North Carolina Safety and Emissions Inspection and Maintenance Programs

Study to Examine Whether the Frequency of Vehicle Safety and Emissions Inspections Should Be Decreased in North Carolina

A Report to the Joint Legislative Transportation Oversight Committee

Submitted by the North Carolina Department of Transportation and Department of Environmental Quality

Final Report

March 1, 2018

Overview

The 2017 session of the North Carolina General Assembly directed the Department of Transportation (DOT), Division of Motor Vehicles (DMV) and the Department of Environmental Quality (DEQ) to jointly study whether the frequency of vehicle safety inspections and vehicle emissions inspections should be decreased.

Specifically, Section 12(b) of Session Law 2017-211 states the following:

The Department of Transportation and the Department of Environmental Quality shall jointly study whether the frequency of vehicle safety inspections and vehicle emissions inspections should be decreased. The Departments shall consider public safety, air quality, savings to vehicle owners, impacts on State revenues, and any other factors the Departments deem necessary. No later than March 1, 2018, the Departments shall jointly report their findings and recommendations to the Joint Legislative Transportation Oversight Committee.

The following presents the DMV's study report and recommendations first followed by the DEQ's study report and recommendations. These reports were submitted together to the Joint Legislative Transportation Oversight Committee on March 1, 2018.

Final February 28, 2018

NC Division of Motor Vehicles

Office of the Commissioner
Torre Jessup

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Executive Summary

The 2017 Session of the North Carolina General Assembly directed the Department of Transportation (DOT), Division of Motor Vehicles (DMV) and the Department of Environmental Quality (DEQ) to jointly study whether the frequency of vehicle safety inspections and vehicle emissions inspections should be decreased.

Specifically, Senate Bill 16 Section 12(b) of Session Law 2017-211 states the following:

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This report details the findings and overall recommendations from DMV based on an analysis of data pertinent to the impact of decreasing required vehicle safety inspection frequency. (The DEQ has prepared a separate report to address consideration of decreasing the frequency of vehicle emissions inspections.) It is important to note that DMV's study uses data from North Carolina state safety inspections for the past five calendar years beginning in 2013 in addition to the most recent motor vehicle crash reports developed by NCDOT.

The technical and cost/benefit analysis detailed in this study report identifies 2019 as the first year for implementing any change to safety inspection frequency. Additional fiscal analysis is forecasted for the following five years through 2023. For the 100 counties, an estimated 9.2 million vehicles were inspected in 2017, and based on safety inspection data, between 9.8 and 13.1 million vehicles are expected to undergo inspections between study years 2019-2023, highlighting the state's anticipated growth in population and vehicles.

Additional considerations include the total annual motor vehicle crashes in North Carolina. These have fluctuated over the past five years, averaging a 5.2 percent increase. Methods for collecting data from

motor vehicle crashes have made the process of conclusively defining a relationship between highway safety and the vehicle safety inspection program a difficult task.

Based on the analysis of data currently available, the Division of Motor Vehicles recommends the following:

Recommendation: The DMV recommends maintaining the annual frequency of safety inspections and conducting a more comprehensive study over the next two to five years to determine whether this frequency has a direct relationship to highway safety and motor vehicle crashes.

I. Introduction

A. Vehicle Safety Inspection Program Background

Pioneered by Massachusetts in 1926, the vehicle safety inspection program acknowledged the evolution of motor vehicles and publicized the need to ensure their operational safety. The shared realization of the impact of vehicle safety on the public welfare initiated a political movement prompting governors of New York, Massachusetts and Maryland to partner in launching "Save a Life" campaigns. These campaigns encouraged motor vehicle owners to have their vehicles inspected for repairs and faulty equipment at designated vehicle repair garages. Initially a voluntary program, additional states continued to adopt the concept contributing to the enactment of laws mandating periodic vehicle inspections in 1929. North Carolina later embraced these civic obligations and introduced the North Carolina vehicle safety inspection program in 1948. The program was repealed the following year. In 1966 the safety inspection program as we know it today was established to require motor vehicle maintenance and increase highway safety.

Administered by the North Carolina DMV License and Theft Bureau, the NC vehicle safety inspection program has evolved with the progression of technology and enhancements to vehicle components. With these technical advancements, the state modernized the program in November 2008 by transitioning from paper inspection records to a centralized electronic system for inspection record entry and retention. The adjustment also eliminated the use of windshield stickers and began the process of aligning vehicle inspection expiration with registration renewal dates by using electronic inspection authorizations.

The state completed its second modernization project in September 2017 with the implementation of a web-safety program. The program that had been implemented in 2008 required dial-up landline connection for input and data transfer of inspection reports. Over time, this process declined in reliability, affecting performance for technicians and consistency in the transfer of data. The web-safety program allows technicians to use any computer with compatible internet access to manage vehicle inspections. The updated system eliminates the requirement for inspection stations to purchase and maintain an expensive inspection analyzer and enhances system communication between the inspection station and DMV.

B. Other State Programs

In 1975, thirty-one states participated in an inspection program that required periodic motor vehicle safety inspections. A 2015 report released by the federal Government Accountability Office (GAO) noted that sixteen of the original 31 states continue to participate in a vehicle safety inspection program. Though the original concept of ensuring vehicle safety has continued, each state has modeled its program based on its own demographics and budgetary concerns. At this time, Delaware, Hawaii, Louisiana, Maine, Massachusetts, Missouri, New Hampshire, New York, North Carolina, Pennsylvania, Rhode Island, Texas, Utah, Vermont, Virginia, and West Virginia require standardized vehicle safety inspections. Eleven states require annual safety inspections of vehicles. Three states require biennial inspections. Two states require safety inspections based on state laws.

All participating states except Delaware require state-licensed private safety inspections with fees ranging from no fee to $55.00 (including emissions testing). Though the states receive a portion of these fees, the amounts are minimal compared to station income.

Table 1: States with Safety Inspection Programs

State	Frequency of Inspection	Fee	Regulating Agency	Inspection Facility
District of Columbia	Biennially	$10 for New Vehicles $35 for Vehicles Over Four Model Years	Department of Motor Vehicles	DC DMV
Delaware	Biennially	Free	Division of Motor Vehicles	Delaware DMV
Hawaii	Annually	$19.19	Department of Transportation	State Authorized Private Businesses
Louisiana	Annually	$10	Department of Environmental Quality	State Authorized Private Businesses
Maine	Annually	$12.50	State Police	State Authorized Private Businesses
Massachusetts	Annually	$29	Department of Environmental Protection	State Authorized Private Businesses
Missouri	Biennially	$12	Department of Public Safety and State Highway Patrol	State Authorized Private Businesses
New Hampshire	Annually	$20 PC - $10 MC	Department of Safety	State Authorized Private Businesses
New York	Annually	$15 LD - $20 HD - $6 M	Department of Motor Vehicles	State Authorized Private Businesses
North Carolina	Annually	$13.60	Division of Motor Vehicles	State Authorized Private Businesses
Pennsylvania	Annually	$20 - $40	Department of Transportation	State Authorized Private Businesses
Rhode Island	Biennially	$55	Division of Motor Vehicles	State Authorized Private Businesses
Texas	Annually	$14.50	Department of Public Safety	State Authorized Private Businesses
Vermont	Annually	Varies by Facility	Department of Motor Vehicles	State Authorized Private Businesses
Virginia	Annually	$16	State Police	State Authorized Private Businesses
West Virginia	Annually	Unspecified	State Police	State Authorized Private Businesses

Requirements for the safety inspections are defined individually by state. Each state has developed a standardized process by which safety inspections are to be conducted and key safety components are to be inspected. Oversight of the program is also contingent on laws specific to the state. North Carolina inspects proper functionality and conditions of brakes, lights, horn, steering mechanism, windows and windshield wipers (if applicable), directional signals, tires and mirrors. Many states determine the components to be inspected by a variation of vehicle examination.

II. Study Approach and Results

A. Vehicle Safety Inspection Analysis

Reviewing the inspection data for calendar years 2013 through 2017 reveals an annual average of 8.9 million inspections conducted each year. However, during calendar years 2016 and 2017, over 9.2 million inspections were performed. Therefore, the fiscal analyses that follow are based on 9.2 million inspections.

A study of the data demonstrates a 6.6% increase in vehicle inspections over the years included. This was derived by examining the trend of inspection growth from 2013 to 2017. The following table provides a more detailed view of inspection data and a projection of how inspection counts would be affected by a 6% annual growth rate.

Table 2. Safety Inspection Data 2013 to 2023

CY Year	Safety Only Inspections	Safety/Emissions Inspections*	Total Inspection Count
2013	3,027,533	5,631,101	8,658,634
2014	2,973,577	5,897,993	8,871,570
2015	3,547,954	5,376,874	8,924,828
2016	3,825,218	5,452,738	9,277,956
2017	3,753,340	5,484,251	9,237,591
2018	3,978,540	5,813,306	9,791,846
2019	4,217,253	6,162,104	10,379,357
2020	4,470,288	6,531,831	11,002,119
2021	4,738,505	6,923,741	11,662,246
2022	5,022,816	7,339,165	12,361,981
2023	5,324,185	7,779,515	13,103,699

*Note: The projection of emissions inspections would differ if the State Implementation Plan is approved by the EPA and the state adopts a rolling 20-year rule for emissions inspections as recommended in the study required by Session Law 2013-413 Section 26 [1].

B. Financial Analysis

Although this Division is not recommending a reduction in inspection frequency, this section will examine the fiscal impact of reducing safety inspections to biennial. The information in the above section revealed that a multiple year average of 8.9 million inspections are conducted each year. Over the last two calendar years however, there have been over 9.2 million inspections performed annually. The following statistics are based on 9.2 million inspections with a 6% growth rate in inspections each

[1] https://www.ncleg.net/Sessions/2013/Bills/House/PDF/H74v5.pdf

year to determine losses or gains.

1. State Inspection Fee

The cost of a safety inspection in North Carolina is $13.60 ($12.75 labor and $0.85 state fee). The cost of a safety/emissions inspection is $30.00 ($23.75 labor and $6.25 state fee). The authorization cost (state fee) is divided across separate funds to include Highway Fund, Volunteer Rescue/EMS Fund, the Rescue Squad Workers' Relief Fund and the Division of Environmental Quality (safety/emissions inspection).

The Highway Fund receives $0.55 from each passing safety inspection and $5.30 from each passing safety/emissions test. The Volunteer Rescue/EMS Fund receives $0.18 from each passing inspection, no matter the type. Likewise, the Rescue Squad Workers' Relief Fund receives $0.12 from each passing inspection. Inspection Station owners collect $12.75 labor for each safety inspection and $23.75 from a safety/emissions inspection.

Table 3. Safety Only Inspection Fee

	Safety Only	Safety/Emissions
DOT Highway Fund	$0.55	$5.30
Volunteer Rescue/EMS Fund	$0.18	$0.18
Rescue Squad Workers' Relief Fund	$0.12	$0.12
Department of Environmental Quality	$0.00	$0.65
Authorization (State Fee)	$0.85	$6.25
Inspection Station Labor	$12.75	$23.75
*Total Cost	$13.60	$30.00

2. Current Program Statistics and Projections

This subsection of the report will review current and projected financial revenues and monies derived from the state inspections. Each vehicle presented for inspection, including vehicles required to obtain an emissions inspection, receive a safety inspection.

Table 4. Inspection Program Monies – Current Program

Year	Type	DOT Highway Fund	Volunteer Rescue/EMS Fund	Rescue Squad Workers' Relief Fund	Division of Air Quality	Inspection Station
2013	**Safety**	$1,665,143	$544,956	$363,304	$0	$38,601,046
	Emissions	$29,844,835	$1,013,598	$675,732	$3,660,216	$133,738,649
	Totals	$31,509,978	$1,558,554	$1,039,036	$3,660,216	$172,339,695
2014	**Safety**	$1,635,467	$535,244	$356,829	$0	$37,913,107
	Emissions	$31,259,363	$1,061,639	$707,759	$3,833,695	$140,077,334
	Totals	$32,894,830	$1,596,883	$1,064,588	$3,833,695	$177,990,441

Year	Type	DOT Highway Fund	Volunteer Rescue/EMS Fund	Rescue Squad Workers' Relief Fund	Division of Air Quality	Inspection Station
2015	**Safety**	$1,951,375	$638,632	$425,754	$0	$45,236,414
	Emissions	$28,497,432	$967,837	$645,225	$3,494,968	$127,700,758
	Totals	$30,448,807	$1,606,469	$1,070,979	$3,494,968	$172,937,171
2016	**Safety**	$2,103,870	$688,539	$459,026	$0	$48,771,530
	Emissions	$28,899,511	$981,493	$654,329	$3,544,280	$129,502,528
	Totals	$31,003,381	$1,670,032	$1,113,355	$3,544,280	$178,274,057
2017	**Safety**	$2,064,337	$675,601	$450,401	$0	$47,855,085
	Emissions	$29,066,530	$987,165	$658,110	$3,564,763	$130,250,961
	Totals	$31,130,867	$1,662,766	$1,108,511	$3,564,763	$178,106,046
	.					
2018	**Safety**	$2,188,197	$716,137	$477,425	$0	$50,726,385
	Emissions	$30,810,522	$1,046,395	$697,597	$3,778,649	$138,066,018
	Totals	$32,998,719	$1,762,532	$1,175,022	$3,778,649	$188,792,403
2019	**Safety**	$2,319,489	$759,106	$506,070	$0	$53,769,976
	Emissions	$32,659,151	$1,109,179	$739,452	$4,005,368	$146,349,970
	Totals	$34,978,640	$1,868,284	$1,245,523	$4,005,368	$200,119,946
2020	**Safety**	$2,458,658	$804,652	$536,435	$0	$56,996,172
	Emissions	$34,618,704	$1,175,730	$783,820	$4,245,690	$155,130,986
	Totals	$37,077,363	$1,980,381	$1,320,254	$4,245,690	$212,127,158
2021	**Safety**	$2,606,178	$852,931	$568,621	$0	$60,415,939
	Emissions	$36,695,827	$1,246,273	$830,849	$4,500,432	$164,438,849
	Totals	$39,302,005	$2,099,204	$1,399,470	$4,500,432	$224,854,788

Table 4. Inspection Program Monies – Current program above shows how the financial revenues continue to grow annually as the number of registered vehicles in North Carolina increases. This 6% rate of growth is an estimate discussed in the section above. This growth rate in the program is not guaranteed to continue, but has shown stability over the past five years.

3. Potential Biennial Program Statistics and Projections

The table below assesses the impact of a biennial inspection program using 2019 as the first calendar year of the modification. The Highway Fund, which receives $5.85 ($0.55 safety + $5.30 emissions) from each passing inspection, would see a reduction of $17.4 million the first year. The Volunteer Rescue/EMS Fund, which receives $0.18 during each passing inspection, would see a reduction of

$934,142 the first year. The Rescue Squad Workers' Relief Fund, which receives $0.12 from each passing inspection, would see decreased funding of $622,761 the first year. Inspection station owners collect $12.75 from each passing safety inspection and $23.75 from each safety/emissions inspection conducted. Inspection station owners would experience a reduction of $100 million in revenue the first year of a biennial inspection.

Table 5. Financial Losses due to a Change from Annual to Biennial Program

	2019	2020	2021	2022	2023
Fund Losses					
DOT Highway Fund Loss	$17,489,320	$18,538,681	$19,651,003	$20,830,062	$22,079,866
Volunteer Rescue/EMS Fund Loss	$934,142	$990,191	$1,049,602	$1,112,578	$1,179,333
Rescue Squad Workers' Relief Fund Loss	$622,761	$660,127	$699,735	$741,719	$786,222
*Department of Environmental Quality	--	--	--	--	--
Inspection Station Losses	$100,059,973	$106,063,579	$112,427,394	$119,173,036	$126,323,420

*The Department of Environmental Quality losses in funding are addressed in the emissions study.

The modification of the inspection program to begin biennial inspections would negatively impact several funds and station owners. However, the citizen currently required to subject their vehicle to an inspection annually would benefit. The $13.60 for a safety-only inspection and $30.00 each emissions inspection would equate to $121.1 million collectively in savings starting the first year. Table 4 below provides the projected savings for citizens.

Table 6. Financial Savings to Citizens

	2019	2020	2021	2022	2023
Benefits/Gains					
Vehicle Owners Savings - Safety Only	$28,677,320	$30,397,958	$32,221,834	$34,155,149	$36,204,458
vehicle Owners Savings - Safety/Emissions	$92,431,560	$97,977,465	$103,856,115	$110,087,475	$116,692,725
Total Gains	$121,108,880	$128,375,423	$136,077,949	$144,242,624	$152,897,183

4. Information Technology Impact/Cost

During this analysis, applicable unit members (DOT IT & License & Theft) discussed potential changes to the state's electronic programs and databases. It was determined by all parties that the modification of the state's inspection program to a biennial system would be minimal. The cost associated with any changes would be consumed by the varying divisions/sections. Therefore, there is no impact on information technology costs.

This section has shown that the state's inspection program provides funding to many different programs. The losses to these funds are great if the program is changed to a biennial inspection program. However, the citizens would benefit financially by a change to biennial inspections.

C. Motor Vehicle Crash Analysis

The study conducted by DMV used motor vehicle crash data from the 2016 North Carolina Traffic Crash Facts Study to analyze relationships between safety inspections, safety inspection outcomes, crash rates, crash severity and vehicle component failures. This data set did not include vehicles 35 model years old or older since they are exempt, as defined by N.C. General Statute 20-79.4(b)(91) and 20-183.2(a1)(1).

The data shown in Chart 1 below depicts the key safety components that have been recorded as potential contributing factors in crashes due to component failures. Safety components including lights, tires, steering mechanisms and brakes are imperative to operate a vehicle in normal weather and traffic conditions. The need for these mechanisms to properly function significantly increases during abnormal conditions. Figures provided in this graph are a clear indication that the vehicle safety program is effective in preventing vehicles with defective equipment from operating on the public roads and highways.

Chart 1. Inspection Component Failures

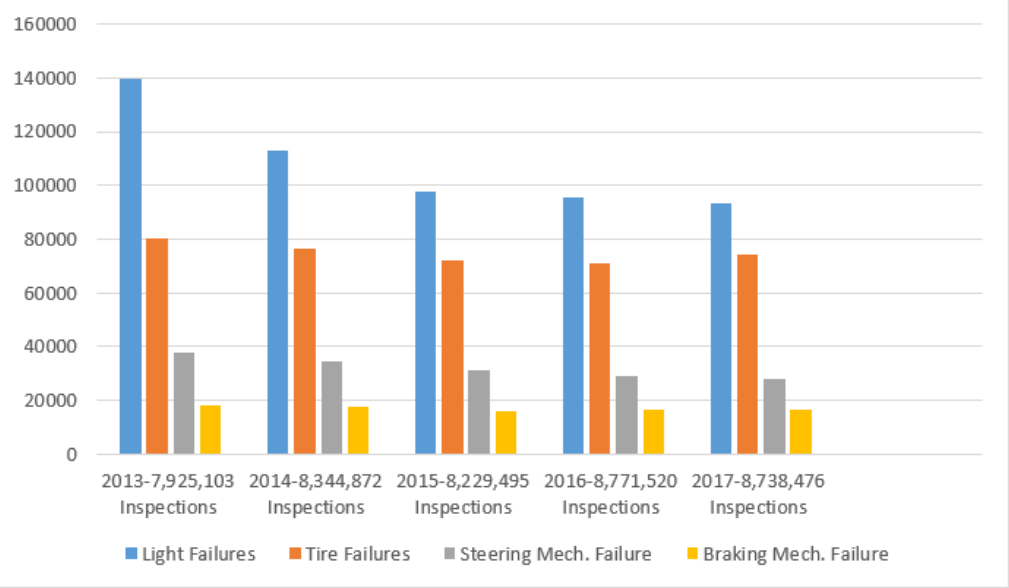
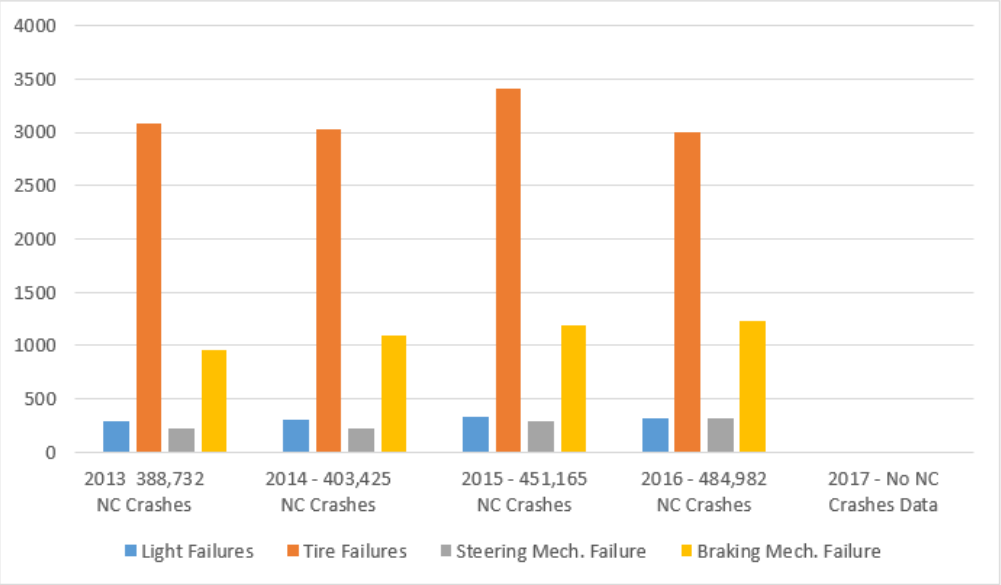


Chart 2 illustrates the number of crashes in which the failure of a safety component played a role in a vehicle crash. The importance of this data is to highlight the occurrence of crashes due to component failure even with the mandated vehicle safety inspection program. Considering the statistics of detected defective components displayed in Chart 1, it can be assumed that the data provided in Chart 2 would significantly increase with the elimination of the vehicle safety program.

Chart 2. Crash Component Failures



Periodic inspections verify the integrity of the vehicle's critical safety components necessary to keep the vehicle is in safe operating condition. By detecting defective vehicle parts before they fail, effective periodic inspection programs can prevent component failure on the highways and prevent vehicle crashes that may result in injury or fatalities.

As required by N.C. General Statute 20-183.2, a North Carolina vehicle safety inspection must confirm vehicle equipment is installed and operating in a safe condition. If components are missing, defective, inoperable or unsafe, the vehicle will fail the inspection until the equipment is repaired or replaced. Without the safety inspection program, there would be no incentive for vehicle owners to make repairs or replace unsafe equipment.

In 2017, there were 194,228 vehicles that failed the safety portion of the inspection due to the inadequacy of one or more safety item.

Items that failed safety inspections in 2017:

- Tires – 74,028
- Steering Mechanism – 28,095
- Lights – 45,570
- Braking Components – 16,392

The total number of failed items does not equate to the total number of failed inspections. During an inspection, multiple items may fail the safety portion of the test. In 2017, 8,738,476 total initial safety/emissions and safety-only inspections were conducted by 6,194 inspection stations across North Carolina. This number captures only the initial vehicle safety inspection failure. It does not include any subsequent inspections required after repairs have been made.

In 2016, 484,982 traffic crashes were reported according to data from the DOT Traffic Engineering Accident Analysis System (TEAAS).

Vehicle defects found to contribute to the traffic crash:

- Tires – 2,997 (.6%)
- Steering Mechanism – 321 (.07%)
- Lights – 323 (.07%)
- Braking Components – 1,226 (.3%)

Of the reported crashes in 2016, 8 percent of the crash reports indicated a failure in a safety component that contributed to the crash. The low percentage of the reported component failures contributing to the crashes could be viewed as a direct result of a comprehensive state safety inspection program.

North Carolina's inspections program is a preventative way to encourage vehicle owners to schedule regular maintenance and service for their automobiles. This preventative measure decreases the risk of vehicle mechanical problems which could result in a collision and makes the roadways safer for the motoring public and pedestrians.

III. Conclusion and Recommendation

Based on the analysis of available crash and inspection data from 2012 – 2017, a conclusive correlation between the vehicle safety inspection program and the occurrence of vehicle crashes cannot be confirmed. However, facts revealed in the study highlighted two significant verities that should be considered prior to modifying the current program.

Statistics prove that the vehicle safety inspections program was effective in preventing 194,228 vehicles with defective equipment from operating on public highways. While a significant amount, this number does not fully reflect the number of people that could be impacted if any failed components were to contribute to a crash. One crash involving one vehicle can greatly affect other drivers sharing the roads and additional passengers in the vehicles involved. Considering both statistical figures and the prospective growth of North Carolina, the number of drivers is expected to increase. Continuation of the annual vehicle safety program accommodates anticipated growth and supplements continuing efforts to protect the citizens and travelers on North Carolina highways.

The second consideration emphasizes the evaluation of the financial impact gleaned from the comparison of data. Financial forecasting based on monetary trends projects the DOT Highway Fund, Volunteer Rescue/EMS Fund and Rescue Squad Workers' Relief Fund will collectively lose approximately $126,323,420.00 by 2023 with the decrease in frequency of the safety inspection program. These programs work cooperatively to provide trained professionals and necessary provisions to help save lives and ensure safe highways. Since these monies go to programs that jointly share public safety as a priority, the sustained loss in funding would greatly impact their work as well as budgeting for future projects and/or enhancements. However, individual citizens would benefit by saving only the cost of $13.60 for the inspection and the cost of repairs to ensure the safety of their vehicle. This amount is

minimal when compared to the value of services provided by these programs. This comparative summary reveals that the cost/benefit analysis economically and practically favors maintaining the annual schedule of the vehicle safety inspection program.

Based on the findings, it is the Division's recommendation to maintain the frequency of annual safety inspections and to conduct a more comprehensive study over the next two to five years to determine if the frequency of the state safety inspection program has a direct relationship to highway safety and motor vehicle crashes. During this time, the Division plans to seek assistance from DOT Traffic Safety Engineers to explore additional data sets that could provide further insight into the correlation of vehicle safety inspections and crash data. The Division hopes to establish a more comprehensive baseline to develop a conclusive determination. Until these tasks have been thoroughly analyzed, a change in the safety inspection frequency would potentially increase risks for the traveling public and negatively impact supported programs and affiliated businesses.

North Carolina Inspection and Maintenance Program

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This report is submitted pursuant to the requirement of Section 12(b) of Session Law 2017-211, Senate Bill 16 enacted on October 10, 2017.

Signed: _____

Michael S. Regan
Department of Environmental Quality

Signed: _____

James Trogdon
Department of Transportation

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This report describes the DEQ's and DMV's recommendations for changing the frequency of vehicle emissions inspections from annual to biennial. The DOT has prepared a separate report to address whether the frequency of vehicle safety inspections should be decreased. It is important to note that DEQ's study approach focuses on the 22 counties that Session Law 2017-10 retained in the emissions inspection and maintenance (I&M) program and that decreased the vehicle model year coverage in those counties from 1996 and newer vehicles to the most recent 20 model years.[1] The 22 counties retained in the program are: Alamance, Buncombe, Cabarrus, Cumberland, Davidson, Durham, Forsyth, Franklin, Gaston, Guilford, Iredell, Johnston, Lee, Lincoln, Mecklenburg, New Hanover, Onslow, Randolph, Rockingham, Rowan, Union, and Wake.

For this study report, the technical and cost/benefit analyses focused on 2018 as the base year. For future years, the impacts are evaluated through 2022 for the fiscal analysis and through 2026 for the onroad vehicle emissions analysis. For the combined 22 counties, an estimated 3.3 million vehicles were inspected in 2016, and between 3.34 and 3.43 million vehicles are expected to be inspected annually during the study period of 2018-2022. It is estimated that changing the program from annual to biennial, 50 percent fewer vehicles would be inspected each year.

[1] Like the current program, the revisions to the vehicle model year coverage per Session Law 2017-10 also excludes the three most recent model years if the vehicle has 70,000 miles or less on its odometer.

The DEQ and DMV jointly recommend the following:

Recommendation 1: Change the frequency of emissions inspections from annual to biennial.

For the combined 22 counties, in 2018, changing the inspection frequency of the I&M program from annual to biennial would increase onroad nitrogen oxide (NOx) and volatile organic compound (VOC) emissions by about 0.4 tons per day (0.3 percent) and 0.7 tons per day (0.7 percent), respectively. However, the decrease in onroad emissions associated with a cleaner vehicle fleet in the future would more than offset the slight increase in emissions. With ozone values generally expected to decline over time due to fleet turnover, federal Tier 3 standards, and emission reduction programs at the local level, it is unlikely that the small emissions increases associated with this recommendation will cause an exceedance of the 70 parts per billion (ppb) ozone standard or any of the other National Ambient Air Quality Standards (NAAQS) in any of the 22 counties.

Recommendation 2: Implement biennial emissions inspections starting in 2021.

The EPA must approve North Carolina's I&M SIP amendment and revised rule before the state may implement a change to the I&M program. This process may take up to 3 years to complete (i.e., about 12 months to complete the rulemaking process, SIP amendment, and Clean Air Act (CAA) Section 110(l) noninterference demonstration for submittal to EPA; up to 18 months for EPA to approve the revision; and 2 to 3 months for the DMV to roll out the program change after the Secretary of the DEQ certifies to the Revisor of Statutes that EPA has approved the amendment to the I&M SIP). Based on this schedule, 2021 would be the earliest year in which the I&M program could be changed to implement biennial emissions inspections if the state legislature adopted the I&M program change in 2018.

Section I of this report provides a brief background on the I&M program and its applicability to the 22 counties subject to the program, an overview of the current NAAQS, and State Implementation Plan (SIP) requirements for demonstrating compliance with the NAAQS. Sections II and III present the study approach and results, respectively. Section IV provides the summary and conclusions of the study results. Section V presents the DEQ's and DMV's recommendations. Appendix A to this report summarizes key aspects of the onroad modeling framework, Appendix B contains the fiscal analysis, and Appendix C provides a list of acronyms and abbreviations used in this report.

I. Introduction

A. Vehicle I&M Program Background

The Environmental Management Commission (EMC) has been given the authority to adopt "a program for testing emissions from motor vehicles and to adopt motor vehicle emission standards" by the North Carolina General Assembly under *North Carolina General Statute (NCGS) §143-215.107 (a)(6), "Air quality standards and classification*s." The EMC has adopted rules for an I&M program under 15A North Carolina Administrative Code (*NCAC) Subchapter 2D, Section .1000 "Motor Vehicle Emissions Control Standards,"* that are federally enforceable by the U.S. Environmental Protection Agency (EPA) under the Code of Federal Regulations (CFR) 40 CFR Part 51. The I&M program is implemented by the state DOT, Commissioner of the DMV through the use of licensed safety/emission inspection stations, *NCGS Article 3 – Motor Vehicle Act of 1937 §20-128.2 (a),"Motor vehicle emission standards."*

The DMV's License and Theft Bureau, has operational responsibility for the I&M program, and has created rules for implementing and monitoring the program under 19A NCAC 03D .0500. The Division of Air Quality (DAQ) in the DEQ provides technical support to DMV's implementation of North Carolina's I&M program. In addition, the DEQ develops specifications for the program and certifies the emissions testing equipment used in the program. The DEQ also prepares revisions to the SIP based on changes made by the North Carolina General Assembly and the EMC. In the past, implementation of this program has been an integral part of North Carolina's SIP(s) to support attainment and maintenance of the NAAQS for ozone and carbon monoxide (CO).

The North Carolina I&M program began in 1982 in Mecklenburg County. From 1986 through 1991, the program was expanded to include eight additional counties, based on a "tailpipe" emissions test. In 1999, the North Carolina General Assembly passed legislation to require an On-Board Diagnostic II (OBD) I&M program in not only the counties required to have an I&M program under 40 CFR 51.350(a), but also in other counties in the state that may need the additional emission reductions to achieve the 1997 8-hour ozone standard. Starting in October 2002, the original nine counties converted from tailpipe testing to the new OBD emissions testing for all model year 1996 and newer light-duty gasoline vehicles and continued tailpipe testing of model year 1995 and older vehicles. The program was expanded from nine counties starting July 1, 2003 to a total of 48 counties on January 1, 2006.[2] At the time of full implementation of the OBD program, inspection stations were performing the OBD emissions test on model year 1996 and newer vehicles, and tailpipe testing for model year 1995 and older vehicles was discontinued.

In 2002, North Carolina inspection stations performed over 2.5 million vehicle emission inspections. As the new I&M counties were added, the number of inspections was expected to rise to a high of about 3.5 million inspections but then dip to a lower figure when all tailpipe testing ended on December 31, 2005. The actual number of OBD inspections has varied from

[2] Session Law 2000-134 (HB 1638) from the 1999 G.S. Session.

3.6 to about 5.4 million since 2006, due to a program change to align registration and inspection dates in 2008 and higher than expected fleet turnover and population growth.
On November 1, 2008, the state ended the use of paper stickers and began the process of aligning vehicle inspection expiration and registration renewal dates by using electronic inspection authorizations. Session Law 2011-95 enacted by the North Carolina General Assembly exempted plug-in electric vehicles from the emissions inspection requirement.

In 2012, the North Carolina General Assembly enacted Session Law 2012-199 which required DEQ and DMV to change the I&M program to exempt the three newest model year vehicles with less than 70,000 miles, and secure EPA approval. The DEQ prepared and submitted to EPA an amendment to the North Carolina I&M SIP and a non-interference demonstration under Section 110(l) of the federal CAA to incorporate these changes to the I&M program. The EPA approved the amendment on February 5, 2015.[3] Statewide, 4.840 million emissions inspections were performed in 2016 which is about 0.07 percent lower than total emissions inspections (4.843 million) performed in 2015.

In 2017, the North Carolina General Assembly enacted Session Law 2017-10, Senate Bill 131 (An Act to Provide Further Regulatory Relief to the Citizens of North Carolina). Section 3.5.(a) of the Act amended *North Carolina General Statute (NCGS) §143-215.107A(c)* to remove 26 of 48 counties from North Carolina's I&M program. For the 22 counties remaining in the I&M program, the Act also amended *NCGS §20-183.2(b)* by changing the vehicle model year coverage to: (i) a vehicle with a model year within 20 years of the current year and older than the three most recent model years, or (ii) a vehicle with a model year within 20 years of the current year and has 70,000 miles or more on its odometer.

Section 3.5.(c) of Session Law 2017-10 requires DEQ to prepare and submit to EPA for approval by the agency a proposed North Carolina SIP amendment and CAA Section 110(l) noninterference demonstration to remove the 26 counties from the I&M program and change the vehicle model year coverage of the program for the remaining 22 counties. The EPA has up to 18 months from the final submittal date to act on the proposed amendments. Shortly after receiving EPA's approval of each SIP amendment, the Secretary of DEQ will certify to the Revisor of Statutes that EPA has approved an amendment to the North Carolina SIP. The DMV would then implement the program change within 60 days after certification. Table 1 provides the estimated schedule for EPA approval and DMV implementation of the I&M program changes required by Session Law 2017-10. The estimated schedule shown in Table 1 assumes that EPA will take 18 months to complete its final action on the program changes.

B. Other State Emissions Inspection Frequency Requirements

The inspection frequency in states that have an I&M program are generally either annual or biennial inspections. No state has an inspection frequency less frequent than biennial. Some states do revert to an annual inspection for vehicles that are six years and older. Some states also require taxis, commercial, state and local government owned vehicles to have annual inspections because these vehicles typically travel more miles per year than privately owned vehicles.

[3] 80 FR 6455-6458 (Vol. 80, No. 24), February 5, 2015.

Table 1. Estimated Schedule for EPA Approval and DMV Implementation of I&M Program Changes per Session Law 2017-10

Action	Removal of 26 Counties from I&M Program	Change Vehicle Model Year Coverage for 22 Counties Retained in I&M Program
DEQ submittals to EPA	Nov. 24, 2017 (I&M SIP amendment and CAA Section 110(l) noninterference demonstration)	July 2018 (I&M SIP amendment, CAA Section 110(l) noninterference demonstration, revised rule 15A NCAC 02D .1002, and revised maintenance plan for the Charlotte maintenance area)
EPA final approval (up to 18 months from DEQ submittal date)	May 2019	Jan. 2020
DEQ certification to Revisor of Statutes	June 2019	March 2020
DMV implements program change (60 days after DEQ certification)	Sept. 2019	June 2020

C. Air Quality Standards and Implementation Requirements

1. Current National Ambient Air Quality Standards (NAAQS)

The federal CAA as amended requires EPA to establish NAAQS for the following criteria air pollutants: CO, lead, ozone, nitrogen dioxide (NO_2), particulate matter ($PM_{2.5}$ and PM_{10}), and sulfur dioxide (SO_2). The current air quality standards are displayed in Table 2. North Carolina adopts the NAAQS into its air quality rules under Section 15A NCAC 02D .0400 as authorized in Article 21B of Chapter 143-215.107 of the General Statutes.

1. Recently Revised Ozone NAAQS and Final Designations

The CAA requires EPA to review, and revise if necessary, the NAAQS every five years. On October 1, 2015, EPA completed its review of the 2008 ozone standard and promulgated its final decision to lower both the primary and secondary ground-level ozone standards from 75 to 70 ppb.[4] The form (fourth-highest daily maximum, averaged across three consecutive years) and averaging time (eight hours) of the new 2015 standard is the same as the 2008 standard. The revised primary and secondary standards became effective on December 28, 2015. In addition, EPA also changed the season during which North Carolina must monitor for ozone from April through October to March through October.

Section 107(d) of the CAA addresses the designations process between EPA and the states. Under Section 107(d), the Governor of a state is required to submit recommendations to EPA for designating areas as attainment, nonattainment, or unclassifiable with the revised ozone NAAQS by October 1, 2016 (i.e., within one year after promulgation of the revised NAAQS). On September 30, 2016, North Carolina fulfilled this requirement and recommended that EPA designate the entire state as attainment for the standard based on certified air quality monitoring

[4] 80 FR 65292-65468 (Vol. 80, No. 206), October 26, 2015.

data for 2014-2016.[5] On November 6, 2017, EPA agreed with North Carolina's recommendation and designated the entire state of North Carolina "attainment/unclassifiable" for the 2015 8-hour ozone NAAQS.[6] North Carolina has continued to maintain compliance with the 2015 8-hour ozone standard through October 31, 2017.

Table 2. Current National Ambient Air Quality Standards

Pollutant	Year Adopted by EPA	Primary / Secondary NAAQS	Averaging Time	Level*	Form
Ozone	2015	Primary and secondary	8-hour	70 ppb	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
CO	2011	Primary	1-hour 8-hour	35 ppm 9 ppm	Not to be exceeded more than once per year
Lead	2008	Primary and secondary	Rolling 3 month average	0.15 µg/m^3	Not to be exceeded
NO_2	2010	Primary	1-hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and secondary	Annual	53 ppb	Annual Mean
$PM_{2.5}$	2012	Primary	Annual	12 µg/m^3	Annual mean, averaged over 3 years
		Secondary		15 µg/m^3	
		Primary and secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
PM_{10}	2012	Primary and secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
SO_2	2010	Primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

* ppm = parts per million, ppb = parts per billion, µg/m^3 = micrograms per cubic meter.

D. Implementation of the NAAQS

Section 110(a)(1) of the CAA requires that each state adopt and submit to EPA for approval a plan which provides for implementation, maintenance and enforcement of primary standards for all areas within the state. For areas previously designated as nonattainment for a NAAQS, the DEQ prepared and submitted a SIP to EPA that demonstrated how each area would attain the NAAQS by adopting and implementing a combination of permanent and enforceable federal,

[5] Letter from Donald R. van der Vaart, Secretary, DEQ to Heather McTeer Toney, Regional Administrator, USEPA Region 4, North Carolina's Recommendations for Air Quality Designations for the 2015 8-hour Ozone Standards, September 30, 2016, https://files.nc.gov/ncdeq/Air%20Quality/planning/ozone/2015_Ozone_DEQ_Designation_Recommendation.pdf.

[6] *Air Quality Designations for the 2015 Ozone National Ambient Air Quality Standards (NAAQS)*, Final Rule, 82 FR 54232, November 16, 2017. This final rule is effective on January 16, 2018.

state, and local control measures.[7] Once each area reached attainment for the NAAQS, the DEQ submitted to EPA a SIP demonstrating that attainment had been reached (based on air quality monitoring data), and requested that EPA redesignate the area as attainment pursuant to Section 107(d)(3)(D) and (E) of the CAA.

As a part of the redesignation request, the DEQ also prepared and submitted a maintenance plan pursuant to Section 175A of the CAA to demonstrate how each area will maintain compliance with each of the NAAQS for at least 10 years after the redesignation. The maintenance plan remains in effect for 20 years after EPA approves the plan. When a state seeks revisions to a maintenance plan, CAA Section 110(l) requires a non-interference demonstration to remove control strategies or make other changes. Section 110(l) states:

> "Each revision to an implementation plan submitted by a State under this chapter shall be adopted by such State after reasonable notice and public hearing. The Administrator shall not approve a revision of a plan if the revision would interfere with any applicable requirement concerning attainment and reasonable further progress (as defined in section 171 of this title), or any other applicable requirement of this Act."

If the vehicle I&M program was changed to remove a county or required substantial operational changes, North Carolina would be required to submit to EPA for approval a demonstration that any emissions change associated with removing the I&M program would not hinder any area from attaining and/or maintaining compliance with all of the NAAQS. For counties that are in attainment for all of the NAAQS and/or under a maintenance plan, the non-interference demonstration would rely on ambient air quality monitoring data and emissions data to show that removing the I&M program will not interfere with continued attainment and maintenance of the NAAQS.

Failure to have a revised SIP approved by EPA before eliminating or modifying an I&M program could result in the state being sued for non-compliance with the CAA. For example, in 2002, Kentucky adopted legislation to immediately end the I&M program for the Louisville, Kentucky area. This prompted a lawsuit by the Kentucky Resource Council since the appropriate SIP revisions demonstrating compliance with Section 110(l) of the CAA had not been submitted to EPA. The lawsuit resulted in a court order reinstating the I&M program until the Section 110(l) demonstration had been submitted to and approved by EPA.

The pollutants that need to be reviewed are NO_2, CO, NOx, and VOC. NOx refers to nitric oxide (NO) and NO_2. Since NOx includes the criteria pollutant NO_2, NO_2 does not need to be reviewed separately. The EPA does not require that the demonstration associated with removing the I&M program address SO_2, lead, or $PM_{2.5}$ because vehicle emissions have little or no impact on ambient concentrations of those pollutants.

[7] Fourteen of the 22 counties that Session Law 2017-10 retained in the I&M program have previously been included in a nonattainment area for either the old 1979 1-hour, 1997 8-hour, and/or 2008 8-hour ozone NAAQS (see Table 3 in Section II.A of this report). All 14 counties have been redesignated to attainment and are under a maintenance plan.

It is also important to note that North Carolina is considered NOx limited with respect to ozone formation. This means that there are significantly more biogenically induced VOC emissions in the atmosphere and that reductions in man-made VOC emissions will not result in reductions of ozone formation. Approximately 90 percent of the VOC emissions come from biogenic or natural sources in North Carolina, which cannot be controlled; therefore, control measures requiring small VOC emitting sources to reduce man-made VOC emissions will not result in a reduction in ozone formation. The best method to achieve reductions in ozone in North Carolina is to reduce NOx emissions.

II. Study Approach to Examine Annual Emissions Inspection Schedule to Biennial Schedule

As discussed earlier, the DEQ has or is in the process of submitting the required SIP documents related to implementation of Session Law 2017-10. As such, the following study approach assumes that the proposed changes are ultimately approved by EPA, and the modified program consists of 22 counties remaining in the I&M program with a rolling 20-year inspection program. For these counties, we examine the air quality, emissions, operational, and fiscal impacts to changing the inspection frequency from annual to biennial.

For each of these 22 counties, the study approach involved an analysis of the available ambient air quality monitoring data for ozone and daily NOx and VOC emissions reductions associated with the program. The emissions data were used in conjunction with ambient monitoring data and the new 2015 8-hour ozone NAAQS to provide a basis for developing our recommendation to change the frequency of emissions inspections. In addition, the study approach included an analysis to evaluate the potential fiscal impacts associated with changing the frequency of emissions inspections from annual to biennial.

A. Ambient Air Quality Data

Attainment of the 2015 8-hour ozone NAAQS is demonstrated by monitoring ambient air ozone concentrations in areas required to be monitored by EPA (typically in and near large metropolitan areas). A monitoring location is considered in attainment if its design value (DV) is less than or equal to the current ozone NAAQS of 70 ppb.[8] A total of 14 of the 22 counties have ozone monitors, and DVs are available for 2014 through 2016 for all 14 counties. The remaining 8 counties are not required to have ozone monitors; however, they are located near counties with monitors. These data can be used to infer the air quality levels in areas without monitors.

Table 3 and Figure 1 show the 22 counties, the 2014-2016 three-year average ozone DV for counties that have monitors, and counties that are covered by a maintenance plan for one or more of the old ozone standards. Table 3 also shows the total number of vehicle inspections conducted in 2016. Figure 1 shows the boundaries for each maintenance area for the old 1997 and 2008 8-hour ozone standards.[9] The counties that previously have only been maintenance for

[8] An ozone design value is the average of the 4th highest ozone measurements for each year of a three-consecutive year period.

[9] For the 1997 8-hour standard, the Charlotte maintenance area includes all of Cabarrus, Gaston, Lincoln, Mecklenburg, Rowan and Union Counties and a portion of Iredell County. The Charlotte maintenance area for the

the old 1979 1-hour ozone standard are also shown since these counties were required to have an I&M program as a result of being designated as a "moderate" nonattainment area for that standard. All of the counties with maintenance plans for the old ozone standards have subsequently been classified attainment for those standards. Historically, the I&M program has been implemented to include the whole county when only a part of the county was included in the maintenance area.

Table 3. Counties Subject to I&M Program

County	Ozone NAAQS	Status	Ozone Design Value, ppb (2014-2016)	Total No. Vehicle Emissions Inspections in 2016[1]	Total I&M Vehicles (Model Years 1996-2014) as a Percentage of All Registered I&M Vehicles[1]
Charlotte-Gastonia-Salisbury Maintenance Area					
Cabarrus[2]	1997 8-hour	Maintenance		121,209	79.9%
	2008 8-hour	Maintenance			
Gaston[2]	1979 1-hour	Maintenance		117,512	75.6%
	1997 8-hour				
	2008 8-hour	Maintenance			
Iredell[2,3]	1997 8-hour	Maintenance		96,921	67.3%
	2008 8-hour	Maintenance			
Lincoln[2]	1997 8-hour	Maintenance	67	49,145	71.0%
	2008 8-hour	Maintenance			
Mecklenburg[4]	1979 1-hour	Maintenance	70	523,067	75.0%
	1997 8-hour				
	2008 8-hour	Maintenance			
Rowan[2]	1997 8-hour	Maintenance	65	76,684	69.9%
	2008 8-hour	Maintenance			
Union[2]	1997 8-hour	Maintenance	68	115,661	67.6%
	2008 8-hour	Maintenance			
Triad Maintenance Area					
Davidson[5]	1979 1-hour	Maintenance		97,675	72.0%
Forsyth[4]	1979 1-hour	Maintenance	68	214,210	80.4%
Guilford[5]	1979 1-hour	Maintenance	65	292,466	81.7%
Triangle Maintenance Area					
Durham[4]	1979 1-hour	Maintenance	62	162,835	84.6%
	1997 8-hour				
Franklin	1997 8-hour	Maintenance		33,474	67.3%
Johnston	1997 8-hour	Maintenance	65	107,743	72.7%
Wake[4]	1979 1-hour	Maintenance	65	591,577	77.0%
	1997 8-hour				

2008 8-hour standard includes all of Mecklenburg County and portions of Cabarrus, Gaston, Iredell, Lincoln, Rowan and Union Counties. At the end of the 2014 ozone season, the Charlotte area demonstrated attainment for the 2008 ozone standard based on 2012-2014 monitoring data. On April 16, 2015, the DEQ submitted a redesignation demonstration and maintenance plan to EPA requesting that EPA reclassify the Charlotte area from marginal nonattainment to attainment for the 2008 ozone standard. The EPA approved this request which was effective August 27, 2015.[9]

County	Ozone NAAQS	Status	Ozone Design Value, ppb (2014-2016)	Total No. Vehicle Emissions Inspections in 2016[1]	Total I&M Vehicles (Model Years 1996-2014) as a Percentage of All Registered I&M Vehicles[1]
Other Counties Not in a Maintenance Area					
Alamance	-	-		93,946	76.2%
Buncombe	-	-	63	139,399	70.4%
Cumberland	-	-	64	144,786	66.8%
Lee	-	-	62	41,200	90.9%
New Hanover	-	-	60	121,005	76.8%
Onslow	-	-		74,960	60.3%
Randolph	-	-		81,847	68.8%
Rockingham	-	-	66	51,188	67.0%

[1] Vehicles subject to the I&M program include all light-duty gasoline vehicles registered in a subject I&M county. Personal vehicles registered in an I&M county operated on a federal installation or military base are subject to the I&M program. Note that North Carolina has not required federal employees and contractors with vehicles registered in non-I&M counties working at federal facilities to obtain an I&M inspection. This process is consistent with an EPA rulemaking that removed the provision of the state's otherwise federally-enforceable regulations that could result in infringement upon the sovereign immunity of federal facilities (see 82 FR 17144, April 10, 2017). Both the DAQ and DMV will request that the legislature amend the state statutes in the next legislative session to align with EPA's final rule. Once the requirement is removed from statute, DAQ will proceed to remove the requirement from administrative code.

[2] Although only part of this county is subject to a maintenance plan for the 2008 8-hour ozone NAAQS, the whole county is subject to the I&M program.

[3] Although only part of this county is subject to a maintenance plan for the 1997 8-hour ozone NAAQS, the whole county is subject to the I&M program.

[4] County is now designated as attainment for CO.

[5] County is also subject to a maintenance plan for particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$).

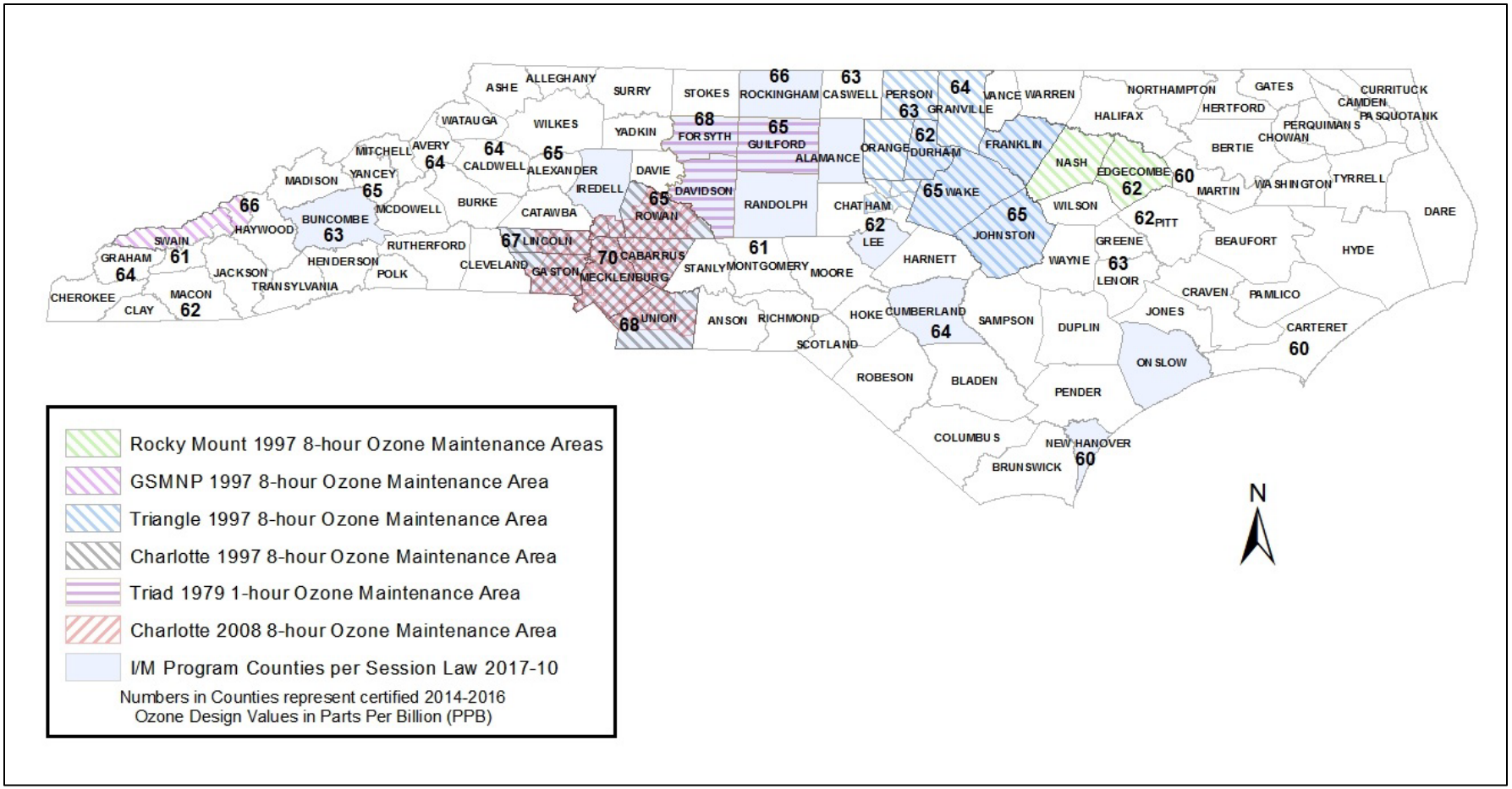

Figure 1. Ozone Design Values (2014-2016), I&M Counties and Ozone Designation Status

Based on the most recent certified ozone monitoring data (2014-2016), North Carolina does not have any areas violating the 2015 8-hour ozone standard or any of the other NAAQS. For the 22 counties with a vehicle I&M program, ozone DVs for 2014-2016 range from a low of 60 ppb for New Hanover County to a high of 70 ppb for Mecklenburg County. This is in sharp contrast to the ambient air quality data when the I&M program was expanded to 48 counties on January 1, 2006. At that time, two-thirds of the state's ozone monitors were violating the federal ozone standard. For the remaining counties without monitors, EPA has determined there is sufficient evidence to demonstrate that they are meeting the ozone NAAQS. As shown in Figure 1, each of the 22 counties subject to the I&M program are surrounded by counties with measurement data well below the 70 ppb NAAQS.

North Carolina continued to maintain compliance with the 2015 8-hour ozone standard throughout the 2017 ozone monitoring season. Based on preliminary 2017 and certified 2015 and 2016 ozone monitoring data, DVs range from a low of 58 ppb in New Hanover County to a high of 70 ppb in Mecklenburg County.

B. Vehicle Emissions Analysis

Air pollution emissions levels associated with changing the frequency of vehicle emissions inspections from annual to biennial were estimated for near-term and longer-term future years using EPA's Motor Vehicle Emission Simulator (MOVES2014a). For each county in the I&M program, modeling was performed to generate emissions to compare emissions increases associated with annual versus biennial emissions inspections. The following summarizes key aspects of the onroad modeling framework; a detailed explanation is provided in Appendix A to this report.

Pollutants Modeled:

- NOx, VOC

Temporal Basis:

- MOVES2014a modeling runs were executed to model emissions for a typical summer workday (specifically a July weekday)

Years of Emissions Analysis:

- Calendar year (CY) 2018 was used in anticipation that the proposed I&M program change would be approved by EPA within one year of 2018 (i.e., 2019); fulfilling EPA's definition of contemporaneous year of evaluation at the time SIP submittals are made.
- CY 2020, 2022, and 2026 were also modeled to observe the combined effects of 20 model year I&M program coverage and biennial emissions inspections.

I&M Program Parameters:

- Annual Inspection, the following I/M parameters will be used:
  - Compliance Rate: 96 percent
  - Waiver Rate: 5 percent
  - Model Years Covered: 20 latest model years
  - Exempted vehicles: 3 year (latest model year) with < 70,000 miles
  - Inspection Frequency: Annual

- Biennial Inspection: the same I/M parameters will be used, with the noted change to inspection frequency:
  - Compliance Rate: 96 percent
  - Waiver Rate: 5 percent
  - Model Years Covered: 20 latest model years
  - Exempted vehicles: 3 years (latest model years) with < 70,000 miles
  - Inspection Frequency: Biennial

Reid Vapor Pressure (RVP) Parameters for Summer Months:

- 9.0 pounds per square inch (psi) for all counties.

C. Fiscal Analysis

The fiscal analysis evaluates the costs and benefits associated with switching from an annual to a biennial emissions inspection frequency on private vehicle owners, state and local fleet operators, DOT Highway Fund, the DAQ budget allocation, and inspection station owners' fees in the 22 counties for the study period of 2018-2022. The fiscal analysis approach is consistent with the methods and procedures employed by the North Carolina Office of State Budget and Management (OSBM) to examine the impact of previous regulatory changes made to the I&M program. The analytical methods, data sources, and assumptions applied in the fiscal analysis are presented in Appendix B to this report.

III. Study Results

A. Vehicle Emissions Analysis

The change in NOx and VOC emissions associated with changing from an annual to a biennial program was modeled for calendar years 2018, 2020, 2022, and 2026. For these model runs, the emissions testing frequency was adjusted from one year to two years for each of the 22 counties. All other model input parameters were unchanged. Table 4 shows the modeling results for the combined 22 counties, and compares the emissions increases to total anthropogenic emissions for all source sectors in 2018. For the combined 22 counties, Figure 2 compares total NOx and VOC emissions under an annual and biennial inspection program for each of the four years modeled.

As shown in Table 4 and Figure 2, from 2018 to 2026, onroad NOx and VOC emissions are estimated to decline by about 58 percent and 38 percent, respectively, under an annual or a biennial emissions inspection program. This decline is due to fleet vehicle turnover because newer low-emitting vehicles would replace older higher-emitting vehicles covered by the I&M program. Additionally, cars are getting even cleaner as new federal fuel and engines standards (Tier 3) are phased in starting in 2017. The federal Tier 3 standards will result in significant emissions reductions from newer vehicles, thus lowering the potential for emission reductions provided by an I&M program regardless of the inspection frequency.

Table 4. Onroad NOx and VOC Emissions by Year Associated with Switching from Annual to Biennial Emissions Inspections for 22 Counties

	NOx Emissions				VOC Emissions			
	2018	**2020**	**2022**	**2026**	**2018**	**2020**	**2022**	**2026**
Total Onroad Emissions for 22 Counties (annual inspections and 20-year rolling vehicle coverage) (TPD)[a]	129.491	105.748	87.937	60.676	92.326	80.776	72.919	57.700
Total Onroad Emissions for 22 Counties (biennial inspections and 20-year rolling vehicle coverage) (TPD)	129.887	106.070	88.228	60.915	92.998	81.434	73.584	58.364
Emissions Increases from Annual to Biennial Conversion (TPD)	0.396	0.322	0.291	0.239	0.672	0.658	0.665	0.664
Emissions Increases from Annual to Biennial Conversion	0.3%	0.3%	0.3%	0.4%	0.7%	0.8%	0.9%	1.2%
Total Emissions for all Anthropogenic Emissions Source Sectors[b] (TPD)	281.5	Not Available			347.1	Not Available		
Emissions Increases (Percent of Total Emissions for all Anthropogenic Emissions Source Sectors in 22 Counties)	0.14%	Not Available			0.19%	Not Available		

[a] TPD = tons per day.

[b] Includes emissions from stationary, onroad and nonroad mobile, and other ground-level sources in the 22 counties.

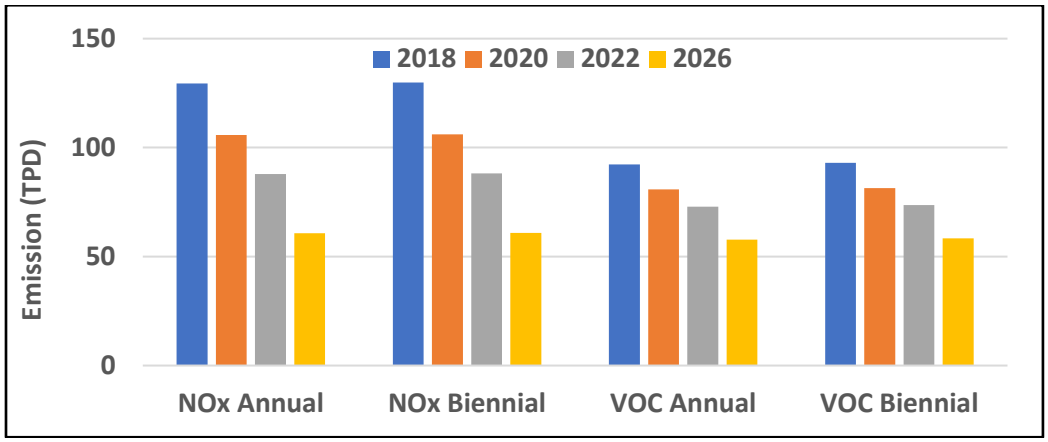

Figure 2. Comparison of Onroad Daily NOx and VOC Emissions by Year for an Annual versus Biennial Emissions Inspection Program for Combined 22 Counties

Switching to a biennial emissions inspection program would result in only slight increases in summer day NOx and VOC emissions. In 2018, total onroad NOx emissions for the combined 22 counties would increase by about 0.4 tons per day (0.3 percent) and total onroad VOC emissions would increase by 0.7 tons per day (0.7 percent) relative to the current annual

inspection program. By 2026, the annual NOx and VOC emissions increases would be slightly less than the NOx and VOC emissions increases in 2018. For 2018, changing the inspection frequency from annual to biennial would increase total anthropogenic NOx and VOC emissions in the combined 22 counties by about 0.14 percent and 0.19 percent, respectively. The increases expected in 2018 represent the worst case, more conservative estimates, as vehicle fleet turnover and Tier 3 standards will result in lower emissions in future years.

Tables 5 through 8 show the onroad emissions modeling results for each county for 2018, 2020, 2022, and 2026, respectively. Figure 3 compares the emissions increases for each of the four years for the Charlotte, Triad, and Triangle maintenance areas and the eight counties not included in a maintenance area. Increases in NOx emissions for the Charlotte, Triad, and Triangle areas are about 0.08, 0.04, and 0.07 ton per day, respectively. Increases in VOC emissions for the Charlotte, Triad, and Triangle areas are about 0.23, 0.11, and 0.12 ton per day, respectively. The Charlotte and Triangle areas show the highest increases mainly because of the high vehicle populations in Mecklenburg and Wake Counties.

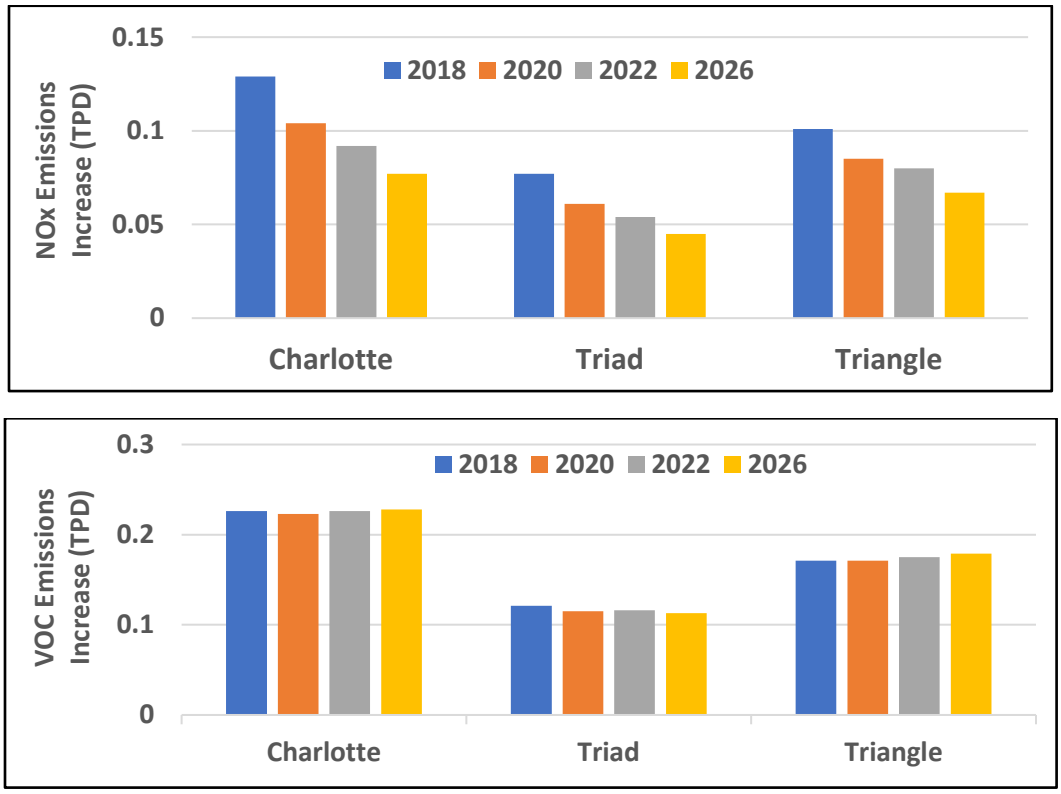

Figure 3. Comparison of Onroad Daily NOx and VOC Emissions Increases by Year for Ozone Maintenance Areas and "Other" Counties Not in a Maintenance Area

Overall, the increase in the emissions for each of the maintenance areas is very low and would not be expected to interfere with on-going attainment for any of the NAAQS including the 2015 ozone standard. In conclusion, the modeling results show that the decrease in onroad emissions associated with a cleaner vehicle fleet in the future under either an annual or biennial program would more than offset the slight increases in emissions associated with switching from an annual to a biennial emissions inspection program.

Table 5. 2018 Emissions Increases from Switching to Biennial Inspection Frequency

	Annual Inspection Frequency	Biennial Inspection Frequency			Annual Inspection Frequency	Biennial Inspection Frequency		
County	**NOx Emissions (TPD)***	**NOx Emissions (TPD)**	**NOx Emissions Increase (TPD)**	**NOx Emissions Increase (Percent)**	**VOC Emissions (TPD)**	**VOC Emissions (TPD)**	**VOC Emissions Increase (TPD)**	**VOC Emissions Increase (Percent)**
Charlotte-Gastonia-Salisbury Maintenance Area								
Cabarrus	4.421	4.434	0.013	0.29%	3.255	3.279	0.024	0.74%
Gaston	5.303	5.317	0.014	0.26%	3.774	3.798	0.024	0.64%
Iredell	5.999	6.013	0.014	0.23%	3.944	3.967	0.023	0.58%
Lincoln	2.355	2.361	0.006	0.25%	1.832	1.843	0.011	0.60%
Mecklenburg	15.453	15.511	0.058	0.38%	11.149	11.25	0.101	0.91%
Rowan	4.502	4.514	0.012	0.27%	3.216	3.235	0.019	0.59%
Union	4.176	4.188	0.012	0.29%	3.256	3.28	0.024	0.74%
Subtotal	**42.209**	**42.338**	**0.129**	**0.31%**	**30.426**	**30.652**	**0.226**	**0.74%**
Triad Maintenance Area								
Davidson	4.734	4.747	0.013	0.27%	3.701	3.723	0.022	0.59%
Forsyth	9.461	9.489	0.028	0.30%	6.382	6.425	0.043	0.67%
Guilford	11.185	11.221	0.036	0.32%	7.766	7.822	0.056	0.72%
Subtotal	**25.38**	**25.457**	**0.077**	**0.30%**	**17.849**	**17.97**	**0.121**	**0.68%**
Triangle Maintenance Area								
Durham	6.303	6.324	0.021	0.33%	4.04	4.072	0.032	0.79%
Franklin	1.322	1.326	0.004	0.30%	1.101	1.108	0.007	0.64%
Johnston	5.615	5.63	0.015	0.27%	3.458	3.481	0.023	0.67%
Wake	15.392	15.453	0.061	0.40%	11.706	11.815	0.109	0.93%
Subtotal	**28.632**	**28.733**	**0.101**	**0.35%**	**20.305**	**20.476**	**0.171**	**0.84%**
Other Counties Not in a Maintenance Area								
Alamance	4.277	4.288	0.011	0.26%	3.073	3.092	0.019	0.62%
Buncombe	6.791	6.81	0.019	0.28%	4.615	4.644	0.029	0.63%
Cumberland	6.388	6.406	0.018	0.28%	4.296	4.326	0.030	0.70%
Lee	1.582	1.586	0.004	0.25%	1.135	1.142	0.007	0.62%
New Hanover	2.953	2.963	0.010	0.34%	2.597	2.619	0.022	0.85%
Onslow	3.511	3.522	0.011	0.31%	2.412	2.429	0.017	0.70%
Randolph	4.637	4.647	0.010	0.22%	3.328	3.346	0.018	0.54%
Rockingham	3.131	3.137	0.006	0.19%	2.29	2.302	0.012	0.52%
Subtotal	**33.27**	**33.359**	**0.089**	**0.27%**	**23.746**	**23.9**	**0.154**	**0.65%**
Totals - All 22 Counties	**129.491**	**129.887**	**0.396**	**0.31%**	**92.326**	**92.998**	**0.672**	**0.73%**

* TPD = tons per day.

Table 6. 2020 Emissions Increases from Switching to Biennial Inspection Frequency

	Annual Inspection Frequency	Biennial Inspection Frequency			Annual Inspection Frequency	Biennial Inspection Frequency		
County	**NOx Emissions (TPD)***	**NOx Emissions (TPD)**	**NOx Emissions Increase (TPD)**	**NOx Emissions Increase (Percent)**	**VOC Emissions (TPD)**	**VOC Emissions (TPD)**	**VOC Emissions Increase (TPD)**	**VOC Emissions Increase (Percent)**
Charlotte-Gastonia-Salisbury Maintenance Area								
Cabarrus	3.674	3.684	0.010	0.27%	2.922	2.946	0.024	0.82%
Gaston	4.285	4.296	0.011	0.26%	3.226	3.25	0.024	0.74%
Iredell	4.888	4.899	0.011	0.23%	3.423	3.445	0.022	0.64%
Lincoln	1.959	1.964	0.005	0.26%	1.615	1.625	0.010	0.62%
Mecklenburg	12.272	12.32	0.048	0.39%	9.792	9.893	0.101	1.03%
Rowan	3.72	3.729	0.009	0.24%	2.784	2.801	0.017	0.61%
Union	3.429	3.439	0.010	0.29%	2.89	2.915	0.025	0.87%
Subtotal	**34.227**	**34.331**	**0.104**	**0.30%**	**26.652**	**26.875**	**0.223**	**0.84%**
Triad Maintenance Area								
Davidson	3.9	3.909	0.009	0.23%	3.185	3.205	0.020	0.63%
Forsyth	7.751	7.773	0.022	0.28%	5.549	5.59	0.041	0.74%
Guilford	9.172	9.202	0.030	0.33%	6.746	6.8	0.054	0.80%
Subtotal	**20.823**	**20.884**	**0.061**	**0.29%**	**15.48**	**15.595**	**0.115**	**0.74%**
Triangle Maintenance Area								
Durham	5.141	5.159	0.018	0.35%	3.549	3.58	0.031	0.87%
Franklin	1.069	1.072	0.003	0.28%	0.96	0.967	0.007	0.73%
Johnston	4.635	4.646	0.011	0.24%	3.041	3.064	0.023	0.76%
Wake	12.65	12.703	0.053	0.42%	10.509	10.619	0.110	1.05%
Subtotal	**23.495**	**23.58**	**0.085**	**0.36%**	**18.059**	**18.23**	**0.171**	**0.95%**
Other Counties Not in a Maintenance Area								
Alamance	3.518	3.526	0.008	0.23%	2.687	2.705	0.018	0.67%
Buncombe	5.592	5.606	0.014	0.25%	4.037	4.065	0.028	0.69%
Cumberland	5.201	5.216	0.015	0.29%	3.679	3.708	0.029	0.79%
Lee	1.277	1.28	0.003	0.23%	0.962	0.969	0.007	0.73%
New Hanover	2.381	2.39	0.009	0.38%	2.286	2.308	0.022	0.96%
Onslow	2.883	2.893	0.010	0.35%	2.119	2.135	0.016	0.76%
Randolph	3.791	3.799	0.008	0.21%	2.862	2.88	0.018	0.63%
Rockingham	2.56	2.565	0.005	0.20%	1.953	1.964	0.011	0.56%
Subtotal	**27.203**	**27.275**	**0.072**	**0.26%**	**20.585**	**20.734**	**0.149**	**0.72%**
Totals - All 22 Counties	**105.748**	**106.07**	**0.322**	**0.30%**	**80.776**	**81.434**	**0.658**	**0.81%**

* TPD = tons per day.

Table 7. 2022 Emissions Increases from Switching to Biennial Inspection Frequency

	Annual Inspection Frequency	Biennial Inspection Frequency			Annual Inspection Frequency	Biennial Inspection Frequency		
County	**NOx Emissions (TPD)***	**NOx Emissions (TPD)**	**NOx Emissions Increase (TPD)**	**NOx Emissions Increase (Percent)**	**VOC Emissions (TPD)**	**VOC Emissions (TPD)**	**VOC Emissions Increase (TPD)**	**VOC Emissions Increase (Percent)**
Charlotte-Gastonia-Salisbury Maintenance Area								
Cabarrus	3.102	3.111	0.009	0.29%	2.716	2.741	0.025	0.92%
Gaston	3.491	3.501	0.010	0.29%	2.852	2.875	0.023	0.81%
Iredell	4.049	4.058	0.009	0.22%	3.084	3.107	0.023	0.75%
Lincoln	1.633	1.637	0.004	0.24%	1.465	1.475	0.010	0.68%
Mecklenburg	10.094	10.137	0.043	0.43%	8.925	9.027	0.102	1.14%
Rowan	3.078	3.086	0.008	0.26%	2.474	2.492	0.018	0.73%
Union	2.873	2.882	0.009	0.31%	2.645	2.67	0.025	0.95%
Subtotal	**28.32**	**28.412**	**0.092**	**0.32%**	**24.161**	**24.387**	**0.226**	**0.94%**
Triad Maintenance Area								
Davidson	3.228	3.236	0.008	0.25%	2.819	2.839	0.020	0.71%
Forsyth	6.457	6.477	0.020	0.31%	4.984	5.026	0.042	0.84%
Guilford	7.637	7.663	0.026	0.34%	6.046	6.1	0.054	0.89%
Subtotal	**17.322**	**17.376**	**0.054**	**0.31%**	**13.849**	**13.965**	**0.116**	**0.84%**
Triangle Maintenance Area								
Durham	4.279	4.296	0.017	0.40%	3.219	3.251	0.032	0.99%
Franklin	0.875	0.877	0.002	0.23%	0.859	0.866	0.007	0.81%
Johnston	3.894	3.905	0.011	0.28%	2.754	2.778	0.024	0.87%
Wake	10.719	10.769	0.050	0.47%	9.746	9.858	0.112	1.15%
Subtotal	**19.767**	**19.847**	**0.080**	**0.40%**	**16.578**	**16.753**	**0.175**	**1.06%**
Other Counties Not in a Maintenance Area								
Alamance	2.91	2.918	0.008	0.27%	2.397	2.415	0.018	0.75%
Buncombe	4.638	4.651	0.013	0.28%	3.628	3.656	0.028	0.77%
Cumberland	4.339	4.353	0.014	0.32%	3.251	3.28	0.029	0.89%
Lee	1.039	1.042	0.003	0.29%	0.841	0.848	0.007	0.83%
New Hanover	1.971	1.979	0.008	0.41%	2.082	2.104	0.022	1.06%
Onslow	2.413	2.421	0.008	0.33%	1.908	1.925	0.017	0.89%
Randolph	3.115	3.122	0.007	0.22%	2.513	2.53	0.017	0.68%
Rockingham	2.103	2.107	0.004	0.19%	1.711	1.721	0.010	0.58%
Subtotal	**22.528**	**22.593**	**0.065**	**0.29%**	**18.331**	**18.479**	**0.148**	**0.81%**
Totals - All 22 Counties	**87.937**	**88.228**	**0.291**	**0.33%**	**72.919**	**73.584**	**0.665**	**0.91%**

* TPD = tons per day.

Table 8. 2026 Emissions Increases from Switching to Biennial Inspection Frequency

	Annual Inspection Frequency	Biennial Inspection Frequency			Annual Inspection Frequency	Biennial Inspection Frequency		
County	**NOx Emissions (TPD)***	**NOx Emissions (TPD)**	**NOx Emissions Increase (TPD)**	**NOx Emissions Increase (Percent)**	**VOC Emissions (TPD)**	**VOC Emissions (TPD)**	**VOC Emissions Increase (TPD)**	**VOC Emissions Increase (Percent)**
Charlotte-Gastonia-Salisbury Maintenance Area								
Cabarrus	2.163	2.171	0.008	0.37%	2.26	2.286	0.026	1.15%
Gaston	2.253	2.261	0.008	0.36%	2.153	2.175	0.022	1.02%
Iredell	2.674	2.682	0.008	0.30%	2.341	2.363	0.022	0.94%
Lincoln	1.061	1.064	0.003	0.28%	1.15	1.161	0.011	0.96%
Mecklenburg	7.424	7.461	0.037	0.50%	7.541	7.645	0.104	1.38%
Rowan	1.991	1.997	0.006	0.30%	1.847	1.864	0.017	0.92%
Union	2.005	2.012	0.007	0.35%	2.18	2.206	0.026	1.19%
Subtotal	**19.571**	**19.648**	**0.077**	**0.39%**	**19.472**	**19.7**	**0.228**	**1.17%**
Triad Maintenance Area								
Davidson	2.105	2.112	0.007	0.33%	2.077	2.096	0.019	0.91%
Forsyth	4.371	4.387	0.016	0.37%	3.869	3.91	0.041	1.06%
Guilford	5.272	5.294	0.022	0.42%	4.704	4.757	0.053	1.13%
Subtotal	**11.748**	**11.793**	**0.045**	**0.38%**	**10.65**	**10.763**	**0.113**	**1.06%**
Triangle Maintenance Area								
Durham	3.026	3.04	0.014	0.46%	2.608	2.64	0.032	1.23%
Franklin	0.557	0.559	0.002	0.36%	0.659	0.667	0.008	1.21%
Johnston	2.791	2.8	0.009	0.32%	2.204	2.229	0.025	1.13%
Wake	7.967	8.009	0.042	0.53%	8.192	8.306	0.114	1.39%
Subtotal	**14.341**	**14.408**	**0.067**	**0.47%**	**13.663**	**13.842**	**0.179**	**1.31%**
Other Counties Not in a Maintenance Area								
Alamance	1.878	1.884	0.006	0.32%	1.822	1.84	0.018	0.99%
Buncombe	3.05	3.06	0.010	0.33%	2.778	2.806	0.028	1.01%
Cumberland	3.05	3.06	0.010	0.33%	2.462	2.489	0.027	1.10%
Lee	0.677	0.679	0.002	0.30%	0.617	0.623	0.006	0.97%
New Hanover	1.39	1.397	0.007	0.50%	1.689	1.711	0.022	1.30%
Onslow	1.68	1.687	0.007	0.42%	1.508	1.524	0.016	1.06%
Randolph	1.98	1.985	0.005	0.25%	1.829	1.846	0.017	0.93%
Rockingham	1.311	1.314	0.003	0.23%	1.21	1.22	0.010	0.83%
Subtotal	**15.016**	**15.066**	**0.050**	**0.33%**	**13.915**	**14.059**	**0.144**	**1.03%**
Totals - All 22 Counties	**60.676**	**60.915**	**0.239**	**0.39%**	**57.7**	**58.364**	**0.664**	**1.15%**

* TPD = tons per day.

B. Fiscal Analysis

For the combined 22 counties, an estimated 3.3 million vehicles were inspected in 2016, and between 3.34 and 3.43 million vehicles are expected to be inspected annually during the study period of 2018-2022. Table 9 shows the annual fiscal impacts to the affected entities. It is estimated that changing the program from annual to biennial, 50 percent fewer vehicles would be inspected each year. Vehicle owners would receive an annual savings of $27 to $28 million. Inspection station owners would experience a loss of over $18 million each year. Reducing the number of vehicles inspected by 50 percent each year would decrease DOT Highway Fund receipts by half (about $8 million per year). The DAQ revenues would also decrease by half (about $1 million per year).

Table 9. Revenue and Expenditure Difference from Changing Annual to Biennial Emissions Frequency

Net Study Impact					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Costs					
DOT Highway Fund Loss	7,923,007	7,935,348	$7,972,775	8,050,630	8,141,198
DAQ Revenue Loss	1,084,201	1,085,890	$1,091,011	1,101,665	1,114,059
Inspection Station Revenue Loss	$18,348,017	$18,376,596	$18,463,267	$18,643,564	$18,853,300
Benefits					
Vehicle Owners Savings	$27,355,226	$27,397,835	$27,527,053	$27,795,860	$28,108,557
Net Impact (Benefits - Costs)	$0	$0	$0	$0	$0
Substantial Impact as defined in G.S. 150B-21.4	$54,710,451	$54,795,669	$55,054,106	$55,591,719	$56,217,113

Table 10 shows the net present value (NPV) of the impacts using a 7 percent discount rate over the period between 2018 and 2022. The revenue loss by the DOT Highway Fund is estimated to be $32.79 million and inspection station revenue loss is estimated at $75.94 million between 2018 and 2022. By dropping the DAQ's receipts by 50 percent, the net impact to the DAQ is $4.49 million over the study period. Vehicle owners would save $113.21 million between 2018 and 2022.

Table 10. Net Present Value of the Impacts

NPV Analysis	
Affected Parties	**Net Impact (2018-22), Present Value (2017$)**
Costs	
DOT Highway Fund Receipts Loss	$32,790,228
DAQ Revenue Loss	$4,487,084
Inspection Station Revenue Loss	$75,935,265
Benefits	
State, Local Fleet & Private Vehicle Owners	$113,212,577
Total (Benefit - Cost)	$0
Substantial Impact of Proposed Frequency Change	$226,425,154

*Assumes a 7 percent discount rate on fiscal impacts.

IV. Summary and Conclusions

A. Emissions Increases are Low and Program Benefits are Declining

The incremental emissions increases associated with changing from an annual to a biennial emissions inspection frequency is low. In 2018, for the combined 22 counties, emissions under a biennial inspection frequency would increase onroad NOx and VOC emissions by only 0.3 percent and 0.7 percent, respectively. In addition, NOx and VOC emissions associated with onroad vehicles have been and will continue to decline over time due to fleet turnover (newer low-emitting vehicles are replacing older higher-emitting vehicles) and the phase-in of new federal fuel and engines standards (Tier 3) starting in 2017. The federal Tier 3 standards will result in significant emissions reductions from newer vehicles, thus lowering the potential for emission reductions provided by an I&M program regardless of the inspection frequency. The decrease in onroad emissions associated with a cleaner vehicle fleet in the future under either an annual or biennial program would more than offset the slight increases in emissions associated with switching from an annual to a biennial program. For these reasons, the DEQ does not anticipate that the slight increase in onroad NOx and VOC emissions associated with switching to a biennial emissions inspection frequency would cause an exceedance of the new ozone standard or any of the other NAAQS in any of the 22 counties.

B. Air Quality has Improved – No Violating Monitors

Another important factor is current air quality. Significant improvements have been realized in North Carolina over the last 20 years in both ozone and fine particle concentrations. As of November 2017, North Carolina does not have a single air quality monitor violating any air quality standard including the 2015 8-hour ozone standard of 70 ppb. This is in sharp contrast to the air quality conditions when the vehicle I&M program was expanded to 48 counties. At that time, two-thirds of the state's monitors were violating the federal ozone standard. The DEQ estimates that changing the frequency of emissions inspections from annual to biennial will not interfere with the state's ability to continue to attain and maintain all current air quality standards statewide.

Based on current 2014-2016 certified ozone monitoring data, 11 of the 14 counties that have ozone monitors have ozone values *at or below 65 ppb*. Three counties in the Charlotte maintenance area have DVs ranging from 67 to 70 ppb. Based on pre-certified ozone monitoring data for the 2017 ozone season, all counties continue to maintain compliance with the current ozone standard. With ozone values generally expected to decline over time due to fleet turnover, Tier 3 standards, and emission reduction programs at the local level, the DEQ believes that it is unlikely that the small NOx emissions increases associated with this recommendation will cause an exceedance of the 70 ppb ozone standard in any of the 22 counties.

C. Fiscal Impacts

A conversion from an annual to a biennial emissions inspection program would cause a substantial economic impact, as defined in the Administrative Procedure Act in G.S. 150B-21.4. For the combined 22 counties, vehicle owners would receive an annual savings of $27 to $28 million. Reducing the number of vehicles inspected by 50 percent each year would cause an annual revenue loss of $18 million to the inspection station owners. The DAQ revenue would decrease by about $1 million annually, and the annual reduction in the state Highway Fund would be about $8 million.

V. Final Recommendations

The DEQ and DMV jointly recommend the following:

Recommendation 1: Change the frequency of emissions inspections from annual to biennial.

For the combined 22 counties, in 2018, changing the inspection frequency of the I&M program from annual to biennial would increase onroad NOx and VOC emissions by about 0.4 tons per day (0.3 percent) and 0.7 tons per day (0.7 percent), respectively. However, the decrease in onroad emissions associated with a cleaner vehicle fleet in the future would more than offset the slight increase in emissions. With ozone values generally expected to decline over time due to fleet turnover, federal Tier 3 standards, and emission reduction programs at the local level, it is unlikely that the small emissions increases associated with this recommendation will cause an exceedance of the 70 parts per billion (ppb) ozone standard or any of the other National Ambient Air Quality Standards (NAAQS) in any of the 22 counties.

Recommendation 2: Implement biennial emissions inspections starting in 2021.

The EPA must approve North Carolina's I&M SIP amendment and revised rule before the state may implement a change to the I&M program. This process may take up to 3 years to complete (i.e., about 12 months to complete the rulemaking process, SIP amendment, and CAA Section 110(l) noninterference demonstration for submittal to EPA; up to 18 months for EPA to approve the revision; and 2 to 3 months for the DMV to roll out the program change after the Secretary of the DEQ certifies to the Revisor of Statutes that EPA has approved the amendment to the I&M SIP). Based on this schedule, 2021 would be the earliest year in which the I&M program could be changed to implement biennial emissions inspections if the state legislature adopted the I&M program change in 2018.

Appendix A

Onroad Modeling Framework

For this study, county-level onroad mobile emissions were modeled for near-term and longer-term future years using the Motor Vehicle Emission Simulator (MOVES2014a). This appendix provides details on the modeling framework and assumptions used to generate emissions data associated with decreasing the frequency of North Carolina's vehicle emissions inspection and maintenance (I&M) program.

Counties Evaluated:
Each of the 22 counties that Session Law 2017-10 retained in the I&M program were modeled.[1] These counties include:

- Charlotte Maintenance Area for the 2008 8-hour ozone national ambient air quality standards (NAAQS): Cabarrus, Gaston, Iredell, Lincoln, Mecklenburg, Rowan, and Union.
- Triad Maintenance Area for the 1997 8-hour ozone NAAQS: Davidson, Forsyth, and Guilford.
- Triangle Maintenance Area for the 1997 8-hour ozone NAAQS: Durham, Franklin, Johnston, and Wake.
- All other counties not in a maintenance area: Alamance, Buncombe, Cumberland, Lee, New Hanover, Onslow, Randolph, and Rockingham.

Pollutants Modeled:
- Oxides of Nitrogen (NOx), Volatile Organic Compounds (VOC)

Previous MOVES2014a modeling results indicate that changing the vehicle coverage of the I&M program would not increase direct particulate matter with an aerodynamic diameter less than or equal to 2.5 or 10 micrometers ($PM_{2.5}$ or PM_{10}), sulfur dioxide, and lead emissions. This is because pollution control systems for light-duty gasoline vehicles subject to the I&M program are not designed to reduce emissions for these pollutants. Therefore, it is assumed that changing the frequency of inspections would not increase direct $PM_{2.5}$ or PM_{10}, sulfur dioxide, and lead emissions. Although changing the frequency of inspections from annual to biennial would increase carbon monoxide (CO) emissions slightly, CO is not considered in the study report because statewide the current ambient air quality levels for CO are less than 20 percent of the CO standard and North Carolina has been in compliance with the CO standards for over 20 years.

[1] The 2017 session of the North Carolina General Assembly enacted Session Law 2017-10, Senate Bill 131 (An Act to Provide Further Regulatory Relief to the Citizens of North Carolina). Section 3.5.(a) of the Act amended *North Carolina General Statute (NCGS) §143-215.107A(c)* to remove 26 of 48 counties from North Carolina's emissions inspection and maintenance (I&M) program. For the 22 counties remaining in the I&M program, Section 3.5.(b) of the Act also amended *NCGS §20-183.2(b)* by changing the vehicle model year coverage.

Temporal Basis:

- MOVES2014a modeling runs were executed to model emissions for a typical summer workday (specifically a July weekday) at the hourly time aggregation level.

Years of Emissions Analysis:

- Calendar year (CY) 2018 was used in anticipation that the proposed I&M program change would be approved by EPA within one year of 2018 (i.e., 2019); fulfilling EPA's definition of contemporaneous.
- CY 2020, 2022 and 2026 were also modeled to observe the combined effects of rolling 20 model year I&M program coverage and biennial emissions inspections.

Data Sources for MOVES2014a Input Files:

- Vehicle Miles Traveled (VMT) and Speed Data – Latest available transportation demand modeling (TDM) and Highway Performance Monitoring System (HPMS) data. County-level VMT estimates for 2018 will be derived by interpolation or extrapolation from the datasets listed below.
  - Charlotte Maintenance Area
    - Project: 2045 Metropolitan Transportation Plan (MTP) TDM Modeling
    - Years: 2015, 2025, 2026, 2035, 2045
  - Triad Maintenance Area, Triangle Maintenance Area, and all other Counties
    - 2016 NC HPMS VMT Data, projected to 2018, 2020, 2022, and 2026 using growth factors derived by linear regression from 2000-2014, 2016 HPMS data
- Source Type Population
  - 2016 county-level vehicle registration by model year and vehicle type from North Carolina Department of Transportation (DOT) and Division of Motor Vehicles (DMV), projected to 2018, 2020, 2022, and 2026 based on certified county-level human population
- Source Type Age Distribution
  - 2016 county-level vehicle registration data by model year and vehicle type from DOT and DMV
- Meteorology
  - 2016 meteorology data from selected weather stations from NC Climate Center
- County human population and projections (for source type population projections)
  - Latest certified data from Office of State Budget and Management website (2016)

Emissions Inspection Program Parameters:

- Annual Inspection, the following I&M parameters will be used:
  - Compliance Rate: 96%
  - Waiver Rate: 5%
  - Model Years Covered: 20 latest model years
  - Exempted vehicles: 3 year (latest model year) with < 70,000 miles
  - Inspection Frequency: Annual

- Biennial Inspection: the same I&M parameters will be used, with the noted change to inspection frequency:
  - Compliance Rate: 96%
  - Waiver Rate: 5%
  - Model Years Covered: 20 latest model years
  - Exempted vehicles: 3 years (latest model years) with < 70,000 miles
  - Inspection Frequency: Biennial

Reid Vapor Pressure (RVP) Parameters for Summer Months:

- 9.0 pounds per square inch (psi) for all counties

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Appendix B

Fiscal Analysis for a Study to Examine the Impact of Decreased Frequency of Vehicle Emissions Inspections

I. Executive Summary

The 2017 session of the North Carolina General Assembly enacted Session Law 2017-211, Senate Bill 16,[1] (An Act to Mandate a Study of the Impact by Decreasing the Frequency of Vehicle Emissions Inspections). This study is examining biennial emissions inspection for the 22 counties remaining in the emissions inspection and maintenance (I&M) program as opposed to annual emissions inspections. The requirements would apply to the following: (1) a vehicle with a model year within 20 years of the current year and older than the three most recent model years, or (2) a vehicle with a model year within 20 years of the current year and has 70,000 miles or more on its odometer.

The purpose of this document is to conduct an evaluation of the costs and benefits associated with switching from annual to a biennial emissions inspection and maintenance program. The fiscal analysis approach used here is consistent with the methods and procedures employed by the Office of State Budget and Management (OSBM) to examine the impact of previous regulatory change made to the I&M program.[2] Key assumption and study design principles are discussed later in the document. The study assumes that the biennial emissions inspections would become effective in 2018.

Table 1a shows the annual fiscal impacts to the affected entities. An estimated 3.3 million vehicles were inspected in 2016 and between 3.34-3.43 million vehicles are expected to be inspected for the study period of 2018-2022. By reducing the frequency of vehicle emissions inspections from annual to biennial, an estimated 1.67-1.71 million vehicles are expected to be inspected in the 2018-2022 study period. Relative to the current annual emissions inspection and maintenance program, this results in approximately a 50 percent reduction in the number of vehicles that would be inspected and receipts received through the North Carolina Department of Transportation's (DOT) Highway Fund during the study period.

Vehicle owners would recognize an annual benefit of about $28 million. The DOT Highway Fund revenue loss would be about $8 million per year. The Division of Air Quality's (DAQ) revenue loss would be about $1 million per year. The inspection stations would experience the highest revenue loss at about $18 million per year.

[1] https://www.ncga.state.nc.us/Sessions/2017/Bills/Senate/PDF/S16v6.pdf See Section 12.(b).
[2] https://deq.nc.gov/about/divisions/air-quality/air-quality-rules/rules-hearing-process

Table 1a. Revenue and Expenditure Difference from Changing Annual to Biennial Emissions Inspection Frequency

Net Study Impact					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Costs					
DOT Highway Fund Loss	7,923,007	7,935,348	$7,972,775	8,050,630	8,141,198
DAQ Revenue Loss	1,084,201	1,085,890	$1,091,011	1,101,665	1,114,059
Inspection Station Revenue Loss	$18,348,017	$18,376,596	$18,463,267	$18,643,564	$18,853,300
Benefits					
Vehicle Owners Savings	$27,355,226	$27,397,835	$27,527,053	$27,795,860	$28,108,557
Net Impact (Benefits - Costs)	$0	$0	$0	$0	$0
Substantial Impact as defined in G.S. 150B-21.4	$54,710,451	$54,795,669	$55,054,106	$55,591,719	$56,217,113

Table 1b shows the net present value (NPV) of the impacts using a 7 percent discount rate. The revenue loss by the DOT Highway Fund is estimated to be $32.79 million and inspection station revenue loss is estimated at $75.94 million between 2018 and 2022. By dropping the DAQ's allocations by 50 percent, the net impact to the DAQ is $4.49 million over the study period. Vehicle owners would save $113.21 million between 2018 and 2022.

Table 1b. Net Present Value of the Impacts*

NPV Analysis	
Affected Parties	**Net Impact (2018-22), Present Value (2017$)**
Costs	
DOT Highway Fund Receipts Loss	$32,790,228
DAQ Revenue Loss	$4,487,084
Inspection Station Revenue Loss	$75,935,265
Benefits	
State, Local Fleet & Private Vehicle Owners	$113,212,577
Total (Benefit - Cost)	$0
Substantial Impact of Proposed Frequency Change	$226,425,154

*Assumes a 7 percent discount rate on fiscal impacts.

A conversion from an annual to a biennial emissions inspection and maintenance program would cause a substantial economic impact, as defined in the Administrative Procedure Act in G.S. 150B-21.4.

II. Description of Existing Rules

Rule 15A NCAC 02D .1005 paragraphs (a) and (b) list requirements of the on-board diagnostics test. Currently annual inspections apply to vehicles that are subject to rule 15A NCAC 02D .1002, *Applicability*. This rule defines the trigger mechanisms for which specific vehicles are subject to the I&M requirements in the 22 counties retained in the I&M program per Session Law 2017-10. The emissions inspections are done annually and the vehicle model year coverage requirements are as follows: (1) a vehicle with a model year within 20 years of the current year and older than the three most recent model years, or (2) a vehicle with a model year within 20 years of the current year and has 70,000 miles or more on its odometer.

Rulemaking action would be required to change the on-board diagnostic test frequency from annual to biennial in paragraph b of rule 15A NCAC 02D .1005 (b).

III. Motivation for the Proposed Study

The motivation for the proposed study is Session Law 2017-211, and examining whether the frequency of vehicle emissions inspections should be decreased.

IV. Identification of the Affected Sources

Moving from an annual to a biennial emissions inspection will impact the affected sources as follows: Private vehicle owners, state and local fleet operators, DOT Highway Fund, the DAQ and inspection station owners in the 22 I&M counties.

Vehicle documentation and records are kept systematically by the North Carolina Division of Motor Vehicles (DMV), as each vehicle must have a registration card, license plate, and annual safety inspection with the odometer mileage recorded. Table 2 shows the distribution of vehicles (model year and number of vehicles) that were inspected in the 22 I&M counties. The total number of vehicles inspected is about 3.29 million for calendar year 2016.

Using the 2016 actual inspections completed, future year projections of vehicles expected to be inspected are estimated for years 2018 through 2022. These projections were developed using county-specific population related growth factors derived from the recent population data projections obtained from the OSBM.[3]

[3] https://www.osbm.nc.gov/demog/county-projections

Table 2. Calendar Year 2016 I&M Vehicle Inspection Data from Mobile Source

Model Year	2016 Inspected Vehicles	Model Year	2016 Inspected Vehicles
1997	76,254	2007	241,451
1998	91,814	2008	218,526
1999	114,031	2009	146,834
2000	139,406	2010	185,829
2001	141,923	2011	209,236
2002	167,330	2012	239,315
2003	190,297	2013	282,172
2004	215,250	2014	29,582
2005	228,912	2015	11,795
2006	219,223	2016	2,412
		2017	27
2016 Total		**3,294,107**	

The DAQ utilizes a removal/scrap rate by age calculation provided by the OSBM to estimate the number of vehicles expected to be exempted with the changes to inspection frequency. The OSBM recommended using a vehicle survivability and travel mileage schedules technical report published by National Center for Statistics and Analysis (NHTSA)[4] to calculate the removal/scrap rate by age. The OSBM also recommended using an April 2017 vehicle registration by counties and towns report to incorporate the different scrap rates for light-duty gasoline vehicles to determine the total number of vehicles exempted with current rule as shown in Table 3.

Table 3. Estimated Vehicle Removal / Scrappage Schedule for Light Duty Gasoline Vehicles

Remaining Vehicles in Fleet by Model Year (MY)	2018	2019	2020	2021	2022
1996	33,274	25,966	20,199	15,702	11,656
1997	46,988	36,685	28,628	22,270	17,312
1998	57,052	44,693	34,894	27,230	21,183
1999	71,569	56,296	44,101	34,431	26,869
2000	88,711	70,079	55,124	43,183	33,714
2001	91,900	73,015	57,679	45,370	35,542
2002	110,740	88,697	70,470	55,668	43,789
Total # Vehicles Scrapped/Removed from Baseline	57,052 (MY 98)	100,989 (MY 98-99)	134,119 (MY 98-00)	150,215 (MY 96-01)	161,097 (MY 98-02)

[4] USDOT NHTSA (January 2006), Vehicle Survivability and Travel Mileage Schedules. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/809952.

It is estimated that vehicle population will grow between 3 to 9 percent relative to 2016. A retrospective analysis for the past 3 years shows that between 2014 and 2016, the number of vehicles emissions inspections grew by a growth factor between 1.0 -1.10 (see Table 4). This actual growth factor is similar to the projected growth factor used in this fiscal analysis, validating the use of 1.01- 1.09 growth factor as being reasonable for determining vehicle populations in years 2017 through 2022. Table 4 provides a projection of the number of vehicles in North Carolina that would be subject to the emissions inspection throughout the 2018-2022 project period.

Table 4. Baseline and Additional Vehicles Exempted under the Revised Statute

All Vehicles Inspected in the I&M Counties							
Year	**2016 (actual)**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Baseline							
# Vehicles	3,294,107	3,343,956	3,393,055	3,442,189	3,491,077	3,539,954	3,588,970
# Vehicles Removed / Scraped			57,052	100,989	134,119	150,215	161,097
Baseline (annual inspection)			3,336,003	3,341,199	3,356,958	3,389,739	3,427,873
Proposed (biennial inspection)			1,668,002	1,670,600	1,678,479	1,694,869	1,713,936
Growth Factor Relative to 2016			1.03	1.04	1.05	1.07	1.09

Retrospective Analysis to Evaluate Growth Factor			
	Vehicles Inspected	Vehicles Inspected with 3-year Exemption	Growth Factor Relative to 2014
2014	3,763,452	3,150,429	
2015	4,046,903	3,463,930	1.10
2016	4,249,977	3,294,107	1.0

V. Establishment of the Regulatory Baseline

This section presents the revenues and costs to the affected parties under the baseline annual inspections and proposed change (biennial inspections). Under the baseline rule, the I&M program requires annual inspections. Under the proposed study, the I&M program will subject vehicles to biennial inspection.

For owners of vehicles required to have an emissions and safety inspection, the total fee charged is $30 (see Table 5). Of this amount, $16.40 is allocated for emissions inspection and $13.60 is allocated for safety inspection. The revenue generated from emissions inspection is disbursed to state agencies via receipts ($5.40) while the remaining $11.00 is retained by the inspection station. The two state agencies benefiting from the receipts are DOT and DMV, and their allocations are based on the rates shown in Table 5. Currently, the DAQ receives $0.65 per inspection for fiscal year 2016-2017. It is assumed that this funding level remains in effect throughout the 2018-2022 study period

Table 6 presents costs and benefits associated with the baseline scenario for future years 2018 through 2022. The number of vehicles inspected per year, shown in Table 4, were multiplied with the cost and revenue data shown in Table 5 to generate the baseline revenues and expenditures shown in Table 6.

Table 5. Vehicle Emissions Inspection Fee Schedule[5]

	Receipts	Revenue to Inspection Station	Cost to Vehicle Owners
1. Emission Inspection			
DOT Highway Fund / DMV Receipts	$4.75 per inspection		
DAQ Receipts	$0.65 per inspection		
Fee Sub-total (State Agency Public Cost)	*$5.40* per inspection		
Inspection Station Revenue for Emission Inspections		*$11.00* per inspection	
Emission Inspection Cost to Vehicle Owner			**$16.40** per inspection

FY2016-2017. It is assumed that this amount remains unchanged in FY 2018 through FY 2022.

Table 6. Baseline Revenue and Expenditures with Annual Emissions Frequency

Year	2018	2019	2020	2021	2022
Costs					
State, Local Fleet & Private Vehicle Owners ($16.40 * # of inspections)	$54,710,451	$54,795,669	$55,054,106	$55,591,719	$56,217,113
Benefits					
DOT Highway Fund Receipts ($4.75* # of inspections)	$15,846,015	$15,870,697	$15,945,549	$16,101,260	$16,282,396
DAQ Revenue	$2,168,402	$2,171,780	2,182,023	$2,203,330	$2,228,117
Inspection Station Revenue for Emission Inspection ($11* # of inspections)	$36,696,034	$36,753,193	$36,926,535	$37,287,129	$37,706,600

VI. Estimated Impacts of Biennial Emissions Frequency and Changes from The Baseline

Table 7 estimates the fiscal impacts of the proposed frequency change based on the numbers of vehicles inspected biennially during the study period (see Table 4). The cost to vehicle owners is estimated to be $27.35 million in 2018 and will reach about $28.11 million by the end of the study period of 2022. By reducing the number of vehicles inspected by 50 percent each year, the receipts received through the Highway Fund is halved. The DAQ receipts are also halved.

[5] § 20-183.7. Fees for performing an inspection and issuing an electronic inspection authorization to a vehicle; use of civil penalties. https://www.ncleg.net/EnactedLegislation/Statutes/PDF/BySection/Chapter_20/GS_20-183.7.pdf

Table 7. Revenues and Expenditures with Biennial Emissions Frequency

Revised Frequency Impact					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Costs					
State, Local Fleet & Private Vehicle Owners	$27,355,226	$27,397,835	$27,527,053	$27,795,860	$28,108,557
Benefits					
DOT Highway Fund Revenue Receipts	$7,923,007	$7,935,348	$7,972,775	$8,050,630	$8,141,198
DAQ Revenue	$1,084,201	$1,085,890	$1,091,011	$1,101,665	$1,114,059
Inspection Station Revenue for Emission Inspection	$18,348,017	$18,376,596	$18,463,267	$18,643,564	$18,853,300

Table 8 estimates the difference, going to a biennial emissions frequency from an annual emissions frequency. Vehicle owners would recognize an annual benefit of about $28 million. The DAQ's revenue loss would be about $1 million per year, and the DOT's Highway Fund revenue loss would be about $8 million per year. The inspection stations would experience the highest revenue loss at about $18 million per year.

Table 9 shows the estimated NPV of the annual fiscal impacts using a 7 percent discount rate. The revenue loss from the DOT Highway Fund is estimated to be $32.79 million and inspection station revenue loss is estimated at $75.94 million between 2018 and 2022. By dropping the DAQ's receipts by 50 percent, the net impact to the DAQ is $4.49 million over the study period. Vehicle owners would save $113.21 million between 2018 and 2022.

Table 8. Revenue and Expenditure Difference from Changing Annual to Biennial Emissions Inspection Frequency

Net Study Impact					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Costs					
DOT Highway Fund Loss	7,923,007	7,935,348	$7,972,775	8,050,630	8,141,198
DAQ Revenue Loss	1,084,201	1,085,890	$1,091,011	1,101,665	1,114,059
Inspection Station Revenue Loss	$18,348,017	$18,376,596	$18,463,267	$18,643,564	$18,853,300
Benefits					
Vehicle Owners Savings	$27,355,226	$27,397,835	$27,527,053	$27,795,860	$28,108,557
Net Impact (Benefits - Costs)	$0	$0	$0	$0	$0
Substantial Impact as defined in G.S. 150B-21.4	$54,710,451	$54,795,669	$55,054,106	$55,591,719	$56,217,113

Table 9. Net Present Value of the Impacts*

NPV Analysis	
Affected Parties	**Net Impact (2018-22), Present Value (2017$)**
Costs	
DOT Highway Fund Receipts Loss	$32,790,228
DAQ Revenue Loss	$4,487,084
Inspection Station Revenue Loss	$75,935,265
Benefits	
State, Local Fleet & Private Vehicle Owners	$113,212,577
Total (Benefit - Cost)	$0
Substantial Impact of Proposed Frequency Change	$226,425,154

*Assumes a 7 percent discount rate on fiscal impacts.

Appendix C

Acronyms and Abbreviations

Acronym / Abbreviation	Definition
$\mu g/m^3$	micrograms per cubic meter
CAA	Clean Air Act
CFR	Code of Federal Regulations
CO	carbon monoxide
CY	calendar year
DAQ	North Carolina Division of Air Quality
DENR	North Carolina Department of Environment and Natural Resources
DEQ	North Carolina Department of Environmental Quality
DMV	North Carolina Division of Motor Vehicles
DOT	North Carolina Department of Transportation
DV	design value
EMC	Environmental Management Commission
EPA	U.S. Environmental Protection Agency
FR	Federal Register
FY	fiscal year
HPMS	Highway Performance Monitoring System
I&M	Inspection and Maintenance
MOVES	Motor Vehicle Emission Simulator
MTP	metropolitan transportation plan
MY	vehicle model year
NAAQS	National Ambient Air Quality Standard
NCAC	North Carolina Administrative Code
NCDOT	North Carolina Department of Transportation
NHTSA	National Center for Statistics and Analysis
NO_2	nitrogen dioxide
NOx	oxides of nitrogen
NPV	net present value
OBD	On-Board Diagnostic
OSBM	Office of State Budget and Management
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers
ppb	parts per billion
ppm	parts per million
psi	pounds per square inch

Acronym / Abbreviation	Definition
RVP	Reid vapor pressure
SIP	State Implementation Plan
SO_2	sulfur dioxide
TDM	Transportation Demand Modeling
VIN	Vehicle Identification Number
VMT	Vehicle Miles Traveled
VOC	volatile organic compounds