

AASHTO Air Quality Peer Exchange

Generalized Case Studies of Project-level PM Hot-spot Modeling of Highways



Michael Claggett
FHWA Resource Center

Presentation Overview

Elements of an Analysis in Progress

Process Streamlining Recommendations

- Defining Links
- Air Dispersion Model Input Templates (Merging Link Data)
 - Traffic
 - Emission factors
 - Endpoint coordinates
- Technical Tools (Utility Programs)
 - Receptor spacing
 - Volume source spacing
 - Meteorology data processing – AERMET to MPRM

Elements of an Analysis in Progress

Add to the research conducted by Lin and Vallamsundar investigating the application of PM hot-spot modeling for highway and arterial cases in Illinois

- Recommendation for additional representative case studies to examine the effects of various project configurations and settings from the ADC20 specialty conference on Particulate Matter Hot-spot Analyses – Research and Applications at TRB

Predicting Roadway Concentration Contributions

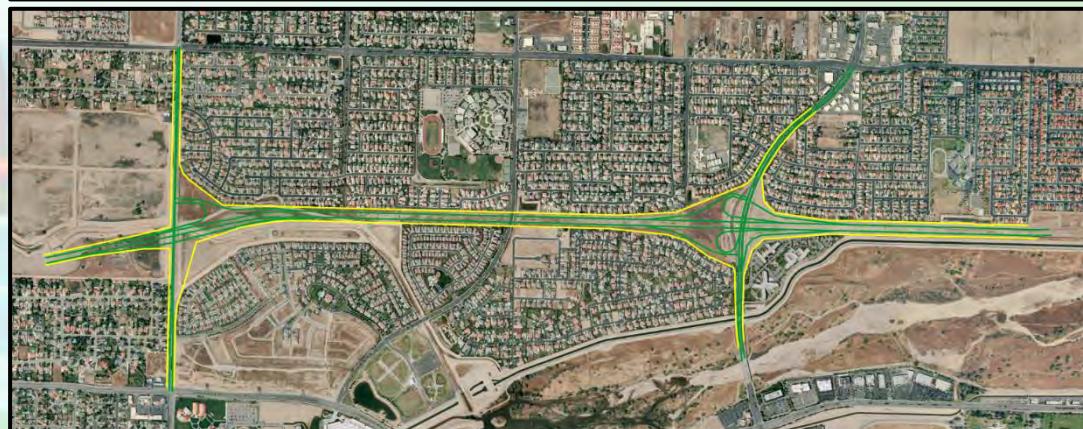
Pollutants

- $\text{PM}_{2.5}$ and PM_{10}

Elements of an Analysis in Progress

Highway Configurations

- Arterial intersection
- Arterial midblock
- Freeway interchange
- Freeway mainline



Emissions Models

- MOVES2010b
- EMFAC2011

Analysis Years

- 2015 and 2030

Elements of an Analysis in Progress

Emission Components

- Vehicle exhaust
 - Vehicle type (non-trucks and trucks)
- Brake wear
- Tire wear
- Re-entrained road dust
- Combined total

Air Dispersion Models

- AERMOD volume sources
- AERMOD area sources
- CAL3QHCR line sources

Process Streamlining Recommendations

Conduct processing steps in parallel rather than in series

- Traffic analysis
- Emission analysis
- Dispersion analysis (link and receptor locations)

Segregate Links – define highway segments with shared characteristics

Adopt Link IDs common to each process

Link IDs used to merge data from each process to supply air dispersion model input templates

Defining Links

Traffic Analysis

- Volume
- Vehicle speed
- Truck percentage

Issues (especially for congestion mitigation projects)

- It may be important to segregate vehicle activity during peak traffic periods instead of averaging over a 3-hour period
- In general, do not rely on regional travel demand models for project-level vehicle speeds, especially near signalized intersections and other traffic controls

Defining Links

Emissions Analysis

- Prepare speed look-up tables (MOVES or EMFAC) segregated by
 - Light-duty and heavy-duty vehicles (non-trucks & trucks)
- Additional segregation required with MOVES
 - Road type
 - Appropriate time periods (months and hours)
 - Roadway grade
- Project-scale inputs that typically do not vary by link
 - Vehicle age distribution
 - Alternative vehicle fuels & technology
 - Fuel supply & formulation
 - Meteorology

Defining Links

Dispersion Analysis

- Highway width
- Orientation or bearing
- Traffic activity affecting emissions
 - Volume
 - Speed
 - Truck percentage

Air Dispersion Model Input Templates – Merging Link Data

| Segment ID | AM Pk Period 7:00-8:00 | | | AM Pk Period 8:00-9:00 | | | PM Pk Period 3:00-4:00 | | | PM Pk Period 4:00-5:00 | | | PM Pk Period 5:00-6:00 | | |
|------------|------------------------|-----------------|--------------|------------------------|-----------------|--------------|------------------------|-----------------|--------------|------------------------|-----------------|--------------|------------------------|-----------------|--------------|
| | Speed_mph | NonTruck_Volume | Truck_Volume |
| MS03N500a | 8 | 787 | 107 | 8 | 644 | 88 | 6 | 593 | 81 | 5 | 697 | 95 | 6 | 593 | 81 |
| MS03N1000a | 45 | 787 | 107 | 45 | 644 | 88 | 45 | 593 | 81 | 45 | 697 | 95 | 45 | 593 | 81 |
| MS03N500d | 32 | 581 | 79 | 31 | 476 | 65 | 30 | 538 | 73 | 30 | 632 | 86 | 30 | 538 | 73 |
| MS03N1000d | 42 | 581 | 79 | 43 | 476 | 65 | 42 | 538 | 73 | 42 | 632 | 86 | 42 | 538 | 73 |
| MS03S500a | 2 | 904 | 123 | 4 | 739 | 101 | 6 | 1,125 | 153 | 5 | 1,322 | 180 | 6 | 1,125 | 153 |
| MS03S1000a | 5 | 904 | 123 | 44 | 739 | 101 | 45 | 1,125 | 153 | 45 | 1,322 | 180 | 45 | 1,125 | 153 |
| MS03S500d | 32 | 1,263 | 172 | 32 | 1,034 | 141 | 32 | 1,731 | 236 | 32 | 2,033 | 277 | 32 | 1,731 | 236 |
| MS03S1000d | 42 | 1,263 | 172 | 41 | 1,034 | 141 | 41 | 1,731 | 236 | 41 | 2,033 | 277 | 41 | 1,731 | 236 |
| RH10E500a | 3 | 2,228 | 304 | 8 | 1,823 | 249 | 8 | 2,189 | 299 | 7 | 2,572 | 351 | 8 | 2,189 | 299 |
| RH10E1000a | 4 | 2,228 | 304 | 45 | 1,823 | 249 | 45 | 2,189 | 299 | 31 | 2,572 | 351 | 45 | 2,189 | 299 |
| RH11E500d | 32 | 2,590 | 353 | 33 | 2,119 | 289 | 33 | 2,172 | 296 | 32 | 2,551 | 348 | 33 | 2,172 | 296 |
| RH11E1000d | 40 | 2,590 | 353 | 40 | 2,119 | 289 | 39 | 2,172 | 296 | 39 | 2,551 | 348 | 39 | 2,172 | 296 |
| RH11W500a | 8 | 2,314 | 316 | 9 | 1,894 | 258 | 10 | 2,416 | 329 | 8 | 2,837 | 387 | 10 | 2,416 | 329 |
| RH11W1000a | 45 | 2,314 | 316 | 45 | 1,894 | 258 | 45 | 2,416 | 329 | 45 | 2,837 | 387 | 45 | 2,416 | 329 |
| RH10W500d | 34 | 1,799 | 245 | 35 | 1,472 | 201 | 35 | 1,884 | 257 | 35 | 2,212 | 302 | 35 | 1,884 | 257 |
| RH10W1000d | 40 | 1,799 | 245 | 41 | 1,472 | 201 | 41 | 1,884 | 257 | 40 | 2,212 | 302 | 41 | 1,884 | 257 |

Air Dispersion Model Input Templates – Merging Link Data

| CalYr | RoadTyp | Fuel | Speed | Q1 (months=1-3, monthID=1) PM2.5 MOVES2010b Emission Factor (g/VMT) | | | | | | | |
|------------|---------|------------|--------|---|------------|------------------------|------------|--------------------------|------------|-------------------------|------------|
| | | | | ON (6pm-7am, hourID=1) | | AM (7am-9am, hourID=8) | | MD (11am-2pm, hourID=13) | | PM (3pm-6pm, hourID=17) | |
| Non-Trucks | Trucks | Non-Trucks | Trucks | Non-Trucks | Trucks | Non-Trucks | Trucks | Non-Trucks | Trucks | Non-Trucks | Trucks |
| 2015 | 4 | TOT | 1 | 0.37872959 | 6.06081492 | 0.40573674 | 6.07597220 | 0.32541208 | 6.03089696 | 0.31163611 | 6.02317578 |
| 2015 | 4 | TOT | 2 | 0.18936489 | 3.03040749 | 0.20286848 | 3.03799686 | 0.16270594 | 3.01544956 | 0.15581793 | 3.01158574 |
| 2015 | 4 | TOT | 3 | 0.13282153 | 2.02490634 | 0.14233914 | 2.02995804 | 0.11403197 | 2.01493302 | 0.10917724 | 2.01235423 |
| 2015 | 4 | TOT | 4 | 0.10668355 | 1.51868048 | 0.11459434 | 1.52246839 | 0.09106611 | 1.51119852 | 0.08703090 | 1.50926641 |
| 2015 | 4 | TOT | 5 | 0.09100085 | 1.22213272 | 0.09794756 | 1.22518362 | 0.07728661 | 1.21610954 | 0.07374320 | 1.21455256 |
| 2015 | 4 | TOT | 6 | 0.08054570 | 1.03830499 | 0.08684974 | 1.04088922 | 0.06810035 | 1.03320423 | 0.06488476 | 1.03188691 |
| 2015 | 4 | TOT | 7 | 0.07307762 | 0.92375062 | 0.07892248 | 0.92600096 | 0.06153847 | 0.91930627 | 0.05855718 | 0.91815900 |
| 2015 | 4 | TOT | 8 | 0.06874821 | 0.84098955 | 0.07424877 | 0.84299137 | 0.05788880 | 0.83704019 | 0.05508308 | 0.83601952 |
| 2015 | 4 | TOT | 9 | 0.06378697 | 0.77381591 | 0.06893825 | 0.77562369 | 0.05361721 | 0.77024825 | 0.05098961 | 0.76932788 |
| 2015 | 4 | TOT | 10 | 0.05874196 | 0.72007512 | 0.06342606 | 0.72172795 | 0.04949456 | 0.71681479 | 0.04710525 | 0.71597301 |
| 2015 | 4 | TOT | 11 | 0.05461416 | 0.67620476 | 0.05891606 | 0.67773342 | 0.04612134 | 0.67318244 | 0.04392705 | 0.67240169 |
| 2015 | 4 | TOT | 12 | 0.05117429 | 0.64899623 | 0.05515765 | 0.65043988 | 0.04331041 | 0.64614615 | 0.04127861 | 0.64540908 |
| 2015 | 4 | TOT | 13 | 0.04892944 | 0.62973677 | 0.05264314 | 0.63110640 | 0.04159759 | 0.62703052 | 0.03970324 | 0.62633044 |
| 2015 | 4 | TOT | 14 | 0.04638697 | 0.61169274 | 0.04986967 | 0.61300119 | 0.03951122 | 0.60911068 | 0.03773472 | 0.60844346 |
| 2015 | 4 | TOT | 15 | 0.04418359 | 0.59605555 | 0.04746611 | 0.59730951 | 0.03770315 | 0.59358256 | 0.03602884 | 0.59294133 |
| 2015 | 4 | TOT | 16 | 0.04215861 | 0.57941955 | 0.04528250 | 0.58062328 | 0.03599143 | 0.57704259 | 0.03439801 | 0.57642750 |
| 2015 | 4 | TOT | 17 | 0.04012111 | 0.56056897 | 0.04314778 | 0.56172703 | 0.03414601 | 0.55828352 | 0.03260221 | 0.55769271 |
| 2015 | 4 | TOT | 18 | 0.03871495 | 0.54481891 | 0.04165509 | 0.54593545 | 0.03291058 | 0.54261416 | 0.03141078 | 0.54204495 |
| 2015 | 4 | TOT | 19 | 0.03707329 | 0.52977364 | 0.03993601 | 0.53085318 | 0.03142156 | 0.52764092 | 0.02996132 | 0.52708927 |
| 2015 | 4 | TOT | 20 | 0.03559563 | 0.51715640 | 0.03838885 | 0.51820546 | 0.03008141 | 0.51508903 | 0.02865661 | 0.51455486 |

Air Dispersion Model Input Templates – Merging Link Data into AERMOD

| | | | | | | |
|--------------------|---------------------------------------|-----------------------|-----------------|---------------|---------------|-----------------|
| CO | STARTING | | | | | |
| TITLEONE | 2015 EMFAC2011 PM2.5 Example Arterial | | | | | |
| TITLETWO | 2008–2012 Meteorology | | | | | |
| MODELOPT | FLAT CONC | | | | | |
| AVERTIME | 24 ANNUAL | | | | | |
| URBANOPT | 2000000 | | | | | |
| POLLUTID | PM2.5 | | | | | |
| FLAGPOLE | 1.5 | | | | | |
| RUNORNOT | RUN | | | | | |
| ERRORFIL | ERRORS.OUT | | | | | |
| CO | FINISHED | | | | | |
| SO | STARTING | | | | | |
| ** | | | Xs1 | Ys1 | Xs2 | Ys2 |
| ** | Scriid | Srctyp | (m) | (m) | (m) | (m) |
| ** | ----- | ----- | ----- | ----- | ----- | ----- |
| LOCATION | 001 | LINE | 1899154.559 | 709066.640 | 1899156.326 | 709181.110 |
| LOCATION | 062 | LINE | 1901374.918 | 709459.414 | 1901573.182 | 709456.141 |
| ** Line Source | | Lnemis | Relhgt | Width | Szinit | |
| ** Parameters: | | (g/s-m ²) | (m) | (m) | (m) | |
| ** | ----- | ----- | ----- | ----- | ----- | ----- |
| SRCPARAM | 001 | 1.0 | 1.3 | 7.315 | 1.2 | |
| SRCPARAM | 062 | 1.0 | 1.3 | 7.315 | 1.2 | |
| ** Variable | | Qflag | ON | AM1 | AM2 | ON |
| ** Emission Rates: | ----- | ----- | ----- | ----- | ----- | ----- |
| EMISFACT | 001 | HROFDY | 7*2.8228968E-07 | 6.0721223E-07 | 5.6048163E-07 | 2*2.8228968E-07 |
| EMISFACT | 062 | HROFDY | 7*5.1687225E-07 | 1.0886432E-06 | 1.0034244E-06 | 2*5.1687225E-07 |
| URBANSRC | ALL | | | | | |
| SRCGROUP | ALL | | | | | |
| SO | FINISHED | | | | | |

Air Dispersion Model Input Templates – Merging Link Data into AERMOD

```
RE STARTING
**
**          Receptor Array
**
**          Xcoord      Ycoord
**          (m)        (m)
**          -----  -----
DISCCART 1899132.486 709502.677
DISCCART 1900976.584 709237.315
RE FINISHED

ME STARTING
SURFFILE 23155_2008-2012.sfc
PROFFILE 23155_2008-2012.pfl
SURFDATA 23155 2008
UAIRDATA 23230 2008
PROFBASE      0.0
ME FINISHED

OU STARTING
RECTABLE 24 1ST
MAXTABLE 24 50
POSTFILE 24 ALL PLOT 2015_EMFAC_PM25_Art_5yrAvg24hr.plt
POSTFILE ANNUAL ALL PLOT 2015_EMFAC_PM25_Art_5yrAvgAnnual.plt
OU FINISHED
```

Air Dispersion Model Input Templates – Merging Link Data into CAL3QHCR

| FILE MANAGEMENT | | | | | | | | | |
|----------------------------------|--|-------------|-------------|--------|---------|-------|------|--------|------|
| ***** | Meteorology File | | | | | | | | |
| MET: | '23155_2008-2012.met' | | | | | | | | |
| ***** | Output File | | | | | | | | |
| OUT: | '2015_MOVES_PM25_Fwy.out' | | | | | | | | |
| ***** | ETS File | | | | | | | | |
| ETS: | '2015_MOVES_PM25_Fwy.ets' | | | | | | | | |
| ***** | Message File | | | | | | | | |
| MSG: | '2015_MOVES_PM25_Fwy.msg' | | | | | | | | |
| ***** | Post File 1 - Concurrent 24-hr averages | | | | | | | | |
| PST1 | '2015_MOVES_PM25_Fwy_24hr.pst' | | | | | | | | |
| ***** | Post File 2 - Concurrent annual averages | | | | | | | | |
| PST2 | '2015_MOVES_PM25_Fwy_Annual.pst' | | | | | | | | |
| ***** | Plot File 1 - Highest 5-yr average 24-hr by quarter | | | | | | | | |
| PLT1 | '2015_MOVES_PM25_Fwy_5yrAvg24hr.plt' | | | | | | | | |
| ***** | Plot File 2 - 5-yr average annual | | | | | | | | |
| PLT2 | '2015_MOVES_PM25_Fwy_5yrAvgAnnual.plt' | | | | | | | | |
| PROGRAM CONTROL & SITE VARIABLES | | | | | | | | | |
| ***** | 'JOB' | ATIM | ZO | VS | VD | NR | SCAL | | IOPt |
| #1: | '2015 MOVES2010b PM2.5 Example Freeway' | | 60 | 108 | 0 | 0 | 2976 | 0.3048 | 1 |
| ***** | 'RUN' | NL | JTIER | 'MODE' | FLINK | FAMB | 'RU' | | |
| #2: | '2008-2012 Meteorology' | | 127 | 2 | 'PM2.5' | 0 | 0 | 'U' | |
| ***** | STRMO | STRDY | STRYR | ENDMO | ENDDY | ENDYR | | | |
| #3: | | 01 | 01 | 08 | 12 31 | | 12 | | |
| RECEPTOR LOCATIONS | | | | | | | | | |
| ***** | [Repeat in succession for each Receptor = 1 to NR] | | | | | | | | |
| ***** | 'RCP' | XR | YR | ZR | | | | | |
| #4: | '217FwyROW 1' | 6220130.011 | 2317283.637 | | 5.0 | | | | |
| #4: | '136Fwy1640ft 3' | 6230424.330 | 2321606.609 | | 5.0 | | | | |

Air Dispersion Model Input Templates – Merging Link Data into CAL3QHCR

| ETS PATTERNS | | | | | | | | | |
|------------------------------------|--|--------|------------|---------------|---------------|---------------|---------------|-------|-------|
| **** | PMOY1 | PMOY2 | PMOY3 | PMOY4 | PMOY5 | PMOY6 | PMOY7 | PMOY8 | PMOY9 |
| #5: | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **** | PHOD1 | PHOD2 | PHOD3 | PHOD4 | PHOD5 | PHOD6 | PHOD7 | PHOD8 | PHOD9 |
| #6: | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 |
| **** | PDOW1 | PDOW2 | PDOW3 | PDOW4 | PDOW5 | PDOW6 | PDOW7 | 1 | 2 |
| #7: | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| BACKGROUND CONCENTRATIONS | | | | | | | | | |
| **** | [Repeat in succession for each hour of day ETS pattern, then for each day of week ETS pattern] | | | | | | | | |
| **** | PDOW1 for PHOD1 to PHOD9: | | | | | | | | |
| #8: | | 0.0 | | | | | | | |
| #8: | | 0.0 | | | | | | | |
| #8: | | 0.0 | | | | | | | |
| #8: | | 0.0 | | | | | | | |
| #8: | | 0.0 | | | | | | | |
| #8: | | 0.0 | | | | | | | |
| #8: | | 0.0 | | | | | | | |
| #8: | | 0.0 | | | | | | | |
| #8: | | 0.0 | | | | | | | |
| LINK CONFIGURATIONS (for IQ = 'F') | | | | | | | | | |
| **** | [Repeat #9 and #10 in succession for each Link = 1 to NL] | | | | | | | | |
| **** | [Repeat #10 in succession for each hour of day ETS pattern, then for each day of week ETS pattern] | | | | | | | | |
| **** | 'LNK' | 'IQ' | 'TYP' | X1 | Y1 | X2 | Y2 | SH | WL |
| #9: | 'ALR02N-02' | 'F' | 'AG' | 6220106.76308 | 2317212.91867 | 6220104.31262 | 2318042.50002 | 0 | 44 |
| **** | PDOW1 for PHOD1 to PHOD9: | | | | | | | | |
| **** | VPHL | EFL-Q1 | EFL-Q2 | EFL-Q3 | EFL-Q4 | | | | |
| #10: | | 603 | 0.04671531 | 0.03760705 | 0.03215120 | 0.03675570 | | | |
| #10: | | 1544 | 0.06177186 | 0.04960248 | 0.04267969 | 0.04918735 | | | |
| #10: | | 1426 | 0.06180129 | 0.04963263 | 0.04271025 | 0.04921753 | | | |
| #10: | | 1174 | 0.04410638 | 0.03637412 | 0.03459958 | 0.03563338 | | | |
| #10: | | 1174 | 0.04410638 | 0.03637412 | 0.03459958 | 0.03563338 | | | |
| #10: | | 1174 | 0.04410638 | 0.03637412 | 0.03459958 | 0.03563338 | | | |
| #10: | | 1494 | 0.05030649 | 0.04320159 | 0.04199898 | 0.04269584 | | | |
| #10: | | 1608 | 0.05009104 | 0.04298312 | 0.04177997 | 0.04247715 | | | |
| #10: | | 1494 | 0.05030649 | 0.04320159 | 0.04199898 | 0.04269584 | | | |

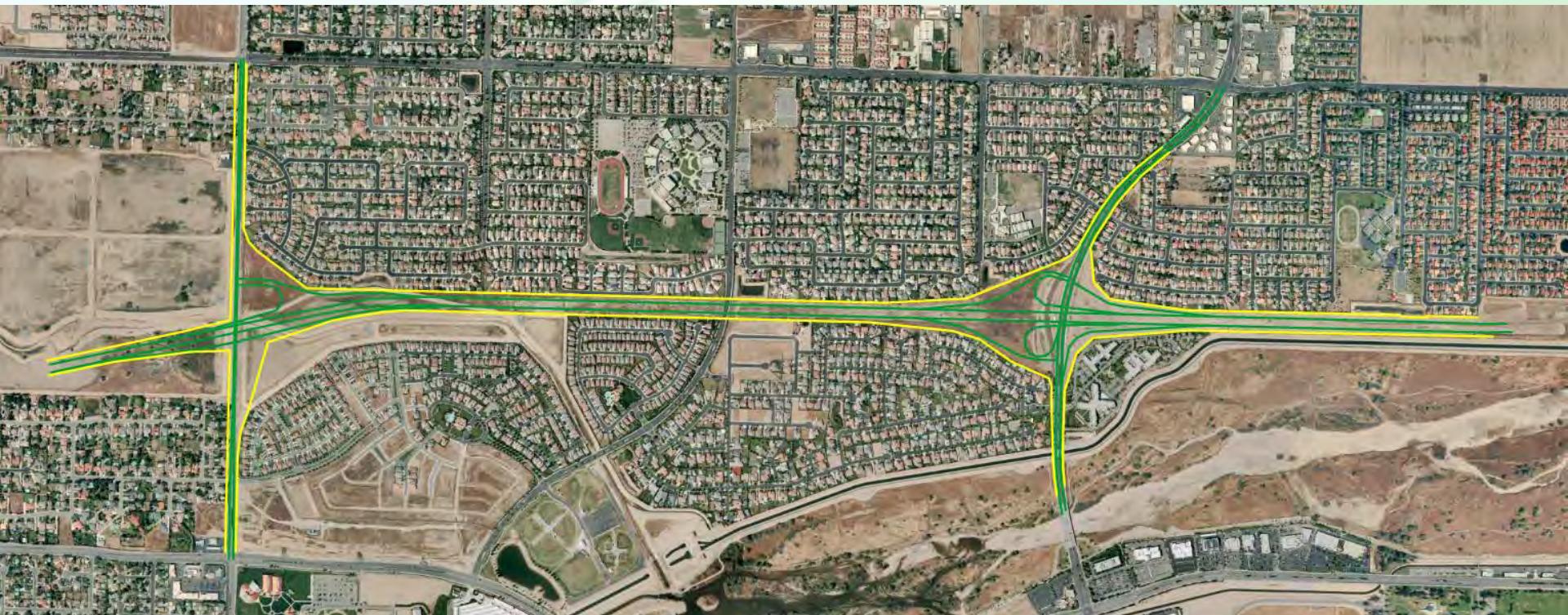
Constructing a Receptor Network

Procedure based on highway right-of-way configuration

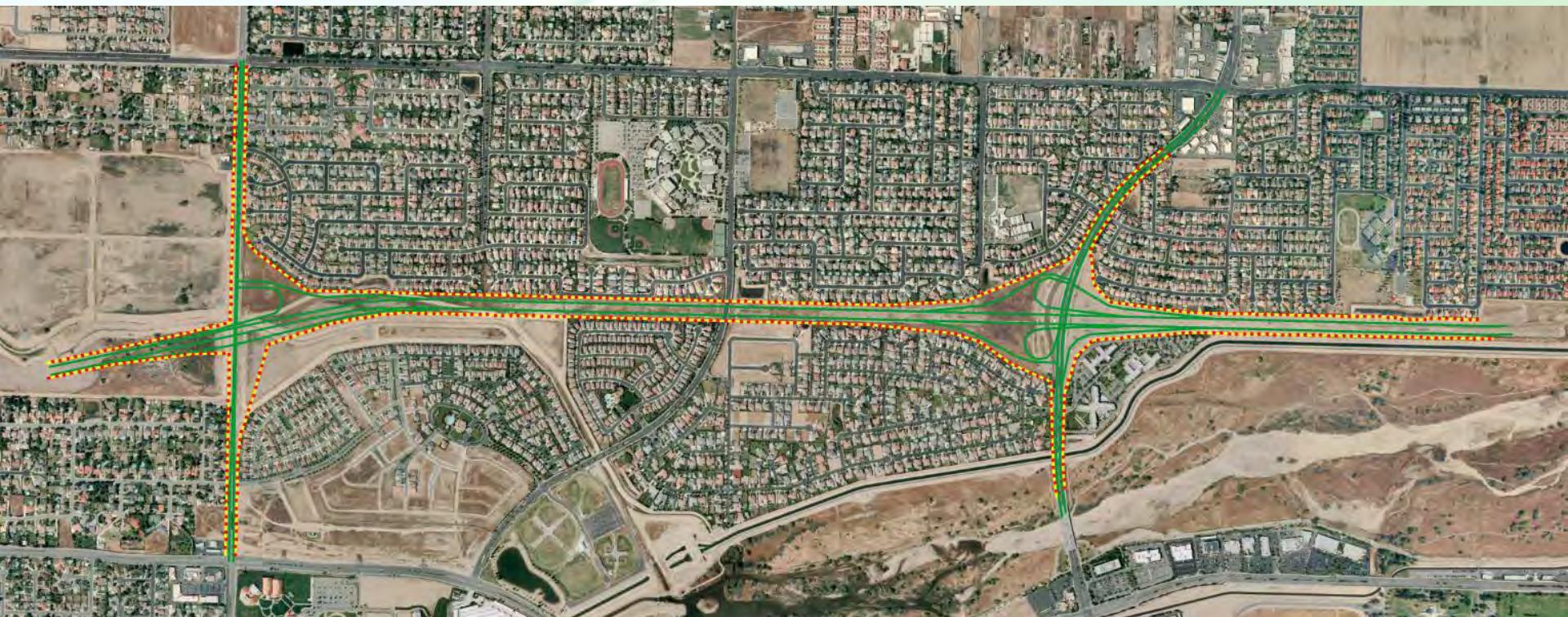
Receptor spacing utility program application

A similar utility program has been developed to establish volume source spacing based on highway centerline coordinates

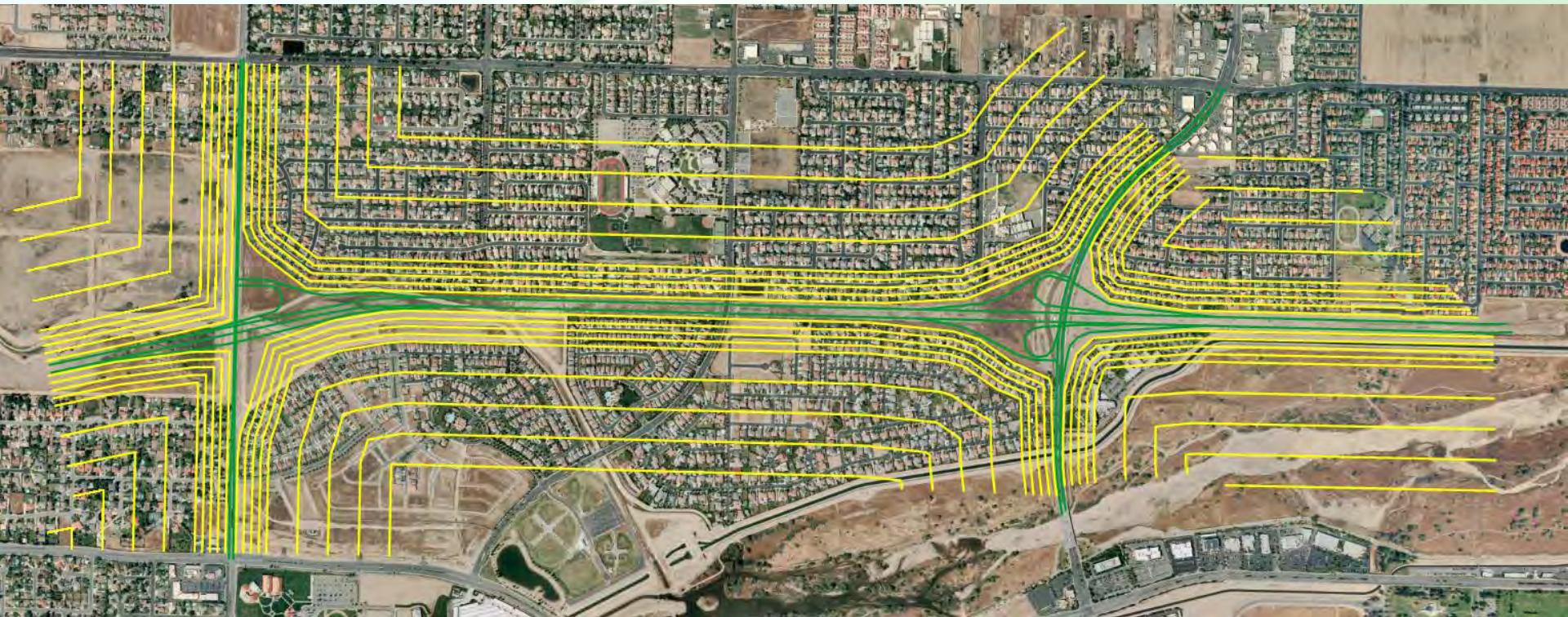
Freeway Links and Right-of Way



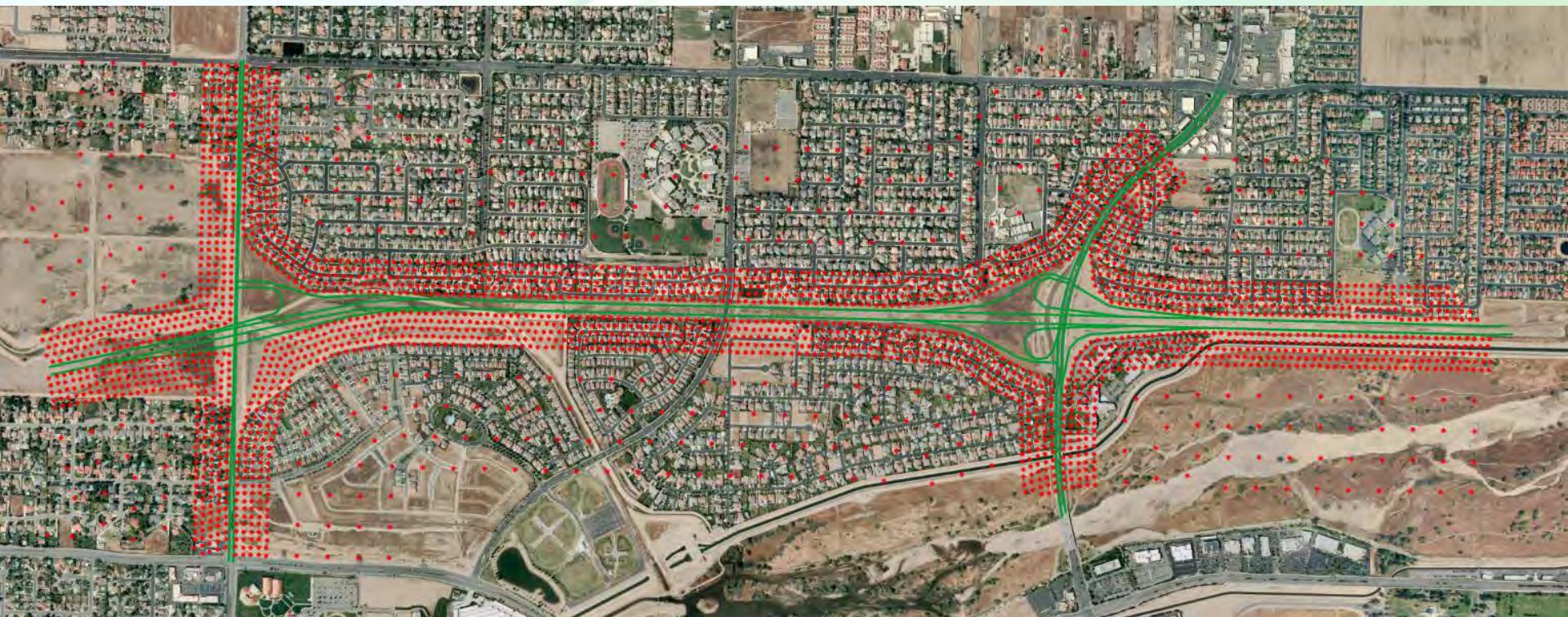
Freeway Links and Right-of Way Receptors



Freeway Links and Receptor Lines



Freeway Links and Receptor Network



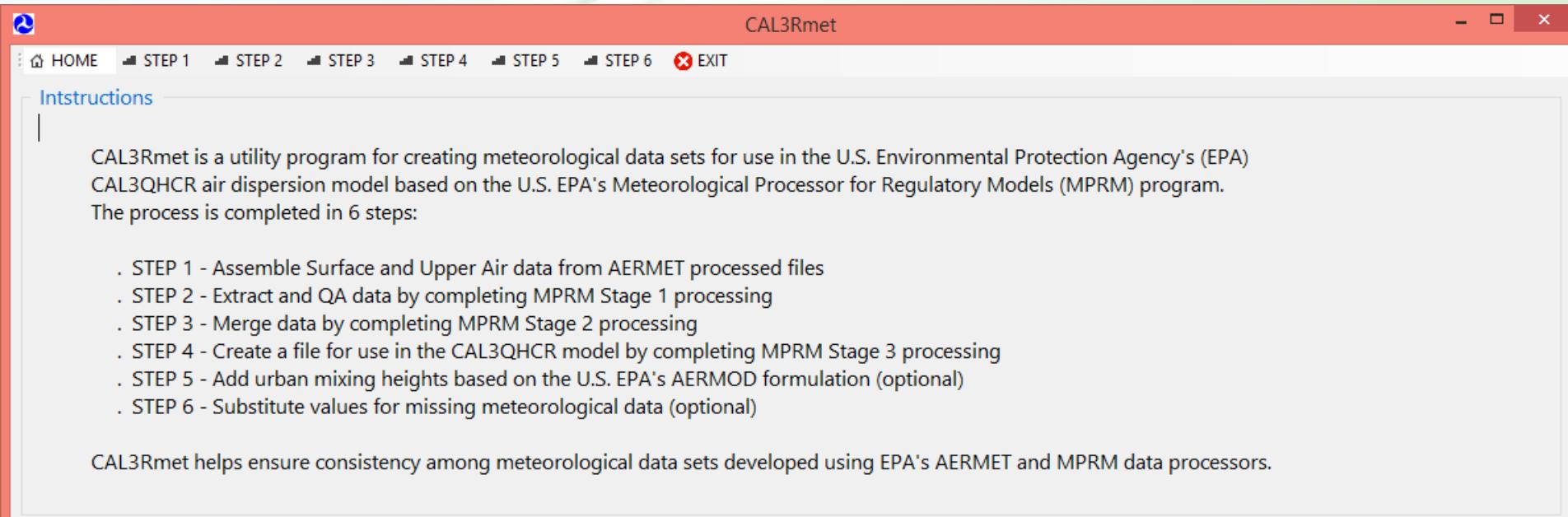
Arterial Links



Arterial Links and Receptor Network



Processing CAL3QHCR Met Data – CAL3Rmet



The screenshot shows the CAL3Rmet software window. The title bar reads "CAL3Rmet". The menu bar includes "HOME", "STEP 1", "STEP 2", "STEP 3", "STEP 4", "STEP 5", "STEP 6", and "EXIT". The main content area is titled "Instructions". It contains text describing CAL3Rmet as a utility program for creating meteorological data sets for use in the U.S. Environmental Protection Agency's (EPA) CAL3QHCR air dispersion model based on the U.S. EPA's Meteorological Processor for Regulatory Models (MPRM) program. It also states that the process is completed in 6 steps. Below this, a list of six steps is provided, each preceded by a bullet point and a short description.

CAL3Rmet is a utility program for creating meteorological data sets for use in the U.S. Environmental Protection Agency's (EPA) CAL3QHCR air dispersion model based on the U.S. EPA's Meteorological Processor for Regulatory Models (MPRM) program.

The process is completed in 6 steps:

- . STEP 1 - Assemble Surface and Upper Air data from AERMET processed files
- . STEP 2 - Extract and QA data by completing MPRM Stage 1 processing
- . STEP 3 - Merge data by completing MPRM Stage 2 processing
- . STEP 4 - Create a file for use in the CAL3QHCR model by completing MPRM Stage 3 processing
- . STEP 5 - Add urban mixing heights based on the U.S. EPA's AERMOD formulation (optional)
- . STEP 6 - Substitute values for missing meteorological data (optional)

CAL3Rmet helps ensure consistency among meteorological data sets developed using EPA's AERMET and MPRM data processors.

MPRM Met Data – CAL3QHCR Input Requirements

| Year | Month | Day | Hour | Bearing | U | Temp | Class | Zrur | Zurb |
|------|-------|-----|------|---------|------|-------|-------|------|------|
| 12 | 1 | 1 | 1 | 0 | 0 | 278.1 | 7 | 15 | 400 |
| 12 | 1 | 1 | 2 | 305 | 2.03 | 278.8 | 6 | 48 | 400 |
| 12 | 1 | 1 | 3 | 304 | 1.18 | 277 | 7 | 21 | 400 |
| 12 | 1 | 1 | 4 | 297 | 1.13 | 275.9 | 7 | 17 | 400 |
| 12 | 1 | 1 | 5 | 263 | 1.21 | 275.4 | 7 | 19 | 400 |
| 12 | 1 | 1 | 6 | 0 | 0 | 275.4 | 7 | 5 | 400 |
| 12 | 1 | 1 | 7 | 0 | 0 | 273.8 | 7 | 9 | 400 |
| 12 | 1 | 1 | 8 | 309 | 1.04 | 275.9 | 6 | 18 | 400 |
| 12 | 1 | 1 | 9 | 312 | 1.25 | 279.9 | 5 | 92 | 400 |
| 12 | 1 | 1 | 10 | 0 | 0 | 282.5 | 4 | 119 | 400 |

AERMET Surface Data

| Year | Month | Day | Jday | Hour | H | u* | w* | VPTG | Zic | Zim | L | z0 |
|------|-------|-----|------|------|------|-------|-------|-------|------|-----|-------|-------|
| 12 | 1 | 1 | 1 | 1 | -1.2 | 0.034 | -9 | -9 | -999 | 15 | 3 | 0.048 |
| 12 | 1 | 1 | 1 | 2 | -6 | 0.076 | -9 | -9 | -999 | 48 | 6.5 | 0.048 |
| 12 | 1 | 1 | 1 | 3 | -2 | 0.044 | -9 | -9 | -999 | 21 | 3.8 | 0.048 |
| 12 | 1 | 1 | 1 | 4 | -1.6 | 0.039 | -9 | -9 | -999 | 17 | 3.2 | 0.029 |
| 12 | 1 | 1 | 1 | 5 | -1.8 | 0.041 | -9 | -9 | -999 | 19 | 3.3 | 0.027 |
| 12 | 1 | 1 | 1 | 6 | -0.3 | 0.017 | -9 | -9 | -999 | 5 | 1.4 | 0.021 |
| 12 | 1 | 1 | 1 | 7 | -0.7 | 0.025 | -9 | -9 | -999 | 9 | 2 | 0.027 |
| 12 | 1 | 1 | 1 | 8 | -1.5 | 0.039 | -9 | -9 | -999 | 18 | 3.5 | 0.048 |
| 12 | 1 | 1 | 1 | 9 | 13.7 | 0.117 | 0.229 | 0.013 | 31 | 92 | -10.4 | 0.048 |
| 12 | 1 | 1 | 1 | 10 | 61.4 | 0.111 | 0.588 | 0.012 | 119 | 85 | -2 | 0.038 |

From AERMET
Stage 1 Surface
Observations

| B0 | r | Ws | Wd | Zref | Temp | Ztemp | IPcode | Pamt | RH | Pres | CCVR | WSadj | CLHT |
|------|------|-------------|------------|------|--------------|-------|--------|------|----|------|----------|--------|--------------|
| 0.99 | 1 | 0.92 | 127 | 10 | 278.1 | 2 | 0 | 0 | 75 | 1005 | 0 | ADJ-A1 | 00099 |
| 0.99 | 1 | 2.03 | 125 | 10 | 278.8 | 2 | 0 | 0 | 75 | 1005 | 0 | ADJ-A1 | 00099 |
| 0.99 | 1 | 1.18 | 124 | 10 | 277 | 2 | 0 | 0 | 78 | 1004 | 0 | ADJ-A1 | 00099 |
| 0.99 | 1 | 1.13 | 117 | 10 | 275.9 | 2 | 0 | 0 | 85 | 1004 | 0 | ADJ-A1 | 00099 |
| 0.99 | 1 | 1.21 | 83 | 10 | 275.4 | 2 | 0 | 0 | 85 | 1004 | 0 | ADJ-A1 | 00099 |
| 0.99 | 1 | 0.53 | 50 | 10 | 275.4 | 2 | 0 | 0 | 81 | 1005 | 0 | ADJ-A1 | 00099 |
| 0.99 | 1 | 0.75 | 86 | 10 | 273.8 | 2 | 0 | 0 | 84 | 1006 | 0 | ADJ-A1 | 00099 |
| 0.99 | 0.61 | 1.04 | 129 | 10 | 275.9 | 2 | 0 | 0 | 81 | 1007 | 0 | ADJ-A1 | 00099 |
| 0.99 | 0.35 | 1.25 | 132 | 10 | 279.9 | 2 | 0 | 0 | 76 | 1007 | 0 | ADJ-A1 | 00099 |
| 0.99 | 0.26 | 0.99 | 176 | 10 | 282.5 | 2 | 0 | 0 | 68 | 1007 | 0 | ADJ-A1 | 00099 |

Processing CAL3QHCR Met Data – CAL3Rmet

CAL3Rmet - STEP 1

HOME STEP 1 STEP 2 STEP 3 STEP 4 STEP 5 STEP 6 EXIT

Assemble Surface and Upper Air Met Data

| | | | | |
|--|-----------------------|--------------|--------------|---|
| Filename of AERMET Stage 1 Surface Obs: | 23155_08.SQA | | |  |
| Filename of AERMOD Surface Met Data: | 23155_08.SFC | | |  |
| Filename of Assembled Surface and Upper Air: | test.dat | | |  |
| Time Period Begin: | Time Period End: | 01 / 01 / 08 | 12 / 31 / 08 | |
| Surface Station ID: | Upper Air Station ID: | 23155 | 23230 | |
| Latitude: | Longitude: | LST Adjust: | 35.433N | 119.050W |
| <input type="button" value="Assemble"/> | | | | |

Assemble Surface and Upper Air Met Data

| OSYR | OSMO | OSDY | OSHR | MHGTT | WS01 | WD01 | TT01 | TSKC | CLHT |
|------|------|------|------|-------|-------|-------|-------|------|------|
| 8 | 1 | 1 | 1 | 51. | 2.36 | 999.0 | 5.64 | 3 | 300 |
| 8 | 1 | 1 | 2 | 1468. | 10.06 | 128.0 | 11.74 | 0 | 300 |
| 8 | 1 | 1 | 3 | 673. | 5.36 | 124.0 | 12.74 | 0 | 300 |
| 8 | 1 | 1 | 4 | 1007. | 7.96 | 123.0 | 12.74 | 3 | 300 |
| 8 | 1 | 1 | 5 | 416. | 3.36 | 113.0 | 12.24 | 0 | 300 |
| 8 | 1 | 1 | 6 | 436. | 4.86 | 122.0 | 11.04 | 3 | 300 |
| 8 | 1 | 1 | 7 | 808. | 6.96 | 125.0 | 12.24 | 0 | 300 |
| 8 | 1 | 1 | 8 | 815. | 6.96 | 123.0 | 13.24 | 0 | 300 |

Processing CAL3QHCR Met Data – CAL3Rmet

CAL3Rmet - STEP 2

HOME STEP 1 STEP 2 STEP 3 STEP 4 STEP 5 STEP 6 EXIT

Extract and QA Met Data (MPRM Stage 1)

| | | | | | | | | | | |
|--|------------|-------------|---------------|-------------|-------------|----|---|----|---|----|
| Filename of Assembled Surface and Upper Air: | test.dat | | | | | | | | | |
| Filename of Stage 1 General Report: | test.rp1 | | | | | | | | | |
| Filename of Stage 1 Error/Messages Output: | test.er1 | | | | | | | | | |
| Filename of Stage 1 Extract and QA Met Data: | test.oqa | | | | | | | | | |
| Time Period Begin: | 01 | / | 01 | / | 08 | 12 | / | 31 | / | 08 |
| Surface Station ID: | 23155 | | | 23230 | | | | | | |
| Latitude: | Longitude: | LST Adjust: | 35.433N | 119.050W | 0 | | | | | |
| Quality Assessment Range Check Parameters - | | | Missing Value | Lower Bound | Upper Bound | | | | | |
| MHGT - Mixing Height (m): | | | -999 | 0 | 4000 | | | | | |
| WS01 - Wind Speed (m/s): | | | 999 | 0 | 50 | | | | | |
| WD01 - Wind Direction (degrees from N): | | | 999 | 0 | 360 | | | | | |
| TT01 - Temperature (oC): | | | 999 | -30 | 40 | | | | | |
| TSKC - Sky Cover (Total or Opaque): | | | 99 | 0 | 10 | | | | | |
| CLHT - Ceiling Height (km * 10): | | | 999 | 0 | 300 | | | | | |
| <input type="button" value="Extract/QA"/> | | | | | | | | | | |

Extract and QA Met Data

| OSYR | OSMO | OSDY | OSHR | MHGТ | WS01 | WD01 | TT01 | TSKC | CLHT |
|------|------|------|------|-------|-------|-------|-------|------|------|
| 8 | 1 | 1 | 1 | 51. | 2.36 | 999.0 | 5.64 | 3 | 300 |
| 8 | 1 | 1 | 2 | 1468. | 10.06 | 128.0 | 11.74 | 0 | 300 |
| 8 | 1 | 1 | 3 | 673. | 5.36 | 124.0 | 12.74 | 0 | 300 |
| 8 | 1 | 1 | 4 | 1007. | 7.96 | 123.0 | 12.74 | 3 | 300 |
| 8 | 1 | 1 | 5 | 416. | 3.36 | 113.0 | 12.24 | 0 | 300 |
| 8 | 1 | 1 | 6 | 436. | 4.86 | 122.0 | 11.04 | 3 | 300 |
| 8 | 1 | 1 | 7 | 808. | 6.96 | 125.0 | 12.24 | 0 | 300 |
| 8 | 1 | 1 | 8 | 815. | 6.96 | 123.0 | 13.24 | 0 | 300 |
| 8 | 1 | 1 | 9 | 1739. | 11.06 | 127.0 | 14.94 | 0 | 300 |
| 8 | 1 | 1 | 10 | 774. | 4.36 | 121.0 | 16.74 | 0 | 300 |
| 8 | 1 | 1 | 11 | 545. | 4.86 | 174.0 | 17.74 | 0 | 300 |
| 8 | 1 | 1 | 12 | 428. | 2.36 | 266.0 | 16.04 | 0 | 300 |
| 8 | 1 | 1 | 13 | 473. | 2.86 | 203.0 | 19.34 | 0 | 300 |
| 8 | 1 | 1 | 14 | 507. | 4.36 | 299.0 | 18.24 | 0 | 300 |
| 8 | 1 | 1 | 15 | 528. | 2.86 | 292.0 | 18.24 | 0 | 300 |
| 8 | 1 | 1 | 16 | 533. | 2.36 | 274.0 | 18.24 | 0 | 300 |

Processing CAL3QHCR Met Data – CAL3Rmet

CAL3Rmet - STEP 4

HOME STEP 1 STEP 2 STEP 3 STEP 4 STEP 5 STEP 6 EXIT

Create a Met Data File for CAL3QHCR (MPRM Stage 3)

| | | | | | |
|--|-----------------------|--------------|--------------|----------|---|
| Filename of Stage 2 Merged Met Data: | test.mrg | | | | |
| Filename of Stage 3 General Report: | test.rp3 | | | | |
| Filename of Stage 3 Error/Messages Output: | test.er3 | | | | |
| Filename of Stage 3 CAL3QHCR Met Data: | test.met | | | | |
| Time Period Begin: | Time Period End: | 01 / 01 / 08 | 12 / 31 / 08 | | |
| Surface Station ID: | Upper Air Station ID: | 23155 | 23230 | | |
| Latitude: | Longitude: | LST Adjust: | 35.433N | 119.050W | 0 |

Create CAL3QHCR Met Data

| Year | Month | Day | Hour | Vector | Speed | Temp | Class | Rural | Urban |
|------|-------|-----|------|----------|---------|-------|-------|--------|--------|
| 8 | 1 | 1 | 1 | -99.0000 | 2.3600 | 278.8 | 6 | 51.0 | 51.0 |
| 8 | 1 | 1 | 2 | 308.0000 | 10.0600 | 284.9 | 5 | 1468.0 | 1468.0 |
| 8 | 1 | 1 | 3 | 304.0000 | 5.3600 | 285.9 | 5 | 673.0 | 673.0 |
| 8 | 1 | 1 | 4 | 303.0000 | 7.9600 | 285.9 | 4 | 1007.0 | 1007.0 |
| 8 | 1 | 1 | 5 | 293.0000 | 3.3600 | 285.4 | 5 | 416.0 | 416.0 |
| 8 | 1 | 1 | 6 | 302.0000 | 4.8600 | 284.2 | 5 | 436.0 | 436.0 |
| 8 | 1 | 1 | 7 | 305.0000 | 6.9600 | 285.4 | 4 | 808.0 | 808.0 |
| 8 | 1 | 1 | 8 | 303.0000 | 6.9600 | 286.4 | 4 | 815.0 | 815.0 |
| 8 | 1 | 1 | 9 | 307.0000 | 11.0600 | 288.1 | 4 | 1739.0 | 1739.0 |

Preliminary Results for Generalized Cases – CAL3QHCR

| Analysis Year | Generalized Case | Annual PM _{2.5} | 24-hr PM _{2.5} |
|---------------|------------------|--------------------------|-------------------------|
| 2015 | MOVES Arterial | 2.5 µg/m ³ | 6 µg/m ³ |
| | MOVES Freeway | 1.7 µg/m ³ | 3 µg/m ³ |
| | EMFAC Arterial | 0.8 µg/m ³ | 2 µg/m ³ |
| | EMFAC Freeway | 1.1 µg/m ³ | 2 µg/m ³ |
| 2035 | EMFAC Arterial | 0.7 µg/m ³ | 2 µg/m ³ |
| | EMFAC Freeway | 1.0 µg/m ³ | 2 µg/m ³ |

Note: These results are subject to change

Contact Information



U.S. Department of Transportation
Federal Highway Administration

Michael Claggett, Ph.D.

Air Quality Modeling Specialist

FHWA Resource Center

4001 Office Court Drive, Suite 800

Santa Fe, NM 87507

Phone: 505.820.2047

Fax: 505.820.2040

Michael.Claggett@dot.gov

www.fhwa.dot.gov/resourcecenter