AQRP Monthly Technical Report

PROJECT TITLE	MOVES-Based NO_x Analyses for Urban Case Studies in Texas	**PROJECT #**	16-010
PROJECT PARTICIPANTS	Sonoma Technology, Inc. (STI)	**DATE SUBMITTED**	July 10, 2017
REPORTING PERIOD	**From:** June 1, 2017 **To:** June 30, 2017	**REPORT #**	9

A Financial Status Report (FSR) and Invoice will be submitted separately from each of the Project Participants reflecting charges for this Reporting Period. I understand that the FSR and Invoice are due to the AQRP by the 15th of the month following the reporting period shown above.

Detailed Accomplishments by Task

During this reporting period, the STI team completed MOVES modeling runs for Task 2 MOVES Sensitivity Analyses, continued analysis of results from Task 1 and Task 2, and started development of the draft report.

Preliminary Analysis

The project team continues work to quantify changes in NO_x emissions and CO/NO_x ratios, for each of the three analysis areas (Fort Worth, Houston, and El Paso), with respect to key factors in MOVES modeling scenarios: fleet mix (truck percentage), vehicle speed (VMT by speed distribution), vehicle age (VMT by age distribution), and meteorology (ambient temperature and relative humidity). The team compared CO/NO_x ratios from MOVES sensitivity scenarios to ambient air quality-based CO/NO_x ratios; the comparison results showed that Fort Worth has a higher CO/NO_x ratios comparing to El Paso and Houston. Additional MOVES modeling and data analyses were conducted to examine the comparison results. A brief summary of the initial analysis results is provided in the following sections. Note that these results are preliminary and may be presented (e.g., in tables and figures) differently in the draft and final reports.

1. Fleet Mix

In general, the CO/NO_x ratios decrease with increased truck traffic; the rate of the decrease is larger within the low truck percentage range (less than 10%). **Table 1** summarizes the changes of CO/NO_x ratios with 1% average increase of truck percentage from the base scenario. The changes of MOVES emission-based CO/NO_x ratios associated with lower truck percentages are larger than the changes for higher truck percentages (e.g., more than 10%), given that NO_x emissions are more sensitive than CO emissions to truck traffic changes.

Table 1. Changes of CO/NO_x ratios with every 1% of increase in truck percentage in the fleet, associated with truck percentage bins for the three study areas.

Truck% Bin	El Paso	Houston	Fort Worth
0 - 5	-0.57	-0.73	-0.71
5 - 10	-0.24	-0.26	-0.35
10 - 20	-0.11	-0.11	-0.17
20 - 30	-0.05	-0.05	-0.08

2. Vehicle Speed

To quantify the impact of speed data on NO_x emissions and CO/NO_x ratios, a fleet average speed was first calculated for each scenario using VMT by speed distributions (i.e., using VMT output from MOVES modeling as weighting factors). **Figure 1** shows the changes of CO/NO_x ratios by fleet average speed. For El Paso and Houston, CO/NO_x ratios and fleet average speeds have a non-linear relationship; however, CO/NO_x ratios for Fort Worth decrease by fleet average speed for the testing scenarios (it's not appropriate to conclude that there is a linear relationship between CO/NO_x ratios and fleet average speed due to limited data points). **Table 2** presented the changes in CO/NO_x ratios per 1 mph speed change within each fleet average speed bin for the three study areas. The MOVES modeling results showed that changes in CO/NO_x ratios against speeds (e.g., 40 to 70 mph) were generally small.

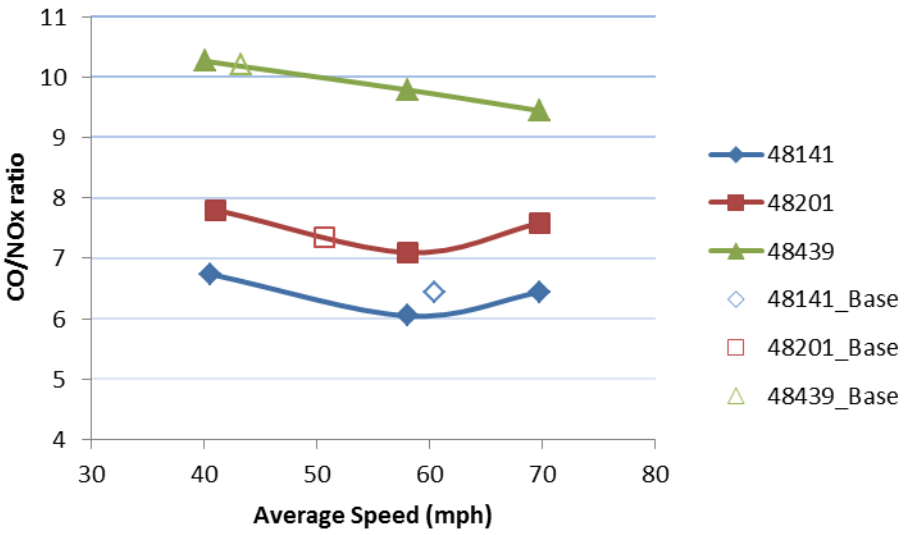

Figure 1. CO/NO_x molar ratio by fleet average speed curve for the three speed sensitivity scenrarios. Note that, the five digit county FIPS codes represents the three analysis areas: 48141 (El Paso), 48201 (Houston), 48439 (Fort Worth). The filled points represent Low, Mid and High speed scenarios while the hollow points represent Base speed scenario.

Table 2. Changes of CO/NO_x ratios with every 1 mph increase in fleet average speed, associated with speed bins for the three study areas.

El Paso		Houston		Fort Worth	
Speed Bin	Ratio Change	Speed Bin	Ratio Change	Speed Bin	Ratio Change
40 - 58	-0.04	40 - 50	-0.05	40 - 44	-0.02
58 - 60	-0.02	50 - 58	-0.04	44 - 58	-0.03
60 - 70	0.00	58 - 70	0.04	58 - 70	-0.03

3. Vehicle Age

To quantify the impact of vehicle age information on MOVES emission-based CO/NO_x ratios, a fleet average vehicle age was developed using the VMT by age distribution for each modeling scenario (i.e., using VMT as weighting factors). The modeled CO/NO_x ratios decrease as average fleet age increases for all three areas. **Figure 2** shows the relationship between CO/NO_x ratio and fleet average age within the age range of 7 to 10 years. **Table 3** presented the impact of fleet average age on CO/NO_x ratios. Within a range of average fleet age of 7 to 10, every 1 year increase in fleet average age is associated with a decrease of 0.3 to 0.85 in CO/NO_x ratios.

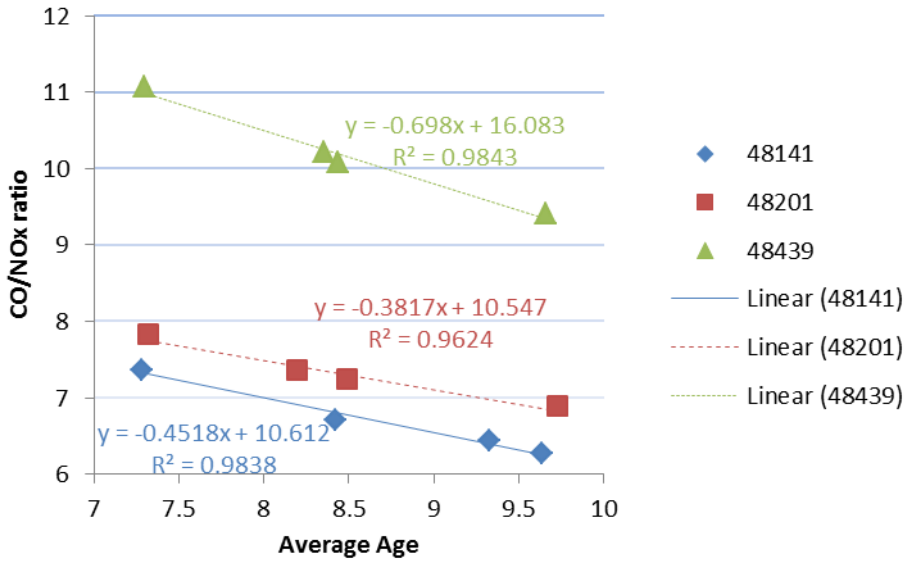

Figure 1. CO/NO_x ratios by fleet average age for the three study areas. The five digit county FIPS codes represents the three analysis areas: 48141 (El Paso), 48201 (Houston), 48439 (Fort Worth). The points represent Low, Mid, High and Base age scenarios.

Table 3. Changes of CO/NO_x ratios with every 1 year increase in fleet average age, associated with fleet age bins for the three study areas.

El Paso		Houston		Fort Worth	
Age Bin	Ratio Change	Age Bin	Ratio Change	Age Bin	Ratio Change
7.0 - 8.5	-0.57	7. 0 - 8.2	-0.54	7.0 - 8.5	-0.80
8.5 - 9.5	-0.31	8.2 - 8.5	-0.41	7.0 - 8.5	-0.85
9.5 - 10	-0.53	8.5 - 10	-0.28	8.5 - 10	-0.56

4. **Meteorology**

Different from fleet mix, vehicle speed, and fleet age, the impact of meteorological data on NO_x emissions and CO/NO_x ratios is a combination of two factors: temperature and relative humidity. The team is working on modeling data analysis and testing ways to present the sensitivity of CO/NO_x ratios to meteorological data.

5. **High Emissions-Based CO/NO_x Ratios for Fort Worth**

The preliminary results showed that Fort Worth emissions-based CO/NO_x ratios, as well as ambient air quality-based CO/NO_x ratios, were higher than ratios for El Paso and Houston. The team designed and tested an additional set of MOVES modeling scenarios to examine this. For example, three MOVES scenarios were modeled for year 2014 following the same approach as base scenarios, except for using 2014 TCEQ AERR CDBs without any modifications. The annualized CO/NO_x ratios based on these runs confirmed a similar pattern: Fort Worth ratio (5.4) is higher than the El Paso raio (2.7) and Houston raio (3.8). The team is conducting additional analysis to quality check MOVES modeling results for the Fort Worth area.

Data Collected

The team completed MOVES modeling work as planned and analyzed the modeling data; no new data were collected during this reporting period.

Identify Problems or Issues Encountered and Proposed Solutions or Adjustments

The team continued to follow the analysis strategy described in previous monthly technical reports; no additional problems or issues were encountered during the reporting period.

Goals and Anticipated Issues for the Succeeding Reporting Period

The team continued work on the planned emissions reconciliation analysis, MOVES sensitivity analyses. No significant issues are expected in the next reporting period.

Detailed Analysis of the Progress of the Task Order to Date

The completion of project tasks and the project deliverables are expected to follow the schedule from the work plan and quality assurance project plan.

Do you have any publications related to this project currently under development? If so, please provide a working title, and the journals you plan to submit to.

___Yes _x_No

Do you have any publications related to this project currently under review by a journal? If so, what is the working title and the journal name? Have you sent a copy of the article to your AQRP Project Manager and your TCEQ Liaison?

___Yes _x_No

Do you have any bibliographic publications related to this project that have been published? If so, please list the reference information. List all items for the lifetime of the project.

___Yes _x_No

Do you have any presentations related to this project currently under development? If so, please provide working title, and the conference you plan to present it (this does not include presentations for the AQRP Workshop).

_x_Yes ___No

Working title: MOVES-Based NO_x Analyses for Urban Case Studies in Texas
Conference: US EPA Emissions Inventory Conference, Baltimore, MD, August 14-18, 2017
Podium session: Reconciling NO_x Emission Inventories with Ambient Observations

Do you have any presentations related to this project that have been published? If so, please list reference information. List all items for the lifetime of the project.

___Yes _x_No

Submitted to AQRP by Song Bai sbai@sonomatech.com

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