Case Studies in Project-Level Mobile Source Air Toxics Analysis

presented to

Northern Transportation Air Quality Summit

presented by

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Objectives

- Summarize published case studies - prepared under contract to FHWA
- Highlight how project sponsors approached various aspects of modeling MSAT emissions estimates at the project level
  - Including the affect network and MOVES inputs
- Identify lessons learned from analyses
- Inform potential updates to FHWA's *Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents*

FHWA's Interim Guidance

- Published 2009; updated 2012 and 2016 (pending)
- Advises how and when to analyze MSAT under the NEPA review process for highway projects
- ***Quantitative analysis*** recommended for projects with higher potential MSAT effects
  - Major intermodal freight facility; or
  - New/added capacity where AADT > 140,000-150,000; and
  - Proximate to populated areas
- FAQs with additional technical guidance issued October 2015

Key FAQ Provisions

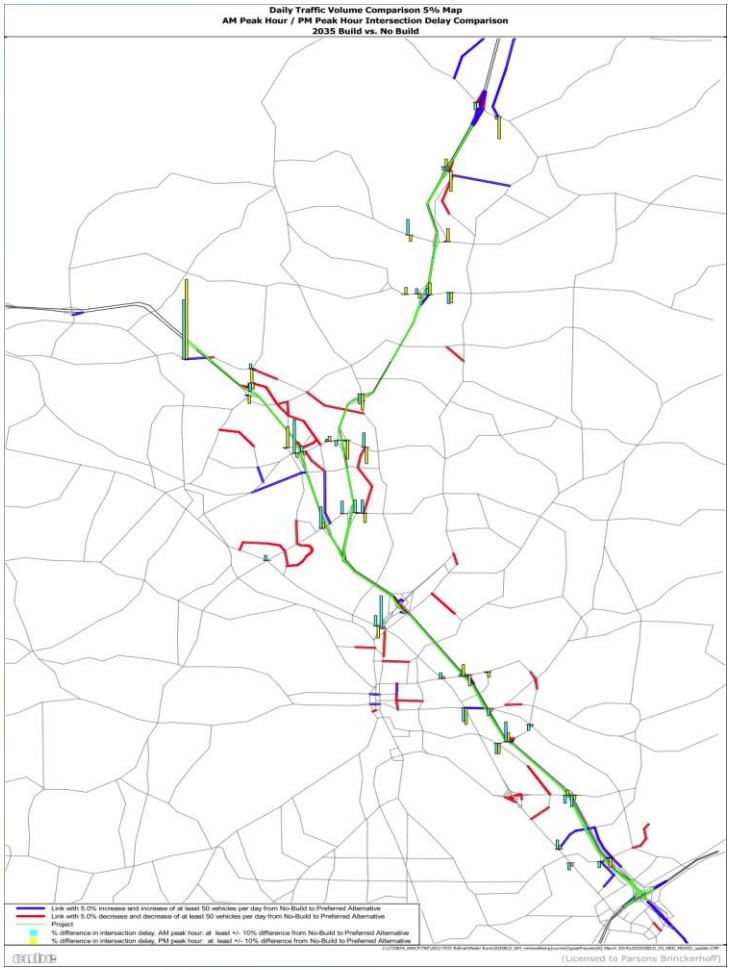
- Definition of affected environment (analysis of road segments and intersections)
- Inputs needed for MOVES and data sources
- QA procedures
- Use of County scale and Inventory calculation type recommended
- Time periods (annual average, based on 4 months)
- Pollutants and processes

Case Study Projects

Atlanta, GA	**Northwest Corridor**
Buffalo, NY	**Gateway Connections**
Los Angeles, CA	**State Route 57/60 Confluence**
Chicago, IL	**Elgin O'Hare-West Bypass**
St. Paul, MN	**I-94 Auxiliary Lanes**

Atlanta
Northwest Corridor

- ~30 miles of reversible managed lanes
- MSAT emissions estimated for base year (2010), expected first year of operation (2018), and project design year (2035)
- Used County scale, inventory mode, July day (hourly)



Atlanta

Northwest Corridor *(continued)*

Pollutant	2010 Base Year (tons/year)	2035 No Build (tons/year)	2035 Selected Alternative (tons/year)	Percent Change 2010 to 2035 Selected	Percent Change 2035 No Build to Selected
Acrolein	1.4	0.27	0.27	-81%	0.0%
Benzene	13.0	3.9	3.9	-70%	0.0%
1,3–Butadiene	2.1	0.52	0.53	-75%	1.9%
Diesel PM	180	14	14	-92%	0.0%
Formaldehyde	19.0	5.8	5.9	-69%	1.7%
Naphthalene	2.4	0.56	0.57	-76%	1.8%
Polycyclic Organic Matter	1.2	0.13	0.13	-89%	0.0%
VMT Total (million miles)	2,682	3,350	3,458	29%	3.2%
Diesel VMT (million miles)	354	435	436	23%	0.2%

Buffalo
Gateway Connections Improvement Project

- Addresses use of local streets by cross-border traffic
- Used MOVES Project Scale; 4 time periods and 4 months
- Piggybacked off PM hot spot analysis
- Included significant queuing/idling

Buffalo Gateway Connections Improvement Project (continued)

Pollutant	2015 No Build (tons/year)	2035 No Build (tons/year)	2035 Build Alternative (tons/year)	Percent Change, 2015 No Build to 2035 Build	Percent Change, 2035 No Build to 2035 Build
Acrolein	0.26	0.06	0.06	-77%	0.0%
Benzene	4.97	0.27	0.27	-95%	0.0%
1,3–Butadiene	0.67	0.05	0.05	-93%	0.0%
Diesel PM	24.9	15.7	15.5	-38%	-1.3%
Formaldehyde	3.88	0.99	0.95	-76%	-4.0%
Polycyclic Organic Matter	0.08	0.05	0.05	-38%	0.0%

California
SR 57/SR 60 Confluence

- Used CT-EMFAC to calculate emissions
- Input VMT by 16 speed bins; peak and off-peak periods
- Calculated MSATs for existing conditions (2009), opening year (2017), and design year (2037)

California

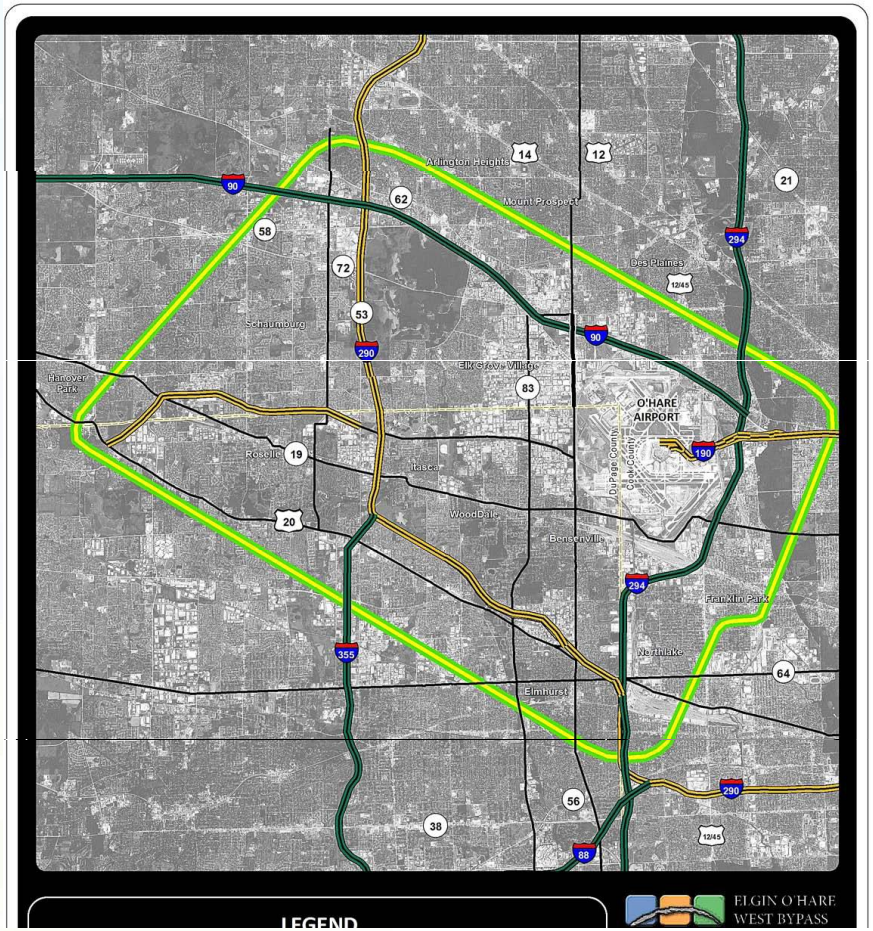
SR 57/SR 60 Confluence *(continued)*

Pollutant	2009 (g/day)	2037 No-Build Alternative (g/day)	2037 Build Alternative (g/day)	Percent Change, 2009 to 2037 Build Alternative	Percent Change, 2037 No-Build to 2037 Build Alternative
Acrolein	768	209	223	-71%	6.7%
Benzene	17,841	5,422	5,514	-69%	1.7%
1, 3–Butadiene	3,425	944	1,002	-71%	6.1%
Diesel PM	40,395	11,277	11,624	-71%	3.1%
Formaldehyde	20,291	6,066	5,994	-70%	-1.2%
Naphthalene	7,593	7,023	6,906	-9%	-1.7%
Polycyclic Organic Matter	1,033	982	966	-6%	-1.6%
Daily VMT	3,611,333	4,230,956	4,230,237	17%	0.0%

Illinois

Elgin O'Hare-West Bypass

- Calculated MSATs for existing conditions (2010) and project completion (2040)
- Used modeled network from PM hot spot analysis
- Modeled at MOVES Project scale (link level for 119 links) using average hourly ADT
- Calculated daily MSAT emissions



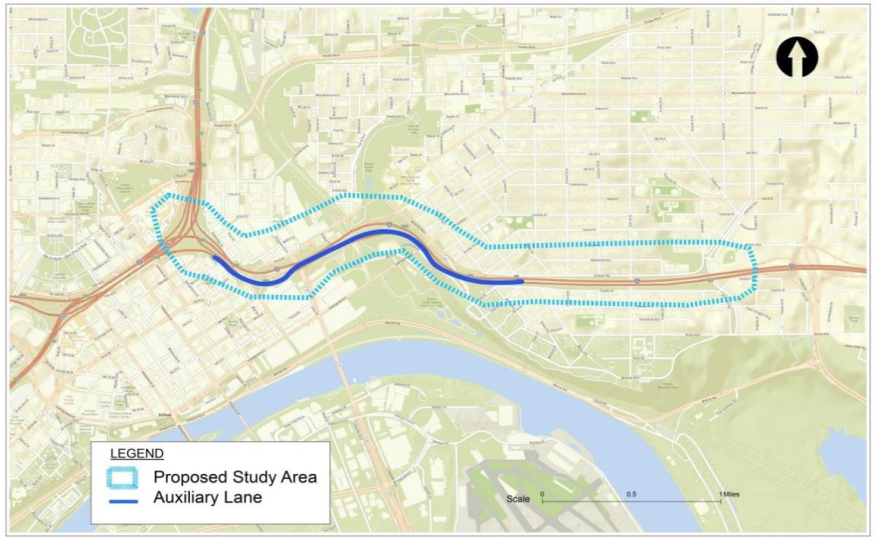
Illinois

Elgin O'Hare-West Bypass (continued)

	Daily Project Area MSAT Emissions (lbs/day)			Percent Change	
Pollutant	**2010 Existing Condition**	**2040 No-Build Alternative**	**2040 Build Alternative**	**2010 Existing to 2040 Build**	**2040 No-Build to 2040 Build**
Acrolein	3.7	0.5	0.6	-84%	20%
Benzene	50.9	11.8	13.4	-74%	14%
1, 3–Butadiene	12.2	2.4	2.8	-77%	17%
Formaldehyde	75.8	8.4	9.6	-87%	14%
Naphthalene	23.2	16.8	19.4	-16%	15%
Polycyclic Organic Matter	N/A	N/A	N/A	N/A	N/A
Diesel PM	685.9	27.8	31.9	-95%	15%
VMT (million miles)	5.047	5.512	6.387	27%	16%

St. Paul
I-94 Auxiliary Lanes

- Performed MSAT trends analysis from 2015-2030 for no-build; calculated build/no-build MSATs in 2016 (year with worst emissions)
- Used MOVES County scale; Inventory mode; 24 weekday hours for 12 months
- Included entire county in affected network



St. Paul

I-94 Auxiliary Lanes *(continued)*

Pollutant	2016 No-Build (lbs/year)	2016 Build Alternative (lbs/year)	Percent Change 2016 No-Build to Build Alternative
Acrolein	2,385	2,384	-0.053%
Benzene	32,091	32,081	-0.030%
Butadiene	5,351	5,349	-0.032%
Formaldehyde	37,055	37,036	-0.051%
Naphthalene	4,706	4,704	-0.046%
Polycyclic Organic Matter	2,417	2,417	-0.009%
Diesel PM	230,123	229,978	-0.063%
VMT Total (million miles)	5,294.6	5,296.2	0.031%
Diesel VMT (million miles)	483.3	483.4	0.031%

Summary of Analysis Approaches

Project	MOVES Analysis Scale	Affected Network	Time Period	Seasonality
Atlanta NWC	County	+/- 5-10% AADT change + judgment	Daily, 24 hours	July
California SR 57/SR 60	County	Same as for criteria pollutants	2 (peak and off-peak)	Average annual conditions
Illinois EO-WB	Project	Expanded on PM hotspot network	1 hour	Average annual conditions
New York Gateway	Project	Same as for criteria pollutants	4 (a.m. peak, p.m. peak, midday, night)	4 months (January, April, July, October)
St. Paul I-94	County	Entire county	Daily	12 months

Findings on MSAT Emissions

Impacts

- All projects showed substantial decline (60-90+ %) for future year versus base year MSATs
- Decline in emissions comes despite increasing VMT
- Projects showed mixed results in terms of “build” alternative increasing or decreasing MSAT emissions versus future-year no-build
  - But typically small difference, <2-3%

Lessons for Project Sponsors?

- Some inconsistencies in approaches – October 2015 FAQs may help address
- Need to balance desired approach for MSAT analysis with streamlining/consistency with other air pollutant analysis
- Use judgment on affected network
- OK to apply MOVES at project level
- Impact of speeds on emissions – attention to speed estimation methodology

For More Information

Case studies available

https://www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/

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