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**	February 7, 2017
REPORTING PERIOD	**From:** January 1, 2017 **To:** January 31, 2017	**REPORT #**	4

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 continued work on Task 1 Emissions Reconciliation Analyses. The team continued processing the ambient pollutant concentration data collected from the U.S. Environmental Protection Agency (EPA) Air Quality System (AQS) and started calculation of CO/NO_x concentration ratios for three monitoring sites in Houston, Fort Worth, and El Paso. The team also reviewed key MOVES modeling data files collected from TCEQ (Texas Commission on Environmental Quality), NCTCOG (North Central Texas Council of Government), and HGAC (Houston-Galveston Area Council); the team continued to contact the staff of El Paso MPO to collect local MOVES data.

Preliminary Analysis

1. Site Selection

The STI team assessed the analysis areas for the selected monitoring sites. As shown in Figure 1 and Figure 2, the Houston and Fort Worth sites are part of the official EPA near-road monitoring network and are very close to major freeways. The El Paso site identified previously is not an official EPA near-road site and is about 630 meters from I-10. The team assessed additional sites in the El Paso area and identified another candidate site that could be more suitable for the proposed reconciliation analyses (see Figure 3).

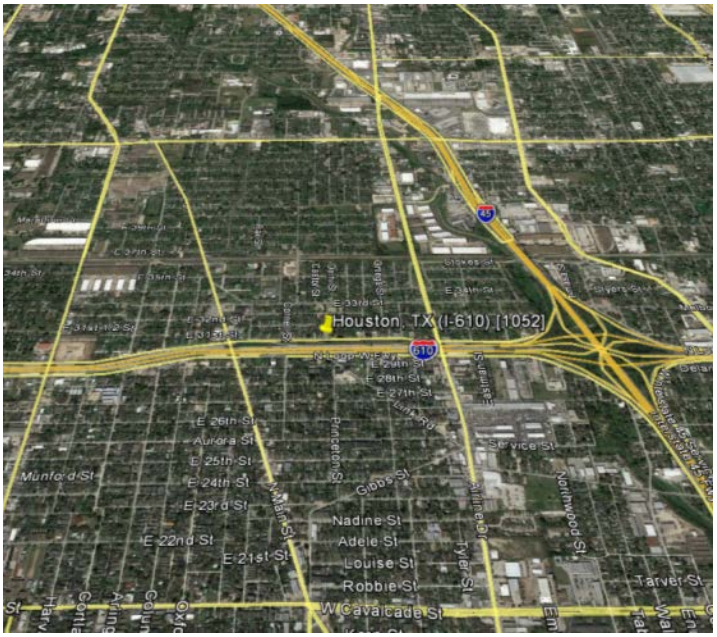

Figure 1. Location of the selected Houston near-road site.

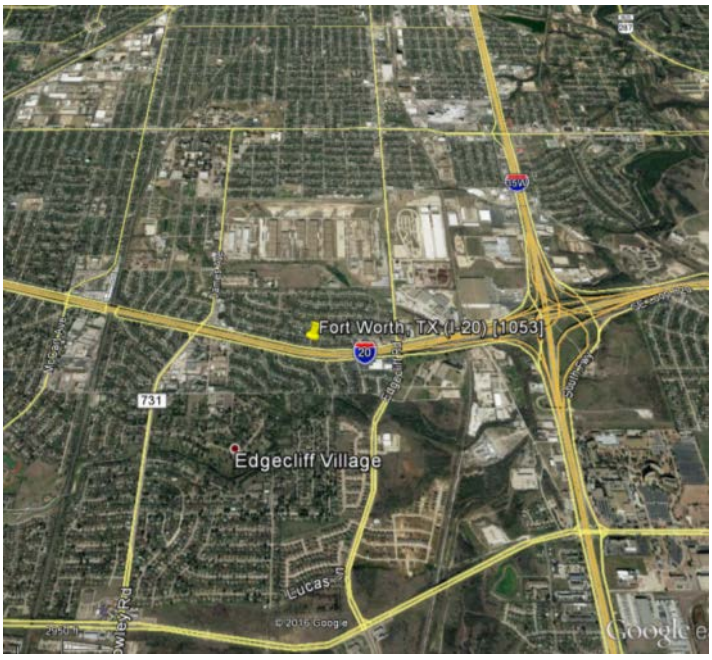

Figure 2. Location of the selected Fort Worth near-road site.

Figure 3. Location of the selected El Paso near-road site.

2. Ambient Data Quality Check

Using the collected ambient CO and NO_x concentrations, the team selected available hourly data for early morning hours (from 6:00 am to 9:00 am), to minimize the influence of transported pollutants and chemical reactions on near-road measurements. Specific data cleaning and quality assurance were performed, such as assessment of time series and removal of invalid data due to potential instrument failure (see data drift before May 1, 2015 in Figure 4 for example) and validation of NO_x concentrations using typical quality checking criteria (see Table 1 for example).

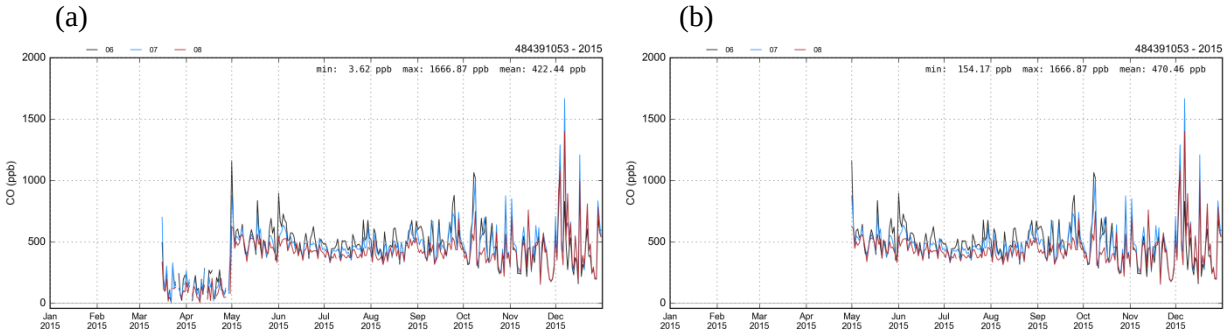

Figure 4. Preliminary time series analysis of Fort Worth near road site CO measurement data (a) with invalid data (before May 1, 2015) and (b) after the invalid data were removed.

Table 1. Summary of validation criteria for quality checking NO_x concentration data

Checking Item	Fail If
NO_2 maximum	NO_2 > 100 ppb
NO_2 minimum	NO_2 is not missing AND < -5 ppb
NO_x vs. NO_y ratios	NO_y is not missing AND NO_x > NO_y
NO_x vs. NO ratios	NO_x < NO

3. Ambient Data Processing

Following the work plan, the team also collected year 2014-2015 wind direction and wind speed data for the selected near-road sites. These data were used to develop wind roses and pollution roses for classifying upwind vs. downwind concentration measurements. For example, as illustrated in Figure 5 for the Fort Worth near-road site, the pollution roses suggested that larger frequencies of medium and high NO_x concentrations are associated with east-southeast to southwest-west wind directions (where the wind blows from); given that the monitoring site locates in the north of the roadway (see Figure 2), the range between east to west wind directions (in the third and fourth quadrants) corresponds to downwind directions for this site (i.e., the site is downwind to the nearby roadway).

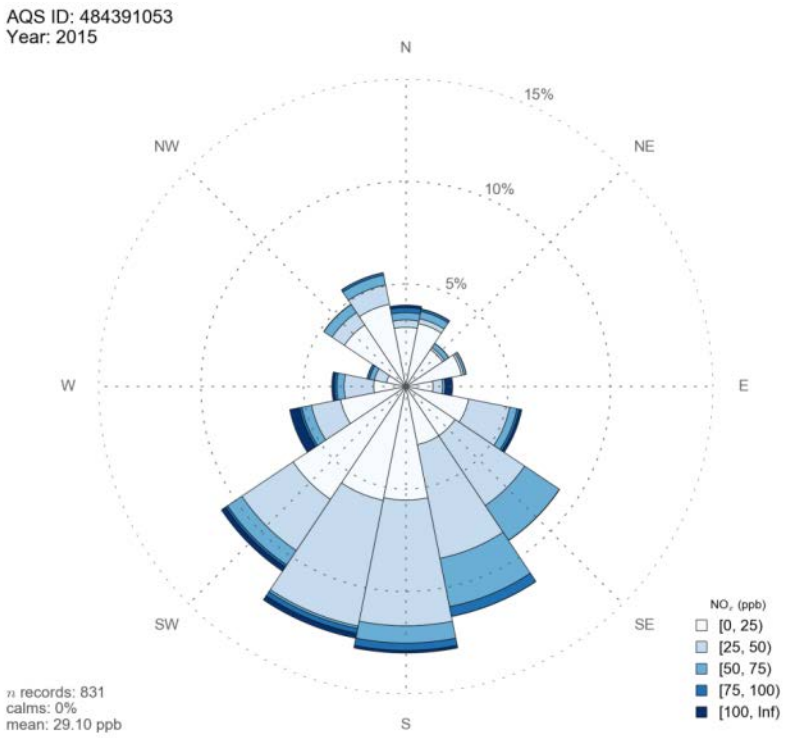

Figure 5. Preliminary NO_x pollution roses for the Fort Worth near-road site.

The team started calculation of ambient CO/NO_x ratios for each monitoring site (see Figure 6 for an example) and are using histograms, box-plots, and other methods to examine variations in these ratios by season, day of the week, and periods when the site is upwind or downwind of the nearby roadway.

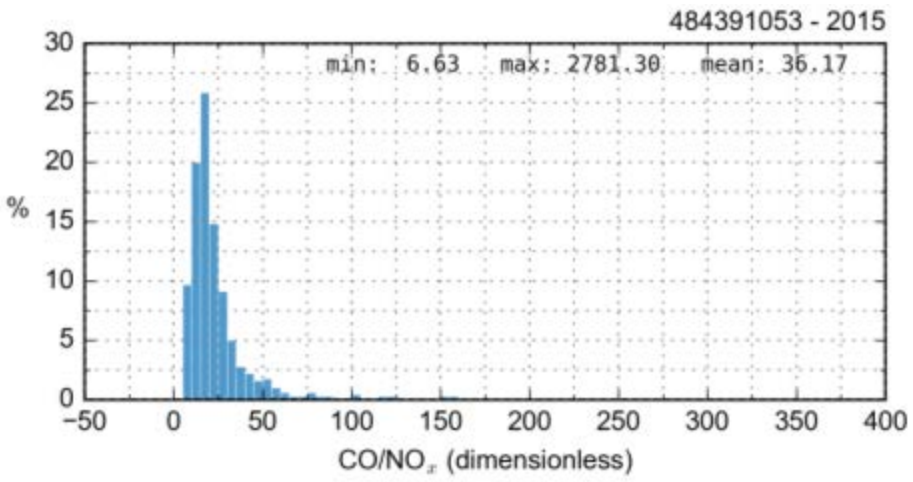

Figure 6. Preliminary ambient CO/NO_x ratios for the Fort Worth near-road site.

Data Collected

For each near-road site included in the analysis, the team also identified a suitable background monitoring site that can be used to characterize local pollutant concentrations in the absence of major roadways and other large emissions sources. As shown in Figure 7 through Figure 9, these background sites were determined by comparing their location similarities, distance, and wind patterns to the near-road monitoring site areas. The team collected CO and NO_x concentrations for the three selected background sites from the EPA's AQS and calculated annual average background concentrations.

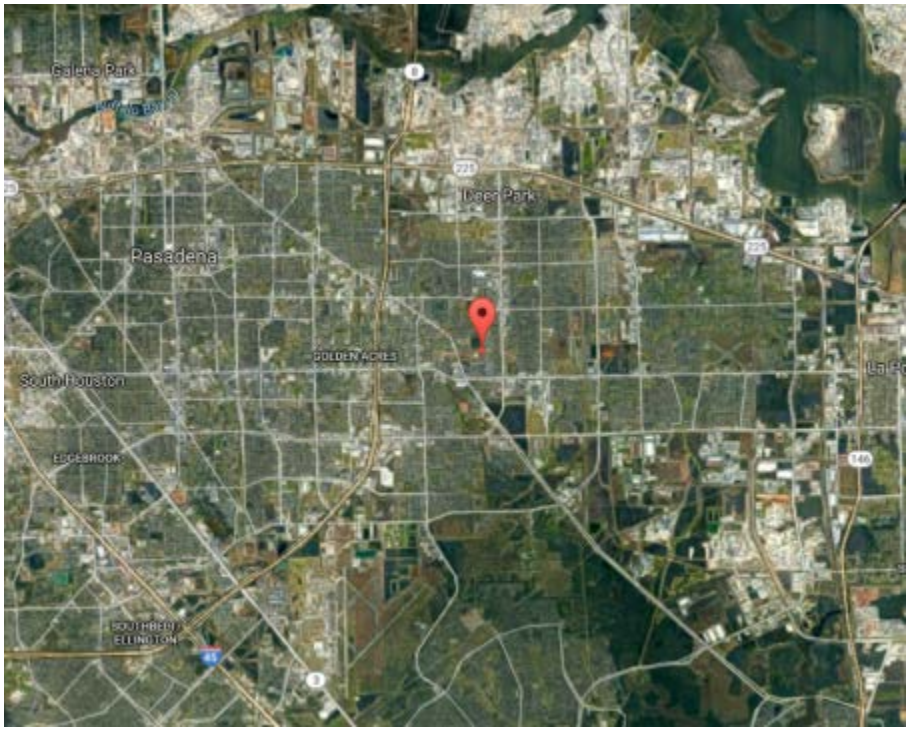

Figure 7. Selected Houston background site (annual average CO = 208.5 ppb; NO_x = 14.3 ppb).

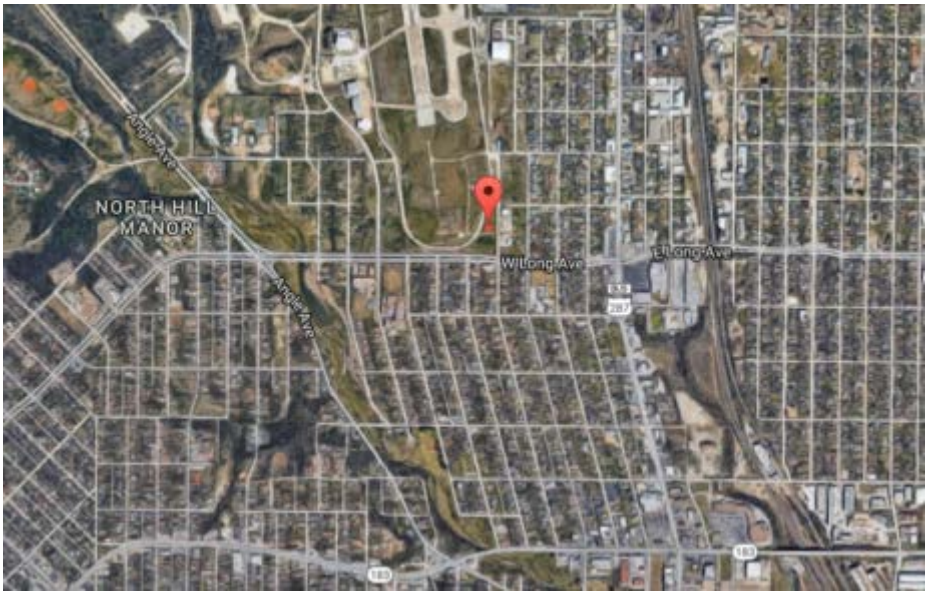

Figure 8. Selected Fort Worth background site (annual average CO = 271.3 ppb; NO_x = 19.1 ppb).

Figure 9. Selected El Paso background site (annual average CO = 115.3 ppb; NO_x = 27.7 ppb).

Identify Problems or Issues Encountered and Proposed Solutions or Adjustments

The proposed analysis involves ambient data and MOVES modeling data that are likely associated with different calendar years. For example, the Houston and Fort Worth near-road sites data became available from March 2015; the TCEQ MOVES modeling data (for NEI on-road inventory development) are associated with year 2014; local MOVES data from HGAC and NCTCOG are associated with analysis years of 2015 and 2017, respectively. As discussed with

the AQRP and TCEQ project managers, the analysis strategy is to match up these data periods and modeling assumption years as best as possible (e.g., using additional ambient data for January to March 2016 to cover the first quarter and using reasonable vehicle age distributions that match analysis year of 2015.

For MOVES modeling data, per suggestion from Jenny Narvaez (NCTCOG), we contacted two additional staff from El Paso MPO regarding the availability of local MOVES data and are waiting for response. If there is no timely response from El Paso MPO and/or their local MOVES data are not available, we will use the MOVES modeling input data for the El Paso area provided in the TCEQ dataset in the planned reconciliation analysis.

Goals and Anticipated Issues for the Succeeding Reporting Period

The STI team continued work on the planned emissions reconciliation analysis with processing near-road monitoring data and collecting MOVES modeling data. In the next reporting period, the team plans to complete the ambient-based pollutant ratios calculation, MOVES modeling runs with local inputs, and include preliminary results of ambient-based vs. emissions-based ratios in the next monthly technical report. We do not expect significant issues in the next reporting period.

Detailed Analysis of the Progress of the Task Order to Date

The completion of each project task 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).

___Yes _x_No

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

Principal Investigator Stephen Reid, Song Bai