AICP EXAM PREPARATION:

Transportation and Infrastructure Planning and Engineering

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AICP EXAM PREPARATION:
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

BEFORE I MAKE MY DECISION, I'D LIKE TO ASK FOR YOUR OPINIONS.

IT'S SUPPOSED TO MAKE YOU FEEL "ENGAGED."

AND YOU ACTUALLY PLAN TO LISTEN TO US?

I'M HOPING IT WILL LOOK THAT WAY ON THE OUTSIDE.

The Engineers

STARTING TODAY, ALL PASSWORDS MUST CONTAIN LETTERS, NUMBERS, DOODLES, SIGN LANGUAGE AND SQUIRREL NOISES.
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
“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

What is the Vision? (Desired End State)

How is the System Working Now?

How Will the System Work in the Future? (given projected conditions)

What Are Our Alternatives for Getting a Better Outcome?

How Will We Compare Our Alternatives?

Which Alternative Perform(s) Best?

How Will We Implement the Best Alternative? (who will do? money? time?)

Inform and Engage Citizens and Stakeholders Throughout the Process
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)
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

- 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.

# 1 – Trip Generation

# 2 – Trip Distribution

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

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

Managed Lane  General Purpose Free Lanes (4)

95 Express in SE Florida

Katy Freeway in Houston
Key Concept: Complete Streets

Complete Streets: designing for all 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.
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

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

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

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