



GoTriangle
Board of Trustees
July 24, 2019
12:00 pm-2:30 pm Eastern Time

I. Call to Order and Adoption of Agenda

ACTION REQUESTED: Adopt agenda with any changes requested.
(1 minute *Ellen Reckhow*)

II. Recognition

- A. Introduction of New Hires
(1 minute *Jeff Mann*)
- B. Announcement of Promotions
(1 minute *Jeff Mann*)
- C. Presentation of Service Awards
(5 minutes *Jeff Mann*)

III. Public Comment

The public comment period is held to give citizens an opportunity to speak on any item. The session is no more than thirty minutes long and speakers are limited to no more than three minutes each. Speakers are required to sign up in advance with the Clerk to the Board.
(*Ellen Reckhow*)

IV. Consent Agenda

Items listed on the consent agenda are considered as a single motion. At the request of any Board member, or member of the public, items may be removed from the consent agenda and acted on by a separate motion. Items pulled from the consent agenda will be placed at the beginning of the general business agenda for discussion and action. Any Board member wishing to remove an item from the consent agenda should advise staff in advance.

ACTION REQUESTED: Approve consent agenda.
(1 minute *Ellen Reckhow*)

A. Minutes

ACTION REQUESTED: Approve draft minutes.

June 26, 2019 - Regular Session

June 26, 2019 - Closed Session

B. RideShark Corporation Contract

ACTION REQUESTED: Authorize the President/CEO to execute a 5-year contract with RideShark Corporation for a user-centric web-based suite and mobile device application of TDM tools.

V. General Business Agenda

Items listed on the general business agenda are for discussion and possible action. Such designation means that the Board intends to discuss the general subject area of that agenda item before making any motion concerning that item.

A. Items Removed from the Consent Agenda

ACTION REQUESTED: Discuss and take action on any items removed from the consent agenda.

(1 minute Ellen Reckhow)

B. Operations & Finance Committee Report

(5 minutes Vivian Jones)

1. Renewal of Triangle J Council of Governments (TJCOG) Contract

ACTION REQUESTED: Authorize the President/CEO to sign a contract with TJCOG to provide continued planning and GIS services used in developing the transportation networks and associated land use required for long range transit planning and project implementation for FY20, with a not-to-exceed (NTE) amount of \$45,000.

(5 minutes Kaitlin Hughes)

TJCOG FY20 Scope of Work

2. Renewal of Triangle Regional Model Service Bureau (TRMSB) Contract

ACTION REQUESTED: Authorize the President/CEO to sign a contract with ITRE to provide continued model development services of the Triangle Regional Model (TRM) for FY20 with a not-to-exceed (NTE) amount of \$220,000.

(5 minutes Jay Heikes)

TRM Service Bureau FY20 Budget

TRM Service Bureau FY20 Scope of Work

Appendix A

Appendix B

Appendix C

C. Durham County Transit Plan Update Framework

(15 minutes Patrick McDonough & Pat Young)

Plan Update Framework

VI. Other Business

A. President & CEO's Report

(5 minutes Jeff Mann)

Contracts

1. Transit Operations Report

(5 minutes Patrick Stephens)

2. Wake Transit Update

(5 minutes Patrick McDonough & Stephen Schlossberg)

3. Communications Update

(5 minutes Mike Charbonneau)

- B. General Counsel's Report
(5 minutes Shelley Blake)
- C. Chair's Report
(5 minutes Ellen Reckhow)
- D. Board Member Reports
 - 1. CAMPO Executive Board Representative
(5 minutes Will Allen III)
 - 2. DCHC MPO Board Representative
(5 minutes Ellen Reckhow)
 - 3. Regional Transportation Alliance (RTA) Rep.
(5 minutes Will Allen III)

VII. Closed Session - Personnel

ACTION REQUESTED: Move into Closed Session pursuant to NCGS §143-318.11(a)(6) to consider the qualifications, competence, performance, character, or fitness of an employee.
(15 minutes Ellen Reckhow)

VIII. Adjournment
(Ellen Reckhow)

**GoTriangle Board of Trustees
Meeting Minutes
June 26, 2019**

Board Room, The Plaza, 4600 Emperor Blvd., Suite 100
Durham, NC

Board Members Present:

Will Allen III
Sig Hutchinson
Wendy Jacobs
Vivian Jones
Valerie Jordan (left 1:26 p.m.)

Mark Marcoplos
Michael Parker
Ellen Reckhow, Chair
Russ Stephenson

Board Members Absent:

Jennifer Robinson (by phone)
Andy Perkins

Steve Schewel (excused)
Nina Szlosberg-Landis (excused)

Chair Ellen Reckhow officially called the meeting to order at 12:23 p.m.

I. Adoption of Agenda

Action: On motion by Parker and second by Hutchinson the agenda was adopted. The motion was carried unanimously.

II. Recognition

A. Introduction of New Hires

President and CEO Mann announced the hiring of Shawn McAlister, Bus Operator and Finance Intern Elaina Chen.

B. Announcement of Promotions

Mann then announced the promotion of Katharine Eggleston from Project Development Manager to Chief Development Officer; Geordian Herron, from Project Intern to Project Controls Support Specialist; Andrea Neri, from Dispatcher/Operator to Transit Service Planner; and Priscilla Bond, from Administrative Assistant to Financial Administrative Support Technician.

C. Presentation of Service Awards

Mann recognized Tammy Romain for 15 years of service.

III. Public Hearing – Proposed FY20 Budget

Action: Chair Reckhow opened the public hearing on the proposed FY20 budget at 12:27 p.m. There being no speakers, the hearing was closed.

IV. Public Comment

No comments.

V. Consent Agenda

Action: On motion by Allen and second by Marcoplos the consent agenda was approved. The motion was carried unanimously.

The following consent agenda items were approved:

- May 22, 2019 – Regular Session Minutes;
- May 22, 2019 – Closed Session Minutes;
- June 4, 2019 – Special Session Minutes; and
- June 4, 2019 – Closed Session Minutes.

VI. General Business Agenda**A. Items Removed from Consent Agenda**

None.

B. Operations & Finance Committee Report**1. Transit Operations Bus Repower Project Authorization**

Committee Chair Sig Hutchinson presented a unanimous recommendation from the Committee to authorize the President/CEO to execute a contract for repowering 30 fixed route buses for a maximum of \$4.5 million, with \$2.25 million coming out of the FY20 budget and the remainder from the next budget year.

Action: On motion by Hutchinson and second by Allen the Board authorized the President/CEO to execute a contract for a bus repower project with Midwest Bus Corporation for repowering up to 30 fixed route buses with a maximum dollar amount of \$4.5 million; \$2.25 million in FY20 and the balance in FY21. The motion was carried unanimously.

2. FY19 Budget Ordinance Amendments

Hutchinson then presented a recommendation from Committee to approve the FY19 budget ordinance amendments.

Action: On motion by Hutchinson and second by Marcoplos the Board unanimously approved *Ordinance 2019 0004 GoTriangle Budget Ordinance Amendment*, which is attached and hereby made a part of these minutes. The motion was carried unanimously.

3. FY20 Budget Ordinances

Hutchinson presented the FY20 budget ordinances, which he said were recommended by a vote of three to one by Committee. He said there was significant discussion about concerns by folks in Durham and Orange counties about 1) wind down costs and staffing for D-O LRT project, 2) small capital projects oversight and 3) administrative overhead. There was a request to reserve half of the support services allocation (\$2.6 million) while conversations are held with Orange and Durham staff about the budget.

Marcoplos suggested that adoption of the budget include the direction to GoTriangle staff to meet with staff from Orange County and Durham County, in consultation with other transit partners including Chapel Hill and the City of Durham, to:

- Consider any revisions to direct and indirect support allocations for Durham and Orange counties;
- Discuss possible transition of small capital projects to local project sponsors;
- Cost allocations between the partners; and
- Bring back a budget amendment reflecting any proposed changes supported by Durham and Orange County staffs by November 1, 2019.

Parker suggested that this language be included in the language of the budget ordinance.

Marcoplos provided a copy of the concerns from the Staff Working Group (Durham and Orange), which is attached and hereby made a part of these minutes.

Action: On motion by Hutchinson and second by Marcoplos the Board approved the budget ordinances (as amended to include the recommended language above) listed below, and the FY20 Wake Transit Work Plan, by a vote of seven to one with Jones voting against the motion. The ordinances and plan are attached and hereby made a part of these minutes.

- FY20 GoTriangle Budget Ordinance (O 2019 0005)
- FY20 Regional Bus Capital Project Fund Budget Ordinance (O 2019 0006)
- FY20 Major Capital Project Fund Budget Ordinance (O 2019 0007)
- FY20 Advanced Technology Project Fund Budget Ordinance (O 2019 0008)
- FY20 Major Transit Investment Fund Budget Ordinance (O 2019 0009)

- FY20 Triangle Tax District – Durham Operating Fund Budget Ordinance (O 2019 0010)
- FY20 Triangle Tax District – Durham Capital Fund Budget Ordinance (O 2018 0011)
- FY20 Durham-Orange Special Tax District Fund Budget Ordinance – Durham County (O 2019 0012)
- FY20 Triangle Tax District – Orange Operating Fund Budget Ordinance (O 2019 0013)
- FY20 Triangle Tax District – Orange Capital Fund Budget Ordinance (O 2018 0014)
- FY20 Durham-Orange Special Tax District Fund Budget Ordinance – Orange County (O 2019 0015)
- FY19 Triangle Tax District - Wake Operating Fund Budget Ordinance (O 2018 0016)
- FY19 Triangle Tax District - Wake Capital Fund Budget Ordinance (O 2018 0017)
- FY19 Wake Special Tax District Fund Budget Ordinance (O 2018 0018)

C. Planning & Legislative Committee Report

Committee Chair Michael Parker reported that the Committee received a presentation on the TOD report and offered suggestions.

VII. Other Business

A. DCHC MPO Board Alternate Representative

Chair Reckhow stated that the Board never appointed an alternate to the DCHC MPO board. She suggested appointing Mark Marcoplos.

Action: On motion by Allen and second by Parker the Board appointed Mark Marcoplos as GoTriangle’s alternate representative to the DCHC MPO Board. The motion was carried unanimously.

Robinson disconnected from the call.

B. Amendment to HR&A Contract (RUS Bus)

Shelley Blake stated that HR&A, the firm contracted to assist with RUS Bus, has assisted with the rezoning process more than initially expected. She requested increasing their contract by \$70,000 to help evaluate the RFPs.

Action: On motion by Allen and second by Parker the Board authorized an amendment to the HR&A contract to increase the project budget by \$70,000. The motion was carried unanimously.

C. Amendment to the Orange County Transit Plan to Increase Funding for the Chapel Hill Transit North South Bus Rapid Transit Project

Praveen Sridharan presented an amendment of the Orange County Transit Plan to include the North South Bus Rapid Transit (NSBRT) project. He stated that the amendment has been approved already by the Orange County Board of County Commissioners.

Action: On motion by Allen and second by Parker the Board approved an amendment to the Orange County Transit Plan, which increases funding for the NSBRT project by \$8 million in fiscal years 2020 through 2022 to \$14.1 million. The motion was carried unanimously. The amendment is attached and hereby made a part of these minutes.

D. President and CEO's Report

A list of contracts approved by the President and CEO is attached and hereby made a part of these minutes.

Mann highlighted the following items:

- Staff is working with NCDOT and NCDMV to evaluate vanpool options to assist with the relocation of the DMV headquarters to Rocky Mount. One option being considered is an express bus service, but would require authorization from the Legislature to operate outside the three-county area.
- Applications have been submitted for two 5339 grants, \$11 million for vehicles and \$2 million for technology.
- We continue to work with NCDOT and the Turnpike Authority (NCTA) to evaluate the inclusion of transit on I-540, including infrastructure for transit services.

Parker suggested that GoTriangle staff develop some guidelines for road and highway projects to make them transit-friendly. Jacobs suggested presenting this at the next joint MPO meeting on October 30th.

1. Transit Operations Report

Patrick Stephens stated that GoTriangle has purchased simulators from Central Ohio Transit Authority. His presentation on bus operator training simulators is attached and hereby made a part of these minutes.

Jordan left.

2. Wake Transit Update

Patrick McDonough's presentation on the Wake-Durham Commuter Rail Major Investment Study (MIS) is attached and hereby made a part of these minutes.

3. Pre-Planning for Commuter Rail

Jeff Mann presented the structure for the Project Management Committee, which will support the continued development of a viable commuter rail system on the North Carolina Railroad corridor to serve the greater multi-county Triangle region. The committee initially consists of representatives from Wake County, Durham County, Go Triangle, North Carolina Railroad Company (NCR), Research Triangle Foundation, the Capital Area Metropolitan Planning Organization (CAMPO), and the Durham-Chapel Hill-Carrboro Metropolitan Planning Organization. Additional members may be added as appropriate.

Parker asked for an update on the APTA review of the D-O LRT project. Mann responded that a panelist list will be sent this week and the team will be here the week of July 29th.

E. General Counsel's Report

No report.

F. Chair's Report

No report.

G. Board Member Reports**1. CAMPO Executive Board Representative**

Will Allen III reported that the FY20 Wake Transit work plan and the Greater Triangle Commuter Rail project management structure were approved. The group also received presentations on the Wake Transit Implementation Update that will extend it to 2030 and the Triangle Strategic Tolling Study update.

2. DCHC MPO Board Representative

Ellen Reckhow reported that the DCHC MPO Board also received a presentation on the Triangle Strategic Tolling Study. She said the group also adopted a resolution to delay improvements in the NC 54 corridor to incorporate high capacity transit.

3. Regional Transportation Alliance (RTA) Representative

See below.

4. RTA Leadership Briefing & Tour

Reports from Will Allen III, Vivian Jones and Ellen Reckhow are attached and hereby made a part of these minutes.

VIII. Closed Session – Employee Performance

Action: On motion by Parker and second by Jacobs the Board adjourned into closed session at 2:45 p.m. pursuant to NCGS §143-318.11 (a) (6) to consider the qualifications, competence, performance, character, fitness, conditions of appointment, or conditions of initial employment of an individual public officer or employee or prospective public officer or employee. The motion was carried unanimously.

Action: The Board returned to open session at 3:07 p.m.

Action: On motion by Parker and second by Stephenson the Board voted to accept the resignation of President and CEO Jeff Mann. The motion was carried 5 to 3 with Allen, Hutchinson and Jones voting in the negative.

Action: On motion by Parker and second by Stephenson the Board voted to name Shelley Blake Interim President and CEO, effective August 1, 2019. The motion was carried unanimously.

Chair Reckhow then read a statement regarding the resignation, which is attached and hereby made a part of these minutes.

IX. Adjournment

Action: On by Allen the meeting was adjourned at 3:14 p.m.

Ellen Reckhow, Chair

Attest:

Michelle C. Dawson, CMC
Clerk to the Board

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Connecting all points of the Triangle

MEMORANDUM

TO: GoTriangle Board of Trustees
FROM: Sustainable Travel Services
DATE: July 24, 2019
SUBJECT: **Contract with RideShark Corporation for Rideshare Matching, Commute Calendar & Incentive Software**

Strategic Objectives Supported

- 1.1 Increase number of customers served with sustainable transportation services
- 1.4 Incorporate innovations
- 2.3 Deliver a customer-friendly experience through our people and systems
- 3.2 Strengthen Partnerships

Action Requested

Staff requests the Board authorize the President and CEO to execute a five-year contract to RideShark Corporation for the amount of \$59,300 in the initial year and \$54,800 in each additional year, which will provide a user-centric web-based suite and mobile device application of Transportation Demand Management (TDM) tools including rideshare matching, Emergency Ride Home management, commute tracking, incentive management, and vanpool management modules, housed on Share the Ride NC. On June 26, 2019, the Operations & Finance Committee approved recommendation to the Board of Trustees to authorize the CEO for negotiation and contract execution.

Background and Purpose

On March 20, 2019, GoTriangle advertised RFP #19-019 on behalf of NCDOT and GoTriangle for the purchase of an integrated suite of Rideshare Matching, Commute Calendar & Incentive Software solutions for TDM program providers across the state. Five vendors responded with a proposed software suite solution. A Selection Committee composed of representatives from GoTriangle and TDM program providers from Charlotte Area Transit System (CATS), Piedmont Authority for Regional Transportation (PART), Orange County, and University of North Carolina – Chapel Hill reviewed proposals. Representatives from Durham County, NCDOT and Gresham Smith, NCDOT's consulting firm, served as non-scoring participants. The Committee selected RideShark Corporation as the most responsive proposal and best value, based on the evaluation criteria set forth in the RFP.

The purchase will renew the contract with RideShark Corporation, the current rideshare matching software provider, allowing administrators in multiple regions of North Carolina to provide rideshare matching, Emergency Ride Home management, commute tracking, incentive management, and vanpool administration, through web-based systems. Software improvements include new modules and add mobile application systems. Activities supported by the software suite are in the work plan and grant agreements between GoTriangle, Triangle J Council of Governments and NCDOT.

Financial Impact

GoTriangle has received the FY2020 NCDOT Advanced Technology Grant for \$39,200 that requires a 10% match. This applies \$35,280 toward the initial year cost of \$59,300 for the RideShark Corporation system. Three organizations will pay for the full cost of an optional feature upgrade, Single Sign-On (SSO), which is \$600 per organization, totaling \$1,800. The remaining cost of \$22,220 is shared between statewide partners based on MSA population to reflect potential use of the software program: CATS \$7,643.68; GoTriangle \$7,643.68; PART \$3,644.08; Land of Sky COG \$1,644.28; and Wilmington MPO \$1,644.28.

The ongoing annual cost for the RideShark Corporation system is \$54,800. GoTriangle will continue to apply for the annual NCDOT Advanced Technology Grant for the full amount of the software less the SSO expenses, which will be paid for by the requesting organizations. The 10% match of the annual \$54,800 will be shared between statewide partners: CATS \$1,823.20; GoTriangle \$1,823.20; PART \$869.20; Land of Sky COG \$392.20; and Wilmington MPO \$392.20.

The financial impact of contract is not expected to exceed \$59,300 for the first year and not expected to exceed an annual cost of \$54,800. The five-year total is not expected to exceed \$278,500. After grants and cost sharing, total five-year financial impact to GoTriangle is not expected to exceed \$14,937.

Attachments

- None

Staff Contacts

William Bryant, Procurement Administrator, 919.485.7429, wbryant@gotriangle.org
 Shelly Parker, Sustainable Travel Services Manager, 919.485.7439, mparker@gotriangle.org
 Paul Straw, Sustainable Travel Services Supervisor, 919.485.7484, pstraw@gotriangle.org



MEMORANDUM

TO: GoTriangle Board of Trustees Operations & Finance Committee
FROM: Capital Development
DATE: July 10, 2019
SUBJECT: **Renewal of Triangle J Council of Governments (TJCOG) Contract**

Strategic Objective or Initiative Supported

Action Requested

Staff requests that the Committee recommend that the Board authorize the President/CEO to sign a contract with TJCOG to provide continued planning and GIS services used in developing the transportation networks and associated land use required for long range transit planning and project implementation for FY 2020, with a not-to-exceed (NTE) amount of \$45,000.

Background and Purpose

Planning and GIS services shall include facilitating the joint efforts of GoTriangle, the ITRE model team, NCDOT, and the MPOs and their constituent members in developing the transportation networks and associated land use required for long range transit planning and project implementation, and addressing the air quality issues associated with Metropolitan Transportation Plans (MTP) and Transportation Improvement Programs (TIP). TJCOG will also provide support as needed for the Triangle Regional Model Team.

Financial Impact

The estimated amount for this contract is \$40,000 for FY 2020 with a not-to-exceed dollar value for FY 2018 to \$45,000.

Attachments

- TJCOG FY20 Scope of work

Staff Contact(s)

- Kaitlin Hughes, Environmental Planner, Capital Development (919) 314-8751



Exhibit A -- Scope of Work

FY 2020 Services for Transit Project Support, Triangle Regional Model Support, and Joint MPO/GoTriangle Projects

Planning and GIS services shall include facilitating the joint efforts of GoTriangle, the ITRE model team, NCDOT, and the MPOs and their constituent members in developing the transportation networks and associated land use required for long range transit planning and project implementation, and addressing the air quality issues associated with Metropolitan Transportation Plans (MTP) and Transportation Improvement Programs (TIP). Activity Areas 1) and 2) below are funded jointly by the DCHC MPO, CAMPO, TJCOG member governments and GoTriangle. Activity Area 3) may be solely funded by GoTriangle, depending on the scale and scope of the requested assistance. The purchase of any digital data layers, including imagery or paper materials from which data layers must be digitized for tasks under Activity Area 3) will be paid for by GoTriangle. TJCOG will clear each purchase with GoTriangle before making the purchase.

- 1) TJCOG will support the activities of long range transit planning and associated land use and air quality planning by providing the planning and GIS services defined by the funding partners and which can include:
 - a) Facilitating MPO and GoTriangle tasks related to the creation and analysis of transportation networks and associated TAZ socioeconomic data for long range planning.
 - b) Conducting work sessions with local and regional partners to debrief on the CommunityViz2 and 2045 MTP processes and results to identify areas for improvement, and defining the scope and schedule for changes to result in the third version of CommunityViz and the initial tasks leading to the next update of the MTP.
 - c) Leading the joint AQ analysis efforts any MTP and TIP updates and amendments to ensure that transit projects can proceed.
 - d) Working at the invitation of GoTriangle on land use and fiscal constraint efforts related to county transit financial plans, MPO transit plans, Transit Oriented Development (TOD) planning, and GoTriangle corridor investment plans such as Major Investment Studies and New Starts submittals.
 - e) Assist in regional efforts to address affordable housing issues as they relate to household transportation costs and public transportation.

- 2) TJCOG will provide support as needed for the Triangle Regional Model Team. This includes:
 - a) Facilitating the work of the Triangle Regional Model Executive Committee.
 - b) Working with the ITRE program director and staff on technical tasks in support of GoTriangle and MPO planning activities.
 - c) Maintaining street centerline coverages for counties in the model study area.
 - d) Creating maps of model data as needed for checking and presentation.
 - e) Maintaining Traffic Analysis Zone and Travel Market Place mapping for the model study area including analyzing zone boundaries with other geographic coverages as needed.
 - f) Exporting map information for use by the Triangle Regional Model Team and local and regional partners

- 3) TJCOG will provide on-call support directly to GoTriangle as requested for GoTriangle-specific projects; services could include but are not limited to:
 - a) Project coordination and/or meeting facilitation.
 - b) GIS mapping and data analysis.
 - c) Undertaking specific tasks for GoTriangle-led projects and activities.

Exhibit B Federal Funding Requirements

The following provisions are required either (i) by a grant agreement or cooperative assistance agreement between the USDOT and GoTriangle or (ii) by a grant agreement or cooperative assistance agreement between the North Carolina Department of Transportation (hereinafter called the "NCDOT") and GoTriangle or (iii) by GoTriangle itself. As to such provisions, if there is variance between the language set forth herein and any such actual grant or cooperative assistance agreement, the provisions of the grant or cooperative assistance agreement shall govern.

To the extent applicable, the federal requirements contained in the FTA Master Agreement dated October 1, 2016, as amended (hereinafter called the "Master Agreement"), including any certifications and contractual provisions required by any federal statutes or regulations referenced therein to be included in this RFP document and the Contract, will be deemed incorporated into the RFP document and Contract by reference and shall be incorporated in any subagreement or subcontract executed by the successful Contractor pursuant to its obligations under the Contract. Contractor and its subcontractors, if any, will represent and covenant that they have complied and shall comply in the future with the applicable provisions of the Master Agreement then in effect and with all applicable federal, state and local laws, regulations and rules and local policies and procedures, as amended from time to time, relating to the equipment or the services provided under the Contract, which may in any manner affect the performance of the Contract, including, without limitation, the following:

No Government Obligation to Third Parties

(1) GoTriangle and contractor acknowledge and agree that, notwithstanding any concurrence by the US Government in or approval of the solicitation or award of the underlying contract, absent the express written consent by the US Government, the US Government is not a party to this contract and shall not be subject to any obligations or liabilities to the recipient, the contractor, or any other party (whether or not a party to that contract) pertaining to any matter resulting from the underlying contract.

(2) Contractor agrees to include the above clause in each subcontract financed in whole or in part with FTA assistance. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

Program Fraud and False or Fraudulent Statements or Related Acts

(1) The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § 3801 et seq. and U.S. DOT regulations, "Program Fraud Civil Remedies," 49 CFR Part 31, apply to its actions pertaining to this Project. Upon execution of the underlying contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract or the FTA assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, the Contractor further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on the Contractor to the extent the Federal Government deems appropriate.

(2) The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FTA under the authority of 49 U.S.C. § 5307, the Government reserves the right to

impose the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 5307 (n)(1) on the Contractor to the extent the Federal Government deems appropriate.

(3) The Contractor agrees to include the above two clauses in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clauses shall not be modified, except to identify the subcontractor who will be subject to the provisions.

Access to Records and Reports

(1) Where the purchaser is not a State but a local government and is an FTA recipient or a subgrantee of FTA recipient in accordance with 49 CFR 18.36(i), contractor shall provide the purchaser, the FTA, the US Comptroller General or their authorized representatives access to any books, documents, papers and contractor records which are pertinent to this contract for the purposes of making audits, examinations, excerpts and transcriptions. Contractor shall also, pursuant to 49 CFR 633.17, provide authorized FTA representatives, including any PMO contractor, access to contractor's records and construction sites pertaining to a capital project, defined at 49 USC 5302(a)1, which is receiving FTA assistance through the programs described at 49 USC 5307, 5309 or 5311.

(2) Where the purchaser is a State and is an FTA recipient or a subgrantee of FTA recipient in accordance with 49 CFR 633.17, contractor shall provide the purchaser, authorized FTA representatives, including any PMO Contractor, access to contractor's records and construction sites pertaining to a capital project, defined at 49 USC 5302(a)1, which receives FTA assistance through the programs described at 49 USC 5307, 5309 or 5311. By definition, a capital project excludes contracts of less than the simplified acquisition threshold currently set at \$100,000.

(3) Where the purchaser enters into a negotiated contract for other than a small purchase or under the simplified acquisition threshold and is an institution of higher education, a hospital or other non-profit organization and is an FTA recipient or a subgrantee of FTA recipient in accordance with 49 CFR 19.48, contractor shall provide the purchaser, the FTA, the US Comptroller General or their authorized representatives, access to any book documents, papers and record of the contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts and transcriptions.

(4) Where a purchaser which is an FTA recipient or a subgrantee of FTA recipient in accordance with 49 USC 5325(a) enters into a contract for a capital project or improvement (defined at 49 USC 5302(a)1) through other than competitive bidding, contractor shall make available records related to the contract to the purchaser, the Secretary of USDOT and the US Comptroller General or any authorized officer or employee of any of them for the purposes of conducting an audit and inspection.

(5) Contractor shall permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.

(6) Contractor shall maintain all books, records, accounts and reports required under this contract for a period of not less than three (3) years after the date of termination or expiration of this contract, except in the event of litigation or settlement of claims arising from the performance of this contract, in which case contractor agrees to maintain same until the recipient, FTA Administrator, US Comptroller General, or any of their authorized representatives, have disposed of all such litigation, appeals, claims or exceptions related thereto. Re: 49 CFR18.39(i)(11).

FTA does not require the inclusion of these requirements in subcontracts.

Federal Changes

Contractor shall comply with all applicable FTA regulations, policies, procedures and directives, including without limitation those listed directly or by reference in the Master Agreement between the purchaser and FTA, as they may be amended or promulgated from time to time during the term of the contract. Contractor's failure to comply shall constitute a material breach of the contract.

Civil Rights Requirements

(1) Nondiscrimination - In accordance with Title VI of the Civil Rights Act, as amended, 42 USC 2000d, Sec. 303 of the Age Discrimination Act (1975), as amended, 42 USC 6102, Sec. 202 of the Americans with Disabilities Act (1990), 42 USC 12132, and 49 USC 5332, contractor shall not discriminate against any employee or applicant for employment because of race, color, creed, national origin, sex, age or disability. Contractor shall also comply with applicable Federal implementing regulations and other requirements FTA may issue.

(2) Equal Employment Opportunity - The following equal employment opportunity requirements apply to the underlying contract:

(a) Race, Color, Creed, National Origin, Sex - In accordance with Title VII of the Civil Rights Act, as amended, 42 USC 2000e, and 49 USC 5332, contractor shall comply with all applicable equal employment opportunity requirements of USDOL, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, USDOL," 41 CFR 60 et seq., (implementing Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," 42 USC 2000e), and any applicable Federal statutes, executive orders, regulations, and policies that may in the future affect construction activities undertaken in the course of the project. Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, creed, national origin, sex or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, contractor shall comply with any implementing requirements FTA may issue.

(b) Age - In accordance with Sec. 4 of the Age Discrimination in Employment Act (1967), as amended, 29 USC 623 and 49 USC 5332, contractor shall refrain from discrimination against present and prospective employees for reason of age. Contractor shall also comply with any implementing requirements FTA may issue.

(c) Disabilities - In accordance with Sec. 102 of the Americans with Disabilities Act (ADA), as amended, 42 USC 12112, contractor shall comply with the requirements of US Equal Employment Opportunity Commission (EEOC), Regulations to Implement Equal Employment Provisions of the Americans with Disabilities Act, 29 CFR 1630, pertaining to employment of persons with disabilities. Contractor shall also comply with any implementing requirements FTA may issue.

(3) Contractor shall include these requirements in each subcontract financed in whole or in part with FTA assistance, modified only if necessary to identify the affected parties.

Incorporation of Federal Transit Administration (FTA) Terms

All USDOT-required contractual provisions, as set forth in FTA Circular 4220.1F, are incorporated by reference. Anything to the contrary herein notwithstanding, FTA mandated terms shall control in the event of a conflict with other provisions contained in this Agreement. Contractor shall not perform any

act, fail to perform any act, or refuse to comply with any grantee request that would cause the recipient to be in violation of FTA terms and conditions. Contractor shall comply with all applicable FTA regulations, policies, procedures and directives, including, without limitation, those listed directly or incorporated by reference in the Master Agreement between the recipient and FTA, as may be amended or promulgated from time to time during the term of this contract. Contractor's failure to so comply shall constitute a material breach of this contract.

Energy Conservation

Contractor shall comply with mandatory standards and policies relating to energy efficiency, stated in the state energy conservation plan issued in compliance with the Energy Policy & Conservation Act.

Geographic Restrictions and Prohibition Against Exclusionary or Discriminatory Specifications

- a. CONTRACTOR agrees to refrain from using state or local geographic preferences, except those expressly mandated or encouraged by federal statute, and as permitted by FTA.
- b. To the extent applicable, CONTRACTOR shall comply with the requirements of 49 U.S.C. § 5323(h)(2) by refraining from using any funds derived from the Contract in performance of the Services to support procurement using exclusionary or discriminatory specifications.

Debarment and Suspension

The CONTRACTOR agrees to comply, and assures the compliance of each subcontractor, lessee, third party contractor, or other participant at any tier of the Project, with Executive Orders Nos. 12549 and 12689, "Debarment and Suspension," 31 U.S.C. § 6101 note, and U.S. DOT regulations, "Nonprocurement Suspension and Debarment," 2 C.F.R. Part 1200, which adopts and supplements the provisions of U.S. Office of Management and Budget (U.S. OMB) "Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement)," 2 C.F.R. Part 180. The CONTRACTOR agrees to, and assures that its subcontractors, lessees, third party contractors, and other participants at any tier of the Project will, review the "Excluded Parties Listing System" at <http://www.sam.gov/portal/public/SAM/> before entering into any subagreement, lease, third party contract, or other arrangement in connection with the Project.

MEMORANDUM

Connecting all points of the Triangle

TO: GoTriangle Board of Trustees
FROM: Regional Services Development
DATE: July 9, 2019
SUBJECT: **Renewal of Triangle Regional Model Service Bureau (TRMSB) Contract**

Strategic Objective or Initiative Supported

1.2 Pursue service improvements and expansion opportunities

Action Requested

Staff requests that the GoTriangle Board of Trustees authorize the President/CEO to sign a contract with ITRE to provide continued model development services of the Triangle Regional Model (TRM) for FY 2020 with a not-to-exceed (NTE) amount of \$220,000.

Background and Purpose

The TRM Service Bureau maintains the Triangle region's travel demand forecasting model. Its work is funded through a four-way partnership involving GoTriangle, NCDOT, DCHC-MPO, and CAMPO.

The model provides sophisticated data analysis of traffic patterns, volumes, and capacities on the Triangle road network as well as bus ridership and rail ridership forecasts for the future. The Federal New Starts process heavily utilizes regional travel demand models like the TRM to assess which capital improvement projects to fund out of a limited pot of money at the federal level.

The model team is continually making improvements to the model to better estimate transit ridership now and in the future.

Financial Impact

The estimated amount for this contract is \$214,322 for FY 2020 with a not-to-exceed dollar value for FY 2020 of \$220,000.

Attachments

- FY20 Budget and Scope of Work

Staff Contact(s)

- Jay Heikes, (919) 314-8741, jheikes@gotriangle.org
- Patrick McDonough, (919) 485-7455, pmcdonough@gotriangle.org

GO TRIANGLE STAKEHOLDER BUDGET TRIANGLE REGIONAL MODEL SERVICE BUREAU BUDGET FOR FY 2020: July 1, 2019 to June 30, 2020		
Budget Items	Description of Level of Effort	Budget
		FY 2019-20
Salaries and Wages (Personnel) *		
ITRE Associate Director	1.25 % effort for 12 mo	\$ -
Director	25 % effort for 12 mo	\$ 26,439
Research Scholar	25 % effort for 12 mo	\$ 23,616
Research Associate	25 % effort for 12 mo	\$ 15,450
Research Associate	62.5 % effort for 12 mo	\$ 36,486
Graduate Intern	50 % /sem; 100 % summer	\$ 4,499
SUBTOTAL PERSONNEL		\$ 106,490
Staff Benefits		
Staff (26.91%+\$6,104 ea. Health Insurance)		\$ 35,839
Graduate Intern (8.05%)		\$ 362
SUBTOTAL STAFF BENEFITS		\$ 36,201
TOTAL PERSONNEL & BENEFITS		\$ 142,692
Supplies and Materials		
(Supplies, plotter paper, plotter ink)		\$ 100
Computer replacements (0)		\$ -
Travel		
In State		\$ 163
Out of State		\$ -
Training		\$ 750
Current Services		
Communications (long distance)		\$ 37
Printing and Binding		\$ -
Contracted Services		
On-call technical assistance		\$ 5,000
		\$ -
		\$ -
Fixed Charges		
Other Fixed Charges TransCAD \$1,800/ea, FORTRAN \$800, 5pm \$305		\$ 2,583
Slack \$228		\$ -
Student Aid / Tuition Remission		
In State		\$ -
Subcontract		
Household travel survey update - Resource Systems Group, Inc.		\$ 10,795
Rental of Office Facilities		
Rent 6.2% of MTDC		\$ 10,051
TOTAL OTHER DIRECT COSTS		\$ 29,480
Facilities & Administrative Costs		
26% of MTDC ***		\$ 42,151
TOTAL BUDGET		\$ 214,322

* Uses a 3% growth factor/yr

** GoTriangle contributes 0.5 FTE plus 25% of remaining 0.5 FTE

*** 26% based on one contract through the Master Agreement between NCSU-ITRE and NCDC

Exhibit A

Project Scope of Work and Budget

Introduction

The following scope of work is presented as the proposed work plan for the TRM Model Team including the TRM Service Bureau for the budget year July 1, 2019 – June 30, 2020. The primary efforts outlined in this scope are intended to focus the efforts of the Model Team and Service Bureau on maintaining the TRMv6 model for the Triangle region, and developing a 2016 model using household survey data collected during 2016, transit on-board survey data collected during 2014 and 2015, and parking behavior data collected in 2016 and to be called version 6.1. Work also includes plans to collect household survey data as a part of a recurring update program. Refer to Appendix A for an overall vision for v6 and v7 models.

Several assumptions are made within the context of this scope.

1. Signatory agencies will commit one-half FTE per agency to the completion of the list of tasks outlined in this work plan. The TRM Program Manager will assume responsibility for providing adequate work to meet this obligation by specifying the task description, deliverables, and person hours required. This information will be provided at least quarterly and will be sufficient to fully incorporate the one-half FTE required of each agency.
2. All TRM staff representing the signatory agencies will, as needed, work on site at ITRE, including any third person who is providing services in the name of a signatory agency. This enables the Team to work together on issues that require the input of multiple team members and reduces the tendency for team members to be reassigned to other tasks in their home offices.
3. The TRM Program Manager will assign tasks with associated deliverables and target dates. TRM Team members will agree to take responsibility for specific tasks and will be held accountable for completion of those tasks. The responsible team member (stakeholder and TRM Service Bureau) will be responsible for **monthly** reporting on progress in 5pm including 1) status, 2) changes in anticipated completion dates, 3) reasons for change, and 4) hours spent on model development work and percent of task complete for the month reported. Stakeholder team members are requested to report in a timely manner if any external resources or assistance is needed to complete tasks.
4. Each signatory agency's one-half FTE contribution may include staff time from people other than their TRM Team member, but the TRM Team member will play a key role and other staff must be adequately trained to meet the needs of the TRM Team.
5. All intermediate and final products of this work program belong to the four stakeholders (NCDOT, CAMPO, DCHC, and GoTriangle) and these will be delivered to the stakeholders in a form and via media acceptable to each stakeholder at the end of the contract year or before. The products include: model files including input files; scripts and program source code; all technical memoranda; estimation data file inputs and outputs; technical reports and user guides; and tools prepared including macro script files and user guides for their use.

Note on model version names: the following version names will be used in this scope of work consistent with model team recommendations (for detailed TRM name history, please refer to Appendix B "TRM History" section).

- **TRM v6:** Updated and enhanced trip based model based on the v5 model. TRM v6 (with a 2010 estimation year, and 2013 base year) was delivered in May, 2016 and was used for developing the 2045 Metropolitan Transportation Plan and Air Quality Conformity Analysis, transit analysis, and Comprehensive Transportation Plan analysis.

- **TRM v6.1:** Enhanced trip based model developed with updated travel survey data, on-board transit survey data, and parking behavior survey data. TRM v6.1 2016 will be delivered in December, 2020 and will be used for the 2050 Metropolitan Transportation Plan development and Air Quality analysis.

Overall Work Program Summary Task Table (including stakeholder work hours)

Task Number	Task Title	FY 18 Task Hours	FY 19 Task Hours	FY 20 Task Hours	% of Total FY 20
1.2	Household survey data collection, processing & analysis	448	560	352	3.5%
1.3	Transit on-board survey data collection, processing & analysis	292	0	80	0.8%
1.4	Process locally collected data	189	240	240	2.4%
1.6	Survey plan	0	120	120	1.2%
2.1	Maintain and update hwy. & transit networks, SE data	1,500	458	640	6.4%
2.3	Zone geography	0	80	240	2.4%
2.5	Transit networks	335	320	120	1.2%
2.6	Zonal data & models	136	392	200	2.0%
2.8	Data management program	0	120	16	0.2%
2.9	Develop improved transit fare model	0	0	896	8.9%
3.2	Investigate improving non-home based trips	120	120	120	1.2%
4.2	Prepare time of day factors	144	144	144	1.4%
5.1	Estimation and calibration of destination choice model	1,076	980	980	9.7%
6.1	Estimation and calibration of non-motorized models	288	288	288	2.9%
7.1	Calibration of mode choice models	280	280	280	2.8%
8.1	Develop improved commercial vehicle model	0	0	120	1.2%
8.4	External travel models	251	300	300	3%
8.5	Airport special generator models	0	0	100	1.0%
8.8	FTA STOPS model	0	200	200	2.0%
9.1	Investigate improving hwy. assignment	56	460	180	1.8%

Task Number	Task Title	FY 18 Task Hours	FY 19 Task Hours	FY 20 Task Hours	% of Total FY 20
9.2	TRM v6.1 2016 model assignment & overall model calibration	0	504	964	9.6%
9.3	Extend quality control metrics	0	112	80	0.8%
19.1	Develop overall model design	0	160	120	1.2%
19.2	Implement elements of overall model design	0	136	300	3.0%
19.3	Emerging issues to address in TRM	0	40	40	0.4%
20.1	TRM technical documentation	200	80	160	1.6%
20.2	TRM User's Guide	40	80	104	1.0%
21.2	Assistance with TRM model application	138	160	224	2.2%
21.3	Action items	528	560	587	5.8%
22.1	Oversight and reporting	1,448	1,536	1,488	14.8%
22.2	Training	320	320	380	3.8%

1 Data collection

1.2 Household survey data collection, processing & analysis

1.2.1 Household survey processing and analysis

A household survey was conducted by the region to support future model development efforts. A sample of households for the region was surveyed during 2015 and 2016. During FY 2017 and FY 2018 this task processed the survey data. During FY 2019 the data was further processed to prepare unlinked trips for model development. This task will prepare an updated report and presentation for the 2016 survey data reflecting processing by the TRM team. A public data set will be prepared along with a data dictionary and report for distribution. An analysis and “travel trends” report will also be prepared summarizing the data collected during 2018 showing trends in travel behavior.

Deliverable(s):

- 1) Updated survey report reflecting processing and analysis to date
- 2) Presentation suitable for policy makers
- 3) Survey data (public version) ready to distribute with data dictionary and report
- 4) Travel trends report for data collected during 2018

Est. start date: 12/11/2019

Est. end date: 1/10/2020

ID	Task Description	Task Hours
1.2.1	Household survey data collection, processing & analysis	112
a)	Prepare report for 2016 household survey reflecting processing & analysis	40
b)	Prepare summary presentation of 2016 household survey for policy makers	16
c)	Set up public data along with data dictionary & report for distribution	16
d)	Prepare analysis of travel trends & report for data collected during 2018	40

1.2.2 Recurrent household survey data collection

Work will continue on a program of recurrent household survey data collection (similar to the American Community Survey or ACS). Benefits from a recurrent program of household survey data collection include: up-to-date data for developing models, ability to track change over time, and predictable and lower annual funding requirements as compared to surveys conducted every ten years. The cost efficiencies can be realized by executing the survey over time, by not repeatedly incurring startup costs. The data collection program was designed during FY 2017 based on stakeholder feedback. The survey instruments and survey materials were updated

during FY18 and the detailed sampling plan was developed. During FY19 the survey was performed and survey data products were delivered. Expected products from the shorter cycle household survey data collection program are expected to include more frequent data updates, and every four or five years (depending on sample size and design of the data collection program) an aggregated set of data and survey documentation suitable for updating the model depending on how frequently the stakeholders want to update the model. Specific tasks will include planning for data collection to take place during FY 2021. A key aspect of the work will be to plan for the amount of and sampling for GPS smartphone surveys. The survey will be set up to work with the new data storage platform now used for GPS smartphones, and the app will be customized. The GPS smartphone survey will be integrated into the overall survey.

Deliverable(s):

- 1) Survey print materials, updated GPS smartphone survey instrument, survey instrument and web-based survey platform
- 2) Final survey sampling plan memo including description of the use and combining of GPS smartphone sample with the internet based sample
- 3) Quality assurance/control memo

Milestones	Delivery date
Update GPS smartphone survey instrument & update survey platform and survey materials	3/31/2020
Draft sampling plan for GPS smartphone survey and internet based survey	4/30/2020
Draft final report	5/31/2020
Final report	6/30/2020

Est. start date: 1/2/2020

Est. end date: 6/30/2020

ID	Task Description	Task Hours
1.2.2	Recurrent household survey data collection	240
a)	Design approach through sub-contractor including administration of sub-contract	40
b)	Review of survey materials and GPS smartphone app	120
c)	Monitor work of sub-contractor during survey design and participating in progress teleconference calls	80

1.3 *Transit on-board survey data collection, processing and analysis*

A transit on-board survey will be conducted by GoRaleigh during FY2020. Support will be provided for design of the survey to enable use with development of the TRM.

Est. start date: 7/5/2019

Est. end date: 3/27/2020

ID	Task Description	Task Hours
1.3	Transit on-board survey data collection, processing and analysis	80
a)	Provide assistance with data collection management including survey design review	40
b)	Review reports and data delivered by survey contractor	40

1.4 *Process locally collected data*

Stakeholders and local governments routinely collect many types of data that could be used for developing the TRM, such as traffic counts, turning movement counts, and transit passenger counts. In order to use the locally collected data for developing the TRM, it needs to be gathered from the agencies that collect it, to organize it for use, and to document it. This task will contact local agencies and compile a catalog of locally collected data including contact information and information about when and how often data is collected. A set of file folders will be created to organize the data, and to make it easy for team members to find it. Finally, the gathering of data and processing of it will be documented including: 1) Person responsible for collecting the data, and the data source (agency or institution), and 2) Processing of the data including by whom, issues addressed and assumptions made in processing the data for model use.

Special traffic counts were collected by NCDOT Traffic Survey during fall 2017. Special traffic counts collected by NCDOT were obtained, and they were processed for use with daily model calibration and validation. The counts will be processed for time of day and classification validation.

Deliverable(s):

Locally collected data gathered, processed, stored, and documented

Est. start date: 7/5/2019

Est. end date: 6/30/2020

Milestones	Delivery date
Traffic count observed & time of day evaluation files	12/21/2019

ID	Task Description	Task Hours
1.4	Gather and process locally collected data	240
a)	Identify data collected by stakeholders and local governments	8
b)	Contact agencies that collect data and arrange for transfer	40
c)	Organize storage for data	16
d)	Load data collected into storage	8
e)	Prepare/update documentation	16
f)	Process special traffic counts collected by NCDOT Traffic Survey	152

1.6 *Survey data collection plan*

This task will update the survey data collection plan to enhance it in several ways. It will list all previous surveys and surveys currently underway. It will describe need for and timing for future surveys and show when they will be used in model updates. It will distinguish between routine or ongoing data gathering, and periodic survey data collection.

Deliverable(s):

- 1) Survey data collection plan document to be kept current
- 2) Clear, easy to understand document showing timing & extent of all surveys used in the model and likely to be used to revise it in the future (recurrent household travel survey, transit on-board survey, etc.)

Est. start date: 7/8/2019

Est. end date: 8/30/2019

ID	Task Description	Task Hours
1.6	Survey data collection plan	120
a)	Revise data collection plan to be current & to add sections as needed	80
b)	Send out draft revised data collection plan and gather comments	16
c)	Revise draft plan and create final version for distribution	24

2 Model inputs

2.1 *Maintain and update networks, and zonal data*

Maintain and update highway and transit networks, and zonal data whenever new data (such as school enrollment or zonal path density and average block size) are available, new attributes (such as on-street parking, truck prohibited links and lanes indicator) are needed in the model, new projects are completed, or errors are discovered.

2.1.1 *Implement a tool to facilitate external review of highway and transit networks*

Highway and transit networks ideally should be reviewed by local planning staff and be updated at least annually. During FY18 scripting was prepared to allow online reviewing of networks using ArcGIS online (AGOL), and the scripts were tested with testing network data. The actual hosting for the tool and contacting of local government reviewers was not completed. During FY20 this task will implement the recommended approach developed during FY18. This task will include setting up the appropriate network for review, developing a list of local government reviewers and technical contacts, and sending out requests for review. After reviewers begin submitting edits using the tool, the results will be downloaded and edits will be made to the TRM highway network as needed. All edits made will be entered in the network editing log.

Deliverable(s):

Brief report describing the process carried out, a summary of the resulting review, and information about the edits undertaken in the TRM networks

Est. start date: 7/10/2019

Est. end date: 9/1/2019

ID	Task Description	Task Hours
2.1.1	Implement a tool to facilitate external review of highway and transit networks	160
a)	Set up tool for use and network for review	40
b)	Develop list of reviewers at local governments and technical contacts	20
c)	Send out request for review & follow up requests	20
d)	Download edits made by local reviewers and as appropriate make edits to TRM networks	64
e)	Prepare brief report documenting the review	16

2.1.2 *Develop 2020 base year highway and transit network and SE data*

It has been requested that model inputs for a 2020 base year model be developed for use during the preparation of the 2050 MTP. The Model Team will organize, check and process the data for

model use. For this task, the team will call on staff at the two MPOs to assist with organizing member jurisdictions to help check population and employment. It is expected that the level of effort to be contributed by MPO staff will be at least one month's effort over an approximately six-month period to provide communication and coordination for the work. The work group assembled to perform the work will meet regularly to review progress and plan next steps.

During FY20, the task will be organized and the working group assigned and assembled. Some data that can be gathered during 2020 will be gathered and processed under Task 1.4 above. This includes information on transit services (schedules), enrolled university students and any other data that may be available. Documentation will be outlined (a template will be prepared) and the task will be organized with roles assigned and a detailed schedule will be prepared.

Deliverables:

- 1) Documentation template and schedule for completing the work with roles assigned.
- 2) Base year model inputs along with documentation of their preparation

Est. start date: 8/5/2019

Ext. end date: 6/30/2020

Data item(s) needed from partners	Date needed
Households by size and income, household population, and employment by establishment type and employee type and earning by TAZ	2021?
Enrolled university students at 4 major universities	2/1/2020
Changes to on campus housing and on campus building area	2/1/2020
K-12 school enrollment by TAZ	3/31/2020
Parking inventory by PASA: <ul style="list-style-type: none"> • Change in parking spaces by type 2016-2020 • CBD PASAs: Monthly contract rate for reserved & not reserved, hourly rate and daily maximum • University PASAs: <ul style="list-style-type: none"> ○ Employee and student permit rate (yearly, monthly, semester) ○ Hourly and daily maximum for visitors 	Spring 2020
Fare box (GFI) counts and transaction data for February, March and April 2020 by fare type for all systems that collect GFI data	6/1/2020
APC data for transit passengers on all systems	6/1/2020

ID	Task Description	Task Hours
2.1.2	Develop 2020 base year highway and transit network and SE data	80
a)	Develop documentation template for all data to be gathered & processed	8
b)	Prepare task list for work and schedule	16
c)	Team meets and assigns work group roles	16
d)	Begin work to gather available data	40

2.1.3 Conduct review of highway and transit networks

A review of the highway and transit networks will be continued to locate any opportunities that may exist to improve network coding. This review will include comparing available speed data to network speeds, attribute coding, and need for adjusting or for additional centroid connectors. Available data will be obtained and will be processed for making comparisons to TRM network files. All findings will be reported and network modifications will be logged.

An initial brief task will develop a general guideline for the review listing: major steps, key attributes/information that are to be reviewed ranked by priority, data sources to be consulted, and the way the review is to be broken up into pieces by functional class and/or geography. The priority will be based on the information that is most important to be correct versus information that may not be equally important. Finally, a reporting and logging framework will be set up for use while conducting the review to properly document the work.

The next sub-task will be to conduct the review based on the detailed plan developed above. All review will be documented in the logging and reporting format.

In addition, this task will develop procedures and network coding rules for applying turn penalties and prohibitions. Once the procedures are prepared, the network will be reviewed to determine where turn penalties need to be added or be updated (location or penalty value). A particular emphasis will be placed on developing procedures to update turn penalties/prohibitions for different MTP/forecast scenarios. Even though the turn penalty table is related to the TrueU link IDs, the table is not automatically created during the scenario creation, and it is possible to use a table with penalties that do not apply to the scenario or to leave penalties out that should be included with projects added to the scenario.

The next sub task will be to develop a procedure for reviewing new development taking place and to determine if centroid and network edits are needed. It will be determined if it is feasible to obtain building permit data or certificates of occupancy (CO) annually and to process it for determining the location of and amount of new development. A short tech memo will be prepared to describe the amount of effort needed to collect and process the data for the region, and the effort needed to update the TRM network based on the data. It is expected an assessment can be made based on CO data collected during the development of the 2016 population estimate by TAZ. Other approaches will also be explored.

Deliverable(s):

- 1) Technical memorandum describing network coding rules for turn penalties and prohibitions suitable for inclusion in the coding manual. Updated procedure/tool will be prepared to implement the network coding rules for turn penalties and prohibitions.
- 2) Technical memorandum describing the data sources used and procedures followed for reviewing TRM networks.

Est. start date: 7/5/2019

Est. end date: 4/5/2020

ID	Task Description	Task Hours
2.1.3	Conduct review of highway and transit networks	400
a)	Develop detailed plan for conducting review of highway & transit networks	16
b)	Conduct review according to the detailed plan developed in sub task a) above and recorded in the reporting framework	160
c)	Prepare technical memorandum documenting the review conducted	24
d)	Develop procedures for identifying the location and amount of development taking place during the prior year and centroid and network edits needed.	80
f)	Develop procedures for coding turn penalties/prohibitions in future projects and scenarios and for tracking/updating them.	80
g)	Update TRM network turn penalty table based on available data	24
h)	Draft tech memo with procedures for turn penalties suitable for use in coding manual	16

2.3 *Zone geography*

Objectives:

To review and if needed update TAZ geography to reflect development changes, and existing or future highway projects.

2.3.1 *TAZ geography revision*

This task will revise TAZ geography for TRM v6.1 based on the MPO review conducted during FY19 and considering census geography. Making changes to TAZ geography will also require making changes to model networks (centroid connector and other changes) and changes to model input tables and input parameters. These changes are also included in the task.

Deliverable(s):

May 27, 2019

- 1) TAZs revised for application during 2050 MTP analysis
- 2) Revised networks, SE data tables, and all other model inputs needed to apply the revised TAZ geography

Est. start date: 1/2/2020

Est. end date: 2/28/2020

ID	Task Description	Task Hours
2.3.1	TAZ geography review - revision	240
a)	Revise TAZs recommended for revision during FY19 review	80
b)	Team review of revised TAZ geography	16
c)	Revise highway and transit networks, SE data table, and all other inputs as needed to apply the revised TAZs	120
d)	Document revisions made and distribute to team	24

2.5 *Transit networks*

This task will work on several aspects of representing transit services in the TRM.

2.5.1 *Develop improved transit model procedures*

This task will identify approaches to efficiently prepare transit alternatives for analysis during development of the MTP.

The following work will be done:

- a) Convene a work session with MPO staff that prepared transit alternatives for the 2045 MTP. During the work session the procedure used to prepare transit alternatives will be described and issues with the existing procedure will be identified. A list will be prepared of possible approaches to overcome the issues identified.
- b) Tests will be prepared using networks and alternatives from the 2045 MTP, and the possible approaches in step a) will be tested.

Deliverable(s):

Technical memorandum describing approaches to efficiently prepare transit alternatives for analysis, testing of the approach and recommended procedures to use.

Est. start date: 1/2/2020

Est. end date: 3/28/2020

ID	Task Description	Task Hours
2.5.1	Develop improved transit model procedures	120
a)	Identify approaches to more efficiently prepare transit alternatives for analysis during MTP alternatives analysis	40
b)	Set up and test approaches for preparing transit alternatives	40
c)	Prepare draft technical memorandum and send to team for review	16
d)	Revise draft technical memorandum and create final version for distribution	24

2.6 *Zonal data & models*

2.6.5.1.3 Implementation of an Auto Ownership Model

During FY19 an auto ownership model was estimated using the 2016 household travel survey. This task will implement the auto ownership model in the TRM.

Deliverable(s):

- 1) Scripting for the implementation of the auto ownership model in the TRM
- 2) Technical memorandum documenting the auto ownership model implementation for including in TRM documentation and User's Guide

Est. start date: 12/11/2019

Est. end date: 1/23/2020

ID	Task Description	Task Hours
2.6.5.1.3	Implementation of an Auto Ownership Model	200
a)	Design implementation of auto ownership model in TRM	40
b)	Prepare scripts to replace existing PopGen auto ownership procedure	80
c)	Test and debug scripts for auto ownership model	40
d)	Prepare tech memo for auto ownership model implementation	40

2.8 *Data management program*

The TRM depends on many data inputs for model development and for model application. It depends on the quality of the data in order to produce quality results. The data is collected at

different times depending on the purpose for the data. A data management program is needed so all partners can understand what input data have been collected or when it will be collected in the future, how and when it was or will be processed, and the quality checks that have or will be applied to it. Note that this incorporates and augments the survey plan to be developed in task 1.6.

2.8.1 Develop and maintain a list of model inputs

This task will maintain a list that can be shared among the TRM partners to track updating and checking of all model inputs. This will collect information about input data already collected and the survey plan, model development schedules, and Metropolitan Transportation Plan update schedules. The objective is to allow the stakeholders to see both the full list for any year, and to be able to see more detailed information about any element in the list. It should also identify the purpose for gathering the data, and lead times for collecting and processing the data before model use. This task will draw upon the Task 1.6 data collection plan products.

Deliverable(s):

Sharable program of model input updates including a schedule and uses intended for inputs

Est. start date: 1/28/2020

Est. end data: 2/15/2020

ID	Task Description	Task Hours
2.8.1	Develop and maintain a list of model inputs	16
a)	Update list of model inputs	16

2.9 Develop an improved transit fare model

Purpose:

To better represent transit fares (costs) for transit passengers

Objective:

The current treatment of transit fares in the TRM relies on a weighted average fare based on actual transit passenger riding numbers by fare paid. While this allows for representing employer paid pass subsidies, it applies them to all transit services provided by each transit company by local and express service types. This task will develop an approach to represent transit fare subsidies in a way that can be used to test different policies, such as for more employers in a specific geographic area to offer pass subsidies.

Previous work:

Literature review prepared during 2017.

2.9.1 Investigate approaches to represent transit fares

This task will update the investigation done previously regarding the approaches that have been

used to represent transit fares and will report on any experience with use of the approaches.

Deliverable(s):

- 1) Technical memorandum with findings regarding approaches used to represent transit fares

Est. start date: 12/11/2019

Est. end date: 1/3/2020

ID	Task Description	Task Hours
2.9.1	Investigate approaches to represent transit fares	96
a)	Collect information on representation of transit fare in travel models	80
b)	Prepare technical memorandum	16

2.9.2 Design and specify transit fare model

This task will identify potential factors that may influence transit fare use choice, potential data sources for model estimation, calibration and validation such as transit on-board survey and other data to design a transit fare model based upon the findings of the investigation. An important consideration will be to determine how to apply the model for individual transit user persons by type.

Deliverable(s):

- 1) Technical memorandum describing design and specification for transit fare model

Est. start date: 1/6/2020

Est. end date: 1/21/2020

ID	Task Description	Task Hours
2.9.2	Design and specify transit fare model	88
a)	Develop model specification	80
b)	Prepare technical memorandum	8

2.9.3 Analyze transit on board survey data, fare box and other data, and prepare estimation data

The transit on board survey data will be analyzed and prepared for model estimation. This will include adding any needed calculated variables not currently existing in the survey data. GFI fare box data will also be analyzed to understand transit user's pass use.

Deliverable(s):

- 1) Technical memorandum for on board survey data and fare box data analysis and preparation
- 2) Model estimation data files ready to use

Est. start date: 1/22/2020

Est. end date: 3/3/2020

ID	Task Description	Task Hours
2.9.3	Analyze transit on board survey data and prepare estimation data	280
a)	Analyze transit on board survey and fare box data to determine relationships for model estimation	112
b)	Prepare estimation data	160
c)	Prepare technical memorandum	8

2.9.4 Estimate transit fare model

The model or models specified will be estimated using the data prepared in task 2.9.3 above, and other available data needed.

Est. start date: 3/4/2020

Est. end date: 3/17/2020

ID	Task Description	Task Hours
2.9.4	Estimate transit fare model	80
a)	Estimate transit fare model	80

2.9.5 Develop model application and calibrate model

Needed modifications to model scripts and application programs will be developed and tested. The model will be applied and will be adjusted to match calibration targets prepared using the transit on board survey data, fare box data and rider data.

Deliverable(s):

- 1) Technical memorandum for transit fare model estimation and calibration process, with statistical test results; and model performance
- 2) Model application
- 3) Calibrated model (parameters, needed input files)

Est. start date: 3/18/2020

Est. end date: 4/8/2020

ID	Task Description	Task Hours
2.9.5	Calibrate model	144
a)	Develop model application	80
b)	Prepare model calibration data	40
c)	Adjust model parameters to meet calibration targets	16
d)	Prepare technical memorandum	8

2.9.6 Validate model & final adjustment

After applying the model, the results will be compared to transit fare usage data provided by transit companies in the model region that charge a fare. Results will be compared for the region as a whole; for transit companies; and if possible by appropriate geography.

Deliverable(s):

- 1) Technical memorandum for transit fare model validation process
- 2) Finalized model specification and parameters (and input files)

Est. start date: 4/9/2020

Est. end date: 4/30/2020

ID	Task Description	Task Hours
2.9.6	Validate model and final adjustment	128
a)	Develop validation data from fare use data	40
b)	Apply transit fare model and compare to validation data	40
c)	Make any needed adjustments to model parameters and scripts to match validation targets	40
d)	Prepare technical memorandum	8

2.9.7 Documentation

Deliverable(s):

- 1) Technical memorandum for Task 2.9 Transit fare model development
- 2) Update TRM model documentation and User's Guide to include information for the transit fare model including parameters, model structure and input files

Est. start date: 5/1/2020

Est. end date: 5/14/2020

ID	Task Description	Task Hours
2.9.7	Documentation	80

3 Trip generation

3.1 Investigate improving non-home based trips in the TRM

One of the findings from investigating advanced trip based models is that non-home based trips are a weakness of trip based models. Approximately 19% of total trips in the TRM are non-home based trips (not including work based non-home trips). Techniques have been developed to improve the representation of non-home based trips. These techniques will be investigated more thoroughly including assessing level of effort and likely improvement to be gained by incorporating them in the TRM. This will form the basis for further work starting in Task 3 Trip Generation.

Deliverable(s):

Technical memorandum describing how techniques for improving non-home based trip making in the TRM could be implemented, level of effort needed to do so, and likely improvement to be expected. A recommendation will be provided regarding techniques to be included in TRM v6.1.

Est. start date: 11/27/2019

Est. end date: 1/28/2020

ID	Task Description	Task Hours
3.2	Investigate improving non-home based trips in the TRM	120
a)	Summarize techniques used to improve non-home based trips in trip based models	40
b)	Determine and summarize work to add these techniques to the TRM	40
c)	Prepare technical memorandum with results of investigation and recommendation for TRMv6.1	40

4 Time of day model

The current TRM v6 model uses fixed time-of-day factors to split a daily trip matrix into multiple time periods of a day and estimates traffic conditions for each time period by assigning the split trip matrices onto the highway network. This is a typical time-of-day modeling approach widely used in the US.

4.2 *Prepare time of day factors*

This task will prepare time of day factors for trips in motion for the eight TRM time periods using 2016 household survey data for use in subsequent steps including trip assignment.

Deliverable(s):

Set of time of day factors for TRM application and technical memorandum documenting their preparation

Est. start date: 7/9/2019

Est. end date: 8/2/2019

ID	Task Description	Task Hours
4.2	Prepare time of day factors	144
a)	Prepare time of day factors from re-expanded/weighted 2016 household survey for 8 total time periods: 2 peaks (each with pre-peak shoulder, peak hour, and post-peak shoulder), mid-day and night periods	128
b)	Prepare technical memorandum for the preparation of time of day factors	16

5 Trip distribution

5.1 Update destination choice model

This task will update parameters for the improved TRM v6.1 2016 destination choice model. The objective is for v6.1 2016 to better model trip distribution for each trip purpose by household strata, by employee type (including establishment type and employee earning levels for HBW, and establishment type for other trip purposes); focusing more on individual person types; to improve the accuracy of trip attraction allocation by purpose to appropriate destinations for each of the five household strata and/or employee types used in TRM v6.1.

This set of tasks will prepare new estimation files using the 2016 household survey data including updating the sampling procedure to sample up to 20 TAZs for each survey record, and calculating all explanatory variables for each possible destination TAZ.

Deliverable(s):

- 1) Model estimation files for updating destination choice models
- 2) Updated parameters for destination choice models
- 3) Calibrated model (parameters, any input files)
- 4) Finalized parameters
- 5) Modified script as needed
- 6) Technical memorandum on entire Task 5.1 TRM v6.1 2016 destination choice model
- 7) Updated TRM documentation and User's Guide
- 8) Ready to use model components (TransCAD script, parameters, input files)

Est. start date: 8/6/2019

Est. end date: 12/10/2019

ID	Task Description	Task Hours
5.1	Update destination choice models	980
a)	Prepare explanatory variables (such as logsum, and congested travel times) in TRM v6.1 2016	40
b)	Prepare the model estimation files, which includes sampling 20 possible destination TAZs for each trip record in the 2016 Household Survey, and calculating all explanatory variables for each possible destination TAZ	80
c)	Estimate model (HBW by 2 employee earning levels by 5 strata, and 5 trip purposes by 5 strata for other general population trip purposes)	288
d)	Identify and prepare calibration target data [mostly likely 2016HTS], including observed target trip tables, county level and district level flow	40
e)	Review model performance result vs. survey based target [trip length/distance, county-to-county flow and district-to-district flow]	80

f)	Calibrate model specification (adjust parameters)	120
g)	Identify validation data source not used for estimation such as CTPP and other data sources	8
h)	Prepare validation data [depends upon availability]	16
i)	Develop validation approach	8
j)	Validate model including: Duke University, Durham & Raleigh downtowns, RTP, NCSU, and UNC	80
k)	Final adjustment	40
l)	Documentation for TRM v6.1 2016 destination choice model	180

6 Nonmotorized

6.1 *Updating and calibration of nonmotorized models*

This task will update parameters for the nonmotorized models and calibrate parameters with 2016 household survey data.

Deliverable(s):

- 1) New parameters for Nonmotorized Models
- 2) Technical memorandum on the re-estimation and re-calibration of Nonmotorized Models
- 3) Updated TRM model documentation and User's Guide
- 4) Model parameter files and updated model script

Est. start date: 12/13/2019

Est. end date: 1/22/2020

ID	Task Description	Task Hours
6.1	Updating and calibration of nonmotorized models	288
a1)	Prepare non-motorized model specific zonal input data	24
a2)	Prepare observed nonmotorized target data from re-expanded/weighted 2016 survey data	24
b)	Prepare model estimation files including calculating household characteristics, TAZ attributes, and inter-TAZ travel impedance for each survey record	80
c)	Re-estimate and calibrate nonmotorized models (6) by time period for 5 strata	40
d)	Implement re-estimated/calibrated nonmotorized model in model stream	40
e)	Documentation for work to update parameters and re-calibrate nonmotorized models including calibration results	80

7 Mode choice

7.1 *Re-calibration of mode choice models*

This task will re-calibrate Mode Choice Model alternative specific constants for the existing TRM v6.1 approach to parking constraint

Deliverable(s):

New parameters for Mode Choice Models and input files, and technical memorandum on the calibration of Mode Choice Models

Est. start date: 1/27/2020

Est. end date: 3/13/2020

ID	Task Description	Task Hours
7.1	Re-calibration of mode choice models	280
a)	Prepare mode choice calibration targets from 2016 household survey data and 2016 combined transit on board survey data consisting of re-expanded/weighted 2014 GoTriangle on-board survey and 2015 GoRaleigh transit on-board survey data plus 2006 Duke on-board survey, and 2016 parking behavior survey data	40
b)	Re-calibrate mode choice models for 6 general population trip purposes and four university student trip purposes by 2 time periods	160
c)	Implement re-calibrated mode choice models into model stream	40
d)	Documentation	40

8 Special models

8.1 *Develop an improved commercial vehicle model (CVM)*

It has been requested to investigate whether or not to use the area type variable in destination choice.

8.1.1 Review and improve CVM destination choice model

This task will investigate the use of the area type variable in destination choice and provide a recommendation regarding whether to include it or not in the CVM. Further work will include removing the area type variable from destination choice (and possible re-estimation of the model), and adding terminal time to the truck model. The time estimate assumes the existing CV model estimation files can be used. If not, more time may be needed to prepare the estimation files.

Deliverable(s):

Technical memorandum reporting findings and recommendation for modification to destination choice

Est. start date: 4/20/2020

Est. end date: 5/31/2020

ID	Task Description	Task Hours
8.1.1	Review and improve CVM destination choice model	120
a)	Review current CV destination choice model	16
b)	Remove the area type variable in CV destination choice and possibly re-estimate the destination choice model	80
c)	Add terminal time to truck model	16
d)	Prepare technical memorandum	8

8.4 *Update external travel models (I-E, E-I, and EE)*

8.4.1 *Update external travel models*

Task will update external trip inputs for the TRM v6.1 2016 model. Based on the EE/EI update done for 2045, the following work listed in the table needs to be done for the 2016 model.

Deliverable(s):

Updated external inputs for external models & documentation of their preparation

Est. start date: 1/20/2020

Est. end date: 3/13/2020

ID	Task Description	Task Hours
8.4.1	Update external travel models	300
a)	Use the latest version of the NC Statewide Model and/or Streetlight data to inform the update of the EI/IE data	160
b)	Prepare any variables not prepared in task 1.5 above. For TRM v6.1 2016 work remains to update the external stations including the EE/EI and %Auto/%CV splits based on the updated traffic counts.	80
c)	Documentation for all updates	40

8.5 *Airport special generator models*

The TRM includes an air passenger model for the purpose of estimating person trips to RDU airport. The model was developed using data collected by an air passenger intercept survey in 2001.

8.5.1 Update/refine RDU airport special generator – freight & air passenger models

This task will develop a freight/truck special generator model using reported freight tonnage shipped and Streetlight data. If time is available, the Streetlight data will be used to update the air passenger model.

Deliverable(s):

- 1) Freight/truck model ready for implementation in TRM
- 2) Technical memorandum documenting all data sources, analysis, and parameters developed for model implementation

Est. start date: 4/6/2020

Est. end date: 6/30/2020

ID	Task Description	Task Hours
8.5.1	Update/refine RDU airport special generator models	100
a)	Develop a special freight/truck airport model using annual RDU freight tonnage and Streetlight data	80
b)	Review whether Streetlight data can be used to update the air passenger model	8
c)	Tech memo documenting data sources, analysis, and parameters developed for model implementation	12

8.8 Interface to STOPS model

The Federal Transit Administration has created the Simplified Trips-on-Project Software (STOPS) to aid project sponsors in quantifying the measures used by FTA to evaluate and rate projects.

8.8.1 Develop interface to STOPS model

This task will briefly review the documentation and software for STOPS to assess what information is needed from the TRM and how a tool could be developed to automate the process to prepare TRM data for use in STOPS. A tool will be developed similar to the Summit or MOVES tools for preparing the needed data and will be tested. It appears from the FTA STOPS overview, that year 2000 population and employment are needed. While current year (either 2013 or 2016) population and employment will be available for TRM geography, it may necessary to prepare this 2000 tabulation to support the tool. This will be determined during the review sub task.

Deliverable(s):

- 1) Technical memorandum describing the review conducted
- 2) All scripts prepared
- 3) User's Guide
- 4) Working scripts for preparing STOPS inputs from the TRM.

Est. start date: 5/24/2020

Est. end date: 6/28/2020

ID	Task Description	Task Hours
8.8.1	Develop interface to STOPS model	200
a)	Review STOPS documentation & design interface	20
b)	Prepare script for interface designed above in sub task a)	140
c)	Prepare technical memorandum documenting work and User's Guide	40

9 Trip assignment, calibration & validation

This task will apply the model with 2016 model inputs and the resulting highway and transit assignments will be compared to calibration targets. Travel time data and traffic counts by time of day and classification will be compared to model results.

9.1 Investigate improving highway assignment

9.1.1 Dynamic traffic assignment

Dynamic traffic assignment is being considered for both pricing and safety planning applications, and tools are being developed that may be appropriate for application in the Triangle region. These include DTALite being developed under an FHWA research project, and the SHRP 2 C10 project combining an activity based model with Dynus T.

An investigation of dynamic traffic assignment was conducted during FY 2013. This task continues work to incorporate dynamic traffic assignment in the TRM.

Timetable:

FY 2017: Select a DTA platform and prepare network and other inputs for a proof of concept

FY 2019: Begin creating a DTA application for TRM v6.1 using TRM inputs including post processors for new data formats as well as any new input data needed for DTA. See task 9.1.1.3 below.

9.1.1.3 Prepare inputs for microscopic traffic simulations from regional models

Regional travel demand models such as the TRM contain detailed information about the network and travel demand. Traffic engineers often rely on this detailed information to build their traffic simulation models. There is already established practice in North Carolina to prepare inputs for TransModeler microsimulation software. Since TransModeler and TransCAD are both Caliper Inc. products, there is a substantial opportunity to streamline the protocol for transferring critical inputs from the TRM to TransModeler.

This task is intended to identify the best practices in North Carolina to prepare inputs for application of TransModeler using TRM v6.1. An example will be set up and applied. The work can be extended to identify discrepancies between modeled and simulated network performance

measures, and the consequent bias from choosing one tool over another for the purpose. Settings and parameters will be identified and a strategy for preparing them appropriately will be developed.

Deliverable(s):

- (1) Technical memorandum with results of investigation conducted.
- (2) Work plan for preparing inputs including settings and parameters for TransModeler application.

Est. start date: 4/23/2020

Est. end date: 5/24/2020

ID	Task Description	Task Hours
9.1.1.3	Prepare inputs for microscopic traffic simulations from regional models	180
a)	Conduct investigation of practices in NC to develop TransModeler simulation inputs, including setup and testing; prepare technical memorandum	100
b)	Using TRM v6.1 prepare inputs for application of TranModeler approach used in NC	80

9.1.4 Toll model refinement/recalibration [task deferred to FY22 at stakeholder recommendation – remains as a placeholder]

This task will refine the toll model component of the TRM for use in task 9.2 below. Studies that have been conducted for toll facilities (including managed lanes) in the Triangle region will be gathered, and data, parameters or tools that could be incorporated in the TRM will be identified. Inputs or scripts developed by consultants conducting the studies will also be gathered. Key sub-tasks are:

- a) Gather reports, data, model inputs and scripts prepared by contractors for toll studies in the TRM region
- b) Determine any elements from sub task a) that can be incorporated in the TRM, and prepare a technical memorandum describing findings and providing recommendations for modifications to the TRM procedures
- c) Based on sub task b) above, incorporate recommended data and procedures to improve the toll component of the TRM
- d) Prepare a technical memorandum documenting all modifications made, sources for data, and information for model users that can be added to the User's Guide for the TRM
- e) Update TRM documentation and User's Guide

Deliverable(s):

- 1) Review findings and recommendations
- 2) Documentation of final parameters, script changes, and inputs

3) Updated TRM documentation and User's Guide

Est. start date: 3/16/2020

Est. end date: 4/30/2020

ID	Task Description	Task Hours
9.1.4	Toll model refinement/recalibration	0
a)	Gather reports, data, model inputs & scripts prepared by contractors to toll studies	24
b)	Prepare tech memo describing findings & recommending modifications	16
c)	Develop recommended modifications to improve toll component of TRM including identifying & preparing calibration/validation data, calibrating & validating the model, and conducting sensitivity testing	140
d)	Prepare technical memorandum documenting all parameters, inputs & script changes	40
e)	Revise TRM documentation and User's Guide to describe toll model refinements	16

9.2 *V6.1 model assignment and overall model calibration*

9.2.1 *Highway assignment*

This task will make sure that the highway assignment procedure works before conducting the calibration/validation review.

- a) Review screen line and cut line definitions for TRM v6.1 2026 and make any needed corrections
- b) Perform assignment and perform reasonableness checks including but not limited to: centroid connectors with zero volumes, highway links with zero volumes, highway links with speed less than five and ten miles per hour, unreasonably high highway speed, high V/C segments, unusual or unexpected directional flow by time of day, select link analysis
- c) Identify and make any needed model improvements in order to improve assignment such as connecting unconnected links, adding links if missing, and correcting any errors in attribute coding.

Est. start date: 3/18/2020

Est. end date: 4/3/2020

ID	Task Description	Task Hours
9.2.1	Highway assignment	104
a)	Review screen line and cut line definitions in TRM v6.1 2016	24
b)	Perform assignment and apply reasonableness checks	40
c)	Identify and make any needed model improvements	40

9.2.2 Transit assignment

This task will make sure that the transit assignment procedure is working before conducting the calibration/validation review.

- a) Perform transit assignment and perform reasonableness checks including: transit lines with zero volumes, low transfer rates at downtown transfer stations
- b) Identify and make any needed model improvements in order to improve assignment

Est. start date: 3/18/2020

Est. end date: 4/7/2020

ID	Task Description	Task Hours
9.2.2	Transit assignment	120
a)	Perform assignment and apply reasonableness checks	56
c)	Identify and make any needed model improvements	64

9.2.3 Model chain calibration/validation

This task will assure that the TRM performs acceptably and is ready to apply for planning studies such as long range plans, corridor studies and project planning studies. The performance of the TRM will be compared to calibration and validation data prepared for the purpose. TRM parameters or other appropriate components will be adjusted as needed until the model performs acceptably.

- a) Calibration and validation data will be identified and processed for comparing to model performance. Traffic counts (including hourly and classification counts), peak period and peak hour counts, and transit ridership by route and other calibration/validation data will be processed.
- b) Initial calibration review –model performance will be compared to targets for measures

listed in Exhibit A-2. Model validation will be performed and will be informed by standard references such as the “Travel Model Validation and Reasonability Checking Manual, Second Edition” available on the TMIP website. Validation checks will be made for a level of facility that will support sub-area and corridor studies.

- c) Model adjustments will be made as needed to improve model performance.
- d) After making adjustments, model components (trip generation, trip distribution, mode choice, trip assignment) will be checked against calibration targets by trip purpose. This process of model testing and adjustment will be iterated until the overall model meets calibration and validation targets.
- e) Sensitivity tests will be performed with inputs developed for the recently adopted 2045 Metropolitan Transportation Plan. Model results will be checked for reasonableness and any problems discovered will be documented and addressed.
- f) A technical memorandum will be written to document model performance testing and all adjustments made to the model during the process of calibration and validation, including adjustments that are made to components already calibrated during model estimation steps (trip generation, trip distribution, non-motorized, and mode choice) completed earlier.

Deliverable(s):

Technical Memorandum on Highway and Transit assignments and model calibration/validation

Est. start date: 4/8/2020

Est. end date: 6/30/2020, remaining documentation work complete by 7/24/2020

ID	Task Description	Task Hours
9.2.3	Model chain calibration/validation	740
a)	Calibration/validation data processed for task	40
b)	Initial calibration review	80
c)	Model adjustments to improve performance	160
d)	Post adjustment model component calibration review and iteration as needed	340
e)	Perform sensitivity tests	100
f)	Technical memorandum prepared documenting calibration/validation (60 hrs. FY21)	20

Highway calibration might include, but not be limited to, the following work:

- a) Focus on the screen lines and cut lines that miss the calibration targets, diagnose and address the issues. The possible approaches are: relocate the centroid connectors, check if the facility type designation is reasonable.
- b) Re-estimate and/or re-calibrate the destination choice models, non-motorized models, and mode choice models with the updated network skim.
- c) Check the modeled speed and observed speed.

Transit calibration might include, but not be limited to, the following work:

- a) Check the transit coding to make sure no coding errors are involved.
- b) Check the posted speed on the transit only links.
- c) Compare the modeled ridership to the observed ridership by corridor, and identify the corridors that have big discrepancies. Study these corridors to diagnose the cause of problems.
- d) Compare the modeled ridership to the observed ridership by route. Any low volume transit routes that do not assign within fifty percent of observed riders and any high volume transit routes that do not assign within thirty percent will be corrected or explained.
- e) Check the bus speed, and adjust the bus speed equations when necessary.
- f) Check the number of riders at major park and ride lots, and address the issues when found.
- g) Re-calibrate the mode choice models when needed.

9.3 *Extend quality control metrics*

It has been requested to develop more detailed and systematic evaluation and QA/QC metrics, by mode. It is anticipated that outside expertise will be sought to assist with this task.

Deliverable(s):

A technical memorandum documenting the development of more detailed and systematic evaluation and QA/QC metrics, by mode.

Est. start date: 2/1/2020

Est. end date: 5/31/2020

ID	Task Description	Task Hours
9.3	Extend quality control metrics	80
a)	Engage with outside experts to supplement team resources for quality control	24
b)	Document extended quality control metrics suggested and their application to the TRM	16
c)	Develop a set of instructions for conducting the extended quality control work	40

19 Overall Model Design

The current version of the Triangle Regional Model (TRM) was developed in 2006 on the TransCAD version 4 platform based on earlier work in 2003 to convert the TRM from TranPlan to TransCAD version 3. The current version of the TRM (v6) was developed on the TransCAD version 6 platform. The current TRM also includes standalone programs for trip generation and mode choice written in FORTRAN, and a set of programs for performing population synthesis (PopGen) written mostly in Python code. The latest version of TransCAD is version 8, and it provides a number of enhancements and improvements over TransCAD version 6.

It is suggested to first convert the existing structure of the TRM v6.1 model to TransCAD version 8. Once the model is working on the new platform, a program of improvements can be undertaken such as, updating GISDK to object oriented programming (which is not included here) including integrating trip generation, mode choice and population synthesis into TC 8 using object oriented programming.

19.1 *Develop overall model design*

This task will continue work to develop a list of model elements to convert TRM v6.1 to TransCAD version 8 with a full description of the work needed to perform the conversion (scripting may be converted, and features of TransCAD version 8 may replace existing modules). Work will continue to design a revised user interface. It is expected that Caliper Corp. staff will continue be consulted about the approach for making the conversion, and be asked to provide advice.

Deliverable(s):

Draft overall model design for review with tasks listed

Est. start date: 1/29/2020

Est. end date: 2/25/2020

ID	Task Description	Task Hours
19.1	Develop overall model design	120
a)	Continue to design revised interface design	40
b)	Refine list of model elements to script or revise for design	40
c)	Revise overall model design report for review	40

19.2 *Implement elements of overall model design*

Converting the logsum and mode choice FORTRAN programs was completed during FY19. During FY20 additional work will be done to implement the model design.

Deliverable(s):

Conversion in progress starting with user interface redesign and adding elements from task 19.1 overall model design.

Est. start date: 2/26/2020

Est. end date: 3/20/2020

ID	Task Description	Task Hours
19.2	Implement elements of overall model design	300
a)	Based on model modernization program in task 19.1, continue conversion with user interface implementation	80
b)	Continue converting TRM elements and adding them to the new user interface	204
c)	Document all conversion work performed	16

19.3 *Emerging issues to address in TRM*

This task will perform a scan for emerging issues that might affect future forecasts that need to be accounted for in the TRM or in post processing of results. An example would be autonomous and connected vehicles.

Deliverable(s):

Brief technical memorandum outlining issue for TRM Executive Committee with options for addressing it.

Est. start date: 3/21/2020

Est. end date: 3/27/2020

ID	Task Description	Task Hours
19.3	Emerging issues to address in TRM	40
a)	Perform scan for emerging issues and prepare a brief technical memorandum	40

20 TRM Documentation

As a large, complex model system, the TRM needs to be well documented so it can be understood and be used effectively by stakeholders and others.

20.1 *TRMv6.1 Technical Documentation*

Technical documentation will be prepared for the model estimation work undertaken for the 2016 model. Note there will be more work in FY21 to document tasks yet to be completed.

Deliverable(s):

- 1) Technical report for TRM v6.1 2016
- 2) TRM v6.1 2016 model report for a more general audience

Est. start date: 3/1/2020

Est. end date: 6/30/2020

ID	Task Description	Task Hours
20.1	TRMv6 Technical Documentation	160
a)	Draft TRMv6.1 2016 documentation and review by Model Team and EC	160

20.2 *TRMv6.1 User's Guide*

The User's Guide will be revised to include new information for the 2016 version of TRM v6.1.

Deliverable(s):

- 1) Updated User's Guide for TRM v6.1 2016

Est. start date: 7/5/2019

Est. end date: 6/30/2020

ID	Task Description	Task Hours
20.2	TRM v6.1 User's Guide	104
a)	Update draft User's Guide and review by Model Team and EC	104

21 Technical Assistance

21.1 *Assistance with model application for developing the Metropolitan Transportation Plan*

Objective:

To enable stakeholders to prepare alternatives using TRM v6.1 for MTP analysis

Work on the 2045 MTP was completed during 2018 and no additional work is expected during FY20. Work for the 2050 MTP will occur in the next (FY21) fiscal year.

21.2 *Technical assistance with TRM model application on as needed basis*

Objective:

May 27, 2019

To enable stakeholders (including stakeholder contractors) to apply the model as needed.

TRM Service Bureau staff will provide technical assistance for stakeholder partners on an as needed basis when they are applying the TRM including GoTriangle or Wake Transit Investment Strategy activities. This will include providing model files and documentation to contractors working on the behalf of stakeholder partners. It will also include answering questions and providing assistance when problems arise.

It is expected that some of the hours for this task will be devoted to improving and simplifying the file structure for the set of files distributed as the official model set to make easier to set up and use.

21.3 *Action items*

Objective:

To address issues identified by stakeholders as Action Items.

From time to time the stakeholders may determine that there are work tasks not covered elsewhere in the work program that nonetheless must be done. During FY2018 such action items were requested by stakeholders. The action item work program element sets aside time for conducting work on tasks as determined by the stakeholders. These tasks will result in a work product, such as a technical memorandum that will document the work done and the completion of the task. Unused time can be allocated to other work tasks after the end of the second quarter.

21.3.1 *Stakeholder requested tasks*

As stakeholders request tasks not listed elsewhere in the scope of work, a task description will be developed for the task, the task will be completed, and a technical memorandum will be prepared.

ID	Task Description	Task Hours
21.3.1	Stakeholder requested tasks	587
a)	Complete tasks as requested by stakeholders	587

22 Oversight, reporting, and training

Objective:

To enable efficient and effective team communication and project management.

This task includes necessary administrative tasks and meetings needed for project oversight and communication with stakeholders such as Executive Committee, Model Team, and internal TRM Service Bureau meetings. Periodically team members meet both internally and with stakeholders to review task progress and approaches, solve problems, and keep stakeholders informed of work taking place on the project. The project also requires developing an annual work program, task assignments, and monthly team reporting.

22.1 Oversight & reporting

22.1.1 Oversight

TRM Team Meetings will be held monthly on the 2nd Thursday of each month unless there are no items to discuss. Model Team members may convene a technical team meeting to review task approaches in detail and develop recommendations for tasks on an as needed basis. Task includes preparation of all presentation materials for meetings.

Executive Committee meetings will be held quarterly as designated by executive committee members.

Quarterly progress reports will be prepared in October, January, April, and July. Monthly status reports will be prepared.

A web site for team collaboration will be maintained to allow the team to share data, analysis, calendar, and documentation to improve collaboration and efficiency.

TRM Service Bureau team members will attend up to a total of four stakeholder project team meetings or one meeting per team member in the course of the project year.

22.1.2 Project management tool

During FY18 the team used 5pm for use during the year for tracking and reporting progress on work tasks. This task will continue use of this tool for tracking and reporting on progress.

Deliverable(s):

1. FY20 work program set up in 5pm for team use
2. Training for team members

Est. start date: 7/5/2019

Est. end date: 7/13/2019

ID	Task Description	Task Hours
22.1.2	Project management tool	40
a)	Setup 5pm project management tool for team use during FY19	40

22.1.3 Issue tracking tool

Both internal (stakeholder) and external users (contractors or others) of the TRM may discover issues or errors while using the model. These can be issues with inputs (geographic files or attributes) or with scripts and procedures. This task will develop or customize an issue tracker to allow users to record any issues found and to track their disposition/resolution. An ideal tool will be online to be available to outside users for entering issues and will report resolution status similar to issue ticket systems. This system will work in concert with quality checking by the model team in task 2.1.3 and any other similar tasks. During FY 2019 the issue tracking tool was developed. This task will make any needed adjustments to the tool.

Deliverable(s):

Revised working tool set up and tested for collecting issues with the TRM

Est. start date: 7/5/2019

Est. end date: 8/2/2019

ID	Task Description	Task Hours
22.1.3	Issue tracking tool	40
a)	Maintenance for issue tracking tool	24
b)	Outreach for team members, stakeholders and contractors	16

22.2 Training**22.2.1 TRM training**

Training modules will be developed for stakeholder staff, and model users/consultants. These two groups will be briefly surveyed regarding their needs for training in the use of the TRM. Based on the survey results it is anticipated that two training modules will be developed with each tailored to the needs of each group. Each of the two modules will be given once during the year, and evaluation forms will be distributed to participants. The evaluations will be used to make adjustments to the training modules for future sessions. The training sessions will be conducted in such a way as to obtain feedback from model users regarding their experience with the model or alternatively as a forum for TRM users.

ID	Task Description	Task Hours
22.2.1	TRM training	120
a)	Draft survey for stakeholder staff, and model users/consultants, review of survey by Model Team, and revisions to survey	30
b)	Conduct survey of stakeholders, and model users/consultants to determine needed training modules including developing a list of those that have requested the TRM files	10
c)	Develop stakeholder training module	20
d)	Develop model users/ consultant training module	20
e)	Set up and provide ½ day training for two groups or conduct annual forum for model users	40

22.2.2 Staff training

The highly technical nature of the work on the Triangle Regional Model requires that team members update their skills by attending training sessions, using on-line training opportunities, watching Travel Model Improvement Program webinars, and attending model user group meetings. This task will help ensure that up to date skills are applied when performing TRM work.

Appendix A

Vision for Developing the v6 and v7 Models

Policy Testing Needs Identified by Stakeholder Partners

Policy Testing Needs Identified by EC 10/20/2009	Part of Model?
1. Dynamic Tolls	Part of model
2. Greenhouse gas – land use change (Urban Sim)	Part of model
3. Peak spreading (a result)	Part of model
4. Parking constraint in CBD and elsewhere	Part of model
5. Environmental Justice (EJ) impacts (a result)	Analysis done outside model
6. Change mix of land uses within TAZs & consider design of land uses	Part of model
7. TDM policies	Analysis done outside model
8. ITS	Analysis done outside model
9. Making decisions on modal investments	Analysis done outside model

Suggested Elements of New Models or Work Programs

Suggested Elements (FY 2012 list)	In v6	In v7	Invest.	Notes
1. Improved Commercial Vehicle Model	X			DCHC #1
2. Improved Transit Assignment		X		DCHC #2
3a. Static Traffic Assignment Improvements	X		X	DCHC #3
3b. Dynamic Traffic Assignment		X		DCHC #3
4. Area Type Sub-model		X		DCHC #4
5. Population Synthesizer		X		DCHC #5

Suggested Elements (FY 2012 list)	In v6	In v7	Invest.	Notes
6. Trip Attraction and Destination Choice Sub-model	X			DCHC #6
7. University Student Trip Model		X		DCHC #7
8. Walk Access - Transit Link		X		DCHC #8
9. Employment Category and Special Trip Generators		X		DCHC #9
10. System Optimization	X			DCHC #10
11. Time of Day Model		X		DCHC #11
12. Parking Survey and/or Behavior Study		X	X	DCHC #12 Tri. Tran. req.
13a. Link Capacity Calculation			X	DCHC #13 CAMPO req.
13b. Intersection Delay			X	DCHC #13
14. HBW Journey or Tour Based Model		X		
15. Strategic data collection plan			X	MPO req.
16. TAZ review			X	

Suggested Elements (FY 2013 list)	In v6	In v7	Invest.	Notes
1. University student trip model	X			DCHC #1
2. Validation on person and CV trip rate	X			DCHC #2
3. Attraction share and destination choice improvement	X			DCHC #3
4. Mode choice estimation/calibration	X		X	DCHC #4
5. Transit model [updates]	X			DCHC #5
6. Time of day	X			DCHC #6
7. Disaggregated population synthesizer	X			DCHC #7
8. Auto ownership model	X			DCHC #8

Suggested Elements (FY 2013 list)	In v6	In v7	Invest.	Notes
9. Meso-scopic dynamic traffic assignment			X	DCHC #9
10. Action items				CAMPO
12. Parking Survey and/or Behavior Study	X			Tri. Tran.

Suggested Elements (FY 2014 list)	In v6	In v7	Invest.	Notes
1. Transit select link analysis tool	X			CAMPO
2. TRM training for stakeholders, model users, & consultants				CAMPO
3. Attend stakeholder project meetings				CAMPO

Suggested Elements (FY 2015 list)	In v6	In v7	Invest.	Notes
1. Procedure for including tools developed by stakeholders and others in TRM				CAMPO
2. Develop a tool to facilitate review of networks	X			CAMPO

Suggested Elements (FY 2016 list)	In v6	In v7	Invest.	Notes
1. Address model fundamentals and performance measures	X			CAMPO
2. Symposium or training to obtain feedback from stakeholders, model users, & consultants	X			CAMPO
3. Test parking policies & constraints in geographic areas where they are not observed today	X			GO Triangle

V6 Model

The v6 model will continue to be an aggregate trip based model based on the v5 model. The v6 model was used for the 2045 Metropolitan Transportation Plan (MTP) development completed in 2017. The focus for this model will be on further enhancement of the aggregate trip based model.

Fiscal Year	TRM v6 Development	Notes
Year 1 July 1, 2011 - June 30, 2012	Design new commercial vehicle model Optimize model run time performance TAZ modifications Modifications of SE data and SE models Develop improved transit network procedures Investigate and specify enhancements below: 1) definition of facility types 2) link capacity calculation 3) update link free flow speeds 4) intersection delay 5) develop GIS approach to changing future road characteristics 6) improve highway traffic assignment 7) employment categories and special generator definitions 8) investigate and implement improvements to area type calculations	
Year 2 July 1, 2012 - June 30, 2013	Design improved destination choice – attraction share model Develop and implement enhancements below: 1) reviewed & revised employment types for v6, developed and implemented SESyn to estimate population types, HH types, and employee by type at both residence and establishment locations 2) recommended changes to the trip attraction/destination choice sub model using new employment types 3) intersection delay & link capacity calculation implementation including data collection and input 4) designed improved parking constraint models specification and data collection. 5) develop peak spreading model 6) develop university student model Trip generation will be re-estimated using existing survey data.	
Year 3 July 1, 2013 - June 30, 2014	Complete the following enhancements: 1) commercial vehicle model, 2) develop new parking constraint models, 3) develop new university student travel models All remaining model components will be re-estimated using existing survey data. Highway assignment will be QA/QC'd.	
Year 4 July 1, 2014 - June 30, 2015	Model calibration and validation. Work tasks will include calibrating and validating model components and overall model performance.	

Fiscal Year	TRM v6 Development	Notes
Year 5 July 1, 2015 - June 30, 2016	Model calibration and validation. Calibrating and validating model components and overall model performance for the 2013 base year model has been completed. Sensitivity tests were conducted for a 2040 forecast year. A test of the TRMv6 True Universe files was conducted, and extensive checking and correcting of the highway and transit networks was conducted.	
Year 6 July 1, 2016 - June 30, 2017	The True Universe network and projects were extensively checked. Household survey data collected during 2016 was cleaned and processed. Parking model estimation files were prepared and model estimation was started.	
Year 7 July 1, 2017 - June 30, 2018	Model inputs were prepared for a 2016 estimation year	Preparation of 2016 model inputs delayed start of model estimation
Year 8 July 1, 2018 - June 30, 2019	TRMv6 models for general population trip purposes will be estimated using 2016 household survey data.	

V7 Model

The v7 model will be either an enhanced trip based, a tour based or activity based model depending on stakeholder direction and perhaps beginning with modifications to the university student components. It is expected the v7 or further enhanced v6.1 model will be used for the 2050 MTP development starting in 2021. This will address policy testing needs that require consideration of how travelers change their daily schedules in response to policies intended to reduce peak congestion.

Fiscal Year	TRM v7 Development	Notes
Year 1 July 1, 2011 - June 30, 2012	Stakeholders agree on concept for v7 1) Convene expert panel 2) Develop work plan for v7 model development	

Fiscal Year	TRM v7 Development	Notes
Year 2 July 1, 2012 - June 30, 2013	Investigation/specification of model structure and components: 1) population synthesizer, 2) land use models. 3) auto ownership model	
Year 3 July 1, 2013 - June 30, 2014		
Year 4 July 1, 2014 - June 30, 2015		
Year 5 July 1, 2015 - June 30, 2016		
Year 6 July 1, 2016 - June 30, 2017		
Year 7 July 1, 2017 - June 30, 2018		
Year 8 July 1, 2018 – June 30, 2019		

Fiscal Year	TRM v7 Development	Notes
<p>Year 9</p> <p>July 1, 2019 – June 30, 2020</p>	<p>Conduct decision making process to select model type for TRMv7</p>	
<p>Year 10</p> <p>July 1, 2020 – June 30, 2021</p>	<p>Investigation/specification of model structure and components: 1) Usual work place location model 2) Usual school location model.</p> <p>Estimate long term decision models: 1) Auto ownership model</p> <p>Investigation/specification of model structure and components: 1) Tour/activity scheduler, 2) Router.</p> <p>Investigate/specify and develop data structures. Determine best data structures for storing, processing and updating model elements. Approaches will be sought that maximize analyst productivity and model runtime performance.</p>	
<p>Year 11</p> <p>July 1, 2021 – June 30, 2022</p>	<p>Estimate long term decision models: 1) Usual work location model 2) Usual school location model</p> <p>Available data will be prepare in the chosen data structure. Modify programs as needed to implement the chosen model specification including: 1) population synthesizer, 2) tour/activity scheduler, 3) router.</p> <p>Model component programs may be borrowed and adapted for use in the Triangle region. Estimate models and implement. Recent survey data will be used to estimate model components specified during years one to three [population synthesizer, tour/activity scheduler, router]. Other model components (commercial vehicles, external models) will be incorporated in overall model structure.</p>	
<p>Year 12</p> <p>July 1, 2022 – June 30, 2023</p>	<p>Model calibration and validation. Initial model will be applied and any problems will be noted and addressed. This process will be iterated until all problems discovered have been addressed. The model will then be validated to observed conditions.</p>	

Conceptual Schedule for Model Development

Model Task	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
v6							
Investigate/specify enhancements	█						
Develop enhancements	█	█	█				
Calibration & validation				█	█		
V6.x							
							█
v7							
Specify model components		█				█	█
Specify data structures							█
Modify programs							
Estimate models							
Calibration & validation							

Appendix B

TRM History

Version - Release Year [Delivered Time]	Key Features Enhancements vs. Previous Version	Base Year	Use
v.1 - 2006 [Not to Stakeholder]	TTA New Start model converted to the TransCad platform with a 2002 base year as delivered by the contractor [Parsons Brinckerhoff] in Fall of 2006	2002	
v.2- 2006 [delivered 12/2006]	Revised and calibrated/validated to 2005 base year highway data only	2005	
v.3 - 2007 [β test version delivered 4/2007]	1. Updated mode choice ASC calibration using 2006 Household Interview Survey and 2006 Transit On Board Survey data 2. Repaired trip generation program and 3. Revised 2005 Socio Economic data provided by the MPOs.	2005	1) Transit Infrastructure Blueprint, 2) the Chapel Hill Long Range Transit Plan, 3) the Orange County Greenhouse Gas project and 4) the Deficiency and Needs Analysis for the 2035 Long Range Transportation Plans.
v.4 - 2008 [Delivered 1/2008; approved spring; adopted 8/2008]	Improved v3-2007 ready for application and including HOV/HOT and toll capabilities.	2005	1) Alternatives Analysis and 2) Air Quality Conformity Analysis for the 2035 Long Range Transportation Plans.

Version - Release Year [Delivered Time]	Key Features Enhancements vs. Previous Version	Base Year	Use
v.5 - 2011 Delivered 6/2011	<p>New:</p> <ol style="list-style-type: none"> 1. Parking capacity constraint 2. Airport trip making model 3. Bicycle and pedestrian travel sub models through trip distribution. 4. External station forecasts methodology. 5. Hourly capacity and traffic assignment 6. Use of Logsum in destination choice 7. Stratified utility coefficients by income in mode choice: 8. Summit analysis for FTA New Start analysis. 9. An off model GIS approach to forecast changes in road characteristics over time as rural areas become more urbanized [planned] 10. Travel by people from outside the region on transit. <p>Improved:</p> <ol style="list-style-type: none"> 1. Parking cost model improved; New: capacity constraint components added 2. Bus speed model: adjusted and validated vs. 2006 bus schedules. 3. Revise Federal Functional Class. Federal Functional Class has been updated in the 2010 v5 model to be consistent with NCDOT updates. <p>Investigated: Cost of Auto Travel [e.g. gas price component]</p>	2005, 2010	<ol style="list-style-type: none"> 1) Alternatives Analysis and 2) Air Quality Conformity Analysis for the 2040 Long Range Transportation Plans.

Version - Release Year [Delivered Time]	Key Features Enhancements vs. Previous Version	Base Year	Use
V6. 2016 Delivered 5/2016	<p>New:</p> <ol style="list-style-type: none"> 1. Free flow speeds based on highway capacity manual 2. Commercial vehicle model by trip purpose and linked to NC Statewide model 3. University student model for on and off campus students 4. Parking cost and parking capacity constraint models based on parking behavior survey data [in process] 5. Synthesized population for trip generation <p>Improved:</p> <ol style="list-style-type: none"> 1. Revised area types with added CBD area type and procedure to smooth and update area types for both TAZs and network links for scenarios and forecasts 	2010, 2013	Alternatives Analysis for the 2045 Metropolitan Transportation Plans

Appendix C

TRM Calibration and Validation Statistics

Triangle Regional Model components will be calibrated and validated to the following targets. These tests based on local and national targets will be used to evaluate the quality of model components.

Calibration/validation Statistics

Model Inputs

Model demographic data inputs will be checked against benchmarks at a regional level for persons/household, employment/population ratio, and autos/household. Plots of persons per household and household income by zone (TAZ) will be compared to census values. A report will document all findings.

Model highway and transit networks will be checked for reasonableness and the results will be reported. Maps of various network characteristics (area types, lanes, speeds, counts, screenlines, and transit routes by company) will be plotted to aid in the checks and to document the process used. The transit on board survey data will be assigned by access mode to the transit network and comparisons of transfer rates and assignments by transit line and company will be made to determine if problems exist. The results will be reported.

Model output from the household and person model (workers, non-workers, and children), and by household strata will be compared to census and other data for the region and sub region levels as appropriate (county and district) depending on the availability of data. This comparison will be documented in a report.

Trip Generation

Work trips per worker match survey work trips per worker

Ratio of region wide trip productions to trip attractions by trip purpose +/- 10%

Summaries comparing observed and model estimated trips by trip purpose will be prepared

Daily trips by trip purpose will be compared to determine if proportions of daily travel by purpose match survey data and proportions from other areas (benchmarks)

Overall trip rates by trip purpose will be compared to those reported for other areas

Trip productions per household and per capita will be compared to standard reasonable ranges

Summary comparisons will be made at the region, county, and district levels

Work trip attractions will be compared to total employment, K-12 school trips will be compared to total school enrollments, and shopping trips will be compared to total retail employment

Trip Distribution

Percent Deviation of Average Trip Length (minutes) for all trip purposes +/- 5%

District to district comparisons will be made of observed and model estimated trips. Trip length frequency distributions by time and distance will be prepared by trip purpose by strata. Coincidence ratios will be prepared for the trip length frequency distributions with a target of >70% coincidence.

Percent intra zonal trips by purpose will be compared to benchmarks.

Mode Choice

All trip purposes will match observed mode shares for auto and transit modes (+/- 2%), though not for transit by access mode to avoid over calibrating

Summaries by trip purpose will be prepared comparing observed mode shares to model estimated mode shares. Work trip mode shares will be compared to census (CTPP) mode share data. District summaries will be prepared. Auto occupancies will be compared to survey auto occupancies. Mean transit trip lengths will be compared to observed and these will be expected to fall within +/- 5%. Parameters will be compared to acceptable ranges.

Validation Statistics*

Vehicle Miles Traveled (VMT) by Federal Functional Class (based on links with counts)

Functional Class	Target % Deviation
Freeway	7%
Principal Arterial	10%
Minor Arterial	10%
Collector	15%
Local	15%
Total	5%

Screenline Comparison

Screenline Name	Target % Deviation
I-85	10%
I-40	10%
Wake/Durham County Line	10%

* All traffic counts used for validation will be factored in a consistent way

Cutline Comparison

Cutline Name	Target Deviation %
SW Durham	15%
Durham	15%
Johnston County	15%
Chatham County	15%
North Raleigh	15%
Eastern Wake	15%
US 1 South	15%
North Wake	15%
US 70	15%

* If unable to match this best practice target, then a secondary check will be performed based on the overall volume of the cutline

Percent Difference of Total Traffic Count Volume and Total Model Assigned Volumes by County and Area Type

Summary Level	% Difference Target (+/-)
<i>County</i>	
Durham	10%
Orange	10%
Wake	10%
Chatham	10%
Harnett	10%
Johnston	10%
Nash	10%
Franklin	10%

Granville	10%
Person	10%
<i>Area Type</i>	
Urban	10%
Suburban	10%
Rural	10%

Percent Difference of Model Estimated Daily Traffic Volumes by Federal Functional Class

Federal Functional Class	FHWA Target (+/-)	TRM Target (+/-)
Freeway	7%	5%
Principal Arterial	10%	8%
Minor Arterial	15%	10%
Collector	25%	15%
Local	25%	15%

Percent Difference of Model Estimated Daily Traffic Volumes by Volume Group

Volume Group	Target % Deviation
1 -1000	55%
1001 – 2500	50%
2501 – 5000	30%
5001 – 10000	25%
10001 – 25000	20%
25001 – 50000	15%
>= 50001	10%
Total	5%

R-Square for Region wide Estimated Volumes vs. Traffic Counts
 Target $R^2 \geq 0.88$

Root Mean Square Error (RMSE) of Estimated Traffic Volumes
 Target RMSE $\leq 35\%$

Evaluation of Peak Period Assignments for AM and PM Peak Periods

Screenline Comparison AM and PM Peak

Screenline Name	Target % Deviation
I-85	10%
I-40	10%
Wake/Durham County Line	10%

Cutline Comparison AM and PM Peak

Cutline Name	Target Deviation %
SW Durham	15%
Durham	15%
Johnston County	15%
Chatham County	15%
North Raleigh	15%
Eastern Wake	15%
US 1 South	15%
North Wake	15%
US 70	15%

* If unable to match this best practice target, then a secondary check will be performed based on the overall volume of the cutline

AM and PM Peak Period Percent Difference of Total Traffic Count Volume and Total Model Assigned Volumes by County and Area Type Based on Links with Hourly Traffic Counts

Summary Level	% Difference Target (+/-)
<i>County</i>	
Durham	10%
Orange	10%
Wake	10%
Chatham	10%
Harnett	10%
Johnston	10%
Nash	10%
Franklin	10%
Granville	10%
Person	10%
<i>Area Type</i>	
Urban	10%
Suburban	10%
Rural	10%

Overall average speeds will be reported for AM peak, PM peak and off peak periods.

Transit Ridership Assigned

Total transit riders target +/- 5%

Target for individual companies +/- 10%

Transit riders by corridor +/- 15% for the following corridors:

US 15-501 between Chapel Hill and Durham

NC 147 between Durham and RTP

I-40 between Chapel Hill and RTP

US 1 North between Raleigh and Wake Forest

US 70 East between Raleigh and Garner

MEMORANDUM

TO: GoTriangle Board of Trustees
FROM: Capital Development
DATE: July 8, 2019
SUBJECT: Durham County Transit Plan Update Framework

Strategic Objective or Initiative Supported

1.2 Pursue service improvements and expansion opportunities

Action Requested

Staff requests that the Board review, discuss, and endorse the Durham County Transit Plan update framework and near-term action items.

Background and Purpose

The previous Durham County Transit Plan was dominated by the Durham-Orange Light Rail Project. With the discontinuation of that project, a very important pair of new questions is what will go into the new plan and how will we as a community make those decisions. City, County, GoTriangle, and DCHC-MPO staff have been meeting and discussing these questions for the past several months, and the proposal in front of Board is the product of that work.

Financial Impact

None.

Attachments

- Plan update framework

Staff Contact(s)

- Katharine Eggleston, 919-485-7564, keggleston@gotriangle.org
- Patrick McDonough, 919-485-7455, pmcdonough@gotriangle.org

Note: This item will be presented by Pat Young, Director, Durham City-County Planning Department. He is leading presentations of this material to all four governing bodies (City, County, GoTriangle, and DCHC-MPO).



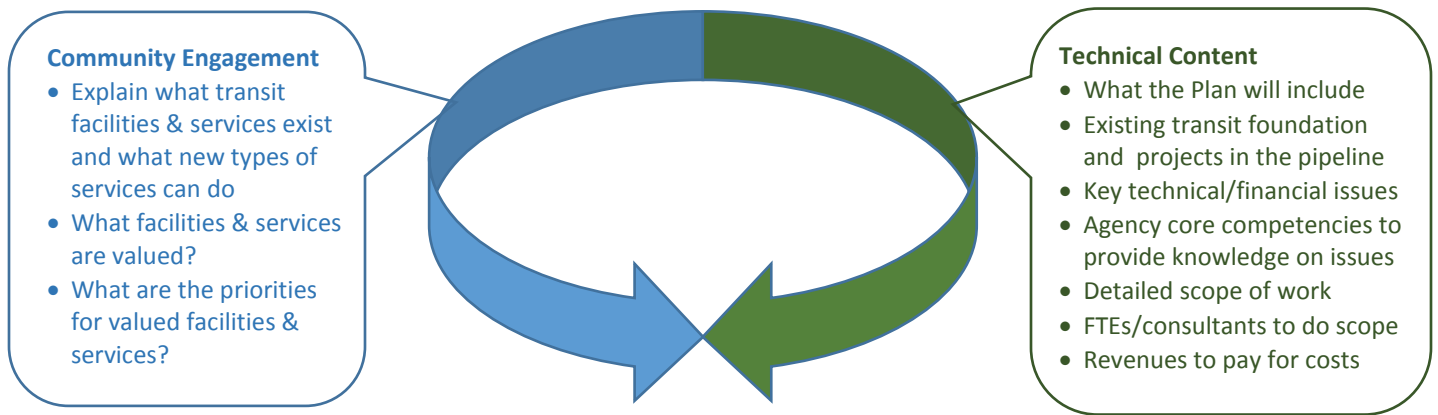
INITIATING THE DURHAM TRANSIT PLAN: 7 KEY NEAR-TERM ACTIONS

JULY 1, 2019

The framework for the Durham County Transit Plan update is designed to accomplish 6 main things:

1. Establish a true collaboration, with leadership from both Durham County and Durham City; technical work by a core group of public agencies; and meaningful engagement by key asset partners and stakeholders
2. Closely align the Transit Plan with the City-County Comprehensive Plan
3. Closely coordinate the Durham Transit Plan with transit plan updates in both Wake and Orange Counties
4. Strengthen the foundation and improve the quality of existing bus service
5. Use a “core competencies” approach to leverage experience, expertise, and demonstrated results from public agencies, with everyone at the table every step of the way
6. Make responsibility and accountability clear for engagement and technical content activities

The Transit Plan has two main components, *community engagement* to identify and prioritize values and *technical content* to provide information to both inform community engagement and make transit infrastructure and service investments that serve community values.



To initiate the Transit Plan work, and provide a foundation for on-going success, 7 key actions are planned, starting immediately. These are summarized below, along with an initial schedule (to be updated):

Key Action (X = board action)		JUL	AUG	SEP	OCT	NOV	DEC	2020 →
1	Communicate Relentlessly (City, County, MPO, GoTriangle)							
2	Revise Governance Agreements				X			
3	Prepare Conditions Assessment (existing & pipeline services)							
4	Create Information & Events for Community Engagement							
5	Develop Detailed Scope of Additional Technical Work							
6	List Agency “Core competency” Staffing for Additional Work							
7	Identify Revenue Sources and Amounts for Staff & Consulting							

Community engagement will be synched with the Durham Comprehensive Plan consultant work.

The technical work is beginning now using existing staff and data resources in the partner agencies to inform the initial community engagement. Key Action #5 in the table above is to determine the additional tasks needed to build on our existing foundation of transit, land use and related expertise and experience.

FRAMEWORK SUMMARY AND OUTLINE OF RESPONSIBILITIES

The matrix below outlines responsibilities under three major activities: Plan engagement, Plan technical content and transit tax revenue governance and administration. The matrix summarizes the purpose and roles for each activity; detailed tasks, staffing and timelines for each should be quickly developed.

<i>Activity</i>	<i>Purpose</i>	<i>Roles</i>	<i>Notes</i>
Transit Plan Engagement <ul style="list-style-type: none"> • Elected Officials <ul style="list-style-type: none"> - City - County - MPO - GoTriangle • Community Stakeholders • Asset Partners 	<p>Elected officials provide a clear charge to the Content Team, guiding principles related to interests such as transparency and accountability, and expectations concerning schedule and products.</p> <p>Larger stakeholder group aligned with Comprehensive Plan.</p> <p>Asset Partners own or manage land, infrastructure and transit assets.</p>	<p>Systematic engagement with chief elected official or board chair, agency manager, and at each regular MPO Board, GoTriangle Board and Joint City-County Committee meetings.</p> <p>Community Stakeholders aligned with Comprehensive Plan (City-County Planning lead) and involving groups such as Coalition for Affordable Housing & Transit, Durham CAN, Inter-neighborhood Council, Durham Chamber, DDI and other groups active in the LRT project.</p> <p>Asset Partners are contacted early in the process to explain the Plan and how it will be developed, encouraging them to actively participate in the stakeholder process. Examples include Anthony Scott (DHA), Stelfanie Williams (Duke), Henry McCoy (NCCU), Bill Ingram (Durham Tech), Scott Levitan (RTP), Michael Landguth (RDU), Scott Saylor (NCRR), Julius Monk (DPS) ...</p>	<p>Same information supplied to all four partners at the same time.</p> <p>Engagement consultant work aligned with Comprehensive Plan engagement.</p>
Transit Plan Technical Content <ul style="list-style-type: none"> • City-County Planning Department • Durham County • Durham City Transportation • DCHC MPO • GoTriangle • NC DOT • Triangle J COG 	<p>“Worker Bees” who undertake specific scoped tasks and deliverables funded by Durham Transit Tax Revenues.</p> <p>Key initial task is to develop a clear, detailed scope describing work to be undertaken, deliverables and schedule</p>	<p>Chaired by City-County Planning Department. Staff need to be able to commit organization’s time and effort and be accountable for results. Examples of agency focus include:</p> <ul style="list-style-type: none"> • Durham City Transportation Department (transportation planning; multi-modal access, local projects, ROW and assets). • Durham County (transit strategic direction) • GoTriangle (transit operations & engineering, (including design & ROW details from LRT project); plan/project revenues and costs (based on existing spreadsheet); CRT project and BRT MIS information. • DCHC MPO (transit analysis: Streetlight data, ridership modeling, SPOT scoring) • NCDOT (state projects, ROW and assets) • Triangle J COG (land use/affordable housing; regional growth; GIS) 	<p>Any consultant services can be contracted by any of the parties and guided by the content team.</p> <p>Synthesis of the 3 County Transit Plans could be modeled on the joint MPO MTP effort.</p>
Transit Tax Finance & Governance Administration <ul style="list-style-type: none"> • Durham County • DCHC MPO • GoTriangle 	<p>Oversight of spending on Transit Plan activities; task progress by Content Team; tax district financial information.</p>	<p>Either County or MPO can lead financial and progress reporting to elected and appointed boards. Ensure all parties receive same information at same time.</p> <p>Detailed financial reporting from GoTriangle as Tax District Administrator.</p> <p>MPO staff might handle detailed activity tracking similar to quarterly UPWP reporting.</p>	<p>GoTriangle is the Tax District Administrator (fiscal agent).</p> <p>MPO role can be similar to annual UPWP role and SWG role.</p>

Board members are required to prepare a written conference report for each event attended on behalf of GoTriangle. Board members may complete the Board Member Conference Report form or prepare a narrative report covering all the areas on the form. The report shall be included in the agenda for the next regular meeting of the Board of Trustees. Attachments (such as the conference agenda, handouts or other materials you feel are valuable, and photographs) to this form or your written report are encouraged.

Board Member:	Will Allen
Conference Attended:	RTA Annual Breakfast: "Regional & Intercity Travel Landscape" (Joe Milazzo), and "The Possibility of a Hyperloop Future" (Virgin One)
Dates:	July 12, 2019
Location:	The Umstead Hotel, Cary
Conference Theme:	New transportation technology

Reason you chose to attend this conference and was your objective met?

To keep abreast of new transportation technologies in the context of existing ones. Yes, my objective was met.

General Summary of the Conference:

"Regional & Intercity Travel Landscape"

Joe Milazzo led off with a summary of where he believes we are today and where we are going, referring to "expanded transit" and a "regional BRT network" as he showed a generalized map of a prospective regional BRT network that connected Raleigh, Chapel Hill, and Durham to each other "with increasing frequencies over time," and with "CRT to provide peak relief." Joe alluded, too, without specificity to turnpikes with dedicated busways.

Joe then introduced NCDOT Deputy Secretary David Howard, who spawned the idea for the Hyperloop theme, entitled, "The Possibility of a Hyperloop Future." David introduced the Virgin Hyperloop One team, and they began the presentations.

"The Possibility of a Hyperloop Future"

First, some level-setting information from The Virgin website <https://hyperloop-one.com/facts-frequently-asked-questions>:

"Hyperloop is a new mode of transportation that moves freight and people quickly, safely, on-demand and direct from origin to destination.

"Passengers or cargo are loaded into the hyperloop vehicle and accelerate gradually via electric propulsion through a low-pressure tube.

“The vehicle floats above the track using magnetic levitation and glides at airline speeds for long distances due to ultra-low aerodynamic drag.

“Virgin Hyperloop One systems will be built on columns or tunneled below ground to avoid dangerous grade crossings and wildlife. It’s fully autonomous and enclosed, eliminating pilot error and weather hazards. It’s safe and clean, with no direct carbon emissions. Watch [this video](#) to get an idea of how hyperloop works.

“We estimate that the top speed for a passenger vehicle or light cargo will be 670 miles per hour or 1080 kilometers per hour. That is 2-3 times faster than high-speed rail and magnetic levitation trains, and 10-15 times faster than traditional rail. The average speed vehicles will travel vary based on the route and customer requirements.

“Virgin Hyperloop One vehicles are propelled using a linear electric motor, which is a straightened-out version of a conventional rotary motor. A conventional electric motor has two primary parts: a stator (the part that stays still) and a rotor (the part that moves or rotates). When voltage is applied to the stator it makes the rotor spin and do the work of, say, spinning a power drill. A proprietary linear electric motor has the same two main parts, however, the rotor doesn’t rotate but instead moves in a straight line along the length of the stator. In the Virgin Hyperloop One system, the stators are mounted to the tube, the rotor is mounted to the pod, and the pod straddles the stators as it accelerates down the tube.

“We’re energy-agnostic. Our system can draw power from whichever energy sources are available along the route. If that means solar and wind, then the entire system is 100% carbon free.

“Capital and operating costs will range widely based on route and application (passenger, cargo) but third parties have concluded that the capital and operational costs of a hyperloop system could be two-thirds that of high-speed rail.”

My report on the hyperloop hoopla:

Overall, while this technology should be watched closely as a future transportation mode, it is, in my opinion, too far ahead of proof of concept to take seriously now.

The briefing was really a sophisticated and polished sales pitch by Virgin. That statement, however, doesn’t diminish its value.

Pitch included the proposition that we haven't invented a new form of transportation in over 100 years, so it's time to innovate. Didn't quite imply rubber-tired transport, rail, and air are so 19th and 20th century quaint as to be nearly useless. In fact, the documentation in the handout states that *“Hyperloop is not intended to replace existing ;’traditional’ transportation networks such as highway, bus rapid transit, intercity rail, and air travel [note no mention of light rail, which have me pause]. Evidence shows that generally the introduction of high speed surface transportation complements and enhances existing transportation networks. They do this be alleviating congestion via mode shift; allowing for better connectivity to certain systems (such as*

air travel) to accommodate suppressed demand for both passenger and freight services; and providing the general public with more choices in the manner in which they travel”

Consistent with the brochure narrative, the idea was presented verbally as "complementary to CRT" in the Raleigh-Durham corridor with "portals" (stations) at Raleigh downtown, NCSU, RDU, RTP, "Durham near Duke", Chapel Hill. No mention of Cary either verbally or in the regional map included in the brochure.

Big ugly tubes were shown all above ground in the renderings, but below ground is also possible as inferred by showing renderings of possible underground portals (stations).

They didn't say so, but I believe they were showing above ground tubes both for reduced cost (cheaper than underground) and especially so that the service can use existing interstate rights of way (center and side) to avoid having to purchase private rights of way.

They didn't get into feasibility or cost/funding, though the website, as I said above, suggests that "capital and operational costs of a Hyperloop system could be two-thirds that of high-speed rail." Nailing down the true cost of HSR depends upon many factors, but may be somewhere in the range of \$80-150 million/mile, assuming funding sources are available.

The presenters aver the system with 28-person pods running at 671 mph can carry 10,000 passengers/hour/direction. When you do the math, that's a 28-person pod launched every 10 seconds to achieve that max capacity.

Portals (stations) can be "as close as ten and as far as 100 miles apart."

The fact that Congress won't even fund rebuilding our crumbling highways and bridges, with money for transit scarce and super-competitive, was ignored. No slide addressed where the money might come from for Hyperloop except to refer to the need for "partners".

One person asked if we might be able to utilize the S-Line corridor for Hyperloop. I couldn't help wondering if the questioner was ready to abandon the proven technology of rail for this shiny new thing. Especially since we have for decades lacked the political will to acquire the S-Line and to build higher speed rail along it between Washington, Raleigh, and Charlotte.

The answer to that question was yes, if we built Hyperloop along the S-Line, then folks could do Raleigh to DC in 30 minutes and, it was also mentioned, Raleigh to Atlanta in 45 minutes.

As stated above, the system works on vacuum low pressure inside the tube + electro-magnetic propulsion + magnetic levitation to achieve motion and speed. All electric.

Their only video dates to 2017 at their test facility in the desert near Las Vegas, but only got to 192 mph after a number of trials. No videos of testing since 2017, which struck me as inauspicious, though the brochure says "as of December, 2018, a full sized pod reached a speed of 240 MOH on their 0.3 DevLoop test track near Las Vegas."

The brochure was customized for our region and includes example routes and benefits which show Raleigh to Chapel Hill in 9 min, 27 sec (top speed of 358 MPH and average of 187 MPH) and Raleigh to Durham in 8 min, 51 sec (top of 314 and average of 181). The table and narrative do not mention Durham to Chapel Hill, but at those speeds, one could travel between Chapel Hill and Durham via Raleigh in 19 minutes, which is faster than driving during peak times.

In conclusion, I am glad I attended to learn about this emerging technology. We should keep Hyperloop in mind once we have tackled funding challenges and built out regional solutions using conventional bus and rail systems on the ten year horizon.

Most Valuable Breakout Session and Summary:

After attending this conference, I'd like to learn more about:

Actual Hyperloop systems installed and operating.

Here's something I learned that I think GoTriangle should pursue or implement:

Monitor Hyperloop development and applications worldwide.

Other information I'd like to share:

I would be interested in attending this conference again.

I would recommend that other Go Triangle Board members attend this conference.