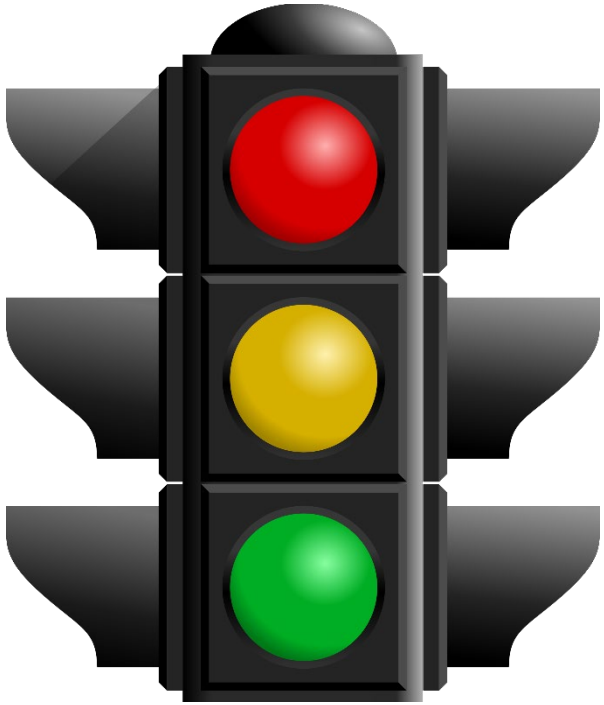
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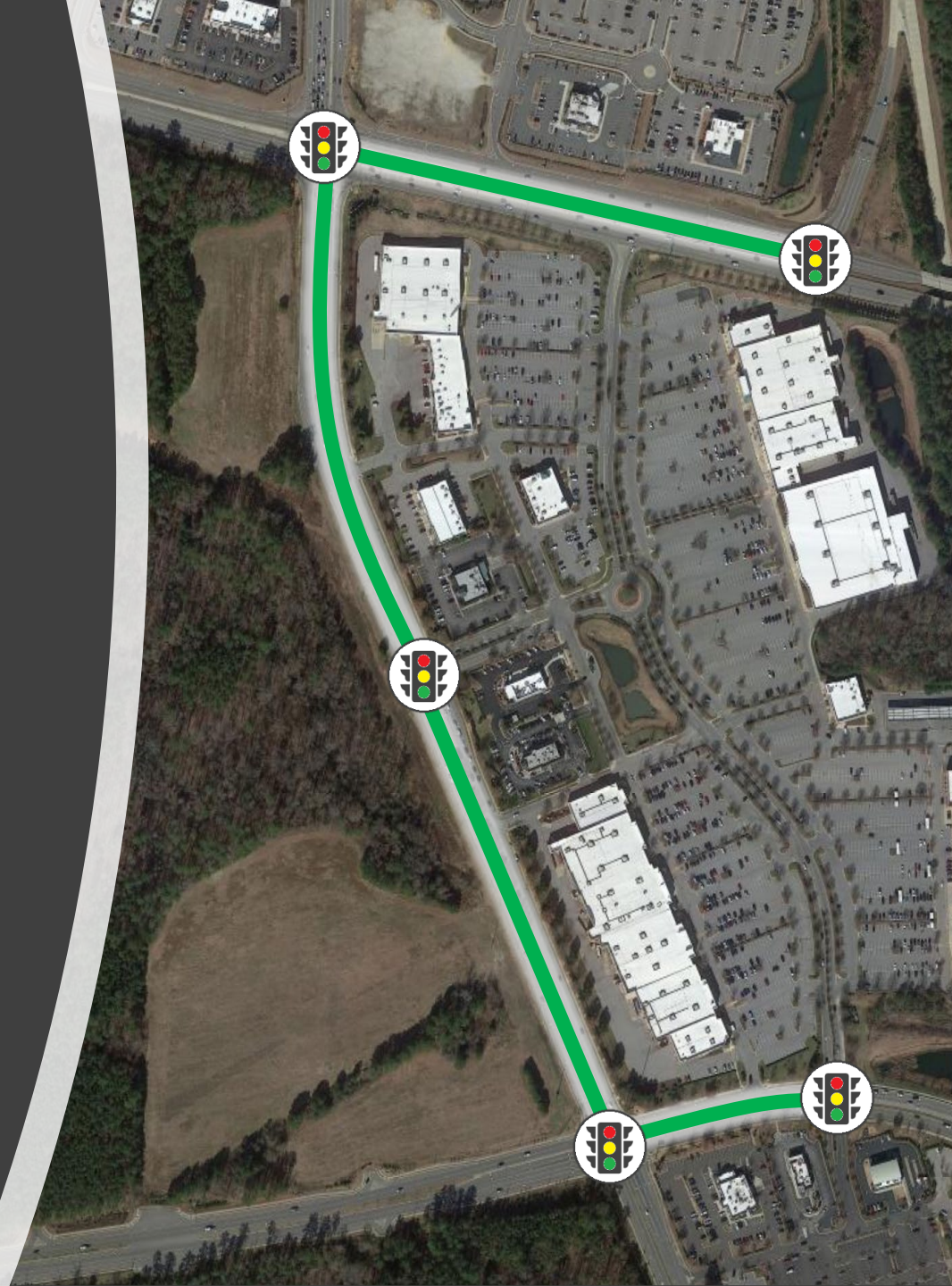


Signal System Progression Basics

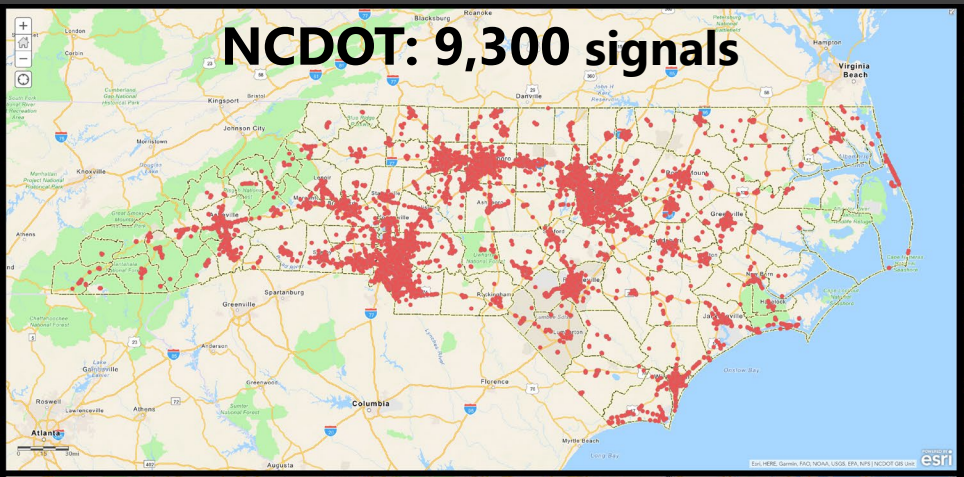
Mohamed S. Deen
Senior Signal Systems Engineer
Signal System Timing and Operations
Traffic Systems Operations Unit

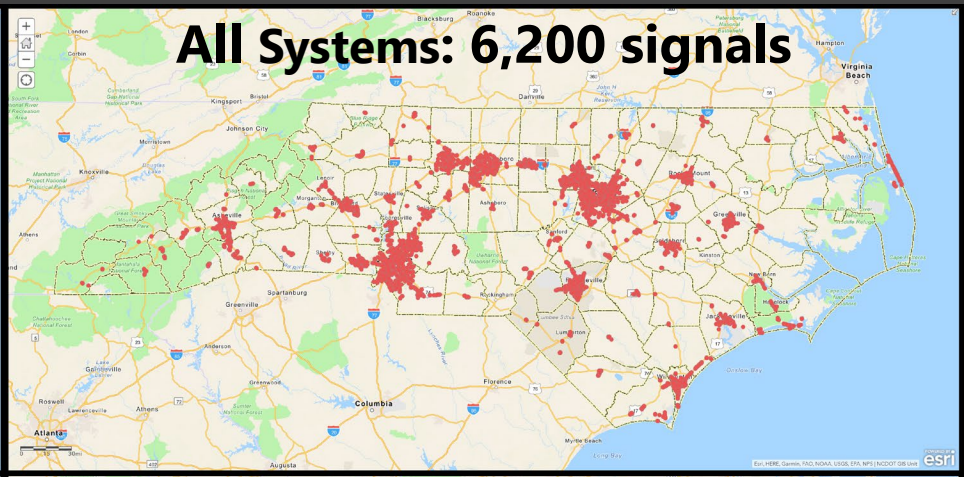
What is Signal Progression?

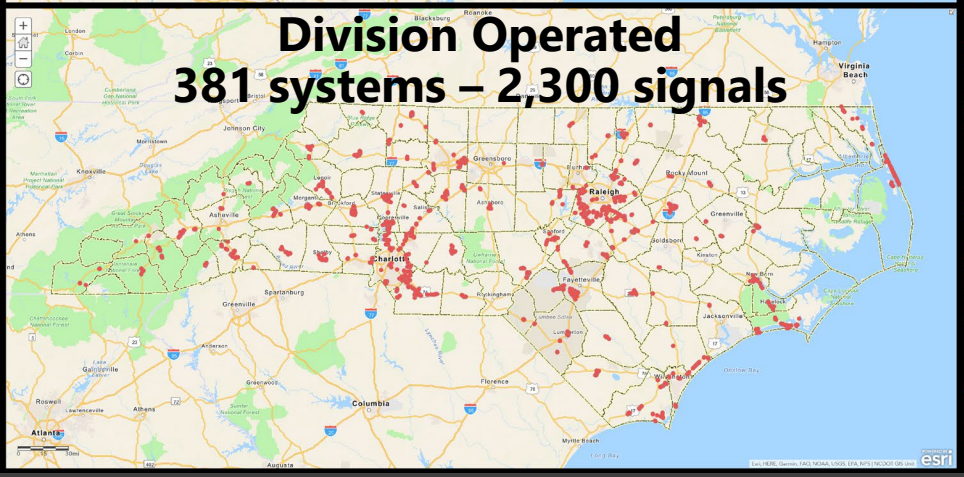
The practice of coordinating the operations of two or more signalized intersections along an arterial or network of arterials, with the goal of maximizing traffic mobility and safety.

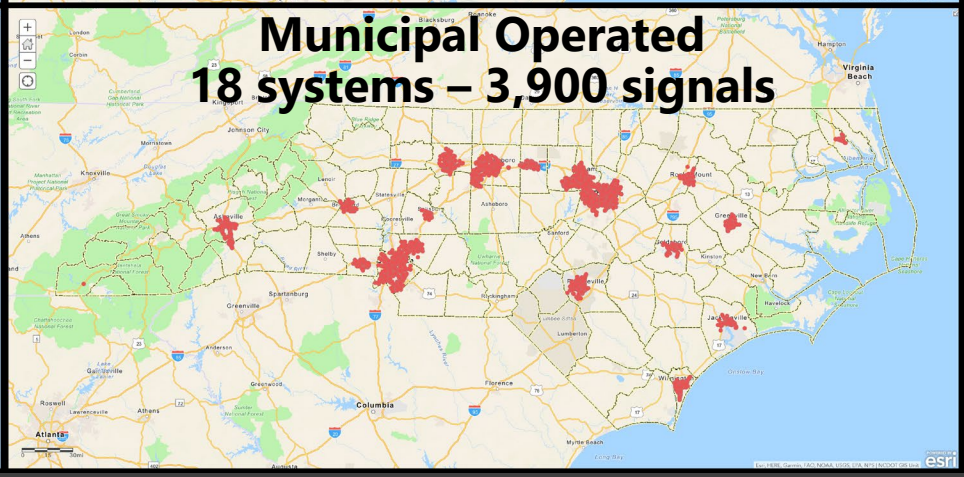


Scope and Scale of North Carolina Signal Network









Benefits and Goals of Signal Progression

Maximize daily mobility and safety along a corridor with improvements in:

- Travel Time
- Delay
- Level of Service
- Number of Stops
- Duration of Stops
- Fuel Consumption
- Vehicle Emissions
- Average Operating Speeds
- Driver Frustration

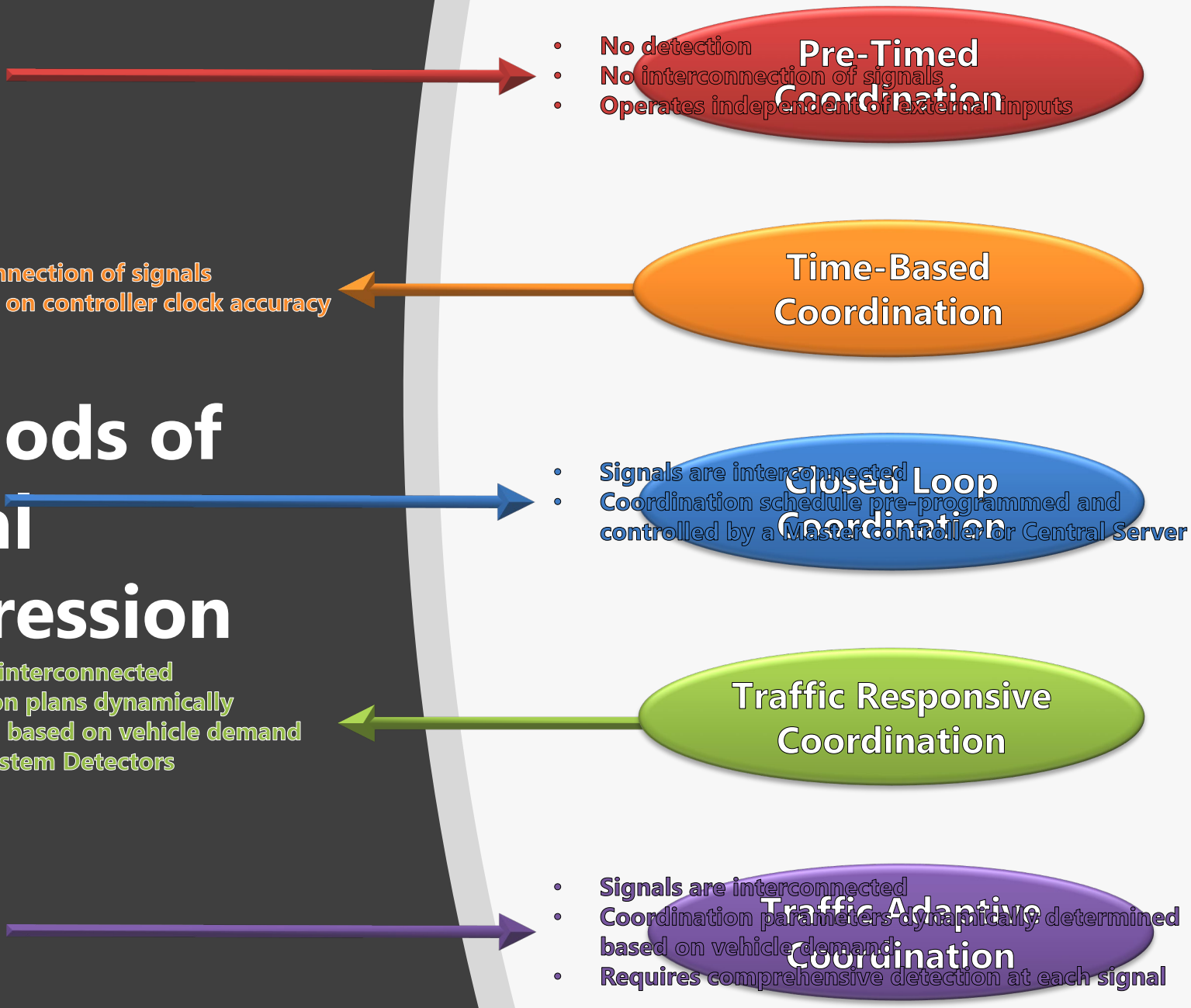
Management of traffic during incidents and events

- Unplanned Events
  - Hurricanes
  - Rockslides
  - Incidents
  - Road Closures
- Planned Events
  - Political Conventions
  - Sporting Events
  - Work Zones

Methods of Signal Progression

- No interconnection of signals
- Contingent on controller clock accuracy

- Signals are interconnected
- Coordination plans dynamically determined based on vehicle demand
- Requires System Detectors



Primary Coordination Parameters

Cycle Length

- The time required to serve a complete sequence of signal indications (Vehicular & Pedestrian) at a given intersection.
- Generally expressed in seconds.

Offsets

- The time relationship between coordinated phases at subsequent traffic signals.
- Generally expressed in seconds or as a % of the cycle length.

Splits

- The portion of time allocated to each phase at an intersection. Generally expressed in seconds or as a % of the cycle length.

Schedule

- Defines at what times and on what days each timing plan operates.

Signal Timing Process Overview



Scoping and Traffic Observation



Data Collection



Model Development & Optimization



Implementation and Fine Tuning



Performance Evaluation



Reporting

Signal Timing Process

Scoping and Traffic Observation

- Confer with local stakeholders to help define the timing needs of the corridor
- Ascertain land-use patterns within study corridor
- Observe traffic patterns to determine the timing needs and operational objectives of the corridor

Data Collection

- Collect turning movement counts at the controlling intersections
- Measure distances between the intersections
- Collect and save "Before" trip logs using Tru-Traffic software, for future system evaluation
- Upload existing controller databases
- Collect latest signal upgrade plans for all the intersections

Model Development & Optimization

- Create a Synchro model of the system, calibrating it as close as possible to the actual system operating features
- Input and balance intersection volumes for the time of day under consideration
- Optimize the model within reasonable limitations
- Review and adjust (if needed) the Synchro suggested timing plan
- Develop an appropriate Time-of-Day (TOD) schedule

Signal Timing Process



Implementation and Fine-Tuning

- Program newly designed timing plans and schedule in the appropriate interfacing software
- Coordinate with Division staff to update controller databases with the latest signal upgrade plans
- Download newly designed and approved timing plans into field controllers
- Observe traffic and field adjust newly implemented plans

Performance Evaluation

- Collect and save “After” trip logs, after the traffic would have adjusted to newly implemented system timing plans
- Generate travel time reports for the “Before” and “After” trip logs, to evaluate efficacy of new plans

Reporting

- Compile a report outlining the before conditions, design methodology, updated coordination plan parameters, operational improvements, and any corridor recommendations

Monitoring

- Upon completion of the timing or retiming of a system, it is turned over to the Division to monitor and maintain. This is achieved by:
  - Random field observations
  - Periodic remote monitoring of operations
  - Periodic trip log collections
  - Responding to corridor user comments
- Currently developing an Automated Traffic Signal Performance Measuring (ATSPM) system for more effective and continuous monitoring of its signal systems.

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Questions?

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