# 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’s *Highway Statistics, State Highway Agency Capital Outlay 2014, Table SF-12A, 1* 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 Florida Department of Transportation (FLDOT) in 2014.2 A conversion of $6.8 million/mile is applied to the urban interstate expenditures and a conversion of $3.8 million/mile is applied to the rural interstate expenditures. For expenditures on other urban arterial and collectors, a conversion factor of $4.1 million/mile is applied, which corresponds to all other projects. For expenditures on other rural arterial and collectors, a conversion factor of $2.1 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 | 6,895 | 94 | 11.4 |
| Rural Areas, Interstate | 3,810 | 89 | 10.8 |
| Urban Areas, Other Arterials | 4,112 | 63 | 7.6 |
| Rural Areas, Other Arterials | 2,076 | 55 | 6.6 |
| Urban Areas, Collectors | 4,112 | 63 | 7.6 |
| Rural Areas, Collectors | 2,076 | 55 | 6.6 |
| \*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 are 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 permits3 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.4 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.4

To account for the silt content, the PM10 emissions are weighted using average silt content for each county. EPA used the National Cooperative Soil Survey Microsoft Access Soil Characterization Database to develop county-level, average silt content values for surface soil.5 This database contains the most commonly requested data from the National Cooperative Soil Survey Laboratories including data from the Kellogg Soil Survey Laboratory and cooperating universities.

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 2014, in Newport County, Rhode Island, acres disturbed and PM10 emissions from urban interstate, urban other arterial, and urban collector road construction are calculated as follows:

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

= ($14,255/$6,895/mi x 11.4 acres/mi) \* (185/952) + ($1,304/$4,112/mi x 7.6 acres/mi) \* (185/952) + ($7,144/$4,112/mi x 7.6 acres/mi) \* (185/952) x EFAdj x M

= 7.59 acres x 0.35 ton/acre-month x 12 months

= 32.06 tons PM10

Where EFAdj is calculated as follows:

EFAdj = 0.42 ton/acre-month \* (24/132 \* 41.45/9)

= 0.35 ton/acre-month

## e. Updates to 2011 Methodology

## The FHWA data on roadway spending were updated to 2014. The data source for $/mile, total affected roadway width, and acres disturbed per mile for new road construction for interstate, other arterials, and collector roads was changed from the North Carolina DOT 2000 data, used in the 2011 methodology, to the 2014 Florida DOT data.

***f. Puerto Rico and US Virgin Islands Emissions Calculations***

Since insufficient data exists to calculate emissions for the counties in Puerto Rico and the US Virgin Islands, emissions are based on two proxy counties in Florida: 12011, Broward County for Puerto Rico and 12087, Monroe County for the US Virgin Islands. The total emissions in tons for these two Florida counties are divided by their respective populations creating a tons per capita emission factor. For each Puerto Rico and US Virgin Island county, the tons per capita emission factor is multiplied by the county population (from the same year as the inventory’s activity data) which served as the activity data. In these cases, the throughput (activity data) unit and the emissions denominator unit are “EACH”.

## g. References

1. Federal Highway Administration, [2014 Highway Spending](https://www.fhwa.dot.gov/policyinformation/statistics/2014/sf12a.cfm), (accessed May 2019).
2. [Florida DOT Generic Cost Per Mile Models for 2014](https://ftp.fdot.gov/public/file/ze-JhsHT0ku2YmntigTtIQ/Summary.pdf), (accessed May 2019).
3. Annual Housing Units Authorized by Building Permits CO2014A, purchased from US Department of Census, September 2015.
4. Midwest Research Institute. Improvement of Specific Emission Factors (BACM Project No. 1). Prepared for South Coast Air Quality Management District. March 29, 1996.
5. U.S. Department of Agriculture, National Cooperative Soil Survey, [NCSS Microsoft Access Soil Characterization Database](https://ncsslabdatamart.sc.egov.usda.gov/), (accessed May 2019).