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MEMORANDUM

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FROM: Katie Hill Brandt, PE, Environmental Engineer
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DATE: May 9, 2014 – Revised December 16, 2015

RE: I-35W Transit/Access Project
Air Quality Analysis
SEH No. HENNC 113114

I-35W TRANSIT/ACCESS PROJECT AIR QUALITY ANALYSIS

This memorandum summarizes a quantitative air quality analysis of Mobile Source Air Toxics (MSAT) emissions for the proposed I-35W Transit/Access Project. The analysis presents MSAT emissions from traffic for three scenarios: Base Year (2011), Design Year (2038) Build, and Design Year No Build. A description of the I-35W Transit/Access Project and three related projects included in the air quality analysis are presented below.

I-35W Transit/Access Project

Hennepin County, the City of Minneapolis, Metro Transit, and the Minnesota Department of Transportation (MnDOT) are planning the I-35W Transit/Access project in Minneapolis, which includes the Lake Street interchange area between approximately 32nd Street and 26th Street, a Bus Rapid Transit (BRT) station near Lake Street, and a Green Crescent pedestrian/bicycle connection between the Midtown Greenway and Lake Street. This project includes a new southbound exit ramp from I-35W to Lake Street and a new northbound exit ramp from I-35W to 28th Street.

MnDOT Chapter 152 Bridge Project (26th Street to I-94)

MnDOT, in coordination with Hennepin County, the City of Minneapolis, and Metro Transit, is completing engineering work for the replacement of two Chapter 152 Bridges (the I-35W "braid" bridge and the I-35W "flyover" bridge connecting I-35W northbound to I-94 westbound). These bridges are required to be replaced by legislative action due to their condition. The replacement of these bridges results in the need for reconstruction work along I-35W between 26th Street and I-94. It is expected that this project will be constructed at the same time that the I-35W Transit/Access project is built. This work will also include the replacement of the 24th Street bicycle/pedestrian bridge, the 26th Street Bridge, the Franklin Avenue Bridge, and bridges in the TH 65/I-35W/I-94 interchange area.

I-35W Gap Project (42nd Street to 32nd Street)

There is a short section of the freeway between the Crosstown Commons area and the Transit/Access project (approximately 42nd Street to 32nd Street) that is not planned for reconstruction. MnDOT is planning to do pavement replacement and other rehabilitation work in this area, commonly referred to as the "Gap Project", at the same time that the Transit/Access project is constructed. A southbound MnPASS lane will be incorporated into the design to complement the existing transit station at 46th Street and the proposed station at Lake Street. No bridges will be replaced in this section and full reconstruction is not planned.

Lake Street (Blaisdell to 5th Avenue)

Hennepin County is also planning to reconstruction Lake Street between Blaisdell & 5th Avenue. This project is funded separately and will be implemented with a separate community engagement process. Construction will need to be coordinated closely with reconstruction of the I-35W/Lake Street interchange area.

MOBILE SOURCE AIR TOXICS

This air quality analysis was performed following the guidance issued by the Federal Highway Administration (FHWA) in a December 6, 2012 memorandum titled, "Interim Guidance Updated on Mobile Source Air Toxic Analysis in NEPA Documents" (FHWA, 2012)[1]. The U.S. Environmental Protection Agency (EPA) released a new emission model, the Motor Vehicle Emissions Simulator (MOVES) in 2010. As of December 20, 2012, MOVES is the emissions model required for use in analyzing MSAT under the National Environmental Policy Act (NEPA) review process for highway projects. The latest version of MOVES, MOVES2010b, was used in this analysis.

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007), and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (http://www.epa.gov/iris/). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (http://www.epa.gov/ttn/atw/nata1999/). These are acrolein, benzene, 1,3-butidiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. While FHWA considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules. The 2007 EPA rule mentioned above requires controls that will dramatically decrease MSAT emissions through cleaner fuels and cleaner engines.

In 2007, EPA issued a final rule for the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, February 26, 2007)[2]. The fuel requires emission controls that will decrease MSAT emissions through cleaner fuels and cleaner engines. FHWA analysis using the MOVES2010b model shows that, even if vehicle-miles travelled (VMT) increases by 102 percent as assumed from 2010 to 2050, a combined reduction of 83 percent in the total annual emissions for the priority MSAT is projected for the same time period (FHWA, 2012)[1].

The FHWA guidance on MSAT analysis in NEPA documents recommends either 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. A quantitative analysis was performed for this project because it meets the following criteria: (a) the project creates new capacity or adds significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the AADT is projected to be in the range of 140,000 to 150,000 or greater by the design year; and (b) the project is proposed to be located in proximity to populated areas (FHWA, 2012)[1].

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[1] Marchese, April memorandum to Division Administrators and Federal Lands Highway Division Engineers, December 6, 2012.
https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/aqintguidmem.cfm. (Accessed December 2013)

[2] Federal Register, Volume 73, Number 37. February 26, 2007. Control of Hazardous Air Pollutants from Mobile Sources; Final Rule. 8428-8570.

INCOMPLETE OR UNAVAILABLE INFORMATION FOR PROJECT SPECIFIC MSAT ANALYSIS

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action (FHWA, 2012)[1.]

The EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System (IRIS), which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (EPA, 2012)[3]. Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (HEI). Two HEI studies are summarized in Appendix D of FHWA's Interim Guidance Update on Mobile source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations (HEI, 2007)[4] or in the future as vehicle emissions substantially decrease (HEI, 2009)[5].

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts - each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways; to determine the portion of time that people are actually exposed at a specific location; and to establish the extent attributable to a proposed action, especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (HEI, 2007)[3]. As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT

[3] EPA Integrated Risk Information System (IRIS). https://www.epa.gov/iris/. (Accessed December 2013)
[4] The Health Effects Institute, Mobile-Source Air Toxics: A Critical Review of the Literature on Exposure and Health Effects. 2007. http://pubs.healeffects.org/view.php?id=282. (Accessed December 2013)
[5] The Health Effects Institute. Traffic-Related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects. 2009. http://pubs.healeffects.org/view.php?id=306. (Accessed December 2013)

compounds, and in particular for diesel PM. The EPA (EPA, 2013)[6] and the HEI (HEI, 2007)[7] have not established a basis for quantitative risk assessment of diesel PM in ambient settings.

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine an "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA's approach to addressing risk in its two step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable.

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

METHODOLOGY

Following FHWA guidance, a quantitative emissions analysis was completed for this project because the project will create new or add significant capacity to an urban highway with traffic volumes where the annual average daily traffic (AADT) is projected to be in the range of 140,000 to 150,000 or greater by the design year (FWHA, 2012)[1]. The I-35W Transit/Access Project is located in an urban environment in the City of Minneapolis, Minnesota. The traffic considered for this analysis includes all project links, plus any other nearby links where traffic volumes change by at least plus or minus five percent as a result of the project (FHWA, 2013)[8].

A quantitative analysis was conducted to estimate emissions of the priority MSAT for three scenarios: Base Year (2011), Design Year (2038) Build, and Design Year No Build. As identified earlier, these seven MSATs are acrolein, benzene, 1,3-butadiene, diesel PM, formaldehyde, naphthalene, and POM.

Hennepin County was the geographic bounds for the project. Each scenario (Base Year, Design Year Build, and Design Year No Build) was modeled as a 24-hour weekday in four different seasons (taking place in January, April, July, and October). Thus, emissions for each scenario were calculated for four separate days which were then scaled up to represent an entire year.

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[6] EPA List of Primary Risk Assessment Sources. http://www.epa.gov/risk/basicinformation.htm#g. (Accessed December 2013)

[7] Health Effects Institute Air Toxics Review Panel. 2007. Mobile-Source Air Toxics: A Critical Review of the Literature on Exposure and Health Effects. HEI Special Report 16. Health Effects Institute, Boston, Mass. http://pubs.healtheffects.org/getfile.php?u=395. (Accessed December 2013)

[8] "Quick-start Guide for Using MOVES for NEPA MSAT Analysis" received from Jeff Houk, FWHA, in March 2013.

The Minnesota Pollution Control Agency provided meteorological data for Hennepin County, vehicle population data for 2011, inspection/maintenance data, and fuel supply data.

Traffic data for each alternative were provided by MnDOT and SEH traffic engineers. The data were broken down into the total volume of “trucks” and “non-trucks” on each project link and affected nearby links. Traffic speed was available on each of these links for each hour of the day. Based on available population data, “trucks” were further divided to include the following vehicle types from MOVES2010b: refuse trucks, single unit short-haul trucks, single unit long-haul trucks, motor homes, combination short-haul trucks, and combination long-haul trucks. In the same way, “non-trucks” were divided to include motorcycles, passenger cars, passenger trucks, light commercial trucks, intercity buses, transit buses, and school buses.

RESULTS

The results of the air toxics emission analysis are described in this section. Table 1 and Figures 1 through 3 present the emissions for each MSAT included in this analysis for three scenarios: Base Year (2011), Design Year (2038) Build, and Design Year No Build.

Table 1 - Mobile Source Air Toxics Emissions (pounds/year)

Pollutant	Base Year	Design Year Build	Design Year No Build	Design Year Build minus Design Year No Build1	Percent Increase between Build and No Build
Acrolein	144	30	30	1	2%
Benzene	3,309	1,142	1,114	29	3%
1,3-Butadiene	499	171	167	4	3%
Diesel PM	12,134	673	658	15	2%
Formaldehyde	2,324	678	664	14	2%
Naphthalene	333	94	91	2	2%
POM	158	50	48	2	3%
[1] Data may not sum to total due to rounding.					

Table 2 – Annual Vehicle Miles Travelled (VMT/year)

Base Year	Design Year Build	Design Year No Build	Design Year Build minus Design Year No Build	Percent Increase between Build and No Build
294,226,409	315,333,720	308,497,544	6,836,176	2%

Table 3 – Total MSAT per million VMT (pounds/10^6 VMT)

Base Year	Design Year Build	Design Year No Build	Design Year Build Minus Design Year No Build
64	9	9	0

Table 4 – Percent Decrease Over 2011 Base Year

	Design Year Build	Design Year No Build
Total MSAT	85%	85%
Total MSAT, Excluding Diesel PM	68%	69%
Diesel PM	94%	95%

SUMMARY

Results of the MSAT analysis highlight the long-term trend of declining on-road air toxics emissions. Emissions from the Build scenario are slightly higher than for the No Build scenario (Table 2), although the difference is diminished when normalized to a total MSAT per million vehicle miles traveled basis (Table 3).

MSAT MITIGATION STRATEGIES

Lessening the effects of mobile source air toxics can be considered for projects with substantial construction-related MSAT emissions that are likely to occur over an extended building period, and for post-construction scenarios where the NEPA analysis indicates potentially meaningful MSAT levels. Such mitigation efforts should be evaluated based on the circumstances associated with individual projects, and they may not be appropriate in all cases.

Mitigating for Construction MSAT Emissions

Construction mitigation techniques may include:

- Reducing the number of trips and extended idling.
- Enacting operational agreements that reduce or redirect work or shift times to avoid community exposures.
- Using verified emissions control technology retrofits (e.g., particulate matter traps, oxidation catalysts) or fleet modernization of engines for construction equipment.
- Implementing maintenance programs per manufacturers' specifications to ensure engines perform at EPA certification levels, as applicable, and to ensure retrofit technologies perform at verified standards, as applicable.
- Using clean fuels, such as ultra-low sulfur diesel, biodiesel, or natural gas.

Post-Construction Mitigation

As MSAT levels are not projected to substantially increase due to the proposed project, no post-construction mitigation techniques are provided.

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Attachment: Figures 1 - 3
I-35W Transit/Access Project MSAT Analysis Work Plan
MOVES Project Files (CD-ROM)

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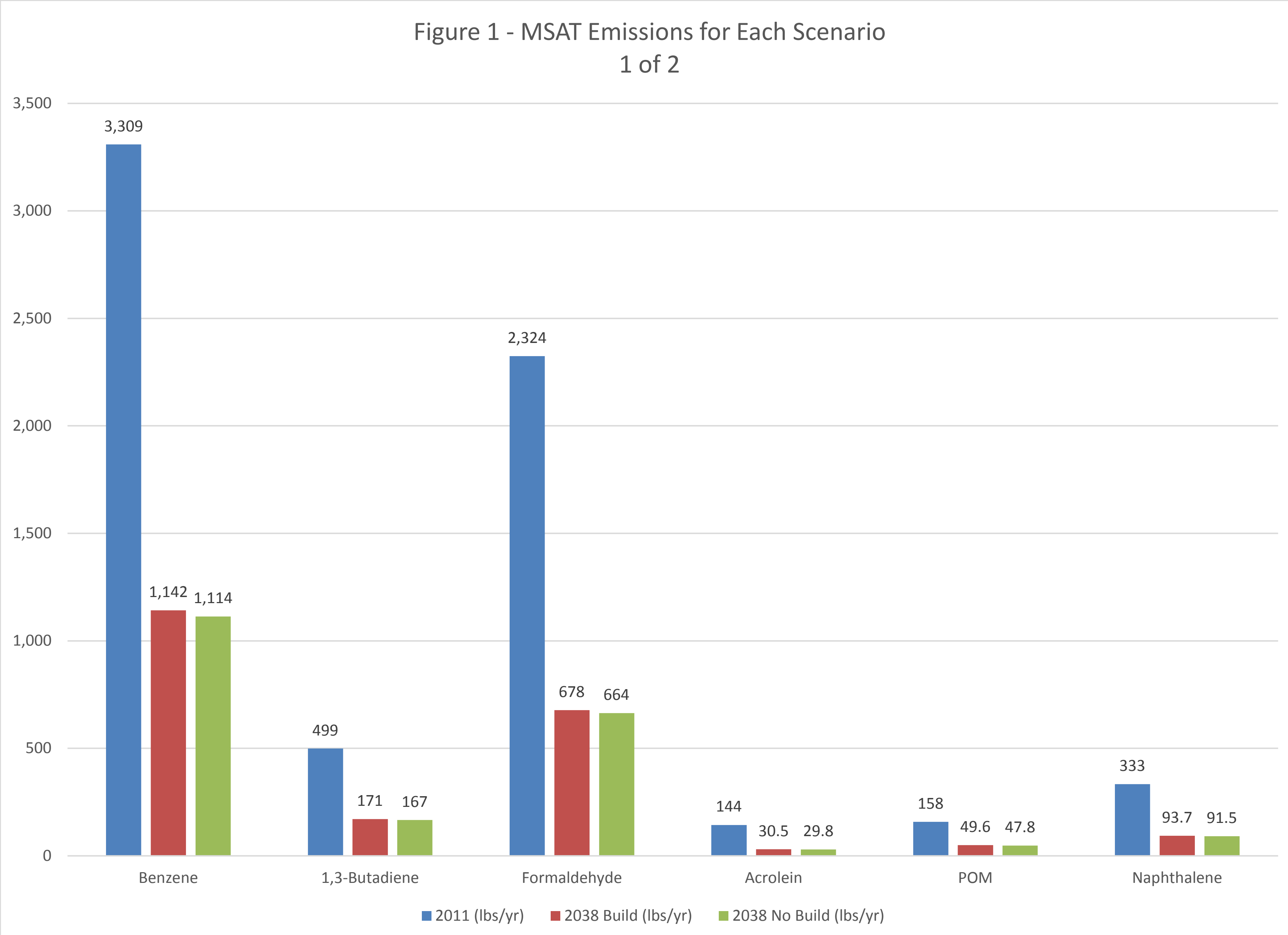
Figure 1 - MSAT Emissions for Each Scenario
1 of 2
3,500
3,000
2,500
2,000
1,500
1,000
500
0
3,309
1,142
1,114
499
171
167
2,324
678
664
144
30.5
29.8
158
49.6
47.8
333
93.7
91.5
Benzene
1,3-Butadiene
Formaldehyde
Acrolein
POM
Naphthalene
2011 (lbs/yr)
2038 Build (lbs/yr)
2038 No Build (lbs/yr)

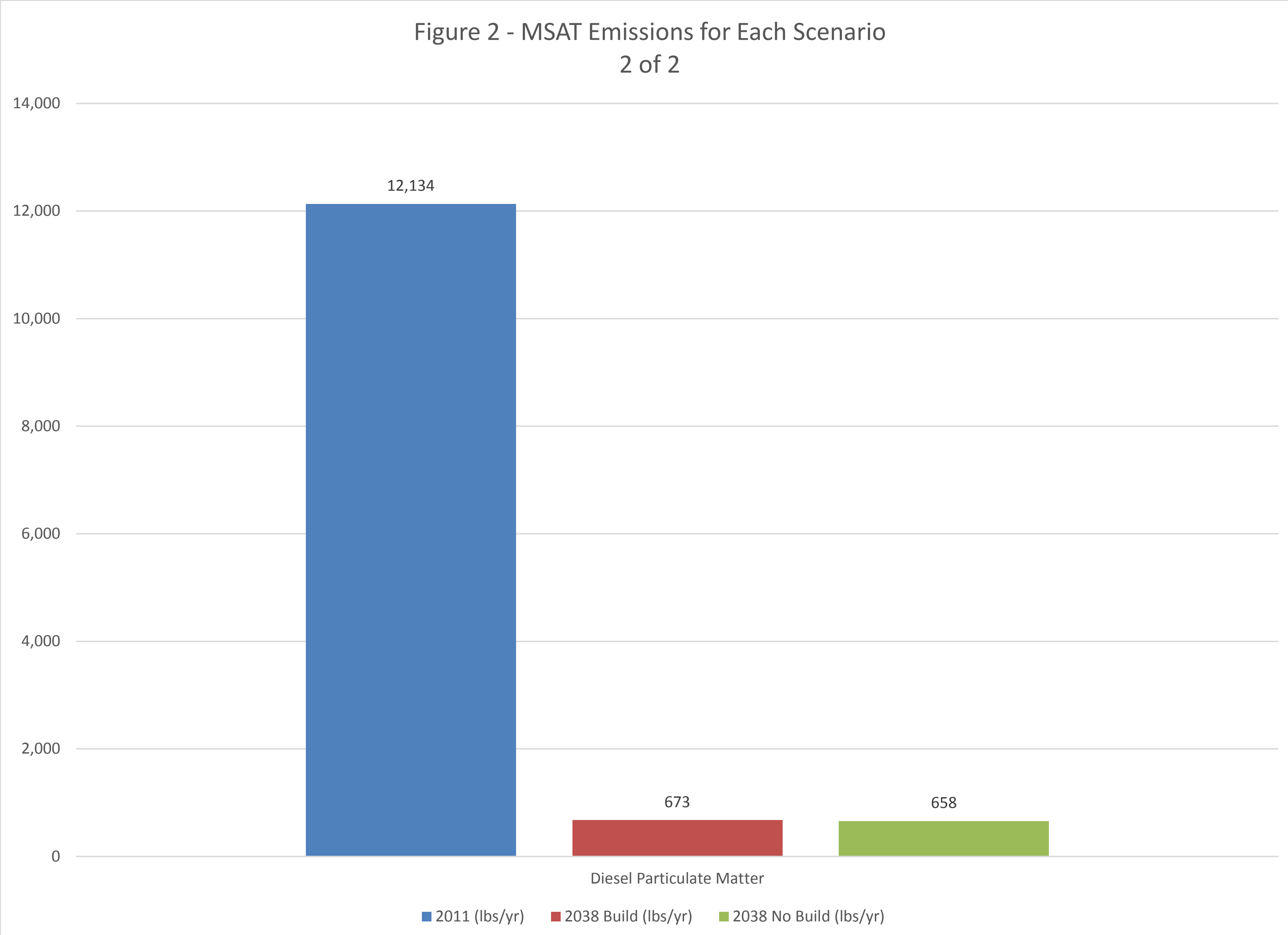
Figure 2 - MSAT Emissions for Each Scenario
2 of 2
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
12,134
673
658
Diesel Particulate Matter
2011 (lbs/yr)
2038 Build (lbs/yr)
2038 No Build (lbs/yr)

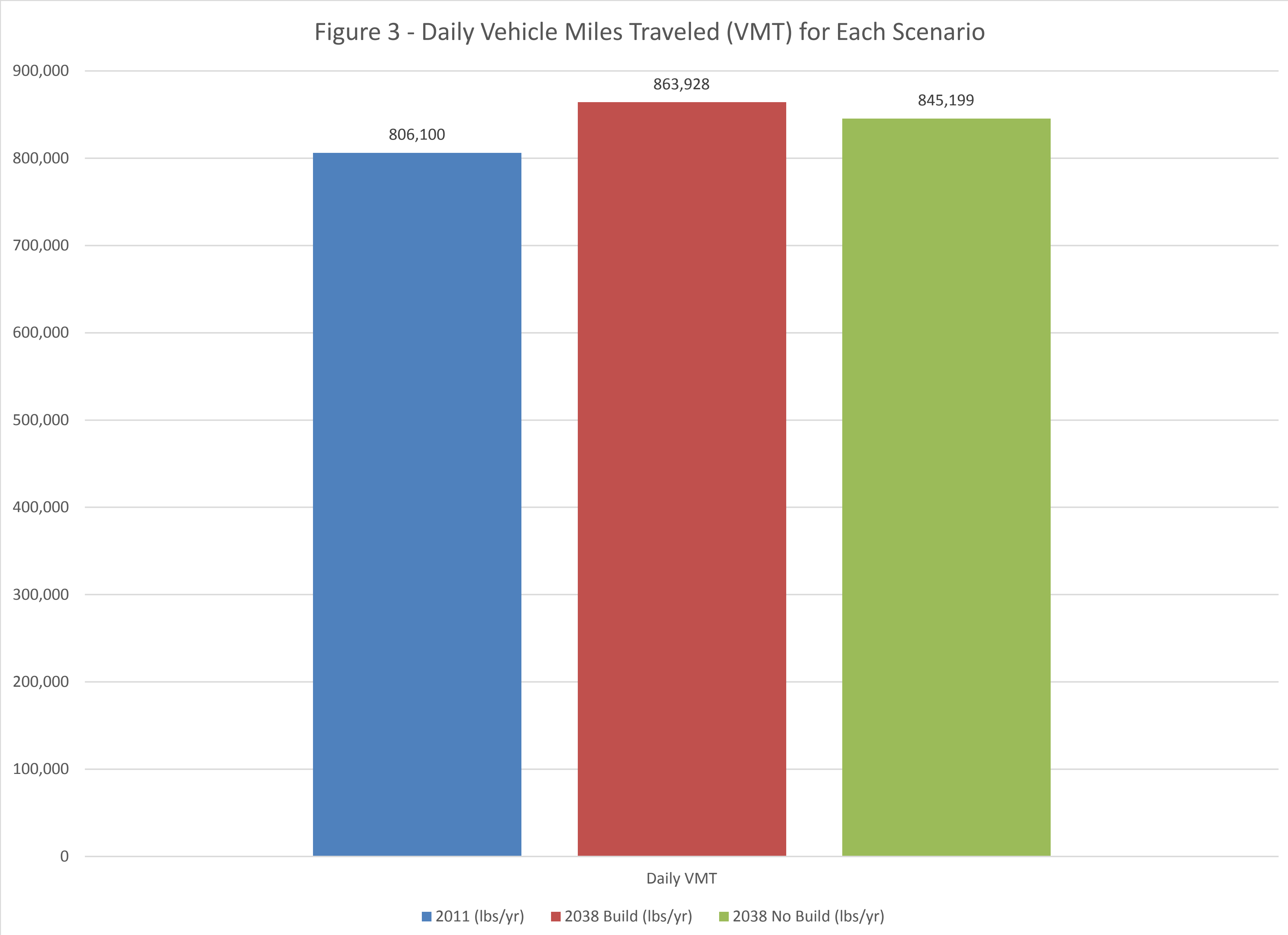
Figure 3 - Daily Vehicle Miles Traveled (VMT) for Each Scenario
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
806,100
863,928
845,199
Daily VMT
2011 (lbs/yr)
2038 Build (lbs/yr)
2038 No Build (lbs/yr)

Table 1 - MOVES MSAT Runspec Template

MOVES GUI Panel	Recommendation	Notes	Project Selections:
Description	Use this to document the purpose of each run (e.g., “base year MSATs,” “2040 No-build MSATs,” etc.)		2011 Base Year; 2038 No-Build; 2038 Build
Scale	Use County scale and Inventory mode	Inventory mode easier to use, less potential for error in post-processing	County scale, Inventory mode
Time Spans	Use “hour” time aggregation level. Model base year, project design year, opening day (optional but recommended) (separate runs needed for each year); Model 4 seasons (e.g., Jan, Apr, Jul, Oct); Model weekdays; Model all 24 hours	MSAT effects are based on long-term exposure, not episodic conditions. This approach captures seasonal variations in emissions without need to model all months. All 24 hours needed to capture effects of temperature and speed.	**Years:** 2011, 2038; **Months:** January, April, July, October; **Days:** Weekdays; **Hours:** 24 hours
Geographic Bounds	County where project is located		Hennepin County, Minnesota
Vehicles/Equipment	All gas and diesel vehicle types, CNG transit bus	CNG bus needed unless local AVFT inputs available with zero CNG fraction for buses.	Use all gas and diesel vehicle types and CNG transit bus
Road type	All road types in affected transportation network; not “off-network”	“Off-network” includes only non-roadway emissions that are not included in MSAT analysis	**Road Types:** Urban restricted, urban unrestricted
Pollutants/Processes	**Pollutants:** Primary Exhaust; PM10-Total (for DPM); Benzene; 1,3-Butadiene; Formaldehyde; Acrolein; PAH (for naphthalene and POM); **Processes:** running exhaust, crankcase running exhaust only		All recommend pollutants and processes.
Manage Input Data Sets	No inputs needed		N/A
Strategies	No inputs needed		N/A
General Output	Units of grams or pounds recommended so results don’t round down to zero; report distance travelled for QA checks		**Units:** pounds

Table 1 - MOVES MSAT Runspec Template

MOVES GUI Panel	Recommendation	Notes	Project Selections:
Output Emissions Detail	Road type, maybe fuel type; not source type, emissions process or model year	For DPM, two options: 1) choose fuel type in Output Emissions Detail, and sum results only for diesel-fueled vehicles, or 2) do a separate run for DPM with only diesel vehicles selected in vehicles/equipment panel	Choose **option 1** for DPM
Advanced Performance Features	No selections needed		N/A

Table 2 - MOVES MSAT County Data Manager Template

Input	Level of Detail/notes	Possible data sources	Data source for project	SEH Comments
Age distribution	Same for all runs.	MPCA, MPO, MnDOT	MPCA	
Sourcetype population	Varies by year, same for all alternatives and seasons. Not used in calculating emissions for processes modeled in MSAT analysis, so defaults are fine.	MOVES defaults, MPCA, MPO, MnDOT	MPCA data for 2011; use population projection data for 2038	Assume population growth of 0.5% per year. Input data will vary from year to year.
Meteorology	Same for all runs. For simplicity, recommend one input table covering all months and hours.	MPCA, MOVES defaults	MPCA (Hennepin County data)	
Inspection/ Maintenance (I/M), Fuel Supply	Same for all alternatives, differ by year, fuels vary by season. One I/M table needed for each year; one complete set of fuel inputs can also be used for each year (instead of separate inputs by month).	MPCA, MOVES defaults	MPCA	I/M same for all months and years since no I/M are in place now and future I/M are unknown. Fuel supply same for all years (contains data from local refineries).
Fuel Type and Technologies	Optional, same for all runs; see note above.	MOVES defaults	Local data for transit buses; default for other vehicle types	Use default values.

Table 2 - MOVES MSAT County Data Manager Template

Input	Level of Detail/notes	Possible data sources	Data source for project	SEH Comments
VMT and speeds	Unique inputs needed for each run (these vary by year and by alternative). Speed inputs should be as detailed as possible to capture congestion relief impacts (at a minimum: peak and off-peak speeds).	Project traffic modeling	Project traffic modeling (CORSIM model and MnDoT data) available on an hourly basis. Data was obtained for 2010 and 2030. Assume linear relationship between years; scale up to obtain data for 2011 (baseline year) and 2038 (design year). Data also obtained from Metro Transit for transit buses running on project links.	Project traffic modeling provided unique inputs for “truck” and “non-truck” vehicle types. Additional information also obtained for transit bus vehicle types. Input files will vary from month to month and year to year.
Road type distribution and ramp fraction	Include unique input for each run if the project changes these factors (e.g., shifting VMT from arterial to freeway, or increases ramp fraction by building new ramps). Also varies by year.	Project traffic modeling, MPO, MnDOT	Project traffic modeling (CORSIM model). Data was obtained for 2010 and 2030. Assume linear relationship between years; scale up to obtain data for 2011 (baseline year) and 2038 (design year).	Input files will vary from month to month and year to year.
Day and month VMT fractions	Same for all runs. For simplicity, recommend one input table covering all months and hours.	MPO, MnDOT, MOVES defaults	Project traffic modeling (SEH, MnDOT data)	Use AADVMT from traffic modeling; input values into AADVMT calculator.
Hour VMT fractions	Same for all alternatives; may differ by year.	MPO, MnDOT, MOVES defaults	MOVES defaults	Use AADVMT from traffic modeling; input values into AADVMT calculator.

Table 3 - Assumptions

Assumption	**Time Frame Affected**	**Reason/Source**	**Affected Model Inputs**
Population increase of 0.05% per year for Hennepin County (equates to 14.42% increase between 2011 to 2038).	Design year (2038)	Based on information provided in "I-35W Transit Access Forecast Memo," Jan. 13, 2012, SEH (Minneapolis total annual growth of 0.05%); "Minnesota Population Projections, 2015 to 2040," Oct. 2012, Minesota State Demographic Center (Hennepin County total growth of 10-20% between 2015 and 2040)	"Population" CDM inputs
No motorcycle traffic during winter months; assign motorcycle VMT to passenger car and truck VMT instead.	January, all years	Poor weather and road conditions during winter months.	"VMT," "Roadtype" CDM inputs
Reduce number of school buses by 93.7% for summer months to reflect summer school transportation.	July, all years	Minneapolis Public Schools enrollment for summer session (typically 5 weeks in June/July) is about 6375 students, compared to about 33,000 during the school year. Therefore, summer bus volumes are about 19% of regular school year bus volumes). Spread out over the entire three months of summer (19% divided by 3), this equates to 6.3% of regular school year bus volumes, or a decrease of 93.7% during summer months.	"VMT," "Roadtype" CDM inputs
No traffic in NB I-35W MnPASS lane.	Non-peak hours, all years	Lane is closed during non-peak hours	"VMT," "Speed," "Roadtype," "Ramps" CDM inputs
Transit bus volumes on 35W will double between 2011 and 2038 for the build scenario. Traffic model data will be used for transit buses for the 2038 non-build scenario.	Design year (2038)	SEH Traffic Engineers	"VMT," "Speed," "Roadtype," "Ramps" CDM inputs
Traffic volumes will increase linearly between base year (2011) and design year (2038), based on traffic model data obtained for 2010 and 2030.	Base year (2011) and Design year (2038)	Reasonable estimation	"VMT," "Speed," "Roadtype," "Ramps" CDM inputs

Table 4 - Modeled Links

Link ID	Link Description	Road Type	Link Length
		(UR=4; UU=5)	(miles)
nw1	NB I-35W- between 36th/45th(1)	4	0.08
nw2	NB I-35W- between 36th/45th(2)	4	0.10
nw3	NB I-35W- between 36th/45th(3)	4	0.50
nw4	NB I-35W- between 36th/45th(4)	4	0.08
nw5	NB I-35W- between 36th/35th	4	0.54
nw6	NB I-35W- between 35th/31st(1)	4	0.07
nw7	NB I-35W- between 35th/31st(2)	4	0.04
a1	NB I-35W- between 31th/28th	4	0.13
a2	NB I-35W- between 31th/28th	4	0.33
nw8	NB I-35W- between 28th/TH 65 split(1)	4	0.07
nw9	NB I-35W- between 28th/TH 65 split(2)	4	0.26
nw10	NB I-35W- between 28th/TH 65 split(3)	4	0.22
nw11	NB I-35W- between split/5th	4	0.54
nw12	NB I-35W- between 5th/EB94	4	0.16
nw13	NB I-35W- between EB94/TH55	4	0.27
n14	NB I-35W- between TH55/wash	4	0.08
nr1	NB MnPASS between 46th/36th(1)	4	0.44
nr2	NB MnPASS between 46th/36th(2)	4	0.44
nr3	NB MnPASS between 36th/35th(1)	4	0.75
nr4	NB MnPASS between 36th/35th(2)	4	0.08
nr5	NB MnPASS between 35th/65Split(1)	4	0.97
nr6	NB MnPASS between 35th/65Split(2)	4	0.08
b1	SB I-35W- between Wash/WB94	4	0.68
b2	SB I-35W- between WB94/toCurve	4	0.36
b3	SB I-35W- between Curve/TH 65	4	0.70
b4	SB I-35W- between TH65/Lake St(1)	4	0.09
b5	SB I-35W- between TH65/Lake St(2)	4	0.31
b6	SB I-35W- between Lake st and 31st	4	0.47
b7	SB I-35W- between 31st/35th(1)	4	0.03
b8	SB I-35W- between 31st/35th(2)	4	0.03
sw3	SB I-35W- between 35th/36th	4	0.61
sw2	SB I-35W- between 36th/45th(1)	4	0.10
sw1	SB I-35W- between 36th/45th(2)	4	0.56

Table 4 - Modeled Links

Link ID	Link Description	Road Type	Link Length
		(UR=4; UU=5)	(miles)
c1	SB TH65 - between Dwtn/12th	4	0.12
c2	SB TH65 - between 12th/EB94	4	0.23
c3	SB TH65 - between EB94/35W	4	0.62
d1	NB I-35W - Exit to 36th	4	0.21
d2	NB I-35W - Exit to 31st	4	0.16
d3	NB I-35W - Exit to 28th	4	0.00
e1	SB I-35W - Entrance from WB I-94	4	0.06
e2	SB I-35W - Entrance from Washington CD Rd	4	0.24
e3	SB I-35W - Exit to Lake St	4	0.00
e4	SB I-35W - Exit to 35th	4	0.10
f1	EB I-94 - Exit to SB I-35W	4	0.16
f2	EB I-94 - Exit to SB TH 55	4	0.33
g1	WB I-94 - Exit to HennLyn(1)	4	0.17
g2	WB I-94 - Exit to HennLyn(2)	4	0.09
g3	WB I-94 - Exit to HennLyn(3)	4	0.36
h1	36th St west of Blaisdell	5	0.23
h2	36th St west of Nicollet	5	0.08
h3	36th St - 2nd to 5th	5	0.25
h4	36th St - 5th to Portland	5	0.07
h5	36th St - Portland to Park	5	0.12
i1	31st St west of Blaisdell	5	0.16
i2	31st St west of Nicollet	5	0.09
i3	31st St west of 1st	5	0.06
i4	31st St - west of Stevens	5	0.07
j1	Lake St west of Blaisdell(1)	5	0.21
J2	Lake St west of Blaisdell(2)	5	0.20
j3	Lake St west of Nicollet	5	0.09
j4	Lake St west of 1st	5	0.07
j5	Lake St - west of Stevens	5	0.07
j6	Lake St - west of 2nd	5	0.06
k1	28th St west of Nicollet	5	0.09
k2	28th St west of 1st	5	0.06
k3	28th St - west of Stevens(1)	5	0.03
k4	28th St - west of Stevens(2)	5	0.03
k5	28th St - west of 5th	5	0.08
k6	28th St - west of Portland	5	0.06
k7	28th St - west of Park	5	0.13
k8	28th St - west of Chicago	5	0.12

Table 4 - Modeled Links

Link ID	Link Description	Road Type	Link Length
		(UR=4; UU=5)	(miles)
k9	28th St - west of 12th	5	0.25
k10	28th St - west of Bloomington	5	0.25
l1	26th St west of Blaisdell(1)	5	0.21
l2	26th St west of Blaisdell(2)	5	0.21
l3	26th St west of 1st	5	0.06
l4	26th St - west of 5th	5	0.09
l5	26th St - west of Portland	5	0.06
l6	26th St - west of Oakland	5	0.06
l7	26th St - west of Park	5	0.06
l8	26th St - west of Columbus	5	0.06
l9	26th St - west of Chicago	5	0.06
l10	26th St - west of 12th	5	0.25
m1	Blaisdell north of 38th	5	0.25
m2	Blaisdell north of 37th	5	0.25
m3	Blaisdell north of 33rd	5	0.25
m4	Blaisdell north of 31st	5	0.11
m5	Blaisdell north of 28th	5	0.12
m6	Blaisdell north of 27th	5	0.12
m7	Blaisdell north of 26th	5	0.27
m8	Blaisdell north of 24th	5	0.11
m9	Blaisdell north of 22nd	5	0.11
m10	Blaisdell north of Franklin	5	0.05
n1	Nicollet north of 38th	5	0.25
n2	Nicollet north of 37th	5	0.12
n3	Nicollet north of 36th	5	0.10
n4	Nicollet north of 33rd	5	0.20
n5	Nicollet north of 27th	5	0.12
n6	Nicollet north of 26th	5	0.25
o1	1st north of 35th	5	0.10
o2	1st north of 34th	5	0.31
o3	1st north of 32nd	5	0.09
o4	1st north of 31st	5	0.11
p1	Stevens north of 35th ramp	5	0.06

Table 4 - Modeled Links

Link ID	Link Description	Road Type	Link Length
		(UR=4; UU=5)	(miles)
p2	Stevens north of 35th	5	0.15
p3	Stevens north of 33rd	5	0.15
p4	Stevens north of 31st	5	0.12
p5	Stevens north of Lake St	5	0.05
p6	Stevens north of Lake Ramp	5	0.20
p7	Stevens north of 28th	5	0.25
q1	2nd north of 35th ramp	5	0.10
q2	2nd north of 36th ramp	5	0.20
q3	2nd north of 31st ramp	5	0.20
q4	2nd north of 31st	5	0.02
r1	5th north of 35th	5	0.10
r2	5th north of 34th	5	0.41
r3	5th north of 31st	5	0.10
r4	5th north of Lake	5	0.25
r5	5th north of 28th	5	0.24
r6	5th north of 26th	5	0.25
r7	5th north of 24th	5	0.24
s1	Portland north of Lake	5	0.25
s2	Portland north of 28th	5	0.24
s3	Portland north of 26th	5	0.08
s4	Portland north of 25th	5	0.04
s5	Portland north of 24th	5	0.04
s6	Portland north of Franklin	5	0.11
s7	Portland north of 19th	5	0.13
s8	Portland north of 17th	5	0.12
t1	Park north of 35th	5	0.10
t2	Park north of 34th	5	0.21
t3	Park north of 33rd	5	0.19
t4	Park north of 31st	5	0.10
t5	Park north of Lake	5	0.25
t6	Park north of 28th	5	0.25
t7	Park north of 26th	5	0.12
u1	Chicago north of 35th	5	0.11
u2	Chicago north of 34th	5	0.20
u3	Chicago north of 33rd	5	0.21
u4	Chicago north of 31st	5	0.10
u5	Chicago north of Lake	5	0.24
u5	Chicago north of 28th	5	0.24

Table 5 - File Names

2011 Base Year run

Input database:	**2011_base_year_in_working**
Output database:	**2011_base_year_out_working**
Input:	**Spreadsheet data file:**
Meteorology	Meteorology.xls
Age distribution	Age_2011.xls
Sourcetype population	Population_2011.xls
I/M	IM_allruns.xls
Fuel supply, fuel formulation	Fuels_allruns.xls
VMT	aadvmtcalculator_hpms_RoadType_4-5_2011.xls
Speed distribution	Speed_2011_update_11.15.13.xls
Road type distribution	Roadtype_2011_update.xls
Ramp fraction	Ramps_2011.xls
Month, Day VMT fractions	aadvmtcalculator_hpms_RoadType_4-5_2011.xls
Hour VMT fractions	aadvmtcalculator_hpms_RoadType_4-5_2011.xls
Fuel type and technologies	N/A

2038 No-Build run

Input database:	**2038_NB_design_year_in_working**
Output database:	**2038_NB_design_year_out_working**
Input:	**Spreadsheet data file:**
Meteorology	Meteorology.xls
Age distribution	Age_2038.xls
Sourcetype population	Population_2038.xls
I/M	IM_allruns.xls
Fuel supply, fuel formulation	Fuels_allruns.xls
VMT	aadvmtcalculator_hpms_2038_NoBuild.xls
Speed distribution	Speed_2038_NB_11.15.13.xls
Road type distribution	Roadtype_2038_NoBuild.xls
Ramp fraction	Ramps_2038_NB.xls
Month, Day VMT fractions	aadvmtcalculator_hpms_2038_NoBuild.xls
Hour VMT fractions	aadvmtcalculator_hpms_2038_NoBuild.xls
Fuel type and technologies	N/A

Table 5 - File Names

2038 Build run

Input database:	**2038_build_design_year_in**
Output database:	**2038_build_design_year_out**
Input:	**Spreadsheet data file:**
Meteorology	Meteorology.xls
Age distribution	Age_2038.xls
Sourcetype population	Population_2038.xls
I/M	IM_allruns.xls
Fuel supply, fuel formulation	Fuels_allruns.xls
VMT	aadvmtcalculator_hpms_2038_Build.xls
Speed distribution	Speed_2038_Build_11.15.13.xls
Road type distribution	Roadtype_2038_Build.xls
Ramp fraction	Ramps_2038_Build.xls
Month, Day VMT fractions	aadvmtcalculator_hpms_2038_Build.xls
Hour VMT fractions	aadvmtcalculator_hpms_2038_Build.xls
Fuel type and technologies	N/A