

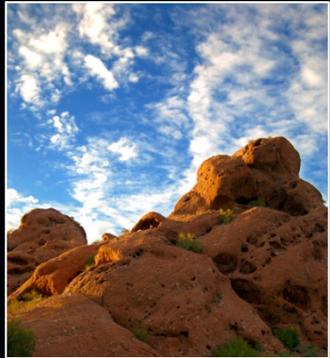
# Overview of CMAQ Air Quality Evaluation for Street Sweepers



**MAG Street Committee**  
**September 13, 2016**

# FHWA Congestion Mitigation and Air Quality (CMAQ) Program

ENVIRONMENTAL  
PROGRAMS

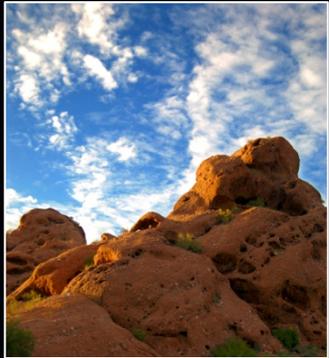


- CMAQ Program continued under the Fixing America's Surface Transportation Act
- Purpose: To fund transportation projects and programs that will contribute to attainment or maintenance of the federal air quality standards for ozone, carbon monoxide, and particulate matter (PM-10, PM-2.5)
- FAST Act continues requirement for MPOs to give priority to cost-effective projects

# FHWA Guidance Overview

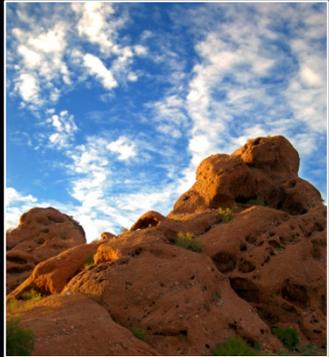
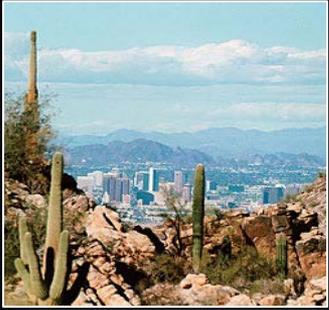
## ENVIRONMENTAL PROGRAMS

- **FHWA published Interim Program Guidance – November 12, 2013**
  - **Eligible activities include purchasing street sweeping equipment**
  - **Proposals for CMAQ funding should include a precise description of the project (e.g. information on its size, scope, location, and timetable.)**
  - **Assessment of the project's expected emission reduction benefits and cost-effectiveness should be completed prior to project selection to better inform the selection of CMAQ projects**



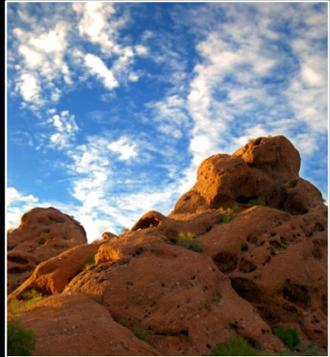
# MAG CMAQ Methodologies

- **MAG CMAQ Methodologies**, first published in 1999, was last updated in September 2011
  - Quantifies proposed project emission reductions in kilograms per day
  - Cost-effectiveness for project in dollars per metric ton of emissions reduced annually
  - Available at:  
[http://www.azmag.gov/Documents/CMAQ\\_2011-04-05\\_Final-CMAQ-Methodologies\\_3-31-2011.pdf](http://www.azmag.gov/Documents/CMAQ_2011-04-05_Final-CMAQ-Methodologies_3-31-2011.pdf)



# MAG CMAQ Methodologies

ENVIRONMENTAL  
PROGRAMS



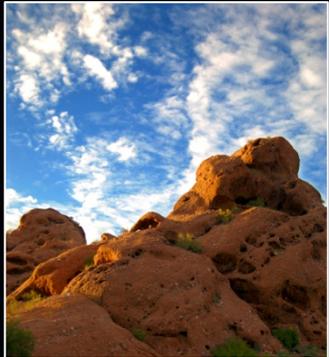
- Calculates CO, TOG, NO<sub>x</sub>, and PM emission reductions in kilograms per day
- Applies seasonal factors and weights to the emissions reduced for each pollutant
- Converts emission reductions to metric tons per year
- Amortizes CMAQ cost over the life of the project, assuming a 3 percent annual discount rate
- Divides the annualized CMAQ cost by the annual emissions reduction to obtain cost-effectiveness (in dollars per metric ton)



ENVIRONMENTAL  
PROGRAMS

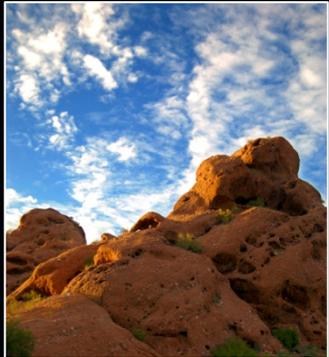
# Street Sweeper Projects

- **Emission reductions from reducing PM-10 reentrained by vehicles on paved roads**
  - **Replace an older sweeper not on the list of Certified Street Sweepers under South Coast AQMD Rule 1186**
  - **Replace an older certified sweeper that:**
    - **At least eight years old**
    - **Recorded 12,000 hours in service**
    - **96,000 miles of operation**
  - **Increase the frequency of sweeping**
  - **Expand the area swept**
  - **Any combination of the above**



# Street Sweeper Projects

- **Project application provides inputs to the emission reduction calculation**
  - CMAQ funding requested
  - Sweeping cycle length measured in days between sweeping by road type to be swept (e.g. arterial, collector, residential) or other
  - Number of lane miles to be swept per cycle by road type
  - Average weekday traffic on streets by road type
  - If expanding service area, specify unswept lane miles to be swept
  - If increasing sweeping frequency, specify previous cycle length
  - If replacing an older certified sweeper, an estimate of the percent of time the older sweeper was out of service due to repairs
  - Indicate whether the project is located in the Salt River Area, or if the project is within 4 miles of a PM-10 monitor



## ENVIRONMENTAL PROGRAMS

# Street Sweeper Example Calculation

$$CEF = \frac{0.21 + 0.24 + 0.26 + 0.29 + 0.31 + 0.34 + (8 * 0.35)}{14} = 0.318$$

$$PEF = \frac{0.10 + 0.14 + 0.17 + 0.21 + 0.23 + 0.26 + 0.29 + 0.31 + 0.34 + (5 * 0.35)}{14} = 0.271$$

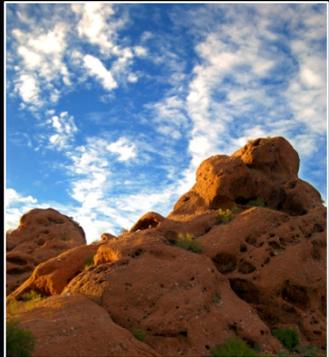
$$\text{Daily Emissions Reduction for Reentrainment} = 2 * 200 * (5,000 * 0.93) * (0.318 - 0.271) * \frac{1}{1000} = 87.42 \frac{\text{kilograms}}{\text{day}}$$

$$\text{Daily Emissions Reduction for the Sweeping Process} = 2 * \frac{200}{14} * 0.023 = 0.66 \frac{\text{kilograms}}{\text{day}}$$

$$\text{Total Daily Emissions Reduction} = 87.42 + 0.66 = 88.08 \frac{\text{kilograms}}{\text{day}}$$

$$CRF = \frac{(1+0.03)^8 * (0.03)}{(1+0.03)^8 - 1} = 0.1425$$

$$\text{Cost-Effectiveness} = \frac{0.1425 * 135,000 * 1000}{88.08 * 365} = 598 \frac{\text{dollars}}{\text{metric ton}}$$





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ASSOCIATION of  
GOVERNMENTS**



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