Learning Objectives

• Identify and discuss the primary areas of transportation engineering
• Discuss the role of a transportation engineer (and potential career opportunities)
• Compare and contrast competing goals of a transportation engineer
• Compare and contrast the historical and changing constraints and advances in the transportation field.

What is transportation engineering?

The science of safe and efficient movement of people and goods.

Why is transportation engineering a core discipline in civil engineering?

Transportation is an “essential service” that most governments supply to its citizens.
What are the primary areas of transportation engineering?

1. Transportation Planning (Ch. 8)
2. Traffic Analysis/Operations (Ch. 5 – 7)
3. Facilities Design (Ch. 3 – 4)
4. Research and Education

Transportation Planning

What are the transportation needs now and in the future? How can we address those needs?

There are basically two options:

1. Increase Supply
   a. Build/widen roads
   b. Provide more facilities (e.g. transit)
2. Decrease Demand
   a. Encourage use of “alternative modes” (e.g. bicycle)
   b. Adjust travel behavior (e.g. telecommuting)

Traffic Analysis/Operations

How do the existing facilities meet the demand or provide the necessary level of service?

For example, at an intersection we measure delay:
- How many lanes?
- Turning lanes?
- Control or uncontrolled?
- Signal timing?

Facilities Design

What and how should facilities be built to accommodate demand?

For example, when designing a roadway:
- What is its path? (horizontal alignments)
- What are the grades? (vertical alignments)
- What type of pavement (asphalt or concrete)? How thick does it need to be to accommodate vehicular demand?
What is the role of the transportation engineer?

1. Minimize travel time (delay)
2. Maximize safety (protect public)
   • What is the problem with these two simple goals?
   • What “mode” are we typically talking about?
   • How about “everyone else”?

Discussion

Why do we have congestion?
Why don’t we just fix it?

Discussion:
Why do we have congestion, and why don’t we just fix it?

• Constraints/challenges are constantly changing:
  – Economic Constraints
  – Political Constraints
  – Environmental Constraints
  – Geographical Constraints
  – Technological Advances and Challenges
  – Behavioral/Societal Challenges

Conclusion:

In this course, you will understand that the “best” engineering solution is not always feasible due to these constraints.
<table>
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<tr>
<th>Economic Constraints</th>
<th>Political Constraints</th>
<th>Environmental Constraints</th>
<th>Technological Challenges/Advances</th>
<th>Geographical Constraints</th>
<th>Behavioral/Societal Challenges</th>
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<tbody>
<tr>
<td>Costs (land, materials, construction, labor, personal insurance, gasoline, operating costs)</td>
<td>Fed, State, Local Laws</td>
<td>Energy consumption</td>
<td>Vehicle Technologies - safety (seatbelts, airbags, ABS), - emission controls, - fuel efficiency gains</td>
<td>Rivers</td>
<td>Dominance of SOV (decreasing average vehicle occupancy: 1.22 to 1.12)</td>
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<tr>
<td>Fed, State, Local Economic Conditions (BUDGETS!)</td>
<td>Individual vs. Business Interests (personal travel vs. commercial freight movement)</td>
<td>Air pollution (CO, HC, NOx, etc.)</td>
<td>Infrastructure Technologies (guardrails, “breakaway” signs)</td>
<td>Mountains</td>
<td>Demographic Changes (older vs younger drivers, suburb-to-suburb commutes, “urban sprawl”)</td>
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<tr>
<td>Taxes/User Fees (tolls, gas tax)</td>
<td>Local Access vs. Throughput</td>
<td>Water pollution (runoff, drainage)</td>
<td>Traffic control technologies (signal coordination, ITS)</td>
<td>Flooding!</td>
<td>Negligent Driver Behavior (DUI, “road rage”)</td>
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<td>Equity/Fairness Issues (rich vs. poor users)</td>
<td>Community-Related Impacts</td>
<td>Noise &amp; light pollution</td>
<td>Big vs Small Vehicles (Popularity of SUVs)</td>
<td>Earthquakes?!</td>
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<td></td>
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<td>Land use conflicts (housing, open space, etc. needs)</td>
<td>Lighter Vehicles (hybrids, electrics)</td>
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Please note that this list far from exhaustive!

The point: the “best” engineering solution is not always feasible because of constraints and challenges!