National Traffic Dataset Applications for Air Quality Analysis

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Southern Transportation Air Quality Summit (STAQS)

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• Ongoing Research Project: “National Traffic Dataset Applications for Air Quality and Noise Analysis”
• Contractors: Cambridge Systematics with ERG and AECOM
• Initial task to combine 3 FHWA databases
• Four Potential Applications
  – Two air quality applications (covered later)
  – Two noise applications (not covered)
    • Noise Worst-Case Hour Determination
    • 24-hour Traffic Distribution for Noise Analysis
Outline

- Background
- Data Sources
- Building a Combined Database
- Air Quality Applications
BACKGROUND
Background

- **Data Availability**
  - FHWA - National Performance Management Research Dataset (NPMRDS)
  - Probe based data in general – some locations using this data for AQ
- **National Database**
  - Reduce data collection burden for State DOT and MPOs
  - Improve consistency
- **Other Research by NCHRP, CRC, and EPA**
  to use telematics data for MOVES

Source: https://en.wikipedia.org/wiki/National_Highway_System_(United_States)
Data Sources

- **NPMRDS**: Auto and truck speeds by segment
- **HPMS**: Auto and truck volumes by segment
- **TMAS**: Vehicle mix by road type and time period
- **MOVES**: Emission rates

The data sources are aggregated into a **Traffic Database**, which is then combined into a **Combined Database**.
National Performance Management Research Dataset (NPMRDS)

- A package of vehicle probe data procured by FHWA
  - 1st procurement (NPMRDS v1): July 2013
  - 2nd procurement (NPMRDS v2): April 2017
- Archived travel time and speed;
- AADT(if available) is conflated from HPMS
- Resolution: 5-minute intervals on over 400,000 TMC segments
- Coverage: National Highway System, 26 border crossings
- Travel time and speed by vehicle type:
  - Passenger vehicles
  - Trucks
  - All (passenger vehicles and trucks)
Note: Alaska, Hawaii, and Puerto Rico also have TMC shapefiles that are not shown here.
Highway Performance Monitoring System (HPMS)

- Developed in 1978
- Roadway condition & performance data
- Used to help determine apportionment of Federal-aid funds
- Key source of data for Conditions & Performance (C&P) Report to Congress
- Relevant data fields:
  - AADT
  - Single Unit Truck AADT
  - Combination Truck AADT
Internal FHWA data program for development of policies and regulations.

Monthly data are published in the Traffic Volume Trends (TVT) report

6,000 continuous monitoring sites – volume
  – 2,400 also monitor vehicle class
  – About 550 also monitor truck weight

Vehicle class data being used for this project

Archived volume data publicly available at: https://www.fhwa.dot.gov/policyinformation/tables/tmasdata/
TMAS Traffic Monitoring Stations

BUILDING A COMBINED DATABASE
Building a Combined Database

- HPMS data already conflated onto NPMRDS network
- Four tiers of matching TMAS point data to NPMRDS line network
  - Tier 1: Near exact location match
  - Tier 2: Matching on county and route
  - Tier 3: Matching on statewide average by functional class
  - Tier 4: Matching on national average by functional class
- Lookup classification data by peaking, month, weekday/weekend, and hour
<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geographic Coverage</strong></td>
</tr>
<tr>
<td>3 states (OH, CO, NC)</td>
</tr>
<tr>
<td><strong>Years of Data</strong></td>
</tr>
<tr>
<td>1 year (2017 NPMRDS, 2015 HPMS &amp; TMAS)</td>
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<tr>
<td><strong>Conflation Used</strong></td>
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<tr>
<td>NPMRDS v2 work (HPMS data onto NPMRDS network)</td>
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<tr>
<td><strong>Geographic Unit</strong></td>
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<tr>
<td>TMCs from NPRMDS Network</td>
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<tr>
<td><strong>Time Aggregation</strong></td>
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<tr>
<td>Hourly Level</td>
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Phase 1 States

- Selection Factors
  - #
  - U
  - G
  - D
- States
  - OH
  - CO
  - NC
### Size of Data

- 24 hours/day * 365 days/year = 8,760 lines (rows) of data per TMC per year
- 44 fields (columns)

<table>
<thead>
<tr>
<th>State</th>
<th>TMCs</th>
<th>Lines of Data – 1 year</th>
<th>Data Size (GB) - 1 year</th>
<th>Data Size (GB) - 3 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohio</td>
<td>13,777</td>
<td>120,686,520</td>
<td>22.8</td>
<td>68.4</td>
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<tr>
<td>North Carolina</td>
<td>12,004</td>
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<td>Colorado</td>
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<td>56,563,320</td>
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<td>United States (estimate)</td>
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<td>3,372,600,000</td>
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<td>2,021.6</td>
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<td>Excel Limit</td>
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<td>Access Limit</td>
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</tbody>
</table>

~2 TB of data!
Example of Portion of GUI Tool
AIR QUALITY APPLICATIONS
• Link-level database could potentially be used for project-level air quality analysis since it will have VMT by vehicle type and speeds
• Emission rates will be matched to links in the combined database based on:
  – State
  – Road type
  – Vehicle type
  – Speed
• Use combined link-level database to calculate MOVES inputs for every county:
  – Average Speed Distribution;
  – Vehicle Type VMT following the (HPMSVTypeYear format);
  – Road Type Distribution;
  – Hour VMT Fraction;
  – Day VMT Fraction; and
  – Month VMT Fraction.
• Could potentially be used for regional air quality modeling
Questions?

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