7TH TRB INNOVATIONS IN TRAVEL MODELING CONFERENCE

Lessons learned

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Background

- 7th Transportation Research Board (TRB) Innovations in Travel Modeling Conference
  - Atlanta, Georgia, June 24-27, 2018
  - Conference series
    - Held every two years since 2006
    - Intended to bridge the gap between research and practice in travel demand modeling
- Major themes this year
  - Connected and autonomous vehicles (CAVs or AVs)
  - Transportation network companies (TNCs)/ride-hailing services, such as Uber and Lyft
  - Big data/data-driven modeling

Findings: Incorporating CAVs into models

- Quotes from presenters
  - "It's all speculative, since no one owns one [a CAV] at this time." Well-known consultant
  - "We cannot forecast CAVs at this point." Another well-known consultant
  - "Even our best ABMs are not ready to model CAVs." Well-known professor from a university in the Mid-West

Image credit: Mark Moran, 2018

Findings: CAVs in four-step models

- Presentation by Chandra Bhat, U. of Texas at Austin: “Incorporating Connected and Autonomous Vehicles and Ride-Hailing Services in the Traditional Four-Step Model.”
  - Work done for North Central Texas COG, Dallas-Fort Worth
  - NCTCOG wants to fix data quality first, before moving to an activity-based model (ABM)
  - Examples
    - Trip generation: Distinguish between HHs with & without an AV => two different sets of trip production rates
    - Traffic assignment: Rather than change assumed link capacities, they changed assumptions about vehicle densities
  - Made use of a stated-preference (SP) survey, Dallas-Fort Worth area

Findings: CAVs in four-step models

- Although not presented at conference, there has been other work to modify a traditional, **four-step travel demand model to reflect CAVs**:
  - Work done by Fehr & Peers and the Union of Concerned Scientists
  - F&P and UCS have written a draft paper that they plan to submit to 98th Annual Meeting of the TRB:
    - Jesse Cohn et al., "Examining the Equity Impacts of Autonomous Vehicles – A Travel Demand Model Approach," 2018 (paper not yet available to the public)
  - Used scenario analysis to model six different future scenarios with CAVs in the Washington, DC area, with an emphasis on the effect on social equity/environmental justice
  - Used COG/TPB Ver. 2.3.70 model
  - I am one of 13 members of a steering committee for the research

Findings: CAVs in ABMs

- Presentation by Mark Bradley, RSG: “Using an Activity-Based Model with Dynamic Traffic Simulation to Explore Scenarios for Private and Shared Autonomous Vehicle Use in Jacksonville [Florida]”
  - Used of DaySim (ABM) and Caliper TransModeler (DTA)
  - Improvements made to DaySim:
    - Auto ownership model includes choice between conventional and autonomous private vehicles
    - Ride-hailing/TNC added to mode choice
    - TNCs can be specified to use AVs
    - AV passengers can have lower disutility of travel time
  - Also used Exploratory Modeling and Analysis (EMA) to deal with risk and uncertainty

Findings: CAVs

- Presentation by Vince Bernardin, RSG: “A Framework for Modeling Connected and Autonomous Vehicles in the New Michigan Statewide Model”
  - Discussed sources of uncertainty in both demand & supply
  - Demand uncertainty
    - Market penetration and use of AVs
    - Level of carsharing and ridesharing as a substitute for private-use vehicles
    - Empty-vehicle or zero-occupancy vehicle (ZOV) trips
    - Overall household vehicle holdings
    - Changes to parking locations and behavior
    - Decreased disutility of travel time
    - Induced trip making

Findings: CAVs

- (Continued) Vince Bernardin, RSG
  - Supply uncertainty
    - Different capacity consumption by CAVs
    - Different speeds of CAVs
    - Provision of CAV infrastructure (e.g., smart signals, dedicated lanes, more/narrower lanes)
    - Frequency and severity of accidents
    - TNC CAV fleet sizes, depot locations, etc.

Image credit: Mark Moran, 2018

Findings: CAVs

- (Continued) Vince Bernardin, RSG
  - Six types of zero-occupancy trips
    - Private CAVs
      - Car sharing among household members (1)
      - To avoid paid parking
        - By parking at home (2)
        - By parking elsewhere (3)
        - By circulating instead of parking (4)
    - Shared CAVs (for-hire CAVs)
      - For passenger pick up/drop off (5)
      - Travel to/from depots (6), for re-charging, etc.

Findings: TNCs

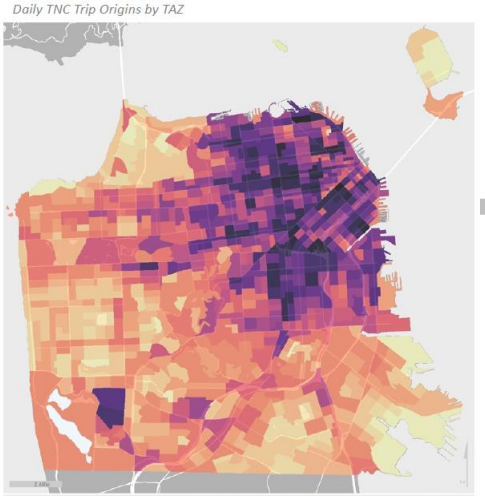

Image credit: SFCTA, 2017

- Presentation by Drew Cooper, San Francisco County Transportation Authority (SFCTA): "Using Big Data to Develop a Profile of TNCs."
  - SFCTA partnered with researchers from Northeastern University (Wilson and Mislove) to collect GPS data from Uber and Lyft.
  - TNC data was gathered by researchers using the Application Programming Interfaces (APIs) of Uber and Lyft, which show the locations of available vehicles to mobile apps.
  - Data provided SFCTA with origin-destination data for thousands of Uber and Lyft trips in 2016.
    - TNCs Today: A Profile of San Francisco Transportation Network Company Activity, Final Report (San Francisco County Transportation Authority, June 2017), http://www.sfcta.org/tncstoday.

Findings: TNCs

- (continued) Drew Cooper, SFCTA
  - **Finding**: Uber and Lyft accounts for about 15% of intra-San-Francisco vehicle trips.
  - **Questions and answers**
    - Q: Did SFCTA ever asked Uber and Lyft for the data?
    - A: Yes, but Uber said “no.” Also noted that, although Uber Movement provides Uber data to MPOs, the data provided by Uber Movement is not very detailed.
    - Q: Was the data collection technique legal?
    - A: SFCTA cleared everything with their legal counsel. Nonetheless, the web scraping methodology that was used is no longer allowed by Uber.

Findings: TNCs

Image credit: Uber, 2016

- Presentation by Jon Petersen, Uber Elevate
  - Uber plans to offer airborne taxi service (UberAIR).
  - Uber has partnered with five companies to build the aircraft
    - Will be a vertical take-off and landing (VTOL) aircraft, such as a quadcopter, or a tilt-rotor/tilt-wing vehicle
    - Quieter than traditional helicopter.
  - Will be tested in two U.S. cities (Dallas and Los Angeles) and a third international city
  - More information can be found in 2016 report by Uber.
  - Planning demonstration flights in 2020, and revenue service in 2023.

Findings: Big data

- Guy Rousseau, ARC
  - Performing work to update the external travel model with AirSage data.
    - Appears to be similar to work that we (Ron) did with AirSage data in 2014 and 2015.
    - Plans to make this data public, posting it on the web, at some point.
  - Also discussed updating volume-delay functions (VDFs), which he now calls Volume-Delay-Reliability functions (VDRFs), using NPMRDS data from 2015-16 (SHRP2 L04).

Findings: Big data

- Presentation by Vince Bernardin, RSG: “Overview of Methods for Validation and Expansion of Passively Collected Origin-Destination Data.”
  - Most Location-Based Services (LBS) data comes from one of three sources: 1) cellular tower signaling; 2) GPS; and 3) Wi-Fi beacons.
  - He discussed the pros and cons of each source
  - He displayed the power of big data with the following example: Tennessee statewide travel model
    - Survey data from the NHTS and four MPOs
      - **Sample size: 0.3%** (in terms of trip table O-D pairs)
    - Big Data (AirSage)
      - **Sample size: 26.3%**

Findings: Big data

- (continued) “Overview of Methods for Validation and Expansion of Passively Collected Origin-Destination Data.”
  - Despite the advantages of big data, there are, nonetheless, drawbacks, including cost, black-box nature, and missing data:
    - Travel mode
    - Trip purpose
    - Traveler characteristics
- Consensus from conference participants: Big data will not replace traditional household travel surveys/transit surveys, but it should be used in concert with these, for synergistic effects.

Findings: Local interest

- Presentation by Jonathan Avner, WRA: "Successes in Multi-Resolution Modeling Case Study 2: Project Ranking and Prioritization using Maryland Department of Transportation's State Highway Administration's Multi-Resolution Modeling System"
  - He talked about the benefits of multi-resolution modeling.
  - Showed examples of two road projects in Maryland: 1) Widening of Maryland Route 32; 2) I-270 Innovative Congestion Management (ICM).

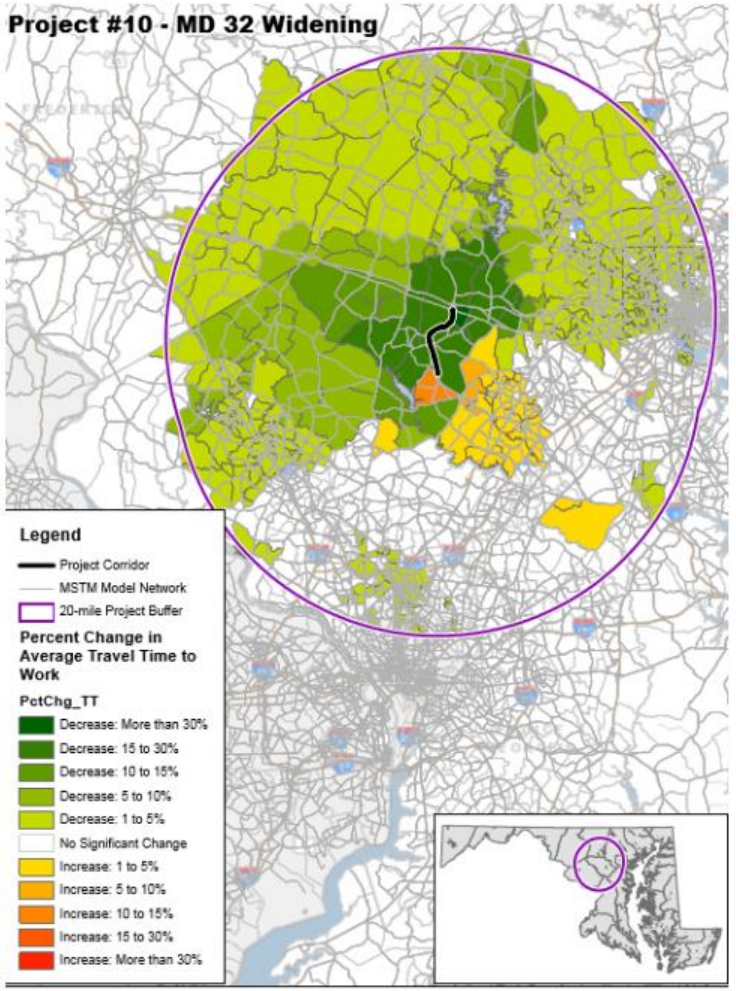

Image credit: WRA, 2018

Findings: Local interest

- Presentation by Feng Liu, Cambridge Systematics, Inc.: “Development of Virginia Statewide Transportation Model”
  - Model includes Maryland and parts of bordering states (i.e., PA, WV, KY, and NC)
  - Includes person travel, truck travel, and transit assignment
  - Used a consistent framework for both short- and long-distance passenger travel markets, using a logit-based model structure.
  - Used survey data from the National Household Travel Survey (NHTS).
  - Also used big data for model development and validation: special generators, external travel, and intra-state truck trips.
  - Model also features value-of-time segmentation

Final thoughts

- Many interesting topics, often in three parallel sessions
- Presentation slides were uploaded to the conference website on July 19, 2018
- Questions?
- Thoughts from other participants?

Image credit: Mark Moran, 2018

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