Overview

• Why did we do this?
• How did we approach it?
• What treatments did we review and what did we find?
  • In summary, how do the treatments compare to each other?
• What are the main takeaways and next steps?

Fehr & Peers, 2017
WHY.
A Potential Hierarchy for Design

1. Mainstream traffic control guidance
   - MUTCD
   - Locally-relevant standards (HCM, in some cases NACTO, etc.)

2. Mainstream, traditional geometric guidance
   - AASHTO Green Book
   - AASHTO Bike Guide

3. Mainstream, innovative guidance
   - ITE Recommended Practices
   - NACTO Urban Bikeway Design Guide
   - NACTO Urban Street Design Guide
   - CROW Design Manual for Bicycle Traffic
   - FHWA Separated Bike Lane Planning & Design Guide

4. Other less-mainstream guidance:
   - ITE Informational Reports
   - Kalamazoo, Michigan bikeway design guidelines (an appendix to the Kalamazoo Bicycle Master Plan)
HOW.
# Levels of Confidence

<table>
<thead>
<tr>
<th></th>
<th>Robust research</th>
<th>Gaps in the research</th>
<th>Inclusive or incomplete research</th>
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<tbody>
<tr>
<td><strong>HIGH</strong></td>
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<td><strong>MEDIUM</strong></td>
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<td><strong>LOW</strong></td>
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<td>Consistently positive results</td>
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<td>Mixed results with a limited number of studies</td>
<td>Mixed results with limited to zero studies</td>
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WHAT.

- Bend-In Crossing
- Bend-Out Crossing
- Bike Boulevards
- Bike Box
- Buffered Bike Lane
- Coordinator
- Combined Bike Lanes
- Conventional Bike Lane
- Green Pavement
- Two-way Protected Bikeway
## RESULTS SUMMARY

<table>
<thead>
<tr>
<th>Documented Safety Efficacy Confidence</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
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<tbody>
<tr>
<td>Devices</td>
<td>Bicycle Boulevards</td>
<td>Bend-Out Crossing</td>
<td>Bend-in Crossing</td>
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<td>Green Pavement</td>
<td>Bike Boxes</td>
<td>Combined Bike Lane/Turn Lane</td>
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<td>Raised Bicycle Crossing</td>
<td>Buffered Bike Lanes</td>
<td>Intersection Crossing Markings (Non-green)</td>
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<td>Separated Bike Phasing (Traffic Signals)</td>
<td>Contraflow Bike Lanes</td>
<td>Through Bike Lane</td>
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<td>Conventional Bike Lanes</td>
<td>Two-stage Left Turn Box</td>
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<td>Coordinated Signal Timing</td>
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<td>Mixing Zone</td>
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<td>One-way Protected Bikeway</td>
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<td>Two-way Protected Bikeway</td>
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BIKE BOXES

MUTCD Status: Allowable through interim approval (IA-18[^1])

Claims
- Helps prevent “right-hook” conflicts with turning vehicles at the start of green
- Reduces vehicle encroachment into crosswalk
- Improves visibility of bicyclists
- Facilitates left turn positioning for bicyclists during red signal (applicable only for bike boxes that extend across a lane from which left-turns are allowed)
- Provides priority for bicyclists at signalized bicycle boulevard crossings of major streets

Documented Crash Reduction
None found. Refer to “Areas of Caution” for documented crash increases.

Areas of Caution
Increase in motorist encroachment into bike box after installation compared to encroachment into crosswalk before installation (26.8% compared to 32.6%)[^2]

Study Details
Sample Size: Small
Notes on Quality/Consistency of Results: None

Conclusion
Recommend with caution especially at signalized intersections with high instances of conflicts during “stale” green. While bike boxes can help with crosswalk encroachment, research shows that they do not eliminate encroachment into the bike box itself.

Recommended for:
- Situations where the majority of right turn conflicts are at the start of green (such as side-street approaches where most bicyclists will arrive on red)
- Locations with high levels of crosswalk encroachment
- Locations where bike lane on intersection approach transitions to shared lane on receiving leg of intersection

Not Yet Recommended for:
- Locations with high instances of conflicts during “stale” green
- Facilitating bicyclist left turns
- Locations with heavy “right turn on red” movements

[^1]: Study described right turn volume as “heavy” although no value was given. The approach volume was 450 vph in the AM and 350 vph in the PM.
[^2]: Small = 1-2 cities, Medium = 3-5 cities, Large = >5 cities
CALL TO ACTION.

Standardized data

Send us your studies!
Kendra Rowley, PE

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Fehr & Peers