Kimley»Horn

M E M O R A N D U M

Date: March 26, 2018

TO: Murray Fontes, City of Watsonville

FROM: Daniel Carley and Bill Wiseman, Kimley-Horn

RE: Freedom Boulevard Plan Line Community Meeting #1 – Meeting Summary

The City of Watsonville, in collaboration with staff from Kimley-Horn conducted a community meeting regarding the Freedom Boulevard Plan Line project on February 20, 2018 in the Community Meeting Room at City Hall in Watsonville. The following is an overview of the project context and objectives, and summary of community comments received at the meeting, as well as written comments.

Meeting Context and Objectives

The community has identified improvements to Freedom Boulevard as a high priority in the recent Measure D surveys. The Freedom Boulevard Plan Line project, which extends from Green Valley Road to Buena Vista Drive, presents an opportunity to extend the City of Watsonville's pedestrian and bicycle access network, as well as provide more uniform mobility throughout the Freedom Boulevard corridor.

Prior to this first community meeting, City staff meet with several property owners to get their feedback on the scope of the project and express their concerns and interests. The focus of their comments was related to potential changes to their property line, parking, and access.

Communication about the meeting included an article in the Register-Pajaronian newspaper, a posting on the City's web site, and written notification to all property owners and businesses within 300 feet of the project site.

The purpose of Community Meeting # 1 included the following:

- Inform the community about the project (scope, schedule, process, and opportunities for public feedback
- Present basic concepts about elements of a plan line project (e.g. right of way, parcel lines, roadway configuration, bike lanes, sidewalks, etc.)
- Present illustrative plan views of existing conditions and one possible design solution
- Seek feedback and comments

Summary of Meeting Feedback

The community meeting was attended by approximately 15 to 20 people, in addition to Mayor Lowell Hurst, City staff, and consultants. Community participants included property owners and nearby residents.

In general, the community was very supportive of the project and supports the concept of improving mobility and safety along the corridor for all modes of travel (i.e. vehicular, pedestrian, and bicycle). Most people use the corridor for vehicular access, but many participants also walk or bike on the corridor and/or expressed an interest in making it safer to do so.

Key themes identified by the community at the meeting included the following:

- Improve road safety, particularly for pedestrians and bicyclists
- Provide a bike lane on both sides of Freedom Boulevard
- Avoid or minimize encroachment into adjacent properties
- Minimize the loss of parking
- Provide continuous sidewalks along the corridor
- Enhance existing cross-walks and add additional cross-walks where possible
- Possibly reduce vehicle lanes and/or speeds to improve pedestrian and bike safety

Responses to Community Meeting Questionnaire

An informal questionnaire was presented to participants at the meeting. A compendium of their responses is as follows:

Are you a property owner or resident along Freedom Boulevard?

- Resident, near courthouse
- Resident on Browns Road, Corralitos
- No (5 responses)
- Property owner

How do you use the corridor?

Mode	Responses
Bike	3
Car	7
Walk	3
Bus	2
Commuter	--
Other	--

How important is providing a continuous bike lane?

- It would be very useful
- Very!
- Important, add them
- Extremely for safety. Also reduce motorist speed to 30 mph in business district. 2nd narrow motor lanes, best if there is a 2' buffer between bike lane and motorist lanes
- I don't notice bike riders in this corridor. It doesn't seem like it's needed to me
- Imperative to prevent deaths from accidents!
- Very important. Kids and families should feel comfortable shopping and going to school

Would you like improved bus stops?

- YES! Yes, Yes, yes, yes, yes many poor and disabled use it, yes they need to support bicycle use and reduce conflicts, but sometimes I ride the bus instead of bike

Do you feel safety is an issue on Freedom Blvd? If so, how and where?

- Yes: no sidewalks, and vehicles turning at driveways don't look both ways and see me (wheelchair user)
- Yes: Airport to Buena Vista
- Yes: no sidewalks, no protection for pedestrians and cyclists, no or few dedicated left turn lanes, road is in poor condition
- Yes: cars drive too fast on this street
- Yes: safety on a bike is extremely needed, pedestrians, especially in the four lane segments need lighted and flashing crosswalks
- Yes, all along Freedom, too little street lighting

- Yes, where the bike lane ends at Green Valley Rd, especially between Quick-Stop and Starbucks
- Not really

How often do you walk along Freedom Blvd? Is the construction of sidewalks important to you?

- No, not safe currently
- Never because it not aesthetically pleasing and it's not safe. Sidewalks are important, it will attract more pedestrians to businesses
- I don't
- Yes, crosswalks ALWAYS make for more comfortable and safer experience
- I never walk Freedom Blvd. However, I like the idea of sidewalks and some landscaping. I feel it would upgrade the area
- Once per month
- Rarely

What are the current issues/challenges with the corridor?

- No left turn lanes, no crosswalks in middle of blocks, lots of jaywalking
- It would be nice if the road would be fixed sooner than 2022.
- Currently, it is constructed to be utilized only by motorists. Bike and pedestrians are left to fend for themselves without bike lanes, and lighted crosswalks. Reduce motorist speeds, narrow motorist lanes, create 2' buffer for bikes.
- No challenges or issues to address other than the sidewalks would enhance the area.
- Ugly, vacant used car lots, weeds, graffiti and abandoned buildings
- Speed of cars, bicyclists feeling unsafe

What types of improvements would you like to see? For example, new sidewalks, bike lanes, crosswalks, etc.

- Improvements for the visually impaired, audible signals, updated signal timing for seniors
- Sidewalks, better lighting, crosswalks
- Flashing beacon lights at crosswalks

- Bike lanes, buffers, narrower motorist vehicle lanes, lighted (flashing) pedestrian crosswalks, preferred bike route signage, pockets for cyclists in left turn lanes and right turn lanes.
- Sidewalks, nice bus stops
- New sidewalks, TREES, bike lanes and tiny houses for the homeless
- Protected bike lanes!

General Comments and Questions

- Fix curb ramp by Little Caesar's
- Sidewalk from Via Verde to Freedom Center
- Airport needs to be repaved all the way up to Watsonville Auto Body or Comfort Inn, Green Valley needs to be repaved between Freedom and Corralitos Creek, and Freedom Alta Vista to Buena Vista.
- A motorist traveling at 40mph that hits a pedestrian or bicyclist will likely result in the victim's death. Reducing speed to 30 mph (like Soquel Ave in Santa Cruz) adding bike lanes and sidewalks will finally tame country road that has become an urban mess.
- One of our parcels would lose all its valuable parking. It's a commercial building where parking is needed.
- We need a "Welcome to Watsonville" sign on Freedom Blvd
- Since plan lines are a long-range plan, would you consider including general language so that protected bike lanes could be included later? We need to plan for the future of transportation: bikes and busses.

Written Comments Received

The following written comments were submitted by the public, either at the meeting or to City staff:

Exhibit Markup Comments

- Consider a roundabout at Freedom/Buena Vista
- Bikes should turn right to Buena Vista before the triangle/Coffey Lane
- Consider adding a crosswalk from Compton Terrace/gas station
- Consider a left turn pocket for Freedom to Buena Vista traffic
- Please consider reducing corridor to 3 lanes. Protected bike lane is very important!

- Consider 30 mph business district
- Consider merging through traffic at Burchell Avenue to provide right turn lane at Airport
- How do bikes make left turn at Airport? Pocket? Green lane?
- Consider changing northbound Airport to be two through lanes and one left turn lane. Only one northbound receiving lane.
- Consider a dedicated left turn lane for Starbucks/shopping center driveway from Freedom
- Consider lighted/enhanced crosswalk at Roache Rd./shopping center driveway
- Consider new street lighting along corridor
- Suggest bike route to downtown is Green Valley then left on Pennsylvania
- Enhanced concept is what we need!

Telephone Comments

The following telephone comments were received by City staff from property owners along the corridor:

- concern about losing on street parking and having property taken.
- concern about impact on parcels.
- Need sidewalk as many walk to Freedom Centre shopping center at intersection of Freedom Blvd and Airport Blvd. Concerned about impact on parcels.

Email Comments

The following email comments were received by City staff:

Date	Comment
2/20/2018	I live near the stretch of Freedom Blvd. under discussion for this project, and I observe the number of pedestrians and cyclists who attempt to use this route, with some difficulty and some danger. Watsonville has a large number of residents who rely on biking or walking for their local trips to jobs, shopping, school, library, and various other errands. Many of them use this stretch of Freedom Blvd. in particular, and for them it is congested, narrow, and dangerous. The Freedom Branch Library attracts a number of students working on homework or a school project, and many of them come by bike. The best solution would be a 4 to 3 conversion: reduce four lanes to three, make the middle lane a series of left-turn turnouts, put a protected bike lane on both

Date	Comment
	sides, improve the sidewalks, and continue to prohibit on-street parking. Granted there is a lot of motor vehicle traffic on Freedom Blvd, but the loss of one lane could be offset by attracting more residents to walking and biking options for their local short trips. USDOT estimates that 40% of all car trips nationwide are 3 miles or less, and for Watsonville residents that percentage is undoubtedly higher. These short trips are precisely those most likely to be converted to biking or walking if appropriate infrastructure is provided. This project should not just be for the benefit of those now brave enough to bike or walk this route — it should also be for those who, given a safe and attractive alternative, would switch from a car trip to a walking or riding trip. And each of those who did switch would take up a lot less pavement than if they were still in a car. Thus it is likely that the 4 to 3 conversion would not increase car congestion at all. And of course, the greatest benefit would come from extending this concept beyond the Green Valley intersection toward the downtown. Bottom line: Watsonville has a large number of residents who use or would like to use biking or walking to make their short trips around town. Whether they would do so by necessity or by choice, they too deserve the attention and support of their City. And ultimately, we would all be better off if they were better served.
2/20/2018	I am not able to attend the meeting tonight due to a previous engagement. Is there any way to view the design proposals on-line at a later date? So disappointed I can't make it. I have 3 parcels on Freedom Blvd. and really would like to know what is possibly going to happen
2/27/2018	The 66 Ft. Right of way concept would most likely work the best for my 3 parcels. It would be less invasive to the existing fences, planters and parking areas which would save money for the city. Keep me in the loop.
2/27/2018	Sorry I missed the meeting February 20th. I just wanted to voice that I would like a sidewalk for my property at 1916 freedom Blvd. Will there be a follow up meeting? Or somewhere we can go online to get updates?
2/22/2018	Since I was not able to attend this week's event, I would like to voice my support for enhanced bicycle infrastructure to the largest extent possible. I live in Corralitos and use my bicycle whenever possible. Due to high traffic volume and inattentive drivers, currently I do not feel safe using Freedom Blvd.
2/21/2018	Thank you for the information. I too think some of the concepts you presented will create safer mobility for everyone. We really do need to calm the speedy traffic on Freedom. I would support BSCC recommendations as well.

Janneke Strause, Executive Director of Bike Santa Cruz County, provided a letter and reference documentation via email, and these materials are provided below as attachments.

Attachments

- Letter from Janneke Strause, Executive Director, Bike Santa Cruz County
- "Designing for All Ages and Abilities" fact sheet, National Association of City Transportation Officials (NACTO)
- "Road Diet Mythbusters" fact sheet, U.S. DOT Federal Highway Administration (FHWA)

BIKE SANTA CRUZ COUNTY
703 Pacific Avenue • Santa Cruz, CA 95060
(831) 425-0665 www.bikesantacruzcounty.org

February 15, 2018

City of Watsonville
Attn: Murray Fontes
Principal Engineer
Public Works

Subject: Freedom Blvd. Plan Line

Dear Murray,

I am writing to you in preparation for next week's Freedom Blvd Plan Line Community Meeting. I look forward to seeing your draft plans, but for now I'd like to submit Bike Santa Cruz County's official recommendations.

Why Freedom Blvd.?
Drafting new plan lines on Freedom Blvd. between Buena Vista and Green Valley Road present an opportunity. This section is especially challenging for cyclists given the density of businesses, debris in the bike lane and shoulder, and the high-speed of heavy motorist traffic. There is a lack of parallel routes through the City of Watsonville that have access to businesses and shopping.

The City of Watsonville is ranked 1st worst for injuries and fatalities among pedestrians under the age of 15, and 4th worst for pedestrians overall, when compared to 105 California cities of similar size. Four schools are located within 1 mile of this section of Freedom Blvd.

Who are we planning for?
Roger Geller, the Bicycle Coordinator of the Portland Office of Transportation says there are four types of bicyclists: 33% are "No Way No How", 60% are "Interested but Concerned", 7% are "Enthused and Confident", and <1% are "Strong and Fearless".

The recreational and commuter cyclists already bicycling on Freedom Blvd. are arguably the "Enthused and Confident" and "Strong and Fearless" riders. As Planners looking to the future of transportation in our county, we must plan for the 60% who are "Interested but Concerned".

Bike Santa Cruz County urges the City of Watsonville to implement traffic calming and Complete Streets measures in the plan lines for Freedom Blvd. to encourage all ages and abilities to bike and walk for daily transportation.

An all ages and abilities bicycle facility includes:

- A 5-foot bike lane with 2-3 foot buffer using a physical barrier such as bollards
- A 4-foot sidewalk
- Green lane treatments at conflict zones
- Median refuge islands

Traffic calming measures to improve bicyclist and pedestrian safety include:

- Reducing 4 lanes to 3 with center turn lane
- Reducing vehicle lane width and speed

In any scenario, please do not add on-street parking or vehicle lanes, or increase motorist speed.

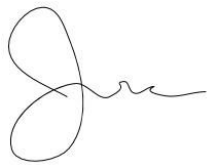
While it is true that there is a high volume of motorists traveling on this route, implementing an all ages and abilities bicycle facility will not necessarily make traffic worse. Level of service is not just for motorists. Maintaining a satisfactory level of service for all road users by increasing bicyclist and pedestrian perceived comfort and safety has been shown to increase non-motorized and transit usage.

See attached “Road Diet Myth Buster” from the Federal Highway Administration and “Designing for All Ages and Abilities” from the National Association of City Transportation Officials.

Bike Santa Cruz County is hopeful that by implementing innovative bicycle and pedestrian infrastructure on Freedom Blvd. between Buena Vista Drive and Green Valley Road, the City of Watsonville will be able to extend these treatments to other sections of Freedom Blvd.

Thank you for your consideration!

Warmly,



Janneke Strause
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Designing for All Ages & Abilities

Contextual Guidance for High-Comfort Bicycle Facilities

NACTO
National Association of City Transportation Officials

December 2017

Streets that are safe and comfortable for All Ages & Abilities bicycling are critical for urban mobility.

NACTO cities are leading the way in designing streets that are truly safe and inviting for bicyclists of All Ages & Abilities and attract wide ridership. This guidance—developed by practitioners from cities across North America—builds on NACTO's *Urban Bikeway Design Guide* and sets an **All Ages & Abilities** criteria for selecting and implementing bike facilities. Building bicycle infrastructure that meets this criteria is an essential strategy for cities seeking to improve traffic safety,[1] reduce congestion,[2] improve air quality and public health,[3] provide better and more equitable access to jobs and opportunities,[4] and bolster local economies.[5]

This All Ages & Abilities facility selection guidance is designed to be used in a wide variety of urban street types. It considers contextual factors such as vehicular speeds and volumes, operational uses, and observed sources of bicycling stress. In doing so, it allows planners and engineers to determine when, where, and how to best combine traffic calming tools, like speed reduction and volume management, with roadway design changes, like full lane separation, to reduce traffic fatalities and increase cycling rates and rider comfort.

The All Ages & Abilities criteria is a national and international best practice that should be adopted for all bicycle facility design and network implementation; lesser accommodation should require additional justification. Along with a problem-solving approach to street design, the All Ages & Abilities benchmark should be applied across a city's entire bicycle network to grow bicycling as a safe, equitable mode for the majority of people.

All Ages & Abilities Bike Facilities are ...

Safe

More people will bicycle when they have safe places to ride, and more riders mean safer streets. Among seven NACTO cities that grew the lane mileage of their bikeway networks 50% between 2007–2014, ridership more than doubled while risk of death and serious injury to people biking was halved.[6] Better bicycle facilities are directly correlated with increased safety for people walking and driving as well. Data from New York City showed that adding protected bike lanes to streets reduced injury crashes for all road users by 40% over four years.[7]

Comfortable

Bikeways that provide comfortable, low-stress bicycling conditions can achieve widespread growth in mode share. Among adults in the US, only 6–10% of people generally feel comfortable riding in mixed traffic or painted bike lanes.[8] However, nearly two-thirds of the adult population may be interested in riding more often, given better places to ride, and as many as 81% of those would ride in protected bike lanes.[9] Bikeways that eliminate stress will attract traditionally under-represented bicyclists, including women, children, and seniors.

Equitable

High-quality bikeways expand opportunities to ride and encourage safe riding. Poor or inadequate infrastructure—which has disproportionately impacted low-income communities and communities of color—forces people bicycling to choose between feeling safe and following the rules of the road, and induces wrong-way and sidewalk riding. Where street design provides safe places to ride and manages motor vehicle driver behavior, unsafe bicycling decisions disappear,[11] making ordinary riding safe and legal and reaching more riders.

SE Mill Street, PORTLAND
(photo credit: Portland Bureau of Transportation)

Who is the "All Ages & Abilities" User?

To achieve growth in bicycling, bikeway design needs to meet the needs of a broader set of potential bicyclists. Many existing bicycle facility designs exclude most people who might otherwise ride, traditionally favoring very confident riders, who tend to be adult men. When selecting a bikeway design strategy, identify potential design users in keeping with both network goals and the potential to broaden the bicycling user base of a specific street.

Children

School-age children are an essential cycling demographic but face unique risks because they are smaller and thus less visible from the driver's seat than adults, and often have less ability to detect risks or negotiate conflicts.

Seniors

People aged 65 and over are the fastest growing population group in the US, and the only group with a growing number of car-free households.[12] Seniors can make more trips and have increased mobility if safe riding networks are available. Bikeways need to serve people with lower visual acuity and slower riding speeds.

Women

Women are consistently under-represented as a share of total bicyclists, but the share of women riding increases in correlation to better riding facilities.[13] Concerns about personal safety including and beyond traffic stress are often relevant. Safety in numbers has additional significance for female bicyclists.

People Riding Bike Share

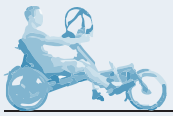
Bike share systems have greatly expanded the number and diversity of urban bicycle trips, with over 28 million US trips in 2016.[14] Riders often use bike share to link to other transit, or make spontaneous or one-way trips, placing a premium on comfortable and easily understandable bike infrastructure. Bike share users range widely in stress tolerance, but overwhelmingly prefer to ride in high-quality bikeways. All Ages & Abilities networks are essential to bike share system viability.

People of Color

While Black and Latinx bicyclists make up a rapidly growing segment of the riding population, a recent study found that fewer than 20% of adult Black and Latinx bicyclists and non-bicyclists feel comfortable in conventional bicycle lanes; fear of exposure to theft or assault or being a target for enforcement were cited as barriers to bicycling.[15] Long-standing dis-investment in street infrastructure means that these riders are disproportionately likely to be killed by a car than their white counterparts.[16]

Low-Income Riders

Low-income bicyclists make up half of all Census-reported commuter bicyclists, relying extensively on bicycles for basic transportation needs like getting to work.[17] In addition, basic infrastructure is often deficient in low-income neighborhoods, exacerbating safety concerns. An All Ages & Abilities bikeway is often needed to bring safe conditions to the major streets these bicyclists already use on a daily basis.



People with Disabilities

People with disabilities may use adaptive bicycles including tricycles and recumbent handcycles, which often operate at lower speeds, are lower to the ground, or have a wider envelope than other bicycles. High-comfort bicycling conditions provide mobility, health, and independence, often with a higher standard for bike infrastructure needed.

People Moving Goods or Cargo

Bicycles and tricycles outfitted to carry multiple passengers or cargo, or bicycles pulling trailers, increase the types of trips that can be made by bike, and are not well accommodated by bicycle facilities designed to minimal standards.

Confident Cyclists

The small percentage of the bicycling population who are very experienced and comfortable riding in mixed motor vehicle traffic conditions are also accommodated by, and often prefer, All Ages & Abilities facilities, though they may still choose to ride in mixed traffic.

Choosing an All Ages & Abilities Bicycle Facility

This chart provides guidance in choosing a bikeway design that can create an All Ages & Abilities bicycling environment, based on a street's basic design and motor vehicle traffic conditions such as vehicle speed and volume. This chart should be applied as part of a flexible, results-oriented design process on each street, alongside robust analysis of local bicycling conditions as discussed in the remainder of this document.

Users of this guidance should recognize that, in some cases, a bicycle facility may fall short of the All Ages & Abilities criteria but still substantively reduce traffic stress. Jurisdictions should not use an inability to meet the All Ages & Abilities criteria as reason to avoid implementing a bikeway, and should not prohibit the construction of facilities that do not meet the criteria.

Contextual Guidance for Selecting All Ages & Abilities Bikeways

Roadway Context				All Ages & Abilities Bicycle Facility
Target Motor Vehicle Speed*	Target Max. Motor Vehicle Volume (ADT)	Motor Vehicle Lanes	Key Operational Considerations	
Any		*Any*	*Any of the following:* high curbside activity, frequent buses, motor vehicle congestion, or turning conflicts‡	**Protected Bicycle Lane**
< 10 mph	Less relevant	No centerline, or single lane one-way	Pedestrians share the roadway	**Shared Street**
≤ 20 mph	≤ 1,000 – 2,000		< 50 motor vehicles per hour in the peak direction at peak hour	**Bicycle Boulevard**
≤ 25 mph	≤ 500 – 1,500			
	≤ 1,500 – 3,000	Single lane each direction, or single lane one-way	Low curbside activity, or low congestion pressure	**Conventional or Buffered Bicycle Lane, or Protected Bicycle Lane**
	≤ 3,000 – 6,000			**Buffered or Protected Bicycle Lane**
	Greater than 6,000			**Protected Bicycle Lane**
	Any	Multiple lanes per direction		
Greater than 26 mph†	≤ 6,000	Single lane each direction	Low curbside activity, or low congestion pressure	**Protected Bicycle Lane, or Reduce Speed**
		Multiple lanes per direction		**Protected Bicycle Lane, or Reduce to Single Lane & Reduce Speed**
	Greater than 6,000	*Any*	*Any*	**Protected Bicycle Lane, or Bicycle Path**
High-speed limited access roadways, natural corridors, or geographic edge conditions with limited conflicts		*Any*	High pedestrian volume	**Bike Path with Separate Walkway or Protected Bicycle Lane**
			Low pedestrian volume	**Shared-Use Path or Protected Bicycle Lane**

* While posted or 85th percentile motor vehicle speed are commonly used design speed targets, 95th percentile speed captures high-end speeding, which causes greater stress to bicyclists and more frequent passing events. Setting target speed based on this threshold results in a higher level of bicycling comfort for the full range of riders.

† Setting 25 mph as a motor vehicle speed threshold for providing protected bikeways is consistent with many cities' traffic safety and Vision Zero policies. However, some cities use a 30 mph posted speed as a threshold for protected bikeways, consistent with providing Level of Traffic Stress level 2 (LTS 2) that can effectively reduce stress and accommodate more types of riders.[18]

‡ Operational factors that lead to bikeway conflicts are reasons to provide protected bike lanes regardless of motor vehicle speed and volume.

The All Ages & Abilities Design Toolbox

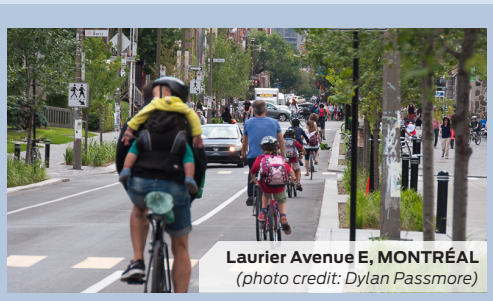
Five major types of bikeway provide for most bike network needs, based on the contextual guidance on page 4. This list is organized from more to less shared operation with automobiles. Each facility type is appropriate as an All Ages & Abilities bikeway in relevant street contexts. The NACTO *Urban Bikeway Design Guide* provides detailed guidance on bikeway facilities.

Argyle Street, CHICAGO
(photo credit: Chicago DOT)

Low-Speed Shared Streets allow bicyclists to comfortably operate across the entire roadway. Shared streets target very low operating speeds for all users, typically no greater than 10 mph. The volume of people walking and bicycling should be much greater than vehicle volume to maintain comfort. Issues for bicycling in shared environments arise from conflicts with people walking, who may be expected at any point across the street's width. Materials and street edges must be appropriate for bicycling; materials are often varied to delineate road space, but any seams or low mountable curbs must be designed to avoid creating fall hazards for bicyclists.

SE Taylor Street, PORTLAND
(photo credit: Greg Raisman)

Bicycle Boulevards (or neighborhood greenways) provide continuous comfortable bicycle routes through the local street network. Bike Boulevards are characterized by slow motor vehicle speeds and low volumes. Sometimes these are present by the very nature of the street and its function (e.g. narrow streets with no major destinations), but sometimes design work is needed, such as adding traffic calming elements, filtering most motor vehicle traffic off, and/or prioritizing bicycles at major and minor street intersections. In this way, bicycling is made comfortable across the entire roadway. Directional markings and wayfinding signage provide riders with intuitive, coherent routing.



Laurier Avenue E, MONTRÉAL
(photo credit: Dylan Passmore)

Buffered & Conventional Bicycle Lanes provide organized space for bicycling, and are often part of street reconfiguration projects that improve safety and comfort for all users. Bicycle lanes are an important tool to improve comfort and safety on streets where the number of passing events is too high for comfortable mixed-traffic bicycling, but where curbside activity, heavy vehicles, and lane invasion are not significant sources of conflict. Buffered bike lanes are almost always higher comfort than conventional bike lanes. In many cases, cross-sections with room for buffered bicycle lanes also have room for protected bicycle lanes.

Dunsmuir Street, VANCOUVER
(photo credit: Paul Kreuger via Flickr)

Protected Bicycle Lanes (also known as Separated Bike Lanes or Cycle Tracks) use a combination of horizontal separation (buffer distance) and vertical separation (e.g. flex posts, parked cars, or curbs) to protect people bicycling from motor vehicle traffic. The combination of lateral buffer distance and vertical separation elements (such as flexible delineators, curbs or height differences, or vehicle parking) can ameliorate most of the stressors of on-street bicycling. The robustness of bikeway separation often scales relative to adjacent traffic stress.

Cultural Trail, INDIANAPOLIS
(photo credit: Green Lanes Project)

Shared-Use & Bicycle Paths have in many cities served as the early spines of an All Ages & Abilities network. Paths can provide a continuous corridor, but usually do not take riders to their destinations. High pedestrian volumes, driveways, obtrusive bollards, sharp geometry, and crossings all degrade bicycling comfort, but often require long project timelines to eliminate. To become useful for transportation, paths work best when connected to an on-street network that meets the same high benchmark of rider comfort, and design provides bicycle-friendly geometry. Ideally, bicycles should be separated from pedestrians where significant volume of either mode is present, but where space limitations exist, multi-use paths are still valuable.

Motor Vehicle Speed & Volume Increase Stress

Whether or not people will bicycle is heavily influenced by the stresses they encounter on their trip. These stressors impact their actual physical safety and their perceived comfort level.

For all roadways and bike facilities, two of the biggest causes of stress are vehicular traffic speed and volume. These factors are inversely related to comfort and safety; even small increases in either factor can quickly increase stress and potentially increase injury risk.[19] The stresses created by speed are compounded by vehicular volume, and vice versa.

Slower or less confident bicyclists experience "near misses"—or non-injury incidents that cause stress—much more frequently per trip than faster riders, which can contribute to discouraging people from riding who would otherwise do so.[20]

SPEED

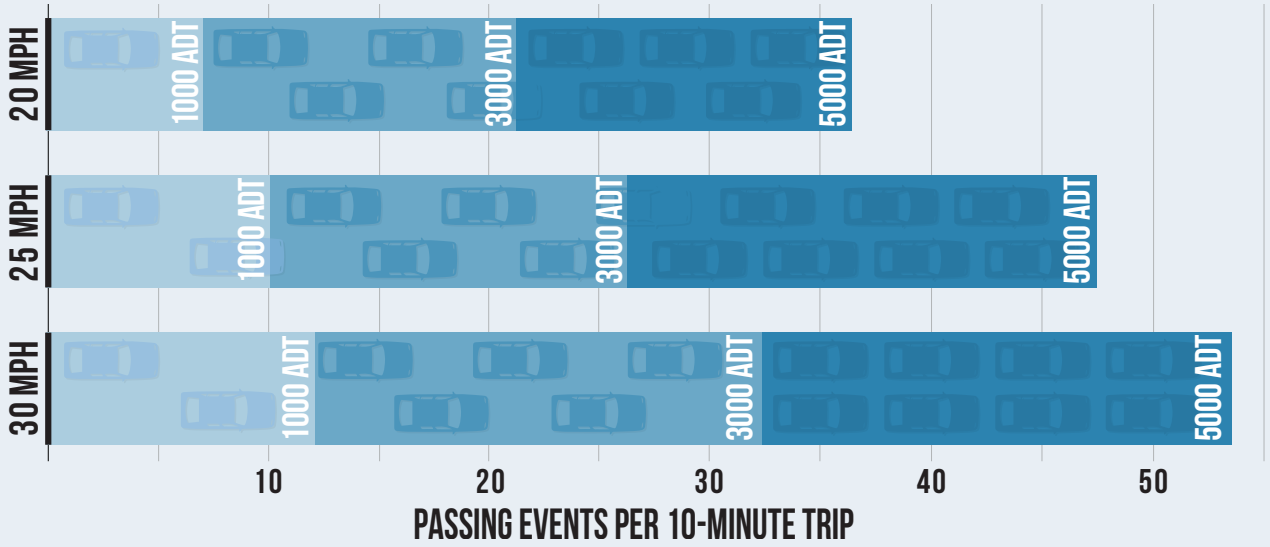
High motor vehicle speeds and speeding introduce significant risk to all road users, narrowing driver sight cones, increasing stopping distance, and increasing injury severity and likelihood of fatality when crashes occur.[21] Most people are not comfortable riding a bicycle immediately next to motor vehicles driving at speeds over 25 mph. Conventional bike lanes are almost always (with rare exceptions) inadequate to provide an All Ages & Abilities facility in such conditions.

VOLUME

When vehicular volumes and speeds are low, most people feel most comfortable bicycling in the shared roadway as they are able to maintain steady paths and riding speeds with limited pressure to move over for passing motor vehicles. However, as motor vehicle volume increases past 1,000 – 2,000 vehicles per day (or roughly 50 vehicles in the peak direction per peak hour), most people biking will only feel comfortable if vehicle speeds are kept below 20 mph.

Conflicts Increase with Speed & Volume

This chart illustrates the number of passing events (at increasing motor vehicle average speed and volume) experienced over a 10-minute period by a bicyclist riding 10 mph. As motor vehicle speed and volume increase, they magnify the frequency of stressful events for people bicycling.



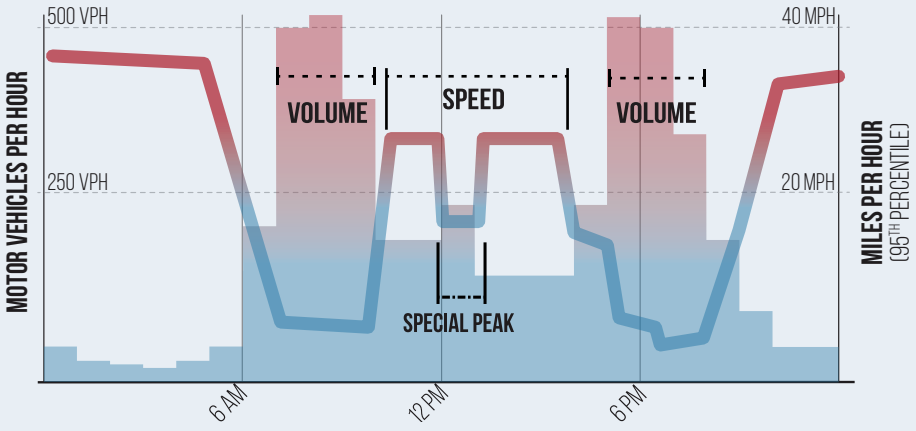
Motor Vehicle Speed and Volume Amplify One Another as They Increase

The frequency at which a person bicycling is passed by motor vehicles is one of the most useful indicators of the level of stress of a roadway or bike facility. Passing events increase with speed and volume, decreasing rider comfort and safety. Where car traffic is routinely above 20 mph, or where traffic volume is higher than 50 vehicles per direction per hour, pressure on bicyclists from motor vehicles attempting to pass degrades comfort for bicycling and increases risk.

- **At speeds of 20 mph,** streets where daily motor vehicle volume exceeds 1,000 – 2,000 vehicles, frequent passing events make shared roadway riding more stressful and will deter many users.
- **Between 20 and 25 mph,** comfort breaks down more quickly, especially when motor vehicle volume exceeds 1,000 – 1,500 ADT. When motor vehicle speeds routinely exceed 25 mph, shared lane markings and signage are not sufficient to create comfortable bicycling conditions.
- **Motor vehicle speeds 30 mph or greater** reduce safety for all street users and are generally not appropriate in places with human activity.
- **Where motor vehicle speeds exceed 35 mph,** it is usually impossible to provide safe or comfortable bicycle conditions without full bikeway separation.

Sources of Stress Change Throughout the Day

Large fluctuations in motor vehicle traffic volume between morning, mid-day, afternoon, and nighttime result in radically different bicycling conditions on the same street throughout the day. The example at right shows a street with roughly 500 vehicles per direction per hour during the peak. While queuing stress occurs at peak times, low off-peak volume results in dangerously high motor vehicle speeds.



Peak vs. Off-Peak

The variation in speed and volume conditions between peak and off-peak hours can manifest as two distinct issues that decrease comfort and safety.

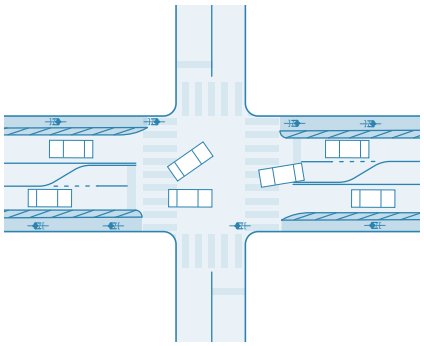
- **During high-volume peak periods,** motor vehicle queuing prevents comfortable mixed-traffic operation and increases the likelihood of bicycle lane incursions, unless physical separation is present.
- **During off-peak periods,** speeds can rise quickly, especially on wide and multi-lane streets, unless the street's design and operations specifically discourage speeding. Streets with very low off-peak volumes that also see little speeding, including many small neighborhood streets, may indicate All Ages & Abilities conditions if peak volumes are managed effectively.
- **Special Peaks** occur on streets that experience intensive peak activity periods. Schools have multiple short windows of time where pedestrian and motor vehicle activity are intense at exactly the time and place where the appeal of All Ages & Abilities bicycling is most sensitive. Downtown cores and retail streets experience intensive commercial freight activity throughout the day including at off-peak times, adding importance to the creation of protected bike lanes.

Changing the Street: Design, Operation, Networks

Not every solution that helps to create safe and comfortable bicycling conditions will be a geometric design. Creating a network of high-comfort bicycle facilities that meet the All Ages & Abilities criteria requires leveraging the full suite of design, operational, and network strategies to transform streets. Strategies can be implemented incrementally to address sources of stress and conflict, change demand for access and movement, and ultimately transform streets for all users by continuously increasing comfort and creating more opportunities to make more trips by bicycle.

Change Design

Design strategies change the cross-section of a street in order to provide bike lanes, buffered bike lanes, protected bike lanes, or other dedicated bicycle infrastructure. Creating dedicated space for bicycling— either by reducing the number of motor vehicle lanes or their width—usually does not involve substantial changes to motor vehicle volume or the types of vehicles that can use a street, and has substantial benefits for the safety of all street users. 4-to-3 and 4-to-2-lane (with left turn pocket) conversions are widely used, and many other street redesigns apply the same basic principle of organizing movements and modes into dedicated space to improve the efficiency of each space.



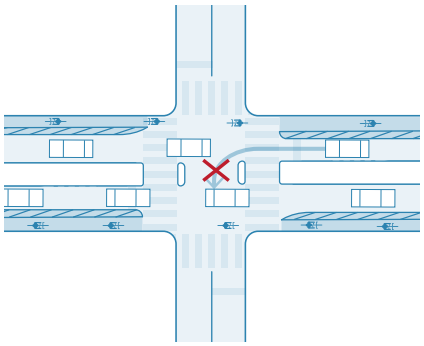
Examples:

- **Repurpose Motor Vehicle Lane**
- **Convert from Buffered to Protected Bike Lane**

Change Operation

Operational changes—such as speed reduction, signalization and other conflict management, and proactive curbside management—improve bicycling conditions by reducing the level of traffic stress on a street. Operational strategies make streets more predictable, efficient, and safe without necessarily changing the street's cross-section or the types of vehicles allowed.

On all facility types, reducing motor vehicle speeds to 20 – 25 mph is a core operational strategy for improving bicycle comfort and meeting the All Ages & Abilities criteria. In addition, reducing speeds can also make it easier to enact other safety changes, such as changes to intersection geometry, signalization, turn lanes, and turn restrictions. Since operational changes do not impact what types of vehicles can use the street, they usually do not require significant planning beyond the street itself, and are often the easiest type of change to implement.



Examples:

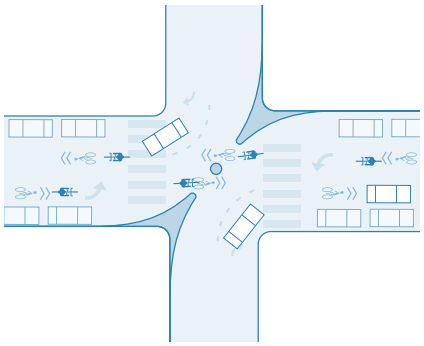
- **Signal Separation of Conflicting Movements**
- **Low-Speed Signal Progression**

Change the Network

Diverting motor vehicle traffic from a street, changing travel direction, (dis)allowing specific types of curbside access, and making other changes to the role of a street in the motor vehicle network are powerful ways to create All Ages & Abilities bicycling conditions. Such network changes allow the street to be transformed into a comfortable bicycling environment without requiring dedicated space.

Bicycle boulevards and shared streets, in particular, often rely on network changes to create the low-speed, very low-volume conditions necessary for cyclists to feel safe and comfortable. Prohibiting through-traffic (requiring all motor vehicles to turn off the street at each intersection), either through physical diverters or signage, is an effective strategy for reducing speed and volume.

Changes to the motor vehicle network can open up opportunities for better bikeway designs. For example, converting a high volume or high speed street from two-way to one-way or removing all curbside parking can provide space for a protected bike lane.



Examples:

- **Bicycle Boulevard**
- **Time-of-Day Regulations**

Ames Street, CAMBRIDGE
(photo credit: People for Bikes)

Low-Speed, Low-Volume Roadways Can Be Shared

See the Urban Bikeway Design Guide *for detailed guidance on Bicycle Boulevards, Conventional Bike Lanes, Buffered Bike Lanes, and Left Side Bike Lanes.*

Bicycle Boulevards & Shared Streets

Bicycle boulevards and shared streets place bicycle and motor vehicle traffic in the same space at the same time. These facilities meet the All Ages & Abilities criteria when motor vehicle volumes and speeds are so low that most people bicycling have few, if any, interactions with passing motor vehicles.

What to do:

- **Use both peak-hour volume and off-peak speed** to determine whether a shared roadway can serve as an All Ages & Abilities bike facility. High peak period volumes or high off-peak speeds create a high-stress bicycling environment. These sources of stress can be addressed through speed management or volume management, or may indicate the need for a separated bicycle facility.
- **Set a 20 – 25 mph target speed (10 mph on shared streets)** for motor vehicles in the majority of urban street contexts. Use the 95th percentile motor vehicle speed, along with the overall speed profile of motor vehicle traffic, to determine whether high outlying speeds exist, since even small numbers of motor vehicles traveling at high speeds can degrade the comfort of people bicycling on shared roadways.
- **Manage motor vehicle speeds** through operational and network tools such as speed humps, pinchpoints, and neighborhood traffic circles.
- **Reduce motor vehicle volume** by constructing diverters, prohibiting through traffic, or removing parking. The All Ages & Abilities condition is likely to be reached below approximately 1,000 – 1,500 vehicles per day or approximately 50 vehicles per hour per direction.
- **Use time-of-day analyses** to match regulations or access restrictions to demand. Commercial setting can also work with bike boulevards if stressors are managed. Prioritize delivery and freight access off-peak, or allow only transit and bikes at peak periods.

SE Ankeny Street Bike Boulevard, PORTLAND
(photo credit: NACTO)

Brookline Street, CAMBRIDGE
(photo credit: City of Cambridge)

Conventional & Buffered Bicycle Lanes

Conventional and buffered bike lanes on urban streets delineate space for bicyclists but provide no physical separation between people bicycling and driving. With on-street parking, they also place the bicycle between parked vehicles and moving motor vehicles. Since bicyclists must enter the motor vehicle lane to avoid conflict with turning vehicles, parking maneuvers, double parking or curbside loading, or open doors, it is important for passing events to be minimized.

What to do:

- **Set target speeds at or below 25 mph.** Speeds of 20 – 25 mph improve comfort and allow drivers to more easily react when bicyclists need to move into the motor vehicle lane. Use strategies such as lower progression speed and shorter signal cycle lengths to reduce the incentive for drivers to speed, and reduce top-end speeding incidents.
- **Discourage motor vehicle through-movement to reduce volumes.** Lower motor vehicle volumes reduce the number of passing events. Depending upon the presence and intensity of other operational stressors, an All Ages & Abilities condition may be reached below approximately 3,000 – 6,000 vehicles per day, or approximately 300 to 400 vehicles per hour.
- **Reduce curbside conflicts**, especially freight, loading, and bus pull-outs (see page 15). Carefully manage loading activity and parking demand. On one-way streets with transit activity, move the bike lane or buffered bike lane to the left side of the street to alleviate intersection and curbside conflicts. On streets with heavy curbside use but low motor vehicle volume, consider moving truck traffic or curbside loading to other streets.
- **Address intersection conflicts** through motor vehicle turn prohibitions, access management, and signal phasing strategies. Due to the likelihood of both left- and right-turning conflicts from bi-directional motor vehicle traffic, use the same motor vehicle volume threshold on two-way streets as on one-way streets.
- **Increase buffer distance** where traffic characteristics adjacent to the bike lane decrease comfort, including large vehicles or curbside parking. Where adjacent sources of stress are present, a buffered bike lane can improve comfort by increasing shy distance between bikes and motor vehicles. Where multiple motor vehicle lanes, moderate truck and large vehicle volumes, or frequent transit indicate that most bicyclists will need more separation to be comfortable.

Separate Bicyclists When Speed & Volume are High

Protected Bicycle Lanes

Protected bike lanes (including raised bikeways) create All Ages & Abilities conditions by using physical separation to create a consistently exclusive, designated bicycling space. The physical protection offered by protected bike lanes means that they can often meet the All Ages & Abilities criteria even in higher speed, high volume, or unpredictable conditions. Protected bike lanes improve the overall organization of the street, and increase safety for people walking, bicycling, and in motor vehicles.

What to do:

- **Build protected bike lanes where motor vehicle speed consistently exceeds 25 mph,** where daily motor vehicle volume is higher than approximately 6,000 vehicles per day, where curbside conflicts are expected, or wherever there is more than one motor vehicle lane per direction.
- **Manage intersection and curbside conflicts** with transit boarding islands, protected (bend-out or offset) intersection designs, signal phasing, and other turn management strategies.
- **Reduce speeds through operational strategies,** such as signal time, lower signal progression, and shorter signal cycles.
- On streets with parking, **reverse the position of the parking and the bike lane to create physical separation** between the bike lane and moving motor vehicle traffic.
- On streets without parking, **add vertical separation elements** (e.g. delineators, barriers, raised curbs) in an existing buffer, or raise existing curbside bike lanes.
- On streets with multiple motor vehicle lanes in each travel direction, **convert one travel lane to a protected bike lane,** better organizing the street and improving safety for people biking, walking and driving.[22]
- **Convert conventional or buffered lanes to protected lanes** if motor vehicle speeds and volumes cannot be otherwise reduced and where there is high curbside activity or peaks of intensive demand such as retail-heavy streets, or around schools, large employers, institutions, and entertainment districts.

Second Avenue, SEATTLE
(photo credit: Adam Coppola for Green Lanes Project)

Strategies to Reduce Other Sources of Stress

In addition to motor vehicle speed and volume, All Ages & Abilities bikeway facility selection should respond to street conditions that increase bicycling stress and often degrade comfort and safety for all people using the street. These sources of stress can be addressed through design, operations, and network solutions that either remove the source of stress or separate it from bicycle traffic.

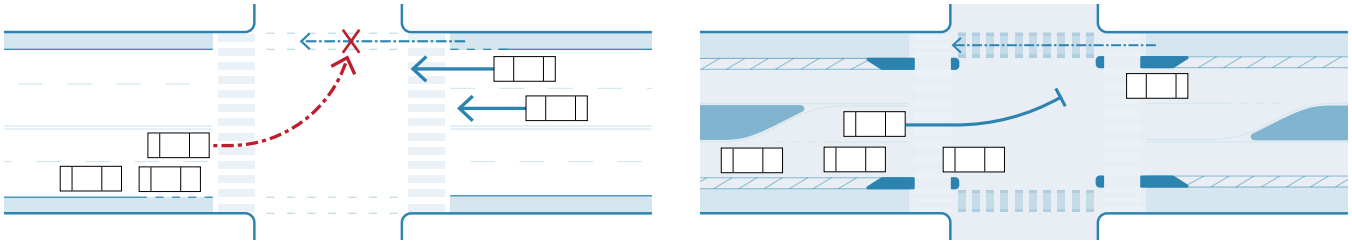
Multiple Motor Vehicle Lanes

Source of Stress

Motor vehicle traffic on multi-lane streets, whether two-way or one-way, is less predictable than on streets with a single lane per direction of travel. Lane changes, acceleration and passing, and multiple-threat visibility issues degrade both comfort and safety. Corridors with a major through-traffic function and multiple motor vehicle lanes are inherently unpredictable biking environments.

Design Strategy

Reduce the cross-section to one motor vehicle travel lane per direction, where possible. On streets where multiple through lanes in one direction are used to allocate very high motor vehicle traffic capacity, provide physical protection and manage turns across the bikeway. 4-to-3 or 5-to-3 lane conversions paired with protected bikeways are transformative for both bicycling and walking safety and comfort.[23]



A common "multiple threat" conflict, where reduced visibility for motor vehicles turning across multiple travel lanes increase bicyclists' risk at crossings. The 4-to-3 lane conversion is a common technique for managing motor vehicle traffic flow while reducing the multiple threat conflict, though two-way left turn lanes introduce turn conflicts at mid-block locations (e.g. driveways).

Motor Vehicle Queuing

Source of Stress

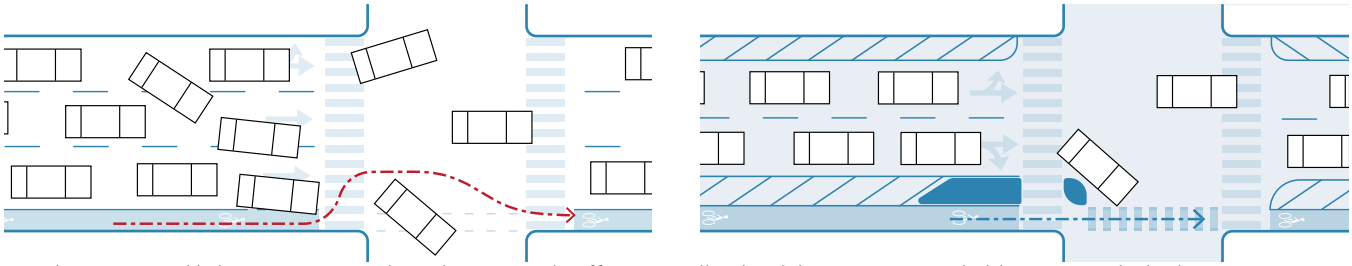
Motor vehicle congestion presents safety and comfort issues for people bicycling. Queued traffic moves at unpredictable speeds and will often invade conventional or buffered bike lanes.

Queuing encourages both motorists and bicyclists to engage in unpredictable movements. Bicyclists may weave through queued cars when bicycle facilities are obstructed, where motorists are also prone to move unexpectedly.

Design Strategy

Protected bike lanes should be implemented where motor vehicle invasion of the bike lane is likely to occur otherwise. Visual and physical barriers can prevent encroachment on the bikeway.

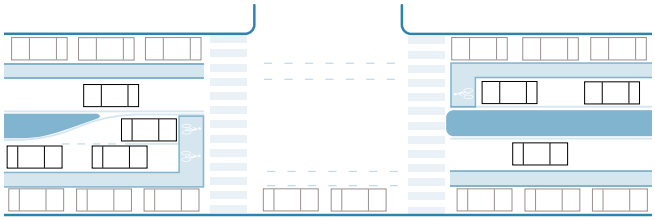
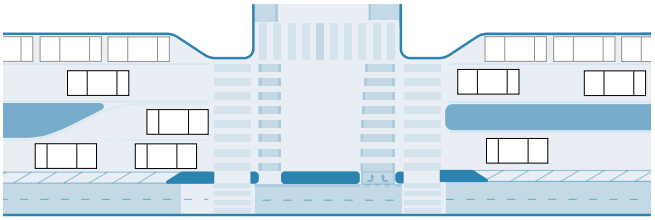
Bicycle facilities should be designed with capacity for growing ridership, including passing of slow-moving cargo bicycles.



Bicyclists are more likely to try to weave through congested traffic, especially when bikeways are impeded, but motor vehicles become unpredictable. Separation and protection prevent queued vehicles from permeating bicycle space and maintain bikeway integrity throughout the day.

Strategies to Reduce Other Sources of Stress

Intersections

Source of Stress	Design Strategy
Motor vehicles turning across the bikeway typically require people bicycling to negotiate with motor vehicles, a significant stressor at all but the very lowest speed conditions. Bicycle design treatments that require people biking to cross or mix with motor vehicle traffic are stressful at all but low volumes.	Provide separation in space and time between bicycles and vehicles to the extent possible, or reduce speed and maximize visibility between drivers and bicyclists. Tighter effective corner radii, raised crossings, and protected intersection designs are effective in slowing motor vehicle turning speed and placing bicyclists in a priority position.
Bicycle left turns, especially on busy streets, can be very stressful or even dangerous for bicyclists, especially if bikes are expected to merge with fast-moving traffic or turn across multiple lanes.[25]	Provide appropriate intersection treatments to accommodate desired turning movements, including bike boxes, two-stage queue boxes, phase separation, or protected intersections (also known as "offset" or "bend-out" crossings) that organize and give priority to people bicycling.
	
Sharp grade or direction changes, such as sharp lateral transitions approaching the intersection, require people biking to slow down and may increase fall risks. Frequent starts and stops also create instability at intersections.	Reduce or mitigate situations that increase risk of falling and instability. Design intersection approaches and transitions with bicycle-friendly geometry; place bicycle movements first in the signal phase; time signal progressions to bike-friendly speeds; and rotate stop signs to face cross streets.

Trucks & Large Vehicles

Source of Stress	Design Strategy
High volumes of truck traffic degrade adjacent bicycling safety and comfort. This is often the case on major streets, or in commercial or industrial places.	Provide protected bicycle facilities—or, at minimum, buffered bike lanes—on observed or designated trucking routes, regardless of general motor vehicle speed and volume.
Large vehicles have large blind spots, increasing risk of side-swipe and right-hook crashes.	Use buffers to increase the distance between truck and bicycle travel paths. Consider protected intersection geometry (also known as "offset" or "bend-out").
Large vehicle noise and exhaust increase bicycling stress and present public health issues.	Provide wide lateral separation—such as with wide buffers, planters or planting strips, or parking-protected facilities—to dissipate pollutants entering the bikeway.[26]

Curbside Activity

Source of Stress	Design Strategy
Frequent freight and passenger loading either happens in the bikeway or adjacent in the curbside lane. Loading activities increase conflicts crossing the bike lane, or even blockages by double-parked vehicles that imperil bicyclists and rapidly decrease assurances of safety.	Provide designated truck loading zones and provide space for other curbside uses to prevent blockages of the bicycle lane. Consider restricting freight loading to off-peak periods. If frequent freight or passenger loading is observed, provide protected bicycle facilities regardless of speed and volume, or move passenger and freight loading uses to a cross-street.
High parking turnover results in frequent weaving and door zone conflicts.	Where parking turnover is high, provide protected bikeways regardless of speed to avoid sudden conflicts and reduce injury risk, or remove parking. Cities should establish local guidance on acceptable levels of parking maneuvers across bicycle lanes.
Freight loading is present throughout the day, but motor vehicle speed and volume are consistently low.	Implement a robust bike boulevard or shared street treatment with traffic calming strategies to provide comfort and safety across the entire roadway.
Car doors open into the bicycle travel path during vehicle exit and entry, but parking turnover is low to moderate.	Provide a wide marked buffer adjacent to the vehicle door zone to guide bicyclists clear of dooring conflicts for both buffered and protected bike lanes.

Frequent Transit

Source of Stress	Design Strategy
Buses merge across conventional bike lanes to access curbside stops. At all but the lowest bus frequencies, conventional "pull-out" transit stops degrade comfort and increase transit delay.	Provide spot protection using transit boarding islands, which are compatible with protected, buffered, and conventional bicycle lanes. Boarding islands create in-lane transit stops, which improve bus reliability and travel time.
Bikes and transit travel at similar average speeds but different moving speeds, as buses stop and accelerate frequently. Overtaking buses and bicycle leapfrogging decrease riding comfort in mixed conditions.	Provide dedicated bicycle facilities. On one-way streets, left-side bicycle facilities can be used to separate bikes and transit vehicles.
Core transit routes and trunklines often operate on streets with dense destinations and demand for bicycle access. In some cases, right-of-way width may constrain design decisions and facility types that can be implemented.	On trunkline transit streets, it is even more important to accommodate users in dedicated lanes, since the major streets are where people need to get to their destinations. If the primary demand for the corridor is through travel, it may be possible to consider providing high-quality bike infrastructure on parallel, nearby, and continuous routes, while allowing local bicycle access on the transit street. To improve All Ages & Abilities bicycling conditions, use low-speed signal progressions and other calming measures consistent with transit effectiveness. As on all transit routes, pedestrian safety is the foremost design need.

The NACTO *Transit Street Design Guide* provides detailed guidance for streets with frequent bus transit routes.

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ROAD DIET

Safety | Livability | Low Cost

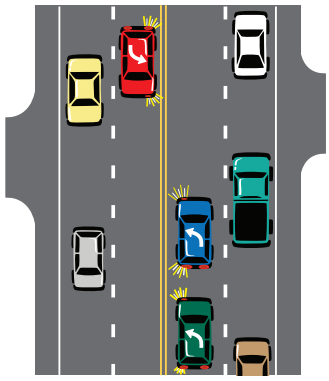
M·Y·T·H·B·U·S·T·E·R·S

Myth: Road Diets Make Traffic Worse

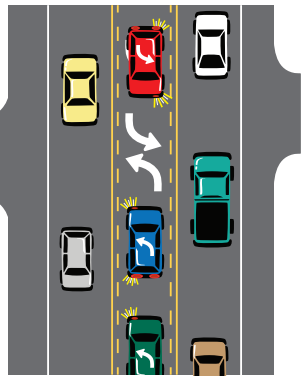
A common misconception is that reducing the number of through lanes by installing a Road Diet will cause traffic to become more congested. However, when applied correctly in the right locations, Road Diets can maintain a roadway's effective capacity. Several scenarios provided below bust this myth.

A four-lane roadway may already operate like a three-lane road.

When a corridor contains a large number of access points (driveways) the majority of through traffic will tend to utilize the outside lanes to avoid being delayed by left-turning vehicles slowing and stopping in the inside lanes. These four-lane corridors essentially behave like a three-lane road (one through lane in each direction and one two-way left turn lane), so when they are converted to a three-lane section they are unlikely to experience a change in capacity.



Before
A four-lane undivided road operating as a de facto three-lane cross section.



After
A Road Diet providing a two-way left-turn lane.

Road Diets can be successful for a broad range of traffic volumes.

FHWA and several other transportation agencies have developed guidelines for selecting candidate Road Diet locations to ensure that the effect on traffic operations is minimized. These volume guidelines for four-lane undivided roadways are summarized below.[1, 2, 3]

LESS THAN 10,000 ADT

Great candidate for Road Diets in most instances. Capacity will most likely not be affected.

10,000 – 15,000 ADT

Good candidate for Road Diets in many instances. Agencies should conduct intersection analysis and consider signal retiming to determine any effect on capacity.

15,000 – 20,000 ADT

Good candidate for Road Diets in some instances. Agencies should conduct a corridor analysis. Capacity may be affected at this volume depending on the "before" condition.

GREATER THAN 20,000 ADT

Agencies should complete a feasibility study to determine whether this is a good location for a Road Diet. There are several examples across the country where Road Diets have been successful with ADTs as high as 26,000. Capacity may be affected at this volume.

1 FHWA, Road Diet Informational Guide, FHWA-SA-14-028 (Washington, DC: FHWA, 2014). Available at: http://safety.fhwa.dot.gov/road_diets/case_studies/roaddiet_cs.pdf.

2 City of Seattle Modeling Flow Chart for Road Diet Feasibility Determination. Available at: http://safety.fhwa.dot.gov/road_diets/info_guide/ch3.cfm#f1.

3 MnDOT Office of Traffic, Safety and Technology, Minnesota's Best Practices for Pedestrian/Bicycle Safety, Report 2013-22 (Roseville, MN: MNDOT, 2013). Available at: http://www.dot.state.mn.us/stateaid/trafficsafety/reference/ped-bike-handbook-09.18.2013-v1.pdf.

Intersections may determine true capacity.

Often, signalized intersections are the most significant constraint on roadway capacity. Converting four through lanes to two through lanes makes it possible to install dedicated turn lanes at the intersection. If the intersection experiences a large number of turning vehicles, this design can help reduce intersection delay. Alternative intersection configurations, like roundabouts, can offer even more opportunities for enhanced traffic operations.

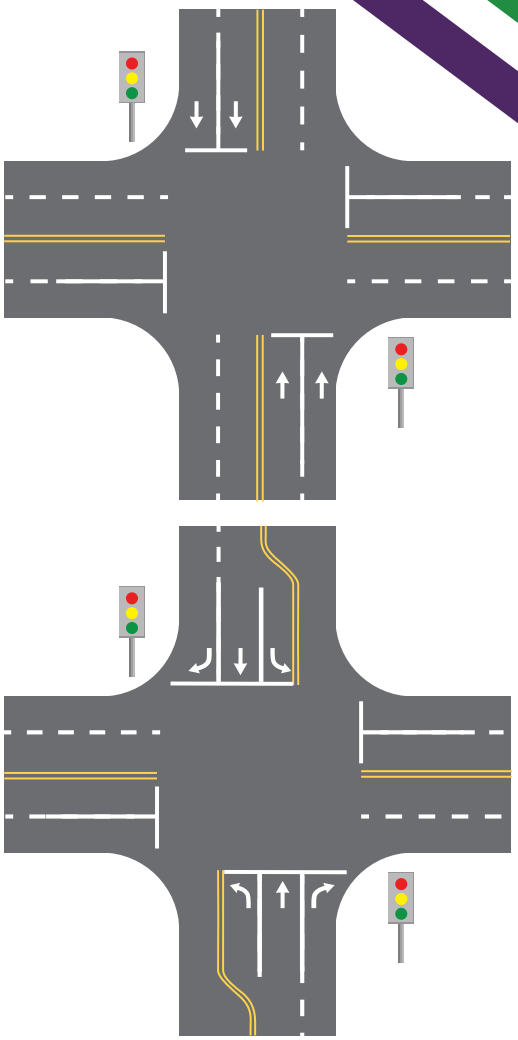
Level of service (LOS) isn't just for motorists.

Maintaining a satisfactory LOS for motorists is important, but people who walk or bike also appreciate efficient road networks. Road Diets can improve travel conditions for these users, too. In most cases, these travelers' usage is linked directly to perceived safety and comfort. When these factors improve, non-motorized and transit usage tend to increase.[4] Factors that affect travelers' perceptions of safety and comfort and are improved by Road Diets include:[5]

- Reduced motor-vehicle speeds
- Increased space and/or barriers between motor-vehicle lanes and pedestrians and bicyclists
- Shorter crossing length for pedestrians
- Pedestrian refuge islands and dedicated bicycle lanes at intersections
- Safer and more comfortable access to transit stops

Trading a little capacity can be worth it.

It is important to consider the big picture when selecting a Road Diet location. The countermeasure's primary objective is to improve safety for all roadway users. Occasionally, this can require accepting a small decrease in mobility to gain a large increase in safety. Additionally, Road Diets can increase livability by creating a friendly bicycle and pedestrian environment as well as encourage economic growth by increasing property values and attracting businesses.



Example of intersection with added turning movements.

Source: PeopleForBikes

Intersection in Chicago, IL after Road Diet Installation.

Source: PeopleForBikes

Dexter Ave, Seattle, WA after Road Diet Installation.

4 FHWA, Road Diet Case Studies, FHWA-SA-15-052 (Washington, DC: FHWA, 2015). Available at: http://safety.fhwa.dot.gov/road_diets/case_studies/roaddiet_cs.pdf.

5 Transportation Research Board of the National Academies, *Highway Capacity Manual 2010* (Washington, DC: TRB, 2010).