2014 Cameron Rian Hays Outside the Box Competition

Annotated Transcript to

Protected Intersections for Bicyclists

Available at www.protectedintersection.com or
www.vimeo.com/nickfalbo/protectedintersection

Nick Falbo
Planner
Alta Planning + Design
711 SE Grand Ave
Portland, OR 97214
(503) 230-3269

Introduction

Urban planners and designers have finally figured it out: If your city is designed so that you can bike instead of drive, it will be a happier, healthier place to live.

We know that protected bike lanes are the key to getting the average person to consider traveling by bike. Sharing busy traffic lanes with cars is absolutely unacceptable[1], and separation by a line of paint is often not enough. Protected Bike Lanes, also called cycle tracks, use curbs, planters, or parking to buffer bicyclists from moving cars.[2]

But there is still a problem; The protected bike lanes lose their benefits when they reach intersections. The buffer falls away, and you're faced with an ambiguous collection of green paint, dashed lines and bicycle symbols[3]. One popular configuration is called "a mixing zone" where cars and bikes share the lane.[4]

It doesn't matter how safe and protected your bike lane is if intersections are risky, stressful experiences.[5]

We need to make intersections just as safe and secure as the lanes that lead into them. What the Protected Bike Lane needs, is the Protected Intersection.

Modeled after Dutch intersection design[6], the Protected Intersection brings the physical protection along with you as your ride through the crossing.

A collection of design elements makes left turns simple and secure, right turns protected and fast, and provides straight through movements that minimize or eliminate conflicts from turning cars. With this design, riders will never feel stranded, exposed, or unsure of where to go and how to get there.

---

[1] Emphasis on “busy.” Sharing traffic lanes is perfectly fine if motor vehicle volumes and speeds are low.

[2] ITE. Separated Bikeways. 2013. and NACTO. Urban Bikeway Design Guide. 2012.

[3] The NACTO Urban Bikeway Design Guide offers 4 alternative markings schemes for bike lanes at intersections, and illustrates 5 options for cycle track intersection approaches, with limited guidance on when one treatment should be used over another.

[4] See NACTO Urban Bikeway Design Guide entry on *Combined Bike Lane/Turn Lane*.

[5] Street level of service concepts evaluate links (streets) separately from intersections. In the Level of Traffic Stress framework conceptualized by Professor Peter Furth to evaluate bicycling conditions, a facility should be graded on the score of it’s “weakest link.” See the Mineta Institute’s *Low Stress Bicycling and Network Connectivity* for more information.

[6] While this design is most associated with those in the Netherlands, the same designs also exist in Belgium, Germany, and Poland. A design in Tokyo uses a similar corner-protection concept for their sidewalk bikeways.

There are four main elements to protected intersection designs:

- A Corner Refuge Island
- A Forward Stop Bar for Bicyclists
- A Setback bike and pedestrian crossing
- And Bicycle Friendly Signal phasing

The Corner Refuge Island

The corner refuge island is the key element that makes these intersections function. This island brings the protective barrier from the bike lane far into the intersection. Think of it like a curb extension for bicyclists.

The island physically separates bicyclists as they make right turns, and provide a secure refuge for those waiting at a red signal protected from moving cars.

The Forward Stop Bar

Paired with the corner refuge island is a forward stop bar for bicyclists[7]. While people driving must stop back behind the crosswalk, people on bikes may yield to pedestrians, and stop at a bicycle waiting area farther ahead in the intersection. Bicyclists turning left also use this space to wait when making a left turn.

The advantage of this design is three fold: The forward stop location makes bicyclists incredibly visible to drivers waiting at a red light; the physical distance ahead of cars gives bicyclist an effective head start when the light turns green[8]; and the distance of the road that bicyclists need to cross is greatly reduced.

The Setback Crossing

In Protected Intersections, the bike lane bends away from the intersection creating in a setback bicycle and pedestrian crossing.

In contrast to conventional bicycle crossing that run next to moving cars, the setback crossings provide the space and time for everyone to react to potential conflicts.

---

[7] The forward stop bar is presented in the NACTO Urban Bikeway Design Guide as a concept to assist in bicycle boulevard crossings. They are in use in Seattle WA and Portland, OR

[8] Depending on configuration, the bicyclist stop bar may be 30-40 feet ahead of the motor vehicle stop bar. A Bike Box provides an advance stop bar for motor vehicles, creating a much smaller separation of 14 feet.

The critical dimension is one car-length of space between the traffic lane and the bicycle crossing, around 6 meters[9]. This space is often already present in the parking and buffer space of the protected bike lane.

With this design, drivers turn 90 degrees to face the bike lane before they even cross it, making people on bikes highly visible and out of the driver's blind spot.

To allow for adequate reaction time for all users, use a small effective corner radius to encourage a slow driver turning speed of 5-10 mph.[10]

Bicycle-Friendly Signal Phasing

The last, element of a protected intersection is the use of bicycle specific signals and bicycle-friendly signal phasing[11]. Just as important the physical design of intersections is the use of signals to control how and when different people can proceed.

At its most secure, a protected signal phase for bicyclists will use red signals to prevent any conflicting car turning movements[12]. There is no risk of right or left hooks from cars when they are prohibited from turning while bicyclists are traveling through.

A variation of the protected signal phase is to give all car movements the red signal, and all bicyclist movements a green. This simultaneous green phase13 gives full rein of the intersection to bicyclists, allowing through movements in all directions at once, left turns in one stage and even full U-turns through the intersection. Even at high-volumes, bicyclists are good at negotiating shared space and will have no trouble staying out of each others way.[14]

---

[9] Dutch CROW guidance's suggests 4-7 meters of separation, depending on context. While different than the design presented here, a setback crossing is a key element to modern roundabout design. The FHWA 2010 report *Roundabouts: An informational Guide* offers a similar "one vehicle length" suggestion to provide space for yielding cars in order to "separate vehicle-vehicle and vehicle-pedestrian conflict points". The guide calls for a separation of 6 meters.

[10] The NACTO Urban Streets Design guide recommends allowing large vehicles to use the whole intersection while turning, using a recessed stop bar to prevent conflict with opposing traffic. This allows the design to promote a slow typical turning speed while still permitting larger vehicle use.

[11] Bicycle Signals were recently given Interim Approval status by the FHWA, although with significant limitations.

[12] The is illustrated as a Protected and Concurrent signal, allowing non-conflicting car traffic to travel in the same signal phase, maintaining signal efficiency. This configuration is evaluated in the paper *Mitigating the Right Turn Conflict Using Protected-Yet-Concurrent Phasing for Cycle Track and Pedestrian Crossings* by Furth, P., Koonce, P., Miao, Y., Peng, F., Littman, M. submitted to the TRB 2014 annual meeting.

[13] The simultaneous green phase as described here is explicitly prohibited by the FHWA Interim Approval on bicycle signal heads. Jurisdictions seeking to use this technique must go through the experimentation process described in section 1A.10 of the MUTCD. The simultaneous green treatment is described in CROW manual.

[14] Watch busy simultaneous green intersection in action here: whttp://www.youtube.com/watch?v=nkyuC7-CaIs

When it is not possible to prohibit conflicting movements entirely, an alternate approach is to provide a leading bicycle interval[15]. This is a head-start green light for bikes of anywhere from 2 to 5 seconds. It provides them a little extra time to get rolling, enter the intersection, and maybe even clear it completely before people driving start to move.

Conclusion

Taken together, these design elements create a safe, clear experience for all people using the street. Signals control movements, refuge islands create protected spaces, and proper positioning of crossings and conflict points provides everyone with the time and space necessary to react to potential risks.

While the protected intersection design is unconventional and nonstandard the US, so were protected bike lanes only a few years ago. Using these design concepts, planners, designers and engineers can bring the protection of their bike lanes into the space where people need it the most, and finally provide a safe place for people of all ages and abilities to ride.

[15] The Leading Bicycle Interval as described here is explicitly prohibited by the FHWA Interim Approval on bicycle signal heads. However, the International Technology Scanning Program, sponsored by the FHWA released the International Scan Summary Report on Pedestrian and Bicycle Safety and Mobility in 2009 identifies the "..leading green phase for bicyclists..." as one of "several approaches and design practices that could be used to improve bicyclist safety in the U.S." As early as 2006, the FHWA recognized the potential benefits of leading bicycle intervals in their University Course on Bicycle and Pedestrian Transportation.