INTERSECTION TRAFFIC CONTROL
COMMITTEE
Meeting Minutes
April 2nd, 2014

Attendees

<table>
<thead>
<tr>
<th>Name</th>
<th>Agency</th>
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<tbody>
<tr>
<td>Morgan Abbott</td>
<td>TKDA</td>
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<tr>
<td>Dean Chamberlain</td>
<td>WSB</td>
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<tr>
<td>Nik Costello</td>
<td>Washington Co</td>
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<tr>
<td>Allen Eisinger</td>
<td>Traffic Control Corp.</td>
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<tr>
<td>John Fahrendorf</td>
<td>WSB</td>
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<tr>
<td>Joe Gustafson</td>
<td>Washington Co</td>
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<tr>
<td>Paul Jung</td>
<td>MnDOT</td>
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<tr>
<td>Jerry Kotzenmacher</td>
<td>MnDOT</td>
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<tr>
<td>Tyler Krage</td>
<td>Alliant Engineering</td>
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<tr>
<td>Jon Krieg</td>
<td>Hennepin County</td>
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<tr>
<td>Guillermo Madrigal</td>
<td>Kimley-Horn</td>
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<tr>
<td>Gus Perron</td>
<td>WSB</td>
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<tr>
<td>Roger Plum</td>
<td>SEH</td>
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<tr>
<td>Scott Poska</td>
<td>SRF</td>
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<tr>
<td>Jan Rybar</td>
<td>Dakota Co</td>
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<tr>
<td>Kevin Schwartz</td>
<td>MnDOT</td>
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<tr>
<td>Molly Stewart</td>
<td>Bolton and Menk</td>
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<tr>
<td>Mark Wagner</td>
<td>SRF</td>
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Meeting Location: MnDOT Water’s Edge, Room 176
Meeting Topic: Adaptive Signal Timing
Meeting Presenters: Justin Effinger (WisDOT Southeast Region) and Jason Matson (HNTB)

1. Adaptive Signal Timing in Milwaukee
   - See attached slides
   - Additional notes from presentation:

www.nc-ite.org
Compatibility with different municipalities’ technology was a key concern – InSync system is compatible with the existing systems

- Bluetooth units used for real-time travel time data
- Before and after data collection in Spring 2013
- Signal systems needed to be ready to go before the Zoo Interchange project
- InSync system order depends on the cabinet type
- InSync system needs Ethernet cable and power cable for operation
- No utility relocations were performed due to the installation of the adaptive signal system
- Weather conditions/temperature are concerns for installation (cannot be too cold)
- Installation of repeaters is necessary when cable length is greater than 100 meters or if cameras are not working correctly
- Good two-way progression was needed in this corridor
- The adaptive system was able to shrink the time period experiencing over-saturated conditions
- The cycle times are dynamic but ended up being close to what they were before the system was installed

II. Question and Answer session

- What effort was put into retiming the signals before looking into adaptive signal timing?
  - Reconstruction project allowed the opportunity for this project
  - Corridor later modeled in Synchro to check operations in the corridor

- How are the maintenance costs handled?
  - Funding through the Zoo Interchange project worked out through the project development process
  - 2 year maintenance and warranty period
  - WisDOT taking over maintenance after warranty period expires (training their workers)

- Was there fine-tuning done through Synchro?
  - Yes, fine-tuning done through Synchro
Are the Synchro files used for the analysis available?
  o Yes, upon request
  o Report also available with raw data and analysis

Was Synchro analysis done internally (at WisDOT)?
  o Yes

What is the cost per signal for this system?
  o About $25,000 per signal not including repeaters, controller upgrades, or cable
  o Total cost was about $230,000 for test segment (6 signals) not including contractor installation costs

Do you need to install video detection, or could you just install loop detectors?
  o A combination of both was used for this project, but video detection was installed at all 6 intersections with this project.
  o Cameras occasionally caused problems due to being covered with snow
  o “Fusion” system (combo of video + loops) is about $30,000 per signal

Were there any corridor cross-coordination problems?
  o There were a few issues due to less adaptability on the crossing corridors

Are you concerned about operator training? Is maintenance of the system too complicated for the average technician?
  o Back-up timing plans were developed in case of issues
  o Development of a WisDOT training class for technicians and electricians
  o It’s rare for technicians to have to change timing in the cabinet; most can be done in the office

How where the signals coordinated (fiber, hardwire interconnect)?
  o Fiber and radio were used on this segment
  o System also supports hardwire interconnect as well

Is it possible to put plans in place for skipping phases or other special signal timing?
  o Skipping phases on this project was mostly for when no vehicles were present on the side streets
The system can be “locked” into a signal plan or let run free

- How where the before and after travel times collected through the corridor?
  - Before: GPS
  - After: Bluetooth

- Would you roll this out statewide?
  - Benefit/cost ratio goes down in rural areas

III. Round Robin

- Scott P.
  - U of M roundabout – peer review or preliminary design requested
  - Upcoming Flashing Yellow Arrow topic: Gary Davis at U of M presenting on latest research; Kevin Schwartz and Nicole Flint of MnDOT presenting latest processes and methodologies of FYA installation and operations; policy for installation of FYA at retrofits; design particulars for FYA (signs, detectors, etc)
  - Do any other agencies have a different process to share for FYA topic? (None noted)

- John K. – Bloomington developing central system program for signals – any other cities running a central system?

- Kevin S. – “U-Turn yield to right turn” sign being used (other than at MnDOT)? (No other uses noted)

- Nik C. – Left-turn phasing by time of day allowed with adaptive signal timing system?
Zoo Interchange Integrated Corridors

MN ITE Meeting
Justin Effinger, WisDOT
Jason Matson, HNTB
April 2, 2014
Why rebuild the Zoo Interchange

- **Safety** – averages nearly three crashes per day
- **Infrastructure and design** – aging infrastructure and outdated design
- **Congestion** – busiest interchange in state
Who uses the interchange

- Busiest interchange in state; ~ 350,000 cars per day
- Gateway to Milwaukee, largest urban center in state of Wisconsin
- Access to the regional medical center, tourism, jobs and education
- Neighborhoods and thriving communities
Why Are We Mitigating Traffic During Zoo IC Core Construction?

- 2013: 1.8 million hours estimated total vehicle delay, $33.8 million estimated user delay costs
- 2014: 3.5 million hours estimated delay, $64.2 million estimated user delay costs
- Safety impacts due to congestion and work zone geometry
Decision Making Process

- Traffic Operations Advisory Committee
  - WisDOT
    - Zoo Interchange Project
    - Bureau of Traffic Operations
    - Southeast Region System Operations
  - Southeast Wisconsin Regional Planning Commission (SEWRPC)
  - FHWA
Decision Making Process

- Stakeholder Input
  - Wisconsin State Patrol
  - Milwaukee County Sheriff’s Office
  - Milwaukee, West Allis, Wauwatosa
    - Public Works – Traffic Engineering
    - Emergency Responders
  - Milwaukee Regional Medical Center
  - Milwaukee County Transit
  - Wisconsin State Fair
Traffic Management

- Integrated Corridor Management (ICM) Operational Strategies
  - Zoo Corridors Traffic Operations Authority
  - Real Time Information Sharing
  - Freeway – Arterial Integrated Operations
  - Traffic Incident Management Expansion
Zoo Interchange Priority Corridors
Emergency Vehicle Preemption

Priority Emergency Response Routes to the Milwaukee Regional Medical Center
**Cameras**

**SCHEDULE**

1. **1st Phase**
   - PSE: Feb. 1, 2013
   - Let: May 14, 2013
   - Begin Construction: July 23, 2013

2. **2nd Phase**
   - PSE: Nov. 1, 2013
   - Let: March 11, 2014
   - Begin Construction: April 22, 2014

**LEGEND**

- **Existing CCTV Camera**
- **Proposed CCTV Camera**
- **1st Tier InSync Signals**
- **2nd Tier InSync Signals**
- **3rd Tier InSync Signals**
Dynamic Message Signs

SCHEDULE

<table>
<thead>
<tr>
<th>Phase</th>
<th>Start Date</th>
<th>End Date</th>
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<tbody>
<tr>
<td>1st</td>
<td>Feb 1, 2013</td>
<td>May 14, 2013</td>
</tr>
<tr>
<td>2nd</td>
<td>Nov 1, 2013</td>
<td>March 11, 2014</td>
</tr>
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</table>

LEGEND

- PSE: Priority Sign Environment
- Let: Let date
- Begin Construction: Begin date

Existing eastbound sign on US 18
Currently part of HWY 100 project
Northbound sign on HWY 100 south of Beleit Road

Tier 1/2 Phase SMSS
Tier 1/3 Phase SMSS
Tier 1/3 Phase Hybrid SMSS
Potential SMSS
Existing SMSS

Zoo Interchange Integrated Corridor Management System
Tier 1 – Phases 1 and 2 Sign Locations

DRAFT
Goal: Improve operations on arterials and better integrate with freeway operations

Many corridors operating at LOS D or worse
Zoo Interchange Signal Ownership
Traffic Signal Technology

- **Time of Day Operation**
  - AM Peak Coordination
  - MID Peak Coordination
  - PM Peak Coordination

- **Advanced Signal Technology**
  - Detectors Monitor Traffic
  - Timing change if necessary to improve traffic flow
  - Software compiles data and applies algorithms
Adaptive Signal Technology

- What are the benefits to Adaptive Signal Control Technology?
  - Continuously distribute green light time equitably for all movements
  - Improve travel time reliability by progressively moving vehicles through green lights
  - Reduce congestion by creating smoother flow
  - Prolong effectiveness of traffic signal timing
Zoo Interchange ICM Systems Engineering Process

- **Concept of Operations**
  (August/September, 2011)
  - Zoo ICM Vision
  - Define boundaries
  - Identify problems, **NEEDS** w/ stakeholder input

- **High Level Requirements**
  (October/November, 2011)

- **Detailed Requirements**
  (Late 2011)

- **High Level Design**
  (Late 2011 to Mid 2012)

- **Detailed Design**
  (June 2012-early 2013)

- **Integration & Testing**

- **Subsystem Verification**

- **System Acceptance**

- **Implementation**
  (Beginning with construction year 2013)

**Determine capabilities/functions of **WHAT** Zoo ICM must have (i.e. stakeholder requirements) based on ConOps needs.**

**HOW** will Zoo ICM satisfy identified requirements:
- Define interfaces/architecture
- Standards, existing systems
- Software
- Plans, Specs, Estimates (PS&E)
- Institutional policies/procedures
- Funding, phasing, procurement

**Operations**
Selecting An ASCT

- Concept of Operations (Systems Engineering Analysis)
  - Compatibility with modern controller types including NEMA TS1 & TS2 (Econolite & EPAC) controllers, Type 170 and 2070 controllers
    - “Different strokes for different folks”
  - Ability to serve a vehicle phase more than once for each time the coordinated phase is served. Ability to skip a phase and choose an appropriate phase pair based on real-time data
  - Ability for the system to fall back to pre-determined time of day timing plan, as specified by the operator in the event of equipment, communications, and/or software failure
Test Segment

- Test Segment (STH 100)

Burleigh Street

6 Signalized Intersections

Mayfair Mall

Walnut Street
Cabinet
ASCT Goals

- Adaptation of the system to variable traffic patterns and conditions
- Travel time reduction with minimal stops on the mainline
- Reduced delay on side streets and left turns
Items being studied:
- Delay and number of stops on STH 100 and selected side streets
- Changes to fuel consumption and vehicle emissions
- Comparison of AM, Mid-Day, PM, and Saturday peak hours
- Travel time through the corridor
- Analysis of incidents on USH 45
Traffic Study

Travel Time (min)

Before InSync
After InSync
Free Flow @ 40 mph

Travel Time Runs
Bluetooth Travel Times

AM NB | AM SB | MID NB | MID SB | PM NB | PM SB | AM NB | AM SB | MID NB | MID SB | PM NB | PM SB | Sat. NB | Sat. SB
Traffic Study

(Significant travel time reduction in both directions for the PM Peak)
Traffic Study

- Average Number of Stops Comparison

![Number of Stops, Travel Time Runs](chart.png)
Traffic Study

Average Travel Time Run Profiles
STH 100 NB - PM Period

After InSync
Before InSync
Free Flow @ 40 mph
Traffic Study

- Approach Delay

Reduction in Delay

Note: Increases in delay are most likely due to construction on STH 100 from USH 18 to Watertown Plank Road.
# Traffic Study

## Cost to Benefit Analysis

<table>
<thead>
<tr>
<th>Savings Scenario</th>
<th>Cost to Deploy InSync</th>
<th>Annual Time &amp; Fuel Savings</th>
<th>Total 5 Year Savings</th>
<th>Total 20 Year Savings</th>
<th>5 Year Benefit to Cost Ratio</th>
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</thead>
<tbody>
<tr>
<td>Savings Applied to All Trips</td>
<td>$239,433</td>
<td>$1,347,215</td>
<td>$6,258,930</td>
<td>$21,001,953</td>
<td>26 to 1</td>
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<tr>
<td>Savings Applied to Half of Trips</td>
<td>$239,433</td>
<td>$673,607</td>
<td>$3,129,463</td>
<td>$10,500,969</td>
<td>13 to 1</td>
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<tr>
<td>Typical PM Peak Hour Savings</td>
<td>$239,433</td>
<td>$111,208</td>
<td>$516,653</td>
<td>$1,733,639</td>
<td>2 to 1</td>
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Values for Benefit Calculations:
- 33,500 total trips per day
- Average travel time savings: 28 seconds/trip
- Average fuel savings: 0.008 gallons/trip
- Average price of gallon of gasoline: $3.605
- Value to time for auto drivers: $10.34
- Value of time for commercial drivers: $22.78
- Real discount rate for economic analysis calculations: 2.50%
Traffic Study Conclusions

- Bi-directional decreases in travel time during the PM Period
- Decreased travel times in the SB direction during all three periods studied
- Decreased delay and number of stops on Wis 100 during travel time runs
- 12% improvement in fuel economy and corresponding improvements in calculated emissions
- Overall, there are mixed results on travel time and delay on side streets (based on small sampling size)
Zoo Interchange Design

**SCHEDULE**

- PS&E: June 11, 2013
- Let: July 23, 2013
- Begin Construction: July 23, 2013

Wsync: Learning segment began operations in early 2013

New signals installed in Fall 2013

Note: Installations in work zones are tentative and will be finalized with the staging schedule.
Zoo Interchange Design

- Retrofit Existing Traffic Signals with InSync Equipment
  - Replace out-dated equipment (pre-timed controllers)
  - Add push buttons for fully actuated control
  - Add additional camera poles, if needed
  - Add additional conduit, if needed
  - Add communication
Zoo Interchange Design

- Design Process
  - Topographic Survey
  - Field Visit & Existing Infrastructure Evaluation
    - Cabinet Type (TS1, TS2, 332)?
    - Controller Type?
    - Cabinet Equipment?
    - Cabinet Space?
    - Conduit Space?
    - Existing Detection?
Zoo Interchange Design

- Design Process (cont.)
  - Preliminary Design
    - Camera Locations
    - Utility Evaluation (if new underground infrastructure)
    - Camera Placement Evaluation
    - Communication Testing (if using radios)
  - Final Design
    - PS&E
Zoo Interchange Design

- Communication to Each Intersection
  - 1st Preference – Fiber
  - Alternate – 5.8 GHz Radio
Zoo Interchange Design

- Detailed Design
  - Ethernet cable length/repeaters
  - Rhythm recommended Ethernet cable temperature rating
  - Cabinet space
  - Installation season
Next steps (SE Region)

- **Integrated Corridors**
  - Integrating the operations of multi-jurisdictional arterial street systems
  - Integrating the freeway and arterial street systems
Next steps (statewide)

- Request for Proposal (RFP)
  - A request for proposal was sent out related to ASCT
  - Six ASCTs were selected to give regions a choice
    - Systems Engineering Analysis is used to determine which ASCT method to use

- Other Potential ASCT deployments in Wisconsin
  - Verona Rd. project in Madison
  - IH 39/90 corridor in Janesville
Any Questions?

- Justin Effinger, WisDOT
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  - Email: jmatson@hntb.com