Computation Guidance for Congestion Mitigation and Air Quality Improvement (CMAQ) Program Total Emissions Reduction Measure

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U.S. Department of Transportation
Federal Highway Administration

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Contents

1 Overview

This document provides guidance on calculating the Total Emissions Reduction measure, as required by 23 Code of Federal Regulation (CFR) part 490. [1] This is the only measure in 23 CFR part 490 that State DOTs and MPOs are required to calculate[2] and report to the Performance Management Form (PMF).[3]

Table 1: Summary of Total Emissions Measure

Measure[4]	Data Source for Measure Computation[5]	Applicability[6]	State DOT Targets[7]	MPO Targets[8]
Total Emissions Reduction Measure	Project information from CMAQ Public Access System. Use data available **July 1** of the year the State DOT Biennial Performance Report is due.	Applicability as published in the FHWA document "Applicability Determination for CMAQ Measures" and posted on the FHWA website.	2-year and 4-year targets reported in the Baseline Performance Period Report. Any adjustments (optional) to the 4-year target are required to be reported in the Mid Performance Period Progress Report.	All applicable MPOs establish 4-year targets. Applicable MPOs with an urbanized area over 1 million within the nonattainment / maintenance area also establish 2-year targets and a CMAQ Performance Plan. Targets are reported in the System Performance Report in the Metropolitan Transportation Plan required in 23 CFR part 450 and, when applicable, in the CMAQ Performance Plan which is submitted with the State DOT Biennial Reports.

[1] 23 CFR - https://www.fhwa.dot.gov/legsregs/directives/cfr23toc.htm
[2] 23 CFR 490.811(a)
[3] The PMF is housed behind UPACS, and is used by State DOTs to meet the reporting requirements in 23 CFR 490.107. The FHWA Division Office can assist the State DOT in gaining access to the PMF.
[4] See Section 2.
[5] See Section 7.
[6] See Section 4.
[7] See Section 2 and Section 9.
[8] See Section 2, Section 5, and Section 9.

2 Total Emissions Reduction Performance Measure

The "Total Emissions Reduction" Measure is the performance measure to assess on-road mobile source emissions for the purpose of carrying out the CMAQ Program. The Total Emissions Reduction Measure is the 2-year and 4-year cumulative reported emission reductions, for all projects funded by CMAQ funds, by applicable criteria pollutant[9] and precursors[10] for which the area is designated nonattainment or maintenance.

Key terms and concepts related to the Total Emission Reduction Measure are as follow:

- **Applicability of the Total Emissions Reduction Measure** is defined in 23 CFR 490.803 and discussed in Section 4.
- **Criteria pollutants[11] and precursors[12] -** Particulate matter that have a diameter less than 2.5 micrometers ($PM_{2.5}$), particulate matter that have a diameter less than 10 micrometers (PM_{10}), carbon monoxide (CO), Volatile organic compound (VOC), and nitrogen oxide (NOx).
- **Data Requirements** for the measure are specified in 23 CFR 490.103 and 23 CFR 490.809 and discussed in Section 7.
- **Targets**

  State DOT: All applicable State DOTs[13] must establish both 2-year and 4-year[14] quantitative targets for each applicable criteria pollutant and precursors for each performance period.[15] The State DOT must establish separate statewide targets for each of the applicable criteria pollutants and precursors (PM2.5, PM10, CO, VOC, and NOx) for which a designated nonattainment or maintenance area lay in part or whole within the state boundary.[16] These

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[9] 23 CFR 490.803(a) - Particulate matter that have a diameter less than 2.5 micrometers (PM2.5), particulate matter that have a diameter less than 10 micrometers (PM10), and carbon monoxide (CO)
[10] 23 CFR 490.803(a) - Volatile organic compound (VOC) and nitrogen oxide (NOx))
[11] 23 CFR 490.803(a) - Particulate matter that have a diameter less than 2.5 micrometers ($PM_{2.5}$), particulate matter that have a diameter less than 10 micrometers (PM_{10}), and carbon monoxide (CO)
[12] 23 CFR 490.803(a) - Volatile organic compound (VOC) and nitrogen oxide (NOx))
[13] 23 CFR 490.803(a) – The measure is applicable to all State DOTs and MPOs with projects financed with funds from the 23 U.S.C. 149 CMAQ program apportioned to State DOTs for areas designated as nonattainment or maintenance in State geographic boundaries for ozone (O_3), carbon monoxide (CO), or particulate matter (PM_{10} and $PM_{2.5}$) National Ambient Air Quality Standards (NAAQS).
[14] 23 CFR 105(e)(4)(iv) & (iii)
[15] "Performance period", as defined in 23 CFR 490.101, is a 4-year time period during which condition/performance is measured and evaluated to assess condition/performance and track progress toward the achievement of the targets. The first performance period for Total Emissions Reduction Measure starts on October 1, 2017 and ends on September 30, 2021. Please see 23 CFR 490.105(e)(4)(i)(B).
[16] 23 CFR 490.807 - The "Total Emissions Reduction" performance measure is the 2-year and 4-year cumulative reported emission reductions, for all projects funded by CMAQ funds, of each criteria pollutant and applicable

State DOTs are required to submit their established targets in their Biennial Performance Reports, as specified in 23 CFR 490.107.

In addition, State DOTs have the option to establish additional targets for any number and combination of nonattainment and maintenance areas by applicable criteria pollutant within the geographic boundary of the State.[17] If a State DOT establishes additional targets, it must report such additional targets in the Biennial Performance Period Report. State DOTs are required to evaluate separately the progress of each of these additional targets and report that progress to FHWA.[18]

MPO: Any MPO containing any part of a nonattainment or maintenance area for the applicable criteria pollutants within its metropolitan planning area must establish 4-year targets for each of the applicable criteria pollutants and precursors ($PM_{2.5}$, PM_{10}, CO, VOC, and NOx) for its metropolitan planning area.[19]

If any part of a designated nonattainment and maintenance area within the metropolitan planning area overlaps the boundary of an urbanized area with more than 1 million in population, as of 1 year before the State DOT Baseline Performance Period Report is due to FHWA, then that MPO must also establish quantifiable 2-year targets for each of the applicable criteria pollutants and applicable precursors ($PM_{2.5}$, PM_{10}, CO, VOC, and NOx).[20] The population of an urbanized area is based on U.S. Census' most recent published annual population estimates available one year before the State Baseline Performance Period Report is due.[21]

When establishing targets, MPOs have the option to adopt the State DOT target, or their own quantifiable target.[22]

- **Targets for the First Performance Period –** State DOTs and MPOs must use projects in the 4 years prior to the first performance year as a basis for establishing a target for the first performance period. The projects entered into the System during the 2- and 4-year performance period will be taken as is to calculate the measure. If a State DOT or MPO felt they would not be able to meet a target, they could adjust the target at the mid-point of the performance period or explain in their final performance report why they were unable to meet their targets.[23]

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precursors (PM2.5, PM10, CO, VOC, and NOx) under the CMAQ program for which the area is designated nonattainment or maintenance.

[17] 23 CFR 490.105(e)(9)(iv)

[18] 23 CFR 490.105(e)(9)(iv)

[19] 23 CFR 490.105(f)

[20] 23 CFR 490.105(f)(6)(iii)

[21] 23 CFR 490.105(f)(6)(iii)

[22] 23 CFR 490.105(f)(3)

[23] 82 FR 6014

3 Performance Period

The performance period for the Total Emissions Reduction Measure is different from the other measures in 23 CFR part 490. For this measure only, the performance period begins at the start of the Federal fiscal year (FY), on October 1st of the year before the State DOT Baseline Performance Period Report is due to FHWA, and extends for a duration of 4 Federal fiscal years.[24] For example, the first Performance Period starts on October 1, 2017 and ends on September 30, 2021 (i.e., FY2018 through FY2021), and the second Performance Period starts on October 1, 2021 and ends on September 30, 2025 (i.e., FY2022 through FY2025).

4 Applicability to States and MPOs

The Total Emissions Reduction Measure is applicable to all State DOTs and MPOs with projects financed with funds from the 23 U.S.C. 149 CMAQ program apportioned to State DOTs for areas designated as nonattainment or maintenance for ozone (O_3), carbon monoxide (CO), or particulate matter (PM_{10} and $PM_{2.5}$) National Ambient Air Quality Standards (NAAQS).[25] This performance measure does not apply to State DOTs and MPOs that do not contain any portions of nonattainment or maintenance areas for the criteria pollutants. Applicability should be checked by each MPO and State DOT one year before the Baseline and Mid Biennial Performance Reports are due. The FHWA will determine applicability and publish it on the FHWA website in a document titled, "Applicability Determination for CMAQ Measures".[26]

5 MPO CMAQ Performance Plan

If any part of a designated nonattainment and maintenance area within the metropolitan planning area overlaps the boundary of an urbanized area with a population more than 1 million in population, then that MPO must establish both 2-year and 4-year quantifiable targets for its metropolitan planning area, and must prepare a CMAQ Performance Plan.[27] The CMAQ Performance Plan will contain the targets specific to the MPO, and must address all requirements in 23 U.S.C. 149(l) and 23 CFR 490.107(c)(3). Guidance on the CMAQ Performance Plan is available on the FHWA website (https://www.fhwa.dot.gov/environment/air_quality/cmaq/measures/).

[24] 23 CFR 490.105(e)(4)(i)(B)
[25] 23 CFR 490.803
[26] https://www.fhwa.dot.gov/environment/air_quality/cmaq/measures/cmaq_applicability/index.cfm
[27] 23 CFR 490.105(f)(6)(iii) and 23 CFR 490.107(c)(3)

Each applicable MPO must provide their CMAQ Performance Plan to the State DOT for submittal with the State DOT's Biennial Performance Report. [28]

6 Measure Computation Methodology

The Total Emission Reductions measure for each of the applicable criteria pollutants or precursors for all projects reported to the CMAQ Public Access System must be calculated to the nearest one thousandths,[29] as follows:

$$Total\ Emission\ Reduction_p = \sum_{i=1}^{T} Daily\ Kilograms\ of\ Emission\ Reductions_{p,i}$$

Where:

i = applicable projects reported in the CMAQ Public Access System for the first 2 Federal fiscal years of a performance period and for the entire performance period, as described in in § 490.105(e)(4)(i)(B);

p = criteria pollutant or applicable precursor: PM2.5, PM10, CO, VOC, or NOx;

Daily Kilograms of Emission Reductions$_{p,\,i}$ = total daily kilograms, to the nearest one thousandths, of reduced emissions for a criteria pollutant or an applicable precursor "p" in the in the first year the project is obligated;

T = total number of applicable projects reported to the CMAQ Public Access System for the first 2 Federal fiscal years of a performance period and for the entire performance period, as described in § 490.105(e)(4)(i)(B); and

Total Emission Reduction$_p$= cumulative reductions in emissions over 2 and 4 Federal fiscal years, total daily kilograms, to the nearest one thousandths, of reduced emissions for criteria pollutant or precursor "p."

This equation means that the cumulative emission reductions (kg/day) for all CMAQ funded projects reported to the CMAQ Public Access System are summed over 2 and 4 Federal fiscal years for each of the applicable criteria pollutants or precursors within the applicable area.

[28] 23 CFR 490.107(b)(1)(ii)(G)
[29] 23 CFR 490.811

Applicable pollutants or precursors include Nitrogen Oxides (NOx), Volatile Organic Compounds (VOCs), Carbon monoxide (CO), Particulate Matter (PM10 and PM2.5).

7 Data Source for Measure Computation

The Total Emission Reduction measure must be calculated using data from the CMAQ Public Access System (PAS).[30] The CMAQ Public Access System includes: (1) individual CMAQ funded projects; (2) the applicable State DOT and MPO; and (3) the emissions reductions estimated for each CMAQ funded project for each of the applicable criteria pollutants and their precursors for which the project area is nonattainment or maintenance. While State DOTs and MPOs are required to use data from the CMAQ PAS, the method to extract the correct data is not prescribed.

To calculate the measure and report on their performance, State DOTs and MPOs will need to extract project data from the CMAQ Public Access System on or after July 1 of each even year.[31] For the first performance period State DOTs and MPOs will extract the following data:

- On or after July 1, 2018, they will extract data for projects obligated in FY14 through FY17 to report baseline performance and to aid in target setting.
- On or after July 1 2020, they will extract data for FY18 and FY19 to calculate the 2-year performance.[32]
- On or after July 1, 2022, they will extract data for FY18 through FY21 to calculate 4-year performance.[33]

7.1 CMAQ TPM Emissions Measure Report

The FHWA has created a feature in the CMAQ Public Access System called the "CMAQ TPM Emissions Measure Report" to help State DOTs and MPOs gather the data needed to calculate the measure. The description below is for utilization of this feature.

1. Visit https://fhwaapps.fhwa.dot.gov/cmaq_pub/ and navigate to the Report tab.

2. Select the "CMAQ TPM Emissions Measure Report - State" for the State report or "CMAQ TPM Emissions Measure Report – MPO" for an MPO report, select the state or MPO respectively and the applicable project year(s).[34] The report can be provided in PDF and

30 23 CFR 490.811
31 23 CFR 490.809(b)(2)
32 23 CFR 490.105(e)(4)(i)(B)
33 23 CFR 490.105(e)(4)(i)(B)
34 The project years shown in the CMAQ Public Access System are all Federal fiscal years

excel format. The Report will reflect the projects reported in the Public Access System for those years in nonattainment and maintenance areas within the state or MPO respectively.

8 FAQs For Calculating the Measure

Q1. How does a State DOT or MPO account for project emissions within its boundary if the projects is regional in nature, e.g., crosses multiple state or MPO boundaries?

When entering emissions reductions as part of the annual CMAQ project reporting process, State DOTs should use the best professional practices to capture the appropriate emissions reductions associated with the nonattainment or maintenance areas.

Q2. Which projects should a State DOT or MPO include when calculating the Total Emissions Reduction measure?

The State DOT or MPO will use those projects listed in the CMAQ Public Access System that are within the portion of the nonattainment or maintenance area(s) that overlaps the relevant boundary (either state boundary or metropolitan planning area). State DOTs and MPOs may include projects funded with "flexible" CMAQ funds as long as the project is within the nonattainment or maintenance area and shows emissions reductions.

Q3. What if both ozone and PM2.5 nonattainment areas are contained within a State boundary or metropolitan planning area? Does the State DOT / MPO submit one NOx target, or two?

The State DOT or MPO will submit one NOx target, and one NOx measure will be reported for performance that covers either ozone, or PM2.5, or both if applicable to the area.

Q4. Are non-CMAQ funded projects that have emissions benefits included in the calculation?

No. Only CMAQ funded projects are included in the calculation for the Total Emissions Reduction measure.

Q5. What if a project has benefits every year for 3 years, but the database shows all the benefits in only one year?

The same annual reporting process used to report the emissions reductions of CMAQ-funded projects will continue, as discussed in the CMAQ Interim Program Guidance.[35] Emissions reductions are estimated for the year that the project will be fully operational. Those estimated reductions are then reported during the annual CMAQ reporting process in the year that the project is obligated. While it is true that emissions

[35] See Section IX.C of the CMAQ guidance
https://www.fhwa.dot.gov/environment/air_quality/cmaq/policy_and_guidance/2013_guidance/cmaq2013.pdf

may be continual over a multi-year program, emissions are only reported once to avoid double counting of benefits. This is consistent over time and projects. State DOTs and MPOs should consider this process when setting targets and adapt accordingly.

Q6. If the State DOT or MPO does not like the emission reductions recorded in the CMAQ Public Access System, can the emissions reductions be recalculated and those numbers used?

No. The data in the CMAQ Public Access System must be used to calculate the Total Emissions Reduction measure and the baseline condition.[36] State DOTs and MPOs can take into consideration any concerns they have with the data when setting targets.

The PMF reporting portal provides space for State DOTs to add qualitative discussion of issues, such as those related to emissions estimates. The MPOs preparing CMAQ Performance Plans can also add explanatory language in the description section, if so desired.

9 Reporting on the Total Emissions Reduction Measure

State DOT targets and performance must be reported to FHWA by October 1, 2018, and every two years thereafter.[37] These are called Biennial Performance Reports. State DOTs will meet the biennial reporting requirement for this measure via FHWA's online form called the Performance Management Form (PMF). The PMF is housed within UPACS. The FHWA Division Office can aid State DOTs in gaining access to UPACS and the PMF.

The MPO Targets are reported in the System Performance Report in the Metropolitan Transportation Plan required in 23 CFR part 450, and in the CMAQ Performance Plan by those MPOs required to prepare one.[38] The CMAQ Performance Plans are to be submitted to the State DOT for inclusion in the Biennial Performance Reports to FHWA.[39] See Section 5 for a discussion of the CMAQ Performance Plan.

10 Key Dates

A table listing the key dates for the first performance period are provided on the TPM website.[40] It includes the dates the performance management regulations became effective, when data must be submitted, and when various data will be extracted. State DOTs, MPOs, and Division Offices can use this document to keep track of required actions and due dates.

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[36] 23 CFR 490.809
[37] 23 CFR 490.107(b)
[38] 23 CFR 490.105(f)(6)(iii) and 23 CFR 490.107(c)(3)
[39] 23 CFR 490.107(b)(1)(ii)(G)
[40] https://www.fhwa.dot.gov/tpm/rule/timeline.pdf

Appendix A – References & Acronyms Table

- American Community Survey: https://www.census.gov/programs-surveys/acs/
- CMAQ Performance Plan Guidebook: https://www.fhwa.dot.gov/environment/air_quality/cmaq/measures/performance_plan
- FHWA TPM Website : https://www.fhwa.dot.gov/tpm/
- U.S. EPA Green-book: https://www.epa.gov/green-book and https://www.epa.gov/green-book/green-book-gis-download
- FHWA CMAQ Website: https://www.fhwa.dot.gov/environment/air_quality/cmaq/

Appendix B – Acronyms Table

Acronym	Full Form
CFR	Code of Federal Regulation
CY	Calendar Year
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CO	Carbon Monoxide
FHWA	Federal Highway Administration
FR	Federal Register
FY	Federal fiscal year
HCFB	Federal Highway Administration - the Office of Budget and Finance
HEPN	Federal Highway Administration - Office of Planning, Environment, & Realty
HPMS	Highway Performance Monitoring System
HPPI	Federal Highway Administration - Office of Policy Information
MPA	Metropolitan Planning Area
MPO	Metropolitan Planning Organizations
NAAQS	National Ambient Air Quality Standards
O_3	Ozone
NOx	Nitrogen Oxides
SQL	Structural Query Language
PM_{10} and $PM_{2.5}$	Particulate Matter
SOP	Standard Operating Procedure
State DOT	State Department of Transportation
U.S.C.	United States Code
UZA	Urbanized Area
VOC	Volatile Organic Compounds