Drivers of Change for Metropolitan Transportation: An Overview

Transportation Research Board
Scenarios in Transportation Planning
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Underlying Assumptions

- Public Action
  - Future Betterment
    - Forecasting
- Data
Devils in the Data

Quantity + Complexity + Uncertainty + Change = Forecasting Problems

Some examples...
Demographics: Pop + Comp + Pref
Economics: Supply + Prices
Environment

- Heat Waves
- Environmental Impact
- Climate Change
- Natural Disasters
- Urbanization Effects
- Resource Depletion
- Policy Implications
Possible, but Plausible...?
And in the other corner...
Social Change

- Exponential growth of information and access to information > globalization and democratization > social change > better policy?
Five broad categories of Drivers

Trends (momentum), innovations (choices), disruptions likely to influence future demand for travel and the facilities and programs to accommodate it.

Demographics

Technology

Policy

Economics

Environment
Drivers Affect Things We Care About

Well-Being: for all people, for all time periods

Livability
Quality of Life (Sustainability)

Cost of Living

Economic Welfare

Environmental Quality

Amenity
Those are Categories of Impacts

Effects on Everything
- Economy
- Environment
- Land Use
- Infrastructure
- Social
- Fiscal
- Public Process
- (Legality: usually implied)

Transportation System Performance
- Safety
- Speed (accessibility and mobility)
- Reliability (Resilience)
- Choice
- Convenience
- Cost / Effectiveness / Fiscal Constraint
- Distribution of impacts (equity)
For Transportation Projects…

- Transportation System Performance
  - Safety
  - Speed (accessibility and mobility)
  - Reliability (Resilience)
  - Choice
  - Convenience
  - Cost / Effectiveness / Fiscal Constraint
  - Distribution of impacts (equity)

- Secondary Effects
  - Economy
  - Environment
  - Land Use
  - Infrastructure
  - Social
  - Fiscal
  - Public Process
  - (Legality: usually implied)
The Elevator Speech

- 5 broad *Categories of Drivers*; 100s of specific, plausible drivers

- Combine some *Specific Drivers* to create *Scenarios*

- Evaluate scenarios (their *Impacts*) against criteria (*measurements*) in well-established categories of what we care about

- Use models for *estimates* of future impacts
Washington County Transportation Futures Study

- 50-year look as context for 10-to-20-year Transportation Investment Package
- Drivers, Scenarios, Investment Packages
Methods for Evaluating Drivers

• Literature Review

• Survey of National Experts
  – ~ 40 invited; ~ 20 responses
  – Two rounds; Modified Delphi
  – Round 1: What drivers are most relevant; are most likely to occur; would have biggest impacts on transportation?
  – Round 2: Given results of Round 1, more focused questions

• Survey of Local Interested Parties
**Demographic Factors**  Population levels | Population composition | Family and household size | Housing and land-use preferences | Travel behavior and preferences | Consumer behavior and preferences | Social behavior | Education levels

**Economic Factors**  Employment levels | Occupational composition of economy | Economic sectors | Global trade | Domestic trade | Price of commodities | Labor force participation

**Environment and Energy**  Price of energy | Types of energy | Sea level | Temperature levels | Weather patterns | Water levels and watersheds | Critical habitats

**Policy**  Fuel taxes | Federal, state, local transportation funding | GHG regulation | Road and congestion pricing | Incentives for alternative energy or transportation technology | Transit subsidies | Insurance and safety regulations | Local and regional land use policies | Emerging world powers and geo-politics

**Technology**  Vehicle technology | Alternative fuels | Traffic management | Consumer and communication technology | Infrastructure technologies
Literature Review

**Demographics**
- Aging population
- Increase in online shopping
- Telecommuting

**Policy**
- Congestion pricing
- PPPs in transportation
- Climate change regulation

**Environment**
- Natural resource constraints
- Rising sea levels
- Intensifying weather

**Technology**
- Autonomous/connected vehicles
- Ubiquitous ITS
- Automation of knowledge work

**Economics**
- Emerging global middle class
- Increase in technology and service industries
- Increasing East Coast port traffic
• Considering the results of Survey 1:
  – What drivers are most important and what are their potential effects?
  – Can and should potential drivers be incorporated into travel demand models?
  – How likely are some potential scenarios for the future of transportation?
5 Driver Categories: multiple responses from Survey 1

Individual: Top 5

Collective Frequency in Top 15

Mean estimates and Std Deviation of Likelihood and Importance

Weighted Score
For top rated, how would they impact (+ or –) key variables?
Pop Growth, Dev Density, # Commuters, Emp in Urban Core, Income Inequality, mode choice

Table 2: Top-rated drivers and their impacts

<table>
<thead>
<tr>
<th>Driver</th>
<th>Frequency in Top 3</th>
<th>Impact on Key Variables</th>
<th>Relative Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aging population</td>
<td>9</td>
<td>Population growth rate</td>
<td>3 / 0</td>
</tr>
<tr>
<td>Congestion road pricing and VMT taxes</td>
<td>9</td>
<td>Development density</td>
<td>2 / 5</td>
</tr>
<tr>
<td>Urbanization and growth in metropolitan areas</td>
<td>6</td>
<td>Number of commuters</td>
<td>6 / 0</td>
</tr>
<tr>
<td>Adoption of autonomous/connected vehicles</td>
<td>5</td>
<td>Employment in urban cores</td>
<td>3 / 0</td>
</tr>
<tr>
<td>Climate change regulations at the federal, state, and local level</td>
<td>4</td>
<td>Income inequality</td>
<td>1 / 2</td>
</tr>
<tr>
<td>Privatization and public-private partnerships in transportation financing</td>
<td>3</td>
<td>Share taking non-auto trips</td>
<td>4 / 3</td>
</tr>
<tr>
<td>Increase in online shopping</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telecommuting</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural resource constraints</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced ubiquitous intelligent transportation services (ITS)</td>
<td>2</td>
<td></td>
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</tr>
</tbody>
</table>
Top Drivers from Experts

• Aging population
• Transportation pricing
• Growth in metropolitan areas
• Adoption of autonomous/connected vehicles
• Climate change regulations
• Online shopping

Rated by combined score for likelihood & impact
Aging Population

It's about more than the Boomers. Retirees in 40 years are 25 today.

More “Retirees” but less retiring

Healthier

Wealthier

Unclear impacts on housing and transportation choices
General agreement among experts that demand-side management through pricing will happen

Increase cost of travel

Shift to alternate modes

Increase development density
Growth in Metro Areas

Metro areas will continue to attract talent and jobs, and preferences will tend toward denser development.

Could slow natural growth rate.

Increase in density, number of urban commuters, jobs in urban core, non-auto trips, and possibly income inequality.
Adoption of autonomous/connected vehicles

Connected vehicles will phase into practice, with full autonomy less certain

Unclear impacts on development density

Increase in number of commuters

Source: U.S. DOT
Climate change regulations at the federal, state, and local level

Climate change regulations will intensify and impact land use and transportation

General incentives for denser development and employment

Increase in non-auto trips

 Likely increase in cost-of-living in metro areas, but will vary across metro areas
Privatization and public-private partnerships in transportation financing

Transportation funding constraints will encourage more creative and collaborative finance schemes with private sector.

Unclear impacts on development density.

Increase in number of commuters.
Increase in Online Shopping

*Online shopping will become more popular and widespread*

Little impact on development density (but likely impacts on location of land uses and non-commute trips)
Regional Stakeholder Survey

• General agreement with experts
• Drivers relevant to local stakeholders
  – Funding limitations
  – Autonomous vehicles
  – Telecommuting
  – West Coast Shipping
  – 3D printing
Some Observations

• Try writing the questions
• No one complained about the structure
• High-level theory a lot easier than specifics
• Non-transportation drivers and policies may be more important to scenarios than transportation ones
• Paradox: (1) important to think long run and (2) impacts on planning investment hard to measure and may be small
Advice to Regions re Scenarios

• Thoughtful discussion and evaluation of drivers improves planning
• Packaging drivers into scenarios helps a public discussion of possible futures
• Don’t get stuck. No end to potential tech work
  – Read what others have done on drivers
  – Check your models: what do they cover or not?
  – Write scenarios that make sense locally, and list the drivers that support those scenarios