INCORPORATING LONG-DISTANCE TRAVEL INTO TRANSPORTATION PLANNING IN THE UNITED STATES

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**NCST MISSION**

- **RESEARCH** – Producing “state of knowledge” white papers and interdisciplinary research projects

- **EDUCATION** – Developing model curricula for graduate programs and advanced training programs

- **ENGAGEMENT** – Informing the policy-making process at the local, state, and federal level
INCORPORATING LONG-DISTANCE TRAVEL INTO TRANSPORTATION PLANNING IN THE UNITED STATES

October 2018
A White Paper from the National Center for Sustainable Transportation

Lisa Aultman-Hall, University of Vermont
OUTLINE

1. What Exactly is Long-distance Travel?
2. Long-distance Travel Demand over Time
3. Sustainability: Emissions, Economy and Equity
4. Prior Long-Distance Travel Research
5. A Framework for Long-Distance Data Collection
LONG-DISTANCE TRAVEL IS NOT NEW

- Leisure resorts in Ancient Greece
- 7 wonders of the world 146BC
- 1292 Marco Polo’s book
- 1600s stage coaches, trains and hotels
- 1800s passenger ships
- 1900s automobiles
- 1950s jets
LONG-DISTANCE TRAVEL IS NOT NEW

- < 1950
  - US planning and infrastructure was focused on long-distance travel
  - Railroads, then US routes, then Interstate Highways
- 1950s re-direct
  - Urban congestion
  - Housing challenges
- Transportation planning agencies and models are urban-focused
- Leaders in long-distance modeling are a limited number of states
- Recently from FHWA
  - County-based Traffic Analysis Framework
  - Simulation-based annual activity model
  - NextGen NHTS
WHAT IS LONG-DISTANCE TRAVEL

- “out-of-town” trips
- intercity or inter-regional
- May be overnight
- May or may not be routine
- EU term “journey”
- Work, personal
- Not typically migration, seasonal travel by migrant workers, movements of refugees, or movements between seasonal homes
WHAT IS LONG-DISTANCE TRAVEL

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50 miles???
Creating a truly sustainable global transportation system requires a national travel demand model.

- Robust data
- Annual overnight activity framework
- Integration of surface and air modes
US-BASED LONG-DISTANCE DATA COLLECTION
US-BASED LONG-DISTANCE DATA COLLECTION

- National representative
- 80,000 households
- > 100 miles from home
- Every three months for 1 year
US-BASED LONG-DISTANCE DATA COLLECTION

- 26,000 households nation-wide
- > 50 miles from home
- 4-week retrospective
US-BASED LONG-DISTANCE DATA COLLECTION

- 3 phases
- 8000 households (some non-traveling households excluded)
- Collected > 40-miles, used >50-miles
- 2- or 4-week retrospective
US-BASED LONG-DISTANCE DATA COLLECTION

- 40-100 mile thresholds
- Challenges
  - Recall
  - Distance estimation

1995
2001
2003
2005
2009
2009-2012
2013
2013
2015
2016-2017

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US-BASED LONG-DISTANCE DATA COLLECTION

- 42,000 Households
- >50-miles
- 8-week retrospective

- Important Lessons learned
  - Burden
  - Study period vs recall
US-BASED LONG-DISTANCE DATA COLLECTION

- 628 individuals (52% completed the panel)
- Overnight not distance-based
- Monthly for 1-year
- Web-based allowed geocoding of ODs
US-BASED LONG-DISTANCE DATA COLLECTION

- >100-miles
- 3-month retrospective
- >2000 trips

American Travel Survey
National Household Transportation Survey
Ohio
Michigan
Colorado
Utah
California Household Travel Survey
Longitudinal Survey of Overnight Travel
Michigan

1995
2001
2003
2005
2009
2009-2012
2013
2013
2015
US-BASED LONG-DISTANCE DATA COLLECTION

- use of farMove mobile app for long-distance
- rotating through 10 regions of Ohio
- > 40-miles from origin
- 6-months per person (3 waves rolling over 1-year)
- account for repeat trips
US-BASED LONG-DISTANCE DATA COLLECTION

- Add-on questions in 6-states
  - >50- or 75- miles
  - Non-commuting
  - Retrospective 2-months

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US-BASED LONG-DISTANCE DATA COLLECTION

Challenges
- Definition
- Study period
- Burden
- Representativeness
- Cost

Solutions
- One-year data
- Global geography
- “big data” ODs
- Convenience sample surveys

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■ National surveys since 1990s
■ EU standardization efforts
■ Often 100-km definition
■ Often interviews and phone still feasible
1. What Exactly is Long-distance Travel?
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Figure 1: International and Domestic Air Revenue Passenger Miles
Figure 2: Approximation of Long-Distance Travel over Time based on Rail, Air and Bus Modes

Sources for Surface and Air: USDOT BTS Table I-40 Passenger Miles of Travel - [https://www.bts.gov/content/us-passenger-miles](https://www.bts.gov/content/us-passenger-miles) - accessed September 2018
Figure 3: Approximation of Long-Distance Travel over Time in the United States
Sources for Surface and Air: USDOT BTS Table I-40 Passenger Miles of Travel - https://www.bts.gov/content/us-passenger-miles - accessed September 2018
Sources for NHTS: Santos et al. 2011 and https://nhts.ornl.gov/ access September 2018
Approx. LD = three linear regression models for Surface - NHTS + 1.5Domestic Air
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# IMPORTANCE OF LONG-DISTANCE TRAVEL

<table>
<thead>
<tr>
<th>Environmental Costs:</th>
<th>Other Costs:</th>
<th>Benefits:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Noise</td>
<td>• Financial costs</td>
<td>• Opportunity and experience</td>
</tr>
<tr>
<td>2. Atmospheric pollutant emissions (greenhouse gasses (GHG), other gas emissions, particulate emissions and air toxics)</td>
<td>• Public Infrastructure Costs</td>
<td>• Cultural exchange</td>
</tr>
<tr>
<td>3. Storm water quantity (primarily due to impervious surfaces)</td>
<td>• Injuries and Fatalities</td>
<td>• Economic development</td>
</tr>
<tr>
<td>4. Pollutants to surface and ground water (including those related to winter maintenance)</td>
<td>• Physical human health</td>
<td>• Social network maintenance and development</td>
</tr>
<tr>
<td>5. Use of land and loss of natural areas, habitat fragmentation</td>
<td>• Time away from home, home social network and family</td>
<td>• Break from routine</td>
</tr>
<tr>
<td>6. Solid waste</td>
<td>• Productivity losses</td>
<td>• Leisure</td>
</tr>
<tr>
<td></td>
<td>• Energy for fuel</td>
<td>• Employment</td>
</tr>
<tr>
<td></td>
<td>• Time</td>
<td>• Emotional health</td>
</tr>
<tr>
<td></td>
<td>• Emotional health</td>
<td></td>
</tr>
</tbody>
</table>

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**Table 1: Costs and Benefits of Long-Distance Travel**

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- The University of Vermont
- Transportation Research Center
PLANNING FOR SUSTAINABILITY

- Emissions (GHG)
- Economy
- Equity
28% of US GHG are transportation (9% aircraft and 2% rail)

Integrated Mode Modeling Considerations
- The favorable profile of rail requires consideration of
  - vehicle occupancy
  - life cycle costs and electricity
  - speed costs
- Fully understanding air requires consideration of
  - Number of takeoffs – trip length and extra miles flown
  - Emissions at altitude
  - Access and egress
  - Private sector actors
- The relative merits of a more full motor coach require consideration
THE BIG QUESTION:

Do passenger miles have to increase for economic growth?

GDP $\equiv$ VMT
LONG DISTANCE AND SOCIAL EQUITY

Source: Michigan Travel Counts Survey 2015

- Visiting Friends and Family, 32%
- Vacation, 29%
- Recreation, 16%
- Work, 13%
- Shopping and Social, 10%
Access to destinations at distance matters to quality of life
- Where is your important social network
- Education, employment and cultural experiences
- Medical and other personal services

We need to measure latent or unmet LD travel demand.
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PRIOR LONG-DISTANCE TRAVEL RESEARCH

- Trip Rate – some descriptive results
- Trip Destination – little if any research
- Mode Choice – limited models
<table>
<thead>
<tr>
<th>Socioeconomic Factor</th>
<th>Impact</th>
<th>Select References</th>
</tr>
</thead>
</table>
| Income               | Widely demonstrated in all countries with studies that show as income increases, levels of long-distance travel increase. Higher income persons are more likely to fly. Education is confounding. | Mallet 2001  
Georggi and Pendyala 2001  
O’Neill and Brown 2001  
McGuckin et al. 2016  
Dargay and Clark 2012  
Limtanakool et al. 2006a  
Limtanakool et al. 2006b  
Rohr et al. 2010 |
| Gender               | Men are typically found to travel more but this is likely associated with men undertaking more work travel. Possible cohort effects over time are not clear. Some studies show women travel more for leisure. | Collins and Tisdell 2002  
Limtanakool et al. 2006a and 2006b  
Gustafson 2006  
Jeong et al. 2013  
Bose et al. 2004 |
| Age                  | Older and younger people travel less than middle age adults but the breakpoints in age and the reasons for the relationships are not measured. This factor may be confounded with income and may also reflect mobility limitations of aging. | Collia et al. 2003  
Bose et al. 2004  
Anderson & Langmeyer 1982 |
<table>
<thead>
<tr>
<th>Socioeconomic Factor</th>
<th>Impact</th>
<th>Select References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children in the Household</td>
<td>Children in the household are almost always shown to correlate with fewer long-distance trips but this is not always the case as it varies by trip purpose and number of adults in the household with single parents traveling less.</td>
<td>Aultman-Hall et al. 2016 Dargay and Clark 2012 Davison and Ryley 2013 McGuckin et al. 2016</td>
</tr>
<tr>
<td>Urban versus Rural</td>
<td>In some studies urban dwellers travel more potentially owing to airport access, income, or lifestyle. However, in other studies rural residents make more long-distance surface trips possibly for access to services.</td>
<td>Holz-Rau et al. 2014 Berliner et al. 2018 Limtanakool et al. 2006b Naess 2006 Czepkiewicz et al. 2018</td>
</tr>
<tr>
<td>Work</td>
<td>Those who travel for work may have more total trips but not necessarily fewer personal trips.</td>
<td>Aultman-Hall et al. 2016</td>
</tr>
</tbody>
</table>
MODE CHOICE

- Ultimate Origin
  - Airport access
  - Ultimate Airport
    - Wait time
    - Taxi time

- Intermediate Airport(s)
  - # of transfers
  - Transfer Time
  - On road Travel Distance and Time

- Ultimate Destination
  - Airport egress
  - Dest. Airport Egress time

Leg 1:
- Freq. of service
- Miles Flown
- Fare

Leg 2:
- Freq. of service
- Miles Flown
- Fare

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38
Air is no longer a non-routine external factor
Surface and air are part of one system
Examples
- General aviation and helicopters
- Electric “VTOL” and other shorter range air services
- “Airport leakage”

It’s not just distance
- Cost
- Travel time
- Access and egress
- Needs at destination
- Travel party
- Pets
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To plan for sustainable transportation, infrastructure and operations, we need:

- National Travel Model
  - Annual *Overnight* Activity Model
  - Surface and air integrated
  - Meaningful global connections
- Daily Regional Models
  - Meaningful visitor behavior “activities at destination”
KEY ACTIONS FOR MOVING AHEAD

1. Utilize “big data” for ODs
2. Embrace convenience sample surveys to understand travel decision making
3. Start assessing latent demand and unserved need
4. Stimulate professional and public discussion regarding the role of long-distance travel in our society
Ohio:
- 4th largest interstate lane-miles (8,129)
- 5th highest VMT (200M)
- Within 600 miles (1 day) of 60% of US and Canadian Population
- 7 Commercial Airports (176 total public airports)
- 6.5M Jobs
- $484B GSP (8th in USA, 28th in world)
Disaggregate Tour-Based Travel Demand Model

- Population is microsimulated
  - Daily Activity Pattern
- LD travel is prioritized
  - Half-Day: AM or PM
  - Full-Day
  - Away on Travel
- SD trips are then simulated if the traveler has time available
- Own Smartphone
- Completed 1 week HTS
Internet has made it easier to find medical specialists
4% of LD trips
1.5% of overnight lodging is medical facilities
**USE OF PASSIVE DATA**

- Using Passive Data to get the size of through travel
- Surveys for the trip information
- ODOT now purchases data to replace both Intercept and ALPR surveys
- 2024 Eclipse
~10 million population

101.7 Annual Vehicle Miles of Travel in 2017

122,032 Miles of public roads (10th largest)

Detroit is the busiest commercial border crossing with Canada and Port Huron is third busiest.
WHY COLLECTING LD DATA IS IMPORTANT TO MICHIGAN

- Large component of travel that is missed in daily travel surveys
- How much LD travel occurs in the state
- Determine if rural residents are making LD trips for basic services
- Does state geography impact LD travel
MICHIGAN’S LD SURVEYS

- Respondents reported all trips >100 miles from home in past 3 months
- Includes mode to destination, mode at destination, purpose, duration, and household members
The percent of LD travel for shopping or medical varies across the state.

More than half of all LD trips by MI residents are within the state.

<table>
<thead>
<tr>
<th>Destination</th>
<th>Percent of LD Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michigan</td>
<td>53.3%</td>
</tr>
<tr>
<td>Illinois</td>
<td>6.4%</td>
</tr>
<tr>
<td>Florida</td>
<td>6.0%</td>
</tr>
<tr>
<td>Ohio</td>
<td>5.8%</td>
</tr>
<tr>
<td>Indiana</td>
<td>4.0%</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>2.2%</td>
</tr>
<tr>
<td>Tennessee</td>
<td>1.7%</td>
</tr>
<tr>
<td>California</td>
<td>1.3%</td>
</tr>
<tr>
<td>Ontario, Canada</td>
<td>1.3%</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>1.2%</td>
</tr>
<tr>
<td>Texas</td>
<td>1.1%</td>
</tr>
<tr>
<td>Kentucky</td>
<td>1.1%</td>
</tr>
<tr>
<td>New York</td>
<td>1.0%</td>
</tr>
<tr>
<td>All Others (each &lt;1%)</td>
<td>15.0%</td>
</tr>
</tbody>
</table>
- Private vehicle is overwhelmingly the mode selected for LD travel.
- The distance traveled by mode varies greatly.
LD TRAVEL IN MI STATEWIDE MODEL

- Daily household travel survey is the source for most LD info.
  - 50 mi. LD length in model vs. 100 mi. in survey
  - Concern of underreporting of retrospective trips
  - LD survey used for air travel rates
- Big data used for pivoting
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