Final Submittal

1) Ensure that the Final Submittal includes all of the following documents:

a. Final Report (PDF)
b. Implemented and fine-tuned Signal Timing Database files and graphics (*TransLink32*, *Centracs*, etc.)
c. Updated *Synchro* and *Tru-Traffic* files of all implemented and fine-tuned timing plans
    i. *Tru-Traffic* files shall include trip logs of "Before" and "After" runs
d. Turning movement counts
e. Implemented Time-of-Day schedule
f. Signal plans for all signals in the system

2) Final Report

a. <u>Table of Contents</u>
b. <u>Section 1 – Executive summary</u>
    A brief synopsis of the system and the subsequent analysis.
c. <u>Section 2 – Study Area</u>
    i. *Overall corridor map, including a listing of each intersection (with signal inventory number)*
    ii. *Master controller (if applicable)*
    iii. *Communication details (fiber, wireless, GPS, none)*
    iv. *Original and implemented signal system zones (if applicable)*
    v. *Special signal timing requirements (pedestrian phases, FYAs, Fire/Railroad pre-emption, etc.)*
    vi. *Facility type, purpose of route, operational objectives*
    vii. *One-Page Summary Sheet*
d. <u>Section 3 – Turning Movement Counts</u>
    i. *Map and location of existing and new counts*
    ii. *Methodology of developing volumes for intersection without tuning movement counts (growth rates, trip generation, trip distribution, interpolation, etc.)*
    iii. *Identify traffic flow characteristics*
    iv. *Table showing counts, who did them, and the date and peak periods counted*
e. <u>Section 4 – Original Timing Plan Details</u>
    i. *Original time-of-day schedule and cycle lengths*
    ii. *Discrepancies between timing databases and latest signal Plans of Record*
    iii. *Discrepancies between signal Plans of Record and current conditions*
    iv. *Dates and times of "Before" travel time runs*
    v. *Information about System, Master, # of timing plans, etc.*
f. <u>Section 5 – Field Observations of Corridor</u>
    i. *Observations from "Before" travel time runs – including any issues related to deficiencies, safety, geometrics, pavement markings, signal heads, etc.*
    ii. *Summary of Division/citizen concerns and complaints*
g. <u>Section 6 – Implemented Timing Plan Details</u>
    i. *Identify performance measures*
    ii. *Define prioritization*
    iii. *Define operational objectives*
    iv. *Changes to Zones (if applicable)*
    v. *Identify critical intersections*
    vi. *Cycle lengths for each plan*
    vii. *Special Timing (half cycle, uncoordinated intersections, lead/lag, etc.)*
h. <u>Section 7 – Implemented Time-of-Day/Day-of-Week schedule</u>
i. <u>Section 8 – Schedule of Final Implementation and Fine-Tuning</u>
j. <u>Section 9 – Final Recommendations</u>
    i. *Separate the signal operations recommendations from other recommendations*
    ii. *Classify the recommendations by their added benefit to operation or safety (i.e. high/medium/low)*
k. <u>Section 10 – Travel Time Run Comparisons</u>
    i. Dates and Times of "Before" and "After" runs

  ii. 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 (i.e. "cumulative summary of all runs, either direction through the route").

  iii. Tables summarizing "before" and "after" run results for the following metrics:
    1. Cumulative Travel Time (CTT)
    2. Cumulative Delay (CD)
    3. Cumulative Stop Delay (CstopD)
    4. Cumulative Stops (CStops)
    5. Level-of-Service Delay (LOSDelay)
    6. Cumulative Average Speed (CAS)

  iv. Before and after travel time study using iPeMS GPS probe data tool and *NCDOT Corridor Travel Time Analysis Tool*

 l. <u>Section 11 – Appendices</u>
  i. *Kick-Off Meeting minutes*
  ii. *Turning Movement Counts*
  iii. *Traffic routing methodology and results (if explanation is needed)*
  iv. *Field Data sheets*
  v. *Red-lined signal plans*
  vi. *Tru-Traffic travel time & delay reports*
  vii. *Synchro Output Files (original and implemented)*
  viii. *System Detector Volume Graphs*

3) <u>Synchro</u>

During review, note that V/C Ratio, Actuated g/C Ratio, Approach Delay, Total Delay, LOS, Queue Length, and optimal Green Band and Lead/Lag usage are all used as measures of effectiveness to assess the model.

Verify accurate coding of each of the following for all *Synchro* files:

 a. <u>System Map</u>
  i. Directional orientation of the system map conforms to the signal design plans.
  ii. The arterial and cross streets are clearly labeled.

 b. <u>Lane Settings</u>

i. Lane Configuration	vi. Saturation Flow Rate	xi. Right Turn Channelized
ii. Street Names	vii. Grades	xii. Add Lanes
iii. Link Distances	viii. Area Type CBD	xiii. Lane Utilization Factor
iv. Link Speeds	ix. Storage lengths	xiv. Right-Turn on Red
v. Lane Widths	x. Storage lanes	

 c. <u>Volume Settings</u>

i. Traffic Volumes	iv. Link OD Volume	vi. Adjacent Parking Lane
ii. Conflicting Pedestrians	v. Bus Blockages	vii. Heavy Vehicle Percentage
iii. Peak Hour Factor		

 d. <u>Node Settings</u>

i. Zone	iv. Offset	vii. Master Intersection
ii. Control Type	v. Referenced Point	
iii. Cycle Length	vi. Reference Phase	

 e. <u>Timing Settings</u>

i. Turn Type	vi. Switch Phase	xi. All-Red Time
ii. Protected Phase	vii. Minimum Initial	xii. Lost Time Adjust
iii. Permitted Phase	viii. Minimum Split	xiii. Lagging Phase
iv. Recall Mode	ix. Total Split	xiv. Allow Lead/Lag Optimize?
v. Detector Phase	x. Yellow Time	

 f. <u>Phasing Settings</u>

i. Vehicle Extension	iv. Pedestrian Phase	vii. Flashing Don't Walk
ii. Minimum Gap	v. Advance Ped Walk	viii. Dual Entry
iii. Time Before Reduce	vi. Walk Time	ix. Fixed Force Off

g. Simulation Settings (if applicable)
- i. Taper Length
- ii. Lane Alignment
- iii. Turning Speed
- iv. Median Width
- v. Crosswalk Width
- vi. TWLTL Median
- vii. Headway Factor
- viii. Positioning Distance
- ix. Mandatory Distance
- x. Enter Blocked Intersection
- xi. Permitted Flashing Yellow

h. Settings Match Timing Database
- i. Cycle Lengths
- ii. Offsets
- iii. Split Values
- iv. Phase Sequence
- v. Offsets

4) Tru-Traffic

Verify accurate coding of each of the following for all *Tru-Traffic* files:

a. Network Parameters – General Tab
- i. Timing Plan Name
- ii. Timing Plan Number
- iii. Cycle Length
- iv. Time-of-Day

b. Arterial Timings Diagram Parameters – Artery Tab
- i. Arterial Name
- ii. Forward Direction
- iii. Offset Reference Point

c. Intersection Parameters
- i. Name Tab
  1. Intersection Name
  2. Distance
  3. ID Number (SIN)
  4. Cycle Length
  5. Offset
  6. Reference Point
- ii. Timings Tab
  1. Splits
  2. Phase Sequence
  3. Movement Settings
  4. Verify Ped Times
  5. Verify Ped Settings
  6. Yellow Times
  7. All-Red Times
  8. Minimum Splits
- iii. Lanes Tab
  1. Lane configuration matches design plan

d. Settings Match Timing Database
- i. Cycle Lengths
- ii. Offsets
- iii. Split Values
- iv. Phase Sequence

5) Timing Database

The timing database is the data that will be in the controller on the street, so it is the reference point against which all other data should be checked.

Verify accurate coding of each of the following for all timing database files:

a. Master Controller Database (if applicable)
- i. Master Properties (Task 4, Scope of Services)
  1. Master Asset ID and System designation are correct.
- ii. Master Graphics (Task 5, Scope of Services)
  1. All intersections and detectors are depicted and labeled.
  2. All phase depictions and intersection descriptions are correct.
- iii. 2, Master Settings
  1. Detector Sample Period is set to 15 minutes
  2. Comm. Fail Timeout is set to 0
- iv. 3, Zone Assignments (if applicable)
  1. Intersections are assigned to the correct zones
- v. 4, System Detectors (Task 5, Scope of Services)
  1. System detectors are associated with the correct intersections and local detectors as detailed on the signal design plan and electrical details.
- vi. B, Scheduling (Task 7, Scope of Services)
  1. All TOD events are programmed and operational (for all zones, when applicable)
- vii. D-4, Logging Controls

1. All logging is enabled
b. <u>Local Controller Database</u>
    i. <u>Local Properties</u>
        1. Local Asset ID and intersection designation are correct
    ii. <u>2-1, Phase Control</u>
        Ensure all phase control parameters detailed on the signal design plan and electrical details are accurately programmed. Consult the Division regarding discrepancies related to these parameters.
        Parameters include, but are not limited to:
1. Soft Recall	4. Simultaneous Gap	7. Gap Reduction
2. Minimum Recall	5. Inhibit Max (Coord)	8. Backup Protection
3. Dual Entry	6. Variable Initial	9. Dynamic/Backup
    iii. <u>2-2, Dynamic/Backup Control Functions</u>
        1. Parameters match Electrical Details, when applicable
    iv. <u>3, Phase Timing</u>
        1. All applicable phase timing parameters are programmed as depicted in the Timing Chart on the signal design plan. Although minor deviations are permitted for some parameters (as indicated on the plan), the Division should be consulted when major deviations are programmed.
    v. <u>4, Phase Sequence</u>
        1. Phase Sequence Page 1 is programmed in accordance with the signal design plan.
    vi. <u>7-1, Vehicle Detector Assignments</u>
        1. Local vehicle detectors used as System Detectors are enabled and enabled to log
    vii. <u>7-2, Pedestrian Detector Assignments</u>
        1. Pedestrian detectors are enabled and enabled to log
    viii. <u>7-3, General Vehicle Detector Settings</u>
        1. Logging Period is set to 15 minutes.
    ix. <u>9, Coordination</u>
        The following parameters are programmed correctly:
1. Cycle Length	5. Splits sum to Cycle Length
2. Min Transition Cycle	6. Secondary Phase Timing pages used (i.e. not Page 1 for Free run)
3. Max Transition Cycle	
4. Coordinated Phase(s) Enabled	7. Secondary Phase Sequence pages used (i.e. not Page 1 for Free run)
    x. <u>B, Scheduling</u>
        1. 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.
        2. 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).
    xi. <u>D-2, General Comm Config</u>
        1. Comm Fail Return to TOD
            a. Master Local set to 0
            b. All Other Locals set to 15
    xii. <u>D-4, Logging Controls</u>
        1. All logs enabled