COLORADO
INSTITUTE FOR
LEADERSHIP
TRAINING

Sustainable Mobility

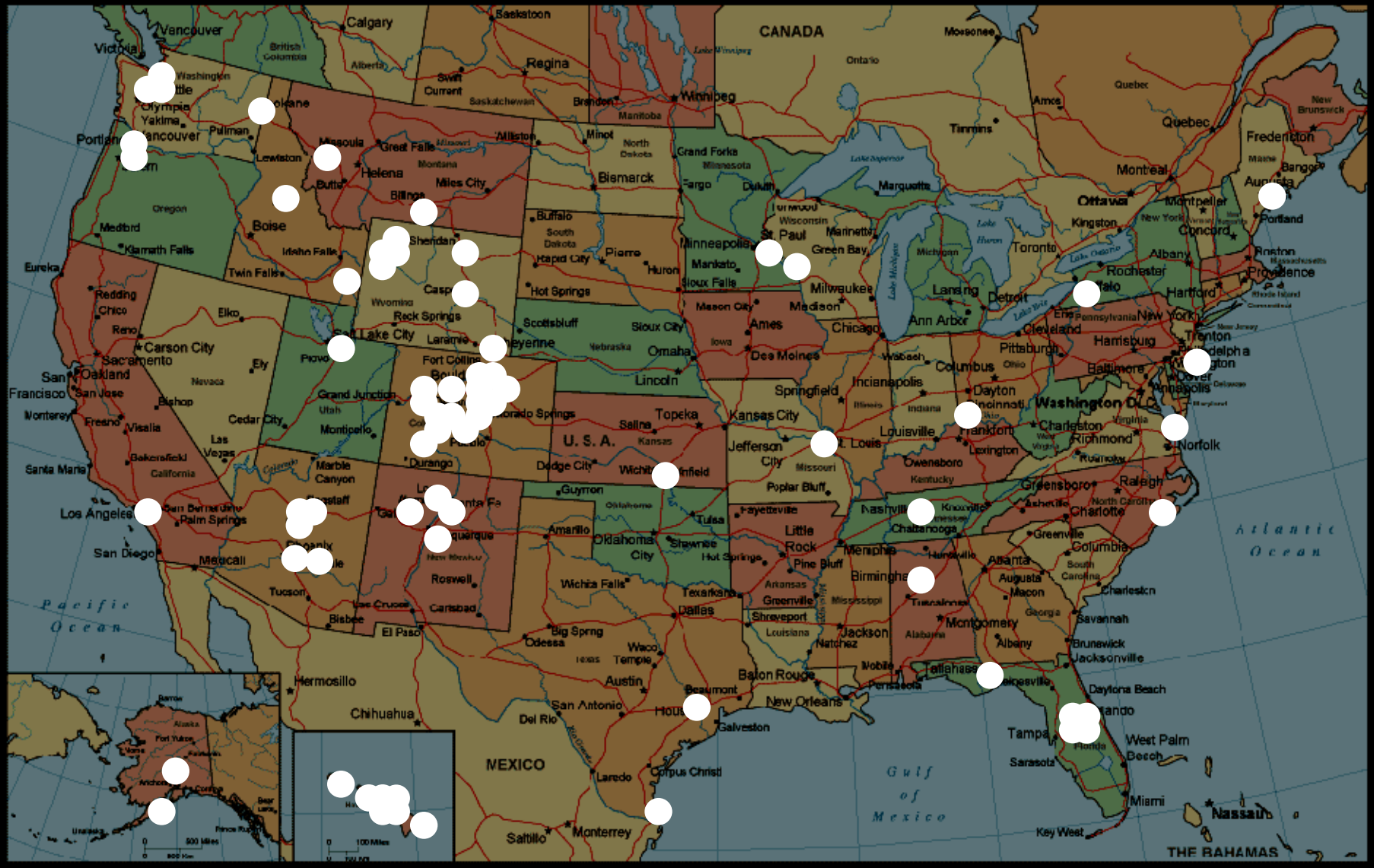
August 26, 2007

Charlier Associates, Inc.

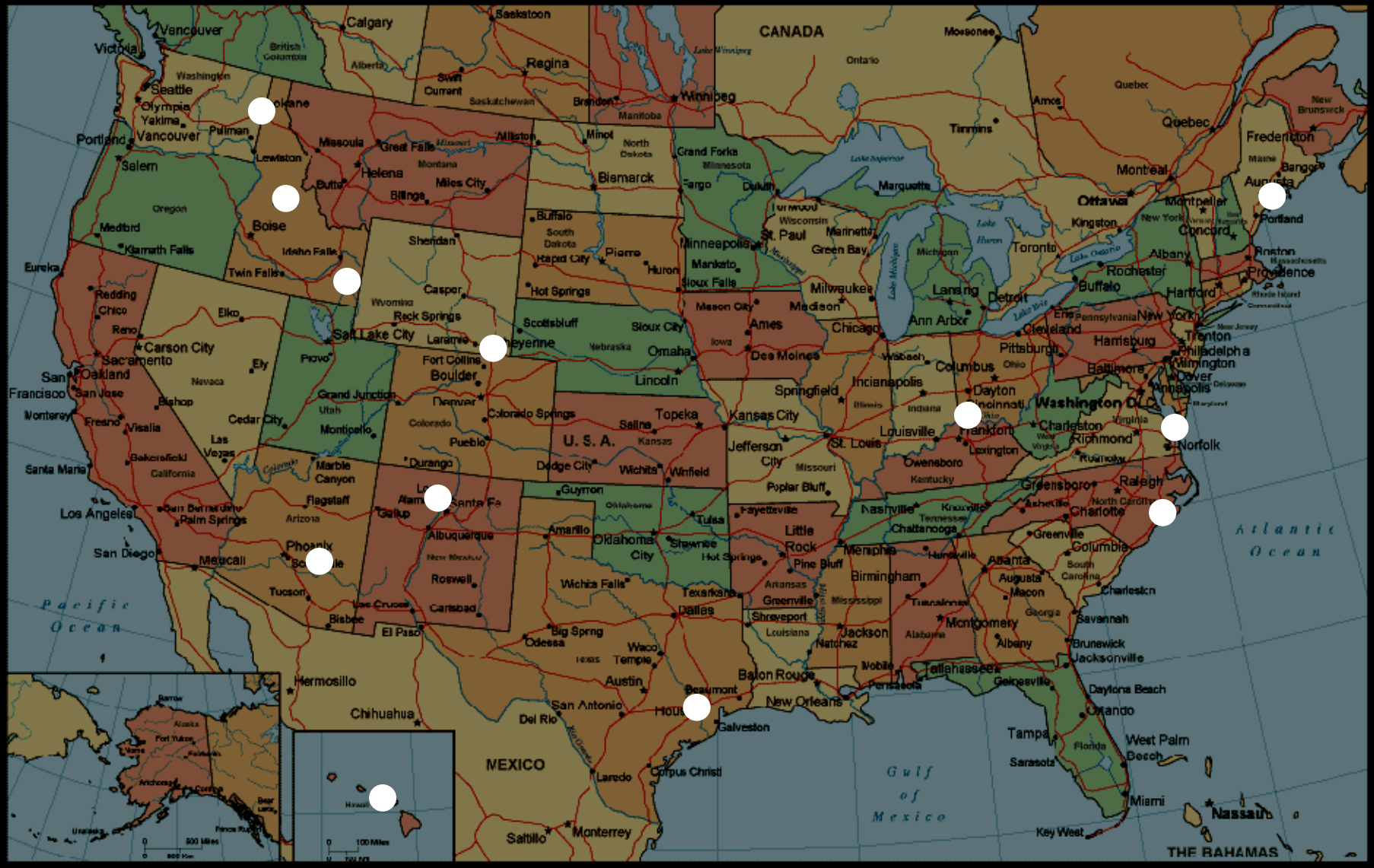
Transportation Policies for a Sustainable Colorado

Our Work

Charlier Associates, Inc.



EPA Smart Growth Implementation Assistance Program



“Sustainable Mobility”

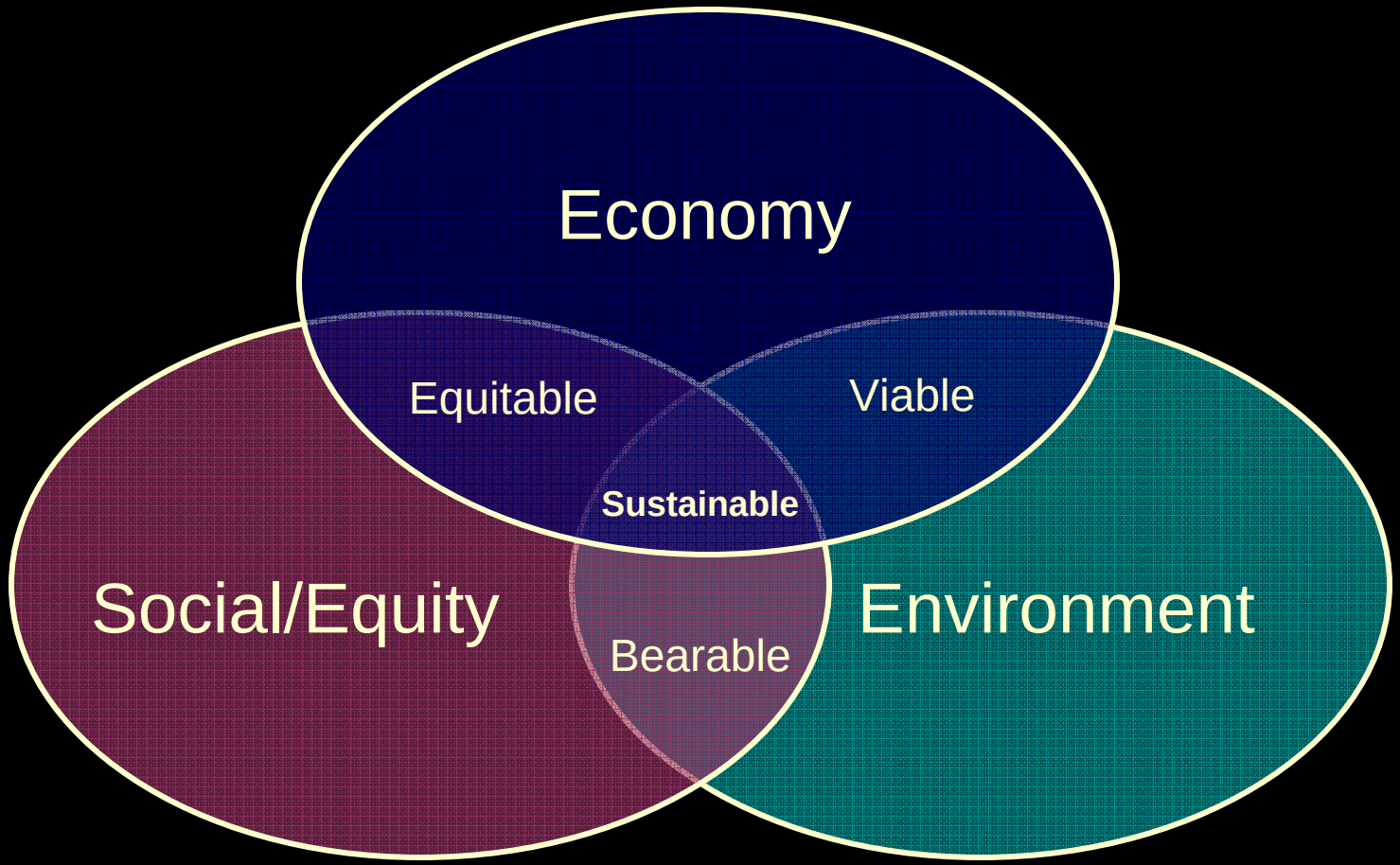
Principles & Policies

Charlier Associates, Inc.

10 Principles – Sustainable Transportation

1. Traffic Growth → Land Use
2. Balanced Mobility → Sprawl
3. Well Connected Networks of Small Streets
4. Scale & Character of Streets → Land Use
5. Limited Value of Traffic Demand Forecasts
6. Public Transit = Choice, Not Congestion Relief
7. Active Living = Personal & Community Health
8. Complete Streets = Multi-Modal Choices
9. Public Empowerment
10. Accountability, Monitoring & Reporting

Classic Sustainability



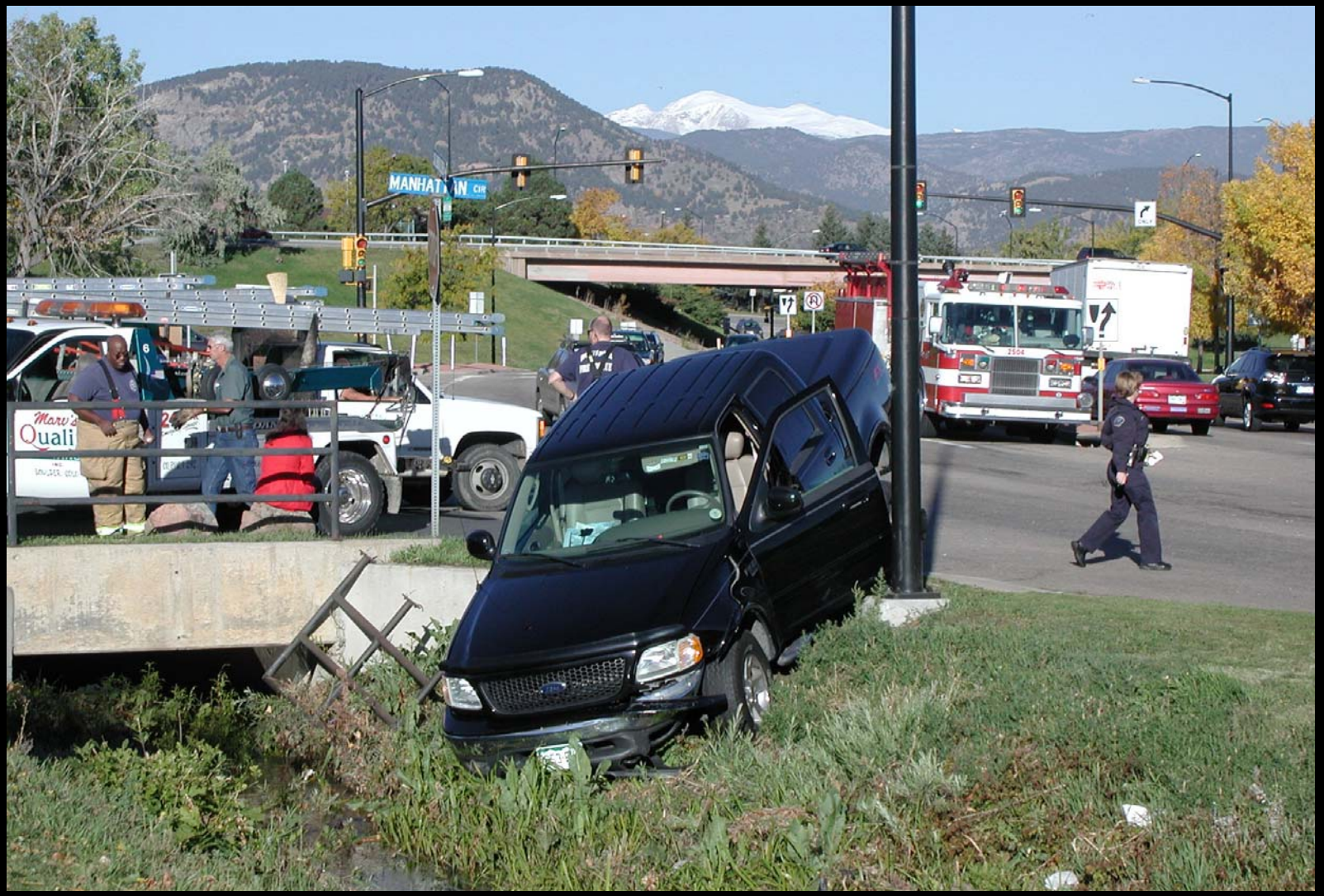
What matters to Coloradans?

- Thriving Family
- Personal Freedom
- Safety
- Physical & Mental Health
- Community Engagement
- Economic Opportunity

Thriving Family

Personal Freedom

Safety



Physical & Mental Health

Community Engagement

Economic Opportunity

10 Principles – Sustainable Transportation

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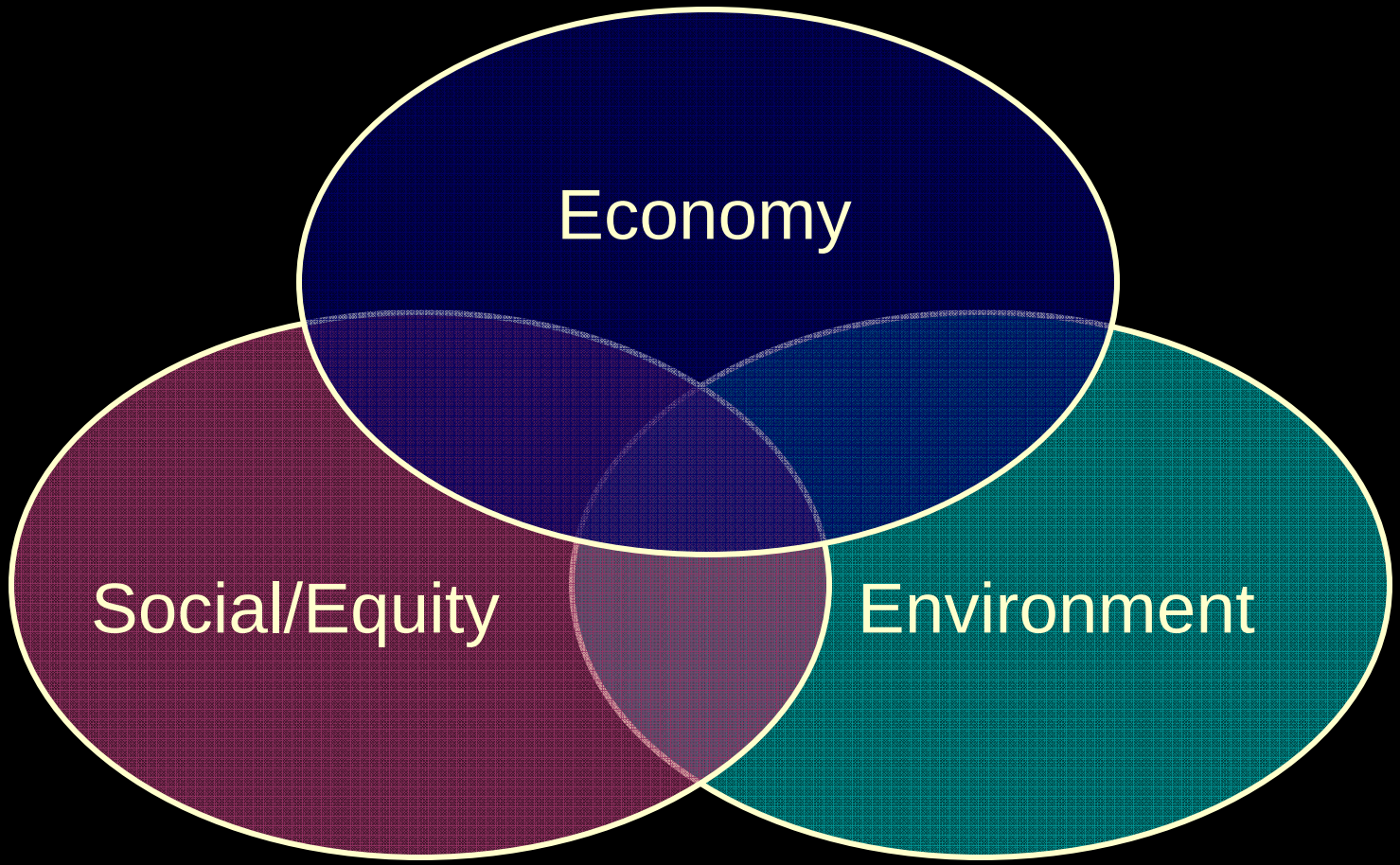
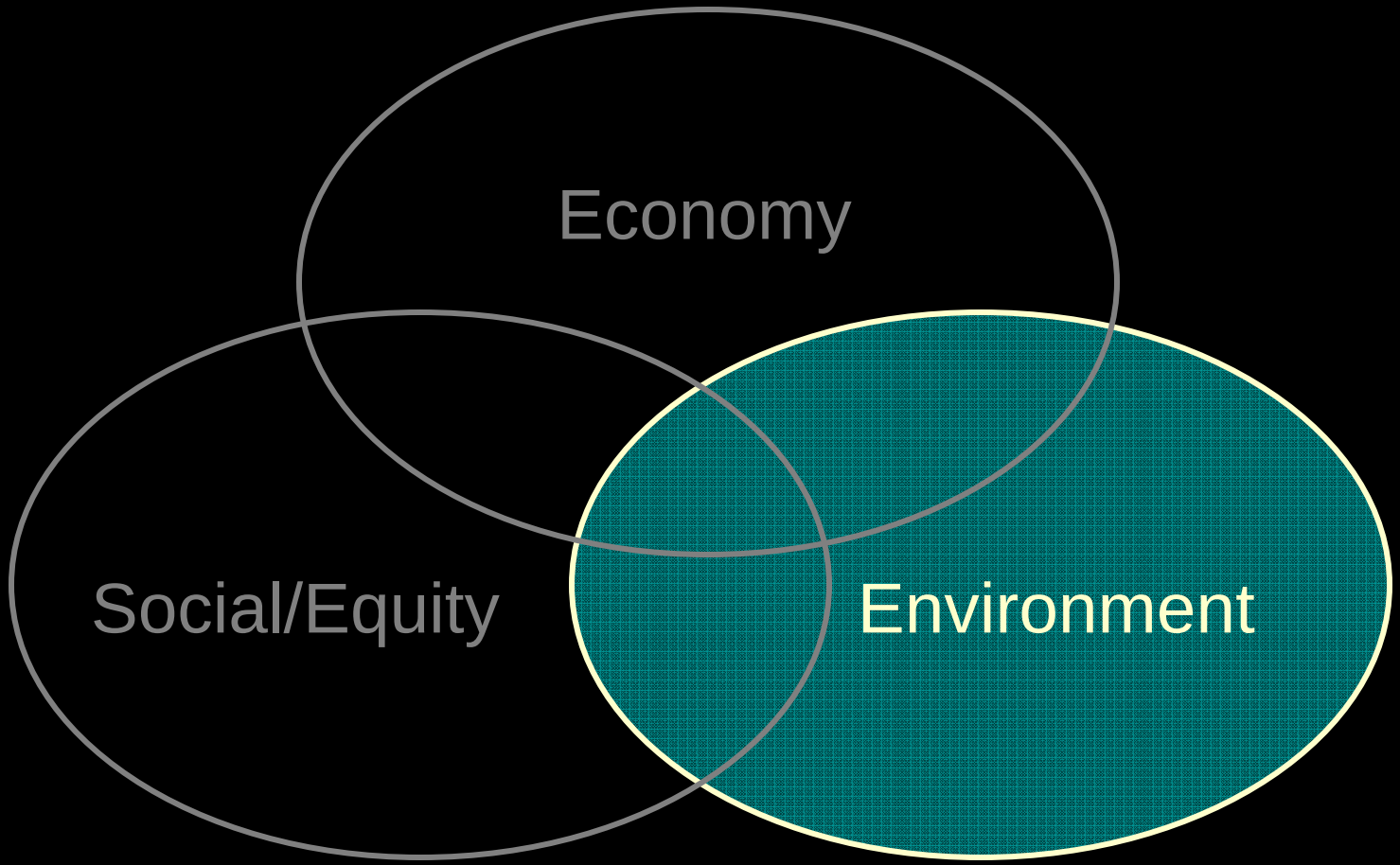
“Sustainability”




1st....

“Sustainability”



Environment

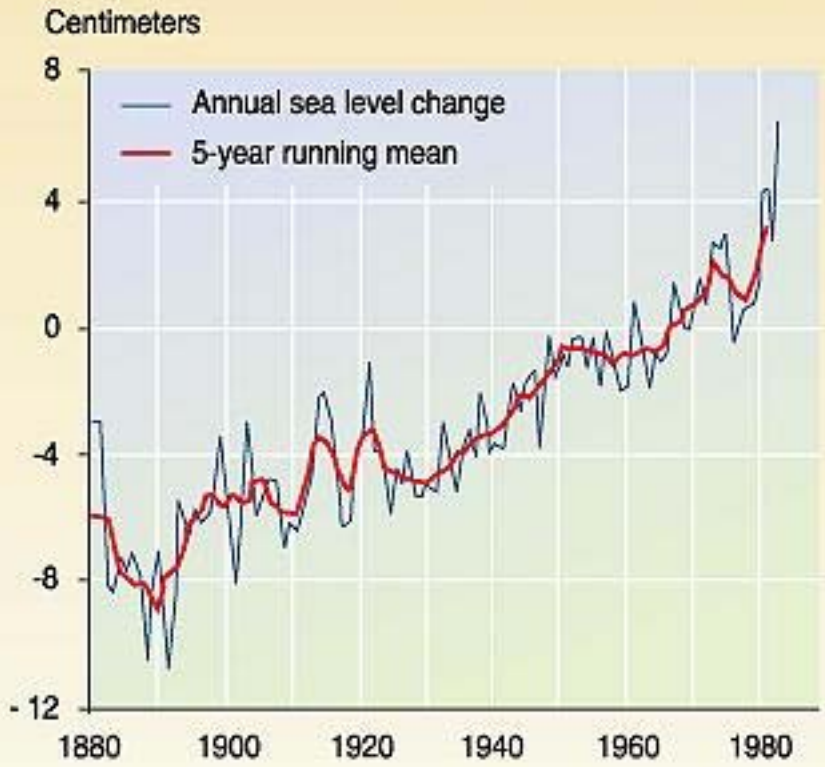
A. Climate Change
B. Pollution
C. Energy Use
D. Landscape
E. Resource Efficiency

Environment

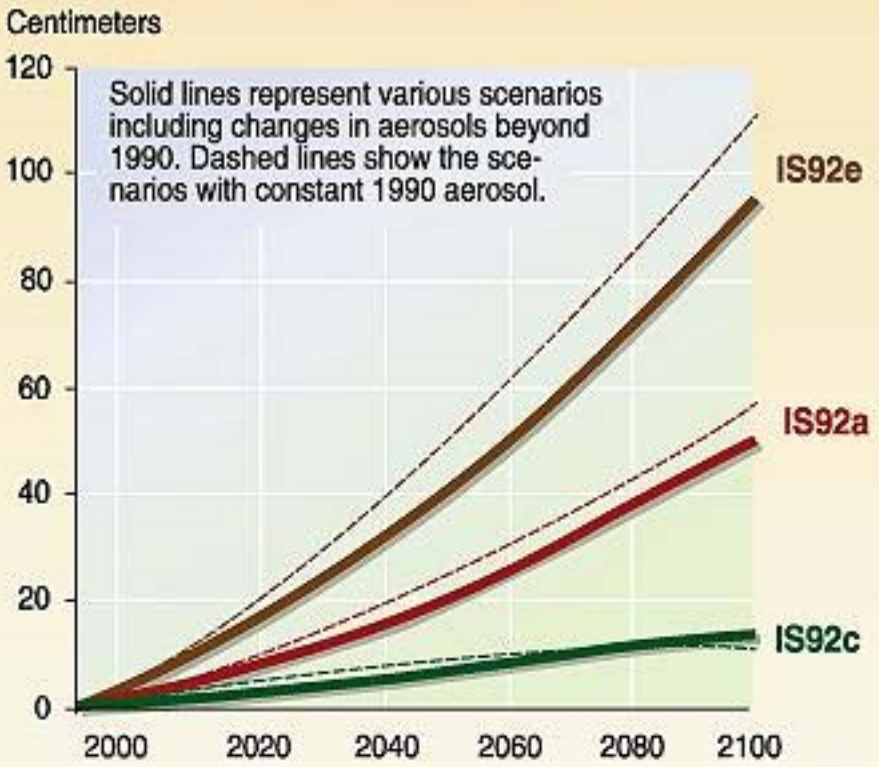
A. Climate Change

Sea level rise due to global warming

Sea level rise over the last century



Sea level rise scenarios for 2100



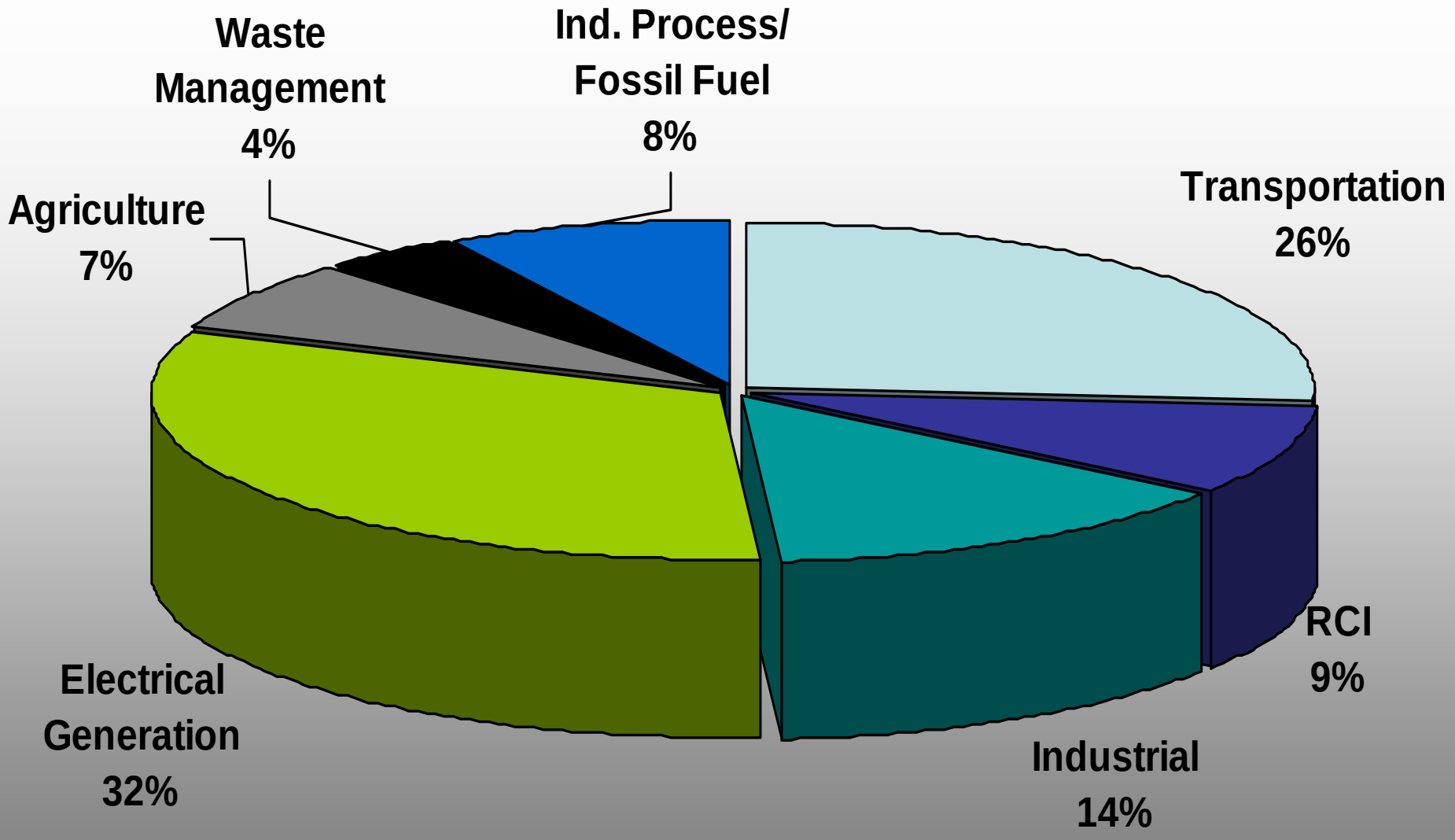
GRID Arendal UNEP

GRAPHIC DESIGN : PHILIPPE REKACEWICZ

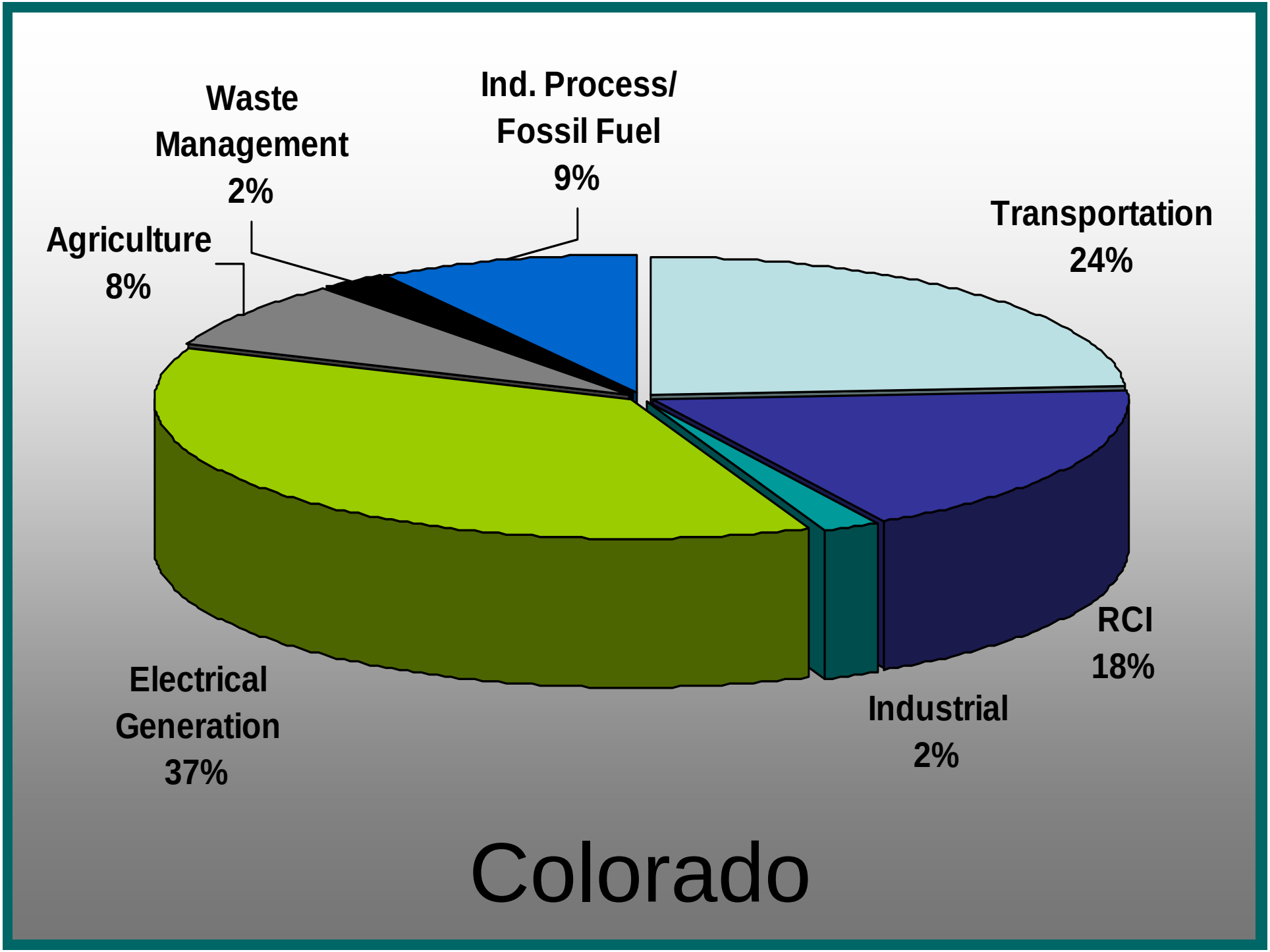
Source: Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996; Sea level rise over the last century, adapted from Gornitz and Lebedeff, 1987.

Kyoto Protocol

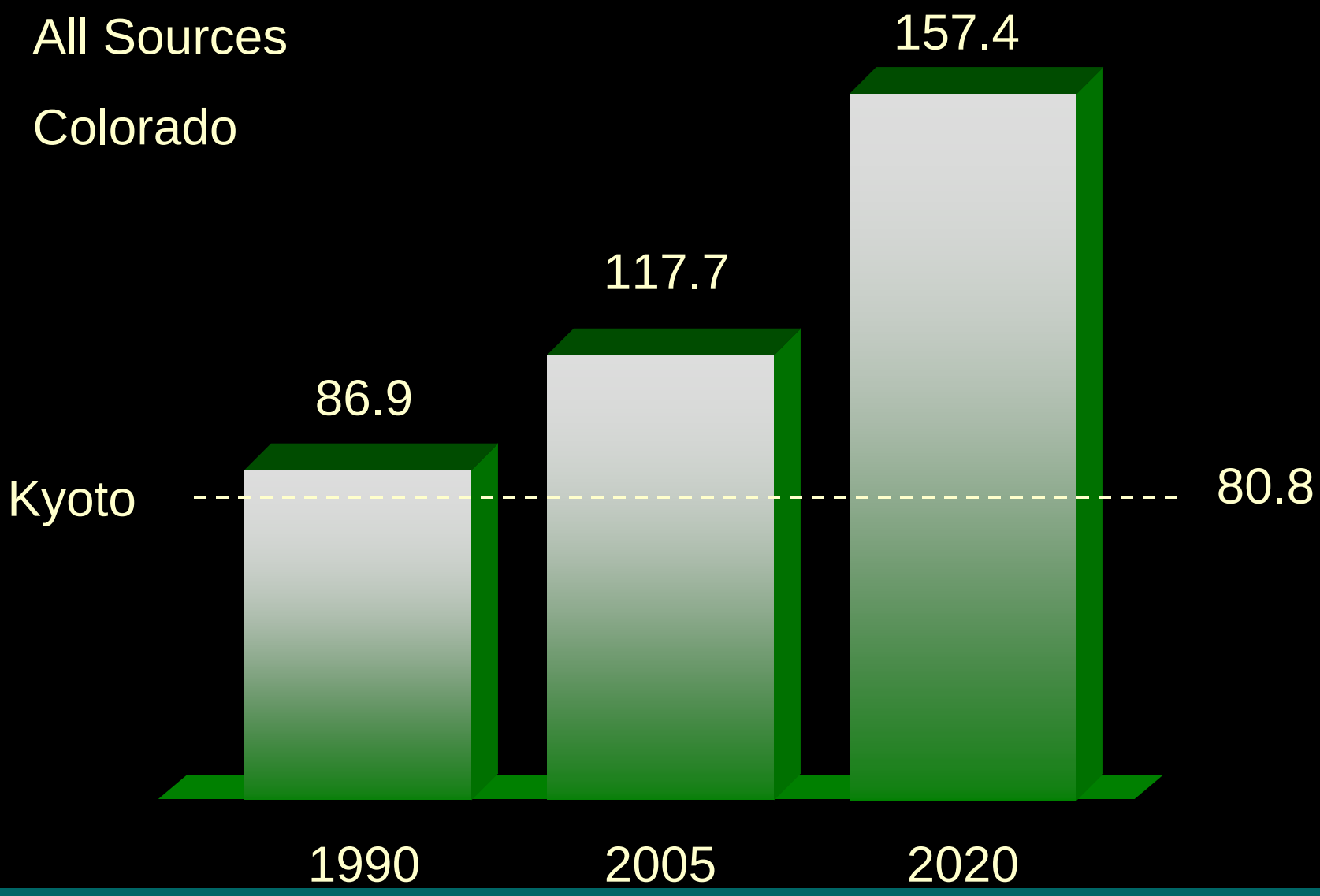
February 2005:
Worldwide goal to reduce emissions
of carbon dioxide and
other greenhouse gases (GHGs)
by at least 5% from 1990 levels
by year 2012



United States


Waste Management 2%
Ind. Process/ Fossil Fuel 9%
Agriculture 8%
Transportation 24%
RCI 18%
Industrial 2%
Electrical Generation 37%
Colorado

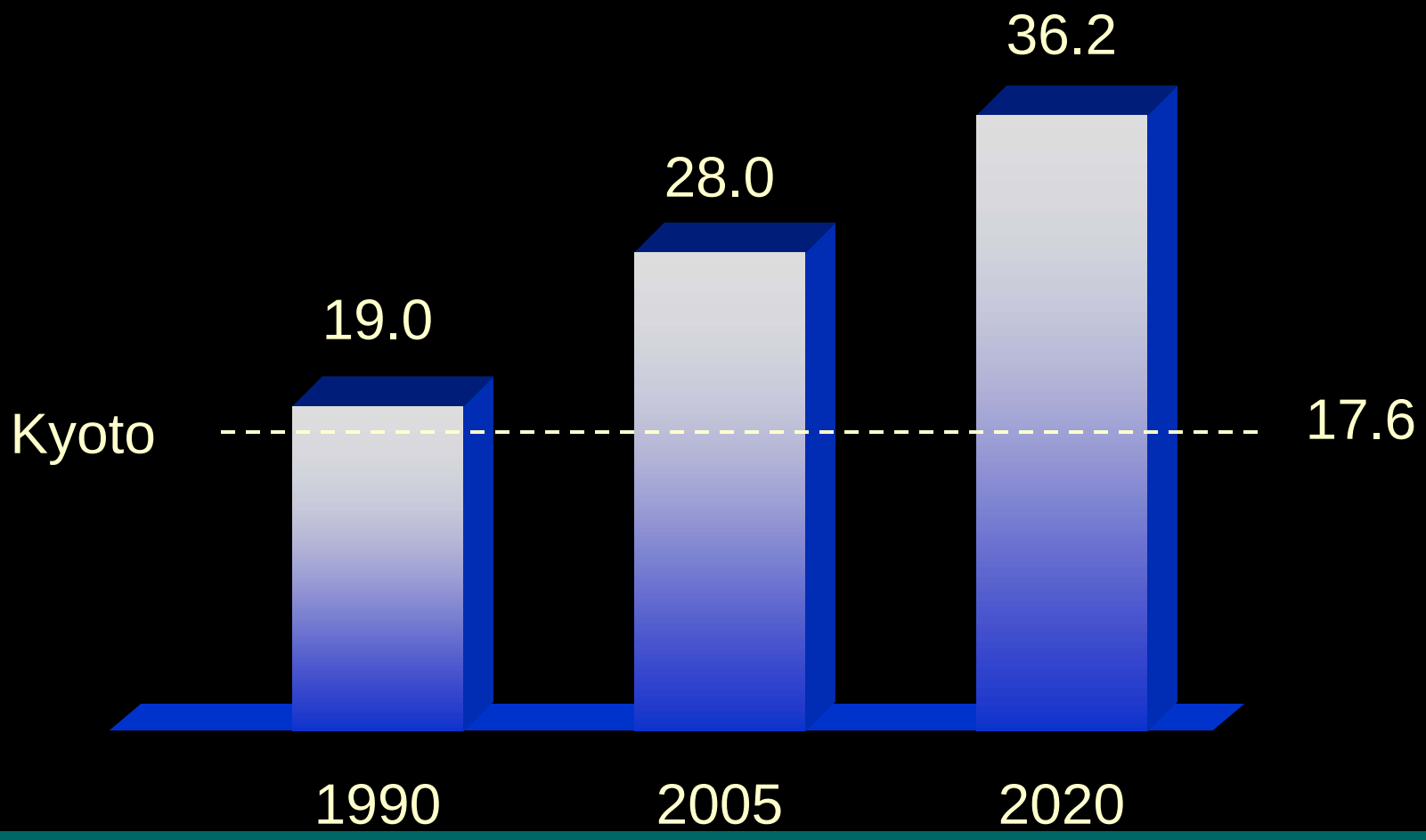
Gross Greenhouse Gas Emissions

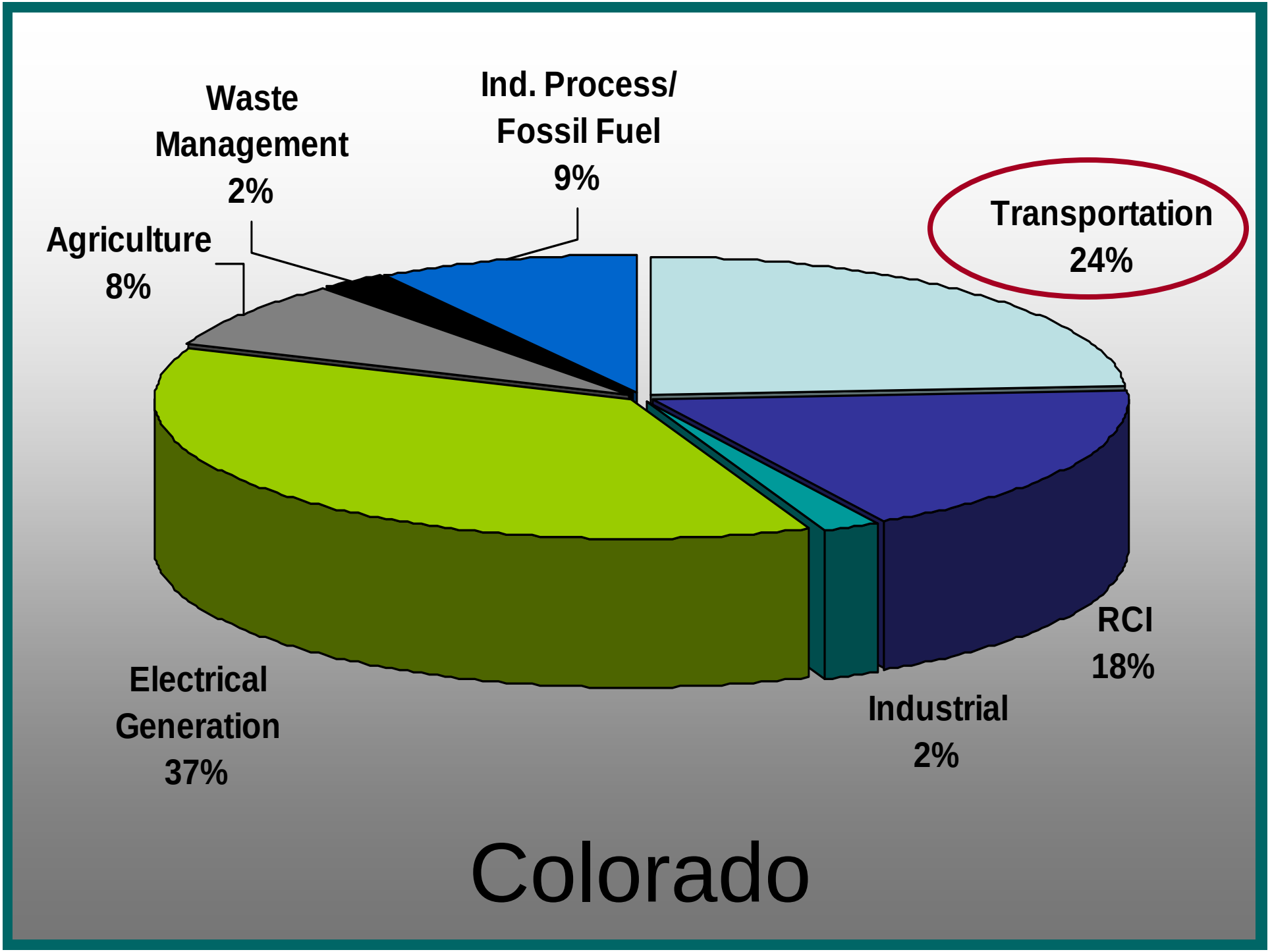


Gross Greenhouse Gas Emissions

Transportation

Colorado




Waste Management 2%
Ind. Process/ Fossil Fuel 9%
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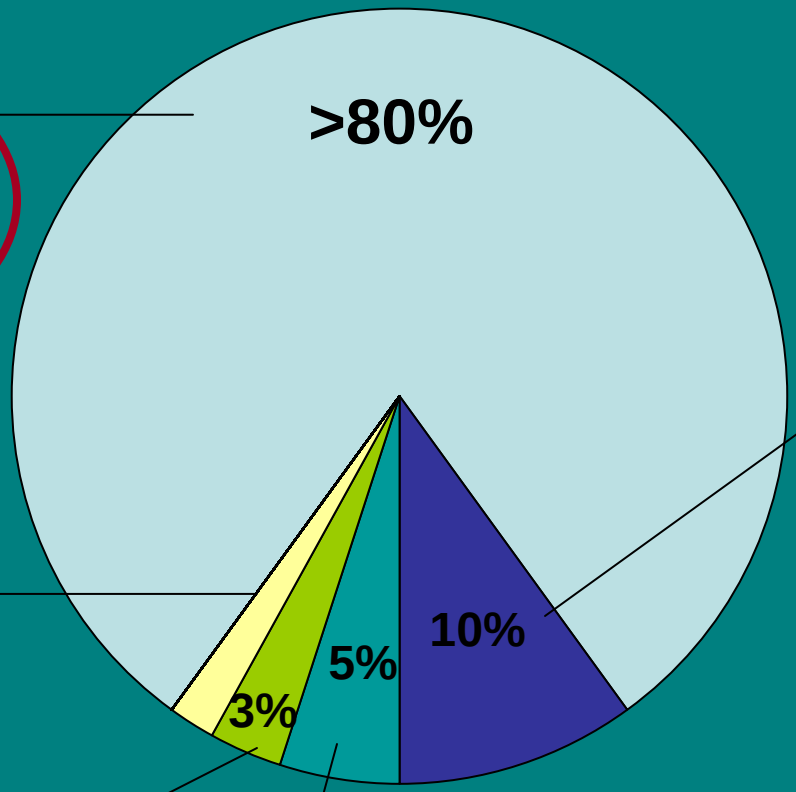
Colorado

Greatest GHG Concerns

Carbon dioxide
- Caused by burning gasoline, natural gas, coal and oil

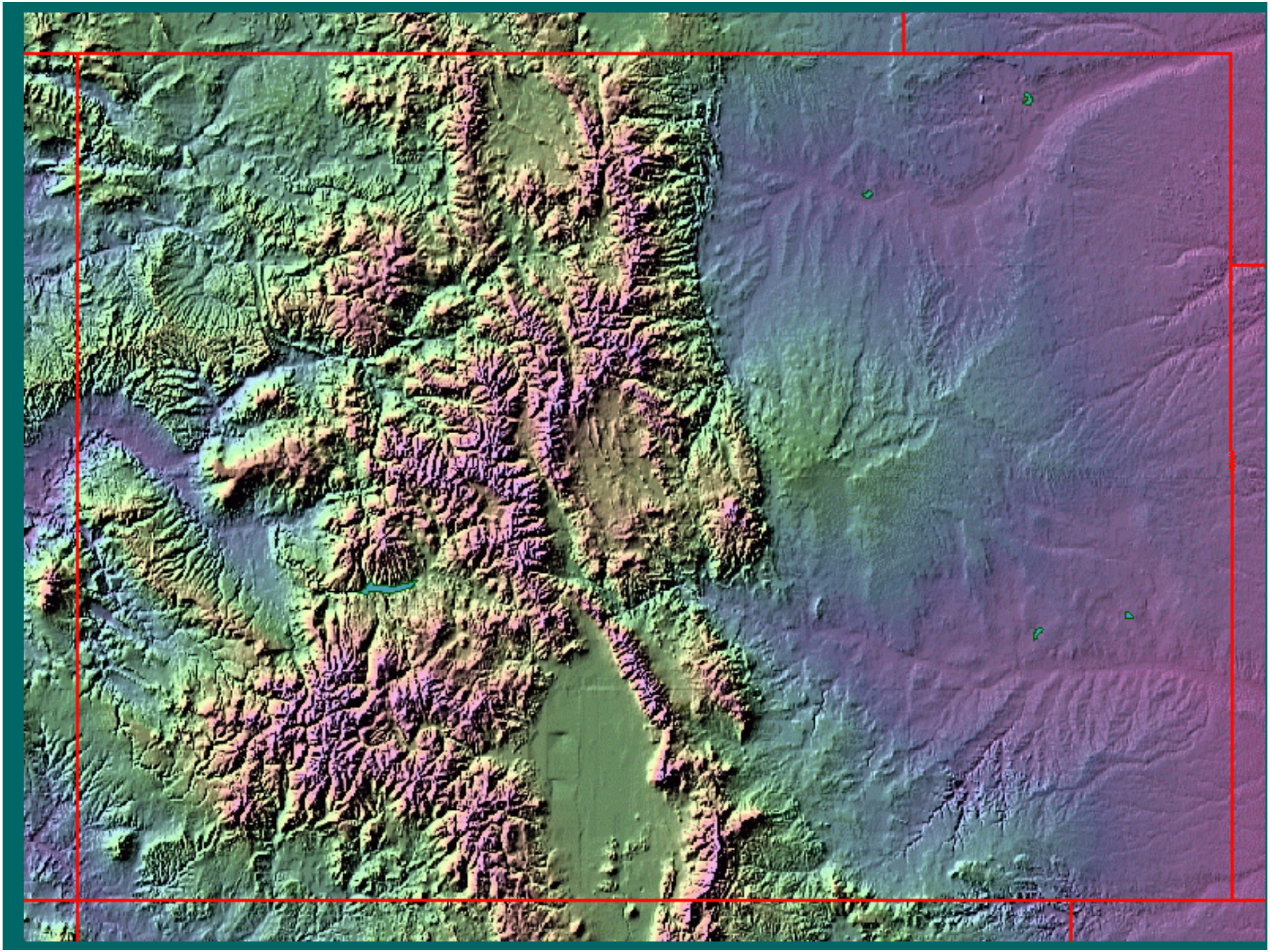


Methane
- Decomposing landfill waste, manure, fertilizers, mining and natural gas

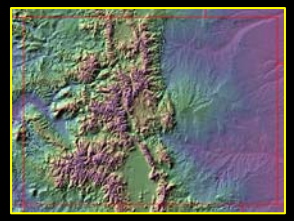
Black carbon & other

Halocarbons
- Produced during the industrial process

Nitrous oxide
- Comes from agricultural soil management and combustion ϵ



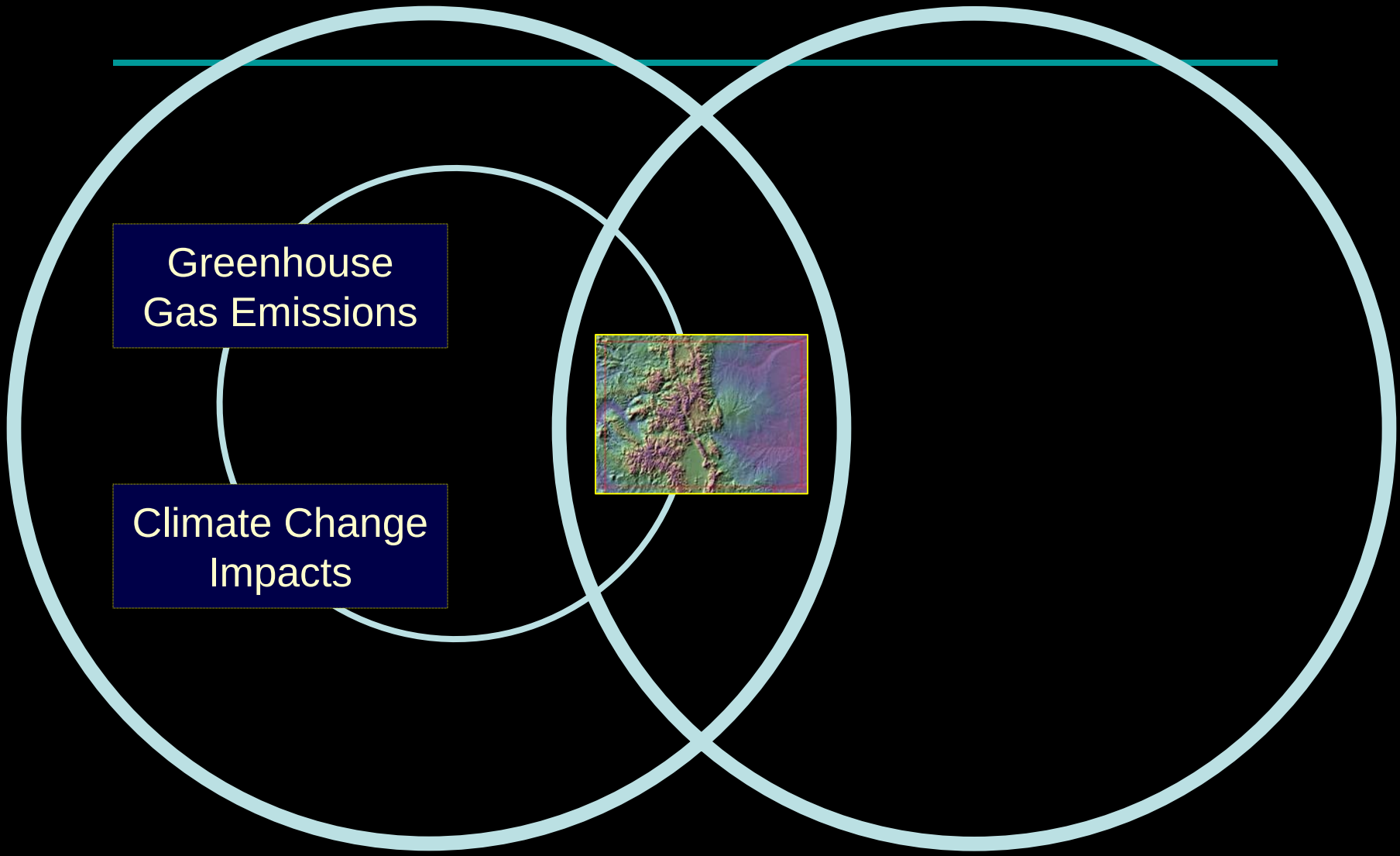
Interconnected Systems



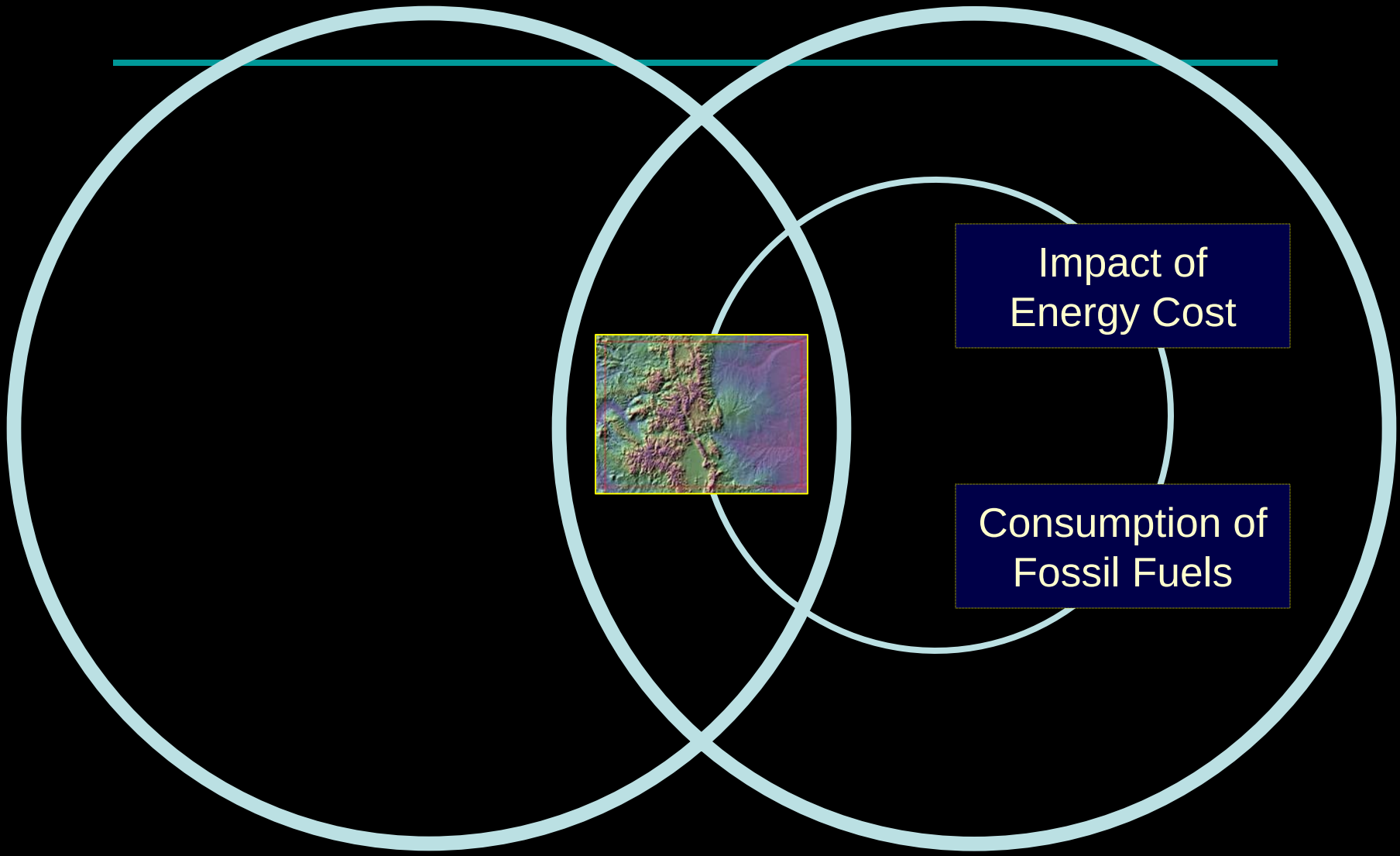
Global Warming

Energy Demand

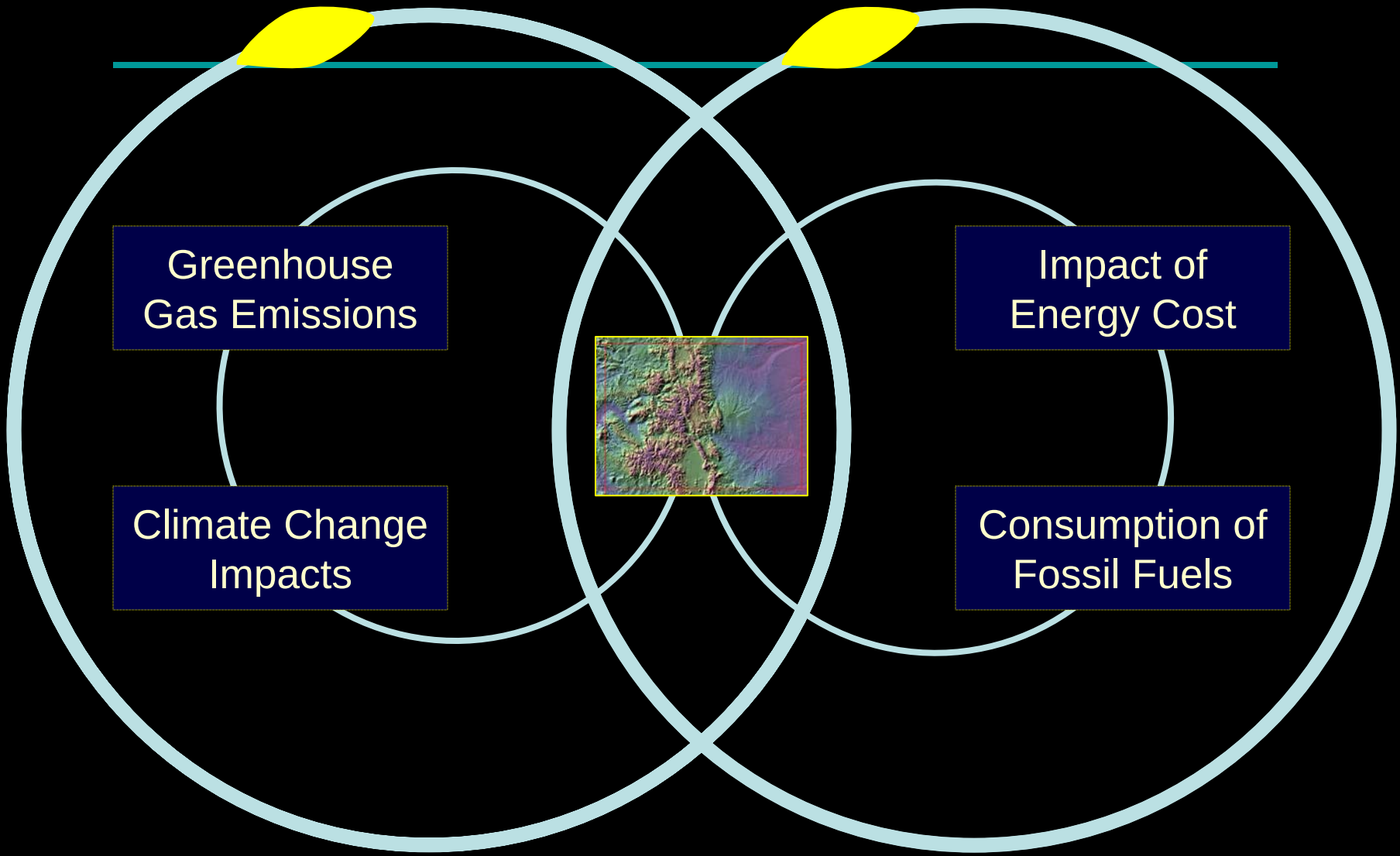
Interconnected Systems



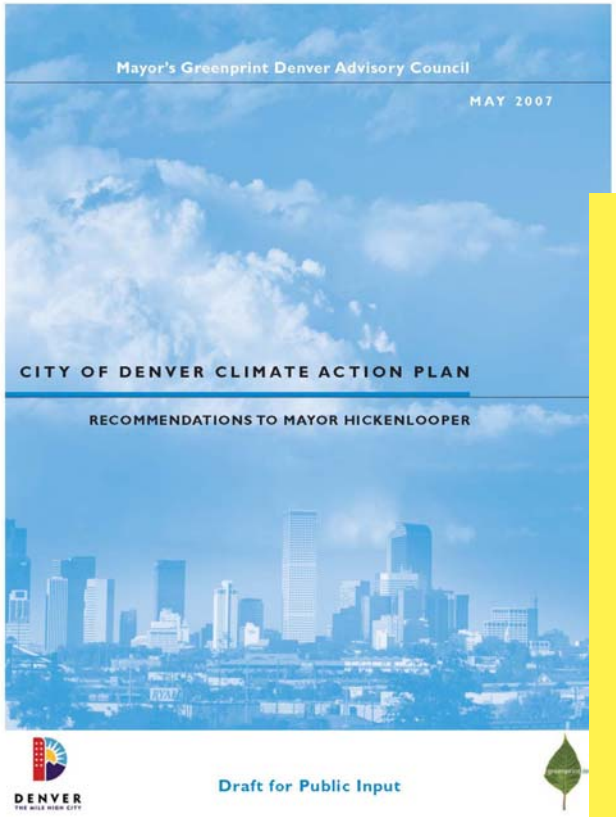
Interconnected Systems



Interconnected Systems

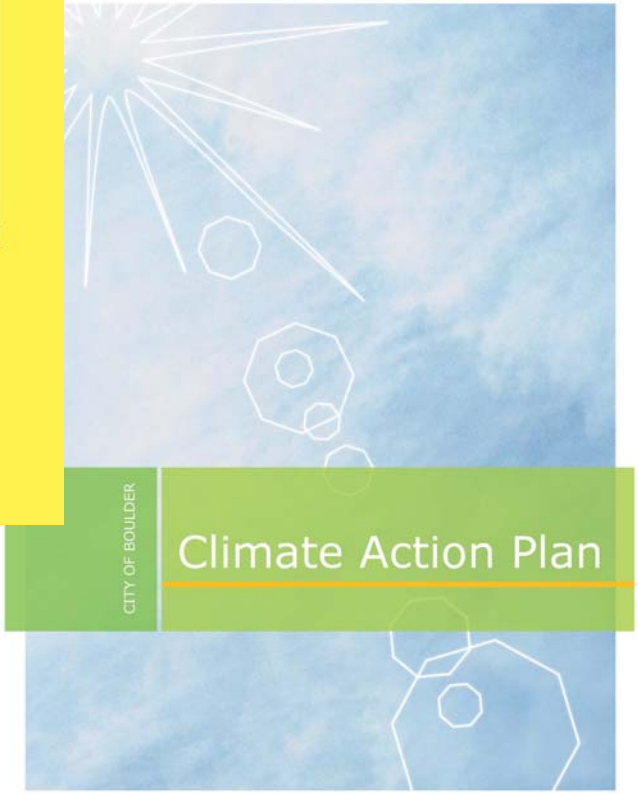


Transportation policy, energy policy and climate change policy are inseparable.



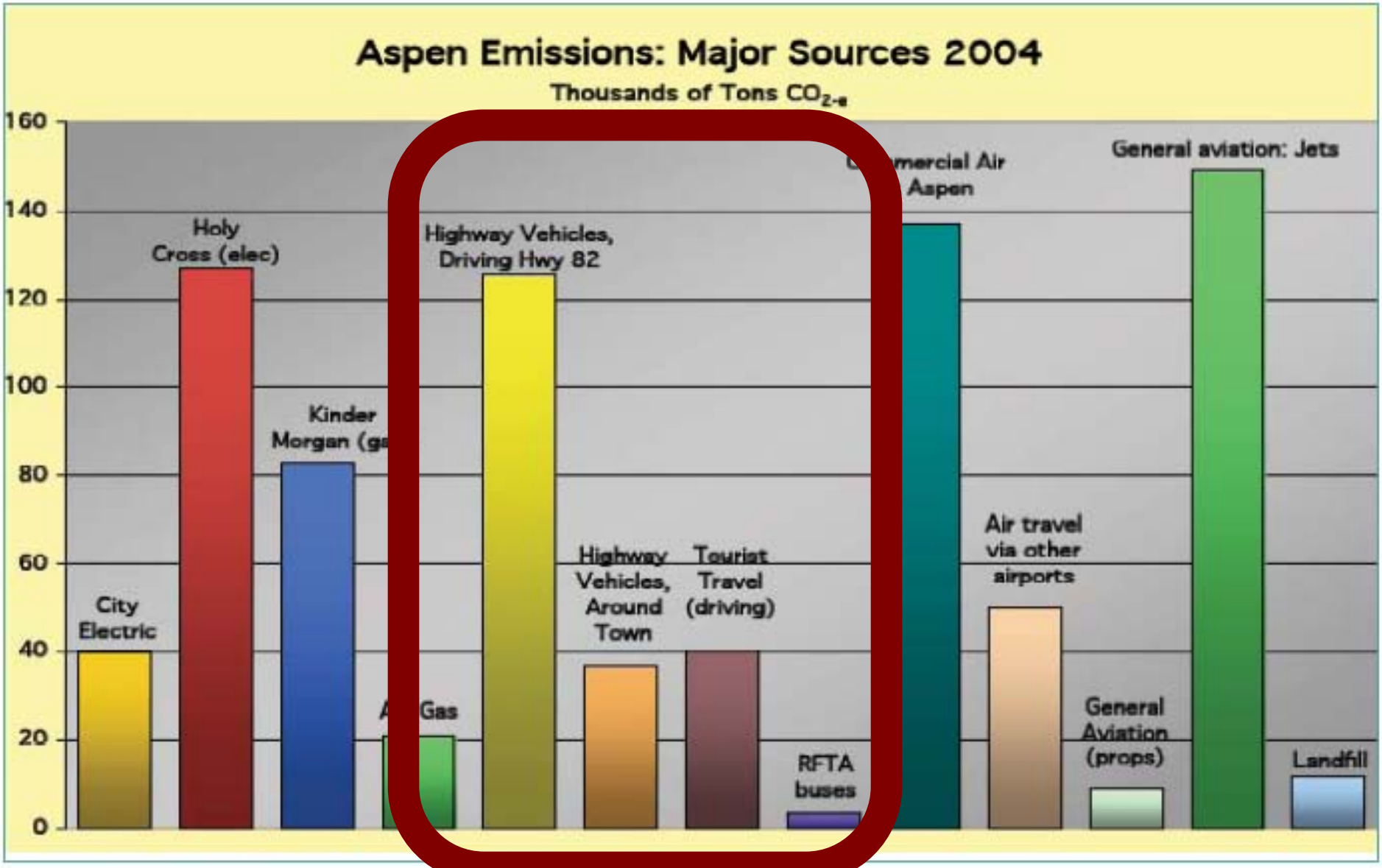
City of Aspen Canary Initiative

Climate Action Plan
2007-2009



Aspen, CO

- economically dependent on winter snow for recreation
- economically dependent on summer snow pack for water supply



Aspen Greenhouse Gas Emissions 2004: Richard Heede, Climate Mitigation Services.

Aspen Transportation Objectives

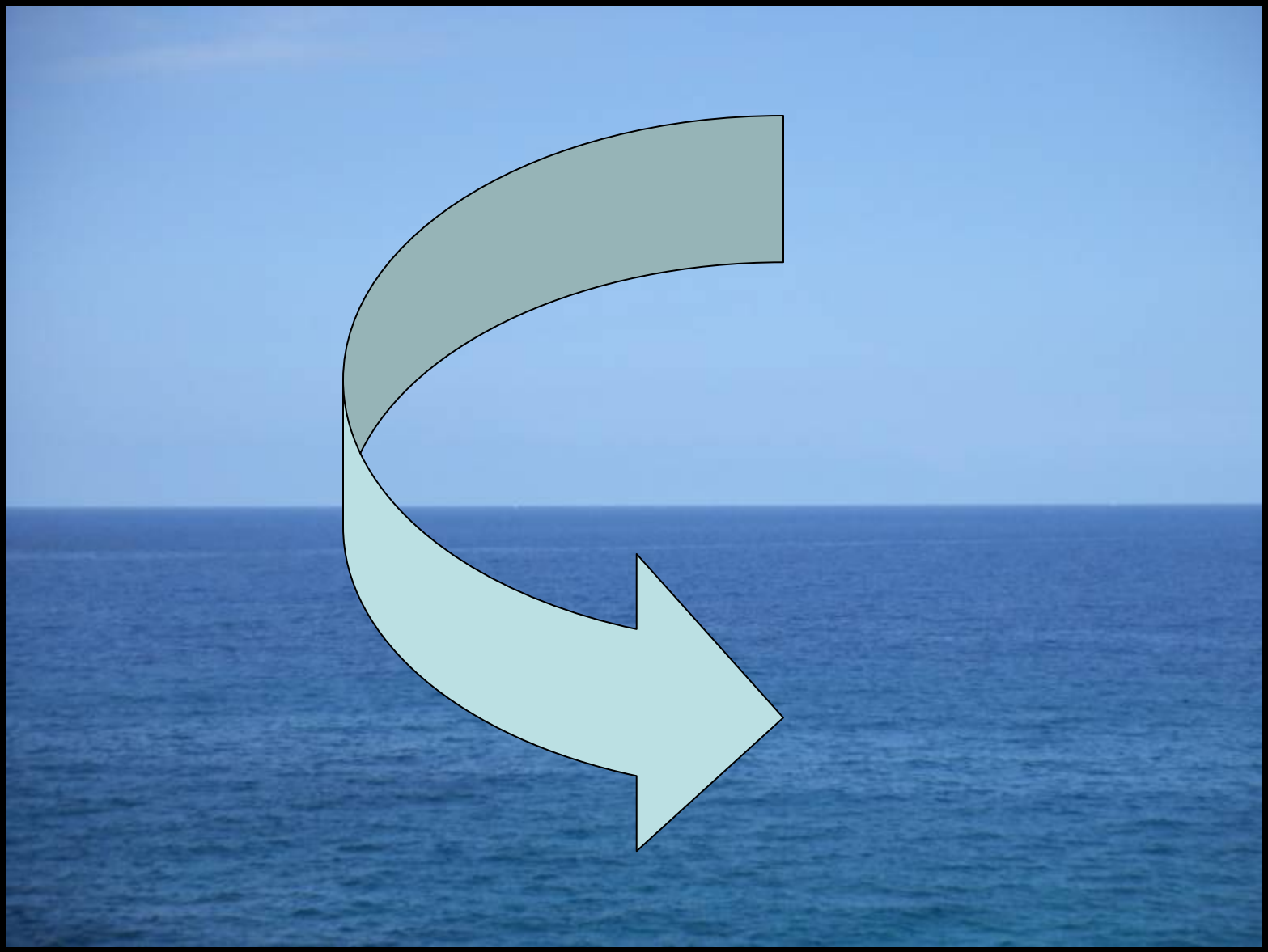
1. Reduce volume of single occupancy traffic
2. Create mass transit-oriented transportation alternatives
3. Increase use of highly fuel-efficient vehicles and low emissions-fuel engines
4. Require all new development projects have a net decrease in transportation related emissions
5. Reduce emissions from air travel

Environment

B. Pollution

Transportation & Pollution

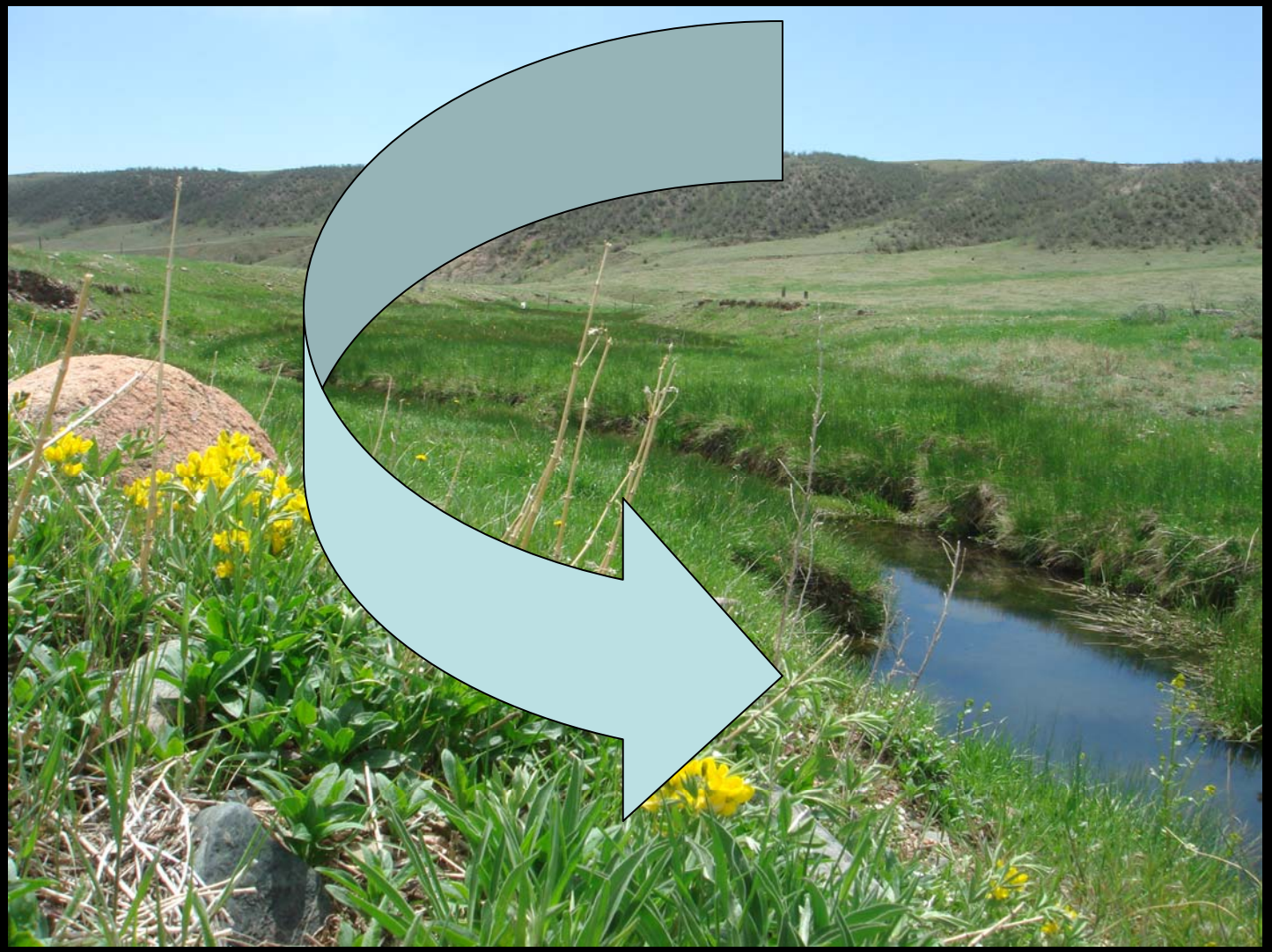
- Air Quality
- Water Quality



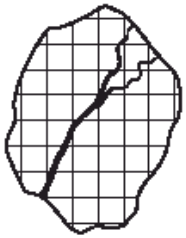
Criteria Air Pollutants

- Carbon Monoxide
- Ozone
  - Hydrocarbons
  - NOx – Nitrous Oxides
- Particulate Matter

Land and Water



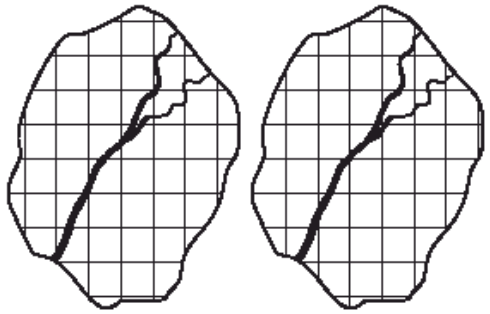
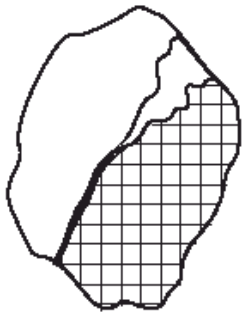
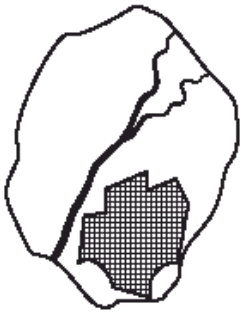
At the watershed level…

Scenario A	Scenario B	Scenario C
		
1 unit/acre	4 units/acre	8 units/acre
10,000 houses built on 10,000 acres produce:	10,000 houses built on 2,500 acres produce:	10,000 houses built on 1,250 acres produce:
10,000 acres x 1 house x 18,700 ft^3/yr of runoff =	2,500 acres x 4 houses x 6,200 ft^3/yr of runoff =	1,250 acres x 8 houses x 4,950 ft^3/yr of runoff =
187 million ft^3/yr of stormwater runoff	**62 million ft^3/yr of stormwater runoff**	**49.5 million ft^3/yr of stormwater runoff**
Site: 20% impervious cover	**Site: 38% impervious cover**	**Site: 65% impervious cover**
Watershed: 20% impervious cover	**Watershed: 9.5% impervious cover**	**Watershed: 8.1% impervious cover**

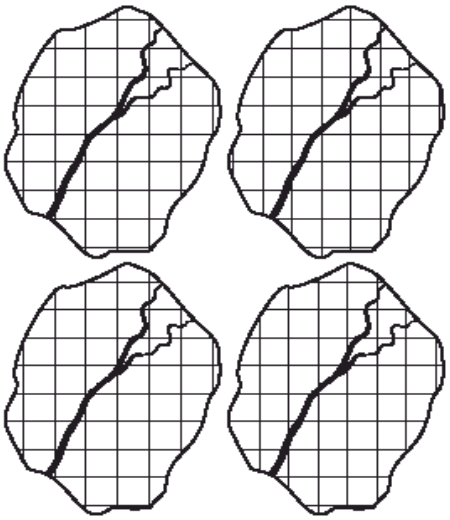
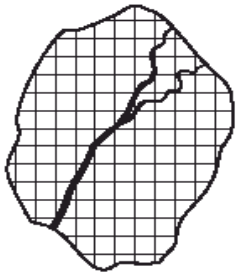
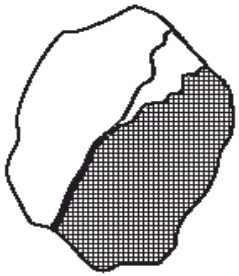
Accommodating 10,000 units on a 10,000 acre watershed at different densities

The lower density scenario creates more run-off and consumes more land that the higher density scenario

By 2020...

Scenario A	Scenario B	Scenario C
		
1 unit/acre 20,000 houses accommodated on 20,000 acres at a density of *1 house per acre* will consume 2 watersheds.	4 units/acre 20,000 houses accommodated on 5,000 acres at a density of *4 houses per acre* will consume ½ of 1 watershed.	8 units/acre 20,000 houses accommodated on 2,500 acres at a density of *eight houses per acre* will consume ¼ of 1 watershed.

And By 2040...

Scenario A	Scenario B	Scenario C
		
40,000 houses on 40,000 acres at a density *of 1 house per acre* will consume 4 watersheds.	40,000 houses on 10,000 acres at a density of *4 houses per acre* will consume 1 watershed.	40,000 houses on 5,000 acres at a density of *8 houses per acre* will consume ½ of 1 watershed.

Which is better for watershed water quality?

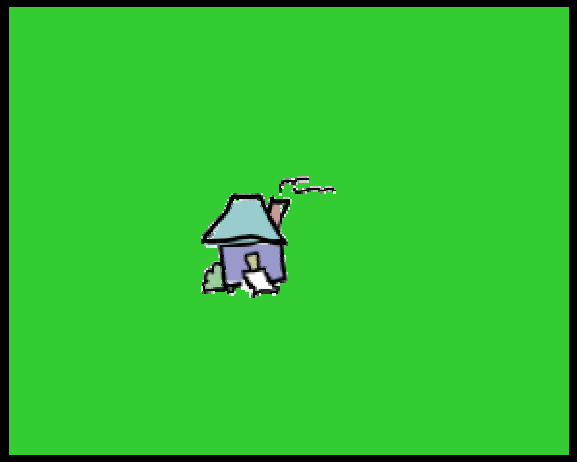
OR

Low Density

Higher Density

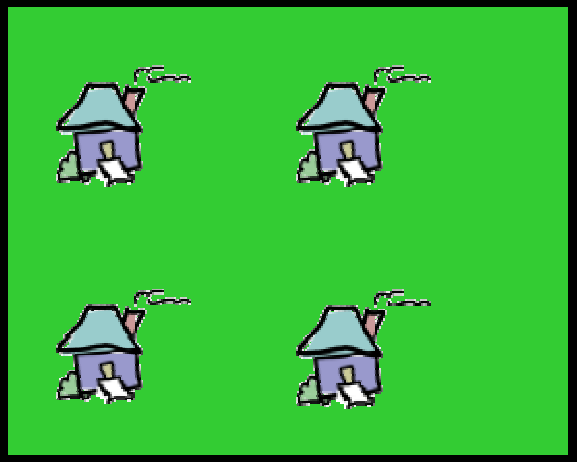
EPA Research: Smart Growth & Water

Scenario A:
1 unit/acre



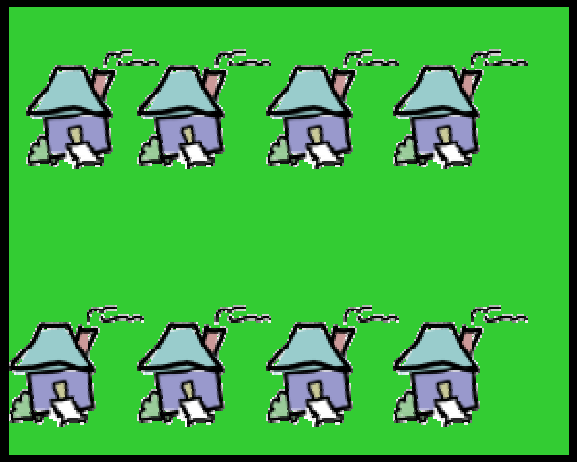
Impervious cover = 20%
Runoff/acre = 18,700 ft^3/yr
Runoff/unit = 18,700 ft^3/yr

Scenario B:
4 units/acre



Impervious cover = 38%
Runoff/acre = 24,800 ft^3/yr
Runoff/unit = 6,200 ft3/yr

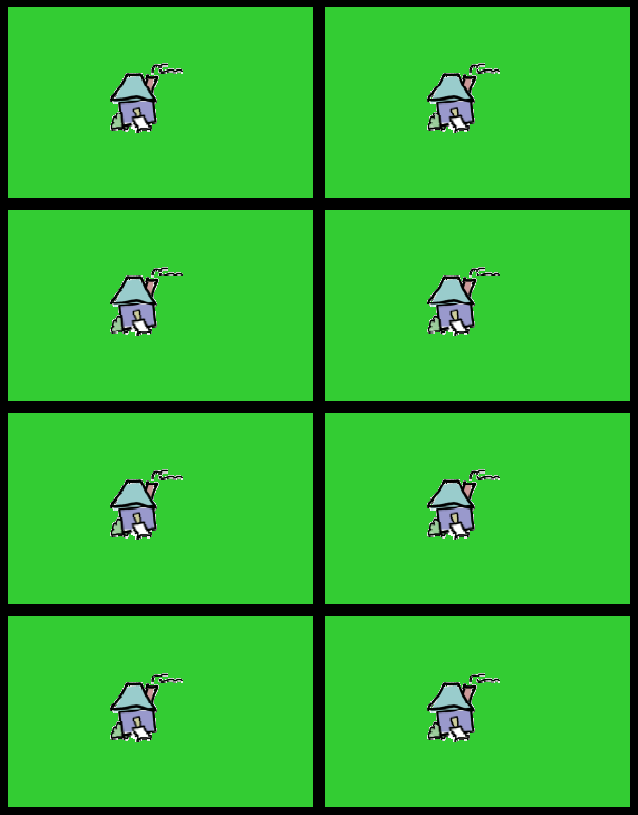
Scenario C:
8 units/acre



Impervious cover = 65%
Runoff/acre = 39,600 ft^3/yr
Runoff/unit = 4,950 ft3/yr

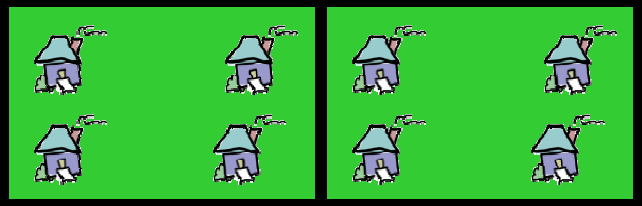
Accommodating 8 homes at varying densities

Scenario A: 1 unit/acre



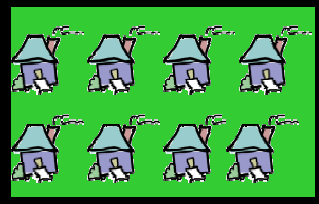
Impervious cover = 20%
Total runoff = 149,600 ft^3/yr
Runoff/house = 18,700 ft^3/yr

Scenario B: 4 units/acre



Impervious cover = **38%**
Total runoff = **49,600 ft^3/yr**
Runoff/house = **6,200 ft^3/yr**

Scenario C: 8 units/acre



Impervious cover = **65%**
Total runoff = **39,600 ft^3/yr**
Runoff/house = **4,950 ft^3/yr**

Managing Pollution

- Reducing vehicle miles of travel per capita
  - Providing full set of travel modes
  - Developing mixed use land patterns
- Reducing stormwater flows into surface water (streams & lakes)
  - Reducing impervious area
  - Detaining flows in rain gardens, etc.

C. Energy Use

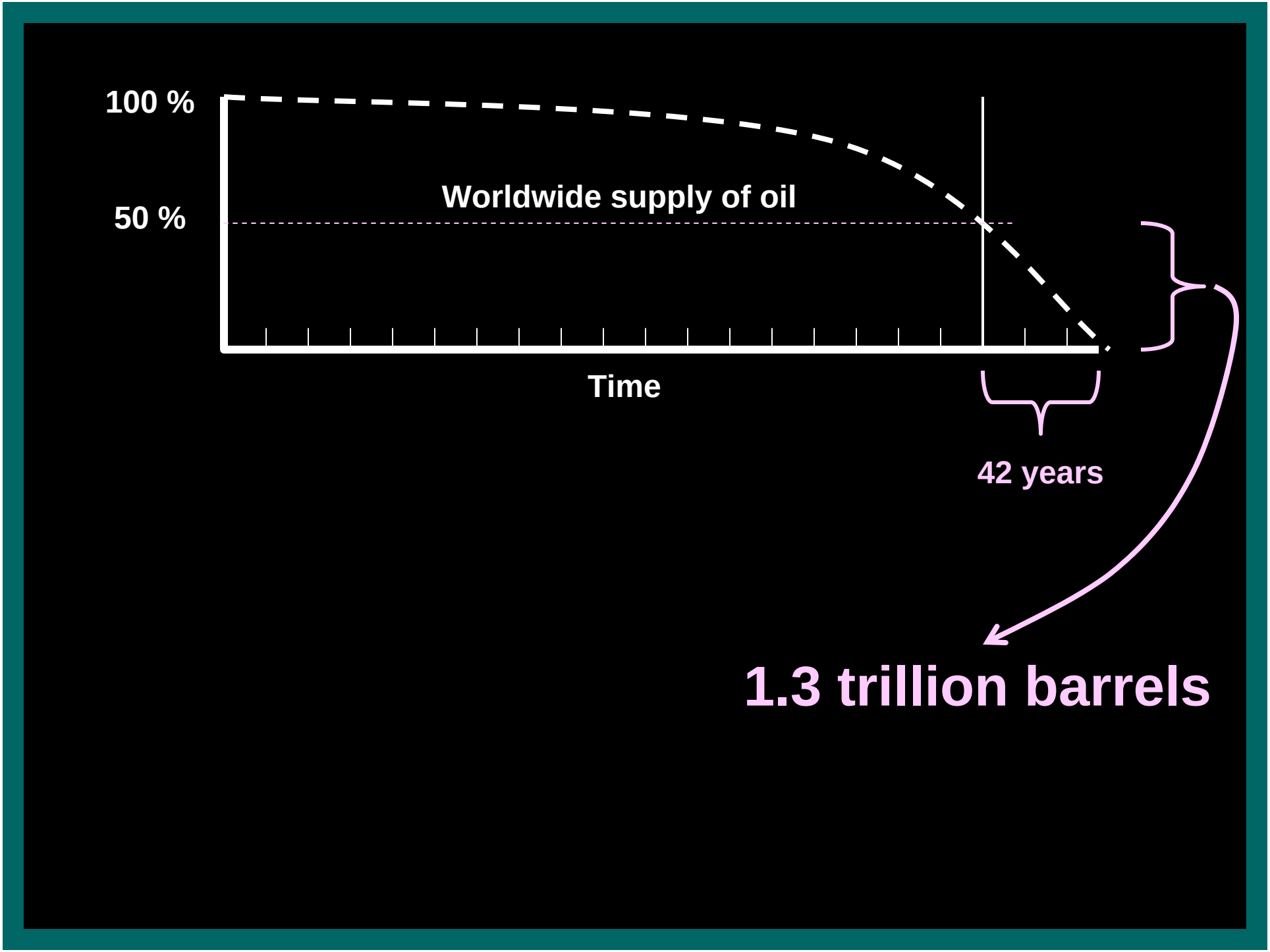
Are we running out of gas?

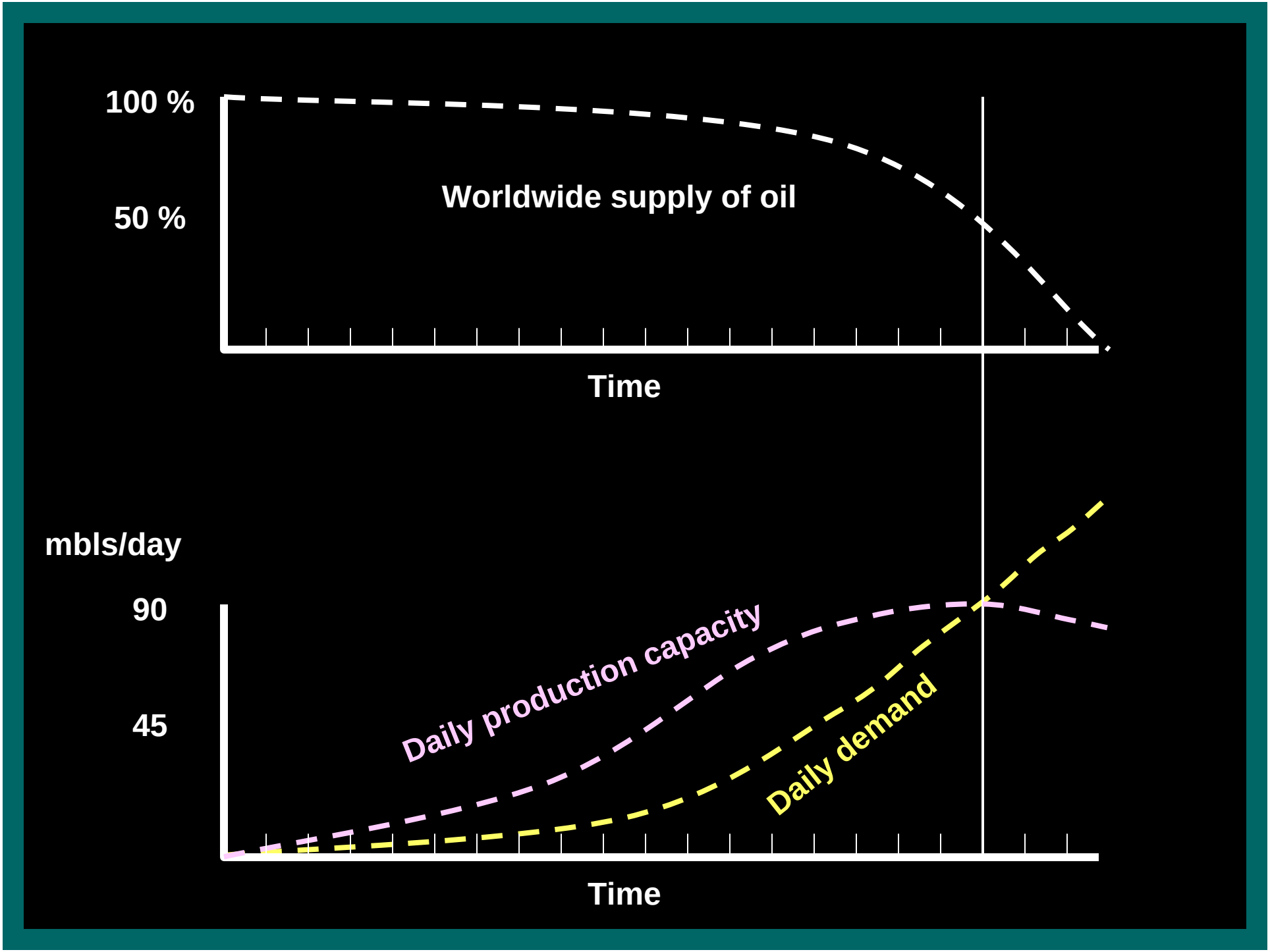
The stone age did not end…

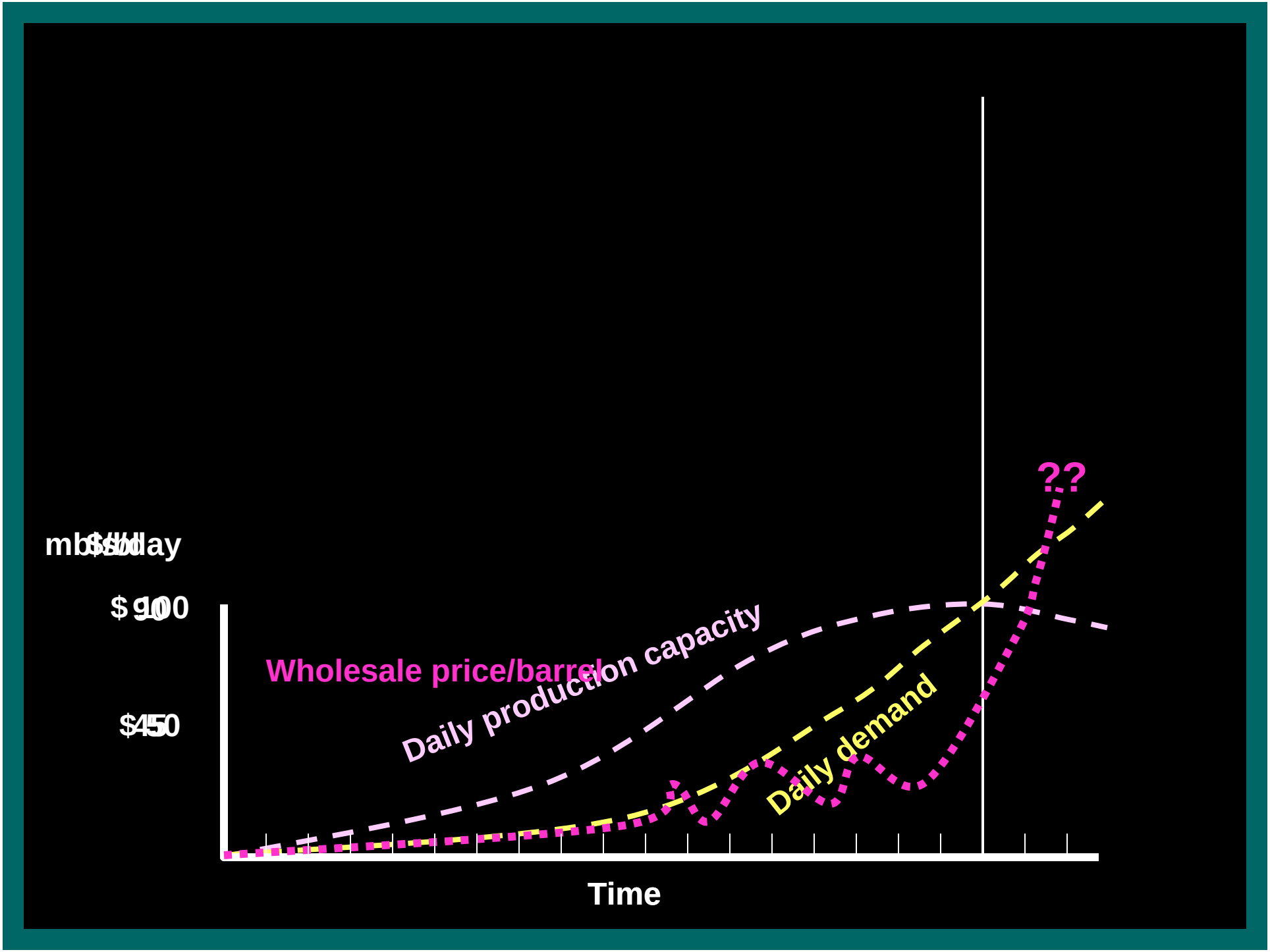
…because we ran out of stones

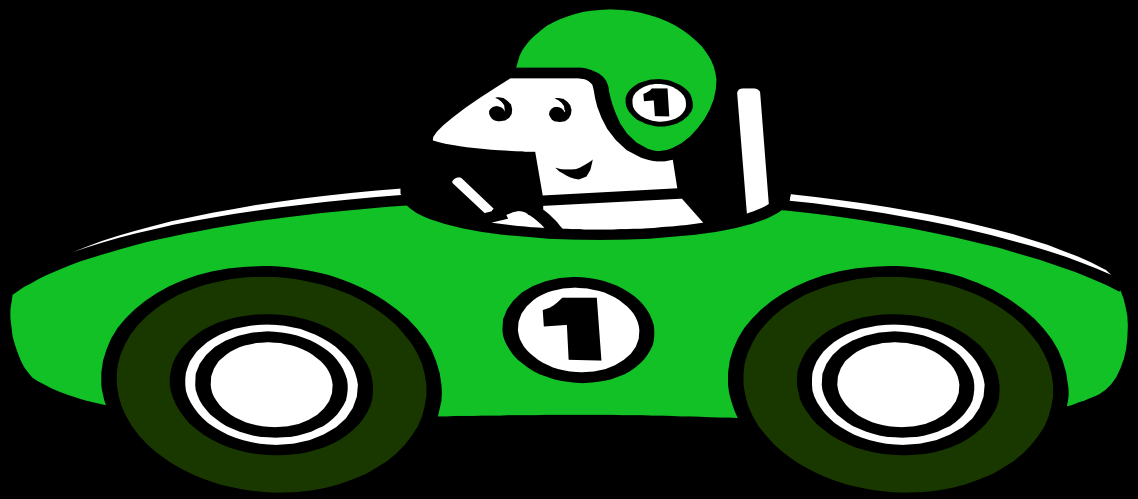
The end of the age of…

…cheap oil


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


??
mb$$dlay
$ 100
$450
Wholesale price/barrel
Daily production capacity
Daily demand
Time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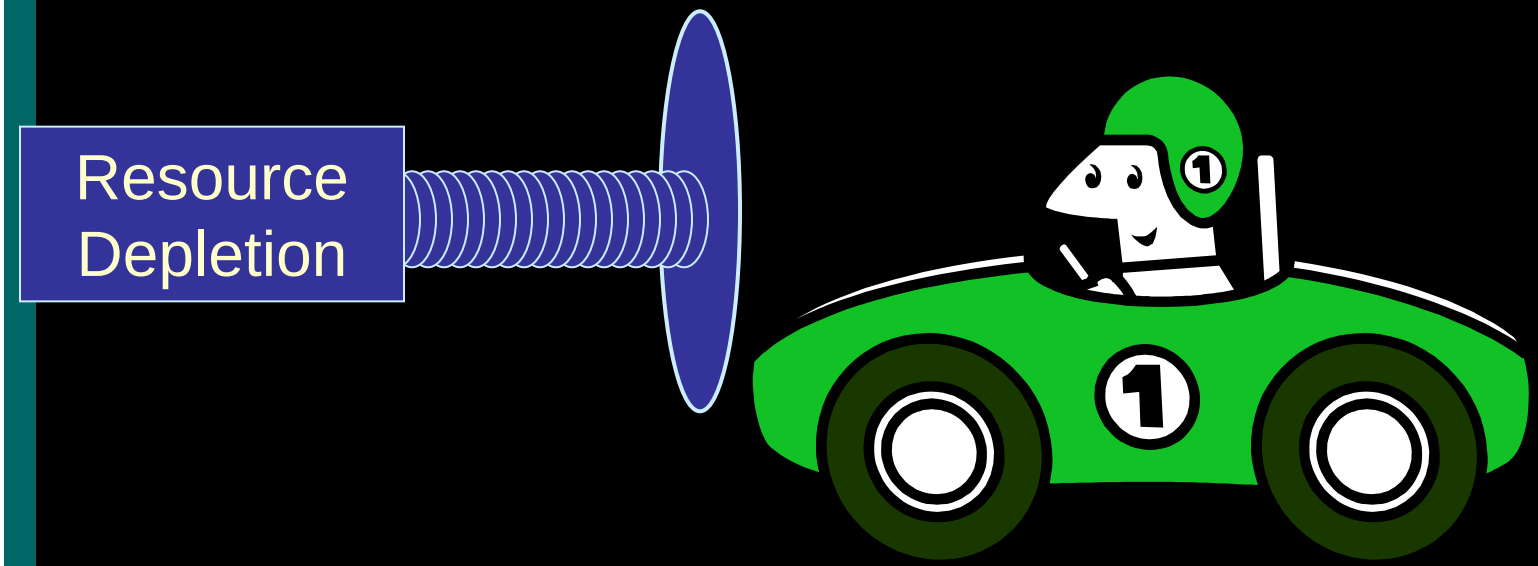
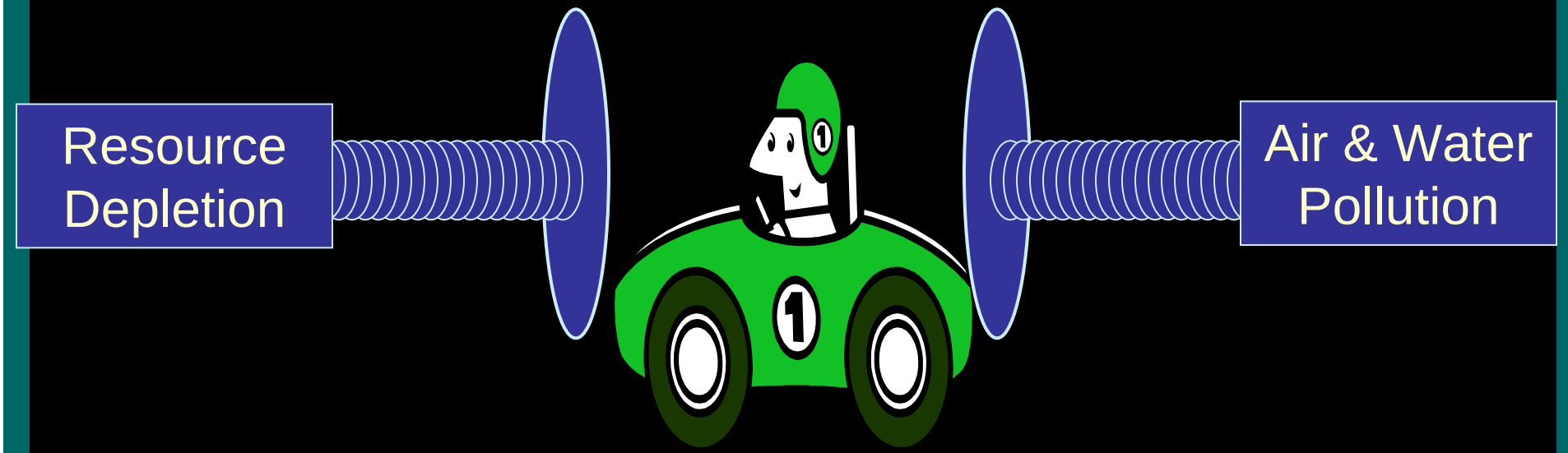
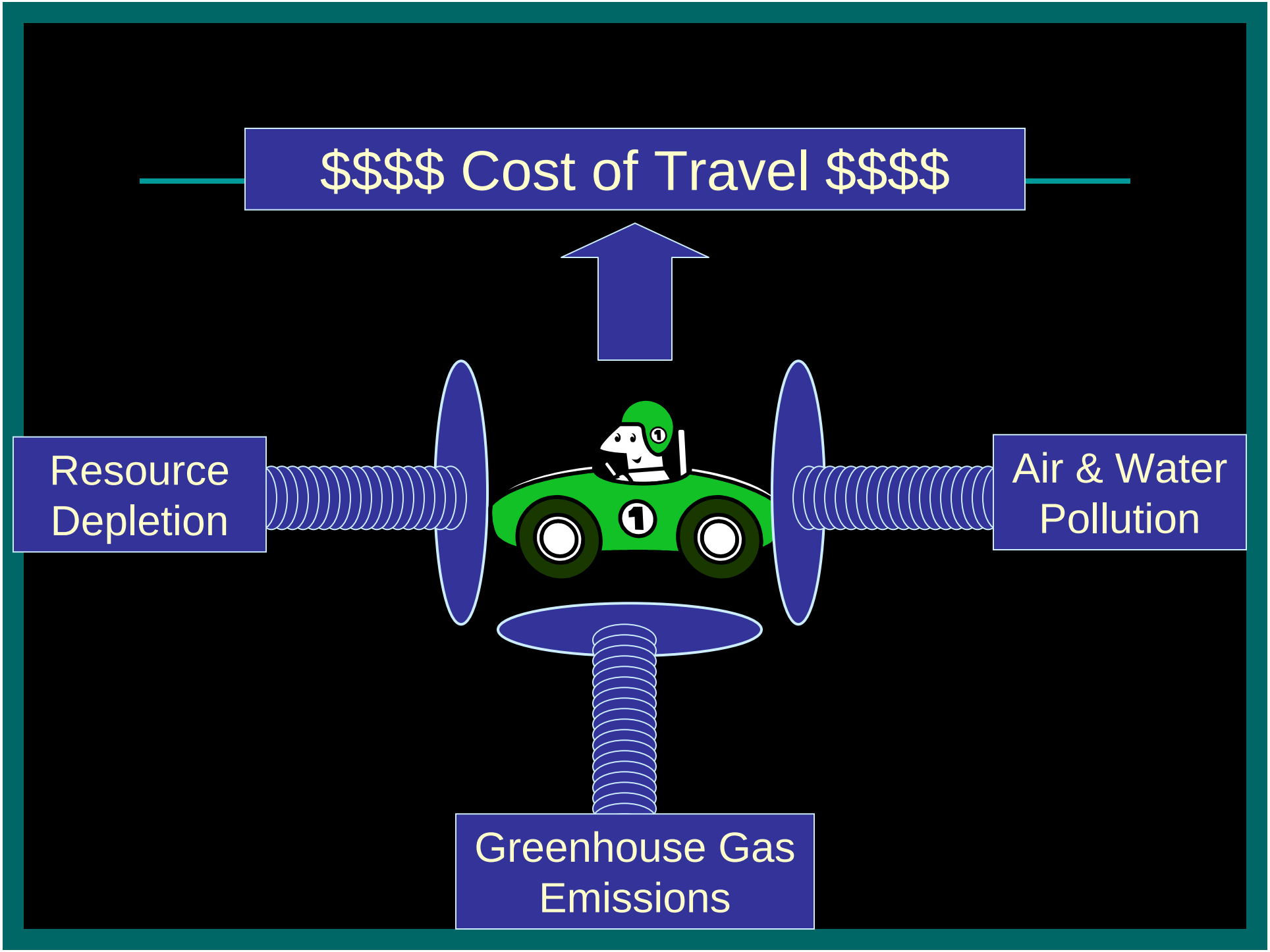
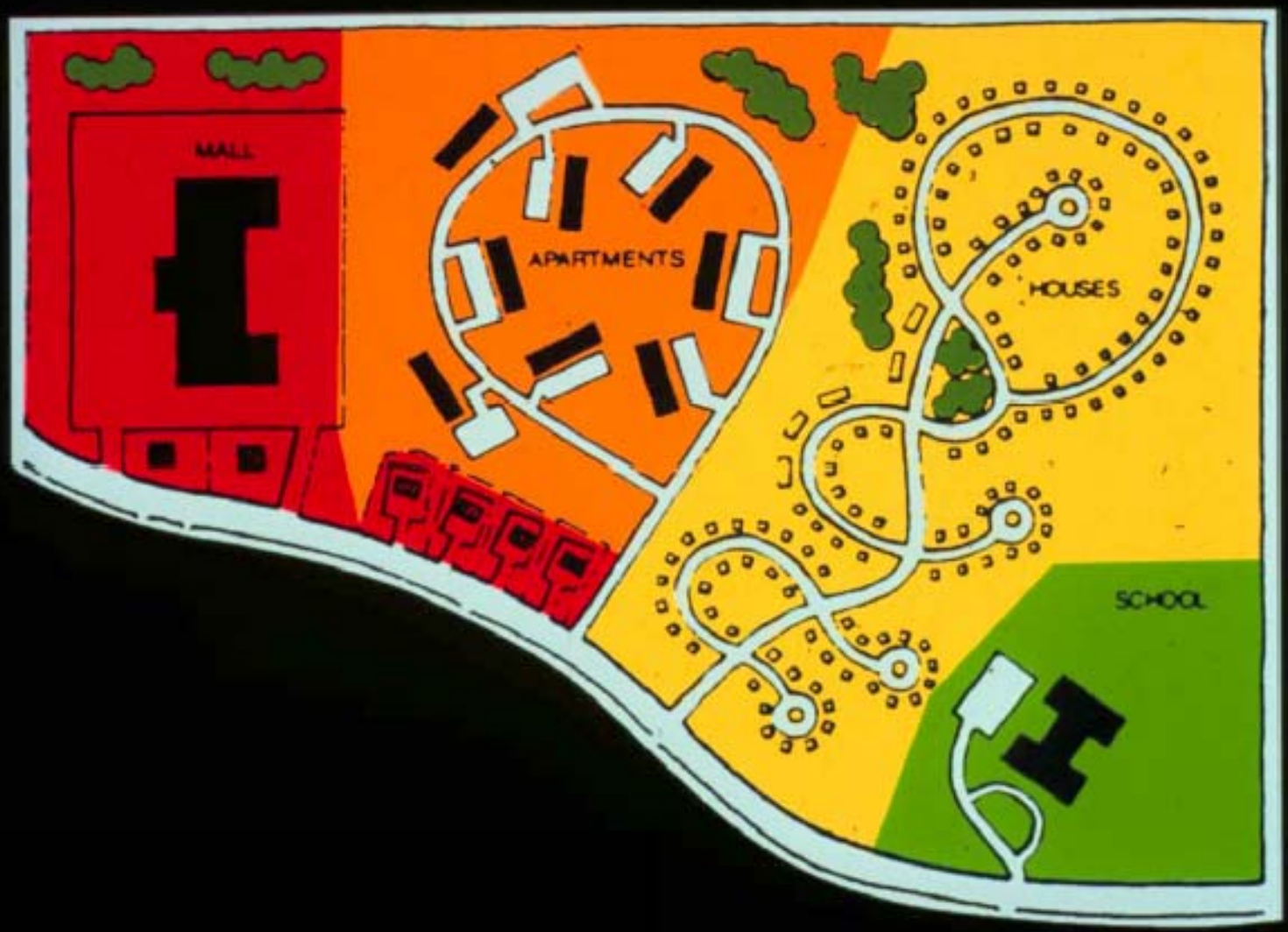

Resource
Depletion


Resource Depletion
Air & Water Pollution
1
1


$$$$ Cost of Travel $$$$
Resource Depletion
Air & Water Pollution
Greenhouse Gas Emissions

Reduce the Need to Travel

Conventional



Traditional

Where’s the connectivity?

Impacts of Poor Connectivity

- Massive, congested arterials
- Increased VMT/household
- Transit voids
- Inactive living
- Poor emergency service access
- Reduced travel safety

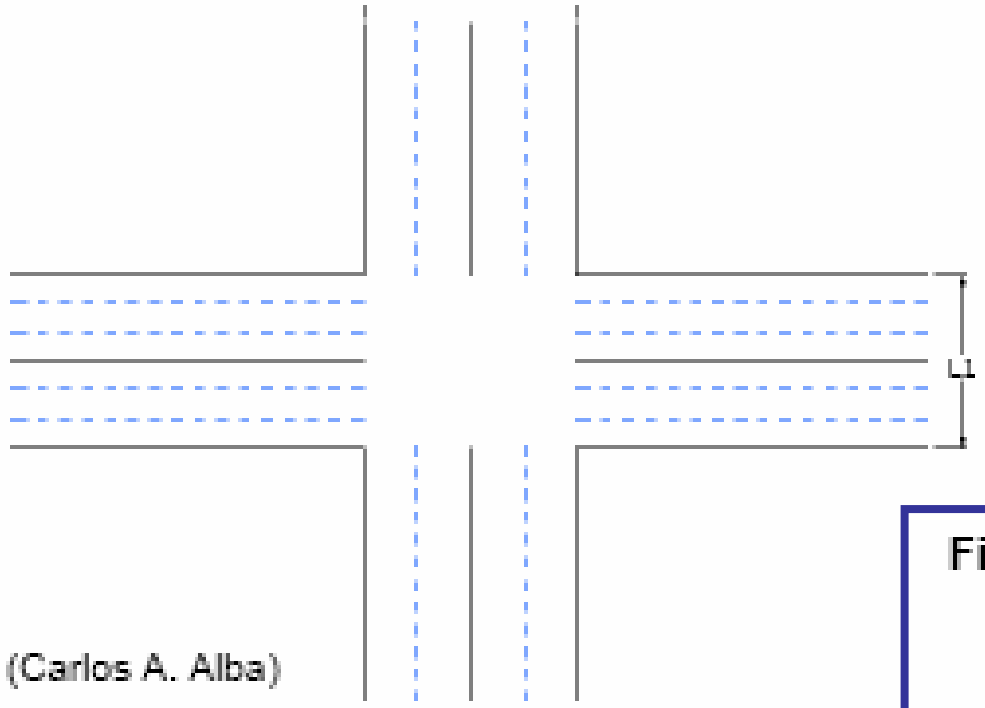

Streets are the principal infrastructure
for all modes of travel

“You can’t get there from here . . .”

(without driving)

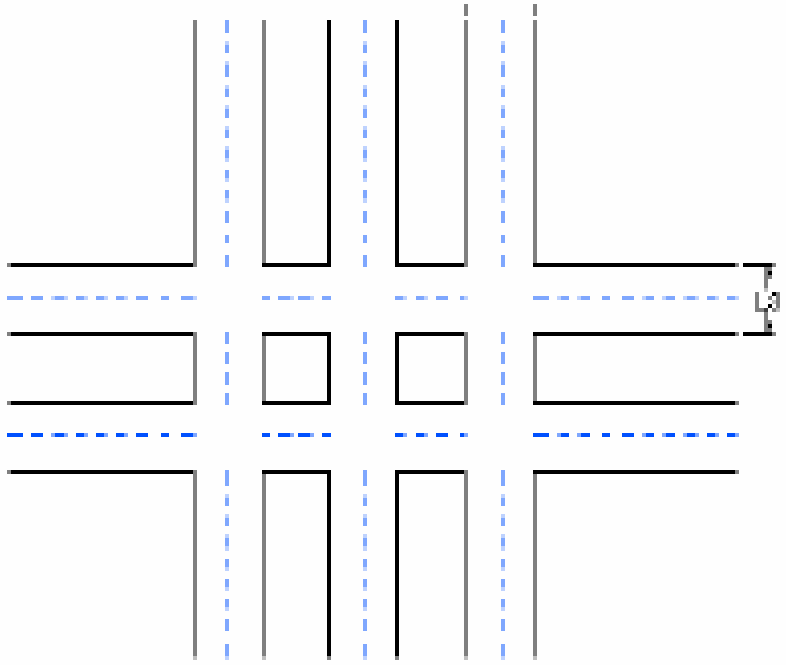
A well-connected network of small streets provides better mobility, is safer and is more efficient than a poorly-connected network of wide streets

Figure No 3 (Conventional Design)



(Carlos A. Alba)

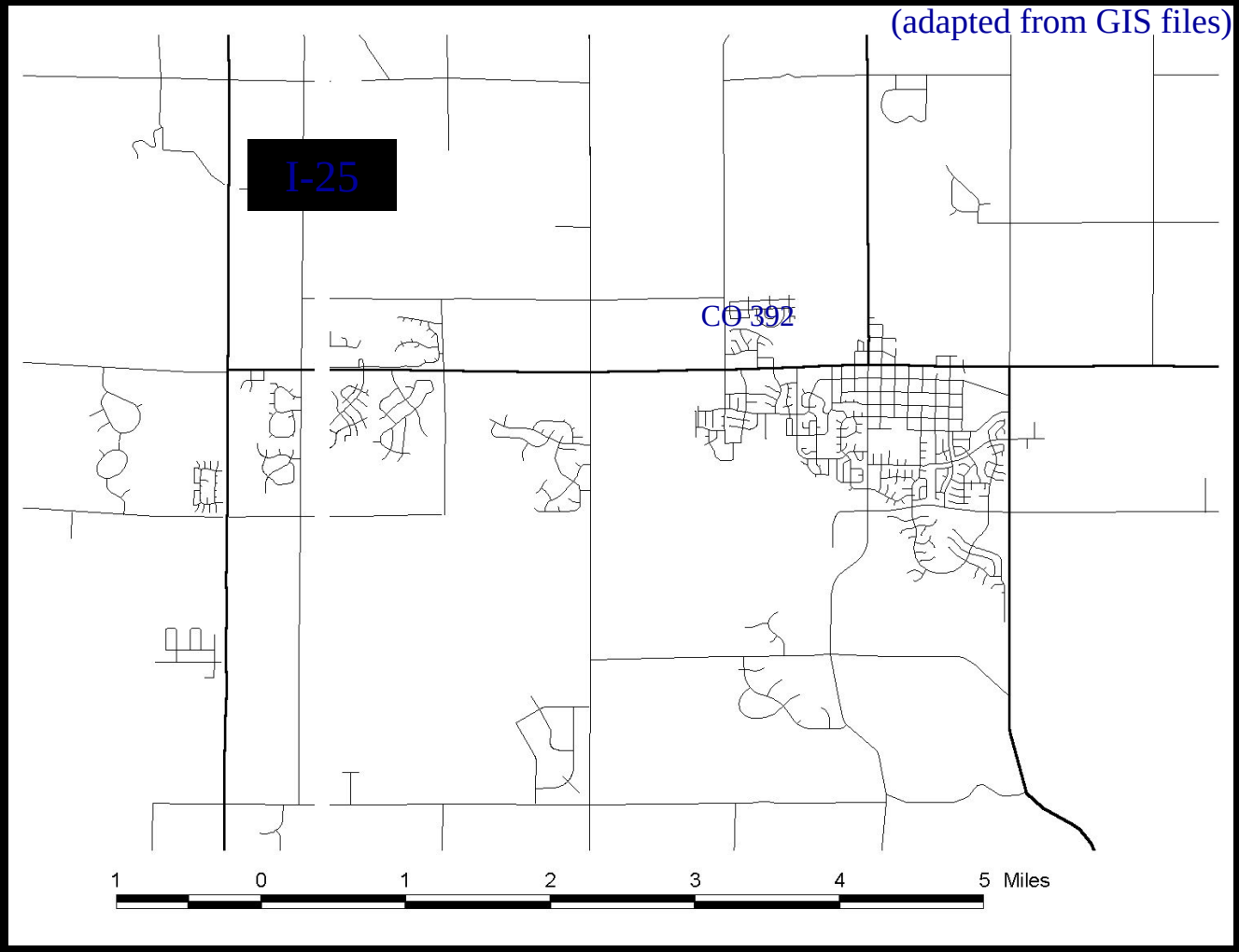
Figure No 4 (Neotraditional Design)



(Carlos A. Alba)

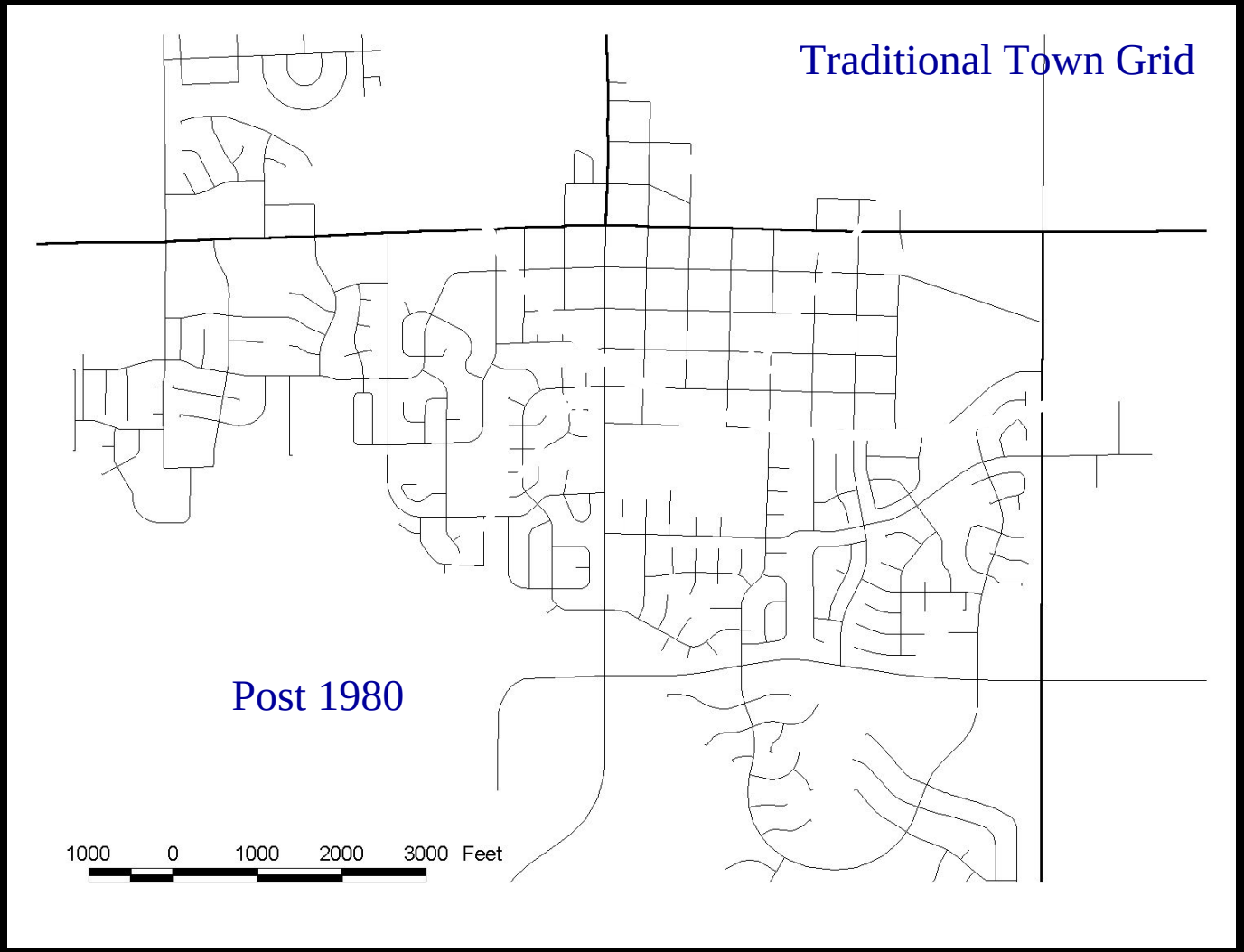
How Does This Happen?

A Colorado Community

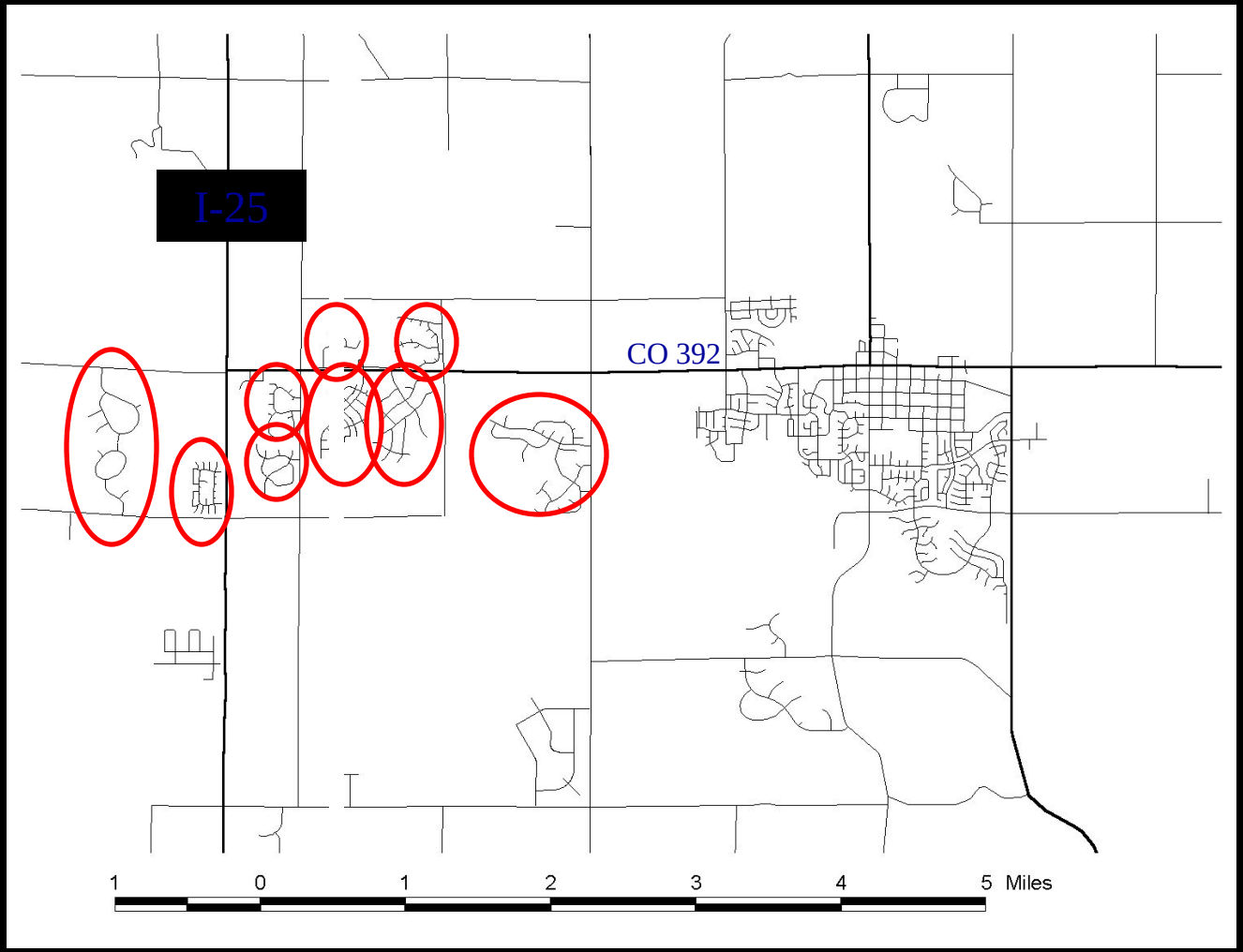


The Original Town

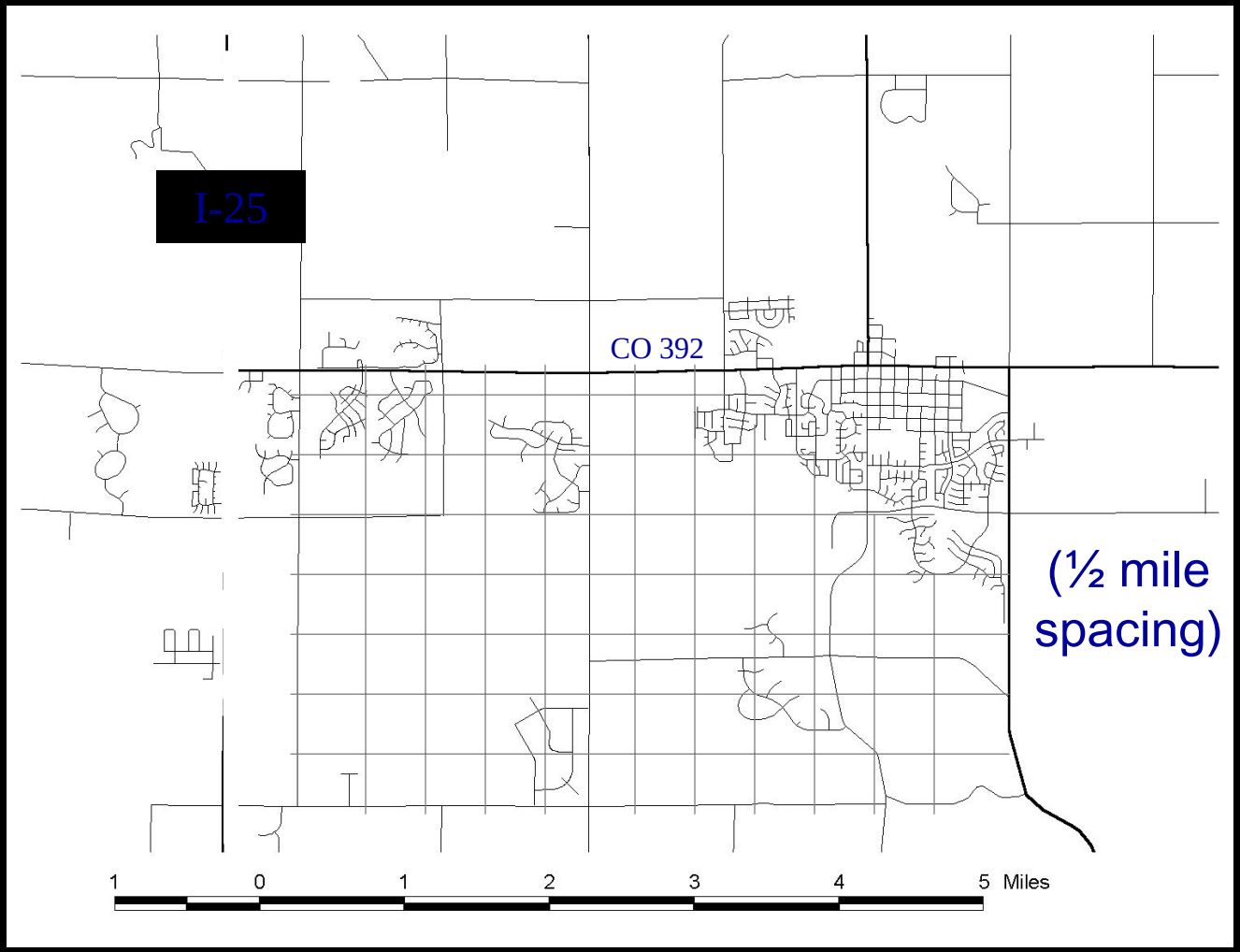
First Tier - New Development



1990s Invasion of the “Pods”

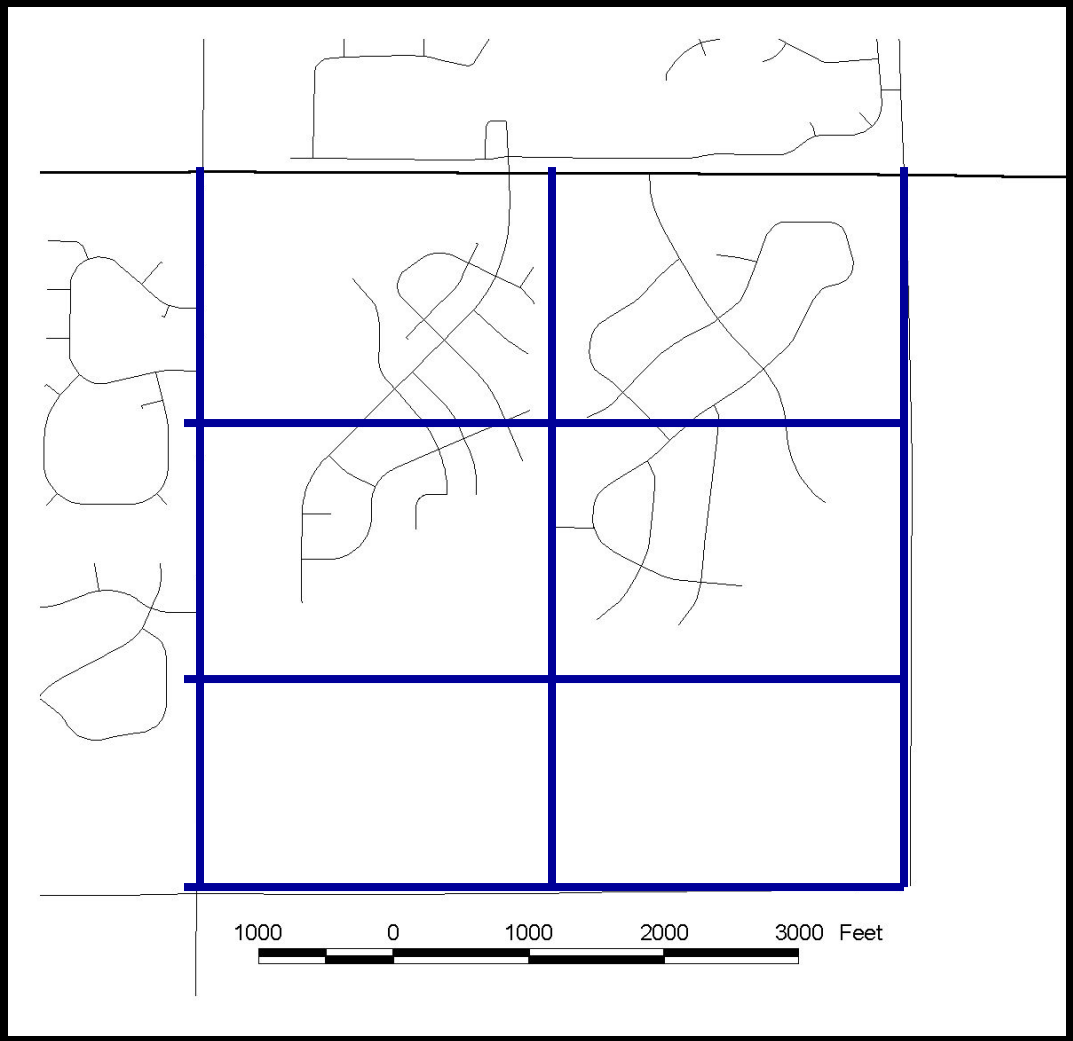


A 40-Year Look: Collectors



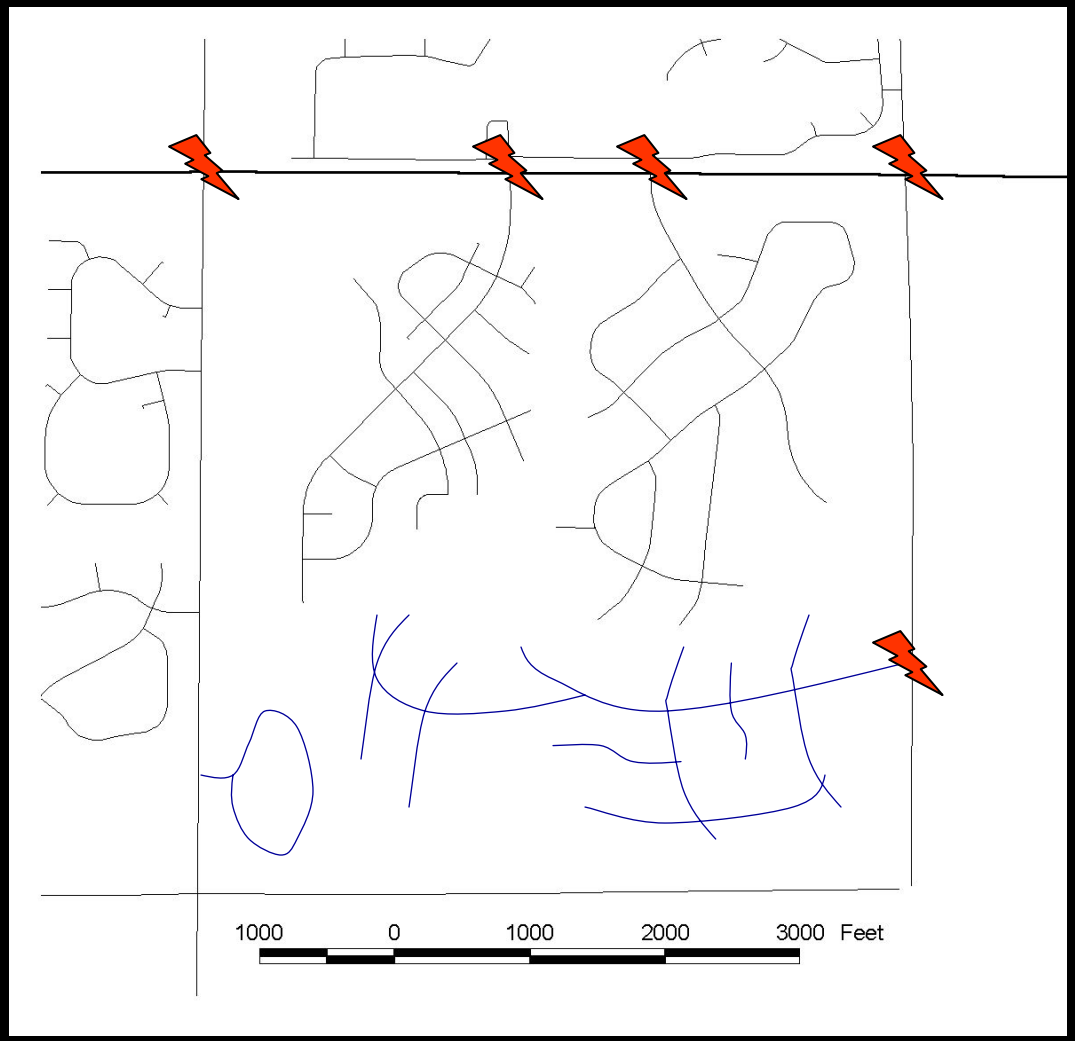
Lost Opportunity

Pods take access from the arterial highway and collectors are no longer feasible.



Build Out

What will actually happen . . .



Trouble intersections

Environment

D. Landscape

Colorado Landscapes

Landscape

- Plant trees, grasses and vegetation as part of transportation projects
- Provide public access to open space
- Preserve and respect the value of viewsheds
- Limit development that is not sensitive to its setting and/or subtracts value from adjacent properties

Environment

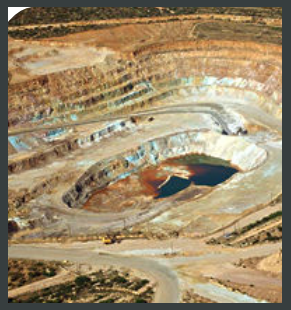
E. Resource Efficiency

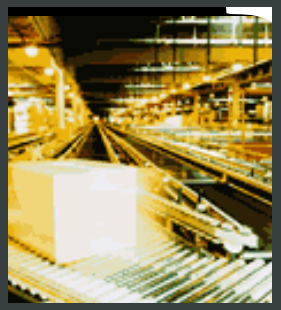
“cradle to cradle” design

“Being less bad is not being good.”

- William McDonough

“Cradle to Grave” Design



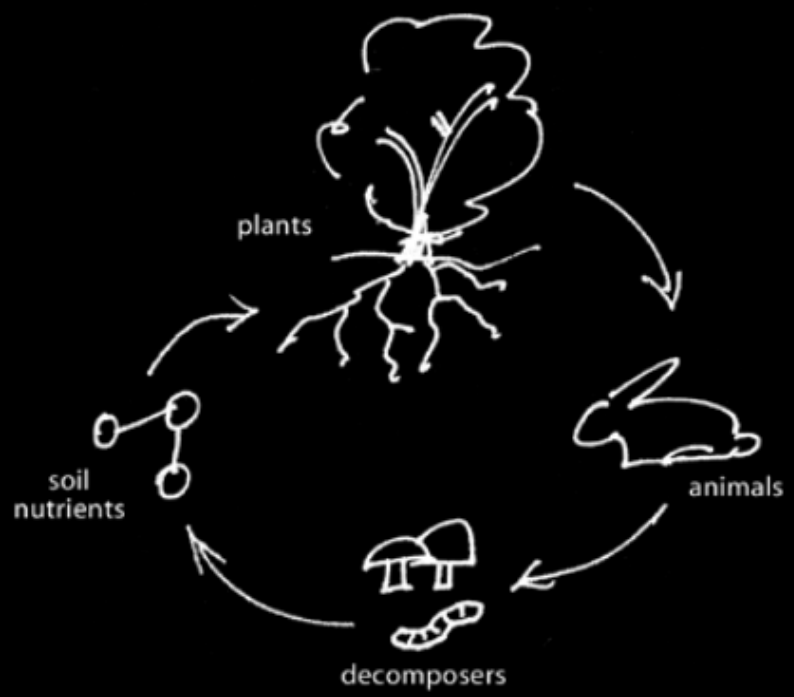


TAKE
raw material
extraction
and
synthesis

MAKE
manufacturing
production
distribution
use

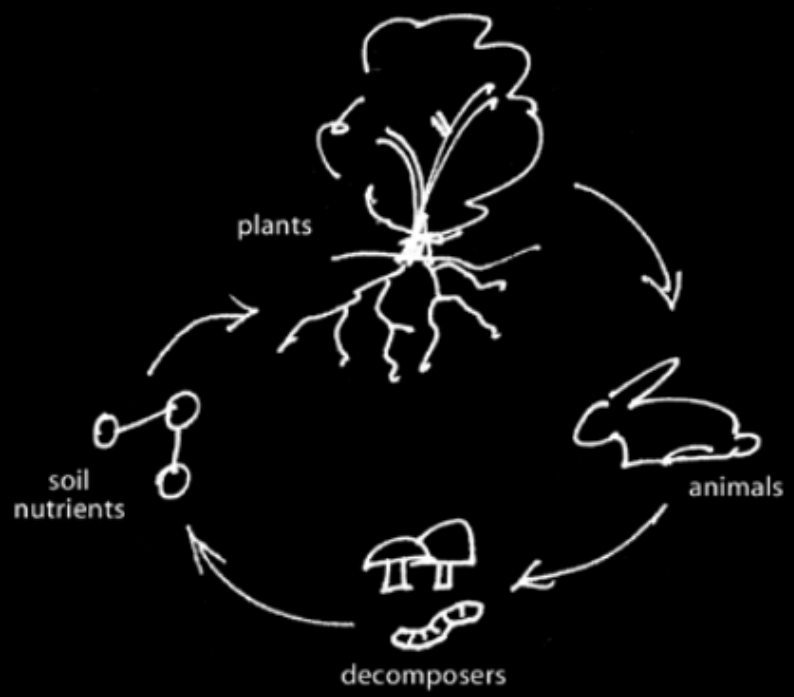
WASTE
landfill
incineration

“Cradle to Cradle” Design

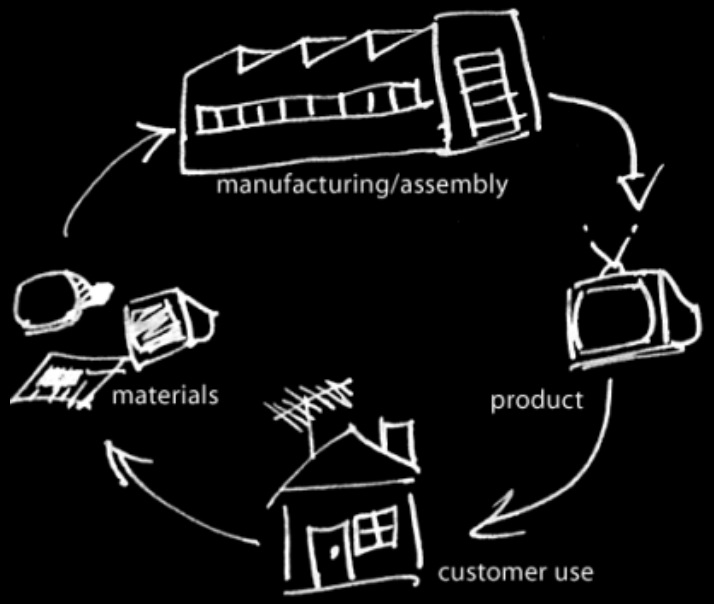


biological nutrient cycle

“Cradle to Cradle” Design



biological nutrient cycle



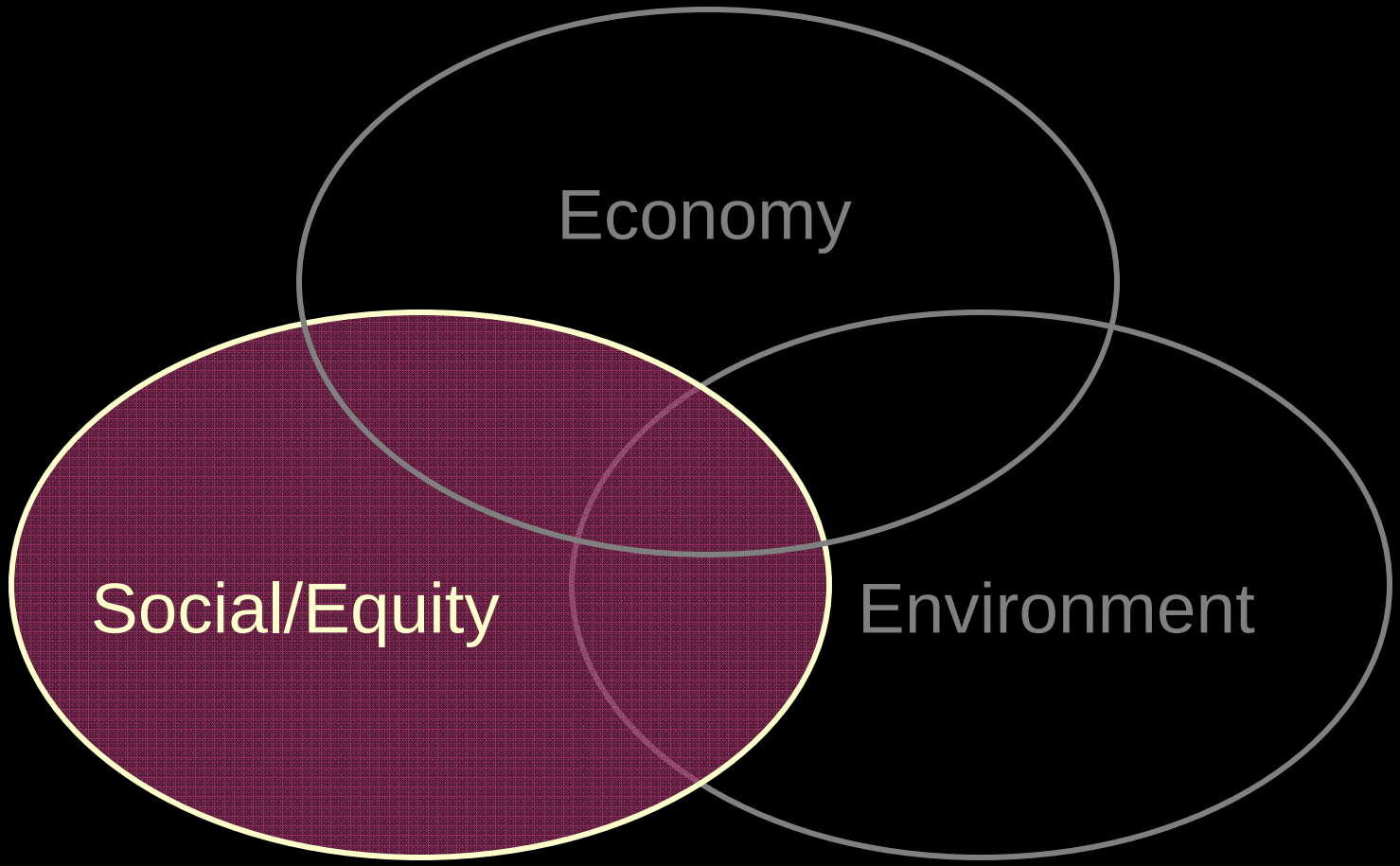
technical nutrient cycle

Cradle to Cradle Goals

- Power by the sun in all its forms
- Design building to optimize natural energy flows
- Use materials that can be endlessly recycled
- Recycle nutrients
- Positively impact environmental, social, and economic systems


Next….

“Sustainability”



Social/Equity

A. Mobility Choices

B. Healthy Societies

C. Community Legacy

Social/Equity

A. Mobility Choice

Mobility Elements

Travel – Moving over distances

Circulation – Moving within areas

Access – Getting in the door

Facilities

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...

Seattle

Redmond

...travel

Built for...

...travel

Built for...

Flagstaff

Redmond

...circulation

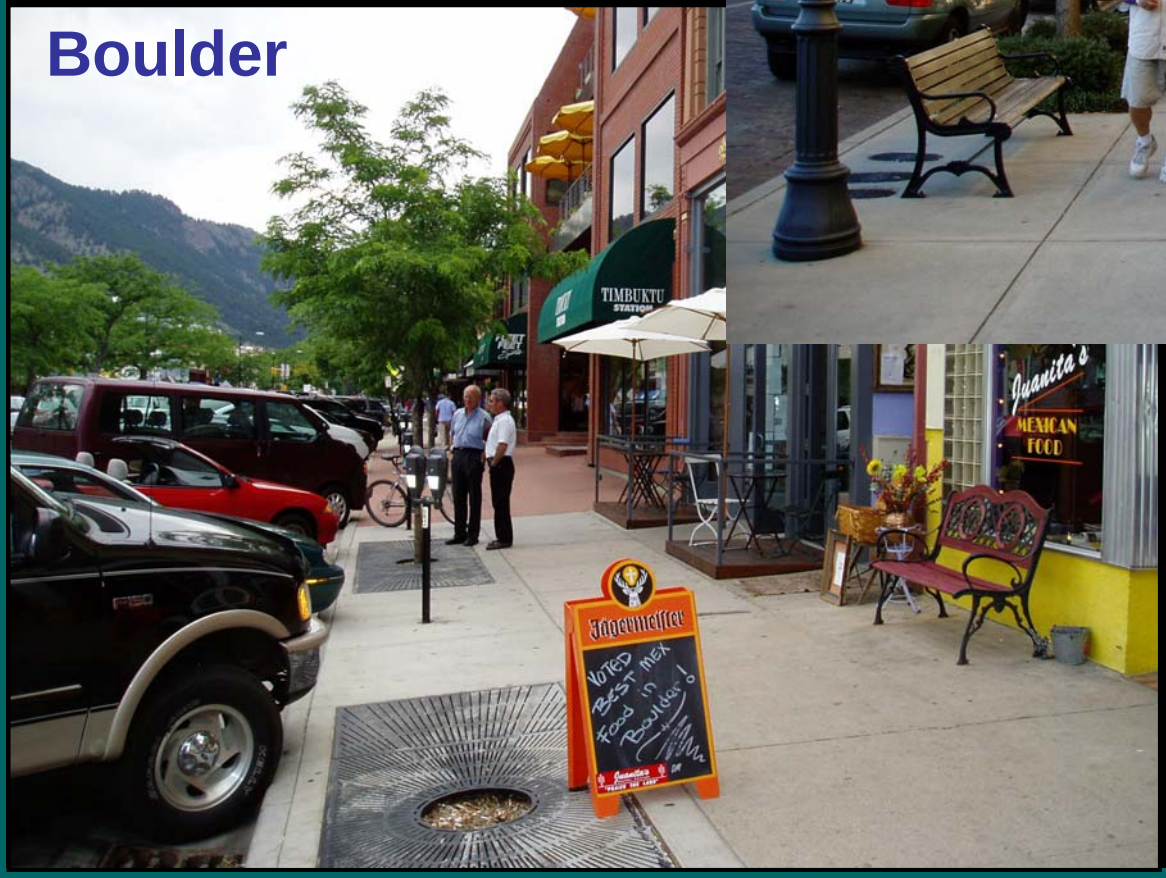
Built for...

Portland

Boulder

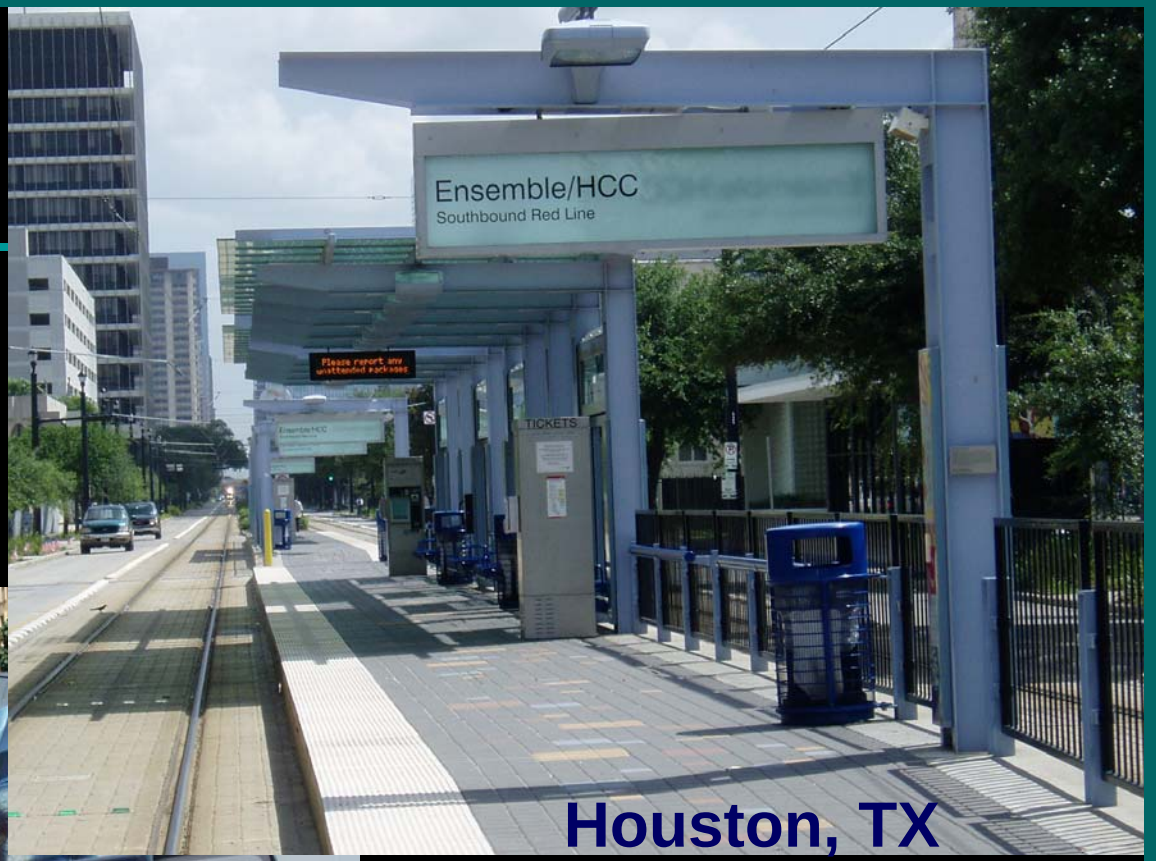
...circulation

Built for...



...access

Built for...



Houston, TX

Minneapolis

...access

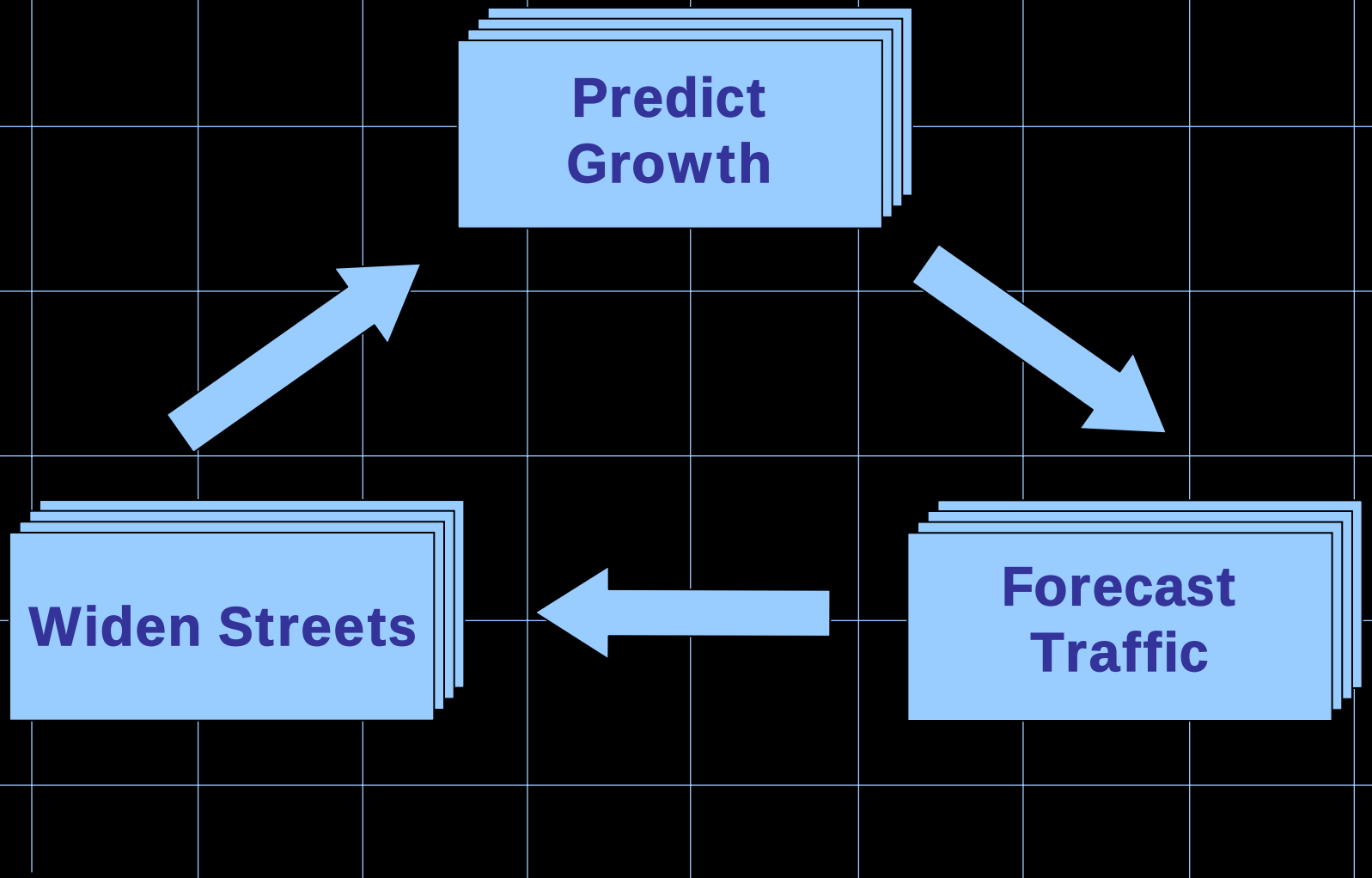
We build
too much for travel
and
too little for circulation
and access


Honolulu

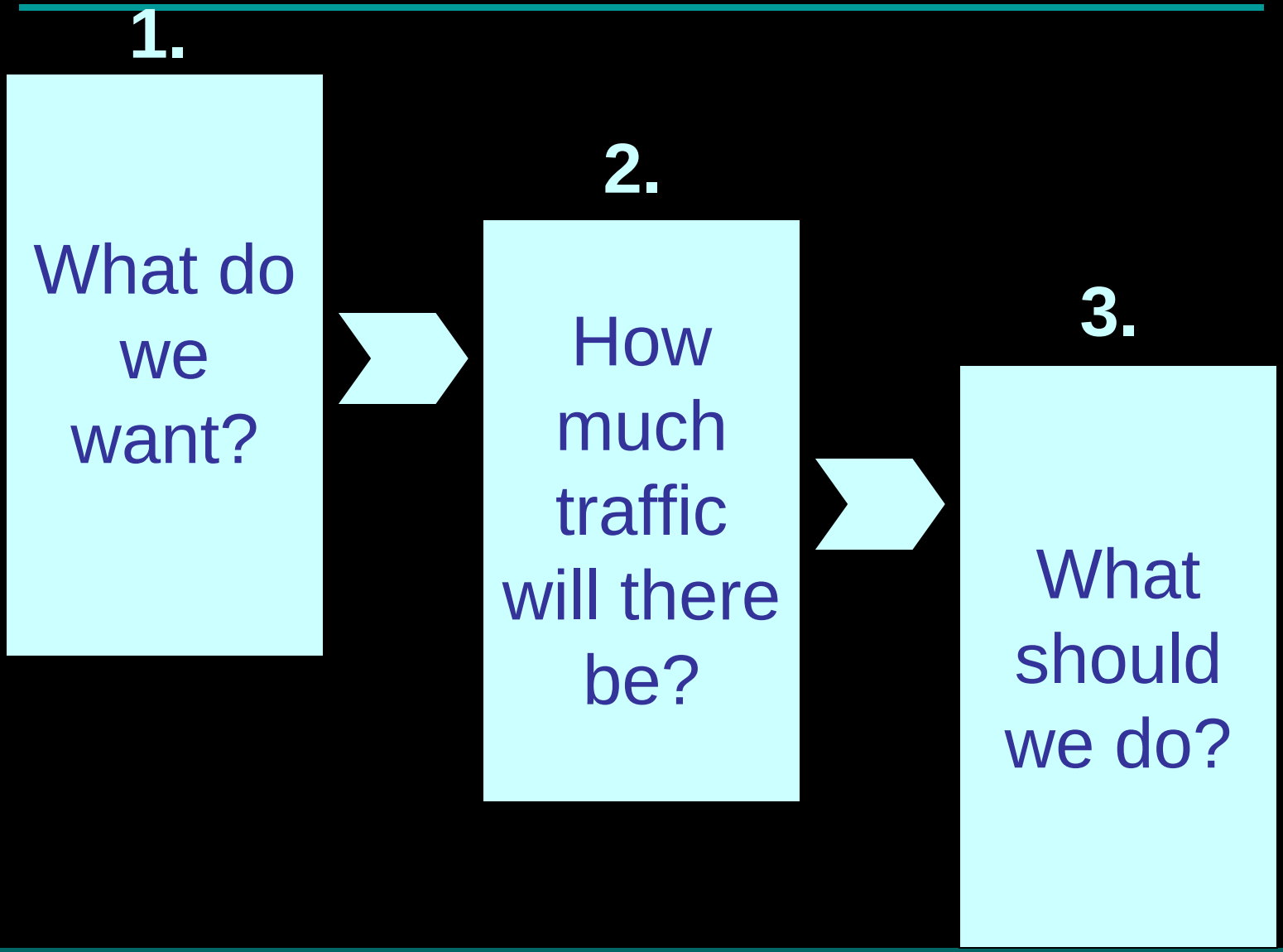

Credit: Richard E. Killingsworth

Traffic Forecasting ≠ Planning

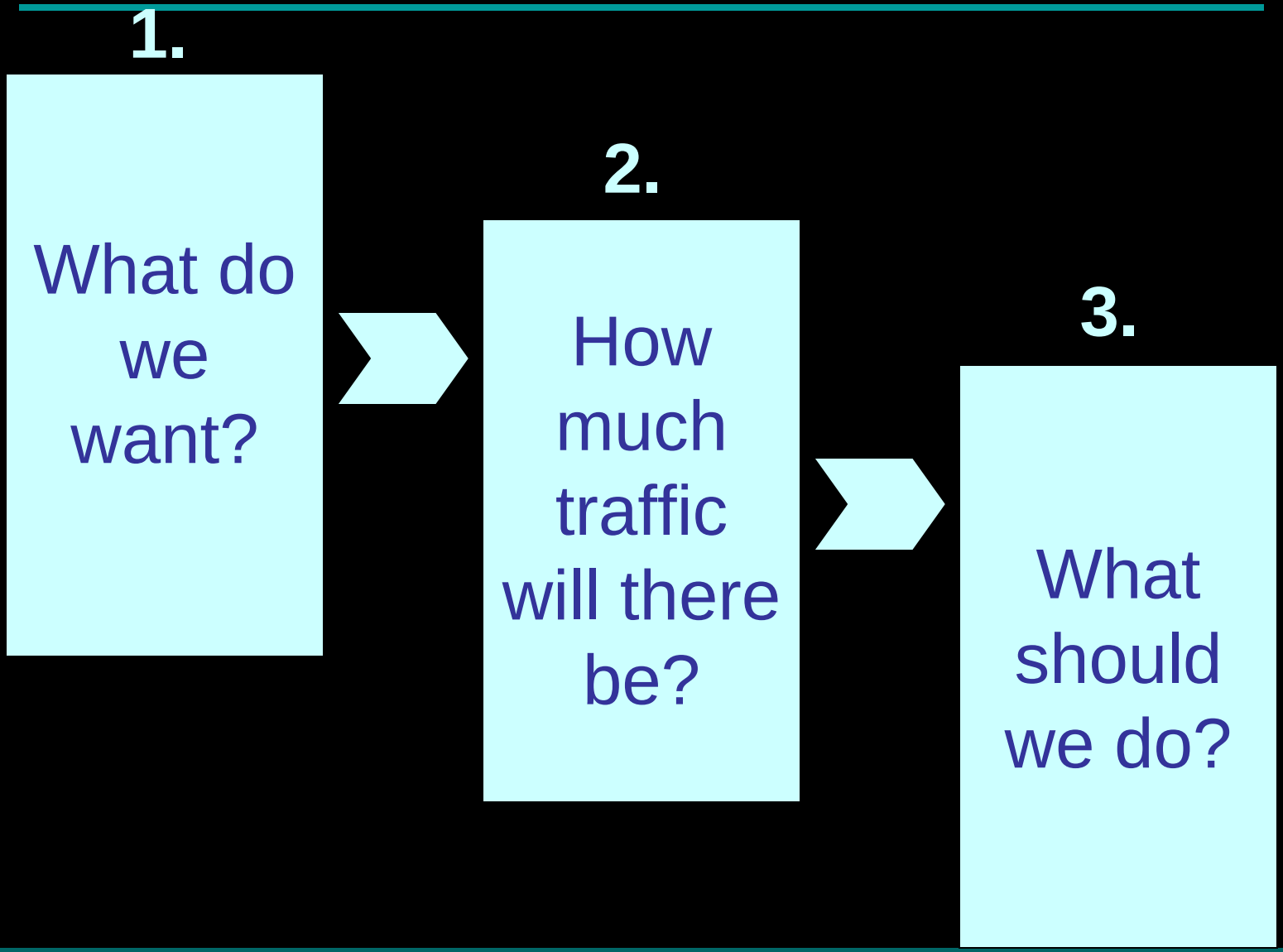
Have you ever noticed...?



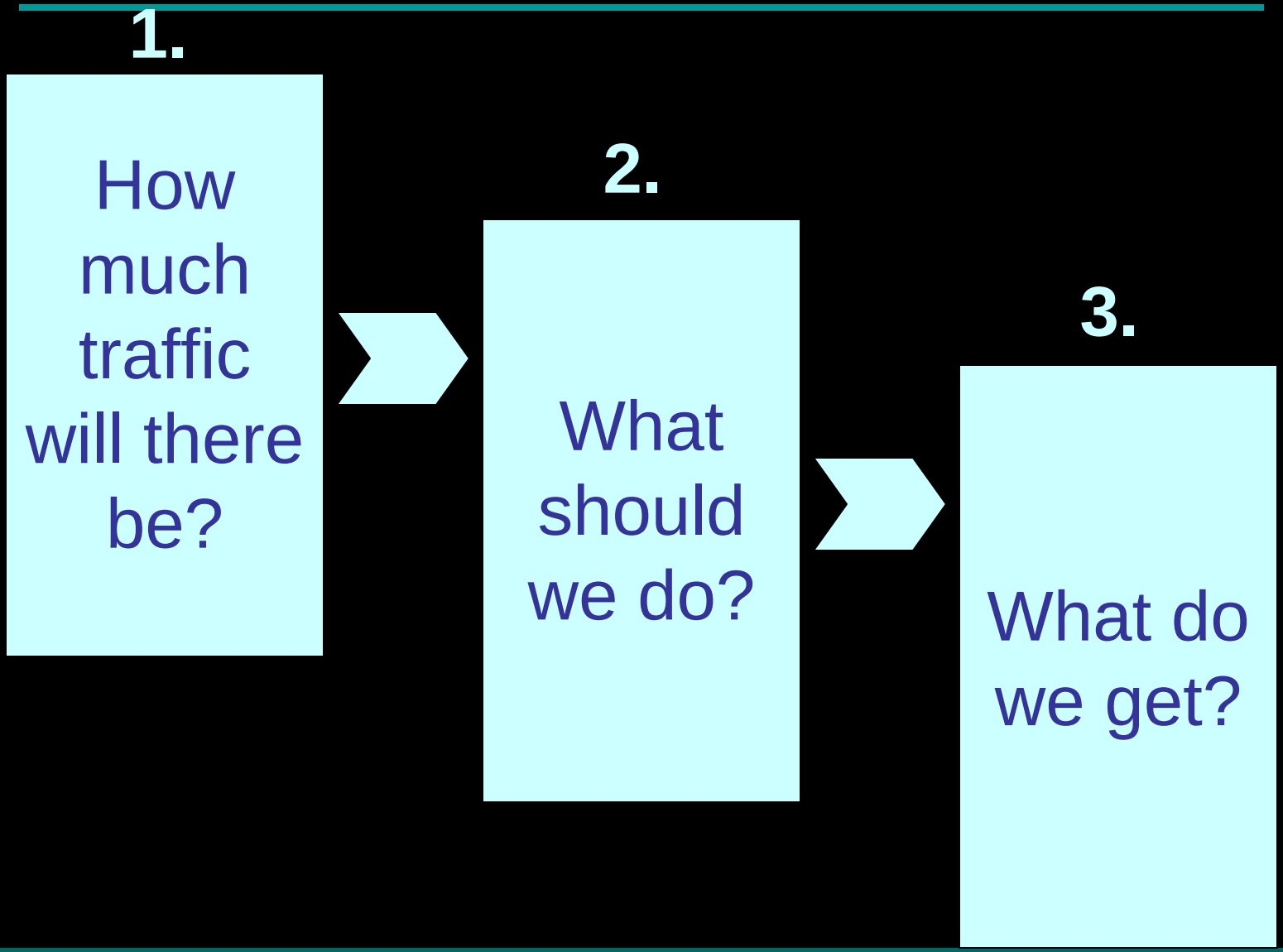
Rational “Planning”



Actual “Planning”



Actual “Planning”



Induced Traffic

Types of Induced Traffic

Changes in travel route …… Immediate

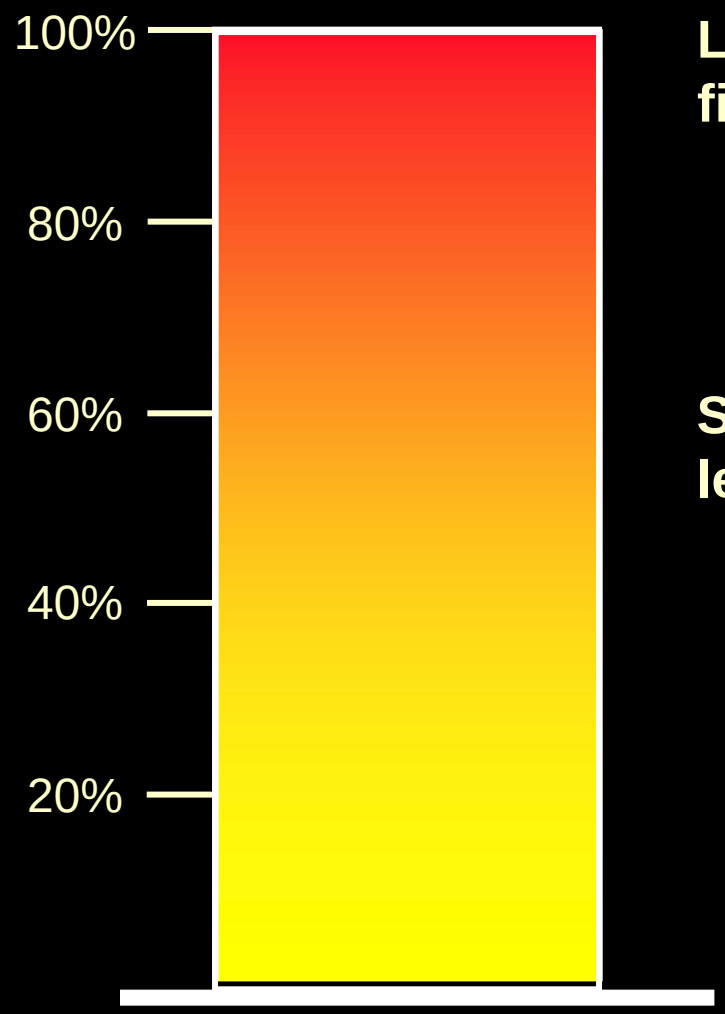
Changes in mode of travel ……. < 6 months

Changes in time of travel ……. < 6 months

Changes in amount of travel ……. < 6 months

Changes in origins & destinations …… < 10 years

% of new capacity consumed by induced traffic…



Long Term:
five to 10 years

Short Term:
less than five years

If you build it . . .

. . . they will come

If you build it . . .

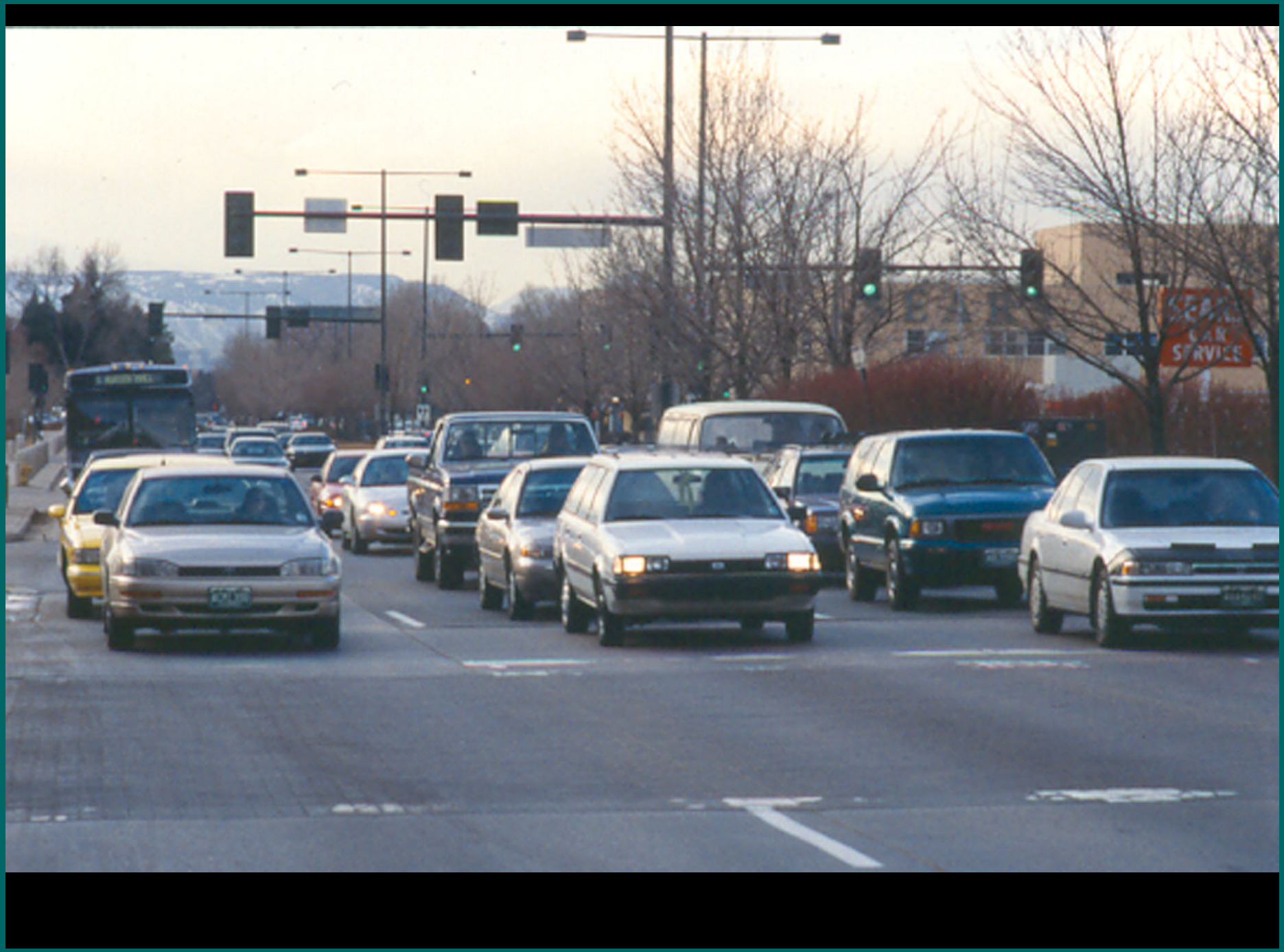
. . . they will come

Are we responding to traffic growth…

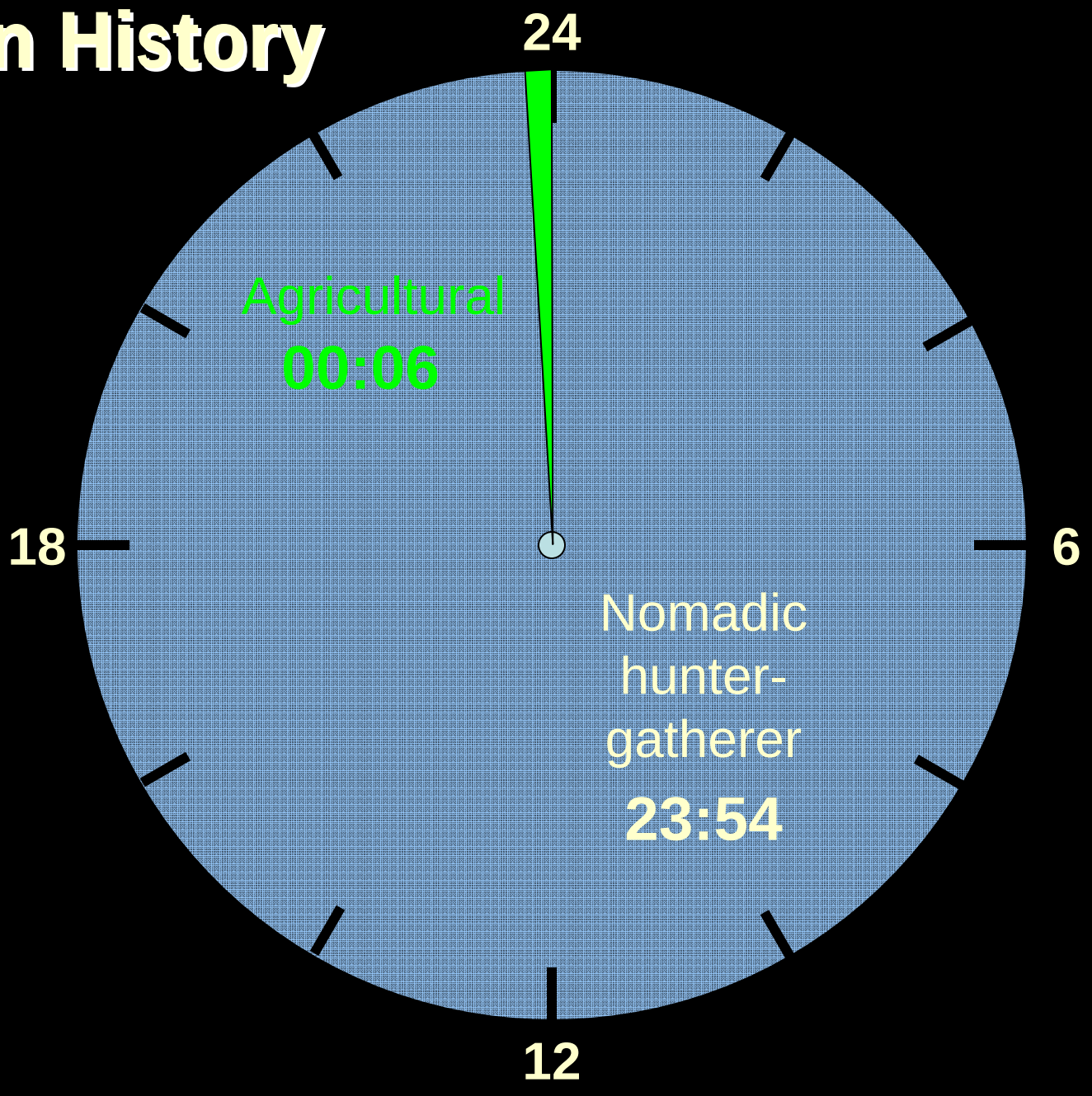
…or are we causing it?

Social/Equity

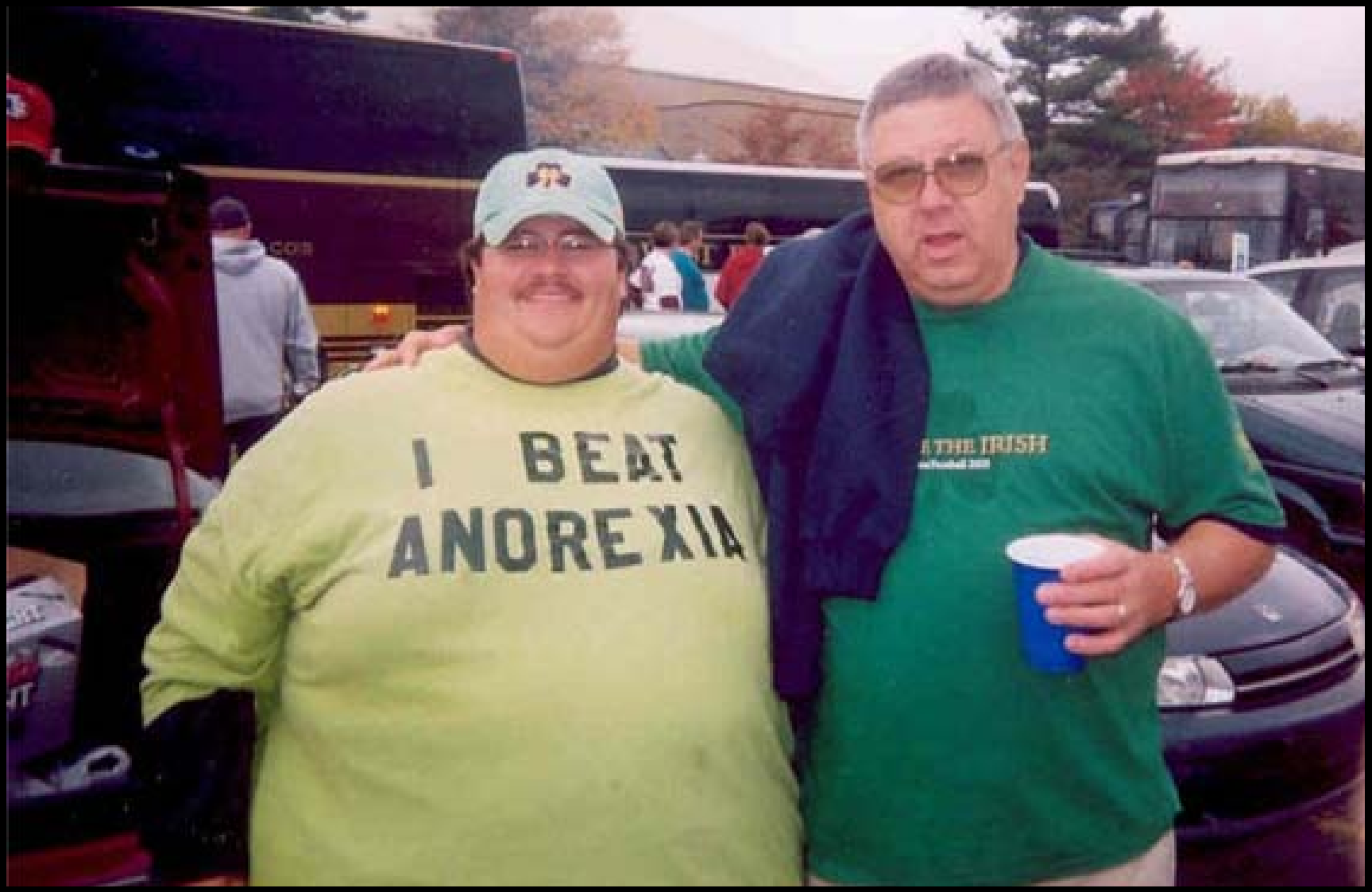
B. Healthy Societies


CAR
SERVICE

Human History

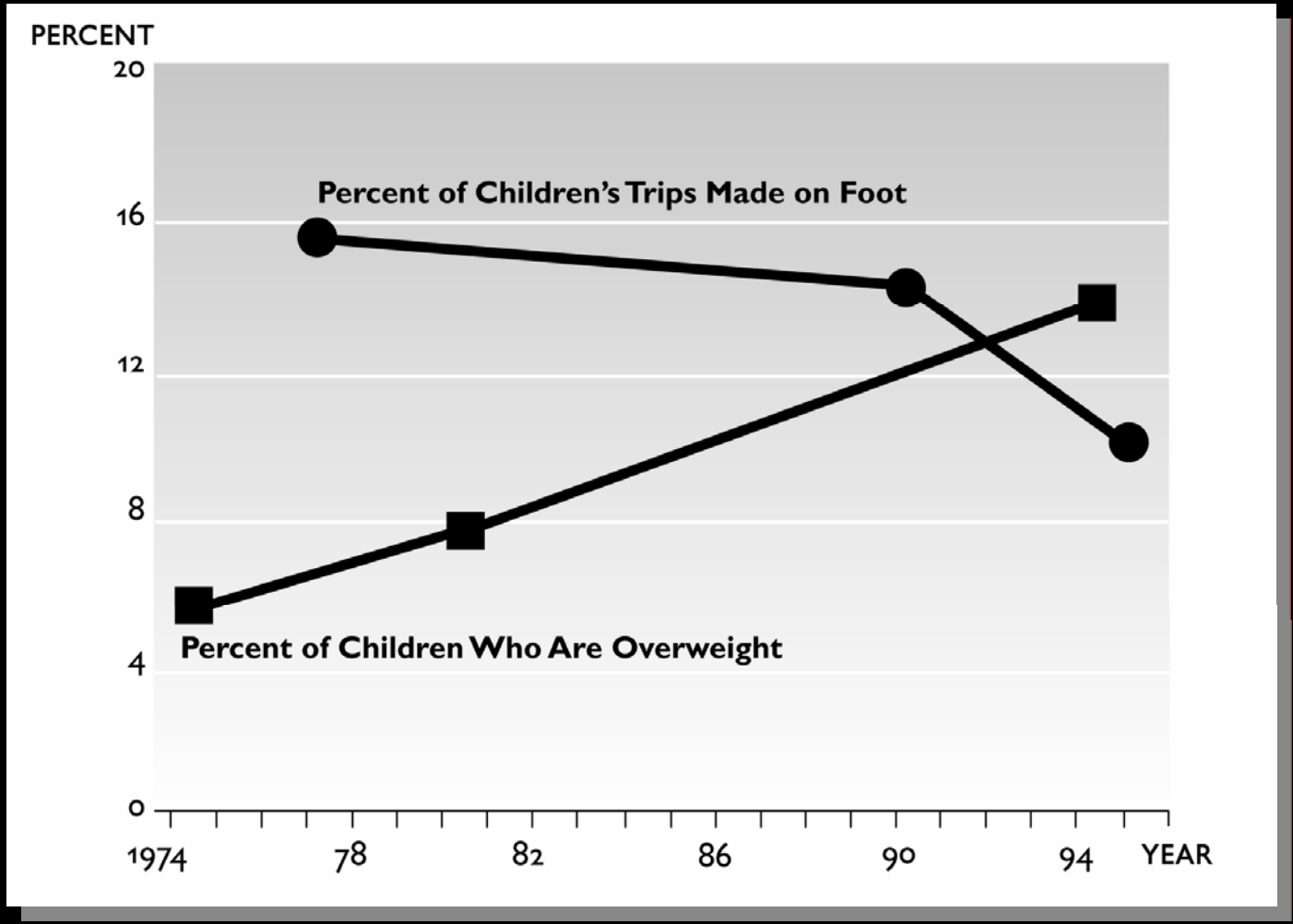


We cannot escape our DNA…



…no matter how hard we try

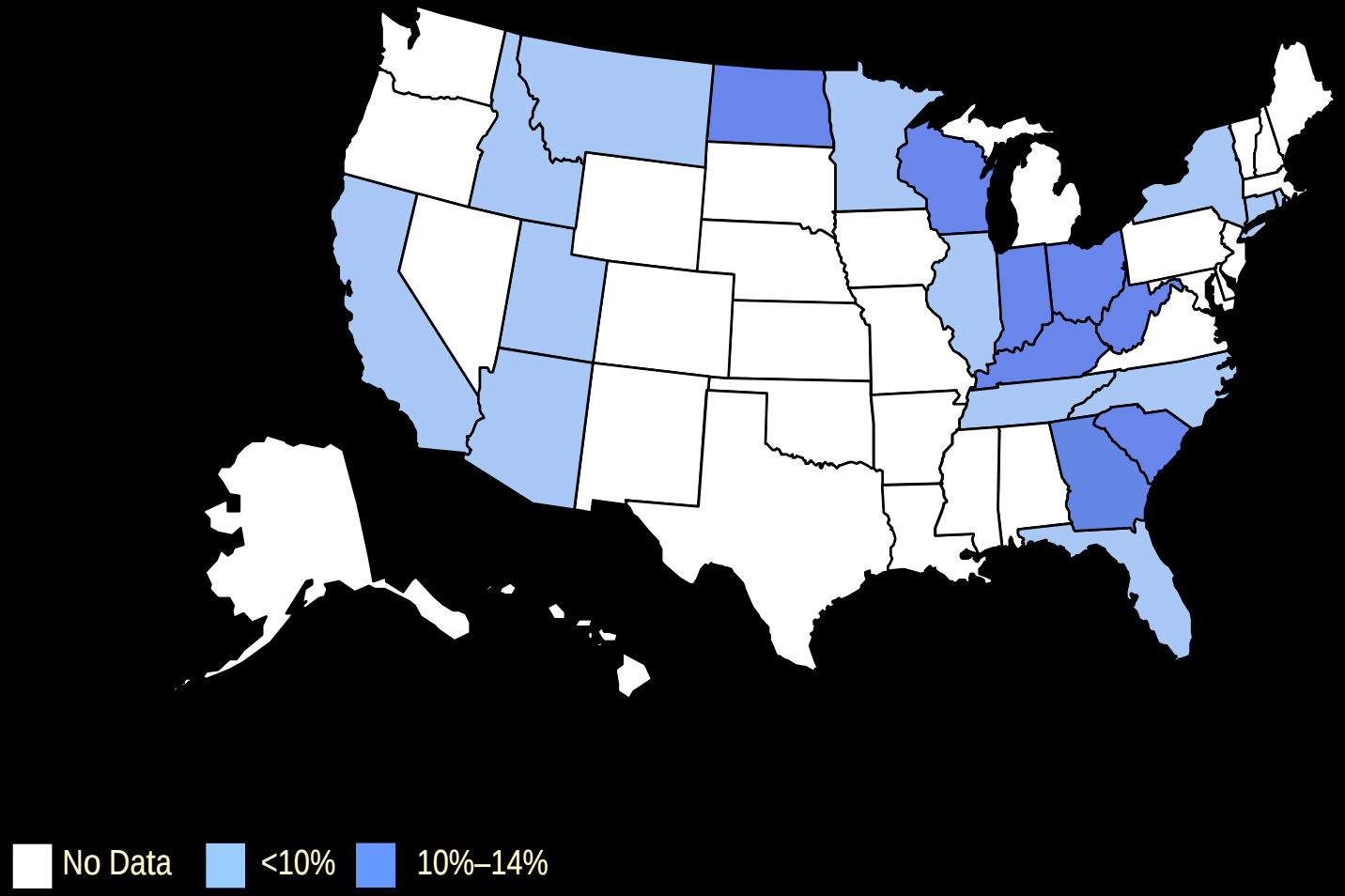
Children Are Walking Less and Becoming Increasingly Overweight



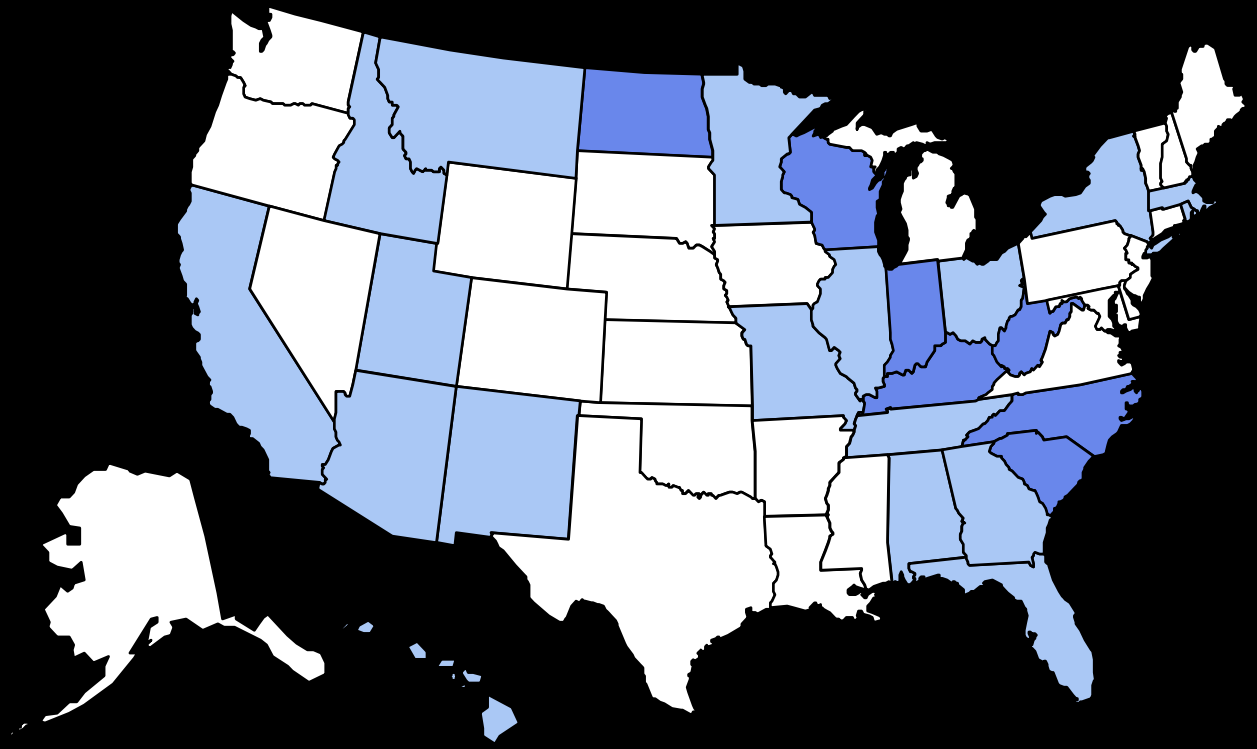
Surface Transportation Policy Project Data Analysis - 2001

1985

Obesity Trends* Among U.S. Adults



1986



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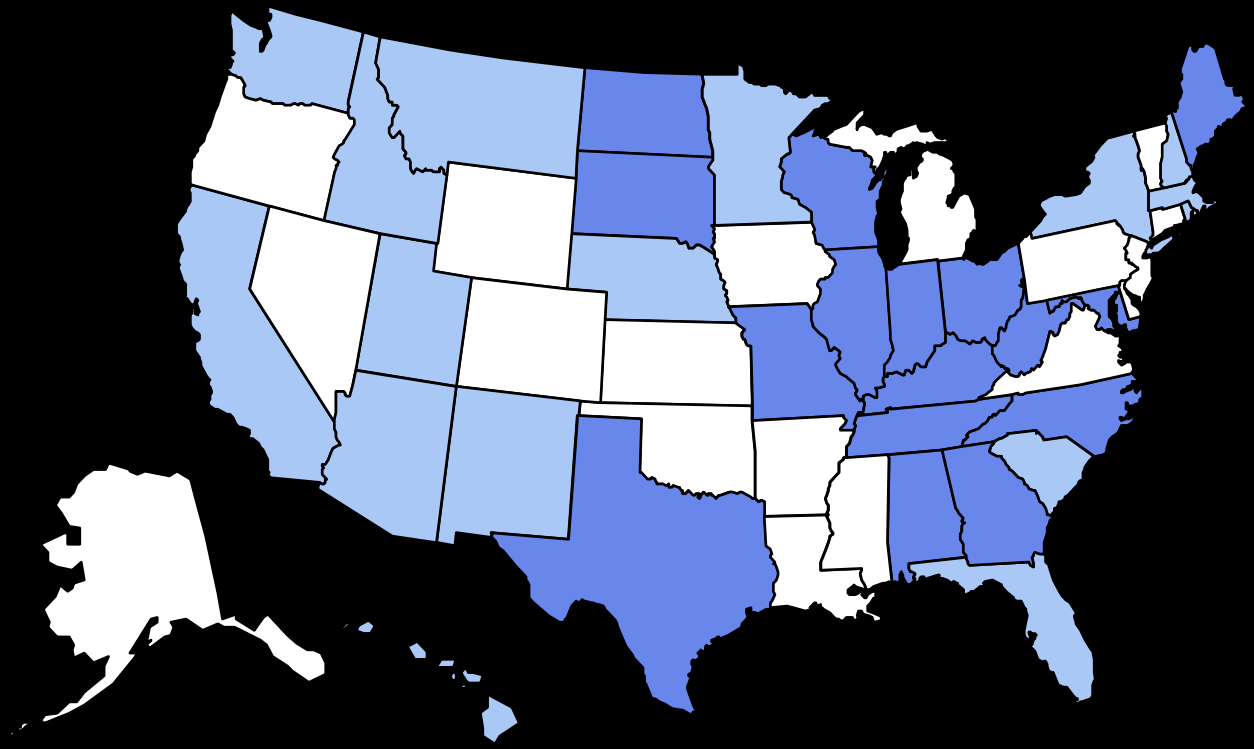
1987



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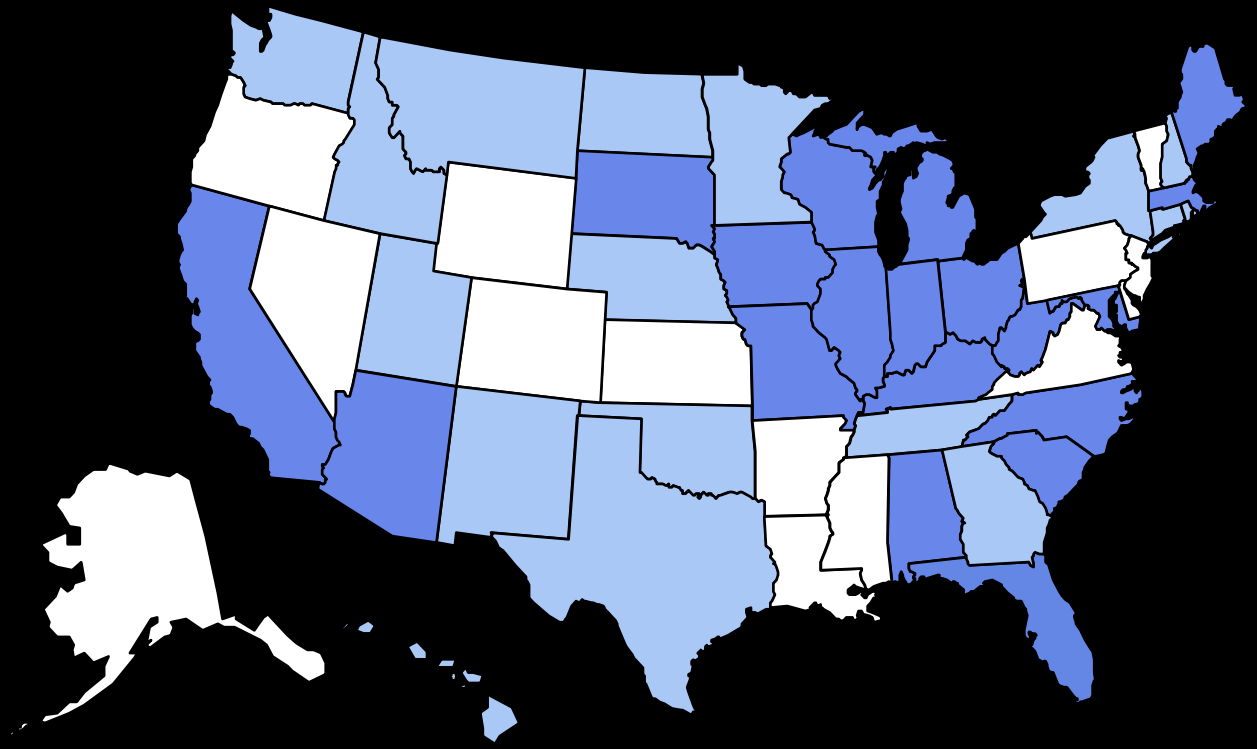

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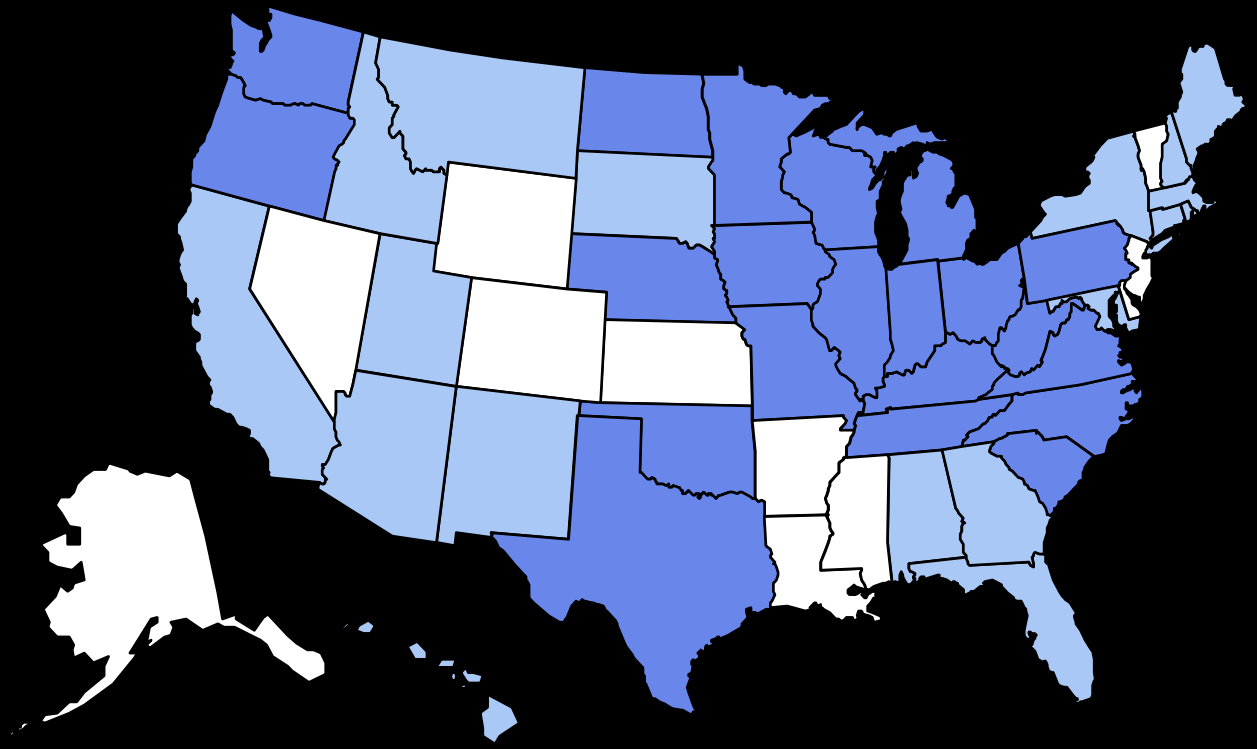
1989



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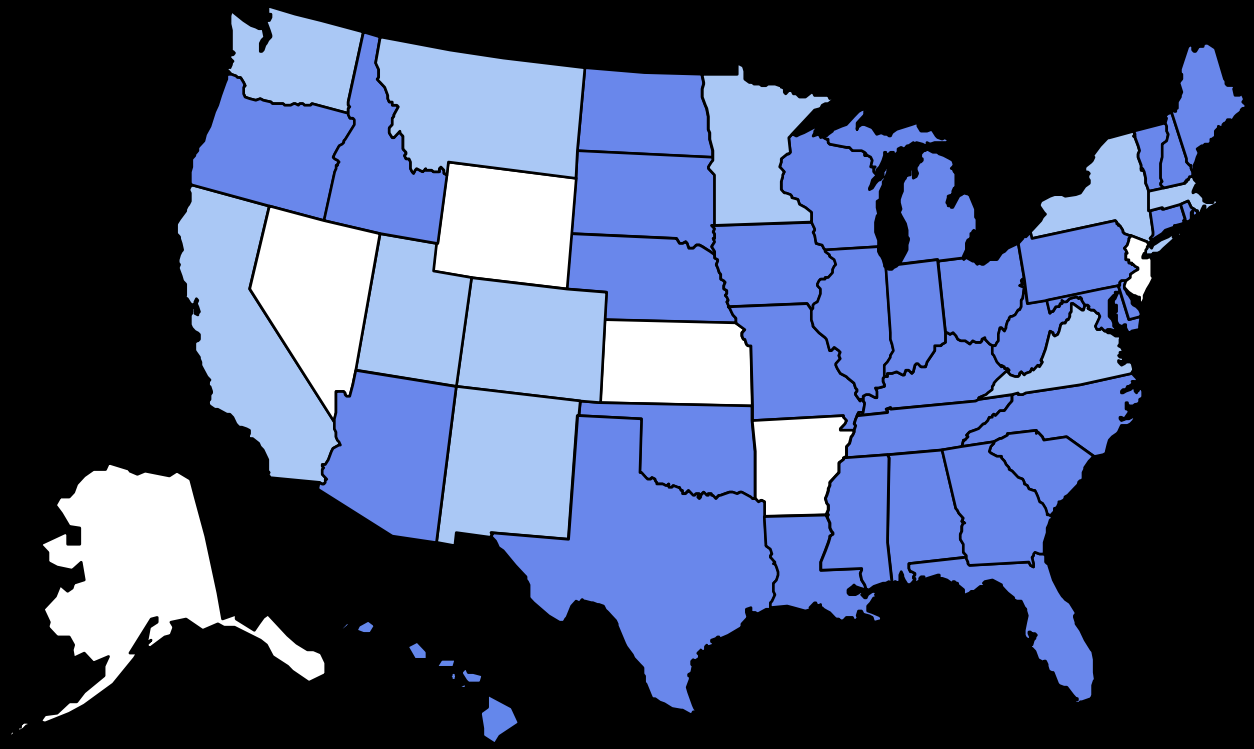
1990



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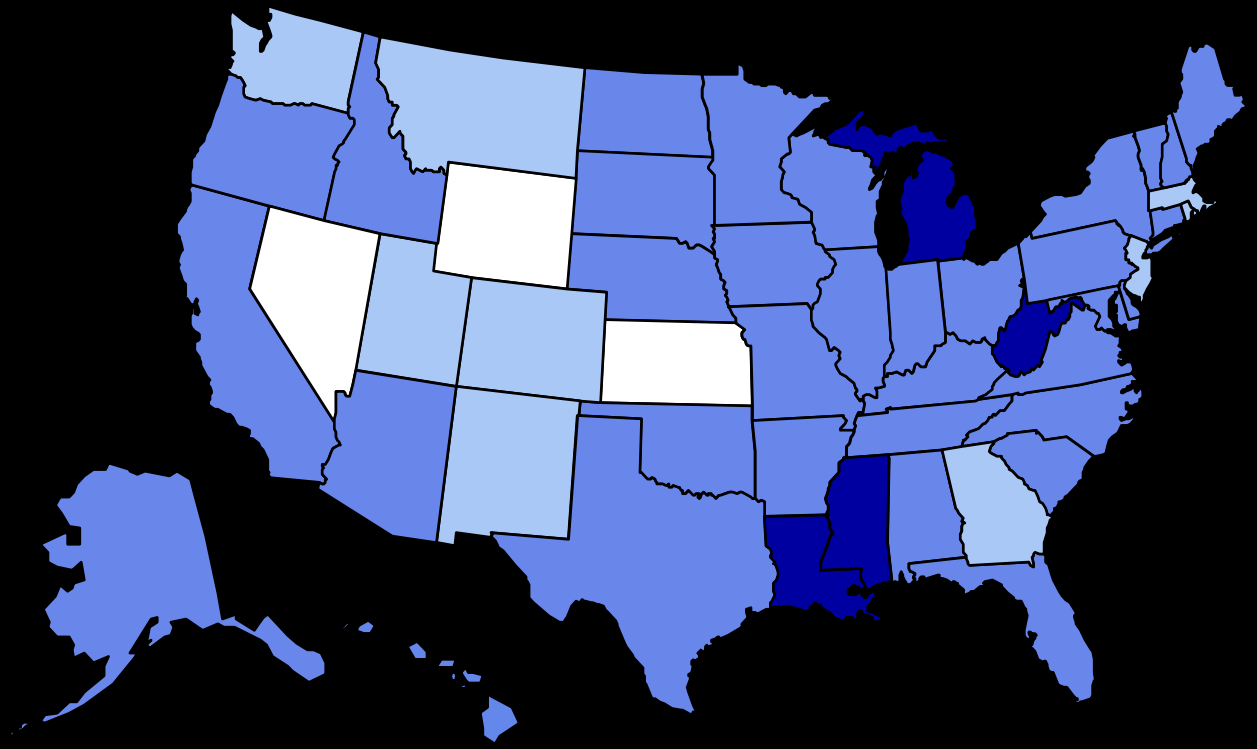

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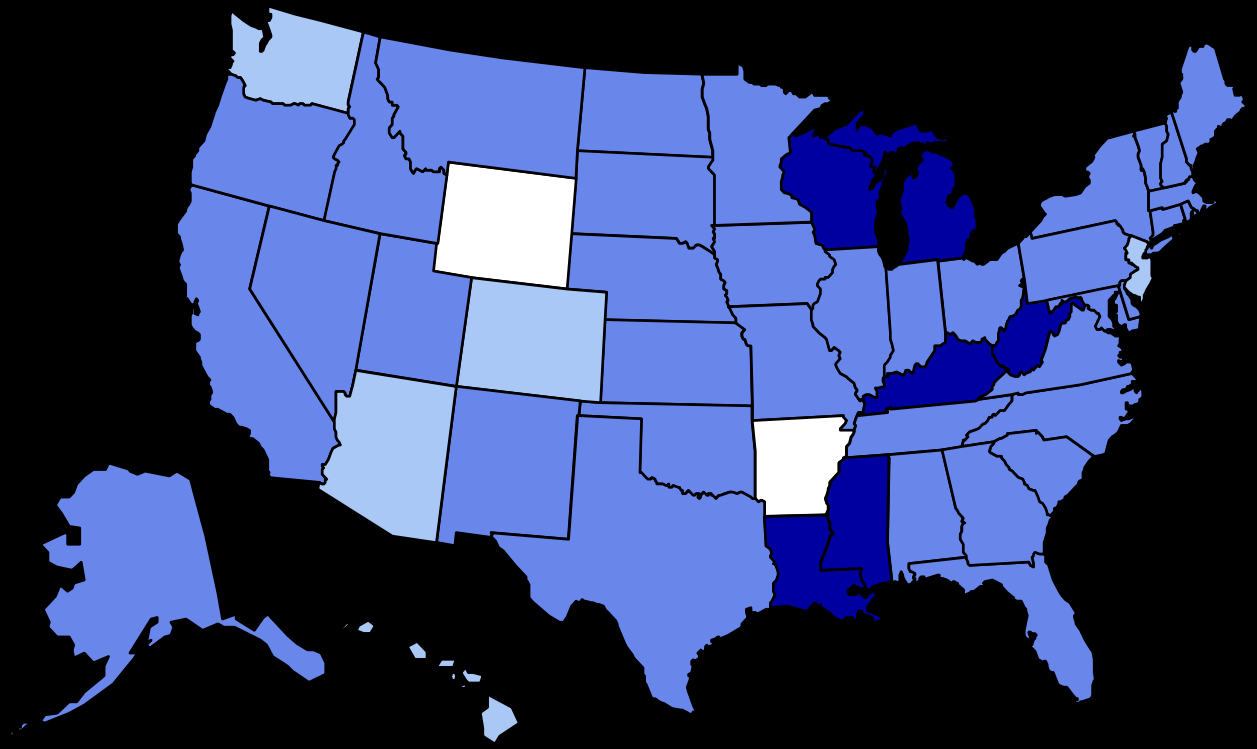

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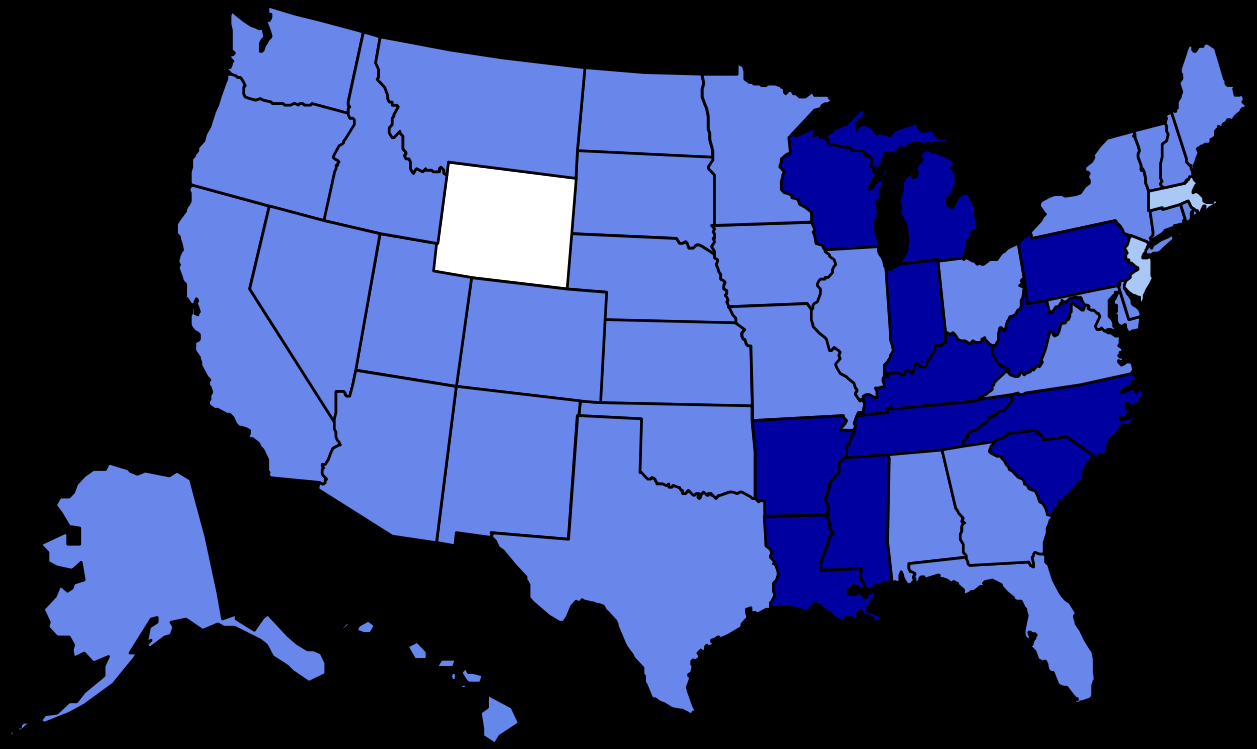

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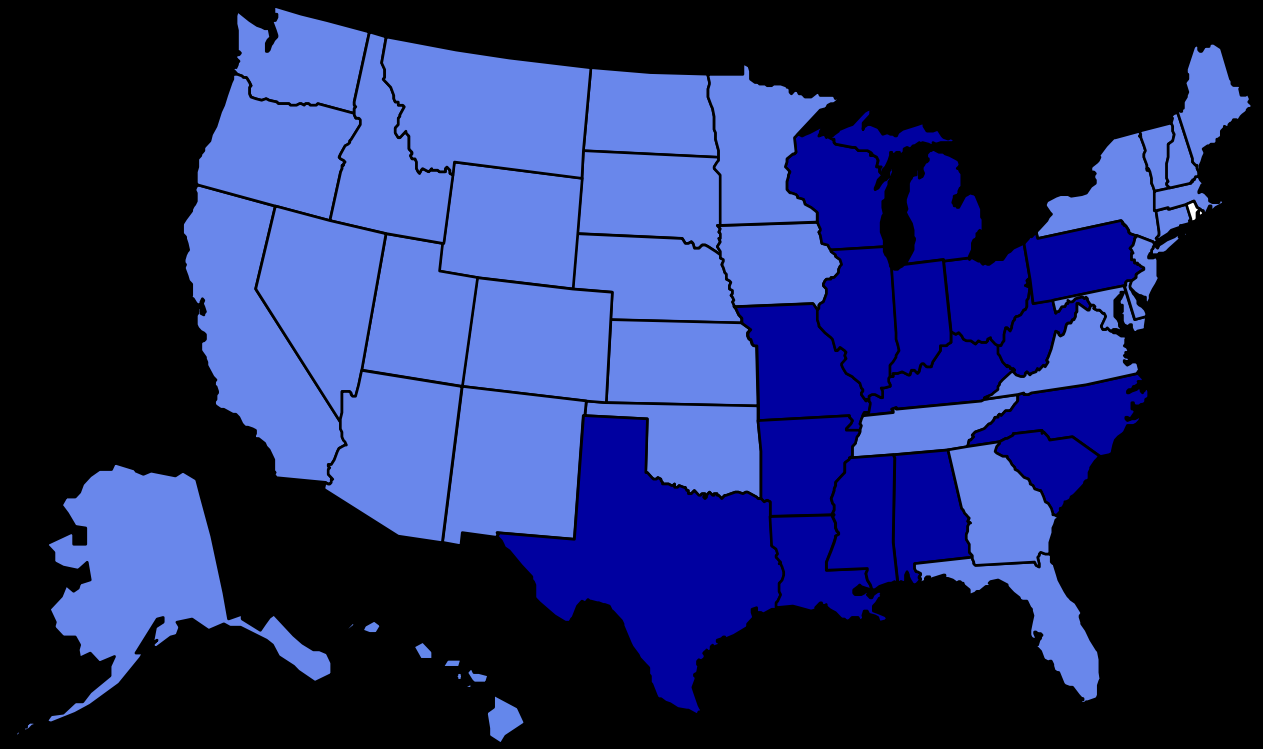

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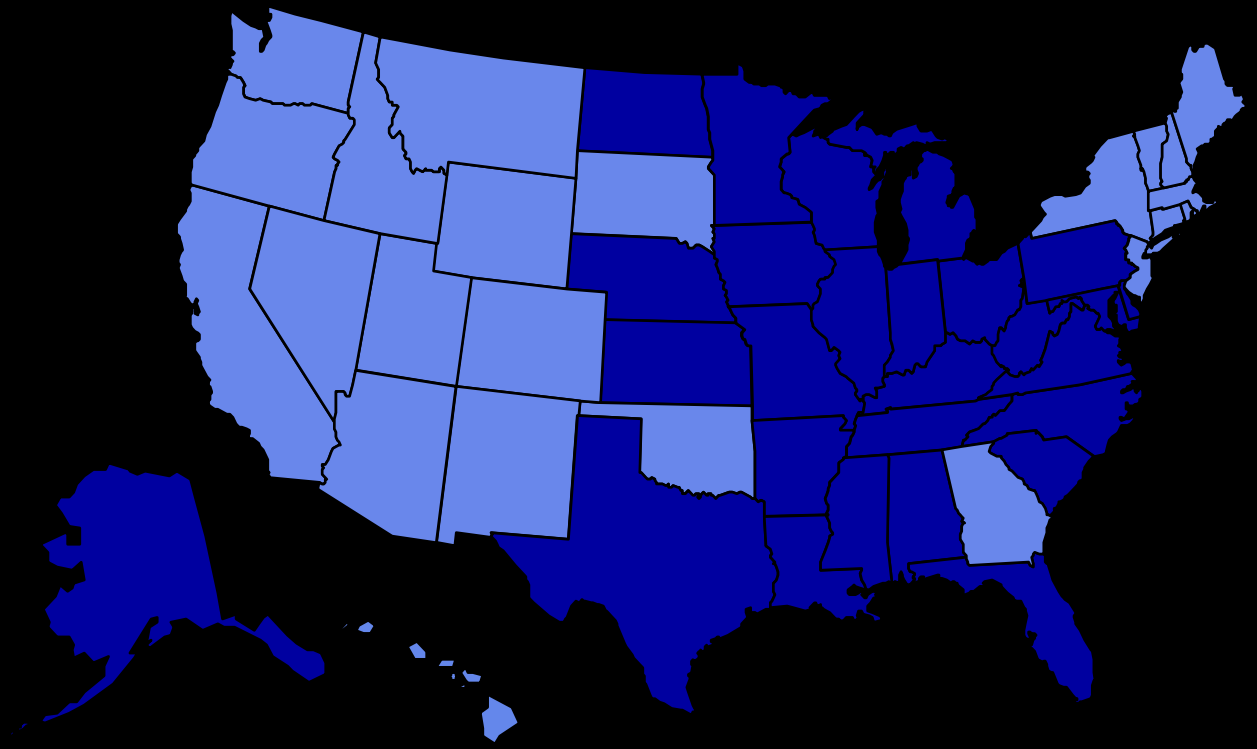

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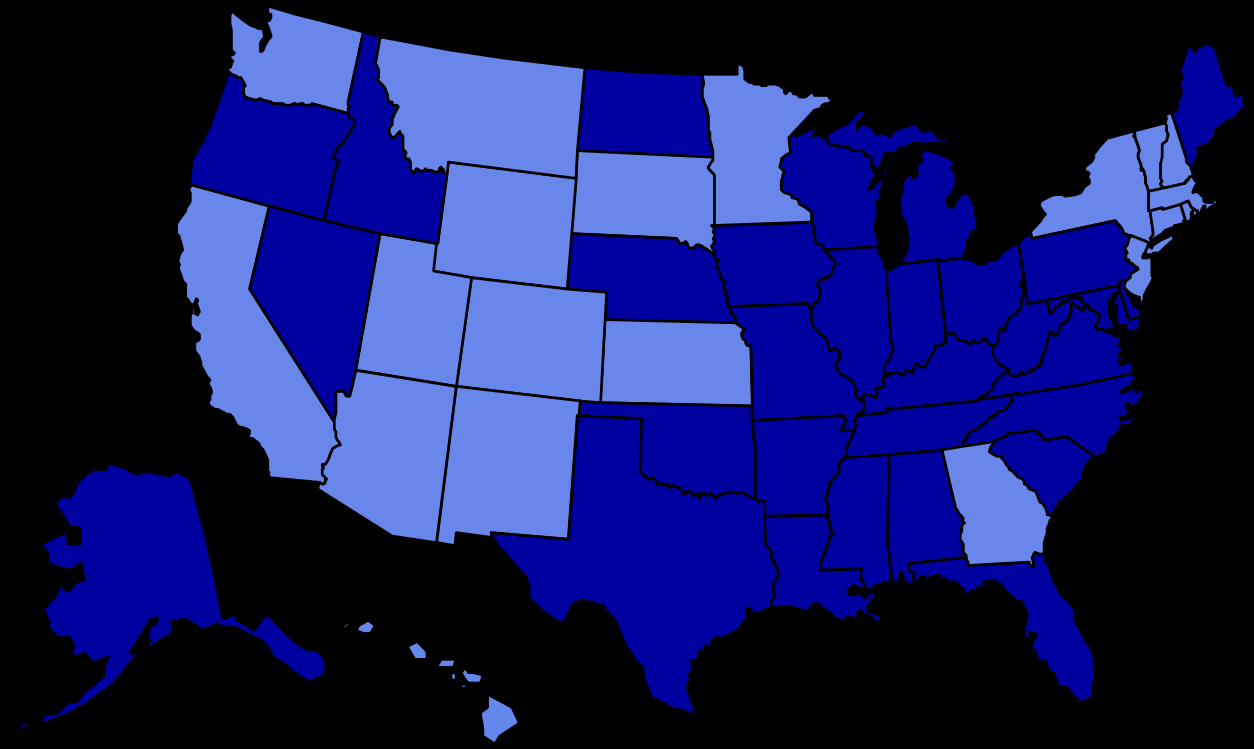

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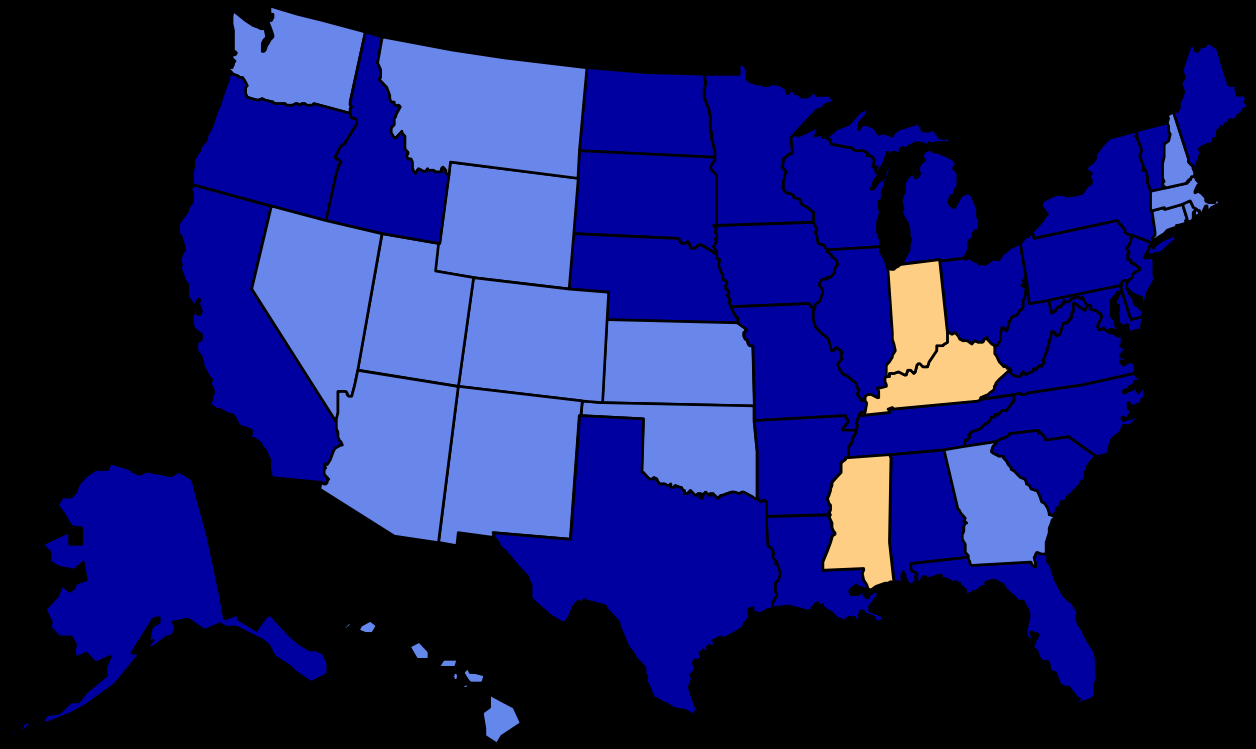

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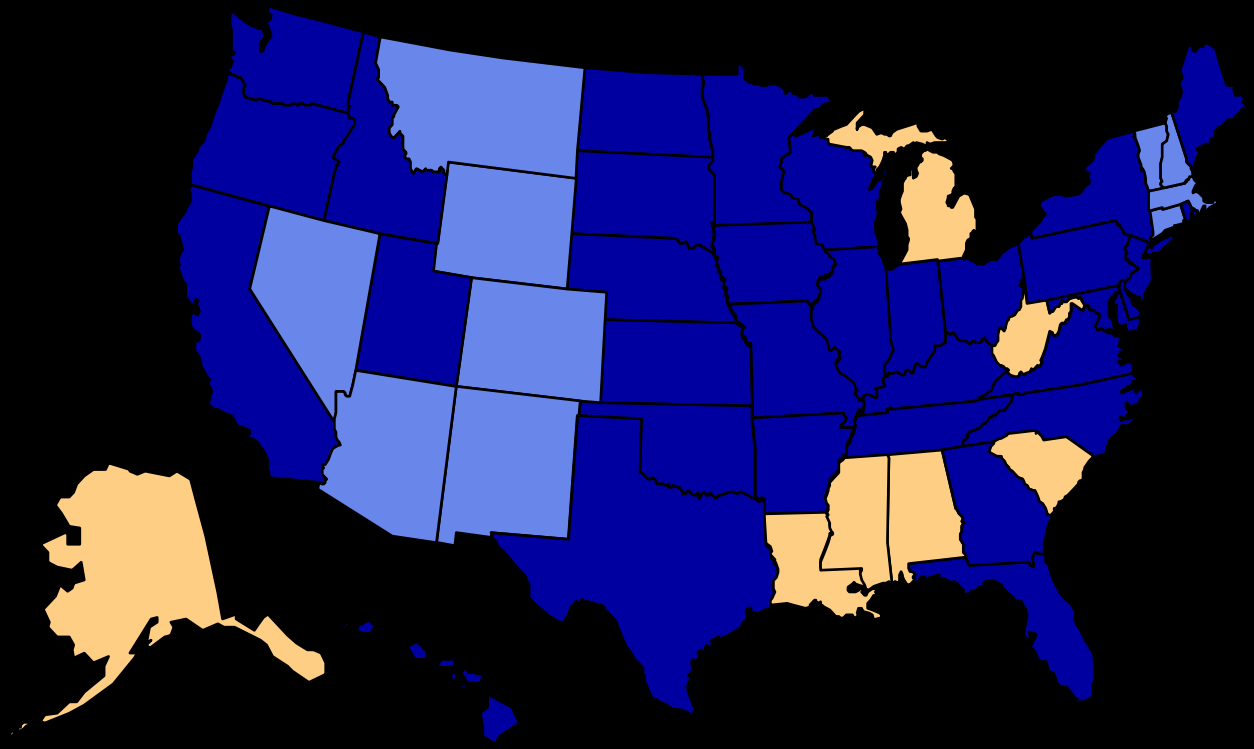

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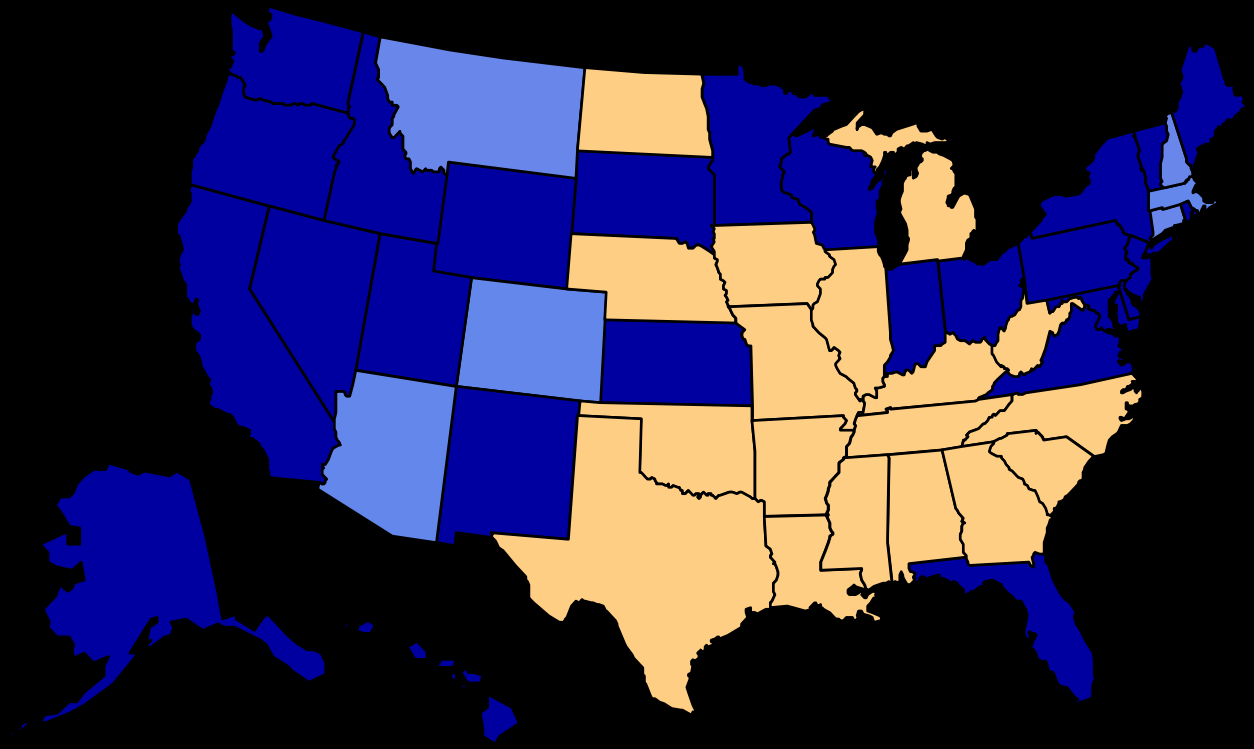

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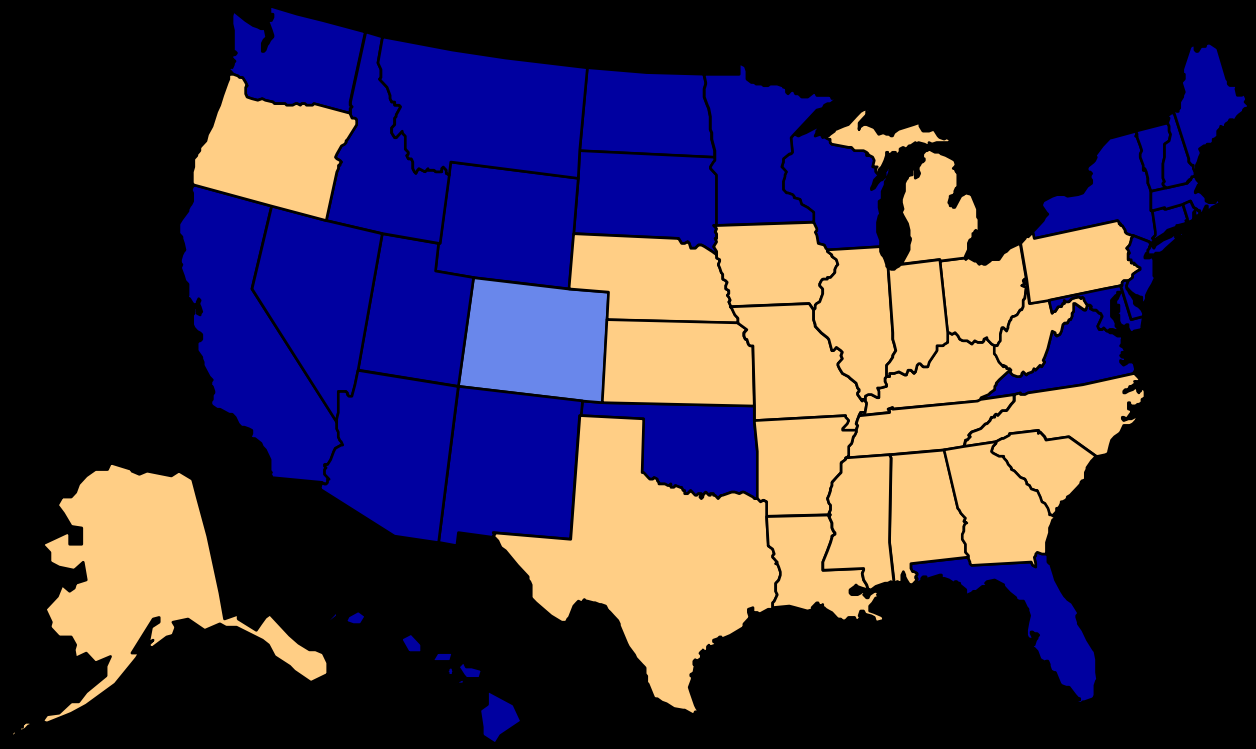

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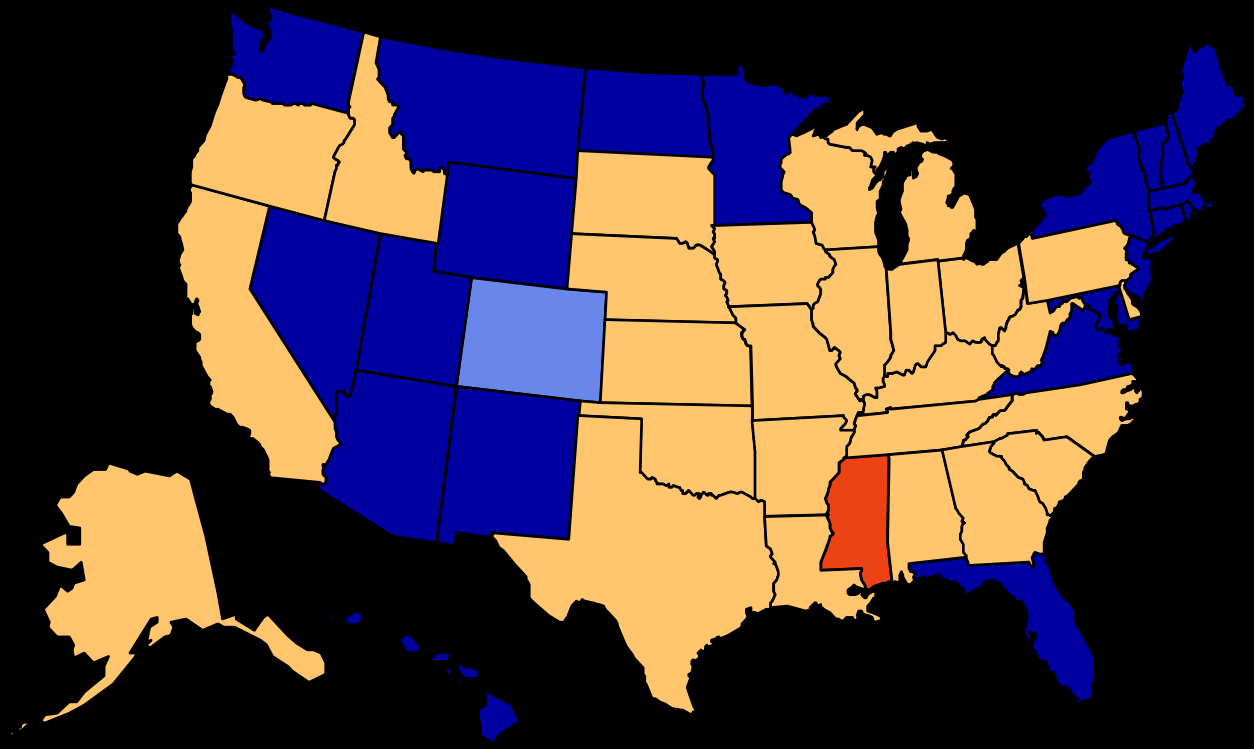

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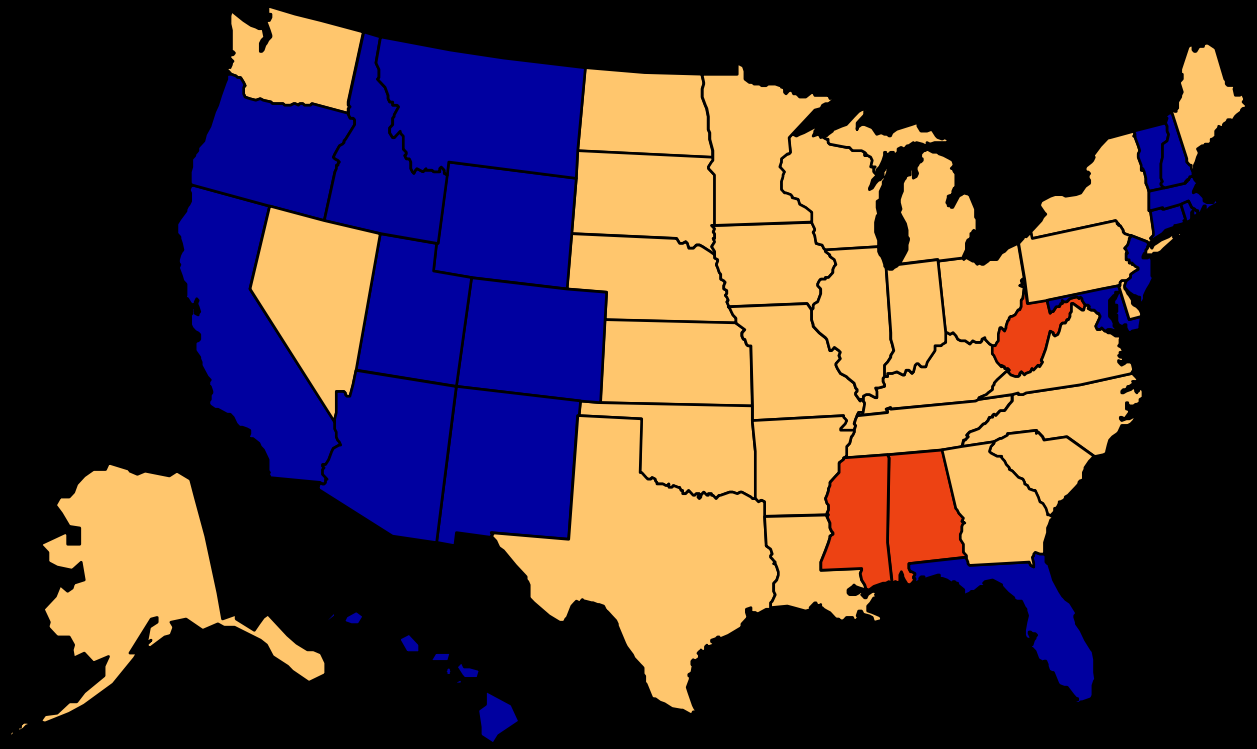

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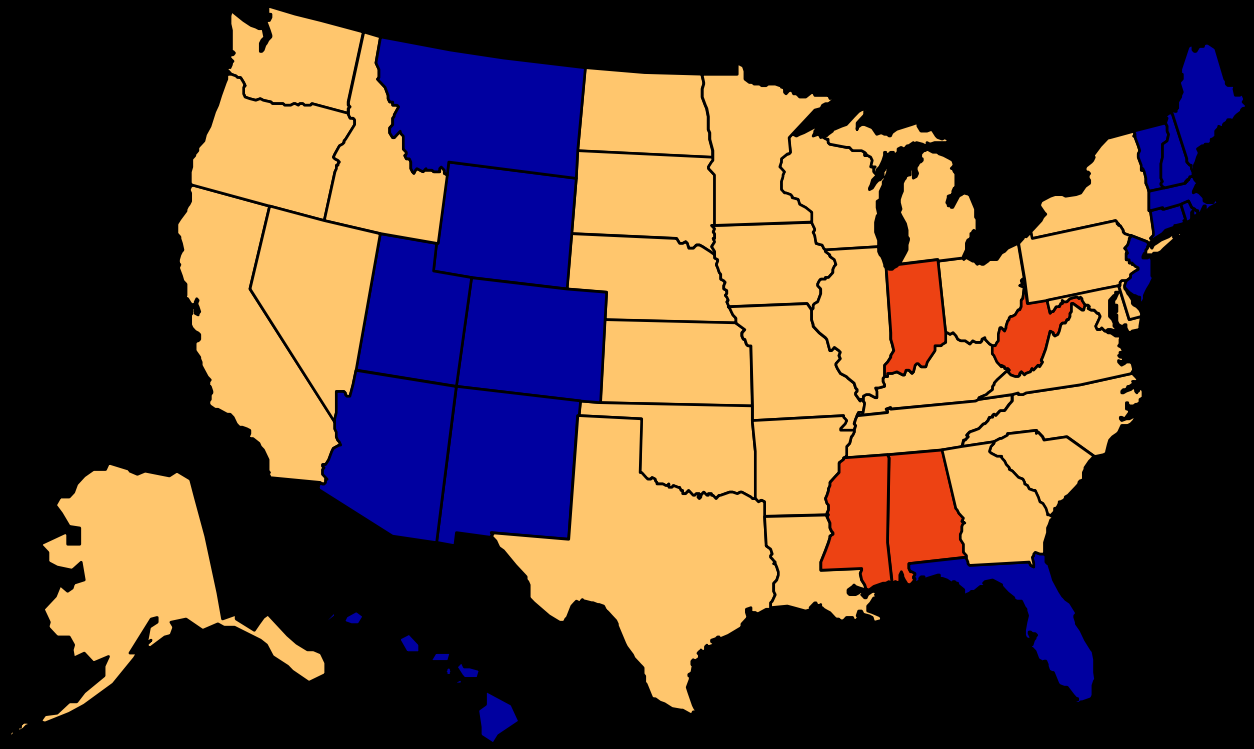
2003



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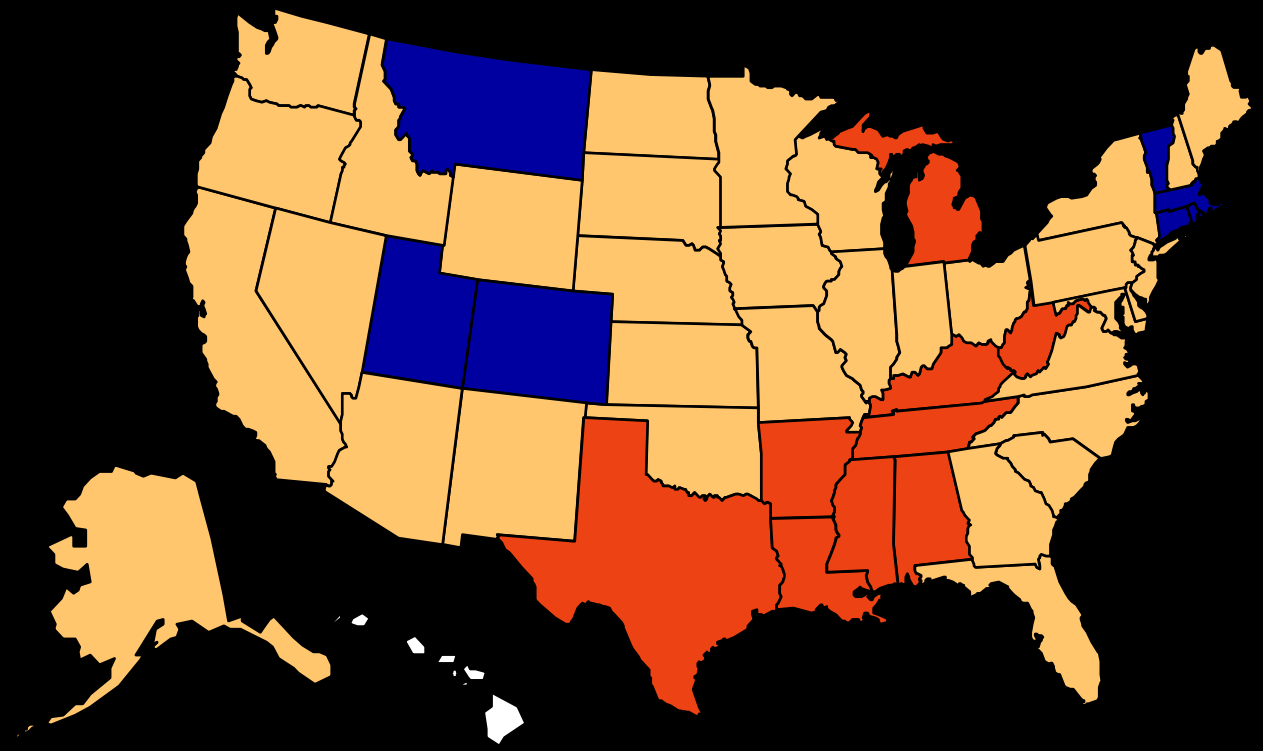
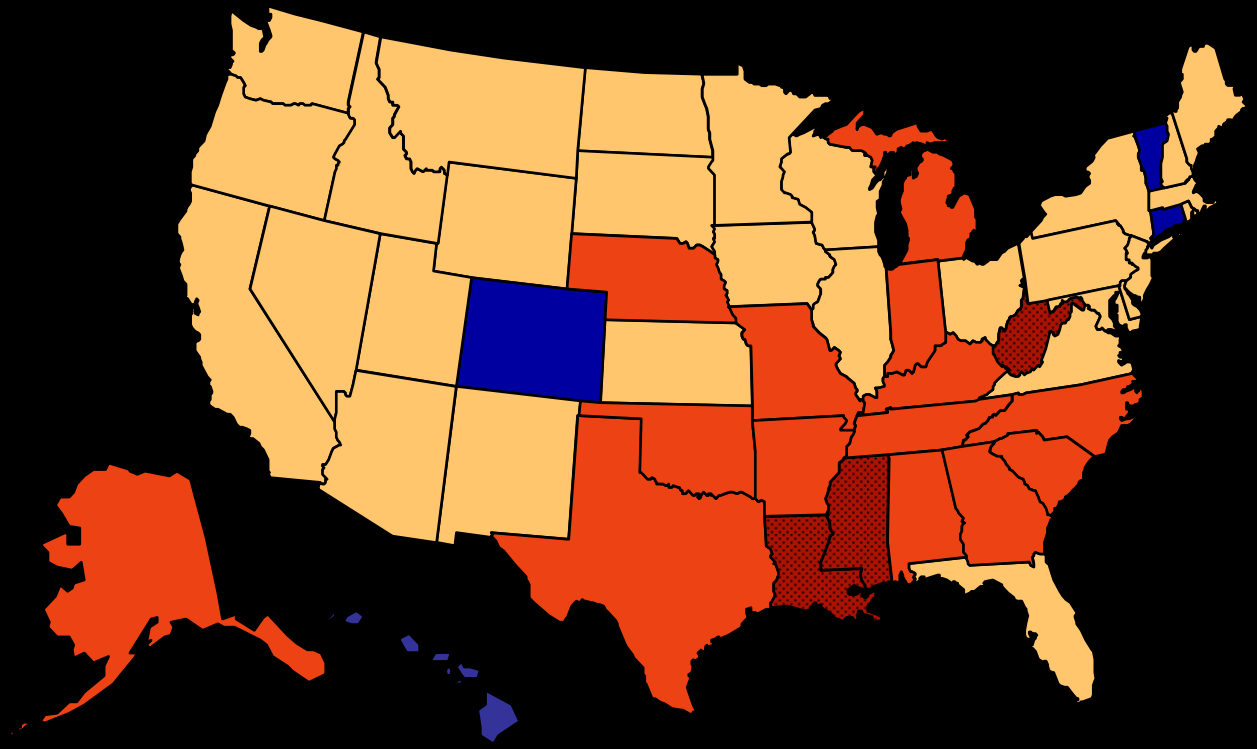
2004



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

2005



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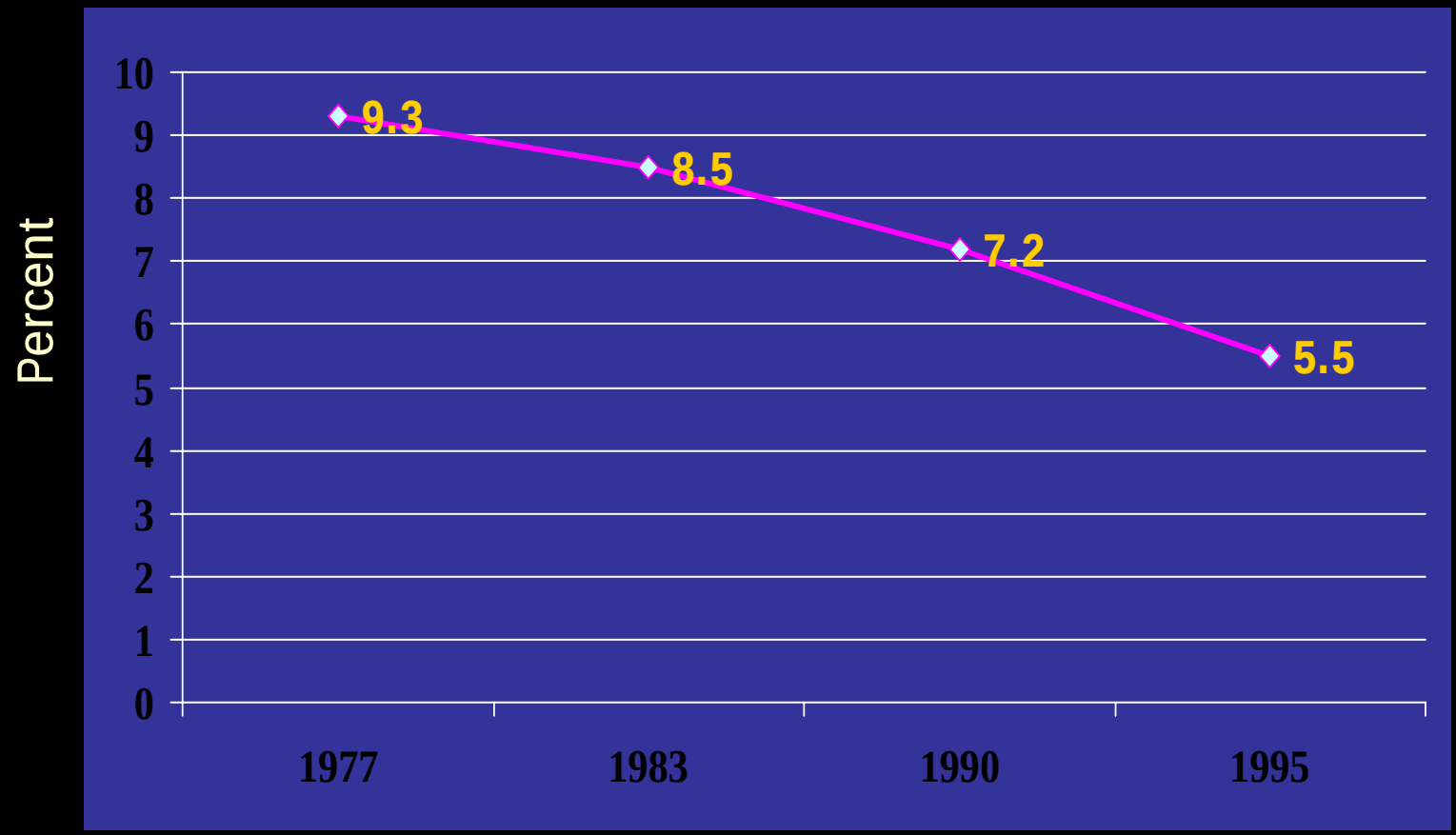
U.S. Walk Trips 1977-1995



Source: Nationwide Personal Transportation Survey, 1995

Moms Become Cab Drivers

Everything is a Drive Away

Suburban mothers spend
17 full days a year
behind the wheel, more than the average parent spends dressing, bathing and feeding a child

Source: Surface Transportation Policy Project

Home

Recreation

Workplace

NATIONAL AWARD FOR Smart Growth ACHIEVEMENT

EPA United States Environmental Protection Agency

Social/Equity

C. Community Legacy

How can we meet the
needs of today and
also allow future generations
to meet their needs?


ARROWHEAD
ARROWHEAD

The public is empowered when…

…they have access to the information they want, not just the information we think they need

The public is NOT empowered when…

…the project schedule cannot be revised

The public is NOT empowered when…

…standards prevent creative design solutions

The public is NOT empowered when…

…the project must fit within or fully spend a predetermined budget

The Tools of Power

- Budgets
- Schedules
- Standards

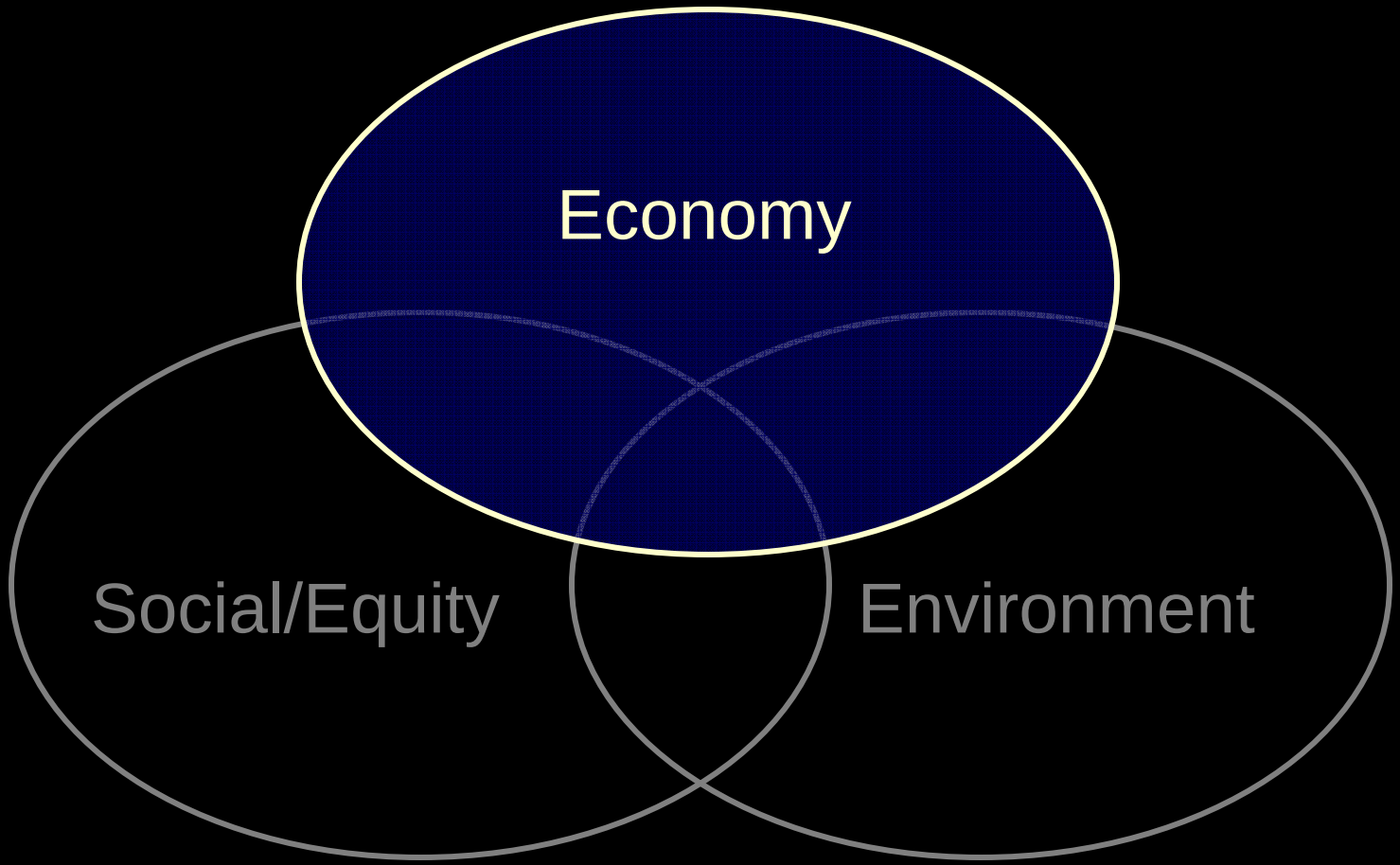
Most public process in transportation planning and design today strives to obtain consent rather than to enlist the public in creative development of their own communities

Process ⟶ Results

- Preserving cultural & historic resources
- Maintaining community character and a strong sense of place
- Creating “great streets” and “complete streets”
- Ensuring equitable access to resources


Next….

“Sustainability”



Economy

A. Access to Jobs
B. Economic Resiliency

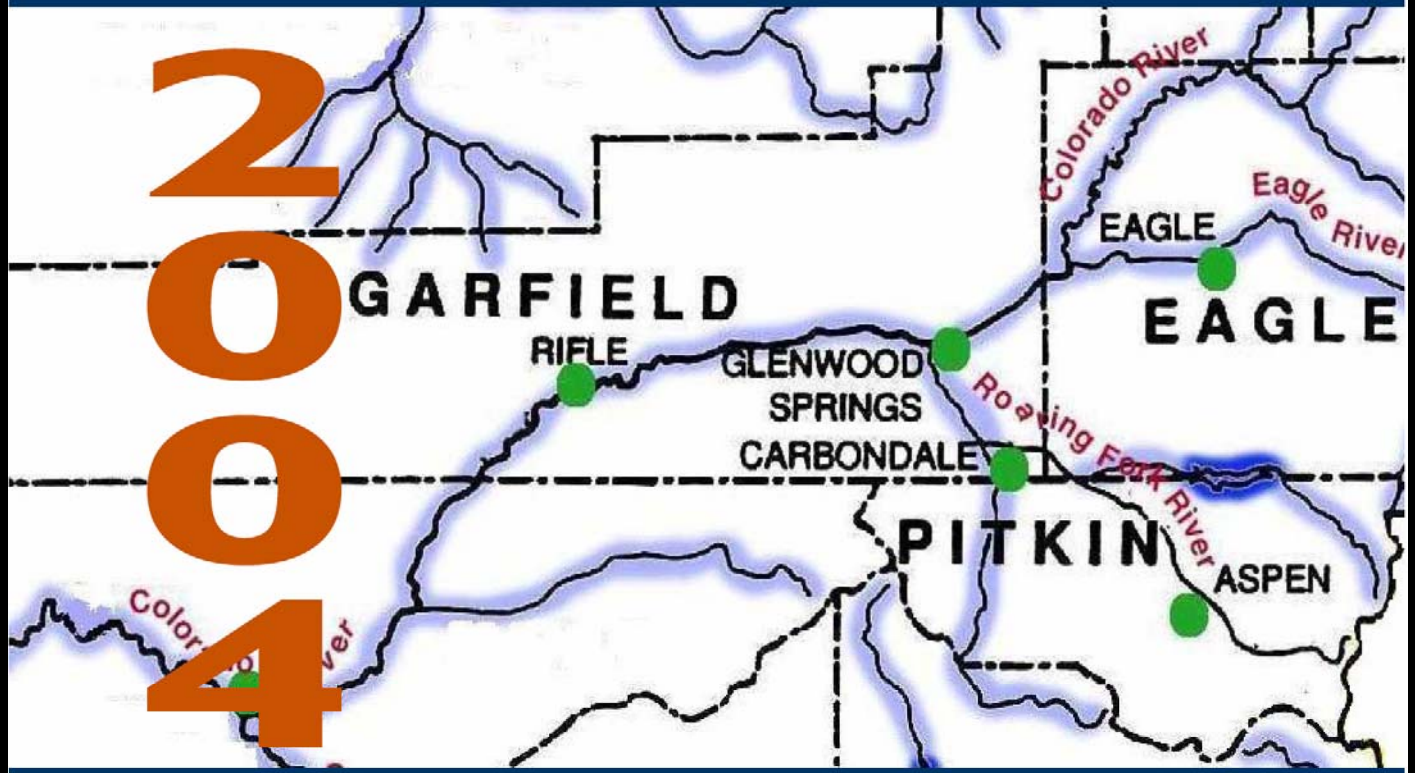
Economy

- Developing in a way that benefits the community
- Avoiding infrastructure deficits
- Supporting resiliency & viability of local commerce
- Avoiding sharp cycles – “boom & bust”
- Avoiding unnecessary local tax burden
- Ensuring jobs & personal opportunity

Economy

A. Access to Jobs

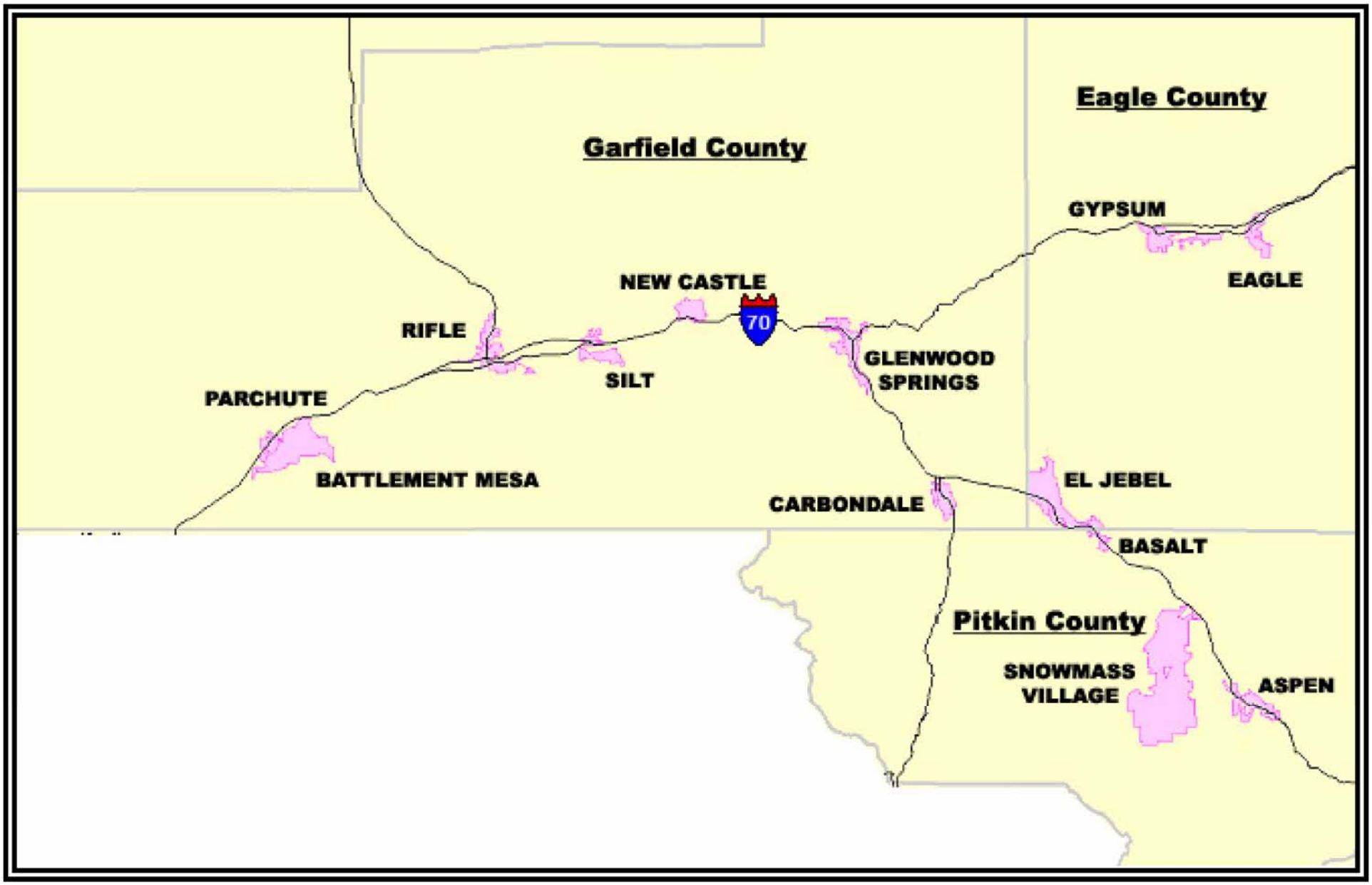
Local & Regional Travel Patterns Study



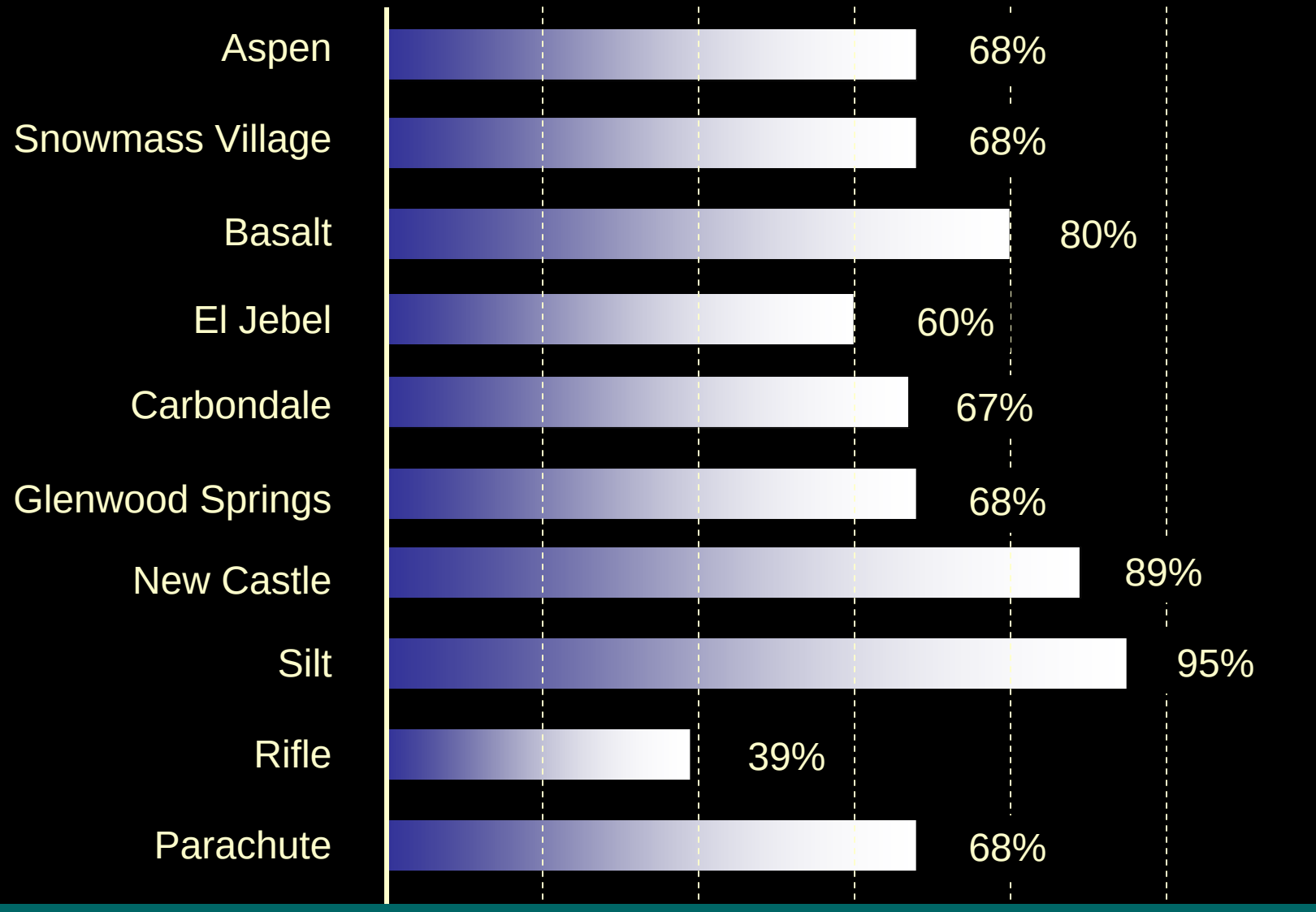
Examining how, why, when, and where people travel in the Roaring Fork and Colorado River Valleys.

Prepared by: RRC Associates, Charlier Associates & Healthy Mountain Communities

Study Area


Eagle County
Garfield County
GYPSUM
EAGLE
NEW CASTLE
70
RIFLE
SILT
GLENWOOD SPRINGS
PARCHUTE
BATTLEMENT MESA
CARBONDALE
EL JEBEL
BASALT
Pitkin County
SNOWMASS VILLAGE
ASPEN

% of Workers Imported from Other Towns (2004)



Mode Share – Work Commute

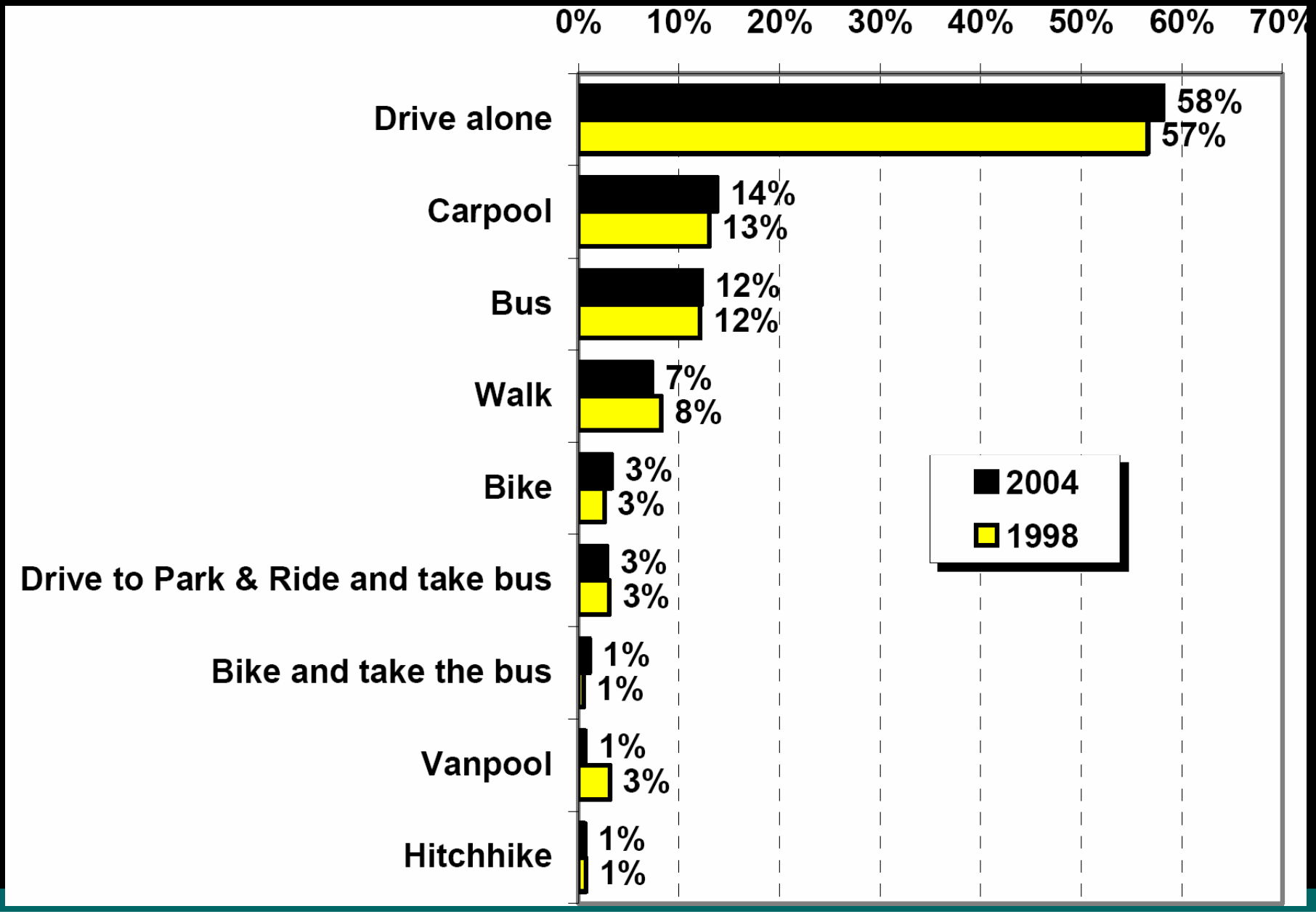
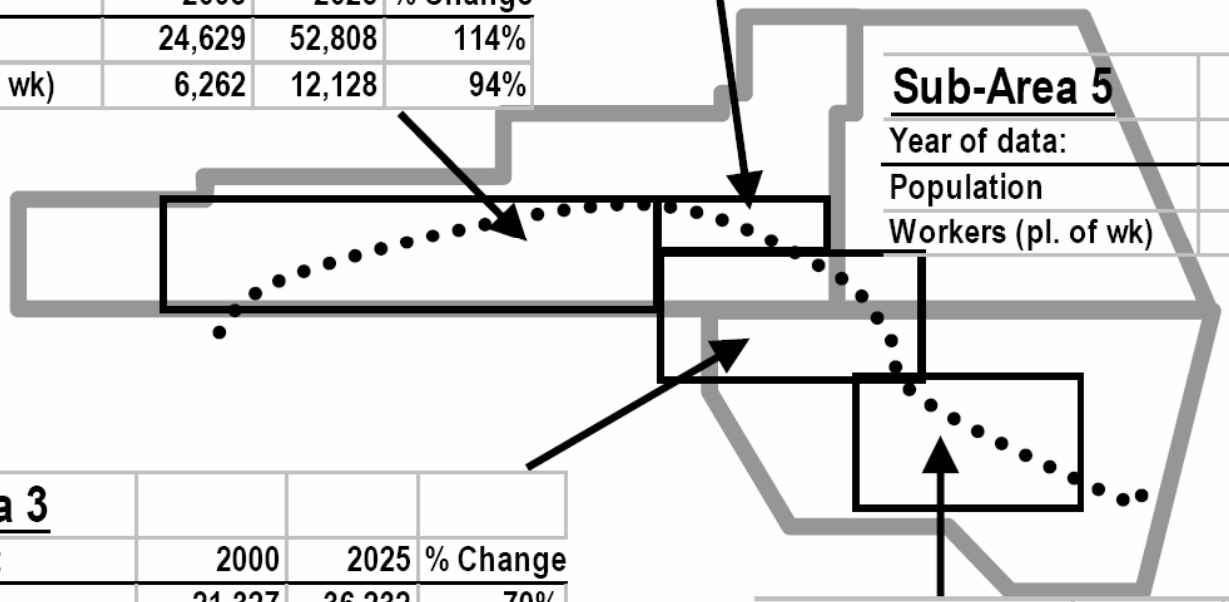


Figure 4.2.6. Population & Workforce Forecasts Map



Sub-Area 1			
Year of data:	2003	2025	% Change
Population	24,629	52,808	114%
Workers (pl. of wk)	6,262	12,128	94%

Sub-Area 2			
Year of data:	2000	2025	% Change
Population	8,048	13,839	72%
Workers (pl. of wk)	10,843	16,841	55%

Sub-Area 3			
Year of data:	2000	2025	% Change
Population	21,327	36,232	70%
Workers (pl. of wk)	10,262	15,748	53%

Sub-Area 4			
Year of data:	2000	2025	% Change
Population	12,069	20,454	69%
Workers (pl. of wk)	18,423	37,648	104%

Sub-Area 5			
Year of data:	2000	2025	% Change
Population	35,945	62,977	75%
Workers (pl. of wk)	25,787	59,738	132%

Figure 4.3.1. I-70: 2003 Traffic Counts vs. 2025 Traffic Projections

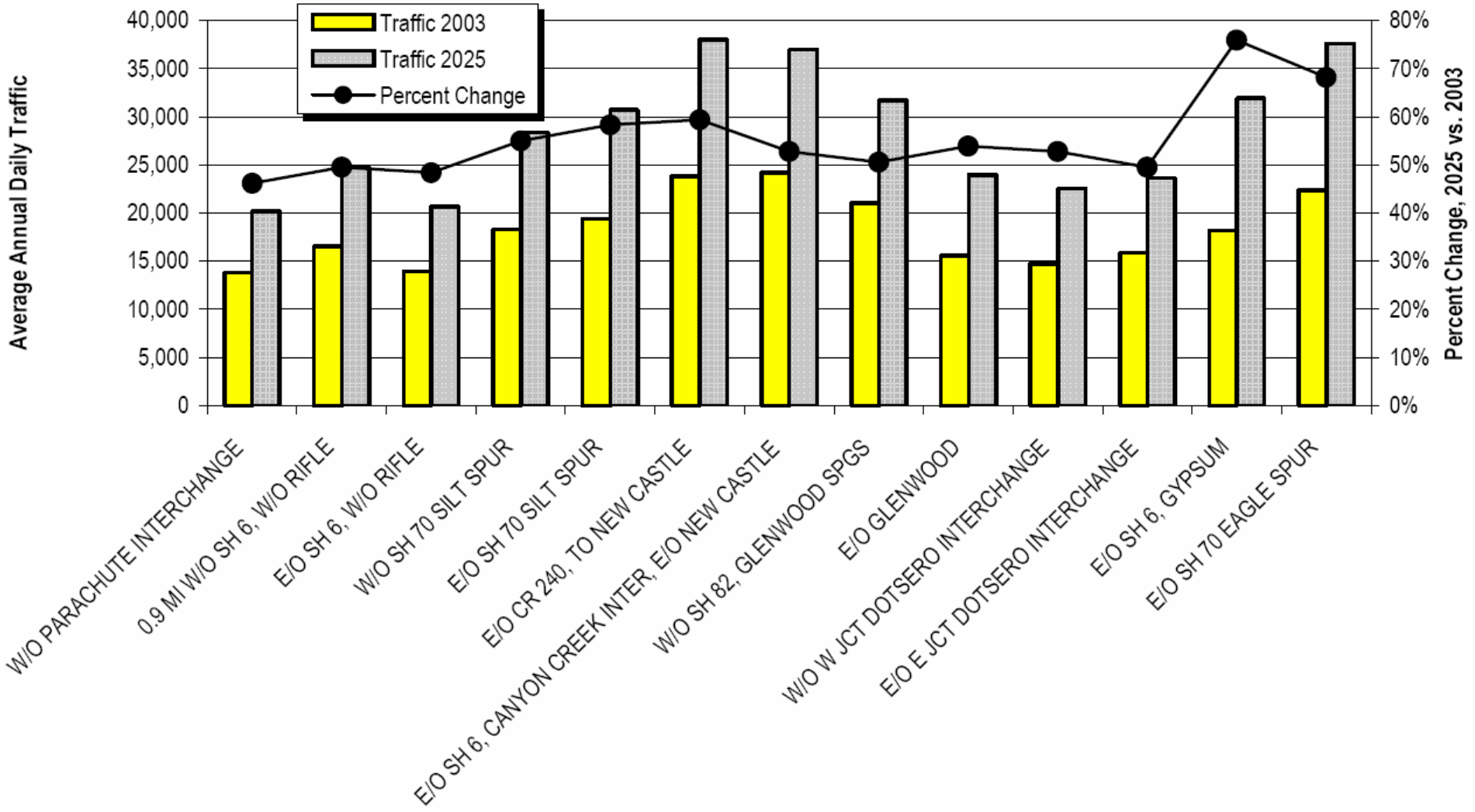
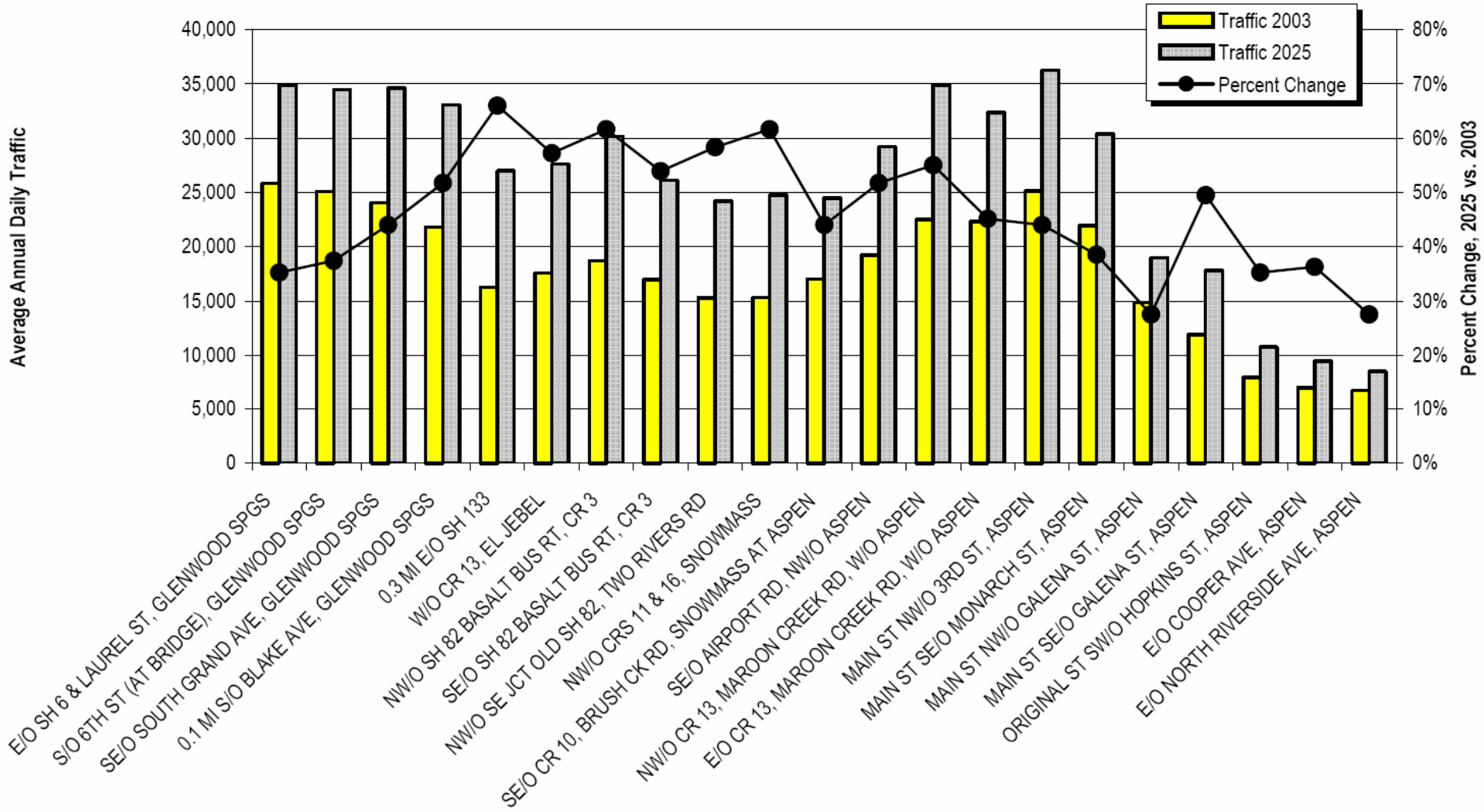
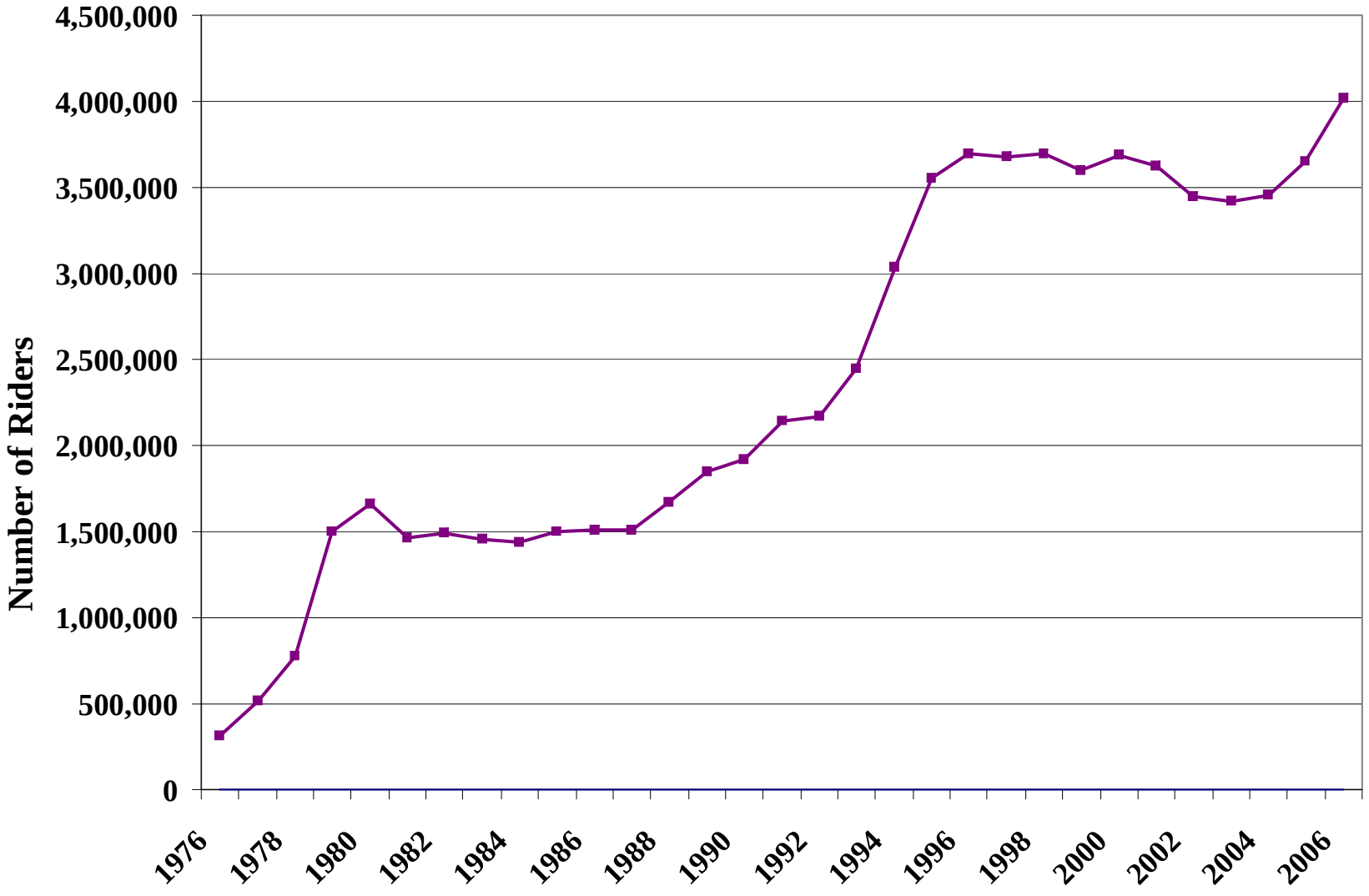


Figure 4.3.2. State Highway 82: 2003 Traffic Counts vs. 2025 Traffic Projections



RFTA Transit Ridership – Annual



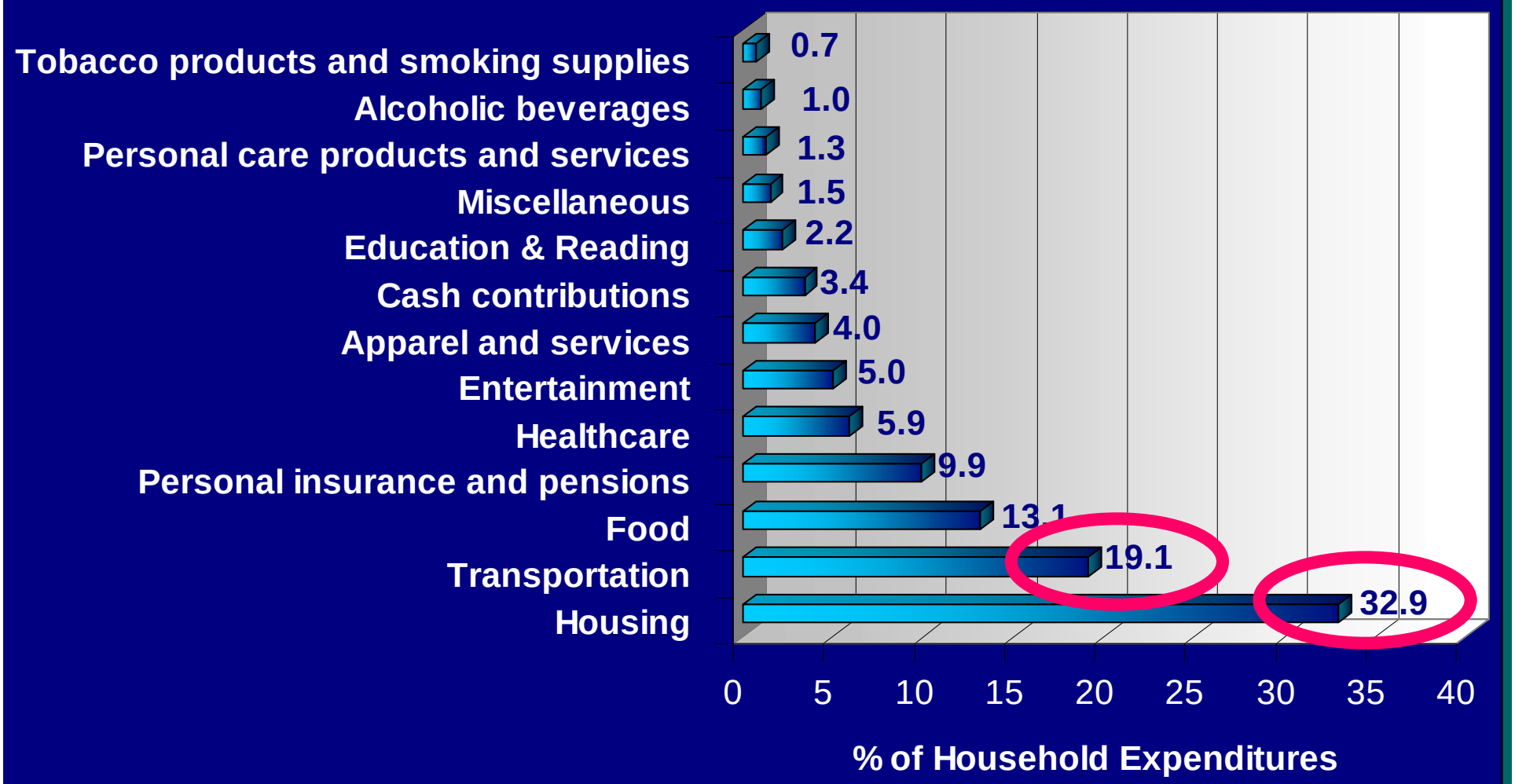
Summary of Findings

- Dramatic Population & Job Growth
- The % of Workforce Commuting Between Towns Will Increase
- Traffic on Regional Highways Will Grow by 50 – 80% by 2025
- No Highway Expansion Program Could Possibly Keep Up With Traffic Growth
- The Demand for Regional Transit Will Grow by 50 – 100% by 2025

Economy

B. Economic Resiliency

Household Expenditures



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

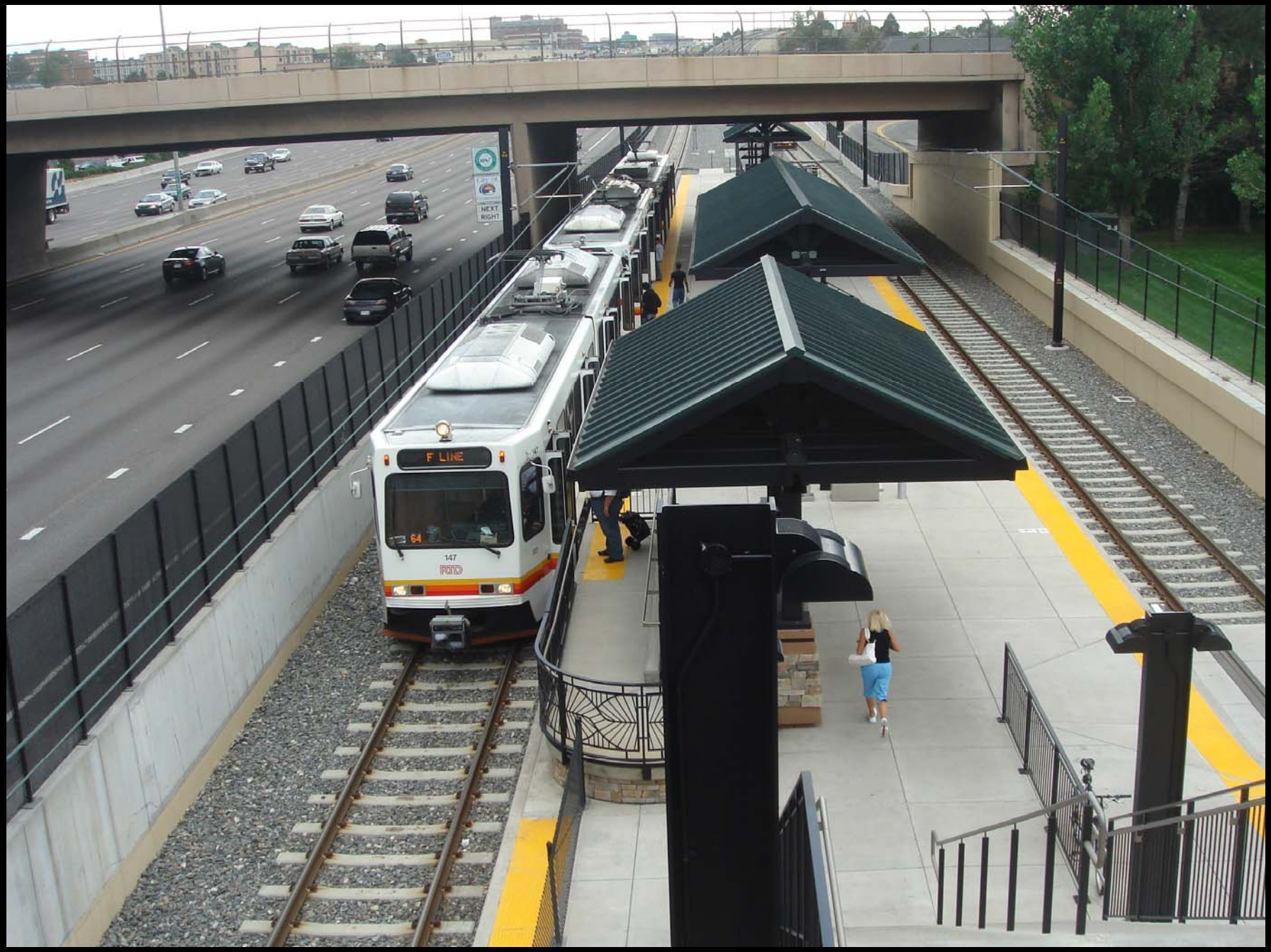
Two Car Family

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

One less car = - $4,000/yr.
(net about $3,500)*

At least $50,000 in additional mortgage capacity

* assumes 2nd or 3rd car for household


F LINE
64
147
RTD
NEXT
RIGHT


THE
RIB
HOUSE


DOWNTOWN
EAST END
HOP ON FOR CLEANER AIR


Thank You

Suggested Resources

- ULI – Urban Land Institute
  www.uli.org
- CNU – Congress for New Urbanism
  www.cnu.org
- Healthy Mountain Communities
  www.hmcnews.org
- New Century Transportation Foundation
  www.newcenturytrans.org