

# **Physically Separated Bikeways: A Game Changer for Bicycle Mode Split?**

**MANY WHO DO NOT  
ALREADY USE BICYCLES  
TO GET AROUND CITE  
SAFETY CONCERNS AS  
THEIR PRIMARY REASON  
FOR NOT DOING SO. COULD  
PHYSICALLY SEPARATED  
BIKEWAYS BE THE ANSWER  
TO INCREASING MODAL  
SHARE?**

THE INSTITUTE OF TRANSPORTATION Engineers Pedestrian and Bicycle Council is currently producing an informational report that presents findings on the current state of practice for installing separated bikeways in North America. The purpose of this report is to assist in determining the current and potential utility of separated bikeways in the United States and Canada and to develop research statements for further investigation of the safety and latent demand for separated bikeways. The report will be available later this year (2011).

As a category, physically separated bikeways fit somewhere between pathways and bike lanes. Though commonly used around the world, most notably Denmark and the Netherlands (and often called "cycle tracks"), they are not explicitly discussed in transportation manuals in the United States. Alternatively, two-way shared use paths adjacent to roadways are fairly common in the United States.

## **BACKGROUND**

Sustainable transportation goals are being adopted by local, regional, and federal agencies worldwide. Like walking, bicycling is widely recognized as one of the most sustainable modes of transportation. Its environmental footprint is very small, and it is affordable for all income levels. What's more, it promotes public health and is not susceptible to congestion.

Despite this growing awareness, we have yet to reach the kind of mode shift toward active, sustainable transportation that the Netherlands, Denmark, and other

countries have experienced. These countries have not always been as bicycle and pedestrian friendly as they are today. In fact, their transportation choices are a direct result of policy decisions and infrastructure improvements that encouraged this behavior.

Case studies from North America and abroad demonstrate that street design can

make the difference between discouraging or encouraging bicycling and walking, particularly for vulnerable or less experienced users such as children and seniors. Many transportation practitioners point to European "cycle tracks" or physically separated bikeways as a key factor in encouraging people to bicycle, because they provide a greater degree of separation from vehicle traffic. Separated bikeways are bikeways within or adjacent to the roadway and separated from moving traffic by barriers/curbs, parking lanes, and/or striped buffers. They are more substantial than bicycle lanes, which are on-street bikeways delineated from the adjacent motor vehicle lane by only a painted stripe.

While common throughout the world, most notably in Denmark and the Netherlands, separated bikeways are not explicitly discussed in transportation design manuals in the United States. This is due to the potential, or perceived, safety and mobility issues they present, as discussed below. Alternatively, in the United States, two-way shared use paths adjacent to roadways are fairly common, but these facilities should not be considered separated bikeways as they are intended to accommodate a wide variety of nonmotorized users, a characteristic important for pedestrian safety and access, but one that limits bicycle accessibility. This characteristic is exemplified by the descriptive evolution of such facilities during the past two decades from a "Class I bikeway" to a "shared" or "multi-use path."

Danish research has shown that providing separated bikeways (versus providing no bicycle infrastructure) can increase bicycle ridership 18 to 20 percent, compared with the five to seven percent increase that has been attributed to bicycle lanes.<sup>1</sup> However, research has not yet

1. Jensen, Søren Underlien, Claus Rosendal and Niels Jensen. Road safety and perceived risk of cycle facilities in Copenhagen. Available at: [http://www.ecf.com/files/2/12/16/070503\\_Cycle\\_Tracks\\_Copenhagen.pdf](http://www.ecf.com/files/2/12/16/070503_Cycle_Tracks_Copenhagen.pdf)

BY BROOKE DUBOSE

demonstrated whether separated bikeways would result in a similar degree of mode shift within the North American context.

## EXISTING GUIDANCE

Many transportation practitioners have been hesitant to install physically separated bikeway facilities, despite their potential benefits. This hesitance appears to stem from the lack of North American-based research on the safety and effectiveness of such facilities, the lack of design standards suited for North America, and potential liability issues associated with these designs (deemed "unconventional" because of the lack of design standards). These types of facilities can also require a greater capital investment than basic bike lanes or signage.

Currently, nearly all discussion regarding paths for bicyclists in nationally accepted manuals, guides, and reports (including the American Association of Highway Transportation Officials (AASHTO) *Guide for the Development of Bicycle Facilities* and the Federal Highway Administration *Manual on Uniform Traffic Control Devices*) applies to "shared-use paths" that are generally two-way paths. Alternative types of paths, such as physically separated bikeways, are generally not recognized.

Before practitioners can construct separated bikeways, design and placement guidance is needed specific to the North American context. Fortunately, extensive guidance on separated bikeways already exists within European design manuals that could be adapted for use in North America.

## PREVIOUS RESEARCH

Some transportation professionals cite safety and operational concerns with separated bikeways, and they point to existing research that suggests there are still outstanding safety questions regarding the design of such bikeways. Specifically, some research suggests that the crash risk increases at intersections and driveways, where sightlines are limited and right of way between drivers and bicyclists is unclear. Two-way separated bikeways introduce additional issues since drivers may not anticipate bicyclists approaching from both directions. Some believe that teaching people to "drive bicycles" according to traffic laws more effectively improves safety compared to separated bikeways.



Figure 1. A traditional cycle track in Amsterdam, The Netherlands. The track is raised from the roadway and physically separated from vehicle traffic by on-street vehicle parking and a buffer zone.

These opinions raise important questions about if, when, and where separated bikeways are an appropriate design treatment.

Safety research regarding separation of bicycles and cars has been conducted since cars first appeared on the roadway. Specific research on separated bikeways has received significantly more attention within the last 30 years; however, the methodologies documented in the existing literature have shortcomings. Studies to date have had varying levels of reliable data and peer review, which has affected their credibility.

Much of the research was conducted in Europe during the 1980s and 1990s, when the first wave of cycle track designs were being introduced. Since that time, facility designs have been modified to improve safety; as a result, bicycling rates have increased. One complicating factor is that many studies focus on the effects of side paths (a path or sidewalk that has been designated for use by bicyclists that is within the public right of way but not directly adjacent to vehicle traffic) or sidewalks where riding is permitted. These designs are substantially different from separated bikeways. These differences in design make it difficult to draw meaningful correlations between study findings and the safety of modern separated bikeways.

A growing body of research is suggesting that separated bikeways encourage more people to bicycle, creating a "safety in numbers" effect (Jacobsen, 2003) that may re-

duce collision rates as drivers come to expect encounters with bicyclists more regularly. The existing research generally does not account for this phenomenon and the positive effect it can have on collision rates.

What is evident in reviewing the previous research is that transportation professionals have a clear need for new safety research on separated bikeways.

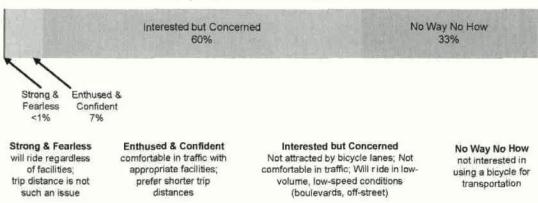
## QUANTIFYING DEMAND

Based on previous research and an ITE Pedestrian and Bicycle Council survey, current and potential cyclists have a clear interest in roadway designs that achieve separation from motor vehicle traffic. This is often expressed as a desire for bikeways and shared-use paths along roadways that provide physical separation (by barriers or differences in elevation) from motorists, especially in urban and suburban settings. For this reason, proponents of separated bikeways argue that less experienced bicyclists would be more inclined to bike on facilities where they feel more protected from traffic.

The actual role that separated bikeways could play in reducing auto vehicle trips and encouraging bicycle trips has yet to be quantified. Most of the existing literature on the demand for separated bikeways originates from Northern Europe, where studies have documented increased bicycle activity along cycle tracks, as well as the perceived and real safety

## Four Types of Transportation Cyclists in Portland

By Proportion of Population



"critical" for making cycling more mainstream, while only 2 percent stated that such bikeways were "never appropriate."

Future safety research will be critical to quantify the potential benefits of separated bikeways, document the relative need for these facilities, and inform the development of appropriate and uniform design guidance. Providing this information to practitioners would allow them to make sound engineering decisions regarding separated bikeways, and in turn, better meet the needs of current and potential bicyclists.

### CURRENT PRACTICE AND ONGOING EFFORTS

Many cities in North America have already installed physically separated bikeways by adapting existing guidance and using professional engineering judgment. Oftentimes, practitioners look to international examples for guidance on installation. The Dutch CROW Design Manual for Bicycle Traffic<sup>2</sup> is a widely used resource in the planning and design of separated bikeways. The Netherlands is a leader in bicycle transportation design. They have a bicycle crash and traffic fatality rate that is approximately half that of the United States per mile/kilometer traveled (Puscher, 2003). Illustrating the best practices in the use and installation of Dutch bicycle facilities, the CROW manual provides detailed standards for the application and design treatments for separated bicycle facilities. While many other jurisdictions in Europe, Asia, and Australia have also developed standards for this type of facility, the CROW manual may provide the most comprehensive and influential set of guidelines.

In the 2008 survey on separated bikeways, more than 75 locations with separated bikeway facilities were identified in the United States and Canada. Many of these facilities are most likely sidewalks and earlier variations of separated bikeway design that are often correlated with safety and operational concerns. However, a new generation of physically separated bikeways is now being installed.

2. The Centre for Research and Contract Standardization in Civil and Traffic Engineering. CROW is the Dutch National Information and Technology Platform for Transport, Infrastructure and Public Space. The not-for-profit organization is active in research and issuing standards and regulations, as well as distributing transportation knowledge products internationally.

Figure 2.

issues associated with these facilities. U.S.-based research of bicyclist preferences and behavior is limited. Jennifer Dill's 2008 study *Understanding and Measuring Bicycling Behavior* on bicyclist preferences in Portland, Oregon, USA is perhaps the most relevant. Dill examined rider characteristics and route choices and found that less experienced riders and women typically preferred routes with less traffic, and overall study participants were willing to travel out of their way to avoid streets with heavy vehicle traffic. This study did not specifically examine physically separated on-street bikeways (at the time of Dill's research there were no separated bikeways in Portland); however, her forthcoming study will evaluate the city's first physically separated bike lane on Broadway. Currently, North American-based research has not yet established a correlation between provision of separated bikeways and a reduction in vehicle trips or an increase in bicycling.

### POTENTIAL FOR MODE SHIFT

Throughout the United States, jurisdictions are expressing a desire for shifts to sustainable transportation modes to help meet targets for greenhouse gas (GHG) reductions. To support public health, mode shift, and climate-action goals, bikeway facilities should be designed to attract and accommodate all types of bicyclists, especially those that are most vulnerable and less experienced, such as children and seniors. To this end, an understanding of

which types of facilities would best attract new riders is an integral step toward the development of more sustainable transportation systems.

The city of Portland's department of transportation posits that only a small percentage of the general population is comfortable and confident about bicycling, while the vast majority is "interested but concerned." This second group has the most potential to affect mode shift. If less confident bicyclists were provided with more protected facilities, opportunities to increase bicycling trips could expand dramatically. The potential public health benefits of additional cycling trips for recreational or optional travel are also significant. Despite this opportunity, many transportation practitioners are hesitant to install physically separated bikeway facilities for reasons previously noted.

Meanwhile, the interest in physically separated facilities continues to rise. In 2008, the ITE Pedestrian and Bicycle Council conducted a survey of members from two organizations based primarily in the United States and Canada: ITE and the Association of Pedestrian and Bicycle Professionals (APBP). With more than 400 responses, the survey demonstrated substantial interest in separated bikeways. Seventy-three percent of respondents indicated that separated bikeways were being used where they live, which translates to 45 states and five provinces. Seventy-four percent stated they thought separated bikeways were "important" or

**Figure 3. Recommended Bicycle Facility Based on Speed & Volume**

Maximum Motor Vehicle Speed	Motor Vehicle Traffic Volumes	Type of Bike Facility
<b>19 mph</b>	1,000-5,000 ADT	<ul style="list-style-type: none"> <li>Shared roadway for &lt;2,000 bicycles/day</li> <li>Shared roadway or bike lane for &gt;2,000 bicycles/day</li> </ul>
	>4,000 ADT	<ul style="list-style-type: none"> <li>Bike lane or separated bikeway</li> </ul>
<b>31 mph</b>	Irrelevant	<ul style="list-style-type: none"> <li>Bike lane on roadways with low bicycle volumes (&lt;1,000/day)</li> <li>Separated bikeway for wider roadways and routes with higher bike volumes (&gt;1,000/day)</li> </ul>
<b>43 mph</b>	Irrelevant	<ul style="list-style-type: none"> <li>Separated bikeway</li> </ul>

Source: Dutch CROW Manual

These examples and others provide an opportunity to initiate North American-based safety research and to better understand the potential of such facilities to attract new bicyclists. Here are a few noteworthy examples:

- **Cambridge, MA** was the first to install the latest generation of physically separated bikeway design in the United States. The Vassar Street bikeway is raised to the sidewalk level and provides some valuable lessons in properly delineating pedestrian and bicycle space, as well as the importance of accommodating bicyclists at intersections where conflicts are most likely to occur.

- **New York City** has installed more than a half-dozen unique separated bikeway designs, including a center-running bikeway adjacent to a pedestrian mall (Allen Street), a two-way bikeway along the waterfront (Kent Avenue), a raised bikeway with rolled curbs (Sands Street), and a one-way bikeway with protected signal phases that separate bicycle movements from turning vehicle traffic (9th Avenue). Driveways are a rarity in New York City, which has allowed the city to experiment with a number of designs with minimal vehicle conflict points. The city has been collecting before-and-after collision and volume data at each of these locations.

- **Portland, OR** completed its first separated bikeway project in 2010. The design includes green bike boxes for left-turning movements and a three-foot buffer between the bike lane and



**Figure 4. 15th Street cycle track, Washington, DC.**

Source: DOT

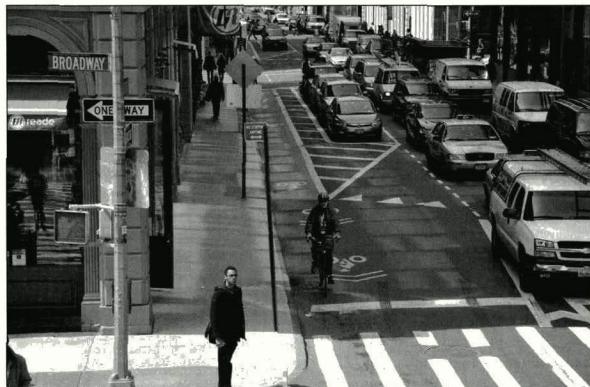
on-street parking that also serves as an ADA-accessible loading zone. The city plans to elevate the bikeway to a separate grade above the roadway.

- **Washington, DC** recently installed a one-way contraflow bikeway along a residential one-way street where no parallel street could accommodate a bike lane. The design includes sharrows

along one of the vehicle travel lanes to provide two-way access for bicyclists.

- **Vancouver, BC** opened a two-way bikeway along a busy commercial street through the downtown core last fall. The design includes a wide landscaped buffer with bike parking. Multiple efforts are underway to evaluate the potential demand and safety benefits of separated bikeways, as well as to provide better design guidance on these and other innovative bike facilities:

- The **ITE Pedestrian and Bicycle Council** continues to investigate current practices, safety research, and the latent demand for separated bikeways. Most recently, the council sponsored an informational report on the current state of the



**Figure 5. New York City is using design treatments that use traffic signal coordination to reduce conflicts and merge bicyclists and motor vehicles at intersections.**

Source: NYCDOT

practice for separated bikeways in North America. (This report is under final review and will be released some time in 2011.) As part of this effort, a research needs statement has been submitted for National Cooperative Highway Research Program (NCHRP) funding consideration.

- **Cities for Cycling**, a project of the National Association of City Transportation Officials (NACTO), brings together a coalition of major U.S. cities to push for greater innovation in bicycle design guidelines. Recognizing the current limitations of federal guidelines, Cities for Cycling is now developing an *Urban Bikeway Design Guide*, which will provide detailed guidance and best practices in bicycle design from around the world. This companion guide will be instrumental for local practitioners looking to install innovative treatments that are not included in AASHTO's Guide to the Development of Bicycle Facilities and the Federal Highway Administration's (FHWA) Manual on Uniform Traffic Control Devices (MUTCD).

## CONCLUSIONS

Although we still have much to learn about the appropriate application of separated bikeways in North America, they have the potential to play an important role in pushing beyond the two percent bicycle mode share we have here today. Indeed, this type of bicycle facility is becoming more common, with the goal of attracting new bicycle trips as part of a larger strategy for a more balanced healthy and sustainable transportation system. Many jurisdictions are developing their own versions of these facilities and others are interested in developing them in the future.

To ensure that these types of innovative treatments are both safe and effective in their design, future research and transportation engineering and planning manuals and guidelines should first establish whether this facility type is appropriate in the North American context and then provide comprehensive design practices and criteria for implementation. Additionally, national research is important to inform the development of appropriate and uniform design guidance. Providing

# ALTHOUGH WE STILL HAVE MUCH TO LEARN ABOUT THE APPROPRIATE APPLICATION OF SEPARATED BIKEWAYS IN NORTH AMERICA, THEY HAVE THE POTENTIAL TO PLAY AN IMPORTANT ROLE IN PUSHING BEYOND THE TWO PERCENT BIKE MODE SHARE WE HAVE HERE TODAY.

this information to practitioners will allow them to make sound engineering decisions regarding separated bikeways, and in turn, better meet the needs of current and potential bicyclists. With more research on separated bikeway safety and demand, followed by an established set of design guidelines, practitioners will have another tool with which to plan and design bikeway systems that will promote active, healthy, and sustainable transportation choices. ■

## References

- Dill, J., 2008. *Understanding and Measuring Bicycling Behavior: a Focus on Travel Time and route Choice*. Oregon Transportation Research and Education Consortium. Available at: [http://www.ibpi.usp.pdx.edu/media/OTREC\\_Dill\\_BikeGPS\\_Report.pdf](http://www.ibpi.usp.pdx.edu/media/OTREC_Dill_BikeGPS_Report.pdf)
- Geyer, J., et al., 2006. *The Continuing Debate about Safety in Numbers—Data from Oakland, California*. Paper UCB-ITS-TSC-RR\_2006-3. UC Berkeley Traffic Safety Center. Available At:

<http://escholarship.org/uc/item/5498x882>

Jacobsen, P. 2003. Safety in numbers: more walkers and bicyclists, safer walking and bicycling (pdf). *Injury Prevention*, 9:205-209.

Jensen, S., et al. Road safety and perceived risk of cycle facilities in Copenhagen. Available at: [http://www.ecf.com/files/2/12/16/070503\\_Cycle\\_Tracks\\_Copenhagen.pdf](http://www.ecf.com/files/2/12/16/070503_Cycle_Tracks_Copenhagen.pdf)

Linderholm, L. 1984. *Signalled Intersections Function and Accident Risk for Unprotected Road Users*. University of Lund, Sweden.

Petritsch et el., 2006. *Sidepath Safety Model—Bicycle Sidepath Design Factors Affecting Crash Rates*. TRR 1982. Available at: <http://www.springleconsulting.com/PDFs/Sidepath%20Safety%20Model%20-%20Bicycle%20Sidepath%20Design%20Factors%20Affecting%20Crash%20Rates.pdf>

Pucher, J., and Dijkstra, L. Promoting Safe Walking and Cycling to Improve Public Health: Lessons from The Netherlands and Germany, *American Journal of Public Health*, Vol. 93, No. 9, September 2003.

Räsänen, M., 1995. *How to Decrease the Number of Bicycle Accidents? A Research Based on Accidents Studied by Road Accident Investigation Teams and Planning Guides of Four Cities*. Finnish Motor Insurer's Centre, Traffic Safety Committee of Insurance Companies. VALT. Finland.

Wachtel, A. and Lewiston, D., 1994. *Risk factors for bicycle-motor vehicle collisions at intersections*. Journal of the Institute of Transportation Engineers, pp 30-35, September, 1994.



**BROOKE DuBOSE**

is a transportation planner for Fehr & Peers, specializing in nonmotorized projects throughout California. Ms. DuBoise has worked on a wide range of

projects, from specific intersection improvements to countywide bicycle and pedestrian master plans. She has designed a variety of bike facilities, including highway interchange improvements, multi-use trails and bicycle parking systems. Prior to Fehr & Peers, Brooke worked for Transportation Alternatives, New York City's leading advocate for walking, biking, and public transit. She provided technical assistance to communities throughout New York City to help design safe and livable streets. Brooke currently serves on the board of directors for the San Francisco Bicycle Coalition.