

# MISCELLANEOUS PROCESS METHODOLOGY 7.9

## Entrained Road Travel, Paved Road Dust

*(Revised and updated, March 2018)*

### EMISSION INVENTORY SOURCE CATEGORY

Miscellaneous Processes / Road Dust

#### EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION

**640-635-5400-0000 (83618)** Paved Entrained Road Dust - Freeways

**640-637-5400-0000 (83626)** Paved Entrained Road Dust - Major Streets

**640-639-5400-0000 (83634)** Paved Entrained Road Dust - Collector Streets

**640-641-5400-0000 (83642)** Paved Entrained Road Dust - Local Streets

**640-643-5400-0000 (89656)** Paved Entrained Road Dust - Rural Streets

**640-636-5400-0000 (47456)** Paved Entrained Road Dust - Unspecified Paved Roads

### METHODS AND SOURCES

The paved road dust category includes emissions of particulate matter (PM) from resuspended road surface material that is entrained by vehicular travel on public and industrial paved roads. Entrained paved road dust, or fugitive dust, contributes to airborne PM emissions throughout California. Because it is not feasible to directly measure region-wide emissions from travel on paved roads, ARB computes emissions using the emission factor equation provided in the Final Section of the Fifth Edition, Volume 1, Chapter 13.2.1, of the U.S. EPA's AP-42 document (January 2011).<sup>[1]</sup> The emission factor equation was derived from regression analyses of 83 tests for PM<sub>10</sub> on public and industrial paved roads. Airborne PM emissions were most closely correlated with vehicle weight and silt loading (the mass of material 75 microns or less per square meter of roadway). Inputs to the paved road dust emission factor equation were developed from California-specific roadway silt loading measurements<sup>[2,3,4,5]</sup> and average vehicle weight data measured by Midwest Research Institute (MRI).<sup>[5]</sup> This updates estimates California paved road dust emissions for 2012. Data from the ARB, air districts and transportation planning agencies were used to estimate county-specific vehicle miles traveled (VMT).<sup>[6]</sup> California Department of Transportation (Caltrans) Highway Performance Monitoring System (HPMS) data were used to estimate the fraction of travel on each of four road types in each county: freeway, major, collector, and local.<sup>[7,8]</sup> Western Regional Climate Center precipitation data were used to estimate the number of days per year that each county within air basin received 0.01 inch or greater of precipitation.<sup>[9]</sup>

## OVERVIEW OF ESTIMATION METHODOLOGY

Particulate emissions less than 10 microns in diameter (PM<sub>10</sub>) from re-suspension of road surface material by vehicle travel on paved roads (entrained paved road dust) are computed using the emission factor equation in the Final Section of the U.S. EPA's January 2011 AP-42, Fifth Edition, Volume 1, Chapter 13.2.1.<sup>[1]</sup> The methodology does not include directly emitted motor vehicle emissions (exhaust, brake or tire wear), nor TOG, CO, NO<sub>x</sub>, SO<sub>x</sub>, or PM exhaust emissions; these emissions are included in ARB's motor vehicle emission inventory.<sup>[10]</sup> Emission estimates for dust from constructing new roads are provided in ARB's Road Construction Dust methodology.<sup>[11]</sup>

## EMISSION ESTIMATION METHODOLOGY

The AP-42 emission factor equation used to estimate paved road dust emissions in California is provided below, followed by a description of the inputs to the equation:<sup>[1]</sup>

$$E = [k(sL)^{0.91} \times (W)^{1.02}] \times (1 - P/4N)$$

Where:

E = the particulate emission factor in units of pounds of particulate matter per VMT

k = the U.S. EPA AP-42 particle size multiplier (PM<sub>10</sub> = 0.0022 lb/VMT),<sup>[1]</sup>

sL = the roadway-specific silt loading in grams/square meter (g/m<sup>2</sup>),<sup>[2,3,4,5]</sup>

W = the average weight of vehicles traveling the road (California statewide default = 2.4 tons),<sup>[5]</sup>

P = number of "wet" days, when at least one site per county received at least 0.01 inch of precipitation during the annual averaging period,<sup>[9]</sup> and

N = the number of days in the annual averaging period (default = 365)

ARB's database system maintains particulate emissions as Total PM (particulate emission greater than 10 microns) using ARB's speciation profile #471 for paved road dust (see Table 1, below), based on paved road dust sampling conducted in California and on evaluations conducted by ARB and MRI.<sup>[12-17]</sup> It is estimated that PM<sub>10</sub> is 45.72% of PM. Based on 2006 updates to ARB speciation profiles for PM<sub>2.5</sub> (particulate matter less than 2.5 microns in diameter), PM<sub>2.5</sub> is estimated to be 6.86% of PM, or 15% of PM<sub>10</sub>.<sup>[15]</sup>

$$\text{Total PM} = \text{PM}_{10}/0.4572$$

$$\begin{aligned} \text{PM}_{2.5} &= [\text{PM}_{10} \times (0.0686/0.4572)] \\ &= \text{PM}_{10} \times 15\% \end{aligned}$$

Table 1. ARB Paved Road Dust Particulate Matter (PM)  
Speciation Profile #471

| Particulate Matter | Size                | Fraction |
|--------------------|---------------------|----------|
| PM10               | < PM <sub>10</sub>  | 0.4572   |
| PM2.5              | < PM <sub>2.5</sub> | 0.0686   |
| PM                 | > PM <sub>10</sub>  | 0.5428   |

Statewide PM<sub>10</sub> and PM<sub>2.5</sub> emissions (tons/year) for 2012 are presented in Table 5, by county/air basin/air district (COABDIS) region, along with total VMT.

### Roadway Category Splits

The HPMS, a federally mandated inventory system and planning tool designed to assess the nation’s highway system, is used by State and Federal governments and local agencies to analyze the system's condition and performance. HPMS provides data on VMT for 12 functional systems, based on mobility and access considerations defined by the Federal Highway Administration (FHWA).<sup>[7,8]</sup> To calculate county-specific travel fractions for each roadway type, ARB apportioned 2008 Caltrans HPMS paved road VMT to four ARB roadway classifications (freeway, major, collector and local), based on their anticipated usage, modes of usage, and silt loading potential.<sup>[7]</sup> As available, ARB can incorporate more refined travel fraction data for COABDIS regions. Data for unspecified roads (canals, drainage ditches, etc.) are provided directly by air districts and counties. Table 2 shows how HPMS functional systems are distributed to ARB road categories and provides FHWA functional system characteristics. Table 6 presents total VMT (millions of miles) for 2012 for each COABDIS region, and the 2008 travel fractions used to distribute VMT to each roadway category.

Table 2. ARB Roadway Categories, Caltrans HPMS Functional Systems and FHWA Functional System Characteristics

| ARB Category  | HPMS Functional System                   | FHWA Functional System Characteristics  |
|---|--|---|
| <b>Systems for Rural Areas (populations &lt; 5,000)</b> |  |   |
| Freeway   | Interstate                               | All designated routes of the Interstate System. Provides substantial interstate travel, highest overall travel speeds.  |
| Major   | Other Principal Arterial                 | Non-interstate principal arterials  |
|   | Minor Arterials                          | Provides substantial statewide travel, links cities and larger towns, links to interstates and inter-county service; relatively high travel speeds.   |
| Collector   | Major Collector                          | Primarily intra-county; shorter distances and more moderate travel speeds than arterials.   |
| Local   | Minor Collector                          | Collects traffic from local roads, services smaller communities, links locally important traffic generators with remote areas.  |
|   | Local                                    | Provides access to adjacent land over relatively short distances.   |
| <b>Systems for Urban Areas (populations ≥ 5,000)</b>    |  |   |
| Freeway   | Interstate, Other Freeway and Expressway | Highest level of mobility, highest traffic volumes and travel speeds, controlled access routes. Serves longest trips and through-movement as well as access to major urban centers. Provides intra-area travel, intra-urban and inter-city bus routes. Integrates with major rural connections. |
| Major   | Other Principal Arterial                 | Provides service to major traffic movements, uncontrolled access to adjacent land.  |
|   | Minor Arterial                           | Interconnects, augments urban principal arterial system, distributes travel to smaller geographic areas, may carry local bus routes. Serves trips of moderate length at somewhat lower mobility and speeds. Connects to rural collector roads.  |
| Collector   | Collector                                | Provides land access, traffic circulation within residential neighborhoods, commercial and industrial areas. Connects to the arterial system.   |
| Local   | Local                                    | Provides direct access to abutting land and higher order functional systems. Restricts through-movement, generally contains no bus routes.  |

## **Silt Loadings**

ARB assigned silt loadings to four roadway types (freeway, major, collector, local), assuming that more highly traveled roadways with fewer entrance and exit points (limited access roadways such as freeways) have less silt loading compared to roadways with multiple access and exit points, and that roads with similar configurations and usage have similar silt loadings statewide. While ARB understands the limitations to this assumption, especially in computing localized emissions, our current strategy is to use the best available California roadway silt loading data to estimate regional entrained road dust emissions. Table 3, below, presents the statewide default silt loading values for the four ARB roadway categories, as well as the derivation of several district and county specific silt loadings. Silt loadings for unspecified roads were provided directly by air districts and counties. Table 7 presents silt loadings and associated PM<sub>10</sub> emission factors, by roadway category, for each COABDIS region. A summary of the data used to develop the silt loadings may be found in Appendix A, Table 1. The basis for the proposed silt loading values is as follows:

### Statewide Default Silt Loadings

- Freeway – U.S. EPA AP-42 (January 2011) default<sup>[1]</sup>
- Major and Collector roadways – geometric mean of 31 California-specific silt measurements of roads with high average daily traffic (ADT) conducted by MRI<sup>[2,5]</sup> and the University of California, Davis (UCD).<sup>[2,3,4]</sup>
- Local roadways – mean of eleven California-specific silt measurements of roads with low ADT conducted by MRI.<sup>[2,5]</sup>

### District and County Specific Silt Loadings

- The San Joaquin Valley Air Pollution Control District (SJVAPCD) splits local roads into urban and rural classes and assigns separate silt loading values to each class. Local urban roads are assigned the statewide Local road default silt loading value. A higher silt loading value (derived from U.S. EPA AP-42 data) is assigned to local rural roads due to anticipated higher silt loading levels from agricultural activities.<sup>[2]</sup>
- For Major, Collector and Local roads, the portion of Los Angeles County in the South Coast Air Quality Management District (SCAQMD) and all portions of Orange, Riverside and San Bernardino counties use silt loading values based on subsets of measurements collected in the SCAQMD and Riverside County.<sup>[2,5]</sup>

Table 3. California Default Statewide and Local Silt Loading Values

| Roadway Category  | Silt Loading (sL) (g/m <sup>2</sup> )  | Source of sL Value  |
|---|--|---|
| <i>California Statewide Silt Loading Values</i>   |  |   |
| Freeway   | 0.015  | U.S. EPA default value <sup>[1]</sup>   |
| Major   | 0.032  | Geometric mean of 31 California samples <sup>[2,3,4,5]</sup>  |
| Collector   | 0.032  | Geometric mean of 31 California samples <sup>[2,3,4,5]</sup>  |
| Local   | 0.32   | Average of 11 California BACM samples <sup>[5]</sup>  |
| <i>District and County Specific Silt Loading Values</i>   |  |   |
| District Specific - SJVAPCD <sup>/a</sup><br>Local Rural (PM <sub>10</sub> )  | 1.6  | Average sL, AP-42 Local roads <sup>[1,2]</sup>  |
| County Specific <sup>/b</sup><br><u>Major, Collector</u><br>Los Angeles & Orange<br>counties: Maj-Coll <sub>[LA&amp;OR]</sub> | 0.013  | 0.013 = Mean of 3 of the 4 South Coast High ADT <sup>/c</sup> BACM <sup>/d</sup> sL measurements <sup>[2,5]</sup><br>0.08 = Mean of all South Coast Low ADT BACM sL measurements <sup>[2,5]</sup> |
| Riverside & San Bernardino<br>counties: Maj-Coll <sub>[RIV&amp;SB]</sub>  | 0.08   |   |
| <u>Major-Collector Scaling Ratio</u><br>Maj-Coll <sub>[RIV&amp;SB]</sub> /Maj-Coll <sub>[LA&amp;OR]</sub>                     | (0.08/0.013) = 6.2   | 6.2 is used below to scale sL Local <sub>[LA&amp;OR]</sub> to sL Local <sub>[RIV&amp;SB]</sub>  |
| <u>Local</u><br>Los Angeles & Orange<br>counties: Local <sub>[LA&amp;OR]</sub>  | 0.135  | 0.135 = Geometric mean of 11 CA High ADT sL measurements <sup>[5]</sup>   |
| Riverside & San Bernardino<br>counties: Local <sub>[RIV&amp;SB]</sub>   | Local <sub>[LA&amp;OR]</sub> x 6.2 = Local <sub>[RIV&amp;SB]</sub><br>0.135 x 6.2 = 0.84 | Local <sub>[LA&amp;OR]</sub> scaled using ratio of Maj-Coll <sub>[RIV&amp;SB]</sub> /Maj-Coll <sub>[LA&amp;OR]</sub> <sup>[2,5]</sup>   |

- a San Joaquin Valley Air Pollution Control District
- b Silt loadings apply to the portion of Los Angeles County in the South Coast Air Quality Management District and all portions of Orange, Riverside, and San Bernardino counties
- c ADT, Average Daily Traffic
- d BACM, Best Available Control Measures

**Vehicle Weight Estimates**

The estimated statewide average vehicle weight is based on an informal traffic count conducted by MRI while performing California silt loading measurements.<sup>[2,5]</sup> The statewide default fleet vehicle weight is 2.4 tons; Table 7 contains fleet vehicle weights.

**Activity Data: Vehicle Miles Traveled (VMT)**

ARB developed both the paved road dust emissions inventory and the modeling inventory using 2012 VMT data from ARB's EMFAC2014 model and transportation planning agencies. VMT was distributed using 2008 travel fractions provided by Caltrans. VMT and travel fractions for each COABDIS are presented in Table 6; footnotes provide source information.

**Paved Road PM Emissions Estimates**

Table 5 presents uncontrolled paved road dust PM<sub>10</sub> emissions (tons/year) for 2012, by paved road category within COABDIS region, except for SCAQMD Unspecified Roads, which reflect District controls. Table 7 presents PM<sub>10</sub> emission factors (lbs PM<sub>10</sub>/VMT) and roadway silt loadings (g/m<sup>2</sup>), by COABDIS region.

**Rainfall Adjustment**

Table 8 shows the number of days per year that at least one site in each county, within air basin, received 0.01 inch or more of precipitation. The data are based on average annual days of precipitation per month over the years of record.

**TEMPORAL ACTIVITY**

Total annual entrained paved road dust emissions are allocated on a monthly basis. During the wet winter months, the relative contribution of paved road emissions is reduced compared to non-rainy months. Table 9 presents the temporal adjustments used to reflect seasonal rainfall patterns for each county, by air basin.

**GROWTH FORECASTING**

In the previous methodology, freeways and major roads were grown based on increases in roadway centerline mileage, and local and collector roads were grown based on increases in VMT.<sup>[18]</sup> For this update, based on discussions with U.S. EPA Region IX staff, growth for all four roadway categories is assumed to be proportional to changes in VMT.

## **ASSUMPTIONS AND LIMITATIONS**

1. The current U.S. EPA AP-42 emission factor equation assumes that entrained paved road dust emissions are proportional to VMT, roadway silt loading, and average vehicle weight.
2. The methodology assumes that roadway silt loading varies by road type, quickly reaches an equilibrium condition, and is adequately characterized by a roadway-specific silt loading factor. Thus, the emission factor varies by the type of road.
3. The Major, Collector and Local roadway silt loadings are based on a total of 42 silt loading measurements collected from 1995 to 1997 in the South Coast Air Basin, Coachella Valley, Bakersfield and Sacramento. This does not fully represent the variability in California silt loading.
4. It is assumed that the U.S. EPA PM<sub>10</sub> particle size multiplier (i.e., the 'k' factor in the AP-42 equation) reasonably represents the size distribution of California paved road dust.
5. ARB's speciation profile for entrained paved road dust is based on six measurements collected in the San Joaquin Valley and in Imperial and Mono counties and may not fully reflect the variability of particle size distributions throughout California.
6. The average vehicle fleet weight is assumed to be 2.4 tons statewide.
7. Caltrans HPMS VMT data by county for 2008 are assumed to accurately represent actual California roadway travel and thus the travel fractions for each roadway type.
8. It is assumed that the average annual number of days of precipitation  $\geq 0.01$  inch remains constant for each county, within air basin.
9. It is assumed that the temporal profile, based on county and air basin specific monthly rainfall, provides appropriate adjustments to allocate unpaved road dust emissions on a monthly basis.

## **CHANGES IN THE METHODOLOGY**

There were substantial changes in the paved road dust emission estimates for this update. These include:

1. Incorporation of the U.S. EPA paved road emission factor equation from the Final Section of the Fifth Edition of U.S. EPA's AP-42 document (January 2011, Chapter 13.2.1).<sup>[1]</sup> Newly incorporated are:
  - a. A revised PM<sub>10</sub> emission factor equation based on regression analyses of 83 tests of emissions from public and industrial paved roads.
  - b. The emissions testing included recent vintage light duty vehicles. The previous update was based on emissions testing of 1980's fleet vehicles.
  - c. Elimination of brake wear, tire wear and exhaust (B/T/E) emissions from the emission factor equation. The previous update included B/T/E emissions, which represented double-counting with the mobile inventory. For the new emission



- factor equation, B/T/E emissions were subtracted from total emissions prior to running the regressions.
- d. New exponents for the vehicle fleet weight and silt loading terms and revised PM<sub>10</sub> particle size multiplier (“k” term, 0.0022 lbs PM<sub>10</sub>/VMT)
  - e. A precipitation adjustment factor (1-P/4N) to reflect the dust suppression effects of days with  $\geq 0.01$  inch precipitation.
2. Estimates of paved road dust PM<sub>2.5</sub> emissions are presented for the first time, calculated using ARB’s particle speciation profile #471. In 2006, ARB updated the paved road dust PM<sub>2.5</sub>/PM<sub>10</sub> particle size fraction from 16.9% to 15%.<sup>[15]</sup>
  3. Incorporation of a revised statewide silt loading value of 0.032 g/m<sup>2</sup> for the Major and Collector roadway categories, based on the geometric mean of 31 silt loading measurements collected between 1995-1997 on roadways with high ADT in the Coachella Valley, Bakersfield, Riverside, Sacramento and the South Coast air basin.<sup>[2,3,4,5]</sup> For Major, Collector and Local roads, the portion of Los Angeles County in the SCAQMD and all portions of Orange, Riverside and San Bernardino counties use silt loading values based on subsets of the measurements in the SCAQMD and Riverside.<sup>[2,5]</sup> SJVAPCD separates Local roads into local urban and local rural roads and uses the statewide default silt loading value for local urban roads. The District assumes that agricultural activities generate a higher silt loading potential for local rural roads and assigns a value based on an average of U.S. EPA AP-42 silt loading values for Local roads.<sup>[1,2]</sup>
  4. Updated VMT data based on EMFAC2014 and transportation planning agencies’ reports of annualized VMT per average weekday for the year 2012.<sup>[6]</sup>
  5. Updated fractions of vehicle miles traveled on Freeway, Major, Collector, and Local roads (travel fractions) to reflect 2008 Caltrans HPMS data.<sup>[7,8]</sup>
  6. Incorporating temporal adjustments to reflect county specific rainfall patterns, by air basin.<sup>[9]</sup>
  7. Revised assumptions that growth for freeways, major, collector and local roads is proportional to changes in VMT.

The above changes reduced statewide PM<sub>10</sub> emissions for entrained paved road dust by about 22% from the previous 2013 published inventory estimates.<sup>[19]</sup>

## COMMENTS AND RECOMMENDATIONS

Research is ongoing to better understand and quantify paved road dust emissions, with recent studies employing mobile monitoring technologies.<sup>[20,21]</sup> When available, the studies will be evaluated and incorporated as appropriate into this methodology. Effort is also needed to better account for the variability in dust emissions based on population density, adjacent land uses, and geographic location.

Silt Loading. This methodology assumes that silt loading values vary by roadway type. Additional research is needed to fully characterize the relationship between roadway type and silt loading values. Also, additional county-specific silt loading measurements are needed to more accurately reflect the variability of silt loading throughout California.

Fleet Vehicle Weight. Based on a 1995 informal traffic count conducted by MRI, the average fleet vehicle weight is assumed to be 2.4 tons.<sup>[2,5]</sup> This value should be re-evaluated to ensure accurate average vehicle fleet weights are used to estimate dust emissions. Since the vehicle distribution among regions may vary, the evaluation should consider developing county-specific average weights.

Calculating Paved Road PM<sub>2.5</sub>. The Final Section of the U. S. EPA's January 2011 AP-42 for paved roads assigns a particle size fraction of 25% to PM<sub>2.5</sub> (PM<sub>2.5</sub> = PM<sub>10</sub> x 25%).<sup>[1]</sup> This fraction is based on test conditions that include heavy vehicles traveling at very slow speeds (less than 5 mph) at corn processing facilities in the Midwest, and are not representative of typical travel on public and industrial paved roads in California. The January 2011 PM<sub>2.5</sub> fraction is 60% greater than the PM<sub>2.5</sub> particle size fraction of 15% used in the previous update of AP-42.

For this update, paved road PM<sub>2.5</sub> is calculated using ARB speciation profile #471, which was derived from testing conducted in the San Joaquin Valley and in Imperial and Mono counties.<sup>[12,13,14]</sup> ARB updated their PM<sub>2.5</sub> fugitive dust profiles in 2006, after a review of recent Western Regional Air Partnership (WRAP) studies and ARB's emission inventory vs. ambient air quality measurement data indicated that PM<sub>2.5</sub> from these sources was overestimated in California.<sup>[15-17,22]</sup> The paved road PM<sub>2.5</sub>/PM<sub>10</sub> fraction was updated from 16.9% to 15% to more accurately reflect measured PM<sub>2.5</sub> emissions.<sup>[15]</sup>

Temporal Profiles. The previous update applied a single temporal profile statewide.<sup>[2]</sup> In 2001, under the sponsorship of the Central California Ozone Study (CCOS), researchers developed temporal profiles for a number of area and off-road emission sources, including paved roads.<sup>[23,24]</sup> On a statewide basis, the temporal profile proposed by the CCOS study allocated an average of up to 75% of annual emissions to the summer months. However, full documentation was not provided for their derivation and ARB could not re-create the results. Based on newer research that shows minimal seasonal variation for paved road dust emissions, ARB developed relatively flat monthly allocations of annual paved road dust emissions for this update.<sup>[25-27]</sup> The new temporal profiles (Table 9) are calculated using county-specific records, within air basin, for monthly days of rain (Table 8).<sup>[9]</sup>

**SAMPLE CALCULATIONS**

The steps below summarize the data computations necessary to estimate the annual tons of paved road dust PM<sub>10</sub> emissions in Santa Cruz County. Sample emissions calculation values are provided below in Table 4.

Step 1: Travel Fractions. From Table 6, enter the road-specific travel fractions.

Step 2: VMT. From Table 5, enter total 2012 VMT. Calculate VMT for each road category by multiplying total VMT by the associated travel fraction.

$$Total\ VMT \times Travel\ Fraction = Road\ Category\ VMT$$

Step 3: Emission Factor. From Table 7, enter the emission factor for each road type.

Emission factors (E, lbs PM<sub>10</sub>/VMT/year) were calculated using the U.S. EPA AP-42 PM<sub>10</sub> emission factor equation shown below, with k = 0.0022 lb PM<sub>10</sub>/VMT, roadway silt loadings (sL) and default average vehicle weight (W) of 2.4 tons from Table 7, 65 days of annual rainfall (P) from Table 8, and 365 days/year (N).

$$E = [k(sL)^{0.91} \times (W)^{1.02}] \times (1 - P/4N)$$

Step 4: Multiply each emission factor from Step 3 by the VMT data from Step 2 to compute annual pounds of PM<sub>10</sub> emissions for each road type; divide by 2000 to calculate the annual tons of PM<sub>10</sub>/year from paved road dust for each roadway type. Sum roadway emissions for total paved road dust emissions.

$$(E \times VMT)/2000 = tons/year\ PM_{10}\ Road\ Emissions$$

Step 5: Calculate PM<sub>2.5</sub> emissions using particle size fractions for ARB’s speciation profile #471, shown in Table 1:

$$\begin{aligned} Tons/year\ PM_{2.5} &= Tons/year\ PM_{10} \times Fraction(<PM_{2.5}/<PM_{10}) \\ &= Tons/year\ PM_{10} \times (0.0686/0.4572) \end{aligned}$$

**Table 4. Estimating Paved Road Dust Emissions in Santa Cruz County<sup>a</sup>**

| Steps | Values   | Source      | ARB Roadway Category |        |           |          | Totals |
|-------|--|-------------|----------------------|--------|-----------|----------|--------|
|       |  |             | Freeway              | Major  | Collector | Local    |        |
| 1     | Travel Fractions   | Table 6     | 0.271                | 0.476  | 0.187     | 0.066    | 1      |
| 2     | 2012 VMT (million/yr)  | Table 5     | 412.73               | 724.95 | 284.80    | 100.52   | 1,523  |
| 3     | Emission Factor PM <sub>10</sub> (lbs PM <sub>10</sub> /million VMT) | Table 7     | 112.40               | 223.95 | 223.95    | 1,820.30 |        |
| 4     | PM <sub>10</sub> Emissions, tons/yr                                  | Calculation | 23.20                | 81.16  | 31.88     | 91.49    | 228    |
| 5     | PM <sub>2.5</sub> Emissions, tons/yr                                 | Table 1     | 3.48                 | 12.17  | 4.78      | 13.72    | 34.20  |

a Table 7 emission factors are rounded from raw data; calculated emissions in Table 4 will differ slightly from emissions shown in Table 5.

**ADDITIONAL CODES**

**SOURCE CATEGORY GROWTH AND CONTROL CODES**

Various

**SOURCE CATEGORY CODE POLLUTANT SPECIATION PROFILES**

For All: PM<sub>10</sub> = 471, VOC = not applicable

**SOURCE CATEGORY CODE REACTIVITY FACTORS**

Not Applicable

**PREPARED BY**

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April 2014

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Janet Spencer

November 2016

Updated statewide emissions to reflect 2012 VMT from EMFAC2014 and transportation planning agencies. Minor editorial changes.

Tiffanie Be

March 2018

Updated Table 7. Minor editorial changes.

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**Table 5**  
**2012 Entrained Road Dust Emissions for PM10 and PM2.5**

| Air Basin | County          | Air District | 2012 VMT<br>(million VMT per year) | 2012 Paved Road Dust PM <sub>10</sub> Emissions, tons/year |          |           |                        |                                       | 2012 PM <sub>2.5</sub> Emissions (tons/year) (1) |        |
|-----------|-----------------|--------------|------------------------------------|--|----------|-----------|------------------------|---------------------------------------|--|--------|
|           |                 |              |                                    | Freeway  | Major    | Collector | Local, Local Urban (2) | Local Rural (3) Sand/Gravel Proc. (4) |  | Total  |
| GB        | Alpine          | GBU          | 67                                 | 0.00   | 5.75     | 0.88      | 6.44                   |                                       | 13   | 1.96   |
| GB        | Inyo            | GBU          | 555                                | 0.07   | 47.37    | 9.96      | 51.28                  |                                       | 109  | 16.30  |
| GB        | Mono            | GBU          | 314                                | 0.00   | 27.77    | 3.05      | 40.37                  |                                       | 71   | 10.68  |
| LC        | Lake            | LAK          | 510                                | 0.00   | 34.72    | 15.82     | 52.17                  |                                       | 103  | 15.41  |
| LT        | El Dorado       | ED           | 387                                | 3.78   | 24.69    | 5.63      | 43.44                  |                                       | 78   | 11.63  |
| LT        | Placer          | PLA          | 312                                | 7.10   | 13.22    | 3.91      | 27.47                  |                                       | 52   | 7.76   |
| MC        | Amador          | AMA          | 443                                | 0.00   | 37.87    | 6.91      | 39.35                  |                                       | 84   | 12.62  |
| MC        | Calaveras       | CAL          | 369                                | 0.00   | 28.26    | 7.65      | 41.95                  |                                       | 78   | 11.68  |
| MC        | El Dorado       | ED           | 1,384                              | 13.54  | 88.53    | 20.17     | 155.75                 |                                       | 278  | 41.70  |
| MC        | Mariposa        | MPA          | 177                                | 0.00   | 9.65     | 1.48      | 70.25                  |                                       | 81   | 12.21  |
| MC        | Nevada          | NSI          | 1,050                              | 25.41  | 30.31    | 19.41     | 127.09                 |                                       | 202  | 30.33  |
| MC        | Placer          | PLA          | 556                                | 12.69  | 23.63    | 6.99      | 49.09                  |                                       | 92   | 13.86  |
| MC        | Plumas          | NSI          | 259                                | 0.00   | 14.93    | 7.85      | 48.85                  |                                       | 72   | 10.74  |
| MC        | Sierra          | NSI          | 90                                 | 0.70   | 4.33     | 1.52      | 22.04                  |                                       | 29   | 4.29   |
| MC        | Tuolumne        | TUO          | 387                                | 0.00   | 25.24    | 10.67     | 60.30                  |                                       | 96   | 14.43  |
| MD        | Kern            | KER          | 1,666                              | 25.83  | 107.88   | 15.66     | 138.17                 |                                       | 288  | 43.13  |
| MD        | Los Angeles     | AV           | 3,466                              | 90.86  | 176.54   | 21.57     | 165.12                 |                                       | 454  | 68.11  |
| MD        | Riverside       | MOJ          | 392                                | 10.91  | 34.84    | 13.14     | 56.27                  |                                       | 115  | 17.27  |
| MD        | Riverside       | SC           | 425                                | 11.83  | 37.77    | 14.25     | 61.00                  |                                       | 125  | 18.73  |
| MD        | San Bernardino  | MOJ          | 8,814                              | 267.22   | 794.95   | 161.97    | 1,338.98               |                                       | 2,563  | 384.47 |
| NC        | Del Norte       | NCU          | 224                                | 0.00   | 15.95    | 5.53      | 22.87                  |                                       | 44   | 6.65   |
| NC        | Humboldt        | NCU          | 1,111                              | 13.30  | 59.30    | 20.89     | 103.03                 |                                       | 197  | 29.48  |
| NC        | Mendocino       | MEN          | 1,020                              | 3.44   | 65.92    | 24.31     | 106.00                 |                                       | 200  | 29.95  |
| NC        | Sonoma          | NS           | 716                                | 10.32  | 37.44    | 14.74     | 56.05                  |                                       | 119  | 17.78  |
| NC        | Trinity         | NCU          | 200                                | 0.00   | 15.71    | 1.81      | 36.91                  |                                       | 54   | 8.17   |
| NCC       | Monterey        | MBU          | 3,620                              | 33.59  | 233.54   | 66.76     | 333.67                 |                                       | 668  | 100.13 |
| NCC       | San Benito      | MBU          | 686                                | 0.00   | 66.22    | 6.38      | 40.56                  |                                       | 113  | 16.97  |
| NCC       | Santa Cruz      | MBU          | 1,523                              | 23.18  | 81.09    | 31.95     | 91.68                  |                                       | 228  | 34.18  |
| NEP       | Lassen          | LAS          | 374                                | 0.00   | 24.68    | 10.75     | 53.65                  |                                       | 89   | 13.36  |
| NEP       | Modoc           | MOD          | 134                                | 0.00   | 6.74     | 3.33      | 39.00                  |                                       | 49   | 7.36   |
| NEP       | Siskiyou        | SIS          | 1,000                              | 24.89  | 24.53    | 13.27     | 179.08                 |                                       | 242  | 36.27  |
| SC        | Los Angeles     | SC           | 78,066                             | 2,032.35   | 1,739.72 | 212.52    | 1,740.69               | 264.20                                | 5,989  | 898.42 |
| SC        | Orange          | SC           | 27,160                             | 754.03   | 590.05   | 37.41     | 705.68                 | 78.06                                 | 2,165  | 324.78 |
| SC        | Riverside       | SC           | 18,207                             | 500.11   | 1,597.31 | 602.46    | 2,579.63               | 138.10                                | 5,418  | 812.64 |
| SC        | San Bernardino  | SC           | 14,487                             | 433.72   | 1,290.29 | 262.89    | 2,173.30               | 120.09                                | 4,280  | 642.04 |
| SCC       | San Luis Obispo | SLO          | 2,761                              | 33.21  | 192.19   | 27.16     | 233.99                 |                                       | 487  | 72.98  |
| SCC       | Santa Barbara   | SB           | 3,304                              | 56.27  | 189.36   | 47.52     | 211.58                 |                                       | 505  | 75.71  |
| SCC       | Ventura         | VEN          | 7,191                              | 153.14   | 386.59   | 67.83     | 530.49                 |                                       | 1,138  | 170.71 |
| SD        | San Diego       | SD           | 30,297                             | 956.62   | 1,098.66 | 276.47    | 1,357.82               |                                       | 3,690  | 553.44 |

- 1 PM<sub>2.5</sub> emissions are calculated from entrained paved road emissions for PM<sub>10</sub> using particle size fractions from ARB speciation profile 471: PM<sub>2.5</sub> = PM<sub>10</sub> × (0.0686/0.4572). See <http://www.arb.ca.gov/ei/speciate/dnldopt.htm#specprof>
- 2 SJU District (San Joaquin Valley Air Pollution Control District): Local emissions include only Local Urban roadways.
- 3 The SJU District splits local roads into urban and rural classes, and uses separate silt loading values. Due to anticipated higher silt loading levels, a higher silt loading value derived from AP-42 data is used in computing emissions for local rural roads (Rural Streets, EIC 640-643-5400-0000).
- 4 SC District (South Coast Air Quality Management District, SCAQMD) provided controlled emissions from paved roads at sand and gravel processing facilities (Unspecified Paved Roads, EIC 640-636-5400-0000).



**Table 5**  
**2012 Entrained Road Dust Emissions for PM10 and PM2.5**

| Air Basin               | County         | Air District | 2012 VMT<br>(million VMT per year) | 2012 Paved Road Dust PM <sub>10</sub> Emissions, tons/year |               |              |                        |                                       | 2012 PM <sub>2.5</sub> Emissions (tons/year) (1) |              |
|-------------------------|----------------|--------------|------------------------------------|--|---------------|--------------|------------------------|---------------------------------------|--|--------------|
|                         |                |              |                                    | Freeway  | Major         | Collector    | Local, Local Urban (2) | Local Rural (3) Sand/Gravel Proc. (4) |  | Total        |
| SF                      | Alameda        | BA           | 13,732                             | 438.13   | 488.91        | 98.79        | 660.76                 |                                       | 1,687  | 252.99       |
| SF                      | Contra Costa   | BA           | 7,985                              | 232.84   | 299.85        | 59.56        | 600.87                 |                                       | 1,193  | 178.97       |
| SF                      | Marin          | BA           | 2,258                              | 63.02  | 73.30         | 36.86        | 137.89                 |                                       | 311  | 46.66        |
| SF                      | Napa           | BA           | 1,101                              | 11.11  | 64.47         | 25.07        | 91.77                  |                                       | 192  | 28.86        |
| SF                      | San Francisco  | BA           | 3,159                              | 63.82  | 183.53        | 23.93        | 151.31                 |                                       | 423  | 63.39        |
| SF                      | San Mateo      | BA           | 5,595                              | 177.70   | 200.81        | 39.35        | 280.51                 |                                       | 698  | 104.76       |
| SF                      | Santa Clara    | BA           | 14,041                             | 342.59   | 706.41        | 84.29        | 812.72                 |                                       | 1,946  | 291.90       |
| SF                      | Solano         | BA           | 2,891                              | 102.69   | 81.78         | 19.79        | 163.13                 |                                       | 367  | 55.11        |
| SF                      | Sonoma         | BA           | 3,047                              | 44.09  | 159.93        | 62.96        | 239.45                 |                                       | 506  | 75.96        |
| SJV                     | Fresno         | SJU          | 8,641                              | 144.11   | 419.25        | 123.56       | 678.73                 | 2,389.79                              | 3,755  | 563.32       |
| SJV                     | Kern           | SJU          | 6,872                              | 105.59   | 441.04        | 64.02        | 423.31                 | 612.38                                | 1,646  | 246.95       |
| SJV                     | Kings          | SJU          | 1,408                              | 21.25  | 80.78         | 23.21        | 82.57                  | 146.47                                | 354  | 53.14        |
| SJV                     | Madera         | SJU          | 1,854                              | 14.72  | 136.91        | 21.08        | 69.78                  | 519.83                                | 762  | 114.35       |
| SJV                     | Merced         | SJU          | 2,575                              | 35.68  | 153.45        | 36.35        | 122.90                 | 534.60                                | 883  | 132.45       |
| SJV                     | San Joaquin    | SJU          | 6,485                              | 167.48   | 256.58        | 85.56        | 341.98                 | 472.49                                | 1,324  | 198.61       |
| SJV                     | Stanislaus     | SJU          | 3,769                              | 64.19  | 159.89        | 97.34        | 260.58                 | 306.61                                | 889  | 133.29       |
| SJV                     | Tulare         | SJU          | 3,777                              | 32.89  | 234.76        | 74.16        | 205.75                 | 1,081.40                              | 1,629  | 244.34       |
| SS                      | Imperial       | IMP          | 2,400                              | 38.24  | 126.44        | 46.75        | 241.40                 |                                       | 453  | 67.92        |
| SS                      | Riverside      | SC           | 4,714                              | 131.03   | 418.49        | 157.84       | 675.86                 |                                       | 1,383  | 207.48       |
| SV                      | Butte          | BUT          | 1,693                              | 7.57   | 105.69        | 45.55        | 190.67                 |                                       | 349  | 52.42        |
| SV                      | Colusa         | COL          | 696                                | 23.96  | 13.10         | 6.05         | 93.82                  |                                       | 137  | 20.54        |
| SV                      | Glenn          | GLE          | 527                                | 16.03  | 12.35         | 7.16         | 61.89                  |                                       | 97   | 14.61        |
| SV                      | Placer         | PLA          | 3,110                              | 71.28  | 132.72        | 39.26        | 275.75                 |                                       | 519  | 77.85        |
| SV                      | Sacramento (4) | SAC          | 13,027                             | 345.20   | 570.67        | 110.47       | 796.54                 |                                       | 1,823  | 273.43       |
| SV                      | Shasta         | SHA          | 1,923                              | 44.73  | 85.24         | 19.13        | 156.23                 |                                       | 305  | 45.80        |
| SV                      | Solano         | YS           | 1,660                              | 58.81  | 46.83         | 11.33        | 93.42                  |                                       | 210  | 31.56        |
| SV                      | Sutter         | FR           | 798                                | 3.91   | 55.74         | 11.41        | 112.13                 |                                       | 183  | 27.48        |
| SV                      | Tehama         | TEH          | 1,065                              | 29.35  | 31.35         | 17.59        | 92.11                  |                                       | 170  | 25.56        |
| SV                      | Yolo           | YS           | 2,167                              | 68.64  | 61.52         | 21.03        | 199.23                 |                                       | 350  | 52.56        |
| SV                      | Yuba           | FR           | 658                                | 6.10   | 37.13         | 16.25        | 66.59                  |                                       | 126  | 18.91        |
| <b>Statewide Totals</b> |                |              | <b>337,332</b>                     | <b>8,405</b>   | <b>15,122</b> | <b>3,568</b> | <b>21,571</b>          | <b>6,664</b>                          | <b>55,328</b>                                    | <b>8,300</b> |

- 1 PM<sub>2.5</sub> emissions are calculated from entrained paved road emissions for PM<sub>10</sub> using particle size fractions from ARB speciation profile 471: PM<sub>2.5</sub> = PM<sub>10</sub> × (0.0686/0.4572). See <http://www.arb.ca.gov/ei/speciate/dnldopt.htm#specprof>
- 2 SJU District (San Joaquin Valley Air Pollution Control District): Local emissions include only Local Urban roadways.
- 3 The SJU District splits local roads into urban and rural classes, and uses separate silt loading values. Due to anticipated higher silt loading levels, a higher silt loading value derived from AP-42 data is used in computing emissions for local rural roads (Rural Streets, EIC 640-643-5400-0000).
- 4 SC District (South Coast Air Quality Management District, SCAQMD) provided controlled emissions from paved roads at sand and gravel processing facilities (Unspecified Paved Roads, EIC 640-636-5400-0000).

**Table 6**  
**2008 Roadway Travel Fractions and VMT (1) Estimates**  
**for California Entrained Paved Road Dust**

| Air Basin | County          | Air District | 2012 VMT (million VMT per year) | 2008 HPMS Travel Fractions (2) |       |           |                        |             |
|-----------|-----------------|--------------|---------------------------------|--------------------------------|-------|-----------|------------------------|-------------|
|           |                 |              |                                 | Freeway                        | Major | Collector | Local, Local Urban (3) | Local Rural |
| GB        | Alpine          | GBU          | 67                              | 0.000                          | 0.775 | 0.118     | 0.107                  |             |
| GB        | Inyo            | GBU          | 555                             | 0.002                          | 0.743 | 0.156     | 0.099                  |             |
| GB        | Mono            | GBU          | 314                             | 0.000                          | 0.776 | 0.085     | 0.139                  |             |
| LC        | Lake            | LAK          | 510                             | 0.000                          | 0.610 | 0.278     | 0.113                  |             |
| LT        | El Dorado       | ED           | 387                             | 0.174                          | 0.572 | 0.130     | 0.124                  |             |
| LT        | Placer          | PLA          | 312                             | 0.408                          | 0.381 | 0.113     | 0.097                  |             |
| MC        | Amador          | AMA          | 443                             | 0.000                          | 0.763 | 0.139     | 0.098                  |             |
| MC        | Calaveras       | CAL          | 369                             | 0.000                          | 0.688 | 0.186     | 0.126                  |             |
| MC        | El Dorado       | ED           | 1,384                           | 0.174                          | 0.572 | 0.130     | 0.124                  |             |
| MC        | Mariposa        | MPA          | 177                             | 0.000                          | 0.488 | 0.075     | 0.437                  |             |
| MC        | Nevada          | NSI          | 1,050                           | 0.437                          | 0.261 | 0.167     | 0.135                  |             |
| MC        | Placer          | PLA          | 556                             | 0.408                          | 0.381 | 0.113     | 0.097                  |             |
| MC        | Plumas          | NSI          | 259                             | 0.000                          | 0.519 | 0.273     | 0.209                  |             |
| MC        | Sierra          | NSI          | 90                              | 0.140                          | 0.435 | 0.153     | 0.272                  |             |
| MC        | Tuolumne        | TUO          | 387                             | 0.000                          | 0.583 | 0.246     | 0.171                  |             |
| MD        | Kern            | KER          | 1,666                           | 0.268                          | 0.562 | 0.082     | 0.089                  |             |
| MD        | Los Angeles     | AV           | 3,466                           | 0.453                          | 0.442 | 0.054     | 0.051                  |             |
| MD        | Riverside       | MOJ          | 392                             | 0.478                          | 0.333 | 0.126     | 0.063                  |             |
| MD        | Riverside       | SC           | 425                             | 0.478                          | 0.333 | 0.126     | 0.063                  |             |
| MD        | San Bernardino  | MOJ          | 8,814                           | 0.524                          | 0.340 | 0.069     | 0.067                  |             |
| NC        | Del Norte       | NCU          | 224                             | 0.000                          | 0.657 | 0.227     | 0.116                  |             |
| NC        | Humboldt        | NCU          | 1,111                           | 0.222                          | 0.497 | 0.175     | 0.106                  |             |
| NC        | Mendocino       | MEN          | 1,020                           | 0.062                          | 0.599 | 0.221     | 0.118                  |             |
| NC        | Sonoma          | NS           | 716                             | 0.258                          | 0.470 | 0.185     | 0.087                  |             |
| NC        | Trinity         | NCU          | 200                             | 0.000                          | 0.712 | 0.082     | 0.206                  |             |
| NCC       | Monterey        | MBU          | 3,620                           | 0.164                          | 0.572 | 0.164     | 0.101                  |             |
| NCC       | San Benito      | MBU          | 686                             | 0.000                          | 0.853 | 0.082     | 0.064                  |             |
| NCC       | Santa Cruz      | MBU          | 1,523                           | 0.271                          | 0.476 | 0.187     | 0.066                  |             |
| NEP       | Lassen          | LAS          | 374                             | 0.000                          | 0.587 | 0.256     | 0.157                  |             |
| NEP       | Modoc           | MOD          | 134                             | 0.000                          | 0.453 | 0.224     | 0.323                  |             |
| NEP       | Siskiyou        | SIS          | 1,000                           | 0.453                          | 0.224 | 0.121     | 0.201                  |             |
| SC        | Los Angeles     | SC           | 78,066                          | 0.453                          | 0.442 | 0.054     | 0.051                  |             |
| SC        | Orange          | SC           | 27,160                          | 0.483                          | 0.431 | 0.027     | 0.059                  |             |
| SC        | Riverside       | SC           | 18,207                          | 0.478                          | 0.333 | 0.126     | 0.063                  |             |
| SC        | San Bernardino  | SC           | 14,487                          | 0.524                          | 0.340 | 0.069     | 0.067                  |             |
| SCC       | San Luis Obispo | SLO          | 2,761                           | 0.211                          | 0.611 | 0.086     | 0.092                  |             |
| SCC       | Santa Barbara   | SB           | 3,304                           | 0.299                          | 0.505 | 0.127     | 0.069                  |             |
| SCC       | Ventura         | VEN          | 7,191                           | 0.370                          | 0.469 | 0.082     | 0.079                  |             |
| SD        | San Diego       | SD           | 30,297                          | 0.553                          | 0.319 | 0.080     | 0.048                  |             |
| SF        | Alameda         | BA           | 13,732                          | 0.566                          | 0.317 | 0.064     | 0.053                  |             |
| SF        | Contra Costa    | BA           | 7,985                           | 0.517                          | 0.334 | 0.066     | 0.082                  |             |
| SF        | Marin           | BA           | 2,258                           | 0.497                          | 0.290 | 0.146     | 0.067                  |             |
| SF        | Napa            | BA           | 1,101                           | 0.180                          | 0.524 | 0.204     | 0.092                  |             |
| SF        | San Francisco   | BA           | 3,159                           | 0.360                          | 0.520 | 0.068     | 0.053                  |             |
| SF        | San Mateo       | BA           | 5,595                           | 0.563                          | 0.319 | 0.063     | 0.055                  |             |
| SF        | Santa Clara     | BA           | 14,041                          | 0.434                          | 0.449 | 0.054     | 0.064                  |             |
| SF        | Solano          | BA           | 2,891                           | 0.627                          | 0.251 | 0.061     | 0.062                  |             |
| SF        | Sonoma          | BA           | 3,047                           | 0.258                          | 0.470 | 0.185     | 0.087                  |             |

1 2012 VMT from EMFAC2014 or provided by regional transportation planning agencies. Does not include VMT on unspecified roads, e.g., sand and gravel processing facilities.  
2 Sacramento Area Council of Governments (SACOG) provided 2008 travel fractions for Sacramento County.  
3 SJU District distributes Local Roads VMT to Local Urban and Local Rural fractions. For all other regions, the Local Roads fraction includes both Local Urban and Local Rural VMT.

**Table 6**  
**2008 Roadway Travel Fractions and VMT (1) Estimates**  
**for California Entrained Paved Road Dust**

| Air Basin              | County         | Air District | 2012 VMT<br>(million VMT<br>per year) | 2008 HPMS Travel Fractions (2) |       |           |                           |             |
|------------------------|----------------|--------------|---------------------------------------|--------------------------------|-------|-----------|---------------------------|-------------|
|                        |                |              |                                       | Freeway                        | Major | Collector | Local, Local<br>Urban (3) | Local Rural |
| SJV                    | Fresno         | SJU          | 8,641                                 | 0.293                          | 0.427 | 0.126     | 0.085                     | 0.022       |
| SJV                    | Kern           | SJU          | 6,872                                 | 0.268                          | 0.562 | 0.082     | 0.066                     | 0.026       |
| SJV                    | Kings          | SJU          | 1,408                                 | 0.264                          | 0.503 | 0.144     | 0.063                     | 0.070       |
| SJV                    | Madera         | SJU          | 1,854                                 | 0.139                          | 0.650 | 0.100     | 0.041                     | 0.052       |
| SJV                    | Merced         | SJU          | 2,575                                 | 0.244                          | 0.527 | 0.125     | 0.052                     | 0.018       |
| SJV                    | San Joaquin    | SJU          | 6,485                                 | 0.456                          | 0.351 | 0.117     | 0.058                     | 0.020       |
| SJV                    | Stanislaus     | SJU          | 3,769                                 | 0.300                          | 0.375 | 0.229     | 0.075                     | 0.071       |
| SJV                    | Tulare         | SJU          | 3,777                                 | 0.152                          | 0.545 | 0.172     | 0.059                     | 0.022       |
| SS                     | Imperial       | IMP          | 2,400                                 | 0.273                          | 0.453 | 0.168     | 0.106                     |             |
| SS                     | Riverside      | SC           | 4,714                                 | 0.478                          | 0.333 | 0.126     | 0.063                     |             |
| SV                     | Butte          | BUT          | 1,693                                 | 0.080                          | 0.557 | 0.240     | 0.124                     |             |
| SV                     | Colusa         | COL          | 696                                   | 0.609                          | 0.167 | 0.077     | 0.147                     |             |
| SV                     | Glenn          | GLE          | 527                                   | 0.541                          | 0.209 | 0.121     | 0.129                     |             |
| SV                     | Placer         | PLA          | 3,110                                 | 0.408                          | 0.381 | 0.113     | 0.097                     |             |
| SV                     | Sacramento (4) | SAC          | 13,027                                | 0.469                          | 0.389 | 0.075     | 0.067                     |             |
| SV                     | Shasta         | SHA          | 1,923                                 | 0.419                          | 0.401 | 0.090     | 0.090                     |             |
| SV                     | Solano         | YS           | 1,660                                 | 0.627                          | 0.251 | 0.061     | 0.062                     |             |
| SV                     | Sutter         | FR           | 798                                   | 0.088                          | 0.628 | 0.129     | 0.155                     |             |
| SV                     | Tehama         | TEH          | 1,065                                 | 0.492                          | 0.264 | 0.148     | 0.095                     |             |
| SV                     | Yolo           | YS           | 2,167                                 | 0.561                          | 0.252 | 0.086     | 0.101                     |             |
| SV                     | Yuba           | FR           | 658                                   | 0.165                          | 0.503 | 0.220     | 0.111                     |             |
| <b>Statewide Total</b> |                |              | <b>337,332</b>                        |                                |       |           |                           |             |

- 1 2012 VMT from EMFAC2014 or provided by regional transportation planning agencies. Does not include VMT on unspecified roads, e.g., sand and gravel processing facilities.
- 2 Sacramento Area Council of Governments (SACOG) provided 2008 travel fractions for Sacramento County.
- 3 SJU District distributes Local Roads VMT to Local Urban and Local Rural fractions. For all other regions, the Local Roads fraction includes both Local Urban and Local Rural VMT.

**Table 7**  
**2008 Silt Loadings and PM<sub>10</sub> Emission Factors for California**  
**Entrained Paved Road Dust Estimates**

| Air Basin | County          | Air District | Silt Loadings (SL, g/m <sup>2</sup> ) and PM <sub>10</sub> Emission Factors (EF; lbs PM <sub>10</sub> /10 <sup>6</sup> VMT) |       |           |       |               |       |                          |         |                                       |    | Avg. Vehicle Weight (tons) |
|-----------|-----------------|--------------|---|-------|-----------|-------|---------------|-------|--------------------------|---------|---------------------------------------|----|----------------------------|
|           |                 |              | Freeway   |       | Major (1) |       | Collector (1) |       | Local, Local Urban (1,2) |         | Local Rural (2) Sand/Gravel Proc. (3) |    |                            |
|           |                 |              | SL  | EF    | SL        | EF    | SL            | EF    | SL                       | EF      | SL                                    | EF |                            |
| GB        | Alpine          | GBU          | 0.015   | 111.8 | 0.032     | 222.8 | 0.032         | 222.8 | 0.32                     | 1,811.2 |                                       |    | 2.4                        |
| GB        | Inyo            | GBU          | 0.015   | 115.4 | 0.032     | 229.9 | 0.032         | 229.9 | 0.32                     | 1,868.6 |                                       |    | 2.4                        |
| GB        | Mono            | GBU          | 0.015   | 114.5 | 0.032     | 228.1 | 0.032         | 228.1 | 0.32                     | 1,854.2 |                                       |    | 2.4                        |
| LC        | Lake            | LAK          | 0.015   | 112.1 | 0.032     | 223.5 | 0.032         | 223.5 | 0.32                     | 1,816.4 |                                       |    | 2.4                        |
| LT        | El Dorado       | ED           | 0.015   | 112.1 | 0.032     | 223.5 | 0.032         | 223.5 | 0.32                     | 1,816.4 |                                       |    | 2.4                        |
| LT        | Placer          | PLA          | 0.015   | 111.4 | 0.032     | 222.0 | 0.032         | 222.0 | 0.32                     | 1,804.7 |                                       |    | 2.4                        |
| MC        | Amador          | AMA          | 0.015   | 112.5 | 0.032     | 224.1 | 0.032         | 224.1 | 0.32                     | 1,821.6 |                                       |    | 2.4                        |
| MC        | Calaveras       | CAL          | 0.015   | 111.8 | 0.032     | 222.8 | 0.032         | 222.8 | 0.32                     | 1,811.2 |                                       |    | 2.4                        |
| MC        | El Dorado       | ED           | 0.015   | 112.3 | 0.032     | 223.8 | 0.032         | 223.8 | 0.32                     | 1,819.0 |                                       |    | 2.4                        |
| MC        | Mariposa        | MPA          | 0.015   | 112.1 | 0.032     | 223.3 | 0.032         | 223.3 | 0.32                     | 1,815.1 |                                       |    | 2.4                        |
| MC        | Nevada          | NSI          | 0.015   | 110.9 | 0.032     | 221.1 | 0.032         | 221.1 | 0.32                     | 1,796.8 |                                       |    | 2.4                        |
| MC        | Placer          | PLA          | 0.015   | 111.7 | 0.032     | 222.7 | 0.032         | 222.7 | 0.32                     | 1,809.9 |                                       |    | 2.4                        |
| MC        | Plumas          | NSI          | 0.015   | 111.6 | 0.032     | 222.3 | 0.032         | 222.3 | 0.32                     | 1,807.3 |                                       |    | 2.4                        |
| MC        | Sierra          | NSI          | 0.015   | 111.3 | 0.032     | 221.7 | 0.032         | 221.7 | 0.32                     | 1,802.0 |                                       |    | 2.4                        |
| MC        | Tuolumne        | TUO          | 0.015   | 112.4 | 0.032     | 223.9 | 0.032         | 223.9 | 0.32                     | 1,820.3 |                                       |    | 2.4                        |
| MD        | Kern            | KER          | 0.015   | 115.7 | 0.032     | 230.5 | 0.032         | 230.5 | 0.32                     | 1,873.8 |                                       |    | 2.4                        |
| MD        | Los Angeles     | AV           | 0.015   | 115.7 | 0.032     | 230.5 | 0.032         | 230.5 | 0.32                     | 1,873.8 |                                       |    | 2.4                        |
| MD        | Riverside       | MOJ          | 0.015   | 116.3 | 0.08      | 533.3 | 0.08          | 533.3 | 0.84                     | 4,531.5 |                                       |    | 2.4                        |
| MD        | Riverside       | SC           | 0.015   | 116.3 | 0.08      | 533.3 | 0.08          | 533.3 | 0.84                     | 4,531.5 |                                       |    | 2.4                        |
| MD        | San Bernardino  | MOJ          | 0.015   | 115.8 | 0.08      | 531.1 | 0.08          | 531.1 | 0.84                     | 4,512.7 |                                       |    | 2.4                        |
| NC        | Del Norte       | NCU          | 0.015   | 108.7 | 0.032     | 216.6 | 0.032         | 216.6 | 0.32                     | 1,760.3 |                                       |    | 2.4                        |
| NC        | Humboldt        | NCU          | 0.015   | 107.9 | 0.032     | 215.0 | 0.032         | 215.0 | 0.32                     | 1,747.2 |                                       |    | 2.4                        |
| NC        | Mendocino       | MEN          | 0.015   | 108.4 | 0.032     | 215.9 | 0.032         | 215.9 | 0.32                     | 1,755.1 |                                       |    | 2.4                        |
| NC        | Sonoma          | NS           | 0.015   | 111.6 | 0.032     | 222.3 | 0.032         | 222.3 | 0.32                     | 1,807.3 |                                       |    | 2.4                        |
| NC        | Trinity         | NCU          | 0.015   | 110.9 | 0.032     | 220.9 | 0.032         | 220.9 | 0.32                     | 1,795.5 |                                       |    | 2.4                        |
| NCC       | Monterey        | MBU          | 0.015   | 113.2 | 0.032     | 225.6 | 0.032         | 225.6 | 0.32                     | 1,833.4 |                                       |    | 2.4                        |
| NCC       | San Benito      | MBU          | 0.015   | 113.5 | 0.032     | 226.2 | 0.032         | 226.2 | 0.32                     | 1,838.6 |                                       |    | 2.4                        |
| NCC       | Santa Cruz      | MBU          | 0.015   | 112.4 | 0.032     | 223.9 | 0.032         | 223.9 | 0.32                     | 1,820.3 |                                       |    | 2.4                        |
| NEP       | Lassen          | LAS          | 0.015   | 112.9 | 0.032     | 224.9 | 0.032         | 224.9 | 0.32                     | 1,828.1 |                                       |    | 2.4                        |
| NEP       | Modoc           | MOD          | 0.015   | 111.5 | 0.032     | 222.2 | 0.032         | 222.2 | 0.32                     | 1,806.0 |                                       |    | 2.4                        |
| NEP       | Siskiyou        | SIS          | 0.015   | 109.9 | 0.032     | 219.0 | 0.032         | 219.0 | 0.32                     | 1,779.9 |                                       |    | 2.4                        |
| SC        | Los Angeles     | SC           | 0.015   | 114.9 | 0.013     | 100.9 | 0.013         | 100.9 | 0.135                    | 848.4   |                                       |    | 2.4                        |
| SC        | Orange          | SC           | 0.015   | 115.0 | 0.013     | 100.9 | 0.013         | 100.9 | 0.135                    | 849.0   |                                       |    | 2.4                        |
| SC        | Riverside       | SC           | 0.015   | 114.9 | 0.08      | 527.0 | 0.08          | 527.0 | 0.84                     | 4,478.2 |                                       |    | 2.4                        |
| SC        | San Bernardino  | SC           | 0.015   | 114.3 | 0.08      | 524.4 | 0.08          | 524.4 | 0.84                     | 4,456.2 |                                       |    | 2.4                        |
| SCC       | San Luis Obispo | SLO          | 0.015   | 114.2 | 0.032     | 227.6 | 0.032         | 227.6 | 0.32                     | 1,850.3 |                                       |    | 2.4                        |
| SCC       | Santa Barbara   | SB           | 0.015   | 113.9 | 0.032     | 227.0 | 0.032         | 227.0 | 0.32                     | 1,845.1 |                                       |    | 2.4                        |
| SCC       | Ventura         | VEN          | 0.015   | 115.1 | 0.032     | 229.4 | 0.032         | 229.4 | 0.32                     | 1,864.7 |                                       |    | 2.4                        |
| SD        | San Diego       | SD           | 0.015   | 114.2 | 0.032     | 227.6 | 0.032         | 227.6 | 0.32                     | 1,850.3 |                                       |    | 2.4                        |

- 1 For Major, Collector and Local roads, the portion of Los Angeles County in the SC Air District (South Coast Air Quality Management District, SCAQMD) and all portions of Orange, Riverside and San Bernardino counties use silt loading values derived from a subset of measurements collected in the SCAQMD and Riverside County. Silt loading measurements used for this update are presented in Appendix A, Table 1. See Table 3 for more information on how silt loading values were derived.
- 2 The SJU District (San Joaquin Valley Air Pollution Control District) splits local roads into urban and rural classes and uses separate silt loading values. A higher silt loading value derived from AP-42 data is used to compute emissions for local rural roads due to anticipated higher loading levels.
- 3 SCAQMD provides ARB with only the total PM<sub>10</sub> emissions for paved roads at sand and gravel processing facilities.
- 4 Sacramento Area Council of Governments (SACOG) provided 2008 travel fractions for Sacramento County.

**Table 7**  
**2008 Silt Loadings and PM<sub>10</sub> Emission Factors for California**  
**Entrained Paved Road Dust Estimates**

| Air Basin | County         | Air District | Silt Loadings (SL, g/m <sup>2</sup> ) and PM <sub>10</sub> Emission Factors (EF; lbs PM <sub>10</sub> /10 <sup>6</sup> VMT) |       |           |       |               |       |                          |         |                                       |        | Avg. Vehicle Weight (tons) |
|-----------|----------------|--------------|---|-------|-----------|-------|---------------|-------|--------------------------|---------|---------------------------------------|--------|----------------------------|
|           |                |              | Freeway   |       | Major (1) |       | Collector (1) |       | Local, Local Urban (1,2) |         | Local Rural (2) Sand/Gravel Proc. (3) |        |                            |
|           |                |              | SL  | EF    | SL        | EF    | SL            | EF    | SL                       | EF      | SL                                    | EF     |                            |
| SF        | Alameda        | BA           | 0.015   | 112.7 | 0.032     | 224.6 | 0.032         | 224.6 | 0.32                     | 1,825.5 |                                       |        | 2.4                        |
| SF        | Contra Costa   | BA           | 0.015   | 112.8 | 0.032     | 224.8 | 0.032         | 224.8 | 0.32                     | 1,826.8 |                                       |        | 2.4                        |
| SF        | Marin          | BA           | 0.015   | 112.3 | 0.032     | 223.8 | 0.032         | 223.8 | 0.32                     | 1,819.0 |                                       |        | 2.4                        |
| SF        | Napa           | BA           | 0.015   | 112.1 | 0.032     | 223.5 | 0.032         | 223.5 | 0.32                     | 1,816.4 |                                       |        | 2.4                        |
| SF        | San Francisco  | BA           | 0.015   | 112.2 | 0.032     | 223.6 | 0.032         | 223.6 | 0.32                     | 1,817.7 |                                       |        | 2.4                        |
| SF        | San Mateo      | BA           | 0.015   | 112.8 | 0.032     | 224.8 | 0.032         | 224.8 | 0.32                     | 1,826.8 |                                       |        | 2.4                        |
| SF        | Santa Clara    | BA           | 0.015   | 112.5 | 0.032     | 224.1 | 0.032         | 224.1 | 0.32                     | 1,821.6 |                                       |        | 2.4                        |
| SF        | Solano         | BA           | 0.015   | 113.3 | 0.032     | 225.7 | 0.032         | 225.7 | 0.32                     | 1,834.7 |                                       |        | 2.4                        |
| SF        | Sonoma         | BA           | 0.015   | 112.1 | 0.032     | 223.3 | 0.032         | 223.3 | 0.32                     | 1,815.1 |                                       |        | 2.4                        |
| SJV       | Fresno         | SJU          | 0.015   | 114.0 | 0.032     | 227.2 | 0.032         | 227.2 | 0.32                     | 1846.4  | 1.6                                   | 7987.1 | 2.4                        |
| SJV       | Kern           | SJU          | 0.015   | 114.6 | 0.032     | 228.4 | 0.032         | 228.4 | 0.32                     | 1856.8  | 1.6                                   | 8032.3 | 2.4                        |
| SJV       | Kings          | SJU          | 0.015   | 114.6 | 0.032     | 228.3 | 0.032         | 228.3 | 0.32                     | 1855.5  | 1.6                                   | 8026.6 | 2.4                        |
| SJV       | Madera         | SJU          | 0.015   | 114.1 | 0.032     | 227.3 | 0.032         | 227.3 | 0.32                     | 1847.7  | 1.6                                   | 7992.8 | 2.4                        |
| SJV       | Merced         | SJU          | 0.015   | 113.5 | 0.032     | 226.2 | 0.032         | 226.2 | 0.32                     | 1838.6  | 1.6                                   | 7953.3 | 2.4                        |
| SJV       | San Joaquin    | SJU          | 0.015   | 113.2 | 0.032     | 225.6 | 0.032         | 225.6 | 0.32                     | 1833.4  | 1.6                                   | 7930.7 | 2.4                        |
| SJV       | Stanislaus     | SJU          | 0.015   | 113.4 | 0.032     | 226.0 | 0.032         | 226.0 | 0.32                     | 1837.3  | 1.6                                   | 7947.6 | 2.4                        |
| SJV       | Tulare         | SJU          | 0.015   | 114.4 | 0.032     | 228.0 | 0.032         | 228.0 | 0.32                     | 1852.9  | 1.6                                   | 8015.4 | 2.4                        |
| SS        | Imperial       | IMP          | 0.015   | 116.7 | 0.032     | 232.6 | 0.032         | 232.6 | 0.32                     | 1890.8  |                                       |        | 2.4                        |
| SS        | Riverside      | SC           | 0.015   | 116.3 | 0.08      | 533.3 | 0.08          | 533.3 | 0.84                     | 4,531.5 |                                       |        | 2.4                        |
| SV        | Butte          | BUT          | 0.015   | 112.5 | 0.032     | 224.3 | 0.032         | 224.3 | 0.32                     | 1,822.9 |                                       |        | 2.4                        |
| SV        | Colusa         | COL          | 0.015   | 113.1 | 0.032     | 225.4 | 0.032         | 225.4 | 0.32                     | 1,832.1 |                                       |        | 2.4                        |
| SV        | Glenn          | GLE          | 0.015   | 112.5 | 0.032     | 224.3 | 0.032         | 224.3 | 0.32                     | 1,822.9 |                                       |        | 2.4                        |
| SV        | Placer         | PLA          | 0.015   | 112.3 | 0.032     | 223.8 | 0.032         | 223.8 | 0.32                     | 1,819.0 |                                       |        | 2.4                        |
| SV        | Sacramento (4) | SAC          | 0.015   | 113.0 | 0.032     | 225.2 | 0.032         | 225.2 | 0.32                     | 1,830.8 |                                       |        | 2.4                        |
| SV        | Shasta         | SHA          | 0.015   | 111.0 | 0.032     | 221.2 | 0.032         | 221.2 | 0.32                     | 1,798.1 |                                       |        | 2.4                        |
| SV        | Solano         | YS           | 0.015   | 112.9 | 0.032     | 225.1 | 0.032         | 225.1 | 0.32                     | 1,829.4 |                                       |        | 2.4                        |
| SV        | Sutter         | FR           | 0.015   | 111.6 | 0.032     | 222.3 | 0.032         | 222.3 | 0.32                     | 1,807.3 |                                       |        | 2.4                        |
| SV        | Tehama         | TEH          | 0.015   | 111.9 | 0.032     | 223.0 | 0.032         | 223.0 | 0.32                     | 1,812.5 |                                       |        | 2.4                        |
| SV        | Yolo           | YS           | 0.015   | 112.9 | 0.032     | 225.1 | 0.032         | 225.1 | 0.32                     | 1,829.4 |                                       |        | 2.4                        |
| SV        | Yuba           | FR           | 0.015   | 112.5 | 0.032     | 224.3 | 0.032         | 224.3 | 0.32                     | 1,822.9 |                                       |        | 2.4                        |

- 1 For Major, Collector and Local roads, the portion of Los Angeles County in the SC Air District (South Coast Air Quality Management District, SCAQMD) and all portions of Orange, Riverside and San Bernardino counties use silt loading values derived from a subset of measurements collected in the SCAQMD and Riverside County. Silt loading measurements used for this update are presented in Appendix A, Table 1. See Table 3 for more information on how silt loading values were derived.
- 2 The SJU District (San Joaquin Valley Air Pollution Control District) splits local roads into urban and rural classes and uses separate silt loading values. A higher silt loading value derived from AP-42 data is used to compute emissions for local rural roads due to anticipated higher loading levels.
- 3 SCAQMD provides ARB with only the total PM<sub>10</sub> emissions for paved roads at sand and gravel processing facilities.
- 4 Sacramento Area Council of Governments (SACOG) provided 2008 travel fractions for Sacramento County.

**Table 8**  
**Annual Rainfall Days: Average Days per Year that California Counties Receive**  
**0.01 Inch or Greater Precipitation Over Years of Record (1)**

| Air Basin | County          | Air District | Annual Rainfall Days (1) |
|-----------|-----------------|--------------|--------------------------|
| GBV       | Alpine          | GBU          | 72                       |
| GBV       | Inyo            | GBU          | 28                       |
| GBV       | Mono            | GBU          | 39                       |
| LC        | Lake            | LAK          | 68                       |
| LT        | El Dorado       | ED           | 68                       |
| LT        | Placer          | PLA          | 77                       |
| MC        | Amador          | AMA          | 64                       |
| MC        | Calaveras       | CAL          | 72                       |
| MC        | El Dorado       | ED           | 66                       |
| MC        | Mariposa        | MPA          | 69                       |
| MC        | Nevada          | NSI          | 83                       |
| MC        | Placer          | PLA          | 73                       |
| MC        | Plumas          | NSI          | 75                       |
| MC        | Sierra          | NSI          | 79                       |
| MC        | Tuolumne        | TUO          | 65                       |
| MD        | Kern            | KER          | 24                       |
| MD        | Los Angeles     | AV           | 24                       |
| MD        | Riverside       | MOJ          | 17                       |
| MD        | Riverside       | SC           | 17                       |
| MD        | San Bernardino  | MOJ          | 23                       |
| NC        | Del Norte       | NCU          | 111                      |
| NC        | Humboldt        | NCU          | 121                      |
| NC        | Mendocino       | MEN          | 115                      |
| NC        | Sonoma          | NS           | 75                       |
| NC        | Trinity         | NCU          | 84                       |
| NCC       | Monterey        | MBU          | 55                       |
| NCC       | San Benito      | MBU          | 51                       |
| NCC       | Santa Cruz      | MBU          | 65                       |
| NEP       | Lassen          | LAS          | 59                       |
| NEP       | Modoc           | MOD          | 76                       |
| NEP       | Siskiyou        | SIS          | 96                       |
| SC        | Los Angeles     | SC           | 34                       |
| SC        | Orange          | SC           | 33                       |
| SC        | Riverside       | SC           | 34                       |
| SC        | San Bernardino  | SC           | 41                       |
| SCC       | San Luis Obispo | SLO          | 42                       |
| SCC       | Santa Barbara   | SB           | 46                       |
| SCC       | Ventura         | VEN          | 31                       |
| SD        | San Diego       | SD           | 42                       |

| Air Basin | County        | Air District | Annual Rainfall Days (1) |
|-----------|---------------|--------------|--------------------------|
| SF        | Alameda       | BA           | 61                       |
| SF        | Contra Costa  | BA           | 60                       |
| SF        | Marin         | BA           | 66                       |
| SF        | Napa          | BA           | 68                       |
| SF        | San Francisco | BA           | 67                       |
| SF        | San Mateo     | BA           | 60                       |
| SF        | Santa Clara   | BA           | 64                       |
| SF        | Solano        | BA           | 54                       |
| SF        | Sonoma        | BA           | 69                       |
| SJV       | Fresno        | SJU          | 45                       |
| SJV       | Kern          | SJU          | 37                       |
| SJV       | Kings         | SJU          | 38                       |
| SJV       | Madera        | SJU          | 44                       |
| SJV       | Merced        | SJU          | 51                       |
| SJV       | San Joaquin   | SJU          | 55                       |
| SJV       | Stanislaus    | SJU          | 52                       |
| SJV       | Tulare        | SJU          | 40                       |
| SS        | Imperial      | IMP          | 11                       |
| SS        | Riverside     | SC           | 17                       |
| SV        | Butte         | BUT          | 63                       |
| SV        | Colusa        | COL          | 56                       |
| SV        | Glenn         | GLE          | 63                       |
| SV        | Placer        | PLA          | 66                       |
| SV        | Sacramento    | SAC          | 57                       |
| SV        | Shasta        | SHA          | 82                       |
| SV        | Solano        | YS           | 58                       |
| SV        | Sutter        | FR           | 75                       |
| SV        | Tehama        | TEH          | 71                       |
| SV        | Yolo          | YS           | 58                       |
| SV        | Yuba          | FR           | 63                       |

1 Average days per year that counties within air basin receive  $\geq 0.01$  inch precipitation over years of record, Western Regional Climate Center data, <http://www.wrcc.dri.edu/>

**Table 9**  
**Temporal Profile for Paved Road Dust Emissions,**  
**Based on Monthly Days of Rain (1,2)**

| Air Basin | County          | Air District | Monthly Rainfall Fraction (1,2) |       |       |       |       |       |       |       |       |       |       |       |
|-----------|-----------------|--------------|---------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|           |                 |              | Jan                             | Feb   | Mar   | April | May   | June  | July  | Aug   | Sept  | Oct   | Nov   | Dec   |
| GBV       | Alpine          | GBU          | 0.078                           | 0.079 | 0.081 | 0.083 | 0.083 | 0.086 | 0.087 | 0.087 | 0.086 | 0.086 | 0.083 | 0.081 |
| GBV       | Inyo            | GBU          | 0.078                           | 0.078 | 0.081 | 0.085 | 0.085 | 0.088 | 0.085 | 0.085 | 0.085 | 0.085 | 0.085 | 0.081 |
| GBV       | Mono            | GBU          | 0.079                           | 0.079 | 0.082 | 0.084 | 0.084 | 0.084 | 0.084 | 0.084 | 0.086 | 0.086 | 0.084 | 0.082 |
| LC        | Lake            | LAK          | 0.074                           | 0.080 | 0.078 | 0.082 | 0.086 | 0.088 | 0.091 | 0.091 | 0.090 | 0.086 | 0.080 | 0.076 |
| LT        | El Dorado       | ED           | 0.080                           | 0.082 | 0.080 | 0.078 | 0.083 | 0.088 | 0.088 | 0.090 | 0.090 | 0.086 | 0.080 | 0.075 |
| LT        | Placer          | PLA          | 0.078                           | 0.079 | 0.079 | 0.082 | 0.084 | 0.086 | 0.090 | 0.089 | 0.087 | 0.085 | 0.082 | 0.079 |
| MC        | Amador          | AMA          | 0.075                           | 0.077 | 0.078 | 0.081 | 0.085 | 0.089 | 0.091 | 0.089 | 0.089 | 0.087 | 0.081 | 0.077 |
| MC        | Calaveras       | CAL          | 0.078                           | 0.078 | 0.077 | 0.081 | 0.084 | 0.088 | 0.091 | 0.090 | 0.088 | 0.086 | 0.081 | 0.078 |
| MC        | El Dorado       | ED           | 0.077                           | 0.077 | 0.077 | 0.081 | 0.085 | 0.088 | 0.091 | 0.091 | 0.089 | 0.085 | 0.081 | 0.077 |
| MC        | Mariposa        | MPA          | 0.079                           | 0.079 | 0.078 | 0.080 | 0.084 | 0.088 | 0.088 | 0.089 | 0.087 | 0.086 | 0.082 | 0.080 |
| MC        | Nevada          | NSI          | 0.077                           | 0.078 | 0.078 | 0.081 | 0.086 | 0.088 | 0.091 | 0.090 | 0.089 | 0.086 | 0.080 | 0.078 |
| MC        | Placer          | PLA          | 0.077                           | 0.078 | 0.077 | 0.081 | 0.085 | 0.088 | 0.091 | 0.090 | 0.088 | 0.086 | 0.080 | 0.078 |
| MC        | Plumas          | NSI          | 0.079                           | 0.079 | 0.079 | 0.081 | 0.084 | 0.087 | 0.090 | 0.090 | 0.088 | 0.085 | 0.081 | 0.078 |
| MC        | Sierra          | NSI          | 0.078                           | 0.079 | 0.079 | 0.082 | 0.083 | 0.087 | 0.090 | 0.090 | 0.087 | 0.085 | 0.081 | 0.078 |
| MC        | Tuolumne        | TUO          | 0.075                           | 0.077 | 0.077 | 0.082 | 0.086 | 0.089 | 0.091 | 0.091 | 0.089 | 0.086 | 0.079 | 0.077 |
| MD        | Kern            | KER          | 0.075                           | 0.075 | 0.075 | 0.083 | 0.087 | 0.091 | 0.091 | 0.087 | 0.087 | 0.087 | 0.083 | 0.079 |
| MD        | Los Angeles     | AV           | 0.076                           | 0.080 | 0.076 | 0.080 | 0.087 | 0.091 | 0.087 | 0.087 | 0.087 | 0.087 | 0.080 | 0.080 |
| MD        | Riverside       | MOJ          | 0.074                           | 0.080 | 0.080 | 0.085 | 0.090 | 0.090 | 0.085 | 0.080 | 0.085 | 0.085 | 0.085 | 0.080 |
| MD        | Riverside       | SC           | 0.074                           | 0.080 | 0.080 | 0.085 | 0.090 | 0.090 | 0.085 | 0.080 | 0.085 | 0.085 | 0.085 | 0.080 |
| MD        | San Bernardino  | MOJ          | 0.075                           | 0.079 | 0.079 | 0.083 | 0.087 | 0.091 | 0.083 | 0.083 | 0.087 | 0.087 | 0.083 | 0.083 |
| NC        | Del Norte       | NCU          | 0.079                           | 0.080 | 0.079 | 0.083 | 0.084 | 0.087 | 0.089 | 0.088 | 0.088 | 0.084 | 0.080 | 0.079 |
| NC        | Humboldt        | NCU          | 0.079                           | 0.080 | 0.079 | 0.082 | 0.085 | 0.086 | 0.089 | 0.089 | 0.088 | 0.085 | 0.080 | 0.079 |
| NC        | Mendocino       | MEN          | 0.078                           | 0.080 | 0.080 | 0.083 | 0.085 | 0.088 | 0.089 | 0.088 | 0.087 | 0.085 | 0.080 | 0.078 |
| NC        | Sonoma          | NS           | 0.076                           | 0.078 | 0.078 | 0.081 | 0.086 | 0.090 | 0.091 | 0.090 | 0.088 | 0.086 | 0.079 | 0.078 |
| NC        | Trinity         | NCU          | 0.078                           | 0.079 | 0.079 | 0.082 | 0.085 | 0.088 | 0.090 | 0.089 | 0.088 | 0.084 | 0.080 | 0.078 |
| NCC       | Monterey        | MBU          | 0.076                           | 0.076 | 0.076 | 0.081 | 0.086 | 0.089 | 0.091 | 0.091 | 0.089 | 0.086 | 0.081 | 0.078 |
| NCC       | San Benito      | MBU          | 0.077                           | 0.075 | 0.077 | 0.082 | 0.087 | 0.089 | 0.091 | 0.091 | 0.089 | 0.086 | 0.080 | 0.077 |
| NCC       | Santa Cruz      | MBU          | 0.076                           | 0.077 | 0.077 | 0.083 | 0.087 | 0.088 | 0.091 | 0.090 | 0.088 | 0.087 | 0.081 | 0.077 |
| NEP       | Lassen          | LAS          | 0.079                           | 0.079 | 0.080 | 0.083 | 0.083 | 0.085 | 0.089 | 0.089 | 0.088 | 0.085 | 0.082 | 0.079 |
| NEP       | Modoc           | MOD          | 0.080                           | 0.080 | 0.080 | 0.081 | 0.083 | 0.085 | 0.089 | 0.089 | 0.087 | 0.085 | 0.081 | 0.080 |
| NEP       | Siskiyou        | SIS          | 0.078                           | 0.080 | 0.080 | 0.082 | 0.084 | 0.087 | 0.090 | 0.089 | 0.088 | 0.084 | 0.080 | 0.078 |
| SC        | Los Angeles     | SC           | 0.075                           | 0.075 | 0.075 | 0.083 | 0.088 | 0.091 | 0.091 | 0.091 | 0.088 | 0.086 | 0.080 | 0.078 |
| SC        | Orange          | SC           | 0.071                           | 0.074 | 0.077 | 0.082 | 0.088 | 0.088 | 0.091 | 0.091 | 0.091 | 0.085 | 0.085 | 0.077 |
| SC        | Riverside       | SC           | 0.075                           | 0.075 | 0.077 | 0.083 | 0.085 | 0.091 | 0.091 | 0.091 | 0.088 | 0.085 | 0.083 | 0.077 |
| SC        | San Bernardino  | SC           | 0.077                           | 0.075 | 0.075 | 0.082 | 0.086 | 0.088 | 0.091 | 0.088 | 0.088 | 0.084 | 0.084 | 0.080 |
| SCC       | San Luis Obispo | SLO          | 0.074                           | 0.074 | 0.076 | 0.082 | 0.087 | 0.091 | 0.091 | 0.091 | 0.089 | 0.087 | 0.080 | 0.078 |
| SCC       | Santa Barbara   | SB           | 0.075                           | 0.075 | 0.075 | 0.081 | 0.087 | 0.089 | 0.091 | 0.091 | 0.089 | 0.087 | 0.081 | 0.079 |
| SCC       | Ventura         | VEN          | 0.073                           | 0.073 | 0.076 | 0.082 | 0.088 | 0.091 | 0.091 | 0.091 | 0.088 | 0.088 | 0.082 | 0.079 |
| SD        | San Diego       | SD           | 0.076                           | 0.076 | 0.076 | 0.080 | 0.087 | 0.089 | 0.091 | 0.091 | 0.089 | 0.087 | 0.082 | 0.078 |
| SF        | Alameda         | BA           | 0.076                           | 0.077 | 0.077 | 0.082 | 0.088 | 0.089 | 0.091 | 0.089 | 0.089 | 0.085 | 0.079 | 0.077 |
| SF        | Contra Costa    | BA           | 0.076                           | 0.077 | 0.077 | 0.082 | 0.086 | 0.089 | 0.091 | 0.091 | 0.089 | 0.086 | 0.080 | 0.076 |
| SF        | Marin           | BA           | 0.074                           | 0.077 | 0.077 | 0.083 | 0.087 | 0.090 | 0.091 | 0.091 | 0.090 | 0.085 | 0.080 | 0.076 |
| SF        | Napa            | BA           | 0.077                           | 0.075 | 0.077 | 0.081 | 0.087 | 0.089 | 0.091 | 0.091 | 0.089 | 0.087 | 0.079 | 0.076 |
| SF        | San Francisco   | BA           | 0.076                           | 0.076 | 0.077 | 0.083 | 0.087 | 0.090 | 0.091 | 0.090 | 0.088 | 0.085 | 0.080 | 0.077 |
| SF        | San Mateo       | BA           | 0.076                           | 0.077 | 0.077 | 0.082 | 0.086 | 0.089 | 0.091 | 0.091 | 0.089 | 0.086 | 0.080 | 0.076 |
| SF        | Santa Clara     | BA           | 0.078                           | 0.074 | 0.077 | 0.080 | 0.087 | 0.090 | 0.091 | 0.091 | 0.090 | 0.087 | 0.080 | 0.077 |
| SF        | Solano          | BA           | 0.072                           | 0.077 | 0.077 | 0.082 | 0.088 | 0.089 | 0.091 | 0.091 | 0.089 | 0.088 | 0.079 | 0.076 |
| SF        | Sonoma          | BA           | 0.075                           | 0.078 | 0.078 | 0.083 | 0.087 | 0.089 | 0.091 | 0.091 | 0.089 | 0.085 | 0.079 | 0.076 |

- 1 Western Regional Climate Center data (<http://www.wrcc.dri.edu/>), average days per month with rainfall of 0.01 inch or greater, based on California meteorological station level rainfall data for years of record.
- 2 Normalized Rainfall per Month = 1 - [Rain days per month/annual rain days]  
 Monthly Rainfall Fraction = [Normalized Rainfall per Month]/[Total Normalized Rainfall]

**Table 9**  
**Temporal Profile for Paved Road Dust Emissions,**  
**Based on Monthly Days of Rain (1,2)**

| Air Basin | County      | Air District | Monthly Rainfall Fraction (1,2) |       |       |       |       |       |       |       |       |       |       |       |
|-----------|-------------|--------------|---------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|           |             |              | Jan                             | Feb   | Mar   | April | May   | June  | July  | Aug   | Sept  | Oct   | Nov   | Dec   |
| SJV       | Fresno      | SJU          | 0.075                           | 0.075 | 0.077 | 0.083 | 0.087 | 0.089 | 0.091 | 0.091 | 0.089 | 0.087 | 0.081 | 0.077 |
| SJV       | Kern        | SJU          | 0.076                           | 0.076 | 0.076 | 0.081 | 0.086 | 0.090 | 0.090 | 0.090 | 0.088 | 0.086 | 0.083 | 0.078 |
| SJV       | Kings       | SJU          | 0.076                           | 0.076 | 0.076 | 0.081 | 0.086 | 0.090 | 0.090 | 0.090 | 0.090 | 0.086 | 0.081 | 0.076 |
| SJV       | Madera      | SJU          | 0.074                           | 0.076 | 0.076 | 0.083 | 0.087 | 0.089 | 0.091 | 0.091 | 0.089 | 0.087 | 0.081 | 0.076 |
| SJV       | Merced      | SJU          | 0.073                           | 0.077 | 0.077 | 0.082 | 0.087 | 0.091 | 0.091 | 0.091 | 0.089 | 0.087 | 0.080 | 0.077 |
| SJV       | San Joaquin | SJU          | 0.076                           | 0.076 | 0.077 | 0.082 | 0.087 | 0.089 | 0.091 | 0.091 | 0.089 | 0.086 | 0.079 | 0.077 |
| SJV       | Stanislaus  | SJU          | 0.074                           | 0.075 | 0.077 | 0.082 | 0.088 | 0.089 | 0.091 | 0.091 | 0.089 | 0.086 | 0.081 | 0.077 |
| SJV       | Tulare      | SJU          | 0.075                           | 0.075 | 0.077 | 0.082 | 0.086 | 0.091 | 0.091 | 0.091 | 0.088 | 0.086 | 0.082 | 0.077 |
| SS        | Imperial    | IMP          | 0.075                           | 0.075 | 0.075 | 0.092 | 0.092 | 0.092 | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 |
| SS        | Riverside   | SC           | 0.074                           | 0.074 | 0.079 | 0.085 | 0.090 | 0.090 | 0.090 | 0.085 | 0.085 | 0.085 | 0.085 | 0.079 |
| SV        | Butte       | BUT          | 0.075                           | 0.076 | 0.078 | 0.082 | 0.085 | 0.088 | 0.091 | 0.091 | 0.089 | 0.085 | 0.081 | 0.078 |
| SV        | Colusa      | COL          | 0.075                           | 0.076 | 0.078 | 0.083 | 0.086 | 0.089 | 0.091 | 0.091 | 0.089 | 0.086 | 0.080 | 0.076 |
| SV        | Glenn       | GLE          | 0.075                           | 0.078 | 0.079 | 0.082 | 0.085 | 0.088 | 0.091 | 0.090 | 0.090 | 0.085 | 0.079 | 0.077 |
| SV        | Placer      | PLA          | 0.076                           | 0.077 | 0.077 | 0.081 | 0.086 | 0.088 | 0.091 | 0.091 | 0.088 | 0.086 | 0.080 | 0.077 |
| SV        | Sacramento  | SAC          | 0.075                           | 0.077 | 0.077 | 0.083 | 0.086 | 0.089 | 0.091 | 0.091 | 0.089 | 0.086 | 0.080 | 0.077 |
| SV        | Shasta      | SHA          | 0.076                           | 0.079 | 0.078 | 0.081 | 0.083 | 0.088 | 0.091 | 0.090 | 0.090 | 0.086 | 0.081 | 0.078 |
| SV        | Solano      | YS           | 0.074                           | 0.077 | 0.077 | 0.083 | 0.086 | 0.089 | 0.091 | 0.091 | 0.089 | 0.086 | 0.080 | 0.075 |
| SV        | Sutter      | FR           | 0.076                           | 0.079 | 0.077 | 0.081 | 0.085 | 0.088 | 0.091 | 0.090 | 0.088 | 0.086 | 0.080 | 0.079 |
| SV        | Tehama      | TEH          | 0.077                           | 0.078 | 0.078 | 0.082 | 0.086 | 0.088 | 0.091 | 0.090 | 0.088 | 0.086 | 0.079 | 0.077 |
| SV        | Yolo        | YS           | 0.075                           | 0.077 | 0.078 | 0.083 | 0.086 | 0.089 | 0.091 | 0.091 | 0.089 | 0.086 | 0.080 | 0.075 |
| SV        | Yuba        | FR           | 0.075                           | 0.078 | 0.078 | 0.082 | 0.087 | 0.089 | 0.091 | 0.089 | 0.089 | 0.085 | 0.079 | 0.076 |

1 Western Regional Climate Center data (<http://www.wrcc.dri.edu/>), average days per month with rainfall of 0.01 inch or greater, based on California meteorological station level rainfall data for years of record.  
 2 Normalized Rainfall per Month = 1 - [Rain days per month/annual rain days]  
 Monthly Rainfall Fraction = [Normalized Rainfall per Month]/[Total Normalized Rainfall]



**Appendix A.  
Table 1. 1995-1997 Silt Loading Values**

| Location   | Date      | Silt Loading (g/m <sup>2</sup> ) | Sampling Location                  | Researcher(1) |
|--|-----------|----------------------------------|------------------------------------|---------------|
| <b>HIGH Average Daily Traffic (ADT) Roads (&gt; 5,000 vehicle passes/day)</b>  |           |                                  |                                    |               |
| South Coast  | Apr-95    | 0.012                            | Composite of 4 roads of same class | MRI           |
| South Coast  | Jun-95    | 0.015                            | Repeat sample of above roads       | MRI           |
| South Coast  | Jun-95    | 0.011                            | Composite of 4 roads of same class | MRI           |
| South Coast  | Jun-95    | 0.046                            | Composite of 4 roads of same class | MRI           |
| Bakersfield  | Apr-95    | 0.054                            | Composite of 4 roads of same class | MRI           |
| Bakersfield  | Jul-95    | 0.015                            | Repeat sample of above roads       | MRI           |
| Bakersfield  | Jul-95    | 0.051                            | Composite of 4 roads of same class | MRI           |
| Bakersfield  | Jul-95    | 0.039                            | Composite of 4 roads of same class | MRI           |
| Coachella Valley   | Apr-95    | 0.027                            | Composite of 4 roads of same class | MRI           |
| Coachella Valley   | Jul-95    | 0.037                            | Repeat sample of above roads       | MRI           |
| Coachella Valley   | Jul-95    | 0.082                            | Composite of 4 roads of same class | MRI           |
| Coachella Valley   | Jul-95    | 0.03                             | Composite of 4 roads of same class | MRI           |
| Sacramento   | 1997      | 0.0332                           | Sunrise Crosswalk North            | UCD           |
| Sacramento   | 1997      | 0.0261                           | Sunrise Crosswalk south            | UCD           |
| Sacramento   | 1997      | 0.0184                           | Greenback Crosswalk West           | UCD           |
| Sacramento   | 1997      | 0.0136                           | Greenback Crosswalk East           | UCD           |
| Sacramento   | 8/23/1995 | 0.0543                           | Florin Rd East                     | UCD           |
| Sacramento   | 8/23/1995 | 0.0034                           | Florin Road West                   | UCD           |
| Sacramento   | 8/23/1995 | 0.0016                           | Stockton Blvd South                | UCD           |
| Sacramento   | 8/23/1995 | 0.002                            | Stockton Blvd North                | UCD           |
| Riverside  | 3/18/1997 | 0.065                            | Canyon Crest Drive                 | UCR           |
| Riverside  | 6/5/1997  | 0.085                            | Canyon Crest Drive                 | UCR           |
| Riverside  | 6/19/1996 | 0.00593                          | Main Street                        | UCR           |
| Riverside  | 9/3/1996  | 0.00593                          | Main Street                        | UCR           |
| Riverside  | 3/17/1997 | 0.2                              | Riverside Street                   | UCR           |
| Riverside  | 5/29/1997 | 0.17                             | Riverside Street                   | UCR           |
| Riverside  | 3/19/1997 | 0.19                             | Riverside Street                   | UCR           |
| Riverside  | 6/4/1997  | 0.085                            | Riverside Street                   | UCR           |
| Riverside  | 5/27/1997 | 0.38                             | Fogg Street                        | UCR           |
| Riverside  | 3/26/1997 | 0.13                             | Fogg Street                        | UCR           |
| Riverside  | 6/3/1997  | 0.14                             | Fogg Street                        | UCR           |
| <b>Geometric mean of high ADT roads = 0.032 g/m<sup>2</sup>, used as California statewide default silt loading for Major and Collector roads. See Table 3 for information on deriving statewide, district and county specific silt loading values.</b> |           |                                  |                                    |               |

1 Researcher:  
 MRI = Midwest Research Institute  
<http://www.arb.ca.gov/ei/areasrc/arbmiscprocpaverddstbkgnd.pdf>  
 UCR = Univ. of California, Riverside  
<http://aqp.engr.ucdavis.edu/Documents/DraftRoadDustreport.pdf>  
 UCD = Univ. of California, Davis  
[http://aqp.engr.ucdavis.edu/Documents/pm10\\_hotspot\\_Sunrise.pdf](http://aqp.engr.ucdavis.edu/Documents/pm10_hotspot_Sunrise.pdf)

**Appendix A.  
Table 1. 1995-1997 Silt Loading Values**

| Location  | Date   | Silt Loading (g/m <sup>2</sup> ) | Sampling Location                  | Researcher(1) |
|---|--------|----------------------------------|------------------------------------|---------------|
| <b>LOW ADT Roads (&lt; 5,000 vehicle passes/day)</b>  |        |                                  |                                    |               |
| South Coast   | Apr-95 | 0.18                             | Composite of 4 roads of same class | MRI           |
| South Coast   | Jun-95 | 0.05                             | Repeat sample of above roads       | MRI           |
| South Coast   | Jun-95 | 0.17                             | Composite of 4 roads of same class | MRI           |
| South Coast   | Jun-95 | 0.14                             | Composite of 4 roads of same class | MRI           |
| Bakersfield   | Apr-95 | 0.52                             | Composite of 4 roads of same class | MRI           |
| Bakersfield   | Jul-95 | 0.19                             | Repeat sample of above roads       | MRI           |
| Bakersfield   | Jul-95 | 0.94                             | Composite of 4 roads of same class | MRI           |
| Bakersfield   | Jul-95 | 0.41                             | Composite of 4 roads of same class | MRI           |
| Coachella Valley  | Jul-95 | 0.42                             | Repeat sample of above roads       | MRI           |
| Coachella Valley  | Jul-95 | 0.35                             | Composite of 4 roads of same class | MRI           |
| Coachella Valley  | Jul-95 | 0.2                              | Composite of 4 roads of same class | MRI           |
| <b>Mean of low ADT roads = 0.32 g/m<sup>2</sup>, used as California statewide default silt loading for Local roads.<br/>See Table 3 for information on deriving statewide, district and county specific silt loading values</b> |        |                                  |                                    |               |

1 Researcher:  
 MRI = Midwest Research Institute  
<http://www.arb.ca.gov/ei/areasrc/arbmiscprocpaverddstbkgrnd.pdf>  
 UCR = Univ. of California, Riverside  
<http://aqp.engr.ucdavis.edu/Documents/DraftRoadDustreport.pdf>  
 UCD = Univ. of California, Davis  
[http://aqp.engr.ucdavis.edu/Documents/pm10\\_hotspot\\_Sunrise.pdf](http://aqp.engr.ucdavis.edu/Documents/pm10_hotspot_Sunrise.pdf)