Ratings: See "RATINGS" herein.

This Official Statement has been prepared by the North Carolina Turnpike Authority to provide information on the Series 2018 Bonds. Selected information is presented on this cover page for the convenience of the user. Unless indicated, capitalized terms used on this cover page have the meanings given hereafter in this Official Statement. To make an informed decision regarding the Series 2018 Bonds, a prospective investor should read this Official Statement in its entirety.

# \$401,155,000



# NORTH CAROLINA TURNPIKE AUTHORITY Triangle Expressway System Senior Lien Turnpike Revenue Refunding Bonds, Series 2018



**Dated: Date of Delivery** 

Due: as shown on inside of front cover

Tax Treatment

In the opinion of Bond Counsel, under current law and subject to conditions described in the Section herein "TAX TREATMENT," interest on the Series 2018 Bonds (a) is not included in gross income for federal income tax purposes, (b) is not an item of tax preference, and (c) is exempt from all income taxes in the State of North Carolina. A holder may be subject to other federal tax consequences as described in the Section herein "TAX TREATMENT."

Redemption

The Series 2018 Bonds are subject to optional redemption on or after January 1, 2029. See "THE SERIES 2018 BONDS – Redemption Provisions."

Security

The Series 2018 Bonds will be special obligations of the Authority, secured by and payable from the Receipts (hereinafter defined) of the Triangle Expressway System described in this Official Statement and, under certain circumstances, the proceeds of the Series 2018 Bonds, investment earnings and certain other proceeds. Neither the credit nor the taxing power of the State of North Carolina (the "State") or any of the State's political subdivisions is pledged for the payment of principal of or interest on the Series 2018 Bonds, and no Owner of the Series 2018 Bonds has the right to compel the exercise of the taxing power of the State or any of the State's political subdivisions or the forfeiture of any of their respective properties other than Receipts in connection with any default on the Series 2018 Bonds. ACCELERATION IS NOT A REMEDY AVAILABLE TO OWNERS OF THE SERIES 2018 BONDS UPON DEFAULT.

Bond Insurance

The scheduled payment of principal of and interest on the Series 2018 Bonds maturing on January 1 in the years 2032 through 2038, inclusive, and 2041 (collectively, the "Insured Series 2018 Bonds") when due will be guaranteed under an insurance policy to be issued concurrently with the delivery of the Series 2018 Bonds by Assured Guaranty Municipal Corp.



Interest Payment Dates

Interest on the Series 2018 Bonds will be paid on January 1 and July 1, beginning

July 1, 2019.

**Denominations** 

\$5,000 or any whole multiple thereof.

 ${\it Closing/Settlement}$ 

On or about December 12, 2018

Bond Counsel

**Hunton Andrews Kurth LLP** 

Underwriters' Counsel

McGuireWoods LLP, Raleigh, North Carolina

Trustee and Bond Registrar

Wells Fargo Bank, N.A., Jacksonville, Florida

The Series 2018 Bonds are offered, when, as and if issued and received by the Underwriters, subject to prior sale and the opinion of Bond Counsel as to their validity, the tax treatment of interest thereon and certain other matters.

J.P. Morgan Citigroup

BofA Merrill Lynch Siebert Cisneros Shank & Co., L.L.C. Loop Capital Markets Wells Fargo Securities

## **MATURITY SCHEDULE**

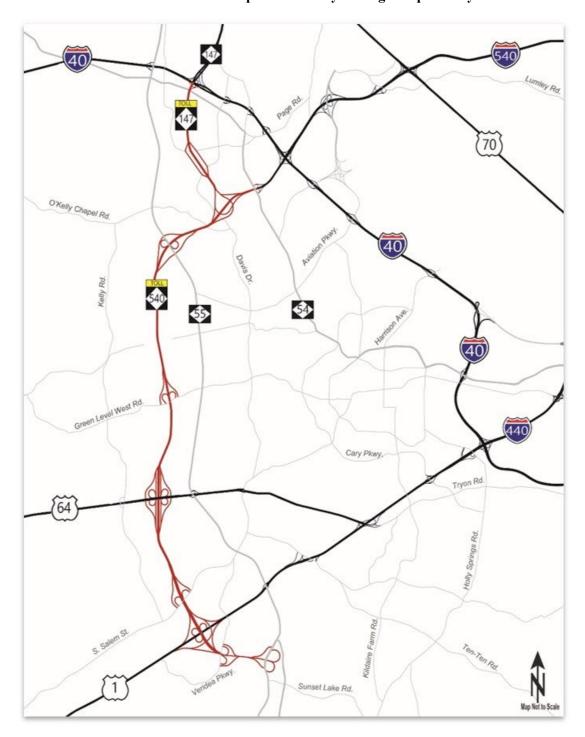
# \$401,155,000 Series 2018 Bonds

Due <u>January 1</u>	Principal <u>Amount</u>	Interest <u>Rate</u>	<u>Yield</u>	<u>Price</u>	CUSIP**
2020	\$890,000	4.00%	2.23%	101.830%	65830RBN8
2021	1,815,000	5.00	2.35	105.279	65830RBP3
2022	2,030,000	5.00	2.47	107.394	65830RBQ1
2023	2,500,000	5.00	2.58	109.254	65830RBR9
2024	3,070,000	5.00	2.70	110.794	65830RBS7
2025	4,930,000	5.00	2.83	111.991	65830RBT5
2026	6,585,000	5.00	2.99	112.694	65830RBU2
2027	8,485,000	5.00	3.10	113.446	65830RBV0
2028	10,555,000	5.00	3.22	113.879	65830RBW8
2029	9,525,000	5.00	3.32	114.257	65830RBX6
2030	14,485,000	5.00	3.42*	113.343	65830RBY4
2031	17,125,000	5.00	3.48*	112.798	65830RBZ1
2032	20,080,000	5.00	3.37*	113.799	65830RCA5
2033	16,775,000	5.00	3.42*	113.343	65830RCB3
2034	19,805,000	5.00	3.51*	112.527	65830RCC1
2035	22,355,000	5.00	3.59*	111.808	65830RCD9
2036	24,990,000	5.00	3.65*	111.272	65830RCE7
2037	27,515,000	4.00	4.04	99.488	65830RCF4
2038	10,000,000	4.00	4.08	98.945	65830RCH0
2038	28,440,000	5.00	3.73*	110.563	65830RCG2
2039	43,315,000	4.00	4.28	96.254	65830RCJ6
2040	56,855,000	5.00	3.96*	108.553	65830RCK3
2041	49,030,000	4.00	4.13	98.128	65830RCL1

<sup>\*</sup>Yield to January 1, 2029 call date at par.

<sup>\*\*</sup> CUSIP® is a registered trademark of the American Bankers Association. CUSIP Global Services is managed on behalf of the American Bankers Association by S&P Capital IQ. Copyright©2018 CUSIP Global Services. All rights reserved. CUSIP data herein is provided by S&P Capital IQ, a division of McGraw-Hill Financial, Inc. The CUSIP data herein is provided solely for the convenience of reference only. Neither the Authority nor the Underwriters are responsible for selection or use of these CUSIP numbers, and no representation is made as to their correctness on the Series 2018 Bonds or as indicated above. The CUSIP number for a specific maturity is subject to being changed after the issuance of the Series 2018 Bonds as a result of various subsequent actions including, but not limited to, a refunding in whole or in part of the Series 2018 Bonds.

North Carolina Turnpike Authority Triangle Expressway





## NORTH CAROLINA TURNPIKE AUTHORITY

# **STATE OFFICIALS**

Roy Cooper Governor

MG(R) James H. Trogdon, III, P.E. Secretary of NCDOT

Bobby Lewis, P.E. Chief Operating Officer of NCDOT Evan Rodewald Chief Financial Officer of NCDOT Tim Little, P.E. Chief Engineer of NCDOT

# <u>AUTHORITY MEMBERS<sup>1</sup></u>

MG(R) James H. Trogdon, III, P.E. Chairman
Perry R. Safran Vice Chairman
Robert D. Teer, Jr. Secretary/Treasurer

Scott Aman Member
Jim Crawford Member
Montell W. Irvin, P.E. Member
Charles L. Travis, III Member
James Walker Member

# **MANAGEMENT STAFF**

Beau Memory Executive Director Marvin T. Butler Deputy Director

David Roy Director of Finance and Budget Andy Lelewski, P.E. Director of Toll Operations

Rodger Rochelle, P.E. Chief Engineer

## **MUNICIPAL ADVISOR**

PFM Financial Advisors, LLC, Orlando, Florida

## TRAFFIC & REVENUE CONSULTANT

CDM Smith Inc., New Haven, Connecticut

# **GENERAL ENGINEERING CONSULTANT**

HNTB Corporation, Raleigh, North Carolina

## BOND COUNSEL

Hunton Andrews Kurth LLP

<sup>&</sup>lt;sup>1</sup> There is currently one vacancy on the Board of Directors of the Authority.

IN CONNECTION WITH THIS OFFERING, THE UNDERWRITERS MAY OVERALLOT OR EFFECT TRANSACTIONS THAT STABILIZE OR MAINTAIN THE MARKET PRICE OF SERIES 2018 BONDS AT A LEVEL ABOVE THAT WHICH MIGHT OTHERWISE PREVAIL IN THE OPEN MARKET. SUCH STABILIZING, IF COMMENCED, MAY BE DISCONTINUED AT ANY TIME.

No dealer, broker, salesman or other person has been authorized to give any information or to make any representation other than those contained in this Official Statement in connection with the offering described herein, and, if given or made, such other information or representation must not be relied upon as having been authorized. This Official Statement does not constitute an offer to sell or the solicitation of an offer to buy any securities other than the Series 2018 Bonds offered hereby, nor shall there be any offer or solicitation of such offer or sale of the Series 2018 Bonds in any jurisdiction in which it is unlawful to make such offer, solicitation or sale. Neither the delivery of this Official Statement nor the sale of any of the Series 2018 Bonds implies that the information herein is correct as of any date subsequent to the date hereof.

Neither the Series 2018 Bonds nor the Trust Agreement have been registered or qualified with the Securities and Exchange Commission by reason of the provisions of Section 3(a)(2) of the Securities Act of 1933, as amended, or Section 304(a)(4) of the Trust Indenture Act of 1939, as amended. The registration or qualification of the Series 2018 Bonds and the Trust Agreement in accordance with applicable provisions of securities laws of the states, if any, in which the Series 2018 Bonds and the Trust Agreement have been registered or qualified, and the exemption from registration or qualification in other states, shall not be regarded as a recommendation thereof.

In making an investment decision, investors must rely on their own examination of the terms of the offering, including the merits and risks involved. These securities have not been recommended by any federal or state securities commission or regulatory authority. Furthermore, the foregoing authorities have not confirmed the accuracy or determined the adequacy of this document. Any representation to the contrary is a criminal offense.

All quotations from and summaries and explanations of laws and documents herein do not purport to be complete, and reference is made to such laws and documents for full and complete statements of their provisions. Any statements made in this Official Statement involving estimates or matters of opinion, whether or not expressly so stated, are intended merely as estimates or opinions and not as representations of fact. The information set forth herein has been obtained from the Authority and other sources that are deemed to be reliable, but is not guaranteed as to accuracy or completeness by, and is not to be construed as a representation of, the Underwriters. The information contained herein is subject to change after the date of this Official Statement, and this Official Statement speaks only as of the date hereof.

Certain statements contained in this Official Statement reflect forecasts and constitute forward-looking statements rather than historical facts. In this respect, the words "estimate," "project," "anticipate," "expect," "intend," "believe" and similar expressions are intended to identify forward-looking statements. All such forward-looking statements are expressly qualified by the cautionary statements set forth in this Official Statement.

References to web site addresses presented herein are for informational purposes only and may be in the form of a hyperlink solely for the reader's convenience. Unless specified otherwise, such web sites and the information or links contained therein are not incorporated into, and are not part of, this Official Statement.

The Underwriters have provided the following sentence for inclusion in this Official Statement. The Underwriters have reviewed the information in this Official Statement in accordance with, and as part of, their responsibilities to investors under the federal securities laws as applied to the facts and circumstances of this transaction, but the Underwriters do not guarantee the accuracy or completeness of such information.

Assured Guaranty Municipal Corp. ("AGM") makes no representation regarding the Series 2018 Bonds or the advisability of investing in the Series 2018 Bonds. In addition, AGM has not independently verified, makes no representation regarding, and does not accept any responsibility for the accuracy or completeness of this Official Statement or any information or disclosure contained herein, incorporated herein, or omitted herefrom, other than with respect to the accuracy of the information regarding AGM supplied by AGM and presented under the heading "BOND INSURANCE" and "APPENDIX F – Specimen Municipal Bond Insurance Policy."

The Trustee has not reviewed or participated in the preparation of this Official Statement and assumes no responsibility for the contents, accuracy, fairness or completeness of the information given in this Official Statement or for the recitals contained in the Trust Agreement or for the validity, sufficiency, or legal effect of any of such documents. Furthermore, the Trustee has no oversight responsibility, and is not accountable, for the use or application by the Authority of the proceeds from the sale of the Series 2018 Bonds. The Trustee has no duty to, has not undertaken to evaluate, and has not evaluated, the risks, benefits, or propriety of any investment in the Series 2018 Bonds and makes no representation, and has reached no conclusions, regarding the investment quality of the Series 2018 Bonds, about all of which the Trustee expresses no opinion and expressly disclaims the expertise to evaluate.

# TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
THE AUTHORITY	
THE SERIES 2018 BONDS	
Authorization	
General	
Redemption Provisions	
Book-Entry-Only	
AMENDMENTS TO PRIOR TRUST AGREEMENT	
PLAN OF FINANCE	
Refunding of TIFIA Series 2009 Bond	9
2009A Bonds	
2009B Bonds	9
2017 Bonds	
State Appropriated Revenues; State Appropriation Revenue Bonds	10
Operations and Maintenance Expense Guaranty	
Renewal and Replacement Reserve Fund Guaranty	
ANNUAL DEBT SERVICE REQUIREMENTS	12
ESTIMATED SOURCES AND USES OF FUNDS	
SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS	
General	
Pledge of Receipts	
Senior Lien Parity Reserve Account	
Other Funds and Accounts	
Application of Receipts	
TIFIA Indebtedness Upon Occurrence of Bankruptcy-Related Event	
Rate Covenant	
Parity and Subordinated Indebtedness	
THE TRIANGLE EXPRESSWAY SYSTEM	
General	
Maintenance of the Triangle Expressway System	
Complete 540	
Extension of NC 147	23
Project Specific Agreement for Triangle Expressway and Executory Contract For Lease of	2.4
Right-of-Way for Triangle Expressway and Lease Agreement.	
All-Electronic Tolling	
Toll Collection System Technology	
Interoperability	
Intelligent Transportation System	
Toll Rate Policy	
PROJECTED CASH FLOW AND DEBT SERVICE COVERAGE	
Table of Projected Revenues, Operations and Maintenance Expenses, Cash Flows and Debt	32
Service Coverage Ratios	32
Preliminary Projected Cash Flow and Debt Service Coverage	
RISK FACTORS	
General	35

Forward-Look	ing Statements	35		
Events of Forc	e Majeure	35		
Operating Risk	ζS	35		
1 0	Not a Guarantee			
Ability to Mair	ntain or Raise Rates	36		
Traffic and Re	venue Assumptions	36		
	Route			
Motor Fuel Pri	ices and Taxes	36		
Dilution of Ser	nior Lien Security Upon Bankruptcy-Related Event	37		
	Enforceability of Remedies			
	DISCLOSURÉ			
LITIGATION		40		
CERTAIN RELA	ATIONSHIPS	40		
LEGAL MATTE	ERS	41		
TAX TREATME	ENT	41		
Opinion of Bor	nd Counsel	41		
Original Issue	Discount	42		
Original Issue Premium				
Other Matters.		42		
BOND INSURA	NCE	43		
Series 2018 Bo	ond Insurance Policy	43		
	nty Municipal Corp.			
LEGALITY FOR	R INVESTMENT	45		
RATINGS		45		
UNDERWRITIN	IG	46		
MISCELLANEO	OUS	47		
APPENDIX A	Definitions of Certain Terms and Summary of the Trust Agreement			
APPENDIX B	2018 Traffic and Revenue Study			
APPENDIX C	Operations and Maintenance Expense Guaranty Agreement and	Construction		
_	Completion Assurance and Standby Renewal and Replacement Funding			
APPENDIX D	Proposed Form of Opinion of Bond Counsel	2		
APPENDIX E	DTC's Book-Entry-Only System			
APPENDIX F Specimen Municipal Bond Insurance Policy				



## **OFFICIAL STATEMENT**

#### Concerning



# NORTH CAROLINA TURNPIKE AUTHORITY Triangle Expressway System Senior Lien Turnpike Revenue Refunding Bonds, Series 2018

#### INTRODUCTION

The purpose of this Official Statement, which includes the appendices, is to provide certain information in connection with the issuance by the North Carolina Turnpike Authority (the "Authority") of its \$401,155,000 Triangle Expressway System Senior Lien Turnpike Revenue Refunding Bonds, Series 2018 (the "Series 2018 Bonds"). The Series 2018 Bonds will be issued pursuant to applicable provisions of law, a bond order adopted by the Authority on November 5, 2018 (the "Bond Order"), a Trust Agreement dated as of June 1, 2009 (the "Original Trust Agreement"), as supplemented by a First Supplemental Trust Agreement dated as of March 1, 2017 (the "Second Supplemental Trust Agreement and the First Supplemental Trust Agreement," and together with the Original Trust Agreement and the First Supplemental Trust Agreement, the "Prior Trust Agreement"), between the Authority and Wells Fargo Bank, N.A., as trustee (the "Trustee"), and a Third Supplemental Trust Agreement, the "Trust Agreement" and, together with the Prior Trust Agreement, the "Trust Agreement"), between the Authority and the Trustee.

The Third Supplemental Trust Agreement amends certain provisions of the Prior Trust Agreement, some of which require consent of the Holders of not less than a majority in aggregate principal amount of Senior Lien Indebtedness then Outstanding. Following the issuance of the Series 2018 Bonds, the Holders of the Series 2018 Bonds will own a majority of the Senior Lien Indebtedness Outstanding. By virtue of their purchase of the Series 2018 Bonds in connection with the transactions described herein, the Holders thereof will be deemed to have irrevocably consented to such amendments. See "AMENDMENTS TO PRIOR TRUST AGREEMENT" and "APPENDIX A – Definitions of Certain Terms and Summary of the Trust Agreement - Amendments to Prior Trust Agreement and Prior Supplemental Trust Agreements" for more information regarding the amendments made by the Third Supplemental Trust Agreement.

This introduction provides certain limited information to serve as a guide to the Official Statement and is expressly qualified by the Official Statement as a whole. Investors should make a full review of the entire Official Statement and the documents summarized or described herein.

For the definition of certain terms used herein and a summary of certain provisions of the Trust Agreement, see APPENDIX A hereto. Capitalized terms used herein and not otherwise defined have the meanings given such terms in the Trust Agreement unless otherwise indicated.

<u>Authorization</u>. The Series 2018 Bonds are being issued pursuant to Article 6H of Chapter 136 of the North Carolina General Statutes (Tolls Roads and Bridges), as amended (the "Authority Act") and The State and Local Government Revenue Bond Act, Article 5 of Chapter 159 of the General Statutes of North Carolina, as amended (the "Revenue Bond Act"), the Bond Order and the Trust Agreement.

Security. The Series 2018 Bonds will be special obligations of the Authority, secured by and payable from the Receipts of the Triangle Expressway System and, under certain circumstances, proceeds of the Series 2018 Bonds, including investment earnings and certain other proceeds. The Series 2018 Bonds will be additionally secured by certain funds, accounts and subaccounts held by the Trustee under the Trust Agreement. See "PLAN OF FINANCE" and "SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS" herein.

Purpose and Plan of Finance. The Series 2018 Bonds are being issued for the purpose of providing funds, together with any other available funds, to (a) refund in advance of its maturity the Authority's Triangle Expressway Revenue Bond, TIFIA Series 2009 (the "TIFIA Series 2009 Bond"), which evidences the Authority's obligation to repay a loan from the United States Department of Transportation ("USDOT") pursuant to a TIFIA Loan Agreement, dated as of July 1, 2009, between the Authority and USDOT (the "TIFIA Loan Agreement"), in an original principal amount not to exceed \$386,662,363 (the "TIFIA Loan"), pursuant to the Transportation Infrastructure Finance and Innovation Act of 1998 ("TIFIA"), to provide funds for the costs of the Triangle Expressway System (as hereinafter defined), of which \$430,405,952.95 in principal amount is currently outstanding (interest having accrued for a portion of the period prior to the first payment of principal thereon), (b) pay the premium for a Bond Insurance Policy issued by AGM with respect to certain maturities of the Series 2018 Bonds, (c) pay the premium for the Series 2018 Debt Service Reserve Policy issued by AGM, and (d) pay certain costs incurred in connection with the issuance of the Series 2018 Bonds.

Under the Prior Trust Agreement, the Authority has previously issued its (a) \$234,910,000 Triangle Expressway System Senior Lien Turnpike Revenue Bonds, Series 2009A (the "2009A Bonds"), of which \$600,000 in principal amount is currently outstanding, (b) \$35,173,108.85 Triangle Expressway System Senior Lien Turnpike Revenue Bonds, Series 2009B (the "2009B Bonds" and, together with the 2009A Bonds, the "2009 Bonds"), which are capital appreciation bonds, all of which remain outstanding, and (c) \$200,515,000 Triangle Expressway System Senior Lien Turnpike Revenue Refunding Bonds, Series 2017 (the "2017 Bonds"), of which \$197,355,000 in principal amount is currently outstanding. The proceeds of the 2017 Bonds were used to redeem certain maturities of the 2009A Bonds.

The proceeds of the 2009 Bonds were used to pay a portion of the costs of land acquisition, design, construction and equipping of the Triangle Expressway System, which currently consists of an approximately 18.8-mile toll road facility located in Durham and Wake Counties, North Carolina (such expressway system together with any future extensions is referred to as the "Triangle Expressway System").

A portion of the costs of the Triangle Expressway System were also paid from the proceeds of the State Appropriation Revenue Bonds (see "PLAN OF FINANCE – State Appropriated Revenues; State Appropriation Revenue Bonds") and the TIFIA Loan which is to be refunded with the proceeds of the Series 2018 Bonds.

The Authority and the Triangle Expressway System. See "THE AUTHORITY" herein for certain information regarding the Authority and "THE TRIANGLE EXPRESSWAY SYSTEM" herein for particular information regarding the Triangle Expressway System. The portion of the Triangle Expressway System financed with the 2009 Bonds has been completed and is operating. See "THE TRIANGLE EXPRESSWAY SYSTEM – General."

Traffic Consultant Analysis. CDM Smith Inc. (the "Traffic Consultant"), prepared the report titled Triangle Expressway Traffic and Revenue Study dated November 2018 (the "2018 Traffic and Revenue Study"), attached hereto as APPENDIX B. The 2018 Traffic and Revenue Study was designed to develop a forty year annual traffic and toll revenue forecast for the Triangle Expressway System, assuming that a planned extension to the Triangle Expressway known as "Complete 540" is not built. See "2018 TRAFFIC AND REVENUE STUDY" herein.

<u>Details of Bonds</u>. The Series 2018 Bonds will be dated the date of delivery thereof. Interest on the Series 2018 Bonds will be payable on January 1 and July 1, beginning July 1, 2019, at the rates shown on the inside front cover. Principal of the Series 2018 Bonds will be payable, subject to prior redemption as described herein, on January 1 in the years and amounts shown on the inside front cover.

The Series 2018 Bonds will be issued as fully registered bonds in book-entry-only form, without physical delivery of bond certificates to the beneficial owners of the Series 2018 Bonds. The Bond Registrar will make payment of principal of and interest on the Series 2018 Bonds to The Depository Trust Company, New York, New

York ("DTC"), which will in turn remit such payment to its participants for subsequent distribution to the beneficial owners of the Series 2018 Bonds. Individual purchases of the Series 2018 Bonds by the beneficial owners will be made in denominations of \$5,000 or whole multiples thereof. See APPENDIX E hereto for more information regarding DTC and the book-entry-only system.

The scheduled payment of principal of and interest on the Series 2018 Bonds maturing on January 1 in the years 2032 through 2038, inclusive, and 2041 (collectively, the "Insured Series 2018 Bonds") when due will be guaranteed under an insurance policy to be issued concurrently with the delivery of the Series 2018 Bonds by AGM. In addition, AGM will provide the Series 2018 Debt Service Reserve Policy in lieu of a cash deposit for the Senior Lien Parity Reserve Account. See "BOND INSURANCE."

Tax Status. See "TAX TREATMENT" herein.

<u>Professionals</u>. The Underwriters set forth on the cover page of this Official Statement (the "Underwriters") are underwriting the Series 2018 Bonds. Hunton Andrews Kurth LLP is serving as Bond Counsel. McGuireWoods LLP, Raleigh, North Carolina, is serving as counsel to the Underwriters. Ebony Pittman, Esq., an Assistant Attorney General for the State, is serving as counsel to the Authority. Wells Fargo Bank, N.A., Jacksonville, Florida, is serving as the Trustee and Bond Registrar. PFM Financial Advisors, LLC, Orlando, Florida, is acting as municipal advisor to the Authority in connection with the issuance of the Series 2018 Bonds.

#### THE AUTHORITY

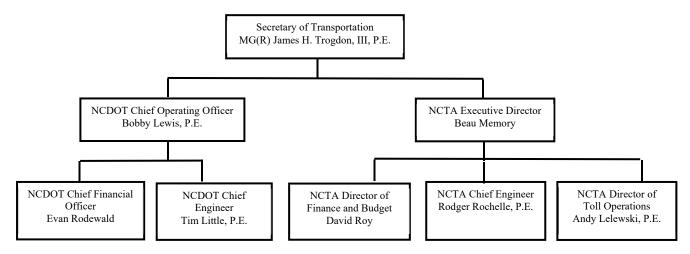
The Authority is a body politic and corporate and a public agency of the State of North Carolina (the "State") created pursuant to the Authority Act and exists within the North Carolina Department of Transportation ("NCDOT"). The Authority is empowered by the Authority Act to design, establish, purchase, construct, operate and maintain the turnpike projects within the State specifically authorized by the North Carolina General Assembly.

The Authority is governed by a nine member Authority Board, consisting of four members appointed by the General Assembly of North Carolina (two members appointed by the President Pro-Tempore of the Senate and two members appointed by the Speaker of the House of Representatives), four members appointed by the Governor of the State, and the North Carolina Secretary of Transportation. The Chair of the Authority is selected by the Authority Board. Currently, MG(R) James H. Trogdon, III, P.E., the North Carolina Secretary of Transportation, serves as the Chairman of the Authority Board. The Authority Board appoints the Executive Director of the Authority, who is the Chief Administrative Officer of the Authority, responsible for the daily administration of the toll projects undertaken by the Authority.

The following is a list of the current members of the Authority Board, their occupations and the expiration of their terms of office. There is currently one vacancy on the Authority Board.

Name	Occupation Occupation	Term Expires
MG(R) James H. Trogdon, III, P.E., Chairman	Secretary, NCDOT	Ex-Officio
Perry R. Safran, Vice Chairman	Attorney, Safran Law Offices	2021
Robert D. Teer, Jr., Secretary/Treasurer	President, Teer Associates	2019
Scott Aman	President, New Dixie Oil Corporation	2021
Jim Crawford	Former Member, North Carolina General Assembly	2019
Montell W. Irvin, P.E.	President and CEO, Ramey Kemp & Associates, Inc.	2019
Charles L. Travis, III	Mayor, Town of Cornelius	2023
James Walker	Attorney/Mediator	2023

The Authority is part of NCDOT, and the executive leadership of both the Authority and NCDOT are involved in all Authority projects. The following organizational chart demonstrates the integration of various functions of NCDOT and the Authority.



The following are the current members of senior management of NCDOT and the Authority and summaries of their professional experience.

MG(R) James H. Trogdon, III, P.E., Secretary, NCDOT. Major General James H. "Jim" Trogdon, III was named as Secretary to NCDOT by Governor Roy Cooper on January 3, 2017. Prior to assuming this role, Mr. Trogdon served as the National Transportation Director for SAS Institute. Mr. Trogdon previously worked at NCDOT spending over 20 years with NCDOT, serving most recently as its Chief Operating Officer from 2009 until his retirement in 2013. Mr. Trogdon holds the rank of Major General (Ret) in the Army National Guard, and retired in 2016 as the Deputy Adjutant General for the North Carolina National Guard. He earned his Masters of Strategic Studies degree from the U.S. Army War College in Carlisle, Pennsylvania, and he earned his bachelor's degree and master's degree in civil engineering from North Carolina State University in Raleigh, North Carolina. He is a licensed professional engineer in North Carolina.

Beau Memory, Executive Director of the Authority. Beau Memory is the executive director of the Authority and is responsible for developing and implementing its strategic vision to address the combined effects of rapid

growth, increasing congestion and funding challenges. Prior to his role at the Authority, Mr. Memory served as a senior policy advisor for the Office of the President Pro Tempore in the North Carolina Senate. His previous experience also includes serving as the legislative program manager for NCDOT and as the communications manager for the Authority. Mr. Memory earned a Bachelor of Science in political science from the University of North Carolina at Charlotte.

Bobby Lewis, P.E., Chief Operating Officer, NCDOT. Bobby Lewis oversees the high-level operations of the Information Technology, Division of Highways, Planning and Programming, Fiscal, and Legislative and Government Affairs divisions within the NCDOT. Before returning to NCDOT as its Chief Operating Officer in February 2017, Mr. Lewis served as the office executive for Michael Baker International's operations in Cary, Asheville, Greensboro and Charlotte. Mr. Lewis began his career in the NCDOT Division of Highways and served in a number of roles at the NCDOT, including county maintenance engineer, district engineer, division maintenance engineer, division engineer and Chief of Staff. Mr. Lewis earned a bachelor's degree from North Carolina State University, and is a licensed professional engineer in North Carolina.

Evan Rodewald, Chief Financial Officer, NCDOT. Evan Rodewald is responsible for overseeing NCDOT's financial operations, including accounting operations, cash management, purchasing and support services. Before joining NCDOT, Mr. Rodewald spent more than two decades working in various capacities in the North Carolina General Assembly Fiscal Research Division. Mr. Rodewald earned a bachelor's degree from The University of the South, a Master of Business Administration from Duke University's Fuqua School of Business and a Master of Public Policy from Duke University's Sanford School of Public Policy.

Tim Little, P.E., Chief Engineer, NCDOT. Tim Little has served as the Chief Engineer of the NCDOT since September 2017. As such, Mr. Little oversees and directs the engineering and program activities of all 14 Transportation Divisions. Mr. Little has worked at NCDOT for more than 25 years, during which time he has held various positions, including county maintenance engineer, district engineer, division operations engineer and division engineer. Mr. Little is a graduate of North Carolina State University and is a licensed professional engineer in North Carolina.

David Roy, Director of Finance and Budget of the Authority. David Roy serves as the Authority's Director of Finance and Budget. Since joining the Authority in 2013, Mr. Roy has been responsible for all aspects of financial analysis, planning, and reporting for turnpike projects. Prior to joining the Authority, Mr. Roy spent seven years in investment banking with Credit Suisse, serving in various fixed income and valuation risk capacities. Mr. Roy is a native of Raleigh, North Carolina and received his undergraduate degree in Business Administration, with a second major in Economics, from The University of North Carolina at Chapel Hill. He later received his MBA from the University of Chicago, Booth School of Business.

Andy Lelewski, P.E., Director of Toll Operations of the Authority. Andy Lelewski serves as the Authority's Director of Toll Operations. He is a registered professional engineer in North Carolina. Prior to his work at Authority, Mr. Lelewski worked for the national consulting firm PBS&J, now a part of the Atkins Group, for 11 years. In 2007, he began working with the Authority as a consultant project manager for toll technology and operations activities and joined the Authority in 2009. He is responsible for the planning, design, implementation, and operation of the toll collection systems and operation services for all Authority projects. Mr. Lelewski is a graduate of the University of Pittsburgh, School of Engineering.

Rodger Rochelle, P.E., Chief Engineer of the Authority. Rodger Rochelle serves as the Authority's Chief Engineer. Prior to this role, Mr. Rochelle served as the Director of NCDOT Transportation Program Management. Mr. Rochelle has 25 years of experience with the NCDOT including various roles within the Structure Design Unit, administrator of the NCDOT Research and Development Program, and the Director of the Alternative Delivery Unit. Mr. Rochelle holds a Bachelors Degree in Civil Engineering and a Masters Degree in Engineering, both from Duke University, and is a licensed Professional Engineer and a Certified Public Manager.

The Authority Act authorizes the Authority to issue bonds pursuant to the Revenue Bond Act to finance the cost of the turnpike projects it undertakes, and to fix, revise, charge and collect tolls and fees for the use of the turnpike projects. The Triangle Expressway System was the first toll project financed by the Authority. In addition to the Triangle Expressway System, the Authority is proceeding with plans for financing and constructing several additional toll road projects in the State. These projects consist of the Monroe Expressway, an approximately 19.7-mile controlled access roadway including 18.1 miles of toll road being built in Mecklenburg and Union Counties, North Carolina (the "Monroe Expressway"), a network of express lanes along I-77, I-485 and U.S. 74 in the Charlotte area, and the Mid-Currituck Bridge to connect the North Carolina Outer Banks to the mainland. **None of these other projects will be cross-collateralized with the Triangle Expressway System**.

The Authority and NCDOT entered into a Master Agreement, dated July 13, 2006 (the "Master Agreement"). This Master Agreement sets forth the responsibilities each party assumes and procedures that will be observed for the purpose of furthering the financing, constructing, equipping, operating or maintaining turnpike projects in accordance with the Authority Act. The Master Agreement establishes terms and conditions under which NCDOT provides general funding and project assistance to the Authority. The Master Agreement provides for entering into project specific agreements to establish terms and conditions under which NCDOT will provide funding and assistance for each turnpike project.

North Carolina law provides that operation and project development costs of the Authority are eligible administrative expenses to be paid by NCDOT. Any funds allocated to the Authority pursuant to this authorization are to be repaid by the Authority from toll revenues as soon as possible, subject to any restrictions included in the agreements entered into by the Authority in connection with the issuance of the Authority's bonds, including the Trust Agreement.

#### THE SERIES 2018 BONDS

# Authorization

The issuance of the Series 2018 Bonds received the required approval of the North Carolina Local Government Commission (the "LGC") on November 6, 2018. The LGC is a division of the State Treasurer's office charged with general oversight of local government finance in North Carolina, as well as certain matters of finance by selected State agencies. Its approval is required for the issuance of the Series 2018 Bonds by the Authority. In determining whether to allow bonds to be issued under the Revenue Bond Act, the LGC has been given wide statutory discretion to consider the need for and feasibility of the projects to be financed, the issuing unit's capability to repay the amount financed from the pledged revenue sources and the issuer's general compliance with State budget and finance laws. Under the Revenue Bond Act, the LGC is also responsible, with the Authority's approval, for selling bonds issued pursuant to the Revenue Bond Act.

#### General

The Series 2018 Bonds will be dated the date of delivery thereof and will bear interest from their date, payable on each January 1 and July 1, beginning July 1, 2019, at the rates shown on the inside front cover page hereof. The Series 2018 Bonds will mature, subject to prior redemption as described below, on January 1 in the years and amounts shown on the inside front cover. The Series 2018 Bonds will be issued as fully registered bonds and will be subject to the provisions of the book-entry-only system described below. Individual purchases of the Series 2018 Bonds by the beneficial owners will be made in denominations of \$5,000 or whole multiples thereof.

# **Redemption Provisions**

Optional Redemption. The Series 2018 Bonds maturing on January 1, 2030, and thereafter are subject to redemption prior to their respective maturities, at the option of the Authority, either in whole or in part on any date

on or after January 1, 2029, at a redemption price equal to 100% of the principal amount of Series 2018 Bonds to be redeemed, plus accrued interest to the redemption date.

Redemption Provisions. At least 30 days, but not more than 60 days, prior to the redemption date of any Series 2018 Bonds to be redeemed, whether such redemption be in whole or in part, the Bond Registrar will cause a notice of redemption to be mailed first-class, postage prepaid, to all Owners of Series 2018 Bonds to be redeemed in whole or in part; provided, however, that notices to any Securities Depository will be sent by registered or certified mail or by other electronic means as may be required by the operational procedures of such Securities Depository. Failure to mail any such notice to any Owner or any defect in such notice will not affect the validity of the proceedings for such redemption as to the Series 2018 Bonds of any other Owner to whom such notice is properly given.

The Series 2018 Bonds shall be redeemed only in whole multiples of \$5,000 principal amount. If less than all of the Series 2018 Bonds are called for redemption, the maturities or portions of maturities of Series 2018 Bonds to be redeemed will be as set forth in an Officer's Certificate of the Authority filed with the Trustee. If less than all the Series 2018 Bonds of any one maturity are called for redemption, and the Series 2018 Bonds are not held in book-entry-only form, the Bond Registrar will effect the redemption of the Series 2018 Bonds of such maturity on a pro rata basis among registered owners, subject to \$5,000 minimum denomination requirements, using such method as the Trustee deems fair and appropriate. If the Series 2018 Bonds are held in book-entry-only form, and less than all of the Series 2018 Bonds of any one maturity are to be called for redemption, the particular Series 2018 Bonds or portions thereof to be redeemed will be selected by lot in accordance with the procedures of the Securities Depository. If a portion of a Series 2018 Bond is called for redemption, a new Series 2018 Bond of the same maturity, in principal amount equal to the unredeemed portion thereof, will be issued to the Owner upon surrender thereof.

Upon giving notice and depositing funds or securities with the Trustee or the Bond Registrar as provided in the Trust Agreement, the Series 2018 Bonds or portions thereof so called for redemption shall become due and payable on the redemption date, and interest on such Series 2018 Bonds or portions thereof shall cease to accrue from and after such date.

Any notice of optional redemption may state that the redemption to be effected is conditioned upon the receipt by the Trustee or Bond Registrar on or prior to the redemption date of moneys sufficient to pay the principal of and interest on the Series 2018 Bonds to be redeemed and that if such moneys are not so received such notice shall be of no force or effect and such Series 2018 Bonds shall not be required to be redeemed. In the event that such notice contains such a condition and moneys sufficient to pay the principal of and interest on such Series 2018 Bonds are not received by the Trustee or Bond Registrar on or prior to the redemption date, the redemption will not be made and the Bond Registrar will within a reasonable time thereafter give notice, in the manner in which the notice of redemption was given, that such moneys were not so received.

# **Book-Entry-Only**

The Series 2018 Bonds will be issued as fully registered bonds in book-entry-only form without physical delivery of bonds to the beneficial owners of the Series 2018 Bonds. The Trustee will make payments of principal of and interest on the Series 2018 Bonds to DTC, which will in turn remit such payments to DTC participants for subsequent distribution to the beneficial owners of the Series 2018 Bonds. See APPENDIX E hereto for more information regarding DTC and the book-entry-only system.

# AMENDMENTS TO PRIOR TRUST AGREEMENT

The Third Supplemental Trust Agreement amends certain provisions of the Prior Trust Agreement to facilitate and provide flexibility to the Authority in future financings under the Trust Agreement while still

preserving the security for Senior Lien Bonds. The Authority anticipates obtaining additional funding from USDOT for future expansions to the Triangle Expressway System, and in connection therewith, has included amendments expected to be required by USDOT in connection with any TIFIA Indebtedness issued in the future. The changes made by the Third Supplemental Trust Agreement are described briefly below, but are subject in all respects to the actual text thereof described in APPENDIX A – "Definitions of Certain Terms and Summary of the Trust Agreement - Amendments to Prior Trust Agreement and Prior Supplemental Trust Agreements" attached hereto.

The amendments to the Prior Trust Agreement effected by the Third Supplemental Trust Agreement include the following:

- Amendment to the definition of Senior Lien Parity Reserve Account Requirement, such that the Senior Lien Parity Reserve Account Requirement is 50% of the least of (i) the Maximum Long-Term Debt Service Requirement for all Senior Lien Bonds and Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account, (ii) 125% of the average annual Long-Term Debt Service Requirement for all Senior Lien Bonds and Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account and (iii) 10% of the stated principal amount of all Senior Lien Bonds and Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account.
- Amendment to the order of the application of Receipts in the Revenue Fund to require the following payments to be made prior to any payments to the Operations and Maintenance Expenses Fund: (i) if any TIFIA Indebtedness is Outstanding, to the credit of the TIFIA Debt Service Reserve Account the amount then needed for the amount therein to equal the TIFIA Debt Service Reserve Account Requirement, and (ii) to a Bond Insurer for Insured Bonds, including the Series 2017 Bond Insurer and the Series 2018 Bond Insurer, any fees and interest, including Excess Interest, due to such Bond Insurer in excess the amount of principal and interest paid to it with respect to such Insured Bonds, to any provider of a Reserve Alternate Instrument, including the Series 2017 Debt Service Reserve Policy and the Series 2018 Debt Service Reserve Policy, any fees and interest payable to such provider in excess of the amount paid to it from the applicable Senior Lien Parity Reserve Account, Senior Lien Special Reserve Account, Subordinate Lien Parity Reserve Account or Subordinate Lien Special Reserve Account, and to any Credit Provider of a Credit Facility other than a Bond Insurance Policy or a Reserve Alternate Instrument, any fees and interest payable to such Credit Provider in excess of the amount paid to it from other sources;
- Amendment to the First Supplemental Trust Agreement to amend the AGM requirement that all or
  a portion of the Outstanding Senior Lien Indebtedness be refunded in certain events such that such
  refunding requirement is waived so long as the Authority has been in compliance with the rate
  covenant contained in the Trust Agreement for two consecutive Fiscal Years;
- Amendment to the Second Supplemental Trust Agreement to eliminate provisions which, upon the
  occurrence of certain events, limited the Authority's use of amounts in the General Reserve Fund
  to repayment of certain amounts owed to AGM and debt service on Senior Lien Indebtedness;
- Amendment to the definition of a "Bankruptcy-Related Event" to include the failure to make two
   (2) consecutive payments of TIFIA Debt Service in accordance with the provisions of the documents relating to any TIFIA Indebtedness; and
- Amendment to the definition of "TIFIA Debt Service Reserve Account Requirement" to provide that after the redemption of the TIFIA Series 2009 Bond, such requirement will mean an amount determined pursuant to the TIFIA Loan Agreement related to any future TIFIA Indebtedness.

This summary is not intended to be definitive and is qualified in its entirety by reference to APPENDIX A – "Definitions of Certain Terms and Summary of the Trust Agreement - Amendments to Prior Trust Agreement and Prior Supplemental Trust Agreements" attached hereto. AGM has consented to the amendments made by the Third Supplemental Trust Agreement. By virtue of their purchase of the Series 2018 Bonds in connection with the transactions described herein, the Holders thereof will be deemed to have irrevocably consented to such amendments.

## PLAN OF FINANCE

Pursuant to the Prior Trust Agreement and the Third Supplemental Trust Agreement, the proceeds of the Series 2018 Bonds will be applied to (a) refund the TIFIA Series 2009 Bond, which evidences the Authority's obligation to repay the TIFIA Loan, (b) pay the premium for the Bond Insurance Policy issued by AGM with respect to certain maturities of the Series 2018 Bonds, (c) pay the premium for the Series 2018 Debt Service Reserve Policy issued by AGM, and (d) pay certain costs incurred in connection with the issuance of the Series 2018 Bonds.

## **Refunding of TIFIA Series 2009 Bond**

A portion of the proceeds of the Series 2018 Bonds will be used to redeem the TIFIA Series 2009 Bond in full. The TIFIA Series 2009 Bond evidences the Authority's obligation to repay the TIFIA Loan made by USDOT to the Authority pursuant to the TIFIA Loan Agreement in an original principal amount not to exceed \$386,662,363, with \$430,405,952.95 in principal amount currently outstanding (interest having accrued for a portion of the period prior to the first payment of principal thereon). Upon completion of such refunding, all amounts in the TIFIA Debt Service Reserve Account (approximately \$5,333,988) will be released and used to pay a portion of the costs of refunding the TIFIA Series 2009 Bond.

## 2009A Bonds

The 2009A Bonds maturing on January 1, 2019 in the principal amount of \$600,000 remain outstanding under the Trust Agreement, and are secured on parity with the Series 2018 Bonds. The scheduled payment of principal of and interest on the 2009A Bonds when due is guaranteed under an insurance policy issued by AGM.

#### 2009B Bonds

Simultaneously with the issuance of the 2009A Bonds, the Authority issued the 2009B Bonds in the principal amount of \$35,173,108.85 as Capital Appreciation Bonds maturing January 1, 2030 through January 1, 2038, in order to provide a portion of the financing for the Triangle Expressway System. The 2009B Bonds remain outstanding under the Trust Agreement, and are secured on parity with the Series 2018 Bonds. The scheduled payment of principal of and interest on the 2009B Bonds when due is guaranteed under an insurance policy issued by AGM.

# **2017 Bonds**

The Authority issued the 2017 Bonds on March 30, 2017, to refund in advance of their maturities the 2009A Bonds maturing on and after January 1, 2020. \$197,355,000 in principal amount of the 2017 Bonds remains outstanding under the Trust Agreement. The outstanding 2017 Bonds are secured on parity with the Series 2018 Bonds. The scheduled payment of principal of and interest on certain maturities of the 2017 Bonds when due is guaranteed under an insurance policy issued by AGM.

# State Appropriated Revenues; State Appropriation Revenue Bonds

Pursuant to Section 136-176(b2) of the North Carolina General Statutes, the General Assembly of North Carolina has provided for a continuing annual appropriation of \$25,000,000 to the Authority from the Highway Trust Fund to finance the Triangle Expressway System. Pursuant to the legislation, amounts so appropriated may be used by the Authority to pay debt service or related financing costs and expenses on revenue bonds or notes issued by the Authority to finance costs of the Triangle Expressway System or to fund debt service reserves, operating reserves, and similar reserves in connection therewith. This State appropriation for the Triangle Expressway System is defined in the Trust Agreement and herein as the "State Appropriated Revenues." The annual appropriation does not constitute a pledge of the faith and credit and taxing power of the State, and nothing prohibits the General Assembly from amending the annual appropriation to decrease or eliminate the amount annually appropriated to the Authority.

The Authority previously entered into a separate Trust Agreement, dated as of July 1, 2009 (the "Original State Appropriation Revenue Bond Trust Agreement"), pursuant to which the Authority issued its Triangle Expressway System State Appropriation Revenue Bonds, Series 2009B (Federally Taxable – Issuer Subsidy – Build America Bonds) in the original principal amount of \$352,675,000 (the "2009 State Appropriation Bonds"). On May 10, 2018, pursuant to the Original State Appropriation Revenue Bond Trust Agreement, as amended by a First Supplemental Trust Agreement dated as of May 1, 2018 (together with the Original State Appropriation Revenue Bond Trust Agreement and any additional supplements thereto, the "State Appropriation Revenue Bond Trust Agreement"), the Authority issued its Triangle Expressway System Appropriation Revenue Refunding Bonds, Series 2018A in the principal amount of \$150,125,000 (the "2018A State Appropriation Bonds"), the proceeds of which were used to refund certain maturities of the 2009 State Appropriation Bonds. In addition, the Authority has entered into a contract with a bank pursuant to which the Authority has agreed to issue and the bank has agreed to purchase its Triangle Expressway System Appropriation Revenue Refunding Bond, Series 2018B (the "2018B State Appropriation Bond") on or about December 31, 2018, the proceeds of which will be used to redeem certain additional maturities of the 2009 State Appropriation Revenue Bonds on January 1, 2019. The 2009 State Appropriation Bonds, the 2018A State Appropriation Bonds, the 2018B State Appropriation Bond and any other bonds issued under the State Appropriation Revenue Bond Trust Agreement (collectively, the "State Appropriation Revenue Bonds") are secured solely by the State Appropriated Revenues and investment earnings thereon and certain funds provided in the State Appropriation Revenue Bond Trust Agreement. The State Appropriation Revenue Bonds are not secured by the tolls or other revenues of the Triangle Expressway System or any funds held under the Trust Agreement. Under the State Appropriation Revenue Bond Trust Agreement, amounts not needed in any fiscal year to make debt service payments on the State Appropriation Revenue Bonds will be withdrawn from the State Appropriation Revenue Bond Trust Agreement and deposited to the Revenue Fund under the Trust Agreement. Upon such withdrawal from the State Appropriation Revenue Bond Trust Agreement, the amounts so transferred shall be transferred free and clear of the lien on and pledge created under the State Appropriation Revenue Bond Trust Agreement and will constitute "Revenues" and "Receipts" under the Trust Agreement. There is no assurance that any such amounts will be available to be transferred to the Trust Agreement.

#### **Operations and Maintenance Expense Guaranty**

As described below under "SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS," the payment of Operations and Maintenance Expenses of the Triangle Expressway System is payable from Receipts after the prior payment of debt service on Senior Lien Bonds, Subordinate Lien Bonds, if any, TIFIA Indebtedness, if any, and the funding of certain debt service and related reserves. In order to assure a source of funds for payment of Operations and Maintenance Expenses of the Triangle Expressway System, the Authority and the NCDOT entered into the Operations and Maintenance Expense Guaranty Agreement.

The Operations and Maintenance Expense Guaranty Agreement provides that in the event that there is a deficiency in the Receipts such that there are not funds available in the Operations and Maintenance Expense Fund

to pay Operations and Maintenance Expenses, the Authority will make a request to NCDOT to fund the deficiency in the Operations and Maintenance Expense Fund, and those expenses will be funded by NCDOT. On March 18, 2018, NCDOT adopted a resolution approving similar guaranties of operation and maintenance expenses for Phases 1 and 2 of Complete 540 (the "2018 NCDOT Guaranty"). See "THE TRIANGLE EXPRESSWAY SYSTEM – Complete 540" herein. The Authority will be required to repay any amount so advanced, with interest. To assure that funds are available as needed to make payments under the Operations and Maintenance Expense Guaranty Agreement, the Trust Agreement creates an Operating Reserve Fund that the Authority would draw upon to pay required Operations and Maintenance Expenses. See APPENDIX C – "Operations and Maintenance Expense Guaranty and Construction Completion Assurance and Standby Renewal and Replacement Funding Agreement."

All payments from NCDOT to the Authority under the Operations and Maintenance Expense Guaranty Agreement are to be repaid to NCDOT, with interest, from Receipts as described below under "SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS – Application of Receipts."

# Renewal and Replacement Reserve Fund Guaranty

The Trust Agreement creates a Renewal and Replacement Fund as a special fund to which deposits are to be made from Receipts to pay all or a portion of the cost of unusual or extraordinary maintenance, repairs, renewals or replacements or capital improvements related to the Triangle Expressway System. Under the Trust Agreement, deposits to the Renewal and Replacement Fund are to be made from Receipts in amounts designed to assure that funds will be available for the required purpose when needed, as described under the caption "SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS – Application of Receipts." In order to assure that the Renewal and Replacement Fund is funded as required, the NCDOT has undertaken pursuant to the Construction Completion Assurance and Standby Renewal and Replacement Guaranty to fund any deficiency in the Renewal and Replacement Fund from the amount that is required at the time to be on deposit in the Renewal and Replacement Fund. See APPENDIX C – "Operations and Maintenance Expense Guaranty and Construction Completion Assurance and Standby Renewal and Replacement Funding Agreement." In the 2018 NCDOT Guaranty, NCDOT approved similar funding of the costs of construction and completion, as well as any deficiency in the Renewal and Replacement Fund, with respect to Phases 1 and 2 of Complete 540.

Repayment of NCDOT Contributions. The Authority may be required to repay any amounts advanced by NCDOT as described above under "Operations and Maintenance Expense Guaranty" and "Renewal and Replacement Reserve Fund Guaranty", with interest, from Receipts, but only after payment of current debt service on the Series 2018 Bonds and other Senior Lien Indebtedness, Subordinate Lien Indebtedness and any TIFIA Indebtedness, the funding of any deficiency in all debt service reserve funds held under the Trust Agreement, funding of required deposits to the Operations and Maintenance Expense Fund, the Operating Reserve Fund, and the Renewal and Replacement Fund, required under the Trust Agreement, or from amounts deposited and held in the General Reserve Fund available for such expense. See "SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS – Application of Receipts."

# ANNUAL DEBT SERVICE REQUIREMENTS

The following table sets forth for each Fiscal Year ending June 30, the amounts required for the payment of debt service on the Bonds currently Outstanding under the Trust Agreement.

Fiscal Year	Series 200	09A Bonds	Series 20	09B Bonds	Series 20	17 Bonds	Series 20	18 Bonds	<u>Total</u>
Ending				Compounded					
<u>June 30</u> ,	<u>Principal</u>	<u>Interest</u>	Initial Principal	Interest	<u>Principal</u>	<u>Interest</u>	<u>Principal</u>	<u>Interest</u>	
2019	\$600,000	\$13,500			\$3,320,000	\$9,652,094		\$10,364,722	\$23,950,315
2020					5,690,000	9,426,844	\$890,000	18,732,450	34,739,294
2021					7,615,000	9,094,219	1,815,000	18,669,275	37,193,494
2022					9,220,000	8,673,344	2,030,000	18,573,150	38,496,494
2023					11,490,000	8,155,594	2,500,000	18,459,900	40,605,494
2024					14,100,000	7,515,844	3,070,000	18,320,650	43,006,494
2025					14,035,000	6,812,469	4,930,000	18,120,650	43,898,119
2026					14,755,000	6,092,719	6,585,000	17,832,775	45,265,494
2027					15,510,000	5,336,094	8,485,000	17,456,025	46,787,119
2028					16,310,000	4,540,594	10,555,000	16,980,025	48,385,619
2029					17,075,000	3,772,297	9,525,000	16,478,025	46,850,322
2030			\$1,141,509	\$3,278,491	13,350,000	3,078,000	14,485,000	15,877,775	51,210,775
2031			401,274	1,293,726	16,830,000	2,323,500	17,125,000	15,087,525	53,061,025
2032			363,576	1,311,425	17,715,000	1,459,875	20,080,000	14,157,400	55,087,275
2033			6,404,961	25,615,039	-	1,017,000	16,775,000	13,236,025	63,048,025
2034			6,229,521	27,365,479	-	1,017,000	19,805,000	12,321,525	66,738,525
2035			6,053,373	29,181,627	-	1,017,000	22,355,000	11,267,525	69,874,525
2036			5,871,256	30,943,744	-	1,017,000	24,990,000	10,083,900	72,905,900
2037			5,672,457	32,657,543	-	1,017,000	27,515,000	8,908,850	75,770,850
2038			3,035,183	19,014,818	-	1,017,000	38,440,000	7,447,550	68,954,550
2039					20,340,000	508,500	43,315,000	5,670,250	69,833,750
2040							56,855,000	3,382,575	60,237,575
2041							49,030,000	980,600	50,010,600
Total	\$600,000	\$13,500	\$35,173,109	\$170,661,891	\$197,355,000	\$92,543,984	\$401,155,000	\$308,409,147	\$1,205,911,631

Notes: Amounts may not foot due to rounding.

Amounts due on July 1 of any year are included in the previous Fiscal Year.

#### ESTIMATED SOURCES AND USES OF FUNDS

#### Sources:

Par Amount of the Series 2018 Bonds	\$401,155,000
Net Original Issue Premium	28,366,951
Transfer from Interest Account for TIFIA Series 2009 Bond	8,218,985
Funds released from TIFIA Debt Service Reserve Account	<u>5,333,988</u>
Total Sources	<u>\$443,074,924</u>
Jses:	

# Uses:

Refunding of TIFIA Series 2009 Bond	\$438,624,938
Costs of Issuance <sup>1</sup>	<u>4,449,986</u>
Total Uses	<u>\$443,074,924</u>

Note: Totals may not foot due to rounding.

#### SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS

#### General

The Series 2018 Bonds will be special obligations of the Authority, secured by and payable from the Receipts of the Triangle Expressway System and, under certain circumstances, proceeds of the Series 2018 Bonds, including investment earnings and certain net insurance and other proceeds.

The principal of and interest on the Series 2018 Bonds shall not be payable from the general funds of the Authority, nor shall they constitute a legal or equitable pledge, charge, lien, or encumbrance upon any of its property or upon any of its income, receipts, or revenues, except the Receipts and other funds which are pledged under the Bond Order and the Trust Agreement. Neither the credit nor the taxing power of the State or any instrumentality thereof are pledged for the payment of the principal or interest of the Series 2018 Bonds, and no Owner of Series 2018 Bonds has the right to compel the exercise of the taxing power by the State or any instrumentality thereof or the forfeiture of any of its property other than Receipts in connection with any default thereon.

As described below under "Application of Receipts," the payment of Operations and Maintenance Expenses of the Triangle Expressway System are payable from Receipts after the payment of debt service on Senior Indebtedness, Subordinated Indebtedness, if any, TIFIA Indebtedness, if any, and the funding of certain reserves. As such, the Series 2018 Bonds and other Senior Lien Indebtedness are secured by a "gross revenue" pledge of the Receipts of the Triangle Expressway System.

# **Pledge of Receipts**

The Receipts of the Triangle Expressway System are pledged to the payment of, and as security for (a) any Senior Lien Parity Debt, Subordinate Lien Parity Debt and TIFIA Indebtedness and (b) any Senior Lien Derivative Agreement Regularly Scheduled Payments and Subordinate Lien Derivative Agreement Regularly Scheduled Payments incurred pursuant to the Trust Agreement.

The term "Receipts" for any particular period means all receipts, revenues, income, proceeds and money received in any period by or for the Authority in respect of the Triangle Expressway System, including all toll revenues, payments, proceeds, fees, charges, rents and all other income derived by or for the Authority from the

<sup>&</sup>lt;sup>1</sup> Includes legal fees, underwriters' discount, premium for the Bond Insurance Policy, premium for the Series 2018 Debt Service Reserve Policy, rating agency fees, fees and expenses of the Trustee and municipal advisor, and miscellaneous fees and expenses.

ownership and operation of the Triangle Expressway System, and all other income derived by the Authority from the operation or ownership of the Triangle Expressway System, the proceeds of use and occupancy or business interruption insurance and amounts received as liquidated damages under contracts for construction of the Triangle Expressway System and the portion of the State Appropriated Revenues transferred to the Revenue Fund from the State Appropriation Revenue Bonds Trust Agreement. See APPENDIX A hereto for a complete definition of Receipts.

# **Senior Lien Parity Reserve Account**

The Trust Agreement creates a special account of the Senior Lien Debt Service Fund designated the Senior Lien Parity Reserve Account. Each Senior Lien Resolution providing for the issuance or incurrence of Senior Lien Indebtedness may provide that the Senior Lien Indebtedness authorized thereby will be secured by the Senior Lien Parity Reserve Account. If any Senior Lien Indebtedness is secured by the Senior Lien Parity Reserve Account, the Authority must fund the Senior Lien Parity Reserve Account in an amount equal to the Senior Lien Parity Reserve Account Requirement at the time of delivery and payment for such Senior Lien Indebtedness. If the Senior Lien Resolution authorizing Senior Lien Indebtedness does not provide that such Senior Lien Indebtedness will be secured by the Senior Lien Parity Reserve Account, such Senior Lien Indebtedness will have no claim on the Senior Lien Parity Reserve Account.

The Series 2018 Bonds will be secured by the Senior Lien Parity Reserve Account. Following the issuance of the Series 2018 Bonds, and the effectiveness of the Third Supplemental Trust Agreement, the amount required to be on deposit in the Senior Lien Parity Reserve Account will be \$34,176,863.20, which is equal to 50% of the least of (i) the Maximum Long-Term Debt Service Requirement for all Senior Lien Bonds and Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account, (ii) 125% of the average annual Long-Term Debt Service Requirement for all Senior Lien Bonds and Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account and (iii) 10% of the stated principal amount of all Senior Lien Bonds and Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account (the "Senior Lien Parity Reserve Account Requirement"). The Senior Lien Parity Reserve Account Requirement will be satisfied by the Series 2018 Debt Service Reserve Policy issued by AGM. Moneys on deposit in the Senior Lien Parity Reserve Account (or provided under a Reserve Alternative Instrument) will be used as necessary to pay the principal of and interest on all Senior Lien Indebtedness secured by the Senior Lien Parity Reserve Account to the extent that moneys on deposit in the Senior Lien Debt Service Fund and Accounts thereof for such payment are insufficient therefor. See APPENDIX A – "Definitions of Certain Terms and Summary of the Trust Agreement" for a more detailed description of the Senior Lien Parity Reserve Account Requirement.

The Authority has purchased the Series 2018 Debt Service Reserve Policy from AGM for deposit in the Senior Lien Parity Reserve Account, which secures the Series 2018 Bonds.

A Senior Lien Resolution authorizing Senior Lien Indebtedness may also provide for the creation of a Special Reserve Account to be maintained by the Trustee or a Depositary that will secure only the Senior Lien Indebtedness authorized by such Senior Lien Resolution. The Series 2018 Bonds will not be secured by a Special Reserve Account.

## **Other Funds and Accounts**

Revenue Fund. The Revenue Fund is held by the Trustee. The Authority will deposit all Receipts as received in the Revenue Fund for application as hereinafter described.

Senior Lien Debt Service Fund. The Senior Lien Debt Service Fund is held by the Trustee and is composed of six separate accounts, consisting of the Capitalized Interest Account, the Interest Account, the Principal Account, the Sinking Fund Account, the Redemption Account and the Senior Lien Parity Reserve Account. Each

Supplemental Agreement authorizing a Series of Bonds will provide for the creation, to the extent applicable, of separate subaccounts within the Capitalized Interest Account, the Interest Account, the Principal Account, the Sinking Fund Account and the Redemption Account relating to the Series of Bonds authorized by such Supplemental Agreement.

<u>Subordinate Lien Debt Service Fund</u>. In addition to the Senior Lien Debt Service Fund, the Trust Agreement creates a Subordinate Lien Debt Service Fund, which is held by the Trustee and is composed of six separate accounts, consisting of the Capitalized Interest Account, the Interest Account, the Principal Account, the Sinking Fund Account, the Redemption Account and the Subordinate Lien Parity Reserve Account. The deposit to such Fund from Receipts is subordinate to the deposits required to be made to the Senior Lien Debt Service Fund.

<u>TIFIA Debt Service Fund</u>. In addition to the Senior Lien Debt Service Fund, the Trust Agreement creates a TIFIA Debt Service Fund, which is held by the Trustee and is composed of two separate accounts, the TIFIA Debt Service Account and the TIFIA Debt Service Reserve Account. Any deposit to such Fund from Receipts relating to any TIFIA Indebtedness is subordinate to the deposits required to be made to the Senior Lien Debt Service Fund.

Hedging Acquisition Account. The Trust Agreement creates a special account designated the Hedging Acquisition Account, which requires that certain deposits be made to such account in the event the Authority issues variable interest rate bonds and enters into a hedging arrangement in connection therewith. The purpose of the Hedging Acquisition Account is to assure that funds are available to pay the termination payments the Authority might be required to pay if such hedge were terminated. The Authority has no present plans to issue variable interest rate bonds under the Trust Agreement.

Operations and Maintenance Expense Fund. Moneys held for the credit of the Operations and Maintenance Expense Fund are to be used only to pay all or a portion of the cost of any Operating Expenses of the Triangle Expressway System.

Operating Reserve Fund. Moneys held for the credit of the Operating Reserve Fund shall be used to pay all or a portion of the cost of any Operating Expenses or as provided in the Capital Improvements Budget to the extent that funds in the Operating and Maintenance Expense Fund are insufficient for such purpose. Any amounts received from NCDOT under its Operating and Maintenance Guaranty Agreement are deposited to the Operating Reserve Fund.

Renewal and Replacement Fund. Moneys held for the credit of the Renewal and Replacement Fund are to be used to pay all or a portion of the cost of unusual or extraordinary maintenance, repairs, renewals or replacements or capital improvements related to the Triangle Expressway. In the Authority's sole discretion, amounts on deposit in the Renewal and Replacement Fund may be used to make debt service payments with respect to Senior Indebtedness, any Subordinate Lien Indebtedness, any TIFIA Indebtedness, any Senior Lien Derivative Agreement or Subordinate Lien Derivative Agreement.

Insurance and Condemnation Award Fund. The Insurance and Condemnation Award Fund is held by the Trustee. Under certain circumstances described in the Trust Agreement, Net Insurance Proceeds and Net Eminent Domain Proceeds are required to be deposited by the Authority in the Insurance and Condemnation Award Fund. Moneys held in the Insurance and Condemnation Award Fund will be disbursed to repair or replace the Triangle Expressway System or to pay or redeem Bonds and Parity Debt, in the manner set forth in the Trust Agreement.

General Reserve Fund. The General Reserve Fund is pledged as security for Senior Lien Parity Debt but amounts therein may be used for any lawful purpose of the Authority, including payment of Operating Expenses, payment for capital improvements, repayment to NCDOT of any amount owed under the Operations and Maintenance Expense Guaranty Agreement or the Construction Completion and Renewal and Replacement Guaranty, and the funding of Non-System Projects.

## **Application of Receipts**

The Trust Agreement provides that on the last Business Day of each month, the Trustee shall withdraw all Receipts and other amounts held in the Revenue Fund and apply the same in the following manner and order (see "The Trust Agreement – Application of Receipts" in APPENDIX A hereto for a more detailed description of the application of the Receipts):

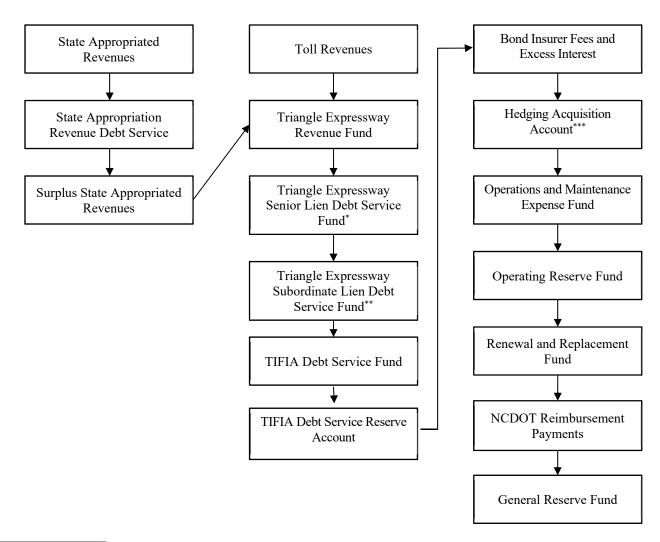
- (a) to the Interest Account of the Senior Lien Debt Service Fund and to any other Persons entitled thereto as the holder of Senior Lien Parity Debt the amount (in equal monthly deposits) needed to pay interest payable on Senior Lien Bonds and other Senior Lien Parity Debt on the next Interest Payment Date (if such Interest Payment Date is within seven months of such deposit);
- (b) to the Principal Account and the Sinking Fund Account of the Senior Lien Debt Service Fund and to any other Persons entitled thereto as the holder of Senior Lien Parity Debt the amount (in equal monthly deposits) needed to pay the Principal payable on Senior Lien Bonds and any other Senior Lien Parity Debt on the next Principal Payment Date for each such Senior Lien Bonds or Senior Lien Parity Debt:
- (c) if the amount in the Senior Lien Parity Reserve Account is less than the Senior Lien Parity Reserve Account Requirement or the amount in any Senior Lien Special Reserve Account is less than the applicable Senior Lien Special Reserve Account Requirement, (1) one-twelfth (1/12) of the amount required to make up any deficiency in the Senior Lien Parity Reserve Account and (2) to the Trustee or other Person holding a Senior Lien Special Reserve Account, one-twelfth (1/12) of the amount required to make up any deficiencies in any Senior Lien Special Reserve Account as provided in the Supplemental Agreement or Parity Debt Resolution creating any Senior Lien Special Reserve Accounts for deposit in such Senior Lien Special Reserve Accounts; provided, however, that if there shall not be sufficient Receipts to satisfy all such deposits and payments, such deposits and payments shall be made for deposit to the Senior Lien Parity Reserve Account and each Senior Lien Special Reserve Account ratably according to the amount so required to be deposited or paid;
- (d) to the appropriate subaccounts of the Subordinate Lien Debt Service Fund amounts needed (in equal monthly installments) to pay interest on and principal of Subordinate Lien Bonds or Subordinate Lien Parity Debt;
- (e) to the Subordinate Lien Parity Reserve Account, if any, and any Subordinate Lien Special Reserve Account, the amount required to make up any deficiencies therein;
- (f) to the credit of the TIFIA Debt Service Account of the TIFIA Debt Service Fund an amount equal to the sum of interest and principal payable (in equal monthly installments) on any Outstanding TIFIA Indebtedness on the next Interest Payment Date;
- (g) to the credit of the TIFIA Debt Service Reserve Account the amount then needed for the TIFIA Debt Service Reserve Account to equal the TIFIA Debt Service Reserve Account Requirement;
- (h) to a Bond Insurer for Insured Bonds, including the Series 2017 Bond Insurer and the Series 2018 Bond Insurer, any fees and interest, including Excess Interest, due to such Bond Insurer in excess the amount of principal and interest paid by it with respect to such Insured Bonds, to any provider of a Reserve Alternate Instrument, including the Series 2017 Debt Service Reserve Policy and the Series 2018 Debt Service Reserve Policy, any fees and interest payable to such provider in excess of the amount paid to it from the applicable Senior Lien Parity Reserve Account, Senior Lien Special Reserve Account, Subordinate Lien Parity Reserve Account, and to any Credit Provider of

a Credit Facility other than a Bond Insurance Policy or a Reserve Alternate Instrument, any fees and interest payable to such Credit Provider in excess of the amount paid to it directly or indirectly from the sources listed in (a) through (g) above; provided that, to the extent there are insufficient amounts available to pay all amounts referenced in this subsection, amounts due relating to Senior Lien Bonds shall be paid first;

- (i) to the credit of the Hedging Acquisition Account, the amount of the requirement therefor;
- (j) to the credit of the Operations and Maintenance Expense Fund an amount equal to the next succeeding month's budgeted Operating Expenses as set forth in the Annual Budget;
- (k) to the credit of the Operating Reserve Fund such amount as shall be necessary to make the amount on deposit therein equal to one-fourth (1/4) of the total budgeted Operations and Maintenance Expenses of the Triangle Expressway System for the current Fiscal Year as set forth in the Annual Budget;
- (l) to the credit of the Renewal and Replacement Fund one-twelfth (1/12) of the total amount, if any, required to be deposited therein in such Fiscal Year as set forth in the Annual Budget;
- (m) to NCDOT any amounts necessary to reimburse NCDOT for any Operating Advance made by NCDOT to the Authority pursuant to the Operations and Maintenance Expense Guaranty Agreement or any payments by NCDOT to the Authority pursuant to the Construction Completion and Renewal and Replacement Guaranty, together with interest thereon, at the rates and in the manner provided in the Operations and Maintenance Expense Guaranty Agreement or the Construction Completion and Renewal and Replacement Guaranty;
- (n) after all deposits are made in accordance with subsections (a) through (m) above, any remaining moneys shall be deposited in the General Reserve Fund.

The following chart depicts the flow of funds under the Trust Agreement, including the flow of funds of the State Appropriation under the State Appropriation Revenue Bond Trust Agreement into the Revenue Fund created by the Trust Agreement. The chart assumes that the amendments made by the Third Supplemental Trust Agreement are in effect.

[See chart on following page]



<sup>\*</sup> Deposits to the following Accounts in the following order of priority until Account requirement is funded: Interest Account, Principal Account and Sinking Fund Account, Senior Lien Parity Reserve Account.

#### TIFIA Indebtedness Upon Occurrence of Bankruptcy-Related Event

In the case of the occurrence of a Bankruptcy-Related Event, any TIFIA Indebtedness automatically and without notice is deemed to constitute Senior Lien Parity Debt, and the Holder of such TIFIA Indebtedness will be entitled to all rights of a Holder of Senior Lien Parity Debt, except that the Holders of any such TIFIA Indebtedness will have no rights in, or claim to, any amounts held in the Senior Lien Parity Reserve Account or any Senior Lien Special Reserve Account. A Bankruptcy-Related Event with respect to the Authority is defined in the Trust Agreement to include voluntary and involuntary proceedings with respect to the Authority under any Insolvency Law, and failure by the Authority generally to pay its debts with respect to the Triangle Expressway as they become due. In addition, in the Third Supplemental Trust Agreement, the definition of Bankruptcy-Related Event is amended to include the failure to make two (2) consecutive payments of TIFIA Debt Service in accordance with the provisions of the documents relating to any TIFIA Indebtedness, among other changes. If and to the extent the

<sup>\*\*</sup> The Authority does not have any current plans to issue Subordinate Lien Turnpike Revenue Bonds (other than possible TIFIA loans from USDOT in connection with Complete 540).

<sup>\*\*\*</sup> The Hedging Acquisition Account would only be used if the Authority were to issue variable interest rate bonds. At present, the Authority has no plans to issue such Bonds.

Authority incurs additional TIFIA Indebtedness in connection with the financing of Complete 540, as expected, this provision will become effective. See "AMENDMENTS TO PRIOR TRUST AGREEMENT" herein.

#### **Rate Covenant**

Under the Trust Agreement, the Authority has covenanted as follows:

- (i) to fix, charge and collect tolls, fees, rentals and other charges for the use of and for services furnished or to be furnished by the Triangle Expressway System, and that from time to time and as often as it shall appear necessary, to revise such tolls, fees, rentals and other charges as may be necessary or appropriate, in order that for each Fiscal Year, beginning with the first full Fiscal Year in which the Triangle Expressway System is in operation, the Revenues in such Fiscal Year will be not less than 130% of the Long-Term Debt Service Requirement for Senior Lien Indebtedness only for such Fiscal Year; and
- (ii) to fix, charge and collect tolls, fees, rentals and other charges for the use of and for services furnished or to be furnished by the Triangle Expressway System, and that from time to time and as often as it shall appear necessary, to revise such tolls, fees, rentals and other charges as may be necessary or appropriate, in order that for each Fiscal Year, beginning with the first full Fiscal Year in which the Initial Project is in operation, the Revenues in such Fiscal Year will be not less than 110% of (x) the Long-Term Debt Service Requirement for Senior Lien Indebtedness, Subordinate Lien Indebtedness and TIFIA Indebtedness for such Fiscal Year and (y) the deposits to be made to the Senior Lien Parity Reserve Account, the Subordinate Lien Parity Reserve Account and the TIFIA Debt Service Reserve Account for such Fiscal Year.

The Authority also covenants to fix, charge and collect tolls, fees, rentals and other charges so that the Receipts will be sufficient in each Fiscal Year to make all the deposits described in paragraphs (a) through (i) in "-Application of Receipts" above to the various funds described above. The Trust Agreement contains certain additional provisions regarding the Authority's covenants as to tolls. See "The Trust Agreement – Rate Covenant" in APPENDIX A hereto for such additional details.

If the rate covenant described in (i) and (ii) above (herein, the "Rate Covenant") is not met, the Authority is obligated to request a Traffic Consultant to make its recommendations, if any, as to a revision of the Authority's tolls, fees, rentals and charges, its Operating Expenses or the method of operation of the Triangle Expressway System in order to satisfy the Rate Covenant. The Authority is obligated under the Trust Agreement to revise its tolls, fees, rentals and charges or its Operating Expenses or alter its methods of operation, which revisions or alterations need not comply with the Traffic Consultant's recommendations but which are projected by the Authority to result in compliance with the Rate Covenant. See also "THE TRIANGLE EXPRESSWAY SYSTEM – Toll Rate Policy" herein.

## **Parity and Subordinated Indebtedness**

Under the conditions and limitations set forth in the Trust Agreement and without the approval or consent of the Owners or Holders of Indebtedness, the Authority may issue or incur additional Senior Lien Indebtedness secured by a pledge, charge and lien upon the Trust Estate on a parity with the Series 2018 Bonds.

In general, additional Long-Term Senior Lien Indebtedness may be incurred if prior to incurrence there is delivered to the Trustee:

(i) an Officer's Certificate certifying that the Authority was in compliance with its rate covenant as described above for the most recent Fiscal Year for which audited financial statements are available;

- (ii) a report of a Traffic Consultant stating that for each Fiscal Year next succeeding the date on which such Senior Lien Indebtedness is incurred through the final maturity date of all Senior Lien Indebtedness, the forecasted Revenues in each such Fiscal Year is at least 140% of the Long-Term Debt Service Requirement with respect to all Senior Lien Indebtedness (excluding any Long-Term Indebtedness constituting Senior Lien Indebtedness to be refunded by the Long-Term Indebtedness to be incurred) and the Long-Term Indebtedness proposed to be incurred;
- (iii) a report of a Traffic Consultant stating that for each Fiscal Year next succeeding the date on which such Long-Term Indebtedness is incurred through the final maturity date of any Long-Term Indebtedness, the forecasted Revenues in each such Fiscal Year is at least (x) 130% of (1) the Long-Term Debt Service Requirement with respect to all Outstanding Senior Lien Indebtedness, Subordinate Lien Indebtedness and TIFIA Indebtedness (excluding any Long-Term Indebtedness to be refunded by the Long-Term Indebtedness to be incurred) and the Long-Term Indebtedness to be incurred and (2) the amounts to be deposited in such Fiscal Year, the Senior Lien Parity Reserve Account, the Subordinate Lien Parity Reserve Account, and the TIFIA Debt Service Reserve Account, and (y) the Loan Life Coverage Ratio is a least 130%;
- (iv) a report of a Traffic Consultant showing that (1) for each Fiscal Year next succeeding the date on which such Long-Term Indebtedness is incurred through the final maturity date of any Long-Term Indebtedness, the forecasted Revenues in each Fiscal Year will be sufficient to make all of the deposits in each such Fiscal Year required under the Trust Agreement as described in paragraphs (a) through (g) under "—Application of Receipts" above and (2) all Outstanding TIFIA Indebtedness will be fully retired by its final maturity date; and
- (v) evidence that such Senior Lien Indebtedness will be rated at an investment grade rating by Fitch, Moody's or S&P.

In addition, under the Third Supplemental Trust Agreement, so long as any of the Insured Bonds are Outstanding, unless AGM agrees otherwise, additional Long-Term Senior Lien Indebtedness may not be incurred unless the Authority files with the Trustee and AGM (a) an Officer's Certificate demonstrating that the Revenues for each of the two most recent Fiscal Years for which audited financial statements are available were, in each Fiscal Year, at least 175% of the Long-Term Debt Service Requirement with respect to all Outstanding Long-Term Indebtedness constituting Senior Lien Indebtedness for such Fiscal Year, (b) a report of the Traffic Consultant described in (ii) above showing that (1) the forecasted Revenues in each Fiscal Year is at least 175% of the Long-Term Debt Service Requirement with respect to all Outstanding Long-Term Indebtedness constituting Senior Lien Indebtedness (excluding any Long-Term Indebtedness constituting Senior Lien Indebtedness to be refunded by the Long-Term Indebtedness to be incurred) and the Long-Term Indebtedness proposed to be incurred, and (2) the forecasted Revenues in each Fiscal Year is also at least 150% of the Long-Term Debt Service Requirement with respect to all Outstanding (and proposed to be incurred) (A) Long-Term Indebtedness constituting Senior Lien Indebtedness (excluding any Long-Term Indebtedness constituting Senior Lien Indebtedness to be refunded by the Long-Term Indebtedness to be incurred) and (B) TIFIA Indebtedness, and (c) evidence that the proposed Senior Lien Indebtedness has been rated at an investment grade rating by at least one nationally recognized municipal bond rating agency.

AGM has waived the foregoing provisions with respect to the issuance of the Series 2018 Bonds and to the issuance of any Senior Lien Indebtedness or TIFIA Indebtedness to finance Complete 540 - Phase 1. See "THE TRIANGLE EXPRESSWAY SYSTEM – Complete 540" herein.

The Trust Agreement contains certain additional provisions setting forth requirements for the issuance of Senior Lien Indebtedness and certain additional conditions under which Senior Lien Indebtedness may be incurred in order to complete the Initial Project or any Additional Project or to refund Outstanding Long Term Indebtedness

or in certain other circumstances. See "The Trust Agreement – Limitation on Senior Lien Indebtedness" in APPENDIX A hereto for such additional details.

Under the conditions and limitations set forth in the Trust Agreement and without the approval or consent of the Owners or Holders of Senior Lien Indebtedness, the Authority may issue or incur Subordinated Indebtedness secured by a pledge, charge and lien upon Trust Estate subordinate to the payment of Senior Lien Indebtedness.

#### THE TRIANGLE EXPRESSWAY SYSTEM

#### General

The "Triangle Expressway" currently extends for approximately 18.8 miles from the interchange of I-40 and NC 147 on the north end to the NC 55 Bypass near Holly Springs, North Carolina on the south end, and includes ten interchanges. The Triangle Expressway is a segment of the partially complete "Outer Loop" around the greater Raleigh, North Carolina area. Using the Triangle Expressway, travelers have a limited-access, six-lane, high-grade facility from I-40 to the NC 55 Bypass near Holly Springs, reducing congestion on NC 55, a heavily utilized road which runs parallel to the Triangle Expressway. The Triangle Expressway provides access to a rapidly developing area within the Triangle region, which is projected to have substantial increases in both population and employment over the next 25 years, and improves access into the Research Triangle Park and other area employment centers.

The Triangle Expressway initially was comprised of two major construction projects known as the Triangle Parkway and the Western Wake Freeway. The two projects were financed together, but had two different opening dates based on the volume of work in each project. The first phase of the Triangle Expressway, the Triangle Parkway, broke ground in August 2009 and opened to traffic in December 2011. The second and third phases of the Triangle Expressway, which made up the Western Wake Freeway, opened in August 2012 and December 2012, respectively.

The Triangle Expressway was constructed under fixed-fee, lump sum design-build contracts. All three phases opened ahead of the original scheduled dates, resulting in the payment of early completion incentive payments to the design-build teams. The Authority was able to deliver the toll road ahead of schedule by utilizing accelerated project delivery techniques including design-build, accelerated right-of-way acquisition processes, and alternate technical concepts, which allowed maximum innovation by the design-build teams. Opening ahead of schedule allowed for a period of toll-free travel and live system testing prior to the initiation of tolling, which began system-wide on January 3, 2013. The toll system has required minimal system corrections since it began collecting tolls system-wide.

In April, 2017, a new interchange known as the Veridea Parkway Interchange was opened for traffic. The Veridea Parkway Interchange is located between the US 1 interchange and the NC 55 Bypass interchange on the southern end of the Triangle Expressway and provides a direct local link between the Triangle Expressway and Veridea Parkway/Old Holly Springs-Apex Road. The Veridea Parkway Interchange was paid for in part with proceeds of the 2009 Bonds. A second interchange, the Morrisville Parkway Interchange, is currently under construction and is expected to be completed in January, 2020 to provide increased connectivity and access. Toll revenues from both the Veridea Parkway Interchange and the Morrisville Parkway Interchange are or will be included in Receipts and Revenues of the Triangle Expressway System.

# Maintenance of the Triangle Expressway System

Maintenance is performed to standards defined in the Authority's maintenance rating program guidelines, standard operating procedures for roadway elements, and NCDOT performance standards, and utilizes criteria used to measure compliance. The Authority has an independent consultant who conducts the Maintenance Rating Program ("MRP") for the Triangle Expressway on a quarterly basis. The maintenance rating program assesses

various elements of the Triangle Expressway, including road surface, unpaved shoulders and ditches, drainage, roadside and traffic control devices. The Authority's target rating for the MRP is 90; the overall 2017 annual maintenance rating of the Triangle Expressway was 91.8. If the Authority is unable to fund the maintenance costs after satisfying debt payments, the Operations and Maintenance Expense Guaranty Agreement with NCDOT ensures that operating and maintenance costs will be paid by NCDOT.

# **Complete 540**

The Authority and NCDOT have undertaken an extension of the Triangle Expressway, known as the "Complete 540" project, which will extend the Triangle Expressway approximately 27 miles from the NC 55 Bypass in Apex to an interchange with I-40 southeast of Raleigh and then on to the US 64/US 264 Bypass in Knightdale, completing the 540 Outer Loop around the greater Raleigh area. See the map below entitled "Complete 540." Complete 540 consists of three separate NCDOT State Transportation Improvement Program ("STIP") Projects, R-2721 (which includes R-2721A and R-2721B), R-2828, and R-2829, which were combined for planning and environmental studies. STIP Projects R-2721A, R-2721B and R-2828, which comprise the approximately 17.1 mile portion of Complete 540 from NC 55 Bypass in Apex to I-40, are referred to as Phase 1 of Complete 540 ("Complete 540 - Phase 1"). Complete 540 – Phase 1 is projected to begin construction in 2019 and be open to traffic in 2024. The Authority and NCDOT have begun soliciting proposals for the design and construction of Complete 540 - Phase 1. NCDOT STIP Project R-2829, which consists of the remaining approximately 10.5 miles from I-40 to US 64/US 264 Bypass, is referred to as Phase 2 of Complete 540, and is currently expected to begin construction in 2027 ("Complete 540 - Phase 2").

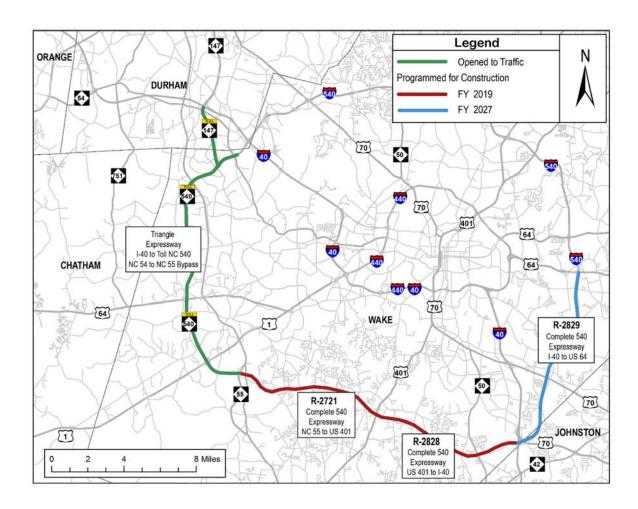
Two primary objectives have been established for the Complete 540 project, based on general transportation problems in the Raleigh area and specific, more localized needs. The first objective is to improve mobility within or through the area during peak travel periods. The second objective is to reduce forecasted congestion on the existing roadway network within the project study area. A secondary purpose of the project is to improve system linkage in the regional roadway network by completing the 540 Outer Loop around the greater Raleigh area, which has been a goal of area planners for more than 40 years. It is expected that construction of the Complete 540 link will benefit local commuters living south and east of Raleigh as well as motorists making longer trips through the Triangle region to and from points south and east.

The Complete 540 project development process, including the production of design plans and the preparation of various technical reports and environmental documentation to fulfill the requirements of the National Environmental Policy Act ("NEPA") is complete. Engineering and environmental studies evaluated and documented the benefits and impacts associated with the detailed study alternatives and formed the foundation of the Draft Environmental Impact Statement ("Draft EIS") that was published in November 2015 for public review and comment through early January 2016. In December 2015, NCDOT held public meetings and a public hearing regarding the Draft EIS. Following the review of public comments on the Draft EIS and from the public hearing, NCDOT selected "Detailed Study Alternative 2" as the Preferred Alternative for the project in April 2016. The Final Environmental Impact Statement (the "Final EIS") was completed in December 2017 and included refined design and technical studies for the Preferred Alternative. The NEPA process concluded with the approval of the Record of Decision in June 2018 for both phases of Complete 540.

NCDOT's approved 2018-2027 STIP includes funding for right of way acquisition and construction beginning in fiscal year 2020 for Complete 540 - Phase 1. Procurement for three design-build contracts is underway for Complete 540 - Phase 1. A detailed construction schedule has not yet been established; however, based on a project award in late 2018 or early 2019, it is estimated that this project would be open to traffic by January 1, 2024. Litigation has been filed challenging the construction of Complete 540 on the basis of certain alleged environmental impacts; such litigation could significantly delay the construction of Complete 540.

The Authority currently intends to finance a portion of the costs of Complete 540 through the issuance of additional Senior Lien Revenue Bonds and additional TIFIA Indebtedness in accordance with the terms of the Trust Agreement.

The following map shows the expected route of Complete 540, including the STIP Project references and expected dates of construction:



#### **Extension of NC 147**

The NCDOT 2018-2027 STIP includes, as Project number U-5966, funding for the construction of a multilane highway that will connect the Triangle Expressway (at the interchange with NC 540) to McCrimmon Parkway at Town Hall Drive in Morrisville, North Carolina (the "Highway 147 Extension"). The STIP shows funding for right-of-way and utility relocation for the Highway 147 Extension in fiscal year 2021 and construction in fiscal year 2023. The Highway 147 Extension would provide the area with more direct access to the Triangle Expressway from the communities to the south of the Triangle Expressway. The Highway 147 Extension will not be part of the Triangle Expressway, but will provide direct highway access to the Triangle Expressway.

# Project Specific Agreement for Triangle Expressway and Executory Contract For Lease of Right-of-Way for Triangle Expressway and Lease Agreement

The Authority and NCDOT entered into a Project Specific Agreement for Triangle Expressway and Executory Contract for Lease of Right-of-Way for Triangle Expressway (the "Project Specific Agreement") on March 6, 2008. The Project Specific Agreement establishes the terms and conditions under which NCDOT supports the Authority in its efforts to finance, construct, equip, operate and maintain the Triangle Expressway System in accordance with the Authority Act. The Authority and the NCDOT entered into a Lease Agreement (the "Lease Agreement") under which the NCDOT leases to the Authority all rights-of-way necessary for the Triangle Expressway System for one dollar per year. The Lease Agreement provides the Authority uninterrupted access to and full use of the Triangle Expressway System rights-of-way up to and until the Authority ceases to operate the Triangle Expressway System as a toll facility, at which time the Lease Agreement will terminate and the Triangle Expressway will revert to the NCDOT.

# **All-Electronic Tolling**

The Authority utilizes an all-electronic tolling ("AET") system for the Triangle Expressway System where vehicles are detected while traveling at highway speeds, without having to stop and pay cash tolls. Tolling zones are located across the Triangle Expressway at four mainline locations and several interchange ramp locations to ensure that all users of the Triangle Expressway pay a toll regardless of their entry and exit locations. Customers may elect to pay tolls using a pre-paid transponder-based account, which results in a 35% discount on rates compared to customers without a transponder. For customers using the Triangle Expressway without a transponder, an image of their license plate is captured and they are sent an invoice by U.S. Mail. All customers can make their payments by cash, check, money order or credit card.

# **Toll Collection System Technology**

Electronic Toll Collection System. The Electronic Toll Collection System ("ETCS") consists of the transponder and reader/antenna technology, which was installed and is operated by Kapsch TrafficCom USA, Inc. ("ETCS Contractor" or "Kapsch"). The ETCS facilitates AET by processing transponder reads from multiple transponder programs at all speeds, effectively communicating transactions, and assigning reads to the proper vehicles. The ETCS Contractor coordinates with the Roadside Toll Collection System ("RTCS") contractor to ensure seamless and accurate operation with and within the RTCS. The ETCS contractor also interfaces with the Back Office System contractor through the transponder reader for automatic input of the transponders into a transponder inventory application and customer accounts.

Roadside Toll Collection System. The RTCS is the system for detecting use of the roadway, and capturing transactions through transponder reads or license plate images with multiple levels of optical character recognition/automated license plate recognition ("OCR/ALPR") capabilities. The RTCS is a fully-automated, multi-lane, free-flow system, specifically designed for high-speed accurate video tolling with strict video and automatic vehicle license plate reading performance requirements. The RTCS includes fully automated toll zone plazas, a toll facilities host and a database, and interfaces with the Back Office System regarding license plate images. The RTCS was installed and is operated by Conduent State and Local Solutions, Inc. ("RTCS Contractor" or "Conduent").

Back Office System. The Back Office System ("BOS"), currently operated by Conduent, processes the roadside toll transactions and posts these transactions to the transponder and video-based accounts. The BOS includes the system host, databases, and the video processing for customers without registered pre-paid transponder accounts. The BOS is the interface to the payment systems and commercial establishments.

*Operation Services*. The Operation Services contractor (the "Operations Contractor") is AECOM, which provides for the operations and staffing of the operations and customer service centers. Customer service and account management services include operational service for the call center, walk-in counters, mail and e-mail processing, transponder inventory control, and all other activities involving BOS processes.

# Interoperability

The Authority is a full member of the E-ZPass Group, with an interoperability agreement that permits all E-ZPass® agencies in 17 states to accept the NC Quick Pass® E-ZPass transponder as a form of payment and permits the Authority to accept E-ZPass as a form of payment on toll roads in North Carolina. This agreement enables the Authority to do business with the more than 35 million drivers who have E-ZPass transponders.

A similar agreement exists between the Authority and Florida's Turnpike Enterprise permitting interoperability between NC Quick Pass, Florida's SunPass® and Georgia's Peach Pass® prepaid toll programs, covering 13 agencies in Florida and Georgia.

The interoperability agreements have expanded the versatility of the NC Quick Pass system and allowed NC Quick Pass to be the premier interoperable transponder program along the east coast. In September, 2016 and again in October, 2018, the Authority received the President's Award for Excellence from The International Bridge, Tunnel and Turnpike Association (IBTTA) for its Multi-Agency Interoperability Program and its leadership in technology solutions for interoperability.

In Fiscal Year 2018, the total number of transactions for interoperable agency customers utilizing the Triangle Expressway System was approximately 5.0 million; the number of NC Quick Pass transactions utilizing other states' facilities was approximately 1.6 million.

The map set forth below shows states with systems that are interoperable with the NC Quick Pass system or where the NC Quick Pass system can be used.

[Map on following page]



#### **Toll Collection Enforcement**

The Authority maintains a North Carolina Quick Pass Operations Center and three (3) Customer Service Centers (each, a "CSC") in the State. The Morrisville, North Carolina CSC is adjacent to the Triangle Expressway for customers to pay toll invoices, establish accounts and buy transponders.

The Authority administers two payment programs on the Triangle Expressway: electronic toll collection using NC Quick Pass transponders or Bill by Mail using the OCR/ALPR system described under "Toll Collection System Technology – *Roadside Toll Collection System*" above. Under the Authority's Toll Rate Policy, Bill by Mail toll rates are the base rates and NC Quick Pass customers receive up to a 35% discount off the Bill by Mail toll rate. The NC Quick Pass transponder program involves setting up a pre-paid account with the Authority and installing a transponder in the vehicle to allow for the automatic deduction of tolls from the pre-paid account. Drivers not in the NC Quick Pass transponder program are invoiced for tolls incurred through the Bill by Mail program.

If a customer uses the Triangle Expressway system and a toll is not paid within 30 days after the travel occurs, a Bill by Mail invoice will be sent to the registered owner of the motor vehicle by first-class mail to the address associated with the vehicle and provided by the North Carolina Division of Motor Vehicles ("NC DMV"), another state's DMV, or another recognized source, as applicable. The first Bill by Mail invoice will include any tolls incurred during this initial 30-day period. A person who receives a bill for an unpaid toll must either pay the bill or request a review of the bill by the Authority. If the person billed does not take one of such actions within 30 days after the bill is sent, the Authority will add a \$6.00 processing fee to the toll amount the person owes with a maximum of \$48.00 in processing fees allowed against that person in a calendar year. Each invoice also includes a failure to pay statement explaining the fees and the consequences of non-payment. The Authority will add a \$25.00 civil penalty after the second unpaid invoice. Only one civil penalty may be assessed within a six-month

period. The failure of a person to pay a toll bill, including any processing fee and any civil penalty, is grounds to withhold the registration renewal of any motor vehicle registered in that person's name. When the Authority notifies the North Carolina Commissioner of Motor Vehicles of a person who owes a toll, processing fee or civil penalty, the North Carolina Commissioner of Motor Vehicles must withhold the registration renewal of any motor vehicle registered in that person's name until the required payment is made. If necessary, the Authority uses collection agencies to collect unpaid tolls and fees from users of the Triangle Expressway. As of the end of fiscal year 2017, the Authority was billing approximately 94% of the transactions and collecting approximately 96% of the tolls billed, resulting in a combined toll collection rate of approximately 90%.

A person whose motor vehicle registration renewal is blocked may pay to the NC DMV the amount owed for unpaid tolls, processing fees, and civil penalties due when renewing the vehicle registration. The NC DMV must remit to the Authority the amount of tolls, fees, and civil penalties collected. The NC DMV's costs of collecting tolls, fees, and civil penalties are considered a necessary expense of the operation of the Authority, and the Authority must reimburse the NC DMV for these costs.

If a person receiving a bill asks for a review of the bill for use of the Triangle Expressway, then the Authority is to conduct a review and determine whether the person is liable for the toll. If the Authority determines that the person is liable for the toll, the person may contest this determination by filing a petition for a contested case hearing at the North Carolina Office of Administrative Hearings.

Under the State constitution, amounts collected in the form of civil penalties in excess of the cost of collection are required to be paid to the school administrative unit to provide additional support for the public school system. Therefore, most or all of the civil penalties the Authority collects from the Triangle Expressway System will not be treated as Receipts under the Trust Agreement and will not be paid to the Authority. The Authority will be entitled to collect the full amount of all tolls and the processing fees.

# **Intelligent Transportation System**

The Triangle Expressway Intelligent Transportation System ("ITS") consists of roadside devices including closed circuit television ("CCTV") cameras, microwave vehicle detection stations ("MVDS"), full-matrix dynamic message signs ("DMS") and a road weather system ("RWIS"). The Intelligent Transportation System is connected via a 38-mile fiber-optic communications system using Gigabit Ethernet technology for both the toll collection system and the Intelligent Transportation System. The ITS provides video and data sharing with the Authority, NCDOT, and Triangle Expressway System users.

The Authority has traffic management workstations and office space allocated in the North Carolina Traffic Operations Center located in the National Guard Joint Headquarters Building in Raleigh. This facility also serves as the State's emergency management center. A small size traffic management center ("TMC") is also equipped for the Authority in the Operations Center. This TMC serves as a location for the Authority to monitor traffic conditions on the Triangle Expressway.

## **Toll Rate Policy**

Pursuant to Section 136-89.183 of the North Carolina General Statutes, the Authority has the power to fix, revise, charge, retain, enforce, and collect tolls and fees for the use of turnpike projects, including the Triangle Expressway System.

On September 17, 2008, the Authority adopted a toll rate policy (the "Toll Rate Policy") which provides guidelines pursuant to which the Authority shall establish and adjust toll rate schedules for its turnpike projects. Pursuant to the Toll Rate Policy, the Authority was required to hire the Traffic Consultant to prepare a Traffic and Revenue Report for the Triangle Expressway System and forecast the projected traffic for and the toll revenues to

be generated from the Triangle Expressway System. After receipt of such traffic and revenue study, the Toll Rate Policy directs the Authority to adopt a toll rate schedule for the use of the turnpike project based upon factors it determines appropriate, including but not limited to, the location of the turnpike project for which the toll is collected, the type of vehicles anticipated to use the turnpike project, the method of collection of the toll (electronic, video, cash or other method) and other factors, including the rate increase assumptions in the traffic and revenue study. The Traffic Consultant prepared the initial Comprehensive Traffic and Revenue Study Final Report for the Triangle Expressway System dated April 6, 2009 (the "Traffic and Revenue Report"), which contained a proposed toll rate schedule with the assumption that the tolls would be increased each year. A copy of the Traffic and Revenue Report is available on the Authority's web page at <a href="https://www.ncdot.gov/divisions/turnpike/turnpike-projects/Pages/triangle-expressway-documents.aspx">https://www.ncdot.gov/divisions/turnpike/turnpike-projects/Pages/triangle-expressway-documents.aspx</a>. References to web site addresses presented herein are for informational purposes only and may be in the form of a hyperlink solely for the reader's convenience. Unless specified otherwise, such web sites and the information or links contained therein are not incorporated into, and are not part of, this Official Statement.

Under the Toll Rate Policy, an increase in the toll rates is required in each year unless the Authority provides to the Trustee (1) a resolution of the Authority's Board directing that the toll rates will not be increased or will be increased in a lesser amount than assumed in the Traffic and Revenue Report; (2) a certificate of an officer of the Authority to the effect that the Authority is in compliance with all applicable rate covenants in the Trust Agreement and all other documents for the Bonds issued to finance the Triangle Expressway; and (3) a report of the Traffic Consultant showing that for each succeeding fiscal year through the final maturity date for all indebtedness issued to finance the Triangle Expressway, the forecasted Revenues in each such fiscal year would be such that one dollar of additional senior lien indebtedness could be issued by the Authority in compliance with the requirements of the additional debt limitations set forth in the documents related to all bonds issued to finance the Triangle Expressway.

In 2012 and 2013, in order to reflect the actual start of toll collections on various phases of the Triangle Expressway System and to ensure that toll rates were not increased precipitately, the Authority engaged the Traffic Consultant to provide revised annual gross toll revenue estimates based on delayed implementation dates for programmed toll increases to better reflect the actual dates of operation of the Triangle Expressway. The Traffic Consultant delivered a 2012 Revised Toll Revenue Letter dated December 13, 2012 (the "2012 T&R Letter") and a 2013 Revised Toll Revenue Letter dated June 3, 2013 (the "2013 T&R Letter"). By resolutions adopted on December 20, 2012, and again on June 20, 2013, the Authority determined to adopt a toll rate schedule that deferred inception of rates or rate increases for certain road segments and changed the date of toll increases from July to January in each year. In March, 2016, the Traffic Consultant delivered a report addressing the impact of the addition of the new Veridea Parkway Interchange to the Triangle Expressway System, based on an expected opening date by the end of March, 2017, which included a revised proposed toll rate schedule for that interchange. On August 4, 2016, the Authority adopted the rates included in the March 31, 2016 report as the toll rates for the Veridea Parkway Interchange. A similar report will be prepared to address the impact of the addition of the new Morrisville Parkway Interchange to the Triangle Expressway System, based on an expected opening date in 2020, which will include a proposed toll rate schedule for that interchange. Each revision of the toll rate schedule included a formal revision to the Traffic and Revenue Report, a determination by the Authority's financial advisor that the new forecasted revenues would be sufficient under the Trust Agreement to meet the Rate Covenant, and an opinion of bond counsel to the Authority that such action would not have an adverse effect on the exclusion of interest on the Bonds issued under the Trust Agreement from gross income for federal income tax purposes or cause the Authority to be in violation of any of its covenants under the Trust Agreement.

# Historical Performance of Triangle Expressway System<sup>†</sup>

The Authority's audited financial statements for the last four fiscal years show total operating revenues for the Authority, all of which are derived from the Triangle Expressway System, of \$24.725 million, \$30.709 million,

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<sup>†</sup> The financial information in this section is presented on an accrual basis.

\$39.148 million and \$45.520 million for Fiscal Years 2014, 2015, 2016 and 2017, respectively. Based on those numbers, and certain agreed upon procedures performed by the Authority's auditor, the Authority's revenues from the Triangle Expressway have been significantly above the levels required to meet the Rate Covenant. The Authority's audited financial statements and the corresponding report on agreed upon procedures are posted as part of the Authority's Continuing Disclosure undertaking.

Rate Covenant	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>
Revenues to Long-Term Debt Service Requirement for Senior Lien Indebtedness (130% minimum)	272%	322%	385%	434%
Revenues to (i) Long-Term Debt Service Requirement for Senior Lien Indebtedness, Subordinate Lien Indebtedness and TIFIA Indebtedness for such Fiscal Year plus (ii) required deposits to Senior Lien Parity Reserve Account, Subordinate Lien Parity Reserve Account and the TIFIA Debt Service Reserve Account (110% minimum)	271%	141%	154%	165%

The number of transactions and corresponding toll revenue have continued to increase in 2018. In the first six months of 2018, total transactions increased by 7.3 percent, and collected toll revenue increased by 11.4 percent compared to the first half of 2017. See APPENDIX B – "Chapter 2 – Existing Conditions."

#### 2018 TRAFFIC AND REVENUE STUDY

In connection with the issuance of the Series 2018 Bonds, the Traffic Consultant prepared the Triangle Expressway Traffic and Revenue Study (the "2018 Traffic and Revenue Study"). The 2018 Traffic and Revenue Study sets forth estimated traffic and revenue for the Triangle Expressway System in a no-expansion scenario, in which traffic and revenue estimates are based solely on the existing toll road that extends from I-40 in the north and terminates at NC 55 Bypass in the south, without Complete 540. A complete copy of the 2018 Traffic and Revenue Study is included as APPENDIX B attached hereto. The 2018 Traffic and Revenue Study has been prepared on the basis of numerous assumptions and other factors described in the 2018 Traffic and Revenue Study, and should be read in its entirety and in light of such assumptions and other factors. The sensitivity analyses in the 2018 Traffic and Revenue Study make certain assumptions about toll rates through 2058. The Board of the Authority has not authorized tolls for the Triangle Expressway beyond 2049.

Assumptions. The traffic and revenue estimates for the Triangle Expressway contained in the 2018 Traffic and Revenue Study are predicated on the following basic assumptions, which are considered reasonable for purposes of the base condition forecast:

- 1. No portion of Complete 540 is assumed to be implemented during the projection period. The forecasts within the 2018 Traffic and Revenue Study envision only the continued operation of the existing Triangle Expressway with certain interchange and toll zone location modifications as enumerated in the 2018 Traffic and Revenue Study.
- 2. A new interchange at Morrisville Parkway will be open to traffic on January 1, 2020. Associated with this new interchange will be a new mainline toll zone, north of the new Morrisville interchange, and associated adjustments in toll rates at the existing mainline toll zones, T17/T18, north of Green Level West Road.
- 3. Existing ramp toll zones at Hopson Road and US 64 will be removed and replaced with two new mainline tolling zones immediately north of these respective interchanges. Associated toll rate

- adjustments also occurred to maintain consistent through-trip per-mile toll rates. These toll-collection system changes are assumed to begin on January 1, 2024.
- 4. Tolls on Triangle Expressway will continue to be charged for three vehicle classes, using a cashless all-electronic toll collection methodology. Toll rates for each year of the forecast period are shown as in Table 6.5 of the 2018 Traffic and Revenue Study, which assumes continued annual increases in toll rates.
- 5. Highway and other transportation improvements set forth in Tables 6.1, 6.2 and 6.3 of the 2018 Traffic and Revenue Study will be implemented within the time frames assumed in those tables. For purposes of the base case traffic and revenue forecast, no other transportation improvement projects, particularly new roads, additional road capacity or new interchanges will be constructed during the forecast period, other than those shown in Table 6.1, 6.2, and 6.3 of the 2018 Traffic and Revenue Study. In particular, the 2018 Traffic and Revenue Study assumes that the planned extension of NC 147 (STIP Project number U-5966) will not occur.
- 6. The annual rate of inflation and estimated method-of-payment market shares among electronic toll collection ("ETC") and bill-by-mail ("BBM") will be shown in Table 6.7 of the 2018 Traffic and Revenue Study for purposes of the forecast.
- 7. Economic growth in the project study area will generally occur as forecasted by the independent economist used in the 2018 Traffic and Revenue Study.
- 8. Leakage and fee revenue adjustments are applied to the estimated gross toll revenue forecasts. The adjustments are based on 5.5 years of actual experience on the Triangle Expressway, provided to the Traffic Consultant by the Authority. The forecast assumes that toll revenue collection, particularly as related to BBM transactions and processing fee revenue, will continue to be collected at similar rates over the forecast period.
- 9. The Triangle Expressway will continue to be well maintained, efficiently operated, effectively signed and promoted to encourage maximum usage.
- 10. Motor fuel will remain in adequate supply throughout the forecast period. Fuel price increases will not significantly exceed the overall rate of inflation.
- 11. No national, state or regional emergency will arise that would abnormally restrict the use of motor vehicles. Future transportation technology changes will not significantly negatively impact traffic and revenue on the Triangle Expressway over the projection period.

*Study Process*. Following is a summary of the study process used in developing the 2018 Traffic and Revenue Study:

A comprehensive work program was developed to meet the specific objectives of the study. In general, the study was comprised of six major efforts:

- 1. Data collection and summarization;
- 2. Corridor growth analysis;
- 3. Stated preference surveys;

- 4. Triangle Regional Model Refinement and Calibration;
- 5. Traffic and Toll Revenue Analysis;
- 6. Traffic and Toll Revenue Sensitivity Tests

The Traffic Consultant previously issued a Complete 540 Planning Level Traffic and Revenue Study (the "Planning Level Study") on May 31, 2017. The Planning Level Study provided traffic and toll revenue forecasts for the existing Triangle Expressway and for three scenarios that included various assumptions regarding portions of the Complete 540 project. Data collected for the Planning Level Study included traffic counts, travel-speed data, travel-pattern data from StreetLight Data, Inc., historical data and toll revenue on the Triangle Expressway, and planned roadway improvements in the study area. The traffic and revenue projections in the Planning Level Study were based on the Triangle Regional Model version 5 ("TRMv5"), including its assumptions regarding growth and location of future population, number of households and employment.

In preparing the 2018 Traffic and Revenue Study, the Traffic Consultant used data collected as part of the Planning Level Study described above and also obtained additional data. Additional data collected included traffic count data from NCDOT made available since the Planning Level Survey was conducted, as well as updated toll transaction and revenue data obtained from the Authority. The Traffic Consultant also received data on leakage and fee revenue associated with BBM transactions on the Triangle Expressway. To supplement the 63 traffic counts conducted in the Fall of 2017 as part of the Planning Level Study, traffic counts were conducted in 15 additional locations. With NCDOT's permission, updated travel speed data for the 2016 calendar year was obtained in the study area from HERE geospatial travel time data via the Regional Integrated Transportation Information System.

The Traffic Consultant obtained the latest version of the Triangle Regional Model, the Triangle Regional Model Version 6 (the "TRMv6"), from the Institute of Transportation Research and Education at North Carolina State University. The Triangle Regional Model is a key tool for evaluating future corridor growth and travel demand in the region and encompasses three complete counties – Durham, Orange and Wake – and seven other partial counties in North Carolina. The official base year of the TRMv6 is 2013 and supports forecast years 2025, 2035, and 2045. Each forecast year includes socioeconomic forecasts for variables such as population, number of households, and employment for geographic units called Traffic Analysis Zones.

The socioeconomic assumptions in the TRMv6 were analyzed by an independent economist, Dr. Stephen J. Appold, who has expertise in North Carolina economic trends and forecasts. Dr. Appold developed a set of socioeconomic inputs to the TRMv6 to enable the Traffic Consultant to create a model year 2016 for calibration purposes. Using an analysis of major employers, employment centers, housing developments, and the latest available historic trends and forecasts, Dr. Appold also created revised socioeconomic inputs, including population, number of households and employment, for each of 2016, 2025, 2035 and 2045. Dr. Appold's adjustments to socioeconomic inputs, after review and acceptance by the Traffic Consultant, were used to create revised trip tables for each forecast year.

Stated preference surveys were conducted by Resource Systems Group, Inc. ("RSG") to estimate "values of time" ("VOT") for motorists in the study area. VOT expresses a driver's willingness to pay a toll to achieve a time savings. Estimated VOT was developed for different market segments and geographic areas in the model area, and incorporated into the TRMv6 to support the development of traffic and toll revenue forecasts. Roadway improvements in the study area were reviewed against current plans of NCDOT and the two Metropolitan Planning Organizations in the area: the Capital Area MPO and the Durham Chapel-Hill Carrboro MPO, and adjusted where necessary.

The TRMv6 was used to analyze the traffic and toll revenue potential of the Triangle Expressway System. Traffic assignments were conducted using the refined and calibrated TRMv6, incorporating the adjusted trip tales,

and using the Traffic Consultant's toll diversion algorithms. The assignments included model inputs developed by the Traffic Consultant and RSG, including motorist VOTs, motor vehicle operating cost ("VOC"), toll rate schedules, and NC Quick Pass and BBM market shares. Estimated annual transactions, traffic, and revenues of the Triangle Expressway under Scenario 1 were calculated for 2020, 2025, 2035 and 2045. Intermediate years were developed by interpolating between model years 2020 and 2025, 2025 and 2035, and 2035 and 2045. After 2045, nominal increases in traffic were assumed.

Lastly, a traffic and toll sensitivity analysis was conducted for fiscal years 2019 and 2040 to provide information on the sensitivity of the forecasts to changes in key assumptions. In particular, the sensitivity tests analyzed the sensitivity of the base condition forecasts against lower economic growth, lower motorist VOTs, higher motor fuel costs, the impact of removing a planned widening on NC 147 north of the tolled portion of NC 147, and the impact of the planned Complete 540 on the Triangle Expressway System.

#### PROJECTED CASH FLOW AND DEBT SERVICE COVERAGE

# Table of Projected Revenues, Operations and Maintenance Expenses, Cash Flows and Debt Service Coverage Ratios

The table below has been compiled by the Authority to show the projections for estimated Toll Revenues, the debt service requirements for the Series 2018 Bonds, the 2017 Bonds, the remaining 2009A Bonds and the 2009B Bonds, estimated debt service coverage ratios for Senior Lien Bonds, projected Operation and Maintenance Expenses, projected deposits to the Renewal and Replacement Fund, and projected deposits to the General Reserve for each of the fiscal years ending June 30, 2019 through June 30, 2049.

See also "RISK FACTORS - Forward-Looking Statements."

## Preliminary Projected Cash Flow and Debt Service Coverage

			Total	Series 2018	Outstanding	Total Senior	Excess Revenues	Senior Lien
Fiscal Year	Total	Net State	Pledged	Bonds	Senior Lien	Lien	after Senior Lien Debt Service	
30-Jun	Revenues	Appropriation	Receipts	Debt Service	Debt Service	Debt Service	Debt Service	Coverage
2019	\$ 52,823,158	\$ 2,886,127	\$ 55,709,285	\$ (10,364,722)	\$ (13,585,594)	\$ (23,950,315)	\$ 31,758,970	2.33x
2020	57,085,766	3,416,997	60,502,763	(19,622,450)	(15,116,844)	(34,739,294)	25,763,469	1.74x
2021	60,713,762	3,413,807	64,127,569	(20,484,275)	(16,709,219)	(37,193,494)	26,934,076	1.72x
2022	63,337,304	2,180,573	65,517,877	(20,603,150)	(17,893,344)	(38,496,494)	27,021,383	1.70x
2023	65,864,735	2,195,252	68,059,986	(20,959,900)	(19,645,594)	(40,605,494)	27,454,493	1.68x
2024	68,727,164	2,208,871	70,936,036	(21,390,650)	(21,615,844)	(43,006,494)	27,929,542	1.65x
2025	71,739,657	2,221,742	73,961,398	(23,050,650)	(20,847,469)	(43,898,119)	30,063,280	1.68x
2026	74,734,406	2,206,568	76,940,974	(24,417,775)	(20,847,719)	(45,265,494)	31,675,480	1.70x
2027	78,111,514	2,219,660	80,331,174	(25,941,025)	(20,846,094)	(46,787,119)	33,544,055	1.72x
2028	81,592,121	2,234,905	83,827,025	(27,535,025)	(20,850,594)	(48,385,619)	35,441,407	1.73x
2029	85,290,767	2,250,585	87,541,351	(26,003,025)	(20,847,297)	(46,850,322)	40,691,029	1.87x
2030	89,269,481	2,266,024	91,535,505	(30,362,775)	(20,848,000)	(51,210,775)	40,324,730	1.79x
2031	93,386,280	2,283,533	95,669,814	(32,212,525)	(20,848,500)	(53,061,025)	42,608,789	1.80x
2032	97,737,051	2,299,450	100,036,502	(34,237,400)	(20,849,875)	(55,087,275)	44,949,227	1.82x
2033	102,221,553	592,260	102,813,813	(30,011,025)	(33,037,000)	(63,048,025)	39,765,788	1.63x
2034	106,947,529	591,160	107,538,690	(32,126,525)	(34,612,000)	(66,738,525)	40,800,165	1.61x
2035	111,913,836	591,660	112,505,496	(33,622,525)	(36,252,000)	(69,874,525)	42,630,971	1.61x
2036	116,676,514	594,960	117,271,475	(35,073,900)	(37,832,000)	(72,905,900)	44,365,575	1.61x
2037	121,263,360	592,460	121,855,820	(36,423,850)	, , , , ,	(75,770,850)	46,084,970	1.61x
2038	125,980,545	590,660	126,571,205	(45,887,550)	(23,067,000)	(68,954,550)	57,616,655	1.84x
2039	130,740,137	501,930	131,242,067	(48,985,250)	(20,848,500)	(69,833,750)	61,408,317	1.88x
2040	135,686,958	25,000,000	160,686,958	(60,237,575)	-	(60,237,575)	100,449,383	2.67x
2041	140,832,655	25,000,000	165,832,655	(50,010,600)	-	(50,010,600)	115,822,055	3.32x
2042	146,351,771	25,000,000	171,351,771	-	-	-	171,351,771	-
2043	152,446,127	25,000,000	177,446,127	-	-	-	177,446,127	-
2044	158,560,062	25,000,000	183,560,062	-	-	-	183,560,062	-
2045	164,598,906	25,000,000	189,598,906	-	-	-	189,598,906	-
2046	169,824,331	25,000,000	194,824,331	-	-	-	194,824,331	-
2047	174,095,260	25,000,000	199,095,260	-	-	-	199,095,260	-
2048	178,335,505	25,000,000	203,335,505	-	-	-	203,335,505	-
2049	182,703,355	25,000,000	207,703,355	-	-	-	207,703,355	-

A Source: CDM Smith Inc.; Toll Revenues shown are based on Table 6.13 of the 2018 Traffic and Revenue Study.

B Scheduled annual State Appropriation of \$25,000,000 less debt service on the State Appropriation Bonds. Note that such funds become Pledged Receipts only after being deposited to the Revenue Fund.

C Toll Revenues (A) plus Net State Appropriation (B).

D Debt service on the Series 2018 Bonds. Amounts due on July 1 of any year are included in the previous Fiscal Year.

E Other outstanding Senior Lien Debt Service, which includes the Outstanding 2017 Bonds, 2009A Bonds and 2009B Bonds. Amounts due on July 1 of any year are included in the previous Fiscal Year.

F Series 2018 Bonds Debt Service (D) plus Outstanding Senior Lien Debt Service (E). Amounts due on July 1 of any year are included in the previous Fiscal Year.

G Total Pledged Receipts (C) minus Total Senior Lien Debt Service (F).

H Total Pledged Receipts (C) divided by the sum of Total Senior Lien Debt Service (F).

## **Preliminary Projected Cash Flow and Debt Service Coverage (continued)**

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	Operations &	Renewal &	General Reserve	General	
Fiscal Year	Maintenance	Replacement	Deposit/		
30-Jun	Requirement	Requirement	(Withdrawl)	Balance	
2019	\$ (20,773,919)		\$ 3,866,332	\$ 96,001,375	
2020	(19,667,608)	(7,098,025)	(1,002,164)	94,999,211	
2021	(19,736,031)	(7,098,665)	99,379	95,098,590	
2022	(20,002,898)	(7,064,966)	(46,481)	95,052,109	
2023	(20,516,706)	(7,061,817)	(124,031)	94,928,078	
2024	(21,076,592)	(7,034,813)	(181,863)	94,746,215	
2025	(21,755,236)	(5,824,552)	2,483,491	97,229,707	
2026	(22,477,634)	(5,797,494)	3,400,353	100,630,059	
2027	(23,217,966)	(5,770,870)	4,555,219	105,185,278	
2028	(23,992,340)	(8,494,485)	2,954,582	108,139,860	
2029	(24,789,111)	(8,495,762)	7,406,156	115,546,016	
2030	(25,631,097)	(8,454,479)	6,239,154	121,785,170	
2031	(26,402,685)	(8,413,226)	7,792,877	129,578,047	
2032	(27,129,728)	(8,372,118)	9,447,380	139,025,427	
2033	(27,905,058)	(8,389,065)	3,471,665	142,497,092	
2034	(28,700,536)	(8,375,097)	3,724,531	146,221,623	
2035	(29,526,933)	(8,334,094)	4,769,944	150,991,568	
2036	(30,338,409)	(8,293,131)	5,734,034	156,725,602	
2037	(31,173,230)	(8,504,600)	6,407,140	163,132,742	
2038	(32,035,897)	(10,475,522)	15,105,236	178,237,978	
2039	(32,917,144)	(10,428,124)	18,063,050	196,301,027	
2040	(33,830,448)	(10,377,415)	56,241,520	252,542,547	
2041	(34,700,504)	(10,327,432)	70,794,119	323,336,666	
2042	(35,521,736)	(10,276,814)	125,553,221	448,889,887	
2043	(36,378,114)	(10,438,416)	130,629,597	579,519,484	
2044	(37,258,982)	(10,420,568)	135,880,512	715,399,996	
2045	(38,164,322)	(10,432,135)	141,002,449	856,402,445	
2046	(39,093,984)	(10,381,546)	145,348,801	1,001,751,246	
2047	(40,051,065)	(10,331,003)	148,713,191	1,150,464,437	
2048	(41,033,933)	(10,312,170)	151,989,403	1,302,453,840	
2049	(42,043,690)	(440,000)	165,219,665	1,467,673,505	

Estimated deposits to the Operations and Maintenance Expense Fund and the Operating Reserve Fund.

J Estimated deposits to the Renewal and Replacement Fund.

K The sum of Excess Revenues after Senior Lien Debt Service (I), Operations & Maintenance Requirement (K), and Renewal & Replacement Requirement (L).

L The sum of the Prior Year General Reserve Balance (N) and current year General Reserve Deposit/(Withdrawal) (M).

#### RISK FACTORS

The following is a discussion of certain risk factors that should be considered in evaluating an investment in the Series 2018 Bonds. This discussion does not purport to be either comprehensive or definitive. The order in which risks are presented is not intended to reflect either the likelihood that a particular event will occur or the relative significance of such an event. Moreover, there may well be other risks associated with an investment in the Series 2018 Bonds in addition to those set forth herein.

#### General

The financial forecasts in this Official Statement are based generally upon certain assumptions and upon projections as to estimated Revenues and Operations and Maintenance Expenses. See "APPENDIX B-2018 Traffic and Revenue Study." Inevitably, some underlying assumptions and projections used to develop the forecasts will not be realized, and unanticipated events and circumstances may occur. Therefore, the actual results achieved during the forecast periods will vary from the forecasts, and such differences may be material.

## **Forward-Looking Statements**

The statements contained in this Official Statement, and in other information provided by the Authority, that are not purely historical, are forward-looking statements, including statements regarding the Authority's expectations, hopes, intentions or strategies regarding the future and the projections in the Traffic and Revenue Report. All forward-looking statements included in this Official Statement are based on information available to the Authority on the date hereof, and the Authority assumes no obligation to update any such forward-looking statements.

The forward-looking statements herein are necessarily based on various assumptions and estimates that are inherently subject to numerous risks and uncertainties, including risks and uncertainties relating to the possible invalidity of the underlying assumptions and estimates and possible changes or developments in social, economic, business, industry, market, legal and regulatory circumstances and conditions and actions taken or omitted to be taken by third parties, including customers, suppliers, business partners and competitors, and legislative, judicial and other governmental authorities and officials. Assumptions related to the foregoing involve judgments with respect to, among other things, future economic, competitive and market conditions and future business decisions, all of which are difficult or impossible to predict accurately and, therefore, there can be no assurance that the forward-looking statements included in this Official Statement will prove to be accurate.

## **Events of Force Majeure**

Operation of the Triangle Expressway System is at risk from events of force majeure, such as earthquakes, tornados, hurricanes or other natural disasters, epidemics, blockades, rebellions, war, riots, acts of sabotage, terrorism or civil commotion, and spills of hazardous materials, among other events. The State self-insures for such risks, and a significant casualty event could affect the availability of funds to repair the Triangle Expressway. Construction or operations may also be stopped or delayed from non-casualty events such as discovery of archaeological artifacts, changes in law, and litigation, among other things.

## **Operating Risks**

The ability of the Triangle Expressway System to generate Receipts in amounts sufficient to pay debt service on the Series 2018 Bonds when due is subject to the risks inherent in toll facilities. The ability

to repay the Series 2018 Bonds will be dependent on the volume of traffic that utilizes the Triangle Expressway System and the ability of the Authority and its vendor's computer systems to accurately process data. Revenues to be generated through such use will be influenced by numerous factors, including, among others, the ability to manage toll evasion; the ability to control expenses; the availability of adequately-trained personnel; population, employment and income trends within the region; the congestion on alternative freeways, highways, and streets; time savings experienced by utilizing the Triangle Expressway System; the toll rates; the availability and price of fuel; and the construction of new or improved competitive roadways or other transit facilities.

#### Rate Covenant Not a Guarantee

The Authority's ability to pay the debt service with respect to the Series 2018 Bonds depends on its ability to generate Receipts at the levels required by the Trust Agreement, which in turn depends on the use of the Triangle Expressway System by a sufficient number of toll-paying vehicles. Although the Authority has covenanted in the Trust Agreement to establish toll rates at specified levels as more particularly described herein, and expects that sufficient Receipts will be generated through the imposition and collection of such tolls, the Authority's covenant does not constitute a guarantee that sufficient Receipts will be available to pay debt service with respect to the Series 2018 Bonds.

#### **Ability to Maintain or Raise Rates**

The Authority may need to raise toll rates in the future above the anticipated scheduled toll rate increases under the projected toll rate schedule to support its debt service requirements. The effect of any future rate increase is unknown. It is possible that a future increase in rates could result in reduced usage of the Triangle Expressway System, resulting in decreased Receipts.

## **Traffic and Revenue Assumptions**

The revenue forecasts in the 2018 Traffic and Revenue Study are based upon certain assumptions described above. See "2018 Traffic and Revenue Study" herein and "APPENDIX B – 2018 Traffic and Revenue Study." The 2018 Traffic and Revenue Study is not a guarantee of any future events or trends and the forecasts therein are subject to future economic and social conditions and demographic developments that cannot be predicted with certainty. Further, any of the estimates and assumptions in the 2018 Traffic and Revenue Study are inherently subject to significant economic and competitive uncertainties and contingencies, many of which are beyond the control of the Authority. Failure to achieve or realize any of the assumptions described above may have a materially adverse effect upon the Receipts actually realized.

#### Free Alternate Route

The Authority Act requires NCDOT to maintain an existing, alternate, comparable non-toll route corresponding to each turnpike project undertaken by the Authority. Although the alternate route for the Triangle Expressway is a less desirable route, motorists wishing to avoid tolls may choose this alternate route.

#### **Motor Fuel Prices and Taxes**

Among other assumptions, the revenue forecasts in the Traffic and Revenue Report incorporated into the 2018 Traffic and Revenue Study make certain assumptions about motor fuel supply, prices and taxes. There is no assurance that motor fuel will remain in adequate supply or that motor fuel prices and federal and State motor fuel taxes will not increase by more than the assumed amounts during the forecast period covered by the Traffic and Revenue Report and the 2018 Traffic and Revenue Study.

## Additional Bonds and TIFIA Indebtedness to Finance Complete 540

The Authority expects to issue additional Senior Lien Revenue Bonds under the Trust Agreement to finance Complete 540. The issuance of such Additional Bonds will reduce the percentage of Senior Lien Bonds held by the Holders of the Series 2018 Bonds under the Trust Agreement. In addition, the Authority intends to issue TIFIA Indebtedness and enter into a loan agreement with USDOT to provide funding for Complete 540. Certain provisions of the Trust Agreement relating to TIFIA Indebtedness, including amendments to the Prior Trust Agreement effected by the Third Supplemental Trust Agreement, will become effective upon issuance of such TIFIA Indebtedness. In addition, the Authority anticipates that USDOT may impose additional covenants or restrictions on the Authority in connection with the TIFIA Indebtedness. No information is being provided as to the possible terms of such TIFIA Indebtedness. See "APPENDIX A - "Definitions of Certain Terms and Summary of the Trust Agreement – Amendments to Prior Trust Agreement and Prior Supplemental Trust Agreements."

## Dilution of Senior Lien Security Upon Bankruptcy-Related Event

Upon the occurrence of an Event of Default that is a Bankruptcy-Related Event under the Trust Agreement, in the event that any TIFIA Indebtedness is outstanding, the Authority's obligations under the TIFIA Indebtedness will be deemed to be Senior Lien Indebtedness, and USDOT will be deemed to be the secured owner of such Senior Lien Indebtedness. In such event, the TIFIA Indebtedness would be secured by and payable from the Trust Estate (except for the Senior Lien Parity Reserve Account) on a basis equal to that of other Outstanding Senior Lien Obligations. Following the issuance of the Series 2018 Bonds, there will not be any TIFIA Indebtedness Outstanding. However, as described above, the Authority expects to incur additional TIFIA Indebtedness in connection with Complete 540. The Third Supplemental Trust Agreement includes an amendment to the definition of a Bankruptcy-Related Event.

## Limitation and Enforceability of Remedies

The remedies available to Owners of the Series 2018 Bonds upon an Event of Default under the Trust Agreement are limited to the seeking of specific performance or a writ of mandamus or other suit, action or proceeding compelling and requiring the Authority and its officers to observe and perform any covenant, condition or obligation prescribed in the Agreement. ACCELERATION IS NOT A REMEDY AVAILABLE TO OWNERS OF THE SERIES 2018 BONDS. See "APPENDIX A – "Definitions of Certain Terms and Summary of the Trust Agreement – The Trust Agreement – Remedies."

The remedies available under the Trust Agreement are in many respects dependent upon regulatory and judicial actions that are often subject to discretion and delay. Under existing law, such remedies may not be readily available. In addition, enforcement of such remedies (i) may be subject to general principles of equity which may permit the exercise of judicial discretion, (ii) are subject to the exercise in the future by the State and its agencies and political subdivisions of the police power inherent in the sovereignty of the State, (iii) are subject, in part, to the provisions of the United States Bankruptcy Act and other applicable bankruptcy, insolvency, reorganization, moratorium or similar laws relating to or affecting the enforcement of creditors' rights generally, now or hereafter in effect, and (iv) are subject to the exercise by the United States of the powers delegated to it by the federal Constitution. The various legal opinions to be delivered concurrently with the delivery of the Series 2018 Bonds will be qualified to the extent that the enforceability of certain legal rights related to the Series 2018 Bonds is subject to limitations imposed by bankruptcy, reorganization, insolvency or other similar laws affecting the rights of creditors generally and by equitable remedies and proceedings generally.

#### CONTINUING DISCLOSURE

In the Third Supplemental Trust Agreement, the Authority will undertake, for the benefit of the beneficial owners of the Series 2018 Bonds, to provide to the Municipal Securities Rulemaking Board (the "MSRB"):

- (a) by not later than seven months from the end of each Fiscal Year, beginning with the Fiscal Year ended June 30, 2018, audited financial statements of the Authority for such Fiscal Year, if available, prepared in accordance with Section 159-34 of the General Statutes of North Carolina, as it may be amended from time to time, or any successor statute, or, if such audited financial statements of the Authority are not available by seven months from the end of such Fiscal Year, unaudited financial statements of the Authority for such Fiscal Year to be replaced subsequently by audited financial statements of the Authority to be delivered within fifteen (15) days after such audited financial statements become available for distribution;
- (b) by not later than seven months from the end of each Fiscal Year, beginning with the Fiscal Year ended June 30, 2018, the financial and statistical data as of a date not earlier than the end of the preceding Fiscal Year evidencing compliance by the Authority with the Rate Covenant described under the heading "SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS Rate Covenant" including the calculation of Revenues and Long-Term Debt Service Requirement, to the extent that such items are not included in the financial statements referred to in (a) above;
- (c) within ten (10) Business Days following the occurrence of an event, notice of any of the following events with respect to the Series 2018 Bonds:
  - (i) principal and interest payment delinquencies;
  - (ii) unscheduled draws on debt service reserves reflecting financial difficulties;
  - (iii) unscheduled draws on credit enhancements reflecting financial difficulties;
  - (iv) substitution of credit or liquidity providers, or their failure to perform;
  - (v) issuance by the Internal Revenue Service of a proposed or final determination of taxability with respect to the Series 2018 Bonds; a Notice of Proposed Issues on IRS Form 5701-TEB with respect to the Series 2018 Bonds; adverse tax opinions, material notices or determinations with respect to the tax status of the Series 2018 Bonds; or other event affecting the tax status of the Series 2018 Bonds;
    - (vi) defeasances;
    - (vii) rating changes;
    - (viii) tender offers; and
    - (ix) bankruptcy, insolvency, receivership or similar proceeding by the Authority;
- (d) within ten (10) Business Days following the occurrence of an event, notice of any of the following events with respect to the Series 2018 Bonds, if material:
  - (i) non-payment related defaults;
  - (ii) modification to the rights of the beneficial owners of the Series 2018 Bonds;

- (iii) bond calls, other than bond calls relating to mandatory sinking fund redemption;
- (iv) release, substitution or sale of any property securing repayment of the Series 2018 Bonds;
- (v) mergers, consolidations, acquisition and sales of assets (other than in the ordinary course of business):
- (vi) appointment of a successor or additional trustee or a change in the name of the trustee:
- (vii) legislation shall be filed with the North Carolina General Assembly by the Governor of North Carolina or legislation is reported out of a committee in either body of the General Assembly which, if adopted in the form so filed or reported, would result in a reduction or delay in the receipt of \$25 million in State Appropriated Revenues in any Bond Year; and
- (viii) an administrative action is taken by the Governor of North Carolina, NCDOT or any other agency or authority of the State which will result in a reduction or delay in the receipt of \$25 million in State Appropriated Revenues in any Bond Year; and
- (e) in a timely manner, notice of a failure of the Authority to provide required annual financial information described in (a), (b), (c) or (d) above on or before the date specified.

At present, Section 159-34 of the General Statutes of North Carolina requires the Authority's financial statements to be prepared in accordance with generally accepted accounting principles and to be audited in accordance with generally accepted auditing standards.

The Third Supplemental Trust Agreement will also provide that if the Authority fails to comply with the undertaking described above, the Trustee or any beneficial owner of the Series 2018 Bonds may take action to protect and enforce the rights of all beneficial owners with respect to such undertaking, including an action for specific performance; provided, however, that the Authority's failure to comply with the undertaking will not constitute an Event of Default under the Trust Agreement. All actions shall be instituted, had and maintained for the benefit of all beneficial owners of the Series 2018 Bonds.

Pursuant to the Third Supplemental Trust Agreement, the Authority will reserve the right to modify from time to time the information to be provided to the extent necessary or appropriate in the judgment of the Authority, provided that any such modification will be done in a manner consistent with Rule 15c2-12 issued under the Securities Exchange Act of 1934, as it may be amended from time to time ("Rule 15c2-12"), and provided further that:

- (a) any such modification may only be made in connection with a change in circumstances that arises from a change in legal requirements, change in law, or change in the identity, nature, or status of the Authority;
- (b) the information to be provided, as modified, would have complied with the requirements of Rule 15c2-12 as of the date of this Official Statement, after taking into account any amendments or interpretations of Rule 15c2-12, as well as any changes in circumstances; and
- (c) any such modification does not materially impair the interests of the beneficial owners of the Series 2018 Bonds, as determined either by the Trustee or bond counsel, or by the approving vote of

the Owners of a majority in principal amount of the Series 2018 Bonds pursuant to the terms of the Trust Agreement, as it may be amended from time to time, at the time of the amendment.

Any annual financial information containing modified operating data or financial information is required to explain, in narrative form, the reasons for the modification and the impact of the change in the type of operating data or financial information being provided.

The undertaking described above will terminate upon payment, or provision having been made for payment in a manner consistent with Rule 15c2-12, in full of the principal of and interest on all of the Series 2018 Bonds.

During the previous five years, the Authority has not failed to comply, in all material respects, with its other undertakings relating to continuing disclosure of information pursuant to Rule 15c2-12 except as described in the following sentences. Although audited financial statements of the State were otherwise publicly available, the Authority did not link the audited financial statements of the State to certain of its issues for the fiscal years ended June 30, 2013 through 2015, as required under certain of its prior undertakings, and did not file a notice of failure to file such audited financial statements of the State. In addition, the Authority was approximately 20 days late in filing such audited financial statements of the State under the requisite CUSIP numbers for the fiscal year ended June 30, 2016. For the fiscal years ended June 30, 2013 through 2015, the Authority failed to file certain required operating data with respect to its outstanding bonds for the Triangle Expressway System, and did not file a notice of failure to file such operating data. For the fiscal years ended June 30, 2016 and 2017, the Authority failed to file certain required operating data with respect to the 2009 State Appropriation Bonds. The Authority has made notice filings with EMMA with respect to such failures to file and has filed the missing audited financial statements of the State and the missing operating data for each applicable fiscal year. On March 18, 2014, S&P Global Ratings Services, a business unit of Standard & Poor's Financial Services LLC, upgraded the insured rating on the 2009 Bonds from "AA-" to "AA". The Authority failed to file timely notice of such rating change. The Authority has since filed notice of such rating change as required by Rule 15c2-12. The Authority has procedures in place to ensure timely filings pursuant to Rule 15c2-12, and has engaged Digital Assurance Certification, LLC ("DAC") to assist it in its continuing disclosure filings.

## **LITIGATION**

No litigation is now pending or, to the best of the Authority's knowledge, threatened against or affecting the Authority seeking to restrain or enjoin the authorization, execution or delivery of the Series 2018 Bonds, the Prior Trust Agreement or the Third Supplemental Trust Agreement or contesting the validity or the authority or proceedings for the authorization, execution or delivery of the Series 2018 Bonds, the Prior Trust Agreement or the Third Supplemental Trust Agreement or the Authority's creation, organization or corporate existence, or the title of any of the Authority's present officers to their respective offices, or the Authority's authority to carry out its obligations thereunder.

## **CERTAIN RELATIONSHIPS**

Hunton Andrews Kurth LLP is serving as Bond Counsel in connection with the issuance of the Series 2018 Bonds. Hunton Andrews Kurth LLP also represents the Trustee and the Underwriters and their affiliates in unrelated matters. McGuireWoods LLP is serving as counsel to the Underwriters in connection with the issuance of the Series 2018 Bonds, and also represents the Trustee and the Underwriters and their affiliates in unrelated matters. In addition, McGuireWoods LLP has been approved as one of the firms that is eligible to provide bond counsel services on other bond issues of the Authority, and may advise the Authority from time to time with respect to such issues.

#### **LEGAL MATTERS**

Legal matters related to the authorization, execution, sale and delivery of the Series 2018 Bonds are subject to the approval of Hunton Andrews Kurth LLP, Bond Counsel. See the form of the Bond Counsel opinion (the "Bond Opinion") attached hereto as APPENDIX D. The Bond Opinion will be limited to matters relating to authorization and validity of the Series 2018 Bonds and to the tax status of interest thereon, as described in the section "TAX TREATMENT." Bond Counsel has not been engaged to investigate the financial resources of the Authority or its ability to provide for payment of the Series 2018 Bonds, and the Bond Opinion will make no statement as to such matters or as to the accuracy or completeness of this Official Statement or any other information that may have been relied on by anyone in making the decision to purchase Series 2018 Bonds.

Certain legal matters will be passed upon for the Authority by Ebony Pittman, Esq., an Assistant Attorney General for the State, and for the Underwriters by McGuireWoods LLP, Raleigh, North Carolina, counsel to the Underwriters.

#### TAX TREATMENT

## **Opinion of Bond Counsel**

In the opinion of Bond Counsel under current law, interest, including accrued original issue discount ("OID"), on the Series 2018 Bonds (a) is not included in gross income for federal income tax purposes, (b) is not an item of tax preference, and (c) is exempt from all income taxes in the State. Except as discussed below regarding OID, no other opinion is expressed by Bond Counsel regarding the tax consequences of the ownership of or the receipt or accrual of interest on the Series 2018 Bonds.

Bond Counsel's opinion with respect to the Series 2018 Bonds will be given in reliance upon certifications by representatives of the Authority as to certain facts relevant to both the opinion and requirements of the Internal Revenue Code of 1986, as amended (the "Code"). Bond Counsel's opinion is subject to the condition that there is compliance subsequent to the issuance of the Series 2018 Bonds with all requirements of the Code that must be satisfied in order for interest thereon to remain excludable from gross income for federal income tax purposes. The Authority has covenanted to comply with the current provisions of the Code regarding, among other matters, the use, expenditure and investment of the proceeds of the Series 2018 Bonds and the timely payment to the United States of any arbitrage rebate amounts with respect to the Series 2018 Bonds. Failure by the Authority to comply with such covenants, among other things, could cause interest on the Series 2018 Bonds to be included in gross income for federal income tax purposes retroactively to their date of issue.

Customary practice in the giving of legal opinions includes not detailing in the opinion all the assumptions, limitations and exclusions that are a part of the conclusions therein. See "Statement on the Role of Customary Practice in the Preparation and Understanding of Third-Party Legal Opinions", 63 Bus. Law. 1277 (2008)" and "Legal Opinion Principles", 53 Bus. Law. 831 (May 1998). Purchasers of the Series 2018 Bonds should seek advice or counsel concerning such matters as they deem prudent in connection with their purchase of Series 2018 Bonds.

Bond Counsel's opinion represents its legal judgment based in part upon the representations and covenants referenced therein and its review of current law, but is not a guarantee of result or binding on the Internal Revenue Service (the "Service") or the courts. Bond Counsel assumes no duty to update or supplement its opinion to reflect any facts or circumstances that may come to Bond Counsel's attention after the date of its opinion or to reflect any changes in law or the interpretation thereof that may occur or become effective after such date.

## **Original Issue Discount**

In the opinion of Bond Counsel, under current law, the difference between (i) the stated principal amount of each maturity of the Series 2018 Bonds maturing in the years 2037, 2038 and bearing interest at 4.00%, 2039 and 2041 (the "OID Bonds"), and (ii) the initial offering price to the public (excluding bond houses and brokers) at which a substantial amount of such maturities of OID Bonds is sold will constitute OID; OID will accrue for federal income tax purposes on a constant-yield-to-maturity method based on regular compounding; and a holder's basis in such a Series 2018 Bond will be increased by the amount of OID treated for federal income tax purposes as having accrued on the Series 2018 Bond while the holder holds the Series 2018 Bond. The offering prices set forth on the inside cover of this Official Statement for the OID Bonds are expected to be the initial offering prices to the public at which a substantial amount of each maturity of such Series 2018 Bonds are sold.

Under the Code, for purposes of determining a holder's adjusted basis in an OID Bond, OID treated as having accrued while the holder holds the OID Bond will be added to the holder's basis. OID will accrue on a constant-yield-to-maturity method based on regular compounding. The adjusted basis will be used to determine taxable gain or loss upon the sale or other disposition (including redemption or payment at maturity) of an OID Bond.

Prospective purchasers of OID Bonds should consult their own tax advisors as to the calculation of accrued OID and the state and local tax consequences of owning or disposing of such OID Bonds.

## **Original Issue Premium**

Series 2018 Bonds purchased, whether upon issuance or otherwise, for an amount (excluding any amount attributable to accrued interest) in excess of their principal amount will be treated for federal income tax purposes as having amortizable bond premium. A holder's basis in such a Series 2018 Bond must be reduced by the amount of premium which accrues while such Series 2018 Bond is held by the holder. No deduction for such amount will be allowed, but it generally will offset interest on the Series 2018 Bonds while so held. Purchasers of such Series 2018 Bonds should consult their own tax advisors as to the calculation, accrual and treatment of amortizable bond premium and the state and local tax consequences of holding such Series 2018 Bonds.

#### **Other Matters**

<u>Tax Consequences Generally.</u> In addition to the matters addressed above, prospective purchasers of the Series 2018 Bonds should be aware that the ownership of tax-exempt obligations may result in collateral federal income tax consequences to certain taxpayers, including without limitation financial institutions, property and casualty insurance companies, S corporations, foreign corporations subject to the branch profits tax, recipients of Social Security or Railroad Retirement benefits and taxpayers who may be deemed to have incurred or continued indebtedness to purchase or carry tax-exempt obligations. Prospective purchasers of the Series 2018 Bonds should consult their tax advisors as to the applicability and impact of such consequences.

Prospective purchasers of the Series 2018 Bonds should consult their own tax advisors as to the status of interest on the Series 2018 Bonds under the tax laws of any state other than North Carolina.

The Service has a program to audit state and local government obligations to determine whether the interest thereon is includible in gross income for federal income tax purposes. If the Service does audit the Series 2018 Bonds, under current Service procedures, the Service will treat the Authority as the taxpayer and the owners of the Series 2018 Bonds will have only limited rights, if any, to participate.

There are many events that could affect the value and liquidity or marketability of the Series 2018 Bonds after their issuance, including but not limited to public knowledge of an audit of the Series 2018 Bonds by the Service, a general change in interest rates for comparable securities, a change in federal or state income tax rates, legislative or regulatory proposals affecting state and local government securities and changes in judicial interpretation of existing law. In addition, certain tax considerations relevant to owners of Series 2018 Bonds who purchase Series 2018 Bonds after their issuance may be different from those relevant to purchasers upon issuance. Neither Series 2018 Bond Counsel's opinion nor this Official Statement purports to address the likelihood or effect of any such potential events or such other tax considerations and purchasers of the Series 2018 Bonds should seek advice concerning such matters as they deem prudent in connection with their purchase of Series 2018 Bonds.

#### **BOND INSURANCE**

## **Series 2018 Bond Insurance Policy**

Concurrently with the issuance of the Series 2018 Bonds, Assured Guaranty Municipal Corp. ("AGM") will issue its Municipal Bond Insurance Policy (the "Policy") for the Series 2018 Bonds maturing on January 1 of the years 2032 through 2038, inclusive, and 2041 (the "Insured Series 2018 Bonds"). The Policy guarantees the scheduled payment of principal of and interest on the Insured Series 2018 Bonds when due as set forth in the form of the Policy included as Appendix F to this Official Statement.

The Policy is not covered by any insurance security or guaranty fund established under New York, California, Connecticut or Florida insurance law.

## Assured Guaranty Municipal Corp.

AGM is a New York domiciled financial guaranty insurance company and an indirect subsidiary of Assured Guaranty Ltd. ("AGL"), a Bermuda-based holding company whose shares are publicly traded and are listed on the New York Stock Exchange under the symbol "AGO". AGL, through its operating subsidiaries, provides credit enhancement products to the U.S. and global public finance, infrastructure and structured finance markets. Neither AGL nor any of its shareholders or affiliates, other than AGM, is obligated to pay any debts of AGM or any claims under any insurance policy issued by AGM.

AGM's financial strength is rated "AA" (stable outlook) by S&P Global Ratings, a business unit of Standard & Poor's Financial Services LLC ("S&P"), "AA+" (stable outlook) by Kroll Bond Rating Agency, Inc. ("KBRA") and "A2" (stable outlook) by Moody's Investors Service, Inc. ("Moody's"). Each rating of AGM should be evaluated independently. An explanation of the significance of the above ratings may be obtained from the applicable rating agency. The above ratings are not recommendations to buy, sell or hold any security, and such ratings are subject to revision or withdrawal at any time by the rating agencies, including withdrawal initiated at the request of AGM in its sole discretion. In addition, the rating agencies may at any time change AGM's long-term rating outlooks or place such ratings on a watch list for possible downgrade in the near term. Any downward revision or withdrawal of any of the above ratings, the assignment of a negative outlook to such ratings or the placement of such ratings on a negative watch list may have an adverse effect on the market price of any security guaranteed by AGM. AGM only guarantees scheduled principal and scheduled interest payments payable by the issuer of bonds insured by AGM on the date(s) when such amounts were initially scheduled to become due and payable (subject to and in accordance with the terms of the relevant insurance policy), and does not guarantee the market price or liquidity of the securities it insures, nor does it guarantee that the ratings on such securities will not be revised or withdrawn.

<u>Current Financial Strength Ratings</u>. On June 26, 2018, S&P announced it had affirmed AGM's financial strength rating of "AA" (stable outlook). AGM can give no assurance as to any further ratings action that S&P may take.

On May 7, 2018, Moody's announced it had affirmed AGM's insurance financial strength rating of "A2" (stable outlook). AGM can give no assurance as to any further ratings action that Moody's may take.

On January 23, 2018, KBRA announced it had affirmed AGM's insurance financial strength rating of "AA+" (stable outlook). AGM can give no assurance as to any further ratings action that KBRA may take.

For more information regarding AGM's financial strength ratings and the risks relating thereto, see AGL's Annual Report on Form 10-K for the fiscal year ended December 31, 2017.

## Capitalization of AGM. At September 30, 2018:

- The policyholders' surplus of AGM was approximately \$2,203 million.
- The contingency reserves of AGM and its indirect subsidiary Municipal Assurance Corp. ("MAC") (as described below) were approximately \$1,187 million. Such amount includes 100% of AGM's contingency reserve and 60.7% of MAC's contingency reserve.
- The net unearned premium reserves and net deferred ceding commission income of AGM and its subsidiaries (as described below) were approximately \$1,863 million. Such amount includes (i) 100% of the net unearned premium reserve and deferred ceding commission income of AGM, (ii) the consolidated net unearned premium reserves and net deferred ceding commissions of AGM's wholly owned subsidiary Assured Guaranty (Europe) plc ("AGE"), and (iii) 60.7% of the net unearned premium reserve of MAC.

The policyholders' surplus of AGM and the contingency reserves, net unearned premium reserves and deferred ceding commission income of AGM and MAC were determined in accordance with statutory accounting principles. The net unearned premium reserves and net deferred ceding commissions of AGE were determined in accordance with accounting principles generally accepted in the United States of America.

<u>Incorporation of Certain Documents by Reference.</u> Portions of the following documents filed by AGL with the Securities and Exchange Commission (the "SEC") that relate to AGM are incorporated by reference into this Official Statement and shall be deemed to be a part hereof:

- (i) the Annual Report on Form 10-K for the fiscal year ended December 31, 2017 (filed by AGL with the SEC on February 23, 2018);
- (ii) the Quarterly Report on Form 10-Q for the quarterly period ended March 31, 2018 (filed by AGL with the SEC on May 4, 2018);
- (iii) the Quarterly Report on Form 10-Q for the quarterly period ended June 30, 2018 (filed by AGL with the SEC on August 2, 2018); and
- (iv) the Quarterly Report on Form 10-Q for the quarterly period ended September 30, 2018 (filed by AGL with the SEC on November 9, 2018).

All consolidated financial statements of AGM and all other information relating to AGM included in, or as exhibits to, documents filed by AGL with the SEC pursuant to Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended, excluding Current Reports or portions thereof "furnished" under Item 2.02 or Item 7.01 of Form 8-K, after the filing of the last document referred to above and before the termination of the offering of the Bonds shall be deemed incorporated by reference into this Official Statement and to be a part hereof from the respective dates of filing such documents. Copies of materials incorporated by reference are available over the internet at the SEC's website at http://www.sec.gov, at AGL's website at http://www.assuredguaranty.com, or will be provided upon request to Assured Guaranty Municipal Corp.: 1633 Broadway, New York, New York 10019, Attention: Communications Department (telephone (212) 974-0100). Except for the information referred to above, no information available on or through AGL's website shall be deemed to be part of or incorporated in this Official Statement.

Any information regarding AGM included herein under the caption "BOND INSURANCE – Assured Guaranty Municipal Corp." or included in a document incorporated by reference herein (collectively, the "AGM Information") shall be modified or superseded to the extent that any subsequently included AGM Information (either directly or through incorporation by reference) modifies or supersedes such previously included AGM Information. Any AGM Information so modified or superseded shall not constitute a part of this Official Statement, except as so modified or superseded.

## Miscellaneous Matters

AGM makes no representation regarding the Series 2018 Bonds or the advisability of investing in the Series 2018 Bonds. In addition, AGM has not independently verified, makes no representation regarding, and does not accept any responsibility for the accuracy or completeness of this Official Statement or any information or disclosure contained herein, or omitted herefrom, other than with respect to the accuracy of the information regarding AGM supplied by AGM and presented under the caption "BOND INSURANCE".

#### LEGALITY FOR INVESTMENT

Section 159-140 of the General Statutes of North Carolina provides that the Series 2018 Bonds are securities in which all public officers and public bodies of the State and its political subdivisions and agencies and all insurance companies, trust companies, investment companies, banks, savings banks, building and loan associations, savings and loan associations, credit unions, pension or retirement funds, other financial institutions engaged in business in the State, executors, administrators, trustees and other fiduciaries may properly and legally invest funds, including capital in their control or belonging to them, and the Series 2018 Bonds are securities which may properly and legally be deposited with and received by any State or municipal officer or any agency or political subdivision of the State for any purpose for which the deposit of bonds, notes or obligations of the State is now or may hereafter be authorized by law.

#### RATINGS

S&P Global Ratings, a business unit of Standard & Poor's Financial Services LLC ("S&P"), is expected to give the Insured Series 2018 Bonds the rating of "AA" on the understanding that AGM will issue the Policy simultaneously with the issuance of the Series 2018 Bonds. S&P and Fitch Ratings ("Fitch") have given the Series 2018 Bonds underlying ratings of "BBB" (stable outlook) and "BBB-" (positive outlook), respectively.

Further explanation of the significance of such ratings may be obtained from S&P and Fitch. The Authority and AGM have provided to S&P and Fitch, as applicable, certain information not included in this Official Statement. The ratings are not a recommendation to buy, sell or hold the Series 2018 Bonds and

should be evaluated independently. The ratings reflect only the view of the particular rating agency, and neither the Authority nor the LGC makes any representation as to the appropriateness of the ratings. There is no assurance that such ratings will not be withdrawn or revised downward by S&P or Fitch. Such action may have an adverse effect on the market price of the Series 2018 Bonds. Neither the Authority, the LGC nor the Underwriters have undertaken any responsibility after the issuance of the Series 2018 Bonds to assure maintenance of the ratings or to oppose any such revision or withdrawal.

Moody's Investor Services ("Moody's") rated the Series 2009 Bonds, but has not provided a rating for the Series 2018 Bonds. No assurance can be given that the issuance of the Series 2018 Bonds will not have a negative effect on the rating currently assigned to the Series 2009 Bonds.

#### UNDERWRITING

The Underwriters have entered into a Bond Purchase Agreement to purchase all of the Series 2018 Bonds, if any of the Series 2018 Bonds are to be purchased, at a purchase price equal to 100% of the principal amount thereof, plus net original issue premium of \$28,366,950.95, and less an underwriters' discount of \$945,759.02. The obligation of the Underwriters to pay for the Series 2018 Bonds is subject to certain terms and conditions set forth in the Bond Purchase Agreement.

The Underwriters and their respective affiliates are full service financial institutions engaged in various activities, which may include securities trading, commercial and investment banking, financial advisory, investment management, principal investment, hedging, financing and brokerage services. Certain of the Underwriters and their respective affiliates have, from time to time, performed, and may in the future perform, various financial advisory and investment banking services for the Authority, for which they received or will receive customary fees and expenses.

In the ordinary course of their various business activities, the Underwriters and their respective affiliates may make or hold a broad array of investments and actively trade debt and equity securities (or related derivative securities, which may include credit default swaps) and financial instruments (including bank loans) for their own account and for the accounts of their customers and may at any time hold long and short positions in such securities and instruments. Such investment and securities activities may involve securities and instruments of the Authority.

The Underwriters and their respective affiliates may also communicate independent investment recommendations, market color or trading ideas and/or publish or express independent research views in respect of such assets, securities or instruments and may at any time hold, or recommend to clients that they should acquire, long and/or short positions in such assets, securities and instruments.

The Underwriters may offer and sell the Series 2018 Bonds to certain dealers (including dealers depositing the Series 2018 Bonds into investment trusts) and others at prices lower than the initial public offering prices stated on the inside cover page hereof. The public offering prices may be changed from time to time by the Underwriters.

J.P. Morgan Securities LLC ("JPMS"), one of the Underwriters of the Series 2018 Bonds, has entered into negotiated dealer agreements (each, a "Dealer Agreement") with each of Charles Schwab & Co., Inc. ("CS&Co.") and LPL Financial LLC ("LPL") for the retail distribution of certain securities offerings at the original issue prices. Pursuant to each Dealer Agreement, each of CS&Co. and LPL may purchase Series 2018 Bonds from JPMS at the original issue price less a negotiated portion of the selling concession applicable to any Series 2018 Bonds that such firm sells.

Wells Fargo Securities is the trade name for certain securities-related capital markets and investment banking services of Wells Fargo & Company and its subsidiaries, including Wells Fargo Bank, National Association, which conducts its municipal securities sales, trading and underwriting operations through the Wells Fargo Bank, NA Municipal Products Group, a separately identifiable department of Wells Fargo Bank, National Association, registered with the Securities and Exchange Commission as a municipal securities dealer pursuant to Section 15B(a) of the Securities Exchange Act of 1934.

Wells Fargo Bank, National Association, acting through its Municipal Products Group ("WFBNA"), one of the underwriters of the Series 2018 Bonds, has entered into an agreement (the "WFA Distribution Agreement") with its affiliate, Wells Fargo Clearing Services, LLC (which uses the trade name "Wells Fargo Advisors") ("WFA"), for the distribution of certain municipal securities offerings, including the Series 2018 Bonds. Pursuant to the WFA Distribution Agreement, WFBNA will share a portion of its underwriting or remarketing agent compensation, as applicable, with respect to the Series 2018 Bonds with WFA. WFBNA has also entered into an agreement (the "WFSLLC Distribution Agreement") with its affiliate Wells Fargo Securities, LLC ("WFSLLC"), for the distribution of municipal securities offerings, including the Series 2018 Bonds. Pursuant to the WFSLLC Distribution Agreement, WFBNA pays a portion of WFSLLC's expenses based on its municipal securities transactions. WFBNA, WFSLLC, and WFA are each wholly-owned subsidiaries of Wells Fargo & Company.

Wells Fargo Bank, National Association is serving as an underwriter, Trustee and Bond Registrar for the Series 2018 Bonds and will be compensated separately for serving in each capacity.

#### **MISCELLANEOUS**

Members of the LGC staff have participated in the preparation of this Official Statement and other documents related to the issuance of the Series 2018 Bonds, but the LGC and its staff assume no responsibility for the accuracy or completeness of any representation or statement in this Official Statement.

The LGC and the Authority have each duly authorized the execution and delivery of this Official Statement.

COMMISSION
By: /s/ Greg C. Gaskins
Secretary
NORTH CAROLINA TURNPIKE AUTHORITY
By: /s/ MG(R) James H. Trogdon, III, P.E.
Chairman

NORTH CAROLINA LOCAL GOVERNMENT



## APPENDIX A

# DEFINITIONS OF CERTAIN TERMS AND SUMMARY OF THE TRUST AGREEMENT



# DEFINITIONS OF CERTAIN TERMS AND SUMMARIES OF THE TRUST AGREEMENT

As described in "AMENDMENTS TO PRIOR TRUST AGREEMENT" in this Official Statement, the Third Supplemental Trust Agreement amends certain provisions of the Prior Trust Agreement, the First Supplemental Trust Agreement and the Second Supplemental Trust Agreement. The amendments effected by the Third Supplemental Trust Agreement are not reflected in the definitions and the summary of the Trust Agreement provisions set forth in "DEFINITIONS" and "THE TRUST AGREEMENT" below, although provisions affected by the amendments are marked with two asterisks (\*\*). Rather, the amendments are described separately and in full detail in "THE THIRD SUPPLEMENTAL TRUST AGREEMENT - Amendments to Prior Trust Agreement and Prior Supplemental Trust Agreements" below. In addition, there are certain terms and provisions in the Trust Agreement which, upon the issuance of the Series 2018 Bonds and payment of the TIFIA Series 2009 Bond and until the entry by the Authority into any future loans from USDOT under its TIFIA program, either entirely or partially, will not have any relevance or value. Such terms and provisions shall have no effect after the issuance of the Series 2018 Bonds, and the Trust Agreement will be construed as if such terms and provisions were not included therein but upon entry into a future loan from USDOT under its TIFIA program or a comparable alternative or replacement program will be effective prospectively, with any amendments thereto as made in the Third Supplemental Trust Agreement or otherwise permitted by the Trust Agreement.

#### **DEFINITIONS**

In addition to the defined terms set forth in the front section of this Official Statement to which this Appendix A is attached, the following is a summary of certain definitions set forth in the Trust Agreement and used in this Official Statement. Capitalized terms used herein and not otherwise defined have the meanings given such terms in the Trust Agreement.

"Additional Project" means any addition, acquisition, improvement, betterment, extension or equipping of or relating to the Initial Project as authorized by the Act, or any previous Additional Project that has become part of the Triangle Expressway System and located within the geographic boundaries comprising the Capital Area Metropolitan Planning Organization and the Durham, Chapel Hill, Carrboro Metropolitan Planning Organization; provided, however, that the term "Additional Project" will not include any Non-System Project unless the Authority specifically identifies such Non-System Project as an Additional Project upon compliance with the provisions of the Trust Agreement.

"Additional Projects Account" means an account in the Project Fund created and so designated by the Trust Agreement.

"Annual Budget" means the Authority's budget for the Triangle Expressway System for a Fiscal Year adopted pursuant to the Authority's bylaws, rules and regulations as in effect from time to time.

"Authority" means the North Carolina Turnpike Authority, a body politic and corporate and a public agency of the State within NCDOT.

"Authority Attorney" means the attorney or law firm designated by the Authority from time to time to perform the duties of counsel to the Authority under the Trust Agreement, including the Attorney General of the State or any assistant or deputy Attorney General of the State.

"Authority Board" means the Board of Directors of the Authority, as the governing body thereof.

"Authority Secretary" means the person appointed or employed by the Authority to perform the duties imposed on the Secretary of the Authority by the Trust Agreement, including the Secretary of the Authority Board or any assistant or deputy Secretary of the Authority Board.

"Authorized Officer" means the Executive Director, the Chief Financial Officer and any other person authorized by resolution of the Authority Board to perform the duties imposed on an Authorized Officer by the Trust Agreement whose name and specimen signature is filed pursuant to an Officer's Certificate with the Trustee for such purpose.

"Balloon Long-Term Indebtedness" means fixed or variable rate Long-Term Indebtedness 25% or more of the principal payments of which are due in a single twelve-month period which portion of the principal is not required by the documents pursuant to which such Indebtedness is incurred to be amortized by redemption or prepayment prior to the expiration of such period.

\*\*"Bankruptcy Related Event" means (a) an involuntary proceeding will be commenced or an involuntary petition will be filed seeking (i) liquidation, reorganization or other relief in respect of the Authority or any of its debts, or of a substantial part of the assets of the Authority, under any Insolvency Law, or (ii) the appointment of a receiver, trustee, liquidator, custodian, sequestrator, conservator or similar official for the Authority for a substantial part of the assets of the Authority, and, in any case referred to in the foregoing subclauses (i) and (ii), such proceeding or petition will continue undismissed for 60 days or an order or decree approving or ordering any of the foregoing will be entered; or (b) the Authority will (i) apply for or consent to the appointment of a receiver, trustee, liquidator, custodian, sequestrator, conservator or similar official for the Authority or for a substantial part of the assets of the Authority, or (ii) generally not be paying its debts with respect to the Triangle Expressway System as they become due unless such debts are the subject of a bona fide dispute, or become unable to pay its debts generally as they become due, or (iii) make a general assignment for the benefit of creditors, or (iv) consent to the institution of, or fail to contest in a timely and appropriate manner, any proceeding or petition with respect to it described in clause (a) of this definition, or (v) commence a voluntary proceeding under any Insolvency Law, or file a voluntary petition seeking liquidation, reorganization, an arrangement with creditors or an order for relief under any Insolvency Law, or (vi) file an answer admitting the material allegations of a petition filed against it in any proceeding referred to in the foregoing subclauses (i) through (v), inclusive, of this clause (b), or (vii) take any action for the purpose of effecting any of the foregoing; or (c) (i) all or a substantial part of the Triangle Expressway System or the Trust Estate will be sold or

otherwise disposed of in a public or private sale or disposition pursuant to a foreclosure of any liens or security interest thereon securing the Senior Lien Indebtedness, or (ii) all or a substantial part of the Triangle Expressway System or the Trust Estate will be transferred pursuant to a sale or disposition in lieu of foreclosure.\*\*

"Base Case Projections" means the projected Receipts of the Project for a Fiscal Year as set forth in the initial financial plan prepared by the Authority and delivered to the USDOT pursuant to Section 21 of the TIFIA Loan Agreement and filed with the Trustee pursuant to the Trust Agreement.

"Bond" or "Bonds" means, collectively, the Senior Lien Bonds and the Subordinate Lien Bonds.

"Bond Insurance Policy" means a municipal bond insurance policy or similar arrangement permitted by the Act and obtained or established in connection with the incurrence of any Bonds or other indebtedness. With respect to the Series 2018 Bonds, "Bond Insurance Policy" means the insurance policy issued by Assured Guaranty Municipal Corp. insuring the scheduled payment of the principal of and interest on the Insured Series 2018 Bonds.

"Bond Insurer" means, with respect to the Trust Agreement, the Person providing a Bond Insurance Policy. With respect to the Series 2017 Bonds and the Series 2018 Bonds, "Bond Insurer" means Assured Guaranty Municipal Corp., a New York stock insurance company, or any successor thereto or assignee thereof.

"Bond Registrar" means, with respect to the Series 2018 Bonds, Wells Fargo Bank, N.A.

"Bond Year" means, with respect to the Series 2018 Bonds, the period commencing on January 1 of any year and ending on December 31 of the same year, provided that the first Bond Year for the Series 2018 Bonds will begin on the date of issuance of the Series 2018 Bonds.

"Business Day" means any day other than a Saturday, a Sunday or a day on which offices of the United States Government or the State are authorized to be closed or on which commercial banks are authorized or required by law, regulation or executive order to be closed in New York, New York, in Raleigh, North Carolina or in the city where the principal or designated office of the Trustee is located.

"Capital Appreciation Bonds" means Bonds the interest on which is compounded at the rates and on the dates set forth in a Supplemental Agreement and is payable upon redemption or on the maturity date of such Bonds; provided, however, that nothing in the Trust Agreement will prohibit the Authority from designating in the appropriate Supplemental Agreement any such Bonds by a name other than Capital Appreciation Bonds.

"Capital Improvements Budget" for any Fiscal Year means the budget for capital improvements adopted by the Authority in accordance with the Trust Agreement.

"Capitalized Interest Account" means the respective accounts in the Senior Lien Debt Service Fund and the Subordinate Lien Debt Service Fund created and so designated by the Trust Agreement.

"Chief Financial Officer" means the person appointed or employed by the Authority to perform the duties imposed on the Chief Financial Officer by the Trust Agreement.

"Completion Date" means the date of acquisition or completion of the Initial Project and any Additional Project, or of any segment of the foregoing, as the case may be, as certified by the Authority pursuant to the Trust Agreement.

"Completion Indebtedness" means any Long-Term Indebtedness incurred for the purpose of financing the completion of the Initial Project or any Additional Project for which Long-Term Indebtedness has theretofore been incurred in accordance with the provisions of the Trust Agreement, to the extent necessary to complete the Initial Project or such Additional Project, in the manner and scope contemplated at the time that such Long-Term Indebtedness theretofore incurred was originally incurred, and, to the extent the same will be applicable, in accordance with the general plans and specifications for the Initial Project or such Additional Project, as originally prepared with only such changes as have been made in conformance with the documents pursuant to which such Long-Term Indebtedness theretofore incurred was originally incurred; provided, however, that such Long-Term Indebtedness will not exceed 5% of the aggregate principal amount of the Long-Term Indebtedness originally incurred by the Authority to finance the costs of the Initial Project or any Additional Project.

"Compounded Amount" means with respect to Capital Appreciation Bonds of any Series, the amount set forth in a Supplemental Agreement as the amount representing the initial public offering price, plus the accumulated and compounded interest on such Capital Appreciation Bonds.

"Construction and Renewal and Replacement Agreement" means the Construction Completion Assurance and Standby Renewal and Replacement Funding Agreement, dated as of April 15, 2009, between the Authority and NCDOT, including any supplement or amendment thereto.

"Credit Facility" means a line of credit, letter of credit, standby bond purchase agreement or similar liquidity or credit facility permitted by the Act (but excluding a Bond Insurance Policy) and established or obtained in connection with the incurrence of any Indebtedness.

"Credit Provider" means the Person providing a Credit Facility. If and to the extent permitted by law, the Authority may be a Credit Provider for the sole purpose of providing liquidity support for Indebtedness.

"Current Interest Bonds" means Bonds the interest on which is payable on the Interest Payment Dates provided therefor in any Supplemental Agreement.

"Default" means any Event of Default and any event that, after notice or lapse of time or both, would become an Event of Default.

"Defaulted Interest" means any interest on any Bond of any Series which is payable, but is not punctually paid or duly provided for, on any Interest Payment Date.

"Defeasance Obligations" means noncallable (a) Government Obligations and (b) Defeased Municipal Obligations.

"Defeased Municipal Obligations" means obligations of state or local government municipal bond issuers which are rated the highest rating category by S&P, Fitch or Moody's, respectively, provision for the payment of the principal of, premium, if any, and interest on which will have been made by deposit with a trustee or escrow agent of Government Obligations, the maturing principal of and interest on which, when due and payable, will provide sufficient money to pay the principal of, premium, if any, and interest on such obligations of state or local government municipal bond issuers. References in this definition to state or local government bond issuers will mean the State of North Carolina and North Carolina local government bond issuers, and, to the extent permitted by law, states other than the State of North Carolina and local government bond issuers other than North Carolina local government bond issuers.

"Depositary" means the State Treasurer of the State and one or more banks or trust companies or other institutions, including the Trustee, duly authorized by law to engage in the banking business and designated by the Authority as a depositary of moneys under the Trust Agreement.

"Derivative Agreement" means an interest rate swap, cap, collar, floor, forward, option, put, call or other agreement, arrangement or security however denominated, entered into in order to hedge interest rate fluctuations on all or a portion of any Indebtedness or to provide debt management by changing payments to be made by the Authority with respect to all or a portion of any Indebtedness.

"Derivative Agreement Additional Payments" means payments required to be paid by the Authority under a Derivative Agreement other than Derivative Agreement Regularly Scheduled Payments, including termination payments required to be paid in connection with the termination of a Derivative Agreement, whether voluntarily or upon the occurrence of an event of default, termination event or similar event thereunder.

"Derivative Agreement Regularly Scheduled Payments" means regularly scheduled payments required to be paid by the Authority under a Derivative Agreement that are based upon a fixed or variable imputed rate on a notional amount set forth in the Derivative Agreement and which are intended by the Authority to correspond to interest payments on the underlying Derivative Indebtedness.

"Derivative Indebtedness" means the portion of any Indebtedness meeting the requirements set forth in clauses (a) and (b) below:

- (a) in connection with such Indebtedness, the Authority will have entered into a Derivative Agreement in respect of all or a portion of such Indebtedness, and
- (b) (i) if such Indebtedness bears interest at a variable rate, such Derivative Agreement provides that during the Derivative Period, the Authority will pay to the provider of the Derivative Agreement a fixed rate (the "Synthetic Fixed Rate") and the provider of the Derivative Agreement will pay to the Authority a variable rate on a notional amount equal to all

or a portion of the Outstanding principal amount of such Indebtedness, or (ii) if such Indebtedness bears interest at a fixed rate, such Derivative Agreement provides that during the Derivative Period, the Authority will pay to the provider of the Derivative Agreement a variable rate (the "Synthetic Variable Rate") and the provider of the Derivative Agreement will pay to the Authority a fixed rate on a notional amount equal to all or a portion of the Outstanding principal amount of such Indebtedness.

"Derivative Period" means the period during which a Derivative Agreement is in effect.

"Eminent Domain" means the eminent domain or condemnation power by which all or any part of the Triangle Expressway System may be taken for another public use or any agreement that is reached in lieu of proceedings to exercise such power.

"Event of Default" means each of those events of default set forth in the Trust Agreement and described in "THE TRUST AGREEMENT – Events of Default" below.

"First Supplemental Trust Agreement" means the First Supplemental Trust Agreement, dated as of July 1, 2009, between the Authority and the Trustee.

"Fiscal Year" means the period commencing on the first day of July of any year and ending on the last day of June of the following year.

"Fitch" means Fitch Inc., a corporation organized and existing under the laws of the State of Delaware, its successors and assigns, and if such corporation will be dissolved or liquidated or will no longer perform the functions of a securities rating agency, "Fitch" will be deemed to refer to any other nationally recognized securities rating agency designated by the Authority by notice to the Trustee.

"General Engineering Consultant" means any engineer or firm of engineers of favorable reputation for skill and experience in performing the duties for which such consultant is required to be employed pursuant to the provisions of the Trust Agreement.

"General Reserve Fund" means the fund created and designated the North Carolina Turnpike Authority Triangle Expressway General Reserve Fund by the Trust Agreement.

"Government Obligations" means direct obligations of, or obligations the principal of and the interest on which are fully and unconditionally guaranteed by, the United States of America in either certificated or book-entry form, including (a) stripped Government Obligations stripped by the United States Treasury itself and (b) interest only portions of obligations issued by the Resolution Funding Corporation.

"Grant Anticipation Notes" means any grant anticipation notes issued by the Authority in compliance with the provisions of the Trust Agreement.

"Hedging Acquisition Account" means the account in the Senior Lien Debt Service Fund created and so designated by the Trust Agreement.

"Hedging Acquisition Account Requirement" means the amount to be deposited from time to time to the credit of the Hedging Acquisition Account in accordance with the requirements of the TIFIA Loan Agreement. The Hedging Acquisition Account Requirement, if any, will be computed by the Authority at the beginning of each Fiscal Year, subject to the approval of USDOT, and will be funded during that Fiscal Year pursuant to the Trust Agreement.

"Holder" means the holder or owner of Senior Lien Parity Debt, Subordinate Lien Parity Debt or TIFIA Indebtedness.

"Indebtedness" means all obligations incurred or assumed by the Authority in connection with the ownership or operation of the Triangle Expressway System:

- (a) for payments of principal and interest with respect to borrowed money, including any obligation to repay a Credit Provider for moneys drawn to pay and retire or purchase Indebtedness and including the continuing obligation to pay principal and interest with respect to any Bonds pursuant to the subrogation provisions of a Bond Insurance Policy following the payment to the Owner of such Bonds of the insured principal and interest from amounts paid by the Bond Insurer under such Bond Insurance Policy; and
- (b) for payments under leases which are required to be capitalized in accordance with generally accepted accounting principles and under installment or lease purchase or conditional sale contracts;

provided, however, that (i) Indebtedness will include only such obligations as are secured by Receipts, (ii) Indebtedness will not include any State Appropriation Revenue Bonds, and (iii) any obligation to pay a Credit Provider for moneys drawn to purchase, but not pay and retire, Indebtedness will constitute Indebtedness only to the extent such payments are in excess of any scheduled payments of principal and interest required to be made to such Credit Provider as an Owner or Holder of such Indebtedness.

"Initial Project" means the land, easements, rights of way, capital improvements and equipment financed with the proceeds of the Series 2009 Bonds, the State Appropriation Revenue Bonds and the TIFIA Series 2009 Bond, as more particularly described in the Supplemental Agreement for the Series 2009 Bonds and the TIFIA Loan Agreement.

"Initial Project Account" means the account in the Project Fund created and so designated by the Trust Agreement.

"Insolvency Laws" means the United States Bankruptcy Code, 11 U.S.C. §101 et seq., as from time to time amended and in effect, and any state bankruptcy, insolvency, receivership or similar law now or hereafter in effect.

"Insurance and Condemnation Award Fund" means the fund created and designated the North Carolina Turnpike Authority Triangle Expressway Insurance and Condemnation Award Fund by the Trust Agreement.

"Insurance Consultant" means any Person or firm having a favorable reputation in the State for skill and experience in dealing with the insurance requirements of road and highway systems similar to the Triangle Expressway System and in performing the duties to be imposed upon the Insurance Consultant by the Trust Agreement, including, without limitation, the Risk Manager for the State Department of Insurance.

"Insured Series 2018 Bonds" means the Series 2018 Bonds maturing on January 1 in the years 2032 through 2038 and 2041.

"Interest Account" means the respective accounts in the Senior Lien Debt Service Fund and the Subordinate Lien Debt Service Fund created and so designated by the Trust Agreement.

"Interest Payment Date" means, with respect to any Series of Bonds, each of the interest payment dates provided for in the Supplemental Agreement relating to such Series, and with respect to any Parity Debt or TIFIA Indebtedness, each of the interest payment dates provided for in the Parity Debt Resolution or TIFIA Loan Agreement relating to such Parity Debt or TIFIA Indebtedness. "Interest Payment Date" means, with respect to the Series 2018 Bonds, any January 1 or July 1, commencing July 1, 2019.

"Investment Obligations" means, to the extent permitted by law, any investment authorized by Section 159-30 of the General Statutes of North Carolina, as such statute may be amended from time to time, or any successor statute.

"Loan Life Coverage Ratio" means a ratio where the numerator is equal to the net present value of projected total Receipts, as determined by the Traffic Consultant, after meeting the requirements of the Trust Agreement, for each Fiscal Year from and including the Fiscal Year in which such calculation is made to and including the Fiscal Year in which the final maturity of the TIFIA Indebtedness occurs, plus the sum of the amounts on deposit in the TIFIA Reserve Fund and General Reserve Fund as of the last Business Day of the previous Fiscal Year, and the denominator is equal to the principal amount of TIFIA Indebtedness Outstanding as of the date of such calculation. The discount rate for the net present value calculation will be equal to the interest rate on the TIFIA Indebtedness.

"Local Government Commission" means the Local Government Commission, a division of the Department of the State Treasurer of the State.

"Long-Term Debt Service Requirement" means, for any period of twelve (12) consecutive calendar months for which such determination is made, the aggregate of the required deposits to be made in respect of Principal and interest (whether or not separately stated) on Outstanding Long-Term Indebtedness during such period, also taking into account:

(a) with respect to Balloon Long-Term Indebtedness, the amount of principal which would be payable in such period if such principal were amortized from the date of incurrence thereof over a period of twenty (20) years (or the actual number of years over which such Balloon Long-Term Indebtedness is being amortized, if greater than twenty (20) years, but in no event greater than forty (40) years) on a level debt service basis at an interest rate equal to the current market rate for an obligation with such assumed amortization as set forth in an opinion of a banking institution or an investment banking institution knowledgeable in financing

of Triangle Expressway System delivered to the Trustee as the interest rate at which the Authority could reasonably expect to borrow the same by incurring Indebtedness with the same term as assumed above; provided, however, that if the date of calculation is within twelve (12) calendar months of the actual final maturity date of such Indebtedness, the full amount of principal payable at maturity will be included in such calculation, unless a binding commitment by an institutional lender or municipal underwriting firm exists, which binding commitment may contain typical and customary conditions, to provide financing to refinance such Indebtedness and such commitment provides for the refinancing of such Indebtedness on terms which would, if such commitment was implemented, constitute Long-Term Indebtedness, then in such case the payment terms contained in such commitment will be utilized for purposes of calculating the Long-Term Debt Service Requirement with respect to such Balloon Long-Term Indebtedness;

- (b) with respect to Long-Term Indebtedness which is Variable Rate Indebtedness, the interest on such Indebtedness will be calculated at the rate which is equal to the average of the actual interest rates which were in effect (weighted according to the length of the period during which each such interest rate was in effect) for the most recent twelve (12) month period immediately preceding the date of calculation for which such information is available (or shorter period if such information is not available for a twelve (12) month period), except that with respect to new Variable Rate Indebtedness proposed to be incurred, the interest rate for such Variable Rate Indebtedness will be equal to the running average of the SIFMA Municipal Index for the most recent 52 weeks immediately preceding the date of calculation for which such information is available;
- (c) with respect to any Credit Facility, (i) to the extent that such Credit Facility has not been used or drawn upon, the principal and interest relating to such Credit Facility will not be included in the Long-Term Debt Service Requirement and (ii) to the extent that the Authority has reimbursed a Credit Provider for a drawing on a Credit Facility to pay principal or interest on Indebtedness that is already included in the Long-Term Debt Service Requirement, only the portion of the reimbursement payment that is in excess of the payment of principal and interest paid from the drawing will be included in the Long-Term Debt Service Requirement; and
- (d) with respect to Derivative Indebtedness, during any Derivative Period and for so long as the provider of the Derivative Agreement has not defaulted on its payment obligations under the Derivative Agreement, the amount of interest payable on such Derivative Indebtedness will be calculated as follows:
  - (i) for any historical computation of the Long-Term Debt Service Requirement:
    - (A) if such Derivative Indebtedness bears interest at a variable rate, the amount derived by adding (1) the amount of interest paid by the Authority on such Derivative Indebtedness at such variable rate (calculated as provided in subparagraph (b) above) and (2) the amount paid by the Authority to the provider of the Derivative Agreement relating to such Derivative Indebtedness at the Synthetic Fixed Rate, and subtracting (3) the amount received by the Authority from the provider of such Derivative Agreement at the variable rate

specified in the Derivative Agreement (calculated as provided in subparagraph (b) above); and

- (B) if such Derivative Indebtedness bears interest at a fixed rate, the amount derived by adding (1) the amount of interest paid by the Authority on such Derivative Indebtedness at such fixed rate and (2) the amount paid by the Authority to the provider of the Derivative Agreement relating to such Derivative Indebtedness at the Synthetic Variable Rate (calculated as provided in subparagraph (b) above) and subtracting (3) the amount received by the Authority from the provider of such Derivative Agreement at the fixed rate specified in the Derivative Agreement; and
- (ii) for any projected computation of the Long-Term Debt Service Requirement:
  - (A) if such Derivative Indebtedness bears interest at a variable rate, at the Synthetic Fixed Rate; and
  - (B) if such Derivative Indebtedness bears interest at a fixed rate, at the Synthetic Variable Rate (calculated as provided in subparagraph (b) above);

provided, however, that notwithstanding the foregoing, (a) accrued and capitalized interest will be excluded from the determination of Long-Term Debt Service Requirement to the extent the same is provided from the proceeds of the Long-Term Indebtedness or otherwise provided so as to be available for deposit into an account for capitalized interest or similar account not later than the date of delivery of and payment for such Long-Term Indebtedness; (b) the aggregate amount of payments made with respect principal or interest on Outstanding Long-Term Indebtedness will not include principal or interest payable from investment earnings on the Senior Lien Debt Service Fund, the Subordinate Lien Debt Service Fund, any Senior Lien Special Reserve Account, any Subordinate Lien Special Reserve Account or any other fund or account established by the Authority that are required to be used to pay the principal of or interest on Indebtedness; and (c) the aggregate of the payments to be made with respect to principal and interest on Outstanding Long-Term Indebtedness will not include principal or interest payable from Qualified Escrow Funds; and

(e) the deposits required to be made for any period in respect of interest on any Outstanding Senior Lien Bonds, Subordinate Lien Bonds or TIFIA Bonds issued or incurred under the Trust Agreement will be reduced by the amount of any investment earnings on the Funds and Accounts created in the Debt Service Fund.

"Long-Term Indebtedness" means all Indebtedness for any of the following:

(a) money borrowed for an original term, or renewable at the option of the Authority for a period from the date originally incurred, of longer than one year;

- (b) leases which are required to be capitalized in accordance with generally accepted accounting principles having an original term, or renewable at the option of the Authority for a period from the date originally incurred, of longer than one year; and
- (c) installment purchase, installment financing or conditional sale contracts having an original term in excess of one year.

Long-Term Indebtedness will include Short-Term Indebtedness if a Credit Facility exists to provide financing to retire such Short-Term Indebtedness and such Credit Facility provides for the repayment of principal on terms which would, if such commitment were implemented, constitute Long-Term Indebtedness. Long-Term Indebtedness will also include the current portion of Long-Term Indebtedness. Long-Term Indebtedness will only include the obligations described in (a), (b) and (c) to the extent that such obligations are Indebtedness, as defined in the Trust Agreement.

"Maximum Long-Term Debt Service Requirement" means the highest Long-Term Debt Service Requirement for the present and any succeeding Fiscal Year.

"Moody's" means Moody's Investors Service, Inc., a corporation organized and existing under the laws of the State of Delaware, its successors and assigns, and if such corporation will be dissolved or liquidated or will no longer perform the functions of a securities rating agency, "Moody's" will be deemed to refer to any other nationally recognized securities rating agency designated by the Authority by notice to the Trustee.

"NCDOT" means the North Carolina Department of Transportation, a department of the State, and any successor to its functions.

"Net Eminent Domain Proceeds" means the gross proceeds paid to the Authority as a final award for the taking by Eminent Domain of any of the Triangle Expressway System less payment of attorneys' and other fees and expenses properly incurred in the collection of such gross proceeds.

"Net Insurance Proceeds" means the gross proceeds paid to the Authority as a result of any casualty insurance policy with respect to the Triangle Expressway System or as a result of any liability insurance policy less payment of attorneys' and other fees and expenses properly incurred in the collection of such gross proceeds.

"Non-System Project" means any additions, acquisitions, improvements, betterments, land, buildings, structures or other facilities, including equipment, acquired or constructed, and the preparation and grading of land, relating to the Triangle Expressway System but which are specifically designated by resolution of the Authority Board as not being part of the Triangle Expressway System and are not otherwise thereafter designated as an Additional Project pursuant to the Trust Agreement.

"Officer's Certificate" means a certificate signed by an Authorized Officer.

"O&M Guaranty Agreement" means the Operating and Maintenance Expense Guaranty Agreement, dated as of August 20, 2008, between the Authority and NCDOT, including any supplement or amendment thereto.

"Operating Advance" means any payment received by the Authority from NCDOT pursuant to the terms of the O&M Guaranty Agreement to replenish amounts drawn from the Operating Reserve Fund pursuant to the Trust Agreement.

"Operating Expenses" means the Authority's current expenses for the operation, maintenance and repair of the Triangle Expressway System as determined in accordance with generally accepted accounting principles, except as modified by this definition, including, without limiting the generality of the foregoing:

- (a) all ordinary and usual expenses of operation, toll collection, maintenance and repair, which may include expenses not annually recurring;
  - (b) direct administrative expenses;
  - (c) salaries, benefits and other compensation;
  - (d) operating lease payments;
- (e) payments to any pension or retirement plan or plans properly chargeable to the Authority;
  - (f) insurance premiums and expenses;
- (g) engineering and architectural expenses relating to the operation, maintenance or repair of the Triangle Expressway System;
- (h) fees and expenses of the Trustee or its counsel, any Bond Registrar, Depositary, Traffic Consultant, tender agent, paying agent or Bond Insurer, fees and expenses payable to the USDOT pursuant to the terms of any TIFIA Loan Agreement, legal expenses, Credit Facility fees, remarketing fees and fees of consultants or professionals; and
- (i) any other similar-type operating expenses required to be paid by the Authority under the Trust Agreement or by law;

but Operating Expenses will not include:

- (a) any reserves for extraordinary replacements or repairs;
- (b) any allowance for depreciation or any amortization of financing expense;
- (c) any deposits to any fund, account and subaccount created under the Trust Agreement or any Supplemental Agreement, Parity Debt Resolution or TIFIA Loan Agreement and payments of principal, premium, if any, and interest on Indebtedness from such funds, accounts and subaccounts;

- (d) any debt service payments or reserves or deposits for debt service payments in respect of Indebtedness or any lease-purchase or installment financing contracts or any other indebtedness of the Authority not secured by a pledge of and lien on the Receipts; or
- (e) any payments made under any Derivative Agreement, whether regularly scheduled payments, termination payments or other payments.

"Operating Reserve Fund" means the fund created and designated the North Carolina Turnpike Authority Triangle Expressway Operating Reserve Fund by the Trust Agreement.

"Operations and Maintenance Expense Fund" means the fund created and designated the North Carolina Turnpike Authority Triangle Expressway Operations and Maintenance Expense Fund by the Trust Agreement.

"Original Trust Agreement" means the Trust Agreement, dated as of June 1, 2009, between the Authority and the Trustee.

"Outstanding" when used with reference to Bonds means, as of a particular date, all Bonds theretofore authenticated and delivered under the Trust Agreement, except:

- (a) Bonds theretofore canceled by the Bond Registrar or delivered to the Bond Registrar for cancellation;
  - (b) Bonds deemed to be no longer Outstanding pursuant to the redemption provisions set forth in the Trust Agreement and described in this Official Statement;
  - (c) Bonds in exchange for or in lieu of which other Bonds have been authenticated and delivered under the Trust Agreement;
  - (d) Bonds deemed to have been paid in accordance with the Trust Agreement and described in "THE TRUST AGREEMENT Defeasance" below; and
  - (e) Bonds constituting Put Indebtedness deemed to have been purchased in accordance with the provisions of the applicable Supplemental Agreement in lieu of which other Bonds have been delivered under such Supplemental Agreement.

When used with reference to Parity Debt or TIFIA Indebtedness, "Outstanding" means, as of a particular date, all Parity Debt and TIFIA Indebtedness except:

- (a) Parity Debt and TIFIA Indebtedness theretofore canceled by the Authority;
  - (b) Parity Debt and TIFIA Indebtedness for the payment or redemption of which money, Defeasance Obligations, or a combination of both, in an amount sufficient to pay on the date when such Parity Debt and TIFIA Indebtedness is to be paid or redeemed the principal amount of or Redemption Price of, and the interest accruing to such date on, the Parity Debt and TIFIA Indebtedness to be paid or redeemed, has been

deposited with an escrow agent in trust for the Holders of such Parity Debt and TIFIA Indebtedness; Defeasance Obligations will be deemed to be sufficient to pay or redeem Parity Debt and TIFIA Indebtedness on a specified date if the principal and the interest on such Defeasance Obligations, when due, together with any money left uninvested, will be sufficient to pay on such date the principal amount of or Redemption Price of, and the interest accruing on, such Parity Debt and TIFIA Indebtedness to such date;

- (c) Parity Debt and TIFIA Indebtedness in exchange for or in lieu of which other Parity Debt of TIFIA Indebtedness has been delivered under the documentation securing such Parity Debt or TIFIA Indebtedness;
- (d) Parity Debt and TIFIA Indebtedness deemed to have been paid in accordance with the defeasance or like provisions of the Parity Debt Resolution or TIFIA Resolution providing for the issuance of the Parity Debt or TIFIA Indebtedness; and
- (e) Parity Debt and TIFIA Indebtedness constituting Put Indebtedness deemed to have been purchased in accordance with the provisions of the applicable Parity Debt Resolution or TIFIA Loan Agreement in lieu of which other Parity Debt or TIFIA Indebtedness has been incurred under the Parity Debt Resolution or TIFIA Loan Agreement.

"Owner" means a Person in whose name a Bond is registered in the registration books provided for in the Trust Agreement.

"Parity Debt" means, collectively, Senior Lien Parity Debt and Subordinate Lien Parity Debt.

"Parity Debt Resolution" means the resolution and any other documentation adopted or executed and delivered by the Authority providing for the incurrence of Parity Debt. If any Senior Lien Indebtedness is to be the subject of a Credit Facility providing for repayments for draws under the Credit Facility on a parity basis with such Senior Lien Indebtedness, then the term Parity Debt Resolution will include any reimbursement agreement or similar repayment agreement executed and delivered by the Authority in connection with the provision of a Credit Facility for such Senior Lien Indebtedness. If any Subordinate Lien Indebtedness is to be the subject of a Credit Facility providing for repayments for draws under the Credit Facility on a parity basis with such Subordinate Lien Indebtedness, then the term Parity Debt Resolution will include any reimbursement agreement or similar repayment agreement executed and delivered by the Authority in connection with the provision of a Credit Facility for such Subordinate Lien Indebtedness.

"Permitted Encumbrances" means in addition to any charge created or permitted by the Trust Agreement upon the Triangle Expressway System or any part thereof or on the Receipts:

- (a) liens for taxes or other governmental charges or levies not delinquent or that are being contested in good faith by the Authority;
- (b) (i) covenants, easements, encumbrances, defects of title, reservations, restrictions and conditions existing at the time of delivery of the Series 2009 Bonds and (ii)

defects, irregularities, encumbrances, easements, including easements for roads and public utilities and similar easements, rights of way, mineral conveyances, mineral reservations, and clouds on title, none of which materially impairs the use of the property affected thereby for its intended purposes;

- (c) mechanics', workers', repairmen's, architects', engineers', surveyors', or carriers' liens or other similar liens provided that the same will be discharged in the ordinary course of business and without undue delay or the validity of the same will be contested in good faith with any pending execution thereof appropriately stayed;
- (d) other liens, charges and encumbrances that, in the written opinion of the Authority Attorney, a copy of which is filed with the Trustee, do not prevent or materially impair the use of the Triangle Expressway System (the Authority Attorney may rely upon a certificate of any engineer or any architect as to whether such liens, charges and encumbrances prevent or materially impair the use of the Triangle Expressway System);
  - (e) liens on any Non-System Projects;
- (f) encumbrances on property, plant and equipment comprising a part of the Triangle Expressway System to the extent permitted by the Trust Agreement;
- (g) the pledge of State Appropriated Revenues under the State Appropriation Revenue Bond Trust Agreement to secure the State Appropriation Revenue Bonds; and
- (h) any contracts, leases or other agreements to the extent permitted by the Trust Agreement.

"Person" includes corporations, firms, associations, partnerships, joint ventures, joint stock companies, trusts, unincorporated organizations, and public bodies, as well as natural persons.

"Predecessor Bonds" of any particular Bond means every previous Bond evidencing all or a portion of the same debt as that evidenced by such particular Bond; and, for purposes of this definition, any Bond authenticated and delivered under the Trust Agreement in lieu of a lost, destroyed or stolen Bond will be deemed to evidence the same debt as the lost, destroyed or stolen Bond.

"Principal" means (a) with respect to any Capital Appreciation Bond, the Compounded Amount thereof (the difference between the stated amount to be paid at maturity and the Compounded Amount being deemed unearned interest) except as used in connection with the authorization and issuance of Bonds and with the order of priority of payments of Bonds after an Event of Default, in which case "Principal" means the initial public offering price of a Capital Appreciation Bond and the difference between the Compounded Amount and the initial public offering price will be deemed to be interest and (b) with respect to any Current Interest Bond, the principal amount of such Bond or Indebtedness payable at maturity or in satisfaction of a Sinking Fund Requirement, if applicable.

"Principal Account" means the respective accounts in the Senior Lien Debt Service Fund and the Subordinate Lien Debt Service Fund created and so designated by the Trust Agreement.

"Principal Payment Date" means any date established by any Supplemental Agreement, Parity Debt Resolution or TIFIA Loan Agreement for the payment of principal of Bonds, Parity Debt or TIFIA Indebtedness, whether at maturity or pursuant to an amortization requirement or otherwise.

"Project Fund" means the fund created and designated the North Carolina Turnpike Authority Triangle Expressway Project Fund by the Trust Agreement.

"Put Indebtedness" means fixed or variable rate Long-Term Indebtedness 25% or more of the principal of which may, at the option of the Owner or Holder thereof, be tendered to the Authority, the Trustee, a Depositary or a paying agent or other fiduciary, or an agent of any of the foregoing, for payment or purchase at one time.

"Qualified Escrow Funds" means amounts deposited in a segregated escrow fund or other similar fund or account in connection with the issuance of Long-Term Indebtedness which fund or account is required by the documents establishing such fund or account to be applied toward the Authority's payment obligations with respect to principal or interest on (a) the Long-Term Indebtedness which is incurred under the documents establishing such fund or account or (b) Long-Term Indebtedness which is incurred prior to the establishment of such fund or account.

"Receipts" means all receipts, revenues, income, proceeds and money received in any period by or for the Authority in respect of the Triangle Expressway System, including, but without limiting the generality of the foregoing:

- (a) all toll revenues, payments, proceeds, fees, charges, rents and all other income derived by or for the Authority from the ownership and operation of the Triangle Expressway System, and all other income derived by the Authority from the operation or ownership of the Triangle Expressway System, and all rights to receive the same, whether in the form of accounts receivable, contract rights or other rights, and the proceeds of such rights whether now owned or held or hereafter coming into existence;
- (b) proceeds of use and occupancy or business interruption insurance and amounts received by the Authority from any contractor as liquidated damages for failures of such contractor to complete its contractual commitment in accordance with the terms of the contract;
- (c) proceeds of any appropriation made by the federal government or any agency or instrumentality thereof or the State or any agency, instrumentality or political subdivision thereof State for use in connection with the Triangle Expressway System, to the extent such proceeds are deposited in the Revenue Fund and are available for use in the same manner as other Receipts under the provisions of the Trust Agreement, including, without limitation, the State Appropriated Revenues; provided, however, that State Appropriated Revenues will not constitute Receipts under the Trust Agreement until such time as such amounts are withdrawn from the State Appropriation Revenue Bond Trust Agreement and deposited to the Revenue Fund;

- (d) any Derivative Agreement Regularly Scheduled Payments or Derivative Agreement Additional Payments received by the Authority under any Derivative Agreement; and
- (e) the investment income realized on, and the income and gains realized upon the maturity or sale of, securities held by or on behalf of the Authority in the Revenue Fund;

but there will not be included in "Receipts":

- (i) the proceeds of any gifts, grants, bequests, contributions or donations (except as provided in clause (c) above in this definition);
- (ii) the proceeds from the sale or disposition of all or any part of the Triangle Expressway System;
- (iii) reimbursements received by the Authority of advances made by it in respect of the Initial Project, any Additional Project, any refinancing of Indebtedness and any capital improvements;
- (iv) the investment income realized on, and the income and gains realized upon the maturity or sale of, securities held by or on behalf of the Authority in any funds, accounts and subaccounts established pursuant to the Trust Agreement (other than the Revenue Fund), except to the extent that such investment income is transferred by the Authority to the Revenue Fund;
- (v) any payments received or revenues derived from the ownership or operation of any Non-System Project, except to the extent expressly included as a Receipt by resolution adopted by the Authority Board;
- (vi) Net Insurance Proceeds or Net Eminent Domain Proceeds other than the net proceeds of any use and occupancy or business interruption insurance;
- (vii) proceeds of any appropriation made by the federal government or any agency or instrumentality thereof or the State or any agency, instrumentality or political subdivision thereof to the extent the use of such funds is limited to a use that is inconsistent with their use as Receipts under the provisions of the Trust Agreement;
- (viii) the income from the investment of Qualified Escrow Funds to the extent such income is applied to the payment of the principal of or the interest on Long-Term Indebtedness which is excluded from the determination of the Long-Term Debt Service Requirement; and
  - (ix) the proceeds of any indebtedness of the Authority.

"Redemption Account" means the respective accounts in the Senior Lien Debt Service Fund and the Subordinate Lien Debt Service Fund created and so designated by the Trust Agreement.

"Redemption Price" means, with respect to any Indebtedness or portion thereof, the principal amount of such Indebtedness or portion called for redemption plus the applicable premium, if any, payable upon redemption thereof.

"Regular Record Date" means, with respect to any Series of Bonds, the regular record date, if any, provided for in the Supplemental Agreement relating to such Series.

"Refunded Bonds" means the Series 2009A Bonds maturing on or after January 1, 2020.

"Regular Record Date" means, with respect to the Series 2018 Bonds, the 15th day of the month preceding any Interest Payment Date, whether or not a Business Day.

"Renewal and Replacement Fund" means the fund created and designated the North Carolina Turnpike Authority Triangle Expressway Renewal and Replacement Fund by the Trust Agreement.

"Reserve Alternative Instrument" means an unconditional insurance policy or surety bond or irrevocable letter of credit or guaranty deposited in the Senior Lien Parity Reserve Account, a Senior Lien Special Reserve Account, the Subordinate Lien Parity Reserve Account or a Subordinate Lien Special Reserve Account in lieu of or in partial substitution for the deposit of cash and Investment Obligations in satisfaction of all or a portion of the Senior Lien Parity Reserve Account Requirement, a Senior Lien Special Reserve Account Requirement, the Subordinate Lien Parity Reserve Account Requirement or a Subordinate Lien Special Reserve Account Requirement. The Reserve Alternative Instrument will be payable (upon the giving of notice as required thereunder) to remedy any deficiency in the appropriate subaccounts in the Interest Account, the Principal Account and the Sinking Fund Account of the Senior Lien Debt Service Fund or the Subordinate Lien Debt Service Fund, as the case may be, in order to provide for the timely payment of interest and principal (whether at maturity or pursuant to Sinking Fund Requirements therefor). Except as may be provided in a Senior Lien Resolution providing for a Senior Lien Special Reserve Account or in a Subordinate Lien Resolution providing for a Subordinate Lien Special Reserve Account, the provider of a Reserve Alternative Instrument will be (a) an insurer that has been assigned either (A) one of the two highest policyholder ratings accorded insurers by A. M. Best & Co. or any comparable service or (B) for bonds insured by the provider of the Reserve Alternative Instrument, a rating by Fitch, Moody's or S&P in one of the two highest rating categories (without regard to gradations within such categories) or (b) a commercial bank, insurance company or other financial institution the bonds payable or guaranteed by which have been assigned a rating by either Fitch, Moody's or S&P in one of the two highest rating categories (without regard to gradations within such categories).

"Revenue Bond Anticipation Notes" means any revenue bond anticipation notes issued by the Authority in compliance with the provisions of the Trust Agreement.

"Revenue Fund" means the fund created and designated the North Carolina Turnpike Authority Triangle Expressway Revenue Fund by the Trust Agreement.

"Revenues" means revenues of the Triangle Expressway System, as determined in accordance with generally accepted accounting principles; provided, however, that revenues will include, without limiting the generality of the foregoing:

- (a) proceeds of use and occupancy or business interruption insurance; and
- (b) proceeds of any appropriation made by the federal government or any agency or instrumentality thereof or the State or any agency, instrumentality or political subdivision thereof State for use in connection with the Triangle Expressway System, to the extent such proceeds are deposited in the Revenue Fund and are available for use in the same manner as other Receipts under the provisions of the Trust Agreement, including, without limitation, the State Appropriated Revenues; provided, however, that State Appropriated Revenues will not constitute Revenues under the Trust Agreement until such time as such amounts are withdrawn from the State Appropriation Revenue Bond Trust Agreement and deposited to the Revenue Fund; and
- (c) the investment income realized on, and the income and gains realized upon the maturity or sale of, securities held by or on behalf of the Authority in the Revenue Fund;

but there will not be included in "Revenues":

- (i) the proceeds of any gifts, grants, bequests, contributions or donations (except as provided in clause (b) above in this definition);
- (ii) the proceeds from the sale or disposition of all or any part of the Triangle Expressway System;
- (iii) reimbursements received by the Authority of advances made by it in respect of (i) the Initial Project, (ii) any Additional Project, (iii) any refinancing of Indebtedness and (iv) any capital improvements;
- (iv) the investment income realized on, and the income and gains realized upon the maturity or sale of, securities held by or on behalf of the Authority in any funds, accounts and subaccounts established pursuant to the Trust Agreement (other than the Revenue Fund), except to the extent that such investment income is transferred by the Authority to the Revenue Fund.
- (v) any payments received or revenues derived from the ownership or operation of any Non-System Project, except to the extent expressly included as a Receipt by resolution adopted by the Authority Board;
- (vi) Net Insurance Proceeds or Net Eminent Domain Proceeds other than the net proceeds of any use and occupancy or business interruption insurance;
- (vii) (proceeds of any appropriation made by the federal government or any agency or instrumentality thereof or the State or any agency, instrumentality or political subdivision thereof to the extent the use of such funds is limited to a use that is inconsistent with their use as Receipts under the provisions of the Trust Agreement;
- (viii) the income from the investment of Qualified Escrow Funds to the extent such income is applied to the payment of the principal of or the interest on Long-

Term Indebtedness which is excluded from the determination of the Long-Term Debt Service Requirement;

- (ix) any payments received by the Authority under any Derivative Agreement;
- (x) the proceeds of any security deposits or moneys received to make refunds to users of the Triangle Expressway System; and
  - (xi) the proceeds of any indebtedness of the Authority.

"S&P" means Standard & Poor's Ratings Services, a Division of The McGraw-Hill Companies, Inc., and its successors and assigns, and if such entity will be dissolved or liquidated or will no longer perform the functions of a securities rating agency, "S&P" will be deemed to refer to any other nationally recognized securities rating agency designated by the Authority by notice to the Trustee.

"Second Supplemental Trust Agreement" means the Second Supplemental Trust Agreement, dated as of March 1, 2017, between the Authority and the Trustee.

"Securities Depository" means the Depository Trust Company, New York, New York, or any other recognized securities depository selected by the Authority, which maintains a bookentry system in respect of a Series of Bonds, and will include any substitute for or successor to the securities depository initially acting as Securities Depository.

"Securities Depository Nominee" means, as to any Securities Depository, such Securities Depository or the nominee of such Securities Depository in whose name there will be registered on the registration books maintained by the Bond Registrar the Bond certificates to be delivered to and immobilized at such Securities Depository during the continuation with such Securities Depository of participation in its book-entry system.

"Senior Lien Bonds" means the Series 2009 Bonds, the Series 2017 Bonds, the Series 2018 Bonds and any other bonds issued under the provisions of the Trust Agreement and secured on a parity with each other and any Senior Lien Parity Debt and Senior Lien Derivative Agreement Regularly Scheduled Payment by the Trust Agreement.

"Senior Lien Debt Service Fund" means the fund created and designated the North Carolina Turnpike Authority Triangle Expressway Senior Lien Debt Service Fund by the Trust Agreement.

"Senior Lien Derivative Agreement Regularly Scheduled Payments" means any Derivative Agreement Regularly Scheduled Payments with respect to Derivative Indebtedness constituting Senior Lien Indebtedness.

"Senior Lien Indebtedness" means, collectively, the Senior Lien Bonds and Senior Lien Parity Debt.

"Senior Lien Parity Debt" means all Indebtedness incurred by the Authority in respect of the Triangle Expressway System and not evidenced by Bonds which is secured on a parity (as so designated in the Parity Debt Resolution) with the Senior Lien Bonds by a pledge, charge and lien upon the Receipts as provided in the Trust Agreement, including, without limiting the generality of the foregoing, and described in "THE TRUST AGREEMENT – Security" below.

"Senior Lien Parity Reserve Account" means the account in the Senior Lien Debt Service Fund created and so designated by the Trust Agreement.

\*\*"Senior Lien Parity Reserve Account Requirement" means, initially at the time of issuance of the Series 2009 Bonds, the least of (i) the Maximum Long-Term Debt Service Requirement for all Senior Lien Bonds and Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account, (ii) 125% of the average annual Long-Term Debt Service Requirement for all Senior Lien Bonds and Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account and (iii) 10% of the stated principal amount of all Senior Lien Bonds and Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account; provided, however, that if any Series of Senior Lien Bonds or Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account has original issue discount or premium that exceeds 2% of the stated redemption price at maturity plus any original issue premium attributable exclusively to underwriter's compensation, the initial offering prices to the public will be used in lieu of the stated principal amount for purposes of the 10% limitation. Thereafter, the Senior Lien Parity Reserve Account will be adjusted annually on the first day of each Fiscal Year to equal the Maximum Long-Term Debt Service Requirement for the Senior Lien Bonds and Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account for the current Fiscal Year and the next succeeding four Fiscal Years to the extent such amount exceeds the initial deposit to the Senior Lien Parity Reserve Account Requirement at the time of issuance of the Series 2009 Bonds. The Senior Lien Parity Reserve Account Requirement may be composed of cash, Investment Obligations or Reserve Alternative Instruments, or any combination of the foregoing, as the Authority may determine.\*\*

"Senior Lien Resolution" means any Supplemental Agreement for Senior Lien Bonds or Parity Debt Resolution for Senior Lien Parity Debt, or both, as the case may be, authorizing the issuance of a Series of Senior Lien Bonds or the incurrence of Senior Lien Parity Debt.

"Senior Lien Special Reserve Account" means a special debt service reserve account, if any, created by a Senior Lien Resolution as a debt service reserve account only for the particular Senior Lien Indebtedness authorized thereby.

"Senior Lien Special Reserve Account Requirement" means the amount required to be placed or maintained in a Senior Lien Special Reserve Account as may be required by the Senior Lien Resolution creating such account. The Senior Lien Special Reserve Account Requirement may be composed of cash, Investment Obligations or Reserve Alternative Instruments or any combination of the foregoing, as the Authority may determine.

"Serial Bonds" means the Bonds of any Series that are stated to mature in consecutive annual installments.

"Series," whenever used herein with respect to Bonds, means all of the Bonds designated as being of the same series.

"Series 2009 Bonds" means, collectively, the Series 2009A Bonds and the Series 2009B Bonds.

"Series 2009A Bonds" means the North Carolina Turnpike Authority Triangle Expressway System Senior Lien Turnpike Revenue Bonds, Series 2009A, issued pursuant to the Trust Agreement and the First Supplemental Trust Agreement.

"Series 2009B Bonds" means the North Carolina Turnpike Authority Triangle Expressway System Senior Lien Turnpike Revenue Bonds, Series 2009B, issued pursuant to the Trust Agreement and the First Supplemental Trust Agreement.

"Series 2017 Bonds" means the North Carolina Turnpike Authority Triangle Expressway System Senior Lien Turnpike Revenue Refunding Bonds, Series 2017, issued pursuant to the Trust Agreement and the Second Supplemental Trust Agreement. The Series 2017 Bonds are Current Interest Bonds.

"Series 2018 Bonds" means the North Carolina Turnpike Authority Triangle Expressway System Senior Lien Turnpike Revenue Refunding Bonds, Series 2018, issued pursuant to the Trust Agreement and the Third Supplemental Trust Agreement. The Series 2018 Bonds are Current Interest Bonds.

"Series 2018 Cost of Issuance Fund" means the fund created and so designated by the Third Supplemental Trust Agreement.

"Series 2018 Subaccount of the Interest Account" means the subaccount created and so designated by the Third Supplemental Trust Agreement.

"Series 2018 Subaccount of the Principal Account" means the subaccount created and so designated by the Third Supplemental Trust Agreement.

"Series 2018 Subaccount of the Redemption Account" means the subaccount created and so designated by the Third Supplemental Trust Agreement.

"Short-Term Indebtedness" means all Indebtedness incurred for borrowed money other than the current portion of Long-Term Indebtedness for any of the following:

- (a) money borrowed for an original term, or renewable at the option of the borrower for a period from the date originally incurred, of one year or less;
- (b) leases which are capitalized in accordance with generally accepted accounting principles having an original term, or renewable at the option of the lessee for a period from the date originally incurred, of one year or less; and
- (c) installment purchase, installment financing or conditional sale contracts having an original term of one year or less.

"SIFMA Municipal Index" means The Securities Industry and Financial Markets Association Municipal Swap Index or such other weekly, high-grade index comprised of sevenday, tax-exempt multi-modal notes produced by Municipal Market Data, Inc., or its successor, or as otherwise designated by The Securities Industry and Financial Markets Association; provided, however, that if such index is no longer produced by Municipal Market Data, Inc. or its successor, then "SIFMA Municipal Index" means such other reasonably comparable index selected by the Authority.

"Sinking Fund Account" means the respective accounts in the Senior Lien Debt Service Fund and the Subordinate Lien Debt Service Fund created and so designated by the provisions of the Trust Agreement.

"Sinking Fund Requirement" means with respect to any Series of Bonds, the Sinking Fund Requirement provided in the Supplemental Agreement relating to such Series.

The Sinking Fund Requirements for the Term Bonds will be initially the respective principal amounts of such Term Bonds for retirement on each January 1 as fixed in the Supplemental Agreement.

If during any Bond Year, the total principal amount of Term Bonds retired by purchase or redemption under the provisions of the Supplemental Agreement will be greater than the amount of the Sinking Fund Requirement for such Term Bonds, the subsequent Sinking Fund Requirements for such Term Bonds will be reduced in such amount aggregating the amount of such excess as will be specified in an Officer's Certificate filed with the Trustee on or prior to July 15 of the next ensuing Bond Year.

"Special Record Date" means a date fixed by the Trustee for determining the Owner of Bonds for the payment of Defaulted Interest pursuant to the Trust Agreement.

"State" means the State of North Carolina.

"State Appropriation Revenue Bond Trust Agreement" means the Trust Agreement, dated as of June 1, 2009, between the Authority and the Trustee as trustee thereunder, authorizing, among other things, the issuance of revenue bonds thereunder secured by the State Appropriated Revenues to pay a portion of the costs of the Initial Project.

"Subordinate Lien Bonds" means any bonds issued under the provisions of the Trust Agreement and secured on a parity with each other and any Subordinate Lien Parity Debt and Subordinate Lien Derivative Agreement Regularly Scheduled Payment by the Trust Agreement.

"Subordinate Lien Debt Service Fund" means the fund created and designated the North Carolina Turnpike Authority Triangle Expressway Subordinate Lien Debt Service Fund by the Trust Agreement.

"Subordinate Lien Derivative Agreement Regularly Scheduled Payments" means any Derivative Agreement Regularly Scheduled Payments with respect to Derivative Indebtedness constituting Subordinate Lien Indebtedness.

"Subordinate Lien Indebtedness" means, collectively, the Subordinate Lien Bonds and Subordinate Lien Parity Debt.

"Subordinate Lien Parity Debt" means all Indebtedness incurred by the Authority in respect of the Triangle Expressway System and not evidenced by Subordinate Lien Bonds which is secured on a parity (as so designated in the Parity Debt Resolution) with the Subordinate Lien Bonds by a pledge, charge and lien upon the Receipts as provided in the Trust Agreement, including, without limiting the generality of the foregoing, as described in "THE TRUST AGREEMENT – Security" below.

"Subordinate Lien Parity Reserve Account" means the account in the Senior Lien Debt Service Fund created and so designated by the Trust Agreement.

"Subordinate Lien Parity Reserve Account Requirement" means the amount required to be placed or maintained in a Subordinate Lien Parity Reserve Account as may be required by the Subordinate Lien Resolution first providing for the funding of the Subordinate Lien Parity Reserve Account. The Subordinate Lien Parity Reserve Account Requirement may be composed of cash, Investment Obligations or Reserve Alternative Instruments, or any combination of the foregoing, as the Authority may determine.

"Subordinate Lien Resolution" means any Supplemental Agreement for Subordinate Lien Bonds or Parity Debt Resolution for Subordinate Lien Parity Debt, or both, as the case may be, authorizing the issuance of a Series of Subordinate Lien Bonds or the incurrence of Subordinate Lien Parity Debt.

"Subordinate Lien Special Reserve Account" means a special debt service reserve account, if any, created by a Subordinate Lien Resolution as a debt service reserve account only for the particular Subordinate Lien Indebtedness authorized thereby.

"Subordinate Lien Special Reserve Account Requirement" means the amount required to be placed or maintained in a Subordinate Lien Special Reserve Account as may be required by the Subordinate Lien Resolution creating such account. The Subordinate Lien Special Reserve Account Requirement may be composed of cash, Investment Obligations or Reserve Alternative Instruments or any combination of the foregoing, as the Authority may determine.

"Supplemental Agreement" means an order or resolution of the Authority authorizing any particular Series of Bonds, together with a supplemental trust agreement executed and delivered by the Authority in connection with the issuance of such Series of Bonds that is required to be executed and delivered by the Trust Agreement prior to the issuance of any such Series.

"Synthetic Fixed Rate" means Synthetic Fixed Rate as defined in the definition of Derivative Indebtedness.

"Synthetic Variable Rate" means Synthetic Variable Rate as defined in the definition of Derivative Indebtedness.

"Term Bonds" means the Bonds of any Series, other than Serial Bonds, that are designated as such in the Supplemental Agreement for such Series.

"Third Supplemental Trust Agreement" means the Third Supplemental Trust Agreement, dated as of December 1, 2018, between the Authority and the Trustee.

"TIFIA Debt Service Fund" means the fund created and designated the North Carolina Turnpike Authority Triangle Expressway TIFIA Debt Service Fund by the Trust Agreement.

"TIFIA Debt Service Account" means the special account in the TIFIA Debt Service Fund created and so designated by the Trust Agreement.

"TIFIA Debt Service Reserve Account" means the special account in the TIFIA Debt Service Fund created and so designated by the Trust Agreement.

\*\*"TIFIA Debt Service Reserve Account Requirement" initially (2009) means \$1,000,000. Thereafter, until the amount on deposit in the TIFIA Debt Service Reserve Account equals 10% of the amount of the Outstanding TIFIA Indebtedness as of June 30 of the previous Fiscal Year, the TIFIA Debt Service Reserve Account Requirement will be an ascending amount computed for each Fiscal Year and will be an amount equal to (i) the TIFIA Debt Service Reserve Account Requirement computed for the prior Fiscal Year, plus (ii) 10% of the amount, if any, the Receipts received in such Fiscal Year exceed the amount projected for such Fiscal Year in the Base Case Projections. When the TIFIA Debt Service Reserve Account Requirement is an amount equal to 10% of the amount of the Outstanding TIFIA Indebtedness as of June 30 of the previous Fiscal Year, the TIFIA Debt Service Reserve Account Requirement will be an amount equal to 10% of the amount of the Outstanding TIFIA Indebtedness as of June 30 of the previous Fiscal Year.\*\*

"TIFIA Indebtedness" means the TIFIA Series 2009 Bond and any additional bonds or other secured loan from the USDOT, as lender, to the Authority, as borrower, pursuant to the Transportation Infrastructure Finance and Innovation Act of 1998, as codified as 23 U.S.C. §601 *et seq.*, as the same may be amended from time to time, with respect to the Triangle Expressway Project, and secured by the pledge, charge and lien on the Receipts in the manner provided in the Trust Agreement.

"TIFIA Loan Agreement" means the TIFIA Loan Agreement, to be entered between the USDOT and the Authority, including any supplements or amendments thereto with respect to the TIFIA Indebtedness evidenced by the TIFIA Series 2009 Bond and any other Loan Agreement or similar instrument executed and delivered by the Authority providing for the incurrence of other TIFIA Indebtedness.

"TIFIA Series 2009 Bond" means the North Carolina Turnpike Authority Triangle Expressway Revenue Bond, TIFIA Series 2009, to be dated the date of issuance thereof, issued by the Authority to the USDOT pursuant to the Trust Agreement hereof to evidence the obligation of the Authority to pay the loan repayments to the USDOT, or its assigns, pursuant to the TIFIA Loan Agreement.

"Traffic Consultant" means any traffic and revenue consultant or firm of traffic and revenue consultants of favorable reputation for skill and experience in performing the duties for which such consultant is required to be employed pursuant to the provisions of the Trust Agreement.

"Triangle Expressway System" means, collectively, Initial Project and any Additional Projects.

"Trust Agreement" means the Trust Agreement, dated as of June 1, 2009, between the Authority and the Trustee, as previously supplemented by the First Supplemental Trust Agreement and the Second Supplemental Trust Agreement and as further supplemented by the Third Supplemental Trust Agreement.

"Trustee" means Wells Fargo Bank, N.A., a national banking association duly organized and existing under the laws of the United States of America and having a designated corporate trust office in Columbia, Maryland.

"Trust Estate" means, collectively, the (a) money and Investment Obligations in the Project Fund (to the extent provided in the Trust Agreement), the Revenue Fund, the Senior Lien Debt Service Fund, the Subordinate Lien Debt Service Fund, the TIFIA Debt Service Fund, the Insurance and Condemnation Award Fund and the General Reserve Fund under the Trust Agreement and Accounts established under the Supplemental Agreements relating to their issuance, except that the Senior Lien Parity Reserve Account will be held solely for the benefit of the Senior Lien Parity Debt secured thereby notwithstanding the provisions relating to Parity Debt and TIFIA Indebtedness in the Trust Agreement, the Subordinate Lien Parity Reserve Account will be held solely for the benefit of the Subordinate Lien Parity Debt secured thereby, the TIFIA Debt Service Reserve Account will be held solely for the benefit of the TIFIA Indebtedness and any fund or account created by a Supplemental Agreement to the extent such Supplemental Agreement expressly excludes such fund or account, (b) the Receipts, except upon the disbursement of Receipts for deposit or credit to NCDOT or for deposit or credit to the Operations and Maintenance Expense Fund, the Operating Reserve Fund or the Renewal and Replacement Fund, (c) unless otherwise provided in a Supplemental Agreement, the rights to the amounts payable to the Authority under any Credit Facility and (d) the rights to amounts payable to the Authority or the Trustee pursuant to any Derivative Agreement.

"USDOT" means the United States Department of Transportation.

## THE TRUST AGREEMENT

# **Project Fund**

A special fund is established with the Trustee and designated the "North Carolina Turnpike Authority Triangle Expressway Project Fund" and within the Project Fund there are established two special accounts designated the "Initial Project Account" and the "Additional Projects Account," respectively. The proceeds of the Series 2009 Bonds were deposited by the Trustee in the Initial Project Account and used for payment of the Costs of the Initial Project. Unless otherwise provided in a Supplemental Agreement, the proceeds of any Series of Bonds to be used for providing any Additional Project will be deposited upon the delivery of such Series of Bonds into a separate subaccount in the Additional Projects Account to be created by the Supplemental Agreement providing for the issuance of the Bonds financing such Additional Project.

The moneys in the Project Fund are held by the Trustee in trust and, pending application to the payment of the refinancing of, the reimbursement for or the Costs of the Initial Project or the Cost of any Additional Project, as the case may be, or transfer as provided in the Trust Agreement or in the Supplemental Agreement, will, to the extent permitted by law, be subject to a lien and charge in favor of the Owners of Bonds issued with respect to the Initial Project or Additional Project and Outstanding under the Trust Agreement and the applicable Supplemental Agreement and will be held for the security of such Owners.

#### **Establishment of Funds**

In addition to the Project Fund, there are established the following funds:

- (a) North Carolina Turnpike Authority Triangle Expressway Revenue Fund;
- (b) North Carolina Turnpike Authority Triangle Expressway Senior Lien Debt Service Fund, in which there are established seven special accounts to be known as the Capitalized Interest Account, the Interest Account, the Principal Account, the Sinking Fund Account, the Redemption Account, the Senior Lien Parity Reserve Account and the Hedging Acquisition Account;
- (c) North Carolina Turnpike Authority Triangle Expressway Subordinate Lien Debt Service Fund, in which there are established six special accounts to be known as the Capitalized Interest Account, the Interest Account, the Principal Account, the Sinking Fund Account, the Redemption Account and the Subordinate Lien Parity Reserve Account;
- (d) North Carolina Turnpike Authority Triangle Expressway Renewal and Replacement Fund;
- (e) North Carolina Turnpike Authority Triangle Expressway TIFIA Debt Service Fund, in which there are established two special accounts to be known as the TIFIA Debt Service Account;
- (f) North Carolina Turnpike Authority Triangle Expressway Operations and Maintenance Expense Fund;
- (g) North Carolina Turnpike Authority Triangle Expressway Operating Reserve Fund;
- (h) North Carolina Turnpike Authority Triangle Expressway General Reserve Fund; and
- (i) North Carolina Turnpike Authority Triangle Expressway Insurance and Condemnation Award Fund.

The Revenue Fund, the Senior Lien Debt Service Fund, the Subordinate Lien Debt Service Fund and the TIFIA Debt Service Fund and the accounts and subaccounts therein and the Insurance and Condemnation Award Fund and the General Reserve Fund will be established with and held by the Trustee. The Renewal and Replacement Fund, the Operations and

Maintenance Expense Fund and the Operating Reserve Fund will be established with and held by a Depositary selected by the Authority.

A Senior Lien Resolution may provide for the creation of a Senior Lien Special Reserve Account for the Senior Lien Indebtedness authorized by such Senior Lien Resolution and for the deposit of moneys to and withdrawal of moneys from such Account. A Senior Lien Special Reserve Account created for any Series of Bonds will be held and maintained by the Trustee; provided, however, that if a Series of Bonds is placed with the purchaser thereof and not publicly offered, then such purchaser or a Depositary may hold the Senior Lien Special Reserve Account created for such Senior Lien Indebtedness as provided for in the Senior Lien Resolution authorizing such Senior Lien Indebtedness.

A Subordinate Lien Resolution may provide for the creation of a Subordinate Lien Special Reserve Account for the Subordinate Lien Indebtedness authorized by such Subordinate Lien Resolution and for the deposit of moneys to and withdrawal of moneys from such Account. A Subordinate Lien Special Reserve Account created for any Series of Bonds will be held and maintained by the Trustee; provided, however, that if a Series of Bonds is placed with the purchaser thereof and not publicly offered, then such purchaser or a Depositary may hold the Subordinate Lien Special Reserve Account created for such Subordinate Lien Indebtedness as provided for in the Subordinate Lien Resolution authorizing such Subordinate Lien Indebtedness.

A Senior Lien Resolution may also provide for the creation of such other funds and accounts, as the Authority may determine, for the Senior Lien Indebtedness authorized by such Senior Lien Resolution. A Subordinate Lien Resolution may also provide for the creation of such other funds and accounts, as the Authority may determine, for the Subordinate Lien Indebtedness authorized by such Subordinate Lien Resolution.

The money in all of the funds, accounts and subaccounts established with and held by the Trustee pursuant to the Trust Agreement will be held in trust and applied as provided in the Trust Agreement and, pending such application, the money in such funds, accounts and subaccounts therein will be subject to a pledge, charge and lien in favor of the Owners of the respective Series of Bonds issued and Outstanding under the Trust Agreement and for the further security of such Owners, except as otherwise provided therein or in any Supplemental Agreement.

Each Supplemental Agreement will provide, to the extent applicable, for the creation of a separate subaccount within the Capitalized Interest Account, the Interest Account, the Principal Account, the Redemption Account and the Sinking Fund Account of the Senior Lien Debt Service Fund or the Subordinate Lien Debt Service Fund, as the case may be, with respect to each Series of Bonds, which subaccounts will bear the designation of such Series of Bonds. A Supplemental Agreement for Senior Lien Bonds may provide that such Senior Lien Bonds authorized thereby may be additionally secured by the Senior Lien Parity Reserve Account or a Senior Lien Special Reserve Account or it may provide that there will not be any debt service reserve fund in respect of such Series of Bonds. If a Series of Senior Lien Bonds is secured by a Senior Lien Special Reserve Account or is not secured by any debt service reserve fund, such Series of Senior Lien Bonds will have no claim on the Senior Lien Parity Reserve Account or any other Senior Lien Special Reserve Account. A Supplemental Agreement for Subordinate Lien Bonds may provide that such Subordinate Lien Bonds authorized thereby may be

additionally secured by the Subordinate Lien Parity Reserve Account or a Subordinate Lien Special Reserve Account or it may provide that there will not be any debt service reserve fund in respect of such Series of Bonds. If a Series of Subordinate Lien Bonds is secured by a Subordinate Lien Special Reserve Account or is not secured by any debt service reserve fund, such Series of Subordinate Lien Bonds will have no claim on the Subordinate Lien Parity Reserve Account or any other Subordinate Lien Special Reserve Account.

Each Parity Debt Resolution for Senior Lien Parity Debt may provide for the creation of such funds and accounts as it may determine, including, without limiting the generality of the foregoing, an account for the payment of interest as mentioned in the Trust Agreement and described in "THE TRUST AGREEMENT – Application of Money in Interest Accounts and Capitalized Interest Accounts" below, an account or accounts for the payment of principal, whether at maturity or pursuant to an amortization requirement, as mentioned in the Trust Agreement and described in "THE TRUST AGREEMENT – Application of Money in Interest Accounts and Capitalized Interest Accounts" below. A Parity Debt Resolution for Senior Lien Parity Debt may provide that the Senior Lien Parity Debt authorized thereby may be additionally secured by the Senior Lien Parity Reserve Account or a Senior Lien Special Reserve Account or it may provide that there will not be any debt service reserve account in respect of such Senior Lien Parity Debt. If Senior Lien Parity Debt is secured by a Senior Lien Parity Debt will have no claim on the Senior Lien Parity Reserve Account.

Each Parity Debt Resolution for Subordinate Lien Parity Debt may provide for the creation of such funds and accounts as it may determine, including, without limiting the generality of the foregoing, an account for the payment of interest as mentioned in the Trust Agreement and described in "THE TRUST AGREEMENT – Application of Money in Interest Accounts and Capitalized Interest Accounts" below, an account or accounts for the payment of principal, whether at maturity or pursuant to an amortization requirement, as mentioned in the Trust Agreement and described in "THE TRUST AGREEMENT – Application of Money in Interest Accounts and Capitalized Interest Accounts" below. A Parity Debt Resolution for Subordinate Lien Parity Debt may provide that the Subordinate Lien Parity Debt authorized thereby may be additionally secured by the Subordinate Lien Parity Reserve Account or a Subordinate Lien Special Reserve Account or it may provide that there will not be any debt service reserve account in respect of such Subordinate Lien Parity Debt. If Subordinate Lien Parity Debt is secured by any debt service reserve account, such Subordinate Lien Parity Debt will have no claim on the Subordinate Lien Parity Reserve Account.

The Authority will provide to the Trustee a certified or otherwise authentic copy of each Parity Debt Resolution and each Derivative Agreement adopted or entered into by the Authority and will otherwise provide the Trustee with such information and documents as the Trustee will request to assure that the Trustee is advised of the payments to be made pursuant to such Parity Debt Resolutions and Derivative Agreements as provided in the Trust Agreement.

# **Application of Receipts**

Except as otherwise expressly provided for in the Trust Agreement, all Receipts will be deposited on a daily basis when received in the Revenue Fund.

All Derivative Agreement Regularly Scheduled Payments received by the Authority will be deposited in the Revenue Fund upon receipt. Any Derivative Agreement Additional Payments received by the Authority from any counterparty under a Derivative Agreement will be deposited in the General Reserve Fund upon receipt. The Authority will provide the Trustee with written schedules of all Derivative Agreement Regularly Scheduled Payments prior to any such deposits in the Reserve Fund.

The Authority has issued the State Appropriation Revenue Bonds pursuant to the State Appropriation Revenue Bond Trust Agreement to pay certain Costs of the Triangle Expressway System not being funded with the proceeds of Bonds and Parity Debt issued under the Trust Agreement. Pursuant to the State Appropriation Revenue Bond Trust Agreement, the Authority has provided that all State Appropriated Revenue will be deposited as received in the Revenue Fund of the State Appropriation Revenue Bond Trust Agreement to be used to pay principal and interest on the State Appropriation Revenue Bonds. The State Appropriation Revenue Bond Trust Agreement further provides that amounts in excess of the amount needed to pay such debt service is to be withdrawn from the State Appropriation Revenue Bond Trust Agreement and deposited to the Revenue Fund under the Trust Agreement. Upon such deposit, but not prior to such deposit, State Appropriated Revenues will constitute "Revenues" and "Receipts" for all purposes of the Trust Agreement including being subject to the lien and pledge of the Trust Estate as provided in the Trust Agreement.

In order to assure that the Authority will have sufficient funds to pay Operating Expenses as the same become due, the Authority and the NCDOT have entered into the O&M Guaranty Agreement, pursuant to which the NCDOT has agreed to provide additional funding for the deposits to be made to the Operating Reserve Fund in the event the Receipts are not sufficient to make the deposits thereto as provided in the Trust Agreement and described in paragraph (k) in "SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS – Application of Receipts" in this Official Statement. In the event that funds from NCDOT are required to make the deposit to the Operating Reserve Fund, the Authority will provide such notices, financial information and additional documentation to NCDOT as may be needed or requested by NCDOT to provide for the timely payment by NCDOT of the amounts needed to fund such deposit. Such payments will be deposited as received to the Operating Reserve Fund and applied as provided in the Trust Agreement and described in "THE TRUST AGREEMENT – Application of Money in the Operating Reserve Fund" below.

In order to assure that the Authority will have sufficient funds to maintain the quality and sustainability of the Triangle Expressway System, the Authority and the NCDOT have entered into the Construction and Renewal and Replacement Agreement, pursuant to which the NCDOT has agreed to provide additional funding for the deposits to be made to the Renewal and Replacement Fund in the event the Receipts are not sufficient to make the deposits thereto as provided in the Trust Agreement and described in paragraph (l) in "SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS – Application of Receipts" in this

Official Statement. In the event that funds from NCDOT are required to make the deposit to the Renewal and Replacement Fund, the Authority will provide such notices, financial information and additional documentation to NCDOT as may be needed or requested to NCDOT to provide for the timely payment by NCDOT of the amounts needed to fund the deposit. Such payments will be deposited as received to the Renewal and Replacement Fund and applied as provided in the Trust Agreement and described in "THE TRUST AGREEMENT – Application of Money in the Operating Reserve Fund" below.

# **Application of Money in Interest Accounts and Capitalized Interest Accounts**

Not later than 10:00 A.M. on each Interest Payment Date, date for the payment of Defaulted Interest or date upon which Bonds are to be redeemed, or on such other date as may be specified in the applicable Supplemental Agreement, the Trustee will withdraw from the applicable subaccount in the respective Interest Accounts and wire transfer to the Bond Registrar, in federal reserve or other immediately available funds, the amounts required for paying interest on the respective Bonds on such Interest Payment Date. The Bond Registrar will remit or otherwise set aside the amount due and payable to the Owners as provided in the Supplemental Agreements.

Unless otherwise provided by a Supplemental Agreement, on the date of issuance of any Series of Bonds, an Authorized Officer will deliver to the Trustee a schedule of transfers to be made from the applicable subaccount in the respective Capitalized Interest Accounts to the applicable subaccount of the respective Interest Accounts. The Trustee will make such transfers as required by the schedule of an Authorized Officer.

If the Authority fails to deposit with the Trustee the amounts required to be deposited in the applicable subaccount of the respective Interest Accounts as provided in the Trust Agreement, or if the balance in the applicable subaccount of the respective Interest Accounts on the Business Day next preceding an Interest Payment Date is insufficient to pay interest coming due on the Bonds on such Interest Payment Date, the Trustee will notify the Authority of the amount of the deficiency and request the Authority to immediately cure such deficiency. Upon failure of the Authority to cure such deficiency and in any event not later than such Interest Payment Date, the Trustee will transfer an amount sufficient to cure the same, drawing only upon funds (a) in the case of Senior Lien Bonds secured by the Senior Lien Parity Reserve Account, from the Senior Lien Parity Reserve Account, (b) in the case of Senior Lien Bonds secured by a Senior Lien Special Reserve Account, from such Senior Lien Special Reserve Account, if any, securing such Series of Senior Lien Bonds, (c) in the case of Subordinate Lien Bonds secured by the Subordinate Lien Parity Reserve Account, from the Subordinate Lien Parity Reserve Account and (d) in the case of Subordinate Lien Bonds secured by a Subordinate Lien Special Reserve Account, from such Subordinate Lien Special Reserve Account, if any, securing such Series of Subordinate Lien Bonds.

## **Application of Money in Principal Account**

Not later than 10:00 A.M. on each Principal Payment Date, the Trustee will withdraw from the applicable subaccount in the respective Principal Accounts and wire transfer to the Bond Registrar, in federal reserve or other immediately available funds, the amount necessary to

pay the principal of the respective Bonds at their respective maturities. The Bond Registrar will remit or otherwise set aside the amount due and payable to the Owners as provided in the Supplemental Agreements.

If on any date there is money in the Principal Account of the Senior Lien Debt Service Fund and no Serial Bonds are then Outstanding or if on any Principal Payment Date money remains therein after the payment of the principal of Serial Bonds then due, the Trustee will withdraw such money therefrom and will apply the same in the following order: (a) deposit into the Sinking Fund Account of the Senior Lien Debt Service Fund the amount then required to be paid thereto by the Authority pursuant to the Trust Agreement, (b) deposit, if and to the extent determined by the Authority, into the Senior Lien Parity Reserve Account or any Senior Lien Special Reserve Account such amounts as may be determined by the Authority in order to make the amounts on deposit therein equal to the Senior Lien Parity Reserve Account Requirement or the Senior Lien Special Reserve Account Requirement, as the case may be, and (c) otherwise make the deposits required by the Trust Agreement.

If on any date there is money in the Principal Account of the Subordinate Lien Debt Service Fund and no Serial Bonds are then Outstanding or if on any Principal Payment Date money remains therein after the payment of the principal of Serial Bonds then due, the Trustee will withdraw such money therefrom and will apply the same in the following order: (a) deposit into the Sinking Fund Account of the Subordinate Lien Debt Service Fund the amount then required to be paid thereto by the Authority pursuant to the Trust Agreement, (b) deposit, if and to the extent determined by the Authority, into the Subordinate Lien Parity Reserve Account or any Subordinate Lien Special Reserve Account such amounts as may be determined by the Authority in order to make the amounts on deposit therein equal to the Subordinate Lien Parity Reserve Account Requirement or the Subordinate Lien Special Reserve Account Requirement, as the case may be, and (c) otherwise make the deposits required by the Trust Agreement.

If the Authority fails to deposit with the Trustee the amounts required to be deposited in the applicable subaccounts of the respective Principal Accounts as provided in the Trust Agreement, or if the balance in the applicable subaccount of the respective Principal Accounts on the Business Day next preceding a Principal Payment Date is insufficient to pay the Principal coming due on the Bonds on such Principal Payment Date, the Trustee will notify the Authority of the amount of the deficiency and request the Authority to immediately cure such deficiency. Upon failure of the Authority to cure such deficiency and in any event not later than such Principal Payment Date, the Trustee will transfer an amount sufficient to cure the same, drawing only upon funds (a) in the case of Senior Lien Bonds secured by the Senior Lien Parity Reserve Account, from the Senior Lien Parity Reserve Account, (b) in the case of Senior Lien Bonds secured by a Senior Lien Special Reserve Account, from such Senior Lien Special Reserve Account, if any, securing such Series of Senior Lien Bonds, (c) in the case of Subordinate Lien Bonds secured by the Subordinate Lien Parity Reserve Account, from the Subordinate Lien Parity Reserve Account and (d) in the case of Subordinate Lien Bonds secured by a Subordinate Lien Special Reserve Account, from such Subordinate Lien Special Reserve Account, if any, securing such Series of Subordinate Lien Bonds.

# **Application of Money in Sinking Fund Account**

Money held for the credit of the subaccounts in the Sinking Fund Account will be applied to the retirement, purchase, redemption or payment of Term Bonds in the manner provided in the applicable Supplemental Agreement.

If the Authority fails to deposit with the Trustee the amounts required to be deposited in the applicable subaccounts of the respective Sinking Fund Accounts as provided in the Trust Agreement, or if the balance in the applicable subaccount of the respective Sinking Fund Accounts on the Business Day next preceding a Principal Payment Date is insufficient to pay the Principal coming due on the Bonds on such Principal Payment Date, the Trustee will notify the Authority of the amount of the deficiency and request the Authority to immediately cure such deficiency. Upon failure of the Authority to cure such deficiency and in any event not later than such Principal Payment Date, the Trustee will transfer an amount sufficient to cure the same, drawing only upon funds (a) in the case of Senior Lien Bonds secured by the Senior Lien Parity Reserve Account, from the Senior Lien Parity Reserve Account, (b) in the case of Senior Lien Bonds secured by a Senior Lien Special Reserve Account, from such Senior Lien Special Reserve Account, if any, securing such Series of Senior Lien Bonds, (c) in the case of Subordinate Lien Bonds secured by the Subordinate Lien Parity Reserve Account, from the Subordinate Lien Parity Reserve Account and (d) in the case of Subordinate Lien Bonds secured by a Subordinate Lien Special Reserve Account, from such Subordinate Lien Special Reserve Account, if any, securing such Series of Subordinate Lien Bonds.

# Deposit and Application of Money in Senior Lien Parity Reserve Account, any Senior Lien Special Reserve Account, Subordinate Lien Parity Reserve Account and any Subordinate Lien Special Reserve Account; Determination of Deficiencies

(a) If a Senior Lien Resolution provides that the Senior Lien Indebtedness incurred thereunder is to be secured by the Senior Lien Parity Reserve Account, the Authority must fund, from the proceeds of such Senior Lien Indebtedness or from any other available sources, concurrently with the delivery of and payment for such Senior Lien Indebtedness, the Senior Lien Parity Reserve Account Requirement. If a Senior Lien Resolution provides that the Senior Lien Indebtedness incurred thereunder is to be secured by a Senior Lien Special Reserve Account, the Authority must fund, from the proceeds of such Senior Lien Indebtedness or from any other available sources, at the time or times and in the manner specified in the applicable Senior Lien Resolution, such Senior Lien Special Reserve Account in an amount equal to the Senior Lien Special Reserve Account Requirement for such Senior Lien Indebtedness.

If a Subordinate Lien Resolution provides that the Subordinate Lien Indebtedness incurred thereunder is to be secured by the Subordinate Lien Parity Reserve Account, the Authority must fund, from the proceeds of such Subordinate Lien Indebtedness or from any other available sources, concurrently with the delivery of and payment for such Subordinate Lien Indebtedness, the Subordinate Lien Parity Reserve Account in an amount equal to the Subordinate Lien Parity Reserve Account Requirement. If a Subordinate Lien Resolution provides that the Subordinate Lien Indebtedness incurred thereunder is to be secured by a Subordinate Lien Special Reserve Account, the Authority must fund, from the proceeds of such

Subordinate Lien Indebtedness or from any other available sources, at the time or times and in the manner specified in the applicable Subordinate Lien Resolution, such Subordinate Lien Special Reserve Account in an amount equal to the Subordinate Lien Special Reserve Account Requirement for such Subordinate Lien Indebtedness.

- The Trustee will use amounts in the Senior Lien Parity Reserve Account (b) to make transfers, or use moneys provided under a Reserve Alternative Instrument to make deposits, in the order specified in the Trust Agreement, in respect of all Senior Lien Indebtedness secured by the Senior Lien Parity Reserve Account, to the appropriate subaccounts of the Interest Account, the Principal Account and the Sinking Fund Account of the Senior Lien Debt Service Fund to remedy any deficiency therein as of any Interest Payment Date or Principal Payment Date (or any earlier date as set forth in a Senior Lien Resolution), or to pay the interest on or the principal of or amortization requirements in respect of any Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account when due, whenever and to the extent the money on deposit for such purposes is insufficient. The Trustee will use amounts in the Subordinate Lien Parity Reserve Account to make transfers, or use moneys provided under a Reserve Alternative Instrument to make deposits, in the order specified in the Trust Agreement, in respect of all Subordinate Lien Indebtedness secured by the Subordinate Lien Parity Reserve Account, to the appropriate subaccounts of the Interest Account, the Principal Account and the Sinking Fund Account of the Subordinate Lien Debt Service Fund to remedy any deficiency therein as of any Interest Payment Date or Principal Payment Date (or any earlier date as set forth in a Subordinate Lien Resolution), or to pay the interest on or the principal of or amortization requirements in respect of any Subordinate Lien Parity Debt secured by the Subordinate Lien Parity Reserve Account when due, whenever and to the extent the money on deposit for such purposes is insufficient. Moneys or Investment Obligations on deposit in the Senior Lien Parity Reserve Account, the Subordinate Lien Parity Reserve Account, any Senior Lien Special Reserve Account or any Subordinate Lien Special Reserve Account will be used to satisfy deficiencies prior to any draw on a Reserve Alternative Instrument.
- The Trustee will use amounts in any Senior Lien Special Reserve Account held by it to make transfers or use moneys provided under a Reserve Alternative Instrument to make deposits, in the order specified in the Trust Agreement, in respect of the particular Senior Lien Indebtedness secured by such Senior Lien Special Reserve Account, to the appropriate subaccounts of the Interest Account, the Principal Account and the Sinking Fund Account of the Senior Lien Debt Service Fund to remedy any deficiency therein as of any Interest Payment Date or Principal Payment Date (or any earlier date as set forth in a Senior Lien Resolution) or to pay the interest on or the principal of or amortization requirement in respect thereof on Senior Lien Parity Debt secured by such Senior Lien Special Reserve Account when due, whenever and to the extent the money on deposit for such purposes is insufficient. The Trustee will use amounts in any Subordinate Lien Special Reserve Account held by it to make transfers or use moneys provided under a Reserve Alternative Instrument to make deposits, in the order specified in the Trust Agreement, in respect of the particular Subordinate Lien Indebtedness secured by such Subordinate Lien Special Reserve Account, to the appropriate subaccounts of the Interest Account, the Principal Account and the Sinking Fund Account of the Subordinate Lien Debt Service Fund to remedy any deficiency therein as of any Interest Payment Date or Principal Payment Date (or any earlier date as set forth in a Subordinate Lien Resolution) or to pay the interest on or the principal of or amortization requirement in respect thereof on Subordinate Lien

Parity Debt secured by such Subordinate Lien Special Reserve Account when due, whenever and to the extent the money on deposit for such purposes is insufficient.

- (d) Any deficiency in the Senior Lien Parity Reserve Account, the Subordinate Lien Parity Reserve Account, any Senior Lien Special Reserve Account and any Subordinate Lien Special Reserve Account resulting from the withdrawal of moneys therein will be made up over the twelve-month period immediately following the month in which such withdrawal is made by monthly deposits of one-twelfth (1/12) of the amount of such deficiency, such deposits to be made pursuant to the Trust Agreement, as applicable. Any deficiency resulting from a draw on a Reserve Alternative Instrument will be made up as provided in such Reserve Alternative Instrument or documentation relating thereto, but any such deficiency must be made up by not later than the final date when such deficiency would have been required to be made up if there had been a withdrawal of moneys from the Senior Lien Parity Reserve Account, the Subordinate Lien Parity Reserve Account, any Senior Lien Special Reserve Account or any Subordinate Lien Special Reserve Account rather than a draw on a Reserve Alternative Instrument. Deficiencies may be satisfied through the deposit of additional moneys or the providing of an additional, or increase in a, Reserve Alternative Instrument.
- (e) Unless a Reserve Alternative Instrument will be in effect, if on any date of valuation pursuant to the Trust Agreement as described in "THE TRUST AGREEMENT Valuation" below, the amount on deposit in the Senior Lien Parity Reserve Account is less than 90% of the Senior Lien Parity Reserve Account Requirement, the Authority will deposit into the Senior Lien Parity Reserve Account monthly one-twelfth (1/12) of the amount required as of such date to bring the amount then on deposit in the Senior Lien Parity Reserve Account up to the Senior Lien Parity Reserve Account Requirement. Any such deficiency may be satisfied through the deposit of additional moneys or the providing of an additional, or increase in a, Reserve Alternative Instrument. Any deficiency in the Subordinate Lien Parity Reserve Account or any Senior Lien Special Reserve Account or Subordinate Lien Special Reserve Account resulting from a valuation of the Investment Obligations therein pursuant to the Trust Agreement as described in "THE TRUST AGREEMENT Valuation" below will be made up as provided in the relevant Senior Lien Resolution or Subordinate Lien Resolution.

# **Application of Money in the Redemption Account**

The Trustee will apply money in the respective Redemption Accounts of the Senior Lien Debt Service Fund and the Subordinate Lien Debt Service Fund, as the case may be, for the purchase or redemption of Senior Lien Bonds or Subordinate Lien Bonds, as applicable, as follows:

(a) Subject to the provisions of clause (c) below, and if instructed to do so in writing by an Authorized Officer, the Trustee will endeavor to purchase and cancel Bonds or portions thereof, whether or not such Bonds or portions thereof are then subject to redemption, at the written direction of an Authorized Officer, provided that the purchase price of each Bond, plus accrued interest to the date of purchase, will not exceed the Redemption Price that would be payable on the next redemption date to the Owners of such Bonds under the provisions of the applicable Supplemental Agreement plus accrued interest to the redemption date if such Bond or such portion thereof were called for redemption on such redemption date from the money in the

applicable subaccount of the Redemption Account. The Trustee will pay the interest accrued on such Bonds or portions thereof to the date of settlement from the applicable subaccount of the respective Interest Account and the purchase price from the applicable subaccount of the respective Redemption Account, but no such purchase will be made by the Trustee from money in the applicable subaccount of the respective Redemption Account within the period of forty-five (45) days immediately preceding any date on which such Bonds or portions thereof are to be redeemed except from moneys other than the moneys set aside in the applicable subaccount of the respective Redemption Account for the redemption of Bonds.

- (b) Subject to the provisions of clause (c) below, the Trustee will call for redemption on a date permitted by the applicable Supplemental Agreement such amount of Bonds or portions thereof as, with the redemption premium, if any, will exhaust the moneys then held in the applicable subaccount of the respective Redemption Account as nearly as may be; provided, however, that not less than Fifty Thousand Dollars (\$50,000) principal amount of Bonds will be called for redemption at any one time unless the Trustee is so instructed by the Authority. The Trustee will pay the accrued interest on the Bonds or portions thereof to be redeemed to the date of redemption from the applicable subaccount of the respective Interest Account or any other available funds of the Authority and the Redemption Price of such Bonds or portions thereof from the applicable subaccount of the respective Redemption Account. On or before the redemption date, the Trustee will withdraw from the applicable subaccounts of the respective Redemption Account and the Interest Account, as applicable, and transfer to the Bond Registrar the respective amounts required to pay the Redemption Price and accrued interest to the redemption date of the Bonds or portions thereof so called for redemption.
- Money in the respective Redemption Accounts may be applied by the Trustee in each Fiscal Year to the purchase or the redemption of Bonds of any one or more Series then Outstanding in accordance with the latest Officer's Certificate filed with the Trustee (i) designating one or more Series of Bonds to be purchased or redeemed, (ii) if more than one Series of Bonds is so designated, setting forth the aggregate principal amount of Bonds of each Series to be purchased or redeemed, and (iii) unless the Supplemental Agreement relating to the Bonds to be redeemed specifies the order of redemption, designating the Bonds to be redeemed within each Series, and if such Bonds are Term Bonds, the years in which future Sinking Fund Requirements are to be reduced as a result of such redemption and the amount of such reduction in each such year. In the event no such certificate is filed and unless the Supplemental Agreement relating to the Bonds to be redeemed specifies otherwise, (A) the Trustee will apply such money to the purchase of one or more Series of Bonds as it will determine or to the redemption of Bonds bearing the highest rate of interest, (B) if Bonds of more than one maturity bear the same interest rate, the Trustee will redeem such Bonds in the inverse order of maturities, and (C) if the Bonds bearing the highest rate of interest are Term Bonds, the Trustee will reduce Sinking Fund Requirements for such Term Bonds in inverse order of the scheduled redemption of such Term Bonds. All Bonds will be redeemed as provided in the applicable Supplemental Agreement.

Money held for the credit of the applicable subaccounts in the respective Redemption Accounts will be applied to the purchase or redemption of Bonds in the manner provided in the applicable Supplemental Agreement.

# **Application of Money in the Operating Reserve Fund**

Moneys held for the credit of the Operating Reserve Fund will be used by the Authority only to pay all or a portion of the cost of any Operating Expenses in accordance with the applicable procedures used in the payment of Operating Expenses or as provided in the Capital Improvements Budget, but only to the extent that amount held in the Operations and Maintenance Expense Fund are not sufficient for such purpose.

In addition to the deposits required by the Trust Agreement as described in paragraph (k) in "SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS – Application of Receipts" in this Official Statement, the Authority will deposit to the credit of the Operating Reserve Fund any amounts received by NCDOT as an Operating Advance pursuant to the terms of the O&M Guaranty Agreement.

#### **General Reserve Fund**

Moneys held for the credit of the General Reserve Fund will be used for any legally available purpose, including, without limitation, the payment of Operating Expenses, the payment of capital improvements, repayment of any amount owed to NCDOT pursuant to the O&M Guaranty Agreement and the Construction and Renewal and Replacement Agreement, the funding of any Non-System Project and the payment of any Derivative Agreement Additional Payments.

In no event will money be released by the Trustee from the General Reserve Fund for an expenditure not related to the Triangle Expressway System or for a Non-System Project unless the Authority will have certified to the Trustee in writing that: (i) the Authority is current on all payments then required to be paid under the TIFIA Loan Agreement and the TIFIA Debt Service Reserve Account is funded at the TIFIA Debt Service Reserve Account Requirement, (ii) all amounts owed to NCDOT under the O&M Guaranty Agreement and the Construction and Renewal and Replacement Agreement have been paid, (iii) the Authority will have delivered a certificate to the Trustee and the USDOT (and the Trustee will have received such certificate) demonstrating that after such release, (x) the Revenues, in each ensuing Fiscal Year as shown in a statement of a Traffic Consultant to be delivered with such certificate, are at least 130% of (1) the Long-Term Debt Service Requirement with respect to all Outstanding Senior Lien Indebtedness, Subordinate Lien Indebtedness and TIFIA Indebtedness for such Fiscal Year and (2) the amounts, if any, to be deposited to the Renewal and Replacement Fund, the Senior Lien Parity Reserve Account, the Subordinate Lien Parity Reserve Account and the TIFIA Debt Service Reserve Account for such Fiscal Year and (y) the Loan Life Coverage Ratio is at least 130%, and (iv) no Event of Default will have occurred and be continuing under the Trust Agreement.

An amount equal to 25% of the amount to be released for a Non-System Project will upon written direction by the Authority be applied to the prepayment of the TIFIA Indebtedness.

# Security

As security for the payment of all Indebtedness issued or incurred under the Trust Agreement and the interest thereon, and as security for the payments of amounts due under any Derivative Agreement, but in each case solely as provided therein, the Authority grants to the Trustee, for the benefit of the Owners and Holders of such indebtedness and the counterparty to any such Derivative Agreement, a pledge, charge and lien upon the Trust Estate.

Any Receipts disbursed by the Trustee for deposit in the Operations and Maintenance Expense Fund, the Operating Reserve Fund or the Renewal and Replacement Fund, and any Receipts disbursed to NCDOT pursuant to the Trust Agreement, will no longer constitute Receipts within the meaning of the Trust Agreement and will no longer be subject to the pledge, charge and lien upon the Trust Estate created by the Trust Agreement.

The pledge, charge and lien upon the Trust Estate will be effective and operate immediately, without any recording or filing of any financing statement or other notice, and the Trustee will have the right to collect and receive the Receipts in accordance with the provisions of the Trust Agreement at all times during the period from and after the date of delivery of the Series 2009 Bonds issued thereunder until all Bonds, Parity Debt, Senior Lien Derivative Agreement Regularly Scheduled Payments, Subordinate Lien Derivative Agreement Regularly Scheduled Payments and TIFIA Indebtedness have been fully paid and discharged, including, without limitation, at all times after the institution and during the pendency of bankruptcy or similar proceedings.

The aforementioned pledge, charge and lien upon the Trust Estate will not inhibit the sale or disposition of any portion of the Triangle Expressway System in accordance with the Trust Agreement and will not impair or restrict the ability of the Authority to invest in securities and other forms of investment, subject to the provisions of the Trust Agreement.

The pledge, charge and lien upon the Trust Estate will be (1) first for the security for the payment of the Owners or Holder of Senior Lien Indebtedness, including the interest thereon, and the payment of any Senior Lien Derivative Agreement Regularly Scheduled Payments, (2) second for the security for the payment of the Subordinate Lien Bonds and Subordinate Lien Parity Debt, including the interest thereon, and the payment of all Subordinate Lien Derivative Agreement Regularly Scheduled Payments, for which such pledge, charge and lien upon the Trust Estate is junior and subordinate to the pledge charge and lien upon the Trust Estate securing the Senior Lien Bonds, the Senior Lien Parity Debt and the Senior Lien Derivative Agreement Regularly Scheduled Payments and (3) third, for the security for the payment of the TIFIA Indebtedness, including the interest thereon, which (other than during any period where such TIFIA Indebtedness will become Senior Lien Bonds pursuant to the Trust Agreement) is junior and subordinate to the pledge charge and lien upon the Trust Estate securing the Senior Lien Bonds, the Senior Lien Parity Debt, the Senior Lien Derivative Agreement Regularly Scheduled Payments, the Subordinate Lien Bonds, the Subordinate Lien Parity Debt and the Subordinate Lien Derivative Agreement Regularly Scheduled Payments.

Notwithstanding any of the foregoing to the contrary, in the case of the occurrence and continuance of a Bankruptcy-Related Event, all TIFIA Indebtedness shall automatically and without notice be deemed to constitute Senior Lien Parity Debt, and the Holder of such TIFIA Indebtedness shall be entitled to all rights of a Holder of Senior Lien Parity Debt, except that the Holders of TIFIA Indebtedness shall have no rights in, or claim to, any amounts held in the Senior Lien Parity Reserve Account or any Senior Lien Special Reserve Account.

# **Security for Deposits**

Any and all money received by the Authority under the provisions of the Trust Agreement will be deposited as received with the Trustee or one or more other Depositaries as provided in the Trust Agreement, and all money so deposited with the Trustee will be trust funds under the terms of the Trust Agreement, and, to the extent permitted by law in the case of the Project Fund, will not be subject to any lien or attachment by any creditor of the Authority.

All money deposited with the Trustee or any Depositary under the Trust Agreement in excess of the amount guaranteed by the Federal Deposit Insurance Corporation or other federal agency will be continuously secured, for the benefit of the Authority and the Owners and Holders of Bonds and Senior Lien Parity Debt, either (a) by lodging with a bank or trust company chosen by the Trustee or Depositary or, if then permitted by law, by setting aside under control of the trust department of the bank or trust company holding such deposit, as collateral security, Government Obligations or other marketable securities eligible as security for the deposit of trust funds under regulations of the Comptroller of the Currency of the United States or applicable State law or regulations, having a market value (exclusive of accrued interest) not less than the amount of such deposit, or (b) if the furnishing of security as provided in clause (a) above is not permitted by applicable law, then in such other manner as may then be required or permitted by applicable State or federal laws and regulations regarding the security for, or granting a preference in the case of, the deposit of trust funds; provided, however, that it will not be necessary for the Trustee or any Depositary to give security for the deposit of any money with it for the payment of the principal of or the redemption premium or the interest on any Bonds, or for the Trustee or any Depositary to give security for any money that will be represented by Investment Obligations purchased under the provisions of described in this clause as an investment of such money.

All money deposited with the Trustee or any Depositary will be credited to the particular fund, account or subaccount to which such money belongs.

## **Investment of Money**

Money held for the credit of all funds, accounts and subaccounts will be continuously invested and reinvested by the Trustee or the Depositaries, whichever is applicable, in Investment Obligations or held as cash to the extent investment or reinvestment in Investment Obligations is not practicable. Except as described below with respect to the disposition of investment income, the particular investments to be made and other related matters in respect of investments may, as to each Series of Bonds, be provided in the applicable Supplemental Agreement.

Except as described below with respect to the Senior Lien Parity Reserve Account, Subordinate Lien Parity Reserve Account and TIFIA Debt Service Reserve Account, Investment Obligations will mature or be redeemable at the option of the holder thereof not later than the respective dates when the money held for the credit of such funds, accounts and subaccounts will be required for the purposes intended.

Investment Obligations in the Senior Lien Parity Reserve Account, Subordinate Lien Parity Reserve Account or TIFIA Debt Service Reserve Account will (a) mature or (b) be redeemable at the option of the holder of such Investment Obligation so that all such Investment Obligations will have an average life of not more than ten (10) years after the date of such investment.

Notwithstanding the forgoing, no Investment Obligations pertaining to any Series in any fund, account or subaccount will mature on a date beyond the latest maturity date of the respective Series of Bonds Outstanding at the time such Investment Obligations are deposited. For purposes of this clause, the maturity date of any repurchase agreement will be deemed to be the stated maturity date of such agreement and not the maturity dates of the underlying obligations.

An Authorized Officer or his designee will give to the Trustee or any Depositary written directions respecting the investment of any money required to be invested under the Trust Agreement, subject, however, to the provisions of the Trust Agreement and described in this clause, and the Trustee or such Depositary will then invest such money as so directed. The Trustee or any Depositary may request additional direction or authorization from the Authorized Officer or his designee in writing with respect to the proposed investment of money under the provisions of the Trust Agreement. Upon receipt of such directions, the Trustee or any Depositary will invest, subject to the provisions of the Trust Agreement, such money in accordance with such directions. If no such directions are given, then any uninvested funds will be invested by the Trustee in Government Obligations having the shortest maturity available, but in no event exceeding a maturity of thirty (30) days from the date of investment in the case of funds held in the Project Fund, and the date funds are required to be used to pay debt service on Bonds or TIFIA Indebtedness in the case of funds held in the Senior Lien Debt Service Fund, the Subordinate Lien Debt Service Fund or the TIFIA Debt Service Fund. The Trustee or any Depositary will have no liability for investments made in accordance with the Trust Agreement.

Investment Obligations acquired with money in or credited to any fund, account or subaccount established under the Trust Agreement will be deemed at all times to be part of such fund, account or subaccount. Any loss realized upon the disposition or maturity of such Investment Obligations will be charged against such funds, accounts or subaccounts. The interest accruing on any such Investment Obligations and any profit realized upon the disposition or maturity of such Investment Obligations will be credited to the particular fund, account or subaccount to which such Investment Obligation relates (and, if such account is part of the Trust Estate, will be subject to the pledge of the Trust Estate in accordance with the Trust Agreement as described in "THE TRUST AGREEMENT – Security" above, except as follows:

Any investment earnings received on amounts deposited in the Senior Lien Debt Service Fund (including the Senior Lien Parity Reserve Account, to the extent that the amount on deposit in the Senior Lien Parity Reserve Account is equal to the Senior Lien Parity Reserve Account Requirement), will be transferred to the Interest Account of the Senior Lien Debt Service Fund. Any investment earnings received on amounts deposited in the Subordinate Lien Parity Reserve Account, to the extent that the amount on deposit in the Subordinate Lien Parity Reserve Account is equal to the Subordinate Lien Parity Reserve Account Requirement, will be transferred to the Revenue Fund. Any investment earnings received on amounts deposited in the

TIFIA Debt Service Reserve Account, to the extent that the amount on deposit in the TIFIA Debt Service Reserve Account is equal to the TIFIA Debt Service Reserve Account Requirement, will be transferred to the Revenue Fund. Any investment earnings on any Special Reserve Account will be transferred or deposited in the manner specified in the Supplemental Agreement or Parity Debt Resolution establishing such Special Reserve Account.

Any such interest accruing and any such profit realized will not be credited or transferred to any other fund, account or subaccount unless there will be no deficiency in the respective fund, account or subaccount. If there will be a deficiency in any fund, account or subaccount, any such interest or profit will remain in such fund, account or subaccount until such deficiency has been made up.

Any such interest accruing and any such profit realized that is required to be transferred to any other fund, account or subaccount will be transferred upon the receipt thereof by the Depositaries or the Trustee, as the case may be, pursuant to the provisions of the Trust Agreement.

The Trustee will sell or reduce to cash a sufficient amount of such Investment Obligations whenever it is necessary to do so to provide money to make any payment from any such fund, account or subaccount in accordance with the provisions of the Trust Agreement. The Trustee will not be liable or responsible for any loss resulting from any such action.

Whenever a transfer of money between two or more of the funds, accounts or subaccounts established under the Trust Agreement is permitted or required, such transfer may be made as a whole or in part by transfer of one or more Investment Obligations at a value determined at the time of such transfer in accordance with the Trust Agreement, provided that the Investment Obligations transferred are those in which money of the receiving fund, account or subaccount could be invested at the date of such transfer.

For purposes of making any investment under the Trust Agreement, the Trustee or any Depositary may consolidate money held by it in any fund, account or subaccount with money in any other fund, account or subaccount. Transfers from any fund, account or subaccount to the credit of any other fund, account or subaccount provided for in the Trust Agreement may be effectuated on the books and records of the Trustee, the Authority or any Depositary without any actual transfer of funds or liquidation of investments. Investment Obligations purchased with consolidated funds will be allocated to each fund, account or subaccount on a pro rata basis in accordance with the initial amount so invested from each such fund, account or subaccount.

Unless otherwise directed by the Authority, Investment Obligations may be purchased by the Trustee or any Depositary through its own investment division or other bank facilities established for such purpose.

#### Valuation

For the purpose of determining the amount on deposit in any fund, account or subaccount, Investment Obligations in which money in such fund, account or subaccount is invested will be valued by the Trustee (a) at face value if such Investment Obligations mature within twelve (12) months from the date of valuation thereof and (b) if such Investment

Obligations mature more than twelve (12) months after the date of valuation thereof, at the price at which such Investment Obligations are redeemable by the holder at its option, if so redeemable, or, if not so redeemable, at the lesser of (i) the cost of such Investment Obligations minus the amortization of any premium or plus the amortization of any discount thereon and (ii) the market value of such Investment Obligations.

All Investment Obligations in all of the funds, accounts and subaccounts created under the Trust Agreement, except the Renewal and Replacement Fund, the Operating Reserve Fund, the Operations and Maintenance Expense Fund and the General Reserve Fund, will be valued as of the last day of each Fiscal Year. When a valuation is made by the Trustee, the Trustee will report the result of such valuation to the Authority within thirty (30) days after such valuation. In addition, Investment Obligations will be valued at any time requested by the Authority on reasonable notice to the Trustee (which period of notice may be waived or reduced by the Trustee); provided, however, that the Trustee will not be required to value Investment Obligations more than once in any calendar month.

Whenever, following a valuation on the last day of each Fiscal Year as described above, the value of the cash and Investment Obligations in the Senior Lien Parity Reserve Account held by the Trustee, plus accrued interest to the date of valuation, is less than 90% of the Senior Lien Parity Reserve Account Requirement, the Trustee will compute the amount by which the Senior Lien Parity Reserve Account Requirement exceeds the balance in the Senior Lien Parity Reserve Account and will immediately give the Authority notice of such deficiency and the amount necessary to cure the same in accordance with the Trust Agreement.

Whenever the value of the cash and Investment Obligations in the Senior Lien Parity Reserve Account held by the Trustee, plus accrued interest to the date of valuation, is greater than the Senior Lien Parity Reserve Account Requirement, the Trustee will compute the amount by which the balance in the Senior Lien Parity Reserve Account exceeds the Senior Lien Parity Reserve Account Requirement, and the Authority will be entitled to transfer such excess to the credit of the Interest Account of the Senior Lien Debt Service Fund or to pay interest on Senior Lien Bonds or Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account in the manner directed by the Authority in an Officer's Certificate filed with the Trustee; provided, however, that nothing in the Trust Agreement will require the Authority to liquidate or sell any Investment Obligation held in the Senior Lien Parity Reserve Account for purposes of making such transfer.

Whenever the value of the cash and Investment Obligations in the Subordinate Lien Parity Reserve Account held by the Trustee, plus accrued interest to the date of valuation, is greater than the Subordinate Lien Parity Reserve Account Requirement, the Trustee will compute the amount by which the balance in the Subordinate Lien Parity Reserve Account exceeds the Subordinate Lien Parity Reserve Account Requirement, and the Authority will be entitled to transfer such excess to the credit of the Interest Account of the Subordinate Lien Debt Service Fund or to pay interest on Subordinate Lien Bonds or Subordinate Lien Parity Debt secured by the Subordinate Lien Parity Reserve Account in the manner directed by the Authority in an Officer's Certificate filed with the Trustee; provided, however, that nothing in the Trust Agreement will require the Authority to liquidate or sell any Investment Obligation held in the Subordinate Lien Parity Reserve Account for purposes of making such transfer.

# Payment of Principal, Interest, Premium and Other Amounts

The Authority will cause to be paid, when due, the principal of (whether at maturity, by redemption or otherwise) and the premium, if any, and interest on the Bonds, Parity Debt and TIFIA Indebtedness and the Derivative Agreement Regularly Scheduled Payments at the places, on the dates and in the manner provided in the Trust Agreement and in the Bonds, Parity Debt and TIFIA Indebtedness and the documentation authorizing and securing such Bonds, Parity Debt and TIFIA Indebtedness and in any Derivative Agreement, according to the true intent and meaning thereof.

The Bonds, Parity Debt and TIFIA Indebtedness are special obligations of the Authority payable solely from the Receipts, the Authority's right to receive the same, and money, Investment Obligations and Reserve Alternative Instruments held in the applicable funds, accounts and subaccounts created under the Trust Agreement for each such Series of Bonds and the income from Investment Obligations in such funds, accounts and subaccounts. The Bonds, Parity Debt and TIFIA Indebtedness will be secured as provided in the Trust Agreement. The Bonds, Parity Debt and TIFIA Indebtedness will not be deemed to a debt, liability or obligation of the State or of any other public body in the State secured by a pledge of the faith and credit of the State or of any other public body in the State, respectively, but will be payable solely from the Receipts and other income or assets pledged under the Trust Agreement. The Authority will not be obligated to pay the principal of, premium, if any, or interest on the Bonds, Parity Debt and TIFIA Indebtedness except from the Receipts and other income or assets pledged under the Trust Agreement, and neither the faith and credit nor the taxing power of the State or of any other public body in the State, including the Authority, is pledged for the payment of the principal of, premium, if any, or interest on the Bonds, Parity Debt and TIFIA Indebtedness. The Authority has no taxing power.

# **Extension of Interest Payment**

If the time for the payment of the interest on any Bond, Parity Debt or TIFIA Indebtedness is extended, whether or not such extension is by or with the consent of the Authority, such interest so extended will not be entitled in case of default under the Trust Agreement to the benefit or security of the Trust Agreement and in such case the Owner of the Bond, Parity Debt or TIFIA Indebtedness for which the time for payment of interest was extended will be entitled only to the payment in full of the principal of all Bonds, Parity Debt and TIFIA Indebtedness then Outstanding and of interest for which the time for payment will not have been extended. The time for the payment of the interest on any Bond or Parity Debt will not be extended in respect of any Bond or Parity Debt covered by a Bond Insurance Policy or Credit Facility without the consent of the Bond Insurer or the Credit Provider.

## **Rate Covenant**

The Authority covenants to fix, charge and collect tolls, fees, rentals and other charges for the use of and for services furnished or to be furnished by the Triangle Expressway System, and that from time to time and as often as it shall appear necessary, to revise such tolls, fees, rentals and other charges as may be necessary or appropriate, in order that for each Fiscal Year, beginning with the first full Fiscal Year in which the Initial Project is in operation, the Revenues

in such Fiscal Year will not be less than 130% of the Long-Term Debt Service Requirement for Senior Lien Indebtedness only for such Fiscal Year.

In addition, the Authority covenants to fix, charge and collect tolls, fees, rentals and other charges for the use of and for services furnished or to be furnished by the Triangle Expressway System, and that from time to time and as often as it shall appear necessary, to revise such tolls, fees, rentals and other charges as may be necessary or appropriate, in order that for each Fiscal Year, beginning with the first full Fiscal Year in which the Initial Project is in operation, the Revenues in such Fiscal Year will not be less than 110% of (x) the Long-Term Debt Service Requirement for Senior Lien Indebtedness, Subordinate Lien Indebtedness and TIFIA Indebtedness for such Fiscal Year and (y) the deposits to be made to the Senior Lien Parity Reserve Account and Subordinate Lien Parity Reserve Account and the TIFIA Debt Service Reserve Account for such Fiscal Year.

In addition, the Authority covenants to fix, charge and collect tolls, fees, rentals and other charges for the use of and for services furnished or to be furnished by the Triangle Expressway System, and that from time to time and as often as it shall appear necessary, to revise such tolls, fees, rentals and other charges as may be necessary or appropriate, in order that for each Fiscal Year, beginning with the first full Fiscal Year in which the Initial Project is in operation, the Loan Life Coverage Ratio will be not less than 130%.

The Authority also covenants to fix, charge and collect tolls, fees, rentals and other charges for the use of and for services furnished or to be furnished by the Triangle Expressway System, and that from time to time and as often as it shall appear necessary, to revise such tolls, fees, rentals and other charges as may be necessary or appropriate, in order that the Receipts will be sufficient in each Fiscal Year to make all of the deposits required for payment of debt service and maintenance of debt service reserves, as described in the Official Statement under the heading "SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS – Application of Receipts."

If the Authority fails to comply with the covenants described above, it shall request a Traffic Consultant to make its recommendations, if any, as to a revision of the Authority's tolls, fees, rentals and charges, its Operating Expenses or the method of operation of the Triangle Expressway System in order to satisfy the foregoing requirements of this Section. Copies of such request and of the recommendations of the Traffic Consultant, if any, shall be filed by the Authority with the Trustee. Promptly upon its receipt of the recommendations of the Traffic Consultant, the Authority shall, after giving due consideration to the recommendations, revise its tolls, fees, rentals and charges or its Operating Expenses or alter its methods of operation, which revisions or alterations need not comply with the Traffic Consultant's recommendations but which are projected by the Authority to result in compliance with the covenants. The Authority and the Traffic Consultant shall advise the Trustee of the actions taken by the Authority with respect to the recommendations of the Traffic Consultant. If the Authority shall comply with all of the recommendations of the Traffic Consultant, failure to comply with the rate covenants shall not constitute an Event of Default under the Trust Agreement. In the event of any failure to comply with the rate covenants and the failure of the Authority to comply with all of the recommendations of the Traffic Consultant, and in addition to the remedies elsewhere provided in the Trust Agreement, the Trustee or the Owners or Holders of not less than 25% in aggregate

principal amount of the Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness then Outstanding may, and the Trustee shall, upon the request of the Owners or Holders of not less than 25% in aggregate principal amount of the Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness then Outstanding and upon being indemnified to its satisfaction, institute and prosecute in a court of competent jurisdiction an appropriate action to compel the Authority to comply with all of the recommendations of the Traffic Consultant in order to satisfy the rate covenants. The Authority covenants that it will adopt and charge tolls, fees, rentals and charges and revise its Operating Expenses or the method of operation of the Triangle Expressway System in compliance with any final order, decree or judgment entered in any such proceeding or modification thereof.

#### **Limitation on Senior Lien Indebtedness**

In addition to the incurrence of Long-Term Senior Lien Indebtedness by meeting the requirements described in the Official Statement under the heading "SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS – Parity and Subordinated Indebtedness," the Authority may incur additional Senior Lien Indebtedness as described in this Section.

Completion Indebtedness constituting Senior Lien Indebtedness may be incurred in an amount not exceeding 5% of the aggregate principal amount of the Long-Term Indebtedness constituting Senior Lien Indebtedness originally incurred by the Authority to finance the costs of the Initial Project or any Additional Project; provided, however, that prior to the incurrence of such Completion Indebtedness, the Authority shall furnish to the Trustee (i) a certificate of a licensed architect or engineer estimating the costs of completing the facilities for which such Completion Indebtedness is to be incurred and (ii) an Officer's Certificate certifying that the amount of such Completion Indebtedness to be incurred will be sufficient, together with other funds, if applicable, to complete construction of the facilities as estimated by the architect or engineer in respect of which such Completion Indebtedness is to be incurred and (iii) evidence that such Senior Lien Indebtedness will be rated at an investment grade rating by such credit rating agency.

Long-Term Indebtedness constituting Senior Lien Indebtedness may be incurred for the purpose of refunding all or any part of any Outstanding Long-Term Indebtedness constituting Senior Lien Indebtedness so as to render it no longer Outstanding if prior to incurrence thereof, an Officer's Certificate is delivered to the Trustee (i) stating that the proceeds of such Long-Term Indebtedness, together with interest earnings on the Defeasance Obligations to be acquired and other available funds, will be sufficient to pay the principal of and interest and any premium on the Long-Term Indebtedness to be refunded to the redemption or maturity date or dates and the expenses incident to the refunding, and (ii) stating that either (A) the Long-Term Debt Service Requirement for any Fiscal Year thereafter on account of all Long-Term Indebtedness constituting Senior Lien Indebtedness to be Outstanding after the incurrence of such Long-Term Indebtedness will not be greater than (1) for Fiscal Years ending prior to the maturity of all TIFIA Indebtedness, the Long-Term Debt Service Requirement on account of all Long-Term Indebtedness constituting Senior Lien Indebtedness Outstanding immediately prior to the incurrence of such Long-Term Indebtedness to accomplish such refunding, including the Long-Term Indebtedness to accomplish such refunding, including the Long-

Term Indebtedness to be refunded and (2) for Fiscal Years ending after the maturity of all TIFIA Indebtedness, 110% of the Long-Term Debt Service Requirement on account of all Long-Term Indebtedness constituting Senior Lien Indebtedness Outstanding immediately prior to the incurrence of such Long-Term Indebtedness to accomplish such refunding, including the Long-Term Indebtedness to be refunded, provided that there is no limit for Fiscal Years beginning after the final maturity date of all Long-Term Indebtedness Outstanding prior to the proposed refunding or (B) the incurrence of such Long-Term Indebtedness to accomplish the refunding will satisfy the requirements of subsection (a) of this Section and (iii) evidence that such Senior Lien Indebtedness will be rated at an investment grade rating by at least one nationally recognized securities credit rating agency.

Short-Term Indebtedness constituting Senior Lien Indebtedness may be incurred if, (i) immediately after the incurrence of such Short-Term Indebtedness, the Outstanding principal amount of all Short-Term Indebtedness constituting Senior Lien Indebtedness does not exceed \$5,000,000; provided, however, that for a period of twenty (20) consecutive calendar days in each Fiscal Year, no such Short-Term Indebtedness shall be Outstanding, (ii) the proceeds of the Short-Term Indebtedness are to be used to pay Operating Expenses, (iii) the Authority is then current in the payment of all debt service then due with respect to all TIFIA Indebtedness and (iv) evidence that such Senior Lien Indebtedness will be rated at an investment grade rating by Fitch, Moody's, S&P or any other nationally recognized securities credit rating agency.

Put Indebtedness constituting Senior Lien Indebtedness may be incurred if prior to the incurrence of such Put Indebtedness (i) the conditions for the incurrence of the Senior Lien Indebtedness are met and (ii) a Credit Facility exists to provide financing sufficient to pay the purchase price or principal of such Put Indebtedness on any date on which the Owner or Holder of such Put Indebtedness may demand payment thereof pursuant to the terms of such Put Indebtedness.

Whenever the Trust Agreement requires a certification for the most recent Fiscal Year preceding the date of incurrence of the Senior Lien Indebtedness in question for which audited financial statements are available, the Authority may, in its discretion, provide a certificate, opinion or report of an independent accountant, in lieu of the audit for such Fiscal Year, on financial statements covering twelve (12) consecutive calendar months of the eighteen (18) full consecutive calendar months preceding the date of incurrence of the Senior Lien Indebtedness in question.

The Authority may enter into Derivative Agreements with respect to Derivative Indebtedness constituting Senior Lien Indebtedness and providing for Derivative Agreement Regularly Scheduled Payments to be made as Senior Lien Derivative Agreement Regularly Scheduled Payments without compliance with any other test under the Trust Agreement.

# **Limitation on Subordinate Lien Indebtedness**

Long-Term Indebtedness constituting Subordinate Lien Indebtedness may be incurred if prior to incurrence there is delivered to the Trustee:

- (i) an Officer's Certificate certifying that the Authority was in compliance with the rate covenants for the most recent Fiscal Year for which audited financial statements are available:
- (ii) a report of a Traffic Consultant stating that for each Fiscal Year next succeeding the date on which such Long-Term Indebtedness is incurred through the final maturity date of any Long-Term Indebtedness, the forecasted Revenues in each such Fiscal Year is at least 120% the Long-Term Debt Service Requirement with respect to all Outstanding Senior Lien Indebtedness, Subordinate Lien Indebtedness and TIFIA Indebtedness (excluding any Long-Term Indebtedness to be refunded by the Long-Term Indebtedness to be incurred) and the Long-Term Indebtedness to be incurred and that the Loan Life Coverage Ratio is a least 130%; and
- (iii) a report of a Traffic Consultant stating that (1) for each Fiscal Year next succeeding the date on which such Long-Term Indebtedness is incurred through the final maturity date of any Long-Term Indebtedness, the forecasted Receipts in each Fiscal Year will be sufficient to make all of the deposits in each such Fiscal Year described in (a) through (g), inclusive, of the Official Statement under the heading "SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS Application of Receipts" and (2) that all Outstanding TIFIA Indebtedness will be fully retired by its final maturity date.

Completion Indebtedness constituting Subordinate Lien Indebtedness may be incurred in an amount not exceeding 5% of the aggregate principal amount of the Long-Term Indebtedness constituting Subordinate Lien Indebtedness originally incurred by the Authority to finance the costs of the Initial Project or any Additional Project; provided, however, that prior to the incurrence of such Completion Indebtedness, the Authority shall furnish to the Trustee (i) a certificate of a licensed architect or engineer estimating the costs of completing the facilities for which such Completion Indebtedness is to be incurred and (ii) an Officer's Certificate certifying that the amount of such Completion Indebtedness to be incurred will be sufficient, together with other funds, if applicable, to complete construction of the facilities as estimated by the architect or engineer in respect of which such Completion Indebtedness is to be incurred.

Long-Term Indebtedness constituting Subordinate Lien Indebtedness may be incurred for the purpose of refunding all or any part of any Outstanding Long-Term Indebtedness constituting Senior Lien Indebtedness or Subordinate Lien Indebtedness so as to render it no longer Outstanding if prior to incurrence thereof, an Officer's Certificate is delivered to the Trustee (i) determining that the proceeds of such Long-Term Indebtedness, together with interest earnings on the Defeasance Obligations to be acquired and other available funds, will be sufficient to pay the principal of and interest and any premium on the Long-Term Indebtedness to be refunded to the redemption or maturity date or dates and the expenses incident to the refunding, and (ii) stating that either (A) the Long-Term Debt Service Requirement for any Fiscal Year thereafter on account of all Long-Term Indebtedness to be Outstanding after the incurrence of such Long-Term Indebtedness will not be greater by more than 10% than the Long-Term Debt Service Requirement on account of all Long-Term Indebtedness Outstanding immediately prior to the incurrence of such Long-Term Indebtedness to accomplish such refunding, including the Long-Term Indebtedness to accomplish such refunding the Long-Term Indebtedness to accomplish such refunding the Long-Term Indebtedness to accomplish the Long-Term Indebtedness

Term Indebtedness to be refunded, or (B) the incurrence of such Long-Term Indebtedness to accomplish the refunding will satisfy the requirements described in the first paragraph of this Section.

Short-Term Indebtedness constituting Subordinate Lien Indebtedness may be incurred if, immediately after the incurrence of such Short-Term Indebtedness, the Outstanding principal amount of all Short-Term Indebtedness constituting Subordinate Lien Indebtedness does not exceed 25% of the General Reserve Fund balance at the end of the most recent Fiscal Year preceding the date of incurrence of such Short-Term Indebtedness for which audited financial statements are available; provided, however, that for a period of twenty (20) consecutive calendar days in each Fiscal Year, no such Short-Term Indebtedness shall be Outstanding.

Put Indebtedness constituting Subordinate Lien Indebtedness may be incurred if prior to the incurrence of such Put Indebtedness (i) the conditions described in the first paragraph of this Section are met and (ii) a Credit Facility exists to provide financing sufficient to pay the purchase price or principal of such Put Indebtedness on any date on which the Owner or Holder of such Put Indebtedness may demand payment thereof pursuant to the terms of such Put Indebtedness.

Whenever the Trust Agreement requires a certification for the most recent Fiscal Year preceding the date of incurrence of the Subordinate Lien Indebtedness in question for which audited financial statements are available, the Authority may, in its discretion, provide a certificate, opinion or report of an independent accountant, in lieu of the audit for such Fiscal Year, on financial statements covering twelve (12) consecutive calendar months of the eighteen (18) full consecutive calendar months preceding the date of incurrence of the Subordinate Lien Indebtedness in question.

Notwithstanding the foregoing, the Authority may enter into Derivative Agreements with respect to Derivative Indebtedness constituting Subordinate Lien Indebtedness and providing for Derivative Agreement Regularly Scheduled Payments to be made as Subordinate Lien Derivative Agreement Regularly Scheduled Payments without compliance with any other requirements under the Trust Agreement.

The Authority agrees that it will not incur any Subordinate Lien Indebtedness while any TIFIA Indebtedness is Outstanding without the consent of the USDOT, except that (i) the Authority may issue Revenue Bond Anticipation Notes constituting Subordinate Lien Indebtedness pursuant to the Trust Agreement in anticipation of repayment thereof from the proceeds of TIFIA Indebtedness and (ii) the Authority may issue Subordinate Lien Indebtedness without the consent of USDOT if the Indebtedness could have been issued as Senior Lien Indebtedness as described above.

# Covenants With Respect to Construction and Operation of the Triangle Expressway System

The Authority covenants to acquire, construct, equip and complete the Initial Project and any Additional Project in conformity with applicable law and all other requirements of all governmental authorities having jurisdiction thereover, and that the Authority will complete the

acquisition, construction and equipping of the Initial Project and any Additional Project with all expedition practicable.

The Authority covenants to establish and enforce reasonable rules and regulations governing the operation and use of the Triangle Expressway System, operate the Triangle Expressway System in an efficient and economical manner, maintain the properties constituting the Triangle Expressway System in good repair and in sound operating condition for so long as the same are necessary for the operation of the Triangle Expressway System, and comply with all valid acts, rules, regulations, orders and directions of any legislative, executive, administrative or judicial body that are applicable to the Triangle Expressway System.

The Authority shall adopt an Annual Budget for the Triangle Expressway System for each Fiscal Year. To the extent possible, the Authority shall prepare its Annual Budget so that it will be possible to determine from such Annual Budget (a) the amount of State Appropriated Revenues budgeted for deposit in the Revenue Fund during such Fiscal Year, (b) the amount of Receipts budgeted for deposit in the Revenue Fund during such year, (c) the amounts to be deposited or paid from Receipts, including the Operating Expenses, (d) the amount of Operating Expenses budgeted to be paid from NCDOT pursuant to the O&M Guaranty Agreement, (e) the amount of any deposits to be made to the Renewal and Replacement Fund from Receipts and (f) the amount of any deposits to be made to the Renewal and Replacement Fund pursuant to the Construction and Renewal and Replacement Agreement.

The Authority shall also adopt a Capital Improvements Budget for the Triangle Expressway System for each Fiscal Year which will show, in addition to such other matters as the Authority may determine to include, (a) the amounts, if any, to be expended during such Fiscal Year from moneys, if any, deposited to the credit of the Project Fund, the Renewal and Replacement Fund or the General Reserve Fund, together with a statement of the purposes for which such amounts are to be expended in each case and (b) the amount estimated by the Authority to be necessary for the renovation, extension, improvement, enlargement, renewal or replacement of the Triangle Expressway System, whether the same are to be commenced, continued or completed during such Fiscal Year or thereafter. The Capital Improvements Budget may be part of the Annual Budget.

The Authority shall keep the funds, accounts, subaccounts, money and investments of the Triangle Expressway System separate from all other funds, accounts, money and investments, if any, of the Authority and shall keep accurate records and accounts of all items of costs and of all expenditures relating to the Triangle Expressway System and of the revenues collected and the application of such revenues. Such records and accounts shall be open to the inspection of the Trustee.

The Authority shall cause its accountant, which may be the State Auditor, to prepare and deliver to the Authority within 180 days after the close of each Fiscal Year an audit of the Authority's books and accounts relating to the Triangle Expressway System. Reports of each such audit shall be filed with the Trustee, the Local Government Commission and the USDOT, and copies of each such report shall be mailed by the Authority to any person requesting the same in writing and shall be made available for inspection at the office of the Chief Financial Officer. Each such audit report shall be accompanied by an opinion of the accountant stating

that the examination of the financial statements was conducted in accordance with generally accepted auditing standards and stating whether such financial statements present fairly the financial position of the Triangle Expressway System and the results of its operations and a statement of cash flows for the period covered by such audit report in conformity with generally accepted accounting principles applied on a consistent basis. If for any reason beyond its control, the Authority is unable to obtain the foregoing opinion as to compliance with generally accepted accounting principles, the Authority shall be deemed to be in compliance with this requirement if it is taking all reasonable and feasible action to obtain such opinion in subsequent Fiscal Years, and if, in lieu of a statement as to compliance and conformity, such opinion states the reasons for such noncompliance or non-conformity.

#### Insurance

The Authority covenants that it will maintain or cause to be maintained a practical insurance program, with reasonable terms, conditions, provisions and costs, which the Authority determines (i) will afford adequate protection against loss caused by damage to or destruction of the Triangle Expressway System or any part thereof and (ii) will provide the Authority reasonable protection from liability for bodily injury and property damage resulting from the construction or operation of the Triangle Expressway System. Furthermore, the Authority covenants that it will maintain use and occupancy insurance covering loss of Receipts by reason of necessary interruption, total or partial, in the use of the facilities of the Triangle Expressway System, due to loss or damage to any such facility in such amount as an Insurance Consultant determines will provide income during a period of interruption of not less than six months and computed on the basis of Revenues for the preceding Fiscal Year (or the estimated Revenues for the current Fiscal Year as estimated by the Insurance Consultant if the Triangle Expressway System was not in operation during the preceding Fiscal Year.

All insurance policies shall be carried by a responsible insurance company or companies, whose claims paying ability is rated at least "A" by S&P, authorized and qualified to assume the risks thereof, or by the North Carolina Department of Insurance. The Authority may also participate in self-insurance programs (except with respect to use and occupancy insurance) so long as the types and levels of such self-insurance programs are determined in writing by an Insurance Consultant to be adequate coverage for the Authority.

#### **Payment of Charges and Covenant Against Encumbrances**

The Authority shall not create or suffer to be created any lien or charge upon the Triangle Expressway System or any part thereof, or on the Receipts, except for Permitted Encumbrances. The Authority shall discharge or cause to be discharged, or shall make adequate provision to satisfy and discharge, within sixty (60) days after the same become due and payable, all lawful costs, expenses, liabilities and charges relating to the maintenance, repair, replacement or improvement of the properties constituting the Triangle Expressway System and the operation of the Triangle Expressway System and lawful claims and demands for labor, materials, supplies or other objects that might by law become a lien upon the Triangle Expressway System or Receipts if unpaid. Nothing contained in this Section shall require the Authority to pay or cause to be discharged, or make provision for the payment, satisfaction and discharge of, any lien, charge,

cost, liability, claim or demand so long as the validity thereof is contested in good faith and by appropriate legal proceedings.

#### **Covenant Against Sale or Disposition**

The Authority covenants that, except as described in this Section, it will not sell, exchange or otherwise dispose of the Triangle Expressway System or any part thereof.

The Authority may from time to time sell, exchange or otherwise dispose of any equipment, motor vehicles, machinery, fixtures, apparatus, tools, instruments or other movable property if it determines that such articles are no longer needed or are no longer useful in connection with the Triangle Expressway System, and the proceeds thereof may be used for any lawful purpose determined by the Authority.

The Authority may from time to time sell, exchange or otherwise dispose of (but not lease, contract or agree for the use thereof) any other property of the Triangle Expressway System if it determines by resolution:

- (a) that the sale, exchange or other disposition thereof would not materially adversely affect the operating efficiency of the Triangle Expressway System and would not materially reduce Receipts; or
- (b) that the sale, exchange or other disposition thereof would not materially adversely affect the ability of the Authority to comply with the rate covenants for the current and next succeeding Fiscal Year.

If the fair market value of any item of real or personal property to be sold, exchanged or otherwise disposed of in any Fiscal Year in accordance with the provisions of this Section shall be in excess of 3% of net property, plant and equipment of the Triangle Expressway System calculated in accordance with generally accepted accounting principles, or if the fair market value of any such item together with the fair market value of all other such items so disposed of in such Fiscal Year shall aggregate in excess of 3% of net property, plant and equipment of the Triangle Expressway System calculated in accordance with generally accepted accounting principles, then no such disposal shall be effected without first obtaining the written approval of a Traffic Consultant of the determinations to be made by the Authority with respect to such disposition under the provisions of this Section.

All buildings, structures and items of personal property that are constructed, placed or installed in or upon the properties constituting the Triangle Expressway System as an addition or improvement to, as a substitute for, or in renewal, replacement or alteration of, any buildings, structures, and personal property constituting part of the Triangle Expressway System, and all real property acquired as an addition to, in replacement of, or as a substitute for real property constituting a part of the Triangle Expressway System shall thereupon become part of the Triangle Expressway System.

The Authority may lease, as lessor, all or any part of the Triangle Expressway System, or contract or agree for the performance by others, of operations or services on or in connection with the Triangle Expressway System or any part thereof, for any lawful purpose, provided, that:

- (a) the Authority shall remain fully obligated and responsible under the Trust Agreement to the same extent as if such lease, contract or agreement, or any amendment or rescission thereof, had not been executed, and
- (b) the obligation of the Authority under such lease, contract or agreement shall not impair the performance of the Authority's obligations under the Trust Agreement.

#### Non-System Projects, Addition of Non-System Projects to the Triangle Expressway System

No Non-System Projects shall be financed by the Authority unless there shall be filed with the Authority and the Trustee:

- (a) an opinion of counsel to the Authority to the effect that the Non-System Project or the indebtedness or other obligations incurred to finance such Non-System Project are not, directly or indirectly, secured by or payable from Receipts or issued under or secured by the Trust Agreement and that the financing of the Non-System Project will not materially conflict with or constitute on the part of the Authority a breach of or default under any of the covenants or provisions of the Trust Agreement,
- (b) a statement, signed by a Traffic Consultant, to the effect that in its opinion the acquisition or construction of such Non-System Project will not materially adversely affect the Receipts or Revenues or impair the operating efficiency of the Triangle Expressway System, and
- (c) a statement, signed by a Traffic Consultant, to the effect that in its opinion the estimated gross revenues to be received from the operation of the Non-System Project will be sufficient to pay the estimated operating and maintenance expenses of such Non-System Project, any debt service or reserve requirements with respect thereto and any other necessary related costs and expenses.

If Non-System Projects are financed by the Authority, the Authority shall put in place necessary measures in order to account for, and keep separate and apart from Receipts and Operating Expenses, the gross revenues received from the operation of such Non-System Projects, as well as the operating and maintenance expenses of such Non-System Projects, any debt service or reserve requirements with respect thereto and any other necessary related costs and expenses.

Upon compliance with the following conditions, the Authority may determine that a Non-System Project shall be redesignated as an Additional Project within the meaning of the Trust Agreement upon which such Non-System Project shall become a part of the Triangle Expressway System:

- (i) the Authority Board shall adopt a resolution redesignating such Non-System Project as an Additional Project and a part of the Triangle Expressway System;
- (ii) there shall be filed with the Trustee a certificate or report of a Traffic Consultant stating that for the last succeeding Fiscal Year for which audited

financial statements are available, the revenues received by the Authority with respect to such Non-System Project (to the extent that such revenues would have constituted Revenues if such Non-System Project were part of the Triangle Expressway System) equaled or exceeded for such period the sum of (A) the operating expenses paid by the Authority with respect to such Non-System Project (to the extent that such operating expenses would have constituted Current Expenses if such Non-System Project were part of the Triangle Expressway System), (B) any additional Current Expenses that would have been incurred by the Authority if such Non-System Project had been a part of the Triangle Expressway System (as estimated by the Traffic Consultant) and (C) a reasonable renewal and replacement reserve deposit with respect to such Non-System Project, as determined by such Traffic Consultant; and

(iii) an Officer's Certificate stating that any outstanding indebtedness relating to such Non-System Project has been duly paid or defeased; provided, however, that the Authority may incur Senior Lien Indebtedness or Subordinate Lien Indebtedness for the purpose of refinancing any outstanding indebtedness incurred to finance a Non-System Project upon compliance with the additional indebtedness limitations described above.

#### **Events of Default**

Each of the following events is an Event of Default under the Trust Agreement:

- (a) payment of the principal of and the redemption premium, if any, on any of the Bonds, is not made when the same are due and payable, either at maturity or by redemption or otherwise:
- (b) payment of the interest on any of the Bonds is not made when the same is due and payable;
- (c) final judgment for the payment of money in excess of \$1,000,000 is rendered against the Triangle Expressway System as a result of the ownership, control or operation of the Triangle Expressway System, and any such judgment is not discharged within one hundred twenty (120) days from the entry thereof or an appeal is not taken therefrom or from the order, decree or process upon which or pursuant to which such judgment will have been granted or entered, in such manner as to stay the execution of or levy under such judgment, order, decree or process or the enforcement thereof;
  - (d) the occurrence of a Bankruptcy-Related Event;
- (e) receipt by the Trustee of written notice from the Holder of any Parity Debt or TIFIA Indebtedness that any event of default has occurred and is continuing under such Parity Debt or Parity Debt Resolution or TIFIA Loan Agreement, including the failure to pay when due and payable the principal of, premium, if any, and interest on such Parity Debt or TIFIA Indebtedness;

- (f) the failure of the State to appropriate the State Appropriated Revenues or a failure of NCDOT to pay a payment required to be paid by NCDOT under the O&M Guaranty Agreement or the Construction and Renewal and Replacement Agreement;
- (g) receipt by the Trustee of written notice from the counterparty under any Derivative Agreement that the Authority has failed to make any Senior Lien Derivative Agreement Regularly Scheduled Payment or Subordinate Lien Derivative Agreement Regularly Scheduled Payment when due; and
- (h) the Authority defaults in the due and punctual performance of any other of the covenants, conditions, agreements and provisions contained in the Bonds or the Trust Agreement, including any Supplemental Agreement, and such default continues for thirty (30) days after receipt by the Authority of a written notice from the Trustee specifying such default and requesting that it be corrected, provided that if prior to the expiration of such 30-day period the Authority institutes action reasonably designed to cure such default, no "Event of Default" will be deemed to have occurred upon the expiration of such 30-day period for so long as the Authority pursues such curative action with reasonable diligence.

#### Remedies

Notwithstanding anything in the Trust Agreement or in any Supplemental Agreement, Parity Debt Resolution or TIFIA Loan Agreement to the contrary, in no event will there be any acceleration of payment of principal of or interest on any Bonds, Parity Debt or TIFIA Indebtedness as a result of the occurrence of any Event of Default under the Trust Agreement or otherwise.

Upon the happening and continuance of any Event of Default, then and in every such case the Trustee may, and upon the written request of the Owners or Holders of not less than 25% in aggregate principal amount of the Bonds, Parity Debt and TIFIA Indebtedness then Outstanding will, proceed (subject to the provisions of the Trust Agreement) to protect and enforce its rights and the rights of the Owners or Holders of the Bonds, Parity Debt and TIFIA Indebtedness under applicable laws and under the Trust Agreement by such suits, actions or special proceedings in equity or at law, or by proceedings in the office of any board or officer having jurisdiction, either for the specific performance of any covenant or agreement contained in the Trust Agreement or in aid or execution of any power therein granted or for the enforcement of any proper legal or equitable remedy, as the Trustee, being advised by counsel, chosen by the Trustee, will deem most effectual to protect and enforce such rights.

In the enforcement of any remedy under the Trust Agreement, the Trustee will be entitled to sue for, enforce payment of and receive any and all amounts then or during any Event of Default becoming, and at any time remaining, due from the Authority for principal, interest or otherwise under any of the provisions of the Trust Agreement or of the Bonds, Parity Debt and TIFIA Indebtedness and unpaid, with interest on overdue payments of principal at the rate or rates of interest specified in such Bonds, Parity Debt and TIFIA Indebtedness, together with any and all costs and expenses of collection and of all proceedings under the Trust Agreement and under such Bonds, Parity Debt and TIFIA Indebtedness, without prejudice to any other right or remedy of the Trustee or of the Owners or Holders of the Bonds, Parity Debt and TIFIA

Indebtedness (except to the extent provided in the Trust Agreement), and to recover and enforce any judgment or decree against the Authority, but solely as provided therein and in such Bonds, Parity Debt and TIFIA Indebtedness, for any portion of such amounts remaining unpaid and interest, costs and expenses as above provided, and to collect (but solely from moneys in the funds and accounts pledged to secure the Bonds, Parity Debt and TIFIA Indebtedness under the provisions of the Trust Agreement and any Supplemental Agreement, Parity Debt Resolution or TIFIA Loan Agreement and any other moneys available for such purpose) in any manner provided by law, the moneys adjudged or decreed to be payable.

If an Event of Default will occur and be continuing, then, unless the same will then be prohibited under applicable law, a court of competent jurisdiction may appoint a receiver to administer and operate the Triangle Expressway System on behalf of the Authority, with full power to pay and to provide for the payment of principal of and interest on the Bonds, Parity Debt and TIFIA Indebtedness and Derivative Agreement Regularly Scheduled Payments as the same will become due, whether at maturity, pursuant to mandatory sinking fund redemption or otherwise, out of the funds and accounts available therefor, and the Operating Expenses of the Triangle Expressway System, to apply Receipts derived from such operation in accordance with the provisions of the Trust Agreement and any Supplemental Agreement, Parity Debt Resolution, TIFIA Loan Agreement or Derivative Agreement, and to take such action to the extent permitted by law to cause to be remedied any Event of Default which will occur or will have occurred and be continuing; and with such other powers, subject to the direction of said court, as are accorded to receivers in general equity cases and under the applicable provisions of the laws of North Carolina; provided, that the power of such receiver to make provisions for the payment of principal of and interest on Bonds, Parity Debt, TIFIA Indebtedness and Derivative Agreement Regularly Scheduled Payments as aforesaid will not be construed as including the power to pledge the general credit of the Authority to such payments. Any appointment of a receiver under the foregoing provision will not, by itself, constitute a separate Event of Default under the Trust Agreement.

#### **Pro Rata Application of Funds**

(a) Anything in the Trust Agreement to the contrary notwithstanding, if at any time the money in the Interest Account, the Principal Account and the Sinking Fund Account of the Senior Lien Debt Service Fund is not sufficient to pay the interest on or the principal of the Senior Lien Indebtedness as the same become due and payable, such money, together with any money then available or thereafter becoming available for such purposes (except for such money that has already been deposited in subaccounts of the Interest Account, Principal Account or Sinking Fund Account for a particular Series of Senior Lien Indebtedness pursuant to the provisions of the Trust Agreement), whether through the exercise of the remedies provided for in the Trust Agreement or otherwise, will be applied, after payment of the reasonable fees and expenses of the Trustee in exercising its rights and remedies under the Trust Agreement:

<u>first</u>: to the payment to the persons entitled thereto of all installments of interest on Senior Lien Indebtedness then due and payable in the order in which such installments became due and payable and, if the amount available will not be sufficient to pay in full any particular installment, then to the payment, ratably according to the amounts due on such installment, to the persons entitled thereto, without any discrimination or preference

except as to any difference in the respective rates of interest specified in such Senior Lien Indebtedness;

second: to the payment to the persons entitled thereto of the unpaid principal of any Senior Lien Indebtedness that will have become due and payable (other than Bonds deemed to have been paid pursuant to the provisions of the Trust Agreement described in "THE TRUST AGREEMENT – Defeasance" below), in the order of their due dates, with interest on the overdue principal at a rate equal to the rate on such Senior Lien Indebtedness, and, if the amount available will not be sufficient to pay in full all of the amounts due on the Senior Lien Indebtedness on any date, together with such interest, then to the payment ratably according to the amount of such principal due on such date, to the persons entitled thereto, without any discrimination or preference; and

<u>third</u>: to the payment of the interest on and the principal of Senior Lien Indebtedness, to the purchase and retirement of Senior Lien Indebtedness, and to the redemption of Senior Lien Indebtedness, all in accordance with the provisions of the Trust Agreement.

(b) Anything in the Trust Agreement to the contrary notwithstanding, if at any time the money in the Interest Account, the Principal Account and the Sinking Fund Account of the Subordinate Lien Debt Service Fund is not sufficient to pay the interest on or the principal of the Subordinate Lien Indebtedness as the same become due and payable, such money, together with any money then available or thereafter becoming available for such purposes (except for such money that has already been deposited in subaccounts of the Interest Account, Principal Account or Sinking Fund Account for a particular Series of Subordinate Lien Indebtedness pursuant to the provisions of the Trust Agreement), whether through the exercise of the remedies provided for in the Trust Agreement or otherwise, will be applied, after payment of the reasonable fees and expenses of the Trustee in exercising its rights and remedies thereunder:

<u>first</u>: to the payment to the persons entitled thereto of all installments of interest on Subordinate Lien Indebtedness then due and payable in the order in which such installments became due and payable and, if the amount available will not be sufficient to pay in full any particular installment, then to the payment, ratably according to the amounts due on such installment, to the persons entitled thereto, without any discrimination or preference except as to any difference in the respective rates of interest specified in such Subordinate Lien Indebtedness;

second: to the payment to the persons entitled thereto of the unpaid principal of any Subordinate Lien Indebtedness that will have become due and payable (other than Bonds deemed to have been paid pursuant to the provisions of the Trust Agreement described in "THE TRUST AGREEMENT – Defeasance" below), in the order of their due dates, with interest on the overdue principal at a rate equal to the rate on such Subordinate Lien Indebtedness, and, if the amount available will not be sufficient to pay in full all of the amounts due on the Subordinate Lien Indebtedness on any date, together with such interest, then to the payment ratably according to the amount of such principal due on such date, to the persons entitled thereto, without any discrimination or preference; and

third: to the payment of the interest on and the principal of Subordinate Lien Indebtedness, to the purchase and retirement of Subordinate Lien Indebtedness, and to the redemption of Subordinate Lien Bonds, all in accordance with the provisions of the Trust Agreement.

(c) Anything in the Trust Agreement to the contrary notwithstanding, if at any time the money in the TIFIA Debt Service Fund is not sufficient to pay the interest on or the principal of all TIFIA Indebtedness as the same become due and payable, such money, together with any money then available or thereafter becoming available for such purposes, whether through the exercise of the remedies provided for in the Trust Agreement or otherwise, will be applied, after payment of the reasonable fees and expenses of the Trustee in exercising its rights and remedies thereunder:

<u>first</u>: to the payment of all installments of interest on the TIFIA Indebtedness then due and payable in the order in which such installments became due and payable and, if the amount available will not be sufficient to pay in full any particular installment, then to the payment, ratably according to the amounts due on such installment, to the persons entitled thereto, without any discrimination or preference except as to any difference in the respective rates of interest specified in such TIFIA Indebtedness;

second: to the payment to the persons entitled thereto of the unpaid principal of any TIFIA Indebtedness that will have become due and payable (other than TIFIA Indebtedness deemed to have been paid pursuant to the provisions of the Trust Agreement described in "THE TRUST AGREEMENT – Defeasance" below), in the order of their due dates, with interest on the overdue principal at a rate equal to the rate on such TIFIA Indebtedness, and, if the amount available will not be sufficient to pay in full all of the amounts due on the TIFIA Indebtedness on any date, together with such interest, then to the payment ratably according to the amount of such principal due on such date, to the persons entitled thereto, without any discrimination or preference.

Whenever money is to be applied by the Trustee pursuant to the provisions (d) of the Trust Agreement described under this clause, such money will be applied by the Trustee at such times and from time to time as the Trustee in its sole discretion will determine, having due regard for the amount of money available for such application and the likelihood of additional money becoming available for such application in the future, (b) setting aside such money as provided in the Trust Agreement in trust for the proper purpose will constitute proper application by the Trustee and (c) the Trustee will incur no liability whatsoever to the Authority, to any Owner or to any other person for any delay in applying any such money so long as the Trustee acts with reasonable diligence, having due regard for the circumstances, and ultimately applies the same in accordance with such provisions of the Trust Agreement as may be applicable at the time of application by the Trustee. Whenever the Trustee exercises such discretion in applying such money, it will fix the date (which will be an Interest Payment Date unless the Trustee will deem another date more suitable) upon which such application is to be made and upon such date interest on the amounts of principal to be paid on such date will cease to accrue. The Trustee will give such notice as it may deem appropriate of the fixing of any such date and will not be required to make payment to the Owner of any Bond until such Bond is surrendered to the Trustee for appropriate endorsement or for cancellation if fully paid.

#### Control of Proceedings; Restrictions Upon Action; Notice of Default

Anything in the Trust Agreement to the contrary notwithstanding, the Owners or Holders of a majority in aggregate principal amount of Bonds, Parity Debt and TIFIA Indebtedness at any time Outstanding will have the right, subject to the provisions of the Trust Agreement, by an instrument or concurrent instruments in writing executed and delivered to the Trustee, to direct the method and place of conducting all remedial proceedings to be taken by the Trustee under the Trust Agreement, provided that such direction will be in accordance with law and the provisions of the Trust Agreement.

Except as provided in the Trust Agreement, no Owner or Holder of Bonds, Parity Debt or TIFIA Indebtedness will have any right to institute any suit, action or proceeding in equity or at law on any Bonds, Parity Debt or TIFIA Indebtedness or for the execution of any trust under the Trust Agreement or for any other remedy hereunder unless such Owner or Holder of Bonds, Parity Debt or TIFIA Indebtedness previously (a) has given to the Trustee written notice of the Event of Default on account of which suit, action or proceeding is to be instituted, (b) has requested the Trustee to take action after the right to exercise such powers or right of action, as the case may be, will have accrued, (c) has afforded the Trustee a reasonable opportunity either to proceed to exercise the powers granted by the Trust Agreement or to institute such action, suit or proceedings in its or their name, and (d) has offered to the Trustee reasonable security and satisfactory indemnity against the costs, expenses and liabilities to be incurred therein or thereby, and the Trustee will have refused or neglected to comply with such request within a reasonable time. Such notification, request and offer of indemnity are declared in every such case, at the option of the Trustee, to be conditions precedent to the execution of the powers and trusts of the Trust Agreement or to any other remedy hereunder. Notwithstanding the foregoing provisions of this clause and without complying therewith, the Owners or Holders of not less than 25% in aggregate principal amount of Bonds, Parity Debt and TIFIA Indebtedness then Outstanding may institute any such suit, action or proceeding in their own names for the benefit of all Owners or Holders of Bonds, Parity Debt and TIFIA Indebtedness. It is understood and intended that, except as otherwise above provided, no one or more Owners or Holders of Bonds, Parity Debt or TIFIA Indebtedness will have any right in any manner whatsoever by his or their action to affect, disturb or prejudice the security of the Trust Agreement or to enforce any right under the Trust Agreement except in the manner provided, that all proceedings at law or in equity will be instituted, had and maintained in the manner therein provided and for the benefit of all Owners and Holders of Bonds, Parity Debt and TIFIA Indebtedness and that any individual rights of action or other right given to one or more of such Owners or Holders by law are restricted by the Trust Agreement to the rights and remedies therein provided.

The Trustee will mail to (a) all Owners of Bonds at their addresses as they appear on the registration books and (b) all Holders of Parity Debt or TIFIA Indebtedness and counterparties under Derivative Agreements providing for Derivative Agreement Regularly Scheduled Payments who will have filed their name with the Trustee for such purpose, written notice of the occurrence of any Event of Default within thirty (30) days after the Trustee has notice of the same pursuant to the provisions of the Trust Agreement that any such Event of Default will have occurred; provided, however that, except upon the happening of an Event of Default specified in the Trust Agreement and described in clauses (a) and (b) in "THE TRUST AGREEMENT – Events of Default" above, the Trustee may withhold such notice to the Owners, Holders and

counterparties under Derivative Agreements if in its opinion such withholding is in the interest of such Owners, Holders and Derivative Agreement counterparties. The Trustee will not be subject to any liability to any such Owner, Holder or Derivative Agreement counterparty by reason of its failure to mail any such notice.

#### **Concerning the Trustee**

Prior to the occurrence of any Event of Default and after the curing of all such Events of Default that may have occurred, the Trustee will perform such duties and only such duties of the Trustee as are specifically set forth in the Trust Agreement. Upon the occurrence and during the continuation of any Event of Default, the Trustee will use the same degree of care and skill in their exercise as a prudent person would exercise or use under the circumstances in the conduct of such person's own affairs.

No provision of the Trust Agreement or any Indebtedness or Derivative Agreement will be construed to relieve the Trustee from liability for its own negligent action, its own negligent failure to act, or its own willful misconduct, except that:

- (a) prior to any such Event of Default under the Trust Agreement, and after the curing of any Event of Default that may have occurred:
  - (i) the duties and obligations of the Trustee will be determined solely by the express provisions of the Trust Agreement, and the Trustee will not be liable except for the performance of such duties and obligations of the Trustee as are specifically set forth in the Trust Agreement, and no implied covenants or obligations will be read into the Trust Agreement against the Trustee and no permissive right of the Trustee under the Trust Agreement will impose any duty on the Trustee to take such action, and
  - (ii) in the absence of willful misconduct on its part, the Trustee may conclusively rely, as to the accuracy of the statements and the correctness of the opinions expressed therein, upon any certificate or opinion furnished to it conforming to the requirements of the Trust Agreement, but in the case of any such certificate or opinion by which any provision thereof is specifically required to be furnished to the Trustee, the Trustee will be under a duty to examine the same to determine whether or not on its face it conforms to the requirements of the Trust Agreement; and
- (b) at all times, regardless of whether or not any such Event of Default will exist:
  - (i) the Trustee will not be liable for any error of judgment made in good faith by a responsible officer or officers of the Trustee unless it will be proved that the Trustee was negligent in ascertaining the pertinent facts, and
  - (ii) the Trustee will not be liable with respect to any action taken or omitted to be taken by it in accordance with the direction of the Owners and Holders of not less than 25% or a majority, as the Trust Agreement will require, in aggregate principal amount of the Bonds, Parity Debt and TIFIA Indebtedness then Outstanding

relating to the time, method and place of conducting any proceeding for any remedy available to the Trustee, or exercising any power conferred upon the Trustee under the Trust Agreement.

None of the provisions contained in the Trust Agreement will require the Trustee to expend or risk its own funds or otherwise incur individual financial liability in the performance of any of its duties or in the exercise of any of its rights or powers.

The Trustee will be under no obligation to institute any suit or to take any remedial proceeding (including, but not limited to, the appointment of a receiver) or to enter any appearance or in any way defend in any suit in which it may be made defendant, or to take any steps in the execution of any of the trusts created by the Trust Agreement or in the enforcement of any rights and powers thereunder, until it will be indemnified to its satisfaction against any and all costs and expenses, outlays and counsel fees and other reasonable disbursements, and against all liability. The Trustee nevertheless may begin suit, or appear in and defend suit, or do anything else in its judgment proper to be done by it as such Trustee, without indemnity, and in such case the Authority, at the request of the Trustee, will reimburse the Trustee from Receipts for all costs, expenses, outlays and counsel fees and other reasonable disbursements properly incurred in connection therewith. If the Authority fails to make such reimbursement, the Trustee may reimburse itself from any money in its possession under the provisions of the Trust Agreement and will be entitled to a preference therefor over any Indebtedness Outstanding.

The Trustee will be under no obligation to effect or maintain insurance or to renew any policies of insurance or to inquire as to the sufficiency of any policies of insurance carried by the Authority, or to report, or make or file claims or proof of loss for, any loss or damage insured against or that may occur, or to keep itself informed or advised as to the payment of any taxes or assessments, or to require any such payment to be made. Except as to the acceptance of the trusts under the Trust Agreement, the Trustee will have no responsibility in respect of the validity or sufficiency of the Trust Agreement, or in respect of the validity of Bonds, Parity Debt and TIFIA Indebtedness or the due issuance or execution and delivery thereof. The Trustee will be under no obligation to see that any duties therein imposed upon the Authority, any Bond Registrar, any consultant, any Depositary (other than a Depositary in which money will have been deposited by the Trustee under the provisions of the Trust Agreement) or any party other than itself, or any covenants therein contained on the part of any party other than itself to be performed, will be done or performed, and the Trustee will be under no obligation for failure to see that any such duties or covenants are so done or performed.

The Trustee will not be liable or responsible because of the failure of the Authority or of any of its employees or agents to make any collections or deposits or to perform any act in the Trust Agreement required of the Authority or because of the loss of any money arising through the insolvency or the act or default or omission of any Depositary (other than the Trustee or a Depositary in which such money will have been deposited by the Trustee under the provisions of the Trust Agreement). The Trustee will not be responsible for the application of any of the proceeds of Bonds or any other money deposited with it and invested, paid out, withdrawn or transferred under the Trust Agreement if such application, investment, payment, withdrawal or transfer will be made in accordance with the provisions of the Trust Agreement. The immunities

and exemptions from liability of the Trustee under the Trust Agreement will extend to its directors, officers, employees and agents.

Except upon the happening of any Event of Default specified in clauses (a), (b), (e) or (f) described in "THE TRUST AGREEMENT – Events of Default" above, or the explicit report of an Event of Default pursuant to the Trust Agreement, the Trustee will not be obliged to take notice or be deemed to have notice of any Event of Default under the Trust Agreement unless specifically notified in writing of such Event of Default by the Authority or the Owners and Holders of not less than 25% in aggregate principal amount of Bonds, Parity Debt and TIFIA Indebtedness then Outstanding.

Subject to the acceptance of appointment by a successor Trustee, the Trustee may resign and thereby become discharged from the trusts created by the Trust Agreement, by notice in writing given to the Authority, and mailed, postage prepaid, at the Trustee's expense, to each Owner and Holder of Bonds and Senior Lien Parity Debt, not less than sixty (60) days before such resignation is to take effect, but such resignation will take effect immediately upon the appointment of a new Trustee under the Trust Agreement if such new Trustee will be appointed before the time limited by such notice and will then accept the trusts under the Trust Agreement.

#### **Supplemental Trust Agreements**

The Authority and the Trustee may, from time to time and at any time, execute and deliver supplemental trust agreements (which supplemental trust agreements will thereafter form a part hereof) as will be substantially consistent with the terms and provisions of the Trust Agreement and, in the opinion of the Trustee, who may rely upon a written opinion of legal counsel, will not materially and adversely affect the interest of the Owners and Holders:

- (a) to cure any ambiguity or formal defect or omission, to correct or supplement any provision in the Trust Agreement that may be inconsistent with any other provision therein, to make any other provisions with respect to matters or questions arising under the Trust Agreement, or to modify, alter, amend, add to or rescind any of the terms or provisions contained in the Trust Agreement, or
- (b) to grant or to confer upon the Trustee, for the benefit of the Owners or Holders, any additional rights, remedies, powers, authority or security that may lawfully be granted to or conferred upon the Owners, the Holders or the Trustee, or
- (c) to add to the provisions of the Trust Agreement other conditions, limitations and restrictions thereafter to be observed, or
- (d) to add to the covenants and agreements of the Authority in the Trust Agreement other covenants and agreements thereafter to be observed by the Authority or to surrender any right or power therein reserved to or conferred upon the Authority, or
- (e) to permit the qualification of the Trust Agreement under any federal statute now or hereafter in effect or under any state blue sky law, and, in connection therewith, if the Authority so determines, to add to the Trust Agreement or any supplemental trust agreement

such other terms, conditions and provisions as may be permitted or required by such federal statute or blue sky law.

At least thirty (30) days prior to the execution and delivery of any supplemental trust agreement for any of the purposes set forth above, the Trustee will cause a notice of the proposed execution and delivery of such supplemental trust agreement to be mailed, postage prepaid, to all Owners of Bonds and Holders of Parity Debt and TIFIA Indebtedness. Such notice will briefly set forth in the nature of the proposed supplemental trust agreement and will state that copies thereof are on file at the designated corporate trust office of the Trustee for inspection by all Owners of Bonds and Holders of Parity Debt and TIFIA Indebtedness. A failure on the part of the Trustee to mail such notice will not affect the validity of such supplemental trust agreement.

The Owners and Holders of not less than a majority in aggregate principal amount of Senior Lien Indebtedness then Outstanding, the Owners and Holders of not less than a majority in aggregate principal amount of the Subordinate Lien Indebtedness then Outstanding and the Owners and Holders of not less than a majority in aggregate principal amount of the TIFIA Indebtedness then Outstanding will have the right, from time to time, anything contained in the Trust Agreement to the contrary notwithstanding, to consent to and approve the execution and delivery of such supplemental trust agreements as are deemed necessary or desirable by the Authority for the purpose of modifying, altering, amending, adding to or rescinding any of the terms or provisions contained in the Trust Agreement or in any supplemental trust agreement; provided, however, that nothing therein contained will permit, or be construed as permitting (a) an extension of the maturity of the principal of or the interest on any Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness without the consent of the Owner or Holder of such Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness, (b) a reduction in the principal amount of any Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness or the redemption premium or the rate of interest on any Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness without the consent of the Owner or Holder of such Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness, (c) the creation of a pledge, charge and lien upon the Receipts other than the pledge, charge and lien created by the Trust Agreement without the consent of all of the Owners and Holders of Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness then Outstanding, (d) a preference or priority of any Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness over any other Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness except as expressly provided by the Trust Agreement without the consent of all of the Owners and Holders of Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness then Outstanding or (e) a reduction in the aggregate principal amount of the any Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness required for consent to such supplemental trust agreement without the consent of all of the Owners and Holders of Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness then Outstanding. For purposes of clauses (a) through (e) of this paragraph, notwithstanding any provisions in the Trust Agreement or in any Supplemental Agreement or Parity Debt Resolution to the contrary, a Bond Insurer or Credit Provider will not be deemed to be the Owner or Holder of Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness.

Nothing contained in the Trust Agreement, however, will be construed as making necessary the approval by Owners or Holders of Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness of the execution and delivery of any supplemental trust agreement as authorized in the Trust Agreement. Furthermore, notwithstanding for the foregoing provisions of this clause, to the extent that the Holders or Owners of Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness, as the case may be, are not "affected" by the proposed supplemental trust agreement as provided in the Trust Agreement described in "THE TRUST AGREEMENT – Senior Lien Indebtedness, Subordinate Lien Indebtedness and TIFIA Indebtedness Affected" below, the consent of such Owners and Holders of not less than a majority in aggregate principal amount of Senior Lien Indebtedness, Subordinate Lien Indebtedness and TIFIA Indebtedness then Outstanding, as the case may be, will not be required as described in the preceding paragraph.

If at any time the Authority and the Trustee determines that it is necessary or desirable to execute and deliver any supplemental trust agreement for any of the purposes described under this clause, the Trustee will cause notice of the proposed supplemental trust agreement to be mailed, postage prepaid, to all Owners Bonds affected thereby at their addresses as they appear on the registration books and to all Holders of Parity Debt and TIFIA Indebtedness affected thereby in accordance with the related Parity Debt Resolution or TIFIA Loan Agreement as of the date of mailing such notice. Such notice will briefly set forth the nature of the proposed supplemental trust agreement and will state that copies thereof are on file at the designated corporate trust office of the Trustee for inspection by all such Owners and Holders of Bonds, Parity Debt and TIFIA Indebtedness. The Trustee will not, however, be subject to any liability to any Owner or Holder of Bonds, Parity Debt or TIFIA Indebtedness by reason of its failure to cause the notice required by the Trust Agreement to be mailed, and any such failure will not affect the validity of such supplemental trust agreement when consented to and approved as provided in the Trust Agreement.

Whenever, at any time within three (3) years after the date of the mailing of such notice, the Authority delivers to the Trustee an instrument or instruments in writing purporting to be executed by the Owners or Holders of not less than a majority in aggregate principal amount of Senior Lien Indebtedness, Subordinate Lien Indebtedness and TIFIA Indebtedness then Outstanding that are affected by a proposed supplemental trust agreement, which instrument or instruments will refer to the proposed supplemental trust agreement described in such notice and will specifically consent to and approve the execution and delivery thereof in substantially the form of the copy thereof referred to in such notice, thereupon, but not otherwise, the Authority and the Trustee may execute and deliver such supplemental trust agreement in substantially such form, without liability or responsibility to any Owner or Holder of any Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness whether or not such Owner or Holder will have consented thereto.

If the Owners or Holders of not less than a majority in aggregate principal amount of any Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness then Outstanding at the time of the execution and delivery of such supplemental trust agreement and that are affected, as defined in the Trust Agreement and described in "THE TRUST AGREEMENT — Senior Lien Indebtedness, Subordinate Lien Indebtedness and TIFIA

Indebtedness Affected" below, by a proposed supplemental trust agreement have consented to and approved the execution and delivery thereof as provided in the Trust Agreement, to the extent permitted by law, no Owner or Holder of any Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness will have any right to object to the execution and delivery of such supplemental trust agreement, to object to any of the terms and provisions contained therein or the operation thereof, to question the propriety of the execution and delivery thereof, or to enjoin or restrain the Authority and the Trustee from executing and delivering the same or from taking any action pursuant to the provisions thereof.

# Senior Lien Indebtedness, Subordinate Lien Indebtedness and TIFIA Indebtedness Affected

For purposes of the Trust Agreement, Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness will be deemed to be "affected" by a supplemental trust agreement if the same adversely affects or diminishes the rights of the Owners or Holders of such Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness against the Authority or the rights of such Owners or Holders in the security for such Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness. The Trustee who may rely upon a written opinion of legal counsel, may in its discretion determine whether any Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness would be affected by any supplemental trust agreement, and any such determination will be conclusive upon the Owners and Holders of all Senior Lien Indebtedness, Subordinate Lien Indebtedness or TIFIA Indebtedness, whether theretofore or thereafter issued or incurred. The Trustee will not be liable for any such determination made in good faith.

#### **Defeasance**

#### When:

- (a) the Bonds, Parity Debt and TIFIA Indebtedness secured by the Trust Agreement will have become due and payable in accordance with their terms or otherwise as provided in the Trust Agreement, and the whole amount of the principal and the interest and premium, if any, and other amounts so due and payable thereon will be paid; and
- (b) if the Bonds, Parity Debt and TIFIA Indebtedness will not have become due and payable in accordance with their terms, the Trustee or any Bond Registrar will hold, sufficient (i) money or (ii) Defeasance Obligations or a combination of (i) and (ii) of this clause (b), the principal of and the interest on which, when due and payable, will provide sufficient money to pay the principal of, and the interest and redemption premium, if any, on all Bonds, Parity Debt and TIFIA Indebtedness then Outstanding to the maturity date or dates of such Bonds, Parity Debt and TIFIA Indebtedness or to the date or dates specified for the redemption thereof, as verified by a verification agent acceptable to the Trustee; and
- (c) if Bonds, Parity Debt or TIFIA Indebtedness are to be called for redemption or prepayment, irrevocable instructions to call the Bonds, Parity Debt or TIFIA Indebtedness for redemption or prepayment will have been given by the Authority to the Trustee; and

(d) sufficient funds will also have been provided or provision made for paying all other obligations payable under the Trust Agreement by the Authority, including any Derivative Agreement Regularly Scheduled Payments;

then and in that case the right, title and interest of the Trustee in the funds, accounts and subaccounts mentioned in the Trust Agreement will thereupon cease, determine and become void and, upon being furnished with an opinion, in form and substance satisfactory to the Trustee, of counsel approved by the Trustee, to the effect that all conditions precedent to the release of the Trust Agreement have been satisfied, the Trustee will release the Trust Agreement and will execute such documents to evidence such release as may be required by such counsel, and the Trustee will turn over to the Authority any surplus in, and all balances remaining in, all funds, accounts and subaccounts other than money held for the redemption or payment of Bonds, Parity Debt or TIFIA Indebtedness. Otherwise, the Trust Agreement will be, continue and remain in full force and effect; provided, however, that in the event Defeasance Obligations will be deposited with and held by the Trustee or the Bond Registrar as provided in the Trust Agreement, (i) in addition to the requirements set forth in the Trust Agreement with respect to redemption, the Trustee, within thirty (30) days after such Defeasance Obligations will have been deposited with it, will cause a notice signed by the Trustee to be mailed, postage prepaid, to all Owners and to all Holders of Bonds, Parity Debt and TIFIA Indebtedness, setting forth (a) the date or dates, if any, designated for the redemption of the Bonds, Parity Debt or TIFIA Indebtedness, (b) a description of the Defeasance Obligations so held by it, and (c) that the Trust Agreement has been released in accordance with the provisions of the Trust Agreement, and (ii) (a) the Trustee will nevertheless retain such rights, powers and privileges under the Trust Agreement as may be necessary and convenient in respect of the Bonds, Parity Debt and TIFIA Indebtedness for the payment of the principal, interest and any premium for which such Defeasance Obligations have been deposited and (b) each Bond Registrar will retain such rights, powers and privileges under the Trust Agreement as may be necessary and convenient for the registration, transfer and exchange of Bonds; provided, however, that failure to mail such notice to any Owner or to the Owners, or to any such Holder or to such Holders, or any defect in such notice so mailed, will not affect the validity of the release of the Trust Agreement.

All money and Defeasance Obligations held by the Trustee or any Bond Registrar pursuant to the Trust Agreement will be held in trust and applied to the payment, when due, of the obligations payable therewith.

#### (e) Treatment of Derivative Agreements

Anything in the Trust Agreement to the contrary notwithstanding, the counterparty under any Derivative Agreement providing for Senior Lien Derivative Agreement Regularly Scheduled Payments, Subordinate Lien Derivative Agreement Regularly Scheduled Payments or otherwise will have no rights under the Trust Agreement to direct the method and place of conducting any remedial proceedings to be taken by the Trustee thereunder and will have no voting rights with respect thereto or for any other purpose under the Trust Agreement, but will only have the right to enforce those specific rights granted to such counterparties under the Trust Agreement, including, without limitation, those rights with respect to the application of moneys in the Revenue Fund.

#### THE THIRD SUPPLEMENTAL TRUST AGREEMENT

#### **Establishment of Subaccounts**

The following Subaccounts of the accounts of the Senior Lien Debt Service Fund are established by the Third Supplemental Trust Agreement:

- (a) Series 2018 Subaccount of the Interest Account;
- (b) Series 2018 Subaccount of the Principal Account; and
- (c) Series 2018 Subaccount of the Redemption Account.

The subaccounts mentioned above will be established with and held by the Trustee pursuant to the Trust Agreement and the Third Supplemental Trust Agreement.

#### **Receipts**; Proceeds

- (a) The Trustee will deposit or cause to be deposited, from Receipts held in the Revenue Fund, to the various accounts and subaccounts specified in the Third Supplemental Trust Agreement the amounts provided by the Trust Agreement and described in "SECURITY AND SOURCES OF PAYMENT FOR THE SERIES 2018 BONDS Application of Receipts" in this Official Statement.
- (b) The Trustee will deposit to the Series 2018 Subaccount of the Redemption Account all amounts as will be delivered to the Trustee by the Authority from time to time with instructions that such amounts be so deposited.

#### **Application of Money in the Series 2018 Subaccount of the Redemption Account**

The Trustee will apply money in the Series 2018 Subaccount of the Redemption Account to the purchase or redemption of Series 2018 Bonds as follows:

- (a) Subject to the provisions of paragraph (c) below, the Trustee will endeavor to purchase and cancel Series 2018 Bonds or portions thereof, regardless of whether such Bonds or portions thereof are then subject to redemption, at the direction of an Authorized Officer, provided that the purchase price of each Series 2018 Bond will not exceed the Redemption Price that would be payable on the next redemption date to the Owner of such Series 2018 Bond under the provisions of the applicable Series 2018 Subaccount of the Redemption Account. The Trustee will pay the interest accrued on such Bonds or portions thereof to the date of settlement from the Series 2018 Subaccount of the Interest Account and the purchase price from the Series 2018 Subaccount of the Redemption Account, but no such purchase will be made by the Trustee from money in the Series 2018 Subaccount of the Redemption Account within the period of forty-five (45) days immediately preceding any date on which such Series 2018 Bonds or portions thereof are to be redeemed.
- (b) Subject to the provisions of paragraph (c) below, the Trustee will call for redemption on a date permitted by the Third Supplemental Trust Agreement such amount of

Series 2018 Bonds or portions thereof as, with the redemption premium, if any, will exhaust the money then held in the Series 2018 Subaccount of the Redemption Account as nearly as may be practicable; provided, however, that not less than Fifty Thousand Dollars (\$50,000) in principal amount of the Series 2018 Bonds will be called for redemption at any one time unless the Trustee is so instructed by the Authority. The Trustee will pay the accrued interest on the Series 2018 Bonds or portions thereof to be redeemed to the date of redemption from the Series 2018 Subaccount of the Interest Account and the Redemption Price of such Bonds or portions thereof from the Series 2018 Subaccount of the Redemption Account. The Trustee will withdraw from the Series 2018 Subaccount of the Redemption Account and set aside the respective amounts required to pay the Redemption Price of the Series 2018 Bonds or portions thereof so called for redemption.

(c) Money in the Series 2018 Subaccount of the Redemption Account will be applied by the Trustee in each Fiscal Year to the purchase or the redemption of Series 2018 Bonds then Outstanding in accordance with the latest Officer's Certificate filed with the Trustee designating the Series 2018 Bonds to be redeemed. In the event no such certificate is filed (i) the Trustee will apply such money to the purchase of Series 2018 Bonds bearing the highest rate of interest and (ii) if Series 2018 Bonds of more than one maturity bear the same interest rate, the Trustee will redeem such Series 2018 Bonds in the inverse order of maturities.

Upon the retirement of any Series 2018 Bonds by purchase or redemption, pursuant to the provisions of the Third Supplemental Trust Agreement, the Trustee will file with the Authority a statement identifying such Series 2018 Bonds and setting forth the date of purchase or redemption, the amount of the purchase price or the Redemption Price of such Bonds and the amount paid as interest thereon. The expenses incurred by the Trustee in connection with the purchase or redemption of any such Series 2018 Bonds will be paid by the Authority from the Revenue Fund or from any other available moneys.

#### Payment of Principal, Interest and Premium and Pledge of Receipts

The Authority covenants that it will promptly pay the principal of and the interest on every Series 2018 Bond issued under the provisions of the Third Supplemental Trust Agreement at the places, on the dates and in the manner provided therein and in said Series 2018 Bonds, and any premium required for the retirement of said Series 2018 Bonds by purchase or redemption, according to the true intent and meaning thereof. The Authority further covenants that it will faithfully perform at all times all of its covenants, undertakings and agreements contained in the Third Supplemental Trust Agreement and the Trust Agreement, or in any Series 2018 Bond executed, authenticated and delivered under the Third Supplemental Trust Agreement or in any proceedings of the Authority pertaining thereto. The Authority represents and covenants that (a) it is duly authorized under the Constitution and laws of the State, particularly the Act, to issue the Series 2018 Bonds authorized hereby and to pledge the Receipts in the manner and to the extent in the Third Supplemental Trust Agreement and in the Trust Agreement set forth, (b) all action on its part for the issuance of the Series 2018 Bonds has been duly and effectively taken and (c) such Series 2018 Bonds in the hands of the Owners thereof are and will be valid and binding special obligations of the Authority payable according to their terms.

#### **Supplemental Trust Agreements**

The Authority may, from time to time and at any time, execute and deliver such trust agreements supplemental to the Third Supplemental Trust Agreement (which supplemental trust agreements will thereafter form a part hereof) as will be substantially consistent with the terms and provisions of the Third Supplemental Trust Agreement and, in the opinion of the Trustee, who may rely upon a written opinion of legal counsel, will not materially and adversely affect the interest of the Owners:

- (a) to cure any ambiguity or formal defect or omission, to correct or supplement any provision in the Third Supplemental Trust Agreement that may be inconsistent with any other provision therein, to make any other provisions with respect to matters or questions arising under the Third Supplemental Trust Agreement or to modify, alter, amend, add to or rescind any of the terms or provisions contained in the Third Supplemental Trust Agreement;
- (b) to grant or to confer upon the Trustee for the benefit of the Owners any additional rights, remedies, powers, authority or security that may lawfully be granted to or conferred upon the Owners or the Trustee;
- (c) to add to the covenants and agreements of the Authority in the Third Supplemental Trust Agreement other covenants and agreements thereafter to be observed by the Authority or to surrender any right or power herein reserved to or conferred upon the Authority;
- (d) to permit the qualification of the Third Supplemental Trust Agreement under any federal statute now or hereafter in effect or under any state Blue Sky law, and, in connection therewith, if the Authority so determines, to add to the Third Supplemental Trust Agreement or any supplemental trust agreement such other terms, conditions and provisions as may be permitted or required by such federal statute or Blue Sky law; or
  - (e) to provide for the issuance of Series 2018 Bonds in bearer form.

At least thirty (30) days prior to the execution and delivery of any supplemental trust agreement for any of the purposes described under this clause, the Trustee will cause at the Authority's expense a notice of the proposed supplemental trust agreement to be mailed first-class, postage prepaid, to the Local Government Commission and to all Owners of the Series 2018 Bonds. Such notice will briefly set forth the nature of the proposed supplemental trust agreement and will state that copies thereof are on file at the designated corporate trust office of the Trustee for inspection by all Owners of the Series 2018 Bonds. A failure on the part of the Trustee to mail such notice will not affect the validity of such supplemental trust agreement.

Subject to the terms and provisions contained in the Third Supplemental Trust Agreement and described under this clause, and not otherwise, the Owners of not less than a majority in aggregate principal amount of the Series 2018 Bonds then Outstanding that will be affected, as defined in the Trust Agreement, by a proposed supplemental trust agreement will have the right, from time to time, anything contained in the Third Supplemental Trust Agreement to the contrary notwithstanding, to consent to and approve the execution and delivery by the Authority and the Trustee of such supplemental trust agreement as will be deemed necessary or desirable

by the Authority for the purpose of modifying, altering, amending, adding to or rescinding any of the terms or provisions contained in the Third Supplemental Trust Agreement or in any supplemental trust agreement; provided, however, that nothing therein contained will permit, or be construed as permitting (a) an extension of the maturity of the principal of or the interest on any Series 2018 Bond without the consent of the Owner of such Series 2018 Bond, (b) a reduction in the principal amount of any Series 2018 Bond or the redemption premium or the rate of interest thereon without the consent of the Owner of such Series 2018 Bond, (c) the creation of a pledge, charge and lien upon the Receipts other than the pledge, charge and lien created by the Trust Agreement without the consent of all Owners of the Series 2018 Bonds then Outstanding, (d) a preference or priority of any Series 2018 Bond over any other Series 2018 Bond without the consent of all Owners of the Series 2018 Bonds then Outstanding, or (e) a reduction in the aggregate principal amount of Series 2018 Bonds required for consent to such supplemental trust agreement without the consent of all Owners of the Series 2018 Bonds then Outstanding. Nothing contained in the Third Supplemental Trust Agreement, however, will be construed as making necessary the approval by the Owners of the execution and delivery of any supplemental trust agreement as authorized in the Third Supplemental Trust Agreement.

The Trustee will, at the expense of the Authority, such expense to be paid from the Revenue Fund or from any other available moneys and cause notice of the proposed supplemental trust agreement to be mailed, postage prepaid, to the Local Government Commission and all Owners of the Series 2018 Bonds as of the date such notice is mailed. Such notice will briefly set forth the nature of the proposed supplemental trust agreement and will state that copies thereof are on file at the principal corporate trust office of the Trustee for inspection by all Owners. The Trustee will not, however, be subject to any liability to any Owner by reason of its failure to mail such notice, and any such failure will not affect the validity of such supplemental trust agreement when approved and consented to as provided in the Third Supplemental Trust Agreement.

Whenever, at any time within three (3) years after the date of the mailing of such notice, the Authority will deliver to the Trustee an instrument or instruments in writing purporting to be executed by the Owners of not less than a majority in aggregate principal amount of Series 2018 Bonds then Outstanding that are affected, as defined in the Third Supplemental Trust Agreement, by a proposed supplemental trust agreement, which instrument or instruments will refer to the proposed supplemental trust agreement described in such notice and will specifically consent to and approve the execution and delivery thereof in substantially the form of the copy thereof referred to in such notice, thereupon, but not otherwise, the Authority and the Trustee may execute and deliver such supplemental trust agreement in substantially such form, without liability or responsibility to any Owner, whether or not such Owner will have consented thereto.

If the Owners of not less than a majority in aggregate principal amount of the Series 2018 Bonds Outstanding at the time of the execution and delivery of such supplemental trust agreement and that are affected, as defined in the Third Supplemental Trust Agreement, by a proposed supplemental trust agreement have consented to and approved the execution and delivery thereof as therein provided, to the extent permitted by law, no Owner will have any right to object to the execution and delivery of such supplemental trust agreement, to object to any of the terms and provisions contained therein or the operation thereof, to question the propriety of

the execution and delivery thereof, or enjoin or restrain the Authority or the Trustee from executing and delivering the same or from taking any action pursuant to the provisions thereof.

Upon the execution and delivery of any supplemental trust agreement pursuant to the provisions of the Third Supplemental Trust Agreement, the Third Supplemental Trust Agreement will be and be deemed to be modified and amended in accordance therewith, and the respective rights, duties and obligations under the Third Supplemental Trust Agreement of the Authority, the Trustee, all Owners and the Bond Insurer with respect to the Series 2017 Bonds and the Series 2018 Bonds will thereafter be determined, exercised and enforced in all respects pursuant to the provisions of the Third Supplemental Trust Agreement, as so modified and amended.

#### **Provisions Relating to the Bond Insurer**

Under the Third Supplemental Trust Agreement, Assured Guaranty Municipal Corp., the Bond Insurer with respect to the Insured Series 2018 Bonds (the "Series 2018 Bond Insurer") has certain rights unless waived by the Bond Insurer in writing including the following:

- (i) The Series 2018 Bond Insurer shall be deemed to be the sole holder of the Insured Series 2018 Bonds for the purpose of exercising any voting right or privilege or giving any consent or direction or taking any other action that the holders of the Insured Series 2018 Bonds are entitled to take pursuant to the Trust Agreement pertaining to (i) defaults and remedies and (ii) the duties and obligations of the Trustee.
- (ii) The Series 2018 Bond Insurer shall, to the extent it makes any payment of principal of or interest on the Insured Series 2018 Bonds, become subrogated to the rights of the recipients of such payments in accordance with the terms of the Bond Insurance Policy for the Series 2018 Bonds (which subrogation rights shall also include the rights of any such recipients in connection with any Insolvency Proceeding).
- (iii) The Traffic Consultant is CDM Smith Inc. In the event that the Authority determines to consider engaging the services of another Traffic Consultant (or any successor thereto), the Authority shall advise the Series 2018 Bond Insurer and shall provide the Series 2018 Bond Insurer with the names of at least three firms that the Authority may engage to provide the services of a Traffic Consultant. Thereafter, unless the Series 2018 Bond Insurer objects within thirty days to the use of any of the firms proposed as the Traffic Consultant (in which event the Authority shall propose an alternative firm for approval), the Authority may engage any of the firms so proposed to be the Traffic Consultant.
- (iv) The Series 2018 Bond Insurer shall be given written notice of any amendment of the Trust Agreement or the Third Supplemental Trust Agreement that does not require the consent of the Owners. Any amendments to the Trust Agreement or the Third Supplemental Trust Agreement that do require the consent of the Owners shall also require the consent of the Series 2018 Bond Insurer.

#### **Amendments to Prior Trust Agreement and Prior Supplemental Trust Agreements**

Upon purchase of the Series 2018 Bonds, the Holders thereof are deemed to have consented to the terms of the Third Supplemental Trust Agreement. Based in part on an opinion of legal counsel, pursuant to the provisions of the Original Trust Agreement, the First Supplemental Trust Agreement and the Second Supplemental Trust Agreement, the following amendments to the Prior Trust Agreement are being made:

- (a) Subsection (g) of Section 503 of the Original Trust Agreement, which directs how Receipts in the Revenue Fund are to be credited to the TIFIA Debt Service Account, is modified to read as follows:
  - "(g) so long as TIFIA Indebtedness has not become Senior Lien Bonds pursuant to Section 213 hereof, to the credit of the TIFIA Debt Service Account of the TIFIA Debt Service Fund an amount equal to the sum of (i) the amount of interest payable on any Outstanding TIFIA Indebtedness on the next Interest Payment Date for such TIFIA Indebtedness (if such Interest Payment Date is within seven months of such deposit) divided by the number of deposits to be made to the TIFIA Debt Service Account with respect to interest on such TIFIA Indebtedness on or prior to such Interest Payment Date and (ii) principal as due pursuant to the applicable TIFIA Loan Agreement."
- (b) Notwithstanding any provisions of the Prior Trust Agreement or the Third Supplemental Trust Agreement, Senior Lien Bonds may be privately placed to evidence the obligation to repay a loan agreement.
- (c) Section 503 of the First Supplemental Trust Agreement and Section 503 of the Second Supplemental Trust Agreement, each of which imposes additional restrictions on the issuance of additional Senior Lien Party Indebtedness so long as the insured Series 2009 Bonds and the insured Series 2017 Bonds are Outstanding, respectively, are amended by adding the following sentence:

"This Section shall not apply to the issuance of the Series 2018 Bonds or any Senior Lien Indebtedness or TIFIA Indebtedness entered into to finance extension of the Triangle Expressway System in the geographic areas for the projects now referred to as NC STIP Projects R-2171A, R-2171B and R-2828."

(e) The definition of "Bankruptcy Related Event" in Section 101 of the Original Trust Agreement is modified to read as follows:

"Bankruptcy Related Event" means (a) an involuntary proceeding shall be commenced or an involuntary petition shall be filed seeking (i) liquidation, reorganization or other relief in respect of the Authority or any of its debts, or of a substantial part of the assets of the Authority, under any Insolvency Law, or (ii) the appointment of a receiver, trustee, liquidator, custodian, sequestrator, conservator or similar official for the Authority for a substantial part of the assets of the Authority, and, in any case referred to in the foregoing subclauses (i) and (ii), such proceeding or petition shall continue undismissed for 60 days or an order or decree approving or ordering any of the foregoing shall be entered; or

(b) the Authority shall (i) apply for or consent to the appointment of a receiver, trustee, liquidator, custodian, sequestrator, conservator or similar official for the Authority or for a substantial part of the assets of the Authority, or (ii) generally not be paying its debts with respect to the Triangle Expressway System as they become due unless such debts are the subject of a bona fide dispute, or become unable to pay its debts generally as they become due, or (iii) fail to make two (2) consecutive payments of TIFIA Debt Service in accordance with the provisions of the TIFIA Loan Agreement, or (iv) make a general assignment for the benefit of creditors, or (v) consent to the institution of, or fail to contest in a timely and appropriate manner to, any proceeding or petition with respect to it described in clause (a) of this definition, or (vi) commence a voluntary proceeding under any Insolvency Law, or file a voluntary petition seeking liquidation, reorganization, an arrangement with creditors or an order for relief under any Insolvency Law, or (vii) file an answer admitting the material allegations of a petition filed against it in any proceeding referred to in the foregoing subclauses (i) through (vi), inclusive, of this clause (b), or (viii) take any action for the purpose of effecting any of the foregoing; or (c) commence a process pursuant to which (i) all or a substantial part of the Triangle Expressway System or the Trust Estate may be sold or otherwise disposed of in a public or private sale or disposition pursuant to a foreclosure of any liens or security interest thereon securing the Senior Lien Indebtedness, or (ii) all or a substantial part of the Triangle Expressway System or the Trust Estate may be transferred pursuant to a sale or disposition in lieu of foreclosure."

(f) The definition of "Senior Lien Parity Reserve Account Requirement" in Section 101 of the Original Trust Agreement is modified to read as follows:

""Senior Lien Parity Reserve Account Requirement" means 50% of the least of (i) the Maximum Long-Term Debt Service Requirement for all Senior Lien Bonds and Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account, (ii) 125% of the average annual Long-Term Debt Service Requirement for all Senior Lien Bonds and Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account and (iii) 10% of the stated principal amount of all Senior Lien Bonds and Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account; provided, however, that if any Series of Senior Lien Bonds or Senior Lien Parity Debt secured by the Senior Lien Parity Reserve Account has original issue discount or premium that exceeds 2% of the stated redemption price at maturity plus any original issue premium attributable exclusively to underwriter's compensation, the initial offering prices to the public shall be used in lieu of the stated principal amount for purposes of the 10% limitation. The Senior Lien Parity Reserve Account Requirement may be composed of cash, Investment Obligations or Reserve Alternative Instruments, or any combination of the foregoing, as the Authority may determine."

(g) The definition of "TIFIA Debt Service Reserve Account Requirement" in Section 101 of the Original Trust Agreement is modified to read as follows:

""TIFIA Debt Service Reserve Account Requirement" means an amount determined pursuant to the terms of the TIFIA Loan Agreement related to such TIFIA Indebtedness."

- (h) Section 503 of the Original Trust Agreement, which directs how Receipts in the Revenue Fund are deposited to various funds and accounts under the Trust Agreement, is amended to include a new subsection (o), and subsections (h) through (o) of such Section 503 are modified and reordered to read as follows:
  - "(h) to the credit of the TIFIA Debt Service Reserve Account the amount then needed for the TIFIA Debt Service Reserve Account to equal the TIFIA Debt Service Reserve Account Requirement;
  - (i) to a Bond Insurer for Insured Bonds, including the Series 2017 Bond Insurer and the Series 2018 Bond Insurer, any fees and interest, including Excess Interest, due to such Bond Insurer in excess of the amount of principal and interest paid by it with respect to such Insured Bonds, to any provider of a Reserve Alternate Instrument, including the Series 2017 Debt Service Reserve Policy and the Series 2018 Debt Service Reserve Policy, any fees and interest payable to such provider in excess of the amount paid to it from the applicable Senior Lien Parity Reserve Account, Senior Lien Special Reserve Account, Subordinate Lien Parity Reserve Account or Subordinate Lien Special Reserve Account, and to any Credit Provider of a Credit Facility other than a Bond Insurance Policy or a Reserve Alternative Instrument, any fees and interest payable to such Credit Provider in excess of the amount paid to it directly or indirectly from subsection (a) through (h) above. To the extent there are insufficient amounts available pursuant to this subsection for all amounts due hereunder, amounts due relating to Senior Lien Bonds shall be paid first."
  - (j) to the credit of the Hedging Acquisition Account, one-twelfth (1/12) of the amount, to be deposited in the Fiscal Year to the Hedging Acquisition Account so that the Account equals the current Hedging Acquisition Account Requirement;
  - (k) to the credit of the Operations and Maintenance Expense Fund an amount equal to the next succeeding month's budgeted Operating Expenses as set forth in the Annual Budget;
  - (l) to the credit of the Operating Reserve Fund such amount as shall be necessary to make the amount on deposit therein equal to one-fourth (1/4) of the total budgeted Operating Expenses of the Triangle Expressway System for the current Fiscal Year as set forth in the Annual Budget;
  - (m) to the credit of the Renewal and Replacement Fund one-twelfth (1/12) of the total amount, if any, required to be deposited therein in such Fiscal Year as set forth in the Annual Budget;
  - (n) to NCDOT any amounts necessary to reimburse NCDOT for any Operating Advance made by NCDOT to the Authority pursuant to the O&M Guaranty Agreement or any payments by NCDOT to the Authority pursuant to the Construction and Renewal and Replacement Agreement, together with interest thereon, at the rates and in the manner provided in the O&M Guaranty Agreement or the Construction and Renewal and Replacement Agreement, as the case may be; and

- (o) after all deposits are made in accordance with subsections (a) through (n) above, any remaining moneys shall be deposited in the General Reserve Fund."
- (i) Section 502(b) of the First Supplemental Trust Agreement, which addresses the waiver of the mandatory refunding of some or all of the Outstanding Senior Lien Indebtedness required under Section 502(a) of the First Supplemental Trust Agreement in the event Revenues are less than 175% of the Long-Term Debt Service Requirement for Senior Lien Indebtedness for two consecutive Fiscal Years, is modified to read as follows:
  - "(b) The Bond Insurer may waive the requirements of Section 502(a), in which event the Authority shall not be required to undertake the refunding transaction; provided if during the period of two (2) consecutive Fiscal Years being measured in Section 502(a) the Authority has not been in violation of the requirements of Sections 701 and 704 of the June 2009 Trust Agreement, the Bond Insurer shall waive such requirements."
- (j) Section 510(a) of the Second Supplemental Trust Agreement is modified to read as follows:
  - "(a) If a draw has been made on the Series 2017 Debt Service Reserve Policy, the Authority shall (i) from the deposits to the Senior Lien Parity Reserve Account made pursuant to Sections 503(c) and 507 of the Original Trust Agreement (or from amounts made available for Senior Lien Indebtedness pursuant to Section 805(a) of the Original Trust Agreement, as applicable), repay the Series 2017 Bond Insurer for such draw on a pro rata basis with any other provider of a Reserve Alternative Instrument credited to the Senior Lien Parity Reserve Account on which a draw has been made, and (ii) pursuant to Section 503(i) of the June 2009 Trust Agreement or from amounts on deposit in the General Reserve Fund pursuant to Section 514 of the Original Trust Agreement, pay the Series 2017 Bond Insurer for all reasonable expenses related to such draw, and pay the Series 2017 Bond Insurer interest on such draw and such expenses from the date of payment by the Series 2017 Bond Insurer at the Late Payment Rate, each on a pro rata basis with any other provider of a Reserve Alternative Instrument credited to the Senior Lien Parity Reserve Account on which a draw has been made. "Late Payment Rate" means the lesser of (x) the greater of (i) the per annum rate of interest, publicly announced from time to time by JPMorgan Chase Bank at its principal office in the City of New York, as its prime or base lending rate ("Prime Rate") (any change in such Prime Rate to be effective on the date such change is announced by JPMorgan Chase Bank) plus 3%, and (ii) the then applicable highest rate of interest on the Bonds and (y) the maximum rate permissible under applicable usury or similar North Carolina laws limiting interest rates. The Late Payment Rate shall be computed on the basis of the actual number of days elapsed over a year of 360 days. In the event JPMorgan Chase Bank ceases to announce its Prime Rate publicly, Prime Rate shall be the publicly announced prime or base lending rate of such national bank as the Series 2017 Bond Insurer shall specify. If the calculation of the Late Payment Rate results in an effective rate of interest which, for any period, exceeds the limit of the usury or any other laws applicable to the Senior Lien Indebtedness, then all sums in excess of those lawfully collectible as interest for the period in question shall, without further agreement or notice between or by any party hereto, be applied as additional interest for any later periods of time when amounts due

pursuant to the provisions of this paragraph (a) are outstanding to the extent that interest otherwise due pursuant to the provisions of this paragraph (a) for such periods plus such additional interest would not exceed the limit of the usury or such other laws, and any excess shall be applied upon principal immediately upon receipt of such moneys by the Series 2017 Bond Insurer, with the same force and effect as if the Issuer had specifically designated such extra sums to be so applied and the Series 2017 Bond Insurer had agreed to accept such extra payment(s) as additional interest for such later periods; provided such amounts are only payable pursuant to Section 503(i) of the June 2009 Trust Agreement or from the General Reserve Fund. In no event shall any agreed-to or actual exaction as consideration for the amounts due pursuant to the provisions of this paragraph (a) exceed the limits imposed or provided by the law applicable to this transaction for the use or detention of money or for forbearance in seeking its collection."

- (k) Section 701 of the Second Supplemental Trust Agreement, which amended Section 514 of the Original Trust Agreement (which originally limited use of the General Reserve Fund to preserve payment of fees and expenses to the Bond Insurer), is deleted and the first paragraph of Section 514 of the Original Trust Agreement shall read as follows:
  - "Section 514. General Reserve Fund. Moneys held for the credit of the General Reserve Fund shall be used for any legally available purpose, including without limitation, the payment of Operating Expenses, the payment of capital improvements, repayment of any amount owed to NCDOT pursuant to the O&M Guaranty Agreement or the Construction and Renewal and Replacement Agreement, the funding of any Non-System Project and the payment of any Derivative Agreement Additional Payments."
- (l) To reflect the reordering of subsections (h) through (o) of Section 503 of the Original Trust Agreement, Section 704(d) of the Original Trust Agreement, which contains the Authority's covenant to fix, charge and collect tolls, fees, rentals and other charges for use of the Triangle Expressway System in order that Receipts will be sufficient in each Fiscal Year to make all deposits required by Section 503(a) through (h), is amended to replace subsection (h) with subsection (j), with the result that deficiencies, if any, in the TIFIA Debt Service Reserve Account and certain fees and expenses of the Bond Insurer are paid before operating expenses.

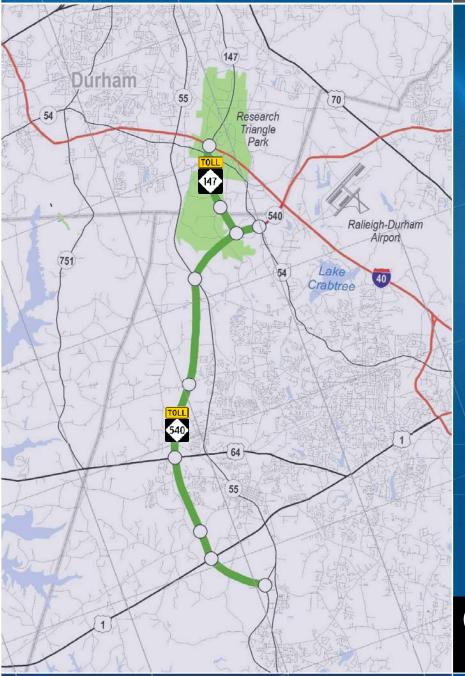


# APPENDIX B 2018 TRAFFIC AND REVENUE STUDY



# Triangle Expressway Traffic and Revenue Study Final Report







November 2018



Prepared for

North Carolina

Department of Transportation



CDM Smith

# **Table of Contents**

1. Introduction	1-1
1.1 Project Description	1-1
1.2 Complete 540	
1.3 Prior Work	1-5
1.4 Work Scope	1-7
1.5 Report Structure	1-9
2. Existing Conditions	2-1
2.1 The Triangle Expressway	
2.1.1 Triangle Expressway Toll Collection, Toll Schedule and Historical Rate Increases	
2.1.2 Triangle Expressway Traffic Volumes and Characteristics	
2.1.3 Travel Patterns on the Triangle Expressway	
2.1.4 Triangle Expressway Transactions and Toll Revenue	
2.2 Study Area Traffic Volumes and Travel Time	2-15
2.2.1 Traffic Volume Data Collection	2-15
2.2.2 Traffic Counts Conducted by The Traffic Group	2-15
2.2.3 Historical Traffic Growth in the Study Area	2-20
2.2.4 Travel Times in the Study Area	2-20
3. Independent Economic Review	3-1
3.1 Introduction	
3.2 Socioeconomics for Calibration Year 2016	3-1
3.2.1 Households and Population	3-2
3.2.2 Group Quarters Population	3-2
3.2.3 Mean Household Income	3-2
3.2.4 Employment	3-3
3.2.5 Earnings	3-3
3.2.6 Enrollment	3-3
3.3 Socioeconomic Forecasts and Adjustments	3-4
3.3.1 TRMv6 Model Area	3-4
3.3.2 Population Forecasts	3-4
3.3.3 Household Forecasts	
3.3.4 Employment Forecasts	
3.3.5 Summary of Socioeconomic Forecasts and Adjustments	3-19
4. Stated Preference Survey	4-1
4.1 Survey Approach	4-1
4.2 Survey Questionnaire	4-2
4.2.1 Introduction and Qualification Questions	4-2
4.2.2 Trip Characteristics and Travel Pattern Questions	4-2
4.2.3 Stated Preference Questions	
4.2.4 Debrief and Opinion Questions	
4.3 Survey Administration	
4.4 Trip Characteristic Analysis	4-5



4.5 Debrief and Opinion Analysis	4-8
4.6 Demographic Analysis	4-9
4.7 Model Estimation for Value of Time	4-9
4.7.1 Specification and Segmentation	4-9
4.7.2 Willingness to Pay for Travel Time Savings (Value of Time)	4-10
4.8 Summary and Conclusions	4-11
5. Model Calibration	5-1
5.1 Refinements to Model Inputs	5-1
5.2 Calibration	
5.3 Traffic Volume Screenline Calibration Results	5-2
5.4 Triangle Expressway Traffic Volume Calibration Results	5-3
5.5 Speed Calibration	
5.6 Travel Pattern Validation	5-4
6. Triangle Expressway Traffic and Revenue Forecast	6-1
6.1 Forecasting Approach	
6.1.1 Planned Triangle Expressway Interchange and Tolling Configuration Changes.	
6.2 Future Transportation Improvements	
6.2.1 Assumed 2025 Roadway Improvements	6-3
6.2.2 Longer Range Roadway Improvements	6-3
6.2.3 Excluded Improvement in the Base Case	6-11
6.3 Basic Assumptions	6-11
6.4 Historical Trends and Short-Term Projections	
6.5 Toll Sensitivity Assessment	6-13
6.6 Modeling Assumptions and Inputs	6-16
6.7 Estimated 2020 Weekday Traffic and Revenue	6-19
6.8 Estimated 2025 Weekday Traffic and Revenue	6-22
6.9 Estimated 2035 Weekday Traffic and Revenue	6-22
6.10 Estimated 2045 Weekday Traffic and Revenue	6-26
6.11 Estimated Annual Transactions and Revenue	6-26
6.11.1 Estimated Adjusted Annual Revenue	
6.12 Disclaimer	6-34
7. Sensitivity Tests	7-1
7.1 Sensitivity Tests on Key Study Assumptions	7-1
7.1.1 Reduced Economic Growth	7-1
7.1.2 Reduced Value of Time	7-3
7.1.3 Increased Motor Fuel Prices	7-3
7.1.4 NC 147 Widening Does Not Occur	7-3
7.2 Complete 540	7-3
7.2.1 Complete 540 Phase 1	7-3
7.2.2 Complete 540 Phase 2	7-5
7.2.3 Comparison of Traffic and Revenue Forecasts	7-8



# List of Figures

Figure 1.1 Project Location Map	1-2
Figure 1.2 Triangle Expressway Toll Zones and Planned Modifications	1-3
Figure 1.3 Planned Complete 540	
Figure 2.1 NC Quick Pass Interoperability	
Figure 2.2 Triangle Expressway: 2018 ETC and BBM Toll Rates	2-3
Figure 2.3 Triangle Expressway: 2017 Average Weekday Traffic and Hourly Distribution	2-5
Figure 2.4 Seasonal Variation of Toll Transactions on Triangle Expressway	2-6
Figure 2.5 Daily Variation in Toll Transactions on Triangle Expressway	2-6
Figure 2.6 Streetlight Data Collection Locations	
Figure 2.7 Weekday Travel Pattern Distribution at Location 1.1 Northbound	2-10
Figure 2.8 Weekday Travel Pattern Distribution at Location 1.8 Southbound	2-11
Figure 2.9 Traffic Count Locations	2-16
Figure 2.10 Historical Traffic Growth on Area Roadways	2-21
Figure 2.11 Freeflow Travel Time in Minutes	2-22
Figure 2.12 2016 AM Peak Hour Travel Time in Minutes (7-8 AM)	2-23
Figure 2.13 2016 PM Peak Hour Travel Time in Minutes (5-6 PM)	2-24
Figure 3.1 TRMV6 Model Area	3-5
Figure 3.2 Regions and Superzones	3-6
Figure 3.3 2016-2035 Average Annual Percent Growth in Population, by Superzone	
(Adjusted Forecast)	3-10
Figure 3.4 2016-2035 Average Annual Percent Growth in Households, by Superzone	
(Adjusted Forecast)	3-15
Figure 3.5 2016-2035 Average Annual Percent Growth in Employment by Superzone	
(Adjusted Forecast)	3-18
Figure 3.6 Population Growth in Study Area	3-20
Figure 3.7 Household Growth in Study Area	3-20
Figure 3.8 Employment Growth in Study Area	3-20
Figure 4.1 Sample Survey Screen – Stated Preference Question	4-3
Figure 4.2 Trip Purpose	4-5
Figure 4.3 Triangle Expressway Entrance and Exit Locations	4-6
Figure 4.4 Reported Travel Time by Market Segment	4-7
Figure 4.5 Amount of Reported Delay by Market Segment	4-7
Figure 4.6 Trip Frequency by Market Segment	
Figure 5.1 Modeling Process for Toll Road Analysis	5-2
Figure 6.1 Assumed Long-Range Highway Improvements - 2025	6-4
Figure 6.2 Assumed Long-Range Highway Improvements – 2035	6-6
Figure 6.3 Assumed Long-Range Highway Improvements - 2045	6-9
Figure 6.4 Triangle Expressway Toll Sensitivity Curve	
Figure 6.5 Assumed 2025 Toll Rates by Toll Zone and Vehicle Class – Triangle Expressway	
Figure 6.6 Estimated Weekday Traffic, Triangle Expressway - 2020	
Figure 6.7 Estimated Weekday Traffic, Triangle Expressway - 2025 2025	
Figure 6.8 Estimated Weekday Traffic, Triangle Expressway - 2035 2035	
Figure 6.9 Estimated Weekday Traffic Triangle Expressway - 2045	



Figure 7.1 Sensitivity Tests: Total Collected Revenue Impacts Compared to the Base Condition
List of Tables  Table 2.1 Triangle Expressway Construction History
Table 2.1 Triangle Expressway Construction History2-1 Table 2.2 Historical Toll Rate Increases on the Triangle Expressway2-4 Table 2.3 Annual Vehicle Class Distribution on the Triangle Expressway by Toll Class2-6 Table 2.4 StreetLight Data Collection Locations2-9
Table 2.1 Triangle Expressway Construction History2-1 Table 2.2 Historical Toll Rate Increases on the Triangle Expressway2-4 Table 2.3 Annual Vehicle Class Distribution on the Triangle Expressway by Toll Class2-6 Table 2.4 StreetLight Data Collection Locations2-9
Table 2.1 Triangle Expressway Construction History2-1 Table 2.2 Historical Toll Rate Increases on the Triangle Expressway2-4 Table 2.3 Annual Vehicle Class Distribution on the Triangle Expressway by Toll Class2-6 Table 2.4 StreetLight Data Collection Locations2-9
Table 2.2 Historical Toll Rate Increases on the Triangle Expressway2-4 Table 2.3 Annual Vehicle Class Distribution on the Triangle Expressway by Toll Class2-6 Table 2.4 StreetLight Data Collection Locations2-9
Table 2.3 Annual Vehicle Class Distribution on the Triangle Expressway by Toll Class2-6  Table 2.4 StreetLight Data Collection Locations2-9
Table 2.3 Annual Vehicle Class Distribution on the Triangle Expressway by Toll Class2-6  Table 2.4 StreetLight Data Collection Locations2-9
Table 2.4 StreetLight Data Collection Locations2-9
Table 2.5 Triangle Expressway Annual Transactions and Collected Toll Revenue2-12
Table 2.6 Triangle Expressway – Monthly Transaction and Collected Toll Revenue Trends 2-13
Table 2.7 2017 Annual Transactions and Collected Toll Revenue by Vehicle Class2-14
Table 2.8 ETC Market Share on the Triangle Expressway2-14
Table 2.9 Summary of Weekday and Weekend-Day Traffic Volumes at Count Locations
Based on Traffic Counts Conducted in the Fall of 20162-17
Table 3.1 Model Area Population Forecasts by County - TRMv6 and Adopted Values3-7
Table 3.2 Model Area Population Adjustments by County3-8
Table 3.3 Detailed Study Area Population Forecasts by Region – TRMv6 and Adopted Values 3-9
Table 3.4 Detailed Study Area Population Adjustments by Region3-9
Table 3.5 Model Area Household Forecasts by County – TRMv6 and Adopted Values3-11
Table 3.6 Model Area Household Adjustments by County3-12
Table 3.7 Detailed Study Area Household Forecasts by Region – TRMv6 and Adopted Values 3-13
Table 3.8 Detailed Study Area Household Adjustments by Region3-13
Table 3.9 Model Area Employment Forecasts by County – TRMv6 and Adopted Values 3-14
Table 3.10 Model Area Employment Adjustments by County
Table 3.11 Detailed Study Area Employment Forecasts by Region – TRMv6 and Adopted
Values
Table 3.12 Detailed Study Area Employment Adjustments by Region3-17
Table 3.13 Detailed Study Area – Summary of Socioeconomic Adjustments
Table 4.1 Completed Surveys by Recruitment Method4-4
Table 4.2 Corridor Use Type4-5
Table 4.3 Mean and Median Trip Distance and Reported Travel Time, by Market Segment4-6
Table 4.4 Reason for Never Choosing a Tolled Alternative4-8
Table 4.5 Reported 2017 Annual Household Income4-9
Table 4.6 Value of Time, By Market Segment and Income4-10
Table 5.1 Daily Volume Calibration Results on Screenlines5-3
Table 5.2 Volume Calibration Results by Time Period on Screenlines5-3
Table 5.3 Volume Calibration Results by Time Period on Triangle Expressway5-5
Table 5.4 Speed Calibration Results by Roadway and Direction5-6
Table 5.5 Through Trip Comparison – Model vs. Streetlight
Table 6.1 2025 STIP Roadway Improvements Assumed in the TRMv66-5
Table 6.2 Year 2035 Roadway Improvements Assumed in the Complete 540 Forecast Model6-7



Table 6.3 Year 2045 Roadway Improvements Assumed in the Complete 540 Forecast Model6-10
Table 6.4 Triangle Expressway Annual Transactions and Gross Toll Revenue - Historical
Trends and Short-Term Projections6-13
Table 6.5 Assumed Class 1 Toll Rates by Year – Triangle Expressway Toll Zones6-17
Table 6.6 Through-Trip Toll Rates by Toll Class – Triangle Expressway6-18
Table 6.7 Model Inputs (VOT, VOC and CPI)6-18
Table 6.8 Estimated 2020 Weekday Transactions and Revenue by Toll Zone, Triangle
Expressway – Base Case6-21
Table 6.9 Estimated 2025 Weekday Transactions and Revenue by Toll Zone, Triangle
Expressway – Base Case6-24
Table 6.10 Estimated 2035 Weekday Transactions and Revenue by Toll Zone, Triangle
Expressway – Base Case6-27
Table 6.11 Estimated 2045 Weekday Transactions and Revenue by Toll Zone, Triangle
Expressway – Base Case6-29
Table 6.12 Estimated Annual Transactions and Toll Revenue, Triangle Expressway – Base
Case6-30
Table 6.13 Estimated Adjusted Annual Revenue, Triangle Expressway – Base Case6-35
Table 7.1 Summary of Sensitivity Test Results on Triangle Expressway, Fiscal Year
Transaction and Toll Revenue Estimates
Table 7.2 Estimated Annual Transactions and Revenue, Triangle Expressway with Complete
540 Phase 1
Table 7.3 Estimated Adjusted Annual Revenue, Triangle Expressway with Complete 540
Phase 1
Table 7.4 Estimated Annual Transactions and Revenue, Triangle Expressway with Complete
540 Phases 1 and 2
Table 7-5 Estimated Adjusted Annual Revenue, Triangle Expressway with Complete 540
Phases 1 and 2
Table 7-6 Comparison of Systemwide Transaction Forecasts by Scenario7-10
Table 7-7 Comparison of Systemwide Total Collected Revenue Forecasts by Scenario7-11



## **Appendices**

Appendix A Volume Calibration Results by Time Period and Direction on Screenlines



### Chapter 1

#### Introduction

This report documents the *Triangle Expressway 2018 Traffic and Revenue Study* conducted for the North Carolina Turnpike Authority (NCTA) and the North Carolina Department of Transportation (NCDOT). The purpose of the study was to develop a 40-year (fiscal years 2019 through 2058) annual traffic and toll revenue forecast for the Triangle Expressway, including a new planned interchange with Morrisville Parkway, and planned toll-zone relocations at the Hopson Road and U.S. 64 interchanges, from the current ramp locations to mainline locations.

This study was conducted simultaneously and in conjunction with the ongoing Complete 540 Traffic and Revenue Study, that evaluated the traffic and revenue potential of extending the Triangle Expressway from its current southern terminus at NC 55 Bypass to U.S. 64 in Knightdale, completing the 540 Outer Loop around Raleigh. Both studies utilized the same data, including traffic counts, travel times and travel patterns, and used the same Triangle Regional Model version 6 (TRMv6), modified by CDM Smith for purposes of forecasting traffic and toll revenue for the Triangle Expressway and Complete 540.

The traffic and toll revenue forecasts presented in this study for the scenario described above are suitable for use in support of project financing.

#### 1.1 Project Description

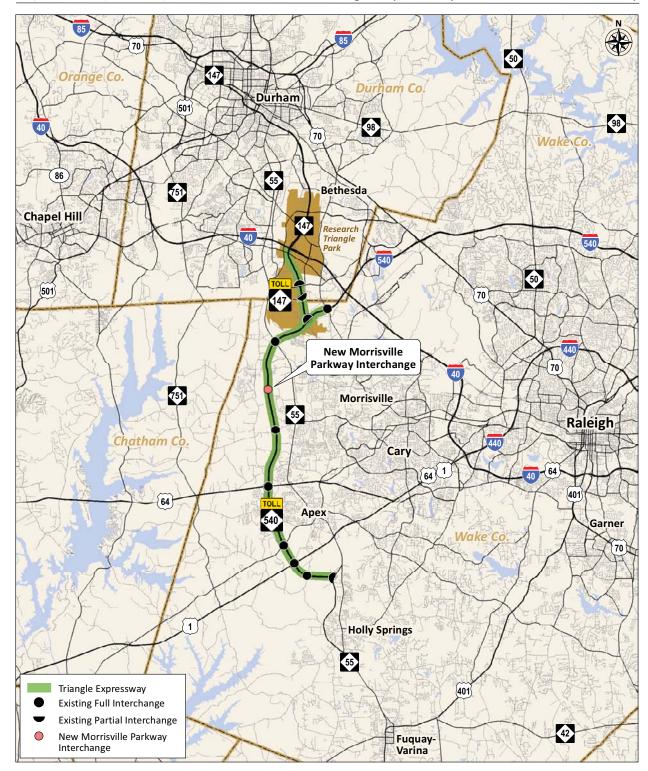
Figure 1.1 depicts the Triangle Expressway in relationship to the surrounding transportation system and Research Triangle Park (RTP), a major employment center in the greater Raleigh and Durham area. The Triangle Expressway provides a high-speed connection from communities to the south and west of Raleigh (such as Fuquay-Varina, Holly Springs, and Apex), to Interstate 40 (I-40), Research Triangle Park (RTP) and the Raleigh-Durham International Airport. Toll NC 540 is part of the 540 Outer Loop.

The existing Triangle Expressway is a 6-lane, 18.5-mile toll road, consisting of Toll NC 540 and Toll NC 147. Toll NC 147 is about 3.4 miles in length and terminates at I-40 in the north and Toll NC 540 in the south. Toll NC 540 is about 15.1 miles in length and terminates at NC 54 in the north and NC 55 Bypass in the south. The posted speed limit is 70 mph.

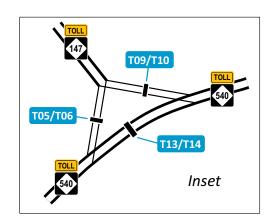
Figure 1.2 provides a schematic of the Triangle Expressway, including the toll zone locations. There are eight intermediate interchanges, listed below from north to south:

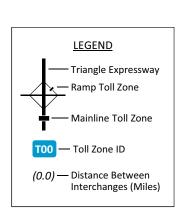
- 1. Hopson Road/Davis Drive with Toll NC 147
- 2. Toll NC 147 and Toll NC 540
- 3. NC 55 with Toll NC 540
- 4. Green Level West Road with Toll NC 540
- 5. U.S. 64 with Toll NC 540
- 6. Old U.S. 1 with Toll NC 540
- 7. U.S. 1 with Toll NC 540
- 8. Veridea Parkway with Toll NC 540

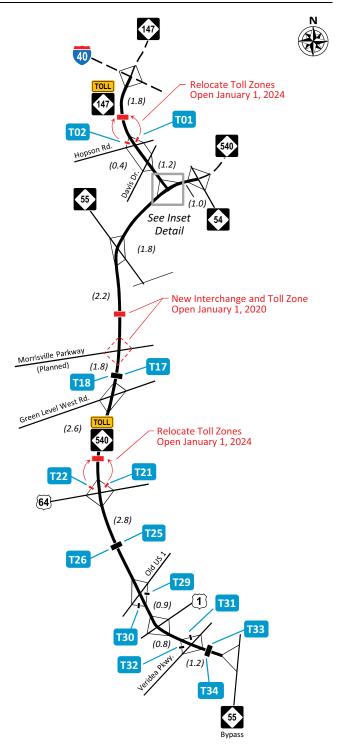
















Tolls are collected at toll zones located on ramp and mainline locations, which are shown in Figure 1.2. There are four mainline toll zones on Toll NC 540, listed below from north to south:

- 1. Between the ramps to-and-from Toll NC 147
- 2. Between the NC 55 and Green Level West Road interchanges
- 3. Between the U.S. 64 and Old U.S. 1 interchanges
- 4. Between the Veridea Parkway and NC 55 Bypass interchanges

There are five ramp toll zones locations listed below from north to south:

- 1. Ramps to-and-from the north at Hopson Road
- 2. Ramps to-and-from NC 147 and Toll NC 540
- 3. Ramps to-and-from the north at U.S. 64
- 4. Ramps to-and-from the south at Old U.S. 1
- 5. Ramps to-and-from the north at Veridea Parkway

There are planned improvements to the Triangle Expressway during the forecast period which are shown in Figure 1.2. The planned Triangle Expressway improvements include:

- 1. A new full-access interchange at Morrisville Parkway and Toll NC 540. NCTA plans on opening the interchange as early as October 1, 2019. For conservative purposes, this study assumes the opening date is January 1, 2020.
- 2. Existing ramp toll zones on Hopson Road (T01 and T02) and US 64 (T21 and T22) will be relocated to adjacent mainline sections. This change is assumed to occur on January 1, 2024. The purpose of the change is to achieve greater toll equity among movements on the Triangle Expressway. These relocations are shown in red in Figure 1.2.

Tolls are collected on the Triangle Expressway via an electronic toll collection (ETC) program named NC Quick Pass®, and a license plate imaging program named Bill by Mail (BBM). There are no physical toll booths on the Triangle Expressway; all tolls are collected via equipment located on overhead gantries at each toll zone. ETC transactions, including NC Quick Pass, require motorists to have a transponder. The transponder automatically deducts tolls from a pre-paid account. Transponders from the following programs are all accepted on the Triangle Expressway:

- NC Quick Pass
- Florida SunPass®
- Georgia Peach Pass®
- E-ZPass®

If a motorist doesn't have a transponder, high-speed cameras mounted on gantries record the license plate and an invoice is mailed to the registered owner through the BBM program. ETC transactions receive an automatic 35 percent discount from the BBM toll rate. No toll-free movements are available on the Triangle Expressway.

The Triangle Expressway has programmed annual toll rate increases that take effect on January 1 of each year. The historical and planned increases are described in Chapter 2.

## 1.2 Complete 540

NCTA plans on completing the 540 Outer Loop around the greater Raleigh area by extending the Triangle Expressway approximately 28 miles from its current southern terminus at the NC 55 Bypass in Apex to U.S. 64 in Knightdale. This future project is shown in **Figure 1.3**. Complete 540 is planned as a six-lane toll road, with a posted speed limit of 70 mph. There would be 12 mainline sections and 11 interchanges provided between the two endpoints. Tolls would be collected via ETC and BBM (consistent with the Triangle Expressway), and toll zones would be located on each mainline section of roadway. No toll-free movements would be permitted on Complete 540.



NCTA plans on constructing Complete 540 in two phases. Phase 1 is defined as the section from the southern terminus of the Triangle Expressway to Interstate 40 (I-40) and U.S. 70, south of Raleigh. Phase 1 is expected to open on January 1, 2024. Phase 2 is defined as the section from I-40 to U.S. 64 in Knightdale. Upon completion, this section would complete the 540 Outer Loop. Phase 2 is expected to open on January 1, 2035.

This report contains the traffic and revenue forecasts for the Triangle Expressway assuming Complete 540 is not built. The potential traffic and toll revenue impacts of Complete 540 are described in Chapter 7, Traffic and Revenue Sensitivity Tests.

## 1.3 Prior Work

CDM Smith issued the *Complete 540 Planning Level Traffic and Revenue Study* on May 31, 2017. It provided traffic and toll revenue forecasts for the existing Triangle Expressway and for three scenarios that included various assumptions regarding phasing options for the Complete 540 project. The traffic and revenue forecasts were intended for planning purposes and were not suitable for project financing. A substantial amount of data was collected for the Planning Level Study, including traffic counts, travel-speed data, travel-pattern data from StreetLight Data, Inc., historical traffic and toll revenue on the Triangle Expressway, and planned roadway improvements in the study area. The traffic and revenue projections were based on the Triangle Regional Model version 5 (TRMv5), including its assumptions regarding growth and location of future population, households and employment.

The current *Triangle Expressway 2018 Traffic and Revenue Study* used the data collected for the Planning Level Study, as well as additional traffic counts, updated travel-time data, updated historical Triangle Expressway traffic and toll revenue, and updated plans for roadway improvements. In addition, this current study used the new version 6 of the Triangle Regional Model (TRMv6); engaged an independent economist to review and adjust forecasted socioeconomic variables assumed in the TRMv6; and had stated preference (SP) surveys conducted to estimate motorist values-of-time.

Prior to the *Complete 540 Planning Level Traffic and Revenue Study*, CDM Smith conducted several studies on the Triangle Expressway and on various sections of proposed loop roads around Raleigh. The following lists the most pertinent studies. The second study in the list, the *2009 Comprehensive Report*, remains the most recent certified forecast of Triangle Expressway traffic and toll revenue. The

study results were based on a TRM version that relied on 2000 Census data. The studies listed subsequent to the **2009 Comprehensive Report**, were all planning level studies, based off of the modeling and socioeconomic assumptions in the **2009 Report**.

#### May 2008: NC Urban Loop Update and Ranking Study

Provided preliminary traffic and toll revenue forecasts for loop-road sections in the Raleigh area, including Complete 540.

## 4/6/2009: Triangle Expressway Comprehensive Traffic and Revenue Study (2009 Comprehensive Report)

This report contains the most recent certified forecast of Triangle Expressway traffic and toll revenue. It contains forecasts for FY 2012 through FY 2051 and was prepared prior to the opening of the Triangle Expressway. The forecasts did not include the Veridea Parkway or Morrisville Parkway interchanges.

## October 2010: Triangle Expressway Veridea Interchange Test

This document presents planning level traffic and revenue estimates for the Veridea Parkway Interchange. It was based on the **2009 Comprehensive Report**.

## <u>December 2010:</u> Morrisville Parkway Interchange Test

This document presents planning level traffic and revenue estimates for the Morrisville Parkway Interchange. It was based on the **2009 Comprehensive Report**.

#### 11/10/2011: Toll NC 147/McCrimmon Parkway Connector T&R Study

This document presents planning level traffic and revenue estimates for the Toll NC 147 extension to McCrimmon Parkway. It was based on the **2009 Comprehensive Report** and did not assume the Veridea Parkway or Morrisville Parkway interchanges.

## 4/25/2012: Technical Memorandum – 24 Month Monthly Transactions and Gross Toll Revenue Estimates for the Triangle Expressway

This document presents revised traffic and toll revenue estimates from January 2012 through December 2014 to reflect changes in the actual phased opening of the Triangle Expressway. The estimates were based on the **2009 Comprehensive Report**. The Veridea Parkway and Morrisville Parkway interchanges were not included in the forecasts.

#### 9/9/2013: Impact of Morrisville Parkway and Old Holly Springs Road Interchanges

Revised traffic and toll revenue forecasts are provided for the Triangle Expressway without the proposed interchanges, with each individual interchange, and with both interchanges. The Old Holly Springs-Apex Road Interchange was the current name for the Veridea Parkway Interchange at the time of the study. The revisions of the Triangle Expressway included adjustments for actual experience, and some toll schedule adjustments that reflected actual phased openings. Both interchanges were assumed to open on January 1, 2016. The forecasts were based on the *2009 Comprehensive Report*.

## $\underline{03/31/2016}$ : Toll NC 540/Old Holly Springs-Apex Road Interchange Toll Schedule Recommendation

Provided the recommended toll rate schedule for the Veridea Parkway Interchange (previously the Old Holly Springs-Apex Road Interchange). This toll rate schedule differed slightly from the assumed toll rates in the 9/9/2013 letter listed above. The recommended Veridea toll rate schedule was adopted by the NCTA Board of Directors.



3/22/2017: Revised transactions and toll revenue forecasts were prepared for the Triangle Expressway and for impacts due to the Veridea Parkway and Morrisville Parkway interchanges to reflect opening dates of April 1, 2017 and January 1, 2019, respectively. The revised transaction and revenue forecasts were used in the North Carolina Turnpike Authority Triangle Expressway Senior Lien Turnpike Revenue Refunding Bonds Official Statement. The revised forecasts were based on the 2009 Comprehensive Report.

## 1.4 Work Scope

The work scope was comprised of the following tasks.

- Task 1: Data Collection and Summarization
- Task 2: Corridor Growth Analysis
- Task 3: Stated Preference Surveys
- Task 4: Triangle Regional Model Refinement and Calibration
- Task 5: Traffic and Toll Revenue Analysis
- Task 6: Traffic and Toll Revenue Sensitivity Tests

#### Task 1: Data Collection and Summarization

CDM Smith used data collected for the Complete 540 Planning Level Traffic and Revenue Study and collected additional data.

## Subtask 1.1: Obtain Available Traffic Counts and Toll Revenue Data

- CDM Smith obtained NCDOT traffic count data that was made available since the Planning Level Study was conducted.
- CDM Smith obtained updated toll transaction and revenue data for the Triangle Expressway from NCTA. In addition, CDM Smith received data on leakage and fee revenue associated with BBM transactions on the Triangle Expressway.

#### Subtask 1.2: Conduct New Traffic Counts

As part of the Planning Level Study, CDM Smith contracted The Traffic Group to conduct traffic counts at 63 locations. Traffic counts were conducted at 15 additional locations as part of the current study.

## Subtask 1.3: HERE Travel Speed Data

 Updated travel speed data was obtained in the study area from HERE via the Regional Integrated Transportation Information System (RITIS) with the permission of the NCDOT.

### Subtask 1.4: Future Roadway Improvements

Future roadway improvement projects were reviewed and checked against assumed improvements in the TRMv6. The following sources were used to identify planned roadway improvements.



- 2018-2027 NC State Transportation Improvement Program (STIP) and interactive map.
- NC Capital Area Metropolitan Planning Organization (CAMPO) and Durham Chapel Hill Carrboro Metropolitan Planning Organization (DCHC MPO)

  \*\*Transportation Improvement Program (TIP)\*\* and interactive map.
- CAMPO and DCHC MPO long range plan the 2045 *Metropolitan Transportation Plan* and interactive map.
- o Go Triangle Recommended Wake County Transit Plan

CDM Smith coordinated with NCDOT/NCTA staff and/or MPO staff to identify needed changes to the TRMv6 model to reflect the current understanding of improvement completion dates or definitions.

## **Task 2: Corridor Growth Analysis**

Economic growth forecasts are one of the most important elements of a traffic and toll revenue forecast, particularly for new toll facilities. Traffic demand and travel patterns in regional models, such as the TRMv6, are based on forecasts of socioeconomic variables such as population, number of households and employment. CDM Smith employed Dr. Steven Appold, an economist with local expertise, to conduct an independent analysis of the land-use and socioeconomic growth forecasts assumed in the TRMv6. Dr. Appold reviewed the forecasts and recommended adjustments where appropriate. The resulting revised socioeconomic forecasts were used in adjusting the TRMv6 trip tables to reflect the changed assumptions in variables such as population, households, and employment. The economic review focused on the Triangle Expressway and Complete 540 corridors. Chapter 3 in this report summarizes Dr. Appold's work and socioeconomic forecasts.

## **Task 3: Stated Preference Surveys**

Stated preference (SP) surveys are an integral part of investment-grade traffic and revenue studies to estimate motorists' willingness to pay tolls, or value of time (VOT), for different market segments. The surveys provide an important analytical tool in evaluating traffic and revenue potential and in enhancing the credibility of the study for presentation to the financial community. Past studies have shown that travelers' VOT are region-specific and depend in complex ways on characteristics of travelers and trip mix such as vehicle classification, personal incomes, trip purposes and availability of discretionary time. These factors and others create wide variations in VOT among regions and facilities, and support the need for context-specific studies to accurately estimate these values.

CDM Smith contracted Resource Systems Group, Inc. (RSG) to conduct SP surveys to estimate VOT for motorists in the study area. Estimated VOT was developed for different market segments and geographic areas in the model area. This information was incorporated into the travel demand model to support the development of traffic and toll revenue forecasts.

### **Task 4: Triangle Regional Model Refinement and Calibration**

The TRMv6 was used to analyze the traffic and toll revenue potential of the Triangle Expressway and Complete 540. Model supported years included 2013, 2025, 2035 and 2045.

The TRMv6 model years were reviewed to identify necessary changes to improve network detail and more accurate route choice in the immediate project vicinity. These reviews included planned



roadway improvements, the size of traffic analysis zones, centroid locations, road capacities and speed limits.

Trip tables were modified to reflect socioeconomic adjustments recommended by Dr. Appold, the economist.

A 2016 model year was created by CDM Smith to use as a calibration year. Traffic assignments were calibrated to reflect actual ground conditions including traffic volumes, travel speeds, ETC market share and trip distance at selected locations. Calibration adjustments were carried through to future year assignments.

## Task 5: Traffic and Toll Revenue Analysis

Traffic assignments were conducted using the refined and calibrated TRMv6, incorporating the adjusted trip tables, and using CDM Smith toll diversion algorithms. The assignments included model inputs developed by CDM Smith and RSG, including motorist VOTs, motor vehicle operating cost (VOC), toll rate schedules, and NC Quick Pass and BBM market shares.

Annual traffic and gross toll revenue forecasts were developed for the model assignment years and the intermediate years. Net revenue was subsequently developed to incorporate adjustments reflecting expected toll-revenue leakage, and fee revenue. Estimated rates of revenue leakage and fee revenue were based on actual experience from the Triangle Expressway.

## Task 6: Traffic and Toll Revenue Sensitivity Tests

There is considerable uncertainty in traffic forecasts as they are dependent on many variables. It is standard practice in investment-grade traffic and revenue studies to include traffic and toll revenue sensitivity testing. The purpose is to help financial analysts assess the potential risk associated with the Project's traffic and revenue forecasts by testing the impact of changes to key variables. Four tests were run for the Triangle Expressway:

- 1. Lower Economic Growth
- 2. Lower motorist VOTs
- 3. The impact of removing a planned widening on NC 147 north of Toll NC 147, and
- 4. The impact of the planned Complete 540 project on the Triangle Expressway

The results of the sensitivity tests are documented in Chapter 7.

## 1.5 Report Structure

This report consists of eight chapters.

## **Chapter 1: Introduction**

Describes the purpose of the study; a project description; the work scope; and structure of the report.

## **Chapter 2: Existing Conditions**

Presents information regarding the existing conditions on the Triangle Expressway and other roads in the Complete 540 study area. Information provided for the Triangle Expressway includes its toll collection system and current toll schedule; historical traffic volumes and traffic characteristics; travel patterns; and historical transaction and toll revenue. Current traffic volumes and travel times are provided for many area roads in the Triangle Expressway and Complete 540 study area.



## **Chapter 3: Independent Economic Review**

This chapter summarizes the work of the independent economist, Dr. Stephen Appold, who reviewed socioeconomic assumptions in the TRMv6, and created revised socioeconomic inputs, including population, number of households and employment, for each of the model years. The revised socioeconomic inputs to the TRMv6 are summarized; and the changes, compared to the original inputs, are quantified. In addition, Dr. Appold developed a set of socioeconomic inputs to the TRMv6 to create a model year 2016 for calibration purposes. This chapter describes the process Dr. Appold used to develop the 2016 socioeconomic dataset.

## Chapter 4: Stated Preference Survey

This chapter summarizes the Resource Systems Group (RSG) work in developing VOT for motorists in study area. RSG administered a SP survey, which is described, along with the survey analysis, and the resulting estimation of VOT by market segment.

## **Chapter 5: Model Refinement**

The TRMv6 is described. Also provided is a summary of modifications made to the model by CDM Smith; the model calibration process and calibration metrics.

## Chapter 6: Triangle Expressway Traffic and Toll Revenue Forecast

Key inputs and assumptions are provided, including planned roadway improvements, toll schedules, and toll zone locations. A toll sensitivity curve is provided, demonstrating the revenue potential of the facility across various toll rate levels. The development of the traffic and toll revenue forecast is described, including how the model weekday traffic output is converted into annual traffic and toll revenue forecasts. Estimated annual toll transactions and toll revenue are provided from FY 2019 through FY 2058. Adjusted annual traffic and revenue forecasts are also provided that account for leakage and fee revenue associated with BBM transactions.

## **Chapter 7: Sensitivity Tests**

Six tests were conducted to determine the impact on forecast traffic and toll revenue if key assumptions were changed. The six tests are:

- 1. Reduce the trip table by 30 percent to reflect lower economic growth.
- 2. Reduce the motorist VOT for all classes by 25 percent.
- 3. Increase fuel costs by 50 percent.
- 4. Assume that the planned widening of NC 147, north of Toll NC 147, from four to eight lanes, does not occur during the forecast period.
- 5. Assume that Complete 540 Phase 1 is operational on January 1, 2024.
- Assume that Complete 540 Phase 1 is operational on January 1, 2024, and Phase 2 is operational on July 1, 2030.

The results of the sensitivity tests are provided in Chapter 7.



## Chapter 2

## **Existing Conditions**

This Chapter describes existing and historical conditions on the Triangle Expressway. Triangle Expressway traffic volumes, toll rates, toll revenue, travel patterns and other traffic characteristics are described. Traffic volumes and travel times by time period are described in the study corridor.

## 2.1 The Triangle Expressway

The Triangle Expressway is a six-lane, 18.5-mile toll road, consisting of Toll NC 540 and Toll NC 147 (please refer to Figure 1.2 in Chapter 1). Toll NC 147 is about 3.4 miles in length and extends from I-40 in the north to Toll NC 540 in the south. Toll NC 540 is about 15.1 miles in length and extends from NC 54 in the north to NC 55 Bypass in the south. The speed limit is posted at 70 miles per hour (mph). The road provides a high-speed connection from communities to the south and west of Raleigh (such as Fuquay-Varina, Holly Springs and Apex), to Interstate 40 (I-40), Research Triangle Park (RTP) and the Raleigh-Durham International Airport. Toll NC 540 is part of the 540 Outer Loop.

The primary competing roadway to the Triangle Expressway is NC 55 and the NC 55 Bypass, which closely parallels the Triangle Expressway. NC 55 and the Bypass generally provide two through travel lanes per direction, with the intermittent provision of left, right and center turn lanes. There are some single-lane sections of NC 55. Posted speed limits range from 35 to 55 mph on NC 55 in the Triangle Expressway corridor. There are 13 signalized intersections on NC 55 and the Bypass between the southern end of Toll NC 540 and US 64, another 13 between US 64 and the interchange with Toll NC 540 near Morrisville, and 10 between the Toll NC 540 interchange and I-40 near Research Triangle Park.

The Triangle Expressway opened in three segments, as shown in **Table 2.1**. The entire project was opened to tolled traffic on January 2, 2013. The most recent improvement to the Triangle Expressway was the full-access interchange with Veridea Parkway which opened on April 4, 2017.

	Table 2.1 Triangle Expressway Construction History											
Improvement	Opening Date	Tolling Began	Location									
Segment 1	December 8, 2011	January 3, 2012	Toll NC 540 between NC 55 and NC 54 Toll NC 147 between I-40 and Toll NC 540									
Segment 2	August 1, 2012	August 2, 2012	Toll NC 540 between NC 55 and U.S. 64 in Apex									
Segment 3	December 12, 2012	January 2, 2013	Toll NC 540 between U.S. 64 and NC 55 Bypass near Holly Springs									
Veridea Parkway Interchange	April 4, 2017	April 4, 2017	Full access interchange at Toll NC 540 and Veridea Parkway									

## 2.1.1 Triangle Expressway Toll Collection, Toll Schedule and Historical Rate Increases

The Triangle Expressway features an all-electronic tolling system (AET), designed to reduce traffic delays and promote safety. This system allows motorists to pay their toll without stopping or slowing down. Tolls are collected via NC Quick Pass, NCTA's electronic toll collection (ETC) program, or by a video toll collection system named Bill by Mail (BBM). No conventional toll plazas are located on the Triangle Expressway; instead, toll collection equipment is located on overhead gantries.

The following describes the three toll classes on the Triangle Expressway:

- <u>Class 1 (2-axle vehicles)</u>: includes all two-axle vehicles regardless of the number of tires.
- <u>Class 2 (3-axle vehicles)</u>: includes all three-axle vehicles including two-axle vehicles towing a single-axle trailer.
- <u>Class 3 (4-or-more axle vehicles)</u>: includes all vehicles with four-or-more axles (4+) including two-axle vehicles towing a dual-axle trailer.

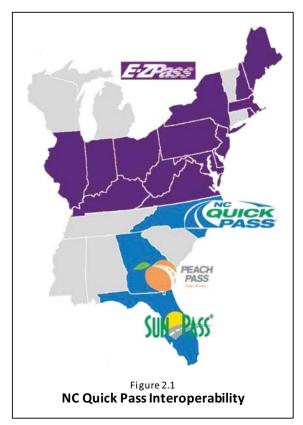
Class 2 toll rates are twice the Class 1 toll rate, and Class 3 toll rates are four times the Class 1 toll rate.

Motorists who pay with NC Quick Pass (or E-ZPass, Florida SunPass, or Georgia Peach Pass) receive an automatic 35 percent discount from the BBM toll rates for all vehicle classes. **Figure 2.1** illustrates all the states that have interoperable transponder programs with NC Quick Pass.

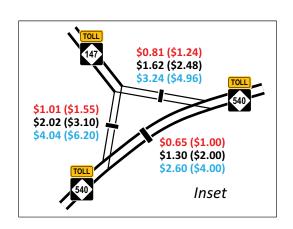
Beginning in August 2017, motorists were able

to obtain a **NC Quick Pass Sticker Transponder** at no cost. It is accepted for tollroad payment in North Carolina, and where
Florida SunPass and Georgia Peach Pass are
accepted. For \$7.40 plus tax, motorists may
obtain a **NC Quick Pass E-ZPass Interior Transponder** that is valid for toll-road
payment in North Carolina and wherever EZPass, Florida SunPass or Georgia Peach Pass
are accepted.

Triangle Expressway toll zones, and 2018 ETC and BBM toll rates are shown in **Figure 2.2**. A through trip on Toll NC 540 (15.1 miles between NC 55 Bypass and NC 54) in 2018 costs \$2.89 for a passenger car with a transponder, which is equal to \$0.191 per mile.

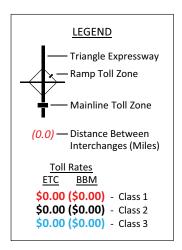


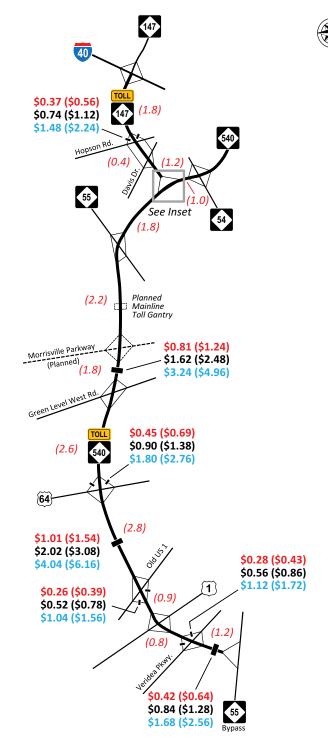
A 5-axle truck with a transponder, making the same trip, would pay \$11.56, or \$0.766 per mile.





	<u>Via Toll</u>	NC 540
Vehicle		Toll
<u>Class</u>	<u>Toll</u>	<u>Per Mile</u>
Class 1	\$2.89	\$0.191
Class 2	\$5.78	\$0.383
Class 3	\$11.56	\$0.766







# TRIANGLE EXPRESSWAY: 2018 ETC AND BBM TOLL RATES

Toll rates increase annually in accordance with an approved toll schedule adopted by the NCTA Board of Directors. Table 2.2 shows the annual historical toll rate increases on the Triangle Expressway from 2013 to 2018 for an ETC-equipped passenger car. It also shows the cost of a through trip on Toll NC 540 for an ETCequipped passenger car, and the equivalent per-mile toll rate. A through trip on Toll NC 540 incurs tolls at four locations. Minor variations in the annual rate-of-increase of the though-trip toll between 2013 and 2018 result from rounding to the nearest penny at each of the four locations. Annual toll rate increases in future years are provided in Chapter 6.

# Table 2.2 Historical Toll Rate Increases on the Triangle Expressway (1)

	Through	er-Car ETC h Trip Toll I NC 540	Percent Annual
Calendar		Per-mile	Toll
Year	Toll (2)	Toll Rate	Increase
2013	\$ 2.34	\$ 0.155	
2014	2.46	0.163	5.1 %
2015	2.59	0.172	5.3
2016	2.70	0.179	4.2
2017	2.78	0.184	3.0
2018	2.89	0.191	4.0

- (1) Tolls increase on January 1st of each year.
- (2) Class 1 Toll (2-axle vehicle) on the 15.1 mile Toll NC 540 portion of the Triangle Expressway.

#### 2.1.2 Triangle Expressway Traffic Volumes and Characteristics

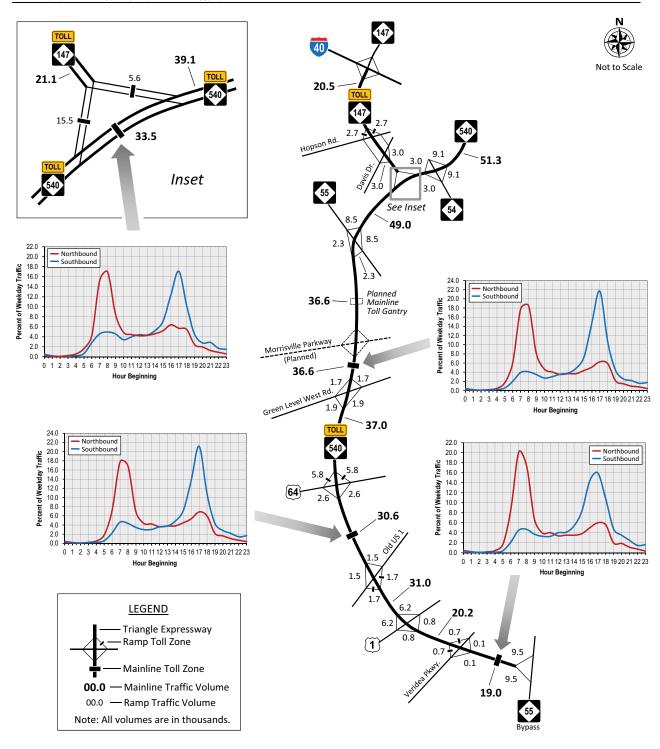
Based on data provided by NCTA, CDM Smith developed a balanced profile of 2016 and 2017 average weekday traffic on the Triangle Expressway. 2017 annual average weekday traffic (AAWDT) volumes are shown in **Figure 2.3**. Weekday traffic is important because about 83 percent of all Triangle Expressway toll transactions occur on weekdays. Traffic volumes build steadily from the south to the north on the Triangle Expressway, ranging from 19,000 vehicles per weekday at the southernmost mainline section to 49,000 on the mainline section between NC 55 and Toll NC 147.

Also shown in Figure 2.3 is the hourly weekday traffic distribution, by direction, at each of the four mainline toll-zone locations. The hourly traffic distributions are based on traffic data from Thursday, November 10, 2016. There is a sharp peaking characteristic to Triangle Expressway traffic, consistent with a commuter-based road. Northbound traffic peaks in the morning, while southbound traffic peaks in the afternoon. There is relatively low traffic demand during the midday.

Northbound traffic at the four selected mainline sections peaks between 7 AM and 9 AM, comprising from 32 to 37 percent of total weekday traffic volumes at each location. Northbound peak-hour (7 AM – 8 AM) traffic volumes comprise 15 to 20 percent of the total weekday volumes at each of the selected mainlines.

Southbound mainline traffic on the Triangle Expressway peaks sharply between 5 PM and 6 PM, comprising 16 to 22 percent of the weekday southbound traffic, as seen at the selected locations. PM peak period traffic, between 4 PM and 7 PM in the southbound direction, accounts for 40 to 47 percent of weekday southbound traffic at these locations.



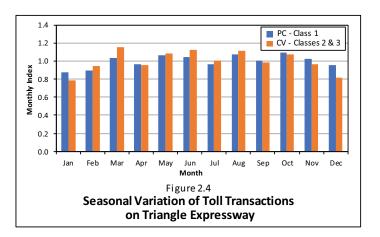




# TRIANGLE EXPRESSWAY: 2017 AVERAGE WEEKDAY TRAFFIC AND HOURLY DISTRIBUTION

Monthly traffic variations on the Triangle Expressway are shown in Figure 2.4 and daily variations are shown in Figure 2.5. Cars and trucks show similar monthly patterns, with traffic volumes highest in the spring, summer and fall, and somewhat lower from November through February. Cars and trucks also have similar daily-variation patterns, with the highest traffic volumes occurring on Tuesdays, Wednesdays and Thursdays. Weekend traffic volumes for both passenger cars and trucks are lower than the weekday volumes.

Table 2.3 shows the proportion of cars and trucks on the Triangle Expressway from 2013 through 2017. Passenger cars have consistently comprised 96 to 97 percent of total transactions. Truck transactions totaled approximately three percent in 2013, and approximately four percent in 2017. Large trucks (four-or-more axles) represented 65 percent of total truck transactions in 2013, and 68 percent in 2017.



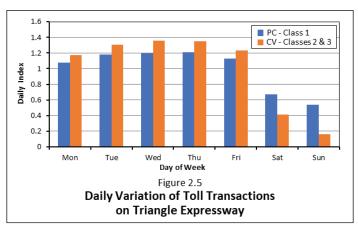


Table 2.3 Annual Vehicle Class Distribution on The Triangle Expressway by Toll Class (all transactions in thousands) Passenger-Car All Transactions **Transactions Truck Transactions** Class 1 Percent Class 2 Percent Class 3 Percent Class 2 & 3 Percent Percent Calendar 2-axle of Total 3-axle of Total 4 or-more of Total ΑII of Total ΑII of Total Vehicles Vehicles Vehicles Vehicles Axle Vehicles Vehicles Vehicles Vehicles Vehicles Year Trucks 2013 22,298 96.7 % 268 1.2 % 493 2.1 761 3.3 23,059 100.0 2014 29,641 357 652 1,010 100.0 96.7 1.2 2.1 3.3 30.650 2015 37.050 96.7 427 1.1 842 2.2 1,268 3.3 38,319 100.0 2016 43,568 100.0 96.3 566 1.3 1.110 2.5 1.676 3.7 45.244 2017 47,599 96.2 602 1.2 1,258 2.5 1,861 3.8 49,460 100.0 Source: NCTA



## 2.1.3 Travel Patterns on the Triangle Expressway

StreetLight Data, Inc. provided CDM Smith with a year of vehicle-matching data for 2016 at the 31 collection points shown in **Figure 2.6** and described in **Table 2.4**. The collection points were selected to obtain trip-distance and travel-pattern information on the Triangle Expressway, and to support the data needs of the ongoing Complete 540 Traffic and Revenue Study. This data provided insights into travel patterns and was available for discrete time periods as well as average days. Similar to license-plate matching surveys, geospatial information is gathered from sources such as mobile phones, GPS devices, connected cars and commercial vehicles. Unique identifiers are used to determine individual trips.

The StreetLight data helped determine what proportion of trips on the Triangle Expressway are either long-distance or through trips. **Figures 2.7 and 2.8** illustrate samples of the StreetLight data. The data is used in a similar manner to a "select link" analysis, where the selected link is identified by a star in each figure.

Figure 2.7 illustrates northbound Triangle Expressway travel patterns during an average weekday, based on all vehicles identified on the mainline section between the NC 55 Bypass and US 1. This section of roadway has the lowest weekday traffic volume of any mainline section. Figure 2.7 shows the percent of all vehicles detected at the select link, at each of the mainline locations to the north of the select link. For example, 69.9 percent of all vehicles identified at the select link location were also identified on the mainline section between Green Level West Road and NC 55, and 30.6 percent were identified on the mainline section between Toll NC 147 and NC 54. Over half of the northbound vehicles (52.4 percent) detected on the southernmost section of the Triangle Expressway made a trip of approximately 15 miles, past the NC 55 interchange and continuing on either Toll NC 147 or Toll NC 540.

Figure 2.8 illustrates weekday travel patterns in the southbound direction from the select link location on Toll NC 540 between NC 54 and Toll NC 147. This point is marked by a star. This mainline section has the second highest weekday traffic volume on the Triangle Expressway. As shown, the majority of traffic identified at this location made short trips on the Triangle Expressway, with 90.4 percent of the vehicles traveling only as far as the NC 55 interchange, and 8.3 percent of the trips traveling all the way to the southernmost mainline section.

The data provided by Streetlight assisted in identifying travel patterns but does not necessarily represent all vehicle trips. It is limited to the vehicles/motorists that are equipped with active devices that connect to cell towers or satellites.

#### 2.1.4 Triangle Expressway Transactions and Toll Revenue

The Triangle Expressway opened in three phases to tolled traffic, with the final section opening to traffic on December 12, 2012. Tolling began on January 3, 2013, on the last section. Annual toll transactions and collected toll revenue from 2013 through 2017 are shown in Table 2.5. Strong growth in transactions and toll revenue occurred from 2013 through 2017; when transactions increased, on average, by 21.0 percent per year and collected toll revenue increased, on average, by 30.1 percent per year. Transactions increased quickly due to a long ramp-up period as motorists became familiar with the new road and its benefits, and to positive economic conditions. Currently, the Triangle Expressway is still the only operating toll road in North Carolina, although the Monroe Expressway is planned to open in the fall of 2018 in the Charlotte area.



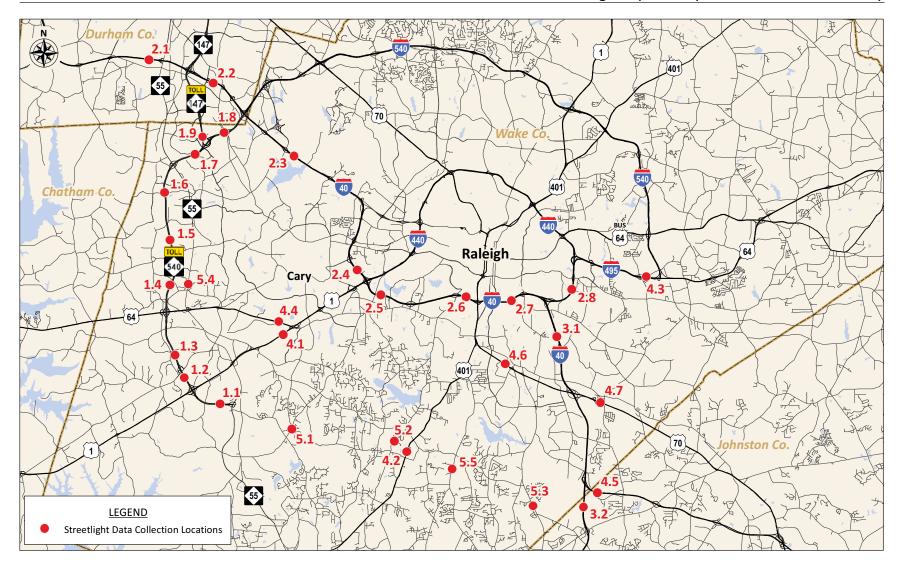
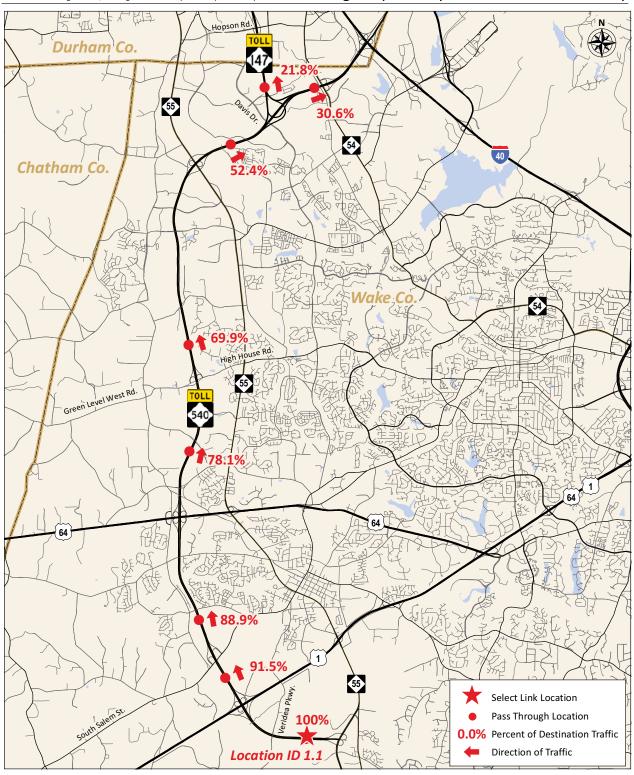




Table 2.4
StreetLight Data Collection Locations

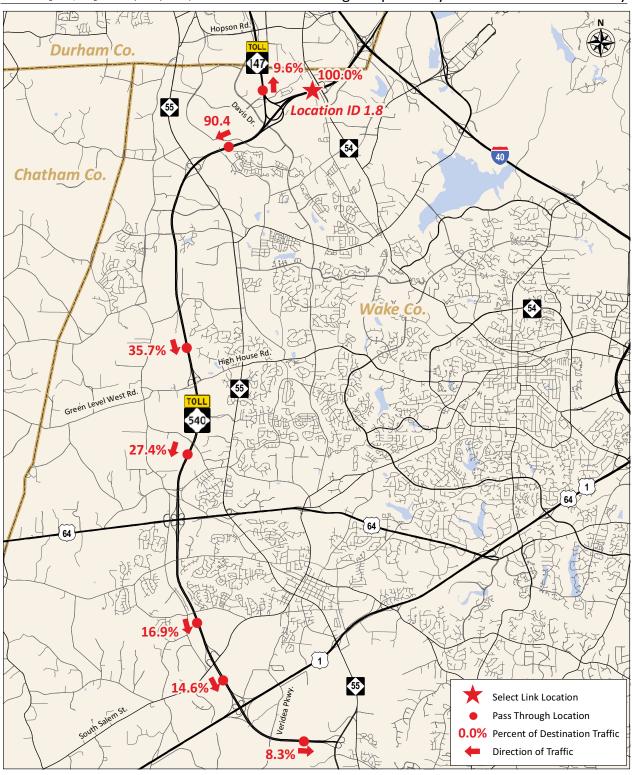
			Data Collected Between These Crossroads					
Location #	Direction	Roadway	Crossroad 1	Crossroad 2				
Corridor 1:	Triangle Expres	sswav						
1.1	NB / SB	Toll NC 540	US 1	NC 55 Bypass				
1.2	NB / SB	Toll NC 540	Old US Hwy 1	US 1				
1.3	NB / SB	Toll NC 540	US Hwy 64	Old US Hwy 1				
1.4	NB / SB	Toll NC 540	Green Level Rd W	US Hwy 64				
1.5	NB / SB	Toll NC 540	Green Hope School Rd	Green Level Rd W				
1.6	NB / SB	Toll NC 540	NC 55	Green Hope School Rd				
1.7	NB / SB	Toll NC 540	Toll NC 147	NC 55				
1.8	NB / SB	Toll NC 540	NC 54	Toll NC 147				
1.9	NB / SB	Toll NC 147	Davis Dr	I-540				
Corridor 2:	I-40 / I-440							
2.1	EB / WB	1-40	NC 54	NC 55				
2.2	EB / WB	1-40	Davis Dr	S Miami Blvd				
2.3	EB / WB	1-40	Aviation Parkway	N Harrison Ave				
2.4	EB / WB	1-40	Cary Towne Blvd	US 1 / I-440				
2.5	EB / WB	I-40	US 1 / I-440	Gorman St				
2.6	EB / WB	I-40	Lake Wheeler Rd	US 401 / S Saunders St				
2.7	EB / WB	I-40	Hammond Rd	Rock Quarry Rd				
2.8	EB / WB	I-440	Poole Rd	I-40				
3.1	NB / SB	I-40	Jones Sausage Rd	I-440				
3.2	NB / SB	I-40	NC 42	US 70 Clayton Bypass				
Selected Bi-	Directional Lo	cations						
4.1	EB / WB	US 1	Ten Ten Rd	US 64				
4.2	NB / SB	US 401	Donny Brook Rd	Ten Ten Rd				
4.3	EB / WB	US 64 Bypass	Hodge Rd	I-540				
4.4	EB / WB	US 64	Lake Pine Dr	US 1				
4.5	EB / WB	US 70 Clayton Bypass	1-40	Cornwallis Rd				
4.6	EB / WB	US 70	Yeargan Rd	Vandora Springs Rd				
4.7	EB / WB	US 70 Business	I-40 / US 70	Auburn-Knightdale Rd				
Selected Co	mbined Direct	tion Locations						
5.1	NB + SB	Holly Springs Rd	Sunset Lake Rd	Kildaire Farm				
5.2	NB + SB	Lake Wheeler Rd	Optimist Farm Rd	Ten Ten Rd				
5.3	NB + SB	NC 50	Cleveland School Rd	Ten Ten Rd				
5.4	NB + SB	NC 55	Jenks Rd	Green Level Rd W				
5.5	NB + SB	Old Stage Rd	Banks Rd	Ten Ten Rd				







WEEKDAY TRAVEL PATTERN
DISTRIBUTION AT LOCATION 1.1 NORTHBOUND





WEEKDAY TRAVEL PATTERN
DISTRIBUTION AT LOCATION 1.8 SOUTHBOUND

Annual collected toll revenue increased at a faster rate than transactions in part due to programmed toll rate increases, and because the average weighted toll increased faster than the programmed toll rate increases. The average weighted toll is influenced each year by 1) the mix of ETC and BBM, 2) the mix of the vehicle classes, and 3) the average trip distance made on the Triangle Expressway.

Table 2.5

Triangle Expressway Annual Transactions and Collected Toll Revenue
(transactions and revenue in thousands)

						Average \	Neighted	
	Toll Transact	ions and	Col	lected Toll	Revenue	Toll Rat	te and	Percent
	Year-over	-Year	a	nd Year-ov	er-Year	Year-ov	er-Year	Annual
Calendar	Percent G	rowth	P	ercent Gro	wth (2)	Percent G	Toll	
Year	Transactions	Growth	R	evenue	Growth	Toll Rate	Growth	Increase
2013	23,059		\$	14,238		\$ 0.62		
2014	30,650	32.9 %		21,045	47.8 %	0.69	11.2 %	5.3 %
2015	38,319	25.0		28,779	36.7	0.75	9.4	4.2
2016	45,244	18.1		35,393	23.0	0.78	4.2	3.0
2017	49,460	9.3		40,792	15.3	0.82	5.4	4.0
Average Ar	nnual Percent Cha	ange						
2013-2017		21.0			30.1		7.5	4.4

<sup>(1)</sup> The average weighted toll rate is calculated by dividing total toll revenue for the year by total toll transactions for the year.

Source: NCTA

Monthly transactions and collected toll revenue are provided in **Table 2.6** from January 2013 through June 2018. In the first six months of 2018, passenger-car transactions and toll revenue increased by 7.3 percent and 11.7 percent respectively, compared to the same period in 2017. Truck transactions and toll revenue increased by 6.9 percent and 8.1 percent, respectively. In total, transactions in the first half of 2018 increased by 7.3 percent, and collected toll revenue increased by 11.4 percent compared to the first half of 2017.

**Table 2.7** shows the 2017 systemwide percent of transactions and collected toll revenue attributed to cars and trucks. Cars comprised 96.2 percent of total transactions, and 91.4 percent of toll revenue. Truck transactions totaled 3.8 percent of total transactions and 8.6 percent of total toll revenue.



<sup>(2)</sup> This is toll revenue collected during the indicated year. It does not include fee revenue.

Table 2.6

Triangle Expressway - Monthly Transaction and Collected Toll Revenue Trends
(transactions and revenue in thousands)

#### Passenger Cars (Class 1: 2-Axle Vehicles)

	Toll Transactions (000s)										Toll Revenue (000s) (1)											
Month	2013	% Chg	2014	% Chg	2015	% Chg	2016 (2)	% Chg	2017 (3)	% Chg	2018	2013	% Chg	2014	% Chg	2015	% Chg	2016 (2)	% Chg	2017 (3)	% Chg	2018
January	1,523	28.9	1,964	34.0	2,632	15.9	3,049	14.4	3,488	5.1	3,665	\$ 75	5 75.9	\$ 1,329	43.6	\$ 1,908	24.0	\$ 2,366	24.2	\$ 2,938	6.5	\$ 3,129
February	1,517	24.2	1,884	19.1	2,244	45.6	3,267	8.3	3,540	8.5	3,840	85	7 44.1	1,235	44.1	1,779	40.4	2,499	9.4	2,734	15.7	3,163
March	1,730	31.3	2,271	30.3	2,959	25.2	3,703	10.4	4,087	5.2	4,298	97	5 47.1	1,434	51.7	2,175	20.0	2,610	24.2	3,243	7.7	3,493
April	1,806	32.1	2,387	28.1	3,057	19.5	3,652	4.9	3,829	10.7	4,239	1,02	2 40.3	1,434	45.5	2,088	24.2	2,592	10.8	2,871	15.7	3,323
May	1,917	34.8	2,585	21.4	3,138	18.9	3,732	12.6	4,204	8.5	4,560	1,11	2 44.3	1,605	28.0	2,053	29.0	2,649	18.3	3,135	14.7	3,596
June	1,820	40.6	2,559	25.3	3,207	17.8	3,777	9.9	4,152	6.2	4,409	1,01	1 60.4	1,622	45.6	2,362	12.2	2,649	21.6	3,222	10.4	3,559
July	1,870	36.3	2,549	25.7	3,205	10.2	3,532	8.4	3,830			1,08	8 54.1	1,677	33.9	2,246	13.5	2,550	19.6	3,050		
August	2,009	31.1	2,634	25.0	3,293	18.8	3,912	9.0	4,263			1,19	9 47.2	1,764	36.9	2,416	20.3	2,905	15.3	3,350		
September	1,949	37.9	2,687	21.2	3,257	12.8	3,676	8.6	3,993			1,16	5 56.3	1,820	27.7	2,324	22.1	2,837	10.7	3,141		
October	2,178	33.8	2,915	20.8	3,522	12.4	3,957	9.8	4,347			1,30	5 40.3	1,830	31.8	2,412	22.2	2,947	13.0	3,328		
November	2,000	27.7	2,555	26.1	3,221	15.8	3,730	9.2	4,074			1,23	5 37.8	1,703	37.6	2,343	18.4	2,774	14.7	3,182		
December	1,978	34.1	2,652	25.0	3,316	8.0	3,580	5.9	3,793	_		1,24	45.7	1,807	26.4	2,284	26.1	2,879	6.9	3,078		
Total Year	22,298	32.9	29,641	25.0	37,050	17.6	43,568	9.3	47,599			\$12,96	5 48.5	\$19,259	37.0	\$26,390	22.2	\$32,257	15.6	\$37,275		
Jan-June	10,314	32.3	13,649	26.3	17,236	22.9	21,181	10.0	23,300	7.3	25,012	5,73	3 51.0	8,658	42.8	12,366	24.3	15,366	18.1	18,145	11.7	\$20,263

	Commercial Vehicles (Class										Classes 2	and :	3: 3-or	-more A	xle Vehi	cles)							
					Toll Tran	saction	s (000s)										Toll Rev	venue (C	00s) (1)				
Month	2013	% Chg	2014	% Chg	2015	% Chg	2016 (2)	% Chg	2017 (3)	% Chg	2018	2	2013	% Chg	2014	% Chg	2015	% Chg	2016 (2)	% Chg	2017 (3)	% Chg	2018
January	37	58.2	59	25.5	74	37.4	102	20.0	122	1.8	124	\$	64	55.8	\$ 99	52.9	\$ 152	28.4	\$ 195	8.2	\$ 211	5.7	\$ 223
February	39	44.6	57	4.5	59	77.7	105	38.5	146	(2.7)	142		66	50.0	99	11.1	109	79.6	197	39.8	275	(4.6)	262
March	57	25.1	72	34.2	96	49.3	143	24.3	178	(8.5)	163		98	25.8	123	44.0	178	53.2	272	26.4	344	(9.5)	311
April	62	41.0	87	24.3	109	28.6	140	5.7	148	20.7	178		104	49.9	157	24.2	194	36.4	265	8.1	287	23.0	353
May	66	46.9	97	19.6	116	20.8	140	20.2	168	17.7	198		112	52.9	171	28.3	220	21.9	268	22.6	328	18.3	388
June	64	47.7	95	27.6	121	29.1	156	12.1	175	12.1	196		112	48.7	166	30.3	216	38.8	300	11.1	334	15.6	386
July	69	34.5	92	27.7	118	20.3	142	9.1	155				118	40.7	166	36.0	226	20.5	273	9.1	298		
August	76	23.4	94	27.3	120	41.2	169	1.7	172				123	40.9	173	35.1	234	29.6	303	5.5	320		
September	78	20.7	94	29.1	121	14.9	139	10.1	153				130	21.9	159	45.2	231	14.3	264	14.8	303		
October	81	27.4	104	18.3	123	31.1	161	3.5	166				138	43.8	198	19.6	237	20.5	285	5.1	300		
November	68	15.5	78	30.7	102	43.5	147	2.4	150				109	34.6	147	28.0	189	44.5	273	4.3	284		
December	63	28.2	81	35.2	110	20.5	132	(4.0)	127				99	29.1	128	58.3	203	19.2	242	(2.9)	235		
Total Year	761	32.7	1,010	25.6	1,268	32.2	1,676	11.0	1,861	_		\$	1,273	40.3	\$ 1,787	33.7	\$ 2,389	31.3	\$ 3,136	12.1	\$ 3,517		
Jan-June	326	43.1	466	23.3	575	36.8	786	19.2	937	6.9	1,002		556	46.7	815	31.2	1,070	40.0	1,497	18.8	1,778	8.1	\$ 1,923

										Total Ve	ehicles (Cla	asse	s 1 thro	ugh 3)									
					Toll Tran	saction	ıs (000s)					Toll Revenue (000s) (1)											
Month	2013	% Chg	2014	% Chg	2015	% Chg	2016 (2)	% Chg	2017 (3)	% Chg	2018		2013	% Chg	2014	% Chg	2015	% Chg	2016 (2)	% Chg	2017 (3)	% Chg	2018
January	1,561	29.6	2,023	33.8	2,705	16.5	3,151	14.6	3,610	5.0	3,789	\$	819	74.3	\$ 1,428	44.3	\$ 2,060	24.3	\$ 2,561	23.0	\$ 3,149	6.4	\$ 3,352
February	1,556	24.7	1,941	18.7	2,303	46.4	3,373	9.3	3,686	8.0	3,982		923	44.5	1,333	41.7	1,889	42.7	2,696	11.6	3,009	13.8	3,425
March	1,787	31.1	2,342	30.4	3,055	25.9	3,847	10.9	4,265	4.6	4,461		1,073	45.2	1,557	51.1	2,353	22.5	2,883	24.4	3,587	6.1	3,804
April	1,868	32.4	2,474	27.9	3,165	19.8	3,792	4.9	3,977	11.1	4,417		1,127	41.2	1,591	43.4	2,282	25.2	2,857	10.5	3,158	16.4	3,676
May	1,983	35.2	2,682	21.3	3,254	19.0	3,872	12.9	4,372	8.8	4,758		1,224	45.1	1,776	28.0	2,273	28.3	2,917	18.7	3,463	15.0	3,985
June	1,884	40.8	2,654	25.4	3,328	18.2	3,933	10.0	4,326	6.4	4,605		1,123	59.2	1,788	44.2	2,578	14.4	2,950	20.6	3,556	10.9	3,944
July	1,938	36.3	2,642	25.8	3,323	10.6	3,674	8.5	3,985				1,207	52.8	1,843	34.1	2,472	14.2	2,823	18.6	3,348		
August	2,086	30.8	2,728	25.1	3,413	19.6	4,081	8.7	4,435				1,322	46.6	1,937	36.7	2,650	21.1	3,208	14.4	3,669		
September	2,026	37.2	2,781	21.5	3,378	12.9	3,815	8.7	4,146				1,295	52.8	1,979	29.1	2,555	21.4	3,101	11.1	3,443		
October	2,260	33.6	3,018	20.7	3,644	13.0	4,118	9.6	4,513				1,442	40.6	2,028	30.6	2,649	22.0	3,232	12.3	3,628		
November	2,068	27.3	2,633	26.2	3,324	16.6	3,876	9.0	4,224				1,345	37.5	1,850	36.9	2,532	20.3	3,046	13.8	3,467		
December	2,041	33.9	2,733	25.3	3,426	8.4	3,712	5.6	3,920				1,339	44.5	1,935	28.5	2,487	25.5	3,121	6.2	3,313		
Total Year	23,059	32.9	30,650	25.0	38,319	18.1	45,244	9.3	49,460	_		\$	14,238	47.8	\$21,045	36.7	\$28,779	23.0	\$35,393	15.3	\$40,792		
Jan-June	10,640	32.7	14,115	26.2	17,811	23.3	21,967	10.3	24,237	7.3	26,013	L	6,288	50.6	9,473	41.8	13,435	25.5	16,863	18.1	19,923	11.4	\$22,186

<sup>(1)</sup> Programmed toll increases occurred every year on January 1st. Refer to Table 2.2 for details.

Source: NCTA

2-13

<sup>(2)</sup> Leap year occurred in 2016, resulting in negative traffic and toll revenue impacts in February 2017 compared to February 2016.

<sup>(3)</sup> A new interchange, Veridea Parkway, opened in April 2017.

Table 2.7
2017 Annual Transactions and Collected Toll Revenue By Vehicle Class
(traffic and revenue in thousands)

	Cars		Trucks		Total
-	Class 1	Class 2	Class 3	Class 2 & 3	Vehicles
Transactions	47,599	602	1,258	1,861	49,460
Percent of Total	96.2 %	1.2 %	2.5 %	3.8 %	100.0 %
Collected Toll Revenue	\$37,275	\$743	\$2,774	\$3,517	\$40,792
Percent of Total	91.4 %	1.8 %	6.8 %	8.6 %	100.0 %

Source: NCTA systemwide monthly transactions and revenue by toll class data

The percent of systemwide ETC transactions has been stable over the last five years, as shown in **Table 2.8**. Among passenger cars, ETC transactions ranged from 57.8 percent in 2013 to 59.1 percent in 2017. Truck ETC transactions averaged around 48 to 49 percent from 2013 to 2017.

	Table 2.8 ETC Market Share on the Triangle Expressway												
Calendar	P	ercent Cars	Transact	io	•	<b>icle Ty</b> rucks (2	pe and Mo	eth	nod of I	Paymer Total	nt		
Year	ETC	BBM	Total		ETC	BBM	Total	_	ETC	BBM	Total		
2013	57.8	42.2	100.0		48.8	51.2	100.0		57.5	42.5	100.0		
2014	58.4	41.6	100.0		48.7	51.3	100.0		58.1	41.9	100.0		
2015	58.0	42.0	100.0		48.1	51.9	100.0		57.6	42.4	100.0		
2016	58.6	41.4	100.0		49.0	51.0	100.0		58.3	41.7	100.0		
2017 (1)	59.1	40.9	100.0		48.0	52.0	100.0		58.7	41.3	100.0		

- (1) NCTA began offering free NC Quick Pass sticker transponders August 30, 2017. Previously the cost was \$5.00.
- (2) Cars are Toll Class 1 (2-axle vehicles).

  Trucks are Toll Classes 2 and 3 (3-or-more axle vehicles).

Source: NCTA

It should be noted that transaction data by payment type (ETC and BBM) is based on information provided by NCTA that represents monthly transactions by vehicle class and payment type as detected at roadside. During the processing of detected roadside transactions, two issues occur that alter the distribution of transactions into ETC and BBM categories from that shown in Table 2.8.

First, some transactions recorded at roadside as BBM are later identified as NC Quick Pass or E-ZPass tag holders during the license plate image review. These transactions, called ITOLs, were recorded as BBM transactions in the data provided by NCTA when they were actually ETC transactions. After the image review process, the toll revenue associated with the ITOL transactions was reported as ETC toll revenue, but the transaction volumes were not adjusted to reflect the shift into ETC.

Second, interoperable ETC transactions with Florida SunPass and Georgia Peach Pass transponders are recorded as BBM in the data provided by NCTA. The agencies that issue these transponders provide license plate files to NCTA and upon image review the transactions are associated with the SunPass and Peach Pass accounts and the appropriate toll is charged. All toll revenue associated with SunPass and Peach Pass transponders is reported as Class 1 ETC toll revenue in the NCTA data.

NCTA monthly transaction data are not changed to account for the portion of transactions initially identified as BBM, but subsequently identified as ITOLs or interoperable ETC and reported as ETC revenue. Upon review of NCTA data on ITOL transactions, and SunPass and Peach Pass transactions, the percentage of Triangle Expressway transactions associated with ETC accounts, and paying ETC toll rates, is higher than reflected in the data provided by NCTA. In 2017, after accounting for ITOLs and interoperable ETC transactions, cars had an ETC market share of about 64.1 percent compared to the 59.1 percent calculated from NCTA monthly transaction data and shown in Table 2.8. Trucks had an ETC market share of about 54.9 percent compared to the 48.0 percent in Table 2.8.

## 2.2 Study Area Traffic Volumes and Travel Time

The following describes traffic volumes and travel times in the study area.

#### 2.2.1 Traffic Volume Data Collection

CDM Smith collected a variety of traffic counts from different sources to validate TRMv6 assigned weekday traffic volumes at locations in the study area. The following sources of traffic counts were used in this study:

- 1. CDM Smith had The Traffic Group conduct traffic counts at 63 locations in the fall of 2016. In the fall of 2017, counts were conducted by The Traffic Group at an additional 15 locations.
- 2. Average annual daily traffic volumes were obtained from the NCDOT's Interactive Traffic Volume Map, located on the NCDOT website.
- 3. As described in Section 2.1.2, the NCTA provided CDM Smith with traffic volume data on the Triangle Expressway at tolled and non-tolled locations.

## 2.2.2 Traffic Counts Conducted by The Traffic Group

The Traffic Group conducted traffic counts at 63 locations in the fall of 2016, and an additional 15 locations in the fall of 2017. Counts were collected by direction in 15-minute increments via tubes or by Wavetronix radar detectors where tubes were not appropriate. Tube counts were collected by FHWA vehicle classifications. Wavetronix counts were collected by length categories. All counts were subsequently summarized into existing NCTA toll classes and TRMv6 time periods. Counts were conducted for at least three continuous weekdays (Tuesday, Wednesday and Thursday). At 12 locations, counts were conducted for seven consecutive days to obtain weekday and weekend-day traffic volumes.

All 78 traffic count locations are shown in Figure 2.9 and Table 2.9. Traffic count locations that closely parallel either the Triangle Expressway or the proposed Complete 540 are grouped into screenlines, shown as green lines in Figure 2.9.

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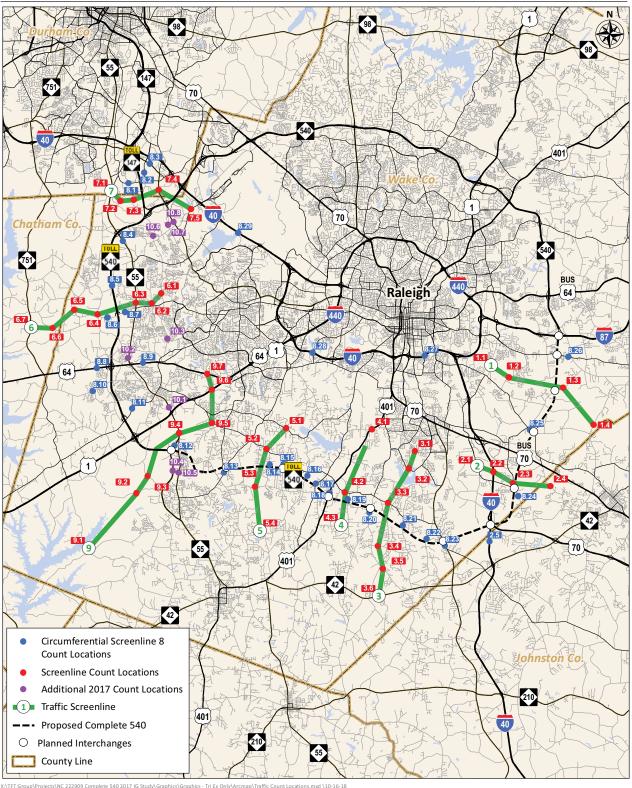




Table 2.9 (Page 1 of 3)
Summary of Weekday and Weekend-Day Traffic Volumes at Count Locations
Based on Traffic Counts Conducted in the Fall of 2016

Location #	Count Location	Average Weekday Traffic (1)	Average Weekend Day Traffic (2)	Percent Trucks Weekday (3)	Percent Trucks Weekend Day (3)
Screenline 1	L: East Side of Raleigh, Sou	th of Poole R	load		
1.1	S New Hope Rd	17,400		2.7%	
1.2	Barwell Rd	6,000		0.5%	
1.3	Auburn Knightdale Rd	2,900		2.3%	
1.4	Mial Plantation Rd	4,600		1.1%	
Screenline 2	2: East side of Raleigh, Sou	th of Busines	s 70		
2.1	White Oak Rd (NC 2547)	14,400		1.0%	
2.2	Interstate 40	90,100	88,100	12.5%	5.8%
2.3	Raynor Rd (NC 2555)	4,900		1.1%	
2.4	Guy Rd (NC 2558)	7,600		0.8%	
2.5	Interstate 40	67,000	64,900	14.5%	8.0%
Screenline 3	3: South of Raleigh, West o	of NC 50			
3.1	Timber Dr.	18,400		0.4%	
3.2	Buffalo Rd	2,900		0.1%	
3.3	Ten Ten Rd	13,100		1.5%	
3.4	Pagan Rd	1,700		0.3%	
3.5	Rock Service Station Rd	4,100		7.2%	
3.6	NC 42	10,400	8,800	2.9%	1.5%
Screenline 4	1: South of Raleigh, East of	US 401			
4.1	US 401	36,500	24,300	2.2%	0.9%
4.2	Ten Ten Rd	17,900		1.4%	
4.3	Banks Rd	6,600		1.1%	
Screenline 5	5: Southwest of Raleigh, Ea	st of Holly Sp	orings Road		
5.1	Penny Rd	9,800		0.6%	
5.2	Ten Ten Rd	19,400		1.7%	
5.3	Optimist Farm Rd	9,600		0.3%	
5.4	Hilltop Needmore Rd	9,300		2.0%	
Screenline 6	5: West of Raleigh, North o	f High House	Road		
6.1	Davis Dr	30,600		1.0%	
6.2	Louis Stephens Dr	3,400		0.0%	
6.3	NC 55	31,400	24,800	19.8%	13.0%
6.4	Green Level Church Rd	8,900		0.8%	
6.5	White Oak Church Rd	700		0.1%	
6.6	Green Level Rd	1,200		1.6%	
6.7	NC 751	7,600		2.5%	

(Continued on next page)



Table 2.9 (Page 2 of 3) Summary of Weekday and Weekend-Day Traffic Volumes at Count Locations Based on Traffic Counts Conducted in the Fall of 2016

		Average Weekday	Average Weekend Day	Percent Trucks	Percent Trucks Weekend
Location #	<b>Count Location</b>	Traffic (1)	Traffic (2)	Weekday (3)	Day (3)
	': West of Raleigh, South o				
7.1	NC 55 (Apex Highway)	24,100	15,000	1.3%	0.6%
7.2	Louis Stephens Dr	5,400		0.1%	
7.3	Davis Dr	23,500		0.7%	
7.4	NC 54	23,000	11,900	1.2%	0.7%
7.5	Airport Blvd	24,200		2.6%	
Screenline 8	3: Circumferential Location	ns Adjacent to	Complete 5	40 Route	
8.1	Hopson Rd.	10,600		0.4%	
8.2	Davis Dr	20,500		0.8%	
8.3	NC 54	12,100		0.4%	
8.4	NC 55	34,500		1.9%	
8.5	Green Hope School Rd	5,700		1.0%	
8.6	Green Level West Rd	6,500		1.9%	
8.7	Green Level West Rd	10,000		1.3%	
8.8	US 64	27,100		6.3%	
8.9	US 64	46,500	37,700	2.5%	1.0%
8.10	Olive Chapel Rd	5,000		2.1%	
8.11	Old US Highway 1	7,400		5.2%	
8.12	NC 55	31,000	24,400	3.5%	1.3%
8.13	Holly Springs Rd	20,800		0.4%	
8.14	West Lake Rd	8,600		0.8%	
8.15	Bells Lake Rd	5,800		0.5%	
8.16	Johnson Pond Rd	4,000		0.7%	
8.17	Lake Wheeler Rd	7,700		0.7%	
8.18	US 401	26,000	14,400	1.6%	0.8%
8.19	Fanny Brown Rd	4,700		0.3%	
8.20	Old Stage Rd	9,800		1.0%	
8.21	Sauls Rd	4,500		0.9%	
8.22	Jordan Rd	2,000		0.2%	
8.23	NC 50	16,200	14,700	1.2%	0.7%
8.24	White Oak Rd.	11,100		0.6%	
8.25	Rock Quarry Rd	5,200		1.8%	
8.26	Poole Rd (NC 2555)	9,900		1.4%	
8.27	Interstate 40	107,100	72,900	8.5%	2.6%
8.28	Interstate 40	125,000		11.6%	
8.29	Interstate 40	185,600		13.3%	

(Continued on next page)



Table 2.9 (Page 3 of 3)
Summary of Weekday and Weekend-Day Traffic Volumes at Count Locations
Based on Traffic Counts Conducted in the Fall of 2017

Location #	Count Location	Average Weekday Traffic (1)	Average Weekend Day Traffic (2)	Percent Trucks Weekday (3)	Percent Trucks Weekend Day (3)
Screenline 9: South of US 1					
9.1	New Hill Holleman Road	5,900		4.2%	
9.2	Holly Springs New Hill Road	2,400		1.2%	
9.3	Veridea Parkway	4,400		0.3%	
9.4	NC 55	47,500		2.2%	
9.5	Ten Ten Road	26,000		1.5%	
9.6	US 1	79,200		7.4%	
9.7	US 64	54,300		2.6%	
Additional 2017 Counts					
10.1	NC 55	31,900		6.1%	
10.2	NC 55	32,400		1.6%	
10.3	Davis Drive	14,600		0.7%	
10.4	NC 55 Bypass	45,000		3.1%	
10.5	NC 55 - North of Easton St.	15,100		0.5%	
10.6	Davis Drive	25,700		0.4%	
10.7	Church Street	8,600		0.6%	
10.8	Chapel Hill Road	17,700		2.3%	

<sup>(1)</sup> Represents the average of Tuesday, Wednesday and Thursday traffic count volumes.

Source: Traffic counts were conducted by The Traffic Group



<sup>(2)</sup> Represents the average of Saturday and Sunday traffic count volumes.

<sup>(3)</sup> Trucks are defined as vehicles with three or more axles.

The traffic volumes in Table 2.9, include the average weekday traffic, the average weekend-day traffic, and the percent of trucks out of the average weekday or weekend-day traffic. Obtaining weekday traffic volumes by 15-minute increments was important in model calibration as the model represents weekday traffic and the small time-periods allowed for the aggregation of traffic into the model time periods.

## 2.2.3 Historical Traffic Growth in the Study Area

Traffic growth on I-40 and selected highways and arterials from 2009 to the most currently available year are shown in **Figure 2.10**. The traffic volumes are annual average daily traffic (AADT) volumes provided by the NCDOT Traffic Survey Group. Traffic volumes are shown on I-40, Davis Drive, NC 42, NC 55, and Ten Ten Road for 2009, 2011, 2013 and 2015. Volumes are also shown at 2016 levels on I-40 locations.

Several roadway improvements occurred between 2009 and 2016 that impacted traffic volumes on area roads. Segment 1 of the Triangle Expressway (Toll NC 147 and Toll NC 540 from NC 54 to NC 55 near Morrisville) opened in January 2012, and Segment 2 (Toll NC 540 from NC 55 near Morrisville to US 64) opened in August 2012. In January 2013, the rest of the Triangle Expressway opened, from U.S. 64 to NC 55 Bypass near Holly Springs. It appears that the opening of the Triangle Expressway dampened traffic growth on Davis Drive and NC 55/NC 55 Bypass as evidenced by the 2013 AADTs.

In addition, Project Fortify I-40/I-440 was underway starting in early 2015. The project consisted of replacing the pavement on I-40 from U.S. 1/64 to the I-40/I-440 split. The work required the closing of one travel lane per direction during parts of 2015, all of 2016, and most of 2017. This work temporarily dampened traffic growth on sections of I-40 from 2015 through 2017. All travel lanes were re-opened by 2018, although some resurfacing and pavement work were completed in 2018.

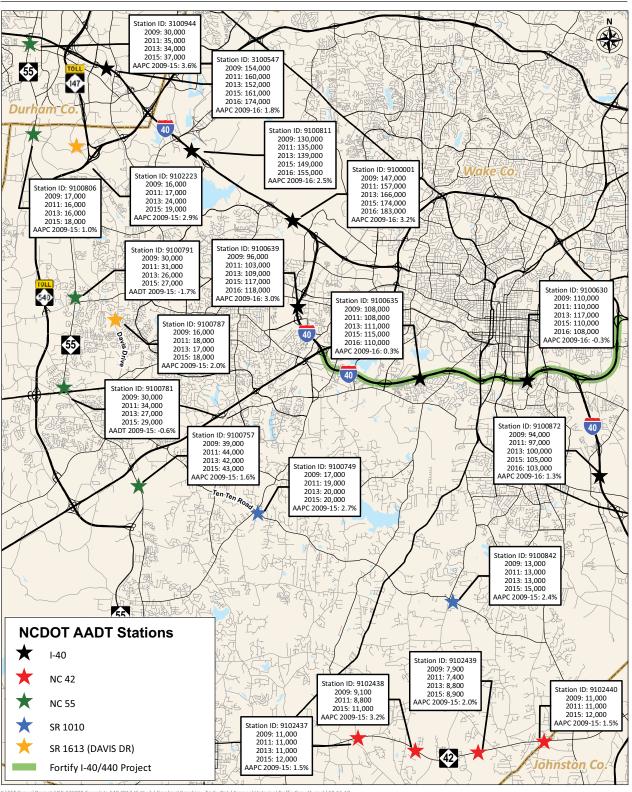
## 2.2.4 Travel Times in the Study Area

Travel speed data was obtained from HERE via Regional Integrated Transportation Information System (RITIS) with permission from NCDOT. Travel speed data was collected for the entire year of 2016. The data consisted of travel speeds and distance by roadway segment based on GPS data, from which travel time can be calculated. CDM Smith reviewed North Carolina-specific data validation reports produced for the I-95 Corridor Coalition for HERE. Based on that review, and prior experience using and validating INRIX data, CDM Smith found the HERE data to be an acceptable indicator of current travel speeds for this study.

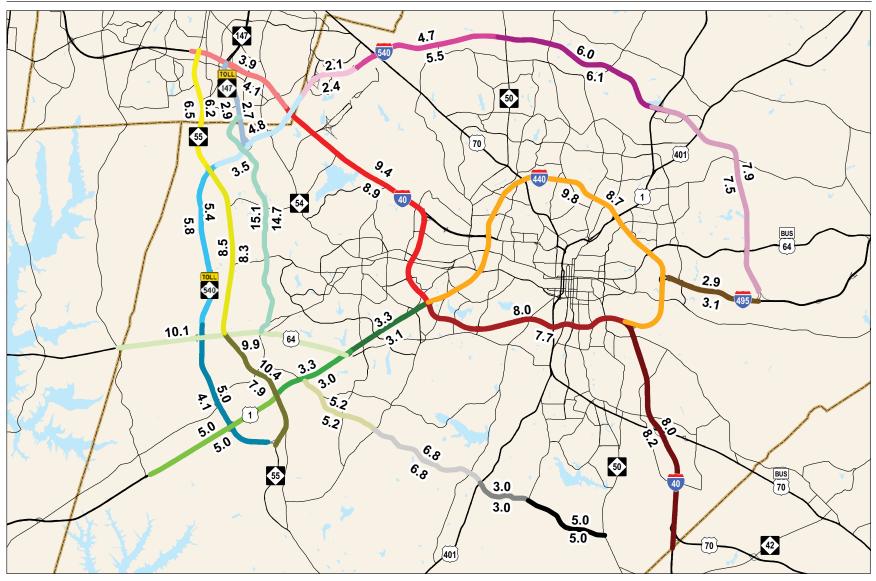
CDM Smith compiled and summarized travel speeds for selected road segments in the study area and used that information to calculate travel times. **Figure 2.11** shows 2016 average free-flow travel times by segment and direction for a sampling of the selected routes. It should be noted that minor differences in free-flow travel time by direction on a given segment can be attributed to directional variances in the distances provided by HERE. For comparison purposes, **Figure 2.12** and **Figure 2.13** show 2016 average travel times by segment and direction for the same routes during the AM peak hour (7 AM – 8 AM) and the PM peak hour (5 PM – 6 PM). For example, northbound travel times on NC 55 between U.S. 64 and Toll NC 540 averaged 8.3 minutes under free-flow conditions, 10.0 minutes during the AM peak hour, and 11.4 minutes during the PM peak hour.

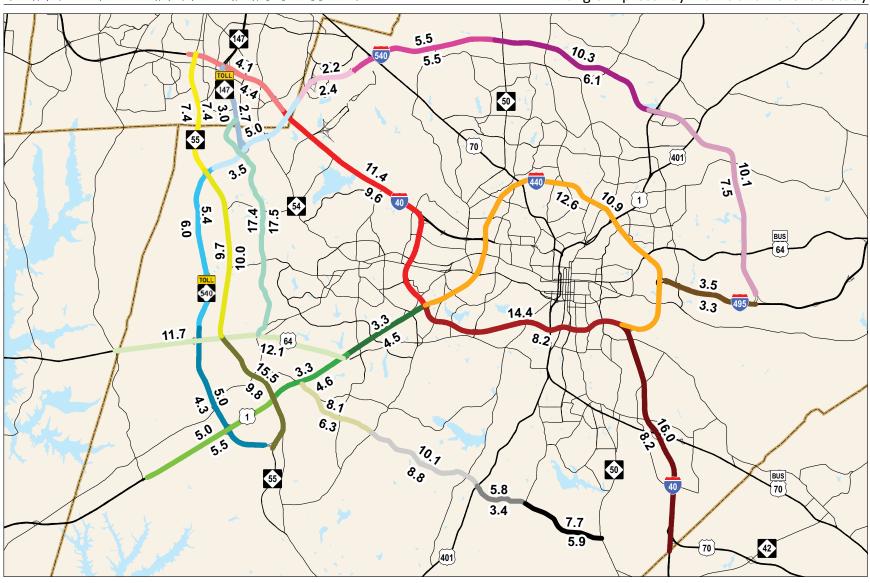
The travel times in Figures 2.8 through 2.10 are high-level summaries. For use in calibrating to 2016, travel times were available in smaller-distance segments.

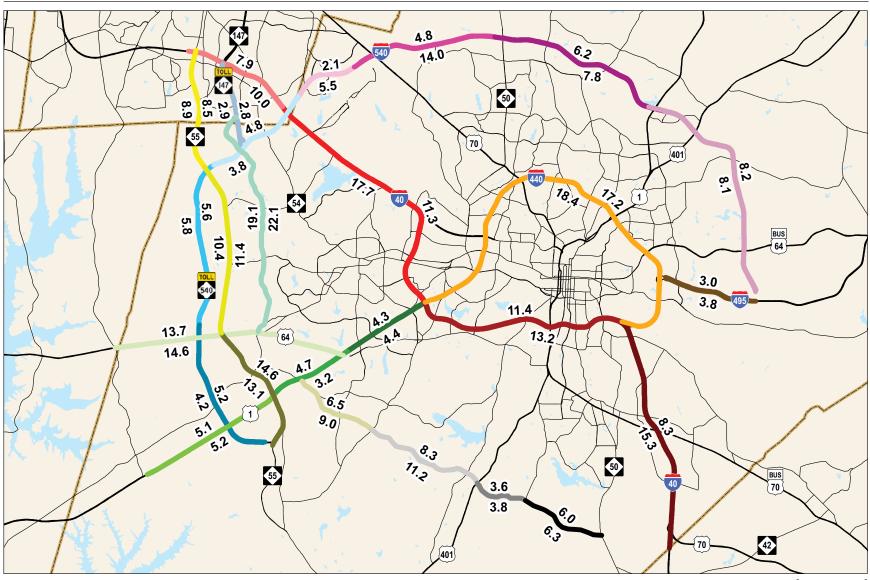
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## Chapter 3

## Independent Economic Review

## 3.1 Introduction

Economic growth forecasts are one of the most critical elements of any traffic and revenue forecast. Because of the inherent uncertainty in the economic forecasting process, this has also become an area of considerable review and scrutiny by rating agencies and others in the financial community. As such, CDM Smith engaged Dr. Stephen J. Appold, an economist with local expertise, to conduct an independent analysis of the economic growth forecasts assumed in the Triangle Regional Model version 6 (TRMv6), a key tool for evaluating future travel demand in the region.

The goal of this effort was to evaluate the reasonableness of regional and corridor growth rates contained in the TRMv6 and to make adjustments where appropriate. In this process Dr. Appold identified and analyzed major employers, employment centers, housing developments, and commercial and retail developments in order to derive an understanding of the economic drivers of the region. He also conducted an analysis of regional and corridor growth rates based on the latest available historic trends and forecasts.

The TRMv6 model uses 2013 as its base year, and supports additional model years 2025, 2035 and 2045. Dr. Appold created forecasts for population, households, and employment for 2016, 2025, 2035 and 2045. CDM Smith requested 2016 socioeconomics to create a Base Year 2016 for model calibration. The resulting socioeconomic forecasts were used as input to the TRMv6 to develop revised trip tables for 2016 and the officially supported TRMv6 years of 2025, 2035 and 2045.

This chapter describes the socioeconomic projections assumed in the TRMv6 and the forecasts developed by Dr. Appold. The chapter also briefly describes Dr. Appold's process to create 2016 Base Year socioeconomic forecasts that were used by CDM Smith to develop a calibrated 2016 model.

CDM Smith reviewed Dr. Appold's methodology and forecasts and adopted his forecasts as input to the travel demand modeling conducted in support of this study. A detailed description of Dr. Appold's methodology and conclusions can be found in his July 2018 study titled, *Evaluation of the Socioeconomic Conditions and Forecasts in the Complete 540 Study Area*.

## 3.2 Socioeconomics for Calibration Year 2016

The TRMv6 model uses 2013 as its base year for socioeconomic data inputs into the model. CDM Smith created a 2016 Base Year for model calibration, using socioeconomic inputs developed by Dr. Appold. The model required estimates of six subsets of socioeconomic data which are described in the following subsections. Dr. Appold developed these inputs to the model independently of the TRMv6 2013 datasets.



## 3.2.1 Households and Population

To estimate the number of households, Dr. Appold consulted 2010 Census data at the block level¹ and added the estimated number of housing units added between 2010 and 2016. The number of housing units added was estimated using Certificates of Occupancy data for Chatham, Durham and Orange Counties; county parcel files for Harnett County; county parcel files augmented with supplemental information for Johnston and Wake Counties; and 2010 Census block-level household counts increased by a uniform overall county growth rate for the peripheral counties of Franklin, Granville, Nash and Person.

After the block-level estimates were calculated, the block-level data was allocated to the 2,857 Traffic Analysis Zones (TAZs) contained in the TRMv6. Most Census Blocks fell within a TAZ, but 265 Census Blocks were split into multiple TAZs. After the data was allocated to TAZs, all estimates were then rounded to the nearest whole number. The resulting estimate of 2016 households was then multiplied by the latest then-available (2011-2015) American Community Survey (ACS) estimates of housing occupancy rates and rounded to the nearest whole number to develop an estimated population.

## 3.2.2 Group Quarters Population

In 2010, approximately three percent of the population in the TRMv6 region lived in group quarters. Of those, 38 percent were in institutional quarters, mostly correctional facilities and nursing facilities. The institutionalized population does not contribute significantly to travel demand, and therefore, is not included in the population dataset. The other 62 percent, comprising less than two percent of the regional population, are not institutionalized and are represented by two group quarters fields included in the 2016 socioeconomic data set.

The first group, covering about 85 percent of the non-institutionalized group quarters population, are students living in public and private dormitories at each of the TRMv6 region's four major universities: North Carolina State University in Raleigh, the University of North Carolina at Chapel Hill, and Duke University and North Carolina Central University in Durham. The student population in the 2016 dataset was not changed from the TRMv6 2013 dataset, because the totals appear to remain relatively constant based on the available information.

The second group quarters field is for non-student, non-institutionalized population. Because a detailed categorization of group quarters population is only available in the decennial Census, the proportion of total block group population that lived in non-student, non-institutionalized group quarters was calculated, and that same proportion applied to the total 2016 block group population to estimate the number for 2016. This procedure assumes that the number of students living in group quarters has remained constant since 2013 but that the non-student, non-institutionalized group quarters population has grown.

## 3.2.3 Mean Household Income

Mean household income estimates were calculated for each TAZ in the model. This was accomplished by using Census Block data (number of households by income category) from the 2012-2016 ACS, aggregating this data into TAZs, and taking the household mean for each TAZ. The calculated 2016

<sup>&</sup>lt;sup>1</sup> Census blocks are the smallest geographic area from which the Census Bureau collects data, with a minimum size of 30,000 square feet (0.69 acres).



3-2

value was translated into 2013 dollars by using the Consumer Price Index Research Series Using Current Methods (CPI-U-RS) all-city average, as the TRMv6 model requires household income to be translated to 2013 dollars.

## 3.2.4 Employment

There are three components of TAZ-level employment estimates: county-level totals, sectoral distribution, and geographic distribution. Dr. Appold used the Quarterly Census of Employment and Wages (QCEW) to generate county-level totals and, following TRMv6 practice, adjusted by  $^{25}/_{23}$  (an approximately eight percent increase) to account for employment not covered by unemployment insurance in order to generate county control totals. Dr. Appold agrees that the adjustment is reasonable as the QCEW number is conservative compared to Bureau of Economic Analysis (BEA) employment estimates.

The TRMv6 data further classifies employment by five sectors: industry, office, high-volume service, low-volume service and retail. Employment is separated out by sectoral category because each is thought to have different propensities to generate customer (client) traffic. Dr. Appold distributed 2016 employment into the five sectors based on QCEW data for four-digit North American Industry Classification System (NAICS) codes at the county-level.

Geographic distribution is the most challenging portion of developing employment estimates, as there are few sources of data at the sub-county level. Dr. Appold based employment distribution on three sets of information, including 1) InfoUSA; 2) the 2013 TRMv6 geographic distributions of employment, and 3) block-level longitudinal employer-household dynamics (LEHD) origin-destination employment statistics (LODES) data.

Using the three sources generated realistic results which compared well with observation and with each other. The TAZ-level estimates of sector employment correlated moderately well, and all relationships are highly statistically significant.

## 3.2.5 Earnings

Besides the TAZ-level inputs of employment by the five employment sectors (industry, office, high-volume service, low-volume service and retail), the TRMv6 model requires an allocation of employment by sector into two earning categories, high and low-wage. Industry and office sectors were combined, as were the high-volume and low-volume service sectors. High and low-wage employment counts are split near the median salary point for each sector. TRMv6 estimated these values for their 2010 and 2013 estimates using the 2010 CTPP version of the ACS data. The 2016 data applied the same proportional TAZ-level split found in those earlier estimates to the 2016 employment estimates.

## 3.2.6 Enrollment

Pre-kindergarten through 12<sup>th</sup> grade student enrollment was estimated from two Department of Instruction reports: month two of the Principal's Monthly Reports for the 2016-2017 school year for public and charter school students and the North Carolina Directory of Non-Public Schools, Conventional Schools Edition, with information for the 2016–2017 school term. The separate enrollment estimates were aggregated and linked to TAZs using public and private school location data obtained from the North Carolina open data portal.



### 3.3 Socioeconomic Forecasts and Adjustments

This section describes the three principal socioeconomic inputs to the TRMv6 model that drive travel demand forecasts; population, households and employment. The forecasts assumed in the TRMv6 are described, along with the adopted forecasts used in this study. The adopted forecasts were developed by Dr. Appold. The socioeconomic forecasts are described by various geographic areas described in the following subsection.

### 3.3.1 TRMv6 Model Area

The TRMv6 includes 10 North Carolina counties comprising 3,379 square miles: Chatham, Durham, Franklin, Graham, Harnett, Johnston, Nash, Orange, Person and Wake. Of the 10 counties, only Durham, Orange and Wake are fully contained within the model area; the other seven counties are only partially included. The area encompassed by the TRMv6 boundary, referred to as the "model area," is shown in **Figure 3.1**. Year 2013 is the official base year. Future year socio-economic and land-use assumptions in the TRMv6 are forecasts.

The TRMv6 contains 2,857 geographic units called Traffic Analysis Zones (TAZs). CDM Smith identified 983 zones in the vicinity of the Triangle Expressway and the proposed Complete 540 as residing in the "Detailed Study Area" or "Study Area". For purposes of summarization, TAZs in the Detailed Study Area were grouped into 43 Superzones, and six Regions. **Figure 3.2** illustrates the Superzones and Regions within the Detailed Study Area. The Regions are identified by a color and name, while the Superzones are identified by a number. The following subsections describe the socioeconomic forecasts by County and Region, with figures provided at the Superzone level.

### 3.3.2 Population Forecasts

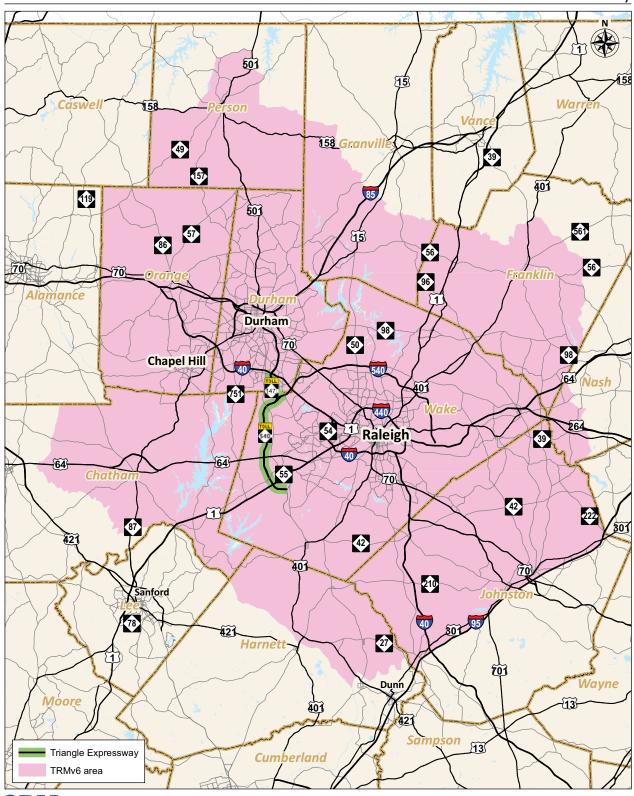
**Table 3.1** presents TRMv6 population forecasts by county for each model year. The upper portion of Table 3.1 shows the original data set contained in the TRMv6. The lower portion shows the data set adjusted by Dr. Appold and adopted by CDM Smith for use in this study. Population growth rates for each 10-year interval are calculated using average annual percent change (AAPC).

The official base year for the TRMv6 is 2013. CDM Smith created a 2016 model for calibration, and, as described in Section 3.2, asked Dr. Appold to develop the 2016 socioeconomic variables required by the model, including population, households and employment for each TAZ. The 2016 socioeconomic dataset developed by Dr. Appold is used as a common benchmark to measure growth for both the TRMv6 future-year socioeconomic forecasts and Dr. Appold's.

The populations shown reflect the portions of the listed counties that are in the TRMv6 model area. Only Durham, Orange and Wake counties are included in their entirety in the TRMv6 model area. The Triangle Expressway is primarily located in Wake County, although Toll NC 147 is partially located in Durham County. Complete 540 is located in Wake and Johnston counties, and is near parts of Harnett County.

Population growth rates are very similar, in total, between the TRMv6 and adopted forecasts. Compared to the TRMv6 forecasts, the annual rates of adopted population growth are lower in Wake and Durham counties for all model years and higher in Johnston County for all model years. Harnett County adopted population growth rates are higher than the original rates between 2016 and 2025.







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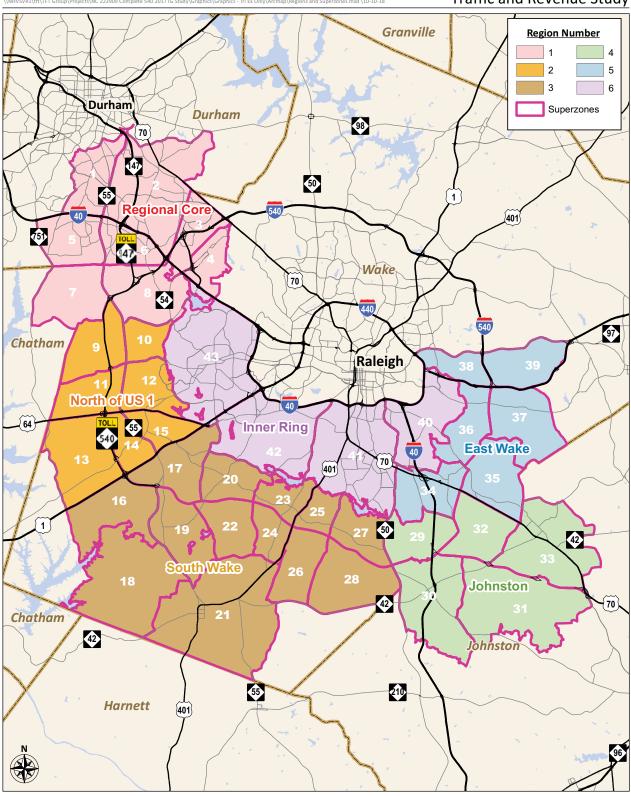




Table 3.1

Model Area Population Forecasts by County - TRMv6 and Adopted Values
(population in thousands)

				TRMv6	Values			
		AAPC		AAPC		AAPC		AAPC
County (1)	2016	2016-25	2025	2025-35	2035	2035-45	2045	2016-45
Chatham	46.4	2.5 %	58.0	2.2 %	71.8	1.7 %	85.4	2.1 %
Durham (1)	291.7	1.5	334.2	1.4	384.5	1.2	431.9	1.4
Franklin	54.0	1.9	64.2	1.5	74.5	1.2	84.3	1.5
Granville	31.2	1.4	35.4	1.3	40.3	1.1	44.8	1.3
Harnett	39.4	1.4	44.8	1.7	53.0	1.4	60.7	1.5
Johnston	159.9	3.0	208.8	2.3	262.3	1.8	313.1	2.3
Nash	3.6	3.0	4.7	1.1	5.3	2.9	7.0	2.3
Orange (1)	131.2	1.3	147.7	1.0	162.6	0.8	176.7	1.0
Person	31.2	0.6	32.8	0.3	33.7	0.2	34.3	0.3
Wake (1)	1,029.9	2.0	1,234.6	1.8	1,476.7	1.5	1,710.8	1.8
Total	1,818.6	2.0	2,165.3	1.7	2,564.5	1.4	2,948.9	1.7

				Adopte	d Values			
		AAPC		AAPC		AAPC		AAPC
County (1)	2016	2016-25	2025	2025-35	2035	2035-45	2045	2016-45
Chatham	46.4	3.1 %	61.0	2.2 %	76.0	2.0 %	92.3	2.4 %
Durham (1)	291.7	1.3	329.0	1.3	373.7	1.1	418.3	1.3
Franklin	54.0	2.2	65.6	1.6	76.8	1.4	88.5	1.7
Granville	31.2	3.2	41.4	1.8	49.6	1.7	58.6	2.2
Harnett	39.4	2.2	47.7	1.6	56.0	1.4	64.6	1.7
Johnston	159.9	3.3	214.4	2.5	274.4	2.1	338.5	2.6
Nash	3.6	2.7	4.6	1.1	5.1	1.0	5.7	1.6
Orange (1)	131.2	1.1	144.6	0.9	158.6	0.8	172.5	0.9
Person	31.2	0.0	31.2	0.0	31.3	0.0	31.3	0.0
Wake (1)	1,029.9	1.8	1,208.1	1.7	1,435.7	1.5	1,663.5	1.7
Total	1,818.6	1.9	2,147.7	1.7	2,537.2	1.5	2,933.6	1.7

<sup>(1)</sup> Only Durham, Orange and Wake counties are entirely contained in the TRMv6 model area. The population in the remaining counties represents only the portion within the TRM model boundaries.

Note: AAPC is an abbreviation for Average Annual Percent Change

The adjustments to population forecasts at a county level are shown in **Table 3.2**. In the model area, total population was consistently adjusted downward by Dr. Appold, largely due to recent revisions of county-level population forecasts by the North Carolina Office of State Budget and Management (OSBM). Both the TRMv6 and adopted forecasts use OSBM projections as their basis for population projections. However, TRMv6 used OSBM figures dating from October 2015, while Dr. Appold used a more recent projection.

Table 3.2
<b>Model Area Population Adjustments by County</b>
(population in thousands)

		2025			2035			2045	
County (1)	TRMv6	Adopted	Adjustment	TRMv6	Adopted	Adjustment	TRMv6	Adopted	Adjustment
Chatham	58.0	61.0	3.1	71.8	76.0	4.2	85.4	92.3	6.9
Durham (1)	334.2	329.0	(5.2)	384.5	373.7	(10.8)	431.9	418.3	(13.5)
Franklin	64.2	65.6	1.3	74.5	76.8	2.3	84.3	88.5	4.2
Granville	35.4	41.4	6.0	40.3	49.6	9.3	44.8	58.6	13.7
Harnett	44.8	47.7	2.9	53.0	56.0	3.0	60.7	64.6	3.8
Johnston	208.8	214.4	5.6	262.3	274.4	12.1	313.1	338.5	25.4
Nash	4.7	4.6	(0.1)	5.3	5.1	(0.1)	7.0	5.7	(1.3)
Orange (1)	147.7	144.6	(3.1)	162.6	158.6	(4.0)	176.7	172.5	(4.3)
Person	32.8	31.2	(1.6)	33.7	31.3	(2.5)	34.3	31.3	(3.1)
Wake (1)	1,234.6	1,208.1	(26.5)	1,476.7	1,435.7	(40.9)	1,710.8	1,663.5	(47.4)
Total	2,165.3	2,147.7	(17.6)	2,564.5	2,537.2	(27.3)	2,948.9	2,933.6	(15.4)

(1) Only Durham, Orange and Wake counties are entirely contained in the TRMv6 model area. The population in the remaining counties represents only the portion within the TRM boundaries.

Note: AAPC is an abbreviation for Average Annual Percent Change

When compared with total model-area TRMv6 projections, the adopted population forecast shows approximately 17,600 fewer residents in 2025 and 15,400 fewer in 2045. These adjustments include lower population growth in the core counties (Durham, Orange and Wake) and more growth in the suburban counties over the next 20 years. Wake County adopted forecasts include approximately 26,500 fewer residents in 2025 and 47,400 fewer in 2045. Johnston County adopted forecasts in the model area include approximately 5,600 more residents in 2025 and 25,400 more in 2045.

The distribution of population growth by small geographic areas within the model area is very important, as population growth proximate to Triangle Expressway impacts potential travel more than population growth further away.

**Table 3.3** presents the population projections within the Detailed Study Area by region for each model year. The Detailed Study Area represents the geography that surrounds the Triangle Expressway and Complete 540 corridor. The upper portion of Table 3.3 shows the original TRMv6 data set. The lower portion shows the adopted data set.

The adopted population is estimated to increase at a faster rate between 2016 and 2025 in the Regional Core (the area surrounding the RTP) and North of U.S. 1 (the area encompassing most of the Triangle Expressway, compared to the original TRMv6 estimates. The population growth rate was reduced in the adopted forecast for the South Wake region (at the southern end of the Triangle Expressway and extending to the east along the Complete 540 corridor) between 2016 and 2025. Annual rates of growth are similar between the adopted and original population estimates in the years after 2025.

The population adjustments in the Detailed Study Area between the TRMv6 and the adopted values are shown in **Table 3.4**. Population was increased in the Regional Core by approximately 6,600 (5.5 percent) in 2025, 5,200 (3.8 percent) in 2035, and 3,900 (2.5 percent) in 2045. Population was also adjusted upwards in the North of U.S. 1 Region in all three model years; by 4.6 percent in 2025, 3.4 percent in 2035 and 2.4 percent in 2045. In the South Wake Region,

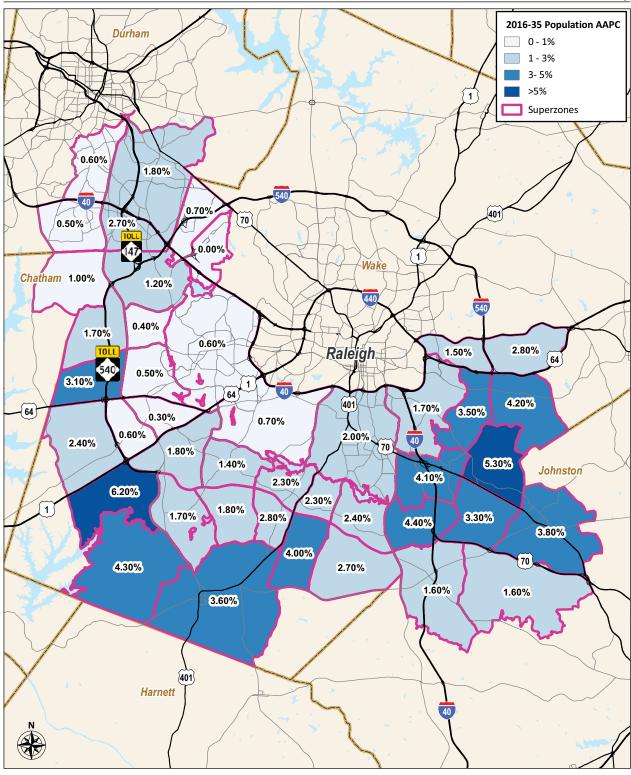
population was reduced by approximately 11,800 (6.0 percent) in 2025, 15,400 (6.1 percent) in 2035, and 18,900 (6.0 percent) in 2045.

TRMv6 Values											
Re	gion Number		AAPC		AAPC	values	AAPC		AAPC		
•	and Name	2016	2016-25	2025	2025-35	2035	2035-45	2045	2016-45		
1	Regional Core	116.7	0.5 %	122.0	1.2 %	137.9	1.1 %	153.7	1.0		
2	North of US 1	104.8	0.6	111	1.3	125.4	1.1	140.1	1.0		
3	South Wake	140.5	3.7	196	2.7	254.4	2.1	313.3	2.8		
4	Johnston	53.3	2.6	67	2.4	85.6	2.0	103.9	2.3		
5	East Wake	48.7	4.5	72	3.0	97.1	2.3	121.9	3.2		
6	Inner Ring	171.0	1.0	186	1.2	210.4	1.1	234.6	1.1		
	Total	635.1	1.9	754.2	1.9	910.8	1.6	1,067.5	1.8		
Adopted Values											
Re	gion Number	-	AAPC		AAPC		AAPC		AAPC		
	and Name	2016	2016-25	2025	2025-35	2035	2035-45	2045	2016-45		
1	Regional Core	116.7	1.1 %	128.7	1.1 %	143.1	1.0 %	157.6	1.0		
2	North of US 1	104.8	1.1	115.7	1.1	129.6	1.0	143.5	1.1		
3	South Wake	140.5	3.0	183.8	2.7	239.1	2.1	294.4	2.6		
4	Johnston	53.3	3.2	70.9	2.5	90.7	2.1	111.7	2.6		
5	East Wake	48.7	3.6	67.1	3.0	90.4	2.3	113.8	3.0		
6	Inner Ring	171.0	1.1	188.8	1.1	211.5	1.0	234.3	1.1		
	Total	635.1	1.9	754.9	1.8	904.4	1.6	1,055.3	1.8		

TRMv6 122.0 5.1 110.6	2025 Adopted 128.7 115.7	Adjustment 6.6	TRMv6 137.9	2035 Adopted 143.1	Adjustment	TRMv6	2045 Adopted	Adjustment
ore 122.0	128.7	6.6					Adopted	Adjustment
			137.9	143.1				
110.6	115 7				5.2	153.7	157.6	3.9
	115.7	5.1	125.4	129.6	4.2	140.1	143.5	3.3
e 195.6	183.8	(11.8)	254.4	239.1	(15.4)	313.3	294.4	(18.9)
67.4	70.9	3.5	85.6	90.7	5.1	103.9	111.7	7.8
72.3	67.1	(5.3)	97.1	90.4	(6.7)	121.9	113.8	(8.1)
186.2	188.8	2.6	210.4	211.5	1.1	234.6	234.3	(0.3)
754.2	754.9	0.7	910.8	904.4	(6.4)	1,067.5	1,055.3	(12.3)
•	72.3 186.2 754.2	72.3 67.1 186.2 188.8 754.2 754.9	72.3     67.1     (5.3)       186.2     188.8     2.6       754.2     754.9     0.7	72.3     67.1     (5.3)     97.1       186.2     188.8     2.6     210.4	72.3     67.1     (5.3)     97.1     90.4       186.2     188.8     2.6     210.4     211.5       754.2     754.9     0.7     910.8     904.4	72.3     67.1     (5.3)     97.1     90.4     (6.7)       186.2     188.8     2.6     210.4     211.5     1.1       754.2     754.9     0.7     910.8     904.4     (6.4)	72.3     67.1     (5.3)     97.1     90.4     (6.7)     121.9       186.2     188.8     2.6     210.4     211.5     1.1     234.6       754.2     754.9     0.7     910.8     904.4     (6.4)     1,067.5	72.3     67.1     (5.3)     97.1     90.4     (6.7)     121.9     113.8       186.2     188.8     2.6     210.4     211.5     1.1     234.6     234.3       754.2     754.9     0.7     910.8     904.4     (6.4)     1,067.5     1,055.3

**Figure 3.3** illustrates the adopted AAPC increase in population by superzone in the Detailed Study Area from 2016 to 2035. The highest growth rates in population are forecast to occur in southwestern superzones in Wake County, around Holly Springs and Fuquay Varina, and in superzones east of I-40 and south of U.S. 64 in Auburn in Wake County and Clayton in Johnston County.







2016 - 2035 AVERAGE ANNUAL PERCENT GROWTH IN POPULATION, BY SUPERZONE (ADJUSTED FORECAST)

#### 3.3.3 Household Forecasts

**Table 3.5** presents TRMv6 household forecasts by county for each model year. The upper portion of Table 3.5 shows the original data set contained in the TRMv6. The lower portion shows the data set adjusted by Dr. Appold and adopted by CDM Smith for use in this study. Household growth rates for each 10-year interval are calculated using average annual percent change (AAPC).

In 2016, Wake County had about 399,900 households, comprising about 56 percent of the total households in the model area. Durham County held the second highest number of households in the model area, comprising about 17 percent of model area households.

In the adopted forecast (model years 2025, 2035 and 2045), household growth rates are higher in the total model area compared to the TRMv6 forecast. Household growth rates for Wake County are forecast to be higher compared to assumptions in the TRMv6, resulting in higher estimated numbers of households.

Table 3.5

Model Area Household Forecasts by County - TRMv6 and Adopted Values
(number of households in thousands)

				TRMv	6 Values			
		AAPC		AAPC		AAPC		AAPC
County (1)	2016	2016-25	2025	2025-35	2035	2035-45	2045	2016-45
Chatham	19.4	2.6 %	24.5	2.0 %	30.0	1.7 %	35.5	2.1 %
Durham (1)	122.0	1.5	139.0	1.3	158.5	1.2	178.0	1.3
Franklin	20.3	2.3	25.0	1.5	29.0	1.3	33.1	1.7
Granville	11.5	1.8	13.5	1.3	15.3	1.1	17.0	1.4
Harnett	14.3	1.9	16.9	1.6	19.8	1.4	22.7	1.6
Johnston	58.6	2.9	76.0	2.2	94.9	1.8	113.8	2.3
Nash	1.5	1.6	1.8	1.1	2.0	1.0	2.2	1.2
Orange (1)	53.5	1.4	60.9	1.0	67.0	0.9	73.2	1.1
Person	12.8	0.5	13.4	0.2	13.7	0.2	14.0	0.3
Wake (1)	399.9	2.0	479.3	1.8	570.3	1.5	661.3	1.7
Total	713.8	2.0	850.3	1.6	1,000.5	1.4	1,150.7	1.7

				Adopte	d Values			
		AAPC		AAPC		AAPC		AAPC
County (1)	2016	2016-25	2025	2025-35	2035	2035-45	2045	2016-45
Chatham	19.4	4.1 %	27.8	2.4 %	35.3	2.3 %	44.4	2.9 %
Durham (1)	122.0	0.5	128.0	1.4	146.6	1.2	165.2	1.1
Franklin	20.3	3.5	27.6	1.7	32.8	1.7	38.8	2.3
Granville	11.5	5.6	18.8	2.0	22.8	2.0	27.7	3.1
Harnett	14.3	2.6	18.0	1.8	21.5	1.6	25.2	2.0
Johnston	58.6	4.2	84.5	2.6	109.3	2.3	137.7	3.0
Nash	1.5	2.4	1.9	1.1	2.1	1.2	2.4	1.5
Orange (1)	53.5	1.5	61.2	1.1	68.5	1.2	77.0	1.3
Person	12.8	0.0	12.8	0.0	12.8	0.0	12.9	0.0
Wake (1)	399.9	2.1	483.9	2.0	591.2	1.8	707.2	2.0
Total	713.8	2.1	864.4	1.9	1,043.1	1.7	1,238.4	1.9

<sup>(1)</sup> Only Durham, Orange and Wake counties are entirely contained in the TRMv6 model area. The population in the remaining counties represents only the portion within the TRM model boundaries.

Note: AAPC is an abbreviation for Average Annual Percent Change



The adjustments to the household forecasts at a county level are shown in **Table 3.6**. In total, the number of households was increased by about 14,100 in 2025, 42,600 in 2035 and 87,800 in 2045. The adopted forecast increased the households in Wake County by 4,600 (1.0 percent) in 2025, 20,900 (3.7 percent) in 2035 and 45,900 (6.9 percent) in 2045, compared to the TRMv6 estimates. Estimated households were decreased in Durham County by about 11,000 (7.9 percent) in 2025, 11,900 (7.5 percent) in 2035, and 12,800 (7.2 percent) in 2045.

Table 3.6

Model Area Household Adjustments by County
(number of households in thousands)

		2025			2035			2045	
County (1)	TRMv6	Adopted	Adjustment	TRMv6	Adopted	Adjustment	TRMv6	Adopted	Adjustment
Chatham	24.5	27.8	3.2	30.0	35.3	5.3	35.5	44.4	8.9
Durham (1)	139.0	128.0	(11.0)	158.5	146.6	(11.9)	178.0	165.2	(12.8)
Franklin	25.0	27.6	2.6	29.0	32.8	3.8	33.1	38.8	5.7
Granville	13.5	18.8	5.3	15.3	22.8	7.6	17.0	27.7	10.7
Harnett	16.9	18.0	1.1	19.8	21.5	1.7	22.7	25.2	2.5
Johnston	76.0	84.5	8.5	94.9	109.3	14.4	113.8	137.7	24.0
Nash	1.8	1.9	0.1	2.0	2.1	0.2	2.2	2.4	0.2
Orange (1)	60.9	61.2	0.3	67.0	68.5	1.5	73.2	77.0	3.9
Person	13.4	12.8	(0.6)	13.7	12.8	(0.9)	14.0	12.9	(1.2)
Wake (1)	479.3	483.9	4.6	570.3	591.2	20.9	661.3	707.2	45.9
Total	850.3	864.4	14.1	1,000.5	1,043.1	42.6	1,150.7	1,238.4	87.8

<sup>(1)</sup> Only Durham, Orange and Wake counties are entirely contained in the TRMv6 model area. The population in the remaining counties represents only the portion within the TRM model boundaries.

Note: AAPC is an abbreviation for Average Annual Percent Change

As discussed in Section 3.3.2, population estimates were adjusted downward in many counties in the model area despite the number of households being adjusted upwards, particularly in Wake County. This occurs because the TRMv6 model holds the population's age distribution constant to a 2010 distribution. Due to an expected aging of the population over time, household composition is also expected to change, resulting in a gradual lowering of average household size in Dr. Appold's adjustments. Both the TRMv6 model and Dr. Appold's projections use the same source information to calculate population estimates, which are then used to estimate the number of households. Because the adjusted numbers estimate a smaller household size as compared to TRMv6, the number of households must increase to reach the estimated population numbers.

**Table 3.7** presents the Detailed Study Area household projections by region for each model year. The upper portion of Table 3.7 shows the original data set. The lower portion shows the adjusted data set. In total, the adopted household forecast in the Detailed Study Area is larger than the original TRMv6 forecast by about 1.9 percent in 2025, 4.5 percent in 2035, and 7.8 percent in 2045. The number of households forecast in each region are higher in the adopted data set compared to the original TRMv6 in 2035 and 2045. In 2025, only the South Wake and East Wake regions have fewer forecast households in the adopted dataset compared to the original TRMv6 dataset.



			Tab	le 3.7				
Detailed Stu	ıdy Area I			s by Region		•	ted Val	ues
		<b>(</b>		TRMv6 V	•			
Region Number		AAPC		AAPC		AAPC		AAPC
and Name	2016	2016-25	2025	2025-35	2035	2035-45	2045	2016-45
1 Regional Core	48.2	0.5 %	50.6	1.3 %	56.6	1.1 %	62.7	0.9 %
2 North of US 1	36.3	0.9	39.2	1.5	44.6	1.3	50.0	1.1
3 South Wake	49.0	3.8	68.6	3.0	89.1	2.3	109.6	2.8
4 Johnston	18.9	2.9	24.5	2.7	31.0	2.1	37.5	2.4
5 East Wake	17.3	4.7	26.0	3.3	34.8	2.5	43.4	3.2
6 Inner Ring	66.1	1.2	73.9	1.3	83.2	1.2	92.6	1.2
Total	235.7	2.0	282.7	2.0	339.3	1.7	395.8	1.8
				Adopted	Values			
Region Number		AAPC		AAPC		AAPC		AAPC
and Name	2016	2016-25	2025	2025-35	2035	2035-45	2045	2016-45
1 Regional Core	48.2	0.7 %	51.5	1.3 %	57.8	1.2 %	64.3	1.0 %
2 North of US 1	36.3	1.4	41.3	1.6	47.7	1.5	54.6	1.4
3 South Wake	49.0	3.7	67.9	3.4	92.1	2.8	118.2	3.1
4 Johnston	18.9	4.1	27.3	3.0	35.7	2.7	45.2	3.0
5 East Wake	17.3	4.3	25.4	3.9	35.6	3.1	46.8	3.5
6 Inner Ring	66.1	1.4	74.7	1.5	85.8	1.5	97.7	1.4
Total	235.7	2.3	288.0	2.3	354.6	2.1	426.8	2.1

Adjustments made to the TRMv6 household forecasts in the Detailed Study Area are shown by region in **Table 3.8**. At a regional level, all household forecasts were adjusted upward, except for South Wake (Region 3) and East Wake (Region 5) in 2025, which both had slight downward adjustments. In 2035 and 2045, however, these regions had upward adjustments. Within the adjusted data set, the most notable changes were made to Region 4 (Johnston), where household projections were adjusted upward by about 11.5 percent in 2025, 15.2 percent in 2035, and slightly more than 20 percent in 2045. Household projections for all other regions stayed within 10 percent of the TRMv6 model.

Note: AAPC is an abbreviation for Average Annual Percent Change

			Detailed	•			ments by Reg sands)	ion		
Re	gion Number		2025			2035			2045	
	and Name	TRMv6	Adopted	Adjustment	TRMv6	Adopted	Adjustment	TRMv6	Adopted	Adjustment
1	Regional Core	50.6	51.5	0.9	56.6	57.8	1.2	62.7	64.3	1.7
2	North of US 1	39.2	41.3	2.1	44.6	47.7	3.1	50.0	54.6	4.6
3	South Wake	68.6	67.9	(0.7)	89.1	92.1	3.0	109.6	118.2	8.6
4	Johnston	24.5	27.3	2.8	31.0	35.7	4.7	37.5	45.2	7.7
5	East Wake	26.0	25.4	(0.7)	34.8	35.6	0.9	43.4	46.8	3.3
6	Inner Ring	73.9	74.7	0.9	83.2	85.8	2.6	92.6	97.7	5.2
	Total	282.7	288.0	5.3	339.3	354.6	15.4	395.8	426.8	31.0
No	ote: AAPC is an a	_ bbreviati	on for Aver	age Annual Pe	rcent Cha	ange				



**Figure 3.4** displays the forecasted average annual growth rate in households within the Detailed Study Area for the adopted data set between 2016 and 2035 by superzone. As with population, forecasted household growth rates are smallest in the northwest superzones, which is the portion of the study area that is already the most densely developed and populated. The highest annualized rates of growth occur on the west side of the Triangle Expressway, from about U.S. 64 southwards towards Holly Springs and Fuquay Varina, and eastward along the NC 42 corridor. Due to an anticipated decrease in average household size, households are forecasted to grow slightly faster than population.

### 3.3.4 Employment Forecasts

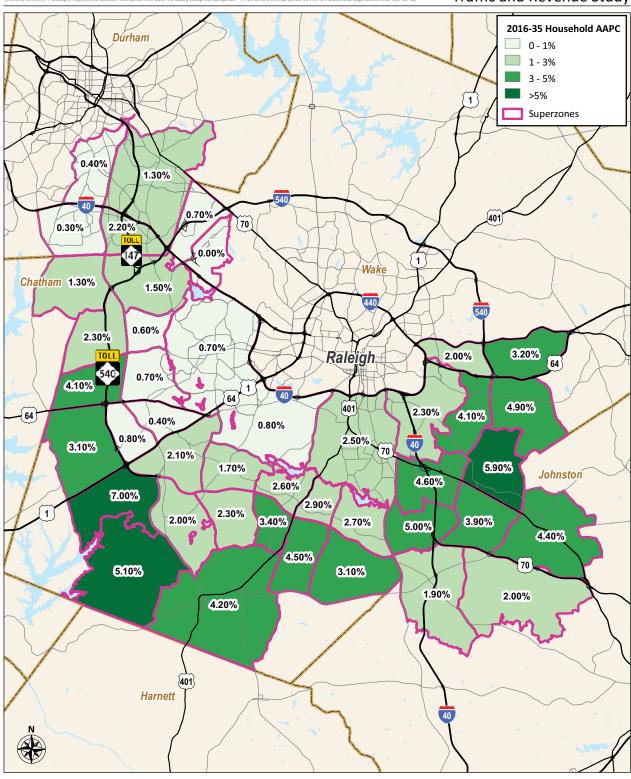
**Table 3.9** presents TRMv6 employment projections by county for each model year. The upper portion of Table 3.9 shows the original data set. The lower portion shows the data set adjusted by Dr. Appold. Population growth rates for each 10-year interval are calculated using AAPC. In total, employment forecasts were adjusted downward in each future year (2025, 2035 and 2045). The employment growth averaged 1.6 percent per year from 2016 to 2045 in the TRMv6 compared to the adopted 1.1 percent per year. The adopted employment forecast results in about 218,100 fewer employed people in 2045 compared to the original forecast.

	Model	Area Employ		Table 3.9	unty - TRM	v6 and Ado	oted Value	s
			(emp	oloyment in th	ousands) 6 Values			
		AAPC		AAPC	values	AAPC		AAPC
County (1)	2016	2016-25	2025	2025-35	2035	2035-45	2045	2016-45
Chatham	9.8	2.8 %	12.6	2.2 %	15.2	1.8 %	17.9	2.1 %
Durham (1)	212.6	1.8	249.2	1.9	296.2	1.6	343.1	1.7
Franklin	12.1	3.6	16.5	1.8	19.5	1.6	22.5	2.2
Granville	10.2	(0.5)	9.8	1.2	10.9	1.1	12.0	0.6
Harnett	7.5	(0.3)	7.3	1.8	8.5	1.4	9.6	0.9
Johnston	46.4	1.0	50.6	1.7	58.8	1.5	67.1	1.3
Nash	0.8	(8.7)	0.3	1.1	0.4	1.9	0.4	(1.9)
Orange (1)	76.3	0.6	80.3	1.7	93.7	1.5	107.1	1.2
Person	10.2	0.4	10.6	0.5	11.2	0.5	11.7	0.5
Wake (1)	576.6	1.7	668.6	2.1	804.1	1.7	939.5	1.7
Total	962.5	1.6	1,105.8	2.0	1,318.5	1.7	1,530.9	1.6
				Adopte	ed Values			
		AAPC		AAPC		AAPC		AAPC
County (1)	2016	2016-25	2025	2025-35	2035	2035-45	2045	2016-45
Chatham	9.8	2.1 %	11.8	1.2 %	13.1	0.7 %	13.9	1.2 %
Durham (1)	212.6	0.6	224.0	1.0	245.7	0.5	257.8	0.7
Franklin	12.1	1.0	13.2	0.9	14.3	0.8	15.3	0.8
Granville	10.2	0.1	10.3	(0.0)	10.2	0.0	10.2	0.0
Harnett	7.5	1.0	8.2	1.2	9.1	0.7	9.7	0.9
Johnston	46.4	2.1	56.1	1.6	65.0	1.5	74.2	1.6
Nash	0.8	0.3	0.8	0.3	0.8	0.3	0.8	0.3
Orange (1)	76.3	0.8	81.7	0.8	88.0	0.8	94.2	0.7
Person	10.2	0.8	10.9	0.4	11.3	0.4	11.7	0.5
Wake (1)	576.6	1.7	668.5	1.3	750.0	1.1	825.0	1.2
Total	962.5	1.3	1,085.5	1.2	1,207.5	0.9	1,312.8	1.1

<sup>(1)</sup> Only Durham, Orange and Wake counties are entirely contained in the TRMv6 model area. The population in the remaining counties represents only the portion within the TRM model boundaries.

Note: AAPC is an abbreviation for Average Annual Percent Change







2016 - 2035 AVERAGE ANNUAL PERCENT GROWTH IN HOUSEHOLDS, BY SUPERZONE (ADJUSTED FORECAST)

The adjustments to employment made by Dr. Appold at the county level are shown in **Table 3.10**. Wake County employment was reduced by 100 in 2025; 54,100 in 2035; and 114,400 in 2045, representing decreases of about 0.0 percent, 6.7 percent, and 12.2 percent respectively compared to the TRMv6 values. In contrast, employment was adjusted upward in Johnston County (in the portion within the model), by 5,500 in 2015; 6,100 in 2035; and 7,000 in 2045. This represents increases of approximately 11 percent in each model year compared to the TRMv6 values.

Dr. Appold adjusted employment downward largely because of two characteristics of the TRMv6 model that he believed resulted in unrealistically high employment growth rates. First; the TRMv6 employment projections assume an employment growth rate based upon a data source with a higher population growth rate than used elsewhere in the model. Second, the TRMv6 model does not account for an aging population that will include fewer adults of prime working age and participating in the labor force. The adopted employment forecasts still assume employment growth but take into account that the older population distribution will not require as many jobs as the younger population distribution required in the TRMv6. Johnston County employment was adjusted upward because the TRMv6 uses an employment growth trajectory based on 2013 data. Johnston County was slow to recover from recession-based employment losses and had just returned to 2007 employment levels in 2013. Dr. Appold adjusted the Johnston County employment forecast to reflect anticipated continued employment growth.

	Model Area Employment Adjustments by County  (employment in thousands)									
2025				2035			2045			
County (1)	TRMv6	Adopted	Adjustment	TRMv6	Adopted	Adjustment	TRMv6	Adopted	Adjustment	
Chatham	12.6	11.8	(0.8)	15.2	13.1	(2.1)	17.9	13.9	(4.0)	
Durham (1)	249.2	224.0	(25.2)	296.2	245.7	(50.5)	343.1	257.8	(85.3)	
Franklin	16.5	13.2	(3.3)	19.5	14.3	(5.2)	22.5	15.3	(7.1)	
Granville	9.8	10.3	0.5	10.9	10.2	(0.7)	12.0	10.2	(1.8)	
Harnett	7.3	8.2	0.9	8.5	9.1	0.6	9.6	9.7	0.0	
Johnston	50.6	56.1	5.5	58.8	65.0	6.1	67.1	74.2	7.0	
Nash	0.3	0.8	0.4	0.4	0.8	0.4	0.4	0.8	0.4	
Orange (1)	80.3	81.7	1.4	93.7	88.0	(5.7)	107.1	94.2	(12.9)	
Person	10.6	10.9	0.3	11.2	11.3	0.2	11.7	11.7	0.0	
Wake (1)	668.6	668.5	(0.1)	804.1	750.0	(54.1)	939.5	825.0	(114.4)	
Total	1,105.8	1,085.5	(20.3)	1,318.5	1,207.5	(111.1)	1,530.9	1,312.8	(218.1)	

Table 3 10

Note: AAPC is an abbreviation for Average Annual Percent Change

**Table 3.11** presents the original and adopted employment growth forecasts by region in the Detailed Study Area, and **Table 3.12** shows the corresponding adjustments made to the TRMv6 dataset. Employment forecasts were reduced in the total Detailed Study Area in each future model year. In the TRMv6, employment growth was forecast to average 2.0 percent per year from 2016 to 2045, while the adopted forecast assumes an annual growth rate 1.3 percent per year. In 2045, the reduced growth rate results in 92,800 fewer employed people, a 17.0 percent decrease compared to the TRMv6 values.



<sup>(1)</sup> Only Durham, Orange and Wake counties are entirely contained in the TRMv6 model area. The population in the remaining counties represents only the portion within the TRM model boundaries.

Table 3.11

Detailed Study Area Employment Forecasts by Region - TRMv6 and Adopted Values

(employment in thousands)

				TRMv6 V	alues			
Region Number		AAPC		AAPC		AAPC		AAPC
and Name	2016	2016-25	2025	2025-35	2035	2035-45	2045	2016-45
1 Regional Core	115.4	2.8 %	148.4	1.9 %	176.2	1.6 %	203.9	2.0 %
2 North of US 1	28.6	0.6	30.1	1.6	34.7	1.4	39.3	1.1
3 South Wake	39.9	2.7	50.7	2.3	62.4	1.9	74.1	2.2
4 Johnston	15.1	3.7	21.0	2.9	27.1	2.3	33.2	2.8
5 East Wake	13.1	6.2	22.6	3.9	31.9	2.9	41.1	4.0
6 Inner Ring	97.5	1.6	112.1	2.0	133.5	1.7	154.9	1.6
Total	309.6	2.4	384.9	2.1	465.8	1.8	546.6	2.0

				Adopted \	Values			
<b>Region Number</b>		AAPC		AAPC		AAPC		AAPC
and Name	2016	2016-25	2025	2025-35	2035	2035-45	2045	2016-45
1 Regional Core	115.4	1.1 %	127.4	1.2 %	142.0	0.8 %	152.8	1.0 %
2 North of US 1	28.6	1.1	31.7	0.9	34.5	0.8	37.0	0.9
3 South Wake	39.9	2.0	47.9	1.5	54.9	1.2	61.4	1.5
4 Johnston	15.1	4.4	22.3	2.9	28.8	2.4	35.6	3.0
5 East Wake	13.1	4.5	19.4	2.9	25.0	2.1	30.2	2.9
6 Inner Ring	97.5	1.6	112.0	1.2	124.9	1.0	136.8	1.2
Total	309.6	1.7	360.7	1.4	410.1	1.1	453.8	1.3

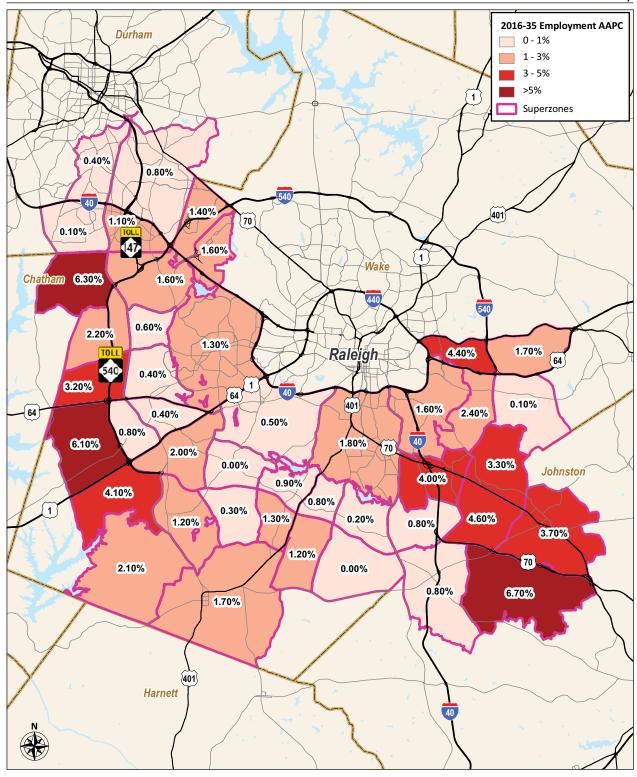
Note: AAPC is an abbreviation for Average Annual Percent Change

Note: AAPC is an abbreviation for Average Annual Percent Change

	Table 3.12  Detailed Study Area Employment Adjustments by Region  (employment in thousands)									
Re	Region Number 2025 2035 2045									
	and Name	TRMv6	Adopted	Adjustment	TRMv6	Adopted	Adjustment	TRMv6	Adopted	Adjustment
1	Regional Core	148.4	127.4	(21.0)	176.2	142.0	(34.2)	203.9	152.8	(51.2)
2	North of US 1	30.1	31.7	1.6	34.7	34.5	(0.2)	39.3	37.0	(2.3)
3	South Wake	50.7	47.9	(2.8)	62.4	54.9	(7.5)	74.1	61.4	(12.7)
4	Johnston	21.0	22.3	1.3	27.1	28.8	1.7	33.2	35.6	2.4
5	East Wake	22.6	19.4	(3.2)	31.9	25.0	(6.9)	41.1	30.2	(10.9)
6	Inner Ring	112.1	112.0	(0.1)	133.5	124.9	(8.6)	154.9	136.8	(18.2)
	Total	384.9	360.7	(24.2)	465.8	410.1	(55.7)	546.6	453.8	(92.8)

Employment growth rate projections in the Detailed Study Area between 2016 and 2035 are shown by the 43 Superzones in **Figure 3.5**. The fastest rates of growth are projected to occur on the west side of the Triangle Expressway corridor, and in the area east of I-40 and south of downtown Raleigh.







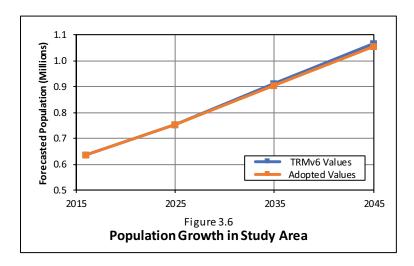
2016 - 2035 AVERAGE ANNUAL PERCENT GROWTH IN EMPLOYMENT BY SUPERZONE (ADJUSTED FORECAST)

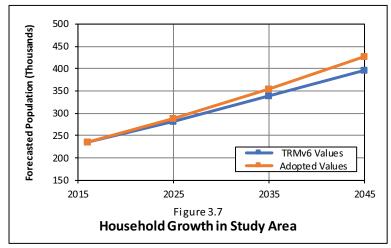
### 3.3.5 Summary of Socioeconomic Forecasts and Adjustments

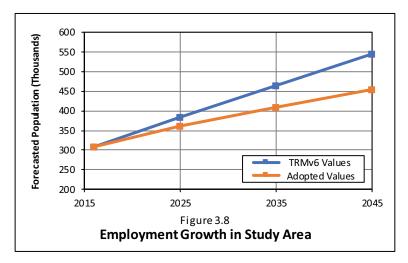
**Table 3.13** summarizes the TRMv6 and adopted socioeconomic forecasts by model year in the Detailed Study Area. The largest differences between the TRMv6 and adopted forecasts can be traced to the models' different age distribution of the population. TRMv6 holds age distribution constant at 2010 levels throughout the model period, while the adjusted numbers take into account forecasts of an aging population. This aging population results in an upward adjustment of the number of households from the TRMv6 model, while leaving forecasted population relatively unchanged. The aging population also accounts for the downward adjustments to employment, as the number of people of working age are expected to increase more slowly than the population as a whole. Therefore, the total employment within the study area was adjusted downward by 6.3 percent in 2025, 12.0 percent in 2035, and 17.0 percent in 2045.

Detailed Study Area - Summary of Socioeconomic Adjustments (Values in thousands)									
Economic Input	2016	2025	2035	2045	2016-25	2025-35	2035-45	2016-45	
<u>Population</u>									
TRMv6 Values	635.1	754.2	910.8	1067.5	1.9%	1.9%	1.6%	1.8%	
Adopted Values	635.1	754.9	904.4	1055.3	1.9%	1.8%	1.6%	1.8%	
Difference	-	0.7	(6.4)	(12.3)					
Percent Difference	-	0.1%	-0.7%	-1.2%					
<u>Households</u>									
TRMv6 Values	235.7	282.7	339.3	395.8	2.0%	1.8%	1.6%	1.8%	
Adopted Values	235.7	288.0	354.6	426.8	2.3%	2.1%	1.9%	2.1%	
Difference	-	5.3	15.4	31.0					
Percent Difference	-	1.9%	4.5%	7.8%					
<u>Employment</u>									
TRMv6 Values	309.6	384.9	465.8	546.6	2.4%	1.9%	1.6%	2.0%	
Adopted Values	309.6	360.7	410.1	453.8	1.7%	1.3%	1.0%	1.3%	
Difference	-	(24.2)	(55.7)	(92.8)					
Percent Difference	-	-6.3%	-12.0%	-17.0%					

A visual comparison of the population, household and employment forecasts is presented in **Figure 3.6**, **Figure 3.7** and **Figure 3.8**, between the TRMv6 and the adopted forecast. As shown the adopted forecasts contain small downward adjustment to population, upward adjustments to households, and downward adjustments to employment.







# Chapter 4

# **Stated Preference Survey**

Resource Systems Group, Inc. (RSG) conducted stated preference (SP) surveys in January and February of 2018 as part of the data collection effort for this traffic and revenue study. The data collected was used to estimate values of time for travelers that currently use or could potentially use the Triangle Expressway. The estimated values of time were incorporated into the travel demand model to reflect the effects of tolls and road pricing. The SP survey was conducted by RSG in support of both this Triangle Expressway Traffic and Revenue Study and the ongoing Complete 540 Traffic and Revenue Study.

This chapter summarizes the stated preference survey report provided by RSG, *Draft Report: Complete 540 Stated Preference Survey (May 2018)*.

### 4.1 Survey Approach

The survey approach used a computer-assisted self-interview technique developed by RSG, and implemented within their proprietary software, rSurvey $^{TM}$ . This software allowed the questionnaire to be customized for each respondent by modifying questions and language based on respondents' specific answers, allowing the presentation of realistic future conditions that correspond with the respondents' previous answers.

Respondents were recruited to take this online survey using multiple methods:

- Postcard invitations mailed to residents of ZIP codes in the study area;
- E-mail invitations sent to members of an online research panel residing in ZIP codes in the study area;
- In-person postcard invitation handout at the Raleigh-Durham International Airport (RDU);
- Invitations mailed with billing statements to NC Quick Pass Bill by Mail customers;
- Invitations mailed with Transponder Fulfillment packets to new NC Quick Pass transponder owners;
- Postcard invitations available at the NC Quick Pass customer service center in Morrisville,
   North Carolina; and
- Outreach to local businesses and organizations in the study area.

A total of 1,673 travelers completed the stated preference survey in total for all methods. After cleaning the dataset for outliers, completed surveys from 1,542 respondents were used for analysis. Data from these travelers was analyzed using accepted statistical methods to estimate travelers' sensitivity to travel time and toll cost, while considering other specific traveler characteristics.



## 4.2 Survey Questionnaire

RSG worked closely with NCTA and CDM Smith to develop a questionnaire to meet the objectives of this traffic and revenue study. The questionnaire collected data regarding current travel behaviors and use (or not) of the Triangle Expressway for a recent trip, provided participants with information regarding the Complete 540 project, and used stated preference questions to estimate travelers' value of time and potential to use the proposed Complete 540 project.

#### 4.2.1 Introduction and Qualification Questions

All respondents were initially provided an introductory screen detailing the purpose of the study, the estimated time it will take to complete the survey, and instructions on how to navigate the online survey. Following the introduction, participants were shown trip qualification criteria to determine whether they were eligible to participate in the survey. Qualifying trips met the following conditions:

- Made within the past two months
- Traveled into, around, or through the highlighted area on a map of the Complete 540 corridor, including the existing Triangle Expressway
- Took at least 10 minutes in total door-to-door travel time
- Made on a weekday

To determine if participants' most recent trip was eligible for the survey, they were provided a map highlighting the study area and were asked to confirm if their trip occurred in this region. Respondents who indicated that they did not meet any of the criteria listed above were directed to the survey exit screen and thanked for their participation.

### 4.2.2 Trip Characteristics and Travel Pattern Questions

Respondents were then asked to focus on this recent trip as they continued through the survey. This trip, also known as their reference trip, formed the basis for constructing the rest of the questions in the survey. Respondents were specifically asked to think about their most recent trip and not a typical or average trip that they might make to ensure that the sample included a diverse range of trip types and travel characteristics.

Respondents were asked a series of questions regarding the following characteristics of a one-way portion of their reference trip:

- Vehicle type and number of axles
- Roads used
- Day of week of travel
- Trip purpose
- Airport trip details (if applicable)
- Beginning and ending locations (home, work, or other)
- · Trip origin and destination



- Start time of travel
- Triangle Expressway entrance and exit interchanges
- Travel time (trip duration)
- Delays encountered (and delay duration, if any)
- Perceived travel time if an alternative route was used
- Toll costs on the Triangle Expressway
- Vehicle occupancy
- Trip frequency
- Electronic Toll Collection (ETC) transponder ownership

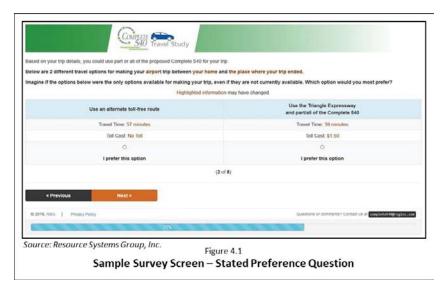
The trip information was used to inform the details of the SP scenarios presented later in the survey.

#### 4.2.3 Stated Preference Questions

Participants were next provided a short description of the proposed Complete 540 project and brief instructions for the stated preference questions. The stated preference section involved eight exercises that provided respondents with two choices for making their reference trip again in the future under hypothetical conditions:

- Tolled Route Alternative using the Triangle Expressway, Complete 540, or both
- Toll-Free Route Alternative

In each of the eight SP exercises, travel times and toll costs were varied, and the respondent was asked to pick their preferred option. These exercises allowed RSG to collect quantitative data that can be used to estimate respondents' travel preferences and behavioral responses. An example of this stated preference screen is shown in **Figure 4.1**.



The travel times presented in each exercise were varied around the user's reported travel time from their reference trip. The toll costs varied based on the user reported trip distance and vehicle axles. By varying the travel time and toll cost independently from each other in each experiment, the survey allowed respondents to demonstrate their travel preferences across a range of values of time.

### 4.2.4 Debrief and Opinion Questions

After finishing the SP questions, respondents were asked to answer questions that will help assess the underlying rationale for their choices and to allow RSG to identify any potential strategic bias in their responses. These questions included asking respondents who never chose the tolled alternative for their primary reason, as well as asking respondents how they felt about the proposed Complete 540 project and why they felt that way. Respondents were also asked for their general attitudes on tolls and taxes for highway improvements. Additionally, questions related to the following demographic topics were asked: home ZIP code, gender, age, employment status, household size, household vehicle ownership and 2017 household income before taxes.

Responses to these questions were used to confirm diversity of the sample respondents, as well as to classify and organize the data to identify any behavioral trends by population. Lastly, respondents were given opportunity to provide comments and feedback regarding the survey and the proposed project. The answers are provided in the full RSG report.

## 4.3 Survey Administration

RSG worked with CDM Smith and NCTA to develop a sampling plan that would produce a comprehensive sample of travelers in the Triangle region. The goal of this plan was to provide representation from different trip purposes, household incomes, and geographies, to accurately reflect behavioral differences. The project team recruited travelers to participate in the SP survey using the distribution methods highlighted in Section 4.1. The survey was administered online through RSG's proprietary software, rSurvey<sup>TM</sup>, from January 17, 2018 through February 19, 2018, and yielded 1,673 completed surveys and 1,542 valid/usable surveys. **Table 4.1** below shows the breakdown of respondents by method of recruitment.

Table 4.1 Completed Surveys by Recruitment Method									
Completed Invalid Final									
Administration Method	Surveys	Surveys	Count	Percent					
Postcard invitations to area residents	965	40	925	60%					
Email invitations to online research panel	377	55	322	21%					
Postcard handout at RDU Airport	236	30	206	13%					
Invitations to Bill by Mail customers	45	5	40	3%					
Invitations in Transponder Fulfillment packets	17	1	16	1%					
Postcard invitations at customer service center	5	0	5	0%					
Outreach to local businesses and organizations	28	0	28	2%					
Total	1,673	131	1,542	1					

Postcard invitations to area residents generated the most responses, with 60 percent of the total 1,542 usable surveys, while postcard invitations at customer service centers generated the lowest responses with five usable surveys.

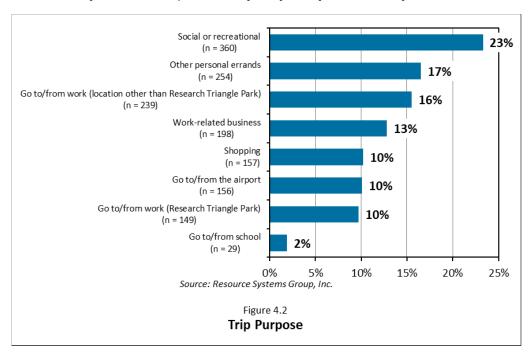


## 4.4 Trip Characteristic Analysis

**Table 4.2** shows the number of respondents who reported reference trips that used the Triangle Expressway and/or the proposed Complete 540 project, could have used the Triangle Expressway, or didn't use the Triangle Expressway but could use the Complete 540 project. More than half of all respondents (53 percent) completed their reference trip in the potential Complete 540 corridor only, while 40 percent used the Triangle Expressway at some point during their trip. Of the remaining 7 percent that could have used the Triangle Expressway but chose not to, a majority stated they did not want to pay a toll and a third reported that the toll on the Triangle Expressway was not worth the time savings for their trip.

Table 4.2 Corridor Use Ty		
User Type	Count	Percent
Triangle Expressway User	614	40%
Potential Triangle Expressway User	110	7%
Potential Complete 540 User	818	53%
Total	1,542	100%

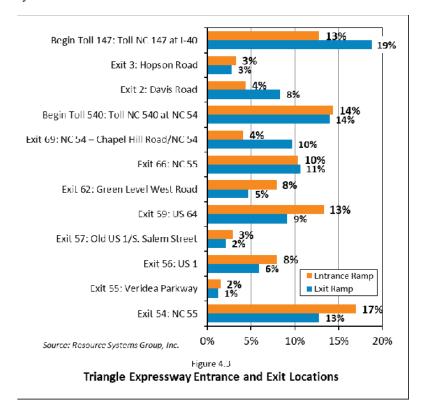
Around a quarter of respondents reported their trip purpose was commuting for work (26 percent), with 10 percent traveling to Research Triangle Park (RTP) and 16 percent traveling to work outside RTP. The second most frequent trip purpose category was social or recreational trips, accounting for 23 percent of all trips surveyed. **Figure 4.2** provides a distribution for all trip purposes in detail. For the purposes of the value of time analysis, responses were divided into market segments representing work commute trips, work-related/business trips, airport trips and other trips.

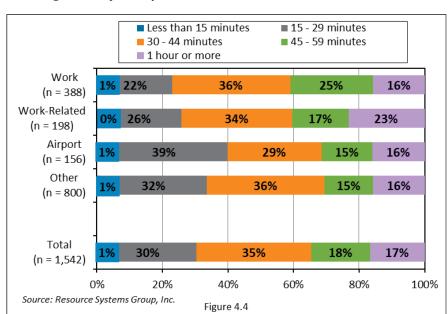


Using the latitude and longitude provided by respondents, estimated trip distances were calculated using a Google Maps route-planning algorithm. From this summary, the average calculated trip distance for all respondents was 25 miles, and the average reported travel time for all respondents was 42 minutes. **Table 4.3** shows the mean and median values for both distance and travel time for all respondents by market segment.

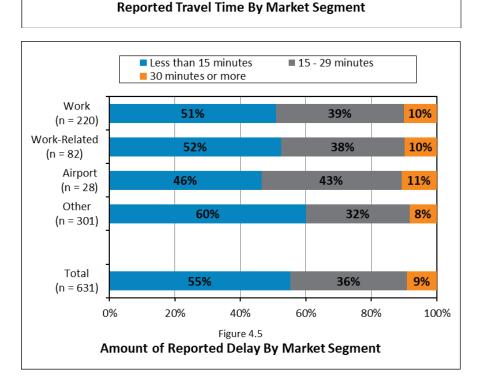
Table 4.3 Mean and Median Trip Distance and Reported Travel Time, By Market Segme							
		stance niles)	Reported Travel Time (minutes)				
Market Segment	Mean	Median	Mean	Median			
Work	24	20	42	40			
Work-Related	26	21	46	40			
Airport	26	20	39	30			
Other	25	17	42	35			
All	25	19	42	35			

Respondents were asked to provide their entry and exit ramps on the Triangle Expressway, or the ramps they would have used, had they used the Triangle Expressway. **Figure 4.3** shows the distribution of trips to each interchange by entry and exit. The project termini at NC 55 and at Toll NC 147/ I-40 were the most commonly used accounting for 30 percent and 32 percent of all entries or exits, respectively.



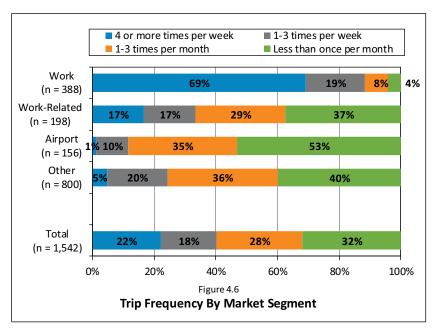


**Figure 4.4** and **Figure 4.5** provide the distribution of reported travel time and amount of perceived delay by market segment, respectively.



Work and work-related trips experienced the longest travel times with about 40 percent of each of these trips taking travelers 45 minutes or longer. These same market segments also reported the highest delay on their trip, with 57 percent of all work trips reporting delays.

**Figure 4.6** shows the trip frequency by market segment. Trip frequency had significant variation among the four market segments. As expected, work trips are made with the highest frequency, with 69 percent of all work respondents traveling the reference trip four or more times a week. Airport trips had the lowest frequency, with 53 percent traveling the reference trip less than once per month. Interestingly, work-related/business trips similar to the reference trip were made four or more times per week by 17 percent of the respondents in this category.



# 4.5 Debrief and Opinion Analysis

In the last section of the survey, respondents were asked to answer a series of debrief questions to provide insight on the underlying reasons for their choices in the SP question. Respondents who never chose a tolled alternative for their trip were asked for the primary reason for their choice. **Table 4.4** provides a summary of these responses; 45 percent said the time savings presented in the experiments was not worth the toll cost, while 31 percent are opposed to paying tolls.

Table 4.4 Reason for Never Choosing a Tolled Alternative						
Reason	Count	Percent				
Time savings not worth the toll cost	219	44%				
Opposed to paying tolls	153	31%				
Other	46	9%				
Tolls presented were too high	29	6%				
Current route is more convenient	23	5%				
Opposed to toll roads for other reasons	14	3%				
Opposed to new roads (if potential Complete 540 user)	4	1%				
Opposed to electonic payment	3	1%				
Total	491	100%				

## 4.6 Demographic Analysis

Of the 1,542 survey respondents, more than half of the respondents identified as male (56 percent), and the median age range was 45-54 years old. Most respondents were employed full-time (66 percent), less than half (43 percent) lived in a two-person household, and 52 percent had two household vehicles.

**Table 4.5** provides the distribution of 2017 household income of respondents who chose to answer this question. The median income category of respondents for this survey was in the \$100,000 - \$124,999 range.

Table 4.5 Reported 2017 Annual Household Income						
Income Category	Count	Percent				
Less than \$15,000	12	1%				
\$15,000-\$24,999	27	2%				
\$25,000-\$34,999	37	2%				
\$35,000-\$49,999	93	6%				
\$50,000-\$74,999	202	13%				
\$75,000-\$99,999	230	15%				
\$100,000-\$124,999	214	14%				
\$125,000-\$149,000	145	9%				
\$150,000-\$199,999	182	12%				
\$200,000 or more	155	10%				
Not provided	245	16%				
Total	1,542	100%				

### 4.7 Model Estimation for Value of Time

The primary purpose of this survey was to estimate value of time for travelers in the Triangle Expressway and Complete 540 corridors. RSG performed statistical analysis and discrete choice model estimation using the SP survey data. The statistical estimation and specification testing were completed using a conventional maximum likelihood procedure that estimated coefficients for a set of multinomial logit (MNL) models. The coefficients are a numerical representation of respondents' sensitivities to variables from the SP experiments (travel time and toll cost) and can be used to calculate value of time for travelers in the study corridor.

#### 4.7.1 Specification and Segmentation

Respondents were presented with the following two options in the SP scenarios, based on the details of their reference trips:

- Use a tolled route (parts of Triangle Expressway or Complete 540 or both)
- **Use a toll-free route** (respondent's current route, or an alternate toll-free route if they used a toll route in their reference trip)



The MNL model estimates a choice probability for each alternative presented in the SP trade-off exercises. Several model forms were tested using different variables collected from the data. In addition to the travel times and toll costs presented in the SP experiments; trip characteristics, transponder ownership, attitudinal indicators, income, and demographic variables, among others, were tested to determine whether they influence respondents' choices in the SP scenarios. More details on the variables tested within the MNL model are provided in Sections 5.2 and 5.3 of the full RSG report

The final model specification was selected based on model fit, intuitiveness and reasonableness of the model coefficients, and the expected application of the model results. The data was divided into four market segments, to be carried forth into the traffic and revenue analysis: work commute, work-related, airport, or other. The interaction between toll cost and household income was significant. The relationship indicates that as household income increases, sensitivity to toll prices decreases, but at a rate that is not directly proportional.

### 4.7.2 Willingness to Pay for Travel Time Savings (Value of Time)

In economic theory, the marginal rate of substitution is the amount of one good (i.e., money) that a person would exchange for a second good (i.e., travel time) while maintaining the same level of utility, or satisfaction. The marginal rate of substitution of the travel time and toll cost coefficients from the MNL model provides the implied toll value that travelers would be willing to pay for a given amount of travel time savings.

The resulting value of time by market segment and income level are presented in **Table 4.6**. As expected, work-related/business trips had the highest value of time, followed by trips to/from the airport. Work commute trips have a higher value of time than trips for other purposes. At the survey sample median income of \$112,500, work-related trips have a value of time of \$24.70 per hour, while commute trips are valued at \$18.59 per hour, and trips for other purposes are valued at \$17.55.

	Table 4.6 Value of Time, By Market Segment and Income							
Household Income	Work Commute Trips	Work-Related Trips	Airport Trips	Other Trips				
\$15,000	\$10.66	\$14.16	\$11.79	\$10.07				
\$20,000	\$11.79	\$15.67	\$13.04	\$11.13				
\$30,000	\$13.39	\$17.79	\$14.81	\$12.64				
\$42,500	\$14.76	\$19.61	\$16.32	\$13.94				
\$62,500	\$16.27	\$21.62	\$18.00	\$15.37				
\$87,500	\$17.60	\$23.38	\$19.47	\$16.62				
\$112,500	\$18.59	\$24.70	\$20.56	\$17.55				
\$137,500	\$19.38	\$25.75	\$21.43	\$18.30				
\$175,000	\$20.33	\$27.01	\$22.48	\$19.20				
\$200,000	\$20.85	\$27.71	\$23.07	\$19.69				

# 4.8 Summary and Conclusions

An SP Survey was conducted to estimate value of time for drivers who currently travel in the Triangle region and could potentially use the Triangle Expressway or Segments 1 and 2 of the proposed Complete 540. The travel preferences from 1,542 drivers were used to develop models to produce estimates of value of time for four trip purpose market segments. The magnitude of the parameters of these models was reasonable, and their signs were intuitively correct. The value of time that was estimated is within the ranges found in other major metropolitan areas across the country, and similar to results from surveys conducted previously in Raleigh prior to the opening of Triangle Expressway and reported in the *Triangle Expressway Comprehensive Traffic and Revenue Study (2009)*.

RSG developed multinomial logit choice models using the survey data to generate value of time estimates by trip purpose. At the median income level of the sample (\$112,500), the value of time estimates were in the range of \$17.55 to \$24.70 per hour, depending on trip purpose.



# Chapter 5

### **Model Calibration**

CDM Smith received the latest version of the Triangle Regional Model (TRM v6) from the Institute of Transportation Research and Education (ITRE) at North Carolina State University for use in the traffic forecasting efforts of this study. The inputs to the model were adopted in April 2018, and the final components of the model were received in June 2018.

TRMv6 is a trip-based, four-step travel demand model that uses socioeconomic data and transportation network (roadway and transit) characteristics as primary inputs. The model was originally developed using population, housing, and employment data for 2010, but has been revalidated to a base year of 2013; future years that are supported by ITRE for the model are 2025, 2035, and 2045. CDM Smith and Dr. Steven Appold used this information as a starting point to develop the 2016 base year model and interim year 2020 used for this study. **Figure 5.1** outlines the steps used in refining the TRMv6 for the traffic and revenue study; the boxes shaded in gray describe the four-step modeling process used in TRMv6, while the blue boxes describe the specific steps used by CDM Smith to refine and run the model for the traffic and revenue study.

### 5.1 Refinements to Model Inputs

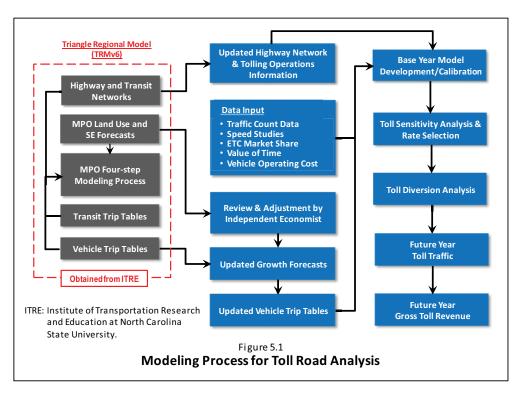
The independent economic forecast, including socioeconomic estimates for 2016, were input to the TRMv6 and revised future trip tables were developed for 2016, 2020, 2025, 2035 and 2045. The TRMv6 traffic assignment process was calibrated first against 2016 traffic volumes and then for observed travel speeds using data collected in 2016 and 2017. Calibration involves modifying the model parameters related to roadway capacity and speeds to reflect observed conditions.

Refinements to the highway network included the review and disaggregation of traffic analysis zones within the project study area, resulting in 30 additional traffic analysis zones; changes to zonal connectors to improve how traffic is loaded onto the roadway network from traffic analysis zones; and changes to the highway network to simulate 2016 roadway conditions, most notably reducing the number of lanes on I-40 between Lake Wheeler Road and Rock Quarry Road to three lanes in each direction to reflect the construction activity as part of the Fortify I-40/I-440 project as well as the addition of other minor roads within the project study area.

### 5.2 Calibration

The TRMv6 model was used with Dr. Steven Appold's estimates of socioeconomic data for 2016 to develop regional travel patterns at 2016 levels. Additional calibration efforts involving traffic assignments were then conducted. The calibration process involved adjustments to the model to confirm that it sufficiently represents observed traffic volumes, speeds, and origin-destination travel patterns, prior to being used to predict future traffic conditions.





In order to demonstrate that the 2016 base-year model sufficiently represents existing conditions, the following comparisons were made between model results and observed field data:

- Model traffic volume output compared to traffic counts at locations along nine screenlines;
- Model traffic volume output compared to existing traffic volumes on Triangle Expressway;
- Model travel speed output compared to observed 2016 HERE<sup>1</sup> travel speeds; and
- Model travel patterns compared to Streetlight data.

Details of the calibration results are provided below.

### 5.3 Traffic Volume Screenline Calibration Results

The goal of traffic volume calibration was to obtain model-estimated traffic volumes in the study area that match reasonably the actual ground counts on those roadways by direction and for weekday and peak vs. off-peak periods (AM, PM, Midday and Overnight). In addition to adjustments to roadway network free-flow speeds and capacities, CDM Smith utilized a matrix adjustment procedure that adjusts the trip table in such a way to obtain model-estimated volumes closer to observed traffic counts. This process allowed the directional peaking patterns of individual links and screenlines to be adjusted to better match observations.

The traffic counts collected for this project are grouped into nine screenlines, depicted in Figure 2.9. Although the level of difference between counts and assigned volume may vary between individual

 $<sup>^{\</sup>rm 1}$  HERE is geospatial travel time data obtained under NCDOT license.



5-2

links, if the total assigned volume crossing the screenline is close to actual counts, the general level of traffic and travel patterns is considered to be well represented by the model.

Table 5.1 shows the volume calibration results at the weekday level for each screenline. Table 5.2 shows the percent difference between model volumes and observed counts by time period for each of the screenlines. In total, the model volumes are within two percent of the counts at the weekday level, with all but one screenline varying by less than five percent. On a time period basis, most screenlines were calibrated to within five percent of counts. There was a 21 percent differential at screenline 1 during the midday period, but this was off of a fairly small traffic volumes as a base. Traffic volume comparisons for individual links by time period and direction are included in Appendix A.

Table 5.1  Daily Volume Calibration Results on Screenlines								
	Number			Modeled	l Volume			
	of	Observed	Before	Percent	After	Percent		
Screenline	Links	Count	Calibration	Difference	Calibration	Difference		
1	8	30,947	28,712	-7%	33,032	7%		
2	10	184,041	171,343	-7%	187,496	2%		
3	12	50,369	40,649	-19%	48,511	-4%		
4	6	60,967	52,901	-13%	59,196	-3%		
5	8	48,087	49,686	3%	49,992	4%		
6	12	104,053	89,884	-14%	99,260	-5%		
7	16	116,979	97,592	-17%	117,864	1%		
8	12	118,711	111,707	-6%	118,956	0%		
9	74	929,872	812,982	-13%	901,140	-3%		
Total	158	1,644,026	1,455,455	-11%	1,615,446	-2%		

				Volu	me Calibrati		le 5-2 oy Time Perio	d on Screen	lines				
	Number		AM			PM			MD			NT	
	of	Observed	Modeled	Percent	Observed	Modeled	Percent	Observed	Modeled	Percent	Observed	Modeled	Percent
Screenline	Links	Count	Volume	Difference	Count	Volume	Difference	Count	Volume	Difference	Count	Volume	Difference
1		8,310	8,696	5%	10,056	10,115	1%	7,648	9,254	21%	4,933	4,967	1%
2	10	42,761	44,769	5%	53,379	52,925	-1%	55,148	57,392	4%	32,753	32,409	-1%
3	12	12,723	12,176	-4%	16,340	15,008	-8%	14,728	14,616	-1%	6,578	6,712	2%
4	6	16,403	16,547	1%	18,612	17,882	-4%	17,977	16,905	-6%	7,975	7,862	-1%
5	8	12,824	13,623	6%	15,607	15,551	0%	14,056	14,732	5%	5,600	6,086	9%
6	12	28,627	26,775	-6%	32,301	29,977	-7%	29,097	28,468	-2%	14,028	14,039	0%
7	16	32,817	32,755	0%	40,330	37,153	-8%	30,342	33,461	10%	13,490	14,495	7%
8	12	35,538	34,940	-2%	38,374	37,993	-1%	32,175	32,150	0%	12,624	13,874	10%
9	74	248,364	235,448	-5%	278,612	260,104	-7%	276,643	273,945	-1%	126,253	131,643	4%
Total	158	438,367	425,730	-3%	503,611	476,708	-5%	477,814	480,923	1%	224,234	232,086	4%

# 5.4 Triangle Expressway Traffic Volume Calibration Results

Table 5.3 shows the traffic volumes (assigned vs. observed) on the existing Triangle Expressway toll facility by direction for an average weekday. As part of the calibration process, select link adjustments were made to the trip tables to better replicate traffic volumes on ramps and mainlines. Any remaining differences between modeled volumes and observed counts were used to develop adjustments that were applied to future year model output.

## 5.5 Speed Calibration

The primary objective of speed calibration was to ensure that the speeds estimated by the travel demand model closely replicate the observed speeds and that the model exhibits congestion at locations where there is actual congestion, while not showing congestion where there is no congestion in the field. CDM Smith compiled observed directional travel speed data from HERE for the year 2016 along the major roadways in the study area and summarized it for the eight time periods in the model, by segment. The resulting speed profiles (color-coded "heat" maps) served as the basis for comparison with the model-estimated speeds.

In addition to changes in the free-flow speeds of selected roadways, adjustments were made to the volume-delay curves at key bottleneck locations to enable the model to better reflect the congestion on the roadways based on observed speed data from HERE. The model calibration process was an iterative process recognizing that adjustments to speed affected the assigned traffic volumes, and changes to assigned traffic volumes resulted in changes in speeds on roadways. The iterative process ensured that adjustments made to improve speeds were not detrimental to the estimated volumes. **Table 5.4** shows the results of the speed calibration by roadway by direction. In general, most of the model-estimated speeds are within five miles per hour (MPH) at the overall corridor level, although there were a few segments where this could not be achieved without considerably affecting the volume calibration.

### 5.6 Travel Pattern Validation

Once the model calibration to speeds and volumes was completed, a final check against the Streetlight travel pattern data was made. Two sample movements from the Streetlight data are shown in Figures 2.7 and 2.8. The observed share of trips that travel from the southern end of the existing Triangle Expressway to a point just north of NC 55 is about 50 percent in the case of both the Streetlight data and the model. The Streetlight data shows 31 percent of the trips from the southern end of the project travel to the northern end of Toll NC 540 (north of Toll NC 147 interchange), while the model shows 19 percent. Similarly, in the southbound direction, **Table 5.5** shows a comparison from the link at the northern end of the Triangle Expressway to multiple points south. From this point, Streetlight data shows about 27 percent of the traffic travels as far as US 64 while the model shows 39 percent. Streetlight data shows about eight percent of the total traffic from the northern end of the Triangle Expressway travels to the southern end, the entire length of the project, while the model shows 11 percent make this movement.

These, and other comparisons, indicate that the travel patterns within the model for the study area zones reasonably replicate the travel patterns observed from the Streetlight data, and are within the tolerance limits of both the data and the model.



Table 5.3 Volume Calibration Results by Time Period on Triangle Expressway

			Weekday			
		Observed	Modeled	Percent		
Link Description	Links	Count	Volume	Difference		
NB On From NC 55 NB	NB Ramp	8,088	8,653	7%		
NB On From NC 55 SB	NB Ramp	938	1,696	81%		
NB Mainline Between NC 55 SB On and US 1 NB Off	NB Mainline	9,026	10,350	15%		
NB Off to US 1 NB	NB Ramp	444	816	84%		
NB Off to US 1 SB	NB Ramp	371	334	-10%		
NB On From US 1 SB	NB Ramp	2,217	2,016	-9%		
NB On From US 1 NB	NB Ramp	3,017	2,352	-22%		
NB Mainline Between US 1 On NB and S Salem St Off	NB Mainline	13,445	13,568	1%		
NB Off to S Salem St NB On From S Salem St	NB Ramp	1,454	1,450	0%		
NB Mainline Between Salem St NB On and US 64 NB Off	NB Ramp  NB Mainline	1,221 <b>13,212</b>	1,869	53% <b>6%</b>		
NB Off to US 64 EB	NB Ramp	857	<b>13,987</b> 1,377	61%		
NB On From US 64 EB	NB Ramp	2.606	3.146	21%		
NB Off to US 64 WB	NB Ramp	1,092	1,592	46%		
NB On From US 64 WB	NB Ramp	2,554	3,039	19%		
NB Mainline Between US 64 SB On and Green Level W Off	NB Mainline	16,423	17,204	5%		
NB Off to Green Level West	NB Ramp	1,404	1,752	25%		
NB On From Green Level West	NB Ramp	1,267	2,256	78%		
NB Mainline Between Green Level W On and NC 55 Off NB	NB Mainline	16,286	17,707	9%		
NB Off to NC 55	NB Ramp	284	111	-61%		
NB Off to NC 55 - Loop	NB Ramp	2,039	1,769	-13%		
NB On From NC 55	NB Ramp	8,874	7,295	-18%		
NB Mainline Between NC 55 On and Toll NC 147 Off	NB Mainline	22,837	23,121	1%		
NB Off to Toll NC 147	NB Ramp	6,995	9,201	32%		
NB Mainline Between Toll NC 147 Off and Toll NC 147 On	NB Mainline	15,842	13,921	-12%		
NB On From Toll NC 147	NB Ramp	2,687	3,434	28%		
NB Mainline Between Toll NC 147 On and NC 54 Off	NB Mainline	18,529	17,354	-6%		
NB Off to NC 54	NB Ramp	2,612	3,471	33%		
NB On From NC 54	NB Ramp	9,830	12,071	23%		
NB North Of NC 54	NB Ramp	25,747	25,954	1%		
NB Mainline Between NC 540 On and Davis Off	NB Mainline	9,019	12,421	38%		
NB Off to Davis Dr	NB Ramp	2,415	3,635	51%		
NB On From Hopson Rd	NB Ramp	2,589	2,901	12%		
NB Off to I-40 SB NB Off to I-40 NB	NB Ramp	179	0	-100%		
	NB Ramp	2,398	3,168	32% - <b>5%</b>		
SB North Of NC 54 SB Off to NC 54	SB Mainline SB Ramp	24,343	<b>23,135</b> 10,500	- <b>5%</b> 11%		
SB On From NC 54	SB Ramp	9,456 2,924	3,402	16%		
SB Mainline Between NC 54 On and Toll NC 147 Off	SB Mainline	17,811	16,037	-10%		
SB Off to Toll NC 147	SB Ramp	2,024	3,221	59%		
SB Mainline Between Toll NC 147 Off and Toll NC 147 On	SB Mainline	15,787	12,816	-19%		
SB On From Toll NC 147	SB Ramp	6,756	8,898	32%		
SB Mainline Between Toll NC 147 On and NC 55 Off	SB Mainline	22,543	21,715	-4%		
SB Off to NC 55	SB Ramp	3,602	3,630	1%		
SB Off to NC 55 - Loop	SB Ramp	4,255	2,822	-34%		
SB On From NC 55	SB Ramp	2,322	2,250	-3%		
SB Mainline Between NC 55 On and Green Level W Off	SB Mainline	17,008	17,513	3%		
SB Off to Green Level West	SB Ramp	1,680	2,193	31%		
SB On From Green Level West	SB Ramp	1,402	1,823	30%		
SB Mainline Between Green Level W On and US 64 Off	SB Mainline	16,730	17,143	2%		
SB Off to US 64 WB	SB Ramp	2,705	3,212	19%		
SB On From US 64 WB	SB Ramp	835	1,752	110%		
SB Off to US 64 EB	SB Ramp	2,701	3,101	15%		
SB On From US 64 EB	SB Ramp	1,247	1,716	38%		
SB Mainline Between US 64 NB On and S Salem St Off	SB Mainline	13,406	14,297	7%		
SB Off to S Salem St	SB Ramp	1,350	1,929	43%		
SB On From S Salem St	SB Ramp	1,551	1,718	11%		
SB Mainline Between S Salem St On and US 1 Off SB	SB Mainline	13,607	14,086	4%		
SB Off to US 1 SB	SB Ramp	2,941	2,654	-10%		
SB On From US 1 SB	SB Ramp	267	986	269%		
SB Off to US 1 NB	SB Ramp	2,482	3,474	40%		
SB On From US 1 NB	SB Ramp	351	436	24%		
SB Mainline Between US 1 NB On and NC 55 SB Off	SB Mainline	8,802	9,381	7%		
SB Off to NC 55 SB	SB Ramp	7,617	7,644	0%		
SB Off to NC 55 NB	SB Ramp	1,185	1,737	47%		
SB On From I-40 NB	SB Ramp	139	2 400	-100%		
SB On From I 40 SB SB Off to Hopson Rd	SB Ramp	2,600	3,488	34%		
SB On From Davis Dr	SB Ramp SB Ramp	2,348	2,961	26% 19%		
	op vanih	2,981	3,562	19%		
SB Mainline Betweeen Davis On and NC 540 Off	SB Mainline	9,443	12,332	31%		



Table 5.4
Speed Calibration Results by Roadway and Direction

															Speed Difference													
					Observed Speed (HERE) (1)						Modeled Speed (1)							(Modeled - Observed) (1)										
Road Name	F	То	Dir.	Length (miles)	Free	A B #1	AM2	Λ N Λ Э	MD	PM1	DM2	DMA2	Free Flow	AM1	AM2	AM3	MD	PM1	PM2	PM3	Free	AM1	AM2	AM3	MD	PM1	PM2	PM3
	From		WB																		0							3
US 64/US 1		US 64/Tryon Rd/Exit 98	-	3.6	66	66	65	64	65	62	50	58	66	63	62	62	62	55	55	60		-3	-3	-2	-3	-7	5	
US 64/US 1	US 64/Tryon Rd/Exit 98	1-40	EB	3.3	65	65	44	38	62	59	45	52	68	56	44	34	62	57	44	53	3	-9	1	-4	0	-2	-1	1
US 64	US 1/Tryon Rd	NC 751/Chapel Rd	WB	9.0	54	51	46	44	46	45	40	43	57	52	47	49	50	42	43	48	4	1	1	4	4	-2	3	5
	NC 751/Chapel Rd	US 1/Tryon Rd	EB	9.0	55	53	45	41	47	46	37	41	58	48	39	42	48	42	44	47	3	-5	-6	1	1	-4	7	6
US 401	S Saunders St	NC 55/NC 42	SB	13.8	47	43	40	38	40	37	33	36	48	46	45	45	44	33	26	40	1	3	6	6	4	-5	-7	4
US 401	NC 55/NC 42	S Saunders St	NB	13.1	48	44	33	33	39	39	39	40	49	37	30	37	44	43	44	45	1	-7	-3	4	4	4	5	5
US 1	US 64/Tryon Rd/Exit 98	New Hill/Exit 89	SB	9.5	69	69	69	68	68	65	59	65	71	69	68	69	68	61	62	66	2	0	0	1	1	-4	3	1
US 1	New Hill/Exit 89	US 64/Tryon Rd/Exit 98	NB	9.4	70	70	56	58	67	68	68	67	71	65	59	63	69	66	67	68	1	-5	3	4	1	-2	-1	1
Ten Ten Rd	Old Stage Rd	US 1	WB	10.7	43	36	27	28	36	35	35	36	39	29	26	29	35	33	33	35	-4	-7	-1	1	-1	-2	-2	-1
Ten Ten Rd	US 1	Old Stage Rd	EB	8.5	43	39	34	34	36	30	25	26	39	37	35	35	35	27	24	30	-3	-2	1	1	-1	-3	-2	4
NC 55 Byp	NC 55 Byp/E Williams St	NC 55/S Main St	SB	4.4	51	48	44	43	41	33	25	28	51	50	49	48	47	38	32	39	0	2	5	6	6	5	8	11
NC 55 Byp	NC 55/S Main St	NC 55 Byp/E Williams St	NB	4.4	52	48	38	40	42	41	41	41	52	44	34	37	47	46	46	48	0	-4	-4	-3	5	5	6	7
NC 55	US 401/N Main St	MLK Pkwy	WB	27.6	42	39	32	31	33	32	31	32	42	34	28	31	37	35	34	36	0	-5	-5	0	3	2	3	4
NC 55	MLK Pkwy	US 401/N Main St	EB	27.7	41	38	34	32	33	30	27	29	41	38	35	36	36	30	28	33	0	0	1	4	3	-1	1	4
NC 540	I-40/Exit 1	NC 55 Byp	WB	15.1	71	70	69	68	69	70	71	70	74	73	73	73	73	72	71	72	3	4	4	5	5	1	0	2
NC 540	NC 55 Byp	I-40/Exit 1	EB	16.5	72	71	71	70	68	69	69	69	73	71	70	71	72	72	72	72	1	0	-1	2	4	3	3	4
NC 42	US 70/S Lombard St	US 401/N Main St	WB	18.0	47	42	38	38	40	37	35	36	44	39	38	39	39	36	34	38	-3	-3	0	1	0	-1	-1	2
NC 42	US 401/N Main St	US 70/S Lombard St	EB	18.1	46	42	38	38	40	37	35	36	44	39	36	38	40	37	37	39	-2	-3	-2	-1	1	0	2	3
NC 147	TW Alexander Dr/ Exit 7	NC 540	SB	4.9	68	68	64	60	66	56	60	65	66	65	64	64	64	62	61	64	-2	-3	-1	4	-2	6	1	-2
NC 147	NC 540	TW Alexander Dr/Exit 7	NB	5.2	69	69	60	59	67	66	51	57	66	63	60	53	64	63	54	65	-3	-6	0	-6	-2	-3	3	8
1-540	US 64/US 264	I-40/Exit 1	WB	26.0	70	70	52	49	68	69	68	68	75	69	58	65	71	70	70	72	5	-1	5	16	3	2	2	4
1-540	I-40/Exit 1	US 64/US 264	EB	24.9	69	69	69	68	69	59	42	52	74	73	71	71	71	64	58	71	5	3	2	3	2	5	16	19
1-440	I-40/Exit 16	US 64	WB	3.5	63	62	54	54	62	62	60	62	61	58	56	58	59	57	57	60	-2	-4	2	4	-3	-5	-3	-2
1-440	US 64	I-40/Exit 16	EB	4.0	62	61	43	45	61	53	43	55	63	61	61	62	61	54	49	60	0	1	18	16	0	1	6	6
1-40	NC 210/Exit 319	Fayetteville Rd/ Exit 276	WB	42.7	68	60	45	46	65	64	53	58	68	54	51	55	60	55	56	62	0	-6	7	8	-5	-8	3	4
1-40	Fayetteville Rd/ Exit 276	NC 210/Exit 319	EB	36.2	67	67	64	61	65	47	36	45	66	62	55	57	58	42	41	55	-1	-5	-9	-4	-6	-4	5	10
Davis Dr	E Cornwallis Rd	US 64	SB	11.6	44	42	37	35	37	35	30	32	44	42	39	39	40	34	32	37	0	1	1	4	4	-1	2	5
Davis Dr	US 64	E Cornwallis Rd	NB	11.6	44	42	38	35	37	36	35	36	44	39	32	34	41	39	38	40	0	-3	-7	-1	3	3	3	4

(1) Time periods correspond to the following hours:

AM1 = 0600-0700

AM2 = 0700-0800

AM3 = 0800-0900

MD = 0900-1600

PM1 = 1600-1700 PM2 = 1700-1800

PM2 = 1700-1800 PM3 = 1800-1900 >50 mph 40-50 mph 30-40 mph 20-30 mph 10-20 mph 0-10 mph

Table 5.5 Through Trip Comparison - Model vs. Streetlight											
Direction	Origin Segment	Destination Segment	Streetlight	Model							
Northbound	NC 55 Byp	North of US64	78%	60%							
	to US 1	North of NC55	52%	50%							
		North of Toll NC 147	31%	19%							
	Origin	Destination									
Location	Segment	Segment	Streetlight	Model							
Southbound	NC 54 to	North of NC 55	90%	80%							
	Toll NC 147	North of US64	27%	39%							
		North of NC 55 Byp	8%	11%							

# Chapter 6

# Triangle Expressway Traffic and Revenue Forecast

This chapter presents the Base Case traffic and revenue forecast for the Triangle Expressway from Fiscal Year 2019 through 2058. The forecast includes a new planned interchange with Morrisville Parkway, and planned toll-zone relocations at the Hopson Road and U.S. 64 interchanges, from the current ramp locations to mainline locations. Also included in this chapter is the forecast methodology, the toll sensitivity analysis, and important assumptions and inputs to the modeling and forecasting process. No further additions or expansions to the Triangle Expressway are assumed in the forecast presented in this chapter.

## 6.1 Forecasting Approach

Traffic and revenue projections were developed for calendar years 2018 through 2058, and then converted to fiscal years (FY), which extend from July 1st through June 30th. In developing the long-range forecasts, the recently released Triangle Regional Model Version 6 (TRMv6) was used; this model has a long-range horizon year of 2045. In developing the estimates, travel demand model runs were made at 2020, 2025, 2035 and 2045. Projections for years 2018 and 2019 were based on historical traffic and toll revenue trends on the Triangle Expressway, available through June 2018. The forecast for 2020 was developed by using model impacts in combination with recent historical trend data. Forecasts between 2020 and 2045 were developed primarily through interpolation between model year control points. Estimates for years following 2045 were based on assumed nominal growth in traffic, and annual toll rate increases of approximately 2.0 percent.

The forecast period in this study extends beyond the year 2040. With progressive developments in vehicle technology, it is widely anticipated there will likely be modifications in urban mobility patterns in the long term. In particular, it is anticipated that there will be a gradual increasing shift toward "shared mobility" travel and ultimately, fully autonomous driverless vehicles. While it is increasingly accepted that mobility change is coming, there remains considerable uncertainty regarding exactly what will occur and when the transition will happen.

As such, the modeling methodology and the overall forecasting process used in this study does not explicitly assume any specific change in how people and goods will travel in the future. Based on research now underway, it is likely that over the long term we may see a reduction in the number of vehicles on the road but an actual increase in vehicle miles of travel, depending on the level of shift to shared mobility services.

On balance, the impact on potential traffic and toll revenue may prove to be negligible. However, it is noted that the forecasts included in this report do not assume any specific change in travel patterns and characteristics, beyond modest assumed increases in telecommuting. If disruptive technology change does ultimately have a significant impact on urban mobility, it will likely occur after the year 2040; hence, relatively late in the forecast period covered by this study.

#### 6.1.1 Planned Triangle Expressway Interchange and Tolling Configuration Changes

As discussed previously in Chapter 1, a new full-access interchange will be added to the Triangle Expressway at Morrisville Parkway, north of the existing interchange at Green Level West Road. Although the interchange is currently under construction and NCTA plans to open the interchange



before the end of 2019, this study assumes the interchange will open to tolled traffic on January 1, 2020. With the opening of the Morrisville Parkway Interchange, a new mainline toll zone will be located north of the interchange, as shown in Figure 1.2. This will, in turn, require an adjustment to the toll rate at the existing mainline toll zone north of Green Level West Road to maintain per-mile toll rates on the Triangle Expressway.

Two other toll-system changes are planned for the Triangle Expressway. Existing ramp toll zones to-and-from the north at Hopson Road and US 64 will be removed and replaced by new mainline toll zones to the north of each interchange (as shown in Figure 1.2). The net result will be the substitution of two new mainline toll points for two pairs of ramp toll locations. These toll system changes are assumed to be implemented on January 1, 2024. At that time, adjustments will be required at adjacent mainline toll points to maintain the overall per-mile rates for through trips.

The new Morrisville Parkway Interchange and changes in toll-zone locations will result in an increased number of toll transactions, and a slight decrease in overall average toll rates per transaction. These changes will be apparent beginning in the traffic and revenue forecasts for FY 2020 and FY 2024. These are the only changes to the current Triangle Expressway physical configuration assumed in the traffic and revenue forecast presented in this chapter.

### **6.2 Future Transportation Improvements**

A critical element in any comprehensive traffic and revenue study is assumptions regarding competing and complementary transportation improvements which may be expected to occur during the forecast period. As part of this study, CDM Smith reviewed the planned and proposed roadway improvement programs in the study area from the following sources:

- The adopted 2018-2027 NCDOT State Transportation Improvement Program (STIP). These
  are projects that have an identified funding and construction schedule. Projects in the STIP
  were all scored and prioritized through the NCDOT's Strategic Prioritization Office (SPOT)
  program, which is the methodology used to evaluate and score all transportation projects.
- 2. The **2045 Metropolitan Transportation Plan** (MTP). This is the long-range plan for transportation in the Triangle region. It includes roadway, transit, rail, bicycle, and pedestrian projects to be implemented through the year 2045. This plan is coordinated by the two Metropolitan Planning Organizations (MPOs) in the study area; the Capital Area MPO (CAMPO) and the Durham Chapel-Hill Carrboro MPO (DCHC MPO). Roadway improvements in the 2045 MTP include the current STIP projects. Future projects not included in the STIP do not have current schedules and are not financially committed but were developed recognizing overall future fiscal sources and constraints.

Roadway improvements in the STIP and the 2045 MTP were included in the newly developed and released TRMv6. The TRMv6 is developed and supported by the Institute for Transportation Research and Education (ITRE), a division of North Carolina State University. The TRMv6 model supports future years 2025, 2035 and 2045, so road improvements were incorporated into the appropriate completion year.

CDM Smith reviewed the STIP and MTP transportation projects and compared them to the projects in the TRMv6 for consistency. NCDOT personnel were contacted by CDM Smith to verify estimated project completion dates for modeling purposes.

A very large number of highway improvements were assumed in this study, many of which would generally be competitive to the Triangle Expressway. While many of these projects are not yet formally committed, it was considered appropriate and conservative to assume the completion of the projects for developing long-range Triangle Expressway forecasts, as the planned improvements generally decrease traffic on the Triangle Expressway. The shorter-term projects identified in the NCDOT STIP were included in the 2025 travel demand model networks. The longer-range improvements covered in the MTP were included in either the 2035 or 2045 TRMv6 networks, as received by CDM Smith.

The following subsections describe many of the roadway improvement projects assumed in the TRMv6 roadway networks in the study area (and included in the STIP and MTP). The improvements discussed are limited to planned additional capacity (increased number of through travel lanes) and new interchanges on limited access roadways. There are additional roadway improvements assumed in the TRMv6 that include work such as pavement repair and maintenance, signalization improvements, turning lane additions, and grade separations.

#### 6.2.1 Assumed 2025 Roadway Improvements

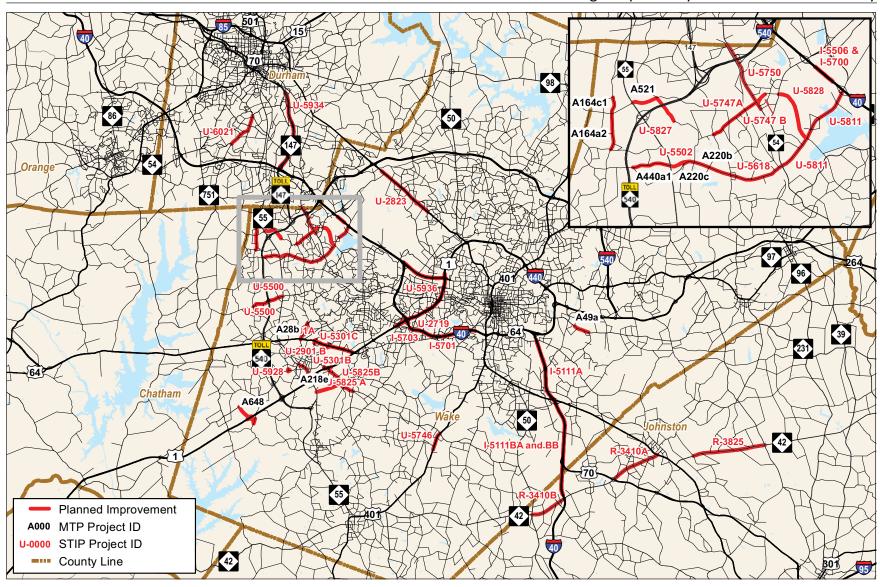
**Figure 6.1** shows roadway improvements included in the TRMv6 2025 highway networks in the Triangle Expressway and Complete 540 corridors. These improvements were assumed in the modeling and in the development of traffic and toll revenue forecasts. All the improvements shown are either road widenings, a new interchange, or, in a few cases, a new road segment. The improvements are generally competitive with the Triangle Expressway and the Complete 540 Project, as they improve traffic flow and connectivity through the area on toll-free routes. One of the more significant improvements is the planned widening of NC 147 north of I-40 from four to eight lanes (STIP # U-5934). **Table 6.1** provides more detail on each of the proposed improvements; the project ID number is shown for each improvement and can be related to the numbers shown in Figure 6.1. Overall, a significant amount of increased capacity is assumed to be provided by 2025; a relatively conservative assumption for purposes of projecting future traffic and revenue on the overall Toll NC 540 corridor.

### **6.2.2 Longer Range Roadway Improvements**

**Figure 6.2** and **Table 6.2**, present additional roadway improvements assumed to be completed by 2035. Many of the improvements are in the Triangle Expressway and Complete 540 corridors. The improvements are primarily road widenings, generally from two to four lanes.

There are many planned improvements on I-40, comprised primarily of roadway widening to address future anticipated traffic demand. Included in the planned improvements is a capacity increase on I-40 of an additional lane in each direction from the Durham County line, southward to NC 210 in Johnston County. This improvement may be implemented as either a managed lane, or possibly, an additional toll-free lane. The TRMv6 model assumes the additional capacity increase as a tolled, managed lane. This study also assumes the proposed capacity increase will be managed lanes, tolled at a level to preserve free-flow traffic conditions in the managed lanes. Managed lanes are also assumed to be implemented on I-540, north of Raleigh.

**Figure 6.3** and **Table 6.3** provide information on long-range improvements assumed to be in place by 2045. The projects shown are mostly roadway widenings, and most are located in the southern Triangle Expressway and Complete 540 corridors. Most notable would be the assumed widening of Ten Road from two to four lanes. Again, improvements shown in Figure 6.3 and Table 6.3 are assumed to be in place by 2045, relatively late in the traffic and revenue projection period.

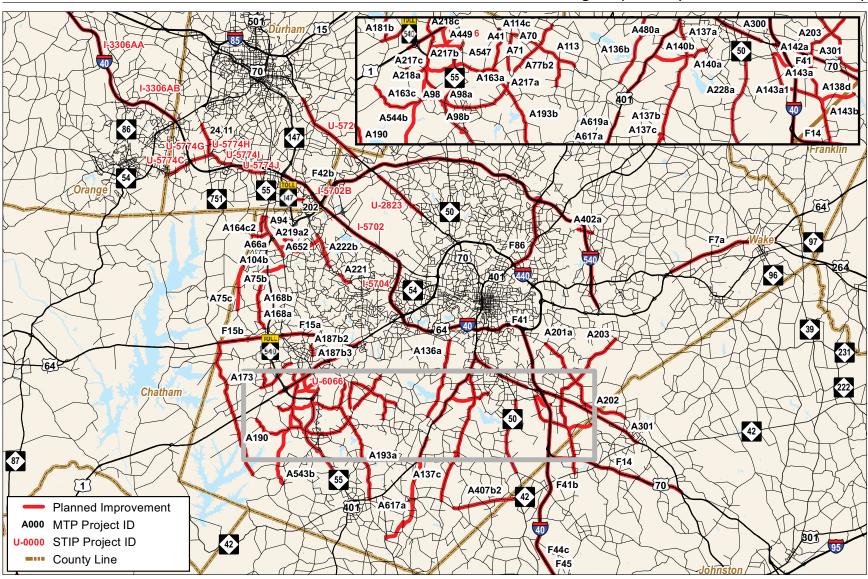




#### Table 6.1 2025 STIP Roadway Improvements Assumed in the TRMv6

Project STIP/MTP ID	Roadway	Location	Description
A164a2	Green Level Church Rd	O'Kelly Chapel Rd to McCrimmon Parkway	Widen from 2 to 4 lanes
A164c1	Green Level Church Rd	Folklore Way to O'Kelly Chapel Rd	Widen from 2 to 4 lanes
A218e	Jessie Dr (part NL)	NC 55 to Ten Ten Rd	Construct 2 lanes on new location
A220b	Morrisville Carpenter Rd	Davis Dr to Louis Stephens Dr	Widen from 2 to 4 lanes
A220c	Morrisville Carpenter Rd	Louis Stephens Dr to Good Hope Church Rd	Widen from 2 to 4 lanes
A28b	Davis Dr	Farm Pond Rd to US 64	Widen from 2 to 4 lanes
A440a1	Carpenter Fire Station Rd	Cameron Pond Dr to NC 55	Widen from 2 to 4 lanes
A49a	Poole Rd	Maybrook Dr to Barwell Rd	Widen from 2 to 4 lanes
A521	O'Kelley Chapel Rd	Louis Stephens Dr to NC 55	Construct 4 lanes on new location
A648	US 1/Friendship Interchange	Ols US 1 Highway to Friendship Rd	Interchange
I-5111A	I-40 (East)	I-440 to US 70 Buisness	Widen from 6 to 8 lanes
I-5111BA & BB	I-40 (East)	US 70 Business to NC 42	Widen from 4 to 8 lanes
I-5506	Aviation Parkway Interchange (Impr)	National Guard Dr to I-40	Interchange
I-5700	Airport Blvd Interchange (Impr)	I-540 to Aviation Parkway	Construct auxillary lanes
I-5701	I-40	US 1/64 to Lake Wheeler Rd	Widen from 6 to 8 lanes
I-5703	I-40/US 1/US 64 Interchange	I-40/US 1/US 64	Interchange
R-3410A	NC 42 West	US 70 Business to US 70 Bypass	Widen from 2 to 4 lanes
R-3410B	NC 42	NC 50 to I-40	Widen from 2 to 4 lanes
R-3410B	NC 42 West Widening	US 70 Bypass to I-40	Widen from 2 to 4 lanes
R-3825	NC 42 East Widening	Glen Laurel Rd to Buffaloe Rd	Widen from 2 to 4 lanes
U-2719	I-440 Widening	US 1/64 to Wade Avenue	Widen from 4 to 6 lanes
U-2823	US 70	Lumley/Westgate Rd to Duraleigh/Millbrook	Widen from 4 to 6 lanes
U-2901B	NC 55	Apex Peakway (South) to Salem St	Widen from 2 to 4 lanes
U-2901B	NC 55	Salem St to Bryan Dr	Widen from 2 to 4 lanes
U-5301A	US 64/Laura Duncan Interchange (New)	US 64 to Laura Duncan Rd	Interchange
U-5301B	US 64/Lake Pine Interchange (New)		Interchange
U-5301C	US 64/Lake Pine Interchange (New)	US 1 to Lake Pine Dr	Interchange
U-5500	Green Level West Rd	NC 55 to I-540	Widen from 2 to 4 lanes
U-5500	Green Lvl W Rd Widening	NC 540 to Green Level Church Rd	Widen from 2 to 4 lanes
U-5502	Carpenter Fire Station Ext	NC 55 to Morrisville Carpenter Rd	Construct 4 lanes on new location
U-5618	Morrisville Carpenter Rd	Page St to Davis Dr	Widen from 2 to 4 lanes
U-5747A	McCrimmon Parkway Ext	NC 54 to Davis Dr	Widen from 2 to 4 lanes
U-5747B	McCrimmon Parkway	Airport Blvd to NC 54	Widen from 2 to 4 lanes
U-5750	NC 54	Perimeter Park Dr to Northern Twn Limits	Widen from 2 to 6 lanes
U-5811	Aviation Parkway	Gateway Centre Blvd to Dominion Dr	Widen from 2 to 4 lanes
U-5811	Aviation Parkway	Evans Rd to NC 54	Widen from 2 to 4 lanes
U-5811	Aviation Parkway	I-40 to Gateway Centre Blvd	Widen from 4 to 6 lanes
U-5825A	Ten Ten Rd	US 1	Interchange
U-5825B	Ten Ten Rd	Kildare Farm Rd to US 1	Widen from 2 to 4 lanes
U-5827	Louis Stephens Dr Ext (NL)	Little Drive to Poplar Pike Lane	Construct 4 lanes on new location
U-5828	McCrimmon Parkway	Airport Blvd to Aviation Parkway	Widen from 2 to 4 lanes
U-5928	Apex Peakway/Salem St Interchange		Interchange
U-5934	NC 147	East End Connector to I-40	Widen from 4 to 8 lanes
U-5936	Wade Ave Widening	I-40 to I-440	Widen from 4 to 6 lanes







# Table 6.2 (Page 1 of 2) Year 2035 Roadway Improvements Assumed in the Complete 540 Forecast Model

Project							
STIP/MTP ID	Roadway	Location	Description				
24.11	Garrett Rd	NC 751 to Old Durham Rd	Widen from 2 to 4 lanes				
202	Hopson Rd	Davis Dr to S Miami Blvd (NC 54)	Widen from 2 to 4 lanes				
A104b	Morrisville Parkway	Green Level Church Rd to NC 55	Widen from 2 to 4 lanes				
A113	Ten Ten Rd	Holly Springs Rd to Bells Lake Rd	Widen from 2 to 4 lanes				
A114c	Ten Ten Rd	Holly Springs Rd and Kildare Farm Rd	Widen from 2 to 4 lanes				
A136a	Lake Wheeler Rd	Tryon Rd to Penny Rd	Widen from 2 to 4 lanes				
A136b	Lake Wheeler Rd	Penny Rd to Ten Ten Rd	Widen from 2 to 4 lanes				
A136c	Lake Wheeler Rd	Ten Ten Rd to Hilltop-Needmore Rd	Widen from 2 to 4 lanes				
A137a	Old Stage Rd	US 40 to Ten Ten Rd	Widen from 2 to 4 lanes				
A137b	Old Stage Rd	Ten Ten Rd to Rock Service Station	Widen from 2 to 4 lanes				
A137c	Old Stage Rd	Rock Service Station to NC 42	Widen from 2 to 4 lanes				
A138d	White Oak-Guy Rd Connector	White Oak Rd to Guy Rd	Construct 4 lanes on new location				
A140a	Vandora Springs Rd & Extension	Timber Dr to Old Stage Rd	Widen from 2 to 4 lanes				
A140b	Vandora Springs Rd & Extension	Old Stage Rd to US 401	Widen from 2 to 4 lanes				
A142a	Timber Dr East	Waterfiled Rd to White Oak Rd	Construct 4 lanes on new location				
A143a	White Oak Rd	US 70 to I-540	Widen from 2 to 4 lanes				
A143a1	I-40/White Oak Interchange		Interchange				
A143b	White Oak Rd	I-540 to NC 42 (Johnston Co)	Widen from 2 to 4 lanes				
A163a	Holly Springs Rd	Old Holly Springs Rd to N of NC 540 Interchange	Widen from 2 to 4 lanes				
A163c	Friendship Rd	Richardson Rd to Old Holly Springs Apex	Widen from 2 to 4 lanes				
A164c2	Green Level Church Rd	Kit Creek Rd to Precept Way	Widen from 2 to 4 lanes				
A165a2	Airport Blvd Extension	Garden Square Lane to NC 54	Construct 4 lanes on new location				
A165b	Airport Blvd Extension	Davis Dr to Louis Stephens Rd	Construct 2 lanes on new location				
A168a	Green Level Church Rd	Green Level West to Jenks Rd	Widen from 2 to 4 lanes				
A168b	Green Level Church Rd	Green Level West to Morrisville Parkway	Widen from 2 to 4 lanes				
A173	New Hill Olive Chapel Rd	Old US 1 to Chatham Co.	Widen from 2 to 3 lanes				
A187b2	Apex Peakway (East)	Laura Duncan to Old Raleigh Rd	Widen from 2 to 4 lanes				
A187b3	Apex Peakway (East)	Old Raleigh Rd to Center Street	Widen from 2 to 4 lanes				
A190	New Hill Holleman Rd	Old US 1 to Avent Ferry Rd	Widen from 2 to 4 lanes				
A193a	Sunset Lake Rd	US 401 to Hilltop-Needmore Rd	Widen from 2 to 4 lanes				
A193b	Sunset Lake Rd	Hilltop-Needmore Rd to Optimist Farm Rd	Widen from 2 to 4 lanes				
A201a	Rock Quarry Rd	New Hope Rd to Battle Bridge Rd	Widen from 2 to 4 lanes				
A202	East Garner Rd	Rock Quarry Rd to Shotwell Rd	Widen from 2 to 4 lanes				
A203	Auburn-Knightdale Rd	Grasshopper Rd to Raynor Rd	Widen from 2 to 4 lanes				
A217a	Sunset Lake Rd	Main St to Optimist Farm Rd	Widen from 2 to 4 lanes				
A217b	Sunset Lake Rd Extension	Old Holly Springs Apex to Main St	Construct 4 lanes on new location				
A218a	Old Holly Springs Apex Rd	Holly Springs Rd to Jessie Dr	Widen from 2 to 4 lanes				
A218b	Jessie Dr (part NL)	Veridea Parkway to NC 55	Construct 4 lanes on new location				
A218c	Veridea Parkway	Tingen Rd to Jessie Dr	Widen from 2 to 3 lanes (turn lane)				
A218d	Tingen Rd	Apex Peakway to Old Holly Springs Apex Rd	Widen from 2 to 3 lanes (turn lane)				
A219a2	McCrimmon Parkway Extension	Davis Dr to Louis Stephens Rd	Widen from 2 to 4 lanes				
A219b	McCrimmon Parkway Extension	Louis Stephens Rd to NC 55	Construct 4 lanes on new location				
A221	NC 54	N.W. Maynard Rd to Wilson Rd	Widen from 2 to 6 lanes				
A222b	NC 54	Weston Parkway to McCrimmon Pkwy	Widen from 2 to 4 lanes				
A228a	NC 50	Timber Dr to I-540	Widen from 2 to 4 lanes				
A27d	Louis Stephens Dr Ext (part existing)	Poplar Pike Lane to Airport Blvd	Widen from 2 to 4 lanes				



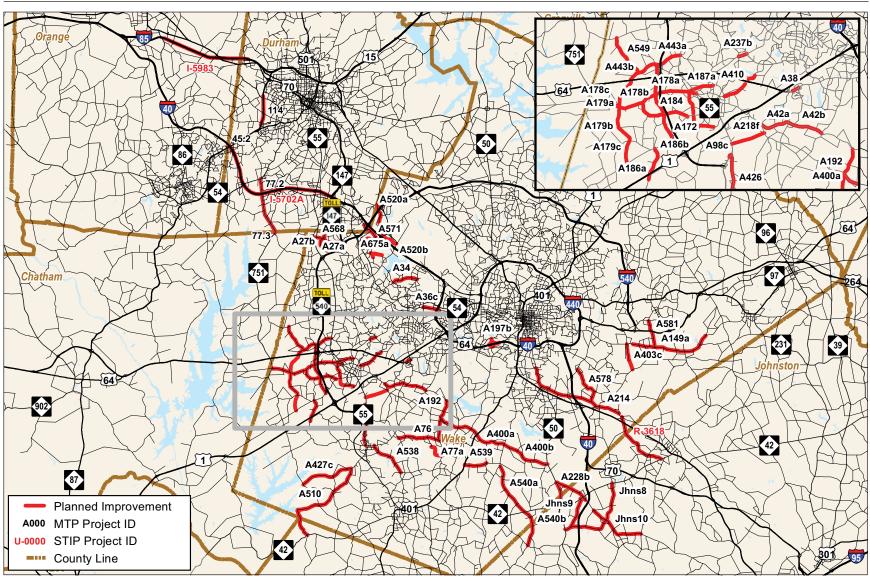
## Table 6.2 (Page 2 of 2) Year 2035 Roadway Improvements Assumed in the Complete 540 Forecast Model

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STIP/MTP ID	Roadway	Location	Description
A300	US 70	US 401 to I-40	Widen from 4 to 6 lanes
A301	US 70	I-40 to NC 42	Widen from 4 to 6 lanes
4402a	Buffaloe Rd	Spring Forest Rd Ext to Forestville Rd	Widen from 2 to 4 lanes
A407b2	NC 42	John Adams Rd to NC 50	Widen from 2 to 4 lanes
A41	Kildare Farm Rd	Ten Ten Rd to Kildare Farm Connector	Widen from 2 to 4 lanes
<b>A</b> 449	Perry Rd Extension	Apex Peakway to NC 55 Bypass	Construct 4 lanes on new location
A480a	US 401 (South)	US 70 to Ten Rd	Widen from 4 to 6 lanes
A543b	Rex Rd Realignment	Avent Ferry Connector to Cass Holt Rd	Construct 4 lanes on new location
A544a	Avent Ferry Connector	Old Holly Springs Apex to Holly Springs Rd	Construct 4 lanes on new location
A544b	Avent Ferry Connector	Holly Springs Rd to Rex Rd	Construct 4 lanes on new location
A547	Stephenson Rd	Ten Ten Rd to Sunset Lake Rd	Widen from 2 to 4 lanes
A617a	US 401 Bypass	US 401 (East of Fuguay-Varina) to NC 55	Construct 6 lanes on new location
A619a	US 401	NC 540 to US 401 Bypass	Widen from 4 to 6 lanes
A619b	US 401	US 401 Bypass to NC 55/NC 42	Widen from 4 to 6 lanes
A652	NC 55	Morrisville Carpenter Rd to NC 540	Widen from 4 to 6 lanes
A66a	O'Kelley Chapel Rd	Alston Avenue to NC 55	Widen from 2 to 4 lanes
466b	O'Kelley Chapel Rd	Alston Avenue to NC 751	Widen from 2 to 4 lanes
470	Holly Springs Rd	Penny Rd to Ten Ten Rd	Widen from 2 to 4 lanes
A71	Holly Springs Rd	Ten Ten Rd to Kildaire Farm Rd Connector	Widen from 2 to 4 lanes
A75b	Yates Store Rd	Yates Store Rd to Morrisville Parkway	Construct 4 lanes on new location
\75c	Wimberley Rd	Morrisville Parkway to Green Level West Rd	Construct 4 lanes on new location
A77b2	West Lake Rd	Ten Ten Rd and Middle Creek Park Ave	Widen from 2 to 4 lanes
A94	NC 55	NC 540 to Kit Creek Rd	Widen from 4 to 6 lanes
A98	NC 55 Bypass	North Main St to Honeycutt Connector	Widen from 4 to 6 lanes
14	Clayton Bypass Widening	I-40 to US 70	Widen from 4 to 6 lanes
-15A	US 64 West conversion to expressway	Laura Duncan Rd to I-540	Widen from 4 to 6 lanes
15B	US 64 West conversion to expressway	NC 540/TriEx to NC 751	Widen from 4 to 6 lanes
41	I-40 Managed Lanes	Wade Avenue to Johnston County	Construct 2 Managed Lanes
41b	I-40 Managed Lanes	Johnston County to Cornwallis Rd	Construct 2 Managed Lanes
42b	I-540 Managed Lanes	I-40 to US 64 Bypass	Construct 2 Managed Lanes
F44c	I-40 (East)	NC 42 to NC 210	Widen from 4 to 6 lanes
F44d	I-40 (East)	NC 210 to CAMPO MAB	Widen from 4 to 6 lanes
F45	I-40 Managed Lanes	Cornwallis Rd to NC 210	Construct 2 Managed Lanes
F7a	US 64 East	US 64 Bypass to US 64/US 264 to	Widen from 4 to 6 lanes
F86	Capital Blvd	I-440 to I-540	Corridor Upgrades on new locatio
-3306AA	1-40	NC 86 to I-85	Widen from 4 to 6 lanes
-3306AB	I-40	US 15-501 to NC 86	Widen from 4 to 6 lanes
-5702	I-40 Managed Lanes	Durham County Line to Wade Avenue	Construct 2 Managed Lanes
-5702B	I-40 Managed Lanes	Wake County Line to NC 147	
-5704	1-40	Wade Avenue to US 1/64	Widen from 6 to 8 lanes
J-5774C	US 70 (freeway conversion)	S Miami Blvd to Northern Durham Parkway	Widen from 4 to 6 lanes
J-5774G	NC 54	I-40 Interchange to NC 751	Widen from 2 to 4 lanes
U-5774H	NC 54	NC 751 to Highgate Dr	Widen from 2 to 4 lanes
U-5774I	NC 54	Fayetteville to Barbee	Widen from 2 to 4 lanes
U-5774J	NC 54	Barbee to NC 55	Widen from 2 to 4 lanes
U-6066	US 1	US 64 to NC 540	Widen from 4 to 6 lanes

Figure 6-2





#### Table 6.3 Year 2045 Roadway Improvements Assumed in the Complete 540 Forecast Model

#### Project

Project								
STIP/MTP ID	Roadway	Location	Description					
A149a	Poole Rd	I-540 to Martin Pond Rd	Widen from 2 to 4 lanes					
A172	Kelly Rd	Jenks Rd to Old US 1	Widen from 2 to 4 lanes					
A178a	Olive Chapel Rd	Kelly Rd to NC 55	Widen from 2 to 4 lanes					
A178b	Olive Chapel Rd	Richardson Rd to Kelly Rd	Widen from 2 to 3 lanes (turn lane)					
A178c	Olive Chapel Rd	New Hill Olive Chapel Rd to Richardson Rd	Widen from 2 to 3 lanes (turn lane)					
A179a	Richardson Rd	US 64 (West) to Olive Chapel Rd	Construct 4 lanes on new location					
A179b	Richardson Rd	Olive Chapel Rd to Humie Olive Rd	Widen from 2 to 4 lanes					
A179c	Richardson Rd	Humie Olive Rd to Old US 1 Highway	Construct 4 lanes on new location					
A184	Apex Barbecue Rd	Old US 1 to Olive Chapel Rd	Widen from 2 to 3 lanes (turn lane)					
A186a	Friendship Rd	Friendship Rd to Winding Way	Widen from 2 to 3 lanes (turn lane)					
A186b	Friendship Rd	Winding Rd to Old US 1	Widen from 2 to 3 lanes (turn lane)					
A187a	Apex Peakway	Olive Chapel Rd to Laura Duncan Rd	Widen from 2 to 4 lanes					
A187c	Apex Peakway	Broadstone Way to Old US 1	Widen from 2 to 4 lanes					
A187d	Apex Peakway	Old US 1 to Olive Chapel Rd	Widen from 2 to 4 lanes					
A192	Graham Newton Rd	Penny Rd to Optimist Farm Rd	Widen from 2 to 4 lanes					
A197b	Center Campus Conn/Interchng	Main Campus Dr Connector to I-40	Const. 4 lanes on new location					
A214	Garner Rd	Tryon Rd to Rock Quarry Rd	Widen from 2 to 3 lanes (turn lane)					
A218f	Jessie Dr	NC 55 to Ten Ten Rd	Widen from 2 to 4 lanes					
A228b	NC 50	I-540 to NC 42	Widen from 2 to 4 lanes					
A237b	Old Apex Rd	Cary Parkway to Laura Duncan Rd	Widen from 2 to 4 lanes					
A27a	Louis Stephens Dr Extension	Wake County Line to Kit Creek Rd	Widen from 2 to 4 lanes					
A27b	Louis Stephens Dr Extension	Kit Creek Rd to O'Kelly Chapel Rd	Widen from 2 to 4 lanes					
A34	Cary Parkway	Evans Rd to Harrison Ave	Widen from 2 to 4 lanes					
A36c	Chatham St	N.E. Maynard Rd to I-40 Bridge	Widen from 2 to 4 lanes					
A38	Tryon Rd	US 64 to Kildare Farm Rd	Widen from 2 to 6 lanes					
A400a	Ten Ten Rd	Bells Lake Rd to Old Stage Rd	Widen from 2 to 4 lanes					
A400b	Ten Ten Rd	Old Stage Rd to NC 50	Widen from 2 to 4 lanes					
A403c	Hodge Rd	Auburn-Knightdale Rd to Poole Rd	Widen from 2 to 4 lanes					
A410	Lake Pine Dr/Old Raleigh Rd	Cary Parkway to Apex Peakway	Widen from 2 to 4 lanes					
A426	NC 55 (Main St)	Holly Springs Rd to Technology Dr	Widen from 2 to 4 lanes					
A427c	Avent Ferry Rd	New Hill Holleman to Cass Holt	Widen from 2 to 4 lanes					
A42a	Penny Rd	Ten Ten Rd to Kildaire Farm Rd	Widen from 2 to 4 lanes					
A42b	Penny Rd	Kildaire Farm Rd to Holly Springs Rd	Widen from 2 to 4 lanes					
A443a	Jenks Rd	NC 55 to Wimberly Rd	Widen from 2 to 3 lanes (turn lane)					
A443b	Jenks Rd	Wimberly Rd to US 64	Widen from 2 to 4 lanes					
A510	Cass Holt Rd	Avent Ferry Rd to NC 42	Widen from 2 to 4 lanes					
A520a	Pleasant Grove Church Rd	Nelson Rd to Airport Blvd	Widen from 2 to 4 lanes					
A520b	Pleasant Grove Church Rd	Airport Blvd to Aviation Parkway	Construct 2 lanes on new location					
A538	Bass Lake Rd	Holly Springs Rd to Hilltop-Needmore Rd	Widen from 2 to 4 lanes					
A539	Banks Rd	US 401 to Fanny Brown Rd	Widen from 2 to 3 lanes (turn lane)					
A540a	Rock Service Station	Old Stage Rd to NC 42	Widen from 2 to 3 lanes (turn lane)					
A540b	Rock Service Station	NC 42 to Mt Pleasant Rd	Widen from 2 to 3 lanes (turn lane)					
A549	Wimberley Rd	Jenks Rd to Green Level West Rd	Widen from 2 to 3 lanes					
A568	Kit Creek Rd	Davis Dr to Green Level Church Rd	Widen from 2 to 3 lanes (turn lane)					
A571	Slater Rd	Airport Blvd to West of NC 540	Widen from 2 to 3 lanes (turn lane)					
A578	Auburn Church Rd	Jones Sausage Rd to Garner Rd	Widen from 2 to 3 lanes (turn lane)					
A581	Bethlehem Rd	Old Faison Rd to Grasshopper Rd	Widen from 2 to 3 lanes (turn lane)					
A675a	Morrisville East Connector	Trans Air Dr/Airport Blvd to Int'l Dr/Nova Dr	Construct 2 lanes on new location					
A677	Marcom Dr Extension	Watkins Rd to Sorrell Grove Church Rd	Construct 2 lanes on new location					
A76	Optimist Farm Rd	Lake Wheeler Rd to Sunset Lake Rd	Widen from 2 to 4 lanes					
A77a	West Lake Rd	Larboard Rd to Bells Lake Rd	Construct 2 lanes on new location					
A98c	Technology Drive	Technology Drive and NC 55 Bypass	Interchange					
R-3618	Guy Rd	US 70 Bus to NC 42	Widen from 2 to 4 lanes					
Jhns8	Cornwallis Rd	NC 42 to Old Drugstore Rd	Widen from 2 to 4 lanes					
Jhns9	Old Drugstore Rd	NC 42 to NC 50	Widen from 2 to 4 lanes					
Jhns 10	Cleveland Rd	NC 50 to Barber Mill Rd	Widen from 2 to 4 lanes					
45	I-40 Managed Lanes	NC 54 to US 15-501	Widen from 6 to 8 lanes					
45	I-40 Managed Lanes	NC 147 to NC 54	Widen from 6 to 10 lanes					
48	1-85	Sparger Rd to US 70	Widen from 4 to 6 lanes					
48	1-85 1-85	US 70 to I-40	Widen from 4 to 6 lanes					
77.2	NC 751	NC 54 to Renaissance Pkwy	Widen from 4 to 6 lanes Widen from 2 to 4 lanes					
77.2 77.3	NC 751 NC 751	Renaissance Pkwy to O'Kelly Chapel Rd	Widen from 2 to 4 lanes					
114	US 15-501 Bypass	MLK Parkway to I-85	Widen from 2 to 4 lanes Widen from 4 to 6 lanes					
114	02 13-201 pypa22	IVILIX FAIRWAY TO 1-03	WINCH HOILS TO BIAIRS					



#### 6.2.3 Excluded Improvement in the Base Case

One planned improvement was excluded from the Triangle Expressway Base Case traffic and revenue analysis and transaction and revenue forecast. Included in the STIP and MTP, and in the original TRMv6 2025, 2035 and 2045 networks are the planned improvement to build an approximately 1.6-mile toll-free extension of NC 147, from the southern end of Toll NC 147 to McCrimmon Parkway and Little Road. The improvement would include modifications to the existing interchange between Toll NC 540 and Toll NC 147, and associated toll zone and toll schedule modifications. This project is identified as TIP number U-5966.

This improvement, while planned, does not have current committed funding, and the completion of the project does have estimated positive transaction and toll revenue impacts on the Triangle Expressway. For conservative purposes, the Triangle Expressway Base Case traffic and revenue forecast assumes that this project does not occur during the forecast period of the Triangle Expressway Base Case.

### **6.3 Basic Assumptions**

Base Case traffic and revenue estimates for the Triangle Expressway are predicated on the following basic assumptions, which are considered reasonable for purpose of the base case forecasts:

- 1. No portion of Complete 540 is assumed to be implemented during the projection period. The traffic and revenue forecasts assume only the continued operation of the existing Triangle Expressway with certain interchange and toll zone location modifications as enumerated herein.
- 2. A new interchange at Morrisville Parkway will be open to traffic on January 1, 2020. Associated with this new interchange will be a new mainline toll zone, north of the new Morrisville interchange, and associated adjustments in toll rates at the existing mainline toll zones, T17/T18, north of Green Level West Road. Triangle Expressway toll zones are shown in Figure 1.2 in Chapter 1.
- 3. Existing ramp toll zones at Hopson Road and U.S. 64 will be removed and replaced with two new mainline tolling zones immediately north of these respective interchanges. Associated toll rate adjustments also occurred to maintain consistent through-trip per-mile toll rates. The toll-collection system changes are assumed to begin on January 1, 2024.
- 4. Tolls on the Triangle Expressway will continue to be charged for three vehicle classes, using a cashless all-electronic toll collection methodology. Two payment types will continue to be offered; electronic toll collection with transponders (ETC) and Bill by Mail (BBM), utilizing video imaging of license plates for those vehicles not equipped with transponders. Toll rates for each year of the forecast period will be as shown in Table 6.5, which assumes continued annual increases in toll rates. Any changes in the assumed rates of annual increase, or discontinuation of annual rate increases, will impact traffic and revenue forecasts.
- 5. Highway and other transportation improvements as set forth in Tables 6.1, 6.2 and 6.3 will be implemented within the time frames assumed in those tables. No other transportation improvement projects, particularly new roads, additional road capacity or new interchanges will be constructed during the forecast period, other than those shown in Table 6.1, 6.2 and 6.3.



- 6. For purposes of the Base Case traffic and revenue forecast, no other planned or potential extensions or connections to Triangle Expressway are assumed during the projection period, other than the modifications described in numbers 2 and 3 above.
- 7. The annual rate of inflation and estimated method-of-payment market shares among ETC and BBM will be as shown in Table 6.7 for purposes of the forecast. Any change in inflation rates could affect traffic and revenue even if toll rates continue to be adjusted in accordance with assumptions shown in Table 6.5.
- 8. Economic growth in the project study area will generally occur as forecasted by the independent economist used in the study, whose work is summarized in Chapter 3.
- 9. Leakage and fee revenue adjustments are applied to the estimated gross toll revenue forecasts. The adjustments are based on 5 ½ years of actual experience on the Triangle Expressway, provided by NCTA. The forecast assumes that toll revenue collection, particularly as related to BBM transactions and processing fee revenue, will continue to be collected at similar rates over the forecast period.
- 10. The Triangle Expressway will continue to be well maintained, efficiently operated, effectively signed and promoted to encourage maximum usage.
- 11. Motor fuel will remain in adequate supply throughout the forecast period. Fuel price increases will not significantly exceed the overall rate of inflation. Fuel price forecasts provided by the US Energy Information Administration through 2050 will generally be experienced.
- 12. No national, state or regional emergency will arise that would abnormally restrict the use of motor vehicles. Future transportation technology changes will not significantly negatively impact traffic and revenue on Triangle Expressway over the projection period.

Any significant departure from these basic assumptions could materially affect traffic and revenue potential on the Triangle Expressway.

## 6.4 Historical Trends and Short-Term Projections

**Table 6.4** shows recent trends in toll transactions, toll revenue and average tolls on the Triangle Expressway. Historical data is shown between calendar 2013, the first full year of operation for Triangle Expressway, and 2017. Near-term projections are shown for calendar 2018 and 2019. The trend data shows a classic pattern of ramp-up on a new, urban toll facility. Transactions in 2014 exceeded opening year transactions by almost 33 percent, with transaction growth in the following years decreasing to 25.0, 18.1 and 9.3 percent, respectively.

This very high level of early-year transaction growth is consistent with ramp up patterns on other toll facilities. It is particularly strong, however, recognizing that toll rates were increased annually, resulting in revenue growth which averaged more than 30 percent per year over the first five years of operation. Specifically, the average annual growth in transactions between 2003 and 2017 was 21.0 percent per year, together with the increase in average tolls, yielding a 30.1 percent per year average increase in revenue.



Table 6.4
Triangle Expressway Annual Transactions and Gross Toll Revenue
Historical Trends and Short-Term Projections
(transactions and revenue in thousands)

Calendar	Toll Transact Year-ove Percent G	r-Year	Toll Ra Year-ov	Weighted Ite and Ver-Year Growth (1)	Gross Toll Revenue and Year-over-Year Percent Growth (2)				
Year	Transactions	Growth	Toll Rate	Growth	Revenue	Growth			
2013	23,059		\$0.617		\$14,238				
2014	30,650	32.9 %	0.687	11.2 %	21,045	47.8 %			
2015	38,319	25.0	0.751	9.4	28,779	36.7			
2016	45,244	18.1	0.782	4.2	35,393	23.0			
2017	49,460	9.3	0.825	5.4	40,792	15.3			
2018 (3)	52,922	7.0	0.855	3.6	45,231	10.9			
2019 (4)	55,410	4.7	0.886	3.7	49,100	8.6			
Average Annu	al Percent Chang	ge							
2013-2017	2017 21.0			7.5	30.1				
2013-2019		15.7		6.2	22.9				

- (1) The average weighted toll rate is calculated by dividing total toll revenue for the year by total toll transactions for the year.
- (2) This is toll revenue collected during the indicated year. It does not include fee revenue.
- (3) Based on data through June 2018.
- (4) Estimated based on trend data.

Source: NCTA

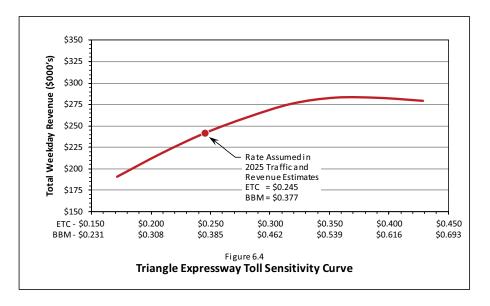
It is important to note that the rate of growth in the average toll per transaction is a function of both programmed rate increases (generally around 3 percent per year) as well as shifts in the distribution of transactions between local ramps and mainline tolling points, and changes in the mix of ETC versus BBM transactions.

Year-end estimates of annual transactions and revenue for calendar year 2018 were developed by extrapolating actual data from January through June of 2018. Transaction growth is expected to reach about 7.0 percent in 2018, with revenue increasing by about 10.9 percent. The projection for 2019 shows a 4.7 percent increase in annual transactions and an 8.6 percent increase in toll revenue growth compared to the prior calendar year. Toll transactions in calendar 2019 are expected to reach about 55 million while gross toll revenue, prior to adjustment for leakage and not including additional fee revenue, is expected to reach just over \$49 million.

## 6.5 Toll Sensitivity Assessment

As part of this traffic and revenue study, an updated toll sensitivity analysis was conducted at 2025 levels for the Triangle Expressway. Future toll rates and rate increases assumed in this study follow previously established patterns which have been adopted by the NCTA Board. The updated toll sensitivity analysis included herein is simply to provide an indication of where current and assumed future toll rates fall within the overall rate sensitivity curve; providing an indication of the ability to increase revenue, if ever needed, with future toll rates increases above those already assumed.

**Figure 6.4** shows the toll sensitivity curve at 2025 levels. The horizontal scale shows the per-mile toll rate levels which were tested in the analysis, for ETC and BBM payment methods. The prior relationship between ETC and BBM is assumed to remain constant, with ETC rates priced at 35 percent less than BBM rates. ETC rates tested ranged from \$0.170 per mile to \$0.430 per mile, at 2025 levels. As shown, maximum revenue potential would be generated at a per-mile ETC toll rate of about \$0.35 per mile. The Triangle Expressway forecast assumes the 2025 rates would be approximately \$0.245 per mile, well below the revenue maximizing rate. This indicates there is considerable ability to raise revenues by increasing toll rates above the assumed rates.



In the curve shown in Figure 6.4, revenue is expressed in average weekday terms, and includes both ETC and BBM revenue elements. On a weekday basis, in 2025, the current assumed toll rate of \$0.245 per mile would yield about \$242,000 revenue per weekday. At revenue maximizing rates, revenue would be increased to about \$283,000 per day, an increase of about 17 percent. However, given the relatively flat shape of the curve, this 17 percent revenue increase would be achieved through a 45 to 50 percent increase in toll rates.

**Figure 6.5** shows equivalent assumed 2025 toll rates by toll zones and vehicle class on the Triangle Expressway. As noted previously, by 2025 a new interchange will be added at Morrisville Parkway and three new mainline toll zones will be added north of the Hopson Road, Morrisville Parkway and US 64 interchanges. Existing ramp toll zones will be removed at the Hopson Road and US 64 interchanges.

Computed toll rates are shown separately for ETC and BBM rates, for each of the three vehicle classes. As is current practice, it is assumed that the Class 2 toll will be twice the Class 1 toll while the Class 3 toll, which represents vehicles with more than three axles, would be set at four times the Class 1 rate.

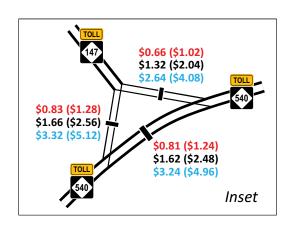
Figure 6.5 also shows the equivalent through-trip toll via Toll NC 540. Note these through-trip rates exclude the Toll NC 147 portion of the toll facility, and instead cover travel on Toll NC 540 between NC



\$0.46 (\$0.70)

\$0.92 (\$1.40)

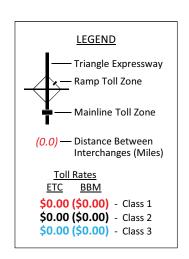
\$1.84 (\$2.80)

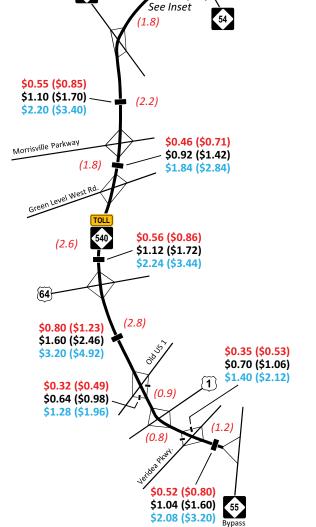




### 2025 Through Trip ETC Toll Rates

	Via Toll NC 540									
Vehicle		Toll								
Class	<u>Toll</u>	Per Mile								
Class 1	\$3.70	\$0.245								
Class 2	\$7.40	\$0.490								
Class 3	\$14.80	\$0.980								







ASSUMED 2025 TOLL RATES BY TOLL ZONE AND VEHICLE CLASS - TRIANGLE EXPRESSWAY

54 on the north and NC 55 Bypass on the south. By 2025, the through-trip toll for passenger cars would be \$3.70 for the 15.1-mile trip. This is equivalent to \$0.245 per mile. Class 2 vehicles would be charged \$7.40 for the full trip while Class 3 vehicles would be charged \$14.80, a per-mile rate of almost \$1.00 per mile for the heaviest vehicles. It is important to recognize that the toll rates shown in Figure 6.5 reflect 2025 conditions, after seven years of annual rate increases from current day levels.

**Table 6.5** shows assumed Class 1 toll rates by year for the toll zones on Triangle Expressway. Rates are shown separately for ETC and BBM transactions at each location. Location T15/T16 is the new mainline toll point associated with the Morrisville Parkway interchange, that is assumed to open on January 1, 2020. Toll rate adjustments were made at the adjacent mainline toll zone (T17/T18) to maintain relatively consistent through-trip per-mile toll rates.

New mainline toll points are also introduced in 2024. The new mainline toll points replace ramp tolls at locations T01/T02 and T21/T22. These toll zone relocations necessitated adjustments to the toll schedule at adjacent mainline sections to maintain or improve consistent per-mile toll rates for both through-trips and shorter distance trips. Overall, the average through trip per-mile toll rate for ETC Class 1 transactions will increase from \$0.221 in 2018 to \$0.245 in 2025, and to \$0.330 in 2035.

Table 6.5 also shows the assumed average annual percent increase in toll rates for each tolling point and payment category on Triangle Expressway. Using the through-trip rate as an overall measure, toll rates will increase by an average of 3.2 percent per year between 2018 and 2023, 3.0 percent per year between 2024 and 2035 and about 2.0 percent per year after 2035. Overall, between 2018 and 2058, toll rates will increase by an average annual amount of 2.6 percent. The values in Table 6.5 are assumed to be in place in each of the future years shown.

Finally, **Table 6.6** provides a comparison of through-trip toll rates on Triangle Expressway, by vehicle class and payment method for each of the four primary modeling years. For example, in 2020, the through trip Class 1 toll for electronic toll collection would be \$3.10, or an average of about \$0.21 per mile. The through-trip toll for a vehicle without a transponder (BBM) would be \$4.74, or \$0.31 per mile. By 2025, the Class 1, ETC, through-trip toll would increase to \$3.70, and to \$4.99 by 2035. Through-trip tolls for Class 3 vehicles in 2035 would reach almost \$20.00, with a per-mile rate of \$1.32.

## 6.6 Modeling Assumptions and Inputs

As noted above, travel demand model runs were made at 2020, 2025, 2035 and 2045. **Table 6.7** provides a concise summary of modeling assumptions and inputs used in each of the assignment years.

A critical parameter in any traffic and revenue analysis relates to value of time (VOT). This is a measure of motorist's willingness to pay for time savings, and the values in Table 6.7 are shown in terms of dollars per minute. VOT information was derived from stated preference (SP) surveys conducted in early 2017 by RSG and summarized in Chapter 4.



Table 6.5
Assumed Class 1 Toll Rates By Year
Triangle Expressway Toll Zones

												,	,										There Take the 2	T-    NC F40
																							Thru Trip via	Thru-trip
Calendar	T01/	T02	02 T09/T10 T05/T06 T13		T13/	T14	T15/	T17/	T18	T21/	T22	T25/	T26	T29/T30		T31/T32		T33/	T34	Through Trip	Per-mile			
Year (1)	ETC	BBM	ETC	BBM	ETC	BBM	ETC	BBM	ETC	BBM	ETC	BBM	ETC	BBM	ETC	BBM	ETC	BBM	ETC	BBM	ETC	BBM	Toll Rate (4)	Rate (4)
2018	\$0.37	\$0.56	\$0.81	\$1.24	\$1.01	\$1.55	\$0.65	\$1.00			\$0.81	\$1.24	\$0.45	\$0.69	\$1.01	\$1.54	\$0.26	\$0.39	\$0.28	\$0.43	\$0.42	\$0.64	\$2.89	\$0.191
2019	0.38	0.58	0.84	1.29	1.05	1.61	0.67	1.03			0.84	1.29	0.47	0.71	1.04	1.60	0.26	0.40	0.29	0.44	0.44	0.67	2.99	\$0.198
2020 (2)	0.39	0.60	0.87	1.33	1.08	1.66	0.70	1.07	0.48	0.73	0.39	0.60	0.48	0.73	1.08	1.65	0.28	0.42	0.30	0.46	0.45	0.69	3.10	\$0.205
2021	0.41	0.62	0.90	1.38	1.12	1.72	0.72	1.10	0.49	0.76	0.41	0.63	0.50	0.76	1.11	1.70	0.28	0.43	0.31	0.47	0.47	0.71	3.20	\$0.212
2022	0.42	0.64	0.93	1.42	1.16	1.77	0.74	1.13	0.51	0.78	0.42	0.65	0.51	0.78	1.14	1.75	0.30	0.45	0.32	0.49	0.48	0.73	3.29	\$0.218
2023	0.43	0.66	0.95	1.46	1.19	1.82	0.77	1.17	0.52	0.80	0.43	0.66	0.53	0.81	1.17	1.80	0.30	0.46	0.33	0.50	0.49	0.75	3.38	\$0.224
2024 (3)	0.45	0.68	0.64	0.99	0.81	1.25	0.79	1.20	0.54	0.83	0.45	0.69	0.54	0.83	0.78	1.20	0.31	0.47	0.34	0.52	0.51	0.78	3.61	\$0.239
2025	0.46	0.70	0.66	1.02	0.83	1.28	0.81	1.24	0.55	0.85	0.46	0.71	0.56	0.86	0.80	1.23	0.32	0.49	0.35	0.53	0.52	0.80	3.70	\$0.245
2026	0.47	0.72	0.68	1.05	0.85	1.31	0.84	1.28	0.57	0.88	0.47	0.72	0.58	0.88	0.82	1.26	0.33	0.50	0.36	0.55	0.54	0.82	3.82	\$0.253
2027	0.49	0.74	0.70	1.08	0.88	1.36	0.86	1.31	0.59	0.90	0.49	0.75	0.60	0.91	0.84	1.29	0.34	0.52	0.37	0.57	0.56	0.85	3.94	\$0.261
2028	0.50	0.76	0.72	1.11	0.91	1.40	0.88	1.35	0.61	0.93	0.50	0.77	0.61	0.93	0.87	1.34	0.35	0.53	0.38	0.58	0.57	0.87	4.04	\$0.268
2029	0.52	0.79	0.74	1.14	0.94	1.45	0.91	1.39	0.62	0.96	0.52	0.80	0.63	0.96	0.90	1.39	0.36	0.55	0.39	0.60	0.59	0.90	4.17	\$0.276
2030	0.53	0.81	0.76	1.17	0.97	1.49	0.94	1.44	0.64	0.99	0.53	0.82	0.65	0.99	0.93	1.43	0.37	0.57	0.40	0.62	0.61	0.93	4.30	\$0.285
2031	0.54	0.83	0.78	1.20	1.00	1.54	0.97	1.48	0.66	1.01	0.55	0.85	0.67	1.02	0.96	1.48	0.38	0.59	0.42	0.64	0.63	0.96	4.44	\$0.294
2032	0.56	0.85	0.80	1.23	1.03	1.59	0.99	1.52	0.68	1.05	0.57	0.88	0.69	1.05	0.99	1.52	0.39	0.60	0.43	0.66	0.65	0.99	4.57	\$0.303
2033	0.58	0.88	0.82	1.26	1.06	1.63	1.03	1.57	0.70	1.07	0.58	0.89	0.71	1.08	1.02	1.57	0.40	0.62	0.44	0.68	0.67	1.02	4.71	\$0.312
2034	0.60	0.91	0.84	1.29	1.09	1.68	1.06	1.62	0.72	1.11	0.60	0.92	0.73	1.11	1.05	1.62	0.41	0.63	0.45	0.70	0.69	1.05	4.85	\$0.321
2035	0.61	0.93	0.87	1.34	1.12	1.72	1.09	1.67	0.74	1.14	0.62	0.95	0.75	1.15	1.08	1.66	0.43	0.66	0.47	0.72	0.71	1.08	4.99	\$0.330
2036	0.62	0.95	0.89	1.37	1.14	1.76	1.11	1.71	0.76	1.17	0.63	0.97	0.77	1.19	1.10	1.69	0.44	0.68	0.48	0.74	0.72	1.11	5.09	\$0.337
2037	0.64	0.99	0.91	1.40	1.16	1.79	1.14	1.76	0.77	1.19	0.65	1.00	0.78	1.20	1.12	1.72	0.45	0.69	0.49	0.75	0.74	1.14	5.20	\$0.344
2038	0.65	1.00	0.93	1.43	1.18	1.82	1.16	1.79	0.79	1.22	0.66	1.02	0.80	1.23	1.14	1.76	0.46	0.71	0.50	0.77	0.76	1.17	5.31	\$0.352
2039	0.66	1.02	0.95	1.46	1.20	1.85	1.18	1.82	0.80	1.23	0.68	1.05	0.82	1.26	1.16	1.79	0.47	0.72	0.51	0.79	0.77	1.19	5.41	\$0.358
2040	0.68	1.05	0.97	1.49	1.23	1.89	1.21	1.86	0.82	1.26	0.69	1.06	0.83	1.28	1.18	1.82	0.48	0.74	0.52	0.80	0.79	1.22	5.52	\$0.366
2041	0.69	1.06	0.99	1.52 1.56	1.26	1.94 1.99	1.23	1.89 1.94	0.84	1.29 1.32	0.70	1.08	0.85	1.31	1.20	1.85	0.49	0.75	0.53	0.82	0.80	1.23	5.62	\$0.372 \$0.381
2042	0.71	1.09	1.01		1.29		1.26		0.86		0.71	1.09	0.87	1.34	1.23	1.89	0.50	0.77	0.54	0.83	0.82	1.26	5.75	
2043 2044	0.72 0.74	1.11 1.14	1.03 1.05	1.59 1.62	1.32 1.35	2.03	1.29 1.31	1.99 2.02	0.87 0.89	1.34 1.37	0.74 0.75	1.14 1.16	0.89 0.90	1.37 1.39	1.26 1.29	1.94 1.99	0.51 0.52	0.79 0.80	0.56 0.57	0.86 0.88	0.84 0.86	1.29 1.32	5.89 6.00	\$0.390 \$0.397
2044	0.74	1.14	1.03	1.65	1.38	2.08	1.34	2.02	0.89	1.40	0.75	1.17	0.90	1.42	1.32	2.03	0.52	0.80	0.58	0.89	0.86	1.34	6.12	\$0.405
2045	0.73	1.19	1.07	1.68	1.41	2.13	1.34	2.06	0.91	1.40	0.76	1.17	0.92	1.42	1.35	2.03	0.53	0.83	0.59	0.89	0.89	1.34	6.25	\$0.403
2046	0.77	1.19	1.11	1.71	1.41	2.17	1.39	2.11	0.95	1.45	0.77	1.19	0.94	1.43	1.38	2.13	0.55	0.85	0.60	0.91	0.89	1.40	6.38	\$0.414
2047	0.80	1.23	1.11	1.74	1.44	2.26	1.42	2.19	0.93	1.49	0.80	1.23	0.98	1.51	1.41	2.17	0.56	0.86	0.62	0.95	0.92	1.42	6.50	\$0.423
2048	0.80	1.25	1.15	1.77	1.50	2.31	1.42	2.23	0.99	1.52	0.82	1.26	1.00	1.54	1.44	2.22	0.57	0.88	0.63	0.97	0.94	1.42	6.64	\$0.440
2050	0.83	1.23	1.17	1.80	1.53	2.36	1.43	2.23	1.00	1.54	0.82	1.29	1.00	1.57	1.44	2.26	0.59	0.88	0.64	0.99	0.96	1.43	6.77	\$0.448
2051	0.85	1.31	1.19	1.83	1.56	2.40	1.51	2.33	1.02	1.57	0.86	1.32	1.04	1.60	1.50	2.31	0.60	0.92	0.65	1.00	0.98	1.51	6.91	\$0.458
2052	0.86	1.32	1.21	1.86	1.59	2.45	1.54	2.37	1.04	1.60	0.87	1.34	1.04	1.63	1.53	2.36	0.61	0.94	0.67	1.03	1.00	1.54	7.04	\$0.466
2053	0.88	1.36	1.23	1.89	1.62	2.49	1.57	2.42	1.04	1.63	0.89	1.37	1.08	1.66	1.56	2.40	0.63	0.97	0.68	1.05	1.02	1.57	7.18	\$0.475
2054	0.90	1.39	1.25	1.93	1.65	2.54	1.60	2.46	1.08	1.66	0.91	1.40	1.10	1.69	1.59	2.45	0.64	0.99	0.69	1.06	1.04	1.60	7.32	\$0.485
2055	0.92	1.42	1.28	1.97	1.68	2.59	1.63	2.51	1.10	1.69	0.93	1.43	1.13	1.74	1.62	2.49	0.65	1.00	0.71	1.09	1.06	1.63	7.47	\$0.495
2056	0.92	1.42	1.31	2.02	1.71	2.63	1.67	2.57	1.13	1.74	0.94	1.45	1.15	1.77	1.65	2.54	0.66	1.02	0.71	1.11	1.08	1.66	7.62	\$0.505
2057	0.95	1.46	1.34	2.06	1.74	2.68	1.70	2.62	1.15	1.77	0.96	1.48	1.17	1.80	1.68	2.59	0.68	1.05	0.72	1.14	1.10	1.69	7.76	\$0.514
2058	0.97	1.49	1.37	2.11	1.77	2.73	1.73	2.66	1.17	1.80	0.99	1.52	1.20	1.85	1.71	2.63	0.69	1.06	0.75	1.16	1.12	1.72	7.92	\$0.525
Average Annu	ıal Percen	t Change	in Toll R	atos																				
2018-2023	3.1	3.3	3.2	3.3	3.3	3.3	3.4	3.2			-11.9	-11.8	3.3	3.3	3.0	3.2	2.9	3.4	3.3	3.1	3.1	3.2	3.2	
2024-2035	2.8	2.9	2.8	2.8	3.0	2.9	3.0	3.1	2.9	2.9	3.0	2.9	3.0	3.0	3.0	3.0	3.0	3.1	3.0	3.0	3.1	3.0	3.0	
2035-2045	2.1	2.2	2.1	2.1	2.1	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.0	2.0	2.1	2.2	2.1	2.1	2.1	2.2	2.1	
2045-2057	2.0	1.9	1.9	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.1	2.0	2.1	2.1	2.0	2.0	2.1	2.0	2.0	2.1	2.0	1.9	2.0	
2018-2058	2.4	2.5	1.3	1.3	1.4	1.4	2.5	2.5			0.5	0.5	2.5	2.5	1.3	1.3	2.5	2.5	2.5	2.5	2.5	2.5	2.6	

<sup>(1)</sup> Annual toll rate increases are assumed to be implemented on January 1st of each year.

<sup>(2)</sup> Assumes new Morrisville Interchange and associated new mainline toll zone north of Morrisville Road open on January 1, 2020.

<sup>(3)</sup> Assumes Ramp tolls to/from the north at Hopson Road and U.S 64 are removed, and replaced by new mainline on January 1, 2024.

<sup>(4) &</sup>quot;Thru Trip" toll rates , and distances, shown in this table exclude the Toll NC 147 portion of Triangle Expressway.

Table 6.6 Through-Trip Toll Rates By Toll Class - Triangle Expressway												
Calendar	Toll	Through-Trip Toll Per-MileToll Ra										
Year	Class	ETC	BBM	ETC	BBM							
2020	Class 1	\$ 3.10	\$ 4.74	\$ 0.21	\$ 0.31							
	Class 2	6.20	9.48	0.41	0.63							
	Class 3	12.40	18.96	0.82	1.26							
2025	Class 1	\$ 3.70	\$ 5.69	\$ 0.25	\$ 0.38							
	Class 2	7.40	11.38	0.49	0.75							
	Class 3	14.80	22.76	0.98	1.51							
2035	Class 1	\$ 4.99	\$ 7.65	\$ 0.33	\$ 0.51							
	Class 2	9.98	15.30	0.66	1.01							
	Class 3	19.96	30.60	1.32	2.03							
2045	Class 1	\$ 6.12	\$ 9.42	\$ 0.41	\$ 0.62							
	Class 2	12.24	18.84	0.81	1.25							
	Class 3	24.48	37.68	1.62	2.50							

Table 6.7 Model Inputs (VOT, VOC and CPI)													
	2016	2020	2025	2035	2045								
Value Of Time (\$/minute)													
Non-Airport													
Commute	\$0.289	\$0.319	\$0.357	\$0.442	\$0.550								
Work-Based Other	0.373	0.411	0.460	0.570	0.708								
Other	0.267	0.295	0.330	0.409	0.510								
Airport													
Commute	\$0.321	\$0.355	\$0.396	\$0.491	\$0.611								
Work-Based Other	0.310	0.341	0.382	0.473	0.588								
Other	0.313	0.346	0.386	0.479	0.596								
Vehicle Operating Cost (\$/mile)													
Toll Class 1	\$0.163	\$0.211	\$0.220	\$0.257	\$0.318								
Toll Class 2 & 3	0.326	0.422	0.440	0.514	0.636								
		2016-	2020-	2025-	2035-								
Annual Inflation (1)		2020	2025	2035	2045								
	·	2.25%	2.24%	2.13%	2.18%								
(1) Moody's Analytics Raleigh M	SA Forec	ast											

Values in Table 6.7 reflect regionwide average-weighted VOT, by primary categories of trip purpose, and further segregated by non-airport and airport-related trips. The VOT was developed at 2016 levels and used in the model calibration. Values shown for subsequent years were adjusted in proportion to inflation assumptions, also shown in the table.

It is important to recognize that the VOT information in Table 6.7 reflects weighted regionwide averages. As part of the study, a relationship was established between VOT and estimated household income by Traffic Analysis Zone (TAZ). Hence, VOT in individual traffic zones also varied from the averages shown based on median household income in each traffic zone. The mean household income forecasts included a component for real income growth by TAZ.

Vehicle operating costs (VOC) are shown in dollars per mile. Estimates were derived for toll Class 1 (two-axle vehicles), and for a combined Class 2 and 3 representing vehicles with three or more axles. As might be expected, vehicle operating costs are considerable higher for larger vehicles, primarily due to lower fuel efficiency. The operating costs were based on fuel forecasts for gasoline and diesel, fuel efficiency standards, and inflation.

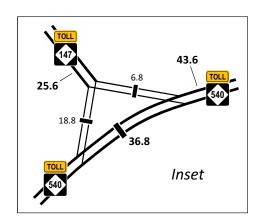
Finally, the bottom of Table 6.7 shows assumptions regarding annual inflation rates in the Raleigh Metropolitan Statistical Area (MSA). From 2016 to 2020, inflation is estimated at 2.25 percent per year, and slightly lower from 2020 to 2025. Forecast CPI averages 2.13 percent per year from 2025 to 2035, and 2.18 percent per from 2035 to 2045. The CPI forecasts were obtained from Moody's Analytics. VOT and VOC projections were increased to reflect changes in CPI. Toll rates on the Triangle Expressway are increased annually through 2035 by a previously adopted toll schedule. Annual rate increases beginning in 2036 are indexed to the forecast CPI. After 2045, toll rates increase by an assumed 2.0 percent per year.

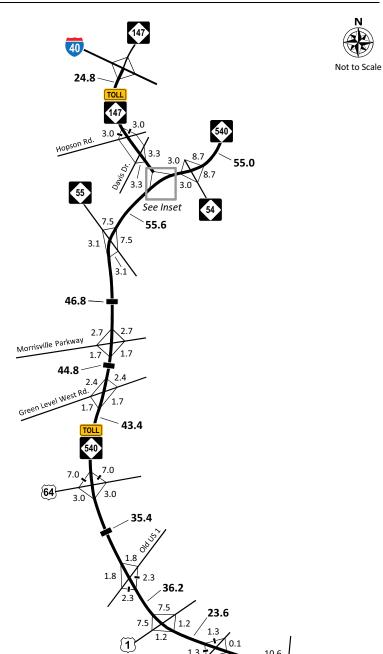
## 6.7 Estimated 2020 Weekday Traffic and Revenue

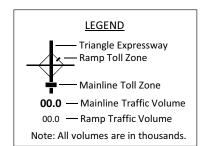
Estimated weekday traffic on Triangle Expressway at 2020 levels is shown in Figure 6.6. The larger bold numbers reflect two-directional traffic on each mainline section. The smaller numbers at each interchange reflect balanced ramp volumes. All values are shown in thousands, and all reflect average weekday conditions. Average daily traffic would be lower than the volumes shown in Figure 6.6, given that weekend day traffic is considerably lower than weekday traffic on the Triangle Expressway.

As discussed previously, by 2020 the Morrisville Parkway interchange is assumed to be in operation. A new mainline tolling zone located just north of Morrisville Parkway will also be in place, but ramp tolls at US 64 and Hopson Road would remain in operation. Weekday traffic is estimated to peak just north of the NC 55 interchange, estimated at 55,600. Of this, about 18,800 vehicles would use Toll NC 147 and the remaining 36,800 would continue on Toll NC 540 to NC 54 and beyond. Weekday mainline traffic on most of the Triangle Expressway would average between 35,000 and 55,000, as far south as US 1. South of that point, volumes drop off considerably, with weekday traffic estimated at 21,200 at the southern end of the project near the NC 55 Bypass.

Gross weekday toll revenue in 2020 is calculated in Table 6.8, based on the weekday traffic volumes shown in Figure 6.6, by toll zone, method-of-payment and toll class. The calculated toll revenue is prior to any adjustment for leakage or fee revenue. Traffic volumes in Table 6.8 may not exactly match traffic volumes in Figure 6.6 due to rounding.









ESTIMATED WEEKDAY TRAFFIC TRIANGLE EXPRESSWAY - 2020

21.2 10.6

Table 6.8
Estimated 2020 Weekday Transactions and Revenue by Toll Zone
Triangle Expressway - Base Case

		Class 1 Vehicles Class 2 and 3 Vehicles																	Total Avg. Toll	
	Toll Zone		ETC	Class I	venicles	BBM			ETC	Class Z allu	3 Venici	BBM		Total Wee	kdav Tran	sactions	Total W	eekdav Re	venue	Per
ID	Location	Trans.	Toll	Revenue	Trans.	Toll	Revenue	Trans.	Toll	Revenue	Trans.	Toll	Revenue	ETC BBM Total			ETC	ввм	Total	Transaction
Triangle	Expressway																			
01/02	Ramps North at Hopson Rd.	3,870	\$0.39	\$1,509	1,982	\$0.60	\$1,189	54	\$1.33	\$72	47	\$1.96	\$92	3,924	2,029	5,953	\$1,581	\$1,281	\$2,862	\$0.481
05/06	SR 147/SR 540 Jct. NW Connection	12,239	\$1.08	\$13,218	5,669	\$1.66	\$9,411	441	\$3.59	\$1,582	368	\$5.78	\$2,126	12,680	6,037	18,717	\$14,800	\$11,537	\$26,337	\$1.407
09/10	SR 147/SR 540 Jct. NE Connection	3,989	\$0.87	\$3,470	2,602	\$1.33	\$3,461	95	\$3.05	\$290	93	\$4.27	\$395	4,084	2,695	6,779	\$3,760	\$3,856	\$7,616	\$1.124
13/14	SR 147/SR 540 Jct. 540 Thru Mvt.	23,318	\$0.70	\$16,322	12,054	\$1.07	\$12,898	743	\$2.28	\$1,694	615	\$3.52	\$2,166	24,061	12,669	36,730	\$18,017	\$15,064	\$33,081	\$0.901
15/16	Mainline N of Morrisville Pky	30,715	\$0.48	\$14,743	14,082	\$0.73	\$10,280	1,155	\$1.62	\$1,872	790	\$2.42	\$1,911	31,871	14,872	46,742	\$16,615	\$12,191	\$28,806	\$0.616
17/18	Mainline N. of Green Level Rd	28,333	\$0.39	\$11,050	14,428	\$0.60	\$8,657	1,132	\$1.31	\$1,482	895	\$1.99	\$1,781	29,465	15,323	44,788	\$12,532	\$10,438	\$22,970	\$0.513
21/22	Ramps North at U.S. 64	9,147	\$0.48	\$4,391	4,327	\$0.73	\$3,159	289	\$1.68	\$486	281	\$2.41	\$678	9,436	4,608	14,045	\$4,876	\$3,837	\$8,713	\$0.620
25/26	Mainline S of US 64	21,872	\$1.08	\$23,622	11,692	\$1.65	\$19,292	982	\$3.66	\$3,595	777	\$5.65	\$4,392	22,854	12,469	35,324	\$27,216	\$23,684	\$50,900	\$1.441
29/30	Ramps South at S. Salem St.	3,205	\$0.28	\$897	1,295	\$0.42	\$544	69	\$0.96	\$66	29	\$1.37	\$40	3,273	1,324	4,597	\$963	\$584	\$1,547	\$0.336
31/32	Ramps North at Veridea Pky	1,762	\$0.30	\$529	867	\$0.46	\$399	37	\$1.03	\$38	26	\$1.50	\$39	1,799	893	2,692	\$567	\$438	\$1,005	\$0.373
33/34	Mainline N of SR 55 Bypass	13,908	\$0.45	\$6,259	6,449	\$0.69	\$4,450	503	\$1.49	\$750	339	\$2.27	\$770	14,411	6,788	21,200	\$7,008	\$5,220	\$12,228	\$0.577
Weekda	ny Total Triangle Expressway	152,358		\$96,010	75,447		\$73,738	5,499		\$11,926	4,261		\$14,391	157,858	79,707	237,565	\$107,936	\$88,129	\$196,065	\$0.825
	Total Triangle Expressway (000) mes Annualization Factor of 305 Days	46,469		\$29,283	23,011		\$22,490	1,677		\$3,637	1,300		\$4,389	48,147	24,311	72,457	\$32,921	\$26,879	\$59,800	

Note: Transaction figures at each toll point may not match estimates shown in Figure 6.6 due to rounding in that figure.

The right portion of the Table 6.8 summarizes average weekday transactions and revenue by ETC and BBM. The average weighted toll is provided by toll location. It is influenced by the mix of vehicle classes and the distribution of payment modes.

In total, it is estimated that there will be a total of 237,565 transactions on Triangle Expressway on an average weekday in 2020, producing an average weekday revenue estimated at \$196,065. This revenue reflects gross or "expected" revenue and has not yet been adjusted to reflect leakage or other uncollectable revenue, particularly from BBM customers.

The bottom row of Table 6.8 converts the estimated weekday values at 2020 levels to estimated annual transaction and revenues. In this case, the figures shown are rounded to thousands. Hence, total annual transactions are estimated at 72.4 million. Of these, an estimated 48.1 million would be ETC and 24.3 million would be BBM. Annual gross revenue is estimated at \$59.8 million. In moving from average weekday to average day an effective annualization factor of 305 days has been used. This annualization factor reflects the relationship between weekday and weekend day transactions and revenue. Since weekend day transactions and revenue are considerably lower than weekdays, the annualization factor, as applied to average weekday conditions, is less than the 365 days per year.

## 6.8 Estimated 2025 Weekday Traffic and Revenue

**Figure 6.7** shows estimated weekday traffic on the Triangle Expressway at 2025 levels. These estimated traffic volumes include the impacts associated with the planned relocation of the ramp toll zones at the Hopson Road and US 64 interchanges to the mainline sections north of each interchange. The traffic volumes also reflect the toll schedule adjustments required to maintain the Triangle Expressway's per-mile rate structure. Weekday traffic at the south end of the project is estimated at 23,600, increasing to a peak of 58,800 north of NC 55. Weekday traffic volumes on the US 64 interchange ramps to and from the south are projected to decrease between 2020 and 2025. A similar decrease is projected for the US 1 interchange ramps to and from the north over the same 5-year period. These changes are the result of minor changes in travel patterns on the southern portion of the Triangle Expressway due primarily to roadway widening on nearby NC 55, US 64 and Ten Ten Road, among others.

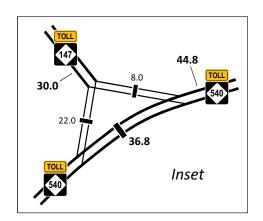
**Table 6.9** shows the calculation of estimated 2025 weekday transactions and gross toll revenue by toll zone. Again, both transactions and revenue are broken out by payment category and overall vehicle class. Weekday revenue is estimated at \$243,760, resulting in estimated annual gross toll revenue of \$74.3 million. Of this, about \$43.3 million would be attributed to ETC transactions, while the remaining \$31.0 million would come from BBM collections. Systemwide, the overall average toll per transaction would be about \$0.78, reflecting the overall mix of toll rates by location, payment type and vehicle class.

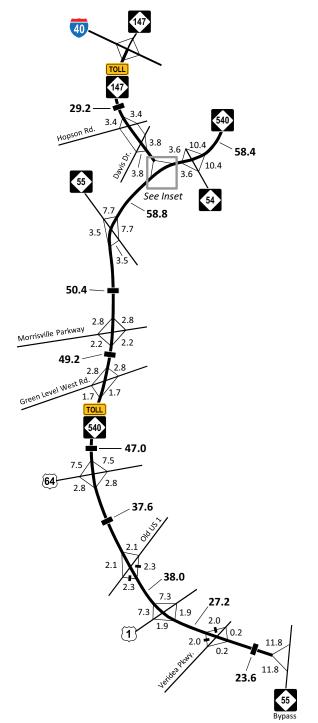
## 6.9 Estimated 2035 Weekday Traffic and Revenue

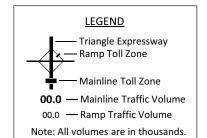
**Figure 6.8** shows estimated weekday traffic on the Triangle Expressway in 2035. Traffic is expected to reach a peak of 66,600 vehicles just north of NC 55. Of this, about 25,000 vehicles would use Toll NC 147, while about 41,600 vehicles per weekday would continue on Toll NC 540 to NC 54 and beyond.



Not to Scale









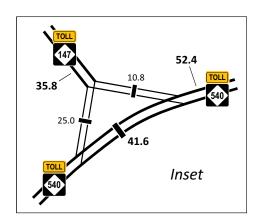
ESTIMATED WEEKDAY TRAFFIC TRIANGLE EXPRESSWAY - 2025

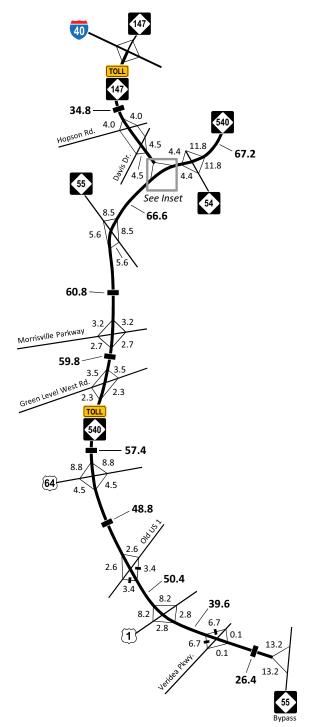
Table 6.9
Estimated 2025 Weekday Transactions and Revenue by Toll Zone
Triangle Expressway - Base Case

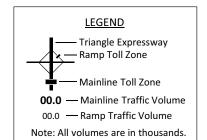
		Class 1 Vehicles Class 2 and 3 Vehicles																Total Avg. Toll		
	ETC Class 1 v			venicles	BBM		-	ETC		3 Venicie	BBM		Total Weekday Transactions			Total W	eekdav Re	venue	Per	
ID	Location	Trans.	Toll	Revenue	Trans.	Toll	Revenue	Trans.	Toll	Revenue	Trans.	Toll	Revenue	ETC	ВВМ	Total	ETC	ВВМ	Total	Transaction
Triangle	e Expressway																			
01/02	Ramps North at Hopson Rd.	19,856	\$0.46	\$9,134	8,224	\$0.70	\$5,757	699	\$1.57	\$1,098	482	\$2.29	\$1,103	20,556	8,706	29,262	\$10,232	\$6,860	\$17,092	\$0.584
05/06	SR 147/SR 540 Jct. NW Connection	15,152	\$0.83	\$12,577	5,950	\$1.28	\$7,616	544	\$2.76	\$1,502	431	\$4.46	\$1,920	15,697	6,381	22,077	\$14,079	\$9,536	\$23,615	\$1.070
09/10	SR 147/SR 540 Jct. NE Connection	4,980	\$0.66	\$3,287	2,757	\$1.02	\$2,813	188	\$2.31	\$434	160	\$3.27	\$524	5,168	2,918	8,086	\$3,721	\$3,336	\$7,057	\$0.873
13/14	SR 147/SR 540 Jct. 540 Thru Mvt.	24,057	\$0.81	\$19,486	11,275	\$1.24	\$13,981	780	\$2.63	\$2,051	635	\$4.08	\$2,590	24,836	11,910	36,746	\$21,536	\$16,571	\$38,107	\$1.037
15/16	Mainline N of Morrisville Pky	34,312	\$0.55	\$18,872	13,886	\$0.85	\$11,803	1,289	\$1.85	\$2,385	869	\$2.82	\$2,449	35,601	14,754	50,355	\$21,256	\$14,252	\$35,509	\$0.705
17/18	Mainline N. of Green Level Rd	32,585	\$0.46	\$14,989	14,383	\$0.71	\$10,212	1,270	\$1.55	\$1,969	974	\$2.36	\$2,298	33,856	15,357	49,213	\$16,958	\$12,510	\$29,469	\$0.599
21/22	Ramps North at U.S. 64	31,926	\$0.56	\$17,878	12,975	\$0.86	\$11,158	1,278	\$1.96	\$2,505	904	\$2.84	\$2,568	33,204	13,879	47,083	\$20,384	\$13,726	\$34,110	\$0.724
25/26	Mainline S of US 64	24,307	\$0.80	\$19,446	11,379	\$1.23	\$13,996	1,055	\$2.71	\$2,859	818	\$4.21	\$3,445	25,362	12,197	37,559	\$22,305	\$17,441	\$39,746	\$1.058
29/30	Ramps South at S. Salem St.	3,263	\$0.32	\$1,044	1,184	\$0.49	\$580	86	\$1.10	\$95	39	\$1.59	\$63	3,349	1,223	4,572	\$1,139	\$643	\$1,782	\$0.390
31/32	Ramps North at Veridea Pky	2,629	\$0.35	\$920	1,174	\$0.53	\$622	68	\$1.20	\$82	48	\$1.72	\$83	2,697	1,222	3,919	\$1,002	\$705	\$1,708	\$0.436
33/34	Mainline N of SR 55 Bypass	16,028	\$0.52	\$8,334	6,594	\$0.80	\$5,275	554	\$1.72	\$953	380	\$2.64	\$1,004	16,581	6,974	23,556	\$9,287	\$6,280	\$15,567	\$0.661
Weekday Total Triangle Expressway		209,094		\$125,966	89,780		\$83,813	7,813		\$15,933	5,740		\$18,048	216,907	95,521	312,428	\$141,899	\$101,860	\$243,760	\$0.780
	Total Triangle Expressway (000) umes Annualization Factor of 305 Days	63,774		\$38,420	27,383		\$25,563	2,383		\$4,860	1,751		\$5,504	66,157	29,134	95,290	\$43,279	\$31,067	\$74,347	

Note: Transaction figures at each toll point may not match estimates shown in Figure 6.7 due to rounding in that figure.

Not to Scale









**ESTIMATED WEEKDAY TRAFFIC TRIANGLE EXPRESSWAY - 2035** 

Toll revenue calculations for 2035 are shown in **Table 6.10**. In 2035, average weekday gross revenue from ETC is estimated at \$255,369 per day. This compares with \$130,860 per day from BBM, resulting in total revenue of about \$386,229 per weekday. The weekday traffic and revenue was annualized, using the 305-day annualization factor to produce estimated annual revenue of almost \$118 million. Of this, about \$78 million would come from electronic toll collection while about \$40 million would come from BBM.

## 6.10 Estimated 2045 Weekday Traffic and Revenue

Finally, **Figure 6.9** presents estimated weekday traffic for Triangle Expressway in year 2045. Estimated weekday traffic would increase from 36,000 at the south end of the project to 70,400 per weekday north of US 64, to 80,400 north of NC 54.

**Table 6.11** provides estimated 2045 weekday transactions and gross toll revenue by toll zone. It is estimated that an average of almost 475,000 transactions will be recorded systemwide, each weekday, yielding more than \$567,000. This results in an overall average toll per transaction, systemwide, of \$1.20.

On an annual basis, almost 145 million annual transactions can be expected by 2045, of which 116 million would be ETC and about 28 million would be BBM. Total annual expected revenue, before leakage adjustment, is estimated at more than \$173 million for Triangle Expressway.

### 6.11 Estimated Annual Transactions and Revenue

The individual transaction and revenue estimates calculated at 2020, 2025, 2035 and 2045 levels, based on travel demand model assignments, were used to develop annual transaction and revenue forecasts over a 40-year projection period. As noted previously, estimates for 2018 and 2019 were based on a review of recent historical trends through mid-2018. Forecasts for 2020 were developed using model output and recent historical trends. Intermediate years were developed by interpolating between model years 2020 and 2025, 2025 and 2035, and 2035 and 2045. After the last model year of 2045, traffic growth was assumed to occur at a nominal 0.6 percent per year.

Base Case estimated annual transactions and toll revenue for the Triangle Expressway are shown in **Table 6.12** from FY 2019 through 20258. The toll revenue in Table 6.12 represents expected toll based on forecast traffic volumes and does not include adjustments for leakage associated with BBM, or anticipated fee revenue.

Annual transactions are expected to increase from 54.2 million in FY 2019 to 94.1 million in FY 2025, an average annual increase of 9.6 percent per year. However, a significant part of this transaction growth results from the new Morrisville Parkway interchange and its associated mainline toll zones that open in January 2020, and the relocation of the ramp toll zones at the Hopson Road and U.S. 64 interchanges to mainline toll zones in January 2024.

Toll revenue from FY 2019 to 2025 is projected to increase by 5.5 percent per year, increasing from \$52.8 million in FY 2019 to \$72.9 million in FY 2025. During this period, programmed annual toll rate increases will occur, but the average toll per transaction will decrease associated with the increased transactions due to toll zone relocations and the lower toll rates on mainline sections.

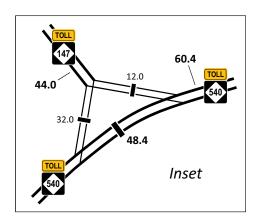
After 2025, transaction and toll revenue growth are not impacted by any additional interchanges or toll zone relocations on the Triangle Expressway. Annual transactions are expected to increase from

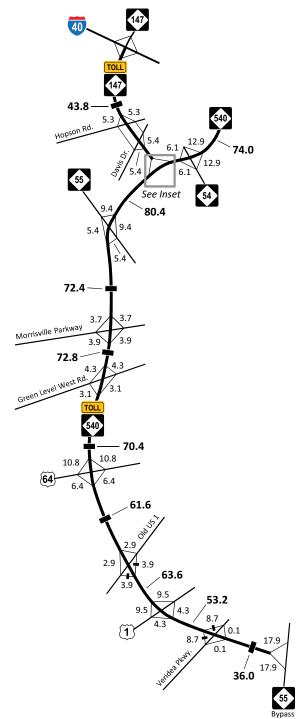
Table 6.10
Estimated 2035 Weekday Transactions and Revenue by Toll Zone
Triangle Expressway - Base Case

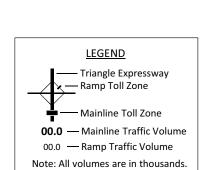
		Class 1 Vehicles Class 2 and 3 Vehicles															Total Avg. Toll		
Toll Zone	ETC Class 1 Venicles			refficies	BBM			ETC		BBM		Total Weekday Transactions			Total W	eekday Re	venue	Per	
ID Location	Trans.	Toll	Revenue	Trans.	Toll	Revenue	Trans.	Toll	Revenue	Trans.	Toll	Revenue	ETC	ввм	Total	ETC	ВВМ	Total	Transaction
<u>Triangle Expressway</u>																			
01/02 Ramps North at Hopson Rd.	25,493	\$0.61	\$15,551	7,801	\$0.93	\$7,255	1,025	\$2.08	\$2,132	429	\$3.04	\$1,304	26,518	8,230	34,748	\$17,683	\$8,559	\$26,242	\$0.755
05/06 SR 147/SR 540 Jct. NW Connection	18,915	\$1.12	\$21,185	5,017	\$1.72	\$8,629	709	\$3.72	\$2,636	355	\$5.99	\$2,129	19,624	5,372	24,996	\$23,821	\$10,758	\$34,580	\$1.383
09/10 SR 147/SR 540 Jct. NE Connection	7,651	\$0.87	\$6,657	2,786	\$1.34	\$3,733	322	\$3.05	\$982	127	\$4.30	\$547	7,973	2,913	10,886	\$7,638	\$4,279	\$11,918	\$1.095
13/14 SR 147/SR 540 Jct. 540 Thru Mvt.	29,405	\$1.09	\$32,051	10,493	\$1.67	\$17,524	1,057	\$3.54	\$3,741	598	\$5.49	\$3,283	30,462	11,091	41,553	\$35,792	\$20,807	\$56,599	\$1.362
15/16 Mainline N of Morrisville Pky	44,839	\$0.74	\$33,181	13,342	\$1.14	\$15,209	1,756	\$2.49	\$4,374	801	\$3.79	\$3,036	46,595	14,143	60,738	\$37,554	\$18,246	\$55,800	\$0.919
17/18 Mainline N. of Green Level Rd	43,444	\$0.62	\$26,935	13,789	\$0.95	\$13,100	1,753	\$2.09	\$3,663	880	\$3.15	\$2,771	45,197	14,669	59,866	\$30,599	\$15,871	\$46,470	\$0.776
21/22 Ramps North at U.S. 64	42,311	\$0.75	\$31,733	12,532	\$1.15	\$14,412	1,743	\$2.63	\$4,584	817	\$3.80	\$3,105	44,054	13,350	57,404	\$36,318	\$17,518	\$53,835	\$0.938
25/26 Mainline S of US 64	34,910	\$1.08	\$37,702	11,655	\$1.66	\$19,346	1,445	\$3.66	\$5,289	779	\$5.68	\$4,423	36,355	12,433	48,788	\$42,992	\$23,769	\$66,761	\$1.368
29/30 Ramps South at S. Salem St.	5,121	\$0.43	\$2,202	1,489	\$0.66	\$983	140	\$1.47	\$205	34	\$2.15	\$73	5,261	1,523	6,784	\$2,407	\$1,056	\$3,463	\$0.510
31/32 Ramps North at Veridea Pky	9,802	\$0.47	\$4,607	3,266	\$0.72	\$2,351	217	\$1.61	\$350	104	\$2.34	\$243	10,019	3,370	13,389	\$4,957	\$2,595	\$7,551	\$0.564
33/34 Mainline N of SR 55 Bypass	19,746	\$0.71	\$14,020	5,727	\$1.08	\$6,185	676	\$2.35	\$1,589	342	\$3.56	\$1,218	20,422	6,069	26,492	\$15,608	\$7,404	\$23,012	\$0.869
Weekday Total Triangle Expressway	281,637		\$225,824	87,896		\$108,727	10,843		\$29,545	5,266		\$22,133	292,479	93,162	385,642	\$255,369	\$130,860	\$386,229	\$1.002
Annual Total Triangle Expressway (000) Assumes Annualization Factor of 305 Days	85,899		\$68,876	26,808		\$33,162	3,307		\$9,011	1,606		\$6,751	89,206	28,415	117,621	\$77,888	\$39,912	\$117,800	

Note: Transaction figures at each toll point may not match estimates shown in Figure 6.8 due to rounding in that figure.

Not to Scale









**ESTIMATED WEEKDAY TRAFFIC TRIANGLE EXPRESSWAY - 2045** 

Table 6.11
Estimated 2045 Weekday Transactions and Revenue by Toll Zone
Triangle Expressway - Base Case

		Class 1 Vehicles Class 2 and 3 Vehicles																	Total Avg. Toll	
	ETC			remeies	BBM		ETC		BBM		Total Weekday Transactions			Total Weekday Revenue			Per			
ID	Location	Trans.	Toll	Revenue	Trans.	Toll	Revenue	Trans.	Toll	Revenue	Trans.	Toll	Revenue	ETC	BBM	Total	ETC	BBM	Total	Transaction
Triangle	Expressway																			
01/02	Ramps North at Hopson Rd.	33,904	\$0.75	\$25,428	8,061	\$1.16	\$9,350	1,452	\$2.55	\$3,703	373	\$3.80	\$1,418	35,356	8,434	43,790	\$29,131	\$10,768	\$39,899	\$0.911
05/06	SR 147/SR 540 Jct. NW Connection	25,551	\$1.38	\$35,260	5,035	\$2.13	\$10,724	1,023	\$4.59	\$4,696	328	\$7.41	\$2,434	26,574	5,363	31,937	\$39,956	\$13,158	\$53,114	\$1.663
09/10	SR 147/SR 540 Jct. NE Connection	9,037	\$1.07	\$9,670	2,480	\$1.65	\$4,092	400	\$3.75	\$1,502	70	\$5.30	\$371	9,438	2,550	11,988	\$11,172	\$4,463	\$15,635	\$1.304
13/14	SR 147/SR 540 Jct. 540 Thru Mvt.	36,230	\$1.34	\$48,549	10,420	\$2.06	\$21,466	1,318	\$4.36	\$5,749	525	\$6.77	\$3,551	37,549	10,945	48,494	\$54,297	\$25,017	\$79,314	\$1.636
15/16	Mainline N of Morrisville Pky	56,448	\$0.91	\$51,367	13,072	\$1.40	\$18,301	2,248	\$3.06	\$6,880	686	\$4.65	\$3,188	58,696	13,758	72,454	\$58,247	\$21,489	\$79,737	\$1.101
17/18	Mainline N. of Green Level Rd	56,024	\$0.76	\$42,578	13,691	\$1.17	\$16,018	2,264	\$2.56	\$5,795	752	\$3.89	\$2,925	58,287	14,443	72,730	\$48,373	\$18,943	\$67,316	\$0.926
21/22	Ramps North at U.S. 64	54,854	\$0.92	\$50,466	12,661	\$1.42	\$17,979	2,232	\$3.22	\$7,188	691	\$4.69	\$3,243	57,086	13,353	70,439	\$57,654	\$21,222	\$78,876	\$1.120
25/26	Mainline S of US 64	46,955	\$1.32	\$61,981	12,095	\$2.03	\$24,552	1,863	\$4.48	\$8,345	696	\$6.95	\$4,839	48,818	12,791	61,609	\$70,326	\$29,391	\$99,717	\$1.619
29/30	Ramps South at S. Salem St.	6,186	\$0.53	\$3,278	1,396	\$0.82	\$1,145	173	\$1.81	\$313	13	\$2.67	\$36	6,359	1,410	7,768	\$3,591	\$1,180	\$4,772	\$0.614
31/32	Ramps North at Veridea Pky	13,462	\$0.58	\$7,808	3,513	\$0.89	\$3,126	295	\$1.99	\$587	92	\$2.89	\$267	13,756	3,605	17,361	\$8,394	\$3,393	\$11,787	\$0.679
33/34	Mainline N of SR 55 Bypass	28,339	\$0.87	\$24,655	6,426	\$1.34	\$8,611	851	\$2.88	\$2,450	308	\$4.42	\$1,363	29,190	6,735	35,924	\$27,105	\$9,975	\$37,079	\$1.032
Weekda	y Total Triangle Expressway	366,989		\$361,040	88,850		\$135,365	14,120		\$47,207	4,536		\$23,635	381,109	93,386	474,495	\$408,247	\$159,000	\$567,247	\$1.195
	Total Triangle Expressway (000) mes Annualization Factor of 305 Days	111,932		\$110,117	27,099		\$41,286	4,306		\$14,398	1,383		\$7,209	116,238	28,483	144,721	\$124,515	\$48,495	\$173,010	

Note: Transaction figures at each toll point may not match estimates shown in Figure 6.9 due to rounding in that figure.

Table 6.12 Estimated Annual Transactions and Toll Revenue Triangle Expressway - Base Case

Fiscal	cal Annual Transactions (000)				Expected	Annual Toll	00) (1)	Average Toll Per Transaction				
Year	ETC	BBM	Total	% ETC	ETC	ВВМ	Total	% ETC	ETC	BBM	Overall	
2019	35,142	19,024	54,166	64.9	\$28,238	\$24,580	\$52,818	53.5	\$0.804	\$1.292	\$0.975	
2020 (2,3)	41,835	21,564	63,399	66.0	31,243	26,056	57,299	54.5	0.747	1.208	0.904	
2021 (3)	48,219	24,018	72,237	66.8	33,832	27,286	61,118	55.4	0.702	1.136	0.846	
2022 (3)	49,742	24,114	73,856	67.4	35,783	28,129	63,912	56.0	0.719	1.167	0.865	
2023 (3)	51,170	24,135	75,304	68.0	37,726	28,882	66,608	56.6	0.737	1.197	0.885	
2024 (3,4)	57,985	26,582	84,567	68.6	39,915	29,737	69,652	57.3	0.688	1.119	0.824	
2025 (3)	65,067	29,057	94,123	69.1	42,208	30,644	72,852	57.9	0.649	1.055	0.774	
2026 (3)	67,050	29,078	96,128	69.8	44,591	31,433	76,024	58.7	0.665	1.081	0.791	
2027 (3)	69,113	29,068	98,181	70.4	47,357	32,230	79,586	59.5	0.685	1.109	0.811	
2028	71,195	29,030	100,224	71.0	50,182	33,091	83,273	60.3	0.705	1.140	0.831	
2029	73,327	28,974	102,301	71.7	53,165	34,035	87,200	61.0	0.725	1.175	0.852	
2030	75,533	28,910	104,443	72.3	56,418	34,995	91,412	61.7	0.747	1.210	0.875	
2031	77,817	28,838	106,655	73.0	59,860	35,890	95,750	62.5	0.769	1.245	0.898	
2032	80,186	28,758	108,944	73.6	63,525	36,801	100,326	63.3	0.792	1.280	0.921	
2033	82,644	28,669	111,313	74.2	67,368	37,659	105,026	64.1	0.815	1.314	0.944	
2034	85,196	28,573	113,769	74.9	71,432	38,543	109,975	65.0	0.838	1.349	0.967	
2035	87,852	28,469	116,320	75.5	75,704	39,473	115,177	65.7	0.862	1.387	0.990	
2036	90,406	28,442	118,848	76.1	79,749	40,412	120,161	66.4	0.882	1.421	1.011	
2037	92,836	28,493	121,329	76.5	83,595	41,360	124,955	66.9	0.900	1.452	1.030	
2038	95,330	28,533	123,864	77.0	87,620	42,249	129,868	67.5	0.919	1.481	1.048	
2039	97,890	28,564	126,454	77.4	91,739	43,072	134,811	68.1	0.937	1.508	1.066	
2040	100,517	28,584	129,101	77.9	96,080	43,854	139,934	68.7	0.956	1.534	1.084	
2041	103,213	28,593	131,806	78.3	100,625	44,631	145,256	69.3	0.975	1.561	1.102	
2042	105,980	28,590	134,570	78.8	105,504	45,463	150,967	69.9	0.996	1.590	1.122	
2043	108,819	28,575	137,394	79.2	110,852	46,437	157,288	70.5	1.019	1.625	1.145	
2044	111,734	28,547	140,281	79.6	116,256	47,366	163,622	71.1	1.040	1.659	1.166	
2045	114,724	28,506	143,230	80.1	121,711	48,135	169,846	71.7	1.061	1.689	1.186	
2046	116,543	28,539	145,083	80.3	126,186	49,100	175,286	72.0	1.083	1.720	1.208	
2047	117,155	28,653	145,808	80.3	129,525	50,280	179,806	72.0	1.106	1.755	1.233	
2048	117,770	28,767	146,537	80.4	132,868	51,416	184,284	72.1	1.128	1.787	1.258	
2049	118,389	28,881	147,270	80.4	136,305	52,594	188,899	72.2	1.151	1.821	1.283	
2050	119,010	28,996	148,006	80.4	139,823	53,826	193,649	72.2	1.175	1.856	1.308	
2051	119,635	29,111	148,746	80.4	143,434	55,080	198,514	72.3	1.199	1.892	1.335	
2052	120,263	29,227	149,490	80.4	147,026	56,320	203,346	72.3	1.223	1.927	1.360	
2053	120,894	29,343	150,237	80.5	150,670	57,568	208,238	72.4	1.246	1.962	1.386	
2054	121,529	29,459	150,989	80.5	154,479	58,870	213,349	72.4	1.271	1.998	1.413	
2055	122,167	29,576	151,743	80.5	158,454	60,225	218,680	72.5	1.297	2.036	1.441	
2056	122,808	29,694	152,502	80.5	162,495	61,622	224,117	72.5	1.323	2.075	1.470	
2057	123,453	29,812	153,265	80.5	166,489	63,006	229,495	72.5	1.349	2.113	1.497	
2058	124,101	29,930	154,031	80.6	170,725	64,421	235,147	72.6	1.376	2.152	1.527	
Average Annu	ual Percent Ch	ange										
2019-25	10.8%	7.3%	9.6%		6.9%	3.7%	5.5%		-3.5%	-3.3%	-3.8%	
2025-35	3.0%	-0.2%	2.1%		6.0%	2.6%	4.7%		2.9%	2.8%	2.5%	
2035-45	2.7%	0.0%	2.1%		4.9%	2.0%	4.0%		2.1%	2.0%	1.8%	
2045-55	0.6%	0.4%	0.6%		2.7%	2.3%	2.6%		2.0%	1.9%	2.0%	
2025-55	2.1%	0.1%	1.6%		4.5%	2.3%	3.7%		2.3%	2.2%	2.1%	

<sup>(1)</sup> Toll rvenue estimates are not adjusted for leakeage or fee revenue associated with BBM.

<sup>(4)</sup> Assumes ramp tolls at US 64 and Hopson Road on the Triangle Expressway are removed, and replaced by new mainline toll points north of each interchange, on January 1, 2024.



<sup>(2)</sup> Assumes the new Morrisville Parkway interchange and its new mainline toll zone are operational on January 1, 2010.

<sup>(3)</sup> Ramp up is applied to the first 36-month period of transaction and revenue impacts associated with new toll zones.

about 94.1 million in FY 2025 to 116.3 million in FY 2035, an average annual increase of 2.1 percent per year. Revenue in that same period is expected to increase by about 4.7 percent per year, resulting from increased transactions and annual toll rate increases. The average toll per transaction will have increased by 2.5 percent per year. ETC average toll rates will increase by 2.9 percent per year, however the share of BBM versus ETC transactions will decrease between 2025 and 2035. Specifically, ETC transactions will increase by 3.0 percent per year over those 10 years, while BBM transactions are forecast to decrease by an average of 0.2 percent per year.

Over the 30-year interval between FY 2025 and FY 2055, in which no toll system changes or new interchanges are assumed to be added, overall annual transactions are forecast to increase by 1.6 percent per year while expected toll revenue will increase by 3.7 percent per year. Annual revenue is expected to reach \$218.7 million by FY 2055.

Figure 6.10 provides a graphic depiction of forecasted annual transactions on the Triangle Expressway, including the distribution of transactions between ETC and BBM. The number of BBM transactions remain fairly constant over time, but they comprise a smaller and smaller proportion of total transactions.

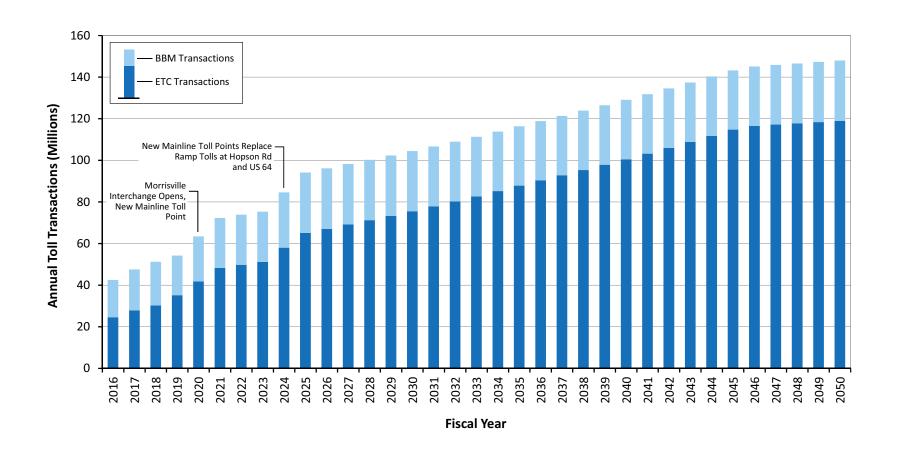
The transactions in Figure 6.10 are actual for FY 2016 through FY 2018. The increase in transactions seen in FY 2020 and FY 2021 is associated with the opening of the Morrisville Parkway interchange and its mainline toll zone in January 2020 in addition to normal growth. The normal growth pattern is also impacted in FY 2024 and FY 2025, when two new mainline toll zones are added to replace existing ramp tolls at the Hopson Road and U.S. 64 interchanges. The impact on transactions of these changes extends over two fiscal years, since the modifications are assumed to commence on January 1, 2024, mid-way through the two fiscal years.

After FY 2025, traffic and toll revenue growth is not impacted by any new interchanges or toll zone relocations. As seen in Figure 6.10, transaction growth levels off after FY 2045. This is because 2045 was the last supported model year, and transactions were assumed to increase at a nominal 0.6 percent per year.

Figure 6.11 provides a visual depiction of forecasted expected toll revenue, by ETC and BBM, for FY 2016 through FY 2050. The forecast toll revenue shown in this figure has not been adjusted for leakage or fee revenue. FY 2016 through FY 2018 reflect actual collected toll revenues. In the case of toll revenue, one doesn't see the same large increases evidenced in transactions in FYs 2020/2021 and 2024/2025. This is because the new toll revenue associated with the Morrisville Parkway interchange is relatively small compared to the total toll revenue, and the increase in toll transactions due to toll zone relocations was intended to be toll revenue neutral, which was accomplished by modifying toll rates on mainline sections to maintain a uniform per-mile rate on the Triangle Expressway. Hence, the addition of new mainline toll zones adds to transactions but does not have an equivalent impact on revenue. Figure 6.11 also demonstrates the increasing share of total revenue expected to be coming from electronic toll collection. Annual revenue estimates shown in Figure 6.11 and Table 6.12 do not yet reflect any adjustment for leakage, nor do they include estimates of fee revenue associated with the BBM collection process.

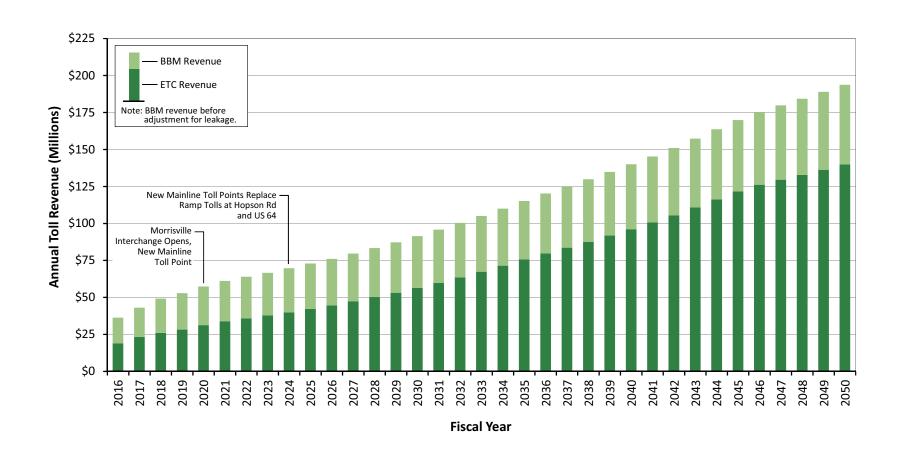
#### 6.11.1 Estimated Adjusted Annual Revenue

The final step in the forecast process was to adjust gross toll revenue estimates for leakage and potential additional processing fee revenue associated with the BBM collections process. Annual



# ESTIMATED ANNUAL TRANSACTIONS BY PAYMENT METHOD TRIANGLE EXPRESSWAY





# ESTIMATED ANNUAL REVENUE BY PAYMENT METHOD TRIANGLE EXPRESSWAY



forecast of adjusted total revenue is provided in Table 6.13. Estimated gross revenue for FY 2019 is shown at \$52.8 million. Of this, \$24.6 million is estimated to come from BBM transactions.

As with other all-electronic toll collection facilities in the United States, there is always some portion of BBM revenue which may not be collected. This is generally referred to as "leakage", and is a result of a variety of factors, including:

- Unreadable or obscured license plates at the time of the transaction;
- Incomplete, unavailable or inaccurate information about vehicle owner name and address; and,
- Non-payment of billed BBM transactions.

Based on actual Triangle Expressway experience, estimates of BBM leakage were applied for each year in Table 6.13. This was applied only to the BBM share of gross revenue. In 2019, for example, losses due to BBM leakage were estimated at \$5.7 million, resulting in adjusted annual revenue of \$47.2 million. Leakage adjustments are expected to increase over time in proportion with the increase in computed BBM revenue. Even though the number of BBM transactions were estimated to grow only slightly over the forecast period, the amount of revenue, and hence the BBM leakage estimate, was assumed to increase over time because of assumptions regarding annual increases in toll rates per transaction. After adjusting for leakage, adjusted annual revenue would be expected to increase from just over \$47 million in FY 2019 to \$65.8 million in FY 2025 and \$106.1 million in FY 2035.

Also shown in Table 6.13 are estimates of processing fee revenue. This relates to processing fees which are added to BBM invoices which are not paid within the first payment interval. These fees, \$6.00 per unpaid invoice, are estimated to generate about \$5.7 million in 2019, increasing to about \$6.0 million to 2025 and remain around that level in subsequent years. Relatively little growth is shown in processing fee revenue, because the proportion of BBM transactions is projected to grow little and no annual increase in the \$6.00 processing fee is assumed in this forecast.

The rightmost column of Table 6.13 shows estimated total collected revenue, which includes the adjusted revenue plus processing fee revenue. Total collected revenue from Triangle Expressway is expected to grow from about \$52.8 million in FY 2019 to \$164.6 million in FY 2045.

#### 6.12 Disclaimer

Current accepted professional practices and procedures were used in the development of these updated traffic and revenue forecasts. However, as with any forecast of the future, there may be differences between forecasted and actual results caused by events and circumstances beyond the control of CDM Smith. In formulating its forecasts, CDM Smith has reasonably relied upon the accuracy and completeness of information provided (both written and oral) by the NCDOT/NCTA and other local and state agencies. CDM Smith also has relied upon the reasonable assurances of some independent parties and is not aware of any facts that would make such information misleading.

CDM Smith has made qualitative judgments related to several key variables in the development and analysis of the traffic and revenue forecasts that must be considered as a whole; therefore, selecting portions of any individual result without consideration of the intent of the whole may create a misleading or incomplete view of the results and the underlying methodologies used to obtain the



Table 6.13
Estimated Adjusted Annual Revenue
Triangle Expressway - Base Case

Fiscal	Comp	uted Gross Re	venue	ввм	Adjusted Toll	Processing	Total Collected
Year	ETC BBM		Total	Leakage	Revenue	Fees	Revenue
2019	\$ 28,238	\$ 24,580	\$ 52,818	\$ (5,652)	\$ 47,166	\$ 5,657	\$ 52,823
2020 (1,2)	31,243	26,056	57,299	(5,991)	51,308	5,778	57,086
2021 (2)	33,832	27,286	61,118	(6,274)	54,844	5,870	60,714
2022 (2)	35,783	28,129	63,912	(6,468)	57,444	5,893	63,337
2023 (2)	37,726	28,882	66,608	(6,641)	59,966	5,898	65,865
2024 (2,3)	39,915	29,737	69,652	(6,838)	62,814	5,913	68,727
2025 (2)	42,208	30,644	72,852	(7,046)	65,806	5,934	71,740
2026 (2)	44,591	31,433	76,024	(7,228)	68,796	5,938	74,734
2027 (2)	47,357	32,230	79,586	(7,411)	72,175	5,936	78,112
2028	50,182	33,091	83,273	(7,609)	75,664	5,928	81,592
2029	53,165	34,035	87,200	(7,826)	79,374	5,917	85,291
2030	56,418	34,995	91,412	(8,047)	83,365	5,904	89,269
2031	59,860	35,890	95,750	(8,253)	87,497	5,889	93,386
2032	63,525	36,801	100,326	(8,462)	91,864	5,873	97,737
2033	67,368	37,659	105,026	(8,659)	96,367	5,855	102,222
2034	71,432	38,543	109,975	(8,863)	101,112	5,835	106,948
2035	75,704	39,473	115,177	(9,077)	106,100	5,814	111,914
2036	79,749	40,412	120,161	(9,293)	110,868	5,808	116,677
2037	83,595	41,360	124,955	(9,511)	115,445	5,819	121,263
2038	87,620	42,249	129,868	(9,715)	120,153	5,827	125,981
2039	91,739	43,072	134,811	(9,904)	124,907	5,833	130,740
2040	96,080	43,854	139,934	(10,084)	129,850	5,837	135,687
2041	100,625	44,631	145,256	(10,263)	134,994	5,839	140,833
2042	105,504	45,463	150,967	(10,454)	140,513	5,839	146,352
2043	110,852	46,437	157,288	(10,678)	146,611	5,836	152,446
2044	116,256	47,366	163,622	(10,892)	152,730	5,830	158,560
2045	121,711	48,135	169,846	(11,069)	158,777	5,822	164,599
2046	126,186	49,100	175,286	(11,290)	163,996	5,828	169,824
2047	129,525	50,280	179,806	(11,562)	168,244	5,851	174,095
2048	132,868	51,416	184,284	(11,823)	172,461	5,875	178,336
2049	136,305	52,594	188,899	(12,094)	176,805	5,898	182,703
2050	139,823	53,826	193,649	(12,377)	181,272	5,922	187,193
2051	143,434	55,080	198,514	(12,666)	185,848	5,945	191,794
2052	147,026	56,320	203,346	(12,951)	190,396	5,969	196,364
2053	150,670	57,568	208,238	(13,238)	195,001	5,992	200,993
2054	154,479	58,870	213,349	(13,537)	199,812	6,016	205,828
2055	158,454	60,225	218,680	(13,849)	204,831	6,040	210,871
2056	162,495	61,622	224,117	(14,170)	209,947	6,064	216,011
2057	166,489	63,006	229,495	(14,488)	215,007	6,088	221,095
2058	170,725	64,421	235,147	(14,813)	220,333	6,112	226,446

<sup>(1)</sup> Assumes new Morrisville Parkway Interchange is opened January 1, 2020. Also, a new mainline toll zone north of the Morrisville Parkway Interchange is put into operation January 1, 2020.

<sup>(3)</sup> Assumes ramp tolls at US 64 and Hopson Road on the Triangle Expressway are removed, and replaced by new mainline toll points north of each interchange, on January 1, 2024.



<sup>(2)</sup> Ramp up is applied to the first 36-month period of transaction and revenue impacts associated with new toll zones.

results. CDM Smith gives no opinion as to the value or merit to partial information extracted from this report. All forecasts and projections reported herein are based on CDM Smith's experience and judgment and on a review of information obtained from multiple state and local agencies, including NCDOT/NCTA. These estimates and projections may not be indicative of actual or future values and are therefore subject to substantial uncertainty. Future developments, economic conditions, and changes in travel behavior resulting from advances in automotive technology cannot be predicted with certainty and may affect the forecasts or projections expressed in this report, such that CDM Smith does not specifically guarantee or warrant any estimate or projection contained within this report.

While CDM Smith believes that some of the projections or other forward-looking statements contained within the report are based on reasonable assumptions as of the date in the report, such forward looking statements involve risks and uncertainties that may cause actual results to differ materially from the results predicted. Therefore, following the date of this report, CDM Smith will take no responsibility or assume any obligation to advise of changes that may affect its assumptions contained within the report, as they pertain to: socioeconomic and demographic forecasts, proposed residential or commercial land use development projects and/or potential improvements to the regional transportation network.

CDM Smith is not, and has not been, a municipal advisor as defined in Federal law (the Dodd Frank Bill) to NCDOT/NCTA and does not owe a fiduciary duty pursuant to Section 15B of the Exchange Act to NCDOT/NCTA with respect to the information and material contained in this report. CDM Smith is not recommending and has not recommended any action to NCDOT/NCTA. NCDOT/NCTA should discuss the information and material contained in this report with any and all internal and external advisors that it deems appropriate before acting on this information.

## Chapter 7

## **Sensitivity Tests**

This chapter provides estimated impacts to the Triangle Expressway Base Case transaction and revenue forecast, detailed in Chapter 6. The first section describes four hypothetical tests that were conducted to determine the sensitivity of the Base Case annual transaction and toll revenue forecast to changes in key study assumptions. The sensitivity tests were conducted for calendar modeled years 2025 and 2045. The results were converted to fiscal year (FY) and are reported for FY 2025 and FY 2045. The following describes the four sensitivity tests related to **Key Study Assumptions**:

- 1. **Reduced Economic Growth** trip table growth was reduced by 30 percent.
- 2. **Reduced Value of Time** passenger car (Class 1) and truck (Classes 2 and 3) values of time were reduced by 25 percent.
- 3. Increased Motor Fuel Prices motor fuel prices were increased by 50 percent.
- 4. NC 147 Widening Does Not Occur the planned widening of NC 147 from four to eight lanes, from I-40 to the future I-885 East End Connector in Durham, STIP number U-5934 does not occur during the forecast period.

The second section provides estimated annual transaction and revenue forecasts assuming two different assumptions, described below, regarding the planned **Complete 540.** In both cases, the transactions and toll revenue forecasts are for the combined Triangle Expressway and Complete 540.

- 1. <u>Complete 540 Phase 1</u> Complete 540 Phase 1 is operational on January 1, 2024.
- 2. **Complete 540 Phases 1 and 2** Complete 540 Phase 1 is operational on January 1, 2024 and Phase 2 is operational on July 1, 2030.

## 7.1 Sensitivity Tests on Key Study Assumptions

**Table 7.1** presents the estimated impacts on Base Case Triangle Expressway transactions and revenue at FY 2025 and FY 2045 associated with the four variables described above as Key Study Assumptions. The Base Case transactions, gross toll revenue, and net toll revenue are provided at the top of the table, and the test results are shown below. The test results include forecast transactions, and gross and net revenue, along with the difference and percent difference between the sensitivity test and the Base Case forecast. The percent impact on net toll revenue for each of these sensitivity tests, compared to the Base Condition, is shown graphically in **Figure 7.1.** 

#### 7.1.1 Reduced Economic Growth

The rate of trip table growth was reduced by 30 percent between the calibration year 2016 and future year 2045 to simulate slower economic growth than assumed in the Base Case trip tables. Because of the lower growth assumption, toll transactions would be reduced by 8.3 percent in FY 2025 and 17.4 percent in FY 2045. Similarly, net toll revenue would decrease by 8.2 percent in FY 2025 and 17.2



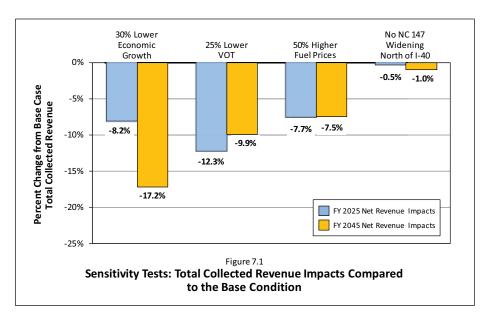
percent in FY 2045. The percent impacts in 2045 are larger compared to those estimated for 2025 because of the compounding nature of the reduced annual growth rates.

		Sensitivity Tes ar Transaction			•								
	Annual Annual Gross Annual												
		Toll Trans	actions	Toll Reve	nue (5)	Reven	ue (6)						
	Base Condition and Sensitivity Scenarios	2025	2045	2025	2045	2025	2045						
	Triangle Expressway Base Case	94,123	143,230	\$72,852	\$169,846	\$71,740	\$164,599						
	Sensitivity Scenarios												
1	Economic Growth Reduced by 30% (1)	86,326	118,311	\$66,912	\$140,654	\$65,878	\$136,314						
	Difference	(7,797)	(24,919)	(5,941)	(29,192)	(5,862)	(28,285)						
	Percent Difference	-8.3%	-17.4%	-8.2%	-17.2%	-8.2%	-17.2%						
2	Value of Time Reduced by 25% (2)	82,540	128,788	\$63,930	\$152,902	\$62,919	\$148,331						
	Difference	(11,584)	(14,442)	(8,922)	(16,944)	(8,821)	(16,268)						
	Percent Difference	-12.3%	-10.1%	-12.2%	-10.0%	-12.3%	-9.9%						
3	Fuel Price Increased by 50% (3)	86,797	132,520	\$67,252	\$157,124	\$66,216	\$152,283						
	Difference	(7,326)	(10,710)	(5,601)	(12,722)	(5,524)	(12,316)						
	Percent Difference	-7.8%	-7.5%	-7.7%	-7.5%	-7.7%	-7.5%						
4	No NC 147 Widening North of I-40 (4)	93,632	141,892	\$72,464	\$168,214	\$71,359	\$163,022						
	Difference	(491)	(1,338)	(388)	(1,632)	(381)	(1,577)						
1													

- (1) 30 percent global reduction in TRM trip table growth from base year 2016 through 2045.
- (2) Value of time is reduced by 25 percent for cars and trucks.
- (3) Fuel price is increased by 50 percent.
- (4) NC 147 planned widening from I-40 to planned I-885 in Durham does not occur during forecast period (NCDOT STIP U-5934).

-0.5%

- (5) Total expected toll revenue for all toll transactions, prior to accounting for leakage or fee revenue.
- (6) Total collected toll revenue and processing fee revenue.





-1.0%

#### 7.1.2 Reduced Value of Time

Motorist value of time (VOT) is an important factor in the modeling process, as it influences a driver's willingness to pay a toll to achieve a time savings by using the toll road. The VOT is based in part on the median household income in each traffic analysis zone in the TRMv6 model. Base Condition VOTs were reduced by 25 percent in calendar years 2025 and 2045, resulting in an estimated 12.3 percent and 10.1 percent decrease in transactions in FY 2025 and FY 2045, respectively. Annual net toll revenue estimates were reduced by 12.3 and 9.9 percent in FY 2025 and FY 2045, respectively.

#### 7.1.3 Increased Motor Fuel Prices

Motor fuel prices can be volatile over a long-term forecast, and this test assumes that the Base Case motor fuel prices increase by 50 percent. This change would result in higher operating costs for the motorist and likely result in reduced travel demand. To reflect the reduced travel demand, the trip tables were reduced by five percent representing an elasticity of -0.10. The motor vehicle operating cost used in the tolling assignment was also increased to reflect the increase in motor fuel prices. Under this test, annual toll transactions decreased 7.8 percent in FY 2025 and 7.5 percent in FY 2045. Net toll revenue decreased by 7.7 percent and by 7.5 percent in FY 2025 and FY 2045, respectively.

#### 7.1.4 NC 147 Widening Does Not Occur

The Base Case assumes that NC 147 north is widened from four to eight lanes for approximately five miles, from I-40 to the future I-85 East End Connector in Durham, and the widening is completed by 2025. This project is listed in the **2018-2027 NCDOT State Transportation Improvement Program** (STIP # U-5934). The planned improvement was assumed in the original TRMv6 2025, 2035 and 2045 networks, and was maintained in the CDM Smith analysis. The improvement does result in slightly more transactions and toll revenue on the Triangle Expressway.

The sensitivity test assumes that the planned improvement is not implemented during the forecast period. Without the improvement, transactions would decrease 0.5 percent in FY 2025 and 0.9 percent in FY 2045 compared to Base Case estimates. Associated decreases in net toll revenue would occur, totaling a 0.5 percent decrease in FY 2025 and a 1.0 percent decrease in FY 2045.

#### 7.2 Complete 540

This section provides annual traffic and toll revenue streams assuming that Complete 540 becomes operational during the forecast period under two build assumptions. The first condition is that Complete 540 Phase 1 is completed and open to traffic on January 1, 2024, and that Phase 2 is not operational through the forecast period. The second condition is that Complete 540 Phase 1 is open on January 1, 2024 and that Phase 2 is open on July 1, 2030. The Complete 540 forecasts were developed as part of the Tringle Expressway and Complete 540 Study conducted for the NCTA in 2017-2018.

#### 7.2.1 Complete 540 Phase 1

Complete 540 Phase 1, which is not included in the Base Condition, would extend the Triangle Expressway approximately 17.1 miles eastward from its southern terminus at NC 55 Bypass to I-40. This project would increase accessibility to the Triangle Expressway for the developing area of southern Wake County. Complete 540 would operate in a consistent manner with the Triangle Expressway including toll operations (an AET facility), permitted payment types, ETC discount rates, and toll classes.

**Table 7.2** presents the estimated annual transactions and gross toll revenue for Triangle Expressway from FY 2019 through FY 2058 with Complete 540 Phase 1 open on January 1, 2024.



Table 7.2
Estimated Annual Transactions and Revenue
Triangle Expressway With Complete 540 Phase 1

Fiscal	Ar	nual Transa	ctions (000)		An	nual Gross R	evenue (00	0)	Average	Toll Per Tra	nsaction
Year	ETC	BBM	Total	% ETC	ETC	BBM	Total	% ETC	ETC	BBM	Overall
2019	35,142	19,024	54,166	64.9	\$28,238	\$24,580	\$52,818	53.5	\$ 0.804	\$ 1.292	\$ 0.975
2020 (1,2)	41,835	21,564	63,399	66.0	31,243	26,056	57,299	54.5	0.747	1.208	0.904
2021 (2)	48,219	24,018	72,237	66.8	33,832	27,286	61,118	55.4	0.702	1.136	0.846
2022 (2)	49,742	24,114	73,856	67.4	35,783	28,129	63,912	56.0	0.719	1.167	0.865
2023 (2)	51,170	24,135	75,304	68.0	37,726	28,882	66,608	56.6	0.737	1.197	0.885
2024 (2,3,4)	71,254	32,779	104,033	68.5	50,085	37,698	87,783	57.1	0.703	1.150	0.844
2025 (2)	97,010	43,751	140,761	68.9	67,106	49,887	116,994	57.4	0.692	1.140	0.831
2026 (2)	108,012	47,409	155,421	69.5	77,492	56,174	133,666	58.0	0.717	1.185	0.860
2027 (2)	115,629	49,263	164,892	70.1	85,933	60,304	146,238	58.8	0.743	1.224	0.887
2028	120,312	49,703	170,015	70.8	92,104	62,634	154,739	59.5	0.766	1.260	0.910
2029	123,779	49,545	173,324	71.4	97,547	64,301	161,848	60.3	0.788	1.298	0.934
2030	127,353	49,369	176,722	72.1	103,452	66,016	169,468	61.0	0.812	1.337	0.959
2031	131,038	49,175	180,213	72.7	109,773	67,691	177,464	61.9	0.838	1.377	0.985
2032	134,842	48,963	183,805	73.4	116,506	69,391	185,897	62.7	0.864	1.417	1.011
2033	138,771	48,733	187,504	74.0	123,510	71,003	194,513	63.5	0.890	1.457	1.037
2034	142,832	48,485	191,317	74.7	130,858	72,603	203,461	64.3	0.916	1.497	1.063
2035	147,033	48,218	195,251	75.3	138,552	74,223	212,775	65.1	0.942	1.539	1.090
2036	151,436	48,202	199,638	75.9	146,238	76,027	222,265	65.8	0.966	1.577	1.113
2037	156,037	48,439	204,476	76.3	154,009	78,036	232,044	66.4	0.987	1.611	1.135
2038	160,777	48,661	209,438	76.8	162,374	80,098	242,472	67.0	1.010	1.646	1.158
2039	165,660	48,868	214,528	77.2	170,934	82,039	252,973	67.6	1.032	1.679	1.179
2040	170,691	49,057	219,748	77.7	179,842	83,874	263,716	68.2	1.054	1.710	1.200
2041	175,874	49,229	225,103	78.1	189,189	85,716	274,906	68.8	1.076	1.741	1.221
2042	181,214	49,381	230,595	78.6	199,323	87,703	287,026	69.4	1.100	1.776	1.245
2043	186,715	49,514	236,229	79.0	210,468	89,949	300,417	70.1	1.127	1.817	1.272
2044	192,383	49,626	242,008	79.5	221,760	92,057	313,817	70.7	1.153	1.855	1.297
2045	198,223	49,715	247,938	79.9	233,365	93,969	327,334	71.3	1.177	1.890	1.320
2046	201,716	49,854	251,569	80.2	242,587	96,137	338,724	71.6	1.203	1.928	1.346
2047	202,775	50,052	252,827	80.2	249,030	98,485	347,515	71.7	1.228	1.968	1.375
2048	203,839	50,252	254,091	80.2	255,373	100,721	356,094	71.7	1.253	2.004	1.401
2049	204,910	50,452	255,362	80.2	261,908	103,045	364,953	71.8	1.278	2.042	1.429
2050	205,986	50,653	256,638	80.3	268,761	105,471	374,232	71.8	1.305	2.082	1.458
2051	207,067	50,854	257,922	80.3	275,723	107,925	383,649	71.9	1.332	2.122	1.487
2052	208,154	51,057	259,211	80.3	282,724	110,425	393,148	71.9	1.358	2.163	1.517
2053	209,247	51,260	260,507	80.3	289,778	112,941	402,719	72.0	1.385	2.203	1.546
2054	210,346	51,464	261,810	80.3	297,016	115,479	412,495	72.0	1.412	2.244	1.576
2055	211,450	51,669	263,119	80.4	304,644	118,171	422,816	72.1	1.441	2.287	1.607
2056	212,560	51,875	264,435	80.4	312,407	120,927	433,333	72.1	1.470	2.331	1.639
2057	213,676	52,081	265,758	80.4	320,025	123,591	443,616	72.1	1.498	2.373	1.669
2058	214,798	52,289	267,087	80.4	328,108	126,383	454,491	72.2	1.528	2.417	1.702
Average Annua	al Percent C	hange_									
2019-25	18.4%	14.9%	17.3%		15.5%	12.5%	14.2%		-2.5%	-2.1%	-2.6%
2025-35	4.2%	1.0%	3.3%		7.5%	4.1%	6.2%		3.1%	3.0%	2.7%
2035-45	3.0%	0.3%	2.4%		5.4%	2.4%	4.4%		2.3%	2.1%	1.9%
2045-55	0.6%	0.4%	0.6%		2.7%	2.3%	2.6%		2.0%	1.9%	2.0%
2025-55	2.6%	0.6%	2.1%		5.2%	2.9%	4.4%		2.5%	2.3%	2.2%

<sup>(1)</sup> Assumes new Morrisville Parkway Interchange is opened January 1, 2020. Also, a new mainline toll zone north of the Morrisville Parkway Interchange is put into operation January 1, 2020.

<sup>(4)</sup> Assumes Phase 1 of Complete 540 is opened on January 1, 2024.



<sup>(2)</sup> Ramp up is applied to the first 36-month period of transaction and revenue impacts associated with new toll zones.

<sup>(3)</sup> Assumes ramp tolls at US 64 and Hopson Road on Triangle Expressway are removed, and replaced by new mainline toll points north of each interchange, on January 1, 2024.

Transactions and toll revenue are provided by ETC and BBM, and ETC as a percentage of total transactions and toll revenue is also shown. The average weighted toll per transaction is provided as it is a good indicator of annual toll increases. It also changes based on the mix of vehicle types, toll rate modifications due to the new Morrisville Parkway interchange and toll zone relocations, and changing travel patterns.

Annual transactions are forecast to increase from 54.2 million in FY 2019 to 267.1 in FY 2058. Gross toll revenue is forecasted at \$52.8 million in FY 2019 and \$454.5 million in FY 2058. Annualized growth in transactions is 17.3 percent per year between FY 2019 and FY 2025, but this high growth is due to new traffic from Complete 540, the new Morrisville Parkway interchange and toll zone, and the ramp toll zones relocated to mainlines. Over this period, gross toll revenue increases at 14.2 percent per year, driven by new tolled traffic from Complete 540 and annual toll rate increases.

After 2025 there are no additional extensions, new interchanges, or toll zone changes, so growth rates become more modest. Transaction and gross toll revenue growth averages 3.3 percent and 6.2 percent respectively from 2025 to 2035. This growth includes continuing ramp-up on Complete 540 traffic. From 2025 to 2055, which excludes the initial impact of Complete 540, growth in transactions and toll revenue is expected to average 2.1 percent and 4.4 percent per year. A nominal growth of 0.6 percent in transactions was assumed after the last model supported year of 2045. Annual toll rate increases are assumed on January 1st of each year.

Estimated adjusted revenue is presented in Table 7.3 for Triangle Expressway and Complete 540 Phase 1. This table provides the gross toll revenue; adjusted toll revenue that takes into account revenue leakage; and total collected toll revenue, which accounts for processing fees. Total collected toll revenue is forecast at \$52.8 million in FY 2019 and \$434.9 million in FY 2058.

#### 7.2.2 Complete 540 Phase 2

This scenario assumes that Complete 540 Phase 1 is open on January 1, 2024 and Phase 2 is open on July 1, 2030. This represents an accelerated opening of Phase 2 compared to the TRMv6 network, which assumed the opening in 2035. Phase 2 would close the NC 540 outer loop by adding the 10.4mile section from the Phase 1 eastern terminus at I-40 to U.S. 64/Knightdale Bypass.

Table 7.4 presents the estimated annual transactions and gross toll revenue for Triangle Expressway and Phases 1 and 2 of Complete 540. Annual transactions are forecast to increase from 54.2 million in FY 2019 to 336.7 in FY 2058. Gross toll revenue is forecasted at \$52.8 million in FY 2019 and \$529.7 million in FY 2058.

The transaction and revenue forecast is identical to the Complete 540 Phase 1 forecast through FY 2030 because Phase 2 does not open until July 1, 2030. The first impact of Phase 2 appears in FY 2031. Ramp-up is applied to the first 36 months of Complete 540 Phase 2 traffic.

After 2025 there are no additional extensions, new interchanges, or toll zone changes other than Complete 540 Phase 2, so growth rates become more modest. Transaction and gross toll revenue growth average 5.7 percent and 7.8 percent respectively from 2025 to 2035. This growth includes the impact of Phase 2, with all ramp-up removed in FY 2034. From 2025 to 2055, growth in transactions and toll revenue is expected to average 2.9 percent and 4.9 percent per year. A nominal growth of 0.6 percent in transactions was assumed after the last model supported year of 2045. Annual toll rate increases are assumed on January 1st of each year.



Table 7.3
Estimated Adjusted Annual Revenue
Triangle Expressway With Complete 540 Phase 1

(all revenue in thousands of \$)

					Adjusted		Total
Fiscal		uted Gross Re		BBM	Toll	Processing	Collected
Year	ETC	BBM	Total	Leakage	Revenue	Fees	Revenue
2019	\$ 28,238	\$ 24,580	\$ 52,818	\$ (5,652)	\$ 47,166	\$ 5,657	\$ 52,823
2020 (1,2)	31,243	26,056	57,299	(5,991)	51,308	5,778	57,086
2021 (2)	33,832	27,286	61,118	(6,274)	54,844	5,870	60,714
2022 (2)	35,783	28,129	63,912	(6,468)	57,444	5,893	63,337
2023 (2)	37,726	28,882	66,608	(6,641)	59,966	5,898	65,865
2024 (2,3,4)	50,085	37,698	87,783	(8,669)	79,114	6,682	85,797
2025 (2)	67,106	49,887	116,994	(11,471)	105,522	7,886	113,408
2026 (2)	77,492	56,174	133,666	(12,917)	120,749	8,546	129,295
2027 (2)	85,933	60,304	146,238	(13,867)	132,371	8,880	141,251
2028	92,104	62,634	154,739	(14,403)	140,336	8,959	149,295
2029	97,547	64,301	161,848	(14,786)	147,062	8,931	155,993
2030	103,452	66,016	169,468	(15,180)	154,288	8,899	163,187
2031	109,773	67,691	177,464	(15,565)	161,899	8,864	170,763
2032	116,506	69,391	185,897	(15,956)	169,941	8,826	178,767
2033	123,510	71,003	194,513	(16,327)	178,186	8,784	186,971
2034	130,858	72,603	203,461	(16,695)	186,766	8,740	195,506
2035	138,552	74,223	212,775	(17,067)	195,708	8,692	204,399
2036	146,238	76,027	222,265	(17,482)	204,783	8,689	213,472
2037	154,009	78,036	232,044	(17,944)	214,100	8,731	222,832
2038	162,374	80,098	242,472	(18,418)	224,054	8,771	232,825
2039	170,934	82,039	252,973	(18,864)	234,108	8,809	242,917
2040	179,842	83,874	263,716	(19,287)	244,429	8,843	253,272
2041	189,189	85,716	274,906	(19,710)	255,196	8,874	264,070
2042	199,323	87,703	287,026	(20,167)	266,859	8,901	275,760
2043	210,468	89,949	300,417	(20,684)	279,734	8,925	288,659
2044	221,760	92,057	313,817	(21,168)	292,649	8,945	301,594
2045	233,365	93,969	327,334	(21,608)	305,726	8,961	314,687
2046	242,587	96,137	338,724	(22,106)	316,618	8,986	325,604
2047	249,030	98,485	347,515	(22,646)	324,869	9,022	333,891
2048	255,373	100,721	356,094	(23,160)	332,934	9,058	341,992
2049	261,908	103,045	364,953	(23,695)	341,258	9,094	350,353
2050	268,761	105,471	374,232	(24,253)	349,979	9,130	359,110
2051	275,723	107,925	383,649	(24,817)	358,832	9,167	367,998
2052	282,724	110,425	393,148	(25,392)	367,757	9,203	376,960
2053	289,778	112,941	402,719	(25,970)	376,749	9,240	385,989
2054	297,016	115,479	412,495	(26,554)	385,941	9,277	395,218
2055	304,644	118,171	422,816	(27,173)	395,642	9,314	404,956
2056	312,407	120,927	433,333	(27,807)	405,527	9,351	414,877
2057	320,025	123,591	443,616	(28,419)	415,197	9,388	424,585
2058	328,108	126,383	454,491	(29,061)	425,430	9,425	434,855

<sup>(1)</sup> Assumes new Morrisville Parkway Interchange is opened January 1, 2020. Also, a new mainline toll zone north of the Morrisville Parkway Interchange is put into operation January 1, 2020.

<sup>(4)</sup> Assumes Phase 1 of Complete 540 is opened on January 1, 2024.



<sup>(2)</sup> Ramp up is applied to the first 36-month period of transaction and revenue impacts associated with new toll zones.

<sup>(3)</sup> Assumes ramp tolls at US 64 and Hopson Road on Triangle Expressway are removed, and replaced by new mainline toll points north of each interchange, on January 1, 2024.

Table 7.4
Estimated Annual Transactions and Revenue
Triangle Expressway With Complete 540 Phases 1 and 2

Fiscal	Estimate	ed Annual T	ransactions	(000)	Estim	ated Annua	Revenue (	000)	Average Toll Per Transaction			
Year	ETC	BBM	Total	% ETC	ETC	BBM	Total	% ETC	ETC	BBM	Overal	
2019	35,142	19,024	54,166	64.9	\$28,238	\$24,580	\$52,818	53.5	\$ 0.804	\$ 1.292	\$ 0.975	
2020 (1,2)	41,835	21,564	63,399	66.0	31,243	26,056	57,299	54.5	0.747	1.208	0.904	
2021 (2)	48,219	24,018	72,237	66.8	33,832	27,286	61,118	55.4	0.702	1.136	0.84	
2022 (2)	49,742	24,114	73,856	67.4	35,783	28,129	63,912	56.0	0.719	1.167	0.86	
2023 (2)	51,170	24,135	75,304	68.0	37,726	28,882	66,608	56.6	0.737	1.197	0.88	
2024 (2,3,4)	71,254	32,779	104,033	68.5	50,085	37,698	87,783	57.1	0.703	1.150	0.84	
2025 (2)	97,010	43,751	140,761	68.9	67,106	49,887	116,994	57.4	0.692	1.140	0.83	
2026 (2)	108,012	47,409	155,421	69.5	77,492	56,174	133,666	58.0	0.717	1.185	0.86	
2027 (2)	115,629	49,263	164,892	70.1	85,933	60,304	146,238	58.8	0.743	1.224	0.88	
2028	120,312	49,703	170,015	70.8	92,104	62,634	154,739	59.5	0.766	1.260	0.91	
2029	123,779	49,545	173,324	71.4	97,547	64,301	161,848	60.3	0.788	1.298	0.93	
2030	127,353	49,369	176,722	72.1	103,452	66,016	169,468	61.0	0.812	1.337	0.95	
2031 (2,5)	152,575	57,239	209,814	72.7	121,657	74,619	196,276	62.0	0.797	1.304	0.93	
2032 (2)	161,695	58,689	220,384	73.4	131,797	78,019	209,816	62.8	0.815	1.329	0.95	
2033 (2)	171,098	60,068	231,166	74.0	142,414	81,331	223,745	63.7	0.832	1.354	0.96	
2034	178,462	60,569	239,031	74.7	152,318	83,909	236,228	64.5	0.854	1.385	0.98	
2035	184,430	60,475	244,905	75.3	161,696	85,969	247,665	65.3	0.877	1.422	1.01	
2036	190,107	60,503	250,610	75.9	170,668	88,041	258,709	66.0	0.898	1.455	1.03	
2037	195,971	60,826	256,797	76.3	179,776	90,370	270,146	66.5	0.917	1.486	1.05	
2038	202,014	61,130	263,145	76.8	189,605	92,787	282,392	67.1	0.939	1.518	1.07	
2039	208,244	61,415	269,659	77.2	199,560	95,005	294,565	67.7	0.958	1.547	1.09	
2040	214,664	61,678	276,342	77.7	209,928	97,107	307,035	68.4	0.978	1.574	1.11	
2041	221,281	61,919	283,200	78.1	220,899	99,273	320,173	69.0	0.998	1.603	1.13	
2041	221,281	62,136	290,237	78.1 78.6	232,754	101,608	334,362	69.6	1.020	1.635	1.15	
2042	235,130	62,328	297,458	79.0	245,733	104,178	349,911	70.2	1.045	1.671	1.17	
2044	242,375	62,493	304,869	79.5	258,974	106,638	365,612	70.2	1.068	1.706	1.19	
2045	242,373	62,630	312,473	80.0	272,654	100,038	381,579	70.8	1.008	1.739	1.22	
2045	-	62,817	317,115	80.2	283,355		-	71.8	1.114	1.773	1.24	
2046	254,298					111,399	394,754			1.773		
	255,633	63,067	318,701	80.2	290,828	114,087	404,915	71.8	1.138		1.27	
2048	256,976	63,318	320,294	80.2	298,252	116,683	414,935	71.9	1.161	1.843	1.29	
2049	258,325	63,571	321,896	80.3	305,925	119,386	425,311	71.9	1.184	1.878	1.32	
2050	259,681	63,824	323,505	80.3	313,961	122,225	436,186	72.0	1.209	1.915	1.34	
2051	261,045	64,078	325,123	80.3	322,078	125,075	447,152	72.0	1.234	1.952	1.37	
2052	262,415	64,333	326,749	80.3	330,174	127,914	458,088	72.1	1.258	1.988	1.40	
2053	263,793	64,590	328,383	80.3	338,419	130,829	469,248	72.1	1.283	2.026	1.42	
2054	265,178	64,847	330,025	80.4	346,968	133,800	480,768	72.2	1.308	2.063	1.45	
2055	266,570	65,105	331,675	80.4	355,889	136,909	492,798	72.2	1.335	2.103	1.48	
2056	267,970	65,364	333,334	80.4	364,973	140,093	505,066	72.3	1.362	2.143	1.51	
2057	269,377	65,624	335,001	80.4	373,866	143,175	517,041	72.3	1.388	2.182	1.54	
2058	270,791	65,885	336,676	80.4	383,278	146,417	529,695	72.4	1.415	2.222	1.57	
verage Annua	al Percent Ch	nange										
019-25	18.4%	14.9%	17.3%		15.5%	12.5%	14.2%		-2.5%	-2.1%	-2.6%	
025-35	6.6%	3.3%	5.7%		9.2%	5.6%	7.8%		2.4%	2.2%	2.0%	
035-45	3.1%	0.4%	2.5%		5.4%	2.4%	4.4%		2.2%	2.0%	1.9%	
045-55	0.7%	0.4%	0.6%		2.7%	2.3%	2.6%		2.0%	1.9%	2.0%	
025-55	3.4%	1.3%	2.9%		5.7%	3.4%	4.9%		2.2%	2.1%	2.0%	

<sup>(1)</sup> Assumes new Morrisville Parkway Interchange is opened January 1, 2020. Also, a new mainline toll zone north of the Morrisville Parkway Interchange is put into operation January 1, 2020.

<sup>(5)</sup> Assumes Phase 2 of Complete 540 is opened on July 1, 2030



<sup>(2)</sup> Ramp up is applied to the first 36-month period of transaction and revenue impacts associated with new toll zones.

<sup>(3)</sup> Assumes ramp tolls at US 64 and Hopson Road on Triangle Expressway are removed, and replaced by new mainline toll points north of each interchange, on January 1, 2024.

<sup>(4)</sup> Assumes Phase 1 of Complete 540 is opened on January 1, 2024

Estimated adjusted revenue is presented in **Table 7.5** for Triangle Expressway and Complete 540 Phase 1. This table provides gross toll revenue; adjusted toll revenue, which takes into account revenue leakage; and total collected toll revenue, which accounts for processing fees. Total collected toll revenue is forecast at \$52.8 million in FY 2019 and \$507.6 million in FY 2058.

#### 7.2.3 Comparison of Traffic and Revenue Forecasts

**Table 7.6** compares toll transaction estimates from Complete 540 Phase 1 and Complete 540 Phase 1 and 2 with the Triangle Expressway Base Case forecast.

Phase 1 would positively impact total transactions, increasing transactions by approximately 68 to 73 percent of Base Case transactions from FY 2028 (after all ramp-up has been removed) through FY 2058. In FY 2028, the first year without ramp-up, Phase 1 would generate 69.8 million more transactions compared to the Base Case, an increase of 69.6 percent. In FY 2045, the Phase 1 impact would be 104.7 million transactions, a 73.1 percent impact. The increased transactions occur not only on Complete 540, but also on the Triangle Expressway.

Complete 540 Phase 1 and 2 impacts on the Base Case are identical from FY 2019 through FY 2030, as Phase 2 is not assumed to open until July 2030. The first year of Phase 2 is entirely contained in FY 2031, although ramp-up is applied to traffic generated by Complete 540 for the first 36 months. In FY 2040, Phase 1 would generate 90.6 million in additional transactions compared to 147.2 million by the combined Phase 1 and 2. In FY 2055, Phase 1 would generate 111.4 million in additional transactions compared to 179.9 million by the combined Phase 1 and 2.

In **Table 7.7**, a comparison is made of total collected toll revenue for the two Complete 540 scenarios with the Triangle Expressway Base Case forecast.

Phase 1 would have a significant impact on toll revenue. It is estimated that in FY 2024, Phase 1, which would only be open for six months, would increase toll revenue by \$17.1 million, an increase of 24.8 percent compared to the Base Case. This includes the adjustment for ramp-up that is applied to the first six months of Complete 540 operation. By FY 2028, the first year without ramp-up, Phase 1 would generate \$67.7 million more compared to the Base Case, an increase of 83.0 percent. In FY 2045, the Phase 1 impact would be \$150.1 million, a 91.2 percent impact. The increased toll revenue is generated not only at Complete 540 toll zones, but also at Triangle Expressway toll zones, as Phase 1 draws additional traffic onto the Triangle Expressway.

Complete 540 Phase 1 and 2 impacts on the Base Case are identical from FY 2019 through FY 2030, as Phase 2 is not assumed to open until July 2030. The first year of Phase 2 is entirely contained in FY 2031, although ramp-up is applied to traffic generated by Complete 540 for the first 36 months. In FY 2040, Phase 1 would generate \$117.6 million in additional revenue compared to \$159.9 million by the combined Phase 1 and 2. In FY 2055, Phase 1 would generate \$194.1 million in additional revenue compared to \$261.9 million by the combined Phase 1 and 2.



Table 7.5
Estimated Adjusted Annual Revenue
Triangle Expressway With Complete 540 Phases 1 and 2

(all revenue in thousands of \$)

Fiscal	C	stad Cuasa Da		BBM	Adjusted Toll	Dunanaina	Total Collected
Year	ETC	uted Gross Re BBM	Total			Processing Fees	Revenue
Teal	EIC	DDIVI	TOTAL	Leakage	Revenue	rees	Revenue
2019	\$ 28,238	\$ 24,580	\$ 52,818	\$ (5,652)	\$ 47,166	\$ 5,657	\$ 52,823
2020 (1,2)	31,243	26,056	57,299	(5,991)	51,308	5,778	57,086
2021 (2)	33,832	27,286	61,118	(6,274)	54,844	5,870	60,714
2022 (2)	35,783	28,129	63,912	(6,468)	57,444	5,893	63,337
2023 (2)	37,726	28,882	66,608	(6,641)	59,966	5,898	65,865
2024 (2,3,4)	50,085	37,698	87,783	(8,669)	79,114	6,682	85,797
2025 (2)	67,106	49,887	116,994	(11,471)	105,522	7,886	113,408
2026 (2)	77,492	56,174	133,666	(12,917)	120,749	8,546	129,295
2027 (2)	85,933	60,304	146,238	(13,867)	132,371	8,880	141,251
2028	92,104	62,634	154,739	(14,403)	140,336	8,959	149,295
2029	97,547	64,301	161,848	(14,786)	147,062	8,931	155,993
2030	103,452	66,016	169,468	(15,180)	154,288	8,899	163,187
2031 (2,5)	121,657	74,619	196,276	(17,158)	179,118	10,063	189,180
2032 (2)	131,797	78,019	209,816	(17,940)	191,876	10,317	202,193
2033 (2)	142,414	81,331	223,745	(18,702)	205,043	10,560	215,603
2034	152,318	83,909	236,228	(19,295)	216,933	10,648	227,581
2035	161,696	85,969	247,665	(19,768)	227,897	10,631	238,528
2036	170,668	88,041	258,709	(20,245)	238,465	10,636	249,101
2037	179,776	90,370	270,146	(20,780)	249,366	10,693	260,059
2038	189,605	92,787	282,392	(21,336)	261,056	10,747	271,802
2039	199,560	95,005	294,565	(21,846)	272,719	10,797	283,515
2040	209,928	97,107	307,035	(22,329)	284,705	10,843	295,548
2041	220,899	99,273	320,173	(22,828)	297,345	10,885	308,230
2042	232,754	101,608	334,362	(23,364)	310,997	10,923	321,921
2043	245,733	104,178	349,911	(23,955)	325,956	10,957	336,913
2044	258,974	106,638	365,612	(24,521)	341,091	10,986	352,077
2045	272,654	108,925	381,579	(25,047)	356,532	11,010	367,542
2046	283,355	111,399	394,754	(25,616)	369,138	11,043	380,181
2047	290,828	114,087	404,915	(26,234)	378,681	11,087	389,768
2048	298,252	116,683	414,935	(26,831)	388,105	11,131	399,236
2049	305,925	119,386	425,311	(27,452)	397,859	11,176	409,034
2050	313,961	122,225	436,186	(28,105)	408,081	11,220	419,301
2051	322,078	125,075	447,152	(28,760)	418,392	11,265	429,657
2052	330,174	127,914	458,088	(29,413)	428,674	11,310	439,984
2053	338,419	130,829	469,248	(30,084)	439,164	11,355	450,519
2054	346,968	133,800	480,768	(30,767)	450,001	11,400	461,401
2055	355,889	136,909	492,798	(31,482)	461,316	11,445	472,761
2056	364,973	140,093	505,066	(32,214)	472,852	11,491	484,343
2057	373,866	143,175	517,041	(32,922)	484,118	11,537	495,655
2058	383,278	146,417	529,695	(33,668)	496,027	11,582	507,610

<sup>(1)</sup> Assumes new Morrisville Parkway Interchange is opened January 1, 2020. Also, a new mainline toll zone north of the Morrisville Parkway Interchange is put into operation January 1, 2020.

<sup>(5)</sup> Assumes Phase 2 of Complete 540 is opened on July 1, 2030



<sup>(2)</sup> Ramp up is applied to the first 36-month period of transaction and revenue impacts associated with new toll zones.

<sup>(3)</sup> Assumes ramp tolls at US 64 and Hopson Road on Triangle Expressway are removed, and replaced by new mainline toll points north of each interchange, on January 1, 2024.

<sup>(4)</sup> Assumes Phase 1 of Complete 540 is opened on January 1, 2024  $\,$ 

Table 7.6
Comparison of Systemwide Transaction Forecasts by Scenario
(all traffic in thousands)

				Base Case			Base Case
		Impact (	Compared	with Complete	Impact C	Compared	with Complete
Fiscal	Base Case	with Ba	ase Case	540 Phase 1	with Ba	ase Case	540 Phase 1 & 2
Year	Transactions	Impact	% Impact	Transactions	Impact	% Impact	Transactions
2019	54,166	-	-	54,166	-	-	54,166
2020	63,399	-	-	63,399	-	-	63,399
2021	72,237	-	-	72,237	-	-	72,237
2022	73,856	-	-	73,856	-	-	73,856
2023	75,304	-	-	75,304	-	-	75,304
2024	84,567	19,466	23.0	104,033	19,466	23.0	104,033
2025	94,123	46,638	49.5	140,761	46,638	49.5	140,761
2026	96,128	59,293	61.7	155,421	59,293	61.7	155,421
2027	98,181	66,711	67.9	164,892	66,711	67.9	164,892
2028	100,224	69,791	69.6	170,015	69,791	69.6	170,015
2029	102,301	71,023	69.4	173,324	71,023	69.4	173,324
2030	104,443	72,279	69.2	176,722	72,279	69.2	176,722
2031	106,655	73,558	69.0	180,213	103,159	96.7	209,814
2032	108,944	74,861	68.7	183,805	111,440	102.3	220,384
2033	111,313	76,191	68.4	187,504	119,853	107.7	231,166
2034	113,769	77,547	68.2	191,317	125,262	110.1	239,031
2035	116,320	78,931	67.9	195,251	128,585	110.5	244,905
2036	118,848	80,790	68.0	199,638	131,762	110.9	250,610
2037	121,329	83,147	68.5	204,476	135,468	111.7	256,797
2038	123,864	85,574	69.1	209,438	139,281	112.4	263,145
2039	126,454	88,074	69.6	214,528	143,205	113.2	269,659
2040	129,101	90,647	70.2	219,748	147,241	114.1	276,342
2041	131,806	93,297	70.8	225,103	151,394	114.9	283,200
2042	134,570	96,025	71.4	230,595	155,667	115.7	290,237
2043	137,394	98,834	71.9	236,229	160,064	116.5	297,458
2044	140,281	101,727	72.5	242,008	164,588	117.3	304,869
2045	143,230	104,708	73.1	247,938	169,243	118.2	312,473
2046	145,083	106,486	73.4	251,569	172,032	118.6	317,115
2047	145,808	107,019	73.4	252,827	172,893	118.6	318,701
2048	146,537	107,554	73.4	254,091	173,757	118.6	320,294
2049	147,270	108,092	73.4	255,362	174,626	118.6	321,896
2050	148,006	108,632	73.4	256,638	175,499	118.6	323,505
2051	148,746	109,175	73.4	257,922	176,377	118.6	325,123
2052	149,490	109,721	73.4	259,211	177,259	118.6	326,749
2053	150,237	110,270	73.4	260,507	178,145	118.6	328,383
2054	150,989	110,821	73.4	261,810	179,036	118.6	330,025
2055	151,743	111,376	73.4	263,119	179,932	118.6	331,675
2056	152,502	111,933	73.4	264,435	180,832	118.6	333,334
2057	153,265	112,493	73.4	265,758	181,736	118.6	335,001
2058	154,031	113,056	73.4	267,087	182,645	118.6	336,676
	Annual Percent Ch	•	75.1	207,007	102,010	110.0	333,070
	-	<del></del>					
2019-25	9.6%			17.3%			17.3%
2025-35	2.1%			3.3%			5.7%
2035-45	2.1%			2.4%			2.5%
2045-55	0.6%			0.6%			0.6%
2025-55	1.6%			2.1%			2.9%

Table 7.7

Comparison of Systemwide Collected Total Collected Revenue Forecasts by Scenario
(all revenue in thousands of \$)

				Base Case			Base Case
		Impact (	Compared	with Complete	Impact C	Compared	with Complete
Fiscal	Base Case	with Ba	ase Case	540 Phase 1	with Ba	se Case	540 Phase 1 & 2
Year	Revenue (1)	Impact	% Impact	Revenue (1)	Impact	% Impact	Revenue (1)
2010	ć 52.022	<u> </u>		\$ 52.823	\$ -		\$ 52.823
2019	\$ 52,823	\$ -	-	, , , , , , ,	\$ -	-	, , , , , , ,
2020	57,086			57,086	-		57,086
2021	60,714	-	-	60,714	-	-	60,714
2022	63,337	-	-	63,337	-	-	63,337
2023	65,865	-	-	65,865	-	-	65,865
2024	68,727	17,070	24.8	85,797	17,070	24.8	85,797
2025	71,740	41,669	58.1	113,408	41,669	58.1	113,408
2026	74,734	54,560	73.0	129,295	54,560	73.0	129,295
2027	78,112	63,139	80.8	141,251	63,139	80.8	141,251
2028	81,592	67,703	83.0	149,295	67,703	83.0	149,295
2029	85,291	70,702	82.9	155,993	70,702	82.9	155,993
2030	89,269	73,918	82.8	163,187	73,918	82.8	163,187
2031	93,386	77,376	82.9	170,763	95,794	102.6	189,180
2032	97,737	81,030	82.9	178,767	104,456	106.9	202,193
2033	102,222	84,749	82.9	186,971	113,381	110.9	215,603
2034	106,948	88,558	82.8	195,506	120,633	112.8	227,581
2035	111,914	92,485	82.6	204,399	126,615	113.1	238,528
2036	116,677	96,795	83.0	213,472	132,424	113.5	249,101
2037	121,263	101,568	83.8	222,832	138,795	114.5	260,059
2038	125,981	106,845	84.8	232,825	145,822	115.7	271,802
2039	130,740	112,177	85.8	242,917	152,775	116.9	283,515
2040	135,687	117,585	86.7	253,272	159,861	117.8	295,548
2041	140,833	123,237	87.5	264,070	167,398	118.9	308,230
2042	146,352	129,409	88.4	275,760	175,569	120.0	321,921
2043	152,446	136,213	89.4	288,659	184,467	121.0	336,913
2044	158,560	143,034	90.2	301,594	193,517	122.0	352,077
2045	164,599	150,088	91.2	314,687	202,943	123.3	367,542
2046	169,824	155,780	91.7	325,604	210,357	123.9	380,181
2047	174,095	159,796	91.8	333,891	215,673		389,768
	•			•		123.9	•
2048	178,336	163,657	91.8	341,992	220,900	123.9	399,236
2049	182,703	167,649	91.8	350,353	226,331	123.9	409,034
2050	187,193	171,916	91.8	359,110	232,108	124.0	419,301
2051	191,794	176,205	91.9	367,998	237,863	124.0	429,657
2052	196,364	180,596	92.0	376,960	243,620	124.1	439,984
2053	200,993	184,995	92.0	385,989	249,526	124.1	450,519
2054	205,828	189,390	92.0	395,218	255,573	124.2	461,401
2055	210,871	194,085	92.0	404,956	261,890	124.2	472,761
2056	216,011	198,866	92.1	414,877	268,332	124.2	484,343
2057	221,095	203,489	92.0	424,585	274,559	124.2	495,655
2058	226,446	208,410	92.0	434,855	281,164	124.2	507,610
Average	Annual Percent Ch	nange					
2019-25	5.2%			13.6%			13.6%
2025-35	4.5%			6.1%			7.7%
2035-45	3.9%			4.4%			4.4%
2045-55	2.5%			2.6%			2.5%
2025-55	3.7%			4.3%			4.9%

<sup>(1)</sup> Represents total collected revenue after leakage and fee revenue



## Appendix A

Volume Calibration Results by Time Period and Direction on Screenlines



Appendix A
Volume Calibration Results by Time Period and Direction on Screenlines

				AM			PM			MD			NT	
Screen-			Observed	Modeled	Percent	Observed	Modeled	Percent	Observed	Modeled	Percent	Observed	Modeled	Percent
line	Roadname	Dir.	Count	Volume	Difference	Count	Volume	Difference	Count	Volume	Difference	Count	Volume	Difference
1	S. New Hope Rd	NB	2,710	2,261	-17%	2,305	2,035	-12%	2,146	2,380	11%	1,448	1,355	-6%
1	S. New Hope Rd	SB	1,920	1,981	3%	3,174	2,680	-16%	2,195	2,507	14%	1,530	1,589	4%
1	Barwell Rd	NB	718	503	-30%	948	1,006	6%	679	750	10%	540	399	-26%
1	Barwell Rd	SB	803	960	20%	1,034	768	-26%	723	807	12%	523	435	-17%
1	Auburn Knightdale Rd	NB	373	627	68%	479	729	52%	412	563	37%	194	252	30%
1	Auburn Knightdale Rd	SB	405	547	35%	514	815	58%	394	590	50%	157	234	49%
1	Mial Plantation Rd	NB	800	988	24%	669	970	45%	532	845	59%	271	325	20%
1	Mial Plantation Rd	SB	581	828	42%	933	1,112	19%	567	811	43%	270	379	40%
2	White Oak Rd (NC 2547)	NB	3,098	2,716	-12%	1,513	1,530	1%	2,057	2,282	11%	671	705	5%
2	White Oak Rd (NC 2547)	SB	983	1,044	6%	2,910	2,901	0%	2,088	2,240	7%	1,088	1,091	0%
2	1-40	NB	7,456	7,842	5%	14,797	15,109	2%	13,401	13,932	4%	9,306	9,255	-1%
2	1-40	SB	12,878	13,886	8%	10,694	10,046	-6%	14,269	14,402	1%	7,314	7,291	0%
2	Raynor Rd (NC 2555)	NB	1,442	1,536	7%	383	899	135%	549	975	78%	302	448	48%
2	Raynor Rd (NC 2555)	SB	256	669	161%	1,045	1,367	31%	597	882	48%	348	511	47%
2 2	Guy Rd (NC 2558) Guy Rd (NC 2558)	NB SB	1,930	1,652 412	-14% 20%	657 1,986	825 1,770	26% -11%	791 835	1,022 953	29% 14%	412 685	373 622	-10% -9%
2	I-40	NB	345 8,963	9,478	6%	7,799	7,767	-11%	10,391	10,706	3%	5,516	5,407	-9%
2	1-40	SB	5,410	5,534	2%	11,595	10,712	-8%	10,331	9,998	-2%	7,111	6,707	-6%
3	Timber Dr.	EB	1,202	1,532	27%	4,250	3,614	-15%	2,709	2,825	4%	1,241	1,250	1%
3	Timber Dr.	WB	3,415	3,499	2%	1,990	2,803	41%	2,664	3,605	35%	969	1,077	11%
3	Buffalo Rd.	EB	289	140	-51%	558	302	-46%	488	150	-69%	231	96	-58%
3	Buffalo Rd.	WB	329	264	-20%	449	212	-53%	429	192	-55%	147	100	-32%
3	Ten Ten Rd.	EB	1,076	1,006	-7%	2,446	2,082	-15%	2,025	1,904	-6%	961	1,041	8%
3	Ten Ten Rd.	WB	1,991	1,948	-2%	1,592	1,441	-9%	1,910	1,701	-11%	817	825	1%
3	Pagan Rd	EB	233	149	-36%	297	434	46%	213	280	31%	101	110	9%
3	Pagan Rd	WB	293	330	13%	234	195	-17%	247	203	-18%	102	98	-4%
3	Rock Service Station Rd	NB	1,000	581	-42%	372	389	5%	434	485	12%	189	196	4%
3	Rock Service Station Rd	SB	316	225	-29%	943	591	-37%	516	469	-9%	282	278	-1%
3	NC 42	EB	1,127	1,127	0%	1,738	1,612	-7%	1,567	1,413	-10%	737	778	5%
3	NC 42	WB	1,452	1,375	-5%	1,471	1,333	-9%	1,526	1,390	-9%	801	861	7%
4	US 401	NB	6,348	7,441	17%	4,091	4,268	4%	5,616	5,725	2%	2,184	2,279	4%
4	US 401	SB	3,576	3,171	-11%	6,797	6,847	1%	5,304	4,817	-9%	2,553	2,559	0%
4	Ten Ten Rd	EB	1,161	1,185	2%	3,630	3,404	-6%	2,933	2,683	-9%	1,536	1,611	5%
4	Ten Ten Rd	WB	3,181	3,466	9%	1,953	1,997	2%	2,589	2,631	2%	944	977	3%
4	Banks Rd	EB	455	402	-12%	1,367	881	-36%	752	644	-14%	423	243	-43%
4	Banks Rd	WB	1,682	882	-48%	774	486	-37%	783	405	-48%	335	192	-43%
5	Penny Rd Penny Rd	EB WB	609	498	-18% -19%	2,535	1,973	-22%	1,252	1,019	-19% -20%	675	631 352	-7%
5	Ten Ten Rd	EB	2,013 1,967	1,630 2,204	12%	1,033 3,325	922 4,026	-11% 21%	1,345 3,061	1,083 3,661	20%	356 1,371	1,666	-1% 22%
5	Ten Ten Rd	WB	2,890	3,693	28%	2,437	2,967	21%	3,260	3,821	17%	1,091	1,223	12%
5	Optimist Farm Rd	EB	1,174	1,987	69%	1,839	1,331	-28%	1,137	1,391	22%	489	576	18%
5	Optimist Farm Rd	WB	1,705	1,166	-32%	1,406	1,674	19%	1,376	1,429	4%	476	562	18%
5	Hilltop Needmore Rd	EB	1,400	1,350	-4%	1,493	1,359	-9%	1,322	1,199	-9%	523	530	1%
5	Hilltop Needmore Rd	WB	1,066	1,095	3%	1,539	1,299	-16%	1,303	1,131	-13%	619	546	-12%
6	New Hill Holleman Rd	NB	1,898	2,511	32%	434	557	28%	526	695	32%	227	170	-25%
6	New Hill Holleman Rd	SB	311	280	-10%	1,738	2,248	29%	583	704	21%	209	255	22%
6	Holly Springs Rd	NB	425	696	64%	394	363	-8%	273	415	52%	117	71	-39%
6	Holly Springs Rd	SB	294	180	-39%	451	657	46%	306	297	-3%	113	252	123%
6	Old Holly Springs Apex Rd	NB	1,187	1,558	31%	444	642	45%	444	720	62%	131	185	41%
6	Old Holly Springs Apex Rd	SB	245	316	29%	1,305	1,347	3%	448	638	42%	185	260	41%
6	NC 540 / Triangle Expressway	NB	4,748	5,343	13%	1,682	1,751	4%	1,829	2,350	28%	767	906	18%
6	NC 540 / Triangle Expressway	SB	1,332	1,237	-7%	4,035	4,879	21%	2,098	2,223	6%	1,337	1,042	-22%
6	NC 55	NB	7,859	6,702	-15%	5,266	5,767	10%	7,185	7,731	8%	3,438	3,613	5%
6	NC 55	SB	3,829	3,318	-13%	8,581	6,055	-29%	7,290	6,617	-9%	4,082	4,324	6%
6	Ten Ten Rd	NB	4,172	3,297	-21%	3,416	2,442	-29%	4,371	3,339	-24%	1,576	1,434	-9%
6	Ten Ten Rd	SB	2,327	1,339	-42%	4,555	3,272	-28%	3,744	2,740	-27%	1,846	1,527	-17%
7	Davis Dr.	NB	5,232	4,460	-15%	4,059	3,913	-4%	4,242	4,488	6%	2,048	2,073	1%
7	Davis Dr.	SB	2,748	2,987	9%	6,252	4,677	-25%	4,312	4,600	7%	1,670	2,104	26%
7	Louis Stephenson Dr.	NB	423	487	15%	619	161	-74%	509	183	-64%	164	44	-73%
7	Louis Stephenson Dr.	SB NB	305	190	-38%	685	493	-28%	467	242	-48% 10%	195	58	-70%
1 '	NC 55		5,375	4,813	-10%	4,256	4,319	1%	4,526	4,968		2,112	2,148	2%
7	NC 55	SB NB	3,195 8 205	3,519 <b>8,267</b>	10%	5,800 <b>3,198</b>	5,154	-11% <b>13%</b>	4,397 3 512	5,063	15% <b>22%</b>	1,705	2,303	35% <b>12%</b>
7	NC 540 / Triangle Expressway NC 540 / Triangle Expressway	SB	8,205 2,307	2,650	1% 15%	3,198 8,736	3,626 8,396	-4%	3,512 3,575	4,282 4,307	22%	1,371 2,390	1,532 2,161	-10%
7	Green Level Church Rd	NB NB	981	1,113	13%	8,736 1,586	1,056	-4% -33%	1,138	1,010	-11%	2,390 581	<b>2,161</b> 487	-10% -16%
7	Green Level Church Rd	SB	1,202	946	-21%	1,718	1,338	-33%	1,138	1,010	-11%	429	487	16%
7	White Oak Church Rd	NB	103	119	16%	1,718	168	10%	90	1,030	66%	30	69	130%
7	White Oak Church Rd	SB	135	172	28%	114	162	42%	101	154	52%	18	74	310%
7	Green Level Rd	EB	151	291	92%	213	402	89%	138	297	116%	55	89	61%
7	Green Level Rd	WB	175	296	69%	239	450	88%	141	315	123%	43	70	63%
7	NC 751	NB	1,495	1,650	10%	931	1,166	25%	906	1,151	27%	303	285	-6%
7	NC 751	SB	785	796	1%	1,772	1,673	-6%	1,050	1,196	14%	376	502	34%
8	NC 55 (Apex Highway)	NB	5,400	4,129	-24%	2,775	2,969	7%	3,124	3,098	-1%	1,350	1,191	-12%
8	NC 55 (Apex Highway)	SB	1,985	1,594	-20%	4,890	4,069	-17%	2,989	2,676	-10%	1,555	1,381	-11%
8	Louis Stephens Dr.	NB	565	462	-18%	1,324	129	-90%	715	70	-90%	173	33	-81%
8	Louis Stephens Dr.	SB	1,215	101	-92%	562	279	-50%	710	65	-91%	125	41	-67%
8	Davis Dr.	NB	5,007	5,023	0%	3,130	4,261	36%	3,055	3,587	17%	946	1,352	43%
	Davis Dr.	SB	2,773	3,393	22%	4,736	4,762	1%	2,860	3,685	29%	1,026	1,878	83%
	NC 147/Triangle Expressway	NB	4,504	6,380	42%	2,132	2,501	17%	1,767	2,503	42%	616	1,038	68%
	NC 147/Triangle Expressway	SB	1,131	1,904	68%	5,354	6,593	23%	1,835	2,499	36%	1,123	1,336	19%
	NC 54	NB	3,938	2,292	-42%	2,979	2,112	-29%	3,900	2,540	-35%	1,471	1,065	-28%
	NC 54	SB	1,752	2,087	19%	4,393	2,830	-36%	3,482	2,531	-27%	1,121	1,002	-11%
8	Airport Blvd Airport Blvd	NB	1,812	2,634	45%	3,508	4,034	15%	3,670	4,213	15%	1,535	1,635	7%
8		SB	5,456	4,942	-9%	2,591	3,454	33%	4,068	4,683	15%	1,583	1,921	21%

Appendix A (continued)
Volume Calibration Results by Time Period and Direction on Screenlines

				AM			PM			MD			NT	
Screen-			Observed	Modeled	Percent	Observed	Modeled	Percent	Observed	Modeled	Percent	Observed	Modeled	Percent
line	Roadname	Dir.	Count	Volume	Difference	Count	Volume	Difference	Count	Volume	Difference	Count	Volume	Differenc
9A	1-40	EB	21,828	19,663	-10%	27,273	25,529	-6%	29,452	27,849	-5%	14,881	15,863	7%
9A 9A	I-40 NC 54	WB EB	26,475 1,071	24,564 835	-7% -22%	22,909 2,110	22,222 744	-3% -65%	28,524 1,801	28,826 1,087	1% -40%	14,269 583	13,987 264	-2% -55%
9A	NC 54	WB	1,579	646	-59%	2,499	1,036	-59%	1,801	972	-51%	522	269	-48%
9A	Davis Dr.	NB	4,719	3,294	-30%	2,622	2,175	-17%	2,594	1,922	-26%	677	700	3%
9A	Davis Dr.	SB	2,236	1,684	-25%	4,316	2,917	-32%	2,331	1,839	-21%	997	1,307	31%
9A	Hopson Rd	EB	2,074	1,687	-19%	1,273	969	-24%	1,338	1,393	4%	419	409	-2%
9A	Hopson Rd	WB	1,159	594	-49%	2,374	1,710	-28%	1,388	1,146	-17%	573	530	-7%
9A	NC 55	NB	7,367	5,769	-22%	4,093	3,449	-16%	4,697	4,200	-11%	1,864	1,817	-3%
9A	NC 55	SB	3,004	1,909	-36%	6,906	4,987	-28%	4,259	2,831	-34%	2,266	1,981	-13%
9A	Green Hope School Rd	EB	733	695	-5%	1,041	674	-35%	745	730	-2%	312	262	-16%
9A	Green Hope School Rd	WB	640	535	-16%	1,170	702	-40%	739	696	-6%	357	243	-32%
9A	Green Level West Rd	EB	1,367	1,262	-8%	2,150	1,797	-16%	1,299	1,146	-12%	397	321	-19%
9A	Green Level West Rd	WB	1,429	1,617	13%	1,518	1,534	1%	1,298	1,208	-7%	480	380	-21%
9A	US 64	EB	6,837	6,177	-10%	7,282	5,881	-19%	7,096	7,012	-1%	2,184	2,283	5%
9A	US 64	WB	5,315	4,502	-15%	7,826	6,046	-23%	7,164	6,417	-10%	2,843	2,955	4%
9A	Old US Highway 1	NB	992	803	-19%	1,292	715	-45%	1,150	654	-43%	297	406	37%
9A	Old US Highway 1	SB	1,075	747	-31%	1,138	1,007	-11%	1,134	798	-30%	367	582	59%
9A	NC 55	NB	4,950	4,336	-12%	4,202	4,586	9%	4,722	4,965	5%	2,267	2,551	13%
9A	NC 55	SB	3,052	2,696	-12%	4,891	4,032	-18%	4,310	4,375	2%	2,616	2,771	6%
9B	Green Level West Rd	EB	976	813	-17%	1,161	791	-32%	962	756	-21%	258	177	-31%
9B	Green Level West Rd	WB	611	533	-13%	1,211	992	-18%	919	768	-16%	386	392	1%
9B	US 64	EB	3,947	3,344	-15%	4,083	3,533	-13%	3,825	3,338	-13%	1,237	1,142	-8%
9B	US 64	WB	3,584	2,961	-17%	4,685	3,704	-21%	4,157	3,316	-20%	1,547	1,456	-6%
9B 9B	Olive Chapel Rd	EB WB	688 598	845 470	23% -21%	821 846	767 971	-7% 15%	736	831 874	13% 15%	208 318	381 549	83% 73%
9B	Olive Chapel Rd	NB NB	4,096	3,258	-21%	2,328	2,549	15% 9%	763 2,993	3,370	15%	318 964	992	73% 3%
9C 9C	Holly Springs Rd Holly Springs Rd	SB	1,539	3,258 1,721	-20% 12%	2,328 4,030	2,549 3,184	-21%	2,993 3,352	3,370 3,479	13% 4%	1,475	1,881	3% 28%
9C	Bells Lake Rd	NB	1,539	1,721	41%	575	936	63%	767	1.171	53%	257	344	34%
9C	Bells Lake Rd	SB	339	511	51%	1,418	1,770	25%	811	1,171	47%	468	642	37%
9C	Johnson Pond Rd	NB	188	982	423%	1,418	430	-61%	439	537	22%	283	134	-53%
9C	Johnson Pond Rd	SB	1,015	214	-79%	335	1,099	228%	469	429	-9%	175	191	9%
9C	Lake Wheeler Rd	NB	1,592	1,839	16%	672	428	-36%	890	575	-35%	402	270	-33%
9C	Lake Wheeler Rd	SB	601	270	-55%	1,990	1,550	-22%	1,012	658	-35%	543	402	-26%
9C	US 401	NB	5,560	6,000	8%	4,019	4,239	5%	6,104	5,915	-3%	2,150	2,282	6%
9C	US 401	SB	2,075	2,957	43%	2,731	5,633	106%	2,624	4,278	63%	768	1,483	93%
9C	Fanny Brown Rd	NB	926	1,724	86%	450	940	109%	611	1,137	86%	259	384	48%
9C	Fanny Brown Rd	SB	215	483	124%	1,036	1,577	52%	728	1,165	60%	518	662	28%
9C	Old Stage Rd	NB	727	1,172	61%	2,136	1,263	-41%	1,283	1,214	-5%	797	657	-18%
9C	Old Stage Rd	SB	1,946	1,115	-43%	1,068	1,425	33%	1,298	1,012	-22%	554	596	8%
9C	Sauls Rd	NB	997	441	-56%	492	408	-17%	579	482	-17%	214	170	-20%
9C	Sauls Rd	SB	305	286	-6%	890	488	-45%	608	455	-25%	377	229	-39%
9C	Jordan Rd	NB	453	491	8%	211	356	68%	246	423	72%	102	141	38%
9C	Jordan Rd	SB	125	187	50%	449	590	31%	275	396	44%	182	205	13%
9C	NC 50	NB	2,792	2,410	-14%	1,956	2,095	7%	2,211	2,448	11%	971	904	-7%
9C	NC 50	SB	1,154	1,309	13%	3,326	2,518	-24%	2,479	2,289	-8%	1,286	1,213	-6%
9D	White Oak Rd	NB	3,267	2,288	-30%	966	1,160	20%	1,206	1,434	19%	527	411	-22%
9D	White Oak Rd	SB	444	585	32%	2,478	2,352	-5%	1,380	1,164	-16%	798	664	-17%
9D	Rock Quarry Road	EB	377	743	97%	1,217	1,732	42%	650	1,205	85%	368	582	58%
9D	Rock Quarry Road	WB EB	1,050	1,525	45%	594	1,094	84%	623	1,199	92% -2%	306	388	27%
9D 9D	Poole Rd (NC 2555)	WB	692	574	-17% 1%	2,272	2,389	5%	1,199	1,178	-,-	779	750	-4%
9E	Poole Rd (NC 2555) I-40	EB	2,383 12,366	2,415 13,777	11%	950 16,295	1,103 18,220	16% 12%	1,113 16,900	1,247 17,997	12%	551 9,374	513 9,476	-7% 1%
9E	1-40	WB	15,548	18,022	16%	12,699	14,365	13%	15,875	16,986	7%	9,374 8,079	9,476 8,444	1% 5%
9F	NC 55	NB	8,832	8,724	-1%	4,508	4,922	9%	6,355	6,615	4%	2,740	3,093	13%
9F	NC 55	SB	3,588	2,979	-17%	8,622	7,496	-13%	6,792	5,897	-13%	3,522	3,450	-2%
9F	Main St	NB	2,412	2,269	-6%	1,981	1,928	-3%	2,086	2,458	18%	1,022	960	-6%
9F	Main St	SB	1,194	1,291	8%	3,241	2,177	-33%	1,999	2,085	4%	1,152	1,174	2%
9F	US 1	NB	12,954	13,138	1%	10,547	10,656	1%	11,815	12,316	4%	4,754	4,922	4%
9F	US 1	SB	7,631	7,259	-5%	12,719	12,217	-4%	11,314	11,033	-2%	7,446	7,220	-3%
9F	US 64	NB	6,844	5,632	-18%	7,849	7,138	-9%	9,217	8,615	-7%	3,478	3,748	8%
9F	US 64	SB	6,957	7,008	1%	7,593	6,579	-13%	9,264	8,811	-5%	3,081	3,245	5%
9F	NC 55	NB	4,693	3,747	-20%	4,640	3,857	-17%	5,224	4,772	-9%	2,261	2,319	3%
9F	NC 55	SB	3,289	3,374	3%	5,109	4,238	-17%	5,212	4,713	-10%	1,928	1,884	-2%
9F	Davis Dr.	NB	2,184	2,420	11%	2,041	2,380	17%	1,964	3,009	53%	892	1,333	49%
9F	Davis Dr.	SB	1,567	2,034	30%	2,856	2,641	-8%	2,250	3,025	34%	875	1,440	65%
9F	Davis Dr.	NB	5,943	4,729	-20%	2,306	2,454	6%	3,270	3,096	-5%	1,268	1,277	1%
9F	Davis Dr.	SB	1,710	2,084	22%	6,330	4,462	-30%	3,600	3,454	-4%	1,296	1,671	29%
9F	Church St	NB	805	672	-17%	1,372	1,167	-15%	1,012	1,023	1%	748	640	-14%
9F	Church St	SB	1,170	1,113	-5%	1,942	929	-52%	1,104	997	-10%	451	488	8%
9F	NC 54	NB	2,654	2,811	6%	2,342	2,763	18%	3,242	3,558	10%	1,306	1,825	40%
9F	NC 54	SB	1,685	2,233	33%	2,239	2,740	22%	2,824	3,486	23%	1,381	1,969	43%
	L.,				F 50/			•						
1	Total		8,310	8,696	- 5%	10,056	10,115	_ 1%	7,648	9,254	21%	4,933	4,967	1%
2	Total		42,761	44,769	5%	53,379	52,925	-1%	55,148	57,392	4%	32,753	32,409	-1%
3	Total		12,723	12,176	-4%	16,340	15,008	-8%	14,728	14,616	-1%	6,578	6,712	2%
4	Total		16,403	16,547	1%	18,612	17,882	-4%	17,977	16,905	-6%	7,975	7,862	-1%
5	Total		12,824	13,623	6%	15,607	15,551	0%	14,056	14,732	5%	5,600	6,086	9%
6	Total		28,627	26,775	-6%	32,301	29,977	-7%	29,097	28,468	-2%	14,028	14,039	0%
7	Total		32,817	32,755	0%	40,330	37,153	-8%	30,342	33,461	10%	13,490	14,495	7%
8	Total		35,538 248,364	34,940 235,448	-2% -5%	38,374 278,612	37,993 260,104	-1% -7%	32,175 276,643	32,150 273,945	0% -1%	12,624 126,253	13,874 131,643	10% 4%
9	Total													



#### **APPENDIX C**

# OPERATIONS AND MAINTENANCE EXPENSE GUARANTY AGREEMENT AND CONSTRUCTION COMPLETION ASSURANCE AND STANDBY RENEWAL AND REPLACEMENT FUNDING AGREEMENT



#### OPERATING AND MAINTENANCE EXPENSE GUARANTY AGREEMENT

Dated as of 10 . 20, 2008

by and between

#### NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

and

NORTH CAROLINA TURNPIKE AUTHORITY

#### OPERATING AND MAINTENANCE EXPENSE GUARANTY AGREEMENT

THIS OPERATING AND MAINTENANCE EXPENSE GUARANTY AGREEMENT, dated as of a 2008, by and between the NORTH CAROLINA DEPARTMENT OF TRANSPORTATION ("NCDOT"), a department of the State of North Carolina duly organized and existing pursuant to Section 143B-345 et seq. of the North Carolina General Statutes, as amended, and the NORTH CAROLINA TURNPIKE AUTHORITY ("NCTA"), a body politic and corporate and a public agency of the State of North Carolina duly organized and existing pursuant to Article 6H of Chapter 136 of the North Carolina General Statutes, as amended (the "Enabling Act");

#### WITNESSETH:

WHEREAS, the General Assembly of North Carolina has created NCTA to study, plan, develop, design, establish, purchase, construct and operate and maintain Turnpike Projects (as defined in the Enabling Act) in the State;

WHEREAS, Section 136-89.183 of the Enabling Act provides that NCDOT and NCTA may enter into partnership agreements for purposes of financing the costs of acquiring, constructing, equipping, operating or maintaining any Turnpike Project;

WHEREAS, Section 136-89.191 of the Enabling Act provides that NCDOT may participate in the cost of preconstruction activities, construction, maintenance or operation of a Tumpike Project;

WHEREAS, Section 136-18(39) of the North Carolina General Statutes authorizes NCDOT to enter into partnership agreements with the NCTA to finance the cost of equipping, maintaining, and operating transportation infrastructure in the State;

WHEREAS, the Authority is undertaking a Turnpike Project located in Wake County and Durham County known as the "Triangle Expressway Project" as more fully described in Section 1 of the Project Specific Agreement for Triangle Expressway, dated March 6, 2008, between NCDOT and NCTA (the "Project"), and intends to finance the cost of acquisition, construction and equipping of the Project with revenue bonds issued by the Authority and other indebtedness incurred by the Authority pursuant to the Enabling Act and The State and Local Government Revenue Bond Act, Article 5 of Chapter 159 of the General Statutes of North Carolina, as amended; and

WHEREAS, NCDOT desires to support the financial viability of the Project and the financing thereof, and to this end has determined to guaranty the payment of Operating and Maintenance Expenses (hereinafter defined) of the Project in order to (a) assure the purchasers and owners of revenue bonds and other indebtedness issued or incurred to finance the Project that the first use of the revenues of the Project will be used to pay the debt service with respect to such bonds and other indebtedness and to maintain required reserves prior to the payment of Operating and Maintenance Expenses, subject to the terms of this Agreement, and (b) assure

NCTA that at all times there will be sufficient funds available to pay Operating and Maintenance Expenses of the Project;

**NOW THEREFORE**, the parties hereto, each in consideration of the promises and undertakings of the other as hereinafter provided, **DO HEREBY** covenant and mutually agree as follows:

Section 1. <u>Definitions</u>. In addition to the meanings of certain capitalized terms as set forth in the recitals set forth above, the following terms shall have the following meanings in this Agreement:

"Agreement" means this Operating and Maintenance Expense Guaranty Agreement, as the same may be supplemented or amended from time to time.

"Credit Facility" means a line of credit, letter of credit, standby bond purchase agreement or similar liquidity or credit facility established or obtained in connection with the incurrence of any Indebtedness.

"Credit Provider" means the entity providing a Credit Facility.

"Debt Service Reserve Fund" means a debt service reserve fund or account created by the Trust Agreement or any other documentation relating to Indebtedness of NCTA as a reserve to provide funds to pay principal of or interest on Indebtedness authorized thereby if insufficient Receipts are available for such payment. The Trust Agreement or such other documentation may establish one or more of such fund funds for this purpose, each of which shall be a "Debt Service Reserve Fund" for purposes of this Agreement.

"Debt Service Reserve Fund Requirement" means, as of the time of any calculation, the aggregate amounts then required to be placed or maintained in any Debt Service Reserve Fund. In the event that the Trust Agreement or other documentation relating to Indebtedness provides that a withdrawal of funds from a Debt Service Reserve Fund is to be replenished over a period of time, or additional funding of such Debt Service Reserve Fund is otherwise required to be made over a period of time, the term "Debt Service Reserve Fund Requirement" as used herein means only the amount required to be on deposit at the time of the calculation.

"Debt Service Requirement" means, for any period for which such determination is made, the aggregate of the required deposits to be made by NCTA to one or more corporate trustees or other entities in respect of principal (whether at maturity or pursuant to a sinking fund redemption or otherwise) or interest (whether or not separately stated) on Indebtedness during such period; including directly to the holders of Indebtedness, such as the United States Department of Transportation. Notwithstanding the foregoing, Indebtedness does not include, for purposes of this Agreement, any amounts owed to NCDOT pursuant to this Agreement.

"General Engineering Consultant" means any independent engineer or independent firm of engineers of favorable reputation retained by NCTA to assist NCTA in assessing the status of maintenance and upkeep of the Project, the costs associated therewith and the expected cost of unusual or extraordinary maintenance, repairs, renewals or replacements or capital improvements

related to the Project, and advising NCTA regarding the level of reserves that should be maintained to assure that funds will be available when needed for that purpose.

"General Reserve Fund" means the fund created under the Trust Agreement that shall be the repository for the deposit of Receipts that are not required to be used to pay or fund the Debt Service Requirement, the Debt Service Reserve Fund Requirement, the Operating Reserve Fund Requirement or the Renewal and Replacement Reserve Fund Requirement or be deposited in the Operations and Maintenance Expense Fund.

"Indebtedness" means all obligations incurred or assumed by the NCTA in connection with the ownership or operation of the Project:

- (a) for payments of principal and interest with respect to borrowed money, including any obligation to repay a Credit Provider for moneys drawn to pay and retire or purchase Indebtedness; and
- (b) for payments under leases which are required to be capitalized in accordance with generally accepted accounting principles and under installment or lease purchase or conditional sale contracts;

provided, however, that Indebtedness shall include only such obligations as are secured by Receipts.

"Operating and Maintenance Expenses" means the NCTA's cash expenses, exclusive of all and any such like expenses capitalized as Project costs, for the operation, maintenance and repair of the Project, including, without limiting the generality of the foregoing,

- (a) expenses of repair and maintenance of the Project, including periodic roadway resurfacing and repair, replacement of toll collection, vehicle identification, toll integration and video enforcement equipment and all administrative and engineering expenses relating to repair and maintenance of the Project,
  - (b) expenses for toll collection,
- (c) salaries and other compensation of NCTA personnel allocable to the operation of the Project,
- (d) operating lease payments, for property, plant and equipment needed for the operation of the Project,
- (e) insurance premiums and expenses, including deposits of reserves required for additional self-insurance, infrastructure replacement, or business interruption coverage required by bond covenants and subject to review by the Risk Management Division of the North Carolina Department of Insurance,
- (f) engineering and consulting expenses relating to the operation, maintenance or repair of the Project, including engineering certifications required pursuant to this Agreement,

- (g) fees and expenses of the bond trustees, registrars and paying agents, and fees and expenses for similar services with respect to the Project;
  - (h) expenses for incident response;
  - (i) costs of legal services relating to Project management and operation;
  - (j) expenses of marketing, promotion and advertising relating to the Project; and
- (k) fees and expenses otherwise required or permitted to be paid by the NCTA under the provisions of the Trust Agreement, by any other documentation relating to Indebtedness or by law for management and operation of the Project;

but Operating and Maintenance Expenses shall not include

- (a) deposits to the Renewal and Replacement Reserve Fund or any other reserves for extraordinary replacements or repairs,
  - (b) any allowance for depreciation or amortization of financing expense;
- (c) payments made by NCTA or the Trustee to any reserve accounts under the Trust Agreement, any expenses of Extraordinary Maintenance and Repair, or any payments of Debt Service; and
- (d) Project costs and expenses of any nature not directly required for the Project, such as operating expenses included in the Annual Plan of Work or Project costs payable from bond proceeds including, but not limited to: administrative office space, supplies, equipment, telephone and other communications service fees; administrative salaries and wages, and travel expenses; bond financing, insurance and legal fees; and like expenses properly allocable to other NCTA turnpike projects.

"Operating Reserve Fund" means the fund or funds created pursuant to the Trust Agreement as a reserve for the payment of Operating and Maintenance Expenses in the event that Receipts are not sufficient for such purpose.

"Operating Reserve Fund Requirement" means, as of the time of calculation, the maximum aggregate amounts required by the Trust Agreement to be set aside in the Operating Reserve Fund as a reserve to fund Operating and Maintenance Expenses in the event that Receipts are not sufficient for such purpose; provided, however, that the Operating Reserve Fund Requirement may not exceed at any time one-fourth (1/4) of the Operating and Maintenance Expenses for the Project for the current Fiscal Year as set forth in the Annual Budget.

"Operations and Maintenance Expense Fund" means the fund or funds created pursuant to the Trust Agreement pursuant to which deposits are to be made from Receipts to pay Operating and Maintenance Expenses.

"Project" has the meaning given such term in the preambles to this Agreement.

"Receipts" means all receipts, revenues, income, proceeds and money received in any period by or for the NCTA in respect of the Project, including, but without limiting the generality of the foregoing,

- (a) all toll payments, proceeds, fees, charges and rents,
- (b) any proceeds of use and occupancy or business interruption insurance, and
- (c) payments from the State of North Carolina received by NCTA to the extent that such payments have been pledged to pay Indebtedness and other obligations of NCTA pursuant to the terms of the Trust Agreement.

"Renewal and Replacement Reserve Fund" means the fund created by the Trust Agreement as a reserve to provide funds to pay the costs of maintenance, repair, renewal, reconstruction or replacement of any portion of component of the Project of a type which is not normally included as an annually recurring cost in the NCTA's Annual Budget for the Project.

"Renewal and Replacement Reserve Fund Requirement" means, as of the time of any calculation, the aggregate amount then required to be placed or maintained in the Renewal and Replacement Reserve Fund by the Trust Agreement.

"State" means the State of North Carolina.

"Trust Agreement" means the Master Trust Agreement, to be executed between NCTA and the Trustee, as the same may be supplemented and amended from time to time, or any similar instrument entered into or adopted by the NCTA that provides for the issuance or incurrence of Indebtedness and contains the terms regarding the collection and disposition of Receipts.

"Trustee" means the Trustee service as such or any successor Trustee under the provisions of the Trust Agreement.

- Section 2. <u>Guaranty of Payment of Operating and Maintenance Expenses</u>. (a) NCTA shall provide in the Trust Agreement or any other documentation pursuant to which any Indebtedness is incurred that the Receipts shall be set aside as received and applied on or prior to the last day of each month in the following order of priority:
  - (i) for the payment of the Debt Service Requirement on Indebtedness then due and payable;
  - (ii) to any Debt Service Reserve Fund for Indebtedness so that the amount in each such Debt Service Reserve Fund equals the Debt Service Reserve Fund Requirement;
  - (iii) to the Renewal and Replacement Reserve Fund so that the amount in the Renewal and Replacement Reserve Fund equals the Renewal and Replacement Reserve Fund Requirement;

- (iv) to the Operations and Maintenance Expense Fund so that the amount in the Operations and Maintenance Expense Fund is equal to the Operating and Maintenance Expenses budgeted for the next succeeding month as set forth in the Annual Budget; and
- (v) to the Operating Reserve Fund so that the amount in the Operating Reserve Fund equals the Operating Reserve Fund Requirement;
- (vi) to NCDOT any amounts necessary to reimburse NCDOT for payments made by NCDOT to NCTA pursuant to this Agreement, interest thereon at the rates and in the manner specified in this Agreement; and
- (vii) the balance, if any, to the General Reserve Fund for uses as provided in the Trust Agreement.

Notwithstanding the foregoing, NCTA may change the order of priority for required deposits of Receipts to fund the Debt Service Requirement or the Debt Service Reserve Fund Requirement, for one class of Indebtedness from another class of Indebtedness in order to provide that selected classes of Indebtedness, and the deposit to a Debt Service Reserve Fund in connection therewith, is senior or subordinate to other Indebtedness, or is payable prior to or after the deposit of any Receipts to fund the Renewal and Replacement Reserve Fund Requirement, and may also provide that deposits of any Debt Service Requirement or Debt Service Reserve Fund Requirement with respect to any Indebtedness may be made after deposits to the Operations and Maintenance Expense Fund and the Operating Reserve Fund.

(b) The Authority shall provide in the Trust Agreement that Operating and Maintenance Expenses are to be paid as due from the Operations and Maintenance Expense Fund. If at any time amounts in the Operations and Maintenance Expense Fund shall not be sufficient to make the required payments, then the Trust Agreement shall provide that a transfer shall be made from the Operating Reserve Fund to the Operations and Maintenance Expense Fund in the amount of such deficiency to the extent that amounts on deposit in the Operating Reserve Fund are available for such purpose. Subject to the availability of funds as provided in subsection (c) below, NCDOT hereby guarantees to NCTA that NCDOT will pay to, or on behalf of, NCTA (i) the amount necessary to replenish the Operating Reserve Fund for any transfers so made to the Operations and Maintenance Expense Fund from amounts held in the Operating Reserve Fund up to the Operating Reserve Fund Requirement at the time the transfer is so made and (ii) the amount required to he transferred from the Operating Reserve Fund to the Operations and Maintenance Expense Fund pursuant to the Trust Agreement (up to the Operating Reserve Fund Requirement at the time such transfer is required by the Trust Agreement) to the extent that there are not sufficient Receipts held in the Operating Reserve Fund for such purpose. Payments to NCTA shall be paid hy NCDOT upon sixty (60) days' written notice from NCTA (or by the Trustee on behalf of NCTA) to NCDOT advising NCDOT of the amount transferred from the Operating Reserve Fund to the Operations and Maintenance Expense Fund and requesting reimbursement therefor. Any such written request shall be accompanied by a certificate of a General Engineering Consultant stating that in the opinion of such General Engineering Consultant, the then current Renewal and Replacement Reserve Fund Requirement is reasonably necessary in order to assure that funds will be available as needed to pay the cost of unusual or

extraordinary maintenance, repairs, renewals or replacements or capital improvements related to the Project in accordance with prudent management practices.

Notwithstanding the foregoing, if following any transfer or required transfer from the Operating Reserve Fund as provided above, but before the time of payment by NCDOT pursuant to the preceding paragraph, additional Receipts have been deposited in the Operating Reserve Fund, then NCTA will provide immediate notice to NCDOT of the amount of Receipts so deposited in the Operating Reserve Fund and the required payment by NCDOT pursuant to the preceding paragraph shall be reduced by the amount of Receipts so deposited in the Operating Reserve Fund. The parties hereto hereby acknowledge and agree that there may be multiple payment from, and deposits to, the Operating Reserve Fund.

- (c) The payments to be paid by NCDOT pursuant to Section 2(b) are to be funded from amounts then available in the State Highway Fund. The payment by the NCDOT is subject to appropriation and availability of funds for such use in the State Highway Fund. All payment requests shall be subject to periodic audits to ensure such payments include only those Operations and Maintenance Expenses allowable pursuant to this Agreement. In the event of an overpayment, NCDOT will withhold or decrease future payments to recoup the overpayment. Costs incurred for maintenance or operations that exceeds the standards agreed upon by the parties herein will not be reimbursed without prior written concurrence.
- (d) The NCTA will include in its Annual Project Budget and Annual Plan of Work a schedule that includes an accounting of operations and maintenance obligations incurred to date (including interest owed), a schedule of anticipated NCDOT operations and maintenance support requirements for the current budget year and future budget years, and a schedule of anticipated NCTA repayments for the current budget year and future budget years.
- (e) The Authority shall keep accurate records and accounts of all items of costs and of all expenditures relating to the Operation and Maintenance of the Triangle Expressway System and of the revenues collected and the application of such revenues. Such records and accounts shall be open to the inspection of the NCDOT.

The NCTA shall cause its accountant, which may be the State Auditor, to prepare and deliver to the NCTA within 180 days after the close of each Fiscal Year an audit of NCTA's books and accounts relating to the Triangle Expressway System. Reports of each such audit shall be delivered by the NCTA to NCDOT in writing. Each such audit report shall be accompanied by an opinion of the accountant stating that the examination of the financial statements was conducted in accordance with generally accepted auditing standards and stating whether such financial statements present fairly the financial position of the Triangle Expressway System and the results of its operations and a statement of cash flows for the period covered by such audit report in conformity with generally accepted accounting principles applied on a consistent basis.

(f) NCTA shall conform to NCDOT's performance standards for Operation and Maintenance for the Statewide Tier Network. (See Attachment A) NCTA may exceed these standards for litter pick-up, Incident Response and Snow and Ice Removal.

- Section 3. Repayment of Guaranty Payments. (a) In the event that NCDOT makes any payment to NCTA pursuant to Section 2 of this Agreement, the amounts so paid shall become an obligation of NCTA to NCDOT to repay the amount so paid, with interest on the unpaid principal, computed at a rate equal to that payable by the NCTA in accordance with G.S. 136-176(b).
- (b) NCTA shall repay the obligations to NCDOT as provided in subsection (a) of this Section solely from Receipts available for such repayment as provided Section 2(a)(ix) above or from amounts deposited and held in the General Reserve Fund. Payments by NCTA shall be credited first to unpaid interest, then to the payment of unpaid principal. The failure to pay any payments due pursuant to this Section 3(b) shall not constitute an event of default hereunder if insufficient Receipts or other amounts held in the General Reserve Fund are not available to make such payments.
- Section 4. <u>Annual Budget</u>. NCTA hereby covenants with NCDOT that it shall maintain an Annual Budget that, to the extent practicable, budgets sufficient funds to make all payments of Operating and Maintenance Expenses from Receipts. Subject to the terms of the Trust Agreement regarding the establishment and maintenance of tolls and other Receipts, NCTA shall endeavor to set tolls at a rate sufficient to generate Receipts to pay the Operating and Maintenance Expenses set forth in the Annual Budget.
- Section 5. <u>Term of this Agreement</u>. The obligation of NCTA to make payments pursuant to Section 2 of this Agreement shall remain in effect for so long as any Indebtedness of the NCTA remains outstanding and unpaid. The obligation of NCTA to reimburse NCDOT for payments made pursuant to Section 3 of this Agreement shall remain in effect until all payments to be paid by NCTA to NCDOT hereunder have been paid.
- Section 6. Remedies; Enforcement NCDOT and NCTA hereby expressly agree that the sole remedy for any noncompliance by either party under this Agreement shall be specific performance enforceable only by an action filed by the other party to this Agreement.
- Section 7. <u>Amendment of the Trust Agreement</u>. Following the execution and delivery of the Trust Agreement by NCTA, the NCTA shall not enter into any amendment to the Trust Agreement that affects the rights or obligations of NCDOT under this Agreement without the consent of NCDOT.
- Section 8. <u>Authorization</u>: Each party to this Agreement represents to the other that it is fully authorized to enter into this Agreement and to perform its obligations hereunder and that no waiver, consent, approval, or authorization from any third party is required to be obtained or made in connection with the execution, delivery, or performance of this Agreement. The execution and delivery of this Agreement by NCDOT has been approved by the State Board of Transportation as required by Section 136-89.183 of the Enabling Act.
- Section 9. Governing Law: This Agreement shall be construed under and in accordance with the laws of the State.

IN WITNESS WHEREOF, NCDOT and NCTA have entered into this Agreement all as of the 20 day of 400051, 2008.

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

Name: J. Douglas Galyon

Title: Chairman, Board of Transportation

(SEAL)

NORTH CAROLINA TURNPIKE AUTHORITY

By:\_\_\_ Name:

Title:\_

# NCDOT Maintenance and Operations Performance Standards for the Statewide Tier

			RELATIVE	ELEMENT	20	008	200	9	2010	) <del></del>
		ELEMENT	IMPORTANCE	WT. VALUE		EL. POINTS				POINTS
0 E	RM-1	Low Shoulder	8	3.25%	85	2.76	90	2.93	95	3.09
SHLD & DITCH	RM-2	High Shoulder	7	2.85%	85	2.42	90	2.56	95	2.70
Ø 🖺	RM-3	Lateral Ditches	6	2.44%	85	2.07	90	2.20	95	2.32
	RM-4	Crossline Pipa (Blocked) < 54"	Ġ	2.44%	85	2.07	90	2.20	95	2.32
Щ	RM-5		7	2.85%	85	2,42	90	2.56	95	2.70
₹ .	RM-6	Curb & Gutter (Blocked)	5	2.03%	85	1.73	90	1.83	95	1.93
DRAINAGE	RM-7	Curb & Gutter (Damaged)	4	1.63%	85	1.38	90	1.46	95	1.54
č	RM-8	Drop Injels, CB's, etc (Blocked)	5	2.03%	85	1.73	90	1.83	98	1.99
'	RM-9	Drop inlets, CB's, etc (Damaged)	4	1.63%	85	1.38	90	1.46	98	1.59
ROADSIDE APPURT	RM-10	Guardraii/Cable/Median Barrier/Conc	9	3.66%	99	3.62	99	3.62	99	3.62
띯	R-8	ROW Fence	2	0.81%	94	0.76	94	0.76	94	0.79
8₽	R-6	Stormwater Devices	4	1.63%	90	1.46	90	1.46	90	1.48
2. ¥	RM-11	Impact Attenuators	9	3.66%	99	3,62	99	3.62	99	3.62
-	R-1	Mowing	7	2,85%	90	2.58	90	2.56	90	2.56
핑	R-2	Brush & Tree Control	6	2,44%	85	2.07	85	2.07	90	2.20
lis I	R-3	Turi Condition	4	1.63%	80	1.30	85	1.38	90	1.46
₽	R-4	Uncontrolled Growth	4	1.63%	70	1.14	70	1.14	70	1.14
ROADSIDE	R-5	Litter & Debris Control	4	1.63%	90	1.48	90	1.46	90	1.48
œ	R-7	Landscape Beds	3	1.22%	90	1.10	90	1.10	90	1.10
	T-1	Long line pavement markings	8	3,25%	85	2.76	90	2.93	95	3.09
	T-2	Words % Symbols	5	2.03%	85	1.73	90	1.83	95	1.93
TRAFFIC/ITS	T-3	Pavement Markers	7	2,85%	85	2.42	90	2.56	95	2.70
	T-5	Overhead Signs	, 6	2,44%	92	2.72	92	2.24	92	2.24
ਠੋ	T-4	Signs ground	9	3,25%	92	2.99	92	2.99	92	2.99
표	T-6	Rwdy, Bridge & IC lighting	4	1.63%	90	1.46	90	1.46	90	1,46
₹ 1	T-7	Traffic Signal Systems	8	3,25%	80	2.93	90	2,93	90	2.93
μ.	T-8	Traffic Signal Maintenance	В	3,25%	90	2,93	90	2,93	90	2.93
	T-9	Traffic Signal Emergency	9	3,68%	90	3.29	90	3.29	90	3.29
	T-12	Dynamic Message Sign	8	3.25%	90	2.93	90	2,93	90	2.93
	B-2	Bridge Decks	9	3.66%	80	2.93	85	3,11	85	3.11
vo i	B-3	•	9					1	90	
BRIDGES	B-4	Superstructure	9	3,66%	80 80	2.93	95	3.11	90	3.29
ă	B-6	Substructure	_	3,65%		2,93	85	3.11	90	3.29
꾶	B-5	Pipes & Culverts > 54"	7	2.85%	90	2.56	90	2.56		2.66
ш,	B-7	NBIS Culvert	7	2.65%	80	2.28	80	2.28	80	2.28
	P-2	Overhead Sign Structures	6	2.44%	95	2.32	95	2.32	95	2,32
PVMT	P-2	Asphalt pavement repair	9	3,66%	95	3,48	95	3.48	95	3,48
₹	P-1	Concrete pavement repair	9	3.66%	95	3.48	95	3,48	95	3,48
	Pel	Pvm't Shoulder Condition	8	2.44%	90	2,20	9D	2,20	90	2.20
	<u> </u>	Total	246	100.00%	L	87.84		89,93		92.07
	OTHER	IMPORTANT MEASURES								
	RKPI-1					90		90		90
	B-9	Tunnels				100		100		100
	B-8					100		100		100
		Drawbridge Machinery								
	PKPI-1	Snow & Ica Control (all lanes clear) Ride Quality				12 HR 1.5/85		12 HR		12 HR 1.5/85
	PKPi-2		of Condi			1.5/85		1.5/65 85		1.5/65 85
	PKPI-3	Pavement Condition Rating (% in Goo	ra Corraj							
	PKPI-4	Narrow Lane Width				99		99		99
		Paved Shoulder Width				95		95		95
	BKPI-1	Bridge Condition Rating (% in Good C				90		90		90
	TKPI-1	Incident Clearance Time (min, TMC/no	on-+MC)			30/90		30/90		30/90
	TKPI-2	ITS Devices (min. TMC/non-TMC)				15/30		15/30		15/30

# CONSTRUCTION COMPLETION ASSURANCE AND STANDBY RENEWAL AND REPLACEMENT FUNDING AGREEMENT

Dated as of April 15, 2009

by and between

#### NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

and

NORTH CAROLINA TURNPIKE AUTHORITY

### CONSTRUCTION COMPLETION ASSURANCE AND STANDBY RENEWAL AND REPLACEMENT FUNDING AGREEMENT

THIS CONSTRUCTION COMPLETION ASSURANCE AND STANDBY RENEWAL AND REPLACEMENT FUNDING AGREEMENT, dated as of \_\_\_\_\_\_\_, 2009, by and between the NORTH CAROLINA DEPARTMENT OF TRANSPORTATION ("NCDOT"), a department of the State of North Carolina duly organized and existing pursuant to Section 143B-345 et seq. of the North Carolina General Statutes, as amended, and the NORTH CAROLINA TURNPIKE AUTHORITY ("NCTA"), a body politic and corporate and a public agency of the State of North Carolina duly organized and existing pursuant to Article 6H of Chapter 136 of the North Carolina General Statutes, as amended (the "Enabling Act");

#### WITNESSETH:

WHEREAS, the General Assembly of North Carolina has created NCTA to study, plan, develop, design, establish, purchase, construct and operate and maintain Turnpike Projects (as defined in the Enabling Act) in the State;

WHEREAS, Section 136-89.183 of the Enabling Act provides that NCDOT and NCTA may enter into partnership agreements for purposes of financing the costs of acquiring, constructing, equipping, operating or maintaining any Turnpike Project;

WHEREAS, Section 136-89.191 of the Enabling Act provides that NCDOT may participate in the cost of preconstruction activities, construction, maintenance or operation of a Turnpike Project;

WHEREAS, Section 136-18(39) of the North Carolina General Statutes authorizes NCDOT to enter into partnership agreements with NCTA to finance the cost of equipping, maintaining, and operating transportation infrastructure in the State;

WHEREAS, NCTA is undertaking a Turnpike Project located in Wake County and Durham County known as the "Triangle Expressway System" as more fully described in Section 1 of the Project Specific Agreement for Triangle Expressway, dated March 6, 2008, between NCDOT and NCTA (the "Triangle Expressway System"), and is now undertaking the construction of the Triangle Expressway System by the construction of a new approximately 19 mile toll road facility (the "Initial Project") and intends to finance the cost of acquisition, construction and equipping of the Initial Project with revenue bonds issued by NCTA and other Indebtedness incurred by NCTA pursuant to the Enabling Act and The State and Local Government Revenue Bond Act, Article 5 of Chapter 159 of the General Statutes of North Carolina, as amended; and

WHEREAS, NCDOT desires to support the financial viability of the Initial Project and the financing thereof, and to this end has determined to enter into this Agreement to (a) assure the purchasers and owners of revenue bonds and other Indebtedness issued or incurred to finance the Initial Project that funds will be available to NCTA to complete the Costs of the Initial Project in the event that the proceeds of the revenue bonds and other Indebtedness described above is not sufficient and (b) assure NCTA that at all times there will be sufficient funds

available to pay for necessary renewals and replacement of the various components of the Initial Project;

**NOW THEREFORE**, the parties hereto, each in consideration of the promises and undertakings of the other as hereinafter provided, **DO HEREBY** covenant and mutually agree as follows:

Section 1. <u>Definitions</u>. In addition to the meanings of certain capitalized terms as set forth in the recitals set forth above, the following terms shall have the following meanings in this Agreement:

"Agreement" means this Construction Completion Assurance and Renewal And Replacement Fund Guaranty Agreement, as the same may be supplemented or amended from time to time.

"Costs of the Initial Project" means all costs for right-of-way acquisition and design, engineering, construction, acquisition and equipping of the Initial Project in accordance with the Plans and Specifications therefore.

"Credit Facility" means a line of credit, letter of credit, standby bond purchase agreement or similar liquidity or credit facility established or obtained in connection with the incurrence of any Indebtedness.

"Credit Provider" means the entity providing a Credit Facility.

"Debt Service Reserve Fund" means a debt service reserve fund or account to be created by the Trust Agreement or any other documentation relating to Indebtedness of NCTA as a reserve to provide funds to pay principal of or interest on Indebtedness authorized thereby if insufficient Receipts are available for such payment. The Trust Agreement or such other documentation may establish one or more of such funds for this purpose, each of which shall be a "Debt Service Reserve Fund" for purposes of this Agreement.

"Debt Service Reserve Fund Requirement" means, as of the time of any calculation, the aggregate amounts then required to be placed or maintained in any Debt Service Reserve Fund. In the event that the Trust Agreement or other documentation relating to Indebtedness provides that a withdrawal of funds from a Debt Service Reserve Fund is to be replenished over a period of time, or additional funding of such Debt Service Reserve Fund is otherwise required to be made over a period of time, the term "Debt Service Reserve Fund Requirement" as used herein means only the amount required to be on deposit at the time of the calculation.

"Debt Service Requirement" means, for any period for which such determination is made, the aggregate of the required deposits to be made by NCTA to one or more corporate trustees or other entities in respect of principal (whether at maturity or pursuant to a sinking fund redemption or otherwise) or interest (whether or not separately stated) on Indebtedness during such period; including directly to the holders of Indebtedness, such as the United States Department of Transportation. Notwithstanding the foregoing, Indebtedness does not include, for purposes of this Agreement, any amounts owed to NCDOT pursuant to this Agreement.

"General Engineering Consultant" means any independent engineer or independent firm of engineers prequalified to do work in North Carolina, in accordance with the established guidelines of the North Carolina Department of Transportation; who is retained by NCTA to assist NCTA in assessing the status of maintenance and upkeep of the Triangle Expressway System, the costs associated therewith and the expected cost of unusual or extraordinary maintenance, repairs, renewals or replacements or capital improvements related to the Initial Project, and advising NCTA regarding the level of reserves that should be maintained to assure that funds will be available when needed for that purpose.

"General Reserve Fund" means the fund to be created under the Trust Agreement that shall be the repository for the deposit of Receipts that are not required to be used to pay or fund the Debt Service Requirement, the Debt Service Reserve Fund Requirement, the Operating Reserve Fund Requirement or the Renewal and Replacement Reserve Fund Requirement or be deposited in the Operations and Maintenance Expense Fund.

"Indebtedness" means all obligations incurred or assumed by NCTA in connection with the ownership or operation of the Triangle Expressway System:

- (a) for payments of principal and interest with respect to borrowed money, including any obligation to repay a Credit Provider for moneys drawn to pay and retire or purchase Indebtedness; and
- (b) for payments under leases which are required to be capitalized in accordance with generally accepted accounting principles and under installment or lease purchase or conditional sale contracts;

provided, however, that Indebtedness shall include only such obligations as are secured by Receipts.

"Initial Project" has the meaning given such term in the preambles to this Agreement.

"Operating Reserve Fund" means the fund or funds created pursuant to the Trust Agreement as a reserve for the payment of Operating and Maintenance Expenses in the event that Receipts are not sufficient for such purpose.

"Operating Reserve Fund Requirement" means, as of the time of calculation, the maximum aggregate amounts required by the Trust Agreement to be set aside in the Operating Reserve Fund as a reserve to fund Operating and Maintenance Expenses in the event that Receipts are not sufficient for such purpose; provided, however, that the Operating Reserve Fund Requirement may not exceed at any time one-fourth (1/4th) of the Operating and Maintenance Expenses for the Project for the current Fiscal Year as set forth in the Annual Budget.

"Operations and Maintenance Expense Fund" means the fund or funds created pursuant to the Trust Agreement pursuant to which deposits are to be made from Receipts to pay. Operating and Maintenance Expenses.

"Receipts" means all receipts, revenues, income, proceeds and money received in any period by or for NCTA in respect of the Triangle Expressway System, including, but without limiting the generality of the foregoing,

- (a) all toll payments, proceeds, fees, charges and rents,
- (b) any proceeds of use and occupancy or business interruption insurance, and
- (c) payments from the State of North Carolina received by NCTA to the extent that such payments have been pledged to pay Indebtedness and other obligations of NCTA pursuant to the terms of the Trust Agreement or other documentation relating to Indebtedness of NCTA.

"Renewal and Replacement Reserve Fund" means the fund to be created by the Trust Agreement as a reserve to provide funds to pay the costs of maintenance, repair, renewal, reconstruction or replacement of any portion of component of the Triangle Expressway System of a type which is not normally included as an annually recurring cost in NCTA's Annual Budget for the Triangle Expressway System.

"Renewal and Replacement Reserve Fund Requirement" means, as of the time of any calculation, the aggregate amount then required to be placed or maintained in the Renewal and Replacement Reserve Fund by the Trust Agreement.

"State" means the State of North Carolina.

"Trust Agreement" means the Trust Agreement, to be executed between NCTA and the Trustee, as the same may be supplemented and amended from time to time, and any similar instrument entered into or adopted by NCTA that provides for the issuance or incurrence of Indebtedness and contains the terms regarding the collection and disposition of Receipts.

"Trustee" means the entity serving as Trustee under the provisions of the Trust Agreement.

Section 2. <u>Undertaking to Provide Additional Funds to Pay Costs of the Initial Project.</u>
(a) Based upon the estimate of its engineers and the contract prices proposed to NCTA, NCTA believes that sufficient funds will be available to pay the Costs of the Initial Project from the proceeds of the revenue bonds and other Indebtedness referred to in the preambles to this Agreement. Nevertheless, the parties hereto acknowledge that unexpected or unforeseen circumstances could result in additional unanticipated costs in excess of the amounts available from such revenue bonds and other Indebtedness. In order to provide assurances to NCTA and to the purchasers of NCTA's revenue bonds or other Indebtedness that sufficient funds will be available to complete the Initial Project, NCDOT hereby undertakes to provide additional funding to provide for the completion of the Initial Project in the event that the funds referred to above are not sufficient therefor.

(b) The payments to be paid by NCDOT pursuant to Section 2(a) are to be funded from amounts then available in the State Highway Trust Fund or the State Highway Fund, as applicable. The payment by NCDOT is subject to appropriation and availability of funds for

such use in the State Highway Trust Fund or the State Highway Fund, as applicable. In the event that NCTA determines that it is necessary to request funds from NCDOT to provide for completion of the Initial Project, NCTA shall provide notice and documentation of such need as soon as such necessity comes to the attention of NCTA and in no event less than ninety (90) days before when such need must be funded. Any such written request shall be accompanied by a certificate of a General Engineering Consultant stating that in the opinion of such General Engineering Consultant, the then current unanticipated costs are reasonably necessary in order to assure that funds will be available as needed to pay the costs of the Initial Project in accordance with prudent management practices.

NCTA will cooperate with the appropriate officials of NCDOT such that the timing of payments to pay the remaining Costs of the Initial Project pursuant to the undertaking set forth above will not disrupt NCDOT's other contractual obligations being funded from the State Highway Trust Fund or State Highway Fund and will not interfere with NCDOT's committed debt service payments.

(c) NCTA shall expend the proceeds of the revenue bonds and other Indebtedness issued to finance the Initial Project in strict compliance with the terms of the Trust Agreement pursuant to which such bonds or other Indebtedness is incurred. Amounts set aside in the Project Fund created under such Trust Agreement shall be used solely for Costs of the Initial Project.

NCTA shall keep accurate records and accounts of all items of costs and of all expenditures relating to the Costs of the Initial Project. Such records and accounts shall be open to the inspection of NCDOT. NCTA shall cause its accountant, which may be the State Auditor, to prepare and deliver to NCTA within 180 days after the close of each Fiscal Year an audit of NCTA's books and accounts relating to the Triangle Expressway System. Reports of each such audit shall be delivered by NCTA to NCDOT in writing immediately upon receipt. In addition, to the extent that there are any findings proposed by the State Auditor, NCTA shall provide the State Auditor's preliminary findings to NCDOT, as well as NCTA's response to those findings. Each such audit report shall be accompanied by an opinion of the accountant stating that the examination of the financial statements was conducted in accordance with generally accepted auditing standards and stating whether such financial statements present fairly the financial position of the Triangle Expressway System and the results of its operations and a statement of cash flows for the period covered by such audit report in conformity with generally accepted accounting principles applied on a consistent basis.

Section 3. Repayment of Amounts Provided to Pay Costs of the Initial Project. (a) In the event that NCDOT makes any payment to NCTA pursuant to Section 2 of this Agreement, the amounts so paid shall become an obligation of NCTA to NCDOT to repay the amount so paid, with interest on the unpaid principal, computed at a rate equal to that payable by NCTA in accordance with G.S. 136-176(b).

(b) NCTA shall repay the obligations to NCDOT as provided in subsection (a) of this Section solely from Receipts available for such repayment-after payment of the Debt Service Requirement, funding of any deficiency in the Debt Service Reserve Fund Requirement, funding any deficiency in the Renewal and Replacement Reserve Fund Requirement under the terms of the Trust Agreement, funding any deficiency in the Operating Reserve Fund Requirement and

making any deposit to the Operations and Maintenance Expense Fund pursuant to the Trust Agreement or from amounts deposited and held in the General Reserve Fund. Payments by NCTA shall be credited first to unpaid interest, then to the payment of unpaid principal. The failure to pay any payments due pursuant to this Section 3(b) shall not constitute an event of default hereunder if insufficient Receipts or other amounts held in the General Reserve Fund are not available to make such payments.

- Section 4. Renewal and Replacement Fund Deposits. (a) NCTA shall provide in the Trust Agreement or any other documentation pursuant to which any Indebtedness is incurred that the Receipts shall be set aside as received and applied on or prior to the last day of each month in the following order of priority:
  - (i) for the payment of the Debt Service Requirement on Indebtedness then due and payable;
  - (ii) to any Debt Service Reserve Fund for Indebtedness so that the amount in each such Debt Service Reserve Fund equals the Debt Service Reserve Fund Requirement;
  - (iii) to the Operating Reserve Fund as a reserve for the payment of Operating and Maintenance Expenses in the event that Receipts are not sufficient for such purpose and the Operations and Maintenance Expense Fund to pay Operating and Maintenance Expenses.
  - (iv) to the Renewal and Replacement Reserve Fund so that the amount in the Renewal and Replacement Reserve Fund equals the Renewal and Replacement Reserve Fund Requirement; and
    - (v) other deposits as set forth in the Trust Agreement.

Notwithstanding the foregoing, NCTA may change the order of priority for required deposits of Receipts to fund the Debt Service Requirement or the Debt Service Reserve Fund Requirement, for one class of Indebtedness from another class of Indebtedness in order to provide that selected classes of Indebtedness, and the deposit to a Debt Service Reserve Fund in connection therewith, is senior or subordinate to other Indebtedness, or is payable prior to or after the deposit of any Receipts to fund the Renewal and Replacement Reserve Fund Requirement, and may also provide that deposits of any Debt Service Requirement or Debt Service Reserve Fund Requirement with respect to any Indebtedness may be made after deposits to the Operations and Maintenance Expense Fund and the Operating Reserve Fund.

(b) If at any time amounts in the Renewal and Replacement Reserve Fund shall not be equal to the Renewal and Replacement Reserve Fund Requirement, then subject to the availability of funds as provided in subsection (c) below, NCDOT hereby agrees that NCDOT will pay to, or on behalf of, NCTA (i) the amount necessary so that amounts in the Renewal and Replacement Reserve Fund shall be equal to the Renewal and Replacement Reserve Fund Requirement. Payments to NCTA shall be paid by NCDOT upon ninety (90) days' written notice from NCTA (or by the Trustee on behalf of NCTA) to NCDOT advising NCDOT of the amount of the deficiency and requesting funding therefor. Any such written request shall be accompanied by a certificate of a General Engineering Consultant stating that in the opinion of

such General Engineering Consultant, based upon a methodology agreed upon by NCTA and NCDOT, the then current Renewal and Replacement Reserve Fund Requirement is reasonably necessary in order to assure that funds will be available as needed to pay the cost of maintenance, repairs, renewals or replacements or capital improvements related to the Triangle Expressway System in accordance with prudent management practices.

- (c) The payments to be paid by NCDOT pursuant to Section 4(b) are to be funded from amounts then available in the State Highway Trust Fund or the State Highway Fund, as applicable. The payment by NCDOT is subject to appropriation and availability of funds for such use in the State Highway Trust Fund or State Highway Fund, as applicable.
- (d) NCTA shall keep accurate records and accounts of all deposits to and costs and expenditures paid from the Renewal and Replacement Reserve Fund. Such records and accounts shall be open to the inspection of NCDOT.
- Section 5. Repayment of Amounts Deposited by NCDOT for the Renewal and Replacement Reserve Fund. (a) In the event that NCDOT makes any payment to NCTA pursuant to Section 4 of this Agreement, the amounts so paid shall become an obligation of NCTA to NCDOT to repay the amount so paid, with interest on the unpaid principal, computed at a rate equal to that payable by NCTA in accordance with G.S. 136-176(b).
- (b) NCTA shall repay the obligations to NCDOT as provided in subsection (a) of this Section solely from Receipts available for such repayment after payment of the Debt Service Requirement, funding of any deficiency in the Debt Service Reserve Fund Requirement, funding any deficiency in the Renewal and Replacement Reserve Fund Requirement under the terms of the Trust Agreement, funding any deficiency in the Operating Reserve Fund Requirement and making any deposit to the Operations and Maintenance Expense Fund pursuant to the Trust Agreement or from amounts deposited and held in the General Reserve Fund. Payments by NCTA shall be credited first to unpaid interest, then to the payment of unpaid principal. The failure to pay any payments due pursuant to this Section 3(b) shall not constitute an event of default hereunder if insufficient Receipts or other amounts held in the General Reserve Fund are not available to make such payments.
- Section 6. <u>Annual Budget</u>. NCTA hereby covenants with NCDOT that it shall maintain an Annual Budget that, to the extent practicable, budgets sufficient funds to make all deposits to the Renewal and Replacement Reserve Fund from Receipts. Subject to the terms of the Trust Agreement regarding the establishment and maintenance of tolls and other Receipts, NCTA shall endeavor to the extent practicable to set tolls at a rate sufficient to generate Receipts to fund the Renewal and Replacement Reserve Fund Requirement set forth in the Annual Budget.
- Section 7. <u>Term of this Agreement</u>. The obligation of NCTA to make payments pursuant to Section 2 and Section 4 of this Agreement shall remain in effect for so long as any Indebtedness of NCTA remains outstanding and unpaid. The obligation of NCTA to reimburse NCDOT for payments made pursuant to Section 3 and Section 5 of this Agreement shall remain in effect until all payments to be paid by NCTA to NCDOT hereunder have been paid.

- Section 8. Remedies; Enforcement NCDOT and NCTA hereby expressly agree that the sole remedy for any noncompliance by either party under this Agreement shall be specific performance enforceable only by an action filed by the other party to this Agreement.
- Section 9. Amendment of the Trust Agreement. NCTA's allocation of funds among the accounts described in Section 3(b) shall not change substantially without the prior written consent of NCDOT.
- Section 10. <u>Effective Date</u>. NCDOT's obligations under this Agreement shall not become effective until the bonds are sold and the design/build contract has been awarded.
- Section 11. <u>Authorization</u>: Each party to this Agreement represents to the other that it is fully authorized to enter into this Agreement and to perform its obligations hereunder and that no waiver, consent, approval, or authorization from any third party is required to be obtained or made in connection with the execution, delivery, or performance of this Agreement. The execution and delivery of this Agreement by NCDOT has been approved by the State Board of Transportation as required by Section 136-89.183 of the Enabling Act.
- Section 12. <u>Governing Law</u>: This Agreement shall be construed under and in accordance with the laws of the State.

IN WITNESS WHEREOF, NCDOT and NCTA have entered into this Agreement all as of the 15th day of April, 2009.

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

Name: J. Douglas Galyon

Title: Chair, North Ca

Carolina Board

Board of

Transportation

(SEAL)

NORTH CAROLINA TURNPIKE AUTHORITY

Name: David Joyner

Title: Executive Director



#### APPENDIX D

#### PROPOSED FORM OF OPINION OF BOND COUNSEL



HUNTON ANDREWS KURTH LLP POST OFFICE BOX 109 RALEIGH, NORTH CAROLINA 27602

TEL 919 · 899 · 3000 FAX 919 · 833 · 6352

December 12, 2018

Board of Directors North Carolina Turnpike Authority Raleigh, North Carolina

# \$401,155,000 North Carolina Turnpike Authority Triangle Expressway System Senior Lien Turnpike Revenue Refunding Bonds, Series 2018

#### Gentlemen:

We have examined the applicable law and certified copies of proceedings and documents relating to the issuance by the North Carolina Turnpike Authority (the "Authority") of its Triangle Expressway System Senior Lien Turnpike Revenue Refunding Bonds, Series 2018, in the aggregate principal amount of \$401,155,000 (the "Bonds") to provide funds, together with other available funds, to (a) refund the Authority's Triangle Expressway Revenue Bond, TIFIA Series 2009 (the "TIFIA Series 2009 Bond"), which financed a portion of the costs of the Authority's Triangle Expressway, an approximately 18.8-mile toll road facility in Durham and Wake Counties, North Carolina (the "Project"), (b) pay the premium for a municipal bond insurance policy issued by Assured Guaranty Municipal Corp. (the "Series 2018 Bond Insurer") with respect to certain Bonds, (c) pay the premium for a municipal bond debt service reserve insurance policy with respect to the Bonds also issued by the Series 2018 Bond Insurer, and (d) pay costs incurred in connection with the issuance of the Bonds. Reference is made to the form of the Bonds for additional information concerning their details, payment and redemption provisions and the proceedings pursuant to which they are issued.

The Bonds recite that they are issued under and pursuant to the Constitution and laws of the State of North Carolina (the "State"), including Article 6H (Public Toll Roads and Bridges) of Chapter 136, as amended, of the North Carolina General Statutes (the "NCGS"), and The State and Local Government Revenue Bond Act, Article 5 of Chapter 159, as amended, of the NCGS, a Bond Order of the Authority adopted on November 5, 2018 (the "Bond Order"), authorizing the issuance of the Bonds, and a Trust Agreement, dated as of June 1, 2009, between the Authority and Wells Fargo Bank, N.A., as trustee (in such capacity, the "Trustee"), as supplemented by a First Supplemental Trust Agreement dated as of July 1, 2009, a Second Supplemental Trust Agreement dated as of March 1, 2017, and a Third Supplemental Trust Agreement dated as of December 1, 2018 (collectively, the "Trust Agreement"). Proceeds of the Bonds will be used to refund the TIFIA Series 2009 Bond. All capitalized terms not defined herein are as defined in the Trust Agreement.

North Carolina Turnpike Authority December 12, 2018 Page 2

The Bonds are limited obligations of the Authority secured by a pledge, charge and lien upon Receipts. The Authority is not obligated to pay the principal of or the interest on the Bonds except from Receipts or certain other monies made available therefor under the Trust Agreement, and neither the faith and credit nor the taxing power of the State or any political subdivision or agency thereof, including the Authority, is pledged to the payment of the principal of and the interest on the Bonds. After the issuance of the Bonds there will be outstanding the Authority's Triangle Expressway System Senior Lien Turnpike Revenue Bonds, Series 2009A, Triangle Expressway System Senior Lien Turnpike Revenue Bonds, Series 2009B, and Triangle Expressway System Senior Lien Turnpike Revenue Refunding Bonds, Series 2017 (in the aggregate, the "Existing Parity Bonds"), which are also secured by a pledge of Receipts on parity with the Bonds. The Trust Agreement provides for the issuance or incurrence from time to time under the conditions, limitations and restrictions therein set forth of additional bonds and Senior Lien Parity Debt secured by the pledge of Receipts on parity with the Bonds and the Existing Parity Bonds.

Without undertaking to verify the same by independent investigation, we have relied on certifications by representatives of the Authority and the North Carolina Department of Transportation as to certain facts relevant to both our opinion and requirements of the Internal Revenue Code of 1986, as amended (the "Code"). The Authority has covenanted to comply with the current provisions of the Code regarding, among other matters, the use, expenditure and investment of the proceeds of the Bonds and the timely payment to the United States of any arbitrage rebate amounts with respect to the Bonds, all as set forth in the proceedings and documents relating to the issuance of the Bonds (the "Covenants").

The Series 2018 Bond Insurer has issued a municipal bond insurance policy with respect to the Bonds maturing in the years 2032 through 2038 and 2041 and a municipal bond debt service reserve insurance policy with respect to all of the Bonds (the "Policies"). Reference is made to the Policies for a full statement of their terms and conditions and to the opinion of counsel to the Series 2018 Bond Insurer as to the validity of the Policies, upon which you are relying as to matters therein. No opinion as to such matters is expressed herein.

Based on the foregoing and in accordance with customary opinion practice, we are of the opinion that:

1. The Bonds have been authorized and issued in accordance with the Constitution and statutes of the State and constitute valid and legally binding limited obligations of the Authority, payable as to principal and interest solely from Receipts. The Bonds do not create or constitute a debt or pledge of the faith and credit of the State or any political subdivision or agency thereof, including the Authority.

North Carolina Turnpike Authority December 12, 2018 Page 3

- 2. The Bond Order has been duly adopted by the Authority, and the Trust Agreement has been duly executed and delivered by the Authority, constitutes a valid and legally binding agreement of the Authority which assigns and pledges the Receipts to the Trustee and is enforceable against the Authority in accordance with its terms.
- 3. The rights of the holders of the Bonds and the enforceability of such rights, including enforcement by the Trustee of the obligations of the Authority under the Trust Agreement, may be limited or otherwise affected by (a) bankruptcy, insolvency, reorganization, fraudulent conveyance, moratorium and other laws affecting the rights of creditors generally and (b) principles of equity, whether considered at law or in equity.
- 4. Under current law, interest, including any accrued original issue discount ("OID"), on the Bonds (a) is not included in gross income for federal income tax purposes and (b) is not an item of tax preference for purposes of the federal alternative minimum income tax. The opinion in the preceding sentence is subject to the condition that there is compliance subsequent to the issuance of the Bonds with all requirements of the Code that must be satisfied in order that interest thereon not be included in gross income for federal income tax purposes. In the case of the Bonds maturing in the years 2030 through 2036, 2038 bearing interest at 4.00% and 2040 (the "OID Bonds"), the difference between (i) the stated principal amount of each maturity of the OID Bonds and (ii) the initial offering price to the public (excluding bond houses and brokers) at which a substantial amount of such maturity is sold will constitute OID; OID will accrue for federal income tax purposes on a constant yield-to-maturity method; and a holder's basis in such a Bond will be increased by the amount of OID treated for federal income tax purposes as having accrued on the Bond while the holder holds the Bond. Failure by the Authority to comply with the Covenants, among other things, could cause interest, including accrued OID, on the Bonds to be included in gross income for federal income tax purposes retroactively to their date of issue. We express no opinion regarding other federal tax consequences of the ownership of or receipt or accrual of interest on the Bonds.
- 5. Under current law, interest, including any accrued OID, on the Bonds is exempt from State income taxes.

Our services as bond counsel to the Authority for the Bonds have been limited to rendering the foregoing opinion based on our review of such legal proceedings as we deem necessary to approve the validity of the Bonds and the tax status of the interest thereon. We have not made any investigation concerning the Project, the Receipts or the financial resources of the Authority or the Series 2018 Bond Insurer, and, therefore, we express no opinion as to the accuracy or completeness of any information, including the Preliminary Official Statement dated November 9, 2018, or the Official Statement dated November 20, 2018, with respect to the Bonds, that may have been relied upon by anyone in making the decision to purchase Bonds.

Very truly yours,



### APPENDIX E DTC'S BOOK-ENTRY-ONLY SYSTEM



#### **APPENDIX E**

#### DTC'S BOOK-ENTRY-ONLY SYSTEM

The Depository Trust Company, New York, New York ("DTC"), will act as securities depository for the Series 2018 Bonds. The Series 2018 Bonds will be issued as fully-registered bonds registered in the name of Cede & Co. (DTC's partnership nominee) or such other name as may be requested by an authorized representative of DTC. One fully-registered Series 2018 Bond for each maturity in the aggregate principal amount of such maturity will be deposited with DTC, or with the Trustee on DTC's behalf.

DTC is a limited-purpose trust company organized under the New York Banking Law, a "banking organization" within the meaning of the New York Banking Law, a member of the Federal Reserve System, a "clearing corporation" within the meaning of the New York Uniform Commercial Code and a "clearing agency" registered pursuant to the provisions of Section 17A of the Securities Exchange Act of 1934. DTC holds and provides asset servicing for issues of U.S. and non-U.S. equity issues, corporate and municipal debt issues, and money market instruments that DTC's participants ("Direct Participants") deposit with DTC. DTC also facilitates the post-trade settlement among Direct Participants of sales and other securities transactions in deposited securities, through electronic computerized book-entry transfers and pledges between Direct Participants' accounts. This eliminates the need for physical movement of securities certificates. Direct Participants include both U.S. and non-U.S. securities brokers and dealers, banks, trust companies, clearing corporations and certain other organizations. DTC is a wholly-owned subsidiary of The Depository Trust & Clearing Corporation ("DTCC"). DTCC is the holding company for DTC, National Securities Clearing Corporation and Fixed Income Clearing Corporation, all of which are registered clearing agencies. DTCC is owned by the users of its regulated subsidiaries. Access to the DTC system is also available to others such as both U.S. and non-U.S. securities brokers and dealers, banks, trust companies and clearing corporations that clear through or maintain a custodial relationship with a Direct Participant, either directly or indirectly ("Indirect Participants"). DTC has Standard & Poor's rating of AA+. The DTC Rules applicable to its Participants are on file with the Securities and Exchange Commission. More information about DTC can be found at www.dtcc.com.

Purchases of the Series 2018 Bonds under the DTC system must be made by or through Direct Participants, which will receive a credit for the Series 2018 Bonds on DTC's records. The ownership interest of each actual purchaser of the Series 2018 Bonds ("Beneficial Owner") is in turn to be recorded on the Direct and Indirect Participants' records. Beneficial Owners will not receive written confirmation from DTC of their purchase. Beneficial Owners are, however, expected to receive written confirmations providing details of the transaction, as well as periodic statements of their holdings, from the Direct or Indirect Participants through which the Beneficial Owner entered into the transaction. Transfers of ownership interests in the Series 2018 Bonds are to be accomplished by entries made on the books of Direct and Indirect Participants acting on behalf of Beneficial Owners. Beneficial Owners will not receive certificates representing their ownership interests in the Series 2018 Bonds, except in the event that use of the book-entry system for the Series 2018 Bonds is discontinued.

To facilitate subsequent transfers, all Series 2018 Bonds deposited by Direct Participants with DTC are registered in the name of DTC's partnership nominee, Cede & Co., or such other name as may be requested by an authorized representative of DTC. The deposit of the Series 2018 Bonds with DTC and their registration in the name of Cede & Co. or such other DTC nominee do not effect any change in beneficial ownership. DTC has no knowledge of the actual Beneficial Owners of the Series 2018 Bonds; DTC's records reflect only the identity of the Direct Participants to whose accounts the Series 2018 Bonds are credited, which may or may not be the Beneficial Owners. The Direct and Indirect Participants are responsible for keeping account of their holdings on behalf of their customers.

Conveyance of notices and other communications by DTC to Direct Participants, by Direct Participants to Indirect Participants and by Direct Participants and Indirect Participants to Beneficial Owners of the Series 2018 Bonds will be governed by arrangements among them, subject to any statutory or regulatory requirements as may be in effect from time to time. Beneficial Owners of the Series 2018 Bonds may wish to take certain steps to augment transmission to them of notices of significant events with respect to the Series 2018 Bonds, such as redemptions, tenders, defaults and proposed amendments to the security documents. For example, Beneficial Owners of the Series 2018 Bonds may wish to ascertain that the nominee holding the Series 2018 Bonds for their benefit has agreed to obtain and transmit notices to Beneficial Owners. In the alternative, Beneficial Owners may wish to provide their names and addresses to the registrar and request that copies of notices be provided directly to them.

Redemption notices will be sent to DTC. If less than all the Series 2018 Bonds are being redeemed, DTC's practice is to determine by lot the amount of the interest of each Direct Participant in such issue to be redeemed.

Neither DTC nor Cede & Co. (nor such other DTC nominee) will consent or vote with respect to the Series 2018 Bonds unless authorized by a Direct Participant in accordance with DTC's Procedures. Under its usual procedures, DTC will mail an Omnibus Proxy to the Authority as soon as possible after the record date. The Omnibus Proxy will assign Cede & Co.'s consenting or voting rights to those Direct Participants to whose accounts the Series 2018 Bonds are credited on the record date (identified in a listing attached to the Omnibus Proxy).

Principal and interest payments on the Series 2018 Bonds will be made to Cede & Co. or such other nominee as may be requested by an authorized representative of DTC. DTC's practice is to credit Direct Participants' accounts upon DTC's receipt of funds and corresponding detail information from the Authority or the Trustee on each payable date in accordance with their respective holdings shown on DTC's records. Payments by Participants to Beneficial Owners will be governed by standing instructions and customary practices, as is the case with securities held for the accounts of customers in bearer form or registered in "street name," and will be the responsibility of such Participants and not of DTC, the Authority, or the Trustee, subject to any statutory or regulatory requirements as may be in effect from time to time. Payments of principal and interest to Cede & Co. (or such other nominee as may be requested by an authorized representative of DTC) is the responsibility of the Authority and the Trustee, disbursement of such payments to Direct Participants shall be the responsibility of DTC, and disbursements of such payments to the Beneficial Owners shall be the responsibility of the Direct and Indirect Participants.

DTC may discontinue providing its services as depository with respect to the Series 2018 Bonds at any time by giving reasonable notice to the Authority or the Trustee. Under such circumstances, in the event that a successor depository is not obtained, Series 2018 Bonds are required to be printed and delivered. The Authority may decide to discontinue use of the system of book-entry-only transfers through DTC (or a successor securities depository). In that event, Series 2018 Bonds are required to be printed and delivered.

The information in this Official Statement concerning DTC and DTC's book-entry system has been obtained from DTC, and the Authority takes no responsibility for the accuracy thereof.

## APPENDIX F SPECIMEN MUNICIPAL BOND INSURANCE POLICY





### MUNICIPAL BOND INSURANCE POLICY

ISSUER: Policy No: -N

BONDS: \$ in aggregate principal amount of Effective Date:

Premium: \$

ASSURED GUARANTY MUNICIPAL CORP. ("AGM"), for consideration received, hereby UNCONDITIONALLY AND IRREVOCABLY agrees to pay to the trustee (the "Trustee") or paying agent (the "Paying Agent") (as set forth in the documentation providing for the issuance of and securing the Bonds) for the Bonds, for the benefit of the Owners or, at the election of AGM, directly to each Owner, subject only to the terms of this Policy (which includes each endorsement hereto), that portion of the principal of and interest on the Bonds that shall become Due for Payment but shall be unpaid by reason of Nonpayment by

On the later of the day on which such principal and interest becomes Due for Payment or the Business Day next following the Business Day on which AGM shall have received Notice of Nonpayment, AGM will disburse to or for the benefit of each Owner of a Bond the face amount of principal of and interest on the Bond that is then Due for Payment but is then unpaid by reason of Nonpayment by the Issuer, but only upon receipt by AGM, in a form reasonably satisfactory to it, of (a) evidence of the Owner's right to receive payment of the principal or interest then Due for Payment and (b) evidence, including any appropriate instruments of assignment, that all of the Owner's rights with respect to payment of such principal or interest that is Due for Payment shall thereupon vest in AGM. A Notice of Nonpayment will be deemed received on a given Business Day if it is received prior to 1:00 p.m. (New York time) on such Business Day; otherwise, it will be deemed received on the next Business Day. If any Notice of Nonpayment received by AGM is incomplete, it shall be deemed not to have been received by AGM for purposes of the preceding sentence and AGM shall promptly so advise the Trustee, Paying Agent or Owner, as appropriate, who may submit an amended Notice of Nonpayment. Upon disbursement in respect of a Bond, AGM shall become the owner of the Bond, any appurtenant coupon to the Bond or right to receipt of payment of principal of or interest on the Bond and shall be fully subrogated to the rights of the Owner, including the Owner's right to receive payments under the Bond, to the extent of any payment by AGM hereunder. Payment by AGM to the Trustee or Paying Agent for the benefit of the Owners shall, to the extent thereof, discharge the obligation of AGM under this Policy.

Except to the extent expressly modified by an endorsement hereto, the following terms shall have the meanings specified for all purposes of this Policy. "Business Day" means any day other than (a) a Saturday or Sunday or (b) a day on which banking institutions in the State of New York or the Insurer's Fiscal Agent are authorized or required by law or executive order to remain closed. "Due for Payment" means (a) when referring to the principal of a Bond, payable on the stated maturity date thereof or the date on which the same shall have been duly called for mandatory sinking fund redemption and does not refer to any earlier date on which payment is due by reason of call for redemption (other than by mandatory sinking fund redemption), acceleration or other advancement of maturity unless AGM shall elect, in its sole discretion, to pay such principal due upon such acceleration together with any accrued interest to the date of acceleration and (b) when referring to interest on a Bond, payable on the stated date for payment of interest. "Nonpayment" means, in respect of a Bond, the failure of the Issuer to have provided sufficient funds to the Trustee or, if there is no Trustee, to the Paying Agent for payment in full of all principal and interest that is Due for Payment on such Bond. "Nonpayment" shall also include, in respect of a Bond, any payment of principal or interest that is Due for Payment made to an Owner by or on behalf of the Issuer which recovered from been such Owner pursuant

Page 2 of 2 Policy No. -N

United States Bankruptcy Code by a trustee in bankruptcy in accordance with a final, nonappealable order of a court having competent jurisdiction. "Notice" means telephonic or telecopied notice, subsequently confirmed in a signed writing, or written notice by registered or certified mail, from an Owner, the Trustee or the Paying Agent to AGM which notice shall specify (a) the person or entity making the claim, (b) the Policy Number, (c) the claimed amount and (d) the date such claimed amount became Due for Payment. "Owner" means, in respect of a Bond, the person or entity who, at the time of Nonpayment, is entitled under the terms of such Bond to payment thereof, except that "Owner" shall not include the Issuer or any person or entity whose direct or indirect obligation constitutes the underlying security for the Bonds.

AGM may appoint a fiscal agent (the "Insurer's Fiscal Agent") for purposes of this Policy by giving written notice to the Trustee and the Paying Agent specifying the name and notice address of the Insurer's Fiscal Agent. From and after the date of receipt of such notice by the Trustee and the Paying Agent, (a) copies of all notices required to be delivered to AGM pursuant to this Policy shall be simultaneously delivered to the Insurer's Fiscal Agent and to AGM and shall not be deemed received until received by both and (b) all payments required to be made by AGM under this Policy may be made directly by AGM or by the Insurer's Fiscal Agent on behalf of AGM. The Insurer's Fiscal Agent is the agent of AGM only and the Insurer's Fiscal Agent shall in no event be liable to any Owner for any act of the Insurer's Fiscal Agent or any failure of AGM to deposit or cause to be deposited sufficient funds to make payments due under this Policy.

To the fullest extent permitted by applicable law, AGM agrees not to assert, and hereby waives, only for the benefit of each Owner, all rights (whether by counterclaim, setoff or otherwise) and defenses (including, without limitation, the defense of fraud), whether acquired by subrogation, assignment or otherwise, to the extent that such rights and defenses may be available to AGM to avoid payment of its obligations under this Policy in accordance with the express provisions of this Policy.

This Policy sets forth in full the undertaking of AGM, and shall not be modified, altered or affected by any other agreement or instrument, including any modification or amendment thereto. Except to the extent expressly modified by an endorsement hereto, (a) any premium paid in respect of this Policy is nonrefundable for any reason whatsoever, including payment, or provision being made for payment, of the Bonds prior to maturity and (b) this Policy may not be canceled or revoked. THIS POLICY IS NOT COVERED BY THE PROPERTY/CASUALTY INSURANCE SECURITY FUND SPECIFIED IN ARTICLE 76 OF THE NEW YORK INSURANCE LAW.

In witness whereof, ASSURED GUARANTY MUNICIPAL CORP. has caused this Policy to be executed on its behalf by its Authorized Officer.



A subsidiary of Assured Guaranty Municipal Holdings Inc. 1633 Broadway, New York, N.Y. 10019 (212) 974-0100

Form 500NY (5/90)

# NORTH CAROLINA Turnpike Authority

