

Chapter 16

AIR QUALITY ANALYSIS AND FINDINGS

The Clean Air Act Amendments of 1990 (CAAA) established the mandate for better coordination between air quality and transportation planning. The CAAA requires that all transportation plans and transportation investments in nonattainment and maintenance areas be subject to an air quality conformity determination. The purpose of this determination is to demonstrate that the Transportation Plan and Transportation Improvement Program (TIP) conform to the intent and purpose of the State Implementation Plan (SIP). The intent of the SIP is to achieve and maintain clean air and meet National Ambient Air Quality Standards (NAAQS). Therefore, the Transportation Plan and the TIP must demonstrate that the implementation of these projects do not result in greater mobile source emissions than the emissions budget. The Kalamazoo – Battle Creek - MI Non-Attainment Area for the eight hour ozone standard was designated a Basic Non-Attainment area effective June 15, 2004. On May 16, 2007, the area was redesignated to Attainment/ Maintenance with a 2018 mobile source emissions budget.

This Attainment/Maintenance area includes the counties of Kalamazoo, Calhoun, and Van Buren. Ozone is formed when volatile organic compounds (VOC) and oxides of nitrogen (NOx) combine with sunlight and high temperatures. One way to reduce the amount of ozone is to reduce the amount of VOC and NOx which are produced in the region. VOC and NOx emissions originate, in part, from highway motor vehicles and can be reduced by decreasing congestion and/or providing for alternatives to the automobile, such as transit and ridesharing.

Air quality analyses were performed in March 2011 on the Battle Creek Area Transportation Study 2035 Transportation Plan, Kalamazoo Transportation Study 2035 Transportation Plan, and the State Transportation Improvement Program (STIP) for the non-urban portion of the nonattainment area, in order to determine the impact of the transportation system improvements on vehicle emissions. The Federal Highway Administration (FHWA) and the United States Environmental Protection Agency (EPA) require that the implementation of projects in the Transportation Plans and TIPs do not result in mobile source emissions greater than the emissions budget. The conformity determination conducted for the Transportation Plans were prepared in accordance with EPA's transportation conformity rule. The conformity demonstration was performed by comparing emissions from year 2011, 2018, 2025, and 2035 to the emission budget.

AIR QUALITY ASSESSMENT CRITERIA

Kalamazoo and Battle Creek's 2035 Transportation Plans and the Van Buren County proportion of the STIP conformity demonstration was made in compliance with all applicable conformity requirements and has been determined to satisfy the following conformity criteria and procedures set forth in the EPA's Transportation Conformity Rule:

1. The conformity demonstration was based on the latest planning assumptions.
2. The conformity demonstration was based on the latest emission model available.
3. The conformity demonstration was made according to the consultation procedures of the final conformity rule and the SIP conformity procedures.
4. The demonstration was made that completing the components of the LRPs and TIPs do not exceed the approved 8-hour conformity budget.
5. Each project contained in the LRPs and TIPs was reviewed by the Interagency Work Group (IAWG), being consistent with the consultation procedures established in the SIP. During the review, a determination was made by the IAWG on each project as to whether it needed to be modeled or was exempt from emission modeling.

BACKGROUND

The following describes the procedures used to estimate and analyze travel demand for the Kalamazoo - Battle Creek - MI Maintenance Area. The Kalamazoo Area Transportation Study (KATS) and Battle Creek Area Transportation Study (BCATS) and the Michigan Department of Transportation (MDOT) developed socio-economic data for 2002, 2008, 2011, 2018, 2025 and 2035.

These data are the basis for forecasting in the travel demand models which, in turn, generate the inputs required for the air quality conformity analysis.

These inputs are the amount of travel expressed as vehicle miles of travel (VMT) and average speed by National Functional Classification (NFC) by county. Individual NFCs by county are then grouped to provide the needed data structure required for EPA's Mobile6.2.

Air quality conformity analysis must be performed on a countywide basis. The urban travel demand forecast models do not cover the whole of all three counties. Kalamazoo County is covered entirely by an urban travel demand model and uses one of the latest travel demand modeling technologies, TransCAD. For Calhoun County, an urban travel demand model covers the cities of Battle Creek and Springfield and the townships of Bedford, Pennfield, Emmett, and Leroy and Newton townships, using TransCAD. In Van Buren County and for the portion of Calhoun County not covered by the urban travel demand model, the MDOT statewide model is used to estimate travel.

The VMT and speed data generated by the KATS model, BCATS model, and the statewide model are normalized using county Highway Performance Monitoring System (HPMS) VMT figures to provide the basis for the estimation of present and future VMT and speeds by NFC for each county. The air quality conformity analysis performed assumes that transportation projects are included in the milestone year they are presumed to be open to traffic. The following table demonstrates and summarizes the data resulting in the conformity determination for the Kalamazoo 2035 Transportation Plan and 2011-14 TIP, and the Battle Creek 2035 Transportation Plan and 2011-14 TIP, and the for the non-urban portion of Van Buren and Calhoun Counties covered by the STIP.

**RESULTS FOR THE KALAMAZOO-BATTLE CREEK-MI MAINTENANCE AREA
8 HOUR OZONE STANDARD
MARCH 2011**

Scenario	Emissions in kilograms/day	
	VOC	NOx
Attainment Budget	26,916.6200	49,315.3900
2011 Action	11,388.0916	18,016.8318
2018 Action	7,793.8609	9,268.0277
2025 Action	6,183.1643	6,531.0889
2035 Action	6,180.8517	5,563.1903

The remainder of this section provides additional technical details and documentation as necessary to support this determination.

MODELING PROCEDURES

MDOT developed and calibrated the travel demand models used in this analysis. Urban travel demand models were developed for Kalamazoo County and part of Calhoun County. The remainder of Calhoun County and all of Van Buren County was modeled with the statewide model. The travel demand models use the standard four-step transportation modeling process.

- 1- Trip generation model
- 2- Trip distribution model
- 3- Mode choice model
- 4- Highway assignment model

KATS Urban Travel Demand Model:

The trip generation model uses a combination of local and (NCHRP 365) trip generation rates. The trip generation variables used in the model are dwelling units, average household size, average household auto, retail employment, service employment, and other (non-retail-non-service) employment. The trip distribution model uses the standard gravity model to estimate origin-destination tables. It also uses Friction Factors for trip attractiveness. The mode choice model is a single mode model. It uses vehicle occupancy rates to convert person trips to vehicle trips on the network. The trip assignment model uses an equilibrium algorithm. The model was calibrated according to the strict calibration standards used by MDOT and suggested by FHWA. The model includes 515 internal and 30 external traffic analysis zones. The network is coded to output information based on area type, facility type, number-of- lanes, speeds, NFC, capacity, street names, and vehicle assignment.

BCATS Urban Travel Demand Model:

The trip generation model uses a combination of local and NCHRP 365 trip generation rates. The trip generation variables used in the model are households, retail employment, service employment, and non-retail - non-service employment. The trip distribution model uses the standard gravity model to estimate origin-destination tables. It also uses Friction Factors for trip attractiveness. The mode choice model is a single mode model. It uses vehicle occupancy rates to convert person trips to vehicle trips. The trip assignment model uses an equilibrium algorithm. The model was calibrated according to the strict calibration standards used by MDOT and suggested by FHWA. The model includes 311 traffic analysis

zones. The network is coded to output information based on area type, facility type, number-of-lanes, speeds, NFC, capacity, street names, and vehicle assignment. The BCATS model covers the greater Battle Creek area; for the portion of the county not covered by the BCATS model the MDOT statewide model is utilized.

Statewide Travel Demand Model:

MDOT developed and calibrated the statewide model. The model was developed in TransCAD and calibrated for year 2005. The model covers all counties of the state and includes NFC collectors and above; local roads are excluded. Trip generation employs a cross classification lookup table with trip rates developed from a combination of local models, National Cooperative Highway Research Program Report 187, Nationwide Personal Transportation Survey (NPTS), and the Transportation Management Area (TMA) model trip generation rates. The trip generation variables used in the model are households by three income groups and five size categories along with six categories of employment. The trip distribution model uses a gravity model to estimate origin/destination tables. The mode choice model converts person trips to vehicle trips by removing transit trips and applying auto occupancy factors, which are sensitive to the length of the trip (longer trips having higher occupancies). The trip assignment model uses an all-or-nothing algorithm. The model was calibrated according to the strict calibration standards used by MDOT and suggested by FHWA. The model includes 2,392 traffic analysis zones and the network is coded to provide as output VMT, VHT, and speeds by NFC.

HIGHWAY PERFORMANCE MONITORING SYSTEM (HPMS) DATA

The EPA and the United States Department of Transportation (USDOT) have both endorsed HPMS as the appropriate source of VMT estimates. HPMS is the FHWA's annual program to collect roadway data in all 50 states to assess the condition of the highway system in terms of traffic congestion, accessibility, and pavement condition. The FHWA requires counts to determine the areawide VMT for all Federal Aid Urban Areas (FAUA). MDOT supplements the counts outside the FAUA with additional counts in small cities, rural areas, and especially in rural areas of counties with nonattainment status. These supplemental counts follow the same random selection procedures as those inside the FAUA.

The HPMS data used is from MDOT's Universe file and is stratified by NFC. MDOT is currently undertaking a data improvement process to update the HPMS Universe, non-sample traffic data.

MODEL VEHICLE MILES OF TRAVEL (VMT)

HPMS Universe data provides the VMT estimates for the calibration year of the travel demand model, 2008 for Kalamazoo County, 2002 for Calhoun County, and 2005 for Van Buren County. To maintain consistency between HPMS and modeled VMT and among milestone years (as an example for Kalamazoo County) model VMT is scaled. The 2008 HPMS VMT distribution was used to scale the 2011, 2018, 2025, and 2035 VMT. Thus, the 2008 total HPMS VMT remained the same while future modeled VMT distributions changed to reflect the HPMS distribution. Then the scaled VMT by NFC are collapsed into four groups, to meet the requirements of Mobile6.2. These groups are: 1) rural interstate, 2) rural major and minor arterials/ collectors/local streets, 3) urban interstate/freeway, and 4) urban principal and minor arterials/ collectors/local streets. This is done for all interim and future analysis years. This same process is used for vehicle hours of travel (VHT). The following are the scaled travel demand modeled VMT for each county.

CALHOUN COUNTY VEHICLE MILES OF TRAVEL

NFC	HPMS 2002	2002	2011	2018	2025	2035
Rural Interstate Freeway	1,352,653	1,352,653	1,390,721	1,430,082	1,466,421	1,505,444
Rural Major & Minor Arterial/Collector/Local Street	1,049,599	1,049,599	1,107,514	1,165,304	1,207,429	1,265,667
Urban Interstate/Freeway	613,280	613,280	674,094	748,368	773,263	824,298
Urban Principal & Minor Arterial/Collector/Local Street	1,745,004	1,745,004	1,956,482	2,189,515	2,319,975	2,360,230
TOTAL	4,760,536	4,760,536	5,128,813	5,533,269	5,767,087	5,955,639

KALAMAZOO COUNTY VEHICLE MILES OF TRAVEL

NFC	HPMS 2008	2008	2011	2018	2025	2035
Rural Interstate Freeway	353,310	353,310	356,496	369,066	382,272	397,637
Rural Major & Minor Arterial/Collector/Local Street	1,114,541	1,114,541	1,136,375	1,182,513	1,203,444	1,304,009
Urban Interstate/Freeway	1,185,160	1,185,160	1,275,087	1,308,329	1,340,799	1,382,668
Urban Principal & Minor Arterial/Collector/Local Street	4,092,361	4,092,361	4,155,769	4,279,263	4,399,411	4,599,411
TOTAL	6,745,372	6,745,372	6,923,727	7,139,171	7,325,925	7,683,725

VAN BUREN COUNTY VEHICLE MILES OF TRAVEL

NFC	HPMS 2005	2005	2011	2018	2025	2035
Rural Interstate Freeway	680,794	680,794	694,463	707,914	722,480	741,572
Rural Major & Minor Arterial/Collector/Local Street	1,320,475	1,320,475	1,380,208	1,429,128	1,469,272	1,502,684
Urban Interstate/Freeway	382,463	382,463	396,826	418,017	426,606	436,063
Urban Principal & Minor Arterial/Collector/Local Street	390,132	390,132	413,515	438,270	451,442	457,601
TOTAL	2,773,864	2,773,864	2,884,648	2,993,329	3,069,800	3,137,919

MODEL SPEED

The modeled speed is derived by dividing the total aggregated scaled VMT by the total aggregated scaled VHT, except for local roads estimated by the statewide model. For Van Buren County and rural Calhoun County speeds for local roads were estimated by averaging speeds generated by the urban models. The speeds for each county are summarized in the next three tables.

CALHOUN COUNTY SPEED

NFC	2002	2011	2018	2025	2035
Rural Interstate Freeway	69.4	69.3	69.3	69.3	69.2
Rural Major & Minor Arterial/Collector/ Local Street	50.5	50.6	50.5	50.4	50.2
Urban Interstate/Freeway	66.2	64.6	62.2	61.0	58.1
Urban Principal & Minor Arterial/Collector/ Local Street	39.7	38.5	36.9	37.2	36.4
TOTAL	50.9	49.7	48.1	48.0	47.2

KALAMAZOO COUNTY SPEED

NFC	2008	2011	2018	2025	2035
Rural Interstate Freeway	65.7	65.5	64.6	63.6	62.3
Rural Major & Minor Arterial/Collector/ Local Street	46.4	46.4	46.0	45.8	45.2
Urban Interstate/Freeway	52.4	52.4	51.8	50.5	50.1
Urban Principal & Minor Arterial/Collector/ Local Street	32.3	32.0	31.7	31.2	30.8
TOTAL	37.7	37.6	37.2	36.6	36.2

VAN BUREN COUNTY SPEED

NFC	2005	2011	2018	2025	2035
Rural Interstate Freeway	69.6	69.5	69.5	69.5	69.5
Rural Major & Minor Arterial/Collector/ Local Street	48.0	47.9	47.9	47.9	47.9
Urban Interstate/Freeway	68.9	68.8	68.7	68.6	68.6
Urban Principal & Minor Arterial/Collector/ Local Street	41.1	41.1	41.0	41.2	41.3
TOTAL	53.0	52.8	52.7	52.7	52.8

CONFORMITY ANALYSIS

The conformity analysis was performed using the Mobile6.2 program. Mobile6.2 is a computer program that estimates VOC and NOx emission factors for gasoline and diesel -fueled on road motor vehicles. The model was developed by the USEPA.

Mobile6.2 calculates emission factors for twenty-eight individual vehicle types in two regions of the country. Mobile6.2 emission factor estimates depend on various conditions such as average travel speed, operating modes, fuel volatility, and mileage accrual rates. Many of the variables affecting vehicle emissions can be specified by the user. The analysis is based on comparing the emissions budget to the analysis years 2011, 2018, 2025, and 2035.

Critical Mobile6.2 inputs assumptions are:

- Temperature:
 - Maximum temperature = 95.0° F
 - Minimum temperature = 71.0° F
- The Reid Vapor Pressure (RVP) value = 9.0
- Emission factors are based on an average day during the month of July.

Sample Mobile6.2 inputs and outputs files are available upon request.

Mobile6.2 - Inputs

The inputs to the Mobile6.2 emissions factor model are VMT and average speed by NFC grouped as shown in the previous tables.

Mobile6.2 - Results

The following tables provide the results of Mobile6.2 emissions. The emission impact for each analysis year 2011, 2018, 2025, and 2035 is compared to the emission budget. To attain conformity, the emissions for the whole area must be less than the emission budget.

CALHOUN COUNTY EMISSIONS

Scenario	Emissions in kilograms/day	
	VOC	NOx
Attainment Budget	n/a	n/a
2011 Action	3,801.1643	6,525.5238
2018 Action	2,687.6893	3,405.4232
2025 Action	2,143.6194	2,398.4101
2030 Action	2,138.3631	2,020.4677

**RESULTS FOR THE KALAMAZOO-BATTLE CREEK-MI MAINTENANCE AREA
8 HOUR OZONE STANDARD
MARCH 2011**

Scenario	Emissions in kilograms/day	
	VOC	NOx
Attainment Budget	26,916.6200	49,315.3900
2011 Action	11,388.0916	18,016.8318
2018 Action	7,793.8609	9,268.0277
2025 Action	6,183.1643	6,531.0889
2035 Action	6,180.8517	5,563.1903

MPO ACTION

A summary of the results were presented and considered by the BCATS and KATS Technical Committees and was also considered by their respective Policy Committees. Based on the materials contained in this document, the BCATS and KATS committees have determined that their respective 2035 Transportation Plans and 2011 - 2014 TIPs demonstrate conformity with the SIP. The rural areas of Calhoun and Van Buren counties followed their public participation process.

**RESULTS FOR THE KALAMAZOO-BATTLE CREEK-MI MAINTENANCE AREA 8
 HOUR OZONE STANDARD
 MARCH 2011**

Scenario	Emissions in kilograms/day	
	VOC	NOx
Attainment Budget	26,916.6200	49,315.3900
2011 Action	11,388.0916	18,016.8318
2018 Action	7,793.8609	9,268.0277
2025 Action	6,183.1643	6,531.0889
2035 Action	6,180.8517	5,563.1903

MPO ACTION

A summary of the results were presented and considered by the BCATS and KATS Technical Committees and was also considered by their respective Policy Committees. Based on the materials contained in this document, the BCATS and KATS committees have determined that their respective 2035 Transportation Plans and 2011 - 2014 TIPs demonstrate conformity with the SIP. The rural areas of Calhoun and Van Buren counties followed their public participation process.