CITY OF PRINCETON
BICYCLE ROUTE STUDY

Version for City Council
November 26, 2018

City of Princeton
2 Main Street S.
Princeton, IL 61356

Prepared By: Ride Illinois

Introduction/Executive Summary

Biking is a popular activity, a moderate form of exercise within the physical capabilities of most people. However, it need not be limited to weekend outings on designated trails or quiet rural roads. Although cycling is often thought of as just for recreation and exercise, nearly half (43%) of all bike trips are destination-based[1]—and many more would be if better facilities existed.

Biking can be a great form of transportation, especially for short, local trips. National data indicate that 27% of all car trips are one mile or shorter; 40% are less than two miles. When cycling conditions are improved, people are more willing to use bikes instead of cars for these short trips—which benefits their health, pocketbooks and surrounding air quality.

Besides those who bicycle by choice, there are many Princeton residents – including children, many teenagers, and some low-income workers – who depend on cycling as a transportation necessity. Whether for choice or necessity, transportation by bicycle is made safer and more inviting when a city designates a network of connected on-road and off-road bikeway segments throughout town.

In 2016, The City of Princeton completed a City Visioning exercise which resulted in developing a set of goals to enhance the city's future growth and development. Members of the Visioning Steering Committee toured model communities to identify best practices. In addition members consulted with Ride Illinois for an initial review of bike needs for the City of Princeton. Included in the vision goals was the development of better access to bikeways and pathways for bike and pedestrian mobility to support the health and wellness, transportation, and recreation needs of the community. A subcommittee of the Visioning exercise members began to set goals and priorities for bike and pedestrian development.

In August 2017, the mayor appointed a Bike-Pedestrian Commission, with a mission to identify and pursue improvements that will make biking accessible and safe for all citizens in Pedestrian. At their inaugural meeting the commission brainstormed ideas for projects which included but were not limited to: creating local bike and pedestrian route maps, creating a safe routes master plan, creating a Bike the Barn Quilt Route Map, creating a bike map of historically significant cemeteries in Bureau County, creation and promotion of bicycle education and safety programs for all ages, and studying the potential of a bike sharing program located at the Depot Campus. Stressed for each of these ideas was the economic benefit to Princeton and surrounding communities.

The Commission's first step was educational, investigating into what other communities in the area had done or were doing. With this knowledge, the Task Force decided to develop a Bike Plan for the city and to improve bike parking at key locations in the community.

The first step in developing a bike plan was to perform a bike study to assess roads for development, identification, and promotion of safe routes to strategic locations in the community

[1] 2001 National Household Travel Survey

including Zearing Park, Soldiers & Sailors Park, the Amtrak Depot, City County Park, local schools and the Metro Center.

Bicycle Route Study Summary

The primary target audience for the additions is the "casual adult" bicyclist, although the needs of advanced cyclists and children are both addressed. A thorough analysis was used to determine which option – if any – is appropriate for each of the "routes to study" suggested by the Princeton Bike-Pedestrian Commission. Criteria include need, cost, technical factors, and strategies to gain public support while avoiding common bike plan pitfalls.

The main section of the study provides an overall map and details the specific recommendations for a proposed bikeway network. Fallback options and other opportunities are presented for some network segments, in case the primary recommendations cannot be met. The recommendations use the "toolbox" of on- and off-road bikeway types described in Appendix 1.

Appendix 2 suggests specific road design standards for bicycle and pedestrian accommodation, as part of a "complete streets" ordinance recommendation for use when roads are reconstructed or new roads built. References are given for bike-friendly development ordinances.

Appendix 3 identifies easy-to-use (and often free) resources and strategies to leverage infrastructure investment with bicyclist education, motorist education, and enforcement efforts.

Appendix 4 lists Bike-Pedestrian Commission members and supporting staff.

Bicycle Network Recommendations

The Princeton Bicycle Route Study provides technical recommendations for a priority network of designated bicycle routes, meant to facilitate bike travel to all sections of the City and beyond. The "routes to study" were selected by the city's Bike-Pedestrian Commission and supplemented by the consultant. Based on this study's findings, many but not all of the routes may be selected by the City and task force to be part of the network. For each segment chosen and implemented, designation should be indicated with bicycle network wayfinding signage, as described in Appendix 1.

A major caveat for almost all of these recommendations is that both the primary and secondary/other option recommendations assume the existing roadway pavement width. Future reconstruction or expansion projects are opportunities to consider better bike accommodations, especially in those places where the bikeway network's comfort level target could not previously be met. Appendix 2's recommended roadway design standards could be used when widening is possible.

East-West Routes

Two priority east-west routes were studied, Clark Street and Central Avenue. These are described below, in north-to-south order. Segmentation corresponds to significant changes in a road's characteristics.

Clark Street, Epperson to Plum

2 lanes, 9.6-ft and striped wide W of Linn, 11.3-ft unstriped E of Linn.
30 mph, 250 Average Daily Traffic, no parking occupancy

This segment of Clark is a low-volume route west out of town. It has a significant hill on its west end, as well as ditches and grading making widening for shoulders difficult.

Recommendation – medium priority: Add a single, westbound "State Law – 3 Feet Min To Pass Bicycles" sign west of Plum, in addition to Bike Route wayfinding signs.

Backup options: 1) Add Shared Lane Markings on both sides, centered 4-ft from the pavement edges – but this is perhaps more than what's needed. 2) Use Bike Route wayfinding signage instead of the 3-Feet Law sign.

Clark Street, Plum to Euclid

2 lanes, 16.5-ft with 1.3-ft gutters, no striping.
30 mph, 950 Average Daily Traffic, estimated 10% parking occupancy

The segment has a bus parking bay and higher parking near Princeton Elementary School, although a November 2018 referendum may result in the school's closing in the future. Flashing yellow beacons – timed to activate during travel times before and after school – is at the otherwise uncontrolled Main Street crossing, which can take a long time to cross.

Recommendation #1 – medium priority: Install Combined Bike/Parking Lanes. Add striping 7.5-ft from each curb face, leaving 20.6-ft unstriped between. In addition, Shared Lane Markings centered 11-ft from the curb could be placed if on-road parking near the school is often high (over 30% full) most of the time during school hours.

Backup option: If CBPL striping is not accepted, a lesser backup is to only install Bike Route wayfinding signs, without stripes.

Recommendation #2 – high priority: To improve the Main Street crossing for both bicyclists and pedestrians, consider replacing the flashing beacons with manually-activated Rapid Rectangular Flashing Beacons (see Appendix 1 for more on RRFB installations and other uncontrolled crossing treatments). Each side of Main should have activation buttons accessible for both pedestrians crossing the north crosswalk and for cyclists biking on Clark.

Particularly if Main south of Clark is not ultimately converted to two lanes + center turn lane, curb extensions (aka "bulbouts") could be added to the two north corners of the intersection and ideally the south corners, as well. If these are added, buffering south of Clark to narrow the northbound lane would be needed – unless bike lanes are added from Clark to the south.

Central Avenue, Fairground to Pleasant

2 lanes, 14.5-ft with 1.5-ft gutters, no striping – except eastbound parking stalls by Logan Junior High School.
30 mph, 750-950 Average Daily Traffic, estimated 5% parking occupancy except higher by Logan.

Recommendation – high priority: Install Bike Route wayfinding signs, alone. Also, Shared Lane Markings centered 11-ft from the curb could be added by Logan – especially by the eastbound parking stalls – if on-road parking near the school is often high (over 30% full) most of the time during school hours. (If the November 2018 school referendum passes and results in this school's closing, Shared Lane Markings there would not be needed.) Options for Central are limited, as the street is too narrow for Combined Bike/Parking Lane striping and nonzero parking occupancy precludes placing Shared Lane Markings 4-ft from the curbs.

Central Avenue, Pleasant to Main

2 lanes, 22.1-ft with gutters paved over, no striping west, striping near Main.
30 mph, 1450 Average Daily Traffic, estimated 10% parking occupancy limited to 15 minutes.

Both the church and City Hall have off-street parking. There is a demand-actuated stoplight at Main.

Recommendation #1 – high priority: Install Combined Bike/Parking Lanes. Add striping 8-ft from each curb face, with center striping for two 14.1-ft travel lanes. Discontinue eastbound striping and parking 75-ft before Main. Unless on-street parking is heavy (>30%) often, Shared Lane Markings 11-ft from the curbs should not be needed.

Backup option: If CBPL striping is not accepted, a lesser backup is to only install Bike Route wayfinding signs, without stripes.

Recommendation #2 – highest priority: Ensure on-road bicycle demand actuation of the Main Street stoplight. By placing a bike on the detector's longitudinal edge, right before the stop line, test whether a bike can trigger a green. If not, determine whether the detector's amplifier can be tuned higher without causing false crosstalk triggers. If a bike can trigger a green as-is, add the MUTCD-approved Bicycle Detector Pavement Marking and accompanying R10-22 signs. Place the marking on a trigger point either near the center of the 22-ft eastbound lane, or in the left part of a new, 11 or 12-ft right-turn lane.

Backup option: Add a new activation button pole near the curb and at the stopline, so that on-road cyclists can call a green – without having to leave and return to the street to access the ped button.

Central Avenue, Main to Vernon

2 lanes, 14.7-ft with gutters paved over, no striping.
30 mph, 1450 Average Daily Traffic, estimated 5% parking occupancy.

Recommendation #1 – high priority: Install Bike Route wayfinding signs, due to other options being limited. As an extra, add one eastbound "State Law – 3 Feet Min To Pass Bicycles" sign.

Recommendation #2 – highest priority: Ensure on-road bicycle demand actuation of the Main Street stoplight, by repeating the recommendation (and backup option) for the west side of Main. The Bicycle Detector Pavement Marking should be placed along the right edge of the detector.

Central Avenue, Vernon to Fifth

2 lanes, 16.8-ft with 1.2-ft gutters, no striping – except eastbound 7.8-ft striped parking stalls by high school (Euclid-Homer).
30 mph, 1450-1000 Average Daily Traffic, estimated 10% parking occupancy away from school and full for school days and events.

Recommendation – high priority: Install Combined Bike/Parking Lanes. Add striping 7.5-ft from each curb face, leaving 21-ft unstriped between. In addition, Shared Lane Markings centered 11-ft from the curb could be placed adjacent to the parking stalls – and wherever on-

road parking near the school is high (over 30% full) most of the time during school hours and events.

Backup option: If CBPL striping is not accepted, a lesser backup is to only install Bike Route wayfinding signs, without stripes.

North-South Routes

Finding one or more good north-south routes was the primary focus of the task force, due to difficulty travelling by bike in that direction. Gosse, Pleasant, Main, Vernon/Church, Euclid, and Fifth were all studied. Results are described below, in west-to-east order.

Gosse Street, Central to Crown

2 lanes, 12-ft with no gutters or striping.
30 mph, 600 Average Daily Traffic, no observed parking occupancy.

Some cars park in front yards, usually in gravel parking bays.

Recommendation – medium priority: Install Shared Lane Markings centered 4-ft from the curb, if parking is not allowed on the asphalt. If it is allowed, add Bike Route wayfinding signs, alone.

Backup option: If parking is not allowed and Shared Lane Markings are not accepted, add Bike Route wayfinding signs, alone.

Gosse Street, Crown to Park

2 lanes, divided as a boulevard, each side 20-ft with no gutters or striping.
30 mph, 1250 (north of Peru) and 450 (south of Peru) Average Daily Traffic, estimated 5% parking occupancy.

Except for turn-on flashing warning beacons, the crossing at Peru is uncontrolled. Mostly residential except near Peru, where businesses have off-street parking.

Recommendation #1 – medium priority: Install Combined Bike/Parking Lanes. Add striping 7.5-ft from the outside edges of the pavement, leaving 12.5-ft lanes. Extra: add a second stripe and Bike Lane pavement markings on each side near the businesses by Peru where there will be no on-street parking. Place the second stripe 5-ft from the outside edges of the pavement, resulting in Buffered Bike Lanes of 5-ft width and 2.5-ft buffers. Differentiate with signage that parking is not allowed for the Buffered Bike Lane segments.

Backup option: If CBPL striping is not accepted, a lesser backup is to only install Bike Route wayfinding signs, without stripes.

Recommendation #2 – highest priority: To improve the Peru Street crossing, consider replacing the flashing beacons with manually-activated Rapid Rectangular Flashing Beacons (see Appendix 1 for more on RRFB installations and other uncontrolled crossing treatments). Each side of Peru should have activation buttons accessible for both pedestrians crossing the east crosswalk and for cyclists biking on Gosse.

First Street, Long to Boyd

2 lanes, 15-ft with 1-ft gutters.
30 mph, 1150 Average Daily Traffic – Clark to Peru, 10% parking.
4-way stops at Marquette, Clark, Warren, Central; 2-way stops at Peru, Park.

Recommendation – medium priority: Install Bike Route wayfinding signs, alone. Options for First are limited, as the street is too narrow for Combined Bike/Parking Lane striping and nonzero parking occupancy precludes placing Shared Lane Markings 4-ft from the curbs. For the uncontrolled crossing of Peru Street, add warning signage in both direction of Peru:

1) W11-1 Bicycle Warning sign with W16-9P "Ahead" plaque in advance of First, and
2) W11-1 Bicycle Warning sign with W16-7 down arrow immediately before First.

Also, where feasible, replace the 4-way stops with 2-way stops for the cross-streets, not First.

Main Street, City County Park to Progress [IDOT jurisdiction]

2 lanes, 12-ft with striping and no gutters, 2-3-ft paved shoulders north and 3.9-ft south.
55 mph, 3250 Average Daily Traffic north and 3800 south, high truck traffic, no parking.

Recommendation – high priority: Extend east-side sidepath from Progress north to City County Park.

Backup option: As a much lesser backup, widen the paved shoulders to 6-ft.

Main Street, Progress to Ace [IDOT jurisdiction]

North: 4 lanes, 12-ft, 45 mph, 8000 Average Daily Traffic, high truck traffic, no parking.
South: 2 lanes, 12-ft, 6.5-ft paved shoulders, continuous two-way left-turn lane plus turn lanes at intersections, 40 mph, 9750 Average Daily Traffic, no parking.

An 8-ft sidepath already exists on east side. No new recommendation.

Main Street, Ace to Backbone [IDOT jurisdiction]

2 lanes, 12-ft with striping, no gutters, and 4.3-ft paved shoulders (plus aggregate shoulder width) except northbound right-turn lane.
40 mph, 9750 Average Daily Traffic, no parking.

There are no off-road facilities on this stretch, creating a gap between sidepaths north and south.

Recommendation – highest priority: Add a sidepath on whichever side is more feasible. Include ped-activation signals and crosswalks at whichever intersection (Ace or Backbone) the crossing occurs between east-side sidepath to the north and west-side sidepath to the south. Ideally, construct right corner islands – compatible with truck-turning movements – where the sidepath crosses both streets. Among other design and safety benefits, this would isolate sidepath users' conflicts with turning motorists and allow crosswalks and stoplines to be much more realistically placed closer to Main Street.

Backup option: As a much lesser backup, widen the paved shoulders to 6-ft. This would require additional road width by the northbound right-turn lane at Ace.

Main Street, Backbone to railroad [IDOT jurisdiction]

2 through lanes, 12-ft with striping and 2-ft gutters. 14-ft continuous two-way left-turn lane.
40 mph north of Orchard and 30 mph south, 9650 Average Daily Traffic, no parking.

An 8-ft sidepath already exists on the west side.

Recommendation – high priority: Visual delineation is needed for sidepath crossings at the many commercial entrances. Add (and maintain) continental-style crosswalks at each of these entrances, and upgrade road crosswalks to continental-style. Ensure that future construction routinely provides visual delineation at commercial entrance crossings, either through crosswalks or different-colored concrete.

Main Street, railroad to Clark [IDOT jurisdiction]

2 lanes, 16-ft with center striping. Striped parallel parking areas by shops 9-ft with gutters paved over. 50-ft total width by Clark. North of Clark, travel lane and total width increases to 55-56-ft, total.
30 mph, 10400 Average Daily Traffic, estimated 70% peak occupancy in parking areas.

Sidewalks are on each side, but directly adjacent to shop entrances.

Recommendation – high priority: Restripe each side for Buffered Bike Lanes. If parking turnover is significant, configure each side for 8-ft parking (including gutter), 2-ft buffer, 4-ft Bike Lane, 11-ft travel lane, by Clark. Further north, the travel lane width can increase. If parking turnover is light, then 8-ft parking, 4.5-ft Bike Lane, 1.5-ft buffer, 11-ft travel lane – with the buffer and travel lane width increasing further north. Also, extend the parking T's into the bike lanes to encourage riding further from the opening doors on parked cars.

Backup options: If 11-ft travel lanes are not accepted, then restripe for traditional Bike Lanes: 8-ft parking, 5-ft Bike Lane, 12-ft travel lane, with the extended parking T's. If Bike Lanes are not accepted, a much lesser backup would be Shared Lane Markings, centered 12-ft from curbs on each side.

Potentially feasible option: The segment could have enough width for Protected Bike Lanes (PBLs, aka "Two-Way Cycle Track"), detailed in the NACTO Urban Bikeway Design Guide. Such a PBL facility would only work if side street cars approaching Main stop before entering the bikeway. The NACTO guide describes how to address issues, including green surfacing at the intersections. For this segment of Main, the cycle track would be placed on the west side (matching the sidepath to the north) as follows: 8-ft PBLs, 3-ft barrier/buffer, 8-ft parking, 11.5-ft travel lanes in each direction, 8-ft parking.

Main Street, Clark to Peru [IDOT jurisdiction]
2 lanes, 19-ft (north of Crown) or 20.5-ft (south of Crown) with center striping and gutters paved over. Turn lanes at Central and Peru.
30 mph, 10400-9000 Average Daily Traffic, no parking occupancy – except for some in a parking bay.

Cars move around stopped left-turners, within the same lane. It seems likely that a 2-to-3 lane reconfiguration, with continuous two-way left-turn lane, has or will be considered, at some point. There are plenty of off-street parking lots throughout the segment. Sidewalks are on both sides.

Recommendation – high priority: If continuous two-way left-turn lanes will not be installed, then add Buffered Bike Lanes. Stripe each side north of Crown for a 5-ft bike lane, 2-ft buffer, and 12-ft travel lane. South of Crown: 5-ft bike lane, 2.5-ft buffer, and 13-ft travel lane. By the turn lanes at Central and Peru, where bike lanes are temporarily not possible, use Shared Lane Markings centered 6-ft from the curbs.

Backup option: In the likely scenario that the segment will be re-striped to add continuous two-way left-turn lanes, bike lanes are not possible so a dramatically lower backup would be Shared Lane Markings centered 4-ft from the curbs.

Potentially feasible option: If no continuous two-way left-turn lanes are added, there might potentially be enough space to extend the Protected Bike Lanes (above) to this segment. This would be true only if either: 1) the Central and Peru turn lanes were removed, or 2) Main was widened to retain the turn lanes. The bikeway could be continued on the left side, with width 9-ft, barrier/buffer 3-ft, and travel lanes 13-ft (north of Crown) or 14.5-ft (south of Crown). Again, NACTO should be used to mitigate intersection issues.

Main Street, Peru to S. Park
2 lanes, 19.3-ft (north of N. Park) or 20.5-ft (south of N. Park) with center striping and gutters paved over. Northbound turn lane near Peru. Pull-in diagonal parking with lateral width 10.4-ft.
30 mph, 5800 Average Daily Traffic, 100% parking occupancy.

Downtown and park area. Diagonally-parked cars extend beyond the striped parking stalls, into the lanes. Sidewalks are on each side, but directly adjacent to shop entrances.

Recommendation #1 – highest priority: More for pedestrians crossing Main than for bicyclists, add curb extensions (bulb-outs) at each corner of side street crossings, where there is diagonal parking. This should be a much-needed safety improvement.

Recommendation #2 – high priority: If pull-in diagonal parking is retained, bike lanes between parking and travel lanes are ruled out – as are Protected Bike Lanes, for lack of space. While not a big improvement in comfort, Shared Lane Markings are the only realistic option. Center the SLMs in the travel lanes to avoid parked cars backing out. Extra: SLM visibility can be enhanced with either green color or longitudinal dashed lines – see options 9 and 10 in the Shared Lane Marking Design Guidance graphic in the NACTO guide.

Potentially feasible options: While the demand for parking likely precludes a switch from diagonal to parallel parking, one benefit of doing so is to make possible buffered or protected bike lanes. Also, converting to back-in diagonal parking (e.g., Fulton Street in Peoria) would improve bicyclist (and motorist) safety and allow Shared Lane Markings to be placed further right within the lanes.

Main Street, S. Park to north of Boyd
2 lanes, northbound 22-ft and 1.5-ft gutter, southbound 20-ft with gutter paved over.
30 mph, 3400 Average Daily Traffic, no parking.

The businesses on the north side have off-street parking. Homes are on the south.

Recommendation – high priority: Remove southbound parking (slightly affecting five homes) and add Buffered Bike Lanes on each side: 4-ft southbound bike lane, 1.5-ft buffer, two 12-ft travel lanes, 1.5-ft buffer, 4-ft northbound bike lane, 8.5-ft northbound parking.

Backup option: If southbound parking removal is not accepted, consider Combined Bike/Parking Lanes with striping for 8-ft southbound CBPL, 13-ft travel lanes, 9.5-ft northbound CBPL. Combined Bike/Parking Lanes are not as suitable at this moderate traffic level.

Main Street, north of Boyd to Bryant Woods
2 lanes, 16-ft with center striping and gutters paved over.
30 mph, 2300 Average Daily Traffic, estimated 5% parking occupancy.

Recommendation #1 – high priority: If parking can be removed for each side, there is space for traditional Bike Lanes of 5-ft and 11-ft travel lanes.

Recommendation #2 – medium priority: Regardless of whether parking is removed for bike lanes or not, add a single, southbound "State Law – 3 Feet Min To Pass Bicycles" sign north of Bryant Woods.

Main Street, Bryant Woods to north of Bryant Blvd
2 lanes, southbound 20-ft and gutters paved over, northbound 18.8-ft and 1.5-ft gutter. Center striping.
35 mph, 1950 Average Daily Traffic, parking allowed but none observed.

Recommendation – high priority: Install Combined Bike/Parking Lanes. Add striping 7.5-ft from each curb face, with center striping for two 12.5-ft travel lanes. For somewhat higher traffic and speed, parking occupancy should be lower than that for other streets with the CLTL striping treatment. That appears to be true here.

Main Street, north of Bryant Blvd to south City limit
2 lanes, 12-ft with center striping and paved shoulders – 2.5-ft southbound and 3.8-ft northbound.
35 mph, 1950 Average Daily Traffic, no parking occupancy observed.

Recommendation – high priority: Could re-stripe, possibly at the next resurfacing, for 11-ft lanes and 4-ft paved shoulders.

Vernon Street, Elm to Company
2 lanes, 16.2-ft with gutters paved over, no striping.
30 mph, 800-500 Average Daily Traffic, estimated 5% parking occupancy.

Vernon, with Church and Company between them, has just three stop signs and is a low-traffic parallel to Main Street. At its north end by Elm, biking between Vernon and west of Main is easier westbound than eastbound, due to the direction of the jog at the Main/Elm traffic signal. Eastbound would require a left turn onto Elm from Main, while westbound could relatively easily jog to Marquette on a green light.

Recommendation – medium priority: Install Bike Route wayfinding signs, alone. Options for Vernon are limited, as the street is too narrow for Combined Bike/Parking Lane striping and nonzero parking occupancy precludes placing Shared Lane Markings 4-ft from the curbs.

Company Street, Vernon to Church
2 lanes, 9-ft with no gutters or striping.
30 mph, estimated 100 Average Daily Traffic, estimated 5% parking occupancy.

Company is recommended as the jog from Vernon to Church, over:

- Peru Street, 6500 ADT traffic without enough width for bike lanes;
- Roads farther north, to minimize distance on the brick section of Church.

Recommendation – medium priority: Install Bike Route wayfinding signs.

Church Street, Company to Peru
Brick surface, 2 lanes, 10.7-ft with 1.5-ft gutters, no striping.
30 mph, 400 Average Daily Traffic, no parking allowed.

Recommendation – medium priority: Install Bike Route wayfinding signs, due to other options being limited. Extra: consider paving the rightmost three feet on each side of the road, only from Company to Peru, for bicycles.

Church Street, Peru to Thompson
2 lanes, 12-ft with gutters paved over, no striping.
30 mph, 650 Average Daily Traffic, no northbound parking, some southbound diagonal parking north of Marion, southbound parking estimated 5% north and 30% south.

The crossing of Park is uncontrolled, but not difficult.

Recommendation – medium priority: Install Bike Route wayfinding signs, due to other options being limited. To avoid the segment of diagonal parking north of Marion, add Shared Lane Markings in the middle or near-left of the southbound lane. Shared Lane Markings centered 4-ft from the curb could be used northbound throughout due to no parking, but that is not recommended since southbound parallel parking is too low to justify SLMs – which would have to be centered 11-ft out. (For long segments, it's better to have SLMs on both sides or none at all.)

Euclid Avenue, Ace to south of Backbone
2 lanes, 15-ft with 1.5-ft gutters.
30 mph, 1300 Average Daily Traffic, no parking allowed.

Recommendation – medium priority: Add Shared Lane Markings, centered 4-ft from the edges of pavement.

Potentially feasible option: Bike Lanes with pavement markings could be added by striping 5.5-ft from the curbs, leaving 11-ft travel lanes.

Euclid Avenue, south of Backbone to Railroad Ave
2 lanes, 10.7-ft with no gutters.
30 mph, 1750 Average Daily Traffic, no parking observed.

Recommendation – high priority: Add Shared Lane Markings, centered 4-ft from the edges of pavement. SLMs are recommended here, instead of wayfinding signage alone, due to the moderate traffic count and narrow width. Long-term: widen Euclid to match north and south of this segment, including 5-ft bike lanes and travel lanes of at least 11-ft.

Backup option: If Shared Lane Markings are not accepted, the lesser backup would be Bike Route wayfinding signs, alone.

Euclid Avenue, Railroad Ave to railroad tracks
2 lanes, 15.5-ft with 1.5-ft gutters.
30 mph, 1750 Average Daily Traffic, no parking observed.

Recommendation – high priority: Add Bike Lanes, by striping 5.5-ft from the curbs, leaving 11.5-ft travel lanes. Include bike lane pavement markings. In addition, add a northbound "State Law – 3 Feet Min To Pass Bicycles" sign after the railroad tracks.

Backup option: If bike lanes are not accepted, a lesser backup would be Bike Route wayfinding signs, coupled with the 3-feet law sign, above.

Euclid Avenue, railroad tracks to Elm
2 lanes, 10.7-ft with no gutters.
30 mph, 1750 Average Daily Traffic, no parking observed.

The crossing of Elm is uncontrolled.

Recommendation – high priority: Add Shared Lane Markings, centered 4-ft from the edges of pavement. SLMs are recommended here, instead of wayfinding signage alone, due to the moderate traffic count and narrow width.

Backup option: If Shared Lane Markings are not accepted, the lesser backup would be Bike Route wayfinding signs, alone.

Euclid Avenue, Elm to Farnham
Brick surface, 2 lanes, 10.8-ft with 1.3-ft gutters.
30 mph, 1600 Average Daily Traffic, no parking allowed.
Construction will result in an asphalt surface, two 10.25-ft lanes plus one 8-ft parking lane.

The current road surface is bumpier at the asphalt patches.

Recommendation – medium priority: Unknown is how much parking occupancy will occur after the Euclid road project's addition of a parking lane. If parking occupancy is moderate to high – say, higher than 30% - then the recommendation is to add Shared Lane Markings, centered 4-ft from the edges of the travel lanes. For lower parking occupancy, or if SLMs are not accepted, use Bike Route wayfinding signage without the Shared Lane Markings. In either case, supplement with one southbound "State Law – 3 Feet Min To Pass Bicycles" sign just past Elm.

Euclid Avenue, Farnham to Central
2 lanes, 17.5-ft with gutters paved over.
30 mph, 1450 Average Daily Traffic, estimated 10% parking occupancy.
Construction will result in an asphalt surface, two 11-ft lanes plus one 11-ft parking lane, over the vast majority of this segment.

Recommendation – medium priority: Unknown is how much parking occupancy will occur after the Euclid road project's addition of a parking lane. If parking occupancy is moderate to high – say, higher than 30% – then the recommendation is to add Shared Lane Markings, centered 4-ft from the edges of the travel lanes. For lower parking occupancy, or if SLMs are not accepted, use Bike Route wayfinding signage without the Shared Lane Markings. In either case, supplement with one northbound "State Law – 3 Feet Min To Pass Bicycles" sign just past Central.

Euclid Avenue, Central to Crown
2 lanes, 16-ft with gutters paved over. 42.3-ft total width including northbound diagonal parking.
30 mph, 1450 Average Daily Traffic, no parking allowed southbound and northbound's diagonal parking occupied during school and events.

Recommendation: **None** – thinking that Church and 5th are sufficient for north-south routes, south of Central. If it were to be added to the bikeway network, use Shared Lane Markings centered 4-ft from the southbound curb (no parking) and centered in the northbound lane to avoid diagonal parking.

Euclid Avenue, Crown to Park
2 lanes, 16.2-ft with 1.3-ft gutters north of Peru, 12.3-ft with gutters paved over south of Peru.
30 mph, 1450-1400 Average Daily Traffic, estimated 10% parking occupancy north of Peru and no parking observed south.

Demand-actuated stoplight at Peru.

Recommendation: **None** – thinking that Church and 5th are sufficient for north-south routes, south of Central. However, if it were to be added to the bikeway network, use Bike Route wayfinding signs as the only feasible option, and add on-road bike demand actuation as at Central and Main, above. Possibly, another 3-Ft Law sign south of Peru would be useful.

Euclid Avenue, Park to south City limit
2 lanes, brick surface and 10.6-ft with 1.5-ft gutters north of Thompson, asphalt and 15.8-ft with gutters paved over from Thompson to north of Zearing Park, and asphalt with 10-ft and no gutters south of there.
30 mph, 650-1350 Average Daily Traffic, no parking allowed north of Thompson and south of Zearing Park, estimated 10% parking occupancy between Thompson and north of Zearing Park.

Recommendation: **None** – thinking that Church and 5th are sufficient for north-south routes, south of Central. However, if it were to be added to the bikeway network, use Bike Route wayfinding signs, as the only feasible option. Consider paving the rightmost 3.5-ft on each side north of Thompson.

Fifth Street, Central to Park

2 lanes, 11.3-ft with no gutters or striping north of 400-ft N of Peru, 13.5-ft with 1.4-ft gutters and no striping south of that to Park.
30 mph, estimated 800 Average Daily Traffic north of Peru and 1200 south of it, parking estimated at 5% except for heavier parking by school during events.

The crossing of Peru (7000 daily traffic) is uncontrolled.

Recommendation #1 – high priority: Install Bike Route wayfinding signs, alone. Options for Fifth are limited, as the street is too narrow for Combined Bike/Parking Lane striping and nonzero parking occupancy precludes placing Shared Lane Markings 4-ft from the curbs.

Recommendation #2 – medium priority: To improve the Peru Street crossing, add manually-activated Rapid Rectangular Flashing Beacons with suitable warning signs (S1-1 school crossing, W11-2 pedestrian, or W11-15 combined bike/ped crossing, with W16-7 diagonal down arrow). Each side of Peru should have activation buttons accessible for both pedestrians crossing the west intersection face and for cyclists biking on Fifth.

Fifth Street, Park to Thompson

2 lanes, 16.6-ft with 1.4-ft gutters, no striping.
30 mph, estimated 800 Average Daily Traffic, parking estimated at 5%.

Recommendation – high priority: Install Combined Bike/Parking Lanes. Add striping 7.5-ft from each curb face, leaving 21-ft unstriped between.

Backup option: If CBPL striping is not accepted, a lesser backup is to only install Bike Route wayfinding signs, without stripes.

Thompson Street, Fifth to Zearing Park trail

2 lanes, 10.5-ft with center striping but no gutters.
30 mph, 1150 Average Daily Traffic, no parking.

Recommendation #1 – high priority: Install Shared Lane Markings, centered 4-ft from pavement edges. Extra: while drainage grading may make it more difficult, adding a sidewalk for child and less traffic-tolerant bicyclists and pedestrians would be a benefit here. If space allows without impacting residents' front yards too much, 8-ft or even 10-ft width would be the ideal. Add Bike Route wayfinding signs along Thompson to (and from) the trail entrance into

the park, possibly supplemented with a more decorative, southbound Zearing Park sign along the trail itself.

Backup option: If Shared Lane Markings are not accepted, a lesser backup is to only install Bike Route wayfinding signs. A backup to a regular or widened sidewalk could be paved shoulders or bike lanes on this short segment.

Recommendation #2 – low priority: Consider removing the post/bollard in the center of the trail at the entrance/exit of Zearing Park. Perhaps posts on the outside of the trail could serve the purpose, instead.

Hennepin Canal Trail access

The Illinois Department of Natural Resource's Hennepin Canal Trail consists of 104.5 miles of unpaved off-road multi-use trail along the canal's main line and feeder. It is part of the 535-mile Grand Illinois Trail network of off-road trails and on-road routes in northern Illinois. Due to IDNR's budgetary issues, the trail's condition has degraded over time, but it remains a recreational and historical attraction.

The City of Princeton would like to facilitate trail access to its residents while encouraging trail users to venture off the trail and visit the City. An off-road trail spur certainly would be the best solution, attracting the same broad range of users as the trail itself. In lieu of any short- or mid-term opportunity to provide a similar off-road trail experience between the City and trail, this study considers possible rural on-road alternative routes.

Illinois Route 26 to Bureau Junction
2 lanes, 12-ft, with 7.8-ft paved shoulders.
Average Daily Traffic 3350 by Princeton, decreases to 2650 and then 2400 by Interstate 180, then 750 to Bureau Junction. Truck traffic.
Roughly 7 miles from Princeton to trail.

Comments: The paved shoulders provide ample riding space for bicyclists who do not mind the adjacent, heavier traffic. That is not the case for many bicyclists, so this should probably not be one of the preferred routes to promote.

S. Euclid / 2050E
2 lanes, 9.8-ft, no striping.
Average Daily Traffic 550 by Princeton, decreases to 375 by trail.
Good sightlines until a substantial, curvy downhill to the trail. That section is 25mph.
Roughly 4 miles from Princeton to trail.
Most heavily used route to the trail, according to Strava's bicycle heat map of tracked bike trips on that smart phone app.

Comments: This is a logical selection as the (or one of the) preferred route(s). If so, add one southbound "State Law – 3 Feet Min To Pass Bicycles" sign just south of town. At the start of the soutbound downhill segment, as well as northbound right after the trail and before the uphill, add W11-1 Bicycle Warning signs.

S. Euclid / 2050E, 1250N, 1950/1890E (Tiskilwa route)

Euclid/2050E: 9.8-ft lanes, 550 ADT
1250N: 9.8-ft lanes, 300 ADT for 0.5 miles from 2050E to S. Main; 12.4-ft lanes, 1050 ADT, stiped for 0.5 miles from S. Main to 1950E
1950/1890E: 10-ft lanes, 550 ADT, steeper hill with curves/sight line concerns

Average Daily Traffic 550 by Princeton, decreases to 375 by trail.
Good sightlines until a substantial, curvy downhill to the trail. That section is 25mph.
Roughly 5.7 miles from Princeton to trail.
Tiskilwa is just past the trail access.

Comments: The longer distance, the 0.5 miles on somewhat busier 1250N, and the downhill section issues make this less attractive than the purely 2050E route. However, it is a direct route to Tiskilwa, and it is used now by bicyclists. Signage similar to the 2050E route could be added, and opportunities to pave 4-ft of the west 1250N half-mile could be explored.

S. Main, 1250N

2 lanes, 12-ft, striped.
Average Daily Traffic 1950 by Princeton, dropping to 1750 and then 1050 on 1250N.
Good sight lines on one straight downhill.
Roughly 4.8 miles from Princeton to trail (access is at a trailhead east of 1250N)

Comments: This is the busiest of the options, and likely not a preferred route for a broad range of cyclists. The smooth surface and relatively good downhill section are plusses. On much but not all of the route, 4-ft paved shoulders might be possible and could be considered for the safety of more traffic-tolerant cyclists. The busiest segment of this route could be avoided by using 2050E and 1250N to Main.

From US6-34/1800E, options to Lock 14 or Wyanet

Lock 14 option: *1800E-1400N/1410N: 9.5-ft lanes, 350 ADT, good surface.*
1675E/1650E: 9.5-ft lanes, <200 ADT, some loose gravel on hill, curves.
1280N: estimated 50 ADT, trailhead parking at Lock 14.
Roughly 3.2 miles from US6-34/1800E intersection.

Wyanet option: *1800E and 1400N/1410N: 9.5-ft lanes, 350-275 ADT, good surface.*
Roughly 4.5 miles from US6-34/1800E intersection.

Comments: Both are favorable options on low traffic roads. Even quieter would be to stay on 1800E to 1350N – avoiding 1410N/1400N. Each option is used somewhat, according to Strava. The issue is getting from the City to the US6-34/1800E intersection.

From Princeton to US6-34/1800E

Park Ave W option: *Park Ave W: 550 ADT, 30mph with 12-ft lanes in town, 35 mph with 11-ft lanes and long hill on west end. Surface is brick from west of Gosse to the east.*
US6-34: 0.75 mile of two 12-ft lanes, 3450 ADT with truck traffic, 2-ft and 3-ft paved shoulders with additional gravel shoulder width.
Roughly 1.9 miles added to Lock 14 and Wyanet options.
Strava's heat map indicates a fair amount of bicycle usage of this option.

Western option: *From the Clark/Epperson intersection – 0.25 mile on Epperson (ADT 550), 1.0 mile on 1600N (ADT 550), 1.2 miles on 1800E/1840E (ADT estimated 200).*
Roughly 4.1 miles added to Lock 14 and Wyanet options.
This option has less bicycle usage, according to Strava.

Comments: The western option uses good roads to reduce the mileage on the US6-34 segment, but adds over two miles. A combination of 0.3 mile on 1525N and 0.18 mile of new sidepath trail from 1525N's dead-end to 1800E would avoid US6-34 completely. Extending this trail east from 1840E encounters an obstacle at the US6-34 bridge over the creek.

Widening paved shoulders along US6-34 looks feasible, and the bridge does have wide paved shoulders already. This would enhance safety for the current bicycle traffic using the US6-34 segment. If that is done, it is recommended to add a westbound 3-Feet Law sign on Park by its hill.

Recommendation

To summarize this study's suggestions for Hennepin Canal Trail access:

- Focus on S. Euclid/2050E as the primary access, making the improvements above.
- As a lower priority, consider US6-34 paved shoulders from Park Ave W to 1840E, and either paved shoulders to 1800E or a sidepath from the 1525N dead-end to 1800E.
- Explore options (and feasible rights-of-way) for the ultimate solution serving a broader range of users: an off-road trail from City to the Hennepin Canal Trail.

Appendix 1 - Bikeway Types in the Bike Route Study

Standards and Guidelines

The 2012 *Guide for the Development of Bicycle Facilities* by the American Association of State Highway and Transportation Officials (AASHTO), the Federal Highway Administration's (FHWA) Manual of Uniform Traffic Control Devices (MUTCD), and the NACTO Urban Bikeway Design Guide (NACTO) form the technical basis for the study's recommendations.

These references are recognized by the industry as the standards for bicycle facility design. The Illinois Department of Transportation encourages communities to consult these guidelines and standards when developing bicycle plans and studies.

After a description of the recommended network wayfinding signage, a general overview of bicycle facility options follows. More engineering details are in the publications.

Bike Network Wayfinding Signage

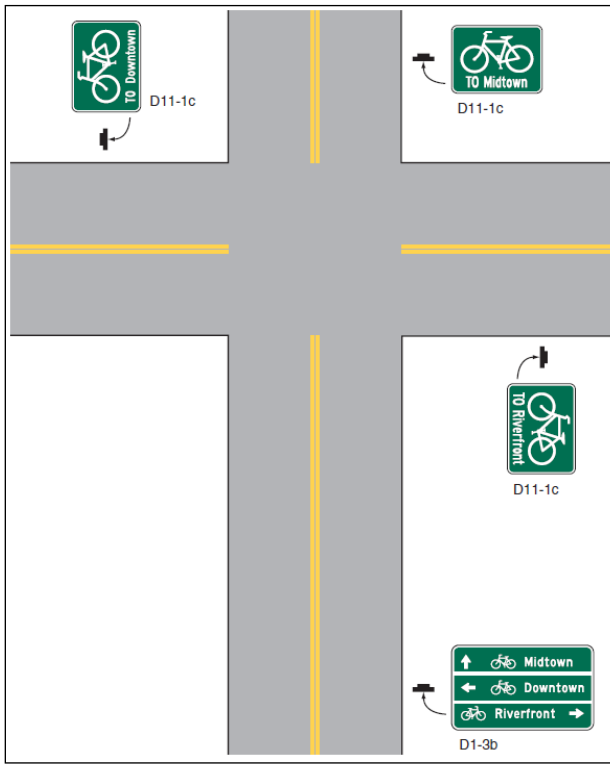
For both on- and off-road bikeway segments in a town, bicycle network signage can serve both wayfinding and safety purposes including:

- Helping to familiarize users with the bikeway system
- Helping users identify the best routes to significant destinations
- Helping to overcome a "barrier to entry" for people who do not bicycle much but who want to get started
- Alerting motorists to expect bicyclists on the route

Recommended network wayfinding signs. Left: D1-3b Middle: D1-2c Right: D11-1c

It is recommended that Princeton adopt wayfinding conventions consistent with the MUTCD and 2012 AASHTO bike guide. Instead of the old D11-1 "Bike Route" signs, recommended is the newer, more informative destination-based signage illustrated above.

Signs should be installed on each officially-designated on-road or off-road segment of the network. The recommendations in this study often list other bikeway types, such as shared lane markings and bike lanes, but **in each case there should be accompanying wayfinding signage.**



Example of signage placement.

The figure at right illustrates signage placement. In general, signs should be placed where a route turns at an intersection, crosses another route, and crosses major intersections. The D1-nb series (above, left) is recommended, with D1-nc (above, center) used where destination distance is far enough to show mileages. The D11-1c confirmation signs (above, right) should be placed on long stretches, too. Besides MUTCD, the NACTO guide gives detail on signage content and placement. Individual signs should be specified by the task force.

DesPlaines QR code sticker.

Additionally, the City of Des Plaines provides an interesting example to consider: proposed 7.5" X 4" stickers on the backs of their bikeway wayfinding signs. The city's bicycle webpage and corresponding QR code are listed. The webpage has background information – and bikeway maps.

Trails

Multi-use trails are physically separated from motor vehicle traffic, except at road crossings. Trails accommodate a variety of users, including pedestrians, bicyclists, and others, for both recreation and transportation purposes. Trails away from roads, on easements or their own rights-of-way, tend to be more pleasant and popular. The Zearing Park Trail and the nearby Hennepin Canal Trail are Princeton examples.

Multi-use trail on its own right-of-way

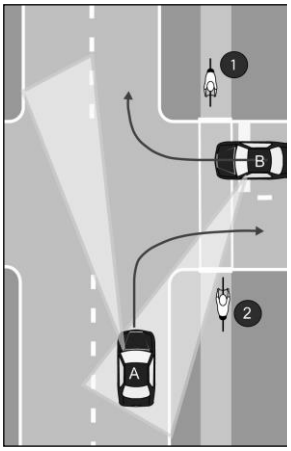
Sidepaths and Sidewalks

Sidepaths are trails running immediately parallel to a roadway, essentially a widened sidewalk. The width, in feet, can vary from eight (minimum) to ten (desired) or more, where heavily used. Compared to trails on their own rights-of-way, most sidepaths have a larger fraction of use for transportation purposes. Princeton has a sidepath along much of North Main Street.

Sidewalks are often used for bicycling, particularly by children or when on-road conditions are uncomfortable. However, widths are usually too narrow for comfortable use by both cyclists and pedestrians. Sidewalks are not considered official bikeways, so where short segments are used for connectivity, signage recommending cyclists to dismount and walk is suggested.

While the physical separation from traffic provides a sense of security to sidepath (and sidewalk) users, intersections present inherent conflicts and visibility problems – especially for off-road cyclists riding against the flow of adjacent traffic. Understanding these inherent conflicts can help in efforts to improve sidepath safety.

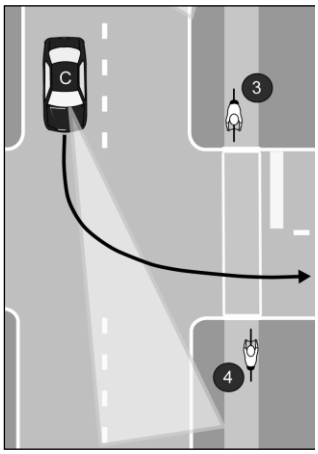
The figures below illustrate the visibility problems leading to intersection conflicts. At left, Car B crosses the sidepath to turn right onto the parallel street. Rarely do motorists stop at the stopline – usually stops are in the crosswalk or at the street edge, if at all. Many will look only to their left. Cyclist 2 might be seen. Cyclist 1 is much less likely to be seen.



Right turns across sidepaths.

Car A turns right off the parallel road then crosses the sidepath. Again, Cyclist 2 might be seen but Cyclist 1 is less visible. Particularly where a large turning radius permits fast turns, many motorists do not yield to cyclists entering or already in the crosswalk.

At right, Car C looks ahead, waiting for a traffic gap to turn left, then accelerates through the turn while crossing the crosswalk. Cyclist 4 might be seen. Again, the contra-flow cyclist (3) is less likely to be seen. If the traffic gap is short, sudden stops would be difficult.



Left-turn across sidepath.

It should be noted that a contributing factor in at least some of these conflicts is disregard of pedestrian crosswalk laws and possibly traffic controls by bicyclists. Education and enforcement of both motorists and bicyclists can help somewhat in controlling sidepath problems. The study provides some recommendations.

In addition, sidepath conflicts can be reduced through engineering by:

- Bringing the sidepath closer to the road at intersections, for better visibility during all turning motions and better stopline adherence for right-turners
- Using pedestrian refuge islands to break up major crossings and right-in-right-out entrances – right-turn corner islands ("porkchops") are particularly effective
- Using higher visibility crosswalks, specifically the "continental" style
- Bicycle Signal Faces for bikeway-specific phases at signalized intersections. This treatment has Interim Approval from the Federal Highway Administration.
- As a backup option to Bicycle Signal Faces, signalized intersections may provide a manually-activated Lead Pedestrian Interval to give off-road cyclists and pedestrians a "head start" before conflicting right-turning traffic gets a green signal.

On-road Bikeways

Expanding Princeton's bicycle network requires the determination of appropriate bikeway choices for various contexts.

Due to the fear of getting hit by a car from behind, many believe sidepaths or sidewalks are *always* safer than on-road bicycling. Surprisingly, this is *not* the case where there are many side streets, residential driveways, and commercial entrances – especially for "contra-flow" cyclists biking against the flow of traffic.[2] The visibility issues described above are a prime reason. Note that for each motorist turning motion illustrated above, an on-road cyclist on the right side of the road is within the motorist's viewing area. In fact, especially in cities during the day or when the bike is well-lit at night, most car-bike crashes occur at intersections – not from cars striking bikes from behind[3].

The AASHTO guide describes the above and other sidepath issues in discouraging their use in inappropriate locations. In general, sidepaths may be better choices than on-road bikeways for faster, busier roads without lots of crossings. Since that is not the case for most of the City's other roads, various on-road bikeway options are usually recommended in this study.

Bike Lanes

Bike lanes are portions of the roadway designated for bicyclist use. Bike lanes are typically between five and six feet wide (including gutter pan) on each side of the road with a stripe and pavement markings. Bike Lane (MUTCD R3-17) signs are optional to supplement markings but are not recommended here. For one-way streets, bike lanes *usually* are better placed on the right side of the road.

Bike lanes (other side not shown).

Cyclists in each bike lane travel one-way with the flow of traffic. Sample results[2,4,5] around the country for roads with bike lanes include:

- More predictable movements by both cars and bikes
- Better cyclist adherence to laws about riding on the right side of the road
- Dramatic increases in bike usage with lower car-bike crash rates

[2] Moritz, W.E., "Survey of North American Bicycle Commuters: Design and Aggregate Results", Transportation Research Board, 1997.
[3] AASHTO Guide for the Development of Bicycle Facilities, pp. 3-8 and 3-9, 2012.
[4] AASHTO Guide for the Development of Bicycle Facilities, p. 22, 1999.
[5] Reynolds, C, et al., "The Impact of Transportation Infrastructure on Bicycling Injuries and Crashes: A Review of the Literature", *Environmental Health*, 2009.

Buffered bike lanes (NACTO).

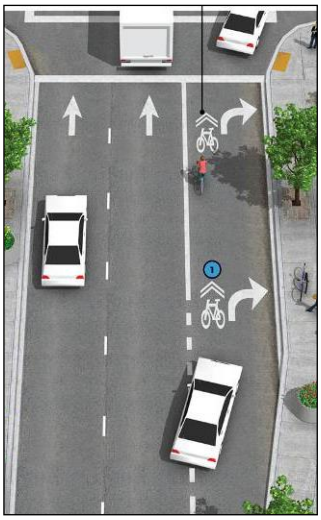
Parking is not permitted in designated bicycle lanes. When a road has bike lanes and adjacent parking, the bike lanes should be striped between the parking space and the travel lanes. When a road has bike lanes but no on-street parking, indicate the parking prohibition using No Parking (MUTCD R8-3) or No Parking Bike Lane (MUTCD R7-9) signs.

Bike lane options are evolving, to provide benefits in various situations. **Buffered Bike Lanes** are now accepted by the Federal Highway Administration and detailed in the NACTO Urban Bikeway Design Guide. A buffer space may be added between travel lane and bike lane, or between bike lane and curbside parking. This study calls for Buffered Bike Lanes on one segment.

Protected Bike Lanes (PBL) use bollards, curbs, or parking to separate bike lanes from travel lanes. American use of PBLs has grown significantly this decade in dense urban cores. While no PBLs are listed as primary recommendations in the study, they may be considered as an option – especially where intersection conflicts can be closely controlled, and motorist stop line compliance is high on cross streets and other intersections.

National standards are continually evolving on handling bike lanes at intersections. The AASHTO guide has long detailed advance merge areas and, where space allows, continuing bike lanes to intersections. New tools are colorized pavement and extensions of bike lanes *through* intersections.

Insufficient pavement width due to the presence of turn lanes may necessitate interruption of bike lanes at intersections. Where this occurs with a right-turn only lane, shared lane markings may now be used for straight-ahead bicycle travel in the right-turn lane. Where this occurs with a left-turn lane but no right-turn only lane, use shared lane markings in the center of the rightmost through lane.



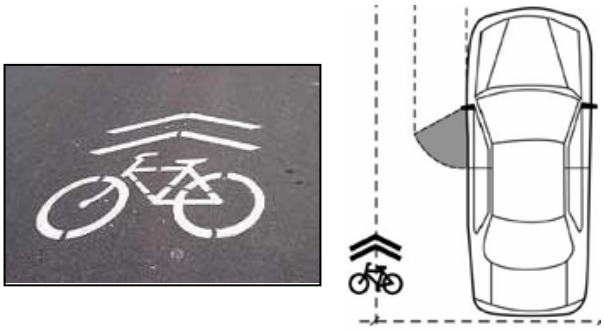
Shared Lane Markings in right-turn only lane. (NACTO)

Green-Colored Pavement may now be used to enhance the conspicuity of bicycle lanes, or extensions of those lanes at intersections. The NACTO guide provides details.

Regular sweeping is important, as bike lanes tend to collect debris.

Shared Lane Markings

Shared lane markings (SLMs, aka "Sharrows") inform cyclists of optimum lane positioning. Bicycle positioning on the roadway is important to avoiding conflicts with cars turning at intersections and doors opening on parked cars. Also, SLMs are more effective than signage alone in reminding drivers of the possibility that they will see a bicyclist in the road.



Shared Lane Marking.

Shared lane markings may only be used on streets with speed limits of 35 mph or lower. Sometimes SLMs are used in lieu of bike lanes on relatively comfortable roads that would still benefit from a higher level of guidance to bicyclists and motorists. More often, however, SLMs are a fallback treatment where there is insufficient width for bike lanes.

On roads with no permitted parking, the center of the marking shall be 4 feet (or more) from the curb. On roads with permitted and *any level* of occupied parking, the center of the marking shall be 11 feet (or more) from the curb. SLMs that far from the curb are best at higher (>30-40%, perhaps) parking occupancies. This study recommends SLMs for some road segments having parking and others that do not.

The markings should be placed right after an intersection and spaced at intervals of 250 feet thereafter. See MUTCD Part 9 for more installation guidance. The shared lane marking also can be used to indicate correct straight-ahead bicycle position at intersections with turn lanes, where bike lanes have been temporarily dropped.

Signed Bike Routes

Some roads may be identified by signage as preferred bike routes, because of particular advantages to using these routes compared to others. These "signed shared roadways" only use the bike network wayfinding signage described above, with no pavement striping or marking. Signed Bike Routes may be appropriate where:

- There is not enough roadway width for bike lanes,
- Relatively low – but nonzero – parking occupancy makes shared lane markings less desirable, or
- Low traffic and comfortable conditions reduce the need for the cost of pavement stripes and/or markings.

A road does not require a specific geometry to be signed as a Bike Route, providing flexibility. A Bike Route may be a striped or unstriped street, or a road with paved shoulders.

Combined Bike/Parking Lanes

Some residential collector streets with wide lane widths permit on-street parking, but parked cars are sparse – under 5% or at most 10% occupancy – except perhaps on special occasions ("party-parking"). While this may be an opportunity for dedicated bike lanes, removal of parking on even one side may be politically infeasible – even though the wider lanes often encourage faster traffic speeds through neighborhoods.

Combined Bike/Parking Lanes.

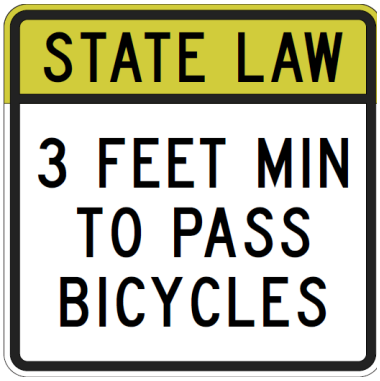
A fallback option, is to stripe off 7.5-8 feet (including gutter pan) for the occasional parked car. This space, essentially an "urban paved shoulder", may be used by bikes, too. Sign the road with bike route wayfinding signage, but do not include any designated bike lane signage or pavement markings. Cyclists in this space would pass parked cars just as they do on road shoulders and unstriped roads. Benefits include:

- An increased perception of comfort by the cyclist
- Lower likelihood of the occasional parked car being hit by another car
- The traffic-calming effect of narrower lanes, i.e., slowing car speeds

"Combined Bike/Parking Lanes" (CBPLs) allow parking, but bike lanes do not. Steps should be taken to avoid confusion. Combined bike/parking lanes should use signage indicating parking permission information. As mentioned earlier, bike lanes should use "no parking" signs – where there is no adjacent on-road parking.

Three-Foot Law Signage

Nationally, the "Share the Road" sign has been falling out of favor, due to recent studies showing misinterpretation by many motorists. To deliver a clearer message, IDOT recently approved local agency use of a regulatory sign informing drivers of the state's three-foot lateral clearance law when passing bikes. Installation should be limited to locations where the operation of the two vehicle types is demonstrating a problem or crash history. Several agencies have installed them, in partnership with Ride Illinois.



3-ft law sign.

Three-foot law signs are recommended in this study for four street segments needed for the bike network but lacking options to achieve a reasonable level of bicyclist comfort.

Signal activation marking and sign.

Signal Activation by Bicycles

Both bicycles and motorcycles have difficulty activating demand-actuated traffic signals. Cars may not be present to trip the signal, or cars may be stopped too far back of a bike. Pedestrian push-button actuation, if present, is often inconveniently located for on-road bikes.

Illinois now has a law by which bicyclists and motorcyclists may treat stoplights like stop signs, after two minutes of not being detected. Engineering solutions are safer and preferred.

For existing intersections, the MUTCD-approved Bicycle Detector Pavement Marking (MUTCD Fig. 9C-7) in Appendix 1, together with the R10-22 Bicycle Signal Actuation Sign, can indicate a detector trigger point for actuating the signal. For standard detectors, the detector's perimeter – such as its right edge – is more sensitive to bicycles. Correct tuning of the detector may be needed, too. Alternatively, a special detector loop can be installed for bikes.

For new intersections, quadrupole loop detectors, microwave or new camera detection technology could be used, as they are more sensitive to bikes and motorcycles.

Improving Unsignalized Crossings

A good goal in developing a bicycle network is to avoid the use of unsignalized crossings of busy roads unless absolutely necessary. If needed, there are Federal Highway Administration-accepted treatments intended to improve safety of those crossings.

Main and Peru Streets present the main crossing challenges for both bicyclists and pedestrians in Princeton. Suggestions for various treatments come from Chapter 3 of National Cooperative Highway Research Program Report #562 "Improving Pedestrian Safety at Unsignalized Crossings".

1) A regular traffic signal is considered the preferred solution, but MUTCD warrants must be met first. If the designated bikeway is on-road, automatic signal activation is needed for on-road bicycles, if pedestrian-activation buttons are out of reach from the road.

2) If the roadway width allows for it, median refuge islands have been demonstrated to reduce pedestrian crashes by nearly half.

3) If more than 20 pedestrians and bicyclists are projected to use an unsignalized crossing per peak hour, a manually-actuated Pedestrian Hybrid Beacon (PHB) traffic signal would be warranted, supplemented with a crosswalk and advance warning signage.

4) If a PHB is not warranted, manually-activated Rectangular Rapid Flashing Beacons (RRFB) could be used with crossing warning signs, below.

Left: Rectangular Rapid Flashing Beacon.
Right: W11-15 and W16-7P signs.

5) As a backup – or supplement – to RRFBs, demand-actuated overhead flashing beacons could be used. Better yet would be both overhead and side-mounted warning beacons, as well as beacons in advance of the intersection. Off-road pedestrians and on-road bicyclists would activate the beacons with a push-button accessible to each.

6) Whether PHB, RRFB, warning beacon, or none; motorist warning signage should be placed in advance of the intersection (W11-15 or W11-2 crossing warning signs, with W16-9p "AHEAD" plaques) and at the intersection (W11-15 or W11-2 with W16-7p diagonal downward arrows), all in MYP color. Pedestrian (and bicyclist) signage should be added to warn about looking both ways – and using the pushbutton activation, if relevant.

7) Especially for crossings of multi-lane roads, use advanced stop lines, 30 to 50-ft in advance of the crossing, with Stop Here for Pedestrians signs (R1-5b or R1-5c). This distance helps reduce "multiple threat" crashes from inner lane traffic.

Appendix 2 - Standards for Road Design and Development

Introduction

Filling in sidewalk gaps and improving intersections helps complete a street.

Complete Streets refers to a way of thinking about roadways that emphasizes the safety needs of all the people who travel along and across them—whether they are in a car, on a bike, on foot, in a wheelchair, or pushing a stroller. A busy street that efficiently moves cars but provides no room for bicyclists or no convenient crossing for school children might be considered "incomplete."

In recent years, agencies from all levels of government have developed policy and planning tools to ensure that road project designs accommodate those who walk or bike by choice or necessity. In 2010, IDOT adopted design policy changes to implement a Complete Streets law for their larger-scale road projects. That same year, the US Department of Transportation also voiced support for Complete Streets with a new bicycle and pedestrian accommodation policy statement:

> *"Every transportation agency, including DOT, has the responsibility to improve conditions and opportunities for walking and bicycling and to integrate walking and bicycling into their transportation systems. Because of the numerous individual and community benefits that walking and bicycling provide — including health, safety, environmental, transportation, and quality of life — transportation agencies are encouraged to go beyond minimum standards to provide safe and convenient facilities for these modes."*

The National Complete Streets Coalition (smartgrowthamerica.org/program/national-complete-streets-coalition) provides resources for communities to adopt and implement a Complete Streets policy. An adopted ordinance can instruct relevant City departments to "make Complete Streets practices a routine part of everyday operations" and "approach every transportation project and program as an opportunity" to improve safety and convenience for all roadway users. A recommendation of this study is for Princeton to develop and adopt such an ordinance.

Roadway Design Guideline Recommendations

By adopting the recommendations of this bicycle study, the City of Princeton has established priorities for road corridors that need improvement. However, to ensure that all road projects—whether or not their corridors are addressed specifically in this study—consider the needs of all potential travelers, the study provides suggestions to consider as guidelines or for separate adoption into the City's roadway design standards.

City-Maintained Roads: To implement a Complete Streets ordinance on a practical level, local road design standards may need to be modified. As a major part of that, the tables below may be used to specify appropriate bikeway accommodation and conditions for sidewalk construction. A "network route" is one that is or could be part of the designated bike network.

Suggested Bicycle Accommodation in Road Designs

Minor urban 25-30 mph roads				
	No parking	*Parking <10%*	*Parking 10-30%*	*Parking >30%*
Under 1000 ADT	None	None	None	None
(Network route)	BR	BR	BR	BR
Over 1000 ADT	None	None	None	None
(Network route)	SLM-4 (or BL*)	CBPL	BR (and 3-ft S*)	SLM-11 (or BL*)

Arterial or Major Collector *(Urban unless noted)*			
	2000-8000 ADT	*8000-15000 ADT*	*Over 15000 ADT*
<35 mph	BL-5 (or BBL*)	BBL (or BL-5)	BBL or SP *[Note A]*
35-40 mph	BBL or SP *[Note A]*	SP (or BBL) *Note A*	SP (or BBL) *Note A*
>40 mph	SP	SP	SP
55 mph rural	SH-4 (or SH-6*)	SH-6 (or SH-8*)	SH-8

- (Parentheses) indicate the secondary option.
- A secondary with an asterisk* indicates the option may be used at the higher ends of a range or where the need is greater.

BR: *Bike network wayfinding signage only. D1-nb and D1-nc (n= # of destinations), and D11-1c are recommended.*
SLM-4: *Shared Lane Markings centered 4-ft from curb faces. Bike network wayfinding signage recommended as a supplement.*
SLM-11: *Shared Lane Markings centered 11-ft from curb faces (on-street parking present). Bike network wayfinding signage recommended as a supplement.*
CBPL: *Combined Bike/Parking Lanes, solid stripes 7-8 ft from curb faces. Parking permission indicated with signage. Bike network wayfinding signage recommended as a supplement.*
3-ft S: *"State Law - 3 Feet Min To Pass Bicycles" sign, which has been approved by IDOT.*
BL-5: *Bike Lanes of width 5-ft, with pavement stencils per AASHTO and bike network wayfinding signage recommended as a supplement.*
BBL: *Buffered bike lanes of 3.5 to 5-ft width, plus 1.5 to 3-ft buffers on travel and/or parking (if present) sides. May substitute with Protected Bike Lanes. Wayfinding signage supplements.*
SP: *Off-road sidepath trail designed per AASHTO, on at least one side of road.*
SH-4, SH-6, or SH-8: *Paved shoulders of width 4, 6, or 8-ft, respectively. Any rumble strips should have longitudinal breaks and a minimum 4-ft clear zone for bikes.*

Note A: *As the frequency of crossings (side streets, commercial entrances, driveways) increase, the choice of buffered bike lanes or sidepath moves closer to buffered bike lanes.*

Federal Highway Administration's Guidelines for New Sidewalk Installation

Roadway Classification and Land Use	Sidewalk Requirements	Future Phasing
Highway (rural)	Min. of 1.525 m (60 in) shoulders required.	Secure/preserve ROW for future sidewalks.
Highway (rural/suburban - less than 2.5 d.u./hectare (1 d.u./acre))	One side preferred. Min. of 1.525 m (60 in) shoulders required.	Secure/preserve ROW for future sidewalks.
Suburban Highway (2.5 to 10 d.u./hectare (1 to 4 d.u./acre))	Both sides preferred. One side required.	Second side required if density becomes greater than 10 d.u./hectare (4 d.u./acre).
Major Arterial (residential)	Both sides required.	
Collector and Minor Arterial (residential)	Both sides required.	1.525 m (60 in)
Local Street (Residential - less than 2.5 d.u./hectare (1 d.u./acre))	One side preferred. Min. of 1.525 m (60 in) shoulders required.	Secure/preserve ROW for future sidewalks.
Local Street (Residential - 2.5 to 10 d.u./hectare (1 to 4 d.u./acre))	Both sides preferred. One side required.	Second side required if density becomes greater than 10 d.u./hectare (4 d.u./acre).
Local Street (Residential - more than 10 d.u./hectare (4 d.u./acre))	Both sides required.	
All Streets (commercial areas)	Both sides required.	
All Streets (industrial areas)	Both sides preferred. One side required.	

Note: *d.u. stands for dwelling unit*

Development Ordinances: Create development guidelines to help new developments contribute to Princeton's efforts to become more pedestrian and bicycle-friendly. Possible topics:

Developments shall contribute to the City of Princeton's efforts to become more pedestrian and bicycle friendly. This includes:

- *Considering bicycle and pedestrian traffic and facilities during the traffic impact analysis process.*
- *Installing bikeways as part of any required roadway improvements, per the table above, and consulting the Princeton Bicycle Route Study for specifically-defined bikeway improvements.*
- *Installing sidewalks (with a minimum preferred width of 5 ft.) according to FHWA New Sidewalk installation guidelines, above.*
- *Considering pedestrian and bicycle access within the development as well as connections to adjacent properties.*
- *Considering connectivity between developments for pedestrians and bicyclists to minimize short-distance trips by motor vehicles. These can be provided as "cut through" easements in suburban cul-de-sac developments, and as part of connected street grids in traditional neighborhood development.*
- *Building out pedestrian and bicycle facilities concurrent with road construction, or in an otherwise timely manner, to prevent gaps due to undeveloped parcels.*

IDOT, County, and Other Agency Roadways: Work closely with IDOT, Bureau County Highway Department, and other appropriate agencies to identify opportunities to improve roadways as part of new, reconstruction and maintenance projects. These are the most cost-efficient times to also make improvements (as needed) for those walking and biking.

Additional Policies and Ordinances: Other policies and ordinances may be adopted by the City of Princeton to make adequate bicycle and pedestrian accommodation part of standard practice for any improvement in town.

The University of Albany provides simple and specific policy text[6] appropriate for:

- The City comprehensive plan
- Subdivision regulations and site plan review
- Zoning laws
- School board policy on Safe Routes to School

[6] "Planning and Policy Models for Pedestrian and Bicycle Friendly Communities in New York State" by the Initiative for Healthy Infrastructure, University at Albany, State University of New York (www.albany.edu/ihi/files/NY_Planning_And_Policy_Models_iHi.pdf)

Appendix 3 – Education and Enforcement Resources

Education

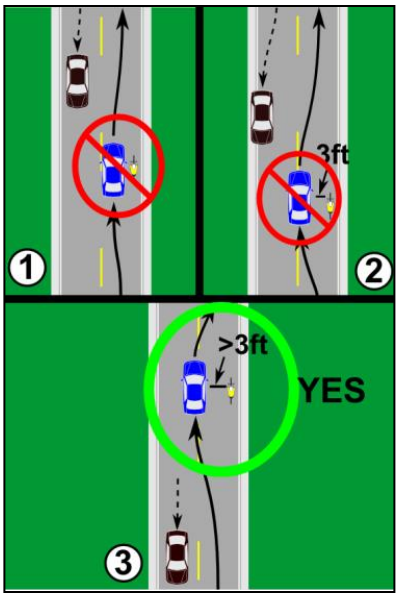
There is a big educational gap – for both bicyclists and motorists – on how to legally and properly share the road. The result: avoidable crashes, too many people afraid to bike, and lots of anger and resentment. Education of both road user types is crucial to improving real and perceived bicycling safety in Princeton. Investing some resources on public outreach and education would greatly leverage the City's infrastructure investment.

Many of the safety resources listed below are free, except for the time to get and use them. Much of this time could come from volunteers.

Bicyclists: Many people are afraid to bike, or bike only on off-road trails, because of their concern about safety. Improving education can lessen these concerns and instill the skills and confidence to bike to more places around town more safely.

The following safety materials could be distributed through schools and PTAs, at public places such as City Hall and the library, and on the City's and park district's websites:

- *Bicycle Rules of the Road*, a free guide from the Illinois Secretary of State: www.cyberdriveillinois.com/publications/pdf_publications/dsd_a143.pdf
- *Bike Safety*, a free brochure from the Illinois State Police: www.isp.state.il.us/docs/5-035.pdf
- Ride Illinois' single-page summaries for children and their parents. rideillinois.org/safety/kids-and-biking-resources
- Illinois Bicycle Law cards, free from Ride Illinois. Relevant state laws, folds to business-card size. rideillinois.org/wp-content/uploads/2018/08/BikeLawCard2018.pdf



Motorist Quiz at www.bikesafetyquiz.com.

In addition, Illinois has a network of bicycle safety instructors, nationally-certified by the League of American Bicyclists, to teach a menu of classes for children and adults. These classes – or training of new instructors – could be conducted in Princeton. Instructors are listed at www.bikeleague.org/bfa/search/list?bfaq=illinois#education.

An online interactive resource on relevant laws and safety techniques is Ride Illinois' www.bikesafetyquiz.com. Concise quiz-based lessons are freely available for Adult Bicyclists, Child Bicyclists, and Motorists. Besides individual use, the application has functionality for easy use by schools, driver education programs, scouts, YMCAs, and more. Ride Illinois has brief text promoting the quiz, available for municipal newsletters and websites.

Motorists: Drivers not trained on car-bike interactions are much more likely to make mistakes that are dangerous to people on bikes. The following safety resources are available from Ride Illinois, for driver education programs and existing motorists:

- The "Motorist" and "Driver Education" quizzes in the www.bikesafetyquiz.com resource mentioned above.
- "Share the Road: Same Road, Same Rights, Same Rules", a 7-minute video available at www.youtube.com/watch?v=S1PXvxh_6MI and as a DVD.

The study recommends that local high schools and private driver education programs be encouraged to use www.bikesafetyquiz.com and/or the video and its accompanying lesson. Both resources could be added to the City website. During warmer months, the video could be shown on the local cable channel and the articles could be published for residents.

Enforcement

A vital component of a safe bicycling environment is enforcement with education to reduce common car-bike collision types.

According to Illinois law, bicyclists have both the rights and responsibilities of other vehicle users. Many cyclists do not know about the law as it applies to bikes and how following the law leads to safe cycling. Other cyclists ignore the law while riding in traffic, not only creating dangerous situations but also causing motorist resentment toward other cyclists trying to share the road safely.

Police are encouraged to stop cyclists if the situation dictates, to educate, issue warning citations, or issue tickets. Changing their behavior could save their lives. The aforementioned Illinois bike law cards are available from Ride Illinois. Also, Ride Illinois has piloted a bicycle ticket diversion program in Urbana, Champaign, Highland Park, and several other cities. To reduce a ticket to a warning, offenders take the Adult Bicyclist quiz at www.bikesafetyquiz.com, emailing their completion certificate to the police department. This has been received well and is suitable for Princeton, too.

In a car-bike crash, the motor vehicle does the most damage. Some aggressive motorists intentionally harass cyclists, while others simply don't know how to avoid common crash types. As with cyclists, police are encouraged to stop motorists if needed, to educate, issue warnings, or issue tickets. An annually-conducted, brief but well-publicized targeted enforcement campaign (aka "sting") can raise community awareness about particular problem issues. Warning tickets would be issued, along with instructions to complete the appropriate www.bikesafetyquiz.com lesson.

Officers are encouraged to learn or refresh their own knowledge on the common crash types through completion of the Motorist and Adult Bicyclist quiz lessons.

Finally, police might consider replicating an earlier Hoffman Estates "bike safety kit" program. There, the police regularly noticed 50-60 mostly low-income workers, relying on their bicycles

for year-round transportation to their jobs. These residents, riding at dark on busy roads, were often at risk due to a lack of bike lights and reflective clothing. Officers distributed a kit of these items when they witnessed a cyclist in that situation. This low-cost program was a much-appreciated success that could be duplicated here.

These and other enforcement ideas are detailed in the Illinois Association of Chiefs of Police's magazine: rideillinois.org/wp-content/uploads/2016/01/PoliceChiefsArticle_Spring2014.pdf

Appendix 4 – Bike-Pedestrian Commission Members

Annette Schnabel-Chair
Matt May-Vice Chair
Brian Church- Secretary
Rick Menzel
Jean Kinsley
Elise Swinford (2017)
Brian Taylor (2017-2018)
Danielle Saletzki (2018)
Angela Thompson (2018)
Rachel Skaggs, City Manager and Bike-Pedestrian Commission Liaison
Pete Nelson, Director of Planning & Zoning

City of Princeton City Council

Mayor Joel Quiram
Laura Favia
Ray Mabry.
Jerry Neumann
Ray Swanson