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Design Principles of Cycling [Draft Version]

This guide will give you information about cycling infrastructure and introduce you to 6 design principles for cycling. It will also provide information about the main need for cities, which is to build safer, more convenient cycling infrastructure integrated with current modes of transportation.

Explore the Collection

This resource is part of a suite of learning products linked with the following publication.

PUBLICATION

Safe Cycling Design Manual for Istanbul

This manual examines three main topics: (1) the benefits of urban cycling; (2) governance of cycling infrastructure and user preferences; and (3) solutions for implementing safe, sustainable cycling infrastructure. The manual draws from field research and a survey of over 3,000 stakeholders in Istanbul.

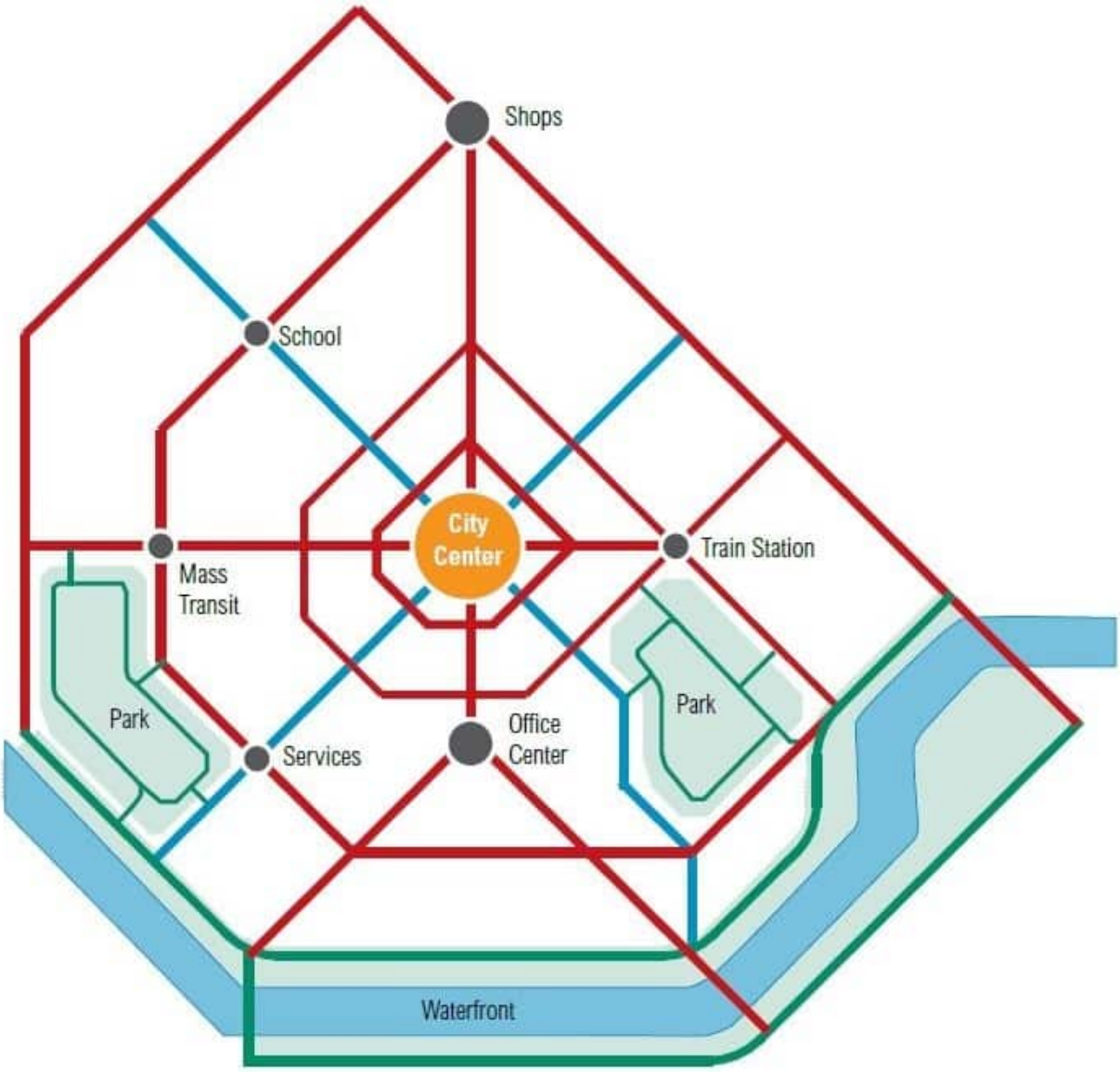
Course Content

What Are the Main Design Principles for Cycling?

Cycling is a healthy, carbon-free, fun means of transportation that facilitates enhanced access to school, work, leisure, and can integrate well with other modes of transport.

This guide offers six design principles for cycling. It will describe the elements for each principle and share evidence for implementing these measures.

The individual characteristics of each community must be taken into account when planning the cycling infrastructure. Moreover, cycling infrastructure must be adapted according to the characteristics of the local population, land use, topography, and other factors.



Principle 1: **Bike networks** must be planned to provide a cohesive, safe and direct route for cyclists.

Principle 4: Improved **intersection design** reduces conflicts for cyclists.

Principle 2: Basic needs of a cyclist, including adequate room for movement and safe travel, must be taken into account during the **design phase**.

Principle 3: **Segregated bike lanes** provide a higher perceived and real safety for cyclists.

Principle 5: **Shared streets** must be low speed and have a low volume of traffic.

Principle 6: Plan **off-street paths** along green routes.

References

Projects and Programs Manual to Encourage Cycling in Communities

Cities Safer by Design

Safety Can Be Improved by Design

Video transcript below.

Video transcript below.

In this video, Anne Eriksson, civil engineer and traffic safety specialist from Copenhagen, speaks about how we can encourage safer behavior through design strategies.

> “It’s very important that on a national level we are focusing on how to reach out to people to diminish speed and do all these things that we know is the better behavior. The police, for example, have a big role in this, and also different laws and other controls.
>
> But on a local level, for example, even though human factors are the most important when the accident happens, what we can do in a municipality is that we can actually make the drivers behave in more safe ways.
>
> We can design the roads so that people slow down the speed and become more aware of each other when they come to an intersection, for example.
>
> By these measures, as road planners and road traffic safety engineers, we can actually help

people to behave in a safe way by designing the streets so they understand they should behave in a more safe way."

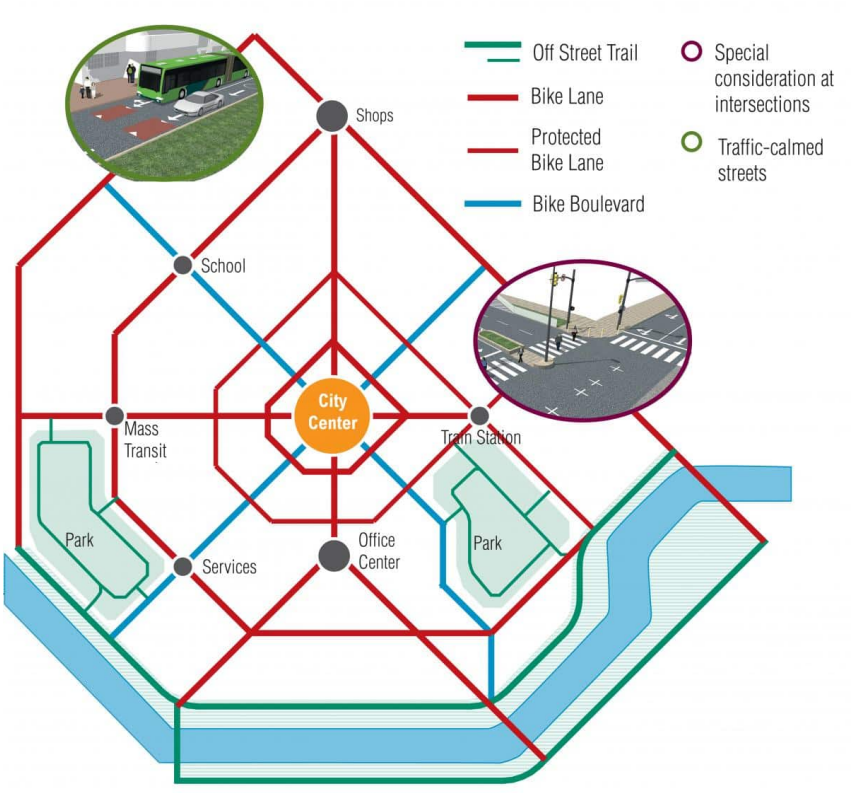
References

Bikeable City Masterclass on WRI Turkey Sustainable Cities YouTube Channel

Principle 1: How to Design a Safe Cycling Network?

In cities around the world, residents have various excuses for not cycling: "*The weather is bad;*" "*There are too many hills;*" "*People love cars too much*". The truth is that the main barrier to cycling in most places is that it is not seen as a normal, common or convenient transportation option.

As soon as biking becomes more convenient than other options, it can take off. For this to happen, the needs of cyclists should be considered throughout the road network. Routes should be **coherent**, **direct**, and **continuous**.



The needs of cyclists should be considered throughout the road network.

Bogota, Colombia found that adding more than 100 km (62 miles) of bike lanes helped reduce cyclist deaths by 47.2 percent between 2003 and 2013. It also increased cycle use from just over 3 percent of all daily trips to over 6 percent.

Regardless of whether the land is flat, hilly or a mixture of both, it is essential to plan for continuity of the bike path network for complete connection across the city.

References

Cities Safer by Design

Safe Cycling Design Manual

Projects & Programs Manual to Encourage Cycling in Communities

Main Requirements For A Complete Cycle Network

A comprehensive, clearly visible cycle network is key to establish cycling as a normal, convenient, and safe transport option.

Main Requirement	Important Aspects
COHESION	Network ConnectivityMatch with need to travelUniform infrastructure and signageWayfinding tools, signs, pavement markingsIntegration with public transportAmple provision of bike parking
DIRECTNESS	Directness in terms of distance and time
SAFETY	Appropriate infrastructure for street typeAvoid/reduce speed at conflictsClear visibility and consideration at junctionsSeparate from high-speed traffic
COMFORT	Prevent conflicts between modesEase of finding destinationComprehensibility
ATTRACTIVENESS	Social safetyMaintenance

References

Adapted from Crowe (2007)

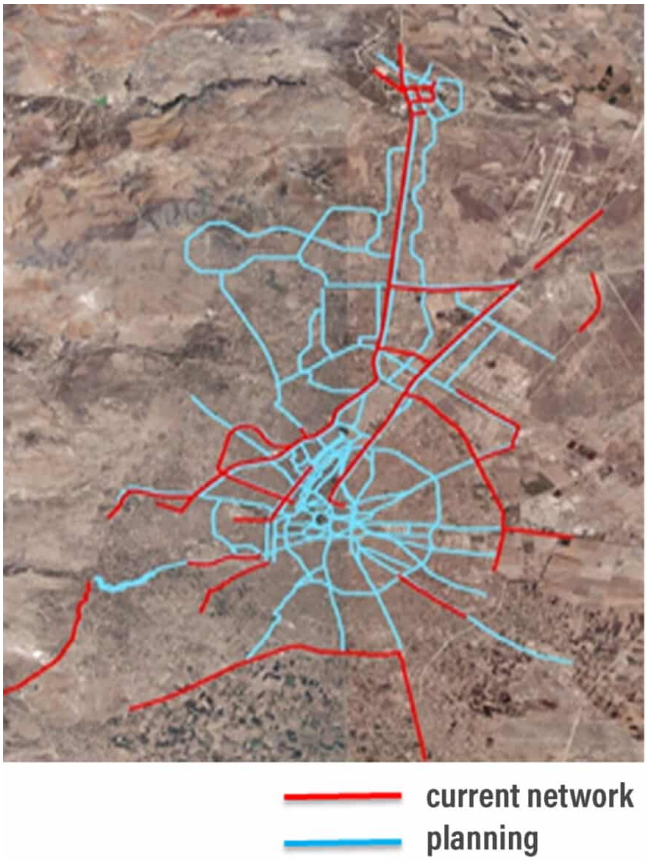
A Case from Konya, Turkey

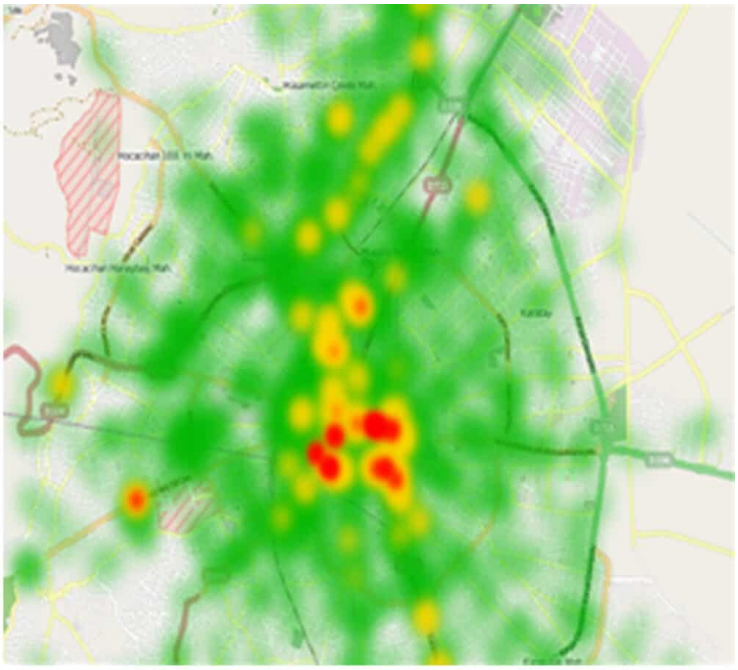
Network design improves safety

Cycling infrastructure should be designed and implemented as a network.

There is a strong relationship between network design and road safety. Evidence from Konya shows that the lack of network design and presence of interruptions along cycling infrastructure increase the number of crashes involving cyclists.

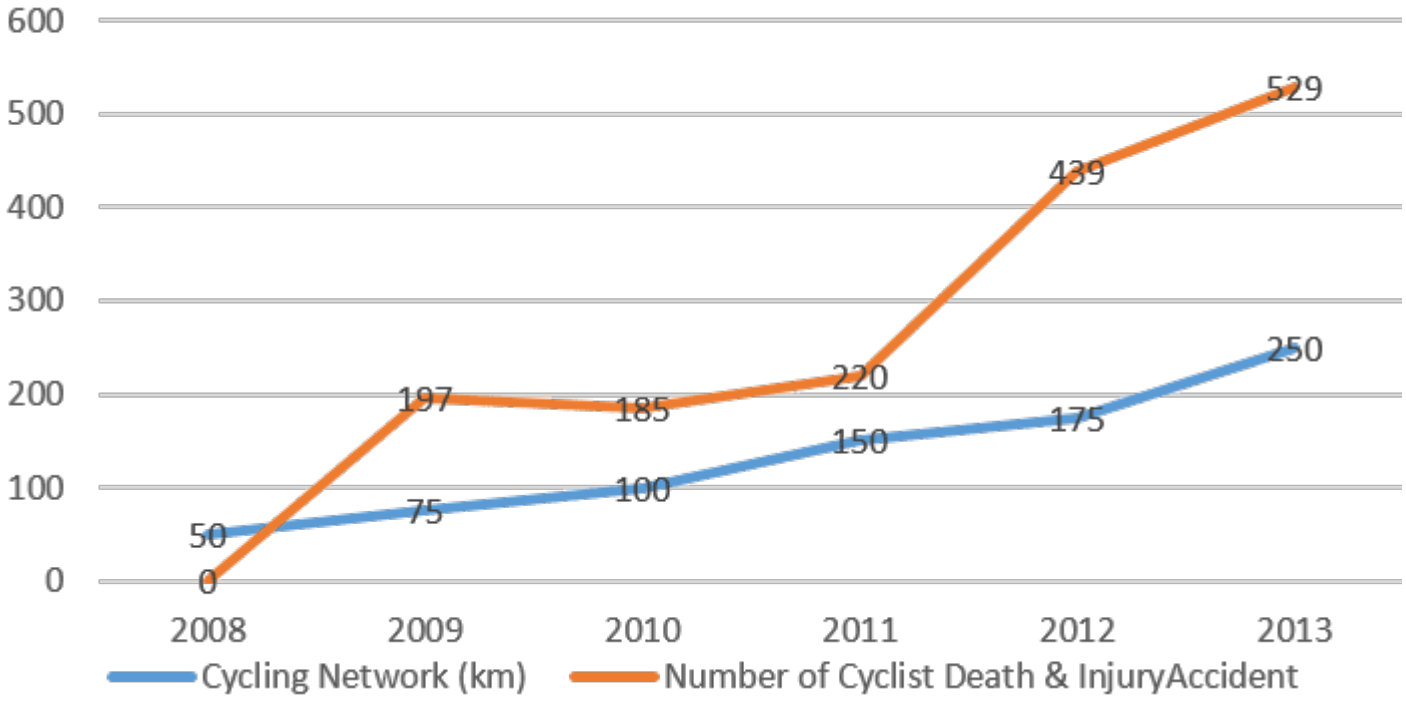
Safe cycling infrastructure is not about how many kilometers are built but how integrated those kilometers are.





The heat map created with PTV Vissum Safety shows the density of crashes involving cyclists. These crashes occurred in downtown where frequent interruption is observed within the network.

Left: The cycling network in Konya, Turkey. Red lines show the current network, while blue lines represent the planned network. Right: The heat map created with PTV Vissum Safety shows the density of crashes involving cyclists. These crashes occurred in the downtown area where frequent interruption is observed within the network.



This graph shows the relationship between the cycling network and crashes involving cyclists in Konya. The blue line shows the extent of the cycling network in kilometers, while the orange line shows the number of cyclist deaths, injuries, and accidents.

References

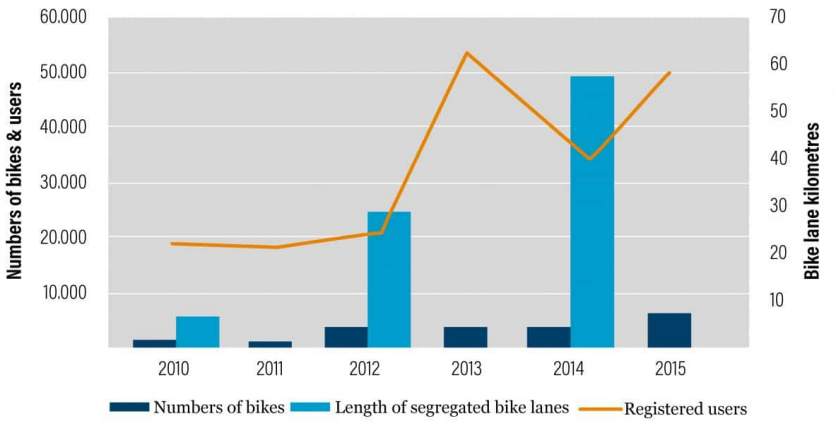
RSLab Project, WRI Turkey Sustainable Cities (October 2015)

A Case from Mexico City

Increasing the number of cyclists

Mexico City's commitment to expanding and improving cycling infrastructure together with promoting cycling for residents, has caused an increase in the number of cyclists over time.

The graph below illustrates the total number of registered EcoBici users each year from 2010 to 2015. While city-wide cyclist data is not available, this graph indicates overall growth in cyclists over time.



Total number of registered EcoBici users in each year from 2010 to 2015

2010-2012: Following the launch of EcoBici and as Mexico City began to expand the network of bike lanes, we see a gradual increase in bicycle users.

2012: A landmark year. The number of bikes in the bike share program almost tripled, while the length of bike lanes was increased to almost five times, compared to 2010.

2013: As a result of the previous year's actions, there was a 14 percent increase in the number of registered EcoBici users.

The expansion of cycling facilities stimulates uptake – a conclusion that follows the general principle of transport supply and demand, which has long been established in relation to road networks.

References

C40, Benefits of Climate Action. Piloting A Global Approach To Measurement. (2016)

How to Design Signs and Markings?

Easily identifiable and consistent pavement markings, infrastructure and signs help people see and understand the network. The primary purpose is to indicate the presence of a bicycle facility or to make that facility clear to bicyclists, motorists, and pedestrians.

Cycling signage includes several sub-categories:

- Way-finding and route signage
- Regulatory signage

- Warning signage

Fig. 1: Example of warning signage for pedestrians and cyclists in Pune, India. Photo by ITDP.

Bike lane markings include any signage applied to the pavement and intended to designate a specific right-of-way, direction, potential conflict area, or route option. Markings may be used to augment a particular lane, intersection, or signal treatment.

Markings can be used to:

- Show cyclists their options in traffic
- Make their trips easier
- Indicate dead-end streets, one-way streets, and non-pedestrianized zones

Fig. 2: Example of lane markings that designate direction for

cyclists in São Paulo, Brazil. Photo by ITDP.

References

NACTO

Safe Cycling Design Manual

Fig. 1: ITDP

Fig. 2: ITDP

A Case from Auckland, New Zealand

Uniform infrastructure and signs

Example of consistent and easily identifiable pavement markings in Auckland New Zealand. Photo by Chris Brunn/Flickr.

In Auckland, a variety of cycle routes – largely separated from traffic and pedestrians – will connect key parts of the city center. The cycleways will include a number of east-west connections and link workplaces, shops, and schools. Particular attention will be paid to intersections and junctions so that people who cycle will experience a safer and more comfortable journey through the city center.

References

New Zealand Transport Agency

How to Integrate Cycling with Other Modes?

To systematically promote cycling within the framework of an integrated transport policy, we must improve the links connecting cycle paths to other modes of transport. This is especially important at **interchanges** – locations where passengers change from one transport mode to another.

While some progress has been made, there are still many barriers to forming integrated transport chains.

Solutions and actions:

- Integrate stations and interchanges into the cycle network
- Provide services for renting, borrowing, or dispatching cycles at stations and other interchanges
- Include cycle parking in the the design of railway stations, bus-stops, and interchanges
- Develop bike-sharing facilities
- Include dedicated section on public transport for cyclists to stow their bikes
- Offer information services

References

Federal Ministry of Transport, Building and Housing (2002). National Cycling Plan 2002-2012. Ride your bike! Measures to Promote Cycling in Germany

Bike Parking

Bicycle parking facilities are welcome in public areas and any location where people travel. For example, transportation terminals, commercial buildings, schools, universities, residential areas, hospitals, shopping centers, and grocery stores receive large volumes of people. Individuals would be better able to access these destinations by bicycle if they had high-quality, abundant and affordable parking.

Adequate bike parking should be:

- Provided in line with demand
- Noticeable from a distance
- Accompanied with signs to guide cyclists
- Accessible directly
- Free from steep ramps, stairs or doors

*Secure bike parking in public transport stations is also necessary to **facilitate "Park and Ride"** and support **intermodal trips**.*

Types of Bike Parking:

- **Short-term parking:** Short-term bicycle parking facilities are **typically used for two hours or less**. These facilities are required near commercial establishments, for use by visitors to commercial buildings and parks. They provide ample street parking for bikes to increase cyclist confidence in the network and promote cycling.

*Examples of **short-term parking**. Top left: London. Photo by Cycle Hoop; Bottom left: Christchurch. Photo by Christchurch Daily Photo; Right: Rio de Janeiro. Photo by WRI.*

- **Long-term parking:** Long-term parking facilities must provide a space with a higher degree of security than regular bike racks, allowing cyclists to leave their bikes **for the entire day, overnight or for even longer periods**. These parking areas can be monitored by a 24-hour attendant and provide parking for 50 bicycles or more.

Examples of **long-term parking**. Left: Biciestacionamiento Massa, Transmilenio. Photo by This Big City; Right: Slovenia. Photo by Richard Drdul.

References

[ASCOBIKE + ITDP: Bicycle Parking Facility Manual]

[Safe Cycling Design Manual for Istanbul]

[Cities Safer by Design]

[Projects and Programs Manual to Encourage Cycling in Communities]

Bike Sharing

Cities can go beyond safer bike lanes to also provide the bicycles themselves. Bicycle sharing has found success in low- and middle-income countries such as China and Mexico.

Promoting cycling through public bike-sharing systems can contribute to the local economy and carbon-free economic growth. Introducing new bicycle infrastructure can enhance bicycling rates and provide residents the choice to use transport that provides physical health benefits.

Implement bike share programs in large and medium-size cities, prioritizing connections to transit.

Examples of public bike-sharing systems. Left: EcoBici, Mexico City; Right: Bike Itaú, Rio de Janeiro

References

Cities Safer by Design

ITDP (2015) A Global High Shift Cycling Scenario: The Potential for Dramatically Increasing Bicycle and E-bike Use in Cities Around the World, with Estimated Energy, CO2, and Cost Impacts

Iván De la Lanza. Eco-bici Case Study of Business Models for Bike Share System.

Principle 2: What Are the Basic Design Considerations?

To increase the level of cycling, cities must pay attention to the design components of cycling infrastructure and provide a comfortable commuting space for citizens.

The basic design considerations for cycling infrastructure include:

- **Vehicle speeds and cyclists' safety**
- **Safer types of cycling infrastructure**
- **Space needed for cycling**
- **Appropriate lighting**

The next 4 cards will share more detail about each of these components.

References

[Projects and Programs Manual to Encourage Cycling in Communities]

[Cities Safer by Design]

Vehicle Speeds and Cyclists' Safety

The cities with the best road safety records in the world design their streets for pedestrians, cyclists, and mass transport to reduce risk of crashes. This can be done by encouraging safer vehicle speeds and prioritizing pedestrian and cyclist safety.

Reducing Risk: Traditional engineering has focused on reducing crash frequency per VKT (vehicle kilometers traveled). This can lead to a bias toward treatments that improve the safety of car occupants, neglecting those who choose to travel by other modes. Instead, cities can diminish risk by treating all modes fairly, encouraging safer vehicle speeds, and focusing on locations that are especially prone to produce fatalities or serious injuries.

Safer Infrastructure and Design: This includes the number of safety engineering treatments per section of street network, characteristics of community design that reduce speed or offer good conditions for walking, cycling and mass transport facilities and volume, and average vehicle speeds by road type.

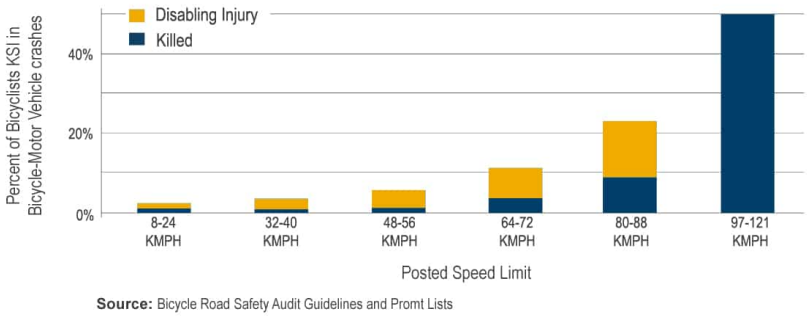


Figure 1 | How vehicle speeds affect cycle-motor vehicle crashes.

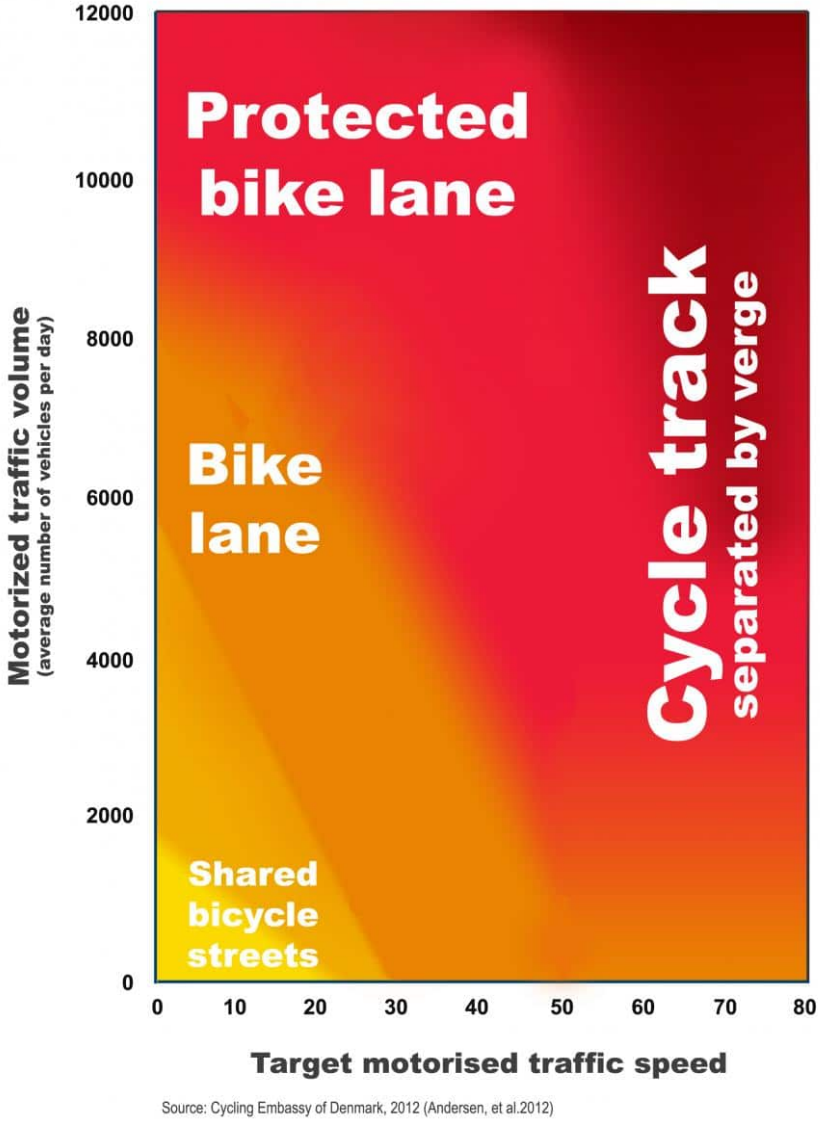


Figure 2 | Recommended types of cycling infrastructure according to speed and volume. For example, cycle tracks are recommended to reduce risk of crashes on high speed roads with average-to-high volume of motorised traffic.

References

[Figure 1 based on data in The University of North Carolina Highway Safety Research Center. North Carolina Bicycle Crash Facts 2004 – 2008. August 2010.]
Figure 2: Cycling Embassy of Denmark, 2012 (Andersen, et al. 2012)
[Cities Safer by Design]

Safer Types of Cycling Infrastructure

Cycling infrastructure can help improve cycling safety and increase cycling levels. There is an important relation between the type of route and injury risk:

- **Cycle tracks and protected bike lanes have the lowest injury ris**k. Cycle tracks and protected bike lanes are on-street cycle lanes that are physically separated from motor vehicles by raised curbs, bollards, or concrete barriers.
- Painted bike lanes on major streets without any parked cars, residential street bike routes, and bike paths in parks are also safer types of infrastructure.

- Sidewalks and multi-use paths, on the other hand, present higher risks than bike-only paths and bike lanes.

Safer routes tend to also be preferred routes, so safer infrastructure should encourage cycling while reducing injury rates. For instance, U.S. and European cities with higher rates of cycling have fewer overall traffic crashes. These cities also have high-quality cycling infrastructure, high street connectivity and compact urban form.

A study from University of Cambridge shows that 85 percent of the effect on increasing cycling is explained by use of the infrastructure. The study identified changes in perceptions of the route to work and use of the cycle path, as potential mediators. The table below outlines additional findings of the study.

Variable		No. Injury Sites/No. Control Sites	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Major street route, parked cars	No bike infrastructure	155/114	1.00 (Ref)	1.00 (Ref)
	Shared lane	9/7	0.78 (0.25, 2.41)	0.71 (0.21, 2.45)
	Bike lane	25/28	0.53 (0.26, 1.07)	0.69 (0.32, 1.48)
Major street route, no parked cars	No bike infrastructure	112/118	0.65 (0.44, 0.97)	0.63* (0.41, 0.96)
	Shared lane	13/12	0.66 (0.24, 1.82)	0.60 (0.21, 1.72)
	Bike lane	35/46	0.47 (0.26, 0.83)	0.54 (0.29, 1.01)
Local street route	No bike infrastructure	89/116	0.44 (0.28, 0.70)	0.51 (0.31, 0.84)
	Designated bike route	52/57	0.53 (0.30, 0.94)	0.49 (0.26, 0.90)
	Designated bike route with traffic calming	49/47	0.59 (0.32, 1.07)	0.66 (0.35, 1.26)
Off-street route	Sidewalk or other pedestrian path	52/47	0.73 (0.42, 1.28)	0.87 (0.47, 1.58)
	Multiuse path, paved	64/56	0.75 (0.42, 1.34)	0.79 (0.43, 1.48)
	Multiuse path, unpaved	12/11	0.63 (0.21, 1.85)	0.73 (0.23, 2.28)
	Bike path	21/21	0.54 (0.20, 1.45)	0.59 (0.20, 1.76)
	Cycle track	2/10	0.12 (0.03, 0.60)	0.11 (0.02, 0.54)
Grade, degree	0 (flat)	245/312	1.00 (Ref)	1.00 (Ref)
	< 0 (downhill)	333/231	2.13 (1.61, 2.81)	2.32 (1.72, 3.13)
	> 0 (uphill)	112/147	1.07 (0.76, 1.50)	1.13 (0.79, 1.63)
Streetcar or train tracks	No	540/592	1.00 (Ref)	1.00 (Ref)
	Yes	150/98	3.48 (2.14, 5.65)	3.04 (1.80, 5.11)

References

[Cities Safer by Design]
https://ecf.com/news-and-events/news/want-safer-cycling-think-infrastruc...
http://ajph.aphapublications.org/doi/full/10.2105/AJPH.2012.300762
https://www.sciencedirect.com/science/article/pii/S0091743516300214
http://road.cc/content/news/186152-cycle-infrastructure-responsible-85

Chart: Teschke et al, 2012

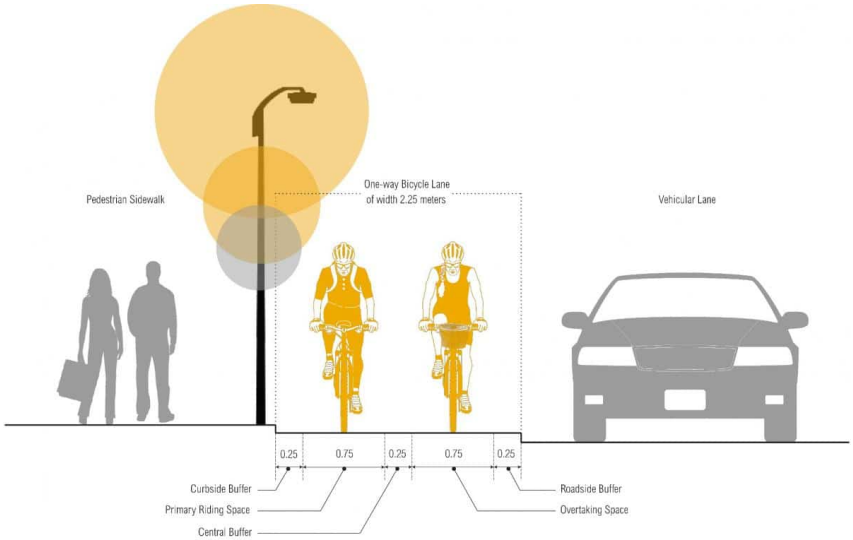
Space Needed for Cycling

Urban planners and designers must be aware of the space needed for a cyclist to pedal and understand the bicycle as a means of transportation. It is strongly recommended that designers cycle to be fully familiar with the cycling environment and user needs.

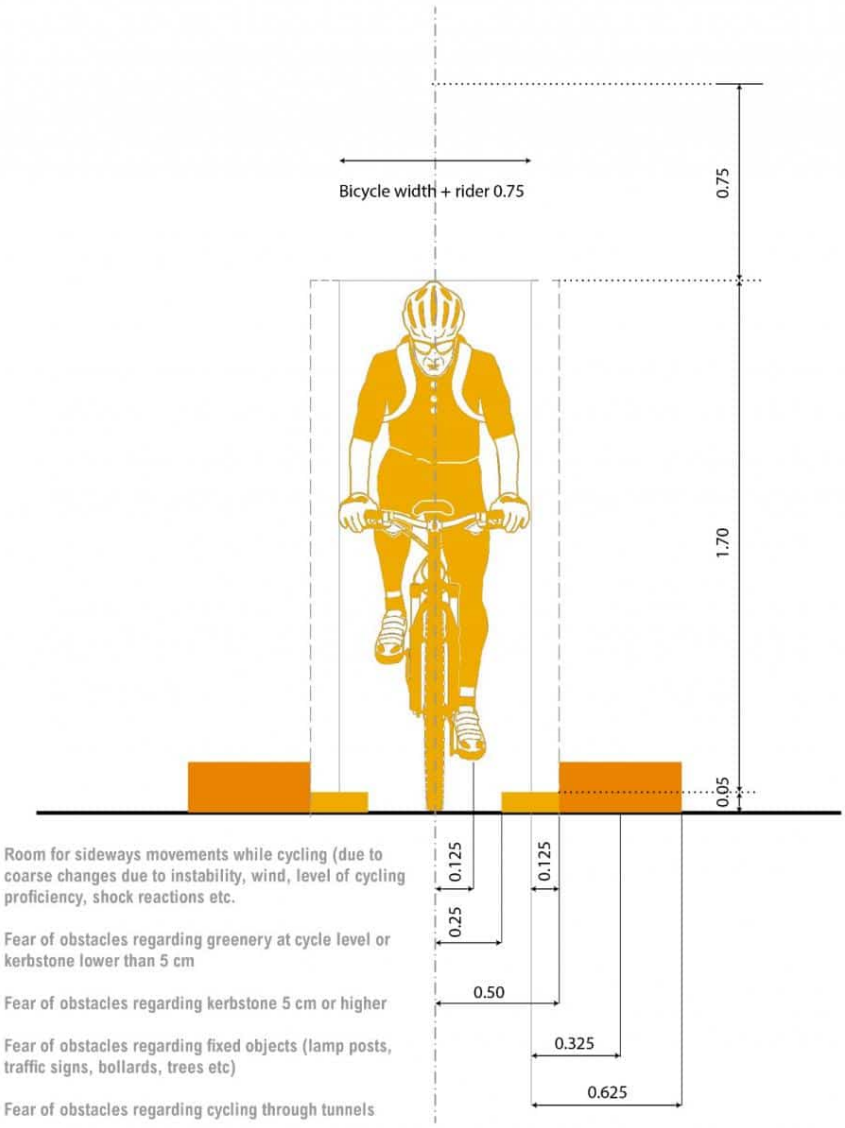
The average width of a cyclist is **1 meter**. However, it is important that all infrastructure designed for cyclists allows **10 cm of wiggle room** on each side.

The purpose of cycle lanes is to allocate and establish space for cyclists in order to:

- Increase drivers’ awareness of cyclists
- Encourage drivers to leave space for cyclists
- Give people greater confidence to cycle on the road network
- Improve perceived and actual safety
- Assist cyclists to pass queuing traffic
- Encourage lane discipline by cyclists and motor vehicle drivers



Allocated space for cyclists should consider their interactions with other road users. Graphic by WRI.



Basic dimensions for a safe cycle path.

References

Cities Safer by Design

Projects and Programs Manual to Encourage Cycling in Communities

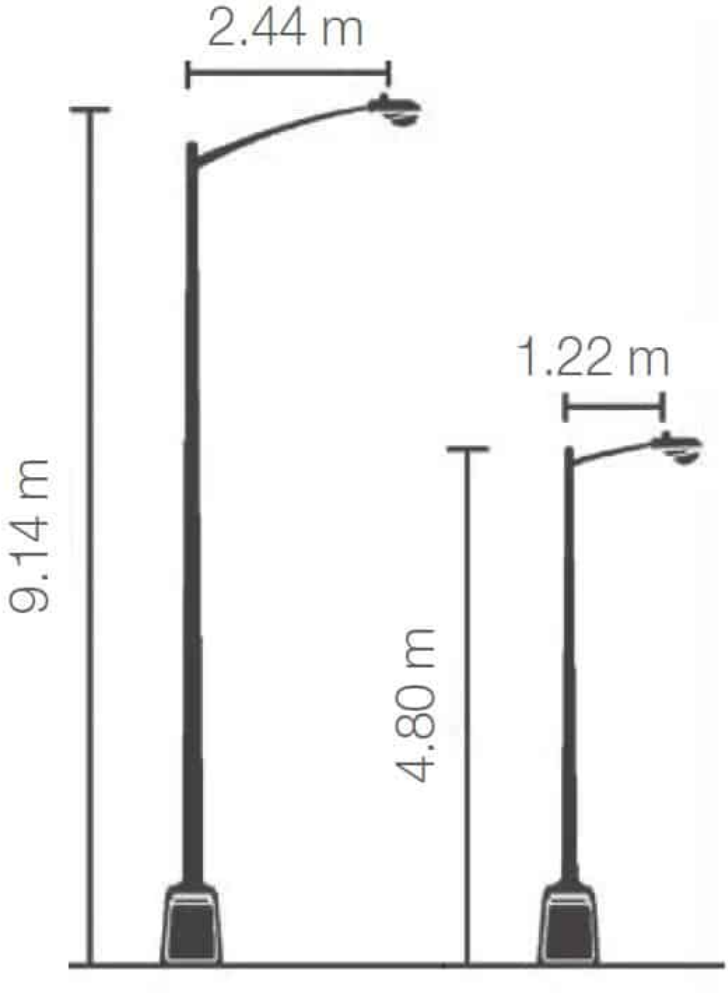
Appropriate Lighting

Adequate, well-positioned, quality lighting can significantly improve an urban nighttime experience.

When **designing lighting for bike lanes**:

- Ensure that routes and crossings are adequately lit
- Add more lighting in areas with a higher volume of cyclists and at major intersections
- Install lighting on both sides of major roadways
- Use uniform light intensity between posts along the same road

Pedestrian & cyclist-scale lighting in Amsterdam



Examples of standard public lampposts

and street lamps for pedestrians and cyclists.

References

Projects and Programs Manual to Encourage Cycling in Communities

Cities Safer by Design

Principle 3: How to Design Segregated Bike Lanes?

Protected bike lanes

Protected bike lanes are intended to physically separate cyclists from motorized traffic and ensure their safety and fluid mobility. On busy roads, protected bike lanes help ensure cyclists feel safe and are not at great risk from distracted drivers.

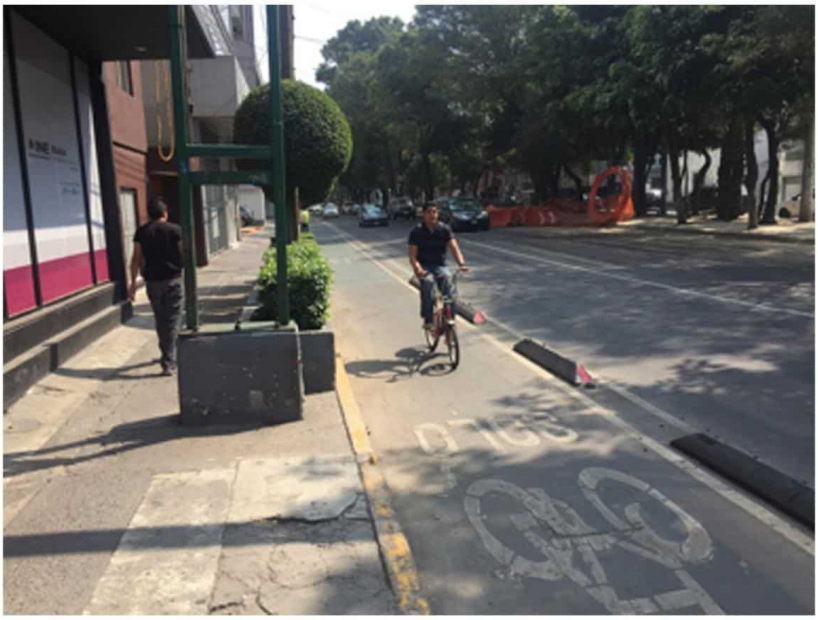
A **protected bike lane is provided by a buffer of some kind**, which could include small “armadillo” humps, a linear curb, a raised bike path, plastic bollard posts within a painted area, or other means to provide physical protection.

Research on Canadian cities found that **cycle tracks had a nearly 90 percent lower risk of cyclist injuries** compared to major streets with no bicycle infrastructure. (Teschke et. al 2012)

Mexico City now has over 120 km of bike lanes, including protected lanes, and places like Shanghai also are installing protected bike lanes.

A new bike lane in New York has **reduced rates of vehicle speeding from 74 percent to 20 percent. Crashes and injuries of all kinds dropped by 63 percent**.

Compare the two photos below, for example. On the left, the bike lane is protected. On the right, the cyclist must navigate between vehicles encroaching on the bike lane.



References

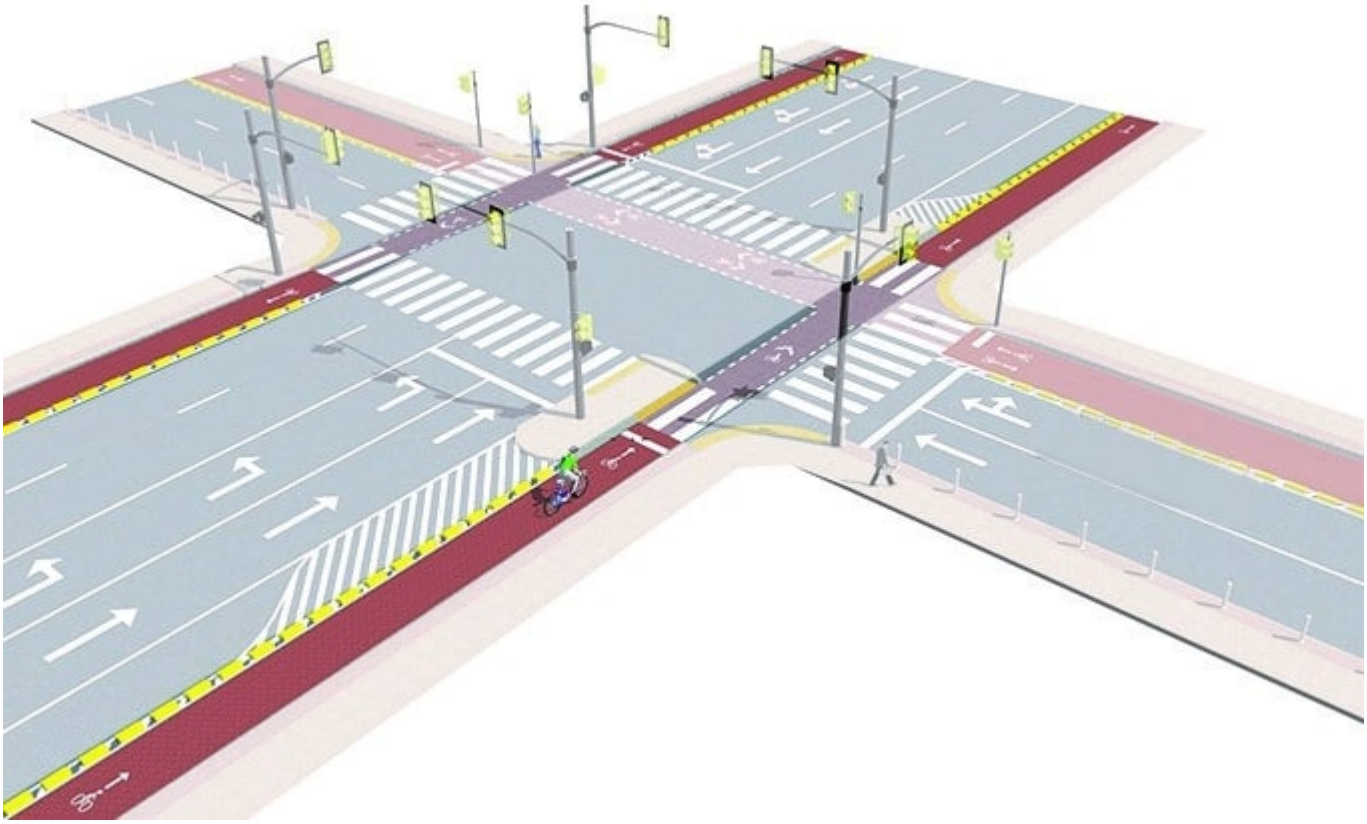
[Cities Safer by Design]

Kay Teschke, M. Anne Harris, Conor C. O. Reynolds, Meghan Winters, Shelina Babul, Mary Chipman, Michael D. Cusimano, Jeff R. Brubacher, Garth Hunte, Steven M. Friedman, Melody Monro, Hui Shen, Lee Vernich, and Peter A. Cripton. Route Infrastructure and the Risk of Injuries to Bicyclists: A Case-Crossover Study. American Journal of Public Health: December 2012, Vol. 102, No. 12, pp. 2336-2343.

Uni-Directional Protected Lanes

One-way protected bike lanes are **at street level** and use a variety of methods for **physical protection from passing traffic**. One-way protected bike lanes may be incorporated into a previous parking lane or other parallel lane, complete with a protective barrier between the bike lane and the motor vehicle travel lane. When a cycle track is elevated above street level, it is called a **raised cycle track** and different design considerations may apply.

Uni-directional protected lanes have a **standard width of 2.2 meters**, with 1.7 meters as the bare minimum. Where an adjacent parking lane doesn’t exist, however, the width may go as low as 1.5 meters, but only on low-traffic, low speed streets.



Uni-directional protected lanes separated from car traffic through physical barrier. Graphic by WRI.

Cycling infrastructure, seen here in Shanghai, provides physical separation from motor vehicles through a fence. Photo by Ben Welle / Cities Safer by Design.

A one-way cycle track in Mexico City protects cyclists with physical barriers. Photo by Jason Margolis / Cities Safer by Design.

References

[NACTO, Urban Design Bikeway Guide]

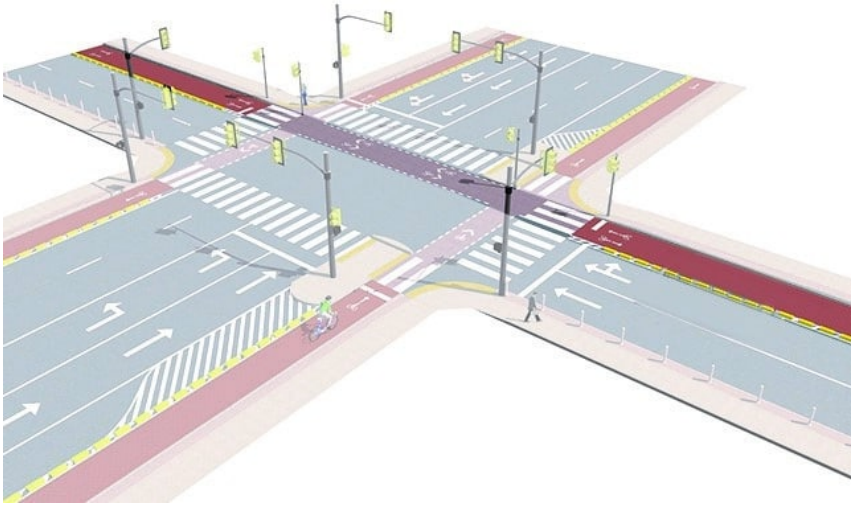
[Cities Safer by Design]

Bi-Directional Protected Lanes

Two-way bike lanes **allow cycle movement in both directions, on one side of the road**. Two-way lanes share some of the same design characteristics as one-way lanes, but may require additional considerations at driveway and side-street crossings. A two-way may be configured as a **protected cycle track** – at street level with a parking lane or other barrier – or as a **raised cycle track** to provide vertical separation from the adjacent motor vehicle lane.

Bi-directional protected bike lanes are **best suited for streets with long segments without access points**, or where it is difficult for cyclists to cross the street. These include: one-way streets, parks, waterfront roads, wide boulevards and generally streets with fewer interruptions.

Bi-directional protected bike lanes have a **standard minimum width of 2.5 meters**, allowing for overtaking and riders in both directions.



Bi-directional protected lanes separated from car traffic through physical barrier.

References

NACTO, Urban Bikeway Design Guide

Schepers et al. Road factors and bicycle—motor vehicle crashes at unsignalized priority intersections. Accident Analysis & Prevention. Volume 43, Issue 2, 2011.

Cities Safer by Design

Bike Lanes at the Sidewalk Level

Lanes on the pavement level can be considered protected and **designed as separate facilities** than those used by pedestrians.

Cycle lanes placed within the pedestrian pavement can constrict the space available for walking, leading to safety and comfort challenges. **Pedestrian walkways require a bare minimum width of 1.5-1.8 meters**, and more for high pedestrian volume areas.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Principle 4: How to Design Intersections and Access Points?

Evidence shows that the crash rate for cyclists is six to nine times as high as it is for car users (Bjornskau 1993). The risk may be even higher in developing countries due to underreporting.

Evidence also shows that through better street design, bicycle injuries and crashes can be greatly reduced. While protected bike lanes can improve safety between junctions, **paying special attention to junction design is crucial for real gains in safety** and ultimately, a more successful cycling system.

A safer intersection for cyclists may include the following elements:

- Better visibility between cyclists and vehicle drivers to reduce risk of turning conflicts
- Proper markings and cycle signals
- Two stage turns for cyclists
- Bike boxes / advanced stop lines
- Speed reduction measures
- Simultaneous green phases for cyclists

References

Cities Safer by Design

Protected Intersections

Learn more about the different design elements of protected intersections. Video created by Nick Falbo.

In addition to protected bike lanes, **cyclists need to be protected at intersections**. A protected intersection continues the physical separation of cycle infrastructure, positioning cyclists prominently ahead of right-turn conflicts and creating safe, simple cyclist movements through the intersection. This can be achieved without moving existing curbs, with modifications making the intersection more compact and organized.

The protected intersection, also known as a Dutch intersection, provides **safe refuge spaces** for cyclists where the various cycle facilities meet. All cyclist turns become **two-stage turns**, and cyclists are given priority position using **advanced stop boxes**, **leading signal priority**, and **smaller curb radii** to slow vehicles turning across the cycle path.

References

Video by Nick Falbo: Protected Intersections for Bicyclists and Pedestrians

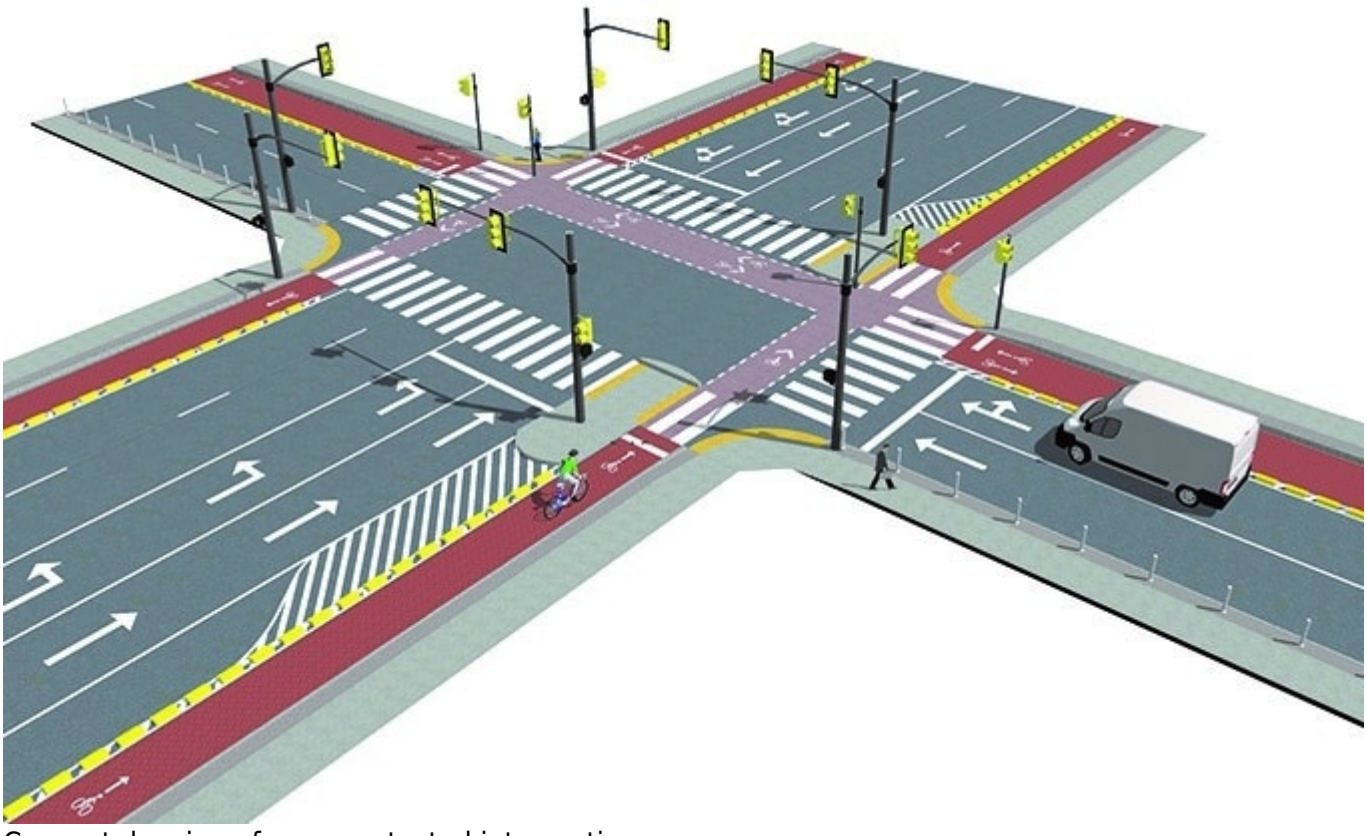
NACTO, Global Street Design Manual

Unprotected Intersections

Although segregated bike lanes and bike paths are safe and comfortable for cyclists, they can cause problems at intersections unless the geometric design is carefully assessed.

In Denmark, a country with many cyclists and a well-developed bike path system, the **most common crash between cars and cyclists occurs at right-turns by motorized vehicles**. When approaching an intersection (or entrance to a parking facility), cyclists and drivers move in parallel to each other, each in their designated lane. However, when cars make a right-turn at an intersection, drivers can quite easily fail to see a cyclist, who has the right of way. In particular this happens when the vehicle's sides are closed off, as in the case of trucks and vans, where drivers rely exclusively on their rear-view mirrors to see cyclists before turning.

Conflicts like this should never come as a surprise to road users and should always be perceived in advance.



Concept drawing of an unprotected intersection.

Concept drawing of an unprotected intersection.

References

Projects and Programs Manual to Encourage Cycling in Communities

Advanced Stop Line (ASL) for Cyclists

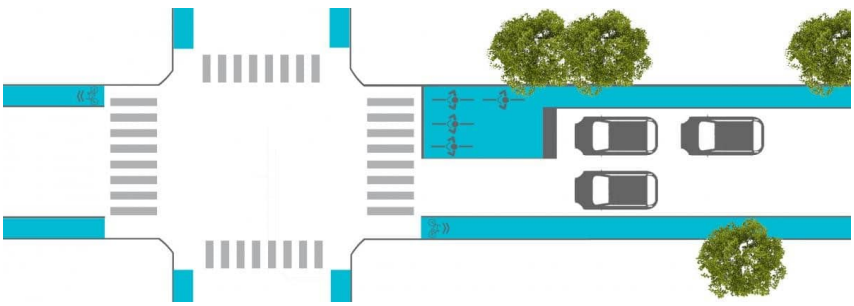
Bike boxes

An advanced stop line (ASL), also called an advanced stop box or a bike box, is a set of **road markings at signalized junctions that allows cycles a head-start** when the traffic signal changes from red to green.

Bike boxes:

- Should be implemented at signalized intersections as a safe space for cyclists
- Make cyclists visible in front of motor vehicle queues during a red light
- Allow cyclists a head-start when the traffic signal changes from red to green
- Should be designed behind pedestrian crossings to minimize the probability of bicycle-pedestrian interaction

Motor vehicles should have a recessed stop line. This allows cyclists to be more visible and “bunch” at busy intersections. The stop line should generally be recessed by 5 meters, providing a de facto “bike box” as well.



Eliminate parking spaces at least 10 meters prior to the

junction to increase visibility.

References

Safe Cycling Design Manual for Istanbul

Two-Step Turns

A two-step turn is often considered safer than a regular turn, with vehicle traffic. To execute this type of turn, a cyclists will ride to the opposite side of the intersection, turn, and then proceed straight. The video below, created by Transport for London, demonstrates this maneouvre.

A cycle box can be provided in front of the pedestrian crossing of the intersecting street to provide space for bicyclists to queue for turns.

References

Cities Safer by Design

Video by Transport for London: Two-stage turn manoeuvre

Speed Reduction at Access Points and Junctions

The most effective measure to improve the safety of cyclists is the use of **speed-reducing measures for drivers leaving or entering a main road** (e.g. a raised bike path and/or exit construction). It is suitable in most cases as it does not require additional space in contrast to the construction of a bike path.

Although cyclists seem more at risk at intersections with two-way bike paths, as compared to intersections with other infrastructure, a number of bike-motor vehicle crashes can be prevented with speed management.

Raised cycle crossings and other speed-reducing measures are effective in decreasing the number of cycle crashes at priority intersections.

Speed-reducing measures could reduce the number of crashes for cyclists. Speed-reducing measures, such as speed humps, did not reduce the crash risk but may reduce the injury risk.

A one-way, single lane street with a chicane and raised crossing. Illustration by Nicolae Duduta.

References

Paul Schepers, A safer road environment for cyclists

Istanbul Historical Peninsula, Design concepts for safe, accessible streets, design

Principle 5: How to Design Shared Streets?

Shared streets are spaces where all modes of transport are given equal priority; pedestrians, cyclists, and other local residents share the right-of-way and travel together.

It is best for shared streets to be located on streets with low traffic volumes designed for vehicle speeds between 20 and 30 km/hr, with an ultimate maximum of 40 km/hr.

An effective shared street:

- Provides continuity to other infrastructure (usually bike lanes)
- Indicates preferred routes through high traffic corridors
- Includes measures to reduce vehicle speed or volume

To ensure low speed, traffic calming measures and horizontal signage should be provided to warn drivers about the presence of cyclists.

Fig. 1 | Shared cycle streets on low speed, low traffic volume streets. Photo by theplanner.co.uk.

Fig. 2 | A shared cycle street, bike boulevard design with road markings and traffic calming measures. Graphic by WRI Ross Center for Sustainable & Cities.

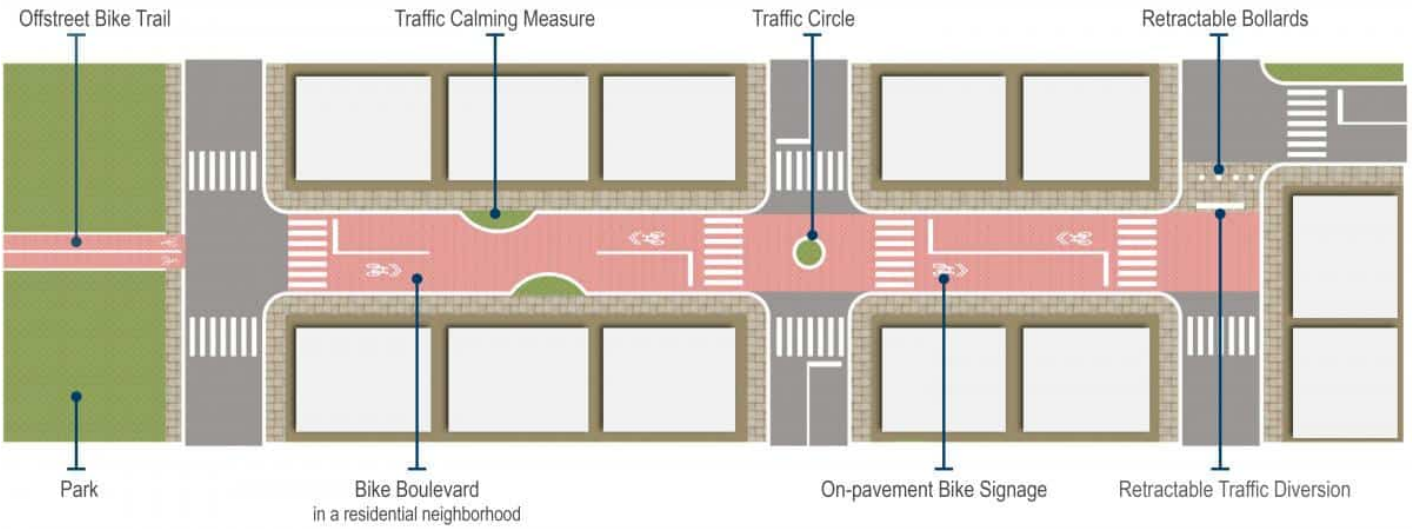


Fig. 3 | Design principles. Graphic by WRI Ross Center for Sustainable Cities.

References

[Projects and Programs Manual to Encourage Cycling in Communities]

[NACTO, What's Mine is Yours: Planning, Designing, and Implementing Shared Streets]

[Eric Jaffe for CityLab, "6 Places Where Cars, Bikes, and Pedestrians All Share the Road As Equals"]

Fig. 1: [The planner.co.uk]

Fig. 2 & Fig. 3: [Cities Safer by Design]

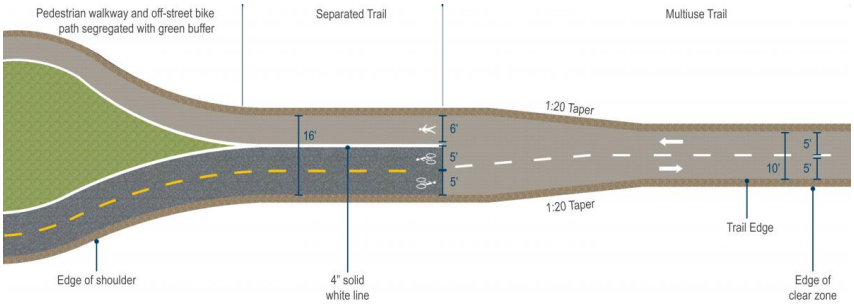
Principle 6: How to Design Off-Street Paths?

An off-street trail is a **path provided in a location away from the main street**, which is exclusive to bicycles and pedestrians. Off street trails are sometimes called greenways or green routes and located on linear corridors, parks, utility or former rail corridors, along streams or waterfronts.

Access to the off-street trail should be:

- responsive to the environment
- adaptive to the territory
- connected to short-distance public transportation and streets

Radial and circular footpaths and bike paths should be available as part of the off-street trail.



*Design principles for safety in **three types of off-street trails**:*
***multi-use**, **separated** and **segregated dual tread** with widths*

References

Safe Cycling Design Manual for Istanbul

Cities Safer by Design

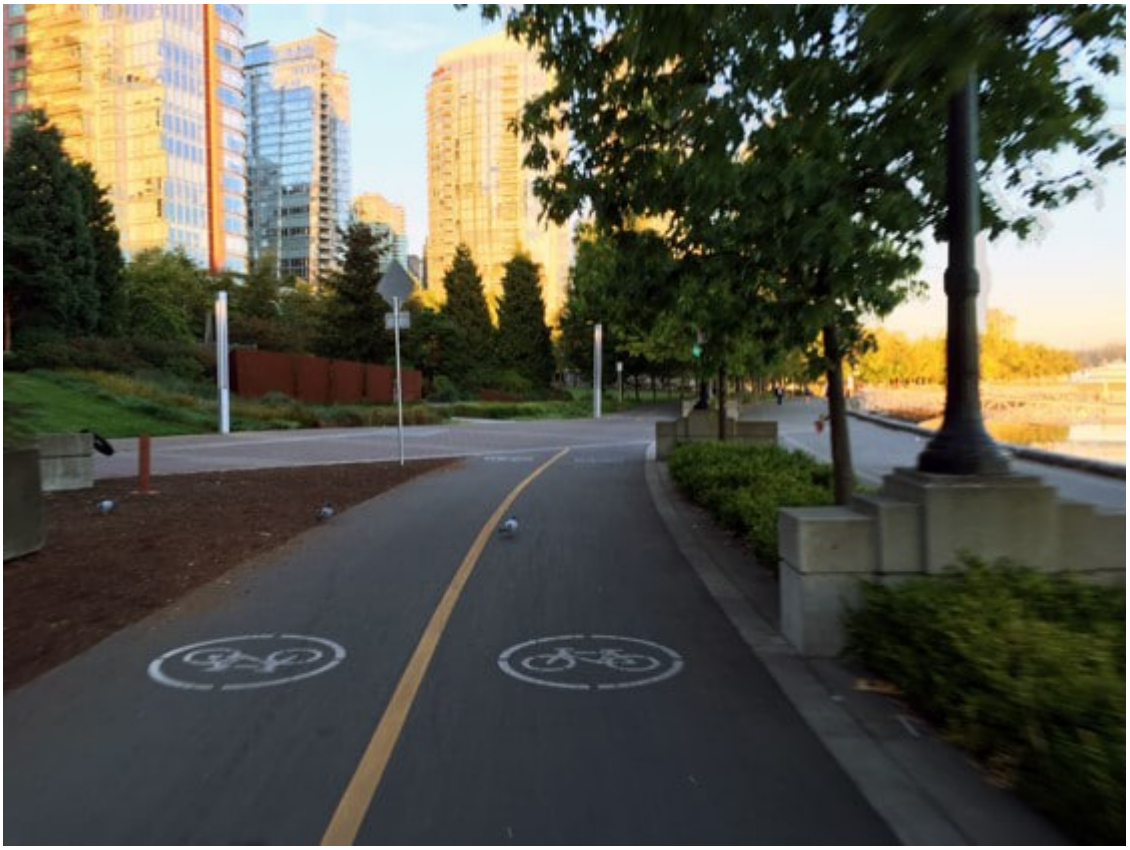
Multi-Use vs. Dual Tread Trails

Off-street paths are safer when provided with **dual treads for walking and cycling**. Two separated trails can be provided, near to each other yet separated by grass or landscaping.

In a dual-tread system, two distinguished trails, one for pedestrians and one for cycling, are near one another and separated by grass or landscaping.

Dual Treads – Separated. This off-street bike trail on the edge of a park in Bogotá, Colombia provides separate paths for pedestrians and cyclists, helping to reduce conflicts between all users.

Dual Treads – Separated. Waterfront trail in Izmir, Turkey with two separate trails for cyclists and pedestrians.



Dual Treads – Separated. Waterfront trail in Vancouver, Canada.

References

Cities Safer by Design

Visit other websites in our broader digital ecosystem:

https://thecityfixlearn.org/courses/design-principles-of-cycling-draft-version