Moving Beyond Adaptive Traffic Signal Control to Semi-Autonomous/Autonomous Systems

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Background

• Hennepin County – Current System
  • 450+ Traffic Signals
  • Approximately ¾ on Aries System
  • Telephone system, based on Masters tied to Locals in Field
  • Two subsystems, N + S
  • System is outdated, no longer supported
Hennepin County Plan

- Update System in 2017
- Central System, Connected Directly to All Signals
- Eventually, all Signals Connected
- Fiber Optic Cable, Cell-Modem Communications
- Add CCTV’s and DMS’s
- Adaptive Traffic Control

Why Adaptive Control?

- 2015 Heavy Construction Activity in County
  - I-494
  - TH 100
  - I-394
  - TH 169 in 2016/2017
Result

- Traffic Diversion Extraordinary
- Nearly all Corridors and Intersections Impacted
- Volumes Increased, Turns Increased, Time of Day Changed
- As a Minimum, Need Adaptive Control Capable of Cycle, Split, Offset Variation to Fit Completely New Traffic Patterns
- Also – Need Greater Flexibility w/LT Phases

Adaptive Systems

- Not New (20\textsuperscript{th} Century Tool)
- Been Used since 1970’s
- SCOOT (200+) and SCATS (140+) First Adaptive
- Many to Choose From, More to Come
- Significant Interest, Finally, in USA (1% vs 50%)
Beyond Adaptive

- Why?
- Completely New Traffic Patterns/Volumes/Streets
  - During Construction
  - Phasing (Ramps, Freeway Lanes, Connections)
  - After Construction – New Again
- Needed to Reevaluate and Adjust Timing/Phasing
- Signal Cycle Length, Splits, Offsets, Phasing (LT’s)
- Need 21st Century Tool

Adaptive -> Semi-Autonomous/Autonomous

- 21st Century -> Robotics, Autonomous Systems, AI, Big Data
- Currently Moving to Connected & Autonomous
- First Step: Semi-Autonomous (Limited Autonomous)
- “Learning” a Big Part of Autonomous and AI
First Step to Autonomous -> Semi-Autonomous

- In addition to Adaptive, add Phasing as New Variable
- LT’s or Not?
- LT’s, What Time of Day?
- LT’s, What Direction?
- What Format – Protected, Permitted, Protected Permitted
- FYA’s a Way Forward – Works in All Formats

How to Use FYA’s to Achieve Semi-Autonomous

- Algorithms
- Use Data Management System
- Need Data Source
- Need Data Management Procedure
Mn/DOT’s FYA Procedure

- Statistical Model within a Spreadsheet Tool (Risk Determination)
  - Sight-Distance Issue?
  - Opposing LT Lanes (including number)
  - Opposing Speed Limit & Geometric Considerations
  - Under 45mph, Sight-Distance Problem or Not
  - 45mph and Over, with Sight-Distance Problem
  - Turning Movement Counts and Opposing Through Traffic
  - Result = Prediction of Risk of LT Crash Occurrence Throughout the Day
  - New Procedure: Collect More Data to Improve Accuracy of Spreadsheet

Transport Data Integration (TDi)

- Tool Developed in Maidstone, UK
- Operating 10+ yrs
- Uses Cellphone Data + Detector Loops
- Through Statistical Analysis and Sampling Provides Results
- Traffic Volumes, Turning Volumes, Speeds, Delays, Congestion, Travel Times, Real-Time O-D’s, etc.
- All Modes (Peds, Bikes, Cars, Trucks, Buses, Trains), 24/7
- Uses Travel History to Predict Future Travel
How Do We Get There?

• Have to Want To Get There
• Use Tools We Have
• Develop Tools We Need
• Start Small → Semi-Autonomous
• Algorithms Important

Semi-Autonomous

• Use Mn/DOT FYA Procedure
• Use TDi Data Management System – Measure!
• Develop Research Plan to Test System and Solutions
Semi-Autonomous ATMS Systems - A Beginning

• Questions?