

Technical Memorandum

February 15, 2017

STI-914202-6665-TM

To: Karin Landsberg, Washington DOT

From: Steven Brown, Annie Seagram, Doug Eisinger

Re: **Near-Road Pooled Fund Task Order 2, Phase 2 – Air quality, meteorological, and traffic data for the 25 highest daily PM, NO₂, and CO concentrations at selected near-road monitoring sites in 2015**

Overview

The goal of this work was to develop a database of meteorological, air quality, and traffic-related data from 2015 that can support comparisons between modeled and monitored near-road concentrations. Database development focused on 2015 data, since 2016 data are not certified by the monitoring agencies until May 2017.

As of September 2016, the U.S. Environmental Protection Agency (EPA) listed 79 official national near-road (NR) monitoring sites,¹ 61 of which were operating in 2015. Sonoma Technology, Inc., developed a database of selected daily and hourly air quality and meteorological data for these 61 NR sites. These data represent the highest 25 values for daily (24-hr) average PM_{2.5},² daily maximum 1-hour NO₂, and daily maximum 8-hour CO concentrations occurring at each site. The database also provides the daily and hourly air quality and meteorological data for all sites monitoring CO, NO₂ (and/or NO_x), or PM_{2.5} within a 100-km radius of the near-road sites; we refer to these additional monitoring stations as “nearby” (NB) sites.

For near-road monitoring sites where a daily maximum PM_{2.5} concentration exceeded 35 µg/m³, and for any near-road sites in a Transportation Pooled Fund (TPF) partner state, we investigated whether hourly traffic data (counts/volume, speed, and/or vehicle characterization) were available from state Department of Transportation (DOT) websites or through contacts with staff from individual DOTs. Hourly traffic data were available at 18 of these sites ([Table 1](#)).³ Traffic data from the nearest traffic count stations within the same traffic corridor were obtained from state DOTs for California (Caltrans), Arizona, Colorado, Indiana, Massachusetts, Missouri, Ohio, Oregon, Rhode Island, Texas,

¹ <https://www3.epa.gov/ttnamti1/nearroad.html>.

² Of the 61 sites that were operational in 2015, PM_{2.5} was monitored at 36 sites: 18 of these sites monitored hourly PM_{2.5}, 15 sites monitored daily (24-hour) PM_{2.5} (at various sampling frequencies), and 3 sites measured both hourly and daily PM_{2.5}.

³ See also the Appendix for site summary information.

and Virginia. The target roads near the near-road monitoring sites vary by number of lanes and configuration, including freeways that are near (a) another freeway interchange, (b) arterial roads, (c) on/off ramps, or (d) interchanges having a diamond or “T” shape (Table 2). Accordingly, traffic data from multiple traffic count stations were obtained, where available, with the aim of better capturing activity along the traffic corridor.

Table 1. Near-road monitoring sites with 2015 traffic data. Associated data and data characteristics are marked with an “x” if available or applicable. The AQS ID refers to the EPA Air Quality System (AQS) identifying number for an air quality monitoring station.

AQS ID	Site Name: City, State (Target Road) [AQS Site Number]	TPF Partner Site	Hourly Traffic Volume	Hourly Traffic Speed	Hourly Vehicle Characterization	PM _{2.5} Data	2015 PM _{2.5} 24-hour Exceeds 35 µg/m ³	2015 NO ₂ 1-hour Exceeds 100 ppb	CO Data	Collocated Meteorological Data
04-013-4019	Tempe, AZ (I-10) [4019]	x	x			x			x	x
04-013-4020	Phoenix, AZ (I-10) [4020]	x	x			x	x		x	x
06-001-0012	Oakland, CA (I-880) [0012]	x	x	x	x	x	x	x	x	
06-037-4008	Long Beach, CA (I-710) [4008]	x	x	x	x	x				
06-071-0027	Ontario, CA (SR-60) [0027]	x	x	x	x	x	x			
06-085-0006	San Jose, CA (US 101) [0006]	x	x	x	x	x	x		x	
08-031-0027	Denver, CO (I-25) [0027]	x	x	x		x			x	x
18-097-0087	Indianapolis, IN (I-70) [0087]		x	x	x	x	x		x	x
25-025-0044	Boston, MA (I-93) [0044]		x	x	x	x			x	
29-510-0094	St. Louis, MO (I-64) [0094]		x	x	x	x	x		x	x
39-035-0073	Cleveland, OH (I-271) [0073]	x	x	x	x				x	x
39-061-0048	Cincinnati, OH (I-75) [0048]	x	x	x	x				x	
41-067-0005	Portland, OR (I-5) [0005]		x	x	x	x	x		x	x
44-007-0030	Providence, RI (I-95) [0030]		x	x	x	x	x		x	
48-201-1052	Houston, TX (I-610) [1052]	x	x			x			x	x
48-439-1053	Fort Worth, TX (I-20) [1053]	x	x	x		x			x	x
48-453-1068	Austin, TX (I-35) [1068]	x	x							x
51-760-0025	Richmond, VA (I-95) [0025]	x	x	x	x	x			x	

Table 2. Roadway characteristics of near-road monitoring sites with 2015 traffic data. The site name is the City, State (Target Road) [AQ5 Site Number]. The Annual Average Daily Traffic (AADT) counts and Fleet Equivalent (FE)-AADT are as reported by EPA.^a

AQS ID	Site Name	AADT	FE-AADT	Target Road Description	No. of Lanes
04-013-4019	Tempe, AZ (I-10) [4019]	320,138	624,315	Freeway/freeway interchange (T shape)	13
04-013-4020	Phoenix, AZ (I-10) [4020]	260,136	490,838	Freeway segment with nearby freeway/freeway interchange	12
06-001-0012	Oakland, CA (I-880) [0012]	424,008	424,008	Urban freeway segment with nearby arterial roads	8
06-037-4008	Long Beach, CA (I-710) [4008]	619,008	619,008	Freeway segment adjacent to on/off ramps	9
06-071-0027	Ontario, CA (SR-60) [0027]	625,736	625,736	Freeway segment	10
06-085-0006	San Jose, CA (US 101) [0006]	294,140	294,140	Freeway/freeway interchange (Diamond shape)	8
08-031-0027	Denver, CO (I-25) [0027]	249,000	263,118	Urban freeway segment with nearby freeway/freeway interchange	10
18-097-0087	Indianapolis, IN (I-70) [0087]	189,760	362,110	Freeway segment	10
25-025-0044	Boston, MA (I-93) [0044]	198,239	251,761	Urban freeway segment with nearby arterial roads	7
29-510-0094	St. Louis, MO (I-64) [0094]	159,326	360,077	Freeway segment with nearby freeway/arterial interchange	8
39-035-0073	Cleveland, OH (I-271) [0073]	153,660	287,580	Freeway segment with nearby freeway/freeway interchange	12
39-061-0048	Cincinnati, OH (I-75) [0048]	163,000	386,380	Freeway segment near diverging highways	6
41-067-0005	Portland, OR (I-5) [0005]	156,000	289,052	Freeway segment with nearby freeway/arterial interchange	6
44-007-0030	Providence, RI (I-95) [0030]	186,300	416,790	Freeway/arterial interchange (turbine)	8
48-201-1052	Houston, TX (I-610) [1052]	202,120	334,915	Freeway segment with nearby stacked interchange	8
48-439-1053	Fort Worth, TX (I-20) [1053]	184,680	242,856	Freeway segment with nearby freeway/freeway interchange	8
48-453-1068	Austin, TX (I-35) [1068]	188,150	350,712	Freeway segment	6
51-760-0025	Richmond, VA (I-95) [0025]	151,000	259,720	Freeway segment	6

^a As of September 2016. See: <https://www3.epa.gov/ttnamti1/nearroad.html>.

Air Quality Data

Data Sources

Pre-generated data files for 2015 for the NR and NB sites were downloaded from EPA's Air Data website⁴ on January 17, 2017. Files downloaded include:

- Air Quality System (AQS) site listing table,
- Daily summary data files for CO, NO₂, NO_x, and PM_{2.5} Federal Reference Method/Federal Equivalent Method (FRM/FEM) mass, and
- Hourly data files for CO, NO₂, NO_x, PM_{2.5} FRM/FEM mass, and resultant wind speed and direction.

Data Processing

Air quality data for 2015 from NR and NB sites were extracted and processed from the files as follows:

- Daily PM_{2.5} data were available in three different sample durations: hourly, 24-hour block average (daily average calculated by EPA using hourly data), and 24-hour (daily filter). Hourly-based daily average data were included only when 24-hour or 24-hour block average data were not available, such that only one daily value remained for each site and instrument (distinguished by Parameter Occurrence Code [POC]) for each day.
- Daily data that had a value less than 75% observed in the raw data were excluded, as prescribed by EPA procedures.
- Daily data that were categorized by the reporting agency as an "Excluded" Event Type in the raw data were excluded. If a daily value was reported for both "None" (no event occurred) and "Included" (events occurred) event types for a given site, parameter, POC, and date, the record flagged as "None" was excluded.

For daily average PM_{2.5}, daily maximum 1-hour NO₂, and daily maximum 8-hour CO, the days when the highest 25 concentrations were measured (the "top 25 days") were identified for each of the near-road sites. Daily and hourly data for all of the top 25 days in 2015 at each near-road site and from all the nearby air quality monitoring sites were then compiled into the data files for delivery. These data include daily PM_{2.5}, daily maximum 1-hour NO₂, daily maximum 1-hour NO_x, and daily maximum 8-hour CO, as well as hourly PM_{2.5}, hourly NO₂, hourly NO_x, hourly CO, wind speed, and wind direction. See [Table 3](#) for hourly air quality data availability at the NR sites. The top 25 days for each parameter are not necessarily coincident; therefore, up to 75 days of data per site may be included in this database.

⁴ https://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/download_files.html.

Table 3. AQS data availability at operational near-road sites in 2015. The first date of available data (in month-day format) is provided for each site by parameter: carbon monoxide (CO), nitrogen dioxide (NO₂), particulate matter of 2.5 microns or less (PM_{2.5}), and wind speed and direction (WSWD). For PM_{2.5}, the sample duration and the estimated sample frequency are also provided. An asterisk denotes that 24-hour PM_{2.5} data are also available at the site, though only the hourly PM_{2.5} data information is reported in this table.

AQS ID	Site Name: City, State (Target Road) [AQS Site Number]	CO Start Date	NO ₂ Start Date	PM _{2.5}			WSWD Start Date
				Start Date	Sample Duration	Sample Frequency	
01-073-2059	Birmingham, AL (I-20) [2059]	01-01	01-01	01-12	24-hour	1-in-6	01-01
04-013-4019	Tempe, AZ (I-10) [4019]	01-01	01-01	01-01	1-hour	Hourly	01-01
04-013-4020	Phoenix, AZ (I-10) [4020]	09-02	09-02	09-02	1-hour	Hourly	09-02
06-001-0012	Oakland, CA (I-880) [0012]	01-01	01-01	01-01	1-hour	Hourly	
06-037-4008	Long Beach, CA (I-710) [4008]		04-01	01-01	24-hour	Daily	
06-059-0008	Anaheim, CA (I-5) [0008]	01-01	01-01				
06-067-0015	Sacramento, CA (I-5) [0015]	10-14	10-13				10-30
06-071-0026	Ontario, CA (I-10) [0026]	01-01	01-01				
06-071-0027	Ontario, CA (SR-60) [0027]		08-01	01-01	24-hour	Daily	
06-073-1017	San Diego, CA (I-15) [1017]	04-24	03-26				
06-085-0006	San Jose, CA (US 101) [0006]	01-01	01-01	01-01	1-hour	Hourly	
08-031-0027	Denver, CO (I-25) [0027]	01-01	01-07	01-01	1-hour*	Hourly*	01-01
08-031-0028	Denver, CO (I-25) [0028]		10-01	10-01	1-hour	Hourly	10-19
09-003-0025	Hartford, CT (I-84) [0025]	01-01	01-01	01-03	24-hour	1-in-3	01-01
11-001-0051	Washington DC, DC (DC-295) [0051]	06-01	06-01	06-01	1-hour*	Hourly*	06-01

AQS ID	Site Name: City, State (Target Road) [AQS Site Number]	CO Start Date	NO ₂ Start Date	PM _{2.5}			WSWD Start Date
				Start Date	Sample Duration	Sample Frequency	
12-011-0035	Fort Lauderdale, FL (I-95) [0035]	08-31	08-21				
12-031-0108	Jacksonville, FL (I-95) [0108]	01-01	01-01	01-01	1-hour	Hourly	
12-057-1111	Tampa, FL (I-275) [1111]	01-01	01-01	01-01	1-hour	Hourly	
13-089-0003	Atlanta, GA (I-285) [0003]		01-01				
13-121-0056	Atlanta, GA (I-85) [0056]	01-01	01-01	01-01	24-hour	Daily	01-01
16-001-0023	Meridian, ID (I-84) [0023]	01-01	01-01				
18-097-0087	Indianapolis, IN (I-70) [0087]	01-01	01-01	01-03	24-hour	1-in-3	01-01
19-153-6011	Des Moines, IA (I-235) [6011]		01-01				
21-111-0075	Louisville, KY (I-264) [0075]	01-01	01-01	01-03	24-hour	1-in-3	
22-071-0021	New Orleans, LA (I-610) [0021]	01-01	01-01	01-03	24-hour	1-in-3	02-27
24-027-0006	Laurel, MD (I-95) [0006]	01-01	01-01	01-01	1-hour	Hourly	01-01
25-025-0044	Boston, MA (I-93) [0044]	01-01	01-01	09-01	1-hour*	Hourly*	
26-163-0093	Detroit, MI (I-96) [0093]	01-01	01-01				01-01
26-163-0095	Livonia, MI (I-275) [0095]	01-01	01-01	01-09	24-hour	1-in-3	01-01
27-037-0480	Lakeville, MN (I-35) [0480]	01-01	01-01	01-01	1-hour	Hourly	
27-053-0962	Minneapolis, MN (I-94/I-35W) [0962]	01-01	01-01	01-01	1-hour	Hourly	
29-095-0042	Kansas City, MO (I-70) [0042]	01-29	01-01	01-01	1-hour	Hourly	01-01
29-189-0016	St. Louis, MO (I-70) [0016]		01-09				01-09
29-510-0094	St. Louis, MO (I-64) [0094]	01-01	01-01	01-01	1-hour	Hourly	01-01

AQS ID	Site Name: City, State (Target Road) [AQS Site Number]	CO Start Date	NO ₂ Start Date	PM _{2.5}			WSWD Start Date
				Start Date	Sample Duration	Sample Frequency	
32-003-1501	Las Vegas, NV (I-15) [1501]		08-01				08-01
34-003-0010	Fort Lee, NJ (I-95/US 1) [0010]	01-01	01-01	01-01	1-hour	Hourly	
36-029-0023	Cheektowaga, NY (I-90) [0023]	01-01	01-01	01-06	24-hour	1-in-3	
36-055-0015	Rochester, NY (I-490) [0015]	01-01	01-01	01-06	24-hour	1-in-3	
37-119-0045	Charlotte, NC (I-77) [0045]		01-01				01-13
37-183-0021	Raleigh, NC (I-40) [0021]		01-01				
39-035-0073	Cleveland, OH (I-271) [0073]	01-01	01-01				01-01
39-049-0038	Columbus, OH (I-270) [0038]	01-01	01-01				01-01
39-061-0048	Cincinnati, OH (I-75) [0048]	01-01	01-13				
40-109-0097	Oklahoma City, OK (I-44) [0097]	06-17	04-01	04-09	24-hour	1-in-3	05-19
41-067-0005	Portland, OR (I-5) [0005]	01-01	01-01	01-06	24-hour	1-in-3	01-01
42-003-1376	Wilkesburg, PA (I-376) [1376]	01-01	01-01				
42-101-0075	Philadelphia, PA (I-95) [0075]	01-01	01-01	01-01	1-hour	Hourly	
42-101-0076	Philadelphia, PA (I-76) [0076]		07-20	09-02	1-hour	Hourly	
44-007-0030	Providence, RI (I-95) [0030]	01-01	01-01	01-01	1-hour	Hourly	
47-037-0040	Nashville, TN (I-40/I-24) [0040]	01-01	01-01				
47-157-0100	Memphis, TN (I-40) [0100]	01-01	01-01				
48-029-1069	San Antonio, TX (I-35) [1069]		01-01				01-01
48-113-1067	Dallas, TX (I-635) [1067]		01-01				01-01

AQS ID	Site Name: City, State (Target Road) [AQS Site Number]	CO Start Date	NO ₂ Start Date	PM _{2.5}			WSWD Start Date
				Start Date	Sample Duration	Sample Frequency	
48-201-1052	Houston, TX (I-610) [1052]	04-15	04-15	04-15	24-hour	1-in-3	05-01
48-201-1066	Houston, TX (I-69/US 59) [1066]		01-01				01-01
48-439-1053	Fort Worth, TX (I-20) [1053]	03-12	03-12	03-22	24-hour	1-in-3	03-12
48-453-1068	Austin, TX (I-35) [1068]		01-01				01-01
51-760-0025	Richmond, VA (I-95) [0025]	01-01	01-01	01-01	1-hour	Hourly	
53-033-0030	Seattle, WA (I-5) [0030]	01-01	01-01	01-01	1-hour	Hourly	01-01
55-079-0056	Milwaukee, WI (I-94) [0056]	01-01	01-01				01-01
72-061-0006	Guaynabo, PR (De Diego Hwy) [0006]	04-01	04-21				

Traffic Data

Data Sources

Hourly traffic data were acquired from state DOTs through personal communications or from the agency's traffic data website ([Table 4](#)). The majority of DOTs use an instance of the Midwestern Software Solutions, LLC (MS2) Traffic Count Database System (TCDS) (also listed as "MS2SOFT" in this document and delivered files). Traffic count stations were selected according to their proximity to the near-road monitoring site; at a minimum, selected stations were within the same traffic corridor as the near-road site's target road. Hourly counts (volume), speed, and vehicle characterization (used to determine the volume of trucks within the fleet) were obtained by traffic flow direction and by lane, if possible. Data from multiple traffic count stations near the near-road monitoring site were also acquired, where possible.

Table 4. Traffic data sources by agency. Agency names are abbreviated as in the database.

Agency Abbreviation	Agency	Website or Primary Contact
AZ DOT	Arizona Department of Transportation	http://adot.ms2soft.com
Caltrans	Caltrans – California Department of Transportation	http://pems.dot.ca.gov
CO DOT	Colorado Department of Transportation	http://cdot.ms2soft.com
IN DOT	Indiana Department of Transportation	http://indot.ms2soft.com
MA DOT	Massachusetts Department of Transportation	http://mhd.ms2soft.com/
MO DOT	Missouri Department of Transportation	Jeffery Baird jeffery.baird@modot.mo.gov
OH DOT	Ohio Department of Transportation	http://odot.ms2soft.com
OR DOT	Oregon Department of Transportation	Don Crownover don.r.crownover@odot.state.or.us
RI DOT	Rhode Island Department of Transportation	Philip d'Ercole philip.dercole@dot.ri.gov
TX DOT	Texas Department of Transportation	http://txdot.ms2soft.com
VA DOT	Virginia Department of Transportation	Ralph Jones ralph.jones@vdot.virginia.gov

Data Processing

The file format, aggregation level, reporting units and/or vehicle classes, and level of quality assurance of the traffic data varied by individual traffic count sensor, data source, and/or agency. Traffic data acquired from Caltrans, Rhode Island DOT, and Virginia DOT included hourly data capture; the data were discarded for hours with less than 75% data capture within the hour, as prescribed by EPA procedures. Through all instances of MS2 TCDSs, traffic data are reported as raw data directly from the traffic counter but are only available if an entire day of data has an "Accepted" count status.

Hourly traffic data in the deliverable database is reported by traffic flow direction (Northbound/Southbound, or Eastbound/Westbound), i.e., all data by lane are aggregated. For speed data reported as volume counts by speed range, the midpoint of the speed range was used to calculate a volume-weighted mean traffic speed. If the maximum speed range was unbounded (e.g., "80+ mph"), the "midpoint" speed for this range was taken as the minimum bound plus half the difference between the bounds of the preceding speed range.⁵

Depending on the individual traffic count sensor and/or agency, vehicle characterization data were reported in one of the following ways:

1. **As an estimated volume.** A truck count may be calculated from aggregated volume and occupancy data (i.e., as data obtained from Caltrans).⁶
2. **As vehicle counts by vehicle length range.** When vehicles were counted by length range, the ranges where the minimum bound equaled or exceeded 48 feet were counted as "truck," as prescribed by FHWA guidance.⁷ If the highest length range was unbounded, but the minimum bound was less than 48 feet, the vehicle counts within this length range were designated as "truck."⁸
3. **As vehicle counts by vehicle class, as defined by the Federal Highway Administration (FHWA) Scheme F.**⁹ This classification scheme includes 13 defined vehicle classes (Class 1-13), as well as Unused (Class 14) and Unclassified (Class 15) categories. All vehicle counts from Classes 5-13 were designated as "truck."

The hourly truck count divided by the total vehicle count was multiplied by 100 to obtain the truck percentage, rounded to one decimal place.

⁵ For example, if the highest two speed ranges were "70-80 mph" and "80+ mph", the midpoints used to calculate the mean speed would be 75 mph and 85 mph.

⁶ See http://pems.dot.ca.gov/?dnode=Help&content=help_calc#truck.

⁷ See http://ops.fhwa.dot.gov/freight/publications/size_regs_final_rpt/index.htm#length.

⁸ For example, if length ranges are defined as "0-30 feet," "31-49 feet," and "49-80 feet," then only the counts within the "49-80 feet" range are assigned as "truck." If the length ranges are defined as "0-30 feet," "31-40 feet," and "41+ feet," then the counts within the "41+ feet" range are assigned as "truck," even though the minimum bound does not exceed 48 feet.

⁹ See <https://www.fhwa.dot.gov/publications/research/infrastructure/pavements/ltp/13091/13091.pdf>.

Description of Delivered Files and Database

STI is delivering both a database and the underlying comma-separated values [CSV] files. The compiled meteorology, air quality, and traffic-related data, with ancillary metadata and cross-reference information comprise 13 tables in the database (which directly correspond to 13 files in CSV format). A description of the data in each column by table is provided in [Tables 5 through 18](#). The name of the table in the database and corresponding CSV format file are noted in each caption.

Some values in the hourly air quality and traffic data records in these tables are blank. For the hourly air quality data, a blank record indicates that the data were not present in the original files downloaded from EPA's Air Data website. For the traffic data, a blank record indicates that either the data did not meet the 75% data capture criterion (for data from Caltrans, Rhode Island DOT, and Virginia DOT), or the record was not present in the original files obtained from the state DOT.

Table 5. Air Quality System (AQS) site information for near-road (NR) and nearby (NB) sites (table: aqs_sites, file: *aqs_sites.csv*).

Field Name	Description
AQS_ID	AQS site identification number, as "SS-CCC-NNNN", where SS is the State FIPS (Federal Information Processing Standards) Code, CCC is the County FIPS Code, and NNNN is the Site Number within the county.
latitude	Latitude of monitoring site, in decimal degrees (positive North).
longitude	Longitude of monitoring site, in decimal degrees (positive East).
elevation	Elevation of monitoring site (meters above sea level).
land_use	Category of land use where the site is located.
location_setting	Setting of site location.
met_site_state_code	Meteorological site State Code.
met_site_county_code	Meteorological site County Code.
met_site_site_number	Meteorological site Site Number.
met_site_type	Type of meteorological site.
met_site_distance	Distance from meteorological site to AQS monitoring site, in meters.
met_site_direction	Direction of meteorological site relative to the AQS monitoring site, as a cardinal direction.
local_site_name	Local site name.
address	Address of monitoring site.
zip_code	Zip code of monitoring site.
state_name	Full state name.
county_name	County name.
city_name	City name.
CBSA_name	Core Based Statistical Area (CBSA) in which the site is located.
tribe_name	Tribe name.
location_type	Designation of site as either a near-road (NR) monitoring site or a "nearby" (NB) site.

Table 6. Daily air quality metrics (table: daily_aq, file: *daily_aq.csv*).

Field Name	Description
AQS_ID	AQS site identification number, as "SS-CCC-NNNN", where SS is the State FIPS (Federal Information Processing Standards) Code, CCC is the County FIPS Code, and NNNN is the Site Number within the county.
parameter	Parameter (chemical species or other data) code measured by the monitor.
POC	Parameter Occurrence Code, used to uniquely identify the monitor on site if there is more than one monitor concurrently measuring the same parameter.
sample_duration	Duration code corresponding to the amount of time used to collect the sample, i.e., averaging time. This can correspond to either the averaging time of one sample, or the averaging time of several individual samples.
unit	Unit code corresponding to the unit of the measured parameter.
method	Sampling methodology code corresponding to the collection and analysis methods used to measure the sample.
datetime	Start date and time information, in "YYYY-mm-dd HH:MM:SS" format, reported in Local Standard Time (LST).
sample_value	The measured sample value of the parameter.
pollutant_standard_ID	Pollutant Standard code of sample value.
event_type	Indication of whether an exceptional event occurred and is included in the sample value statistic. "None" indicates that no event occurred; "Included" indicates that an event occurred and that the data during the event are included in the sample value.
observed_pct	Percentage (%) of observations recorded during the averaging time (sample duration) of the maximum number expected.

Table 7. Date and time information (table: `dt_info`, file: `dt_info.csv`). This table can be used to easily access individual date and time attributes (e.g., to perform a “group by hour” operation).

Field Name	Description
<code>datetime</code>	Start date and time information, in “YYYY-mm-dd HH:MM:SS” format, reported in Local Standard Time (LST).
<code>year</code>	Year of the date and time information
<code>month</code>	Month of the date and time information
<code>day</code>	Day of the date and time information
<code>hour</code>	Hour of the date and time information (as 24-hour clock)
<code>quarter</code>	Quarter of the date and time information [defined as Quarter 1 (JFM), 2 (AMJ), 3 (JAS), or 4 (OND)].

Table 8. Sample duration codes and descriptions (table: `durations`, file: `durations.csv`).

Field Name	Description
<code>sample_duration</code>	Duration code corresponding to the amount of time used to collect the sample, i.e., averaging time. This can correspond to either the averaging time of one sample, or the averaging time of several individual samples.
<code>duration_description</code>	Full name of sample duration.
<code>observed_or_calculated</code>	Whether the sample value is observed or calculated over the sample duration period.

Table 9. Hourly air quality and meteorological data from AQS for the top 25 days (table: hourly_aq, file: *hourly_aq.csv*). Refer to the AQS file format documentation for more information^{a,b}.

Field Name	Description
AQS_ID	AQS site identification number, as "SS-CCC-NNNN", where SS is the State FIPS (Federal Information Processing Standards) Code, CCC is the County FIPS Code, and NNNN is the Site Number within the county.
parameter	Parameter (chemical species or other data) code measured by the monitor.
POC	Parameter Occurrence Code, used to uniquely identify the monitor on site if there is more than one monitor concurrently measuring the same parameter.
sample_duration	Duration code corresponding to the amount of time used to collect the sample, i.e. averaging time. This can correspond to either the averaging time of one sample, or the averaging time of several individual samples.
unit	Unit code corresponding to the unit of the measured parameter.
method	Sampling methodology code corresponding to the collection and analysis methods used to measure the sample.
datetime	Start date and time information, in "YYYY-mm-dd HH:MM:SS" format reported in Local Standard Time (LST).
sample_value	The measured sample value of the parameter.

^a https://aqz.epa.gov/aqsweb/documents/AQS_Format.html.

^b https://www.epa.gov/sites/production/files/2016-08/documents/aqs_user_guide_2016.pdf.

Table 10. Method codes and descriptions (table: methods, file: *methods.csv*).

Field Name	Description
method	Sampling methodology code corresponding to the collection and analysis methods used to measure the sample.
parameter	Parameter (chemical species or other data) code measured by the monitor.
sample_duration	Duration code corresponding to the amount of time used to collect the sample, i.e., averaging time. This can correspond to either the averaging time of one sample, or the averaging time of several individual samples.
unit	Unit code corresponding to the unit of the measured parameter.
recording_mode	Mode of how the samples were recorded (continuously or intermittently).
collection_description	Description of sample collection method.
analysis_description	Description of sample analysis method.
method_type	Indicator for type of method used to collect the sample: Federal Reference Method (FRM), Federal Equivalent Method (FEM), or neither (left blank).
reference_method_ID	Federal Reference Method (FRM) identification code.
equivalent_method	Description of Federal Equivalent Method (FEM).
federal_MDL	Federal Method Detection Limit (MLD).

Table 11. Metadata for NR sites (table: *nr_sites*, file: *nr_sites.csv*).

Field Name	Description
AQS_ID	AQS site identification number, as "SS-CCC-NNNN", where SS is the State FIPS (Federal Information Processing Standards) Code, CCC is the County FIPS Code, and NNNN is the Site Number within the county.
site_name	Name of the NR site as "City, State (Target Road) [AQS Site Number]".
phase	Installation phase of the near-road monitoring site.
target_road	Name of target road.
distance_to_target_m	Distance between the near-road monitoring site and the target road, in meters.
AADT	Annual Average Daily Traffic (AADT) counts on the target road
AADT_rank_in_CBSA	Rank of AADT within the CBSA.
FEAADT	Fleet Equivalent (FE) AADT.
FEAADT_rank_in_CBSA	Rank of FE-AADT within the CBSA.
population_2014	Population within the CBSA in 2014.
population_2015	Population within the CBSA in 2015.

Table 12. Cross-reference of NR sites to NB sites, i.e., all sites within 100 km of the NR site (table: *nr_sites_nb_sites_association*, file: *nr_sites_nb_sites_association.csv*).

Field Name	Description
NR_AQS_ID	AQS site identification number of the near-road (NR) site.
NB_AQS_ID	AQS site identification number of the associated nearby (NB) site.
distance_m	Distance from the NB site to the associated NR site, in meters.
distance_rank	Rank of distance between NB sites and NR site, by NR site.

Table 13. Cross-reference of NR sites to associated traffic counting stations (table: nr_sites_tr_sites, file: *nr_sites_tr_sites.csv*).

Field Name	Description
AQS_ID	AQS site identification number, as "SS-CCC-NNNN", where SS is the State FIPS (Federal Information Processing Standards) Code, CCC is the County FIPS Code, and NNNN is the Site Number within the county.
agency	Owner (agency/DOT) of the traffic monitoring site.
sensor_ID	Sensor identification number.
direction	Direction of traffic flow: Northbound (NB), Eastbound (EB), Southbound (SB), Westbound (WB).
TR_latitude	Latitude of traffic monitoring sensor, in decimal degrees (positive North)
TR_longitude	Longitude of traffic monitoring sensor, in decimal degrees (positive East)
TR_location_estimated	Boolean flag of whether the traffic monitoring sensor location was estimated (1 = True) or was provided by the agency (0 = False).
data_source	Abbreviation of source (agency) of traffic monitoring data; "MS2SOFT" indicates that the data were acquired online via the agency's MS2 TCDS website.

Table 14. Parameter codes and full names (table: parameters, file: *parameters.csv*).

Field Name	Description
parameter	Parameter (chemical species or other data) code measured by the monitor.
parameter_name	Full name of parameter.

Table 15. Pollutant standard codes and descriptions (table: pollutant_standards, file: *pollutant_standards.csv*).

Field Name	Description
pollutant_standard_ID	Pollutant Standard code of sample value.
pollutant_standard_short_name	Pollutant Standard short name.
pollutant_standard_description	Pollutant Standard description of the rules used to aggregate statistics.
NAAQS_basis	National Ambient Air Quality Standard (NAAQS) basis.
round_or_truncate	Whether the sample value should be rounded (R) or truncated (T) when compared to the NAAQS.

Table 16. Hourly traffic data for the top 25 days (table: traffic, file: *traffic.csv*).

Field Name	Description
agency	Owner (agency/DOT) of the traffic monitoring site.
sensor_ID	Sensor identification number.
direction	Direction of traffic flow: Northbound (NB), Eastbound (EB), Southbound (SB), Westbound (WB).
lane	Lane number; "0" indicates that data is aggregated across all lanes in the direction indicated (counts are summed, speeds are averaged).
datetime	Start date and time information, in "YYYY-mm-dd HH:MM:SS" format, reported in Local Standard Time (LST).
counts	Count (volume) of vehicles per hour (vehicle/hour).
speed	Speed of vehicles, rounded to nearest integer (mph).
truck	Count (volume) of trucks per hour (vehicle/hour).
truck_pct	Percentage (%) of trucks per hour (i.e., count of trucks divided by the total count of vehicles per hour), rounded to one decimal place.

Table 17. Unit codes and unit names (table: units, file: *units.csv*)

Field Name	Description
unit	Unit code corresponding to the unit of the measured parameter.
unit_name	Full name of unit.

Table 18. Value and category of “truck” definition (table: truck_definitions, file: truck_definitions.csv)

Field Name	Description
agency	Owner (agency/DOT) of the traffic monitoring site.
sensor_ID	Sensor identification number.
truck_ge	Minimum criterion of truck classification; vehicle counts greater than or equal to (ge) this value are classified as “truck”.
truck_unit	Unit of minimum truck measure or category.

Summary

The tables in the database (or individual files) consist of hourly data and daily statistics of CO, NO₂, and PM_{2.5}; meteorological data (wind speed and direction); traffic data (vehicle counts, speed, and/or fleet characterization); and metadata for official near-road monitoring sites and other monitoring sites within a 100 km radius. Taken together, these tables are designed to support various near-road air quality analyses and to serve as the basis for future comparisons between monitored and modeled pollutant concentrations.

Appendix. Additional Site Information

The graphics on the following pages show summaries of information for the 18 near-road sites for which hourly traffic data are available.

Tempe, Arizona
I-10 & Hwy 60

1



(33.3961, -111.968)

Traffic data availability

Counts	Hourly
Speeds	N/A
Characterization	N/A

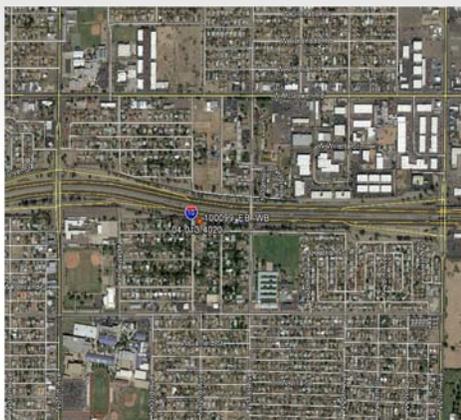
Site information

AQS ID	04-013-4019
PM _{2.5} nonattainment	No
TPF	Yes
Road type	Freeway/freeway interchange (T shape)
Number of lanes	13
AAAT	320,138
FE-AAAT	624,315
Distance to road	12 m
PM _{2.5} increment*	0.1 µg/m ³
PM _{2.5}	Hourly
PM _{2.5} max. 24-hr	22.6 µg/m ³
Annual mean PM _{2.5}	7.9 µg/m ³
CO max. 1-hr	1.9 ppm
NO ₂ max. 1-hr	59.0 ppb
Collocated met.	Yes

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Phoenix, Arizona
I-10

2



(33.36177, -112.128)

Traffic data availability

Counts	Hourly
Speeds	N/A
Characterization	N/A

Site information

AQS ID	04-013-4020
PM _{2.5} nonattainment	No
TPF	Yes
Road type	Freeway segment with nearby freeway/freeway interchange
Number of lanes	12
AAAT	260,136
FE-AAAT	490,838
Distance to road	20 m
PM _{2.5} increment*	2.7 µg/m ³
PM _{2.5}	Hourly
PM _{2.5} max. 24-hr	35.3 µg/m ³
Annual mean PM _{2.5}	12.6 µg/m ³
CO max. 1-hr	3.4 ppm
NO ₂ max. 1-hr	69.0 ppb
Collocated met.	Yes

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Oakland, California
I-880



(37.793624, -122.263376)

Traffic data availability

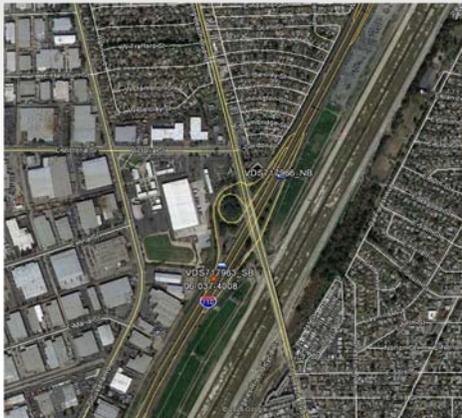
Counts	Hourly
Speeds	Hourly
Characterization	Hourly (truck/non-truck)

Site information

AQS ID	06-001-0012
PM _{2.5} nonattainment	No
TPF	Yes
Road type	Urban freeway segment with nearby arterial roads
Number of lanes	8
AAADT	216,000
FE-AAADT	424,008
Distance to road	20 m
PM _{2.5} increment*	1.3 µg/m ³
PM _{2.5}	Hourly
PM _{2.5} max. 24-hr	37.3 µg/m ³
Annual mean PM _{2.5}	10.0 µg/m ³
CO max. 1-hr	2.7 ppm
NO ₂ max. 1-hr	105.9 ppb
Collocated met.	No; OAK is 5 mi away

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Long Beach, California
I-710



(33.860643, -118.200781)

Traffic data availability

Counts	Hourly
Speeds	Hourly
Characterization	Hourly (truck/non-truck)

Site information

AQS ID	06-037-4008
PM _{2.5} nonattainment	Yes
TPF	Yes
Road type	Freeway segment adjacent to on/off ramps
Number of lanes	9
AAADT	192,000
FE-AAADT	619,008
Distance to road	9 m
PM _{2.5} increment*	2.2 µg/m ³
PM _{2.5}	24-hour (daily)
PM _{2.5} max. 24-hr	48.8 µg/m ³
Annual mean PM _{2.5}	12.7 µg/m ³
CO max. 1-hr	N/A
NO ₂ max. 1-hr	94.7 ppb
Collocated met.	No; LAX is 13 mi away

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Ontario, California
SR-60

5



(34.030903, -117.617143)

Traffic data availability

Counts	Hourly
Speeds	Hourly
Characterization	Hourly (truck/non-truck)

Site information

AQS ID	06-071-0027
PM _{2.5} nonattainment	Yes
TPF	Yes
Road type	Freeway segment
Number of lanes	10
AAAT	215,000
FE-AAAT	625,736
Distance to road	9 m
PM _{2.5} increment*	2.3 µg/m ³
PM _{2.5} 24-hour (daily)	52.8 µg/m ³
Annual mean PM _{2.5}	14.3 µg/m ³
CO max. 1-hr	N/A
NO ₂ max. 1-hr	79.3 ppb
Collocated met.	No; ONT is 2 mi away

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

San Jose, California
US-101 & I-680

6



(37.338, -121.85)

Traffic data availability

Counts	Hourly
Speeds	Hourly
Characterization	Hourly (truck/non-truck)

Site information

AQS ID	06-085-0006
PM _{2.5} nonattainment	No
TPF	Yes
Road type	Freeway/freeway interchange (Diamond shape)
Number of lanes	8
AAAT	191,000
FE-AAAT	294,140
Distance to road	32 m
PM _{2.5} increment*	-0.1 µg/m ³
PM _{2.5} Hourly	46.9 µg/m ³
PM _{2.5} max. 24-hr	8.4 µg/m ³
Annual mean PM _{2.5}	2.7 ppm
CO max. 1-hr	61.1 ppb
NO ₂ max. 1-hr	No; SJC is 4.5 mi away
Collocated met.	

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Denver, Colorado
I-25

7



(39.73215, -105.01526)

Traffic data availability

Counts Hourly
Speeds Hourly
Characterization N/A

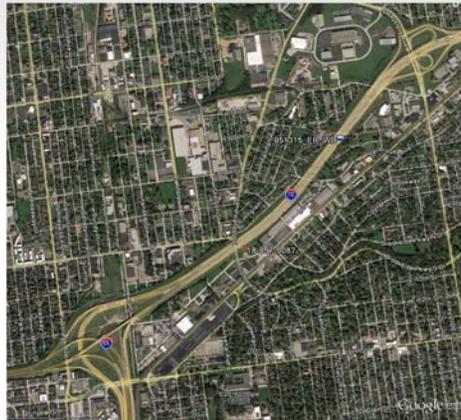
Site information

AQS ID 08-031-0027
 PM_{2.5} nonattainment No
 TPF Yes
 Road type Urban freeway segment, nearby freeway/freeway interchange
 Number of lanes 10
 AADT 249,000
 FE-AADT 263,118
 Distance to road 9 m
 PM_{2.5} increment* 2.6 µg/m³
 PM_{2.5} Hourly
 PM_{2.5} max. 24-hr 29.1 µg/m³
 Annual mean PM_{2.5} 9.0 µg/m³
 CO max. 1-hr 2.9 ppm
 NO₂ max. 1-hr 81.1 ppb
 Collocated met. Yes

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Indianapolis, Indiana
I-70

8



(39.7878, -86.131)

Traffic data availability

Counts Hourly
Speeds Hourly
Characterization Hourly (FHWA)

Site information

AQS ID 18-097-0087
 PM_{2.5} nonattainment No
 TPF No
 Road type Freeway segment
 Number of lanes 10
 AADT 189,760
 FE-AADT 362,110
 Distance to road 24.5 m
 PM_{2.5} increment* 1.3 µg/m³
 PM_{2.5} 24-hour (1-in-3)
 PM_{2.5} max. 24-hr 54.9 µg/m³
 Annual mean PM_{2.5} 11.5 µg/m³
 CO max. 1-hr 1.7 ppm
 NO₂ max. 1-hr 53.7 ppb
 Collocated met. Yes

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Boston, Massachusetts
I-93

9



(42.32498, -71.0559)

Traffic data availability

Counts	Hourly
Speeds	Hourly
Characterization	Hourly (length ranges)

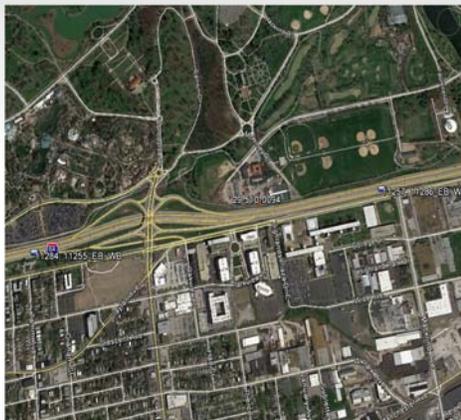
Site information

AQS ID	25-025-0044
PM _{2.5} nonattainment	No
TPF	No
Road type	Urban freeway segment with nearby arterial roads
Number of lanes	7
AADT	198,239
FE-AADT	251,761
Distance to road	10 m
PM _{2.5} increment*	0.3 µg/m ³
PM _{2.5}	Hourly, 24-hour (1-in-3)
PM _{2.5} max. 24-hr	20.8 µg/m ³
Annual mean PM _{2.5}	6.7 µg/m ³
CO max. 1-hr	1.8 ppm
NO ₂ max. 1-hr	61.0 ppb
Collocated met.	No, BOS is 3.5 mi away

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

St. Louis, Missouri
I-64

10



(38.631057, -90.281144)

Traffic data availability

Counts	Hourly
Speeds	Hourly
Characterization	Hourly (length ranges)

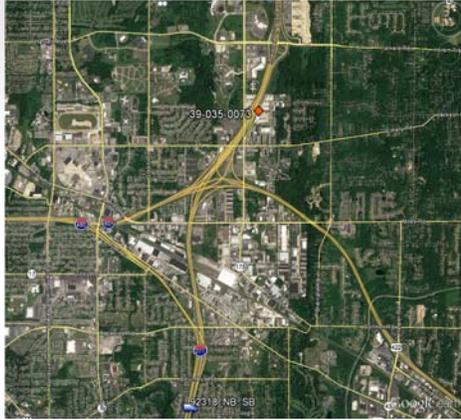
Site information

AQS ID	29-510-0094
PM _{2.5} nonattainment	Yes
TPF	No
Road type	Freeway segment with nearby freeway/arterial interchange
Number of lanes	8
AADT	159,326
FE-AADT	360,077
Distance to road	25 m
PM _{2.5} increment*	-1.2 µg/m ³
PM _{2.5}	Hourly
PM _{2.5} max. 24-hr	39.4 µg/m ³
Annual mean PM _{2.5}	9.2 µg/m ³
CO max. 1-hr	1.9 ppm
NO ₂ max. 1-hr	55.5 ppb
Collocated met.	Yes

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Cleveland, Ohio
I-271

11



(41.440075, -81.494919)

Traffic data availability

Counts	Hourly
Speeds	Hourly
Characterization	Hourly (length ranges)

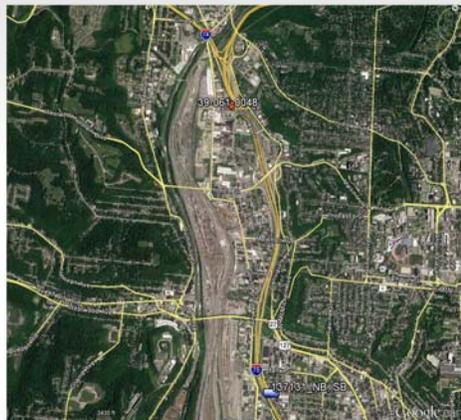
Site information

AQS ID	39-035-0073
PM _{2.5} nonattainment	No
TPF	Yes
Road type	Freeway segment with nearby freeway/freeway interchange
Number of lanes	12
AAADT	153,660
FE-AAADT	287,580
Distance to road	20 m
PM _{2.5} increment*	N/A
PM _{2.5}	N/A
PM _{2.5} max. 24-hr	N/A
Annual mean PM _{2.5}	N/A
CO max. 1-hr	1.125 ppm
NO ₂ max. 1-hr	59.0 ppb
Collocated met.	Yes

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Cincinnati, Ohio
I-75

12



(39.146055, -84.538957)

Traffic data availability

Counts	Hourly
Speeds	Hourly
Characterization	Hourly (FHWA)

Site information

AQS ID	39-061-0048
PM _{2.5} nonattainment	No
TPF	Yes
Road type	Freeway segment near diverging highways
Number of lanes	6
AAADT	163,000
FE-AAADT	386,380
Distance to road	8 m
PM _{2.5} increment*	N/A
PM _{2.5}	N/A
PM _{2.5} max. 24-hr	N/A
Annual mean PM _{2.5}	N/A
CO max. 1-hr	2.575 ppm
NO ₂ max. 1-hr	85.0 ppb
Collocated met.	No

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Portland, Oregon
I-5

13



(45.393497, -122.747894)

Traffic data availability

Counts	Hourly
Speeds	Hourly
Characterization	Hourly (length ranges)

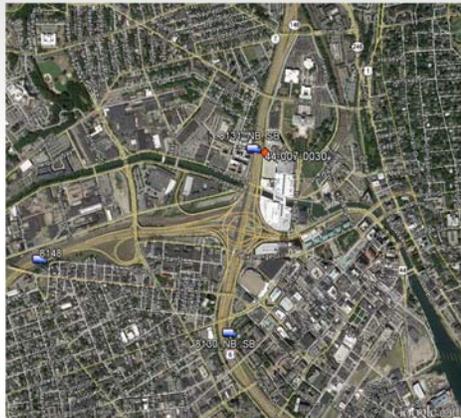
Site information

AQS ID	41-067-0005
PM _{2.5} nonattainment	No
TPF	No
Road type	Freeway segment with nearby freeway/arterial interchange
Number of lanes	6
AAADT	156,000
FE-AAADT	289,052
Distance to road	27 m
PM _{2.5} increment*	0.6 µg/m ³
PM _{2.5}	24-hour (1-in-3)
PM _{2.5} max. 24-hr	61.5 µg/m ³
Annual mean PM _{2.5}	7.9 µg/m ³
CO max. 1-hr	1.8 ppm
NO ₂ max. 1-hr	40.9 ppb
Collocated met.	Yes

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Providence, Rhode Island
I-95 & Hwy 6

14



(41.829475, -71.417447)

Traffic data availability

Counts	Hourly
Speeds	Hourly
Characterization	Hourly (length ranges)

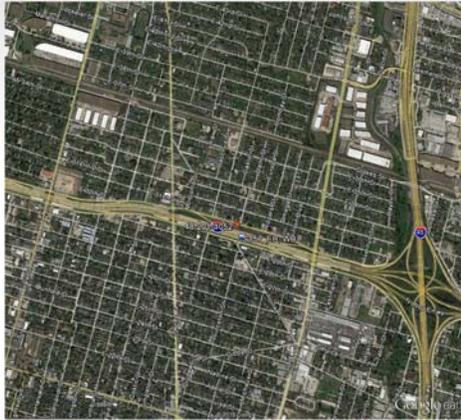
Site information

AQS ID	44-007-0030
PM _{2.5} nonattainment	No
TPF	No
Road type	Freeway/arterial interchange (turbine)
Number of lanes	8
AAADT	186,300
FE-AAADT	416,790
Distance to road	5 m
PM _{2.5} increment*	3.0 µg/m ³
PM _{2.5}	Hourly
PM _{2.5} max. 24-hr	92.5 µg/m ³
Annual mean PM _{2.5}	9.9 µg/m ³
CO max. 1-hr	3.7 ppm
NO ₂ max. 1-hr	86.2 ppb
Collocated met.	No; PVD is 7.5 mi away

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Houston, Texas
I-610

15



(29.81453, -95.38769)

Traffic data availability

Counts Hourly
Speeds N/A
Characterization N/A

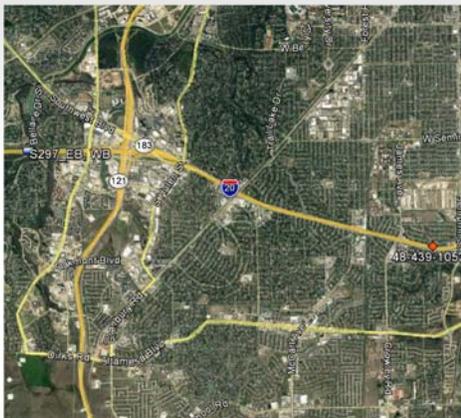
Site information

AQS ID 48-201-1052
 PM_{2.5} nonattainment No
 TPF Yes
 Road type Freeway segment with nearby stacked interchange
 Number of lanes 8
 AADT 202,120
 FE-AADT 334,915
 Distance to road 15 m
 PM_{2.5} increment* N/A
 PM_{2.5} 24-hour (1-in-3) 27.0 µg/m³
 PM_{2.5} max. 24-hr 27.0 µg/m³
 Annual mean PM_{2.5} 12.5 µg/m³
 CO max. 1-hr 2.636 ppm
 NO₂ max. 1-hr 67.9 ppb
 Collocated met. Yes

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Fort Worth, Texas
I-20

16



(32.66472, -97.3381)

Traffic data availability

Counts Hourly
Speeds Hourly
Characterization N/A

Site information

AQS ID 48-439-1053
 PM_{2.5} nonattainment No
 TPF Yes
 Road type Freeway segment with nearby freeway/freeway interchange
 Number of lanes 8
 AADT 184,680
 FE-AADT 242,856
 Distance to road 15 m
 PM_{2.5} increment* 0.3 µg/m³
 PM_{2.5} 24-hour (1-in-3) 21.1 µg/m³
 PM_{2.5} max. 24-hr 21.1 µg/m³
 Annual mean PM_{2.5} 9.3 µg/m³
 CO max. 1-hr 1.67 ppm
 NO₂ max. 1-hr 58.6 ppb
 Collocated met. Yes

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Austin, Texas
I-35

17



(30.35386, -97.69166)

Traffic data availability

Counts Hourly
Speeds N/A
Characterization N/A

Site information

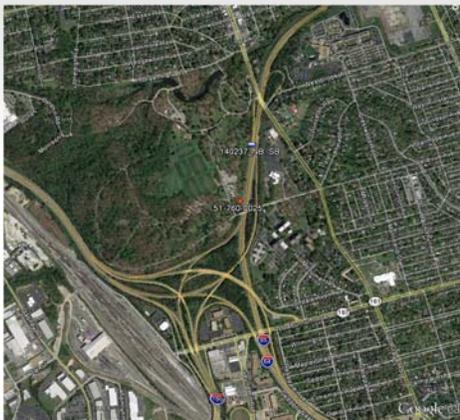
AQS ID 48-453-1068
PM_{2.5} nonattainment No
TPF Yes
Road type Freeway segment

Number of lanes 6
AADT 188,150
FE-AADT 350,712
Distance to road 27 m
PM_{2.5} increment* N/A
PM_{2.5} N/A
PM_{2.5} max. 24-hr N/A
Annual mean PM_{2.5} N/A
CO max. 1-hr N/A
NO₂ max. 1-hr 55.3 ppb
Collocated met. Yes

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"

Richmond, Virginia
I-95 & I-64/I-195

18



(37.590821, -77.469326)

Traffic data availability

Counts Hourly
Speeds Hourly
Characterization Hourly (FHWA)

Site information

AQS ID 51-760-0025
PM_{2.5} nonattainment No
TPF Yes
Road type Freeway segment

Number of lanes 6
AADT 151,000
FE-AADT 259,720
Distance to road 21 m
PM_{2.5} increment* 2.3 µg/m³
PM_{2.5} Hourly
PM_{2.5} max. 24-hr 27.8 µg/m³
Annual mean PM_{2.5} 10.1 µg/m³
CO max. 1-hr 1.2 ppm
NO₂ max. 1-hr 56.5 ppb
Collocated met. No; RIC is 10 mi away

* Taken from TO3 final report "National Near-Road Data Assessment Report No. 2 With 2015 Data"