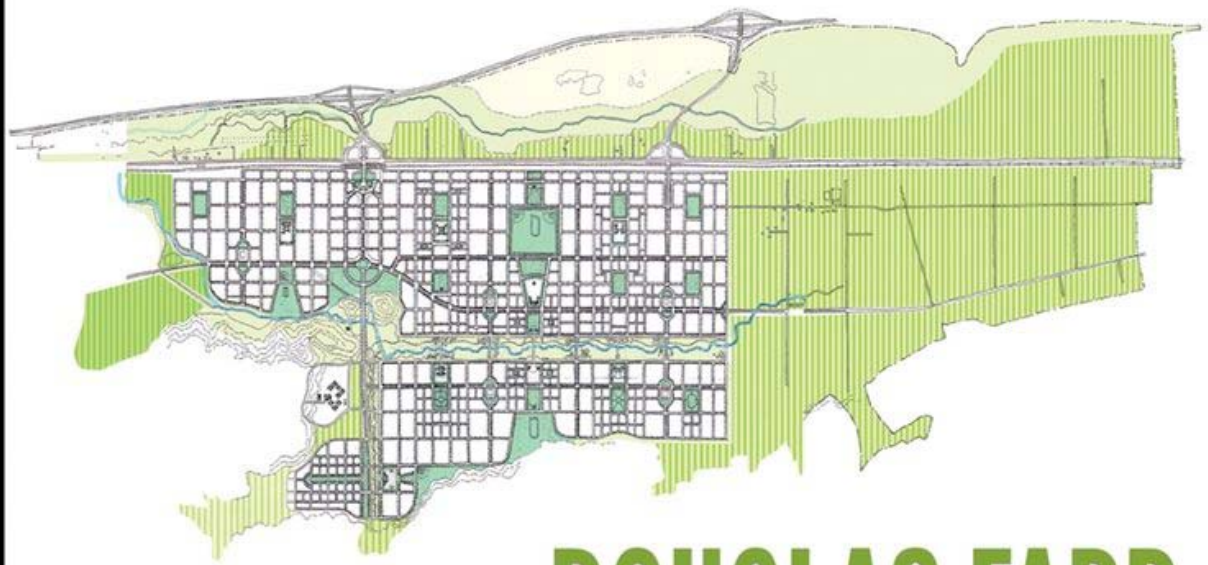
SUSTAINABLE URBANISM

URBAN DESIGN WITH NATURE



DOUGLAS FARR

FOREWORD BY ANDRES DUANY

Sustainable Urbanism:
Urban Design with Nature

Publisher: John Wiley and Sons, November 2007

Walkable, transit-served urbanism

integrated with green buildings

and high performance infrastructure

Book Organization

Section 1: Essay on the Imperitive of SU

Section 2: Implementing Sustainable Urbanism

Section 3: Emerging Thresholds of SU

Section 4: Twenty Case Studies of SU

Finding:

The country is on the wrong course

Thesis:

Sustainable Urbanism will become the norm in U.S. by 2030

Sustainable Urbanism/Urban Design with Nature

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Step One

Establish Weights and Measures

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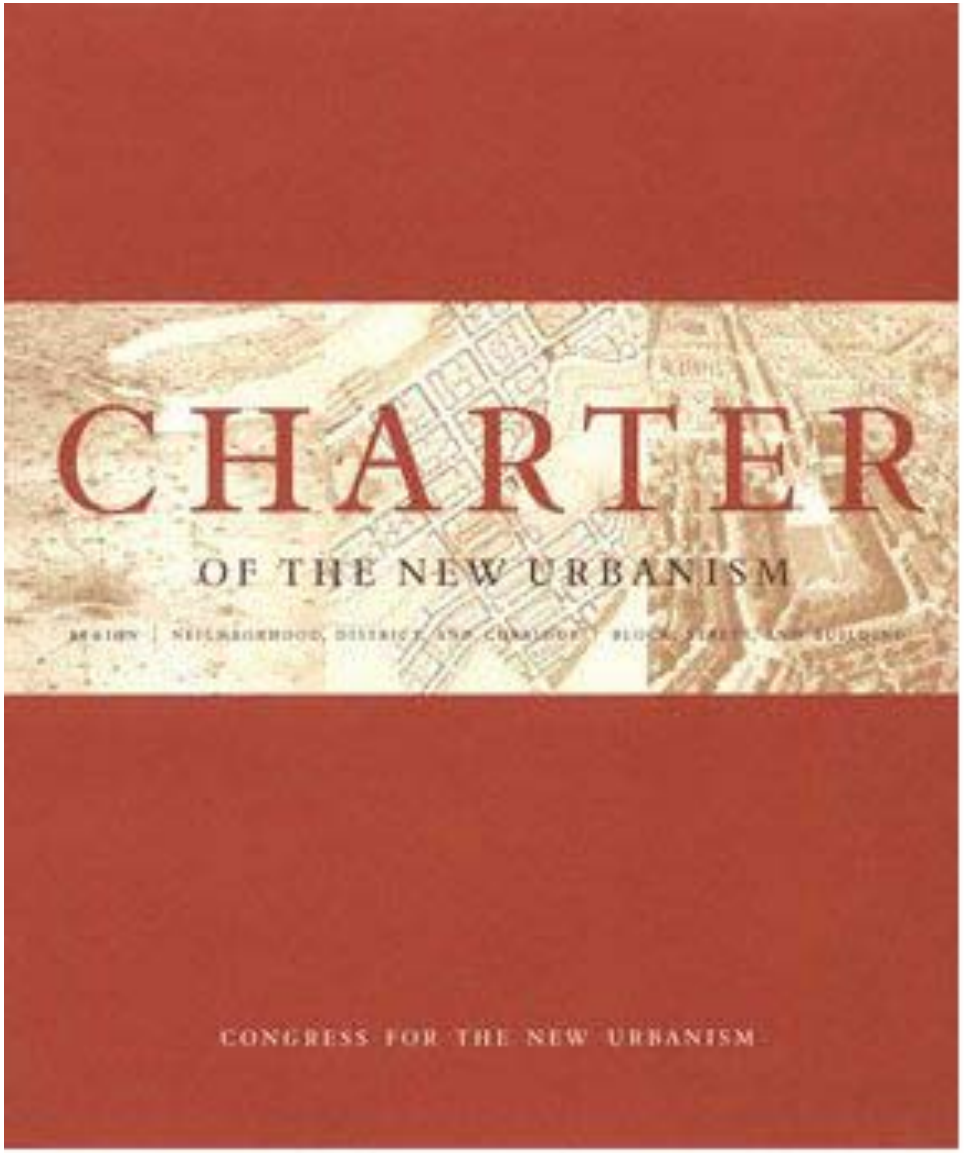

The Congress for the New Urbanism views disinvestment in central cities, the spread of placeless sprawl, increasing separation by race and income, environmental deterioration, loss of agricultural lands and wilderness, and the erosion of society's built heritage as one interrelated community-building challenge.

The Congress for the New Urbanism/CNU

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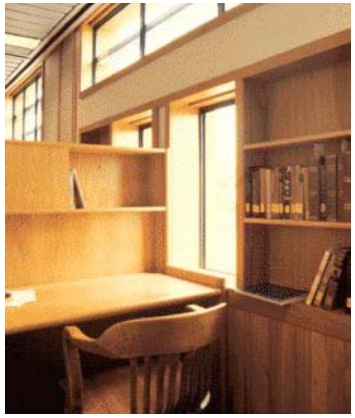
LEED™

LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN





Leadership in Energy and Environmental Design® /LEED

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Half Measures of Sustainability

A Green Building Critique of Seaside

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Location Efficiency

LEED-CI Pilot

"The LEED Rating System does not distinguish between the size (or quantity) of mass transit systems in proximity to a project... Awarding extra credit would create an added advantage for projects located in larger metropolitan areas."

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An Urbanist Critique of LEED

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LEED® for
Neighborhood Developments

LEED-ND Critique

Urban waterfront Pre-requisite

Per square foot versus per capita

More and better use of transect

Lack of clarity on ideal urban form

Step Two

Dismantle Carbon-Era Standards

Carbon-Era (Auto-Dependent) Land Use

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Reversing Regulations

Maximums become minimums

Development density

Building heights

Minimums become maximums

Setbacks

Off street parking

Public lighting

Step Three

Launch a national campaign to adopt Sustainable Urbanism

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Sustainable Urbanism/Urban Design with Nature

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5 Years

10 Years

25 Years

The Campaign for Efficient Tools

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An Inconvenient Truth

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REDUCE YOUR IMPACT WHILE ON THE MOVE

Almost one third of the carbon dioxide produced in the United States comes from our cars, trucks and airplanes. Here are some simple, practical things you can do to reduce the amount of carbon dioxide you produce while on the move.

Reduce the number of miles you drive by walking, biking, carpooling or taking mass transit wherever possible
Avoiding just 10 miles of driving every week would eliminate about 500 pounds of carbon dioxide emissions a year! Click **here** to find transit options in your area.

Start a carpool with your coworkers or classmates
Sharing a ride with someone just 2 days a week will reduce your carbon dioxide emissions by 1,590 pounds a year. **eRideShare.com** runs a free national service connecting commuters and travelers.

Keep your car tuned up
Regular maintenance helps improve fuel efficiency and reduces emissions. When just 1% of car owners properly maintain their cars, nearly a billion pounds of carbon dioxide are kept out of the atmosphere.

Check your tires weekly to make sure they're properly inflated
Proper **inflation** can improve gas mileage by more than 3%. Since every gallon of gasoline saved keeps 20 pounds of carbon dioxide out of the atmosphere, every increase in fuel efficiency makes a difference!

When it is time for a new car, choose a more fuel efficient vehicle
You can save 3,000 pounds of carbon dioxide every year if your new car gets only 3 miles per gallon more than your current one. You can get up to 60 miles per gallon with a hybrid! You can find information on fuel efficiency **here** and **here**.

Try car sharing
Need a car but don't want to buy one? Community car sharing organizations provide access to a car and your membership fee covers gas, maintenance and insurance. Many companies – such as **Flexcar** – offer low emission or hybrid cars too! Also, see **ZipCar**.

Try telecommuting from home
Telecommuting can help you drastically reduce the number of miles you drive every week. For more information, check out the **Telework Coalition**.

Fly less
Air travel produces large amounts of emissions so reducing how much you fly by even one or two trips a year can reduce your emissions significantly. You can also **offset** your air travel by investing in renewable energy projects.

An Inconvenient Truth: What to do?

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2030 Architecture Challenge

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2030 Architecture Challenge

Targets for energy efficiency reduction

60% in 2010

70% in 2015

80% in 2020

90% in 2025

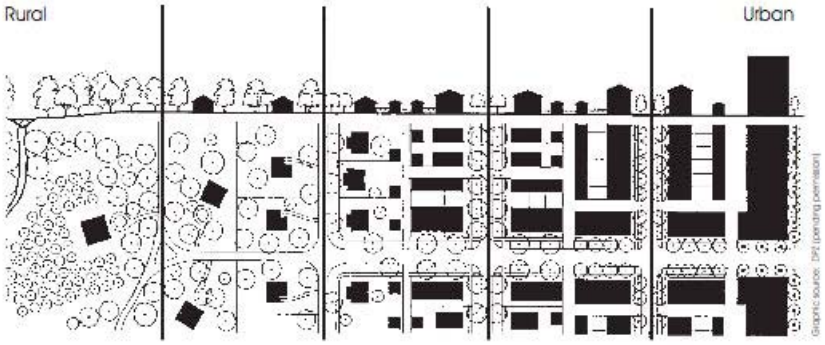
100% in 2030 (Carbon neutral)

Draft Concept

AN ENVIRONMENTAL TRANSECT FOR THE NEW URBANISM

Step 1: Calibrate Regional Transect

Sacramento, California



Design Context

Residential Density (net DU/ac)	0.20	35.00
Open Space (% total land area)	20.00	5.00
Employment Proximity (jobs w/i 1 mi.)	10.00	30,000.00
Street Density (centerline mi./sq.mi)	1.00	25.00
Transit Proximity (avg. ft. DU-closest stop)	25,000.00	400.00
Auto Use (total VMT/capita/day)	35.00	10.00

Environmental Performance

Land Consumption (gross ac/capita)	10.00	0.01
Water Use (gal/capita/day)	200.00	50.00
Energy Use (MMBtu/capita/yr)	200.00	100.00
Imperviousness (impervious ac/DU)	0.20	0.03
Nonpoint Source Pollutants (kg/capita/yr)	0.04	0.01
Criteria Air Pollutants (lbs/capita/yr)	800.00	200.00
Greenhouse Gases (tons/capita/yr)	12.00	4.00

Urban (per capita) Sustainability

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BuildingGreen.com [close this window]

Comparing Transportation and Operating Energy Use for an Office Building

	U.S. UNITS	METRIC UNITS
Average U.S. commute distance – one way[1]	12.2 mi	19.6 km
U.S. average vehicle fuel economy – 2006[2]	21.0 mi/gal	8.9 km/liter
Work days	235 days/yr	
Annual fuel consumption	273 gal/year	1,030 liters/yr
Annual fuel consumption per automobile commuter[3]	33,900 kBtu/yr	9,890 kWh/yr
Transportation energy use per employee[4]	27,700 kBtu/yr	8,100 kWh/yr
Average office building occupancy[5]	230 ft^2/person	21.3 m^2/person
Transportation energy use for average office building	121 kBtu/ft^2	381 kWh/m^2
Operating energy use for average office building[6]	92.9 kBtu/ft^2-yr	293 kWh/m^2-yr
Operating energy use for code-compliant office building[7]	51.0 kBtu/ft^2-yr	161 kWh/m^2-yr
Percent transportation energy use exceeds operation energy use for an average office building	30.2%	
Percent transportation energy use exceeds operation energy use for an office building built to ASHRAE 90.1-2004 code	137%	

1. U.S. Department of Transportation, Transportation Energy Data Book 26th Edition, 2007, Table 8.6

2. U.S. EPA Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2006

3. Assumes 124,000 Btu/gallon of gasoline, DOE Energy Information Administration data

Building v. Transport Energy

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Per capita VMT will increase 5% w/ > CAFE standards

Average dwelling size grew 60% from 1970 - 2005

The Tragic Irony of Efficiency

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The 2030 Community Challenge

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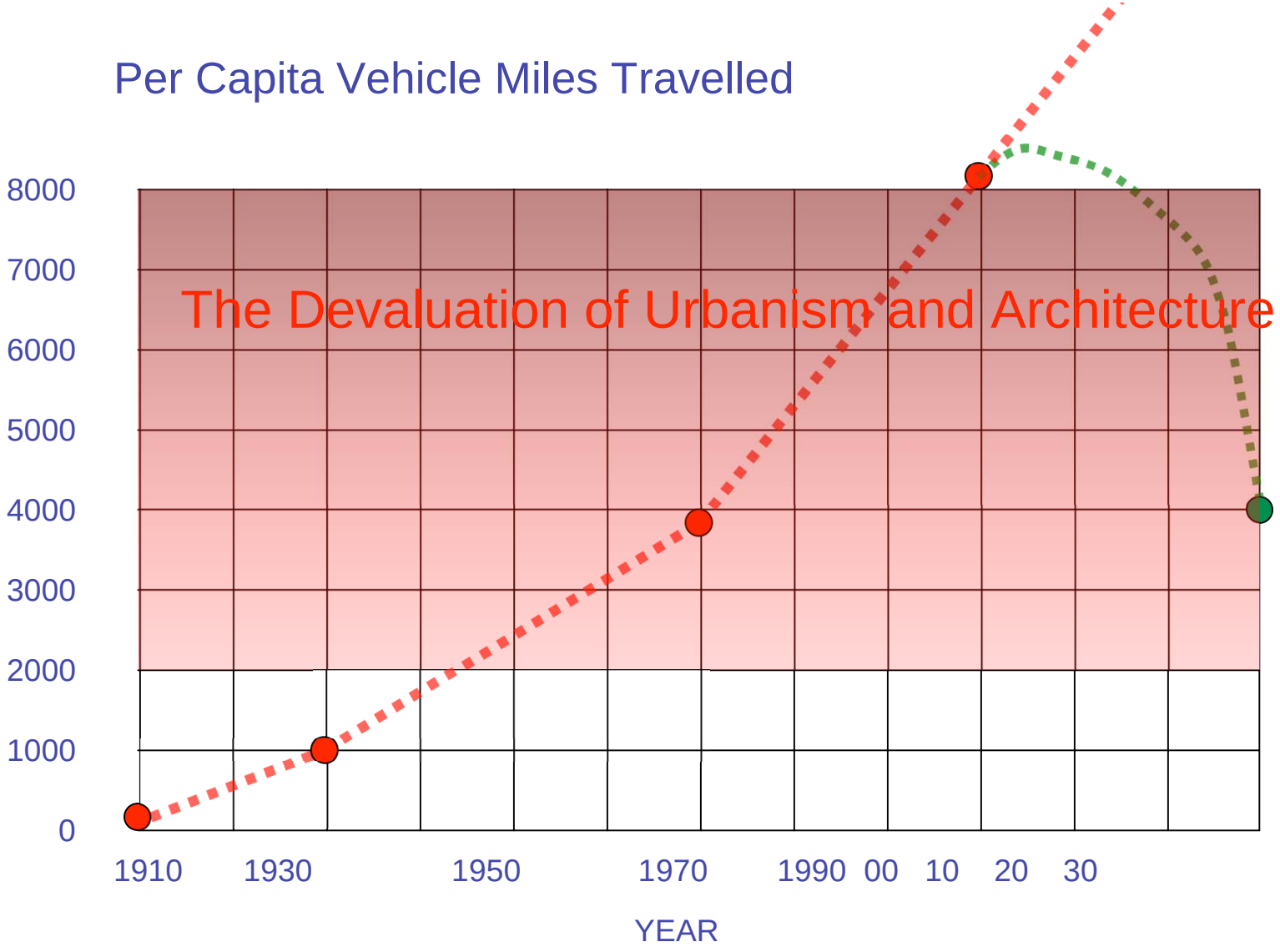
Per Capita Vehicle Miles Travelled



2030 Community Challenge

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Target: 2% VMT reduction per year

The vehicle miles traveled within a given jurisdiction shall be decreased to:

90% in 2010

80% in 2015

70% in 2020

60% in 2025

50% in 2030

Step Three - A

The commoditization of Sustainable Urbanism

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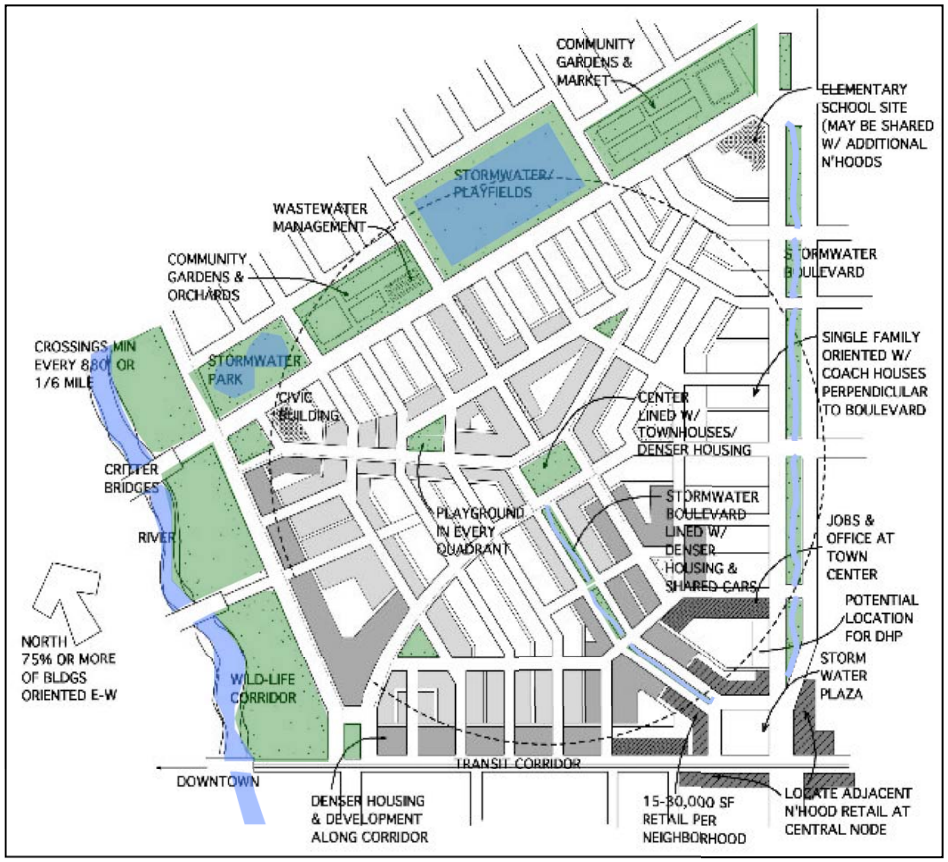
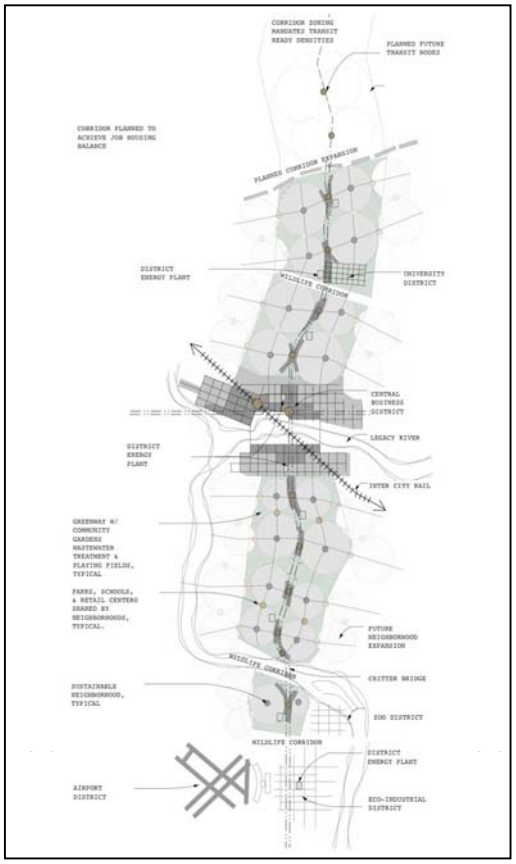
Urbanist Strategy:
Transport/land use integration

Walking in the neighborhood



Transit in the corridor



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	Residential (1)	Non-Residential
Physical Measures		
Net Residential Density	Up to 55%	N/A
Mix of Uses	Up to 9%	Up to 9%
Local-Serving Retail	2%	2%
Transit Service	Up to 15%	Up to 15%
Pedestrian/Bicycle Friendliness	Up to 9%	Up to 9%
Physical Measures subtotal	*Up to 90%*	*Up to 35%*
Demand Management and Similar Measures		
Affordable Housing	Up to 4%	N/A
Parking Supply (2)	N/A	No limit
Parking Pricing/Cash Out	N/A	Up to 25%
Free Transit Passes	25% * reduction for transit service	25% * reduction for transit service
Telecommuting (3)	N/A	No limit
Other TDM Programs	N/A	Up to 2%, plus 10% of the credit for transit and ped/bike friendliness
Demand Management subtotal (4)	*Up to 7.75%*	*Up to 31.65%*

Notes:

(1) For residential uses, the percentage reductions shown apply to the ITE average trip generation rate for single-family detached housing. For other residential land use types, some level of these mitigation measures is implicit in ITE average trip generation rates, and the percentage reduction will be lower.

(2) Only if greater than sum of other trip reduction measures.

(3) Not additive with other trip reduction measures.

(4) Excluding credits for parking supply and telecommuting, which have no limit.

Trip Reduction Potential

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Nelson/Nygaard 2007

Neighborhood (Pedshed) Timeline

1920 1940 1960 1980 2000 2020

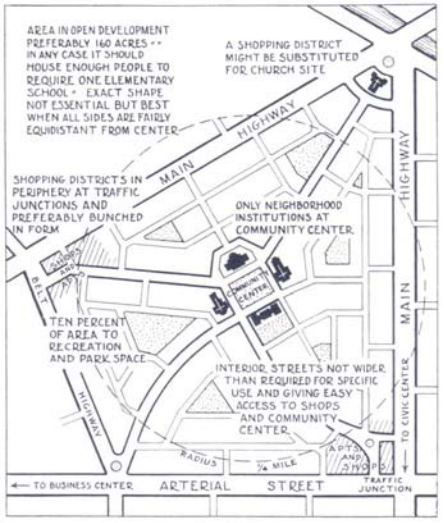
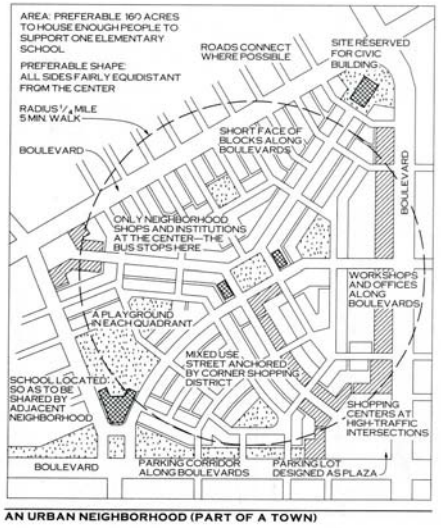


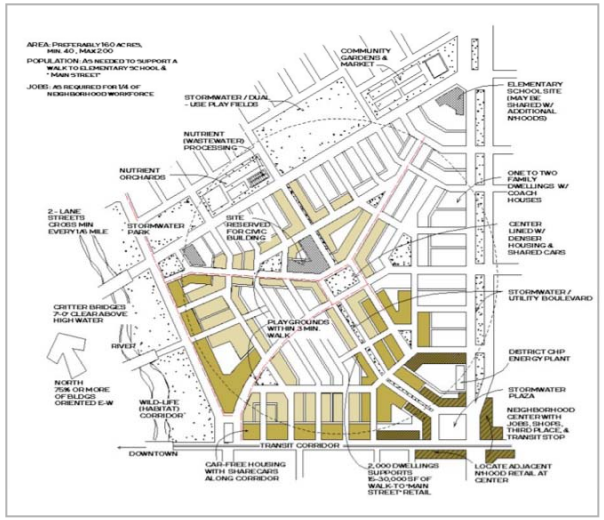
FIG. 33
NEIGHBORHOOD-UNIT PRINCIPLES

Perry



AN URBAN NEIGHBORHOOD (PART OF A TOWN)

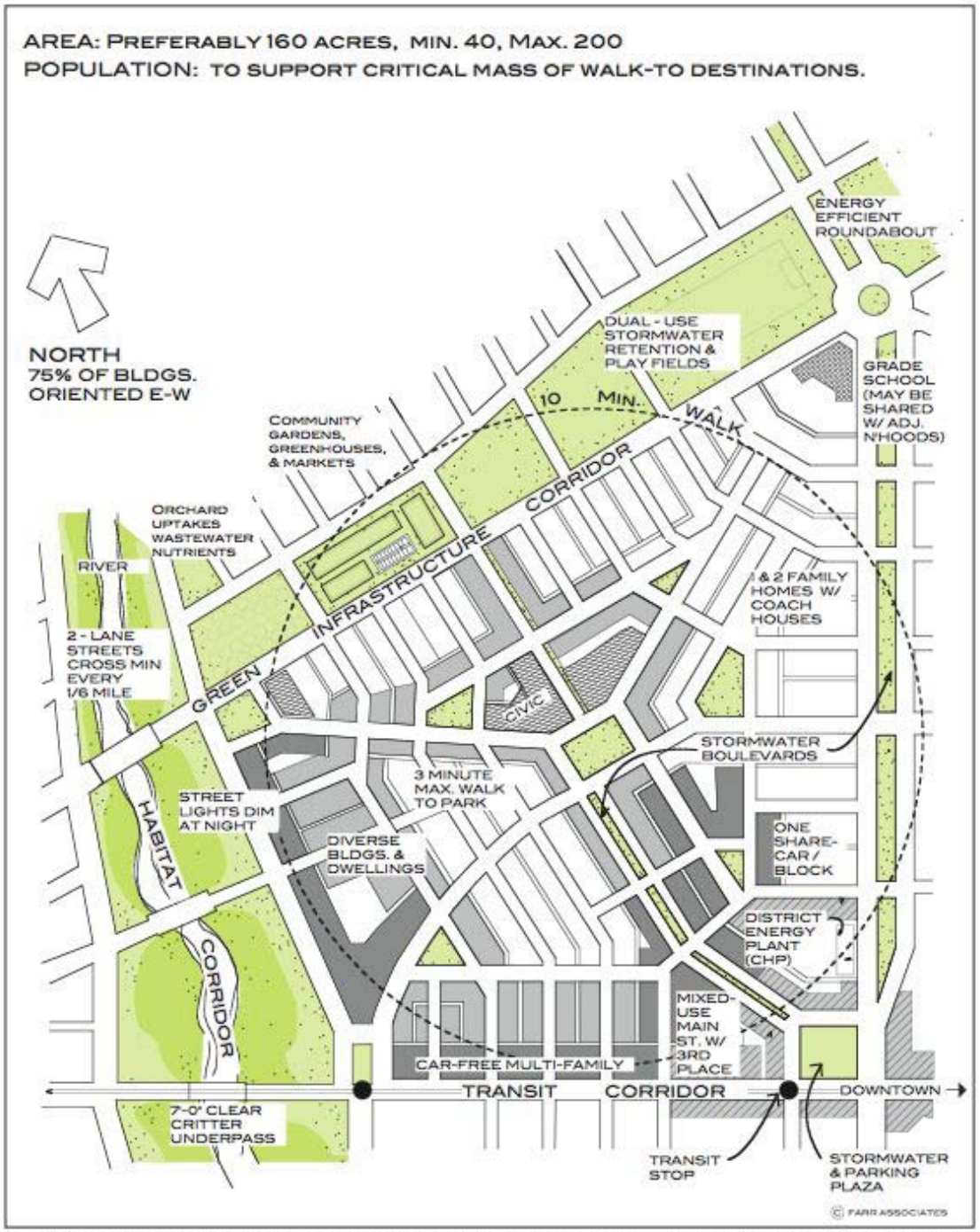
DPZ



Sustainable Neighborhood

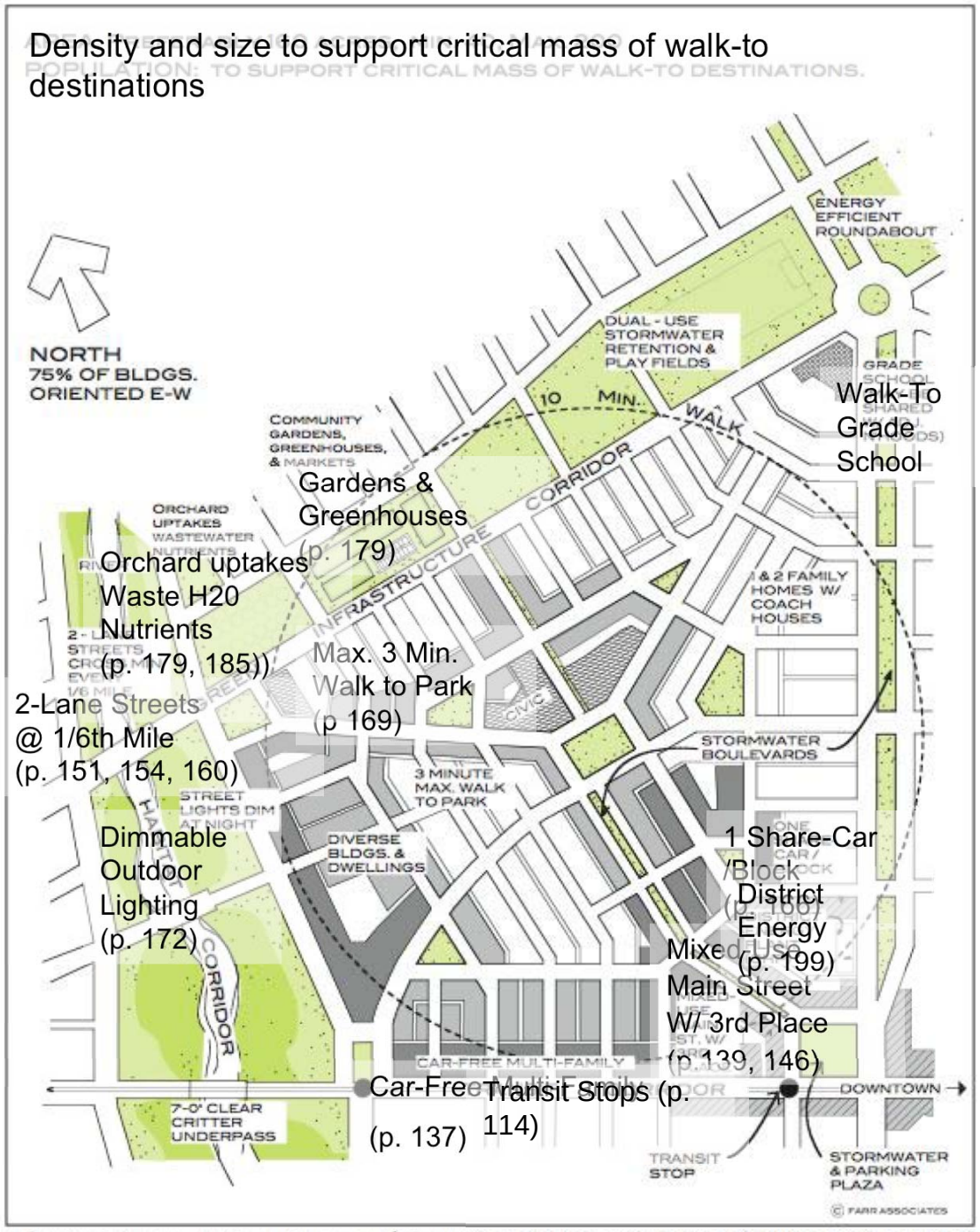
The Sustainable Neighborhood

A place designed so well that people willingly meet daily needs using foot and bike (no car)



A SUSTAINABLE NEIGHBORHOOD (BUILDING BLOCKS OF A SUSTAINABLE CORRIDOR)

Density and size to support critical mass of walk-to destinations



Walk-To Grade School

Gardens & Greenhouses (p. 179)

Orchard uptakes Waste H20 Nutrients (p. 179, 185))

Max. 3 Min. Walk to Park (p 169)

2-Lane Streets @ 1/6th Mile (p. 151, 154, 160)

Dimmable Outdoor Lighting (p. 172)

1 Share-Car /Block (p. 160)

District Energy (p. 199)

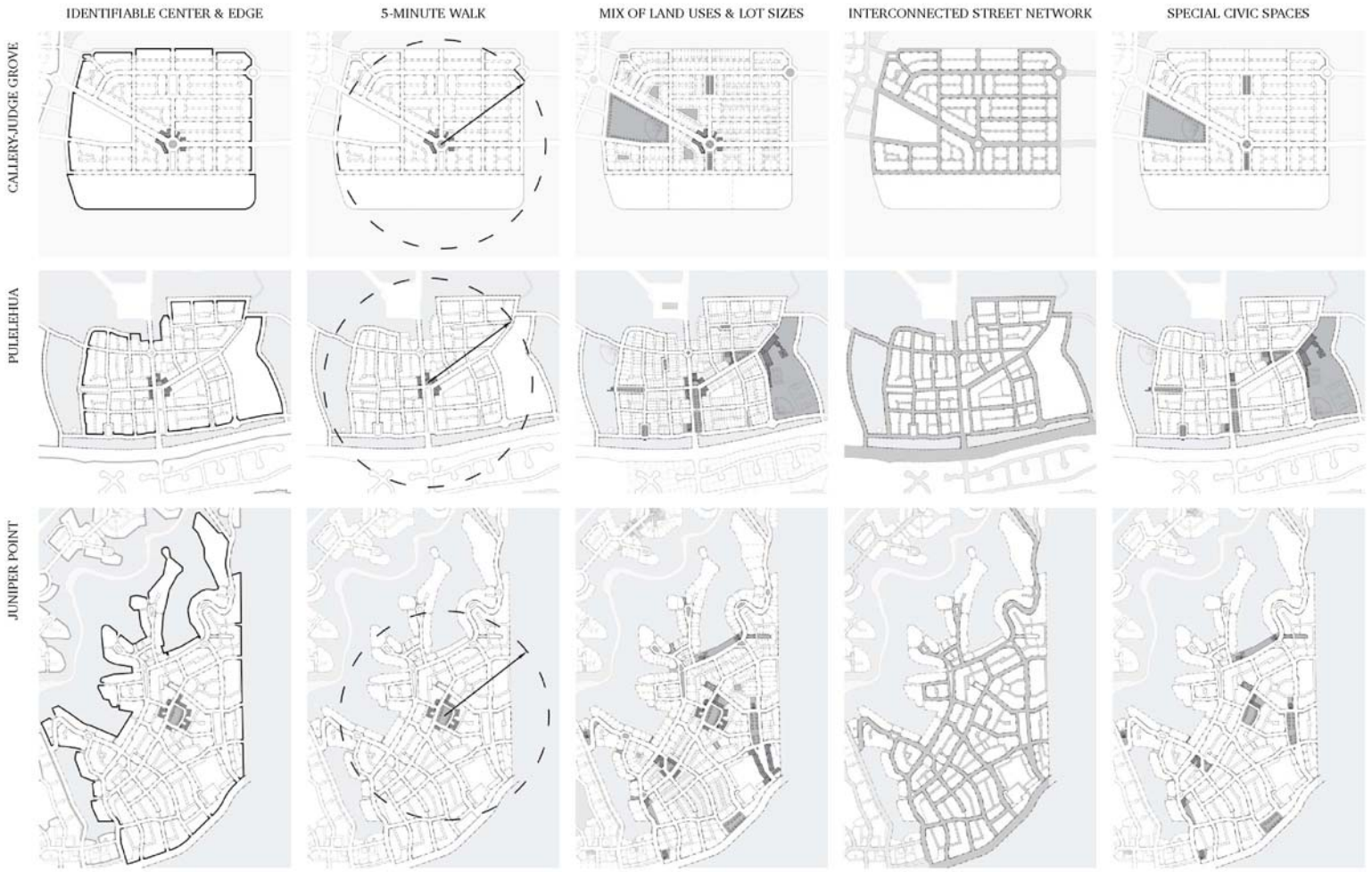
Mixed Use Main Street W/ 3rd Place (p 139, 146)

Car-Free (p. 137)

Transit Stops (p. 114)

A SUSTAINABLE NEIGHBORHOOD (BUILDING BLOCKS OF A SUSTAINABLE CORRIDOR)

Neighborhood Definition



Dover Kohl Associates 2007

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Neighborhood Definition

Neighborhood Definition		Size (Acre)	% Area Devoted to Center	Number of Primary Dwellings	Number of Accessory Dwellings	Net Residential Density (DU/Acre) [2]	S.F. of Commercial Space	Net Commercial Area (S.F./Acre)
Name	***Location***							
Historic City of Charleston	Charleston, SC	1,015	9% (88 acres)	5,428 [1]	UNKNOWN *	7.6	UNKNOWN *	UNKNOWN *
Four wards in Historic Savannah[5]	Savannah, GA	50	9% (4.5 acres)	320 [1]	UNKNOWN *	9.1	180,200 [3]	3,604
Seaside (Original 80 Acres)	Seaside, FL	80	5% (4.1 acres)	330 [1]	UNKNOWN *	8.2	153,034 [3]	1,912
The North End Neighborhood	Boston, MA	148	7% (10.3 acres)	6,600 [1]	UNKNOWN *	82.6	708,319 [6]	4,785
Forest Hills Gardens	Queens, NY	142	2.8% (4.1 acres)	800 [1]	UNKNOWN *	7.2	7,500 [3]	52
Callery Judge Grove	Palm Beach County, FL	89	3% (2.7 acres)	460	350 [7]	9.96	18,000	390
Pulelehua	Maui, HI	108	6.4% (6.9 acres)	438	101 [7]	11	62,768	1,586
Juniper Point	Flagstaff, AZ	151	9.5% (14.4 acres)	1739	342 [7]	20	116,200	1,417
Optimun Range		40-200	3-10%	Min_ Max_		Min_ Max_		100-400

Dover Kohl Associates 2007

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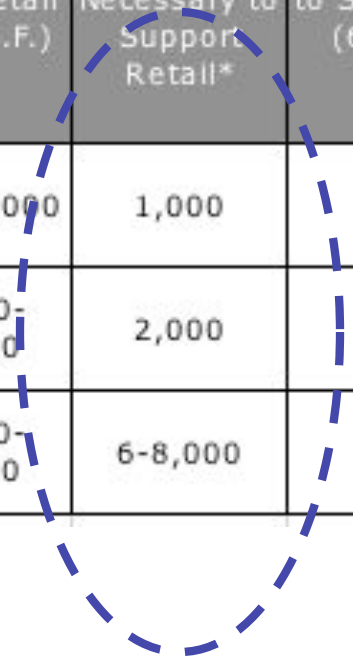
Rooftops (#) to support n'hood retail?

	Gross Retail Area (S.F.)	Dwellings Necessary to Support Retail*	TND's Necessary to Support Retail (6 DU/Gross Acre)	Sales (S.F.)	Avg. Annual Rent pr S.F	Avg. Trade Area
Corner Store	1,500-3,000	1,000	1	$210	$14-16	1 Neighborhood (5 Minute Walk)
Convenience Center	10,000-30,000	2,000	2	$225	$12-18	1 Mile Radius
Neighhborhood Center	60,000-80,000	6-8,000	6 to 8	$245	Highly varied from $7.25 to $40.00	1-2 Mile Radius



Dwelling Types in New TND's

	Rental Lofts/ Apartments		For-Sale Lofts/ Apartments		For-Sale Rowhouses/ Townhouses/ Duplexes		For-Sale Small-Lot Detached Houses		For-Sale Mid-Range Detached Houses		For-Sale Urban Large-Lot Detached Houses	
	Range:	*Average:*	*Range:*	*Average:*	*Range:*	*Average:*	*Range:*	*Average:*	*Range:*	*Average:*	*Range:*	*Average:*
Younger Singles & Couples	20% - 72%	43%	15% to 75%	41%	15% to 75%	33%	3% to 33%	14%	0% to 30%	11%	0% to 31%	11%
Traditional & Non-Traditional Families	18% to 56%	33%	0% to 55%	25%	0% to 62%	37%	30% to 76%	54%	28% to 81%	60%	15% to 84%	55%
Empty Nesters & Retirees	7% to 44%	24%	16% to 62%	34%	0% to 47%	30%	14% to 61%	32%	14% to 67%	29%	11% to 64%	34%
		100%		100%		100%		100%		100%		100%

	Rental Lofts/ Apartments	For-Sale Lofts/ Apartments	For-Sale Rowhouses/ Townhouses/Duplexes	For-Sale Small-Lot Detached Houses	For-Sale Mid-Range Detached Houses	For-Sale Urban Large-Lot Detached Houses	
Range	15% to 31%	4% to 17%	2% to 16%	5% to 35%	13% to 34%	4% to 30%	Total %
Average	23%	9%	9%	24%	22%	13%	100%

Zimmerman Volk Associates 2007

*Based on 30 market TND market studies (400 to 4500 du)

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Massing and Orientation Options

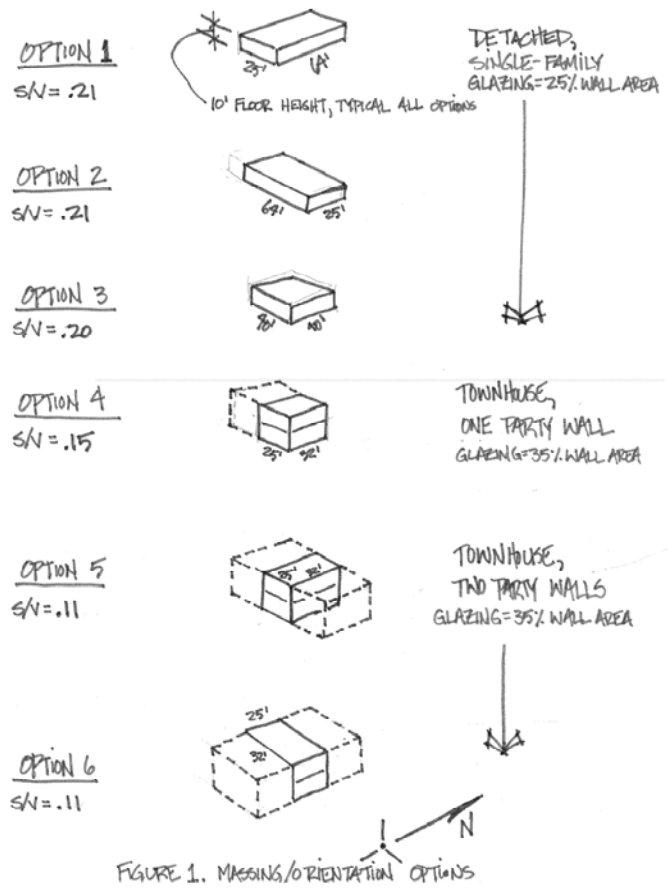
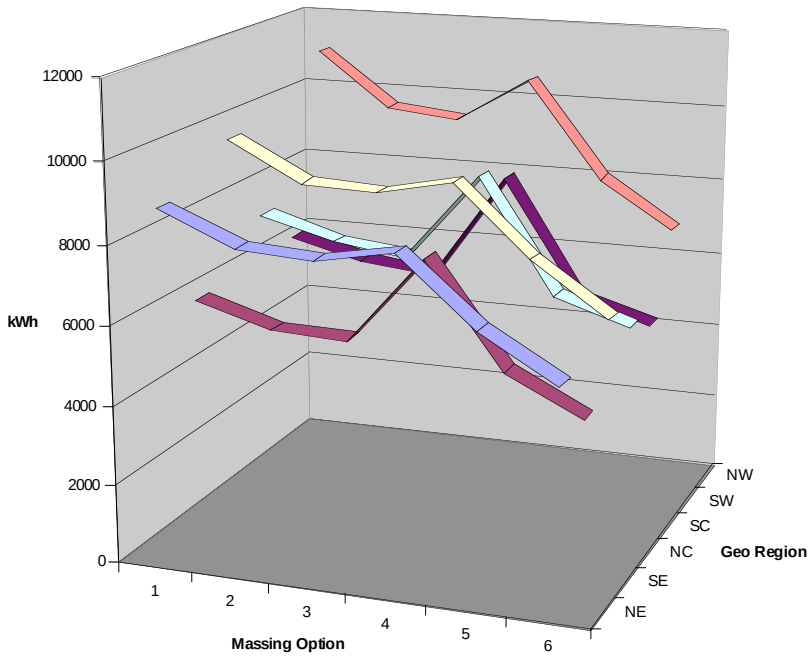


FIGURE 1. MASSING/ORIENTATION OPTIONS

Figure 2. Annual Energy Usage



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Massing and Orientation Options

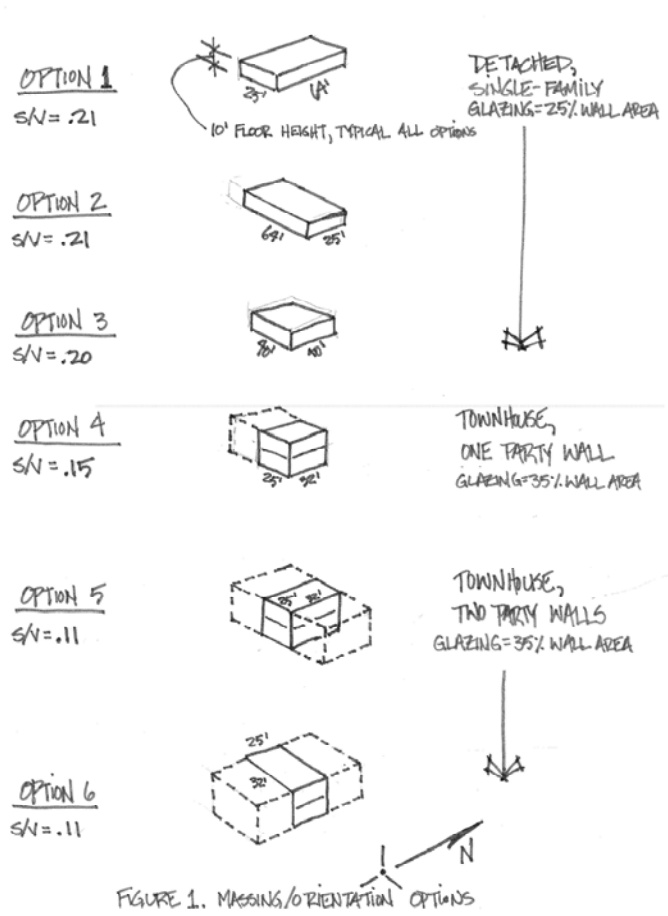
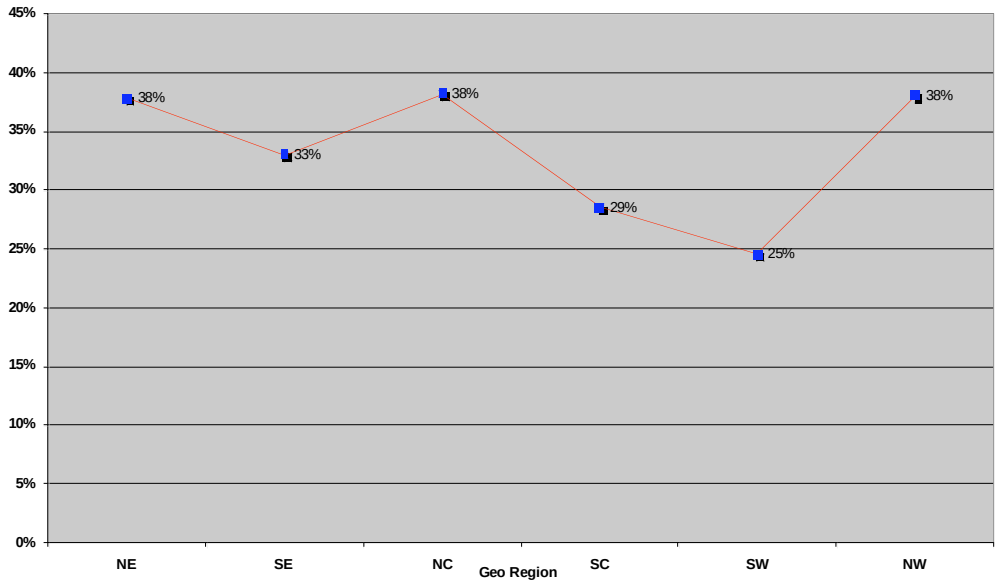


FIGURE 1. MASSING/ORIENTATION OPTIONS

Figure 3.
Percent Reduction of Annual Energy Usage due to Massing, Orientation & Stacking Changes



% Energy Reduction from Option 1 to 6

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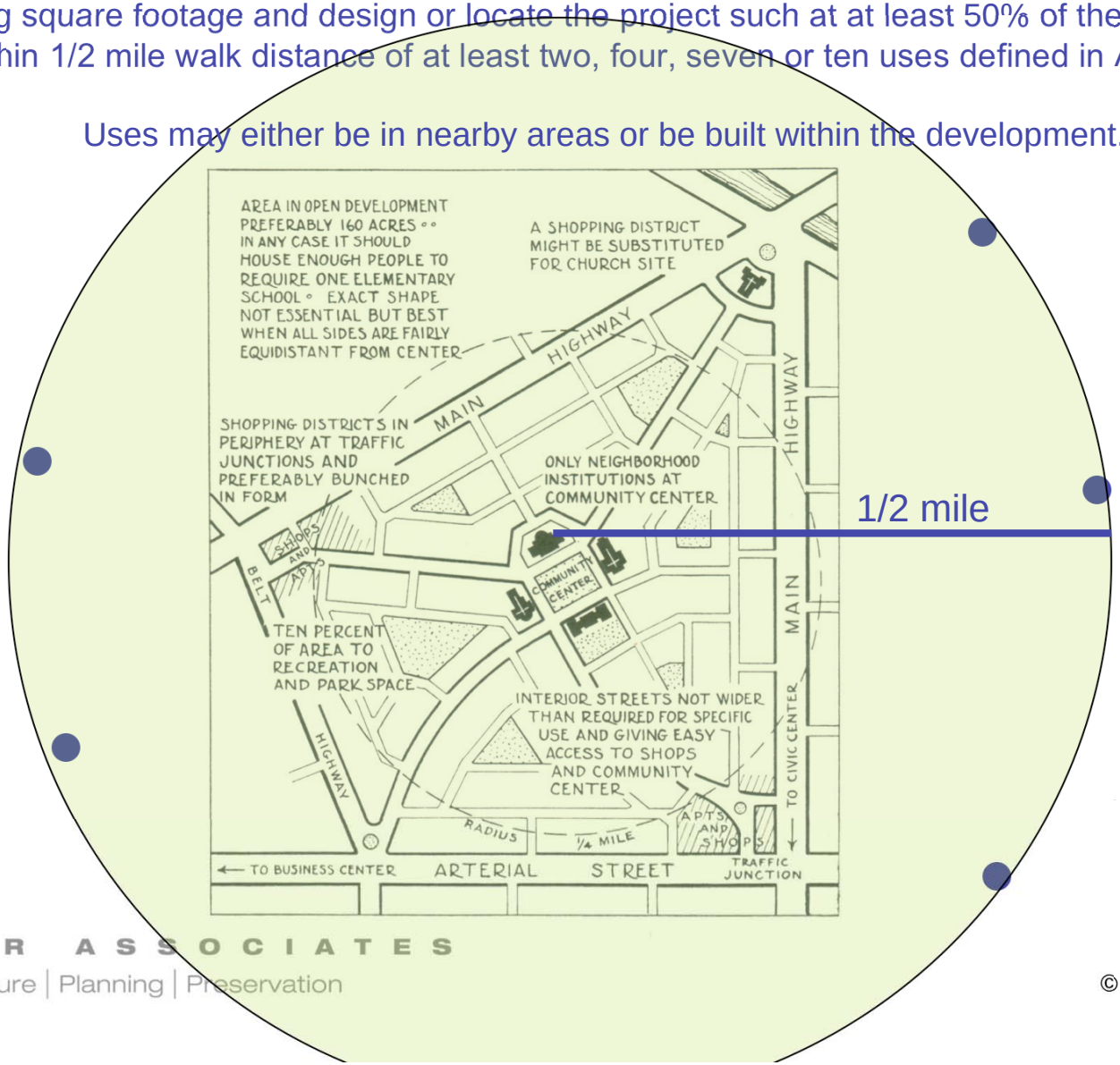
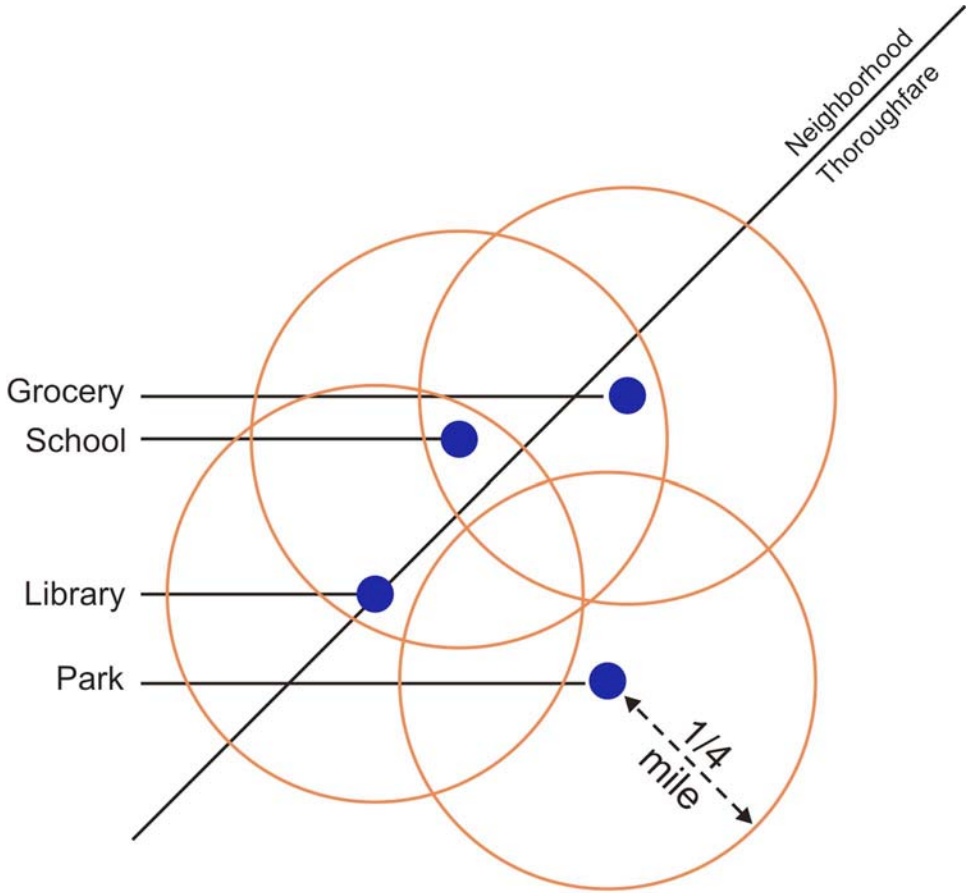
LEED-ND Diversity of Uses

Include a residential component in the project that consitutes at least 25% of the project's total building square footage and design or locate the project such at at least 50% of the dwelling units are within 1/2 mile walk distance of at least two, four, seven or ten uses defined in Appendix A.

Uses may either be in nearby areas or be built within the development.



Neighborhood Completeness



Criterion Partners 2007

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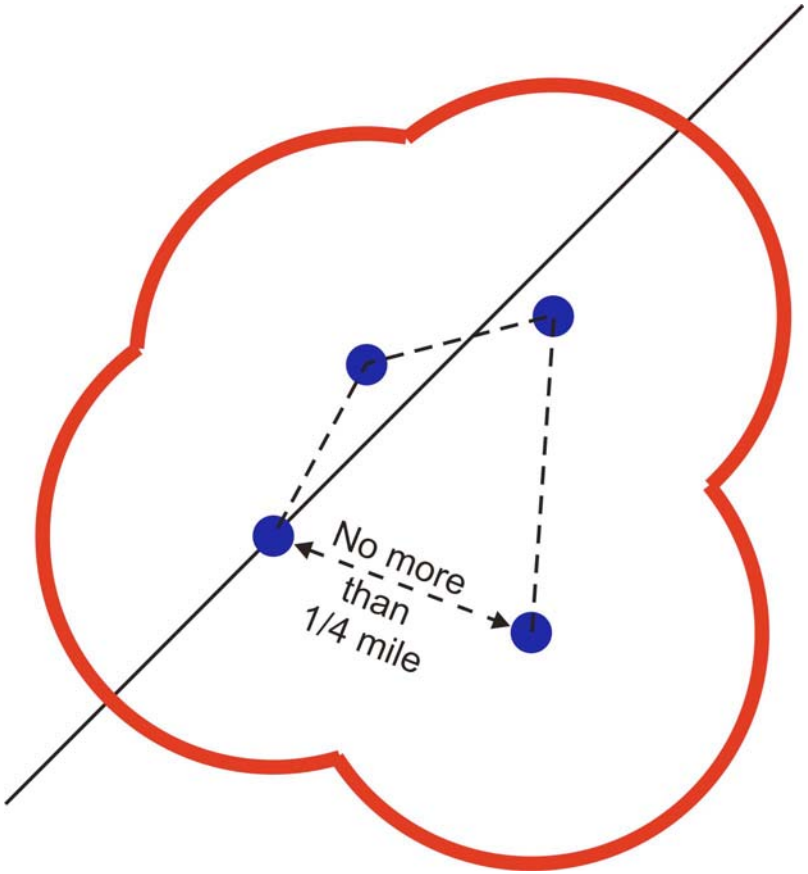
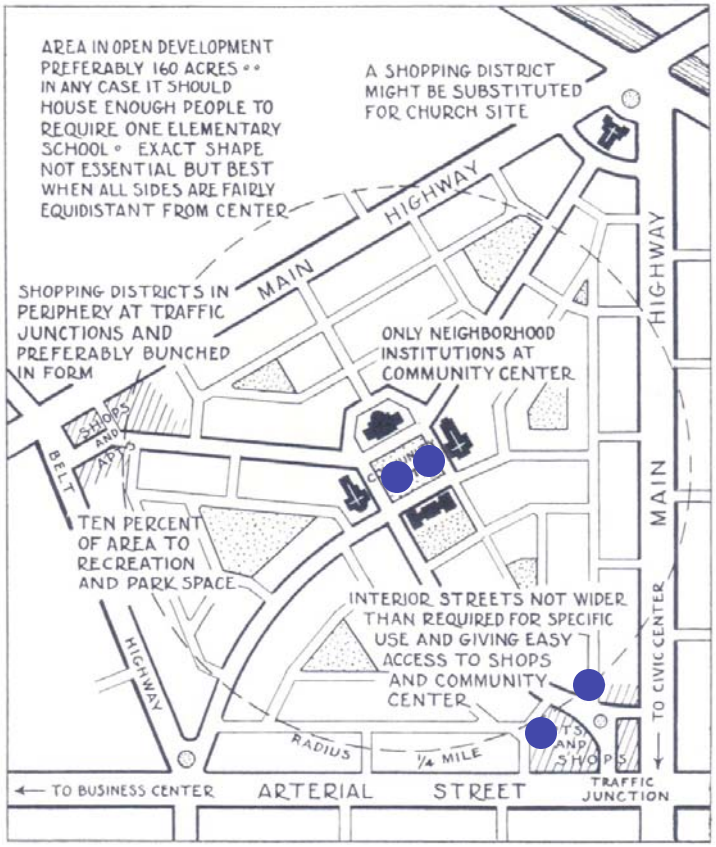
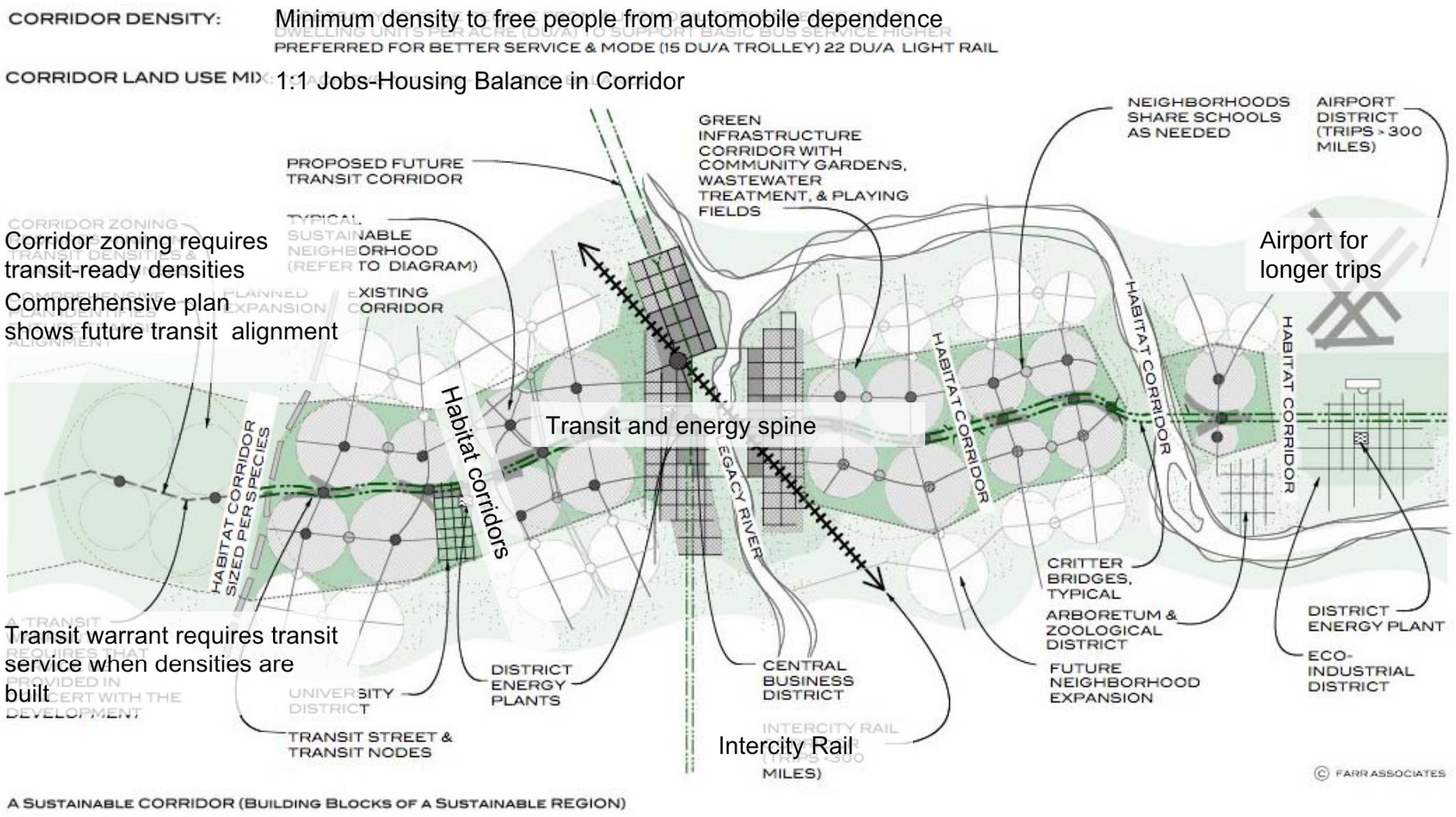
Neighborhood Completeness







The Sustainable Corridor

Meeting weekly needs using foot, bike and transit

Minimum Transit Corridor Densities

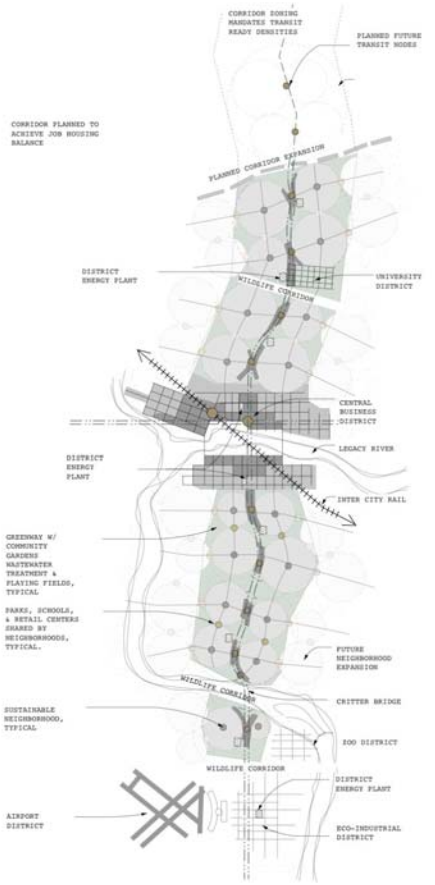
Mode	Service	Minimum Necessary Residential Density (dwelling units per acre)	Remarks
Dial-a-bus	Many origins to many destinations	6	Only if labor costs are not more than twice those of taxis
Dial-a-bus	Fixed destination or subscription service	3.5 to 5	Lower figure if labor costs twice those of taxis; higher if thrice those of taxis
Local bus	"Minimum," ½ mile route spacing, 20 buses per day	4	Average, varies as a function of downtown size and distance from residential area to downtown
Local bus	"Intermediate," ½ mile route spacing, 40 buses per day	7	
Local bus	"Frequent," ½ mile route spacing, 120 buses per day	15	
Express bus —reached on foot	Five buses during two hour peak period	15 Average density over two square mile tributary area	From 10 to 15 miles away to largest downtowns only
Express bus —reached by auto	Five to ten buses during two hour peak period	3 Average density over 20 square mile tributary area	From 10 to 20 miles away to downtowns larger than 20 million square feet of nonresidential floorspace
Light rail	Five minute headways or better during peak hour.	9 Average density for a corridor of 25 to 100 square miles	To downtowns of 20 to 50 million square feet of nonresidential floorspace
Rapid transit	Five minute headways or better during peak hour.	12 Average density for a corridor of 100 to 150 square miles	To downtowns larger than 50 million square feet of nonresidential floorspace
Commuter rail	Twenty trains a day	1 to 2	Only to largest downtowns, if rail line exists

Source: Regional Plan Association

RPA. Zupan 2006

Transit Technology

Technology	Heavy Rail	Commuter Rail	Light Rail	Modern Streetcar	Heritage Streetcar	Bus Rapid Transit	Express Bus
Example Cities	Washington DC New York Subway Chicago	Boston Chicago San Francisco	Denver Portland Minneapolis	Portland Tacoma Seattle	New Orleans San Francisco Kenosha	Los Angeles Pittsburg Eugene	Most Cities Served by Bus Systems
Approximate Cost Per Mile (Millions)	$50-$250	$3-$25	$20-$60	$10-$25	$2-$12	$4-$50	$1-$2
Service Type	Regional/Urban	Regional/ Interurban	Regional/ Urban	Urban Circulator	Urban Circulator	Regional/Urban	Regional/Urban
Station Spacing/Type (Miles)	Urban Core <1 Periphery 1-5 Station/Platform	2-5 Station/Platform	.25-2 Sidewalk Sign/ Station/Platform	.25 Sidewalk Sign/ Platform	.25 Sidewalk Sign/ Platform	.25-2 Sidewalk Sign/ Station/Platform	Limited Stops Along Normal Bus Routes
Peak Service Frequency (Minutes)	5-10	20-30	5-30	8-15	8-15	3-30	10-30
Operating Speed (MPH)	30-80	30-60	20-60	8-12	8-12	8-12	30-80
Alignment/ROW Width	Separate ROW 25-33 Feet	Existing Freight ROW/ 37+ Feet	Street Running or Separate ROW/11-33 Feet	Street Running 11-24 Feet	Street Running 11-24 Feet	HOV or Separated Median/28 Feet	Street Running
Typical Power Source	Electric	Diesel/Hybrid	Electric	Electric	Electric	Diesel/Hybrid	Diesel/Hybrid
Photos							



5 10 25 40 60+

Years required to reform each human tool

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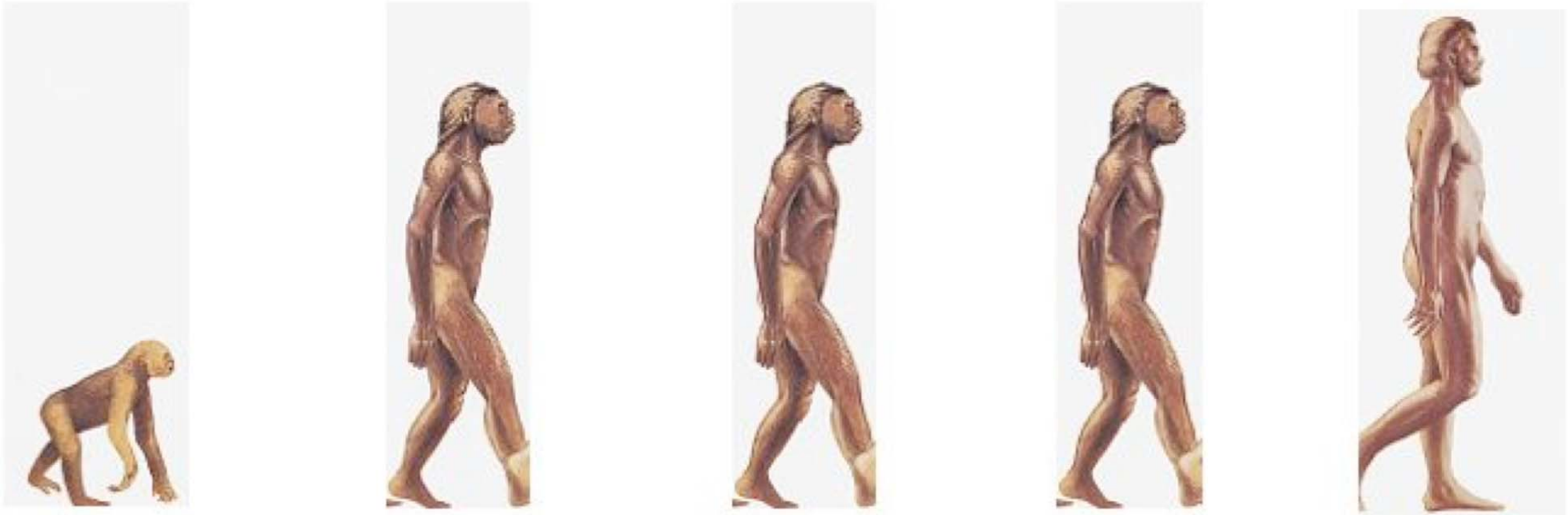

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