AICP EXAM PREPARATION:

Transportation and Infrastructure Planning and Engineering

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Transportation and Infrastructure Planning and Engineering

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Agenda

- Definition of Infrastructure
- Key Concepts
- Types of Infrastructure Systems
  - Passenger and Freight Transportation
  - Environmental Systems (Water, Wastewater, Solid Waste)
  - Utilities/Energy (i.e. Electricity, Gas, etc.)
  - Community Facilities
  - "Green" and "Blue" Infrastructure
- Discussion/Closing Remarks

Infrastructure Planning and Engineering: A Match Made in Heaven

The Planners

The Engineers

What is Public Infrastructure?

"…Infrastructure refers to the physical structures and processes that support community development and enhance physical health and safety – roads, streets, bridges, water treatment and distribution systems, wastewater treatment facilities, irrigation systems, waterways, airports, public transit and utilities…public infrastructure traditionally includes those systems that ensure a healthy quality of life and enhance movement of people, goods, and services…"

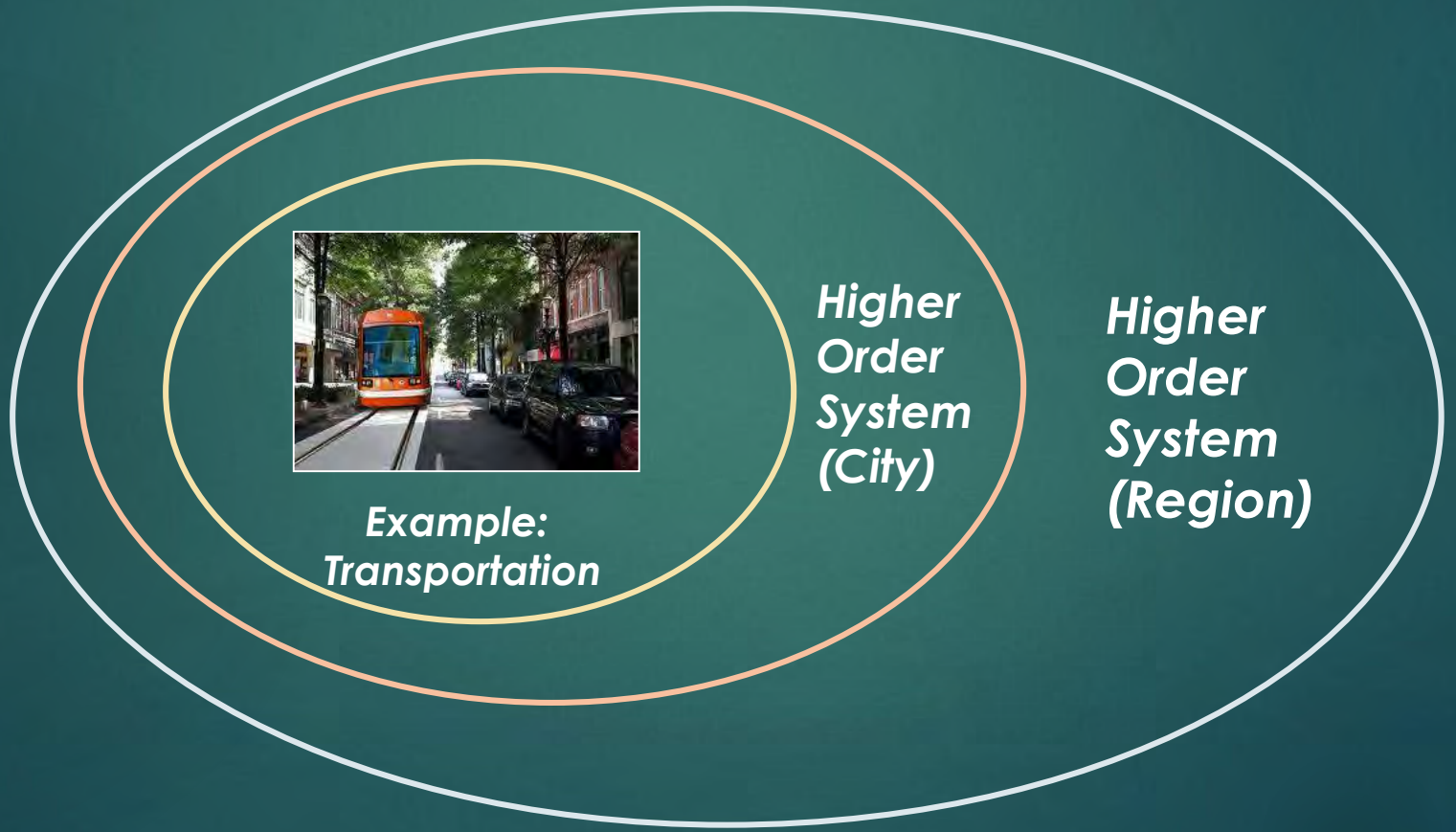
Claire Felbinger

Key Concepts and Approaches

- The Systems Approach to Infrastructure
- Evolution of Infrastructure in the U.S.
- The Planning Process
- Infrastructure Service Standards (Level of Service)
- Lifecycle Cost Analysis
- The Concept of Smart Cities (Communities)
- Financing Infrastructure
- Asset Management/State of Good Repair

Systems Approach to Infrastructure

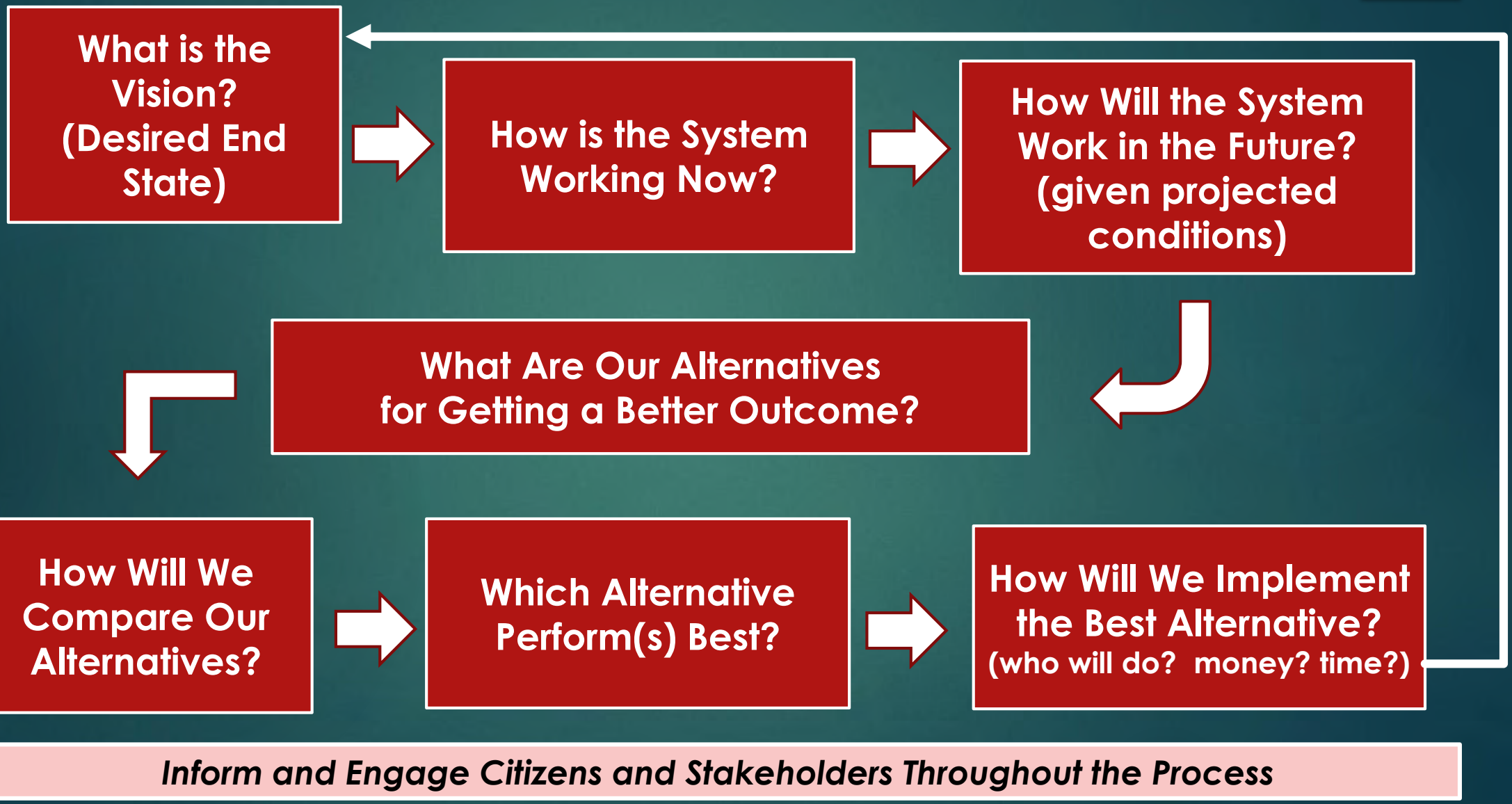
"A system is a group *of interdependent and interrelated components that form a complex and unified whole* intended to serve some purpose through the performance of its interacting parts." *Dr. Michael Meyer and Eric J. Miller*



American Historical Eras

- Colonial Era: 1770-1850
- Industrial and Scientific City: 1850s – 1930
- Depression and World War II: 1930 – 1945
- Post World War II: 1945 – 1960s
- Post-Industrial City: 1970s-2001
- Smart, Sustainable, Resilient Cities: 2000s and Beyond?

The Planning Approach



Approach to Lifecycle Costs

- Best solution is least cost option over the life of the infrastructure project/system.

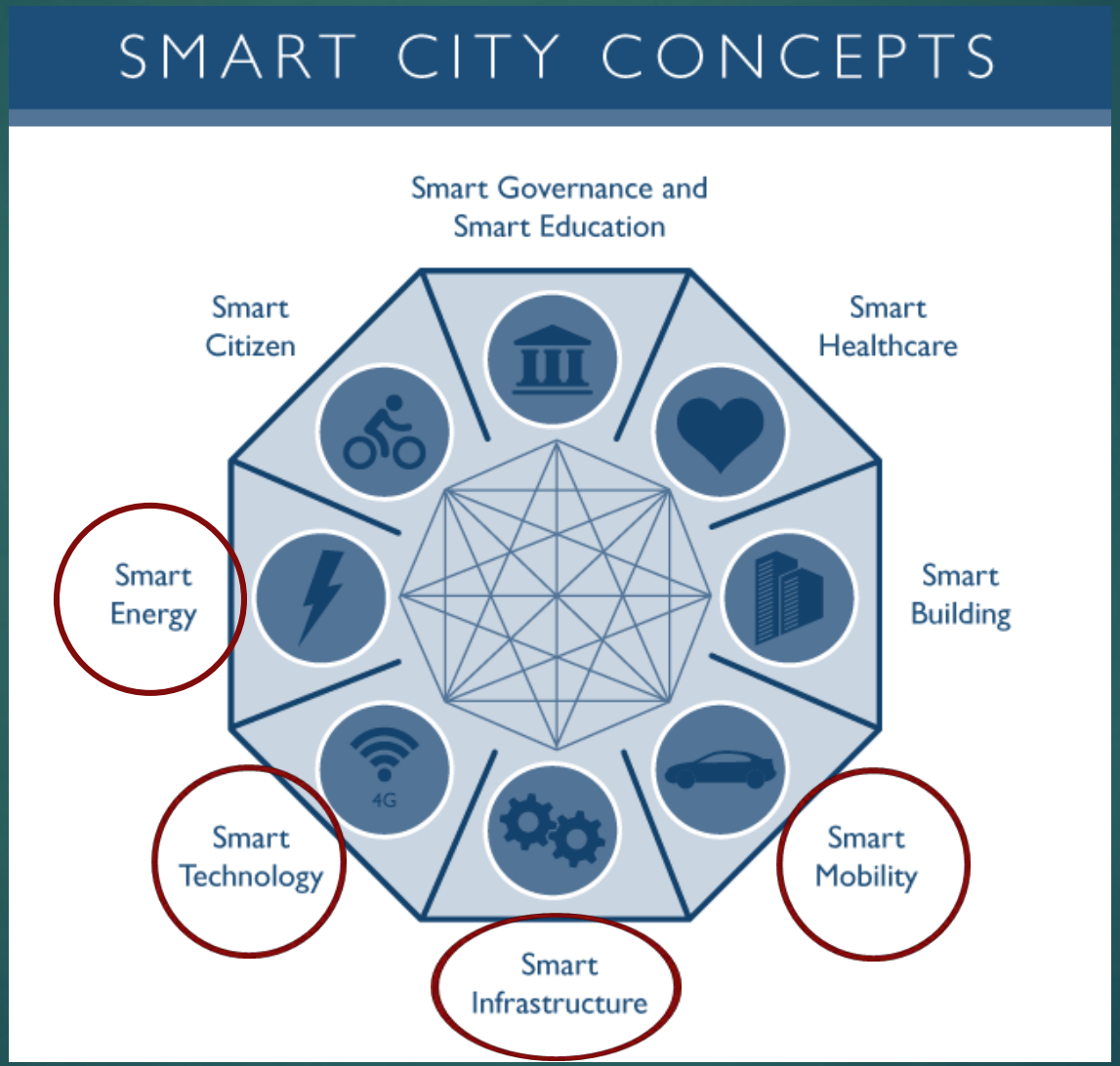
- Factors that are weighed in lifecycle costs:
  - Initial capital cost
  - Cost of community impacts (positive and negative)
  - Continuing operations and maintenance costs

- There are different methodologies for calculating these costs - the "best" investment solution is the one with the lowest total costs over the life of the project.

Financing Public Infrastructure

- Capital Improvement Program (CIP) – Listing of Funded Capital Projects
- Potential Financing Tools
  - Revenue and General Obligation (GO) Bonds
  - Federal and State Grants and Loans
  - Public/Private Partnerships (3Ps)
  - Special Purpose Districts/Community Improvement Districts
  - Special Purpose Sales Taxes
  - Local Government General Revenue (Property Taxes)
  - State Infrastructure Banks
  - Enterprise Funds (funds generated by utility authority)
  - User Fees
  - Exactions and Impact Fees
  - Privatization

Using Technology for "Smart Cities"



Transportation Infrastructure

- Planning and Implementation Roles and Responsibilities
- Context for Multimodal Transportation Systems
- Key Players
- Primary Modes of Transportation
- Current Transportation Infrastructure Challenges

Branches of Transportation Infrastructure

- Urban and Regional Planning (Planning and Environmental)
- Sustainable Transportation (emerging area)
- Transportation Engineering (Design, Construction, etc.)
- Traffic Engineering and Operations
- Intelligent Transportation Systems (ITS)

- Public Transit System Management and Operations
- Logistics/Freight Transport
- Public Policy/Public Management/Public Administration
- Modal Systems (Rail Systems, Aviation, Port, etc.)
- Transportation Finance

Responsibilities are Distributed

- Federal Agencies (USDOT)
  - Federal Highway Administration (FHWA)
  - Federal Transit Administration (FTA)
  - Federal Railroad Administration (FRA)
  - Federal Aviation Administration (FTA)
- State Departments of Transportation (DOTs) and Special Authorities (GRTA, for example)
- Metropolitan Planning Organizations (MPOs)
- Transit or Transportation Authorities/Systems
  - Regional Expressway Authorities
  - Regional Mobility and Transit Authorities
  - Local Transportation Authorities
- Local Governments (Cities and Counties)

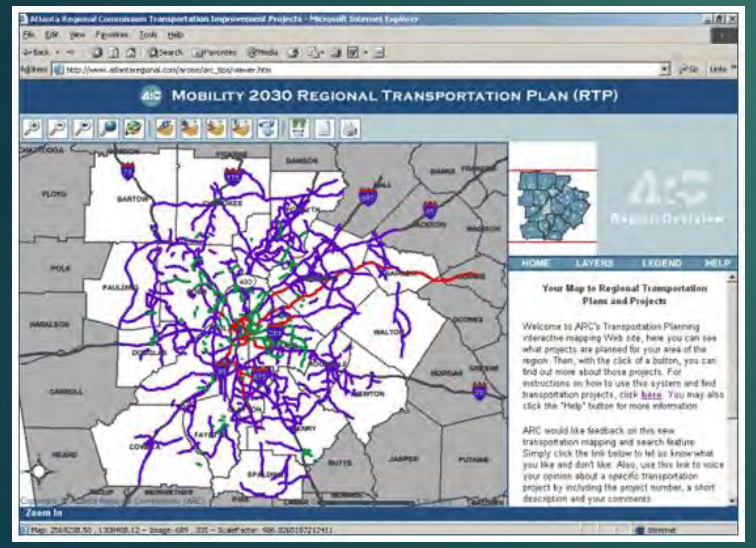
Georgia Department of Transportation

GRTA

marta

DEPARTMENT OF TRANSPORTATION UNITED STATES OF AMERICA

Stakeholders are Broad and Diverse



- Citizens
  - Property Owners
  - Affected Citizens
  - Community Members
- Business/Community Leaders
- Environmental Organizations
- Community Organizations
- Transportation Advocates (AAA, AARP, etc.)
- Good Government Advocates
- Freight Transportation Interests

Methods to Engage the Public and Stakeholders

- Personal contacts
- Small group meetings
- Public open house meetings
- Social media and on-line opportunities

Policy Basis of Transportation Decisions

- Performance-Based Framework
- Needs-Based Framework
- Policy Constraints
  - Current Federal Transportation Authorization Act (FAST)
  - State Constitution, Laws, Statewide Plans and Programs
  - Local Government Ordinances and Policies

Key Players: State Depts. of Transportation

- Stewards of MOST of the federal funds apportioned to states by U.S. Congress.
- Depending on **State** law, **State DOTs have varying responsibilities**, especially in the area of transit, rail, aviation, and waterway/ports modes.
- Responsible for carrying out statewide transportation plans that include urban (MPO) and non-urban (rural) areas.
- Play a critically important role in **emergency response operations**

Key Players: Special Authorities

- Special planning or transportation agencies are sometimes created by state law – they have only the powers given to them by the State in their enabling legislation – also known as "*creatures of the State*"

- They may have a designated role in transportation planning, if specified in their enabling law

- Examples: Georgia Regional Transportation Authority (GRTA); Georgia State Road and Tollway Authority (SRTA); etc.

Key Players: Cities and Counties

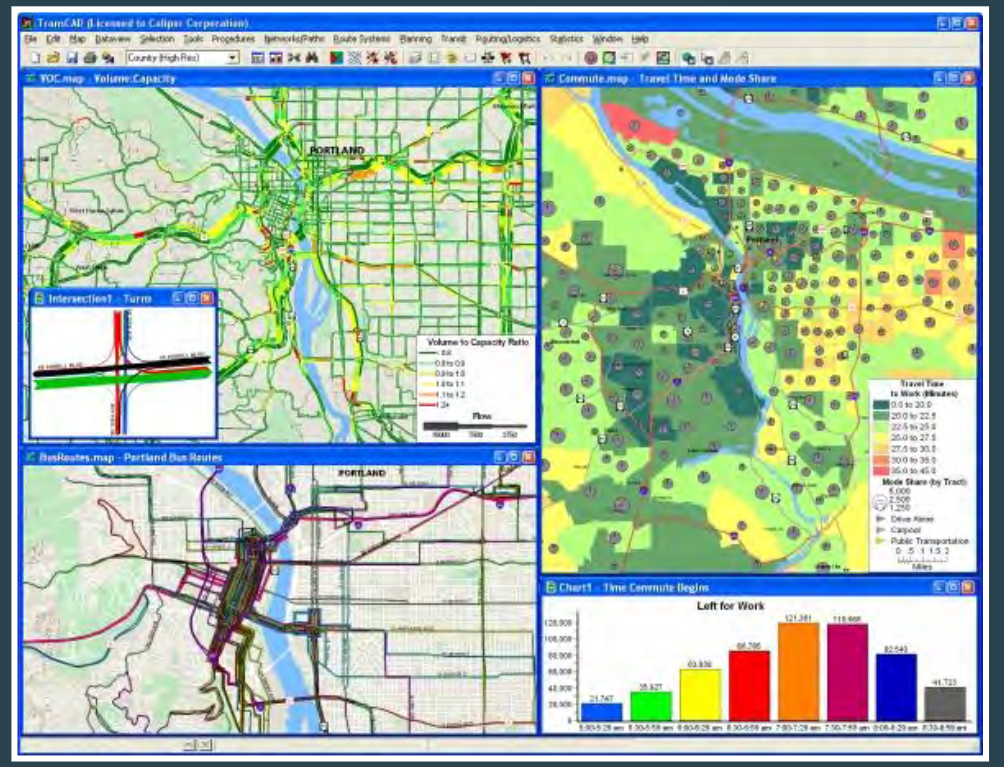
- Cities and counties may have their own locally-funded transportation programs.
- Programs vary by priorities and ordinances
- Local jurisdictions use a range of funding sources:\
  - General revenue (property taxes)
  - Special purpose sales taxes
  - Impact fees
  - Special assessment districts
- Must coordinate their planning with their MPO (if there is one)

Key Players:
Metropolitan Planning Organizations (MPOs)

- Responsible for carrying out federal and state planning requirements
- Designated after each US Census in all communities/regions with at least 50,000 population
- Has a governing/policy board and committees
- Are responsible for developing the Long-Range Regional Transportation Plan with a 20-year plan horizon and a Transportation Improvement Program (TIP) identifying projects over the near-term three-to-five year period

Key Concept: Performance-Based Planning

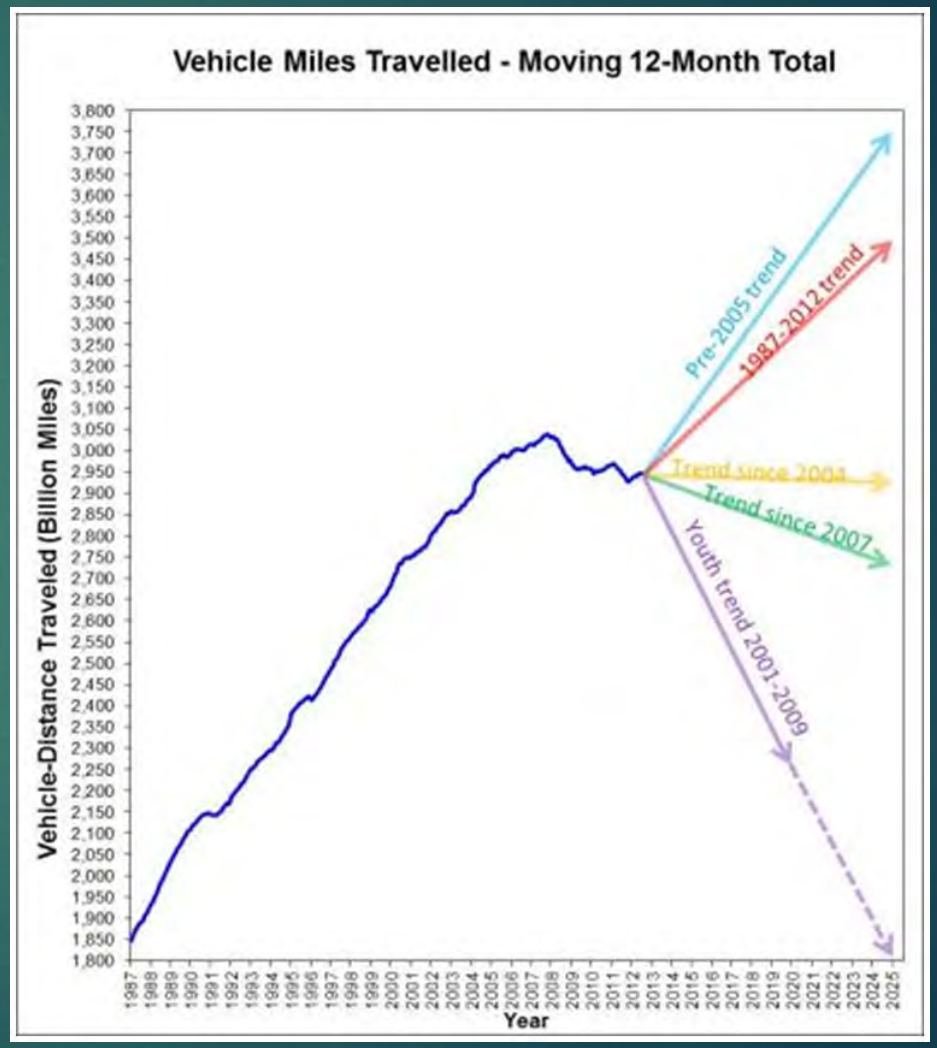
- Foundation in federal transportation law – applies to State DOTs and MPOs
- Decisions must be made based on the analysis of how the transportation system is actually performing
- Covers a specific geographic area (i.e. state, region, city, corridor, neighborhood, etc.)
- Requires agreed-up performance measures and targets and continuous system monitoring



Key Concept: Vehicle Miles of Travel (VMT)

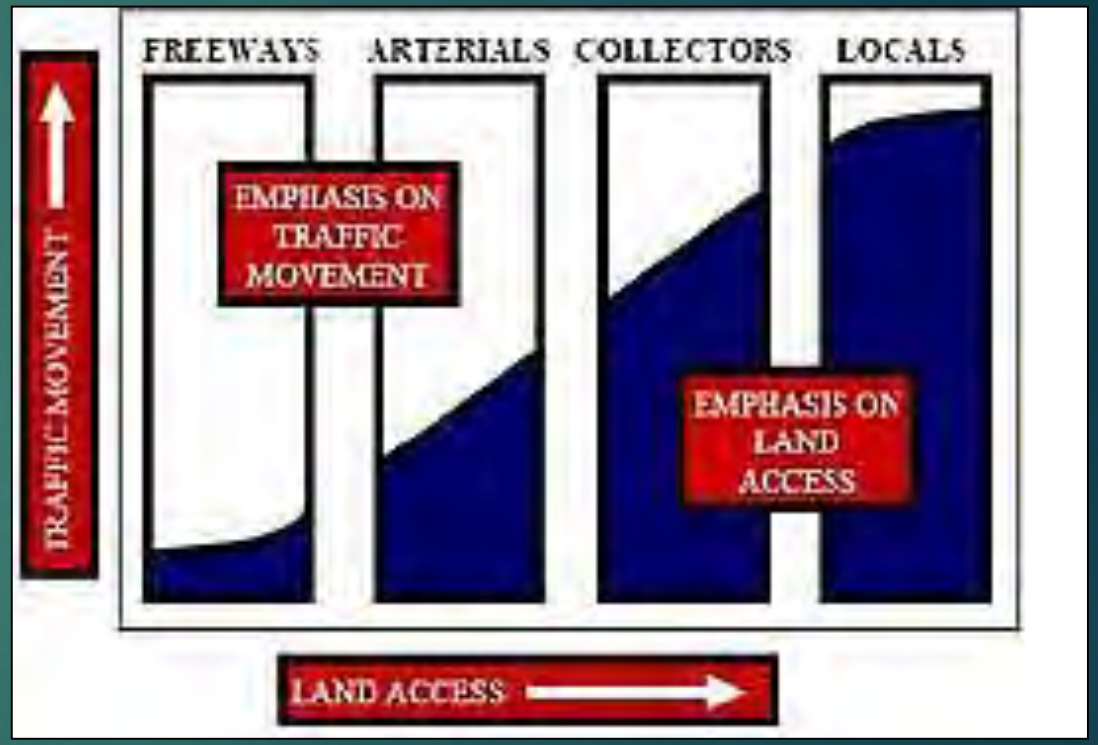
- Defines the aggregate measure of the demand for transportation service – on average, about 90% of all commute trips in the US is made by people driving alone.

- Up until the 2000s, auto use was growing faster than population growth as measured in vehicles miles travelled (VMT). *However, during after the Great Recession (2007) and beyond, that trend has changed and Americans are driving less. What is causing this?*

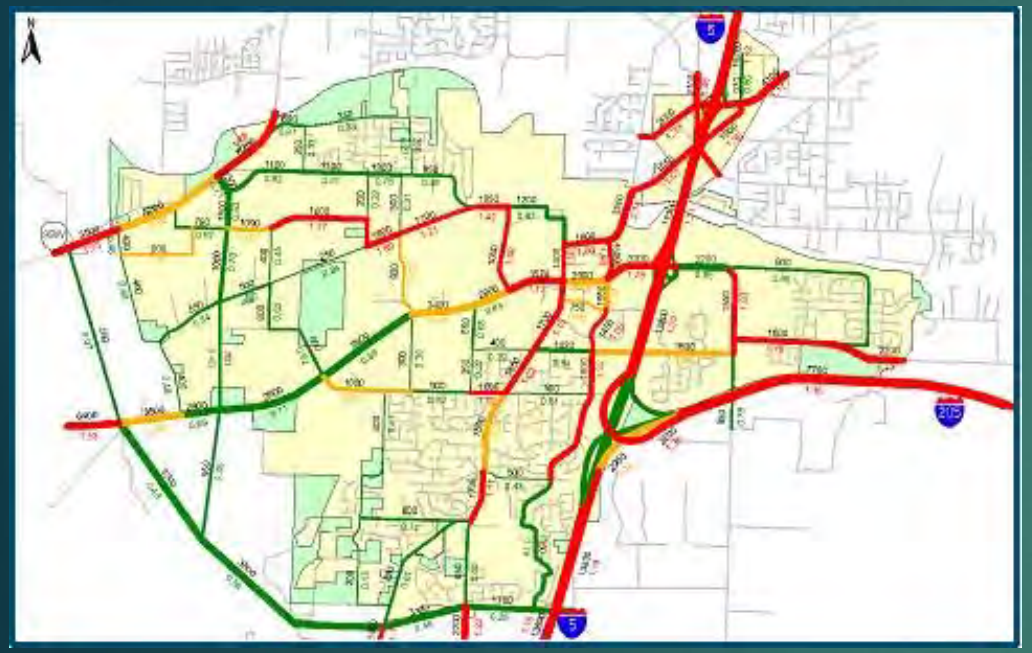


Key Concept:
Roadway Functional Classification

This is the concept that defines the categories of roads depending on their role in the overall transportation system (in terms of **mobility or traffic movement** and **land access**) and their related physical and operating characteristics, including speeds, spacing of traffic signals, etc.



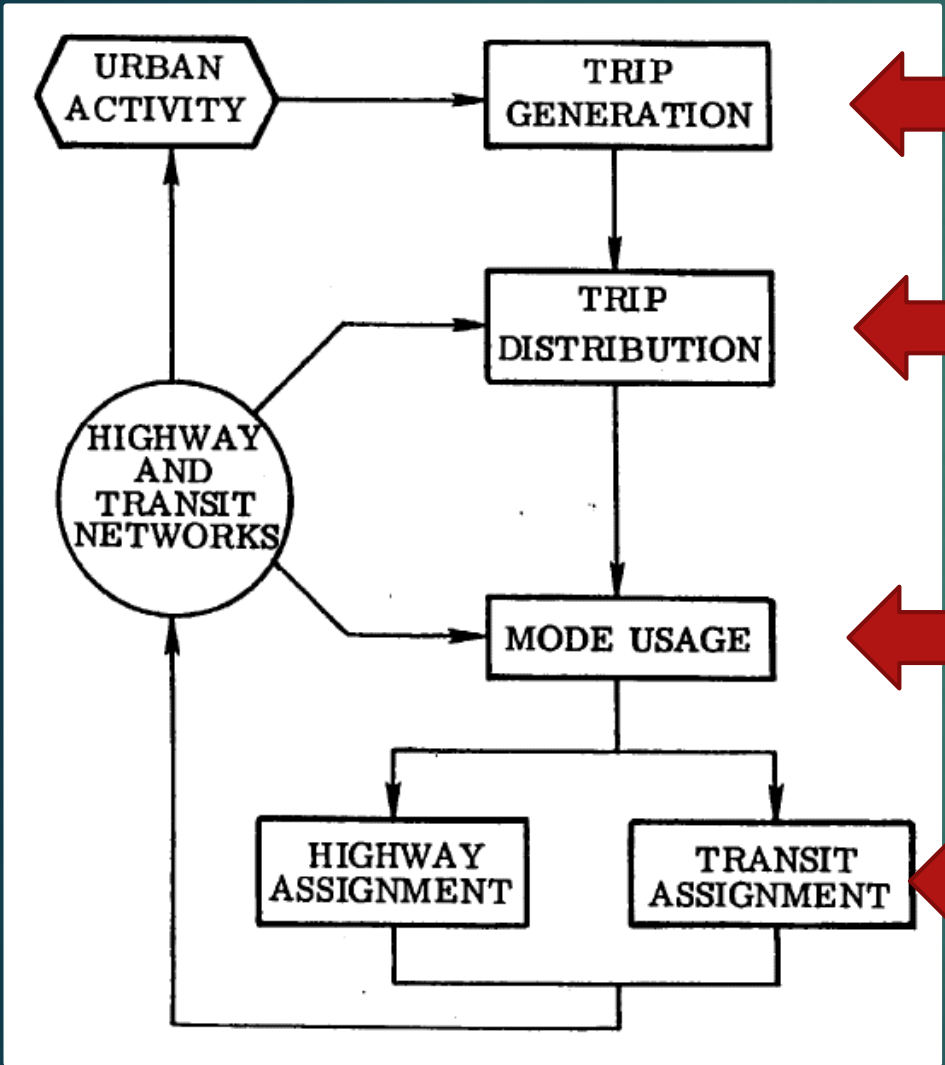
Key Concept: Travel Demand Modeling



- **Most transportation models use a system of traffic analysis zones (TAZs) links, nodes, and centroids to REPRESENT and actual transportation network to ANALYZE options for improving the system.**
- A TAZ is a subarea of the community being modeled.

  Links represent the segments of a road or transit line.
- Nodes represent intersections or interchanges.
- Centroids represent the physical link from a TAZ to a link (representing traffic).

Key Concept: Four-Step Transportation Model



 # 1 – Trip Generation

 # 2 – Trip Distribution

 # 3 – Mode Choice (SOV, HOV, express bus, local bus or rail)

 # 4 – Trip Assignment (total of trips by by type expected on each link)

- Also referred to as a "gravity" model.
- Relies on estimates of population and employment
- Newer models are being developed based on "tours" of travel or "activity-based" models.
- These new models are very data-intensive.

Key Concept: Managed Lanes

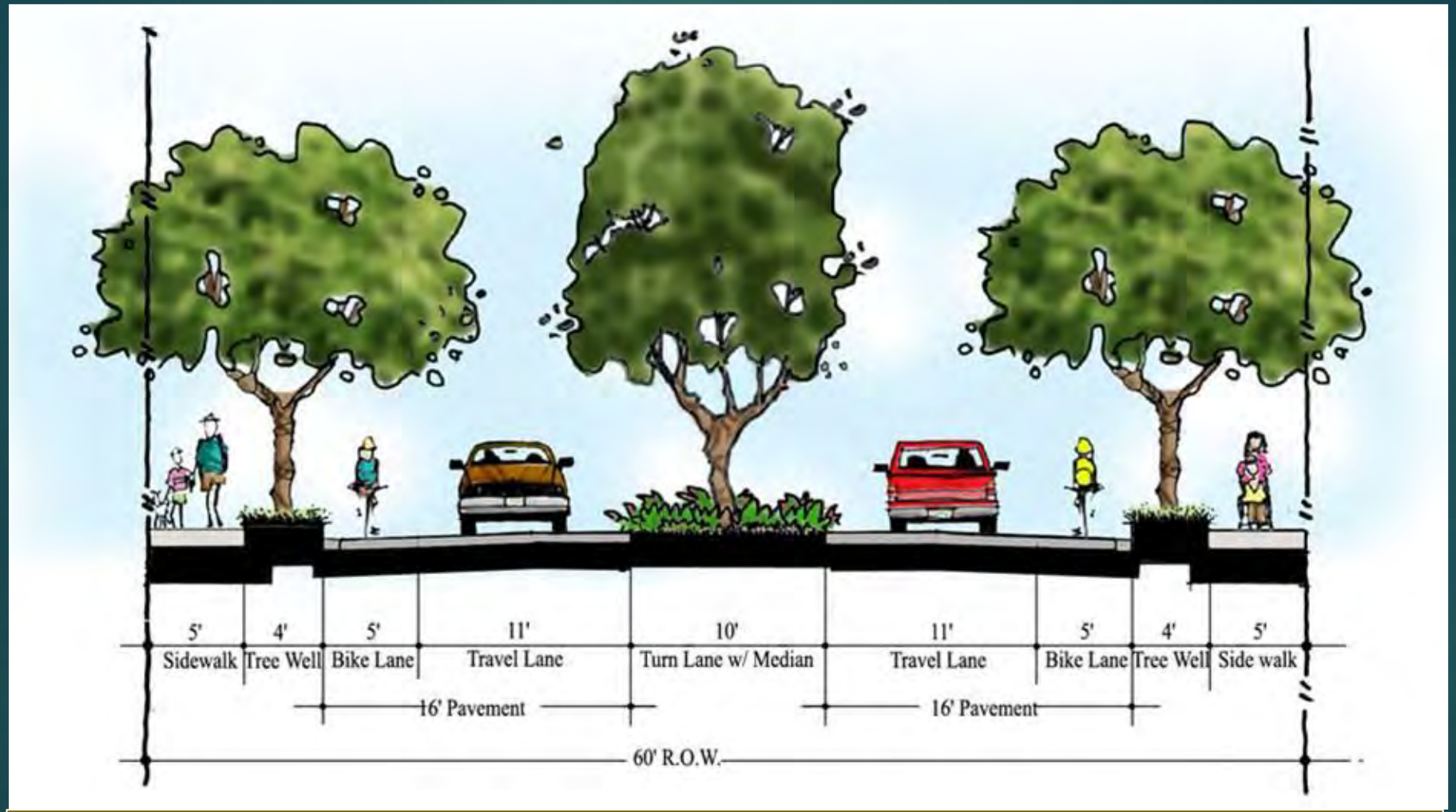
Applies to expressways (limited access roadways) serving high volumes of high speed traffic where users can choose to pay a premium (more $$) to ride in high-occupancy toll (HOT) lanes with tolls set based on the level of congestion or ride with others in more congested, "free" lanes.

95 Express in SE Florida

Managed Lane *General Purpose Free Lanes (4)*

Katy Freeway in Houston

Key Concept: Complete Streets



Complete Streets: designing for <u>all</u> users of a street, not just cars (walking, biking, transit riders, motorists, trucks, and emergency vehicles).

Key Concept: Context-Sensitive Design

Context-Sensitive Design: takes into account the land uses and activities adjacent to the transportation corridor and designs with them in mind.

Key Concept: Traffic Calming

Traffic calming measures are design features that are aimed at showing the speed of vehicles or encouraging them to use other streets in order to make the area safer and more pedestrian-, bicycle-, and transit-friendly.

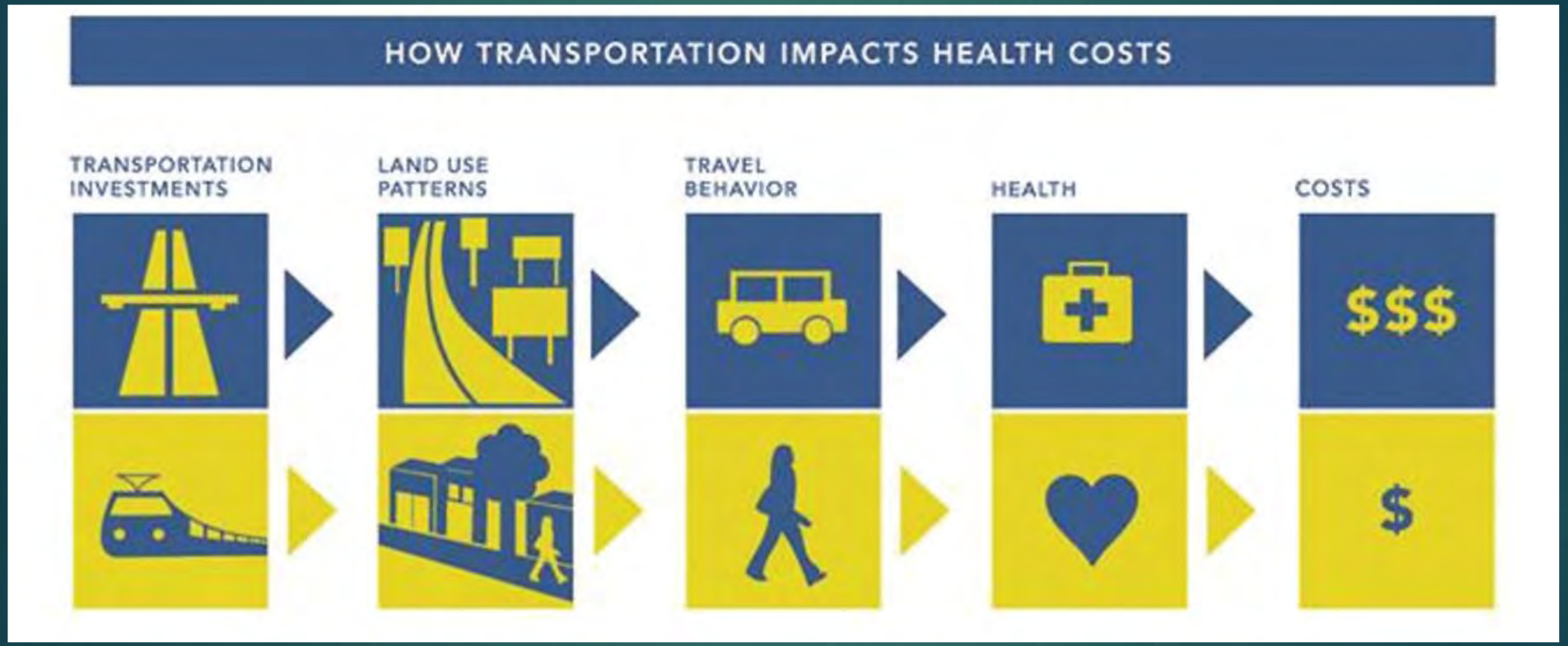
Public Transit Modes

Public Transit Modes

Other Transportation Infrastructure

Commercial Service and General Aviation Airports	Freight Rail/Trucking Systems	Waterway/Port Facilities
- Commercial service – large-scale air passenger travel - General aviation – smaller communities – critical for economic development - Very carefully planned and designed facilities - Air space considerations - Building heights - Other obstructions - Compatible land uses - Strict design standards - Noise impacts	- Freight movement is increasing 2-3 times faster than passenger travel – why? - Very important at the state, regional, and local levels - stiff competition for economic development - New inland ports - Very large federal interest in freight infrastructure	- Ports are very competitive for economic growth - Recent Panama Canal widening enabled much larger container ships - U.S. East Coast is benefitting, including Port of Savannah, Jacksonville, Norfolk, NY/NJ, etc.

Current Challenges:
Link Between Transportation and Public Health

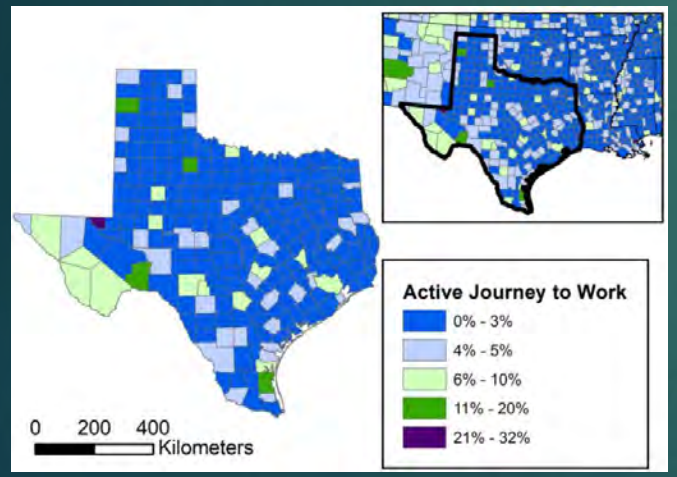


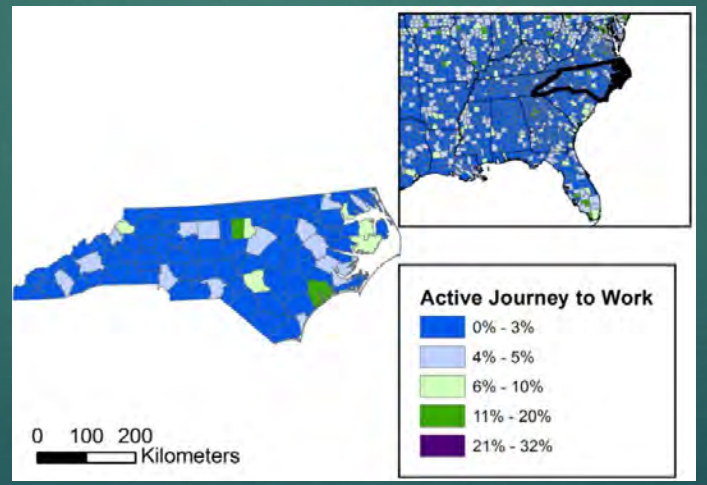
Source: American Public Health Assn.

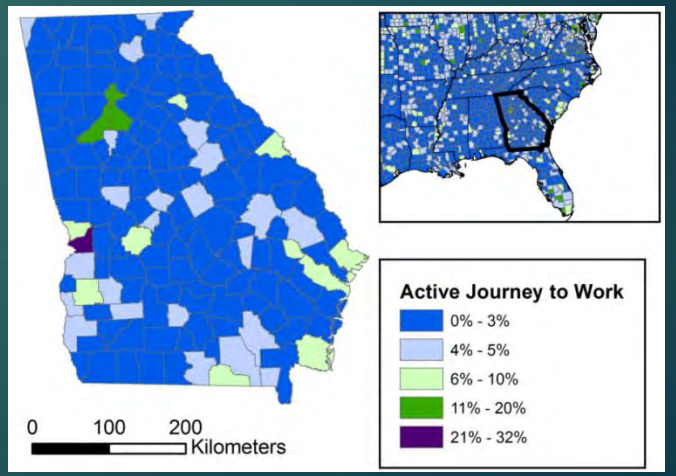
Current Challenges: Developing "Active Transportation" Options

Percent of work trips defined as "active journey to work" (i.e. travel by walking, biking, or accessing public transit…."

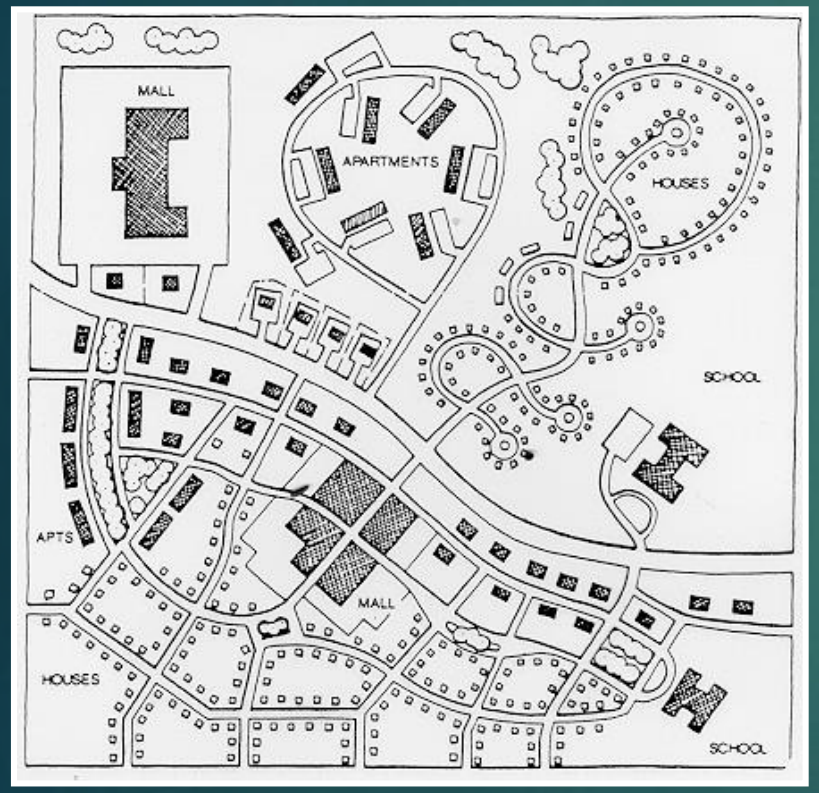
Source: Harvard University, School of Public Health, 2009







Current Challenges: Coordinating Land Development and Mobility Systems



Travel behavior (when, where, how often, and what travel mode is used) is influenced by the area's "urban form".

Urban form has to do with:

- Density/intensity of development
- Street patterns
- Mix of land uses
- Distance between uses
- What is "acceptable" to the community

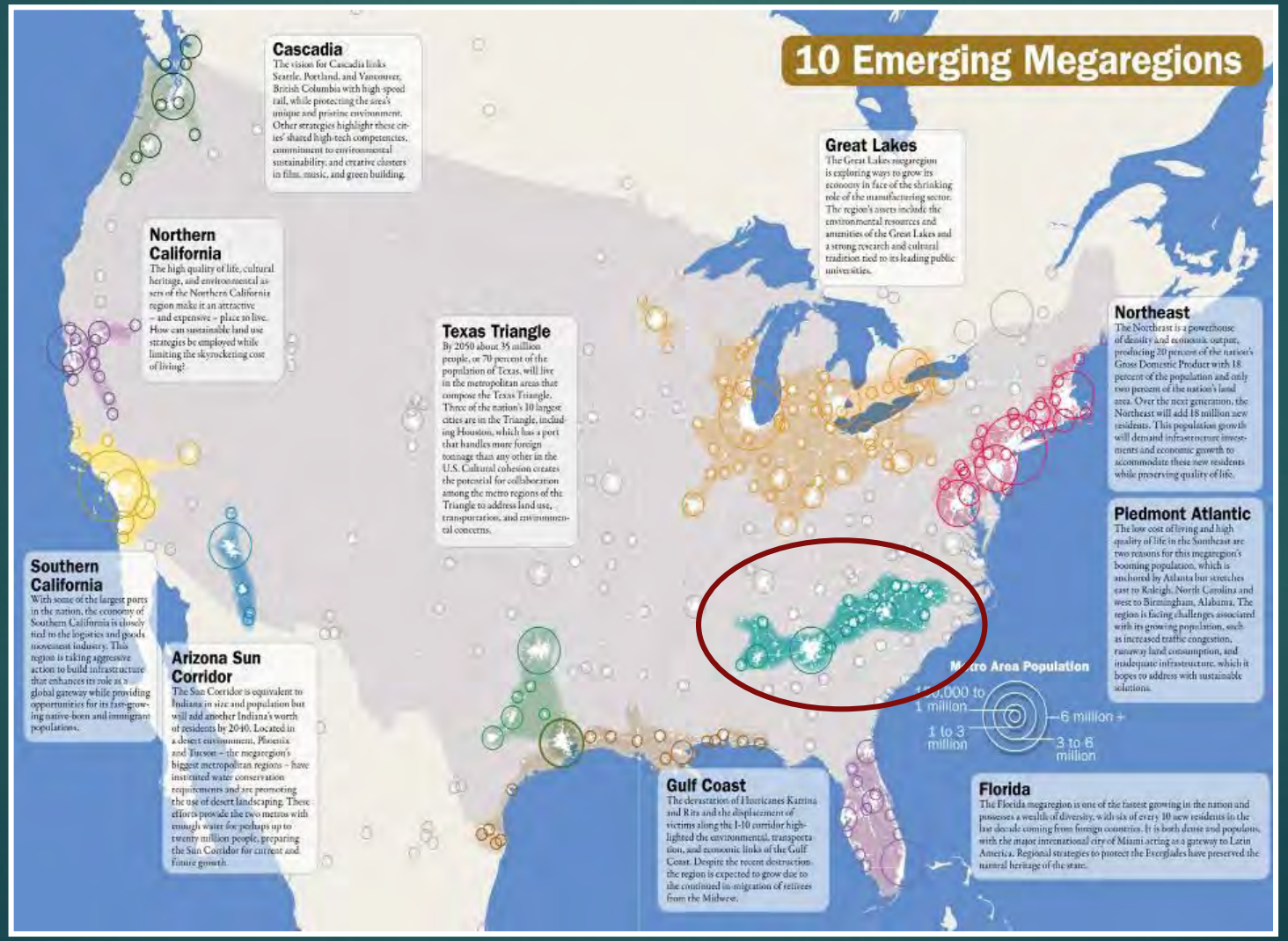
Transportation systems need to become more "connected" across all modes of travel

Current Challenges: Unsustainable Land Use Patterns

In many communities in the US, we have separated our land uses and created development patterns that are so dispersed that it nearly requires auto travel.

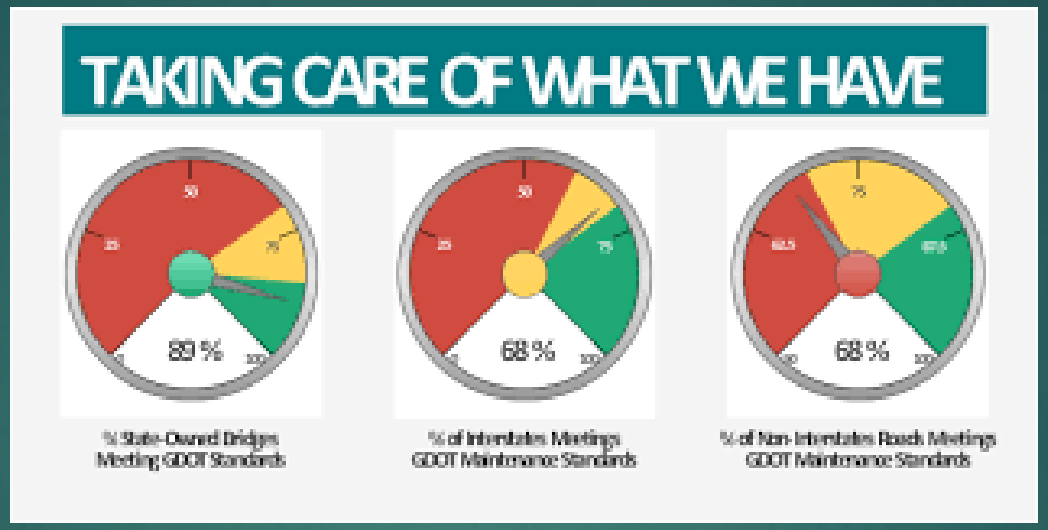
This is changing in some cities, but the lack of transportation options (i.e. drive, walk, bike, ride transit, etc.) is very obvious.

Current Challenges: Strengthening Megaregion Connectivity



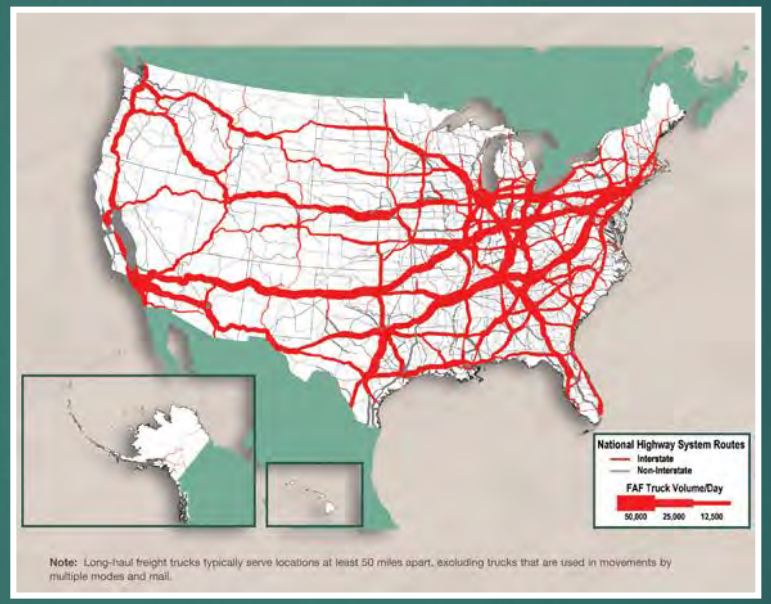
Current Challenges:
Insufficient Attention to Asset Management

Current Challenges: Asset Management



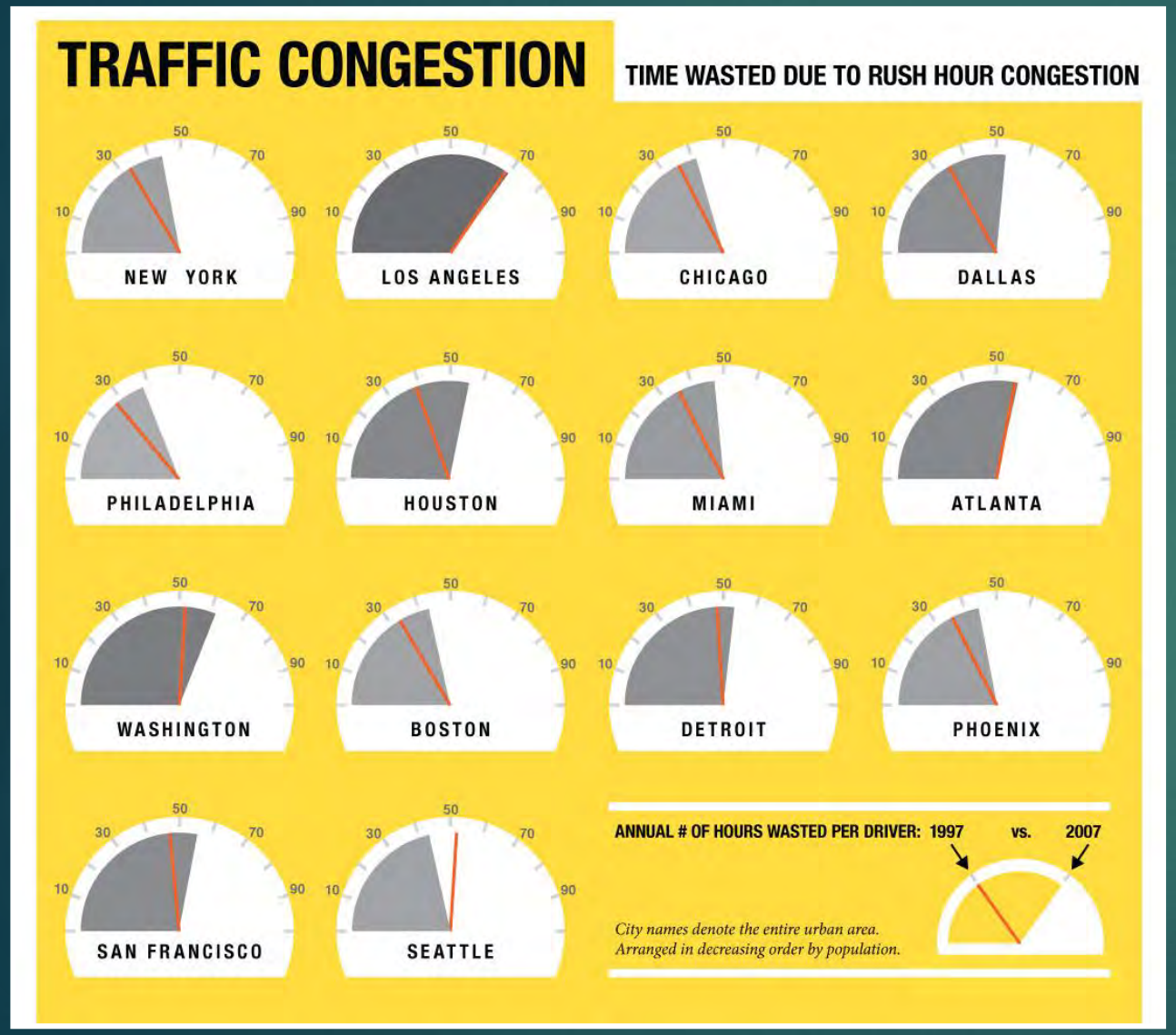
- Conducted by the American Society of Civil Engineers every two years
- Overall national assessment and ratings for each state - urges actions by US Congress and states to deal with the issue
- Assesses capacity, condition, funding, future needs, operation and maintenance, public safety, and resilience
- For more info: www.asce.org

Current Challenges: Rapidly Growing Freight Traffic



Freight traffic is growing 2-3 times faster than passenger traffic in the U.S.

Current Challenges: Travel Time Reliability

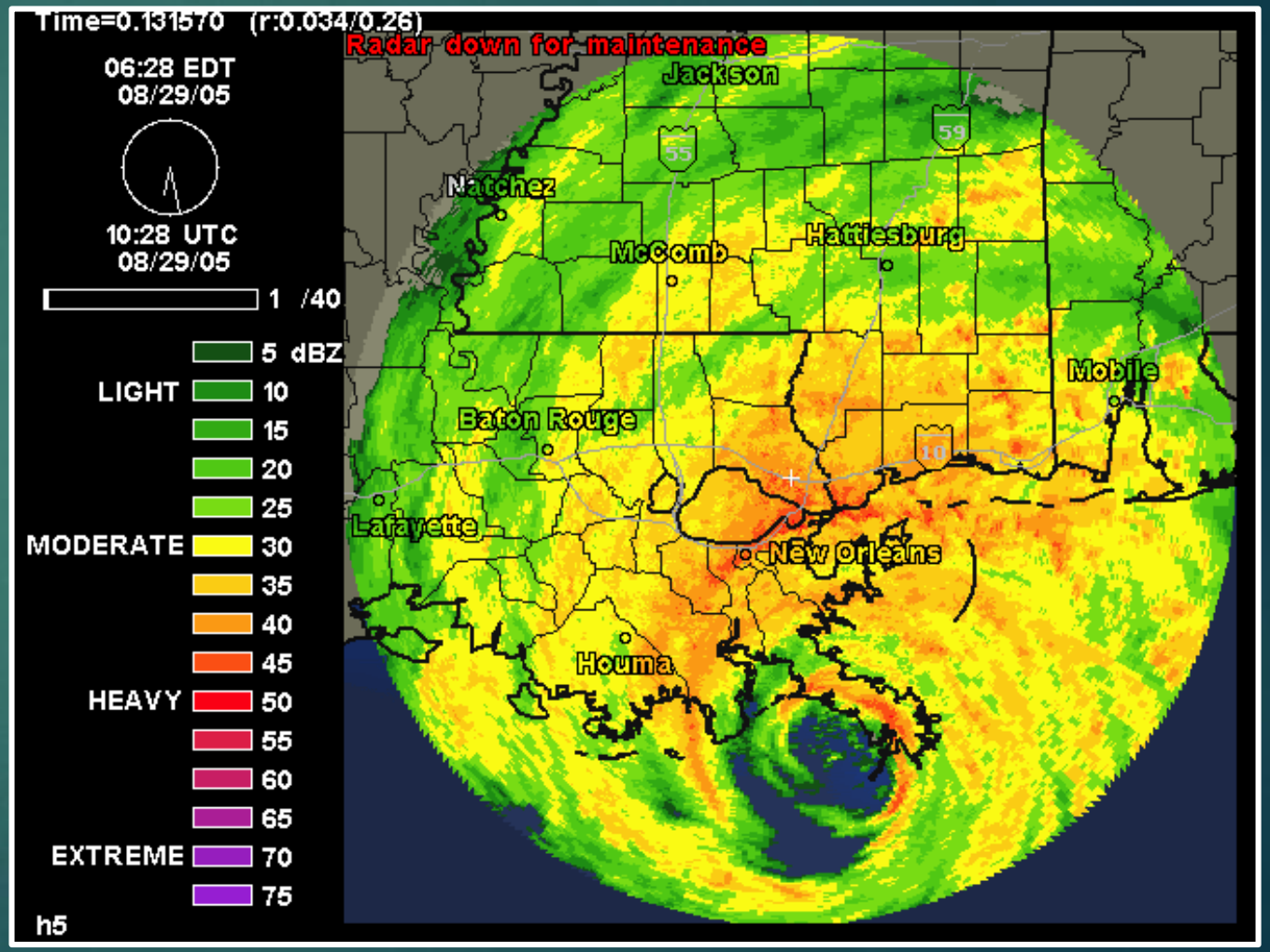


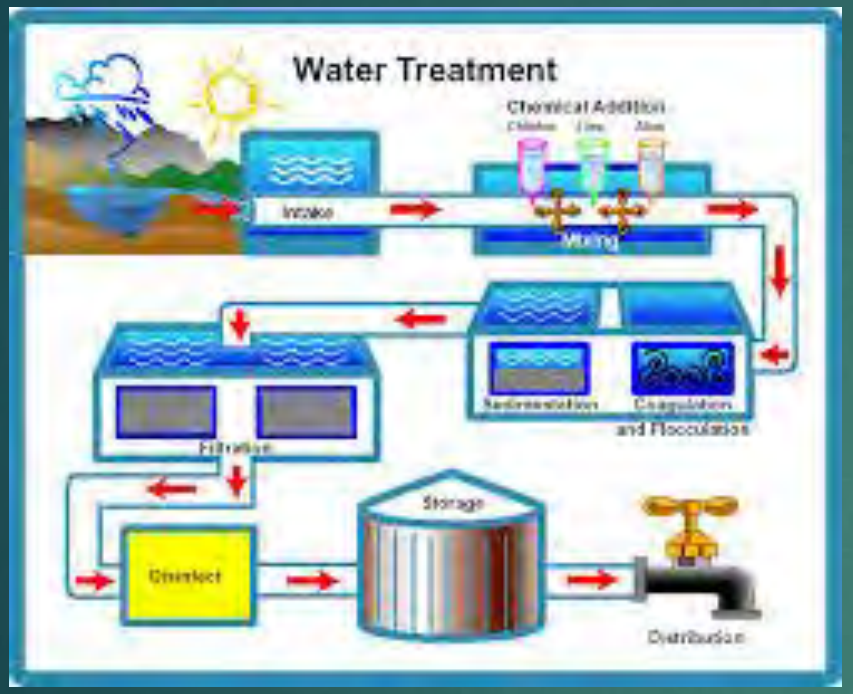
Major metro areas compete for new jobs – transportation conditions either help or hinder job creation.

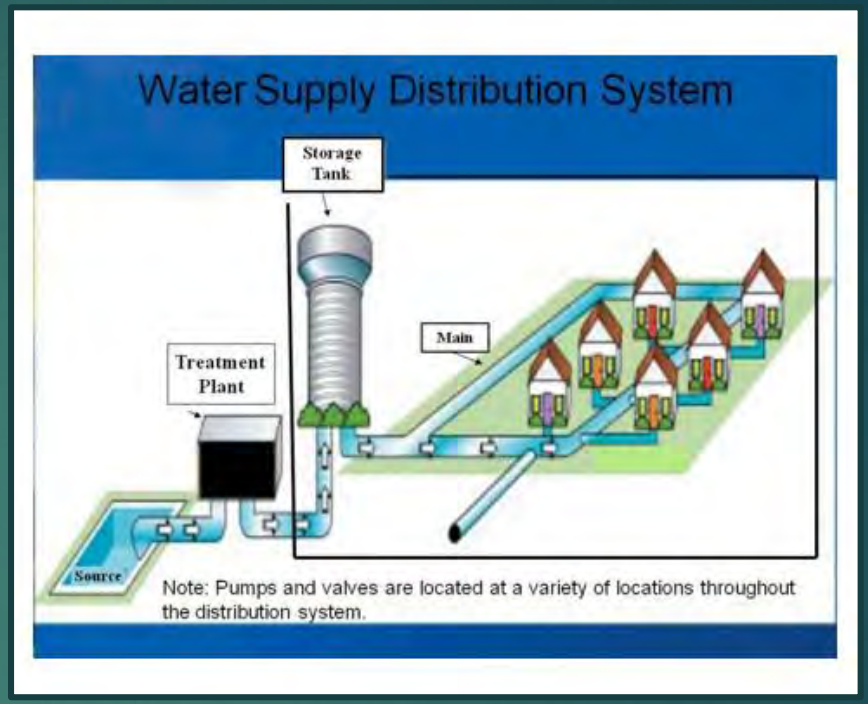
Unpredictable travel times – for people or for business/ Industry hurts economic success

Current Challenges: Climate Change and Resiliency

Finding resources to protect our infrastructure from climate change and natural disasters and making it more resilient is a huge policy and financial challenge.







Environmental Systems

(Water, Wastewater, and Solid Waste)

Key Aspects of Environmental Systems

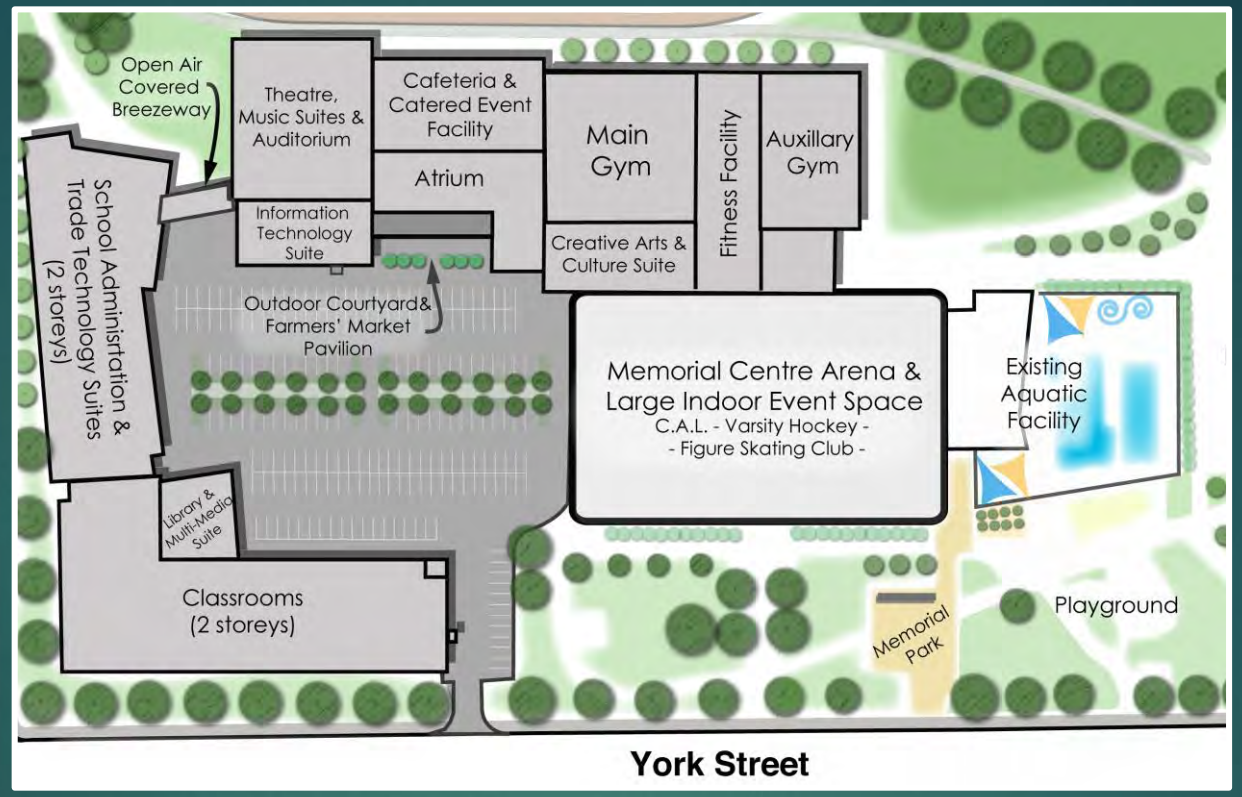
Water Treatment and Distribution	Wastewater Treatment/ Stormwater Management	Solid Waste/ Recycling
- Water management - Water sources (surface and ground water) - Distribution systems (pipes) - Treatment plants - Demand management/ conservation - Aging infrastructure One of the two MOST INFLUENTIAL infrastructure systems on the form and density of cities/ communities.	- Wastewater collection - Wastewater treatment - Sewers vs. septic tanks - Water reuse (gray water, etc.) - Aging infrastructure - Urban runoff - Agricultural runoff - Severe flooding - Sea-level rise	- Landfills and Incineration (up until the 1970s) - Solid waste (garbage, rubbish or trash, construction and demolition materials, roadside litter, etc.) - Waste collection systems - Resource recovery plants - Growing recycling and repurposing programs

Energy and Communications

Electric, Natural Gas, Solar, Wind, etc.

Energy and Communications

Energy Systems	Communications Systems
- Essential for quality of life and economic prosperity - Some energy options provoke strong community reaction – hard to find community consensus - Power generation, transportation, and distribution systems – private sector firms - Heavily regulated – Utility Commissions (public sector) - influence on pricing - Some municipal-owned systems - More planning for low carbon emission programs - More and more focus on clean fuel/ energy systems, i.e. low carbon and renewable energy	- Emergency management aspect - Largely private sector activity - Very little regulation – lots of consumer choice - Regulated by Federal Communications Commission (FCC) - Some state and local regulation (mostly through land use/zoning policies) - Push to increase access to broadband for smaller communities/rural areas



Community Facilities

K-12 Schools, Universities, Hospitals/Wellness, Civic Places, Libraries, Museums, Public Safety Facilities, Cultural/Historic Places, Criminal Justice Facilities, and Sports Facilities

Planning, Developing, and Paying for Community Facilities

- Very broad range of funding/financing strategies
- Very difficult to reach community consensus and funding strategies, depending on type of facility
- Aging infrastructure across facility types
- Growing interest in “active transportation/parks and recreation facilities”
- Difficult for small communities and rural areas to afford these amenities

“Green” and “Blue” Infrastructure

Parks and recreation areas, connected greenways, connected blueways, etc.

"Places to Change/Places to Save"

- City planners focus on "saving" important greenspace and blue spaces (i.e. rivers, wetlands, bays, streams, etc.) for future generations (and not letting them change into developed areas).
- Serve as natural habitats, water recharge areas, recreational/park areas, etc.
- Must protect from land development pressures.
- Usually cannot save these areas through policies – local governments can only save these places by acquiring/buying the land.

Thank You For Participating Today
and GOOD LUCK on your AICP Exam

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