Overview of CMAQ Air Quality Evaluation for Bicycle and Pedestrian Projects

MAG Bicycle and Pedestrian Committee
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FHWA Congestion Mitigation and Air Quality (CMAQ) Program

- Moving Ahead for Progress in the 21st Century Act reauthorized the CMAQ Program
- 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)
- MAP-21 continues requirement for MPOs to give priority to cost-effective projects

FHWA Guidance Overview

- **FHWA published Interim Program Guidance – November 12, 2013**
  - **Eligible Bicycle and Pedestrian Facilities and Programs activities include:** constructing paths, bike racks, support facilities, etc. that are not exclusively recreational and reduce vehicle trips; outreach related to safe bicycle use; funding state coordinator position
  - **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**

ENVIRONMENTAL PROGRAMS

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**

MAG CMAQ Methodologies

ENVIRONMENTAL PROGRAMS

- **Emissions benefit calculations**
  - Reductions in carbon monoxide (CO), total organic gases (TOG), nitrogen oxides (NOx), and particulate matter (PM) emissions in kilograms per day
  - Apply EPA-approved emissions model MOVES2014 and EPA AP-42 equations for reentrained dust from paved and unpaved roads to obtain emission rates
  - Emission rates are calculated for the first year that the project is implemented

ENVIRONMENTAL PROGRAMS

MAG CMAQ Methodologies

- **Emissions benefit calculations**
  - **Seasonal adjustments**
    - **The CO emission rate is divided by four to represent the 3-month winter season**
    - **The TOG and NOx emission rates are divided by two to reflect the 6-month ozone season**
    - **PM is not adjusted seasonally, because violations can occur at any time of year**
  - **Priority weights**
    - **The CO weight is set to zero, since the CO standard has been attained**
    - **The weights for TOG, NOx, and PM are set to one**

ENVIRONMENTAL PROGRAMS

MAG CMAQ Methodologies

- Calculates CO, TOG, NOx, 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

Bicycle and Pedestrian Projects

- Emission reductions occur when bicycle and pedestrian trips replace vehicle trips
- Project application provides inputs to the emission reduction calculation
  - CMAQ funding requested
  - Average weekday traffic on the nearest parallel arterial
  - Number of activity centers within ¼ and ½ mile of the project
  - Length of project (for a bridge/underpass, the combined length of the paths connected)
  - If shoulder paving is part of the project, whether the project is located within 4 miles of a PM-10 monitor

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Bicycle Lane Example Calculation

$$\textit{Vehicles Reduced } (\boldsymbol{VR}) = 16{,}740 * (0.0020 + 0.0015) = 59 \ \frac{vehicles}{day}$$

$$\textit{VMT Reduced } (\boldsymbol{VMTR}) = 59 * 4.0 = 236 \ \frac{vehicle-miles}{day}$$

$$\textit{Daily Emissions Reduction for Bike Lane} = [59 * (\frac{0.0*4.16}{4} + \frac{1.0*0.48}{2} + \frac{1.0*0.26}{2} + (1.0*0.004)] +$$

$$[236 * (\frac{0.0*2.04}{4} + \frac{1.0*0.13}{2} + \frac{1.0*0.42}{2} + (1.0*(0.04+0.35))] * \frac{1}{1000} = 0.18 \ \frac{kilograms}{day}$$

Bicycle Lane Example Calculation

ENVIRONMENTAL PROGRAMS

$$\textit{Daily Emissions Reduction for Paving Shoulder} = (1.0 * 0.27 * 16{,}740 * 1.5) * \frac{1}{1000} = 6.78 \ \frac{\textit{kilograms}}{\textit{day}}$$

$$\textit{Total Daily Emissions Reduction} = 0.18 + 6.78 = 6.96 \ \frac{\textit{kilograms}}{\textit{day}}$$

$$\textit{Capital Recovery Factor } (\textbf{\textit{CRF}}) = \frac{(1+0.03)^{20} * (0.03)}{(1+0.03)^{20} - 1} = 0.0672$$

$$\textit{Cost-Effectiveness} = \frac{0.0672 * 585{,}000 * 1000}{6.96 * 365} = 15{,}475 \ \frac{\textit{dollars}}{\textit{metric ton}}$$

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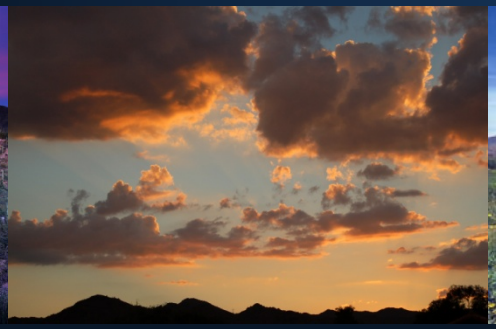


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