California Air Resources Board
Technical Support Division

Draft July 2, 1997
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ENTRAINED DUST FROM PAVED ROAD TRAVEL

EMISSION ESTIMATION METHODOLOGY BACKGROUND DOCUMENT

INTRODUCTION

ARB staff has updated the methodology for estimating the entrained particulate matter (PM) emissions from vehicular travel on paved roads. The new methodology includes the following changes:

- Incorporation of the new EPA paved road emission factor from the Fifth Edition of EPA's AP-42 document (January 1995, Section 13.2.1)
- Update of the Vehicle Miles Traveled (VMT) data to 1993 levels
- Update of the fractions of vehicle miles traveled on each of the four major roadway categories (i.e., freeways, major roads, collectors, and local roads) to reflect 1993 data
- Incorporation of new proposed default Statewide roadway silt loading values
- An improvement in how paved road dust emissions are grown for future years

The purpose of this document is to provide a detailed description of the new methodology, our rationale for the methodology, limitations of the method, and background information used to develop the method.

BACKGROUND

Throughout the State, entrained paved road dust contributes to airborne particulate matter (PM) emissions. Because it is not feasible to directly measure the region-wide emissions from paved roads, emission are developed to estimate regional PM emissions due to vehicular travel on paved roads. Currently, the ARB uses the emission factor developed by Midwest Research Institute (MRI) for the U.S. EPA's AP-42 document. The emission factor from AP-42 was derived from upwind-downwind monitoring of paved roads while traffic passed by. Simplistically, this method measures the difference in the amount of particulate matter between the "clean" upwind air and the downwind air that includes the entrained road dust emissions.

In developing an emission factor, correlations between the measured airborne PM concentrations and other physical parameters such as the amount of material on the road, number of vehicle tires, vehicle weight, and vehicle speed were examined. Using the available data, it was determined that emissions correlated most closely with vehicle weight, and silt loading (i.e., the mass of material 75 microns or less per square meter of roadway). The current emission factor provided in AP-42 is:

$$E = k \left(\frac{sL}{2} \right)^{0.65} \left(\frac{W}{3} \right)^{1.5}$$

where E is the particulate emission factor, k is the particle size multiplier, sL is the roadway silt loading in grams/square meter, and W is the average weight (in tons) of vehicles traveling the road.

Using the emission factor shown, three parameters are needed to compute emissions: roadway silt loadings, average vehicle weight data, and the total number of miles traveled by vehicles on the roads. Because a single silt loading value cannot reasonably be assigned to all roads, roadways are subdivided into four major categories which are expected to have roughly similar silt loading characteristics. These categories are: freeways, major roads, collectors, and local roads, both in urban and rural environments. A default vehicle weight value is used Statewide, and Vehicle Miles Traveled (VMT) is from the ARB's motor vehicle emission inventory computations.

The remaining sections describe how the Statewide entrained road dust emissions are computed, and how the input activity data (i.e., travel fractions, silt loadings, and VMT) were derived.

Roadway Category Splits

To compute paved road dust emissions, it is necessary to compute an emission factor for each major road type. This is done by determining the road type and assigning the appropriate silt loading value to the road. To make this process manageable, we use four roadway categories. Each category--freeways, major roads, collectors, and local roads--is assumed to have similar ranges of silt loading under typical average conditions. Of course, this is a large oversimplification. Regional and climatological variations, adjacent land use, daily travel, and other factors can dramatically affect the loading on any individual road. However, because it is unrealistic to collect road specific silt information throughout the State, it is necessary to generalize road types and silt loadings until more region specific data are available.

To split all of the State's paved roadways into the four major road categories, we used data available from the California Department of Transportation (Caltrans). As part of their Federal reporting requirements, Caltrans is required to compile annual paved road statistics and report them as part of the Federal Highway Performance Monitoring System (HPMS). Using the HPMS groupings shown in Table 1A , we worked with Caltrans to consolidate the twelve categories down to four as shown in Table 1B.

The HPMS data divides roads based on their functional classifications, which are predominantly based on mobility and access considerations, not necessarily their potential to emit particulate matter. Because of this, our ARB categories do not always match the HPMS categories in a direct way. For the road dust emission calculations, roads were apportioned based on their anticipated usage levels, modes of usage, and anticipated silt loading potential. In categorizing roads for silt loading assignments, it was assumed that the more traveled roadways with fewer entrance and exit points have less silt loading.

For this reason, rural arterials and small urban freeways & expressways were put into the 'Major' roadway category. This is because these roads tend to have more points of uncontrolled access than freeways, and their usage more closely aproximates that of major highway and arterials. Also, rural minor collectors and small urban collectors were incorporated into the 'Local' road category based on the description of the road category and the expectations that their use and silt loading characteristics are similar to local roads. For the San Joaquin Valley, the air district staff requested that their local roads be split into urban and rural components. In this case, the two local roads in the top of Table 1B are considered rural local roads, the remainder of the local roads are considered urban local roads. This split allows unique silt loadings to be assigned to each of the road types.

TABLE 1A. CALTRANS HPMS ROADWAY CATEGORIES.

RURAL	Interstate	Other Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local
CODE	(01)	(02)	(06)	(07)	(08)	(09)
URBAN	Interstate	Other Freeways & Expressways	Other Prin. Arterial	Minor Arterial	Collector	Local
CODE	(11)	(12)	(14)	(16)	(17)	(19)

TABLE 1B. ARB ROADWAY APPORTIONMENT.

Rural	Freeway	Major	Major	*Collector*	Local	Local
Small Urban	*Freeway*	Major	Major	Major	Local	Local
Urbanized	*Freeway*	*Freeway*	Major	Major	*Collector*	Local
Large Urban	*Freeway*	*Freeway*	Major	Major	*Collector*	Local

Based on the Table 1B apportionment and the VMT data provided with HPMS for each of the twenty-four road types, we generated the travel fraction of miles traveled for each of the four major groupings for each county in the State. Table 2 below shows an example of these data. Appendix A provides a complete listing of travel fractions for each county in the State based on the HPMS data and the ARB roadway splits. For regions that are able to provide more refined travel fraction data than that available through HPMS, the local data can be incorporated into the regional emission estimates.

TABLE 2. EXAMPLE OF ARB/HPMS TRAVEL FRACTIONS.

COUNTY	FREEWAY	MAJOR	COLLECTOR	LOCAL
ALPINE	0.000	0.767	0.123	0.110
MONTEREY	0.130	0.590	0.165	0.115
LOS ANGELES	0.437	0.458	0.054	0.05
SAN FRANCISCO	0.384	0.507	0.062	0.048
FRESNO	0.196	0.501	0.151	0.153
SACRAMENTO	0.403	0.428	0.088	0.082
STATEWIDE AVG	0.252	0.500	0.119	0.123

Silt Loading Derivation

The primary reason for apportioning roadways to the four roadway categories is so that silt loadings can be assigned to them. This allows computation of road-type specific emission factors. As mentioned, assigning silt loadings requires the significant assumption that roads which have similar configurations and similar types of usage will have similar silt loadings. We are clearly aware of the limitations of this assumption, especially in computing localized emissions. However, with the currently available information, our current strategy is to use the best available California roadway silt loading data and use these to compute generalized, regional, entrained road dust estimates. Where better local silt loading data are available, these data may be used instead of the statewide defaults.

Table 3 below shows the default roadway silt loading values proposed for use throughout California. The Freeway value is the U.S. EPA default value; the Major and Collector values were derived from recent silt loading measurements performed by the Midwest Research Institute (MRI) under contract to the Best Available Control Measures (BACM) working group; and the Local silt loadings were derived from AP-42 Fifth Edition silt loading values. Appendix B fully describes how the default values were derived and summarizes additional silt loading data.

Table 3. California Default Paved Road Silt Loading Values.

Road Type	Silt Loading (g/m^2)	Notes
Freeway	0.02	U.S. EPA default value.
Major	0.035	Average of 12 California BACM samples.
Collector	0.035	Average of 12 California BACM samples.
Local	0.32	Average of 11 California BACM samples.

Vehicle Weight

Currently we are using a single vehicle weight factor of 2.4 tons throughout the State. This value is based on informal traffic counts and weight estimates performed by Midwest Research Institute (MRI) while performing their silt loading measurements while under contract to the BACM working group. If more refined local data are available, it may be incorporated. For example, the South Coast AQMD developed county specific vehicle weight factors based on the regional traffic mix and average weights for each vehicle class.

Vehicle Miles Traveled

Before emissions can be computed, the final data needed are vehicle miles traveled (VMT). Using data from Caltrans and local juristictions, the Air Resources Board computes VMT for each county throughout the State to estimate emissions from motor vehicle exhaust exhaust, tire wear, and brake wear. The VMT used for the 1993 road dust emission estimates is from the 1993 ozone State Implementation Plan EMFAC/Burden7F runs. However, the SCAQMD and SJVUAPCD provided more recent data from their local transportation agencies.

Emissions Calculations

With all of the components now presented, the dust emissions from vehicle traffic on paved roads (reentrained paved road dust) can now be computed. Using the default silt loadings and the previous emission factor formula:

$$E = k \left(\frac{sL}{2}\right)^{0.65} \left(\frac{W}{3}\right)^{1.5}$$

(where k = 0.016 for PM_{10} and W = 2.4 tons), the default emission factors for each road type are as shown in Table 3. Appendix C shows the emission factors for all road types for all counties and includes the variations in silt loadings and vehicle weight used in some regions.

Table 3. ARB Paved Road Dust Emission Factors.

Road Type	Default Silt Loading (g/m^2)	PM_{10} Emission Factor (lbs/1e^6 VMT)
Freeway	0.02	574
Major	0.035	825
Collector	0.035	825
Local	0.32	3479

By multiplying the emission factors in Table 3 by the fraction of travel in each roadway category and the total VMT in a region, emissions can be computed. For example:

$$\text{Emissions} = \text{VMT} \times [EF_{freeway} \times Fraction_{freeway} + EF_{major} \times Fraction_{major} + EF_{collector} \times Fraction_{collector} + EF_{local} \times Fraction_{local}]$$

Using actual Sacramento county data, the equation becomes:

$$\text{Emissions} = 24811 \times [EF_{freeway} \times 0.403 + EF_{major} \times 0.428 + EF_{collector} \times 0.088 + EF_{local} \times 0.082]$$

Based on this method and inputs, the equation shows that PM_{10} emissions in Sacramento county due to entrained dust from paved road travel is 4261 pounds per year. Appendix C provides a complete listing of VMT, roadway travel fractions, and the resulting emissions for each county in California.

Growth Factors

The AP-42 road dust emission factor is directly tied to vehicle miles traveled. Therefore, future year forecast road dust emissions may be generated by simply increasing the road dust emissions proportionally to the increases in vehicle miles traveled on paved roads. Using this approach, if VMT doubles, so does the quantity of paved road dust. After discussions with staff at EPA, air districts, and road dust researchers, it was concluded that for heavily traveled roads, growing paved road dust by VMT does not realistically represent actual conditions.

Instead, it was decided that for heavily traveled roads (which includes freeways and major roads) emissions will be forecast based on the increase in centerline roadway miles for the two road types. The rationale behind this change is the belief that highly traveled roads typically have reached an equilibrium condition in which all of the available road dust is continuously entrained. In short, adding additional traffic passes probably does not create additional dust for heavily traveled roads. But, any new roads built would produce additional road dust.

Roads that are not as heavily traveled, such as the collectors and locals, are generally less likely to reach an equilibrium condition. In this case, there could be sufficient time for material to deposit during vehicle passes, so each additional car could potentially create additional emissions. For these road types, emissions are still grown based on VMT increases. There is concern that the relationship between emissions and VMT is not linear, as it is now applied. Unfortunately, there are not data available to modify the current growth methodology.

Areas for Improvement

At the time of writing, studies were in progress by the University of California, Riverside (UCR), and the University of California, Davis (UCD). Both studies are finding paved road dust estimates that are lower than the current AP-42 equation predicts. They are also finding very low silt loadings, unclear correlations between silt loadings and emissions, and the relationship between VMT and emissions appears to be more complex than what is currently used. Unfortunately, due to all of the ambiguity in the recent results, it may be awhile before the results of these studies can actually be incorporated into emission inventory improvements.

ADDITIONAL INFORMATION

For additional information, contact Patrick Gaffney, California Air Resources Board, Technical Support Division, (916) 322-7303. The e-mail address is *pgaffney@arb.ca.gov*.

APPENDICES

Appendix A: Roadway Travel Splits from HPMS and VMT Data
Appendix B: Roadway Silt Loading Analysis
Appendix C: County Emission Factors, Silt Loading, and Vehicle Weight

REFERENCES

1. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, AP-42, Section 13.2.1, Fifth Edition. January 1995.

2. Muleski, Greg. Improvement of Specific Emission Factors (BACM Project No. 1), Final Report. Midwest Research Institute, March 29, 1996.

3. California Air Resources Board, Technical Support Division. 1993 Vehicle Miles Traveled by County from 1993 Ozone SIP BURDEN runs.

4. County VMT data for 1993 for the San Joaquin Valley Unified Air Pollution Control District and South Coast Air Quality Management District were obtained from district staff (who collected the information from local transportation agencies).

5. California Department of Transportation. California 1993 Daily Vehicle Miles of Travel for Public Maintained Paved Roads based on Highway Performance Monitoring System (HPMS) Data from 'TRAV93'. Barry Chrissinger, May, 1995.

APPENDIX B

SILT LOADING

ENTRAINED DUST FROM PAVED ROAD TRAVEL
EMISSION ESTIMATION METHODOLOGY

INTRODUCTION

The emission factor used to estimate entrained road dust emissions due to motor vehicle travel on paved roads is based on the amount of material present on the road. The quantity of material on the road is measured by vacumning a known area of roadway, sieving the material to determine the portion that is silt (defined as particles 75 microns or less), and computing the mass (in grams) of silt per square meter of roadway. This procedure is described fully in Appendices C.1 and C.2 of EPA's AP-42 document (January, 1995).

This appendix provides:

- A summary of silt loading data recently collected in the South Coast, Coachella, and Bakersfield regions by Midwest Research Institute under contract to the BACM (Best Available Control Measures) working group.
- A compilation of some current silt loading values from various studies.
- The derivation of California's default silt loading values.

CALIFORNIA 1995 SILT LOADING DATA

The most current silt loading measurements available for California were performed by Midwest Research Institute (MRI) under contract to the Best Available Control Measures (BACM) working group. As part of the study, MRI performed a total of eight silt loading measurments at each of three California locations: the South Coast area, Coachella Valley, and Bakersfield. They also performed eight measurements in Las Vegas, Nevada, for a total of 32 measurements performed during April, June, and July of 1995. Half of these measurements were performed on high average daily travel (ADT) roads in each region, and half were performed on low ADT roads (i.e., roads with roughly less than 5000 vehicle passes per day). The results of MRI's measurements are presented in their report, "Improvement of Specific Emission Factors (BACM Project No. 1)," dated March 29, 1996.

Figures B-1 and B-2 below summarize the MRI data for the three California regions. Las Vegas data is also included for comparison purposes. The figures include a line that shows the overall arithmetic average of the data set. The recommend EPA default silt loading value is also listed for comparison purposes (although it does not fit in the scale of the graph). Generally, the graphs show that the average MRI silt loading measurements are approximately ten times smaller than the AP-42 default silt loading values.

Table B-1, which follows, shows the average silt loading values for high and low ADT roads in each region. Silt loadings from some other sources are also included for comparison purposes.

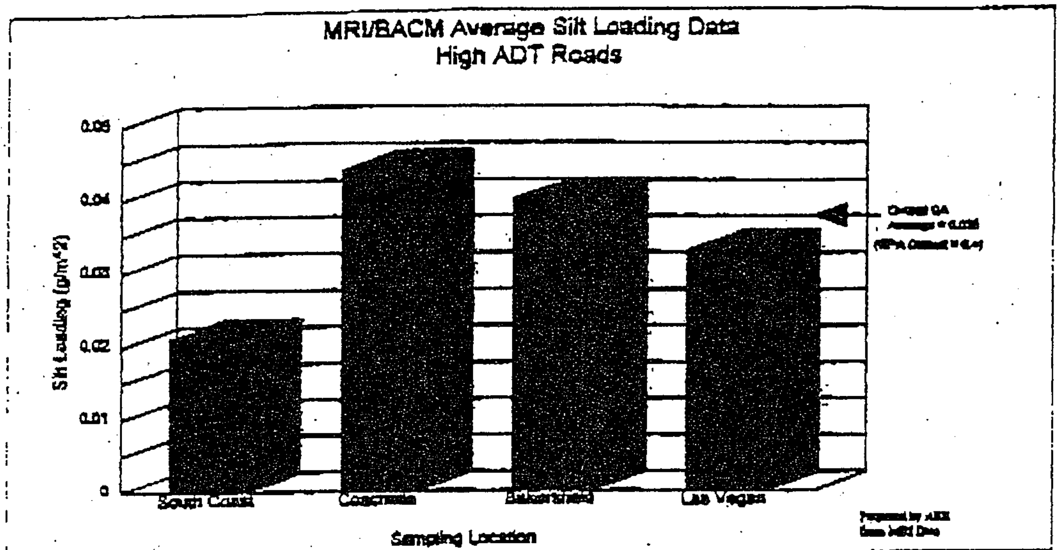

FIGURE B-1. SILT LOADINGS FOR SELECTED HIGH ADT ROADS IN CALIFORNIA

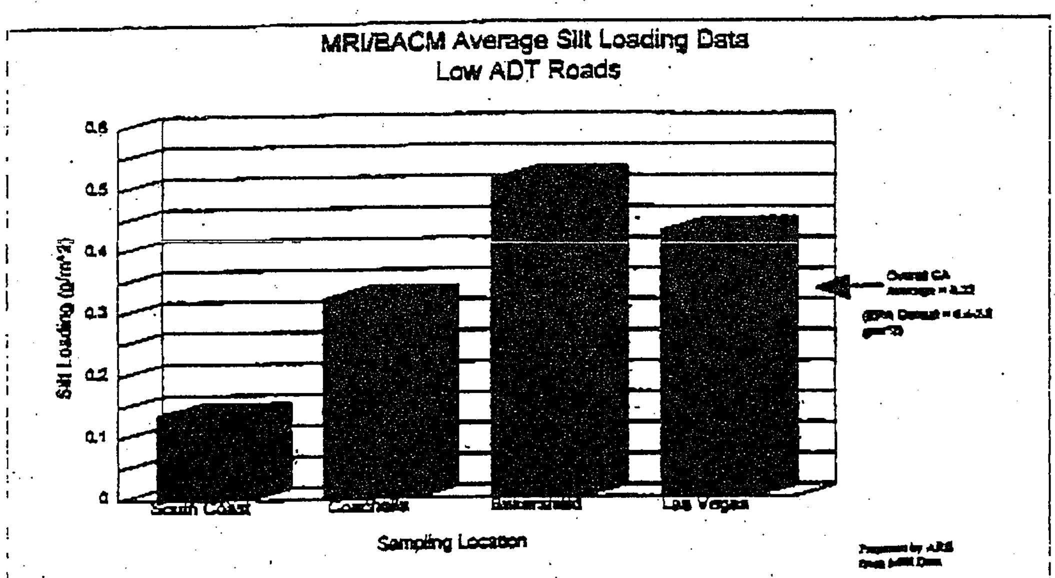

FIGURE B-2 SILT LOADINGS FOR SELECTED LOW ADT ROADS IN CALIFORNIA.

TABLE B-1
MEAN CALIFORNIA ROADWAY SILT LOADING BY SAMPLING REGION AND OTHER SILT LOADING DATA

Source of Silt Data	Road Type & Silt Loading (g/m^2)				Comments
MRI/BACM	High ADT*		Low ADT		
South Coast	0.021		0.137		
Coachella	0.044		0.323		
Bakersfield	0.04		0.515		
Las Vegas	0.078		0.432		
Other CA Studies	Freeway	Major	Collector	Local	Comments
ARB Default, 1995	0.02	0.035	0.32	0.32	Averaged BACM/MRI values
SCAQMD, 1991[1]		0.42	0.42		18 samples, averaged
Riverside[2]		0.093	1.5	5.5	ABB Env/SCE; AWMA 1992
Rubidoux[2]		0.21	1.5	2.7	ABB Env/SCE; AWMA 1992
CE-CERT[3]	0.003 to 0.0002 g/m^2				Riverside County urban sites
UCD[4]	0.05 to 0.0016 g/m^2				Urban Sacramento intersection
AP-42 and Others					
5th Edition 50th Percentile value	0.02	0.4 high ADT	0.4 high ADT	2.5 low ADT	50th percentile value recommended by AP-42
5th Edition Avg.	0.39	4.8	12.1	11.7	Averages of all 5th edition values
5th Edition Avg. w/o Montana data	0.04	0.39	0.76	1.6	5th edition average values with Montana data removed
4th Edition AP-42 Defaults	0.02	0.36	0.92	1.41	Defaults from 4th edition of AP-42
Denver, 1992[5]	0.02	0.21	0.81	1.66	AWMA Proceedings 1992

*Note: High ADT = greater than 5000 vehicles per day

[1] Final Air Quality Management Plan, 1991 Revision, Technical Report IIIF. Inventory of PM_{10} Emission from Fugitive Dust Sources in the South Coast Air Basin. July 1991. Page 13.

[2] AWMA Proceedings, 1992. PM_{10} Standards and Nontraditional Particulate Source Controls. Chow and Ono, Editors.

[3] UC-Riverside, CE-CERT. Interim Progress Report, July, 1996. ARB Contract #94-336. Dr. Akula Venkatra, Dennis Fitz.

[4] UC Davis, Crocker Nuclear Laboratory. "Traffic Generated PM10 Hot Spots, Final Report", August 1996. Caltrans Contract #53V606. Dr. Lowell Ashbaugh

[5] AWMA Proceedings, 1992. PM_{10} Standards and Nontraditional Particulate Source Controls. Chow and Ono, Editors.

California's Default Silt Loading Values for Paved Roads

Using the averages of the MRI/BACM data shown previously, default California silt loading values were computed. Table B-2 shows these values, which are used in nearly all of the counties in California for computing paved road dust emissions. Table B-3 provides a complete listing of all of the collected MRI silt data used, including the names of the streets sampled. Because of the danger involved, no new freeway silt loading sampling was performed in California, so the existing AP-42 default value is used for freeways.

To best represent their conditions, the San Joaquin Valley Air Pollution Control district decided to separate their local roads into urban and rural components, and use separate silt loadings for each. For their urban local roads, they are using the statewide default value. For their rural local roads, they are using the average of the nationwide AP-42 local road silt loadings, which is higher than the ARB default values. Also, the South Coast Air Quality Management District uses slightly different silt loadings for major roads, collectors, and locals, because they took the median rather than the average of the original MRI silt loading values. The silt values South Coast used are shown in Appendix C, Table C-3.

Table B-2. California Default Paved Road Silt Loading Values

Road Type	Silt Loading (g/m^2)	Comments
Freeway	0.02	U.S. EPA default value.
Major	0.035	Average of 12 California BACM samples. High ADT roads.
Collector	0.32	Average of 11 California BACM samples. Low ADT roads.
Local	0.32	Average of 11 California BACM samples. Low ADT roads.
SJV Local Rural	1.6	Average of AP-42 local roads

TABLE 8-3
ROADWAY SILT LOADINGS MEASURED BY MRI

Location	Silt Loading (g/m^2)	Total Loading (g/m^2)
South Coast		
Low ADT - Maple, Simmons, Willowwood, Struck	0.064	0.9
Low ADT - Maple, Simmons, Willowwood, Struck during April	0.184	1.49
High ADT - Crown Canyon, Golden Lantern, Moulton, Alicia	0.015	0.13
High ADT - Crown Canyon, Golden Lantern, Moulton, Alicia during April	0.012	0.091
Orange County (C-5) Low ADT - Stewart, Walnut, Varsity, Palm	0.17	1.9
Orange County High ADT - Glassel, Katella, Main, Garden Grove	0.011	0.21
San Fernando Low ADT - Noble, Orion, Tupper, Glenhill	0.14	2.24
San Fernando High ADT - Nordhoff, Plummer, Woodman, Devonshire	0.046	0.69
Bakersfield		
Low ADT - Calloway, Seabeck, Pacheco, Winter Ridge	0.19	0.99
Low ADT - Calloway, Seabeck, Pacheco, Winter Ridge during April	0.52	1.03
High ADT - H, Planz, Stine, Ashe	0.015	0.56
High ADT - H, Planz, Stine, Ashe during April	0.054	0.65
Northeast Residential Low ADT - St. Marys, Rampart, Wendy, Oakridge	0.94	16.5
Northeast Residential High ADT - Columbus, Fairfax, Panorama, Mt. Vernon	0.051	0.43
Industrial Low ADT - Inyo, Kentucky, Lincon, Chico	0.41	8.94
Industrial High ADT - Truxon, Baker, Bernard, Monterey	0.039	0.38
Coachella Valley		
Low ADT - Miles, Dune Palms, Westward Ho, Desert Stream	0.42	4.27
Low ADT - Miles, Dune Palms, Westward Ho, Desert Stream during April	2.04	22.4
High ADT - Dina Shore, Ramon, Gene Autry, Sunrise	0.037	1.73
High ADT - Dina Shore, Ramon, Gene Autry, Sunrise during April	0.027	0.55
City of Coachella Low ADT - Frederick, Westerfield, Tripoli, Cypress	0.35	6.28
City of Coachella High ADT - Harrison, 52nd, Grapefruit, 50th	0.082	1.49
Palm Desert Low ADT - Desert Lily, Rutledge, Merle, Deep Canyon	0.2	3.07
Palm Desert High ADT - Fred Waring, Monterey, Country Club, El Paso	0.03	0.87
Las Vegas		
Low ADT - Spring Mountain, Poineer, Desert Inn, Odette	0.097	1.46
Low ADT - Spring Mountain, Poineer, Desert Inn, Odette during April	0.084	1.68
High ADT - Rainbow, Jones, Tropicana, Charleston	0.033	0.9
High ADT - Rainbow, Jones, Tropicana, Charleston during April	0.052	1.88
Residential Low ADT - Edison, Phoenix, Surrey, Boca Grande	1.27	14.2
Residential High ADT - Russel, Sandhill, Pecos, Desert Inn	0.029	1.2
Industrial Low ADT - Hermon, Ali Baba, Saddletree, Red Oak	0.28	4.74
Industrial High ADT - Western, S. Highland, Industrial, Valley View	0.2	7.19

AP-42 SILT LOADINGS

The Fifth Edition of AP-42 includes a extensive tabulation of available silt loading data which was used in the derivation of the AP-42 paved road dust emission factor (Section 13.2.1, Table 13.2.1-3). The table in AP-42 includes 205 measured silt loading values. About two-thirds of these samples are from Montana, which tend to show much higher average silt loadings than was measured in other states. The remaining loading samples are from Colorado, Utah, Nevada, Arizona, Missouri, Kansas, and Illinois. As shown previously in Table B-1, the average silt loadings vary drastically if the Montana data are excluded.

AP-42 stongly recommends using local silt loading data where available. In the absence of local data, AP-42 provides default silt loading values which correspond to the 50th and 90th percentile values of the silt loading data set. The 90th percentile values are displayed in Table B-1, but note that these values do incorporate the high Montana data, so they may not be representative of most regions.

To illustrate the variability of the AP-42 silt loading data set, Figure B-3 plots silt loading against the estimated average daily travel (ADT) for the sampled roadway. The plot clearly supports the statement in AP-42 that there is not a readily identifiable, coherent relationship bewteen silt loading and ADT, although there does tend to be a trend towards less silt with higher ADT. Grouping the samples by road type also does not show any obvious correlations. This is not surprising. The samples were collected in very different regions at different times of the year using sometimes inconsistent methods. Viewing the data compiled for AP-42 data, it is reassuring to note the relative consistency in the California 1995 silt loading measurements shown previously in Figures B-1 and B-2.

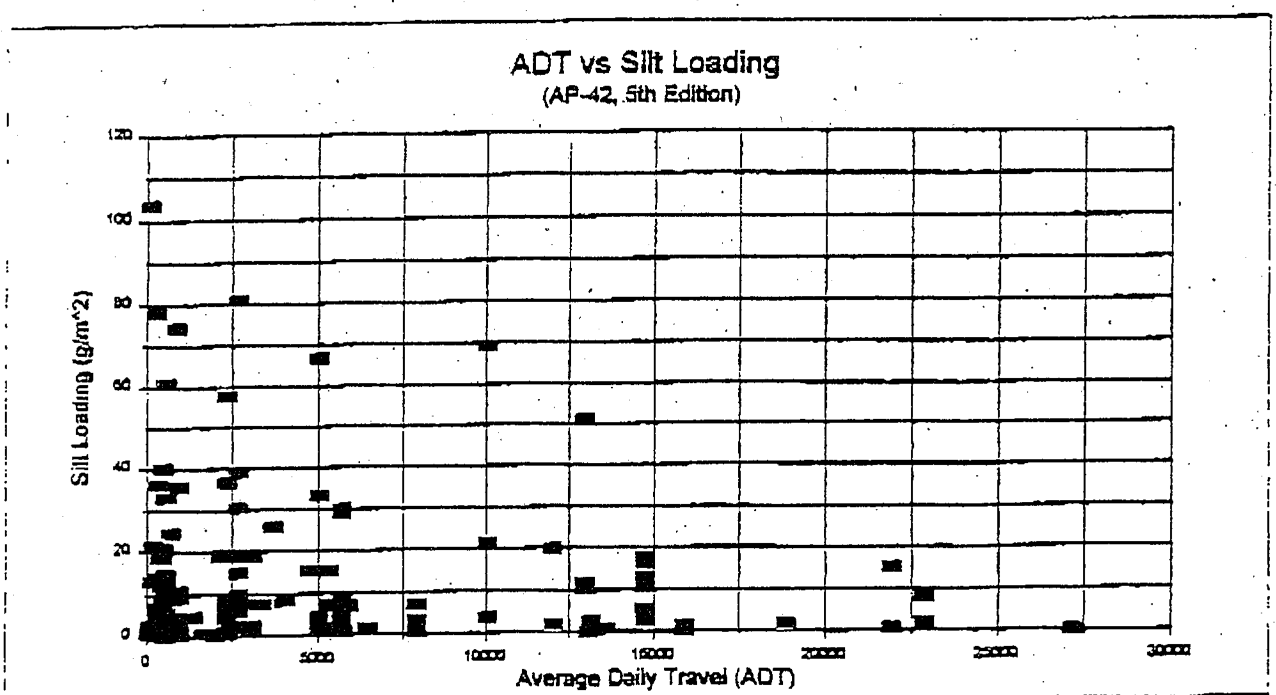

FIGURE B-3. AP-42 SILT LOADING VS AVERAGE DAILY TRAVEL

In addition to the California BACM/MRI regional silt loadings, AP-42, and the loadings compiled in Table B-2, some other silt loading measurements were performed by the following agencies:

- Washoe County Air Quality Management Division - Performed a year of roadway sampling on local, collector, major/minor roads, and a freeway in the Reno area during 1995 and 1996.
- Maricopa Association of Governments - Contract by Harding Lawson Associates to develop improved paved road emission factors in Phoenix area (silt loadings measured, but not provided in report). March 1996.

The loadings measured in these areas may be applicable to some regions, but, as with the AP-42 silt loadings, they are not used in California because of the availability of California specific silt loading data.