ON TO 2050 plan update air quality conformity analysis appendix

May 2022 draft

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ON TO 2050 Update and Federal Fiscal Years 2023-2028 TIP Conformity

Conformity finding

Chicago Metropolitan Agency for Planning (CMAP) staff finds that the ON TO 2050 update and the *Federal Fiscal Year 2023-2028 Transportation Improvement Program (FFY 2023-28 TIP)* conform to the State Implementation Plan (SIP) for the 8-hour Ozone National Ambient Air Quality Standards (NAAQS) based on the results of the conformity analysis.

This report makes the determination that the region's transportation plan and program satisfy all applicable criteria and procedures in the conformity regulations. The *Transportation Conformity Analysis for the 8-Hour Ozone National Ambient Air Quality Standards* documentation is the subject of a public comment period from June 10-August 13, 2022. CMAP will recognize, consider, and respond to comments received. The ON TO 2050 update and FFY 2023-2028 TIP, including this conformity determination, will be brought to the CMAP Metropolitan Planning Organization Policy Committee and Board for approval and update in accordance with federal regulations on October 12, 2022.

History of attainment status

Ozone

1997 Ozone NAAQS

Based on air quality monitoring data gathered from 1988-90, the northeastern Illinois area was designated as a "severe" nonattainment area for the 1-hour national ambient air quality standard (NAAQS) for ozone by the U.S. Environmental Protection Agency (U.S. EPA) on November 6, 1991 (56 FR 56694). The northeastern Illinois ozone nonattainment area included the counties of Cook, DuPage, Kane, Lake, McHenry, and Will, the townships of Aux Sable and Goose Lake in Grundy County, and Oswego Township in Kendall County. The Indiana counties of Lake and Porter were also included in the nonattainment area.

On April 15, 2004, U.S. EPA issued final designations of areas not attaining the 8-hour NAAQS for ozone promulgated in 1997 under the Clean Air Act (69 FR 23898). The same area of northeastern Illinois and northwestern Indiana was designated as a moderate nonattainment area under this standard. On August 13, 2012, U.S. EPA issued a final rule finding the region in attainment of this standard, approving the Illinois Environmental Protection Agency's (Illinois EPA) redesignation request, and approving and finding adequate motor vehicle emissions budgets for 2008 and 2025 for volatile organic compounds (VOC) and nitrogen oxides (NOx) for use in conformity (77 FR 48062).

2008 Ozone NAAQS

On June 11, 2012, U.S. EPA issued final designations of areas not attaining the 8-hour NAAQS for ozone promulgated in 2008 (77 FR 34221). The northeastern Illinois nonattainment area included the counties of Cook, DuPage, Kane, Lake, McHenry, and Will,

the townships of Aux Sable and Goose Lake in Grundy County, and Oswego Township in Kendall County. The Indiana counties of Lake and Porter were included in the nonattainment area, as were Pleasant Prairie and Somers townships in Kenosha County, Wisconsin. These areas were designated as marginal nonattainment, meaning that they are expected to attain the NAAQS by the attainment year of 2015. The region did not reach attainment in 2015. This resulted in the designation for the aforementioned areas to be reclassified from marginal to moderate nonattainment on May 4, 2016, by the U.S. EPA (81 FR 26697). On September 23, 2019, the region was reclassified from moderate to serious nonattainment for failing to meet the 2008 Ozone NAAQS by U.S. EPA (84 FR 44238). On March 10, 2022, a federal register notice (87 FR 13668) to approve the Illinois portion of the Chicago-Naperville, Illinois-Indiana-Wisconsin area to attainment of the 2008 ozone standard was published for public comment. While the final approval of the redesignation to attainment of the 2008 ozone NAAQS has not yet been done, it is anticipated that that will occur during the late spring or summer of 2022. On May 20, 2022, the U.S. EPA published a final rule that redesignated the Illinois Portion of the Chicago-Naperville, Illinois-Indiana-Wisconsin Area to attainment of the 2008 ozone standard and approved a revision to SIP to include a 2008 ozone maintenance SIP with a horizon year of 2035 (87 FR 30828). In the notice a revised Motor Vehicle Emissions Budget (MVEB) for 2035 and beyond of 65 tons/day of VOCs and 110 tons/day of NO_x was also included.

2015 Ozone NAAQS

On October 26, 2015, the U.S. EPA issued the final rule for the 2015 NAAQS, which strengthened the ozone standard from .075 parts per million (ppm) to .070 ppm for the 8-hour standard. On April 30, 2018, the U.S. EPA published the nonattainment area designations on its website. It designated as marginal nonattainment five counties and two partial counties in the Chicago area nonattainment area: Cook, DuPage, Kane, Lake, and Will counties, Aux Sable and Goose Lake townships in Grundy County, and Oswego Township in Kendall County. The U.S. EPA also designated as part of the nonattainment area Calumet, Hobart, North, Ross, and St. John townships in Lake County, Indiana. In Wisconsin, it designated a portion of Kenosha County bounded by the Lake Michigan shoreline on the east, the Kenosha County boundary on the north, the Kenosha County boundary on the south, and the 88th Avenue (including the entire avenue) on the west as the Wisconsin portion of the of the Chicago-Naperville, Illinois-Indiana-Wisconsin Area nonattainment area for the 2015 ozone NAAQS[1]. On June 14, 2021, U.S. EPA approved revising the initial Air Quality Designation for 14 counties and partial counties across the country including McHenry County and parts of Porter County, Indiana, and Kenosha County, Wisconsin (86 FR 31438) from attainment to nonattainment of the 2015 ozone NAAQS. This action resulted in the 2008 and 2015 having the same ozone nonattainment areas for Chicago-Naperville, Illinois-Indiana-Wisconsin. On April 13, 2022, the U.S. EPA published a notice in the federal register (87 FR 21842) of the intent to reclassify, by operation of law, the region

[1] U.S. Environmental Protection Agency, "Chicago, IL-IN-WI Nonattainment Area Final Area Designations for the 2015 Ozone National Ambient Air Quality Standards Technical Support Document (TSD)," 2018, https://www.epa.gov/sites/production/files/2018-05/documents/il_in_wi_chicago_final.pdf.

from Marginal to Moderate nonattainment area due to a failure to attain the current ozone NAAQS by August 3, 2021. As noted above, the region was redesignated as being in attainment for the 2008 ozone NAAQS. However, as shown in the redesignation approval the region has a 3-year ozone design value of .075 which is the minimum met the standard for the 2008 ozone NAAQS. A 3-year design value of .070 is required to meet the 2015 ozone NAAQS. Data from recent ozone seasons suggest that the region is highly unlikely to demonstrate attainment of the 2015 ozone NAAQS by the moderate attainment date of September 24, 2024 and will likely be bumped up to serious nonattainment at that time.

$PM_{2.5}$

Based on air quality monitoring data gathered from 2001-03, the northeastern Illinois area was designated as a "moderate" nonattainment area for the 1997 annual $PM_{2.5}$ NAAQS by the U.S. EPA on April 5, 2005 (70 FR 944). The northeastern Illinois $PM_{2.5}$ nonattainment area includes the counties of Cook, DuPage, Kane, Lake, McHenry, and Will, the townships of Aux Sable and Goose Lake in Grundy County, and Oswego Township in Kendall County. The Indiana counties of Lake and Porter are also included in the nonattainment area.

On October 2, 2013, U.S. EPA issued a final rule finding the region in attainment of the 1997 annual $PM_{2.5}$ standard, approving Illinois EPA's redesignation request, and approving and finding adequate motor vehicle emissions budgets for 2008 and 2025 for direct $PM_{2.5}$ emissions and NOx for use in conformity (78 FR 60704).

On January 15, 2012, U.S. EPA issued a final rule lowering the annual $PM_{2.5}$ NAAQS from 15.0 micrograms per cubic meter to 12.0 micrograms per cubic meter (78 FR 3086). On December 13, 2013, Illinois EPA submitted a recommendation to U.S. EPA that the same counties and townships be designated as nonattainment as have been designated for the prior $PM_{2.5}$ and ozone NAAQS. U.S. EPA's review of Illinois EPA's designation request determined that the data used to support a determination was not valid. Because the U.S. EPA could not make a determination that a violation existed, it could not make a designation for the Chicago region. The result was that Cook, DuPage, Kane, Lake, McHenry, and Will counties, Aux Sable Township and Goose Lake Township in Grundy County, and Oswego Township in Kendall County were determined to be "unclassifiable." On October 9, 2018, U.S. EPA proposed to approve a redesignation for Illinois from "unclassifiable" to "unclassifiable/attainment" (83 FR 50556). Once Illinois, specifically northeast Illinois, received a determination that the monitor data for a 3-year period was valid (as shown in the federal register notice above), it could be determined that the region met the $PM_{2.5}$ NAAQS. Since the area had already been redesignated to attainment for the 1997 annual $PM_{2.5}$ NAAQS, transportation conformity no longer applied on the effective date of the final $PM_{2.5}$ SIP requirements rule, which was October 24, 2016.[2]

[2] U.S. Environmental Protection Agency, "Transportation Conformity Guidance on the Revocation of the 1997 Annual $PM_{2.5}$ NAAQS https://19january2017snapshot.epa.gov/sites/production/files/2016-10/documents/420b16072.pdf

Overview of the conformity process

The transportation conformity provisions of the Clean Air Act Amendments of 1990 require that the metropolitan planning organization (MPO) for northeastern Illinois determine if the region's transportation plan, program, and projects conform to applicable SIPs and that emissions — taken as a whole from the plan, program, and projects — will not negatively impact the region's ability to meet the NAAQS deadlines. Conformity to a SIP means that the region's transportation plan and program:

1) Will not cause any new violations of the NAAQS;
2) Will not cause any worsening of existing violations; and
3) Will not delay efforts to attain the NAAQS in a timely manner.

This demonstration is conducted by comparing motor vehicle emissions estimates developed from implementation of the ON TO 2050 plan update and the FFY 2023–28 TIP for specific analysis years to the motor vehicle emissions budgets (MVEBs) contained in the applicable SIP.

Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) must also make a conformity determination for the ON TO 2050 plan update and the TIP. In addition, the region's TIP needs to be amended into the Statewide TIP (STIP), and that amendment must be approved by FHWA and FTA.

The purpose of this report is to document the process and findings developed as part of the transportation conformity analysis of the ON TO 2050 plan update and the FFY 2023–28 TIP.

Summary of 8-Hour ozone conformity process

The Illinois EPA submitted a redesignation request and maintenance SIP for the 1997 8-hour ozone standard to U.S. EPA on March 18, 2009. In 2011, Illinois EPA submitted a revised redesignation request that included proposed budgets developed with the U.S. EPA's Motor Vehicle Emission Simulator (MOVES) model. U.S. EPA approved these MOVES-based budgets and found them adequate for conformity on August 13, 2012. On March 28, 2014, Illinois EPA submitted to U.S. EPA updated MVEBs for its maintenance SIP. On October 6, 2014, U.S. EPA published approval of the revised budgets in the Federal Register (79 FR 60073).

As previously mentioned, on May 20, 2022, a federal register notice (87 FR 30828) to redesignate the region to attainment of the 2008 ozone NAAQS was published. It included a maintenance plan designed to demonstrate that the Chicago area is in attainment of the 2008 ozone NAAQS through 2035. The notice also included a revised MVEB budget for 2035 and beyond (MVEB prior to 2035 was unchanged). With 2035 being the final year of the 2008 ozone maintenance plan that year needed to be added as a scenario year to CMAP transportation conformity process so that maintenance of the 2008 ozone NAAQS could be demonstrated. The revised MVEB and inclusion of 2035 as a scenario year to be modeled was discussed at a Tier II Consultation meeting on April 7, 2022. Conformity analysis for the ON TO 2050 update and FFY 2023-2028 TIP evaluated mobile source emissions in the region against these MVEB for scenario years 2025, 2030, 2035, 2040, and 2050.

Federal acceptance of the plan and TIP

The most recent federal review of the TIP conformity determination occurred on January 13, 2022. The U.S. Department of Transportation (U.S. DOT), through the FHWA Illinois Division and the FTA Region 5, found that the conformity analysis performed by CMAP met the applicable criteria of 40 CFR 51 and 93, and approved the amendment to the FFY 2019-24 TIP.

Interagency consultation

Interagency consultation is required under the transportation conformity rule, as described in 40 CFR 93.105. In the northeastern Illinois region, these procedures are addressed through the consultation process described below and through the work of CMAP's committees, working committees, and other groups as described in the region's Public Participation Plan.[3]

In the northeastern Illinois region, consultation involving CMAP, Illinois EPA, Illinois Department of Transportation (IDOT), Regional Transportation Authority (RTA), FHWA, FTA, U.S. EPA, and other entities as appropriate, facilitates the local, regional, and state decision-making process by providing a forum for all affected federal, state, regional, and local agencies to discuss and resolve important issues. Decisions made through this interagency consultation process guide CMAP in making the conformity determination.

Consultation process

The consultation process facilitates the regional planning process in several ways. First, consultation assures early and proactive participation by the U.S. EPA, FTA, and FHWA in the plan and TIP development process. Second, consultation serves as a forum for interagency communication and understanding to prevent or resolve potential obstacles in the conformity process. Finally, the expertise of the federal agency representatives is relied upon for assistance in interpreting air quality regulations, transportation plan requirements, and TIP requirements.

Acceptable means of communication for the purpose of consultation include telephone, fax, email, person-to-person communication, and arranged meetings. The consultation team has found that having all parties present at meetings greatly facilitates interagency coordination and assures mutual understanding of issues and determinations. Therefore, CMAP relies heavily upon scheduled consultation meetings with federal agency representatives and other members of the consultation team.

[3] Chicago Metropolitan Agency for Planning, "Public Participation Plan," 2019, https://www.cmap.illinois.gov/documents/10180/996489/Public+Participation+Plan+FINAL.pdf/7204bc72-0def-6682-2bf3-9832b705c70b.

The consultation group is comprised of representatives of FHWA, FTA, U.S. EPA, Illinois EPA, IDOT, RTA, and CMAP.

The consultation process in northeastern Illinois consists of two levels, or "tiers." Tier I participants include federal representatives from headquarters offices in Washington, D.C. Tier II participants include federal representatives from U.S. EPA's Region 5 office, FTA's Region 5 office, FHWA's Division Office, Illinois EPA, IDOT, RTA, and CMAP. In addition to the standing members of the consultation team, representatives of local transportation implementing agencies and other stakeholders are invited to attend as appropriate. The Tier I consultation team is convened in the event the Tier II team is unable to resolve a particular issue.

The consultation process used during the development of the ON TO 2050 update, FFY 2023-28 TIP, and this conformity analysis consisted solely of Tier II meetings.

The consultation team meets at the CMAP office on an as-needed basis; however, it has historically met at least twice a year. Every attempt is made to schedule meetings so that all representatives can attend, but meetings are held whether or not all members are present. No decision is put into effect until all parties involved in the consultation process agree.

To provide a reference for discussion items and issue resolution, CMAP staff prepares meeting summaries following the completion of each scheduled consultation meeting. These summaries are reviewed for accuracy and approved by the consultation team at a subsequent meeting. Following resolution of an issue, staff typically provides a verbal update to pertinent CMAP committees to assist committee members in their decision-making processes.

Summary of formal consultation meetings

Agendas, minutes of consultation meetings, and other materials used by the Tier II Consultation Team are available on the CMAP website.[4]

Public participation

The Public Participation Plan adopted by the CMAP Board and the MPO Policy Committee in June 2019[5] establishes the mechanisms by which CMAP reaches out to its many stakeholders and the public.

[4] Chicago Metropolitan Agency for Planning, Tier II Consultation webpage, http://www.cmap.illinois.gov/committees/other-groups/tier-ii-consultation.

[5] Chicago Metropolitan Agency for Planning, "Public Participation Plan," 2019, https://www.cmap.illinois.gov/documents/10180/996489/Public+Participation+Plan+FINAL.pdf/7204bc72-0def-6682-2bf3-9832b705c70b.

A formal public comment period for the draft Transportation Conformity Analysis for the $PM_{2.5}$ and Eight-Hour Ozone National Ambient Air Quality Standards will be held from June 10-August 13, 2022. A formal public hearing will be held August 11, 2022. Comments are accepted via fax, mail, and email.

CMAP or the Tier II Consultation committee will respond to any public comments received during the public comment period on the conformity analysis.

Procedures for determining regional transportation demand

The procedures for determining regional transportation demand are subject to requirements set out in the conformity regulations, at 40 CFR 93.122(b).

The *Travel Demand Model Documentation*[6] appendix describes the modeling process used to develop inputs from the travel demand model for this transportation conformity analysis. This material demonstrates the inherent behavioral connections between regional land use, demographics, transportation infrastructure, and policy input to the quantification of travel demand levels and patterns, and the subsequent measurement of transportation system performance, which the models contain.

The following is a description of how CMAP's demand model meets the specific criteria from the regulations:

Paragraph	Requirement	How the requirement is satisfied
(b) (1) (i)	Network-based travel models must be validated against observed counts (peak and off-peak, if possible) for a base year that is not more than 10 years prior to the date of the conformity determination. Model forecasts must be analyzed for reasonableness and compared to historical trends and other factors, and the results must be documented.	The models were validated against 2019 ground counts and will be documented in the 2022 CMAP Travel Demand Model Validation Report.
(b) (1) (ii)	Land use, population, employment, and other network-based travel model assumptions must be documented and based on the best available information.	The socioeconomic forecasts used are based on the best available information including census data and a sound methodology as described in the *Regional Socioeconomic Forecast*[7] appendix of the ON TO 2050 update.

[6] Chicago Metropolitan Agency for Planning, "Travel Model Documentation Report," 2018, https://www.cmap.illinois.gov/documents/10180/1439048/ON+TO+2050+Update+Travel+Demand+Model+Documentation+Appendix.pdf/

[7] Chicago Metropolitan Agency for Planning, ON TO 2050 socioeconomic forecast webpage, http://www.cmap.illinois.gov/onto2050/socioeconomic-forecast.

(b) (1) (iii)	Scenarios of land development and use must be consistent with the future transportation system alternatives for which emissions are being estimated. The distribution of employment and residences for different transportation options must be reasonable.	The analysis uses forecasts of population, employment, and land use developed by CMAP. The Local Area Allocation process described in the *Regional Socioeconomic Forecast*[8] specifically accounts for the interaction between residential and business locations; transportation system improvements; and land values and redevelopment policies. The transportation simulation model has been structured with a feedback mechanism. Analysis and scenario testing were performed on land use/transportation interactions during the development of ON TO 2050 update.
(b) (1) (iv)	A capacity-sensitive assignment methodology must be used, and emissions estimates must be based on a methodology that differentiates between peak and off-peak link volumes and speeds, and uses speeds based on final assigned volumes.	Separate capacity restraint assignments are produced to estimate vehicle miles and travel speeds for eight time periods during the day. Results of the separate period assignments are accumulated into daily volumes and tabulated by vehicle mile by speed range as required for the emission calculations.
(b) (1) (v)	Zone-to-zone travel impedances used to distribute trips between origin and destination pairs must be in reasonable agreement with the travel times estimated from final assigned traffic volumes. Where use of transit currently is anticipated to be a significant factor in satisfying transportation demand, these times should also be used for modeling mode splits.	The modeling process includes three iterations through the steps of destination choice, mode split, and assignment. The final distribution and assignment of vehicle trips is based on the times from the third model iteration. In the iteration process, the highway and transit times for each step are the same for destination choice, mode split, and assignment.
(b) (1) (vi)	Network-based travel models must be reasonably sensitive to changes in the time(s), cost(s),	The joint mode-destination choice logit mode-choice model contains the full range of pricing (or cost) variables in

[8] CMAP, ON TO 2050 socioeconomic forecast webpage, http://www.cmap.illinois.gov/onto2050/socioeconomic-forecast

	and other factors affecting travel choices.	the individual utility equation expressions for private auto, hired auto, transit, and non-motorized modes. These cost variables include destination zone parking cost, rail station parking cost, automobile operating cost (cents per mile), tolls, and transit fares. In addition, the transit path selection uses the transit fares as one of the key parameters in selecting the transit path. The use of transit fares in path building is very important in a region that has transit options including commuter rail, rapid transit, express bus, and local bus. The impact of tolling on vehicle route choice is realized in the traffic assignment procedures through generalized cost calculations, which make the choices sensitive to changes in toll amounts.

Travel demand for ozone conformity

Because the ozone NAAQS are based on daily measurements, the vehicle miles of travel (VMT) estimates for conformity analysis are daily values. Furthermore, because the highest ozone concentrations are monitored during the summer, the VMT estimates are adjusted to be daily VMT for a summer weekday. The travel demand model runs produce weekday averages over the year, so the VMT results of the model runs are adjusted by increasing the model averages to summer weekday averages, based on analysis of traffic monitoring data by IDOT. The adjusted VMT values are then used as input to U.S. EPA's MOVES3 emissions model. The adjustment factors are:

Table 1: **Average daily traffic (ADT) conversion factors**

Facility	Multiplier
Arterial	1.0700
Expressway	0.9969
Local	1.0700
Ramp	1.0700

Latest planning assumptions

Socioeconomic forecasts

A major input to any transportation demand modeling process is the socioeconomic data used to develop the number and types of trips to be assigned to the transportation system. There are three components to this data: the geographic or spatial component, the socioeconomic variables used to describe or characterize these areas, and the base and forecast years that define the time horizons for the analysis.

CMAP has systematically forecast 2050 population, employment, and economic activity from the land use and transportation strategies of ON TO 2050. The CMAP travel demand models are then used to estimate travel behavior, congestion, and VMT resulting from these forecasts. Population and employment estimates were developed for five-year increments through the regional socioeconomic forecast process. These forecasts are used for interim conformity years and are tested against transportation improvements expected to be implemented at the time. A description of the method used to prepare the forecasts and data summaries are included in the ON TO 2050 socioeconomic forecast update.[9]

Transit operating policies

The RTA develops operating and capital budgets and plans[10] that are updated annually and serve as the basis for considering the impact of transit operating policies on travel demand model estimates. These documents include projections over the near term of key transit operating policies including fare, service, and ridership levels.

Because the most recent conformity determination was adopted in January 2022, transit operating policies (including fares and service levels) and assumed transit ridership have not changed. The impacts of the COVID-19 pandemic are not reflected in the travel demand model or the mobile source emissions modeling as the base year is 2019. Future impacts regarding transit ridership caused by the COVID-19 pandemic are uncertain and warrant further evaluation but at this time data that can be used for modeling to support long-term changes in transit ridership, have yet to be developed.

Transit fares and highway costs in the conformity analysis

The transportation model used in the conformity analysis requires information on the cost of transportation by each mode. Of particular importance are the relative costs of transportation versus all other costs, and the relative costs of the transit and auto modes to each other. Auto costs used in the model are based on the cost to own and operate an automobile, parking costs, and charges for tollway facilities. Transit costs include information on the base fares, transfers, and access costs.

[9] Chicago Metropolitan Agency for Planning, ON TO 2050 Socioeconomic forecast webpage, http://www.cmap.illinois.gov/onto2050/socioeconomic-forecast.

[10] Regional Transportation Authority, Finance & Management webpage, http://www.rtachicago.org/index.php/finance-management.html.

It was assumed that the relative costs of the two transportation modes (highway and transit) would be the same in the future years as that which existed in the base year. This treatment of future costs for the transit mode and for the toll component of the auto operating cost is consistent with observed trends.

Transportation Control Measures (TCMs)

TCMs were used to develop SIPs related to the one-hour ozone standard, including the 15 percent Rate of Progress (ROP) SIP (1993), control strategy SIP (1995), 1996 ROP SIP, 9 percent control strategy SIP (1998), and 9 percent ROP control strategy SIP (1999). All the TCMs adopted for these SIPs were implemented by 1999.

The ozone maintenance SIP, which has budgets found adequate for conformity, assume no TCMs. Thus, no such measures are identified here.

Emissions budgets and modeling scenarios

Five analysis years are included in the region's conformity analyses:

- 2019 – the base year (not modeling for conformity)
- 2025 – the horizon budget year for the 1997 ozone maintenance SIP
- 2030 – an intervening year not more than 10 years apart from the preceding and succeeding scenario years
- 2035 – the proposed horizon budget year for the 2008 ozone maintenance SIP.
- 2040 – an intervening year not more than 10 years apart from the preceding and succeeding scenario years
- 2050 – the horizon year of the plan

Ozone conformity

Mobile source emissions budgets for ozone precursors — VOC and NOx — were developed by Illinois EPA as part of the 8-hour ozone maintenance SIP. On August 13, 2012, U.S. EPA issued a final rule approving and finding adequate MVEBs for 2008 and 2025 (77 FR 48062). As previously stated, the proposed rule for the redesignation for the 2008 ozone NAAQS to attainment have a budget that can be used for 2035 and beyond which is what CMAP, in consultation with the Tier II committee has chosen to do.

These are the budgets that are used in conformity determinations by CMAP.

Table 2: Motor Vehicle Emissions Budget (MVEB) by Model Year

Model year	VOC (tons/day)	NOx (tons/day)
2025	60.13	150.27
2030	60.13	150.27
2035	65.00	110.00
2040	65.00	110.00
2050	65.00	110.00

Illinois EPA and CMAP worked closely during the development of the VOC and NOx emission budgets to determine the appropriate MOVES model settings. This conformity demonstration uses the same applicable settings in MOVES runs as were used in developing the SIP budgets. A full discussion of the settings and input files is provided in the *Travel Model Documentation Report*.[11]

[11] Chicago Metropolitan Agency for Planning, Travel Model Documentation Report, 2022, https://www.cmap.illinois.gov/documents/10180/1439048/ON+TO+2050+Update+Travel+Demand+Model+Documentation+Appendix.pdf/ .

Off-network calculations

The final estimate of regional emissions does not include credit for off-network calculations. However, many of the projects not currently incorporated explicitly in the travel demand model have been programmed using federal Congestion Mitigation and Air Quality Improvement Program funds. These funds are programmed by CMAP on the basis of the project's demonstrated air quality benefits. A benefit evaluation method has been developed for each type of project. The methods are structured so that, if appropriate, a project's benefits can be incorporated in the appropriate SIP by the Illinois EPA as a TCM, or used in conformity determinations.

Emissions Calculation

CMAP is required to use the most current version of the U.S. EPA's Motor Vehicle Emission Simulator, MOVES3 for transportation conformity analyses (86 FR 1106). As stated in the Federal register notice, MOVES3 is the latest state- of-the art upgrade to EPA's modeling tools for estimating emissions from cars, trucks, buses, and motorcycles based on the latest data and regulations. MOVES3 uses a variety of data inputs. Illinois EPA provides CMAP data on meteorology, inspection/maintenance programs, and fuels used in the region. The Illinois Secretary of State provides vehicle registration data for the region. CMAP provides various VMT data along with average speeds, and road types for the region. Data not provided by Illinois EPA, Illinois Secretary of State, or CMAP is derived from U.S. EPA, such as day and monthly VMT fractions. It should be noted that the MOVES3 model includes a number of updates from the previous model, MOVES 2014a that CMAP had been using. New regulations, features and significant new data incorporated in MOVES3 are:

- Improvements to heavy-duty (HD) diesel running emission rates based on manufacturer in-use testing data from hundreds of HD trucks.
- Updated emission rates for HD gasoline and compressed natural gas (CNG) trucks;
- Updated light-duty (LD) vehicle emission rates for hydrocarbons (HC), CO and NO_x-based on in-use testing data;
- Updated LD PM rates for Model Year (MY) 2004 and later, incorporating data on gasoline direct injection engines;
- New fuel characteristic data from EPA fuel compliance submissions;
- Updated fuel effect calculations to better characterize the base fuel used to develop LD base emission rates;
- The effects of the HD Phase 2 GHG rule;
- The effects of the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule on light-duty fuel economy.

It should be noted that in U.S. EPA testing, NO_x emissions estimates were higher in future modeled years. This is due to higher running emissions from heavy-duty trucks outweighing declines from heavy-duty hoteling. When CMAP conducted tests of the MOVES3 model, increased NO_x emissions were also observed and in fact the results seen in table 3 also reflect an increase in NO_x emissions compared to MOVES modeling conducted for prior transportation conformity analysis. The transportation conformity analysis CMAP conducts

consists of a calculation of total emissions for each required analysis year. The total emissions must be lower than the corresponding approved motor vehicle emission budgets (MVEB) for ozone precursors; Volatile Organic Compounds (VOCs) and Oxides of Nitrogen (NO_x). The geographic distribution of emissions within the region is not considered in conformity calculations.

When the travel simulation process is complete, several additional steps need to be taken to calculate scenario emissions. The regional model results must be transformed to be compatible with the MOVES3 emission rate structure. The MOVES3 model must then be run to produce emission rates that match the transportation data available and reflect the region's environmental and vehicular conditions. This chapter explains how the mobile source emission rates are developed and how the total emissions are calculated from the assignment results. The steps completed to compute the scenario network-based mobile source emissions are given below.

Model Data Processing

Highway networks are built with zone connectors coded to lengths proportional to zone size, so connector link volumes represent the amount of "local" travel needed to reach the regional highway system. Thus, this conformity analysis does not have a separate off-network mobile emission component. Mobile source emission estimates based upon the network traffic assignment reflect both specifically coded non-local roadways and local non-coded roadways.

The highway assignment process produces two basic pieces of information essential to calculating emissions: link loads and link speeds. While essential, the information on link loading is not a perfect match for use with the MOVES emission rates. While the assignment model defines vehicles in terms of how much of a roadway's available capacity to carry traffic is used for a given loading, the MOVES model defines vehicles in terms of engine type and size. For assignment, it makes no difference if a vehicle is diesel or gasoline powered, but it does impact the calculation of emission rates. Highway assignment accounts for the different operating characteristics of various vehicle types using the concept of vehicle equivalents[12] (VEQ). In the simplest case a standard passenger auto is one VEQ, while a semi-trailer truck is three VEQs. The truck occupies approximately the same physical space on the roadway as several standard passenger cars and interacts with other traffic in ways akin to multiple standard vehicles. For example, the truck takes more time to reach cruising speed from a stop than an individual standard passenger auto; the amount of time is similar to that needed by several standard passenger cars to reach cruising speed when driver reaction delay and vehicle spacing are considered. However, the emissions from a large truck and several standard autos are not the same (especially if the truck is diesel powered).

[12] Comparable terms also used are passenger car equivalents (pce) and passenger car units (pcu).

During the data processing, the travel model vehicle classes must be converted to the MOVES vehicle classes.

The time-of-day highway assignment process makes use of the modeling software's ability to keep track of multiple vehicle classes (as described in the Traffic Assignment chapter). The travel information of fixed route public transportation buses is also included. Table shows the correspondence between the MOVES vehicle types and the travel demand model vehicle classes. It also includes the correspondence with the HPMS (Highway Performance Monitoring System) vehicle types.

Table 3. Correspondence between MOVES and HPMS Vehicle Types

MOVES Vehicle Type & Description	HPMS Vehicle Type & Description	VHT Distribution Source from Travel Model
11: Motorcycle	10: Motorcycles	(use auto distribution)
21: Passenger Car	25: Passenger Cars	autos
31: Passenger Truck	25: Other 2 axle-4 tire vehicles	b-plate trucks
32: Light Commercial Truck	25: Other 2 axle-4 tire vehicles	light duty trucks
41: Intercity Bus	40: Buses	(use transit bus distribution)
42: Transit Bus	40: Buses	transit bus
43: School Bus	40: Buses	(use transit bus distribution)
51: Refuse Truck	50: Single Unit Trucks	(use medium duty trucks under 200 miles distribution)
52: Single Unit Short-haul Truck	50: Single Unit Trucks	medium duty trucks under 200 miles
53: Single Unit Long-haul Truck	50: Single Unit Trucks	medium duty trucks 200+ miles
54: Motor Home	50: Single Unit Trucks	(use medium duty trucks 200+ miles distribution)
61: Combination Short-haul Truck	60: Combination Trucks	heavy duty trucks under 200 miles
62: Combination Long-haul Truck	60: Combination Trucks	heavy duty trucks 200+ miles

Following the completion of a region travel demand model run for an Air Quality Conformity Analysis, the results must be processed and formatted for input into MOVES3 for emissions calculation. Two scripts are used to first export the relevant information from Emme® and then to process it into the data inputs MOVES requires. In addition to basic network link data (e.g., length and number of lanes), the first script also captures the following information for every link in a scenario network by the TOD highway assignment:

- final loaded speed
- number of autos
- number of b-plate trucks
- number of light trucks
- number of medium truck VEQ
- number of heavy truck VEQ
- number of fixed route public transit buses
- number of long-distance (i.e., traveling at least 200 miles) medium and heavy trucks

After the appropriate data have been extracted from the travel demand model, a second script processes the data for input into MOVES. This script performs a number of functions. First, vehicle equivalents are converted to the actual number of vehicles so that VMT and vehicle hours of travel can be computed for each link in all of the TOD networks. The modeled vehicles are converted into MOVES vehicle categories, as shown in Table .

Next, the model network links are converted into the MOVES road types; this correspondence is shown in Table. The links are identified based on the volume-delay function they reference. The urban/rural designation is determined by the *areatype* (capacity zone) value attached to the from-node of each link: a value less than nine is considered urban and a value greater than or equal to nine is rural. Note that “off-network” in the MOVES model refers to processes that generate emissions but are not associated with being on a road. These include starts, emissions from a parked vehicle, and extended idling by heavy-duty trucks.

Table 4. Correspondence between MOVES Road Types and Model Links

MOVES Road Type & Description	Model Volume-Delay Function
1: Off-Network	N/A
2: Rural Restricted Access	rural 2,3,4,5,7,8
3: Rural Unrestricted Access	rural 1,6
4: Urban Restricted Access	urban 2,3,4,5,7,8
5: Urban Unrestricted Access	urban 1,6

A set of link speed bins is created to store the link data. The lowest bin reflects link speeds under 2.5 miles per hour (MPH). The bins then proceed in 5- mile per hour increments beginning with 2.5<=MPH<7.5 MPH and ending with 67.5<=MPH<72.5. A final bin captures links with speeds of at least 72.5 MPH.

Finally, the vehicle-specific VMT and VHT values are disaggregated from the time period totals into hourly values for each link. The script then produces the following files for use by MOVES:

1. **Average Speed Distribution** – This file contains the share of daily VHT summarized for each vehicle type within each unique combination of [road type – hour of the day – speed bin] category. Within each group of [road type – vehicle type – hour of the day], the values must sum to one. MOVES requires a VHT distribution for all of these categories. If the results of a model run do not provide a distribution for a given category, the following substitutions are made:
    - Bus – when no distribution is available for rural restricted access facilities, the distribution from urban restricted access facilities is used. This applies to vehicle types 41, 42, and 43.
    - Single-unit Long-haul truck – when no distribution is available, the distribution from Single-unit Short-haul truck is used. This applies to vehicle types 53 and 54.
    - Combination Long-haul truck – when no distribution is available, the distribution from Combination Short-haul truck is used. This applies to vehicle type 62.
2. **Road Type Distribution –** This file contains the daily share of VMT for each [vehicle type – road type] combination. Within each vehicle type, the VMT shares must sum to one. The same substitution method described above is implemented if necessary.
3. **Ramp Fraction –** This file reports the share of total freeway VHT that occurs on ramps. This value is reported separately for urban and rural restricted access facilities.
4. **Hourly VMT Fraction –** This file contains the hourly share of daily VMT for each [vehicle type – road type – hour of the day] combination for weekdays. The shares

within each [vehicle type – road type] category must sum to one. The Average Speed Distribution substitution method is used if necessary.

5. **HPMS Daily VMT –** This file contains total VMT by road type summarized by HPMS vehicle type.

MOVES Model Emissions Calculation

This conformity analysis used MOVES3.03, the current version of the approved U.S. EPA emissions model. The default database is from the November 2020 release by U.S. EPA . Files used to supply the input to calculate the emissions inventory for each of the emissions types (VOC and NOx for ozone) are included on the following pages. Descriptions of the input commands and changes for other scenario years are also given.

For ease of execution, one MOVES run was created for each scenario year. The runs developed inventories for both VOC and NOx ozone precursors.

MOVES allows the user to calculate emissions rates, which can be applied to VMT, or to calculate emissions inventories, which can be compared directly to SIP budgets. Since a limited number of "small" MOVES runs are required for conformity, and the calculation of inventories from emissions rates requires detailed VMT, trip and fleet size breakdowns, CMAP prefers to run MOVES in inventory mode. Running MOVES in inventory mode is also consistent with the approach that Illinois EPA uses for their emissions modeling and was discussed and agreed upon through the Tier II consultation process.

MOVES Model Settings Used in Conformity Analysis

This section describes the various inputs used to obtain emission inventories from MOVES for conformity analysis:

Navigation Panel input

County Data Manager input

Navigation Panel Input

Each MOVES run requires completion of the parameters in the navigation panel. CMAP has chosen to make a separate run for each analysis year and by the inspection maintenance (IM) area and non-inspection maintenance (non-IM) area. The IM area is the portion of the nonattainment area where registered vehicles are subject to the Illinois EPA IM program. The non-IM area is the portion of the nonattainment area where registered vehicles are not subject to the Illinois EPA IM program. The IM and non-IM areas are defined by zip codes in Illinois law. The emission results from the IM and non-IM areas are combined to create the total emissions for the nonattainment area. The parameters in the navigation panels and their inputs are listed below. Unless otherwise indicated, the parameters are the same for each year that is modeled.

Description – a narrative description to identify the run; this varies slightly between analysis years to help distinguish them. It has no effect on emissions.

Scale – The county scale is selected, as recommended for conformity analyses. The inventory calculation type is selected.

Time Spans – The Time Aggregation Level is set to hour, as recommended in the guidance. The year is set to the appropriate analysis year. Both weekdays and weekends are selected, as are all months and all hours. These are required for the annual $PM_{2.5}$ emissions inventory; for ozone precursors, only July weekday data are used from the output database.

Geographic Bounds – In MOVES3 the user must select a county to model. CMAP, tested running MOVES for each county in the Illinois portion of the nonattainment area. The model running time was a significant increase from the custom domain approach CMAP used with MOVES 2014a. As an example, it took about 12 hours to run one scenario year, such as 2025 (including pre and post database preparation and analysis) in MOVES 2014a. Running MOVES 3 for each county, the modeling time increased to about 50 hours per scenario year. As there are five scenarios years to model, 250 hours of modeling time was a substantial increase in time. In consultation with U.S. EPA's office of Transportation and Air quality and the Tier II consultation committee, it was decided that CMAP could divide the region into two parts, an IM area and non-IM area (as CMAP had done using MOVES 2014a), using a representative county for each area. The representative county for the IM area is Cook County, and the non-IM area is McHenry County.

Onroad Vehicles – All fuel types are selected, and all available vehicle types are selected for each fuel type. (Only motorcycles are not available for diesel fuel; only inter-city buses and combination long-haul trucks are not available for gasoline.)

Road Type – All five road types (Off-Network, Rural Restricted Access, Rural Unrestricted Access, Urban Restricted Access, Urban Unrestricted Access) are selected.

Pollutants and Processes – The following pollutants are selected. In most cases subsidiary pollutants are required; they are listed following each pollutant. In all cases, all applicable processes are selected (achieved by selecting the pollutant check box to the left of the pollutant name in the window):

a. Volatile Organic Compounds – Total Gaseous Hydrocarbons and Non-Methane Hydrocarbons
b. Oxides of Nitrogen (NOx) – no subsidiary pollutants are required
c. Primary Exhaust $PM_{2.5}$ – Total – Primary $PM_{2.5}$ – Organic Carbon, Primary $PM_{2.5}$ – Elemental Carbon, Primary $PM_{2.5}$ – Sulfate Particulate (Sulfate Particulate requires Total Energy Consumption)

d. Primary $PM_{2.5}$ – Brakewear Particulate (combined with Primary Exhaust $PM_{2.5}$ and Tirewear to produce total $PM_{2.5}$)

e. Primary $PM_{2.5}$ – Tirewear Particulate (combined with Primary Exhaust $PM_{2.5}$ and Brakewear to produce total $PM_{2.5}$)

f. CO_2 Equivalent – Total Energy Consumption, Atmospheric CO_2, Nitrous Oxide, Methane, Total Gaseous Hydrocarbons

Input Data Sets – No databases are used for input other than the default MOVES database, and the run-specific inputs entered through the County Data Manager.

Output

a. General Output – Each run's output is sent to a separate database. As noted previously, the emissions for ozone are estimated in one run; thus a conformity analysis consists of 10 MOVES runs, and hence there are 10 output databases. Mass units are specified as grams, energy as millions of BTU, and distance as miles. The activity output selected is distance traveled and population.

b. Output Emissions Detail – Time is set to hour, and the location is set to county. No vehicle/equipment categories are selected. Among the On Road/Off Road selections, Road Type and Source Use Type are selected.

c. Database – The names follow the convention of tipamendment yyyymmdd_all_YYYY_out, where yyyymmdd is the date of the Policy Committee consideration, "all" refers to all pollutants, YYYY is the analysis year and "out" means that this is the output file. If other types of analysis are conducted, the "tipamendment" portion of the name is changed appropriately. If only selected pollutants are estimated, then the "all" is changed appropriately.

Advanced Performance Features – These parameters to improve program performance in complex run situations are not used in the conformity analysis.

County Data Manager Inputs

The County Data Manager allows the analyst to include specific data for the geography under consideration and the analysis year in the MOVES dataset. Much of the data comes from the travel demand model.

Database – The input database unique to this MOVES run is created here. CMAP currently creates a separate database for each run. The names follow the convention of tipamendment_yyyymmdd_YYYY_in, where yyyymmdd is the date of the Policy Committee consideration, YYYY is the analysis year and "in" means that this is the input file. If other types of analysis are conducted, the "tipamendment" portion of the name is changed appropriately. The

database will be associated with the county chosen in the geographic bounds. If a different county is selected, then a new database needs to be created. CMAP prepares a spreadsheet that has all the inputs for each scenario year and IM/non-IM area as a separate in the spreadsheet.

Road Type Distribution – The fraction of VMT for each vehicle type by road type is calculated from the travel demand model results, based on the classification of each link in the network.

Source Type Population – Data from the Secretary of State's office was examined for suitability in this input. The data yielded inconsistent results, so the default procedure suggested in the Technical Guidance was used. The procedure uses national default values relating vehicles to VMT which are applied to VMT from the travel demand model to estimate populations. The default procedure yielded a motorcycle population that was clearly inconsistent with the region's actual population. Therefore, motorcycle registration data from the Illinois Secretary of State's office was used to create a more realistic estimate.

Vehicle Type VMT

a. Annual VMT by vehicle type is calculated by expanding average weekday VMT resulting from the travel demand model. This takes place in two steps. First, model VMT is summarized by MOVES category vehicle type and facility type. Using vehicle count data from IDOT's monitoring program, average weekday VMT is factored into average daily VMT for all days, including weekends. Again, using IDOT monitoring data, daily VMT for each month is adjusted to be a percentage of annual average daily VMT. The annual average daily VMT (based on the travel demand model) is then adjusted to the monthly daily averages and multiplied by the number of days in the month to obtain monthly VMT. The monthly VMT values are summed to yield annual VMT

b. Monthly – Each month's fraction of annual VMT, by vehicle type, is computed using the same data and factors as the annual VMT described previously. However, the monthly VMT values are converted to fractions of the annual total rather than simply being summed.

c. Daily – Since the travel demand model results are for average weekdays only, IDOT traffic monitoring data were used to estimate the weekday vs. weekend VMT fractions. These observed data are limited because they do not include information by vehicle type. Therefore, the weekday and weekend fractions used to create the MOVES inputs are the same for all vehicle types. Finally, off-network (road type 1) data are not part of the IDOT monitoring system, so the Cook County default values were used.

d. Hourly – The travel demand model results support the calculation of VMT by time of day, road type and vehicle type. A post-processing routine was used to generate this input directly from the model results. The same values were used for both weekday and weekend days.

I/M Programs – The inspection and maintenance program description was created by staff at the Illinois Environmental Protection Agency, which administers the program. The same basic file is used for each analysis year. They differ in that the last model year of vehicle inspected depends on the analysis year; this parameter thus varies from year to year (increasing with later years).

Age Distribution – The vehicle age distribution is calculated by CMAP using the most current vehicle registration file from the Illinois secretary of state. This creates a base year age distribution file. The base year data is then input into the U.S. EPA's age distribution spreadsheet to create an age distribution for which every scenario year is being modeled.

Average Speed Distribution – The average speed distribution is developed by post-processing the travel demand model results. The travel demand model produces annual average weekday results, but there are no other sources for weekend speed distributions. Thus, the weekday values from the model were also used for the weekend.

Fuel Type and Technologies – MOVES defaults were used for all vehicle types.

Fuel

a. Fuel Supply – The types of fuel supplied to the region were supplied by the Illinois Environmental Protection Agency, as used in SIP development. The input is the same for all analysis years, except that the input file has a year in it, which is set to the analysis year.

b. Fuel Formulation – the formulation of the fuels in the region is also supplied by the Illinois Environmental Protection Agency, as used in SIP development. The input is the same for all analysis years.

Meteorology Data – These data are from climate records at O'Hare Airport, as compiled in the MOVES input format by the Illinois Environmental Protection Agency, as used in SIP development. The input is the same for all analysis years.

At the conclusion of a MOVES run, a summary report is generated using the MOVES interface. This summary report produces daily emissions inventories by month and day type (weekday versus weekend). These inventories are then multiplied by the number of weekdays and weekend days in each month to produce the annual $PM_{2.5}$ emissions

inventories. For ozone inventories, the summary results for the July weekday are used directly.

Modeled projects

Projects included in the ON TO 2050 update and FFY 2023-28 TIP transportation demand estimation modeling process are listed on the CMAP website. Regionally significant projects included in the ON TO 2050 update are listed and discussed in detail in the plan's mobility section; TIP projects that require conformity are listed on the CMAP Conformity Analysis page under the Conformity Amendments section.[13]

Results of the conformity analysis

Results of the conformity analysis for the ON TO 2050 plan update and the FFY 2023-28 TIP are given below. CMAP maintains a policy of accepting amendments and updating the conformity analysis semiannually. The results of the most recent conformity analysis are listed on the CMAP Conformity Analysis web page under Current Conformity Analysis.[14]

Ozone conformity results

The VOC and NOx emissions estimates for each of the scenario years are shown in Table 3. No credits are taken for projects that have air quality benefits but are not represented within the transportation networks. As shown in the table, the emission results from the conformity analysis for the analysis years show that the VOC and NOx emissions are lower than the applicable SIP budgets, and conformity for the 8-hour ozone standard is demonstrated.

Table 5: VOC and NOx emissions in tons per summer day for ozone conformity

VOC and NOx Emissions in Tons per Summer Day for Ozone Conformity

	Volatile Organic Compounds		Nitrogen Oxides	
Year	Northeastern Illinois	SIP Budget	Northeastern Illinois	SIP Budget
2025	41.89	60.13	112.04	150.27
2030	36.31	60.13	85.63	150.27
2035	32.56	65.00	75.86	110.00
2040	29.49	65.00	75.02	110.00
2050	27.55	65.00	80.17	110.00

[13] Public eTIP website, Amendments for the Transportation Improvement Program, https://etip.cmap.illinois.gov/#tabs-2.

[14] Chicago Metropolitan Agency for Planning, Conformity Analysis webpage, http://www.cmap.illinois.gov/mobility/roads/conformity-analysis.

Conformity is demonstrated by comparison of analysis year emissions to the SIP budgets

Notes:

Off-model benefits are not included in the total emissions estimates

Results updated as of May 2022

Conclusion

The conformity analysis conducted by CMAP concludes that the ON TO 2050 plan update and the FFY 2023-28 TIP meet all applicable requirements for conformity for the 8-hour ozone standard. The ON TO 2050 plan update and the FFY 2023-28 TIP are recommended for approval by the MPO Policy Committee, FHWA and FTA.

The *Transportation Conformity Analysis for the and 8-Hour Ozone National Ambient Air Quality Standards* was the subject of a public comment period running from June 10 through August 13, 2022. This report and the accompanying appendices make the determination that the region's transportation plan and program satisfy all applicable criteria and procedures in the conformity regulations and comply with all applicable implementation plan conformity requirements.