# ROAD CONSTRUCTION

***a. Source Category Description***

Emissions from road construction activity are a function of the acreage disturbed for road construction. Road construction activity is developed from data obtained from the Federal Highway Administration (FHWA).

For this category, the following SCC was assigned:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Source Classification Code** | **SCC Level One** | **SCC Level Two** | **SCC Level Three** | **SCC Level Four** |
| 2311030000 | Industrial Processes | Construction: SIC 15 - 17 | Road Construction | Total |

## b. Activity Data

The Federal Highway Administration has *Highway Statistics, Section IV - Highway Finance, Table SF-12A, State Highway Agency Capital Outlay1* for 2008 which outlines spending by state in several different categories. For this SCC, the following columns are used: New Construction, Relocation, Added Capacity, Major Widening, and Minor Widening. These columns are also differentiated according to the following six classifications:

1. Interstate, urban

2. Interstate, rural

3. Other arterial, urban

4. Other arterial, rural

5. Collectors, urban

6. Collectors, rural

The State expenditure data are then converted to new miles of road constructed using $/mile conversions obtained from the North Carolina Department of Transportation (NCDOT) in 2000. A conversion of $4 million/mile is applied to the interstate expenditures. For expenditures on other arterial and collectors, a conversion factor of $1.9 million/mile is applied, which corresponds to all other projects.

The new miles of road constructed are used to estimate the acreage disturbed due to road construction. The total area disturbed in each state is calculated by converting the new miles of road constructed to acres using an acres disturbed/mile conversion factor for each road type as given in the table below:

### Table 1: Spending per Mile and Acres Disturbed per Mile by Highway Type

|  |  |  |  |
| --- | --- | --- | --- |
| Road Type | Thousand Dollars per mile | Total Affected Roadway Width (ft)\*3 | Acres Disturbed per mile3 |
| Urban Areas, Interstate | 4,000 | 125 | 15.2 |
| Rural Areas, Interstate | 4,000 | 125 | 15.2 |
| Urban Areas, Other Arterials | 1,900 | 125 | 15.2 |
| Rural Areas, Other Arterials | 1,900 | 105 | 12.7 |
| Urban Areas, Collectors | 1,900 | 81 | 9.8 |
| Rural Areas, Collectors | 1,900 | 65 | 7.9 |
| \*Total Affected Roadway Width = (lane width (12 ft) \* number of lanes) + (shoulder width \* number of shoulders) + area affected beyond road width (25 ft) | | | |

The acres disturbed per mile data shown in Table 1 is calculated by multiplying the total affected roadway width (including all lanes, shoulders, and areas affected beyond the road width) by one mile and converting the resulting land area to acres. Building permits2 are used to allocate the state-level acres disturbed by road construction to the county. A ratio of the number of building starts in each county to the total number of building starts in each state is applied to the state-level acres disturbed to estimate the total number of acres disturbed by road construction in each county.

## c. Emission Factors

Initial PM10 emissions from construction of roads are calculated using an emission factor of 0.42 tons/acre-month.3 This emission factor represents the large amount of dirt moved during the construction of roadways, reflecting the high level of cut and fill activity that occurs at road construction sites. The duration of construction activity for road construction is assumed to be 12 months.

Regional variances in construction emissions are corrected using soil moisture level and silt content. These correction parameters are applied to initial PM10 emissions from road construction to develop the final emissions inventory.

To account for the soil moisture level, the PM10 emissions are weighted using the 30-year average precipitation-evaporation (PE) values from Thornthwaite’s PE Index. Average precipitation evaporation values for each State were estimated based on PE values for specific climatic divisions within a State.3

To account for the silt content, the PM10 emissions are weighted using average silt content for each county. A data base containing county-level dry silt values was complied. These values were derived by applying a correction factor developed by the California Air Resources Board to convert wet silt values to dry silt values.4

The equation for PM10 emissions corrected for soil moisture and silt content is:



where: Corrected EPM10 = PM10 emissions corrected for soil moisture and silt content,

PE = precipitation-evaporation value for each State,

S = % dry silt content in soil for area being inventoried.

Once PM10 adjustments have been made, PM2.5 emissions are set to 10% of PM10. Primary PM emissions are equal to filterable emissions since there are no condensible emissions from road construction.

## d. Example Calculation

EmissionsPM10 = ∑(HDrt x MCrt x ACrt) x (HSCounty / HSState) x EFAdj x M

Where HDrt = Highway Spending for a specific road type

MCrt = Mileage conversion for a specific road type

ACrt = Acreage conversion for a specific road type

HSCounty = Housing Starts in a given county

HSState = Housing Starts in a given State

EFAdj = Adjusted PM10 Emission Factor

M = duration of construction activity

As an example in 2010, in Newport County, Rhode Island, acres disturbed and PM10 emissions from urban interstate and urban other arterial road construction are calculated as follows:

EmissionsPM10 = ∑(HDrt x MCrt x ACrt) x (HSCounty / HSState) x EFAdj x M

= ($35,474/$4,000/mi x 15.2 acres/mi) \* (187/1058) + ($21,332/$1,600/mi x 15.2 acres/mi) \* (187/1058)

= 54 acres x 0.28ton/acre-month x 12 months

= 181.4 tons PM10

Where EFAdj is calculated as follows:

EFAdj = 0.42 ton/acre-month \* (24/110.1 \* 33/9)

= 0.28 ton/acre-month

## e. References

1. [2008 Highway Spending](https://www.fhwa.dot.gov/policyinformation/statistics/2008/sf12a.cfm)
2. [2008 Building Permits data](https://www.census.gov/construction/bps/) from US Census “BPS01”.
3. Midwest Research Institute. Improvement of Specific Emission Factors (BACM Project No. 1). Prepared for South Coast Air Quality Management District. March 29, 1996.
4. Campbell, 1996: Campbell, S.G., D.R. Shimp, and S.R. Francis. *Spatial Distribution of PM-10 Emissions from Agricultural Tilling in the San Joaquin Valley*, pp. 119-127 in Geographic Information Systems in Environmental Resources Management, Air and Waste Management Association, Reno, NV. 1996.