

Critique of the 2012 AASHTO
*Guide for the Development of
Bicycle Facilities*
Bicycle Lane width specifications



Wayne Pein
wpein@nc.rr.com

February 2014

AASHTO Guidelines

In describing the bicycle Design Vehicle, on page 3-2 of the 2012 AASHTO *Guide for the Development of Bicycle Facilities* it says,

“Critical physical dimensions for upright adult bicyclists are shown in Figure 3-1. The minimum operating width of 4 ft (1.2 m), sufficient to accommodate forward movement by most bicyclists, is greater than the physical width momentarily occupied by a rider because of natural side-to-side movement that varies with speed, wind, and bicyclist proficiency. Additional operating width may be needed in some situations, such as on steep grades, and the figure does not include shy distances from parallel objects such as railings, tunnel walls, curbs, or parked cars. In some situations where speed differentials between bicyclists and other road users are relatively small, bicyclists may accept smaller shy distances. However this should not be used to justify designs that are narrower than recommended minimums.”

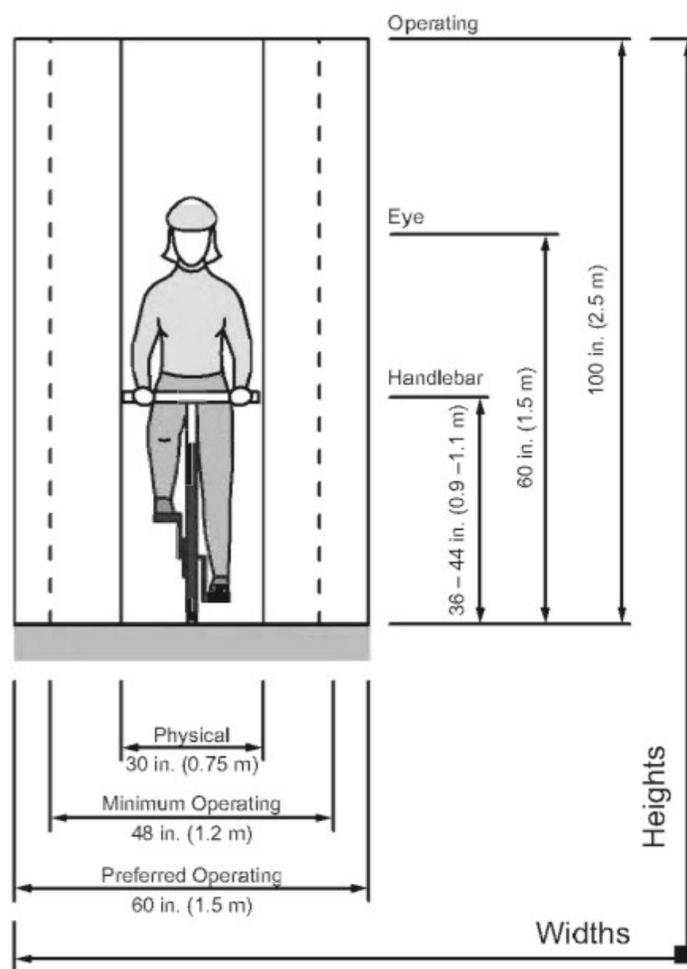
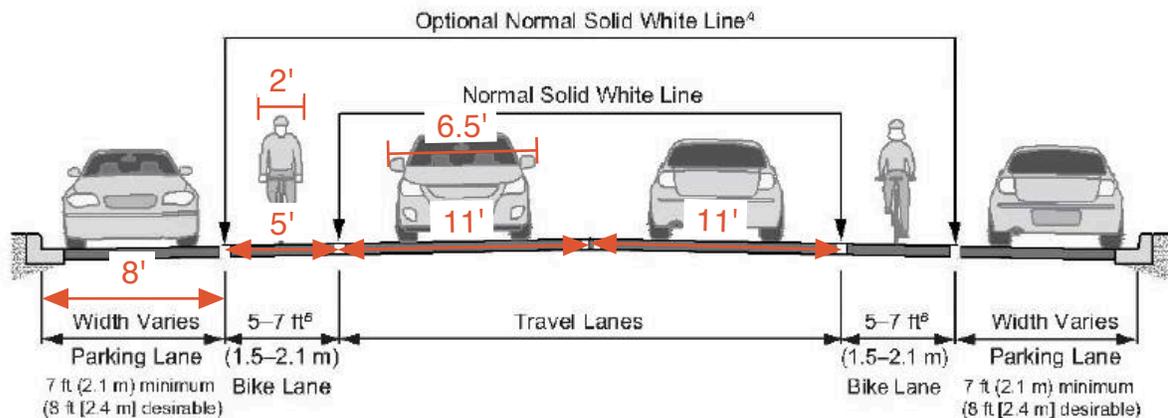
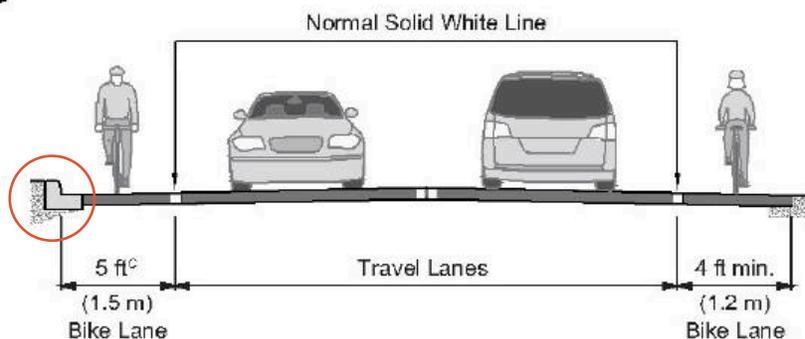


Figure 3-1. Bicyclist Operating Space

Shown below are Figure 4-13 and the accompanying text on bicycle lane widths from pages 4-14 to 4-16 of the AASHTO *Guide*. I have added the scaling in red.



On Street Parking



Parking Prohibited

Notes:

- ^A An optional normal (4–6-in./100–150-mm) solid white line may be helpful even when no parking stalls are marked (because parking is light), to make the presence of a bicycle lane more evident. Parking stall markings may also be used.
- ^B Bike lanes up to 7 ft (2.1 m) in width may be considered adjacent to narrow parking lanes with high turnover.
- ^C On extremely constrained, low-speed roadways (45 mph [70 km/h] or less) with curbs but no gutter, where the preferred bike lane width cannot be achieved despite narrowing all other travel lanes to their minimum widths, a 4-ft (1.2-m) wide bike lane can be used.

Figure 4-13. Typical Bike Lane Cross Sections

Figure 4-13 Criticisms: Bicyclists are depicted as just 2 feet wide. Did the authors forget about their Figure 3-1? Trucks and buses with 8.5 foot wide bodies and 10 foot plus mirror span are not used, travel lane width is not a variable, and parked car doors are not open. These omissions disingenuously make it appear as if there is abundant space between users. Further, Bike Lane width improperly includes the gutter pan, in opposition to written instruction in both the 1999 and 2012 *Guide* (further description on page 10). The gutter pan is not usable surface on which to operate; it is for storm water management and provides a buffer to the vertical curb face.

“4.6.4 Bicycle Lane Widths

Bicycle lane widths should be determined by context and anticipated use. The speed, volume, and type of vehicles in adjacent lanes significantly affect bicyclists' comfort and desire for lateral separation from other vehicles. Bike lane widths should be measured from the center of the bike lane line. The appropriate width should take into account design features at the right edge of the bicycle lane, such as the curb, gutter, on-street parking lane, or guardrail. Figure 4-13 shows two typical locations for bicycle lanes in relation to the rest of the roadway, and the widths associated with these facilities.

As discussed in the previous chapter, a bicyclist's preferred operating width is 5 ft (1.5 m). Therefore, under most circumstances the recommended width for bike lanes is 5 ft (1.5 m). Wider bicycle lanes may be desirable under the following conditions:

- * Adjacent to a narrow parking lane (7 ft [2.1 m]) with high turnover (such as those servicing restaurants, shops, or entertainment venues), a wider bicycle lane (6-7 ft or 1.8-2.1 m) provides more operating space for bicyclists to ride out of the area of opening vehicle doors.
- * In areas with high bicycle use and without on-street parking, a bicycle lane width of 6 to 8 ft (1.8-2.4 m) makes it possible for bicyclists to ride side-by-side or pass each other without leaving the lane.
- * On high-speed (greater than 45 mph [70 km/h]) and high-volume roadways, or where there is a substantial volume of heavy vehicles, a wide bicycle lane provides additional lateral separation between motor vehicles and bicycles to minimize wind blast and other effects.

Where bicycle lanes are provided, appropriate marking or signing should be used so the lanes are not mistaken for motor-vehicle travel lanes or parking areas. For roadways with no curb and gutter and no on-street parking, the minimum width of a bicycle lane is 4 ft (1.2 m). For roadways where the bike lane is immediately adjacent to a curb, guardrails, or other vertical surface, the minimum bike lane width is 5 ft (1.5 m), measured from the face of a curb or vertical surface to the center of the bike lane line. There are two exceptions to this:

- * In locations with higher motor-vehicle speeds where a 2-ft (0.6 m) wide gutter is used, the preferred bike lane width is 6 ft: (1.8 m), inclusive of the gutter.
- * On extremely constrained, low-speed roadways with curbs but no gutter, where the preferred bike lane width cannot be achieved despite narrowing all other travel lanes to their minimum widths, a 4-ft (1.2 m) wide bike lane can be used.

Along sections of roadway with curb and gutter, a usable width of 4 ft (1.2 m) measured from the longitudinal joint to the center of the bike lane line is recommended. Drainage inlets and utility covers are sometimes built so they extend past the longitudinal gutter joint. Drain inlets and utility covers that extend into the bike lane may cause bicyclists to swerve, and have the effect of reducing the usable width of the lane. This is a particular concern if the minimum operating width of the lane falls below 4 ft (1.2 m). Therefore, the width of the bike lane should be adjusted accordingly, or else the structures should be removed. Also, bicycle-compatible grates should be used (see Section 4.12).

Critique of Bicycle Lane width specifications

AASHTO Statement 1

“The minimum operating width of 4 ft (1.2 m), sufficient to accommodate forward movement by most bicyclists, is greater than the physical width momentarily occupied by a rider because of natural side-to-side movement that varies with speed, wind, and bicyclist proficiency. Additional operating width may be needed in some situations, such as on steep grades, and the figure does not include shy distances from parallel objects such as railings, tunnel walls, curbs, or parked cars. In some situations where speed differentials between bicyclists and other road users are relatively small, bicyclists may accept smaller shy distances. However this should not be used to justify designs that are narrower than recommended minimums.”

Criticism 1

In explaining Figure 3-1, 30 inch wide bicyclists are described as having a larger, forward-moving footprint that can be accommodated in a 4-foot space. This represents an insufficient 9 inches of left-right lateral variation to shelter bicyclists, who do not have protective metal crumple zones. Even the widest dual-track trucks and buses with 8.5 foot wide bodies have as much or more leeway in typical 10-12-foot lanes. Five feet should be the minimum width to accommodate bicyclists, and 6 feet should be standard.

Here the *Guide* correctly indicates that the minimum operating space is clear space, since it says there should be added shy distance (unspecified how much) to parallel objects. And, narrower designs are not allowed. Egregiously, both of these advisements are contradicted in later guidance.

AASHTO Statement 2

“Bicycle lane widths should be determined by context and anticipated use. The speed, volume, and type of vehicles in adjacent lanes significantly affect bicyclists' comfort and desire for lateral separation from other vehicles.”

Criticism 2

Bicycle lanes are intended to attract novices who, lacking experience and education, perceive the need for maximal lateral separation. Wide trucks and buses with 10-foot plus mirror spread should be expected as these are roadway “design vehicles.” Such vehicles are conspicuously absent from *Guide* drawings. And why isn't bicycle speed a design consideration?

AASHTO Statement 3

“Bike lane widths should be measured from the center of the bike lane line. The appropriate width should take into account design features at the right edge of the bicycle lane, such as the curb, gutter, on-street parking lane, or guardrail.”

Criticism 3

Bicycle lane width should be independent of adjacent design features, (except travel lane width as discussed in Criticism 4). As the narrowest lanes by far, bicycle lanes should fully clear space, with added buffer to lateral roadside elements.

AASHTO Statement 4

“As discussed in the previous chapter, a bicyclist's preferred operating width is 5 ft (1.5 m). Therefore, under most circumstances the recommended width for bike lanes is 5 ft (1.5 m).

Criticism 4

Bicycle drivers' “preferred” operating width is as wide as motorcyclists', a full lane width of 10-12 feet. Both types of narrow single-track vehicle operator rely on a [Space Cushion](#) as their primary means of protection from other vehicles and roadside features. If bicyclist operating space is to be reduced with the provision of a bicycle lane, then the bicycle lane should be a minimum of 5 feet of usable surface clear space.

Total width of bike lane and adjacent lane should be 17 feet minimum because the clearance between a bicyclist and adjacent traffic is a function of the combined width of both the bike lane and the adjacent traffic lane. A wide vehicle in a 12-foot travel lane adjacent to a 5-foot bike lane results in a mere 3-foot clearance to the bicyclist when both operators are at lane centers per lane design concept of operation.

Motor vehicles in the adjacent lane can be expected to sometimes drift and operate abutting the bicycle lane line. This creates a “parallel object” from which there is no buffer to the bike lane. In order to guarantee 3 feet of clearance from a motor vehicle abutting the bike lane line to a bicyclist at bike lane center, the bike lane should be 8.5 feet wide.

AASHTO Statement 5

“Wider bicycle lanes may be desirable under the following conditions:

- * Adjacent to a narrow parking lane (7 ft [2.1 m]) with high turnover (such as those servicing restaurants, shops, or entertainment venues), a wider bicycle lane (6-7 ft or 1.8-2.1 m) provides more operating space for bicyclists to ride out of the area of opening vehicle doors.
- * In areas with high bicycle use and without on-street parking, a bicycle lane width of 6 to 8 ft (1.8-2.4 m) makes it possible for bicyclists to ride side-by-side or pass each other without leaving the lane.
- * On high-speed (greater than 45 mph [70 km/h]) and high-volume roadways, or where there is a substantial volume of heavy vehicles, a wide bicycle lane provides additional lateral separation between motor vehicles and bicycles to minimize wind blast and other effects.”

Criticism 5

If bicycle lanes are to exist, wider bicycle lanes are always desirable, particularly since maximally wide trucks, buses, or pulled utility trailers can be expected in the adjacent lane. There should be a 5-foot minimum buffer between the bike lane and parked vehicles to protect bicyclists from suddenly opened doors which can extend as much as 4 feet.

AASHTO Statement 6

“For roadways with no curb and gutter and no on-street parking, the minimum width of a bicycle lane is 4 ft (1.2 m). For roadways where the bike lane is immediately adjacent to a curb, guardrails, or other vertical surface, the minimum bike lane width is 5 ft (1.5 m), measured from the face of a curb or vertical surface to the center of the bike lane line. There are two exceptions to this:

- * In locations with higher motor-vehicle speeds where a 2-ft (0.6 m) wide gutter is used, the preferred bike lane width is 6 ft: (1.8 m), inclusive of the gutter.
- * On extremely constrained, low-speed roadways with curbs but no gutter, where the preferred bike lane width cannot be achieved despite narrowing all other travel lanes to their minimum widths, a 4-ft (1.2 m) wide bike lane can be used.

Along sections of roadway with curb and gutter, a usable width of 4 ft (1.2 m) measured from the longitudinal joint to the center of the bike lane line is recommended. Drainage inlets and utility covers are sometimes built so they extend past the longitudinal gutter joint. Drain inlets and utility covers that extend into the bike lane may cause bicyclists to swerve, and have the effect of reducing the usable width of the lane. This is a particular concern if the minimum operating width of the lane falls below 4 ft (1.2 m). Therefore, the width of the bike lane should be adjusted accordingly, or else the structures should be removed. Also, bicycle-compatible grates should be used (see Section 4.12).

Criticism 6

Again, the minimum width of a bicycle lane should be 5 feet of usable surface clear space. If the bicycle lane is adjacent to a curb or other fixed vertical surface, an additional minimum of 2 feet of shy buffer is required from the edge of the bicycle lane.

If there is a concrete gutter pan, it is a minimally acceptable buffer from the curb face. The asphalt-gutter pan seam presents a diversion fall hazard.

Where a concrete gutter pan has been covered with asphalt, the bicycle lane is measured from the virtual hidden edge of the gutter pan. A longitudinal crack will develop along the gutter pan edge due to differing expansion and contraction rates and loading.

The *Guide* has claimed 4 feet is minimum bicycle lane width and bicyclists' preferred width is 5 feet, which should be used "under most circumstances." Yet it also says,

"In locations with higher motor-vehicle speeds where a 2-ft (0.6 m) wide gutter is used, the preferred bike lane width is 6 ft: (1.8 m), inclusive of the gutter."

A 6-foot bike lane "inclusive" of the gutter in locations where gutter pans are 2 feet wide would be only 4 feet of usable surface. Did the author mean *not* inclusive, and poor editorial review allowed this error?



Image 1. Clearly visible longitudinal crack in the asphalt covering a concrete 2-foot wide debris-filled gutter pan. MLK Jr. Blvd., Chapel Hill, NC.

The gutter pan, whether visible or covered by asphalt, is not usable space and is not inclusive in bicycle lane width as was clearly stated on page 23 of the 1999 AASHTO *Guide for the Development of Bicycle Facilities*:

“The width of the gutter pan should not be included in the measurement of the rideable (sic) or usable surface...”

Moreover, in discussing shared lanes on major roadways of the 2012 *Guide* it says on page 4-3,

“The gutter should not be included in the measurement as usable width,...”

There should be no exceptions. If a 5-foot bicycle lane cannot be achieved with proper buffer and minimum total 17 feet it should not be placed. Instead, Shared Lane Markings may be placed in the center of the effective usable travel lane and Bicycles May Use Full Lane signs may be installed.

Critique Conclusions

Bicycle lanes are a reduction in bicyclist space. A bicycle-only lane is narrow, and results in tight clearances compared to when bicycle users control full width travel lanes. Tight clearances are uncomfortable, risky, and result in poor sight lines and obscuration, leading to increased likelihood of several different collision mechanisms. For further insult, bicycle lanes harbor debris.

The 2012 AASHTO *Guide* is no better than the 1999 version. Four-foot minimum bicycle lanes are too narrow. Confusing, illogical, and contradictory prose reads as if written by committee and without an editor. It is used to rationalize substandard width bicycle lanes with no shy distances even though it says on page 3-2 that “...this should not be used to justify designs that are narrower than recommended minimums.” Further, wording to justify wider bicycle lanes is weak and unconvincing.

Figures A-E are *Streetmix* graphics. Bicyclists are scaled as only 2 feet wide and truck bodies are shown as just 8 feet rather than 8.5 feet.

According to AASHTO, the following “extremely constrained” cross section that originally was four 12-foot lanes is an allowable exception to already weak minimum standards. This design features 4-foot bicycle lanes, including when adjacent to the curb face, and narrow general travel lanes.

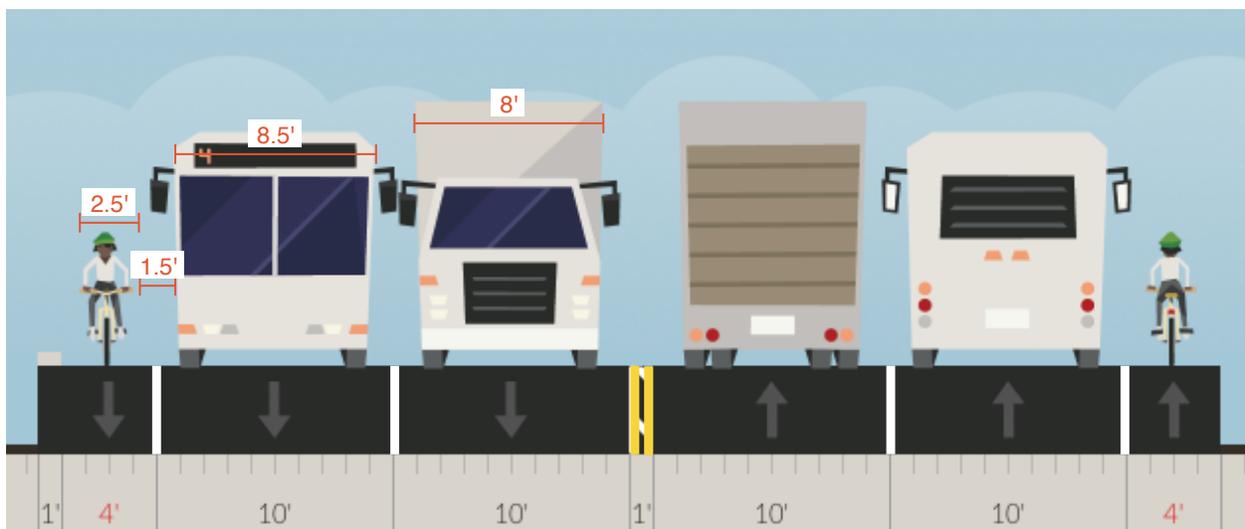


Figure A. AASHTO compliant minimums are unacceptable.

When used as intended by design with both vehicles tracking at lane centers, the lateral separation between bicyclist and adjacent bus body is just 1.5 feet; wide mirrors may be at head height.

Other horrendous AASHTO acceptable designs feature a Door Zone Bike Lane sandwiched between narrow parking and general travel lanes, and a bike lane with 4 feet of usable surface wedged between a 2-foot gutter pan (depicted as buffer stripping) and narrow travel lane.

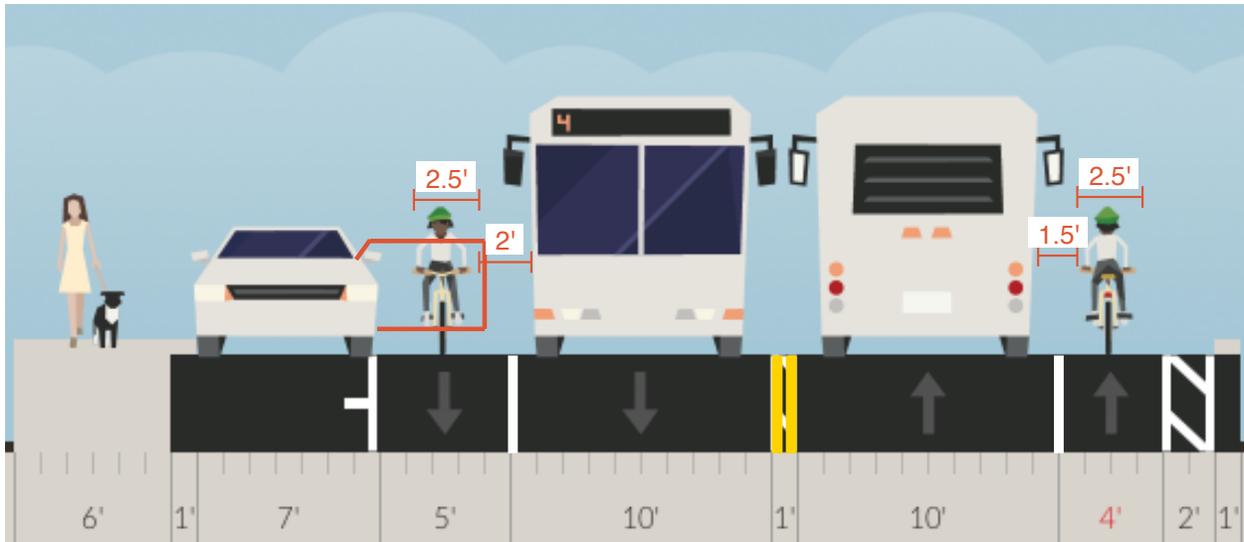


Figure B. AASHTO compliant minimum designs have proven deadly.

The 2 feet adjacent to the curb face is not usable travel space whether it is separate gutter pan or asphalt; it is buffer from the vertical surface.

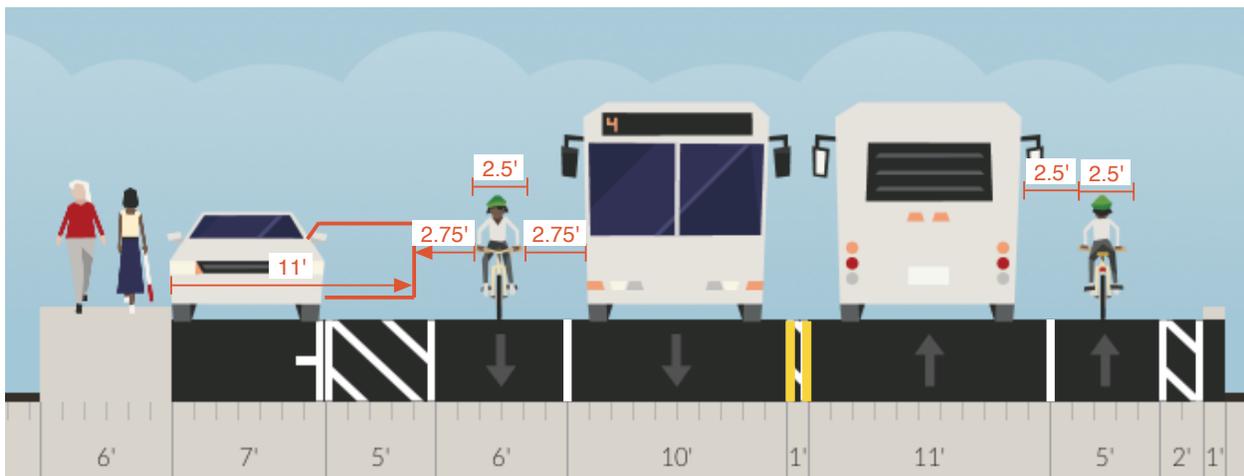


Figure C. Even 5 and 6-foot widths can expose the limitations of bike lanes.

Given a total width for bike lane and adjacent lane of 16 feet, the clearance to just the *body* of an 8.5-foot wide vehicle at lane center per lane use concept of operation is less than 3 feet.

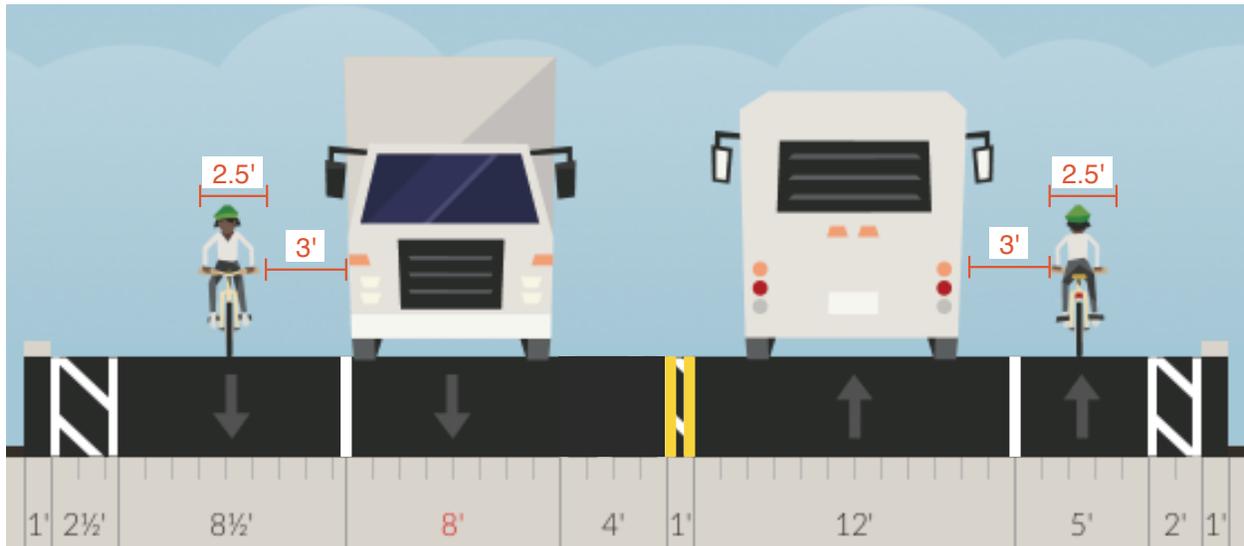


Figure D. Clearances: 1. and 2.

1. Motor vehicle drivers sometimes drift and operate abutting the bike lane line. To ensure a minimum 3-foot clearance when motor vehicles wander to the bike lane line, the bike lane must be 8.5 feet wide.

2. When operating at lane centers, a 12-foot travel lane and 5-foot bike lane (17 feet total) offer just 3 feet of clearance between bus body and bicyclist. A motor vehicle skimming the bike lane line results in 1.25 feet of clearance.

Appendix

Here I critique two additional 2012 AASHTO *Guide* roadway bicycling statements.

On page 3-5 of the 2012 AASHTO *Guide* it says,

“Bicyclists' Lateral Position on the Roadway Is Determined by Speed and Usable Width

Bicyclists ride as far right as practical, which on a typical roadway means that the bicyclist rides in (or near) the right tire track. A bicyclist traveling at the same speed as other traffic, or in a travel lane too narrow for a motor vehicle to safely pass without encroaching into the adjacent lane, travels in the center of the lane (often referred to as "taking the lane"). The primary reason for taking the lane is to encourage overtaking traffic to make a full lane change instead of squeezing past the bicyclist in the same lane. The Uniform Vehicle Code and most State codes support bicyclists' right to take the lane, if necessary. Most vehicle codes also allow exceptions to the rightmost position on the road requirement for reasons such as avoiding hazards, passing other bicyclists and preparing for and making left turns. Slower bicyclists travel to the right of faster bicyclists (and other vehicles). Like other vehicles, emergency stops made by bicyclists must occur at the rightmost position on the road.”

Criticism

General traffic “Far To Right” laws originally were written to clarify use of roads without lane markings. Many — but not all — places have distorted these laws to apply to bicyclists even in marked lanes as described by the *Guide*. Bicycle specific “Far To Right” laws should be repealed, as they compromise bicyclist safety for motorist convenience. Bicycle driver right-of-way should be superior to the right-of-speed.

Like motorcyclists who also primarily rely on a [Space Cushion](#) for safety and are instructed to protect their lane space, by default bicyclists should assume a lane control lateral position to deter within-lane passing and encourage caution in motorists with a full lane change. Such a leftward position also reduces the risk of Left Cross, Right Hook, and Drive Out type collisions. This is defensive bicycling.

On page 4-3 of the 2012 AASHTO *Guide* it says,

“4.3.1 Shared Lanes on Major Roadways (Wide Curb/Outside Lanes)

Lane widths of 13 ft (4.0 m) or less make it likely that most motor vehicles will encroach at least part way into the next lane to pass a bicyclist with an adequate and comfortable clearance (usually 3 ft [0.9 m] or more depending on the speed of the passing vehicle). Lane widths that are 14 ft (4.3 m) or greater allow motorists to pass bicyclists without encroaching into the adjacent lane. The usable lane width is normally measured from the center of the edge line to the center of the traffic lane line, or from the longitudinal joint of the gutter pan to the center of the lane line. The gutter should not be included in the measurement as usable width, as bicyclists will typically ride well to the left of the joint.”

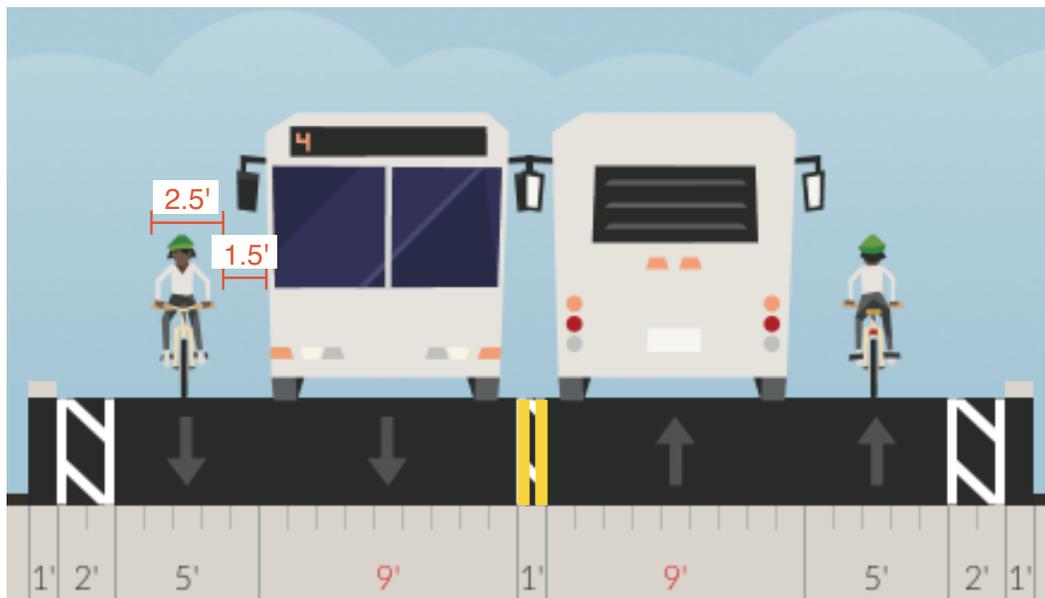


Figure E. AASHTO minimum “shared lane” width is far too narrow.

Criticism

Figure E depicts 14-foot total lane widths with bicyclist so-called “preferred” 5-foot operating space. The 2-foot buffer adjacent to vertical curb face is not usable space. Passing clearance from a bus body (not including mirror) that has moved far left in the lane to a 30 inch bicyclist tracking at operating space center is just 1.5 feet. Note too that the buses’ mirrors are hitting. It’s a zombie myth that 14 feet is adequate for side-by-side use.