ADVISORY BICYCLE LANES – REALITY VERSUS DESIGN GUIDANCE

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ABSTRACT

An advisory bicycle lane is a roadway striping configuration which supports two-way motor vehicle and two-way bicycle traffic using a central vehicle travel lane and “advisory” bicycle lanes on either side. The center lane is shared by motorists traveling in both directions. The bicycle lanes on either side are for travel in one direction only. Bicyclists have preference in the bike lanes but motorists can encroach, after yielding to cyclists, in order to bypass oncoming vehicles.

Advisory bicycle lanes (ABLs) are a new and inexpensive treatment in North America which can provide bicycle facilities on roads too narrow for standard bicycle lanes. Thousands of road-miles are candidates for ABLs. Despite its potential, this facility has seen little study in North America.

The Netherlands has thousands of road-kilometers of ABLs and substantial experience with this facility. Dutch design guidance may provide easily-adopted lessons for the U.S and Canada.

A recent survey of eleven existing ABLs in the U.S. and Canada found center lane widths ranging from 9 feet to 21 feet, bike lane widths ranging from 4.5 feet to 6 feet, posted speed limits of 25-30 MPH, and ADT levels ranging from 200 to 5,000.

This paper compares existing ABLs in the U.S. and Canada to American and Dutch guidance, finds that a number of design values conflict with available guidance, and concludes that more research is needed on design guidance suitable for the North American context.

Keywords: Advisory Bike Lane, Advisory Bicycle Lane, Design Guidance, Research Needs

INTRODUCTION

An advisory bicycle lane (ABL) is a roadway striping configuration which provides for two-way motor vehicle and two-way bicycle traffic using a central vehicle travel lane and "advisory" bicycle lanes on either side. The center lane is dedicated to, and shared by, motorists traveling in both directions. The bicycle lanes on either side are for travel in one direction only. Bicyclists are given preference in the bike lanes but motorists can encroach into the bike lanes, after yielding to cyclists, in order to bypass oncoming vehicles.

Operation of an ABL-equipped roadway is demonstrated in the figures below courtesy of the FHWA Small Town and Rural Multimodal Networks Guide *(1)*, in which the bicycle lanes are called the advisory shoulder space.

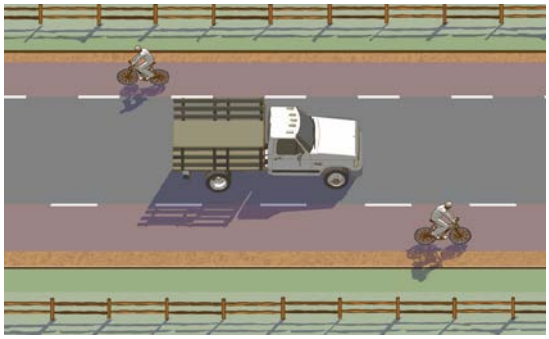

FIGURE 1 Motorists travel in the two-way center travel lane. When passing a bicyclist, no lane change is necessary.

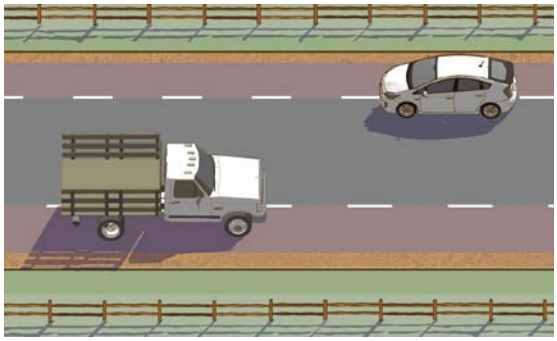

FIGURE 2 When two motor vehicles meet, motorists may need to encroach into the advisory shoulder space.

An ABL-equipped roadway has no center line and differentiates the center lane from the bicycle lanes with broken lines rather than the solid line used for standard bicycle lanes. The broken line indicates a permissive condition allowing motor vehicles to move into the bicycle lanes after yielding to any bicyclists. A variety of treatments are possible at the outside edge of the bicycle lane, e.g. edge line, unmarked edge of pavement, or an on-street parking lane. Current North American installations are dominated by five foot wide bike lanes and center travel lane widths ranging from nine feet to twenty-one feet *(2)*. On roads lacking sidewalks, the bike lanes may serve as pedestrian facilities.

According to the FHWA Small Town and Rural Multimodal Networks Guide *(1)*, ABLs are appropriate for roads with posted speed limits of 35 MPH or less and with volumes of less than 6,000 ADT.

ABLs have the potential to inexpensively provide thousands of miles of pedestrian and bicycle facilities. Rural roads with little chance of widening to support bicycle or pedestrian facilities are candidates. Urban roads on which removal of on-street parking is considered infeasible to allow installation of dedicated bicycle lanes are candidates. Legacy roads of substandard width are candidates. Any two-way roadway which is currently too narrow for dedicated bicycle lanes may be a candidate for an ABL treatment.

ABLs are popular in other countries. The Netherlands have over a thousand kilometers of ABLs in their country *(3)*. They have found them to be safe and attractive to cyclists.

ADVISORY BICYCLE LANES IN NORTH AMERICA

ABLs are being implemented in North America. The first ABL was installed in 2011 in Minneapolis, MN. Eleven installations were known as of June, 2017 with ten in the United States and one in Canada. More facilities are in the design stage. Given the thousands of road-miles which are potential candidates

for an ABL installation, the ABL's ability to inexpensively provide bicycle facilities, and its ability to provide bicycle facilities on roads with too little width for standard bicycle lanes, continued expansion of its use seems likely.

LITERATURE REVIEW

Despite their potential, the use of ABLs in North America has received little examination. This is primarily due to the small number of installations and their recency. The only published North American literature found regarding this facility are a high-level design guide published by the FHWA for the rural context *(1)* and a white paper on existing ABL installations in North America *(2)*.

Four of the ten communities interviewed for the white paper *(2)* had conducted studies of their installations. Those communities were: Boulder, CO, Hanover, NH, Minneapolis, MN, and Edina, MN. These studies were, of necessity, based on limited data. The average facility length was 1589 feet, average ADT was 2000, and average facility age was 4 years.

A number of studies assessing the impact of ABLs have been conducted outside North America, primarily in the Netherlands. These studies involve many kilometers of roadway and longer durations. Application of their findings to the North American context may be difficult or controversial.

The Dutch CROW Design Manual for Bicycle Traffic *(4)* is the Netherlands' design guidance for bicycle facilities and incorporates lessons learned from their experience.

PURPOSE

The primary purpose of this paper is to compare the design parameter values of existing American and Canadian ABL installations to American and Dutch guidance, review any conflicts and assess the implications of those conflicts. Parameters to be evaluated are center lane width, bike lane width, traffic volumes and posted speed limits.

SUMMARY OF AMERICAN DESIGN GUIDANCE

Existing North American design guidance for this facility comprises three sources: 1) the FWHA Small Town and Rural Multimodal Networks Guide *(1)*, 2) Lessons Learned: Advisory Bicycle Lanes in North America white paper *(2)*, and 3) the FHWA webpage on experimentation with "dashed bicycle lanes" *(5)*.

The white paper *(2)* introduces no new design guidance and defers to the FHWA Small Town and Rural Multimodal Networks Guide (also called the Small Town Guide in this paper) *(1)* in that area. The FHWA webpage *(5)* differs from the more-recently published Small Town and Rural Multimodal Networks Guide *(1)* in some areas, e.g. center lane width.

Center Lane Width

The Small Town Guide *(1)* gives four recommendations for center lane width. It recommends a minimum width of 10 feet, a preferred minimum width of 13.5 feet, a preferred maximum width of 16 feet, and an absolute maximum width of 18 feet. The FHWA webpage *(5)* suggests a center lane width of 16 feet or greater but is assumed to be superseded by the Small Town Guide *(1)*.

Bike Lane Width

The Small Town Guide *(1)* describes the bike lanes as having an absolute minimum width of 4 feet and a preferred width of 6 feet.

Traffic Volumes And Speeds

With respect to volume, the Small Town Guide *(1)* recommends a preferred ADT of less than 3,000 and a maximum ADT of 6,000. The maximum ADT appears to be driven by the MUTCD's *(6)* requirement that streets over 6,000 ADT are required to possess a centerline. The Small Town Guide *(1)* recommends a preferred speed of 25 MPH or less and a potential maximum speed of 35 MPH.

North American design guidance makes no reference to bicycle volumes. This is likely due to the lower rate of cycling which limits experience in this area and reduces concern for the rare occurrence of facility oversubscription.

SUMMARY OF DUTCH DESIGN GUIDANCE

The Dutch CROW Design Manual for Bicycle Traffic *(4)* is the Netherlands' design guidance for bicycle facilities. There are a significant number of studies on ABLs performed by the Dutch but only published design guidance will be referenced for this work.

Center Lane Width

The CROW manual *(4)* prohibits center lane widths from 3.8 m (12.5 feet) to 4.8 m (15.75 feet) on all ABLs because "it is unclear whether the space is intended for one car or two". This introduces doubt into the mind of the motorist which can lead to poor decisions.

Both urban and rural settings can use ABLs with center lane widths below 3.8 m. No minimum center lane width is provided and examples of center lanes narrower than a single car exist in the Netherlands.

Center lanes above 4.8 m are prohibited in a rural setting due to the higher speeds expected there. Urban areas can use center lane widths over 4.8 m (5.5 m is recommended) to increase street capacity but additional traffic calming should be considered for these larger center lanes. A maximum width of 6 m (19.7 feet) is shown for an ABL center lane *(4)*.

Bike Lane Width

Bike lanes should range from 1.7 m to 2.25 m (5.5 feet to 7.4 feet) wide with a recommended width of 2 m (6.5 feet) *(4)*.

Traffic Volumes And Speeds

An ABL can be placed on rural residential streets with 30 or 60 KPH (19 or 37 MPH) speed limits as long as volumes range from 2,000 to 3,000 ADT *(4)*.

On urban streets with 30 KPH speed limits, more than 500 bikes/day, and 2-5,000 ADT, an ABL can be used; above 4,000 ADT exploration of a separate cycle path is recommended. ABLs can only be used on urban roads with speed limits of 50 KPH (31 MPH) if the center lane is large enough to allow two passenger vehicles to pass without entering the cycle lanes (4.8 – 6 m / 15.75 – 20 ft) *(4)*.

EXAMINATION OF U.S. AND CANADIAN ABLS

Center Lane Widths

The center lane widths of the ABLs surveyed in *Lessons Learned (2)* are listed in the table below.

TABLE 1 Center Lane Widths Of American And Canadian ABLs

City	Street	Center Lane Width (ft/m)
Burlington, VT	Flynn Ave	10/3 & 18/5.5
Boulder, CO	Harvard Lane	15/4.6
Sandpoint, ID	Oak St	21/6.4
Hanover, NH	Valley Road	10/3
Minneapolis, MN	E. 14th/Grant St	17/5.2

Bloomington, IN	E. 7th St	13/4
Alexandria, VA	Potomac Greens Dr	17/5.2
Cambridge, MA	Irving/Scott St	9/2.7
Cambridge, MA	Lakeview Ave	9/2.7
Edina, MN	54th St	15/4.6
Ottawa, ON	Somerset St East	14/4.3

Bike Lane Widths

The bike lane widths of the ABLs surveyed in *Lessons Learned (2)* are listed in the table below.

TABLE 2 Bike Lane Widths Of American And Canadian ABLs

City	Street	Bike Lane Width (ft/m)
Burlington, VT	Flynn Ave	5/1.5
Boulder, CO	Harvard Lane	5/1.5
Sandpoint, ID	Oak St	5/1.5
Hanover, NH	Valley Road	5/1.5
Minneapolis, MN	E. 14th/Grant St	6/1.8
Bloomington, IN	E. 7th St	5/1.5
Alexandria, VA	Potomac Greens Dr	5/1.5
Cambridge, MA	Irving/Scott St	5/1.5
Cambridge, MA	Lakeview Ave	5/1.5
Edina, MN	54th St	5/1.5
Ottawa, ON	Somerset St East	4.5/1.4 & 6/1.8

Traffic Volumes And Speeds

The traffic volumes and posted speed limits of the ABLs surveyed in *Lessons Learned (2)* are listed in the table below.

TABLE 3 Traffic Volumes And Posted Speed Limits Of American And Canadian ABLs

City	Street	MV ADT	Bike ADT	Posted Speed Limit (MPH/KPH)
Burlington, VT	Flynn Ave	5000	N/A	25/40 & 15/24
Boulder, CO	Harvard Lane	380	1600	25/40
Sandpoint, ID	Oak St	810	N/A	25/40
Hanover, NH	Valley Road	468	54	25/40

Minneapolis, MN	E. 14th/Grant St	4700	285	30/48
Bloomington, IN	E. 7th St	200	N/A	25/40
Alexandria, VA	Potomac Greens Dr	2000	N/A	25/40
Cambridge, MA	Irving/Scott St	1000	N/A	30/48
Cambridge, MA	Lakeview Ave	1000	N/A	30/48
Edina, MN	54th St	2450	N/A	30/48
Ottawa, ON	Somerset St East	1000	1900	25/40

TABLE 3 Notes:
MV ADT = Motor Vehicle Average Daily Traffic
Bike ADT = Bike Average Daily Traffic
N/A = Not Available

DISCUSSION

One caveat which must be mentioned when comparing design guidance from the Netherlands to the U.S. and Canada is the difference in vehicle size. Motor vehicles tend to be smaller in the Netherlands and this can make direct application of Dutch dimensional design guidance difficult.

Center Lane Width

Two ABLs, both in Cambridge, MA, possess center lanes narrower than the American guidance suggests as a minimum. It is interesting to note that these two facilities have posted speed limits of 30 MPH rather than 25 MPH.

One ABL, in Sandpoint, ID, possesses a center lane significantly wider than the maximums recommended by both American and Dutch guidance. The Sandpoint street is wide enough to support ten foot wide vehicle lanes and five foot wide bike lanes. The community prefers wider vehicle lanes. An ABL allowed them to provide that and bicycle facilities without removing on-street parking.

Dutch guidance prohibits center lanes between 3.8 m (12.5 feet) and 4.8 m (15.75 feet) *(4)*. Four of the eleven installations possess center lane widths within this range. Increasing this range slightly to account for larger American vehicle dimensions, 13.5 feet to 16.75 feet, for example, does not change this number. These installations may face problems with a center lane width in this ambiguous zone.

Bike Lane Width

Existing ABLs are dominated by the 5 foot wide bike lane. Only two of the eleven installations have bike lanes of different width. A 5 foot bike lane falls in the middle of the American guidance but falls below the Dutch minimum. Dutch guidance requires a minimum 1.7 m (5.5 ft) *(4)*, not including the pavement markings, in order to support parents riding next to children, bicyclists overtaking slower bicyclists and companions riding side-by-side. Bike lanes of 5 foot width may produce degraded experiences, conflict, or collisions on these facilities.

Traffic Volumes And Speeds

All of the existing ABLs are in an urban setting. Despite the lack of rural installations, the Dutch restriction on ABL placement on roads with posted speed limits of 60 KPH (near 35 MPH) to traffic volumes of less than 3,000 ADT *(4)* provides an alternate perspective to the American guidance which does not explicitly suggest a reduction of traffic volume as vehicular speeds increase.

In no situation does Dutch guidance allow the use of ABLs on streets with more than 5,000 ADT and suggests exploring other alternatives if over 4,000 ADT *(4)* while American guidance allows siting on

streets with up to 6,000 ADT *(1)*. American guidance may produce higher crash rates and more severe crashes for ABLs than seen in the Netherlands.

On urban streets with a posted 50 KPH speed limit (near 30 MPH), Dutch guidance requires the center lane be wide enough to allow two passenger vehicles to pass without entering the bike lanes (4.8 – 6 m / 15.75 – 20 ft) *(4)*. This requirement does not exist in the American guidance. Seven of the existing ABL installations feature 25 MPH speed limits and four have 30 MPH speed limits. Of the ABLs posted at 30 MPH, only one has a center lane above 15.75 feet. The remaining three have center lanes which cannot support oncoming vehicles passing without use of the bike lanes. This may lead to higher crash rates and more severe crashes for ABLs than seen in the Netherlands.

Consideration of additional traffic calming measures for ABLs with center lane widths above 4.8 m is included in the Dutch guidance *(4)* but not in the American guidance *(1)*. This may lead to higher crash rates and more severe crashes for ABLs than seen in the Netherlands.

CONCLUSION

ABLs have the potential to provide bicycle facilities quickly and cheaply across the U.S. and Canada. Little study has been done on the use of ABLs in the U.S. and Canada. This has led to design guidance and installed facilities which differ from Dutch design guidance. Dutch design guidance is based on extensive experience with this facility. Issues which are addressed by Dutch guidance but not by American guidance may lead to higher crash rates and/or more severe crashes in American and Canadian ABLs. This suggests that there may be more to learn about the use of ABLs in the U.S. and Canada that has already been learned in other countries.

From the information presented here, it is possible that existing American guidance may result in ABLs which are more dangerous than necessary. This could lead to results under the FHWA experimentation process which advise against ABLs or rule out safer designs.

More research is needed to determine if these issues, or others, need to be addressed in future design guidance for ABLs.

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