2018 Spring AICP Exam Review

Fundamentals of Knowledge (Part 2)
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Sustainable urban form and mobility

- **Natural, social, and economic systems**
  - How cities came to be
    - Agricultural surplus
    - Security of that surplus
    - Social and political order
  - Economic reasons for the growth of cities
    - Trade
    - Agglomeration economies

- **Patterns of human settlements**
  - Suburbanization
  - Urban form and mobility
What is a city?

The city-state was built upon political relationships, which subordinated kin and tribal loyalties. What makes a city-state different from hunter-gatherer societies and small agricultural villages is the synergy created by its people interacting with each other on the basis of political relationships rather than traditional blood ties.
The Early Cities

A ceremonial hub in Uruk (3500BC)
Complex economic and political organizations were necessary to conduct trade and reciprocal arrangements. These led to the development of writing, also reflected in tokens that were used for transactions.
The first civilizations with city-states
Mumford and his dissection of cities

**Lewis Mumford** (October 19, 1895 – January 26, 1990)

Seminal contributions to understanding the role of technology and cities in human civilizations
Mumford’s definition of a City

*Economic functions and physical form of the city is secondary to the relationship to the natural environment and to spiritual values of human community*

The city is a related collection of social associations and groups
Ricardian Comparative advantage

Self-sufficient households (only require shirts and bread)

ASSUMPTIONS
- All households are equally productive
- All land is equally productive
- Constant returns to scale in exchange
- Constant returns to scale in production

NO incentive to trade as trade provides no benefits

Without trade – no incentive to concentrate activities close together
Now suppose that North is more productive in making both bread and shirts than the South.

<table>
<thead>
<tr>
<th></th>
<th>NORTH</th>
<th>SOUTH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bread</td>
<td>Shirts</td>
</tr>
<tr>
<td>Output per hour</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Opportunity cost</td>
<td>3 shirts</td>
<td>1/3 loaf</td>
</tr>
</tbody>
</table>
Comparative advantage

Comparative advantage = low opportunity cost

South has a comparative advantage in making bread over North

Opportunity cost for bread (1 loaf) = 1 shirt in south vs. 1.5 shirts in the north!

In the same analysis, North has a comparative advantage over South in making shirts

Opportunity cost in the North is 1/3 loafs vs. 1 loaf in the South
Production Possibility Frontier (PPF)

• How much can each region consume without trade (with 100hrs. of labor each)?
Gains from Trade

• How can cities consume beyond the production possibility frontier?
  ▫ They can negotiate the terms of trade to make “Pareto” improvements
    • What happens if the term of trade is settled at 2 loaves for 4 shirts?
Transaction Time and Gains from Trade

Gross gain from trade = 2 shirts for each region

Net gain = gross gain - transaction time \( (t) \)

North: If \( t < 20 \text{ min} \) (time for 2 shirts), net gain > 0

South: If \( t < 2 \text{ hr} \) (time for 2 shirts), net gain > 0

So if transaction takes 20 minutes or more (per hour of labor), North will have no incentive to trade
Accessibility and Land Rent

Johann Heinrich von Thünen
1783 – 1850

Assumptions:
1. All land is equally fertile
2. Production costs are the same in all locations
3. Free entry into farming -- in equilibrium all farmers make zero economic profits
4. Output prices are fixed
5. Output shipped to a central marketplace at a cost of $t$ tons per mile.
Alfred Weber (1868-1958)

Among the founders of industrial location theory

Basic tenet – Industries are drawn to locations that minimize transportation costs (and labor costs)

Cost of transportation depends on:
1) Weight of goods transported
2) Distance
3) The type of transportation system; extent of use
4) The nature of the region
5) The nature of the goods themselves

These can be expressed in terms of 1 and 2
Towards central city

Why?
Forces underlying suburbanization

"Urban sprawl will be defined as spatial growth of cities that is excessive relative to what is socially desirable."

Market failures leading to excessive spatial growth

Failure to account for:
1. Social value of open space
2. Congestion costs
3. Infrastructure costs of new developments

Traffic Congestion = externalities of auto travel
What explains the dominance of auto travel (mostly single-occupancy)?

**Reasons include:**
- People prefer the freedom of movement and the independence
- **More control?!**
- A fragmented daily work schedule
- Other reasons – I am sure you can come up with many
Auto drivers do not pay the full (social) costs of travel

$\text{Social trip costs}$

$\text{Private trip costs}$

$\text{Congestion tax}$

$\text{Demand} = \text{marginal benefit}$

$\text{Vehicles/ lane/ hr.}$
How Americans Get to Work

- Drive Alone: 77%
- Car Pool: 10.7%
- Public Transportation: 4.7%
- Work from Home: 3.6%
- Walk: 2.5%
- Other Means: 0.9%
- Bicycle: 0.4%
- Taxi: 0.1%

Source: 2005 American Community Survey

U.S. Census Bureau
Commute Patterns in Major US Cities 2008

Transit Ridership

SOURCE: U.S. Department of Transportation, Federal Railroad Administration
Amtrak Ridership

SOURCE: U.S. Department of Transportation, Federal Railroad Administration
An average of 1.9 personal vehicles is owned or available to U.S. households — more, for the first time, than the 1.8 drivers per household.

- 8 percent of U.S. households do not have a vehicle.
- 90 percent of long-distance trips are made by personal vehicle.
- 17 percent of adults report having used public transit in the last two months.
- 13 percent of long distance trips over 50 miles from home to the farthest destination are for commuting to and from work.
Auto drivers do not pay the full (social) costs of travel

Vehicles/ lane/ hr.

$\begin{align*}
\text{Social trip costs} \\
\text{Private trip costs} \\
\text{Demand} = \text{marginal benefit}
\end{align*}$
How does urban density impact energy use in transportation?
But is the pattern more a function of density or price?
Also, how wealthy a city is, does not seem to matter much for car use.
So what (else) could explain the variation in transportation energy use?
Supply of freeways vs. auto travel

FIGURE 3.6.2: RELATIONSHIP BETWEEN LENGTH OF FREEWAY PER PERSON AND PASSENGER CAR KILOMETRES

Source: Adapted from: Kenworthy 2003
Bob Cervero and Kara Kockleman suggested the importance of the 5 D’s

- **Density**: Population and employment by geographic unit (e.g., per square mile, per developed acre).
- **Diversity**: Mix of land uses, typically residential and commercial development, and the degree to which they are balanced in an area (e.g., jobs-housing balance).
- **Design**: Neighborhood layout and street characteristics, particularly connectivity, presence of sidewalks and other design features (e.g., shade, scenery, presence of attractive homes and stores) that enhance the pedestrian and bicycle friendliness of an area.
- **Destination accessibility**: Ease or convenience of trip destinations from point of origin, often measured at the zonal level in terms of distance from the central business district or other major centers.
- **Distance to transit**: Ease of access to transit from home or work (e.g., bus or rail stop within 1/4–1/2 mi of trip origin).
Finding 1 (from a more recent study by the National Academy... )

• Developing more compactly, that is, at higher residential and employment densities, is likely to reduce vehicle miles traveled (VMT).
  ▫ The literature suggests that doubling residential density across a metropolitan area might lower household VMT by about 5 to 12 percent, and perhaps by as much as 25 percent, if coupled with higher employment concentrations, significant public transit improvements, mixed uses, and other supportive demand management measures.

Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions -- Special Report 298
http://www.nap.edu/catalog/12747.html
Finding 2 (from the same study by the National Academy...)

- More compact, mixed-use development can produce reductions in energy consumption and CO2 emissions both directly and indirectly.
  - if the fuel efficiency of the passenger vehicle fleet improves through either regulation or sustained higher fuel prices that encourage consumers to purchase more energy-efficient vehicles, the savings in fuel use and CO2 emissions from developing more compactly will be reduced, all else being equal.
  - if the energy efficiency of residential heating and cooling improves, the savings in energy and CO2 emissions from shifting to multifamily or smaller single-family units will decline proportionately.
Finding 3 (from the same study by the National Academy...)

- Illustrative scenarios developed by the committee suggest that significant increases in more compact, mixed-use development will result in modest short-term reductions in energy consumption and CO2 emissions, but these reductions will grow over time.

- A more moderate scenario, which assumes that 25 percent of new and replacement housing units will be built in more compact development and that residents of those developments will drive 12 percent less, would result in reductions in fuel use and CO2 emissions of about 1 percent relative to base case conditions in 2030, growing to between 1.3 and 1.7 percent less than the base case in 2050.
**Finding 5:** Promoting more compact, mixed-use development on a large scale will require overcoming numerous obstacles. These obstacles include the traditional reluctance of many local governments to zone for such development and the lack of either regional governments with effective powers to regulate land use in most metropolitan areas or a strong state role in land use planning.
What are the impacts of U.S. transportation choices on urban sustainability?
Environmental Dimensions of Transportation

Source: EPA
Spatial and Durational Environmental Effects

Source: adapted from K. Button, Center for Transportation Policy, Operations and Logistics, George Mason University, Lecture Notes.
Distance Driven and Carbon Emissions, U.S. Automobile Fleet, 1970

Source: John DeCicco and Feng An, Automakers’ Corporate Carbon Burden, Environmental Defense Fund, Washington, DC, July 30, 2002
Other dimensions of auto travel

• **Isolation**
  ▫ Long commutes tend to take away from important “family time”

• **Dependence on foreign energy sources**
  ▫ Increases chances for economic and political crises

• **On the positive side – more freedom to be spontaneous and flexible**

• **Others? (anybody?)**
WHY DID SUBURBS FORM AND GROW?
The pre-suburban industrial city

- Industrial revolution
  - Competition for land near transport
  - Industrial agglomeration
  - Labor needed to be close by
  - Density
  - Dumbbell tenements
  - Unpleasant living conditions
Fig. 4.8  A New York alleyway (off Baxter Street), photographed by Jacob Riis in 1888. [Library of Congress]
Fig. 4.9 Maximizing space: the airshaft of one of the notorious "dumb-bell" tenements in New York City. (left) rooftop view, (right) view from interior tenement. The design allowed 24 families to be crowded onto a lot just 25 feet wide and 100 feet deep. Further construction of tenements of this design was outlawed in 1901 after two Tenement House Commissions (in 1894 and 1900) had documented evidence of their effects on people's health and well-being. [National Archives]
The beginnings of suburbanization

- Carriages
- Horse cars
- Streetcars
  - starfish pattern
  - city becomes larger geographically
  - work and home begin to be separated
  - social segregation begins

Source: Dr. Mark Purcell, University of Washington
STAGES OF INTRAURBAN GROWTH

- Electric streetcars, commuter railroads
- Arterial highways
- Expressways

Source: Dr. Mark Purcell, University of Washington
Suburbanization

• Four Waves of suburbanization
• 1850 – 1945 – “romantic suburbs”
• 1945 – 1985 – “mass suburbanization”
• 1985 – present – the rise of the Megaburb; “edge city”; urbanization of the suburbs
• Megapolitan Regions
Romantic Suburbs

- Rail technology allowed a select few to separate home from work
- Primarily just the elite, a very small scale phenomena
- “bedroom suburbs”; primarily residential
- Residential “retreats” from the chaotic, industrial city
- Designed around “romantic principles”
Source: Dr. Mark Purcell, University of Washington
Next wave: Suburbanization increases

- **Residential suburbanization** continued along streetcar lines
- **Commercial suburbanization** increases
  - follow population
- **Industrial suburbanization also increases**
  - invention of truck
  - high land prices in city center
Mass Suburbanization: After 1945

- The Middle-class, and even the working-class suburbanizes
- Levittown, NY
Levittown IN 1957

One of four different styles of the Jubilee

One of four different styles of the Levittowner

One of five different styles of the Pennsylvania

One of four different styles of the Country Clubber
Why the “levittownization” of American cities?

1. Pent-up demand for housing
2. returning vets
3. economic boom
4. new building technologies
5. consolidation in the development industry
6. much higher rates of automobile ownership
7. building of the freeway network (the I-system, after 1946)
8. the role of the federal government
   - VA/FHA loans and “redlining”
   - Freeway construction
Fig. 5.38  Stages in the suburbanization of retail trade. (A. Keilerman, "Telecommunications and the Geography of Metropolitan Areas." Progress in Human Geography 8 (1984): p. 22)

Fig. 5.29  Changing urban density gradients. See text for explanation.
Rise of the automobile

- About 1920 automobile ownership rising
- Ford improves mass production techniques
  - cars become more affordable
- Government subsidizes car travel
- Cars out-compete streetcars
- Starfish is filled in
Fig. 5.1 Motor vehicle registrations, 1900–1990 (includes both private and publicly owned vehicles). [Federal Highway Administration, Highway Statistics: Summary to 1985; Federal Highway Administration, Highway Statistics, 1990]
Public subsidy of roads
(Cars defined as public good)

- Removal of horse from streets
- Streets require massive investment
- Lobby for cars
  - Car manufacturers, tire manufacturers, oil companies, AAA, land developers
- Railway owners vilified
Fig. 9.4 Tenure of occupied nonfarm dwelling units, 1890–1990. [U.S. Bureau of the Census, Historical Statistics of the United States: Colonial Times to 1970; U.S. Bureau of the Census, Statistical Abstract of the United States, various years]
Elements of the suburban ideal

- **low-density**
- residential space—separation of home and work
- clean, quiet, healthy, safe
- in harmony with nature (*setbacks, easements*)
- nuclear family/*single family house*
- private life/private space
- gender
- Protestant, white, middle-class
The Rise of the “Megaburb”: 1985 - present

- Jobs follow the people to the suburbs
- Suburbs are no longer “bedroom communities”; rather they are essentially independent of the central city
- The rise of the “edge city” suburban downtown, or suburban cluster
- Traffic congestion (and job growth!) is often more intense in suburbs than in central city
- Suburbs are also much more socially diverse than in previous eras.
Itasca, IL.
Schaumburg, IL.
Oak Brook, IL.
Naperville, IL.
Special types of new suburbs

• The new immigrant suburb
  ▫ Monterey Park, CA
• The middle-class African-American suburb
  ▫ Princes George, MD
• The mostly “job and retail” suburb
  ▫ Elk Grove Village, IL
• The declining “inner-ring” suburb
  ▫ West Allis, WI
Consequences of Mass Suburbanization

- **The Fiscal health of the central cities**
  - Population declines = less tax money
    - Abandonment in certain areas
  - In worst case scenarios, only the poorest of the poor left behind
  - Tax-service inequities
    - Schools
    - Roads/fire/police/libraries/other services
Environmental Consequences

- Sprawl
- Emissions
- Excessive pavement
- Long commutes
- Automobile dependency
- Traffic jams/idle engines
Commuting Patterns in US Metros

Figure 15-11. Work Trip Flow Patterns across Geographic Categories
Source: ACS 2011
Living spaces in new homes
Is there a back-to-the-city movement?

Population change in Washington DC, 1960 – 2010

Source: Derek Hyra [http://bit.ly/1lZj0r8]
What are the impacts of U.S. transportation choices on urban sustainability?

- Sprawl
- Pollution
- Congestion
- Climate altering gases
- Obesity and ill health
- Social inequities
Thank You!

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