INTERSECTION TRAFFIC CONTROL
COMMITTEE
Signals for Protected Bikeways
Meeting Minutes
September 7th, 2016

ATTENDEES

<table>
<thead>
<tr>
<th>Name</th>
<th>Agency</th>
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<tr>
<td>Nick Erpelding</td>
<td>SRF</td>
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<td>Luke James</td>
<td>SRF</td>
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<td>Tyler Krage</td>
<td>Alliant Engineering</td>
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<td>Jon Krieg</td>
<td>Hennepin County</td>
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<td>Jerry Kotzenmacher</td>
<td>MnDOT</td>
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<td>Phil Kulis</td>
<td>SRF</td>
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<td>Ken Levin</td>
<td>Hennepin County</td>
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<td>John Maczko</td>
<td>City of St. Paul</td>
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<td>Mike Martinez</td>
<td>HDR</td>
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<td>Nick Ollrich</td>
<td>Metro Transit</td>
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<td>Sonja Piper</td>
<td>MnDOT</td>
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<tr>
<td>Hannah Pritchard</td>
<td>Toole Design Group</td>
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<td>Jan Rybar</td>
<td>Dakota County</td>
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<td>Mark Wagner</td>
<td>SEH</td>
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MEETING LOCATION: HDR

I. Bicycle Signals and Protected Bikeways
Hannah Pritchard presented on protected bikeways and the current practice for signal and phasing options. The presentation drew guidance from MassDOT’s Separated Bike Lane Guide, and utilized case studies from Jackson Street in St. Paul, Washington Avenue in Minneapolis, and Los Angeles DOT. Key points were protected bikeway basics, signal phasing options, and case studies.

Protected Bikeway Basics-
- Mixing zone tends to be most dangerous part of protected bikeways.
- Utilization of protected intersections reduces mixing zone issues, as well as increased visibility.
- FHWA approval requires no conflicting turn movements, causing possible issues with through bike and vehicle right phasings.
Signal Phasing Options:

1) Concurrent bike phase with concurrent permissive vehicle turns
   - Requires Request to Experiment
   - Assumes similar scenario as existing bike operations

2) Concurrent bike phase with leading interval
   - Requires Request to Experiment with permissive turns
   - Allows for early bike clearance

3) Concurrent protected bike phase
   - No conflicting turns, meets interim approval
   - May cause delay to turning vehicles

4) Protected bike phase
   - No conflicting turns, meets interim approval
   - May cause delay and non-compliance for bicycles

Case Studies:

1) Jackson Street in St. Paul
   - 2-way protected bike lane
   - No turns for vehicles
   - Flashing Yellow Arrow for right turning motorists and Flashing Yellow bike signal

2) Washington Avenue in Minneapolis
   - Cycle track on each side of street
   - Permissive vehicle turning (green ball), bike has flashing signal

3) Los Angeles DOT
   - Dedicated turn lanes per intersection
   - Bikes only received 7 seconds per cycle
   - DOT was cautious due to possible litigious outcomes

Discussion:

-A large discussion on pairing bike phases with pedestrian walks, lead interval time standards, phasing configurations, and operator behavior took place.

II. Round Robin

Jon- MnDOT has made selection on ATMS, awaiting other agencies to test outside system capabilities (Dakota County, Bloomington)
Jerry- MnDOT Pedestrian Station plate has been updated
    -Cabinet painting policy has also been updated
    -New Northfield bike detection working fine currently
Ken- ASC3 controllers to be discontinued for replacement by Cobalt
Nick E.- Question on a St. Cloud leading protected/permisive signal with 4 section head. As per 2009 MUTCD, signal type was prohibited, Nick was curious on when law was changed.
John- City of St. Paul has been going through issues with audible pedestrian signals either functioning too quiet or far too loud. Investigation yields a large amount of possible errors with ambient volume and positioning depending on sensor type.

NEXT MEETING:

   Date:       Wednesday, October 5th (8:00-10:00am)

   Location:   MnDOT Water’s Edge – Conference Room A
              1300 County Road B2 West
              Roseville, MN 55113

   Topics:     TBD

Minutes Submitted By: Tyler Krage
Bicycle Signals

NCITE

September 7th, 2016

Hannah Pritchard, PE PTOE
Toole Design Group
hpritchard@tooledesign.com
MassDOT Separated Bike Lane Guide

• Released 11/4/2015
• First state DOT guidance on separated bike lanes
• First protected intersection guidance in the US

Download: goo.gl/stmXQG
Hardcover: goo.gl/wZsNgJ
Chapters

1. Overview
2. Planning
3. General design
4. Intersection design
5. Curbside activity design
6. Signals
7. Maintenance
Separated Bike Lane Zones

- sidewalk
- sidewalk buffer
- bike lane
- street buffer
- street
Chapter 4

Intersections
Intersection Design Principles

- Minimize exposure to conflicts
- Reduce speeds at conflict points
- Communicate right-of-way priority
- Provide adequate sight distance

maximize safety and comfort
Minimize Exposure

bicycle exposure at intersections

high ➔ low

conventional bike lanes and shared lanes

separated bike lanes with mixing zones

separated bike lanes through roundabouts

protected intersections

bicycle ➔ motor vehicle ➔ conflict area
Mixing Zones

- Physical separation removed where it’s most needed
- Only as interim solutions or in severely constrained conditions
Mixing Zones

- Locate merge point close to intersection
- Provide deceleration lane where >35 mph

merge area

50’ – 100’
Protected Intersections
“Protected intersections maintain the physical separation through the intersection, thereby eliminating the merging and weaving movements inherent in conventional bike lane and shared lane designs.”
 Protected Intersections

1. Corner refuge island
2. Forward bicycle queuing area
3. Motorist yield zone
4. Pedestrian crossing island
5. Pedestrian crossing of separated bike lane
6. Pedestrian curb ramp
Visibility at Conflict Points

motorist's view at conventional bike lane

motorist's view at separated bike lane
Visibility at Conflict Points

protected intersection

conventional bike lane
Protected Intersections in the US

Salt Lake City, UT

Chicago, IL

Austin, TX

Davis, CA

photo source: WBUR

photo source: Streetsblog

photo source: Google

photo source: People for Bikes
Chapter 6
Signals
**Bike signal head warrant:**
- Leading or protected phasing
- Contra-flow movements
- Signal heads beyond cone of vision

**Bike signal head application:**
- Can only be used *without* conflicting vehicle turns
Signal Head Positioning

1. Bike signal (near side)
2. Bike signal (far side)
3. Pedestrian signal
4. Vehicle signal
Signal Positioning

one-way SBL

bike signal
pedestrian signal
motor vehicle signal

two-way SBL
Bicycle Detection

- Actuated signals
- Bicycle minimum green
- Protected bicycle phases

100’ for advanced detection
Phasing Options
Signal Phasing Overview

1. **Concurrent bike phase** with concurrent permissive vehicle turns
2. **Concurrent bike phase** with leading interval
3. Concurrent protected bike phase
4. Protected bike phase

1
2
3
4

none

*time separation from motor vehicles*

full
Concurrent bike phase with concurrent permissive vehicle turns

- None
- Time separation from motor vehicles
- Full
Concurrent Bike Phase
with Concurrent Permissive Vehicle Turns

showing phase 1

- green interval
- yellow change interval
- red clearance interval
Concurrent Bike Phase with Concurrent Permissive Vehicle Turns

showing phase 2
Concurrent Bike Phase with Concurrent Permissive Vehicle Turns

- Request to experiment required for use of bike signal with permissive turns
- Basically the same as existing bike lane operations – bike signal not required
- Assuming one-way bikeway without cone of vision issues
Signal Phasing Overview

1. Concurrent bike phase with concurrent permissive vehicle turns
2. Concurrent bike phase with leading interval
Concurrent Bike Phase with Leading Interval

showing phase 1
Concurrent Bike Phase with Leading Interval

showing phase 2

1 ➝ 2

- green interval
- yellow change interval
- red clearance interval
- red interval
Concurrent Bike Phase with Leading Interval

showing phase 3
Concurrent Bike Phase with Leading Interval

showing phase

1→2→3→4

- green interval
- yellow change interval
- red clearance interval
- red interval
Concurrent Bike Phase with Leading Interval

- Bike signal required for leading interval
- Request to experiment required for use of bike signal with permissive turns
<table>
<thead>
<tr>
<th>Separated Bike Lane Operation</th>
<th>Motor Vehicles per Hour Turning across Separated Bike Lane</th>
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<tr>
<td></td>
<td>Two-way Street</td>
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<tr>
<td></td>
<td>Right Turn</td>
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<tr>
<td>One-way</td>
<td>150</td>
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<tr>
<td>Two-way</td>
<td>100</td>
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Signal Phasing Overview

1. Concurrent bike phase with concurrent permissive vehicle turns
2. Concurrent bike phase with leading interval
3. Concurrent protected bike phase

1  none
2  time separation from motor vehicles
3  full
Concurrent Protected Bike Phase

Showing phase 1
Concurrent Protected Bike Phase

showing phase 3

1 2 3

green interval
yellow change interval
red clearance interval
red interval
Concurrent Protected Bike Phase

showing phase 4
Concurrent Protected Bike Phase

- No conflicting turns, meets interim approval guidance
- May result in delay for turning vehicles
Signal Phasing Overview

1. Concurrent bike phase with concurrent permissive vehicle turns
2. Concurrent bike phase with leading interval
3. Concurrent protected bike phase
4. Protected bike phase

1 2 3 4

none time separation from motor vehicles full
Protected Bike Phase

showing phase 1

1

green interval
yellow change interval
red clearance interval
red interval
Protected Bike Phase

showing phase 2

1 → 2

- green interval
- yellow change interval
- red clearance interval
- red interval
Protected Bike Phase

Showing phase 3
Protected Bike Phase

showing phase 4

1 → 2 → 3 → 4

- green interval
- yellow change interval
- red clearance interval
- red interval
Concurrent Protected Bike Phase

- No conflicting turns, meets interim approval guidance
- May result in delay for bicyclists
Implementation Case Studies
Case Study: Jackson Street
Case Study: Jackson Street

Shared Through/Right
- Green ball for thru
- FYA for right

Right Turn Lane
Who has Right of Way?
Case Study: Washington Ave

Permissive turn across bikeway

- Green ball implies vehicles yield to peds
- Flashing yellow bike implies bikes yield to vehicles

Who has Right of Way?
Case Study: LA DOT

- Dedicated turn lanes at every intersection
- No RTOR (may or may not be dynamic)
Case Study: LA DOT

- One-way bikeway on Main Street
- Following the interim approval to the letter
- Bicycle phase – 7 seconds out of 90 second cycle
- Adjacent pedestrian phase: walk/FDW during red bicycle phase
Current State of Bike Signal Approval

• Need to have opportunity to separate phases without
  • punishing bicyclists
  • causing confusion about right of way

• Long delays for bicyclists (or right turns) may lead to low compliance
Proposed Usage

- FYA: means turns are permitted, but you must first yield to oncoming traffic and pedestrians and then proceed with caution.
- Confirms bicyclist right of way
- Consistent with pedestrian right of way
Discussion