MSAT Technical Report

ArDOT JOB NO. CA0602

I-30 (From I-530/I-440 to I-40) and I-40 (From Hwy. 365/MacArthur Dr. to Hwy. 67)

Pulaski County, Arkansas

October 2017

U.S. Department of Transportation
Federal Highway Administration

ARDOT ARKANSAS DEPARTMENT OF TRANSPORTATION

CONNECTING ARKANSAS PROGRAM CAP

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1.0 INTRODUCTION

Approved by Arkansas voters, the Arkansas Department of Transportation (ArDOT) is implementing an accelerated State Highway Construction and Improvement Program named the Connecting Arkansas Program (CAP).

A major component of the CAP is to implement a project to improve a portion of Interstate 30 (I-30) from Interstate 530 (I-530) and Interstate 440 (I-440) to Interstate 40 (I-40), including the Arkansas River Bridge, and a portion of I-40 from Highway (Hwy.) 365 (MacArthur Drive [Dr.]) to Hwy. 67. This project is CA0602: I-530 - Hwy. 67 (Widening & Reconst.) (I-30 & I-40), commonly known as the 30 Crossing project. **Figure 1** illustrates the proposed 7.3-mile project limits.

1.1 Existing Facility

I-30 is one of the critical links of the Central Arkansas Freeway System. It connects communities within the Central Arkansas Region and serves local, regional and national travelers with varied destinations and trip purposes.

The I-30 corridor generally consists of three main lanes in each direction with parallel one-way discontinuous frontage roads on each side of the interstate. In the northern portion of the project limits, the I-40 corridor consists of three to four main lanes in each direction with parallel one-way frontage roads on each side of the interstate between the I-30/I-40 interchange and North Hills Boulevard (Blvd.). Within the 7.3-mile corridor, four system interchanges are located:

- I-30 with I-530 and I-440
- I-30 with I-630
- I-30 with I-40
- I-40 with Highways 67/167

1.2 Proposed Alternatives

1.2.1 No-Action Alternative

The No-Action Alternative represents the case in which the proposed project is not constructed, but could include future projects identified through the long range planning process for maintaining a state of good repair as funding becomes available.

Figure 1: Project Limits Map

1.2.2 Action Alternatives

Two different main lane configurations are under consideration. Both would include the replacement of the Arkansas River Bridge.

- Eight-Lane General Purpose (GP) Alternative would provide four main lanes in each direction with no Collector Distributor (C/D) lanes.
- Six-Lane with C/D Lanes Alternative would reconstruct the existing six-lane (three in each direction) roadway while adding two decision lanes on each side that ultimately feed into a C/D system located at the Arkansas River Bridge.

The current Hwy. 10 (Cantrell Road [Rd.]) interchange provides direct access to the downtown business district of Little Rock. Its proximity to the Arkansas River Bridge and the I-30 interchange with I-630 creates a unique level of complexity. In order to balance various project goals, two interchange concepts are being considered for replacement of this interchange:

- An elevated Single Point Urban Interchange (SPUI) constructed in the same location as the current interchange;
- A Split Diamond Interchange (SDI) constructed south of the existing interchange at 4th and 9th Streets.

Combining the two main lane configurations with the two Hwy. 10 (Cantrell Rd.) interchange concepts results in the four Action Alternatives as follows:

Alternative 1A: 8-Lane GP with SPUI Alternative
Alternative 1B: 8-Lane GP with SDI Alternative
Alternative 2A: 6-Lane with C/D Lanes with SPUI Alternative
Alternative 2B: 6-Lane with C/D Lanes with SDI Alternative

For detailed information on the Action Alternatives, refer to the **30 Crossing Environmental Assessment** (EA) for the proposed project.

2.0 PURPOSE

In compliance with the Federal Highway Administration's (FHWA) Guidance on mobile source air toxics (MSAT) analysis, this technical report discusses the MSAT analysis prepared for the 30 Crossing project. It presents background information on MSATs, discusses the scope and methodology of the analysis and presents the results of the MSAT quantitative analysis for the existing year (2014), the anticipated first year of completion (2021), and the design year (2041).

3.0 MOBILE SOURCE AIR TOXICS

In October 2016 FHWA issued updated guidance for the analysis of MSATs in the National Environmental Policy Act (NEPA) process for highway projects (*Interim Guidance Update on Air Toxic Analysis in NEPA Documents*). The following language is consistent with the FHWA guidance documents.

3.1 MSAT Background

Controlling air toxics emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that the U.S. Environmental Protection Agency (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).[1] In addition, EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment (NATA).[2] These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter. While FHWA considers these the priority MSATs, 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.

Motor Vehicle Emissions Simulator (MOVES)

According to EPA, MOVES2014 is a major revision to MOVES2010 and improves upon it in many respects. MOVES2014 includes new data, new emissions standards, and new functional improvements and features. It incorporates substantial new data for emissions, fleet, and activity developed since the release of MOVES2010. These new emissions data are for light- and heavy-duty vehicles, exhaust and evaporative emissions, and fuel effects. MOVES2014 also adds updated vehicle sales, population, age distribution, and vehicle miles travelled (VMT) data. MOVES2014 incorporates the effects of three new Federal emissions standard rules not included in MOVES2010. These new standards are all expected to impact MSAT emissions and include Tier 3 emissions and fuel standards starting in 2017 (79 FR 60344), heavy-duty greenhouse gas regulations that phase in during model years 2014-2018 (79 FR 60344), and the second phase of light duty greenhouse gas regulations that phase in during model years 2017-2025 (79 FR 60344).

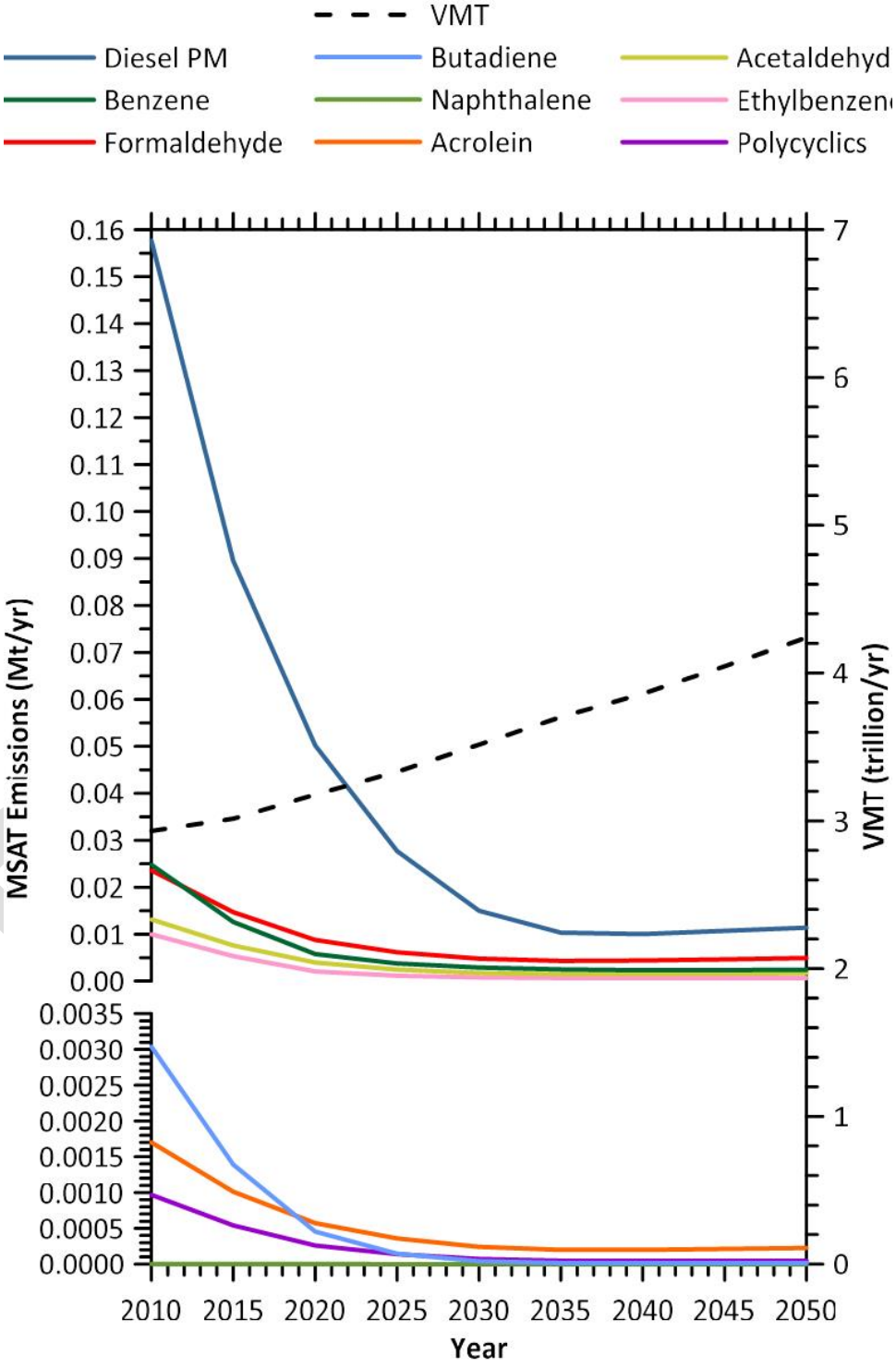
Since the release of MOVES2014, EPA has released MOVES2014a. In the November 2015 MOVES2014a Questions and Answers Guide,[3] EPA states that for on-road emissions, MOVES2014a adds new options requested by users for the input of local VMT, includes minor updates to the default fuel tables, and corrects an error in MOVES2014 brake wear emissions. The change in brake wear emissions results in small decreases in PM emissions, while emissions for other criteria pollutants remain essentially the same as MOVES2014.

Using EPA's MOVES2014a model, as shown in **Figure 2**, FHWA estimates that even if VMT increases by 45 percent from 2010 to 2050 as forecast, a combined reduction of 91

[1] EPA, https://www.epa.gov/iris
[2] EPA, https://www.epa.gov/national-air-toxics-assessment
[3] EPA, https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100NNR0.txt

percent in the total annual emissions for the priority MSAT is projected for the same time period.

Figure 2: National MSAT Emission Trends, 2010-2050, for Vehicles Operating on Roadways Using EPA's MOVES2014a Model



Source: EPA MOVES2014a model runs conducted by FHWA, September 2016.
Note: Trends for specific locations may be different, depending on locally derived information representing vehicle-miles travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorological, and other factors.

3.2 MSAT Research

Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how potential public health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA.

Nonetheless, air toxics concerns continue to arise on highway projects during the NEPA process. Even as the science emerges, the public and other agencies expect FHWA to address MSAT impacts in its environmental documents. The FHWA, EPA, the Health Effects Institute, and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with highway projects. The FHWA will continue to monitor the developing research in this field.

3.3 Consideration of MSAT in NEPA Documents

The FHWA developed a tiered approach with three categories for analyzing MSAT in NEPA documents, depending on specific project circumstances:

1. No analysis for projects with no potential for meaningful MSAT effects;
2. Qualitative analysis for projects with low potential MSAT effects; or
3. Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.

For projects warranting an MSAT analysis, the nine priority MSATs should be analyzed.

(1) <u>Projects with No Meaningful Potential MSAT Effects, or Exempt Projects.</u>

The types of projects included in this category are:

- Projects qualifying as a categorical exclusion under 23 CFR 771.117(c) (subject to consideration whether unusual circumstances exist under 23 CFR 771.117(b));
- Projects exempt under the Clean Air Act (CAA) conformity rule under 40 CFR 93.126; or
- Other projects with no meaningful impacts on traffic volumes or vehicle mix.

(2) <u>Projects with Low Potential MSAT Effects</u>

The types of projects included in this category are those that serve to improve operations of highway, transit, or freight without adding substantial new capacity or without creating a facility that is likely to meaningfully increase MSAT emissions. This category covers a broad range of projects.

Any projects not meeting the criteria in category (1) or category (3) below should be included in this category. Examples of these types of projects are minor widening projects, new interchanges, replacing a signalized intersection on a surface street, or projects

where design year traffic is projected to be less than 140,000 to 150,000 annual average daily traffic (AADT).

(3) Projects with Higher Potential MSAT Effects

This category includes projects that have the potential for meaningful differences in MSAT emissions among project alternatives. Projects in this category are those that:

- Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location, involving a significant number of diesel vehicles for new projects or accommodating with a significant increase in the number of diesel vehicles for expansion projects; or
- Create new capacity or add 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[4] or greater by the design year; and
- Proposed to be located in proximity to populated areas.

As shown in **Table 1**, the 30 Crossing project meets the criteria of category 3, projects with higher potential MSAT effects; therefore, a quantitative MSAT analysis is required.

Table 1: Criteria for Projects with Higher Potential MSAT Effects

Criteria	30 Crossing Project
Create new capacity or add significant capacity to urban highways such as interstates, urban arterials or urban CD 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.	Increases in design year (2041) main-line average daily traffic (ADT) anticipated on I-30 and I-40: • I-30 in the southern portion of the project: 128,000 to 132,000 ADT in 2041 compared to 97,500 ADT in 2014; • I-30 south and north of the Arkansas River: 161,000 to 175,000 ADT compared to 123,000 to 126,000 ADT in 2014; • I-40: 165,000 to 168,000 ADT compared to 124,000 ADT in 2014.
Proposed to be located in proximity to populated areas.	Land use abutting the right-of-way includes single and multi-family residences, schools, churches, parks, mixed-use commercial areas and the Arkansas River Trail in both Little Rock and North Little Rock.

Source: ArDOT, MSAT Consultation Memorandum & Recommendations, April 2016.

[4] FHWA, https://www.fhwa.dot.gov/environMent/air_quality/air_toxics/policy_and_guidance/msat/

3.4 Quantitative MSAT Analysis

A quantitative analysis was completed to provide a basis for identifying and comparing the potential differences among MSAT emissions—if any—from the various alternatives.

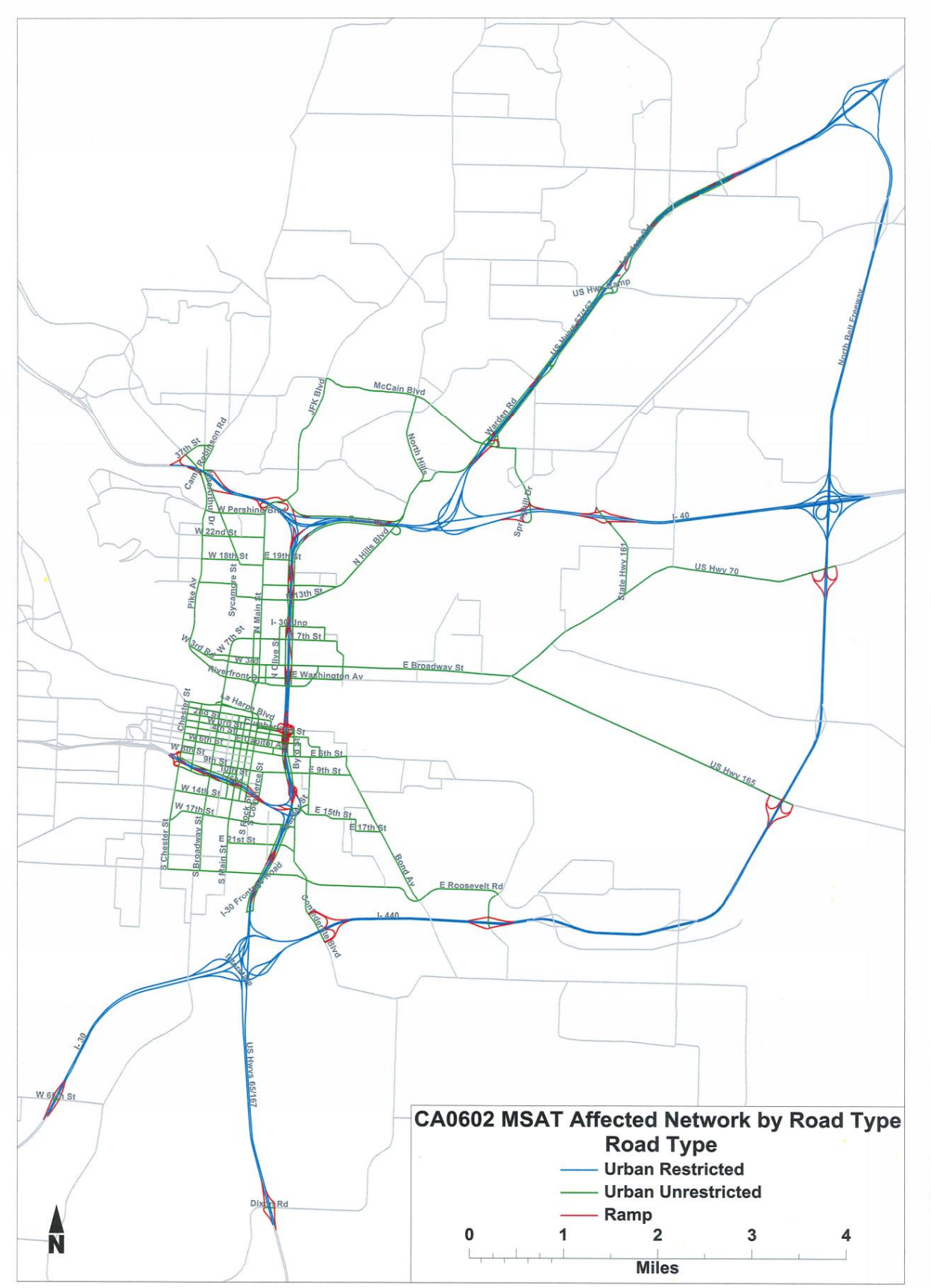
3.4.1 Scope and Methodology

The quantitative MSAT analysis estimates the annual emissions of the nine priority MSATs as a function of VMT and MSAT emission rates developed by MOVES2014a. The simplest scope of analysis would be to only calculate emissions for those roadway segments that would be constructed as part of the project. However, that methodology would not consider the influence of the proposed project on the surrounding areas. Therefore, it is more appropriate to define an Affected Transportation Network to better capture the MSAT emissions that would be generated as a result of the project. This network would include the proposed project plus other transportation links where traffic volumes are expected to change as a result of the project.

The Affected Transportation Network was developed based upon multiple meetings held in 2015 to discuss the 30 Crossing project MSAT analysis methodology and assumptions. Depending on the meeting, attendees included representatives from ArDOT, Arkansas Department of Environmental Quality (ADEQ), Metroplan, the project team and the FHWA Arkansas Division and FHWA Resource Center. The resulting recommendations from these meetings were summarized in the *MSAT Consultation Memorandum & Recommendations,* April 13, 2016, included in **Attachment A**. The Affected Transportation Network developed through this process is shown in **Figure 3**.

The MSAT analysis years included the existing year (2014), first full opening year (2021) and design year (2041) for the No-Action and the Action Alternatives. The MSAT emissions analysis was completed using the current version of EPA's MOVES2014a based upon recommendations in the FHWA's Frequently Asked Questions (FAQ) Conducting Quantitative MSAT Analysis for FHWA NEPA Documents.

Figure 3: 30 Crossing MSAT Affected Network by Road Type

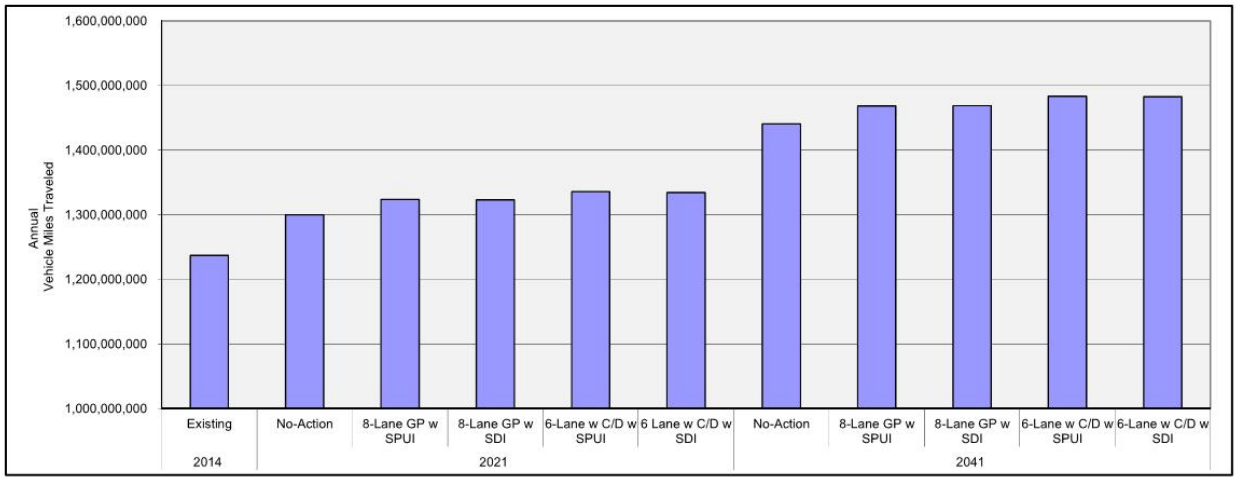


3.4.2 MSAT Analysis Results

The amount of MSATs emitted in the region would be proportional to VMT. However, because of improvements in emissions technologies, total MSAT emissions will decline over time, even while VMT increases.

The results of the 30 Crossing MSAT analyses are presented graphically in **Figure 4** and **Figure 5** and numerically in **Table 2**. Within the Affected Transportation Network, VMT would increase as shown in **Figure 4** from existing to the 2021 Alternatives and a greater amount with the 2041 Alternatives. The overall increase in VMT from existing to the Action Alternatives in 2041 would be 19 to 20 percent, as shown in **Table 2**. **Figure 4** shows that the estimated 2041 Action Alternatives VMT would be greater than the No-Action Alternative. Based on the data presented in **Table 2,** the increase in VMT from the 2041 No-Action to the Action Alternatives would be 1.9 to 3.0 percent.

Figure 4: 30 Crossing Annual VMT for the Affected Transportation Network



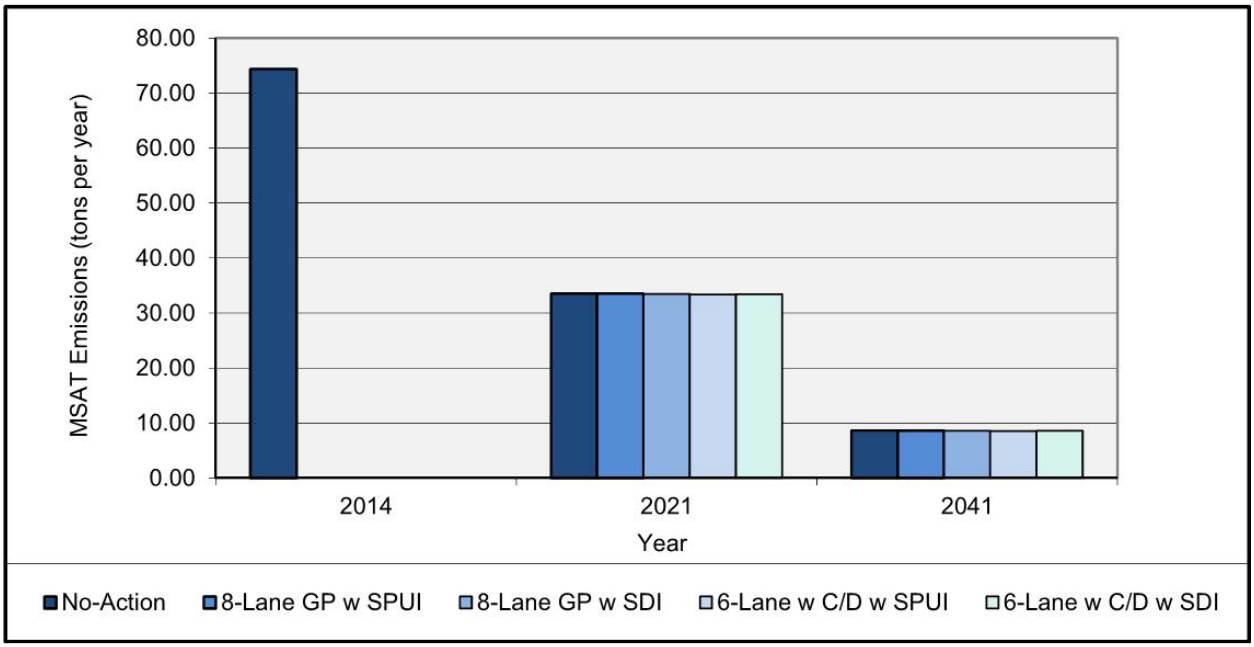
Source: Project Team, October 2017

Under the Action Alternatives, MSAT emissions would be lower than present levels in the design year as a result of EPA's national control programs. On a national basis, a combined reduction of 91 percent in the total annual emission rate for the priority MSATs is projected from 2010 to 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions are lower in the future.

As shown in **Figure 5**, annual total MSAT emissions in the Affected Transportation Network would drop dramatically from 2014 to 2021 and would continue to decline into the 2041 design year for all alternatives. The data in **Table 2** indicates that the analyses predict a decrease of 88 percent from 2014 to 2041 despite a 19 to 20 percent increase in VMT. **Figure 5** also indicates that the differences in MSAT emissions between the No-Action Alternative and the Action Alternatives would be relatively small. **Table 2** indicates that the difference in total MSAT emissions between the No-Action Alternative and the Action Alternatives would vary by 0.0 to -0.15 tons per year in 2021 and -0.06 to 0.08 tons per year in 2041. All the Action Alternatives had lower MSAT emissions in 2041 than the

No-Action Alternative by -0.3% to -0.9% with 6-Lane with C/D Alternatives producing slightly lower emissions than the 8-Lane GP Alternatives.

Figure 5: 30 Crossing Annual Total MSAT Emissions for the Affected Transportation Network



Source: Project Team, October 2017.

As shown in **Table 2**, Diesel Particulate Matter (Diesel PM) is the major contributor to the total MSAT emissions. Diesel PM would decrease 90% from existing levels by 2041. The greatest percentage reduction in MSAT emissions, 99%, occurs with 1.3 Butadiene. Smaller reductions are anticipated for the remaining pollutants. Variations between the No-Action Alternative and Action Alternatives are minor.

The additional travel lanes contemplated as part of the Action Alternatives will have the effect of moving traffic closer to some homes, and businesses; therefore, there may be localized areas where ambient concentrations of MSATs could be higher compared to the No-Action Alternative. Also, MSATs will be lower in other locations when traffic shifts away from them. However, as discussed below, the magnitude and the duration of these potential increases compared to the No-Action Alternative cannot be reliably quantified due to the inherent deficiencies of current models.

In summary, MSAT emissions in 2041 are expected to be relatively similar under the Action Alternatives relative to the No-Action Alternative. In comparing the Action Alternatives to the No-Action Alternative, MSAT levels could be higher in some locations than others, but current tools and science are not adequate to reliably quantify them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that will cause region-wide MSAT levels to be significantly lower than today. As this analysis shows, despite VMT increases from 2014 to 2041, MSAT emissions are still anticipated to decline considerably over the same period. The proposed project would not interfere with the substantial emissions

reductions forecasted in the project area due to the implementation of EPA's regulations.

Table 2: 30 Crossing MSAT Analyses for the Affected Transportation Network

	2014	2021					2041					Percent Change 2014 to 2041			
	Existing	No-Action	Action				No-Action	Action				Action			
			8-Lane GP w SPUI	8-Lane GP w SDI	6-Lane w C/D w SPUI	6 Lane w C/D w SDI		8-Lane GP w SPUI	8-Lane GP w SDI	6-Lane w C/D w SPUI	6 Lane w C/D w SDI	8-Lane GP w SPUI	8-Lane GP w SDI	6-Lane w C/D w SPUI	6 Lane w C/D w SDI
Annual Vehicle Miles Traveled	1,237,158,284	1,299,830,883	1,323,605,523	1,323,159,675	1,335,915,786	1,334,410,618	1,440,528,710	1,468,279,751	1,468,762,008	1,483,628,914	1,482,631,825	19%	19%	20%	20%
MSAT Pollutant	**(Tons per Year)**														
Benzene	6.87	2.62	2.67	2.68	2.69	2.7	0.66	0.67	0.68	0.68	0.68	-90%	-90%	-90%	-90%
Diesel PM (DPM)	49.35	22.59	22.49	22.48	22.32	22.34	4.85	4.81	4.82	4.78	4.79	-90%	-90%	-90%	-90%
1,3 Butadiene	0.84	0.26	0.27	0.27	0.27	0.27	0.01	0.01	0.01	0.01	0.01	-99%	-99%	-99%	-99%
Formaldehyde	7.72	3.91	3.92	3.91	3.91	3.91	1.8	1.78	1.78	1.77	1.77	-77%	-77%	-77%	-77%
Naphthalene	0.93	0.42	0.42	0.42	0.42	0.42	0.14	0.14	0.14	0.14	0.14	-85%	-85%	-85%	-85%
Acrolein	0.53	0.25	0.25	0.25	0.25	0.25	0.08	0.08	0.08	0.08	0.08	-85%	-85%	-85%	-85%
Acetaldehyde	4.18	1.87	1.88	1.88	1.88	1.88	0.62	0.61	0.61	0.61	0.61	-85%	-85%	-85%	-85%
Ethyl Benzene	3.55	1.41	1.43	1.43	1.44	1.44	0.45	0.45	0.46	0.46	0.46	-87%	-87%	-87%	-87%
Polycyclics	0.42	0.18	0.18	0.18	0.18	0.18	0.03	0.03	0.03	0.03	0.03	-93%	-93%	-93%	-93%
Totals	74.39	33.51	33.51	33.5	33.36	33.39	8.64	8.58	8.61	8.56	8.57	-88%	-88%	-88%	-88%
Note: Totals may not add correctly due to rounding															

Source: Project Team, October 2017.

* Identifies the overall changes in VMT from existing to the Action Alternatives in 2041.

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3.5 Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts 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.

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 CAA 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 IRIS, which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects."[5] 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 HEI. A number of HEI studies are summarized in Appendix D of FHWA's Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents.[6] 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[7] or in the future as vehicle emissions substantially decrease.

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.

[5] EPA, http://www.epa.gov/iris
[6] FHWA, http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/index.cfm
[7] HEI Special Report 16, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI.[8] As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA states that with respect to diesel engine exhaust, "[t]he absence of adequate data to develop a sufficiently confident dose-response relationship from the epidemiologic studies has prevented the estimation of inhalation carcinogenic risk" (EPA IRIS database, Diesel Engine Exhaust, Section II.C.).[9]

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 CAA 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.[10]

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.

4.0 CONCLUSION

In this Technical Report, the FHWA and ArDOT have provided a quantitative analysis of MSAT emissions relative to the No-Action and Action Alternatives. The FHWA and ArDOT have acknowledged that the project may result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain,

[8] Special Report 16, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects
[9] https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0642.htm#quainhal
[10] https://www.cadc.uscourts.gov/internet/opinions.nsf/284E23FFE079CD59852578000050C9DA/$file/07-1053-1120274.pdf

and because of this uncertainty, the health effects from these emissions cannot be reliably estimated.

5.0 REFERENCES

Frequently Asked Questions (FAQ) Conducting Quantitative MSAT Analysis for FHWA NEPA Documents, http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/moves_msat_faq.cfm, updated September 9, 2017.

Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA, https://www.fhwa.dot.gov/environMent/air_quality/air_toxics/policy_and_guidance/msat/, updated May 17, 2017.

MOVES2014a User Guide, Assessment and Standards Division, Office of Transportation and Air Quality, U.S. Environmental Protection Agency, EPA-420-B-15-095, November 2015.

Attachment A:

MSAT Consultation Memorandum & Recommendations

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MSAT CONSULTATION MEMORANDUM & RECOMMENDATIONS

ArDOT JOB NO. CA0602

I-30 (From I-530/I-440 to I-40) and
I-40 (From Hwy. 365/MacArthur Dr. to Hwy. 67)
Pulaski County, Arkansas
April 2016
Revised October 2017

U.S. Department of Transportation
Federal Highway Administration

ARDOT ARKANSAS DEPARTMENT OF TRANSPORTATION

CONNECTING ARKANSAS PROGRAM CAP

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1.0 INTRODUCTION

This memorandum outlines the Mobile Source Air Toxics (MSAT) analysis to be completed for the 30 Crossing project. The information presented in the memorandum is based on the Arkansas Department of Transportation's (ArDOT) understanding and application of the Federal Highway Administration's (FHWA) 2015 *Frequently Asked Questions (FAQ) Conducting Quantitative MSAT Analysis for FHWA NEPA Documents* (hereafter referred to as FHWA MSAT FAQs) to the project along with discussions with Metroplan, the project team (HNTB and Garver) and consultation with the FHWA Arkansas Division and FHWA Resource Center.

The 30 Crossing project includes the widening and reconstruction of Interstate 30 (I-30) from Interstate 530 (I-530) to Interstate 40 (I-40), including the Arkansas River Bridge, and I-40 from Highway (Hwy.) 365 (MacArthur Drive [Dr.]) to Hwy. 67. Following the completion of the April 2016 MSAT analysis the Action Alternatives were refined. Additional consultation was not conducted because the methodology agreed upon during the coordination that took place in early 2016 is still appropriate and applicable for the refined Action Alternatives. Two different main lane configurations are under consideration. Both would include the replacement of the Arkansas River Bridge.

- Eight-Lane General Purpose (GP) Alternative would provide four main lanes in each direction with no Collector Distributor (C/D) lanes.
- Six-Lane with C/D Lanes Alternative would reconstruct the existing six-lane (three in each direction) roadway while adding two decision lanes on each side that ultimately feed into a C/D system located at the Arkansas River Bridge.

The current Hwy. 10 (Cantrell Road [Rd.]) interchange provides direct access to the downtown business district of Little Rock. Its proximity to the Arkansas River Bridge and the I-30 interchange with I-630 creates a unique level of complexity. In order to balance various project goals, two interchange concepts are being considered for replacement of this interchange:

- An elevated Single Point Urban Interchange (SPUI) constructed in the same location as the current interchange;
- A Split Diamond Interchange (SDI) constructed south of the existing interchange at 4th and 9th Streets.

Combining the two main lane configurations with the two Hwy. 10 (Cantrell Rd.) interchange concepts results in the four Action Alternatives as follows:

Alternative 1A: 8-Lane GP with SPUI Alternative
Alternative 1B: 8-Lane GP with SDI Alternative
Alternative 2A: 6-Lane with C/D Lanes with SPUI Alternative
Alternative 2B: 6-Lane with C/D Lanes with SDI Alternative

For detailed information on the Action Alternatives, refer to the 30 Crossing Environmental Assessment (EA) for the proposed project.

FHWA's 2012 *Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA* (hereafter referred to as 'interim guidance') identifies a tiered approach with three categories for analyzing MSAT in NEPA documents, depending on the project circumstances:

1. No analysis for projects with no potential for meaningful MSAT effects;
2. Qualitative analysis for projects with low potential MSAT effects; or
3. Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.

As shown in **Table 1**, the 30 Crossing project meets the criteria of category 3, projects with higher potential MSAT effects; and therefore, a quantitative MSAT analysis is required.

Table 1: Criteria for Projects with Higher Potential MSAT Effects

Criteria	30 Crossing Project	Meet or Exceeds Criteria
Create new capacity or add significant capacity to urban highways such as interstates, urban arterials or urban CD 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	Increases in design year (2041) main-line average daily traffic (ADT) anticipated on I-30 and I-40: • 1-30 in the southern portion of the project: 128,000 to 132,000 ADT in 2041 compared to 97,500 ADT in 2014; • I-30 south and north of the Arkansas River: 161,000 to 175,000 ADT compared to 123,000 to 126,000 ADT in 2014; • I-40: 165,000 to 168,000 ADT compared to 124,000 ADT in 2014.	√
Proposed to be located in proximity to populated areas.	Land use abutting the right-of-way includes single and multi-family residences, schools, churches, parks, mixed-use commercial areas and the Arkansas River Trail in both Little Rock and North Little Rock.	√

The central Arkansas region is in attainment of the National Ambient Air Quality Standards (NAAQS) and as such is not subject to the associated transportation conformity process.

2.0 MSAT CONSULTATION

The information presented in this section served as the starting point for the MSAT analysis discussion between the FHWA and ArDOT.

2.1 Project Background

2.1.1 Limits: I-30 from I-530 in Little Rock to I-40 in North Little Rock, and I-40 from Hwy. 365 (MacArthur Dr.) to Hwy. 67/167 in North Little Rock (approximately 7.3 miles).

2.1.2 Proposed improvements: 6-lane with CD and 8-lane General Purpose (GP). MSAT emissions analyses will be completed for both alternatives.

- 6-lane with CD:
  - I-30 north and south of the CD limits. Added capacity improvement. Change existing 3-lane facility in each direction to 3 travel lanes and 2 decision lanes. Decision lanes are additional lanes predominately used for drivers exiting and entering the facility, whereas travel lanes are for traffic moving through the corridor.
  - I-40. Rehabilitation and added capacity improvement. Change existing 4-lane facility to 3 travel lanes and 2 auxiliary lanes.
  - I-30 from just south of Broadway Street (St.). in North Little Rock to Hwy. 10 (Cantrell Rd.) Interchange just north of 3rd St. in Little Rock. Added capacity improvement. Add 2 CD lanes to the existing 3 travel lanes.

- 8-lane GP
  - I-30 northbound from I-30/I-530/I-440 to I-630. Added capacity improvement. Change existing 3-lane facility to a 4 travel lane facility with an additional auxiliary lane between interchanges.
  - I-30 southbound from I-630 to south of Roosevelt Rd. Added capacity improvement. Change existing 3-lane facility to a 4-travel lane facility with an additional auxiliary lane between interchanges.
  - I-30 southbound from south of Roosevelt Rd. to I-30/I-530/I-440 interchange. Added capacity improvement. Change existing 3-lane facility to 4-travel lane facility.
  - I-30 from I-630 to 9th St. No Added Capacity. Facility to remain three lanes in each direction.
  - I-30 from 9th St. to I-40 interchange. Added capacity improvement. Change existing 3-lane facility in both directions to 4-travel lane facility in both directions.
  - I-40. Pavement rehabilitation of the existing lanes of I-40. No added capacity. Facility to remain four lanes in each direction.

2.1.3 Environmental Document: EA per FHWA approval of Class of Action Letter dated August 18, 2015.

2.1.4 Timeline

- Anticipated Finding of No Significant Impact (FONSI): January 2017
- Estimated Time of Project Completion (ETC): December 2021

2.2 Proposed Methodology for MSAT

2.2.1 MSAT methodology: link-by-link/quantitative MSAT.

2.2.2 Affected transportation network threshold: links with traffic changes between Build and No-Build scenarios of +/- 5% or other threshold as determined in consultation with FHWA.

Note: Per FHWA MSAT FAQs:

"FHWA recommends analyzing all segments associated with the project, plus those segments expecting meaningful changes in emissions as a result of the project (e.g., ± 10% or more). Define the affected network based on available project-specific information such as the environmental document traffic analysis considering changes in such metrics as:

- *± 5% or more in annual average daily traffic (AADT) on congested highway links of level of service (LOS) D or worse*
- *± 10% or more in AADT on uncongested highway links of LOS C or better;*
- *± 10% or more in travel time; and*
- *± 10% or more in intersection delay.*

These recommendations are not a substitute for project-specific knowledge and consideration of local circumstances."

2.2.3 Traffic data: as available through the 2010/2040 CARTS Travel Demand Model.

2.2.4 Analysis years/scenarios: Base Year, First Year of Operation Build and No-Build, Horizon Build, and Horizon No-Build.

2.2.5 Pollutants: acrolein, benzene, 1,3-butadiene, diesel particulate matter plus diesel exhaust organic gases (DPM), formaldehyde, naphthalene, and polycyclic organic matter.

2.2.6 Data Needs:

- Metroplan TDM Networks for Base Year, Horizon Build and Horizon No-Build (needed to determine affected transportation network).

- MOVES county (counties) specific input data to determine MSAT emissions factors, including but not limited to:
  - Age Distribution
  - Population - for each evaluation year
  - Meteorology – preferably one input covering all months and hours

- I/M (Inspection/Maintenance) – all months for each evaluation year
- Fuels – all months for each evaluation year
- VMT – each evaluation year
- Speed Distribution – detailed as possible for each evaluation year
- Road Type Distribution – detailed as possible for each evaluation year
- Ramp Fraction - detailed as possible for each evaluation year
- Month Day VMT Fractions
- Hour VMT Fractions

3.0 MSAT RECOMMENDATIONS

Beginning in late September 2015 through December 2015, six coordination meetings were held to discuss the 30 Crossing project MSAT analysis. Depending on the meeting, attendees included representatives from ArDOT, Arkansas Department of Environmental Quality (ADEQ), Metroplan, the project team and the FHWA Arkansas Division and FHWA Resource Center. Coordination topics included determining the Affected Transportation Network (ATN), the type of MSAT analysis to be performed, and the MSAT analysis years to be evaluated. MSAT analysis recommendations are presented below. A narrative outlining meeting attendees, content and development of these recommendations is presented in **Attachment A**.

Recommended ATN

Figure 1 presents the 30 Crossing MSAT ATN recommended by ArDOT. This ATN was developed through an iterative process summarized below and detailed in **Attachment A**.

1. Based on the FHWA recommended metrics outlined in FHWA's MSAT FAQs, ArDOT and Metroplan applied the following metrics to the CARTS Travel Demand Model to define affected transportation network.

    - ±5% ADT on Freeways
    - ±10% ADT on Arterials/Collectors with more than 3,000 ADT
    - ±5% ADT on Arterials/Collectors with more than 6,000 ADT/lane (i.e., Metroplan's surrogate for LOS D or worse)

2. The resulting ATN met the ±5/10% metrics. This included some major roadways extending beyond the project corridor, such as I-440 and Hwy. 67. For example, I-440 saw a -5/10% decrease in ADT. This decrease is because increasing capacity on I-30 would likely decrease traffic on I-440, an alternate route to I-30. Hwy. 67 saw a +5/10% increase in ADT because as more motorists choose to travel I-30 instead of I-440, Hwy. 67 would likely receive more traffic as motorists use that route to access the improved I-30.

    In addition, some gaps were identified in the ATN that ArDOT and Metroplan determined should be closed to more completely reflect the traffic and environmental impacts, such as I-40 between Hwy. 67 and I-440. The ATN was further refined by removing outlier network segments that did not have a substantial impact on the project and would dilute meaningful impacts of the proposed project.

3. Subsequent to the above coordination, Metroplan submitted a more extensive ATN to ArDOT for consideration. In many instances, the routes proposed by Metroplan for addition to the ATN had less than a 5% change in ADT, and therefore, did not meet the FHWA MSAT FAQ recommendations. Other segments were located outside the boundary of Pulaski County and were not directly related to travel characteristics within the project corridor.

4. After reviewing Metroplan's more extensive network, ArDOT recommended the network presented in **Figure 1** for the following reasons:

    - It included the corridor footprint
    - The routes fell within the ArDOT and Metroplan ADT metrics
    - Additional routes in both the Little Rock and North Little Rock Central Business District were included to fully account for the impact of traffic in the areas adjacent to the project addressing Metroplan's concerns
    - Additional routes were included to provide gap closure and a closed network addressing Metroplan's concerns

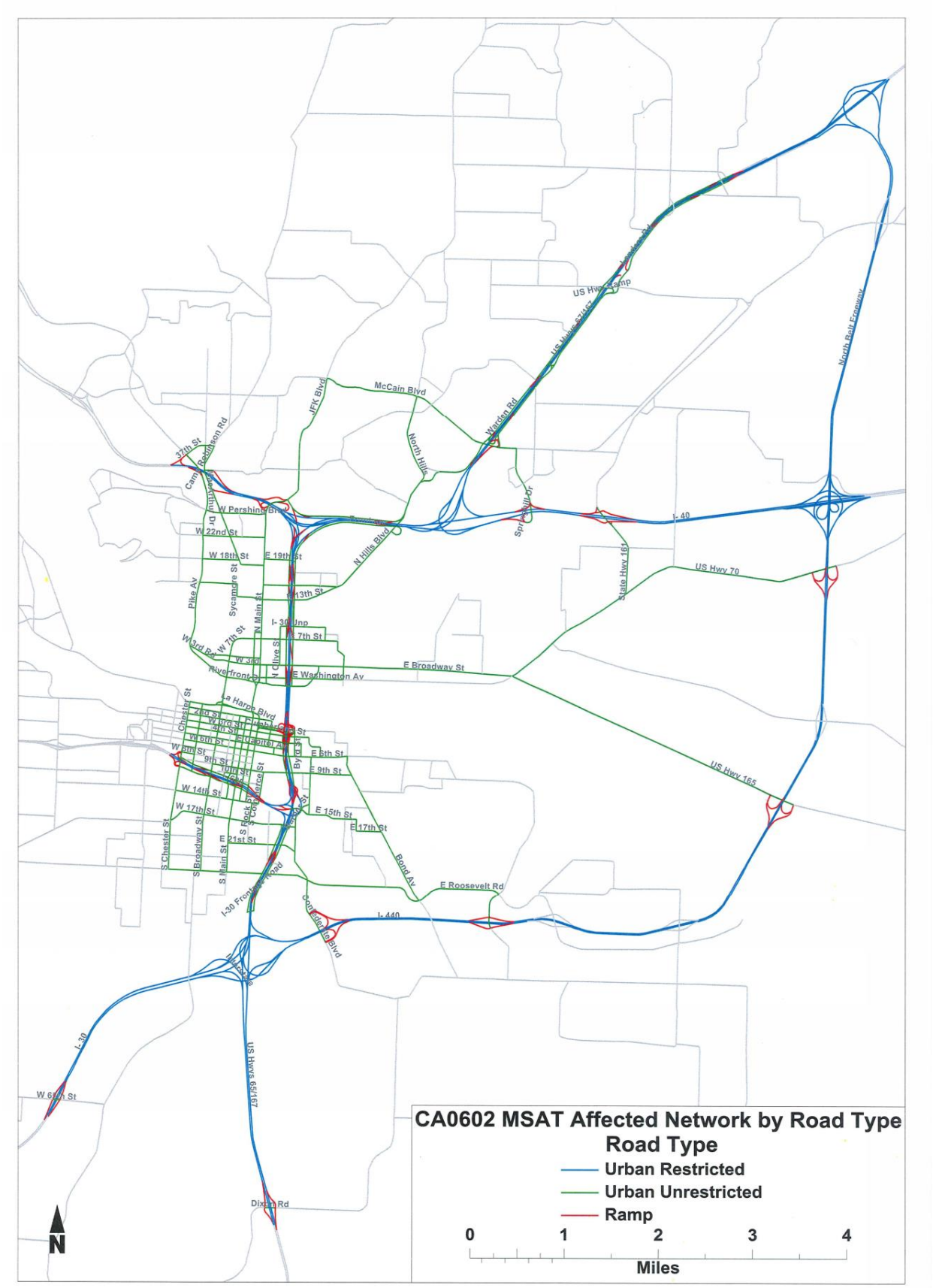
Recommended Type of Analysis

It is recommended that a quantitative analysis of the emission impacts be conducted on the recommended ATN shown in **Figure 1**.

Recommended Analysis Years

The MSAT interim guidance recommends the following as a guide to define the network analysis years; the base year (current), the project opening year, and the project design year. For the 30 Crossing project, that will translate to 2014, 2021 and 2041.

Figure 1: 30 Crossing Proposed MSAT Network



4.0 MSAT SPEED ASSESSMENT APPROACH

This narrative provides the approach to developing speed information for the MSAT model.

1. Calculate historical class and hourly fractions for representative locations on the affected network.
   - Obtain historical ArDOT counts on the MSAT affected network.
   - Calculate class distributions for each location and aggregate (as needed based on road type).
   - Calculate hourly traffic distribution factors.

2. Collect data from the CARTS Travel Demand Model (TDM).
   - Use the CARTS TDM to determine daily traffic volumes for all scenarios for links on the affected network.
   - Apply hourly distribution curves to daily link volumes to determine hourly link volumes.

3. Calculate speeds and speed distributions.
   - Obtain historical ArDOT speed data from the affected network to identify best-fit volume-delay equations and approximate distribution of speeds around average speed.
   - Apply best-fit volume-delay function to hourly link volumes to obtain average hourly link speeds.
   - Apply speed distribution to average link speeds to obtain hourly speed distribution curves.
   - Aggregate hourly speed distribution curves to produce daily speed distribution curves by roadway type.

4. Final deliverable
   - Speed distribution curves by roadway type for each scenario.

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Attachment A:

MSAT Coordination Meeting Notes

During the preparation of the I-30 Planning and Environment Linkages (PEL) Report, Metroplan submitted comments regarding air quality impacts of the project within the corridor. Due to the volume of traffic forecast for the main lane portion of this project, a Mobile Source Air Toxics (MSAT) analysis is required to determine the impact of this project on the emissions of the region. The central Arkansas region is in attainment of the National Ambient Air Quality Standards (NAQQS) and as such is not subject to the associated conformity process.

Note: All of the below meetings took place prior to the re-branding of the 10-lane CD Alternative to the 6-lane with CD Alternative; thus all references to this alternative are done so under the old naming convention of 10-lane CD Alternative.

September 30, 2015

On September 30, 2015, ArDOT began consultation activities with the project team and FHWA to determine the appropriate course of action.

December 9, 2015

On December 9, 2015, ArDOT, the project team, Metroplan, FHWA, and the Arkansas Department of Environmental Quality (ADEQ) met to determine the methodology to assess the air quality impacts of the project. FHWA provided interim guidance related to the MSAT analysis and published a subsequent Frequently Asked Questions.

Based on the interim guidance, there are three major tasks to be accomplished:

- Determine affected network
- Choose a quantitative or qualitative analysis
- Determine the analysis years

This narrative will concentrate on the determination of the affected network. This is the most critical part of the process. Based on the FHWA interim guidance, the network should either closely align with the other affected networks defined in the PEL Report or be presented with an explanation of the network limits are substantially different.

December 17, 2015

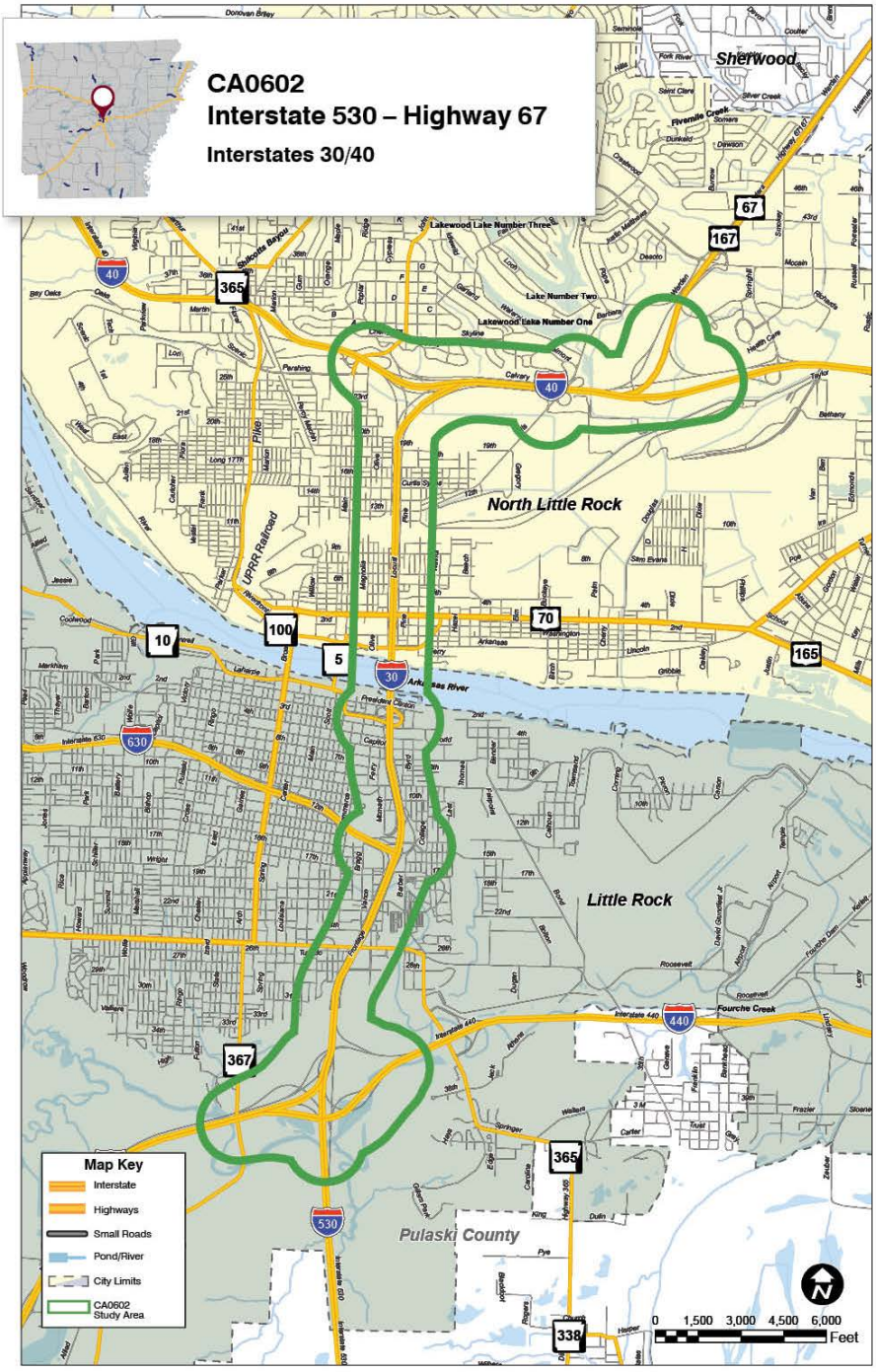
At the December 9, 2015 meeting, a working group was named to prepare a recommendation regarding the definition of the affected network for the Technical Oversight Committee (TOC) to consider. The MSAT Working Group met on December 17, 2015 to review the FHWA interim guidance and the FAQs. Much of the discussion at that meeting related to the definition of the affected network and work that had been performed to date.

For this project, the safety and operational analyses were originally defined for the PEL and are displayed in in **Figure A-1.** As a part of the operational analyses, the limits of this network were expanded to allow representative loading of traffic onto the VISSIM network. The differences between **Figure A-1** and the revised limits for the VISSIM analysis are listed below:

- Extension along I-30 to the west to include the Scott Hamilton Drive interchange

- Extension along I-40 to the west to include the Levy/Hwy. 365 interchange
- Extension along I-40 to the east to include the western-oriented ramps at the Springhill Drive interchange
- Extension along I-530 to the south to capture the Dixon Rd. interchange
- Extension along I-630 to the west to an undefined point

Figure A-1: I-30 PEL Study Area



The network additions for the VISSIM modeling are minimal in terms of additional lane miles analyzed and should be considered as the base analysis network.

Prior to the MSAT analysis, the CARTS Travel Demand Model (CARTS TDM) was used as one of the input values to for the traffic forecast to determine the total future demand within the corridor. The TDM was used in conjunction with historic growth rates, individual station forecasts, and other growth forecasts to provide a project growth rate. Specific, individual link volumes from the traffic assignment were not published as a part of this project. Instead, the growth rate agreed upon in the traffic forecast was applied to ground counts collected for this specific project.

Since that time, Metroplan has created additional traffic forecasts for the project that were used to conduct a system analysis of the project and other freeways in the central Arkansas region. The original CARTS TDM provided for the traffic forecast will not be used. Instead, the more recent traffic forecasts from the system analysis will be used as the data source traffic volumes along the project and within the CARTS TDM area.

The FHWA interim guidance stresses the MSAT analysis is to determine the impacts of emissions related to the project under development, independent of other improvements made to the network. As such, FHWA suggests thresholds to define impacted or affected network links. These suggestions are based on the forecast travel along network links, the total volume, volume to capacity ratio, or a change in the travel time as forecast by a working travel demand model for the project area.

The following thresholds were discussed by representatives of ArDOT, the project team, FHWA, and Metroplan:

- ±5% ADT on Freeways
- ±10% ADT on Arterials/Collectors with more than 3,000 ADT
- ±5% ADT on Arterials/Collectors with more than 6,000 ADT/lane (Metroplan's surrogate for LOS D or worse)

The change in travel time between specific origin-destination pairs was considered but dropped from these filters. The interim guidance also suggests that a single 'affected network' be defined for analysis of all alternatives.

December 22, 2015

On December 22, 2015, ArDOT and Metroplan met to further discuss the affected network designation. Metroplan provided the following assignment files from their Systems Analysis activities.

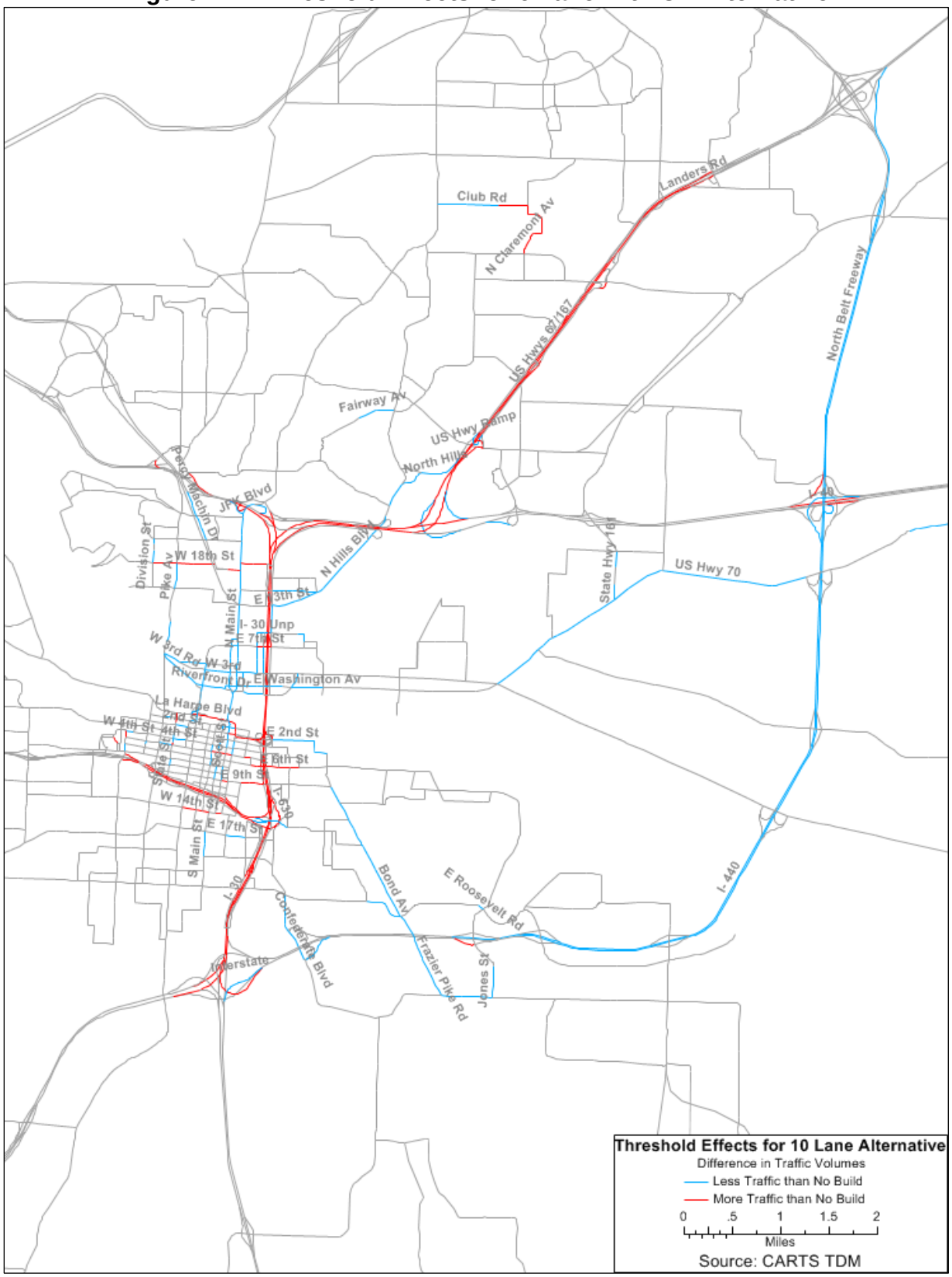
- CARTS TDM – No Build, 2010
- CARTS TDM – No Build, 2040
- CARTS TDM – 8-lane GP Alternative, 2040
- CARTS TDM – 10-lane CD Alternative, 2040
- CARTS TDM – 10-lane CD Alternative with additional widening along I-30 to 65th St. and along I-630 to University Avenue (Ave.), 2040

There are two alternatives under consideration. They are defined as the 8-lane GP and 10-lane with CD Alternatives. The CARTS TDM is not coded to show the difference in the operations of the lanes within the cross section (freeway versus collector-distributor). There is no commitment for further widening along I-30 or I-630 as described above. Therefore, only simplified 8-lane or 10-lane CD Alternatives (with no additional widening) are considered.

Following the December 22, 2015 meeting, ArDOT staff completed a comparison of the 8-lane GP assignment to the No-Build and the 10-lane CD assignment (without the additional widening) to the No-Build. This resulted in a draft affected network that is displayed in **Figure A-2**. This map displays those segments from the 10-lane CD Alternative that meet the prescribed percentage definitions for additions or reductions in assigned 24-hour volumes. This network is more robust than the safety and operations network shown in **Figure A-1**, and highlights the impact of the project within the project corridor and along I-440, I-40 and Hwy. 67/167.

The network presented in **Figure A-2** meets the ±5/10% parameters as described by the FHWA interim guidance and the supplemental ADT filters. However, there are gaps in the affected network that should be closed to more completely reflect the traffic and environmental impacts. There should also be some arterial network links added to the affected network to reflect the impacts in both the Little Rock and North Little Rock Central Business Districts (CBDs).

Figure A-2: Threshold Effects for 6 Lane with CD Alternative



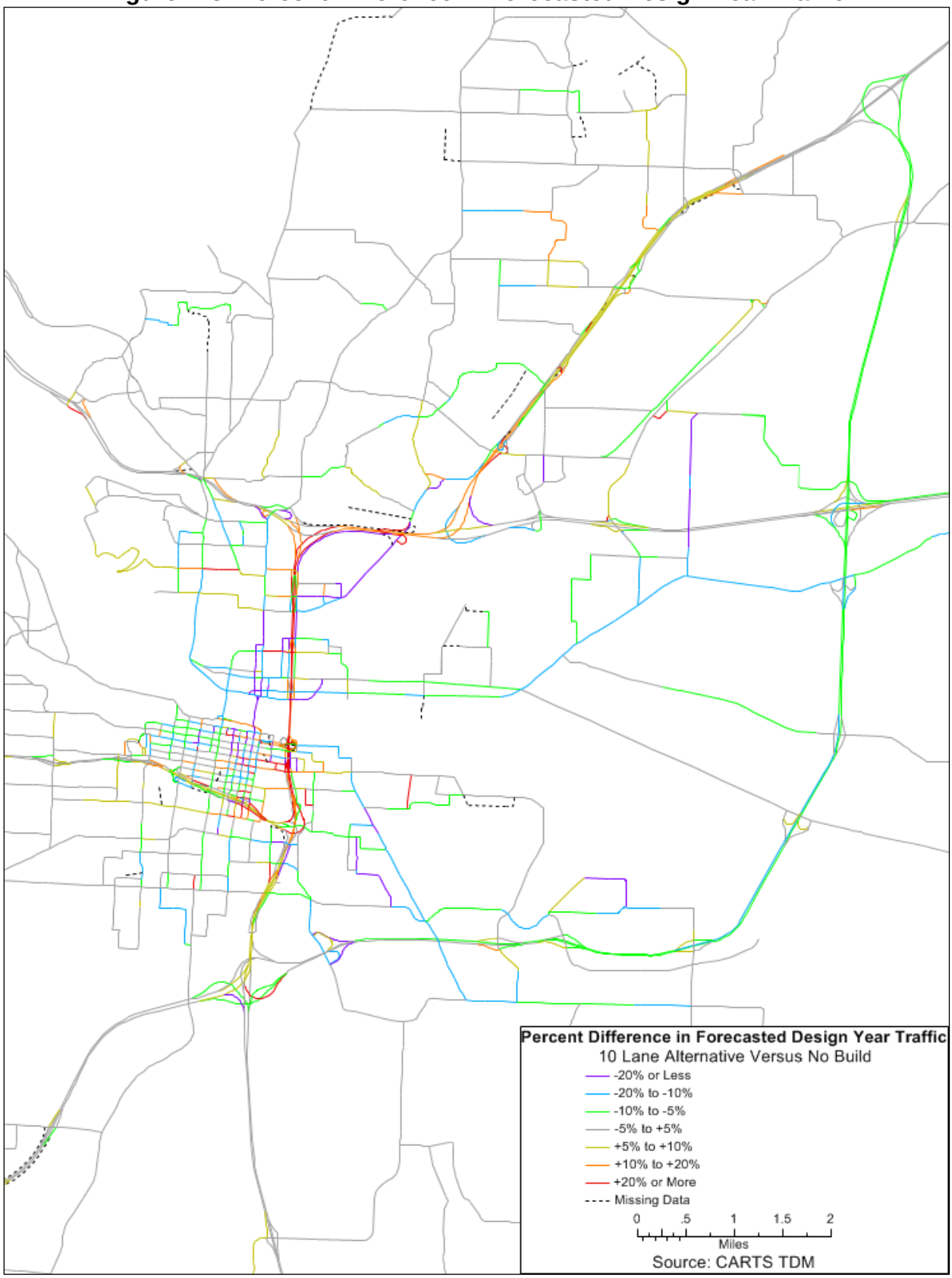
December 29, 2015

On December 29, 2015 ArDOT and Metroplan met again to review the draft affected network. There was consensus that some of the 'non-connected' network segments that met the ADT percentage criteria could be removed from the affected network as they did not have a substantial impact on the project (example – routes to the west of Hwy. 67/167 in the Sherwood area). Additionally, there would be some routes added to the network to, provide a complete a closed network and to remove gaps in the affected network (example – East Broadway in North Little Rock and other collectors in the Little Rock and North Little Rock CBDs).

As a frame of reference, and to place this project in context with the entire CARTS TDM network, **Figure A-3** was developed to show the magnitude of change in the traffic forecasts between the 10-lane CD Alternative and the No Build. This figure shows that routes with the greatest increase in average daily traffic will be along, and adjacent to the project corridor. A smaller increase of traffic is forecast on adjacent and cross-facilities.

To the other end of the spectrum, routes that are somewhat parallel to the project corridor will experience a decrease in average daily traffic – such as I-440 and several collectors in the Little Rock CBD. **Figure A-3** also indicates those routes with less than a 5% increase or decrease in daily traffic. General corridors that meet this description are I-40 from the Levy/Hwy. 365 interchange to the west, I-430, I-30 from Scott Hamilton to the west, I-630 from the Woodrow Interchange to the west, and University Ave.

Figure A-3: Percent Difference in Forecasted Design Year Traffic



December 31, 2015

On December 31, 2015, Metroplan submitted a more extensive affected network to ArDOT. In many instances the routes proposed by Metroplan for addition to the affected network have less than a 5% change in average daily traffic and therefore do not meet the MSAT interim guidance from FHWA. Other segments are located outside the boundary of Pulaski County and are not directly related to travel characteristics within the project corridor. Finally, some of these segments are not valid roadways (traveling through park land with no vehicle access). A general list of the proposed additional segments is below:

- Extension of I-40 to the Hwy. 286 Interchange in Conway
- Extension of I-30 to the Springhill Rd. Interchange in Bryant
- Extension of Hwy. 67/167 to the Hwy. 5 Interchange in Cabot
- Inclusion of the entire lengths of I-430 and I-630, University Ave. from I-630 to I-30, and the Arch St. and Dixon Rd. loop between I-30 and I-530

Staff members from ArDOT reviewed the network as proposed by the latest submittal from Metroplan. ArDOT staff recommends the use of the affected network displayed in **Figure A-4** for the following reasons:

- The routes are within the corridor footprint
- The routes are included in the VISSIM-defined network
- The routes fall within the FHWA recommended parameters of change in ADT as defined in the interim guidance
- There are enhanced routes in both the Little Rock and North Little Rock CBD to fully account for the impact of traffic in the areas adjacent to the project.
- The routes are included to provide gap closure and a closed network

RECOMMENDED AFFECTED NETWORK:

It is recommended that the affected network for the MSAT analysis be the one displayed in **Figure A-4**. This network reflects the PEL-defined network, the segments with ADT variances as defined above, routes included for gap closure, and an enhanced CBD network to reflect impacts of the transportation system.

RECOMMENDED TYPE OF ANALYSIS:

It is recommended that a quantitative analysis of the emission impacts be conducted on the affected network defined in **Figure A-4**.

RECOMMENDED ANALYSIS YEARS:

The MSAT interim guidance recommends the following as a guide to define the network analysis years; the base year (current), the project opening year, and the project design year. For the CA0602 project, that will translate to 2014, 2021 and 2041.

Figure A-4: 30 Crossing Proposed MSAT Network