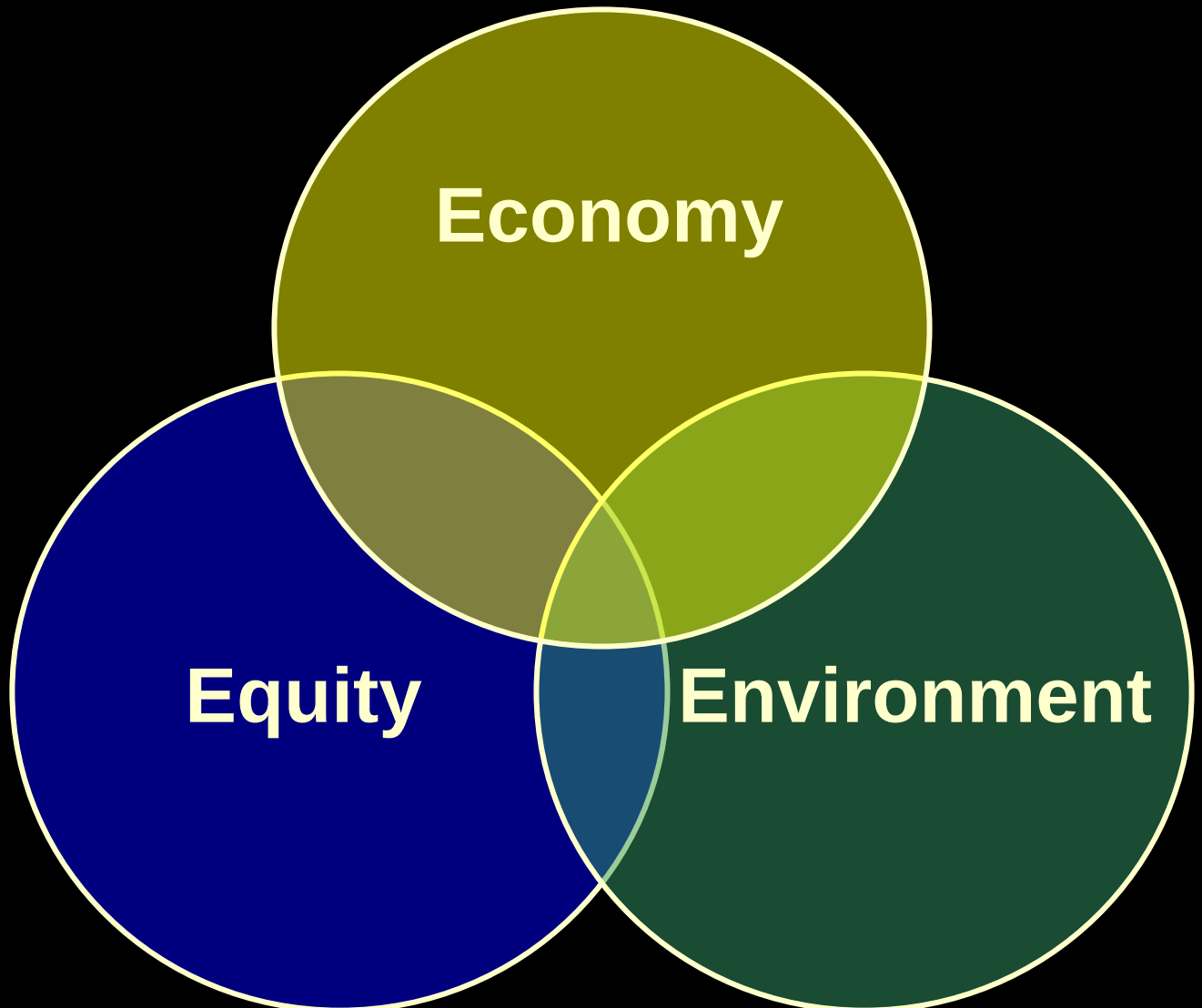
Sustainable Mobility

Challenges and Opportunities for Damascus

Charlier Associates, Inc.

Defining Sustainable Mobility

“Triple Bottom Line”

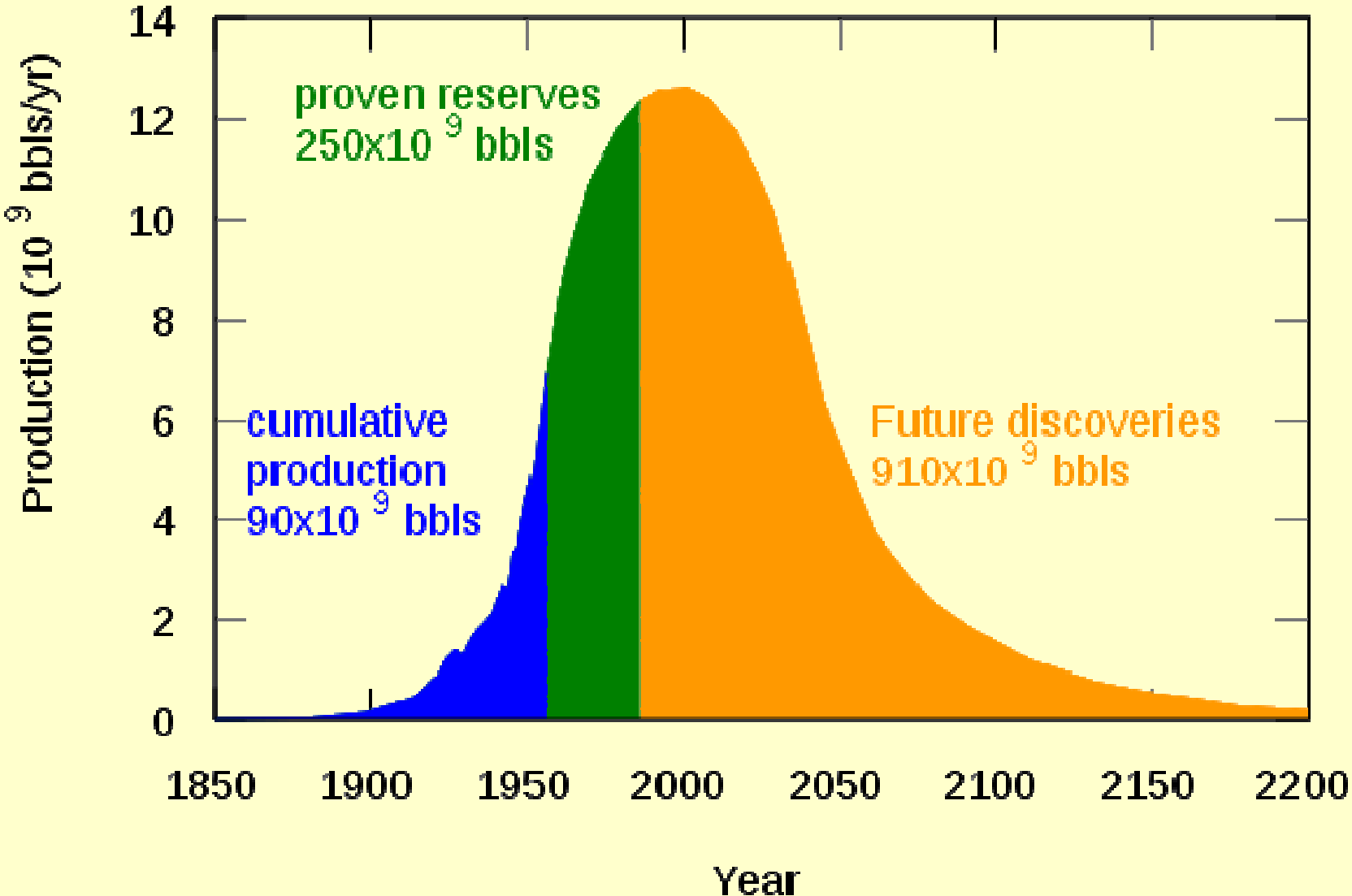


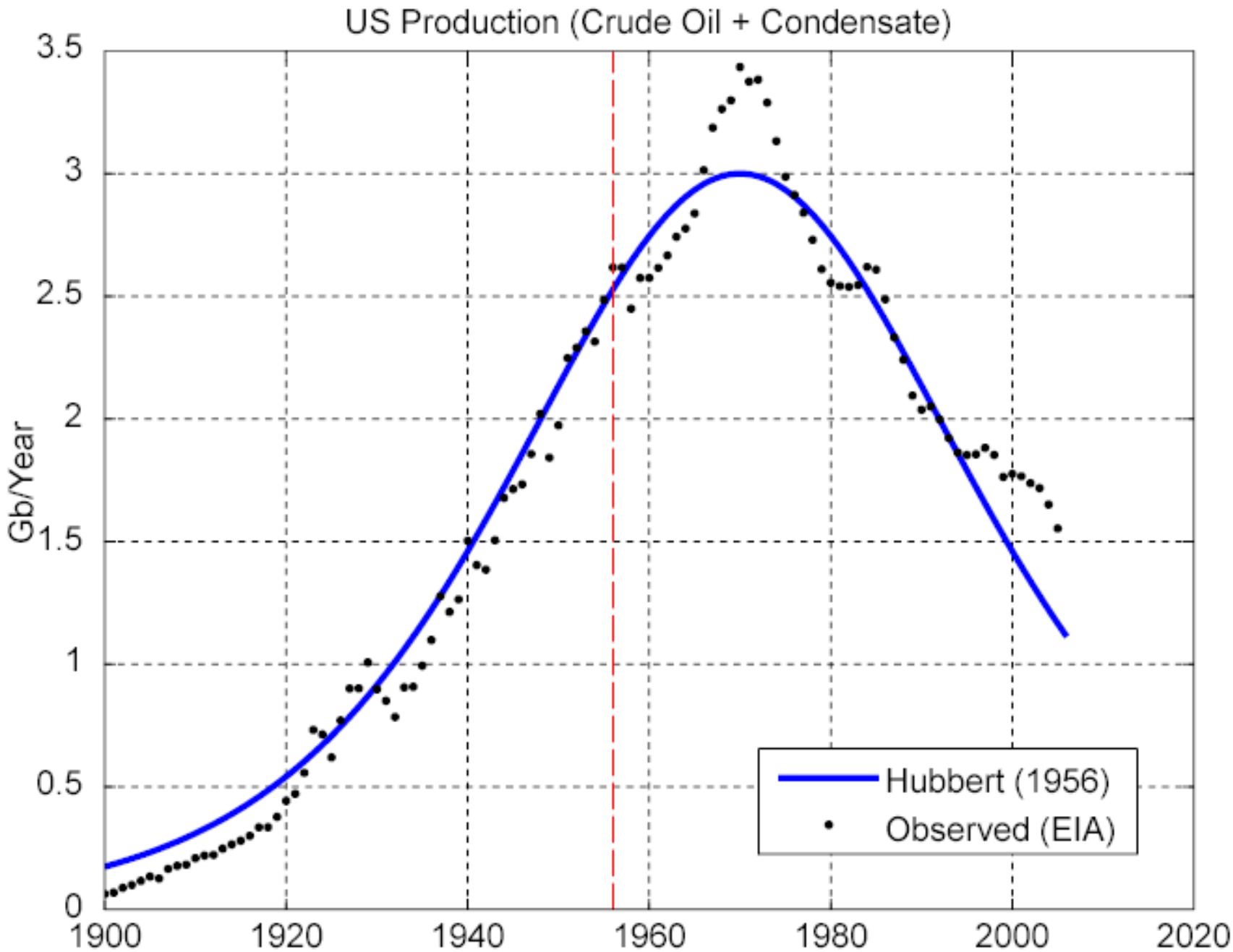
Elements of Sustainable Mobility

- Preparing for the post-petroleum era
- Climate change management
- Active living & public health
- Balanced mobility
- Connected networks
- Household budgets, local economies

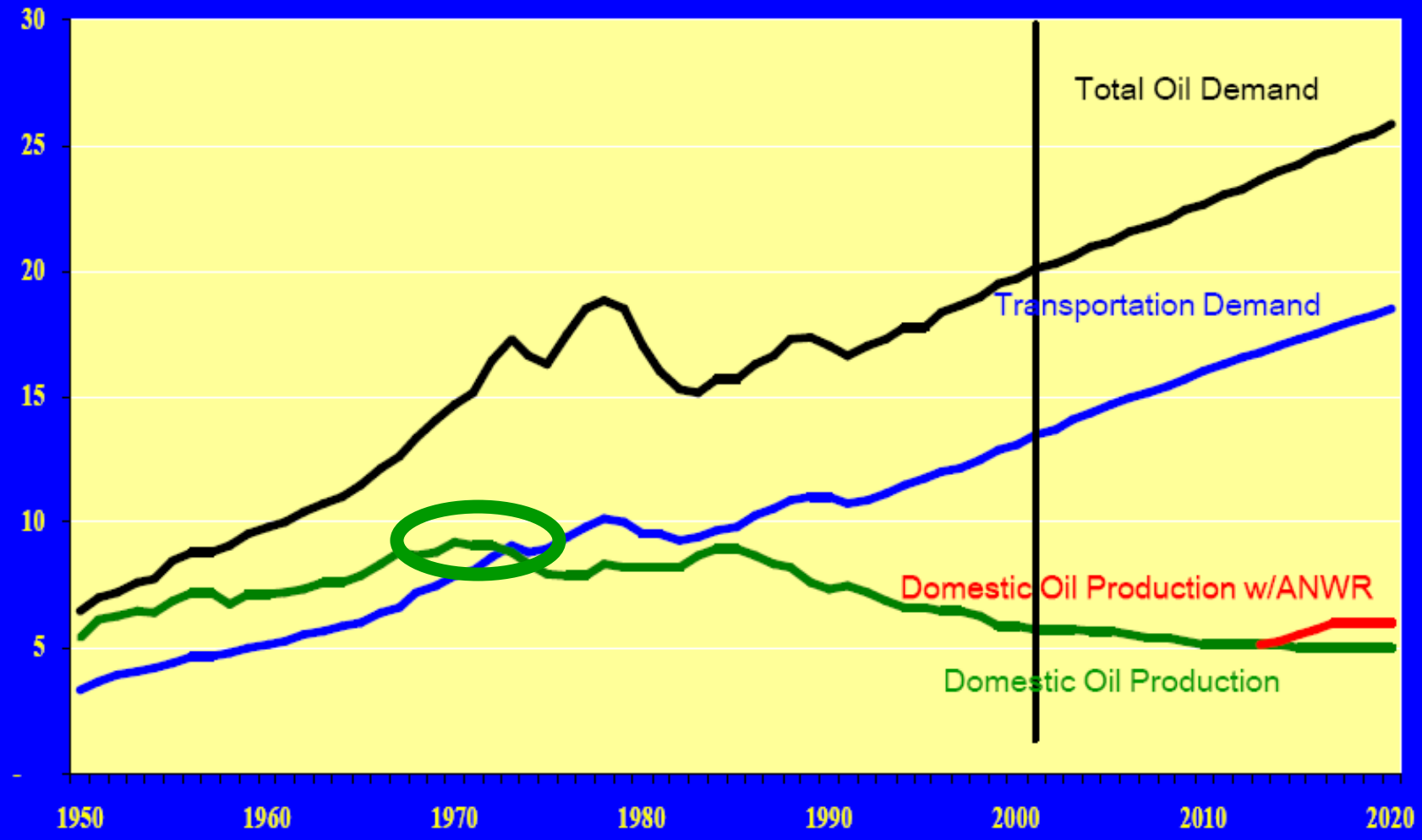
Preparing for the Post-Petroleum Era

The Original Hubbert Curve



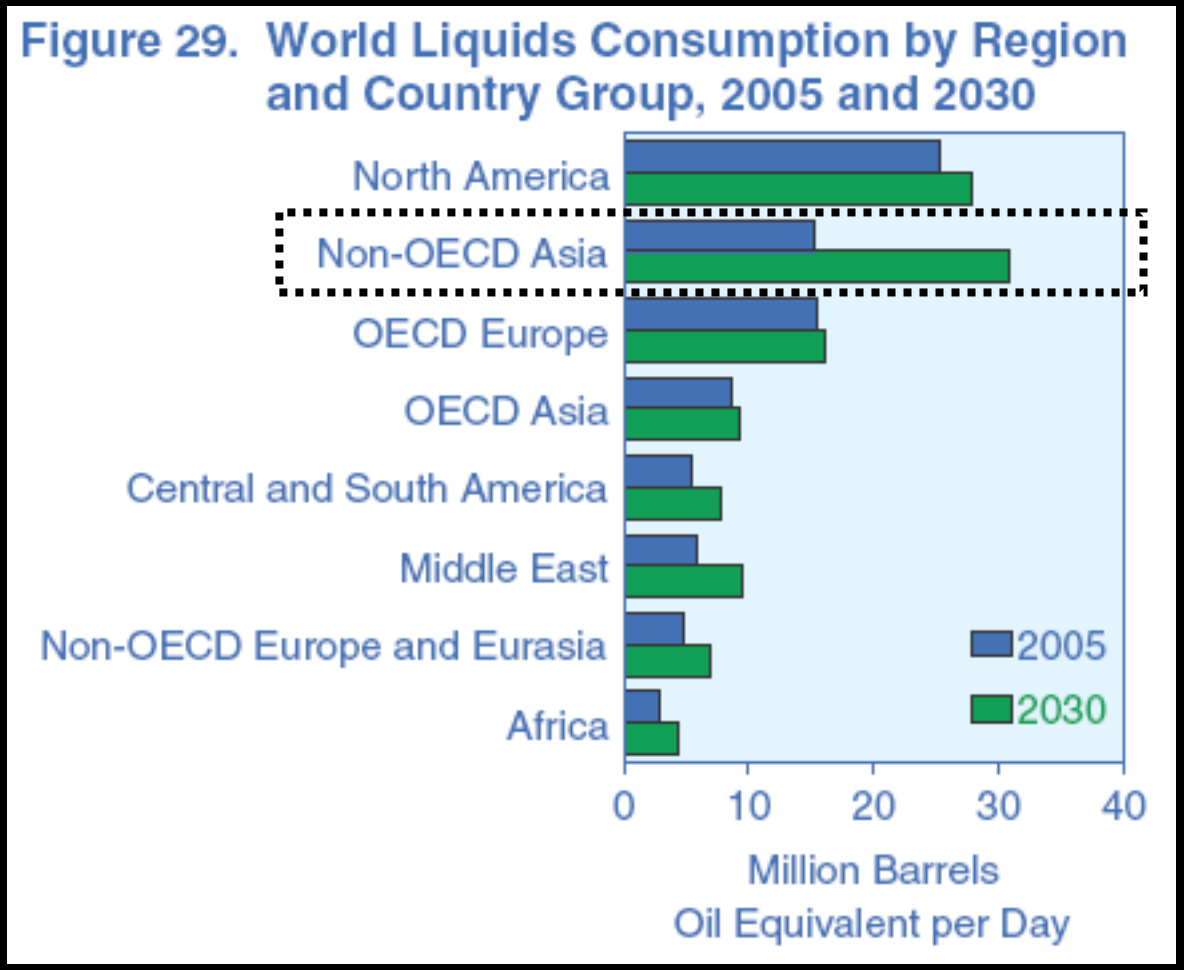

US Production (Crude Oil + Condensate)
Gb/Year
3.5
3
2.5
2
1.5
1
0.5
0
1900
1920
1940
1960
1980
2000
2020
Hubbert (1956)
Observed (EIA)

US Oil Consumption (million barrels per day)



EIA, Annual Energy Outlook 2001; "Potential Oil Production from the Coastal Plain of ANWR," - EIA Reserves & Production Division

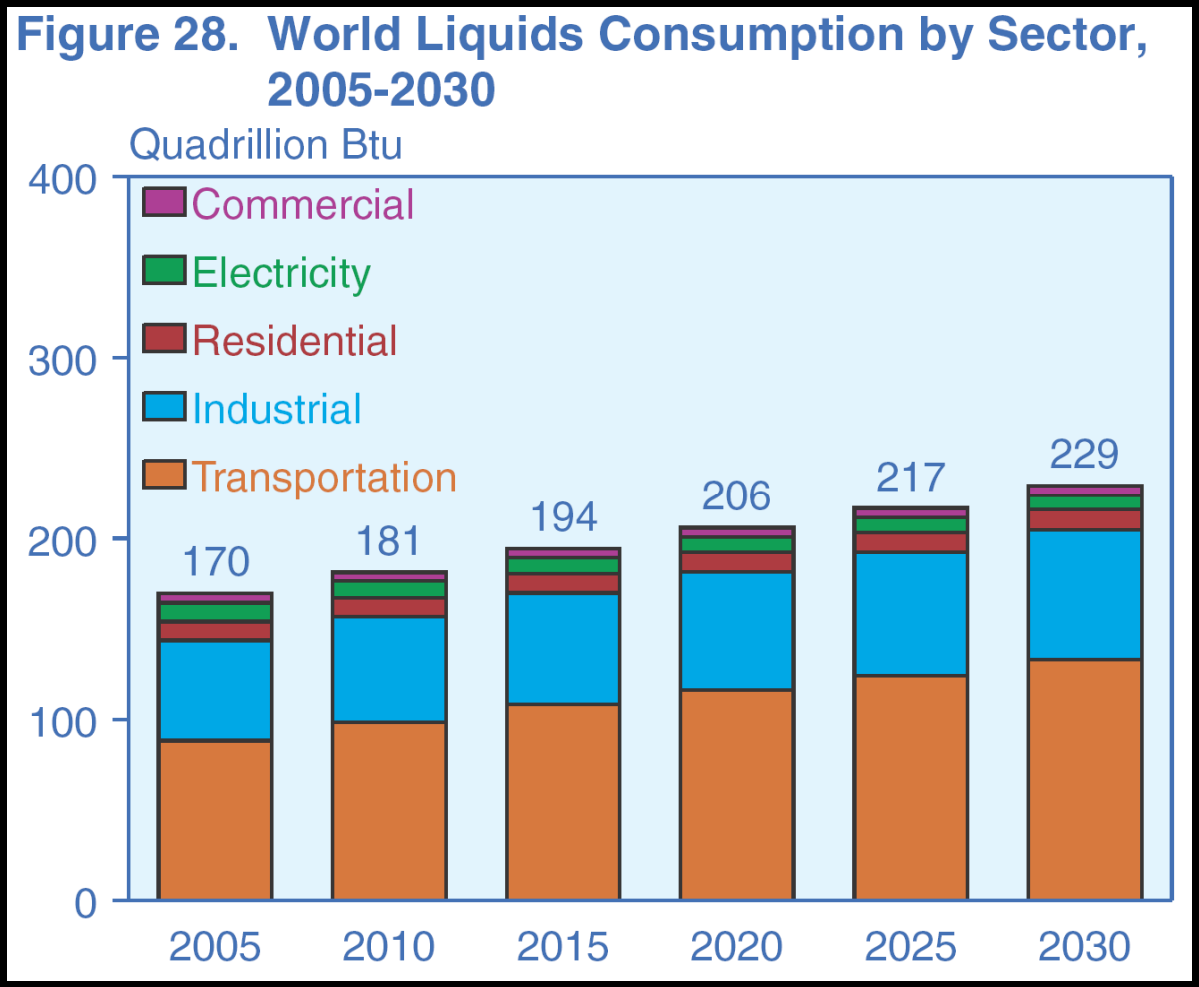
Growth by World Region



India and China will double their demand for petroleum by 2030

Source: United States Energy Information Administration, International Energy Outlook 2008, September 2008

Worldwide Growth in Demand



Transportation = 74% of increase in U.S. petroleum consumption

Source: United States Energy Information Administration, International Energy Outlook 2008, September 2008

We have not “run out of” oil

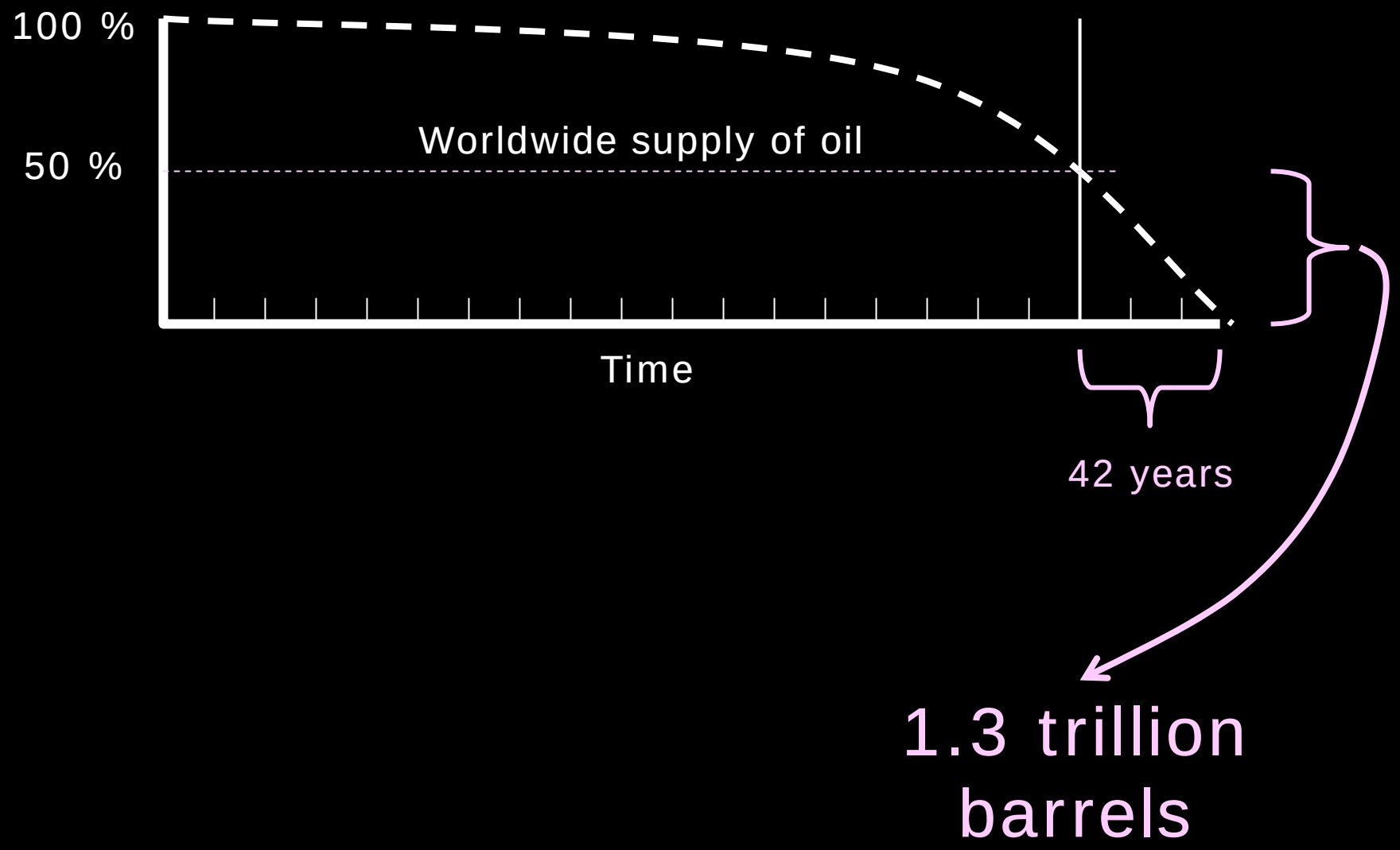
The stone age did not end…

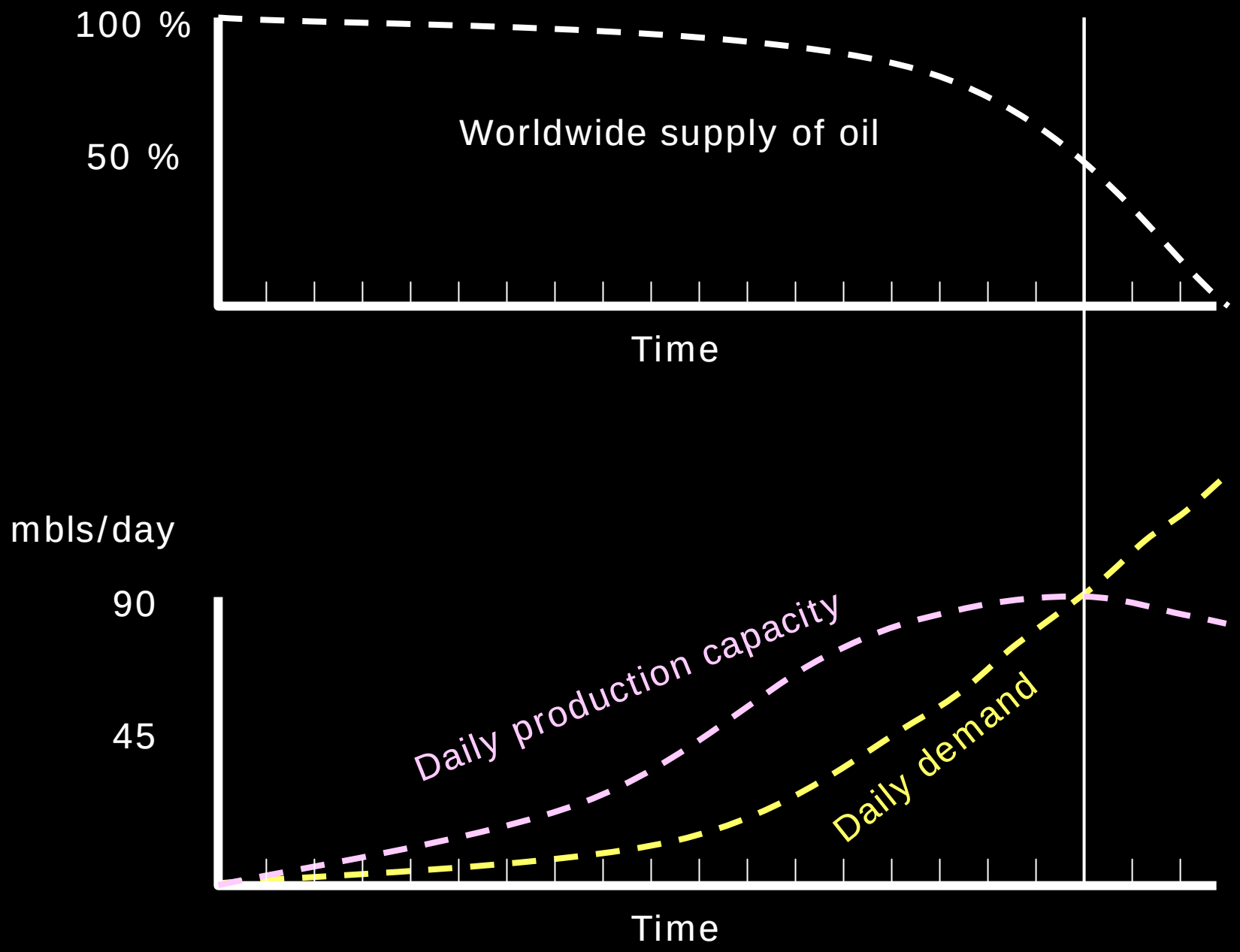
…because we ran out of stones

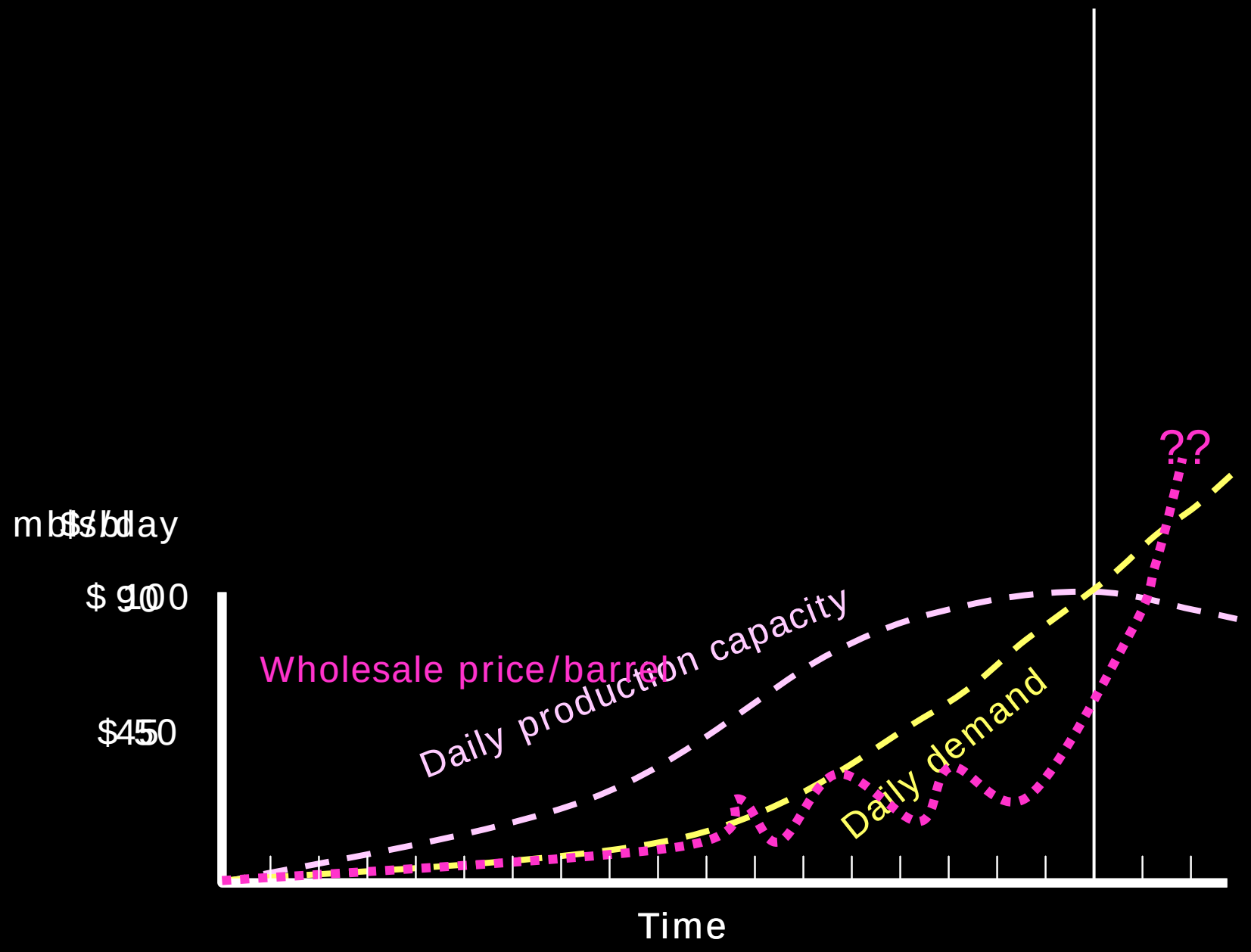
We are at the end of the age of…

…cheap oil…

…and the beginning of the Post-Petroleum era.


100 %
50 %
Worldwide supply of oil
Time
42 years
1.3 trillion barrels


100 %
50 %
Worldwide supply of oil
Time
mbls/day
90
45
Daily production capacity
Daily demand
Time

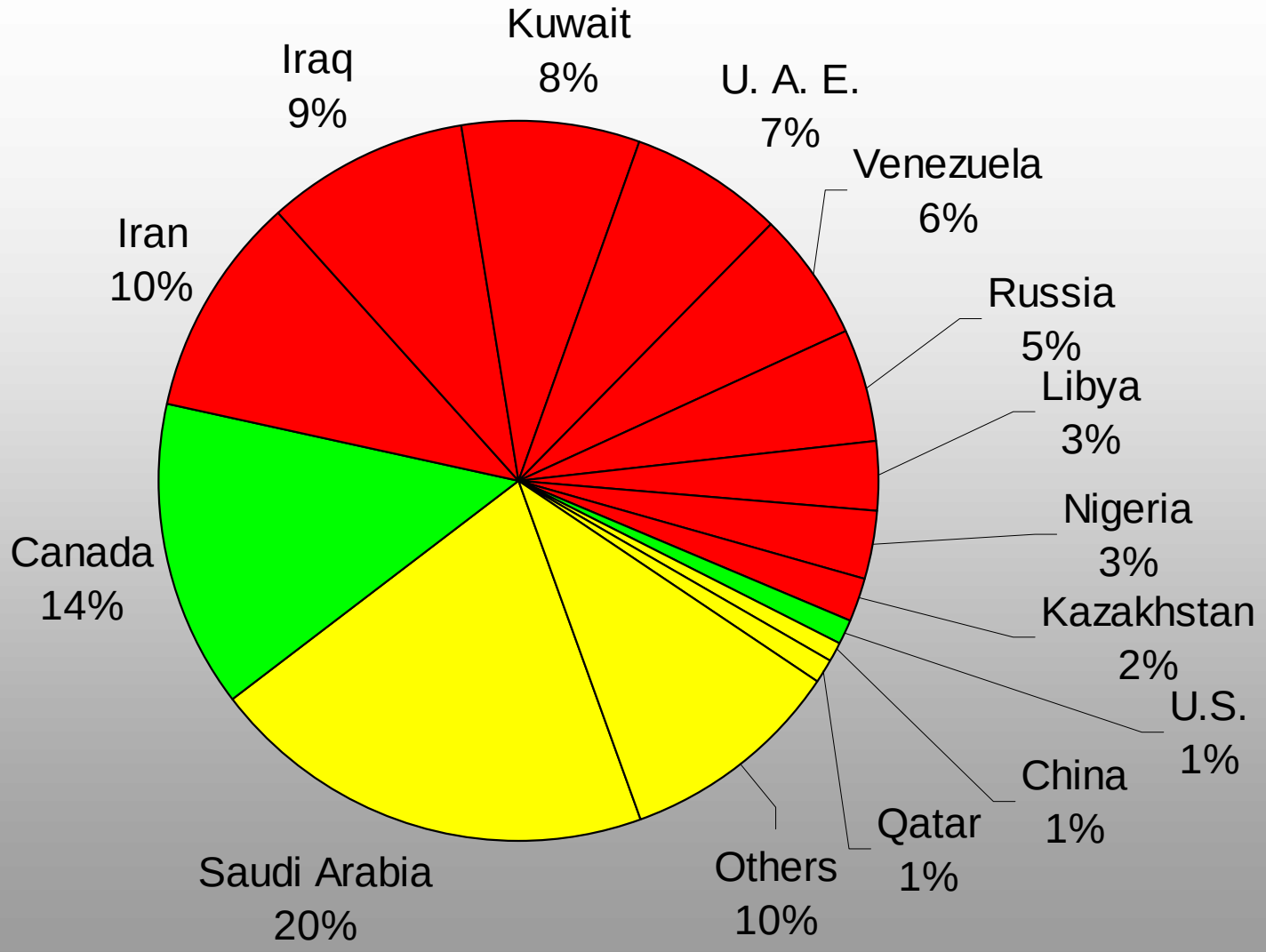


mbs/day
$ 100
$ 50
Wholesale price/barrel
Daily production capacity
Daily demand
??
Time

“Peak Oil”

- We are not “out of oil”
- But world-wide production capacity of petroleum-based fuels has peaked
- Demand will continue to rise
- Prices will rise <u>and</u>
- Prices will be unstable

Remaining Oil Reserves by Country



STABILITY OF U.S. RELATIONS

HIGH

15%

MODERATE

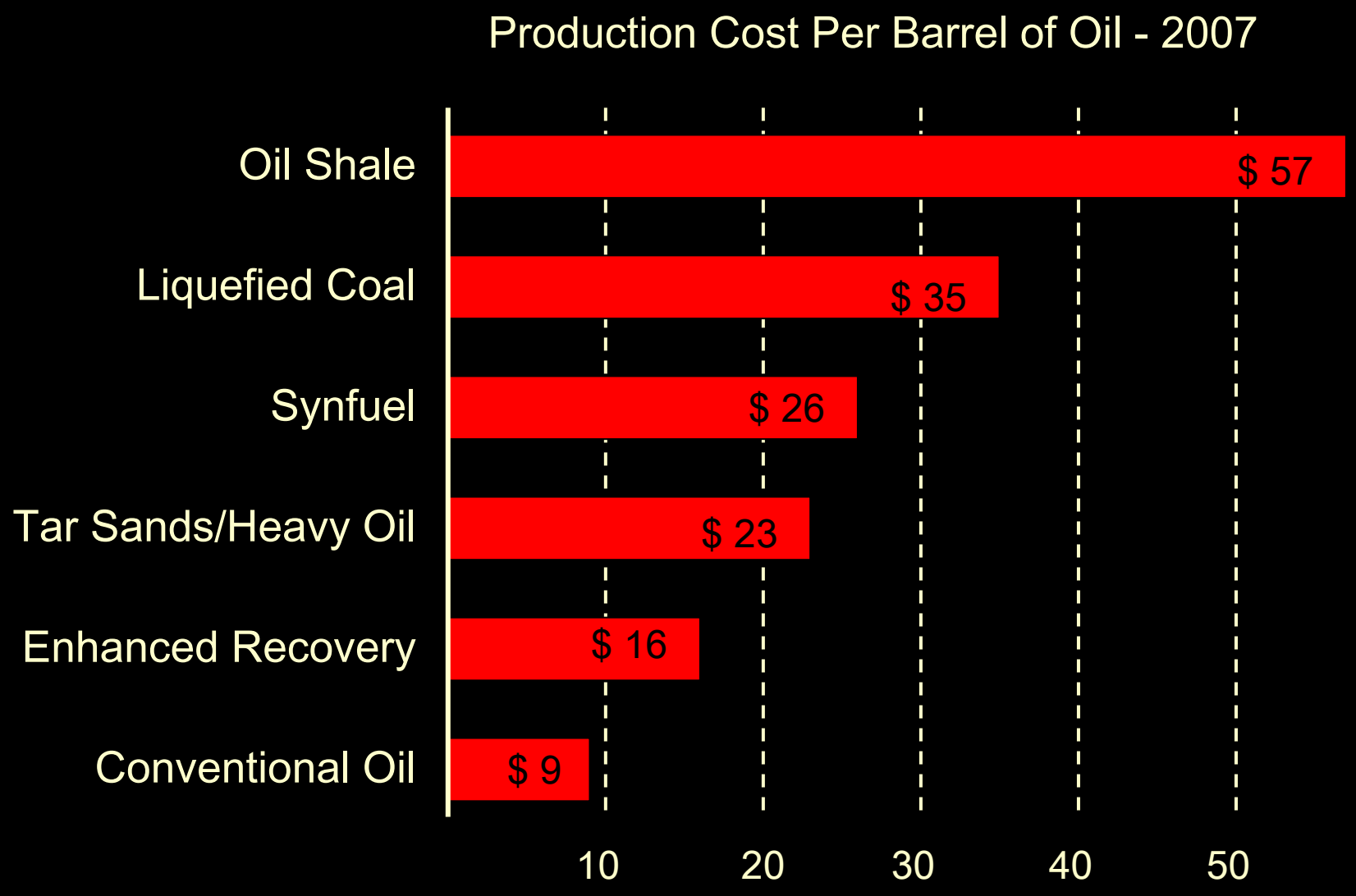
32%

LOW

53%

Source: Oil & Gas Journal

Production Cost – Sources of Oil



Source: Brandt & Farrell, UC Berkeley

Powering Mobility with Oil

- Most (> 75%) of the money you spend on gasoline leaves the state
- This is a financial drain that slows economic growth

Bottom Line:

Preparing for the Post-Petroleum Era

1. Carbon-based energy will be more expensive & prices will fluctuate
2. Carbon-dependent economies will be at a disadvantage
3. Suburban Oregon is highly carbon-dependent

Managing Climate Change

Potential Responses to Climate Change

- Ignore
- Mitigate
- Adapt

U.S. Greenhouse Gases

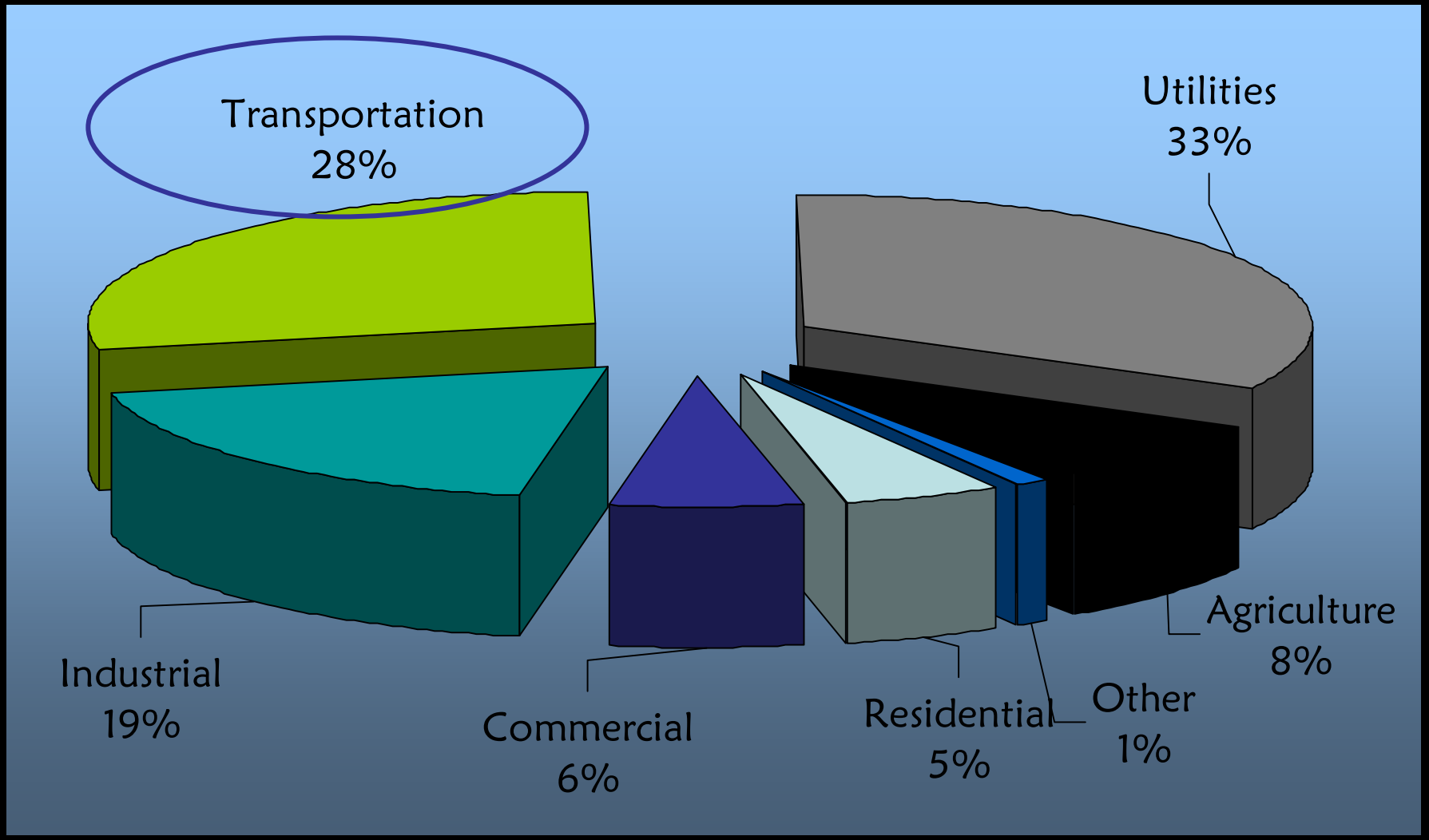
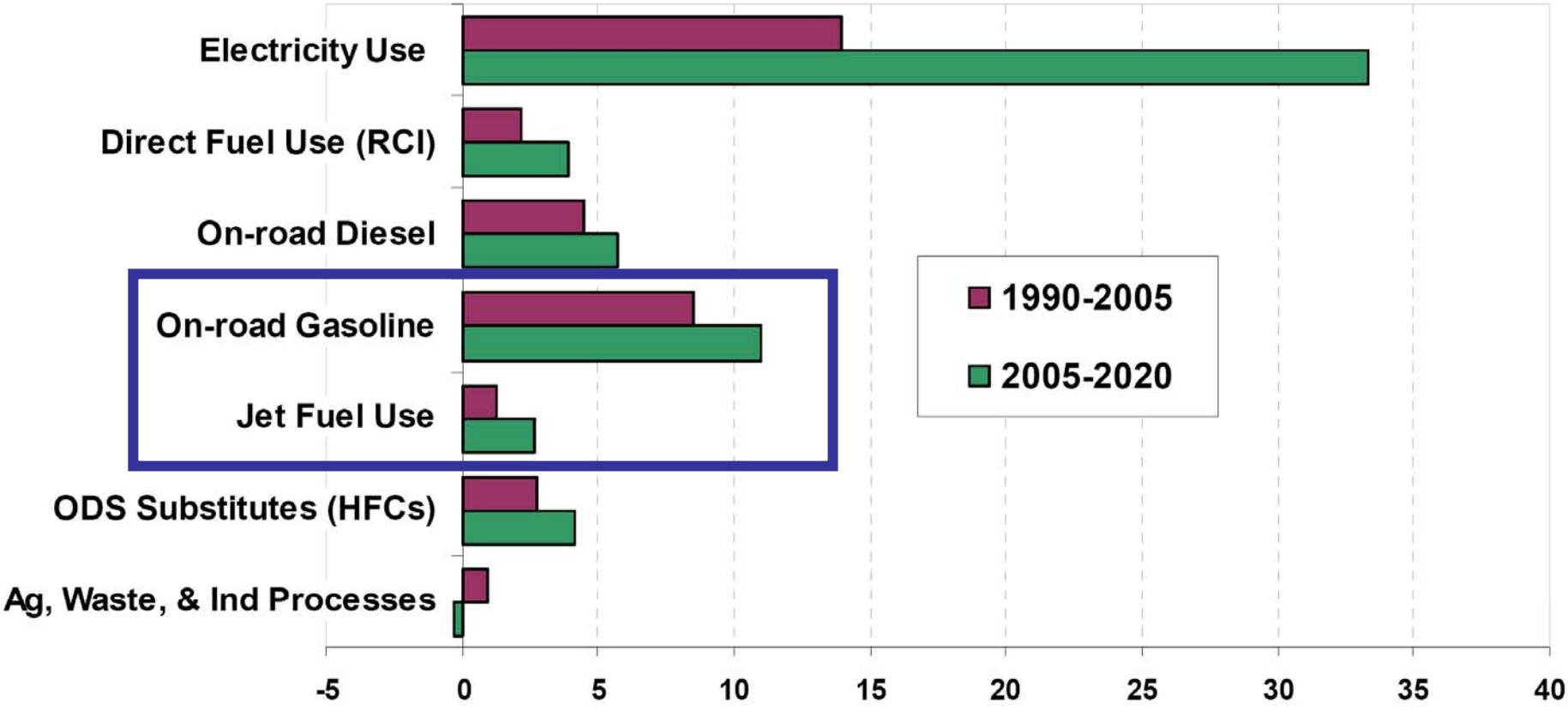
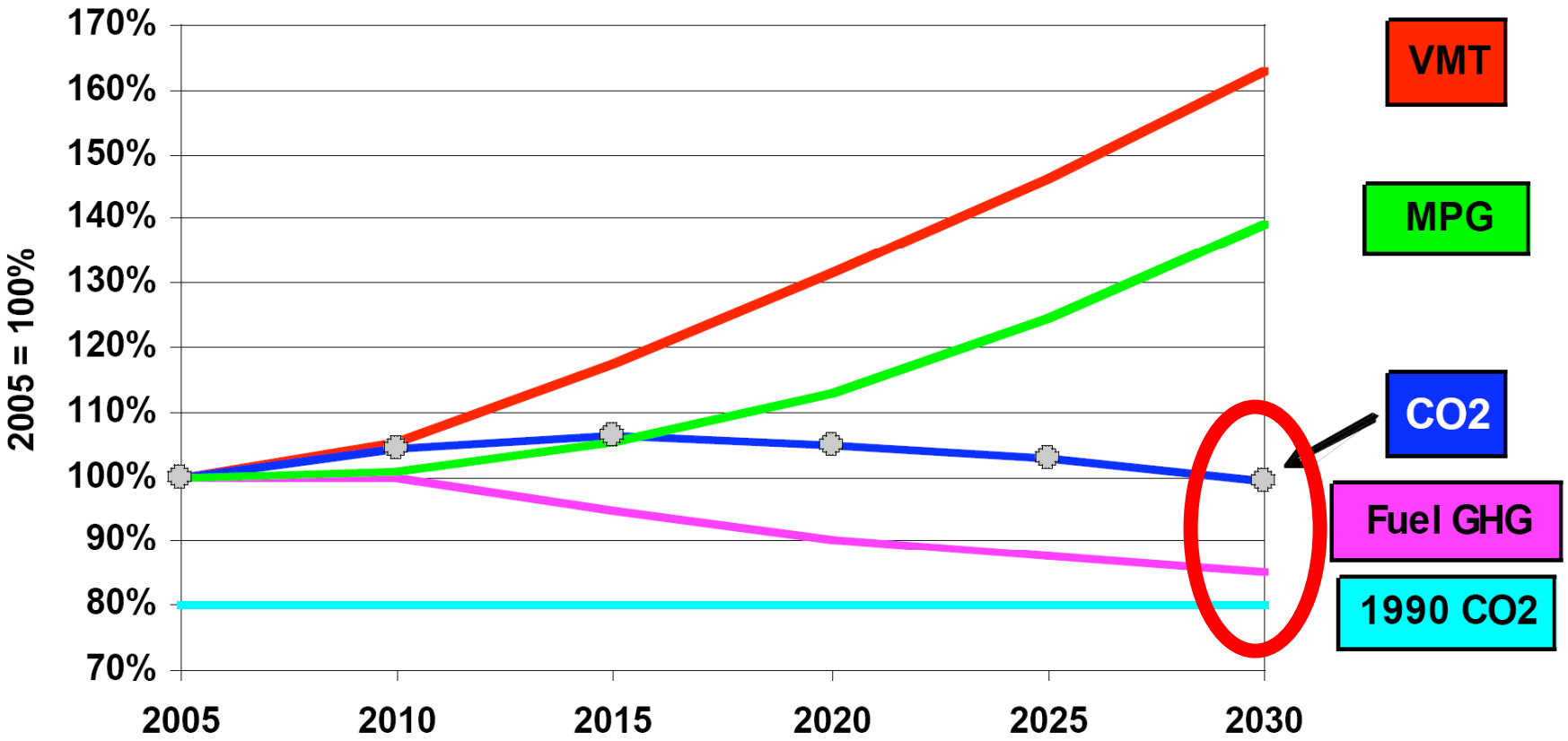


Figure 4. Contributions to Emissions Growth, 1990-2020: Reference Case Projections (MMTCO2e)



Reducing Emissions at the Tailpipe Will Not Be Enough



Sources: VMT: EIA with 10% rebound, MPG & Fuel: Trend Extrapc

Center for Clean Air Policy

California's Approach to Transportation GHG

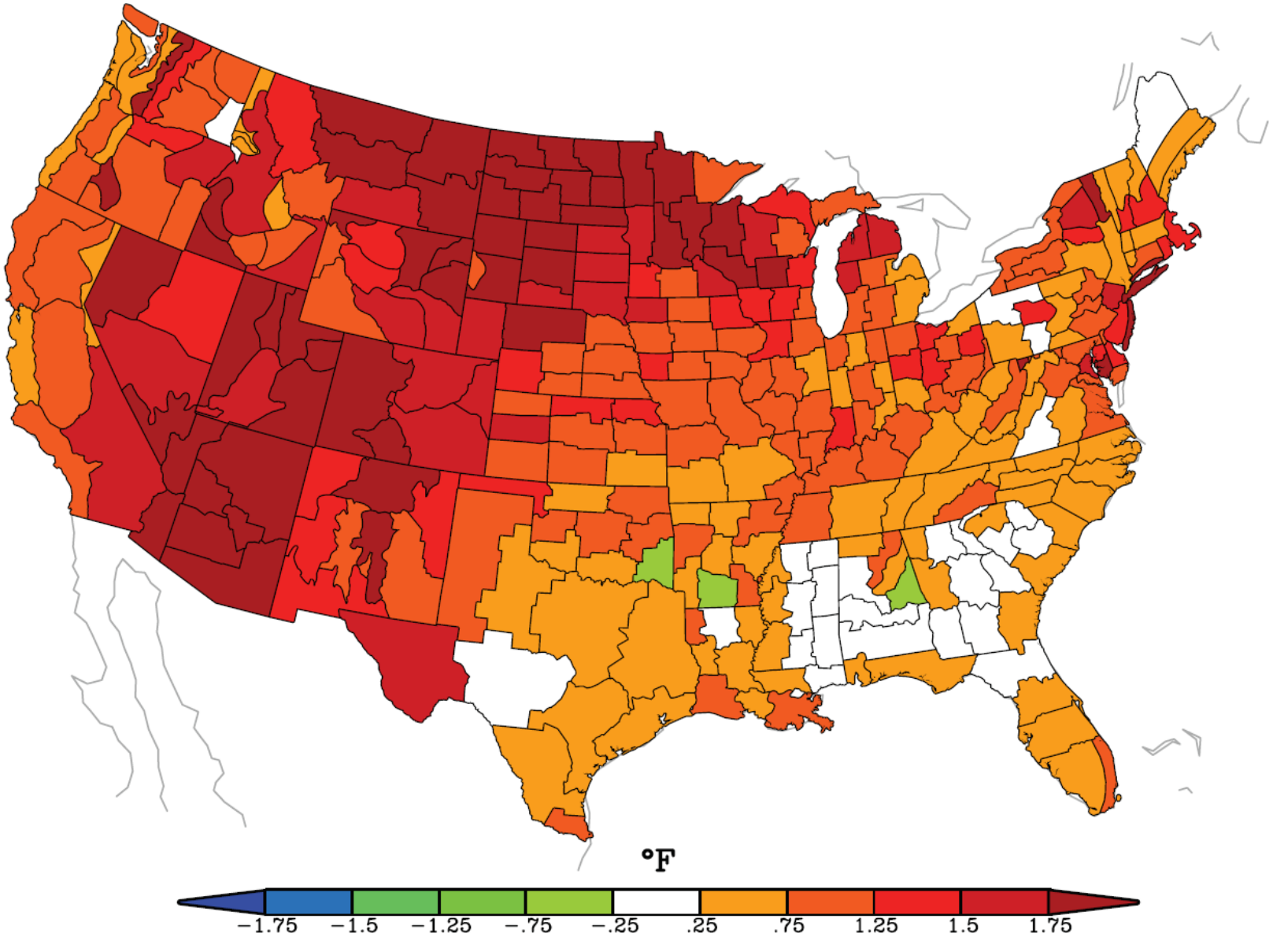
	Vehicle Technology		Fuels		Vehicle Use
Transp. GHG =	$\frac{\text{GHG}}{\text{Mile}}$	,	$\frac{\text{GHG}}{\text{Gallon}}$	,	VMT
	AB 1493 Regulation		Low-Carbon Fuel Standard		SB 375

California ARB

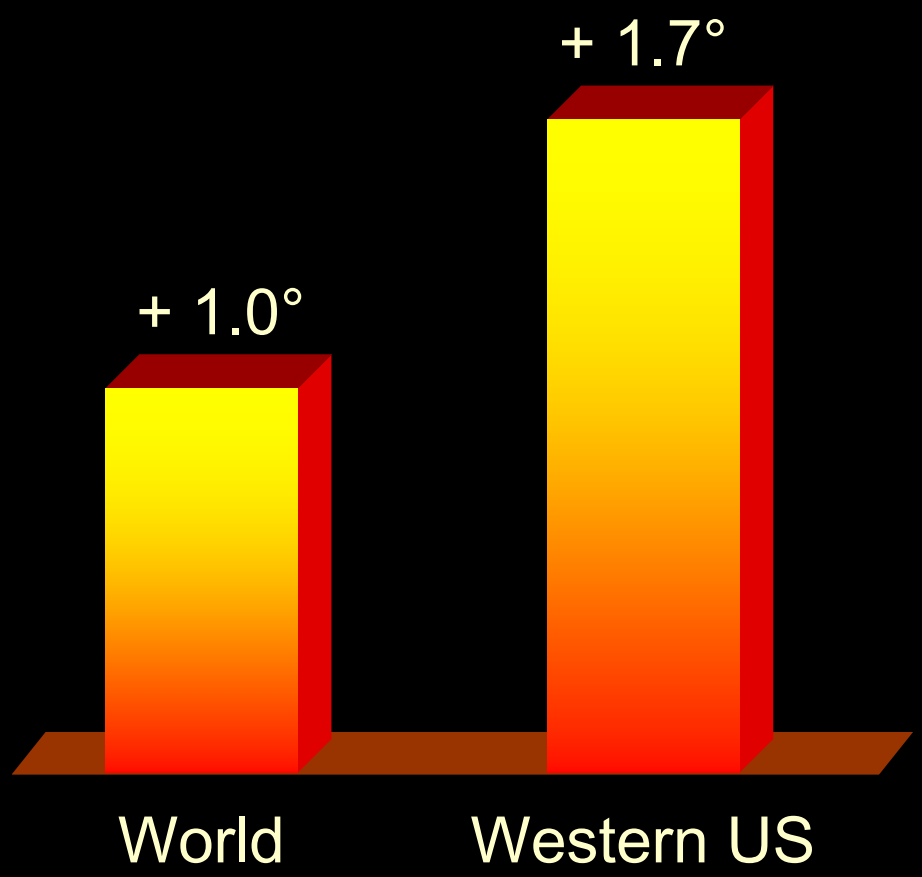
Potential Responses to Climate Change

- ~~Ignore~~
- Mitigate
- Adapt

Figure 3. The Interior West: Epicenter of Warming in the Contiguous U.S. (2000 - 2007 Average Temperatures Compared to 20th Century Averages)



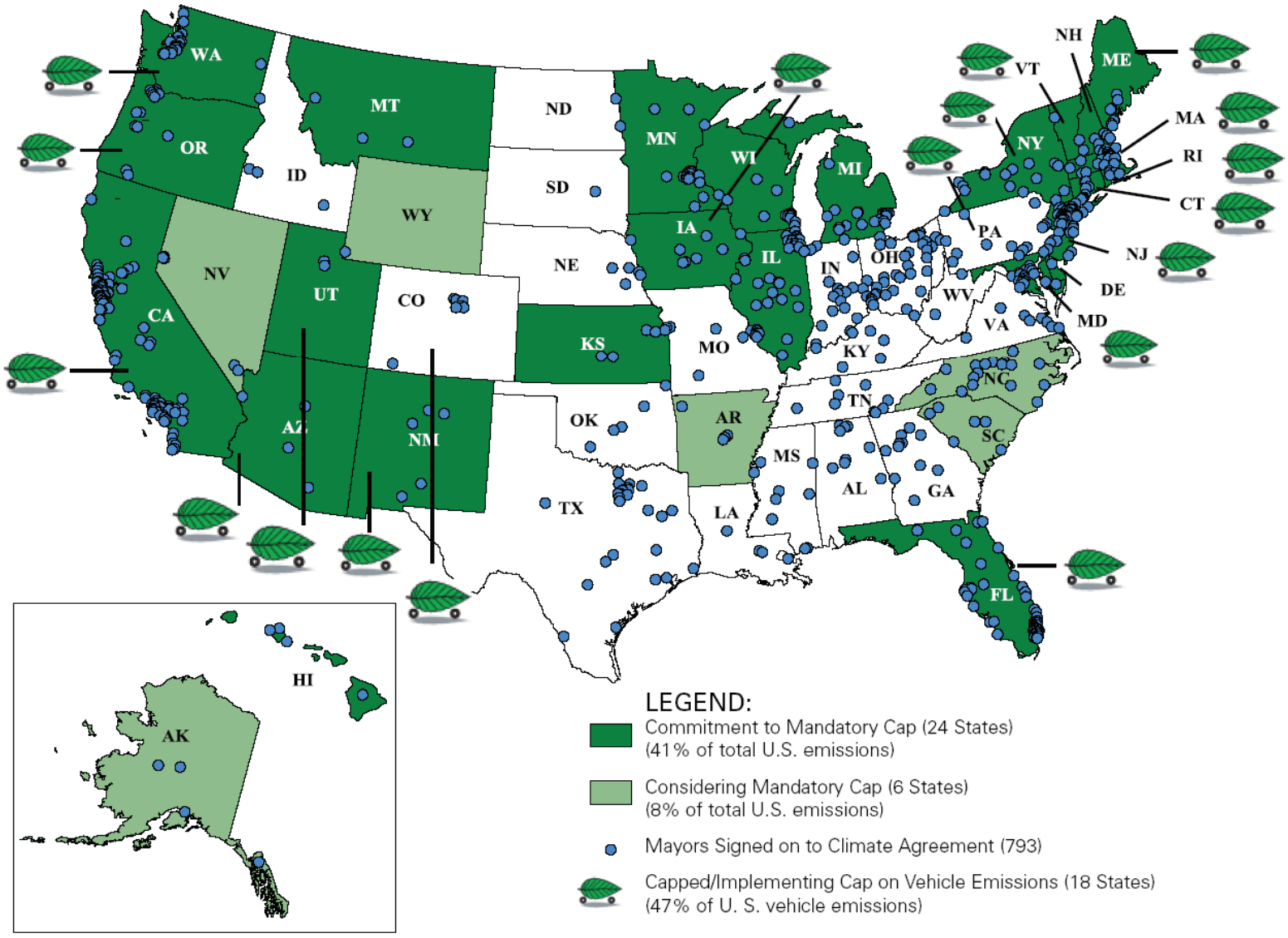
Ambient Temperature Change 1980 – 2007 (° F)



The dead and dying red trees show how completely mountain pine beetles are killing the lodgepole pines in this Colorado forest.

RON COUSINEAU, COLORADO STATE FOREST SERVICE

Figure 6. The Rising Tide for Global Warming Solutions



Climate Change

- Bottom Line:
  1. We Must Mitigate GHG Emissions

     [this will be driven by regulations]
  2. We Must Adapt to Climate Change

     [this will be driven by politics]
  3. A Late Start is a Bad Idea

     [the magnitude of these issues will be exponential over time]

Active Living & Public Health

This is what we do…

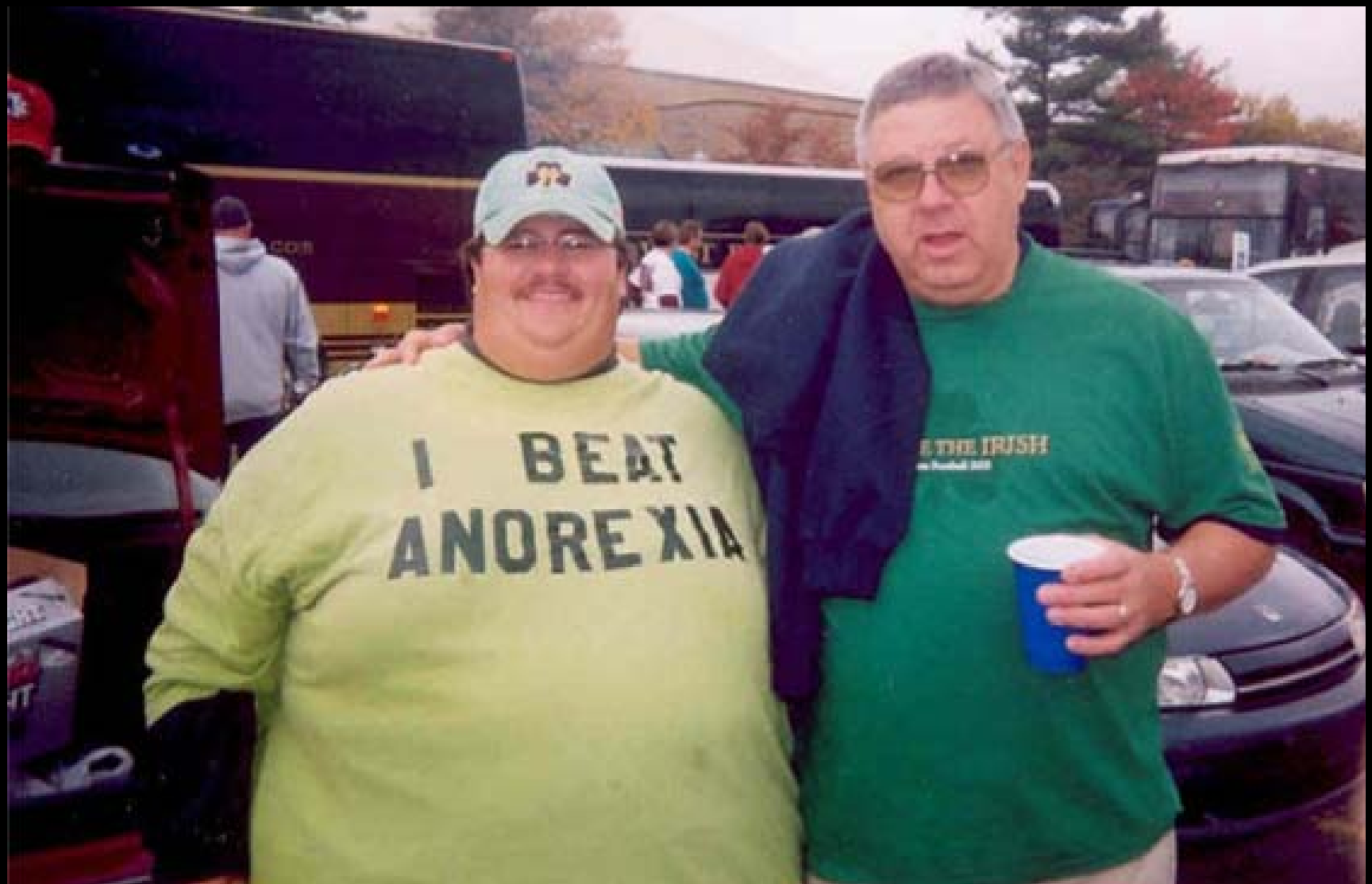
…but it is not who we are.

This is who we are:

- **Recently descended from nomadic hunter/gatherers**
- **Who walked extensively… and burned lots of calories**

Human History

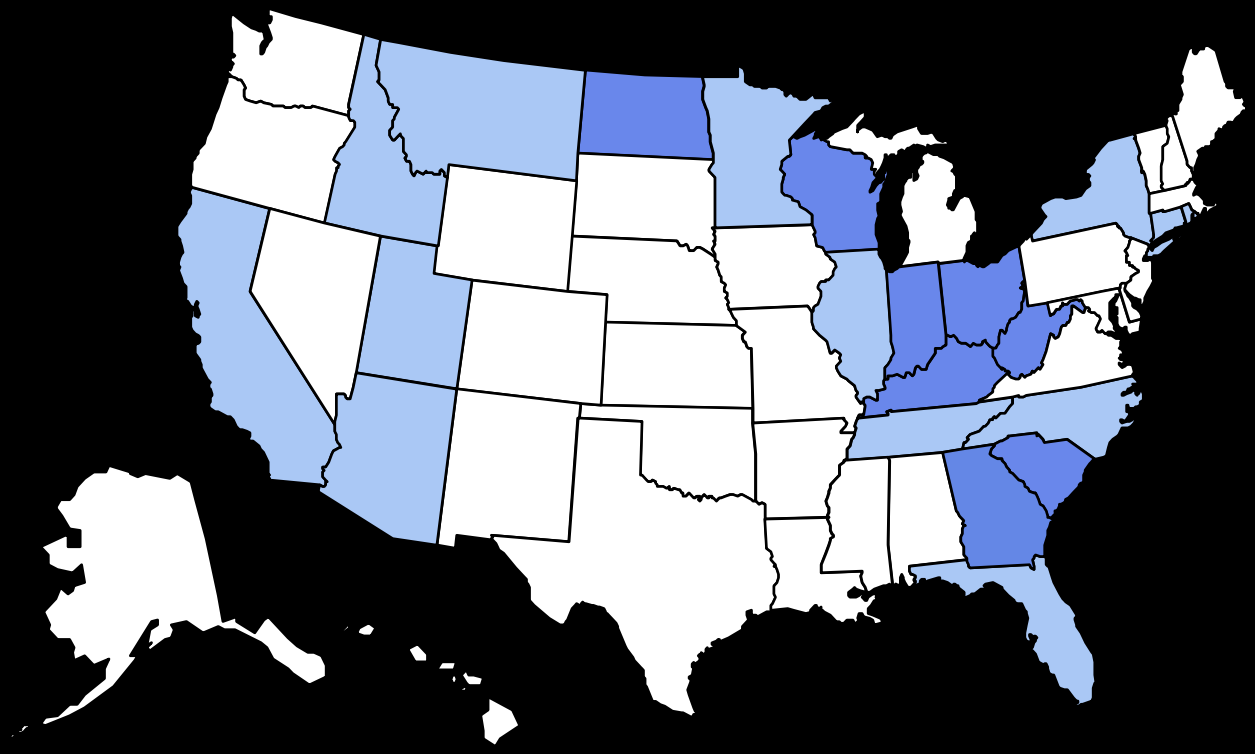
We cannot escape our DNA…



…no matter how hard we try

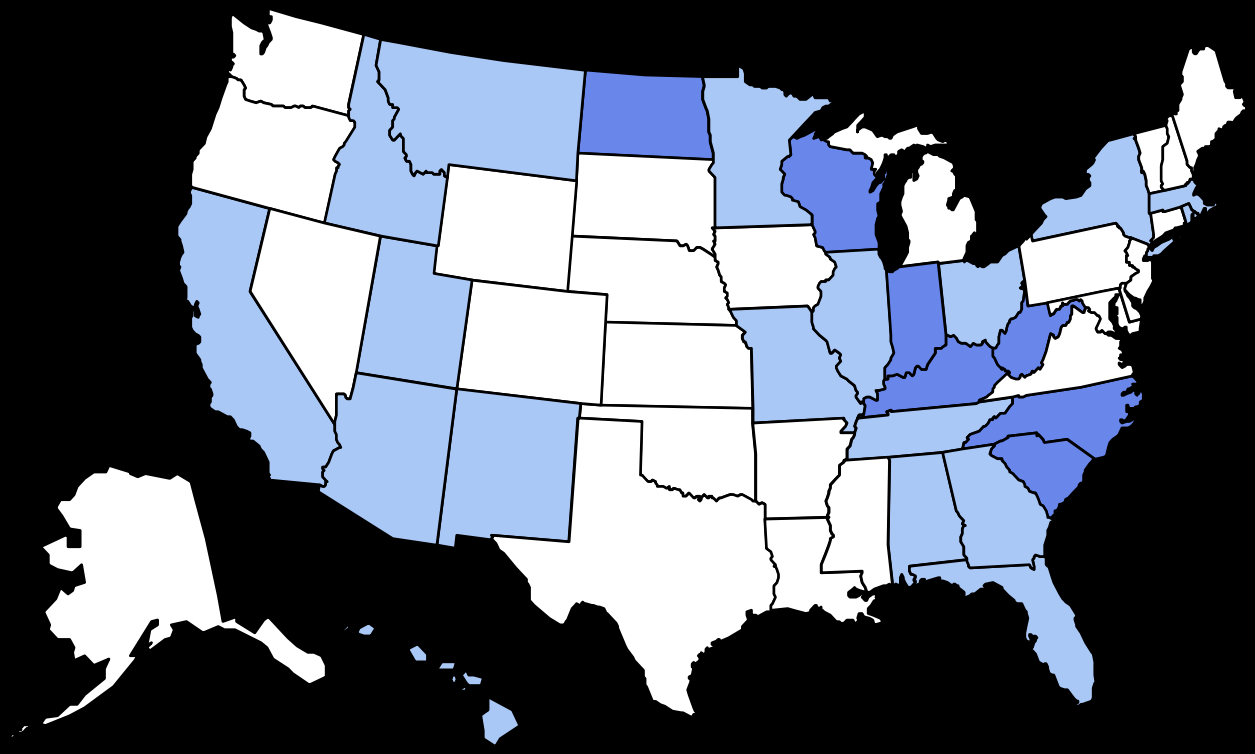
1985

Obesity Trends Among U.S. Adults



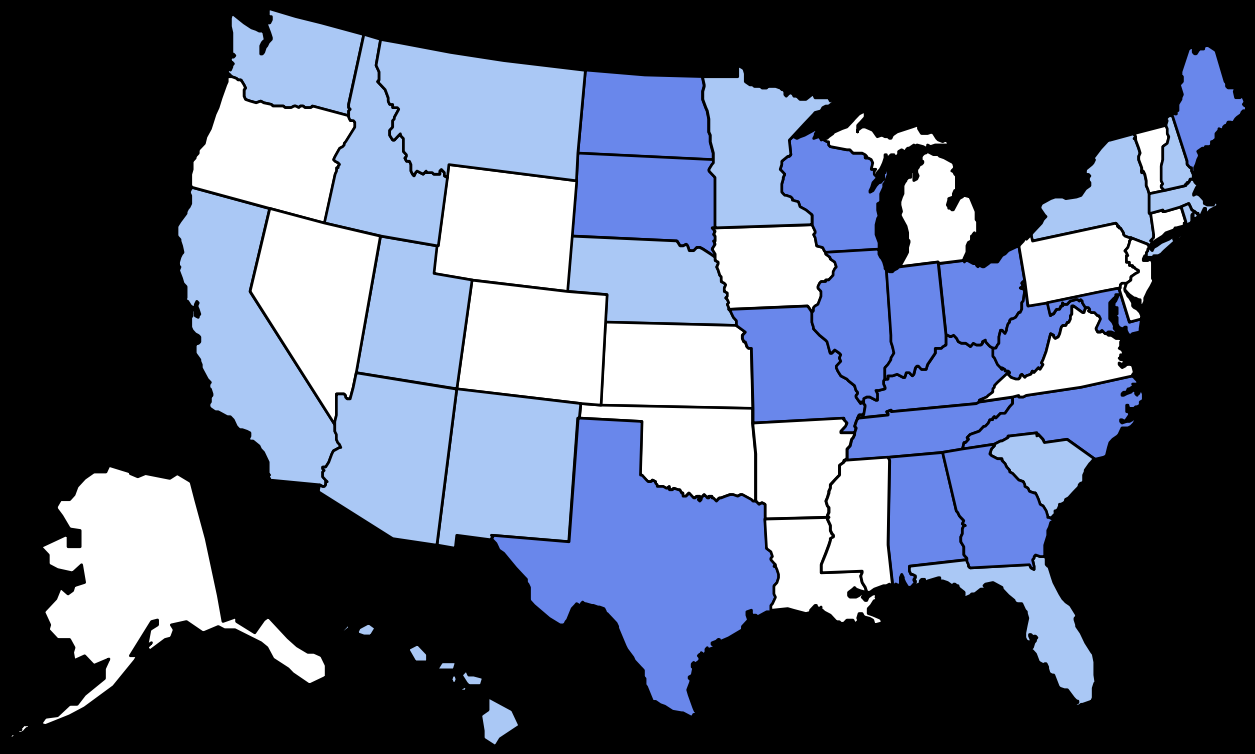
No Data | <10% | 10%–14%

1986



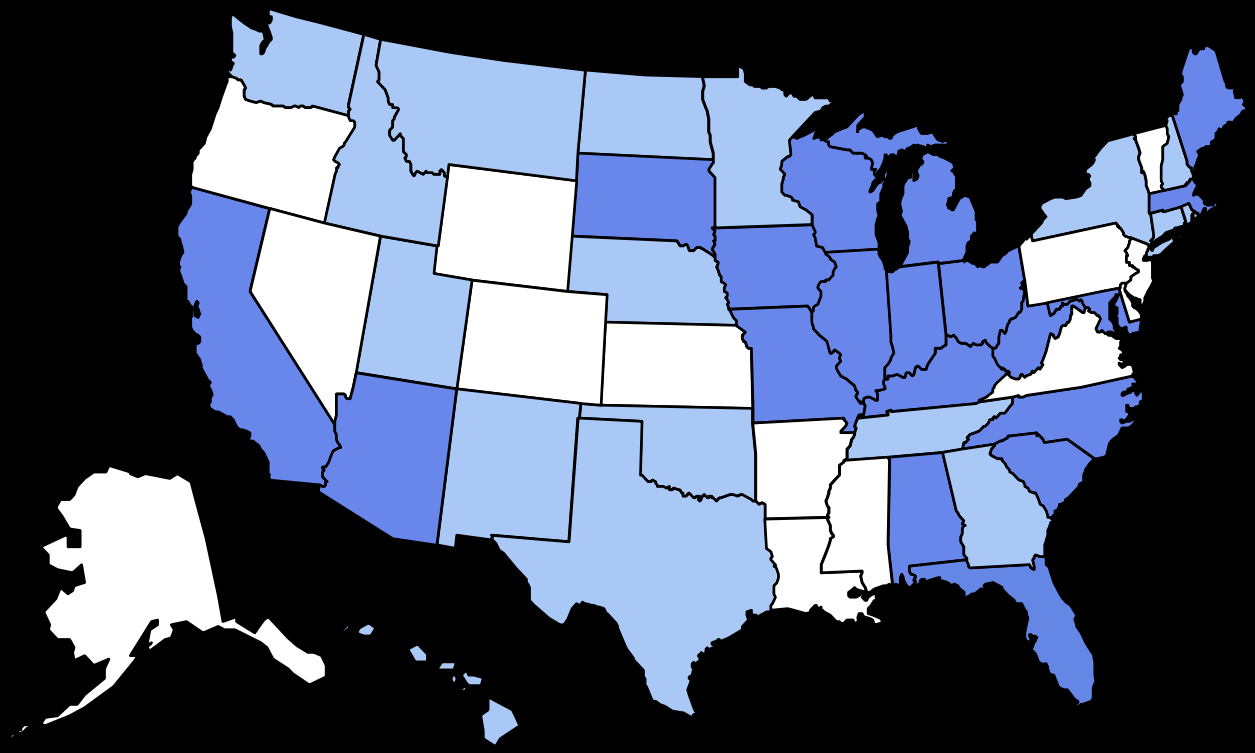
No Data | <10% | 10%–14%

1987



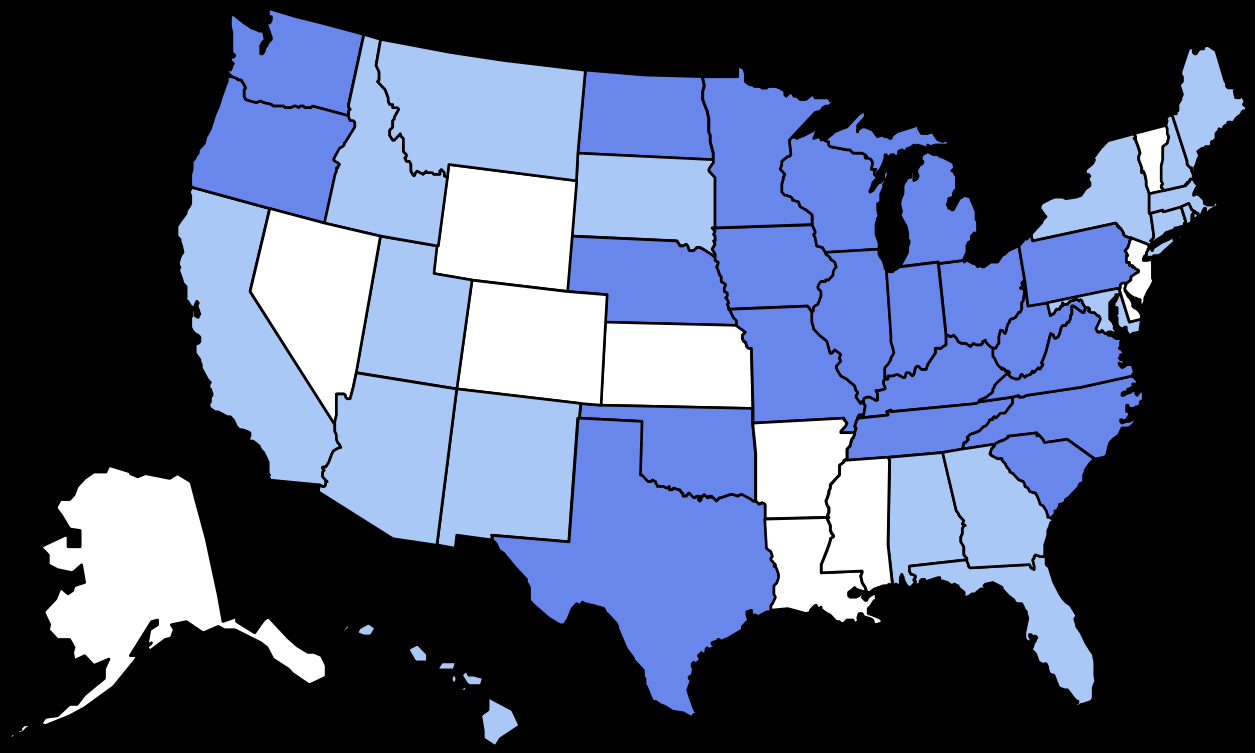
No Data <10% 10%–14%

1988



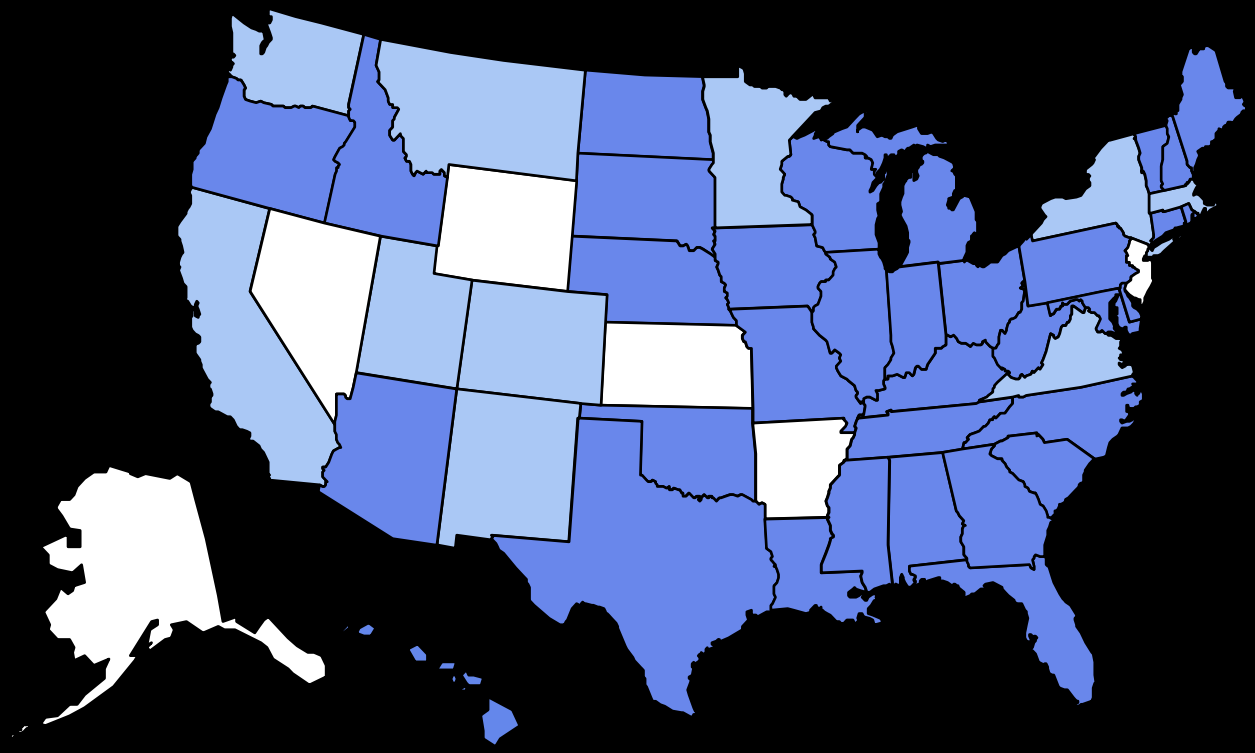
No Data | <10% | 10%–14%

1989



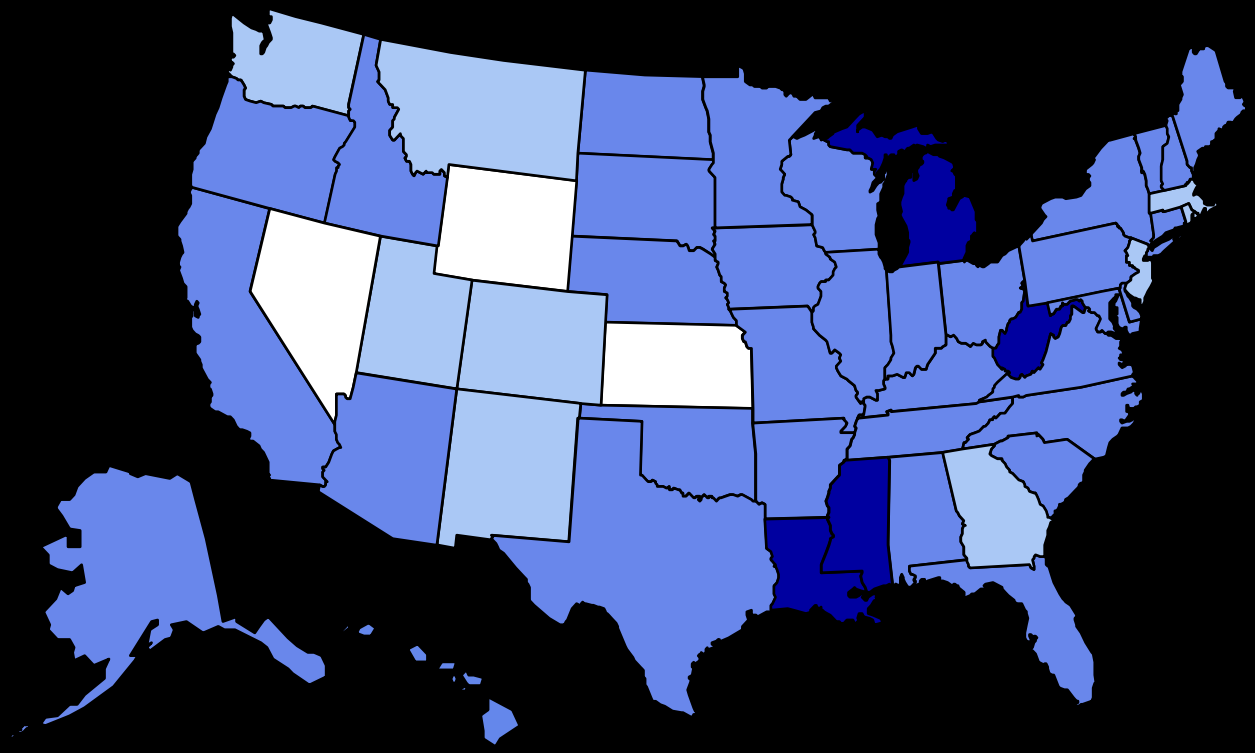
No Data | <10% | 10%–14%

1990



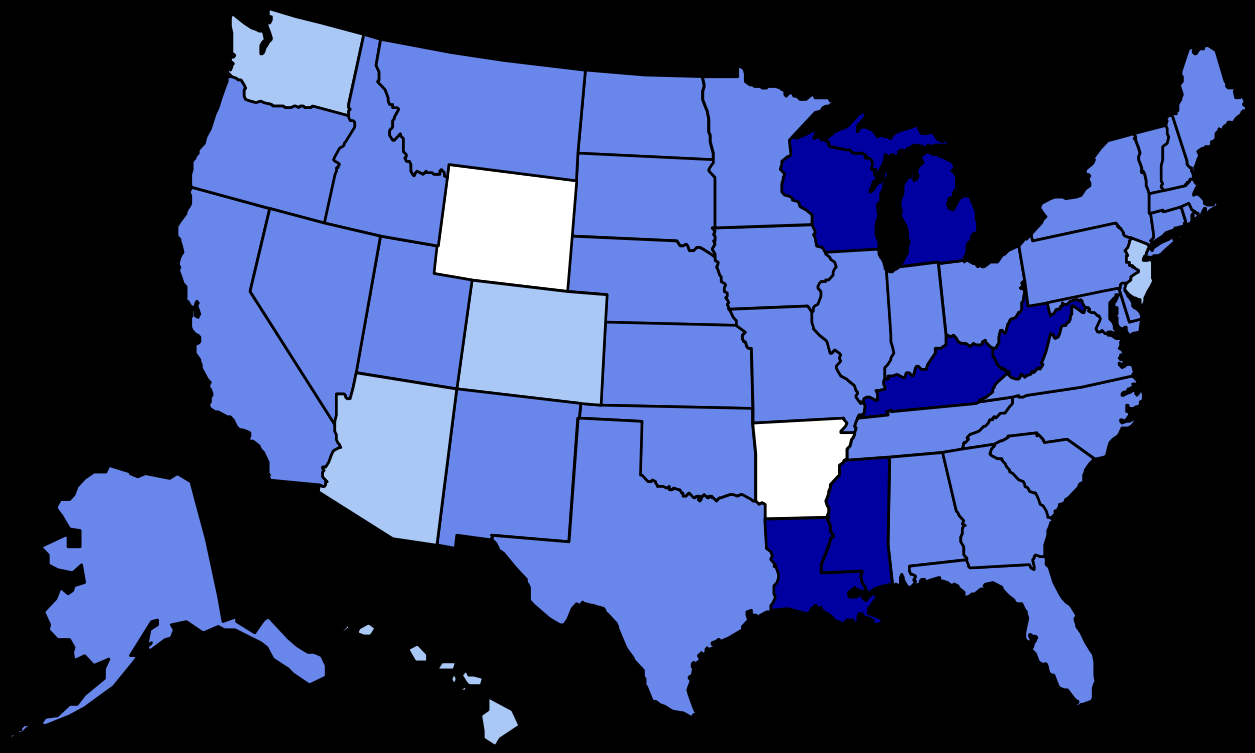
No Data <10% 10%–14%

1991



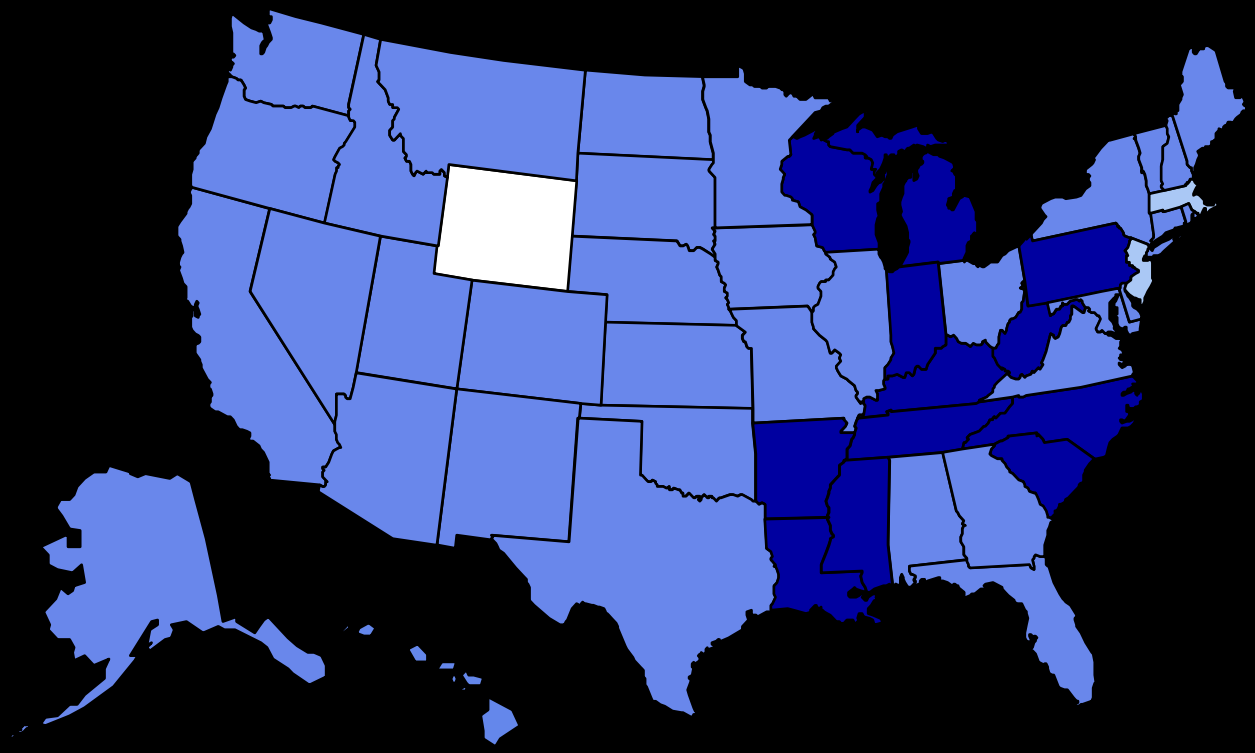
No Data | <10% | 10%–14% | 15%–19%

1992



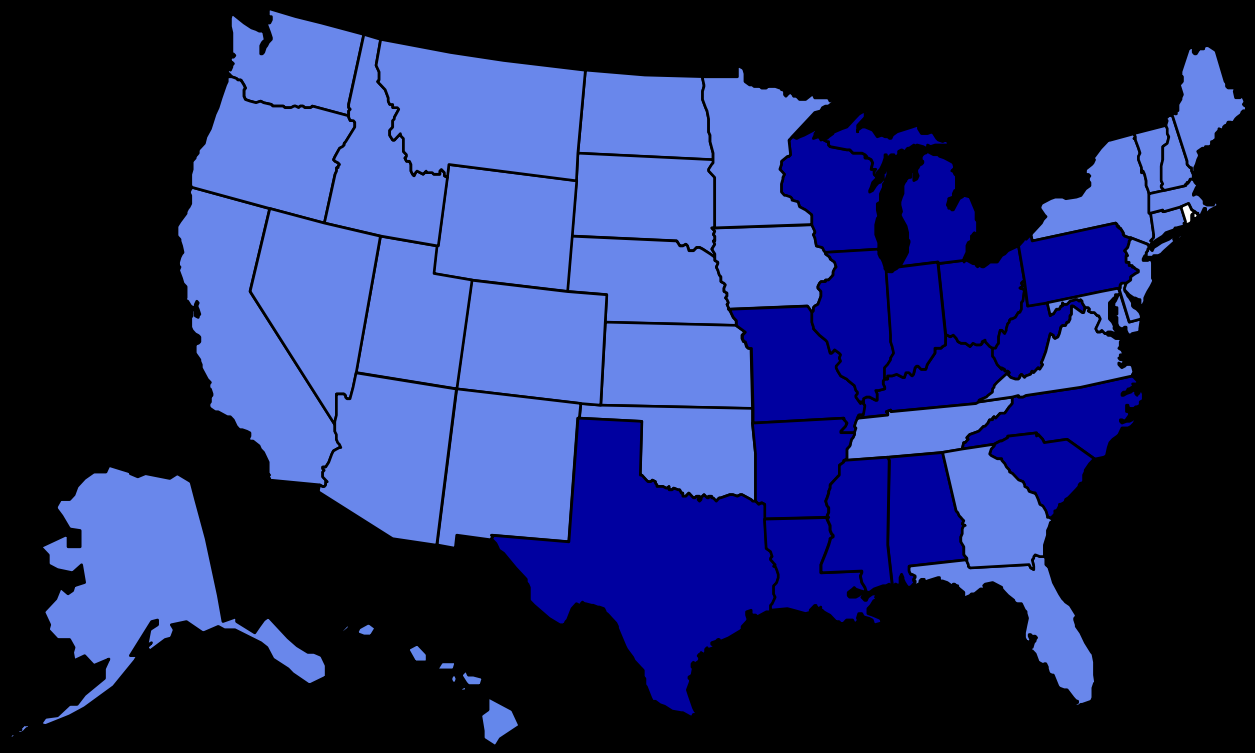
No Data | <10% | 10%–14% | 15%–19%

1993



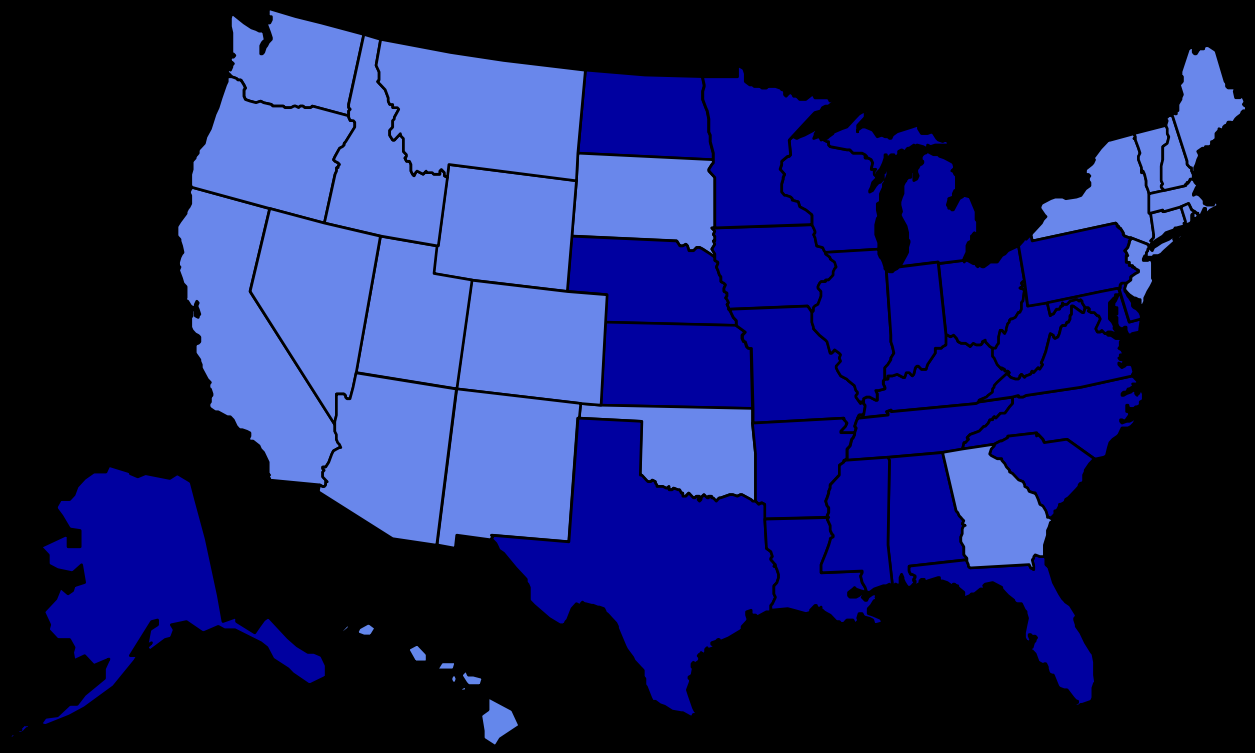
No Data | <10% | 10%–14% | 15%–19%

1994



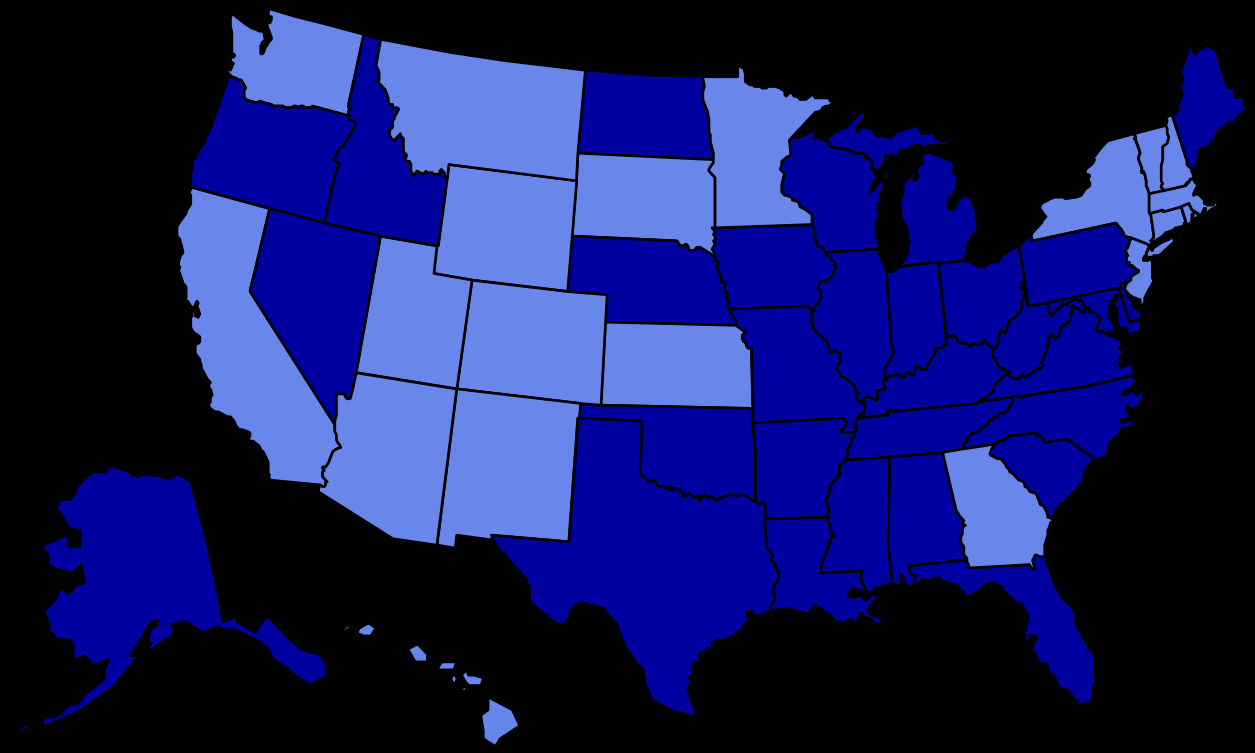
No Data | <10% | 10%–14% | 15%–19%

1995



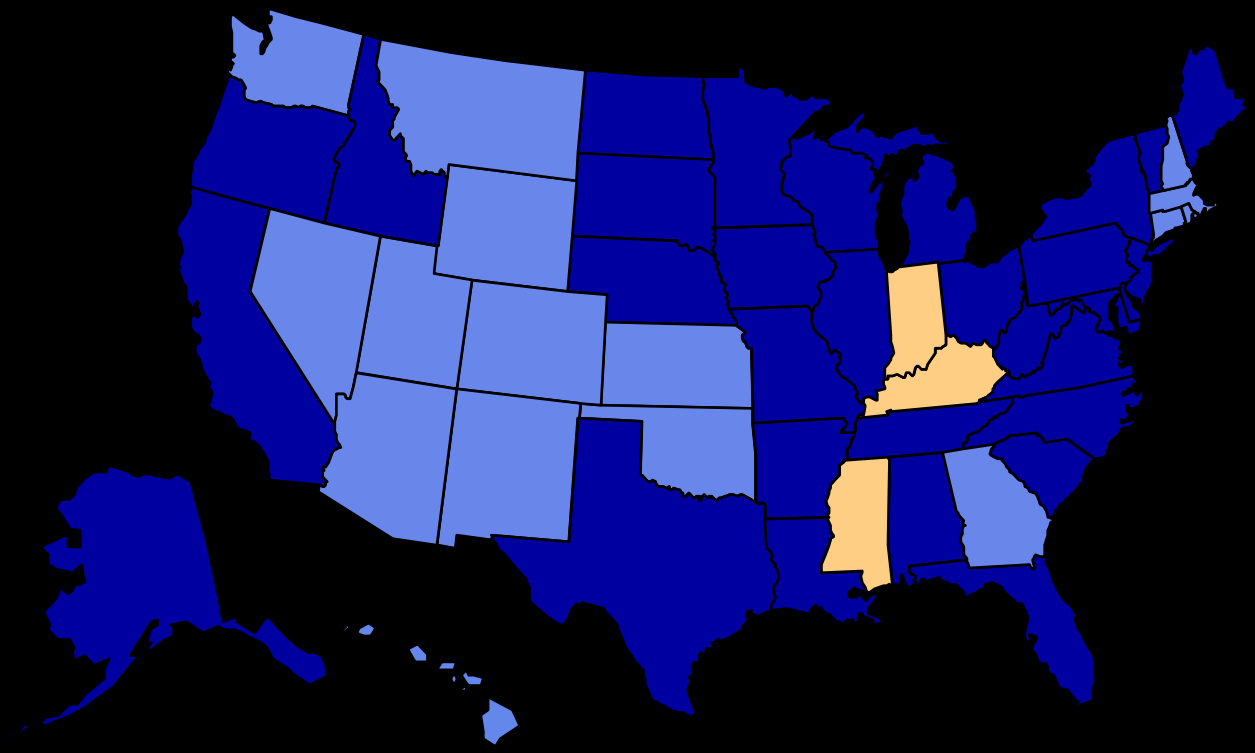
No Data | <10% | 10%–14% | 15%–19%

1996



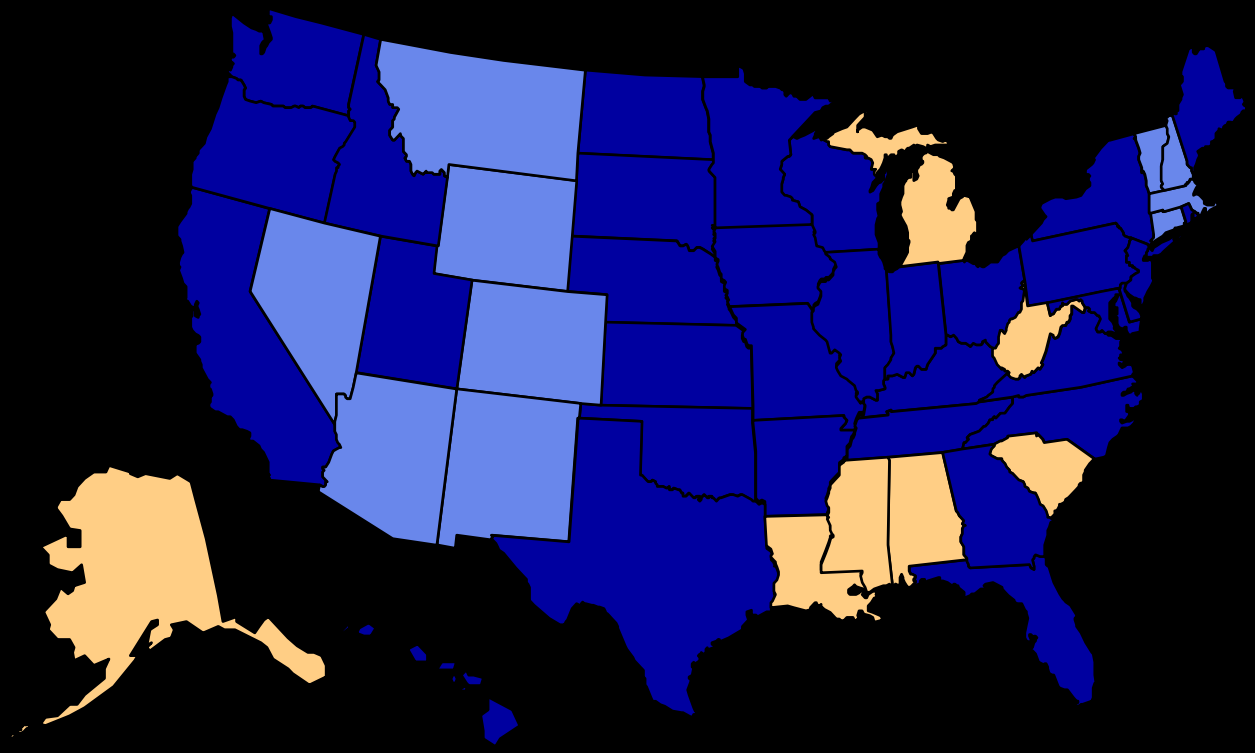
No Data | <10% | 10%–14% | 15%–19%

1997



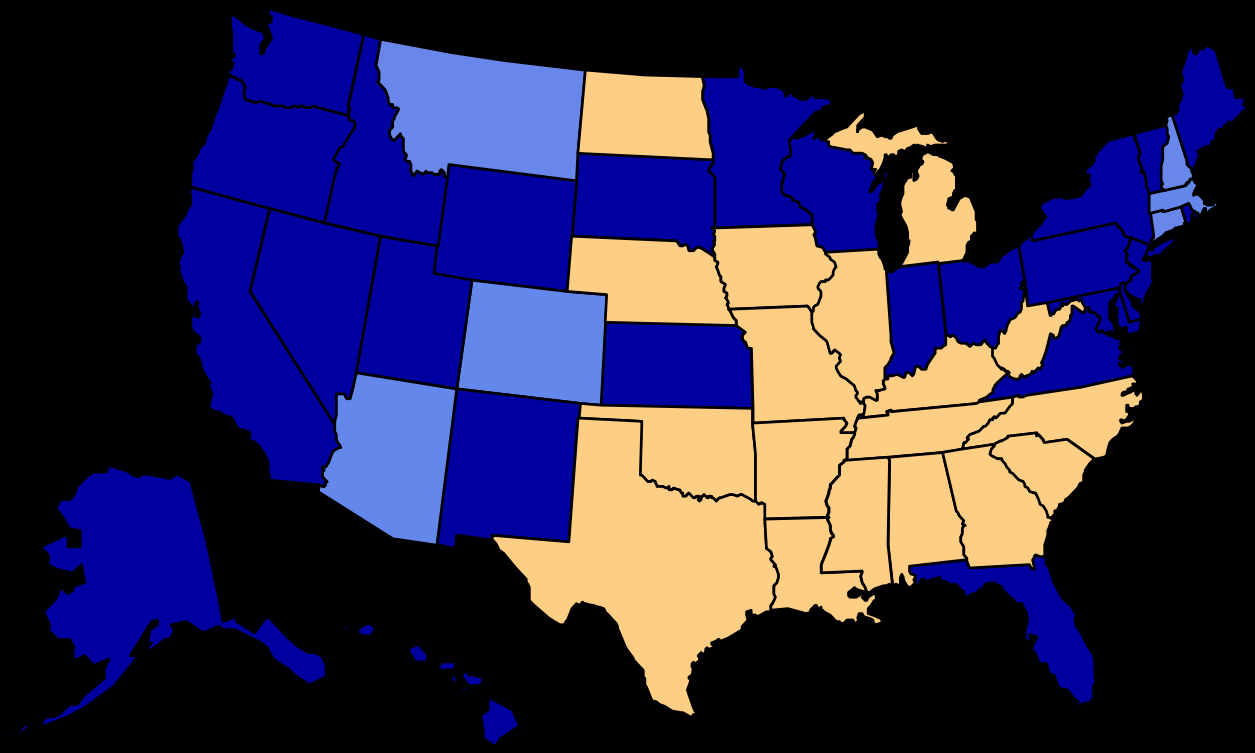
No Data | <10% | 10%–14% | 15%–19% | ≥20%

1998



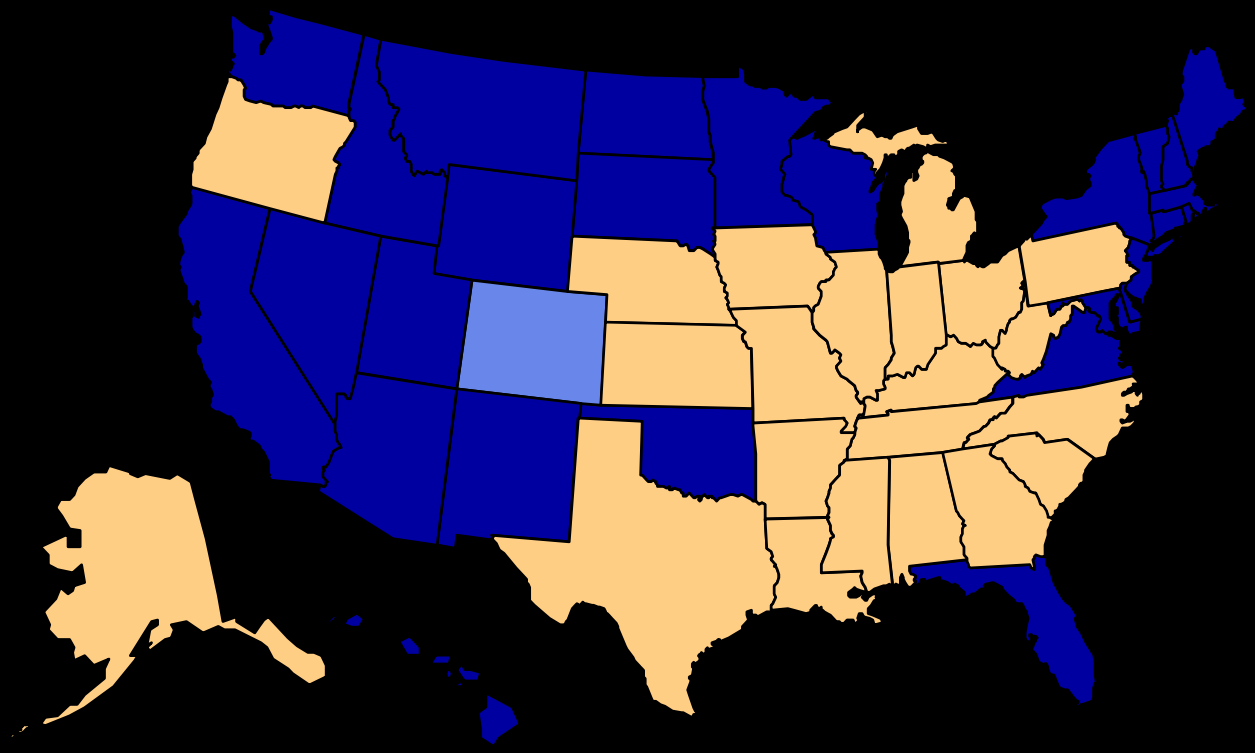
No Data | <10% | 10%–14% | 15%–19% | ≥20%

1999



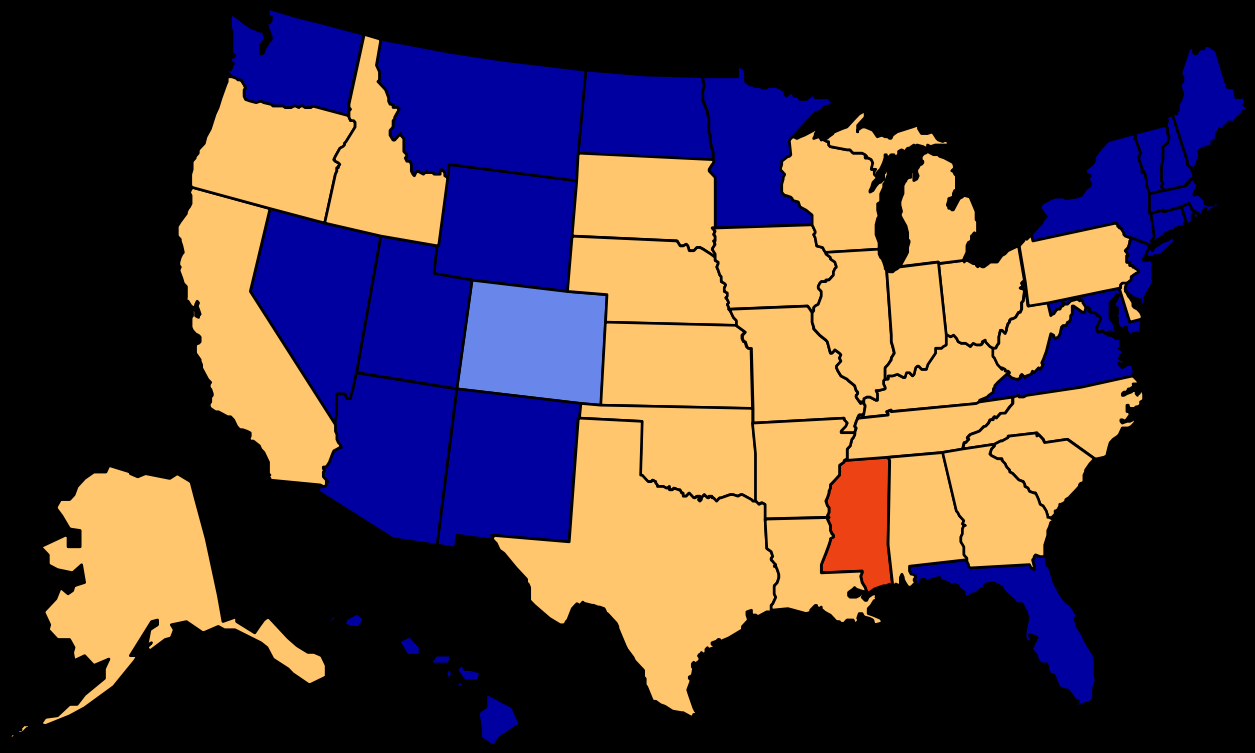
No Data | <10% | 10%–14% | 15%–19% | ≥20%

2000



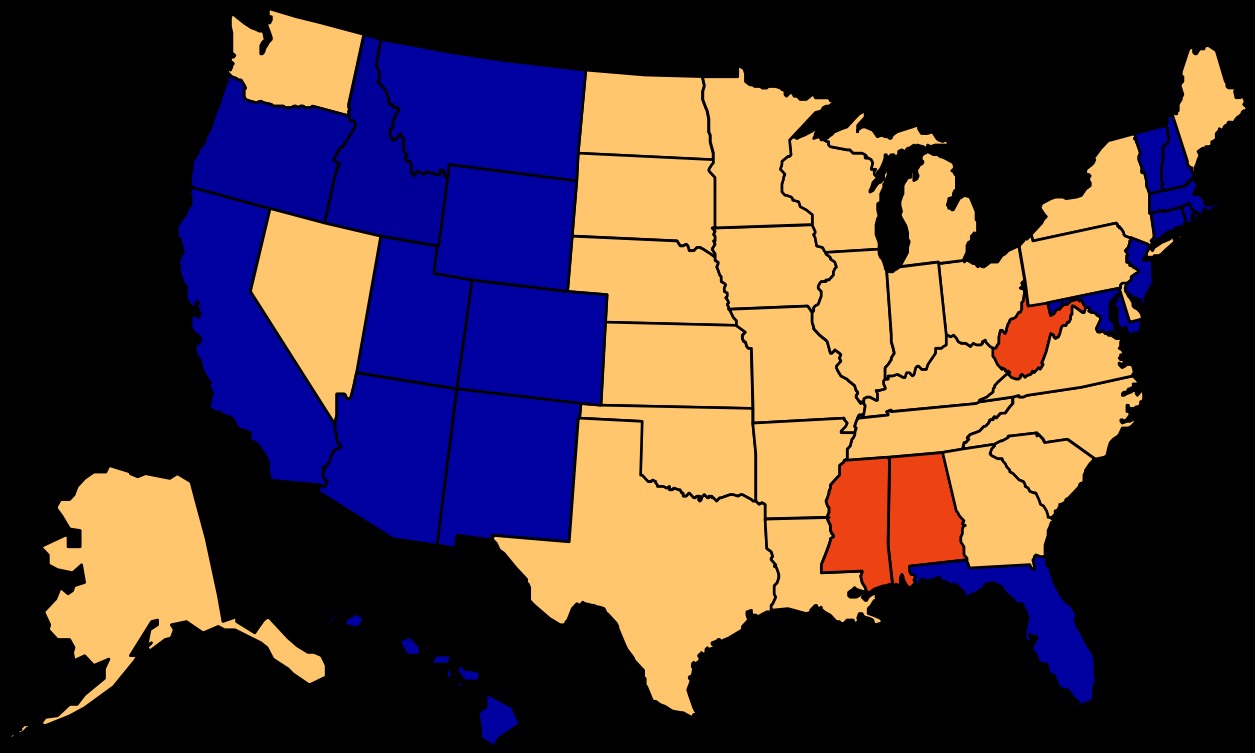
No Data | <10% | 10%–14% | 15%–19% | ≥20%

2001



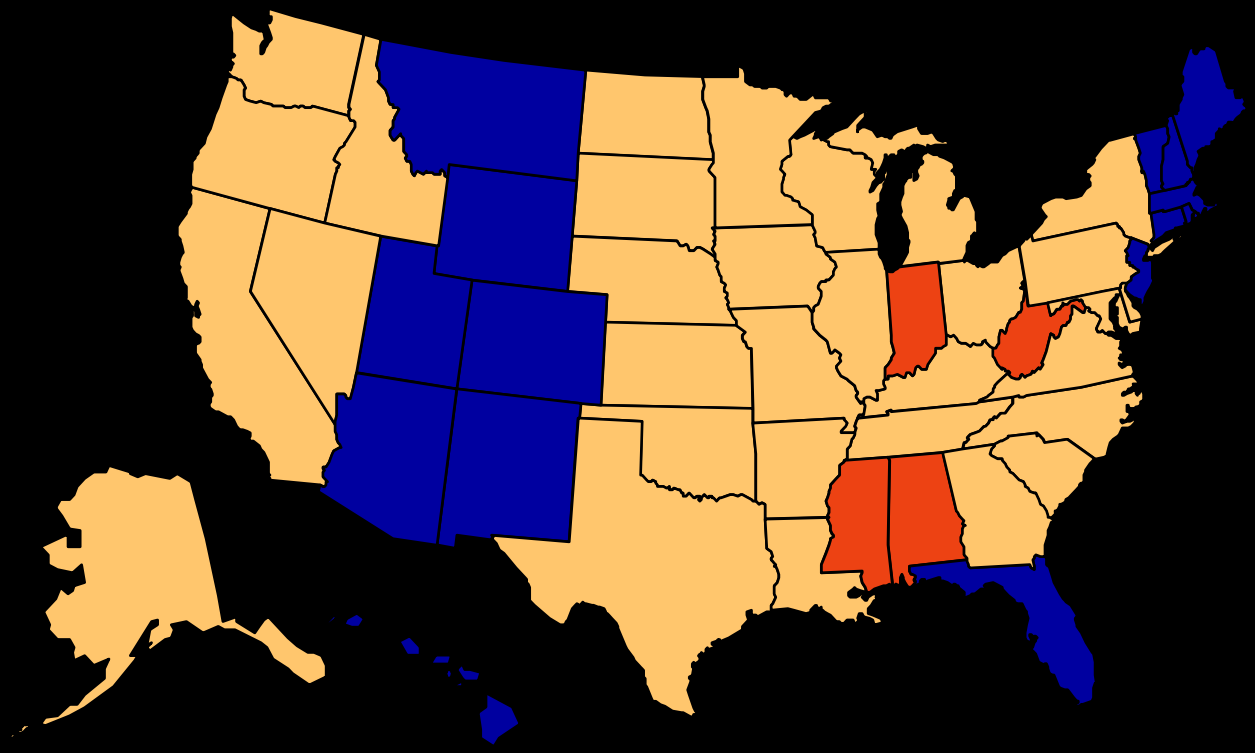
No Data | <10% | 10%–14% | 15%–19% | 20%–24% | ≥25%

2002



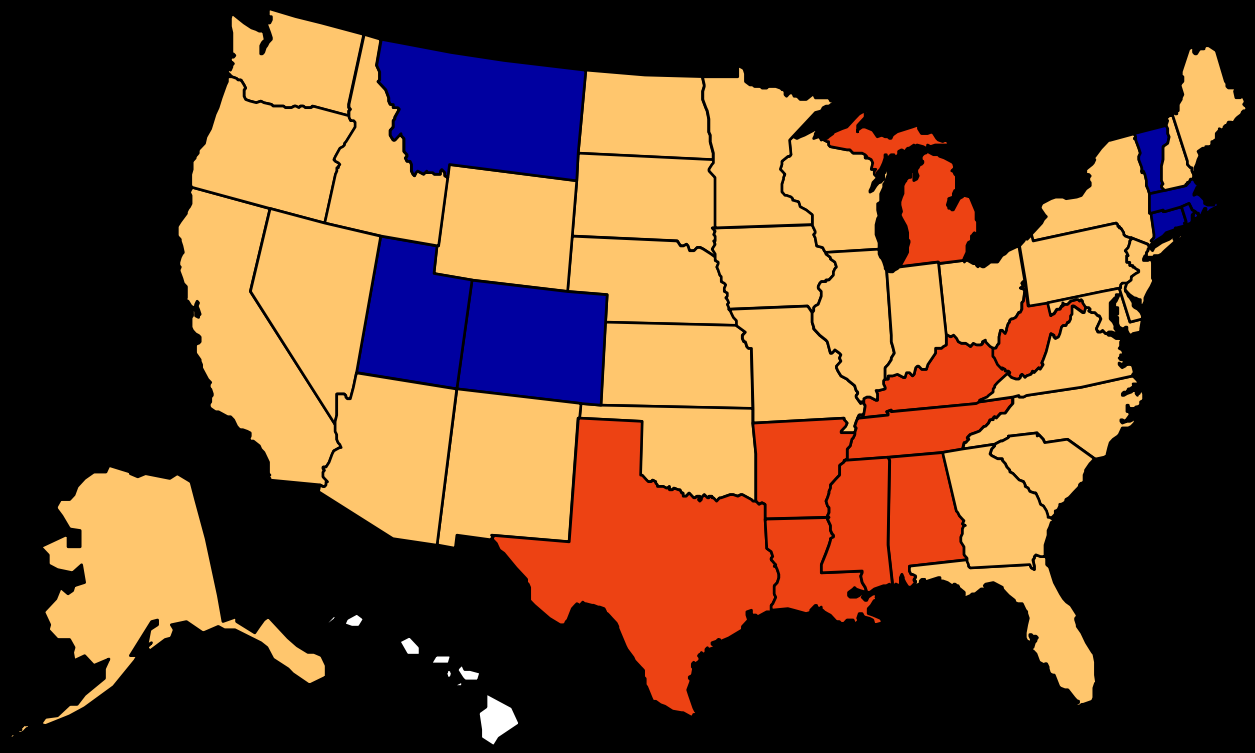
No Data | <10% | 10%–14% | 15%–19% | 20%–24% | ≥25%

2003



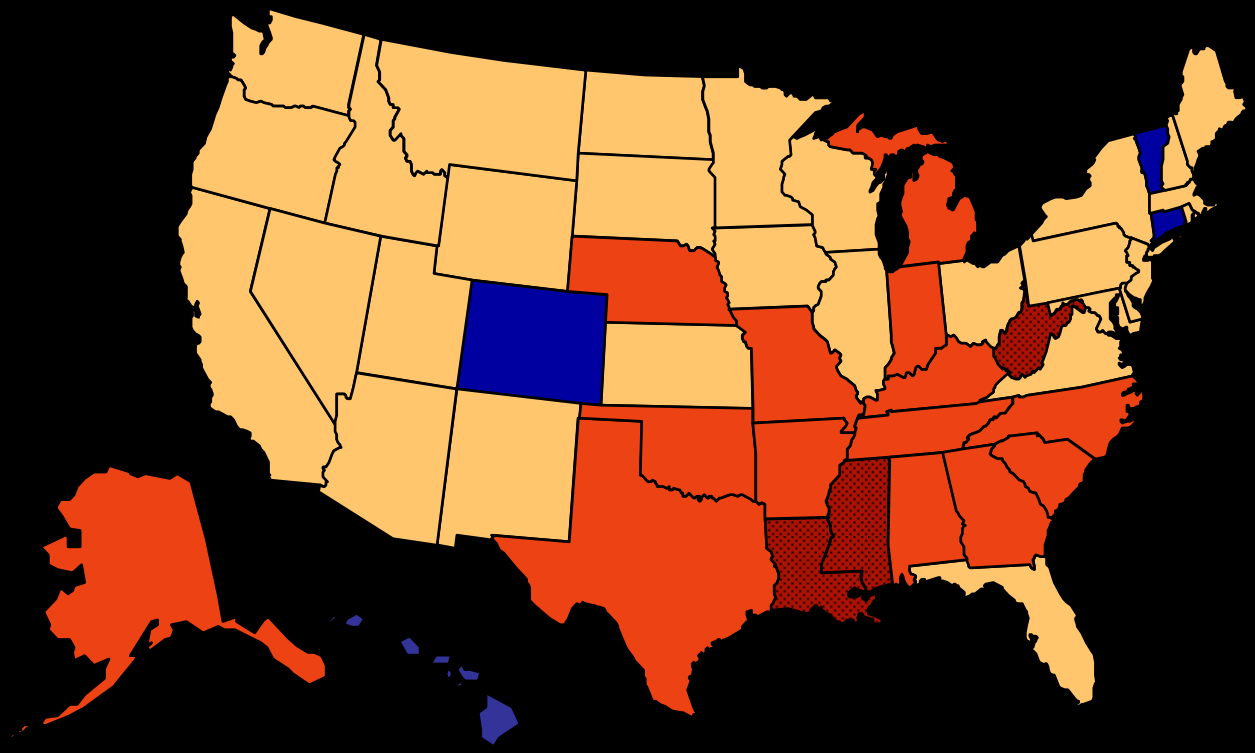
No Data | <10% | 10%–14% | 15%–19% | 20%–24% | ≥25%

2004



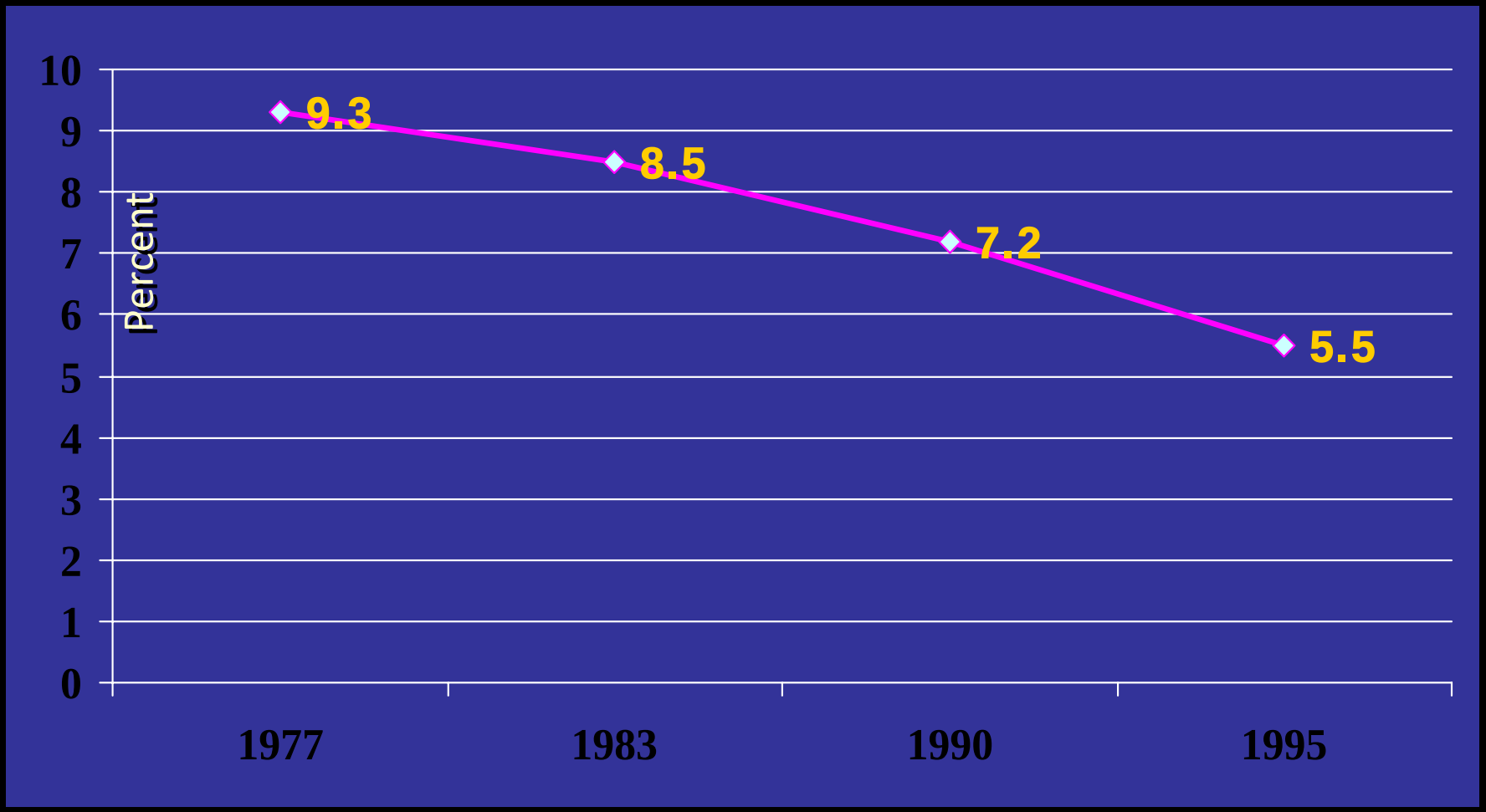
No Data | <10% | 10%–14% | 15%–19% | 20%–24% | ≥25%

2005

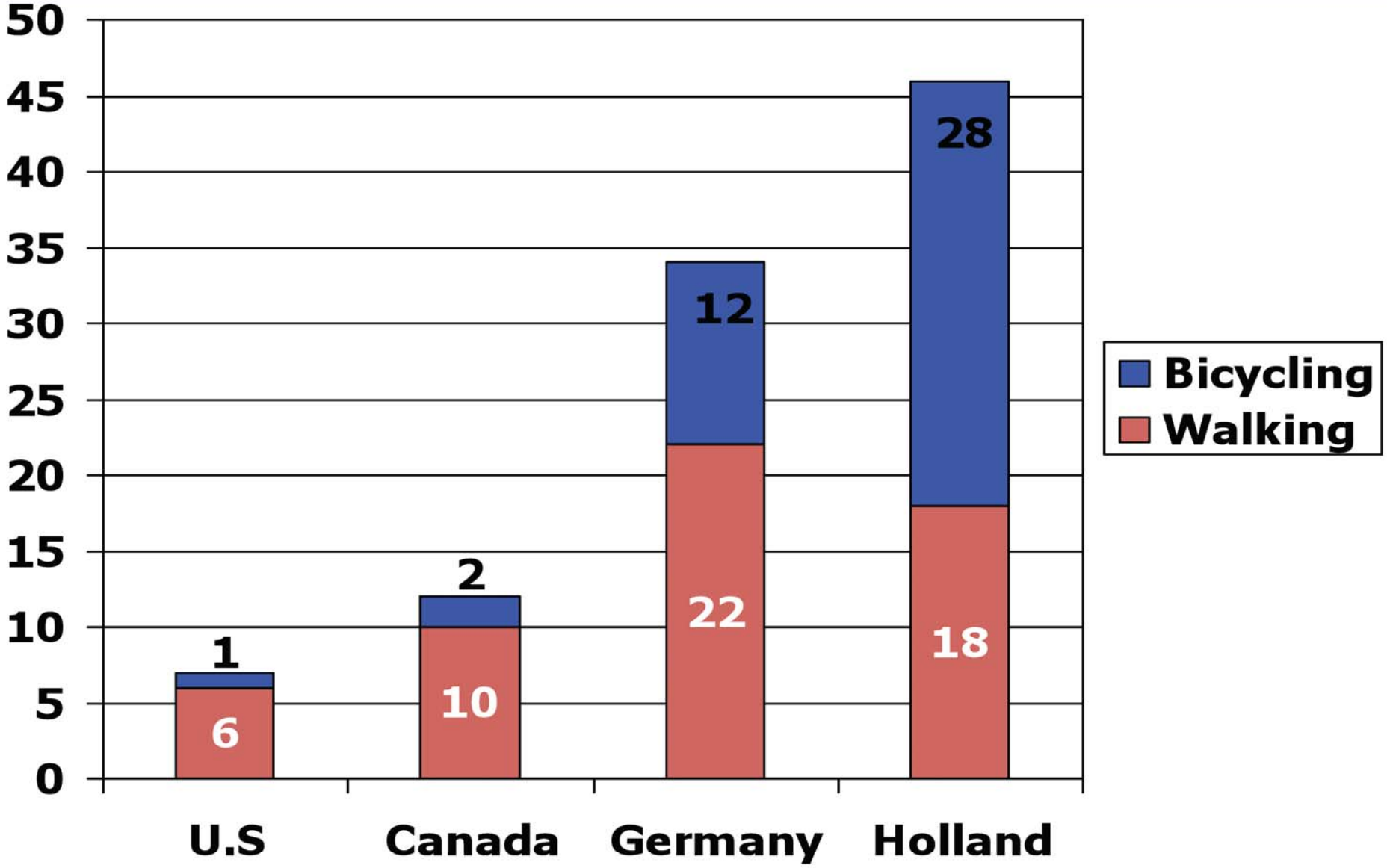


No Data | <10% | 10%–14% | 15%–19% | 20%–24% | 25%–29% | ≥30%

U.S. Walk Trips 1977-1995



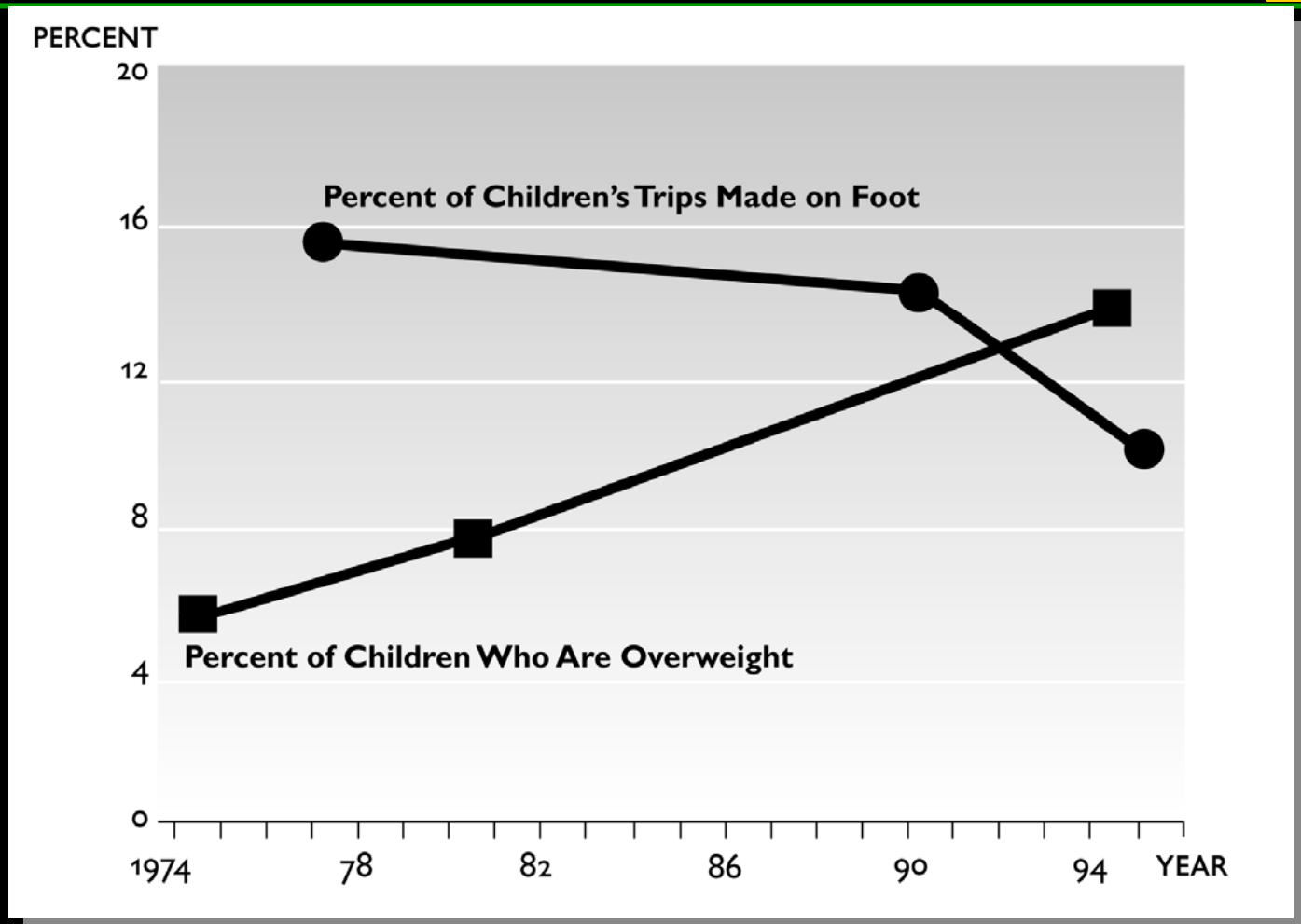
Source: Nationwide Personal Transportation Survey, 1995



Pucher J and Dijkstra L. Promoting Safe Walking and Cycling to Improve Public Health: Lessons From The Netherlands and Germany. AJPH, September 2003;93(9):1509-16.

% of Trips in Urban Areas – 1995

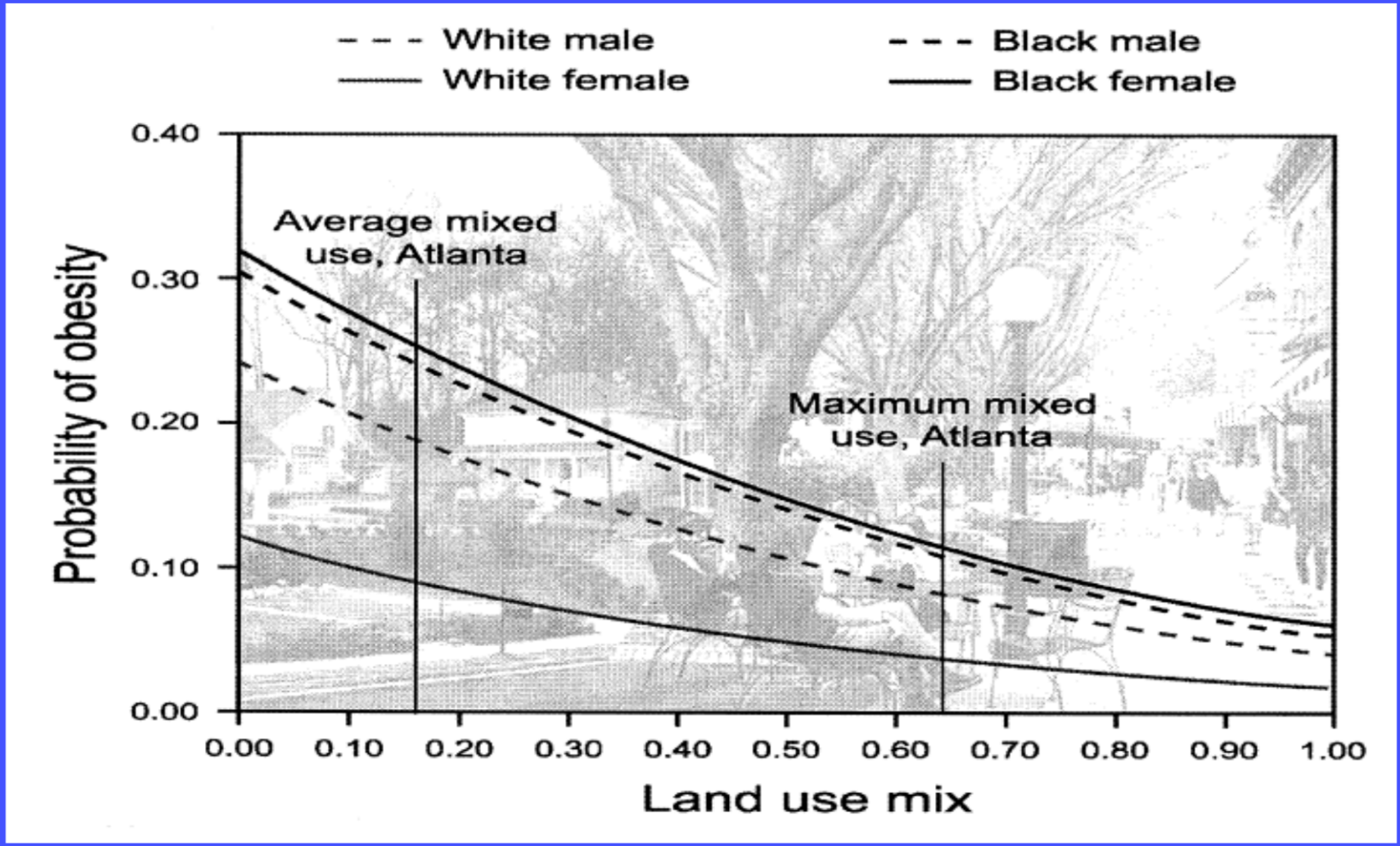
Children Are Walking Less and Becoming Increasingly Overweight



Surface Transportation Policy Project Data Analysis - 2001

Auto Zone
Discount Auto Parts

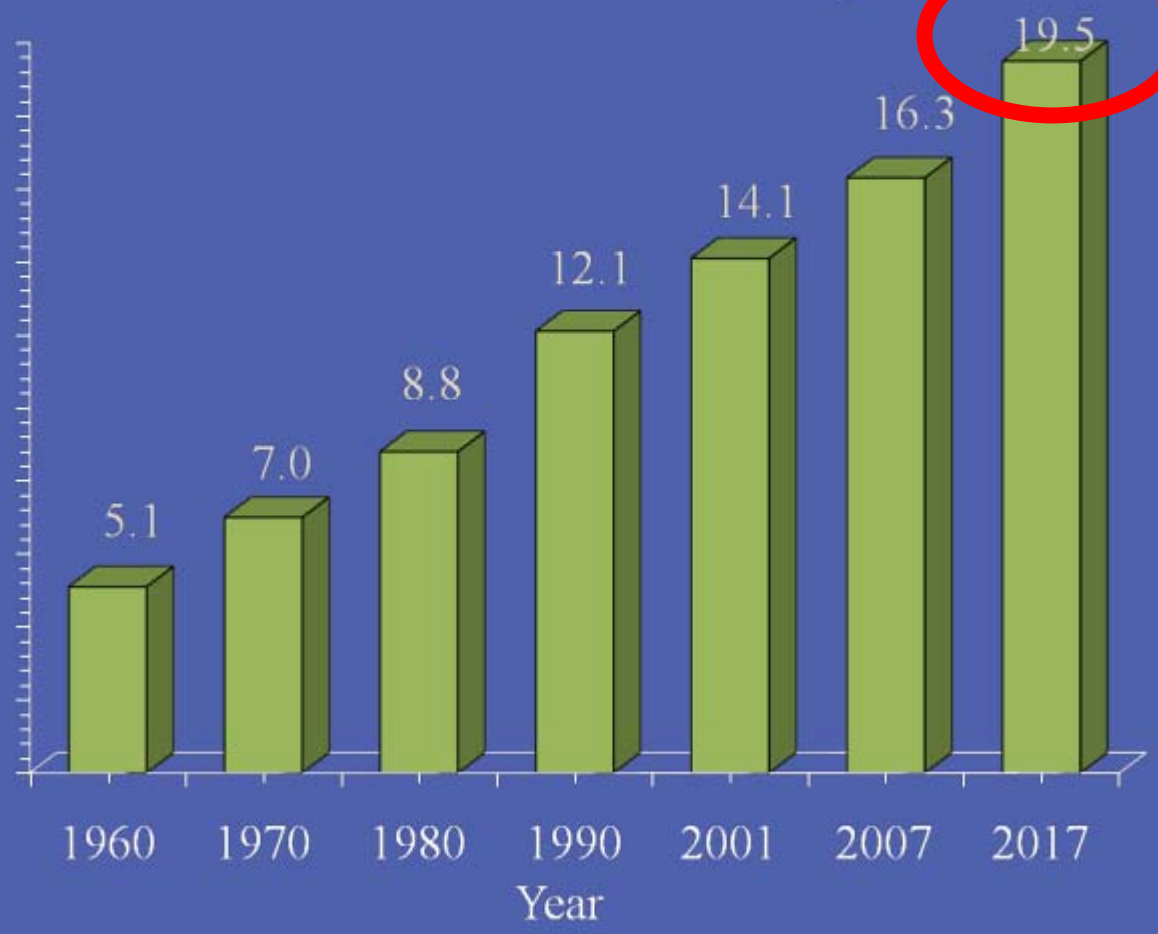
Higher density and connectivity: lower obesity– Atlanta study 2004



Obesity Relationships with Community Design, Physical Activity, and Time Spent in Cars

Lawrence D. Frank, PhD, Martin A. Andresen, MA, Thomas L. Schmid, PhD

U.S. Health Care Expenditures as Percent of GDP Projections



Keehan et al:
Health Affairs
March/April 2008 27:
145-155

Active Living & Public Health

- Bottom Line:
  1. The way we are building our cities is preventing active living
  2. Our inactive lifestyles are causing serious health problems
  3. Treating these health problems will represent a major impact to our economy

Balanced Mobility

Balanced Mobility

- Functional mobility
- Good streets, good transit
- Connected networks

Functional Mobility

Travel – Moving over distances

Circulation – Moving within areas

Access – Getting in the door

Facility Type

Travel –	Freeways, arterials, rail transit, express bus lanes
Circulation –	Collectors, connectors, transit routes, bike trails and lanes
Access –	Local streets, parking, sidewalks and crosswalks

Built for…

…travel

Built for...

Flagstaff

Redmond

...circulation

Built for…

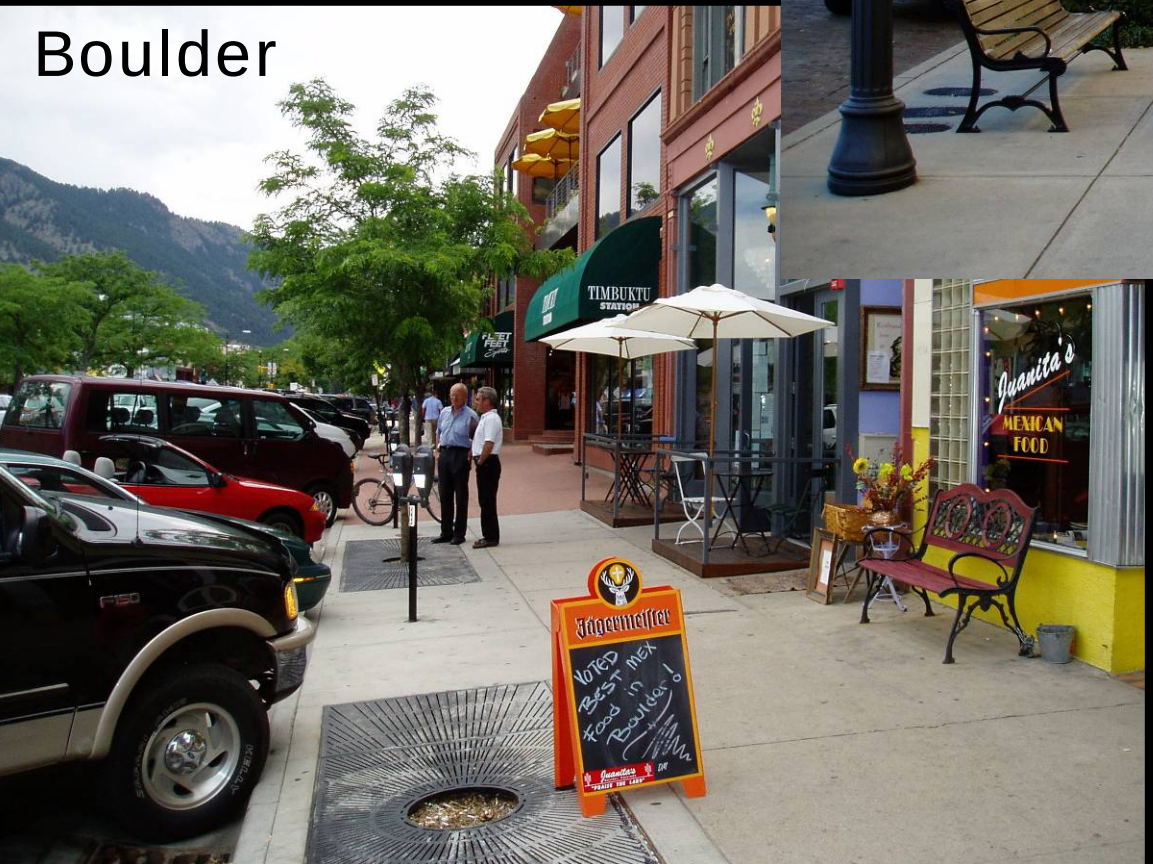
Portland

Boulder

…circulation

Built for…

Winter Park, Fl



Boulder

…access

St. Louis Region

Balanced Mobility

- Good streets
- Good transit

Newbury, Boston

Pleasanton, CA

Lakewood, CO

How we got here

From no roads

OMAHA
2 OMAHA 45
OMAHA SHORT CUT
45 LESS CORNERS TO THE PAVEMENT AT
COUNCIL BLUFFS 45 MI
FREE CAMP GROUNDS AT
GRISWOLD 6MI.
WHITE - WAY
OMAHA
SHORTEST & BEST
ROUTE
SHORTER HILLS
NO BAD CORNERS
OAKLAND
FREE CAMPING GROUND

“Oops”

Our Learned Approach

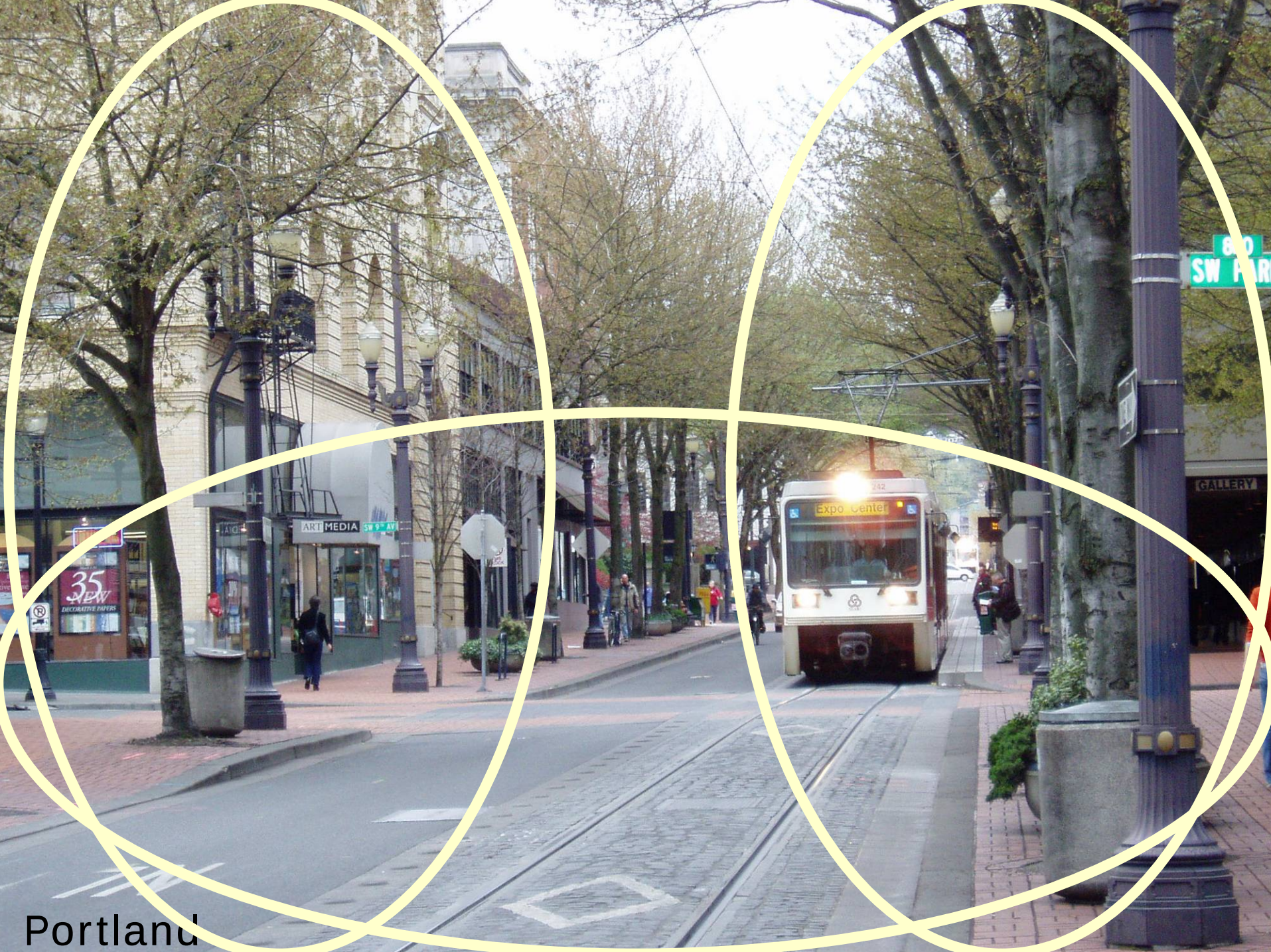
- Build it fast, build it cheap
- Wider, straighter, faster = better
- Don’t worry about abutting property
- Just get ‘er done

- A FACILITY-CENTERED APPROACH

Neighborhood

Lakewood, CO

Boulder


ART MEDIA
SW 9TH AV
35
NEW
DECORATIVE PAPERS
Expo Center
GALLERY

Portland

You can’t design a street like this…

...and expect this to result.

Balanced Mobility

- Good streets
- Good transit

Local
Bus Transit

Express Bus – Commuter Service

LRT –
Light Rail Transit

Houston

Portland

Streetcar

Portland

Seattle

BRT

(Bus Rapid Transit)

Orlando, FL

BRT

(Bus Rapid Transit)

Charlotte, NC

Commuter Rail

Boston

Bay Area

Metro

Miami

Washington, DC

Monorail

Jacksonville

Las Vegas

Monorail

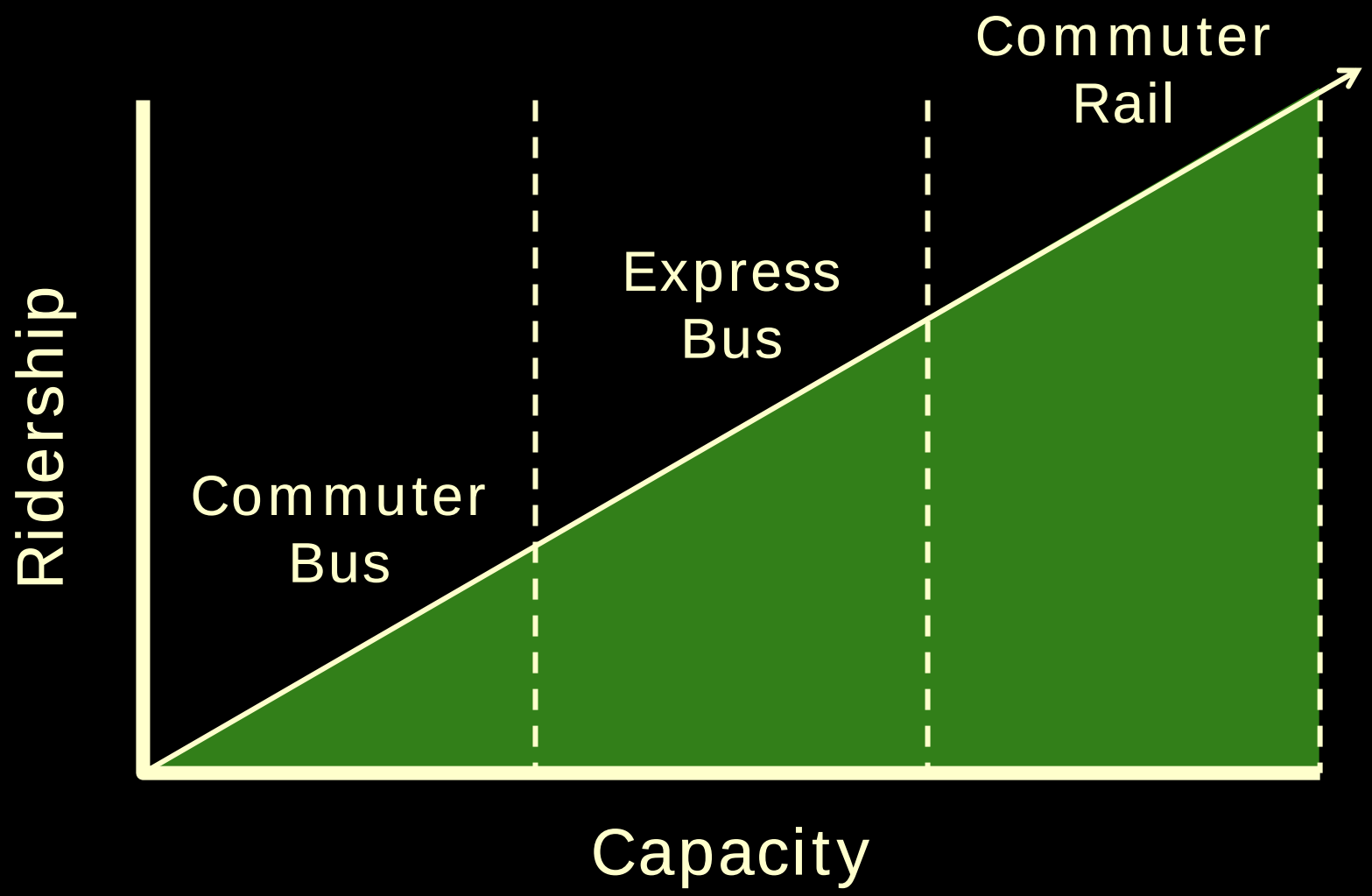
Seattle

PRT (Personal Rapid Transit)

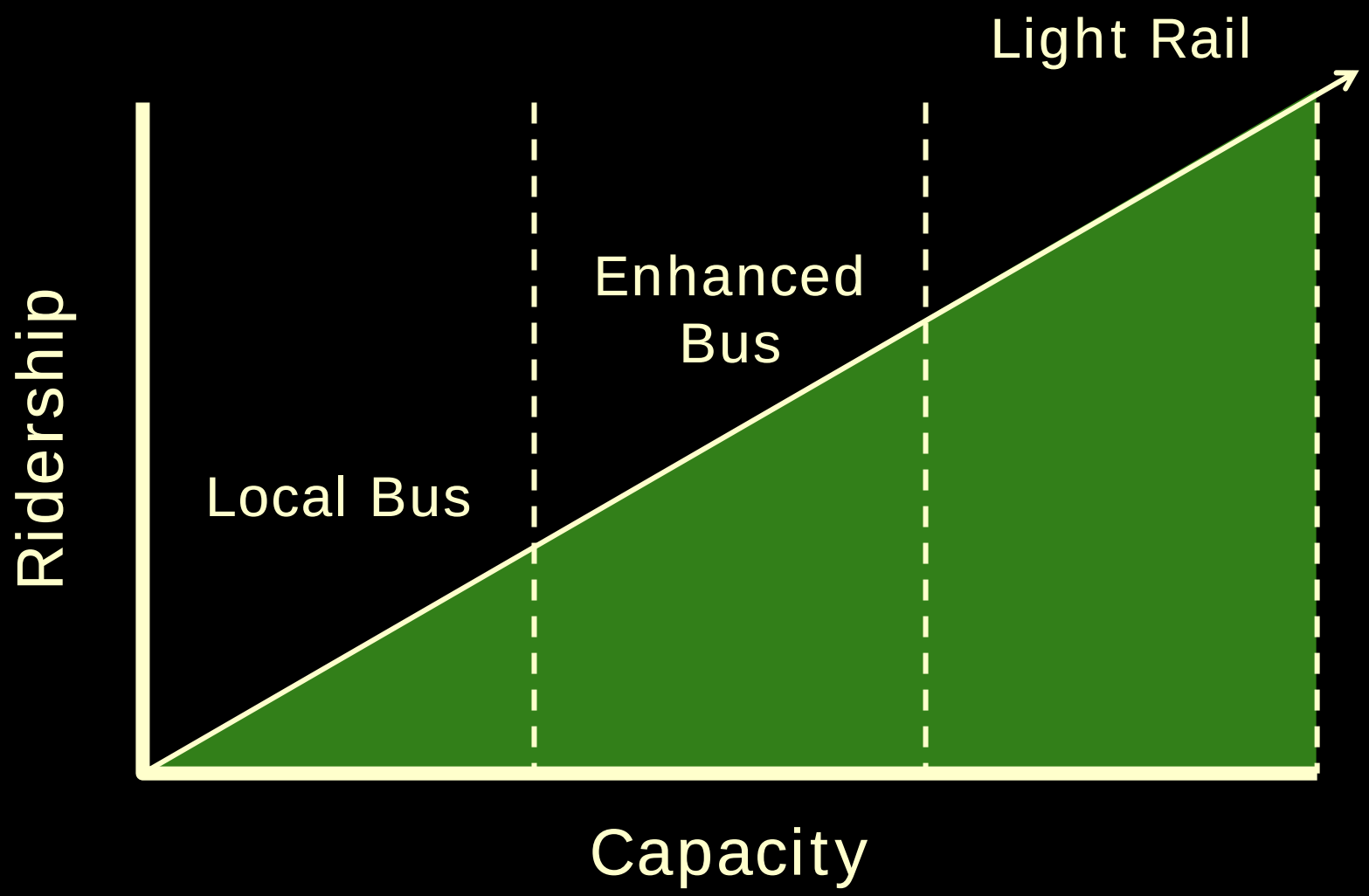
Morgantown, WV

Transit is Evolutionary

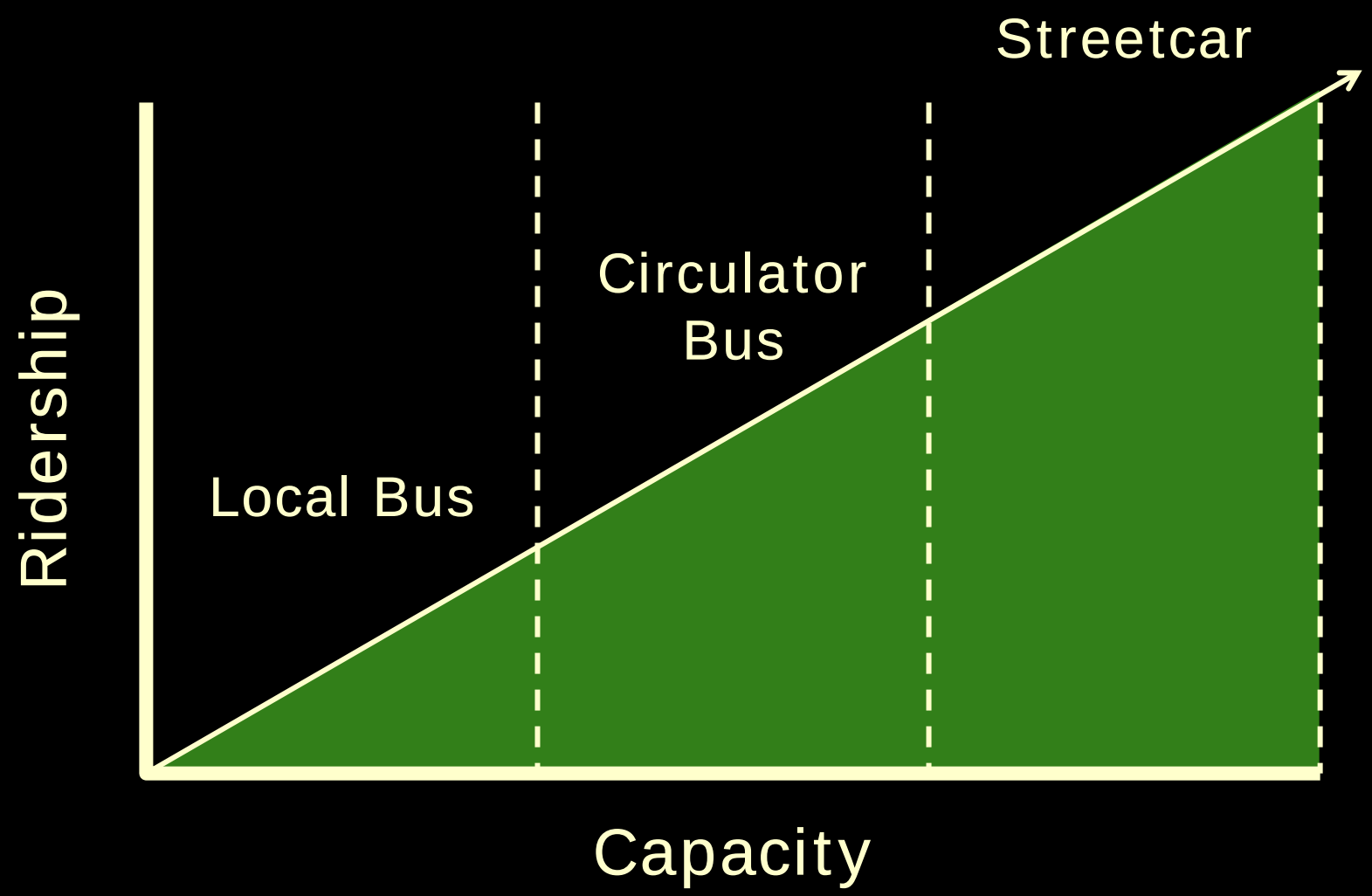
Regional Commuter Service



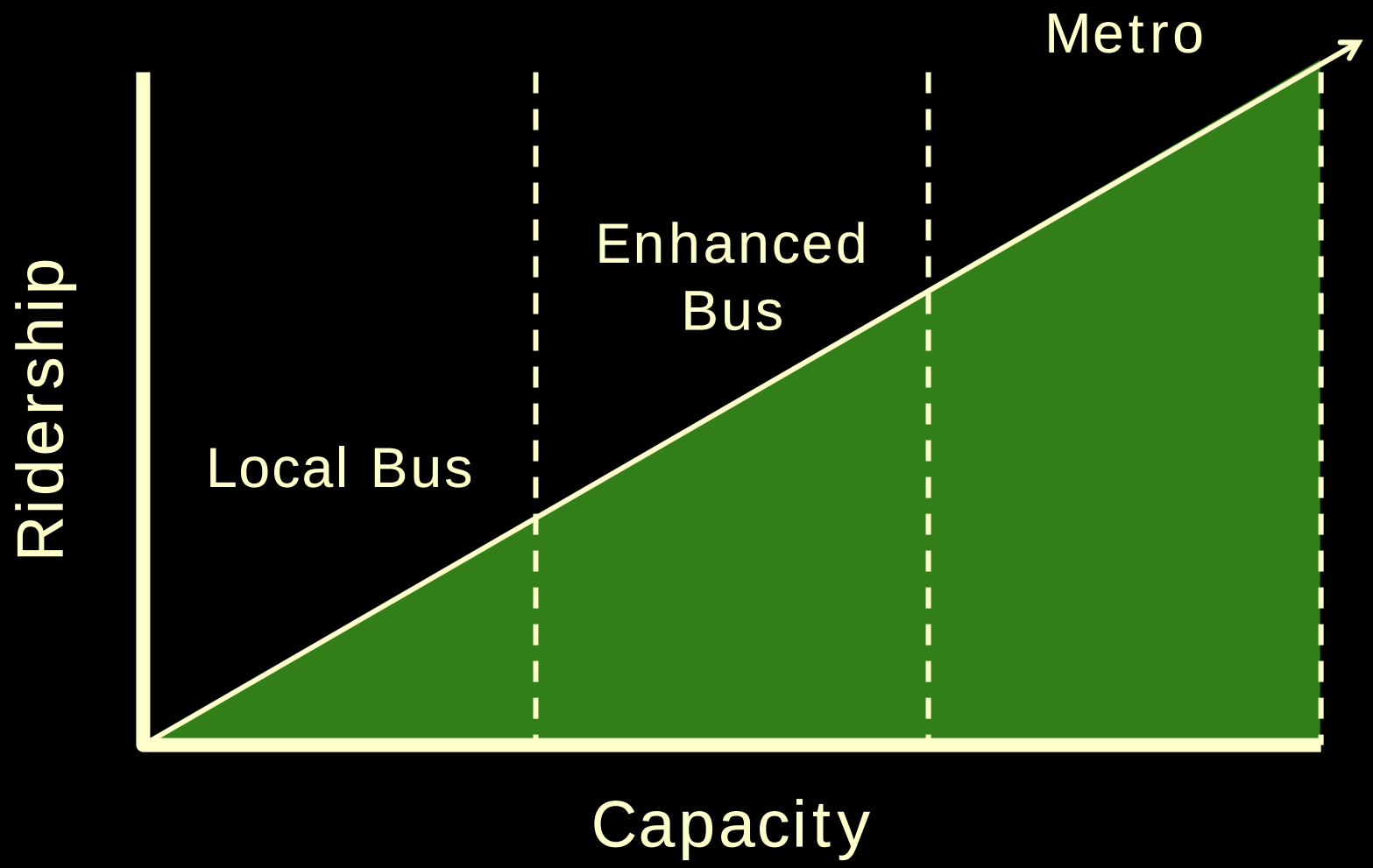
Urban Center Connectors



Urban Center Circulation



Major Cities (> 1 M)



Typical Transit Evolution

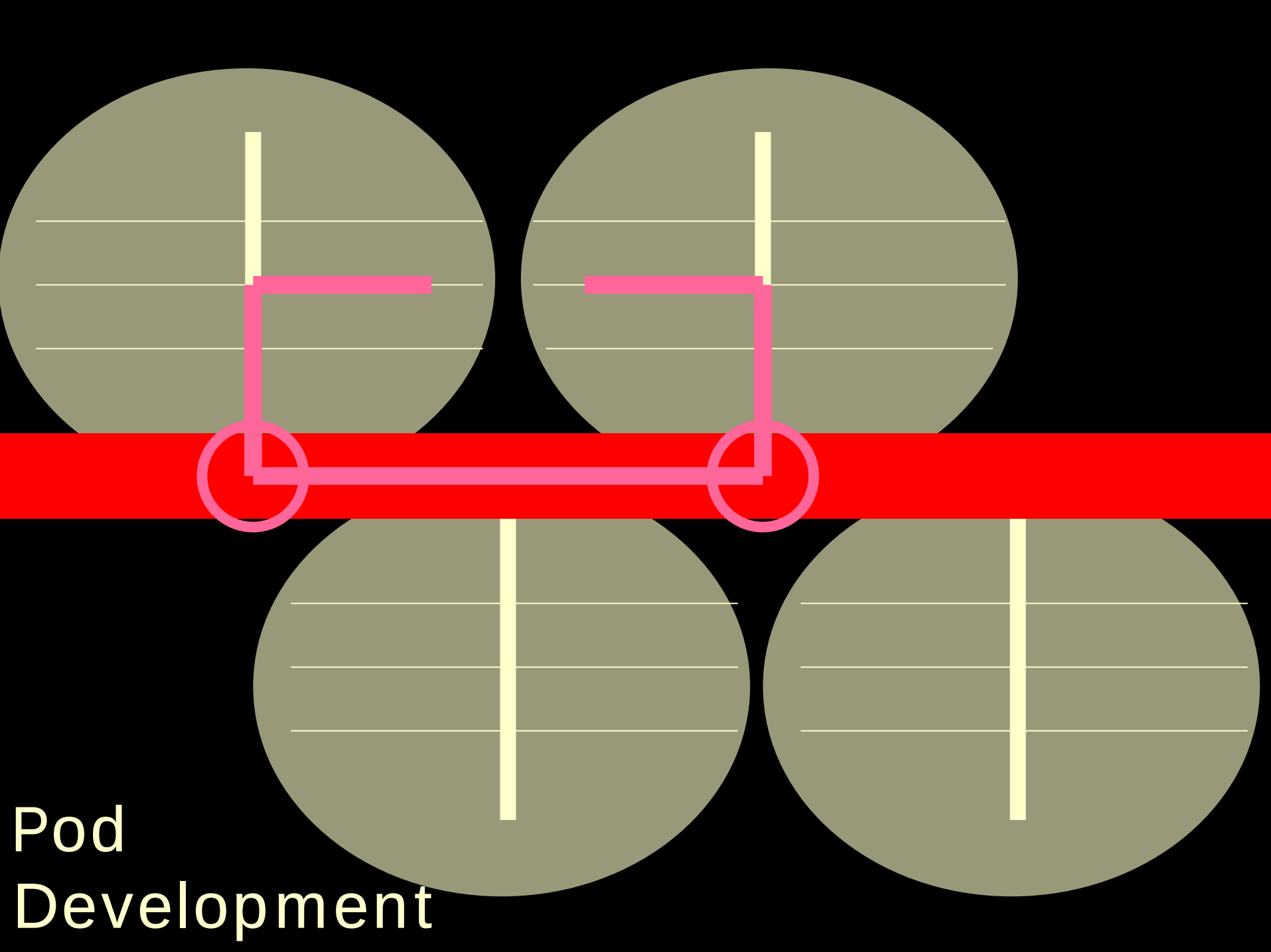
LOCAL	Social Services Demand Response	Fixed Route Scheduled Service > 60 min / < 30 min	High Capacity (BRT, LRT) Corridors	Multimodal Services Including Streetcars
REGIONAL	Employer Vans No Scheduled Services	Commuter Bus Services Peak Hour Express Bus Routes	Commuter Rail All Day Express Bus Routes	Intercity Rail Long Commuter Rail Routes
POPULATION	0 – 50,000	50,000 – 100,000	100,000 – 1,000,000	> 1,000,000

Connected Networks

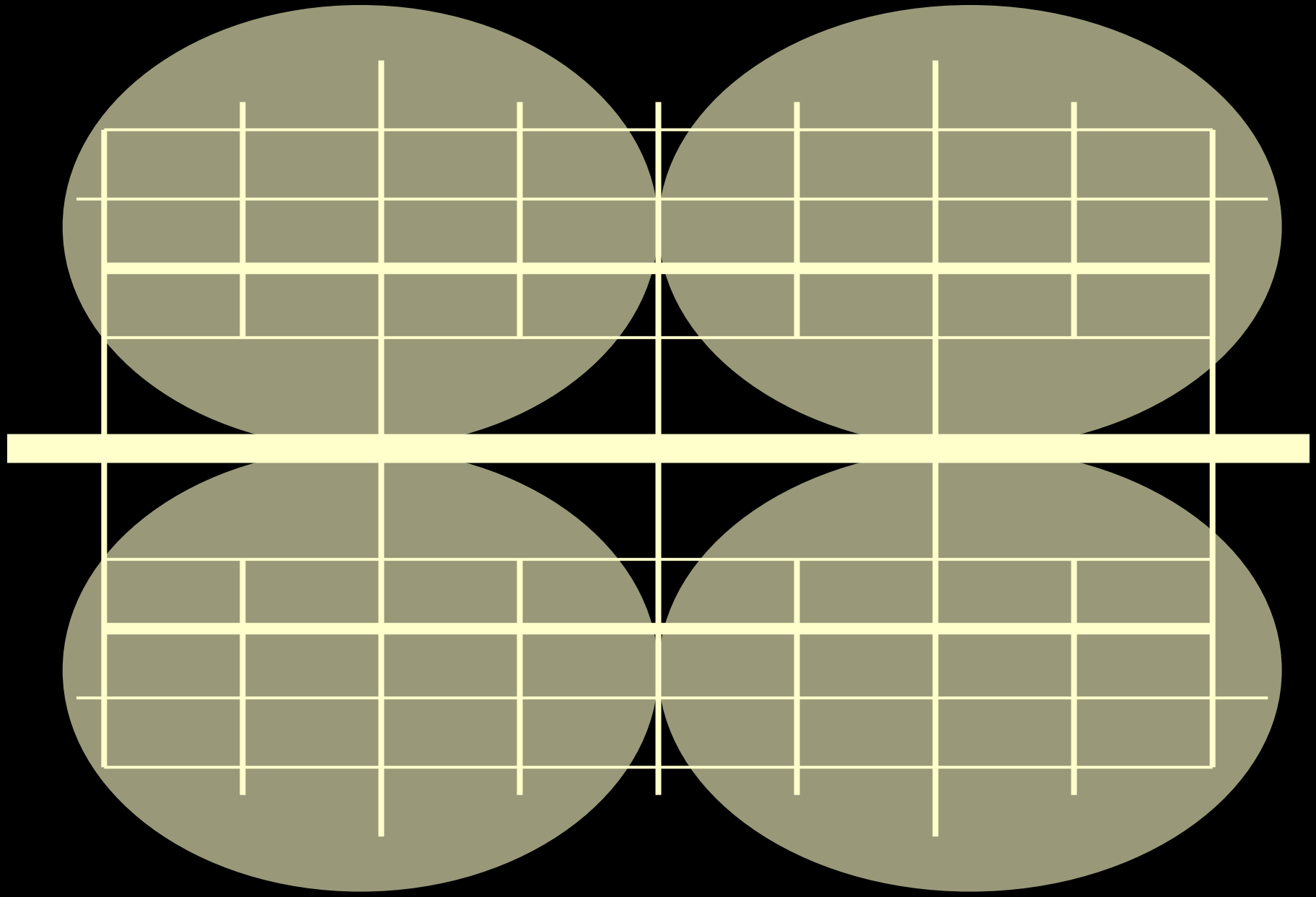
Poor Connectivity Means:

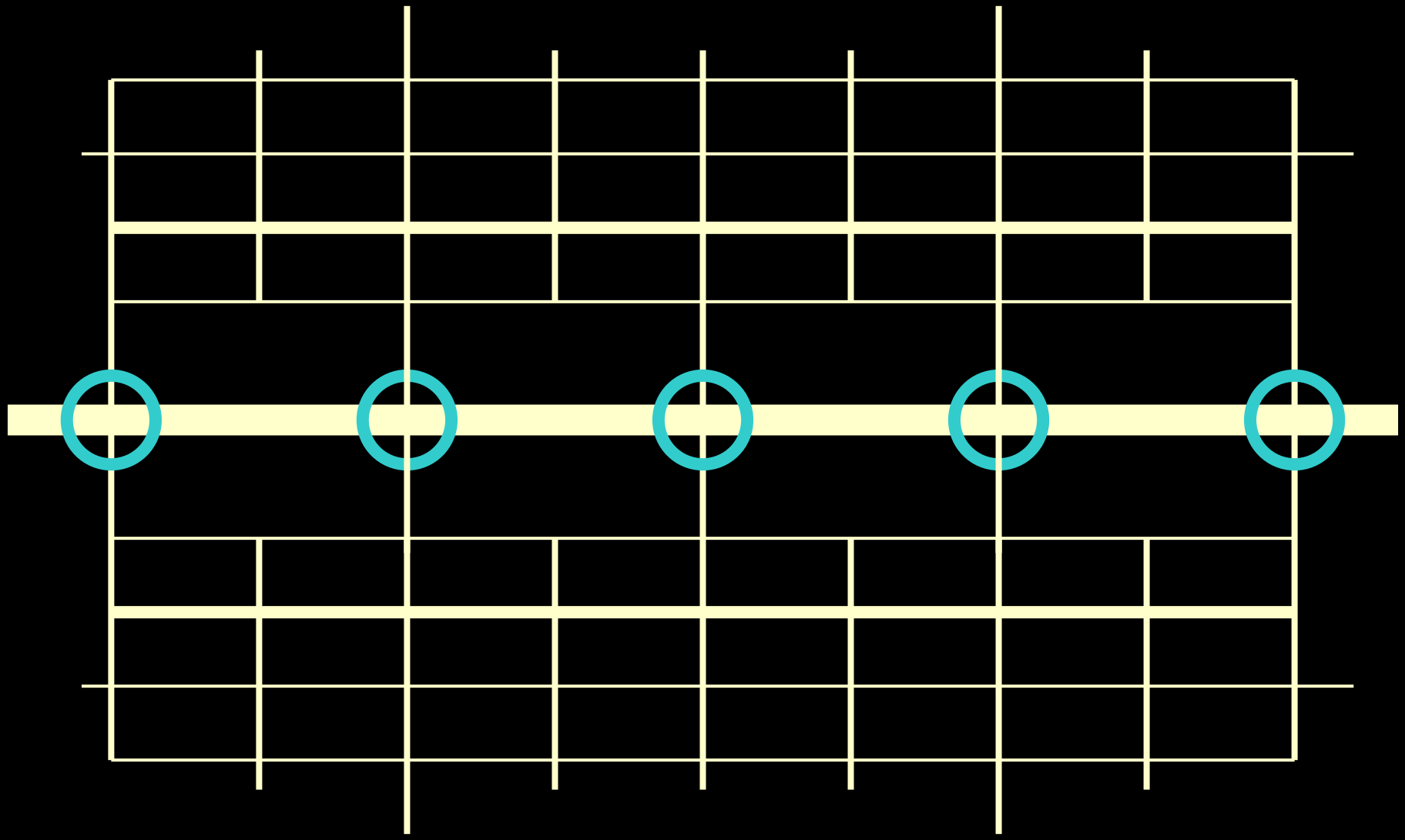
"You can't get there from here . . ."

(without driving)

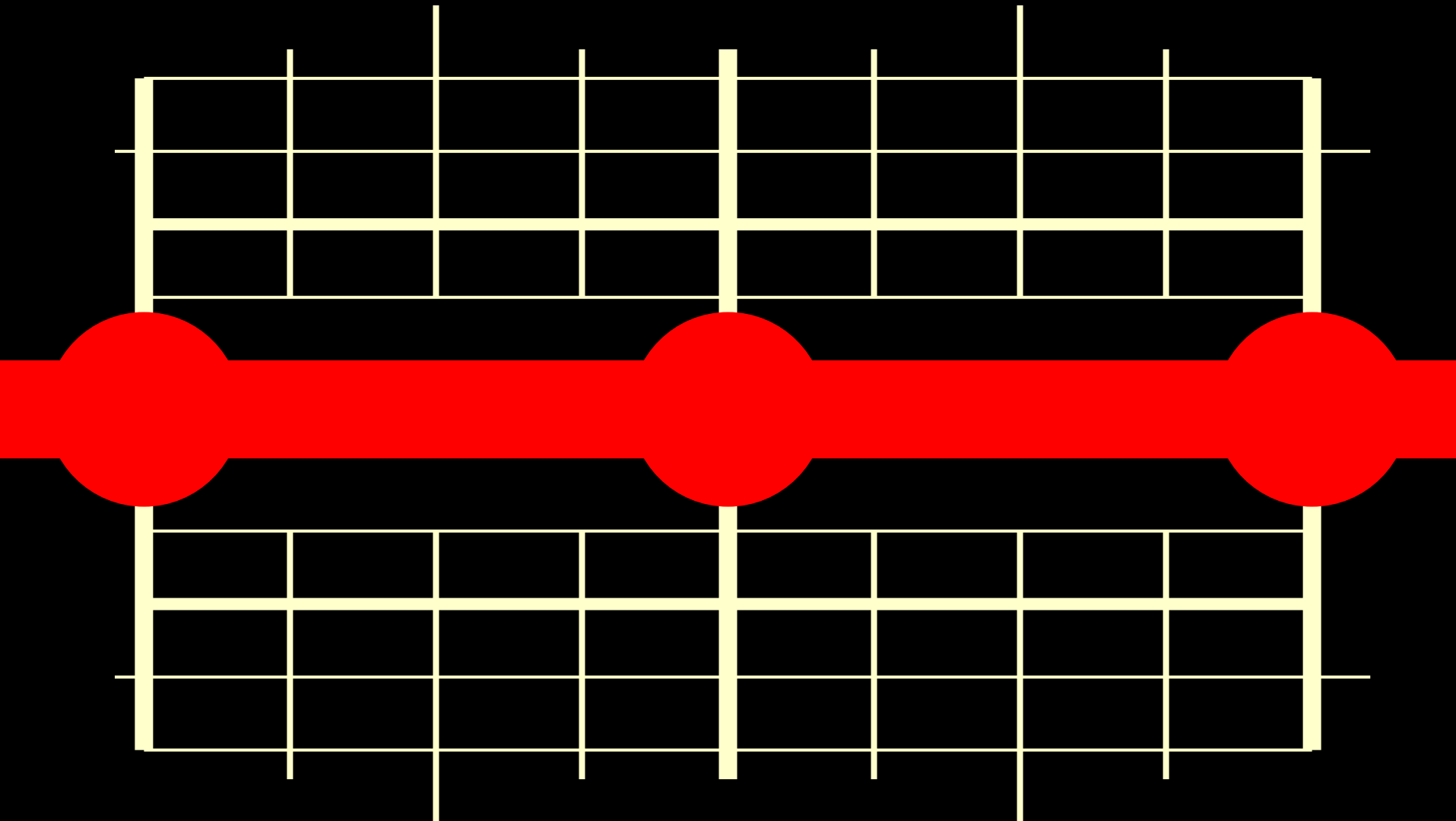


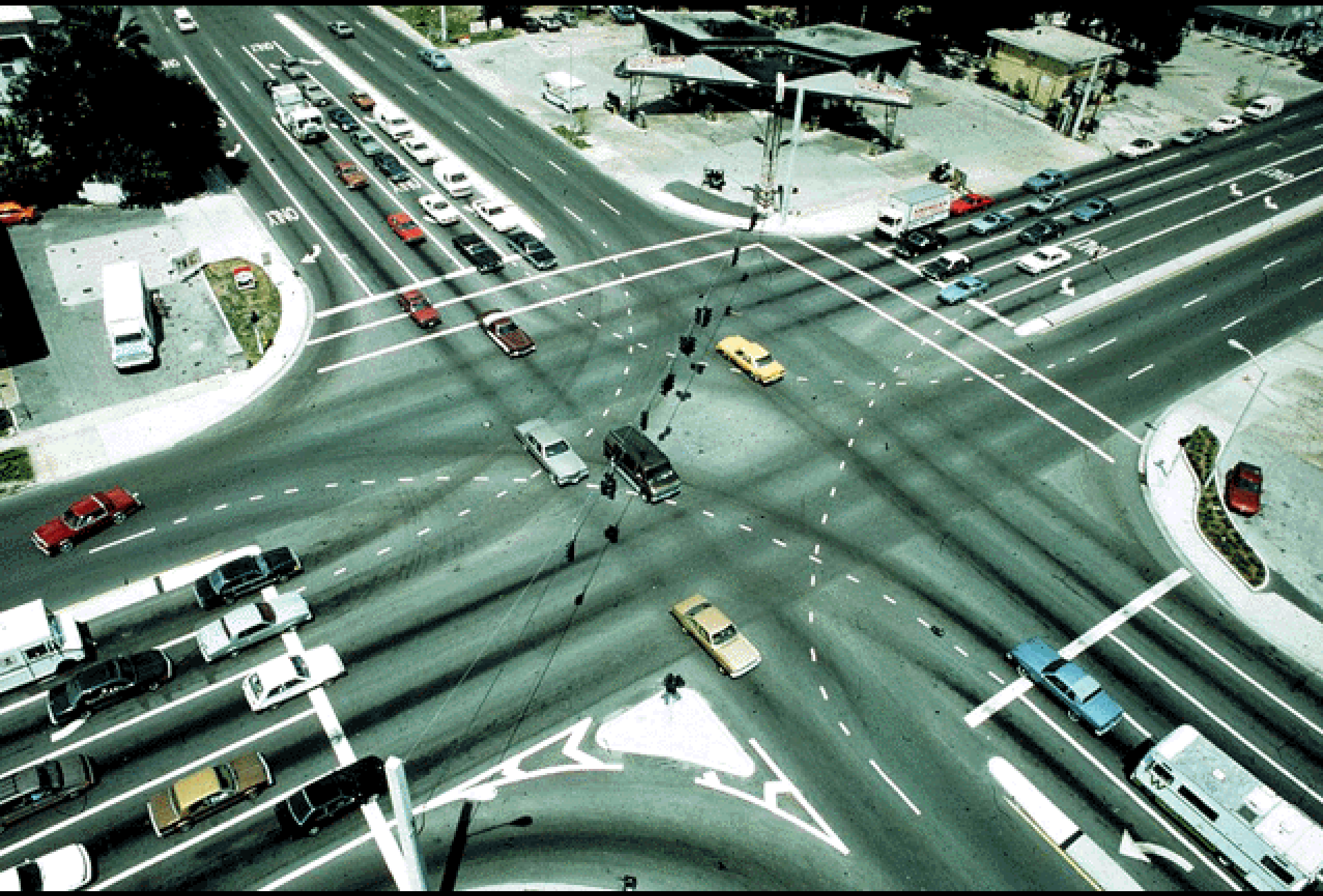
Pod Development





Built-In Inefficiency





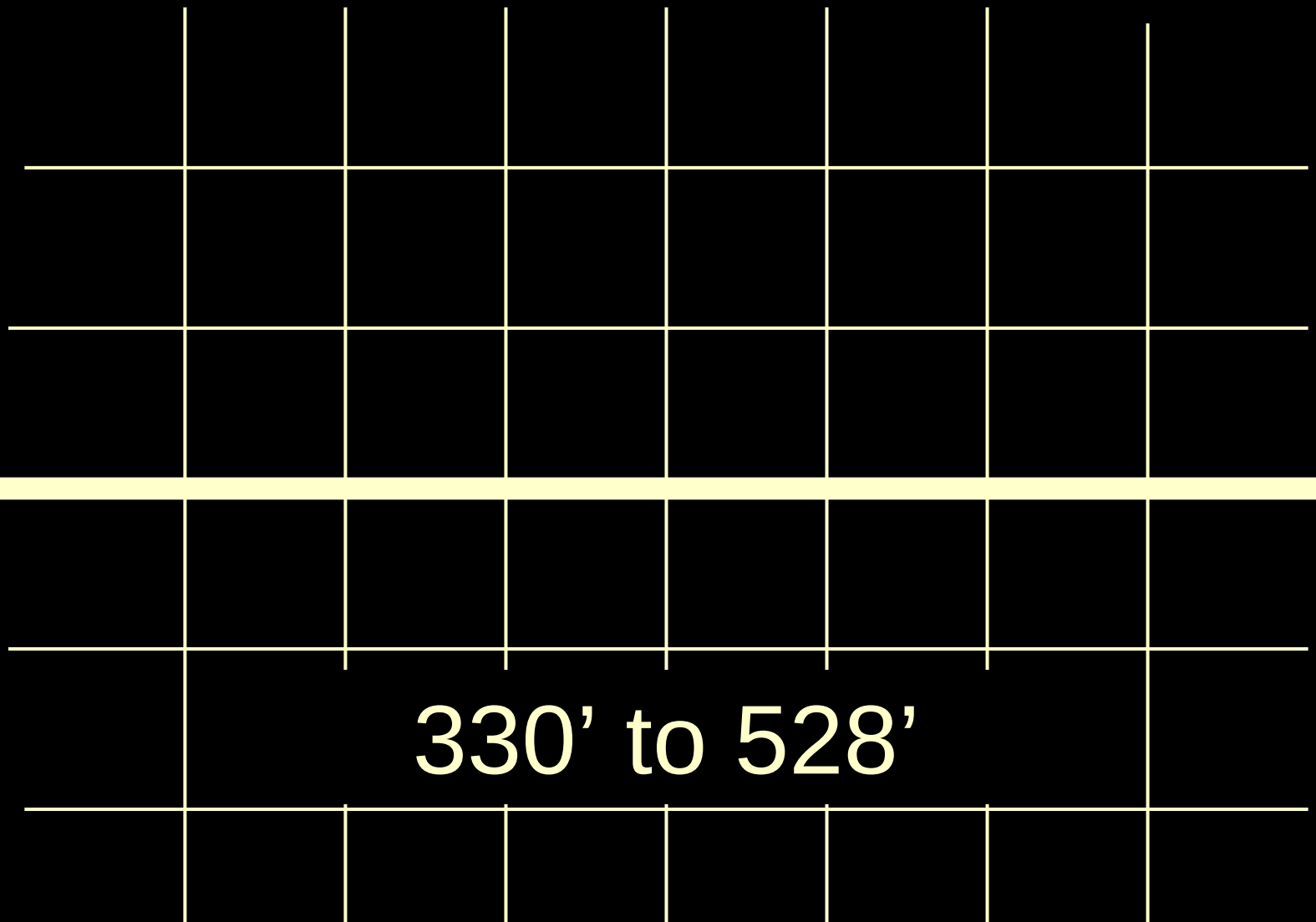
Network Traffic Capacity 101

A dense network of small streets is much safer and provides more capacity than a coarse network of large streets

Connectivity Standards

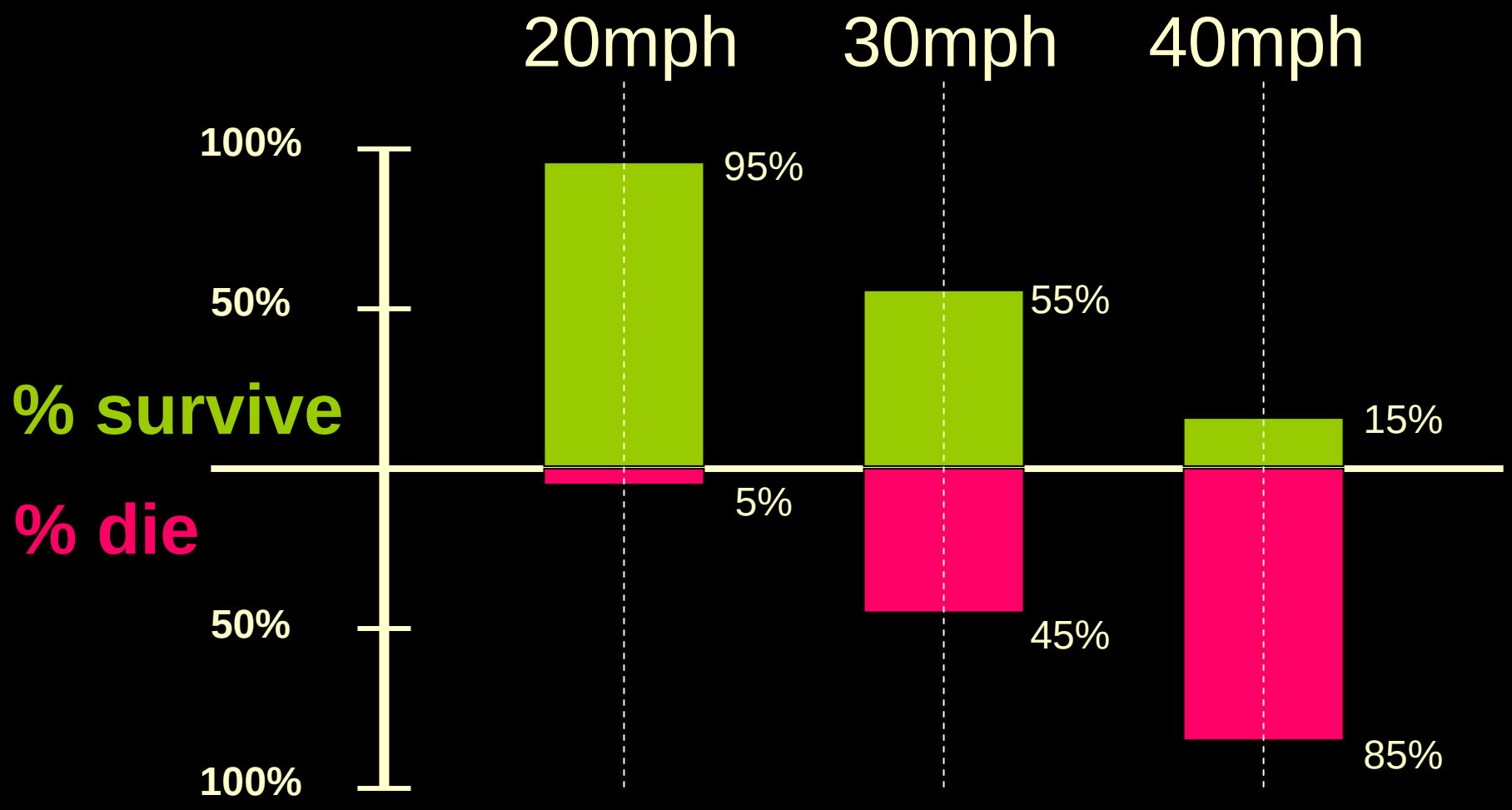
- Intersections/square mile (min 200)
- Maximum block perimeter (1320’ – 1800’)
- Block length (330’ – 528’)
- Links/nodes

Ideal Block Size for Efficient Flow

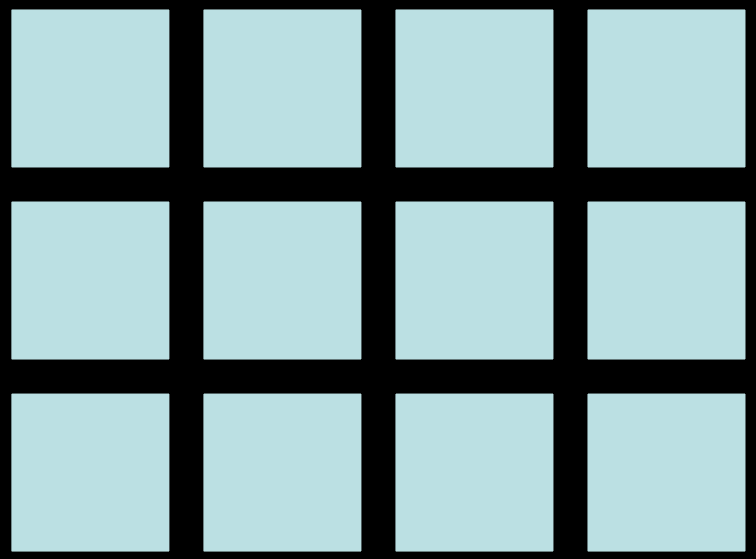


Aurora

Pedestrian Survival Rates – Vehicle Speeds



Pedestrian Networks



The ideal pedestrian “grain” is 250’ to 350’

Path Index

Shortest feasible route on street network

$$\frac{\circ}{\circ}$$

Straight line distance (as the crow flies)

2100 feet
300 feet
Path Index: 7.0
LOS A < 1.4

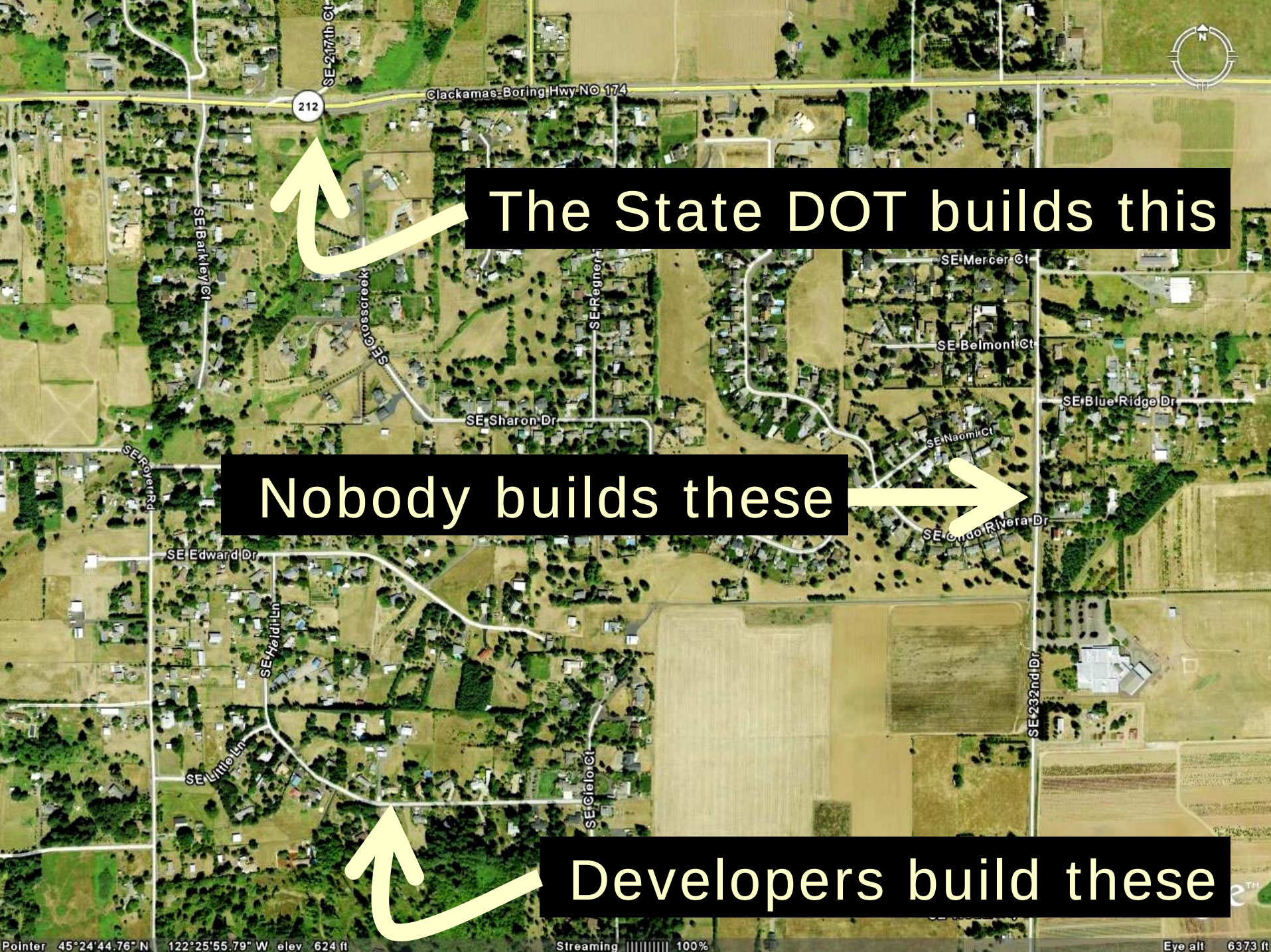
Impacts of Poor Connectivity

- Massive, congested arterials
- Increased driving/household
- Transit voids
- Inactive living
- Poor emergency service access
- Reduced pedestrian safety & convenience

SE High Ridge Cr
SE Scoot Ln
SE Foster Rd
SE Alder Spring Cr
SE Rus Way
SE Sunnyside Rd
Damascus, Oregon
212
SE Red Dirt Rd
Clackamas Hwy
SE Old Barn Ln
SE Royer Rd
SE Barlow Cr
Image © 2009 Metro, Portland Oregon
© 2009 Tele Atlas
Google

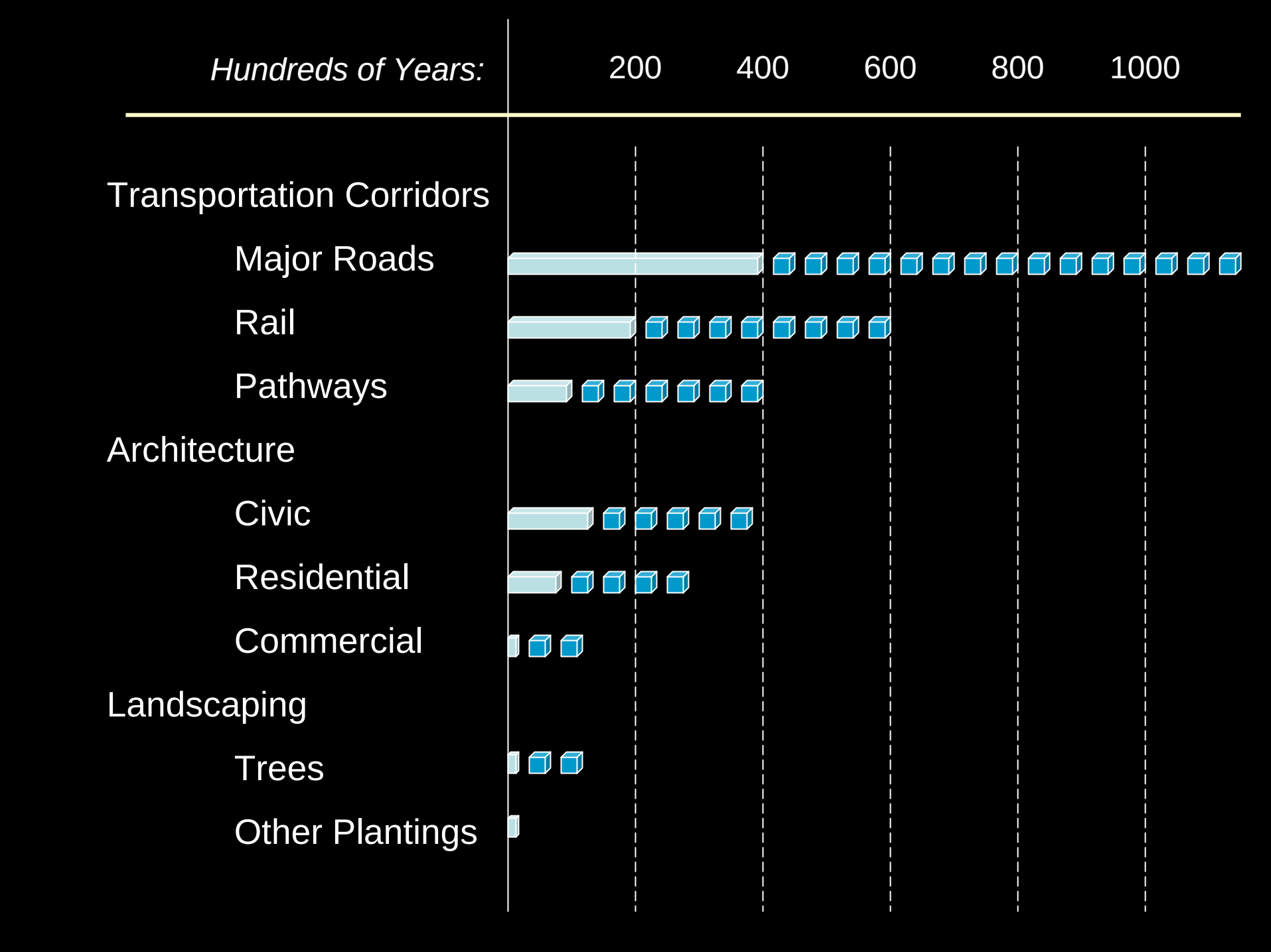
What's missing?

Collectors, connectors


The State DOT builds this
Nobody builds these
Developers build these
Clackamas-Boring Hwy-NO 174
212
SE 217th Ct
SE Barkley Ct
SE Crosscreek
SE Regner
SE Mercer Ct
SE Belmont Ct
SE Blue Ridge Dr
SE Sharon Dr
SE Naomi Ct
SE Royer Rd
SE Edward Dr
SE Heidi Ln
SE Little Ln
SE Cielo Ct
SE 232nd Dr
Pointer 45°24'44.76" N 122°25'55.79" W elev 624 ft
Streaming 100%
Eye alt 6373 ft

Collectors, connectors:

- 1,000’ to 1,500’ spacing (av – 1,320’)
- low speed complete streets
- connect residential areas
- connect residential areas to commercial uses


Hundreds of Years:
200
400
600
800
1000
Transportation Corridors
Major Roads
Rail
Pathways
Architecture
Civic
Residential
Commercial
Landscaping
Trees
Other Plantings

Balanced Mobility

- Bottom Line:
  1. The way we plan and design our street networks permanently shapes our communities, our economies and our quality of life
  2. Growing a transit system is a strategic process

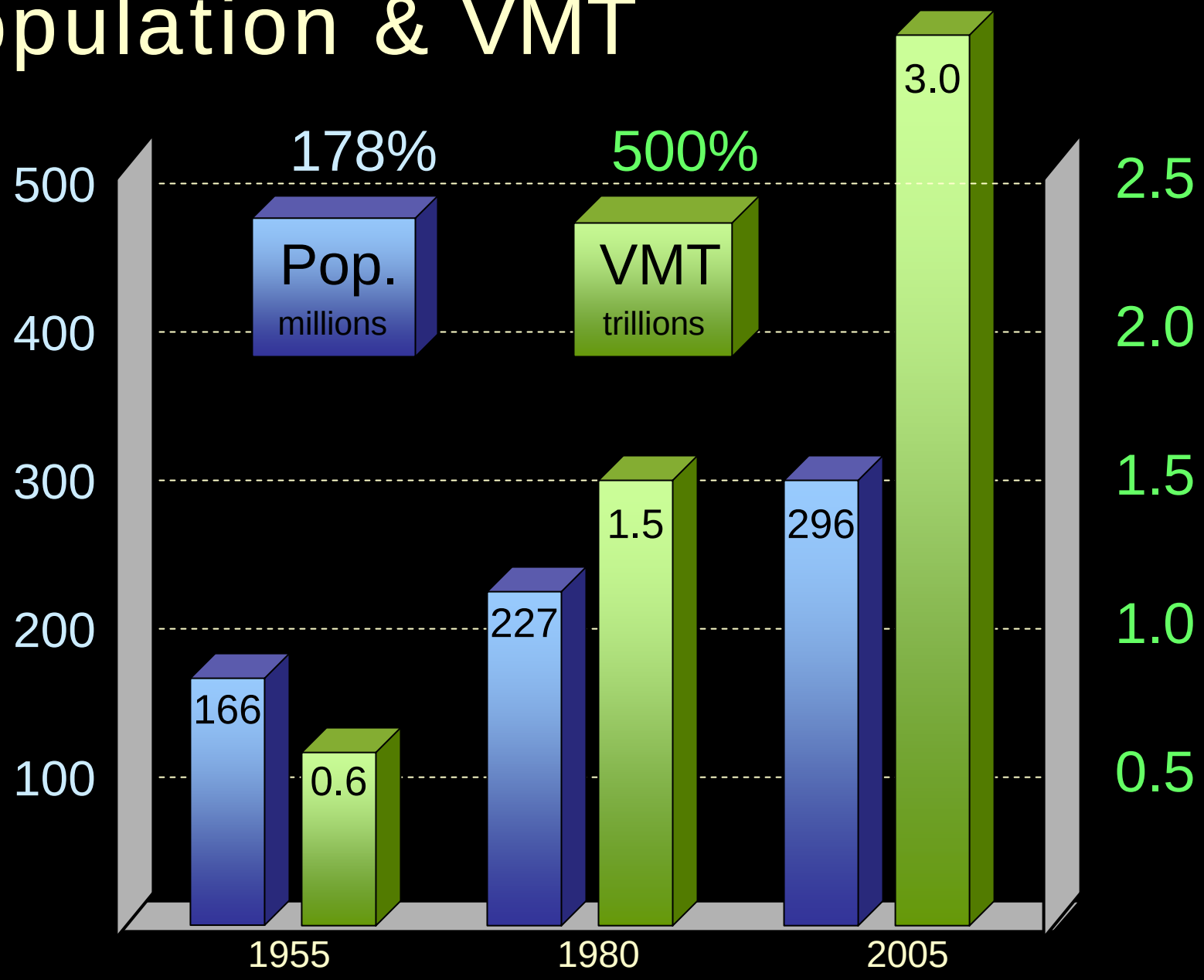
Household Budgets

def. “Location Efficiency”

The intrinsic accessibility and mobility performance of a given land development pattern, measured in unavoidable transportation costs (incl. time) and associated secondary impacts of non-productive travel volumes

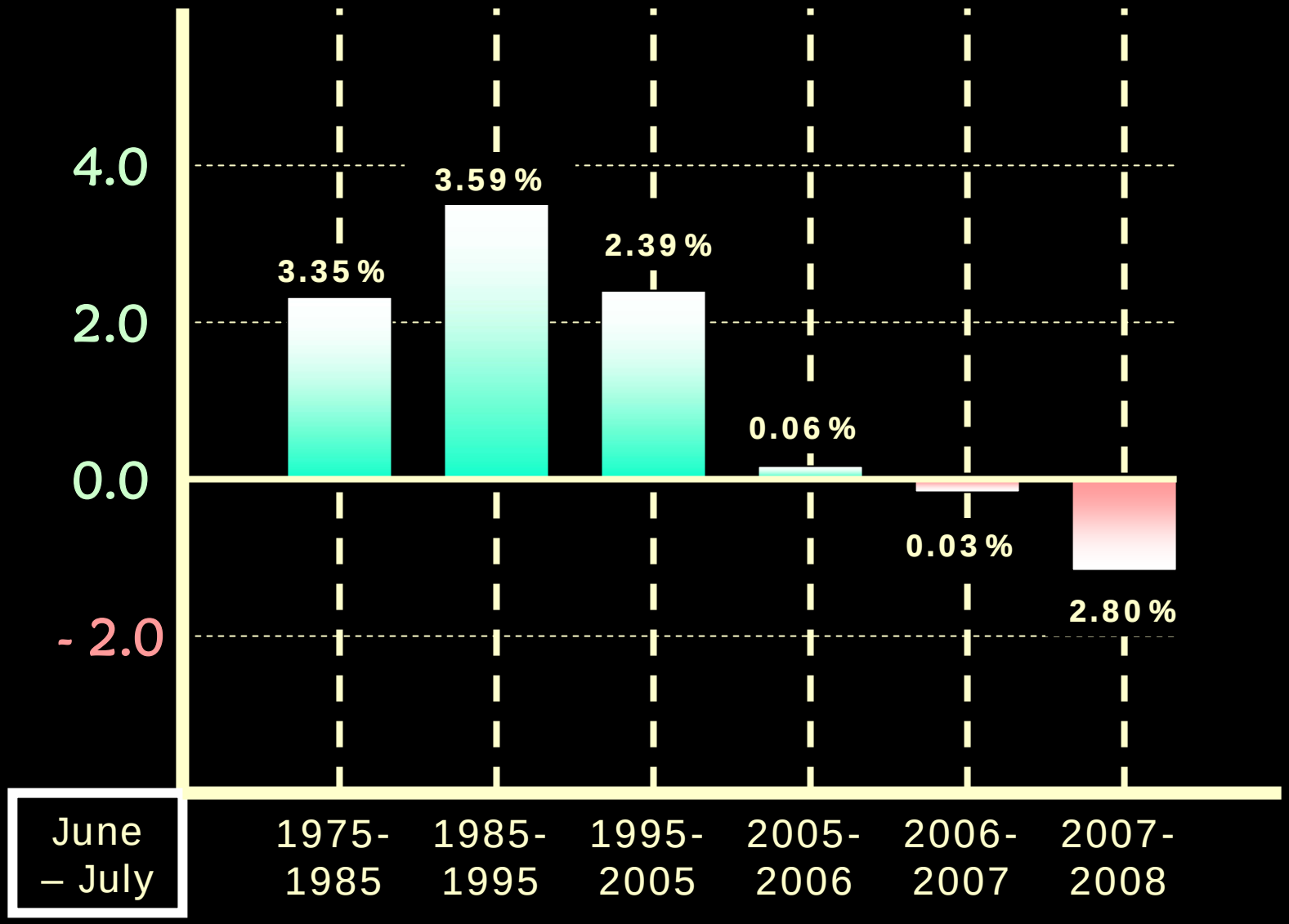
United States

Population & VMT



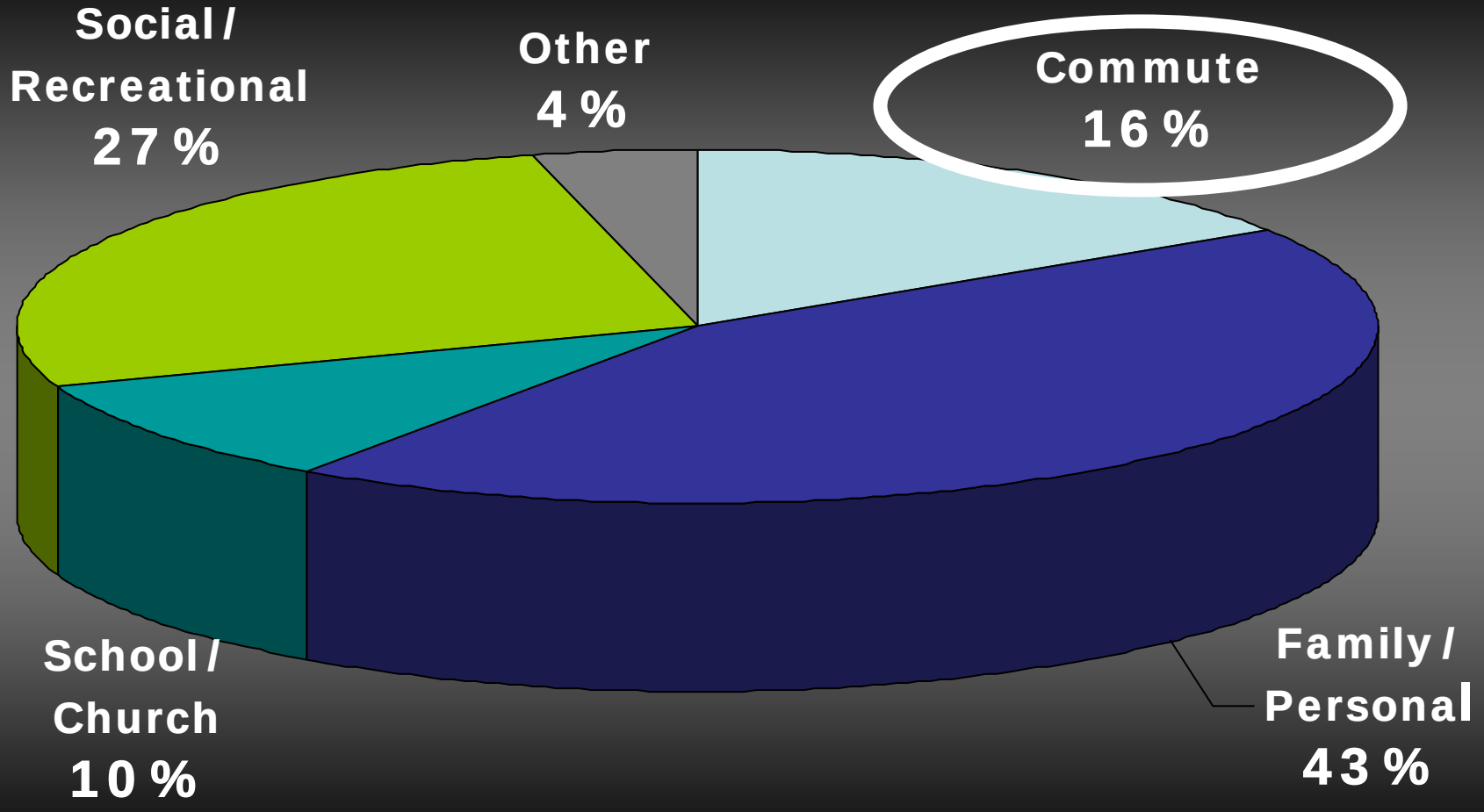
United States

Annual Rate of Change in VMT



Daily Trips/Person

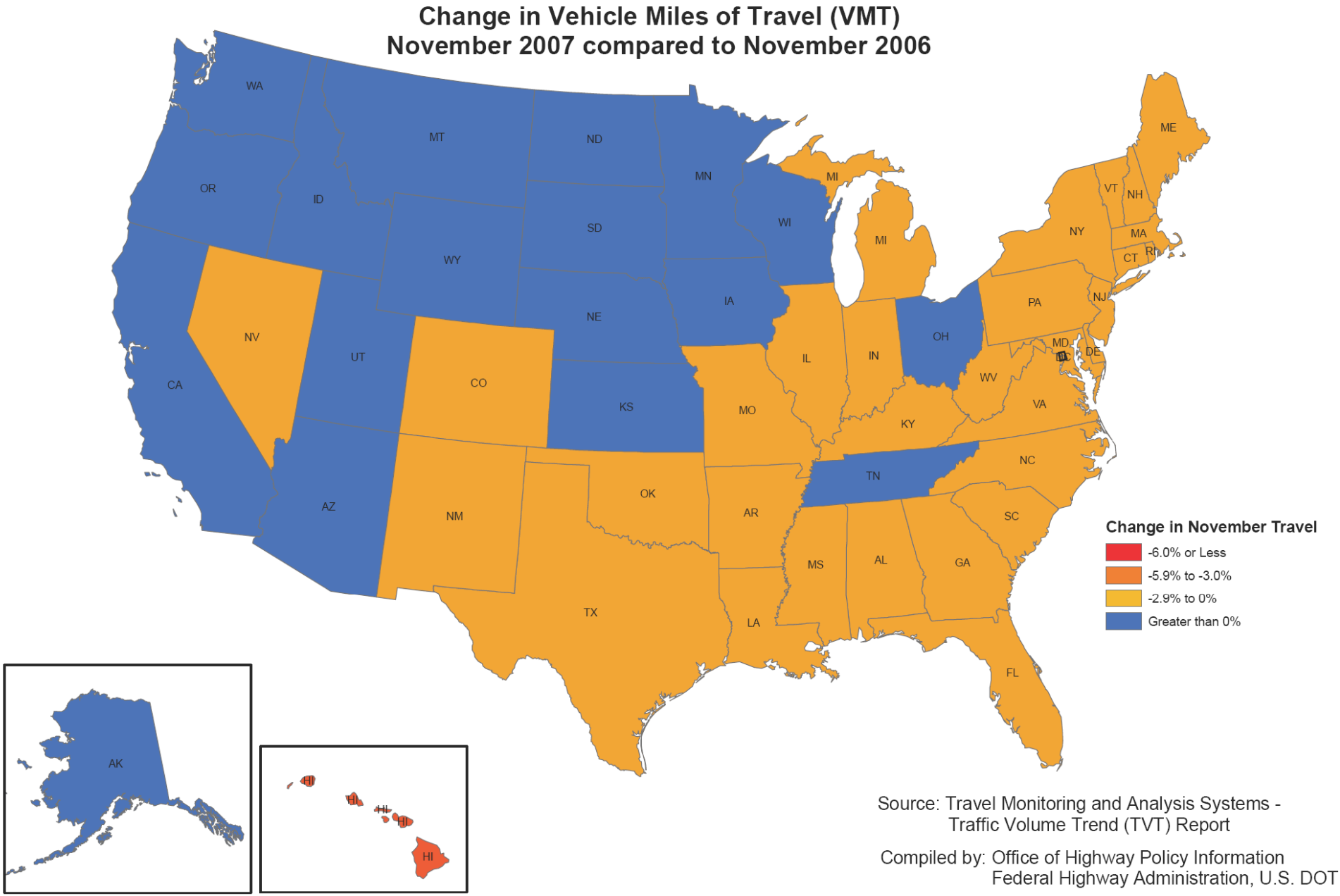
Source: US 2001 NHTS



Daily Miles of Travel Per Capita

(NHTS)

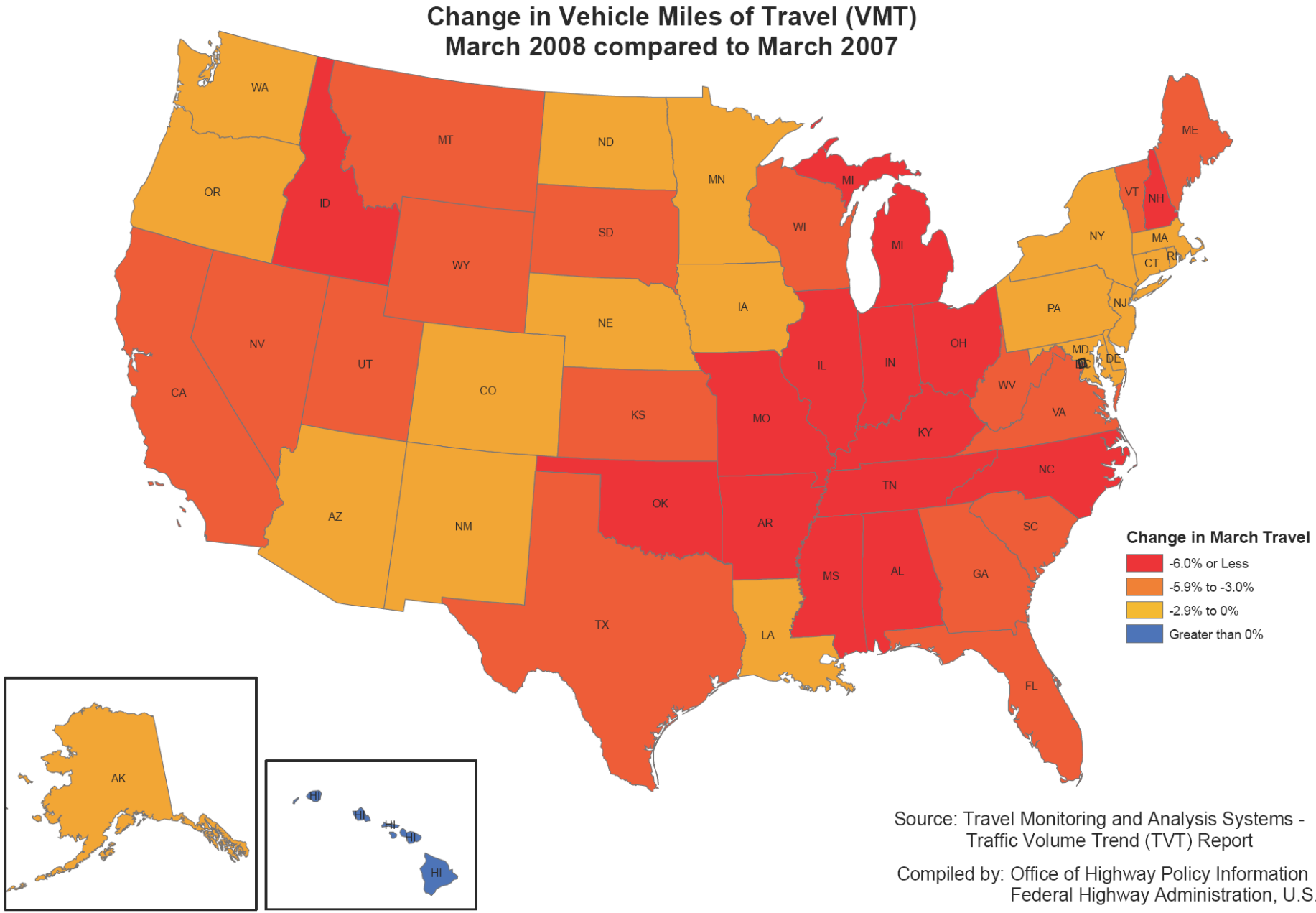
November 2006 – November 2007



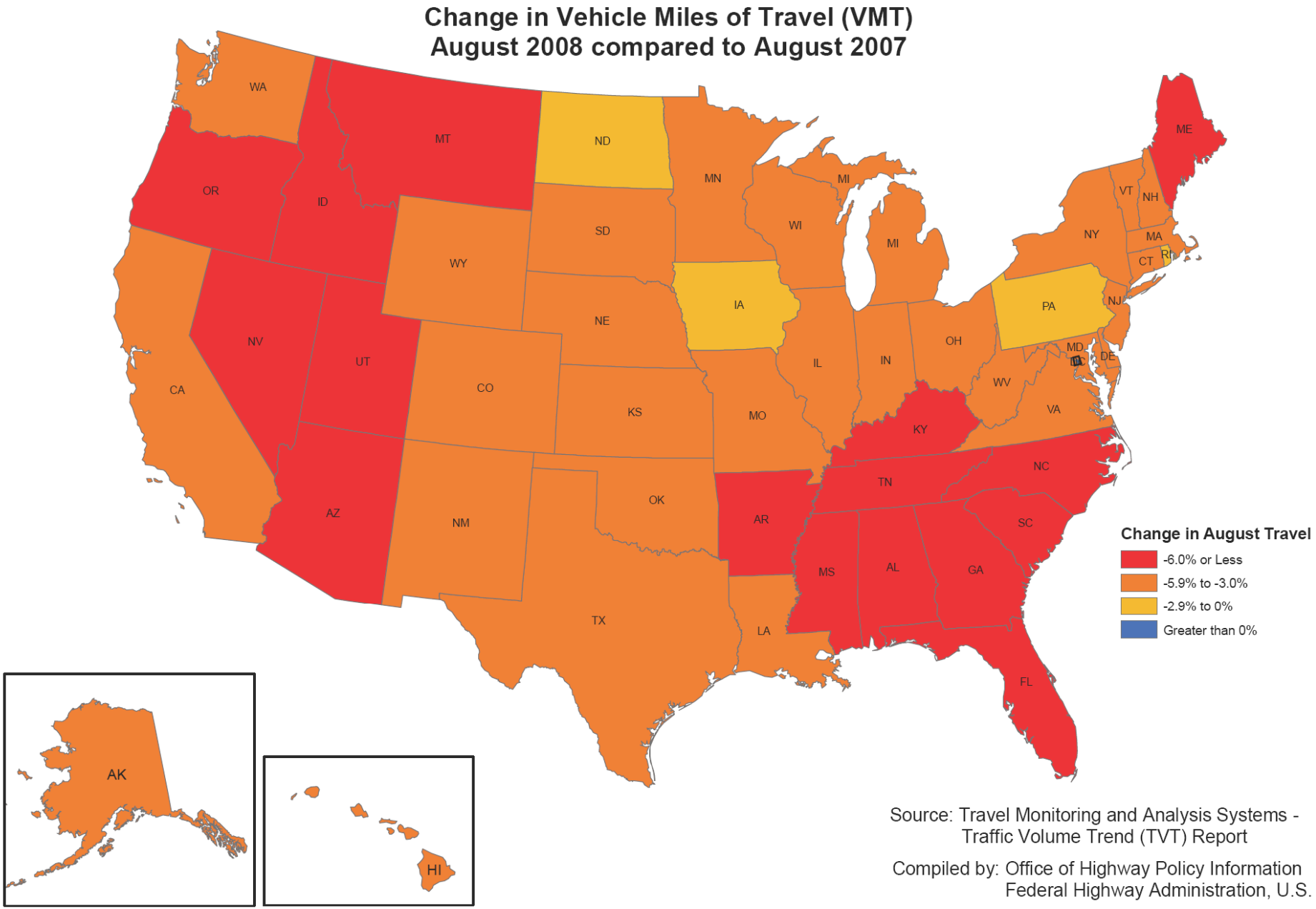
Source: Travel Monitoring and Analysis Systems - Traffic Volume Trend (TVT) Report

Compiled by: Office of Highway Policy Information
Federal Highway Administration, U.S. DOT

March 2007 – March 2008



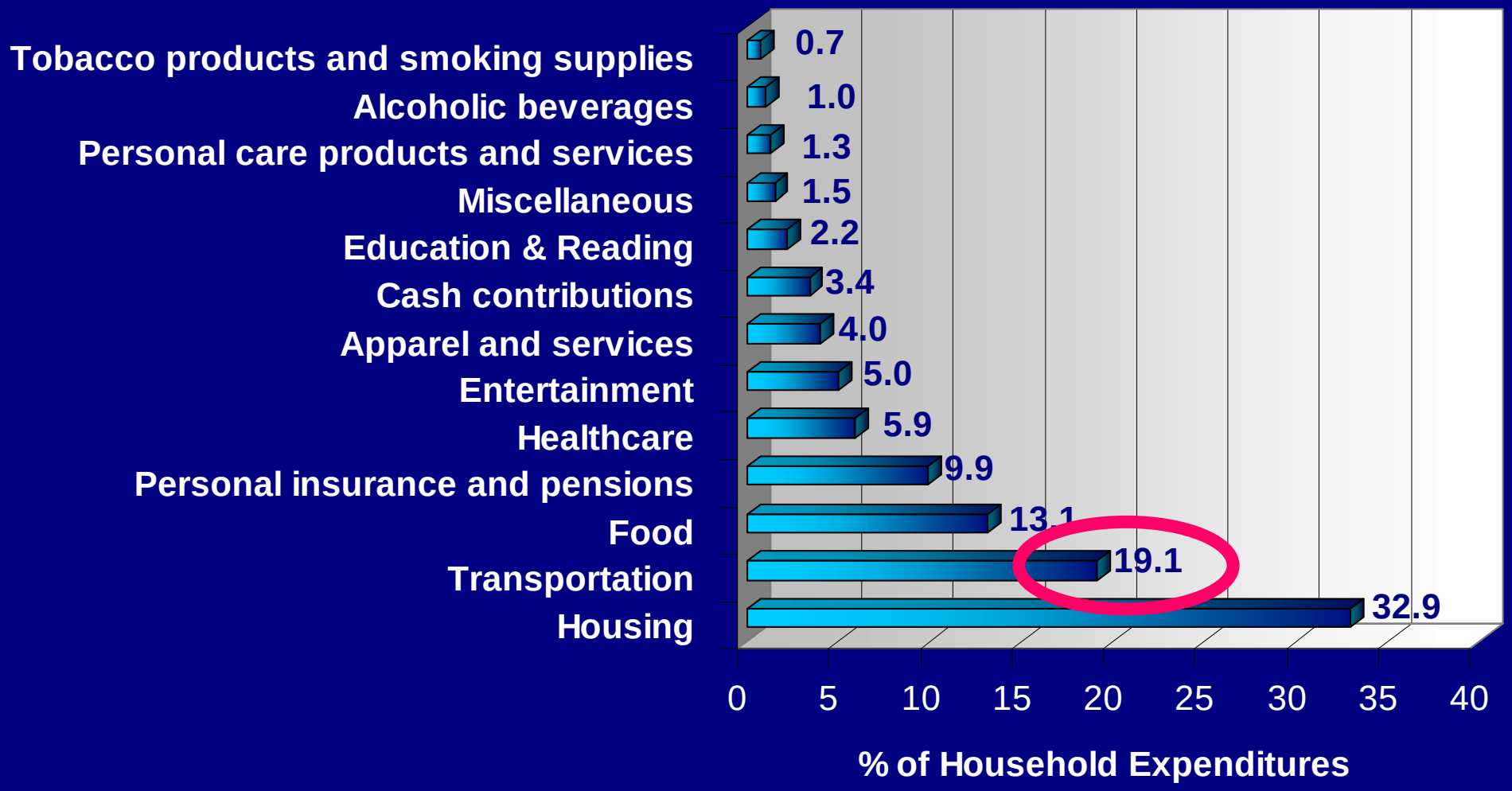
August 2007 – August 2008



Source: Travel Monitoring and Analysis Systems - Traffic Volume Trend (TVT) Report

Compiled by: Office of Highway Policy Information
Federal Highway Administration, U.S. DOT

Household Expenditures



TYPICAL HOUSEHOLD BUDGET IN 28 METROPOLITAN AREAS

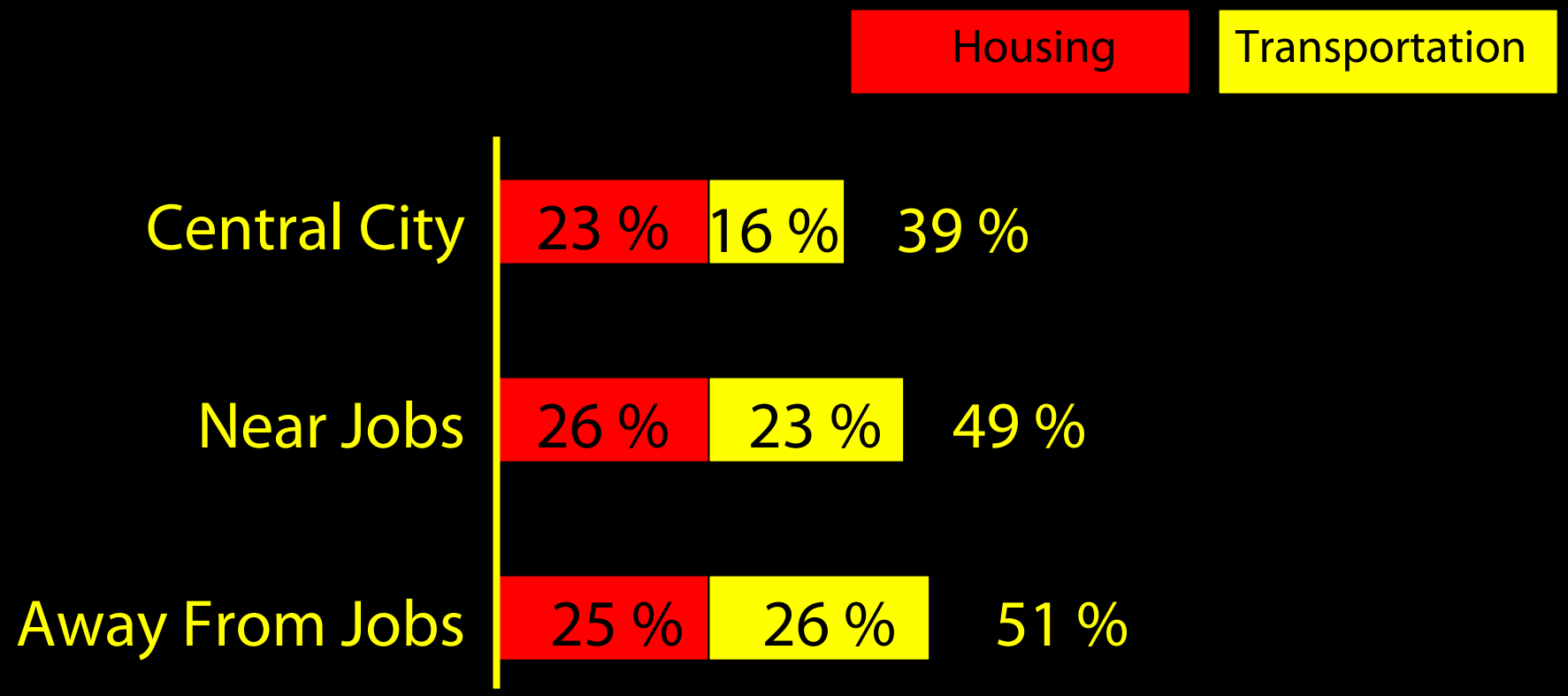
(Expenses as a share of income)

	All Households	Working Families Incomes $20,000 – $50,000
Housing	27.4%	27.7%
Transportation	20.2%	29.6%
Food	10.6%	15.1%
Healthcare	4.7%	7.7%

Source: A Heavy Load, Center for Neighborhood Technology

Share of Family Income Spent On Housing & Transportation

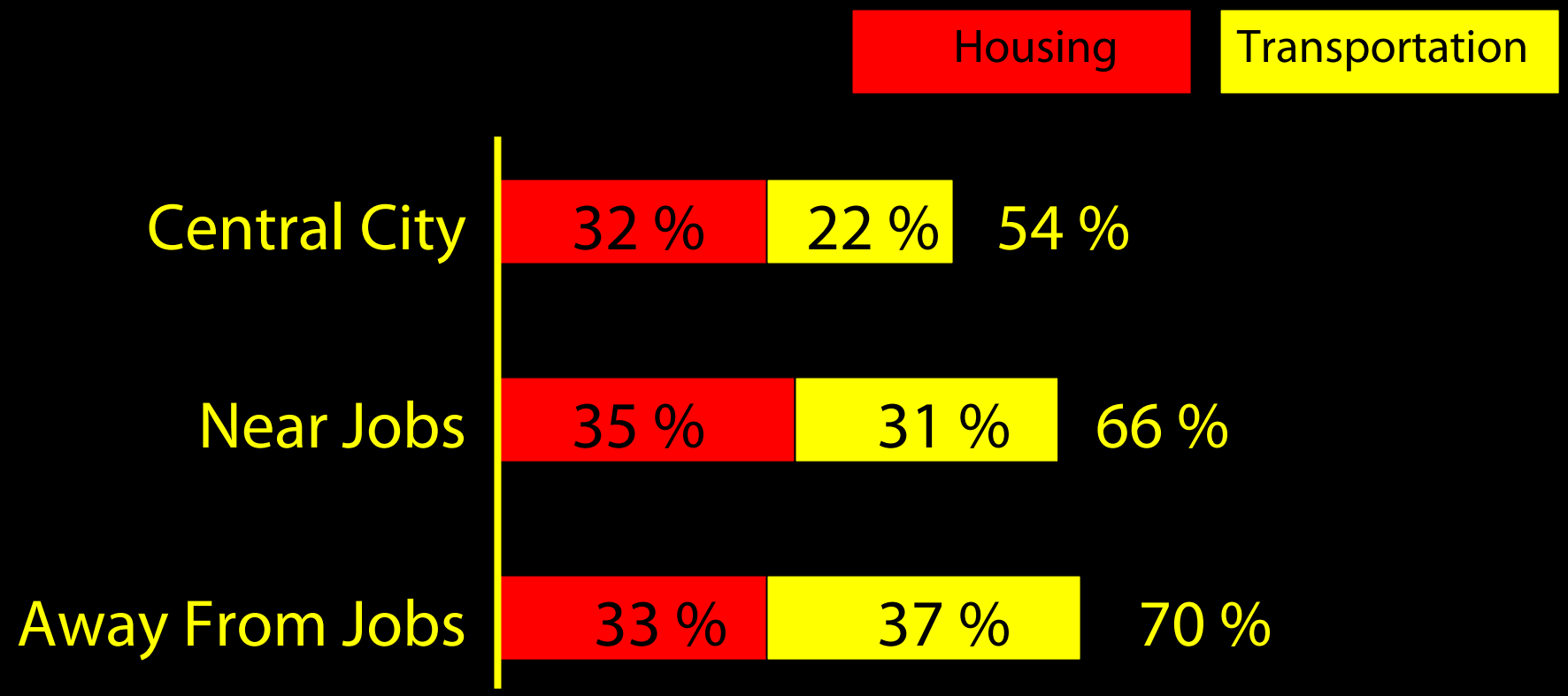
Family Income = $35,000 - $50,000



Source: A Heavy Load, Center for Neighborhood Technology

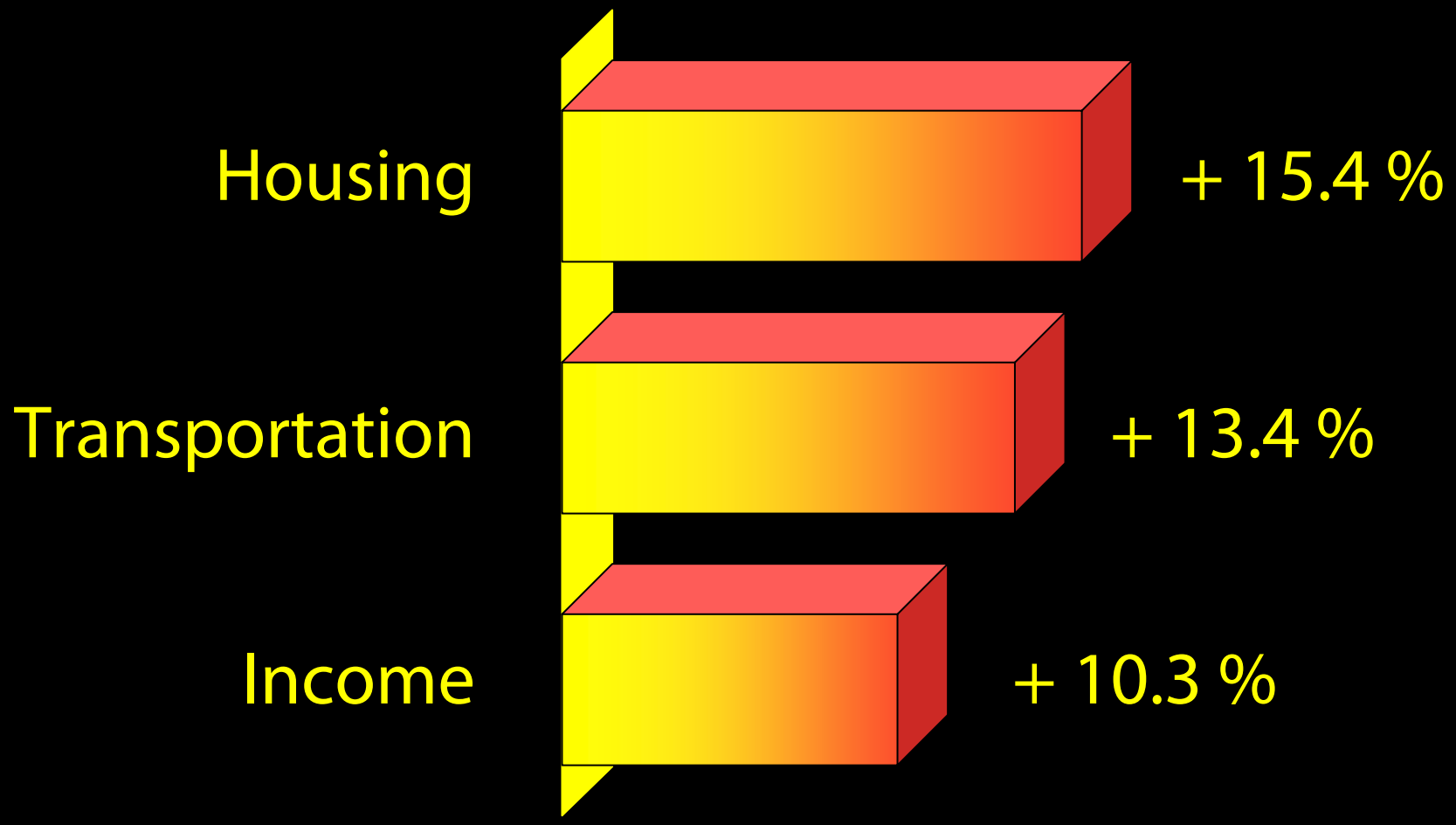
Share of Family Income Spent On Housing & Transportation

Family Income = $20,000 - $35,000



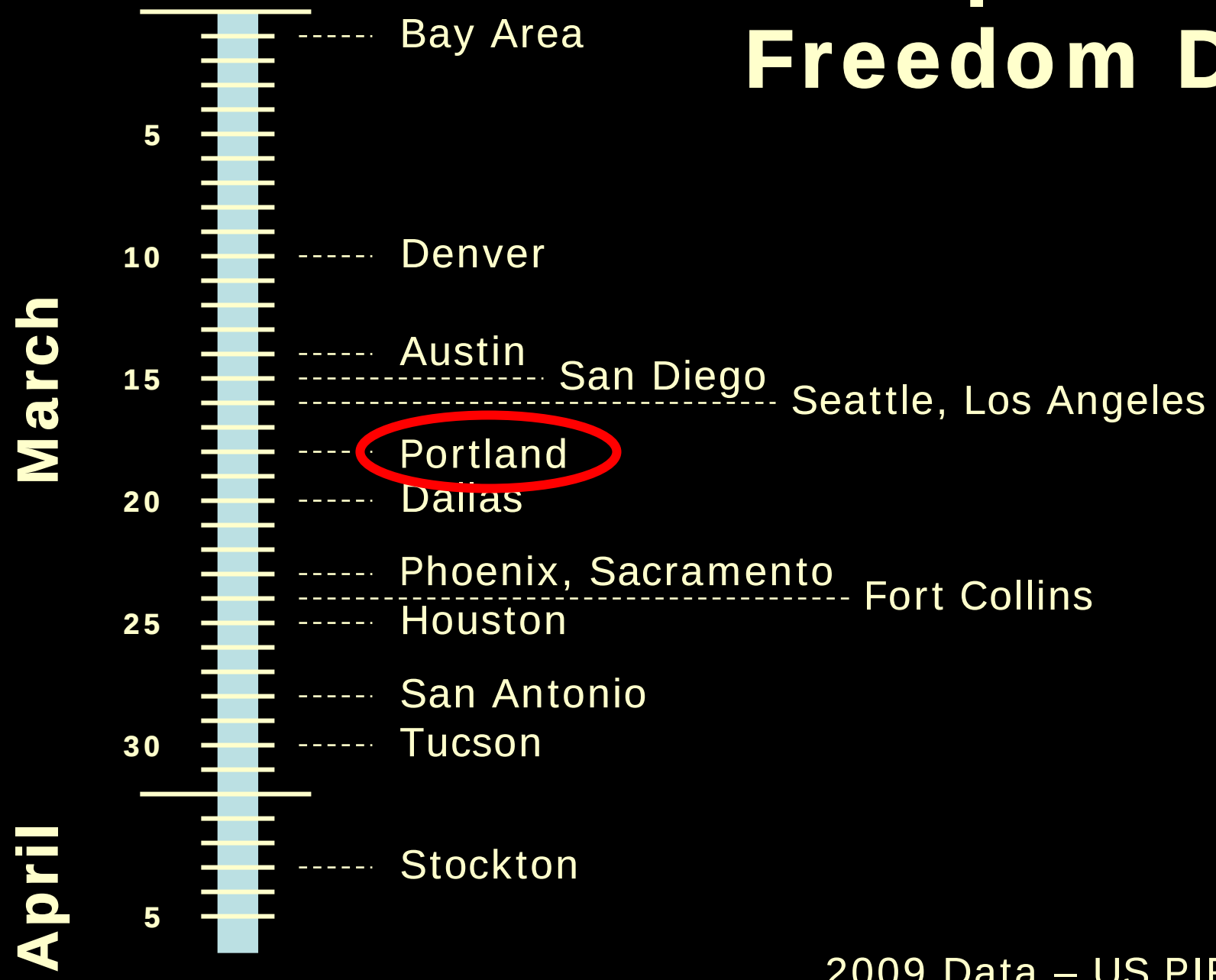
Source: A Heavy Load, Center for Neighborhood Technology

Family Costs Rising Faster Than Incomes (2000 – 2005)



Source: A Heavy Load, Center for Neighborhood Technology

Transportation Freedom Day



2009 Data – US PIRG

Emerging Trend

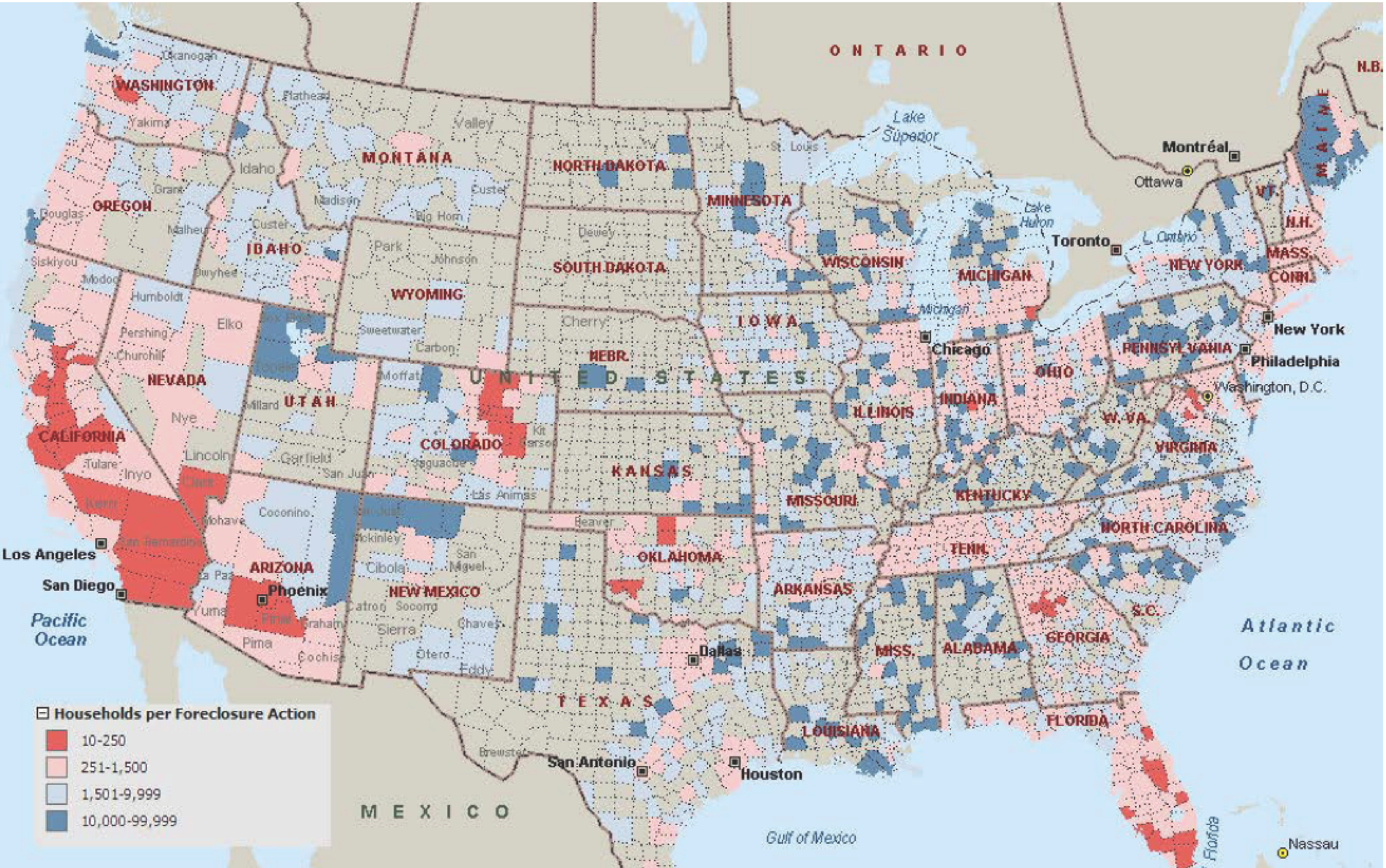
Table: The Effect of Centrality on Housing Price Changes

Change in Housing Prices Last 12 Months

Metro Area	Region-wide Average	Close-In Neighborhoods	Distant Neighborhoods
Chicago	-4%	0%	-4%
Los Angeles	-11%	-6%	-10%
Pittsburgh	0%	2%	-5%
Portland	-1%	3%	-5%
Tampa	-13%	-9%	-14%

Source: Driven to the Brink: How the Gas Price Spike Popped the Housing Bubble and Devalued the Suburbs, Joe Cortright, May 2008. CEOs for Cities.

Foreclosures by County, March 2008

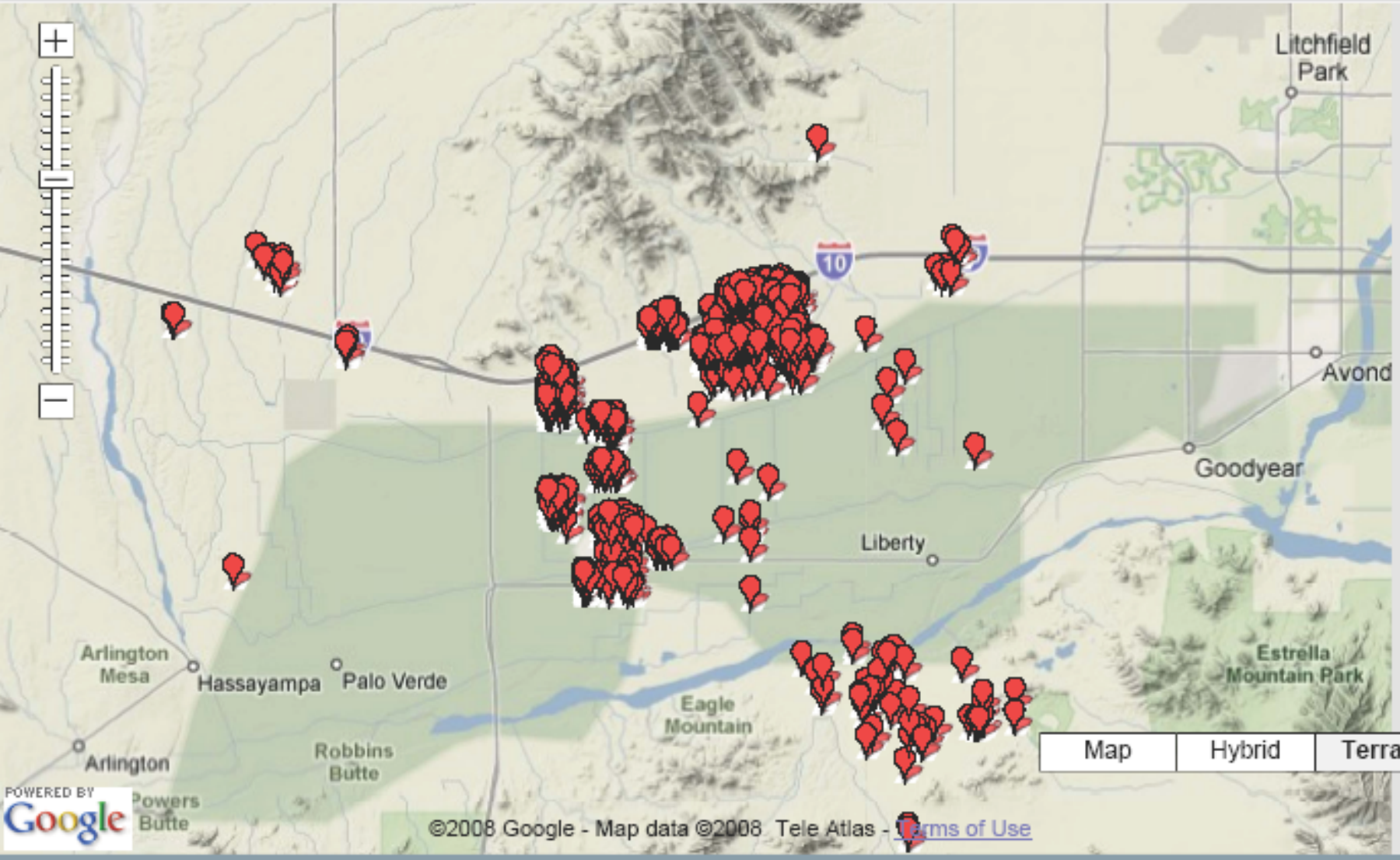


Source: RealtyTrac.com

FORECLOSURES BY ZIP CODE

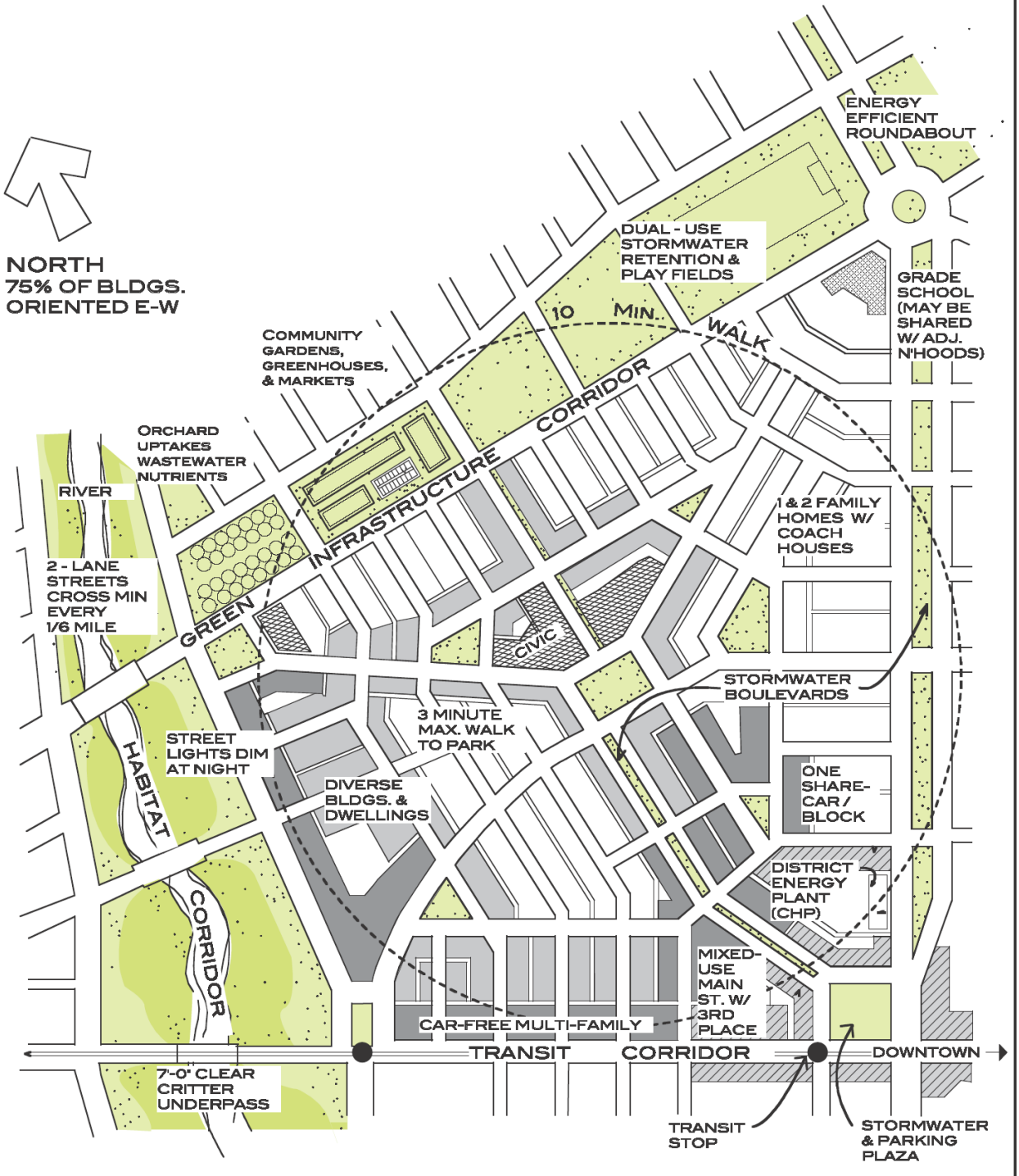
azcentral.com

Show controls | FAQ | Credits



Complete Neighborhood

- 160 acres
- 1,320’ radius
- Walkable
- Connected
- Uses:
  - ✓Homes
  - ✓Schools
  - ✓Shops
  - ✓Services



A Neighborhood Model

- 160 acres @ 10 du/acre (net) = 6.25 du/acre (gross) =
  - 1,000 du x 2.5 people/du =
  - 2,500 population in average neighborhood
- Requires:
  - ✓Horizontal land use mix
  - ✓Walkable, bike-able environment

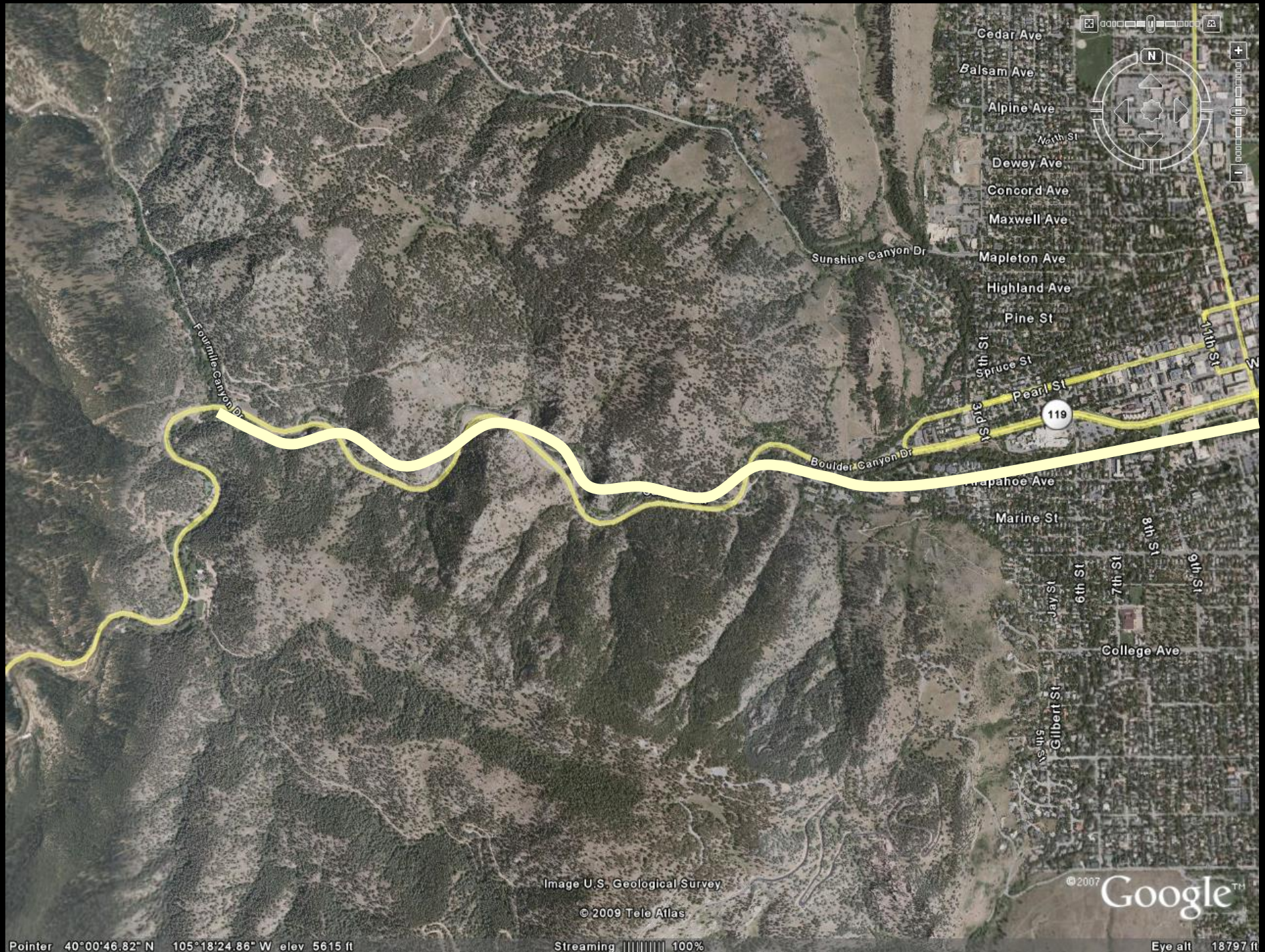
Holiday Neighborhood – North Boulder

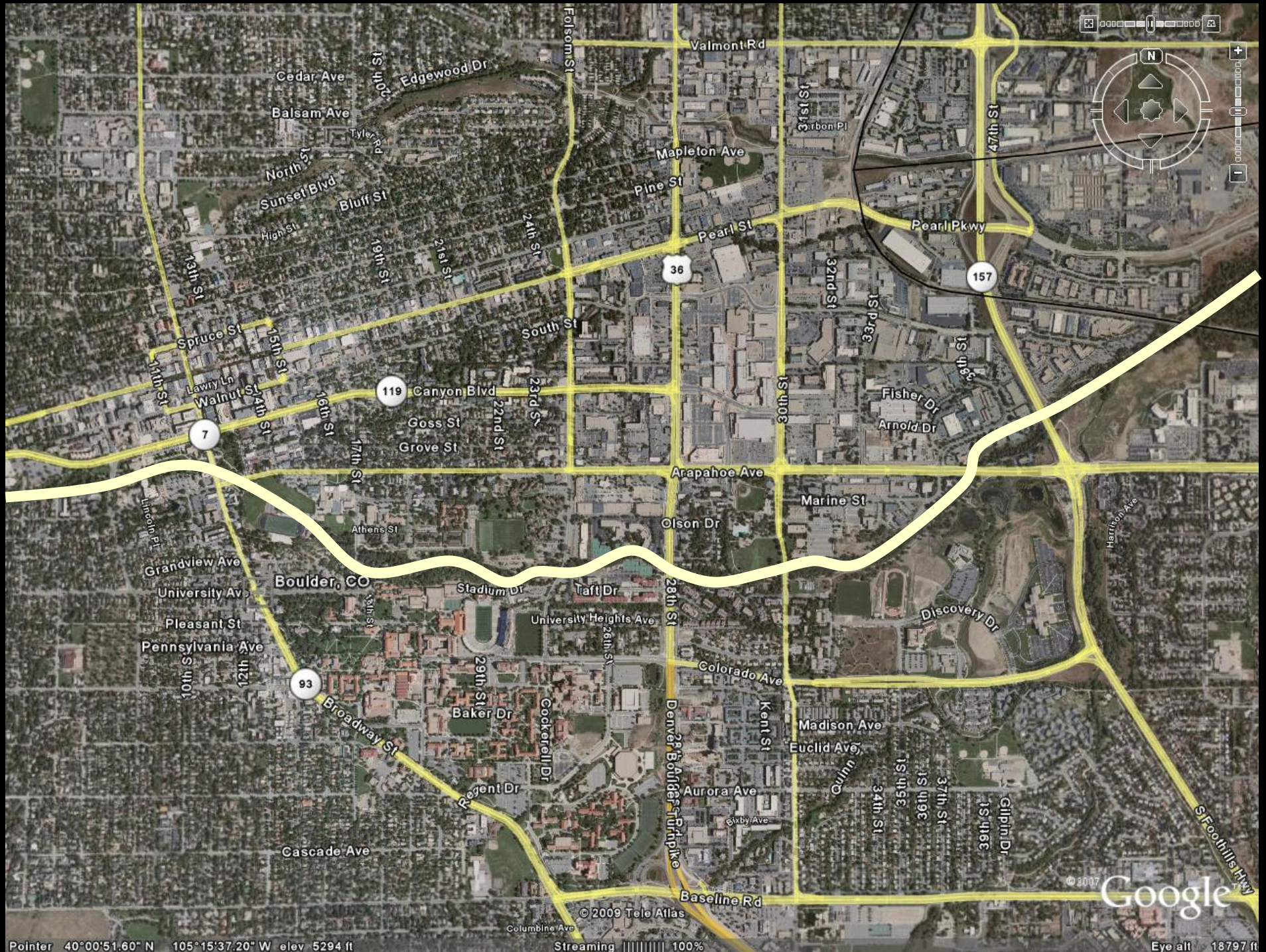
Max allowable residential density: 20 units/acre

Actual gross density: 333 units on 27 acres (12.3 du/acre)

SE Lala Dr
SE Cole Dr
SE 152nd Ave
SE 162nd Ave
Carver Rd
212
SE Gladys Rose Way
SE Goosehollow Dr
224
SE Slate St
SE Pyrite St
SE Windswept Waters Dr
SE Eckert Ln
SE Widgeon Ln
SE Tallina Dr
Clackamas Hwy
SE Van Zyl Dr
SE Bel Air Dr
Image © 2009 Metro, Portland Oregon
© 2009 Tele Atlas
©2007 Google

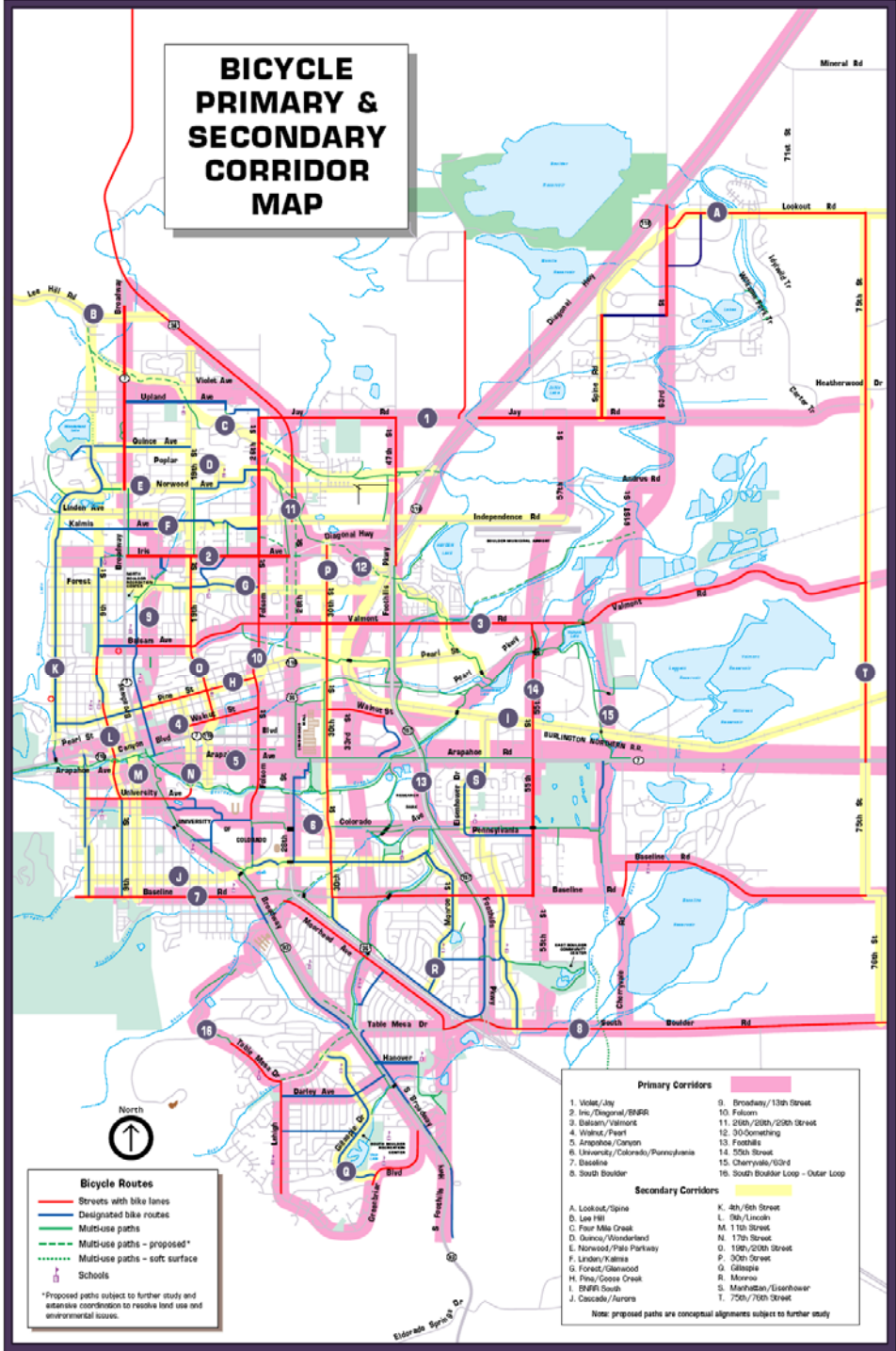
Boulder Creek Path


Cedar Ave
Balsam Ave
Alpine Ave
North St
Dewey Ave
Concord Ave
Maxwell Ave
Sunshine Canyon Dr
Mapleton Ave
Highland Ave
Pine St
Fourmile Canyon Dr
1st St
Spruce St
Pearl St
3rd St
119
Boulder Canyon Dr
Arapahoe Ave
Marine St
11th St
8th St
9th St
7th St
6th St
Jay St
College Ave
Gilbert St
5th St
Image U.S. Geological Survey
© 2009 Tele Atlas
©2007 Google
Pointer 40°00'46.82" N 105°18'24.86" W elev 5615 ft
Streaming 100%
Eye alt 18797 ft


Valmont Rd
Cedar Ave
Edgewood Dr
20th St
Balsam Ave
Tyler Rd
North St
Sunset Blvd
Bluff St
High St
Folsom St
Mapleton Ave
Pine St
Pearl St
Pearl Pkwy
31st St
Arbon Pl
47th St
36
157
13th St
19th St
21st St
24th St
32nd St
33rd St
34th St
Spruce St
15th St
South St
11th St
Lawry Ln
Walnut St
4th St
16th St
119
Canyon Blvd
23rd St
22nd St
30th St
Fisher Dr
Arnold Dr
7
Goss St
Grove St
17th St
Arapahoe Ave
Marine St
Lincoln Pl
Athens St
Olson Dr
Harrison Ave
Grandview Ave
University Av
Boulder, CO
Stadium Dr
Taft Dr
18th St
University Heights Ave
28th St
Discovery Dr
Pleasant St
Pennsylvania Ave
26th St
10th St
12th
29th St
Colorado Ave
93
Broadway St
Baker Dr
Cockerell Dr
Kent St
Madison Ave
Euclid Ave
Denver Boulder Turnpike
Regent Dr
Aurora Ave
Quinn
34th St
35th St
36th St
37th St
39th St
Gilpin Dr
Pixby Ave
S Foothills Hwy
Cascade Ave
Baseline Rd
© 2009 Tele Atlas
Columbine Ave
© 2007
Google
Pointer 40°00'51.60" N 105°15'37.20" W elev 5294 ft
Streaming 100%
Eye alt 18797 ft

1995

Boulder Transportation Master Plan



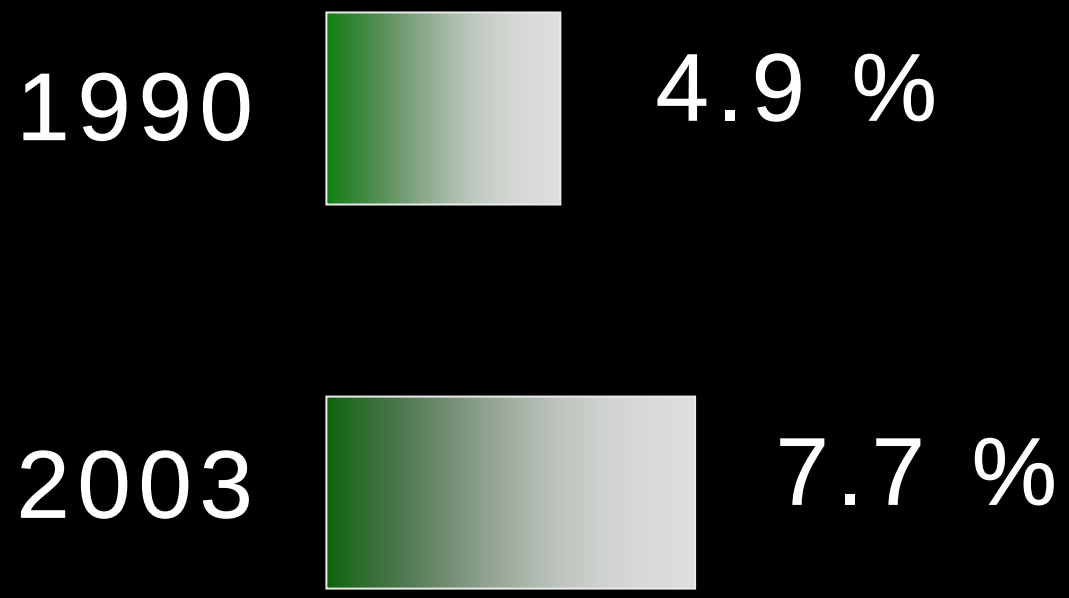
PUBLIC

PED
XING

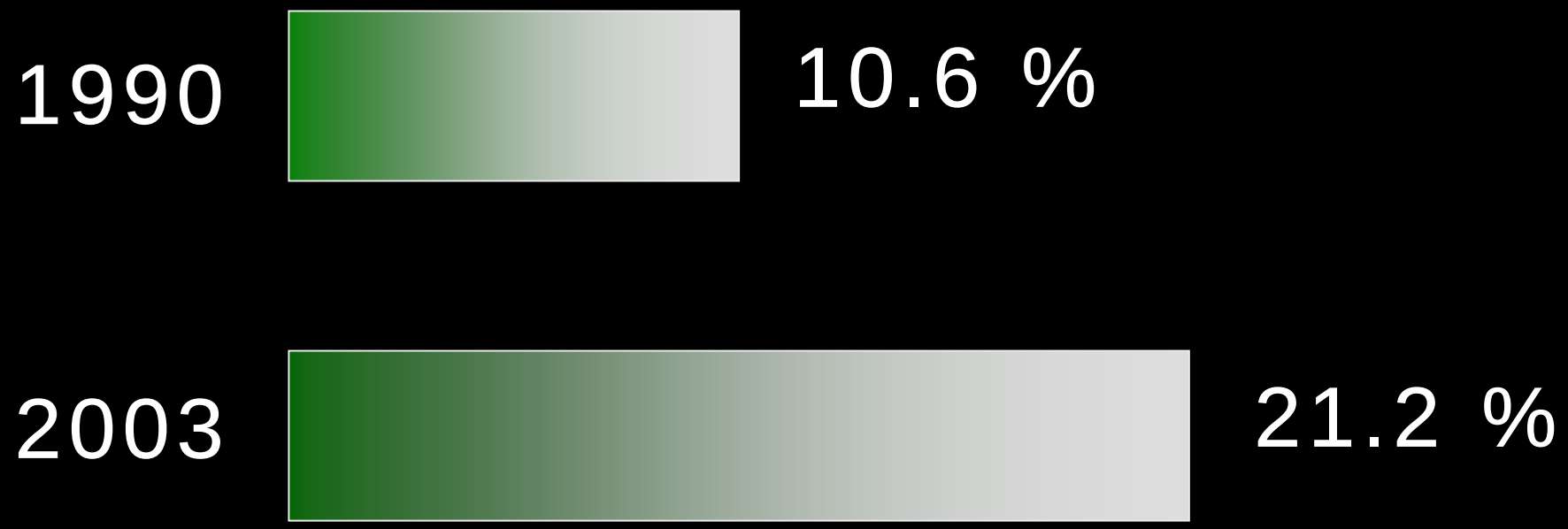
Y TIRE CO.
2001 11

BROADWAY
BOOGIE
BEAR CREEK
TRAIL

Boulder Bike Mode Share – All Trips



Boulder Bike Mode Share – Commute Trips



Three Car Family

	Mom	Dad	Daughter
Monday	SOV	SOV	SOV
Tuesday	SOV	SOV	SOV
Wednesday	SOV	SOV	SOV
Thursday	SOV	SOV	SOV
Friday	SOV	SOV	SOV
Saturday	--	SOV	--
Sunday	varies	varies	varies

Two Car Family

	Mom	Dad	Daughter
Monday	SOV	**Transit**	SOV
Tuesday	SOV	SOV	**Bike**
Wednesday	SOV	**Transit**	SOV
Thursday	SOV	SOV	**Bike**
Friday	SOV	**Transit**	SOV
Saturday	--	SOV	--
Sunday	varies	varies	varies

Well Designed Density

It is not this:

Well Designed Density

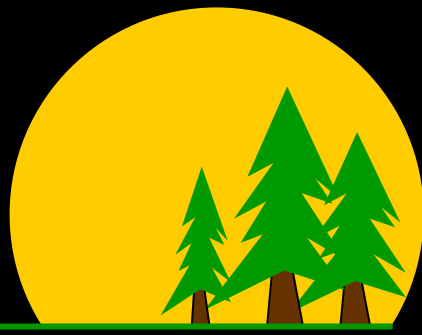
Well Designed Density

Neighborhood Commercial Center

Location Efficiency

- Bottom Line:
  1. Location Efficiency Shapes Your Economy (land values, jobs, etc.)
  2. The Trends are Towards “Urbanity”
  3. Damascus Must Plan for Location Efficiency
  4. Give People an Alternative to Driving Everywhere

Summary

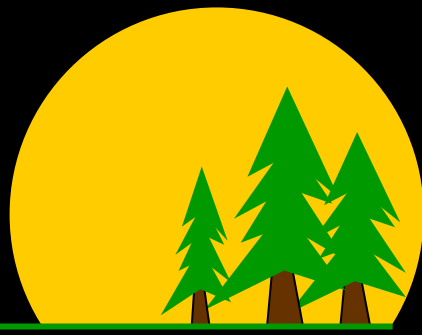


Challenges & Opportunities for Damascus

Elements of Sustainable Mobility

- Preparing for the post-petroleum era
- Climate change management
- Active living & public health
- Balanced mobility
- Connected networks
- Household budgets, local economies

Challenges, Opportunities

1. Developing a connected street network
   Find a way to build collectors & connectors
2. Growing a transit system over time
   Develop transit incrementally, building ridership in a transit-ready landscape
3. Developing a walkable, bike-able city
   Build walk & bike facilities first; require good design
4. Developing complete neighborhoods
   Modernize your land development code

www.charlier.org