**Scope of Services**

**NCDOT Signal System Timing and Operations (SSTO) Section – Timing/Retiming of Signal Systems**

For each of the signal systems listed below, the Firm shall provide professional engineering services necessary for evaluating the current operation in order to develop optimized signal timing plans, implement and fine-tune the new plans, and evaluate the final operational benefits associated with the work performed.

**Full system details including specific signals and number of timing plans are covered in the cost estimate.**

Work performed under this scope shall be under the direct charge of a licensed North Carolina Professional Engineer.

# Links of Interest

* [Signal System Timing Section of TEPPL](https://connect.ncdot.gov/resources/safety/Teppl/Pages/Teppl-Topic-Original.aspx?Topic_List=T72#InplviewHash4ba6d1a1-d69f-4c2e-a9c8-c16427eb590e=-Topic_List%3DT72-SortField%3DLinkFilenameNoMenu-SortDir%3DAsc-FilterField1%3DSection-FilterValue1%3DT72)
  + Oasis User Manual
  + ASC/3 Programming Manual
  + Centracs User Manual
  + Standard Practice for Travel Time Runs
* [Cost Estimate Template](https://connect.ncdot.gov/resources/safety/Teppl/TEPPL%20All%20Documents%20Library/(05a)%20Cost%20Estimate%20Template.xlsx)
* [Project Process and Review Timeline](https://connect.ncdot.gov/resources/safety/Teppl/TEPPL%20All%20Documents%20Library/(00)%20Project%20and%20Review%20Timeline.pdf)
* [Traffic Data Collection Request System](https://connect.ncdot.gov/site/Traffic-Requests/Pages/default.aspx)
* [Existing Traffic Count Data](https://connect.ncdot.gov/resources/safety/Pages/Volume-Class.aspx)

* [Standard Practice for Travel Time Runs](https://connect.ncdot.gov/resources/safety/Teppl/TEPPL%20All%20Documents%20Library/(14)%20Standard%20Practice%20for%20Travel%20Time%20Runs.pdf)
* [PEF Project Review Checklist\_Preliminary](https://connect.ncdot.gov/resources/safety/Teppl/TEPPL%20All%20Documents%20Library/(10)%20PEF%20Project%20Review%20Checklist_Preliminary%20Submittal.pdf)
* [PEF Project Review Checklist\_Final Submittal](https://connect.ncdot.gov/resources/safety/Teppl/TEPPL%20All%20Documents%20Library/(15)%20PEF%20Project%20Review%20Checklist_Final%20Submittal.pdf)

# Signal System(s) and Due Dates

* **DXX-XX\_City:** Route – Due Date
* **DXX-XX\_City:** Route – Due Date
* **DXX-XX\_City:** Route – Due Date
* **DXX-XX\_City:** Route – Due Date

# Cost Estimate

Prior to completing a cost estimate, the Firm shall have preliminary discussions with the Division to ascertain their general signal timing needs. All pertinent information collected from the Division shall be provided to the SSTO Project Engineer in order to negotiate the Direct Costs prior to submitting the full cost estimate. After NTP has been issued, more specific needs will be discussed with the Division during the kick-off meeting.

Once the Direct Costs have been agreed upon by the Firm and SSTO Project Engineer, the Firm shall submit a detailed cost estimate for review and approval directly to the designated NTP Reviewer. ***Only*** ***the SSTO section’s latest signal timing cost estimate template will be accepted*** (available [here](https://connect.ncdot.gov/resources/safety/Teppl/TEPPL%20All%20Documents%20Library/(05a)%20Cost%20Estimate%20Template.xlsx))*.*The NTP Reviewer will advise if negotiations are needed between the Firm and the SSTO Section. If necessary, the Firm may need to revise the cost estimate and resubmit after negotiations. Once the SSTO Section and the NTP Reviewer both approve the cost estimate, the NTP Reviewer will issue a Notice to Proceed (NTP). The Firm will not be allowed to begin retiming efforts until NTP is issued.

After NTP is issued, minor adjustments to the number of timing plans may be made without affecting the scope, schedule, and budget of the project(s).

The Firm is responsible for completing each of the following tasks over the course of the life of the project.

Tasks

[Task 1: Project Management 2](#_Toc63229876)

[Task 2: Kick-Off Meeting and One-Page Project Summary Sheet 2](#_Toc63229877)

[Task 3: Field Data Collection 3](#_Toc63229878)

[Task 4: Evaluation of Existing Signal System Operations 3](#_Toc63229879)

[Task 5: Develop Signal System Timing Plans 4](#_Toc63229881)

[Task 6: Preliminary Submittal and Report 4](#_Toc63229882)

[Task 7: Field Implementation and Fine-Tuning of New Timing Plans 5](#_Toc63229883)

[Task 8: Evaluation of Signal System Operations (travel-time runs) 5](#_Toc63229884)

[Task 9: Project Closeout Meeting with Division Staff 6](#_Toc63229886)

[Task 10: Final Submittal and Report 6](#_Toc63229887)

# Task 1: Project Management

The Firm will manage and administer the project with the SSTO Section throughout the duration of this assignment. This includes the coordination of meetings, technical aspects of the assignment, and submittals.

Follow the *Project and Review Timeline* document ([here](https://connect.ncdot.gov/resources/safety/Teppl/TEPPL%20All%20Documents%20Library/(00)%20Project%20and%20Review%20Timeline.pdf)) to ensure all steps are followed properly.

Work Standards

Plans will be prepared in accordance with the latest edition of the following:

* NCDOT Traffic Management and Signal Systems Unit Design Manual
* NCDOT Signal System Timing Philosophy Manual
* The Manual on Uniform Traffic Control Devices (MUTCD)
* North Carolina Supplement to the MUTCD
* Customary practices for plan preparation, including CADD conventions, of the NCDOT ITS & Signals Unit

The Firm shall notify the Division in advance of performing any field work.

Invoices

* All invoices shall include:
  + Signal System Number(s) and Corridors
  + A *Summary of Progress* chart that identifies each Task and the corresponding Percent of Completion. Each Task is a percentage of the overall project as shown on the cost estimate. Use the percentage completion of each task in order to calculate invoice amount.
* Submit invoices to Mobility & Safety Contract Administration at [mobilityandsafetycontractadmin@ncdot.gov](mailto:mobilityandsafetycontractadmin@ncdot.gov)
* Expect payment of the Final Invoice after the Post-Implementation Observation Period has ended (one month after final implementation and fine-tuning) and the Final Report has been approved.

Schedule

The Firm shall commence work in conjunction with receiving the Notice to Proceed (NTP) and complete the project no later than **the applicable project due date**.Due dates are reflective of the final project completion, including the final report and implementation. The Firm must factor into their schedule the review time of the SSTO Section. Standard review time is three weeks, although additional time is required if multiple submittals are received simultaneously.

The Firm shall try to minimize the time between the implementation/fine-tuning and final report submittal, with a target of no more than four weeks between the two.

Reasonable extensions for unforeseen delays may be allowed as agreed to by mutual consent between the Firm and the SSTO Section.

Existing System Data

The SSTO Project Engineer will collect and distribute all existing data available for the system including timing databases, Synchro files, Tru-Traffic files, current signal plans, past retiming reports, etc.

# Task 2: Kick-Off Meeting and One-Page Project Summary Sheet

The Firm and SSTO Project Engineer shall meet with Division, Municipal, and Regional Traffic representatives to discuss the scope of the project, operational objectives of the corridor, and any additional pertinent information or recommendations. This meeting may be held virtually if agreed to by all parties.

After the Kick-Off Meeting, the Firm shall prepare and submit to the SSTO Project Engineer a One-Page Project Summary Sheet of the corridor and kick-off meeting. This summary shall include a map of the corridor showing each signal, as well as the corridor’s operational objectives, communications, current signal timing operations (i.e. schedule, plans, cycle lengths, etc.), and any key operational issues specific to the corridor. SSTO Project Engineer will review and reply with requested changes.

**Once approved by SSTO Project Engiener, the One-Page Project Summary Sheet shall be distributed to pertinent staff within three weeks of the Kick-Off Meeting. Pertinent staff includes, at a minimum, attendees of the Kick-Off Meeting, SSTO Project Engineer, State Signal Systems Engineer, Division Traffic Engineer, Deputy Division Traffic Engineer, and Regional Traffic Engineer.**

# Task 3: Field Data Collection

* Work with the SSTO Project Engineer to identify the total number of critical intersections.
* Request 13-hour turning movement counts via the online [Traffic Data Collection Request System](https://connect.ncdot.gov/site/Traffic-Requests/Pages/default.aspx)

* + [Existing count data](https://connect.ncdot.gov/resources/safety/Pages/Volume-Class.aspx) may be used if less than three years old and includes an agreed-upon adjustment factor. All turning movement counts will be handled under the Statewide Traffic Data Collection Contract. None will be paid for under this Scope of Services.
* Upload the existing controller data from the field. Where connectivity exists, this can be done remotely via the Statewide Signal System or dial-up modem.
* Field review signalized locations to verify:
  + Existing geometrics and signal phasing
  + Speed limits and distances between intersections
  + All equipment is in necessary working order including controllers, detectors, communication, etc.
  + All system detectors are assigned, and the detector data is logging
    - Make the necessary assignments and enable data logging if not properly implemented already.
    - Ensure Logging Period is programmed to 15 minutes.
  + Verify that field programming matches the most-recent traffic signal Plan of Record (POR).
    - Contact the Division regarding discrepancies in parameters that are not open to field adjustments.
      * Any discrepancies that may affect plan design shall be brought to the attention of the Deputy Division Traffic Engineer and SSTO Project Engineer so that a course of action to correct the changes can be made prior to development of the coordination plans.
    - Revisions to existing traffic signal Plans of Record, beyond field notes and red-lines, are not included in this Scope of Services. However, any recommendations/suggestions for improvements to traffic safety and efficiency are requested to be included in the *Final Report*.
* Note issues that will need to be addressed prior to implementation and report these issues to the Division and SSTO Project Engineer. Some examples of issues that should be reported to the Division include:
  + Communications issues, loops not detecting vehicles or pedestrian push buttons that don’t work, signal heads rotated or displays not functioning, blank controller screens, or programming discrepancies with the most-recent Plan of Record.

# Task 4: Evaluation of Existing Signal System Operations

* Update or create the *Translink32* Database so that the Signal System Number is listed in standard order of Signal System Number (preceded by 2-digit Division number), System Name @ Division, County, City  
  (example: MS – 0310312 – US 17 (Ocean Hwy) @ Division 3, Brunswick Co, Leland)
  + This step is not necessary for systems operating on Centracs, the Statewide Signal Management System.
* Perform "Before Runs" using *Tru-Traffic* software in accordance with the *Standard Practice for Tru-Traffic Travel Time Runs.*
* Make note of existing failing timing conditions such as lane blockages, cycle failures, split failures, etc.

Any existing files and/or information provided by the Department (including, but not limited to signal plans, *Synchro* files, timing schedules, *Tru-Traffic* files, etc.) shall be checked for accuracy by the Firm.

# Task 5: Develop Signal System Timing Plans

* Coordinate and finalize the number of timing plans with the Division and SSTO Project Engineer.
* Develop/update time-of-day schedules.
* Develop/update *Synchro* network model for existing conditions.
  + Interpolation of traffic counts is acceptable for non-critical intersections when count data is not available.
  + Ensure that all intersection geometrics, timing data, and phasing data in *Synchro* match field conditions and *TransLink32/Centracs*.
* Ensure that all settings in *Synchro* and *Tru-Traffic* match.
* Develop/update *TransLink32/Centracs* databases.
  + Develop/update Master Graphics (*TransLink 32)* or Local Graphics (*Centracs)*.
    - All new graphics should use photogrammetry and/or signal design plans as a minimum standard
    - Intersection approaches, movements and detectors shall be labeled appropriately.
    - *Centracs* graphics shall include, at a minimum:
      * Controller asset number
      * Signal System number (DXX-XX)
      * An arrow for each lane, movement, and/or phase
      * Phase numbers for each lane, movement, and/or phase
      * All detectors
      * Cycle length countdown timer (placed in center of intersections)
      * Current coordination plan number indication (placed on cabinet corner)
      * System-level view graphic shall be oriented correctly, properly showing the major and minor phase indications by ensuring that the phases are set accurately in “Properties”.
      * Reference signal 05-0281 as a graphics template and *ask for assistance if needed*.
* Ensure all system detectors are assigned and the detector data is logging in field.
  + Make the necessary assignments and enable data logging if not properly implemented already.
* For Centracs systems, ensure detector logging is properly enabled for *all* enabled detectors. Ensure controller logging is properly enabled with the appropriate logging period. Much of this is software-specific – *ask for assistance if needed.*

# Task 6: Preliminary Submittal and Report

* Refer to the *PEF Project Review Checklist\_Preliminary Submittal* document available [here](https://connect.ncdot.gov/resources/safety/Teppl/TEPPL%20All%20Documents%20Library/(10)%20PEF%20Project%20Review%20Checklist_Preliminary%20Submittal.pdf).
* **Prior to submitting preliminary plans, all timing databases shall be tested on a physical controller using the same local controller software package and version that is running on the corresponding field controllers.**
* Submit an electronic preliminary timing plan report and supporting documentation to the SSTO Project Engineer for review, using the DOT File Transfer System (FTS). The Preliminary Report shall include, at a minimum:
  + *Existing and Proposed TransLink32/Centracs* Database files
  + *Synchro* files of all existing and proposed timing plans
  + *Tru-Traffic* files of existing and proposed timing plans (if any), with logged “Before” runs
  + Traffic Counts
* Prepare the Preliminary Report using the following format:
  + Table of Contents
  + Section 1 – Executive Summary
  + Section 2 – Study Area
    - Individual intersections and overall map
    - Communications details (fiber, wireless, GPS, none)
    - Master controller (if applicable)
    - Existing signal system zones (if applicable)
    - Special signal timing requirements (pedestrian phases, FYAs, railroad preemption, etc.)
    - Facility Type and Purpose of Route/Operational Objectives
  + Section 3 – Turning Movement Counts
    - Map and location of existing and new counts
    - Methodology of developing volumes for intersections without turning movement counts
    - Identify traffic flow characteristics
    - Table showing counts, who did them, and the date and peak periods counted
  + Section 4 – Existing Timing Plans
    - Existing TOD Schedule
    - Discrepancies between *TransLink32/Centracs* & signal Plans of Record
    - Discrepancies between signal Plans of Records and current conditions
    - Day and time of “Before” travel time runs
  + Section 5 – Field Observations of Corridor
    - Observations from “Before” travel time runs – including any issues related to deficiencies, safety, issues with geometrics, pavement marking, signal heads, etc.
    - Summary of Division concerns and/or Citizen complaints
  + Section 6 – Proposed Timing Plans
    - Identify performance measures
    - Define prioritization and operational objectives
    - Changes to Zones
    - Identify critical intersections
    - Cycle lengths for each plan
    - Special timing (half cycle, uncoordinated intersections, lead/lag, etc.)
  + Section 7 – Proposed Time-of-Day/Day-of-Week Schedule
    - Show proposed and existing TOD schedules for comparison
  + Section 8 – Proposed Implementation Schedule
  + Section 9 – Preliminary Recommendations
    - Separate the signal operations recommendations from others
    - Classify recommendations by their added benefit to operation or safety (i.e. high, medium, or low)
  + Section 10 – Appendices
    - One Page Summary Sheet
    - Traffic routing methodology and results (if explanation is needed)
    - Additional information
    - Hard Copies (if requested)
* Allow three (3) weeks for review, comments, and approval to be completed by the SSTO Project Engineer.
* ***Wait to implement until all review comments have been addressed and the preliminary submittal has been approved by the SSTO Project Engineer.***
* Receive *Preliminary Review Rating* form after preliminary review approval is completed.

# Task 7: Field Implementation and Fine-Tuning of New Timing Plans

* For closed loop systems connected to a Master controller, ensure all time-of-day scheduled events are programmed and operational ***only*** in the local controllers (not in the Master). For systems with multiple zones, the Master scheduler can be used for the purposes of implementation and fine-tuning, but the final configuration of the system should have all TOD schedules programmed ***only*** in the local controllers. For *Centracs* systems, ensure local databases are programmed in both *Centracs* and the field controllers. This can be done by programming in the field and uploading to *Centracs*, or programming in *Centracs* and downloading to the controllers in the field (on-site, not remotely).
* Observe new traffic operations at the intersections and along corridors.
  + Drive the system with *Tru-Traffic* synced to the system timing plan in operation at the time.
* Fine-tune timing plans as necessary.
* Without additional cost to the Department, the Firm shall be responsible for responding to any operational issues related to the final signal timing plans for up to one (1) month after final implementation and fine-tuning.

# Task 8: Evaluation of Signal System Operations (Travel-Time Runs)

The Firm shall perform "After” runs using *Tru-Traffic* in accordance with the *Standard Practice for Tru-Traffic Travel Time Runs*, available [here](https://connect.ncdot.gov/resources/safety/Teppl/TEPPL%20All%20Documents%20Library/(14)%20Standard%20Practice%20for%20Travel%20Time%20Runs.pdf). **Final report shall include cumulative summaries for each separate direction of coordination and a cumulative summary of both directions together for each of the timing plans and all plans combined.**

Outputs of the final report must include, at a minimum, the following metrics:

* Cumulative Travel Time (CTT), Cumulative Delay (CD), Cumulative Stop Delay (CStopD), CStops, LOSDelay, CAS

# Task 9: Project Closeout Meeting with Division Staff

The Firm shall meet with Division, Municipal, SSTO, and Regional Traffic representatives, for up to an hour per system, to review and explain all work done. The discussion shall include background information for decisions made regarding coordination schedules and cycle lengths, as well as details of recommendations and the before/after travel time results. This meeting may be held virtually if agreed to by all parties.

This meeting does not replace stakeholder coordination throughout the life of the project to ensure the Division’s needs and goals are being met.

# Task 10: Final Submittal and Report

* Refer to the *PEF Project Review Checklist\_Final Submittal* document available [here](https://connect.ncdot.gov/resources/safety/Teppl/TEPPL%20All%20Documents%20Library/(15)%20PEF%20Project%20Review%20Checklist_Final%20Submittal.pdf).
* Submit Final Report, timing plans, and all supporting documentation to the SSTO Project Engineer a minimum of one (1) month in advance of the deadline of the project to provide adequate time to review, evaluate, and approve. The Final Report shall include final versions of all information provided in the preliminary submittal.
  + One (1) electronic copy to SSTO Project Engineer
* Prepare the Final Report using the following format:
  + Table of Contents
  + Section 1 - Executive Summary
  + Section 2 – Study Area
    - *Refer to Preliminary Submittal outline*
  + Section 3 - Turning Movement Counts
    - *Refer to Preliminary Submittal outline*
  + Section 4 – Pre-Existing Timing Plans
    - *Refer to Preliminary Submittal outline*
  + Section 5 – Field Observations of Corridor
    - *Refer to Preliminary Submittal outline*
  + Section 6 - Implemented Timing Plans
    - *Refer to Preliminary Submittal outline*
    - *Major changes/deviations from preliminary*
  + Section 7 - Implemented Time-of-Day/Day-of-Week Schedule
    - *Refer to Preliminary Submittal outline*
    - *Major changes/deviations from preliminary*
  + Section 8 – Schedule of Final Implementation and Fine-Tuning
  + Section 9 – Final Recommendations
    - *Refer to Preliminary Submittal outline*
  + Section 10 - Travel Time Run Comparison
    - Dates and Times of “Before” and “After” runs
    - Tables summarizing “Before” and “After” run results
  + Section 11 – Appendices
    - *Refer to Preliminary Submittal outline*
    - NCDOT Corridor Travel Time Analysis report
* Allow three (3) weeks for review, comments, and approval to be completed by the SSTO Project Engineer.
* Notify SSTO Section if System retiming effort does not provide an improvement/benefit to the current System operations. SSTO Section, Division, and Firm will meet to discuss result and agree on further actions and/or recommendations. If agreement between SSTO Section and Firm is that improvement/benefit to the System operations cannot be accomplished through the System retiming effort, then written justification should be included in the Final Report.
* State Signal Systems Engineer will distribute the final report, results, and recommendations directly to Division staff, copying PEF staff.
* Receive *Final Evaluation Rating* form after Final Report and accompanying documents are reviewed and approved.