

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

**Lisa Aultman-Hall, Professor**  
University of Vermont

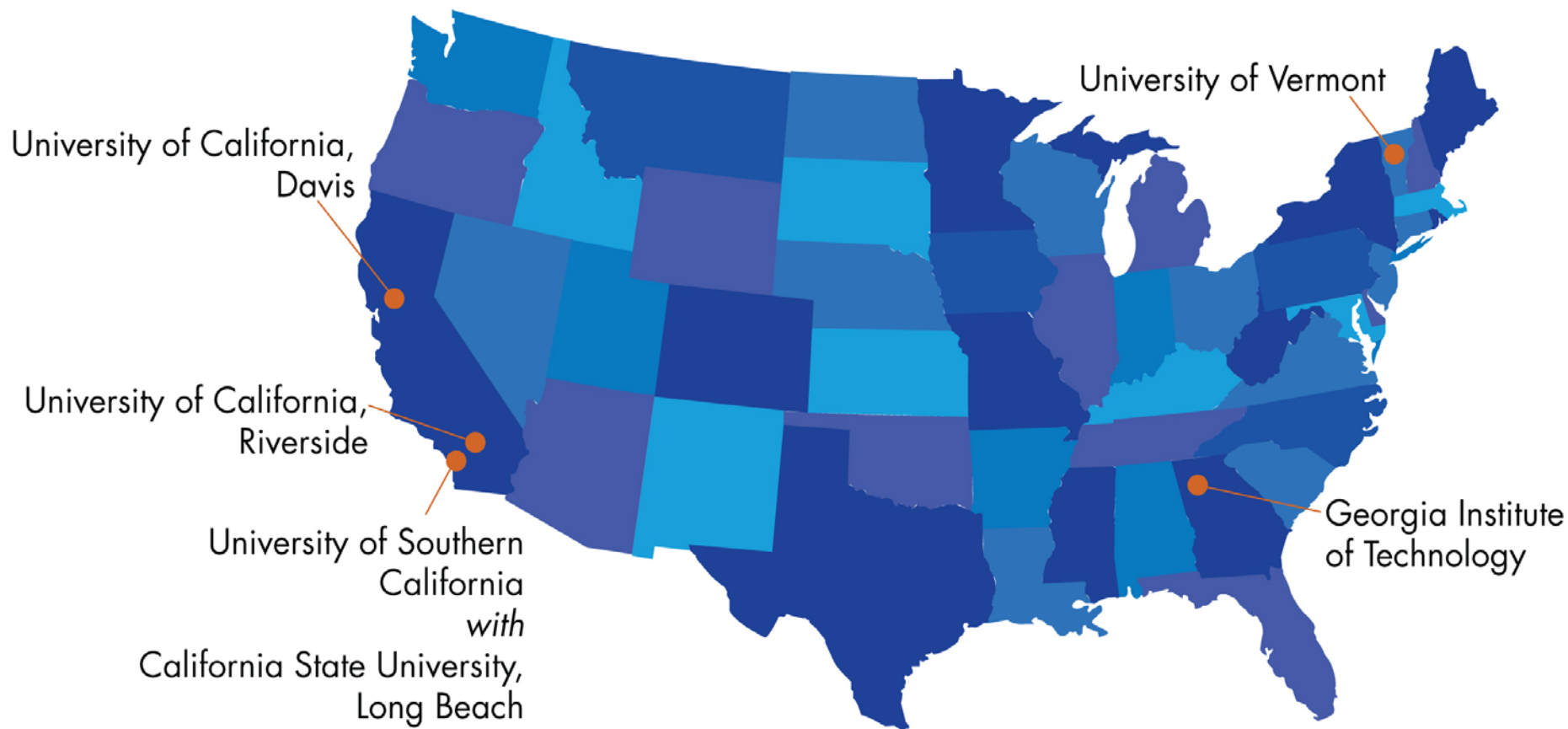
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Michigan Department of Transportation

# NATIONAL CENTER FOR SUSTAINABLE TRANSPORTATION A USDOT “NATIONAL” UTC



# 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*

# NCST WHITE PAPER

## 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? [SEP]
2. Long-distance Travel Demand over Time [SEP]
3. Sustainability: Emissions, Economy and Equity [SEP]
4. Prior Long-Distance Travel Research [SEP]
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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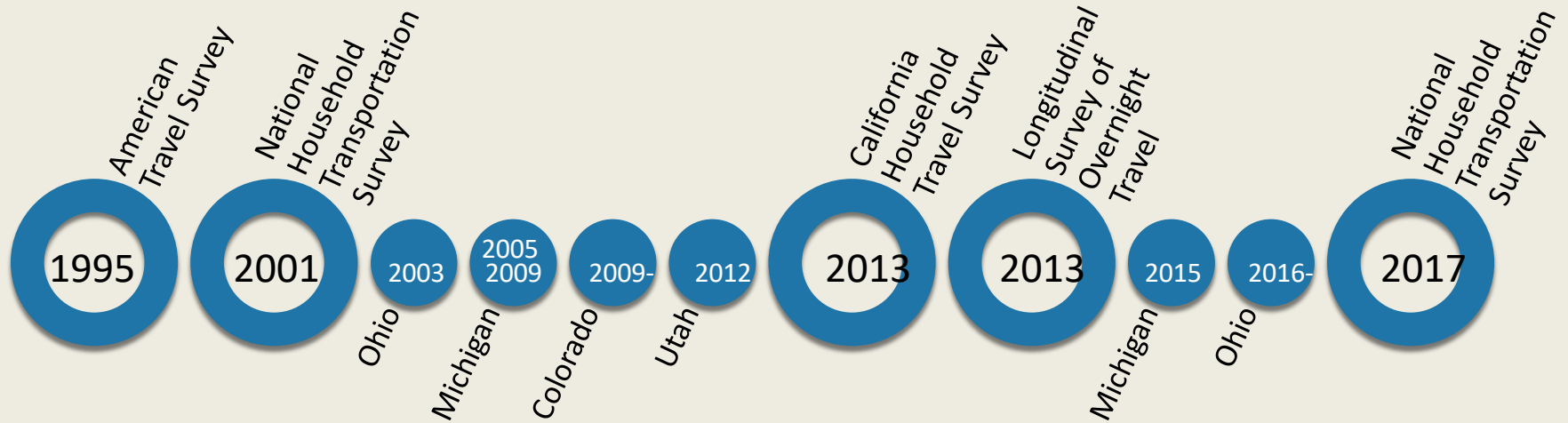
**50 miles???**

# THE PREMISE

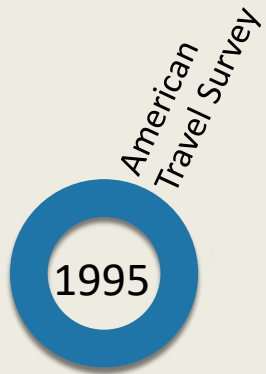
Creating a truly sustainable global transportation system requires a national travel demand model.

- Robust data
- Annual overnight activity framework
- Integration of surface and air modes

# US-BASED LONG-DISTANCE DATA COLLECTION

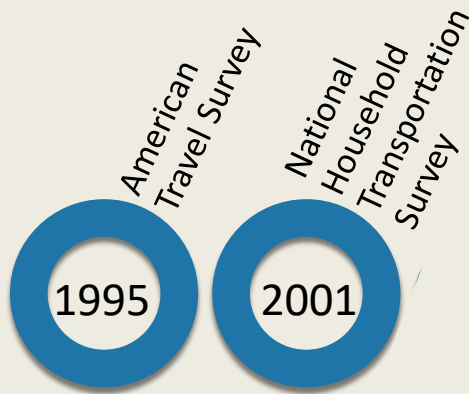


# US-BASED LONG-DISTANCE DATA COLLECTION



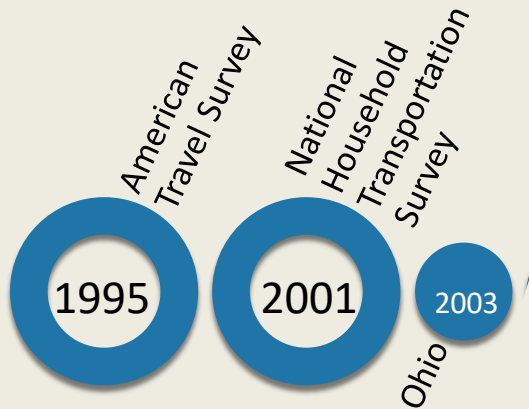
- national representative
- 80,000 households
- > 100 miles from home
- every three months for 1-year

# US-BASED LONG-DISTANCE DATA COLLECTION



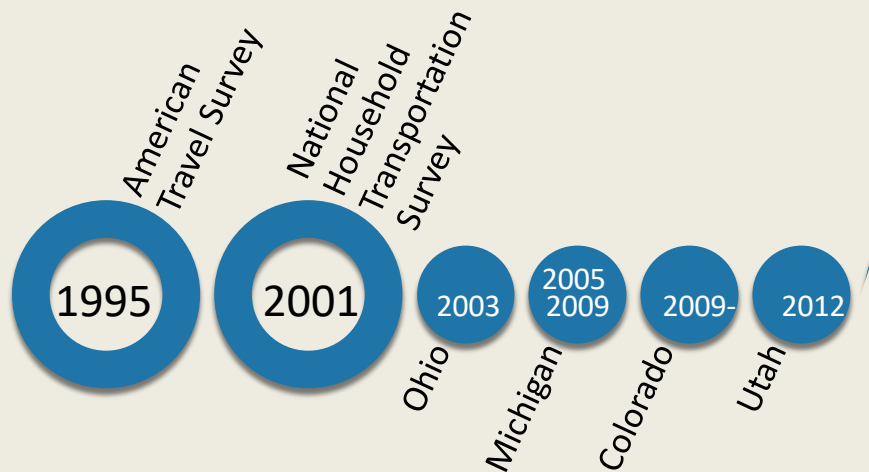
- 26,000 households nation-wide
- > 50 miles from home
- 4-week retrospective

# US-BASED LONG-DISTANCE DATA COLLECTION



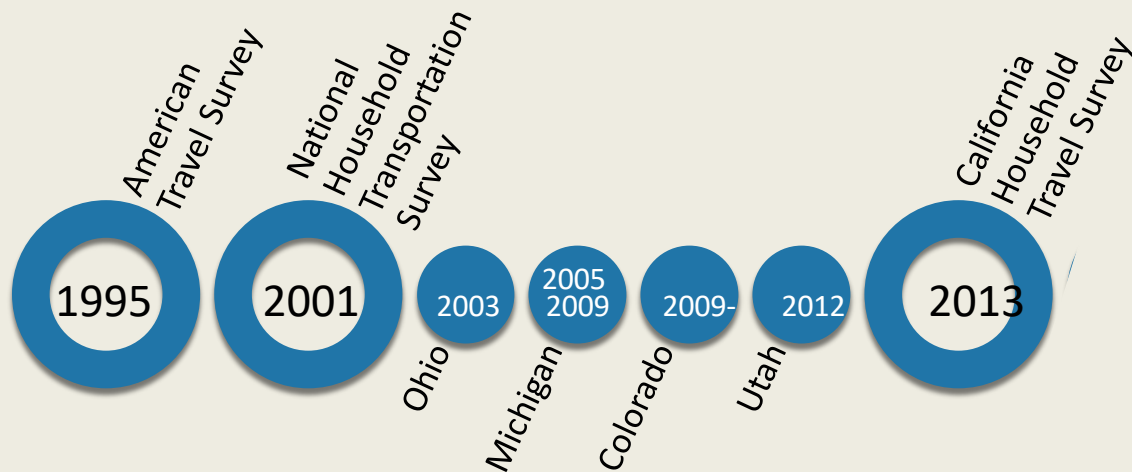
- 3 phases
- 8000 households (some non-traveling households excluded)
- Collected > 40-miles, used >50-miles
- 2- or 4-week retrospective

# US-BASED LONG-DISTANCE DATA COLLECTION



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

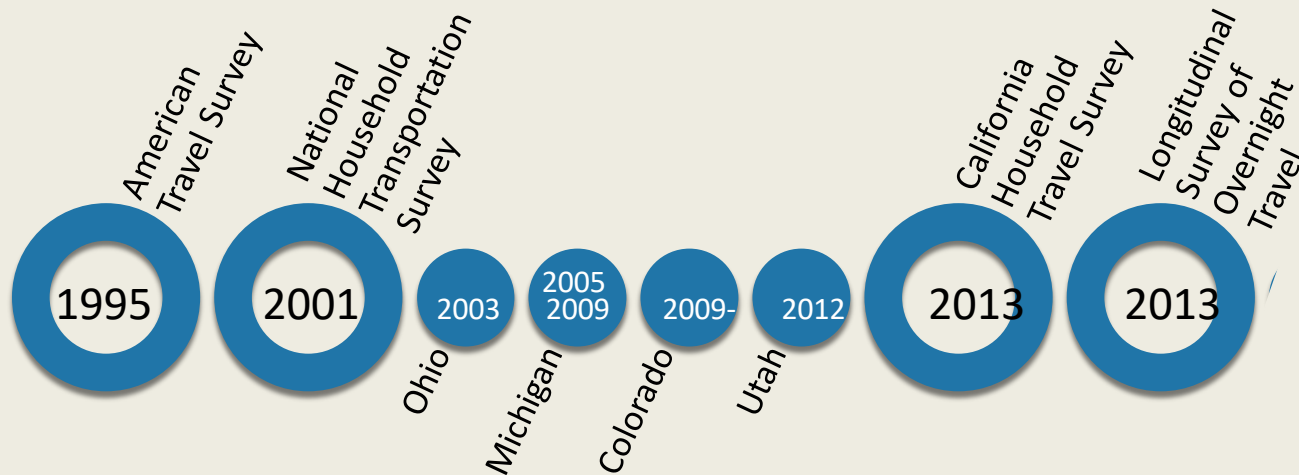
# US-BASED LONG-DISTANCE DATA COLLECTION



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

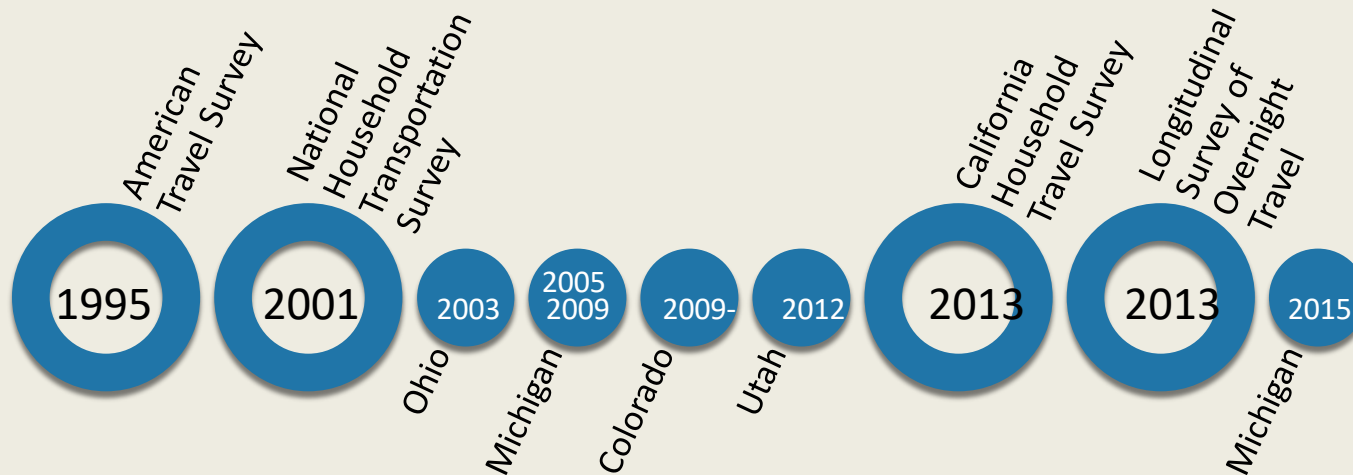
- Important Lessons learned
  - Burden
  - Study period vs recall

# US-BASED LONG-DISTANCE DATA COLLECTION



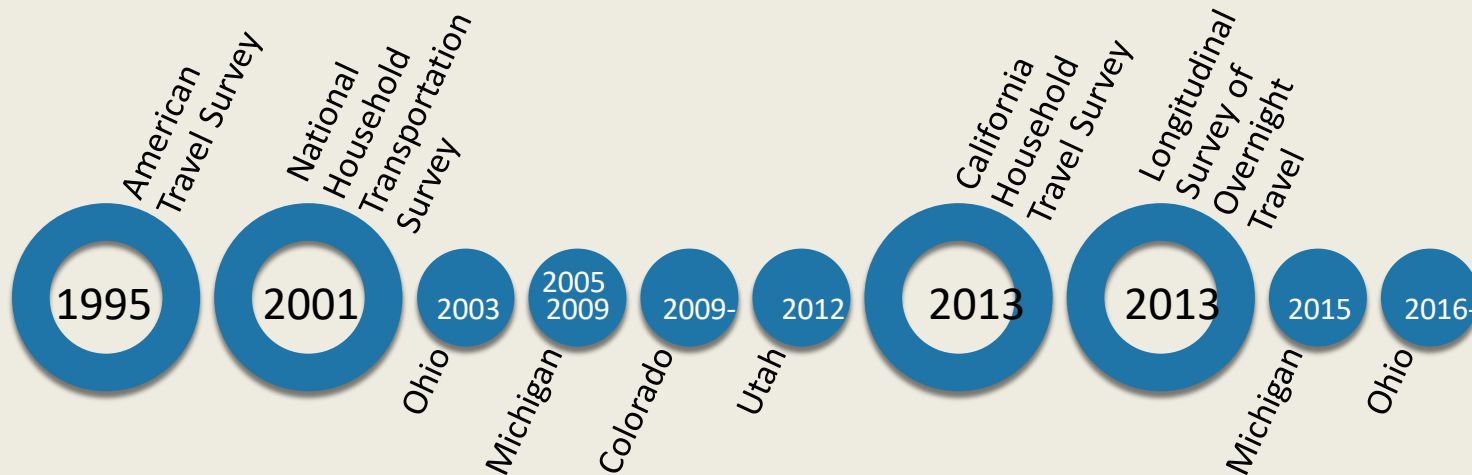
- 628 individuals (52% completed the panel)
- Overnight not distance-based
- Monthly for 1-year
- Web-based allowed geocoding of ODs

# US-BASED LONG-DISTANCE DATA COLLECTION



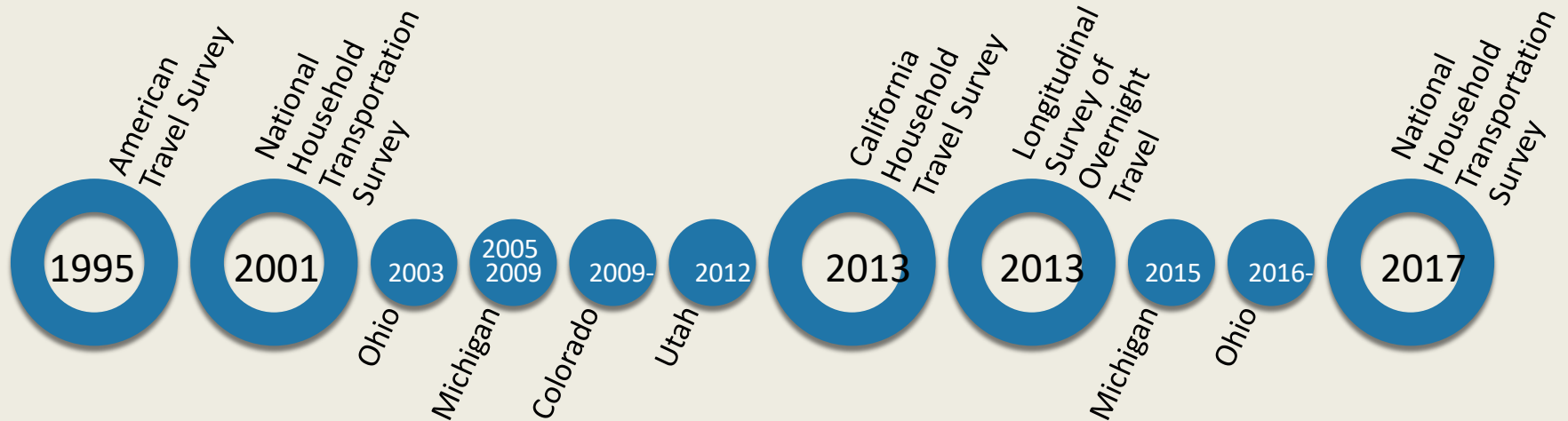
- >100-miles
- 3-month retrospective
- > 2000 trips

# US-BASED LONG-DISTANCE DATA COLLECTION



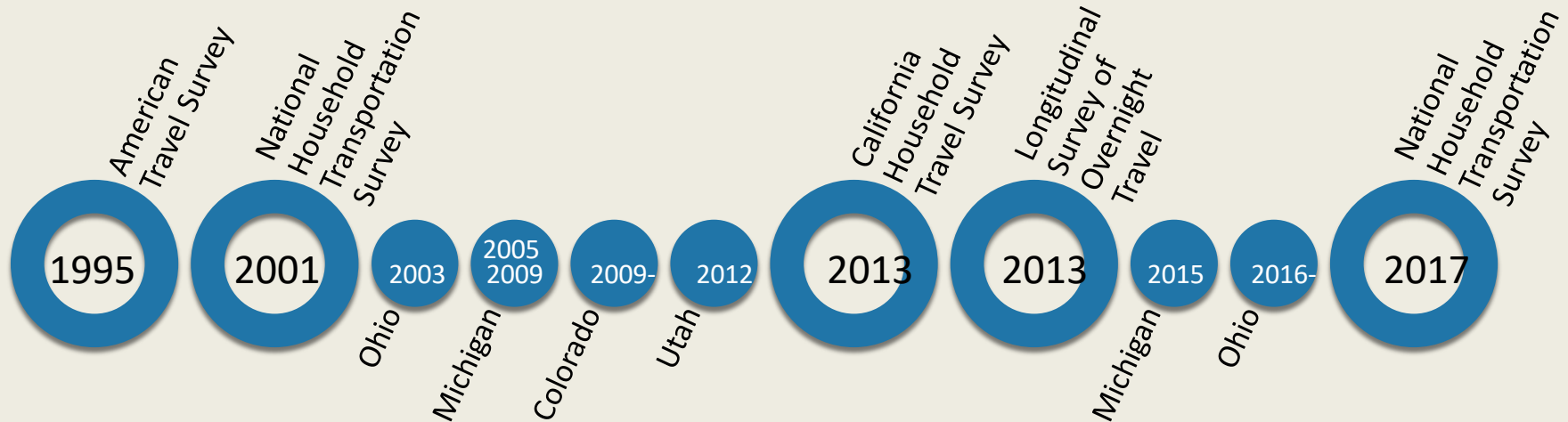
- use of *farMove* mobile app for long-distance
- rotating through 10 regions of Ohio
- > 40-miles from origin
- 6-months per person (3 waves rolling over 1-year)
- account for repeat trips

# US-BASED LONG-DISTANCE DATA COLLECTION



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

# 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

EUROPEAN LONG-DISTANCE DATA  
COLLECTION

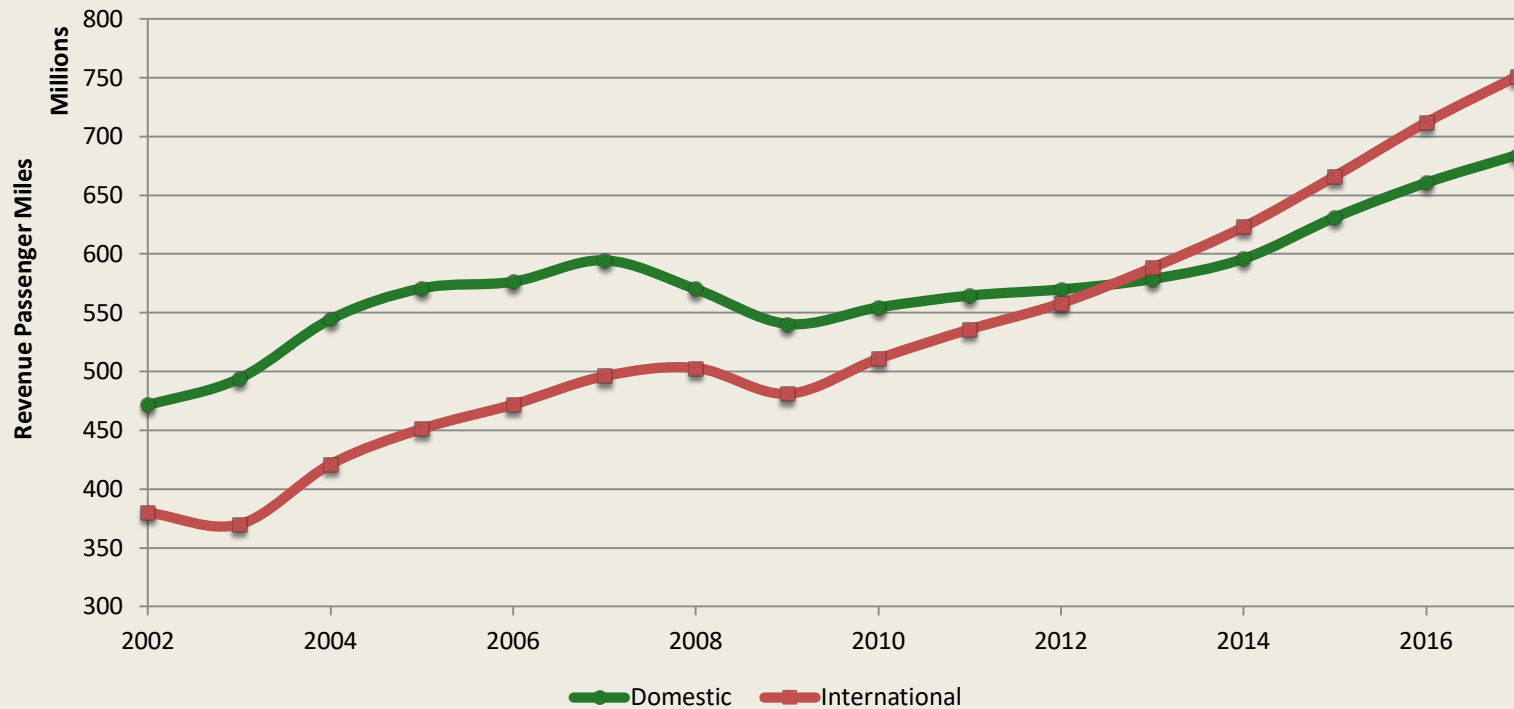
- National surveys since 1990s
- EU standardization efforts
- Often 100-km definition
- Often interviews and phone still feasible



# OUTLINE

1. What Exactly is Long-distance Travel? [L][SEP]
2. **Long-distance Travel Demand over Time** [L][SEP]
3. Sustainability: Emissions, Economy and Equity [L][SEP]
4. Prior Long-Distance Travel Research [L][SEP]
5. A Framework for Long-Distance Data Collection [L][SEP]

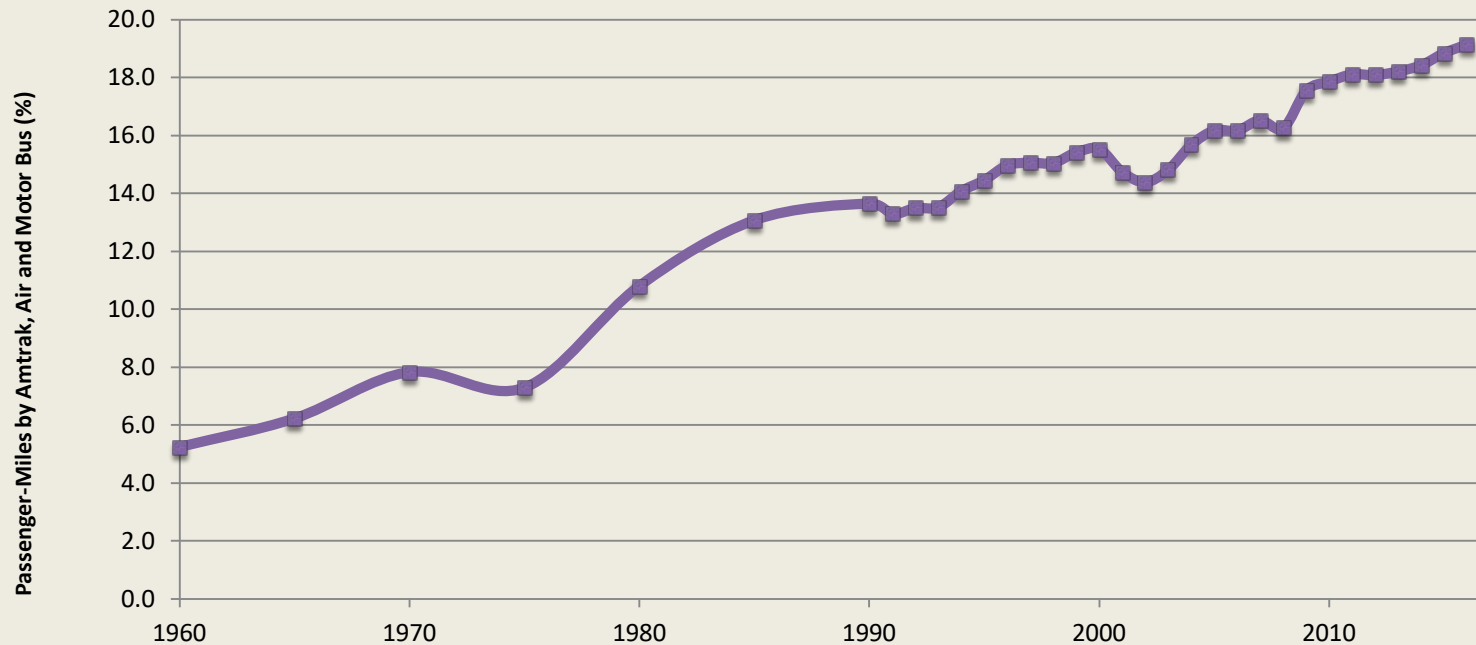
# AIR TRAVEL



**Figure 1: International and Domestic Air Revenue Passenger Miles**

(Source: USDOT BTS [https://www.transtats.bts.gov/Data\\_Elements.aspx?Data=3](https://www.transtats.bts.gov/Data_Elements.aspx?Data=3) accessed Sept 2018)

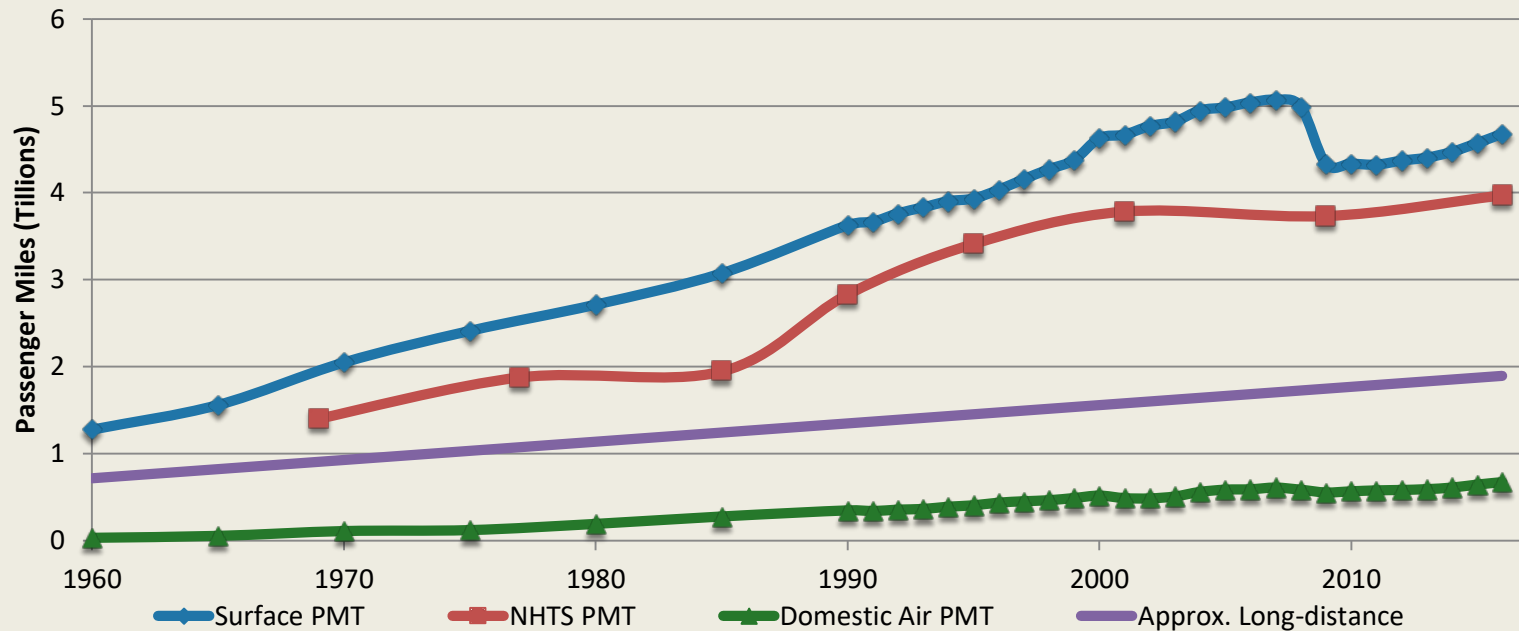
# RAIL, AIR AND MOTOR COACH



**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> - accessed September 2018

# INCORPORATING ALL MODES (30% OF PMT)



**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

# OUTLINE

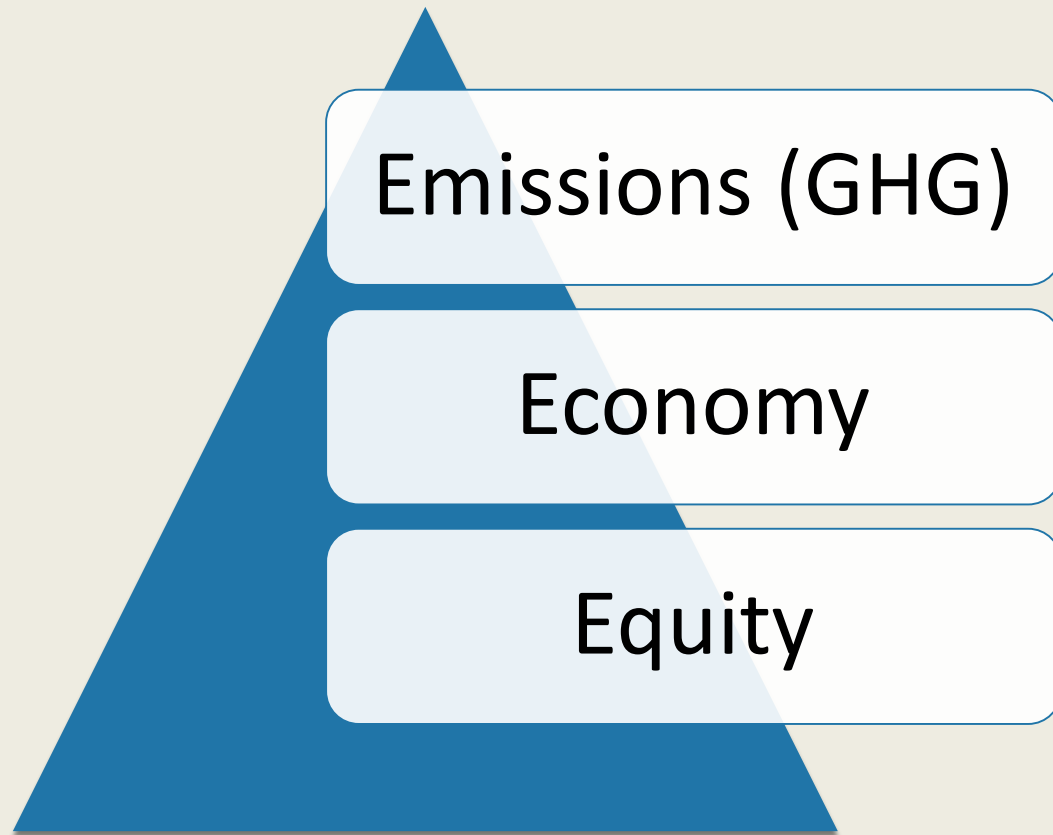
1. What Exactly is Long-distance Travel? [L][SEP]
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# IMPORTANCE OF LONG-DISTANCE TRAVEL

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

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

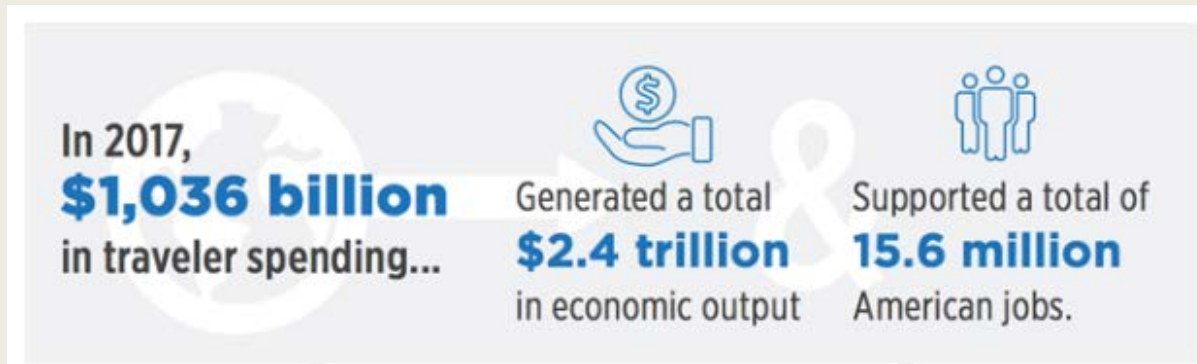
# PLANNING FOR SUSTAINABILITY



# LONG DISTANCE AND EMISSIONS (ENERGY)

- 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

# SUSTAINABILITY - ECONOMY

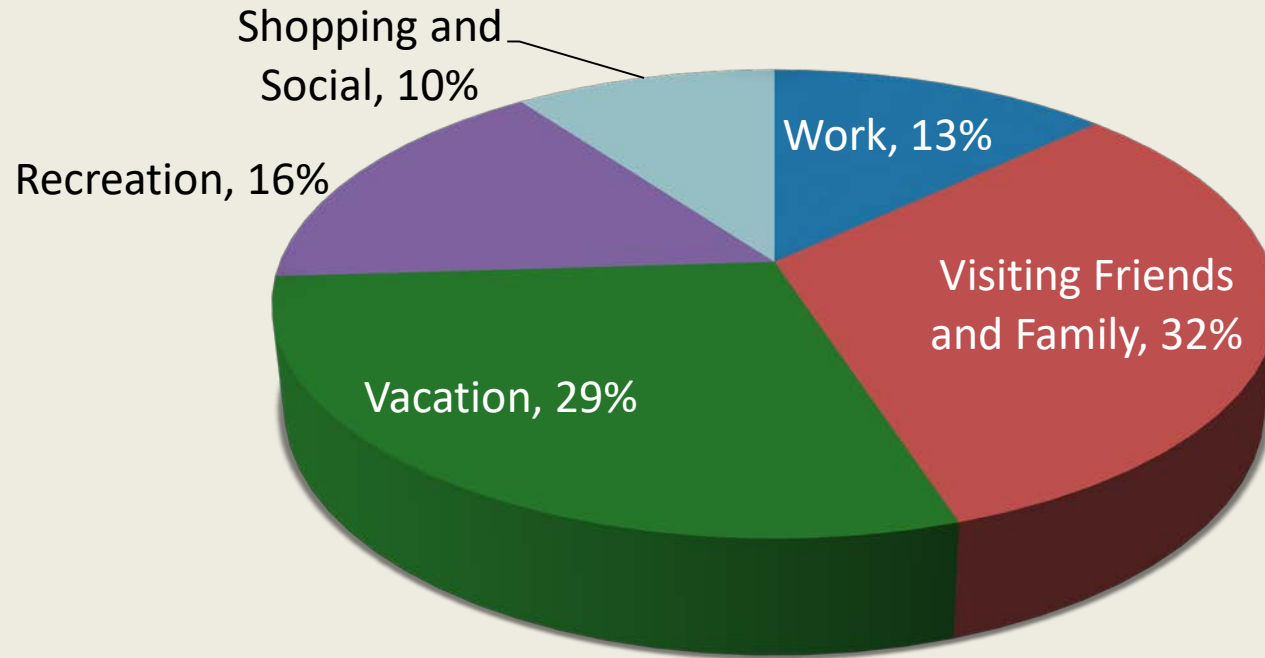


## THE BIG QUESTION:

Do passenger miles have to increase for economic growth?

GDP  $\approx$  VMT

# LONG DISTANCE AND SOCIAL EQUITY



Source: Michigan Travel Counts Survey 2015

# LONG DISTANCE TRAVEL & SOCIAL EQUITY

- 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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[SEP]
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# PRIOR LONG-DISTANCE TRAVEL RESEARCH

- Trip Rate – some descriptive results
- Trip Destination – little if any research
- Mode Choice – limited models

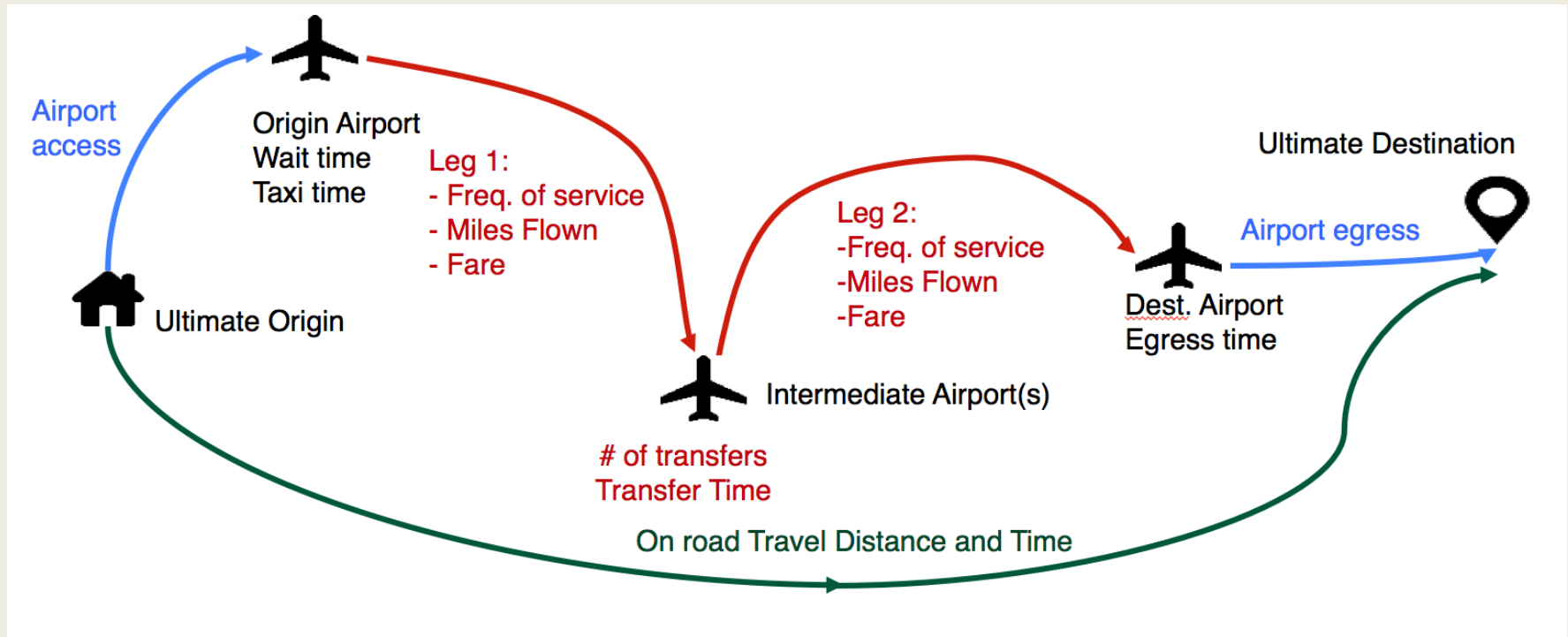
# TRIP RATE (1 OF 2)

| Socioeconomic Factor | Impact                                                                                                                                                                                                                                       | Select References                                                                                                                                                                      |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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<br>Georggi and Pendyala 2001 O'Neill and Brown 2001 McGuckin et al. 2016<br>Dargay and Clark 2012 Limtanakool et al. 2006a<br>Limtanakool et al. 2006b<br>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<br>Limtanakool et al. 2006a and 2006b<br>Gustafson 2006<br>Jeong et al. 2013<br>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<br>Bose et al. 2004<br>Anderson & Langmeyer 1982                                                                                                                    |

# TRIP RATE (2 OF 2)

| Socioeconomic Factor      | Impact                                                                                                                                                                                                                               | Select References                                                                                                 |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Children in the Household | 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. | Aultman-Hall et al. 2016 Dargay and Clark 2012 Davison and Ryley 2013 McGuckin et al. 2016                        |
| Urban versus Rural        | 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.               | Holz-Rau et al. 2014<br>Berliner et al. 2018<br>Limtanakool et al. 2006b<br>Naess 2006<br>Czepkiewicz et al. 2018 |
| Work                      | Those who travel for work may have more total trips but not necessarily fewer personal trips.                                                                                                                                        | Aultman-Hall et al. 2016                                                                                          |

# MODE CHOICE



# MODE CHOICE

- 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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# THE FUTURE NATIONAL MODEL

- 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 LD DATA AND ITS USES



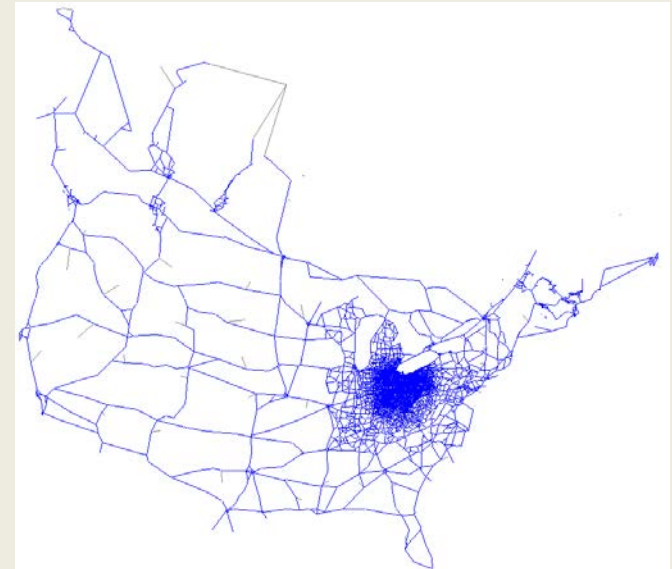
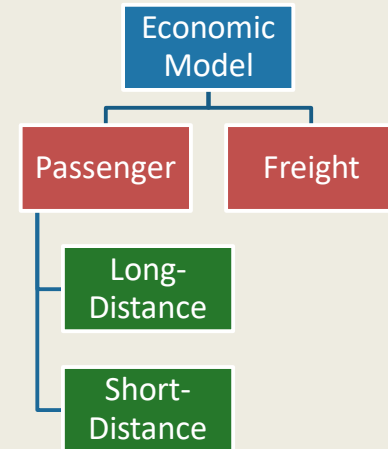
## ■ Ohio:

- 4<sup>th</sup> largest interstate lane-miles (8,129)
- 5<sup>th</sup> 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 (8<sup>th</sup> in USA, 28<sup>th</sup> in world)

# OHIO STATEWIDE MODEL

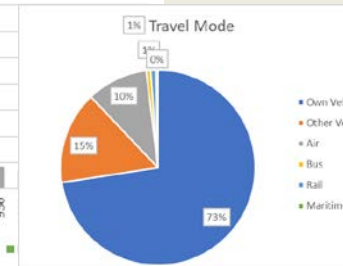
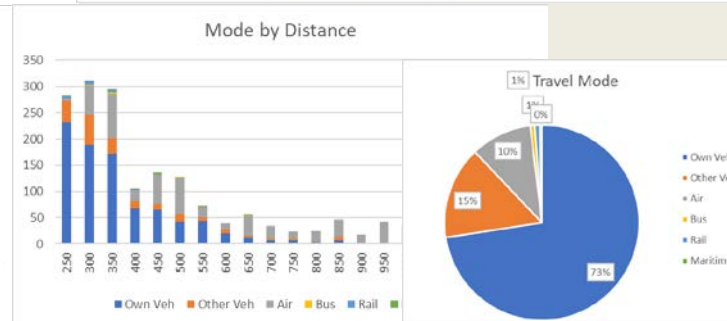
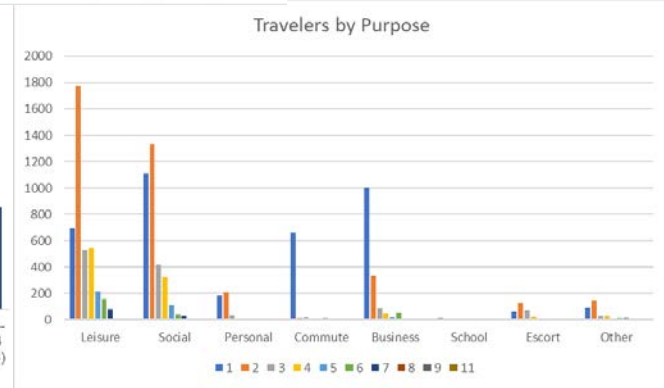
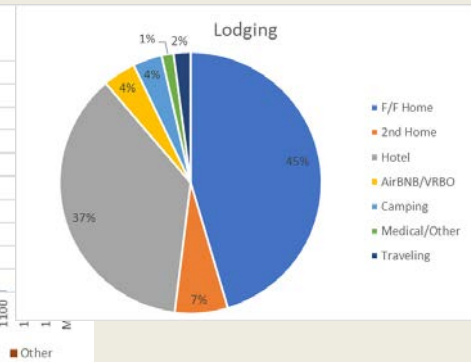
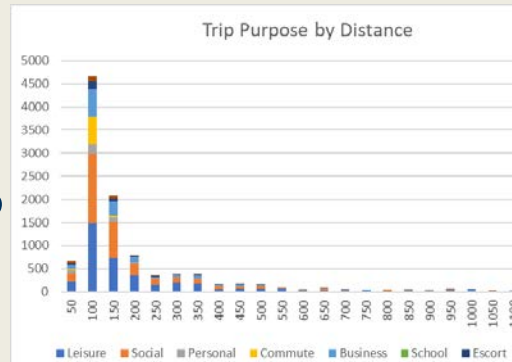
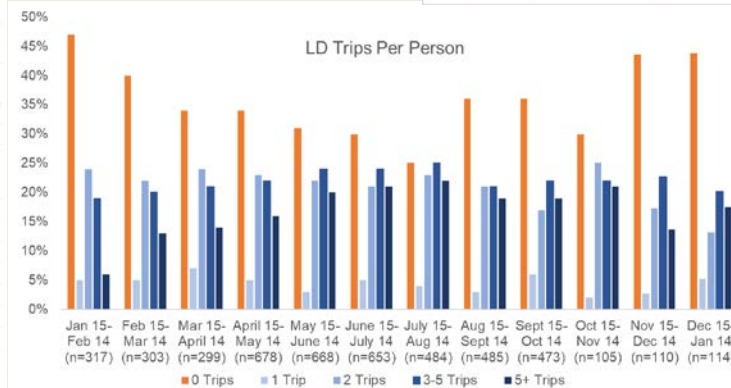
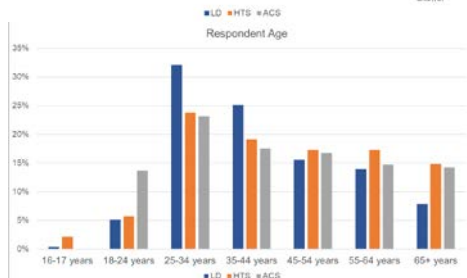
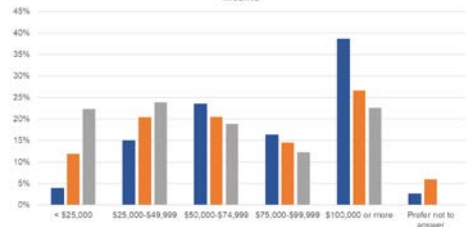
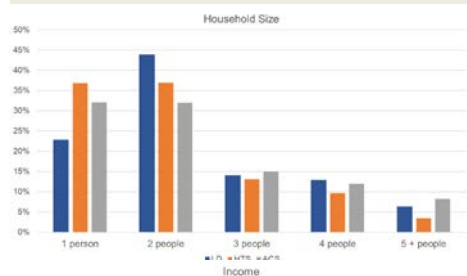
## ■ Disaggregate Tour-Based Travel Demand Model

- 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



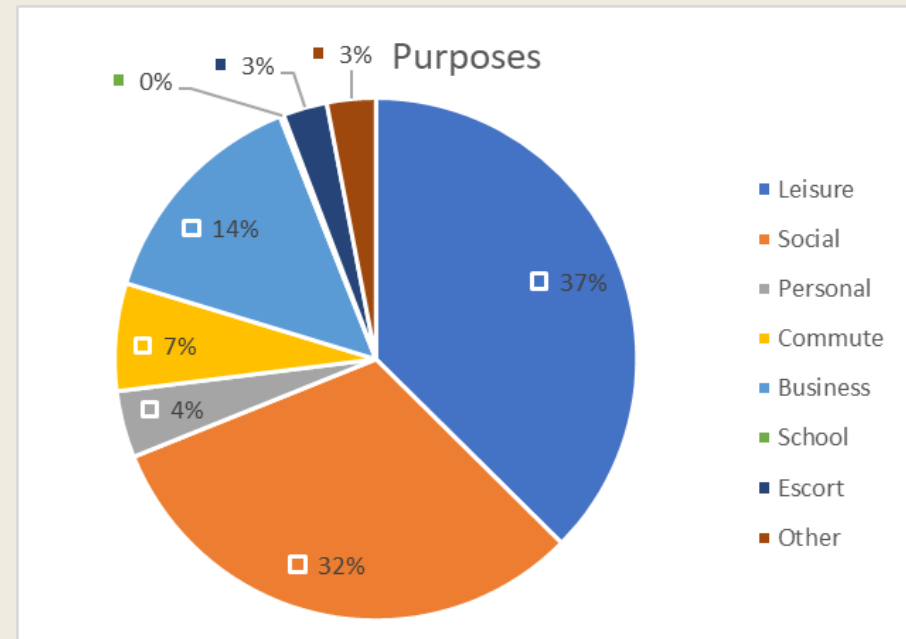
# OHIO LD SURVEY DATA (YEAR 1 UNWEIGHTED)

- Own Smartphone
- Completed 1 week HTS



# MEDICAL/PERSONAL BUSINESS TRIPS

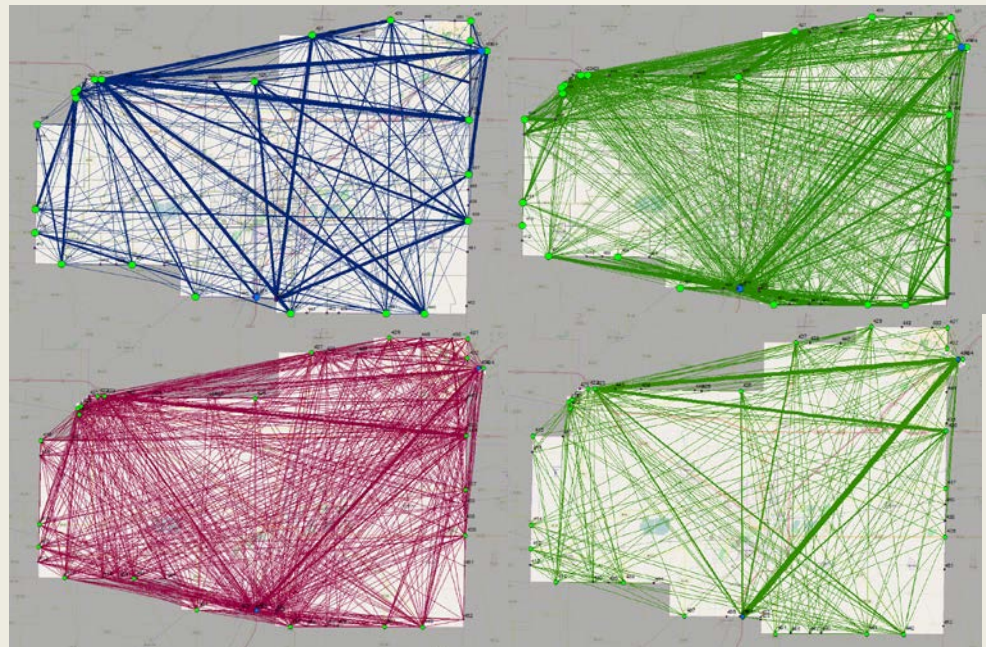
- Internet has made it easier to find medical specialists
- 4% of LD trips
- 1.5% of overnight lodging is medical facilities



# 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

Lima EE Trips - Survey (Blue) and Three Providers

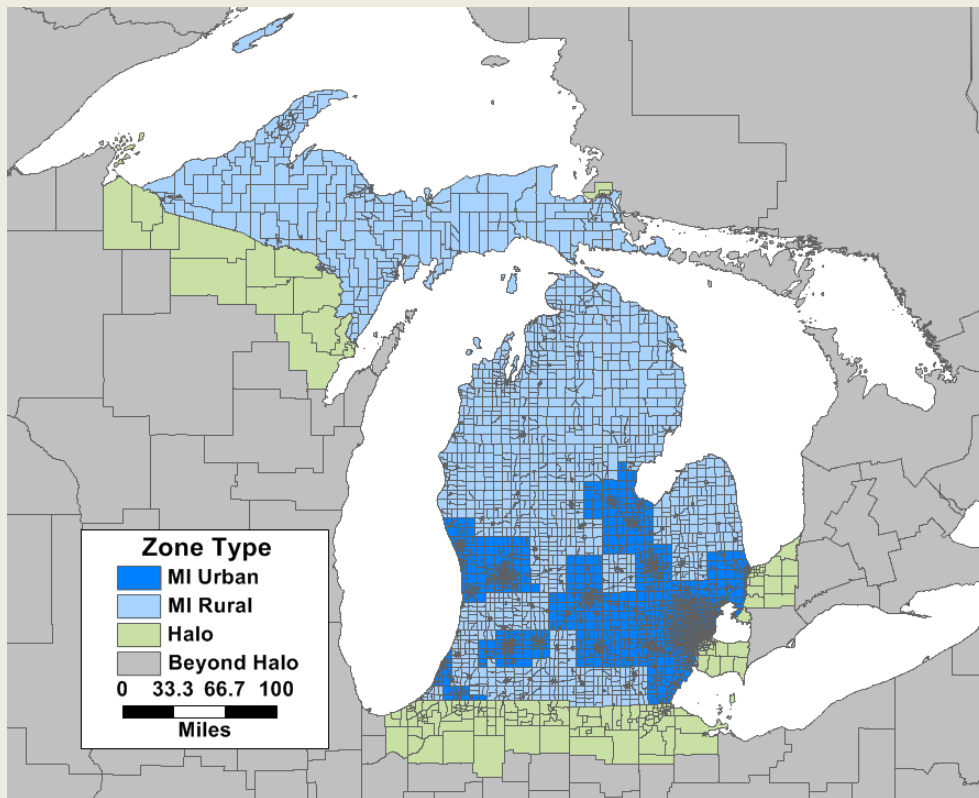


# MICHIGAN



- ~10 million population
- 101.7 Annual Vehicle Miles of Travel in 2017
- 122,032 Miles of public roads (10<sup>th</sup> 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

## Long Distance Travel Log

Michigan's transportation planning community is interested in the way people travel when they leave their home region. As part of your participation in the MI Travel Counts survey, you and the members of your household are being asked to provide information about all of the long distance trips made in the past 3 months.

- Use this log to gather information about all of the long distance trips made in the **past 3 months**.
- A long distance trip is a visit to any place at least **100 miles** from your home.
- If the trip included visits to multiple places, **record the place that was the farthest** from your home.
- Remember to include all trips made by **every member of your household**.
- If the same trip is made more than once, **record the trip once and indicate the number of times** in the last column.
- You will be asked to report this information during the follow-up survey.



### Questions?

[www.MITravelCounts.com](http://www.MITravelCounts.com)

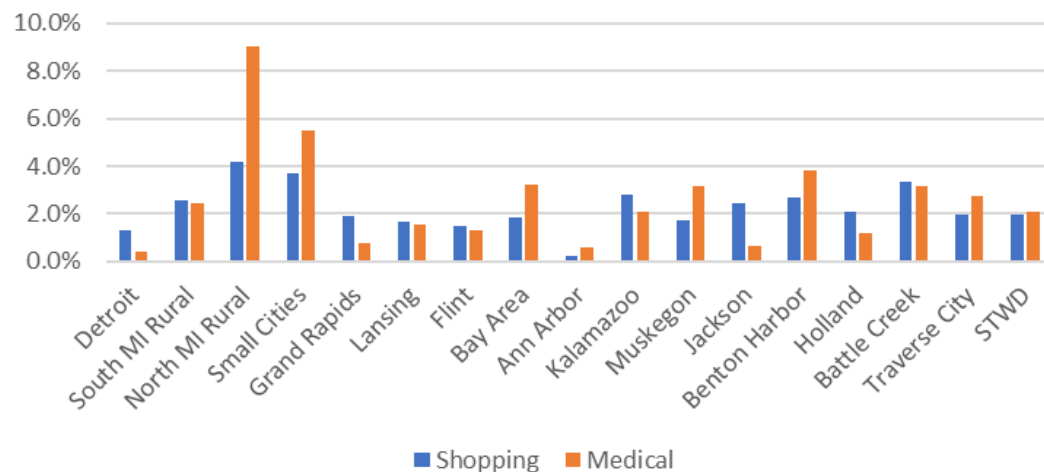
1-855-774-1800

| Long Distance Trip Number | Destination/ Place visited | Which household members went on this trip? | Departure date/ Trip start date | Return date/ Trip end date | What was the main reason for going on this trip? | How did the people on this trip...           |                                                      | How many times has this trip been made in the last 3 months? (If more than 1 time, do not record this trip again) |
|---------------------------|----------------------------|--------------------------------------------|---------------------------------|----------------------------|--------------------------------------------------|----------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
|                           |                            |                                            |                                 |                            |                                                  | Get there? (e.g., car, train, airplane, bus) | Get around during the visit? (e.g., taxi, car, walk) |                                                                                                                   |
| 1                         | City, State:               | Names:                                     | ___ / ___ / ___                 | ___ / ___ / ___            |                                                  |                                              |                                                      |                                                                                                                   |
| 2                         | City, State:               | Names:                                     | ___ / ___ / ___                 | ___ / ___ / ___            |                                                  |                                              |                                                      |                                                                                                                   |
| 3                         | City, State:               | Names:                                     | ___ / ___ / ___                 | ___ / ___ / ___            |                                                  |                                              |                                                      |                                                                                                                   |
| 4                         | City, State:               | Names:                                     | ___ / ___ / ___                 | ___ / ___ / ___            |                                                  |                                              |                                                      |                                                                                                                   |
| 5                         | City, State:               | Names:                                     | ___ / ___ / ___                 | ___ / ___ / ___            |                                                  |                                              |                                                      |                                                                                                                   |
| 6                         | City, State:               | Names:                                     | ___ / ___ / ___                 | ___ / ___ / ___            |                                                  |                                              |                                                      |                                                                                                                   |
| 7                         | City, State:               | Names:                                     | ___ / ___ / ___                 | ___ / ___ / ___            |                                                  |                                              |                                                      |                                                                                                                   |

- Retrospective component of 3 household travel surveys – 2004-2005, 2009, 2015
- Respondents reported all trips >100 miles from home in past 3 months
- Includes mode to destination, mode at destination, purpose, duration, and household members

# SELECTED MI LD CHARACTERISTICS

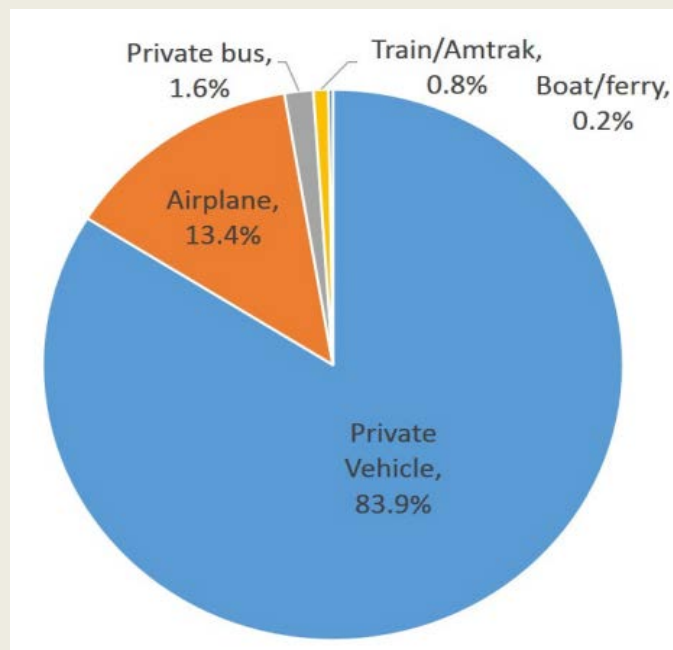
Percent of LD Trips for Shopping or Medical by Area



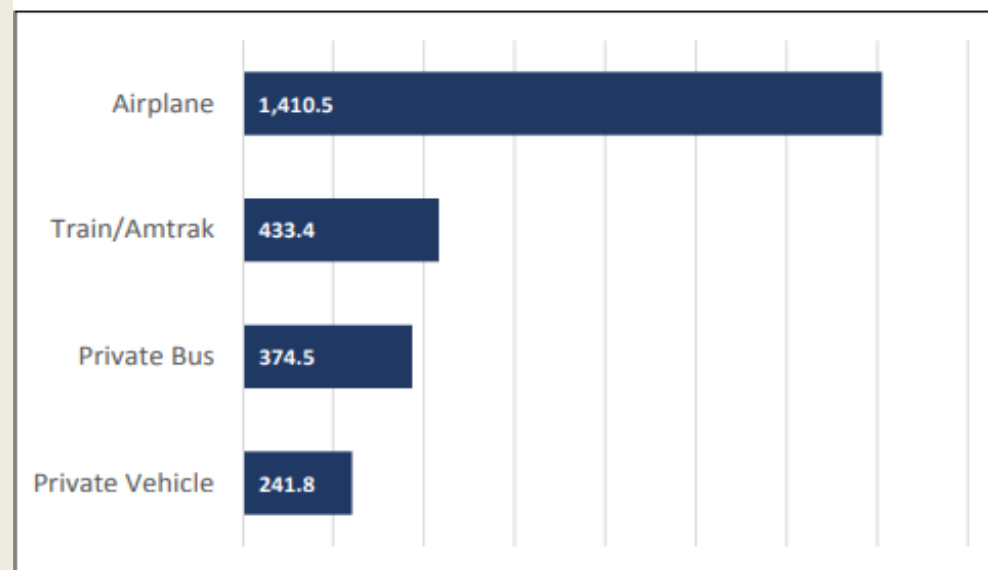
| Destination           | Percent of LD Trips |
|-----------------------|---------------------|
| Michigan              | 53.3%               |
| Illinois              | 6.4%                |
| Florida               | 6.0%                |
| Ohio                  | 5.8%                |
| Indiana               | 4.0%                |
| Wisconsin             | 2.2%                |
| Tennessee             | 1.7%                |
| California            | 1.3%                |
| Ontario, Canada       | 1.3%                |
| Pennsylvania          | 1.2%                |
| Texas                 | 1.1%                |
| Kentucky              | 1.1%                |
| New York              | 1.0%                |
| All Others (each <1%) | 15.0%               |

- 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

# SELECTED MI LD CHARACTERISTICS

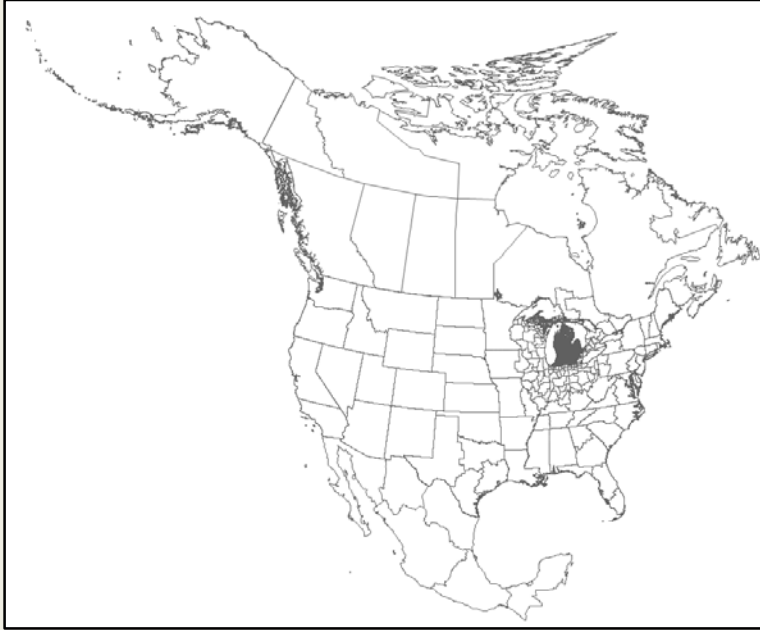


1. Average distance in miles by means of travel for long-distance trips



- 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

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

National Center for Sustainable Transportation

[ncst.ucdavis.edu](http://ncst.ucdavis.edu)

UVM Transportation Research Center

[uvm.edu/trc](http://uvm.edu/trc)

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