EmiLink:
Mobile Source Air Toxic Analysis Tool

17th International Emission Inventory Conference

Session 11: Mobile Sources

Madhusudhan Venugopal

North Central Texas Council of Governments

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MSAT BACKGROUND

Mobile Source Air Toxics

- Mobile source air toxics are compounds emitted from highway vehicles and non-road equipment which are known, or suspected, to cause cancer or other serious health and environmental effects.

- The Clean Air Act identified 188 air toxics, also known as hazardous air pollutants (HAPs). Mobile Sources are a significant contributor.

MSAT BACKGROUND

Mobile Source Air Toxics

- **The Environmental Protection Agency (EPA) has identified a group of 21 as mobile source air toxics (MSAT) in its Final Rule *(66 FR 17235)*.**

- **EPA Has Extracted Six Priority MSATs:**
  - **Benzene,**
  - **Formaldehyde**
  - **Acetaldehyde**
  - **Diesel Particulate Matter / Diesel Exhaust Organic Gases**
  - **Acrolein**
  - **1,3-Butadiene**

MSAT BACKGROUND

Mobile Source Air Toxics

The Federal Highway Administration (FHWA) has developed a tiered approach for analyzing MSATs in the NEPA documents.

- **No Analysis For Projects With No Potential For Meaningful MSAT Effects**
- **Qualitative Analysis For Projects With Low Potential MSAT Effects Or**
- **Quantitative Analysis To Differentiate Alternatives For Projects With Higher Potential MSAT Effects**

MSAT ANALYSIS

Procedure

- Emissions Factors Estimation - MOBILE6.2
- MSAT Emissions Estimation Including Estimation Of Vehicle Miles Of Travel - EmiLink Module
- Identifying Affected Transportation Network Comparing Build Versus No-Build

MSAT ANALYSIS

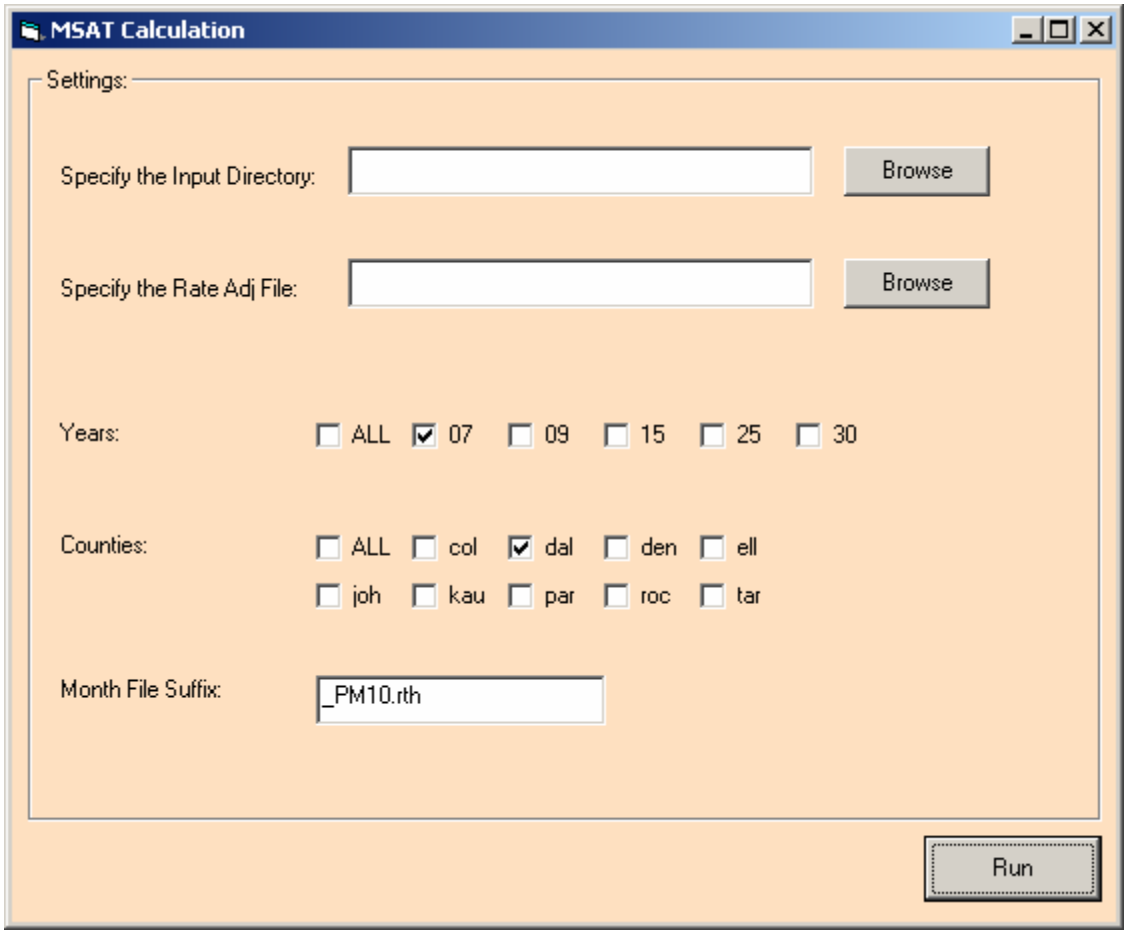
Emissions Factors Estimation

- Estimation Of Annual Emission Factors Rates, Calculated By Combining Monthly Emissions Factors Using Weighting Factors Corresponding To Each Month

- Local Inputs include
  - Vehicle Age Distribution
  - Diesel Fraction
  - Trip Length Distribution
  - Hourly VMT Distribution
  - Inspection And Maintenance, Etc.

MSAT ANALYSIS

Emissions Factors Estimation



MSAT ANALYSIS

Emissions Factors Estimation

TransCAD (Licensed to North Central Texas COG) - [Dataview5 - 15col_PM10]

File Edit Map Dataview Selection Matrix Layout Tools Procedures Networks/Paths Route Systems Planning Transit Routing/Logistics Statistics Window Help

All Records

RATE	POL	SPEED	ETYPE	HOUR	RDW	LDGV	LDGT1	LDGT2	
RATE	SO4	2.5	COMPOSITE	HOUR00	FRWY	0.000498900000000	0.000596100000000	0.000596100000000	0.000595
RATE	SO4	5.0	COMPOSITE	HOUR00	FRWY	0.000498900000000	0.000596100000000	0.000596100000000	0.000595
RATE	SO4	10.0	COMPOSITE	HOUR00	FRWY	0.000498900000000	0.000596100000000	0.000596100000000	0.000595
RATE	SO4	15.0	COMPOSITE	HOUR00	FRWY	0.000498900000000	0.000596100000000	0.000596100000000	0.000595
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RATE	SO4	25.0	COMPOSITE	HOUR00	FRWY	0.000397700000000	0.000535800000000	0.000535800000000	0.000534
RATE	SO4	30.0	COMPOSITE	HOUR00	FRWY	0.000304100000000	0.000480000000000	0.000480000000000	0.000478
RATE	SO4	35.0	COMPOSITE	HOUR00	FRWY	0.000214200000000	0.000426500000000	0.000426500000000	0.000425
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RATE	SO4	45.0	COMPOSITE	HOUR00	FRWY	0.000214200000000	0.000426500000000	0.000426500000000	0.000425
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RATE	ECARBON	5.0	COMPOSITE	HOUR00	FRWY	0.000000000000000	0.000000000000000	0.000000000000000	0.000000
RATE	ECARBON	10.0	COMPOSITE	HOUR00	FRWY	0.000000000000000	0.000000000000000	0.000000000000000	0.000000

Dataview: Records 1 - 31 of 18540 Network: None

MSAT ANALYSIS

EmiLink - Vehicle Miles of Travel Estimation

EmiLink Uses Vehicle Miles Of Travel (VMT) Calculation Consistent With The Transportation Conformity Process

- **Travel Demand Modeling Four-Step Process**
- **Non-Recurring Congestion Factor**
- **HPMS Adjustment Factor**
- **Seasonal Adjustment Factor**

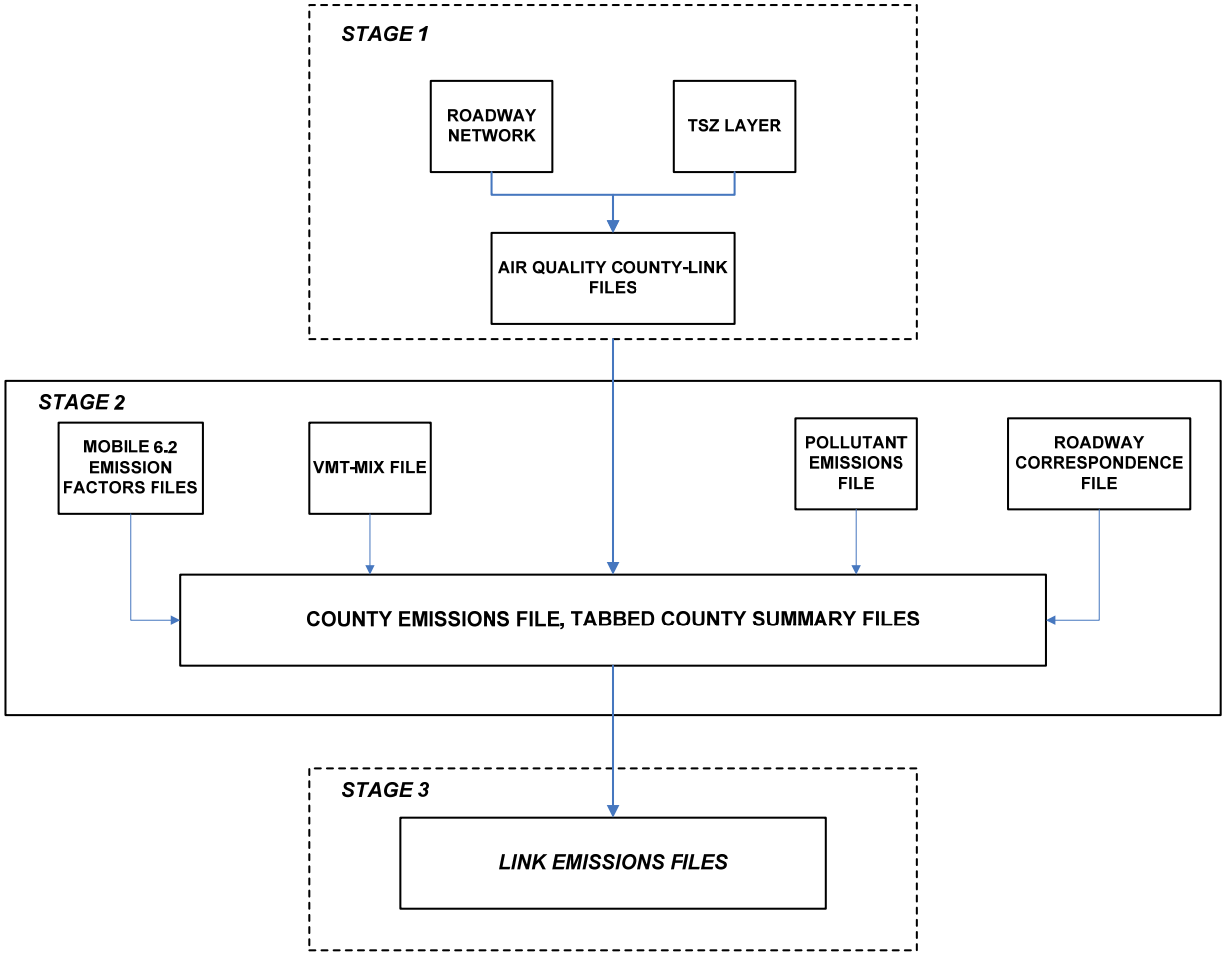
MSAT ANALYSIS

EmiLink Features

- Capable Of Estimating Link-Level Emissions That Can Be Used Easily For MSAT Analysis
- Capable Of Estimating Hourly Emissions
- Capable Of producing Emissions Files That Can Be Used In EPS3 (Emissions Processing System) For Photochemical Modeling
- Eliminates Writing Job Control Files (JCF)
- Has Run Time Of Three Hours For DFW Network With Approximately 40,000 Links

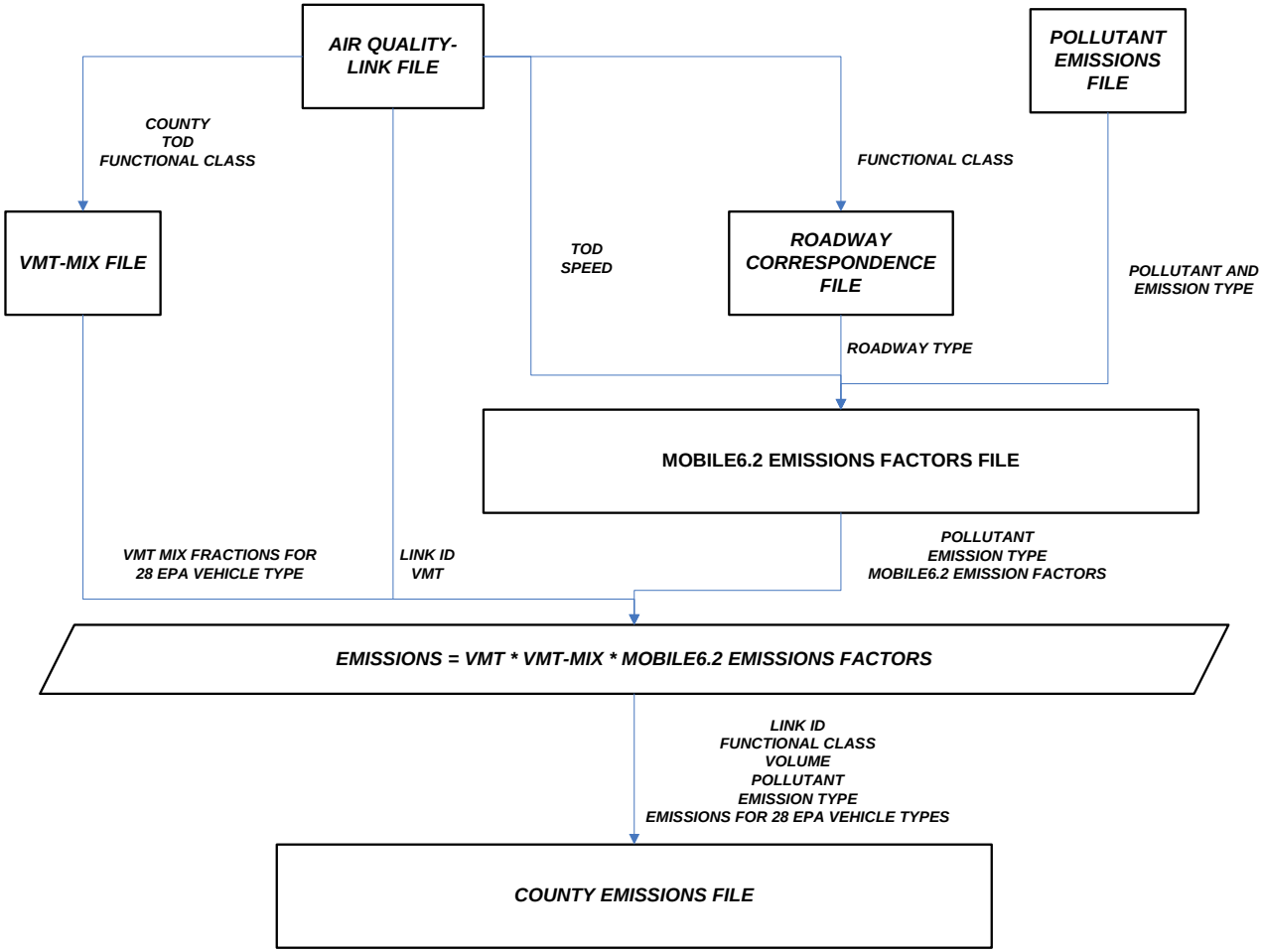
MSAT ANALYSIS

Emilink Module



MSAT ANALYSIS

Emilink Module – Stage 2



TOD = Time of day

MSAT ANALYSIS

EmiLink Interface

AQ Report EmiLink (c:)

Reports:

- AQ Trip Length Distribution Report
- AQ Report #1: Link, Speed, VMT (Reports for each Day and TOD)
  - All Days / Midweek only
- AQ Report #3: Auto Truck VMT
- AQ Report #5: VMT Distribution (Reports for each county)
- AQ Report #6: Avg Loaded Speed Distribution (Reports for each county)
- AQ Report #8: Center-Line Miles, Lane Miles (Reports for AM/PM/OP)
- EmiLink: Link Emissions Report

ESTIMATED RUN TIME
00:00:00

Folders:

Drive Name:	c:
Roadway Network Folder (RDWY):	
Zone Structure Folder (GEO):	GEO Folder
Zonal Activity Folder (ACT):	ACT Folder
Airport Folder (APT):	APT Folder
Transit Network Folder (TRNT):	TRNT Folder
External Folder (EXT):	EXT Folder
Output Folder Suffix:	
Output Name Extra Description:	
Output Month Name:	Aug
Output Year Name:	07

Required Variables:

Name:	
HPMS Factor:	1.017
Non-Recurring Congestion Factor:	0.961
Half Hour Factors:	
Day Of Week Factors:	
Perimeter Counties Representation:	'Other' County

MSAT:

Rdw Correspondence File:	
Pollutant-Emission Type File:	
VMT Mix File:	...
Mobile 6 Emission Factor Files:	...

Cancel

Run

MSAT ANALYSIS

EmiLink Output Files

- Tab-Delimited Hourly Emission Summary By County, Roadway Type And Vehicle Type
- Database Format File With Daily And Annual Link Level Emissions, VMT And Volume
- Hourly Emissions By Link In EPS3 Format

MSAT ANALYSIS

EmiLink Output: Link-Emissions File

TransCAD - [Dataview4 - 15B_LINKPOLLUTANTDAILY]

File Edit Map Dataview Selection Matrix Layout Tools Procedures Window Help

All Records

LINK_ID	FUNCL	VOLUME	VMT	SO4	OCARBON	ECARBON	PMT
1041973	1	1543.3100	1990.8600	0.0014958729	0.0038758378	0.0084864305	0.013858
1042016	7	1630.3700	1043.4300	0.0007652214	0.0025979756	0.0038724415	0.007235
1042035	7	1752.5000	1191.7100	0.0008668881	0.0012768461	0.0029682492	0.005111
1042056	4	1319.6300	910.5400	0.0009611463	0.0009953878	0.0023171810	0.004273
1042088	3	6723.2600	7731.7500	0.0062353830	0.0162075036	0.0392184480	0.061661
1042144	3	3589.0400	3050.6800	0.0024442162	0.0061958555	0.0149757802	0.023615
1042211	4	1835.6200	881.1000	0.0006281103	0.0007919286	0.0018161565	0.003236
1042254	3	2852.6500	11524.7800	0.0092788993	0.0239671949	0.0579790017	0.091225
1042482	6	709.9900	184.6000	0.0001493816	0.0003793436	0.0009172826	0.001446
1042541	6	1090.4300	338.0400	0.0002739124	0.0006991981	0.0016911065	0.002664
1042595	4	2942.3200	617.8800	0.0004489575	0.0008732387	0.0013760150	0.002698
1042613	4	1882.5000	1148.3300	0.0009972678	0.0016195805	0.0025519395	0.005168
1042659	4	2107.7100	3077.2800	0.0021742752	0.0042917484	0.0067605084	0.013226
1042726	4	617.7300	407.6900	0.0004004898	0.0005946567	0.0009377647	0.001932
1042776	4	5692.0000	3585.9700	0.0036628605	0.0052250868	0.0082396780	0.017127
1042809	4	224.7900	260.8200	0.0002399911	0.0003850479	0.0006073911	0.001232
1042890	4	2035.8600	1425.0800	0.0014752302	0.0022641200	0.0035775688	0.007316
1042924	6	0.0000	0.0000	0.0000000000	0.0000000000	0.0000000000	0.000000
1042934	6	1027.7700	226.1100	0.0001745659	0.0006919930	0.0010338987	0.001900
1042953	1	32503.4800	21127.2600	0.0160804012	0.0436112041	0.0956259878	0.155317
1042980	4	2080.4000	104.0200	0.0001246081	0.0001621137	0.0002560478	0.000542
1042994	1	32512.5500	18532.1500	0.0141031603	0.0382296802	0.0838246833	0.136157
1043015	4	689.5300	1165.3300	0.0010038573	0.0016514833	0.0026025212	0.005257
1043129	6	1078.5100	377.4800	0.0002801453	0.0009555184	0.0014245546	0.002660
1043157	6	933.6400	317.4400	0.0002374365	0.0008362788	0.0012473929	0.002321
1043199	7	316.7000	300.8700	0.0002177757	0.0006985786	0.0010403177	0.001956
1043261	1	33582.1000	11082.0900	0.0084331767	0.0228561331	0.0501154678	0.081404
1043292	1	33378.5100	8010.8400	0.0060967188	0.0165300791	0.0362450805	0.058871
1043311	7	328.5800	308.8500	0.0002222966	0.0006950298	0.0010345852	0.001951
1043388	4	9849.3000	4235.2100	0.0037942199	0.0061263689	0.0096592412	0.019579
1043427	1	29180.9500	14882.2900	0.0113229760	0.0306691057	0.0672452916	0.109237
1043458	1	29276.9000	18737.2200	0.0142611027	0.0386753752	0.0848031141	0.137739

Dataview: Records 1 - 32 of 37612

MSAT ANALYSIS

Quantitative MSAT Procedure

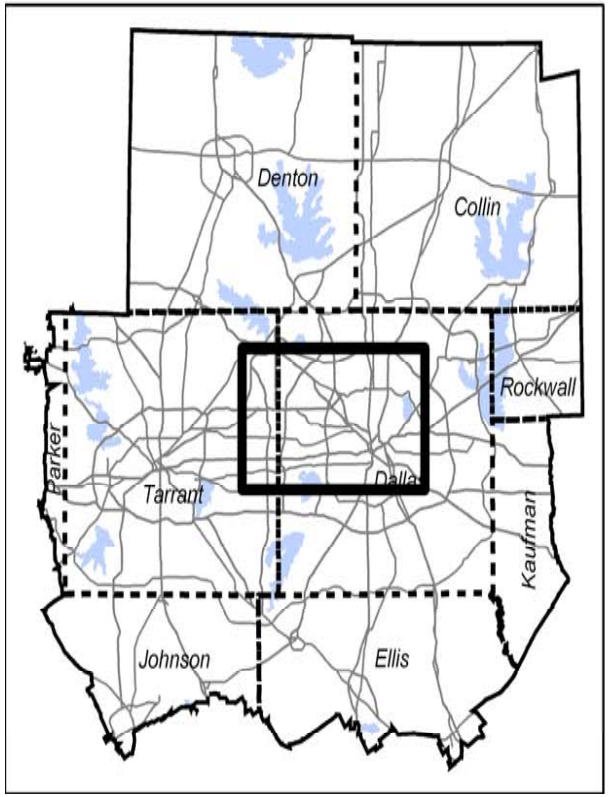
Quantitative MSAT Analysis Should Include:

- **Estimation Of Total Emissions For Build And No Build Scenarios**
- **Identification Of Affected Transportation Network**
- **Estimation Of Change In Emission And VMT In The Affected Area/Links From A No-Build To A Build Alternative**

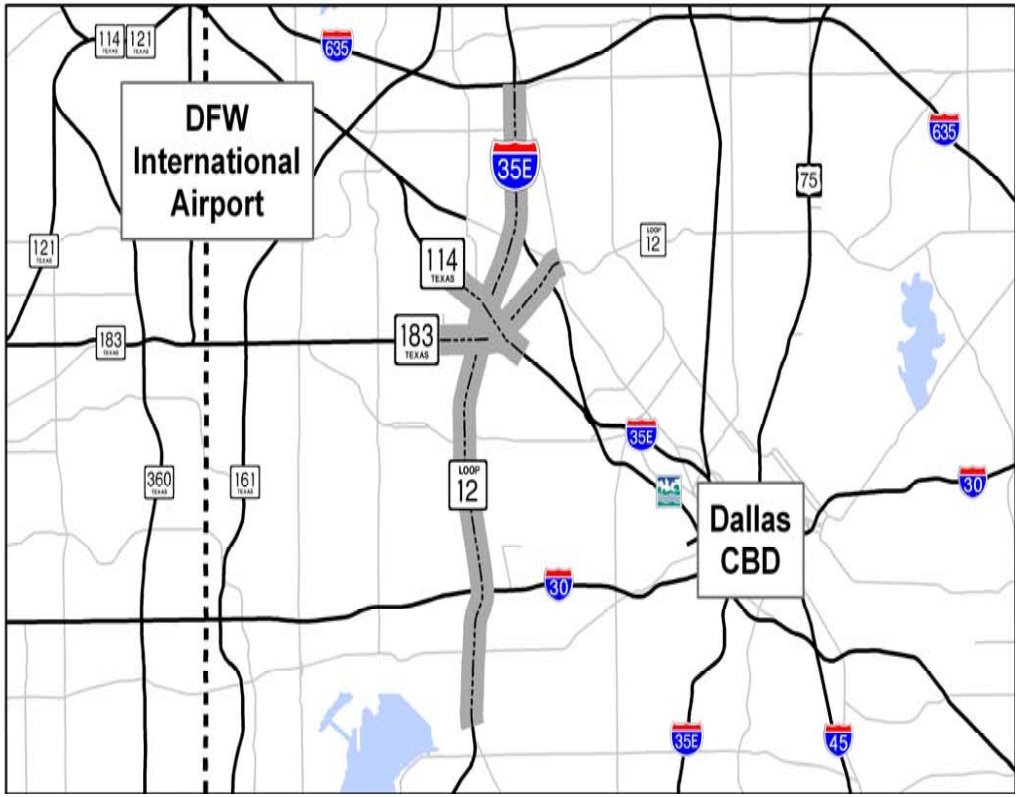
MSAT ANALYSIS

Loop 12 Roadway Case Study

Overview Map

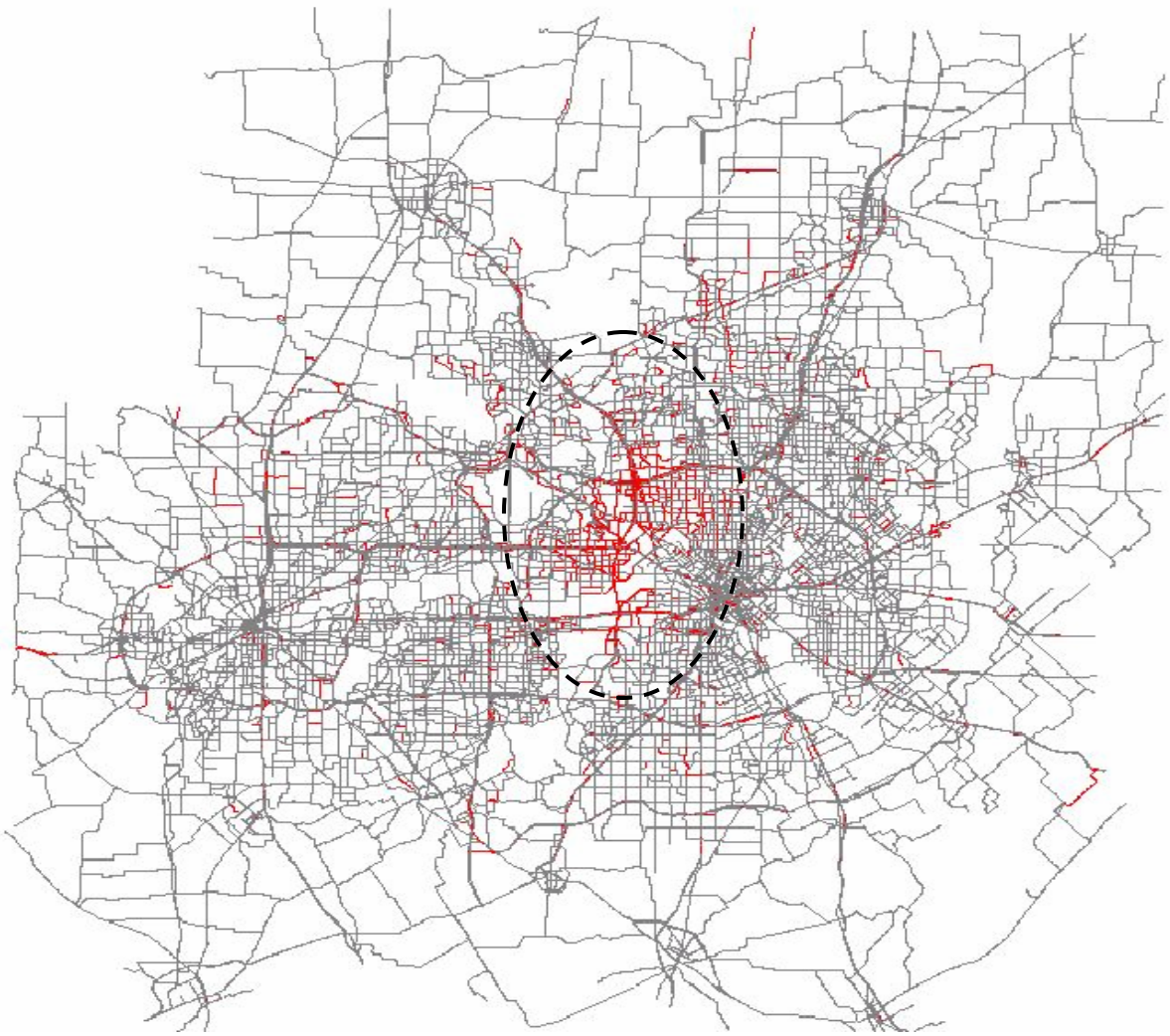


Detail Map



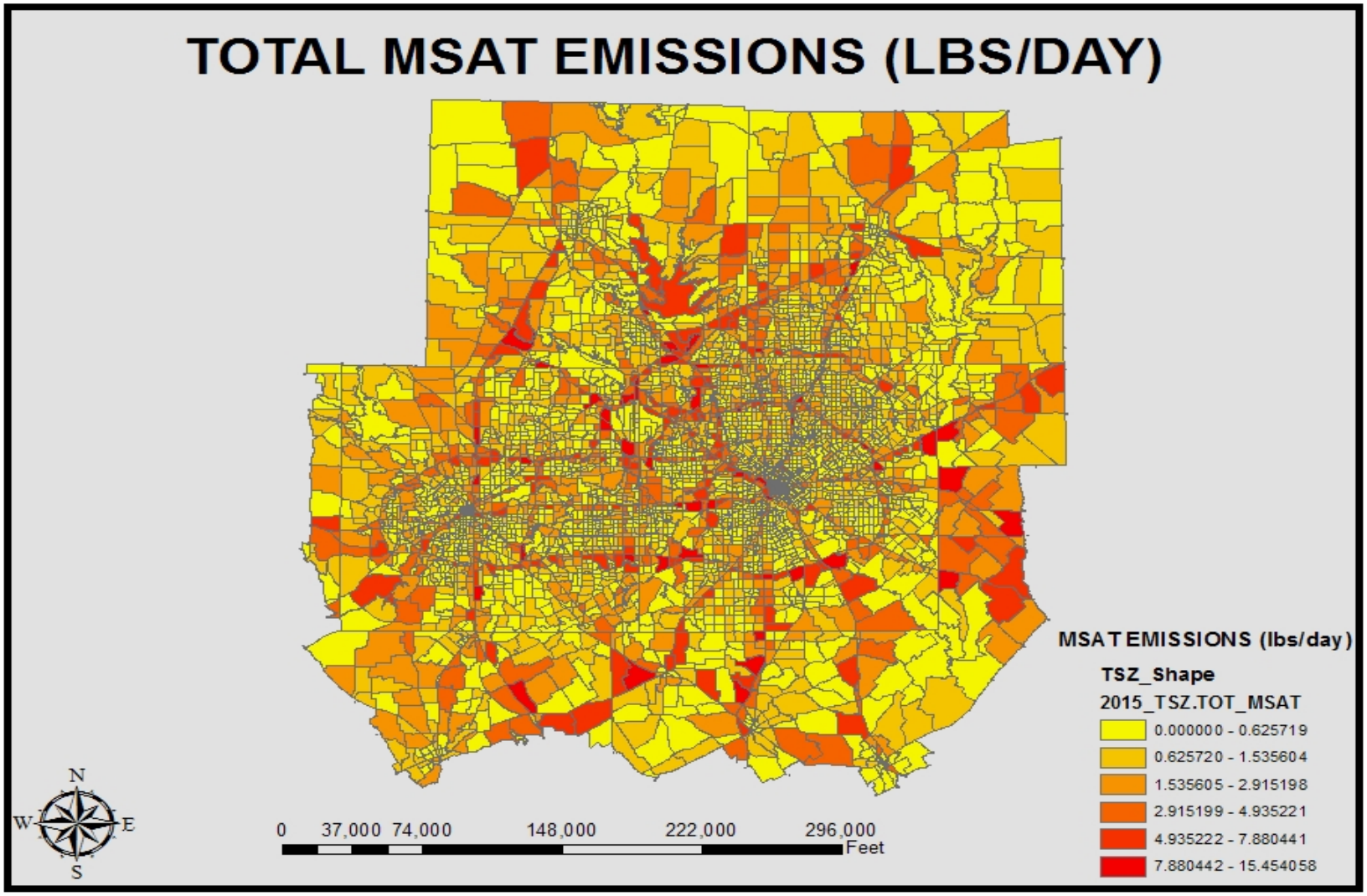
MSAT ANALYSIS

FHWA Recommended Five-Percent Volume Change



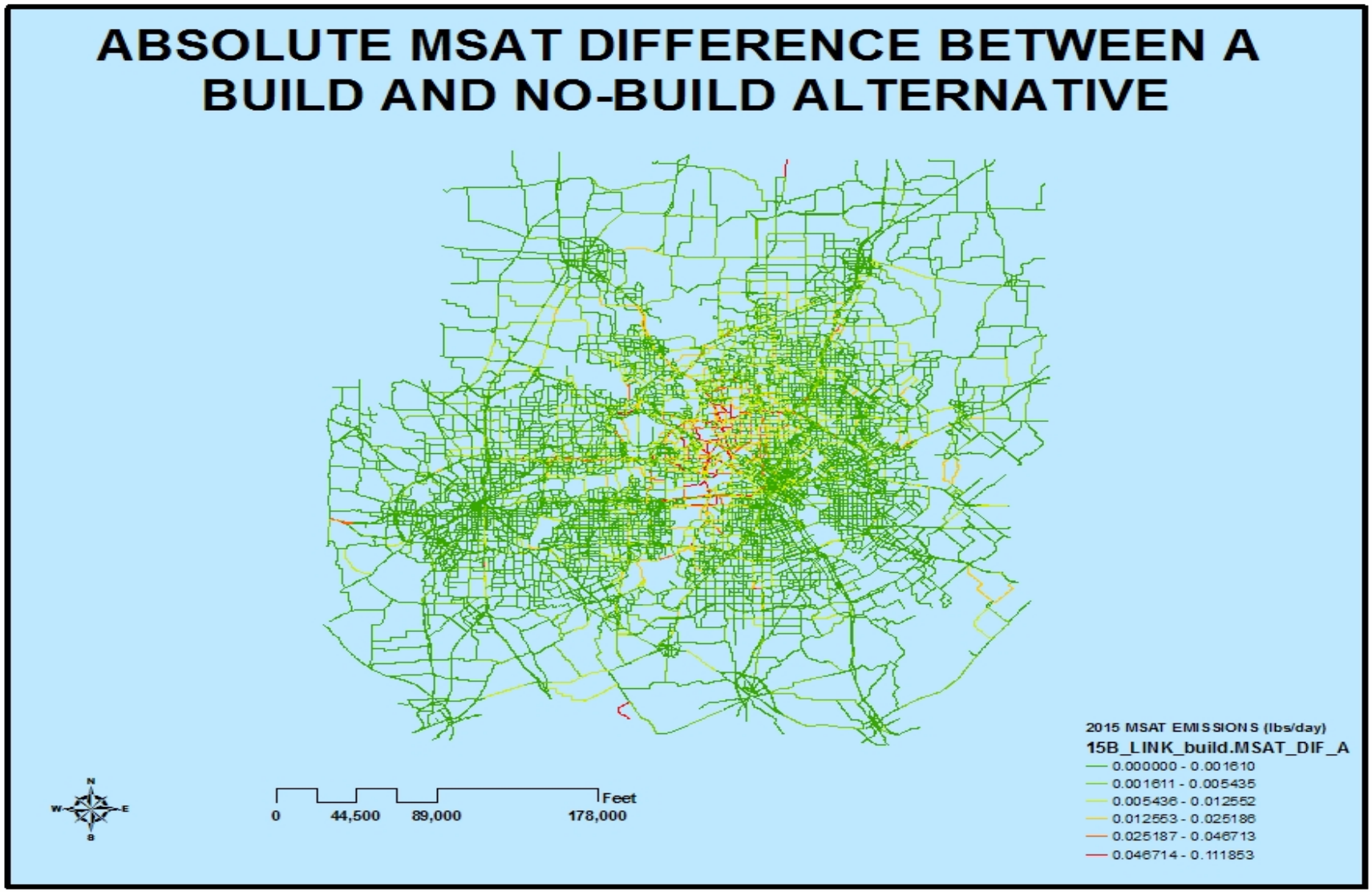
MSAT ANALYSIS

Traffic Survey Zone Analysis



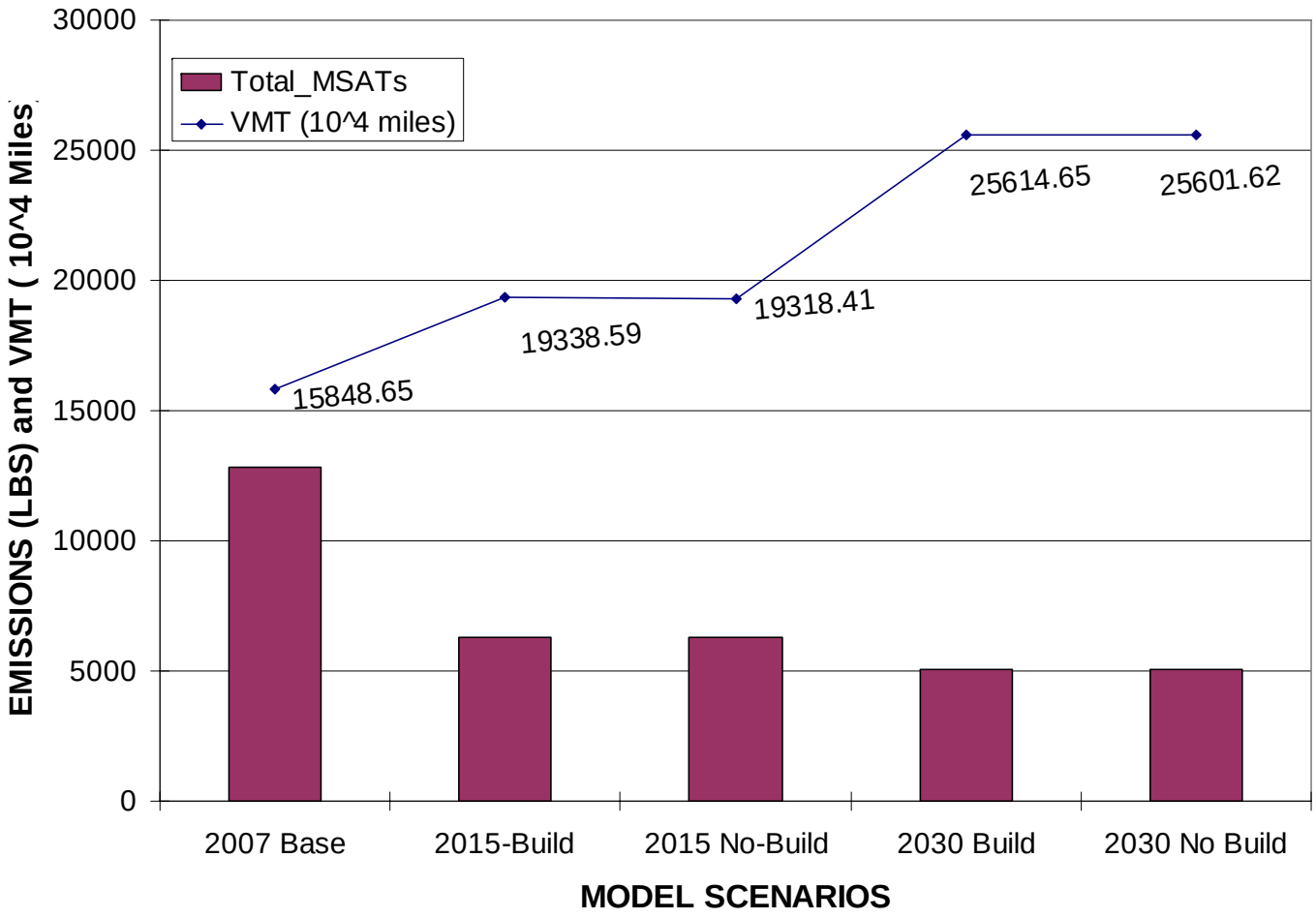
MSAT ANALYSIS

Link Level Emissions



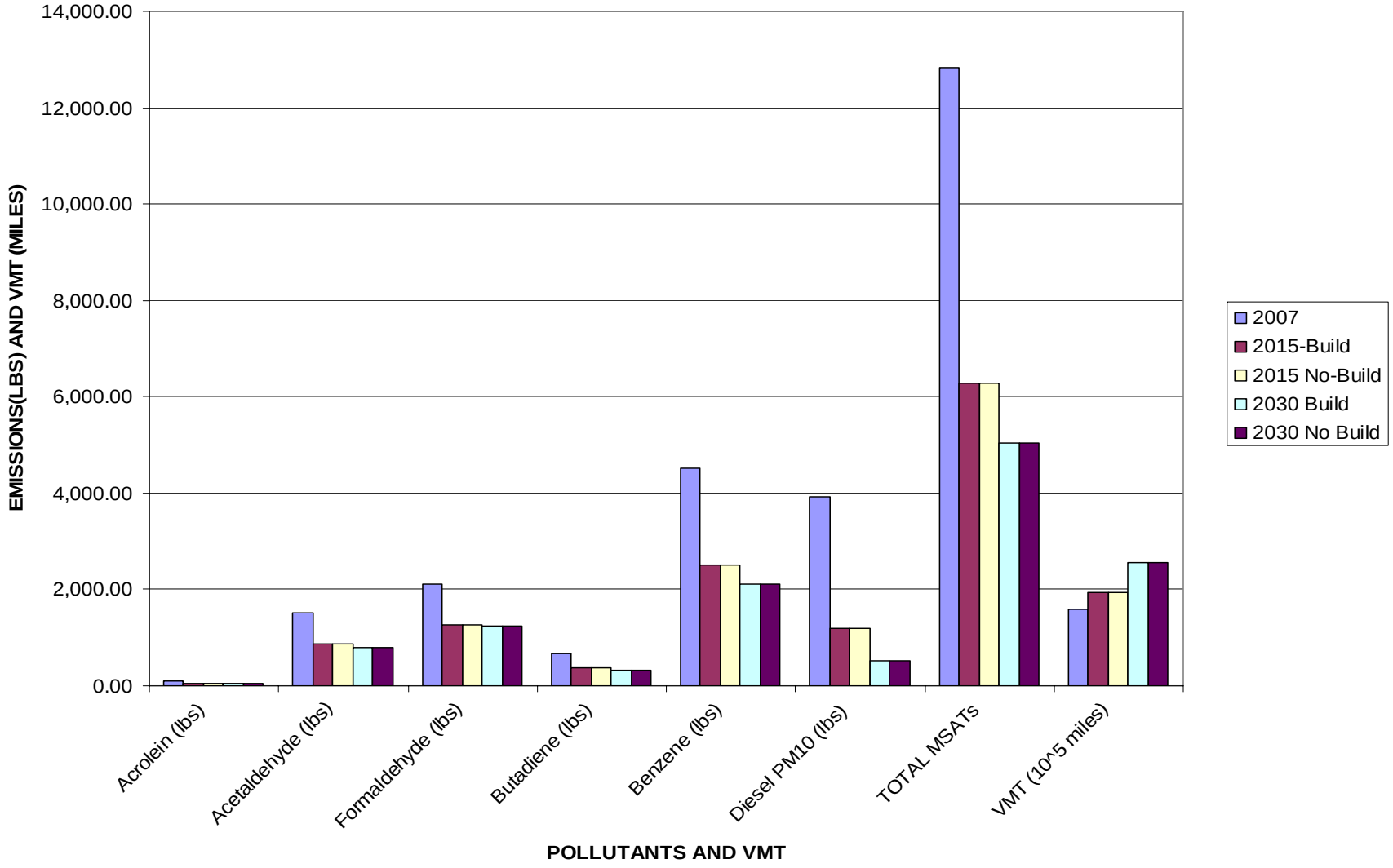
MSAT EMISSIONS

Total MSAT Emissions and VMT Growth



MSAT EMISSIONS

Build And No-Build Analysis



MSAT ANALYSIS

Conclusions

EmiLink Has Been Used Successfully On Projects In DFW And Has Shown The Following Advantages:

- **Reduces The Calculation Time For The MSAT Analysis**
- **Significantly Decreases The Cost Of The Work From Initial Estimates**
- **Provides Consistency Of Results By Its Consistent VMT Estimation**
- **Provides A Stream-Lined Process To Get From The Mobile 6.2 Emission Factor Files To The Emissions Output**
- **Provides User-Friendly Interface For Specifying Inputs**

MSAT ANALYSIS

Future Directions

- EmiLink can be modified to be used by other metropolitan planning areas.
- Improvements are needed in the process of finding affected roadways links.
  - A recommendation for EPA and FHWA would be to develop a process for quantitative MSAT analysis that targets only the affected roadway links.
  - Applying an emission threshold yields better results than percent volume or VMT change.

MSAT ANALYSIS

Contact Information

Madhusudhan Venugopal
Senior Transportation Planner
(817) 608-2333
mvenugopal@nctcog.org

Kathleen Yu
Senior Transportation System Modeler
(817) 608-2343
kyu@nctcog.org